Delta Operations for Salmonids and Sturgeon (DOSS) Group
Conference call: 11/26/13 at 9:00 a.m.

Objective: Provide advice to the Water Operations Management Team (WOMT) and National Marine Fisheries Service (NMFS) on measures to reduce adverse effects from Delta operations of the Central Valley Project and the State Water Project on salmonids and green sturgeon. DOSS will work with other technical teams. DOSS notes and advice can be found at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/doss.html.

Attendees

DWR: Mike Ford, Kevin Reece, Farida Islam, Andy Chu, James Gleim
FWS: Leigh Bartoo
NMFS: Barbara Rocco, Jeff Stuart, Barb Byrne, Doug Hampton
Reclamation: Russ Yaworsky, Josh Israel
DFW: Chris McKibbin, Krystal Acierto
EPA: Erin Foresman
SWRCB: Scott Ligare
USGS: not present

Agenda

1. Action items
2. Fish monitoring (including check in on GCID juvenile and smolt late-fall run from last week's call)
3. Current operations
4. Smelt Working Group
5. Spring-run surrogate releases
6. DCC operations (Action IV.1.2) discussion
   a. review of risks to WQ
   b. review of risks to winter-run and spring-run Chinook migrating out of the Sacramento River.
7. Check-in on current and upcoming RPA actions
8. DOSS advice

Action Items:

1) 11/19: Purdy (DFW) or Byrne (NMFS) will follow up with Glenn–Colusa Irrigation District (GCID) on which classifications it is using.

   11/26: Byrne (NMFS) reported that the length-at-date criteria for late fall run–sized Chinook salmon on 11/15 were 82–148 mm; given that the largest fish caught on that day was 139 mm, it was classified as a late-fall-run Chinook. The "juvenile" and "smolt" classifications in the GCID reporting table do not represent young-of-year vs. yearling size classes based on the length-at-date criteria, but rather are determined based on appearance.

2) 11/19: It was suggested that DOSS review the "key" for determining "smolt" vs. "juvenile" at GCID and compare to the keys used at other monitoring locations. Ideally,

life-stage classification keys would be standardized for all studies and monitoring locations.

Byrne will ask about the key used at GCID and report to DOSS when she has more information. She suggested that the standardization of protocols was an important issue, but perhaps beyond the scope of DOSS; some DOSS members felt that it was well within DOSS' scope given the wide range of monitoring and studies required by the 2009 NMFS biological opinion.

3) 11/19: Chu (DWR) and Yaworsky (Reclamation) will summarize (a) the water quality (WQ) standards (D-1641 and those under contract with the North Delta Water Agency) of concern; (b) the concern levels used by the operators to manage the buffer for those standards; and (c) the "knobs" (*e.g.*, Delta Cross Channel [DCC] operations, reservoir releases, export levels) that can be used to manage to those standards.

11/26: There was discussion about these points during the DCC discussion. Please see notes below for details.

Fish Monitoring: The following table presents fish monitoring data. Unless otherwise noted, reported sizes are fork length. See also: http://www.water.ca.gov/swp/operationscontrol/calfed/calfedmonitoring.cfm.

Location	**Chipps Is. Midwater Trawl**	**Sacramento Trawls**	**Mossdale Kodiak Trawl**	**GCID**	**Knights Landing RST**	**Tisdale RST**	**Beach Seines**
Sample Date	11/18, 20	11/18, 20, 21	11/18, 20, 21	11/19–25	11/19–24	11/19–25	11/18–21
Total Catch	**0**	**0**	**0**	**612**	**0**	**0**	**1**
FR				1			
WR				585			
SR				2			
LFR				24			
Ad-Clipped Chinook							
DS							1 (64 mm, Sandy Beach)
Splittail							
Longfin							
SH (ad-clip)							
SH (wild)							
W. Temp. (avg. °F)	14.1	12.7	13.4	57.6	54	51.6	12.9
Flows (avg. cfs)					4,982	4,446	
Turbidity (avg. NTU)	17.5	5.4	7.3	2.1	4.0	8.2	13.9
WR/LFR Avg. CPUE				3.79			
FR/SR Avg. CPUE							

CPUE = catch per unit of effort reported as the average fish/hour over reported sampling dates; ACT = acoustic tag; GCID = Glenn–Colusa Irrigation District; RST = rotary screw trap
[1]Flows at GCID are Bypass flows (in cfs) not Sacramento River flows.
[2]Note that FTU is used at Knight's Landing in place of NTU.

Holiday Sampling Schedules: No sampling will be done on Thanksgiving at the Knights Landing and Tisdale rotary screw traps (RSTs), so no Knights Landing Catch Index will be reported on Thursday 11/28. The Sacramento seine and trawl sampling will still be done three times this week, so the Sacramento Catch Index will be available as usual.

Fish Salvage: Islam (DFW) reported data for 11/18–11/25. No listed species were salvaged at either CVP or SWP. The preliminary report for 11/26 had not yet been received.

Operations (11/26/13)

SWP		CVP	
Exports (cfs)			
Clifton Court Forebay	1,500	Jones Pumping Plant	1,000
Reservoir Releases (cfs)			
Feather - Oroville	1,250	American - Nimbus	1,300 (will remain at that level through December; if still dry, will decrease in January)
		Sacramento - Keswick	3,750 (will remain at that level until there is some rain)
		Stanislaus - Goodwin	200
Reservoir Storage (in TAF, % of capacity)			
San Luis (SWP)	226	San Luis (CVP)	282 (29)
Oroville	1,413 (40)	Shasta	1,703 (37)
New Melones		Folsom	244 (25)
Delta Operations			
DCC	Closed (as of 11/25)	Sacramento River at Freeport (cfs)	9,020
Outflow Index (cfs)	~6,200	San Joaquin River (cfs) at Vernalis	1,104
Total Delta Inflow (cfs)	10,483	OMR (daily) (cfs)	
Water Temperature (°F)		OMR 5-day avg (cfs)	
X2 (km)	>81	OMR 14-day avg (cfs)	
E/I (%)	22.5 (3-d avg)		

Controlling: The chloride standard at the Contra Costa canal location in Rock Slough is still controlling Delta operations. Rio Vista flows and Delta outflow are not controlling right now.

California Data Exchange Center (CDEC) Graphs and Presentation of Operations Data: Last week, CDEC graphs of reservoir storage and flows were included with the DOSS materials distributed before or during the call. DOSS participants were asked whether there was active interest in having these graphs provided each week; there was not. After this week, those graphs won't be distributed to DOSS or included in the notes. During the discussion on presenting operations information, DOSS participants confirmed that the operations table in the notes could include incidental, factual, information (*e.g.*, reservoir storage as a percentage of capacity) even if the information had not been discussed during the call. This is a very limited exception to the general rule that the DOSS notes not reflect things not discussed during the DOSS call.

RPA Actions:

- IV.1.1: Based on flow data from 11/20, the first alert in Action IV.1.1 has been triggered. The first (and second) alert in Action IV.1.1, based on conditions associated with salmon emigration, warn NMFS and Reclamation that changes in DCC gate operations are likely to be necessary within a short time period.

	First component of first alert: Mean daily flows greater than 110 cfs in Deer Creek or Mill Creek.	**Second component of the first alert:** Mean daily flow increases by more than 50 percent in Deer Creek or Mill Creek.
Watershed	Mean daily flows on 11/20/13	% increase in flow from 11/19/13 to 11/20/13
Deer Creek	134 cfs	46%
Mill Creek	145 cfs*	57%**

*Data missing from 0:00 to 10:45 on 11/20.
** Data missing from 0:00 to 1:45, 9:00 to 23:45 on 11/19 and from 0:00 to 10:45 on 11/20.

- IV.1.2: No triggers exceeded in the past week.
- IV.3: No triggers exceeded in the past week.

Smelt Working Group (SWG): SWG met on 11/25 and discussed the roles and responsibilities of participants. It did not discuss risk assessment; therefore, there was no recommendation. Hydrology will be discussed in more detail as SWG moves into December; Bartoo (FWS) will begin sending out the hydrology update to SWG participants. Previous SWG meeting notes are available at: http://www.fws.gov/sfbaydelta/cvp-swp/smelt_working_group.cfm.

Spring-Run Surrogate Releases from Coleman National Fish Hatchery (CNFH): CNFH has set aside three batches of late-fall-run Chinook to be released as surrogates for spring-run Chinook yearlings in late 2013 and early 2014. DOSS was asked to provide guidance to Coleman for their release schedule. The spring-run Chinook surrogates are used to track incidental take at the export facilities, and, if the estimated loss of any spring-run surrogate release group at the export facilities exceeds 0.5% of the release group size, an action response is required per Action IV.3 (export reduction; this action ends 12/31) and Action IV.2.3 (OMR management; this action does not take effect until 1/1/14). Last year, DOSS asked that the surrogates be released in early December, January, and February; however, because of efforts to link releases to rain events, the February release was moved to late January.

The DOSS discussion focused on several key factors:

<u>Migration timing of naturally produced spring-run Chinook yearlings</u>
Because these fish are surrogates for spring-run yearlings, the migration timing of naturally produced yearling spring-run migration is relevant. Byrne provided DOSS with information on spring-run Chinook yearling outmigration from catch data from the Mill and Deer creek RSTs from 1994 through 2010. These data show that the peak catch at both Mill and Deer creeks is in November, with most outmigration from October through January. The data from Mill and Deer creeks also indicated that yearling outmigration is associated with precipitation events that cause flows to spike.

Timing of the late-fall run production release

CNFH expects to release approximately 800,000 late-fall-run Chinook with the first precipitation event in early December. Some felt that releasing the surrogates at a time different from that of the CNFH releases might be detrimental because predation could be higher without the potential of the production release to "swamp" predators. Looking at last year's data on salvage of production vs. surrogate releases, the salvage of the production group exceeded the 0.5% threshold and was as much as five times higher than the salvage of the surrogate groups. If the goal were to improve survival of the surrogate groups, one might choose to release the surrogates with the production release; if naturally produced yearling spring run are not associated with 800,000 hatchery fish, a surrogate release that is offset from the production release might better represent natural spring-run survival.

Links to precipitation

One DOSS member pointed out that the surrogates are released to measure loss at the export facilities and not to make changes to DCC operations and that timing the surrogate releases with precipitation events might not be necessary. It was also noted that the released fish might not actively migrate downstream until a precipitation event, so that the main migration of the surrogate fish might co-occur with a precipitation event even if the release does not.

DOSS provided the following guidance regarding the release schedule for the spring-run surrogate groups at CNFH, based on the information that the production release would occur during the first significant rainfall event in December:

- **Production release:** early December with first significant rainfall event
- **1st surrogate release:** mid-December, ideally at least a week after the production release and coincident with a rainfall event
- **2nd surrogate release:** 2–3 weeks after the first release, ideally coincident with a rainfall event (early January, if first release is done mid-December)
- **3rd surrogate release:** 2–3 weeks after the second release, ideally coincident with a rainfall event (late January, if second release is done early January)

Based on the migration timing pattern of yearling spring-run Chinook in Mill and Deer creeks, which shows sparse RST catches February onward, DOSS encourages that all surrogate groups be released by the end of January.

Byrne will send an email to Kevin Niemela at CNFH with these recommended release dates.

DCC: Byrne provided the background of the discussion from last week. At the WOMT call last week, NMFS asked Reclamation to send a letter if requesting a change in DCC operations per Action IV.1.2. At the time of the DOSS call, no letter had been received. Further discussion on this issue was expected later today on the WOMT call.

Per the action item from last week, the operators were asked to provide an overview of how the projects operate to the WQ standards, including any specific concern levels or knobs used to manage risks to WQ. DOSS also discussed information relevant for assessing how DCC operations would affect risks to outmigrating salmon.

Managing risks to WQ

Yaworsky (Reclamation) reported that, since last week, WQ has improved somewhat in the Delta from the rain event, but with the anticipated dry weather over the next 7 days, Reclamation

plans to open the DCC gates tomorrow to keep WQ fresh heading into the holiday weekend. As indicated last week, beyond the WQ concerns, Reclamation would prefer to keep the gates open for boaters on Sunday 12/1 (the day on which the default closure begins per Action IV.1.2); Reclamation expects that the issue of closure on 12/1 will be discussed at WOMT.

The 250 mg/L chloride standard at the Contra Costa Canal location was identified as the interior Delta WQ standard most likely to be of concern in early to mid-December; opening the DCC gates is one way to help meet this standard. The operators agreed that it is not that simple to identify a specific concern level to define a buffer for a particular standard because WQ conditions can be quickly, and unpredictably, affected by tides, barometric pressure, and wind in addition to flows and exports. Knobs to manage WQ include upstream reservoir releases and export reductions, but the operators noted that additional upstream releases are a concern given the desire to conserve storage, and that exports are already near minimum levels. That leaves DCC gate operations as the remaining knob to control WQ in the interior Delta. NMFS asked about what WQ modeling might be included with Reclamation's request to modify Action IV.1.2, but the operators reiterated that WQ modeling is very uncertain.

Byrne and Stuart (NMFS) acknowledged that modeling had some limitations, but emphasized that NMFS would need some specifics to modify Action IV.1.2 (*e.g.*, WQ modeling results that compared the WQ consequences of preemptive vs. reactive DCC closures).

<u>Managing risks to fish</u>
The following indicators were identified as relevant to assessing the potential risk of DCC operations to outmigrating salmon, with some discussion points highlighted.

- Knights Landing Catch Index (KLCI)—Most likely the most useful for detecting migration of winter-run Chinook because spring-run yearling Chinook are strong swimmers and are less likely to be captured in the RSTs used for sampling at KL. Although the index is measured in fish/day, it was noted that any quantitative inference drawn from the index should be tempered by the expectation that the RSTs used to sample at this location have a low and variable efficiency.
- Sacramento Catch Index (SCI)—Most likely the most useful for detecting migration of winter-run Chinook because spring-run yearling Chinook are strong swimmers and are less likely to be captured by the trawling and seining methods used to sample the locations used to calculate this index.
- First Alert in Action IV.1.1, Either Component—Mean daily flow >110 cfs or an increase in mean daily flow of 50% is an indicator that spring-run yearlings might be moving out of the tributaries into the mainstem Sacramento River.
- Second Alert in Action IV.1.1—The second alert is an indicator that flow and temperature conditions in the Wilkins Slough/KL area have reached thresholds that have been associated with the migration of salmonids in the Sacramento River. It was suggested that forecasted flows and temperature trends could be used to predict whether the second alert might be tripped in the near future.

DOSS generally agreed that KLCI, SCI, and the combination of the first and second alerts were relevant indicators that winter-run Chinook and/or spring-run Chinook yearlings might be migrating past DCC, and thus potentially be routed into the interior Delta through an open DCC; however, there was no consensus about how those indicators might be used to predict what fraction of a population might be at risk and there was a difference of opinion about whether

triggering of the first alert but not the second alert indicated any risk to spring-run yearlings to entrainment through an open DCC.

DOSS also reviewed some historical migration timing patterns for both yearling spring-run Chinook and winter-run Chinook:

- Migration timing of spring-run Chinook yearlings; Figure 3 from report on Mill Creek and Deer Creek RST data 1994–2010 (CDFW, *Juvenile Salmonid Monitoring Using Rotary Screw Traps in Deer Creek and Mill Creek, Tehama County, California Summary Report: 1994–2010*):

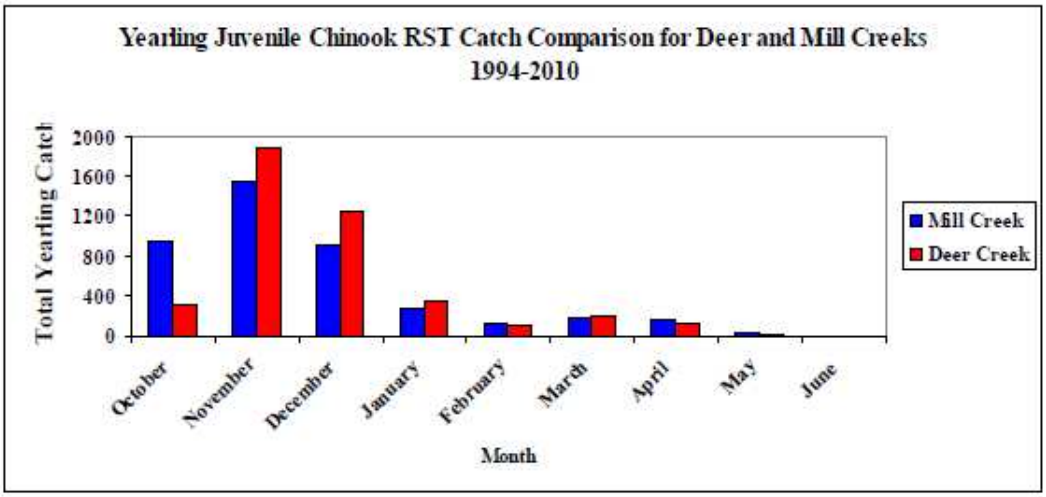


Figure 3.— A comparison of yearling juvenile Chinook out-migration timing and catch statistics based on the 1994-2010 Deer and Mill Creek rotary screw trap data.

- Migration timing of winter-run Chinook (personal communication, Jeff Stuart [NMFS]). See data in Attachment 1.

Several DOSS members were of the opinion that real-time information (fish monitoring, weather forecast data), rather than/in addition to historical patterns should be used to assess real-time operational risks to fish and that the RPA actions were developed for an "average" migration pattern based on analyses of many years; others responded that while in principle this makes sense, (a) it is particularly difficult to "see" spring-run yearlings in the system; therefore, assessments of risks to that run will rely heavily on historical timing and/or environmental surrogates (which could take into account weather forecast data) such as the flow conditions in the first alert; and (b) it is difficult to put any period of risk into a population context prospectively because we don't know the full distribution of outmigration timing until the outmigration season is over. A general suggestion was made to consider a temporary sampling station on the downstream Mokelumne River side of DCC during a DCC opening for WQ improvement if there was a desire to measure biological risks and benefits; no specifics as to methods or location were discussed.

A question was asked about the action triggers in consideration of degraded WQ conditions in the 12/1–12/14 vs. 12/15–1/31 phases of Action IV.1.2. Byrne noted that, based on the expected presence of fish near DCC from mid-December onward, just a single action trigger in consideration of WQ was allowed for the later period; she also noted that much of the language

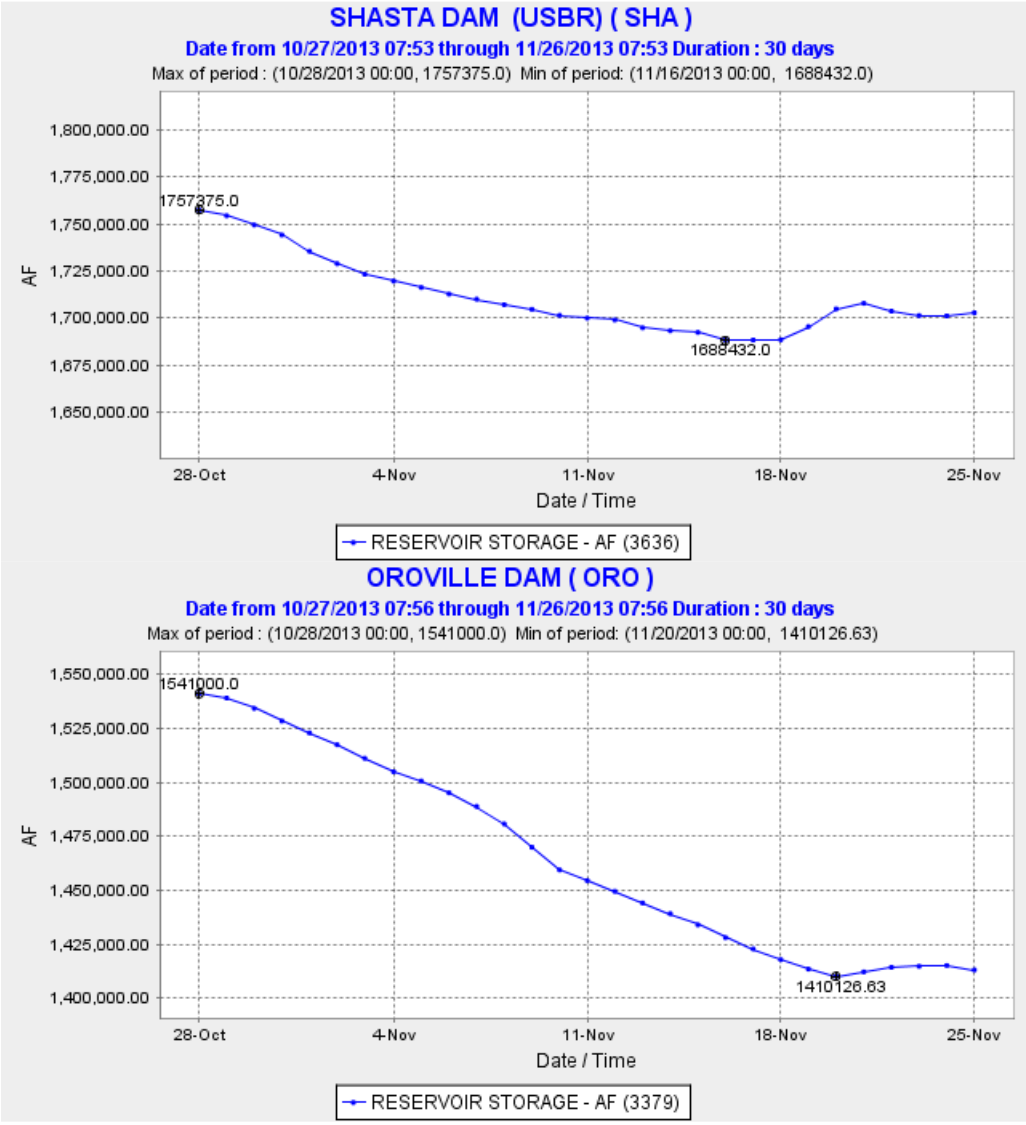
in Action IV.1.2 came from the Salmon Decision Process proposed by Reclamation in its 2008 biological assessment. One member opined that circumstances and available data have changed since the early days of the Salmon Decision Process and that it would be appropriate to review and rethink how we manage operations for fish protection.

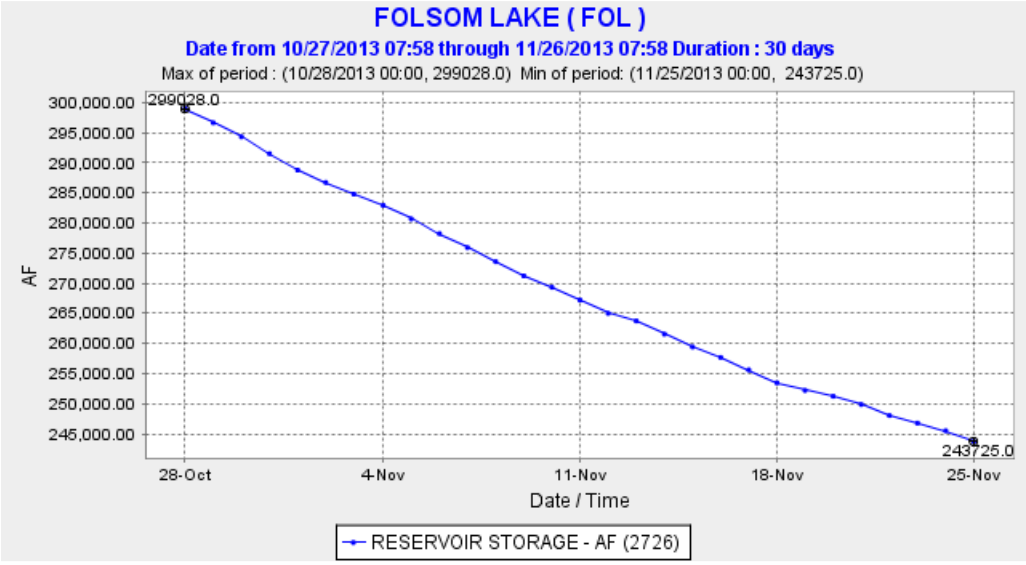
Next steps: If NMFS receives the request for an alternate WQ exception procedure from Reclamation, Byrne (acting for Yip) will draft a response that incorporates the considerations discussed above.

DOSS Advice to WOMT and NMFS: None.

Next Meeting: The next DOSS conference call will be on 12/3 at 9:00 a.m.

Below are graphs provided by NMFS for reservoir storage and flows, and by DWR for Chinook salmon and steelhead observed at monitoring locations in the Sacramento and San Joaquin rivers and Delta. For additional graphs, please visit the DWR website at: http://www.water.ca.gov/swp/operationscontrol/calfed/calfedmonitoring.cfm.




FOLSOM LAKE (FOL)
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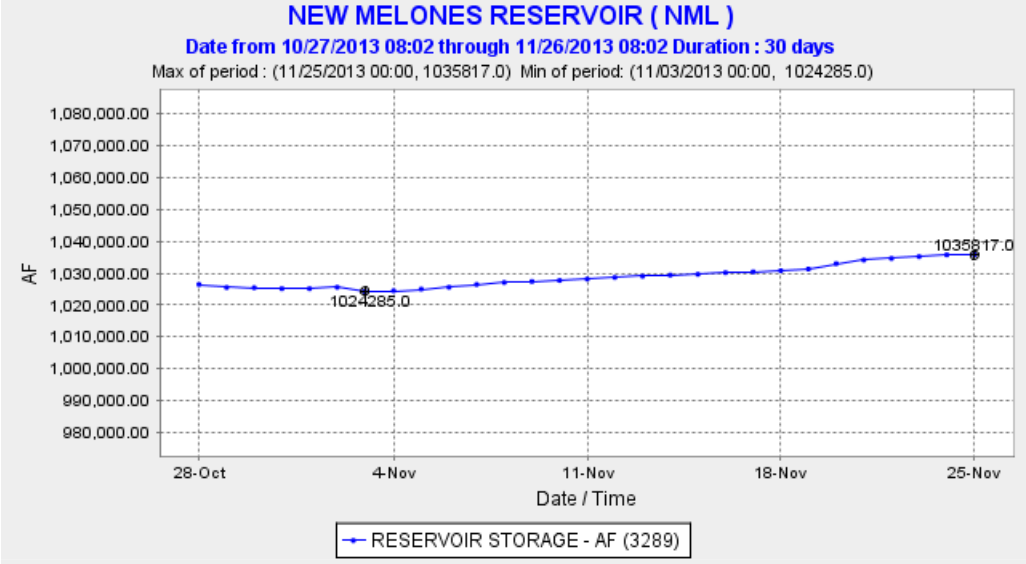
Max of period : (10/28/2013 00:00, 299028.0) Min of period: (11/25/2013 00:00, 243725.0)
AF
300,000.00
295,000.00
290,000.00
285,000.00
280,000.00
275,000.00
270,000.00
265,000.00
260,000.00
255,000.00
250,000.00
245,000.00
299028.0
243725.0
28-Oct
4-Nov
11-Nov
18-Nov
25-Nov
Date / Time
RESERVOIR STORAGE - AF (2726)


NEW MELONES RESERVOIR (NML)
Date from 10/27/2013 08:02 through 11/26/2013 08:02 Duration : 30 days
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1,060,000.00
1,050,000.00
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1,010,000.00
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990,000.00
980,000.00
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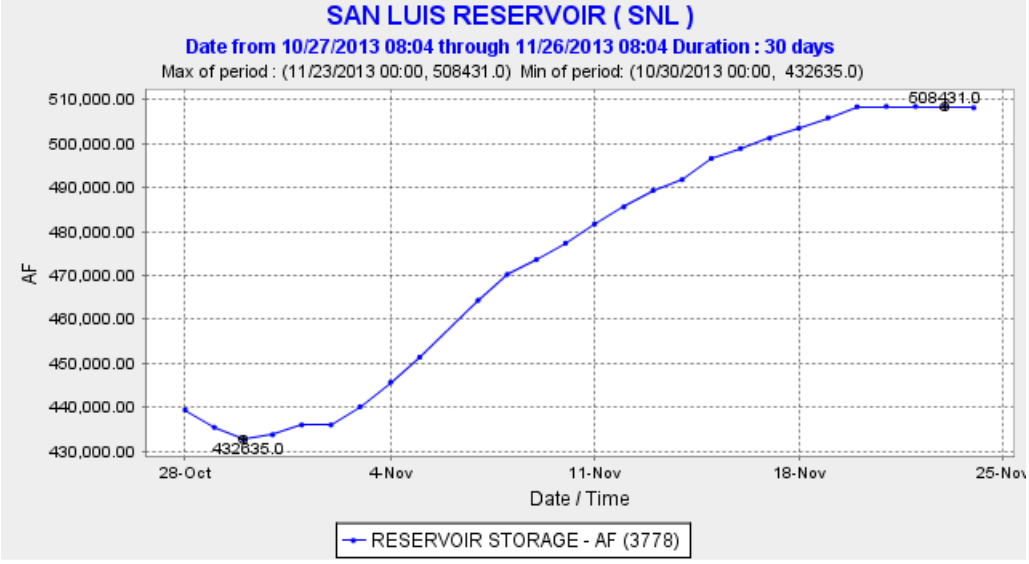
28-Oct
4-Nov
11-Nov
18-Nov
25-Nov
Date / Time
RESERVOIR STORAGE - AF (3289)


SAN LUIS RESERVOIR (SNL)
Date from 10/27/2013 08:04 through 11/26/2013 08:04 Duration : 30 days
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490,000.00
480,000.00
470,000.00
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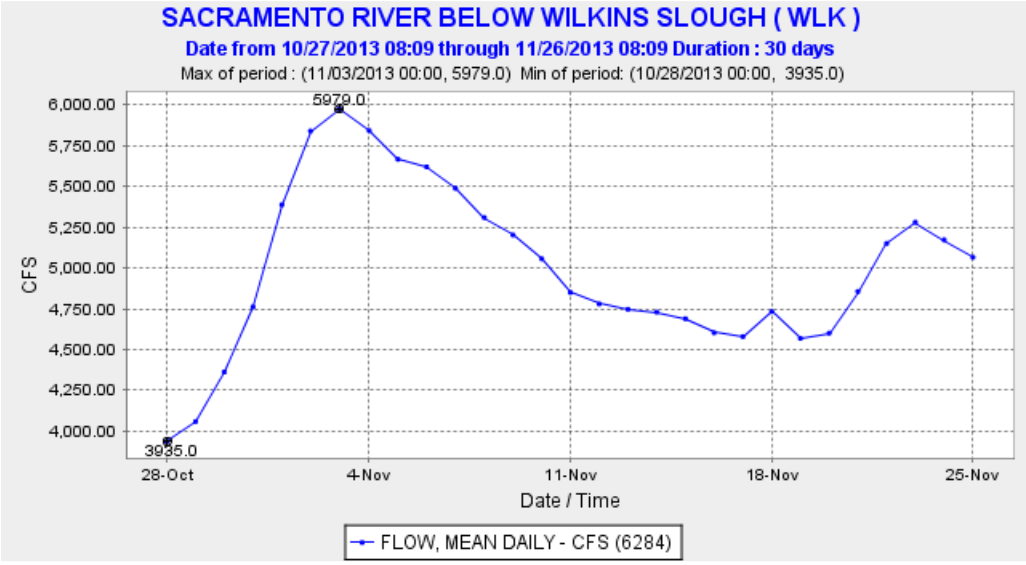
Date / Time
RESERVOIR STORAGE - AF (3778)


SACRAMENTO RIVER BELOW WILKINS SLOUGH (WLK)
Date from 10/27/2013 08:09 through 11/26/2013 08:09 Duration : 30 days
Max of period : (11/03/2013 00:00, 5979.0) Min of period: (10/28/2013 00:00, 3935.0)
CFS
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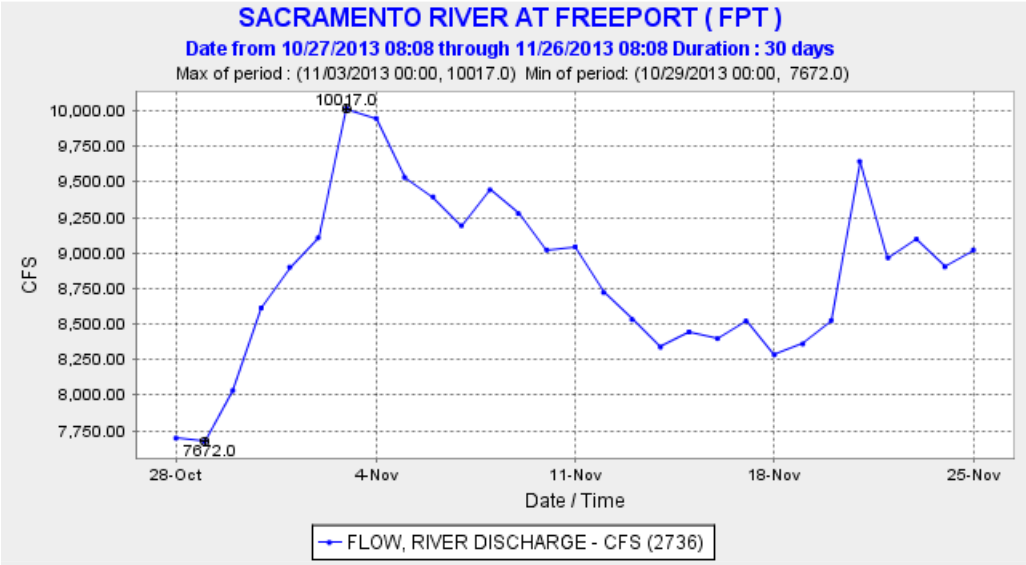
5,750.00
5,500.00
5,250.00
5,000.00
4,750.00
4,500.00
4,250.00
4,000.00
5979.0
3935.0
28-Oct
4-Nov
11-Nov
18-Nov
25-Nov
Date / Time
FLOW, MEAN DAILY - CFS (6284)


SACRAMENTO RIVER AT FREEPORT (FPT)
Date from 10/27/2013 08:08 through 11/26/2013 08:08 Duration : 30 days
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CFS
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9,250.00
9,000.00
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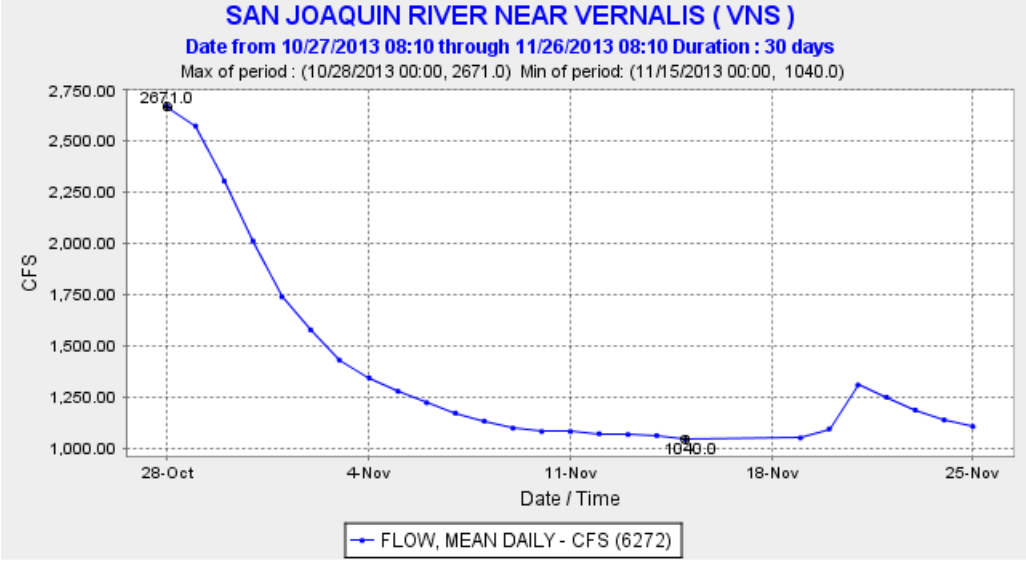
8,500.00
8,250.00
8,000.00
7,750.00
10017.0
7672.0
28-Oct
4-Nov
11-Nov
18-Nov
25-Nov
Date / Time
FLOW, RIVER DISCHARGE - CFS (2736)


SAN JOAQUIN RIVER NEAR VERNALIS (VNS)
Date from 10/27/2013 08:10 through 11/26/2013 08:10 Duration : 30 days
Max of period : (10/28/2013 00:00, 2671.0) Min of period: (11/15/2013 00:00, 1040.0)
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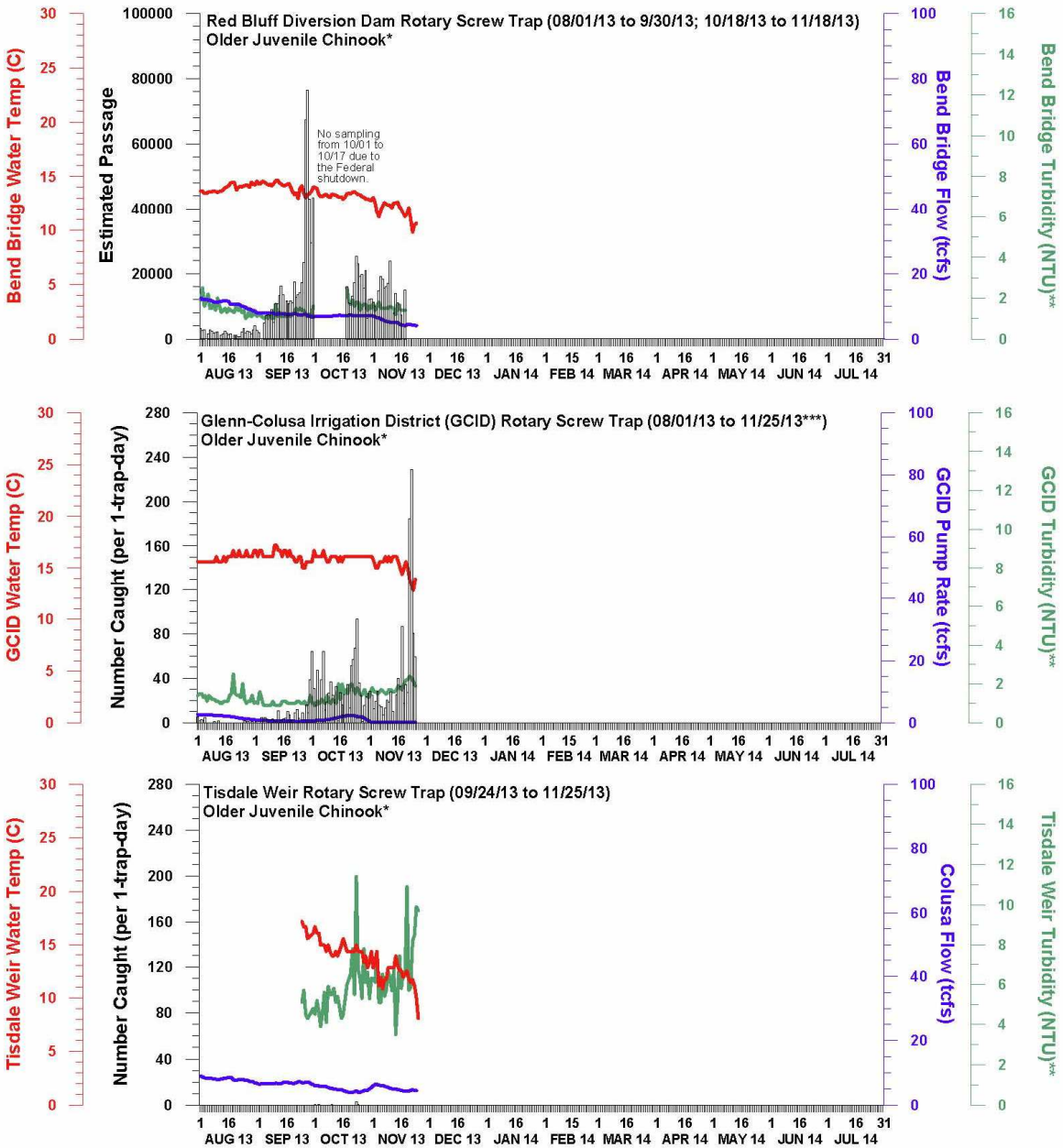
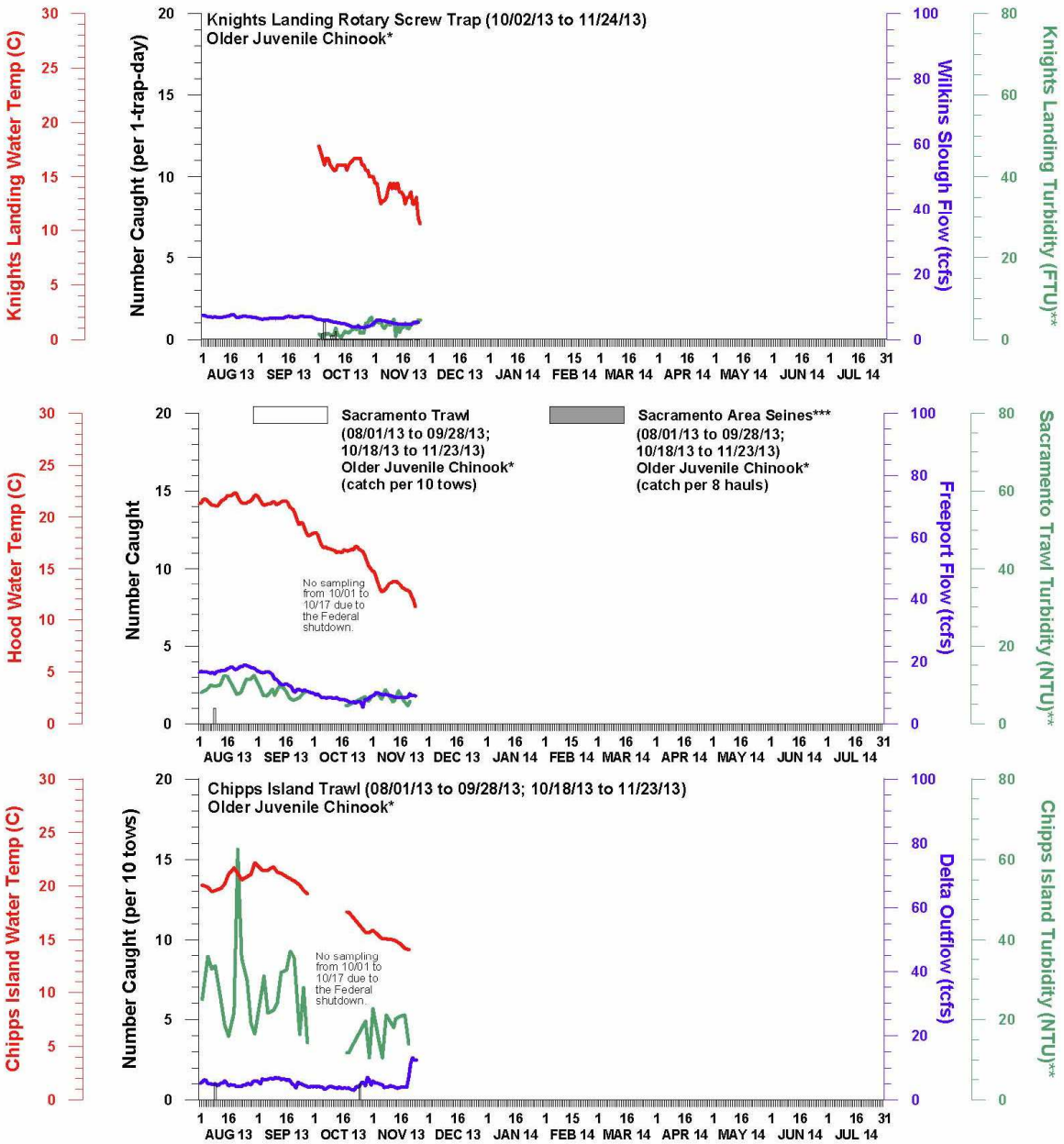
1,750.00
1,500.00
1,250.00
1,000.00
2671.0
1040.0
28-Oct
4-Nov
11-Nov
18-Nov
25-Nov
Date / Time
FLOW, MEAN DAILY - CFS (6272)

NUMBER OF UNMARKED OLDER JUVENILE CHINOOK MEASURED IN THE SACRAMENTO RIVER



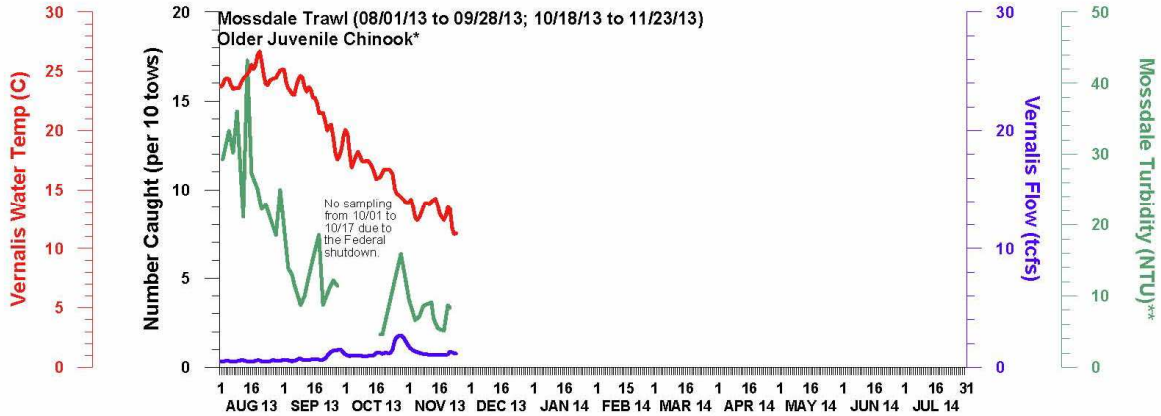
DWR-DES 25 NOV 2013
Preliminary data from DFW, FWS, GCID, and CDEC; subject to revision.
*Older juvenile Chinook defined as all Chinook greater than or equal to the minimum winter run length-at-date criteria and less than the maximum size included in the length-at-date criteria (Frank Fisher model) for which a race is assigned on a given sampling date.
**Turbidity is a discrete measurement and is not measured continuously. Therefore, data are interpolated on days when turbidity was not measured.
***GCID: Five older juveniles caught on 9/25, 9 older juveniles caught on 9/27, 57 older juveniles caught on 10/5 and 23 older juveniles caught on 11/14. However, catch could not be standardized to 1-trap day since hours fished could not be calculated due to problems with the revolution counter. As a result, data are not presented on the graph.

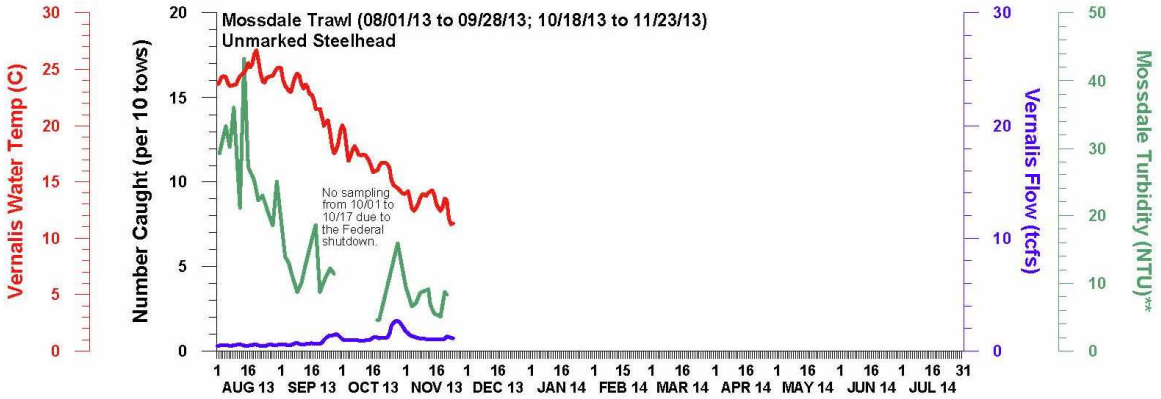
NUMBER OF UNMARKED OLDER JUVENILE CHINOOK MEASURED IN THE LOWER SACRAMENTO RIVER AND CHIPPS ISLAND



DWR-DES 25 NOV 2013
Preliminary data from DFW, FWS, and CDEC; subject to revision.
*Older Juvenile Chinook defined as all Chinook greater than or equal to the minimum winter run length-at-date criteria and less than the maximum size included in the length-at-date criteria (Frank Fisher Model) for which a race is assigned on a given sampling date.
**Turbidity is a discrete measurement and is not measured continuously. Therefore, data are interpolated on days when turbidity was not measured. Knights Landing turbidity measured in FTU, which should be roughly equivalent to NTU.
***Sacramento area seine route consists of the following seine sites: Verona, Elkhorn, Sand Cove, Discovery Park, American River, Miller Park, Sherwood Harbor, and Garcia Bend. Bars are stacked if Chinook caught from the trawl and seines are from the same day.

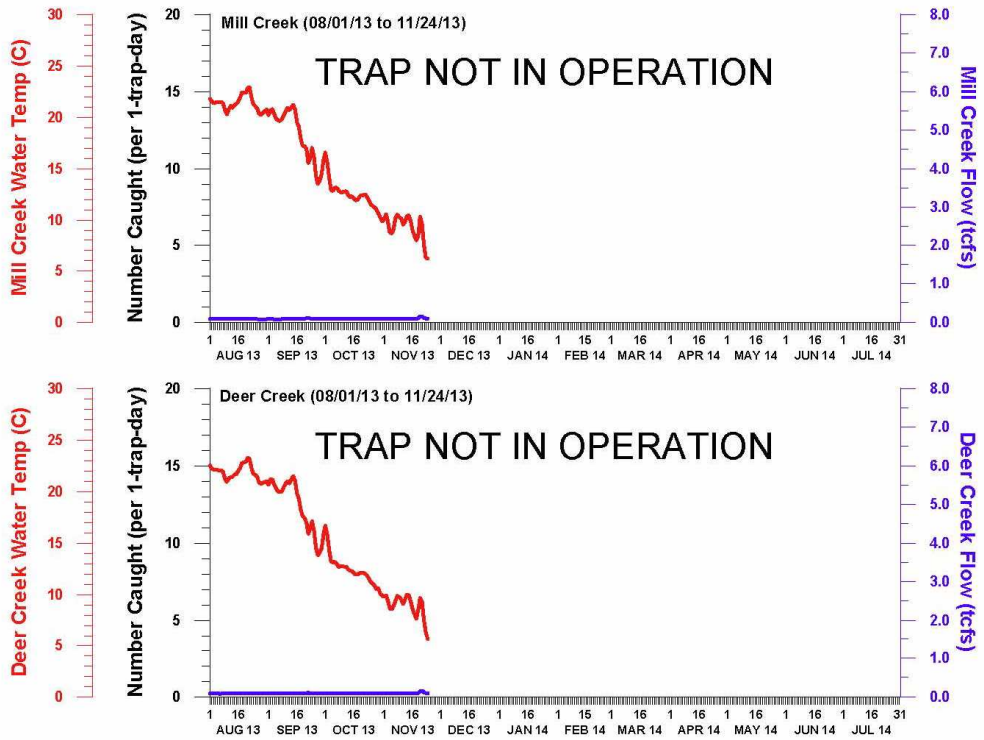
NUMBER OF UNMARKED OLDER JUVENILE CHINOOK AND STEELHEAD MEASURED IN THE SAN JOAQUIN RIVER





DWR-DES 25 NOV 2013
Preliminary data from FWS and CDEC; subject to revision.
*Older juvenile Chinook defined as all Chinook greater than or equal to the minimum winter run length-at-date criteria and less than the maximum size included in the length-at-date criteria (Frank Fisher model) for which a race is assigned on a given sampling date.
**Turbidity is a discrete measurement and is not measured continuously. Therefore, data are interpolated on days when turbidity was not measured.

WATER TEMPERATURE AND FLOW MEASURED AT MILL AND DEER CREEK



DWR-DES 25 NOV 2013
Preliminary data from CDEC; subject to revision.

ATTACHMENT 1 to 11/16/13 DOSS Notes

Winter-run Chinook migration timing

Table 1: Quartile cumulative percentage of winter-run sized Chinook salmon by date captured at the Knights Landing rotary screw traps for water years 2000-2001 through 2011-2012. Colored cells occur after December 31. Note magenta colored cells occur first week of January – include with end of December group.

								Water Year							Percentage occuring
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012		before January
Water Year type	D	D	AN	BN	BN	W	D	C	D	BN	W	BN		
Date first WR @ KL	11/6/2000	11/16/2001	10/11/2002	10/6/2003	10/29/2004	10/11/2005	10/6/2006	12/12/2007	12/29/2008	10/15/2009	10/11/2010	10/10/2011		100
25% @ KL	1/19/2001	11/27/2001	12/17/2002	12/9/2003	12/11/2004	12/3/2005	12/15/2006	12/31/2007	1/26/2009	10/28/2009	12/8/2010	1/23/2012		75
50% @ KL	1/29/2001	12/11/2001	12/22/2002	12/11/2003	12/13/2004	12/6/2005	12/17/2006	1/12/2008	2/24/2009	1/20/2010	12/17/2010	1/25/2012		58
75% @ KL	2/23/2001	1/4/2002	1/4/2003	12/20/2003	1/5/2005	12/24/2005	12/30/2006	1/28/2008	2/27/2009	1/26/2010	12/23/2010	1/27/2012		58
100% @ KL	4/25/2001	4/24/2002	4/21/2003	4/5/2004	4/22/2005	4/18/2006	3/13/2007	3/3/2008	4/6/2009	4/16/2010	4/9/2011	4/11/2012		0

Water year type Key:
W = Wet
AN = Above normal
BN = Below normal
D = Dry
C = Critically dry

Table 2: Cumulative percentage of winter-run sized Chinook salmon captured by month at the Knights Landing rotary screw traps for water years 2000-2001 through 2011-2012.

							Water Year									
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012		Mean	Range	Stdev
% of Annual WR Catch																
End of October	0	0	0.4	0.3	0.1	1.6	2.1	0	0	26.5	15	4.8		4.23	0 - 26.5	8.22
End of November	0.6	43	1.2	0.5	4.9	20.2	3.8	0	0	29.4	19.1	5.7		10.70	0-29.4	14.09
End of December	6.7	71.9	65.9	85.2	64.2	91.8	80.9	2.5	22.3	32.9	82.3	6.7		51.11	2.5-91.8	34.34
End of January	60	93	94.7	92.9	92	95.4	90.8	78.8	36.9	90	94.4	86.7		83.80	36.9-95.4	17.81
End of February	81.6	97	97.7	97.2	97.5	98.5	99.5	99.1	82.3	94.7	96.1	91.4		94.38	81.6-99.5	6.20
End of March	99	98.8	99.3	99.9	99.9	99.6	100	100	99.2	98.8	99.2	95.2		99.08	95.2-100	1.30
End of April	100	100	100	100	100	100	100	100	100	100	100	100		100.00	100-100	0.00
End of May	100	100	100	100	100	100	100	100	100	100	100	100		100.00	100-100	0.00