Continued Review of Drought and CVP/SWP Operational Effects on Fish

A Fish Agency Overview

SWRCB Meeting - December 15, 2015

Operation and Monitoring Actions Conducted in 2015

- Smelt
- Temperature Management on the Sacramento River

Smelt

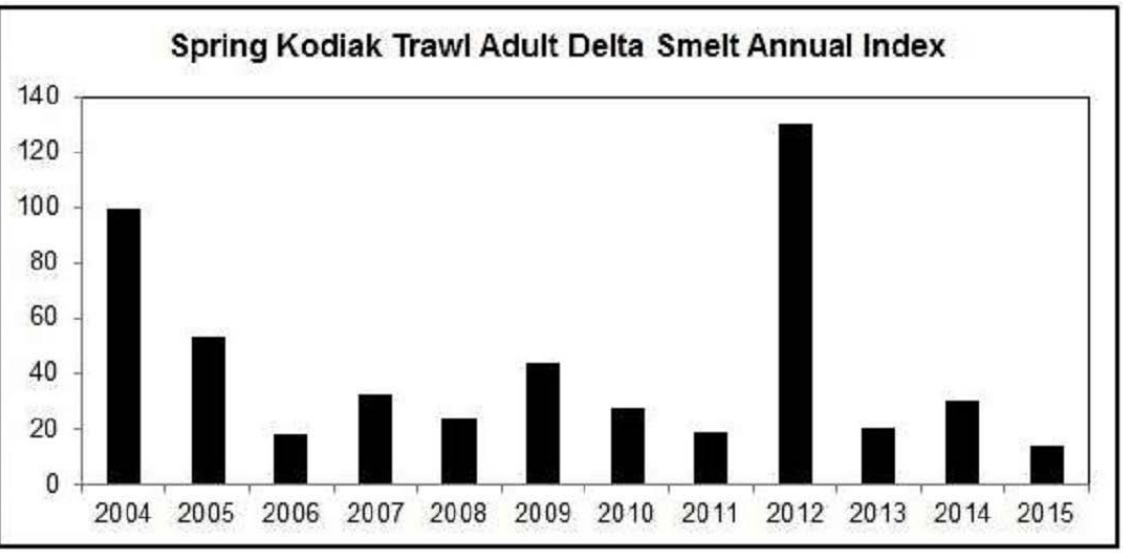
- Longfin smelt
  - 2 year fish
  - Migrate upstream to spawn in the late fall
  - Peak spawning January through March
- Delta smelt
  - 1 year fish
  - Migrate upstream to spawn in the fall
  - Peak spawning March through Mid-May
- Smelt Monitoring (Survey Data)

2015 Smelt Monitoring

- Spring Kodiak Trawl (SKT)
  - Targets adult Delta smelt
  - Samples from January to May
- Smelt Larva Survey (SLS)
  - Provides near real-time distribution data for Longfin smelt larvae
  - Surveys occur every two weeks January through March.
- 20-mm
  - Samples postlarval-juvenile (~ 20mm) Longfin and Delta smelt
  - Surveys start in March and end in June
- Summer Townet (STN)
  - June-August, juvenile Delta Smelt abundance and distribution.
- Fall Midwater Trawl (FMWT)
  - Samples from September through December. Captures sub adult Delta smelt and adult Longfin smelt.

2015 Index of Delta Smelt Relative Abundance from Spring Kodiak Trawl

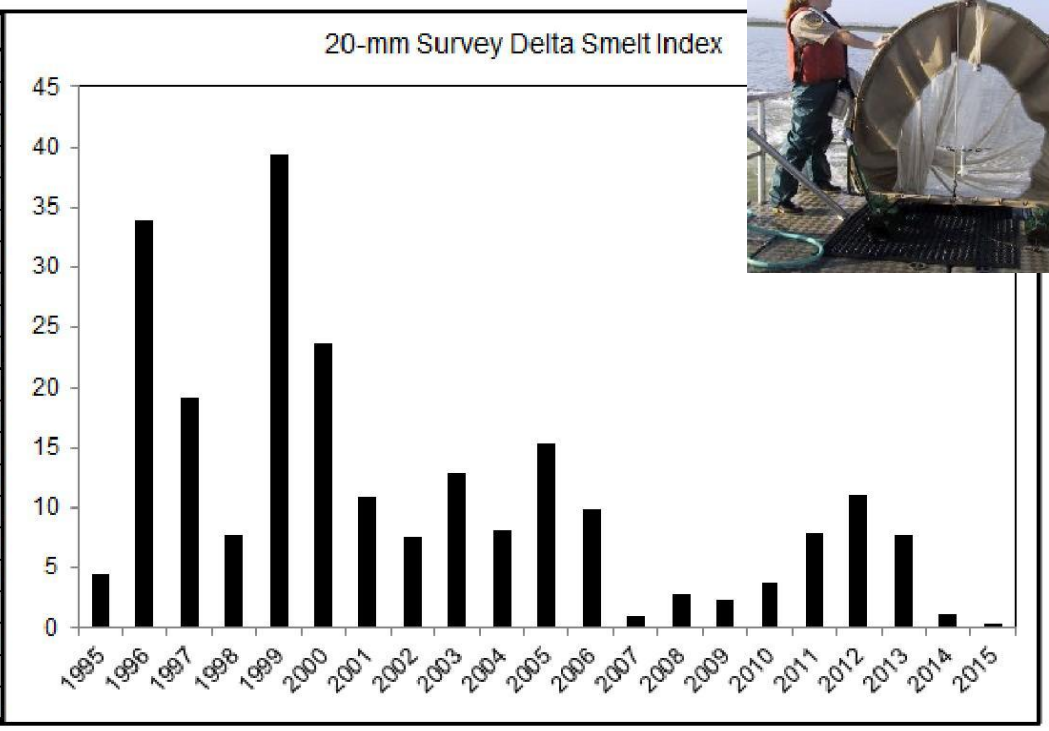
Year	Index
2002	N/A
2003	N/A
2004	99.7
2005	52.9
2006	18.2
2007	32.5
2008	24.1
2009	43.8
2010	27.4
2011	18.8
2012	130.2
2013	20.4
2014	30.1
2015	13.8



The CDFW's Spring Kodiak Trawl Delta Smelt index over the period of record, 2004-2015.

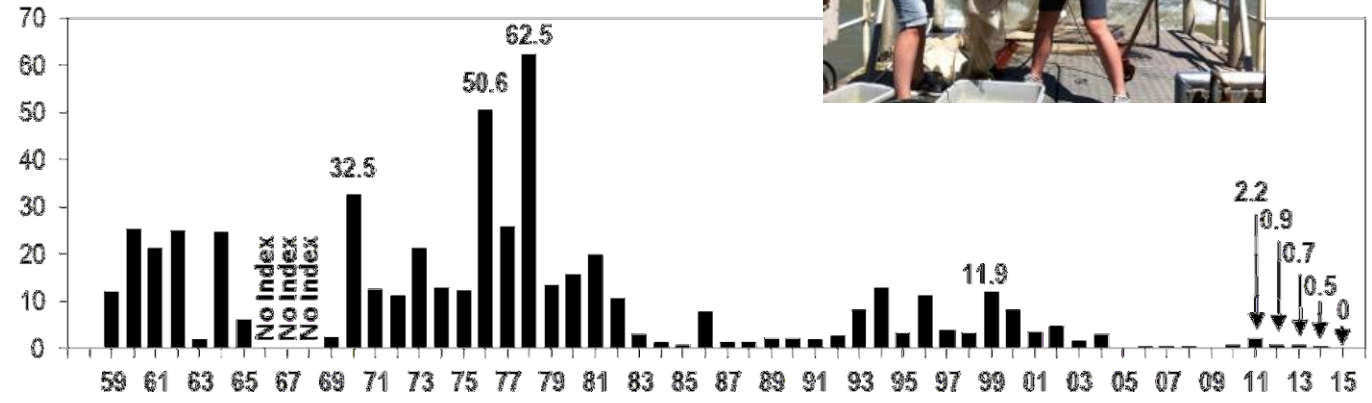
2015 Index of Delta Smelt Relative Abundance from 20-mm survey

Year	Index
1995	4.4
1996	33.9
1997	19.2
1998	7.7
1999	39.4
2000	23.7
2001	10.9
2002	7.7
2003	13.0
2004	8.2
2005	15.4
2006	9.8
2007	1.0
2008	2.9
2009	2.3
2010	3.8
2011	8.0
2012	11.1
2013	7.8
2014	1.1
2015	0.3



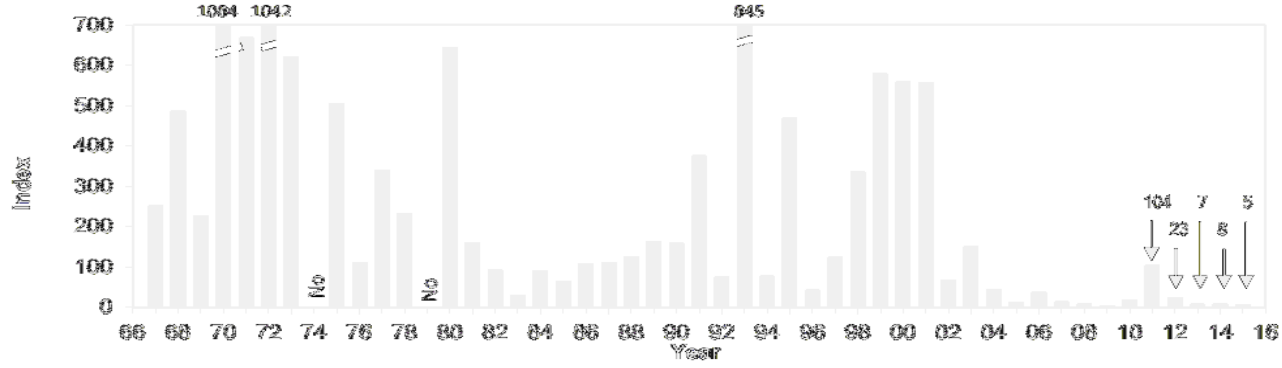
Delta Smelt index of abundance from CDFW's 20-mm Survey, 1995-2015.

2015 Index of Delta Smelt Relative Abundance from Summer Townet Survey

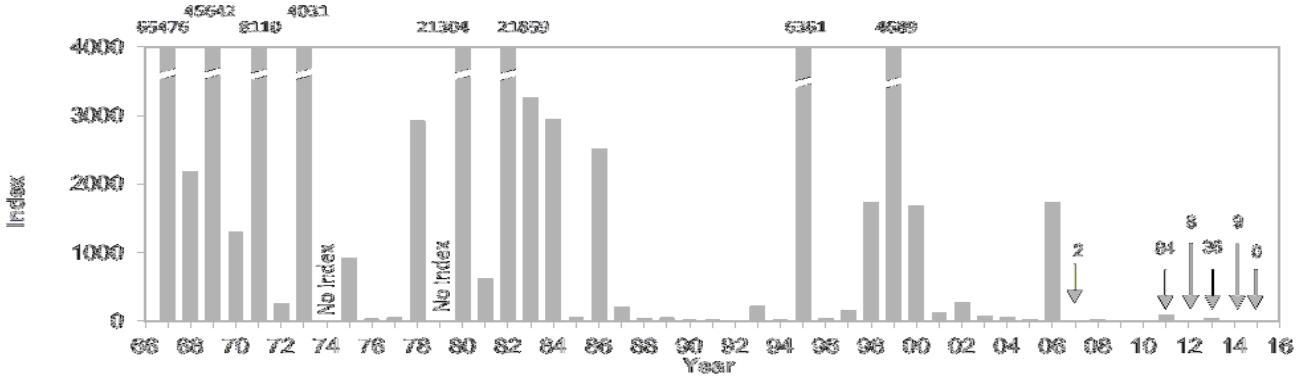


Summer Townet Survey Age-0 Delta Smelt Abundance Indices, 1959-2014

2015 FMWT
September-October Fish Abundance

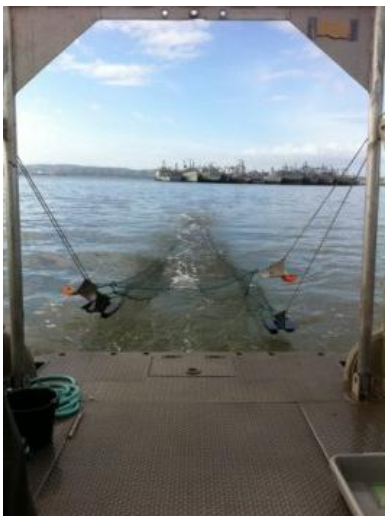


FMWT Delta Smelt September-October abundance indices, 1967-2015.



FMWT Longfin Smelt September-October abundance indices, 1967-2015.

2016 Smelt Monitoring



- December FMWT collected both Longfin and Delta smelt at index locations.
  - FMWT indices will be lowest on record for both species.
- Similar to 2015, an additional SKT 2016 sampling event will be conducted in December.
- Early Warning Sampling began on November 30th.

Temperature Management on the Sacramento River

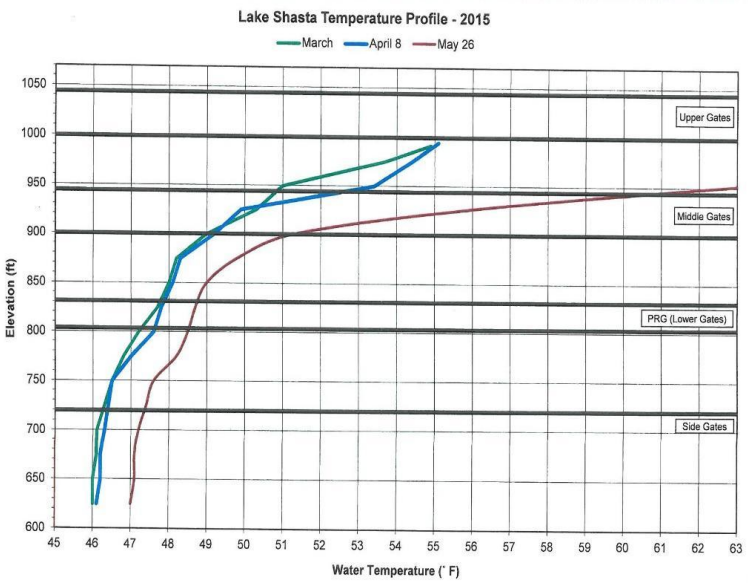
- Temperature management is critical throughout egg/alevin incubation
- Winter-run peak spawning typically occurs in the Sacramento River in May and June
  - Egg to fry emergence is ~80 days
- Fall-run peak spawning typically occurs in November in the Sacramento River

State Water Resources Control Board Workshop

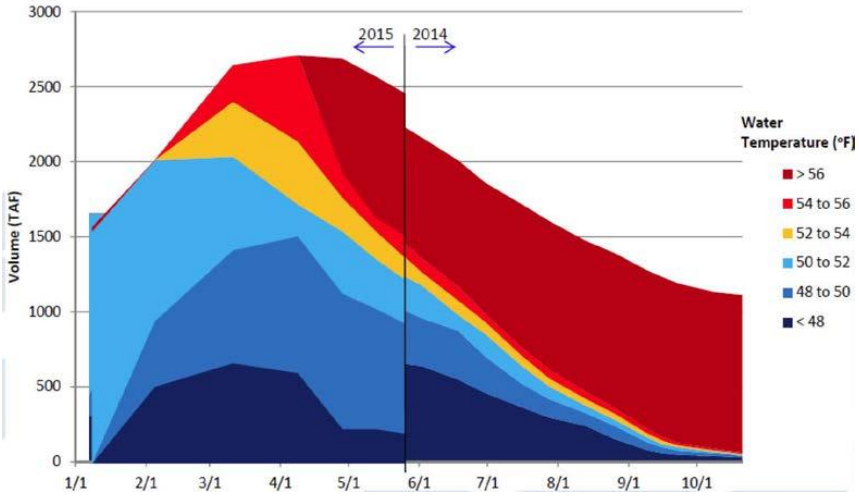
Fisheries Presentation

May 20, 2015

Updated May 2015 Shasta Lake profiles and isothermobaths



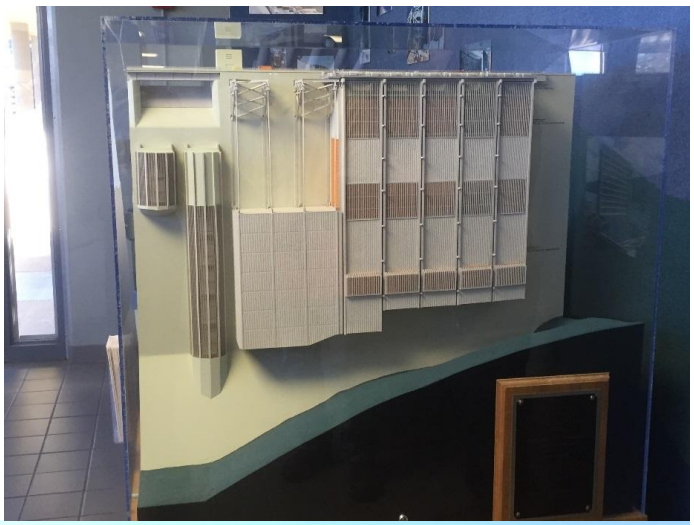
Lake Shasta Isothermobaths as of 5/26/15 (Water Temps in °F)

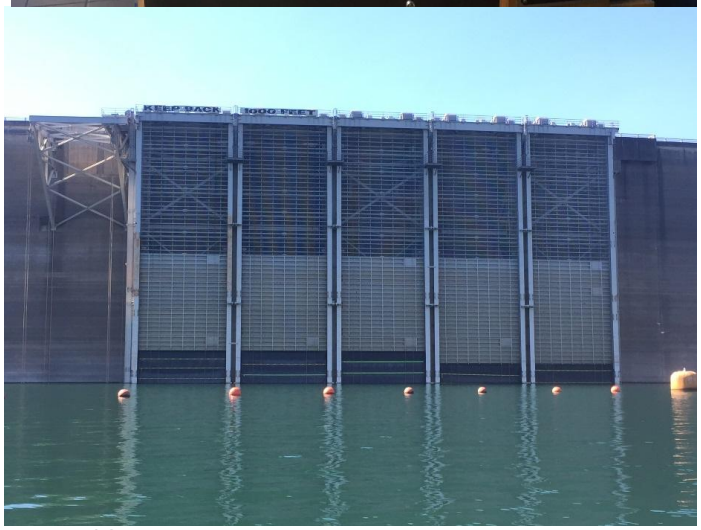


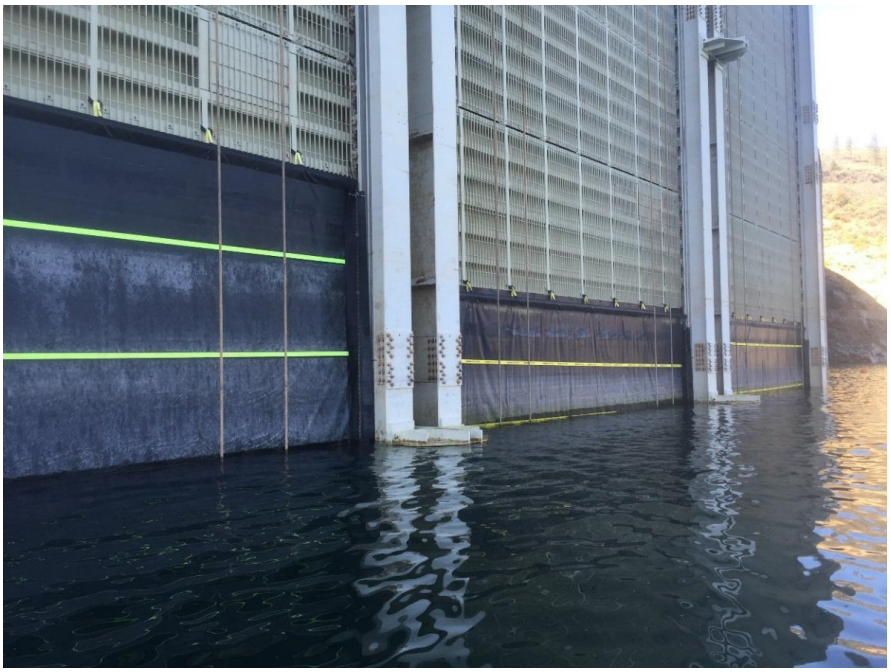
2015 Revised Sacramento River Temperature Management Plan (June 25, 2015)

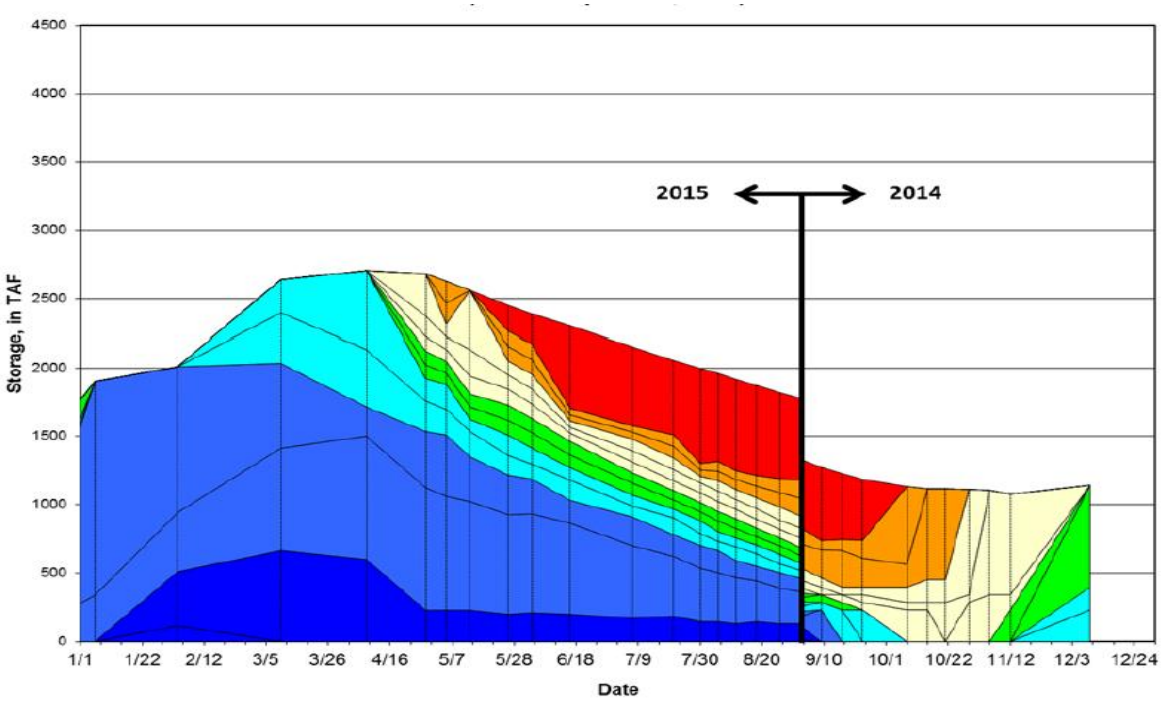
- Target 57° F at Clear Creek (CCR)
- Maintain Keswick releases of 7,250 cfs
- Delay full side gate operation as long as possible
- Optimize temperature using real-time monitoring and decision making
- Increase water temperature monitoring
  - Establish real-time Shasta/Keswick reservoir temperature profiles
  - Install new upstream temperature gage location
  - Deploy additional temperature sensors in river
- Increase redd monitoring
- Increase production and capacity at LSNF Hatchery
- Review temperature model for refinements

Installation of TCD curtains









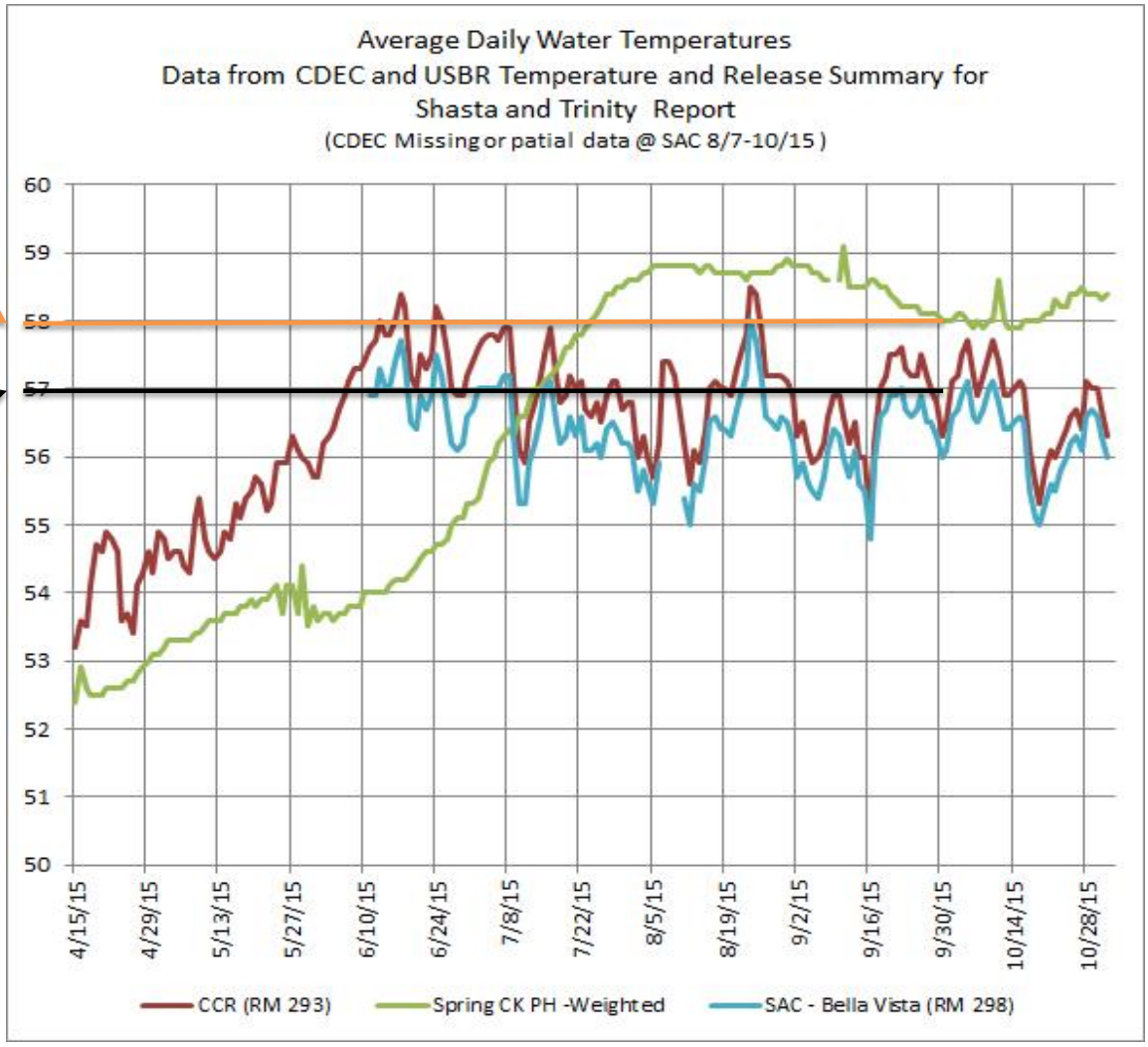
Lake Shasta Isothermobaths as of 9/3/15 (Water Temps in °F)

Credit: Rachel Hallnan/University of Nevada, Reno

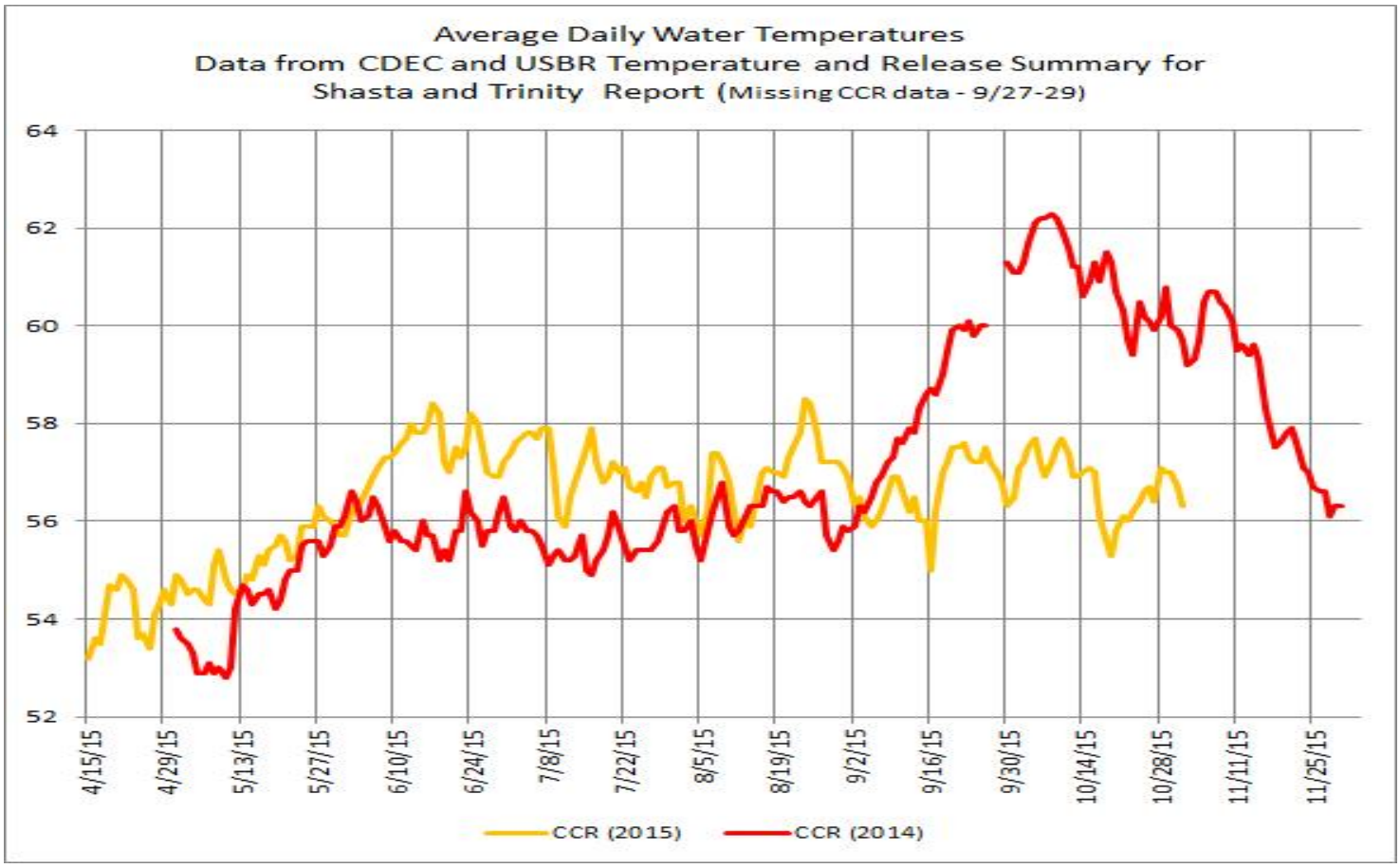
Temperature Deviations

58°F

57°F

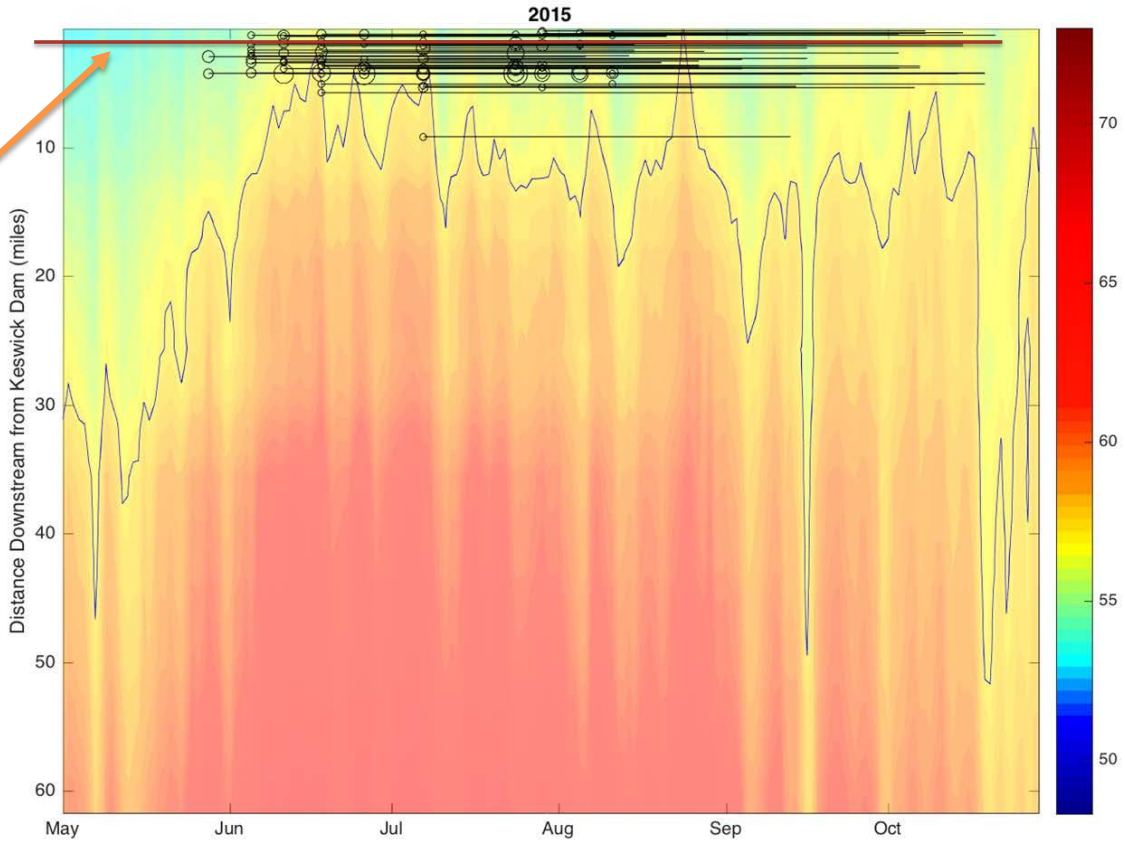


CCR comparison 2014 - 2015

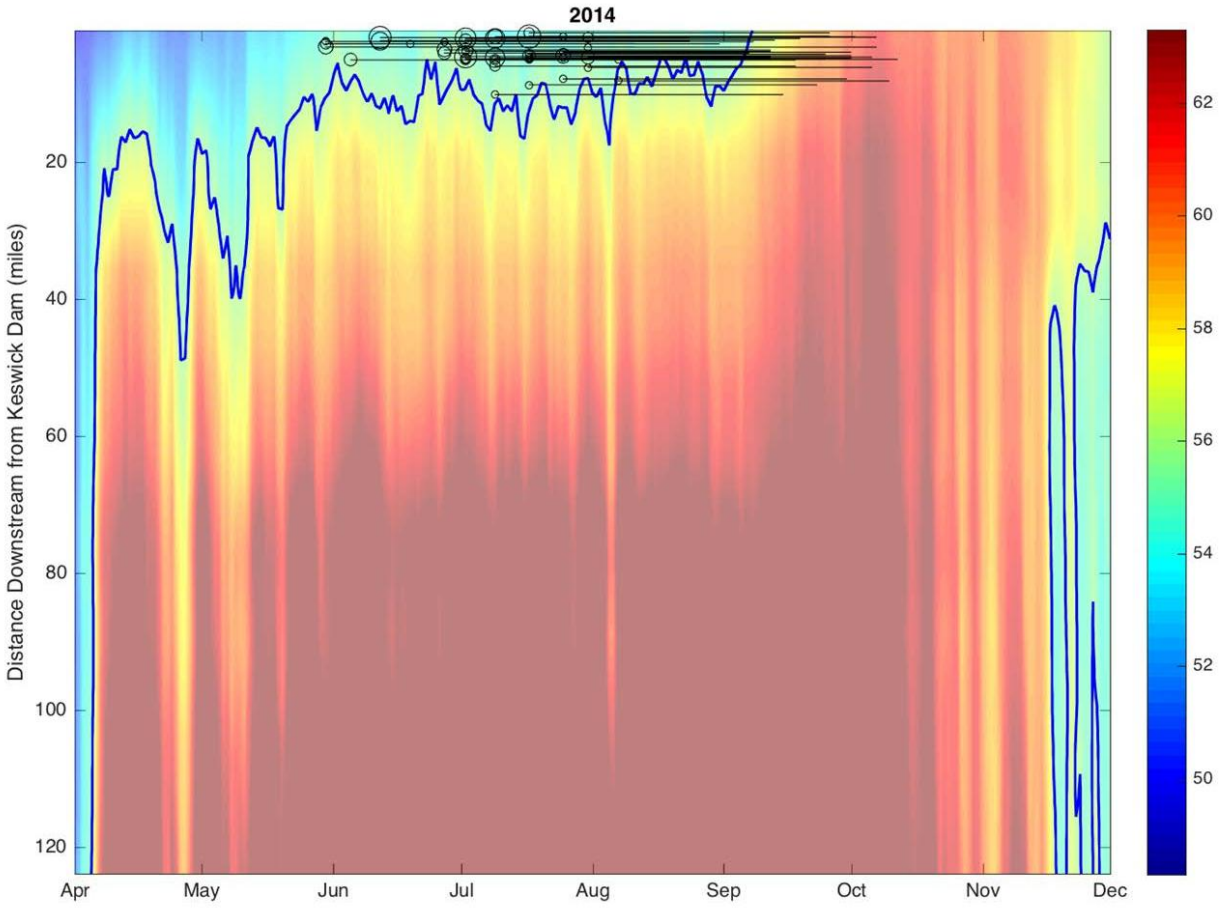


2015 Temperature Landscape and Redd Location

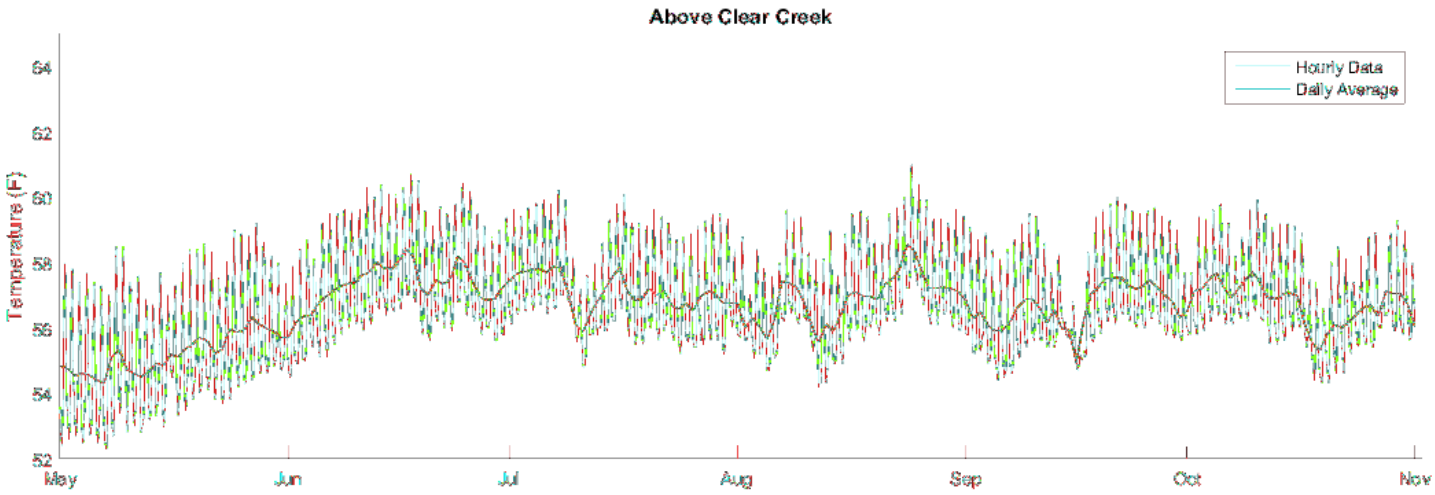
CCR



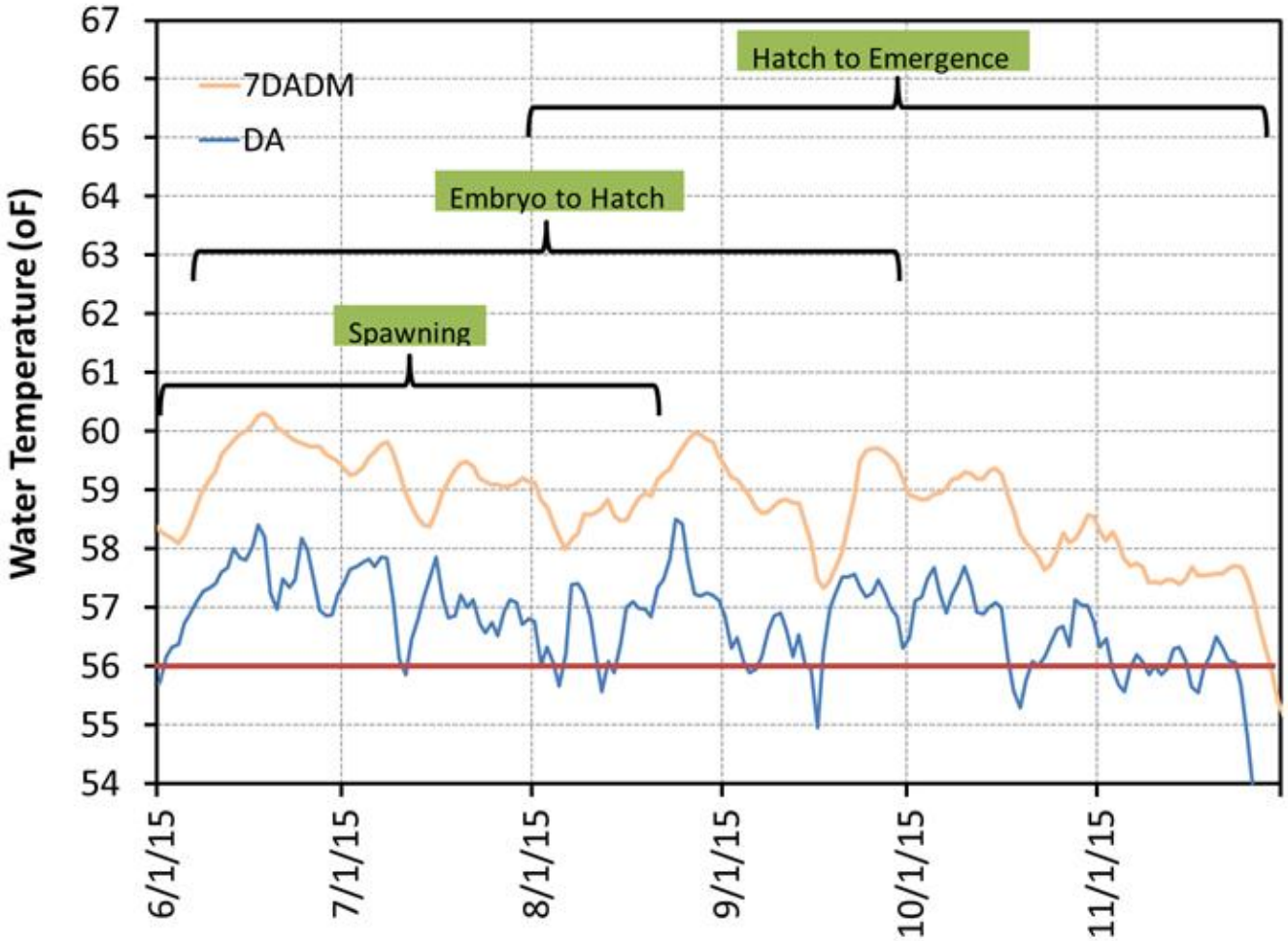
2014 High Temperatures Throughout the Sacramento River



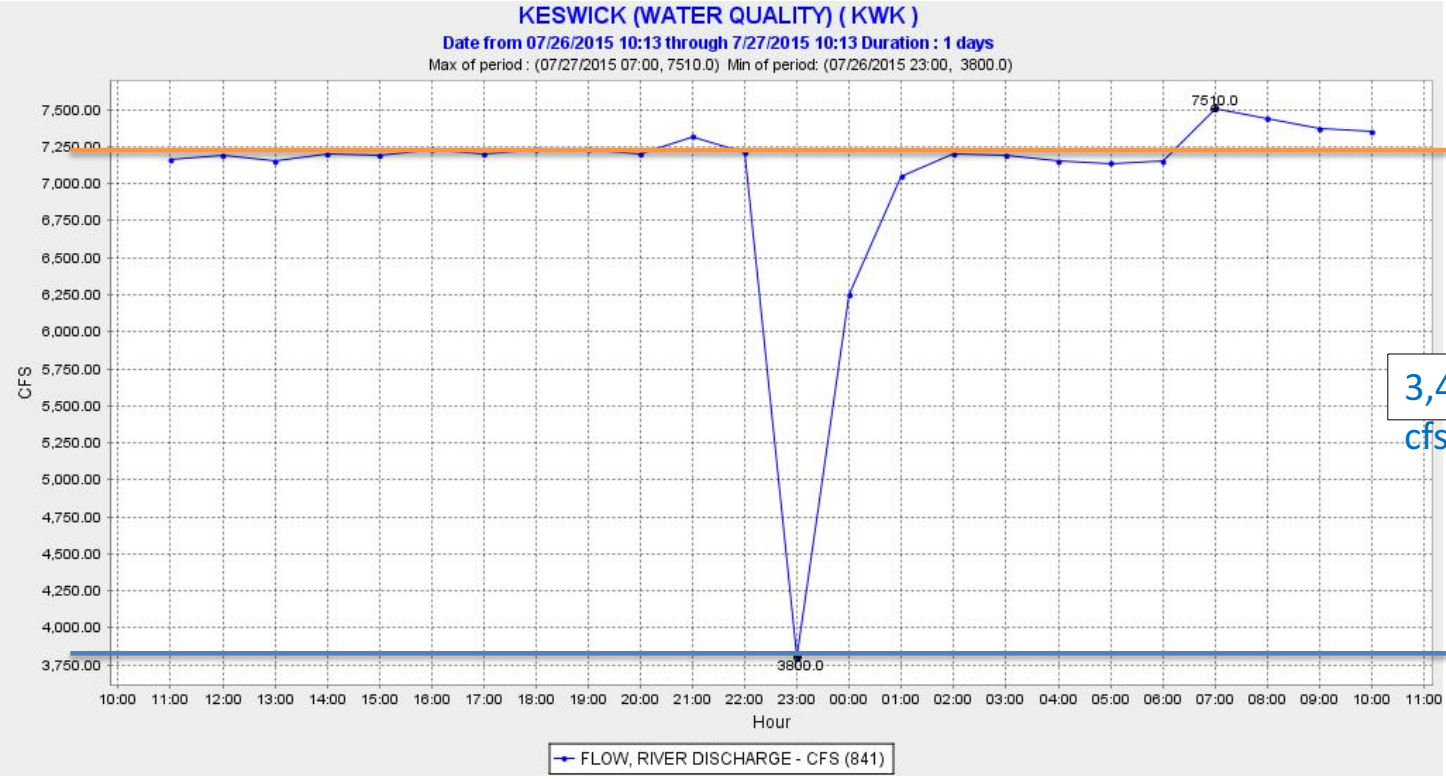
Temperature Variation



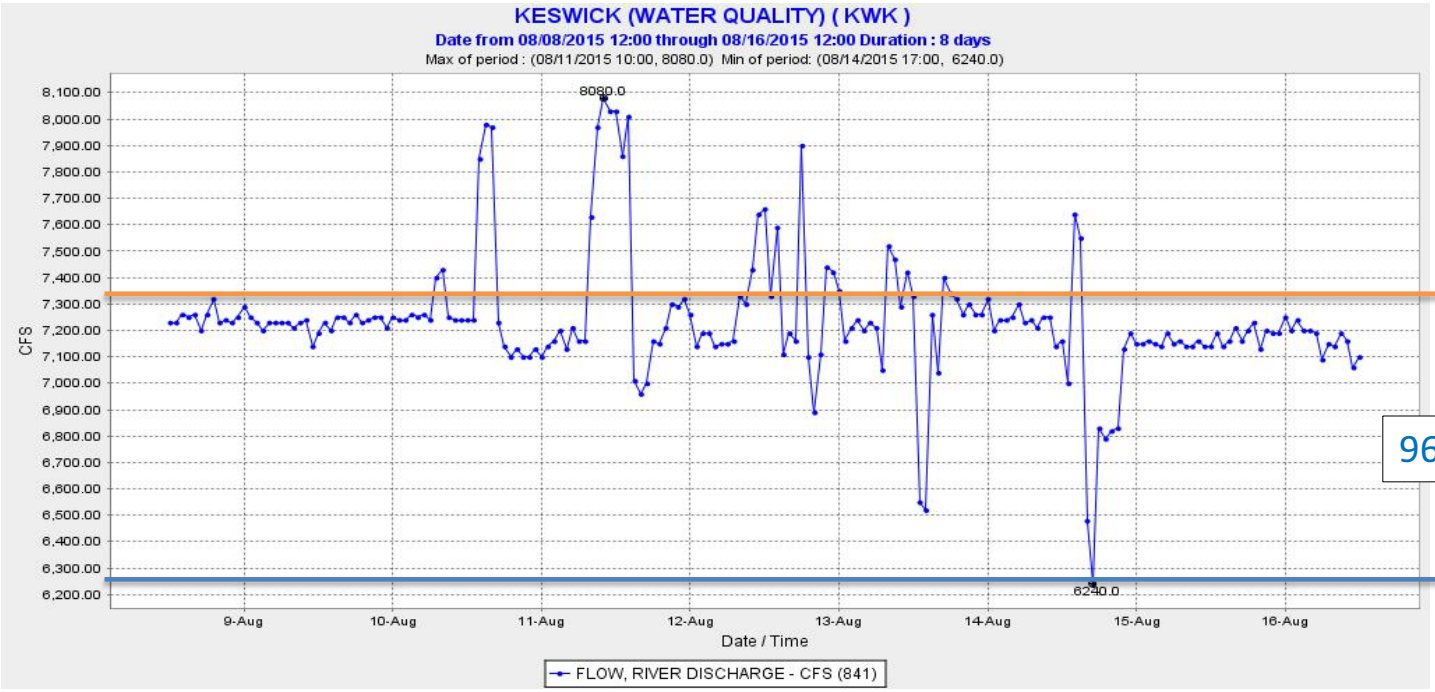
Temperature variation (cont'd)



Flow Fluctuations
Flow Interruption (7/26)

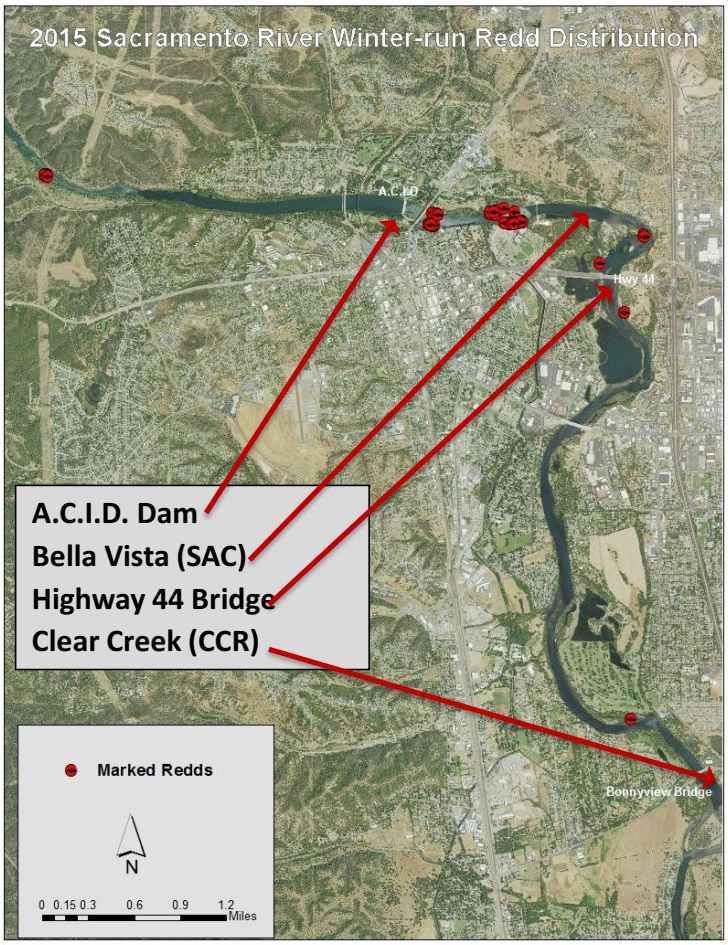


Flow Fluctuations
NERC Testing (8/10 -8/15)

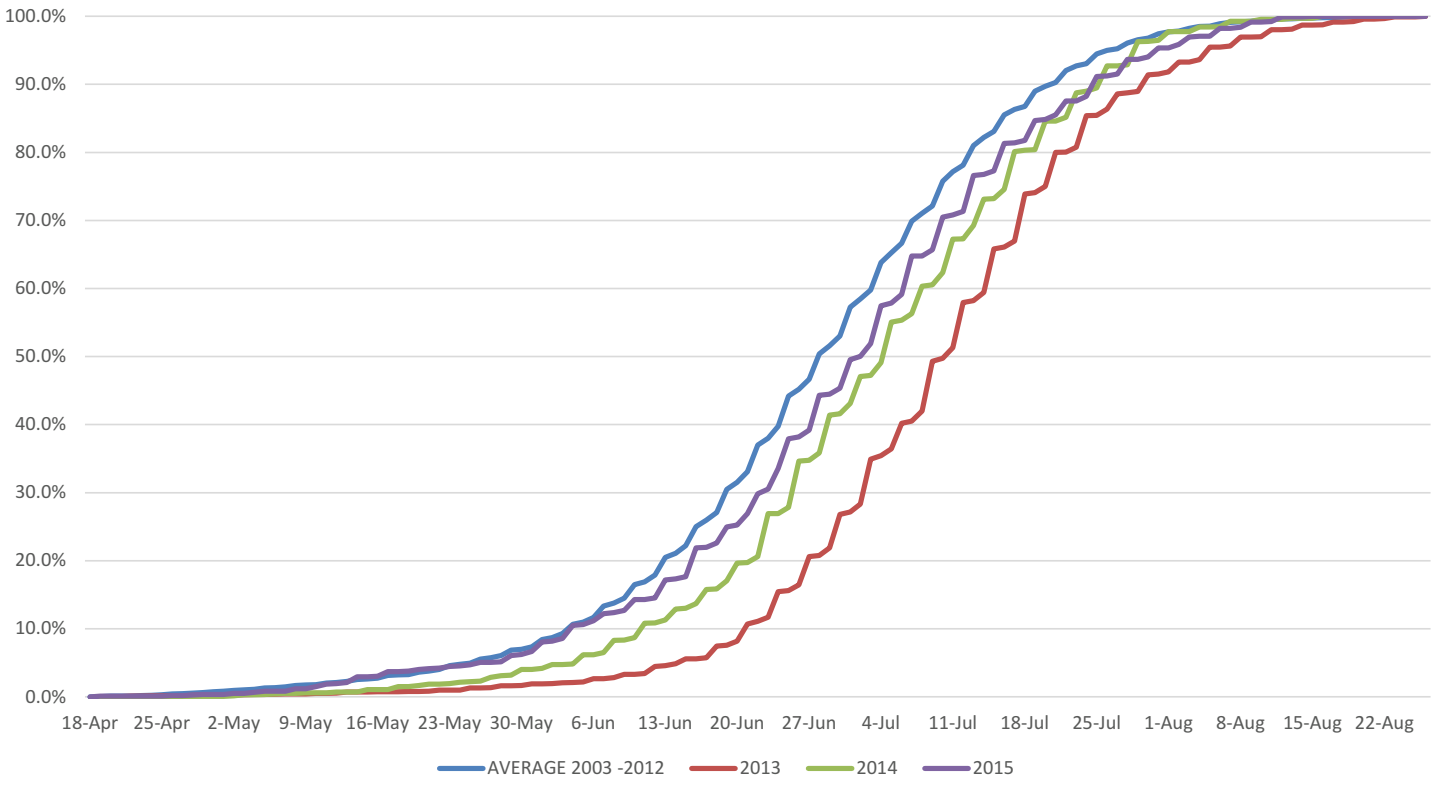


BY 2015 WR redds at 12” water depth or shallower

- 19 redds were found to be at a depth of 12” or shallower as of Aug 27 (@ 7,217 cfs)
- CDFW continued to monitor for redd dewatering and juvenile stranding
- no WR redds were dewatered this year



Proportion of WR spawning (Carcass survey) by date and year



Fish and Redd Location

2015 Winter-Run aerial Redd counts by river area			
Flight Sections	Redds	2015 Percent	% Average (2003-2014)
Keswick to A.C.I.D. Dam (RM 302 to 298)	74	37.8%	45.0%
A.C.I.D. Dam to Highway 44 Bridge (RM 296)	120	61.2%	42.1%
Highway 44 Br. to Airport Rd. Br. (RM 284)	2	1.0%	12.2%
Airport Rd. Br. to Balls Ferry Br. (RM 275)	0	0.0%	0.3%
Balls Ferry Br. to Battle Creek (RM 271)	0	0.0%	0.1%
Battle Creek to Tehama Br. (RM 229)	0	0.0%	0.3%
Total	196	100.0%	100%

[1] These two redds were located just downstream of the Hwy 44 Bridge close to rm 296.

2015 Winter-Run Carcass counts by river area			
River Section	Carcasses	2015 Percent	% Average (2003-2014)
Keswick Dam to ACID Dam (RM 302 to 298)	593	49.8%	35.4%
ACID Dam to Hwy 44 Brg (RM 296)	349	29.3%	39.6%
Hwy 44 Brg down to Clear Crk Powerlines (RM 288)	205	17.2%	21.8%
Clear Crk Pwrl to Balls Ferry Brg (RM 276)	44	3.7%	3.2%
Total	1191	100.0%	100.0%

Estimate of Juvenile Winter-Run Passage at RBDD

Year	Winter-run Fecundity (eggs per female)	Winter-run Population Estimate[1]			Red Bluff Juvenile passage estimate through 12/2
		In-river	LSNFH[2]	Total	
2014	5,308	2,627	388	3,015	381,019
2015	4,819	3,171	256	3,428	269,386
Dif 2015-2014	-489	544	-132	413	-102,201
Percentage	-9%	21%			-29.3%

[1] Population estimate is preliminary and may change

[2] LSNFH = Livingston Stone National Fish Hatchery

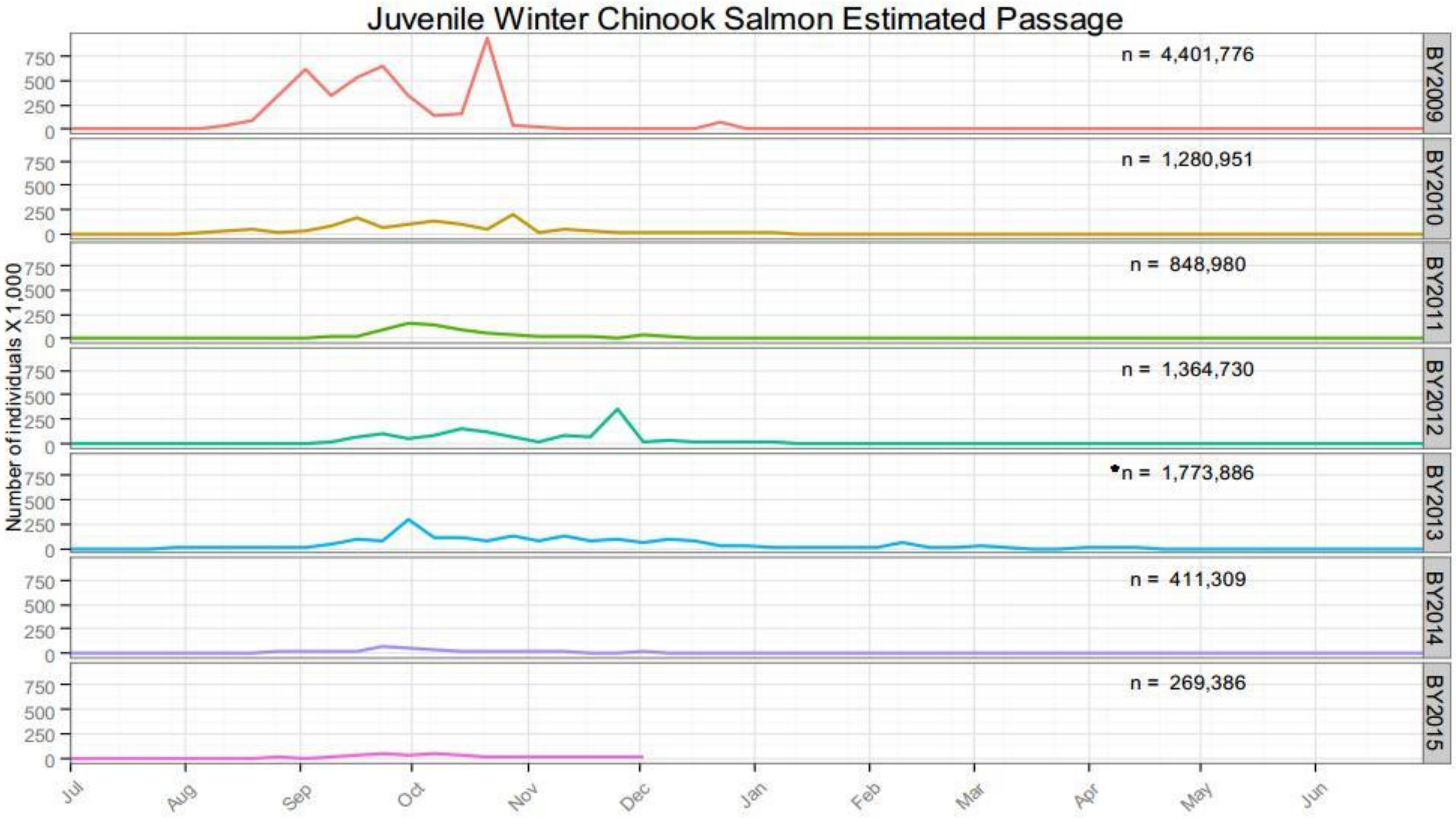
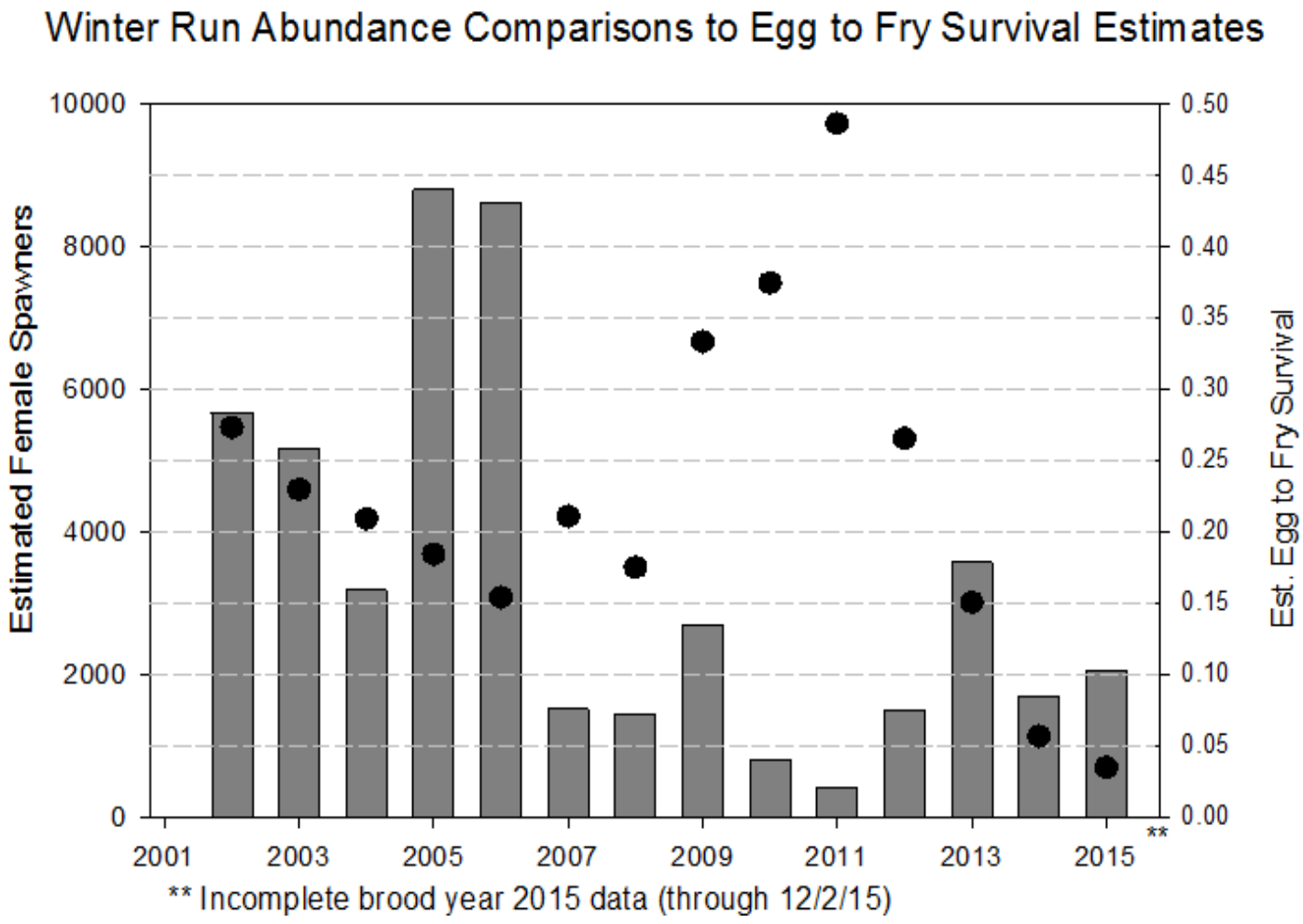
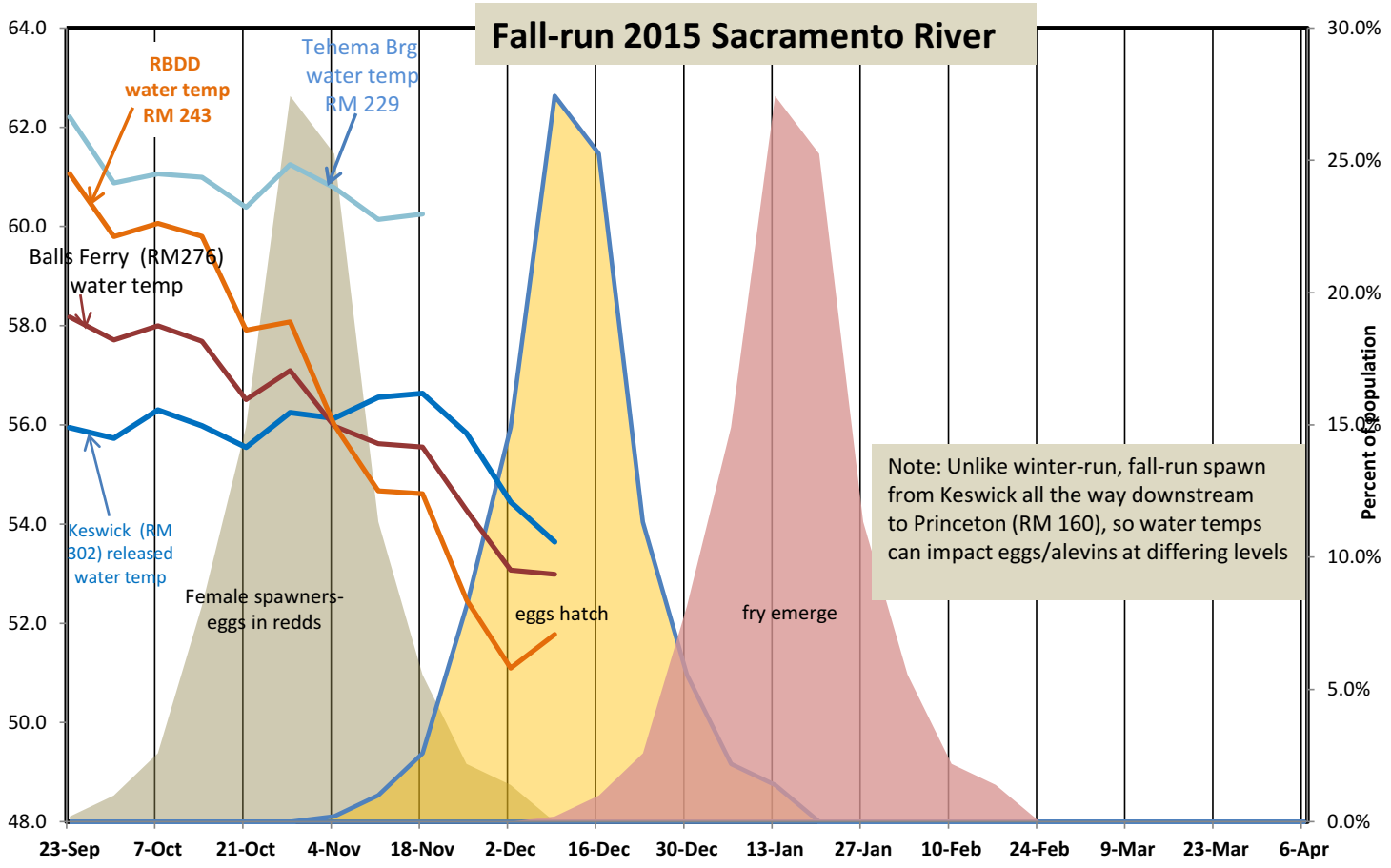


Figure 1. Weekly estimated passage of unmarked juvenile winter Chinook salmon at Red Bluff Diversion Dam (RK391) by brood-year (BY). Fish were sampled using rotary-screw traps for the period July 1, 2009 to present .

*Winter run passage value interpolated using a monthly mean for the period October 1, 2013 - October 17, 2013 due to government shutdown .

Figure taken from USFWS Biweekly report (November 13, 2015 – December 2, 2015)


Winter Run Abundance Comparisons to Egg to Fry Survival Estimates
Estimated Female Spawners
Est. Egg to Fry Survival
10000
8000
6000
4000
2000
0
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2001
2003
2005
2007
2009
2011
2013
2015
**
** Incomplete brood year 2015 data (through 12/2/15)


Fall-run 2015 Sacramento River
RBDD water temp RM 243
Tehema Brg water temp RM 229
Balls Ferry (RM276) water temp
Keswick (RM 302) released water temp
Female spawners-eggs in redds
eggs hatch
fry emerge
Note: Unlike winter-run, fall-run spawn from Keswick all the way downstream to Princeton (RM 160), so water temps can impact eggs/alevins at differing levels
Percent of population
64.0
62.0
60.0
58.0
56.0
54.0
52.0
50.0
48.0
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr

New Fish Disease Information in 2015

- Pilot effort started in summer/fall looking at possible fish disease impacts in the Upper Sacramento River.
- Late fall-run Chinook salmon:
  - 90% infected with the parasite Ceratomyxa shasta (Cshasta).
  - In the Klamath and Feather rivers, a higher infection rate for Cshasta has been associated with higher water temperatures and lower flows.
- Winter-run Chinook salmon:
  - 10% infected with Cshasta
  - 85% infected with kidney parasite that is an early indicator of future infection with Cshasta
  - 95% infected with ich
- Additional study is required to better understand the extent and geographic scope of the impact.

White Spot Disease

Independent Review Panel (IRP) Report for the 2015 Long-term Operations Biological Opinions (LOBO) Annual Science Review

A report to the
Delta Science Program

Prepared by

Dr. James J. Anderson – University of Washington
Dr. James A. Gore (Panel Chair) – University of Tampa
Dr. Ronald T. Kneib (Lead Author) – RTK Consulting Services & University of Georgia (Emeritus)
Dr. Nancy E. Monsen – Civil/Environmental Engineering Consultant
Dr. Geoffrey Schladow – University of California, Davis
Dr. John Van Sickle – U.S. Environmental Protection Agency, Western Ecology Division (Retired)

December 2016

Delta Stewardship Council
Delta Science Program

2009 CVP/SWP Operations Opinion and RPA: Action I.2.1 Performance measures

- End of September Shasta carryover storage on a 10-year running average:
  - 87% of years: Min 2.2 MAF
  - 82% of years: Min 2.2 MAF and End of April (EOA) storage of 3.8 MAF
  - 40% of years: Min 3.2 MAF

2009 CVP/SWP Operations Opinion and RPA: Action I.2.1 Performance measures (cont'd)

- Temperature compliance point on a 10-year running average:
  - Meet Clear Creek Compliance point 95 percent of time
  - Meet Balls Ferry Compliance point 85 percent of time
  - Meet Jelly's Ferry Compliance point 40 percent of time
  - Meet Bend Bridge Compliance point 15 percent of time

Take Home Messages

- Drought continues to have an effect on Smelt and Salmonid species in the Delta and its tributaries
- Given the continuing decline of Delta Smelt, protective measures under the 2008 BiOp will need to be implemented, if conditions warrant.
- Winter-run broodyear 2016 will be the 3rd of three cohorts. The last 2 had very low survival.
- Improve management tools in order to meet temperature requirements on the Sacramento River
- LOBO annual review recommendations
- 7DADM vs. daily average water temperatures
- NMFS' Opinion and RPA