UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District	)	
	)	
and	)	Project No. 2299
	)	
Modesto Irrigation District	)	

2003 LOWER TUOLUMNE RIVER ANNUAL REPORT

March 2004

List of Acronym and Abbreviations

AF	acre-feet, a measure of water volume
AFRP	Anadromous Fish Restoration Program (part of USFWS)
AMF	Adaptive Management Forum
AT	air temperature
BAWSCA	Bay Area Water Supply and Conservation Agency
CALFED	now known as California Bay-Delta Authority
CBDA	California Bay-Delta Authority
CCSF	City and County of San Francisco
CDEC	California Data Exchange Center
CDRR	combined differential recovery rate
cfs	cubic feet per second, a measure of flow rate
CRRF	California Rivers Restoration Fund
CSPA	California Sportfishing Protection Alliance
CWT	coded wire tag
CVP	Central Valley Project
CY	cubic yard
DFG	California Department of Fish and Game
CDFG	California Department of Fish and Game
DWR	Department of Water Resources
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FERC	Federal Energy Regulatory Commission
FL	fork length
FOT or FOTT	Friends of the Tuolumne
FSA	Don Pedro Project 1995 FERC Settlement Agreement
FWS	see USFWS
HORB	Head of Old River Barrier
HRI	harvest rate index
IEP	Interagency Ecological Program
IFIM	Instream flow incremental methodology
mm	millimeter

M&T	McBain and Trush (consultants)
MID	Modesto Irrigation District
NHI	Natural Heritage Institute
NMFS	National Marine Fisheries Service
NOAA Fisheries	also National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
ORNL	Oak Ridge National Laboratory
PFMC	Pacific Fishery Management Council
R(letter and/or #)	a specific riffle (location identifier, e.g. RA7 is Riffle A7)
RM	river mile
RST	rotary screw trap
SJRA	San Joaquin River Agreement
SJRMP	San Joaquin River Management Program
SPCA	S. P. Cramer and Associates (consultants)
SRP	Special Run/Pool (mined area of river – usually with a #, e.g. SRP 9)
SWP	State Water Project
SWS	Stillwater Sciences (consultants)
TID	Turlock Irrigation District
TRE	Tuolumne River Expeditions
TRPT	Tuolumne River Preservation Trust (also as Tuolumne River Trust)
TRTAC	Tuolumne River Technical Advisory Committee
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VAMP	Vernalis Adaptive Management Plan
WT	water temperature
WY	Water Year

- FERC PROJECT NO. 2299 -
2003 LOWER TUOLUMNE RIVER ANNUAL REPORT

2003 SUMMARY REPORT

Turlock and Modesto Irrigation Districts

By

Tim Ford
Aquatic Biologist

Exhibits:

1. Spawning run estimates
2. Ocean catch and harvest rate data
3. 2002 & 2003 screw trap data
4. Delta salmon salvage data
5. FSA program expenses through 2003

Attachments:

A. Water, Flow Schedule, Water Temperature, and Correspondence
B. 2003 Technical Advisory Committee Materials

1 – Introduction

This is the eighth annual report to the Federal Energy Regulatory Commission (FERC) as required by Order Items (F) and (G) of the 31JUL96 FERC Order on Project License 2299 and by Section 15 of the 1995 Don Pedro Project FERC Settlement Agreement (FSA).

This report covers the 2003 calendar year and contains:

(1) A summary of 2003 FSA activities, including meeting notes and materials from the Tuolumne River Technical Advisory Committee, and related items.

(2) Monitoring and other reports.

The License 2299 Article 58 reporting requirement calls for a summary report by 01APR2005 (i.e. the next annual reporting period). There are several technical reports noted within this annual report that will be available later in 2004 and the Districts may submit them prior to the summary report in 2005.

2 - Tuolumne River Technical Advisory Committee (TRTAC)

The TRTAC is a key element in implementing the 1996 FERC Order and the FSA. The TRTAC is responsible for coordinating monitoring activities and non-flow measures and developing adaptive management strategies. The TRTAC also provides input into flow schedule decisions by the Districts, CDFG, and USFWS.

Quarterly TRTAC meetings were held in 2003: 19MAR, 24JUN, 25SEP, and 17DEC. Included in **Attachment B** of this volume are materials related to those meetings as well as other TRTAC materials and correspondence. Several TRTAC subgroup meetings and conference calls were also held.

3 - Program Goals And Comparative Population Goals

FSA Section 8, the Strategy for Salmon Recovery, sets forth the Tuolumne River Chinook Salmon Program goals as (1) increase naturally occurring salmon populations; (2) protect any remaining genetic distinction; and (3) increase salmon habitat in the Tuolumne River. The program is to employ flow and non-flow measures and an adaptive management strategy.

Relating to FSA Section 8 Program Goal 1, FSA Section 9 recognized that many factors affecting the Tuolumne salmon population are beyond the control of the FSA participants. Thus the FSA established narrative comparative population goals: (1) Improvements in smolt survival and successful escapement in the Tuolumne River; (2) increase in naturally reproducing chinook salmon in this subbasin; (3) barring events outside the control of the participants to the settlement, by 2005 the salmon population should be at levels where there is some resiliency so that some of the management measures described herein may be tested, on an experimental basis.

This annual report provides information on the progress in implementing the FSA strategy and meeting the FSA goals. More detailed background is provided in the summary updates in Reports 2003-1, 2, and 3, and in other sections, to further gauge progress.

3.1 - Salmon Population

The preliminary 2003 Tuolumne fall-run chinook population estimate is about 2,900 salmon, a decrease from the 7,100 salmon estimated for the 2002 run (**Exhibit 1,** see also Report 2003-1). The 2003 run consisted of salmon from several age classes, mostly 2-5 years old, which are progeny from the 1998-2001 runs that mostly outmigrated as juveniles in the winter/spring of 1999-2002. The estimated contribution by age-class based on length frequencies is not yet available for the 2003 run, but DFG will issue their 2003 spawning survey report later this year. About 20% of the 2003 run had an adipose fin clip, indicating they were likely hatchery salmon with a coded-wire tag (CWT) – this was down from the 2002 run. Run estimates for the Stanislaus and Merced Rivers were also down, resulting in a combined 3-river total of about 11,000, as compared to about 24,000 in 2002.

A counting weir was employed for the first time on the Stanislaus River, just to the north of the Tuolumne River. Estimates from the weir operation can be compared to the carcass survey estimates derived from different calculation formulas, which potentially may lead to revision of some previous estimates on other rivers, including the Tuolumne. For example, the Stanislaus weir count was closer to the lower estimate from the carcass survey obtained using the Jolly-Seber formula than the higher estimate using the Schaefer formula, the method typically used by DFG for basin estimates. There has been some prior information developed by DFG, however, suggesting that the Jolly-Seber method should not be applied to runs of less than 3,000 salmon.

Production is the total of harvest plus escapement for a given brood year (cohort). This is obtained by summing up for several years (e.g. from 2-5 years following a given fall run for the Tuolumne) the annual numbers from a single cohort. That is, the estimated harvest by cohort, plus the estimated run component by cohort. The harvest component of the Tuolumne can be approximated using the overall Central Valley Harvest Rate index. The run component also can be approximated, generally based on size distribution, which typically overlaps by age class and can vary from year to year due to factors such as ocean conditions or hatchery production. The length of known-age salmon, typically tagged salmon of hatchery origin, can be used to assist in the assignment of age classes from the carcass length data. The Districts hope to obtain such information from DFG for use in refining age class distribution of the runs and hence, adult production estimates. Although the production numbers are inherently imprecise, they can be useful for identifying general trends and overall survival.

Hatchery fish can complicate, if not prevent, the development of natural production estimates in several ways. Most of the known hatchery-origin salmon in Tuolumne salmon runs are typically CWT Merced River hatchery fish used in Tuolumne smolt survival studies (Report 2003-3). Returns of prior CWT releases made through 2002 in the Tuolumne can be expected through

2006, although the percent in the run may go down as CWT releases in the Tuolumne ended in 2002.

3.2 - Outside Factors

The FSA (Section 10) recognized there are many factors outside the control of the Districts or outside the Tuolumne River that affect the Chinook salmon population, including juvenile mortality associated with south Delta water export operations and the ocean salmon catch. Many other outside factors, such as ocean conditions and San Joaquin River water quality, including periods of low dissolved oxygen levels near Stockton, can also affect salmon populations. Some of these outside factors are discussed in this section.

3.2.1 - Ocean Harvest

Preliminary 2003 ocean harvest and Central Valley escapement (spawning run) data are available from the Pacific Fishery Management Council (PFMC 2003). The PFMC reported a lower 2003 ocean catch of 307,600 Chinook salmon landed south of Pt. Arena as compared to 447,600 in 2002. The estimated 2003 Central Valley total "adult" escapement (including hatchery) of 594,700 salmon (539,600 fall run) was lower than the 844,400 (806,900 fall run) estimated for 2002. 2003 was still the third-highest escapement total since1970, and the hatchery total (number spawned in hatcheries) for fall run in the Sacramento basin was the highest in that period (108,500 of 519,600 total).

These catch and escapement values resulted in an estimated Central Valley "Harvest Rate Index" (HRI) of 34% in 2003 (307,600 of 902,300), nearly the same as in 2002. The HRI has been much lower in the last six years (range of 26-55%) than in the nine-year period from 1987-95 (range of 71-79%). Graphs of the PFMC data are in the **Exhibit 2**. The portion of total California Chinook landings made south of Pt. Arena dropped sharply in 2003, mostly as a result of higher landings at Fort Bragg to the north. River-specific ocean harvest data are not available for this mixed-stock fishery.

3.2.2 - Salmon Salvage and Losses at Delta Water Export Pumps

Natural/unmarked salmon salvage and losses for JAN-JUN at the State (SWP) and Federal (CVP) Delta water export facilities were higher in 2003 than in 2002, mostly due to increases at the SWP. Salmon salvage data for JAN-JUN, monthly, and weekly periods are in **Exhibit 4**. Combined facility estimates for JAN-JUN2003 were 23,923 salmon salvaged and 57,498 in losses. Density (shown as number/1000 AF) was highest in APR at both facilities. The reported numbers do not include associated indirect losses within the Delta and the salvage and loss estimates for fry (mostly in JAN-MAR) are probably low due to reduced screening efficiency. It is not certain to what extent these salmon were from the San Joaquin basin as there is presently no method to ascertain specific origins. However, comparison of salmon size and timing with tributary and mainstem seine, screw trap, and trawl catch data can indicate the potential interception of San Joaquin basin salmon at the facilities.

Few salmon <70mm were evident at the facilities prior to about 12MAR, indicating that early fry/juvenile migration was low out of the San Joaquin system in 2003, with the exception of an early FEB increase associated with a small pulse flow on the Stanislaus River. The daily graph of length for salvaged salmon showed an extended salvage period of larger juveniles/smolts (70-110 mm) from mid-MAR to early JUN.

Salvage and loss data on weekly intervals is again presented to better identify patterns before, during, and after implementation of salmon protective measures, e.g. the Head of Old River Barrier (HORB – a temporary rock barrier, with six culverts, installed for improving survival of migrating juvenile San Joaquin River salmon) and reduced exports in mid-APR to mid-MAY. The highest salvage and losses mostly occurred during the three weeks prior to VAMP (period of March 23 to April 12) when combined exports averaged 7,500-10,900 cfs.

3.2.3 - SJRA/VAMP

CWT hatchery salmon releases to evaluate San Joaquin Delta smolt survival began in 1986. Feather River Hatchery (Sacramento basin) salmon were used during 1989-98 and Merced River Hatchery salmon have been used in 1986, 87, 89, and 1996-2003. A spring HORB has been installed for varying periods in 1992, 94, 96, 97, and 2000-2003. Culverts have been placed in the barrier since 1997 to pass limited flows into Old River for irrigation needs. Chipps Island has been a CWT salmon recovery trawl location in all years and an additional trawl site has been either at Jersey Point (1997-99) or Antioch (2000-2003).

The San Joaquin River Agreement (SJRA) and the Vernalis Adaptive Management Plan (VAMP) are elements for meeting the objectives of the 1995 State Water Resources Control Board (SWRCB) Bay-Delta Water Quality Control Plan over a 10-12 year period. 2003 was the fourth year of formal compliance with SWRCB Decision 1641, revised in MAR2000. The program includes a 31-day period, usually mid-APR to mid-MAY with an experimental combination of salmon protective measures: HORB, specified San Joaquin River flows at Vernalis, and reduced State and Federal delta exports. An additional Tuolumne River spring pulse flow volume of up to 22,000 acre-feet (AF) from TID/MID, supplemental to the FERC pulse allocation, can be required under the SJRA to help meet target flows at Vernalis. More spring pulse flow may also be added to the Tuolumne River through a water sharing arrangement with other parties to the SJRA.

As reported by the San Joaquin River Group Authority (2004), a HORB with 6 operable culverts was again installed in 2003. During the 15APR-15MAY period, the target flow at Vernalis was 3,200 cfs and the combined export target was 1,500 cfs during that 1-month period – same as in 2002. Only 3 of the HORB culverts were open as those were sufficient to meet downstream water needs in 2003. About 58,065 AF of total SJRA supplemental water were released for the VAMP pulse flow period, including 9,729 AF in the Tuolumne River.

"Absolute survival" indices for Mossdale and Durham Ferry releases to Jersey Point (recovered at Antioch and Chipps Island) were all very low this year and ranged from 1.4 – 4.3% (average = 2.6%). The overall "combined differential recovery rate" (CDRR) of 1.9% was also very low. There is some speculation that high disease levels, in combination with other factors, may have contributed to low survival in 2003, although that has not been determined. The CDRR of 15.1-19.1% for the 3 preceding years are indicative of relatively low spring Delta survival for the brood year 1999-2002 salmon cohorts that will be returning to the basin over the next few years. Furthermore, the spring conditions of flow and export anticipated for 2004 in the Delta, which will bear on the spring survival on brood year 2003, looks to be in range of those in 2001-2003. Low winter flows throughout the basin during 2001-2003 also means that few fry migrated out of the tributaries in those years, as evidenced by seine, screw trap, trawl, and salvage data.

3.3 - ESA Actions

National Marine Fisheries Service (NOAA Fisheries) determined "threatened" status for anadromous forms of rainbow trout (steelhead), *Oncorhynchus mykiss,* in the California Central Valley ESU in 1998 (63 FR 13347). Several parties, including the Districts, in DEC2002, filed a lawsuit against the listing. Some general NOAA Fisheries actions in 2003 regarding listed steelhead ESUs throughout the West Coast included:

- Solicited comments through 14FEB on the relationship of resident rainbow trout and steelhead: http://www.nwr.noaa.gov/HatcheryListingPolicy/SRSoCalFRN.html
- 25FEB – requested agency comments on draft Part 1 of updated status review: http://www.nwr.noaa.gov/BRTdraftreport/BRTdraftreport.html
- 19AUG -- Updated schedule for completing the status reviews of 26 populations of West Coast salmon and steelhead by MAR2004
- 29SEP – published advance notice of proposed rulemaking and schedule for ESA Critical Habitat Designations for 20 ESUs of salmon and steelhead: http://www.nwr.noaa.gov/1salmon/salmesa/crithab/anprpg92903.htm
- 30SEP – updated its 4(d) Rule Implementation Binder http://www.nwr.noaa.gov/1salmon/salmesa/final4d.htm

Several other measures were specific to the Don Pedro Project and involved FERC staff and consultants, the Districts, and other parties, as NOAA Fisheries requested formal consultation on steelhead in regards to project operations. These were a continuation of prior activities on this subject in recent years and included additional trout data exchange amongst the parties and TRTAC involvement. The 2003 actions included:

- 06MAR – FERC letter to Districts in response to 19NOV2002 letter from NOAA Fisheries requesting Section 7 consultation.
- 18MAR – Distribution to the TRTAC of the summer habitat assessment requested by NOAA Fisheries and prepared by SWS (dated 14MAR).
- 31MAR – Districts letter to FERC in response to 06MAR letter, agreeing to act as non-federal representative in consultations.
- 12MAY – NOAA Fisheries petition filed with FERC to modify flows for steelhead, modify project operations, and initiate formal consultation. "Conservation Groups", represented by Natural Heritage Institute (NHI), and the Friends of the Tuolumne, filed supporting briefs in JUN.
- 26JUN – Districts submitted to FERC their response to the NOAA Fisheries petition.

- 06AUG – Initial meeting at NOAA Fisheries office in Sacramento of Districts, FERC staff and ORNL consultant, NHI, and FOT.
- 28AUG – Letter from FERC staff to Districts requesting specific rainbow trout/steelhead information.
- 09OCT –Districts' first response to FERC's 28AUG request for information; contained an initial tabulation of O. mykiss data and SWS IFIM/WT model output using FERC's suggested temperature criteria.
- 19NOV – 2nd meeting held at NOAA Fisheries office in Sacramento
- 01DEC –Districts second response to FERC's 28AUG request for information; contains presentation and analysis of all available O. mykiss data for the lower Tuolumne River
- 04 and 19DEC – Conference calls with FERC staff, NOAA Fisheries, Districts, and other parties.
- 22DEC – FERC issued an order deferring action on the NOAA Fisheries petition pending completion of the ongoing informal consultation process (involving the TRTAC and other parties)

For other fishes, NOAA Fisheries maintained the "candidate species" status of the California Central Valley Fall/Late Fall-Run chinook salmon (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit (ESU) as determined in 1999 (64 FR 50394). The USFWS removed the Sacramento splittail (*Pogonichthys macrolepidotus*) from the list of "threatened" species in September.

4 - Flow Schedules And Operations

Calendar year 2003 included minimum flow and pulse flow requirements of Article 37 spanning the 2002-2003 and 2003-2004 "fish flow year" schedules, which are typically from about 15APR-14APR, although some spring pulse flow may begin as early as 12APR to coincide with timing of flow needs at Vernalis on the San Joaquin River. **Attachment A** of this volume contains the FERC flow schedule correspondence. The 2003-2004 "fish flow year" was the third consecutive year with an annual Article 37 flow requirement of less than 300,923 AF; the final scheduled flow volume based on license provisions was 192,859 AF.

The 2003 calendar year included part of the 2003 and 2004 "water years (WY)" which run from OCT-SEP. WY2003 (OCT2002-SEP2003) Tuolumne River computed natural runoff volume was 86% of the WY1897-2003 average. The April 1 San Joaquin Basin 60-20-20 Water Supply Index 50% Exceedence Forecast (2.153 in 2003) was used to initially determine the water year classification and corresponding Article 37 annual minimum required streamflow volume at 126,064 AF, with 32, 619 AF for spring pulse. The WY2003 San Joaquin Basin 60-20-20 Water Supply Index increased during season and ended up at 2.815, based on the provisional data through JUL2003. This basin index increase from the April 1 forecast was mainly the result of a wet April and necessitated "true-up" adjustments to the flow schedule, resulting in additional flow that was added by agreement for most of the fish flow year from 20MAY on. The daily average computed natural flow, actual La Grange flows, and FERC minimum flow schedules for WY2003/2004 are graphed in **Attachment A**. Actual flows at other basin locations, Don Pedro

Reservoir storage, and snow and precipitation data used in forecasting are included as well.

Base flow requirements were generally 150 cfs from 15APR through MAY, 75 cfs from JUN through SEP, 200 cfs from 01-15OCT, and 150 cfs from 16OCT on. Operational flows due to winter flood space requirements in Don Pedro Reservoir did not occur and the 12APR-16MAY period within the spring pulse flow had 9,729 AF of additional water for implementation of the SJRA/VAMP. The fall pulse flow was augmented and spread out over a 15-day period from 16-30OCT. Much of the summer flow period was operated with a flow requirement of 195 or 235 cfs, varying with air temperature forecasts (Report 2003-4).

5 - Monitoring Information

FERC License 2299 Article 58 and FSA Section 13 list several monitoring elements. Article 58 specifies that the monitoring frequencies and methods shall be agreeable to the Districts and consulted agencies. Section 13 provides the TRTAC with authorization to modify the monitoring program within the total Section 13 funding limit of $1,355,000.

5.1 – Salmon Spawning Escapement

The California Department of Fish and Game (CDFG) conducts the spawning surveys under FSA Section 13a. This year assistance from the Districts was needed to conduct the surveys. The CDFG report for the 2003 spawning run will be available later this year - the long-term update based on currently available data is in Report 2003-1.

5.2 - Quality and Condition of Spawning Habitat

A consultant's report on previous work associated with emergence in artificial redds as part of a fine sediment assessment is pending. CDFG will complete their 1999 redd count comparison study report later in 2004.

5.3 - Relative Salmon Fry Density/Female Spawners

Tuolumne River peak salmon fry density from seining in 2003 was similar in timing (early FEB) to 1998-2002 and the highest in the 1998-2003 period (Report 2003-2). Fry density was also higher for the number of female spawners than in other comparable years.

5.4 – Salmon Fry Distribution and Survival

Sustained low flows in JAN-MAR resulted in little movement of salmon fry (<or=50 mm) below Dry Creek (lower river section) or to the San Joaquin River as evidenced by seine monitoring (Report 2003-2). Screw trap sampling at Grayson Ranch in 2003 was limited to the APR-JUN period in 2003, when fry are not as abundant. However, few fry were caught in 2002 during the FEB-MAR screw trap monitoring under similar conditions (**Exhibit 3**). CDFG reports for 1998, 2002, and 2003 screw trap sampling will be available later in 2004.

5.5 - Juvenile Salmon Distribution and Temperature Relationships

Seine sampling monitored the winter/spring distribution of juvenile salmon (>50 mm) and other fishes in the Tuolumne River (Report 2003-2). Peak juvenile density was in late MAR and at a level similar to 1999.

The TRTAC selected to fund DFG to conduct rotary screw trap monitoring at Grayson Ranch for APR-MAY in 2003. As noted in 5.4 above, CDFG screw trap reports will be available later in 2004; however, preliminary data graphs for 2002 and 2003 are in **Exhibit 3**. The two peak daily catches of natural smolts in 2002 were associated with rapid flow increases as was the first peak catch in 2003. The secondary peak in 2003 followed a flow decrease. Size of natural smolts was similar in both years.

Snorkel surveys in JUN found about 537 Chinook salmon and 101 rainbow trout. A comparable SEP snorkel survey recorded 13 Chinook salmon and 71 rainbow trout. This followed the variable summer flow operation reviewed in Report 2003-4.

The daily average thermograph data are shown in **Attachment A.**

5.6 – Salmon Smolt Survival

There were no CWT smolt survival releases made in the Tuolumne River in 2003, but ocean and adult returns from earlier releases made through 2002 will continue coming in through about 2006. The graphs in **Exhibit 3** show that screw trap catch of CWT smolts in 2002 dwarfed those of naturally produced (unmarked) salmon. Report 2003-3 updates the CWT recovery information and survival estimates. An analysis of the validity of the 2002 test, based on Mossdale recoveries as has been done for 1987-2001 releases, will be available later this year.

Appendix A of Report 2003-3 includes an initial review of all paired release CWT survival evaluations in the San Joaquin River tributaries.

5.7 – Project-related Monitoring

This monitoring in 2003 included electro-fishing at the SRP 9/10 project sites and associated locations. The results will be included in a future report, along with habitat mapping.

5.8 - Other Monitoring Information

Aquatic invertebrate monitoring continued by the Districts in July 2003, using the sites and methods employed in 2002. There were 3 Hess samples each taken at Riffles 4A and 23C and composite kick net samples taken in Riffles A4, 4A, 23C, 33, 57, 72. No decision has been made on when to analyze these samples. This effort is supplemental to the FSA-funded monitoring program.

An extensive review and analysis of rainbow trout data was submitted to FERC and distributed to the TRTAC in DEC (see Sec. 3.3 above).

6 - Non-Flow Measure Activities In 2003

Both the 1996 FERC Order Section (G) and the FSA (Section 12) have non-flow measure and reporting requirements. Construction at the 7/11 Mining Reach Project was completed in 2003. More detailed information is contained in the TRTAC materials section of this report. Other notable 2003 items were:

- CALFED contract awarded for $4.35 million for Gravel Acquisition and Addition
- Ruddy Project design completed and right of way acquisition started
- Design for SRP10 Project started

Work by others included:

- CDFG Gravel Addition near La Grange
- TRPT had a La Grange floodplain restoration proposal for the State Wildlife Conservation Board

Several outreach/information efforts on Tuolumne River habitat restoration took place in 2003. These included:

(1) Fryer (TID): MAY – AFRP Restoration Tour; MAY – CBDA Rivers Conference presentation

(2) Friends of the Tuolumne: JAN - Slide presentation to the Stanislaus County Planning Commissioners Workshop; FEB - volunteer tree planting at the Waterford Perc Ponds; MAR - Slide presentation to the SJRMP Advisory Council; MAY- Tour of Bobcat Flat as part of the AFRP tour; OCT - Slide presentation to the Mariners group at Trinity United Presbyterian Church; Slide presentation to the McHenry Museum Docents

7 - Anticipated Non-Flow Measure Activities In 2004

Section (G) of the 31JUL96 FERC Order requires a description of non-flow measures planned for implementation in the next year be included in the annual report. Those 2004 activities include:

- Construction of the Ruddy Mining Reach Project may begin
- Completion of design work on SRP 10 and the Warner-Deardorff Mining Reach Project is anticipated. Right of way acquisition to begin on Warner-Deardorff Project.
- CBDA contract amendment request on the Gravel Acquisition and Addition
- Initial work on several other TRTAC projects (River Mile 43, Fine Sediment, and

Gasburg Creek projects) is expected to continue.

- Continued efforts to secure additional funding for projects from various sources, such as CALFED and through the Tuolumne River Coalition process.
- Coordination with other projects, such as Bobcat Flat, and efforts of the Tuolumne River Coalition, will continue.

8 - Other FERC Settlement Agreement Activities

8.1 - Section 11 - Flood Management

No flood management releases were made in 2003 to maintain flood reservation space in Don Pedro Reservoir (see flow graphs and Don Pedro Reservoir storage graph in **Attachment A**).

8.2 - Section 19 – Riparian Habitat and Recreation

The East Stanislaus Resource Conservation District (ESRCD) continued as the public agency funded with the $500,000 from CCSF pursuant to FSA Section 19. The RCD receives assistance from the Natural Resources Conservation Service (NRCS). Expenditures or pledges in 2003 were (1) Increased pledge for Caro Property purchase by Waterford – MAR $7,500; (2) Boating access at County's Riverdale Park – FEB $32,500; (3) Increased pledge for 7 ½ acres in Waterford – MAR $20,000. A unallocated balance of about $150,000 remained at the end of 2003.

8.3 - Section 20 – CDFG Staff Position

The CDFG Tuolumne River fishery biologist position funded under FSA Section 20 continued to be staffed by Dennis Blakeman working out of their La Grange office.

9 - Program Expenses Through 2003

The annual program expenses for 1996-2003 for FSA Sections 12 and 13 are in **Exhibit 5**. The Districts have not yet received billing from DFG for 2003 screw trapping, so the tables show the amount approved by the TRTAC in that category.

The 2003 expenses for Section 12 (non-flow measures) were $291,560 and for Section 13 (monitoring) were estimated at $80,407, for a combined total of $371,967. A comparative table of initial Section 13 categories and TRTAC implementation tracking is included. A new Section 13 expense item in 2003 was for assisting DFG in conducting the fall spawning pursuant to Section 13a at a cost of $12,653. More detailed 2003 monthly costs per task category and agency/consultant are included. There may be a few miscellaneous monitoring charges since 1996 not included in these totals yet and these will be checked on this year. The higher Section 12 costs were mostly associated with contingency costs of the 7/11 large channel restoration project in the gravel mining reach.

Overall funding obligations of FSA costs shared by the Districts and City and County of San Francisco are up to $1,000,000 for non-flow options (Section 12) and $1,355,000 for monitoring (Section 13). The total expenses through 2003 for Section 12 were $889,417 and for Section 13 were estimated at $1,268,440 for a combined program total of $2,157,857. The FSA monitoring allocation is anticipated to be fully expended by the end of 2004, while the restoration funds may not be exhausted until 2005.

10 - References

Pacific Fishery Management Council. 2004. *Review of 2003 Ocean Salmon Fisheries* and *Preseason Report 1: stock abundance analysis for 2004 ocean salmon fisheries.* Portland, Oregon

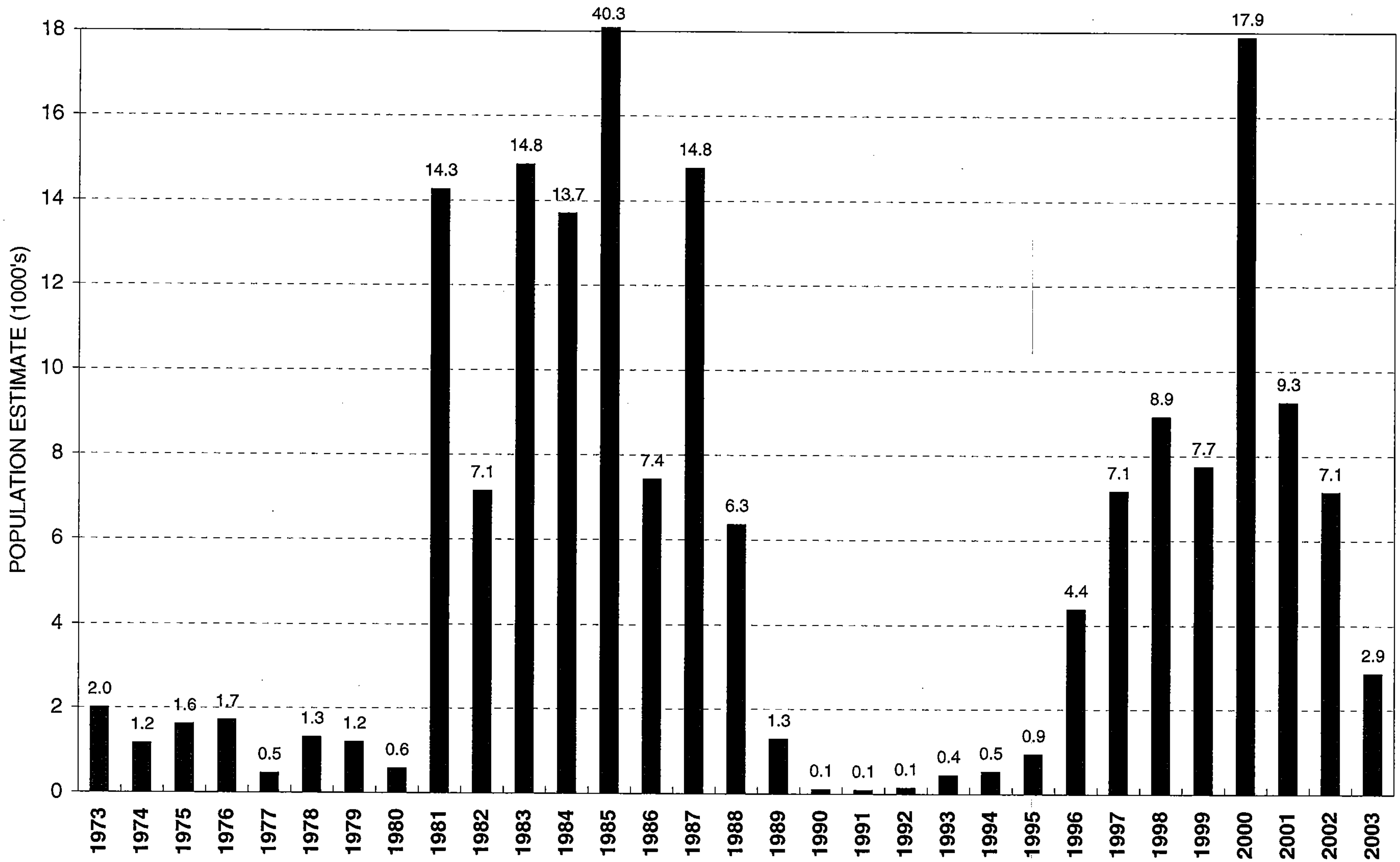
San Joaquin River Group Authority. 2004. *2003 Annual Technical Report.* Prepared for California State Water Resources Control Board in Compliance with D-1641.

EXHIBITS

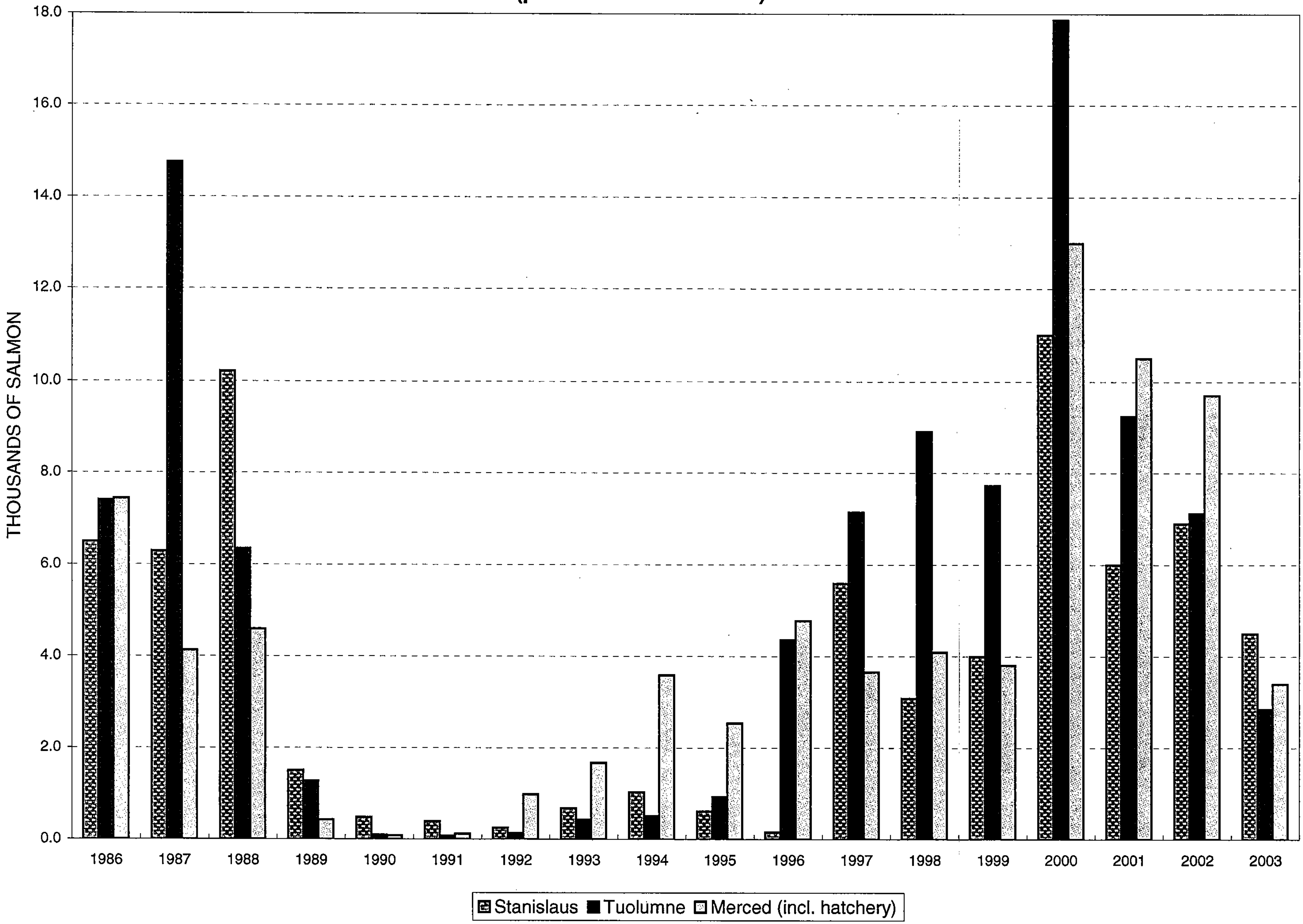
Exhibits

1. Spawning run estimates
2. Ocean catch and harvest rate data
3. 2002 & 2003 screw trap data
4. Delta salmon salvage data
5. FSA program expenses through 2003

TUOLUMNE RIVER SALMON RUN
Post-New Don Pedro Period - 1973 on



San Joaquin River Tributary Salmon Run Estimates Since 1986 (in 1000's)
(prelim. 2003 estimates)



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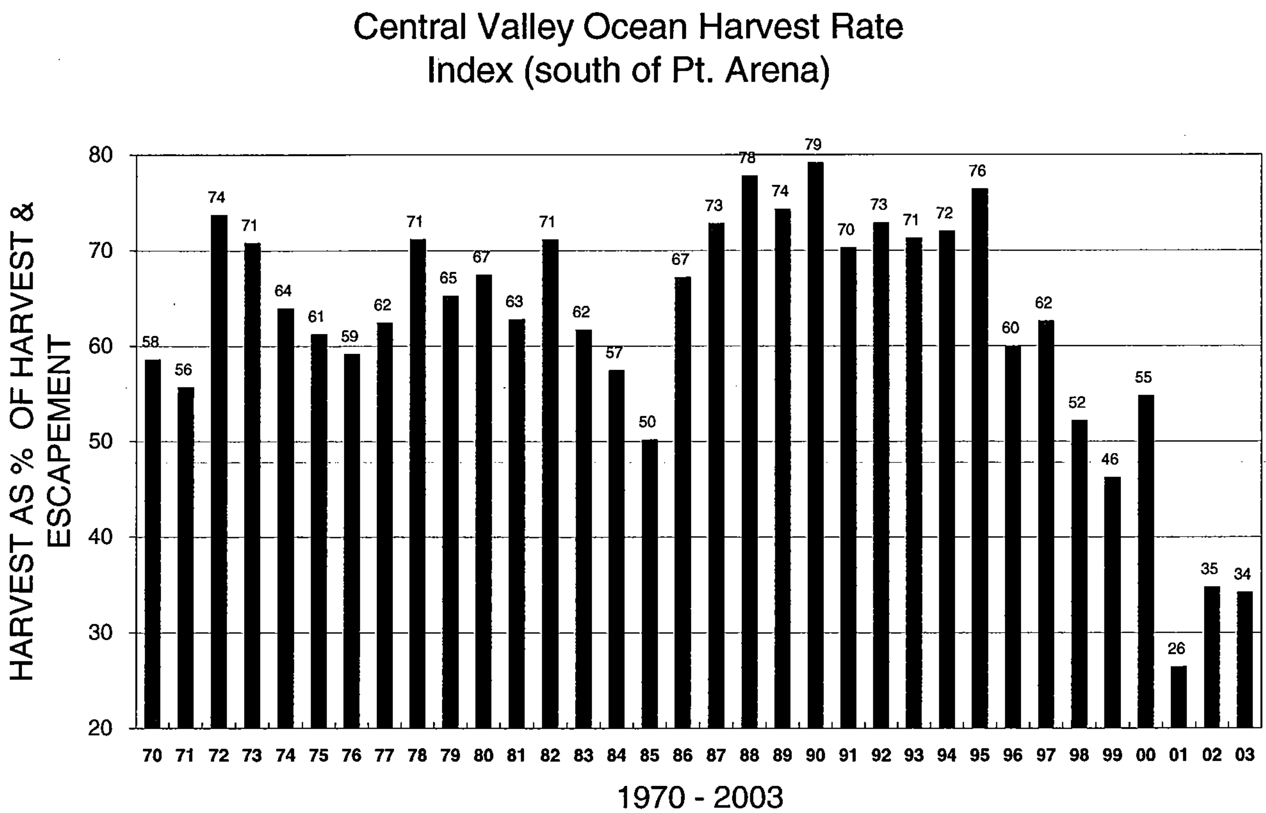
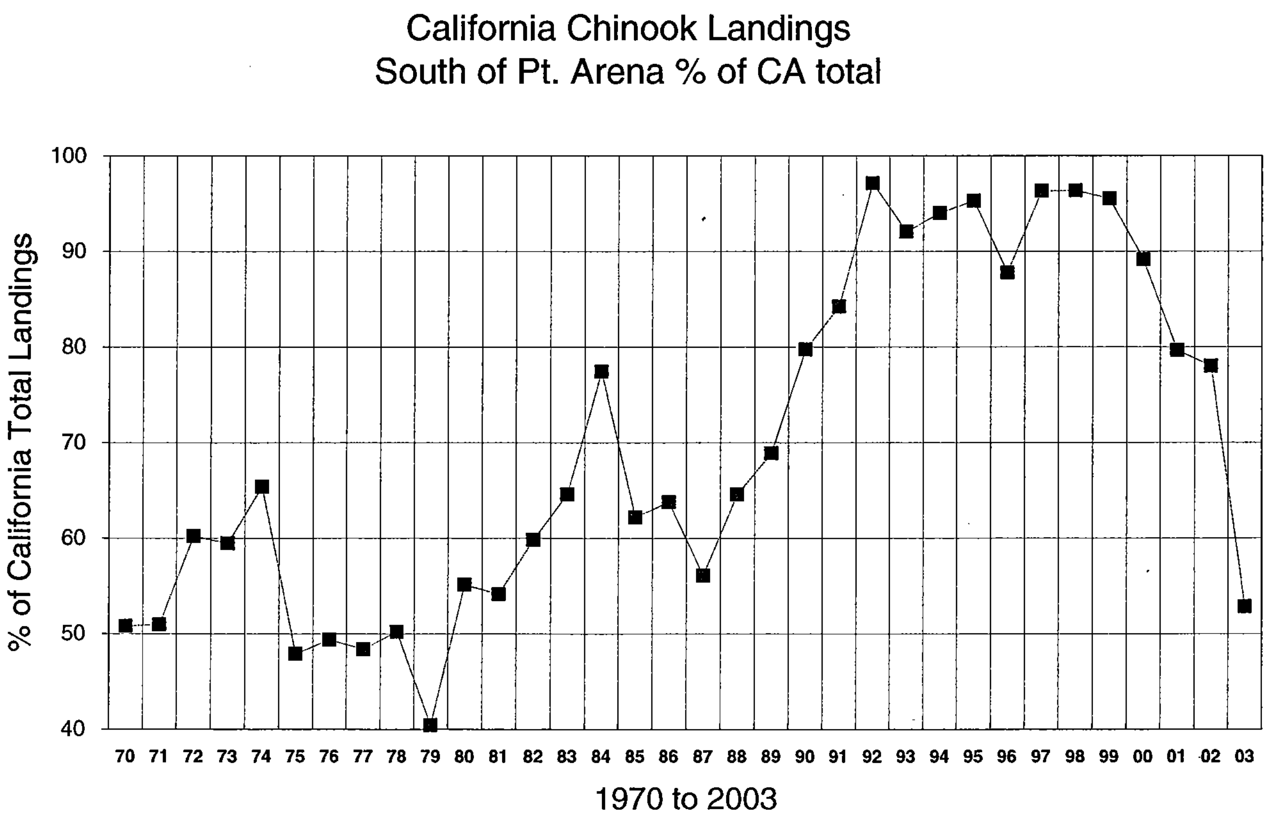
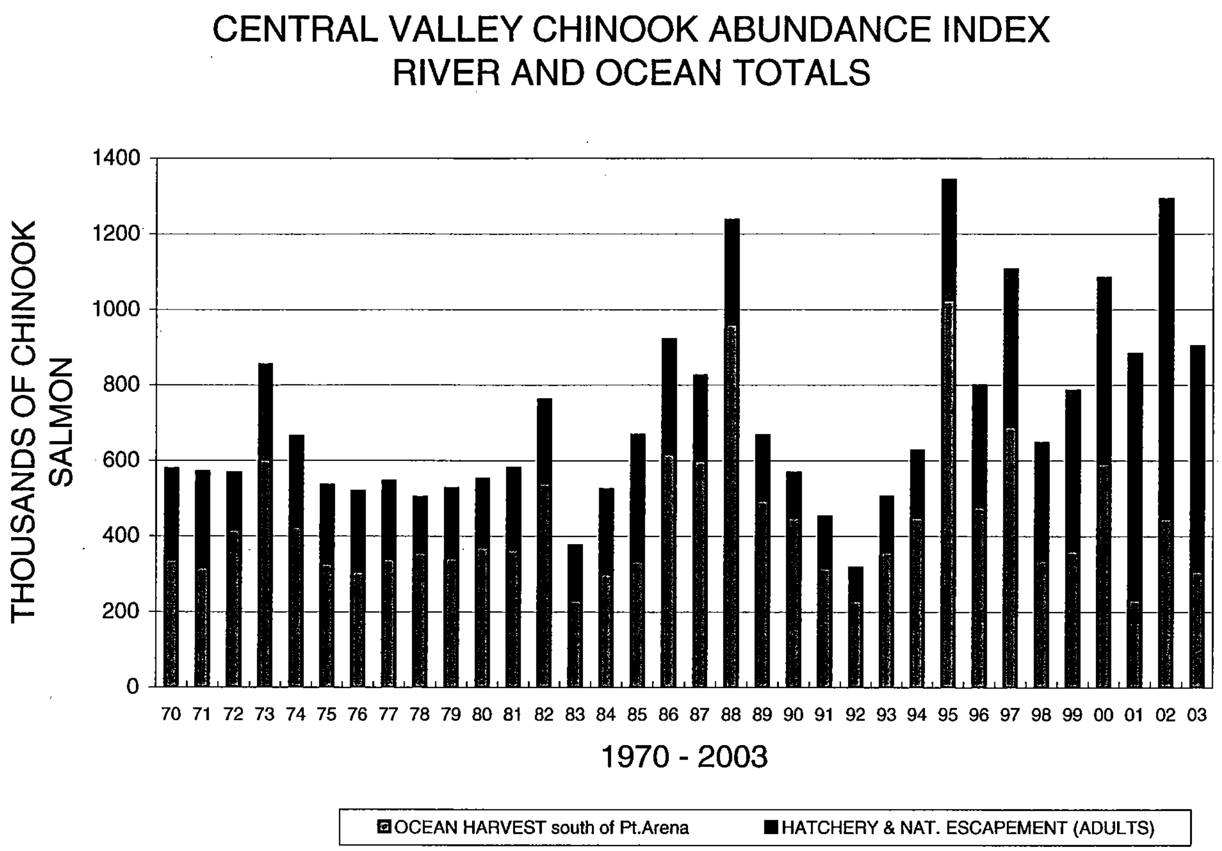
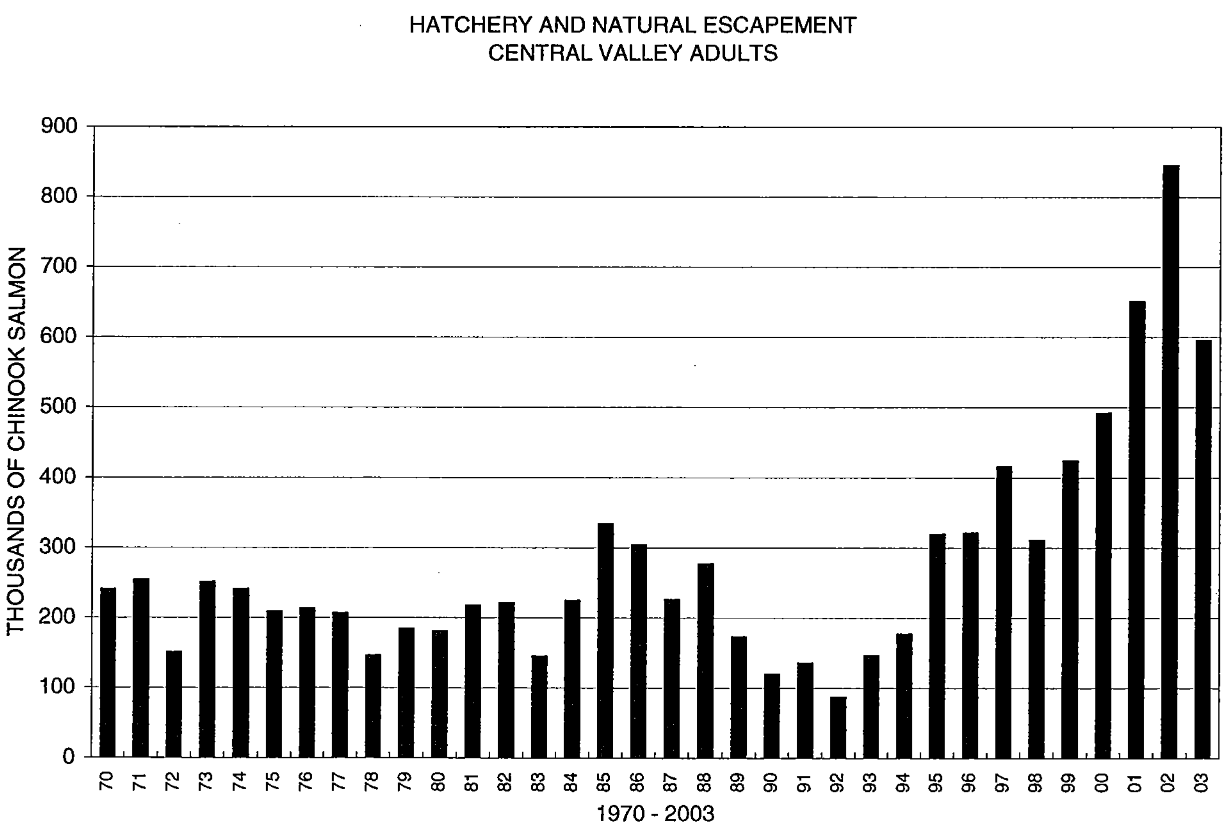
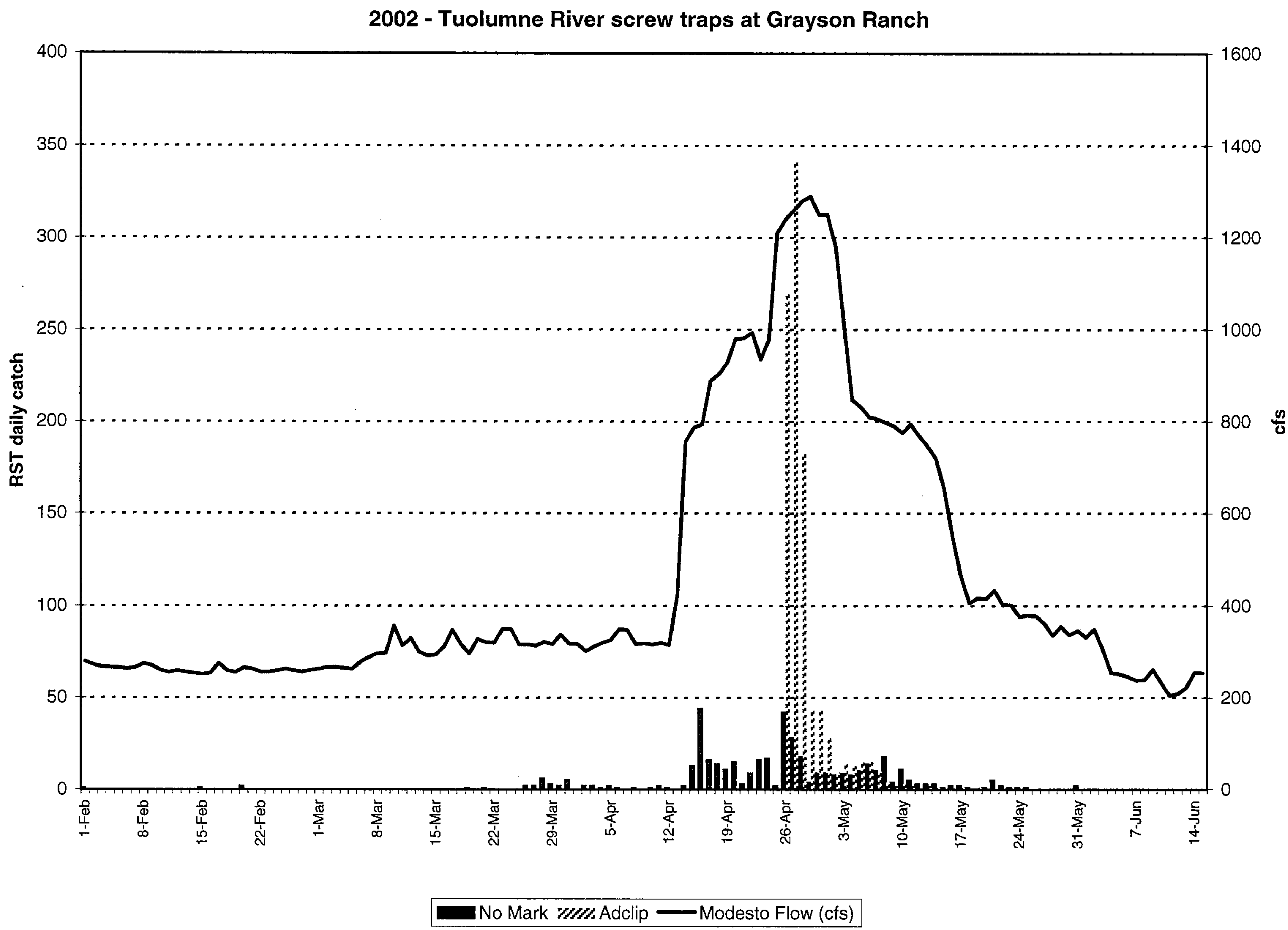

Central Valley Ocean Harvest Rate
Index (south of Pt. Arena)
HARVEST AS % OF HARVEST & ESCAPEMENT
80
70
60
50
40
30
20
58 56 74 71 64 61 59 62 71 65 67 63 71 62 57 50 67 73 78 74 79 70 73 71 72 76 60 62 52 46 55 26 35 34
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
1970 - 2003

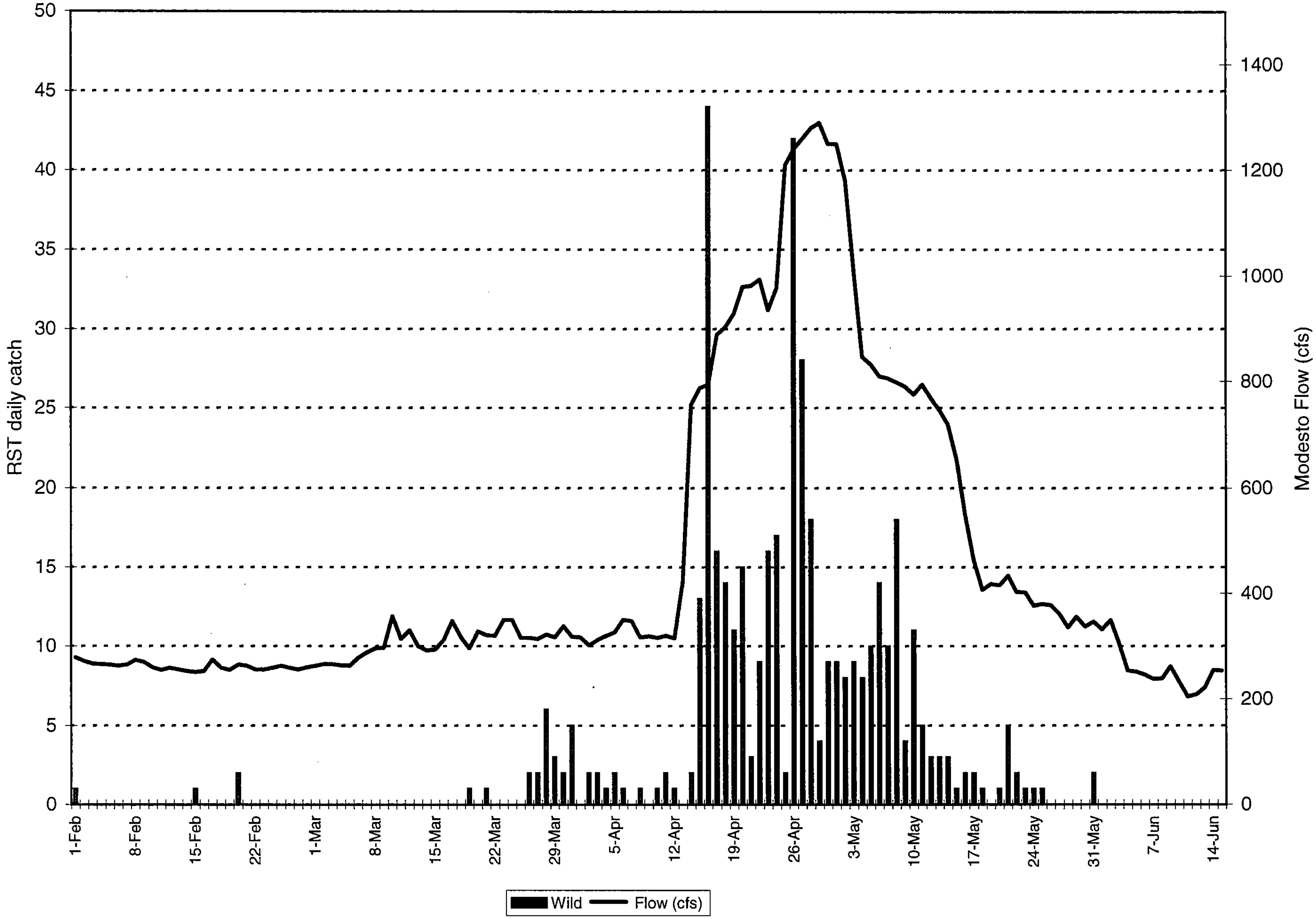

California Chinook Landings
South of Pt. Arena % of CA total
% of California Total Landings
100
90
80
70
60
50
40
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
1970 to 2003


CENTRAL VALLEY CHINOOK ABUNDANCE INDEX
RIVER AND OCEAN TOTALS
THOUSANDS OF CHINOOK SALMON
1400
1200
1000
800
600
400
200
0
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
1970 - 2003
OCEAN HARVEST south of Pt.Arena
HATCHERY & NAT. ESCAPEMENT (ADULTS)

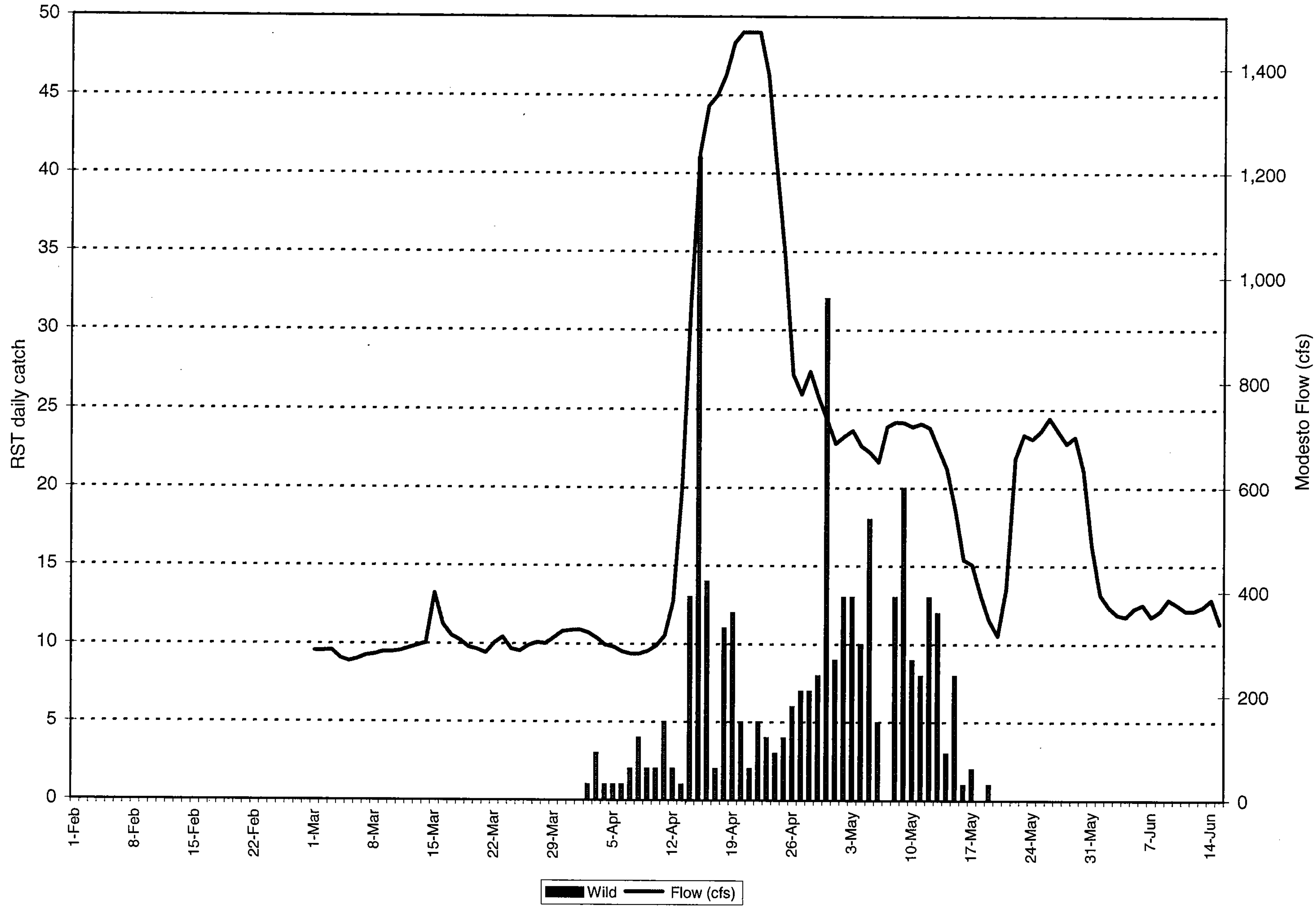

HATCHERY AND NATURAL ESCAPEMENT
CENTRAL VALLEY ADULTS
THOUSANDS OF CHINOOK SALMON
900
800
700
600
500
400
300
200
100
0
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
1970 - 2003

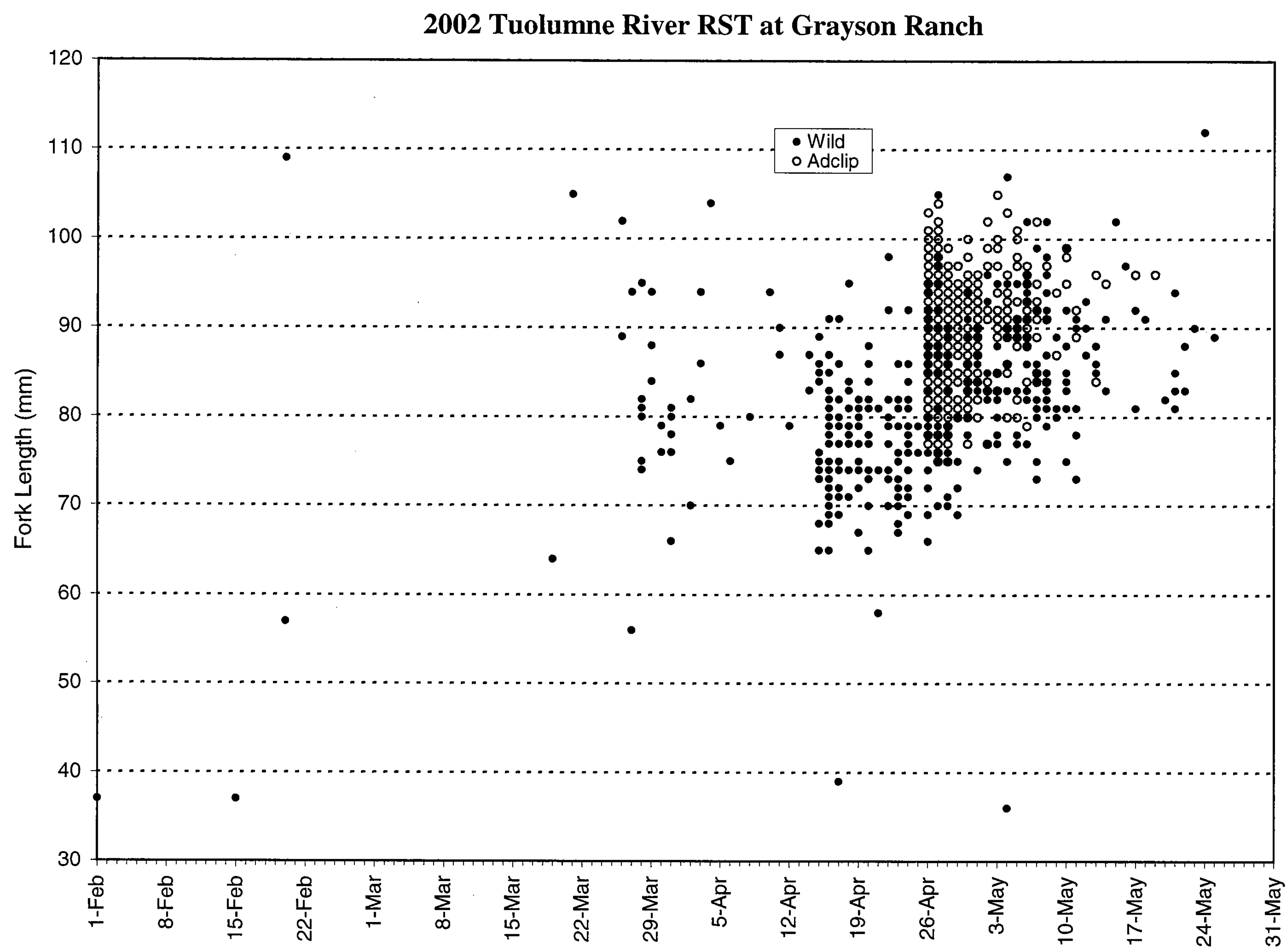

2002 - Tuolumne River screw traps at Grayson Ranch
RST daily catch
cfs
400
350
300
250
200
150
100
50
0
1600
1400
1200
1000
800
600
400
200
0
1-Feb
8-Feb
15-Feb
22-Feb
1-Mar
8-Mar
15-Mar
22-Mar
29-Mar
5-Apr
12-Apr
19-Apr
26-Apr
3-May
10-May
17-May
24-May
31-May
7-Jun
14-Jun
No Mark
Adclip
Modesto Flow (cfs)

2002 - Tuolumne River screw traps at Grayson Ranch

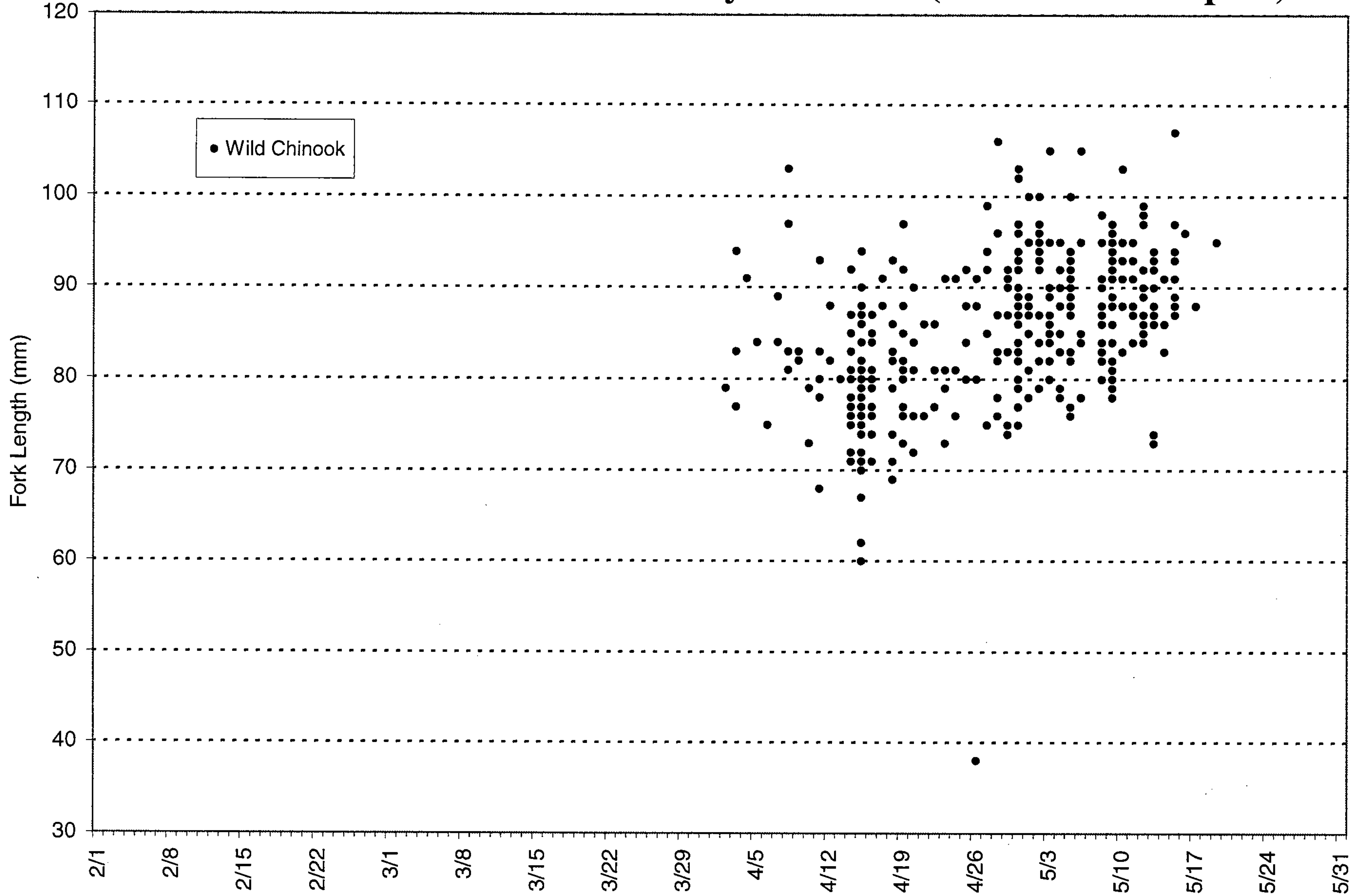


2003 - Tuolumne River screw traps at Grayson Ranch (APR-MAY sampled)




2002 Tuolumne River RST at Grayson Ranch
Wild
Adclip
Fork Length (mm)
120
110
100
90
80
70
60
50
40
30
1-Feb
8-Feb
15-Feb
22-Feb
1-Mar
8-Mar
15-Mar
22-Mar
29-Mar
5-Apr
12-Apr
19-Apr
26-Apr
3-May
10-May
17-May
24-May
31-May

2003 Tuolumne River RST at Grayson Ranch (APR-MAY sampled)



Chinook salmon caught at the Grayson screw trap on the Tuolumne River (CDFG) in 2002 and 2003.

PRELIMINARY DATA
2002 Grayson screw trap on the Tuolumne River
Chinook salmon catch

Date	Adclip	Wild	Modesto Flow (cfs)
2/1/2002		1	279
2/2/2002			272
2/3/2002			267
2/4/2002			266
2/5/2002			265
2/6/2002			263
2/7/2002			265
2/8/2002			274
2/9/2002			270
2/10/2002			260
2/11/2002			255
2/12/2002			259
2/13/2002			256
2/14/2002			253
2/15/2002		1	251
2/16/2002			253
2/17/2002			275
2/18/2002			259
2/19/2002			255
2/20/2002		2	265
2/21/2002			263
2/22/2002			256
2/23/2002			256
2/24/2002			259
2/25/2002			263
2/26/2002			259
2/27/2002			256
2/28/2002			260
3/1/2002			263
3/2/2002			266
3/3/2002			266
3/4/2002			264
3/5/2002			263
3/6/2002			278
3/7/2002			288
3/8/2002			296
3/9/2002			297
3/10/2002			357
3/11/2002			314
3/12/2002			330
3/13/2002			300
3/14/2002			292
3/15/2002			294
3/16/2002			312
3/17/2002			348
3/18/2002			317
3/19/2002		1	296
3/20/2002			328
3/21/2002		1	321
3/22/2002			320
3/23/2002			350
3/24/2002			350
3/25/2002			316
3/26/2002		2	316
3/27/2002		2	314
3/28/2002		6	322
3/29/2002		3	317
3/30/2002		2	338
3/31/2002		5	318
4/1/2002			317
4/2/2002		2	302
4/3/2002		2	312
4/4/2002		1	320
4/5/2002		2	326
4/6/2002		1	350
4/7/2002			348
4/8/2002		1	317
4/9/2002			319
4/10/2002		1	316
4/11/2002		2	320
4/12/2002		1	315
4/13/2002			424

2003 Grayson screw trap on the Tuolumne River
Chinook salmon catch

Date	Wild	Modesto Flow (cfs)
2/1/2003		
2/2/2003		
2/3/2003		
2/4/2003		
2/5/2003		
2/6/2003		
2/7/2003		
2/8/2003		
2/9/2003		
2/10/2003		
2/11/2003		
2/12/2003		
2/13/2003		
2/14/2003		
2/15/2003		
2/16/2003		
2/17/2003		
2/18/2003		
2/19/2003		
2/20/2003		
2/21/2003		
2/22/2003		
2/23/2003		
2/24/2003		
2/25/2003		
2/26/2003		
2/27/2003		
2/28/2003		
3/1/2003		
3/2/2003		
3/3/2003		
3/4/2003		
3/5/2003		
3/6/2003		
3/7/2003		
3/8/2003		
3/9/2003		
3/10/2003		
3/11/2003		
3/12/2003		
3/13/2003		
3/14/2003		
3/15/2003		
3/16/2003		
3/17/2003		
3/18/2003		
3/19/2003		
3/20/2003		
3/21/2003		
3/22/2003		
3/23/2003		
3/24/2003		
3/25/2003		
3/26/2003		
3/27/2003		
3/28/2003		
3/29/2003		
3/30/2003		
3/31/2003		
4/1/2003		317
4/2/2003	1	312
4/3/2003	3	302
4/4/2003	1	289
4/5/2003	1	287
4/6/2003	1	277
4/7/2003	2	272
4/8/2003	4	274
4/9/2003	2	281
4/10/2003	2	292
4/11/2003	5	311
4/12/2003	2	387
4/13/2003	1	600

Chinook salmon caught at the Grayson screw trap on the Tuolumne River (CDFG) in 2002 and 2003.

PRELIMINARY DATA

2002 Grayson screw trap on the Tuolumne River
Chinook salmon catch

Date	Adclip	Wild	Modesto Flow (cfs)
4/14/2002		2	756
4/15/2002		13	787
4/16/2002		44	794
4/17/2002		16	889
4/18/2002		14	904
4/19/2002		11	929
4/20/2002		15	980
4/21/2002		3	982
4/22/2002		9	994
4/23/2002		16	936
4/24/2002		17	978
4/25/2002		2	1210
4/26/2002	270	42	1240
4/27/2002	342	28	1260
4/28/2002	183	18	1280
4/29/2002	44	4	1290
4/30/2002	44	9	1250
5/1/2002	29	9	1250
5/2/2002	9	8	1180
5/3/2002	15	9	1010
5/4/2002	14	8	847
5/5/2002	16	10	832
5/6/2002	16	14	810
5/7/2002	10	10	806
5/8/2002	4	18	798
5/9/2002	2	4	790
5/10/2002	3	11	775
5/11/2002	2	5	794
5/12/2002		3	769
5/13/2002	2	3	746
5/14/2002	1	3	719
5/15/2002		1	653
5/16/2002		2	550
5/17/2002	1	2	464
5/18/2002		1	407
5/19/2002	1		418
5/20/2002		1	416
5/21/2002		5	434
5/22/2002		2	403
5/23/2002		1	402
5/24/2002		1	377
5/25/2002		1	380
5/26/2002			378
5/27/2002			362
5/28/2002			336
5/29/2002			356
5/30/2002			337
5/31/2002		2	347
6/1/2002			332
6/2/2002			350
6/3/2002			305
6/4/2002			254
6/5/2002			252
6/6/2002			246
6/7/2002			238
6/8/2002			239
6/9/2002			262
6/10/2002			233
6/11/2002			205
6/12/2002			209
6/13/2002			222
6/14/2002			255
6/15/2002			254
sum	**1008**	**436**	

2003 Grayson screw trap on the Tuolumne River
Chinook salmon catch

Date	Wild	Modesto Flow (cfs)
4/14/2003	13	918
4/15/2003	41	1142
4/16/2003	14	1179
4/17/2003	2	1175
4/18/2003	11	1180
4/19/2003	12	1211
4/20/2003	5	1223
4/21/2003	2	1226
4/22/2003	5	1202
4/23/2003	4	1128
4/24/2003	3	1020
4/25/2003	4	903
4/26/2003	6	740
4/27/2003	7	714
4/28/2003	7	746
4/29/2003	8	709
4/30/2003	32	678
5/1/2003	9	645
5/2/2003	13	683
5/3/2003	13	744
5/4/2003	10	717
5/5/2003	18	702
5/6/2003	5	689
5/7/2003		751
5/8/2003	13	758
5/9/2003	20	758
5/10/2003	9	750
5/11/2003	8	755
5/12/2003	13	748
5/13/2003	12	713
5/14/2003	3	674
5/15/2003	8	603
5/16/2003	1	510
5/17/2003	2	503
5/18/2003		438
5/19/2003	1	380
5/20/2003		343
5/21/2003		450
5/22/2003		696
5/23/2003		738
5/24/2003		729
5/25/2003		745
5/26/2003		766
5/27/2003		747
5/28/2003		730
5/29/2003		743
5/30/2003		680
5/31/2003		536
6/1/2003		447
6/2/2003		418
6/3/2003		396
6/4/2003		391
6/5/2003		414
6/6/2003		423
6/7/2003		391
6/8/2003		407
6/9/2003		435
6/10/2003		423
6/11/2003		412
6/12/2003		415
6/13/2003		427
6/14/2003		444
6/15/2003		384
sum	**359**	

STATE WATER PROJECT

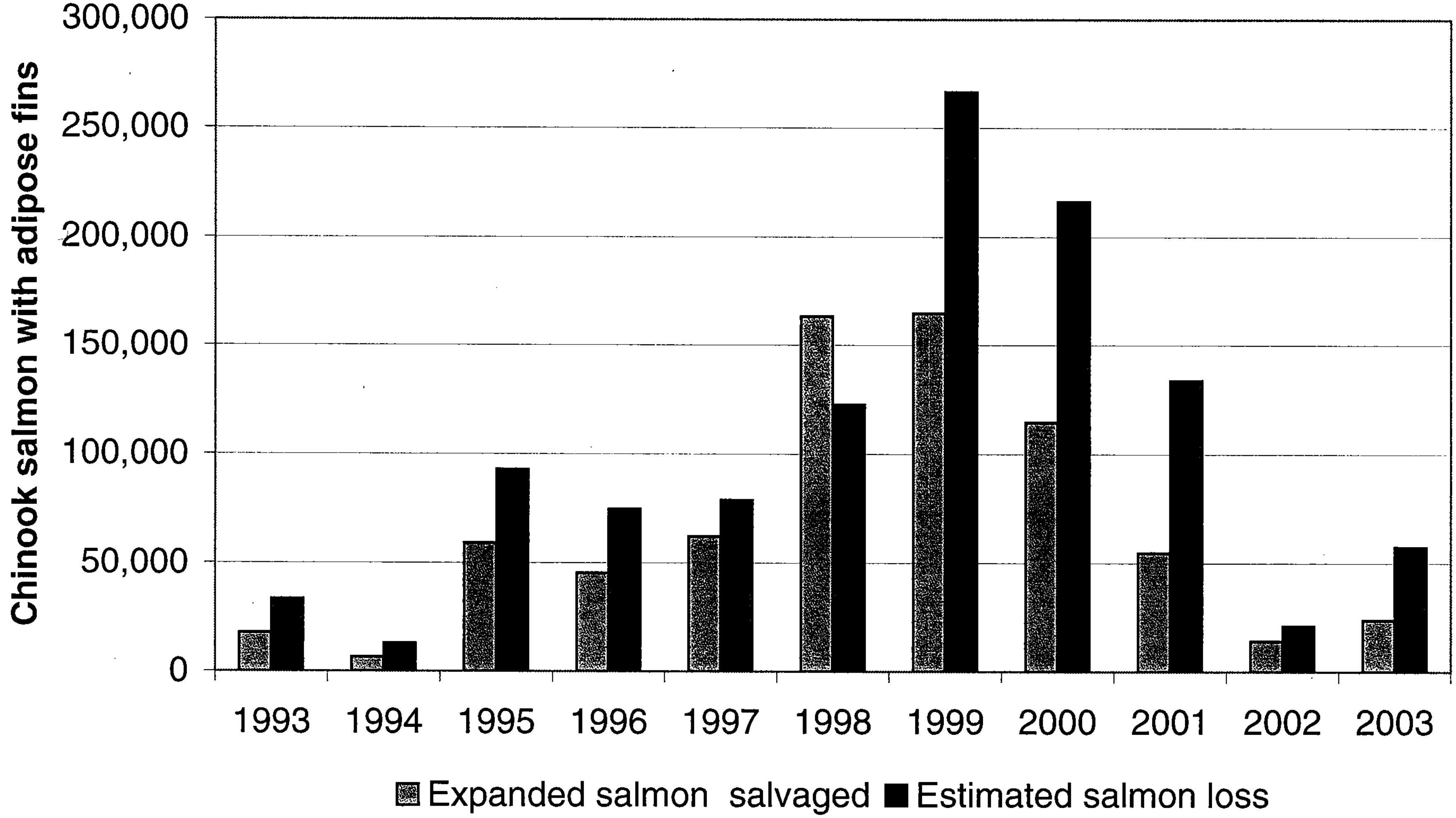
2003	Total chinook salvage (no clip) Observed	Expanded	Est. Loss	Ave. cfs Export	Acre ft. Export	Expanded salmon / 1000 ac.ft.
JANUARY	54	387	1,683	5,783	355,498	1.1
FEBRUAR'	81	384	1,664	6,351	352,633	1.1
MARCH	659	2,961	12,327	6,252	384,329	7.7
APRIL	1,345	6,136	25,776	2,546	151,462	40.5
MAY	522	1,513	6,581	880	54,096	28.0
JUNE	55	278	1,205	5,929	364,473	0.8
TOTAL	2,716	11,659	49,236		1,662,492	7.0

CENTRAL VALLEY PROJECT

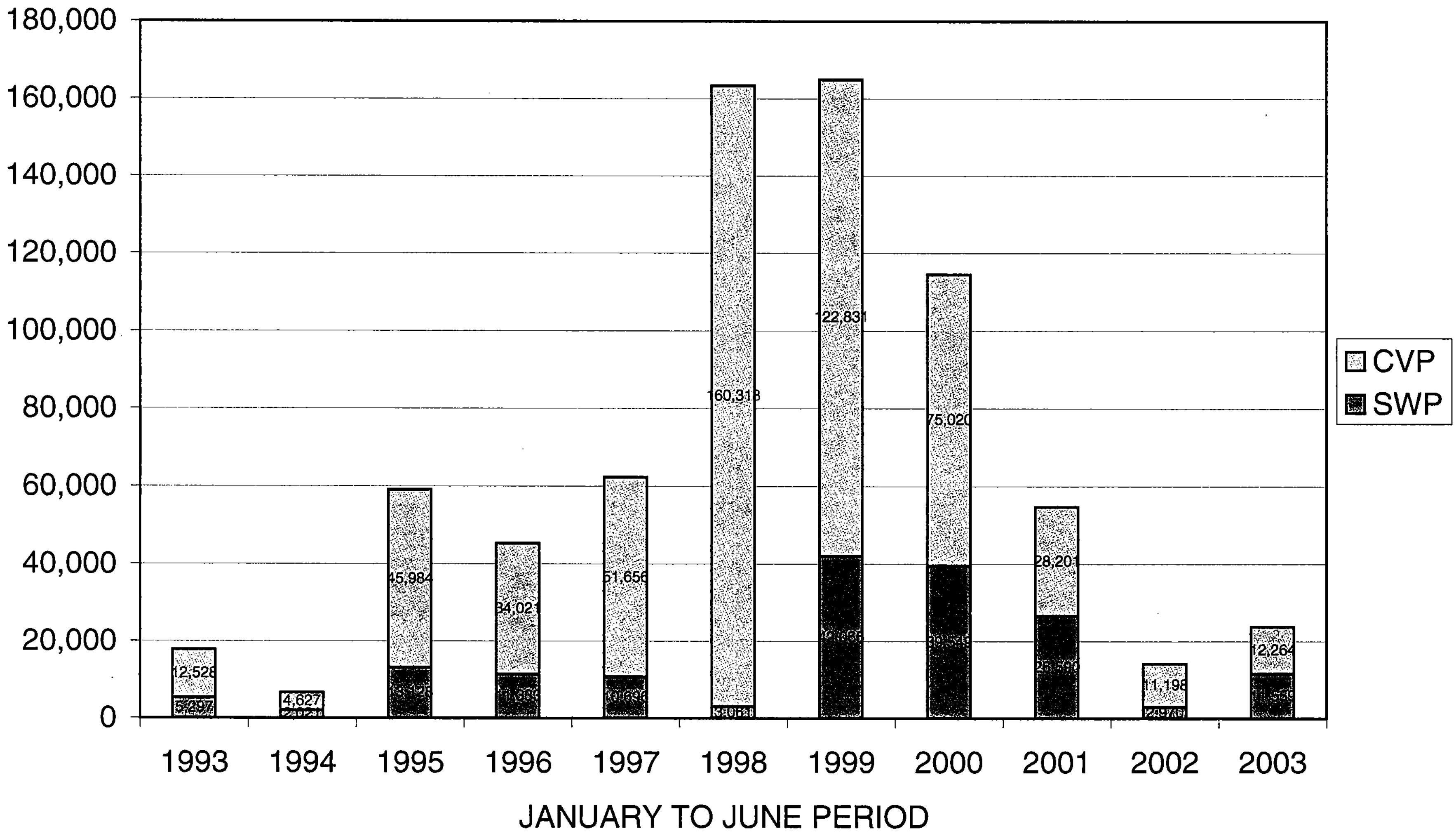
2003	Total chinook salvage (no clip) Observed	Expanded	Est. Loss	Ave. cfs Export	Acre ft. Export	Expanded salmon / 1000 ac.ft.
JANUARY	18	216	135	4,254	261,506	0.8
FEBRUAR'	132	1584.0	943	4,266	236,865	6.7
MARCH	293	3,264	1,932	4,349	267,346	12.2
APRIL	726	5,388	3,858	1,900	113,031	47.7
MAY	150	1,536	1,230	1,462	89,874	17.1
JUNE	23	276	164	4,405	270,789	1.0
TOTAL	1,342	12,264	8,262		1,239,411	9.9

SWP + CVP						
TOTAL	4,058	23,923	57,498		2,901,902	8.2

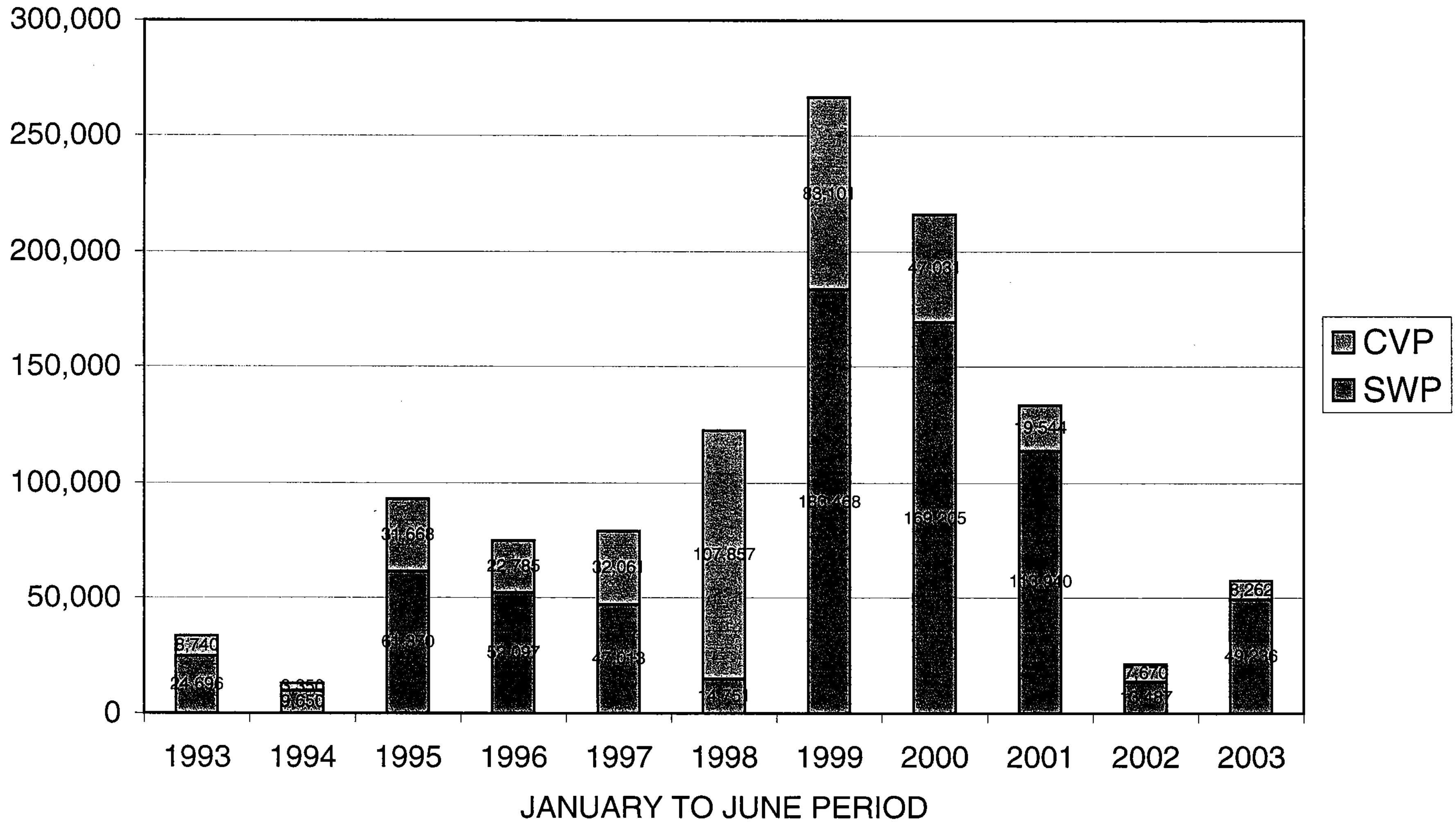
Combined SWP and CVP salmon salvaged and estimated loss (JAN-JUN)



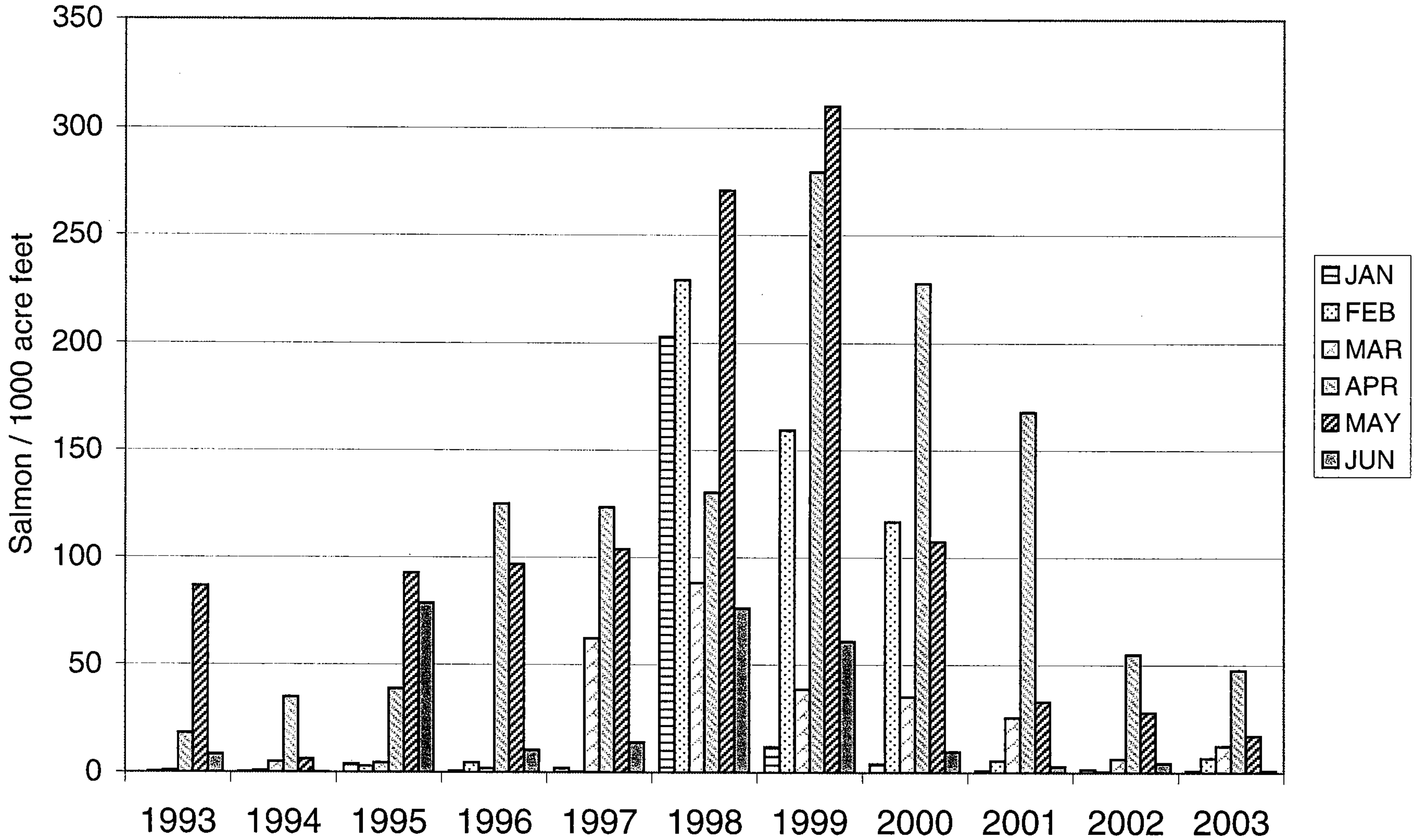
EXPANDED NO. OF SALMON SALVAGED AT DELTA PUMPS

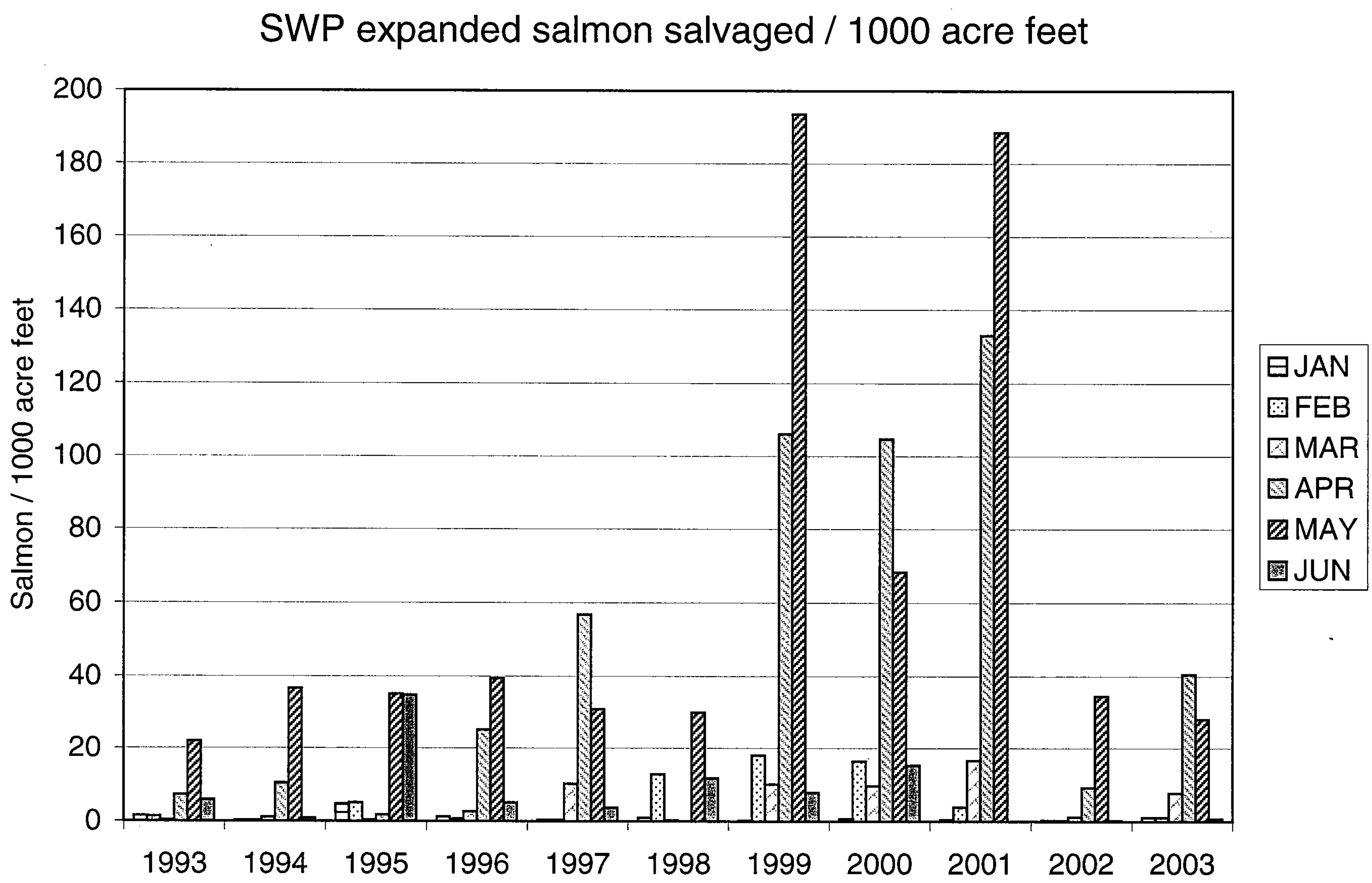


ESTIMATED SALMON LOSS AT DELTA PUMPS

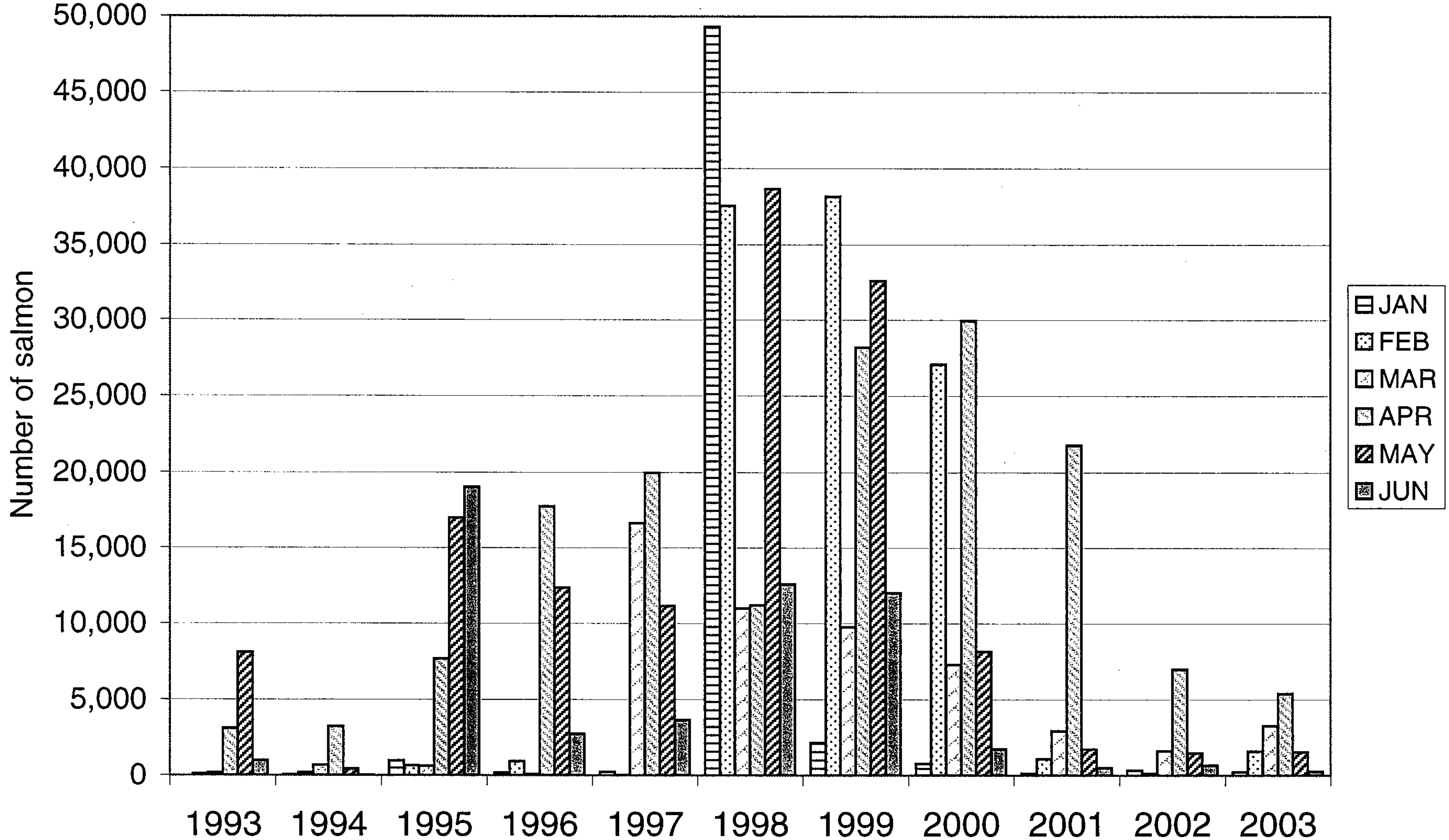


CVP expanded salmon salvaged / 1000 acre feet

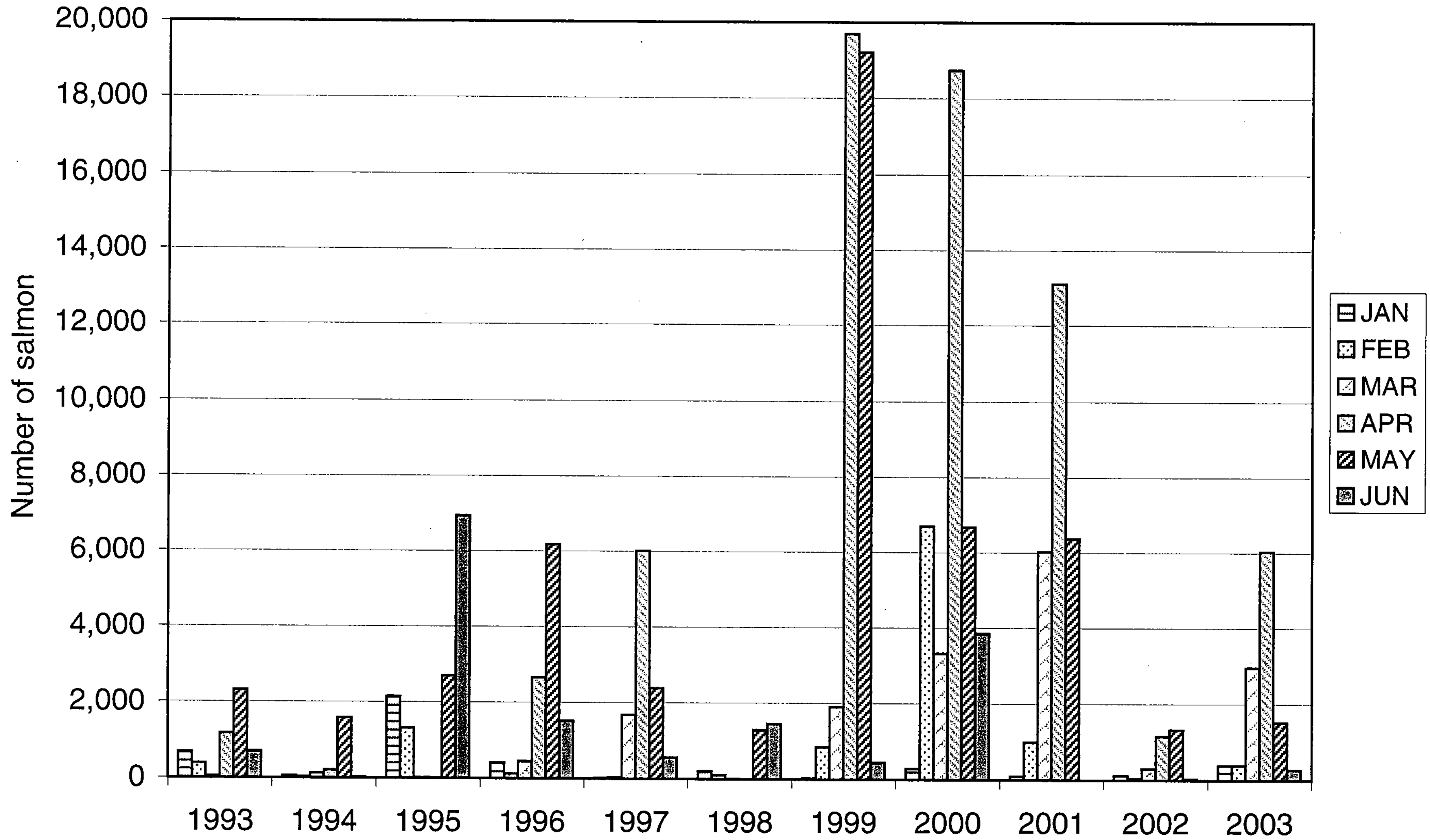



SWP expanded salmon salvaged / 1000 acre feet
Salmon / 1000 acre feet
200
180
160
140
120
100
80
60
40
20
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
JAN
FEB
MAR
APR
MAY
JUN

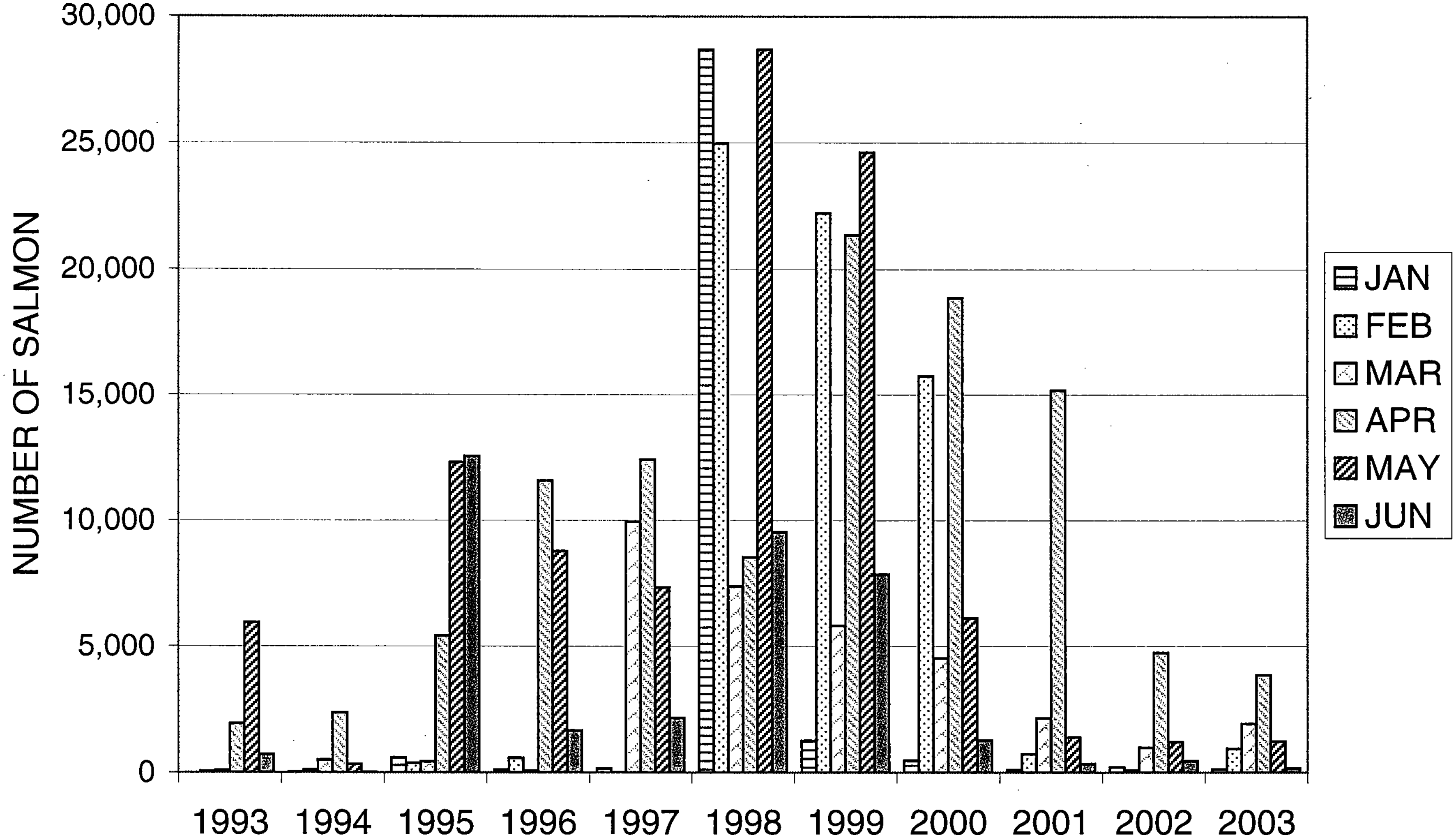
CVP expanded salmon salvaged

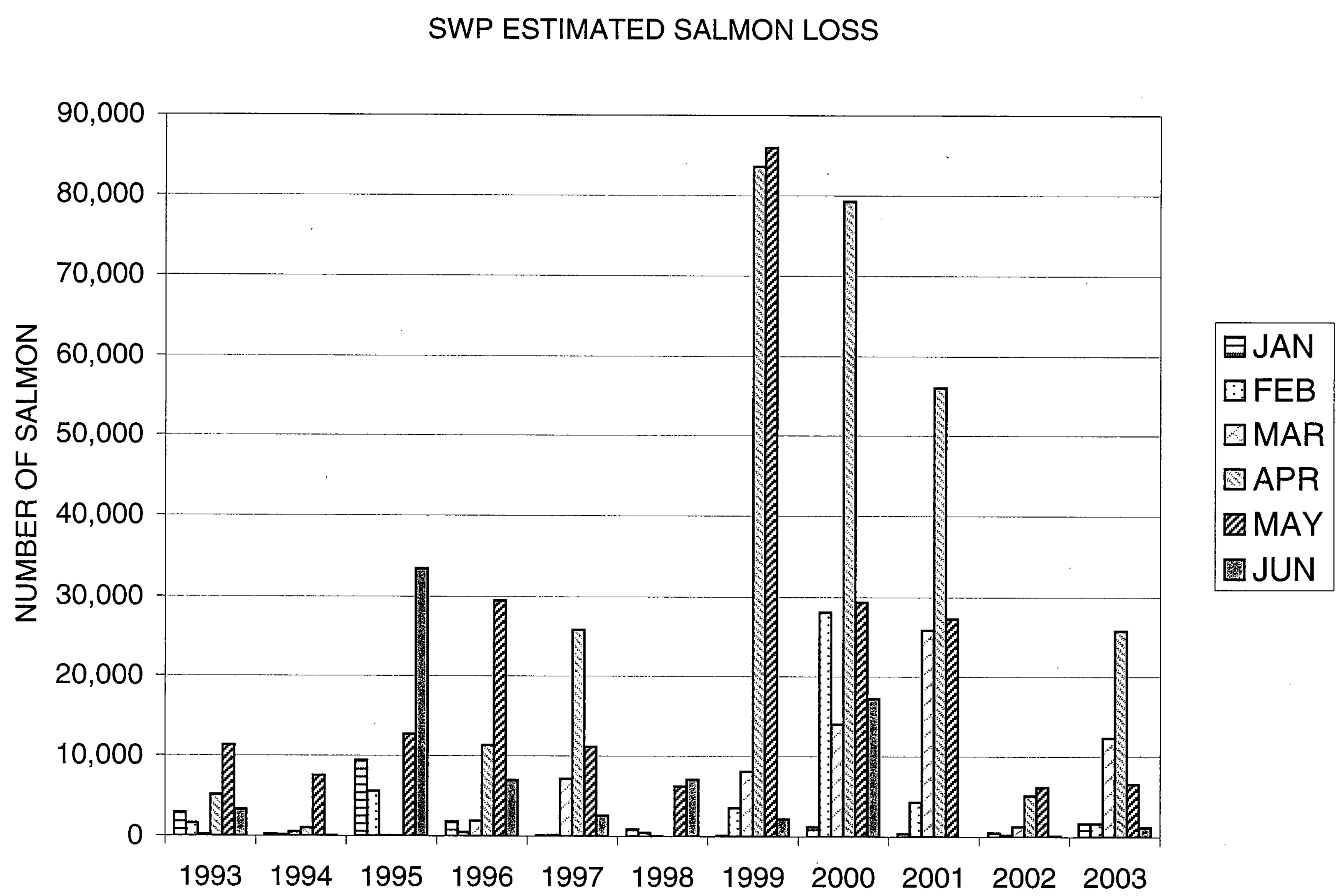


SWP expanded salmon salvaged

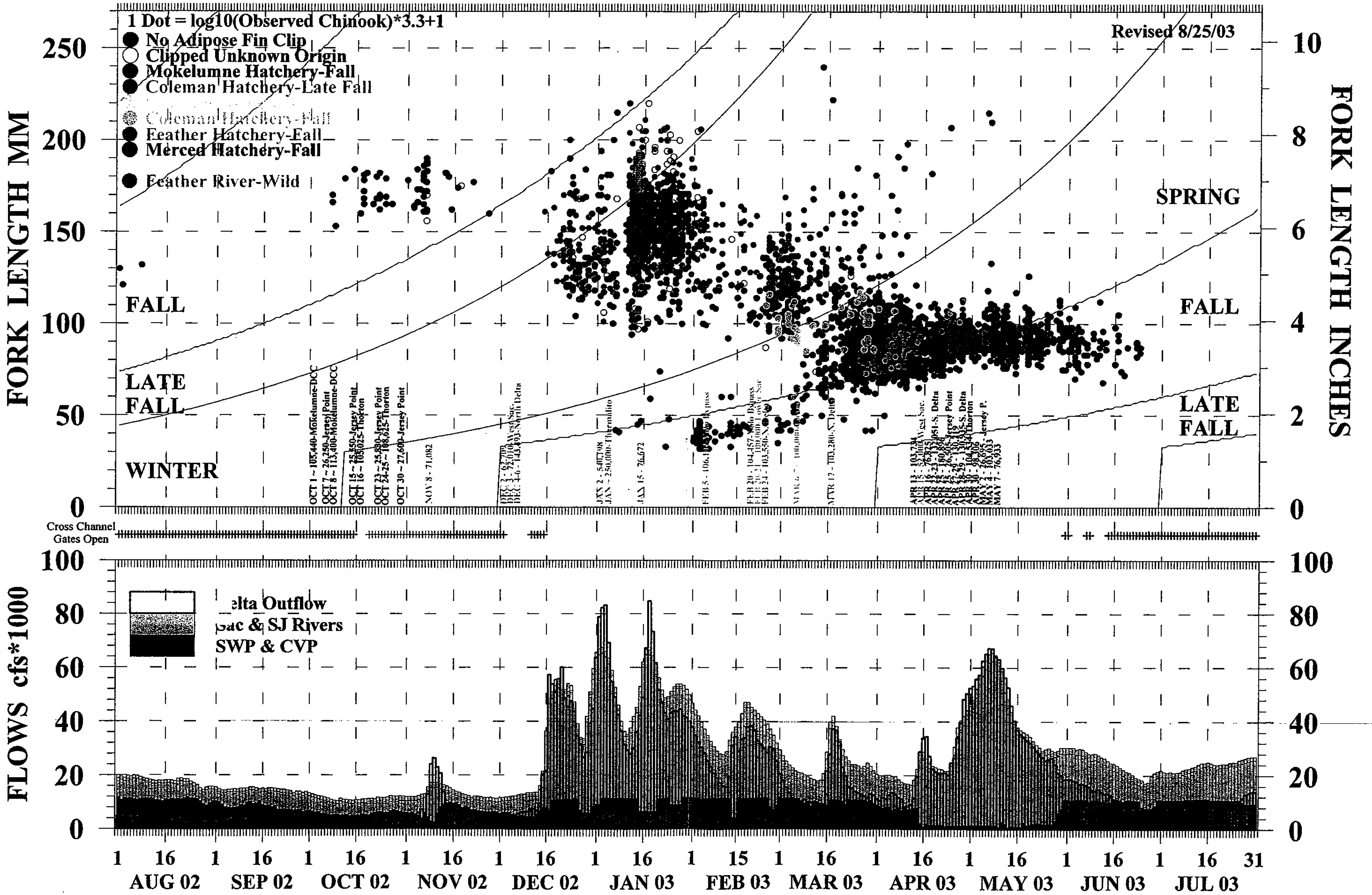


CVP ESTIMATED SALMON LOSS




SWP ESTIMATED SALMON LOSS
NUMBER OF SALMON
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
JAN
FEB
MAR
APR
MAY
JUN

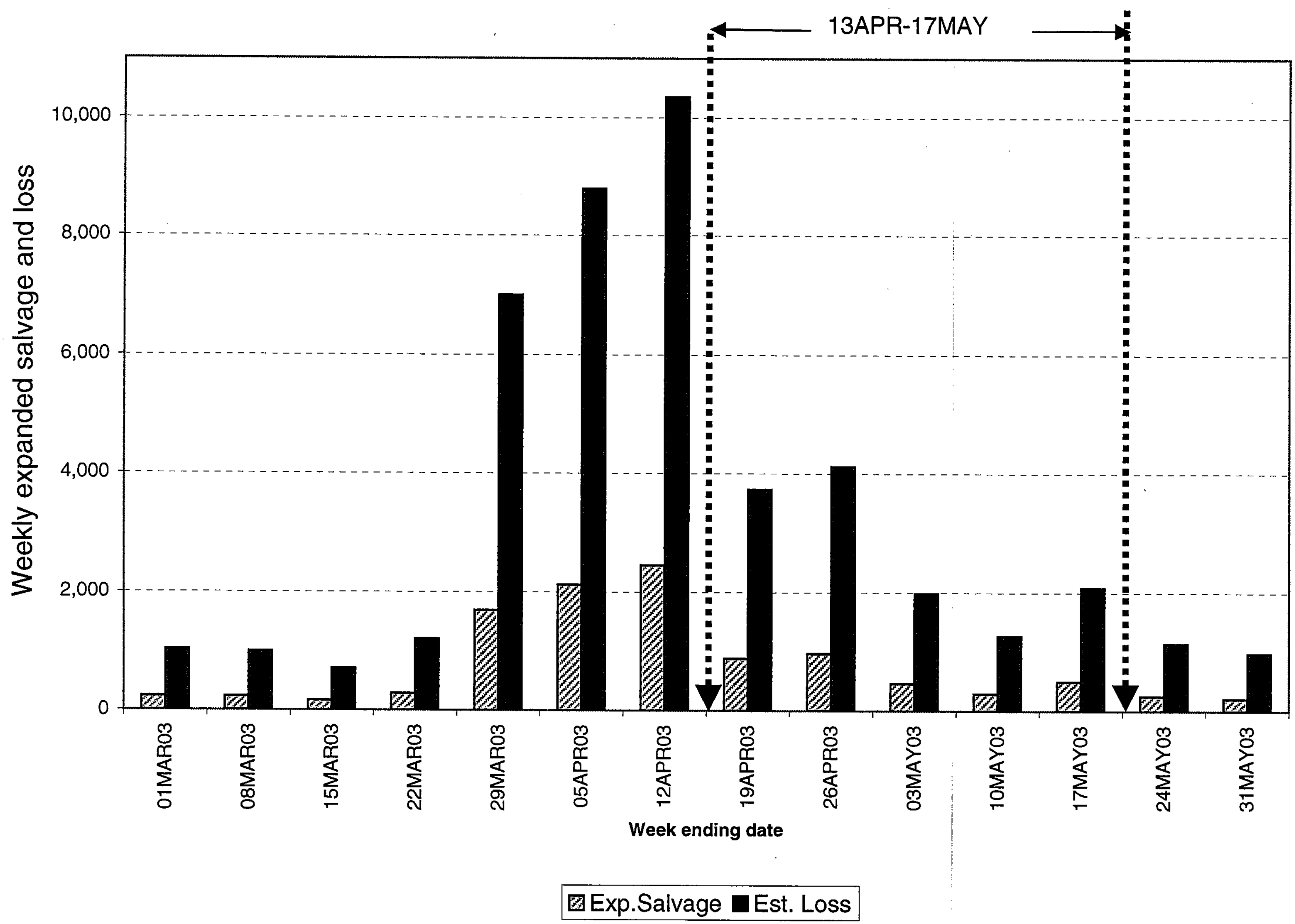
OBSERVED CHINOOK SALVAGE AT THE SWP & CVP DELTA FISH FACILITIES 8/1/02 THROUGH 7/31/03



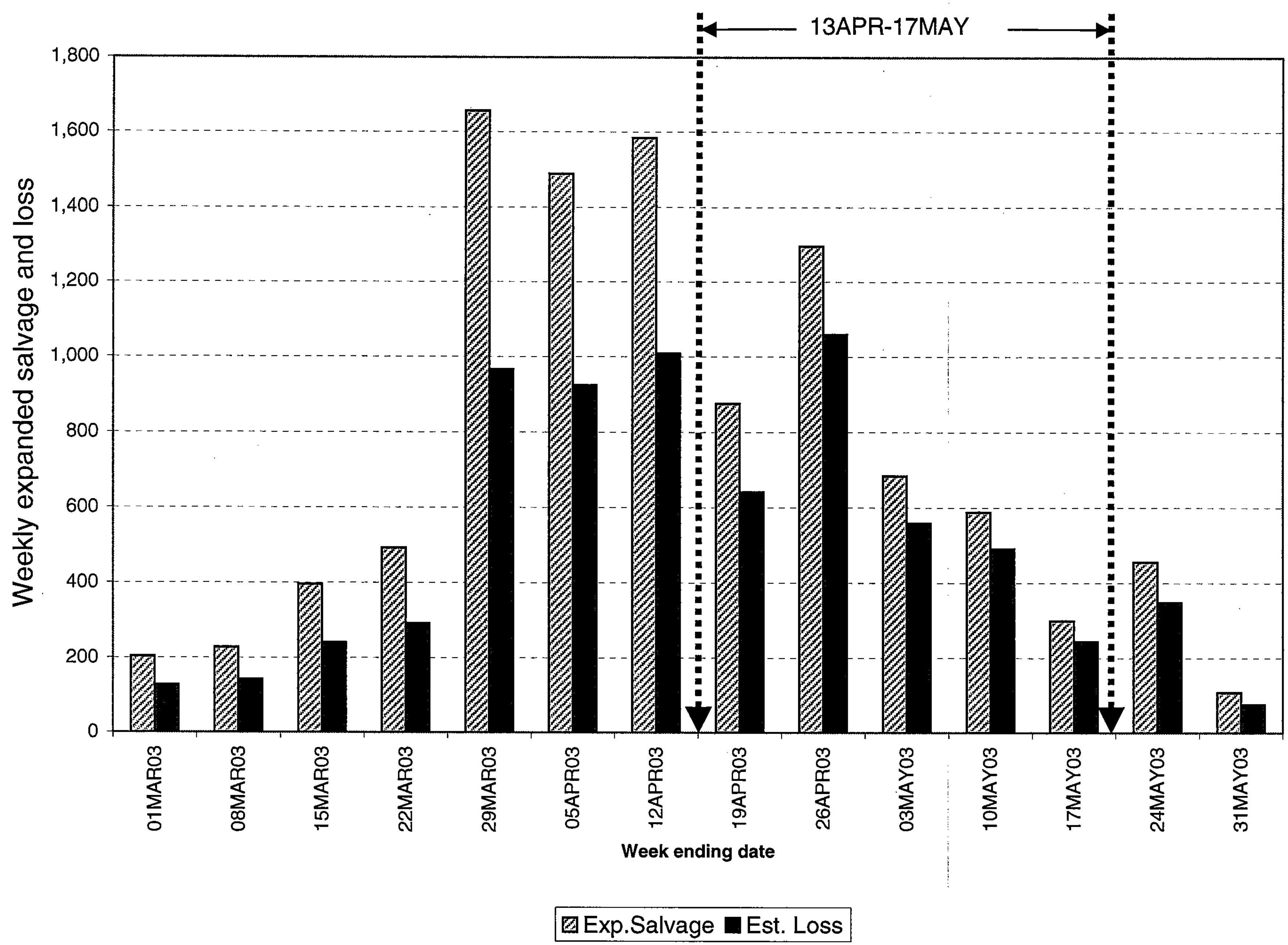
	STATE WATER PROJECT							
							SWP	CVP&SWP
							Expanded	average
	2003	Total chinook salvage			Ave. cfs	Acre ft.	salvage /	export rate
		Observed	Exp.Salvag	Est. Loss	Export	Export	1000 ac.ft.	(cfs)
4	2/23-3/1	52	237	1,028	5,814	80,704	2.9	10,162
MAR	3/2-3/8	56	232	998	7,001	97,181	2.4	11,316
2	3/9-3/15	38	168	708	5,423	75,277	2.2	9,770
3	3/16-3/22	59	284	1,210	6,022	83,591	3.4	10,359
4	3/23-3/29	356	1,693	7,007	6,477	89,907	18.8	10,870
APR	3/30-4/5	470	2,127	8,794	5,521	76,637	27.8	8,963
2	4/6-4/12	549	2,461	10,351	4,604	63,908	38.5	7,511
3	4/13-4/19	186	882	3,730	1,718	23,848	37.0	3,413
4	4/20-4/26	213	972	4,120	482	6,691	145.3	1,340
MAY	4/27-5/3	106	464	1,987	530	7,357	63.1	1,386
2	5/4-5/10	70	294	1,266	564	7,829	37.6	1,421
3	5/11-5/17	246	498	2,088	528	7,329	67.9	1,368
4	5/18-5/24	121	254	1,146	530	7,357	34.5	2,067
5	5/25-5/31	42	209	979	2,009	23,903	8.7	4,884
	TOTAL	**2,564**	**10,775**	**45,412**		**651,519**	**16.5**	
	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX							

	CENTRAL VALLEY PROJECT							
							CVP	Prelim.
							Expanded	Vernalis
	2003	Total chinook salvage			Ave. cfs	Acre ft.	salvage/	flow
		Observed	Expanded	Est. Loss	Export	Export	1000 ac.ft.	(cfs)
4	2/23-3/1	17	204	128	4,348	60,355	3.4	2,003
MAR	3/2-3/8	40	228	143	4,315	59,897	3.8	2,109
2	3/9-3/15	33	396	241	4,347	60,341	6.6	2,274
3	3/16-3/22	41	492	293	4,337	60,202	8.2	2,401
4	3/23-3/29	138	1,656	966	4,393	60,979	27.2	2,088
APR	3/30-4/5	124	1,488	924	3,442	47,778	31.1	2,013
2	4/6-4/12	409	1,584	1,009	2,907	40,352	39.3	1,951
3	4/13-4/19	73	876	641	1,695	23,528	37.2	2,886
4	4/20-4/26	108	1,296	1,060	858	11,910	108.8	3,273
MAY	4/27-5/3	57	684	559	856	11,882	57.6	3,310
2	5/4-5/10	49	588	491	857	11,896	49.4	3,325
3	5/11-5/17	47	300	245	840	11,660	25.7	2,864
4	5/18-5/24	38	456	349	1,537	21,335	21.4	2,084
5	5/25-5/31	9	108	76	2,875	34,207	3.2	1,941
	TOTAL	**1,183**	**10,356**	**7,125**		**516,322**	**20.1**	**3,132**

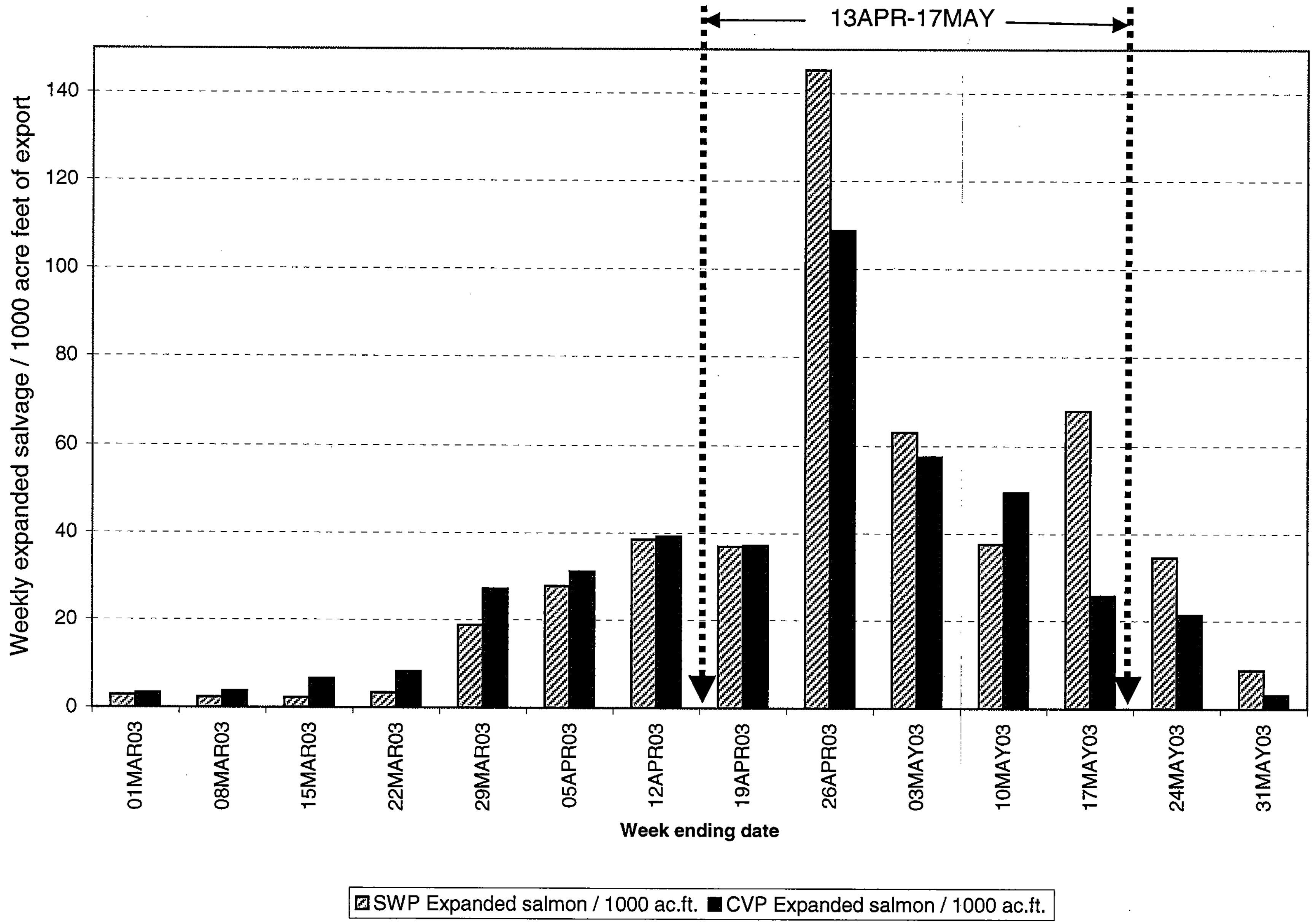
2003 SWP SALMON SALVAGE & LOSS

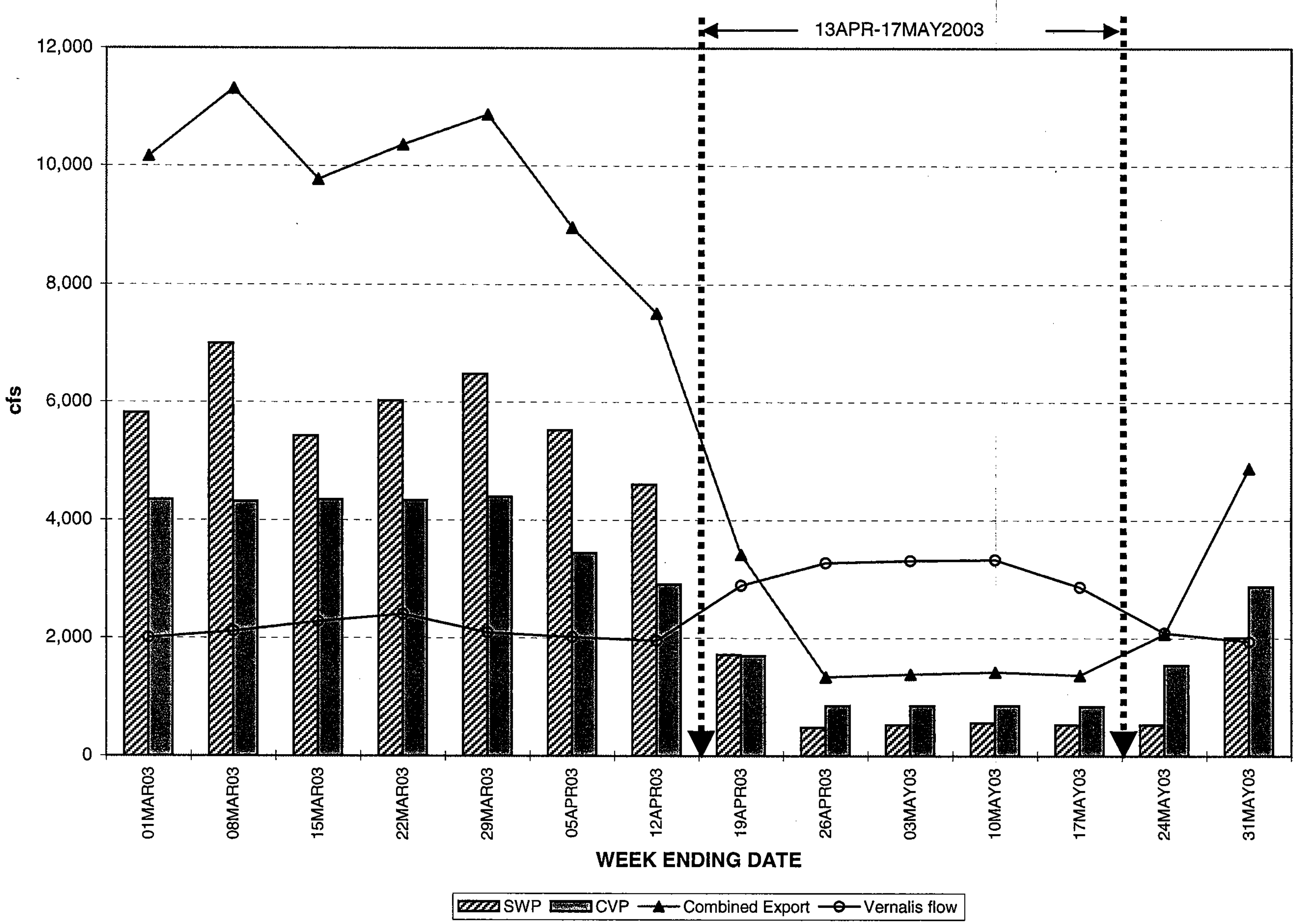


2003 CVP SALMON SALVAGE & LOSS



2003 SWP/CVP expanded salmon salvage density



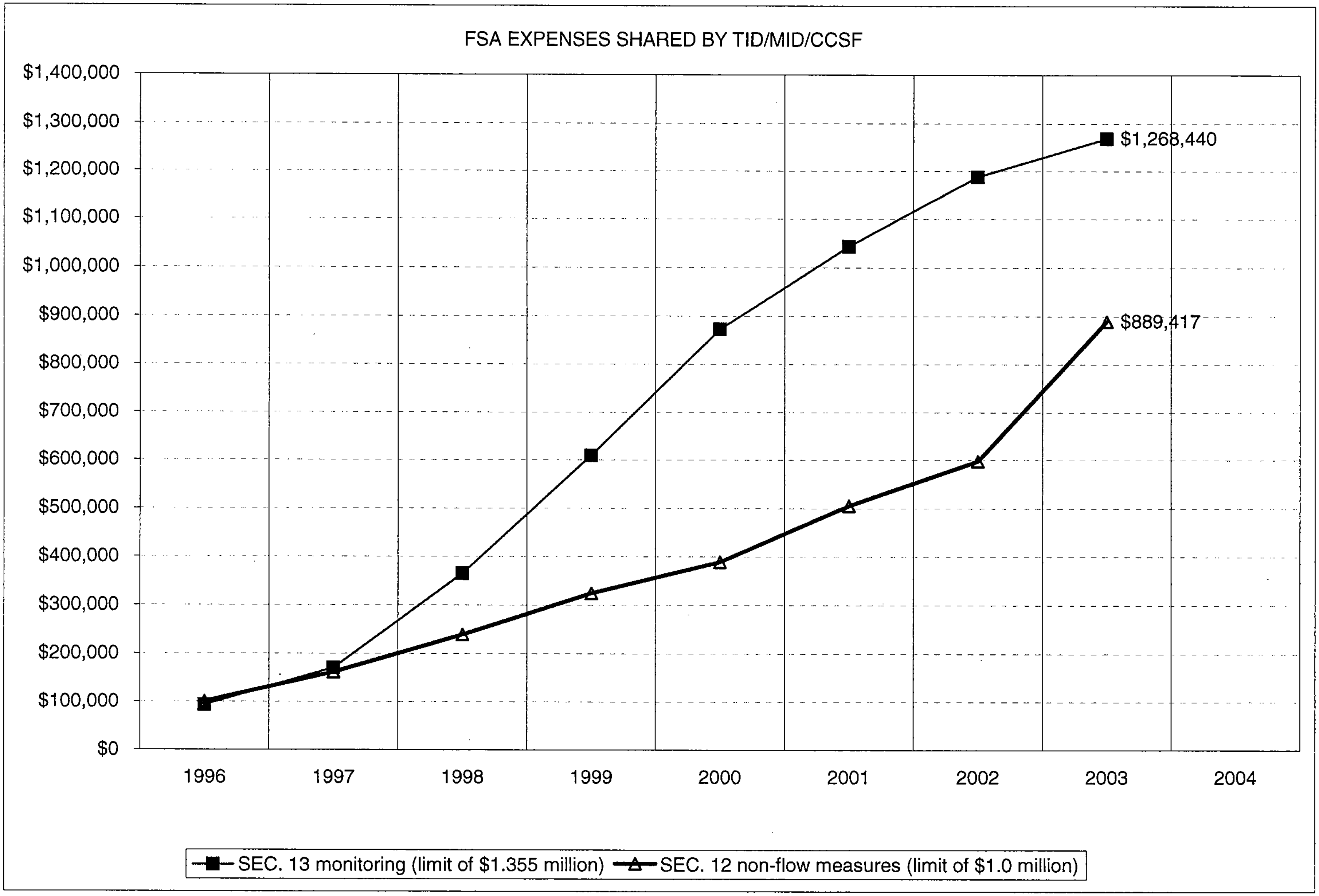


13APR-17MAY2003
12,000
10,000
8,000
6,000
4,000
2,000
0
cfs
01MAR03
08MAR03
15MAR03
22MAR03
29MAR03
05APR03
12APR03
19APR03
26APR03
03MAY03
10MAY03
17MAY03
24MAY03
31MAY03
WEEK ENDING DATE
SWP
CVP
Combined Export
Vernalis flow

DON PEDRO PROJECT FERC SETTLEMENT AGREEMENT EXPENSES
FOR COSTS SHARED BY TID/MID/CCSF

ITEM	1996 EXPENSE	1997 EXPENSE	1998 EXPENSE	1999 EXPENSE	2000 EXPENSE	2001 EXPENSE	2002 EXPENSE	2003 EXPENSE	TOTAL EXPENSE TO DATE	*Projected 2004 EXPENSE*	*Projected TOTAL EXPENSE*
Section 13 (Monitoring):											
Water Temperature	$4,563	$4,723	$4,082	$4,087	$5,284	$6,210	$5,358	$4,473	$38,780	*$5,400*	*$44,180*
Fry/Juv. Salmon (seine/snorkel)	$21,720	$22,713	$23,428	$27,199	$26,756	$25,001	$27,532	$26,640	$200,989	*$28,160*	*$229,149*
Fry/Juv. Salmon (screw trap: JAN-MAR)			$40,800	$44,766	$38,295	$495			$124,356		*$124,356*
Smolt (screw trap/MMR: APR-MAY)			$51,455	$54,423	$97,881	$1,486		*$30,000*	$235,245	*$25,000*	*$260,245*
SMOLT (Large CWT/trawl/96-97 screw trap)	$67,067	$50,151	$32,814	$48,739	$56,691	$102,132	$91,387		$448,980	*$10,000*	*$458,980*
{AFRP SHARE}			{$75,718}	{$47,432}							
REDD COUNTS/Spawning survey					$5,856			$12,653	$18,509	*$13,000*	*$31,509*
SPAWNING HABITAT QUALITY			$15,163	$46,414	$12,288	$1,769	$9,056		$84,690		*$84,690*
STRANDING ASSESSMENT			$24,615	$19,067	$206				$43,888		*$43,888*
SMOLT SURVIVAL REVIEW			$1,800		$19,837	$33,590	$11,136	$6,641	$73,004	*$5,000*	*$78,004*
{AFRP SHARE}			{$1,800}								
SUBTOTAL	$93,350	$77,587	$194,157	$244,695	$263,093	$170,683	$144,469	*$80,407*	$1,268,440	*$86,560*	*$1,355,000*
Remaining Balance									**$86,560**		***($0)***
Section 12 (Non-flow measures):											
PILOT RESTORATION SCOPING	$25,000								$25,000		*$25,000*
RESTORATION PLAN (TAC SHARE)	$75,483	$29,517		$12,500					$117,500		*$117,500*
{AFRP SHARE}		{$79,988}	{$24,736}								
MINING REACH PROPOSAL		$0									
{AFRP SHARE}		{$10,769}									
SRP 9/10, MINING REACH, & RM 43		$22,541	$77,459	$68,587	$58,956	$111,474	$92,570	$275,230	$731,920	*$76,083*	*$782,899*
SEDIMENT MANAGEMENT				$3,500	$5,700	$5,000		$16,330	$35,530	*$34,500*	*$65,030*
GIS MAPPING		$9,571							$9,571		*$9,571*
SUBTOTAL	$100,483	$61,629	$77,459	$84,587	$64,656	$116,474	$92,570	$291,560	$889,417	*$110,583*	*$1,000,000*
Remaining Balance									**$110,583**		***($0)***
COMBINED TOTAL	$193,833	$139,216	$271,616	$329,282	$327,748	$287,156	$237,038	$371,967	$2,157,857	*$197,143*	*$2,355,000*
Combined Remaining Balance									**$197,143**		**($0)**

Italicized values for 2003-2004 are estimates based on TRTAC approvals


FSA EXPENSES SHARED BY TID/MID/CCSF
$1,400,000
$1,300,000
$1,200,000
$1,100,000
$1,000,000
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
1996
1997
1998
1999
2000
2001
2002
2003
2004
$1,268,440
$889,417
SEC. 13 monitoring (limit of $1.355 million)
SEC. 12 non-flow measures (limit of $1.0 million)

3/23/2004 TJF

COMPARATIVE TABLE OF FSA SECTION 13 (MONITORING) EXPENSES FOR COSTS SHARED BY TID/MID/CCSF

FSA APPENDIX "A" CATEGORY	YEARS	EXPENSE	TOTAL	TRTAC CATEGORY	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL EXPENSE TO DATE
FSA APPENDIX "A"				*TRTAC IMPLEMENTATION*									
B. SPAWNING HABITAT QUALITY	1	$25,000	$55,000	SPAWNING HABITAT QUALITY			$15,163	$46,414	$12,288	$1,769	$9,056		$84,690
(La Grange to Waterford)	3	$10,000		REDD COUNTS/spawning survey					$5,856			$12,653	$18,509
				WATER TEMPERATURE									
											Subtotal		**$103,199**
C. REL. FRY DENSITY/FEMALE SPAWNERS	4	$25,000	$100,000	FRY/JUV. SALMON (1/2 of seine/snorkel)	$10,860	$11,357	$11,714	$13,600	$13,378	$12,500	$13,766	$13,320	$100,495
(seining 15JAN-15MAR)				FRY/JUV. (screw trap: JAN-MAR)									
D. FRY DISTRIB. & SURVIVAL (Fluctuation)	4	$50,000	$200,000	FRY/JUV. SALMON (1/2 of seine/snorkel)									
(screw traps 15JAN-15MAR; mark/recapture)				FRY/JUV. (screw trap: JAN-MAR)			$40,800	$44,766	$38,295	$495			$124,356
				STRANDING ASSESSMENT			$24,615	$19,067	$206				$43,888
											Subtotal		**$168,244**
E. JUVENILE DISTRIBUTION & TEMP.	10	$25,000	$250,000	WATER TEMPERATURE	$4,563	$4,723	$4,082	$4,087	$5,284	$6,210	$5,358	$4,473	$38,780
(seining 15MAR-15JUN; thermographs)				FRY/JUV. SALMON (1/2 of seine/snorkel)	$10,860	$11,357	$11,714	$13,600	$13,378	$12,500	$13,766	$13,320	$100,495
				FRY/JUV. (screw trap: JAN-MAR)									
				SMOLT (screw trap: APR-MAY)								*$30,000*	
											Subtotal		**$139,275**
F. SMOLT SURVIVAL	10	$75,000	$750,000	SMOLT (screw trap/MMR: APR-MAY)			$51,455	$54,423	$97,881	$1,486			$205,245
(screw trap or trawl; mark/recapture)				SMOLT (Large CWT/trawl/96-97 screw trap)	$67,067	$50,151	$32,814	$48,739	$56,691	$102,132	$91,387	$0	$448,980
				SMOLT SURVIVAL REVIEW			$1,800		$19,837	$33,590	$11,136	$6,641	$73,004
				WATER TEMPERATURE									
											Subtotal		**$727,229**
		TOTAL	**$1,355,000**	**TOTAL**	$93,350	$77,587	$194,157	$244,695	$263,093	$170,683	$144,469	$80,407	$1,268,440
				Remaining Balance of $1,355,000									**$86,560**

Items in underline overlap into other original FSA categories from where the costs are shown. For example, (1) the JAN-MAR screw trapping costs are shown in Section 12d, but are applicable to Sections 12c and 12e as well,
(2) APR-MAY screw trapping documents juvenile movement - Sec. 13e, (3) seining documents fry distribution - Sec. 13d, and (4) and water temperature relates to all life stages

TJF 3/23/2004

2003 FSA Section 12 costs

	Sediment M&T	M&T	Other Work	EDAW	HDR	TOTAL
JAN			$769.68		$1,629.20	$2,398.88
FEB			$3,870.85	$3,842.40	$15,383.94	$23,097.19
MAR			$50,000.00	$2,709.03	$12,689.60	$65,398.63
APR			$729.17	$850.20	$8,882.57	$10,461.94
MAY			$130,000.00		$10,028.54	$140,028.54
JUN			$1,775.00	$4,957.50		$6,732.50
JUL		$4,802.00	$700.00	$521.81	$1,791.08	$7,814.89
AUG		$154.00			$18,910.41	$19,064.41
SEP		$233.37				$233.37
OCT						$0.00
NOV	$16,329.89					$16,329.89
DEC						$0.00
	$16,329.89	$5,189.37	$187,844.70	$12,880.94	$69,315.34	$291,560.24
					(less Sediment)	*$275,230.35*

2003 FSA Section 12 costs		$291,560
2003 FSA Section 13 costs		$50,407
	Total:	$341,967

2003 FSA Section 13 costs

	Large CWT DFG	Large CWT TMID/CCSF	RST	RST DFG	RST TMID/CCSF	Seine/snorkel Cramer	Seine/snorkel SWS	Fluctuation Cramer	Fluctuation SWS	Sp. Survey Cramer	Redd Counts DFG	Thermographs SWS	TOTAL
JAN		**$1,787**				$294	$1,420					$2,556	$6,057
FEB		**$2,372**				$662	$1,846						$4,880
MAR		**$2,482**				$624	$1,846						$4,952
APR						$635	$2,881						$3,516
MAY						$885	$4,686						$5,571
JUN							$7,338						$7,338
JUL							$568					$1,917	$2,485
AUG													$0
SEP							$164						$164
OCT							$1,136			$2,384			$3,520
NOV										$5,770			$5,770
DEC							$1,654			$4,499			$6,153
	$0	$6,641	$0	$0	$0	$3,101	$23,539	$0	$0	$12,653	$0	$4,473	$50,407
Subtotals		$6,641			$0		$26,640		$0	$12,653	$0	$4,473	
(Bold = review)		**$6,641**											

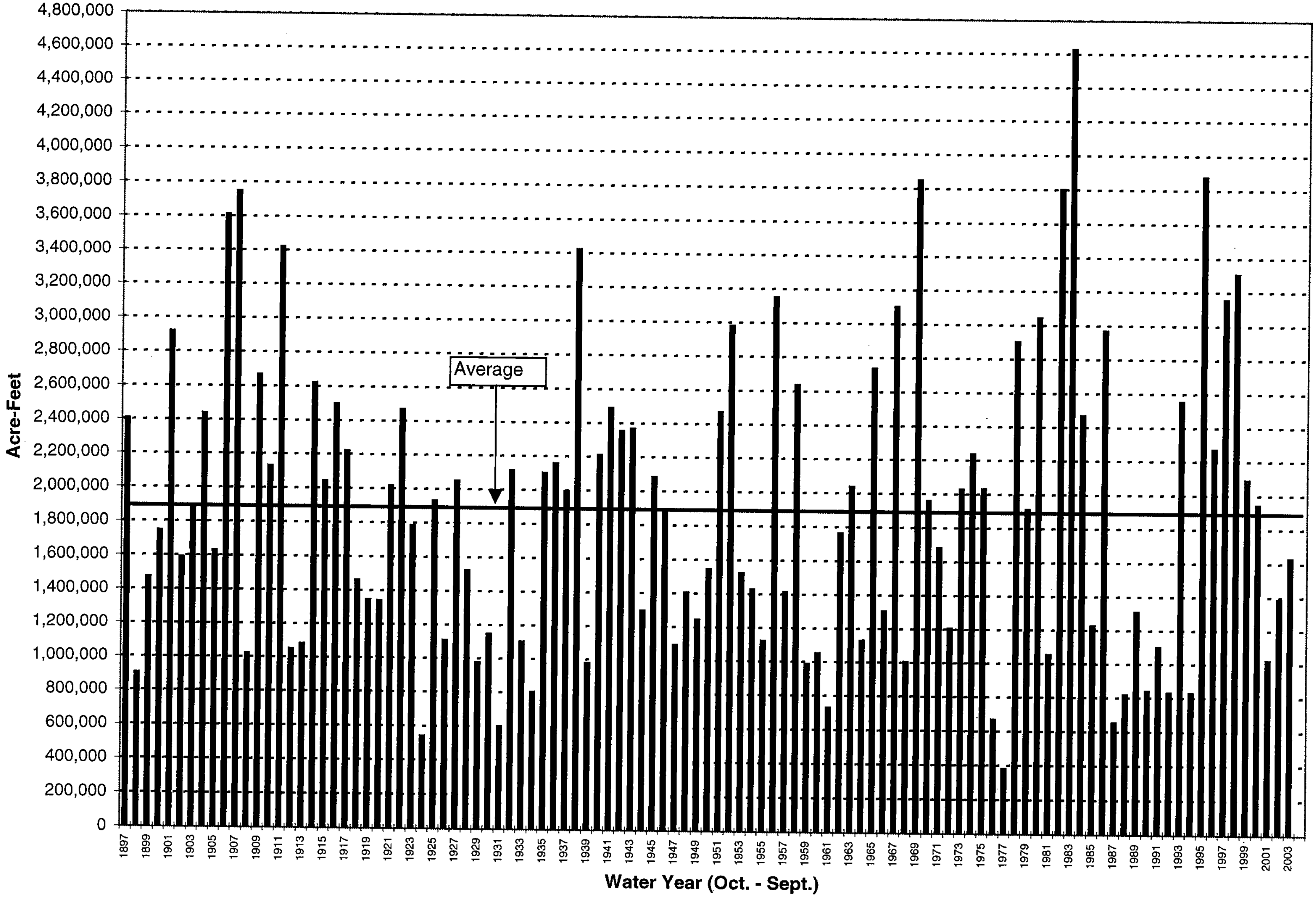
ATTACHMENT A

ATTACHMENT -A-

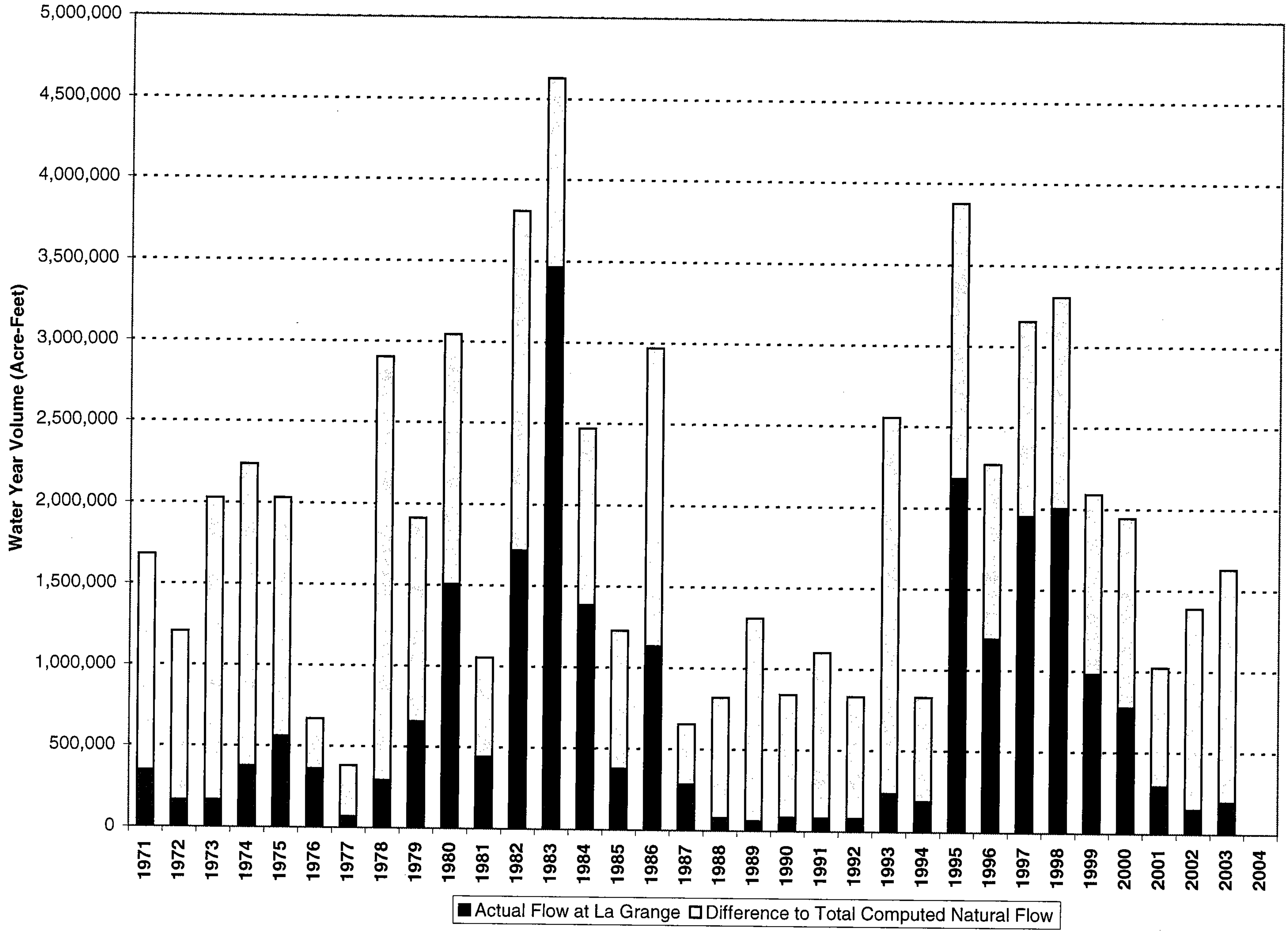
Water, Flow Schedule, Water Temperature, and Correspondence

- Graphs of flows, FERC flow schedule, and reservoir data
  - ➢ Annual computed natural and actual flows at La Grange
  - ➢ 2003/2004 Water Years daily computed natural and actual flows and FERC minimum and pulse flow schedule at La Grange
  - ➢ 2003/2004 Water Years actual flow at La Grange, Modesto, and Dry Creek
  - ➢ 2003/2004 Water Years actual flow at Modesto, Ripon, Stevinson, & Vernalis
  - ➢ 2003/2004 Water Years Don Pedro Reservoir storage
  - ➢ San Joaquin basin 60-20-20 index
  - ➢ 2003/2004 Precipitation Years (SEP-AUG) watershed precipitation and snow water content as percent of average
- Daily water and air temperature graphs for OCT2002-DEC2003
- Flow schedule correspondence
  - ➢ 04FEB – Review of Fall 2002 pulse flow and 45-day period
  - ➢ 18APR – Initial fish flow year schedule
  - ➢ 20MAY – Updated fish flow year volume and schedule revision
  - ➢ 30JUN – Updated flow schedule
  - ➢ 09OCT –Final flow schedule

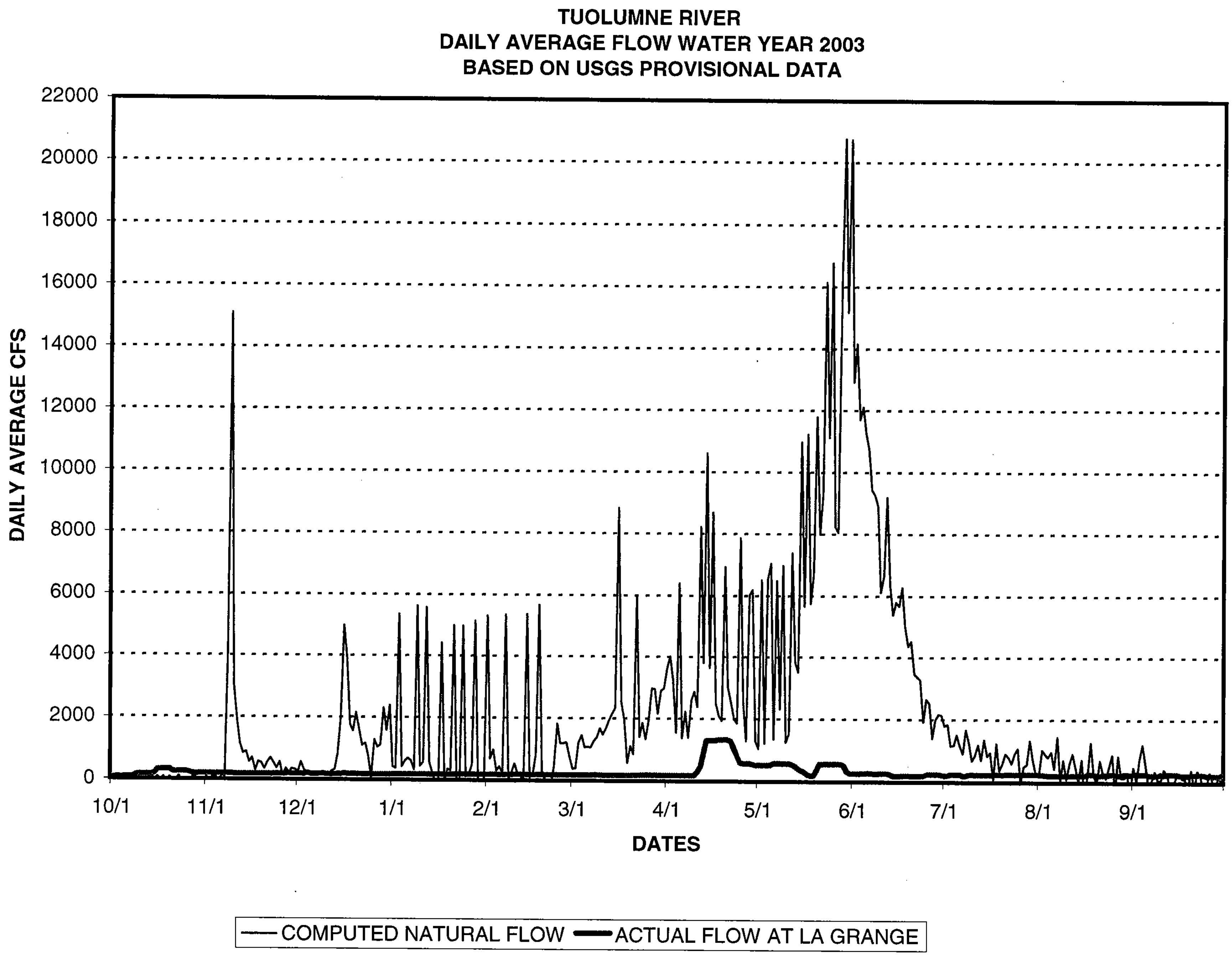
Tuolumne River Computed Natural Flow



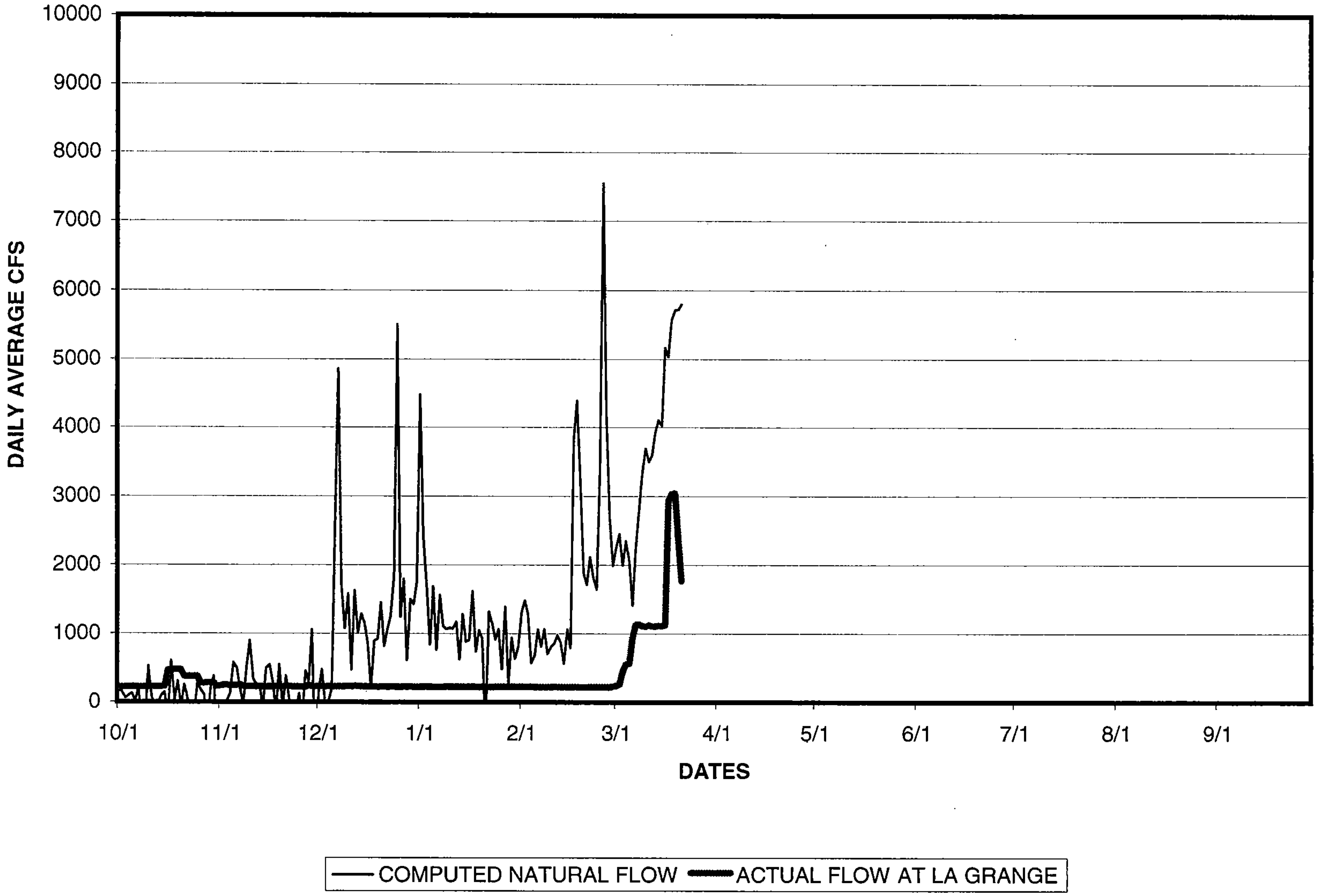
Tuolumne River since New Don Pedro Dam



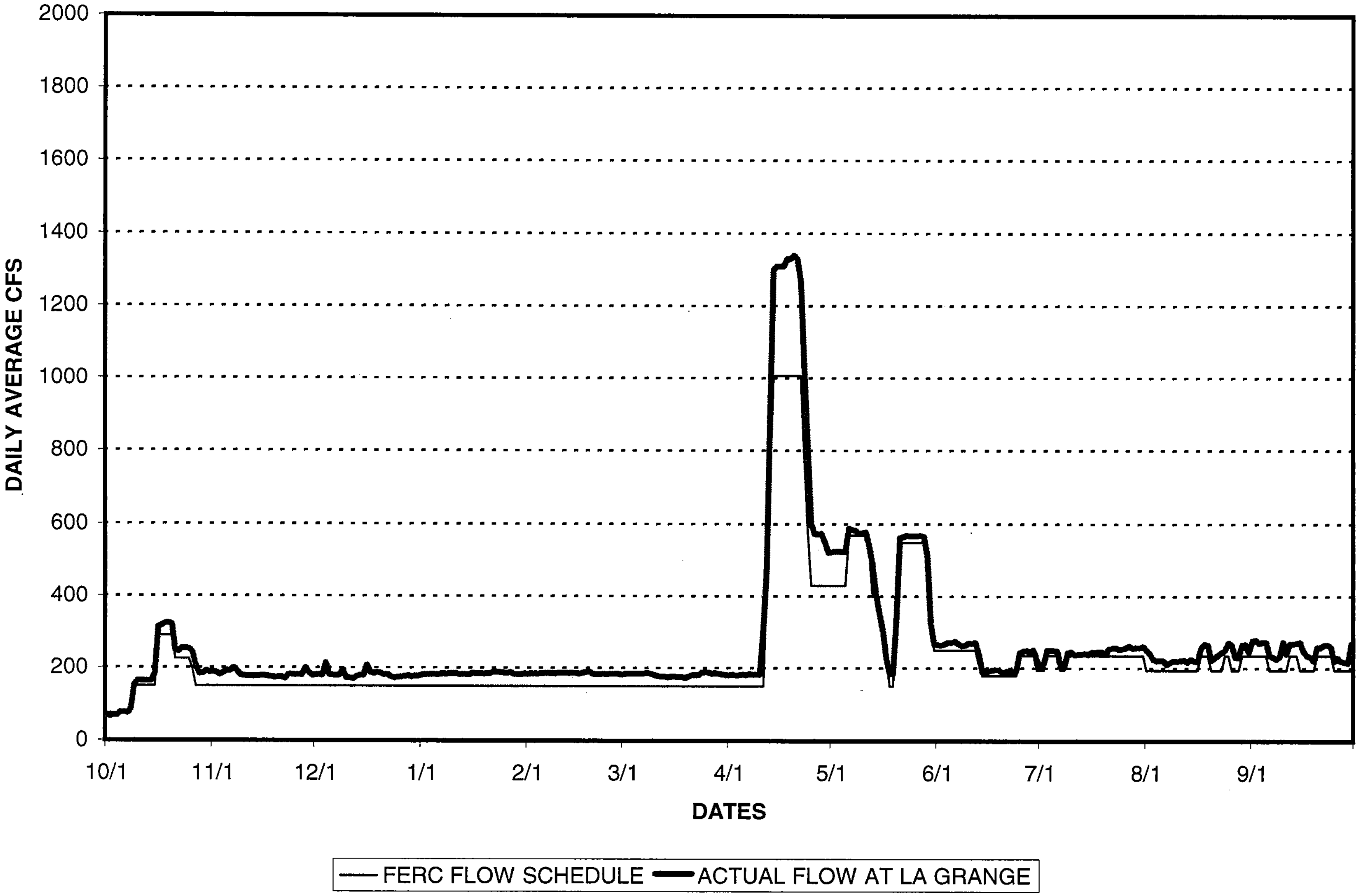
cnfyrs.xls Diff71-present TJF


TUOLUMNE RIVER
DAILY AVERAGE FLOW WATER YEAR 2003
BASED ON USGS PROVISIONAL DATA
DAILY AVERAGE CFS
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
10/1
11/1
12/1
1/1
2/1
3/1
4/1
5/1
6/1
7/1
8/1
9/1
DATES
COMPUTED NATURAL FLOW
ACTUAL FLOW AT LA GRANGE

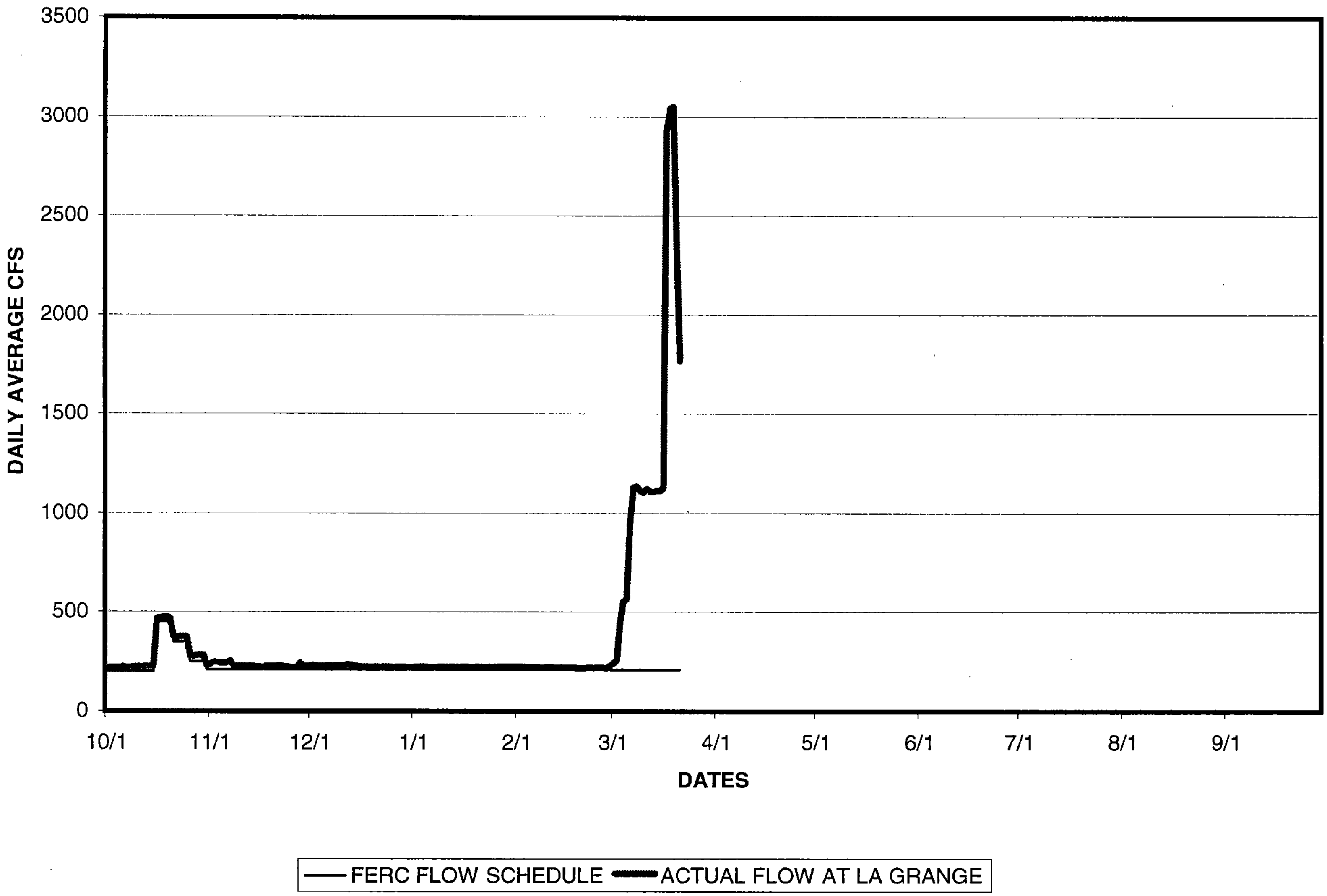
TUOLUMNE RIVER
DAILY AVERAGE FLOW WATER YEAR 2004
BASED ON USGS PROVISIONAL DATA

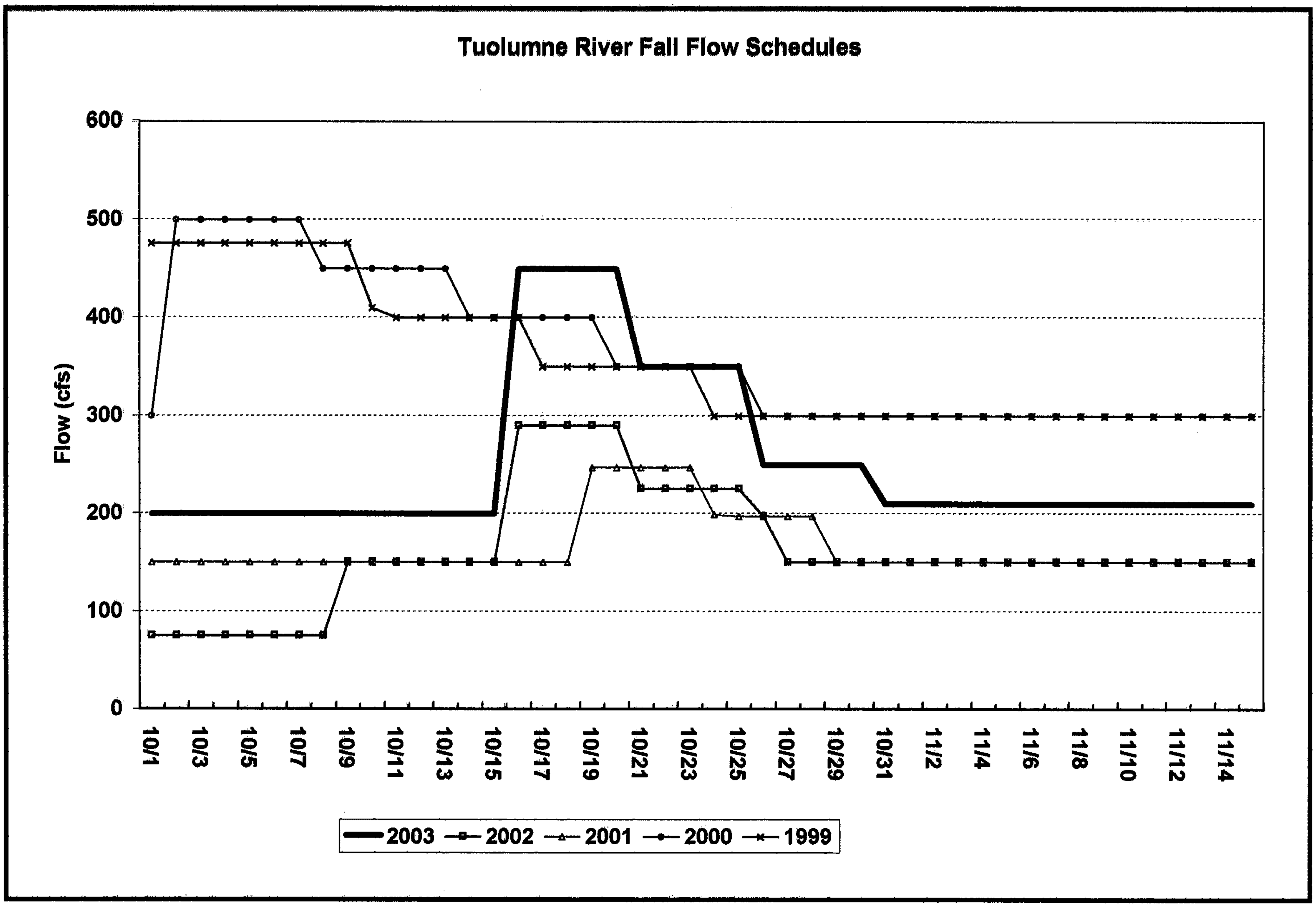


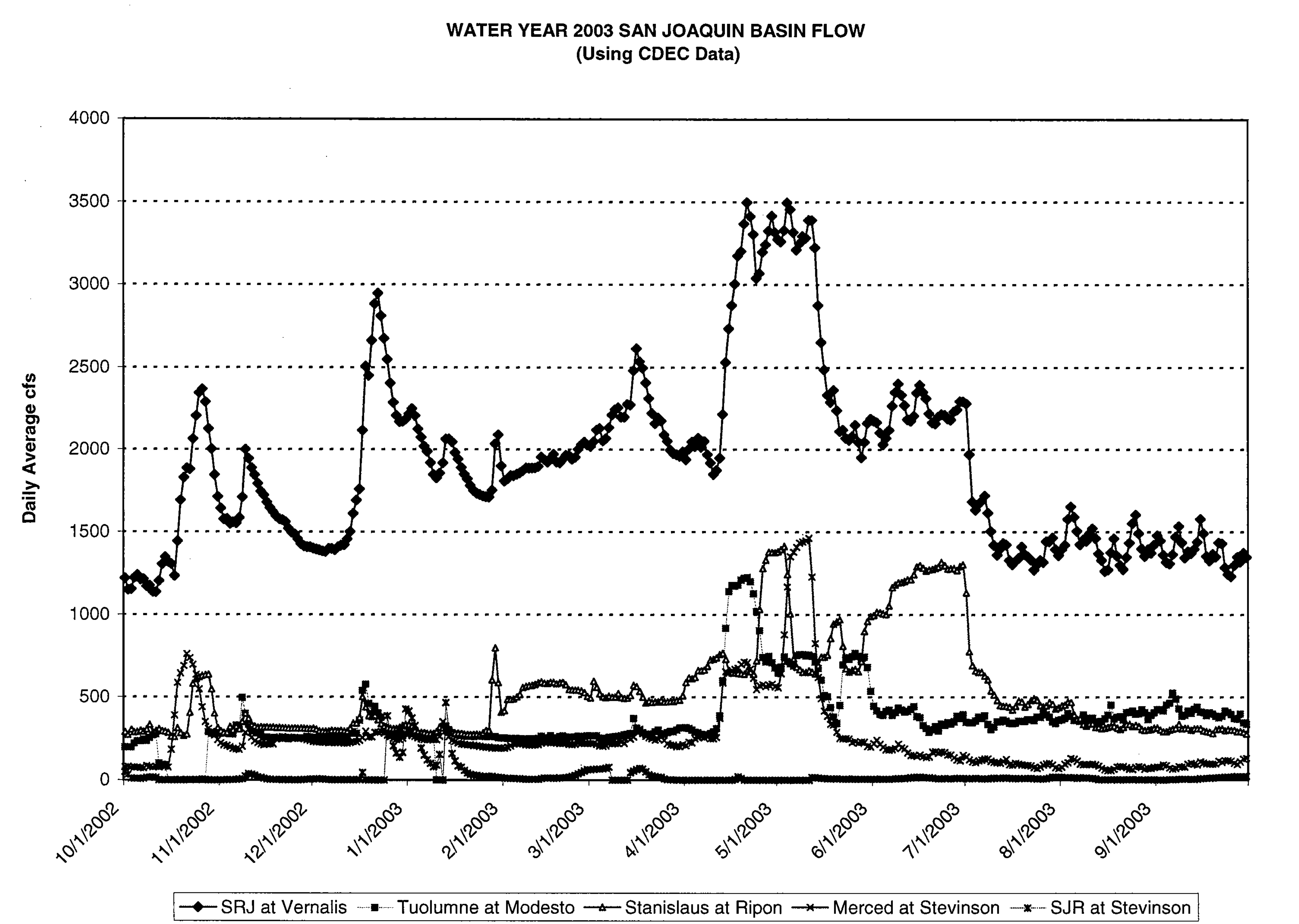
TUOLUMNE RIVER
DAILY AVERAGE FLOW WATER YEAR 2003
BASED ON USGS PROVISIONAL DATA



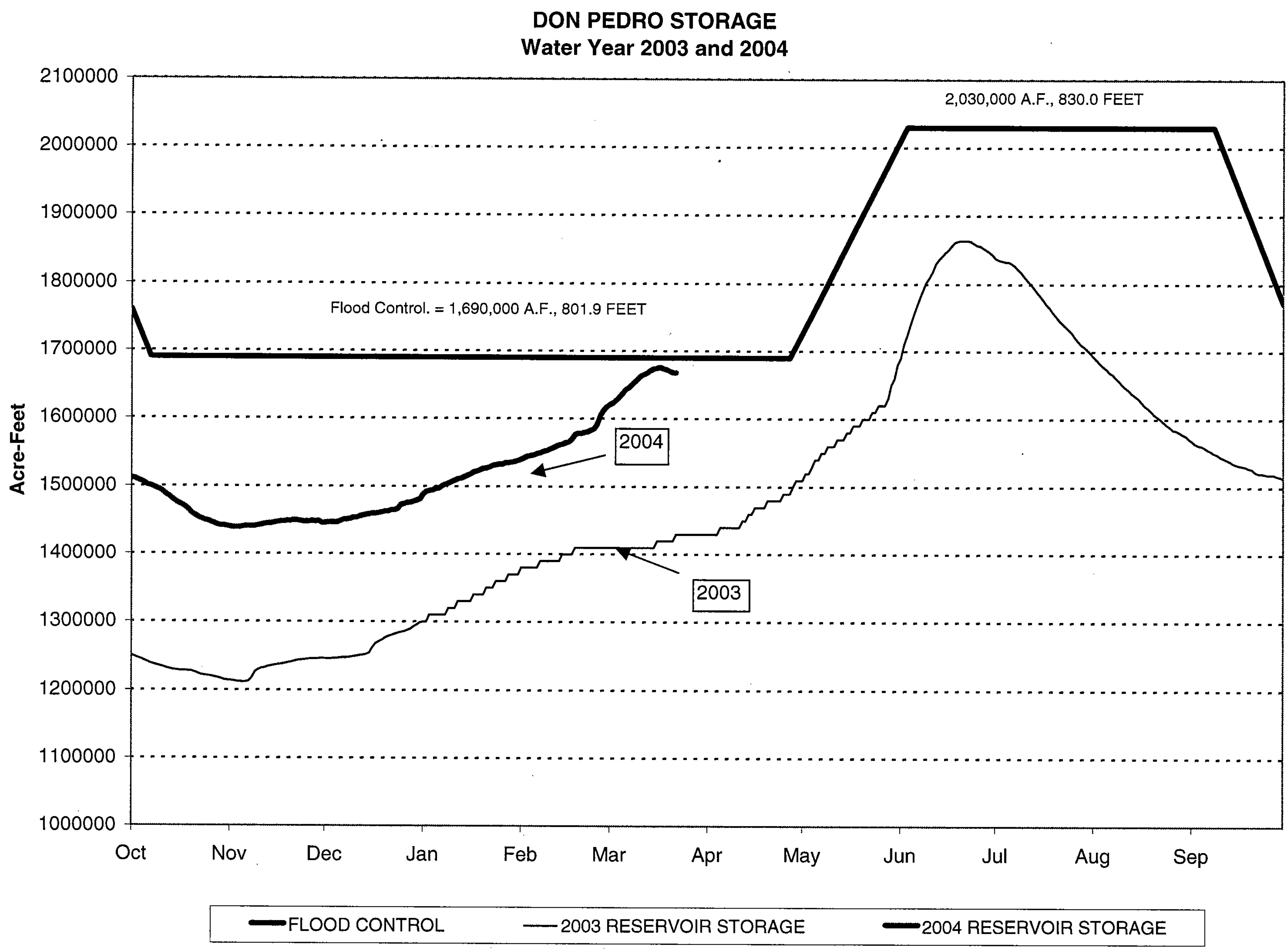
TUOLUMNE RIVER
DAILY AVERAGE FLOW WATER YEAR 2004
BASED ON USGS PROVISIONAL DATA



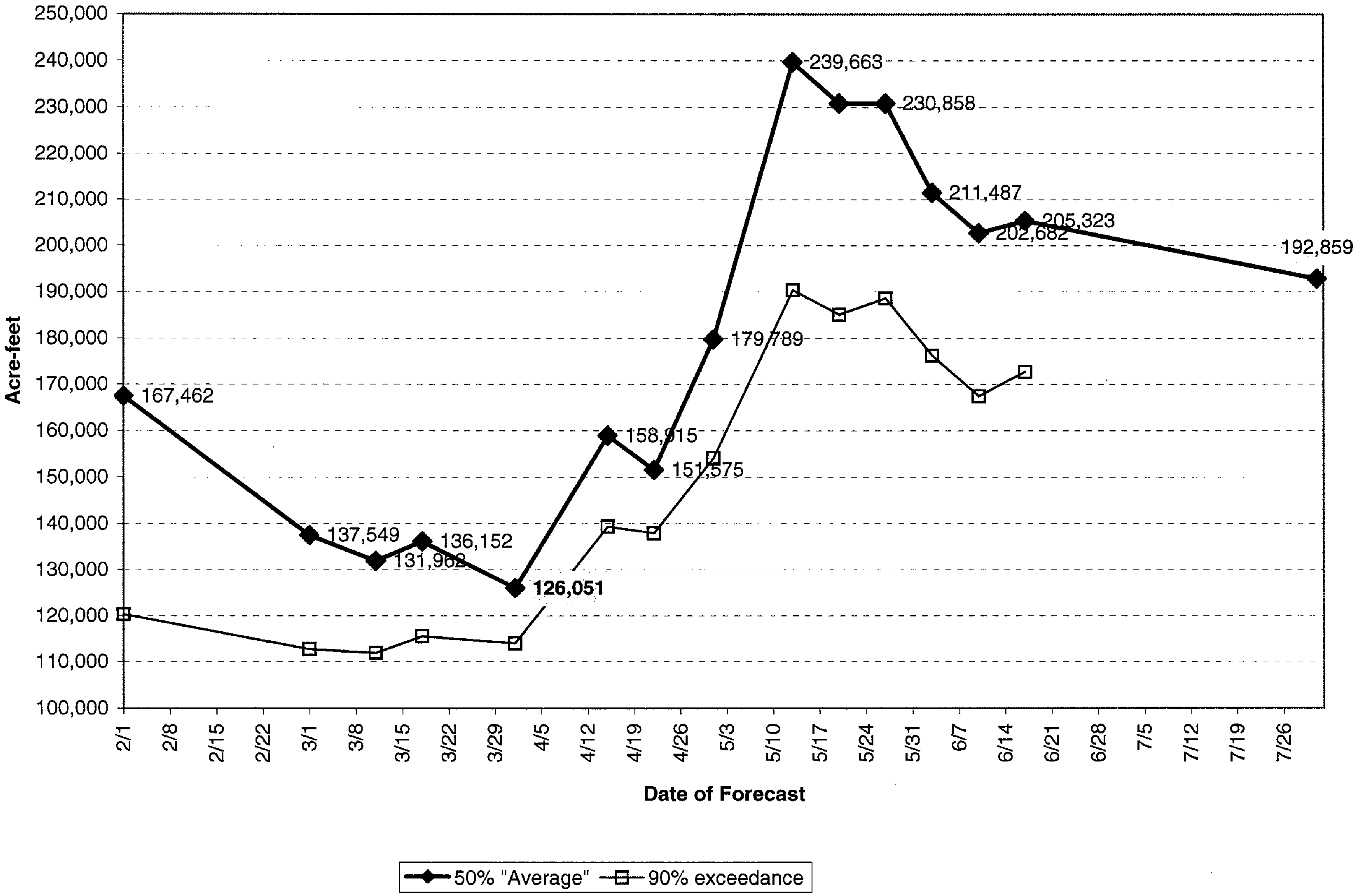

Tuolumne River Fall Flow Schedules
Flow (cfs)
600
500
400
300
200
100
0
10/1
10/3
10/5
10/7
10/9
10/11
10/13
10/15
10/17
10/19
10/21
10/23
10/25
10/27
10/29
10/31
11/2
11/4
11/6
11/8
11/10
11/12
11/14
2003
2002
2001
2000
1999



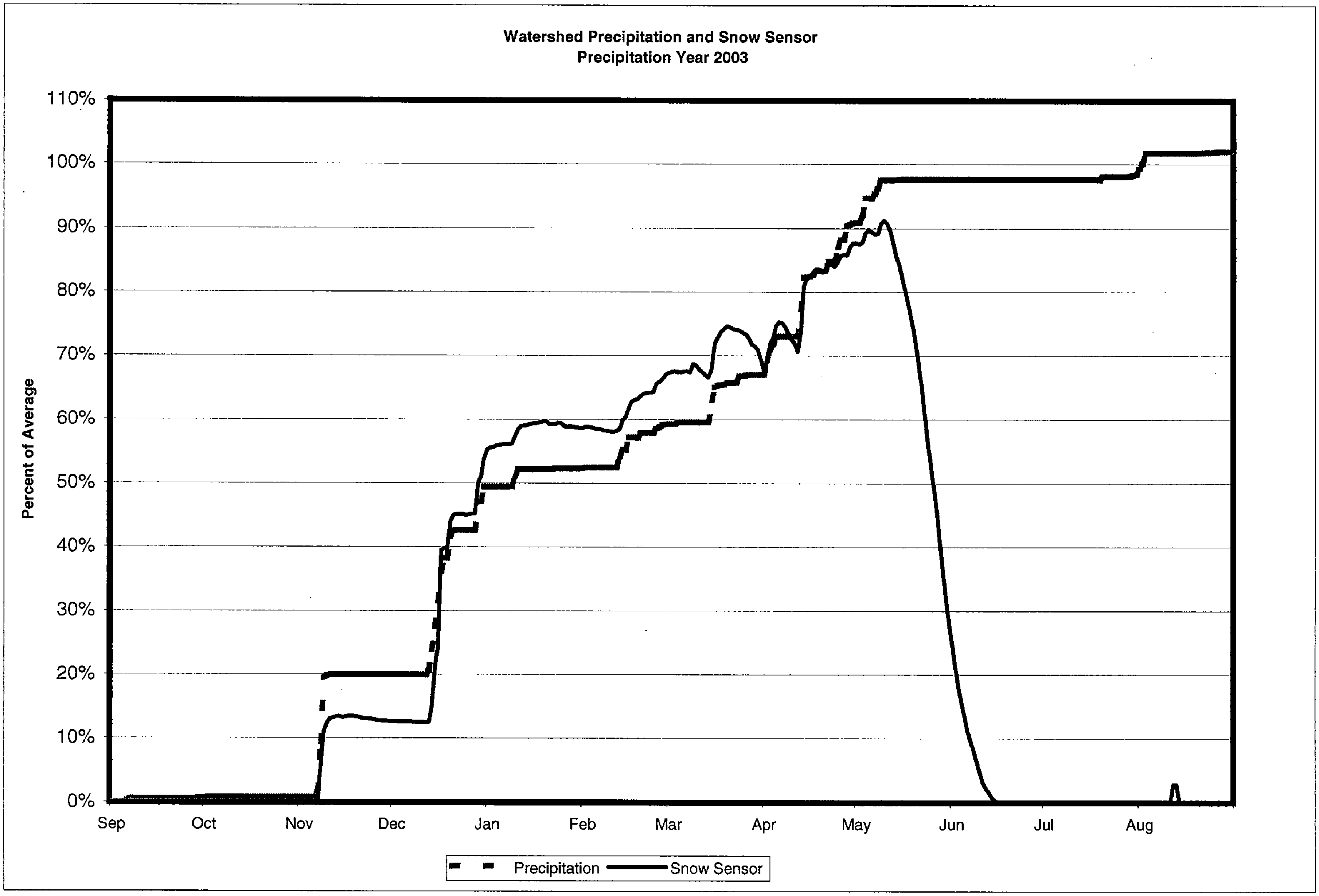
WATER YEAR 2003 SAN JOAQUIN BASIN FLOW
(Using CDEC Data)
Daily Average cfs
4000
3500
3000
2500
2000
1500
1000
500
0
10/1/2002
11/1/2002
12/1/2002
1/1/2003
2/1/2003
3/1/2003
4/1/2003
5/1/2003
6/1/2003
7/1/2003
8/1/2003
9/1/2003
SRJ at Vernalis
Tuolumne at Modesto
Stanislaus at Ripon
Merced at Stevinson
SJR at Stevinson


DON PEDRO STORAGE
Water Year 2003 and 2004
2,030,000 A.F., 830.0 FEET
Flood Control. = 1,690,000 A.F., 801.9 FEET
2004
2003
Acre-Feet
2100000
2000000
1900000
1800000
1700000
1600000
1500000
1400000
1300000
1200000
1100000
1000000
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
FLOOD CONTROL
2003 RESERVOIR STORAGE
2004 RESERVOIR STORAGE

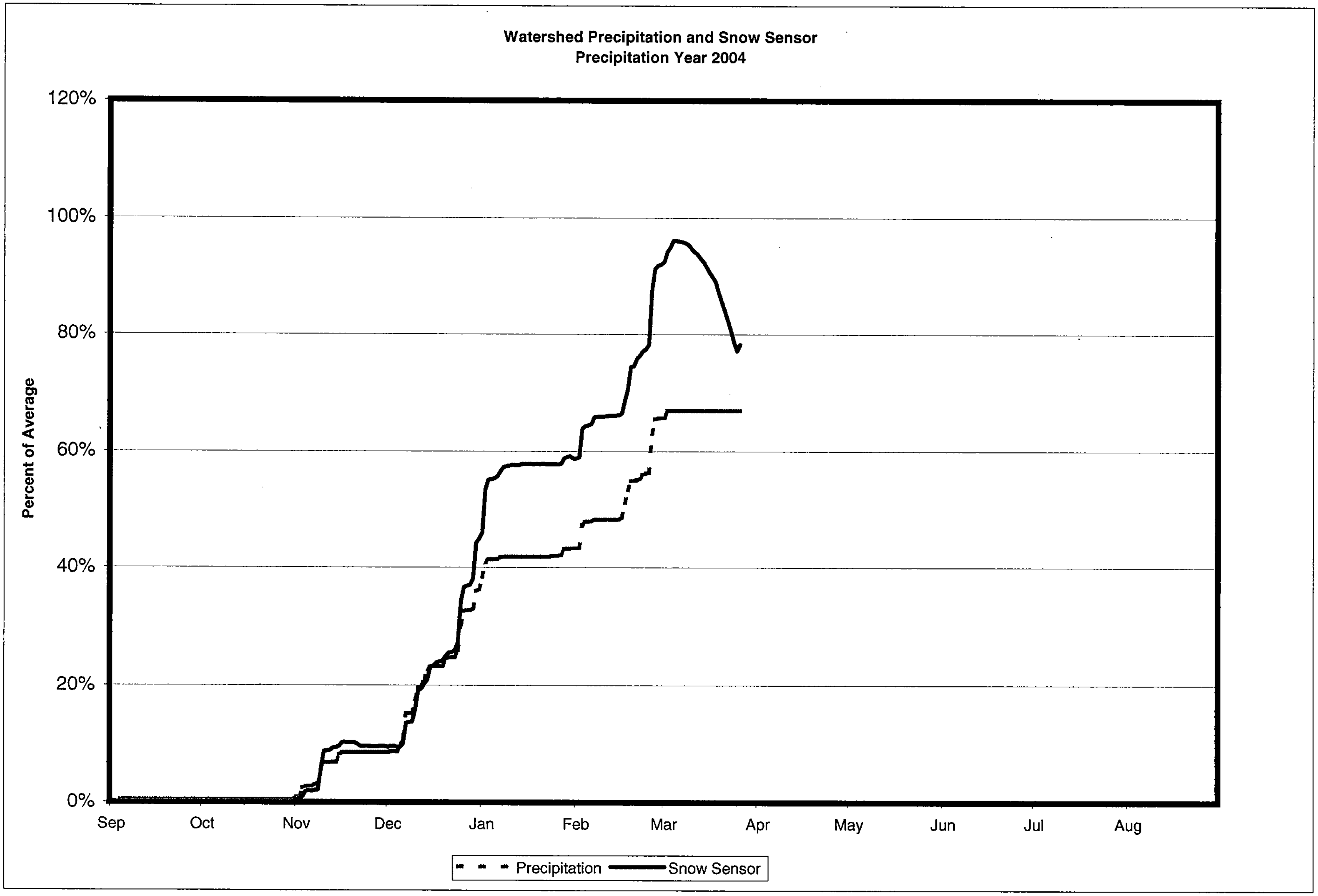
2003-04 Tuolumne FERC Flow Volume based on SJ Basin Index



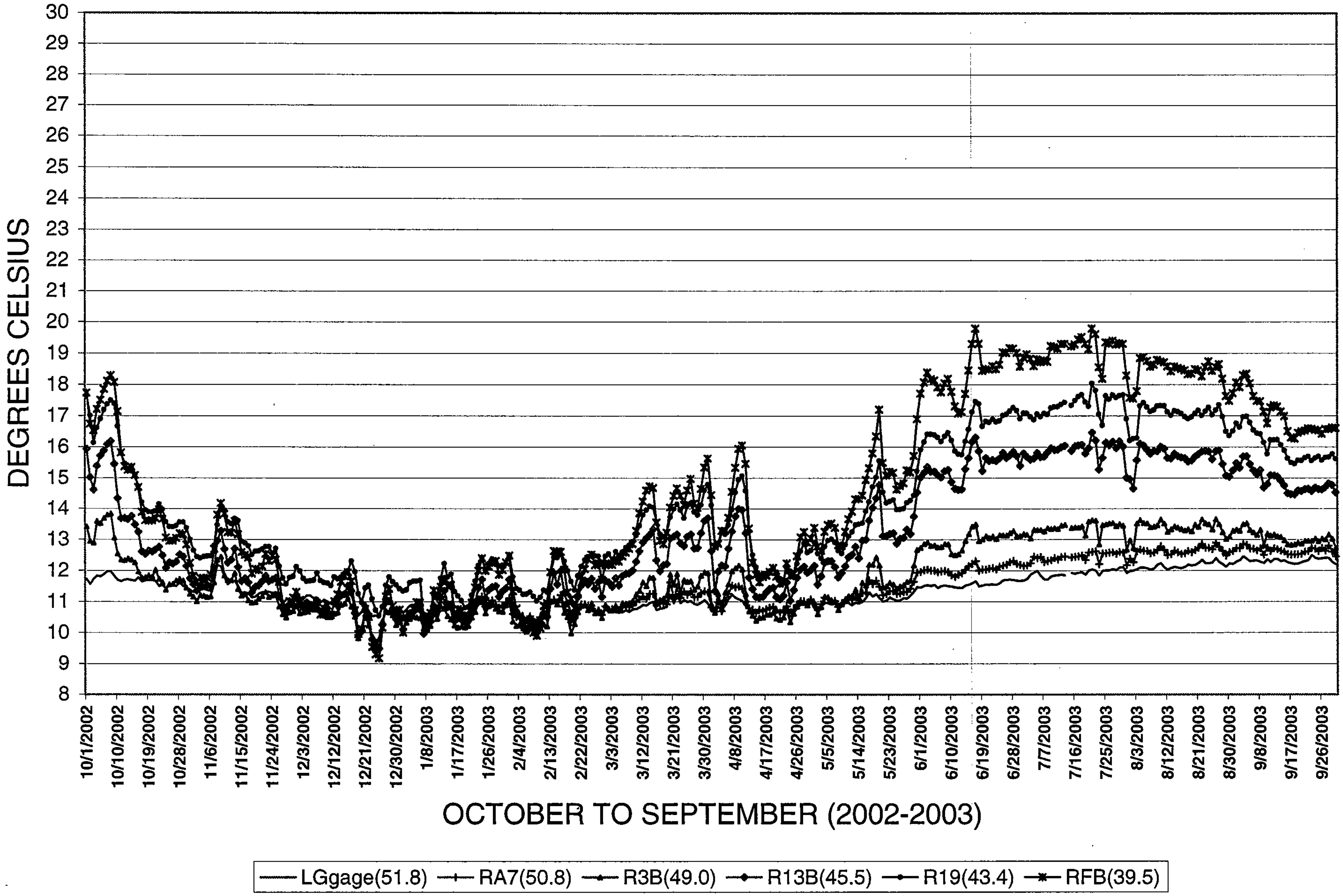
3/25/2004 forecasts&volume.xls FERC Vol. 03-04

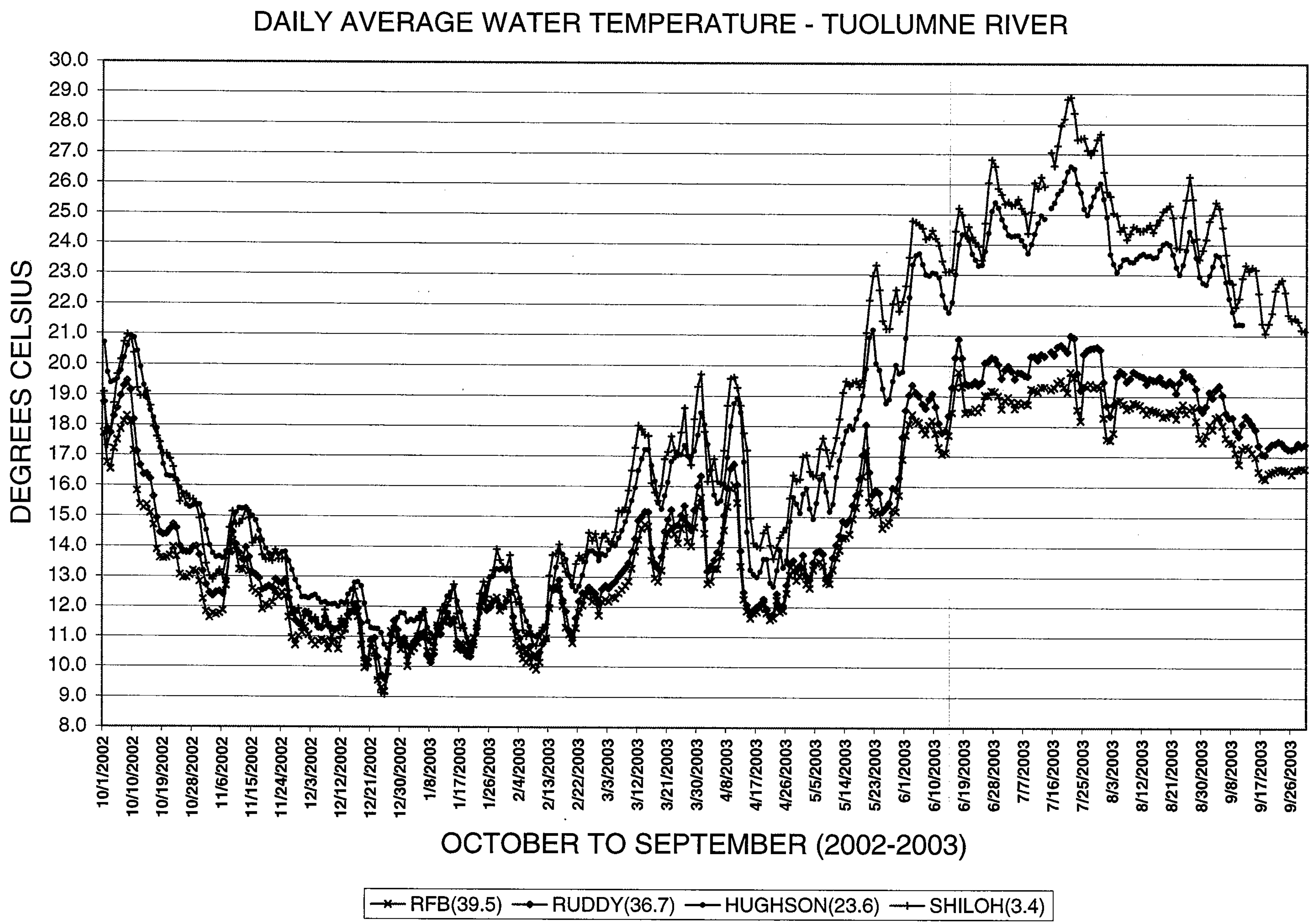


Watershed Precipitation and Snow Sensor
Precipitation Year 2003
Percent of Average
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Precipitation
Snow Sensor

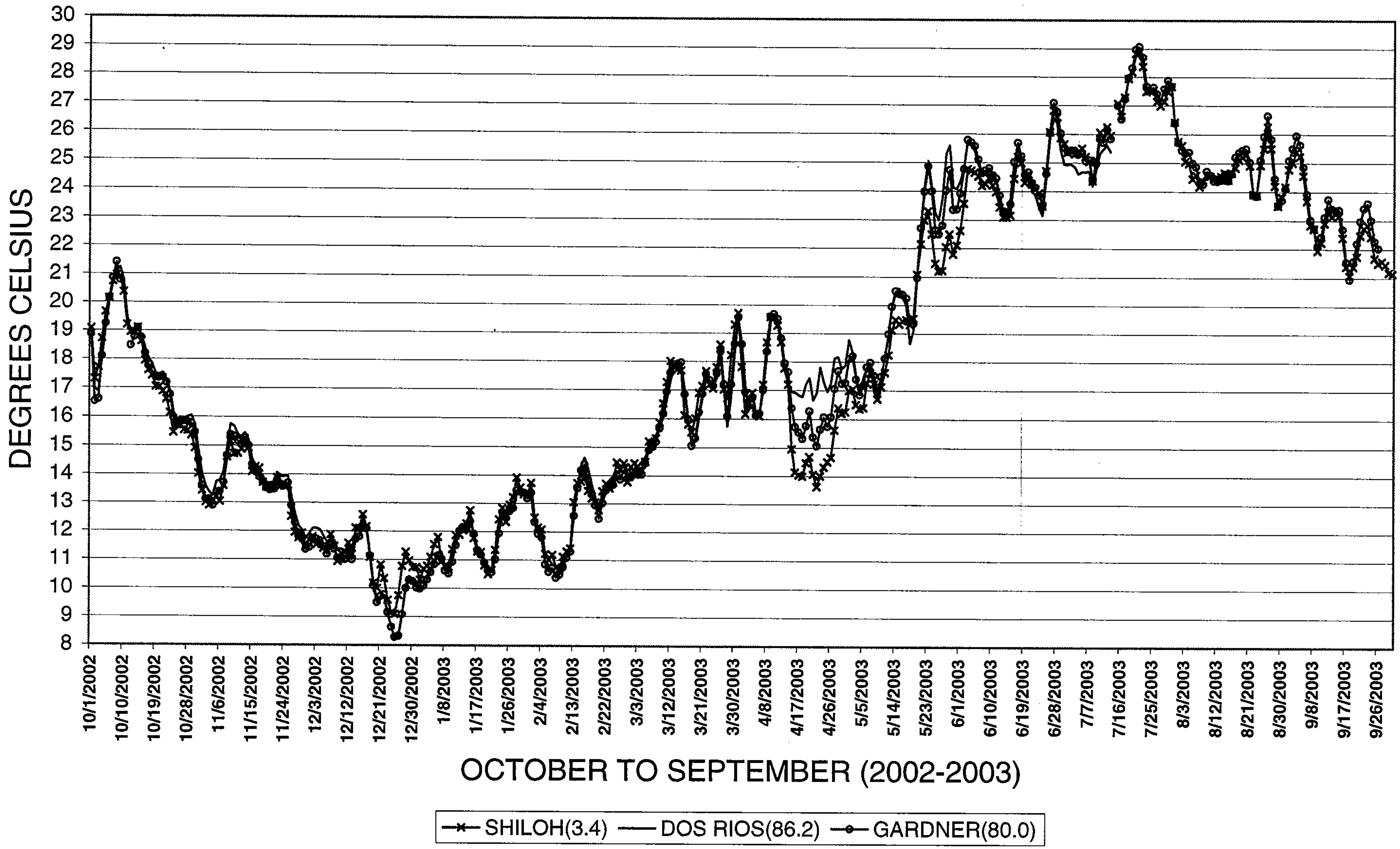

Watershed Precipitation and Snow Sensor
Precipitation Year 2004
120%
100%
80%
60%
40%
20%
0%
Percent of Average
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Precipitation
Snow Sensor

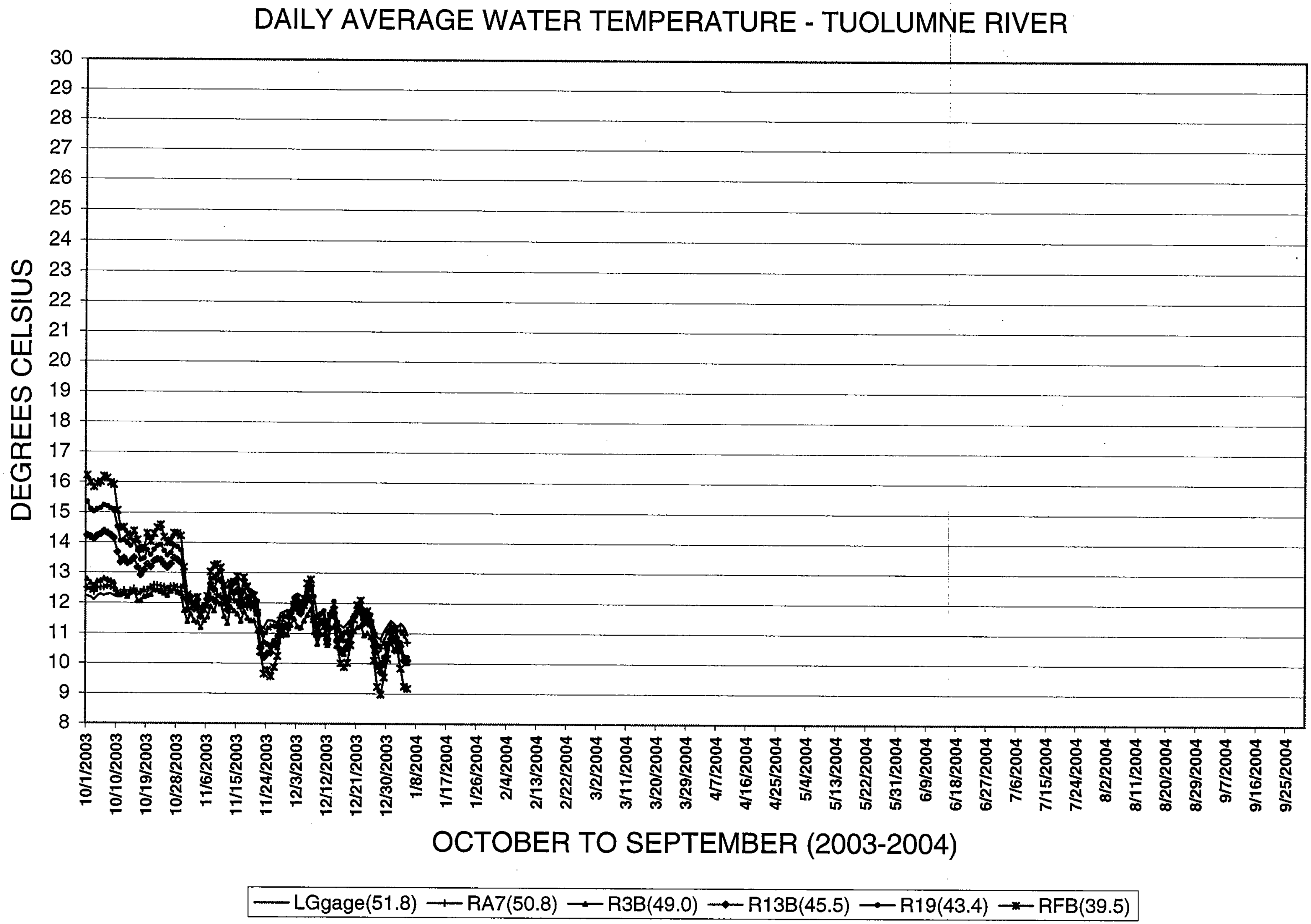
DAILY AVERAGE WATER TEMPERATURE - TUOLUMNE RIVER

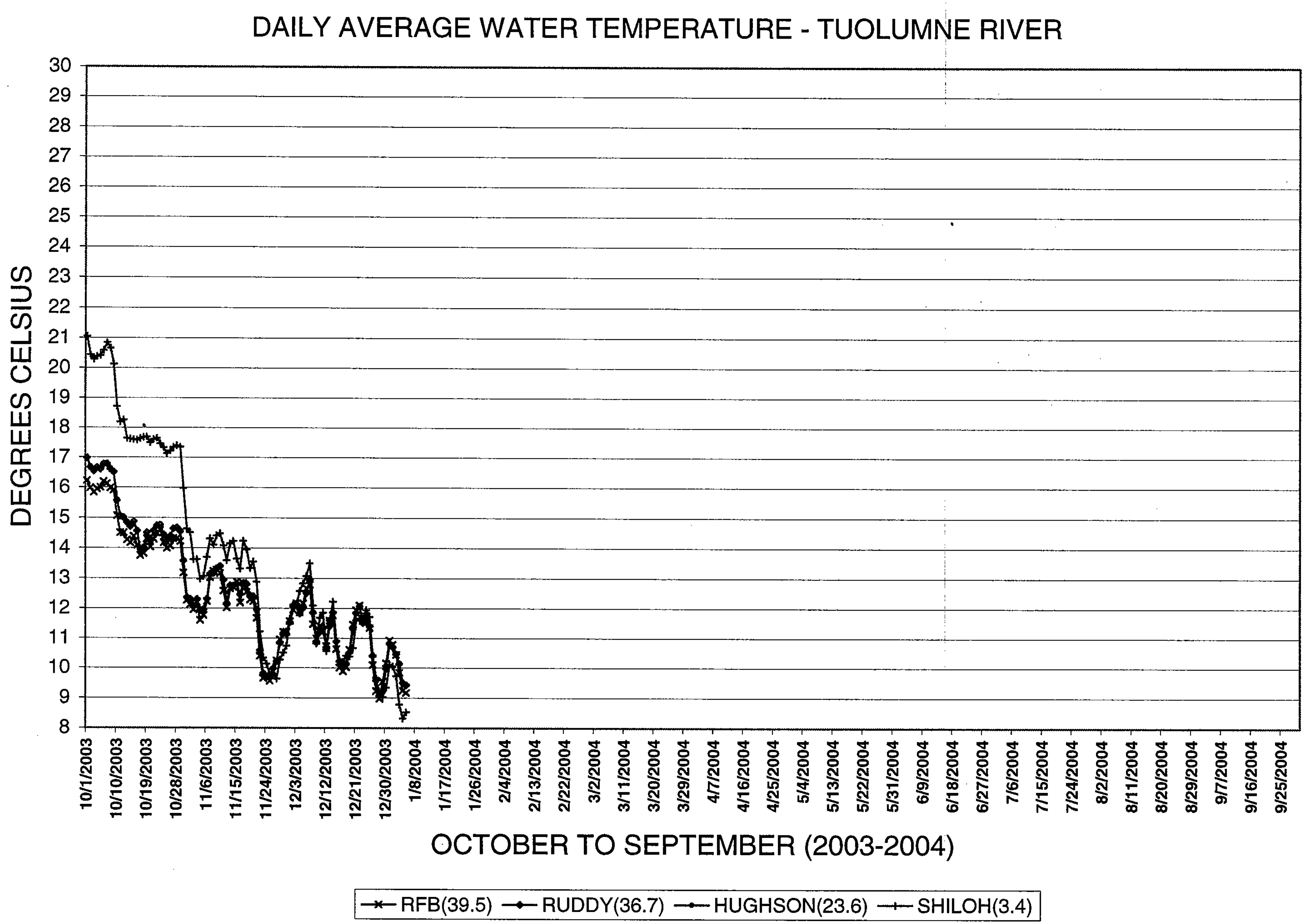



DAILY AVERAGE WATER TEMPERATURE - TUOLUMNE RIVER
DEGREES CELSIUS
30.0
29.0
28.0
27.0
26.0
25.0
24.0
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
10/1/2002
10/10/2002
10/19/2002
10/28/2002
11/6/2002
11/15/2002
11/24/2002
12/3/2002
12/12/2002
12/21/2002
12/30/2002
1/8/2003
1/17/2003
1/26/2003
2/4/2003
2/13/2003
2/22/2003
3/3/2003
3/12/2003
3/21/2003
3/30/2003
4/8/2003
4/17/2003
4/26/2003
5/5/2003
5/14/2003
5/23/2003
6/1/2003
6/10/2003
6/19/2003
6/28/2003
7/7/2003
7/16/2003
7/25/2003
8/3/2003
8/12/2003
8/21/2003
8/30/2003
9/8/2003
9/17/2003
9/26/2003
OCTOBER TO SEPTEMBER (2002-2003)
RFB(39.5)
RUDDY(36.7)
HUGHSON(23.6)
SHILOH(3.4)

DAILY AVERAGE WATER TEMPERATURE
SAN JOAQUIN AND TUOLUMNE RIVERS




DAILY AVERAGE WATER TEMPERATURE - TUOLUMNE RIVER
DEGREES CELSIUS
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
10/1/2003
10/10/2003
10/19/2003
10/28/2003
11/6/2003
11/15/2003
11/24/2003
12/3/2003
12/12/2003
12/21/2003
12/30/2003
1/8/2004
1/17/2004
1/26/2004
2/4/2004
2/13/2004
2/22/2004
3/2/2004
3/11/2004
3/20/2004
3/29/2004
4/7/2004
4/16/2004
4/25/2004
5/4/2004
5/13/2004
5/22/2004
5/31/2004
6/9/2004
6/18/2004
6/27/2004
7/6/2004
7/15/2004
7/24/2004
8/2/2004
8/11/2004
8/20/2004
8/29/2004
9/7/2004
9/16/2004
9/25/2004
OCTOBER TO SEPTEMBER (2003-2004)
LGgage(51.8)
RA7(50.8)
R3B(49.0)
R13B(45.5)
R19(43.4)
RFB(39.5)


DAILY AVERAGE WATER TEMPERATURE - TUOLUMNE RIVER
DEGREES CELSIUS
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29
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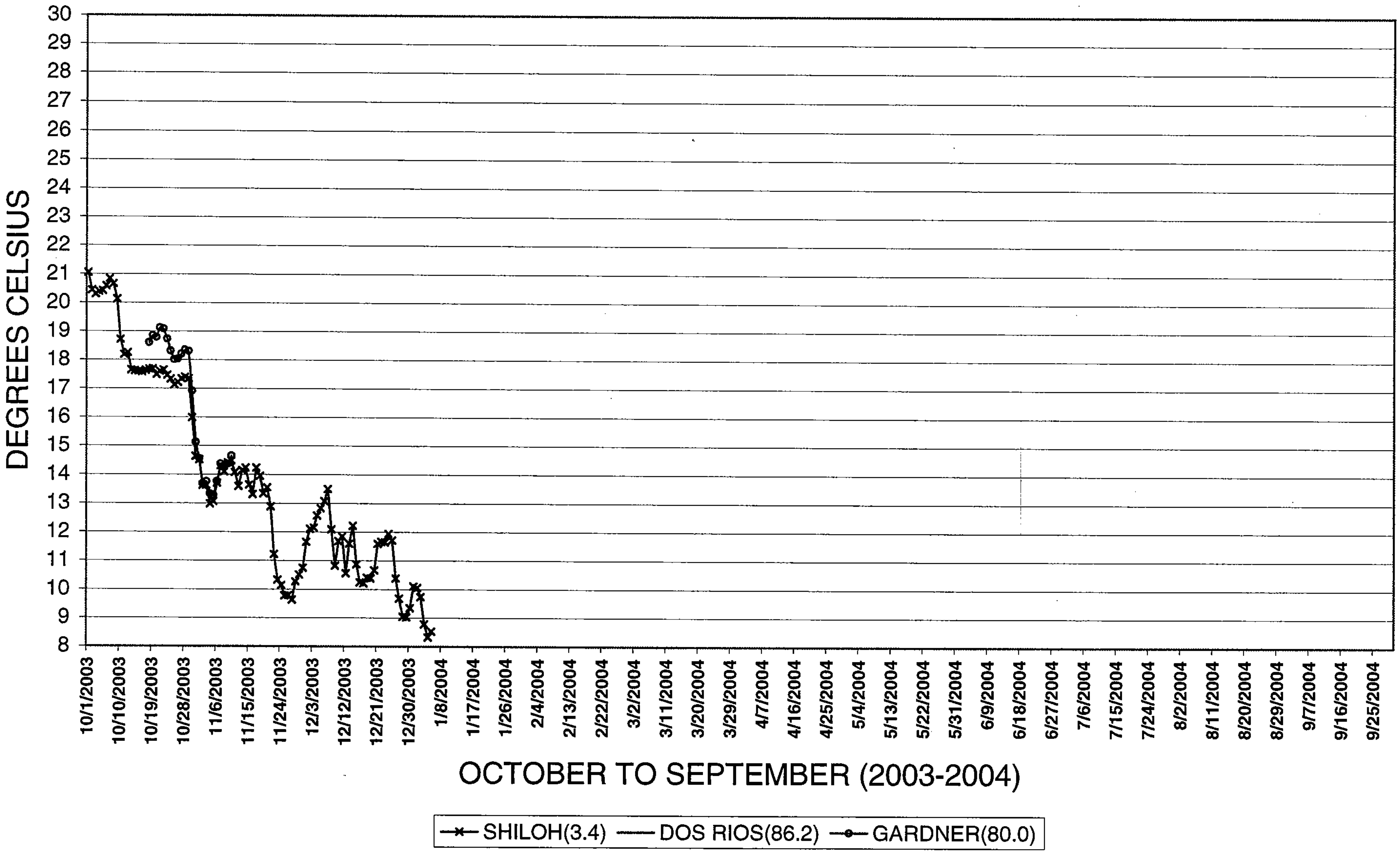
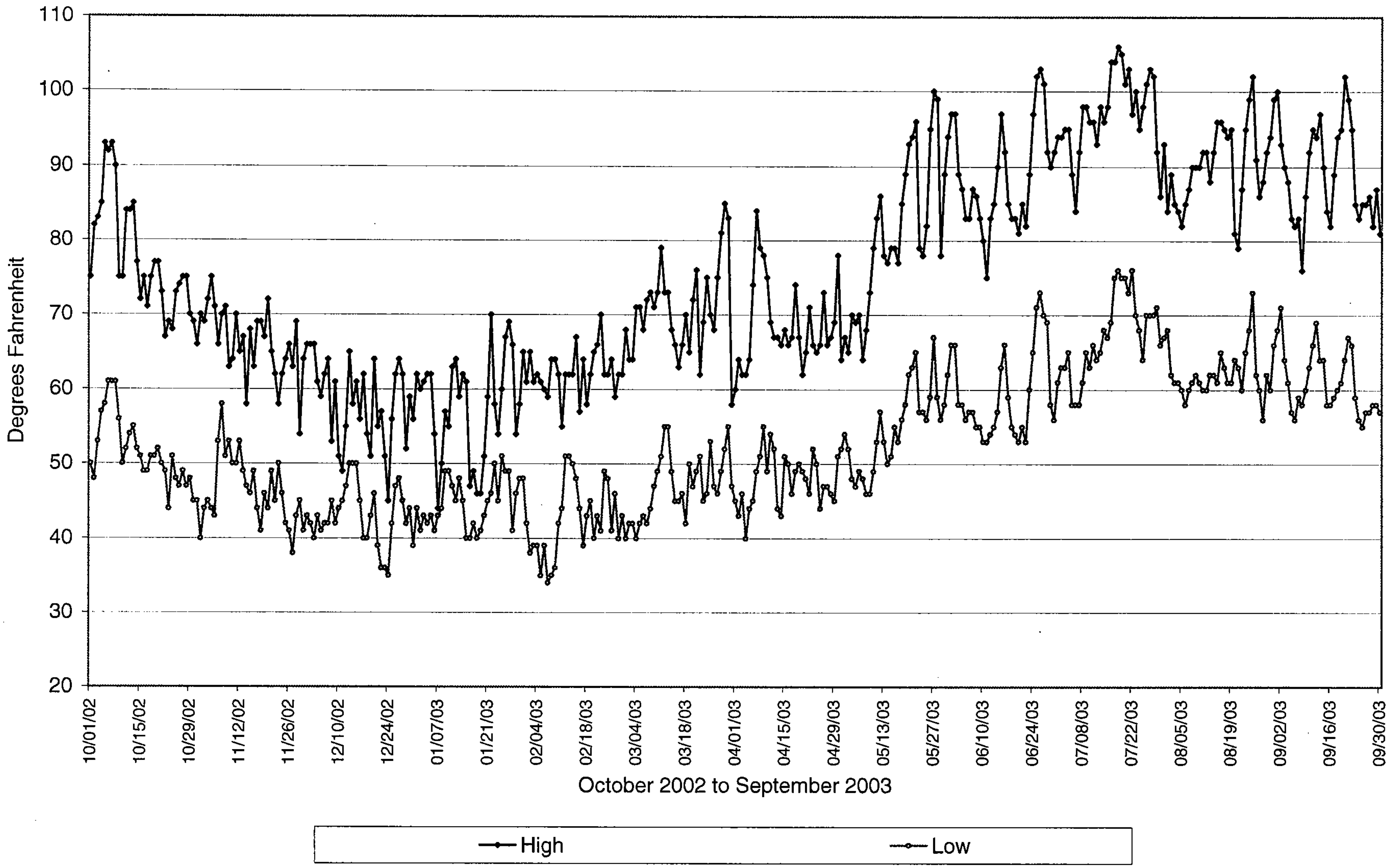
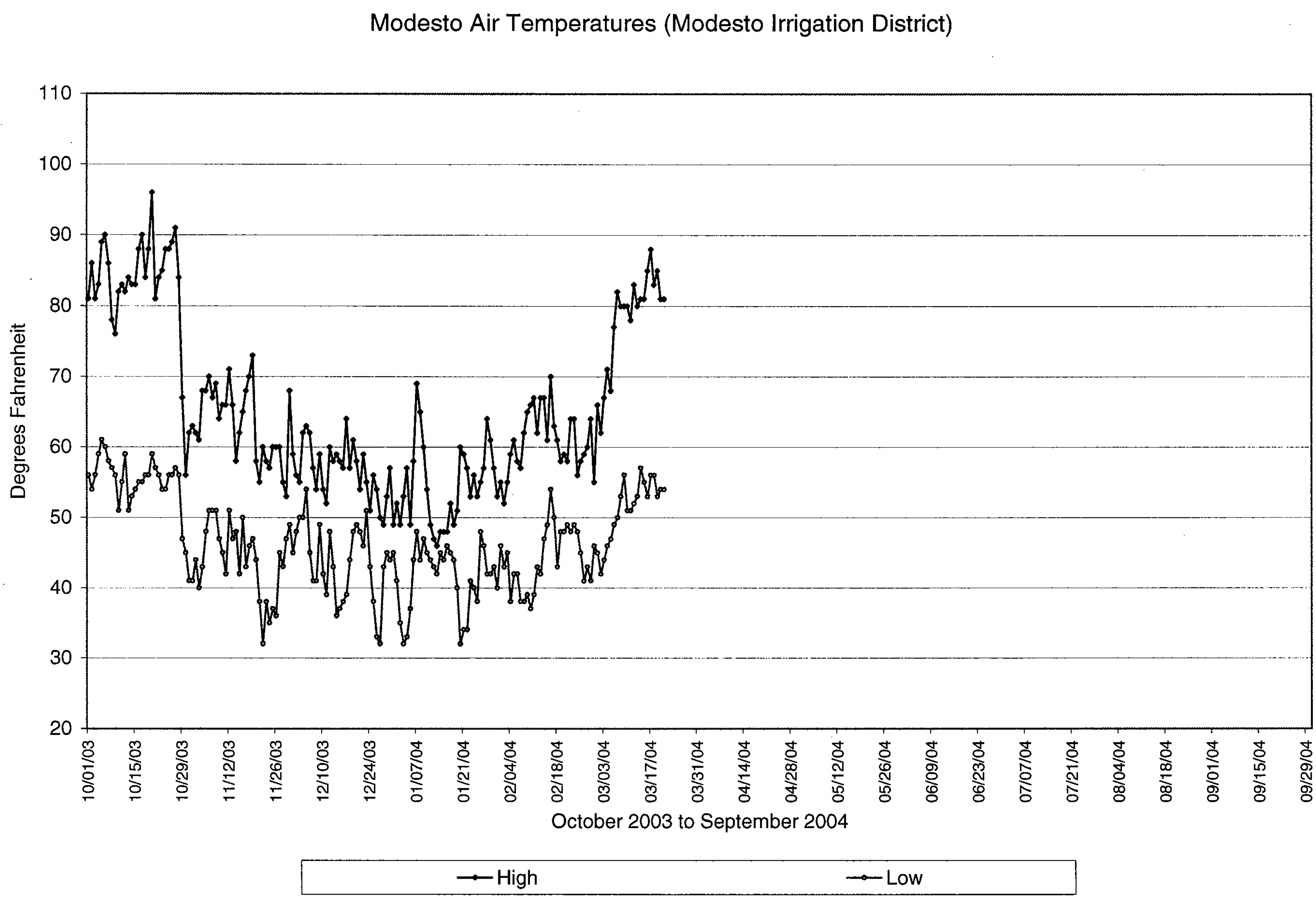
10/1/2003
10/10/2003
10/19/2003
10/28/2003
11/6/2003
11/15/2003
11/24/2003
12/3/2003
12/12/2003
12/21/2003
12/30/2003
1/8/2004
1/17/2004
1/26/2004
2/4/2004
2/13/2004
2/22/2004
3/2/2004
3/11/2004
3/20/2004
3/29/2004
4/7/2004
4/16/2004
4/25/2004
5/4/2004
5/13/2004
5/22/2004
5/31/2004
6/9/2004
6/18/2004
6/27/2004
7/6/2004
7/15/2004
7/24/2004
8/2/2004
8/11/2004
8/20/2004
8/29/2004
9/7/2004
9/16/2004
9/25/2004
OCTOBER TO SEPTEMBER (2003-2004)
RFB(39.5)
RUDDY(36.7)
HUGHSON(23.6)
SHILOH(3.4)

DAILY AVERAGE WATER TEMPERATURE
SAN JOAQUIN AND TUOLUMNE RIVERS



Modesto Air Temperatures (Modesto Irrigation District)




Modesto Air Temperatures (Modesto Irrigation District)
Degrees Fahrenheit
110
100
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70
60
50
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30
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10/01/03
10/15/03
10/29/03
11/12/03
11/26/03
12/10/03
12/24/03
01/07/04
01/21/04
02/04/04
02/18/04
03/03/04
03/17/04
03/31/04
04/14/04
04/28/04
05/12/04
05/26/04
06/09/04
06/23/04
07/07/04
07/21/04
08/04/04
08/18/04
09/01/04
09/15/04
09/29/04
October 2003 to September 2004
High
Low

TURLOCK IRRIGATION DISTRICT
333 EAST CANAL DRIVE
POST OFFICE BOX 949
TURLOCK, CALIFORNIA 95381
(209) 883-8300

Don Pedro Dam and Powerhouse

February 4, 2003

Mr. William Loudermilk
Regional Manager, SJVSS Region
California Dept. of Fish and Game
1234 E. Shaw Ave.
Fresno, CA 93710

Mr. Dale Pierce
Assistant Field Supervisor
United States Fish and Wildlife Service
2800 Cottage Way, W-2605
Sacramento, CA 95825

Subject: Tuolumne River Fall 2002 Pulse Flow and Article 45-Day Period

Dear Sirs:

The fall 2002 pulse flow for the Tuolumne River was scheduled to take place from October 16, 2002 through October 26, 2002. Provisional flow data from the USGS gage at La Grange shows that the fall pulse flow obligation of 2,225 acre-feet was completed during that timeframe. The actual pulse flow volume released was about 3,133 acre-feet. A table of daily flows for the period is attached (ATTACHMENT 1).

The Article 38 45-Day Period began October 17, 2001 and ended November 30, 2001 (Note the fall pulse flow overlapped ten days of the 45-Day Period). Using Provisional daily flow data for the period from the USGS gage at La Grange, we have calculated an average flow of 214 cfs for the period, which corresponds to a river height of 169.69 feet at the Old La Grange Bridge according to the USGS 1996 rating table. In accordance with Article 38, any reduction in river height between the end of the 45-day period and March 31 shall not exceed four inches below the average height established during the 45 days. That level would be 169.36 feet or 110 cfs. The flow schedule and actual flows since November 30, 2001 have exceeded 150 cfs. A table of daily USGS recorded flows for Article 38 45-Day Period is attached (ATTACHMENT 2) as well as the 2002-2003 Fish Flow Schedule (ATTACHMENT 3).

Sincerely,

TURLOCK IRRIGATION DISTRICT

Robert M. Nees
Assistant General Manager
Water Resources and Regulatory Affairs

cc: Larry Weis
Randy Baysinger
Wes Monier
John Schnagl, FERC
Allen Short, MID
William Madden, Winston and Strawn
TRTAC e-mail list

TID

Tuolumne River at La Grange Daily Flow Data
USGS Station Number 11289650
Period of 2002 Fall Pulse Flow: 10/16/02 - 10/26/02
Based on USGS Provisional Data Available as of 1/15/2003

	(a) Minimum Flow Schedule (cfs)	(b) Fall Pulse Flow Daily Target (cfs)	(c) Total River Flow (Min Flow + Pulse Target) (cfs)	(d) Cumulative Fall Pulse Schedule (Acre-feet)	(e) Provisional USGS Flow (cfs)	(f) USGS Less Min. Flow = Actual Pulse Flow (cfs)	(g) Cumulative Actual Fall Pulse based on USGS (Acre-feet)
10/16/2002	150	140	290	278	331	181	359
10/17/2002	150	140	290	555	334	184	724
10/18/2002	150	140	290	833	338	188	1097
10/19/2002	150	140	290	1111	339	189	1472
10/20/2002	150	140	290	1388	335	185	1839
10/21/2002	150	75	225	1537	259	109	2055
10/22/2002	150	75	225	1686	254	104	2261
10/23/2002	150	75	225	1835	265	115	2489
10/24/2002	150	75	225	1983	262	112	2711
10/25/2002	150	75	225	2132	261	111	2931
10/26/2002	150	47	197	2225	252	102	3133

TURLOCK IRRIGATION DISTRICT

October 17 - November 30, 2002 Average Flow

In Tuolumne River at La Grange

ACTUAL FLOWS (Preliminary USGS Numbers)

DATE	FLOW CFS	DATE	FLOW CFS
17-Oct	334	08-Nov	200
18-Oct	338	09-Nov	189
19-Oct	339	10-Nov	188
20-Oct	335	11-Nov	187
21-Oct	259	12-Nov	186
22-Oct	254	13-Nov	186
23-Oct	265	14-Nov	186
24-Oct	262	15-Nov	188
25-Oct	261	16-Nov	187
26-Oct	252	17-Nov	186
27-Oct	213	18-Nov	185
28-Oct	189	19-Nov	183
29-Oct	195	20-Nov	183
30-Oct	211	21-Nov	184
31-Oct	201	22-Nov	181
01-Nov	201	23-Nov	191
02-Nov	198	24-Nov	193
03-Nov	192	25-Nov	190
04-Nov	196	26-Nov	188
05-Nov	204	27-Nov	189
06-Nov	201	28-Nov	207
07-Nov	209	29-Nov	192
		30-Nov	186
		TOTAL RELEASE=	9,644

45 day average = 214.3 cfs = 169.69 ft elevation *

Less 4 inches -0.33

Minimum Flow = 110.2 CFS = 169.36 ft elevation *

*
From U.S.G.S. table 22

Attachment 3

Tuolumne River Flow Schedule

26SEP2002 Proposed Revision

SCHEDULE FOR 2002 - 2003 Fish Flow Year

DATE		Number of	BASE FLOW		
From:	To:	DAYS	CFS	AF	ACCUM. A.F.
12-Apr-2002	12-Apr-2002	1	150	298	
13-Apr-2002	14-Apr-2002	2	150	595	
15-Apr-2002	15-Apr-2002	1	175	347	347
16-Apr-2002	23-Apr-2002	8	175	2,777	3,124
24-Apr-2002	1-May-2002	8	175	2,777	5,901
2-May-2002	2-May-2002	1	175	347	6,248
3-May-2002	8-May-2002	6	175	2,083	8,331
9-May-2002	10-May-2002	2	175	694	9,025
11-May-2002	13-May-2002	3	175	1,041	10,066
14-May-2002	14-May-2002	1	175	347	10,413
15-May-2002	15-May-2002	1	175	347	10,760
16-May-2002	16-May-2002	1	175	347	11,107
17-May-2002	30-May-2002	14	175	4,860	15,967
31-May-2002	31-May-2002	1	135	268	16,235
1-Jun-2002	1-Jun-2002	1	100	198	16,433
2-Jun-2002	30-Sep-2002	121	75	18,000	34,433
1-Oct-2002	8-Oct-2002	8	75	1,190	35,623
9-Oct-2002	15-Oct-2002	7	150	2,083	37,706
16-Oct-2002	20-Oct-2002	5	150	1,488	39,193
21-Oct-2002	25-Oct-2002	5	150	1,488	40,681
26-Oct-2002	26-Oct-2002	1	150	298	40,979
27-Oct-2002	31-Mar-2003	156	150	46,413	87,392
1-Apr-2003	14-Apr-2003	14	150	4,165	91,557

No. of days 365 (April 15 through April 14)

PULSE FLOW		
CFS	AF	ACCUM. A.F.
175	347	347
550	2,182	2,529
525	1,041	3,570
625	9,917	13,488
1125	17,851	31,339
720	1,428	32,767
425	5,058	37,825
400	1,587	39,412
375	2,231	41,643
275	545	42,188
175	347	42,536
75	149	42,684
0	0	42,684
0	0	42,684
0	0	42,684
0	0	42,684
0	0	42,684
0	0	42,684
140	1,388	44,073
75	744	44,817
47	93	44,910
0	0	44,910
0	0	44,910

TOTAL	
CFS	ACCUM. A.F.
325	347
700	2,529
700	3,917
800	16,612
1,300	37,240
895	39,015
600	46,155
575	48,436
550	51,709
450	52,602
350	53,296
250	53,792
175	58,651
135	58,919
100	59,117
75	77,117
75	78,307
150	80,390
290	83,266
225	85,498
197	85,888
150	132,301
150	136,467

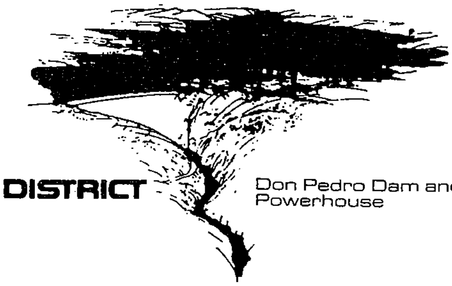
1 cfs day = 1.983471 acre-feet (af)

Notes: 1. Based on 60-20-20 Index is 2,337,853. July 31, 1996 FERC Order Flow Interpolated as 136,467 AF fish flow year requirement.

2. The pulse flows are a target that represents a daily average.

3. The schedule includes the spring pulse flow schedule refinement during the VAMP process to achieve a period at 1300 cfs.

4. Base flow amounts shown prior to April 15 are not included in this year's total.



Don Pedro Dam and Powerhouse

TURLOCK IRRIGATION DISTRICT
333 EAST CANAL DRIVE
POST OFFICE BOX 949
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(209) 883-8300

April 18, 2003

Mr. Dean Marston
California Dept. of Fish and Game
1234 E. Shaw Ave.
Fresno, CA 93710

Ms. Deborah Giglio
U.S. Fish and Wildlife Service
2800 Cottage Way, W-2605
Sacramento, CA 95825

RE: Tuolumne River 2003-2004 FERC Article 37 Flow Schedule

Dear Fishery Agency representatives:

The 1996 FERC Order, Amended Article 37, contained a Water Year Classification Index for determining the volume of scheduled stream flows for each fish flow year. The classifications were based on the San Joaquin Basin 60-20-20 Indices for water years 1906-1995. The order stated, "60-20-20 index numbers used each year shall be updated to incorporate subsequent water years pursuant to standard Water Resources Department procedures so as to maintain approximately the same frequency distribution of water year types." We recently updated the index to incorporate water years 1996 through 2002 (TABLE 1). While the frequency distribution remains the same, the index numbers have changed slightly with the update to coincide with the frequency distribution.

Attached is a Tuolumne River flow schedule for the 2003-2004 FERC fish flow year (TABLE 2). The schedule is developed from the DWR April 1, 2003 60-20-20 San Joaquin Basin Index forecast of 2.153, which results in 126,064 acre-feet of volume forecasted for the fish flow year, based on accepted interpolation of the updated FERC Article 37 Flow Requirements table (TABLE 3). The summer (June-September) flow presently is shown as 86 cfs, resulting from placing the current interpolation volume on top of the 50 cfs base flow in that period for now; the base flow for the remaining (non-summer) months is 150 cfs. The schedule will be updated later this year to reflect changes in the basin index, based on actual runoff.

We began implementation of the spring pulse flow portion of the schedule on April 12, 2003 based on the earlier communication during the ongoing basin-wide flow coordination within the Vernalis Adaptive Management Plan (VAMP) process. The attached schedule reflects a spring pulse flow schedule in accordance with the beginning of VAMP target flows at Vernalis on April 15 and is subject to change. Extended multi-day flow transition periods are planned for mid and late May flow reductions in the current schedule.

If you have any questions please feel free to contact Wes Monier at 209-883-8321.

Sincerely,

Robert Nees
Assistant General Manager
Water Resources and Regulatory Affairs Administration

C: Larry Weis - TID
Wes Monier- TID
Allen Short - MID
Walt Ward - MID
Roger Masuda - Griffith & Masuda
John Schnagl - FERC
TRTAC (via e-mail)

TABLE 1
DETERMINATION OF WATER YEAR CLASSIFICATION THRESHOLDS
Water Year Classification

	Water Year Classification	Cumulative Occurrence				Settlement Agreement	602020 INDEX (x 1000) 1996	1997	1998	1999	2000	2001	2002
	Critical Water Year and Below	0.0%	-	6.4%	<	1500	1,441	1,441	1,441	1,476	1,476	1,476	1,476
	Median Critical Water Year	6.4%	-<	14.4%	>=	1500	1,441	1,441	1,441	1,476	1,476	1,476	1,476
	Intermediate Critical Dry Water Year	14.4%	-<	20.5%	>=	2000	1,964	1,964	1,964	1,964	1,964	1,964	1,964
	Median Dry	20.5%	-<	31.3%	>=	2200	2,159	2,159	2,183	2,183	2,183	2,183	2,183
	Intermediate Dry-Below Normal	31.3%	-<	40.4%	>=	2400	2,441	2,441	2,442	2,442	2,442	2,442	2,441
	Median Below Normal	40.4%	-<	50.7%	>=	2700	2,698	2,720	2,720	2,720	2,763	2,720	2,720
*	Intermediate Below Normal-Above Normal	50.7%	-<	66.2%	>=	3100	3,139	3,139	3,183	3,183	3,225	3,183	3,183
	Median Above Normal	66.2%	-<	71.3%	>=	3100	3,689	3,689	3,740	3,740	3,689	3,689	3,689
	Intermediate Above Normal-Wet	71.3%	-<	86.7%	>=	3100	3,898	3,903	4,028	4,028	3,903	3,903	3,903
	Median Wet/Maximum	86.7%	-<	100.0%	>=	3100	4,593	4,593	4,653	4,653	4,653	4,653	4,653

* Maximum index value for fish flow year is not to go above value shown in this row.
** The index in the Settlement Agreement was based on Water Years 1906-1995

TABLE 2
Tuolumne River Flow Schedule
09APR2003 Preliminary Draft
SCHEDULE FOR 2003 - 2004 Fish Flow Year

DATE		Number of	BASE FLOW			PULSE FLOW			INTERPOLATION FLOW			TOTAL FERC FLOW	
From:	To:	DAYS	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	ACCUM. A.F.
12-Apr-2003	12-Apr-2003	1	150	298		275	545	545	0	0	0	425	545
13-Apr-2003	13-Apr-2003	1	150	298		550	1,091	1,636	0	0	0	700	1,636
14-Apr-2003	14-Apr-2003	1	150	298		856	1,699	3,335	0	0	0	1,006	3,335
15-Apr-2003	15-Apr-2003	1	150	298	298	856	1,699	5,034	0	0	0	1,006	5,332
16-Apr-2003	16-Apr-2003	1	150	298	595	856	1,699	6,733	0	0	0	1,006	7,328
17-Apr-2003	17-Apr-2003	1	150	298	893	856	1,699	8,432	0	0	0	1,006	9,324
18-Apr-2003	18-Apr-2003	1	150	298	1,190	856	1,699	10,130	0	0	0	1,006	11,321
19-Apr-2003	19-Apr-2003	1	150	298	1,488	856	1,699	11,829	0	0	0	1,006	13,317
20-Apr-2003	20-Apr-2003	1	150	298	1,785	856	1,699	13,528	0	0	0	1,006	15,313
21-Apr-2003	21-Apr-2003	1	150	298	2,083	856	1,699	15,227	0	0	0	1,006	17,310
22-Apr-2003	22-Apr-2003	1	150	298	2,380	856	1,699	16,926	0	0	0	1,006	19,306
23-Apr-2003	23-Apr-2003	1	150	298	2,678	630	1,250	18,175	0	0	0	780	20,853
24-Apr-2003	24-Apr-2003	1	150	298	2,975	430	853	19,028	0	0	0	580	22,003
25-Apr-2003	25-Apr-2003	1	150	298	3,273	280	555	19,584	0	0	0	430	22,856
26-Apr-2003	26-Apr-2003	1	150	298	3,570	280	555	20,139	0	0	0	430	23,709
27-Apr-2003	27-Apr-2003	1	150	298	3,868	280	555	20,694	0	0	0	430	24,562
28-Apr-2003	28-Apr-2003	1	150	298	4,165	280	555	21,250	0	0	0	430	25,415
29-Apr-2003	29-Apr-2003	1	150	298	4,463	280	555	21,805	0	0	0	430	26,268
30-Apr-2003	30-Apr-2003	1	150	298	4,760	280	555	22,360	0	0	0	430	27,121
1-May-2003	1-May-2003	1	150	298	5,058	280	555	22,916	0	0	0	430	27,974
2-May-2003	2-May-2003	1	150	298	5,355	280	555	23,471	0	0	0	430	28,827
3-May-2003	3-May-2003	1	150	298	5,653	280	555	24,027	0	0	0	430	29,679
4-May-2003	4-May-2003	1	150	298	5,950	280	555	24,582	0	0	0	430	30,532
5-May-2003	5-May-2003	1	150	298	6,248	280	555	25,137	0	0	0	430	31,385
6-May-2003	6-May-2003	1	150	298	6,545	420	833	25,970	0	0	0	570	32,516
7-May-2003	7-May-2003	1	150	298	6,843	420	833	26,803	0	0	0	570	33,646
8-May-2003	8-May-2003	1	150	298	7,140	420	833	27,637	0	0	0	570	34,777
9-May-2003	9-May-2003	1	150	298	7,438	420	833	28,470	0	0	0	570	35,908
10-May-2003	10-May-2003	1	150	298	7,736	420	833	29,303	0	0	0	570	37,038
11-May-2003	11-May-2003	1	150	298	8,033	420	833	30,136	0	0	0	570	38,169
12-May-2003	12-May-2003	1	150	298	8,331	380	754	30,889	0	0	0	530	39,220
13-May-2003	13-May-2003	1	150	298	8,628	250	496	31,385	0	0	0	400	40,013
14-May-2003	14-May-2003	1	150	298	8,926	250	496	31,881	0	0	0	400	40,807
15-May-2003	15-May-2003	1	150	298	9,223	175	347	32,228	0	0	0	325	41,451
16-May-2003	16-May-2003	1	150	298	9,521	125	248	32,476	0	0	0	275	41,997
17-May-2003	17-May-2003	1	150	298	9,818	72	143	32,619	0	0	0	222	42,437
18-May-2003	31-May-2003	14	150	4,165	13,983		0	32,619	0	0	0	150	46,602
1-Jun-2003	1-Jun-2003	1	129	256	14,239		0	32,619	0	0	0	129	46,858
2-Jun-2003	2-Jun-2003	1	108	214	14,454		0	32,619	0	0	0	108	47,073
3-Jun-2003	30-Jun-2003	28	50	2,777	17,230		0	32,619	36	1,978	1,978	86	51,828
1-Jul-2003	31-Jul-2003	31	50	3,074	20,305		0	32,619	36	2,190	4,169	86	57,093
1-Aug-2003	31-Aug-2003	31	50	3,074	23,379		0	32,619	36	2,190	6,359	86	62,357
1-Sep-2003	30-Sep-2003	30	50	2,975	26,354		0	32,619	36	2,120	8,479	86	67,452
1-Oct-2003	15-Oct-2003	15	150	4,463	30,817		0	32,619	0	0	8,479	150	71,915
16-Oct-2003	31-Oct-2003	16	150	4,760	35,578		0	32,619	0	0	8,479	150	76,676
1-Nov-2003	30-Nov-2003	30	150	8,926	44,503		0	32,619	0	0	8,479	150	85,601
1-Dec-2003	31-Dec-2003	31	150	9,223	53,726		0	32,619	0	0	8,479	150	94,824
1-Jan-2004	31-Jan-2004	31	150	9,223	62,949		0	32,619	0	0	8,479	150	104,047
1-Feb-2004	29-Feb-2004	29	150	8,628	71,578		0	32,619	0	0	8,479	150	112,676
1-Mar-2004	31-Mar-2004	31	150	9,223	80,801		0	32,619	0	0	8,479	150	121,899
1-Apr-2004	14-Apr-2004	14	150	4,165	84,966		0	32,619	0	0	8,479	150	126,064
No. of days		366 (April 15 through April 14)											

1 cfs day = 1.983471 acre-feet (af)

Notes: 1. Based on 60-20-20 Index is 2,152,867 July 31, 1996 FERC Order Flow Interpolated as 126,064 AF fish flow year requirement.
2. The pulse flows are a target that represents a daily average.

TABLE 3

MINIMUM TUOLUMNE RIVER FLOW REQUIREMENT BASED ON 1996 SETTLEMENT AGREEMENT

INDEX CUTOFFS BASED ON SAN JOAQUIN 602020 INDEX UPDATED THROUGH WATER YEAR 2002

BASE FLOW
C.F.S.

	INDEX CUTOFF	31 JAN	28 FEB	31 MAR	30 APR	31 MAY	30 JUN	31 JUL	31 AUG	30 SEP	31 OCT	30 NOV	31 DEC
1 CRITICAL WATER YEAR AND BELOW	0	150	150	150	150	150	50	50	50	50	126	150	150
2 MEDIAN CRITICAL WATER YEAR	1,476	150	150	150	150	150	50	50	50	50	126	150	150
3 INTERMEDIATE C-D WATER YEAR	1,964	150	150	150	150	150	50	50	50	50	150	150	150
4 MEDIAN DRY	2,183	150	150	150	150	150	75	75	75	75	150	150	150
5 INTERMEDIATE D-BN	2,441	180	180	180	180	180	75	75	75	75	180	180	180
6 MEDIAN BELOW NORMAL	2,720	175	175	175	175	175	75	75	75	75	187	175	175
7 INTERMEDIATE BN-AN	3,183	300	300	300	300	300	250	250	250	250	300	300	300
8 MEDIAN ABOVE NORMAL	3,689	300	300	300	300	300	250	250	250	250	300	300	300
9 INTERMEDIATE AN-W	3,903	300	300	300	300	300	250	250	250	250	300	300	300
10 MEDIAN WET/ MAXIMUM	4,653	300	300	300	300	300	250	250	250	250	300	300	300

PULSE FLOWS
A.F.

		31 JAN	28 FEB	31 MAR	30 APR	31 MAY	30 JUN	31 JUL	31 AUG	30 SEP	31 OCT	30 NOV	31 DEC
1 CRITICAL WATER YEAR AND BELOW	0				11,091								
2 MEDIAN CRITICAL WATER YEAR	1,476				20,091								
3 INTERMEDIATE C-D WATER YEAR	1,964				32,619								
4 MEDIAN DRY	2,183				37,060								
5 INTERMEDIATE D-BN	2,441				35,920						1,676		
6 MEDIAN BELOW NORMAL	2,720				60,027						1,736		
7 INTERMEDIATE BN-AN	3,183				89,882						5,950		
8 MEDIAN ABOVE NORMAL	3,689				89,882						5,950		
9 INTERMEDIATE AN-W	3,903				89,882						5,950		
10 MEDIAN WET/ MAXIMUM	4,653				89,882						5,950		

TURLOCK IRRIGATION DISTRICT
333 EAST CANAL DRIVE
POST OFFICE BOX 949
TURLOCK, CALIFORNIA 95381
(209) 883-8300

Don Pedro Dam and Powerhouse

May 20, 2003

Mr. Dean Marston
California Dept. of Fish and Game
1234 E. Shaw Ave.
Fresno, CA 93710

Ms. Deborah Giglio
U.S. Fish and Wildlife Service
2800 Cottage Way, W-2605
Sacramento, CA 95825

RE: Tuolumne River 2003-2004 FERC Article 37 Flow Schedule

Dear Fishery Agency representatives:

As notified by e-mail communications to the Tuolumne River Technical Advisory Committee e-mail list on May 8 and on May 16, the estimated volume for the fish flow year has increased since the 126,064 acre-feet initially established by the April 1 DWR 60-20-20 San Joaquin Basin Index forecast of 2.1526. The DWR May 1 60-20-20 basin index of 2.7706 equated to a total volume of about 179,800 acre-feet. The DWR May 13 update to a basin index of 2.9746 results in a fish flow year volume presently estimated at about 239,700 acre-feet.

Mr. Ford of my staff recommended on May 16 to have 250 cfs for May 19-31 and the June-September period based on the increased volume. On May 19, CDFG e-mailed a recommendation for 500-600 cfs for the remainder of May, followed by 200 cfs until further agreement on the schedule. This was based on a view that a higher flow now could be beneficial for remaining outmigrating salmon being monitored by screw traps operated by CDFG for the TRTAC at River Mile 5.

Attached is a revised Tuolumne River flow schedule for the 2003-2004 FERC fish flow year (TABLE 1) using the current numbers based on interpolation of the updated FERC Article 37 Flow Requirements table (TABLE 2). The base flows starting on May 20 are from the "median below normal" schedule in Table 2. For now, the remaining May flow is shown at 550 cfs (350 cfs average for today), the summer (June-September) flow is shown as 200 cfs, and flow for the remaining (non-summer) months is 300 cfs. A flow transition period is included in early June in this schedule. The balance is placed as pulse flow in early October. The schedule is subject to further change and the volume will be updated later this year to reflect changes in the basin index, based on actual runoff.

If you have any questions please feel free to contact Wes Monier at 209-883-8321.

TID

Sincerely,

Robert Nees
Assistant General Manager
Water Resources and Regulatory Affairs Administration

C: Larry Weis - TID
Wes Monier- TID
Allen Short - MID
Walt Ward - MID
Roger Masuda - Griffith & Masuda
John Schnagl - FERC
TRTAC (via e-mail)

TABLE 1

Tuolumne River Flow Schedule

20MAY2003 Preliminary Draft

SCHEDULE FOR 2003 - 2004 Fish Flow Year

DATE		Number of	BASE FLOW			PULSE FLOW			ADDITIONAL FLOW			TOTAL FERC FLOW	
From:	To:	DAYS	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	ACCUM. A.F.
12-Apr-2003	12-Apr-2003	1	150	298		275	545	545	0	0	0	425	545
13-Apr-2003	13-Apr-2003	1	150	298		550	1,091	1,636	0	0	0	700	1,636
14-Apr-2003	14-Apr-2003	1	150	298		856	1,699	3,335	0	0	0	1,006	3,335
15-Apr-2003	15-Apr-2003	1	150	298	298	856	1,699	5,034	0	0	0	1,006	5,332
16-Apr-2003	16-Apr-2003	1	150	298	595	856	1,699	6,733	0	0	0	1,006	7,328
17-Apr-2003	17-Apr-2003	1	150	298	893	856	1,699	8,432	0	0	0	1,006	9,324
18-Apr-2003	18-Apr-2003	1	150	298	1,190	856	1,699	10,130	0	0	0	1,006	11,321
19-Apr-2003	19-Apr-2003	1	150	298	1,488	856	1,699	11,829	0	0	0	1,006	13,317
20-Apr-2003	20-Apr-2003	1	150	298	1,785	856	1,699	13,528	0	0	0	1,006	15,313
21-Apr-2003	21-Apr-2003	1	150	298	2,083	856	1,699	15,227	0	0	0	1,006	17,310
22-Apr-2003	22-Apr-2003	1	150	298	2,380	856	1,699	16,926	0	0	0	1,006	19,306
23-Apr-2003	23-Apr-2003	1	150	298	2,678	630	1,250	18,175	0	0	0	780	20,853
24-Apr-2003	24-Apr-2003	1	150	298	2,975	430	853	19,028	0	0	0	580	22,003
25-Apr-2003	25-Apr-2003	1	150	298	3,273	280	555	19,584	0	0	0	430	22,856
26-Apr-2003	26-Apr-2003	1	150	298	3,570	280	555	20,139	0	0	0	430	23,709
27-Apr-2003	27-Apr-2003	1	150	298	3,868	280	555	20,694	0	0	0	430	24,562
28-Apr-2003	28-Apr-2003	1	150	298	4,165	280	555	21,250	0	0	0	430	25,415
29-Apr-2003	29-Apr-2003	1	150	298	4,463	280	555	21,805	0	0	0	430	26,268
30-Apr-2003	30-Apr-2003	1	150	298	4,760	280	555	22,360	0	0	0	430	27,121
1-May-2003	1-May-2003	1	150	298	5,058	280	555	22,916	0	0	0	430	27,974
2-May-2003	2-May-2003	1	150	298	5,355	280	555	23,471	0	0	0	430	28,827
3-May-2003	3-May-2003	1	150	298	5,653	280	555	24,027	0	0	0	430	29,679
4-May-2003	4-May-2003	1	150	298	5,950	280	555	24,582	0	0	0	430	30,532
5-May-2003	5-May-2003	1	150	298	6,248	280	555	25,137	0	0	0	430	31,385
6-May-2003	6-May-2003	1	150	298	6,545	420	833	25,970	0	0	0	570	32,516
7-May-2003	7-May-2003	1	150	298	6,843	420	833	26,803	0	0	0	570	33,646
8-May-2003	8-May-2003	1	150	298	7,140	420	833	27,637	0	0	0	570	34,777
9-May-2003	9-May-2003	1	150	298	7,438	420	833	28,470	0	0	0	570	35,908
10-May-2003	10-May-2003	1	150	298	7,736	420	833	29,303	0	0	0	570	37,038
11-May-2003	11-May-2003	1	150	298	8,033	420	833	30,136	0	0	0	570	38,169
12-May-2003	12-May-2003	1	150	298	8,331	380	754	30,889	0	0	0	530	39,220
13-May-2003	13-May-2003	1	150	298	8,628	250	496	31,385	0	0	0	400	40,013
14-May-2003	14-May-2003	1	150	298	8,926	250	496	31,881	0	0	0	400	40,807
15-May-2003	15-May-2003	1	150	298	9,223	175	347	32,228	0	0	0	325	41,451
16-May-2003	16-May-2003	1	150	298	9,521	125	248	32,476	0	0	0	275	41,997
17-May-2003	17-May-2003	1	150	298	9,818	72	143	32,619	0	0	0	222	42,437
18-May-2003	19-May-2003	2	150	595	10,413		0	32,619	0	0	0	150	43,032
20-May-2003	20-May-2003	1	175	347	10,760		0	32,619	175	347	347	350	43,726
21-May-2003	31-May-2003	11	175	3,818	14,579		0	32,619	375	8,182	8,529	550	55,726
1-Jun-2003	1-Jun-2003	1	75	149	14,727		0	32,619	325	645	9,174	400	56,520
2-Jun-2003	2-Jun-2003	1	75	149	14,876		0	32,619	225	446	9,620	300	57,115
3-Jun-2003	31-Jul-2003	59	75	8,777	23,653		0	32,619	125	14,628	24,248	200	80,520
1-Aug-2003	30-Sep-2003	61	75	9,074	32,727		0	32,619	125	15,124	39,372	200	104,718
1-Oct-2003	15-Oct-2003	15	200	5,950	38,678	599	17,809	50,428	100	2,975	42,347	899	131,452
16-Oct-2003	31-Oct-2003	16	175	5,554	44,231		0	50,428	125	3,967	46,314	300	140,973
1-Nov-2003	30-Nov-2003	30	175	10,413	54,645		0	50,428	125	7,438	53,752	300	158,824
1-Dec-2003	31-Dec-2003	31	175	10,760	65,405		0	50,428	125	7,686	61,438	300	177,271
1-Jan-2004	31-Jan-2004	31	175	10,760	76,165		0	50,428	125	7,686	69,124	300	195,717
1-Feb-2004	29-Feb-2004	29	175	10,066	86,231		0	50,428	125	7,190	76,314	300	212,973
1-Mar-2004	31-Mar-2004	31	175	10,760	96,992		0	50,428	125	7,686	84,000	300	231,419
1-Apr-2004	14-Apr-2004	14	175	4,860	101,851		0	50,428	125	3,471	87,471	300	239,750
No. of days		366	(April 15 through April 14)										

1 cfs day = 1.983471 acre-feet (af)

Notes: 1. Based on 60-20-20 Index is 2,974,867. July 31, 1996 FERC Order Flow Interpolated as 239,750 AF fish flow year requirement.

2. The pulse flows are a target that represents a daily average.

TABLE 2

MINIMUM TUOLUMNE RIVER FLOW REQUIREMENT BASED ON 1996 SETTLEMENT AGREEMENT

INDEX CUTOFFS BASED ON SAN JOAQUIN 602020 INDEX UPDATED THROUGH WATER YEAR 2002

BASE FLOW
C.F.S.

	INDEX CUTOFF	31 JAN	28 FEB	31 MAR	30 APR	31 MAY	30 JUN	31 JUL	31 AUG	30 SEP	31 OCT	30 NOV	31 DEC
1 CRITICAL WATER YEAR AND BELOW	0	150	150	150	150	150	50	50	50	50	126	150	150
2 MEDIAN CRITICAL WATER YEAR	1,476	150	150	150	150	150	50	50	50	50	126	150	150
3 INTERMEDIATE C-D WATER YEAR	1,964	150	150	150	150	150	50	50	50	50	150	150	150
4 MEDIAN DRY	2,183	150	150	150	150	150	75	75	75	75	150	150	150
5 INTERMEDIATE D-BN	2,441	180	180	180	180	180	75	75	75	75	180	180	180
6 MEDIAN BELOW NORMAL	2,720	175	175	175	175	175	75	75	75	75	187	175	175
7 INTERMEDIATE BN-AN	3,183	300	300	300	300	300	250	250	250	250	300	300	300
8 MEDIAN ABOVE NORMAL	3,689	300	300	300	300	300	250	250	250	250	300	300	300
9 INTERMEDIATE AN-W	3,903	300	300	300	300	300	250	250	250	250	300	300	300
10 MEDIAN WET/ MAXIMUM	4,653	300	300	300	300	300	250	250	250	250	300	300	300

PULSE FLOWS
A.F.

		31 JAN	28 FEB	31 MAR	30 APR	31 MAY	30 JUN	31 JUL	31 AUG	30 SEP	31 OCT	30 NOV	31 DEC
1 CRITICAL WATER YEAR AND BELOW	0				11,091								
2 MEDIAN CRITICAL WATER YEAR	1,476				20,091								
3 INTERMEDIATE C-D WATER YEAR	1,964				32,619								
4 MEDIAN DRY	2,183				37,060								
5 INTERMEDIATE D-BN	2,441				35,920						1,676		
6 MEDIAN BELOW NORMAL	2,720				60,027						1,736		
7 INTERMEDIATE BN-AN	3,183				89,882						5,950		
8 MEDIAN ABOVE NORMAL	3,689				89,882						5,950		
9 INTERMEDIATE AN-W	3,903				89,882						5,950		
10 MEDIAN WET/ MAXIMUM	4,653				89,882						5,950		

TOTAL MINIMUM FLOW REQUIREMENT
CFS

		31 JAN	28 FEB	31 MAR	30 APR	31 MAY	30 JUN	31 JUL	31 AUG	30 SEP	31 OCT	30 NOV	31 DEC	TOTAL
1 CRITICAL WATER YEAR AND BELOW	0	9,223	8,331	9,223	20,017	9,223	2,975	3,074	3,074	2,975	7,736	8,926	9,223	94,000
2 MEDIAN CRITICAL WATER YEAR	1,476	9,223	8,331	9,223	29,017	9,223	2,975	3,074	3,074	2,975	7,736	8,926	9,223	103,000
3 INTERMEDIATE C-D WATER YEAR	1,964	9,223	8,331	9,223	41,545	9,223	2,975	3,074	3,074	2,975	9,223	8,926	9,223	117,016
4 MEDIAN DRY	2,183	9,223	8,331	9,223	45,986	9,223	4,463	4,612	4,612	4,463	9,223	8,926	9,223	127,506
5 INTERMEDIATE D-BN	2,441	11,068	9,997	11,068	46,631	11,068	4,463	4,612	4,612	4,463	12,744	10,711	11,068	142,502
6 MEDIAN BELOW NORMAL	2,720	10,760	9,719	10,760	70,440	10,760	4,463	4,612	4,612	4,463	13,240	10,413	10,760	165,003
7 INTERMEDIATE BN-AN	3,183	18,446	16,661	18,446	107,733	18,446	14,876	15,372	15,372	14,876	24,396	17,851	18,446	300,923
8 MEDIAN ABOVE NORMAL	3,689	18,446	16,661	18,446	107,733	18,446	14,876	15,372	15,372	14,876	24,396	17,851	18,446	300,923
9 INTERMEDIATE AN-W	3,903	18,446	16,661	18,446	107,733	18,446	14,876	15,372	15,372	14,876	24,396	17,851	18,446	300,923
10 MEDIAN WET/ MAXIMUM	10,000	18,446	16,661	18,446	107,733	18,446	14,876	15,372	15,372	14,876	24,396	17,851	18,446	300,923

TURLOCK IRRIGATION DISTRICT
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Don Pedro Dam and Powerhouse

June 30, 2003

Mr. Dean Marston
California Dept. of Fish and Game
1234 E. Shaw Ave.
Fresno, CA 93710

Ms. Deborah Giglio
U.S. Fish and Wildlife Service
2800 Cottage Way, W-2605
Sacramento, CA 95825

RE: Tuolumne River 2003-2004 FERC Article 37 Flow Schedule

Dear Fishery Agency representatives:

As notified by recent e-mail communications to the Tuolumne River Technical Advisory Committee (TRTAC), and presented at the TRTAC June 24 meeting, the DWR June 17 forecast update has a basin index of 2.8576, resulting in a Article 37 fish flow year volume presently estimated at about 205,300 acre-feet.

Attached is a revised Tuolumne River flow schedule for the 2003-2004 FERC fish flow year (TABLE 1). This table contains the flow requirements in effect through June 24 and depicts the current default schedule thereafter. The actual daily flow schedule for the period of June 25- September 30, as agreed to at the TRTAC June 24 meeting on a trial basis, will be at 195 cfs or 235 cfs (targeting an average of 205 cfs), depending on specified criteria for National Weather Service air temperature forecasts at Modesto. This schedule is subject to further change, but the annual volume will be finalized in August when the basin index is based on actual runoff through July, not forecasted amounts.

If you have any questions please feel free to contact Wes Monier at 209-883-8321.

Sincerely,

Robert Nees
Assistant General Manager
Water Resources and Regulatory Affairs Administration

C: Larry Weis – TID
Allen Short – MID
Roger Masuda - Griffith & Masuda
Magalie Salas – FERC Secretary
Wes Monier- TID
Walt Ward – MID
John Schnagl – FERC
TRTAC (via e-mail)

TID

TABLE 1

Tuolumne River Flow Schedule

BASED ON DWR 17JUN2003 FORECAST

SCHEDULE FOR 2003 - 2004 Fish Flow Year

DATE		Number of	INITIAL BASE FLOW			PULSE FLOW			ADDITIONAL FLOW			TOTAL FERC FLOW	
From:	To:	DAYS	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	ACCUM. A.F.
12-Apr-2003	12-Apr-2003	1	150	298	[illegible]	275	545	545	0	0	0	425	545
13-Apr-2003	13-Apr-2003	1	150	298	[illegible]	550	1,091	1,636	0	0	0	700	1,636
14-Apr-2003	14-Apr-2003	1	150	298	[illegible]	856	1,699	3,335	0	0	0	1,006	3,335
15-Apr-2003	15-Apr-2003	1	150	298	298	856	1,699	5,034	0	0	0	1,006	5,332
16-Apr-2003	16-Apr-2003	1	150	298	595	856	1,699	6,733	0	0	0	1,006	7,328
17-Apr-2003	17-Apr-2003	1	150	298	893	856	1,699	8,432	0	0	0	1,006	9,324
18-Apr-2003	18-Apr-2003	1	150	298	1,190	856	1,699	10,130	0	0	0	1,006	11,321
19-Apr-2003	19-Apr-2003	1	150	298	1,488	856	1,699	11,829	0	0	0	1,006	13,317
20-Apr-2003	20-Apr-2003	1	150	298	1,785	856	1,699	13,528	0	0	0	1,006	15,313
21-Apr-2003	21-Apr-2003	1	150	298	2,083	856	1,699	15,227	0	0	0	1,006	17,310
22-Apr-2003	22-Apr-2003	1	150	298	2,380	856	1,699	16,926	0	0	0	1,006	19,306
23-Apr-2003	23-Apr-2003	1	150	298	2,678	630	1,250	18,175	0	0	0	780	20,853
24-Apr-2003	24-Apr-2003	1	150	298	2,975	430	853	19,028	0	0	0	580	22,003
25-Apr-2003	25-Apr-2003	1	150	298	3,273	280	555	19,584	0	0	0	430	22,856
26-Apr-2003	26-Apr-2003	1	150	298	3,570	280	555	20,139	0	0	0	430	23,709
27-Apr-2003	27-Apr-2003	1	150	298	3,868	280	555	20,694	0	0	0	430	24,562
28-Apr-2003	28-Apr-2003	1	150	298	4,165	280	555	21,250	0	0	0	430	25,415
29-Apr-2003	29-Apr-2003	1	150	298	4,463	280	555	21,805	0	0	0	430	26,268
30-Apr-2003	30-Apr-2003	1	150	298	4,760	280	555	22,360	0	0	0	430	27,121
1-May-2003	1-May-2003	1	150	298	5,058	280	555	22,916	0	0	0	430	27,974
2-May-2003	2-May-2003	1	150	298	5,355	280	555	23,471	0	0	0	430	28,827
3-May-2003	3-May-2003	1	150	298	5,653	280	555	24,027	0	0	0	430	29,679
4-May-2003	4-May-2003	1	150	298	5,950	280	555	24,582	0	0	0	430	30,532
5-May-2003	5-May-2003	1	150	298	6,248	280	555	25,137	0	0	0	430	31,385
6-May-2003	6-May-2003	1	150	298	6,545	420	833	25,970	0	0	0	570	32,516
7-May-2003	7-May-2003	1	150	298	6,843	420	833	26,803	0	0	0	570	33,646
8-May-2003	8-May-2003	1	150	298	7,140	420	833	27,637	0	0	0	570	34,777
9-May-2003	9-May-2003	1	150	298	7,438	420	833	28,470	0	0	0	570	35,908
10-May-2003	10-May-2003	1	150	298	7,736	420	833	29,303	0	0	0	570	37,038
11-May-2003	11-May-2003	1	150	298	8,033	420	833	30,136	0	0	0	570	38,169
12-May-2003	12-May-2003	1	150	298	8,331	380	754	30,889	0	0	0	530	39,220
13-May-2003	13-May-2003	1	150	298	8,628	250	496	31,385	0	0	0	400	40,013
14-May-2003	14-May-2003	1	150	298	8,926	250	496	31,881	0	0	0	400	40,807
15-May-2003	15-May-2003	1	150	298	9,223	175	347	32,228	0	0	0	325	41,451
16-May-2003	16-May-2003	1	150	298	9,521	125	248	32,476	0	0	0	275	41,997
17-May-2003	17-May-2003	1	150	298	9,818	72	143	32,619	0	0	0	222	42,437
18-May-2003	19-May-2003	2	150	595	10,413		0	32,619	0	0	0	150	43,032
20-May-2003	20-May-2003	1	150	298	10,711		0	32,619	200	397	397	350	43,726
21-May-2003	28-May-2003	8	150	2,380	13,091		0	32,619	400	6,347	6,744	550	52,454
29-May-2003	29-May-2003	1	150	298	13,388		0	32,619	325	645	7,388	475	53,396
30-May-2003	30-May-2003	1	150	298	13,686		0	32,619	150	298	7,686	300	53,991
31-May-2003	12-Jun-2003	13	50	1,289	14,975		0	32,619	200	5,157	12,843	250	60,437
13-Jun-2003	13-Jun-2003	1	50	99	15,074		0	32,619	180	357	13,200	230	60,893
14-Jun-2003	24-Jun-2003	11	50	1,091	16,165		0	32,619	130	2,836	16,036	180	64,821
25-Jun-2003	30-Jun-2003	6	50	595	16,760		0	32,619	155	1,845	17,881	205	67,260
1-Jul-2003	31-Jul-2003	31	50	3,074	19,835		0	32,619	155	9,531	27,412	205	79,865
1-Aug-2003	31-Aug-2003	31	50	3,074	22,909		0	32,619	155	9,531	36,942	205	92,470
1-Sep-2003	15-Sep-2003	15	50	1,488	24,397		0	32,619	155	4,612	41,554	205	98,569
16-Sep-2003	30-Sep-2003	15	50	1,488	16,463		0	32,619	155	4,612	17,455	205	104,669
1-Oct-2003	15-Oct-2003	15	150	4,463	20,926	165	4,909	37,528	95	2,826	20,281	410	116,867
16-Oct-2003	31-Oct-2003	16	150	4,760	25,686		0	37,528	95	3,015	23,296	245	124,642
1-Nov-2003	30-Nov-2003	30	150	8,926	34,612		0	37,528	95	5,653	28,949	245	139,221
1-Dec-2003	31-Dec-2003	31	150	9,223	43,835		0	37,528	95	5,841	34,790	245	154,285
1-Jan-2004	31-Jan-2004	31	150	9,223	53,058		0	37,528	95	5,841	40,631	245	169,350
1-Feb-2004	29-Feb-2004	29	150	8,628	61,686		0	37,528	95	5,464	46,096	245	183,442
1-Mar-2004	31-Mar-2004	31	150	9,223	70,909		0	37,528	95	5,841	51,937	245	198,507
1-Apr-2004	14-Apr-2004	14	150	4,165	75,074		0	37,528	95	2,638	54,575	245	205,310
No. of days		366 (April 15 through April 14)											

1 cfs day = 1.983471 acre-feet (af)

The pulse flows are a target that represents a daily average.

Flows for period 25JUN2003 to 30SEP2003 are projected averages

TURLOCK IRRIGATION DISTRICT
333 EAST CANAL DRIVE
POST OFFICE BOX 949
TURLOCK, CALIFORNIA 95381
(209) 883-8300

Don Pedro Dam and Powerhouse

October 9, 2003

Mr. Dean Marston
California Dept. of Fish and Game
1234 E. Shaw Ave.
Fresno, CA 93710

Ms. Deborah Giglio
U.S. Fish and Wildlife Service
2800 Cottage Way, W-2605
Sacramento, CA 95825

RE: Don Pedro Project No. 2299 -- Tuolumne River 2003-2004 FERC Article 37 Flow Schedule

Dear Fishery Agency representatives:

Attached is the Tuolumne River flow schedule for the remainder of the 2003-2004 FERC fish flow year (Attachment 1). The annual volume is based on the DWR 60-20-20 San Joaquin Basin Index of 2.815099, which results in 192,859 acre-feet for this fish flow year, as indicated previously in an e-mail to the Tuolumne River Technical Advisory Committee (TRTAC) on August 8, 2003.

The schedule represents the consensus reached by the Districts, U.S. Fish and Wildlife Service, and the California Department of Fish and Game at the September 25, TRTAC meeting. The October 1-15 minimum flow is 200 cfs and the minimum flow for the remaining period through April 14, 2004 is 210 cfs. A fall pulse flow ranging from 250-450 cfs will be from October 16 through October 30 as identified in Attachment 1. The daily minimum flow schedule for the recent June 25- September 30, 2003 period was at 195 cfs or 235 cfs depending on air temperature forecasts at Modesto, as noted in my letter of June 30.

If you have any questions please feel free to contact Wes Monier at 209-883-8321.

Sincerely,

for

Robert M. Nees
Assistant General Manager
Water Resources and Regulatory Affairs

C: Larry Weis – TID
Allen Short – MID
TRTAC (via e-mail)
Wes Monier- TID
Magalie Salas – FERC Secretary

TID

ATTACHMENT 1

Tuolumne River Flow Schedule

30SEP2003 Preliminary Draft

SCHEDULE FOR 2003 - 2004 Fish Flow Year

DATE		Number of	BASE FLOW			PULSE FLOW			ADDITIONAL FLOW			TOTAL FERC FLOW	
From:	To:	DAYS	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	ACCUM. A.F.
12-Apr-2003	12-Apr-2003	1	150	298	[illegible]	275	545	545	0	0	0	425	545
13-Apr-2003	13-Apr-2003	1	150	298	[illegible]	550	1,091	1,636	0	0	0	700	1,636
14-Apr-2003	14-Apr-2003	1	150	298	[illegible]	856	1,699	3,335	0	0	0	1,006	3,335
15-Apr-2003	15-Apr-2003	1	150	298	298	856	1,699	5,034	0	0	0	1,006	5,332
16-Apr-2003	16-Apr-2003	1	150	298	595	856	1,699	6,733	0	0	0	1,006	7,328
17-Apr-2003	17-Apr-2003	1	150	298	893	856	1,699	8,432	0	0	0	1,006	9,324
18-Apr-2003	18-Apr-2003	1	150	298	1,190	856	1,699	10,130	0	0	0	1,006	11,321
19-Apr-2003	19-Apr-2003	1	150	298	1,488	856	1,699	11,829	0	0	0	1,006	13,317
20-Apr-2003	20-Apr-2003	1	150	298	1,785	856	1,699	13,528	0	0	0	1,006	15,313
21-Apr-2003	21-Apr-2003	1	150	298	2,083	856	1,699	15,227	0	0	0	1,006	17,310
22-Apr-2003	22-Apr-2003	1	150	298	2,380	856	1,699	16,926	0	0	0	1,006	19,306
23-Apr-2003	23-Apr-2003	1	150	298	2,678	630	1,250	18,175	0	0	0	780	20,853
24-Apr-2003	24-Apr-2003	1	150	298	2,975	430	853	19,028	0	0	0	580	22,003
25-Apr-2003	25-Apr-2003	1	150	298	3,273	280	555	19,584	0	0	0	430	22,856
26-Apr-2003	26-Apr-2003	1	150	298	3,570	280	555	20,139	0	0	0	430	23,709
27-Apr-2003	27-Apr-2003	1	150	298	3,868	280	555	20,694	0	0	0	430	24,562
28-Apr-2003	28-Apr-2003	1	150	298	4,165	280	555	21,250	0	0	0	430	25,415
29-Apr-2003	29-Apr-2003	1	150	298	4,463	280	555	21,805	0	0	0	430	26,268
30-Apr-2003	30-Apr-2003	1	150	298	4,760	280	555	22,360	0	0	0	430	27,121
1-May-2003	1-May-2003	1	150	298	5,058	280	555	22,916	0	0	0	430	27,974
2-May-2003	2-May-2003	1	150	298	5,355	280	555	23,471	0	0	0	430	28,827
3-May-2003	3-May-2003	1	150	298	5,653	280	555	24,027	0	0	0	430	29,679
4-May-2003	4-May-2003	1	150	298	5,950	280	555	24,582	0	0	0	430	30,532
5-May-2003	5-May-2003	1	150	298	6,248	280	555	25,137	0	0	0	430	31,385
6-May-2003	6-May-2003	1	150	298	6,545	420	833	25,970	0	0	0	570	32,516
7-May-2003	7-May-2003	1	150	298	6,843	420	833	26,803	0	0	0	570	33,646
8-May-2003	8-May-2003	1	150	298	7,140	420	833	27,637	0	0	0	570	34,777
9-May-2003	9-May-2003	1	150	298	7,438	420	833	28,470	0	0	0	570	35,908
10-May-2003	10-May-2003	1	150	298	7,736	420	833	29,303	0	0	0	570	37,038
11-May-2003	11-May-2003	1	150	298	8,033	420	833	30,136	0	0	0	570	38,169
12-May-2003	12-May-2003	1	150	298	8,331	380	754	30,889	0	0	0	530	39,220
13-May-2003	13-May-2003	1	150	298	8,628	250	496	31,385	0	0	0	400	40,013
14-May-2003	14-May-2003	1	150	298	8,926	250	496	31,881	0	0	0	400	40,807
15-May-2003	15-May-2003	1	150	298	9,223	175	347	32,228	0	0	0	325	41,451
16-May-2003	16-May-2003	1	150	298	9,521	125	248	32,476	0	0	0	275	41,997
17-May-2003	17-May-2003	1	150	298	9,818	72	143	32,619	0	0	0	222	42,437
18-May-2003	19-May-2003	2	150	595	10,413		0	32,619	0	0	0	150	43,032
20-May-2003	20-May-2003	1	175	347	10,760		0	32,619	175	347	347	350	43,726
21-May-2003	28-May-2003	8	175	2,777	13,537		0	32,619	375	5,950	6,298	550	52,454
29-May-2003	29-May-2003	1	75	149	13,686		0	32,619	400	793	7,091	475	53,396
30-May-2003	30-May-2003	1	75	149	13,835		0	32,619	225	446	7,537	300	53,991
31-May-2003	31-May-2003	1	75	149	13,983		0	32,619	175	347	7,884	250	54,487
1-Jun-2003	12-Jun-2003	12	75	1,785	15,769		0	32,619	175	4,165	12,050	250	60,437
13-Jun-2003	13-Jun-2003	1	75	149	15,917		0	32,619	135	268	12,317	210	60,854
14-Jun-2003	24-Jun-2003	11	75	1,636	17,554		0	32,619	105	2,291	14,608	180	64,781
25-Jun-2003	29-Jun-2003	5	75	744	18,298		0	32,619	160	1,587	16,195	235	67,112
30-Jun-2003	2-Jul-2003	3	75	446	18,744		0	32,619	120	714	16,909	195	68,272
3-Jul-2003	6-Jul-2003	4	75	595	19,339		0	32,619	160	1,269	18,179	235	70,136
7-Jul-2003	8-Jul-2003	2	75	298	19,636		0	32,619	120	476	18,655	195	70,910
9-Jul-2003	31-Jul-2003	23	75	3,421	23,058		0	32,619	160	7,299	25,954	235	81,631
1-Aug-2003	16-Aug-2003	16	75	2,380	25,438		0	32,619	120	3,808	29,762	195	87,819
17-Aug-2003	19-Aug-2003	3	75	446	25,884		0	32,619	160	952	30,714	235	89,217
20-Aug-2003	23-Aug-2003	4	75	595	26,479		0	32,619	120	952	31,666	195	90,764
24-Aug-2003	25-Aug-2003	2	75	298	26,777		0	32,619	160	635	32,301	235	91,697
26-Aug-2003	28-Aug-2003	3	75	446	27,223		0	32,619	120	714	33,015	195	92,857
29-Aug-2003	5-Sep-2003	8	75	1,190	28,413		0	32,619	160	2,539	35,554	235	96,586
6-Sep-2003	11-Sep-2003	6	75	893	29,306		0	32,619	120	1,428	36,982	195	98,907
12-Sep-2003	14-Sep-2003	3	75	446	29,752		0	32,619	160	952	37,934	235	100,305
15-Sep-2003	19-Sep-2003	5	75	744	30,496		0	32,619	120	1,190	39,124	195	102,239
20-Sep-2003	24-Sep-2003	5	75	744	31,240		0	32,619	160	1,587	40,711	235	104,569
25-Sep-2003	30-Sep-2003	6	75	893	32,132		0	32,619	120	1,428	42,139	195	106,890
1-Oct-2003	15-Oct-2003	15	200	5,950	38,083		0	32,619	0	0	42,139	200	112,840
16-Oct-2003	20-Oct-2003	5	175	1,736	39,818	175	1,736	34,355	100	991	43,130	450	117,303
21-Oct-2003	25-Oct-2003	5	175	1,736	41,554		0	34,355	175	1,736	44,866	350	120,774
26-Oct-2003	30-Oct-2003	5	175	1,736	43,289		0	34,355	75	744	45,609	250	123,254
31-Oct-2003	30-Nov-2003	31	175	10,760	54,050		0	34,355	35	2,160	47,770	210	136,174
1-Dec-2003	31-Dec-2003	31	175	10,760	64,810		0	34,355	35	2,160	49,930	210	149,095
1-Jan-2004	31-Jan-2004	31	175	10,760	75,570		0	34,355	35	2,160	52,091	210	162,016
1-Feb-2004	29-Feb-2004	29	175	10,066	85,636		0	34,355	35	2,021	54,112	210	174,103
1-Mar-2004	31-Mar-2004	31	175	10,760	96,397		0	34,355	35	2,160	56,272	210	187,024
1-Apr-2004	14-Apr-2004	14	175	4,860	101,256		0	34,355	35	976	57,248	210	192,859
No. of days		366	(April 15 through April 14)										

1 cfs day = 1.983471 acre-feet (af)

Notes: 1. Based on 60-20-20 Index is 2,815,099 July 31, 1996 FERC Order Flow Interpolated as 192,859 AF fish flow year requirement.

2. The pulse flows are a target that represents a daily average.

3. Base flow amounts shown prior to April 15 are not included in this year's total.

ATTACHMENT B

ATTACHMENT -B-

2003 Tuolumne River Technical Advisory Committee Materials:

- Index to Attachment –B-
- 19MAR MEETING
- 24JUN MEETING
- 25SEP MEETING
- 17DEC MEETING

The following material in this Attachment is organized in chronological sections based on the TRTAC meetings and within each section as follows:

- Meeting notice and agenda
- Meeting notes and attendance list for the meeting
- Correspondence provided prior to the meeting
- Meeting handouts and other materials
- Correspondence following the meeting

Since overall TRTAC-related materials have become voluminous, some meeting handouts or correspondence that were later updated, were draft documents, were of an informal nature, or otherwise determined, are not included.

INDEX TO ATTACHMENT -B-

Tuolumne River Technical Advisory Committee
2003 Materials:

19MAR2003 Meeting:

* Agenda, meeting notes, and attendance list
* 04FEB2003: letter reviewing the 2002 fall pulse flow and 45-day period (TID) *(see Attachment A)*
* 14FEB2003: 29JAN subgroup meeting notes

* Handouts:
    - TRTAC materials since the 13DEC2001 meeting (Ford)
    - Watershed snowpack and precipitation data (Ford) *(not included)*
    - 14MAR SWS memo packet on oversummering habitat for steelhead (Hume)
    - 17MAR SWS memo on GIS task cost estimates (Hume)
    - Restoration project status update (Fryer)
    - News article on smaller eggs at salmon farms (Ford)

* **Actions:**
    - Monitoring spending allocations were not changed from those made at the JAN subgroup meeting

* 18APR: Initial Fish Flow Year schedule letter *(see Attachment A)*
* 20MAY: Revised flow schedule letter *(see Attachment A)*

24JUN03 Meeting:

* Agenda, meeting notes, and attendance list
* Summary of 13JUN flow schedule decisions
* 20JUN2003: meeting notice and agenda (Ford) *(not included)*

* Handouts:
    - TRTAC materials list since the 18MAR meeting (Ford)
    - Updated FSA expense tables (Ford) *(not included)*
    - Fish flow volume and schedule (Ford)
    - Flow and air temperature data (Ford)
    - Flow and stage at La Grange data (Ford)
    - Snorkel summary to date (Ford)
    - Restoration project status update (Fryer)

* Presentation:
    - RWQCB water quality monitoring and TMDL programs

* **Actions:**
    - Decision on summer flow operation

* 25JUN: Summary of 24JUN flow schedule decision (Ford)
* 03JUL: Flow schedule letter of 30JUN from Districts *(see Attachment A)*

25SEP2003 Meeting:

* Agenda, meeting notes, and attendance list

* Handouts:
    - Materials list since September meeting (Ford)
    - August letter from FERC to the Districts requesting steelhead information
    - Updated FSA expense tables (Ford) *(not included)*
    - Graph/table of summer flow schedule and air temperatures (Ford)
    - Graph of observed first dates of La Grange salmon sightings *(Ford - not included)*
    - Proposed fall flow schedules (DFG and Ford)
    - Restoration project status and funding summary (Fryer)
    - La Grange floodplain restoration proposal to Wildlife Conservation Board (Koepele)

17DEC2003 Meeting:

* Agenda, meeting notes, and attendance list
* 15OCT: Flow schedule update letter dated 09OCT (TID) *(see Attachment A)*
* 15DEC: Memo from McBain and Trush on coarse sediment project
* 16DEC: TRTAC materials list (Ford) and potential steelhead concerns from FERC (Gaedeke)

* Handouts:
    - Updated FSA expense table/graph (Ford) *(not included)*
    - CCRF Section 10 permit application (Mesick)
    - CCRF restoration designs and presentation (Mesick)
    - Restoration project status and gravel addition project scope change (Fryer)

* **Actions:**
    - Several followup actions related to trout were identified (see list below)
    - Fryer was approved to submit Gravel Project amendment

* 18DEC: Source of trout WT info used in 01DEC filing and limited DO data (Ford)
* 18DEC: Trout WT criteria information (Martinez) *(report cover included)*
* 19DEC: Comments on trout WT criteria (Bevelheimer)
* 19DEC: New DFG fishing stamp information (Ford)
* 19DEC: Habitat maps for La Grange Dam to Roberts Ferry Bridge from M&T (Ford)
* 22DEC: Central Valley trout genetics report and north coast survey protocol (Heyne) *(cover/abstract included)*

TUOLUMNE RIVER TECHNICAL ADVISORY COMMITTEE
DON PEDRO PROJECT - FERC LICENSE 2299

MODESTO IRRIGATION DISTRICT
TURLOCK IRRIGATION DISTRICT
CITY & COUNTY OF SAN FRANCISCO
CALIFORNIA DEPARTMENT OF FISH & GAME
U. S. FISH & WILDLIFE SERVICE

333 East Canal Drive
Turlock, CA 95381-0949
Phone: (209) 883-8275
Fax: (209) 656-2180
Email: tjford@tid.org

TECHNICAL ADVISORY COMMITTEE MEETING

March 19, 2003, 9:30 a.m.

Turlock Irrigation District, Lunch Room (2nd floor)

DRAFT AGENDA

1. Introduction
   A. Comments on draft agenda
   B. Correspondence since last meeting
2. **ACTION ITEMS**:
3. General FSA Update:
   A. FSA/Order activity and expense tracking, subgroup activity, and report status
   B. AMF, NGO, and agency updates
   C. Monitoring
   D. River operations and flow schedule
   E. Restoration
      1. Planning and implementation
      2. Project monitoring
      3. Other restoration
4. Additional items:
   A. Other topics
   B. Next meeting and items

TUOLUMNE RIVER TECHNICAL ADVISORY COMMITTEE
DON PEDRO PROJECT - FERC LICENSE 2299

MODESTO IRRIGATION DISTRICT
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TECHNICAL ADVISORY COMMITTEE MEETING MINUTES of

19 March 2003

DRAFT

1. AGENDA & PRIOR MINUTES

No Changes were made to the Agenda. Tim Ford distributed correspondence since the last meeting.

2. ACTION ITEMS:

No action items carried over from the last meeting.

3. GENERAL INFORMATION:

A. FSA/Order Activities: Subgroup meetings in January and February identified the remaining monitoring activities that are planned for the $164,000 left in the funds available for monitoring. These include thermographs, seining, and snorkeling by the Districts, and APR-MAY screw trap monitoring by DFG. Analysis of the 2002 smolt survival study data will be completed. Under restoration funding only $35,000 currently remains unallocated, pending the final closeout on SRP 9 and 7\11 Projects. DFG provided an update on the 2002 spawning monitoring. There will be no redd count report or Grayson rotary screw trap report for the FERC report this year.

B. Agency Updates: J.D. Wikert, USFWS, indicated the Service is considering on a basin wide forum to meet quarterly (?) to review and exchange information from groups implementing restoration projects. Roger Masuda indicated that consideration needs to be given for project construction contracts to have change order language on time & material basis for implementing adaptive management practices during construction. Madelyn Martinez will try to bring language used by NOAA Fishery for such activities. The need for long-term project related monitoring was identified for potential Phase II CBDA funding requests.

Allison Boucher, FOTT, reported that beaver activity at Grayson River Ranch had become a problem and depredation permits would be sought. The City of Waterford tree planting went well with 70 volunteers participating. Development of a plan for Bobcat Flat was continuing. The FOTT is working on a tour to show how steelhead habitat could be incorporated into current riffle rehabilitation projects. The Ceres Bluff park area will have some of the riprap removed.

Patrick Koepele, TRPT, reported on the development of flyers and other public outreach materials for the Tuolumne River Coalition (TRC) activities. They are looking to adopt the Army COE hydraulic model for the Big Bend project. There were questions on how the TRC would handle contracting for use of Proposition bond funds; JPA, MOA, etc.

Tim Heyne, DFG, reported on the spawning use of the recent gravel additions in La Grange. The lowermost addition was little used, but the rest of the areas were used extensively. They paid more for the gravel than originally in the budget. The permits are not yet in place for additions in 2003.

Madelyn Martinez, NOAA Fisheries, indicated it requires 6 to 8 months to get through the review and public notice requirements for Section 10 Permits. There is increased emphasis on the monitoring associated with the permit.

Jeff McLain, USFWS, indicated that the FWS and NOAA Fisheries were continuing to work on the consultation coordination for VAMP flows now required for steelhead issues. Pat Brantley will be replacing Rhonda Reed as the DFG – AFRP coordinator with Jeff.

3C Monitoring: DFG reported the rotary screw trap will run only April through May due to funding and there could be some fish not counted. The Districts have been conducting the annual seining and will follow that up in June with snorkel surveys. There was discussion on expanding invertebrate studies and the level of assessment to be used. The use of a Rapid Bioassessment Method would allow a greater portion of the river to be covered, but at a lesser resolution. The intensive monitoring gives a better indication of population changes. Tim Heyne, DFG, questioned the need for invertebrate studies unless there is indication of nutritional problems in the fishery. The Stillwater report will be discussed at the next TRTAC meeting in June.

3D River Operations & Flow Schedules: The water conditions are very dry and with average from this point forward would only yield 130,000 AF available for the FERC flow schedule. The current recommendation would be to allocate this as 35,000 AF for the VAMP pulse flow period yielding 700-800 cfs average flows. The shape of the pulse flow curve is being developed for a mid-April start date.

3E Restoration Update: Wilton Fryer provided a handout on the funding and status of the projects currently being administered by the District. Monitoring fieldwork was completed as planned, with some habitat mapping left to be done in the fall.

4. ADDITIONAL ITEMS:

4A1 TRTAC GIS: Noah Hume, Stillwater Sciences, reported on a proposal to upgrade the format of the information in the current GIS database. There have been a few requests for the database layers. The old data is in ArcView format and McBain could update the layers in that format for $1,000. There is old pre-1997 flood data form La Grange to Empire (RM 21) and new Army COE photo negatives and ground data from the San Joaquin River to RM 31. It would take several days to put that data into the ArcView format. The issue to be considered is putting the river into a digital terrain model rather than the ArcView format. The digital information is easier to manipulate the ArcView information is more like a picture. No decision was made.

4A2. Trout Compilation: Allison Boucher, FOTT, proposed compiling all the information on Central Valley trout with FOTT as the contract agent. This would include steelhead use of the rivers. It was suggested the scope should be to look at just the San Joaquin River system with linkage to the existing NOAA Fishery Science lab data, the AFRP IFIM work for the San Joaquin Basin, and the DFG Biological Review Team project. FOTT will work with the TRTAC Subgroup to develop a scope of work and make a determination of what is currently being developed. It was suggested to focus on sufficient information to understand how to accommodate steelhead when restoration activities are implemented for salmon.

4A3. Noah Hume, Stillwater Sciences, reported on the "Flow vs Temperature" memo handout to the TRTAC. It is an expansion of earlier IFIM models for salmon applied to information on trout. There can be too much flow in the river, where the velocity over the riffles is no longer suitable for trout juvenile survival, even though adult habitat is expanded. The models suggest that the location of the 65 degree F temperature threshold is generally downstream of current gravel infusion projects near La Grange in normal runoff years (i.e. summer flows > 150 cfs). Flows above 150 cfs appear to provide greater downstream extant for adult trout habitat, but at the expense of upstream juvenile habitat due to higher water velocities.

4B. NEXT MEETING & TOPICS:

The next meeting will be at 0930 on Tuesday 24 June 2003.

FERC 2299 TAC Meeting
19 March 2003

Name	Organization
Tim Ford	TID/MID
Wilton Fryer	TID
Roger Masuda	TID
Patrick Koepele	TRPT
Jeff McLain	USFWS
J. D. Wikert	USFWS
Allison Boucher	FOTT
Ron Yoshiyama	CCSF
Noah Hume	Stillwater Sciences
Tim Heyne	DFG
Madelyn Martinez	NMFS

DRAFT NOTES

TRTAC Subgroup Meeting
January 29, 2003, 9:30-5:00 at MID

Meeting Notes by R. Yoshiyama and T. Ford

ATTENDING: Tim Ford, Jeff McLain, Patrick Koepele, Allison Boucher, Darren Mierau, Madelyn Martinez, Dean Marston, Tim Heyne, Ron Yoshiyama.

Agenda Items. Dean Marston specified four monitoring-related topics on which timely Subgroup decisions would facilitate CDFG's operational planning for this spring's field studies (e.g., with regard to Merced Hatchery operations):

Flow Fluctuation and Fish Stranding
The Subgroup briefly discussed the status of fish stranding concerns that can result from flow fluctuations. Districts' operations since prior to the 1996 FERC Order generally have attempted to avoid large flow changes. Stillwater Sciences completed a report to the TRTAC (FERC Report 2000-6) summarizing potential stranding areas in connection with flow changes and review field observations. The stranding monitoring by the Districts in recent years has been mostly limited to rampdown periods of the spring pulse flows, which are outside the primary season of interest.

Noah Hume suggested that a potential study effort at this point would be computer-based determination of changes in river elevations at selected locations as a function of flow changes. Stillwater Sciences will prepare an example analysis of archived data to show the relationship between ramping rates and river elevations for a couple of locations. The Subgroup can then decide how much further analysis of data should be pursued.

River Habitat Mapping. There remains interest in obtaining more mapping of river inundation at various flow levels for the river GIS. Ford will try find out if anyone outside the TAC has constructed a map for high flow(s) and McBain & Trush, SWS, and McLain will provide a cost estimate for extending the GIS mapping for lower flow levels downstream of Empire.

Ford stated that the District's river GIS data will be made available (in CD format) to other parties that desire a copy. The current version exists in a compilation of Arcview layers. Anyone who wishes maps, etc. will likely contract with McBain & Trush to have the work done.

Coarse Sediment Management
Darren Mierau gave a brief overview of recent activities of McBain & Trush related to Tuolumne River habitat restoration. These activities include:

- The Coarse Sediment Management Report will soon be completed. A goal of the coarse sediment management plan is to determine the availability of gravel supplies for restoration work, as well as provide a framework for the study and management of in-river coarse sediment. The Plan will call for developing implementation designs for five high-priority sites that are slated for gravel infusions.

- Determination of unimpaired sediment supply. McBain & Trush estimated that ~100,000 cubic yards of sediment was transported downriver each year prior to the emplacement of dams on the Tuolumne River.

- Determination of available salmon spawning habitat. Information compiled for different time-points indicates that substantial loss of spawning habitat has occurred since 1988. Continued monitoring of coarse sediment supply is needed.

- A system for monitoring bedload transport volume (of sediment) has been set up.

D.Mierau noted that these projects reinforce the need to define the quantitative objectives for monitoring coarse sediment.

CWT Evaluation
The latest progress on the CWT evaluation is summarized in a report-memorandum (with attached files) recently distributed by Stillwater Sciences. That report combines the data analysis for years 1987, 1990, 1999-2001 with the earlier results for years 1994-1998. Noah Hume noted that the recent analysis showed that adding temperature as an independent variable in the survival-versus-flow regression did not substantially improve the regression fit (i.e., it did not increase r-squared very much). In fact, adding temperature caused a loss of statistical power (i.e., raised the p-value of the regression, making it harder to detect any significant relationship. Hume stated that the regression graph that has emerged from the CWT evaluation shows that there is a general relationship of survival with flow, but the confidence intervals are very wide and allow little quantitative predictive power

Hume will put finishing touches on the report for inclusion in the annual (2002) FERC Report. Subgroup members recommended that the narrative be filled out a little more to more clearly explain the procedures employed in the evaluation.

Yoshiyama noted that the next step in the CWT evaluation is to determine the extent to which the survival-versus-flow regression can be interpreted. That issue will be discussed in subsequent Subgroup meetings.

Budget and Available Funds for FERC SA Elements
Ford had previously distributed via email an updated spreadsheet of FERC SA expenditures (dated January 17, 2003). Based on that accounting, there is about $408,000 remaining of Section 12 (non-flow) funds, of which $225,000 was set aside as a contingency fund for the 7/11 project and will likely be used up. That would leave $408,000-$225,000 = $183,000 of Section 12 funds. Some of those remaining funds have previously been pledged and the actual remainder needs to be determined by W. Fryer.

Presently, there is about **$164,000** left of Section 13 (monitoring) funds to last through 2004 or 2005. The Subgroup sketched a basic budget and sampling plan for remaining Section 13 monitoring activities. As a minimum sampling plan, it was agreed to continue three monitoring elements for Section 13 funds for the next two years:

temperature monitoring:	$5,000	x 2 years =	$10,000
seine / snorkel sampling:	$30,000	x 2 years =	$60,000
screwtrap sampling (2 months each year):	$30,000	x 2 years =	$60,000
		subtotal =	$130,000

Additional items related to smolt survival that would be added (continue CWT evaluation (add 2002) - $5,000; DFG ongoing decoding of CWT samples from field-collected fish- $10,000) will cost another $15,000.

That basic monitoring plan would then use up $145,000 of the Section 13 funds -- leaving about $20,000 for other monitoring needs.

Aside from the Section 13 funds, some Section 12 (non-flow measures) funds might be used for certain elements related to habitat restoration – specifically, gravel permeability measurements; GIS mapping; redd studies.

The above plan may be augmented if additional funding is obtained by DFG to extend screwtrap sampling beyond the minimum 2-month (APR-MAY) period as planned for above. The Subgroup will further discuss how much monitoring, if any, can be pursued in year 2005 as funded under the FERC SA.

There are not sufficient FERC SA funds remaining after the allocations above to conduct other significant monitoring, such as another large CWT study (which may cost about $60,000 or more). Yoshiyama asked how many more years of large-release CWT studies CDFG wished to conduct (if funding were available) and whether CDFG was interested in doing only one additional year of CWT study. Marston will report back to the Subgroup after conferring with CDFG management on future CWT study plans. The Districts, San Francisco and USFWS representatives (T. Ford, R. Yoshiyama, J. McLain) favored not conducting a CWT study this spring (2002) in view of the limited availability of funds and likelihood that this year's flow will not be in the range (4,000-6,000 cfs) where CWT-survival data might be needed. However, T. Heyne stated that we know little about smolt survival values at very low flows (e.g, 250 cfs). Ford pointed out that additional data on CWT releases through 2002 would continue to be gathered over the next 2-3 years.

Marston noted that the Subgroup should decide upon the specific objectives of each of the monitoring activities for the next few years to help determine the usefulness of continuing those activities. The next meeting will specifically address remaining funding allocations for Sec. 12 (non-flow) tasks.

Ford asked about the interest in resuming SJ Basin Salmonid Work Team meetings this year.

Next Meeting. Subgroup meeting is scheduled for **February 20, 2003, 9:30 A.M. at MID** (3^{rd} floor rooms).

Tuolumne River Technical Advisory Committee
Materials since 18DEC2002 TRTAC meeting

(underlined items are designated for inclusion in the FERC Report)

* 13JAN: Don Pedro Project Fish Flow Procedural Steps (Masuda)

* 14FEB: <u>DEC meeting notes</u> (Ford)

* 14FEB: Bobcat Flat gravel information (FOT)

* 17MAR: <u>Meeting notice, draft agenda, and material list</u> (Ford)

Noteworthy Subgroup items:

* 17JAN: FSA activity update (Ford)

* 29JAN: Subgroup meeting

* 14FEB: <u>Draft 29JAN meeting notes</u>

* 20FEB: Subgroup meeting

* 28FEB: Draft temperature, flow, and invertebrate reports and revised report schedule

* 03MAR: Gravel addition material (M&T)

* 03MAR: Abridged AMF report (Ford)

* 10MAR: Draft Large CWT Analysis Report (SWS)

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DRAFT MEMORANDUM

DATE: March 14, 2003

TO: Tuolumne River Technical Advisory Committee (TRTAC)

FROM: Noah Hume and Peter Baker

SUBJECT: Preliminary assessment of over-summering habitat for steelhead based on 1995 IFIM Study Results for the lower Tuolumne River

BACKGROUND

A number of concerns have been raised at the TRTAC meetings over the past several years regarding the management of the Tuolumne River for the benefit of Steelhead Trout (*Oncorhynchus Mykiss*). These concerns generally are related to instream flows and their effect on summertime water temperatures, but other concerns regarding rearing and spawning habitat have been discussed. On April 30, 2002, the U.S. District Court for the District of Columbia approved a NMFS consent decree withdrawing a February 2000 critical habitat designation for the Central Valley and 18 other ESUs. In anticipation of the publication of the updated status reviews from NOAA Fisheries, Madelyn Martinez requested that an evaluation of over-summering habitat be conducted for steelhead so that TRTAC members could make informed responses to any potential ESA consultations that may arise in the future.

INTRODUCTION

This memorandum summarizes the results of a preliminary habitat assessment conducted by Stillwater Sciences that uses a combination of SNTEMP temperature model results and the PHABSIM model results for the lower Tuolumne River (USFWS 1995) to express the useable riffle and pool habitat area for O. mykiss juveniles and adults.

SNTEMP Model Description. An SNTEMP model was implemented for the Tuolumne River during the late 1980's (TID/MID 1992). The SNTEMP model (Theurer et al. 1984) is a one-dimensional model originally developed through a cooperative effort of the Instream Flow and Aquatic Systems Group of the U.S. Fish and Wildlife Service and the U.S. Soil and Conservation Service. SNTEMP requires user-supplied input of water temperatures and flows at the uppermost ends of the stream network. The model then routes water downstream and computes changes in temperature resulting from radiation, evaporation, convection at the air-water interface, streambed conduction, streambed friction, and lateral inflow/outflow. Meteorological data (i.e., air temperature, relative humidity, solar insolation, and wind speed) used in the model is from an eleven-year record at Modesto between 1978 and 1988. The model uses this data record (with corrections for differences in elevation) to predict instream temperatures from New Don Pedro Dam to the San Joaquin River confluence. Although much more extensive instream temperature data has been collected almost continuously starting in 1986, the post-calibration model validation indicated that the modeled water temperatures lie within a 50% confidence interval of ± 1.5°C and a 90% confidence interval of ± 3.0°C (TID/MID 1992).

The Relationship Between Instream Flow and Habitat Using PHABSIM. In 1992, the USFWS Instream Flow Incremental Methodology (IFIM) was applied to the Tuolumne River below La Grange dam to provide a rational basis for the instream flow release requirements for fall run chinook salmon (O. tshawytscha). The PHABSIM system is part of the IFIM and was developed by the Instream Flow and Aquatic Systems Group at US Fish and Wildlife Service in Fort Collins, Colorado, USA (Milhous 1973, Bovee 1982, Milhous et al. 1984). PHABSIM synthesizes several components, including both hydraulic and habitat simulations of a stream reach using defined hydraulic parameters and habitat sustainability criteria, to provide a definition of the physical aquatic habitat or "usable" fish habitat at different stream flows.

For the 1992 evaluation on the lower Tuolumne River, habitat mapping was conducted between La Grange dam (RM 52) and Waterford (RM 31.5) based upon twenty five transects across three major habitat types: riffles, run/glides, and deep pool. Ten riffles, ten run/glides, and five pools were characterized to represent habitat characteristics throughout the river. Although the channel cross-sectional information was collected up the banks to ensure they would reflect changes in hydraulic geometry up to 1200 cfs, the instream surveys measured, substrate, water depth and velocities along the transects at 250, 500, and 1050 cfs. To provide an overall relationship between physical habitat availability and discharge, the survey results were combined into each habitat type, with the WUA estimates applied by the total lengths of these habitat types represented in the river from La Grange (RM 52) down to the San Joaquin River confluence (RM 0).

It should be noted that since this study was primarily conducted for chinook salmon habitat assessment, the habitat suitability criteria (HSC) for the *O. mykiss* for the Tuolumne River IFIM studies were not based upon direct observations of habitat use in the Tuolumne River, but those published by Bovee (1978) that considered habitat use across a wide number of rivers. Most importantly, since the O. mykiss HSC curves are for relatively low velocities and depths, the resulting WUA curves for the lower Tuolumne River do not extend above 500 cfs. For this reason, EWUA calculations at higher flows represent truncations at the 500 cfs level and may over- or under-estimate suitable habitat.

METHODS

For the September 28 2002 TRTAC flow workshop last fall, chinook salmon WUA curves were superimposed with SNTEMP temperature model data, emphasizing that flows high enough to move the cool water zone further downstream in late summer would actually eliminate significant amounts of suitable chinook spawning habitat because of high velocities. Extending this to *O. mykiss*, we ran modeled temperature and velocity to produce the effective weighted useable area (EWUA) for juvenile and adult trout during summer and autumn at several potential flow scenarios. The term "Effective" is used to show locations that are excluded from habitat suitability based upon exceeding a user supplied temperature criteria. Lastly, although true steelhead adults are likely present in the river from late October until May, we have analyzed the adult *O. mykiss* curves to represent conditions for rainbow trout.

Flows and Dates of Analysis. Figure 1 shows the annual variation in Tuolumne River Flow at La Grange based upon the 1995 FSA flow schedule (FERC 1996). As a basis of this evaluation, we ran simulations both year-round as well as more detailed evaluations at summer and autumn flows in the portion of the flow schedule shown in Table 1. For the August through September time periods, we also included an intermediate flow of 180 cfs that is not in the current flow schedule. For the early October time period, we ran simulations at 75, 100, 150, 180, and 300 cfs.

Table 1. Flows (cfs) used in Tuolumne River SNTEMP and EWUA Calculations

Water Year Class from FSA and DWR 602020 Basin Index	1-Aug	1-Sep	1-Oct*
Median Critical and Below	50	50	75
Median Dry	75	75	100
Median Below Normal	75	75	150
unscheduled flows*	180	180	180
Above Normal and Wet	250	250	300

*note the 1-Oct and "unscheduled flows" do not correspond to flows under the FSA

Temperatures. Based on TRTAC discussion we provided SNTEMP simulations for average air temperatures and have also indicated the range of uncertainty between the temperature minimizing and temperature maximizing meteorology. Because the EWUA calculations do not indicate the downstream location of particular temperature boundaries in the river, the SNTEMP curves are supplied for reference. The temperatures used were to indicate the range of "optimal" (55F), "suitable" (65F) and "marginal/critical" (70F).

RESULTS

As a means to understand the relationship between summer flows and temperatures,

Downstream temperature criteria boundaries under the 1995 FSA Flow Schedule. Figures 2a-2f show SNTEMP model predictions of weekly water temperature below La Grange dam. Instream temperatures in the lower Tuolumne River rise rapidly to air temperature equilibrium within the first few miles downstream of La Grange. For example, Figure 2c shows that for a 65F temperature criterion, flows near 150 cfs are required to extend suitable cool water below Basso Bridge (RM 47.5). Although the model shows a small distance of suitable water temperatures in summer for all but the highest water temperature criterion (70F), it should be noted that the location of the downstream temperature boundary can move several in response to both river flow and the range in ambient meteorology.

River-wide habitat availability for O. mykiss under the 1995 FSA Flow Schedule. The SNTEMP results were integrated with the IFIM model curves to include or exclude habitat on the basis of changing depths, velocities, and temperatures. Figures 3 and 4 show year-round river-wide EWUA estimates for juvenile and adult *O. mykiss* habitat under the 1995 FSA flow schedule (Figure 1) and the three temperature criterion. In general, juveniles are more sensitive to high velocities in riffle and run/glide habitat than adults (USFWS 1995) and thus to the high flows required to extend cool water downstream. For example, in the absence of temperature limitations the 1995 IFIM showed that WUA was greatest for juveniles between 50–125 cfs and 175–375 cfs for adults. In the simulations conducted here, this would suggest that additional habitat would be available for *O. mykiss* at the flows above the current summer low flows (*e.g.*, 50–75 cfs) associated with dry water years types in Table 1. Although Figures 3 and 4 show the "optimal" or maximum EWUA lines lay above those for the 1995 FSA Flow schedules. In order to examine which flows would optimize habitat a separate plot is required.

Reach-by-reach variations in summertime habitat availability for *O. mykiss* with flow. As a means of understanding the sensitivity of habitat availability with flow Figures 5 and 6 show predictions of summertime EWUA by reach for juveniles and adults at the three selected temperature criteria. In general, EWUA availability follows the form of the unique WUA curves for each river segment, and follows the general form of temperature equilibration with distance at each discharge.

For a given river segment and varying discharges, these we can examine the competing influences of improved water temperature conditions but poorer conditions related to depth and velocity suitability. For example, Figure 4f shows that 300 cfs is insufficient to extend a 55F temperature boundary below Old La Grange Bridge in early August, whereas the first river segment in Figure 5a shows that maximum 55F habitat availability is attained at a flow of approximately 150 cfs. Similarly for a 65F temperature criterion, Figure 2c shows that 150 cfs would extend suitable habitat to near Basso Bridge (RM 47.5), whereas Figure 5b shows that EWUA rapidly falls off above these flows for juveniles.

For adult *O. mykiss*, habitat suitability with flow follows different patterns than juveniles and reflects increased pool habitat use as well as higher velocity thresholds. For example, using 70F and 250 cfs would extend the temperature criteria boundary to near Turlock State Recreation Area (RM 42) in early August (Figure 2e), very near the optimal EWUA at 300 cfs for this time period (Figure 6b). However, at still higher flows the downstream temperature boundary begins to encompass significant pool habitat and Figure 6b suggests a second local optimum at flows in excess of 500–700 cfs.

DISCUSSION

The results are presented in a series of figures for TRTAC Discussion and further analysis. For example, a habitat maximizing flow schedule could be developed using the tools presented. Perhaps the most important consideration for discussion by the TRTAC is the tradeoff between habitat maximizing conditions for adults and juveniles. In general, the results here show that optimal conditions (i.e., higher flows) for adult *O. mykiss* are unsuitable for juveniles, and optimal juvenile conditions may exclude cool water from downstream pool habitat for adults. However, there are a number of cautions that the TRTAC should consider before considering these results as a basis of future management discussions. As stated previously, the EWUA calculations at higher flows represent truncations at the 500 cfs level and may over- or under-estimate suitable habitat. In order to improve the available WUA curves, either inferences form chinook WUA curves or additional field study would be required.

The PHABSIM model that underlies the WUA calculations contains several assumptions that affect the relationships presented and habitat suitability predictions in other rivers are often shown to be related to other factors than the depth, velocity and substrate criteria used. In addition to the use of species curves for rainbow trout, the HSC used here are based upon generic depth, substrate and velocity criteria from other rivers. The collection of Tuolumne specific data is confounded by the inability to detect steelhead individuals from which to base habitat preference criteria more appropriate to the Central Valley. Problems with the extrapolation of PHABSIM transects to river-wide conditions relate to the position of the water column where the water velocity is measured, as well as the proximity of transect measurements. Although we have incorporated temperature into the EWUA calculations, meteorology strongly influences annual water allocations as well as short term variations in water temperatures. This can affect the predictive capability of the SNTEMP model, changing the location of the downstream extent of various temperature criteria.

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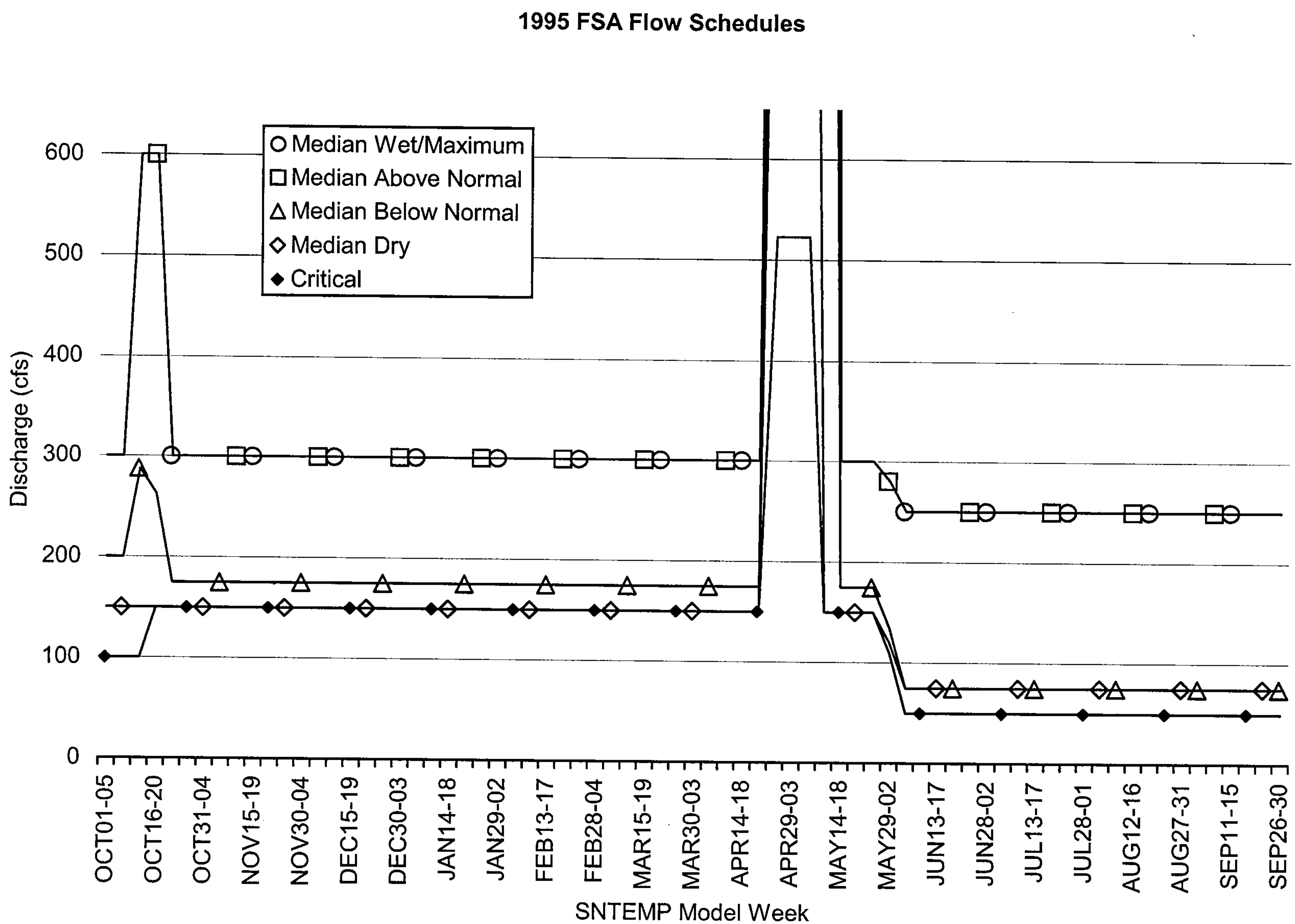

Figure 1: Annual Variation in Tuolumne River Flow at La Grange Based Upon the 1995 FSA.
Note that April pulse flows for three wettest water year classifications (not shown) are 1400, 1700 and 2600 cfs.

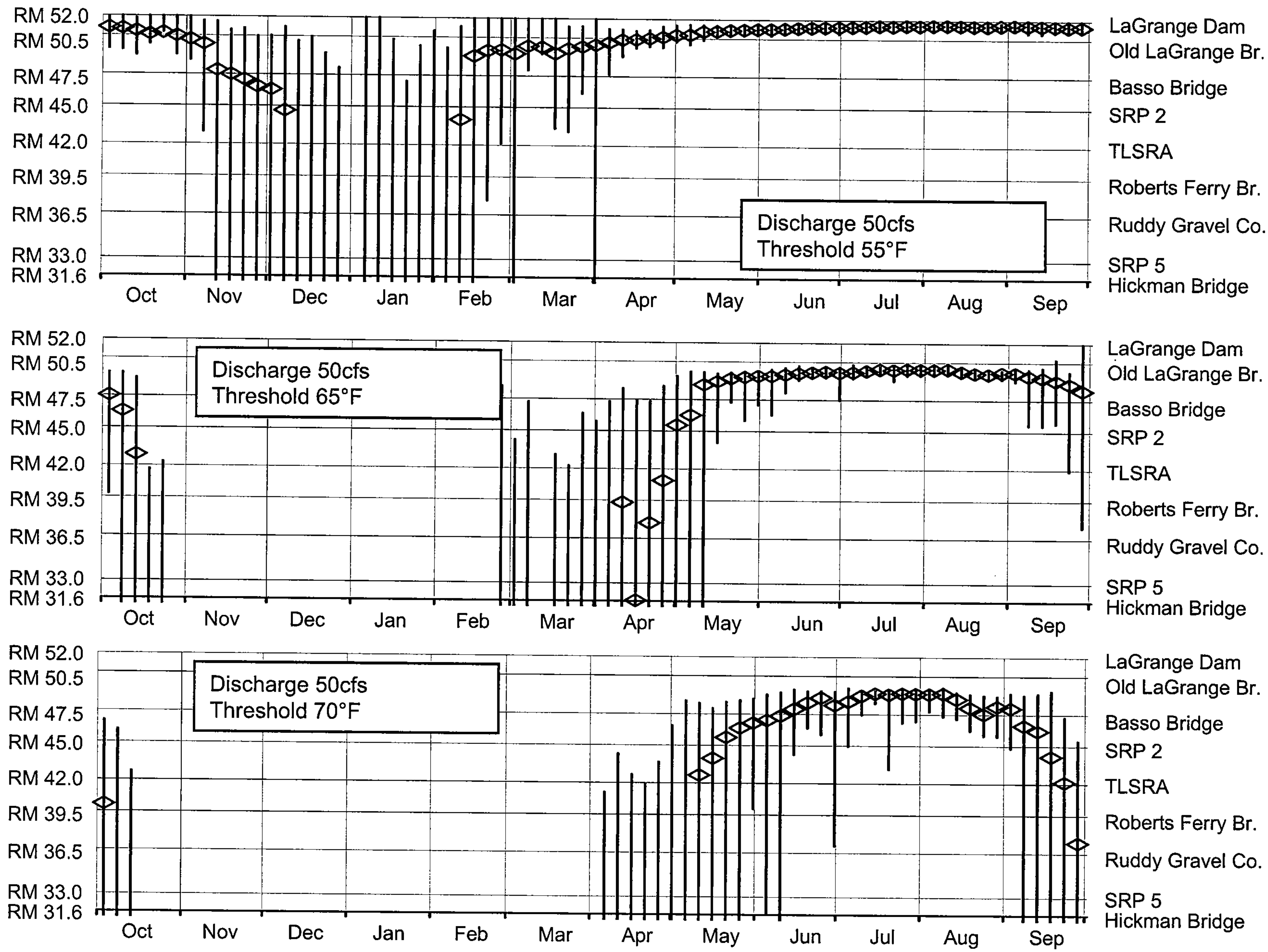

Figure 2a. Location of first transgression below dam of various temperature criterion, assuming constant LaGrange discharge of 50 cfs.

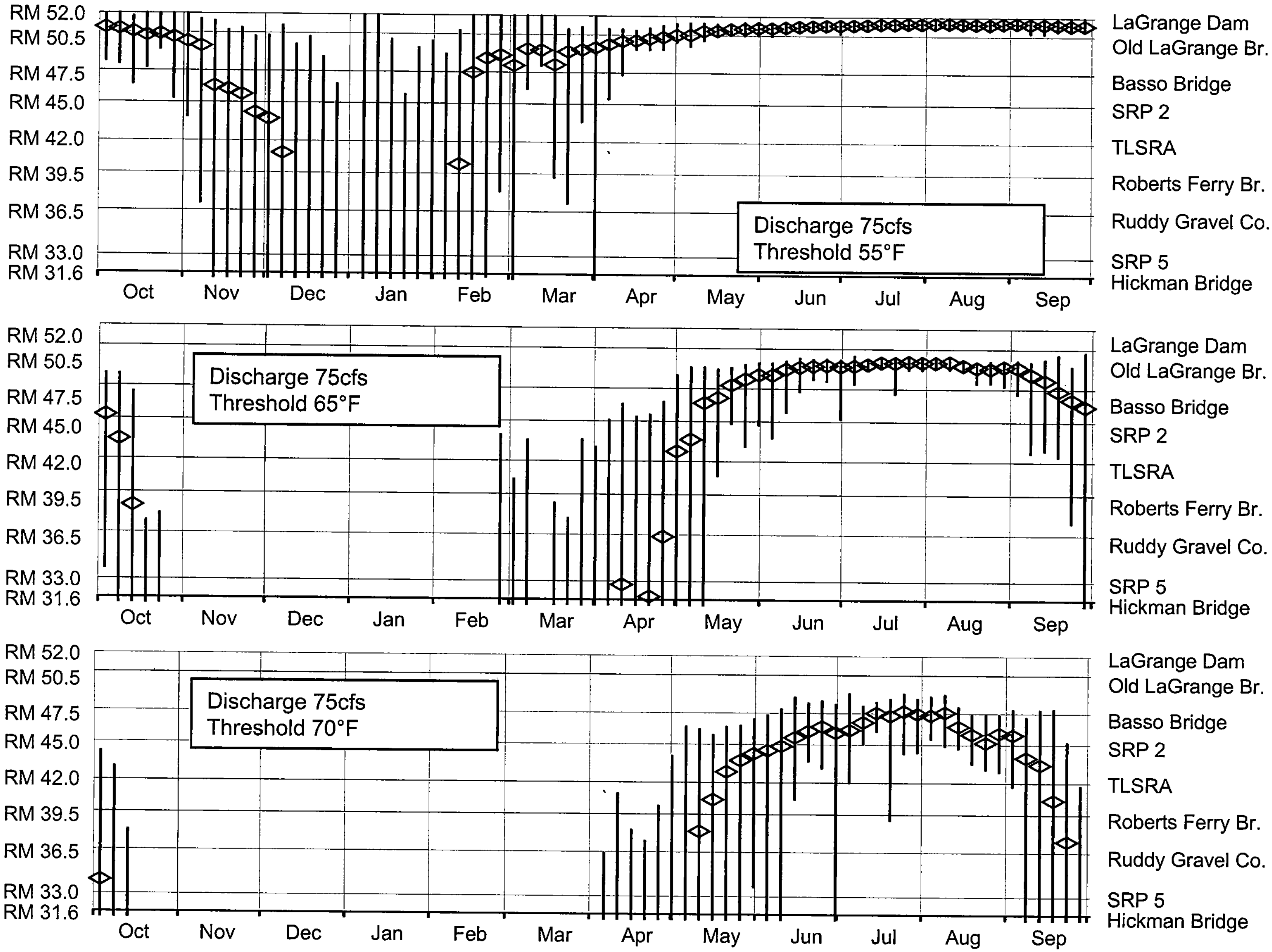

Figure 2b. Location of first transgression below dam of various temperature criterion, assuming constant LaGrange discharge of 75 cfs.

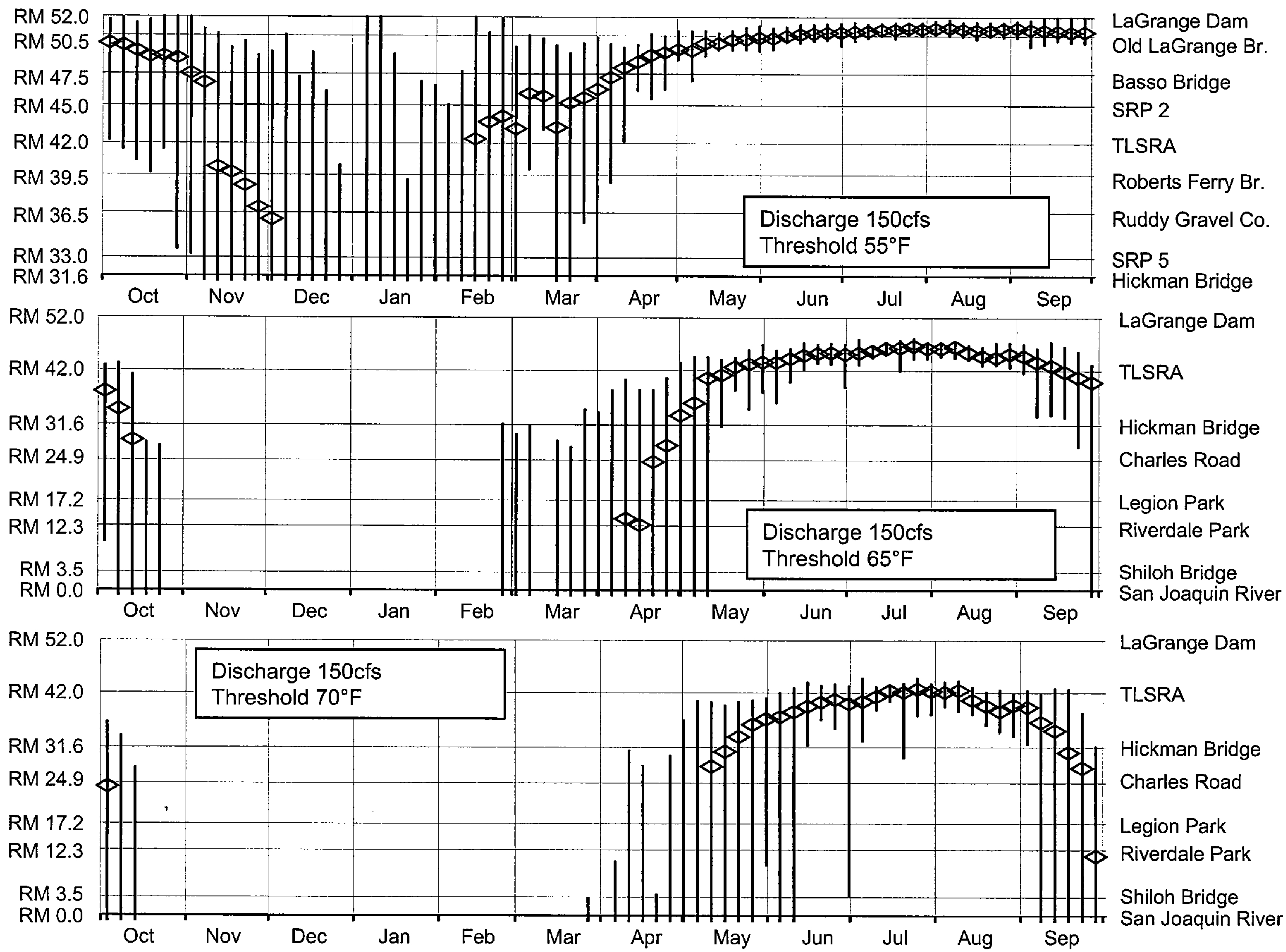

Figure 2c. Location of first transgression below dam of various temperature criterion, assuming constant LaGrange discharge of 150 cfs.

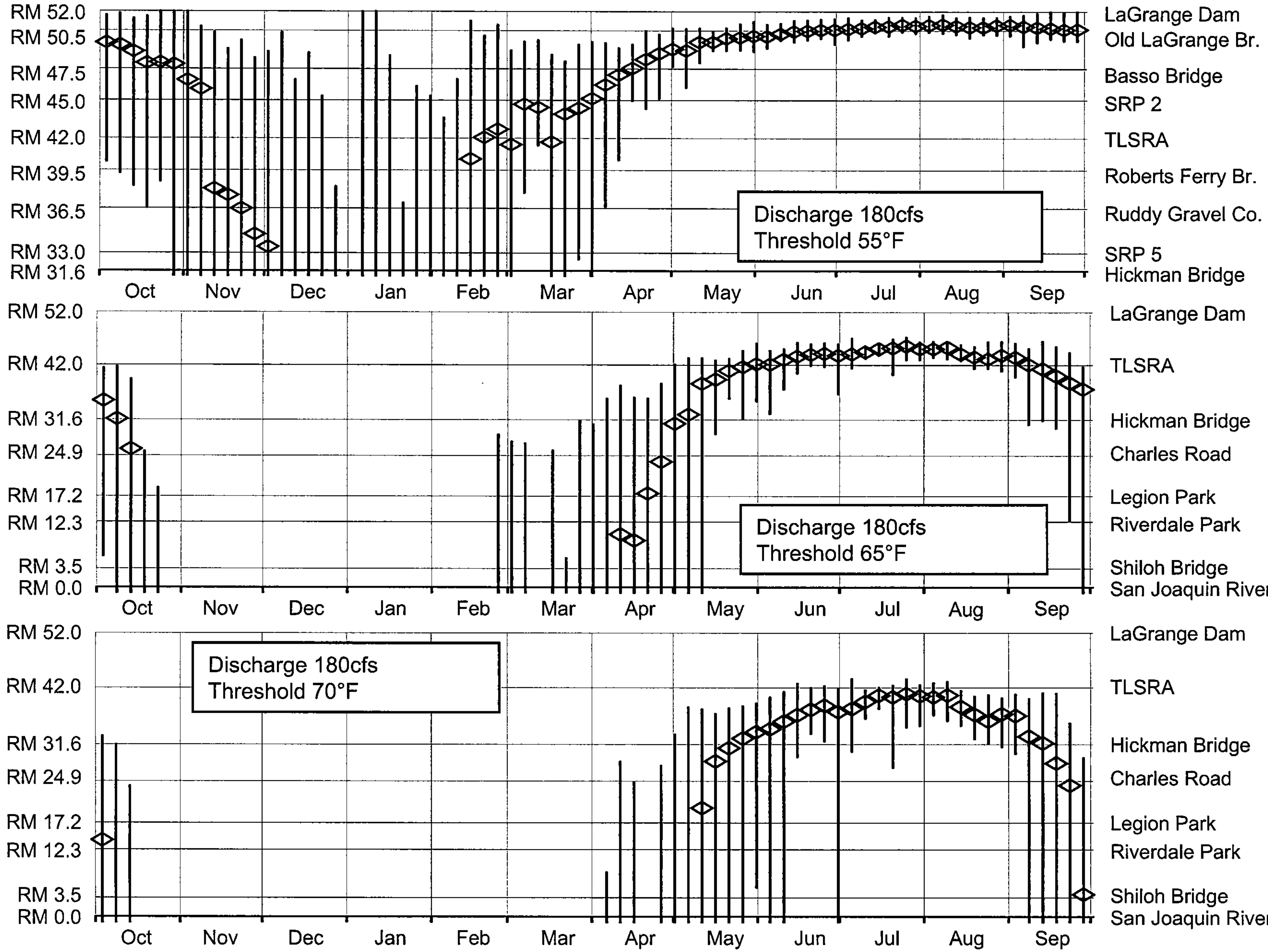

Figure 2d. Location of first transgression below dam of various temperature criterion, assuming constant LaGrange discharge of 180 cfs.

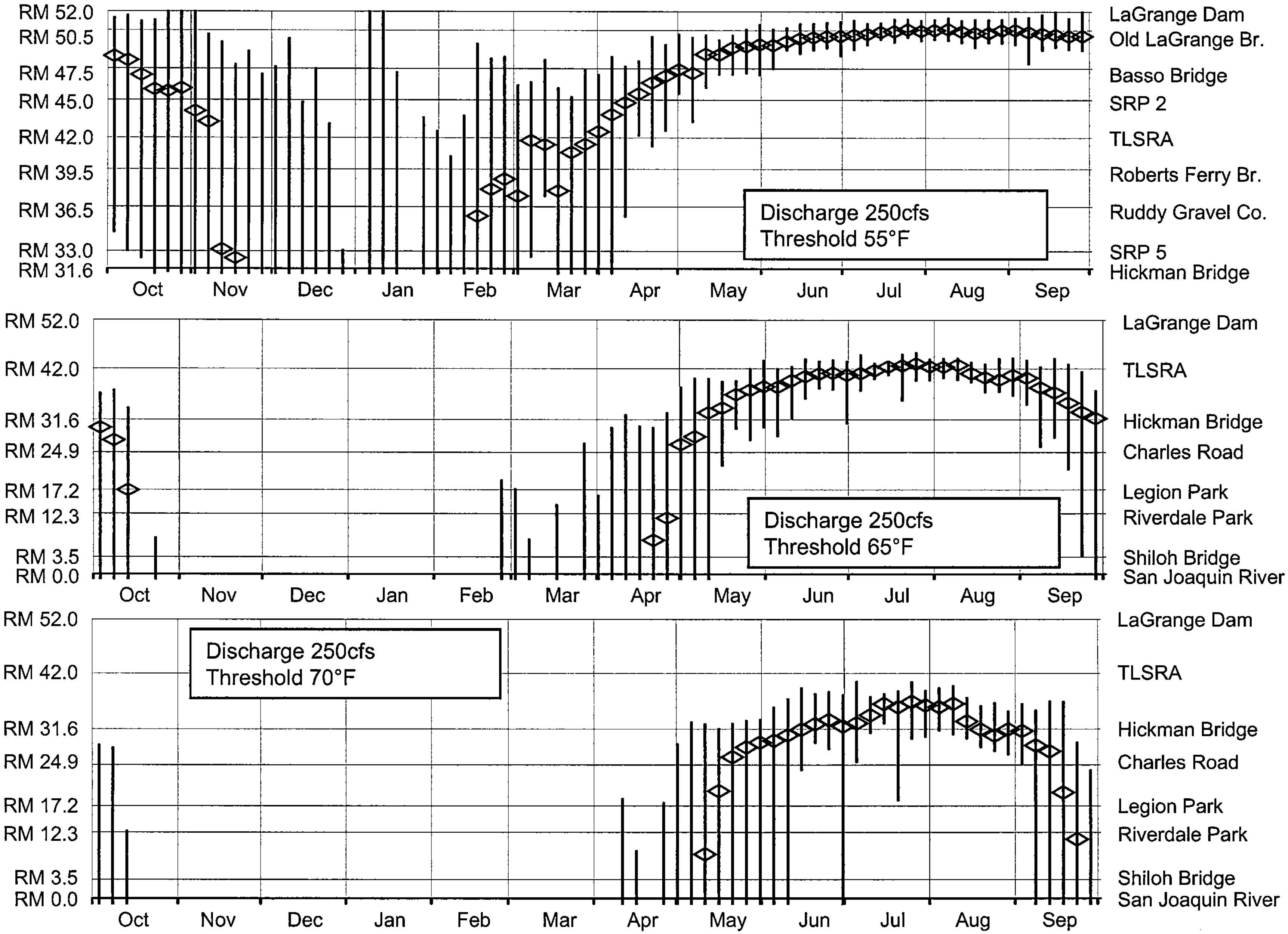

Figure 2e. Location of first transgression below dam of various temperature criterion, assuming constant LaGrange discharge of 250 cfs.

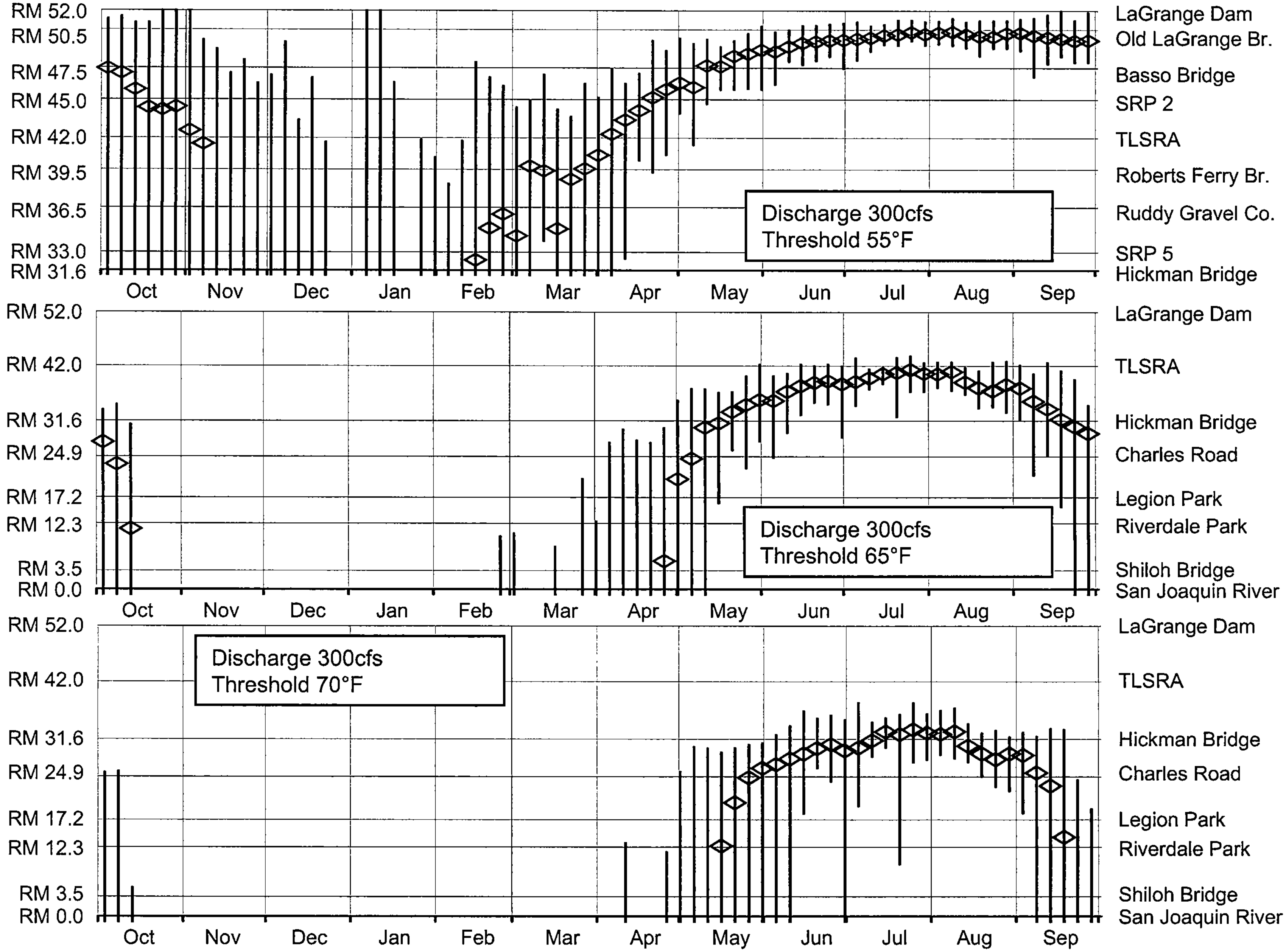

Figure 2f. Location of first transgression below dam of various temperature criterion, assuming constant LaGrange discharge of 300 cfs.

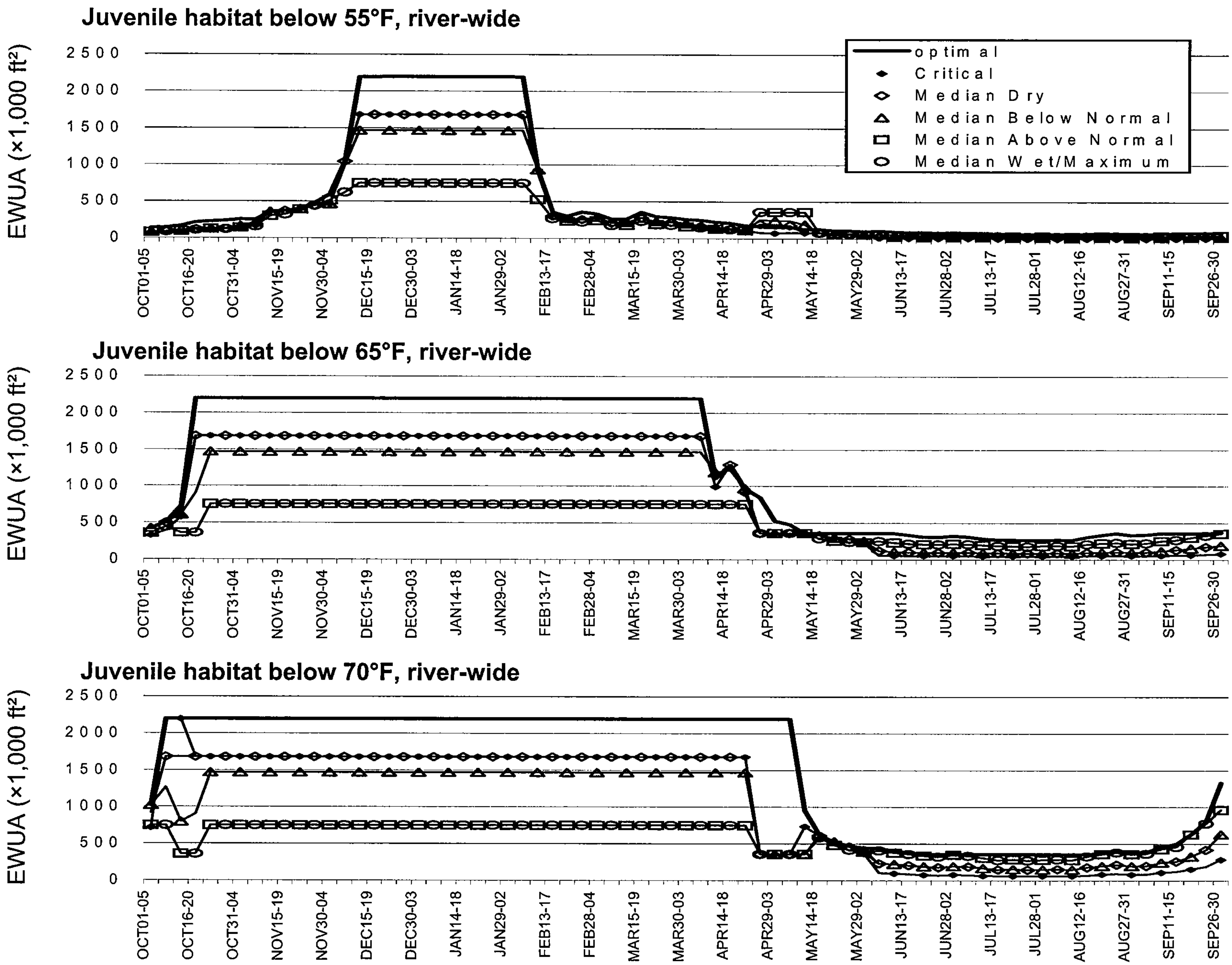

Figure 3: Juvenile *O. mykiss* habitat availability under the 1995 FSA Flow Schedule at three temperature criteria.

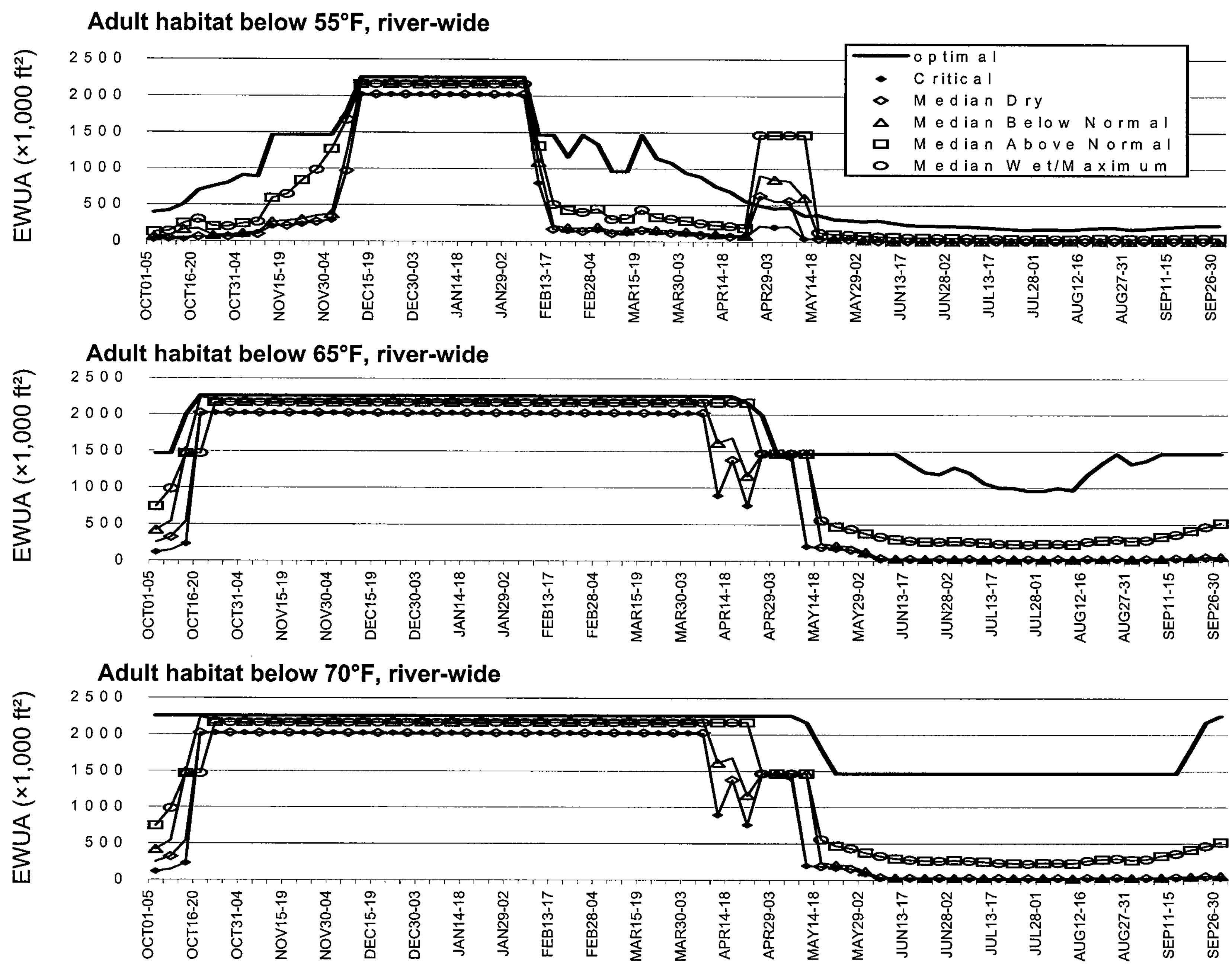

Figure 4: Adult *O. mykiss* habitat availability under the 1995 FSA Flow Schedule at three temperature criteria.

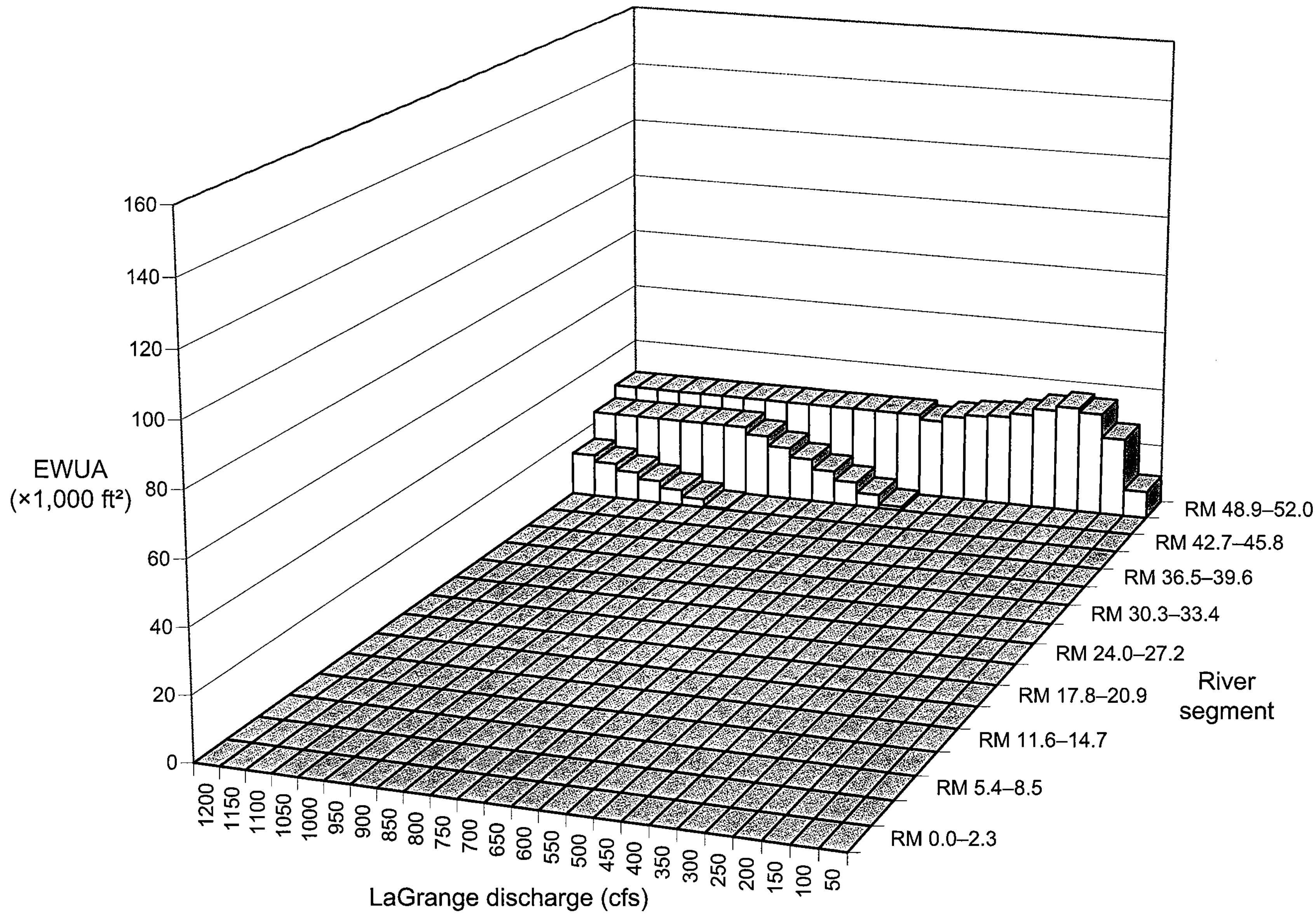

Figure 5a: Juvenile *O. mykiss* Habitat below 55°F, August 2–6 using SNTEMP 11-year average meteorology and constant flows

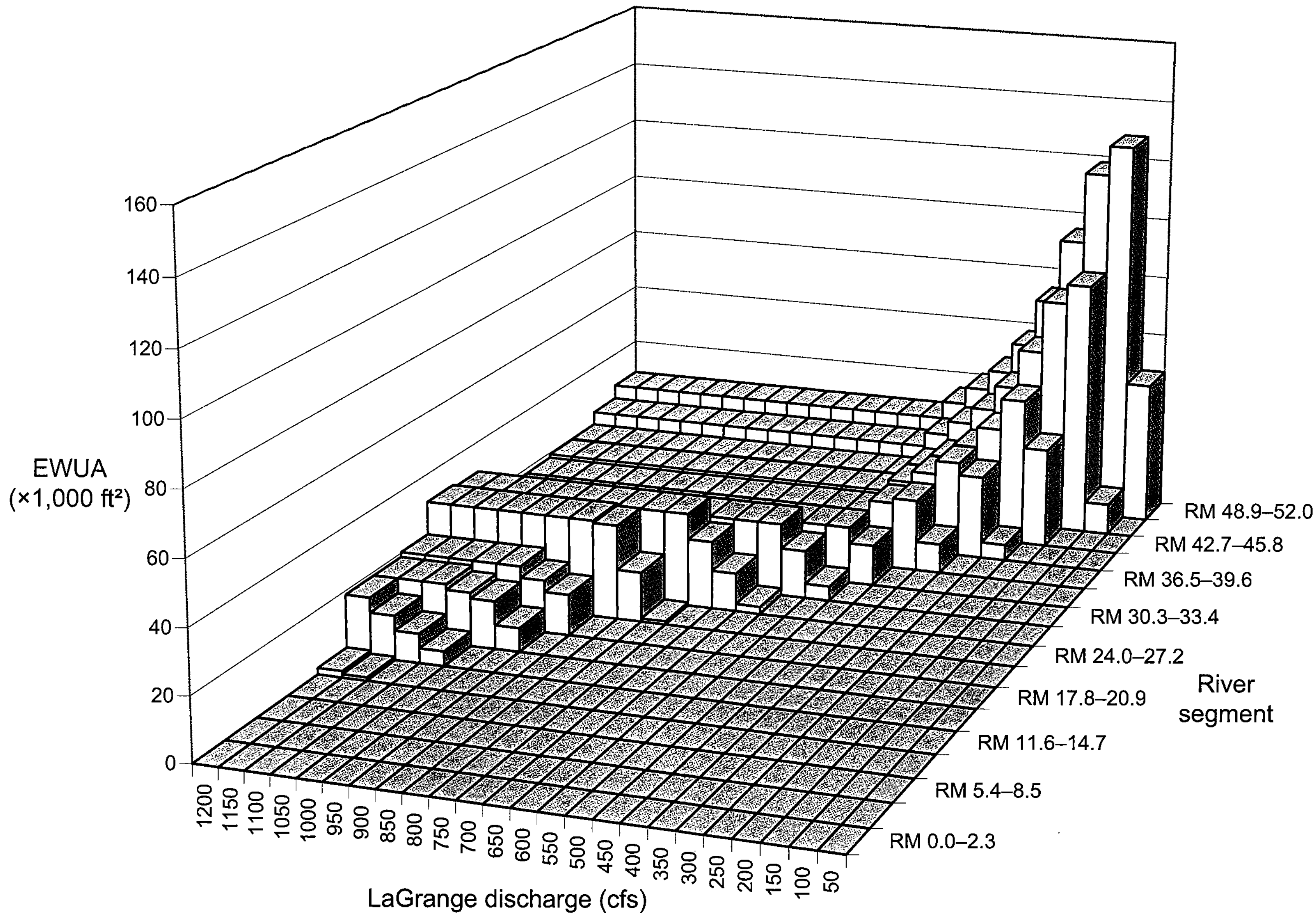

Figure 5b: Juvenile Steelhead Habitat below 65°F, August 2–6 using SNTEMP 11-year average meteorology and constant flows

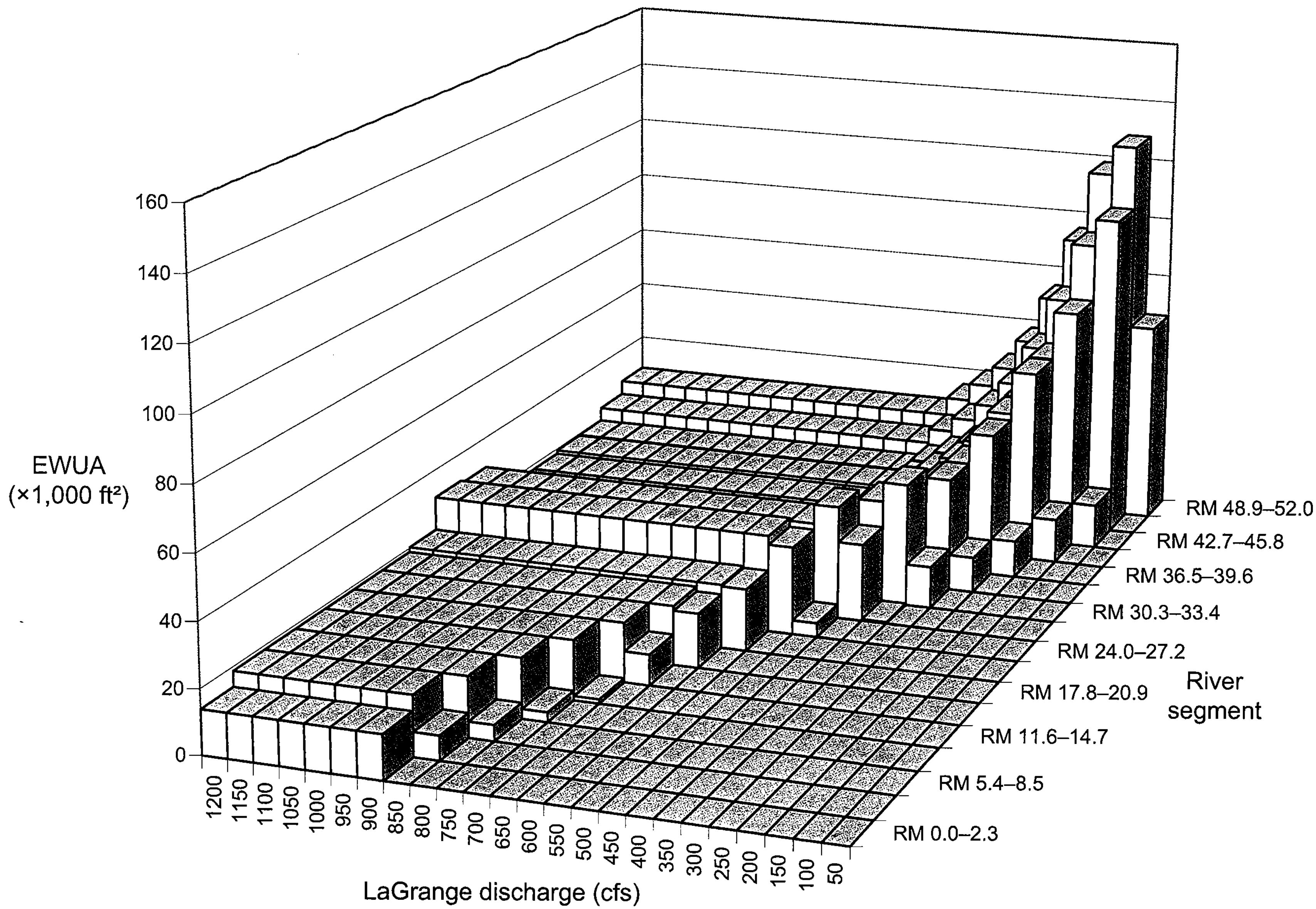

Figure 5c: Juvenile *O. mykiss* Habitat below 70°F, August 2–6 using SNTEMP 11-year average meteorology and constant flows

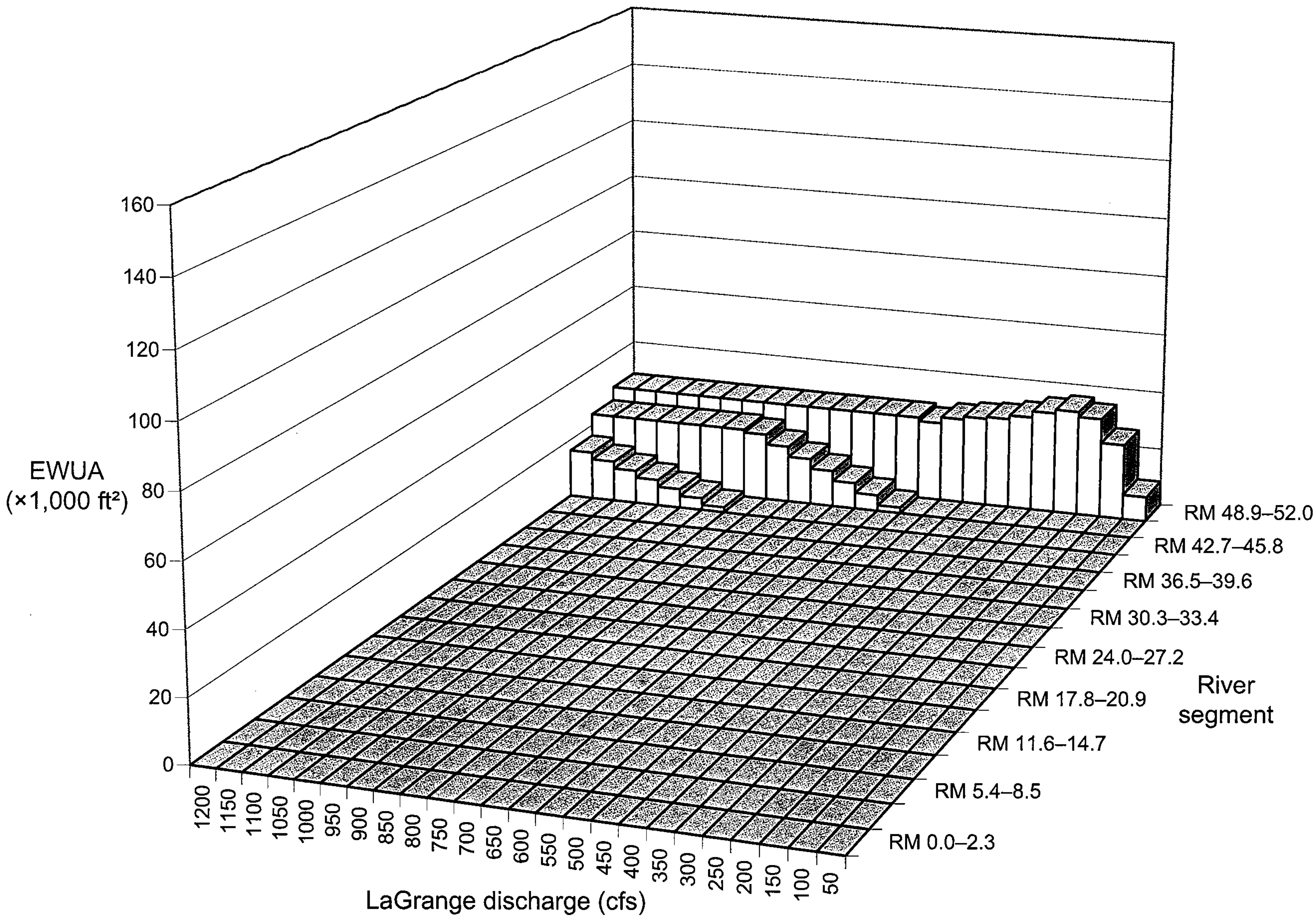

Figure 5d: Juvenile *O. mykiss* Habitat below 55°F, September 1–5 using SNTEMP 11-year average meteorology and constant flows

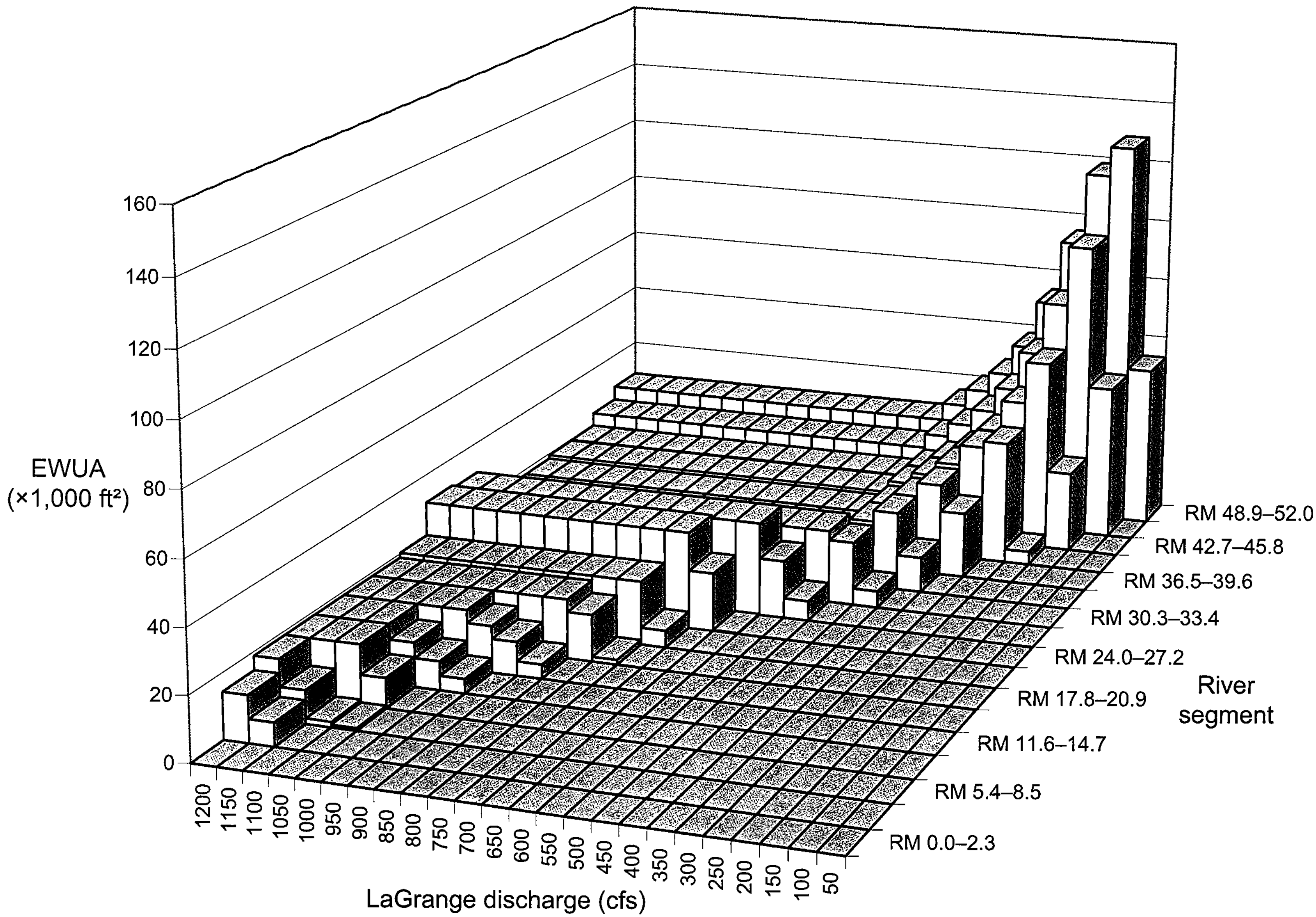

Figure 5e: Juvenile *O. mykiss* Habitat below 65°F, September 1–5 using SNTEMP 11-year average meteorology and constant flows

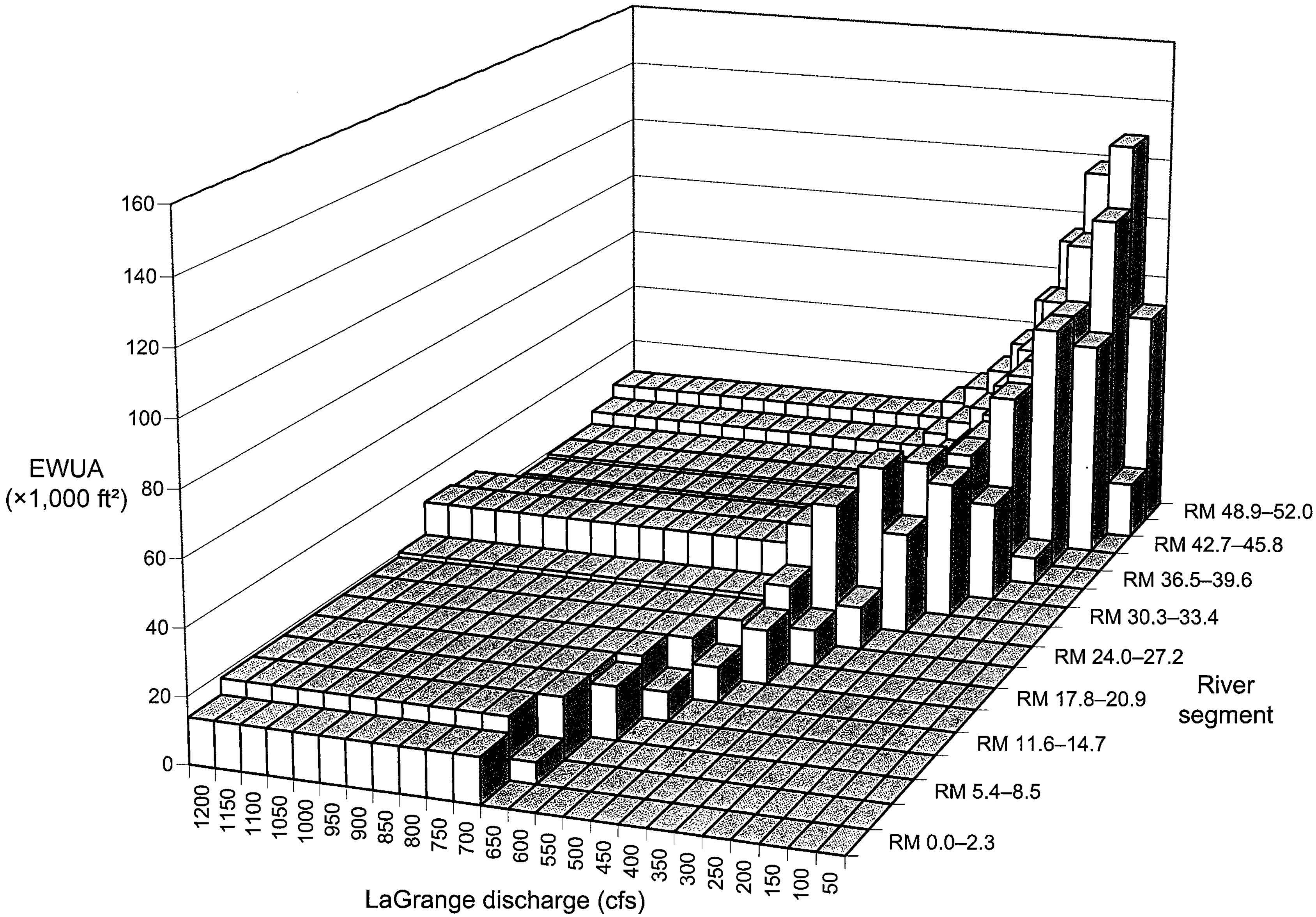

Figure 5f: Juvenile *O. mykiss* Habitat below 70°F, September 1–5 using SNTEMP 11-year average meteorology and constant flows

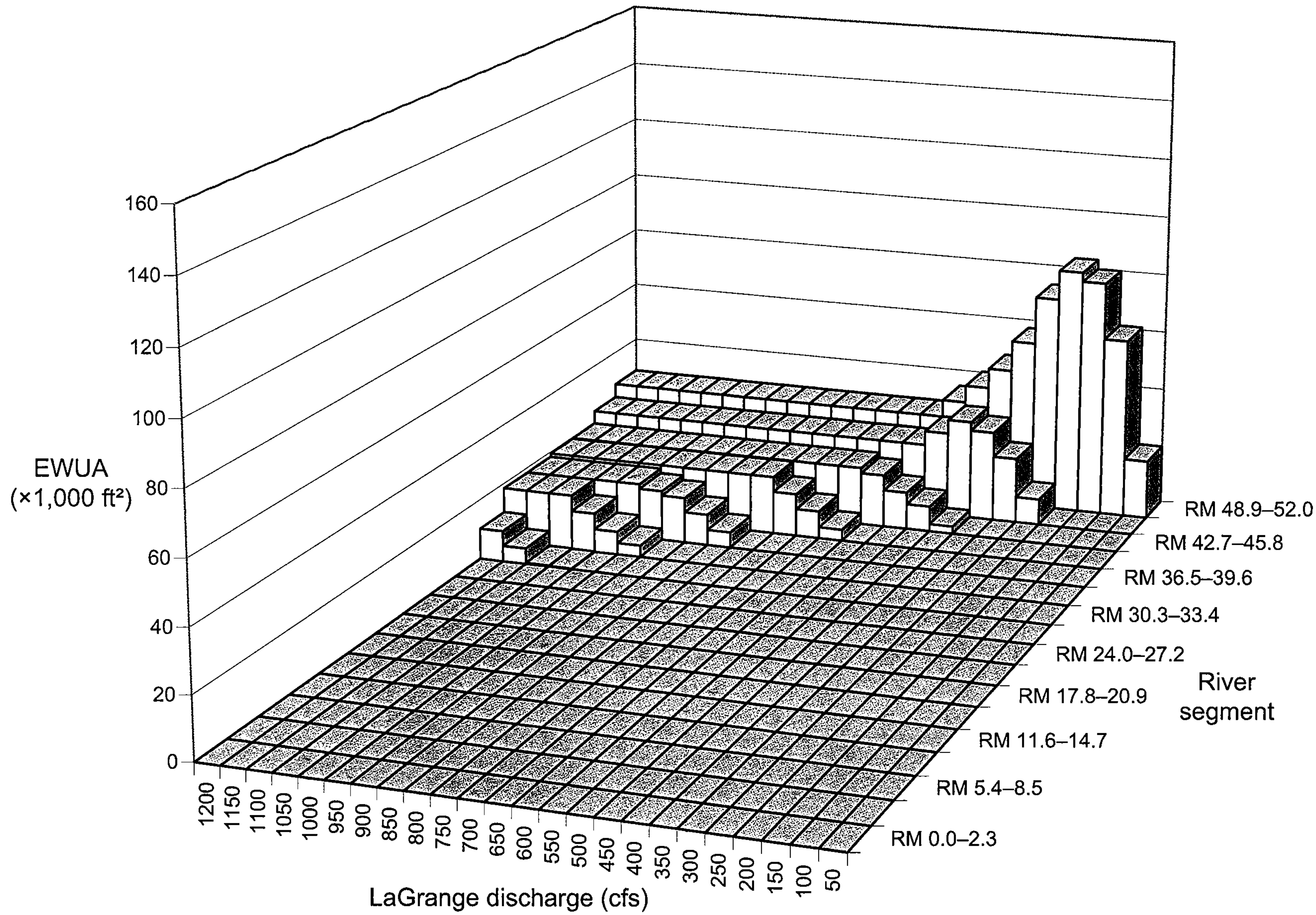

Figure 5g: Juvenile *O. mykiss* Habitat below 55°F, October 1–5 using SNTEMP 11-year average meteorology and constant flows

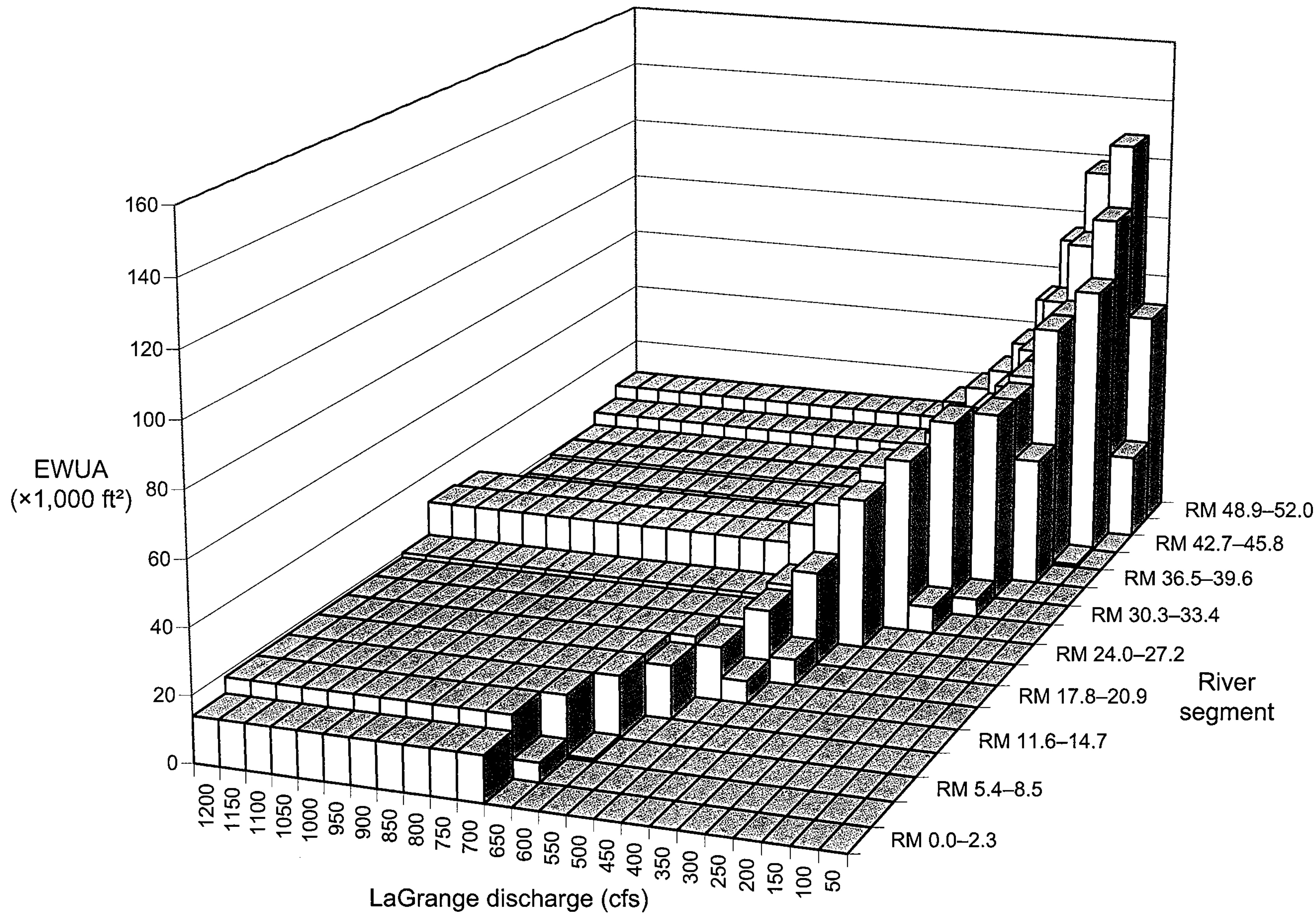

Figure 5h: Juvenile *O. mykiss* Habitat below 65°F, October 1–5 using SNTEMP 11-year average meteorology and constant flows

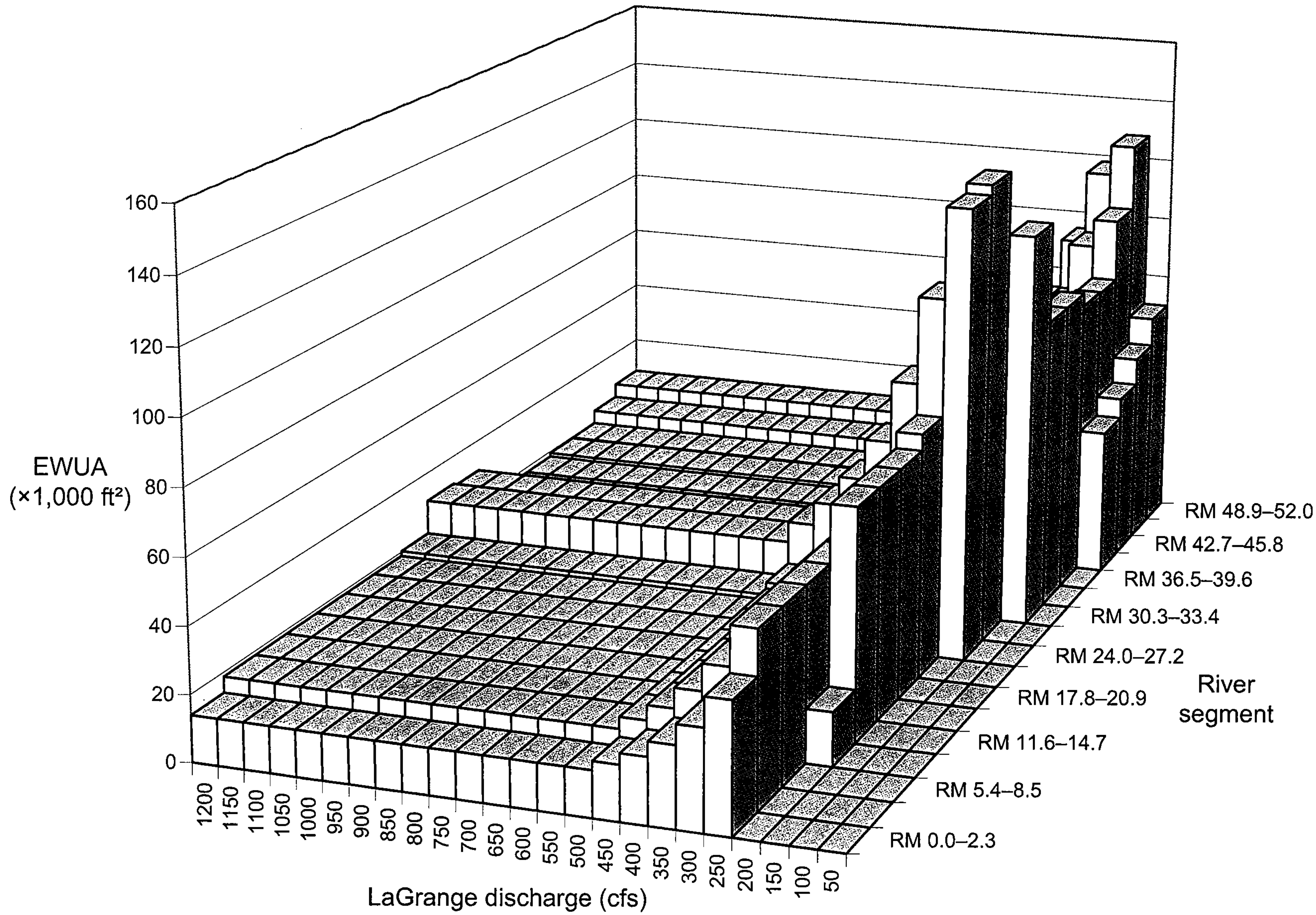

Figure 5i: Juvenile *O. mykiss* Habitat below 70°F, October 1–5 using SNTEMP 11-year average meteorology and constant flows

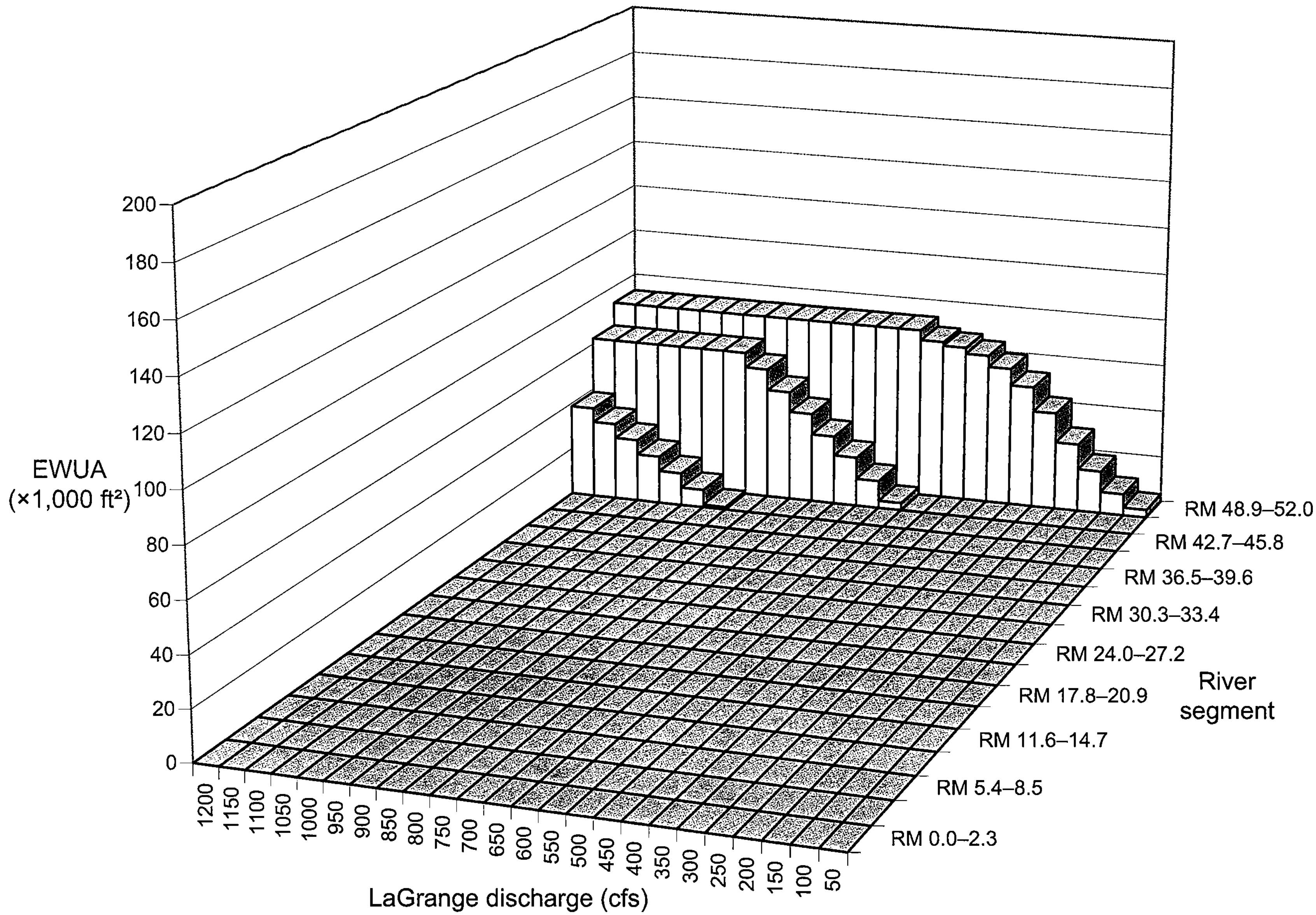

Figure 6a: Adult *O. mykiss* Habitat below 55°F, August 2–6 using SNTEMP 11-year average meteorology and constant flows

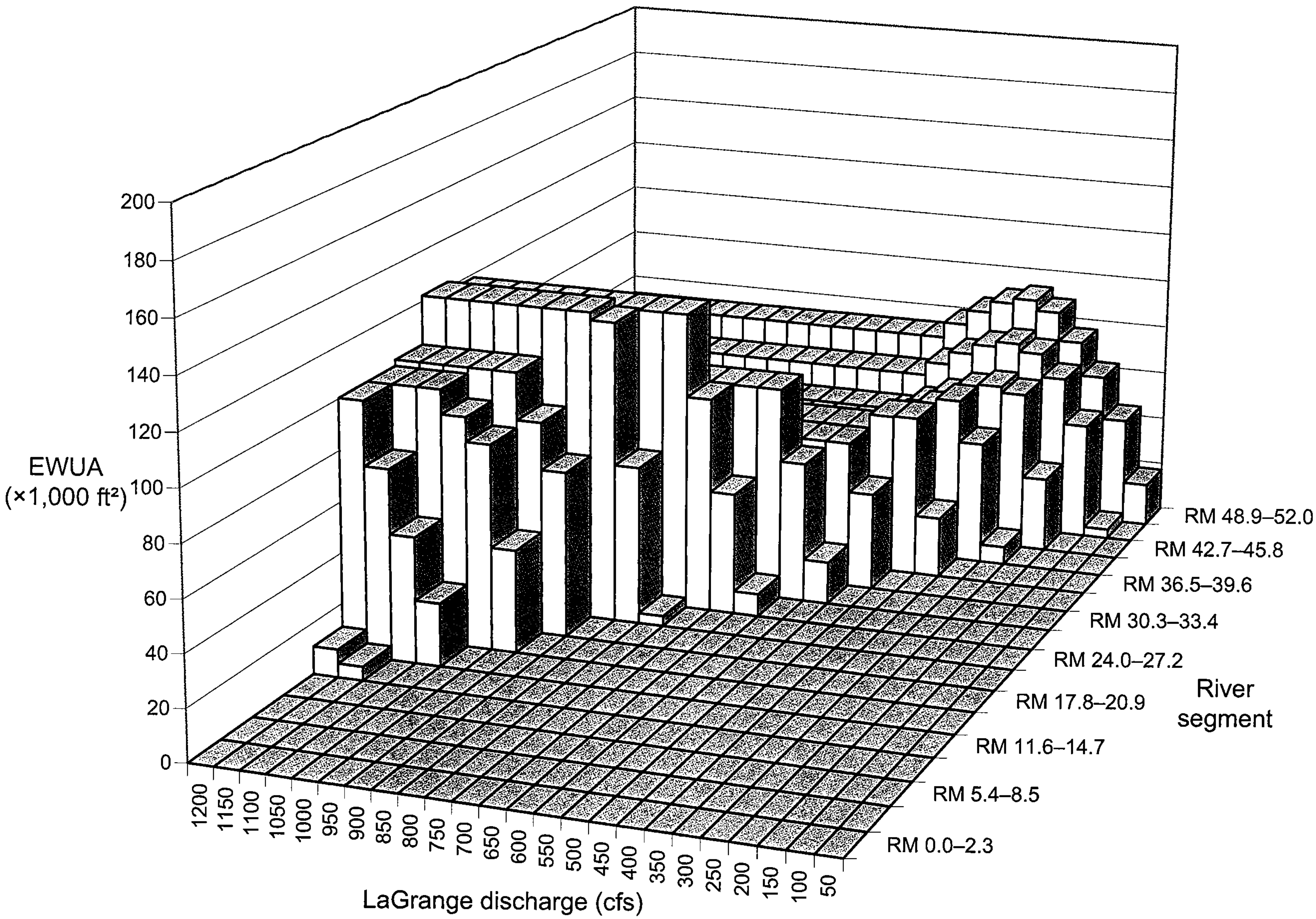

Figure 6b: Adult *O. mykiss* Habitat below 65°F, August 2–6 using SNTEMP 11-year average meteorology and constant flows

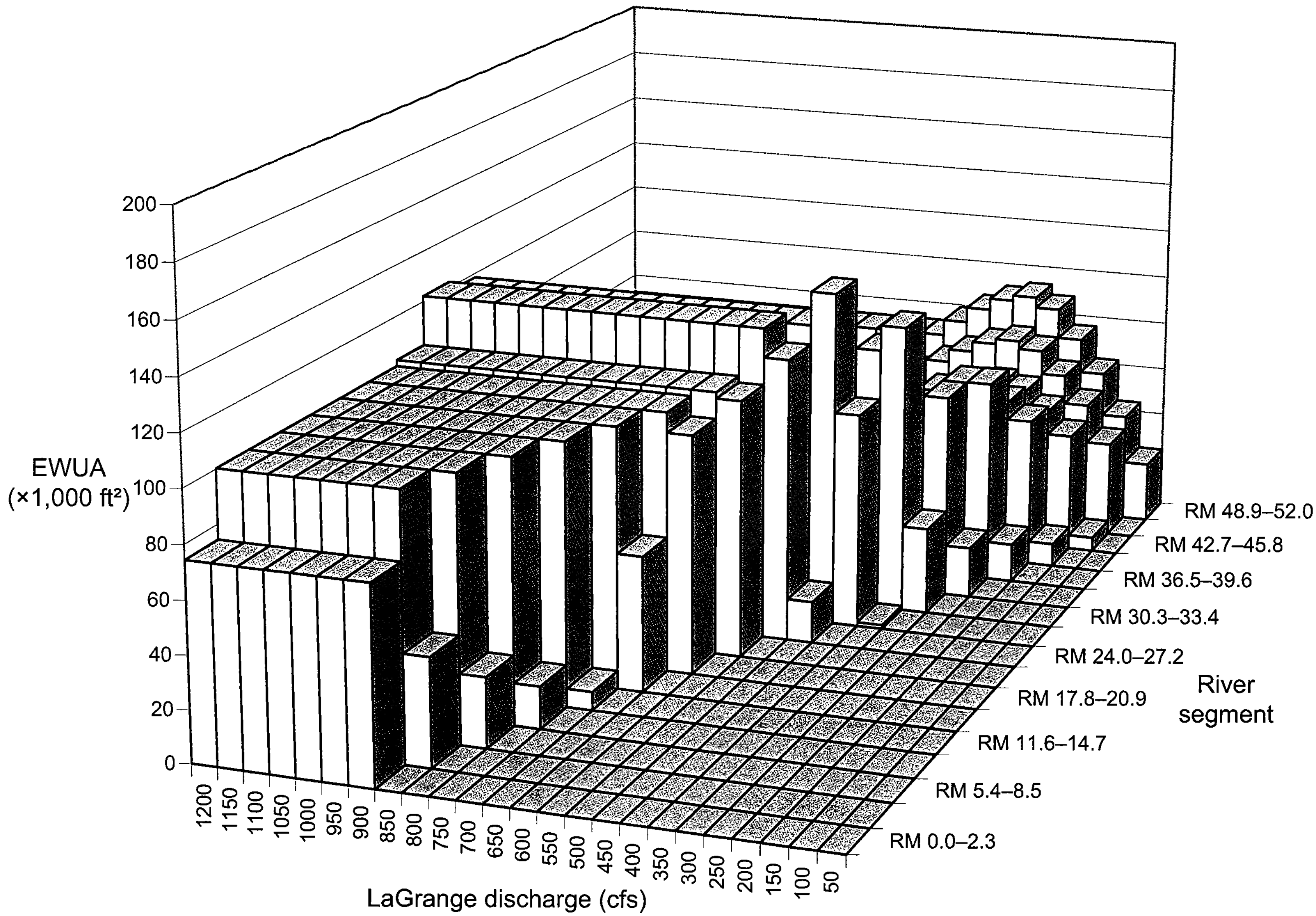

Figure 6c: Adult *O. mykiss* Habitat below 70°F, August 2–6 using SNTEMP 11-year average meteorology and constant flows

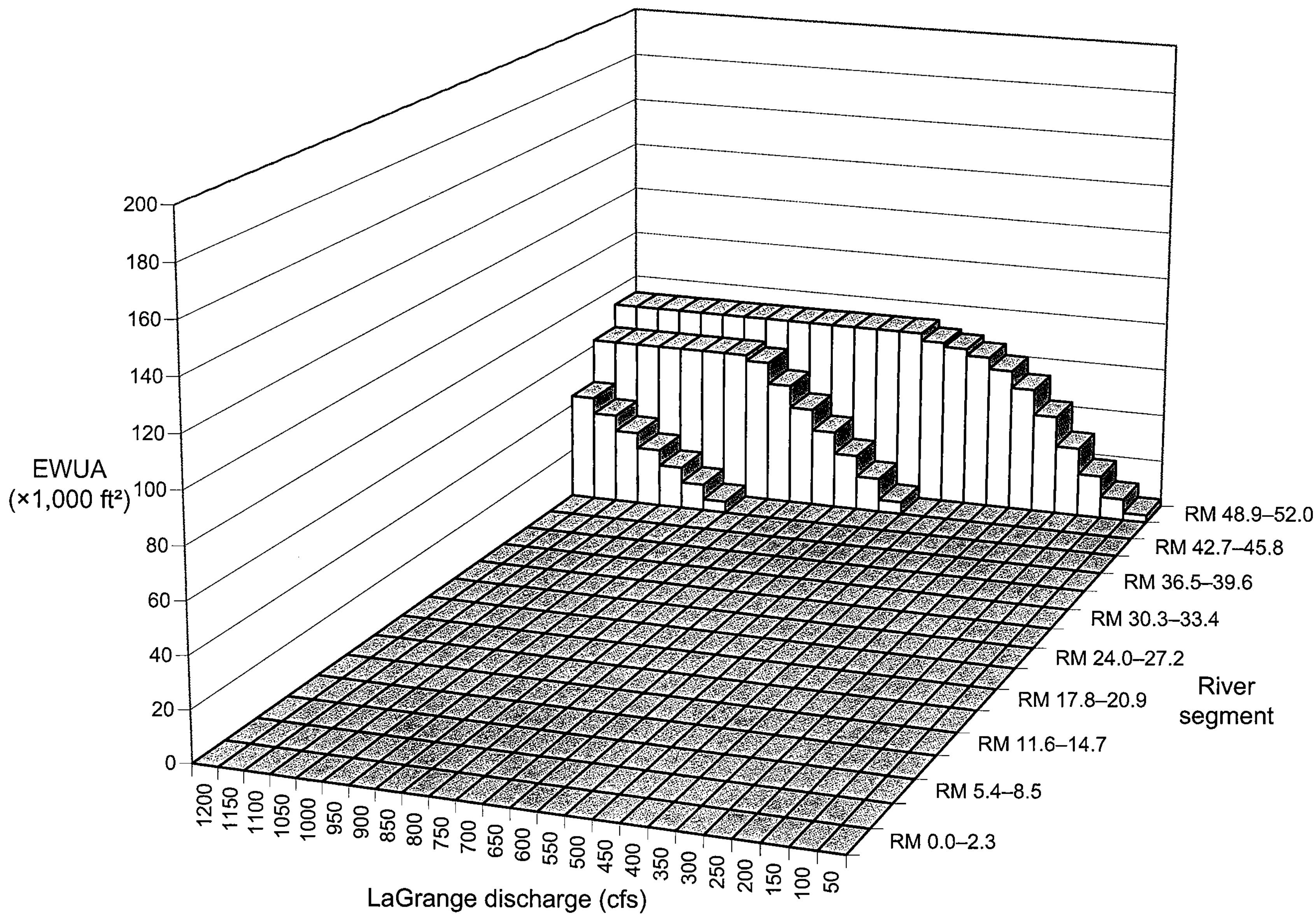

Figure 6d: Adult *O. mykiss* Habitat below 55°F, September 1–5 using SNTEMP 11-year average meteorology and constant flows

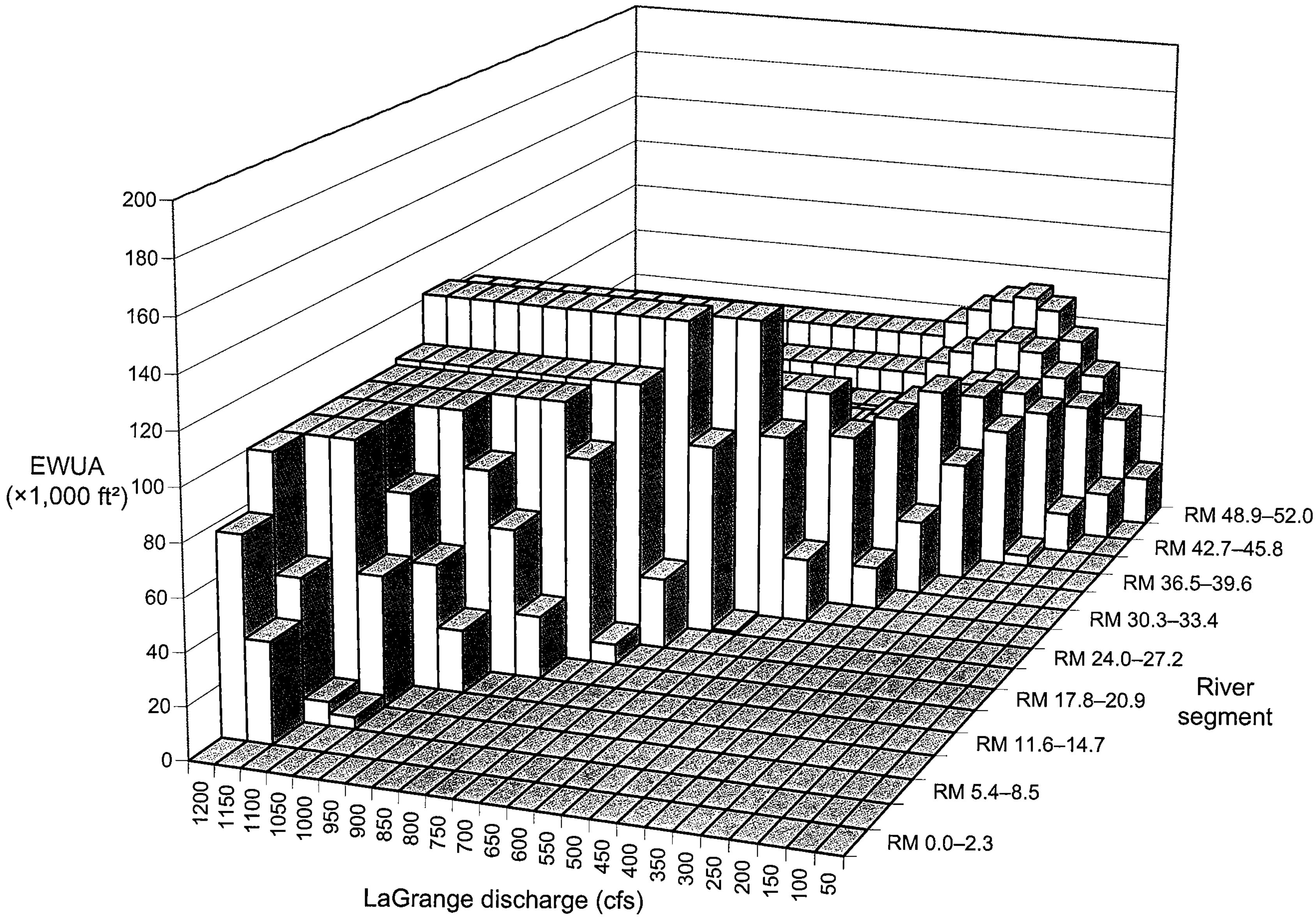

Figure 6e: Adult *O. mykiss* Habitat below 65°F, September 1–5 using SNTEMP 11-year average meteorology and constant flows

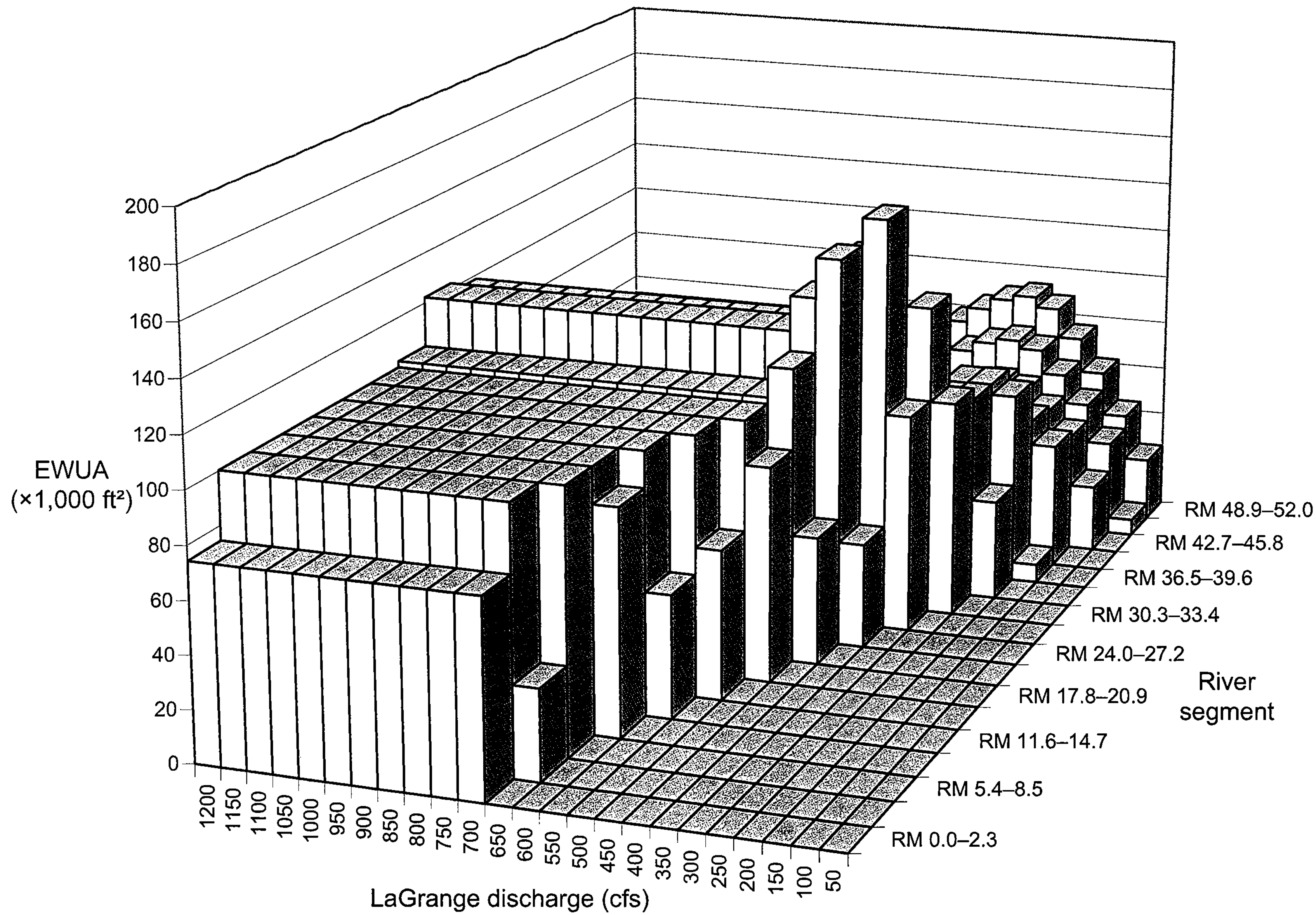

Figure 6f: Adult *O. mykiss* Habitat below 70°F, September 1–5 using SNTEMP 11-year average meteorology and constant flows

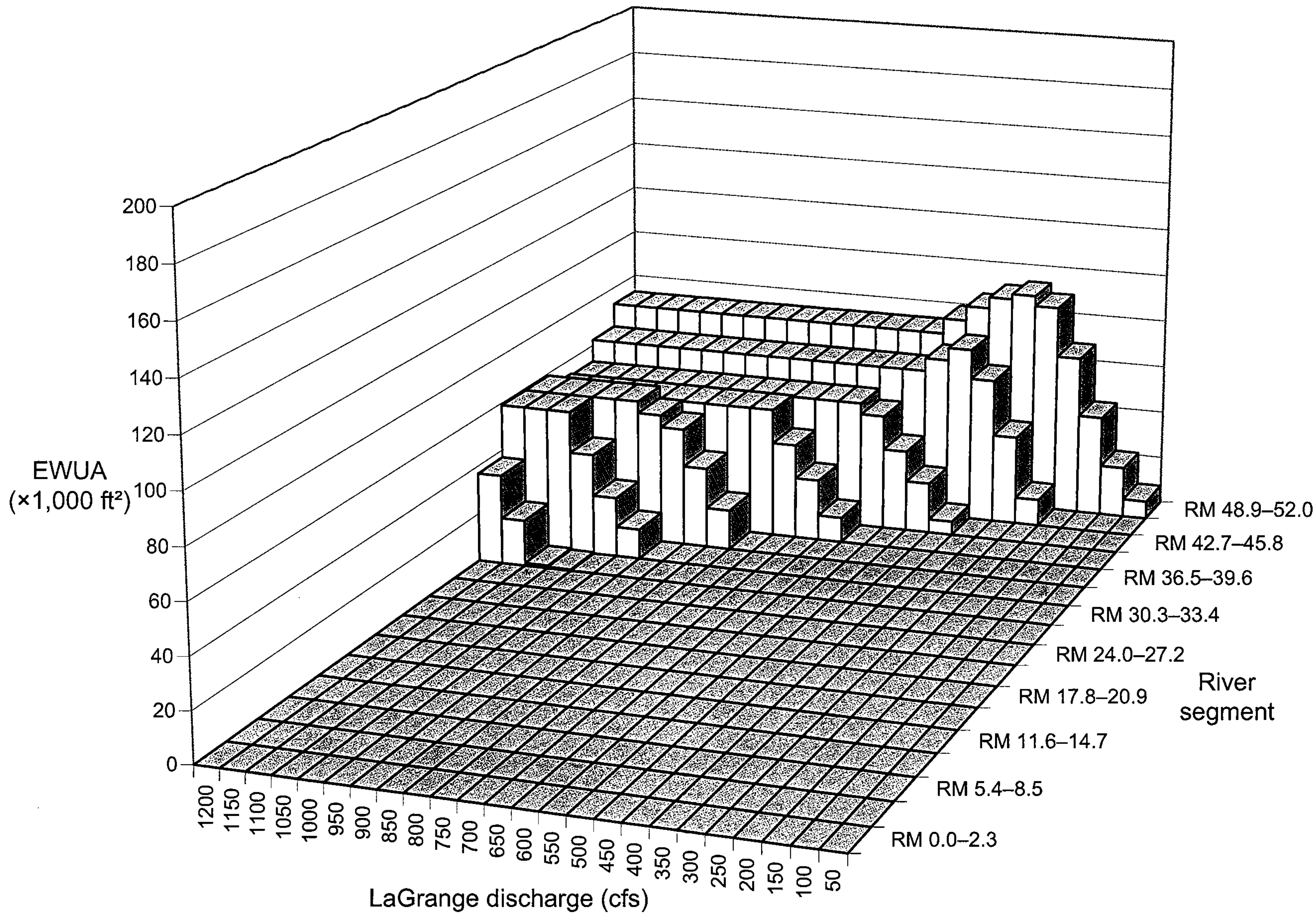

Figure 6g: Adult *O. mykiss* Habitat below 55°F, October 1–5 using SNTEMP 11-year average meteorology and constant flows

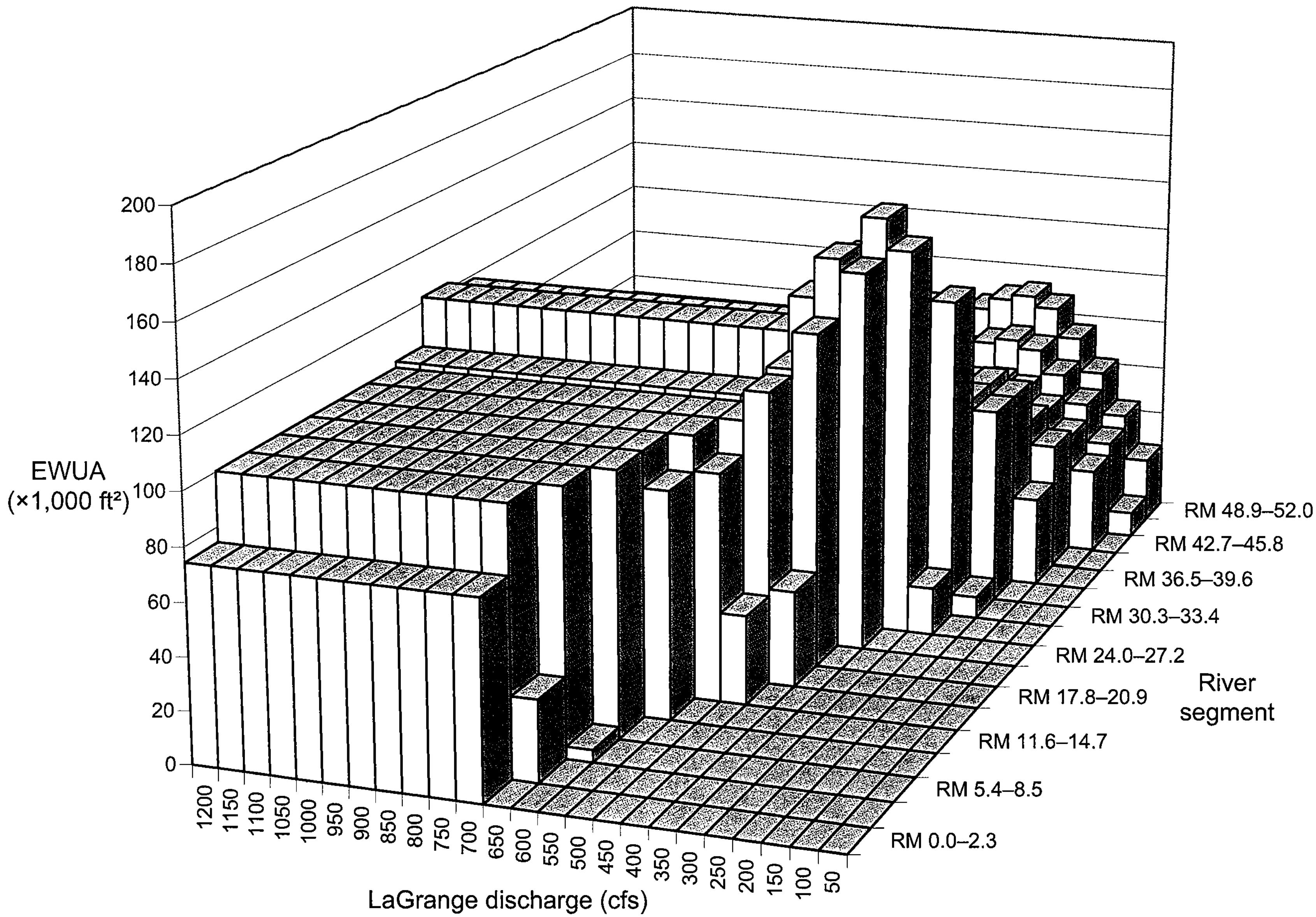

Figure 6h: Adult *O. mykiss* Habitat below 65°F, October 1–5 using SNTEMP 11-year average meteorology and constant flows

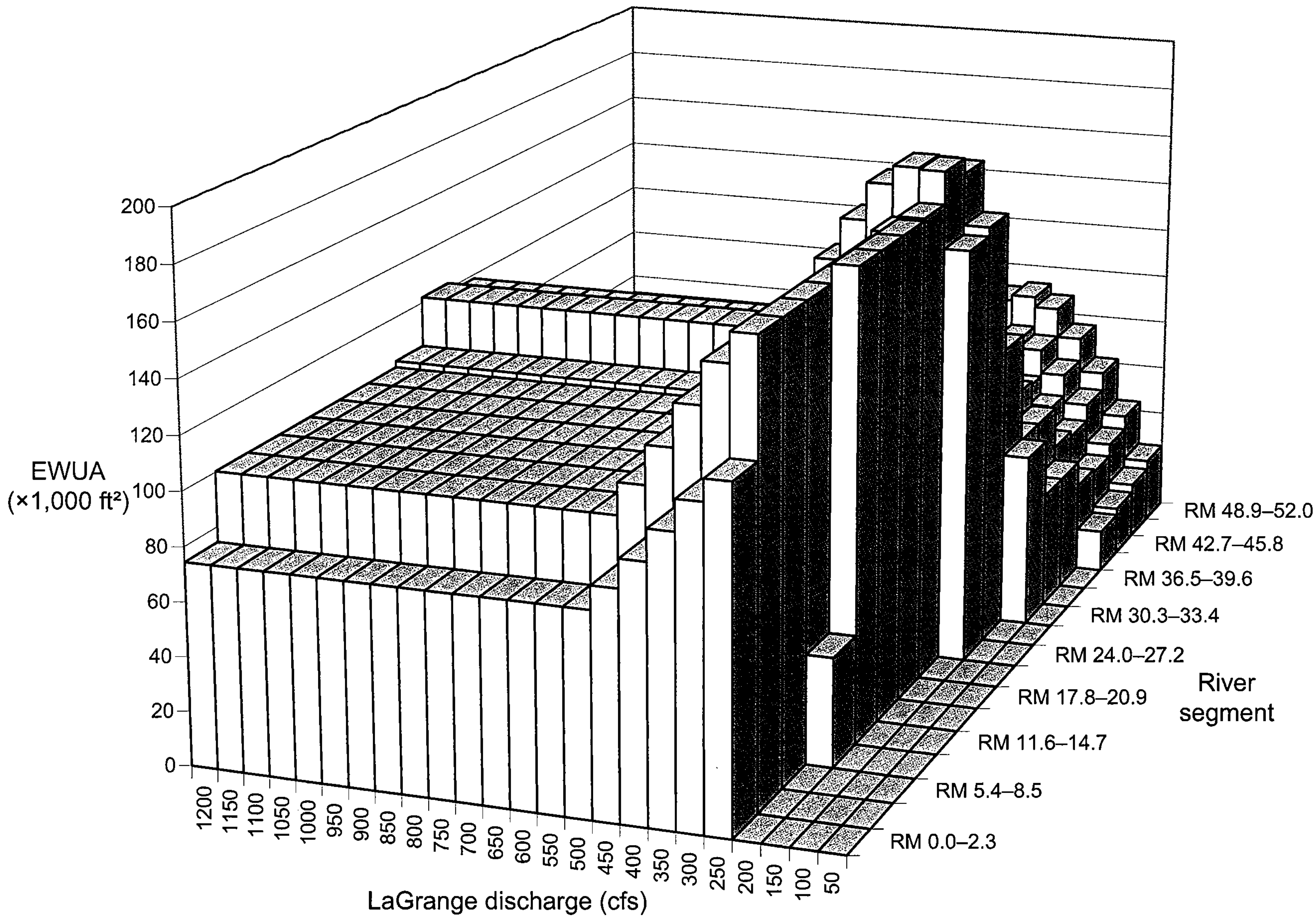

Figure 6i: Adult *O. mykiss* Habitat below 70°F, October 1–5 using SNTEMP 11-year average meteorology and constant flows

Stillwater Sciences

2532 Durant Avenue, Berkeley, CA 94704 Phone (510) 848-8098 Fax (510) 848-8398

MEMORANDUM

DATE: March 17, 2003

TO: Tuolumne River Technical Advisory Committee (TRTAC)

FROM: Noah Hume and Sayaka Araki

SUBJECT: Preliminary cost estimates for extending current Tuolumne River GIS coverage from Empire (RM 21.5) to the San Joaquin River (RM 0).

BACKGROUND

The original Tuolumne River GIS map was created in 1992 from stereo photographs (1:24,000 scale) at flows ranging from approximately 100 cfs, taken in January 1991 (TID/MID 1992), to 8,400 cfs, taken in April 1995 (TID/MID 1997). Using coordinates from common landmarks (*e.g.*, road intersections, buildings) on 7.5 minute USGS quad sheets, six control points were established per photograph to use in ortho-rectification. The coordinates and photographic data are accurate to approximately 2% of the photo and map scales (approx 40 ft) and were delineated using a stereo compiler and later translated into data attributed GIS coverage in ESRI ARC/INFO format.

Although photographic coverage exists for the entire lower Tuolumne River, from La Grange Dam (RM 52.0) to the confluence with the San Joaquin River, only the upper portion, La Grange to Empire (RM 21.5) is included in the GIS for flows of 1,100 cfs, 3,100 cfs, 5,300 cfs, and 8,400 cfs. Although this coverage contains attributed information for channel features and has been updated to include major landmarks and property ownership, no electronic orthophotos are available and the portion below Empire is available as wetted perimeter lines at 100 cfs, 230 cfs, and 620 cfs with major habitat type classifications in the channel (e.g., vegetated, island, pool, bar, pond, backwater, etc.). Below we discuss available information and costs to improve the existing GIS coverage.

INFORMATION RESOURCES

Recent USACE Coverage of the lower Tuolumne River. As part of the USACE Comprehensive Study, the San Joaquin River and the lower Tuolumne River (RM 0–12) were surveyed in 1998. Topographic and hydrographic mapping data was compiled and mapped into a 2-ft resolution DEM that is currently available under the Freedom of Information Act (FOIA). Additional aerial photogrammetric surveys were conducted in 2000 by USACE up to RM 33.6, including the supporting ground control surveys but without bathymetric data. Although these data and exposed aerial photographic negatives have not been reduced to final mapping products, conversations with USACE suggest that they would be available in exchange for their use of the processed ortho-photos and DEM.

Existing Photo Coverage of the lower Tuolumne River. Extending the existing 2D GIS coverage may be possible by digitizing the remaining flows and adding property information from assessors parcels maps, etc. The three highest flows tested in the 1990s (*i.e.,* 1,100 cfs, 3,100 cfs, 5,300 cfs, and 8,400 cfs) are available as 1:24,000 stereo color negatives covering the lower river in approximately 2-dozen images. The advantage of this method is to indicate habitat inundation in a similar manner as the existing GIS coverage. The disadvantage is the age of the photographs which precede the major channel re-setting event of winter 1997. Although the majority of the damage of these floods occurred in the spawning riffles in the upper portion of the river, it may be that the inundation surfaces recorded prior to 1997 no longer an accurately reflect channel morphology.

COSTS FOR EXTENDED GIS COVERAGE

In response to questions raised at the last TRTAC meeting, we have investigated several options available for extending the current GIS coverage of the lower Tuolumne River from Empire (RM 26) to the San Joaquin River (RM 0). In addition to queries at Hammon Jensen Wallen (aka, Pacific Aerial Survey, the air photo company used in the original surveys), we queried seven aerial photography companies for costs on the basis of re-flight, photographic and orthorectification. Although we asked for the costs to produce a DEM, this service was not offered by more than a handful of companies. The cost estimates below do not include post-processing time to attribute information or formatting for use by the TAC. Three options are presented to indicate the differences in approaches that may be taken should funds become available in the future.

Costs to extend the existing GIS coverage from existing photographs. The estimate for topographic data extraction and overlay to existing photographs is highly variable, with an estimate range from $16,000 to $55,700. Most modern equipment uses digital images and the existing negatives, approximately 24 per flow range for four of the flows tested in the 1990s, will have to be converted to electronic form.

Costs to process USACE data and Incorporate into existing GIS coverage. The number of images and survey data from USACE was unavailable at the time of this memorandum, but it is likely that the costs would be similar to those based upon District photography above. The creation of a DEM (i.e., digital topography) could involve significant additional post-processing costs ($10k–15k) and would likely be required in exchange for the use of this data from USACE.

Costs to survey, re-fly, photograph and produce new river-wide DEM. In addition to the major habitat alterations of the 1997 floods, there are some concerns with the quality existing GIS. For example, the source data used was coarser (i.e., less accurate) than that used for present day GIS. The current GIS does not have electronic photo coverage and does not contain the high resolution topography needed for vegetation analysis or integration into transects used in hydraulic models (*e.g.,* HEC-RAS). Although the GIS data is suitable for many uses, to improve the quality we believe some consideration should be made to updating the GIS for the upper and lower potions of the river with the inclusion of a DEM and a recent orthorectified photo-set. An overview shows that the cost to re-fly and re-photograph with topographic data generation to be between $30,000 and $65,000, with a common estimate to be around $43,000. Post-processing costs for integration into the existing GIS would be greater.

DISCUSSION

Information Requests on Eisting GIS Coverage. As an immediate response to information request from outside resource agencies and public requests, the existing GIS coverage can be assembled into a viewable ArcView project and shape files. It should be noted that navigating these files requires some familiarity with ArcView, which is generally run on UNIX operating systems but now has a Windows based program.

Completion of Riverwide GIS Coverage. Based upon the existing GIS coverage available from USACE (RM 0–12), the existing Tuolumne River GIS could be completed to within 10 miles (RM 12–21.6 would remain) with some costs (approx $15k) for post processing time to create data attributes and integrate with existing maps. Costs for digitizing and mapping existing aerial photos appears to be nearly as expensive as brand new coverage (approx $50k–60k), perhaps related to digital conversion problems or perhaps related to marginal discounts of excluded work. While it is understood that funds are limited and we understand that this work is not being considered at present, should an opportunity for funding arise there are a great many possibilities for improved habitat mapping, hydraulic modeling, riparian modeling as well as public information. As an example, we describe two of these below:

Example vegetation analysis using San Joaquin River DEMs. To show the usefulness of a spatially explicit GIS and DEM of the lower Tuolumne River, we have included some preliminary work products from analyses conducted on the San Joaquin River. The examples include:

- Shaded topographic relief
- Soil salinity and texture
- Existing vegetation
- Ground surface elevation above summer baseflow WSEL
- Area inundated by various flows

This last item was available directly in the Tuolumne GIS by delineation of the existing photography, whereas a combination of HEC and topographic modeling was used to generate the sample plots described above.

Web-hosted Watershed Information Center. In addition to the use of improved GIS of the lower Tuolumne River corridor, a long term goal of the TRTAC could be the development of a watershed information center (WIC) being developed in other parts of the state. A WIC is intended as an information clearinghouse that would be hosted by an internet service provider. As an example, a WIC could include:

1. Links to existing data sets. Where data currently exist on the World Wide Web, a WIC could provide well-organized links to the site providing the data (e.g. a link to a specific USGS or CDEC station). To facilitate public access and use of these existing sites, the WIC could provide an explanation of the data and its source along with the link.

2. Spatial data. As part of this, the Tuolumne River GIS could be "served" to the public by a product such as ESRI ArcView Internet Map Server (IMS). The IMS is a web-hosted software package that allows interactive mapping and analysis sessions over the Internet. The familiar web-type interface allows users of the site who do not have GIS

software on their computer or familiarity with GIS to view and query geographic data sets. As part of this, the Tuolumne River GIS could be "served" to the public by a product such as ESRI ArcView Internet Map Server (IMS). The IMS is a web-hosted software package that allows interactive mapping and analysis sessions over the Internet. The familiar web-type interface allows users of the site who do not have GIS software on their computer or familiarity with GIS to view geographic data projects. Potential data that could be linked include GIS layers of vegetation, land use, parcels, restoration project plans, soils, geology, fish distributions, water quality, etc. There are many possibilities and it is clear that these types of data would have to be integrated over time.

3. Time-series/monitoring data. Historical and recent monitoring could include water quality data, historic and current river and tributary flows, rainfall, geomorphologic data (e.g., including channel cross sections, longitudinal profiles, pebble counts, etc.), water temperatures, hatchery releases, salmon numbers from screw traps, and fish and wildlife population data.

Although the costs for a web-site with some level of information content is relatively low, there would be a number of technical and cost considerations in addition to the security and sensitivity of the information provided.

REFERENCES

TID/MID (Turlock Irrigation District and Modesto Irrigation District). 1992. GIS Methods for Lower Tuolumne River Map. Attachment B of the Lower Tuolumne River Spawning Gravel Availability and Superimposition Report. Appendix 6 to Don Pedro Project Fisheries Studies Report (FERC Article 39, Project No. 2299). *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. IV. Prepared by EA Engineering, Science, and Technology, Lafayette, California.

TID/MID. 1997. Tuolumne River GIS Database Report and Map. Report 96-14 *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. VII. Prepared by EA Engineering, Science, and Technology, Lafayette, California.

TURLOCK IRRIGATION DISTRICT

WATER PLANNING DEPARTMENT
M E M O R A N D U M

TO: TRTAC
FROM: Wilton Fryer
DATE: 18 March 2003
RE: Project Status Update

Project	Funding	Status
SRP 9	Full	Constructed, revegetation planted, and plant maintenance & irrigation on going. NOC filed March 2003.
SRP 10 Dike	Full	Construction complete. NOC filed March 2003.
7\11 Segment	Full	Earthwork complete & revegetation will be complete 21 March. Start revegetation irrigation & maintenance April.
MJ Ruddy	Full	Negotiations and ROW underway for June 2003 construction start.
Warner-Deardorff	Partial	30% design complete, permitting started, remaining design started. CALFED Directed Action awarded construction funding, but no contract in place.
Design Manual	Full	Due to complete by May 2003.
Course Sediment	Full	Site methods and strategy completed. Domeqe\Zanker gravel acquisition funded by CALFED.
Fine Sediment	Full	Survival to emergence fieldwork done, draft report under review. Gasburg Creek watershed analysis report was revised, as has sediment basin design. Evaluation of gravel cleaning equipment and methods continuing.
RM 43	Full	DWR is working on contract based on Scope of Work generated with larger FOTT Bobcat Flat Project.
SRP 10	Partial	New channel concept prepared. TRC funding request made for land acquisition. Concept informally presented to County.

seattletimes.com
The Seattle Times

Friday, March 14, 2003, 12:00 a.m. Pacific

Study: Eggs smaller at fish farm

By Jeff Barnard
The Associated Press

GRANTS PASS, Ore. — Salmon raised at a Canadian fish farm rapidly evolved to produce smaller eggs, according to a study that heightens doubts about whether hatchery-bred fish can be successfully released into the wild to rebuild endangered species.

Smaller eggs generally produce smaller young fish. And smaller fish do not compete for food in the wild as effectively as larger ones.

"It's sort of a cautionary tale for salmon-enhancement efforts," said Daniel Heath, an expert on conservation genetics at the University of Windsor in Canada and author of the study in today's issue of the journal Science.

Researchers examined eggs produced by four generations of chinook salmon over the past 12 years at Yellow Island Aquaculture in British Columbia. They found that the fish produced more eggs, but the size of the eggs declined by 25 percent as wild fish interbred with hatchery fish.

Hatchery fish develop a genetic tendency to produce smaller eggs because in hatcheries, there is no competition for food the way there is in the wild. The lack of competition means smaller fish can more easily survive.

As a result, the genetic trait for small eggs "just swept through the population," Heath said.

The study complicates the debate over how best to rebuild the 26 populations of Pacific salmon and steelhead that are classified as threatened or endangered species.

Conservationists said the Canadian study shows that hatchery fish do not help to rebuild declining runs.

"Some researchers suggest that the only thing wild fish and hatchery fish have in common is water," said Bill Bakke of the Native Fish Society.

About 5 billion young fish are released from hatcheries each year around the Pacific Rim.

Hatchery fish are not generally used to supplement wild populations, but to provide fish for sport and commercial fisheries. The two groups do occasionally breed, however.

24 JUN 2003 MEETING

TUOLUMNE RIVER TECHNICAL ADVISORY COMMITTEE

DON PEDRO PROJECT - FERC LICENSE 2299

MODESTO IRRIGATION DISTRICT
TURLOCK IRRIGATION DISTRICT
CITY & COUNTY OF SAN FRANCISCO
CALIFORNIA DEPARTMENT OF FISH & GAME
U. S. FISH & WILDLIFE SERVICE

333 East Canal Drive
Turlock, CA 95381-0949
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Email: tjford@tid.org

TECHNICAL ADVISORY COMMITTEE MEETING

June 24, 2003, 9:30 a.m.

Turlock Irrigation District, Lunch Room (2nd floor)

DRAFT AGENDA

1. Introduction
   A. Comments on draft agenda
   B. Correspondence since last meeting
2. **ACTION ITEMS**:
3. General FSA Update:
   A. FSA/Order activity and expense tracking, subgroup activity, and report status
   B. AMF, NGO, and agency updates
   C. Monitoring
   D. River operations and flow schedule
   E. Restoration
      1. Planning and implementation
      2. Project monitoring
      3. Other restoration
4. Additional items
5. Next meeting and topics

MODESTO IRRIGATION DISTRICT
TURLOCK IRRIGATION DISTRICT
CITY & COUNTY OF SAN FRANCISCO
CALIFORNIA DEPARTMENT OF FISH & GAME
U. S. FISH & WILDLIFE SERVICE

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TECHNICAL ADVISORY COMMITTEE
MEETING MINUTES of

24 June 2003

1. AGENDA & PRIOR MINUTES

A. Comments were received on the draft 19 March 2003 meeting minutes.

2. ACTION ITEMS:

Decisions on the flow schedule for the remainder of the summer will be made under Item 3D, River Operations & Flow Schedules.

3. GENERAL INFORMATION:

A. 1) Project GIS system has been converted to autoCAD format from the arcView format. This should help with scaling issues, but it is not in a web based viewing system. The ACOE Tuolumne River flood data is on a 2ft DTM, but is not available much above Modesto. The ACOE data is not incorporated into the Districts' GIS data.

2) There was discussion on pulse flow studies in the basin and how the California Bay-Delta Authority (CBDA) staff like the way the TRTAC subgroup managed the CWT studies as a model for others to follow. Noah Hume of Stillwater indicated there was a proposal to model the pulse flow through at least the ship channel. A key issue is the mixing of Tuolumne flows with the San Joaquin flows and how to incorporate peer review. FOTT and DFG were concerned with timing of the fall pulse flow in attracting fish early through the delta when the conditions were not as favorable than if the fish came through later. USFWS is concerned with the water accounting true up process and how the water would be budgeted for salmon vs. steelhead. Noah indicated temperature and water quality issues were relatively easy to model, but straying and arrival time were difficult to quantify. The fall pulse flow plans will be reviewed at the Subgroup meeting in August.

B. AGENCY – NGO Updates

1) DFG: The Rotary Screw Trap (RST) was run into June. The redd count report is not completed (in August?) and the RST reports are being worked on. They hope to have the RST reports done in July.

2) TRPT: The conceptual plan for opening up berms on the south side of the Big Bend site is underway to be followed by the CEQA – NEPA permitting process. The TRPT did sign

onto a brief supporting NMFS petition to FERC requesting consultation for the current steelhead issues. The TRC is studying other types of entity (legal status) they could become and developing a vision document as part of their public outreach process. The TRC is looking for more assistance from TID & MID on lobbying other agencies.

3) FOTT: The Attorney General flight and meeting were successful. The Grayson River Ranch revegetation maintenance – irrigation work was extended 1 year. The conceptual plan for the RM 43 and larger Bobcat Flat Projects are progressing through CBDA.

4) NOAA Fisheries: FERC will be asking the Districts to set up monitoring for steelhead as part of a NMFS – FERC process on steelhead and the settlement agreement.

5) USFWS: Comments on the draft Adaptive Management Forum Report are due by the End of Day Friday, 27 June 2003.

C. Monitoring:

1) Snorkel results show the number of rainbow trout is up from the numbers found in 2002. The distribution down to the Turlock Lake State Recreation area is the same as in recent years. There will be supplemental snorkeling on 2 July as an adjunct to the normal areas covered.

2) Thermographs will be downloaded in July.

3) The RST operated through the first week in June, but the numbers were quite low by that time. The numbers of fish caught went up when the flows went up in late May.

4) Hume stated that the redd excavation/emergence study report could be ready by the SEP meeting.

D. River Operations & Flow Schedule

1) The annual flows (including spring VAMP and summer flows) are developed using the Basin Index runoff values starting in April. There can be significant changes in the forecasted index between April and the final values in August. The Basin Index used for flow volume has been based on the 50% probability for the runoff.

Typically the summer flow is set at a constant rate. NOAA Fisheries and USFWS asked if temperature considerations could be incorporated into the release schedule without triggering any stranding if the flow rate did vary. FOTT asked that recreational boating flows of over 180 cfs be provided if possible. Data on typical summer temperature fluctuations for both air and water were presented. Starting with an estimated average flow of 205 cfs, the following flow adjustment regime was developed with the goal of maintaining a more constant reach of cooler water consistent with changes in air temperature. An example of the concept was shown using 2002 flows and air temperatures.

A) If the projected air temperature is 95 or less, then the river flow would be 195cfs.

B) If the projected air temperature is 96 or more, then the river flow would be 235 cfs. The higher flow would be carried 1 day past when the temperature drops below 96.

This flow regime will be reassessed after the final Basin Index comes out after July. The fall pulse flow and fall/winter flows will be adjusted accordingly. The thermograph data will be evaluated to see if this flow adjustment was effective.

E. Restoration Update:

1) DFG will be placing 15,000 CY of aggregate in the river upstream of the old La Grange Bridge and may be reshaping materials previously placed near the J59 Bridge. The gravel mix will be adjusted to be more accommodating for steelhead sized spawning aggregate needs.

2) A TRTAC project update report was distributed. Based of the status of the amendments before CBDA, it is possible that the MJ Ruddy project construction will not be started this summer.

4. ADDITIONAL ITEMS:

None

5. NEXT MEETING & TOPICS:

The next meeting will be 25 September 2003 starting at 0930.

FERC 2299 TAC Meeting
24 June 03

Name	Organization
Tim Ford	TID/MID
Wilton Fryer	TID
Patrick Koepele	TRPT
Jeff McLain	USFWS
Allison Boucher	FOTT
Ron Yoshiyama	CCSF
John Chester	CCSF
Noah Hume	Stillwater Sciences
Tim Heyne	DFG
Madelyn Martinez	NMFS
Erin Strange	NMFS
Roger Masuda	TID
Jim Koontz	TID

Tim Ford - Summary of 13JUN flow schedule decisions

From: Tim Ford
To: Allison Boucher; Andrea Fuller; Art Jensen; B. Johnston; Bill Jennings; Bill Johnston; Bill Loudermilk; Cesar Blanco; Darren Mierau; Dave Boucher; Dean Marston; Deborah Giglio; Donn Furman; Eric Theiss; Jeff McLain; Jenna Olsen; Jim Koontz; John Chester; John Schnagl; Madelyn Martinez; Mike McElhiney; Nicole Sandkulla; Noah Hume; Norman Crow; Patrick Koepele; Robert M. Nees; Roger Masuda; Ron Yoshiyama; Scott McBain; Tim Ford; Tim Heyne; Tim Ramirez; Walter Ward; Wil Fryer
Date: 6/13/2003 11:57 AM
Subject: Summary of 13JUN flow schedule decisions
CC: hsk; Wes Monier

To TRTAC list:

This e-mail is intended to summarize the interim flow schedule decisions reached in this morning's conference call. Participants included Ford, Monier, McLain, Martinez (and another NMFS staff), Heyne, Koepele, Yoshiyama, Masuda, Mierau, D. Boucher (anyone missing? - let me know).

The decision was made to start a flow reduction today from the current schedule of 250 cfs with tomorrow being at 180 cfs. To spread out this transition a bit, we will go to 210 cfs today, so the daily average in the schedule for today will be shown as 230 cfs. The 180 cfs will continue to apply until at least 24JUN, the date of the next TRTAC meeting, unless modified by other agreement. However, the applicable flow schedule will go up to 220 cfs for any days that the NWS forecast for Modesto maximum air temperature is 100 degrees or greater. This is an initial attempt to adjust to changing conditions - the current NWS forecast has no triple digit days anticipated during the next week (see http://www.wrh.noaa.gov/cgi-bin/wrhq/TotalForecast.csh?TotalForecast+WR+CA+019+099). A more refined approach may be considered at the TRTAC meeting - Wes Monier will be looking into this.

Associated monitoring was discussed. DFG will try to provide some recently downloaded thermograph data and there is much previous thermograph data we have already provided available to review. Wes will be providing some Turlock air temperature data which he has readily available. There is also the SWS model output material sent out prior to and at the MAR TRTAC meeting.

Our first "standard" snorkel survey of the season is planned for next week with the second one likely in September. Some folks discussed doing a "targeted" snorkel survey (more intensive in a shorter reach), perhaps on 02JUL.

Another DWR forecast may be out next Thursday; if so, I will try to provide a volume update similar to yesterday's (see below).

Tim Ford, Aquatic Biologist
Turlock Irrigation District
333 E. Canal Drive
Turlock, CA 95380
209-883-8275 Phone
209-656-2180 FAX

>>> Tim Ford 06/12/03 04:27PM >>>
To TRTAC list:

DWR has issued a 10JUN runoff update, lowering their APR-JUL forecast for each river in the basin. The result is a drop in the SJ basin index to 2.8486, and a corresponding reduction in the estimated FERC fish flow volume of about 8,800 AF, to an annual total of about 202,700 AF (see attached graph).

The default schedule, determined as described yesterday and based on continuing the current 250 cfs through tomorrow, would now be 200 cfs through September, 4,730 AF pulse, and 240 cfs base flow for OCT-14APR. The default schedule could change if another forecast is issued or when the final volume is determined after July.
We will go to the default schedule starting 14JUN unless it is determined tomorrow to vary from that for now. The pulse volume, if added evenly to the remainder of the year, equals about 8 cfs/day.

Tuolumne River Technical Advisory Committee
Materials since 18MAR2003 TRTAC meeting

(underlined items are designated for inclusion in the FERC Report)

* 21MAR: Update on FERC Report status (Ford)
* 10APR: Spring pulse/VAMP period flow schedule (Ford)
* 30APR: <u>Flow schedule letter of 18APR from Districts</u>
* 30APR: Forward revised VAMP period flow schedule of 22APR (Ford)
* 06MAY: Coarse sediment management plan draft and appendices (M&T)
* 08MAY: Basin index forecast update (Ford)
* 16MAY: Basin index forecast update (Ford)
* 20MAY: <u>Flow schedule letter from Districts</u>
* 29MAY: Basin index forecast update (Ford)
* 05JUN: Basin index forecast update (Ford)
* 05JUN: DFG flow schedule priority (Marston)
* 09JUN: FWS flow schedule priority (McLain)
* 09JUN: Flow schedule and water temperature (Ford)
* 10JUN: Flow schedule comments (Martinez and Boucher)
* 10JUN: Draft AMF report for review and comment (Fryer)
* 11JUN: Flow schedule comments (Boucher)
* 11JUN: Request to NMFS for steelhead information (Johnston)
* 12JUN: Basin index forecast update (Ford)
* 12JUN: Reply to request for steelhead information (Martinez)
* 13JUN: Conference call on flow schedule and summary of decisions (Ford)
* 13JUN: Addition to TRTAC list (Martinez)
* 13JUN: Recent water temperature data from DFG (Heyne)
* 19JUN: Basin index forecast update (Ford)
* 20JUN: <u>Meeting notice, draft agenda and notes, and material list</u> (Ford)

2003-04 Tuolumne FERC Flow Volume based on SJ Basin Index

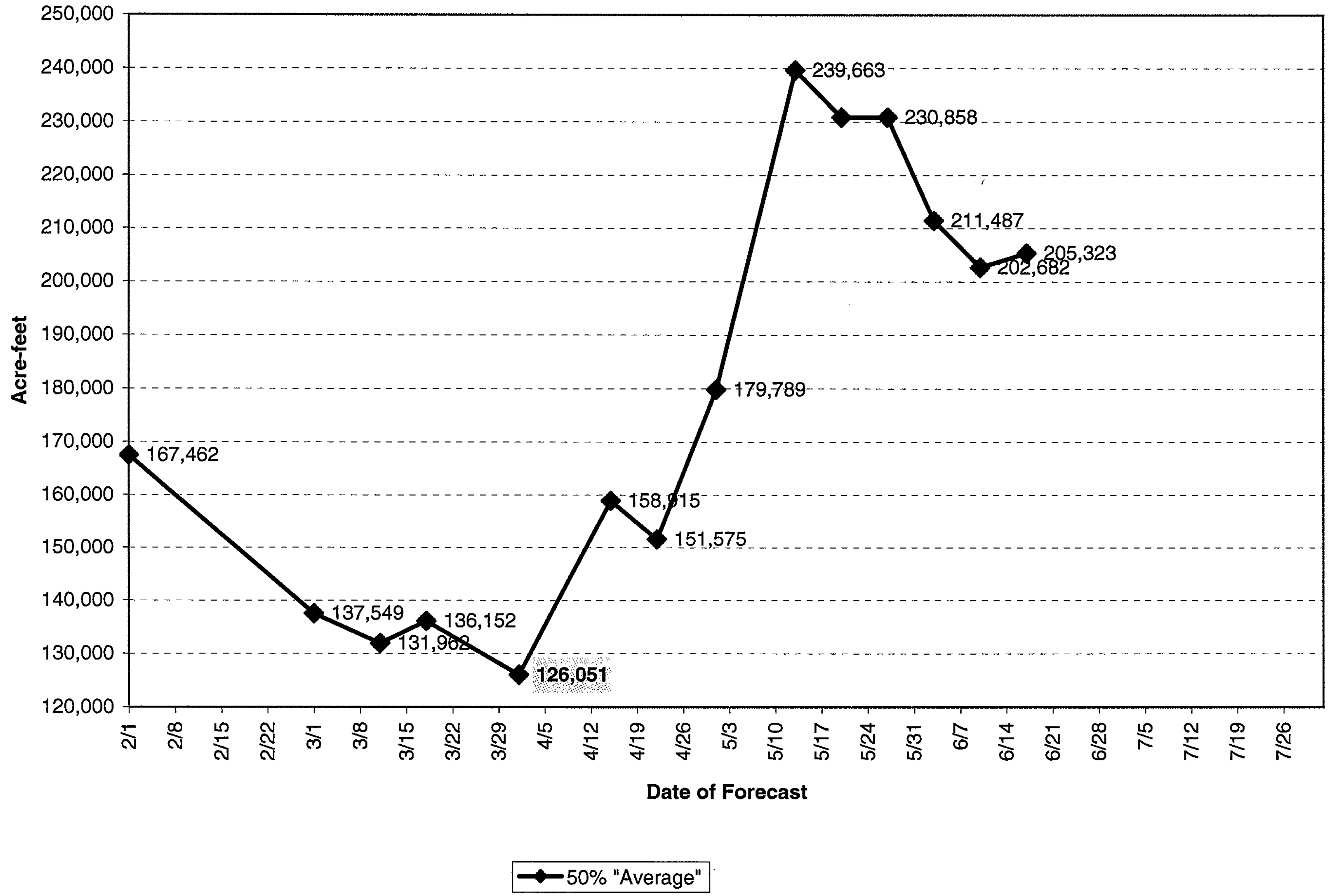


TABLE 2

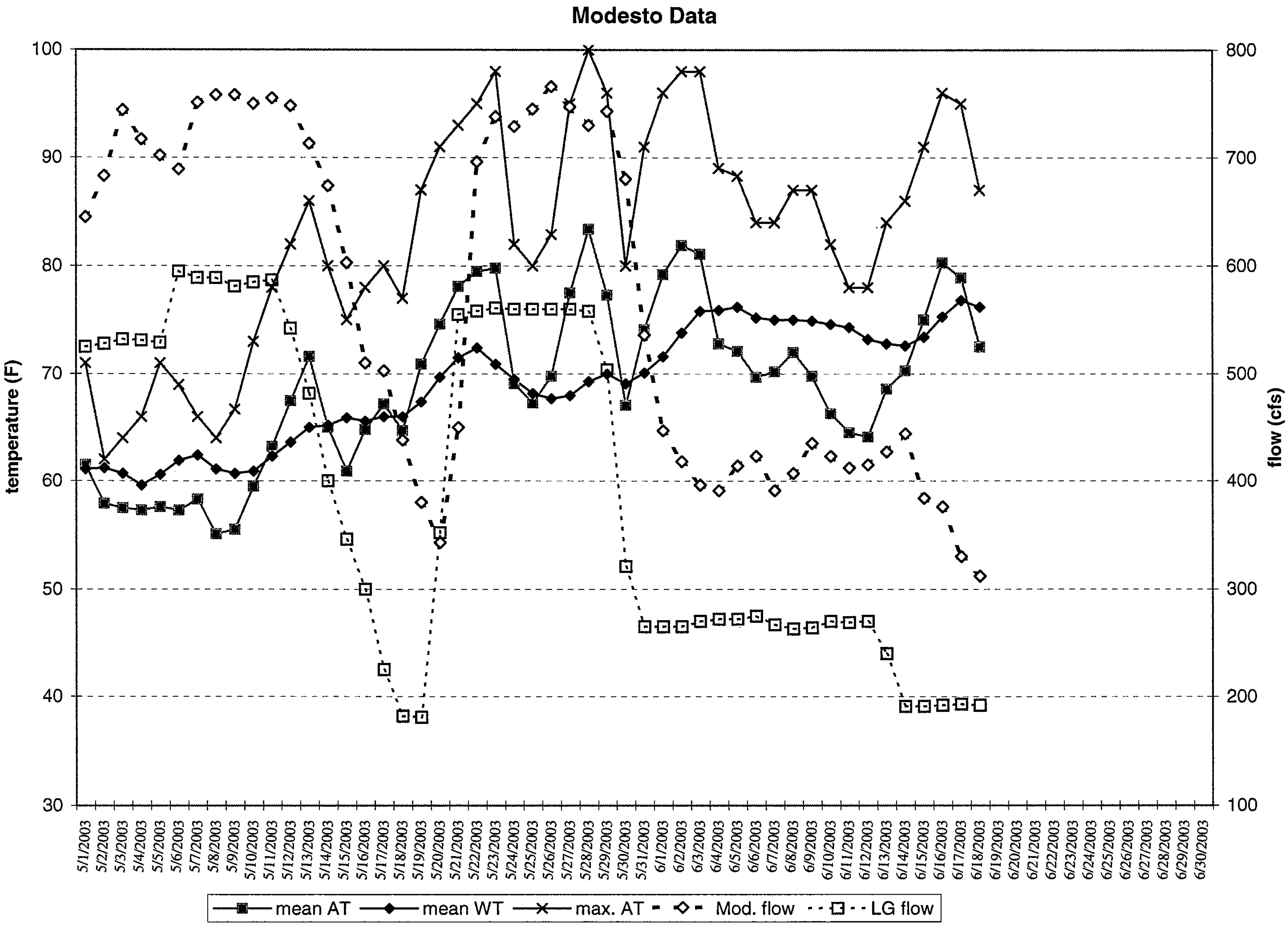
Tuolumne River Flow Schedule

17JUN2003 FORECAST - DRAFT

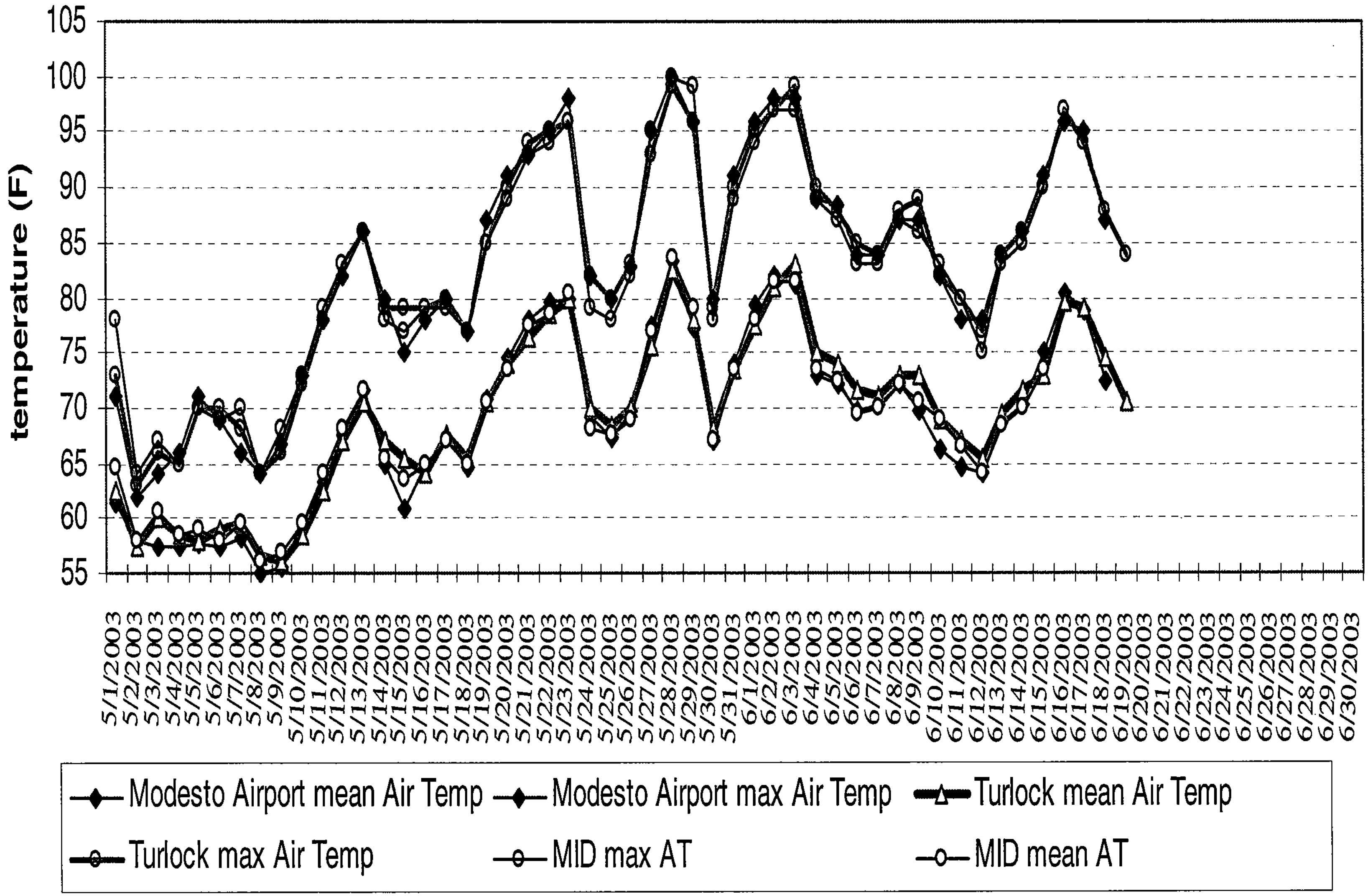
SCHEDULE FOR 2003 - 2004 Fish Flow Year

DATE		Number of	INITIAL BASE FLOW			PULSE FLOW			ADDITIONAL FLOW			TOTAL FERC FLOW	
From:	To:	DAYS	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	ACCUM. A.F.
12-Apr-2003	12-Apr-2003	1	150	298		275	545	545	0	0	0	425	545
13-Apr-2003	13-Apr-2003	1	150	298		550	1,091	1,636	0	0	0	700	1,636
14-Apr-2003	14-Apr-2003	1	150	298		856	1,699	3,335	0	0	0	1,006	3,335
15-Apr-2003	15-Apr-2003	1	150	298	298	856	1,699	5,034	0	0	0	1,006	5,332
16-Apr-2003	16-Apr-2003	1	150	298	595	856	1,699	6,733	0	0	0	1,006	7,328
17-Apr-2003	17-Apr-2003	1	150	298	893	856	1,699	8,432	0	0	0	1,006	9,324
18-Apr-2003	18-Apr-2003	1	150	298	1,190	856	1,699	10,130	0	0	0	1,006	11,321
19-Apr-2003	19-Apr-2003	1	150	298	1,488	856	1,699	11,829	0	0	0	1,006	13,317
20-Apr-2003	20-Apr-2003	1	150	298	1,785	856	1,699	13,528	0	0	0	1,006	15,313
21-Apr-2003	21-Apr-2003	1	150	298	2,083	856	1,699	15,227	0	0	0	1,006	17,310
22-Apr-2003	22-Apr-2003	1	150	298	2,380	856	1,699	16,926	0	0	0	1,006	19,306
23-Apr-2003	23-Apr-2003	1	150	298	2,678	630	1,250	18,175	0	0	0	780	20,853
24-Apr-2003	24-Apr-2003	1	150	298	2,975	430	853	19,028	0	0	0	580	22,003
25-Apr-2003	25-Apr-2003	1	150	298	3,273	280	555	19,584	0	0	0	430	22,856
26-Apr-2003	26-Apr-2003	1	150	298	3,570	280	555	20,139	0	0	0	430	23,709
27-Apr-2003	27-Apr-2003	1	150	298	3,868	280	555	20,694	0	0	0	430	24,562
28-Apr-2003	28-Apr-2003	1	150	298	4,165	280	555	21,250	0	0	0	430	25,415
29-Apr-2003	29-Apr-2003	1	150	298	4,463	280	555	21,805	0	0	0	430	26,268
30-Apr-2003	30-Apr-2003	1	150	298	4,760	280	555	22,360	0	0	0	430	27,121
1-May-2003	1-May-2003	1	150	298	5,058	280	555	22,916	0	0	0	430	27,974
2-May-2003	2-May-2003	1	150	298	5,355	280	555	23,471	0	0	0	430	28,827
3-May-2003	3-May-2003	1	150	298	5,653	280	555	24,027	0	0	0	430	29,679
4-May-2003	4-May-2003	1	150	298	5,950	280	555	24,582	0	0	0	430	30,532
5-May-2003	5-May-2003	1	150	298	6,248	280	555	25,137	0	0	0	430	31,385
6-May-2003	6-May-2003	1	150	298	6,545	420	833	25,970	0	0	0	570	32,516
7-May-2003	7-May-2003	1	150	298	6,843	420	833	26,803	0	0	0	570	33,646
8-May-2003	8-May-2003	1	150	298	7,140	420	833	27,637	0	0	0	570	34,777
9-May-2003	9-May-2003	1	150	298	7,438	420	833	28,470	0	0	0	570	35,908
10-May-2003	10-May-2003	1	150	298	7,736	420	833	29,303	0	0	0	570	37,038
11-May-2003	11-May-2003	1	150	298	8,033	420	833	30,136	0	0	0	570	38,169
12-May-2003	12-May-2003	1	150	298	8,331	380	754	30,889	0	0	0	530	39,220
13-May-2003	13-May-2003	1	150	298	8,628	250	496	31,385	0	0	0	400	40,013
14-May-2003	14-May-2003	1	150	298	8,926	250	496	31,881	0	0	0	400	40,807
15-May-2003	15-May-2003	1	150	298	9,223	175	347	32,228	0	0	0	325	41,451
16-May-2003	16-May-2003	1	150	298	9,521	125	248	32,476	0	0	0	275	41,997
17-May-2003	17-May-2003	1	150	298	9,818	72	143	32,619	0	0	0	222	42,437
18-May-2003	19-May-2003	2	150	595	10,413		0	32,619	0	0	0	150	43,032
20-May-2003	20-May-2003	1	150	298	10,711		0	32,619	200	397	397	350	43,726
21-May-2003	28-May-2003	8	150	2,380	13,091		0	32,619	400	6,347	6,744	550	52,454
29-May-2003	29-May-2003	1	150	298	13,388		0	32,619	325	645	7,388	475	53,396
30-May-2003	30-May-2003	1	150	298	13,686		0	32,619	150	298	7,686	300	53,991
31-May-2003	12-Jun-2003	13	50	1,289	14,975		0	32,619	200	5,157	12,843	250	60,437
13-Jun-2003	13-Jun-2003	1	50	99	15,074		0	32,619	180	357	13,200	230	60,893
14-Jun-2003	24-Jun-2003	11	50	1,091	16,165		0	32,619	130	2,836	16,036	180	64,821
25-Jun-2003	30-Jun-2003	6	50	595	16,760		0	32,619	155	1,845	17,881	205	67,260
1-Jul-2003	31-Jul-2003	31	50	3,074	19,835		0	32,619	155	9,531	27,412	205	79,865
1-Aug-2003	31-Aug-2003	31	50	3,074	22,909		0	32,619	155	9,531	36,942	205	92,470
1-Sep-2003	15-Sep-2003	15	50	1,488	24,397		0	32,619	155	4,612	41,554	205	98,569
16-Sep-2003	30-Sep-2003	15	50	1,488	16,463		0	32,619	155	4,612	17,455	205	104,669
1-Oct-2003	15-Oct-2003	15	150	4,463	20,926	165	4,909	37,528	95	2,826	20,281	410	116,867
16-Oct-2003	31-Oct-2003	16	150	4,760	25,686		0	37,528	95	3,015	23,296	245	124,642
1-Nov-2003	30-Nov-2003	30	150	8,926	34,612		0	37,528	95	5,653	28,949	245	139,221
1-Dec-2003	31-Dec-2003	31	150	9,223	43,835		0	37,528	95	5,841	34,790	245	154,285
1-Jan-2004	31-Jan-2004	31	150	9,223	53,058		0	37,528	95	5,841	40,631	245	169,350
1-Feb-2004	29-Feb-2004	29	150	8,628	61,686		0	37,528	95	5,464	46,096	245	183,442
1-Mar-2004	31-Mar-2004	31	150	9,223	70,909		0	37,528	95	5,841	51,937	245	198,507
1-Apr-2004	14-Apr-2004	14	150	4,165	75,074		0	37,528	95	2,638	54,575	245	205,310
No. of days		366	(April 15 through April 14)										

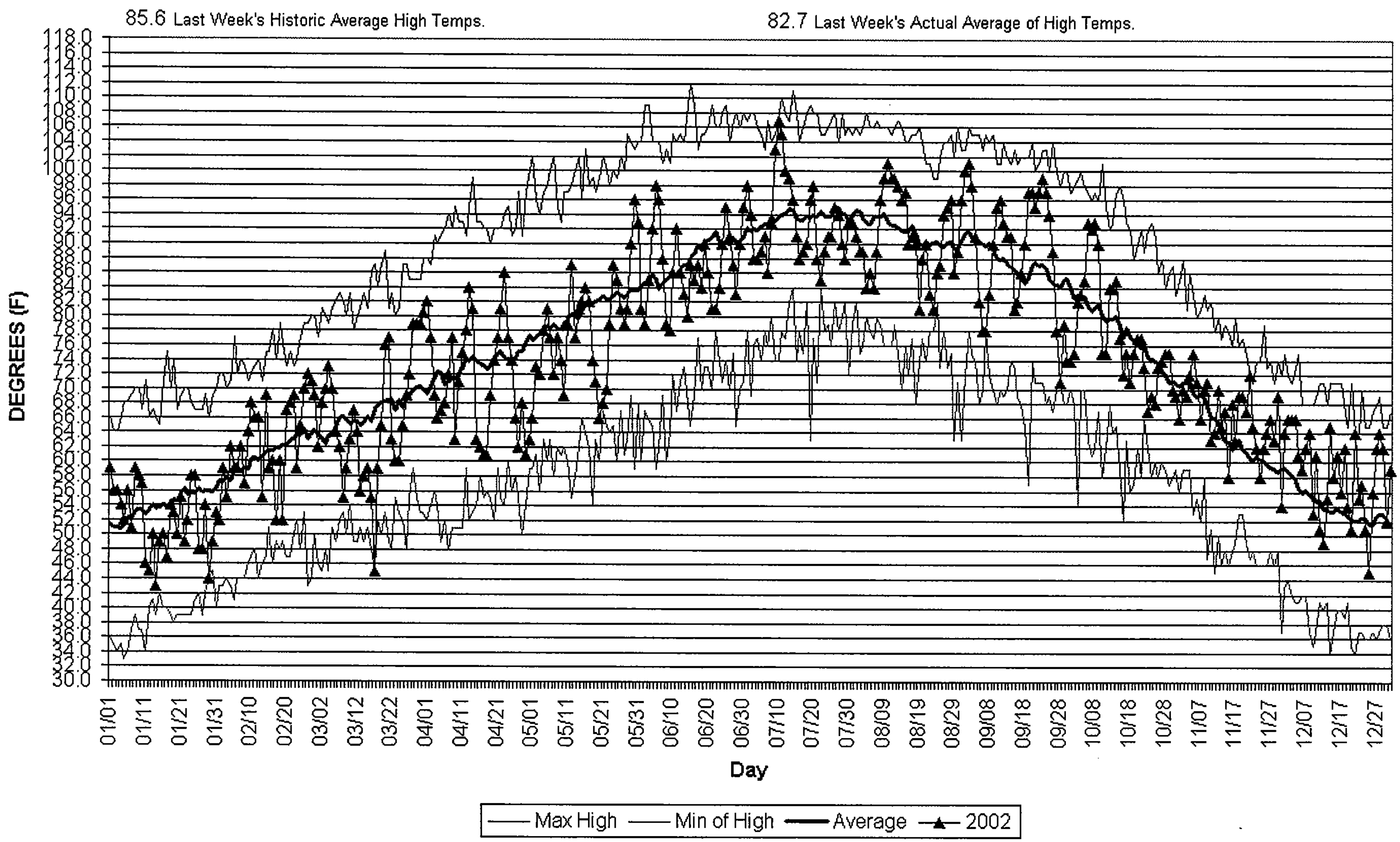
1 cfs day = 1.983471 acre-feet (af)
The pulse flows are a target that represents a daily average.
Flows for period 25JUN2003 to 14APR2004 are projected averages


Modesto Data
temperature (F)
flow (cfs)
100
90
80
70
60
50
40
30
800
700
600
500
400
300
200
100
5/1/2003 … 6/30/2003
mean AT
mean WT
max. AT
Mod. flow
LG flow

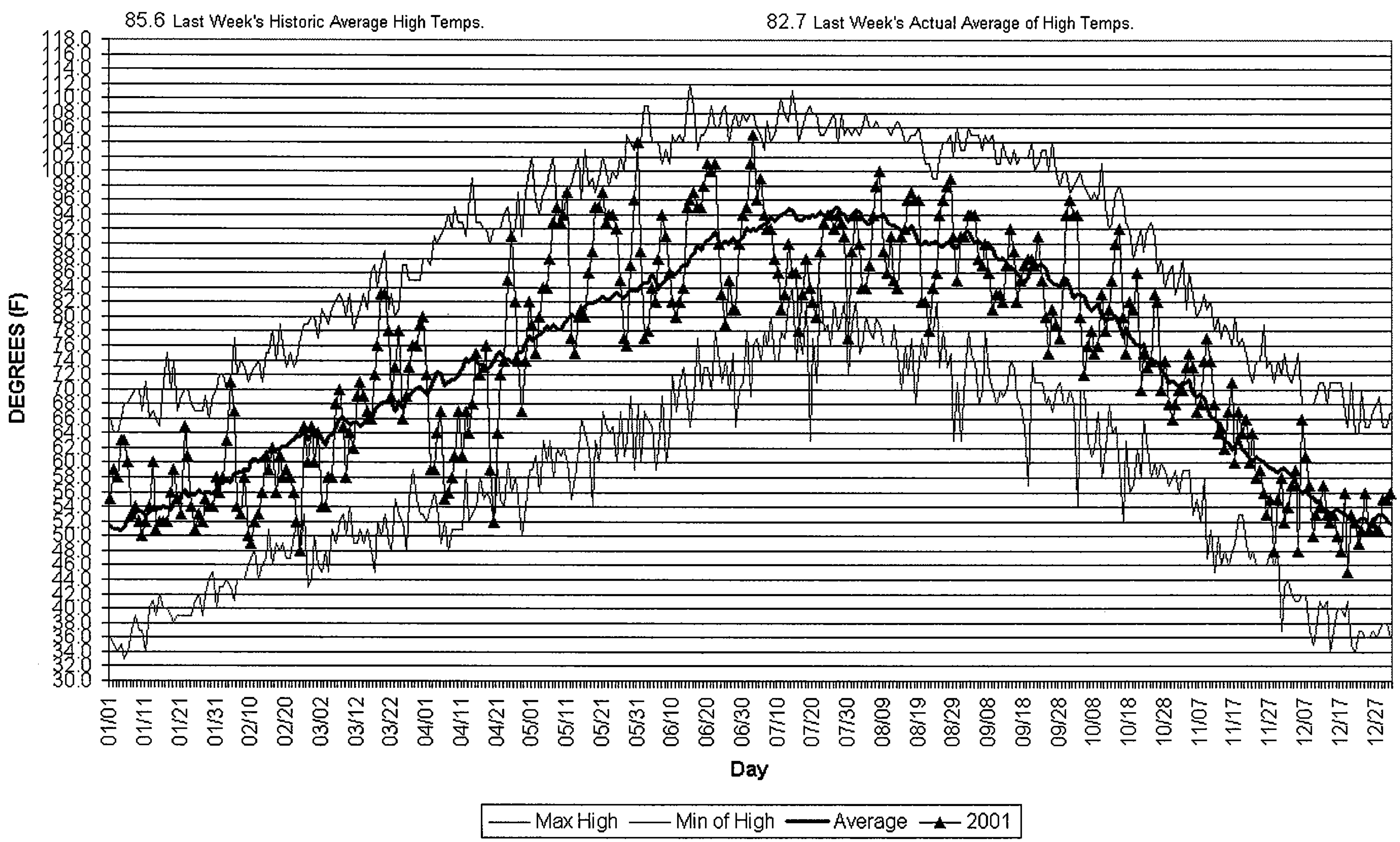
Air Temperature Data



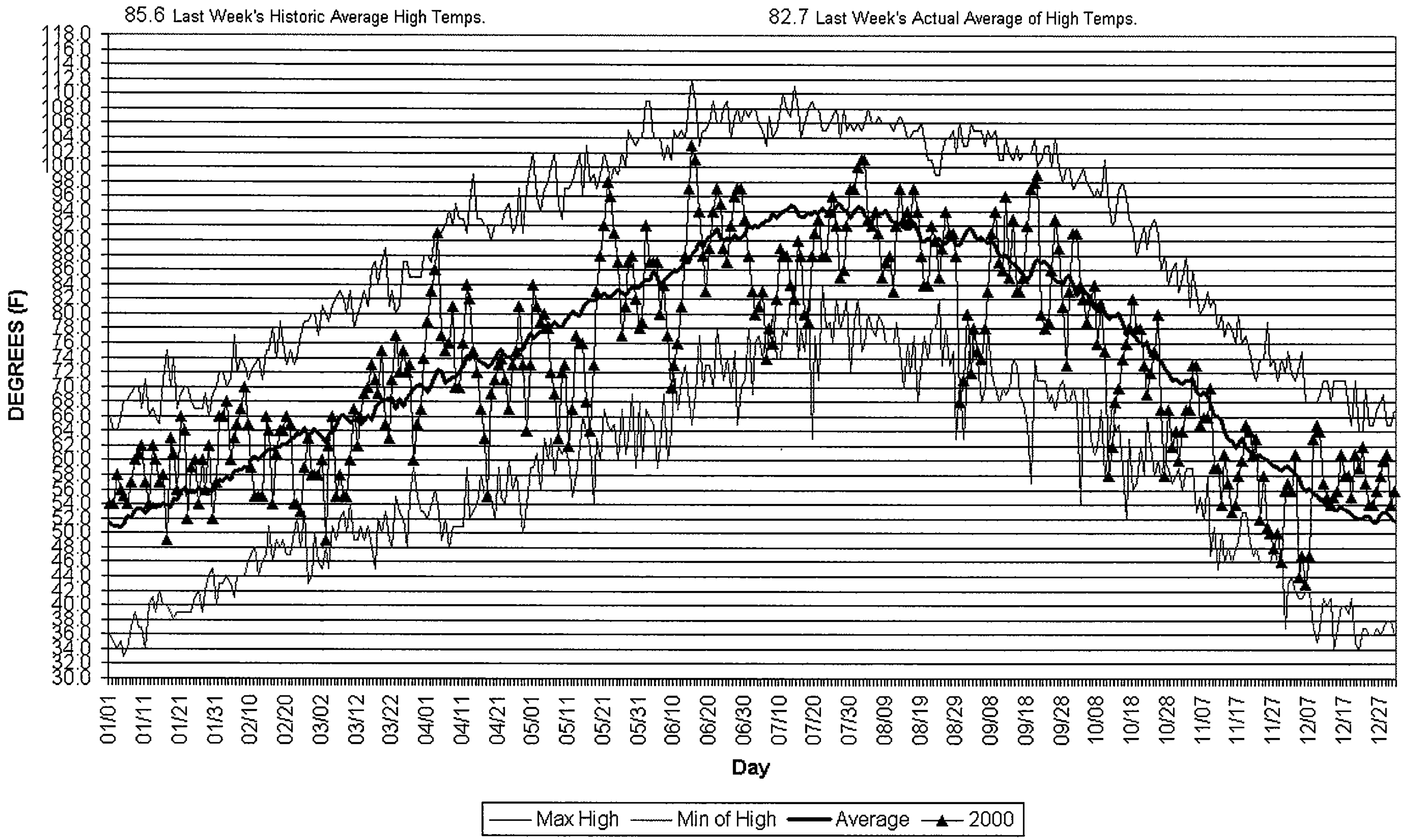
TURLOCK IRRIGATION DISTRICT
MODESTO (High Temperatures)

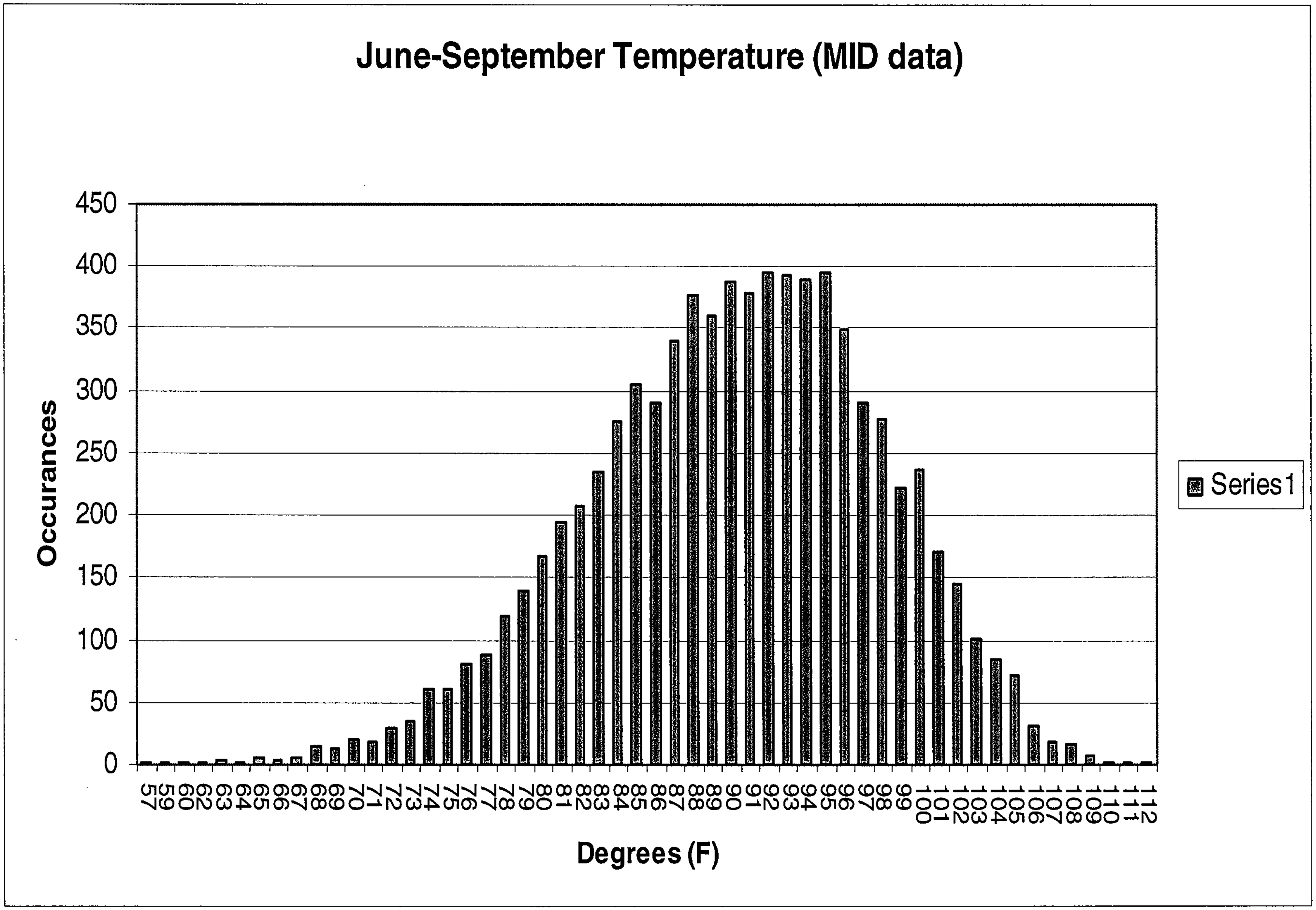


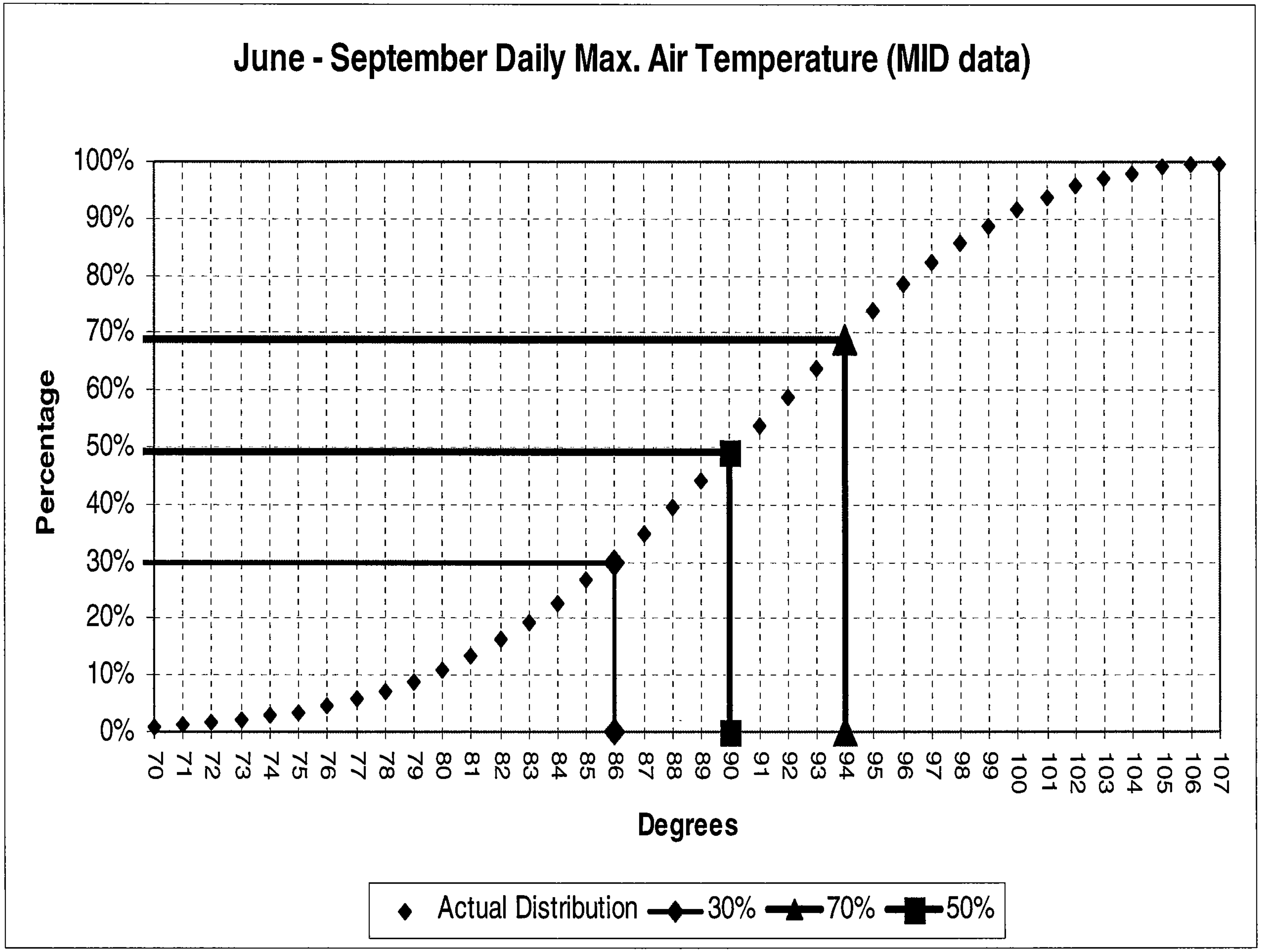
TURLOCK IRRIGATION DISTRICT
MODESTO (High Temperatures)



TURLOCK IRRIGATION DISTRICT
MODESTO (High Temperatures)




June-September Temperature (MID data)
Occurances
450
400
350
300
250
200
150
100
50
0
57 59 60 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112
Degrees (F)
Series1


June - September Daily Max. Air Temperature (MID data)
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
Degrees
Actual Distribution
30%
70%
50%

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National Weather Service Forecast Office

Sacramento, CA

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Hazardous Weather Outlook

NORTHERN SAN JOAQUIN VALLEY- INCLUDING STOCKTON...MODESTO

NATIONAL WEATHER SERVICE SACRAMENTO CALIFORNIA
1030 AM PDT MON JUN 23 2003

TODAY...MOSTLY SUNNY... HIGHS 81 TO 86... LIGHT WINDS BECOMING WEST 10 TO 20 MPH.
TONIGHT...MOSTLY CLEAR... LOWS 53 TO 58... WEST WINDS 10 TO 20 MPH BECOMING LIGHT.
TUESDAY...MOSTLY SUNNY AND WARMER... HIGHS 85 TO 90... NORTHWEST WINDS 10 TO 20 MPH.
TUESDAY NIGHT...MOSTLY CLEAR... LOWS IN THE UPPER 50S
WEDNESDAY...MOSTLY CLEAR... HIGHS IN THE LOWER 90S
THURSDAY...DRY... LOWS 55 TO 65... HIGHS IN THE 90S
FRIDAY...DRY... LOWS 55 TO 65... HIGHS IN THE 90S
SATURDAY...DRY... LOWS 55 TO 65... HIGHS 85 TO 95
SUNDAY...DRY... LOWS 55 TO 65... HIGHS IN THE 80S

Location	Forecast Temperature			Probability Of Precipitation		
	Today	*Tonight*	*Tue*	*Today*	*Tonight*	*Tue*
STOCKTON	85	55	88	0%	0%	0%
MODESTO	85	55	89	0%	0%	0%

Current Observations for:

Stockton

Date/Time	Jun 23 12:55PM PDT
Weather	Fair
Visibility	10 mile(s)
Temperature	81 F
Dewpoint	50 F
Relative Humidity	34%
Wind	W 14 Gust 20 MPH
Pressure	29.73 in

Nearby Weather

Location	*Date/Time*	*Weather*	*Temperature*
Modesto	01:53PM	Fair	81 F
Sacramento International Airport	12:53PM	Partly Cloudy	78 F
San Francisco	01:56PM	Cloudy/Overcast and Windy	64 F
Merced	01:53PM Jun 23	Fair	81 F
Fresno	01:56PM PDT	Mostly Cloudy	81 F

Other Observation Links

Road Conditions

Satellite Imager

[Infrared] [Water Vapor] [Visible]
[Fog Enhancement]

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Hazardous Weather Outlook

NORTHERN SAN JOAQUIN VALLEY-INCLUDING STOCKTON...MODESTO

NATIONAL WEATHER SERVICE SACRAMENTO CALIFORNIA
330 PM PDT MON JUN 23 2003

TONIGHT...MOSTLY CLEAR... LOWS 51 TO 56... WEST WINDS 10 TO 20 MPH BECOMING LIGHT AFTER MIDNIGHT.
TUESDAY...MOSTLY SUNNY... HIGHS 85 TO 90... NORTHWEST WINDS 5 TO 15 MPH
TUESDAY NIGHT...MOSTLY CLEAR... LOWS 55 TO 60... NORTHWEST WINDS 10 TO 20 MPH.
WEDNESDAY...MOSTLY SUNNY... HIGHS 89 TO 94... NORTH WINDS 5 TO 15 MPH
WEDNESDAY NIGHT...MOSTLY CLEAR... LOWS IN THE LOWER 60S
THURSDAY...MOSTLY CLEAR... HIGHS IN THE MID 90S
FRIDAY...DRY... LOWS 55 TO 65... HIGHS IN THE 90S
SATURDAY...DRY... LOWS 55 TO 65... HIGHS IN THE 90S
SUNDAY...DRY... LOWS 55 TO 65... HIGHS 85 TO 95
MONDAY...DRY... LOWS 55 TO 65... HIGHS IN THE 80S

Location	Forecast Temperature				Probability Of Precipitation			
	Tonight	*Tue*	*Tue Night*	*Wed*	*Tonight*	*Tue*	*Tue Night*	*Wed*
STOCKTON	55	88	58	93	0%	0%	0%	0%
MODESTO	55	89	58	94	0%	0%	0%	0%

Satellite Imager

[Infrared] [Water Vapor] [Visible]
[Fog Enhancement]

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Current Observations for:

Stockton

Date/Time	Jun 23 02:55PM PDT
Weather	Fair
Visibility	10 mile(s)
Temperature	83 F
Dewpoint	50 F
Relative Humidity	32%
Wind	W 14 MPH
Pressure	29.69 in

Nearby Weather

Location	*Date/Time*	*Weather*	*Temperature*
Modesto	02:53PM	Fair	83 F
Sacramento International Airport	02:53PM	Partly Cloudy	85 F
San Francisco	02:56PM	Mostly Cloudy and Windy	62 F
Merced	02:53PM	Fair	83 F
Fresno	02:56PM	Mostly Cloudy	83 F

Other Observation Links

Road Conditions

Other Pages

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Sacramento, CA

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Hazardous Weather Outlook

NORTHERN SAN JOAQUIN VALLEY-INCLUDING STOCKTON...MODESTO

NATIONAL WEATHER SERVICE SACRAMENTO CALIFORNIA
530 AM PDT TUE JUN 24 2003

TODAY...SUNNY AND WARMER... HIGHS 86 TO 91... NORTHWEST WINDS 5 TO 15 MPH.
TONIGHT...CLEAR... LOWS 55 TO 60... NORTHWEST WINDS 10 TO 20 MPH
WEDNESDAY...SUNNY AND VERY WARM... HIGHS 94 TO 99... NORTH WINDS 5 TO 15 MPH.
WEDNESDAY NIGHT...CLEAR... LOWS IN THE LOWER 60S
THURSDAY...SUNNY AND HOT... HIGHS 96 TO 101
FRIDAY...DRY... LOWS IN THE 60S... HIGHS IN THE 90S
SATURDAY...DRY... LOWS 55 TO 65... HIGHS IN THE 90S
SUNDAY...DRY... LOWS 55 TO 65... HIGHS 85 TO 95
MONDAY...DRY... LOWS 55 TO 65... HIGHS IN THE 80S

Location	Forecast Temperature			Probability Of Precipitation		
	Today	*Tonight*	*Wed*	*Today*	*Tonight*	*Wed*
STOCKTON	91	58	97	0%	0%	0%
MODESTO	90	58	98	0%	0%	0%

Current Observations for:

Stockton

Date/Time	Jun 24 07:55AM PDT
Weather	Fair
Visibility	10 mile(s)
Temperature	66 F
Dewpoint	48 F
Relative Humidity	52%
Wind	NW 12 MPH
Pressure	29.81 in

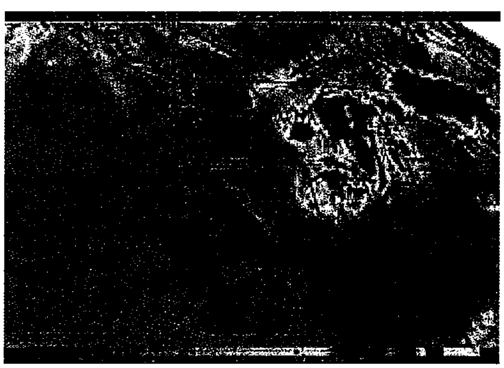
Nearby Weather

Location	*Date/Time*	*Weather*	*Temperature*
Modesto	07:53AM	Fair	67 F
Sacramento International Airport	07:53AM	Fair	67 F
San Francisco	07:56AM	Fair	59 F
Merced	07:53AM	Fair	65 F
Fresno	07:56AM	Fair	63 F

Other Observation Links

Road Conditions

Satellite Imager



[Infrared] [Water Vapor] [Visible]
[Fog Enhancement]

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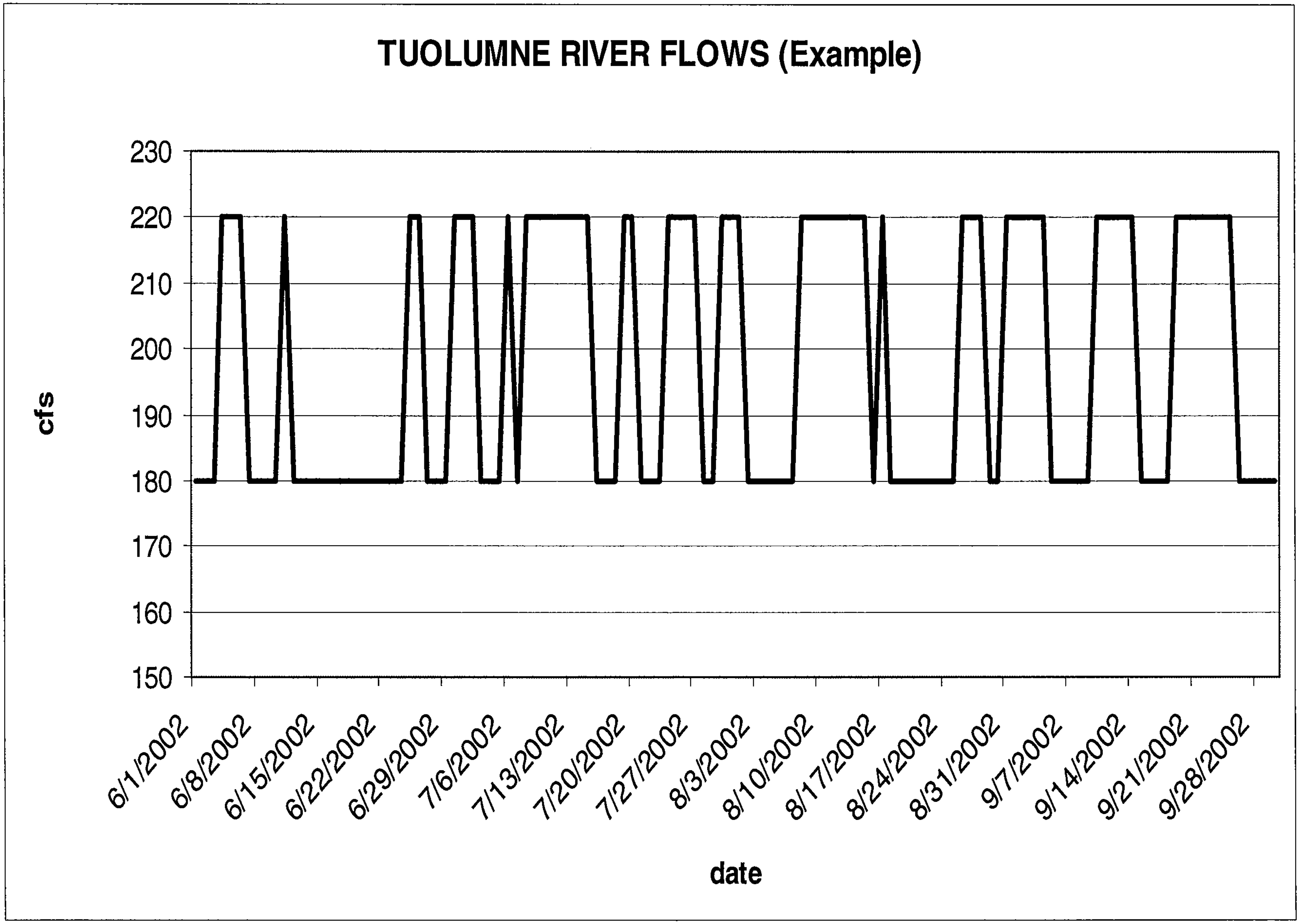
TUOLUMNE RIVER FLOWS (Example)
cfs
230
220
210
200
190
180
170
160
150
6/1/2002
6/8/2002
6/15/2002
6/22/2002
6/29/2002
7/6/2002
7/13/2002
7/20/2002
7/27/2002
8/3/2002
8/10/2002
8/17/2002
8/24/2002
8/31/2002
9/7/2002
9/14/2002
9/21/2002
9/28/2002
date

Tuolumne Minimum Flow Requirement

Average of flow YEAR	MONTH 6	7	8	9	Average of flow For Period	A.F. For Period	
1939	203	207	203	197	203	49,031	
1940	208	206	203	180	199	48,238	
1941	189	214	193	185	195	47,286	
1942	192	208	201	187	197	47,683	
1943	187	206	195	199	197	47,603	
1944	191	202	201	200	198	48,000	
1945	196	216	201	195	202	48,873	
1946	185	206	206	193	198	47,841	
1947	196	190	194	204	196	47,445	
1948	191	205	193	195	196	47,365	
1949	199	199	192	191	195	47,207	
1950	195	212	208	188	201	48,635	
1951	196	206	201	192	199	48,079	
1952	184	212	206	200	201	48,555	
1953	191	219	193	192	199	48,079	
1954	191	214	197	188	197	47,762	
1955	188	201	211	196	199	48,159	
1956	201	208	194	193	199	48,238	
1957	204	212	203	196	204	49,349	
1958	193	211	217	205	207	50,063	
1959	200	219	211	192	206	49,745	
1960	208	214	212	200	209	50,460	
1961	203	212	208	195	205	49,507	
1962	199	215	206	193	203	49,190	
1963	191	206	208	199	201	48,635	
1964	189	207	207	191	199	48,079	
1965	185	208	206	184	196	47,445	
1966	199	203	212	192	202	48,793	
1967	197	219	219	199	209	50,460	
1968	203	212	198	191	201	48,635	
1969	184	215	215	200	204	49,269	
1970	195	216	203	196	203	49,031	
1971	191	212	210	197	203	49,031	
1972	204	207	210	185	202	48,793	
1973	201	206	206	185	200	48,317	
1974	201	208	206	204	205	49,587	
1975	195	202	197	195	197	47,683	
1976	197	206	190	191	196	47,445	
1977	203	210	201	189	201	48,555	
1978	191	212	203	191	199	48,238	
1979	201	206	202	205	204	49,269	
1980	185	206	199	195	196	47,524	
1981	209	217	207	201	209	50,539	
1982	188	210	207	192	199	48,238	
1983	192	201	205	200	199	48,238	
1984	200	215	212	212	210	50,777	
1985	211	215	206	187	205	49,507	
1986	199	207	214	191	203	49,031	
1987	201	195	203	195	199	48,079	
1988	196	215	203	195	202	48,952	
1989	196	206	199	191	198	47,921	
1990	191	207	199	191	197	47,683	
1991	187	206	193	201	197	47,603	
1992	193	206	208	199	202	48,793	
1993	195	205	202	199	200	48,397	
1994	196	208	210	195	202	48,952	
1995	189	198	205	192	196	47,445	
1996	199	216	208	195	205	49,507	
1997	197	212	198	203	203	49,031	
1998	184	206	211	197	200	48,317	
1999	189	190	192	189	190	46,017	
2000	197	192	202	193	196	47,445	
2001	196	199	202	189	197	47,603	
2002	189	205	198	201	198	48,000	
2003	188				188	45,493	
						a.f.	diff.
Average	195	208	204	195	200	48,433	
Max	211	219	219	212	210	50,777	2,344
Min	184	190	190	180	188	45,493	(2,940)

2003 TUOLUMNE RIVER SNORKEL SUMMARY (TID/MID) *DRAFT*

DATE	START TIME	LOCATION	RIVER MILE	SITE	AREA (Sq. Ft.)	AVG. DEPTH (FEET)	TIME (Min.)	HABITAT	SUBSTRATE	WATER TEMP. (C)	EC	TURB. (NTU)	HORIZ. VISIB. (FEET)	CHINOOK count/est.	CHINOOK size	RAINBOW count/est.	RAINBOW size	SACRAMENTO SUCKER	SACRAMENTO PIKEMINNOW	HARDHEAD	RIFFLE SCULPIN	LARGEMOUTH BASS	SMALLMOUTH BASS	REDEAR SUNFISH	BLUEGILL	CARP
														NUMBER COUNTED (ESTIMATED TOTAL LENGTH OR SIZE RANGE IN MM)												
18-Jun	0942	Riffle A7	50.7	1	5,625	1.2	34.0	Riffle	cobble,gravel,bedrock	12.1	42	0.5	17	250 1	(40-70) (120)			9(375-425)								
	0940			2	5,000	3.0	26.0	Run-Riffle	cobble,gravel,boulder					25 150	(45-60) (80-120)	5 60 1	(45-55) (90-140) (350)									
18-Jun	1106	Riffle 2	49.9	1	3,075	1.0	29.0	Riffle	cobble,gravel,sand	13.4	43	0.5	18.0	47 25	(80-120) (60-85)	5	(120-130)	(500,525)			(60,90)					
	1129			2	3,000	8.0	20.0	Pool	bedrock,boulder,sand							2	(300,325)	40(300-450)	(80)							
	1135			3	6,000	5.0	14.0	Run	sand,cobble,boulder							1	(420)	(450,600,650)								
18-Jun	1338	Riffle 3B	49.1	1	4,000	1.8	25.0	Riffle	cobble,gravel,sand	13.9	44	0.7	16.0	15	(80-110)	5	(110-150)	3(350-400) (500-600)			(70)					
	1345			2	6,250	2.3	26.0	Run-Riffle	cobble,sand,bedrock					1	(50)			25(500-600)								
18-Jun *	1515	Riffle 5B	47.9	1	2,000	2.0	16.0	Riffle	cobble,gravel,sand	15.4	43	0.8	15.0	4	(90-100)	5	(90-120)	8(350-500)								
	1536			2	7,500	4.5	10.0	Run	cobble,boulder,bedrock									8(350-500)								
	1517			3	5,400	5.5	22.0	Run-Pool	bedrock,sand,cobble							1	(370)	11(500-650)	(460)							
					47,850		222.0			Subtotal				518		85		111	2		3					
19-Jun	0934	Riffle 7	46.9	1	1,875	1.2	21.0	Riffle	cobble,gravel,sand	12.6	50	0.7	15.0			4 9	(110-125) (80-110)	(525,550)								
	0930			2	6,000	3.5	19.0	Run	bedrock,cobble,sand							1	(375)	36(400-650)	(350,400)							
19-Jun	1059	Riffle 13B	45.5	1	4,000	2.4	22.0	Run-Riffle	cobble,gravel,sand	14.4	49	1.1	13.0	9	(80-110)	1	(390)	(75) 5(550-600)								
	1054			2	3,600	2.0	22.0	Riffle	gravel,cobble,sand									3(450-550)								
19-Jun	1312	Riffle 21	42.9	1	1,000	1.6	14.0	Riffle	cobble,gravel,sand	17.2	52	1.0	12.0					(600)	7(150-210)							
	1308			2	4,000	4.5	20.0	Run	cobble,sand,boulder									11(400-600) 3(250-350)	24(120-275) (320,350,450)	21(150-250) 3(110-130)		(120,220)		(120)	(90,120)	
19-Jun	1414	Riffle 23C	42.3	1	1,750	2.8	15.0	Run	cobble,gravel,bedrock	18.4	51	1.3	12.0	6	(60-120)	1	(90)		50(120-220) 20(225-350)	30(175-275)						
	1410			2	3,000	1.8	18.0	Riffle	cobble,gravel,bedrock					2	(110,120)			(700)	14(140-220)	19(140-220)	(90)					
					25,225		151.0			Subtotal				17		16		63	120	73	1	2		1	2	
20-Jun	0926	Riffle 30B	38.5	1	6,000	2.5	19.0	Run-Riffle	boulder,cobble,sand	17.0	63	1.5	10.0					50(50-70)								
	0934			2	3,500	4.0	16.0	Run	sand,cobble,gravel									(575,650)				5(130-160) (240)	(200)			(750)
20-Jun	1041	Riffle 35A	37.1	1	2,400	1.0	15.0	Riffle	gravel,cobble,sand	18.5	64	1.3	11.0	2	(110,120)				15(120-150) 3(200-240)(300)	(120,140,150)						
	1050			2	5,250	2.8	18.0	Run	vegetation.,sand,gravel									6(550-650)	8(150-200) (250)			11(120-175) 5(180-225)				
20-Jun	1300	Riffle 41A	35.3	1	3,000	2.8	16.0	Run-Riffle	cobble,gravel,sand	19.7	67	1.3	8.0					(575,600)	14(150-250)			(150,160)				
	1249			2	2,400	5.5	8.0	Pool	gravel,sand,bedrock									(260,300)	(200,240,360)			(90,100)	(180)			
	1257			3	4,000	2.5	10.0	Run-Riffle	boulder,cobble,gravel									(700,750)								
20-Jun	1424	Riffle 57	31.5	1	3,000	1.3	17.0	Riffle-Run	cobble,gravel,sand	22.0	67	1.4	12.0					(600)	(260,275)				(160,160,170)			
	1421			2	7,500	2.5	15.0	Run	cobble,bedrock,sand													(110,110,140,200)	(180,140)			
					37,050		134.0			Subtotal				2				65	47	3		30	7			1
										TOTAL#				537		101		239	169	76	4	32	7	1	2	1

* Swimmers were at the site location during the survey
Young-of-the-year sucker were commonly observed along the margins at most sites.

TURLOCK IRRIGATION DISTRICT

WATER PLANNING DEPARTMENT

MEMORANDUM

TO: TRTAC
FROM: Wilton Fryer
DATE: 24 June 2003
RE: Project Status Update

Project	Funding	Status
SRP 9	Full	Constructed, revegetation planted, and plant maintenance & irrigation on going. NOC filed March 2003.
SRP 10 Dike	Full	Construction complete. NOC filed March 2003.
7\11 Segment	Full	Constructed, revegetation 95% planted, and plant maintenance & irrigation on going. 7\11 Materials NOC filed March 2003.
MJ Ruddy	Full	ROW costs exceed budget, seeking CBDA Amendment 26 June 03 with September construction start.
Warner-Deardorff	Partial	30% design complete, permitting started, remaining design started. CALFED Directed Action awarded construction funding. Working on revised SOW for contract.
Design Manual	Full	Due to complete by June 2003.
Course Sediment	Full	Draft final report under review.
La Grange Gravel	Full	Domecq\Zanker gravel acquisition funding contract is in place.
Fine Sediment	Full	Gasburg Creek watershed analysis report was revised, as has sediment basin design. Waiting for DFG comments on site layout. Evaluation of gravel cleaning equipment and methods continuing.
RM 43	Full	DWR is working on contract based on Scope of Work generated with larger FOTT Bobcat Flat Project.
SRP 10	Partial	Several channel layouts under review for construction, navigation, and ESA compliance conflicts.

Tim Ford - Summary of 24JUN flow schedule decision

From: Tim Ford
To: TRTAC LIST 6-2003
Date: 6/25/2003 8:20 PM
Subject: Summary of 24JUN flow schedule decision
CC: Steve Kirihara; Wes Monier

To TRTAC list:

This e-mail is intended to summarize the flow schedule decision reached in yesterday's TRTAC meeting.

The recent flow schedule of 180 cfs and the latest DWR basin index update have resulted in a default flow level for the remainder of the "summer" period (25JUN-30SEP) of 205 cfs, subject to further determination after 31JUL. After reviewing and discussing several handouts, the decision was made to adjust from the interim decision previously reached on 13JUN. That initial decision was to have a flow schedule at 180 cfs, except 220 cfs would apply on days when the NWS prior day forecast for Modesto maximum air temperature was 100 degrees or greater. As it turned out, there were no days during that period with that forecast, so the schedule stayed at 180 cfs.

The new criteria starting today is a schedule at 195 cfs, except 235 cfs applies on days when the NWS prior day forecast for Modesto maximum air temperature is 96 degrees or greater. The schedule would return to 195 cfs on the second consecutive day with a forecast less than 96 degrees. The La Grange rating table handout indicated the difference in river height at the 195-235 cfs range is less than 2 inches.

An assumption is this operation would result, under average temperature conditions, in an schedule for the period averaging reasonably close to 205 cfs. Wes will take a closer look at this as these specific criteria had not been analyzed, so some further refinements may be need to be considered. The Districts will make a good faith effort to implement this variable schedule, although some operational procedures for us remain to be established. We will notify the parties should unforeseen problems occur and may endeavor to provide e-mail updates (weekly?) of temperature and flow conditions.

The net difference (from a steady 205 cfs schedule) this operation plan intends is to have 30 cfs more during the warmest periods, with 10 cfs less the rest of the time. Yesterday's forecasted high for today was 98 degrees, so the flow schedule for today was 235 cfs and the flow was increased overnight accordingly. The current forecast for tomorrow and Friday also exceeds 95 degrees, so the schedule will remain at 235 cfs in the near term.

<u>Calendar Items</u>:

- A "supplemental" snorkel survey is planned for 02JUL for those are interested. Meeting time and place is 8 AM at the NE corner of Hwy. 132/Hickman Road intersection in Waterford (4-way stop) in the former IGA market lot.

- A subgroup meeting at MID was scheduled for 9 AM, 26AUG. A specific topic will be fall pulse flow evaluation. This would also be an opportunity to review the status of flow operations.

- The next TRTAC meeting is scheduled for 9:30 AM, 25SEP at TID.

Tim Ford, Aquatic Biologist
Turlock Irrigation District
333 E. Canal Drive
Turlock, CA 95380
209-883-8275 Phone
209-656-2180 FAX

25 SEP 2003 MEETING

TUOLUMNE RIVER TECHNICAL ADVISORY COMMITTEE

DON PEDRO PROJECT - FERC LICENSE 2299

MODESTO IRRIGATION DISTRICT
TURLOCK IRRIGATION DISTRICT
CITY & COUNTY OF SAN FRANCISCO
CALIFORNIA DEPARTMENT OF FISH & GAME
U. S. FISH & WILDLIFE SERVICE

333 East Canal Drive
Turlock, CA 95381-0949
Phone: (209) 883-8275
Fax: (209) 656-2180
Email: tjford@tid.org

TECHNICAL ADVISORY COMMITTEE MEETING

September 25, 2003, 9:30 a.m.

Turlock Irrigation District, Lunch Room (2nd floor)

DRAFT AGENDA

1. Introduction
   - A. Comments on draft agenda
   - B. Correspondence since last meeting
2. **ACTION ITEMS**:
   - A. Flow schedule
   - B. Spawning survey monitoring
3. General FSA Update:
   - A. FSA/Order activity and expense tracking, subgroup activity, and report status
   - B. VAMP, NGO, and agency updates
   - C. Monitoring
   - D. River operations and flow schedule
   - E. Restoration
     1. Planning and implementation
     2. Project monitoring
     3. Other restoration projects and proposals
4. Additional items
5. Next meeting and topics

TUOLUMNE RIVER TECHNICAL ADVISORY COMMITTEE
DON PEDRO PROJECT - FERC LICENSE 2299

MODESTO IRRIGATION DISTRICT
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TECHNICAL ADVISORY COMMITTEE
MEETING MINUTES of

25 September 2003

DRAFT

1. AGENDA & PRIOR MINUTES

A. No comments on draft minutes from meeting of 24 June 2003.

B. Correspondence since last meeting:

1. Reviewed list of items

2. The August letter from FERC to the Districts requested several items regarding rainbow trout and steelhead (handout).

3. There is a new bridge proposed for a Faith Home/Claus Road connection across the river between Santa Fe and Mitchell Roads.

2. ACTION ITEMS:

A. Summer Flow Schedule: This has been a warmer than average summer so many of the days have been at the higher 235 cfs requirement in the two-step schedule. At the end of the season there will be a review of thermograph data to see effects on water temperature profile in the upper reach of the river from varying the flows about 40 cfs. In addition, there will be consideration of updating the existing model from a 5-day average to a daily time step.

B. Fall Flow Schedule: Given the hot temperatures, low DO situation in the Stockton ship channel, past water year v. fish arrival date information, and the timing for the barrier installation at the head of Old River, it was agreed to start the fall attraction flow on 16 October and use a series of decreasing flow steps. The steps will run for 5 days at flows of 450 cfs, 350 cfs, and 250 cfs.

C. Monitoring: There was a discussion of how the current snorkel survey examines various habitats and about monitoring of macroinvertebrates. The TRTAC agreed to fund assisting DFG with the fall spawning surveys. Estimated cost should be less than $20,000.

3. GENERAL INFORMATION:

A. Ford reviewed TRTAC monitoring and restoration project spending status (handout).

B. Agency and NGO activities. DFG is still working on their reports. The TRT is proposing a project for funding by the Wildlife Conservation Board regarding improving habitat on riparian lands in the La Grange area, including stockpiling of spawning aggregates as part of floodplain recontouring. This proposal is independent of the current DFG and TRTAC projects for gravel infusion at spawning riffles in the same reach of the river (handout). FOT (Boucher) is relocating to Stockton. They suggest mitigation funds as part of the Hetch Hetchy Project expansion be applied to the lower river.

C. Monitoring: Studies are underway to evaluate potential mercury contamination issues from use of tailings materials for restoration work. The study is focusing on the Merced River tailings at this time. The RWQCB is looking at any use of tailings to include remediation of industrial wastes.

D. Restoration Project Updates.

1. Wilton Fryer discussed a handout summarizing the status of the TRTAC projects.

2. There was a general discussion of riffle designs and implementation that will be a part of the final Course Sediment Management Plan developed by McBain & Trush for the TRTAC. FOT and NOAA Fisheries desire to have holding habitat for steelhead included in the designs for riffle rehabilitation above the Mining Reach projects. They are asking for changes in riffle length, undulations along the riffle, thalweg pools, and monitoring programs to evaluate the effectiveness of such changes on steelhead. There was reference to work being done on the Stanislaus by Carl Mesick.

4. ADDITIONAL ITEMS:

There is a new nonprofit NGO group with Steve Walser and Carl Mesick titled California Rivers Restoration Fund that could become active on Tuolumne River issues.

5. NEXT MEETING & TOPICS:

The next meeting was set for 17 December 2003 starting at 0930 in the TID upstairs conference room.

FERC 2299 TAC Meeting
25 September 2003

Name	**Organization**
Tim Ford	TID/MID
Wilton Fryer	TID
Patrick Koepele	TRPT
Jeff McLain	USFWS
Allison Boucher	FOTT
Ron Yoshiyama	CCSF
Noah Hume	Stillwater Sciences
Dean Marston	DFG
Tim Heyne	DFG
Madelyn Martinez	NMFS

Tuolumne River Technical Advisory Committee
Materials since 24JUN2003 TRTAC meeting

(underlined items are designated for inclusion in the FERC Report)

* 25JUN: StanCOG meeting notice on proposed roads with bridges over Tuolumne River (Boucher)
* 25JUN: Summary of 24JUN flow schedule decision (Ford)
* 28JUN: Proposed design for River Mile 43 (Bobcat Flat) project (Mierau)
* 03JUL: Flow schedule letter of 30JUN from Districts and temperature/flow operation table (Ford)
* 07JUL: FOT letter to FERC in support of NMFS petition to FERC (Boucher)
* 10JUL: Flow operation update (Ford)
* 08AUG: Update on flow schedule and annual volume (Ford)
* 19SEP: Update on flow schedule and 25SEP meeting (Ford)

FEDERAL ENERGY REGULATORY COMMISSION
Washington, D.C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 2299-053 -- California
New Don Pedro Project
Turlock Irrigation District
Modesto Irrigation District

Walter P. Ward
AGM Water Operations
Modesto Irrigation District
P.O. Box 4060
Modesto, CA 95352

AUG 2 2003

Robert M. Nees
AGM Water Resources & Regulatory Affairs
Turlock Irrigation District
P.O. Box 949
Turlock, CA 95381

Subject: August 2003 Meeting on Central Valley Steelhead for the New Don Pedro Project

Dear Messrs. Ward and Nees:

This letter regards our August 6, 2003 meeting on Central Valley steelhead for the New Don Pedro Project (FERC No. 2299). In the meeting, we stated that we would identify the information we need to determine potential project effects in order to prepare a biological evaluation related to the protection of the Central Valley steelhead in the Tuolumne River.

We are therefore requesting that you provide the following information related to the species:

1. Identify the current distribution and abundance of steelhead and rainbow trout in the lower Tuolumne River, between La Grange Dam and the San Joaquin River confluence, based on existing information. This should include length distribution data where available, and describe seasonal and year-to-year patterns if possible.

2. Identify the current effects of project operation on the physical habitat condition and water temperature suitability for steelhead spawning, incubation, and juvenile rearing in the lower Tuolumne River. This should include IFIM data from the final CDFG instream flow report. Habitat data could be scaled as percent of optimum for different life stages of steelhead, for the relevant seasons of the year. It is suggested that temperature data be presented as percent of days in relevant seasons for each of the following categories, at specific locations throughout the lower river (source: literature review by C.C. Coutant in FERC/FEIS-0067, 1993, see enclosure):

	Suboptimal	Optimal	Stressful	Lethal
Spawning	<45 F (<7.2 C)	45-50 (7.2-10)	> 68 (>20)	> 72 (> 22)
Incubation	<48 F (<8.9 C)	48-52 (8.9-11.1)	> 55 (>12.8)	> 60 (> 15.6)
Juvenile Rearing	<55 F (<12.8 C)	55-65 (12.8-18.3)	> 68 (>20)	> 77 (> 25)

3. Identify improvements that can be made in current monitoring procedures to better detect the presence and utilization of Tuolumne River habitats by steelhead. Identify how these improvements can be incorporated into the 2003-2004 sampling seasons and how the results can be incorporated into the April 2005 program final report. This should consider improvements in the screw trap and smolt survey, spawning survey, and snorkel surveys, including extensions in the sampling periods to cover the complete life history of steelhead in the lower Tuolumne River (e.g., spawning observations through March, etc.).

4. Identify the expected results of the on-going non-flow, PM&E activities of the Habitat Restoration Program in the lower Tuolumne River on steelhead and rainbow trout populations. This should document currently predicted improvements that will benefit all salmonids in the lower river over the course of the current license and when those benefits are expected to happen.

Please provide a schedule for providing the information identified in items 1 and 2 and your responses to items 3 and 4 within 45 days from the date of this letter.

Please file an original and seven copies of the requested information with:

The Secretary
Federal Energy Regulatory Commission
Mail Code: DHAC, PJ-12.3
888 First Street N.E.
Washington, DC 20426

Thank you for your cooperation and we look forward to continuing to work with you to protect the listed species in the Tuolumne River. If you have any questions, please contact Erich Gaedeke at (202) 502-8777.

Sincerely,

George H. Taylor
Chief, Biological Resources Branch
Division of Hydropower Administration
and Compliance

cc:

Ms. Madelyn Martinez
NOAA Fisheries
650 Capital Mall, Suite 8-300
Sacramento, CA 95814

Mr. Christopher Keifer
NOAA Fisheries
501 W. Ocean Blvd.
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Mr. Steve Edmondson
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Stillwater Sciences
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Mr. Roger Masuda
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517 E. Olive St.
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Ms. Julie Gantenbein
Natural Heritage Institute
2140 Shattuck Ave.
Berkeley, CA 94704

Mr. Richard Roos-Collins
Natural Heritage Institute
2140 Shattuck Ave.
Berkeley, CA 94704

FERC/FEIS-0067

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF HYDROPOWER LICENSING

FINAL ENVIRONMENTAL IMPACT STATEMENT

PROPOSED MODIFICATIONS TO THE LOWER MOKELUMNE RIVER PROJECT, CALIFORNIA

FERC Project No. 2916-004

(Licensee: East Bay Municipal Utility District)

Division of Project Compliance and Administration
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, DC 20426

November 1993

Temperature Requirements

The temperature requirements of chinook salmon have been studied extensively throughout its range. The CDWR recently compiled a literature review with emphasis on the American River (Boles 1988). Staff expanded this review and compiled requirements by life stage. There is considerable variability among studies, due perhaps mostly to differences in experimental design or type of observations. Some difference may be attributed to geographic differences in stocks. However, a weight of evidence for certain thermal limitations for chinook salmon is clear. These thermal limitations include:

spawning: optimum 50°F (10°C); stressful >60°F (15.6°C); lethal >70°F (21.1°C),

incubation: optimum <50°F (10°C); stressful >56°F (13.3°C); lethal >60°F (15.6°C), and

juvenile rearing: optimum 58°F (14.4°C); stressful >65°F (18.3°C); lethal 77°F (25°C).

These limits are shown diagrammatically with historical water temperatures in the Mokelumne River at three locations at the times when the activities occur (Figure 3.3-11).

Temperature requirements of chinook salmon in warm climates can cause the population to be stressed at both ends of the freshwater phase of life (Figure 3.3-11). Adult chinook salmon enter fresh water to spawn as temperatures decline in autumn. In warm years (usually the dry years), temperatures remain high for a longer period. This situation causes spawners to either delay migration (and thus spawning) or migrate in temperatures that are detrimental to both the adult and to the gametes. At the other end of the freshwater phase, smolts normally migrate late in the following spring as temperatures rise. In warm years (also often the dry years), water warms earlier causing either earlier cues to emigrate (at an abnormally small size) or outmigration in detrimentally warm temperatures. When there is both a warm autumn and a warm spring, there may not be enough time for normal development in the intervening period. Thus, later spawning can cause juveniles to be delayed in development and emigrate late in water that is detrimentally warm. Incubation and rearing temperatures in the interval between spawning and outmigration will affect the development rate and the degree to which delayed spawning will result in damage to juveniles by high temperatures. Therefore, the seasonal progression of temperatures during the freshwater phase of life, including adult spawning migration, spawning, incubation, fry rearing, and smolt emigration, must be accounted for and not just the specific temperature during a specific life stage.

Limiting Factor Analysis

Staff has tried to place the contribution of each of the above factors affecting the population of chinook salmon in the Lower Mokelumne River into some relative perspective. This could be called a general "limiting factor analysis." A more quantitative and explicit analysis would include use of a life-cycle model that quantitatively relates mortality and growth to each of the sources of potential biological influence in the full life cycle of the fish's population. The model could be used with a hydrological record of the river to establish relative probabilities of certain features being limiting under certain circumstances. Such models are available but not well quantified for the Lower Mokelumne River; future work might be directed profitably to this area of investigation.

Staff approached the analysis with four assumptions. These are: 1) that chinook salmon follow a normal biological pattern of producing many fertilized eggs that undergo a rapid decline in survivors in early life stages followed by a slower decline in later years, except as human harvest causes a large loss of mature adults; 2) that without initial spawning there are no subsequent options; 3) that the particular limiting factor for each year-class will likely differ from year to year according to variations in environmental and

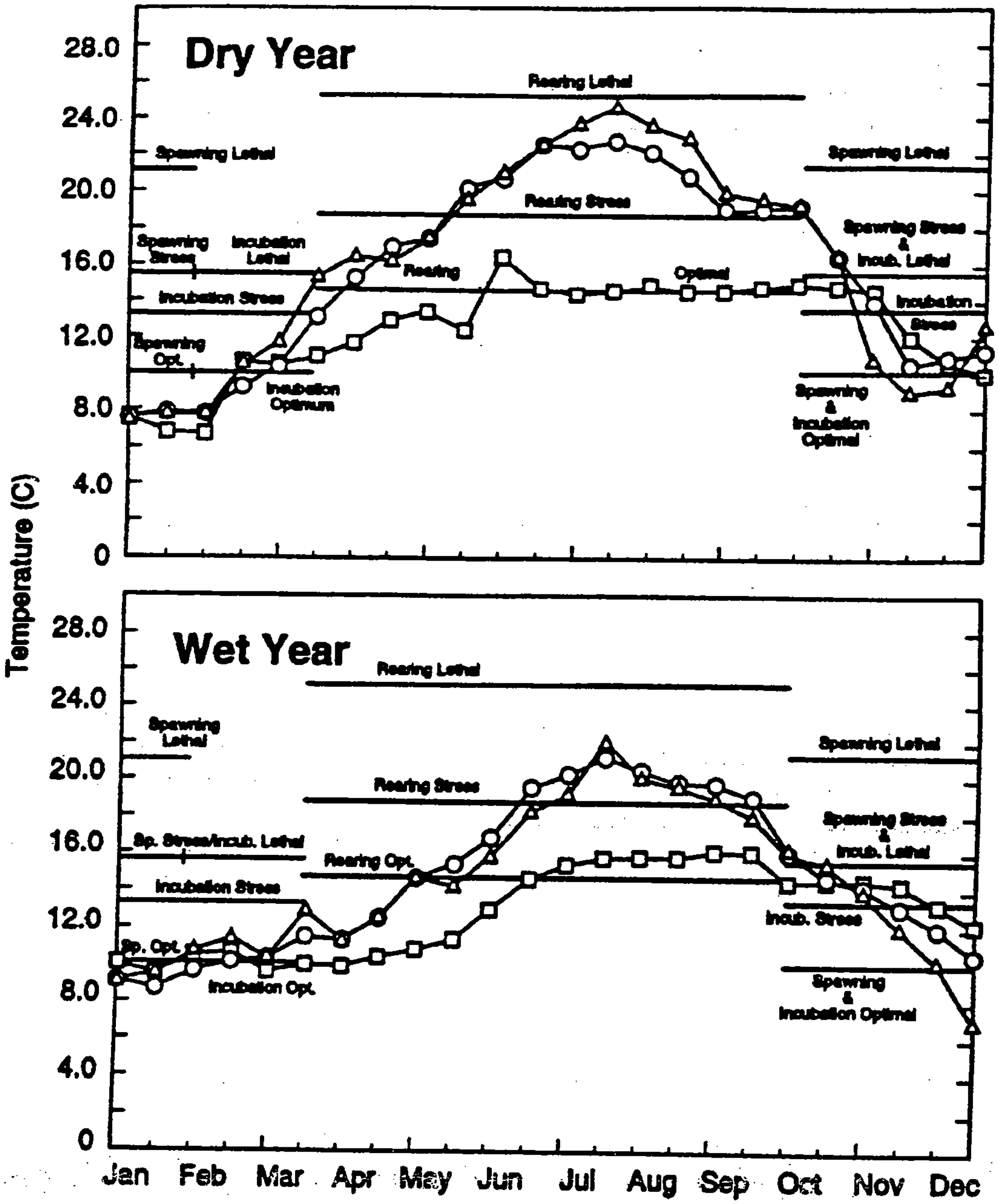


Figure 3.3-11. Temperature requirements (optimal, stressful, and lethal) of chinook salmon life stages (spawning, incubation, rearing) compared to 15-day average water temperatures in three locations of the Mokelumne River in a dry hydrologic year (1964: upper panel) and a wet hydrologic year (1974; lower panel). The three locations are below Camanche Dam (square), at Woodbridge Dam (circle), and at junction with Cosumnes River (diamond). (*Source:* Temperature data are from CDFG 1991.)

anthropogenic factors and the number of spawners that year; and 4) that the run size is average (about 3,200 fish). Staff has ranked the factors in order of its impression of their relative importance for achieving the CDFG goal of 15,000 spawners annually above Woodbridge Dam. We have also noted whether the parties to this proceeding can do anything about the factor. The factors are, in order of decreasing importance for the escapement goal:

1. Harvest. Approximately 75–85% of the subadult and adult chinook salmon are estimated to be harvested in the ocean fishery. More are taken by poaching in the Lower Mokelumne River during the spawning run. This level of mortality of potentially reproducing adults is probably the most severe constraint on escapement of adults to the spawning grounds. There is little control of this source of mortality (except poaching) by anyone in the Lower Mokelumne River.

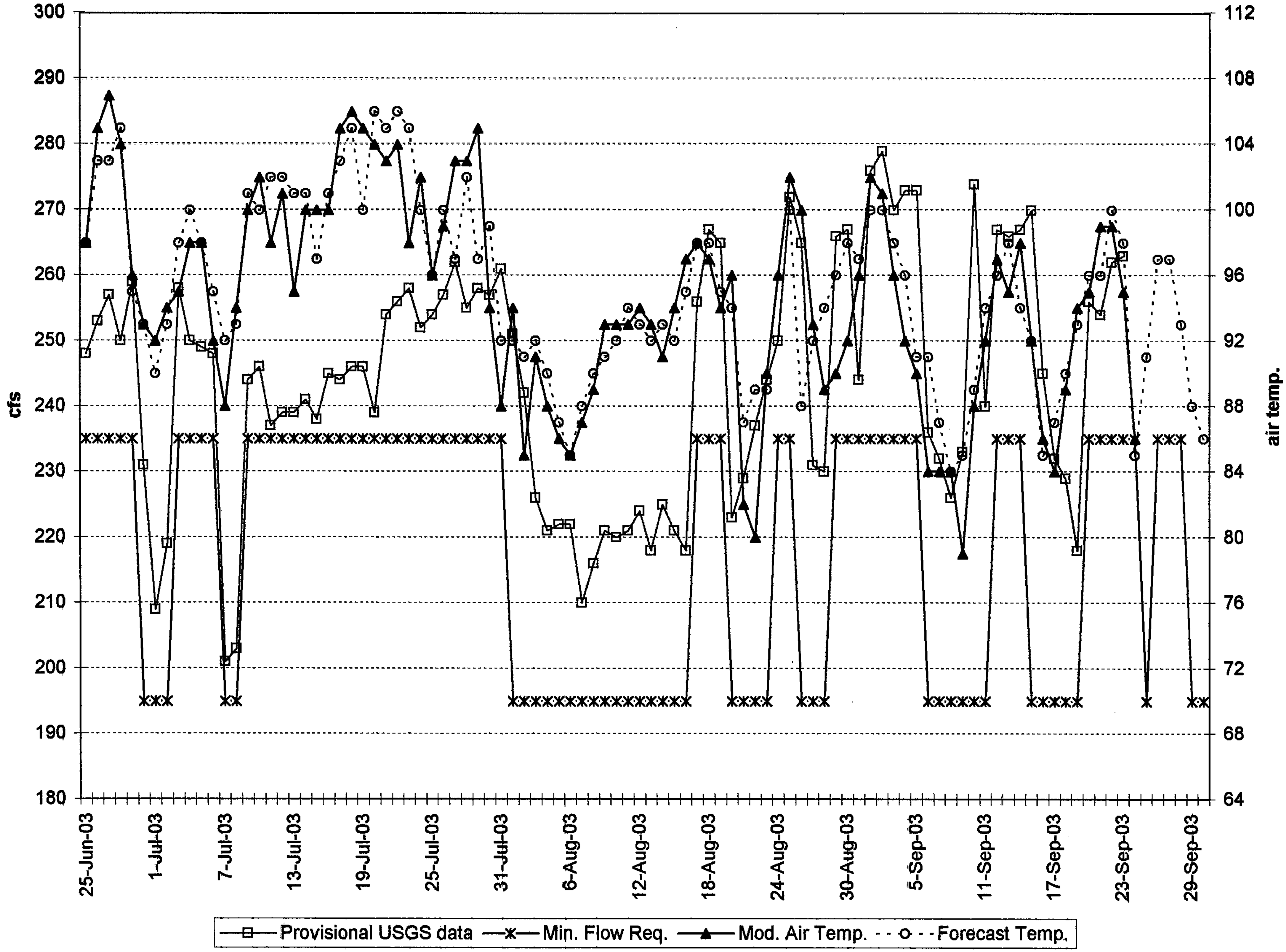
2. Spawning. Spawning certainly limits the number of wild juveniles produced and constrains any additional efforts to provide adequate conditions for survival. Spawning habitat quantity and quality is suitable for control by EBMUD. In years with abundant adult salmon, spawning habitat may not be the limiting factor, but rather the habitat and survival of the progeny. The numbers of spawners and the habitat availability on which this balance hinges is poorly understood and probably varies from year to year.

3. Hatchery production. Level of production and survival of fish spawned in the hatchery to replace lost natural production is both variable and problematic and can be a major limitation to the successul use of the hatchery. Numbers of fish produced, source of the stock, and method and location of release of young fish are controlled by CDFG and its arrangements with EBMUD. The importance of the hatchery as a "limitation" or a mitigation depends on management decisions by these organizations.

4. Survival of smolts in the Delta. Mortalities in the Delta are acknowledged by most parties to be excessively large, partly because of heavy predation on emigrating fry in the early emigration season and high temperatures later in the season. The timing and condition of outmigrating salmon and the water flows and temperatures in the Mokelumne portion of the Delta are determined by factors in the Lower Mokelumne River and can affect survival in the Delta. Mokelumne flows do little to affect overall Delta conditions. Most of the direct effects in the Delta are beyond control of anyone in the Lower Mokelumne River.

5. Passage in the Lower Mokelumne River. Smolt and later fry outmigration appears to be constrained by passage through Lake Lodi. Survival there is affected by the diversion screens, water temperature, predators in the lake, and unknown factors. The evidence for this is not robust. Modest engineering actions by the parties, however, can reduce these losses even without ironclad proof.

6. Rearing in the Lower Mokelumne River. Availability and quality of rearing habitat may be limiting the production of smolts. Physical habitat limitation is suggested by the early peak of fry emigration at Woodbridge that may be the result of newly emerged fish being forced downstream by those already occupying the best habitats. Fry trapping studies by EBMUD have shown relatively little fry movement out of the reach above Bruella Road, suggesting that the upstream reaches are less saturated with fry. Most of the emigrating fry appear to come from the more downstream reaches that lack the mixture of riffles, runs, and pools that characterize optimal habitat. As fry survival during downstream migration and in the Delta is probably low, provision of more habitat for rearing in the Lower Mokelumne River could yield more of the larger (and presumably better surviving) smolt emigrants in the May-June outmigration, assuming adequate spawning and incubation success. Such provision is within the capabilities of the parties in the Lower Mokelumne River.



cfs
air temp.
300
290
280
270
260
250
240
230
220
210
200
190
180
112
108
104
100
96
92
88
84
80
76
72
68
64
25-Jun-03
1-Jul-03
7-Jul-03
13-Jul-03
19-Jul-03
25-Jul-03
31-Jul-03
6-Aug-03
12-Aug-03
18-Aug-03
24-Aug-03
30-Aug-03
5-Sep-03
11-Sep-03
17-Sep-03
23-Sep-03
29-Sep-03
Provisional USGS data
Min. Flow Req.
Mod. Air Temp.
Forecast Temp.

TABLE 1

Tuolumne River Flow Schedule

19SEP2003 Preliminary Draft

SCHEDULE FOR 2003 - 2004 Fish Flow Year

DATE		Number of	BASE FLOW			PULSE FLOW			ADDITIONAL FLOW			TOTAL FERC FLOW	
From:	To:	DAYS	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	AF	ACCUM. A.F.	CFS	ACCUM. A.F.
12-Apr-2003	12-Apr-2003	1	150	298		275	545	545	0	0	0	425	545
13-Apr-2003	13-Apr-2003	1	150	298		550	1,091	1,636	0	0	0	700	1,636
14-Apr-2003	14-Apr-2003	1	150	298		856	1,699	3,335	0	0	0	1,006	3,335
15-Apr-2003	15-Apr-2003	1	150	298	298	856	1,699	5,034	0	0	0	1,006	5,332
16-Apr-2003	16-Apr-2003	1	150	298	595	856	1,699	6,733	0	0	0	1,006	7,328
17-Apr-2003	17-Apr-2003	1	150	298	893	856	1,699	8,432	0	0	0	1,006	9,324
18-Apr-2003	18-Apr-2003	1	150	298	1,190	856	1,699	10,130	0	0	0	1,006	11,321
19-Apr-2003	19-Apr-2003	1	150	298	1,488	856	1,699	11,829	0	0	0	1,006	13,317
20-Apr-2003	20-Apr-2003	1	150	298	1,785	856	1,699	13,528	0	0	0	1,006	15,313
21-Apr-2003	21-Apr-2003	1	150	298	2,083	856	1,699	15,227	0	0	0	1,006	17,310
22-Apr-2003	22-Apr-2003	1	150	298	2,380	856	1,699	16,926	0	0	0	1,006	19,306
23-Apr-2003	23-Apr-2003	1	150	298	2,678	630	1,250	18,175	0	0	0	780	20,853
24-Apr-2003	24-Apr-2003	1	150	298	2,975	430	853	19,028	0	0	0	580	22,003
25-Apr-2003	25-Apr-2003	1	150	298	3,273	280	555	19,584	0	0	0	430	22,856
26-Apr-2003	26-Apr-2003	1	150	298	3,570	280	555	20,139	0	0	0	430	23,709
27-Apr-2003	27-Apr-2003	1	150	298	3,868	280	555	20,694	0	0	0	430	24,562
28-Apr-2003	28-Apr-2003	1	150	298	4,165	280	555	21,250	0	0	0	430	25,415
29-Apr-2003	29-Apr-2003	1	150	298	4,463	280	555	21,805	0	0	0	430	26,268
30-Apr-2003	30-Apr-2003	1	150	298	4,760	280	555	22,360	0	0	0	430	27,121
1-May-2003	1-May-2003	1	150	298	5,058	280	555	22,916	0	0	0	430	27,974
2-May-2003	2-May-2003	1	150	298	5,355	280	555	23,471	0	0	0	430	28,827
3-May-2003	3-May-2003	1	150	298	5,653	280	555	24,027	0	0	0	430	29,679
4-May-2003	4-May-2003	1	150	298	5,950	280	555	24,582	0	0	0	430	30,532
5-May-2003	5-May-2003	1	150	298	6,248	280	555	25,137	0	0	0	430	31,385
6-May-2003	6-May-2003	1	150	298	6,545	420	833	25,970	0	0	0	570	32,516
7-May-2003	7-May-2003	1	150	298	6,843	420	833	26,803	0	0	0	570	33,646
8-May-2003	8-May-2003	1	150	298	7,140	420	833	27,637	0	0	0	570	34,777
9-May-2003	9-May-2003	1	150	298	7,438	420	833	28,470	0	0	0	570	35,908
10-May-2003	10-May-2003	1	150	298	7,736	420	833	29,303	0	0	0	570	37,038
11-May-2003	11-May-2003	1	150	298	8,033	420	833	30,136	0	0	0	570	38,169
12-May-2003	12-May-2003	1	150	298	8,331	380	754	30,889	0	0	0	530	39,220
13-May-2003	13-May-2003	1	150	298	8,628	250	496	31,385	0	0	0	400	40,013
14-May-2003	14-May-2003	1	150	298	8,926	250	496	31,881	0	0	0	400	40,807
15-May-2003	15-May-2003	1	150	298	9,223	175	347	32,228	0	0	0	325	41,451
16-May-2003	16-May-2003	1	150	298	9,521	125	248	32,476	0	0	0	275	41,997
17-May-2003	17-May-2003	1	150	298	9,818	72	143	32,619	0	0	0	222	42,437
18-May-2003	19-May-2003	2	150	595	10,413		0	32,619	0	0	0	150	43,032
20-May-2003	20-May-2003	1	175	347	10,760		0	32,619	175	347	347	350	43,726
21-May-2003	28-May-2003	8	175	2,777	13,537		0	32,619	375	5,950	6,298	550	52,454
29-May-2003	29-May-2003	1	75	149	13,686		0	32,619	400	793	7,091	475	53,396
30-May-2003	30-May-2003	1	75	149	13,835		0	32,619	225	446	7,537	300	53,991
31-May-2003	31-May-2003	1	75	149	13,983		0	32,619	175	347	7,884	250	54,487
1-Jun-2003	12-Jun-2003	12	75	1,785	15,769		0	32,619	175	4,165	12,050	250	60,437
13-Jun-2003	13-Jun-2003	1	75	149	15,917		0	32,619	135	268	12,317	210	60,854
14-Jun-2003	24-Jun-2003	11	75	1,636	17,554		0	32,619	105	2,291	14,608	180	64,781
25-Jun-2003	29-Jun-2003	5	75	744	18,298		0	32,619	160	1,587	16,195	235	67,112
30-Jun-2003	2-Jul-2003	3	75	446	18,744		0	32,619	120	714	16,909	195	68,272
3-Jul-2003	6-Jul-2003	4	75	595	19,339		0	32,619	160	1,269	18,179	235	70,136
7-Jul-2003	8-Jul-2003	2	75	298	19,636		0	32,619	120	476	18,655	195	70,910
9-Jul-2003	31-Jul-2003	23	75	3,421	23,058		0	32,619	160	7,299	25,954	235	81,631
1-Aug-2003	16-Aug-2003	16	75	2,380	25,438		0	32,619	120	3,808	29,762	195	87,819
17-Aug-2003	19-Aug-2003	3	75	446	25,884		0	32,619	160	952	30,714	235	89,217
20-Aug-2003	23-Aug-2003	4	75	595	26,479		0	32,619	120	952	31,666	195	90,764
24-Aug-2003	25-Aug-2003	2	75	298	26,777		0	32,619	160	635	32,301	235	91,697
26-Aug-2003	28-Aug-2003	3	75	446	27,223		0	32,619	120	714	33,015	195	92,857
29-Aug-2003	5-Sep-2003	8	75	1,190	28,413		0	32,619	160	2,539	35,554	235	96,586
6-Sep-2003	11-Sep-2003	6	75	893	29,306		0	32,619	120	1,428	36,982	195	98,907
12-Sep-2003	14-Sep-2003	3	75	446	29,752		0	32,619	160	952	37,934	235	100,305
15-Sep-2003	19-Sep-2003	5	75	744	30,496		0	32,619	120	1,190	39,124	195	102,239
20-Sep-2003	22-Sep-2003	3	75	446	30,942		0	32,619	160	952	40,076	235	103,637
23-Sep-2003	30-Sep-2003	8	75	1,190	32,132		0	32,619	120	1,904	41,980	195	106,731
1-Oct-2003	15-Oct-2003	15	200	5,950	38,083	58	1,736	34,355	100	2,975	44,955	358	117,393
16-Oct-2003	31-Oct-2003	16	175	5,554	43,636		0	34,355	34	1,081	46,036	209	124,027
1-Nov-2003	30-Nov-2003	30	175	10,413	54,050		0	34,355	34	2,026	48,062	209	136,467
1-Dec-2003	31-Dec-2003	31	175	10,760	64,810		0	34,355	34	2,094	50,156	209	149,321
1-Jan-2004	31-Jan-2004	31	175	10,760	75,570		0	34,355	34	2,094	52,250	209	162,175
1-Feb-2004	29-Feb-2004	29	175	10,066	85,636		0	34,355	34	1,959	54,208	209	174,200
1-Mar-2004	31-Mar-2004	31	175	10,760	96,397		0	34,355	34	2,094	56,302	209	187,054
1-Apr-2004	14-Apr-2004	14	175	4,860	101,256		0	34,355	34	946	57,248	209	192,859
No. of days		366 (April 15 through April 14)											

1 cfs day = 1.983471 acre-feet (af)

Notes: 1. Based on 60-20-20 Index is 2,815,099   July 31, 1996 FERC Order Flow Interpolated as 192,859 AF fish flow year requirement.

2. The pulse flows are a target that represents a daily average.

0.785953   91   70

192,859

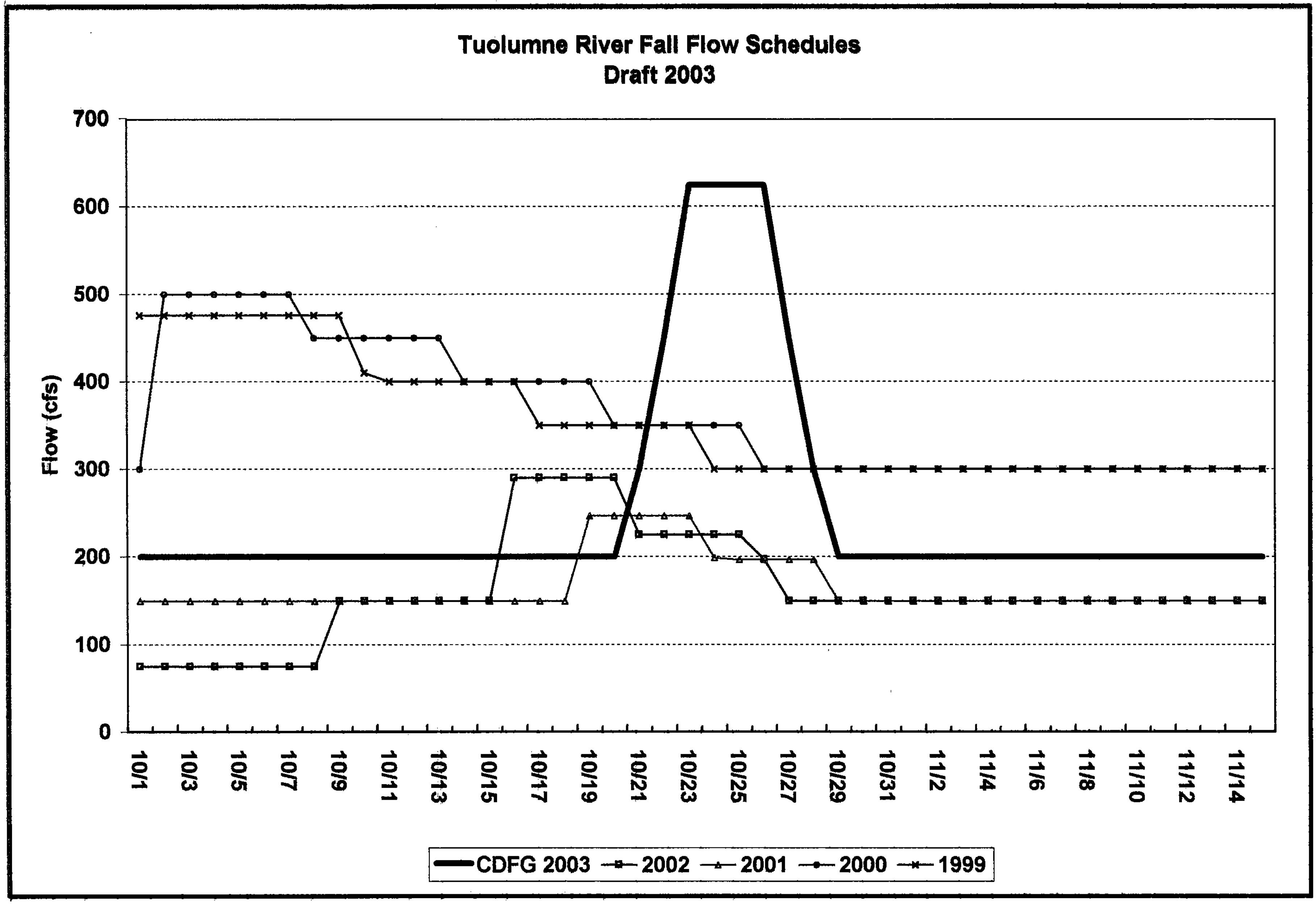
Proposed 2003 Fall SJR Flow Schedule

Version: 09/17/03

Note: SJR ungaged + upper SJR mean daily flow calculated by monthly averages f

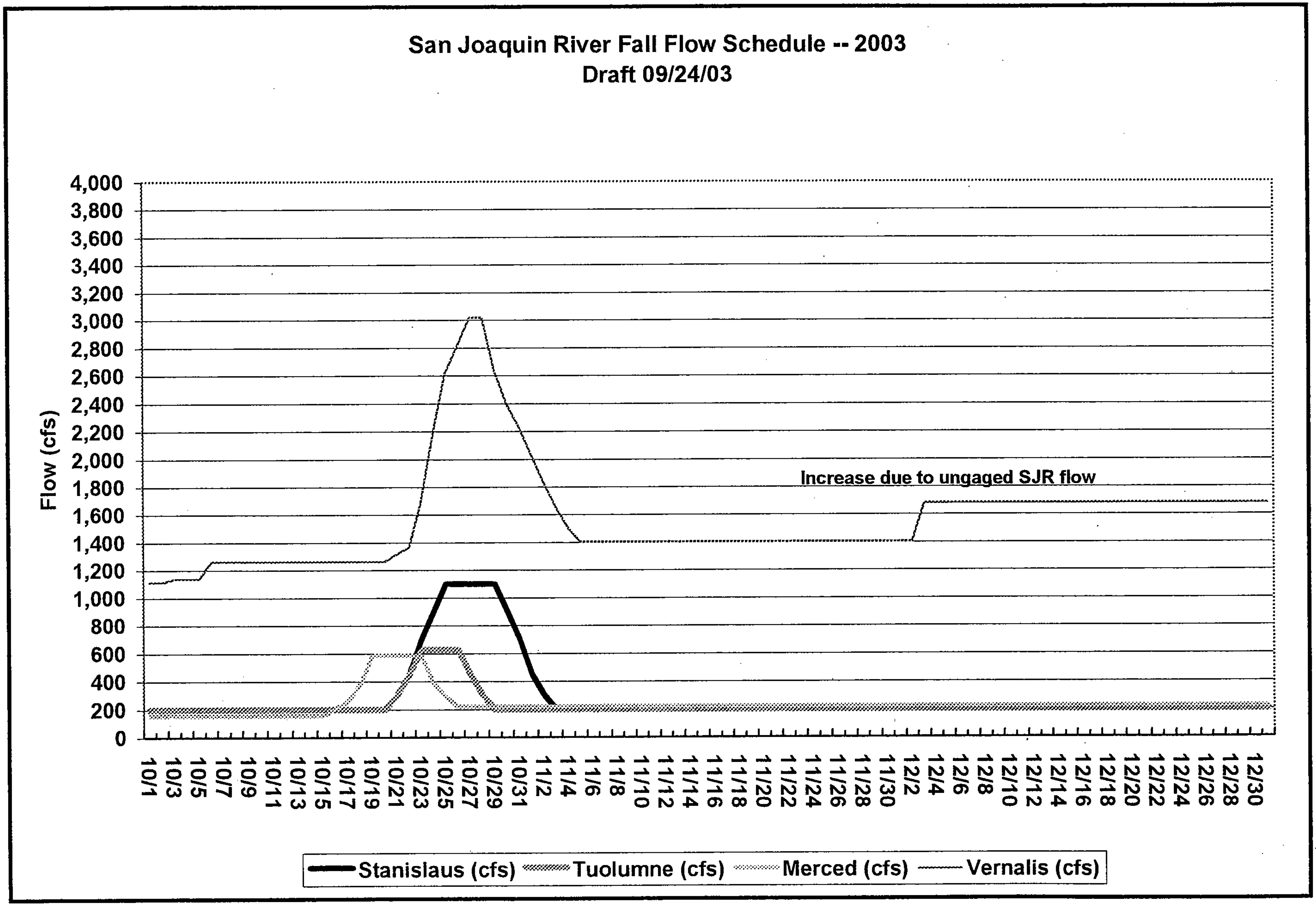
Oct 21 = Pulse ramp start date at Vernalis

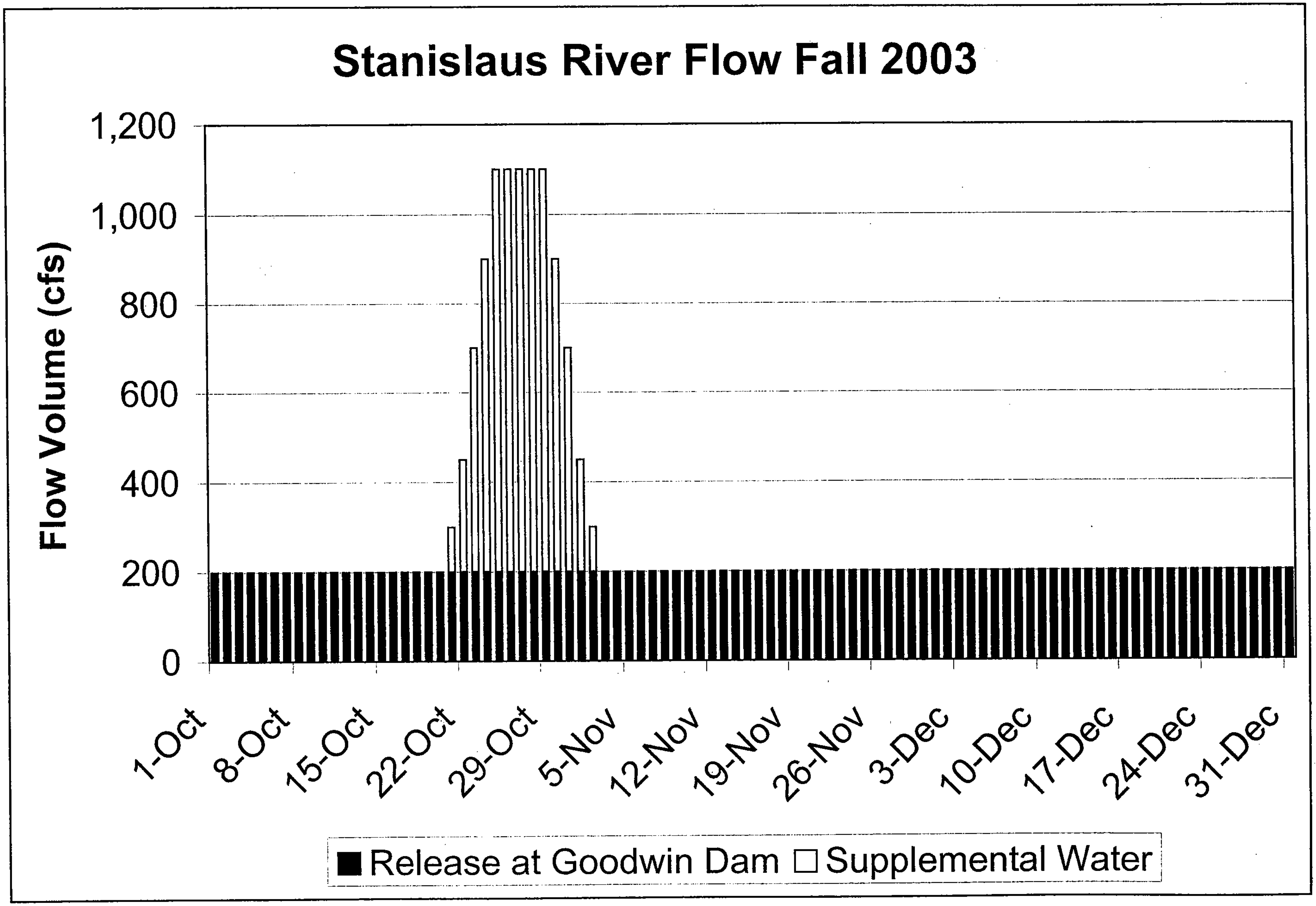
Date	Stanislaus (cfs)	Tuolumne (cfs)	Merced (cfs)	SJR Ungaged + Upper SJR (cfs)	Vernalis (cfs)	
26-Sep-03	200	175	30			
27-Sep-03	200	175	30			
28-Sep-03	200	175	30			
29-Sep-03	200	175	30			
30-Sep-03	200	175	30			
1-Oct-03	200	200	30	707	405	
2-Oct-03	200	200	30	707	405	
3-Oct-03	200	200	30	707	1137	
4-Oct-03	200	200	30	707	1137	
5-Oct-03	200	200	30	707	1137	
6-Oct-03	200	200	30	707	1137	
7-Oct-03	200	200	30	707	1137	
8-Oct-03	200	200	30	707	1137	
9-Oct-03	200	200	30	707	1137	
10-Oct-03	200	200	30	707	1137	
11-Oct-03	200	200	30	707	1137	
12-Oct-03	200	200	30	707	1137	
13-Oct-03	200	200	30	707	1137	
14-Oct-03	200	200	30	707	1137	
15-Oct-03	200	200	30	707	1137	
16-Oct-03	200	200	85	707	1137	
17-Oct-03	200	200	85	707	1137	
18-Oct-03	200	200	390	707	1137	
19-Oct-03	200	200	685	707	1137	
20-Oct-03	200	200	1,000	707	1137	TR pulse A
21-Oct-03	300	300	1,000	707	1192	**198**
22-Oct-03	450	450	1,000	707	1192	**496**
23-Oct-03	700	625	1,000	707	1697	**843**
24-Oct-03	900	625	700	707	2292	**843**
25-Oct-03	1,100	625	400	707	3032	**843**
26-Oct-03	1,100	625	220	707	3232	**843**
27-Oct-03	1,100	450	220	707	3432	**496**
28-Oct-03	1,100	300	220	707	3432	**198**
29-Oct-03	1,100	200	220	707	2957	tot. AF =
30-Oct-03	900	200	220	707	2507	**4760**
31-Oct-03	700	200	220	707	2227	
1-Nov-03	450	200	220	784	2027	
2-Nov-03	300	200	220	784	1827	
3-Nov-03	200	200	220	784	1654	
4-Nov-03	200	200	220	784	1504	
5-Nov-03	200	200	220	784	1404	
6-Nov-03	200	200	220	784	1404	
7-Nov-03	200	200	220	784	1404	



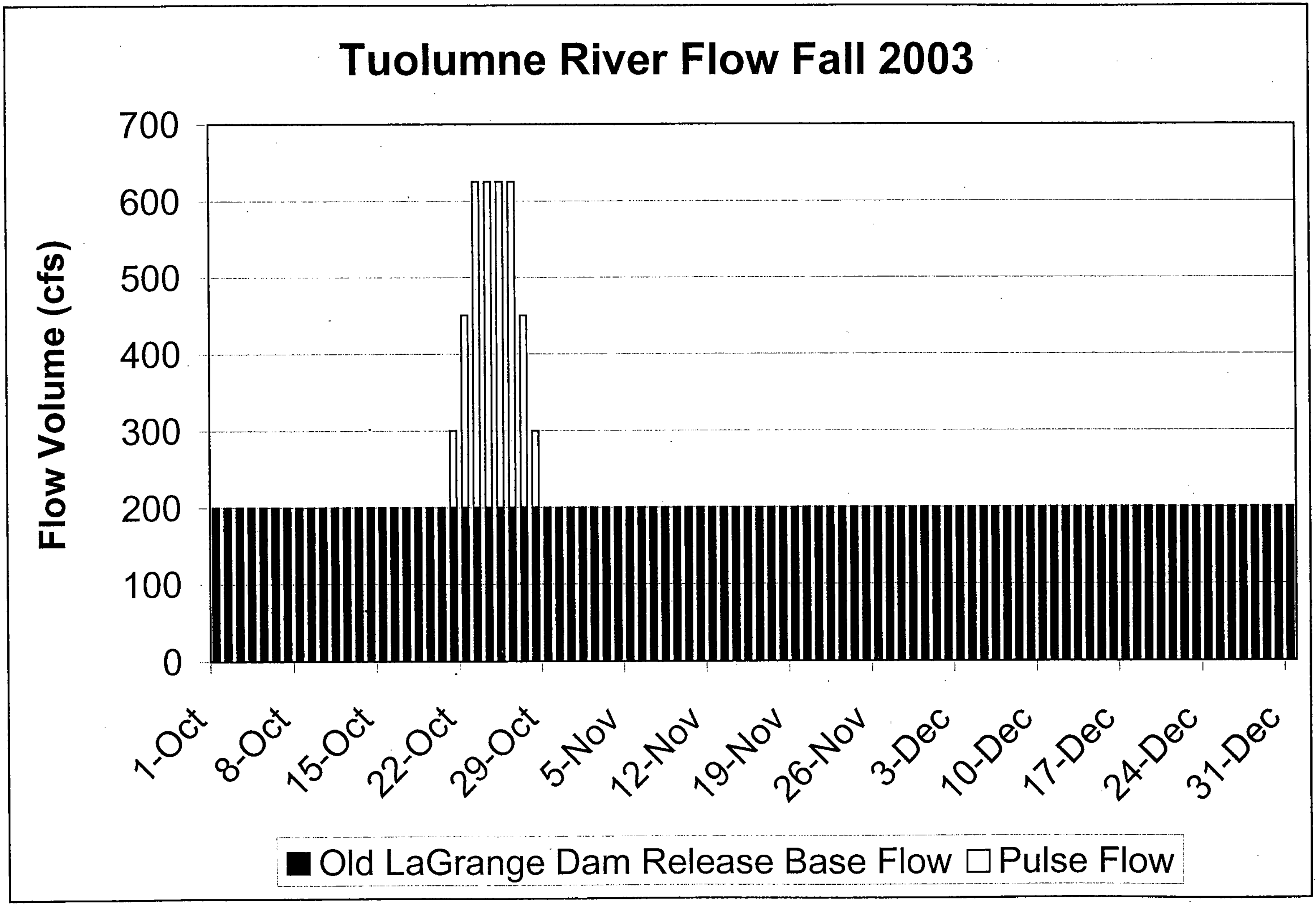
Tuolumne River Fall Flow Schedules
Draft 2003
Flow (cfs)
700
600
500
400
300
200
100
0
10/1
10/3
10/5
10/7
10/9
10/11
10/13
10/15
10/17
10/19
10/21
10/23
10/25
10/27
10/29
10/31
11/2
11/4
11/6
11/8
11/10
11/12
11/14
CDFG 2003
2002
2001
2000
1999

Marston

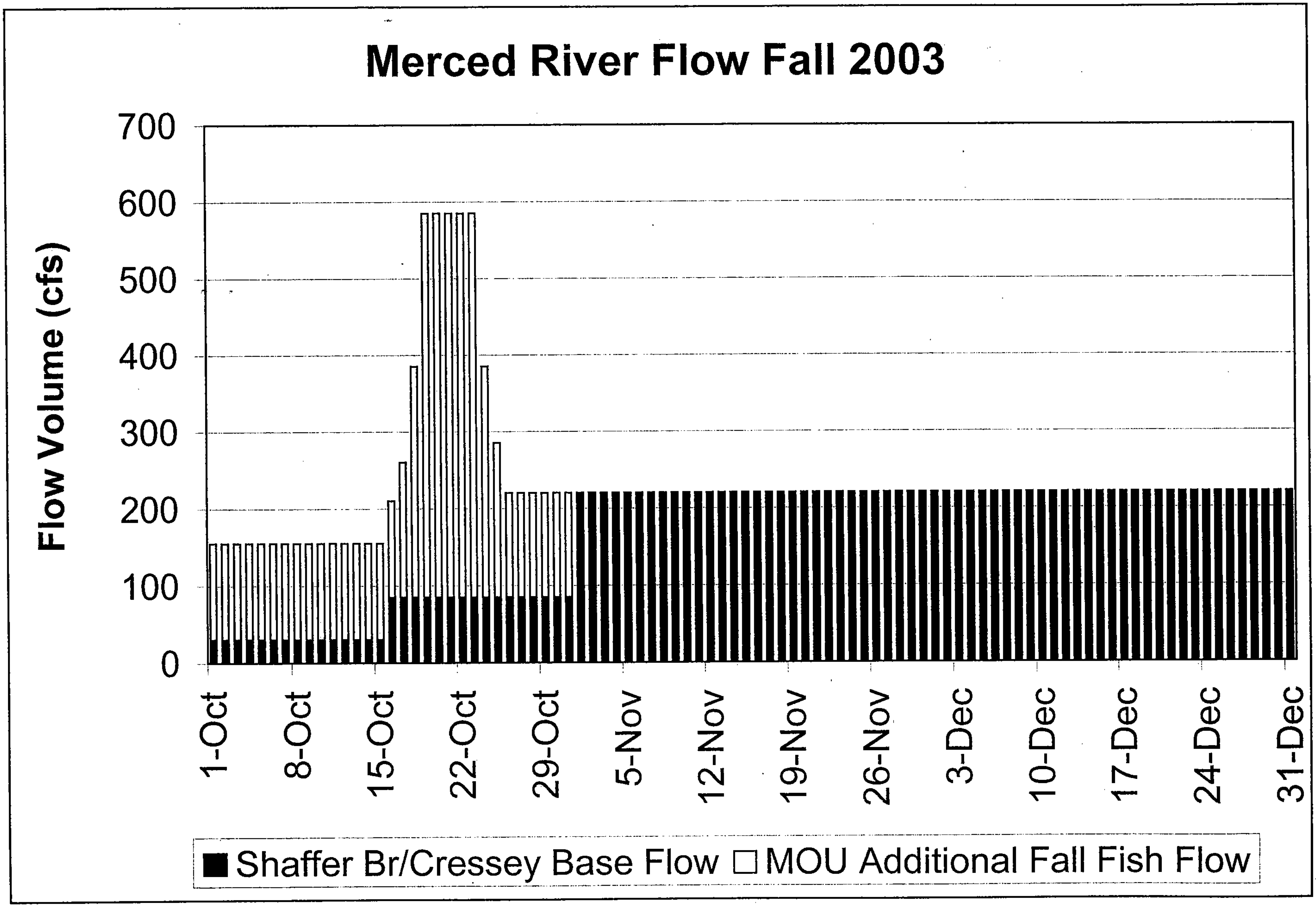

San Joaquin River Fall Flow Schedule -- 2003
Draft 09/24/03
Flow (cfs)
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
10/1 10/3 10/5 10/7 10/9 10/11 10/13 10/15 10/17 10/19 10/21 10/23 10/25 10/27 10/29 10/31 11/2 11/4 11/6 11/8 11/10 11/12 11/14 11/16 11/18 11/20 11/22 11/24 11/26 11/28 11/30 12/2 12/4 12/6 12/8 12/10 12/12 12/14 12/16 12/18 12/20 12/22 12/24 12/26 12/28 12/30
Increase due to ungaged SJR flow
Stanislaus (cfs)
Tuolumne (cfs)
Merced (cfs)
Vernalis (cfs)

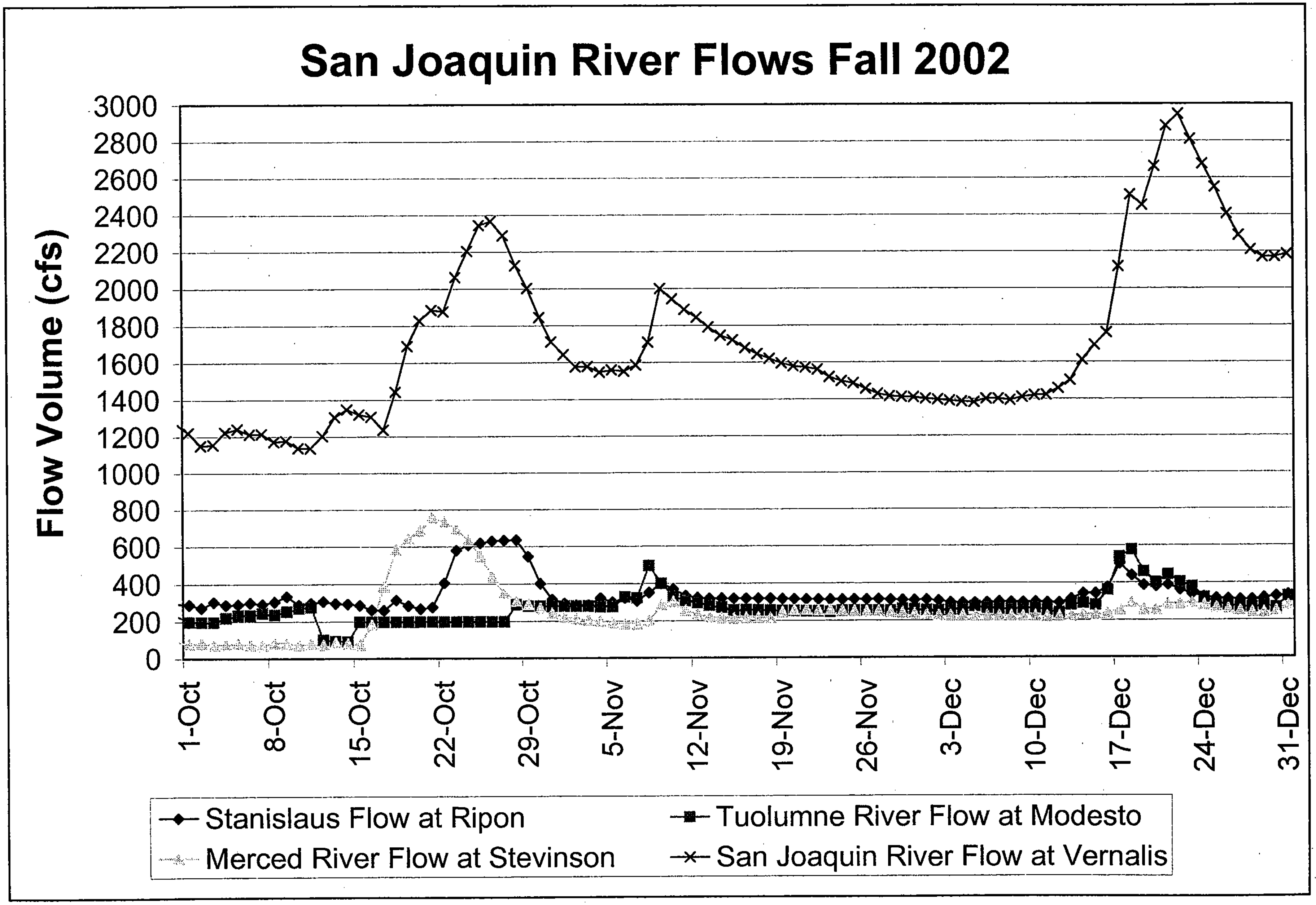


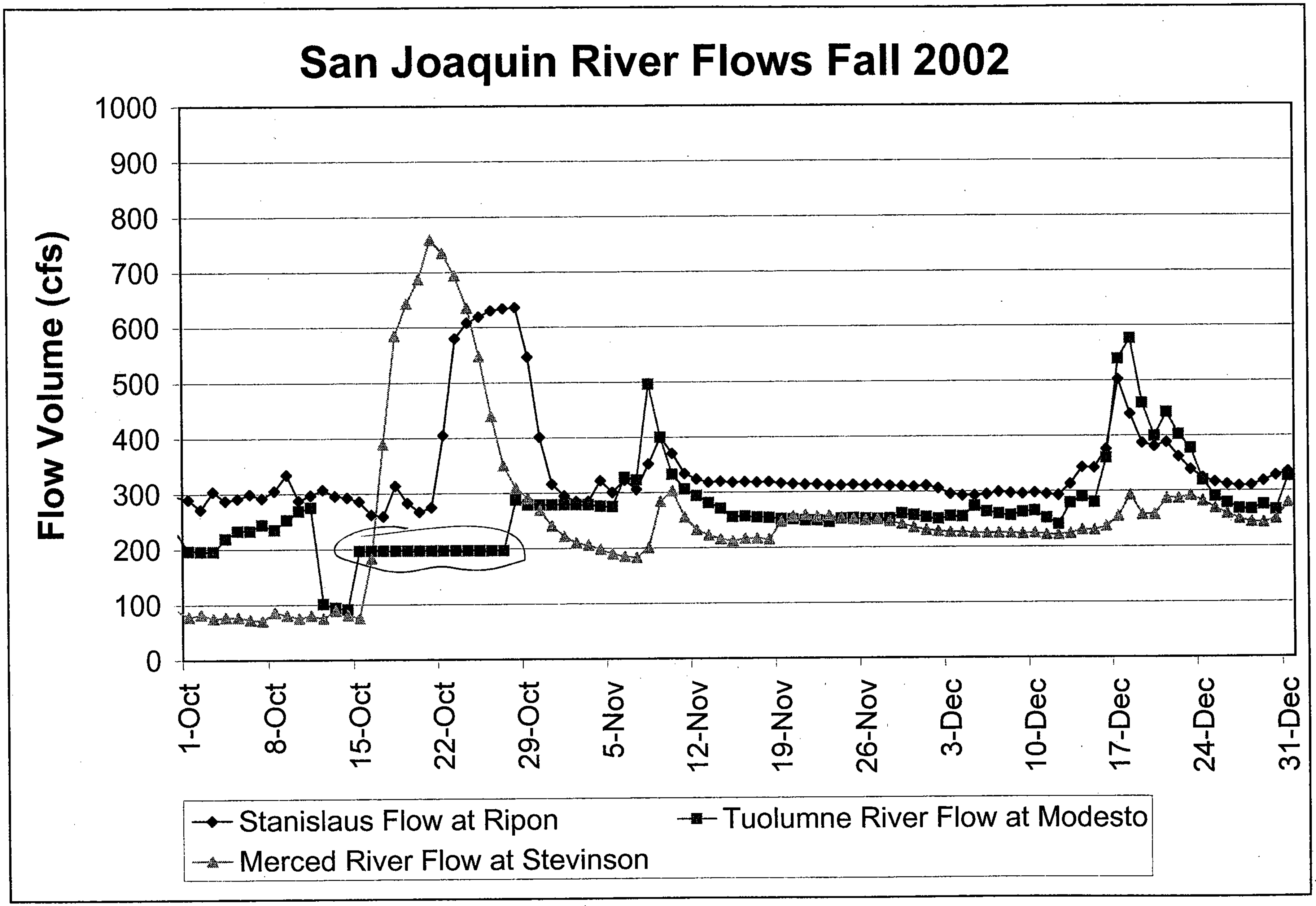
Stanislaus River Flow Fall 2003
Flow Volume (cfs)
1,200
1,000
800
600
400
200
0
1-Oct
8-Oct
15-Oct
22-Oct
29-Oct
5-Nov
12-Nov
19-Nov
26-Nov
3-Dec
10-Dec
17-Dec
24-Dec
31-Dec
Release at Goodwin Dam
Supplemental Water



Tuolumne River Flow Fall 2003
Flow Volume (cfs)
700
600
500
400
300
200
100
0
1-Oct
8-Oct
15-Oct
22-Oct
29-Oct
5-Nov
12-Nov
19-Nov
26-Nov
3-Dec
10-Dec
17-Dec
24-Dec
31-Dec
Old LaGrange Dam Release Base Flow
Pulse Flow


Merced River Flow Fall 2003
Flow Volume (cfs)
700
600
500
400
300
200
100
0
1-Oct
8-Oct
15-Oct
22-Oct
29-Oct
5-Nov
12-Nov
19-Nov
26-Nov
3-Dec
10-Dec
17-Dec
24-Dec
31-Dec
Shaffer Br/Cressey Base Flow
MOU Additional Fall Fish Flow


San Joaquin River Flows Fall 2002
Flow Volume (cfs)
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1-Oct
8-Oct
15-Oct
22-Oct
29-Oct
5-Nov
12-Nov
19-Nov
26-Nov
3-Dec
10-Dec
17-Dec
24-Dec
31-Dec
Stanislaus Flow at Ripon
Tuolumne River Flow at Modesto
Merced River Flow at Stevinson
San Joaquin River Flow at Vernalis



San Joaquin River Flows Fall 2002
Flow Volume (cfs)
1000
900
800
700
600
500
400
300
200
100
0
1-Oct
8-Oct
15-Oct
22-Oct
29-Oct
5-Nov
12-Nov
19-Nov
26-Nov
3-Dec
10-Dec
17-Dec
24-Dec
31-Dec
Stanislaus Flow at Ripon
Tuolumne River Flow at Modesto
Merced River Flow at Stevinson

TURLOCK IRRIGATION DISTRICT

WATER PLANNING DEPARTMENT
MEMORANDUM

TO: TRTAC
FROM: Wilton Fryer
DATE: 25 September 2003
RE: Project Status Update

Project	Funding	Status
SRP 9	Full	Constructed, revegetation planted, and plant maintenance & irrigation will finish in November. NOC filed March 2003.
SRP 10 Dike	Full	Construction complete. NOC filed March 2003.
7\11 Segment	Full	Constructed, revegetation 95% planted, and plant maintenance & irrigation on going. 7\11 Materials NOC filed March 2003.
MJ Ruddy	Full	CBDA amendment approved with Federal funds for ROW available starting in September and October 03. Revised date for construction start has not been set.
Warner-Deardorff	Partial	30% design complete, permitting started, remaining design started. Continuing work on revised SOW for CALFED Directed Action funding contract.
Design Manual	Full	Due to complete by October 2003.
Course Sediment	Full	Draft final report under review.
La Grange Gravel	Full	Domecq\Zanker gravel acquisition funding contract is in place. 1st public introduction was in La Grange, 9 September.
Fine Sediment	Full	Gasburg Creek watershed analysis report was revised, as has sediment basin design. Waiting for DFG comments on site layout. Evaluation of gravel cleaning equipment and methods continuing.
RM 43	Full	DWR contract in place, site reviews done, starting design.

SRP 10	Partial	Several channel layouts under review in preparation of design and budget information for anticipated Fall CBDA PSP for construction. Looking for alternative land acquisition funding.

I. Project Description

Summary

This is a proposal to restore approximately 200 acres of floodplain habitat along the lower Tuolumne River near the town of La Grange. The project area, approximately 30 miles east of the City of Modesto, lies on public land owned by Stanislaus County Parks Department, and lies adjacent to the prime salmon and steelhead spawning reach of the lower Tuolumne River (Figure 1). The Tuolumne's salmon population is, on average, the largest natural salmon population in the San Joaquin Valley and has been the focus of intensive large-scale restoration over the past 10 years.

Existing Conditions

The existing conditions of the project site are defined by intensive uses over the past several decades, including dredger mining, removal of gravels for the construction of New Don Pedro, and cattle grazing.

The Tuolumne River between Old La Grange Bridge (RM 50.5) and Basso Bridge (RM 47.5) is a focal point in the Tuolumne watershed. Here, the river emerges from the upstream canyons and foothills onto the alluvial valley. Prior to the construction of La Grange Dam in 1893, deposition of coarse sediment transported from the upper watershed began in this reach, forming alternating bar sequences that historically provided high quality spawning and rearing habitats for spring and fall-run chinook salmon (and potentially steelhead) populations. Broad expanses of floodplain along the river channel also historically provided riparian habitat for native plant and wildlife species.

Beginning in the early 1900's, gold dredges razed the river channel and floodplains in this reach, and then in the late 1960's floodplains were scraped clean of most abandoned dredger tailings to build New Don Pedro Dam (completed in 1971). While the river channel was partially reconstructed in the early 1970's with Davis-Grunsky Act funds, the surrounding floodplains were left with an unnatural and dysfunctional topography and fragmented riparian habitats of low diversity.[1] These floodplains are inundated much less frequently under the regulated streamflow regime, and when floods do occur, salmon risk becoming stranded in the numerous floodplain depressions left behind by the gold dredgers. In recent years, the river channel and salmonid habitats have further deteriorated due to the lack of coarse sediment recruitment below the dams.

Finally, the project site is subject to un-permitted grazing by cattle because there is an inadequate or no fence to prevent trespass. Except for willows, cattle have grazed and walked upon any incipient vegetation preventing its establishment.

Ecological Problem

The problem this project addresses, common to all rivers throughout California's Central Valley, is insufficient channel-floodplain connectivity to support riparian species and rearing habitat for

[1] The floodplains along the Tuolumne were never rehabilitated because dredger mining occurred prior to the instituting of the Surface Mining and Reclamation Act (SMARA) of 1975.

juvenile chinook (*Oncorhynchus tshawytscha*), and steelhead (*O. mykiss*). The prime spawning reach of the Tuolumne River suffers from lack of native riparian vegetation, fine sediment overloading, high stranding, and a floodplain disconnected from its channel. Secondary problems this project addresses include insufficient gravel supplies for gravel augmentation projects, degradation of vegetation by cattle, and low diversity and complexity of riparian vegetation.

Solution

The proposal solves the problem of insufficient channel-floodplain connectivity by recontouring and lowering floodplain surfaces to better match the regulated flow regime(Figure 2). Whereas pre-Don Pedro channel forming flows of 8,000-9,000 cfs would have occurred approximately every 2 years, the river rarely is subject to these flows under regulated conditions. The regulated 2-year flow is 4,600 cfs. This reduction in flows has left the floodplain high and inaccessible to these floodwater so that floodplain inundation occurs very infrequently. By physically lowering the floodplain surfaces, we will create a floodplain that will be inundated, on average, every 1 to 2 years.

The project will contribute to a solution of insufficient gravel supply by stockpiling gravel on site for use by the California Department of Fish and Game and/or the Turlock Irrigation District for ongoing gravel supplementation programs. While this project does not include gravel additions as a task, stockpiling gravel for this purpose will create a readily available source for the ongoing programs. Costs of these programs, which have been funded by CALFED, State Delta Pumping Plant Mitigation Funds, and other State sources, will be significantly decreased as a result of the gravel stockpiling.

The project will solve the problem of cattle trespass by installing fencing either along the entire perimeter of the project site or at key locations. Cattle have been trespassing on the site from nearby ranchlands because existing fencing, if any, is insufficient to exclude cattle from the site.

The project will solve the condition of poor riparian habitat by planting a diverse palate of riparian species at appropriate elevations on the project site. We anticipate that a diverse riparian forest will more readily establish once floodplains have been graded and the inundation frequency has increased. This will facilitate the establishment of actively planted areas and improve natural recruitment of riparian species. It will also improve the ability of the riparian forest to sustain itself over time.

The opportunity to reverse these degraded conditions is enormous. Over 85% of the floodplain land on the south bank of the Tuolumne River between Basso Bridge and Old La Grange Bridge is publicly owned by either Stanislaus County or the State of California. The remaining stretch of privately owned land (31 acres) is under negotiation for purchase by the Wildlife Conservation Board. The proposed "La Grange Floodplain Restoration and Gravel Augmentation Project" proposes to undertake the deferred reclamation of county-owned land of these highly valuable but damaged floodplains, restoring native riparian habitat and functional floodplains on public lands, and dovetailing with ongoing channel rehabilitation efforts. The project also provides the opportunity to incorporate public access for boating, biking, and hiking, wildlife viewing, and picnicking to satisfy public use and Parks Department needs.

The overall project contains the following six tasks. This proposal seeks funding for Task 1; subsequent tasks will be funded through separate grants once the project designs are completed:

- 1. Prepare conceptual restoration designs (including existing and proposed design topography) to lower the floodplain surface to elevations that inundate at contemporary bankfull floods;
- 2. Process (screen and wash) and stockpile excess coarse sediment material to produce spawning gravel material that can be placed in the river to supplement spawning gravel supplies;
- 3. Reduce fine sediment stored on the floodplain, and eliminate floodplain depressions that expose salmonids to stranding mortality;
- 4. Revegetate floodplains with native riparian vegetation, including Fremont cottonwood and Valley Oak plant stands;
- 5. Incorporate facilities for public recreation, including trails, restrooms, picnicking sites, etc.

Resulting Habitats

The project will result in the following:

- 200 acres of improved floodplain habitat. Portions of the floodplain will be regraded and lowered to improve connectivity with the channel, thus providing greater access to the floodplain for salmonids while eliminating salmonid stranding locations. Additionally, improved natural regeneration of riparian species will result from lowered floodplain terraces.
- Improved salmon spawning gravels. Although this project does not propose gravel supplementation, excess gravels will be processed and stockpiled on site for future use by ongoing gravel supplementation programs of California Department of Fish and Game and the Tuolumne River Technical Advisory Committee. We estimate 50,000 to 100,00 cu yds[2] of high quality salmonid spawning gravel will be stockpiled through this project.
- 200 acres of improved riparian habitat. Subsequent to regrading, riparian corridors will be re-planted, including valley oaks, Fremont cottonwoods, willows, alders, box elder, and other native tree and herbaceous species.

Long-term Management Plan

Project planning will include the development of a long-term management plan for the project site. The CALFED Adaptive Management Forum has focused attention on lower Tuolumne River projects; thus, much collective thought has been directed to Tuolumne restoration projects, what has worked, and what has not. This plan will be consistent with contemporary adaptive management standards.

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[2] This estimate assumes approximately 25% (50 acres) of the total project area can be mined to an average of 2-3 ft, and that approximately 40% is coarse spawning gravel material.

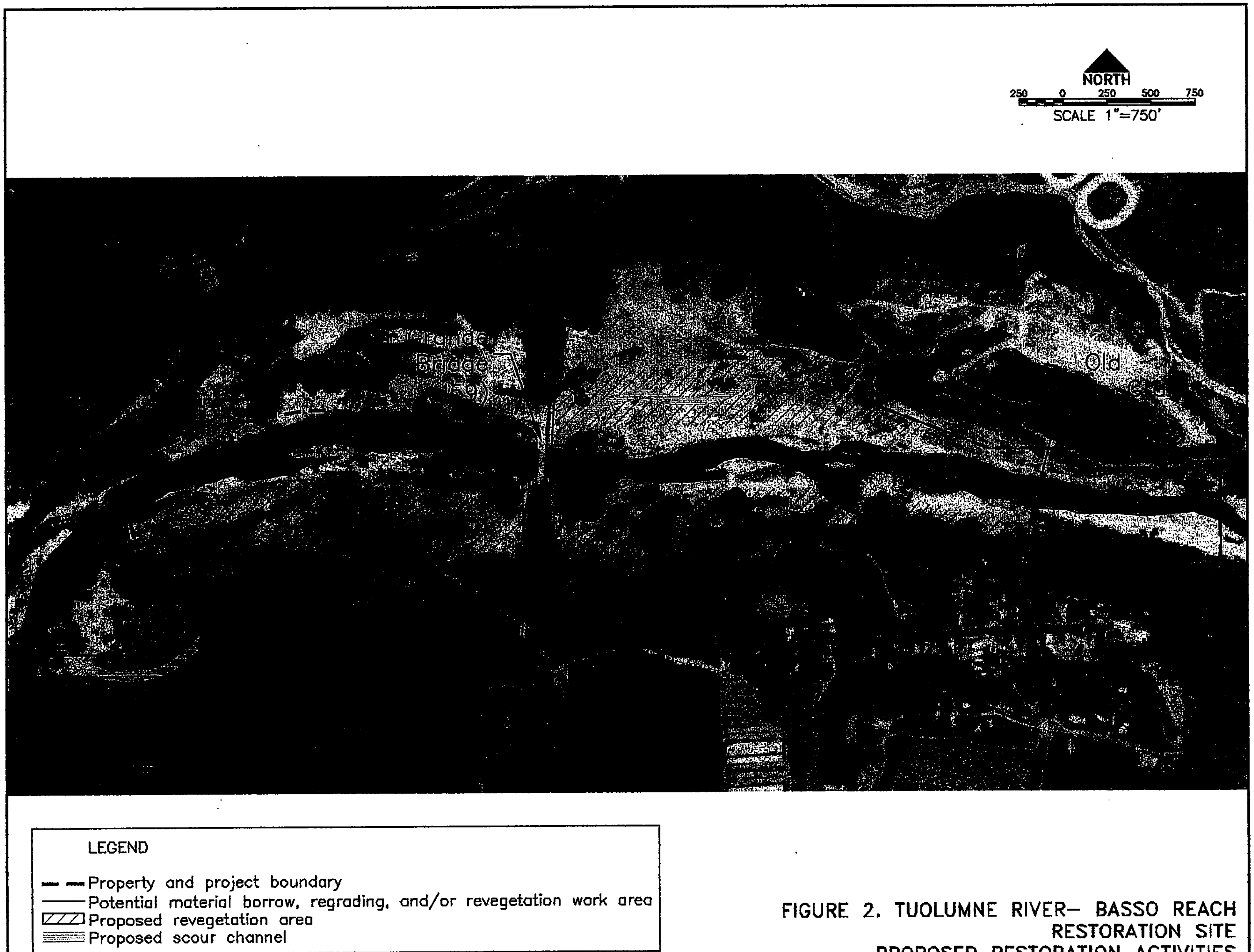


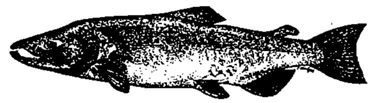
FIGURE 2. TUOLUMNE RIVER– BASSO REACH
RESTORATION SITE
PROPOSED RESTORATION ACTIVITIES

9/22/2003

17 DEC 2003 MEETING

TUOLUMNE RIVER TECHNICAL ADVISORY COMMITTEE
DON PEDRO PROJECT - FERC LICENSE 2299

MODESTO IRRIGATION DISTRICT
TURLOCK IRRIGATION DISTRICT
CITY & COUNTY OF SAN FRANCISCO
CALIFORNIA DEPARTMENT OF FISH & GAME
U. S. FISH & WILDLIFE SERVICE



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TECHNICAL ADVISORY COMMITTEE MEETING

17DEC, 2003, 9:30 a.m.

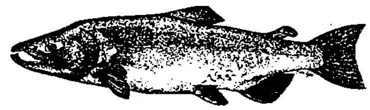
Turlock Irrigation District, Lunch Room (2nd floor)

AGENDA

1. Introduction
   A. Comments on draft agenda and prior meeting notes
   B. Correspondence since last meeting
2. **ACTION ITEMS:**
   A. Tasks associated with December response to FERC
   B. 2004 monitoring
3. General FSA Update:
   A. FSA/Order activity, expense tracking, and report status
   B. Review of activities from last meeting
   C. VAMP, Agency, and NGO updates
   D. Monitoring
      1. Spawning survey status
      2. Sampling proposals (Districts, Mesick, other?)
      3. Other monitoring
   E. River operations
   F. Restoration
      1. Funding, planning and implementation
      2. Project monitoring
      3. Mesick presentation and Lover's Leap proposal
      4. Other restoration information
4. Additional items
5. Next meeting and topics

TUOLUMNE RIVER TECHNICAL ADVISORY COMMITTEE
DON PEDRO PROJECT - FERC LICENSE 2299

MODESTO IRRIGATION DISTRICT
TURLOCK IRRIGATION DISTRICT
CITY & COUNTY OF SAN FRANCISCO
CALIFORNIA DEPARTMENT OF FISH & GAME
U. S. FISH & WILDLIFE SERVICE



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TECHNICAL ADVISORY COMMITTEE
MEETING MINUTES of

17 December 2003

DRAFT #1

1. AGENDA & PRIOR MINUTES

A. The agenda was accepted as proposed. The minutes for the meeting of 25 September 2003 had been sent by email with the agenda. No comments were received regarding the minutes. Ligon, Gaedeke, and Bevelheimer joined the meeting by phone.

B. The correspondence list since the last TRTAC meeting was presented by Ford.

2. ACTION ITEMS:

A. The information filed with FERC on 1 December was the rainbow trout information available to the Districts. It was acknowledged that there are data gaps that could be filled. Tim Heyne of DFG reported that the genetic study by Jennifer Nielson may be completed and he would distribute it when available. The trout otoliths are with Chris Zimmerman in Alaska as part of a valley-wide study being conducted. He indicated the trout scales were with Brian Beale in Visalia (Region 4 Wild Trout biologist) and there was no priority to get them analyzed. Any other data should be provided for complete summary.

B. Potential tasks to be included in the 2004 Monitoring Program, with particular emphasis on trout:

a. There was discussion on the difficulty in conducting spawning surveys for steelhead compared to the current effort for salmon. Walser indicated the survey period could be extended into May. Redds are smaller, more difficult to see and the fish are fewer and more wary than salmon, making counting difficult. There was further discussion on the need to agree on what constituted steelhead spawning habitat, particularly related to future riffle reconstruction projects. 2004 could have reconnaissance surveys for typical habitat features and a subsequent surveys to better detail those habitat areas. Heyne proposed consideration of a more intensive approach using a North Coast method that he would provide. He further suggested that approach could take a year or two to develop a study approach. He was also concerned about DFG staffing any survey work. He did confirm that DFG had no winter survey data. Martinez will provide American River survey methods. Mesick/Walser will ID sites on the habitat maps.

b. There was discussion on the status of the current temperature model and the interest in moving to a daily time step and incorporating additional thermograph data. Hume will provide an estimate of the cost of model update. The discussion included DO monitoring and it should be considered. There was some brief discussion of trout temperature ranges in the December submittal to FERC. There was discussion on the issue of how to consider impacts due to conditions in the Delta as it affected the survival of both salmon and steelhead.

c. Martinez suggested one or more snorkel surveys be done between the current June and September surveys.

d. Martinez requested monitoring plans in January, as a permit for some monitoring may need to be expedited.

3. GENERAL INFORMATION:

A. Tim Ford went over the FSA program expenses to date. The use of the contingency funds for completing the earthwork on the 7\11 Project pushed the FSA funds significantly higher for the year, leaving about $100,000 for non-flow measures. There is only about $80,000 estimated remaining for monitoring.

B. Other updates: The next CBDA PSP will focus on monitoring and this could be problematic for obtaining construction funds for next phases of projects that are designed and permitted on the Tuolumne River. FERC decision on petition will be posted in 2-3 days.

C. Monitoring (not covered under the Item 2 monitoring discussion):
The status of the current year spawning survey was not available from DFG. The monitoring subgroup may resume working on the monitoring "umbrella document" to combine river wide and project specific monitoring.

D. River Operations were not discussed, as there is no planned changes in the current flow schedule.

E. Restoration Project Update:

a. Wilton distributed a summary sheet indicating the status of the TRTAC sponsored restoration projects. Wilton requested TRTAC approval to proceed with an amendment to the La Grange Gravel Acquisition and Sediment Transfusion project. Technical mining permit and aggregate acquisition issues, combined with protests by adjacent neighbors and a Grand Jury inquiry into how the mining and acquisition portion of the project was formulated and presented to the public will make the mining and acquisition portion of the project problematic. The amendment to go before the CBDA review panel would delete the mining and acquisition portion of the project and shift those funds to increasing the inchannel gravel placement portion of the project. There was discussion if another agency or NGO on the TRTAC would be able to takeover the project in its original form. It was agreed that the current controversy would remain regardless of who was managing the project. **ACTION ITEM**: Wilton was directed to proceed with the amendment submittal.

b. Carl Mesick and Steve Walser (California Rivers Restoration Fund) presented riffle design features for steelhead and monitoring for riffle restoration projects in the vicinity of Lovers Leap on the Stanislaus River. Handouts were distributed showing the use of GPS to map out velocity profiles over riffles and typical microhabitat features the steelhead seem to prefer, including aggregate sizes. Salmon and steelhead habitats were found to be in close proximity. There were questions as to what level of detail would be sufficient for laying out the basic design during reconstruction of riffles. Mesick presented information on the difficulties in conducting monitoring for steelhead and a proposal for sampling under a NOAA Fisheries Section 10 permit.

5. NEXT MEETING & TOPICS:

a. The next monitoring subgroup meeting will be 0930 to 1530 on Wednesday 28 January 2003 in Room 3A at MID. The meeting will further focus on steelhead.

b. The next TRTAC meeting will be 0930 to 1530 on Thursday 11 March 2003 at TID.

FERC 2299 TAC Meeting
17 Dec2003

Name	Organization
Tim Ford	TID/MID
Wilton Fryer	TID
Darren Mierau	M&T
Patrick Koepele	TRPT
Jeff McLain	USFWS
J.D. Wikert	USFWS
Allison Boucher	FOTT
Ron Yoshiyama	CCSF
Noah Hume	SWS
Tim Heyne	DFG
Janiel Killen	NOAA Fisheries
Madelyn Martinez	NOAA Fisheries
Carl Mesick	CRRF
Steve Walser	CRRF

By phone:

Frank Ligon	SWS
Mark Bevelhimer	ORNL
Erich Gaedeke	FERC

McBain & Trush
FISHERIES
HYDROLOGY
RIPARIAN ECOLOGY
STREAM RESTORATION
FLUVIAL GEOMORPHOLOGY
P.O. Box 663, Arcata, CA 95518 • 824 L Street, Studio 5, Arcata, CA 95521
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Summary of the challenges, options, and recommendations for the Zanker/Domecq Sediment Acquisition and Spawning Gravel Transfusion Project

December 10, 2003

Prepared for: The Tuolumne River Technical Advisory Committee
FROM: Wilton Fryer (TID) and Darren Mierau (McBain and Trush)

In Spring of 2003 TID was awarded funding from the California Bay Delta Authority (CBDA) to acquire a large source of former dredger tailings at the Joe Domecq County Park (owned by Stanislaus County) and the Zanker family properties along Lake Road near Basso Bridge, and then begin the "sediment transfusion" phase of coarse sediment management as described in the Tuolumne River Coarse Sediment Management Plan. In response to some recent critical issues raised as the project has developed, some major changes to the project are being proposed. This memorandum is intended to bring the TRTAC up to date on the status of the project, describe some of the critical issues we've identified, describe alternatives that have been evaluated by TID and McBain and Trush, and propose a course of action based on our evaluation of the alternatives.

The original intent of the project was to

- Purchase and develop a large volume of coarse sediment (gravel and cobble) to be used for immediate and future restoration and spawning gravel augmentation projects along the river;
- Introduce gravel and cobbles to the Tuolumne River in appropriate locations to increase salmonid spawning and rearing habitat, and improve geomorphic processes during high flow events;
- Reduce the demand for regionally valuable commercial aggregate;
- Restore off-channel wildlife habitat (wetlands, riparian, and woodland habitats) in the Joe Domecq County Park and Zanker parcels as the dredger spoils are removed;
- Improve recreational uses (hiking trails, picnic areas, wildlife viewing), and general habitat value on the Stanislaus County parcels;

The gravel augmentation component of this project would continue the gravel transfusion work begun in 1999 by CDFG, and address the critical need, outlined in the Coarse Sediment Management Plan, to restore the severely depleted salmonid spawning gravel supplies in the river.

Since the project began in September 2003, McBain and Trush have been collecting field data needed to develop the reclamation plan at the Zanker/Domecq sediment source sites, including (1) conceptual habitat designs for wetland and riparian restoration, (2) topographic surveys with licensed surveyor for the 300 acre parcel, (3) sediment composition sampling and volume analyses, (4) groundwater data, and vegetation mapping. Aldaron Laird of Trinity Associates has also begun developing CEQA/NEPA documents and regulatory permit applications for the project. During this ongoing planning phase of the project, however, two critical issues have arisen that jeopardize the implementation of the mineral purchase and processing component of the project. The critical issues are as follows.

First, as the project is proposed, TID would purchase the mineral rights for all aggregate available for mining at the Zanker and Domecq properties, but would mine and remove only a portion of the total available at the site. Approximately 200,000 cu yds would be excavated and sorted to produce approximately 100,000 cu yds of spawning gravel. The total estimated volume of mineral purchased is 1,486,000 cu yds. The mineral rights for the remaining un-mined aggregate would remain under TID ownership for future, as yet unfunded, projects. This scenario presents technical and contractual issues (e.g., tax liability, guaranteed long-term access, perpetual easements, undefined project termination, uncertainty over future funding) that present potential barriers to project implementation. The TID Board of Directors does not wish to engage in the mining business, and have directed staff to that effect.

Second, some local landowners have objected to the project, particularly the volume of aggregate initially proposed to be extracted, and potential impacts to existing wildlife habitat. While the property has been identified by the California Division of Mines and Geology as a high priority Mineral Resource Zone (MRZ), the support of the local community is nevertheless important to the project's success.

To minimize or avoid these issues but maintain the project goals, several alternatives to the existing project were explored, including:

(1) Avoid the mining component of the project altogether, shifting all available budget to purchasing gravel supplies from the commercial market and proceeding with the gravel transfusion. This alternative would address the local landowner concerns and TID Board of Directors interests, but it may result in increased unit costs for purchased gravel, it presents conflicts with using commercial aggregate for river restoration, and it may contribute to additional mining pit excavation.

(2) Concentrate all available project funds at the Joe Domecq County Park, with the intent of purchasing **only** the volume of gravel that would be processed, transported to the river, and inserted at proposed gravel augmentation sites. The excavation, processing, and placement of gravel would be put out to bid similar to the Mining Reach projects. This alternative would eliminate the problems of long-term mineral ownership, and maximize the amount of gravel that could be produced and placed into the river. The Zanker properties would be excluded to avoid having to purchase up-front their entire supply of available mineral. This option does not address concerns expressed by local landowners, nor the direction from the TID BOD, but it maintains project objectives related to avoiding the use of commercial aggregate and contributing to floodplain pit excavation, and reducing gravel per-unit costs.

(3) Transfer the long-term ownership of the acquired mineral to a third party that has the capability of maintaining long-term ownership and potential future use of the gravel (e.g., CDFG, FOTT, TRT, etc.). Again, this option may eliminate some or all of the technical/contractual difficulties and TID BOD issues, but does not address the landowner concerns.

Any of these proposed changes would likely require amending the existing CBDA contract.

On December 8, the TID Board of Directors directed the project managers to pursue Alternative 1 above. A letter was sent to Kevin Williams of Stanislaus County Department of Environmental Resources, describing the Board's decision. The Zanker family has also been notified of potential changes to the project.

Tim Ford - Memo to TRTAC on coarse sediment project

From: Tim Ford
To: Allison Boucher; Andrea Fuller; Art Jensen; B. Johnston; Bill Jennings; Bill Johnston; Bill Loudermilk; Carl Mesick; Darren Mierau; Dave Boucher; Dean Marston; Deborah Giglio; Dennis Blakeman; Donn Furman; Eric Theiss; Erich Gaedeke; Erin Strange; Frank Ligon; Jeff McLain; Jenna Olsen; Jim Koontz; John Chester; Madelyn Martinez; Mike McElhiney; Nicole Sandkulla; Noah Hume; Pat Brantley; Patrick Koepele; Robert M. Nees; Roger Masuda; Ron Yoshiyama; Scott McBain; Tim Ford; Tim Heyne; Tim Ramirez; Walter Ward; Wil Fryer
Date: 12/16/2003 2:37 PM
Subject: Memo to TRTAC on coarse sediment project

To TRTAC list:

- See attached "TRTAC material list since 25SEP meeting"

- See attached "Potential project concerns for steelhead trout" write-up provided today by Erich Gaedeke (FERC). We can discuss this as part of agenda item 2A and see if we can have Erich and Mark Bevelhimer (ORNL) join by phone for that part of the TRTAC meeting. Please try to bring a copy of the 01DEC filing (I sent that out on 04DEC) and other recently distributed materials to the meeting.

Tuolumne River Technical Advisory Committee
Materials since 25SEP2003 TRTAC meeting

(underlined items are designated for inclusion in the FERC Report)

* 15OCT: TID Flow schedule update letter dated 09OCT
* 12DEC: 17DEC Meeting notice and Mesick proposals
* 15DEC: Draft agenda and SEP meeting notes
* 15DEC: Memo from McBain and Trush on coarse sediment project
* 16DEC: TRTAC materials list (Ford) and potential steelhead concerns from FERC (Gaedeke)

Subgroup items:

* 15NOV: Article about eastern Pacific ecosystem changes
* 04DEC: Districts 01DEC letter to FERC re: *Oncorhynchus mykiss*

I:\WORD\TRTAC-1\2003\material list 12-2003.doc 12/16/03 TJF

Don Pedro Project – Potential Project Concerns for Steelhead Trout

I. Potential Project Concerns

Based on preliminary analysis of the situation, it seems that the principle questions are:

1) For adults, do river temperatures or flows (both of which are directly related to project operations) affect immigration, spawning site availability, survival, and emigration from the system?
2) For juveniles, do river temperatures or flows affect over-summer survival and emigration from the system?

Table 1 lists potential project concerns by life stage and the types of tools or analyses that might be useful in addressing these concerns. Below the table is a summary of existing information that addresses the types of potential concerns identified. We expect that those more familiar with existing data can add to this analysis.

Table 1. Potential prospective and retrospective tools that could be used to provide evidence for the assessment of the Don Pedro project concerns on steelhead trout in the Tuolumne River. Numbers in brackets refer to discussion of available evidence in text.

Life Stage	Concern	Prospective Tools	Retrospective Tools
Adult	Mortality [1.1] (as a result of poor water quality or perhaps stranding)	Temporal and spatial thermal analysis (available temps vs. life stage tolerances)	Observed mortality during periods of high temps or extreme flow fluctuations
	Growth [1.2] (reduced growth while in river)	Predicted growth as function of environmental conditions using a bioenergetics model	Measure of observed growth (otoliths, scales) relative to steelhead in nearby river systems
	Migration [1.3] (blockage or delay)	Temporal and spatial thermal analysis (primarily in lower river)	Observed difficulties in migration due to physical or water quality barriers
Egg	Reduced hatching [1.4]	Comparison of environmental needs (i.e., gravel, water quality, flow) and existing conditions	Measured hatching success in known steelhead redds
Alevin/Fry	Mortality [1.5]	Comparison of environmental needs (i.e., gravel, water quality, flow) and existing conditions	Measured swimup success in known steelhead redds

Life Stage	Concern	Prospective Tools	Retrospective Tools
Juvenile	Mortality [1.6]	Comparison of environmental needs (i.e., water quality, flow) and existing conditions	
	Growth [1.7]	Bioenergetics model of expected growth	Observed growth in field (periodic length-weight measurement; otolith analysis)
	Migration [1.8]	Temporal and spatial thermal analysis (primarily in lower river)	Observed difficulties in migration due to physical or water quality barriers (screwtrap results)

1.1 Adult Mortality

Water temperatures since 1996 in the upper river are conducive to successful spawning (< 60 °F, Dec-Apr)[1]. See Figure 27 in TID/MID (2003b).

June 10, 2001, fish kill that reportedly included steelhead among other species (Declaration of S. B. Walser in NHI 2003). No dead salmonids were found by CDFG biologist on the following day.

1.2 Adult Growth

No known evidence.

1.3 Adult Migration

Temperatures in the lower Tuolumne River (and the Delta) during the late spring and early summer warm to the point that may present unfavorable conditions for outmigrants and late-spawning adults. Actual temperature data from the lower river is scant, but water temperature modeling suggests that temperatures would exceed 70 °F in the lower river as early as May, especially during low flows (TID/MID 2003a).

1.4 Reduced Hatching of Eggs

Water temperatures since 1996 appear adequate for hatching of eggs (< 55 °F; Dec - May)[1] from the dam to RM 43.4 through the winter until at least the middle of May.

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[1] The temperature criteria presented here are derived from the table presented in TID/MID (2003b) and are included here only as a starting point for this analysis and discussion. Temperature criteria are a complex concept and should be evaluated further for consensus among the parties.

During the last half of May, temperatures typically range from the mid 50's to the mid 60's °F. See Figure 27 in TID/MID (2003b).

1.5 Alevin/Fry Mortality

Water temperatures since 1996 appear adequate for fry development and survival (< 73 °F; all year)[1] from the dam to RM 43.4 except for periods in June and July during 2001 and 2002, which were low flow years. See Figure 27 in TID/MID (2003b).

Although an extensive temperature monitoring record is not available for the lower river, results from temperature modeling suggest that lower river temperatures likely exceed stressful levels during summer months during some years especially those when flows are low (TID/MID 2003a).

1.6 Juvenile Mortality

Water temperatures since 1996 appear adequate for juvenile survival (< 73 °F; all year)[1] from the dam to RM 43.4 except for periods in June and July during 2001 and 2002, which were low flow years. See Figure 27 in TID/MID (2003b).

Although an extensive temperature monitoring record is not available for the lower river, results from temperature modeling suggest that lower river temperatures likely exceed stressful levels during summer months during some years especially those when flows are low (TID/MID 2003a).

1.7 Juvenile Growth

No known evidence.

1.8 Juvenile Migration

No known evidence.

II. Data Gaps

A more thorough analysis of the above items should help identify data gaps that may be addressed with future monitoring and data collection. Some of these data gaps may be:

- When and where are juvenile *O. mykiss* found throughout the system and what proportion of them leave the system toward the ocean?

- How accurate is the existing river temperature model? It likely needs recalibration given that river characteristics have changed due to recent channel mitigation. There is also more data available for further calibration and validation.

- Procedures should be established for a rapid investigation of any future fish kills. Perhaps some further investigation of the possible causes of past reported fish kills should also be undertaken.

- A better assessment of the number of adult steelhead in the system including information on their seasonal distribution and movement. Knowing when spawners enter and leave the river seems may be necessary to address potential project concerns.

REFERENCES

NHI (Natural Heritage Institute). 2003. Conservation Groups' Brief in Support of the Petition of the National Marine Fisheries Service for Modifying Project Structures and Operations. Letter to the Service List from Roos-Collins, R., and J. Gantenbein (NHI) on 6 June 2003.

TID/MID (Turlock Irrigation District/Modesto Irrigation District). 2003a. Letter to G.H. Taylor (FERC) from R. Nees (TID) and W. Ward on 9 October 2003.

TID/MID. 2003b. Letter to G.H. Taylor (FERC) from R. Nees (TID) and W. Ward on 1 December 2003.

CALIFORNIA RIVERS RESTORATION FUND

CRRF

Distribution and Anadromy of *Oncorhynchus mykiss* in the Tuolumne River
Application for a Section 10 Permit

Project Description, Purpose, and Significance

Information on the current distribution and abundance of steelhead and rainbow trout in the lower Tuolumne River, between La Grange Dam and the San Joaquin River confluence, is needed to prepare a biological evaluation regarding the impacts of the New Don Pedro Project (FERC No. 2299) on Central Valley steelhead.

The proposed project would collect length and weight data, samples of scales, and distribution information from live adult *O. mykiss* caught using hook-and-line methods and from adult carcasses in the lower Tuolumne River between La Grange Dam and the confluence with the San Joaquin River. These data would provide valuable information on the distribution of adult *O. mykiss* and help determine the percentage of steelhead and non-anadromous trout in the lower Tuolumne River. Hook-and-line methods would provide the greatest amount of data but relatively little harm to steelhead compared to snorkeling and electrofishing surveys. Our surveys would simply collect a small number of scales from adult *O. mykiss* that will be normally caught with hook-and-line for legal recreational purposes. In contrast, snorkel surveys are not very effective for detecting adult trout due to poor visibility during the spring migration period and because the adults readily seek refuge when disturbed. Moreover, scale samples cannot be collected during snorkeling surveys. Although electrofishing surveys can provide good information, they have a relatively high potential for injuries or mortality of adult fish.

Surveys of adult fish are most useful because the scale samples provide evidence of ocean residency and, therefore, anadromy. In contrast, juvenile *O. mykiss*, would have to be sacrificed so that anadromy of their parents could be determined with a chemical analysis of their otoliths. Collecting scales from adult fish is unlikely to cause significant injury or mortality.

Project Methodology:

During professionally guided sport angling trips on the lower Tuolumne River between La Grange Dam and the confluence of the San Joaquin River, scales samples will be collected annually from up to 30 individual live adult *O. mykiss* in each 10 centimeter interval of fork length. It is anticipated that the adult fish will range between 30 and 70 centimeters in fork length and so a total of up to 120 samples of scales will be collected from live fish each year. Scale samples and heads (otoliths) will be collected from all *O. mykiss* carcasses observed. All live fish would be collected by Mr. Walser and Mr. Smith using hook-and-line methods that comply with all CDFG fishing regulations: only artificial lures with barbless hooks will be used, a zero creel limit, and angling will occur only between January 1 and October 15. Scales would be collected from live fish only when water temperatures are below 60 degrees F to minimize stress. Approximately 10 scales will be collected from each fish from between their lateral line and dorsal fin. If the scales are embedded and therefore difficult to remove, forceps will be used to remove each scale. Otherwise, scales will be collected by scraping with a blunt-edged knife toward the direction of the head. The fish will be kept wet for the approximately one minute period while samples are being collected and measurements are being made. Immediately after taking the measurements and samples, the fish will be returned to the capture location. The location of each fish collected will be determined with GPS equipment. Scale samples will be placed in a coin envelope on which the species, date, location of capture, length, and weight of the fish is recorded. An impression of scales taken from adult fish will be made by Dr. Carl Mesick for the purpose of evaluating the anadromous history of the fish. Within two weeks of collection, the samples would be given to the California Department of Fish and Game or other resource agencies for the purpose of conducting genetic and life history studies. The results of Dr. Mesick's scale analysis will be provided to representatives of NOAA Fisheries, CDFG, and TID/MID by email within 14 days of completing the analysis.

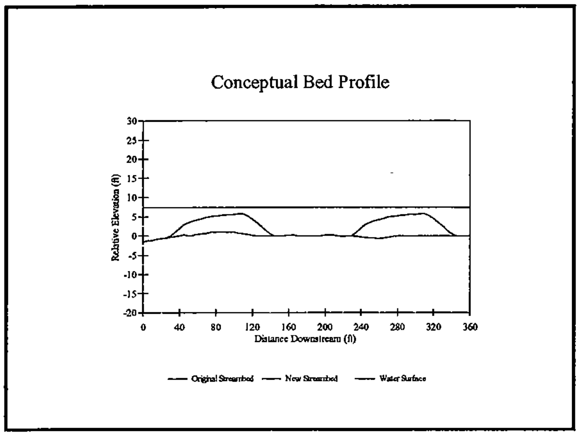
There is a slight possibility that injury and mortality may occur from (1) hooking with a barbless hook, (2) suffocation due to drying the gill tissues while samples and measurements are taken, and (3) collecting scales. Hooking injuries will be minimized by applying pressure to the wound until bleeding ceases while holding the fish in flowing water. The potential for suffocation will be minimized by frequently wetting the fish and its gills with river water while samples and measurements are taken. And prior to release, fish will be held in flowing water so that water flows over its gills until it fully recovers and it is capable of swimming. The potential for injury during scale collection will be minimized by either using forceps to collect embedded scales or forgoing scale collection if the scales cannot be quickly removed or if bleeding results from the collection process. By employing these steps, no mortalities or substantial injuries are expected from sampling. However, if mortalities do occur, the carcasses will be "iced" and delivered to CDFG within 24 hours.

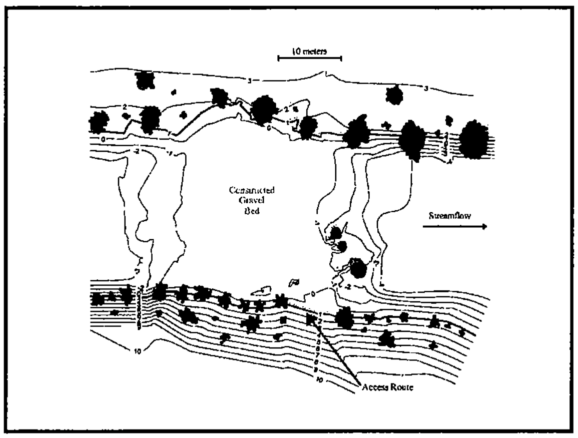
Proposed Project Start Date: January 1, 2004
Proposed Project End Date: December 31, 2007

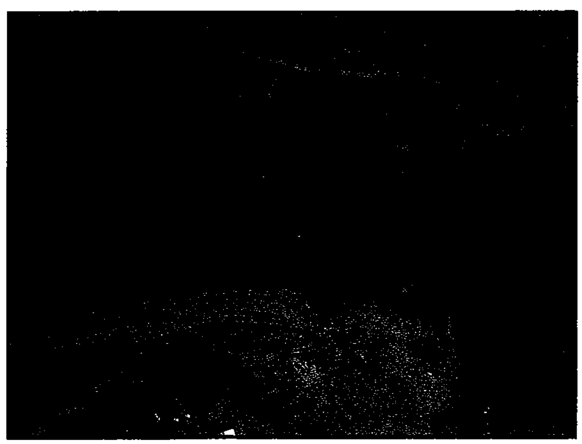
CALIFORNIA RIVERS RESTORATION FUND

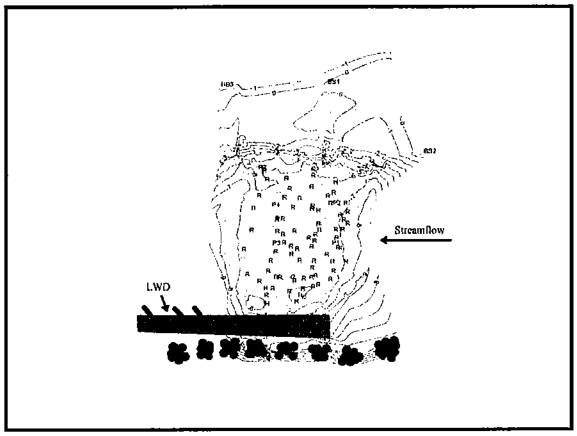
Restoration Designs for Chinook salmon and O. mykiss

- Short riffle-pool sequences
- Cover in pool habitat
- Small gravel ($d_{50} \leq 25$ mm)








LWD
Streamflow

Lovers Leap Restoration Project
Monitoring Plan
Carl Mesick Consultants
November 2003

Project Description, Purpose, and Significance

The purpose of the Lovers Leap Restoration Project is to assist in an overall effort of improving the habitat and increase the abundance of fall-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss)* in the lower Stanislaus River.

Project Methodology:

Adult steelhead use will be compared between sites that have nearby deep-water ($\geq$ 4 feet) with cover provided by either surface turbulence or large woody debris deep with sites that lack nearby deep water or cover in the Stanislaus, Tuolumne, and Merced rivers. In the Stanislaus River, the study sites will include four Lovers Leap Restoration Project sites that will have both deep water and cover and four nearby KFGRP sites (R12A, 12B, R14, and R15) that lack cover. In the Tuolumne River, study sites will include the restoration site about 0.25 miles upstream of the J59 bridge and the restoration site just downstream of the new La Grange Bridge, neither of which appears to provides adequate cover or holding habitat for steelhead. The Tuolumne River sites will also include two nearby natural sites that provide both cover and holding habitat. The sites in the Merced River will include two sites within the Robinson Ranch reach, which provides surface turbulence but little holding habitat, and nearby natural sites that provide both holding habitat and cover.

Fish use and their habitat will be documented by Mr. Steve Walser and Mr. Tim Smith, who are professional fishing guides employed by the California Rivers Restoration Fund, under the supervision of Dr. Carl Mesick. During each year in 2005 and 2006, steelhead use will be surveyed during 5 days of snorkeling and underwater videography and 5 days of hook-and-line surveys on each of the three rivers between mid-January and mid-March. Hook-and-line methods will comply with all CDFG fishing regulations including using only artificial lures with barbless hooks, a zero creel limit, the restricted season between January 1 and October 15. The location of each fish observed or caught will be determined with GPS equipment and marked on detailed project site maps. In each of the three study rivers, the length and weight of up to 60 fish caught with hook-and-line will be measured annually and visually estimated for all those observed during snorkeling. Photos will be taken of each fish caught with hook-and-line that indicate the date and study site. Photos will also be taken of all fish observed while snorkeling, conditions permitting. Scale samples will be collected from up to 60 fish caught with hook-and-line annually to assess whether the fish are anadromous or resident trout. Scales would be collected only when water temperatures are below 60 degrees F to minimize stress. Two scales will be collected from each fish from between their lateral line and dorsal fin with forceps. The fish will be kept wet for the approximately one minute period while samples are being collected and measurements are being made. Immediately after taking the measurements and samples, the fish will be returned to the capture location. Scale samples will be placed in a coin envelope on which the species, date, location of capture, length, and weight of the fish is recorded. An impression of scales taken from adult fish will be made by Dr. Carl Mesick for the purpose of evaluating the anadromous history of the fish. Within two weeks of collection, the samples would be given to the California Department of Fish and Game or other resource agencies for the purpose of conducting genetic and life history studies.

There is a slight possibility that injury and mortality may occur from (1) hooking with a barbless hook, (2) suffocation due to drying the gill tissues while samples and measurements are taken, and (3) collecting scales. Hooking injuries will be minimized by applying pressure to the wound until bleeding ceases while holding the fish in flowing water. The potential for suffocation will be minimized by frequently wetting the fish and its gills with river water while samples and measurements are taken. And prior to release, fish will be held in flowing water so that water flows over its gills until it fully recovers and it is capable of swimming. The potential for injury during scale collection will be minimized by either using forceps to collect embedded scales or forgoing scale collection if the scales cannot be quickly removed or if bleeding results from the collection process. By employing these steps, no mortalities or substantial injuries are expected from sampling. However, if mortalities do occur, the carcasses will be "iced" and delivered to CDFG within 24 hours.

As-Built Dimensions Of Restoration Sites

Relative streambed elevations will be measured to show the as-built dimensions of each of the 31 project sites immediately following construction. Measurements will be taken in a 15- to 20-foot grid pattern, at major changes in grade along the streambank and channel bottom, and along a single transect across the new gravel bed with a total station in fall 2004. Four bench marks will be established at each site to permit comparisons of data sets collected at different times. Bench marks will consist of 18-inch long, 3/4-inch diameter steel rods driven into the ground. The pre-project bed elevations were measured in spring 2003 by Hawkins and Associates Engineering, Modesto, CA.

The elevation data will be collected as X, Y, Z coordinates that are stored electronically and then downloaded to a laptop computer. The data will then be converted into AutoCAD DXF format files. The DXF files will then be used to generate contour maps in one-foot intervals that show the locations of the bench marks. These files will be made available to future researchers so they can estimate the change in volume of the added restoration gravel at each site over time.

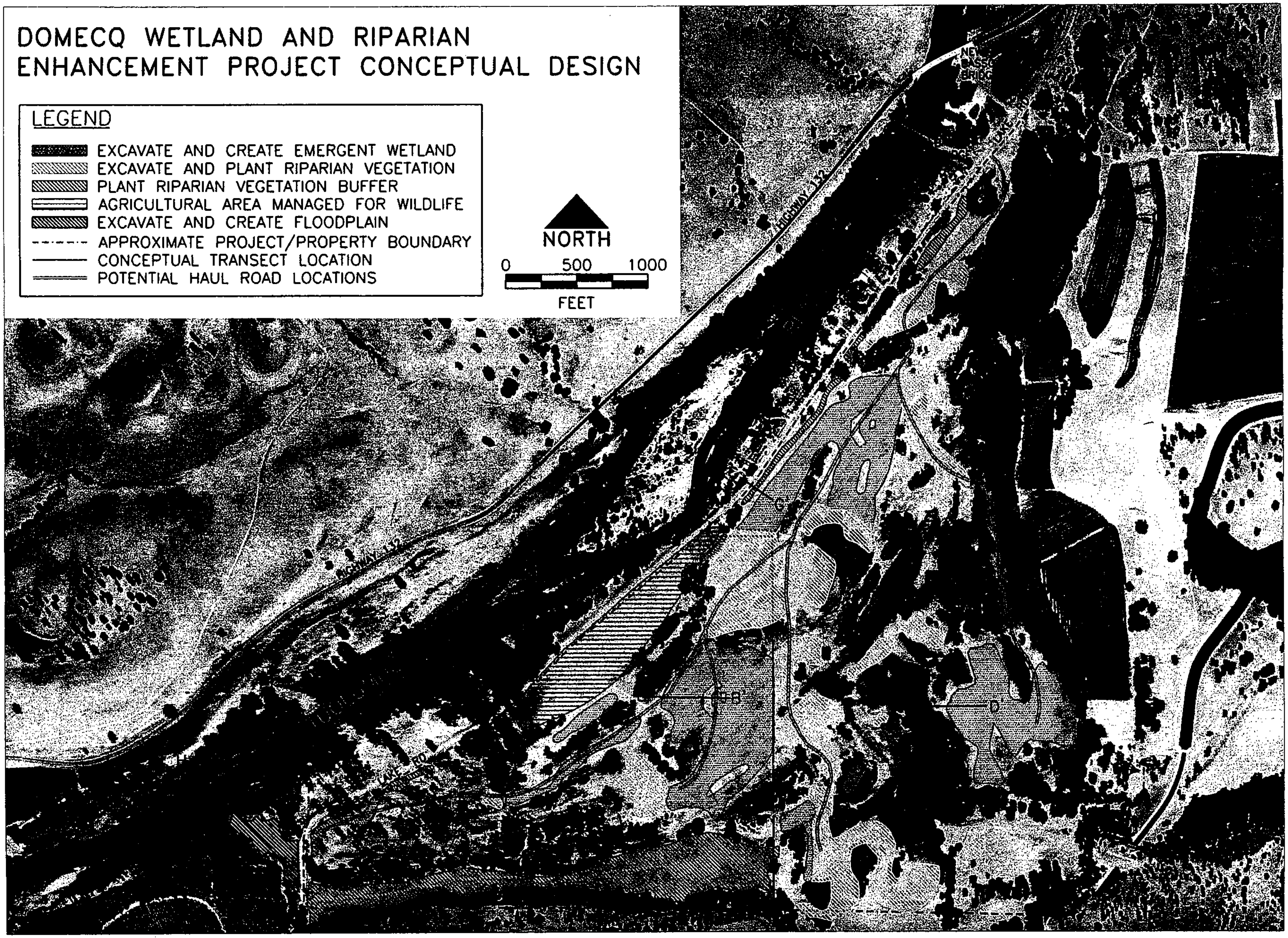
TURLOCK IRRIGATION DISTRICT

WATER PLANNING DEPARTMENT
<u>MEMORANDUM</u>

TO: TRTAC
FROM: Wilton Fryer
DATE: 17 December 2003
RE: Project Status Update

Project	Funding	Status
SRP 9	Full	Construction completed, revegetation planted and maintained for two years, and final replacement planting completed in December 2003. NOC filed March 2003.
SRP 10 Dike	Full	Construction complete. NOC filed March 2003.
7\11 Segment	Full	Construction complete with remaining revegetation planted in December 2003. 7\11 Materials NOC filed March 2003.
MJ Ruddy	Full	ROW appraisal under review by Interior Dept. with acquisition scheduled for January 2004. Revised date for 2004 construction is pending completion of land acquisition.
Warner-Deardorff	Partial	Design at 90% stage, permitting well under way, and ROW appraisal starts in January. Awaiting response from CALFED for Directed Action package submitted 21 November 2003.
Design Manual	Full	Final Report due to TRTAC 17 December 2003.
Course Sediment	Full	Final Report submitted to TRTAC 17 December 2003.
La Grange Gravel	Full	The TID Board has asked that the mineral rights and mining operations portion of the project be dropped due to uncertainty over future funding for remaining mining operations and associated permitting & mining contract issues. Site investigation was completed. A project amendment will be sought to increase the amount of gravel infusion work.
Fine Sediment	Full	Gasburg Creek watershed analysis is being revised. Waiting for DFG comments on settling basin & site layout.

RM 43	Full	DWR contract in place, site reviews done, starting design.
SRP 10	Partial	Draft Hydraulic & Design Report submitted for review with two channel layouts evaluated. Preparation of design and budget information for anticipated February CBDA PSP for construction. Looking for alternative land acquisition funding.


DOMECQ WETLAND AND RIPARIAN
ENHANCEMENT PROJECT CONCEPTUAL DESIGN
LEGEND
EXCAVATE AND CREATE EMERGENT WETLAND
EXCAVATE AND PLANT RIPARIAN VEGETATION
PLANT RIPARIAN VEGETATION BUFFER
AGRICULTURAL AREA MANAGED FOR WILDLIFE
EXCAVATE AND CREATE FLOODPLAIN
APPROXIMATE PROJECT/PROPERTY BOUNDARY
CONCEPTUAL TRANSECT LOCATION
POTENTIAL HAUL ROAD LOCATIONS
NORTH
0
500
1000
FEET
HIGHWAY 132

NO MINING	TASK	Existing 2003 Budget	Revised Budget	Budget Change
YEAR 1				
Task 1	Project Management and Administration (3% of Project Costs)	$50,000	$50,000	?
Task 2	Public Participation	$5,000	$5,000	$0
Task 3	Environmental Compliance and Permitting	$150,000	$100,000	-$50,000
Task 4	Conceptual Design	$25,000	$25,000 +$50,000 TRTAC	$0
Task 5	Mineral Appraisal	$40,000	$0	-$40,000
	Mineral Rights Purchase	$1,200,000	$0	-$1,200,000
Task 6	Final Grading plans, Construction Specifications, Bid Packages	$55,000	$55,000	$0
YEAR 2				
Task 7	Project Implementation (Sediment Development)	$1,940,000	$0	-$1,940,000
YEAR 3				
Task 8	Project Implementation (Gravel Augmentation)	$410,000	$3,680,000	$3,270,000
Task 9	Revegetation	$100,000	$0	-$100,000
Task 10	Monitoring	$60,000	$300,000	$240,000
Task 11	Contingencies	$280,000	$100,000	-$180,000
Task 12	Project Closure	$35,000	$35,000	$0
	PROJECT TOTAL	**$4,350,000**	**$4,350,000**	**$0**
	TID Project Management Budget	$50,000	$50,000	
	Design/Permitting Budget	$285,000	$235,000	
	Mineral Appraisal/Purchase	$1,240,000	$0	
	Monitoring Budget	$60,000	$300,000	
	Implementation Budget	$2,450,000	$3,680,000	
	TOTAL	$4,350,000	$4,350,000	
	Low cost of gravel from commercial producers (/ton)	$13 ton		
	High cost of gravel from commercial producers(/ton)	$18 ton		
	Cost of placing gravel (/ton)	$5 ton		
	Low estimate of gravel purchased, delivered, placed (tons)	160,000 tons		
	High estimate of gravel purchased, delivered, placed (tons)	204,444 tons		
	Low estimate of gravel purchased, delivered, placed (cu yards)	100,000 cu yds	[$43]	
	High estimate of gravel purchased, delivered, placed (cu yards)	127,778 cu yds	[$34]	

From: Tim Ford
To: TRTAC LIST 12-2003
Date: 12/18/2003 4:18:45 PM
Subject: Re: DEC 1 letter to FERC

To TRTAC list:

Madelyn inquired at yesterdays' meeting about the Districts' reference to a NOAA fisheries statement regarding O. mykiss 'critical thermal maxima' in Note (4) of the temperature criteria table on page 5 of the 01DEC2003 filing. That information came from the NOAA Fisheries petition, dated May 2, 2003, in footnote 3 of Part II.A. I notice that the FERC eLibrary version of the petition is missing page 9, the one that should have the footnotes.

The Oroville Relicensing reference cited in Note (3) of the table is at http://orovillerelicensing.water.ca.gov/pdf_docs/01-29-03_Enviro_wg_Att7/steelhead-lifehistory.pdf

I also found there has been some DO data collected in recent years associated with the invertebrate sampling - attached is a tabulation of that information.

CC: Mark Bevelhimer

Tuolumne River dissolved oxygen data from invertebrate sampling 2001-2003 (YSI instrument)

Date	Arrival Time	Location	River mile	DO mg/l	DO % sat.	W.Temp. deg. C	Velocity ft/sec
2-Aug-01	1000	RA4	51.6		128.0	11.7	2.8
2-Aug-01	1330	R21	42.9		117.0	21.9	2.5
2-Aug-01	1500	R57	31.6		N.A.	27.3	2.6
31-Jul-02	1100	RA4	51.6	13.1	122.5	12.5	2.7
31-Jul-02	0900	R4A	48.8	10.6	105.3	15.2	0.8
31-Jul-02	1630	R23C	42.3	13.8	163.5	24.4	1.8
1-Aug-02	N.A.	R33	37.8	8.4	98.1	22.9	1.3
1-Aug-02	N.A.	R57	31.6	8.2	102.1	25.3	2.2
1-Aug-02	N.A.	R72	25.5	10.3	130.7	27.2	2.3
30-Jul-03	0900	RA4	51.6	10.9	104.0	11.8	2.8
30-Jul-03	1030	R4A	48.8	8.9	89.0	13.2	1.1
31-Jul-03	0900	R23C	42.3	8.7	107.0	16.9	2.6
31-Jul-03	1300	R31	38.1	11.8	128.0	19.0	3.4
30-Jul-03	1500	R57	31.6	8.0	109.5	23.8	3.5
31-Jul-03	1500	R72	25.5	12.6	153.6	25.4	3.1

Tim Ford - Re: DEC 1 letter to FERC

From: "M. Bevelhimer" <bevelhimerms@ornl.gov>
To: Madelyn Martinez <Madelyn.Martinez@noaa.gov>, Tim Ford <tjford@tid.org>
Date: 12/19/2003 6:37 AM
Subject: Re: DEC 1 letter to FERC
CC: <agengr6@aol.com>, <deltakeep@aol.com>, <ajensen@bawua.org>, <nsandkulla@bawua.org>, <michael.mcelhiney@ca.usda.gov>, <timr@calwater.ca.gov>, <jkoontz@calwaterlaw.com>, <rmasuda@calwaterlaw.com>, <donn_w_furman@ci.sf.ca.us>, <dblakeman@dfg.ca.gov>, <dmarston@dfg.ca.gov>, <pbrantley@dfg.ca.gov>, <THEYNE@dfg.ca.gov>, <wlouderm@dfg.ca.gov>, <Erich.Gaedeke@ferc.gov>, <deborah_giglio@fws.gov>, <Jeff_McLain@fws.gov>, <cmcfish@innercite.com>, <fuller@inreach.com>, <darren@mcbaintrush.com>, <scott@mcbaintrush.com>, <billj@mid.org>, <walterw@mid.org>, <aboucher@netfeed.com>, <dboucher@netfeed.com>, <eric.theiss@noaa.gov>, <Erin.Strange@noaa.gov>, <jchester@puc.sf.ca.us>, <noah@stillwatersci.com>, "Robert M. Nees" <rmnees@tid.org>, Wil Fryer <wbfryer@tid.org>, <jenna@tuolumne.org>, <patrick@tuolumne.org>, <rmyoshiyama@ucdavis.edu>, Erich Gaedeke <Erich.Gaedeke@ferc.gov>

Madelyn,

Thanks for the attachments. They contain some very useful information. However, I'm not sure that all would agree that "critical thermal maxima" is the same as "incipient lethal temperature". These terms usually refer to two different methodologies that both provide estimates of upper (or lower) temperature tolerance, but they're not the same. See Beitinger et al. 2000 (Environmental Biology of Fishes 58:237-275) for an excellent description and review of temperature tolerance determination. The review includes tolerance data for over 100 species. EPA typically applies a 2 degree C safety factor to upper tolerance data to derive their short-term exposure criteria.

Having said all that, I think the biggest concern in the Tuolumne is not what the ultimate upper limit is, but instead understanding the chronic effect of long-term exposure to less than immediately lethal temperatures. Unfortunately, the effects of long-term exposure to "stressful" temperatures (or whatever you want to call them) has not been very well defined by the scientific community. Defining exposure limits for stressful temperatures will be a challenge for the committee, but not unattainable. It's more than just a temperature value, it's duration of exposure as well (not to mention a handful of other factors).
-Mark Bevelhimer

At 06:23 PM 12/18/2003 -0800, Madelyn Martinez wrote:

> TO TRTAC List:
> Take NOTE ..... "Critical thermal maxima" means "incipient lethal temperature"...meaning ...immediate death upon exposure. I advice you to look very closely on the numbers chosen and how the numbers were taken from the context particularly the Oroville FERC relicensing Interim Report Appendix A. It references Moyle 2002 *Inland Fishes of California* pp 271 - 282 esp pp276. If you would like to see the most recent, best available scientific data, I've attached EPA' s April 2003 document on temperature criteria and several supporting documents for your reference. From my understanding, NOAA Fisheries SWR staff (water quality person) is working with EPA region 9 to adopt these numbers for California. If this is the case, I will start adopting these temperature criteria in my consultation. Just to let you know.
> -mm
>
> Tim Ford wrote:

EPA

Region 10
1200 Sixth Avenue
Seattle WA 98101

Alaska
Idaho
Oregon
Washington

EPA Issues Final Water Temperature Guidance - April 2003

Water temperature is a critical aspect of the freshwater habitat of Pacific Northwest salmon and trout. These fish, including those listed as threatened or endangered under the Endangered Species Act (ESA), need cold water to survive. Human-caused increases in river water temperatures have been identified as a factor in the decline of ESA-listed fish in the Pacific Northwest. State and Tribal temperature water quality standards can play an important role in helping to maintain and restore water temperatures to protect these salmon and trout and aid in their recovery.

The guidance is intended to assist States and Tribes to adopt temperature water quality standards that EPA can approve consistent with its obligations under the Clean Water Act (CWA) and the ESA. The CWA requires States and authorized Tribes to adopt water quality standards and requires the EPA to approve or disapprove those standards. The ESA requires EPA, in consultation with the federal fisheries agencies, to insure its approval of a State or Tribes's water quality standards does not jeopardize the continued existence of endangered or threatened species.

The guidance represents one approach for water temperature standards that a State or Tribe could adopt that would likely pass the complex approval process. The guidance, however, is optional and States and Tribes can adopt alternative standards as long as EPA determines they meet CWA and ESA requirements.

The guidance is a product of a three year collaborative effort involving the Idaho Department of Environmental Quality, Oregon Department of Environmental Quality, Washington Department of Ecology, NOAA Fisheries (formerly the National Marine Fisheries Service), U.S. Fish and Wildlife Service, Nez Perce Tribe, and the Columbia River Inter-Tribal Fish Commission. EPA issued two public review drafts, the first in October, 2001 and the second in October, 2002, and received valuable comment from the public.

Recommended Temperature Criteria to Protect Salmon and Trout

<u>Applies to the Summer Maximum Temperature</u>

- 12°C (55°F) for Bull Trout Rearing - *generally in the upper portion of river basins*
- 16°C (61°F) for Salmon and Trout "Core" Juvenile Rearing - *generally in the mid to upper part of river basins*
- 18°C (64°) for Salmon and Trout Migration plus Non-Core Juvenile Rearing - *generally in the lower part of river basins*
- 20°C (68°F) plus cold water refugia protection for Salmon and Trout Migration - *generally in the lower part of a few river basins that likely reach this temperature naturally*

<u>Applies Where and When Fish Use a River (generally during the fall-winter-spring period)</u>

- 9°C (48°F) for Bull Trout Spawning
- 13°C (55°F) for Salmon and Trout Spawning, Egg Incubation, and Fry Emergence
- 14°C (57°F) for Steelhead Smoltification

Note: the above criteria are based on the 7 day average of the daily maximum values

Recommendations to Protect Existing Cold Waters

Keeping cold waters cold is important to protect the last remaining high quality fish habitat and help cool downstream river reaches. The guidance, therefore, recommends that State and Tribes adopt mechanisms in their standards that protect waters that are currently colder than the summer maximum numeric criteria.

Recommendations to Protect Fish in the Vicinity of Point-Source Discharges

In some situations, water temperatures in the immediate vicinity of an industrial or municipal discharge may exceed the recommended temperature criteria as long as fish are not harmed from short-term exposure. The guidance recommends that States and Tribes adopt measures to protect fish from temperatures that would be lethal, cause thermal shock, block migration, or harm fish eggs.

What if the Temperature Criteria are Unattainable or Inappropriate?

EPA recognizes that because of the inherent variability of Pacific Northwest rivers and streams there are likely to be situations where the recommended temperature criteria will be unattainable or inappropriate. The guidance offers several approaches a State or Tribe can take to address these situations. For example, where the natural background temperature (i.e., the temperature absent human impacts) is estimated to be higher than the recommended criteria, the natural background temperature can be adopted as criteria. Further, if human impacts cannot be remedied, alternative criteria can be established based on the water temperature that is attainable.

What Are Water Temperature Criteria Used For?

Water temperature criteria serve as goals in order to protect salmon and trout and other uses. Criteria are used for determining what waters do not attain water quality standards (CWA 303(d) list) and require the development of a Total Maximum Daily Load (TMDL), which calculates the temperature reductions needed from contributing sources to meet the criteria. Criteria are also used to set effluent limits for NPDES sources and used by States for non-point control programs.

For More Information

For a copy of the guidance go to EPA's website: www.epa.gov/r10earth/temperature.htm. or call 1-800-424-4372.

Contacts: John Palmer at 206-553-6521, palmer.john@epa.gov
Dru Keenan at 206-553-1219, keenan.dru@epa.gov

United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 NE. 11th Avenue
Portland, Oregon 97232-4181

IN REPLY REFER TO:

APR 21 2003

Mr. John Iani
Regional Administrator
U.S. Environmental Protection Agency
Region 10
1200 6th Avenue
Seattle, Washington 98101

Dear Mr. Iani:

The U.S. Fish and Wildlife Service (Service) is pleased to provide comments on the final version of the Environmental Protection Agency (EPA) Region 10 Guidance for State and Tribal Temperature Water Quality Standards (April 2003). We have participated in the development of this document as a member of the workgroup over the last three years and we are supportive of the process and the outcomes. The EPA is to be commended for addressing this large scale and difficult issue as it is a critical factor in the recovery of both threatened and endangered species. We support the processes, approaches and methods recommended in the guidance.

The Service has been asked to define the level of assurances that we can provide to States and Tribes if they follow the EPA guidance in the development of their water quality temperature standards. More specifically, if the States and Tribes follow the guidance, to what degree will they meet the requirements of the Endangered Species Act (ESA).

The Service will eventually be consulting with the EPA on the approval of new or revised State and Tribal water quality standards. We support the temperature guidance document recommendations and believe that if the States and Tribes follow the EPA guidance in the development of their water quality standards the consultation process will be expedited.

The law does not allow for the Service to provide *a priori* ESA approval for any action without a review and impact assessment, or in this case consultation pursuant to section 7 of the ESA. The EPA guidance document provides some specific and some general guidelines regarding the development of temperature water quality standards, and thus allows for subjective interpretation in some areas. Moreover, the guidance is not mandatory, so States and Tribes may adopt or ignore any part of the guidance. Therefore, the Service must review and analyze each water quality standard revision that may affect listed species or critical habitat. If States and Tribes develop alternative approaches that do not follow the guidance or interpret the guidance differently than the Service it will likely result in additional information and analysis being required in the consultation process.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

APR 23 2003

Mr. John Iani
Regional Administrator
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

Dear Mr. Iani:

I want to thank you and your staff for the Environmental Protection Agency's (EPA's) strong and productive efforts to develop guidance for state and tribal water temperature standards in EPA Region 10. We appreciate the opportunity to be a part of this effort, due to the importance of protecting and restoring thermal regimes in watersheds inhabited by Pacific salmon and steelhead.

The guidance provides a good general overview of water temperatures supporting salmon and steelhead, and outlines useful approaches to help ensure that biological requirements are accommodated in state and tribal water temperature standards. As you note in the guidance, NOAA Fisheries cannot reach a conclusion with respect to the Endangered Species Act (ESA) or Essential Fish Habitat (EFH) Consultations until it reviews the specifics of a proposed action. Because we cannot pre-judge the effects of various features or combinations of features that states and tribes may apply in their standards, EPA and NOAA Fisheries will need to consult on each set of standards that EPA proposes to approve under the Clean Water Act (CWA). Nevertheless, state and tribal water temperature standards consistent with this guidance are likely to be able to satisfy the requirements of both the ESA and the EFH, since most of the potential consultation issues have been addressed to the extent possible in the guidance. Because of this, application of the guidance by states and tribes in modifying their water temperature standards would facilitate more efficient and timely completion of ESA and EFH consultations.

Salmon and steelhead populations show considerable adaptation to special circumstances, and some fish may be able to occupy habitat that might otherwise be unsuitable by locating thermal refuges within a stream that might otherwise be too warm. While we believe this guidance represents an excellent description of the general water temperature requirements for these fish and should be applicable to most habitats where those fish are present, we also recognize that, in some instances, local fish populations may be supported by criteria different (either warmer or cooler) than the criteria in the guidance, or natural water temperatures may be warmer than the recommended criteria.

We therefore support provisions, of the kind contained in the guidance (Section VI), that allow for the consideration of unique local circumstances. The options that EPA has included in the guidance that describe how states and tribes can develop alternative criteria where the general numeric criteria are unattainable or inappropriate are good examples of such adaptive provisions. These options include: 1) site-specific numeric criteria that support the use, 2) numeric criteria based on estimates of natural background temperatures (with an allowance for human use), and 3) alternative numeric criteria in conjunction with a use attainability analysis. We support inclusion of these options in the guidance because there likely will be situations that warrant different criteria than those recommended in the guidance.

Large Federal dams and large Federally-licensed dams require special consideration. Most of these hydro projects are already subject to extensive regulation and consultation under the authority of the ESA or in conjunction with FERC license proceedings. Typically, these consultations take into account all of the effects of the project on salmon and steelhead, not just water temperature, and the consultations attempt to review the temperature effects for a variety of juvenile and adult fish and the passage routes taken by each. In addition, these consultations normally look at the effects of the project as part of a multi-project storage system, and not as stand-alone activities.

In this context, meeting these general temperature guidelines at all times at a particular project may be desirable, but may not reflect the highest system-wide priority for the available water or for the funding available for capital improvements to benefit salmon and steelhead. For this reason, NOAA Fisheries believes that the temperature effects of large Federal and Federally-licensed dams should be considered in combination with other project effects, as part of a comprehensive consultation. While these guidelines should be used as a starting point for a part of that discussion, they are not intended to determine how to best strike a balance among all of the factors involved in these unique circumstances. This is an example where it may be appropriate for states and tribes to develop alternate temperature criteria using provisions of the CWA, summarized in Section VI of the guidance.

Sections of the guidance that are particularly likely to help expedite consultations include (1) considerations for designation of beneficial uses, (2) numeric criteria to protect the beneficial uses, and (3) the recommendation to adopt strong provisions to protect existing waters inhabited by ESA-listed salmonid fishes that have summer temperatures colder than the EPA-recommended numeric criteria. Ideally, states and tribes also would apply measure 3 in waters designated as EFH that are colder than the criteria, in order to help support salmon and steelhead fisheries not listed under the ESA. Based on the extent of current listings of water bodies as impaired for water temperature under section 303 (d) of the CWA, relatively few streams would be at issue in measure number 3.

EPA also has identified crucial aspects of thermal plume effects from point sources of heat pollution in the guidance. The guidance's recommendations that are intended to minimize potential adverse effects of instantaneous lethal temperatures, and to minimize degradation of spawning, egg incubation, and fry emergence areas, are specific, well-developed and scientifically supported. Adoption of these recommendations by states and tribes likely would expedite consultations involving thermal plume effects. The guidance's recommendations pertaining to other potential effects of thermal plumes (i.e. loss of localized cold water refugia, thermal shock, and migration blockage) may give a good starting point for more detailed discussions in subsequent consultations dealing with these effects.

Our views of the guidance are offered with the qualification that the guidance includes both specific and general guidelines regarding the development of water temperature standards, and necessarily allows for subjective interpretation of some measures. For example, while values for the numeric temperature criteria generally would be supportive of the thermal requirements of salmon and steelhead where the criteria are adopted and attained, this is only true if the state or tribe designates beneficial uses in a manner that protects the full diversity of life history strategies (e.g. timing of migrations) demonstrated by local fish populations.

Although water temperature improvements alone cannot restore native fish populations, protection and restoration of stream temperature patterns is necessary to provide freshwater habitat that will support the long-term survival and recovery of Pacific salmon and steelhead. This guidance represents an important step in that direction. We look forward to working with EPA, and with Pacific Northwest states and tribes, in any future consultations on water temperature standards reflecting recommendations in the guidance. If you have any questions regarding these comments, please contact me at 503-231-2337.

Sincerely,

Bob Lohn

D. Robert Lohn
Regional Administrator

cc: David Allen, USFWS
John Palmer, EPA Region 10
Randy Smith, EPA Region 10

United States
Environmental Protection Agency

Region 10
Office of Water

EPA 910-B-03-002
April 2003

EPA

EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards

Mike Lidgard, Christine Psyk, Jannine Jennings, Rick Parkin, and Jayne Carlin of EPA Region 10's Office of Water; Ben Cope and Peter Leinenbach of EPA Region 10's Office of Environmental Assessment; and Derek Poon and Steve Ralph of EPA Region 10's Office of Ecosystems and Communities.

EPA gratefully acknowledges the above individuals, members of the peer review panels, and the public for their participation and valuable input into the development of the guidance. Although members of the organizations listed above contributed to the development of the guidance, this guidance ultimately reflects the views of EPA.

This report should be cited as:

U.S. Environmental Protection Agency. 2003. *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards.* EPA 910-B-03-002. Region 10 Office of Water, Seattle, WA.

To obtain a copy of this guidance free of charge, contact:

EPA Region 10's Public Environmental Resource Center
Phone: 1-800-424-4372

This guidance, along with other supporting material, is available on the internet at:

www.epa.gov/r10earth/temperature.htm

Tim Ford - Fwd: DFG Implements New Bay-Delta Sport Fishing Enhancement Stamp

From: Tim Ford
To: Frank Ligon; Steve Kirihara; TRTAC LIST 12-2003
Date: 12/19/2003 2:36 PM
Subject: Fwd: DFG Implements New Bay-Delta Sport Fishing Enhancement Stamp

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To TRTAC list

>>> "Catherine Prusinski" <CPrusinski@dfg.ca.gov> 12/18/2003 8:54:20 AM >>>
Department of Fish and Game
NEWS RELEASE FOR IMMEDIATE RELEASE 03:120 December 18, 2003

Contacts: Heather McIntire, Central Valley Bay Delta Branch, (209)948-7800
Perry Herrgesell, Chief, Central Valley Bay Delta Branch, (209)
48-7800; Steve Martarano, Office of Public Affairs, (916) 654-5866

DFG Implements New Bay-Delta Sport Fishing
Enhancement Stamp

The California Department of Fish and Game (DFG) has begun implementation of the new Bay-Delta Sport Fishing Enhancement Stamp (Senate Bill 692). Beginning Jan. 1, 2004, all anglers fishing in specified waters in the Delta, the Sacramento and San Joaquin rivers, including major tributaries, and the San Francisco Bay east of the Golden Gate Bridge will be required to possess the $5 (plus any applicable tax) stamp.

The new Bay-Delta Stamp will supercede the Striped Bass Stamp.

Revenue from sale of the stamp will be used only for long-term, sustainable sport fishing benefits in the geographic area where possession of the stamp is required. A nine-member advisory committee appointed by the Director of DFG will recommend projects for the expenditure of revenue received by the sale of the stamp. Projects are likely to include improvements to sport fishing access, enforcement of angling regulations, sport fish population and fisheries monitoring, habitat improvement, and environmental education. Committee members will be nominated by individual anglers and associations representing anglers affected by sale of the stamp. All committee meetings will be open to the public.

The stamp was developed in conjunction with several stakeholder groups, including representatives from United Anglers, California Sport Fish Protection Alliance, Northern California Federation of Fly Fishers, and Recreational Fishing Alliance. Development of a strategic plan for expenditures and on-going implementation of the program will be through collaboration with the advisory committee, experts, and sport fishing interests from throughout the area affected by sale of the stamp.

"Working with angler representatives to develop this multiple-species program has been an exciting and successful process," said Perry Herrgesell, Chief of DFG's Central Valley Bay Delta Branch. Bob Strickland of United Anglers concurred. "I am glad to be part of the group putting this stamp together and I think we can do some good work with it," Strickland said.

Anyone fishing in the following areas will be required to possess the Bay-Delta Sport Fishing Enhancement Stamp:

*The tidal waters of San Francisco Bay and Delta – The areas east of Golden Gate Bridge and into the San Francisco and San Pablo bays, and Carquinez Strait.

*The Sacramento-San Joaquin Delta – This includes all rivers, sloughs, canals, cuts, forebays, and flooded islands within the area south of Interstate 80, west of Highway 99, north of I-580, I-205, and I-120, and east of I-680. This area includes the Cosumnes River west of Highway 99.

*The Sacramento River below Keswick Dam, the Feather River below Oroville Dam, the Yuba River below Englebright Dam, the American River below Nimbus Dam, the Cosumnes River west of Highway 99, the Mokelumne River below Camanche Dam, the Calaveras River below New Hogan Dam, the San Joaquin River below Mendota Dam, the Stanislaus River below Goodwin Dam, the Tuolumne River below LaGrange Dam, and the Merced River below Crocker-Huffman Dam.

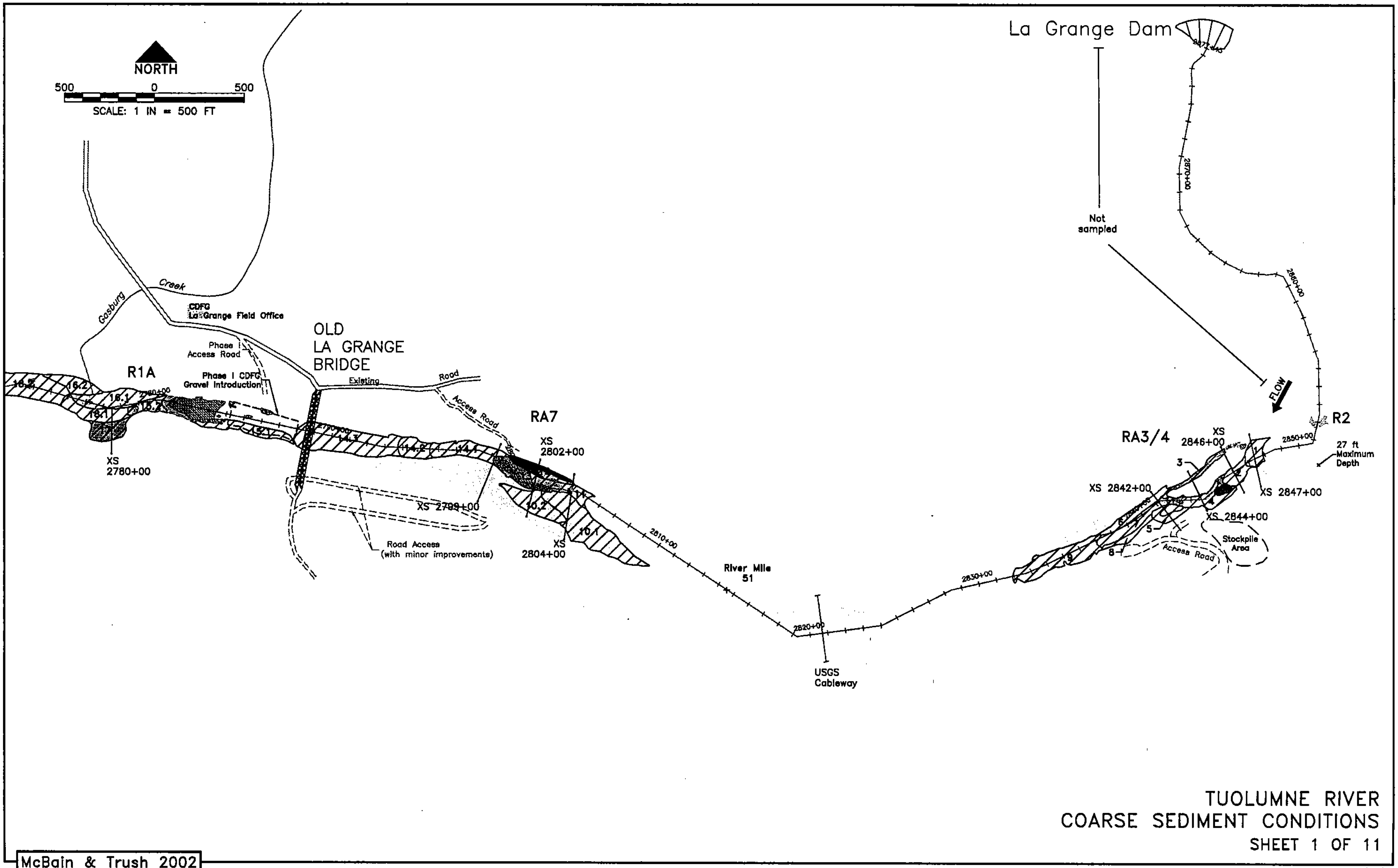
###

From: Tim Ford
To: TRTAC LIST 12-2003
Date: 12/19/2003 3:14:20 PM
Subject: Tuolumne River habitat maps

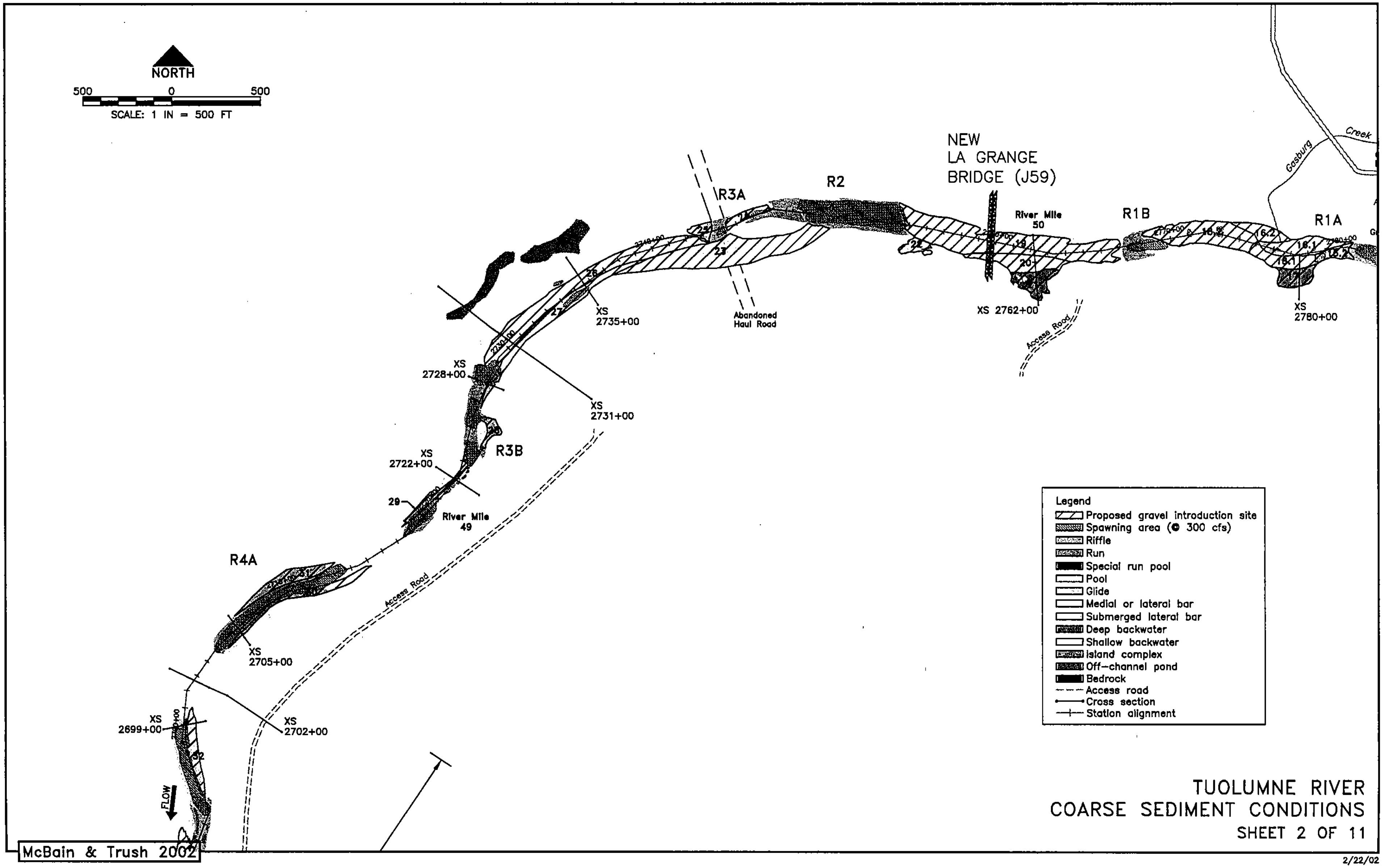
To TRTAC list:

Attached is a file with the mesohabitat maps for the upper 15 miles of river (down to Santa Fe Aggregates). These are part of the coarse sediment management plan recently completed by McBain & Trush. The map view can be rotated under the 'View' menu in Adobe Reader 6 - I don't know about earlier versions. I will try to find out from Jeff McLain if the entire report will be posted on the AFRP website.

CC: Frank Ligon; Mark Bevelhimer

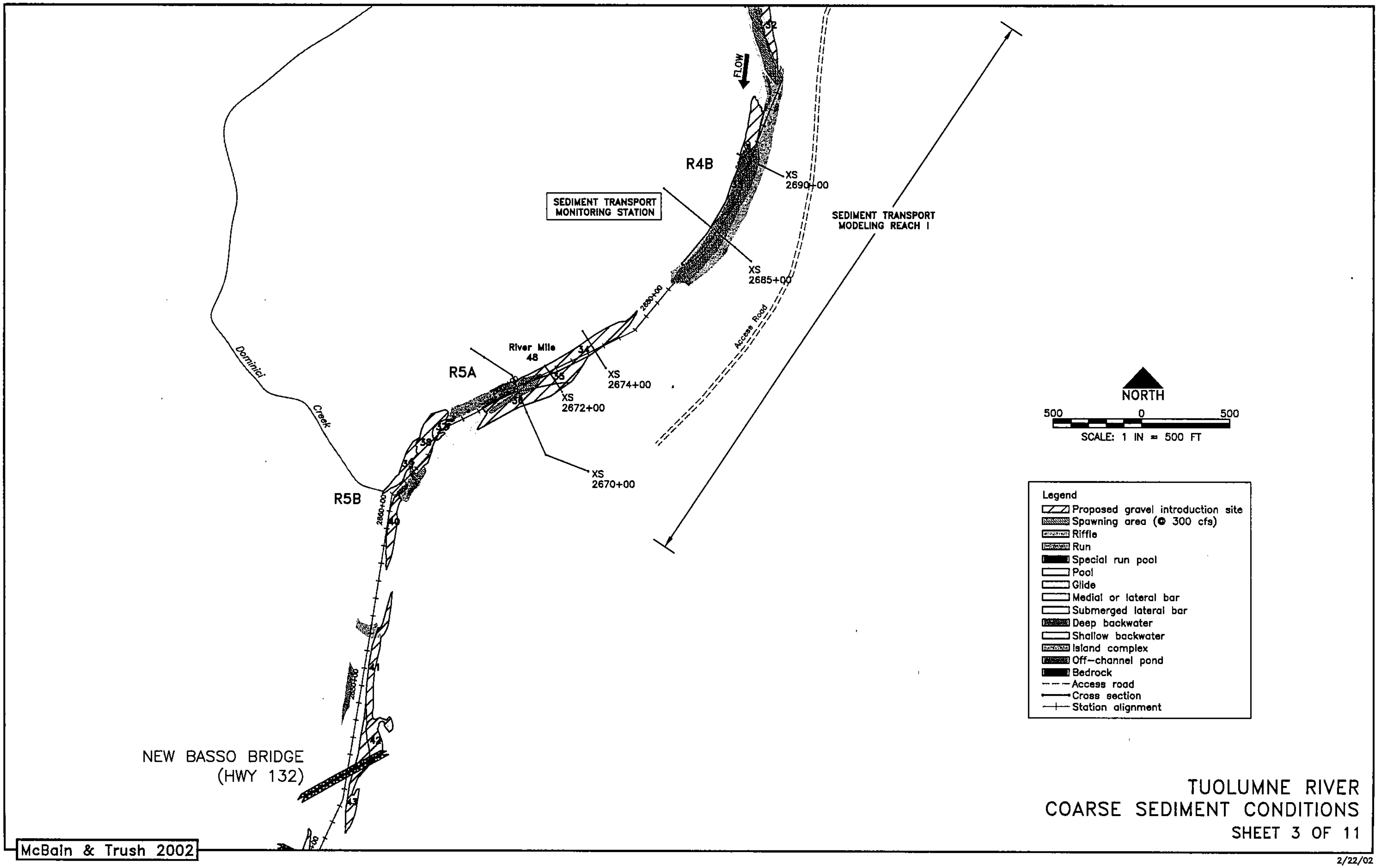


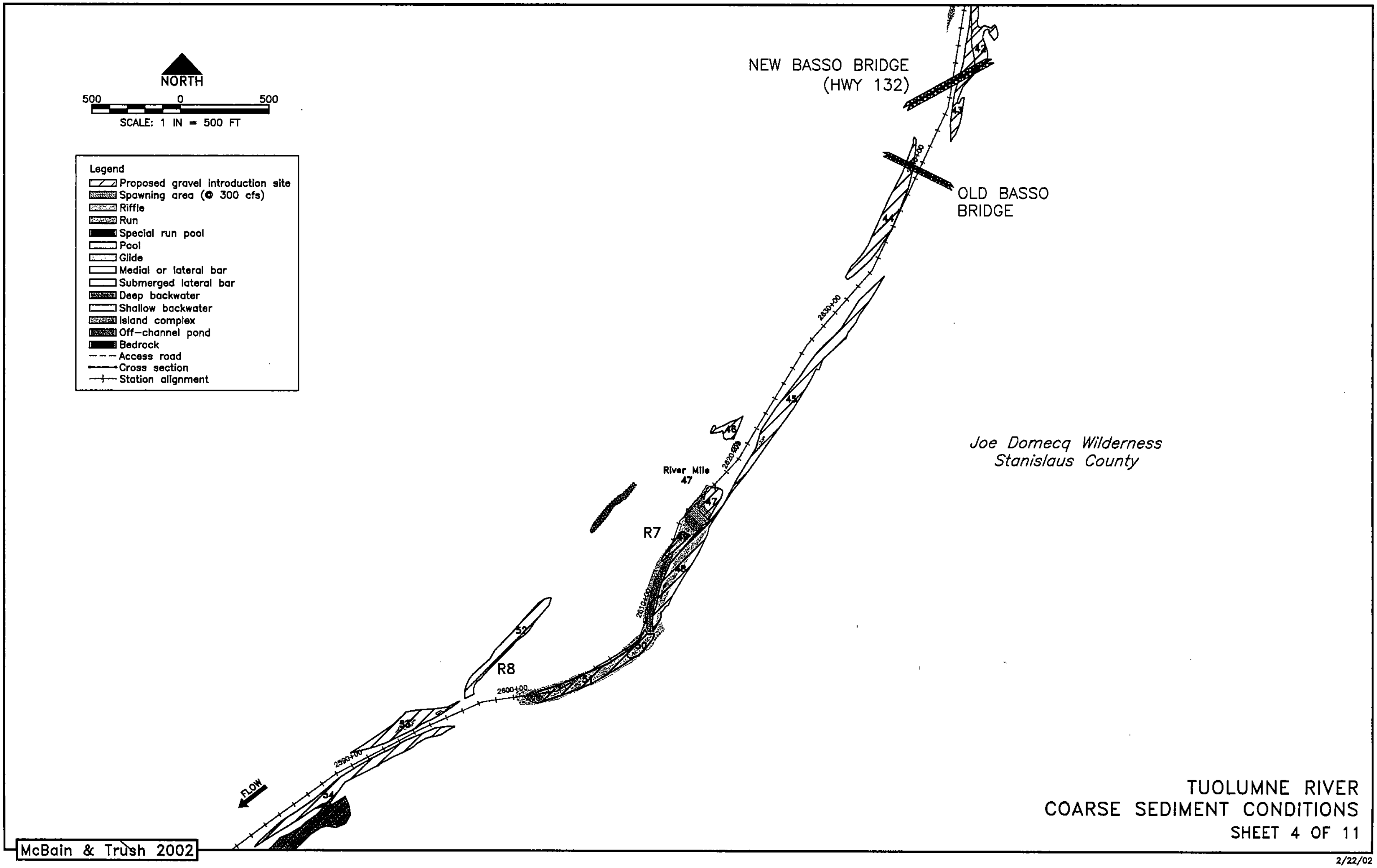
TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 1 OF 11

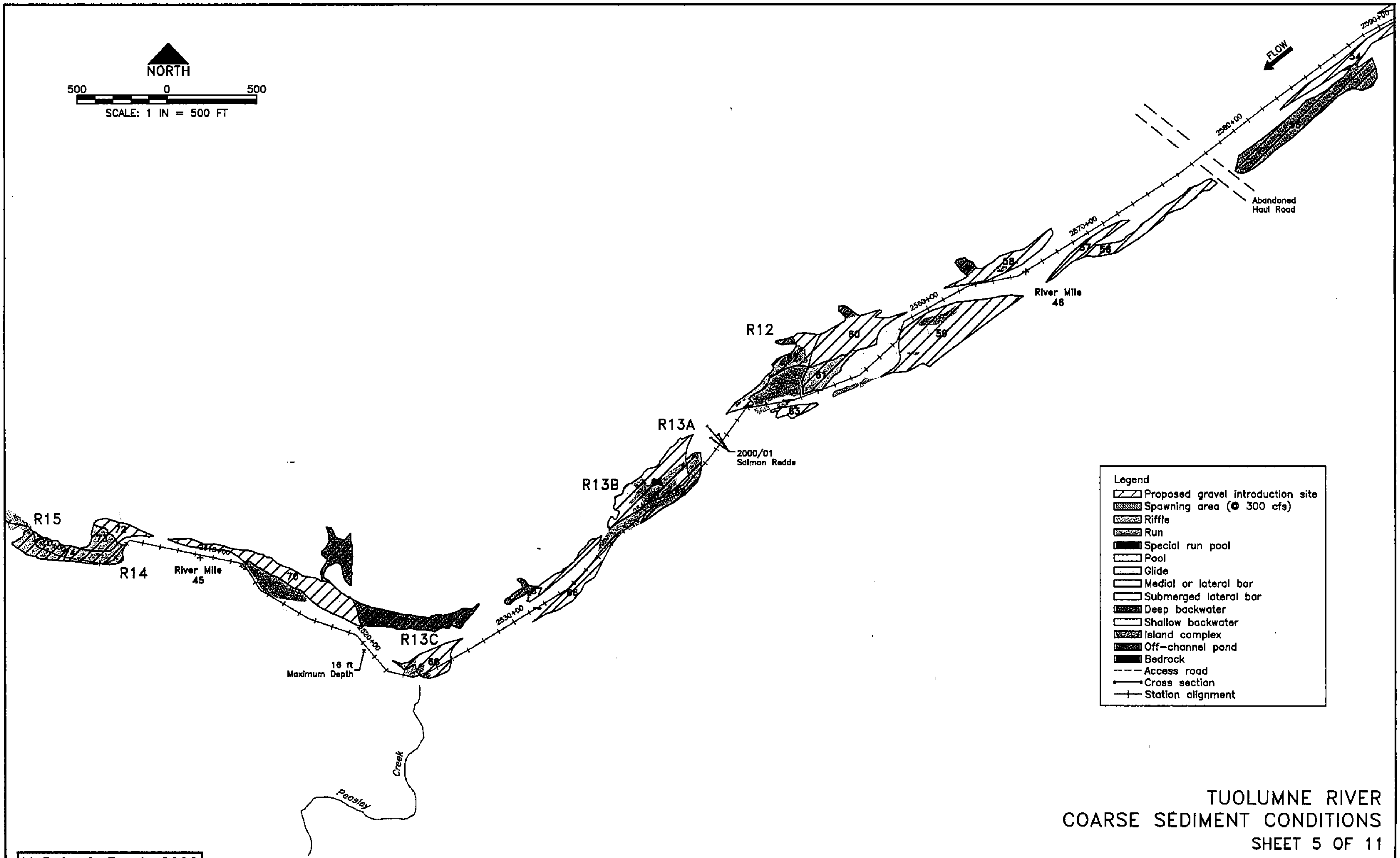


TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 2 OF 11

2/22/02


FLOW
R4B
XS 2690+00
SEDIMENT TRANSPORT MONITORING STATION
SEDIMENT TRANSPORT MODELING REACH I
XS 2685+00
Access Road
River Mile 48
R5A
XS 2674+00
XS 2672+00
XS 2670+00
Dominici Creek
R5B
NEW BASSO BRIDGE (HWY 132)
NORTH
500 0 500
SCALE: 1 IN = 500 FT
Legend
Proposed gravel introduction site
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 3 OF 11
McBain & Trush 2002
2/22/02

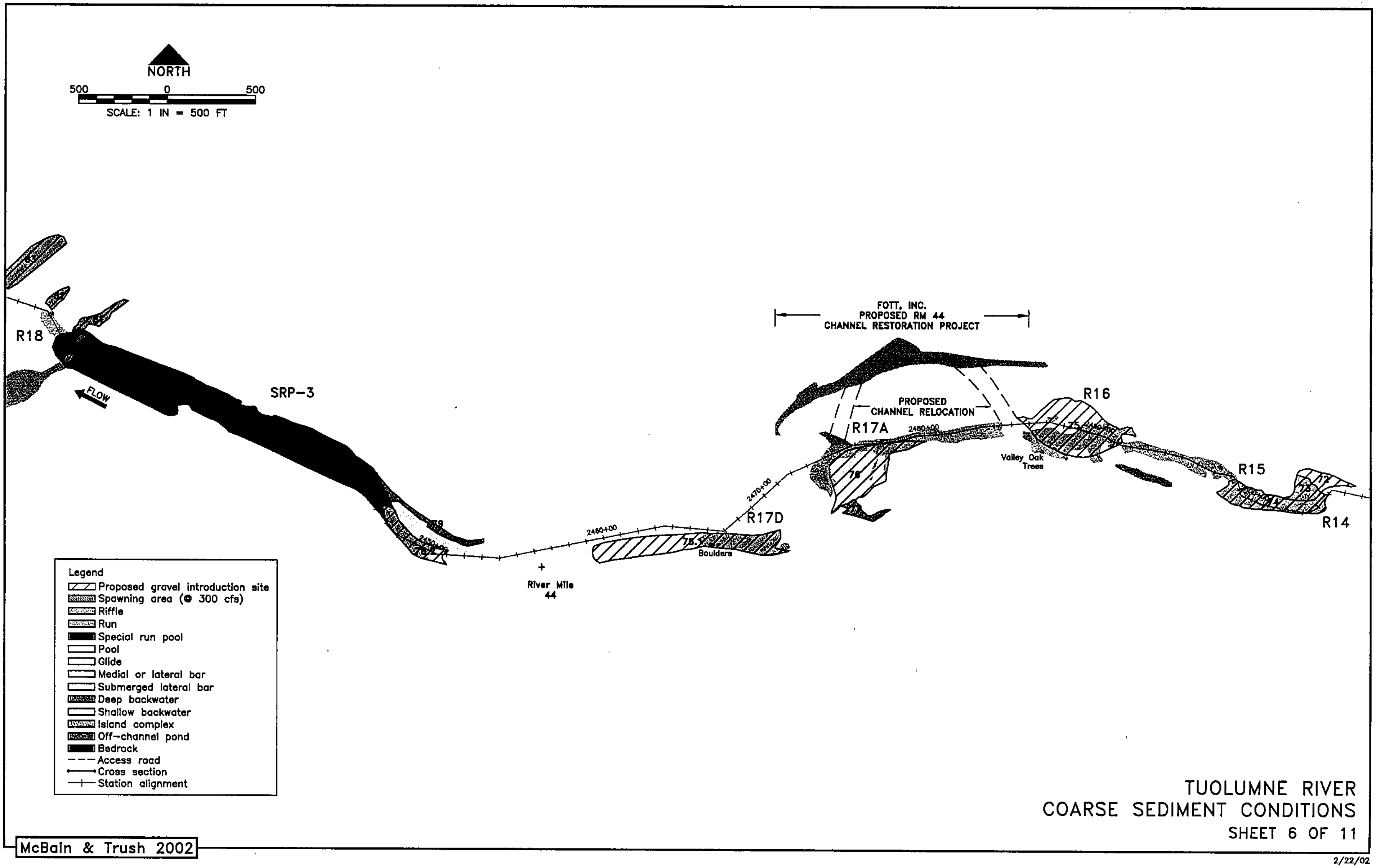

NORTH
500
0
500
SCALE: 1 IN = 500 FT
Legend
Proposed gravel introduction site
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
NEW BASSO BRIDGE
(HWY 132)
OLD BASSO
BRIDGE
2630+00
River Mile
47
R7
R8
2600+00
2590+00
FLOW
Joe Domecq Wilderness
Stanislaus County
TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 4 OF 11
McBain & Trush 2002
2/22/02

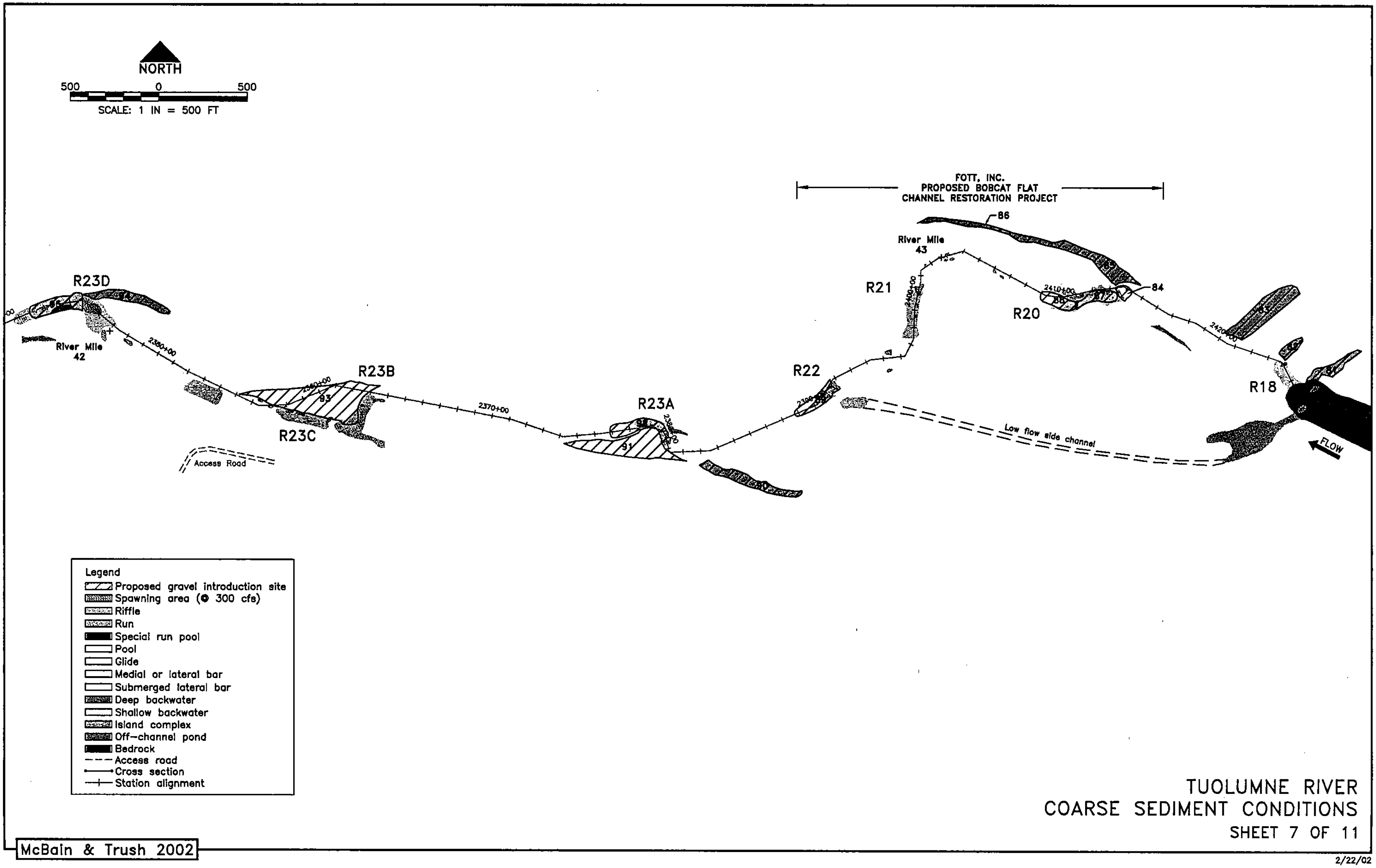


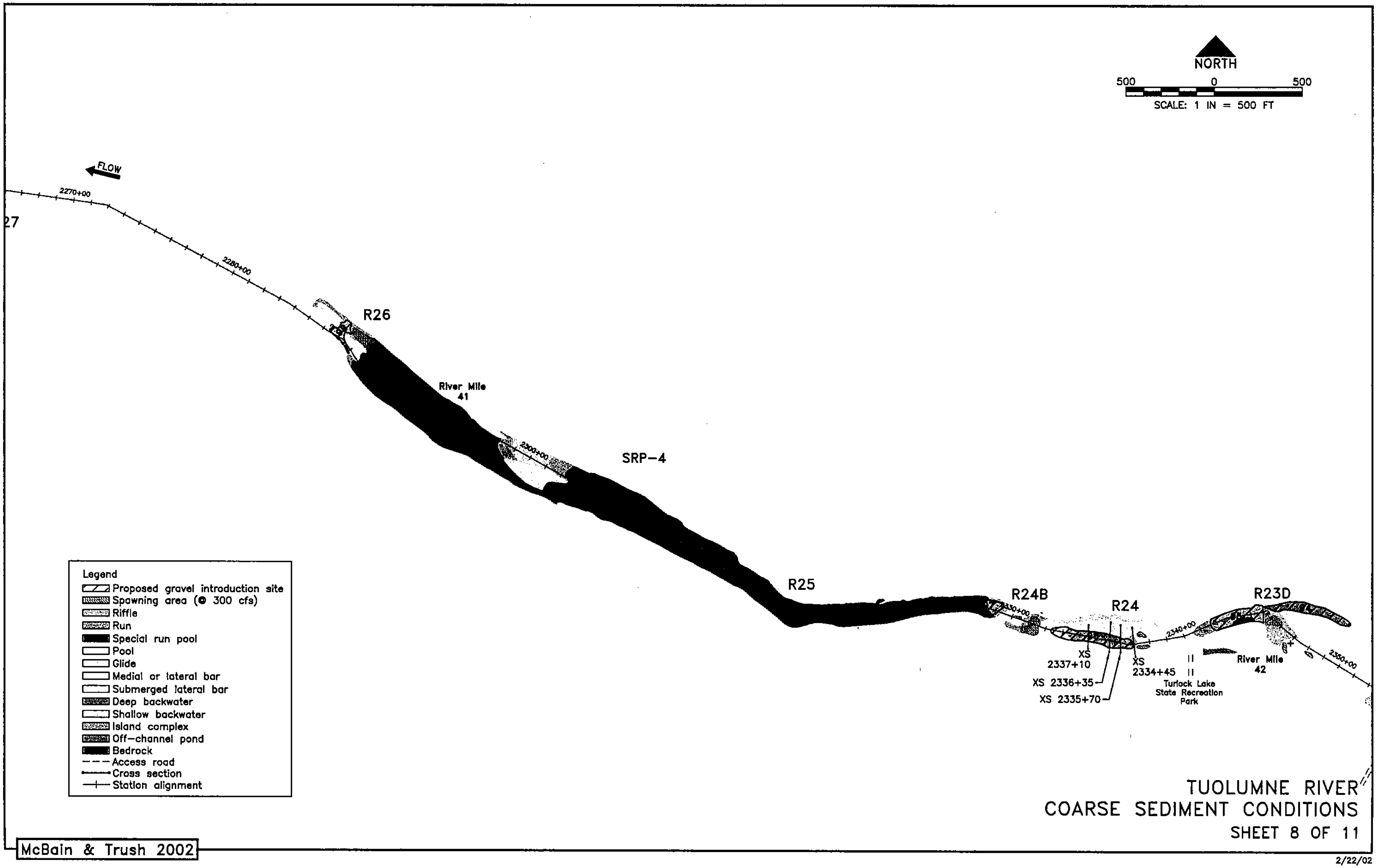
TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 5 OF 11

McBain & Trush 2002

2/22/02


NORTH
500 0 500
SCALE: 1 IN = 500 FT
R18
SRP-3
FLOW
FOTT, INC.
PROPOSED RM 44
CHANNEL RESTORATION PROJECT
PROPOSED
CHANNEL RELOCATION
R17A
R17D
R16
R15
R14
Valley Oak Trees
Boulders
River Mile 44
2480+00
2470+00
Legend
Proposed gravel introduction site
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 6 OF 11
McBain & Trush 2002
2/22/02

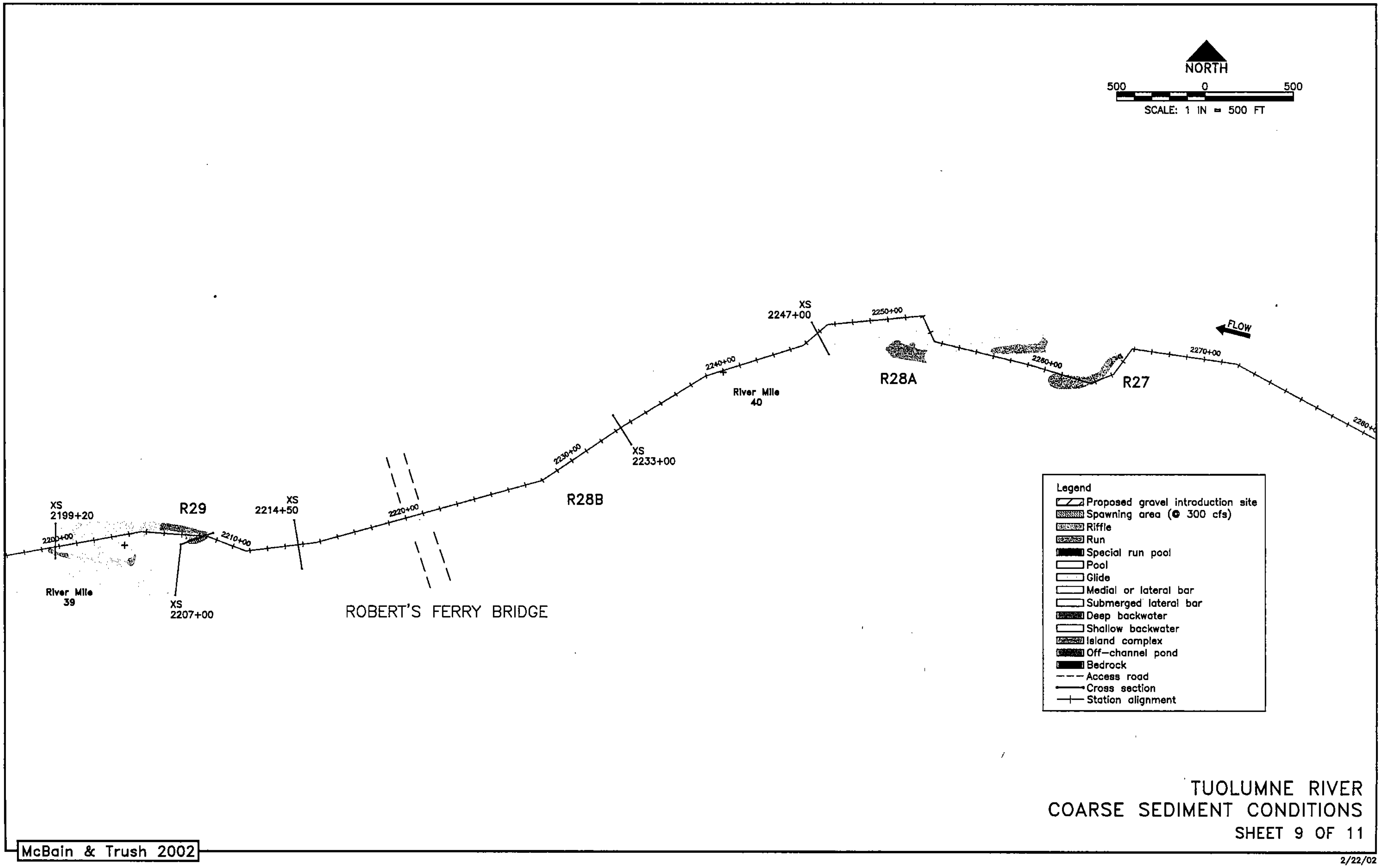

NORTH
500 0 500
SCALE: 1 IN = 500 FT
FOTT, INC.
PROPOSED BOBCAT FLAT
CHANNEL RESTORATION PROJECT
R23D
River Mile
42
2380+00
R23B
R23C
Access Road
2370+00
R23A
R22
R21
River Mile
43
2400+00
2410+00
R20
86
84
2420+00
R18
Low flow side channel
FLOW
Legend
Proposed gravel introduction site
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 7 OF 11
McBain & Trush 2002
2/22/02



TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 8 OF 11

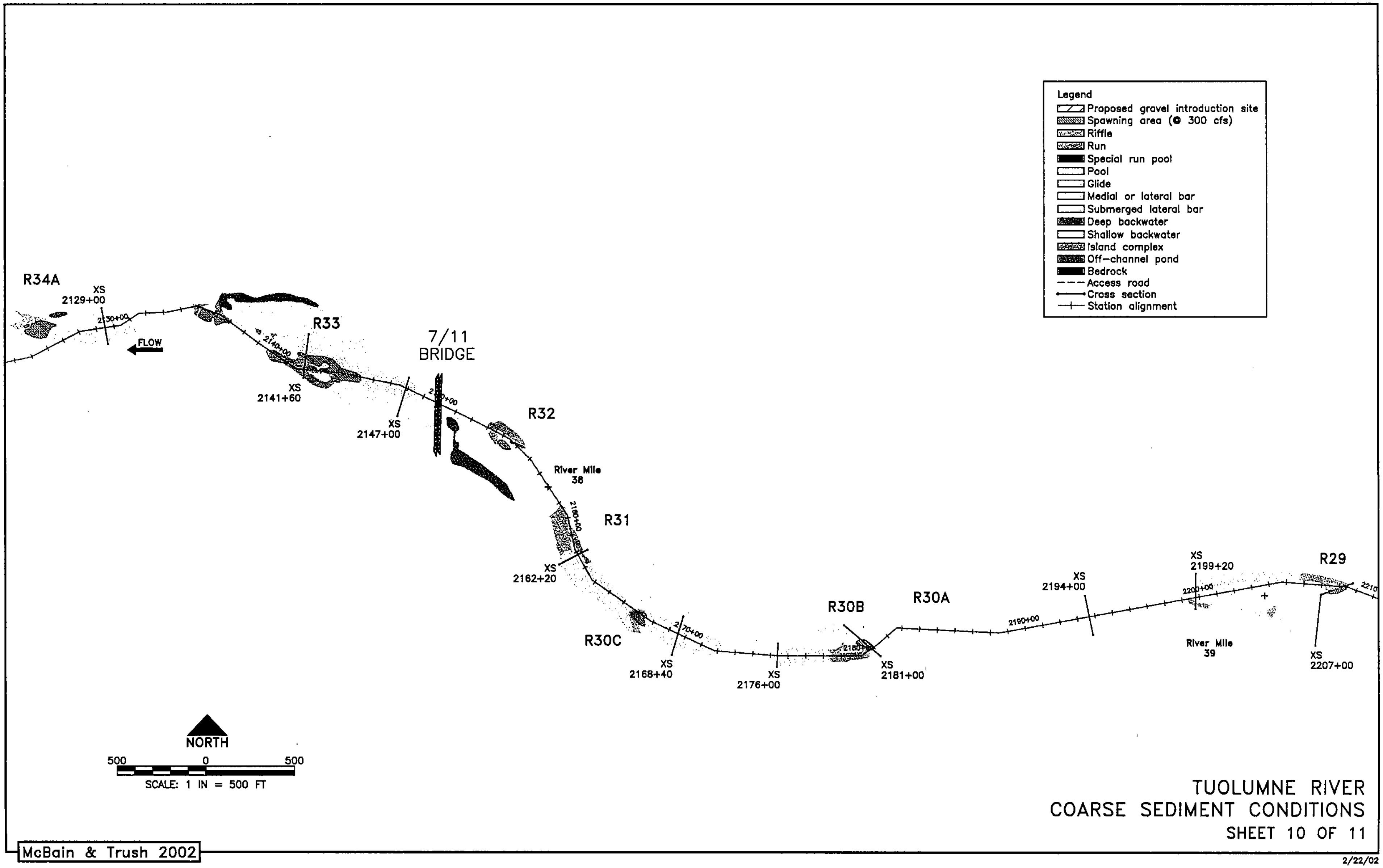
McBain & Trush 2002

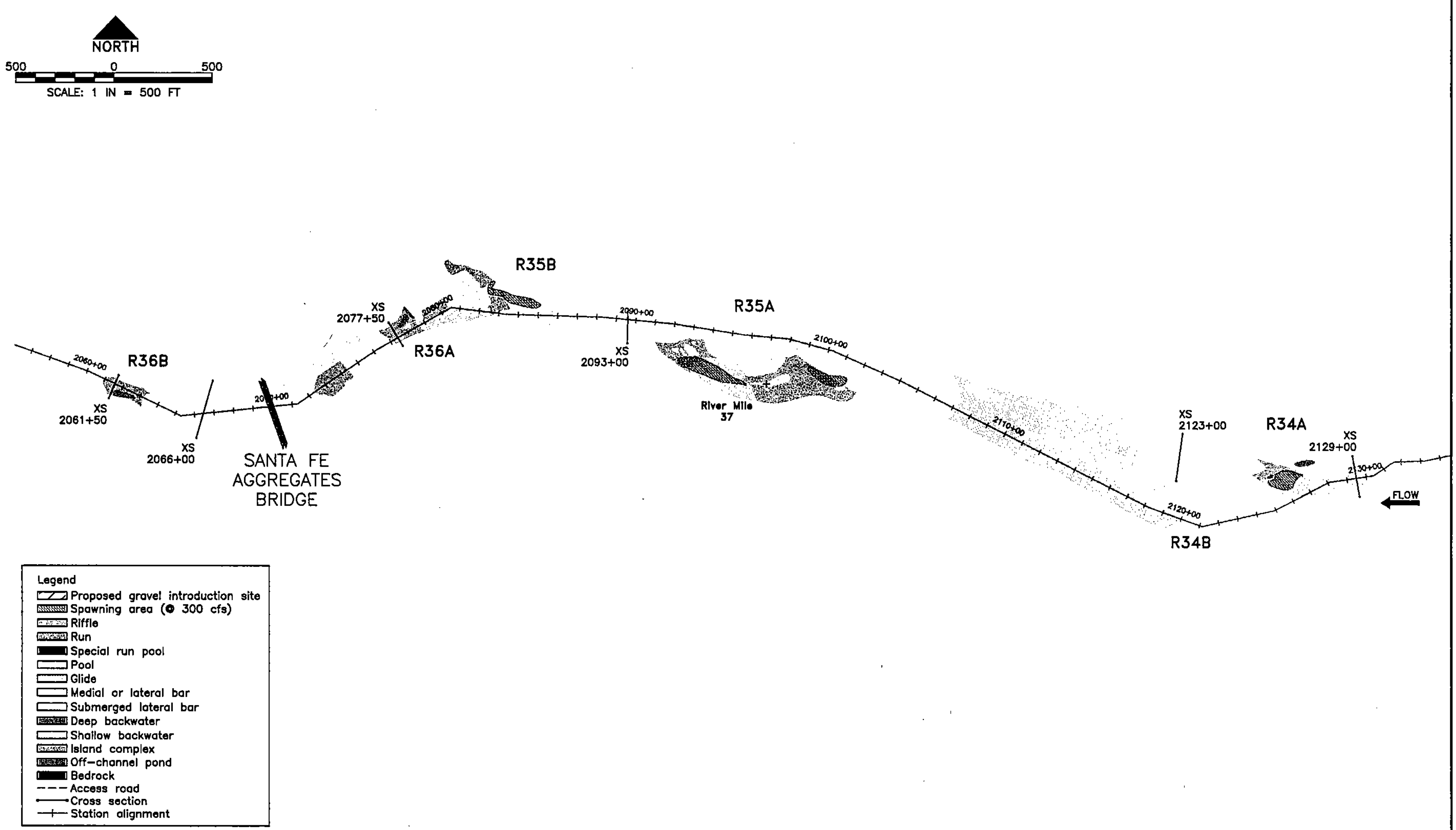
2/22/02



TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 9 OF 11

2/22/02


Legend
Proposed gravel introduction site
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
R34A
XS 2129+00
FLOW
R33
XS 2141+60
7/11 BRIDGE
XS 2147+00
R32
River Mile 38
R31
XS 2162+20
R30C
XS 2168+40
XS 2176+00
R30B
XS 2181+00
R30A
XS 2194+00
XS 2199+20
River Mile 39
R29
XS 2207+00
NORTH
500 0 500
SCALE: 1 IN = 500 FT
TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 10 OF 11
McBain & Trush 2002
2/22/02



TUOLUMNE RIVER
COARSE SEDIMENT CONDITIONS
SHEET 11 OF 11

McBain & Trush 2002

2/22/02

Genetic Analyses of Central Valley Trout Populations 1999-2003

by

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Final Technical Report submitted December 8, 2003
California Department of Fish and Game Sacramento, CA
and US Fish and Wildlife Service, Red Bluff Fish and Wildlife Office

ABSTRACT

Genetic variation found at 11 microsatellite loci was used to describe population structure for steelhead and rainbow trout (*Oncorhynchus mykiss*) in the Central Valley, California, looking at both spatial and temporal genetic variation as well as relationships among hatchery and wild populations. We analyzed genetic diversity at two scales: within drainage spatial allelic diversity analyzed for five trout populations sampled in Clear Creek; between and among drainage genetic diversity analyzed for 23 population of trout found in the Central Valley. DNA was amplified and analyzed for 1570 trout samples. Significant regional spatial structuring of populations was apparent, both within Clear Creek and among trout populations in the Central Valley. Significant differences in allelic frequencies were found among most river or drainage systems containing wild trout. However, less than 1% of the molecular variance could be attributed to differences between trout populations found within the Sacramento River and samples from the San Joaquin River drainage. Hatchery populations were shown to be similar in genetic diversity to geographically proximate local wild populations. Overall classification accuracy of single individuals to their stream of origin using these 11 microsatellite loci was 83%. Garza and Williamson's (2001) M over all populations of trout in the Central Valley was $M = 0.626$, below the published threshold ($M \leq 0.68$), supporting recent population reductions for steelhead within the Central Valley. Average estimated effective population size for Central Valley steelhead populations, however, was relatively high ($Ne = 5066$). Significant allelic differences were found in trout collected above and below impassable dams on the American, Yuba, Stanislaus and Tuolumne rivers. Trout sampled in Spring Creek were found to be extremely bottlenecked with genetic variation found at only two loci and an effective population size of 62. These data suggest that significant genetic population structure remains for steelhead populations within the Central Valley, and careful consideration of this genetic diversity should be part of future conservation and restoration efforts.

Coastal Northern California Salmonid Spawning Survey Protocol

Prepared By
Sean P. Gallagher[1] and Morgan Knechtle
Draft, 19 November 2003

INTRODUCTION

Coho (*Oncorhynchus kisutch*) and Chinook salmon (*O. tshawytscha*) and steelhead (*O. mykiss*) are listed as Threatened under the Endangered Species Act in coastal Northern California (Federal Register 1997, 1999, 2000). Breeding population size is important for assessing population status (McElhany et al. 2000). The National Marine Fisheries Service focuses on the number of adults escaping to spawn to evaluate the natural viability of salmon populations for recovery planning (Busby et al. 1996). There is a need for a reliable technique for long term monitoring of adult Chinook and Coho salmon and steelhead populations in coastal Northern California.

Spawning surveys; redd counts, live fish observations, carcass mark-recapture surveys, and releases above weirs and counting structures are commonly used to assess salmonid population abundance (Maahs 1997, Rieman and Myers 1997, Susac and Jacobs 1999, Jacobs et al. 2001, Gallagher 2002, 2003, Gallagher and Gallagher In Preparation, Hannon and Healey 2002). The California State Department of Fish and Game's Anadromous Fisheries Resource Assessment and Monitoring Program has been testing, modifying, and evaluating various approaches for estimating salmonid populations in Northern California since it's inception in 1999. Spawning surveys, which include redd measurement, redd counts, live fish counts, and carcass marking, in a stratified index sampling scheme (Irvine et al 1992) have been shown to produce reasonable population estimates with reduced field effort (Gallagher 2003, Gallagher and Gallagher In Preparation). The purpose of this Protocol is to describe field methods for collecting information to estimate salmonid escapement in coastal Northern California streams. Predetermined, randomly selected survey reaches (Appendix A) will be surveyed weekly beginning in late-November, with one survey occurring prior to fish entering spawning areas, and continuing until late-April (or when new redds and fish are no longer observed). Some reaches may be temporally surveyed a maximum of two weeks apart and stream flows and/or weather conditions will likely have some bearing on the temporal intensity of surveys. All redds will be identified to species, measured, and geo-referenced. All live and dead fish will be identified, measured, and marked (carcasses only). Redd longevity and observer efficiency in redd detection should be estimated for each watershed each year. The condition of redds measured during previous surveys will be recorded to assess the duration of redd observability and observer efficiency. To further evaluate observer efficiency, one reach should be selected and surveyed by two crews each week, one crew measuring redds and recording data but not flagging new redds, followed by the second crew measuring and flagging all new redds.

STUDY AREA

The current study area is coastal Mendocino County, although it should be expanded to include other rivers and streams throughout coastal Northern California in a stratified sampling design (Gallagher and Gallagher In Preparation) or a rotating panel design (see the Oregon Plan for Salmonids at www.oregon-plan.org) in order to estimate salmonid escapement within and among ESU's. To determine the entire length of spawning habitat in streams where the extent of spawning habitat is not known, it should be determined by surveying the entire area of suspected habitat during the first year with each survey continuing for about one hour above the last redd observed or to assumed barriers. The Albion River (ALB), Caspar (CAS), Hare (HAR), and Pudding (PUD) creeks, The Little (LTR), Noyo (NOY), Little North Fork Big (LNFB), and the Ten Mile (TEN) rivers are of primary interest due to the history of similar

[1] Primary author to whom correspondence should be addressed. California State Department of Fish and Game, 1031 South Main Street, Suite A, Fort Bragg, CA 95437. Phone 707-964-1492. Email: Sgallagh@dfg.ca.gov. Draft, 11/19/2003.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District	)	
	)	
and	)	Project No. 2299
	)	
Modesto Irrigation District	)	

2003 LOWER TUOLUMNE RIVER ANNUAL REPORT

Report 2003-1

Spawning Survey Summary Update

Prepared by

Tim Ford
Turlock and Modesto Irrigation Districts

and

Steve Kirihara
Stillwater Ecosystem, Watershed & Riverine Sciences
Berkeley, CA

March 2004

SPAWNING SURVEY SUMMARY UPDATE

1. INTRODUCTION

The California Department of Fish and Game (CDFG) have conducted fall-run Chinook salmon spawning surveys on the Tuolumne River since 1971 as required under the fish study program for the Don Pedro Project FERC license. TID/MID (1992) reviewed the 1971-1988 period and TID/MID (1997) summarized the 1989-1995 Tuolumne River surveys. This report updates Report 2002-2 and summarizes the entire 1971-2003 post-New Don Pedro study period, including new data for 2002 and partial data for 2003. Sections with updated analyses were presented in regular type. Italicized sections, that were unchanged, will be updated at a later date when CDFG provides the required data. Only tables and figures with updated analyses were included in this report.

2. SUMMARY UPDATE

2.1 Population Estimates, *Sex Composition, and Potential Eggs*

Population estimates for each year are in Table 1 and Figure 1. Estimates for the Tuolumne River and the San Joaquin basin are available since1940 (Table 2). Tuolumne salmon runs for the 1971-2003 period have ranged from less than 100 salmon in 1990 and 1991 to 40,300 fish in 1985. The 2003 run estimate was 2,854 (Blakeman, 2004) a significant reduction from the previous 6 years with runs exceeding 7,000 salmon.

The percentage of females in the 1971-2002 runs shows a wide range from a low of 25% in 1983 to a high of 67% in 1978 (Figure 2). The years with less than 40% females had runs containing a large percentage of 2-year-old males. 2002 had about 54% females in the run, similar to the previous year.

The estimated number and average size of females are used to estimate the potential egg deposition for the run. Beginning in 1981, the potential egg deposition for each year has been estimated. This is based on a formula from CDFG Los Banos trap data collected in 1988 using a female size to egg number relationship. These potential egg deposition values have ranged from 145,000 in 1991 to 128.6 million in 1985 (Figure 3, Table 3). The estimated 2002 potential egg number was about 23.3 million based on approximately 3,900 females with an average fork length of 76.6 cm. Egg survival can decrease with increasing number of females due to redd superimposition.

2.2 *Spawning Distribution* and Timing

The high number of redds counted for each riffle was summarized each year for the 1981-2002 period (Table 4). The pattern from redd counts shows the most heavily used riffles are usually found in the upper river, upstream of Basso Bridge (RM 47.5). Prior to 1999, this upper reach of river (4.5 miles) often accounted for up to 50% of the total number of redds. In 1999 this reach contained 58.6% of the total number of redds counted, in 2000, 59.4% and in 2001 about 62%. In 2002, however, only about 37% of the total number of redds counted were reported in this reach. Section 1 (Riffle 1A to Riffle 5B) contained 50 to 53% of the total in 1999, 2000 and 2001 *but only 32% in 2002. Section 3, Turlock Lake State Recreation Area (RM 42.0) to Riffle 46 (RM 34.2) showed an increase in 2002 to about 28% of the total redd count. Changes in personnel conducting the surveys could account for some uncertainty in yearly comparisons of redd count data.*

The first reported arrival of salmon at the La Grange area has been noted since 1981 (Table 5). Although this is not a definitive record for arrival timing, it provides some information on the variation in the onset of the runs. For the 1981-200 3period, the earliest arrival date was 05SEP01 and the latest date was 06NOV91 (Figure 4). The arrival date for 2003 was 13OCT and the average date for the entire period was 05OCT.

The earliest date of peak weekly live count for the 1971-2003 period was 31OCT 96 and the latest peak was 27NOV72 with a median date of 12 NOV (Table 5). The 2003 run had a peak live count of 463 salmon on 18 NOV.

2.3 Length Frequency Distribution and Age Class Composition

Fork length measurements have been recorded for carcasses since 1981. The size distribution for males and females is different with males typically being longer than females of the same age. Generally, the average length of all males is longer than of all females with the exception of years that have a high proportion of 2-year-olds, which are mostly males (Fig. 5, Table 6). Estimation of age-class composition based on visual examination of the length frequency distribution of fresh measured carcasses was made for the 1981-2002 surveys (Table 7). These imprecise estimates are made for comparative purposes and will be modified when age analysis of scale and otolith samples collected by CDFG and lengths of known age hatchery fish are provided. The estimated female maximum fork lengths for ages two, three, and four are typically about 65, 85, and 95 cm respectively. Male fork length maximums for ages two, three, and four were 70, 95, and 105 cm, respectively. The most notable exceptions to the age/length estimates occurred in 1983, 1984, 1997, 1998 and 1999 when ocean growth of salmon may have been reduced due to El Niño (warm water) conditions that affected food resources.

Using these estimated age/length ranges, two-year-olds dominated the 1981, 1983, 1984, 1987, 1992, and 1996 runs. The 1982, 1985, 1986, 1988-1991, 1993-1995, 1997, 2000 and 2002 runs were mostly three-year-olds (Figure 6). The 1998 and 1999 runs were estimated to have fairly equal numbers of two and three-year-old salmon. Four-year-olds had not been the most abundant age class in any year until 2001, but were estimated to be more than 10% of the1986, 1989, 1990, and 1997-2002 runs. The 2001 run was estimated to have about 41% four-year-old salmon. This is the highest estimated percentage of four-year-old salmon in the 1981-2002 study period. Five-year-olds are estimated to have comprised from 0-5% of the runs. The overlap in size range of three and four-year-old salmon probably resulted in underestimates of the actual number of four-year-old salmon in some years.

2.4 Linear Regression Analysis of 2-year old salmon vs. following year 3-year olds

A linear regression analysis of the logarithmic values for all estimated 2-year old salmon and the following year estimated 3-year olds resulted in an $r^2 = .88$ *for the 1981-2001 period (excluding the 1984 outlier). A similar analysis for estimated 2-year old female salmon only and the following year estimated 3-year old females resulted in an* $r^2 = .84$ *(Figure 7). These* *analyses indicate a high degree of correlation for both all 2-year old salmon and for 2-year old females returning the following year as 3-year olds of that brood year.*

2.5 Coded Wire Tagged Salmon

Large numbers of coded wire tagged (CWT) hatchery salmon have been released into the Tuolumne River or nearby San Joaquin River since 1986 as part of the Tuolumne River smolt survival evaluations (Figure 8). A small percentage of these fish shed their tags but still have the external mark of a clipped adipose fin. In addition, smaller numbers of untagged salmon have been released since 1995 as part of the rotary screw trap evaluations (and other survival evaluations in 1998). Nearly all of these artificially reared salmon have been from the Merced River Hatchery (TID/MID, 2003). Other large releases of CWT salmon are made by CDFG in the Merced, Stanislaus, and San Joaquin Rivers. In addition, CDFG releases large numbers of unmarked hatchery salmon in some years in the Merced River.

From 1981 to 1986, the estimated proportion of adult CWT salmon in the run was less than 2% (Figure 9). That proportion began increasing with the first return of 1986 CWT study fish in the 1987 run. Since 1989, the proportion of CWT salmon has generally ranged from 10-25% with the exception of a higher percentage in 1990 and 1991 with runs of less than 100 salmon and with a lesser percentage in the 2000 run, during a percentage decline in recent years as total run estimates increased after 1995. The 2002 run was estimated to have about 30.5% CWT, this was the highest percent of hatchery origin salmon since the small runs of 1990 and 1991. The 2003 run was estimated to have 21.0% CWT based on the ratio of adipose clipped fish to total tagged carcasses. CWT verification has not been provided by CDFG for the 2003 clipped fish.

For the 1981-2003 period, the estimated number of CWT in the runs ranged from a low of 0 in 1981 and 1982 to high of about 2175 in 2002 (Figure 9). The 2003 run was estimated to include about 600 CWT fish. Most of the Tuolumne River CWT's are of Merced River Hatchery origin, specifically the Tuolumne River and south delta smolt study releases (Figure 10, Table 8). The 2002 run had a large number of CWT's that originated in the south delta and Jersey Point releases. Unweighted returns from Tuolumne River upper and lower smolt survival release groups have been roughly equal (Figure 11). Beginning in 1990, the upper release group was significantly larger in number than the lower release group; ranging from 20 to 100% larger. This factor correspondingly affects the CWT returns by group. Decoded tag data on the origin of CWT salmon in the 2003 run have not yet been provided by CDFG.

3. REFERENCES

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TABLE 1. TUOLUMNE RIVER SPAWNING SALMON SURVEY COUNTS AND ESTIMATES, 1971-2003.

YEAR	TOTAL CARCASSES	% FEMALE	TAGGED CARCASSES NUMBER TAGGED	NUMBER RECOVERED	% RECOVERED	(WEEKLY) MAXIMUM LIVE COUNT	(1) (WEEKLY) MAXIMUM REDD COUNT	ESTIMATED RUN
1971	2,283	58			10.4 e	2,128	1,598	21,885
1972	537	52			10.5 e	349	423	5,100
1973	351	59	270	35	13.0			1,989
1974	90	55	84	7	8.3			1,150
1975	130	60	125	8	6.4	154	212	1,600
1976	336	51	330	61	18.5	241	312	1,700
1977	45							450
1978	116	67	35	2	9.0 e	81	119	1,300
1979	305	51	75	22	29.3	153	204	1,184
1980	248	61	74	30	40.5	112	117	559
1981	5,819	44	664	334	50.3	1,646	1,650	14,253
1982	2,135	60	293	123	42.0	530	1,111	7,126
1983	1,280	25	270	25	9.3	263	465	14,836
1984	3,841	34	693	201	29.0	1,084	1,143	13,689
1985	11,651	56	895	273	30.5	2,986	3,034	40,322
1986	2,463	48	456	172	37.7	1,123	1,250	7,288
1987	5,280	31	1,069	461	43.1	2,155	850	14,751
1988	3,011	60	2,171	1,316	60.6	1,066	1,936	6,349
1989	625	52	491	318	64.8	291	461	1,274
1990	37	32	30	14	46.7	44	42	96
1991	30	45	12	7	58.3	24	51	77
1992	55	43	47	26	55.3	49	38	132
1993	187	61	169	96	56.8	94	215	431
1994	215	50	185	110	59.5	226	264	513
1995	461	54	415	175	42.2	270	174	928
1996	1,301	35	1,186	369	31.1	636	216	4,362
1997	1,520	59	1,056	253	24.0	1,258	716	7,548
1998	2,712	51	2,170	679	31.3	1,058	448	8,967
1999	3,980	46	2,375	1,398	58.9	1,403	404	7,730
2000	6,884	63	2,162	870	40.2	3,269	2,104	17,873
2001	5,400	54	1,170	717	61.3	1,865	1,251	9,222
2002	4,702	54	1,283	826	64.4	1,366	478	7,125
2003	1,489		585	328	56.1	463	349	2,854

(1) Redd counts were taken from TID/MID summary tables after 1980; redd counts for 1986 partially based on aerial photographs taken on 26 November 1986.

e - estimated

Table 2. SAN JOAQUIN BASIN CHINOOK SALMON SPAWNING STOCK ESTIMATES (in 1000's of fish)

Year	STANISLAUS	TUOLUMNE	MERCED (river)	MERCED (hatchery)	MERCED (total)	Trib. Total	SJ RIVER	Basin Total	Event
1939							5.00		No tributary estimates
1940	3.00	122.00			1.00	126.00		126.00	
1941	1.00	27.00			1.00	29.00	9.00	38.00	
1942		44.00				44.00		44.00	No Stan. or Merced estimates
1943							35.00		No tributary estimates
1944		130.00				130.00	5.00	135.00	No Stan. or Merced estimates
1945							56.00		No tributary estimates
1946		61.00				61.00	30.00	91.00	Friant Dam on San Joaquin River
1947	13.00	50.00				63.00	6.00	69.00	
1948	15.00	40.00				55.00	2.00	57.00	
1949	8.00	30.00				38.00	8.00	46.00	
1950							0.50		Last SJ run; Early flood - no trib. estimates
1951	4.00	3.00				7.00		7.00	Tracy Pumping Plant, No Merced estimate
1952	10.00	10.00				20.00		20.00	
1953	35.00	45.00			0.50	80.50		80.50	
1954	22.00	40.00			4.00	66.00		66.00	
1955	7.00	20.00				27.00		27.00	No Merced estimate
1956	5.00	6.00			0.00	11.00		11.00	
1957	4.00	8.00			0.40	12.40		12.40	Inland gill-netting banned
1958	6.00	32.00			0.50	38.50		38.50	
1959	4.00	46.00			0.40	50.40		50.40	Drought
1960	8.00	45.00			0.40	53.40		53.40	Drought
1961	2.00	0.50			0.05	2.55		2.55	Drought
1962	0.30	0.20			0.06	0.56		0.56	
1963	0.20	0.10			0.02	0.32		0.32	Lowest total of record
1964	4.00	2.10			0.04	6.14		6.14	First Old River fall rock barrier
1965	2.00	3.20			0.09	5.29		5.29	
1966	3.00	5.10			0.04	8.14		8.14	New Exchequer Dam on Merced
1967	11.89	6.80			0.60	19.29		19.29	
1968	6.39	8.60			0.60	15.59		15.59	State Pumping Plant
1969	12.33	32.20			0.60	45.13		45.13	
1970	9.30	18.40	4.70	0.10	4.80	32.50		32.50	Merced River Hatchery
1971	13.62	21.89	3.45	0.10	3.55	39.06		39.06	New Don Pedro Dam on Tuolumne
1972	4.30	5.10	2.53	0.12	2.65	12.05		12.05	
1973	1.23	1.99	0.80	0.20	1.00	4.22		4.22	
1974	0.75	1.15	1.00	0.40	1.40	3.30		3.30	
1975	1.20	1.60	1.70	0.40	2.10	4.90		4.90	
1976	0.60	1.70	1.20	0.30	1.50	3.80		3.80	Drought
1977	0.00	0.45	0.35	0.20	0.55	1.00		1.00	Drought
1978	0.05	1.30	0.53	0.10	0.63	1.98		1.98	New Melones Dam on Stanislaus
1979	0.10	1.18	1.92	0.30	2.22	3.50		3.50	
1980	0.10	0.56	2.85	0.16	3.01	3.67		3.67	
1981	1.00	14.25	9.49	0.92	10.42	25.67		25.67	

Table 2. SAN JOAQUIN BASIN CHINOOK SALMON SPAWNING STOCK ESTIMATES (in 1000's of fish)

Year	STANISLAUS	TUOLUMNE	MERCED (river)	MERCED (hatchery)	MERCED (total)	Trib. Total	SJ RIVER	Basin Total	Event
1982		7.13	3.07	0.19	3.26	10.39		10.39	No Stanislaus estimate
1983	0.50	14.84	16.45	1.80	18.25	33.58		33.58	
1984	11.44	13.69	27.64	2.11	29.75	54.88		54.88	
1985	13.47	40.32	14.84	1.21	16.05	69.85		69.85	
1986	6.50	7.40	6.79	0.65	7.44	21.34		21.34	
1987	6.29	14.75	3.17	0.96	4.13	25.17		25.17	Drought
1988	10.21	6.35	4.14	0.46	4.59	21.15	2.30	23.45	Drought
1989	1.51	1.27	0.35	0.08	0.43	3.21	0.33	3.54	Drought
1990	0.48	0.10	0.04	0.05	0.08	0.66	0.28	0.94	Drought
1991	0.39	0.08	0.08	0.04	0.12	0.59	0.18	0.77	Drought
1992	0.26	0.13	0.62	0.37	0.99	1.37	0.00	1.37	Drought; Electric barrier on SJR
1993	0.68	0.43	1.27	0.41	1.68	2.79	0.00	2.79	Start of Annual Physical barrier on SJR
1994	1.03	0.51	2.65	0.94	3.59	5.13	0.00	5.13	
1995	0.61	0.93	1.96	0.58	2.54	4.08	0.00	4.08	
1996	0.16	4.36	3.76	1.01	4.77	9.29	0.00	9.29	
1997	5.59	7.15	2.71	0.95	3.66	16.39	0.00	16.39	Prelim. estimates
1998	3.09	8.91	3.29	0.80	4.09	16.09	0.00	16.09	Prelim. estimates
1999	4.00	7.73	3.01	0.80	3.81	15.54	0.00	15.54	Prelim. estimates
2000	11.00	17.87	11.00	2.00	13.00	41.87	0.00	41.87	Prelim. estimates
2001	6.00	9.25	9.20	1.30	10.50	25.75	0.00	25.75	Prelim. estimates
2002	6.90	7.13	7.90	1.80	9.70	23.73	0.00	23.73	Prelim. estimates
2003	4.50	2.85	2.90	0.50	3.40	10.75	0.00	10.75	Prelim. estimates
2004									
2005									
	(1940 Stan. and Merced, and 1941 Stan., Tuol., and Merced, are partial counts)								
Average:									
1940-2001	5.51	17.39			3.65	25.65	6.18	26.68	
1940-1949	8.00	63.00			1.00	68.25	18.88	75.75	40's
1950-1959	10.78	23.33			0.97	34.76	0.50	34.76	50's
1960-1969	5.01	10.38			0.25	15.64		15.64	60's
1970-1979	3.12	5.48	1.82	0.22	2.04	10.63		10.63	70's
1980-1989	5.67	12.06	8.88	0.85	9.73	26.89	1.32	27.15	80's
1990-1999	1.63	3.03	1.94	0.59	2.53	7.19	0.05	7.24	90's
2000-2010	5.68	9.28	7.75	1.40	9.15	25.53	0.00	25.53	2000's
1967-1991	4.74	8.92	4.87	0.49	5.36	18.26	0.77	18.38	CVPIA baseline period
1973-2004	3.67	6.37	4.73	0.71	5.44	15.02	0.19	15.12	Post-New Don Pedro period

Table 5. Tuolumne River salmon survey periods, peak live counts, and arrival dates.

Year	Survey Period Start Date	Survey Period End Date	Peak Live Count Date	Peak Live Count Number	Tuolumne Estimate (x 1,000)	Peak Live / Pop.est. (%)	La Grange Powerhouse Observed Arrival
1940	26-Sep	02-Dec	04-Nov	5,447	122.0	4.5%	
1941	21-Sep	18-Nov	13-Nov	2,807	27.0	10.4%	
1942	13-Sep	30-Nov	01-Nov	3,386	44.0	7.7%	
1944	30-Sep	30-Nov	06-Nov	10,039	130.0	7.7%	
1946	11-Oct	20-Nov	04-Nov	6,002	61.0	9.8%	
1957	05-Nov	03-Jan			8.0		
1958	06-Nov	09-Jan			32.0		
1959	03-Nov	01-Jan			46.0		
1960	12-Nov	13-Jan			45.0		
1961					0.5		
1962	08-Nov	04-Jan			0.2		
1963	10-Feb				0.1		
1964	04-Nov	18-Dec			2.1		
1965	19-Nov	12-Jan			3.2		
1966	08-Nov	18-Jan	09-Nov	271	5.1	5.3%	
1967	18-Oct	13-Jan	21-Nov	184	6.8	2.7%	
1968	11-Nov	15-Dec	22-Nov	1,490	8.6	17.3%	
1969	20-Nov	12-Jan			32.2		
1970	19-Nov	20-Jan	20-Nov	1,517	18.4	8.2%	
1971	15-Nov	27-Dec	16-Nov	2,128	21.9	9.7%	
1972	13-Nov	23-Jan	27-Nov	349	5.1	6.8%	
1973	05-Nov	17-Jan			2.0		
1974					1.2		
1975	06-Nov	31-Dec	06-Nov	154	1.6	9.6%	
1976	03-Nov	29-Dec	15-Nov	241	1.7	14.2%	
1977	29-Nov	20-Dec			0.5		
1978	26-Oct	19-Dec	24-Nov	81	1.3	6.2%	
1979	05-Nov	17-Dec	02-Nov	153	1.2	12.8%	
1980	12-Nov	18-Dec	12-Nov	112	0.6	18.7%	
1981	04-Nov	16-Dec			14.3		14-Oct
1982	08-Nov	29-Nov	15-Nov	545	7.1	7.7%	29-Sep
1983	07-Nov	01-Dec	15-Nov	263	14.8	1.8%	13-Oct
1984	01-Nov	30-Nov	01-Nov	1,084	13.7	7.9%	04-Oct
1985	29-Oct	20-Dec	12-Nov	2,986	40.3	7.4%	24-Sep
1986	27-Oct	05-Dec	03-Nov	1,123	7.3	15.4%	10-Sep
1987	28-Oct	16-Dec	17-Nov	2,155	14.8	14.6%	06-Oct
1988	25-Oct	29-Dec	14-Nov	1,066	6.3	16.8%	17-Oct
1989	24-Oct	29-Dec	09-Nov	291	1.3	22.8%	15-Oct
1990	23-Oct	26-Dec	19-Nov	44	0.1	45.8%	24-Oct
1991	22-Oct	02-Jan	25-Nov	24	0.1	31.2%	06-Nov
1992	05-Nov	21-Dec	19-Nov	49	0.1	37.1%	31-Oct
1993	14-Oct	18-Dec	06-Nov	94	0.4	21.8%	26-Sep
1994	03-Nov	05-Jan	21-Nov	226	0.5	44.1%	26-Oct
1995	27-Oct	30-Dec	03-Nov	270	0.9	29.1%	05-Oct
1996	22-Oct	04-Dec	31-Oct	636	4.4	14.6%	
1997	14-Oct	23-Dec	12-Nov	1,258	7.5	16.7%	09-Oct
1998	07-Oct	22-Dec	02-Nov	1,058	9.0	11.8%	17-Sep
1999	04-Oct	28-Dec	01-Nov	1,403	7.7	18.2%	16-Sep
2000	02-Oct	05-Jan	06-Nov	3,269	17.9	18.3%	18-Sep
2001	04-Oct	05-Jan	05-Nov	1,865	9.2	20.2%	05-Sep
2002	01-Oct	02-Jan	04-Nov	1,366	7.1	19.2%	22-Sep
2003	30-Sep	30-Dec	18-Nov	463	2.9	16.2%	13-Oct
For period 1971-2003:							1981-2003
Minimum	30-Sep	29-Nov	31-Oct	---	---	---	05-Sep
Maximum	29-Nov	23-Jan	27-Nov	---	---	---	06-Nov
Median	28-Oct	25-Dec	12-Nov	---	---	---	06-Oct

TABLE 8. HATCHERY CONTRIBUTION TO THE TUOLUMNE RIVER SALMON RUNS (BY RELEASE LOCATIONS)

					TID/MID EST.	SMOLT RELEASE LOCATIONS											YEARLING RELEASE LOCATIONS				
RUN YEAR	TOTAL POP. EST.	ACTUAL DECODED CWT	SAMPLE POP.	ACTUAL % DECODED CWT	BASED ON ACTUAL % DECODED CWT	MERCED	TUOL.	STAN.	MERCED S. DELTA + JERSEY PT.	FEATHER S. DELTA JERSEY PT.	FEATHER OTHER DELTA	FEATHER	AMERICAN OTHER DELTA	MOKEL.	MOKEL. OTHER DELTA	BATTLE CR. OTHER DELTA	MERCED	TUOL.	MERCED S. DELTA	MERCED OTHER DELTA	MOKEL. OTHER WILD
1981	14,253	0	-	0.0	0																
1982	7,126	0	-	0.0	0																
1983	14,836	6	347	1.7	257				2		3								1		
1984	13,689	2	944	0.2	29				2												
1985	40,322	7	1052	0.7	268	1				1							4		1		
1986	7,288	12	806	1.5	109						1								9	2	
1987	14,751	100	1446	6.9	1020		87	7	3			1					2				
1988	6,349	29	719	4.0	256		25	1	3												
1989	1,274	64	625	10.2	130		32	4	25	1			1		1						
1990	96	13	22	59.1	57		6	1	4		1		1								
1991	77	5	20	25.0	19			2	2	1											
1992	132	8	47	17.0	22		1	1			2					1		3			
1993	431	35	169	20.7	89					13				3			1	18			
1994	513	16	81	19.8	101												6	9			1
1995	928	56	415	13.5	125		46			4	2				1		3				
1996	4,362	233	1186	19.6	857	19	196			9	1				3		5				
1997	7,548	164	1056	15.5	1172	37	106		4	15					1		1				
1998	8,967	259	2170	11.9	1070	3	147		25	79	1				2						
1999	7,730	229	2375	9.6	745	9	122	0	77	17					3						
2000	17,873	109	2162	5.0	901	19	55	0	28	4	0	0			2	1					
2001	9,222	243	1808	13.4	1239	15	150	0	76	1	0				1						
2002	7,125	449	1795	25.0	1782	7	181	3	217		12		1		28						
2003	2,854		585																		

The estimated total number of CWT's by DFG (taken from Job #2, Pg 15 of the 1992-93 Region 4 annual report) for the 1988 to 1992 period were 85, 312, 52, 21, and 14 respectively.
*The 1988 sample population was determined from TID/MID data analysis.
**1989 has been reported with different numbers by DFG. (If CWT were all fresh, the sample pop. of 288 would yield 289 estimated CWT.)

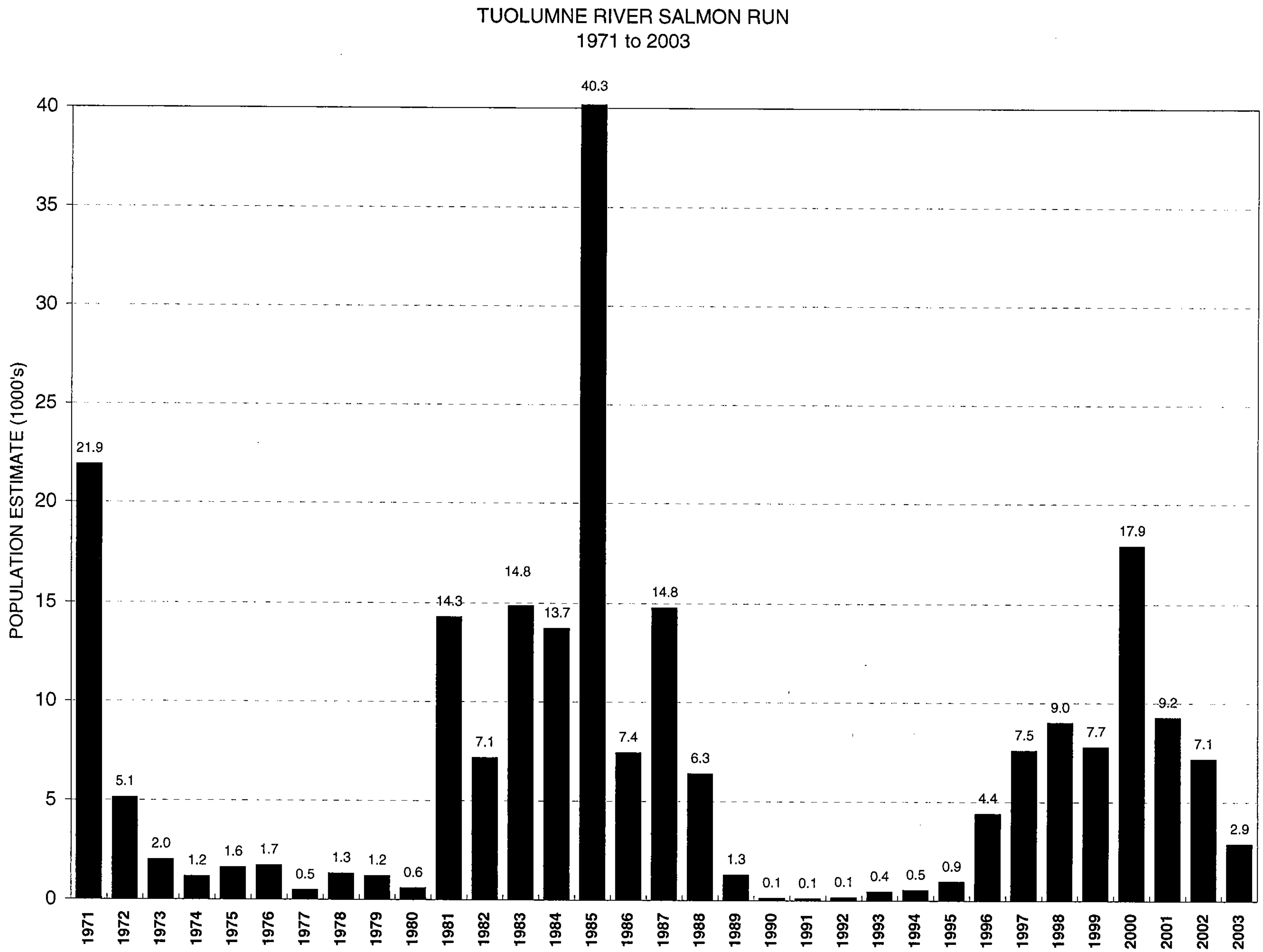


Figure 1. Estimated population of adult Chinook salmon for the Tuolumne River.

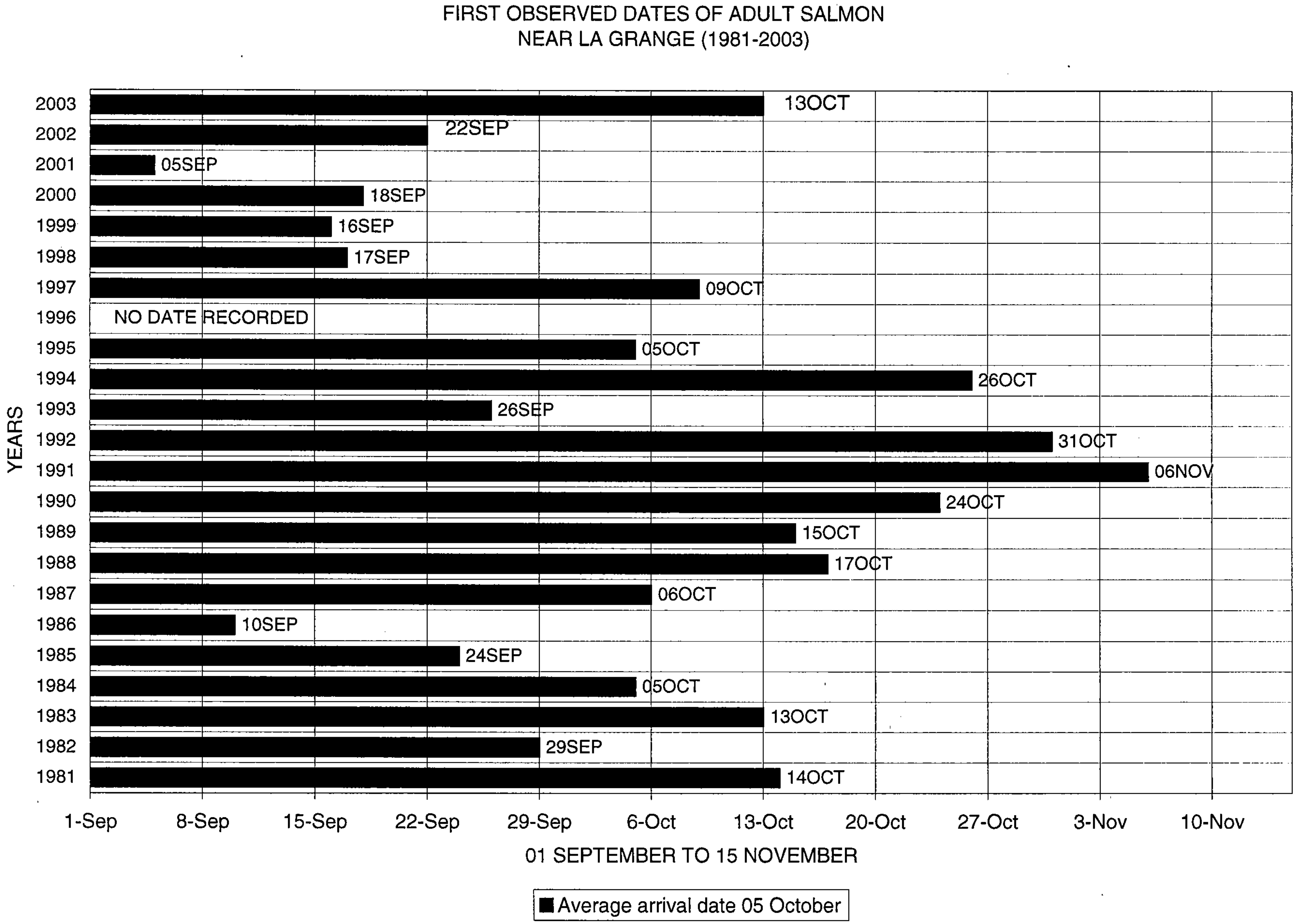
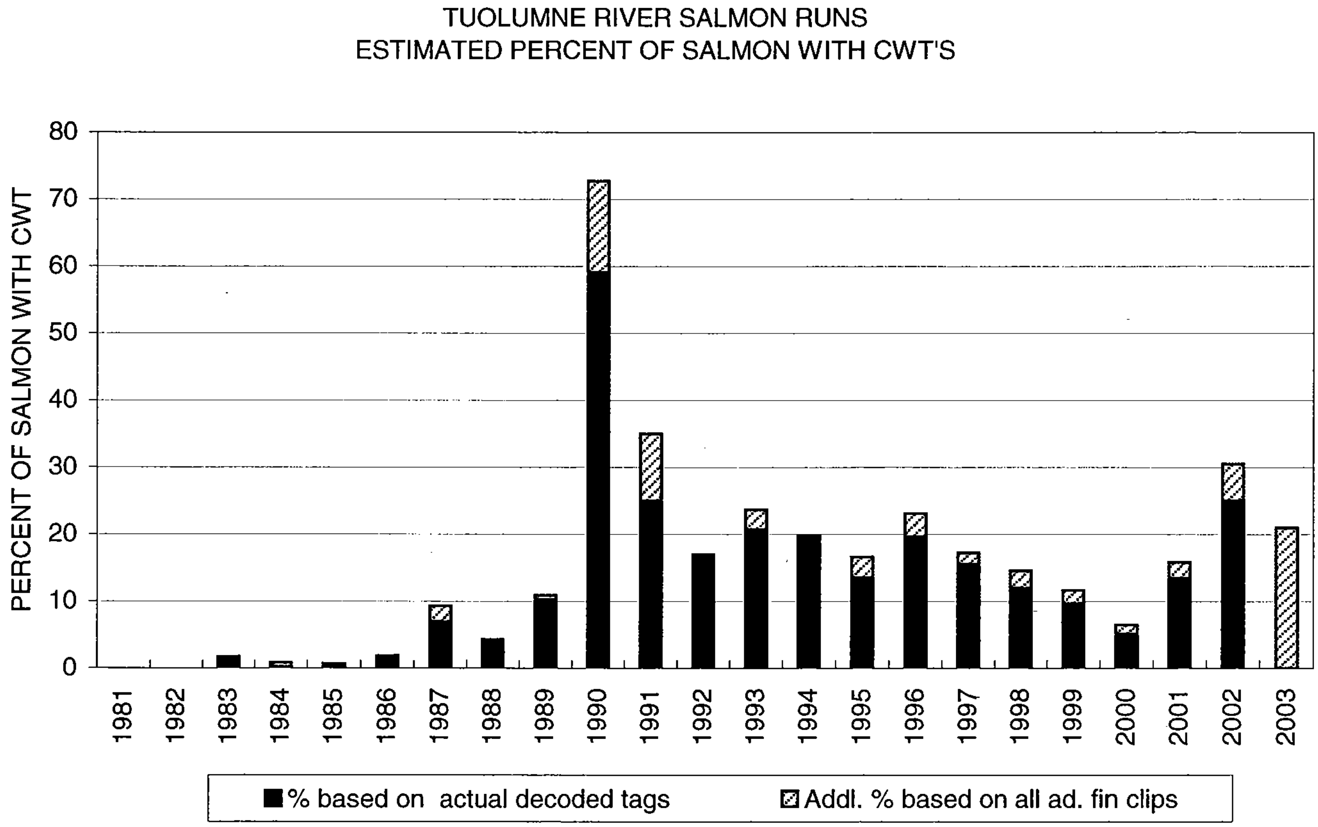
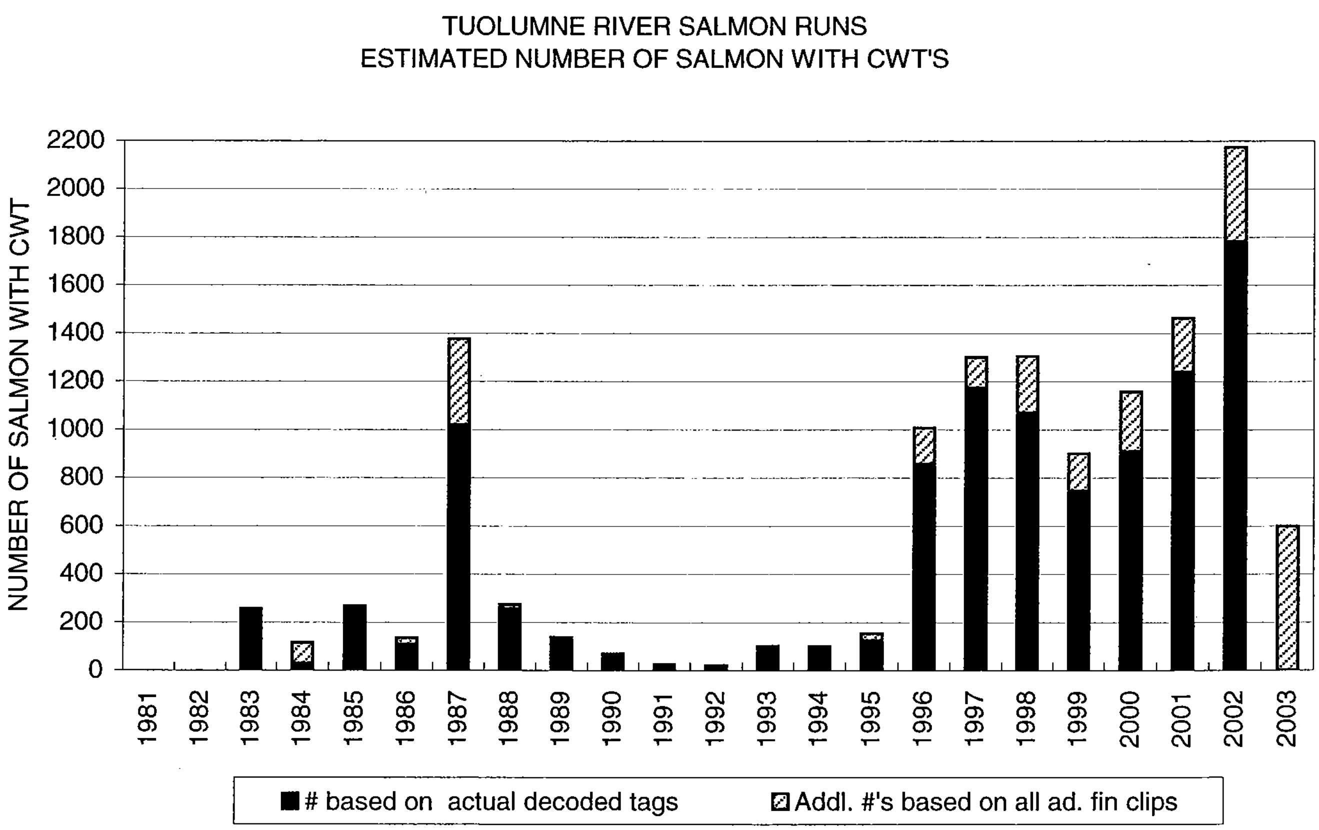


Figure 4. Tuolumne River salmon arrival near La Grange (1981-2003)





% and number of CWT for the 1981-1988 period were determined from fresh measured carcasses, only. Beginning in 1989, % and number of CWT was determined from all measured carcasses (both fresh and old)

Figure 9. Estimated % and number of Coded-Wire-Tag salmon in the Tuolumne runs, 1981-2003.

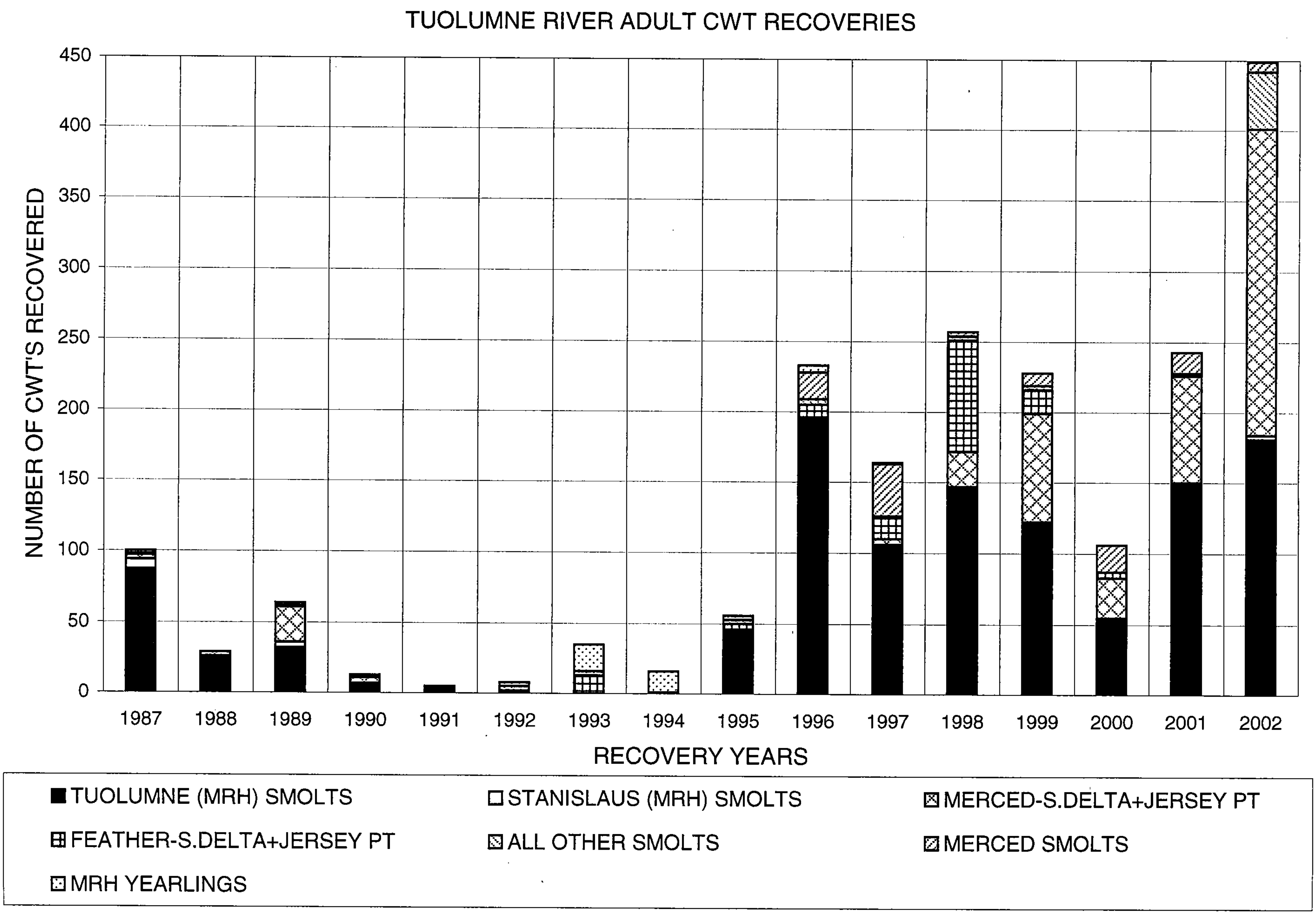


Figure 10. Actual number of CWT salmon recovered in the Tuolumne River based on release origin.

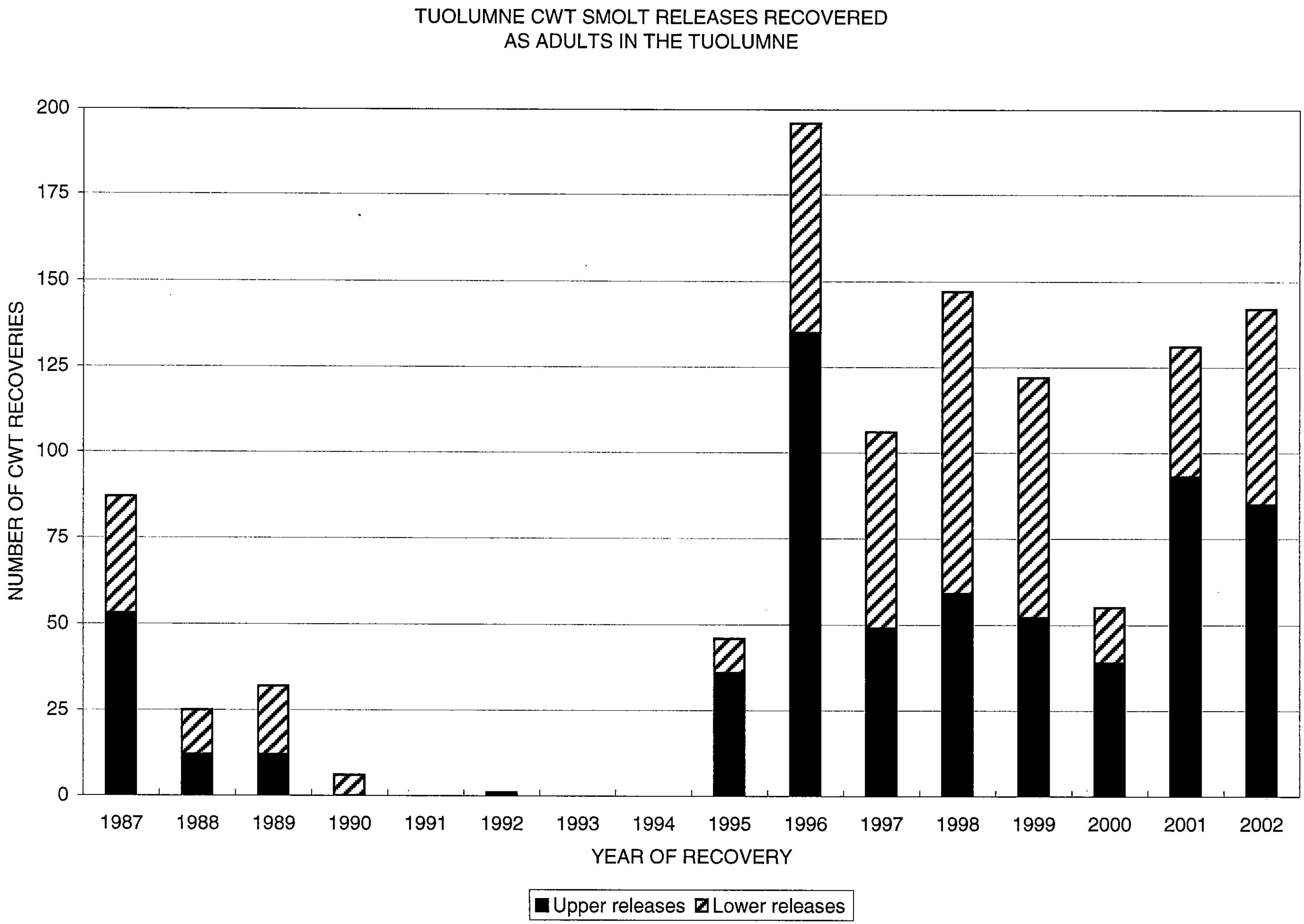


Figure 11. Number of adult CWT salmon recovered in the Tuolumne River based on release group origin.

REPORT 2003-2

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District	)	
	)	
and	)	Project No. 2299
	)	
Modesto Irrigation District	)	

2003 LOWER TUOLUMNE RIVER ANNUAL REPORT

Report 2003-2

2003 Seine/Snorkel Report and Summary Update

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EXECUTIVE SUMMARY

The 2003 seining survey was conducted at two-week intervals from 21 January to 28 May for a total of 10 sample periods. This was the 18th consecutive annual monitoring study on the Tuolumne River conducted by the Turlock and Modesto Irrigation Districts.

A total of 5,983 natural Chinook salmon were caught in the Tuolumne River and one in the San Joaquin River. Peak density of salmon in the Tuolumne was 166.1 salmon per 1,000 square feet on 04 February. Maximum fork length (FL) in the Tuolumne River increased from 46 mm FL to 84 mm FL from 21 January to 18 March and overall FL ranged from 31 mm to 95mm.

Flows during the sampling period ranged from about 170 to 1,253 cubic feet per second (cfs) in the Tuolumne River at La Grange and from about 1,700 to 3,500 cfs in the San Joaquin River at Vernalis.

Water temperature in the Tuolumne ranged from 10.1°C to 23.3°C and in the San Joaquin from 10.6°C to 26.2°C. Conductivity in the Tuolumne River ranged from 43 to 242 µS and in the San Joaquin from 504 to 1,726 µS.

A comparative analysis of fork length and salmon density for the 1998-2003 period is included. Increase in average fork length in 2003 was similar in timing and magnitude to the pattern observed in 1998-2002. The peak in fry (≤ 50 mm) density in 2003 occurred on 04 February and was similar in timing to 1998-2000. The density of juveniles (> 50 mm) peaked on 01 April and was similar in timing to most other years in the study period except for 1999 and 2002. In 2003, the average density of salmon in the Tuolumne River was 39.3 salmon per 1,000 ft^2 and was similar to densities found in 2001, which had the highest average for the entire 1986-2003 period.

Snorkel surveys were conducted on 18-20 June and 17-19 September, within a 20-mile section below La Grange Dam. Preliminary USGS flow at La Grange was about 190 cfs and water temperature ranged from 12.1°C to 22.0°C in June and flow was about 210 cfs with water temperature ranging from 12.0°C to 19.4°C in September. About 537 juvenile salmon and 101 rainbow trout were observed in June and 13 juvenile salmon and 71 rainbow trout were observed in September. Other species seen were Sacramento sucker, Sacramento pikeminnow, hardhead, riffle sculpin, largemouth bass, smallmouth bass, redear sunfish, bluegill and carp.

CONTENTS

1. INTRODUCTION

Stillwater Sciences, with assistance from SP Cramer and Associates, conducted juvenile salmon monitoring in the Tuolumne and San Joaquin Rivers in 2003 on behalf of the Tuolumne River Technical Advisory Committee. Seine sampling was done in both rivers and snorkeling was limited to the Tuolumne River. The Tuolumne River salmon were the progeny of the 2002 fall spawning run, estimated to be about 7,125 fish. The study was undertaken pursuant to the 1995 Don Pedro Project FERC Settlement Agreement (FSA) as an aspect of the river-wide monitoring program. The primary objective was to monitor juvenile salmon size, abundance and distribution. The seining study focused on the specific goals of evaluating the relative number, size, and timing of naturally produced juvenile Chinook salmon and their migration within and out of the river. In addition, the seining study helped assess the relationship of flow and other environmental variables to salmon distribution. The data gathered correspond to monitoring components of Sections 13c, d and e of the FSA. This was the 18th consecutive annual seining study and represents the longest continuous monitoring effort on juvenile salmon in the San Joaquin River system. A summary of the entire period is contained in this report.

Snorkel surveys were conducted on 18-20 June and 17-19 September in conjunction with the seine study to evaluate the juvenile salmon population and other fish species. A comparison of salmonids caught in prior years is included.

1.1 STUDY AREAS

1.1.1 Seine

The area studied was the Tuolumne River from La Grange Dam (river mile [RM] 52.0) to its confluence with the San Joaquin River at RM 83.8, and the San Joaquin River from Laird Park (RM 90.2) to Gardner Cove (RM 77.8) (Figure 1). A total of ten sites were sampled, eight on the Tuolumne and two on the San Joaquin. The locations of the sites were as follows:

Site	Location	River Mile
	Tuolumne River	
1	Old La Grange Bridge (OLGB)	50.5[a]
2	Riffle 5 (R5)	48.0
3	Tuolumne River Resort (TRR)	42.4
4	Hickman Bridge	31.6
5	Charles Road	24.9
6	Legion Park	17.2
7	Venn Ranch	7.4
8	Shiloh Road	3.4
	San Joaquin River	
9	Laird Park	90.2[b]
10	Gardner Cove	79.4

a. From the confluence with the San Joaquin River.
b. From the confluence with the Sacramento River.

The Tuolumne River was stratified by a longitudinal profile into three sections. The upper section (RM 52 to 34), sites 1-3, is a higher gradient area that includes most of the primary spawning riffles in the river. The middle section (RM 34 to 17), sites 4-6, is the transitional area from the gravel-bedded to sand-bedded river reaches. This section contains much of the in-channel gravel mined areas. The lower section (RM 17 to 0), sites 7-8, is a low gradient, slow moving, sand-bottom reach downstream of the Dry Creek confluence.

1.1.2 Snorkel

The snorkel surveys were limited to the area from Riffle A7 (RM 50.7) downstream to Riffle 57 (RM 31.5) below Hickman Bridge. The survey area was divided into three sections.

1.2 2003 TUOLUMNE AND SAN JOAQUIN RIVER SAMPLING CONDITIONS

1.2.1 Seine

Flows in the Tuolumne River below La Grange Dam were approximately 180 cfs in January when the surveys began. Flows were steady until the spring pulse flows from mid-April to mid-May. During that period a pulse flow of about 1,200 cfs was implemented from 14 to 22 April (Figure 2). Flows were then reduced to about 550 cfs through mid-May, to 180 cfs on 19 May and then returned to about 550 through the end of May. Flows were then reduced to 250 cfs beginning in June and then to 190 in mid-June.

Flows in the San Joaquin River at Vernalis (RM 72.5) ranged from 1,700-2,600 cfs from mid-January to mid-April. Flows then increased to about 3,400 cfs from mid-April to mid-May during the Vernalis Adaptive Management Plan schedule. Flows then decreased to about 2,200 cfs through June.

Flows upstream of Vernalis, at Patterson Bridge (RM 98.5) and Maze Road (RM 77.3), represent flow levels at the sampling locations of Laird Park upstream of the Tuolumne and Gardner Cove downstream of the Tuolumne, respectively.

The minimum water temperature recorded in the Tuolumne River during the study period, based on hand-held temperature measurements, was 10.1°C (50.2°F) at Riffle 5 on 04 February, and the maximum temperature was 23.3°C (73.9°F) at Shiloh Road on 28 May (Figure 3). The lowest San Joaquin River water temperature, 10.6°C (51.1°F) was at Laird Park and Gardner Cove on 21 January; the highest was 26.2°C (79.2°F) at Laird Park on 28 May.

1.2.2 Snorkel

The flow at La Grange during the snorkel surveys in June was about 190 cfs. Water temperature ranged from 12.1°C (53.8°F) at Riffle A7 on 18 June to 22.0°C (71.6°F) at Riffle 57 on 20 June. The flow at La Grange during the snorkel surveys in September was about 210 cfs. Water temperature ranged from 12.0°C (53.6°F) at Riffle A7 on 17 September to 19.4°C (66.9°F) at Riffle 57 on 19 September.

2. METHOD OF THE STUDY

2.1 STUDY TIMING

The 2003 seining study began on 21 January and ended on 28 May. Sampling was done at two-week intervals, with a total of 10 sampling dates. Snorkel surveys were conducted in late spring on 18-20 June and late summer on 17-19 September.

2.2 SAMPLING METHODS AND DATA RECORDING

2.2.1 Seine

Seining was done using 6-ft high, 1/8-inch mesh nylon seine nets in lengths of 20 or 30 feet. The same general areas were sampled each time, to permit comparisons through the sampling period, but sample areas varied somewhat as a result of changes in flow. Seine hauls were made with the current and parallel to shore. The salmon caught were anesthetized with MS-222, measured (FL in mm) and then revived before being released. Other measurements taken were area sampled, (determined from estimating average length and width of a seine haul) water temperature, visibility, conductivity, and maximum depth of the area sampled. Other observations include time of day, weather conditions, habitat type, and substrate type. Other fish species were recorded separately. Any salmon undergoing outward signs of smoltification, such as losing scales during handling, were also noted.

2.2.2 Snorkel

Underwater observations were conducted using an underwater "sightings" per unit effort method where a person would snorkel a specified area for a given period of time and record the species, numbers, and sizes of fish observed. A combination of different habitat types were observed, including riffles, runs, and pools.

2.3 DATA ANALYSIS

Seining catch data was examined by site (see Figure 1 for locations), by river section, and by river. Catch densities of salmon were divided into two size groups for analysis. The density index for "fry" (fish ≤50 mm FL) and for "juveniles" (>50 mm), by site and by section, were computed by multiplying the number of salmon caught by 1,000 and dividing it by the area sampled. These are taken as indices of population density (relative abundance), and used for comparisons. To permit examination of the densities and sizes of salmon fry and juveniles by general river reach, the lower Tuolumne River was divided into an upper section (Sites 1-3), a middle section (Sites 4-6), and a lower section (Site 7-8).

3. RESULTS AND DISCUSSION

3.1 SEINE CATCH

A total of 5,983 salmon were caught from the Tuolumne River and one from the San Joaquin (Table 1). Of these, 1,188 salmon were measured and riverwide peak density for the Tuolumne was 166.1 salmon per 1,000 ft^2 on 04 February.

3.1.1 Density of Fry and Juvenile Salmon

Salmon up to 46 mm fork length (FL) were caught in the Tuolumne River on 21 January in the first sampling period. The highest density of salmon fry in the Tuolumne was 164.3 fry/1,000 ft^2 found on 04 February (Table 2). The highest density of juvenile salmon in the Tuolumne was 12.0 juveniles/1,000 ft^2 found on 01 April.

The density of salmon fry by location exhibited a peak for most sites on 04 February. The density of juveniles by location generally peaked from 04 to 18 March for most locations (Figure 4).

The density of salmon fry in sections of the Tuolumne River had a peak in the upper section and middle sections on 04 February (Figure 5). The density of juveniles by section shows a peak in the upper section on 01 April and a peak in the middle section on 18 March. Only 2 salmon were caught in the lower section of the Tuolumne River and 1 in the San Joaquin River.

3.1.2 Size, Growth, and Smoltification

The fork length of salmon from the Tuolumne River caught in 2003 ranged from 31 mm to 95 mm. The average fork length (FL) of salmon generally showed a steady increase from 21 January to 01 April (Figure 6).

An indirect method to estimate growth rate was made by dividing the amount of increase in maximum FL, over an extended period of time, by the number of days during the period. Maximum FL in the Tuolumne River increased from 46 to 84 mm during the 21 January to 18 March period (Figure 6). This indicates a potential FL increase of approximately .68 mm per day (38mm / 56 days).

Length frequency distributions reflect the change in average fork length through the entire study period (Figure 7 & 8). The change in FL by location generally shows an increase from late January to late May at most of the Tuolumne River sampling locations (Figure 9). Salmon estimated to be large enough to undergo smoltification (> 70 mm FL) were present by early March. The first salmon exhibiting smolting characteristics was caught on 04 March. Fry were present through mid-May.

3.1.3 Conductivity and Turbidity

Conductivity in the Tuolumne River generally increased with increasing distance below La Grange Dam, from a low of 43 μS at Old La Grange Bridge to a high of 242 μS at Shiloh Road (Table 3). Conductivity also increased as flows were reduced (Figure 10).

Conductivity in the San Joaquin River was much higher than in the Tuolumne and ranged from a low of 504 μS at Gardner Cove to a high of 1726 μS at Laird Park.

Turbidity in the Tuolumne River was less than 7.0 Nephelometric Turbidity Units (NTU's) except for two readings at Shiloh Road on 16 and 30 April. Turbidity also generally increased with increasing distance below La Grange Dam and generally decreased with higher flows.

Turbidity in the San Joaquin River ranged from 10.8 at Gardner Cove to 45.8 NTU at Laird Park.

3.1.4 Other Fish Species Caught

The numbers of other fish species caught during the seining study are tabulated by species, location, and date in Table 4. Fourteen species other than Chinook salmon were caught in the Tuolumne River and 13 other species in the San Joaquin River. Eight of these species were common to both rivers and 19 species were caught overall. One rainbow trout (29 mm FL) was caught at the Tuolumne River Resort on 01 April. The distribution of species in the Tuolumne was generally determined by habitat and water temperature with coldwater species such as rainbow trout and riffle sculpin found in the upper third of the river. The San Joaquin River had a greater number of species present that favor warmer water temperatures.

3.1.5 Coded-Wire-Tagged Salmon

No coded-wire-tag (CWT) salmon were released in the Tuolumne River in 2003 and no CWT salmon were caught in the San Joaquin River.

3.2 SNORKEL SURVEY

Survey conditions and fish observations from the snorkel surveys conducted on 18-20 June and 17-19 September are summarized in Table 5. The fish species observed were all native species characteristic of the lower elevation zone adjacent to the Sierra foothills with the exception of the largemouth bass, smallmouth bass, redear sunfish, bluegill, and carp. The same species were also observed in previous snorkel surveys.

In the June surveys, juvenile Chinook salmon were observed downstream to Riffle 35A (RM 37.1). 426 of the total 537 salmon observed were counted in Riffle A7. Rainbow trout were observed downstream to Riffle 23C (RM 42.3). Other species seen were Sacramento sucker, Sacramento pikeminnow, hardhead, riffle sculpin, largemouth bass, smallmouth bass, redear sunfish, bluegill and carp.

In the September surveys, Chinook salmon were observed downstream to Riffle 41A (RM 35.3). Rainbow trout were observed downstream to Riffle 23C (RM 42.3). The same other species seen in June, except redear sunfish, bluegill and carp, were observed in September.

4.0 COMPARATIVE ANALYSIS

4.1 SEINE: 1986-2003

Annual TID/MID Tuolumne River seining surveys began in 1986. The number, location, and sampling frequency of sites have varied over the years (Tables 6 and 7). The total number of salmon captured in 2003 (5,983) is most similar to the 2001 total of 5,567, in recent years. The number of salmon captured in the Tuolumne has ranged from 120 (1991) to 14,825 (1987). In 2003, the average density of salmon in the river was 39.3 salmon per 1,000 ft^2 and was also similar to densities found in 2001.

The San Joaquin River has been sampled upstream and downstream of the Tuolumne River confluence in each of the study years. The total number of salmon caught has ranged from 0 to 854 with average density much lower than the Tuolumne (Table 6). One wild salmon was caught in 2003.

Comparative analyses of fork length and density will be mostly limited to the 1998 to 2003 study period in this report update.

4.1.1 Size and Growth

In 2003, the increase in average FL during the January to March period was similar in timing and magnitude to the pattern observed in 1998-2002 (Figure 11). The increase in average FL peaked on 28 May. Minimum FL found in 2003 remained low into May and was similar to most other years (Figure 12). Maximum FL in 2003 increased from January to early April (Figure 13). The estimated 2003 growth rate of .68 mm per day was in the upper range of growth rate values for 1986-2003 (Table 6).

4.1.2 Fry and Juvenile Salmon Density

In 2003, the density of salmon fry (≤ 50 mm) for the Tuolumne River peaked on 04 February at the highest level during the 1998-2003 period (Figure 14). The 04 February timing of peak fry density was about the same as the late January to mid-February peaks of 1998-2000.

The density of salmon juveniles (>50 mm) in 2003 peaked on 01 April and was most similar in timing to 2001 (Figure 15).

Combined fry and juvenile densities for the Tuolumne River are shown for the years 1998-2003 (Figure 16). The 2003 densities peaked in early February and showed a characteristic decline to early May.

4.1.2.1 Tuolumne River Section Density

Upper section density of fry generally peaks from mid-January to mid-February and steadily declines through March (Figure 17A). For 2003, the density of fry exhibited this general pattern. Upper section density of juveniles typically increases beginning in late February and peak in mid March to early April. In 2003, juvenile salmon density also followed this pattern.

Middle section density of fry generally peaks from mid January to late February about 2 weeks after the peak in the upper section (Figure 17B). For 2003, the density of fry exhibited the same pattern observed in the upper section. Middle section density of juveniles often peak from mid February to late March. In 2003, juvenile density peaked in mid-March and rapidly declined by mid April.

Lower section density of fry and juvenile salmon has been relatively low in most years. This section was often sampled only at the Shiloh Road location in prior years. Since 1999, two sites have been sampled. Peak density of both fry and juveniles were similar in timing to the middle section in the 1998-2002 period (Figure 17C). In 2003, no fry were caught in the lower section and only two juveniles were caught.

Section abundance indices of fry and juvenile salmon combined were standardized as a percent of the annual riverwide average abundance index and plotted at section midpoints for recent years (Figure 18). In general, the abundance indices decline from the upper to lower sections. There were two years that did not follow this pattern. In 1999 the middle section index, plotted at RM 27.0, was higher than the upper section. In 1998 the lower section index, plotted at RM 8.1, was highest for all sections. In 2001 the standardized section abundance index was about equal in the upper and middle sections and was very low in the lower section. In 2003 the standardized indices were similar in magnitude to the 2000 indices.

4.1.2.2 San Joaquin River Density

Density of salmon caught in the San Joaquin River at Laird Park and Gardner Cove or nearby sites were analyzed to compare relative abundance of salmon upsteam and downstream of the Tuolumne River confluence. The abundance indices were calculated for fry and juvenile salmon combined due to low numbers caught. The average salmon abundance at Laird Park, downstream of the Merced confluence, was extremely low for all years during the 1986-2003 period (Figure 19). The total number of wild salmon caught at Laird Park during this period was 135. The average abundance at Gardner Cove, downstream of the Tuolumne River confluence, was much higher in 1986 and 1999 and moderately higher in 1995, 1998 and 2001. A total of 1048 salmon were caught at this location during the 1986-2003 period, 509 of which were caught in 1999. One wild salmon was caught at Gardner Cove in 2003.

4.1.3 Linear Regression of Tuolumne River Fry Density Versus Number of Female Spawners

A linear regression analysis of the logarithmic values of peak fry density in the Tuolumne River and the estimated total number of female spawners (TID/MID data), from the preceding fall-run, resulted in an R-squared of .693 for the 1986-2003 period (Figure 20, Table 8). A similar result with R-squared of .698 was found using average fry density from 15JAN-15MAR (Figure 21). The R-squared value for the 1986-1996 period for peak fry density and number of female spawners was .756 (FERC Report 96-2). The reduction in R-squared values for the 1986-2003 period resulted from the relatively low number of fry captured in 1997. The low number of fry captured that year is likely due to the effects of flood releases made in early January 1997, which reduced the survival of incubating eggs / alevins in the gravel and moved fry downstream of the Tuolumne River.

4.1.4 Other Fish Species

The number of fish species other than Chinook salmon observed during the 1986-2003 study period has ranged from 11 to 16 on the Tuolumne River. In 2003, 14 other species were caught including 5 native species (Table 4). 13 fish species, including 2 native, were caught on the San Joaquin River in 2003. Of native species, Pacific lamprey, rainbow trout, Sacramento pikeminnow, and riffle sculpin were caught only in the Tuolumne River and tule perch was caught only in the San Joaquin River. The only native specie caught in both rivers was the Sacramento sucker. Native species that were not caught were Sacramento blackfish, hitch, hardhead, Sacramento splittail and prickly sculpin.

4.2 SNORKEL: 1996-2003

Annual TID/MID Tuolumne River snorkel surveys, designed to augment the seining study, began in 1996. The precursor to these surveys was the 1988-1994 summer flow studies. Comparative analysis of the 1996-2003 period is limited to total number and density of salmonids observed during the June-July surveys and a comparative analysis of the 2001-2003 September surveys.

The number, location, and area sampled by site have varied over the years (Table 9). The total number of salmon and rainbow trout observed in June 2003 was 537 and 101 respectively. 2003 had higher summer flow conditions than the previous two years. The number and relative density of salmon observed were similar to most other years since 2000. Rainbow trout were observed downstream to Riffle 23C (RM 42.3). The total number and relative density of rainbow trout were similar to those found in 2001-02 with the exception of significantly more trout observed at Riffle A7 (RM 50.7). Similar to the previous 2 years, 2003 had fewer rainbow trout than those found in the year 2000.

The low number of salmon observed in September 2003 was similar to September 2001-02. There was a substantial decrease in the number of juvenile Chinook salmon observed between the June and September sampling periods of the past 3 years. The number of rainbow trout observed in September 2003 was significantly higher than the two previous years.

Table 1. Summary table of weekly seine catch for the Tuolumne and San Joaquin Rivers, 2003.

2003 JUVENILE SALMON SEINING STUDY (TID/MID)

TUOLUMNE RIVER

DATE	SALMON CATCH	AREA (SQ. FT.)	DENSITY (/1000 ft^2)	MINIMUM FL	MAXIMUM FL	AVERAGE FL	NUMBER MEAS.	SACFRY	NUMBER KILLED
21JAN	682	16,300	41.8	31	46	37.1	138	1	0
04FEB	2,110	12,700	166.1	31	51	38.7	184	1	2
18FEB	1,337	15,550	86.0	32	56	40.3	209	0	5
04MAR	1,150	15,100	76.2	33	72	43.4	209	0	7
18MAR	366	16,350	22.4	33	84	49.3	198	1	0
01APR	250	13,900	18.0	34	86	56.4	162	1	0
16APR	43	13,400	3.2	37	76	55.8	43	0	1
30APR	5	16,750	0.3	67	80	71.0	5	0	0
14MAY	38	16,450	2.3	43	95	68.8	38	0	0
28MAY	2	15,750	0.1	76	87	81.5	2	0	0
TOTAL:	5,983	152,250	39.3				1,188	4	15

SAN JOAQUIN RIVER

DATE	SALMON CATCH	AREA (SQ. FT.)	DENSITY (/1000 ft^2)	MINIMUM FL	MAXIMUM FL	AVERAGE FL	NUMBER MEAS.	SACFRY	NUMBER KILLED
21JAN	0	2,700	0.0						
04FEB	0	4,050	0.0						
18FEB	0	3,300	0.0						
04MAR	0	4,200	0.0						
18MAR	0	3,750	0.0						
01APR	0	3,450	0.0						
16APR	1	3,300	0.3	68	68	68.0	1	0	0
30APR	0	3,900	0.0						
14MAY	0	2,700	0.0						
28MAY	0	3,000	0.0						
TOTAL:	1	34,350	0.0				1	0	0

Table 2. Summary table of weekly seine catch by location for the Tuolumne and San Joaquin Rivers, 2003.

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

						Extrapolated				EXTRAPOLATED					
										UPPER SECTION	MIDDLE SECTION	LOWER SECTION	UPPER SECTION	MIDDLE SECTION	LOWER SECTION
		Total		Measured	Measured	Density	Density	Density	Average	Density	Density	Density	Density	Density	Density
Date	Location	Catch	Area	Fry	Juvenile	Fry	Juvenile	Total	FL	Fry	Fry	Fry	Juvenile	Juvenile	Juvenile
21JAN	OLGB	2	2400	2	0	0.8	0.0	0.8	35.5	104.3	4.3	#DIV/0!	0.0	0.0	#DIV/0!
21JAN	R5	281	2100	55	0	133.8	0.0	133.8	36.0						
21JAN	TRR	374	1800	56	0	207.8	0.0	207.8	38.2						
21JAN	HICKMAN	25	2000	25	0	12.5	0.0	12.5	37.0						
21JAN	CHARLES	0	1650					0.0							
21JAN	LEGION	0	2200					0.0							
21JAN	VENN	0	1350					0.0							
21JAN	SHILOH	0	2800					0.0							
21JAN	LAIRD	0	1050					0.0							
21JAN	GARDNER	0	1650					0.0							
TUOL.TOT.		682	16300	138	0	41.8	0.0	41.8	37.1						
SJR. TOT.		0	2700	0	0			0.0							

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

						Extrapolated				EXTRAPOLATED					
										UPPER SECTION	MIDDLE SECTION	LOWER SECTION	UPPER SECTION	MIDDLE SECTION	LOWER SECTION
		Total		Measured	Measured	Density	Density	Density	Average	Density	Density	Density	Density	Density	Density
Date	Location	Catch	Area	Fry	Juvenile	Fry	Juvenile	Total	FL	Fry	Fry	Fry	Juvenile	Juvenile	Juvenile
04FEB	OLGB	3	1800	3	0	1.7	0.0	1.7	34.3	298.0	118.9	#DIV/0!	4.8	0.0	#DIV/0!
04FEB	R5	341	1600	56	0	213.1	0.0	213.1	38.4						
04FEB	TRR	1231	1800	64	2	663.2	20.7	683.9	38.7						
04FEB	HICKMAN	532	1100	56	0	483.6	0.0	483.6	39.0						
04FEB	CHARLES	3	1000	3	0	3.0	0.0	3.0	42.0						
04FEB	LEGION	0	2400					0.0							
04FEB	VENN	0	1200					0.0							
04FEB	SHILOH	0	1800					0.0							
04FEB	LAIRD	0	1350					0.0							
04FEB	GARDNER	0	2700					0.0							
TUOL.TOT.		2110	12700	182	2	164.3	1.8	166.1	38.7						
SJR. TOT.		0	4050					0.0							

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

						Extrapolated				EXTRAPOLATED					
										UPPER SECTION	MIDDLE SECTION	LOWER SECTION	UPPER SECTION	MIDDLE SECTION	LOWER SECTION
		Total		Measured	Measured	Density	Density	Density	Average	Density	Density	Density	Density	Density	Density
Date	Location	Catch	Area	Fry	Juvenile	Fry	Juvenile	Total	FL	Fry	Fry	Fry	Juvenile	Juvenile	Juvenile
18FEB	OLGB	5	2400	5	0	2.1	0.0	2.1	36.2	173.3	45.5	#DIV/0!	4.4	8.5	#DIV/0!
18FEB	R5	218	1650	53	0	132.1	0.0	132.1	36.7						
18FEB	TRR	817	1800	59	3	431.9	22.0	453.9	40.5						
18FEB	HICKMAN	272	1650	56	8	144.2	20.6	164.8	42.6						
18FEB	CHARLES	25	1450	19	6	13.1	4.1	17.2	42.2						
18FEB	LEGION	0	2400					0.0							
18FEB	VENN	0	1800					0.0							
18FEB	SHILOH	0	2400					0.0							
18FEB	LAIRD	0	1350					0.0							
18FEB	GARDNER	0	1950					0.0							
TUOL.TOT.		1337	15550	192	17	79.0	7.0	86.0	40.3						
SJR. TOT.		0	3300					0.0							

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

						Extrapolated				EXTRAPOLATED					
										UPPER SECTION	MIDDLE SECTION	LOWER SECTION	UPPER SECTION	MIDDLE SECTION	LOWER SECTION
		Total		Measured	Measured	Density	Density	Density	Average	Density	Density	Density	Density	Density	Density
Date	Location	Catch	Area	Fry	Juvenile	Fry	Juvenile	Total	FL	Fry	Fry	Fry	Juvenile	Juvenile	Juvenile
04MAR	OLGB	5	2200	5	0	2.3	0.0	2.3	35.4	116.5	57.0	#DIV/0!	7.8	16.3	#DIV/0!
04MAR	R5	359	1800	57	1	196.0	3.4	199.4	37.6						
04MAR	TRR	357	1800	58	7	177.0	21.4	198.3	44.7						
04MAR	HICKMAN	407	1800	48	11	184.0	42.2	226.1	45.4						
04MAR	CHARLES	20	1650	13	7	7.9	4.2	12.1	52.1						
04MAR	LEGION	2	2400	2	0	0.8	0.0	0.8	43.5						
04MAR	VENN	0	1800					0.0							
04MAR	SHILOH	0	1650					0.0							
04MAR	LAIRD	0	1500					0.0							
04MAR	GARDNER	0	2700					0.0							
TUOL.TOT.		1150	15100	183	26	66.7	9.5	76.2	43.4						
SJR. TOT.		0	4200					0.0							

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

						Extrapolated				EXTRAPOLATED					
										UPPER SECTION	MIDDLE SECTION	LOWER SECTION	UPPER SECTION	MIDDLE SECTION	LOWER SECTION
		Total		Measured	Measured	Density	Density	Density	Average	Density	Density	Density	Density	Density	Density
Date	Location	Catch	Area	Fry	Juvenile	Fry	Juvenile	Total	FL	Fry	Fry	Fry	Juvenile	Juvenile	Juvenile
18MAR	OLGB	0	2600					0.0		20.8	9.8	#DIV/0!	4.9	22.8	#DIV/0!
18MAR	R5	111	2100	52	17	39.8	13.0	52.9	46.9						
18MAR	TRR	56	1800	49	7	27.2	3.9	31.1	44.9						
18MAR	HICKMAN	187	1650	21	40	39.0	74.3	113.3	53.0						
18MAR	CHARLES	4	1650	1	3	0.6	1.8	2.4	53.3						
18MAR	LEGION	8	2800	0	8	0.0	2.9	2.9	71.1						
18MAR	VENN	0	1650					0.0							
18MAR	SHILOH	0	2100					0.0							
18MAR	LAIRD	0	1350												
18MAR	GARDNER	0	2400					0.0							
TUOL.TOT.		366	16350	123	75	13.9	8.5	22.4	49.3						
SJR. TOT.		0	3750					0.0							

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

Date	Location	Total Catch	Area	Measured Fry	Measured Juvenile	Extrapolated Density Fry	Density Juvenile	Density Total	Average FL	EXTRAPOLATED UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
01APR	OLGB	0	1800					0.0		18.9	0.7	0.0	10.8	18.7	0.3
01APR	R5	132	1800	40	16	52.4	21.0	73.3	46.1						
01APR	TRR	24	1650	11	13	6.7	7.9	14.5	50.3						
01APR	HICKMAN	90	1300	3	75	2.7	66.6	69.2	64.7						
01APR	CHARLES	2	1500	0	2	0.0	1.3	1.3	74.0						
01APR	LEGION	1	2000	0	1	0.0	0.5	0.5	68.0						
01APR	VENN	1	1650	0	1	0.0	0.6	0.6	85.0						
01APR	SHILOH	0	2200					0.0							
01APR	LAIRD	0	1500					0.0							
01APR	GARDNER	0	1950					0.0							
TUOL.TOT.		250	13900	54	108	6.0	12.0	18.0	56.4						
SJR. TOT.		0	3450					0.0							

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

Date	Location	Total Catch	Area	Measured Fry	Measured Juvenile	Extrapolated Density Fry	Density Juvenile	Density Total	Average FL	EXTRAPOLATED UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
16APR	OLGB	0	2050					0.0		2.0	#DIV/0!	#DIV/0!	5.1	#DIV/0!	#DIV/0!
16APR	R5	25	2200	8	17	3.6	7.7	11.4	53.0						
16APR	TRR	18	1800	4	14	2.2	7.8	10.0	59.6						
16APR	HICKMAN	0	1200					0.0							
16APR	CHARLES	0	1650					0.0							
16APR	LEGION	0	1100					0.0							
16APR	VENN	0	1800					0.0							
16APR	SHILOH	0	1600					0.0							
16APR	LAIRD	0	1500					0.0							
16APR	GARDNER	1	1800	0	1	0.0	0.6	0.6	68.0						
TUOL.TOT.		43	13400	12	31	0.9	2.3	3.2	55.8						
SJR. TOT.		1	3300	0	1	0.0	0.3	0.3	68.0						

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

Date	Location	Total Catch	Area	Measured Fry	Measured Juvenile	Extrapolated Density Fry	Density Juvenile	Density Total	Average FL	EXTRAPOLATED UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
30APR	OLGB	0	2000					0.0		#DIV/0!	0.0	0.0	#DIV/0!	0.7	0.2
30APR	R5	0	2300					0.0							
30APR	TRR	0	1800					0.0							
30APR	HICKMAN	2	1650	0	2	0.0	1.2	1.2	70.5						
30APR	CHARLES	2	1800	0	2	0.0	1.1	1.1	73.5						
30APR	LEGION	0	2400					0.0							
30APR	VENN	0	2400					0.0							
30APR	SHILOH	1	2400	0	1	0.0	0.4	0.4	67.0						
30APR	LAIRD	0	1650					0.0							
30APR	GARDNER	0	2250					0.0							
TUOL.TOT.		5	16750	0	5	0.0	0.3	0.3	71.0						
SJR. TOT.		0	3900					0.0							

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

Date	Location	Total Catch	Area	Measured Fry	Measured Juvenile	Extrapolated Density Fry	Density Juvenile	Density Total	Average FL	EXTRAPOLATED UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
14MAY	OLGB	0	2400					0.0		0.4	0.0	#DIV/0!	3.5	2.0	#DIV/0!
14MAY	R5	27	2600	3	24	1.2	9.2	10.4	61.6						
14MAY	TRR	0	1800					0.0							
14MAY	HICK	11	1650	0	11	0.0	6.7	6.7	86.7						
14MAY	CHARLES	0	1400					0.0							
14MAY	LEGION	0	2400					0.0							
14MAY	VENN	0	2400					0.0							
14MAY	SHILOH	0	1800					0.0							
14MAY	LAIRD	0	900					0.0							
14MAY	GARDNER	0	1800					0.0							
TUOL.TOT.		38	16450	3	35	0.2	2.1	2.3	68.8						
SJR. TOT.		0	2700					0.0							

2003 Weekly Summary of TID/MID Seining Study
Salmon Density is the Number of Salmon / 1000 sq. ft.

Date	Location	Total Catch	Area	Measured Fry	Measured Juvenile	Extrapolated Density Fry	Density Juvenile	Density Total	Average FL	EXTRAPOLATED UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
28MAY	OLGB	0	2600					0.0		#DIV/0!	0.0	0.0	#DIV/0!	0.4	0.0
28MAY	R5	0	2350					0.0							
28MAY	TRR	0	1650					0.0							
28MAY	HICK	0	1650					0.0							
28MAY	CHARLES	2	1500	0	2	0.0	1.3	1.3	81.5						
28MAY	LEGION	0	2400					0.0							
28MAY	VENN	0	1800					0.0							
28MAY	SHILOH	0	1800					0.0							
28MAY	LAIRD	0	1200												
28MAY	GARDNER	0	1800					0.0							
TUOL.TOT.		2	15750	0	2	0.0	0.1	0.1	81.5						
SJR. TOT.		0	3000					0.0							

Table 3. Summary table of weekly seine catch by location for the Tuolumne and San Joaquin Rivers, 2003.

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
21JAN	OLGB	50.5	2	2400	0.8	35	36	35.5	2	1	0	10.3	50		104.3	4.3	0.0	1.8
21JAN	R5	48.0	281	2100	133.8	31	46	36.0	55	0	0	10.4	49					1.4
21JAN	TRR	42.3	374	1800	207.8	35	44	38.2	56	0	0	10.3	74					1.6
21JAN	HICK	31.6	25	2000	12.5	33	39	37.0	25	0	0	10.5	95					1.1
21JAN	CHARLES	24.9	0	1650	0.0							10.5	146					1.1
21JAN	LEGION	17.2	0	2200	0.0							10.8	191					1.2
21JAN	VENN	7.4	0	1350	0.0							10.9	226					3.3
21JAN	SHILOH	3.4	0	2800	0.0							10.8	242					4.0
21JAN	LAIRD	90.2	0	1050	0.0							10.6	1574					16.4
21JAN	GARDNER	77.8	0	1650	0.0							10.6	1224					21.3
TR TOT.			682	16300	41.8	31	46	37.1	138	1	0							
SJR TOT.			0	2700	0.0				0									

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
04FEB	OLGB	50.5	3	1800	1.7	31	37	34.3	3	1	0	10.2	48		302.9	118.9	0.0	1.2
04FEB	R5	48.0	341	1600	213.1	32	44	38.4	56	0	0	10.1	49					1.3
04FEB	TRR	42.3	1231	1800	683.9	34	51	38.7	66	0	2	10.8	68					1.0
04FEB	HICK	31.6	532	1100	483.6	31	50	39.0	56	0	0	11.0	90					0.7
04FEB	CHARLES	24.9	3	1000	3.0	39	48	42.0	3	0	0	12.3	143					0.8
04FEB	LEGION	17.2	0	2400	0.0							12.5	188					1.2
04FEB	VENN	7.4	0	1200	0.0							13.3	228					3.0
04FEB	SHILOH	3.4	0	1800	0.0							13.2	240					2.9
04FEB	LAIRD	90.2	0	1350	0.0							12.8	1726					24.8
04FEB	GARDNER	77.8	0	2700	0.0							12.6	1379					14.6
TR TOT.			2110	12700	166.1	31	51	38.7	184	1	2							
SJR TOT.			0	4050	0.0													

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
18FEB	OLGB	50.5	5	2400	2.1	33	39	36.2	5	0	0	10.2	46		177.8	54.0	0.0	1.1
18FEB	R5	48.0	218	1650	132.1	32	42	36.7	53	0	3	10.5	48					1.1
18FEB	TRR	42.3	817	1800	453.9	32	55	40.5	62	0	1	11.2	69					0.8
18FEB	HICK	31.6	272	1650	164.8	33	55	42.6	64	0	1	12.2	90					1.4
18FEB	CHARLES	24.9	25	1450	17.2	34	56	42.2	25	0	0	13.7	138					1.1
18FEB	LEGION	17.2	0	2400	0.0							14.3	179					1.7
18FEB	VENN	7.4	0	1800	0.0							14.6	222					2.7
18FEB	SHILOH	3.4	0	2400	0.0							14.6	233					5.4
18FEB	LAIRD	90.2	0	1350	0.0							14.2	1664					31.4
18FEB	GARDNER	77.8	0	1950	0.0							14.3	1339					19.9
TR TOT.			1337	15550	86.0	32	56	40.3	209	0	5							
SJR TOT.			0	3300	0.0													

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
04MAR	OLGB	50.5	5	2200	2.3	34	36	35.4	5	0	0	10.5	46		124.3	73.3	0.0	0.7
04MAR	R5	48.0	359	1800	199.4	33	53	37.6	58	0	2	11.0	50					1.3
04MAR	TRR	42.3	357	1800	198.3	37	60	44.7	65	0	0	12.5	64					0.9
04MAR	HICK	31.6	407	1800	226.1	37	65	45.4	59	0	5	13.1	89					0.8
04MAR	CHARLES	24.9	20	1650	12.1	36	72	52.1	20	0	0	14.2	134	72(S.I.4)				2.0
04MAR	LEGION	17.2	2	2400	0.8	42	45	43.5	2	0	0	14.5	178					2.2
04MAR	VENN	7.4	0	1800	0.0							15.7	215					3.4
04MAR	SHILOH	3.4	0	1650	0.0							15.6	223					4.0
04MAR	LAIRD	90.2	0	1500	0.0							15.2	1587					35.3
04MAR	GARDNER	77.8	0	2700	0.0							14.9	1311					30.5
TR TOT.			1150	15100	76.2	33	72	43.4		0	7							
SJR TOT.			0	4200	0.0													

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
18MAR	OLGB	50.5	0	2600	0.0							10.4	44		25.7	32.6	0.0	1.5
18MAR	R5	48.0	111	2100	52.9	36	73	46.9	69	0	0	11.0	51					1.0
18MAR	TRR	42.3	56	1800	31.1	33	57	44.9	56	1	0	12.8	66					1.0
18MAR	HICK	31.6	187	1650	113.3	39	71	53.0	61	0	0	13.8	95					1.4
18MAR	CHARLES	24.9	4	1650	2.4	40	59	53.3	4	0	0	15.3	137					1.6
18MAR	LEGION	17.2	8	2800	2.9	63	84	71.1	8	0	0	16.6	175	5(69-84)				2.2
18MAR	VENN	7.4	0	1650	0.0							16.9	207					5.2
18MAR	SHILOH	3.4	0	2100	0.0							16.7	211					4.5
18MAR	LAIRD	90.2	0	1350	0.0							16.1	1548					45.8
18MAR	GARDNER	77.8	0	2400	0.0							16.1	1246					25.1
TR TOT.			366	16350	22.4	33	84	49.3		1	0							
SJR TOT.			0	3750	0.0													

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
01APR	OLGB	50.5	0	1800	0.0							10.6	48		29.7	19.4	0.3	0.6
01APR	R5	48.0	132	1800	73.3	34	63	46.1	56	0	0	11.4	48					1.0
01APR	TRR	42.3	24	1650	14.5	36	62	50.3	24	1	0	14.0	60					1.1
01APR	HICK	31.6	90	1300	69.2	39	86	64.7	78	0	0	16.3	88	4(80-86)				1.3
01APR	CHARLES	24.9	2	1500	1.3	73	75	74.0	2	0	0	18.0	135					1.4
01APR	LEGION	17.2	1	2000	0.5	68	68	68.0	1	0	0	17.5	162					2.4
01APR	VENN	7.4	1	1650	0.6	85	85	85.0	1	0	0	17.6	205	85				4.7
01APR	SHILOH	3.4	0	2200	0.0							17.4	216					5.3
01APR	LAIRD	90.2	0	1500	0.0							18.4	1600					34.1
01APR	GARDNER	77.8	0	1950	0.0							18.1	1258					25.8
TR TOT.			250	13900	18.0	34	86	56.4	162	1	0							
SJR TOT.			0	3450	0.0													

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
16APR	OLGB	50.5	0	2050	0.0							10.6	43		7.1	0.0	0.0	0.6
16APR	R5	48.0	25	2200	11.4	37	65	53.0	25	0	1	11.0	45					0.7
16APR	TRR	42.3	18	1800	10.0	41	76	59.6	18	0	0	11.0	49	76(S.I.4)				1.4
16APR	HICK	31.6	0	1200	0.0							11.8	52					3.2
16APR	CHARLES	24.9	0	1650	0.0							13.0	55					1.9
16APR	LEGION	17.2	0	1100	0.0							13.4	57					3.6
16APR	VENN	7.4	0	1800	0.0							13.8	62					5.8
16APR	SHILOH	3.4	0	1600	0.0							14.2	62					8.3
16APR	LAIRD	90.2	0	1500	0.0							17.5	1043					25.7
16APR	GARDNER	77.8	1	1800	0.6	68	68	68.0	1			16.0	504	68(S.I.4)				14.0
TR TOT.			43	13400	3.2	37	76	55.8	43	0	1							
SJR TOT.			1	3300	0.3	68	68	68.0	1	0	0							

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
30APR	OLGB	50.5	0	2000	0.0							10.6	43		0.0	0.7	0.2	0.8
30APR	R5	48.0	0	2300	0.0							11.0	45					0.9
30APR	TRR	42.3	0	1800	0.0							11.4	53					1.1
30APR	HICK	31.6	2	1650	1.2	67	74	70.5	2	0	0	13.5	62					1.3
30APR	CHARLES	24.9	2	1800	1.1	67	80	73.5	2	0	0	15.0	80	80(S.I.4)				2.3
30APR	LEGION	17.2	0	2400	0.0							15.9	91					2.4
30APR	VENN	7.4	0	2400	0.0							16.9	104					6.8
30APR	SHILOH	3.4	1	2400	0.4	67	67	67.0	1	0	0	17.5	106					7.7
30APR	LAIRD	90.2	0	1650	0.0							18.6	1060					20.1
30APR	GARDNER	77.8	0	2250	0.0							18.1	657					10.8
TR TOT.			5	16750	0.3	67	80	71.0	5	0	0							
SJR TOT.			0	3900	0.0													

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
14MAY	OLGB	50.5	0	2400	0.0							10.7	42		4.0	2.0	0.0	0.5
14MAY	R5	48.0	27	2600	10.4	43	86	61.6	27	0	0	10.9	43	76-86(S.I.4)				0.8
14MAY	TRR	42.3	0	1800	0.0							12.2	54					0.8
14MAY	HICK	31.6	11	1650	6.7	79	95	86.7	11	0	0	14.9	51	11(79-95)				1.6
14MAY	CHARLES	24.9	0	1400	0.0							17.5	81					1.4
14MAY	LEGION	17.2	0	2400	0.0							18.0	91					3.0
14MAY	VENN	7.4	0	2400	0.0							19.6	114					4.7
14MAY	SHILOH	3.4	0	1800	0.0							20.5	117					3.9
14MAY	LAIRD	90.2	0	900	0.0							21.2	807					26.6
14MAY	GARDNER	77.8	0	1800	0.0							21.1	549					14.5
TR TOT.			38	16450	2.3	43	95	68.8	38	0	0							
SJR TOT.			0	2700	0.0													

2003 TUOLUMNE RIVER SEINING STUDY (TID/MID)

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN.	FL MAX.	FL AVG.	NO. MEAS.	SACFRY	NO. KILLED	WATER TEMP.	ELEC. COND.	SMOLT FL	SECTION DENSITY UPPER	MIDDLE	LOWER	TURB.
28MAY	OLGB	50.5	0	2600	0.0							11.7	45		0.0	0.4	0.0	0.7
28MAY	R5	48.0	0	2350	0.0							12.3	45					0.8
28MAY	TRR	42.3	0	1650	0.0							13.0	50					0.6
28MAY	HICK	31.6	0	1650	0.0							17.0	57					1.5
28MAY	CHARLES	24.9	2	1500	1.3	76	87	81.5	2	0	0	19.2	73	76,87				2.2
28MAY	LEGION	17.2	0	2400	0.0							20.3	79					2.6
28MAY	VENN	7.4	0	1800	0.0							22.3	98					4.1
28MAY	SHILOH	3.4	0	1800	0.0							23.3	100					5.6
28MAY	LAIRD	90.2	0	1200	0.0							26.2	1373					30.4
28MAY	GARDNER	77.8	0	1800	0.0							25.0	673					15.8
TR TOT.			2	15750	0.1	76	87	81.5	2	0	0							
SJR TOT.			0	3000	0.0													

Table 4. Summary table of other fish species caught in the Tuolumne and San Joaquin Rivers, 2003.

2003 OTHER SPECIES SAMPLED DURING SEINING STUDIES ON JUVENILE SALMON

OTHER SPECIES SAMPLED (ACTUAL COUNTS OR ESTIMATED ABUNDANCE)

DATE	SITE_LOCATION	MILE	LP	TFS	RT	CP	GF	GSH	SBF	HH	HCH	PM	ST	PRS	FHM	SKR	WCF	GAM	ISS	SB	WCR	GSF	BG	LMB	SMB	BLP	TP	RSCP	RSF	CCF	CENT
21JAN	1 OLGB	50.5																													
21JAN	2 R5	48.0																													
21JAN	3 TRR	42.3										3						15													
21JAN	4 HICK	31.6																7													
21JAN	5 CHARLES	24.9																					3								
21JAN	6 LEGION	17.2																3													
21JAN	7 VENN	7.4																1													
21JAN	8 SHILOH	3.4																6						1							
21JAN	9 LAIRD	90.2												500																	
21JAN	10 GARDNER	77.8												50					30				8						1		
04FEB	1 OLGB	50.5																													
04FEB	2 R5	48.0										1				2															
04FEB	3 TRR	42.3																1													
04FEB	4 HICK	31.6																3													
04FEB	5 CHARLES	24.9																				2	1	1							
04FEB	6 LEGION	17.2																2	1												
04FEB	7 VENN	7.4												2					2					1							
04FEB	8 SHILOH	3.4																15					1								
04FEB	9 LAIRD	90.2												30				12				1	4	3					4		
04FEB	10 GARDNER	77.8												30					20				1	2					4		
18FEB	1 OLGB	50.5																													
18FEB	2 R5	48.0										2																			
18FEB	3 TRR	42.3																													
18FEB	4 HICK	31.6																5													
18FEB	5 CHARLES	24.9																1					4								
18FEB	6 LEGION	17.2																6													
18FEB	7 VENN	7.4												1				5					1								
18FEB	8 SHILOH	3.4												6				40												1	
18FEB	9 LAIRD	90.2												20				6	3			1	4	1					1		
18FEB	10 GARDNER	77.8												20					10				3	3		1					
04MAR	1 OLGB	50.5										1																			
04MAR	2 R5	48.0										3				2															
04MAR	3 TRR	42.3																2													
04MAR	4 HICK	31.6																1													
04MAR	5 CHARLES	24.9																1				2	4	1							
04MAR	6 LEGION	17.2																20													
04MAR	7 VENN	7.4												2				15	2												
04MAR	8 SHILOH	3.4												7				50						1							
04MAR	9 LAIRD	90.2												30				2					2	1			1		2		
04MAR	10 GARDNER	77.8				1								30					10				6			1			2		
18MAR	1 OLGB	50.5																													
18MAR	2 R5	48.0																													
18MAR	3 TRR	42.3																1													
18MAR	4 HICK	31.6																4													
18MAR	5 CHARLES	24.9																				1	4	3							
18MAR	6 LEGION	17.2																						1							
18MAR	7 VENN	7.4																	5												
18MAR	8 SHILOH	3.4												1				50					3	1							
18MAR	9 LAIRD	90.2												50				50					3								
18MAR	10 GARDNER	77.8												200					15				10	1					1		

DATE	SITE	LOCATION	MILE	LP	TFS	RT	CP	GF	GSH	SBF	HH	HCH	PM	ST	PRS	FHM	SKR	WCF	GAM	ISS	SB	WCR	GSF	BG	LMB	SMB	BLP	TP	RSCP	RSF	CCF	CENT
01APR	1	OLGB	50.5																													
01APR	2	R5	48.0										2				3												1			
01APR	3	TRR	42.3			1																										
01APR	4	HICK	31.6																				1									
01APR	5	CHARLES	24.9																				1	15	5							
01APR	6	LEGION	17.2																6					1								
01APR	7	VENN	7.4																4					2	2							
01APR	8	SHILOH	3.4																30													
01APR	9	LAIRD	90.2		7										6									2	1		1					
01APR	10	GARDNER	77.8		8		1								10					7				4	1						WCF	

DATE	SITE	LOCATION	MILE	LP	TFS	RT	CP	GF	GSH	SBF	HH	HCH	PM	ST	PRS	FHM	SKR	WCF	GAM	ISS	SB	WCR	GSF	BG	LMB	SMB	BLP	TP	RSCP	RSF	CCF	CENT
16APR	1	OLGB	50.5																													
16APR	2	R5	48.0																													
16APR	3	TRR	42.3																													
16APR	4	HICK	31.6																													
16APR	5	CHARLES	24.9																													
16APR	6	LEGION	17.2														YOY															
16APR	7	VENN	7.4																6					1								
16APR	8	SHILOH	3.4												1																	
16APR	9	LAIRD	90.2												50					2				1	1							
16APR	10	GARDNER	77.8		47		1								30					12				6								

DATE	SITE	LOCATION	MILE	LP	TFS	RT	CP	GF	GSH	SBF	HH	HCH	PM	ST	PRS	FHM	SKR	WCF	GAM	ISS	SB	WCR	GSF	BG	LMB	SMB	BLP	TP	RSCP	RSF	CCF	CENT
30APR	1	OLGB	50.5																													
30APR	2	R5	48.0														YOY															
30APR	3	TRR	42.3														YOY															
30APR	4	HICK	31.6														YOY		1													
30APR	5	CHARLES	24.9																					25	4				1	1		
30APR	6	LEGION	17.2														YOY															
30APR	7	VENN	7.4																1	1				1								
30APR	8	SHILOH	3.4																					1								
30APR	9	LAIRD	90.2												6				2	6				1	1							
30APR	10	GARDNER	77.8		20										40		1			20				4						1		

DATE	SITE	LOCATION	MILE	LP	TFS	RT	CP	GF	GSH	SBF	HH	HCH	PM	ST	PRS	FHM	SKR	WCF	GAM	ISS	SB	WCR	GSF	BG	LMB	SMB	BLP	TP	RSCP	RSF	CCF	CENT
14MAY	1	OLGB	50.5																													
14MAY	2	R5	48.0														YOY															
14MAY	3	TRR	42.3														YOY															
14MAY	4	HICK	31.6										1				YOY															
14MAY	5	CHARLES	24.9	1																			1	20	8					2		
14MAY	6	LEGION	17.2														YOY		3						1							
14MAY	7	VENN	7.4																20					5	5					1		
14MAY	8	SHILOH	3.4																1						1							
14MAY	9	LAIRD	90.2												500				10	10												
14MAY	10	GARDNER	77.8				1								30			1		10				6	1							

DATE	SITE	LOCATION	MILE	LP	TFS	RT	CP	GF	GSH	SBF	HH	HCH	PM	ST	PRS	FHM	SKR	WCF	GAM	ISS	SB	WCR	GSF	BG	LMB	SMB	BLP	TP	RSCP	RSF	CCF	CENT
28MAY	1	OLGB	50.5														YOY		6													
28MAY	2	R5	48.0														YOY															
28MAY	3	TRR	42.3														YOY															
28MAY	4	HICK	31.6														YOY															
28MAY	5	CHARLES	24.9																				1	15	8					1		
28MAY	6	LEGION	17.2														YOY		5													
28MAY	7	VENN	7.4																2					8	1	1				3		
28MAY	8	SHILOH	3.4																10					3		1						
28MAY	9	LAIRD	90.2												25				10	2												
28MAY	10	GARDNER	77.8												30					10				10	1					2		

Table 4. Key to other species caught and distribution.

KEY TO OTHER SPECIES SAMPLED AND DISTRIBUTION
(List includes all species caught during 1986-2003 seining studies)

FAMILY	COMMON NAME	NATIVE SPECIES	ABBREV.	SAN JOAQUIN	TUOL.
Petromyzontidae	Pacific lamprey	N	LP		X
Clupeidae	threadfin shad		TFS	X	
Salmonidae	chinook salmon	N	CS	X	X
Salmonidae	rainbow trout	N	RT		X
Cyprinidae	carp		CP	X	
Cyprinidae	goldfish		GF		
Cyprinidae	golden shiner		GSH		
Cyprinidae	Sacramento blackfish	N	SBF		
Cyprinidae	hitch	N	HCH		
Cyprinidae	hardhead	N	HH		
Cyprinidae	Sacramento pikeminnow	N	PM		X
Cyprinidae	Sacramento splittail	N	ST		
Cyprinidae	red shiner		PRS	X	X
Cyprinidae	fathead minnow		FHM		
Catostomidae	Sacramento sucker	N	SKR	X	X
Ictaluridae	channel catfish		CCF		X
Ictaluridae	white catfish		WCF	X	
Ictaluridae	brown bullhead		BBH		
Poeciliidae	western mosquitofish		GAM	X	X
Atherinidae	inland silverside		ISS	X	X
Percichthyidae	striped bass		SB		
Centrarchidae	white crappie		WCR		
Centrarchidae	warmouth		WM		
Centrarchidae	green sunfish		GSF	X	X
Centrarchidae	bluegill		BG	X	X
Centrarchidae	redear sunfish		RSF	X	X
Centrarchidae	largemouth bass		LMB	X	X
Centrarchidae	smallmouth bass		SMB		X
Percidae	bigscale logperch		BLP	X	
Embiotocidae	tule perch	N	TP	X	
Cottidae	prickly sculpin	N	PSCP		
Cottidae	riffle sculpin	N	RSCP		X
TOTAL:	32			14	15

2003 species presence designated with 'X'

Table 5. Tuolumne River snorkel summary, 2003.

2003 TUOLUMNE RIVER SNORKEL SUMMARY (TID/MID)

														NUMBER COUNTED (ESTIMATED TOTAL LENGTH OR SIZE RANGE IN MM)												
DATE	START TIME	LOCATION	RIVER MILE	SITE	AREA (Sq. Ft.)	AVG. DEPTH (FEET)	TIME (Min.)	HABITAT	SUBSTRATE	WATER TEMP. (C)	EC	TURB. (NTU)	HORIZ. VISIB. (FEET)	CHINOOK count/est.	CHINOOK size	RAINBOW count/est.	RAINBOW size	SACRAMENTO SUCKER	SACRAMENTO PIKEMINNOW	HARDHEAD	RIFFLE SCULPIN	LARGEMOUTH BASS	SMALLMOUTH BASS	REDEAR SUNFISH	BLUEGILL	CARP
18-Jun	0942	Riffle A7	50.7	1	5,625	1.2	34.0	Riffle	cobble,gravel,bedrock	12.1	42	0.5	17	250	(40-70)			9(375-425)								
														1	(120)											
	0940			2	5,000	3.0	26.0	Run-Riffle	cobble,gravel,boulder					25	(45-60)	5	(45-55)									
														150	(80-120)	60	(90-140)									
																1	(350)									
18-Jun	1106	Riffle 2	49.9	1	3,075	1.0	29.0	Riffle	cobble,gravel,sand	13.4	43	0.5	18.0	47	(80-120)	5	(120-130)	(500,525)			(60,90)					
														25	(60-85)											
	1129			2	3,000	8.0	20.0	Pool	bedrock,boulder,sand							2	(300,325)	40(300-450)	(80)							
	1135			3	6,000	5.0	14.0	Run	sand,cobble,boulder							1	(420)	(450,600,650)								
18-Jun	1338	Riffle 3B	49.1	1	4,000	1.8	25.0	Riffle	cobble,gravel,sand	13.9	44	0.7	16.0	15	(80-110)	5	(110-150)	3(350-400)			(70)					
																		(550,600)								
	1345			2	6,250	2.3	26.0	Run-Riffle	cobble,sand,bedrock					1	(50)			25(500-600)								
18-Jun	1515	Riffle 5B	47.9	1	2,000	2.0	16.0	Riffle	cobble,gravel,sand	15.4	43	0.8	15.0	4	(90-100)	5	(90-120)	8(350-500)								
*	1536			2	7,500	4.5	10.0	Run	cobble,boulder,bedrock									8(350-500)								
	1517			3	5,400	5.5	22.0	Run-Pool	bedrock,sand,cobble							1	(370)	11(500-650)	(460)							
					47,850		222.0			Subtotal				518		85		111	2		3					
19-Jun	0934	Riffle 7	46.9	1	1,875	1.2	21.0	Riffle	cobble,gravel,sand	12.6	50	0.7	15.0			4	(110-125)	(525,550)								
																9	(80-110)									
	0930			2	6,000	3.5	19.0	Run	bedrock,cobble,sand							1	(375)	36(400-650)	(350,400)							
19-Jun	1059	Riffle 13B	45.5	1	4,000	2.4	22.0	Run-Riffle	cobble,gravel,sand	14.4	49	1.1	13.0	9	(80-110)	1	(390)	(75) 5(550-600)								
	1054			2	3,600	2.0	22.0	Riffle	gravel,cobble,sand									3(450-550)								
19-Jun	1312	Riffle 21	42.9	1	1,000	1.6	14.0	Riffle	cobble,gravel,sand	17.2	52	1.0	12.0					(600)	7(150-210)							
	1308			2	4,000	4.5	20.0	Run	cobble,sand,boulder									11(400-600)	24(120-275)	21(150-250)		(120,220)		(120)	(90,120)	
																		3(250-350)	(320,350,450)	3(110-130)						
19-Jun	1414	Riffle 23C	42.3	1	1,750	2.8	15.0	Run	cobble,gravel,bedrock	18.4	51	1.3	12.0	6	(60-120)	1	(90)		50(120-220)	30(175-275)						
																			20(225-350)							
	1410			2	3,000	1.8	18.0	Riffle	cobble,gravel,bedrock					2	(110,120)			(700)	14(140-220)	19(140-220)	(90)					
					25,225		151.0			Subtotal				17		16		63	120	73	1	2		1	2	
20-Jun	0926	Riffle 30B	38.5	1	6,000	2.5	19.0	Run-Riffle	boulder,cobble,sand	17.0	63	1.5	10.0					50(50-70)								
	0934			2	3,500	4.0	16.0	Run	sand,cobble,gravel									(575,650)				5(130-160) (240)	(200)			(750)
20-Jun	1041	Riffle 35A	37.1	1	2,400	1.0	15.0	Riffle	gravel,cobble,sand	18.5	64	1.3	11.0	2	(110,120)				15(120-150)	(120,140,150)						
																			3(200-240)(300)							
	1050			2	5,250	2.8	18.0	Run	vegetation.,sand,gravel									6(550-650)	8(150-200) (250)			11(120-175)				
																						5(180-225)				
20-Jun	1300	Riffle 41A	35.3	1	3,000	2.8	16.0	Run-Riffle	cobble,gravel,sand	19.7	67	1.3	8.0					(575,600)	14(150-250)			(150,160)				
	1249			2	2,400	5.5	8.0	Pool	gravel,sand,bedrock									(260,300)	(200,240,360)			(90,100)	(180)			
	1257			3	4,000	2.5	10.0	Run-Riffle	boulder,cobble,gravel									(700,750)								
20-Jun	1424	Riffle 57	31.5	1	3,000	1.3	17.0	Riffle-Run	cobble,gravel,sand	22.0	67	1.4	12.0					(600)	(260,275)				(160,160,170)			
	1421			2	7,500	2.5	15.0	Run	cobble,bedrock,sand													(110,110,140,200)	(180,140)			
					37,050		134.0			Subtotal				2				65	47	3		30	7			1
										TOTAL#				537		101		239	169	76	4	32	7	1	2	1

* Swimmers were at the site location during the survey

Young-of-the-year sucker were commonly observed along the margins at most sites.

Table 5. Tuolumne River snorkel summary, 2003.

2003 TUOLUMNE RIVER SNORKEL SUMMARY (TID/MID)

DATE	START TIME	LOCATION	RIVER MILE	SITE	AREA (Sq. Ft.)	AVG. DEPTH (FEET)	TIME (Min.)	HABITAT	SUBSTRATE	WATER TEMP. (C)	EC	TURB. (NTU)	HORIZ. VISIB. (FEET)	CHINOOK count/est.	CHINOOK size	RAINBOW count/est.	RAINBOW size	SACRAMENTO SUCKER	SACRAMENTO PIKEMINNOW	HARDHEAD	RIFFLE SCULPIN	LARGEMOUTH BASS	SMALLMOUTH BASS	REDEAR SUNFISH	BLUEGILL	CARP
														NUMBER COUNTED (ESTIMATED TOTAL LENGTH OR SIZE RANGE IN MM)												
17SEP	0930	Riffle A7	50.7	1	4,500	1.5	30.0	Riffle	cobble,gravel,bedrock	12.0	40	0.5	22.5	2	(100,110)	15	(45-60)									
																1	(210)									
(1)				2	5,000	3.0	25.0	Riffle-Run	cobble,gravel,boulder												(80)					
17SEP	1058	Riffle 2	49.9	1	3,700	1.3	34.0	Riffle	gravel,cobble,boulder	12.8	40	0.7	23.0	1	(90)	1	(200)	(70) 9(450-600)			2(70,110)					
				2	3,000	8.0	20.0	Pool	bedrock,boulder,sand							1	(350)	35(280-450)8(500-600)	4(280-320)(400,450)							
				3	4,000	5.0	15.0	Run	cobble,sand,gravel									55(300-600)	(425)							
17SEP	1315	Riffle 3B	49.1	1	4,000	2.0	23.0	Riffle	cobble,gravel,sand	14.8	40	0.6	18.5	3	(70,75,80)	16	(60-80)									
																1	(180)									
				2	5,000	2.5	18.0	Run-Riffle	cobble,bedrock,gravel							2	(200,220)	(450)								
																2	(325,475)									
17SEP	1500	Riffle 5B	47.9	1	1,500	1.8	17.0	Riffle	cobble,gravel,sand	15.7	43	0.8	17.0	4	(80-110)	9	(60-70)	(80)								
				2	6,000	4.5	26.0	Run	cobble, gravel,bedrock									(550) (YOY)								
				3	5,000	5.0	20.0	Run-Pool	bedrock,sand,cobble							1	(325)	16(350-600)	(220)							
					41,700		228.0			Subtotal				10		49		127	8	0	3	0	0	0	0	0
18SEP	0900	Riffle 7	46.9	1	1,800	1.3	18.0	Riffle	cobble,gravel,sand	12.3	47	0.7	17.5			9	(125-225)									
				2	6,000	3.5	21.0	Run	bedrock,cobble,sand									45(400-550) (YOY)	(380,400,430)							
18SEP	1030	Riffle 13B	45.5	1	4,500	2.5	19.0	Riffle-Run	cobble,gravel,sand	13.5	44	0.8	16.0			3	(190-225)	19(400-650)	(270,315)							
																2	(300,330)									
				2	3,600	2.0	19.0	Riffle	gravel,cobble,sand							1	(60)	(50,60,60)								
18SEP	1130	Riffle 21	42.9	1	1,800	2.2	18.0	Riffle	cobble,gravel,sand	15.1	44	1.0	20.0	1	(110)	5	(190-225)	(375,400)								
				2	4,000	4.5	18.0	Run	cobble,sand,boulder							1	(320)	16(150-200)(450,500)	5(160-200)	3(140-160)						
18SEP	1330	Riffle 23C	42.3	1	2,250	2.0	15.0	Riffle-Run	cobble,gravel,bedrock	15.5	47	1.1	18.0			1	(210)		(140,180)							
				2	3,000	1.5	18.0	Riffle	cobble,gravel,bedrock									(80,120,450)	40(40-60) 9(140-200)	5(140-200)						
					26,950		146.0			Subtotal				1		22		90	61	8	0	0	0	0	0	0
19SEP	0915	Riffle 31	38.0	1	4,000	1.5	19.0	Riffle	cobble,gravel,sand	15.0	62	1.2	15.0					(80) 41(400-650)	13(110-150)				(120)			
(2)				2	3,750	3.0	14.0	Run-Pool	cobble,sand,vegetation									45(450-700)	8(220-300)							
19SEP	1030	Riffle 35A	37.1	1	2,100	1.2	17.0	Riffle	gravel,cobble,sand	16.5	65	1.2	13.0	1	(120)				14(120-180) 6(180-260)			(110)				
				2	5,250	3.0	20.0	Run	cobble,gravel,sand									35(400-600)	12(190-300)			30(120-250)	(270)			
19SEP	1145	Riffle 41A	35.3	1	2,400	2.0	18.0	Run-Riffle	cobble,gravel,sand	17.3	66	0.9	20.0	1	(115)			5(400-650)	29(140-220)	8(170-240)		(150)				
				2	2,400	5.0	7.0	Pool	gravel,sand,bedrock									(600)	(140,160) 4(300-450)	5(120-260)			(120,140)			
				3	3,000	2.5	11.0	Run-Riffle	cobble,gravel,sand									(90,600)	40(40-80) (140,160)							
19SEP	1400	Riffle 57	31.5	1	5,000	1.5	19.0	Riffle	cobble,gravel,sand	19.4	68	0.9	17.0					(550,575)	(180,190,215)		(55)					
				2	7,000	2.0	17.0	Run	cobble,gravel,sand										15(40-60)				(90,200)			
					34,900		142.0			Subtotal				2		0		132	148	13	1	32	6	0	0	0
										TOTAL#				13		71		349	217	21	4	32	6	0	0	0

(1) Location 2 was modified by CDFG gravel addition.

(2) New snorkel site (replacing Riffle 30B).

Table 6. Yearly seining summary for the Tuolumne, San Joaquin, and Stanislaus Rivers, 1986-2003.

Tuolumne River Seining Study Summary (Tuolumne, San Joaquin and Stanislaus Rivers)

	TUOLUMNE RIVER					SAN JOAQUIN			STANISLAUS				
Sampling Year	Sampling Periods	Salmon Captured	Sites Sampled	Average Density	Growth Rate Index (mm/day)	Salmon Captured	Sites Sampled	Average Density	Salmon Captured	Sites Sampled	Average Density	Start Date	End Date
1986	18	5514	8	20.7	0.45	854	3	14.2	---	---		22JAN	27JUN
1987	21	14825	11	22.4	0.45	734	6	1.9	---	---		05JAN	04JUN
1988	14	6134	11	14.3	0.58	295	4	2.1	84	1	2.9	05JAN	17MAY
1989	13	10043	11	27.0	0.64	83	3	0.6	1206	1	45.4	05JAN	12MAY
1990	14	2286	11	6.0	0.57	48	3	0.5	---	---		04JAN	11MAY
1991	8	120	11	0.5	No estimate	0	3	0	3	1	0.2	15JAN	24MAY
1992	5	144	7	1.2	No estimate	0	3	0	54	1	3.9	27JAN	13MAY
1993	7	124	8	0.8	0.68	0	3	0	6	1	0.3	26JAN	12MAY
1994	7	2068	5	21.6	0.65	2	2	0	---	---		25JAN	20MAY
1995	8	512	5	6.1	0.79	43	2	1.1	---	---		09FEB	12JUL
1996	8	785	6	7.6	0.66	7	2*	0.2	---	---		17JAN	13JUN
1997	10	379	7	2.7	0.48	11	2*	0.4	---	---		14JAN	28MAY
1998	10	1950	7	14.4	0.46	99	2	2.5	---	---		14JAN	21MAY
1999	10	3443	8	24.6	0.54	560	2	13.6	---	---		14JAN	19MAY
2000	10	3213	8	27.0	0.46	19	2	0.6	---	---		11JAN	17MAY
2001	11	5567	8	41.3	0.67	83	2	2.6	---	---		09JAN	30MAY
2002	10	3486	8	25.6	0.64	0	2	0	---	---		15JAN	21MAY
2003	10	5983	8	39.3	0.68	1	2	0	---	---		21JAN	28MAY

--- Not Sampled

*All San Joaquin River locations were not always sampled

Table 7. Summary table of locations sampled, 1986-2003.

1986 TO 2002 SEINING LOCATIONS

TUOLUMNE RIVER

Site	Location	River Mile	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	Old La Grange Bridge	50.5	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X
2	Riffle 4B	48.4	X	X	X	X	X	X				X	X	X	X					
3	Riffle 5	47.9		X	X	X	X	X	X	X	X					X	X	X	X	X
4	Tuolumne River Resort	42.4			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	Turlock Lake State Rec. Area	42.0	X	X																
6	Reed Gravel	34.0	X	X	X	X	X	X												
7	Hickman Bridge	31.6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	Charles Road	24.9		X	X	X	X	X	X	X				X	X	X	X	X	X	X
9	Legion Park	17.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	Riverdale Park / Venn	12.3 / 7.4		X	X	X	X	X								X	X	X	X	X
11	McCleskey Ranch	6.0	X	X	X	X	X	X	X	X	X									
12	Shiloh Bridge	3.4	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X

SAN JOAQUIN RIVER

Site	Location	River Mile	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
13	Laird Park	90.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14	Gardner Cove	77.8		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
15	Maze Road	76.6	X	X	X															
16	Sturgeon Bend	74.3		X	X															
17	Durham Ferry Park	71.3	X	X	X	X	X	X	X	X										
18	Old River	53.7		X																

STANISLAUS RIVER

Site	Location	River Mile	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
19	Caswell State Park	8.5			X	X		X	X	X										

DRY CREEK

Site	Location	River Mile	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
20	Beard Brook Park	0.5							X	X										

In 1987 additional sites on the Tuolumne, San Joaquin, Merced and Stanislaus Rivers were sampled occasionally (1987 annual report).

Table 8. Tuolumne River analysis of female spawners to fry density.

TUOLUMNE RIVER ANALYSIS OF FEMALE SPAWNERS TO FRY DENSITY (TID/MID)

TUOL.R. FALL-RUN	TOTAL FEMALE SPAWNERS	JUVENILE SEINING	PEAK FRY DENSITY	AVERAGE FRY DENSITY 15JAN-15MAR	LOG TRANSFORMATION TOTAL FEMALE SPAWNERS	PEAK FRY DENSITY	AVERAGE FRY DENSITY 15JAN-15MAR
1985	22600	86	158.8	59.5	4.4	2.2	1.8
1986	3800	87	69.3	46.2	3.6	1.8	1.7
1987	4600	88	70.2	33.9	3.7	1.8	1.5
1988	4100	89	115.1	39.7	3.6	2.1	1.6
1989	680	90	11.4	5.0	2.8	1.1	0.7
1990	28	91	1.3	0.5	1.4	0.1	-0.3
1991	28	92	6.1	2.9	1.4	0.8	0.5
1992	55	93	1.7	0.9	1.7	0.2	0.0
1993	237	94	79.5	41.5	2.4	1.9	1.6
1994	249	95	12.5	9.8	2.4	1.1	1.0
1995	522	96	16.1	13.0	2.7	1.2	1.1
1996	1142	97	2.8	2.1	3.1	0.4	0.3
1997	4224	98	49.3	24.6	3.6	1.7	1.4
1998	4527	99	78.0	39.3	3.7	1.9	1.6
1999	3535	00	78.8	48.0	3.5	1.9	1.7
2000	11260	01	126.3	85.6	4.1	2.1	1.9
2001	4970	02	92.8	41.5	3.7	2.0	1.6
2002	3876	03	164.3	68.8	3.6	2.2	1.8

LINEAR REGRESSION ON LOG VALUES
Total females to peak fry density (1986-2003)
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.832394549
R Square	0.692880685
Adjusted R Square	0.673685728
Standard Error	0.397429385
Observations	18

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5.701527932	5.701527932	36.09702	1.82415E-05
Residual	16	2.527201856	0.157950116		
Total	17	8.228729788			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.54625465	0.349247165	-1.564091869	0.137357	-1.286625399	0.194116098	-1.286625399	0.194116098
X Variable 1	0.656907427	0.109337344	6.008079263	1.82E-05	0.425122665	0.888692189	0.425122665	0.888692189

LINEAR REGRESSION ON LOG VALUES
Total females to average fry density (1986 to 2003)
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.835732146
R Square	0.69844822
Adjusted R Square	0.679601234
Standard Error	0.387107891
Observations	18

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5.553366687	5.553366687	37.05888	1.57041E-05
Residual	16	2.397640314	0.14985252		
Total	17	7.951007001			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.8014892	0.340176994	-2.356094654	0.031553	-1.522632048	-0.08034635	-1.522632048	-0.080346348
X Variable 1	0.648315969	0.106497783	6.087600591	1.57E-05	0.422550805	0.874081134	0.422550805	0.874081134

Table 9. Summary table of salmonids observed during the 1996-2003 (June/July) snorkel surveys.

TUOLUMNE RIVER SNORKEL SUMMARY – YEARLY COMPARISON OF SALMONIDS OBSERVED

	CHINOOK 1996	CHINOOK 1997	CHINOOK 1999	CHINOOK 2000	CHINOOK 2001	CHINOOK 2002	CHINOOK 2003	RAINBOW 1996	RAINBOW 1997	RAINBOW 1999	RAINBOW 2000	RAINBOW 2001	RAINBOW 2002	RAINBOW 2003
DATES	July 02-09	June 25-26	June 15-16	June 5-21	June 18-20	June 11-13	June 18-20	July 02-09	June 25-26	June 15-16	June 5-21	June 18-20	June 11-13	June 18-20
LOCATIONS														
Riffle A7 (RM 50.7)	20	0	23	211	277	429	426	0	2	14	14	7	5	66
Riffle 1A (RM 50.4)	29	-	-	47				2	-	-	3			
Riffle 2 (RM 49.9)	16	0	3	-	4	10	72	88	2	0	-	3	1	8
Riffle 3B (RM 49.1)	4	0	108	34	52	83	16	127		31	14	8	11	5
Riffle 5B (RM 47.9)	56	0	20	35	47	17	4	25	0	10	19	4	3	6
Sec. Total	**125**	**0**	**154**	**327**	**380**	**539**	**518**	**242**	**4**	**55**	**50**	**22**	**20**	**85**
Riffle 7 (RM 46.9)	20	1	57	0	17	15	0	4	0	15	52	4	5	14
Riffle 12 (RM 45.8)	-	-	-	6				-	-		5			
Riffle 13A-B (RM 45.6)	-	-	-	5	6	10	9	-	-		20	3	2	1
Riffle 17A2 (RM 44.4)	-	-	-	0				-	-		14			
Riffle 21 (RM 42.9)	2	-	-	0	0	1	0	0	-		27	2	1	0
Riffle 23B-C (RM 42.3)	-	2	1	0	1	2	8	-	0	9	4	0	0	1
Sec. Total	**22**	**3**	**58**	**11**	**24**	**28**	**17**	**4**	**0**	**24**	**122**	**9**	**8**	**16**
Riffle 26 (RM 40.9)	-	-	-	0				-	-	-	4			
Riffle 27 (RM 40.3)	-	-	-	0				-	-	-	2			
Riffle 30B (RM 38.5)	-	-	0	-			0	-	-	0	-			0
Riffle 31 (RM 38.1)	-	-	-	0	0			-	-	-	2	0		
Riffle 35A (RM 37.0)	0	-	-	0		0	2	0	-	-	0		0	0
Riffle 36A (RM 36.7)	0	0	0	-				0	0	0	-			
Riffle 37 (RM 36.2)	-	-	-	0	0			-	-	-	0	0		
Sec. Total	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**8**	**0**	**0**	**0**
Riffle 41A (RM 35.3)	-	-	-	0	0	0	0	-	-	-	0	0	0	0
Riffle 46 (RM 34.0)	-	-	-	0				-	-	-	0			
Riffle 52B (RM 32.2)	-	-	-	0				-	-	-	0			
Riffle 57 (RM 31.5)	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Sec. Total	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Grand Total	**148**	**3**	**213**	**338**	**404**	**567**	**537**	**246**	**4**	**79**	**180**	**31**	**28**	**101**

TUOLUMNE RIVER SNORKEL SUMMARY – YEARLY COMPARISON OF DENSITY INDICES
(SALMONIDS OBSERVED / 1000 SQ. FT.)

	CHINOOK 1996	CHINOOK 1997	CHINOOK 1999	CHINOOK 2000	CHINOOK 2001	CHINOOK 2002	CHINOOK 2003	RAINBOW 1996	RAINBOW 1997	RAINBOW 1999	RAINBOW 2000	RAINBOW 2001	RAINBOW 2002	RAINBOW 2003
DATES	July 02-09	June 25-26	June 15-16	June 5-21	June 18-20	June 11-13	June 18-20	July 02-09	June 25-26	June 15-16	June 5-21	June 18-20	June 11-13	June 18-20
LOCATIONS														
Riffle A7 (RM 50.7)		0	5.44	37.02	44.68	45.2	40.1		0.42	3.31	2.46	1.13	0.50	6.2
Riffle 1A (RM 50.4)		-	-	9.40					-	-	0.60			
Riffle 2 (RM 49.9)		0	0.43	-	0.38	0.6	6.0		0.19	0	-	0.29	0.06	0.7
Riffle 3B (RM 49.1)		0	24.55	7.08	4.77	9.4	1.6			7.05	2.92	0.73	1.20	0.5
Riffle 5B (RM 47.9)		0	3.09	5.67	4.53	0.8	0.3		0	1.55	3.08	0.39	0.10	0.4
Sec. Total		**0.00**	**6.95**	**15.09**	**10.02**	**9.8**	**10.8**		**0.15**	**2.48**	**2.31**	**0.58**	**0.36**	**1.78**
Riffle 7 (RM 46.9)	13.33	0.21	21.92	0	2.36	2.4	0.0	2.67	0	5.77	8.78	0.56	0.80	1.8
Riffle 12 (RM 45.8)	-	-	-	1.13				-	-		0.94			
Riffle 13A (RM 45.6)	-	-	-	2.94	1.64	1.5	1.2	-	-		11.76	0.82	0.30	0.1
Riffle 17A2 (RM 44.4)	-	-	-	0				-	-		4.12			
Riffle 21 (RM 42.9)	1.14	-	-	0	0	0.2	0.0	0.00	-		15.00	0.61	0.20	0.0
Riffle 23B-C (RM 42.3)	-	0.53	0.70	0	0.21	0.5	1.7	-	0	6.32	1.60	0	0	0.2
Sec. Total	**6.77**	**0.35**	**14.41**	**0.53**	**1.27**	**1.29**	**0.67**	**1.23**	**0.00**	**5.96**	**5.92**	**0.48**	**0.37**	**0.63**
Riffle 26 (RM 40.9)	-	-	-	0				-	-	-	2.00			
Riffle 27 (RM 40.3)	-	-	-	0				-	-	-	0.67			
Riffle 30B (RM 38.5)	-	-	0	-			0.0	-	-	0	-			0.0
Riffle 31 (RM 38.1)	-	-	-	0	0			-	-	-	1.00	0		
Riffle 35A (RM 37.0)	0	-	-	0		0	0.3	0	-	-	0		0	0.0
Riffle 36A (RM 36.7)	0	0	0	-				0	0	0	-			
Riffle 37 (RM 36.2)	-	-	-	0	0			-	-	-	0	0		
Sec. Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.12**	**0.00**	**0.00**	**0.00**	**0.70**	**0.00**	**0.00**	**0.00**
Riffle 41A (RM 35.3)	-	-	-	0	0	0	0.0	-	-	-	0	0	0	0.0
Riffle 46 (RM 34.0)	-	-	-	0				-	-	-	0			
Riffle 52B (RM 32.2)	-	-	-	0				-	-	-	0			
Riffle 57 (RM 31.5)	1.25	0	0.74	0	0	0	0.0	0	0	0	0	0	0	0.0
Sec. Total	**1.25**	**0.00**	**0.74**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

CDFG did not provide area measurements needed to calculate density indices

Table 9. Summary table of salmonids observed during the 2001-2003 (September) snorkel surveys.

TUOLUMNE RIVER SNORKEL SUMMARY -- YEARLY COMPARISON OF SALMONIDS OBSERVED

	CHINOOK	CHINOOK	CHINOOK					RAINBOW	RAINBOW	RAINBOW			
	2001	2002	2003					2001	2002	2003			
DATES	Sept. 18-20	Sept. 24-26	Sept. 17-19					Sept. 18-20	Sept. 24-26	Sept. 17-19			
LOCATIONS													
Riffle A7	21	2	2					3	1	16			
(RM 50.7)													
Riffle 2	0	0	1					3	4	2			
(RM 49.9)													
Riffle 3B	0	0	3					1	1	21			
(RM 49.1)													
Riffle 5B	0	0	4					2	0	10			
(RM 47.9)													
Sec. Total	**21**	**2**	**10**	**0**	**0**	**0**		**9**	**6**	**49**	**0**	**0**	**0**
Riffle 7	0	1	0					0	2	9			
(RM 46.9)													
Riffle 13B,13A	0	0	0					0	4	6			
(RM 45.5 / 45.6)													
Riffle 21	0	0	1					3	0	6			
(RM 43.1)													
Riffle 23B-C	0	0	0					0	0	1			
(RM 42.3)													
Sec. Total	**0**	**1**	**1**	**0**	**0**	**0**		**3**	**6**	**22**	**0**	**0**	**0**
Riffle 31 / 30B	0	0	0					0	0	0			
(RM 38.1 / 38.5)													
Riffle 37 / 35A	0	0	1					0	0	0			
(RM 36.2 / 37.1)													
Sec. Total	**0**	**0**	**1**	**0**	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**0**
Riffle 41A	0	0	1					0	0	0			
(RM 35.3)													
Riffle 57	0	0	0					0	0	0			
(RM 31.5)													
Sec. Total	**0**	**0**	**1**	**0**	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**0**
Grand Total	**21**	**3**	**13**	**0**	**0**	**0**		**12**	**12**	**71**	**0**	**0**	**0**

TUOLUMNE RIVER SNORKEL SUMMARY -- YEARLY COMPARISON OF DENSITY INDICES
(SALMONIDS OBSERVED / 1000 SQ. FT.)

	CHINOOK	CHINOOK	CHINOOK					RAINBOW	RAINBOW	RAINBOW			
	2001	2002	2003					2001	2002	2003			
DATES	Sept. 18-20	Sept. 24-26	Sept. 17-19					Sept. 18-20	Sept. 24-26	Sept. 17-19			
LOCATIONS													
Riffle A7	2.97	0.14	0.21					0.42	0.07	1.68			
(RM 50.7)													
Riffle 2	0	0	0.09					0.20	0.21	0.19			
(RM 49.9)													
Riffle 3B	0	0	0.33					0.08	0.12	2.33			
(RM 49.1)													
Riffle 5B	0	0	0.32					0.16	0	0.80			
(RM 47.9)													
Sec. Total	**0.45**	**0.03**	**0.24**					**0.19**	**0.09**	**1.18**			
Riffle 7	0	0.19	0.00					0	0.38	1.15			
(RM 46.9)													
Riffle 13B,13A	0	0	0.00					0	0.48	0.74			
(RM 45.5 / 45.6)													
Riffle 21	0	0	0.17					0.67	0	1.03			
(RM 43.1)													
Riffle 23B-C	0	0	0.00					0	0	0.19			
(RM 42.3)													
Sec. Total	**0.00**	**0.04**	**0.04**					**0.12**	**0.22**	**0.82**			
Riffle 31	0	0	0.00					0	0	0.00			
(RM 38.1)													
Riffle 37	0	0	0.14					0	0	0.00			
(RM 36.2)													
Sec. Total	**0.00**	**0.00**	**0.07**					**0.00**	**0.00**	**0.00**			
Riffle 41A	0	0	0.13					0	0	0.00			
(RM 35.3)													
Riffle 57	0	0	0.00					0	0	0.00			
(RM 31.5)													
Sec. Total	**0.00**	**0.00**	**0.05**					**0.00**	**0.00**	**0.00**			
Grand Total													

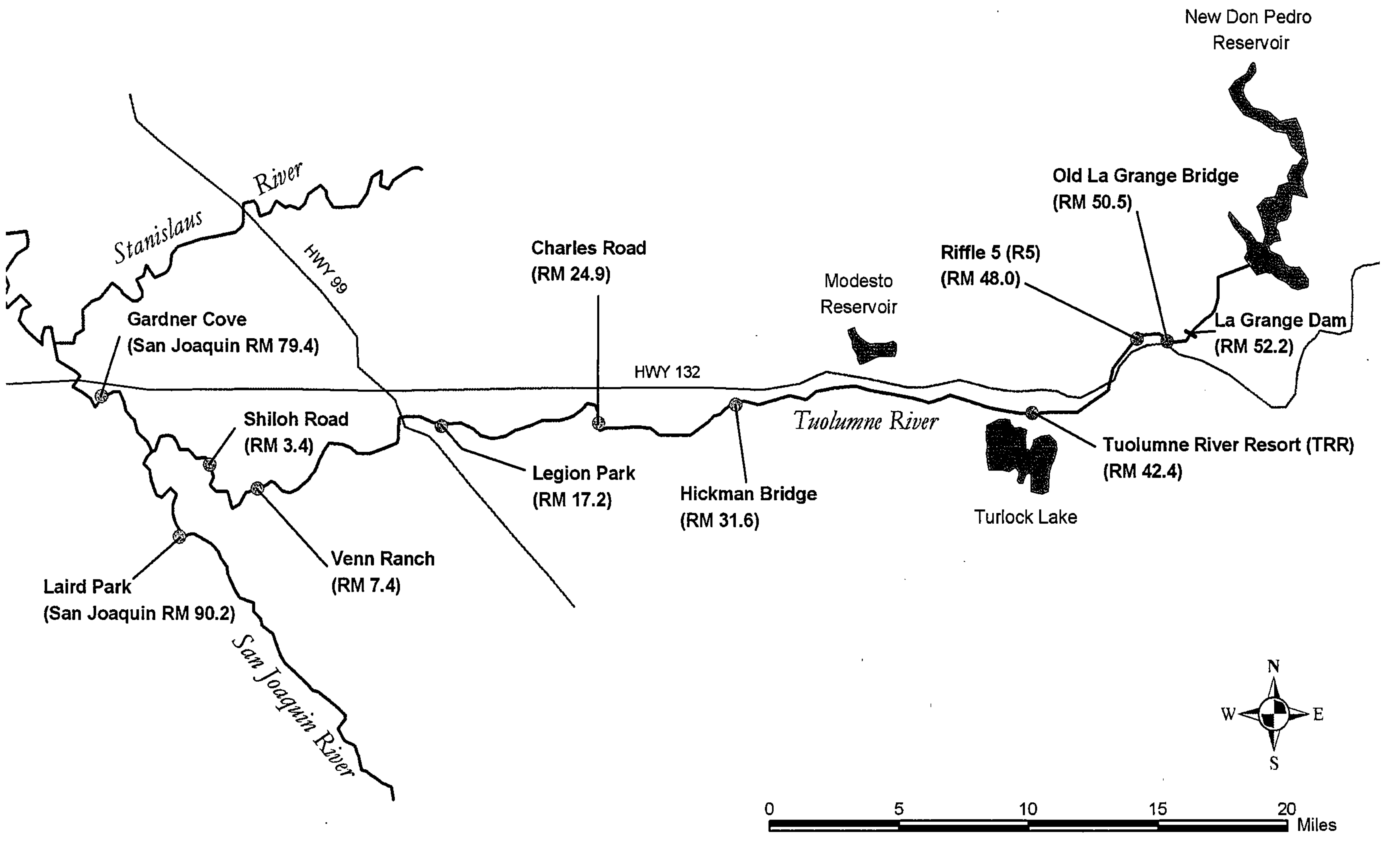
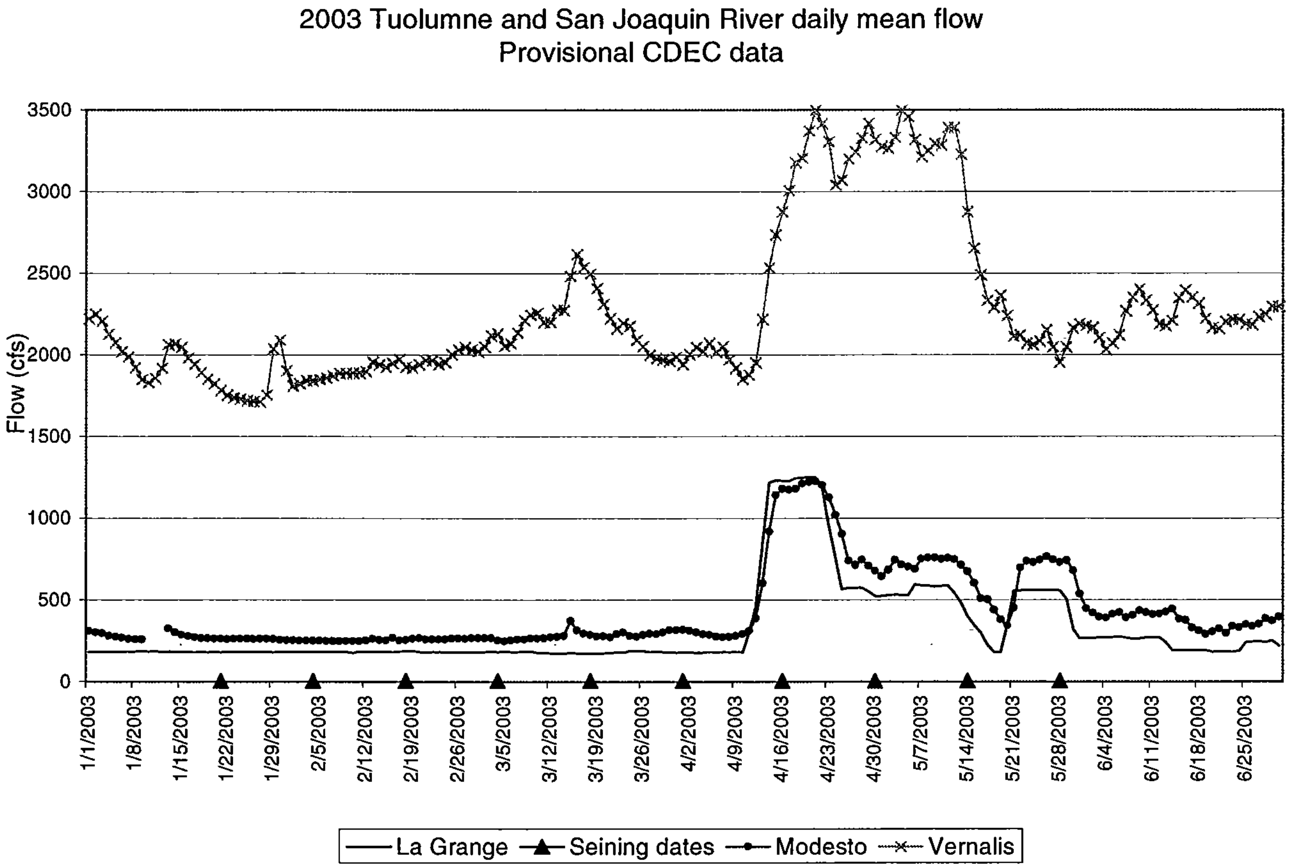


Figure 1. Locations of seine sampling sites on the lower Tuolumne and San Joaquin Rivers, 2003.



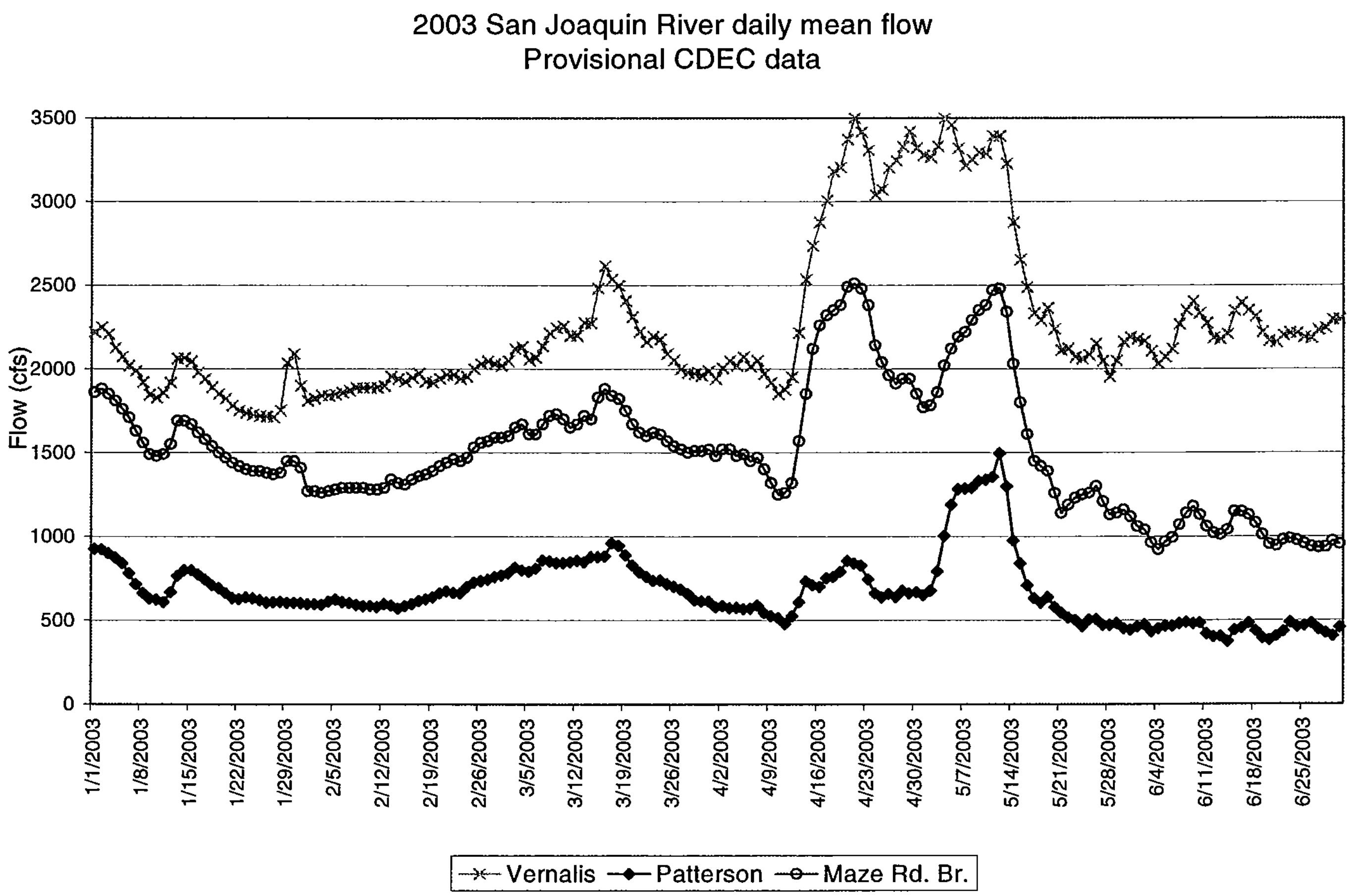


Figure 2. Tuolumne and San Joaquin River daily average flow.

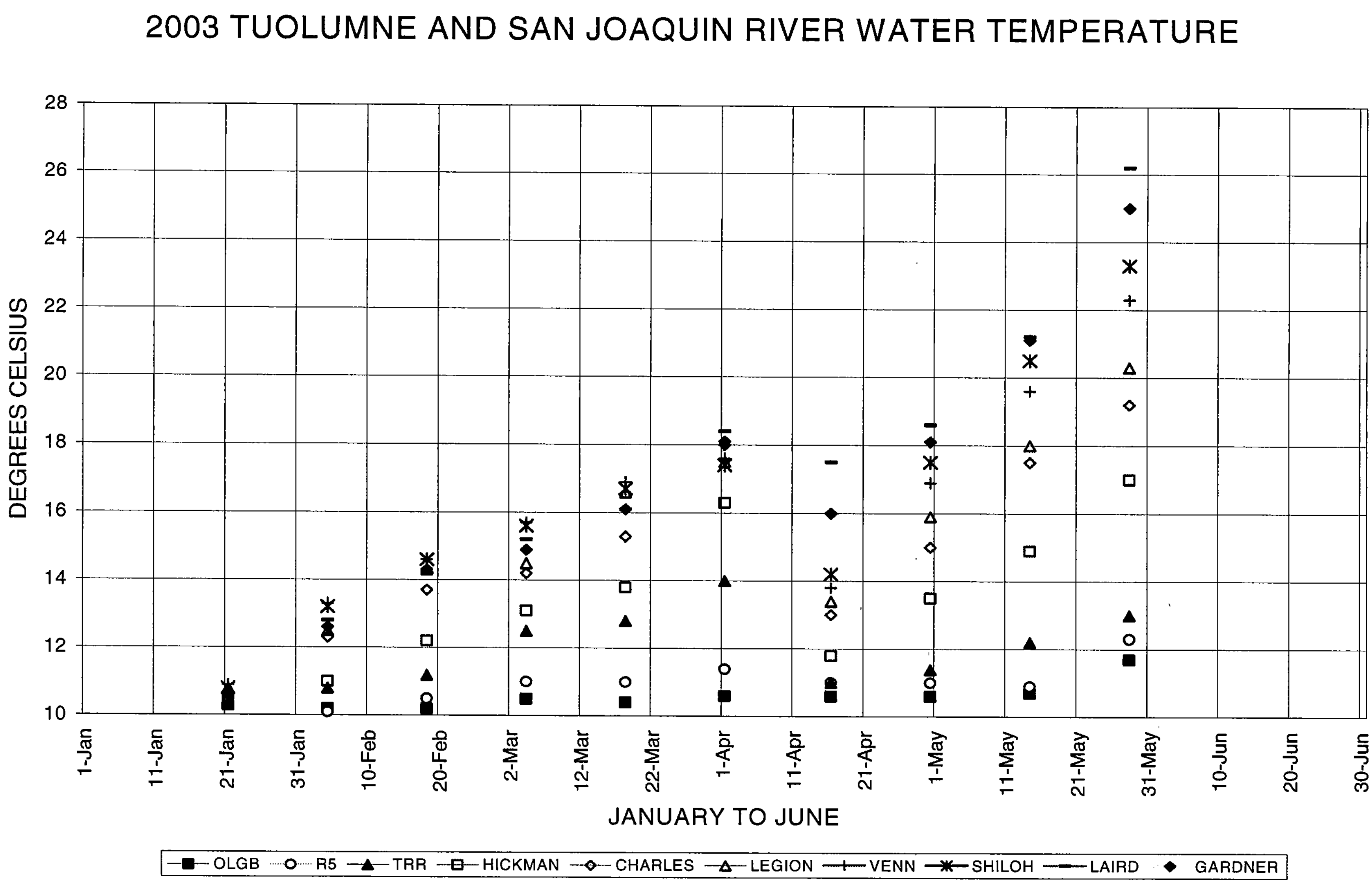
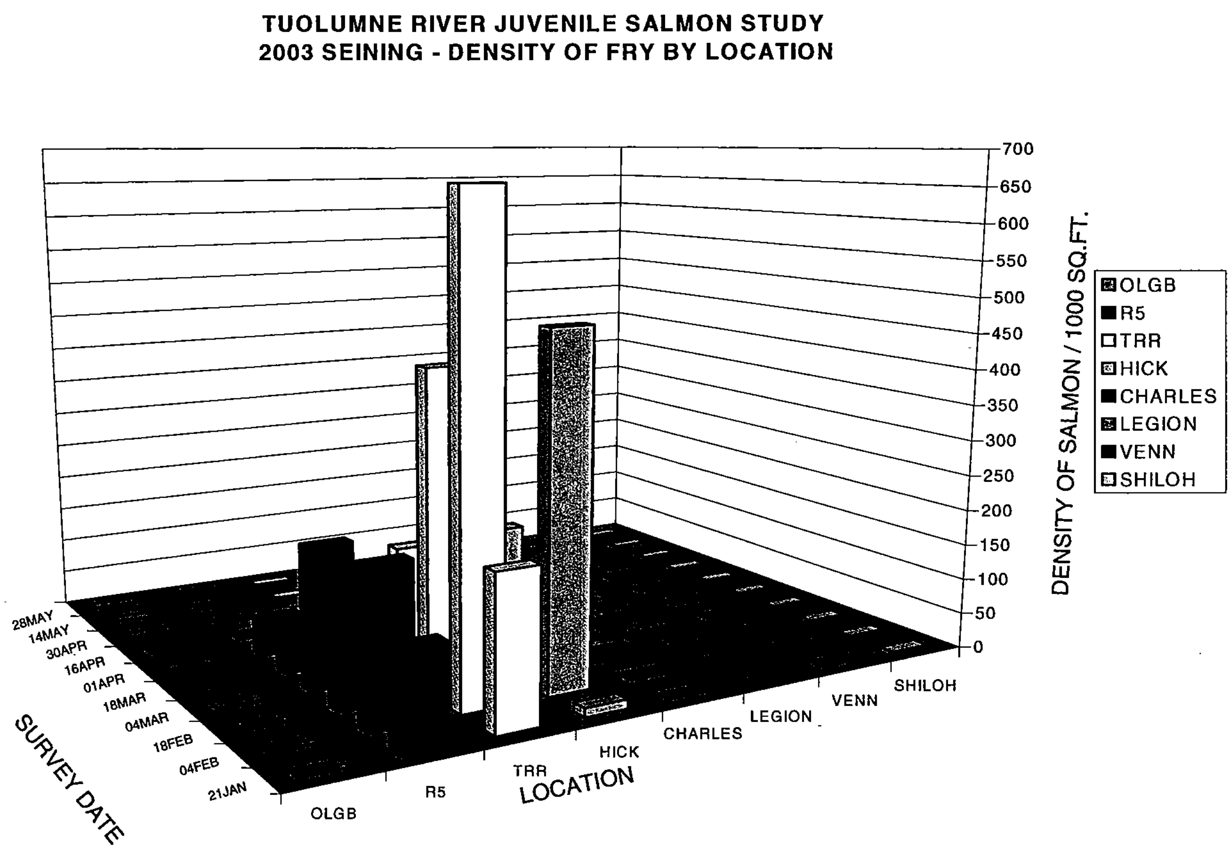


Figure 3. 2003 San Joaquin and Tuolumne River water temperatures.



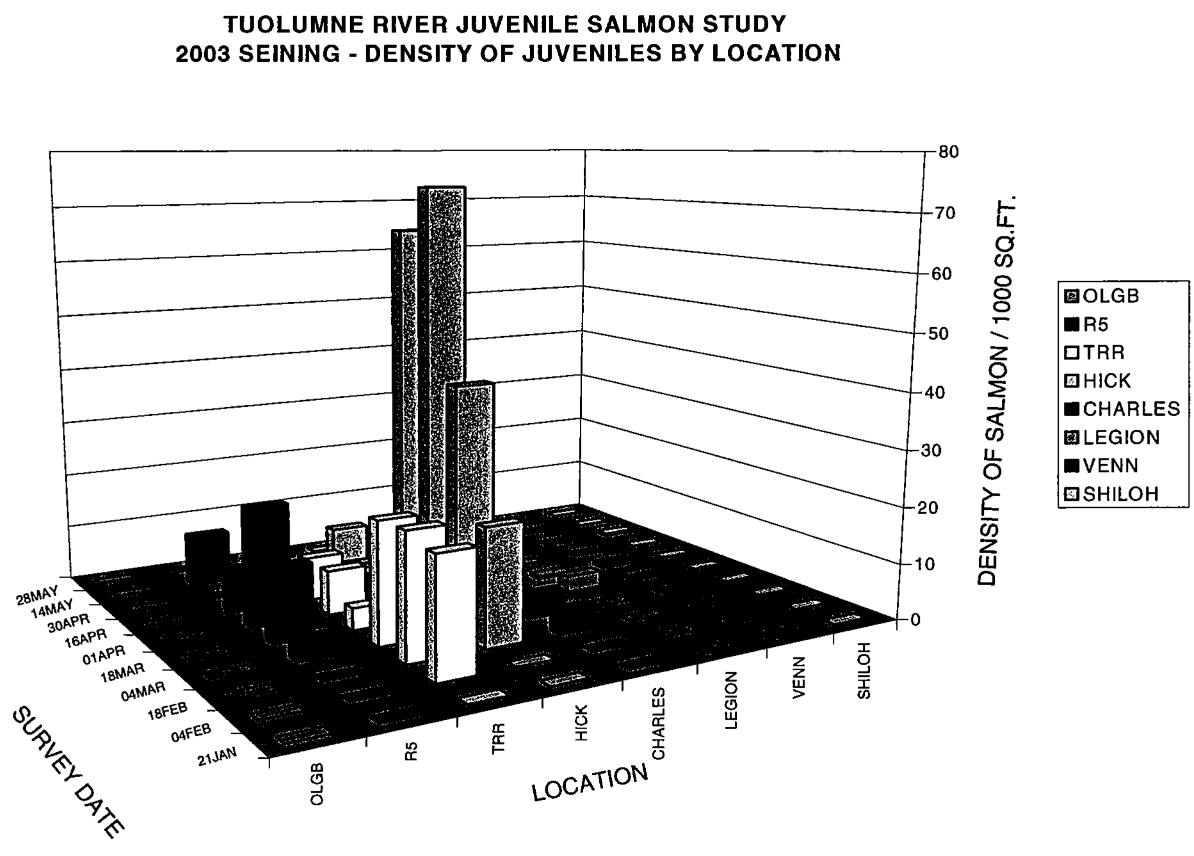


Figure 4. Tuolumne River density of fry and juvenile salmon by location.

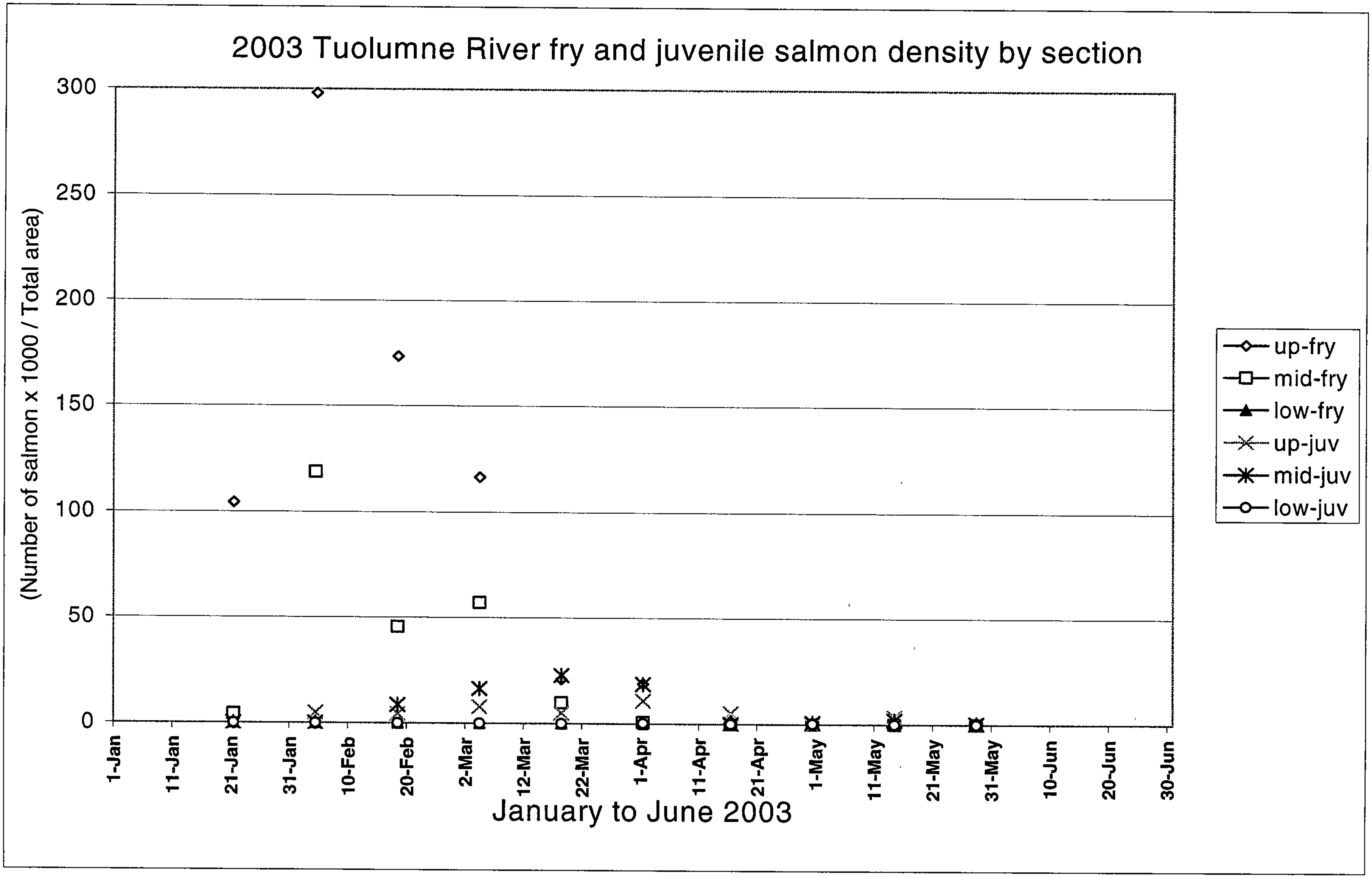


Figure 5. 2003 Tuolumne River fry and juvenile salmon density by section.

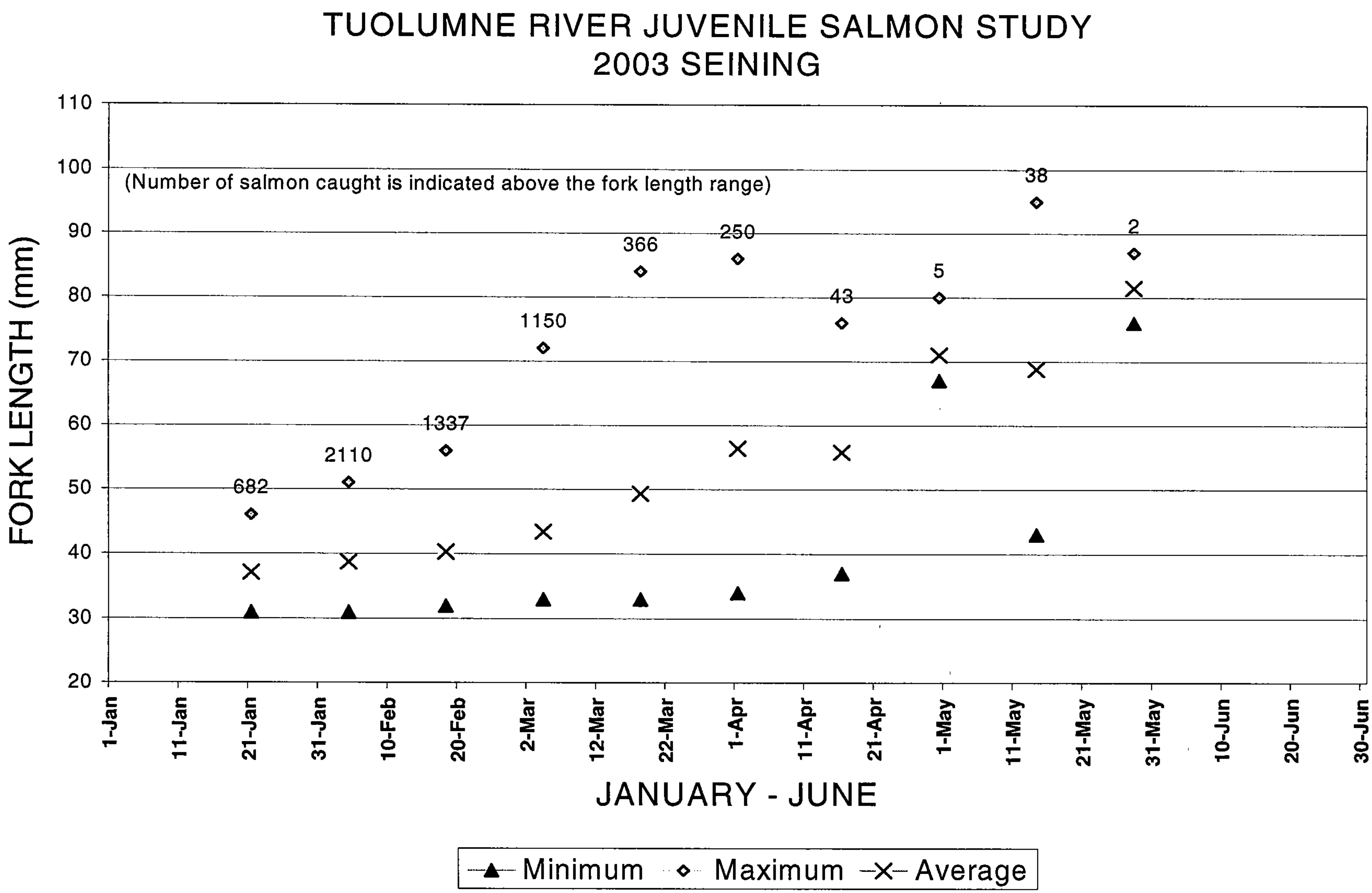


Figure 6. Fork length ranges of wild salmon in the Tuolumne River, 2003.

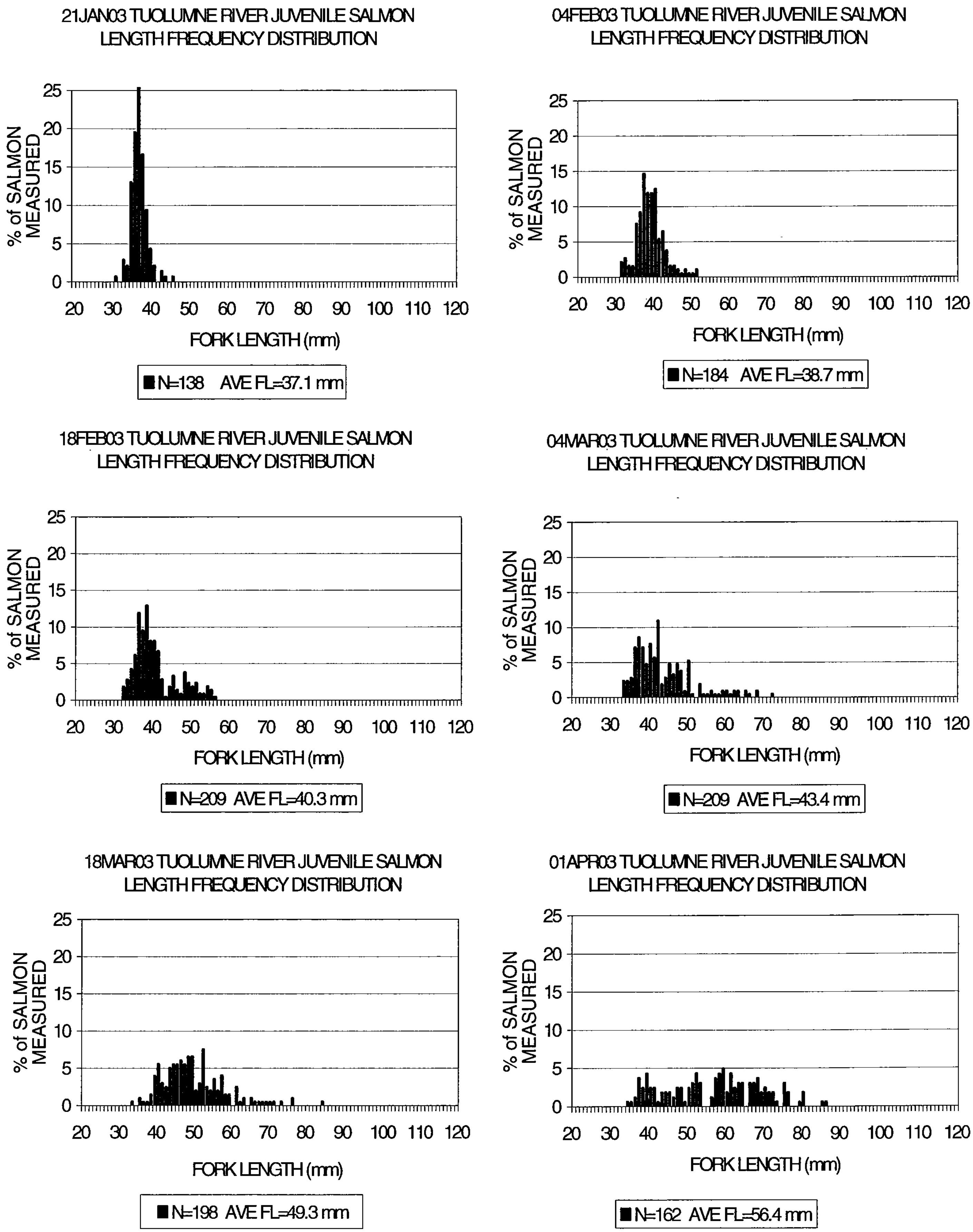


Figure 7. Length frequency distribution by date of salmon in the Tuolumne River, 2003.

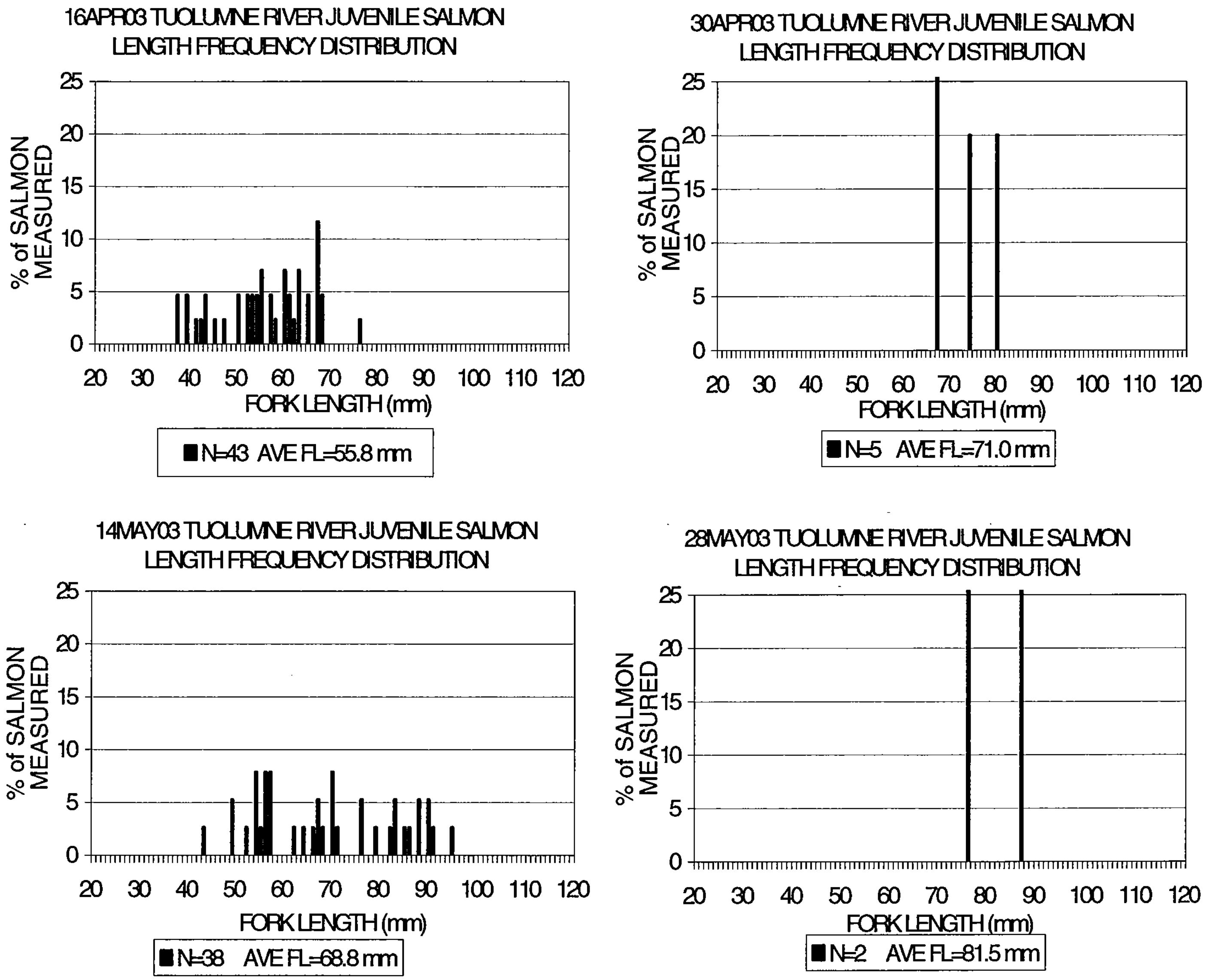


Figure 8. Length frequency distribution by date of salmon in the Tuolumne River, 2003.

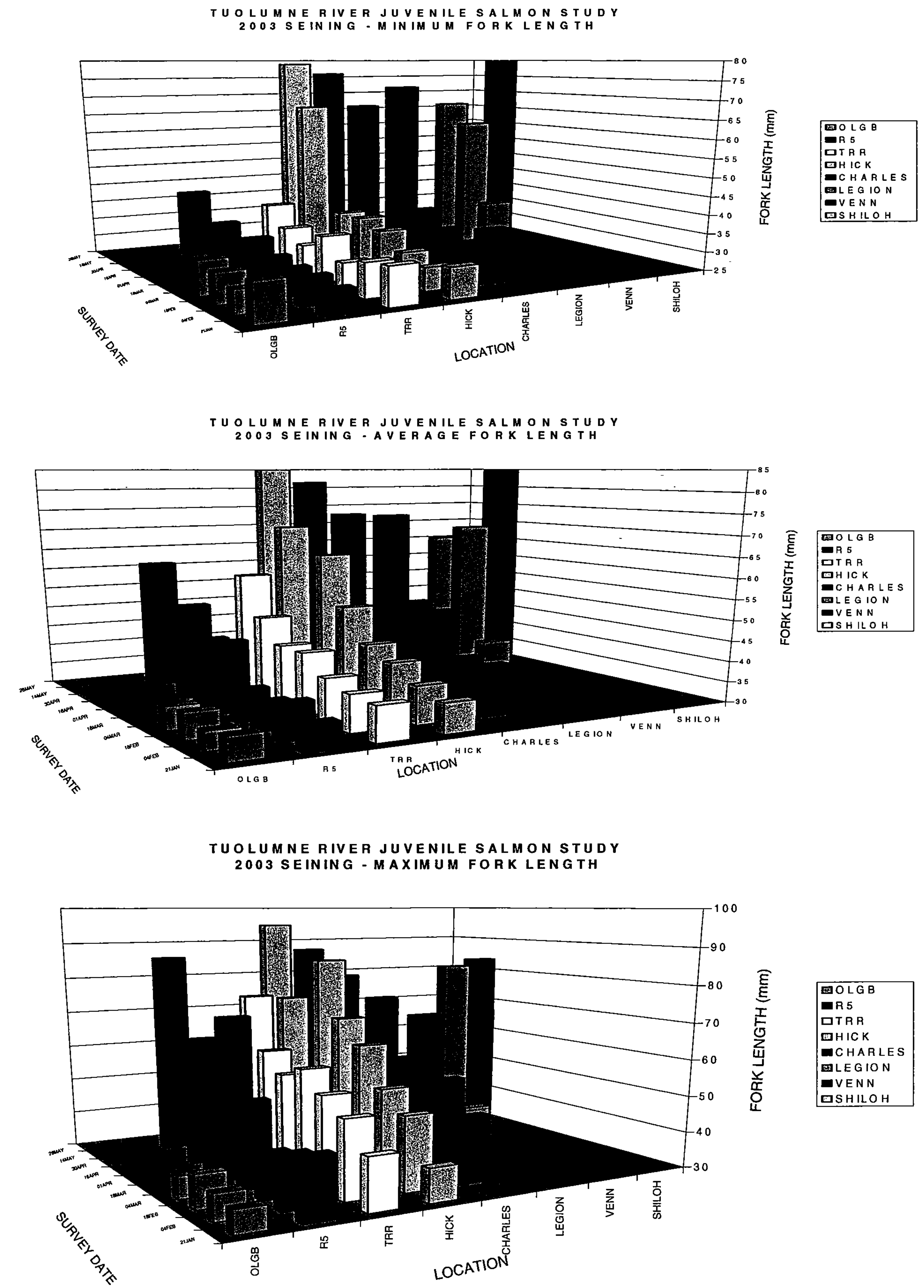
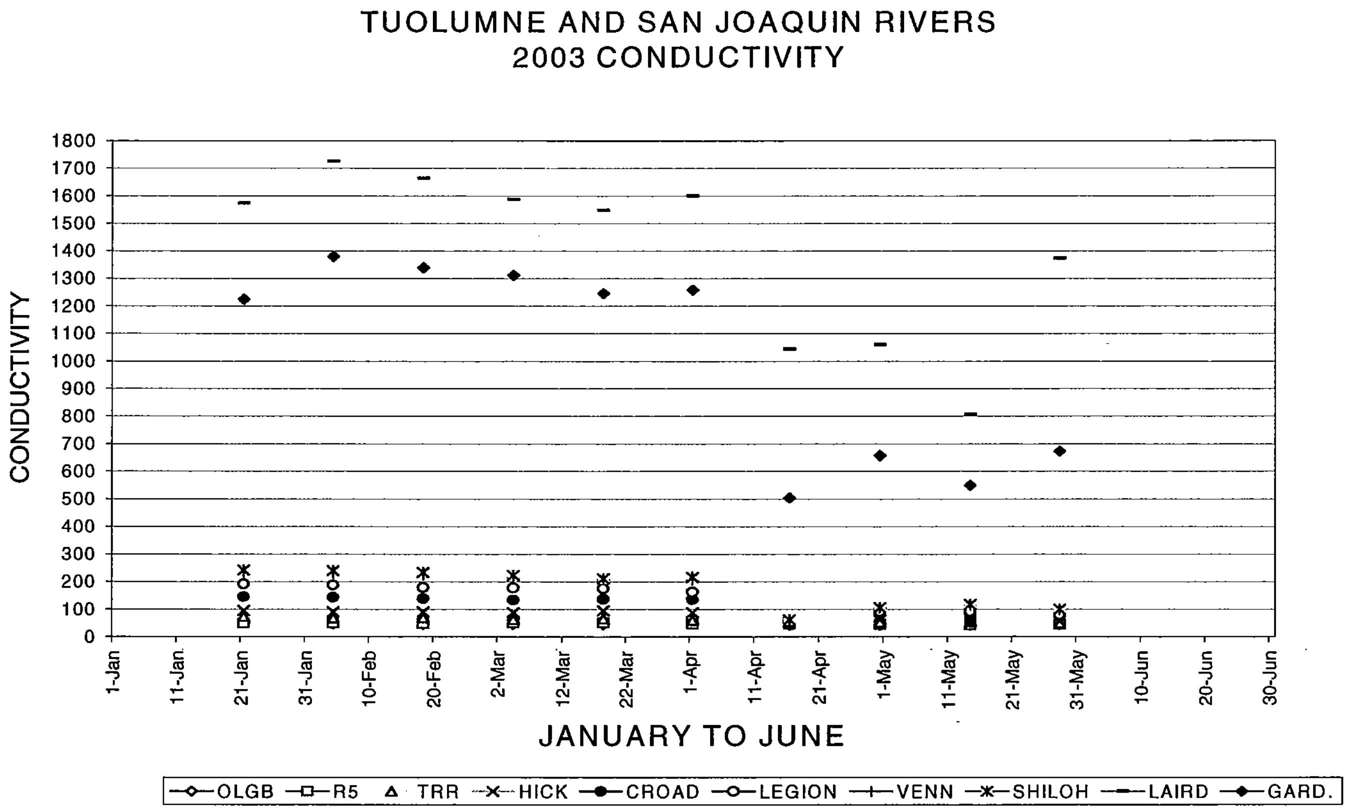


Figure 9. Minimum, average, and maximum fork length by location and survey period, 2003.



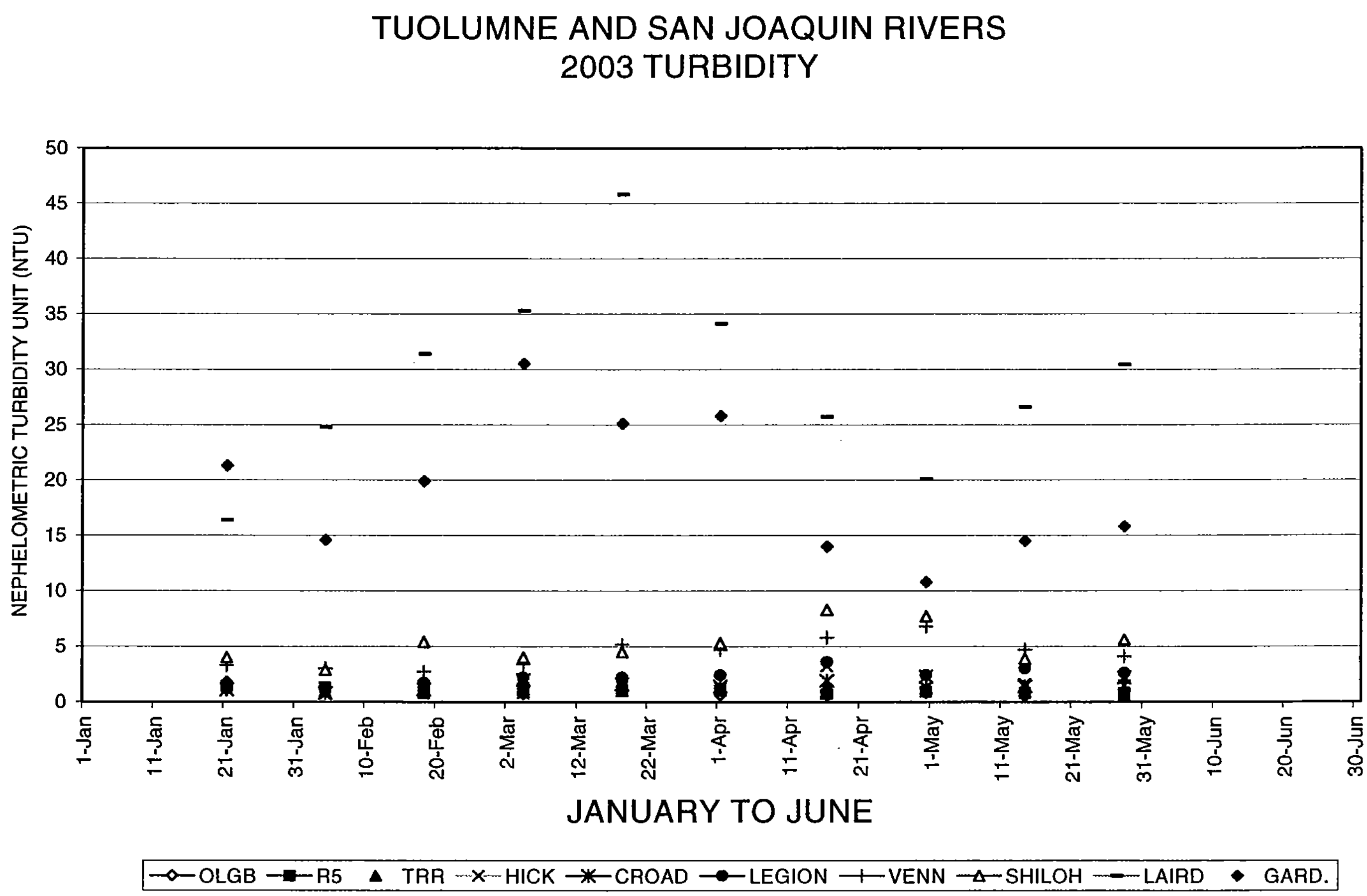
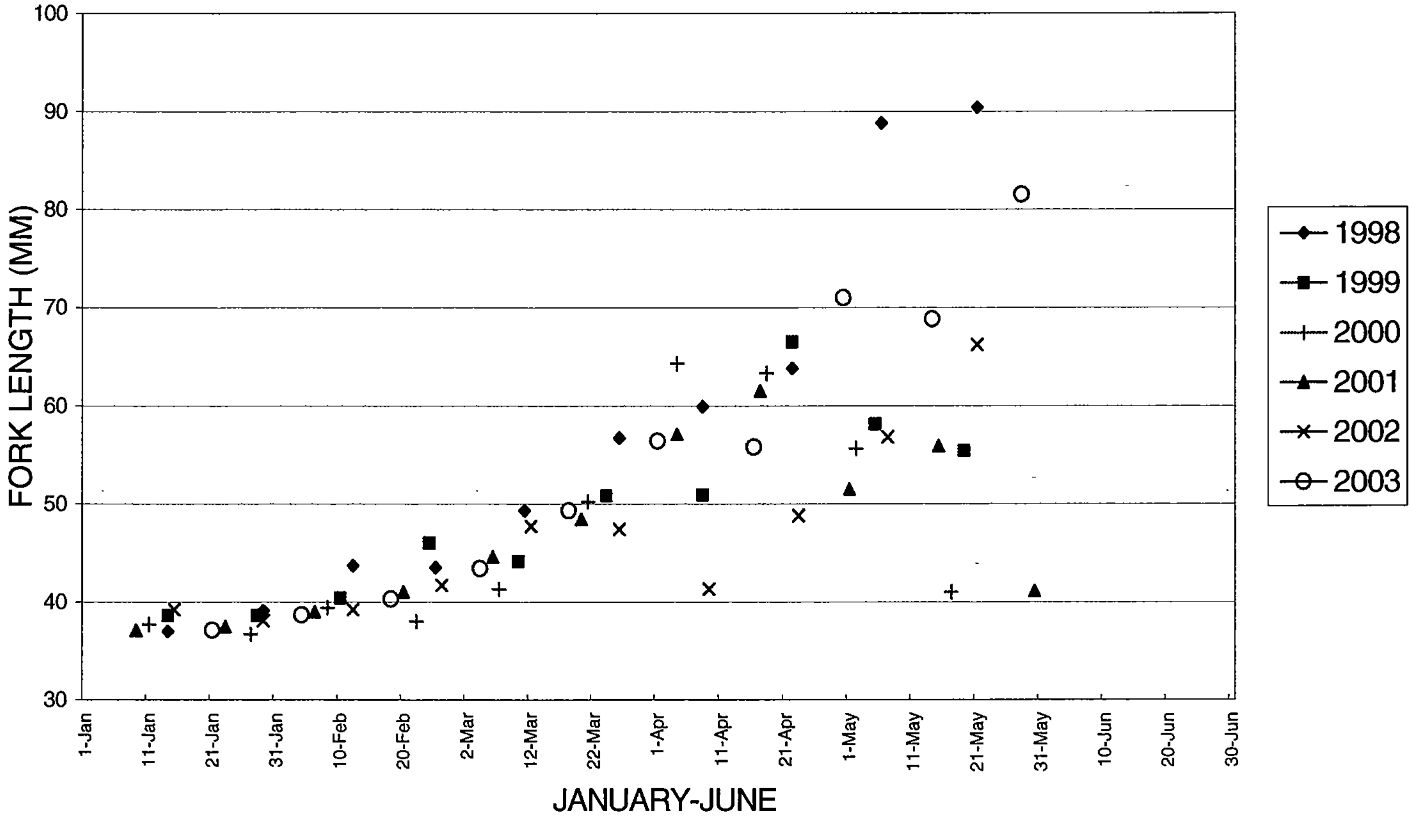
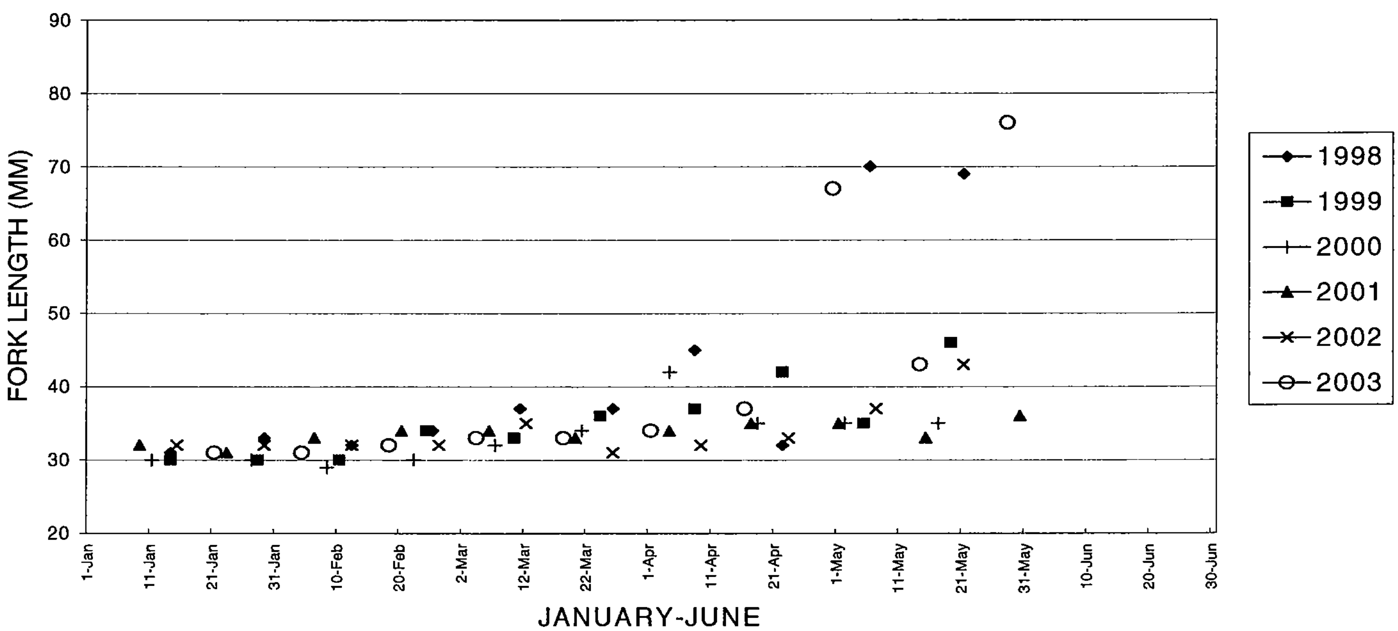


Figure 10. Conductivity and turbidity in the Tuolumne and San Joaquin Rivers, 2003.

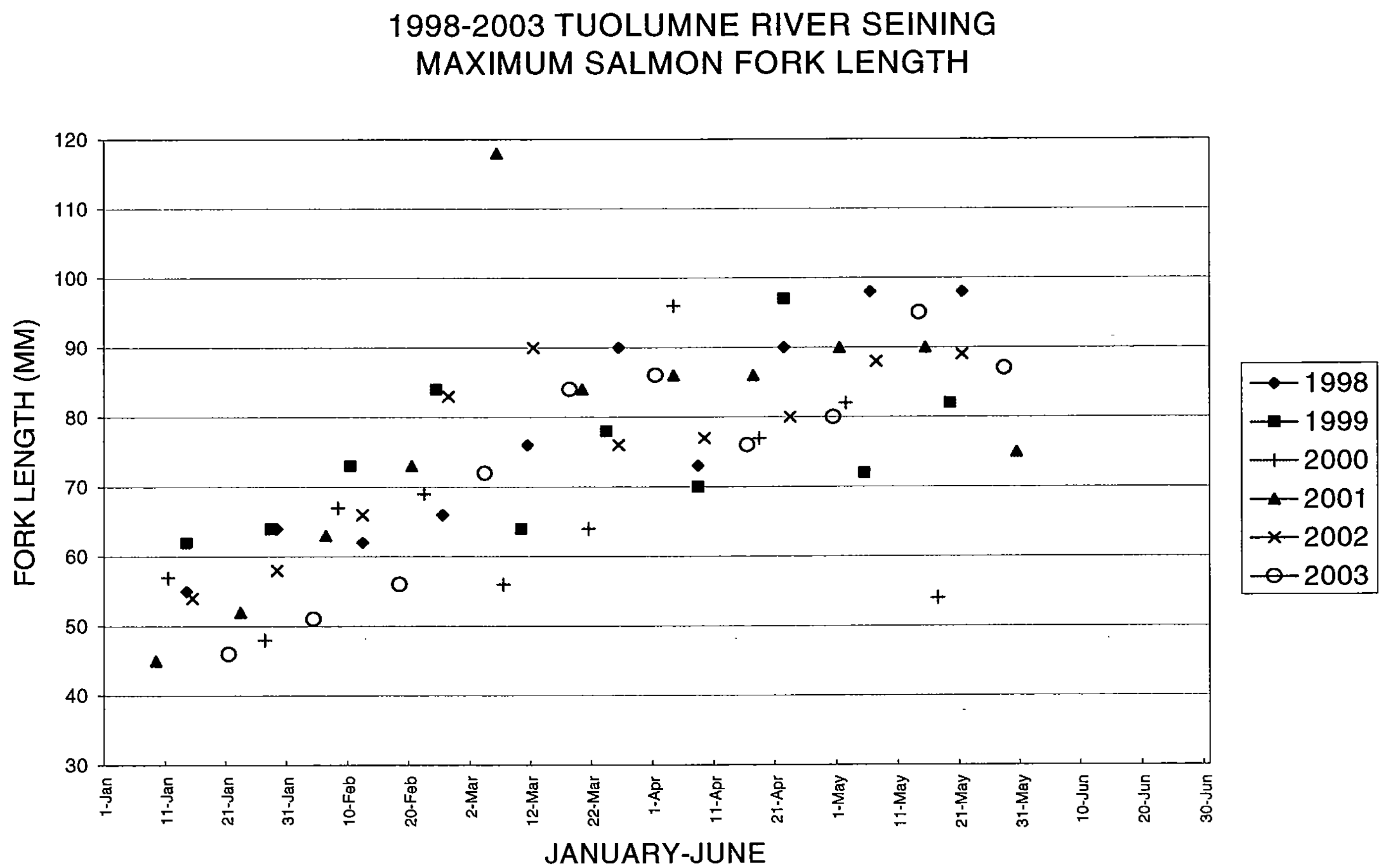
1998-2003 TUOLUMNE RIVER SEINING
AVERAGE SALMON FORK LENGTH

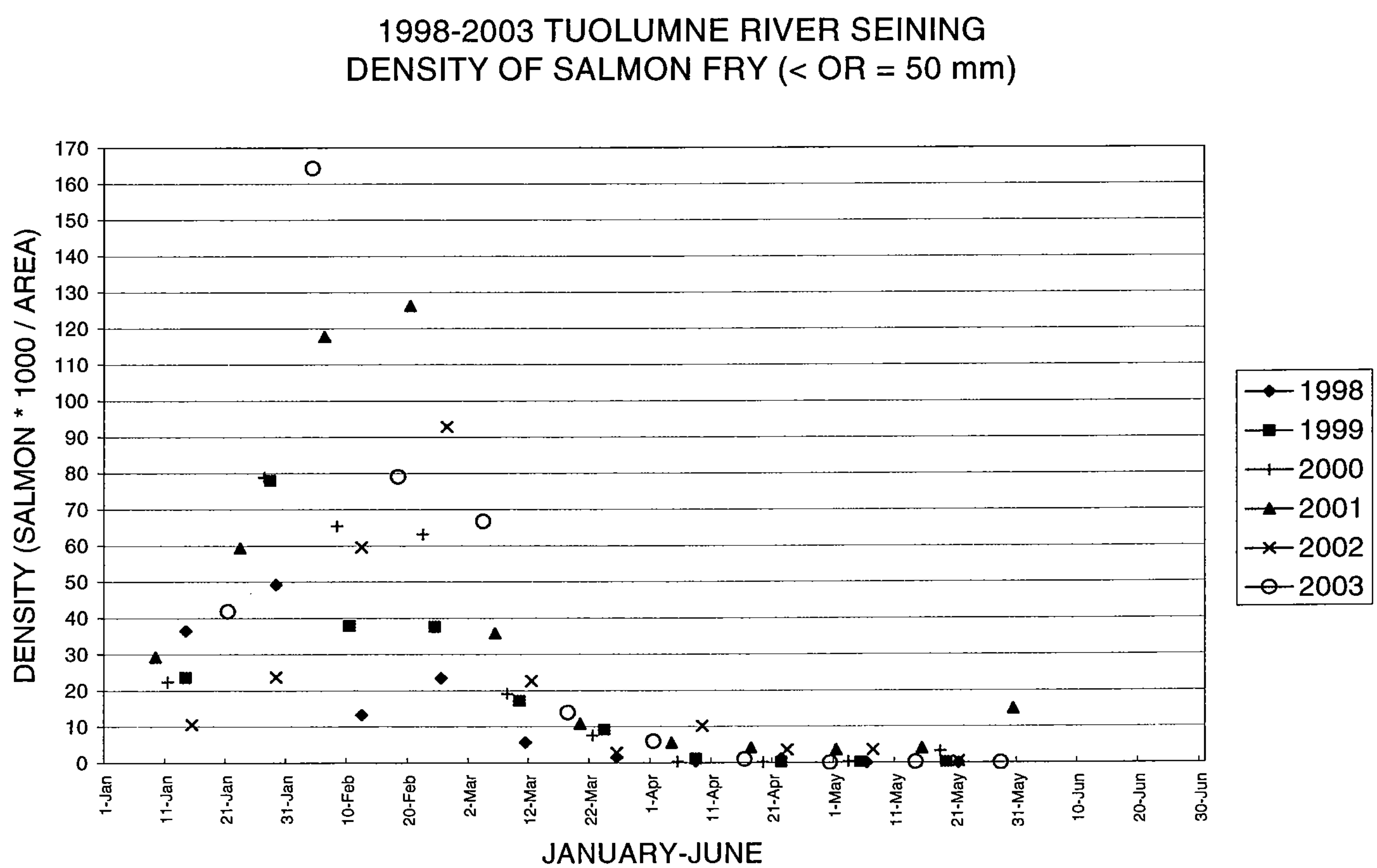


1998-2003 TUOLUMNE RIVER SEINING
MINIMUM SALMON FORK LENGTH



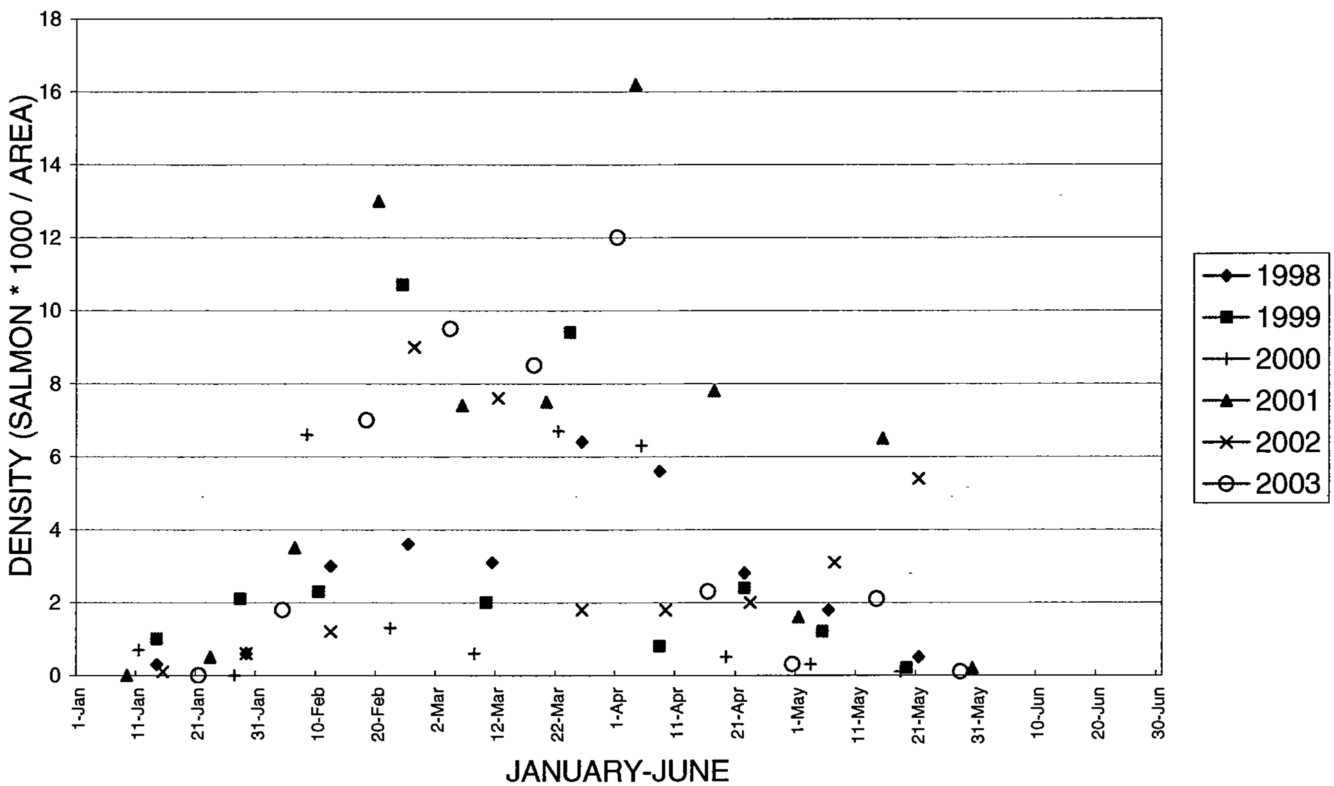
Figures 11 & 12. Average and minimum fork lengths of Tuolumne River salmon, 1998-2003.



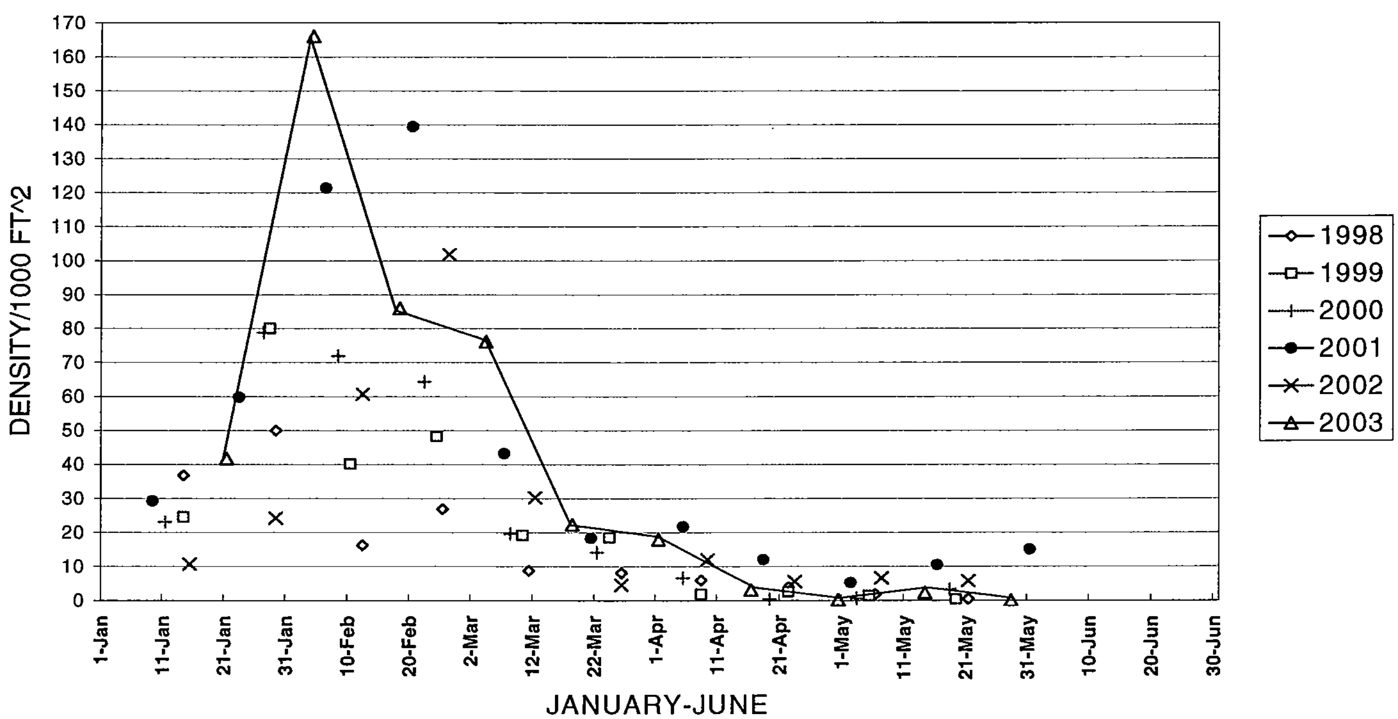


Figures 13 & 14. Maximum fork length and Density index of salmon fry, 1998-2003.

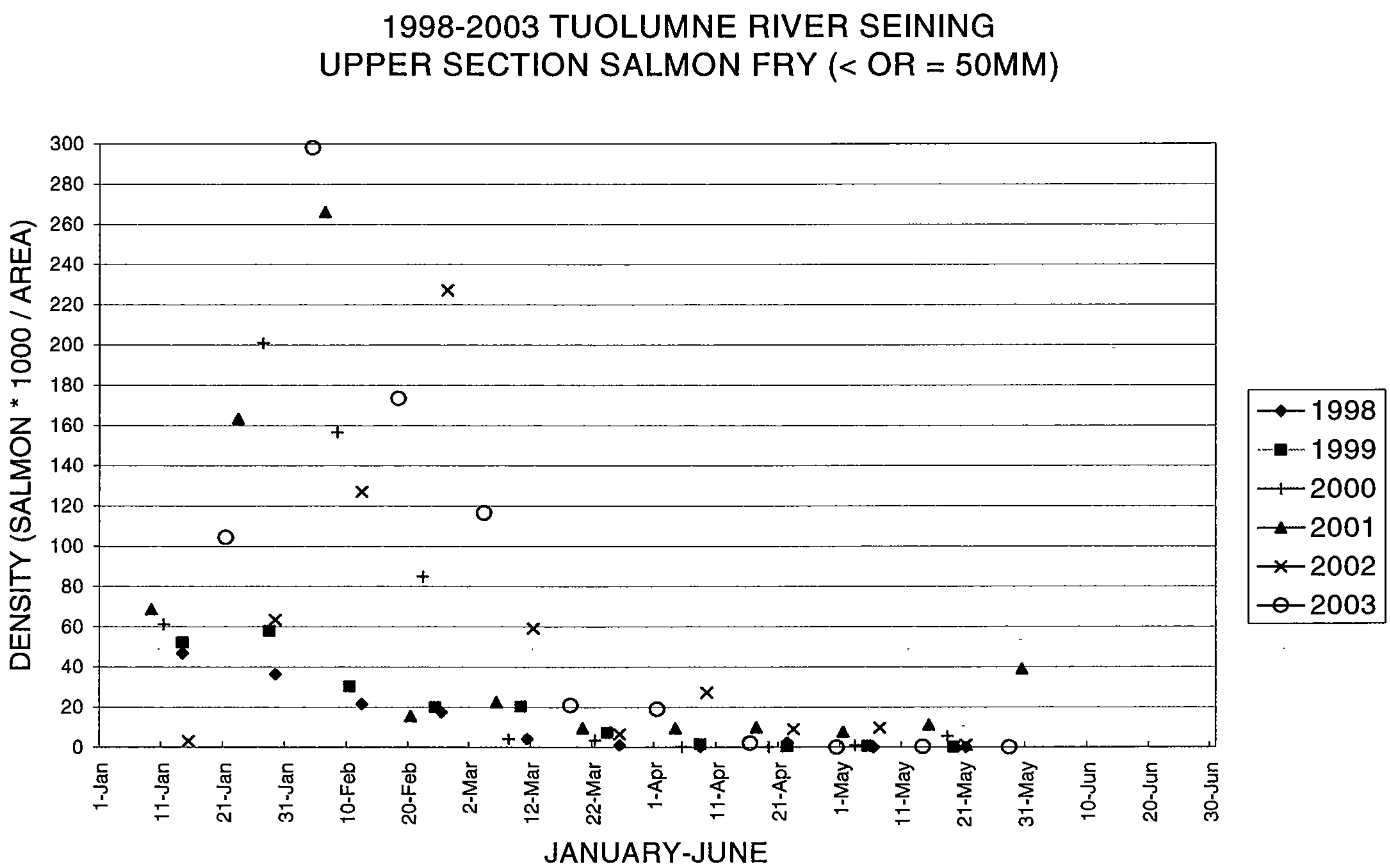
1998-2003 TUOLUMNE RIVER SEINING
DENSITY OF SALMON JUVENILES (> 50 mm)



1998-2003 TUOLUMNE RIVER SEINING
COMBINED FRY AND JUVENILE SALMON DENSITY INDEX



Figures 15 & 16. Density index of salmon juveniles and total river salmon catch, 1998-2003.



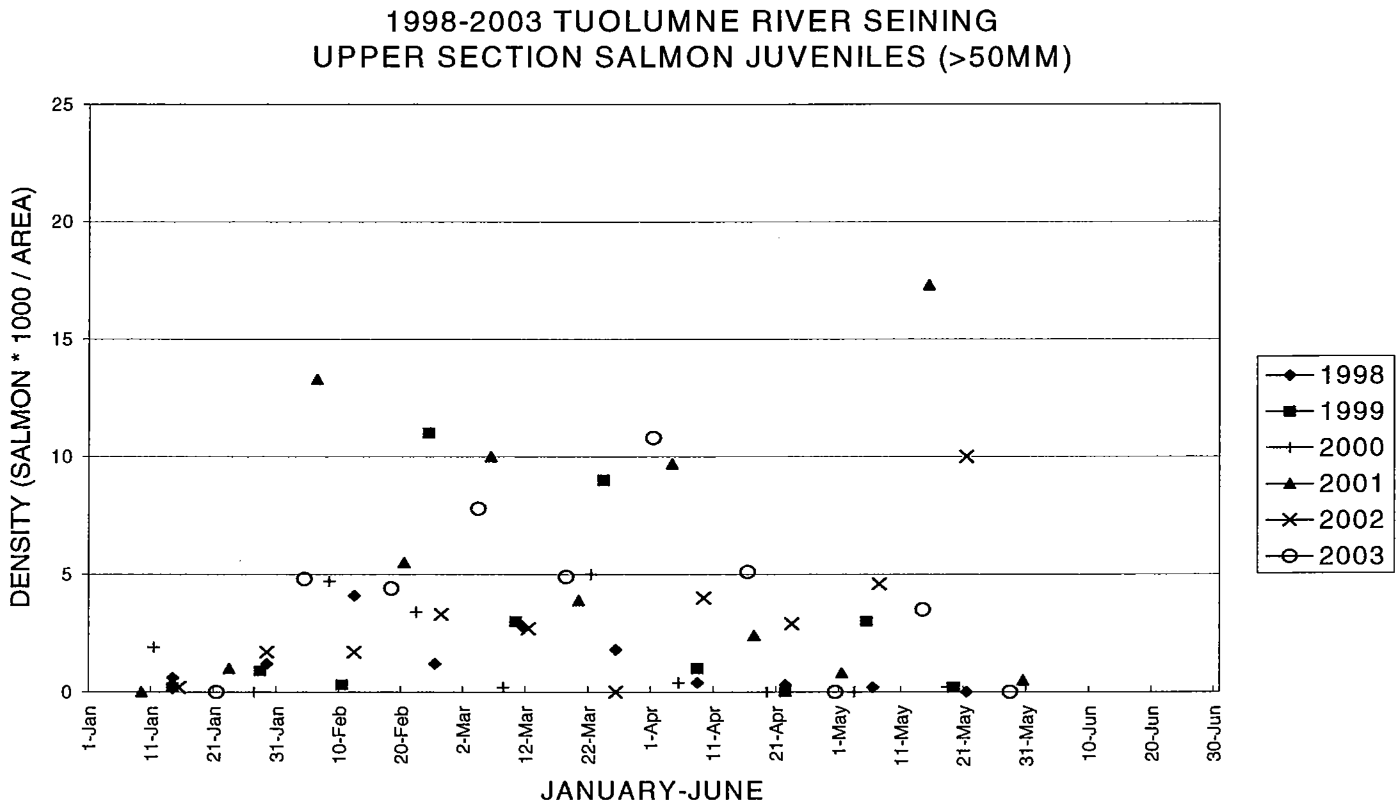
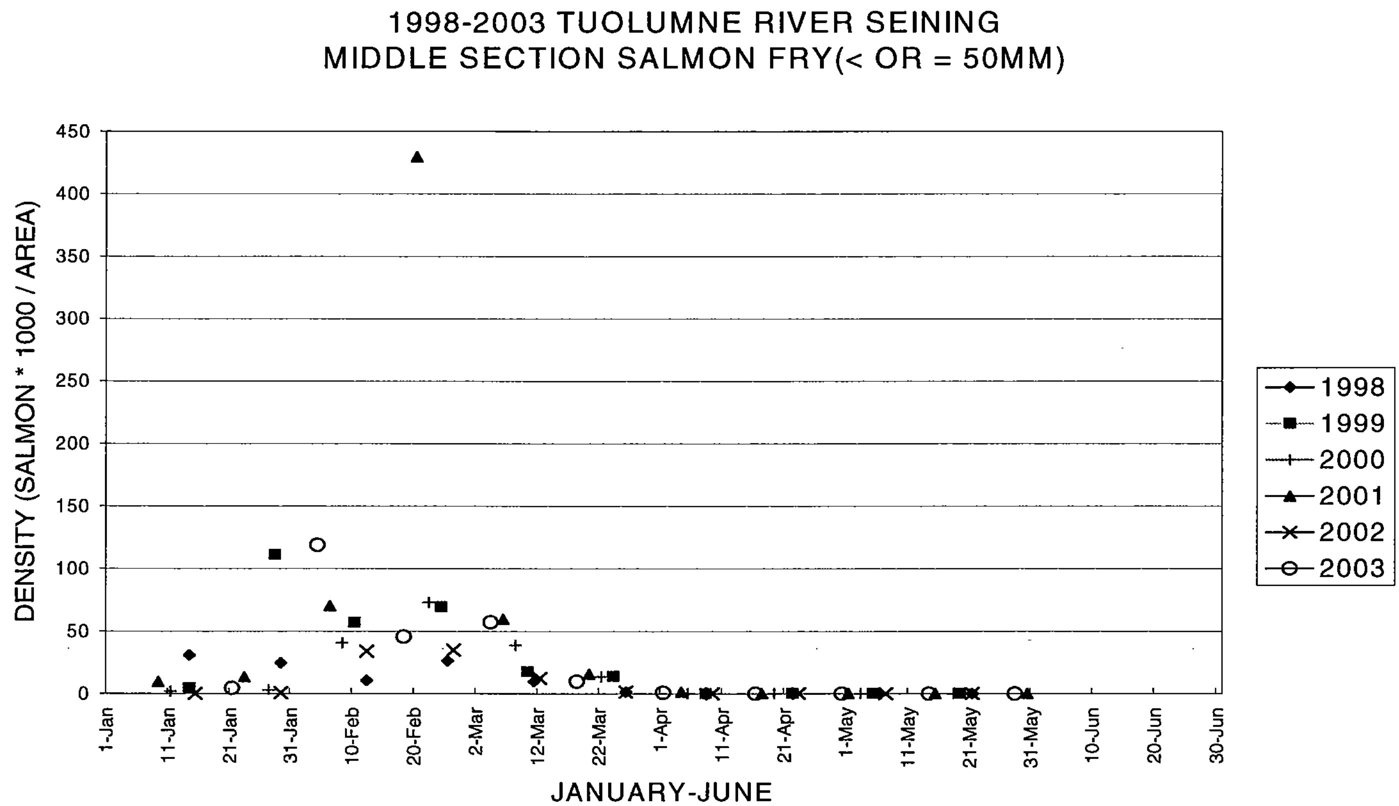


Figure 17A. Upper section density indices for salmon fry and juveniles, 1998-2003.



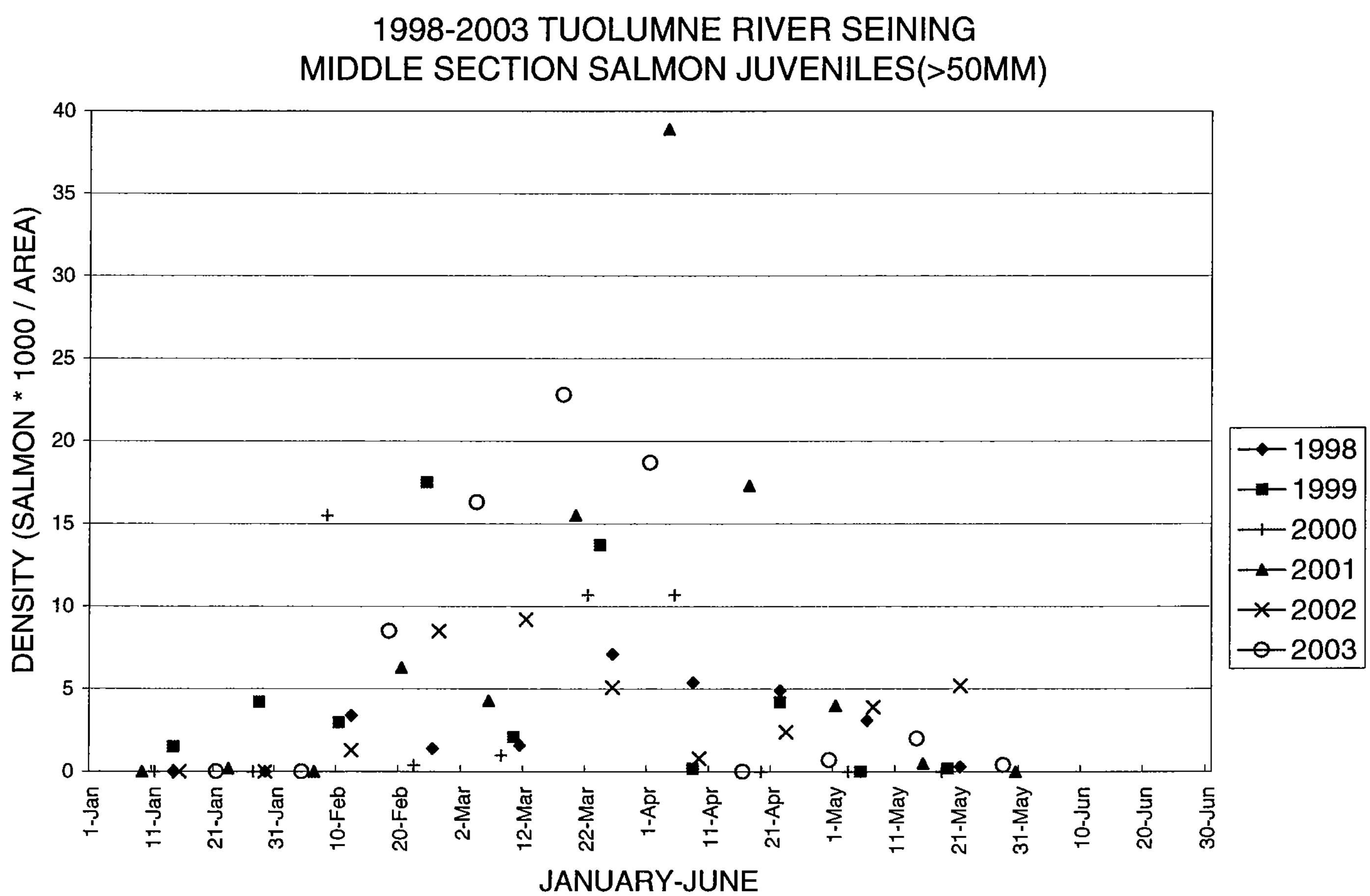
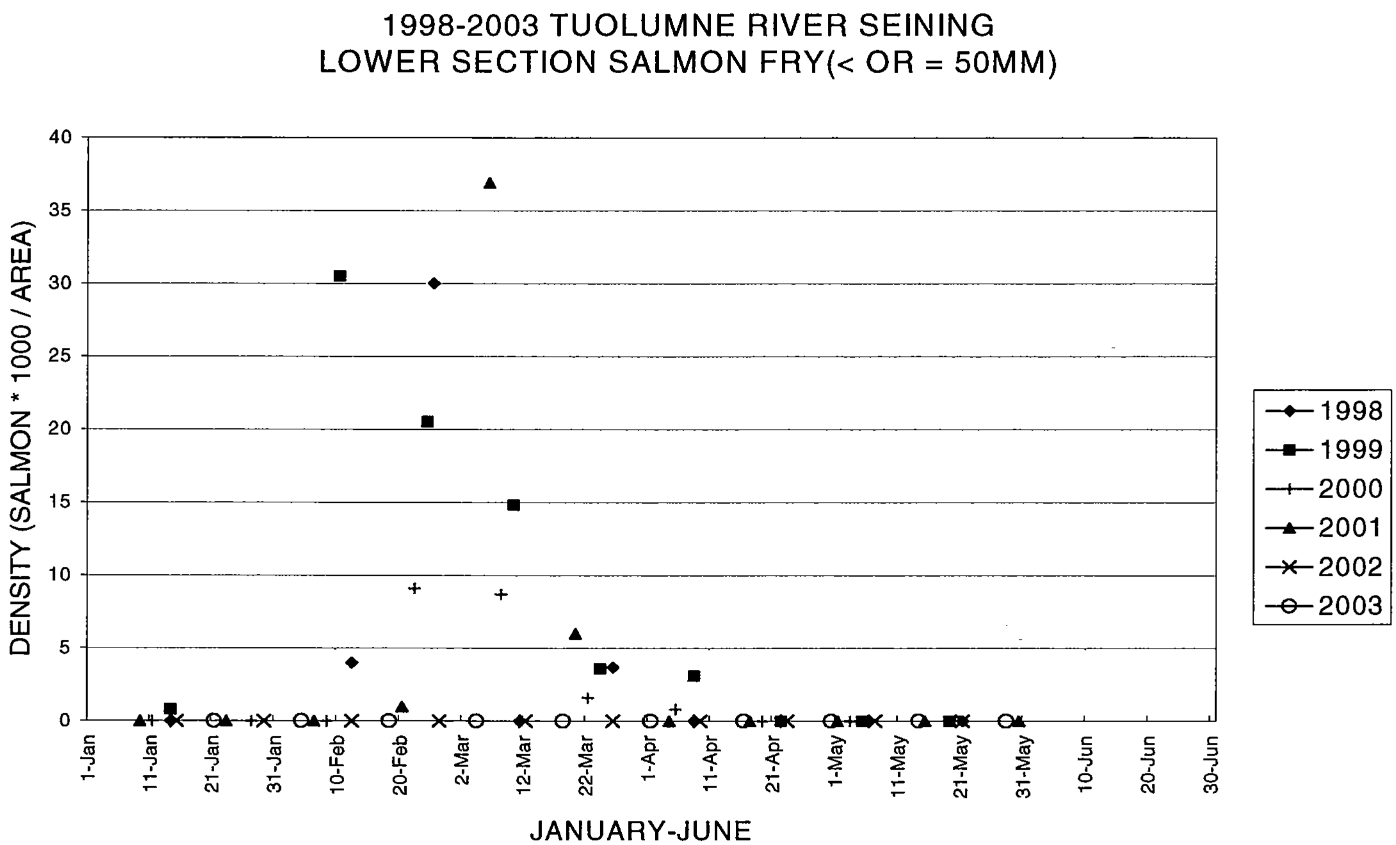


Figure 17B. Middle section density indices for salmon fry and juveniles, 1998-2003.



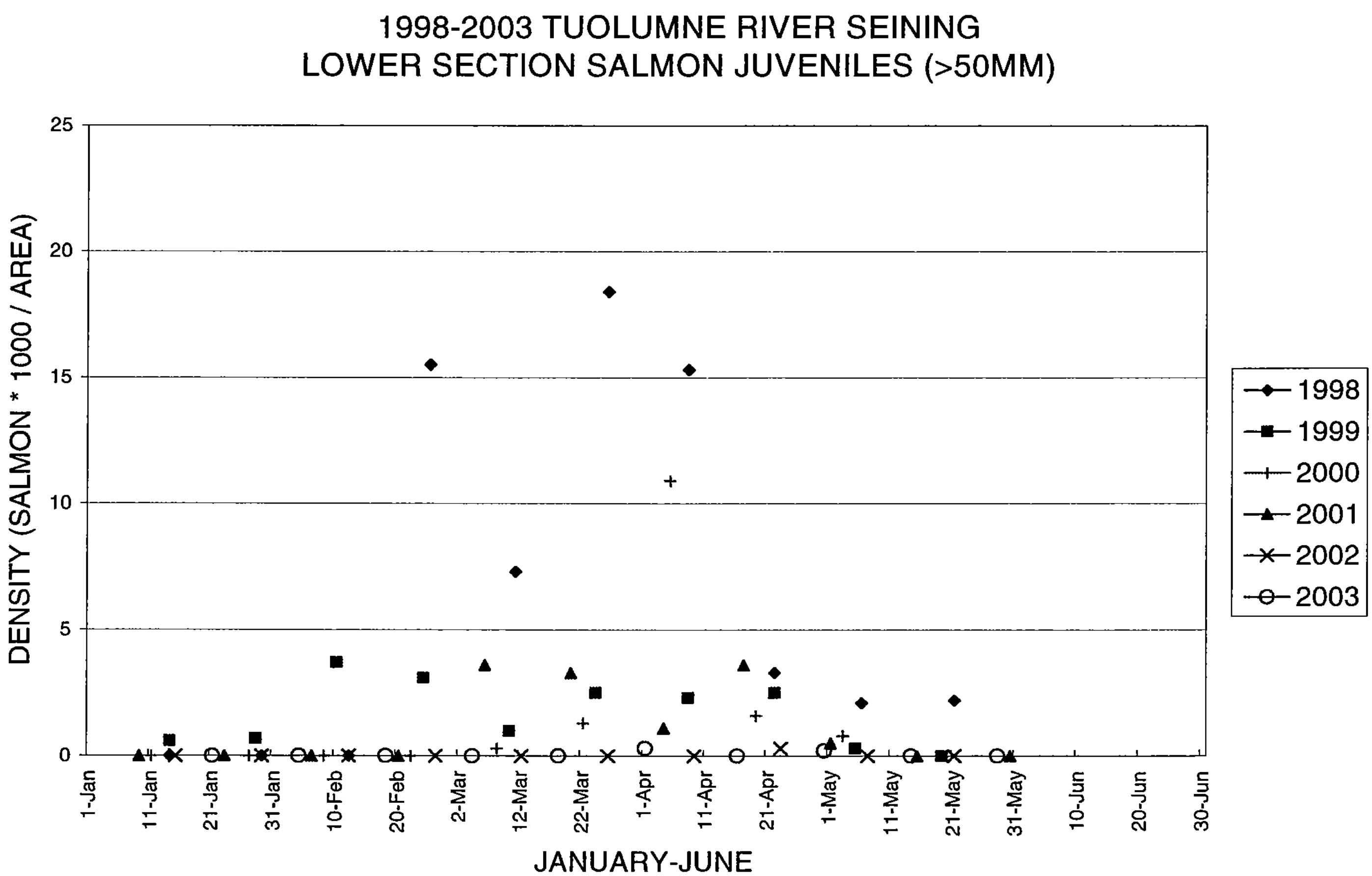


Figure 17C. Lower section density indices for salmon fry and juveniles, 1998-2003.

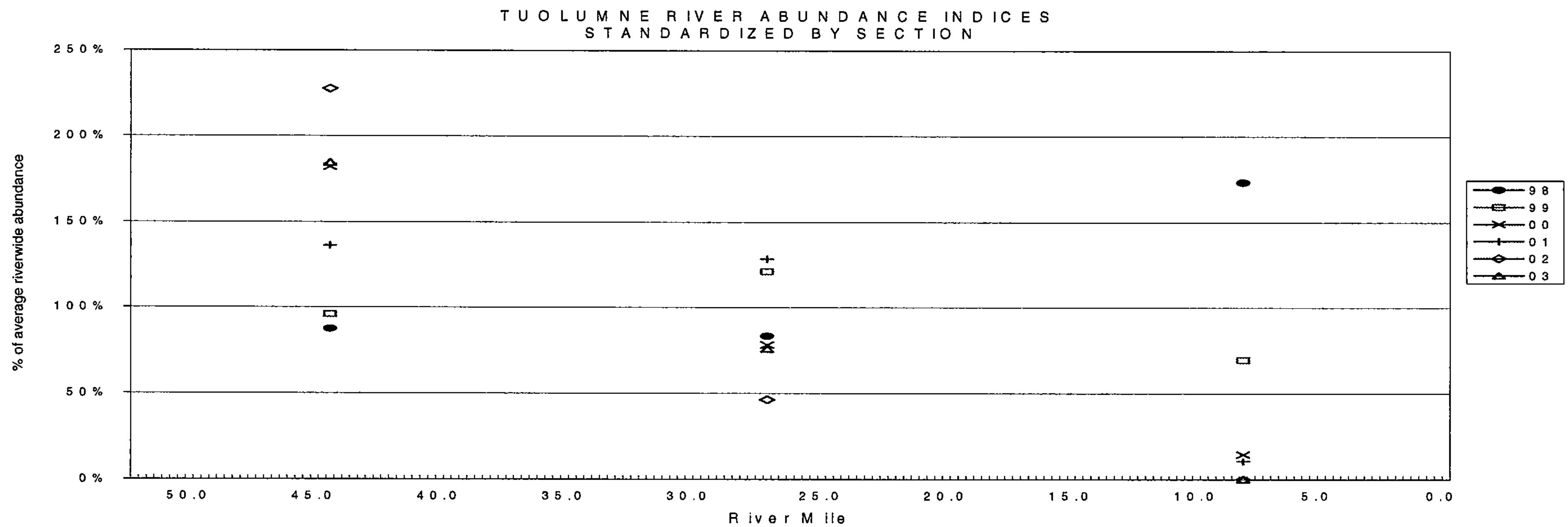


Figure 18. Tuolumne River abundance indices standardized by section, 1998-2003.

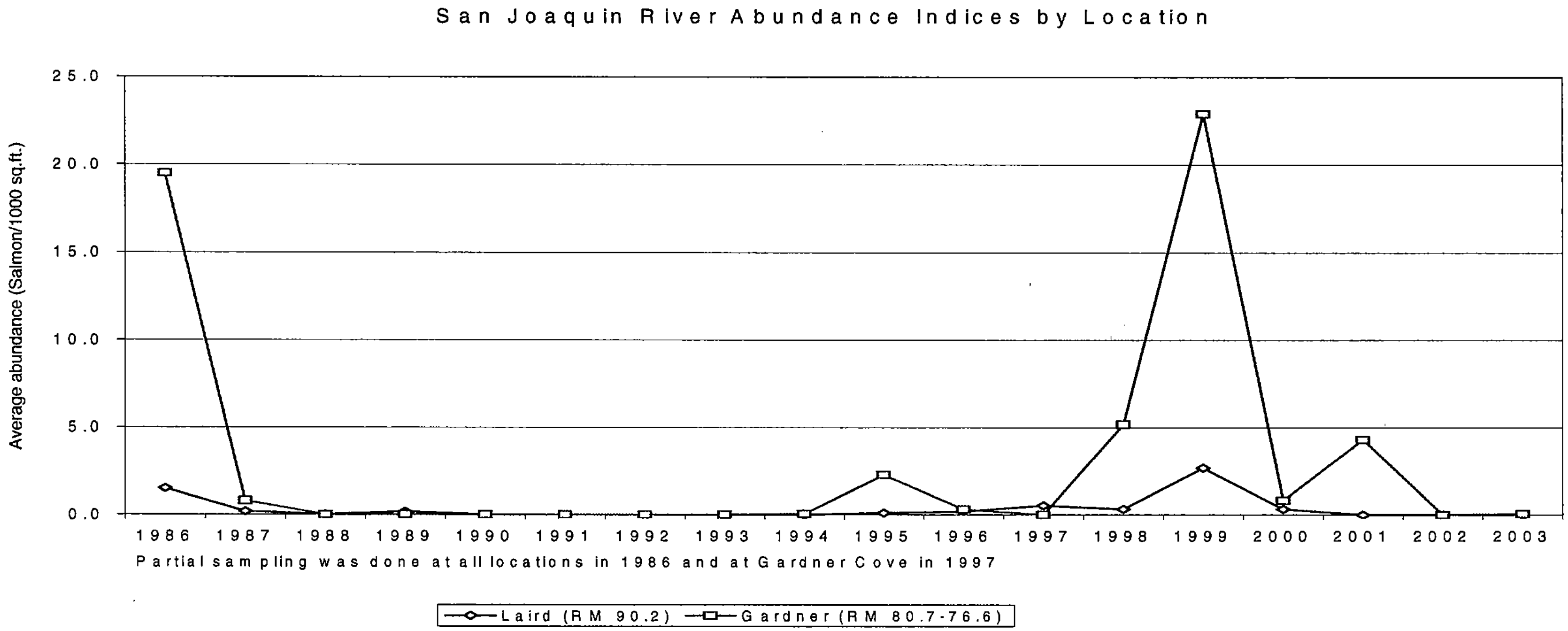


Figure 19. San Joaquin River abundance indices by location, 1986-2003.

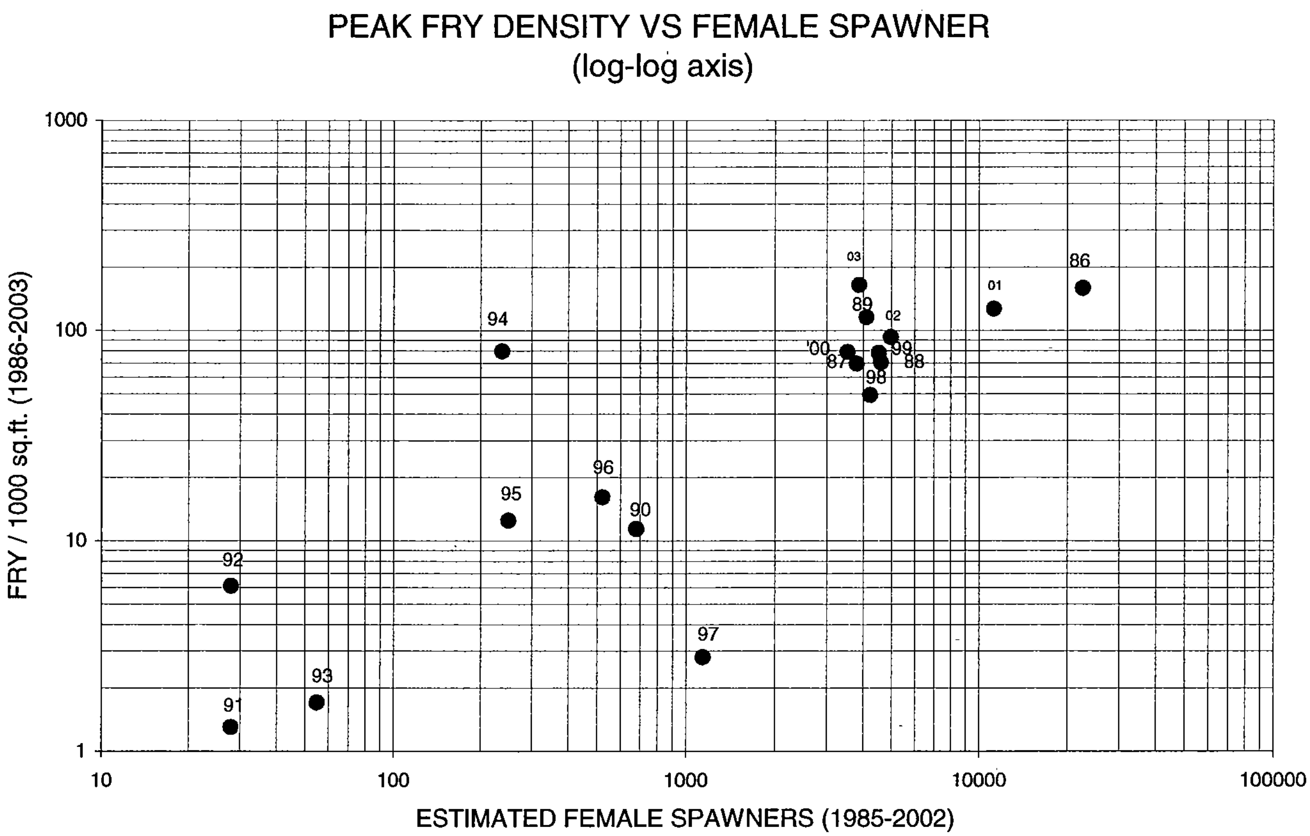


Figure 20. Tuolumne River peak fry density vs female spawners.

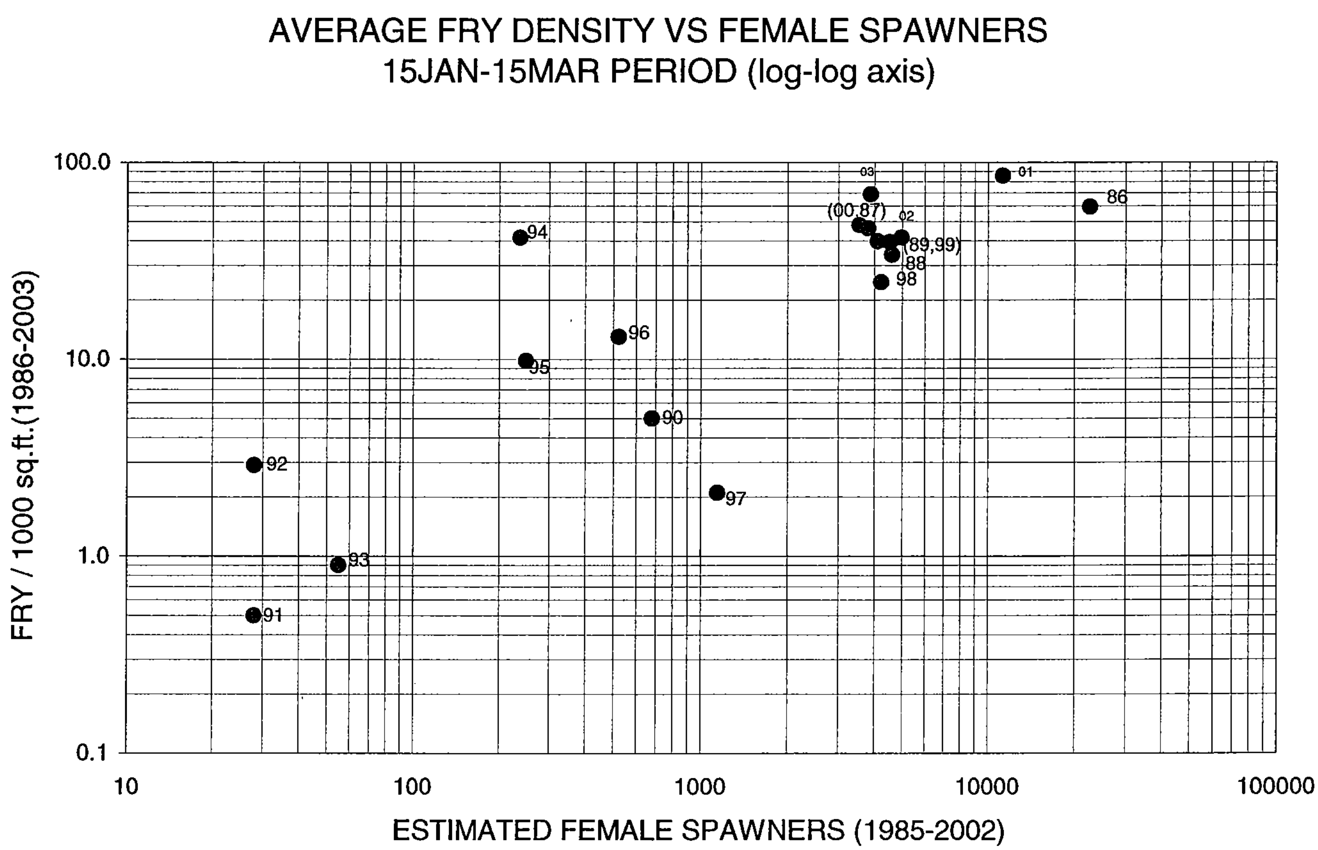


Figure 21. Tuolumne River average fry density vs female spawners.

REPORT 2003-3

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District	)	
	)	
and	)	Project No. 2299
	)	
Modesto Irrigation District	)	

2003 LOWER TUOLUMNE RIVER ANNUAL REPORT

Report 2003-3

Coded-wire Tag Summary Update

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and

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Stillwater Ecosystem, Watershed & Riverine Sciences
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EXECUTIVE SUMMARY

Releases of coded-wire-tagged (CWT) fall-run Chinook salmon originating from the San Joaquin Basin, primarily from the Merced River Hatchery, have been made in the San Joaquin River and tributaries since 1978. Beginning in 1986, CWT hatchery smolt releases have been made in mid-April to early-May of most years to study differential survival of smolts released at various river flows and locations.

This report, an update of FERC Reports 96-13 and 2002-5, summarizes the recovery data for the 1998-2002 basin release groups. The principal focus of survival estimates in this report is for the Tuolumne River CWT smolt survival studies, which began in 1986. Relative survival indices for upper and lower Tuolumne release groups are calculated for juvenile and adult recovery locations from various sampling programs. No CWT smolt releases were made in the Tuolumne River in 2003. This report updates analyses of adult CWT recoveries from ocean harvest data for 2003 and from adult inland survey and hatchery returns for 2002. Updated adult survival indices for expanded ocean harvest for 1999, 2000 and 2001 releases were .95, .56 and .32, respectively, based on preliminary 2003 ocean harvest data. Escapement survival indices for these years were .70, .53 and .22, respectively, based on preliminary inland adult recovery data through the 2002 run. These adult indices indicate variable survival for the 1999 upper releases, variable moderate survival for the 2000 upper releases, and lower survival for the 2001 upper releases. Adult recovery data for the 2000-2002 release groups are incomplete at this time.

CWT releases in the Merced, Stanislaus, and San Joaquin rivers that originated from the Merced River Hatchery are summarized in Table 1 for the 1998-2003 period. An appendix reviews data from survival tests in all three San Joaquin River tributaries.

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CODED-WIRE TAG SUMMARY UPDATE

1. INTRODUCTION

This report summarizes data on coded-wire tagged (CWT) hatchery salmon originating in the southern San Joaquin Basin reared by the California Department of Fish and Game (CDFG) at the Merced River Hatchery (MRH) or other basin facilities. Specific focus here is on the results of Tuolumne River smolt survival study releases, but Appendix A includes an initial review of all paired release CWT survival evaluations in the tributaries and was prepared as a result of a request by parties involved in south delta survival studies – some information here is repeated in the Appendix as a result. Included are updated release and recovery data for all tag codes used in the basin since 1998. CWT smolt releases were not made in the Tuolumne River in 2003 so there is no new juvenile recovery data from Tuolumne River studies.

This report updates Federal Energy Regulatory Commission (FERC) Report 96-13 (TID/MID 1997) which included data available through 1996 and FERC Report 2002-5 (TID/MID 2003) which included data available through 2002. Springtime CWT smolt releases of MRH salmon in the San Joaquin system began in 1986 (brood year 1985). Since 1998, some CWT salmon were also pan-jet marked and released in smaller groups, often over extended periods and at various locations.

Prior to 1999, CDFG conducted the tagging and releases of hatchery Chinook salmon. Starting in 1999, a private contractor has conducted most of the tagging operation at the Merced River Hatchery. For these studies, a CWT is inserted into the snout of each juvenile salmon. The wire tags are coded by group, usually in lots of about 25,000 tags. The code allows for later determination of the group release date and release location for recovered fish. The tagged fish also have the adipose fin removed to provide an external mark to enable identification of fish containing tags during various sampling efforts. Large CWT releases often include more than one tag code. For most years, an estimate is available of the tag loss, or shed, rate.

Tag recoveries are made from (1) sacrificed adipose-clipped juvenile salmon captured at several inland monitoring locations and (2) heads of adult tagged fish retained from port landings, hatcheries, and carcasses found in spawning run surveys. The tags are dissected from the specimens and decoded by CDFG and the U.S. Fish and Wildlife Service (FWS). Analyses of the decoded data enable estimates of relative and absolute survival indices and the contribution of the tagged fish to the commercial/sport ocean catch and to spawning runs. The CWT smolt survival index studies were primarily intended to examine relative survival rates of hatchery smolts in specific river reaches at various flows within the San Joaquin River (SJR) system and Sacramento-San Joaquin delta.

The Tuolumne River evaluations since 1996 have been conducted for the Tuolumne River

Technical Advisory Committee (TRTAC) pursuant to the 1995 Don Pedro Project FERC Settlement Agreement. More data details and discussion of study assumptions and implementation are contained in Baker and Speed (1998), Neillands and Loudermilk (1998), the TRTAC peer review process of December 1998 (Centers for Water and Wildland Resources 1998), and FERC Report 2002-4 which is an ongoing review of the results of large Tuolumne River CWT study releases, focusing on Mossdale recovery data in the 1987-2001 period. The 2002 release has not yet been analyzed in that manner.

An original premise of the Tuolumne study design was that hatchery fish (as a surrogate for naturally produced salmon) would be released during a steady "test" flow period at La Grange and relative survival would be established at that flow. In practice, it has been determined that the CWT salmon migration has often extended past a change in the flow, thereby affecting the determination of what flow(s) was tested. Report 2002-4 attempted to address this by adjusting the test flow based on daily recovery data at Mossdale for 1987-2001 (1986 had no Mossdale sampling), although capture probability likely varied with flow at Mossdale.

See Appendix A for more on study assumptions and flow discussion.

2. METHODS

2.1 Database Format

Each CWT release group was catalogued by tag code(s) and recoveries were summarized by code and release group. Inland recoveries of juvenile salmon and ocean and inland adult salmon were made at various locations (Table 1). Data were grouped by year and location for the Merced, Tuolumne, Stanislaus, and the lower San Joaquin Rivers. Juvenile recovery locations include a trawl near Mossdale on the San Joaquin River, the state (SWP) and federal (CVP) fish salvage operations at the two delta water export facilities, the USFWS Chipps Island trawl, and the Jersey Point or Antioch trawl operations by Hanson Environmental (1997-2003). In addition to these recovery sites, a pushnet in the SJR below the Tuolumne confluence (1987) and screw traps at Shiloh Road or Grayson River Ranch in the Tuolumne River (1995-2003) have also been used (Figure 1).

Adult recovery data are from the commercial and sport ocean harvest at various ports. Ocean harvest data were obtained from Pacific States Marine Fisheries Commission (2004) and includes preliminary 2003 data from CDFG, Oregon Department of Fish and Wildlife (ODFW) and other agencies. Inland recoveries of CWT spawners are from escapement surveys and hatchery return data from CDFG (1986-2002) and are limited to the San Joaquin tributaries and other northern CA hatcheries (2001-2002). Adult recoveries are presented by age group and inland recoveries listed by river. The juvenile recovery data is from CDFG (Region 4) and USFWS (Bay-Delta Office, Stockton). The data is preliminary for juvenile recoveries in 2003 and inland adult recoveries in 2002.

2.2 Data Analysis

Salmon recovery data were analyzed by comparing recovery numbers of release groups for each recovery location. The release locations were chosen to compare the "relative survival" of salmon in various reaches of the river system. Upstream and downstream release locations in the San Joaquin tributaries were intended to show relative survival differences between release sites under certain flow conditions. The San Joaquin River release locations were chosen to provide survival differences of salmon within reaches of that river and in migration routes through the delta.

See Appendix A for more on survival indices and some sampling issues.

Relative survival index values were calculated for the Tuolumne River releases made in 1986, 1987, 1990, and 1994-2002 (Table 2). Expanded recoveries that account for sampling effort were used for SWP, CVP, and ocean harvest analyses. Actual recoveries were used for the Mossdale trawl and adult inland spawner analyses. Survival index values obtained from USFWS were used for Jersey Point / Antioch and Chipps Island analyses. The "relative survival" index values were calculated by dividing the number of recoveries from the upper release group by the lower release group, adjusting to account for different numbers in the release groups. Adult recoveries for the expanded CWT fish recovered from the ocean harvest port surveys, and actual carcasses found during spawning surveys, or hatchery returns, are composed of 1+ to 5- year old salmon. Grouping survival estimates by averaging survival estimates based on recovery type (trawl, export salvage, harvest and escapement) is also presented here.

No "absolute" survival estimates are made in this report. These would indicate the percent survival to adult (harvest and escapement) of each release group and would have to account for sampling effort within the San Joaquin Basin. The CDFG initially identified significant concerns about the validity of the 1990 and 1994 Tuolumne releases due to concerns about the manner in which those studies were conducted and possible failure to meet study assumptions. The review in Report 2001-5 found that 1997 also had significant problems, so results of the 1990, 1994, and 1997 releases are to be generally eliminated at this time. None of the Tuolumne River results have been standardized to account for the difference in river miles between release groups, which has ranged from 38 to 53.5 miles. Also, no examination of recovery variability among tag codes within release groups has been done.

3. RESULTS AND DISCUSSION

3.1 Updated Relative Survival Index Results for Tuolumne River CWT Smolt Releases

1999, 2000 and 2001 Survival Indices

Updated ocean harvest survival indices for 1999, 2000 and 2001 CWT smolt releases are .95, .56

and.32 based on preliminary 2003 expanded ocean harvest data (Table 2). Escapement survival indices for the 1999, 2000 and 2001 releases are .70, .53 and .22, respectively based on preliminary data through the 2002 run. The 2001 escapement survival index is based on 2-year old salmon only. Survival indices for adult recoveries from 2000-2002 smolt releases are incomplete at this time. No tag recovery data is yet available for adult inland returns in 2003. Average indices of juvenile and adult recoveries, based on sites with at least 4 recoveries from one release group, were .48, .22 and 1.09 for the 1999, 2000 and 2001 releases.

3.2 Relative Survival Indices in Relation to Tuolumne Flow

Figure 2 includes all years and indices for all recovery operations that captured 4 or more salmon from either upper and lower release groups. Figure 3 excludes the years generally determined to be invalid (1990, 1994, 1997 – see Report 2002-4 for explanation) and has log regression lines for the Chipps, ocean, and spawner recoveries, which had the higher R^2 values. Figure 4 is that same data plotted at adjusted La Grange flow values. Figures 5 and 6 use averages from trawl sampling locations, delta water export fish salvage facilities ("pump"), and ocean harvest and San Joaquin basin spawning runs ("adult"), and average of all values (excluding 2002 for now), for initial and adjusted La Grange flow values, respectively. Table 3 has the values used for Figures 3 to 6 - the Mossdale survival indices are unadjusted values (see Report 2002-4 for adjusted values, which are not very different).

See Appendix A for review of test results by flow category.

3.3 Other Data in Table 1

Table 1 includes CWT recovery data from: (1) Merced River smolt releases made between 1998-2003, (2) Stanislaus River smolt releases made in 1999-2003, (3) Lower San Joaquin River/Delta smolt releases made in 1998-2003 which originated from the Merced Hatchery. Data for earlier years was in FERC Report 98-5 and 2002-5.

3.4 Summary and Recommendations

The Tuolumne paired release CWT survival tests have been made 12 times from 1986-2002, resulting in 8-9 tests considered to be valid. In general, the survival indices, when examined for all recovery locations, are variable, but trend toward higher survival (all values >0.6) in the three years with higher flow conditions (>6,000 cfs or >4,000 cfs adjusted) - results at moderate to low flows all had some values of less than 0.6. In some cases the indices far exceed 1.0 and/or are based on few recoveries (Table 2). Survival averages based on recovery type (trawl, pump salvage, and ocean/spawner), and overall average (excluding 2002), are shown with the overall average log based trend line ($R^2 = 0.78$; 0.75 with adjusted flow). Individual trend lines for Chipps trawl, ocean, and spawner results had the higher R^2 values of 0.42-0.72 (Figures 3 and 4).

There have been a number of significant issues that have been identified over time regarding these tests, including:

- There has been difficulty in implementing valid tests in some years
- It is difficult to determine what flow conditions were actually tested in some years
- The tests results may only generally determine survival trends over a broad flow range
- It is not known if these tests are suitable indicators for natural smolts
- It is not known if other major assumptions are reasonable, such as flow being a surrogate for most other variables that may be affecting survival
- Population effects and genetic concerns have generally been disregarded in conducting these tests within the basin.
- The costs associated with conducting these tests has been very substantial, averaging over $100,000 annually in 2001-2002, not including all evaluation and report costs.

Some potential areas for additiona review are:

- Recovery data from all delta juvenile sampling sites could be further analyzed to review the timing pattern of recoveries.
- Consider analyzing by individual tag codes to better understand the variation of the results forming the basis of the entire release group survival index.
- Absolute survival to adult, accounting for harvest, could be estimated for release groups. This may require more inland adult recovery data that accounts for sampling effort for each tributary.
- Continue assessment of grouping survival indices, e.g. by recovery type.
- Consider ways to address the variability in indices from different recovery locations or methods.
- Obtain and analyze inland recovery data for locations other than the three San Joaquin River tributaries.
- Consider accounting for the difference in distance between release groups, since the downstream release locations have varied up to 15.5 river miles.
- Complete the examination for determining data validity and apply to 1986 and 2002 to ascertain if there are problems in those years. It already appears that at least the second release of the lower group in 2002 may have to be omitted.
- Confidence intervals for the indices should be determined by appropriate methods.
- Linking of within-Tuolumne survival to other CWT data in the San Joaquin River and Delta could be done where feasible to compare and examine survival in the inland reaches down to Jersey Point in the central Delta.
- Compare Tuolumne River indices with those in the two adjacent tributaries (see Appendix A).
- Review population effects of CWT salmon and compare magnitude, size, and timing pattern of CWT smolts to natural smolts in all tributaries.

4. REFERENCES

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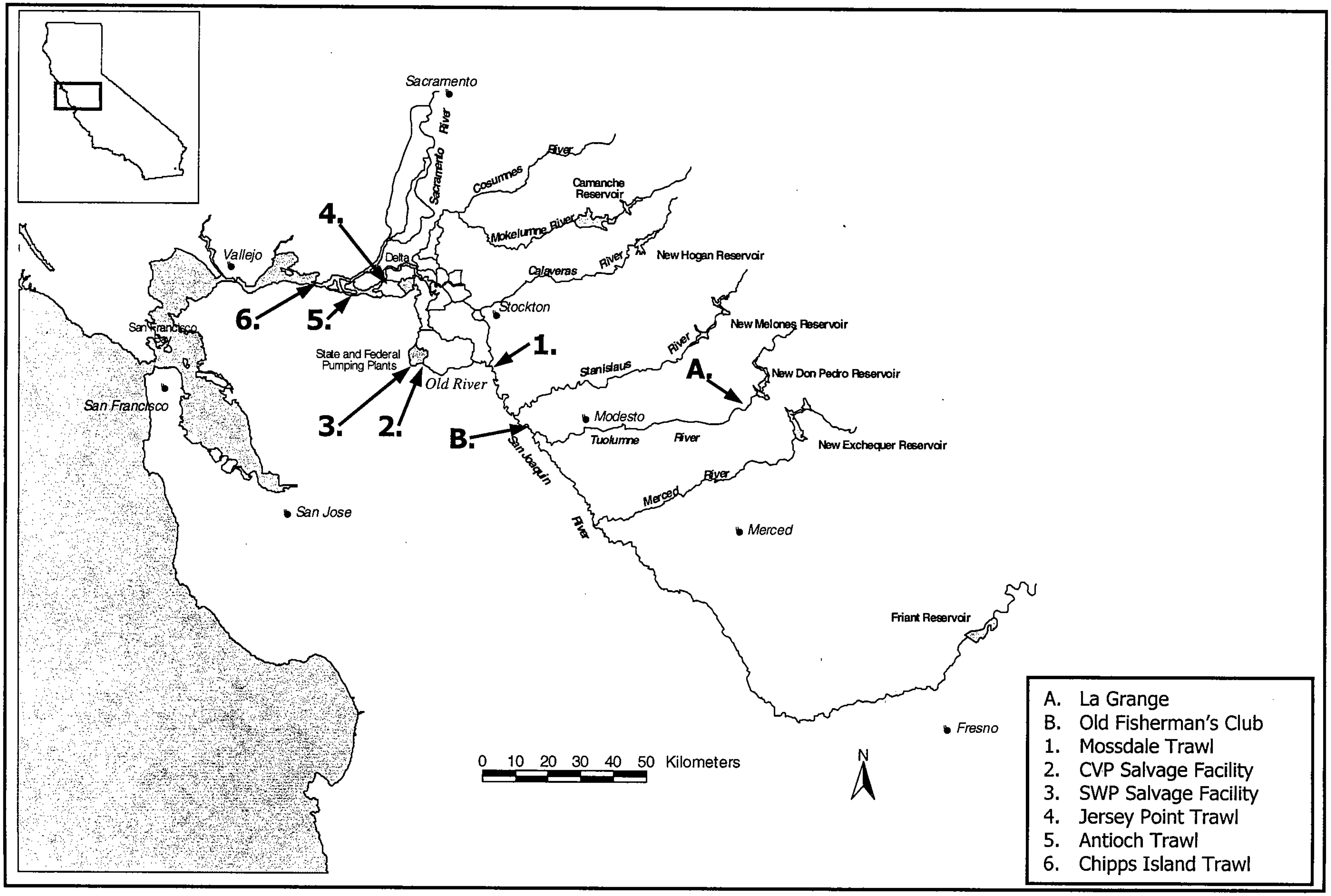


Figure 1. La Grange and Old Fisherman's Club Release Locations and CWT Smolt Recovery Sites

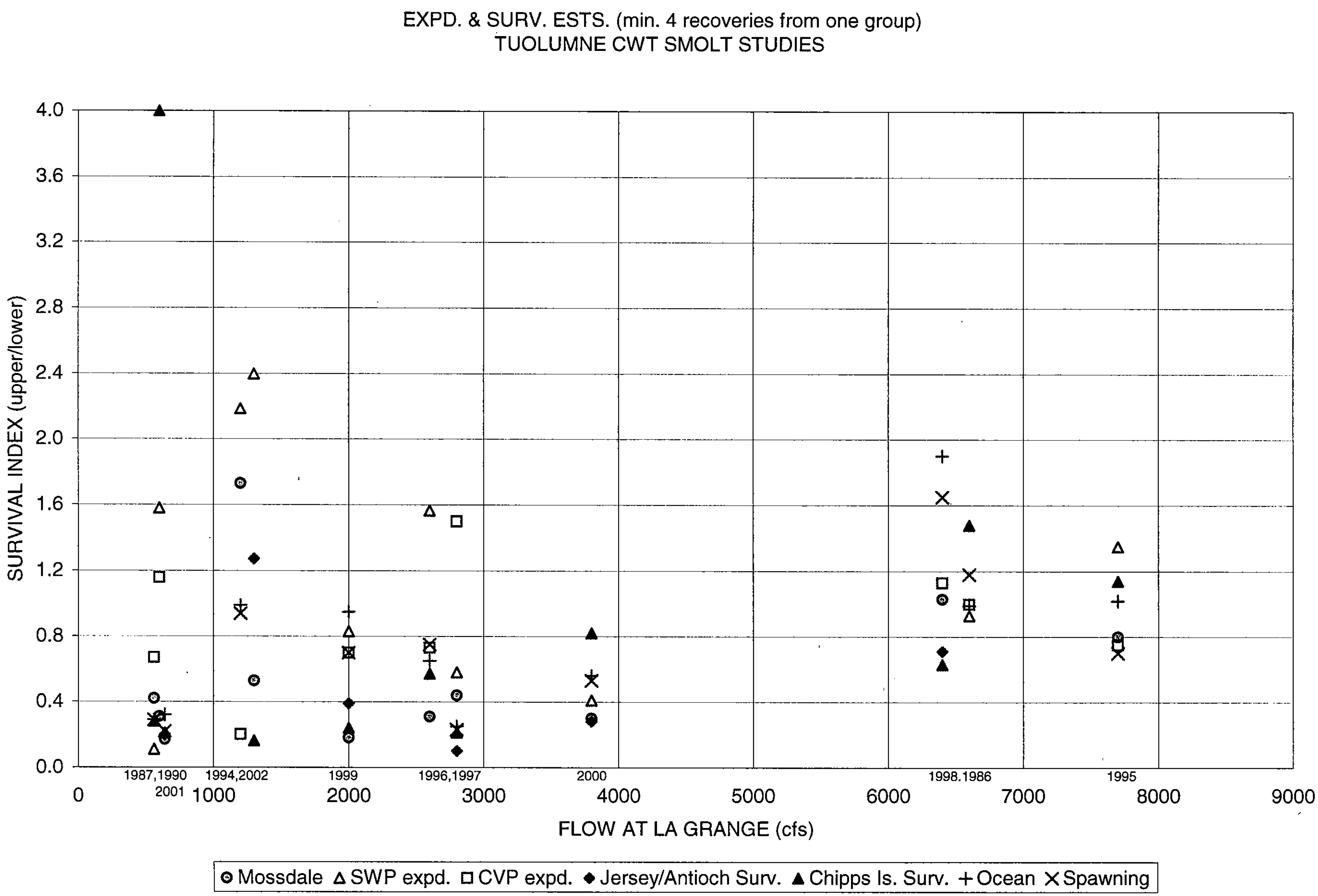


Figure 2. Tuolumne River CWT Smolt Survival Indices for all years (excluding < 4 recoveries from either group)

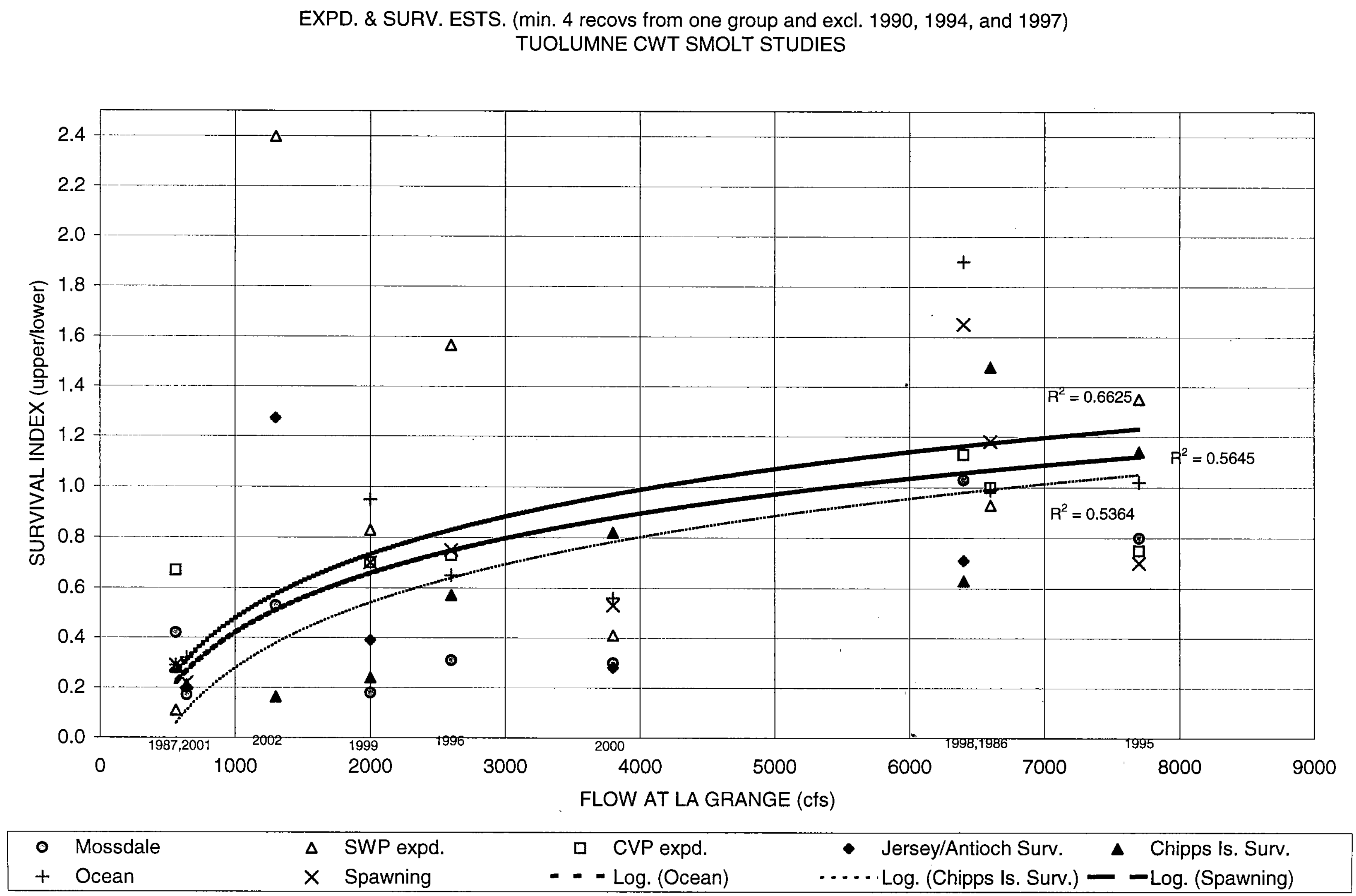


Figure 3. Tuolumne River CWT smolt survival indices

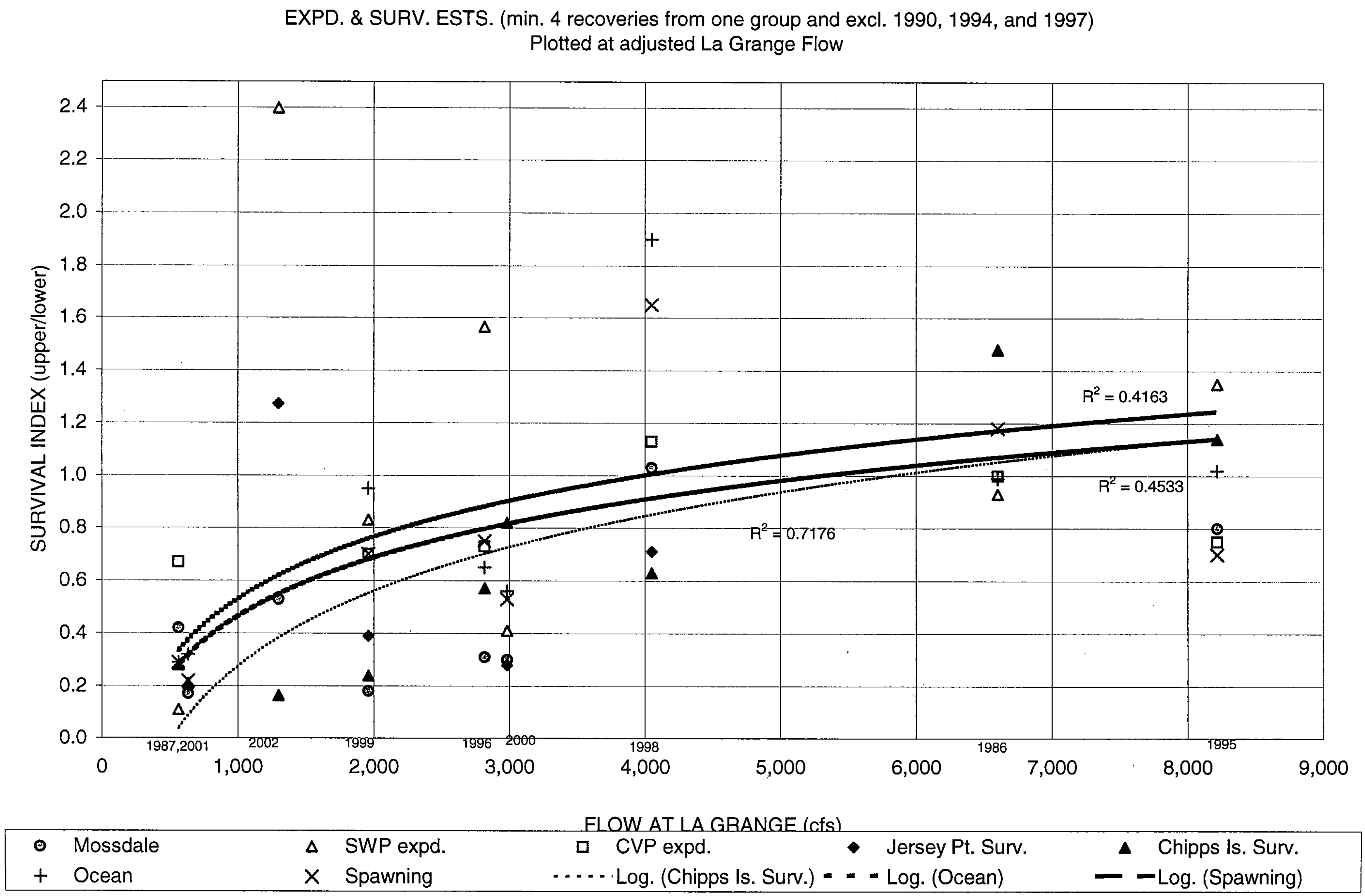
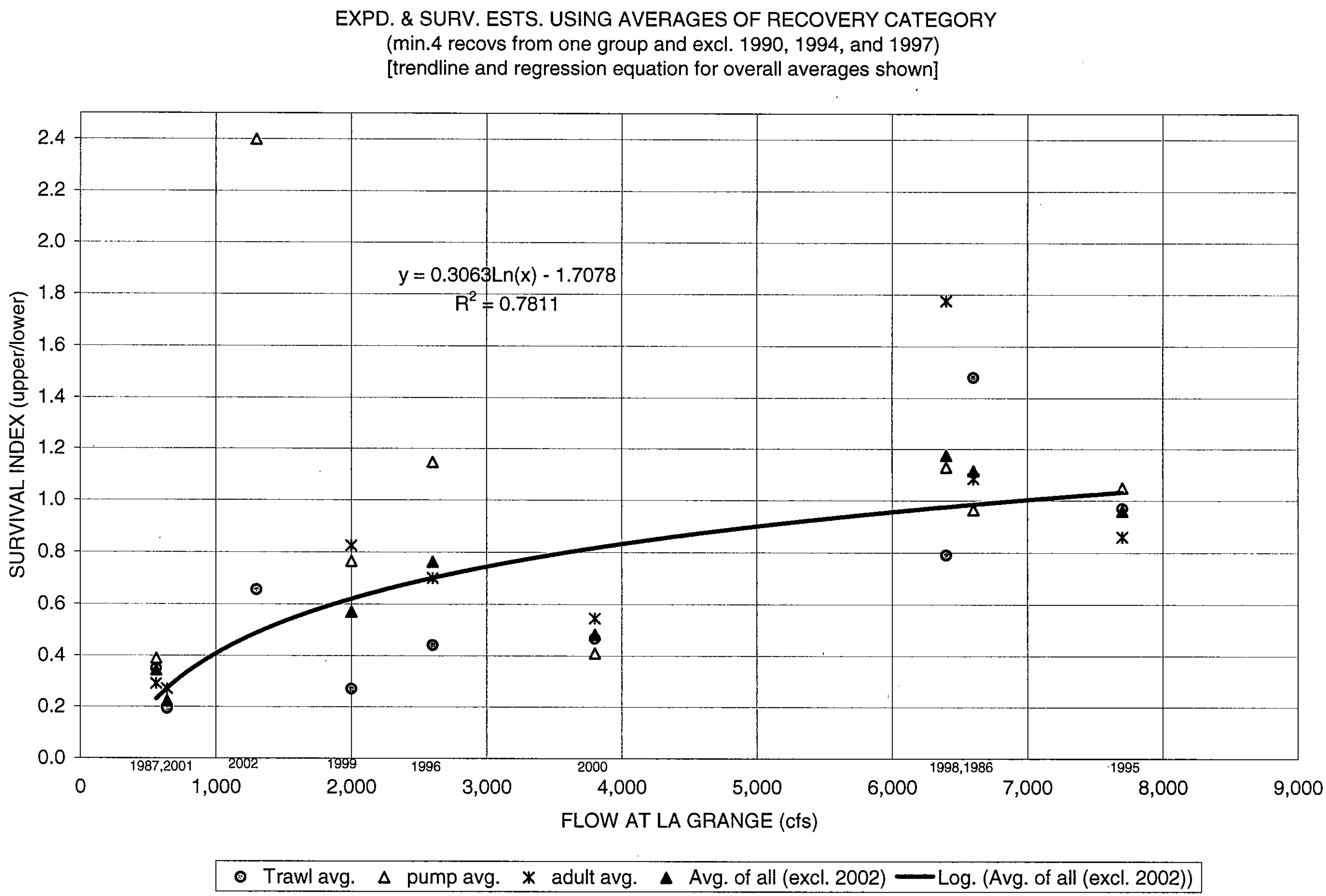


Figure 4. Tuolumne River CWT smolt survival indices at adjusted La Grange flow



EXPD. & SURV. ESTS. USING AVERAGES OF RECOVERY CATEGORY
(min.4 recovs from one group and excl. 1990, 1994, and 1997)
[trendline and regression equation for overall averages shown]
y = 0.3063Ln(x) - 1.7078
R2 = 0.7811
SURVIVAL INDEX (upper/lower)
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1987,2001
2002
1999
1996
2000
1998,1986
1995
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
FLOW AT LA GRANGE (cfs)
Trawl avg.
pump avg.
adult avg.
Avg. of all (excl. 2002)
Log. (Avg. of all (excl. 2002))

Figure 5.

EXPD. & SURV. ESTS. USING AVERAGES OF RECOVERY CATEGORY
(min.4 recovs from one group and excl. 1990, 1994, and 1997)
[trendline and regression equation for overall averages shown]
Plotted at adjusted La Grange Flow

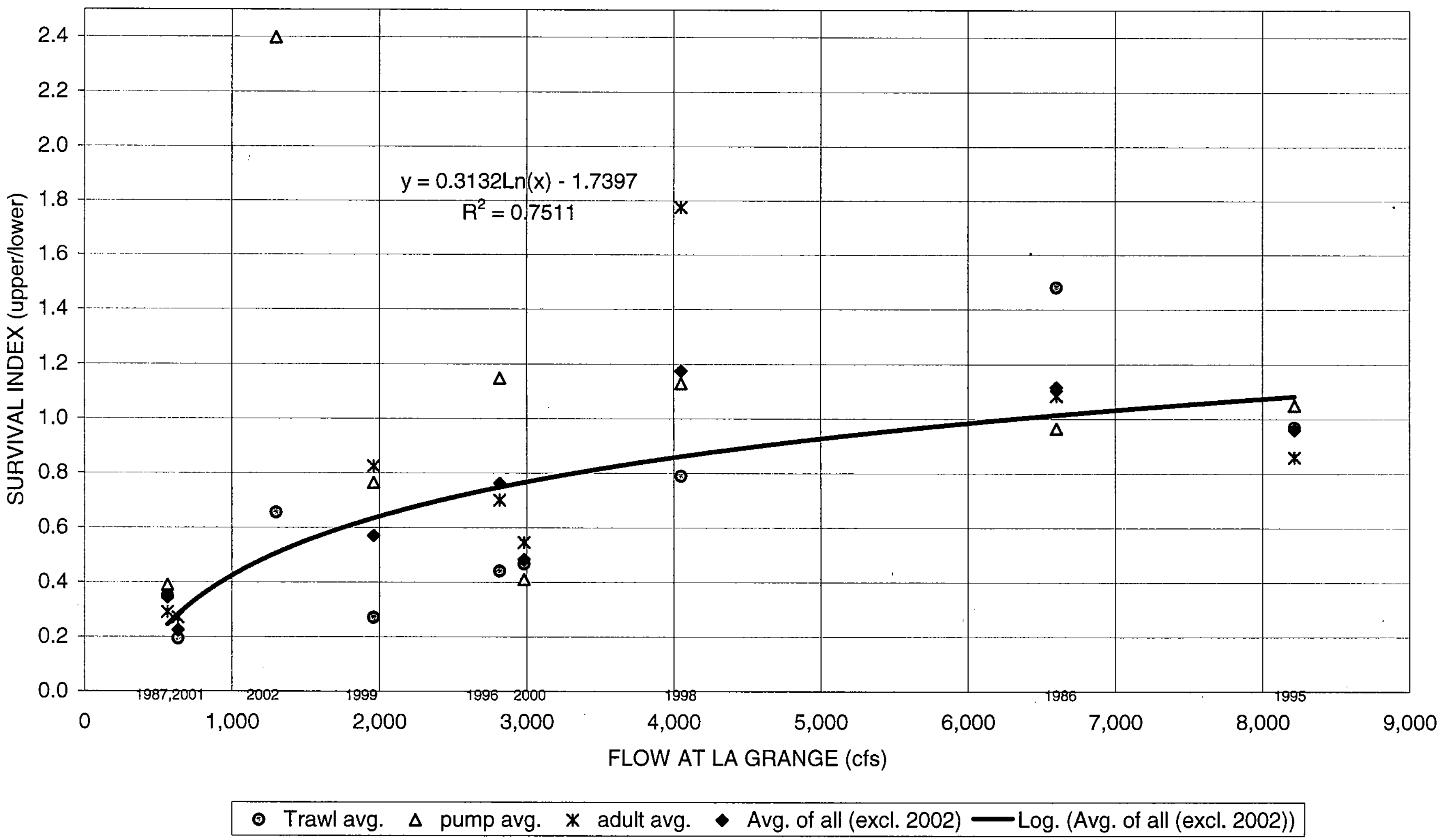


Figure 6.

TUOLUMNE RIVER	JUVENILE SALMON CWT RELEASES					JUVENILE RECOVERIES						ADULT OCEAN RECOVERIES ESTIMATED												
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SMOLTS/ YEARLING	SJR PUSH. /SCREWTRAP	MOSSDALE	SWP	CVP	CHIPPS	JERSEY Antioch	1+ COMM.	1+ SPORT	1+ TOTAL	2+ COMM.	2+ SPORT	2+ TOTAL	3+ COMM.	3+ SPORT	3+ TOTAL	4+ COMM.	4+ SPORT	4+ TOTAL	1+ - 4+ TOTAL
BY97	61110703	32787	OLGB	15APR98	SMOLTS		51	1	26	25	26				75	16	91	3	0	3				94
	61110704	26633	OLGB	15APR98	SMOLTS		40	0	22	5	4	0	4	4	55	16	71							75
	61110705	27404	OLGB	15APR98	SMOLTS		30	1	25	19	8	0	4	4	57	42	99	1	0	1				104
	61110706	7234	OLGB	15APR98	SMOLTS		9	2	7	2	0				41	4	45							45
	61110707	25754	OFC(SJR)	16APR98	SNOLTS		34	0	17	17	13				37	6	44							44
	61110708	22006	OFC(SJR)	17APR98	SMOLTS		30	0	18	19	5				34	8	41							41
TOTAL		94058	OLGB	15APR98	SMOLTS	46	130	4	80	51	38	0	8	8	228	78	306	4	0	4				318
TOTAL		47760	OFC(SJR)	16APR98	SMOLTS	------	64	0	35	36	18	0	0	0	71	14	85	0	0	0				85
BY98	06-46-01	25534	OLGB	17APR99	SMOLTS		10	56	41	3	6	0	13	13	59	7	66	5	0	5				84
	06-46-02	25679	OLGB	18APR99	SMOLTS		17	67	58	2	6	1	18	19	56	10	67	5	0	5				91
	06-46-03	25008	OLGB	19APR99	SMOLTS		18	61	62	2	3	0	14	14	53	16	70	3	0	3				87
	06-46-04	25121	OFC(SJR)	18APR99	SMOLTS		49	78	83	11	11	0	3	3	58	13	71	16	2	18				92
	06-46-05	25836	OFC(SJR)	19APR99	SMOLTS		115	94	52	9	15	0	11	11	68	10	77	5	0	5				93
	06-46-07	12017	OLGB/HUGH.	4/18-5/1	SMOLTS			16	17			0	4	4	9	2	11	3	0	3				18
	06-45-33	17684	GRAYSON	3/24-5/26	SMOLTS			27	30			0	4	4	22	5	26	2	0	2				32
TOTAL		76221	OLGB	18APR99		184	45	184	161	7	15	1	45	46	168	33	203	13	0	13				262
TOTAL		50957	OFC(SJR)	19APR99		------	164	172	135	20	26	0	14	14	126	23	148	21	2	23				185
BY99	06-45-56	23603	OLGB	13APR00	SMOLTS		17	13	1	6	5	0	0	0	55	14	69	0	3	3				72
	06-45-57	22096	OLGB	15APR00	SMOLTS		15	4	2	1	2	0	14	14	33	32	64	0	3	3				81
	06-45-58	26975	OLGB	15APR00	SMOLTS		8	10	0	5	3	0	7	7	28	20	48	9	4	13				68
	06-45-59	23071	OFC(SJR)	16APR00	SMOLTS		33	27	1	4	12	0	2	2	101	31	132	5	2	7				141
	06-45-60	21698	OFC(SJR)	14APR00	SMOLTS		49	20	1	5	10	0	4	4	70	24	94	3	3	6				104
	06-45-61	17936	RF/HUGH.	4/13-5/5	SMOLTS		7	10	2			0	12	12	24	7	31	0	4	4				47
	06-45-62	19198	RF/HUGH.	4/13-5/5	SMOLTS		9	6	0			3	0	3	13	11	24							27
	06-46-08	11803	GRAYSON	4/16-5/23	SMOLTS		8	1	0			0	3	3	7	3	10							13
TOTAL		72674	OLGB			241	40	27	3	12	10	0	21	21	116	66	181	9	10	19				221
TOTAL		44769	0FC(SJR)			------	82	47	2	9	22	0	6	6	171	55	226	8	5	13				245
BY00	06-44-12	24600	OLGB	22APR01	SMOLTS		38	0	0	2	2			0	7	0	7							7
	06-44-13	22758	OLGB	22APR01	SMOLTS		40	0	1	2	6			0	19	4	23							23
	06-44-14	21527	OLGB	22APR01	SMOLTS		32	0	0	4	10			0	12	3	15							15
	06-44-43	22051	OFC(SJR)	28APR01	SMOLTS		165	0	0	13	35	6	4	9	23	8	31							40
	06-44-44	24393	OFC(SJR)	26APR01	SMOLTS		262	2	1	12	25	0	12	12	40	5	44							56
TOTAL		68885	OLGB			109	110	0	1	8	18	0	0	0	38	7	45							45
TOTAL		46444	0FC(SJR)			------	427	2	1	25	60	6	16	21	63	13	75							96
BY01	06-44-06	24976	OLGB	24APR02	SMOLTS		65	2	1	1	3			0										
	06-44-67	24813	OLGB	24APR02	SMOLTS		63	2	0	7	5			0										
	06-44-68	25220	OLGB	24APR02	SMOLTS		51	2	1	0	3			0										
	06-44-61	25701	OFC(SJR)	26APR02	SMOLTS		116	1	0	6	1			0										
	06-44-69	23870	OFC(SJR)	29APR02	SMOLTS		25	2	1	3	2			0										
	06-44-62	15434	GRAYSON	4/3-5/30				0	1	1	3			0										
TOTAL		75009	OLGB			1008	179	6	2	8	11			0										
TOTAL		49571	0FC(SJR)			------	141	3	1	9	3			0										

TABLE 1. Tuolumne River (1 of 3)

TUOLUMNE RIVER	JUVENILE SALMON CWT RELEASES				ADULT INLAND TOTAL (HATCHERY AND SURVEY				Age 2 to 5	INLAND TOTAL BY RIVER Age 2										INLAND TOTAL BY RIVER Age 3									
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	2	3	4	5	TOTAL	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY97	61110703	32787	OLGB	15APR98	11	6	5		22							10	1									4	2		
	61110704	26633	OLGB	15APR98	12	8	1		21							11	1									7	1		
	61110705	27404	OLGB	15APR98	8	18	1		27							7	1									17	1		
	61110706	7234	OLGB	15APR98	4	2	2		8							4										1	1		
	61110707	25754	OFC(SJR)	16APR98	6	4	0		10							3	3									3	1		
	61110708	22006	OFC(SJR)	17APR98	5	7	2		14							2	3									2	5		
TOTAL		94058	OLGB	15APR98	35	34	9		78							32	3									29	5		
TOTAL		47760	OFC(SJR)	16APR98	11	11	2		24							5	6									5	6		
BY98	06-46-01	25534	OLGB	17APR99	2	21	3		26							2						2				19			
	06-46-02	25679	OLGB	18APR99	2	28	6		36							2						2		1		24	1		
	06-46-03	25008	OLGB	19APR99	5	24	6		35							5						1				23			
	06-46-04	25121	OFC(SJR)	18APR99	5	37	7		49								5					2	1	3		14	17		
	06-46-05	25836	OFC(SJR)	19APR99	9	26	8		43							5	4								2	10	14		
	06-46-07	12017	OLGB/HUGH.	4/18-5/1	1	4	3		8							1								1		3			
	06-45-33	17684	GRAYSON	3/24-5/26	2	4	5		11							2							1			2	1		
TOTAL		76221	OLGB	18APR99	9	73	15		97													5	0	1	0	66	1		
TOTAL		50957	OFC(SJR)	19APR99	14	63	15		92													2	1	3	2	24	31		
BY99	06-45-56	23603	OLGB	13APR00	8	26			34							8						1				22	3		
	06-45-57	22096	OLGB	15APR00	5	19			24							5										19			
	06-45-58	26975	OLGB	15APR00	6	23			29							6										20	3		
	06-45-59	23071	OFC(SJR)	16APR00	17	33			50							7	10								1	16	16		
	06-45-60	21698	OFC(SJR)	14APR00	18	33			51				1			5	12								2	20	11		
	06-45-61	17936	RF/HUGH.	4/13-5/5	8	15			23							7	1									15			
	06-45-62	19198	RF/HUGH.	4/13-5/5	7	13			20					1		6										12	1		
	06-46-08	11803	GRAYSON	4/16-5/23	1	8			9							1										7	1		
TOTAL		72674	OLGB		19	68			87							19	0								0	61	6		
TOTAL		44769	0FC(SJR)		35	66			101							12	22								3	36	27		
BY00	06-44-12	24600	OLGB	22APR01	6				6							6													
	06-44-13	22758	OLGB	22APR01	2				2							2													
	06-44-14	21527	OLGB	22APR01	1				1							1													
	06-44-43	22051	OFC(SJR)	28APR01	13				13						2	5	6												
	06-44-44	24393	OFC(SJR)	26APR01	15				15							5	10												
TOTAL		68885	OLGB		9				9						0	9	0												
TOTAL		46444	0FC(SJR)		28				28						2	10	16												
BY01	06-44-06	24976	OLGB	24APR02																									
	06-44-67	24813	OLGB	24APR02																									
	06-44-68	25220	OLGB	24APR02																									
	06-44-61	25701	OFC(SJR)	26APR02																									
	06-44-69	23870	OFC(SJR)	29APR02																									
	06-44-62	15434	GRAYSON	4/3-5/30																									
TOTAL		75009	OLGB																										
TOTAL		49571	0FC(SJR)																										

TABLE 1. Tuolumne River (2 of 3)

TUOLUMNE RIVER	JUVENILE SALMON CWT RELEASES				INLAND TOTAL BY RIVER										INLAND TOTAL BY RIVER									
		EFFECTIVE	RELEASE		Age 4										Age 5									
	TAG NO.	RELEASE	SITE	DATE	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY97	61110703	32787	OLGB	15APR98							4	1												
	61110704	26633	OLGB	15APR98							1													
	61110705	27404	OLGB	15APR98							1													
	61110706	7234	OLGB	15APR98							2													
	61110707	25754	OFC(SJR)	16APR98							0													
	61110708	22006	OFC(SJR)	17APR98							2													
TOTAL		94058	OLGB	15APR98																				
TOTAL		47760	OFC(SJR)	16APR98																				
BY98	06-46-01	25534	OLGB	17APR99							3													
	06-46-02	25679	OLGB	18APR99							6													
	06-46-03	25008	OLGB	19APR99							6													
	06-46-04	25121	OFC(SJR)	18APR99					1	1	5													
	06-46-05	25836	OFC(SJR)	19APR99							6	2												
	06-46-07	12017	OLGB/HUGH.	4/18-5/1							3													
	06-45-33	17684	GRAYSON	3/24-5/26					2		2	1												
TOTAL		76221	OLGB	18APR99					0	0	15	0												
TOTAL		50957	OFC(SJR)	19APR99					1	1	11	2												
BY99	06-45-56	23603	OLGB	13APR00																				
	06-45-57	22096	OLGB	15APR00																				
	06-45-58	26975	OLGB	15APR00																				
	06-45-59	23071	OFC(SJR)	16APR00																				
	06-45-60	21698	OFC(SJR)	14APR00																				
	06-45-61	17936	RF/HUGH.	4/13-5/5																				
	06-45-62	19198	RF/HUGH.	4/13-5/5																				
	06-46-08	11803	GRAYSON	4/16-5/23																				
TOTAL		72674	OLGB																					
TOTAL		44769	0FC(SJR)																					
BY00	06-44-12	24600	OLGB	22APR01																				
	06-44-13	22758	OLGB	22APR01																				
	06-44-14	21527	OLGB	22APR01																				
	06-44-43	22051	OFC(SJR)	28APR01																				
	06-44-44	24393	OFC(SJR)	26APR01																				
TOTAL		68885	OLGB																					
TOTAL		46444	0FC(SJR)																					
BY01	06-44-06	24976	OLGB	24APR02																				
	06-44-67	24813	OLGB	24APR02																				
	06-44-68	25220	OLGB	24APR02																				
	06-44-61	25701	OFC(SJR)	26APR02																				
	06-44-69	23870	OFC(SJR)	29APR02																				
	06-44-62	15434	GRAYSON	4/3-5/30																				
TOTAL		75009	OLGB																					
TOTAL		49571	0FC(SJR)																					

TABLE 1. Tuolumne River (3 of 3)

MERCED RIVER	JUVENILE SALMON CWT RELEASES					JUVENILE RECOVERIES						ADULT OCEAN RECOVERIES ESTIMATED												
												1+			2+			3+			4+			1+ - 4+
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SMOLTS/ YEARLING	SJR PUSH. /SCREWTRAP	MOSSDALE	SWP	CVP	CHIPPS	JERSEY Antioch	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	TOTAL
BY 1997	64523	35800	MRH	12APR98	SMOLTS		44	1	19	23	10	0	4	4	49	27	73	5	0	5				82
	64524	36289	MRH	12APR98	SMOLTS		29	0	29	16	11	0	11	11	50	2	52	3	0	3				66
	62520	27973	MRH	12APR98	SMOLTS		28	2	22	15	4	0	8	8	33	10	43	0	2	2				53
	62521	34805	HATFIELD	14APR98	SMOLTS		38	0	42	22	9	0	5	5	38	24	62	2	0	2				69
	62522	30857	HATFIELD	14APR98	SMOLTS		29	0	23	17	9				25	19	44	2	0	2				46
	62523	8447	HATFIELD	14APR98	SMOLTS		6	0	7	2	1				4	0	4							4
TOTAL	UPPER	100062	MRH		SMOLTS		101	3	70	54	25	0	23	23	132	39	168	8	2	10				201
TOTAL	LOWER	74109	HATFIELD		SMOLTS		73	0	72	41	19	0	5	5	67	43	110	4	0	4				119
BY 1997	61110709	28248	MRH	03MAY98	SMOLTS		26	1	19	7	10	0	4	4	93	20	113	7	0	7	4	0	4	128
	61110710	25482	MRH	03MAY98	SMOLTS		32	0	15	6	3				79	15	94	4	0	4				98
	61110711	25220	MRH	03MAY98	SMOLTS		23	3	16	5	3	3	0	3	66	18	84	0	7	7				94
	61110712	25046	MRH	03MAY98	SMOLTS		20	3	20	10	5				40	15	55	3	0	3				58
	61110502	49873	HATFIELD	05MAY98	SMOLTS		79	4	66	18	12	3	13	16	139	50	189	7	4	11				216
	61110713	25314	HATFIELD	05MAY98	SMOLTS		27	4	33	15	6				66	31	97							97
TOTAL	UPPER	103996	MRH		SMOLTS		101	7	70	28	21	3	4	7	278	68	346	14	7	21	4	0	4	378
TOTAL	LOWER	75187	HATFIELD		SMOLTS		106	8	99	33	18	3	13	16	205	81	286	7	4	11	0	0	0	313
BY 1998	06-45-28	25462	MRH	14APR99	SMOLTS		24	57	28	3	4	3	4	7	29	0	29	8	4	12				48
	06-45-29	25445	MRH	14APR99	SMOLTS		21	38	29	5	7	0	13	13	38	15	54							67
	06-45-30	25221	MRH	15APR99	SMOLTS		28	46	25	4	3	0	4	4	25	20	44							48
	06-45-31	24123	HATFIELD	16APR99	SMOLTS		28	57	75	14	10	3	22	25	76	28	104	9	4	13				142
	06-45-32	24640	HATFIELD	16APR99	SMOLTS		39	53	66	7	16	0	7	7	59	9	68							75
TOTAL	UPPER	76128	MRH				73	141	82	12	14	3	21	24	92	35	127	8	4	12				163
TOTAL	LOWER	48763	HATFIELD				67	110	141	21	26	3	29	32	135	37	172	9	4	13				217
BY 1998	0601110714	24075	MRH	05MAY99	SMOLTS		4	6	8	0					4	0	4							4
	0601110801	25923	MRH	05MAY99	SMOLTS		0	6	4	1					9	0	9							9
	0601110802	23868	MRH	06MAY99	SMOLTS		2	6	6	0					0	0	0	4	0	4				4
	0601110803	23936	MRH	06MAY99	SMOLTS		1	9	8	0					0	3	3	7	0	7				10
	06-45-34	24337	HATFIELD	07MAY99	SMOLTS		9	54	41	1					41	11	52	12	9	20				72
	06-45-35	23215	HATFIELD	07MAY99	SMOLTS		12	38	32	2					52	6	58	6	4	10				68
	06-45-36	23436	HATFIELD	07MAY99	SMOLTS		9	34	45	0					45	6	51	7	7	14				65
TOTAL	UPPER	97802	MRH				7	27	26	1					13	3	16	11	0	11				27
TOTAL	LOWER	70988	HATFIELD				30	126	118	3					138	23	161	25	20	44				205
BY 1999	06-45-39	25313	MRH	4/12-4/13	SMOLTS		9	5	0	5	2	0	2	2	18	0	18	3	0	3				23
	06-45-40	25507	MRH	4/12-4/13	SMOLTS		7	11	0	3	9	0	0	0	6	3	9	5	0	5				14
	06-45-41	25318	MRH	4/12-4/13	SMOLTS		14	8	1	4	2	0	0	0	8	0	8	2	0	2				10
	06-45-42	25395	MRH	4/12-4/13	SMOLTS		12	10	1	5	2	0	0	0	32	18	50	5	4	9				59
	06-45-43	24525	HATFIELD	4/13-4/14	SMOLTS		45	28	1	5	8	7	7	14	58	36	93	3	0	3				110
	06-45-44	24490	HATFIELD	4/13-4/14	SMOLTS		51	25	0	6	9	0	0	0	35	13	48	28	4	31				79
	06-45-45	24432	HATFIELD	4/13-4/14	SMOLTS		41	29	1	2	8	6	3	9	83	32	114	14	0	14				137
TOTAL	UPPER	101533	MRH				42	34	2	17	15	0	2	2	64	21	85	15	4	19				106
TOTAL	LOWER	73447	HATFIELD				137	82	2	13	25	13	10	23	176	81	255	45	4	48				326
BY 1999	06-45-49	25433	MRH	24APR00	SMOLTS		5	2	0	5	3	0	4	4	31	4	35							39
	06-45-50	27042	MRH	24APR00	SMOLTS		10	2	3	6	2	0	8	8	22	0	22	6	0	6				36
	06-45-51	24378	MRH	24APR00	SMOLTS		8	6	0	1	8	0	5	5	10	0	10	0	4	4				19
	06-45-52	25293	MRH	24APR00	SMOLTS		6	0	1	4	7	0	0	0	17	6	23	3	0	3				26
	06-45-53	25794	HATFIELD	27APR00	SMOLTS		24	12	0	5	13	6	0	6	35	7	42	11	4	15				63
	06-45-54	26189	HATFIELD	27APR00	SMOLTS		26	20	1	4	5	0	4	4	75	18	93							97
	06-45-55	25444	HATFIELD	27APR00	SMOLTS		23	16	2	6	10	0	4	4	30	6	36							40
TOTAL	UPPER	102146	MRH				29	10	4	16	20	0	17	17	80	10	90	9	4	13				120
TOTAL	LOWER	77427	HATFIELD				73	48	3	15	28	6	8	14	140	31	171	11	4	15				200

TABLE 1. Merced River (1 of 6)

MERCED RIVER	JUVENILE SALMON CWT RELEASES TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	ADULT INLAND TOTAL (HATCHERY AND SURVEY) 2	3	4	5	Age 2 to 5 TOTAL	INLAND TOTAL BY RIVER Age 2 SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	INLAND TOTAL BY RIVER Age 3 SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY 1997	64523	35800	MRH	12APR98	18	12	1		31							1	17										12		
	64524	36289	MRH	12APR98	17	21	3		41								17									2	19		
	62520	27973	MRH	12APR98	25	20	2		47							1	24										20		
	62521	34805	HATFIELD	14APR98	13	13	3		29							2	11										13		
	62522	30857	HATFIELD	14APR98	16	13	0		29							2	14									4	9		
	62523	8447	HATFIELD	14APR98	3	5	1		9								3										5		
TOTAL	UPPER	100062	MRH		60	53	6		119							2	58									2	51		
TOTAL	LOWER	74109	HATFIELD		32	31	4		67							4	28									4	27		
BY 1997	61110709	28248	MRH	03MAY98	40	52	4		96								40									2	50		
	61110710	25482	MRH	03MAY98	34	43	4		81								34									3	40		
	61110711	25220	MRH	03MAY98	22	42	7		71							2	20										42		
	61110712	25046	MRH	03MAY98	29	33	5		67								29										33		
	61110502	49873	HATFIELD	05MAY98	76	64	6		146								76									4	60		
	61110713	25314	HATFIELD	05MAY98	26	34	3		63							1	25									4	30		
TOTAL	UPPER	103996	MRH		125	170	20		315							2	123									5	165		
TOTAL	LOWER	75187	HATFIELD		102	98	9		209							1	101									8	90		
BY 1998	06-45-28	25462	MRH	14APR99	15	16	1		32								15										16		
	06-45-29	25445	MRH	14APR99	13	17	0		30								13										17		
	06-45-30	25221	MRH	15APR99	12	17	0		29								12							1			16		
	06-45-31	24123	HATFIELD	16APR99	13	33	1		47								13					2				5	26		
	06-45-32	24640	HATFIELD	16APR99	16	32	2		50								16							1		1	30		
TOTAL	UPPER	76128	MRH		40	50	1		91								40									0	49		
TOTAL	LOWER	48763	HATFIELD		29	65	3		97								29									6	56		
BY 1998	0601110714	24075	MRH	05MAY99	1		1		2								1												
	0601110801	25923	MRH	05MAY99		2	1		3																				
	0601110802	23868	MRH	06MAY99	2	3	0		5								2										2		
	0601110803	23936	MRH	06MAY99	1		3		4								1										3		
	06-45-34	24337	HATFIELD	07MAY99	4	27	4		35								4							2			25		
	06-45-35	23215	HATFIELD	07MAY99	6	13	3		22								6									1	12		
	06-45-36	23436	HATFIELD	07MAY99	4	12	8		24								4										12		
TOTAL	UPPER	97802	MRH		4	5	5		14																	0	5		
TOTAL	LOWER	70988	HATFIELD		14	52	15		81																	1	49		
BY 1999	06-45-39	25313	MRH	4/12-4/13	6	15			21								6						1				14		
	06-45-40	25507	MRH	4/12-4/13	9	10			19								9			1							9		
	06-45-41	25318	MRH	4/12-4/13	9	15			24								9							1			14		
	06-45-42	25395	MRH	4/12-4/13	4	19			23								4										19		
	06-45-43	24525	HATFIELD	4/13-4/14	14	24			38								14					1		1			22		
	06-45-44	24490	HATFIELD	4/13-4/14	15	32			47								15					1					31		
	06-45-45	24432	HATFIELD	4/13-4/14	13	29			42	2							11					1					28		
TOTAL	UPPER	101533	MRH		28	59			87								28			1	0	0	1	1			56		
TOTAL	LOWER	73447	HATFIELD		42	85			127								40			0	0	3	0	1			81		
BY 1999	06-45-49	25433	MRH	24APR00	3	15			18								3										15		
	06-45-50	27042	MRH	24APR00	9	12			21							1	8										12		
	06-45-51	24378	MRH	24APR00	11	15			26								11										15		
	06-45-52	25293	MRH	24APR00	9	25			34								9									1	24		
	06-45-53	25794	HATFIELD	27APR00	17	23			40								17						1			3	19		
	06-45-54	26189	HATFIELD	27APR00	22	36			58								22										36		
	06-45-55	25444	HATFIELD	27APR00	11	27			38								11									1	26		
TOTAL	UPPER	102146	MRH		32	67			99							1	31									1	66		
TOTAL	LOWER	77427	HATFIELD		50	86			136							0	50									4	81		

TABLE 1. Merced River (2 of 6)

MERCED RIVER	JUVENILE SALMON CWT RELEASES				INLAND TOTAL BY RIVER Age 4										INLAND TOTAL BY RIVER Age 5									
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY 1997	64523	35800	MRH	12APR98								1												
	64524	36289	MRH	12APR98								3												
	62520	27973	MRH	12APR98								2												
	62521	34805	HATFIELD	14APR98					1		1	1												
	62522	30857	HATFIELD	14APR98																				
	62523	8447	HATFIELD	14APR98								1												
TOTAL	UPPER	100062	MRH								0	6												
TOTAL	LOWER	74109	HATFIELD								1	2												
BY 1997	61110709	28248	MRH	03MAY98								4												
	61110710	25482	MRH	03MAY98							2	2												
	61110711	25220	MRH	03MAY98							2	5												
	61110712	25046	MRH	03MAY98								5												
	61110502	49873	HATFIELD	05MAY98							1	5												
	61110713	25314	HATFIELD	05MAY98							1	2												
TOTAL	UPPER	103996	MRH								4	16												
TOTAL	LOWER	75187	HATFIELD								2	7												
BY 1998	06-45-28	25462	MRH	14APR99								1												
	06-45-29	25445	MRH	14APR99																				
	06-45-30	25221	MRH	15APR99																				
	06-45-31	24123	HATFIELD	16APR99			1																	
	06-45-32	24640	HATFIELD	16APR99							1	1												
TOTAL	UPPER	76128	MRH																					
TOTAL	LOWER	48763	HATFIELD																					
BY 1998	0601110714	24075	MRH	05MAY99								1												
	0601110801	25923	MRH	05MAY99								1												
	0601110802	23868	MRH	06MAY99																				
	0601110803	23936	MRH	06MAY99							1	2												
	06-45-34	24337	HATFIELD	07MAY99								4												
	06-45-35	23215	HATFIELD	07MAY99								3												
	06-45-36	23436	HATFIELD	07MAY99								8												
TOTAL	UPPER	97802	MRH								1	4												
TOTAL	LOWER	70988	HATFIELD								0	15												
BY 1999	06-45-39	25313	MRH	4/12-4/13																				
	06-45-40	25507	MRH	4/12-4/13																				
	06-45-41	25318	MRH	4/12-4/13																				
	06-45-42	25395	MRH	4/12-4/13																				
	06-45-43	24525	HATFIELD	4/13-4/14																				
	06-45-44	24490	HATFIELD	4/13-4/14																				
	06-45-45	24432	HATFIELD	4/13-4/14																				
TOTAL	UPPER	101533	MRH																					
TOTAL	LOWER	73447	HATFIELD																					
BY 1999	06-45-49	25433	MRH	24APR00																				
	06-45-50	27042	MRH	24APR00																				
	06-45-51	24378	MRH	24APR00																				
	06-45-52	25293	MRH	24APR00																				
	06-45-53	25794	HATFIELD	27APR00																				
	06-45-54	26189	HATFIELD	27APR00																				
	06-45-55	25444	HATFIELD	27APR00																				
TOTAL	UPPER	102146	MRH																					
TOTAL	LOWER	77427	HATFIELD																					

TABLE 1. Merced River (3 of 6)

MERCED RIVER	JUVENILE SALMON CWT RELEASES					JUVENILE RECOVERIES						ADULT OCEAN RECOVERIES ESTIMATED													
		EFFECTIVE	RELEASE		SMOLTS/							1+			2+			3+			4+			1+ - 4+
	TAG NO.	RELEASE	SITE	DATE	YEARLING	SJR PUSH. /SCREWTRAP	MOSSDALE	SWP	CVP	CHIPPS	JERSEY Antioch	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	TOTAL
BY00	06-44-15	25107	MRH	21APR01	SMOLTS		59	0	0	3	3			0	13	0	13							13
	06-44-16	24270	MRH	21APR01	SMOLTS		39	1	0	3	10			0	21	8	29							29
	06-44-17	24537	MRH	21APR01	SMOLTS		48	1	0	1	1	0	9	9	16	0	16							25
	06-44-18	24229	MRH	21APR01	SMOLTS		49	0	0	0	7	0	4	4	8	3	12							16
	06-44-19	24974	HATFIELD	26APR01	SMOLTS		164	3	0	8	11	3	11	14	22	9	32							46
	06-44-20	24989	HATFIELD	26APR01	SMOLTS		154	3	2	6	17	4	8	12	31	9	40							52
	06-44-21	24916	HATFIELD	26APR01	SMOLTS		153	3	0	17	24			0	39	0	39							39
TOTAL	UPPER	98143	MRH				195	2	0	7	21	0	13	13	58	11	70							83
TOTAL	LOWER	74879	HATFIELD				471	9	2	31	52	7	19	26	92	18	111							137
BY00	06-44-22	25311	MRH	08MAY01	SMOLTS		39	0	0	2	10			0										
	06-44-23	24685	MRH	08MAY01	SMOLTS		51	0	0	1	9			0										
	06-44-24	26534	MRH	08MAY01	SMOLTS		36	0	0	1	12			0										
	06-44-25	23641	MRH	08MAY01	SMOLTS		57	0	0	0	7			0	6	0	6							6
	06-44-26	23074	HATFIELD	11MAY01	SMOLTS		138	0	0	1	19			0	7	4	11							11
	06-44-27	23186	HATFIELD	13MAY01	SMOLTS		122	0	0	1	20			0	8	0	8							8
	06-44-28	23387	HATFIELD	13MAY01	SMOLTS		116	1	0	4	14			0	6	0	6							6
TOTAL	UPPER	100171	MRH				183	0	0	4	38				6	0	6							6
TOTAL	LOWER	69647	HATFIELD				376	1	0	6	53				21	4	25							25
BY01	06-44-63	23188	MRH	31MAR02	SMOLTS		2	1	1	1	1			0										
	06-44-64	23915	MRH	31MAR02	SMOLTS		0	0	0	0	0			0										
	06-44-65	23775	MRH	31MAR02	SMOLTS		0	0	0	0	0			0										
	06-44-66	23185	MRH	31MAR02	SMOLTS		2	0	0	0	0			0										
	06-44-51	24380	HATFIELD	4/3-4/5	SMOLTS		118	9	40	2	10			0										
	06-44-52	24228	HATFIELD	4/3-4/5	SMOLTS		140	6	41	1	1			0										
	06-45-48	24890	HATFIELD	4/3-4/5	SMOLTS		146	9	44	3	3			0										
TOTAL	UPPER	94063	MRH				4	1	1	1	1													
TOTAL	LOWER	73498	HATFIELD				404	24	125	6	14													
BY01	06-44-82	22522	MRH	21APR02	SMOLTS		4	0	0	0	0			0										
	06-44-83	23086	MRH	21APR02	SMOLTS		11	0	0	0	1			0										
	06-44-84	23140	MRH	21APR02	SMOLTS		10	0	0	0	0			0										
	06-44-85	22183	MRH	21APR02	SMOLTS		9	0	0	0	0			0										
	06-44-86	23349	HATFIELD	4/26-4/29	SMOLTS		44	1	1	2	2			0										
	06-44-87	23363	HATFIELD	4/26-4/29	SMOLTS		50	2	0	0	5			0										
	06-44-88	23639	HATFIELD	4/26-4/29	SMOLTS		50	1	0	1	2			0										
TOTAL	UPPER	90931	MRH				34	0	0	0	1													
TOTAL	LOWER	70351	HATFIELD				144	4	1	3	9													
BY02	06-44-89	22677	MRH	13APR03	SMOLTS			1	2	1	3													
	06-44-90	22816	MRH	13APR03	SMOLTS			0	0	1	1													
	06-44-91	22946	MRH	13APR03	SMOLTS			1	0	0	2													
	06-44-92	21725	MRH	13APR03	SMOLTS			1	0	1	0													
	06-44-93	23274	HATFIELD	16APR03	SMOLTS			3	1	4	6													
	06-44-94	23872	HATFIELD	16APR03	SMOLTS			2	1	1	2													
	06-44-95	23833	HATFIELD	16APR03	SMOLTS			0	1	4	4													
TOTAL	UPPER	90164	MRH					3	2	3	6													
TOTAL	LOWER	70979	HATFIELD					5	3	9	12													
BY02	06-44-96	24232	MRH	25APR03	SMOLTS			0	0	0	0													
	06-44-97	23869	MRH	25APR03	SMOLTS			0	0	0	0													
	06-44-98	23757	MRH	25APR03	SMOLTS			0	0	0	1													
	06-44-99	23950	MRH	25APR03	SMOLTS			0	1	0	0													
	06-45-64	24545	HATFIELD	29APR03	SMOLTS			0	0	0	0													
	06-45-65	24483	HATFIELD	29APR93	SMOLTS			0	0	2	0													
	06-45-66	24358	HATFIELD	29APR03	SMOLTS			1	0	0	1													
TOTAL	UPPER	95808	MRH					0	1	0	1													
TOTAL	LOWER	73386	HATFIELD					1	0	2	1													
BY02	06-27-77	23590	MRH	04MAY03	SMOLTS			0	0	1	0													
	06-27-78	23862	MRH	04MAY03	SMOLTS			0	1	0	0													
	06-44-49	23512	MRH	04MAY03	SMOLTS			0	1	1	1													
	06-44-50	24330	MRH	04MAY03	SMOLTS			1	0	2	0													
	06-45-46	22603	HATFIELD	07MAY03	SMOLTS			0	0	1	0													
	06-45-47	22714	HATFIELD	07MAY03	SMOLTS			0	0	0	2													
	06-45-72	22649	HATFIELD	07MAY03	SMOLTS			0	0	2	0													
TOTAL	UPPER	95294	MRH					1	2	4	1													
TOTAL	LOWER	67966	HATFIELD					0	0	3	2													

TABLE 1. Merced River (4 of 6)

MERCED RIVER	JUVENILE SALMON CWT RELEASES				ADULT INLAND TOTAL (HATCHERY AND SURVEY)				Age 2 to 5	INLAND TOTAL BY RIVER Age 2										INLAND TOTAL BY RIVER Age 3									
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	2	3	4	5	TOTAL	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY00	06-44-15	25107	MRH	21APR01	5												5												
	06-44-16	24270	MRH	21APR01	13							1					12												
	06-44-17	24537	MRH	21APR01	7												7												
	06-44-18	24229	MRH	21APR01	8												8												
	06-44-19	24974	HATFIELD	26APR01	6												6												
	06-44-20	24989	HATFIELD	26APR01	6												6												
	06-44-21	24916	HATFIELD	26APR01	15												15												
TOTAL	UPPER	98143	MRH		33												32												
TOTAL	LOWER	74879	HATFIELD		27												27												
BY00	06-44-22	25311	MRH	08MAY01	0																								
	06-44-23	24685	MRH	08MAY01	0																								
	06-44-24	26534	MRH	08MAY01	1												1												
	06-44-25	23641	MRH	08MAY01	0																								
	06-44-26	23074	HATFIELD	11MAY01	0																								
	06-44-27	23186	HATFIELD	13MAY01	1												1												
	06-44-28	23387	HATFIELD	13MAY01	0																								
TOTAL	UPPER	100171	MRH		1												1												
TOTAL	LOWER	69647	HATFIELD		1												1												
BY01	06-44-63	23188	MRH	31MAR02																									
	06-44-64	23915	MRH	31MAR02																									
	06-44-65	23775	MRH	31MAR02																									
	06-44-66	23185	MRH	31MAR02																									
	06-44-51	24380	HATFIELD	4/3-4/5																									
	06-44-52	24228	HATFIELD	4/3-4/5																									
	06-45-48	24890	HATFIELD	4/3-4/5																									
TOTAL	UPPER	94063	MRH																										
TOTAL	LOWER	73498	HATFIELD																										
BY01	06-44-82	22522	MRH	21APR02																									
	06-44-83	23086	MRH	21APR02																									
	06-44-84	23140	MRH	21APR02																									
	06-44-85	22183	MRH	21APR02																									
	06-44-86	23349	HATFIELD	4/26-4/29																									
	06-44-87	23363	HATFIELD	4/26-4/29																									
	06-44-88	23639	HATFIELD	4/26-4/29																									
TOTAL	UPPER	90931	MRH																										
TOTAL	LOWER	70351	HATFIELD																										
BY02	06-44-89	22677	MRH	13APR03																									
	06-44-90	22816	MRH	13APR03																									
	06-44-91	22946	MRH	13APR03																									
	06-44-92	21725	MRH	13APR03																									
	06-44-93	23274	HATFIELD	16APR03																									
	06-44-94	23872	HATFIELD	16APR03																									
	06-44-95	23833	HATFIELD	16APR03																									
TOTAL	UPPER	90164	MRH																										
TOTAL	LOWER	70979	HATFIELD																										
BY02	06-44-96	24232	MRH	25APR03																									
	06-44-97	23869	MRH	25APR03																									
	06-44-98	23757	MRH	25APR03																									
	06-44-99	23950	MRH	25APR03																									
	06-45-64	24545	HATFIELD	29APR03																									
	06-45-65	24483	HATFIELD	29APR93																									
	06-45-66	24358	HATFIELD	29APR03																									
TOTAL	UPPER	95808	MRH																										
TOTAL	LOWER	73386	HATFIELD																										
BY02	06-27-77	23590	MRH	04MAY03																									
	06-27-78	23862	MRH	04MAY03																									
	06-44-49	23512	MRH	04MAY03																									
	06-44-50	24330	MRH	04MAY03																									
	06-45-46	22603	HATFIELD	07MAY03																									
	06-45-47	22714	HATFIELD	07MAY03																									
	06-45-72	22649	HATFIELD	07MAY03																									
TOTAL	UPPER	95294	MRH																										
TOTAL	LOWER	67966	HATFIELD																										

TABLE 1. Merced River (5 of 6)

MERCED RIVER	JUVENILE SALMON CWT RELEASES				INLAND TOTAL BY RIVER Age 4										INLAND TOTAL BY RIVER Age 5									
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY00	06-44-15	25107	MRH	21APR01																				
	06-44-16	24270	MRH	21APR01																				
	06-44-17	24537	MRH	21APR01																				
	06-44-18	24229	MRH	21APR01																				
	06-44-19	24974	HATFIELD	26APR01																				
	06-44-20	24989	HATFIELD	26APR01																				
	06-44-21	24916	HATFIELD	26APR01																				
TOTAL	UPPER	98143	MRH																					
TOTAL	LOWER	74879	HATFIELD																					
BY00	06-44-22	25311	MRH	08MAY01																				
	06-44-23	24685	MRH	08MAY01																				
	06-44-24	26534	MRH	08MAY01																				
	06-44-25	23641	MRH	08MAY01																				
	06-44-26	23074	HATFIELD	11MAY01																				
	06-44-27	23186	HATFIELD	13MAY01																				
	06-44-28	23387	HATFIELD	13MAY01																				
TOTAL	UPPER	100171	MRH																					
TOTAL	LOWER	69647	HATFIELD																					
BY01	06-44-63	23188	MRH	31MAR02																				
	06-44-64	23915	MRH	31MAR02																				
	06-44-65	23775	MRH	31MAR02																				
	06-44-66	23185	MRH	31MAR02																				
	06-44-51	24380	HATFIELD	4/3-4/5																				
	06-44-52	24228	HATFIELD	4/3-4/5																				
	06-45-48	24890	HATFIELD	4/3-4/5																				
TOTAL	UPPER	94063	MRH																					
TOTAL	LOWER	73498	HATFIELD																					
BY01	06-44-82	22522	MRH	21APR02																				
	06-44-83	23086	MRH	21APR02																				
	06-44-84	23140	MRH	21APR02																				
	06-44-85	22183	MRH	21APR02																				
	06-44-86	23349	HATFIELD	4/26-4/29																				
	06-44-87	23363	HATFIELD	4/26-4/29																				
	06-44-88	23639	HATFIELD	4/26-4/29																				
TOTAL	UPPER	90931	MRH																					
TOTAL	LOWER	70351	HATFIELD																					
BY02	06-44-89	22677	MRH	13APR03																				
	06-44-90	22816	MRH	13APR03																				
	06-44-91	22946	MRH	13APR03																				
	06-44-92	21725	MRH	13APR03																				
	06-44-93	23274	HATFIELD	16APR03																				
	06-44-94	23872	HATFIELD	16APR03																				
	06-44-95	23833	HATFIELD	16APR03																				
TOTAL	UPPER	90164	MRH																					
TOTAL	LOWER	70979	HATFIELD																					
BY02	06-44-96	24232	MRH	25APR03																				
	06-44-97	23869	MRH	25APR03																				
	06-44-98	23757	MRH	25APR03																				
	06-44-99	23950	MRH	25APR03																				
	06-45-64	24545	HATFIELD	29APR03																				
	06-45-65	24483	HATFIELD	29APR93																				
	06-45-66	24358	HATFIELD	29APR03																				
TOTAL	UPPER	95808	MRH																					
TOTAL	LOWER	73386	HATFIELD																					
BY02	06-27-77	23590	MRH	04MAY03																				
	06-27-78	23862	MRH	04MAY03																				
	06-44-49	23512	MRH	04MAY03																				
	06-44-50	24330	MRH	04MAY03																				
	06-45-46	22603	HATFIELD	07MAY03																				
	06-45-47	22714	HATFIELD	07MAY03																				
	06-45-72	22649	HATFIELD	07MAY03																				
TOTAL	UPPER	95294	MRH																					
TOTAL	LOWER	67966	HATFIELD																					

TABLE 1. Merced River (6 of 6)

STANISLAUS RIVER	JUVENILE SALMON CWT RELEASES					JUVENILE RECOVERIES						ADULT OCEAN RECOVERIES ESTIMATED												
												1+			2+			3+			4+			1+ - 4+
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SMOLTS/ YEARLING	SJR PUSH. /SCREWTRAP	MOSSDALE	SWP	CVP	CHIPPS	JERSEY Antioch	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	COMM.	SPORT	TOTAL	TOTAL
BY 98	06-45-37	23358	KNIGHTS F	01JUN99	SMOLTS			0	7						5	0	5	1	0	1				6
	06-45-38	23532	LOWER SR	01JUN99	SMOLTS			1	5															
TOTAL	UPPER	23358	KNIGHTS F																					
	LOWER	23532	LOWER SR																					
BY 99	06-44-07	25511	KNIGHTS F	19MAY00	SMOLTS		66	18	17	3	0				7	0	7							7
	06-44-08	25786	KNIGHTS F	18MAY00	SMOLTS		77	21	12	1	0				4	0	4							4
	06-44-09	26140	KNIGHTS F	18MAY00	SMOLTS		71	17	13	0	0						0	3	0	3				3
	06-44-10	25712	TWO RIVERS	20MAY00	SMOLTS		91	52	23	4	0				0	4	4	8	0	8				12
	06-44-11	24835	TWO RIVERS	20MAY00	SMOLTS		157	32	12	0	0						0	6	0	6				6
TOTAL	UPPER	77437					214	56	42	4	0				11	0	11	3	0	3				14
	LOWER	50547					248	84	35	4	0				0	4	4	14	0	14				18
BY00	0601110804	24273	KNIGHTS F	22MAY01	SMOLTS		51	0	2	0	0			0	11	0	11							11
	0601110805	24225	KNIGHTS F	22MAY01	SMOLTS		69	0	2	0	0			0										
	0601110715	25634	TWO RIVERS	25MAY01	SMOLTS		32			0	0			0										
TOTAL	UPPER	48498					120	0	4	0	0													
	LOWER	25634					32			0	0													
BY01	06-44-46	23745	KNIGHTS F	01MAY02	SMOLTS		76	0	1	2	1													
	06-44-47	24236	KNIGHTS F	01MAY02	SMOLTS		82	1	0	2	5	0	4	4										4
	06-44-48	24646	TWO RIVERS	04MAY02	SMOLTS		196	0	0	1	3													
TOTAL	UPPER	47981					158	1	1	4	6													
	LOWER	24646					196	0	0	1	3													
BY 02	06-45-67	25599	KNIGHTS F	25APR03	SMOLTS			0	0	0	1													
	06-45-68	26226	KNIGHTS F	25APR03	SMOLTS			0	0	1	0													
	06-45-69	26136	KNIGHTS F	25APR03	SMOLTS			0	0	0	1													
	06-45-70	26101	TWO RIVERS	27APR03	SMOLTS			0	0	0	1													
	06-45-71	26632	TWO RIVERS	28APR03	SMOLTS			0	0	0	3													
TOTAL	UPPER	77961						0	0	1	2													
	LOWER	52733						0	0	0	4													

TABLE 1. Stanislaus River (1 of 3)

STANISLAUS RIVER	JUVENILE SALMON CWT RELEASES TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	ADULT INLAND TOTAL (HATCHERY AND SURVEY 2	3	4	5	Age 2 to 5 TOTAL	INLAND TOTAL BY RIVER Age 2 SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	INLAND TOTAL BY RIVER Age 3 SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY 98	06-45-37	23358	KNIGHTS F	01JUN99		1																			1				
	06-45-38	23532	LOWER SR	01JUN99																		1							
TOTAL	UPPER	23358	KNIGHTS F																										
	LOWER	23532	LOWER SR																										
BY 99	06-44-07	25511	KNIGHTS F	19MAY00		1			1																1				
	06-44-08	25786	KNIGHTS F	18MAY00		0			0																				
	06-44-09	26140	KNIGHTS F	18MAY00		1			1																1				
	06-44-10	25712	TWO RIVERS	20MAY00		4			4																2	1	1		
	06-44-11	24835	TWO RIVERS	20MAY00		3			3																	2	1		
TOTAL	UPPER	77437				2			2																				
	LOWER	50547				7			7																				
BY00	0601110804	24273	KNIGHTS F	22MAY01																									
	0601110805	24225	KNIGHTS F	22MAY01																									
	0601110715	25634	TWO RIVERS	25MAY01																									
TOTAL	UPPER	48498																											
	LOWER	25634																											
BY01	06-44-46	23745	KNIGHTS F	01MAY02																									
	06-44-47	24236	KNIGHTS F	01MAY02																									
	06-44-48	24646	TWO RIVERS	04MAY02																									
TOTAL	UPPER	47981																											
	LOWER	24646																											
BY 02	06-45-67	25599	KNIGHTS F	25APR03																									
	06-45-68	26226	KNIGHTS F	25APR03																									
	06-45-69	26136	KNIGHTS F	25APR03																									
	06-45-70	26101	TWO RIVERS	27APR03																									
	06-45-71	26632	TWO RIVERS	28APR03																									
TOTAL	UPPER	77961																											
	LOWER	52733																											

TABLE 1. Stanislaus River (2 of 3)

STANISLAUS RIVER	JUVENILE SALMON CWT RELEASES				INLAND TOTAL BY RIVER Age 4										INLAND TOTAL BY RIVER Age 5									
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY 98	06-45-37	23358	KNIGHTS F	01JUN99																				
	06-45-38	23532	LOWER SR	01JUN99																				
TOTAL	UPPER	23358	KNIGHTS F																					
	LOWER	23532	LOWER SR																					
BY 99	06-44-07	25511	KNIGHTS F	19MAY00																				
	06-44-08	25786	KNIGHTS F	18MAY00																				
	06-44-09	26140	KNIGHTS F	18MAY00																				
	06-44-10	25712	TWO RIVERS	20MAY00																				
	06-44-11	24835	TWO RIVERS	20MAY00																				
TOTAL	UPPER	77437																						
	LOWER	50547																						
BY00	0601110804	24273	KNIGHTS F	22MAY01																				
	0601110805	24225	KNIGHTS F	22MAY01																				
	0601110715	25634	TWO RIVERS	25MAY01																				
TOTAL	UPPER	48498																						
	LOWER	25634																						
BY01	06-44-46	23745	KNIGHTS F	01MAY02																				
	06-44-47	24236	KNIGHTS F	01MAY02																				
	06-44-48	24646	TWO RIVERS	04MAY02																				
TOTAL	UPPER	47981																						
	LOWER	24646																						
BY 02	06-45-67	25599	KNIGHTS F	25APR03																				
	06-45-68	26226	KNIGHTS F	25APR03																				
	06-45-69	26136	KNIGHTS F	25APR03																				
	06-45-70	26101	TWO RIVERS	27APR03																				
	06-45-71	26632	TWO RIVERS	28APR03																				
TOTAL	UPPER	77961																						
	LOWER	52733																						

TABLE 1. Stanislaus River (3 of 3)

SAN JOAQUIN RIVER	JUVENILE SALMON CWT RELEASES					JUVENILE RECOVERIES						ADULT OCEAN RECOVERIES ESTIMATED												
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SMOLTS/ YEARLING	SJR PUSH. /SCREWTRAP	MOSSDALE	SWP	CVP	CHIPPS	JERSEY	1+ COMM.	1+ SPORT	1+ TOTAL	2+ COMM.	2+ SPORT	2+ TOTAL	3+ COMM.	3+ SPORT	3+ TOTAL	4+ COMM.	4+ SPORT	4+ TOTAL	1+ - 4+ TOTAL
BY 97	61110809	26465	MOSSDALE	16APR98	SMOLTS		129	0	1	25	20	0	15	15	35	6	42	4	0	4				61
	61110810	25264	MOSSDALE	16APR98	SMOLTS		116	0	2	31	17	0	10	10	21	7	29	1	0	1				40
	61110811	25926	MOSSDALE	16APR98	SMOLTS		109	0	1	32	33	0	8	8	36	12	48	2	0	2				58
	61110806	26215	DOS REIS	17APR98	SMOLTS			0	0	33	56	0	3	3	19	26	44							47
	61110807	26366	DOS REIS	17APR98	SMOLTS			0	0	23	40				22	13	35							35
	61110808	24792	DOS REIS	17APR98	SMOLTS			0	0	34	39	0	4	4	34	20	53	4	0	4				61
	61110812	24598	JERSEY PT	20APR98	SMOLTS			0	0	87	20	0	8	8	58	38	96	4	3	6				110
	61110813	25673	JERSEY PT	20APR98	SMOLTS			0	0	100	28	0	6	6	63	20	84	1	0	1				91
TOTAL		77655	MOSSDALE				354	0	4	88	70	0	33	33	92	25	119	7	0	7				159
		77373	DOS REIS					0	0	90	135	0	7	7	75	59	132	4	0	4				143
		50271	JERSEY PT					0	0		48	0	14	14	121	58	180	5	3	7				201
BY 98	064606	25005	MOSSDALE	20APR99	SMOLTS		1230	76	54	2	4	0	1	1	43	16	58	8	0	8				67
	062642	24715	MOSSDALE	19APR99	SMOLTS		118	74	50	8	21	8	7	15	79	14	93	13	7	20				128
	062643	24725	MOSSDALE	19APR99	SMOLTS		103	77	52	15	21	0	14	14	80	34	112	2	6	8				134
	062644	25433	MOSSDALE	19APR99	SMOLTS		126	76	56	13	15	0	4	4	98	12	110	14	4	18				132
	062645	25014	DOS REIS	19APR99	SMOLTS			4	8	20	42	0	13	13	104	26	130	8	0	8				151
	062646	24841	DOS REIS	19APR99	SMOLTS			4	7	19	47	0	18	18	164	22	187	13	2	14				219
	0601110815	24927	JERSEY PT	21APR99	SMOLTS			4	1	34		0	25	25	181	61	242	58	8	66	5	0	5	338
	062647	24193	JERSEY PT	21APR99	SMOLTS			1	0	25		2	17	19	236	68	304	34	23	58				381
TOTAL		99878	MOSSDALE					303	212	38	61	8	26	34	300	76	373	37	17	54	0	0	0	461
		49855	DOS REIS					8	15	39	89	0	31	31	268	48	317	21	2	22	0	0	0	370
		49120	JERSEY PT					5	1	59		2	42	44	417	129	546	92	31	124	5	0	5	719
BY 99	06-45-63	24457	DFP	17APR00	SMOLTS		20	40	1	11	11	6	4	10	147	78	225	4	0	4				239
	06-04-01	23529	DFP	17APR00	SMOLTS		20	33	2	7	6	3	11	14	130	46	176	18	0	18				208
	06-04-02	24177	DFP	17APR00	SMOLTS		19	31	2	10	10	2	18	20	148	57	205	1	0	1				226
	06-44-01	23465	MOSSDALE	18APR00	SMOLTS		7	41	1	9	14	0	13	13	138	47	185	8	0	8				206
	06-44-02	22784	MOSSDALE	18APR00	SMOLTS		10	45	1	9	16	5	4	9	121	28	150	10	1	11				170
	06-44-05	23371	MOSSDALE	4/19-5/03	SMOLTS		21	32	1	7	9	4	4	8	87	52	140	7	0	7				155
	06-44-03	25527	JERSEY PT	20APR00	SMOLTS			0	0	24	50	12	44	56	399	142	542	39	7	45				643
	06-44-04	25824	JERSEY PT	20APR00	SMOLTS			0	0	41	47	10	14	24	451	142	593	67	6	73				690
TOTAL		72163	DFP				59	104	5	28	27	11	33	44	425	181	606	23	0	23				673
		69620	MOSSDALE				38	118	3	25	39	9	21	30	346	127	475	25	1	26				531
		51351	JERSEY PT				0	0	0	65	97	22	58	80	850	284	1135	106	13	118				1333
BY 99	0601060914	23698	DFP	28APR00	SMOLTS		27	15	1	7	8	0	4	4	29	10	39	3	0	3				46
	0601060915	26805	DFP	28APR00	SMOLTS		32	19	2	5	15	0	4	4	32	0	32	6	0	6				42
	0601110814	23889	DFP	28APR00	SMOLTS		35	12	1	10	8	0	0	0	61	8	70							70
	0601061001	25572	JERSEY PT	01MAY00	SMOLTS			1	0	48	76	0	14	14	223	63	286	44	12	56				356
	0601061002	24661	JERSEY PT	01MAY00	SMOLTS			1	0	30	76	11	22	33	140	42	182	13	0	13				228
TOTAL		74392	DFP				94	46	4	22	31	0	8	8	122	18	141	9	0	9				158
		50233	JERSEY PT					2	0	78	152	11	36	47	363	105	468	57	12	69				584
BY 00	06-44-29	23354	DFP	30APR01	SMOLTS			0	1	14	28	0	4	4	54	12	66							70
	06-44-30	22837	DFP	30APR01	SMOLTS			0	2	22	30	3	24	26	98	17	115							141
	06-44-31	22491	DFP	30APR01	SMOLTS			0	4	17	18	0	4	4	76	14	90							94
	06-44-32	23000	MOSSDALE	01MAY01	SMOLTS			2	2	17	18	4	12	16	84	16	100							116
	06-44-33	22177	MOSSDALE	01MAY01	SMOLTS			0	1	14	15	0	0	0	87	13	101							101
	06-44-34	24443	JERSEY PT	04MAY01	SMOLTS					50	156	13	38	50	328	38	366							416
	06-44-35	24992	JERSEY PT	04MAY01	SMOLTS					61	173	27	45	72	299	96	395							467
TOTAL		68682	DFP					0	7	53	76	3	32	34	228	43	271							305
		45177	MOSSDALE					2	3	31	33	4	12	16	171	29	201							217
		49435	JERSEY PT							111	329	40	83	122	627	134	761							883

TABLE 1. San Joaquin River (1 of 6)

SAN JOAQUIN RIVER JUVENILE SALMON CWT RELEASES					ADULT INLAND TOTAL (HATCHERY AND SURVEY				Age 2 to 5	INLAND TOTAL BY RIVER Age 2										INLAND TOTAL BY RIVER Age 3									
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	2	3	4	5	TOTAL	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY 97	61110809	26465	MOSSDALE	16APR98	5	7	1		13								5									3	4		
	61110810	25264	MOSSDALE	16APR98	4	5	0		9								4									1	4		
	61110811	25926	MOSSDALE	16APR98	6	8	0		14								6									4	4		
	61110806	26215	DOS REIS	17APR98	5	10	2		17								5									3	7		
	61110807	26366	DOS REIS	17APR98	7	10	3		20								7									1	9		
	61110808	24792	DOS REIS	17APR98	7	8	1		16								7									1	7		
	61110812	24598	JERSEY PT	20APR98	5	8	0		13								5										8		
	61110813	25673	JERSEY PT	20APR98	13	7	2		22								13									3	4		
TOTAL		77655	MOSSDALE		15	20	1		36								15									8	12		
		77373	DOS REIS		19	28	6		53								19									5	23		
		50271	JERSEY PT		18	15	2		35								18									3	12		
BY 98	064606	25005	MOSSDALE	20APR99	6	14	5		25						1		5					1	1	1	1	2	8		
	062642	24715	MOSSDALE	19APR99	4	23	7		34							1	3						1	1		2	19		
	062643	24725	MOSSDALE	19APR99	1	25	8		34							1						1			2	9	13		
	062644	25433	MOSSDALE	19APR99	7	33	6		46							1	6					1		1	1	5	25		
	062645	25014	DOS REIS	19APR99	11	45	13		69							5	6							1	6	4	34		
	062646	24841	DOS REIS	19APR99	5	36	11		52								5					3	1	1	2	4	25		
	0601110815	24927	JERSEY PT	21APR99	7	38	10		55								7					22	1	2			13		
	062647	24193	JERSEY PT	21APR99	6	44	12		62							1	5			2		16	4	4		1	17		
TOTAL		99878	MOSSDALE		18	95	26		139											0	0	3	2	3	4	18	65		
		49855	DOS REIS		16	81	24		121											0	0	3	1	2	8	8	59		
		49120	JERSEY PT		13	82	22		117											2	0	38	5	6	0	1	30		
BY 99	06-45-63	24457	DFP	17APR00	19	58			77			1			1	6	11					1		1	10	26	20		
	06-04-01	23529	DFP	17APR00	32	51			83			2			1	9	20			1			1		6	23	20		
	06-04-02	24177	DFP	17APR00	23	67			90						1	4	18					1			5	25	36		
	06-44-01	23465	MOSSDALE	18APR00	18	67			85			1		1		4	12							1	9	20	37		
	06-44-02	22784	MOSSDALE	18APR00	13	54			67	1		1			1	3	7					2			3	11	38		
	06-44-05	23371	MOSSDALE	4/19-5/03	19	52			71							5	14			1				2	8	11	30		
	06-44-03	25527	JERSEY PT	20APR00	68	124			192			7	3	12	1		45			2		16	6	11	7	8	74		
	06-44-04	25824	JERSEY PT	20APR00	84	123			207			11	4	14		5	50			2		15	10	14	3	7	72		
TOTAL		72163	DFP		74	176			250	0		3	0	0	3	19	49			1	0	2	1	1	21	74	76		
		69620	MOSSDALE		50	173			223	1		2	0	1	1	12	33			1	0	2	0	3	20	42	105		
		51351	JERSEY PT		152	247			399	0		18	7	26	1	5	95			4	0	31	16	25	10	15	146		
BY 99	0601060914	23698	DFP	28APR00	13	21			34							4	9					2		1	3	8	7		
	0601060915	26805	DFP	28APR00	6	23			29						1	2	3							1	4	11	7		
	0601110814	23889	DFP	28APR00	1	16			17			1													4	5	7		
	0601061001	25572	JERSEY PT	01MAY00	43	60			103			8	3	3	2	3	24					1	5	5	2	7	40		
	0601061002	24661	JERSEY PT	01MAY00	25	37			62			3	1	4			17			1	1	5	2	2	2	5	19		
TOTAL		74392	DFP		20	60			80	0	0	1	0	0	1	6	12			0	0	2	0	2	11	24	21		
		50233	JERSEY PT		68	97			165	0	0	11	4	7	2	3	41			1	1	6	7	7	4	12	59		
BY 00	06-44-29	23354	DFP	30APR01	15							1			2	1	11												
	06-44-30	22837	DFP	30APR01	31							2			5	10	14												
	06-44-31	22491	DFP	30APR01	23							1	1		4	3	14												
	06-44-32	23000	MOSSDALE	01MAY01	23										5	6	12												
	06-44-33	22177	MOSSDALE	01MAY01	26							2			2	2	20												
	06-44-34	24443	JERSEY PT	04MAY01	64							8	1	6		2	47												
	06-44-35	24992	JERSEY PT	04MAY01	78					1		6	5	6	4	4	52												
TOTAL		68682	DFP		69					0	0	4	1	0	11	14	39												
		45177	MOSSDALE		49					0	0	2	0	0	7	8	32												
		49435	JERSEY PT		142					1	0	14	6	12	4	6	99												

TABLE 1. San Joaquin River (2 of 6)

SAN JOAQUIN RIVER JUVENILE SALMON CWT RELEASES					INLAND TOTAL BY RIVER										INLAND TOTAL BY RIVER									
		EFFECTIVE	RELEASE		Age 4										Age 5									
	TAG NO.	RELEASE	SITE	DATE	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY 97	61110809	26465	MOSSDALE	16APR98					1															
	61110810	25264	MOSSDALE	16APR98																				
	61110811	25926	MOSSDALE	16APR98																				
	61110806	26215	DOS REIS	17APR98	1						1													
	61110807	26366	DOS REIS	17APR98					1		2													
	61110808	24792	DOS REIS	17APR98								1												
	61110812	24598	JERSEY PT	20APR98																				
	61110813	25673	JERSEY PT	20APR98								2												
TOTAL		77655	MOSSDALE								0	0												
		77373	DOS REIS								3	1												
		50271	JERSEY PT								0	2												
BY 98	064606	25005	MOSSDALE	20APR99				1			3	1												
	062642	24715	MOSSDALE	19APR99			1			1	1	4												
	062643	24725	MOSSDALE	19APR99			1			3	2	2												
	062644	25433	MOSSDALE	19APR99					1		5													
	062645	25014	DOS REIS	19APR99				1		2	2	8												
	062646	24841	DOS REIS	19APR99						2	4	5												
	0601110815	24927	JERSEY PT	21APR99			5	1		1	1	2												
	062647	24193	JERSEY PT	21APR99			8	1				3												
TOTAL		99878	MOSSDALE				2	1	1	4	11	7												
		49855	DOS REIS				0	1	0	4	6	13												
		49120	JERSEY PT				13	2	0	1	1	5												
BY 99	06-45-63	24457	DFP	17APR00																				
	06-04-01	23529	DFP	17APR00																				
	06-04-02	24177	DFP	17APR00																				
	06-44-01	23465	MOSSDALE	18APR00																				
	06-44-02	22784	MOSSDALE	18APR00																				
	06-44-05	23371	MOSSDALE	4/19-5/03																				
	06-44-03	25527	JERSEY PT	20APR00																				
	06-44-04	25824	JERSEY PT	20APR00																				
TOTAL		72163	DFP																					
		69620	MOSSDALE																					
		51351	JERSEY PT																					
BY 99	0601060914	23698	DFP	28APR00																				
	0601060915	26805	DFP	28APR00																				
	0601110814	23889	DFP	28APR00																				
	0601061001	25572	JERSEY PT	01MAY00																				
	0601061002	24661	JERSEY PT	01MAY00																				
TOTAL		74392	DFP																					
		50233	JERSEY PT																					
BY 00	06-44-29	23354	DFP	30APR01																				
	06-44-30	22837	DFP	30APR01																				
	06-44-31	22491	DFP	30APR01																				
	06-44-32	23000	MOSSDALE	01MAY01																				
	06-44-33	22177	MOSSDALE	01MAY01																				
	06-44-34	24443	JERSEY PT	04MAY01																				
	06-44-35	24992	JERSEY PT	04MAY01																				
TOTAL		68682	DFP																					
		45177	MOSSDALE																					
		49435	JERSEY PT																					

TABLE 1. San Joaquin River (3 of 6)

SAN JOAQUIN RIVER	JUVENILE SALMON CWT RELEASES					JUVENILE RECOVERIES					ADULT OCEAN RECOVERIES ESTIMATED												
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SMOLTS/ YEARLING	SJR PUSH. MOSSDALE /SCREWTRAP	SWP	CVP	CHIPPS	JERSEY	1+ COMM.	1+ SPORT	1+ TOTAL	2+ COMM.	2+ SPORT	2+ TOTAL	3+ COMM.	3+ SPORT	3+ TOTAL	4+ COMM.	4+ SPORT	4+ TOTAL	1+ - 4+ TOTAL
BY 00	06-44-36	24025	DFP	07MAY01	SMOLTS		1	1	2	8	0	5	5	6	3	9							14
	06-44-37	24029	DFP	07MAY01	SMOLTS		0	0	5	11	4	4	9	17	8	26							35
	06-44-38	24177	DFP	07MAY01	SMOLTS		1	1	2	10	0	4	4	18	3	21							25
	06-44-39	23878	MOSSDALE	08MAY01	SMOLTS		0	1	4	8	0	11	11	3	5	8							19
	06-44-40	25308	MOSSDALE	08MAY01	SMOLTS		2	1	4	11	0	0	0	21	6	27							27
	06-44-41	25909	JERSEY PT	11MAY01	SMOLTS				17	43	0	18	18	157	15	173							191
	06-44-42	25465	JERSEY PT	11MAY01	SMOLTS				27	53	9	4	13	223	34	257							270
TOTAL		72231	DFP				2	2	9	29	4	13	18	41	14	56							74
		49186	MOSSDALE				2	2	8	19	0	11	11	24	11	35							46
		51374	JERSEY PT						44	96	9	22	31	380	49	430							461
BY01	06-44-71	23920	DFP	18APR02	SMOLTS		2	1	4	11			0										
	06-44-72	25176	DFP	18APR02	SMOLTS		7	5	9	20	0	12	12										
	06-44-73	23872	DFP	18APR02	SMOLTS		5	0	4	12			0										
	06-44-74	24747	DFP	18APR02	SMOLTS		7	2	4	20			0										
	06-44-57	25515	MOSSDALE	19APR02	SMOLTS		14	2	6	13			0										
	06-44-58	25272	MOSSDALE	19APR02	SMOLTS		7	6	7	29			0										
	06-44-59	24802	JERSEY PT	22APR02	SMOLTS				46	101	2	32	34										
	06-44-60	24128	JERSEY PT	22APR02	SMOLTS				37	89	0	40	40										
TOTAL		97715	DFP				21	8	21	63	0	12	12										
		50787	MOSSDALE				21	8	13	42	0	0	0										
		48930	JERSEY PT						83	190	2	72	74										
BY01	06-44-70	24680	DFP	25APR02	SMOLTS		1	3	3	6													
	06-44-75	24659	DFP	25APR02	SMOLTS		4	0	5	2	0	3	3										
	06-44-76	24783	DFP	25APR02	SMOLTS		4	2	3	4													
	06-44-77	24381	DFP	25APR02	SMOLTS		4	2	4	6													
	06-44-78	24519	MOSSDALE	26APR02	SMOLTS		8	1	2	3	0	3	3										
	06-44-79	24820	MOSSDALE	26APR02	SMOLTS		3	0	3	4													
	06-44-80	24032	JERSEY PT	30APR02	SMOLTS				18	43	0	14	14										
	06-44-81	22880	JERSEY PT	30APR02	SMOLTS				28	32	0	19	19										
TOTAL		98503	DFP				13	7	15	18	0	3	3										
		49339	MOSSDALE				11	1	5	7	0	3	3										
		46912	JERSEY PT						46	75	0	33	33										
BY02	06-02-82	24563	DFP	21APR03	SMOLTS		0	2	0	1													
	06-02-83	26036	DFP	21APR03	SMOLTS		0	1	2	4													
	06-27-42	24179	DFP	21APR03	SMOLTS		1	2	1	1													
	06-27-48	24706	MOSSDALE	22APR03	SMOLTS		0	0	2	2													
	06-27-43	25480	MOSSDALE	22APR03	SMOLTS		0	0	3	2													
	06-27-44	24649	JERSEY PT	25APR03	SMOLTS				57	71													
TOTAL		74778	DFP				1	5	3	6													
		50186	MOSSDALE				0	0	5	4													
		24649	JERSEY PT						57	71													
BY02	06-27-45	24815	DFP	28APR03	SMOLTS		0	1	0	0													
	06-27-46	25319	DFP	28APR03	SMOLTS		0	1	0	0													
	06-27-47	24758	DFP	28APR03	SMOLTS		0	0	0	0													
	06-27-49	24219	MOSSDALE	29APR03	SMOLTS		0	1	0	0													
	06-27-50	24505	MOSSDALE	29APR03	SMOLTS		0	0	1	0													
	06-27-51	25950	JERSEY PT	02MAY03	SMOLTS				39	36													
TOTAL		74892	DFP				0	2	0	0													
		48724	MOSSDALE				0	1	1	0													
		25950	JERSEY PT						39	36													

TABLE 1. San Joaquin River (4 of 6)

SAN JOAQUIN RIVER	JUVENILE SALMON CWT RELEASES				ADULT INLAND TOTAL (HATCHERY AND SURVEY				Age 2 to 5	INLAND TOTAL BY RIVER Age 2										INLAND TOTAL BY RIVER Age 3									
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	2	3	4	5	TOTAL	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY 00	06-44-36	24025	DFP	07MAY01	3												3												
	06-44-37	24029	DFP	07MAY01	3										1	0	2												
	06-44-38	24177	DFP	07MAY01	1												1												
	06-44-39	23878	MOSSDALE	08MAY01	3											1	2												
	06-44-40	25308	MOSSDALE	08MAY01	2										1	0	1												
	06-44-41	25909	JERSEY PT	11MAY01	30					1		1	1	5	1	0	21												
	06-44-42	25465	JERSEY PT	11MAY01	29					1		1	2	5	1	2	17												
TOTAL		72231	DFP		7										1	0	6												
		49186	MOSSDALE		5										1	1	3												
		51374	JERSEY PT		59					2	0	2	3	10	2	2	38												
BY01	06-44-71	23920	DFP	18APR02																									
	06-44-72	25176	DFP	18APR02																									
	06-44-73	23872	DFP	18APR02																									
	06-44-74	24747	DFP	18APR02																									
	06-44-57	25515	MOSSDALE	19APR02																									
	06-44-58	25272	MOSSDALE	19APR02																									
	06-44-59	24802	JERSEY PT	22APR02																									
	06-44-60	24128	JERSEY PT	22APR02																									
TOTAL		97715	DFP																										
		50787	MOSSDALE																										
		48930	JERSEY PT																										
BY01	06-44-70	24680	DFP	25APR02																									
	06-44-75	24659	DFP	25APR02																									
	06-44-76	24783	DFP	25APR02																									
	06-44-77	24381	DFP	25APR02																									
	06-44-78	24519	MOSSDALE	26APR02																									
	06-44-79	24820	MOSSDALE	26APR02																									
	06-44-80	24032	JERSEY PT	30APR02																									
	06-44-81	22880	JERSEY PT	30APR02																									
TOTAL		98503	DFP																										
		49339	MOSSDALE																										
		46912	JERSEY PT																										
BY02	06-02-82	24563	DFP	21APR03																									
	06-02-83	26036	DFP	21APR03																									
	06-27-42	24179	DFP	21APR03																									
	06-27-48	24706	MOSSDALE	22APR03																									
	06-27-43	25480	MOSSDALE	22APR03																									
	06-27-44	24649	JERSEY PT	25APR03																									
TOTAL		74778	DFP																										
		50186	MOSSDALE																										
		24649	JERSEY PT																										
BY02	06-27-45	24815	DFP	28APR03																									
	06-27-46	25319	DFP	28APR03																									
	06-27-47	24758	DFP	28APR03																									
	06-27-49	24219	MOSSDALE	29APR03																									
	06-27-50	24505	MOSSDALE	29APR03																									
	06-27-51	25950	JERSEY PT	02MAY03																									
TOTAL		74892	DFP																										
		48724	MOSSDALE																										
		25950	JERSEY PT																										

TABLE 1. San Joaquin River (5 of 6)

SAN JOAQUIN RIVER JUVENILE SALMON CWT RELEASES					INLAND TOTAL BY RIVER Age 4										INLAND TOTAL BY RIVER Age 5									
	TAG NO.	EFFECTIVE RELEASE	RELEASE SITE	DATE	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER	SAC.	BATT.	FEATH.	AMER.	MOK.	STAN.	TUOL.	MER.	LBWA	OTHER
BY 00	06-44-36	24025	DFP	07MAY01																				
	06-44-37	24029	DFP	07MAY01																				
	06-44-38	24177	DFP	07MAY01																				
	06-44-39	23878	MOSSDALE	08MAY01																				
	06-44-40	25308	MOSSDALE	08MAY01																				
	06-44-41	25909	JERSEY PT	11MAY01																				
	06-44-42	25465	JERSEY PT	11MAY01																				
TOTAL		72231	DFP																					
		49186	MOSSDALE																					
		51374	JERSEY PT																					
BY01	06-44-71	23920	DFP	18APR02																				
	06-44-72	25176	DFP	18APR02																				
	06-44-73	23872	DFP	18APR02																				
	06-44-74	24747	DFP	18APR02																				
	06-44-57	25515	MOSSDALE	19APR02																				
	06-44-58	25272	MOSSDALE	19APR02																				
	06-44-59	24802	JERSEY PT	22APR02																				
	06-44-60	24128	JERSEY PT	22APR02																				
TOTAL		97715	DFP																					
		50787	MOSSDALE																					
		48930	JERSEY PT																					
BY01	06-44-70	24680	DFP	25APR02																				
	06-44-75	24659	DFP	25APR02																				
	06-44-76	24783	DFP	25APR02																				
	06-44-77	24381	DFP	25APR02																				
	06-44-78	24519	MOSSDALE	26APR02																				
	06-44-79	24820	MOSSDALE	26APR02																				
	06-44-80	24032	JERSEY PT	30APR02																				
	06-44-81	22880	JERSEY PT	30APR02																				
TOTAL		98503	DFP																					
		49339	MOSSDALE																					
		46912	JERSEY PT																					
BY02	06-02-82	24563	DFP	21APR03																				
	06-02-83	26036	DFP	21APR03																				
	06-27-42	24179	DFP	21APR03																				
	06-27-48	24706	MOSSDALE	22APR03																				
	06-27-43	25480	MOSSDALE	22APR03																				
	06-27-44	24649	JERSEY PT	25APR03																				
TOTAL		74778	DFP																					
		50186	MOSSDALE																					
		24649	JERSEY PT																					
BY02	06-27-45	24815	DFP	28APR03																				
	06-27-46	25319	DFP	28APR03																				
	06-27-47	24758	DFP	28APR03																				
	06-27-49	24219	MOSSDALE	29APR03																				
	06-27-50	24505	MOSSDALE	29APR03																				
	06-27-51	25950	JERSEY PT	02MAY03																				
TOTAL		74892	DFP																					
		48724	MOSSDALE																					
		25950	JERSEY PT																					

TABLE 1. San Joaquin River (5 of 6)

TUOLUMNE RIVER -LARGE GROUP- CWT RELEASES AND RECOVERIES

RELEASE YEAR	TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	RIVER WT	RELEASE SITE	DATE	SMOLT RECOVERIES PUSHNET/ RS TRAP	MOSS-DALE	SWP PUMPS	EXPAND. SWP	CVP PUMPS	EXPAND. CVP	JERSEY PT. (ANTIOCH)	JERSEY(ANT) SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	OCEAN CATCH EXPD.	SPAWN
1986	06-46-54	49,630			OLGB	14APR86	-	-	131		183		-	-	16		226	976	60
LG FLOW:	06-46-55	49,518			OLGB	14APR86	-	-	135		205		-	-	18		210	929	58
6600 cfs	06-46-56	51,300			MAPES	14APR86	-	-	159		255		-	-	10		219	969	54
w/o HORB	06-46-57	52,174			MAPES	14APR86	-	-	155		238		-	-	10		231	1037	50
TOTAL	UPPER	99,148	81	51	OLGB	RM diff.	-	-	266	6573	388	3312	-	-	34	0.40	436	1905	118
TOTAL	LOWER	103,474	80	51	MAPES	= 50	-	-	314	7351	493	3465	-	-	20	0.27	450	2006	104
1987	06-46-60	29,953			OLGB	16APR87	97	47	20		44		-	-	2		10	32	2
	06-46-61	30,609			OLGB	16APR87	137	47	23		48		-	-	0		6	37	1
LG FLOW:	06-46-62	29,037			OLGB	16APR87	120	34	22		46		-	-	3		7	31	5
560 cfs	06-46-63	30,703			RDP	16APR87	374	109	184		71		-	-	4		25	142	12
w/o HORB	06-45-01	31,869			RDP	16APR87	339	91	213		62		-	-	5		25	141	8
	06-45-02	30,937			RDP	16APR87	353	117	204		79		-	-	8		23	82	9
TOTAL	UPPER	89,599	85	55	OLGB	RM diff.	354	128	65	593	138	1648	-	-	5	0.05	23	100	8
TOTAL	LOWER	93,509	82	64	RDP	= 38	1066	317	601	5685	212	2569	-	-	17	0.18	73	365	29
1990	H601110201	23,494			OLGB	30APR90	-	19	40		23		-	-	1		0	0	0
	H601110202	21,766			OLGB	30APR90	-	12	27		11		-	-	1		0	0	0
LG FLOW:	H601110114	24,134			OLGB	30APR90	-	21	45		25		-	-	1		2	12	0
600 cfs	H601110115	24,259			OLGB	30APR90	-	11	34		18		-	-	1		1	5	0
w/o HORB	H601110203	27,263			MAPES	01MAY90	-	47	29		26		-	-	1		1	1	0
	H601110204	26,067			MAPES	01MAY90	-	47	21		21		-	-	0		1	17	0
	H601110205	24,905			MAPES	01MAY90	-	75	2		27		-	-	0		0	0	0
TOTAL	UPPER	93,653	83	52	OLGB	RM diff.	-	63	146	878	77	440	-	-	4	0.04	3	17	0
TOTAL	LOWER	78,235	72	66	MAPES	= 50	-	169	52	463	74	316	-	-	1	0.01	2	18	0
1994	0601110302	27,803			OLGB	23APR94	-	85	2	7	1	12	-	-	2		24	86	39
LG FLOW:	0601110303	27,803			OLGB	23APR94	-	62	2	40	1	12	-	-	1		23	86	44
1200 cfs	0601110304	27,802			OLGB	23APR94	-	60	2	4	0	0	-	-	0		24	81	31
w/ HORB	0601110305	25,029			MAPES	24APR94	-	47	0	0	3	48	-	-	1		28	110	46
	0601110306	25,029			MAPES	24APR94	-	25	2	14	2	24	-	-	1		15	43	27
TOTAL	UPPER	83,408	85	51	OLGB	RM diff.	-	207	6	51	2	24	-	-	3	0.03	71	253	114
TOTAL	LOWER	50,058	82	62	MAPES	= 50	-	72	2	14	5	72	-	-	2	0.04	43	153	73
1995	H61110311	29,989			OLGB	04MAY95		22	28	474	48	510	-	-	8		87	290	50
LG FLOW:	H61110312	28,988			OLGB	04MAY95		16	13	177	43	461	-	-	5		96	337	59
7700 cfs	H61110313	30,287			OLGB	04MAY95		20	17	277	55	572	-	-	8		108	373	54
w/o HORB	H61110314	27,770			SERVICE	05MAY95		23	19	236	57	607	-	-	5		91	315	67
	H61110315	29,139			SERVICE	05MAY95		23	19	203	67	707	-	-	7		96	310	82
TOTAL	UPPER	83,549	86	48	OLGB	RM diff.	11	58	58	928	146	1543	-	-	21	0.25	291	1000	163
TOTAL	LOWER	53,298	89	51	SERV.RD	= 41.5	11	46	38	439	124	1314	-	-	12	0.22	187	625	149
1996	H61110506	21,501			OLGB	26APR96		25	2	18	14	192	-	-	0		1	3	2
LG FLOW:	H61110507	22,761			OLGB	26APR96		16	2	8	7	84	-	-	2		2	9	2
2600 cfs	H61110508	22,893			OLGB	26APR96		23	4	24	11	132	-	-	1		3	8	5
w/o HORB	H61110509	22,715			SERVICE	27APR96		67	2	24	13	180	-	-	1		3	10	4
	H61110510	27,745			SERVICE	27APR96		89	2	0	17	240	-	-	3		4	13	5
TOTAL	UPPER	67,155	88	49	OLGB	RM diff.	222	64	8	50	32	408	-	-	3	0.04	6	20	9
TOTAL	LOWER	50,460	90	57	SERVICE	= 41.5	133	156	4	24	30	420	-	-	4	0.07	7	23	9
1997	H61110607	35,004			OLGB	22APR97	4	8	1	12	7	84	1		1		3	6	18
	H61110608	33,695			OLGB	22APR97	5	12	3	16	16	204	2		0		7	29	11
LG FLOW:	H61110609	27,622			OLGB	22APR97	4	10	1	8	8	96	3		1		8	30	7
2800 cfs	H61110610	8,882			OLGB	22APR97	0	2	0	0	1	12	0		1		1	3	2
w/ HORB	H61110604	31,739			SERVICE	23APR97	52	14	4	28	4	48	19		6		25	83	55
	H61110605	32,297			SERVICE	23APR97	66	22	3	14	6	72	13		2		21	84	46
	H61110606	27,075			SERVICE	23APR97	43	20	2	6	7	84	7		4		11	46	26
TOTAL	UPPER	93,501	71	48	OLGB	RM diff.	13	32	5	36	32	396	6	0.01	3	0.04	19	68	38
TOTAL	LOWER	72,464	75	56	SERVICE	= 41.5	161	56	9	48	17	204	39	0.11	12	0.17	57	213	127

TABLE 2. Recovery data and survival indices for Tuolumne River CWT smolt survival releases.

TUOLUMNE RIVER -LARGE GROUP- CWT RELEASES AND RECOVERIES

RELEASE YEAR	TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	RIVER WT	RELEASE SITE	DATE	SMOLT SURVIVAL INDEX (Upper / Lower; corrected for release group number) PUSHNET/ RS TRAP	MOSS-DALE	SWP PUMPS	SWP EXPD.	CVP PUMPS	CVP EXPD.	JERSEY PT. (ANTIOCH)	JERSEY(ANT) SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	OCEAN CATCH EXPD.	SPAWN
1986	06-46-54	49,630			OLGB	14APR86													
LG FLOW:	06-46-55	49,518			OLGB	14APR86													
6600 cfs	06-46-56	51,300			MAPES	14APR86													
w/o HORB	06-46-57	52,174			MAPES	14APR86													
TOTAL	UPPER	99,148	81	51	OLGB	RM diff.	NA	NA	0.88	0.93	0.82	1.00	NA		1.77	1.48	1.01	0.99	1.18
TOTAL	LOWER	103,474	80	51	MAPES	= 50													
1987	06-46-60	29,953			OLGB	16APR87													
	06-46-61	30,609			OLGB	16APR87													
LG FLOW:	06-46-62	29,037			OLGB	16APR87													
560 cfs	06-46-63	30,703			RDP	16APR87													
w/o HORB	06-45-01	31,869			RDP	16APR87													
	06-45-02	30,937			RDP	16APR87													
TOTAL	UPPER	89,599	85	55	OLGB	RM diff.	0.35	0.42	0.11	0.11	0.68	0.67	NA		0.31	0.28	0.33	0.29	0.29
TOTAL	LOWER	93,509	82	64	RDP	= 38		(.31?)											
1990	H601110201	23,494			OLGB	30APR90													
	H601110202	21,766			OLGB	30APR90													
LG FLOW:	H601110114	24,134			OLGB	30APR90													
600 cfs	H601110115	24,259			OLGB	30APR90													
w/o HORB	H601110203	27,263			MAPES	01MAY90													
	H601110204	26,067			MAPES	01MAY90													
	H601110205	24,905			MAPES	01MAY90													
TOTAL	UPPER	93,653	83	52	OLGB	RM diff.	NA	0.31	2.35	1.58	0.87	1.16	NA		3.34	4.00	1.25	0.79	NO
TOTAL	LOWER	78,235	72	66	MAPES	= 50													RECOVS.
1994	0601110302	27,803			OLGB	23APR94													
LG FLOW:	0601110303	27,803			OLGB	23APR94													
1200 cfs	0601110304	27,802			OLGB	23APR94													
w/ HORB	0601110305	25,029			MAPES	24APR94													
	0601110306	25,029			MAPES	24APR94													
TOTAL	UPPER	83,408	85	51	OLGB	RM diff.	NA	1.73	1.80	2.19	0.24	0.20	NA		0.90	0.89	0.99	0.99	0.94
TOTAL	LOWER	50,058	82	62	MAPES	= 50													
1995	H61110311	29,989			OLGB	04MAY95													
LG FLOW:	H61110312	28,988			OLGB	04MAY95													
7700 cfs	H61110313	30,287			OLGB	04MAY95													
w/o HORB	H61110314	27,770			SERVICE	05MAY95													
	H61110315	29,139			SERVICE	05MAY95													
TOTAL	UPPER	83,549	86	48	OLGB	RM diff.	0.64	0.80	0.97	1.35	0.75	0.75	NA		1.12	1.14	0.99	1.02	0.70
TOTAL	LOWER	53,298	89	51	SERV.RD	= 41.5													
1996	H61110506	21,501			OLGB	26APR96													
LG FLOW:	H61110507	22,761			OLGB	26APR96													
2600 cfs	H61110508	22,893			OLGB	26APR96													
w/o HORB	H61110509	22,715			SERVICE	27APR96													
	H61110510	27,745			SERVICE	27APR96													
TOTAL	UPPER	67,155	88	49	OLGB	RM diff.	1.25	0.31	1.50	1.57	0.80	0.73	NA		0.56	0.57	0.64	0.65	0.75
TOTAL	LOWER	50,460	90	57	SERVICE	= 41.5													
1997	H61110607	35,004			OLGB	22APR97													
	H61110608	33,695			OLGB	22APR97													
LG FLOW:	H61110609	27,622			OLGB	22APR97													
2800 cfs	H61110610	8,882			OLGB	22APR97													
w/ HORB	H61110604	31,739			SERVICE	23APR97													
	H61110605	32,297			SERVICE	23APR97													
	H61110606	27,075			SERVICE	23APR97													
TOTAL	UPPER	93,501	71	48	OLGB	RM diff.	0.06	0.44	0.43	0.58	1.46	1.50	0.12	0.10	0.19	0.21	0.26	0.25	0.23
TOTAL	LOWER	72,464	75	56	SERVICE	= 41.5													

TABLE 2. Recovery data and survival indices for Tuolumne River CWT smolt survival releases.

TUOLUMNE RIVER -LARGE GROUP- CWT RELEASES AND RECOVERIES

RELEASE YEAR	TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	RIVER WT	RELEASE SITE	DATE	SMOLT RECOVERIES PUSHNET/ RS TRAP	MOSS- DALE	SWP PUMPS	EXPAND. SWP	CVP PUMPS	EXPAND. CVP	JERSEY PT. (ANTIOCH)	JERSEY(ANT) SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	OCEAN CATCH EXPD.	SPAWN
1998	61110703	32787			OLGB	15APR98		51	1	6	26	284	26	0.14	25	0.42	31	94	22
	61110704	26633			OLGB	15APR98		40	0	0	22	280	4	0.03	5	0.09	24	75	21
LG FLOW:	61110705	27404			OLGB	15APR98		30	1	6	25	312	8	0.05	19	0.36	32	104	27
6400 cfs	61110706	7234			OLGB	15APR98		9	2	22	7	84	0	0.00	2	0.13	14	45	8
w/o HORB	61110707	25754			OFC(SJR)	16APR98		34	0	0	17	212	13	0.09	17	0.35	12	44	10
	61110708	22006			OFC(SJR)	17APR98		30	0	0	18	220	5	0.05	19	0.45	11	41	14
TOTAL	UPPER	94058	83	51	OLGB	RM diff.	46	130	4	34	80	960	38	0.05	51	0.25	101	318	78
TOTAL	LOWER	47760	86	59	OFC(SJR)	= 53.5	------	64	0	0	35	432	18	0.07	36	0.40	23	85	24
1999	06-46-01	25534			OLGB	17APR99		10	56	355	41	339	6	0.05	3	0.07	23	85	26
	06-46-02	25679			OLGB	18APR99		17	67	475	58	542	6	0.05	2	0.05	28	91	36
LG FLOW:	06-46-03	25008			OLGB	19APR99		18	61	390	62	538	3	0.03	2	0.05	28	86	35
2000 cfs	06-46-04	25121			OFC(SJR)	18APR99		49	78	426	83	883	11	0.10	11	0.27	30	92	49
w/o HORB	06-46-05	25836			OFC(SJR)	19APR99		115	94	559	52	466	15	0.12	9	0.21	32	93	43
TOTAL	UPPER	76221	86		OLGB	RM diff.	184	45	184	1220	161	1419	15	0.04	7	0.06	79	262	97
TOTAL	LOWER	50957	85		OFC(SJR)	= 53.5	------	164	172	985	135	1349	26	0.11	20	0.24	62	185	92
2000	06-45-56	23603			OLGB	13APR00		17	13	59	1	12	5	0.05	6	0.13	23	72	34
	06-45-57	22096			OLGB	15APR00		15	4	22	2	24	2	0.02	1	0.02	24	81	24
LG FLOW:	06-45-58	26975			OLGB	15APR00		8	10	59	0	0	3	0.03	5	0.11	22	68	29
3800 cfs	06-45-59	23071			OFC(SJR)	16APR00		33	27	116	1	12	12	0.12	4	0.09	44	141	50
w/ HORB	06-45-60	21698			OFC(SJR)	14APR00		49	20	95	1	12	10	0.10	5	0.12	34	104	51
TOTAL	UPPER	72674	74		OLGB	RM diff.	241	40	27	140	3	36	10	0.03	12	0.09	69	221	67
TOTAL	LOWER	44769	74		OFC(SJR)	= 53.5	------	82	47	211	2	24	22	0.11	9	0.10	78	245	101
2001	06-44-12	24600			OLGB	22APR01		38	0	0	0	0	2	0.02	2	0.04	2	7	6
	06-44-13	22758			OLGB	22APR01		40	0	0	1	12	6	0.05	2	0.04	4	23	2
LG FLOW:	06-44-14	21527			OLGB	22APR01		32	0	0	0	0	10	0.09	4	0.09	5	15	1
620 cfs	06-44-43	22051			OFC(SJR)	28APR01		165	0	0	0	0	35	0.30	13	0.28	12	10	13
w/ HORB	06-44-44	24393			OFC(SJR)	26APR01		262	2	12	1	12	25	0.19	12	0.23	16	56	15
TOTAL	UPPER	68885	82	52	OLGB	RM diff.	109	110	0	0	1	12	18	0.05	8	0.06	11	45	9
TOTAL	LOWER	46444	84	68	OFC(SJR)	= 53.5	------	427	2	12	1	12	60	0.25	25	0.26	28	96	28
2002	06-44-06	24976			OLGB	24APR02		65	2	12	1	12	3	0.020	1	0.020			
	06-44-67	24813			OLGB	24APR02		63	2	12	0	0	5	0.037	7	0.141			
LG FLOW:	06-44-68	25220			OLGB	24APR02		51	2	18	1	12	3	0.023	0	--			
1300 cfs	06-44-61	25701			OFC(SJR)	26APR02		116	1	6	0	0	1	0.007	6	0.111			
w/ HORB	06-44-69	23870			OFC(SJR)	29APR02		25	2	15	1	12	2	0.015	3	0.063			
TOTAL	UPPER	75009	86	54	OLGB	RM diff.	1008	179	6	42	2	24	11	0.026	8	0.053			
TOTAL	LOWER	49571	86	62	OFC(SJR)	= 53.5	------	141	3	21	1	12	3	0.011	9	0.087			

Notes:
Shading indicates data updated from FERC Report 02-5
1990 groups had different origin, rearing conditions, and sizes
1994 lower release occurred prior to pulse
1996 recoveries at Shiloh and Mossdale are considered to be invalid; also a high tag loss rate
1997 fish sizes were small; also a high tag loss rate
River mile differences range from 38 to 53.5 miles
2002 survival indices were calculated using tagcode 06-44-61 only, for the lower release group.

TABLE 2. Recovery data and survival indices for Tuolumne River CWT smolt survival releases.

TUOLUMNE RIVER -LARGE GROUP- CWT RELEASES AND RECOVERIES

RELEASE YEAR	TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	RIVER WT	RELEASE SITE	DATE	SMOLT SURVIVAL INDEX (Upper / Lower; corrected for release group number) PUSHNET/ RS TRAP	MOSS-DALE	SWP PUMPS	SWP EXPD.	CVP PUMPS	CVP EXPD.	JERSEY PT. (ANTIOCH)	JERSEY(ANT) SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	OCEAN CATCH EXPD.	SPAWN
1998	61110703	32787			OLGB	15APR98													
	61110704	26633			OLGB	15APR98													
LG FLOW:	61110705	27404			OLGB	15APR98													
6400 cfs	61110706	7234			OLGB	15APR98													
w/o HORB	61110707	25754			OFC(SJR)	16APR98													
	61110708	22006			OFC(SJR)	17APR98													
TOTAL	UPPER	94058	83	51	OLGB	RM diff.		1.03			1.16	1.13	1.07	0.71	0.72	0.63	2.23	1.90	1.65
TOTAL	LOWER	47760	86	59	OFC(SJR)	= 53.5													
1999	06-46-01	25534			OLGB	17APR99													
	06-46-02	25679			OLGB	18APR99													
LG FLOW:	06-46-03	25008			OLGB	19APR99													
2000 cfs	06-46-04	25121			OFC(SJR)	18APR99													
w/o HORB	06-46-05	25836			OFC(SJR)	19APR99													
TOTAL	UPPER	76221	86		OLGB	RM diff.		0.18	0.72	0.83	0.80	0.70	0.39	0.39	0.23	0.24	0.85	0.95	0.70
TOTAL	LOWER	50957	85		OFC(SJR)	= 53.5													
2000	06-45-56	23603			OLGB	13APR00													
	06-45-57	22096			OLGB	15APR00													
LG FLOW:	06-45-58	26975			OLGB	15APR00													
3800 cfs	06-45-59	23071			OFC(SJR)	16APR00													
w/ HORB	06-45-60	21698			OFC(SJR)	14APR00													
TOTAL	UPPER	72674	74		OLGB	RM diff.		0.30	0.35	0.41	0.92	0.92	0.28	0.29	0.82	0.84	0.54	0.56	0.53
TOTAL	LOWER	44769	74		OFC(SJR)	= 53.5													
2001	06-44-12	24600			OLGB	22APR01													
	06-44-13	22758			OLGB	22APR01													
LG FLOW:	06-44-14	21527			OLGB	22APR01													
620 cfs	06-44-43	22051			OFC(SJR)	28APR01													
w/ HORB	06-44-44	24393			OFC(SJR)	26APR01													
TOTAL	UPPER	68885	82	52	OLGB	RM diff.		0.17			0.67	0.67	0.20	0.20	0.22	0.21	0.26	0.32	0.22
TOTAL	LOWER	46444	84	68	OFC(SJR)	= 53.5													
2002	06-44-06	24976			OLGB	24APR02													
	06-44-67	24813			OLGB	24APR02													
LG FLOW:	06-44-68	25220			OLGB	24APR02													
1300 cfs	06-44-61	25701			OFC(SJR)	26APR02													
w/ HORB	06-44-69	23870			OFC(SJR)	29APR02													
TOTAL	UPPER	75009	86	54	OLGB	RM diff.		0.53	2.06	2.40			3.77	3.71	0.46	0.48			
TOTAL	LOWER	49571	86	62	OFC(SJR)	= 53.5													

Notes:
Shading indicates data updated from FERC Report 02-5
1990 groups had different origin, rearing conditions, and sizes
1994 lower release occurred prior to pulse
1996 recoveries at Shiloh and Mossdale are considered to be invalid; also a high tag
1997 fish sizes were small; also a high tag loss rate
River mile differences range from 38 to 53.5 miles
2002 survival indices were calculated using tagcode 06-44-61 only, for the lower releas

TABLE 2. Recovery data and survival indices for Tuolumne River CWT smolt survival releases.

Table 3.

Tuolumne Smolt Survival Index -- min. of 4 recoveries in one release group and excluding 1990, 1994, and 1997

La Grange flow adjusted in 1987-2001 only

RELEASE YEAR	LG FLOW (cfs)	ADJUSTED LG FLOW	Trawl MOSS-DALE	"pump" SWP EXPD.	"pump" CVP EXPD.	Trawl JERSEY PT. ANTIOCH	Trawl CHIPPS	"adult" OCEAN CATCH	"adult" SPAWN	Trawl average	Pump average	Adult average	Avg. of all
1986	6,600	6,600		0.93	1.00		1.48	0.99	1.18	1.48	0.97	1.09	1.12
1987	560	563	0.42	0.11	0.67		0.28	0.29	0.29	0.35	0.39	0.29	0.34
1995	7,700	8,217	0.80	1.35	0.75		1.14	1.02	0.70	0.97	1.05	0.86	0.96
1996	2,600	2,816	0.31	1.565	0.73		0.571	0.65	0.75	0.44	1.15	0.70	0.76
1998	6,400	4,050	1.03		1.13	0.71	0.63	1.90	1.65	0.79	1.13	1.78	1.18
1999	2,000	1,960	0.18	0.83	0.70	0.39	0.24	0.95	0.70	0.27	0.77	0.83	0.57
2000	3,800	2,982	0.30	0.41		0.28	0.82	0.56	0.53	0.47	0.41	0.55	0.48
2001	640	634	0.17			0.20	0.21	0.32	0.22	0.19		0.27	0.22
2002	1,300	1,300	0.53	2.398		1.273	0.16			0.65	2.40		1.09
							Avg. high flow (1986, 1995, 1998)			1.08	1.05	1.24	1.08
							Avg. mod. flow (1996, 1999, 2000)			0.39	0.77	0.69	0.61
							Avg. low flow (87, 2001, excl. 2002)			0.27	0.20	0.28	0.28

FERC Report 2003-3: Appendix A

Initial Review of Paired Release CWT Survival Evaluations

in the Stanislaus, Tuolumne, and Merced Rivers

March 2004

Prepared by

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Turlock and Modesto Irrigation Districts

Attached are files with tables and graphs of CWT survival ratios (upper release recoveries/lower release recoveries, adjusted for difference in release numbers) for three San Joaquin River tributaries made since 1986. Please consider this material as draft at this time - the Tuolumne discussion is more extensive as that data has been examined more extensively. The tables of Stanislaus and Merced data complement Table 2 of the main report. This summary has been prepared at the request of the VAMP Biological Technical group.

Introduction

The graphed results are shown on the same survival (y-axis) scale, with the Tuolumne flow scale (x-axis) twice that of the Merced and Stanislaus scale – it is the biggest river of the three. The plotted data shows ratios from various sources available each year that had at least four actual recoveries from either group. In a few cases there is no ratio for a recovery site as no fish were caught from the lower release group. I do not have 2003 average size data, juvenile recovery data at Mossdale, or inland adult recovery data yet. Ocean and inland adult data will still be coming in for releases made since 1998 (e.g. 1998 brood year released in 1999 may have 5-year olds in the 2003 run). Results for SWP facilities, CVP facilities, and ocean catch are usually based on expanded values adjusted for sample effort; Antioch/Jersey Point trawl and Chipps Island trawl are based on survival estimates that are adjusted for sample effort; Mossdale and spawner are based on actual recoveries.

A survival ratio of 1.0 indicates no difference in survival of the two groups. Survival index values substantially greater than one may indicate problems of at least two types: 1) that there is a significant difference between the two release groups, such as size, disease, stress, behavioral, or physiological factors, and/or 2) the likelihood of recovery from each group differed due to sampling effort and timing, migration rates, or other factors. Survival indices of less than 1.0 may have similar problems that are not readily evident and may require careful review to see if study assumptions are met. For example, if fish of either group migrate at different rates or after flows have changed, then data comparability may be compromised. Low recovery numbers (e.g. less than 4 from either group) from a recovery location also can lead to highly variable results. The ocean harvest data may represent the most reliable recovery data due to the number of tag recoveries and the extended recovery period, assuming that other study criteria are met. Sampling closest to the lower release group can result in greater differential capture probability among release groups and spurious results. This problem may occur at Mossdale in some years, at least for Tuolumne and Stanislaus tests, and precludes using San Joaquin pushnet (only done in 1987) or tributary screw trap data (few tests) for survival ratios.

In addition, flow is being considered here as a surrogate for all other factors that may contribute to survival, such as predator populations, predation rates, food availability, temperature, turbidity, pumping or diversion effects, pollution, etc. These factors, which can vary from year to year, and independently from flow, are often unknown (other than temperature or turbidity), further complicating the assessment of study results in regards to the relative survival of CWT hatchery salmon as related to flow. Major changes in habitat conditions over time resulting from floods, restoration projects, etc. may further lead to differences from year to year. A key assumption of using CWT hatchery smolts as surrogates for naturally produced salmon has not been well evaluated, such that the results of these tests may not necessarily be applicable to naturally produced salmon. Another concern has been the use of Merced smolts in the other rivers as that has resulted in a large number of Merced salmon returning to those rivers.

Tributary CWT survival studies

Stanislaus: There have been 8 study releases during 1986-2003. Releases in three years were made after 15MAY (1999, 2000, 2001) and release group numbers have ranged from about 25,000-100,000. These tests have been at a limited flow range below Goodwin Dam of 600-1500 cfs.

The overall results for this narrow flow range appear to be variable, with most survival ratios in the range of about 0.2-0.8. I have made no other refinement to this data and have not yet reviewed the material in the draft summary of Stanislaus fishery studies.

Tuolumne: There have been 12 study releases during 1986-2002, although only 8-9 may be considered valid at this time for reasons noted below. The lower release location has varied somewhat over time, resulting in a distance between upper and lower release locations ranging from about 38-53.5 river miles. These releases have been made at flows below La Grange Dam ranging from about 550-7,700 cfs. The release group numbers have ranged from about 50,000-100,000 and all releases were made within mid-APR to early MAY. The recovery at Mossdale of 1987-2001 releases has been more specifically analyzed (1986 had no Mossdale trawl and 2002 has yet to be looked at in the same manner) and tests for 1990, 1994, and 1997 have been deemed "invalid". The 1990 and 1994 tests had known problems with the lower release groups not matching the timing of pulse flows. That analysis also found that river flow tested for some years might need to be adjusted to account for flow changes during the often extended CWT smolt migration to Mossdale - plots at initial and "adjusted" flow are presented. The 2002 results seem suspect at this time, in part due to large difference in recoveries of the 2 lower release groups that were 3 days apart (results using the first group are plotted).

Tuolumne results grouped by general flow category are:

High Flows: Survival indices for three years (1986, 1995,1998) with high flow conditions (6,400-7,700 cfs or 4,050-8,200 adjusted) in the Tuolumne River ranged from .63 to 1.89, excluding values based on less than 4 recoveries in either release group (Table 2). These indices generally indicate relatively high survival, averaging 1.08 from all sites for those years, but with variable results.

Moderate Flows: Survival indices for 1996, 1999 and 2000 with moderate flows (2,000-3,800 cfs or 2,000-3,000 adjusted) show variable results, ranging from .18-1.57 (to 0.95 excluding SWP in 1996). Adult survival indices for 1996 releases were relatively high, .65 for ocean recoveries and .75

for spawners. Adult survival indices for 1999 were also relatively high, .95 for ocean recoveries and .70 for spawners. Initial adult survival indices for 2000 are .56 for ocean recoveries and .53 for spawners. These indices, combined with the juvenile results, have an overall medium survival, averaging 0.61 from all sites for those years. The 1997 survival indices at 2,900 cfs (1,400 cfs adjusted) were omitted due to problems mentioned above.

Low Flows: Survival indices for 1987, 2001, and 2002 with low flows (560-1,300 cfs) generally show variable results. The 1987 juvenile survival indices (560 cfs) ranged from .11 to .67 and both adult indices were .29. The juvenile survival indices ranged from .17 to .21 in 2001 and preliminary adult survival indices are .32 for ocean recoveries and .22 for inland spawners. The juvenile survival indices for 2002 were highly variable, ranging from .16 at Chipps to 2.4 at SWP (all based on first lower release group). These indices generally indicate lower survival, averaging 0.28 from all sites for 1987 and 2001; the 1990 and 1994 survival indices were omitted due to concerns noted earlier.

In general, the survival indices, when examined for all recovery locations, are variable, but trend toward higher survival (all values >0.6) in the three years with higher flow conditions (>6,000 cfs or >4,000 cfs adjusted) - results at moderate to low flows all had some values of less than 0.6. In some cases the indices exceed 1.0 and/or are based on few recoveries. Survival averages based on recovery type (trawl, pump salvage, and ocean/spawner), and overall average (excluding 2002), are shown with the overall average log based trend line ($R^2 = 0.78$; 0.75 with adjusted flow). Individual trend lines for Chipps trawl, ocean, and spawner results had the higher R^2 values of 0.42-0.72 (not shown).

Merced: There have been 18 study releases during 1994-2003, with 1-3 tests per year and release group numbers have ranged from about 67,000-110,000. The releases have been in a flow range below Crocker-Huffman Dam (as measured at Cressey) of about 200-4,000 cfs, releases have been made in APR through mid-MAY, and release locations seem to have been fairly consistent. The 1994 and early 1997 tests appear to have problems with the lower release groups matching the timing of pulse flows, similar to some Tuolumne releases, so these are excluded, leaving a total of 16 tests in the graphs (not all years are labeled there due to space constraints). There are no results on the graph from the middle 2003 test due to <4 recoveries for either group per recovery site and Mossdale data is yet unavailable.

The overall results again are variable, but generally appear similar to the Tuolumne (although at about half the flow level) with all survival ratios > 0.5 at flows of 2,000-4,000 cfs. Some very low survival ratios of 0.0-0.05 were obtained at flows <600 cfs, the lowest survival ratios obtained for the tributaries. Survival averages based on recovery type (trawl, pump salvage, and ocean/spawner), and overall average, are shown with the overall average log based trend line ($R^2 = 0.47$). Individual trend lines for Mossdale trawl, SWP salvage, CVP salvage, and JP/Antioch trawl had the higher R^2 values of 0.44-0.67 (not shown). These are the recovery sites that had lower R^2 values in the Tuolumne data. Other than averaging survival ratios similar to that done for the Tuolumne, I have made no further refinement to the data.

Other Evaluations

Many of the lower tributary test releases have been made at a location and timing such that they enable a survival ratio to be developed for various reaches of the San Joaquin River when combined with Delta test releases made from Durham Ferry to Dos Rios (below head of Old River). These reaches may comprise (1) the Merced River to Tuolumne River, Stanislaus River, Durham Ferry, Mossdale, or Dos Rios, and (2) the Tuolumne River to Stanislaus River, Durham Ferry, Mossdale, or Dos Rios. I am still working on this information, but these results, in combination with tributary survival upstream, and delta survival downstream, may be used to obtain an overall survival estimate from the upper tributary to Jersey Point in some cases, and to compare with tributary and Delta survival ratios.

Besides survival ratios, the adult production could be compared, perhaps as a percentage of fish accounted for in ocean (adjusted for harvest rate?) and inland returns. For example, the 1995 upper Tuolumne release had an expanded ocean catch and spawner recovery of 1,000 and 163, respectively, compared to 20 and 9 in 1996. Comparable numbers for the lower release group those same years were 625 and 149 vs. 23 and 9. Thus the overall unadjusted production of 1995 upper and lower releases (combined total of 1,163 and 774) is many times that of 1996 upper and lower releases (29 and 32). These numbers are influenced by overall survival resulting from outmigration, ocean conditions, and adult migration.

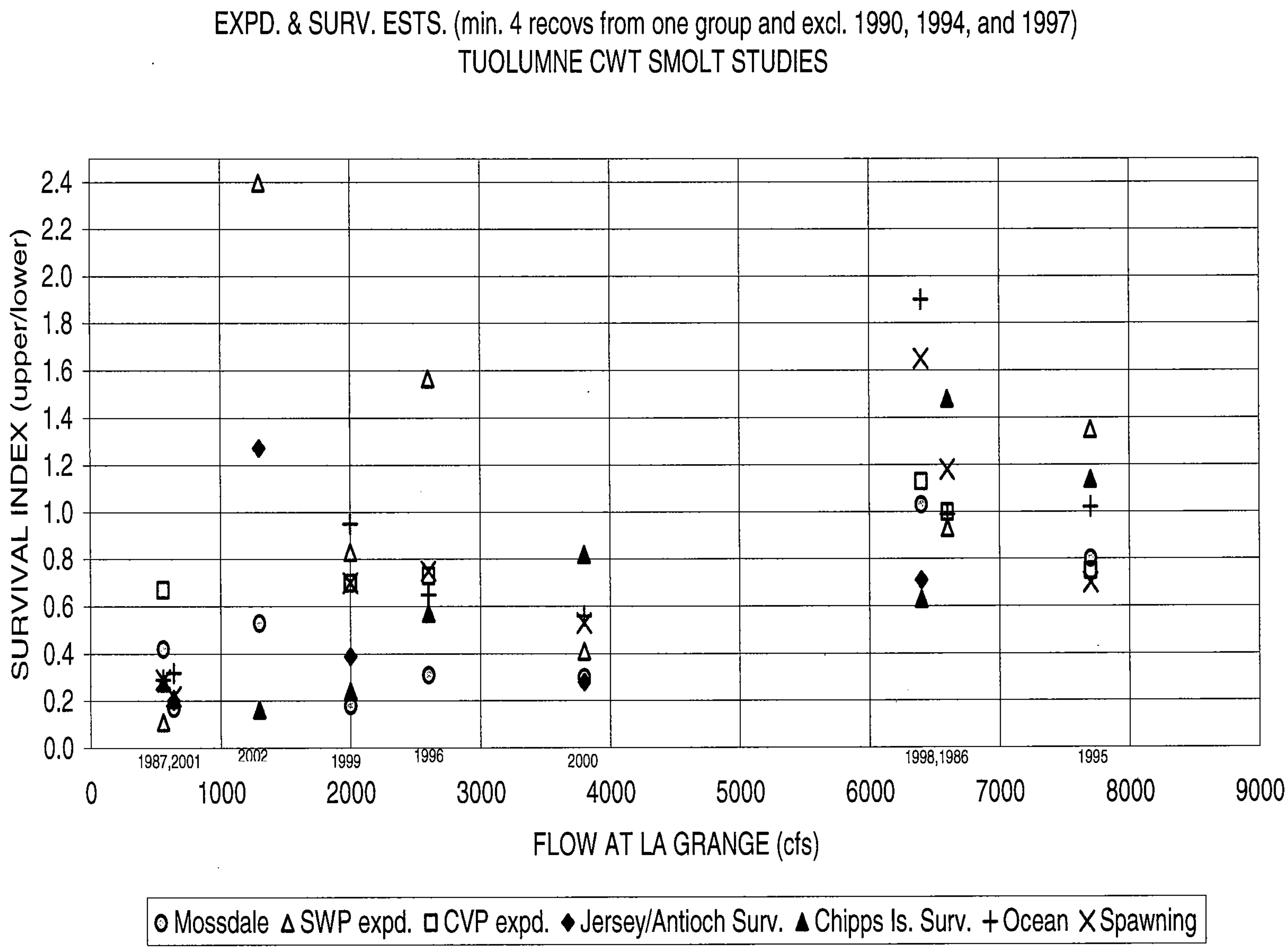
Although not used for estimating within-tributary survival, the survival estimates for each test group, not just the ratios, could also be examined in a manner as has been done in the Delta studies. It may be that some groups from paired test releases considered invalid for ratios can still be utilized for some assessment information.

Summary

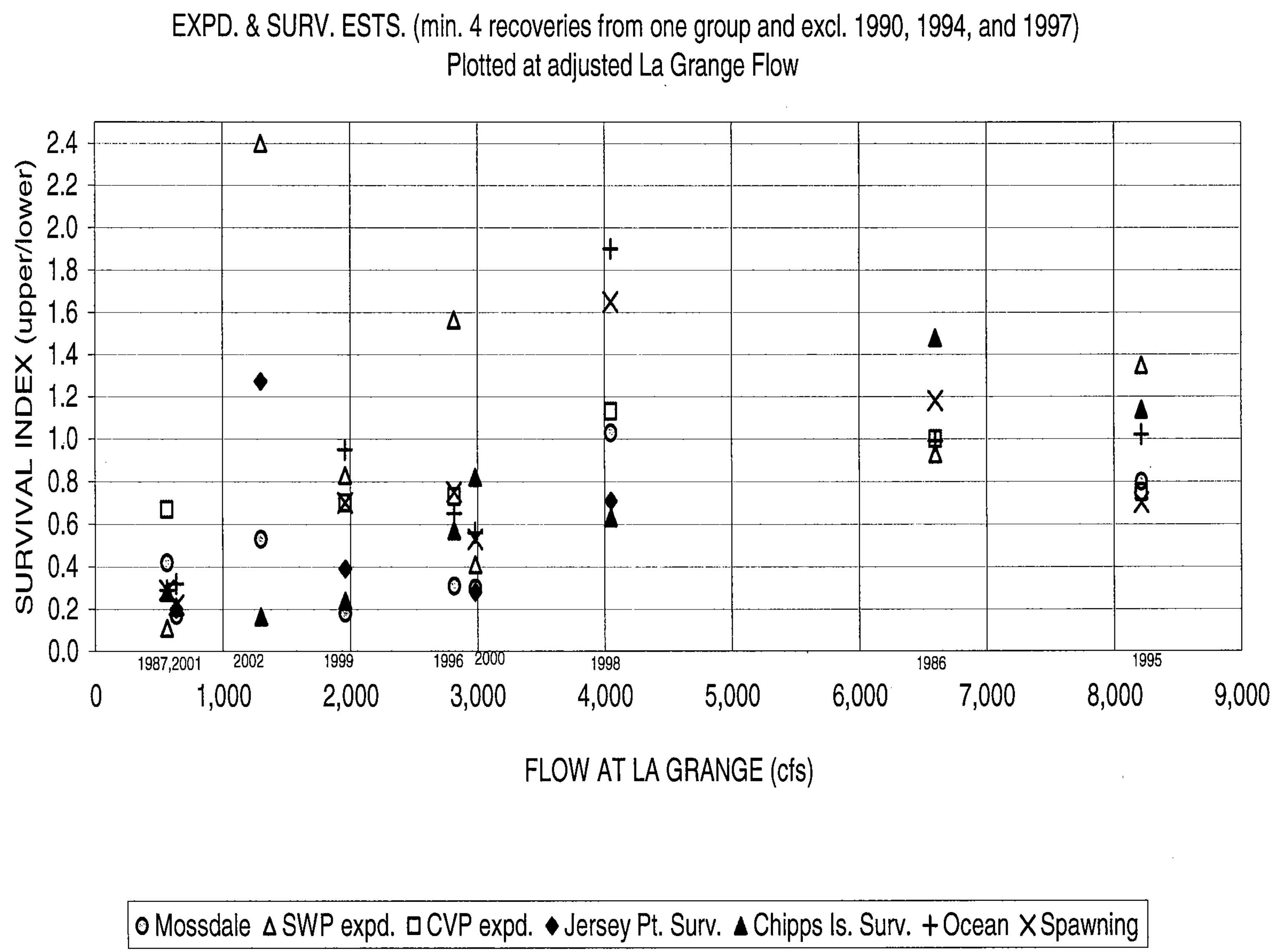
There have been a total of 38 CWT survival studies consisting of upper and lower release groups made in the three SJR tributaries during 1986-2003. About 5-6 of these studies may presently be considered invalid for developing survival ratios, although most of Stanislaus and Merced releases have not been assessed yet, so there could be more. This leaves 32 tests for now that are plotted on the tributary graphs.

The results thus far suggest this method has shown a general trend of increasing survival ratio associated with increasing tributary flow when examined over a span including higher flows, as in the Tuolumne and Merced Rivers. This is not an unexpected outcome and may be the primary conclusion derived from all the expense, effort, stock mixing, and population effects to date. The results are quite variable and the method may inherently not be suited to detect major differences over a small flow range of "non-flood" releases. This could have some bearing on the VAMP evaluations that are examining Delta survival over a "non-flood" range of flows at Vernalis and varying export, although there are differences in application of the method there and in other options to obtain information as compared to the tributaries. The results of the existing tributary releases are still in need of further evaluation, but it seems continuing tributary CWT survival tests is questionable unless further insights are developed. More analysis should be done on existing Merced and Stanislaus data. Inquiries regarding suggestions, data questions/discrepancies, or other comments are welcome.

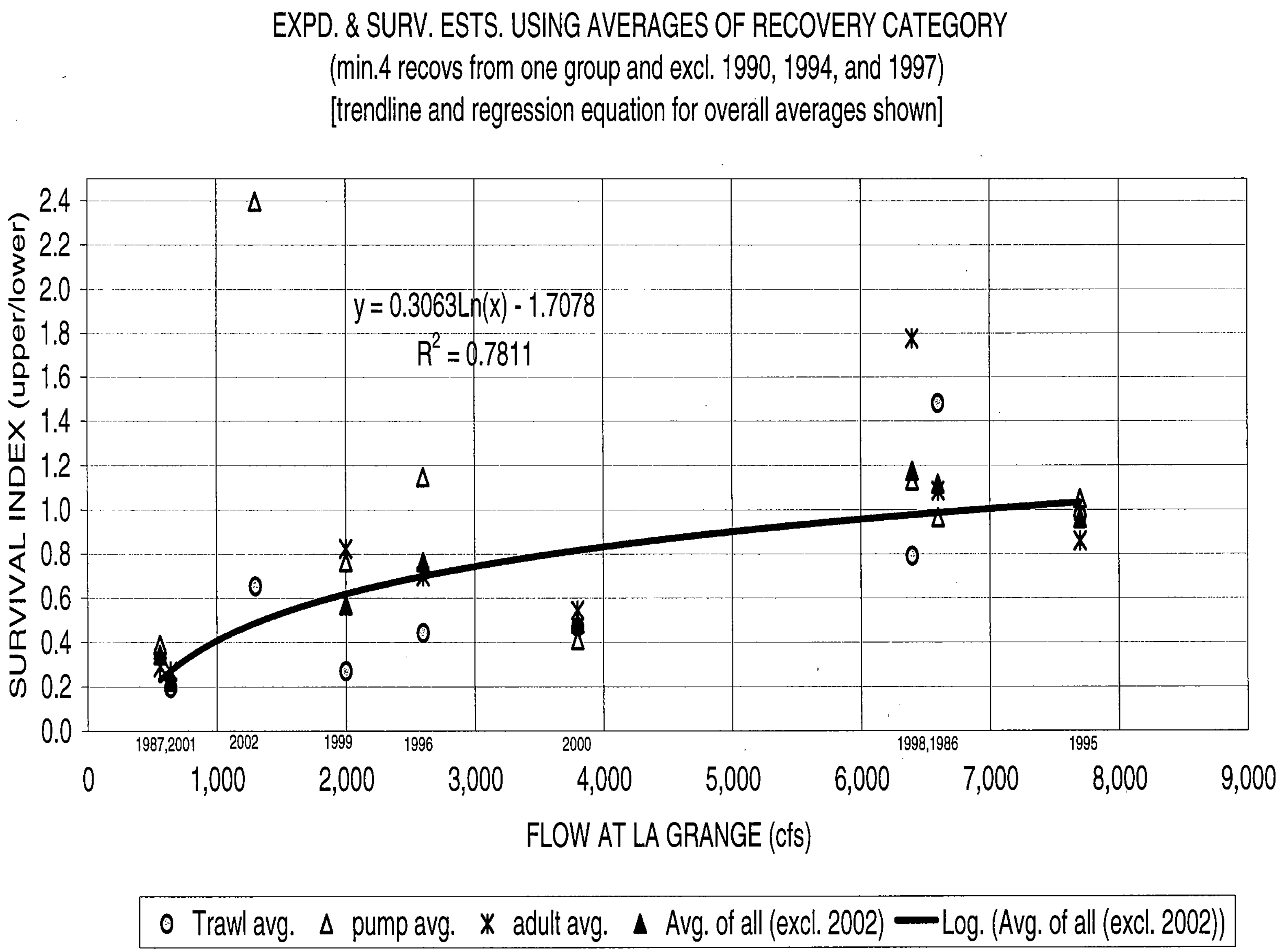
Tuolumne - CWT survival estimates (ratio of upper to lower recoveries) – plotted at “original” test flows



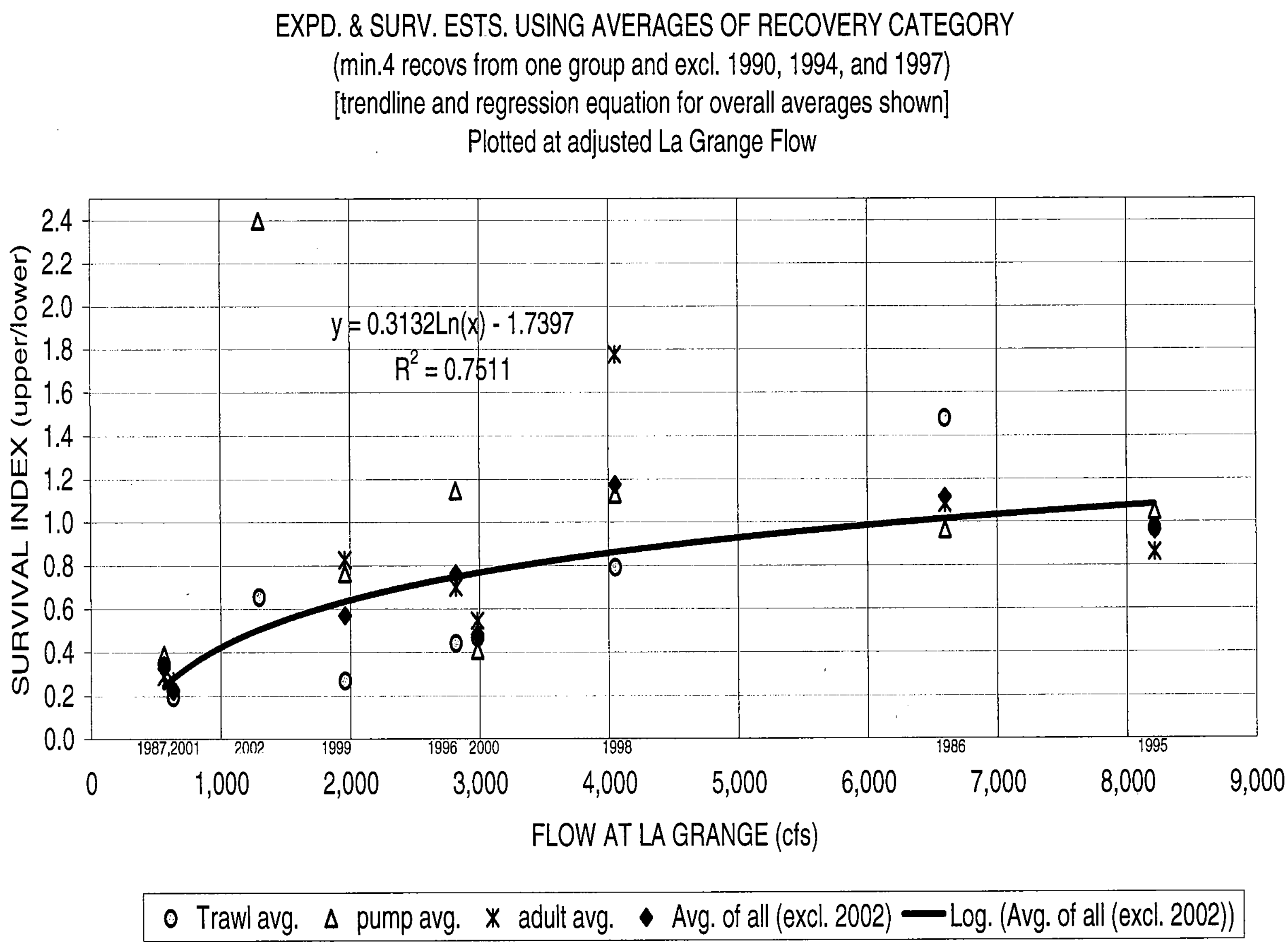
Tuolumne - CWT survival estimates (ratio of upper to lower recoveries) – plotted at "adjusted" test flows



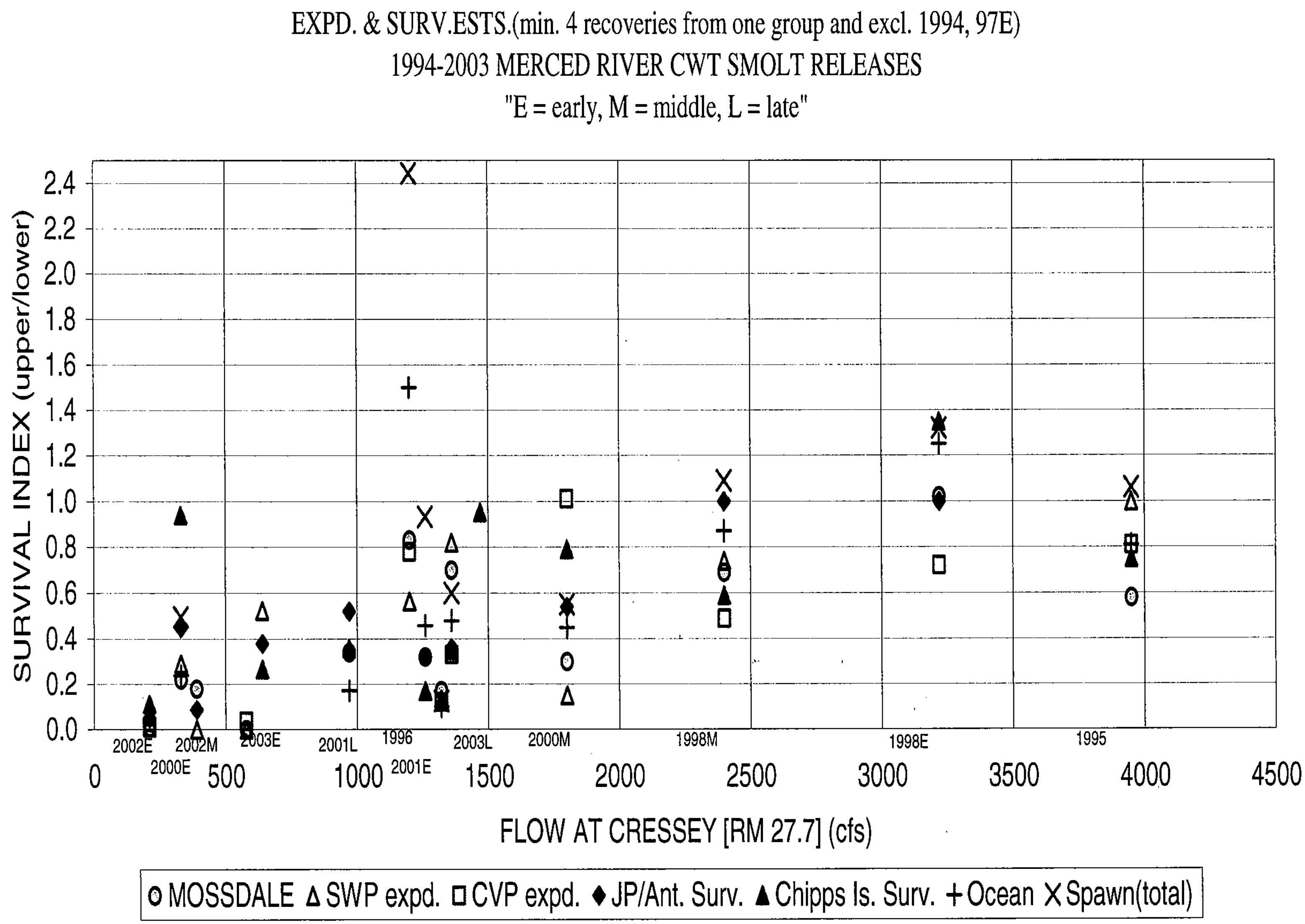
Tuolumne – CWT survival estimates using averages



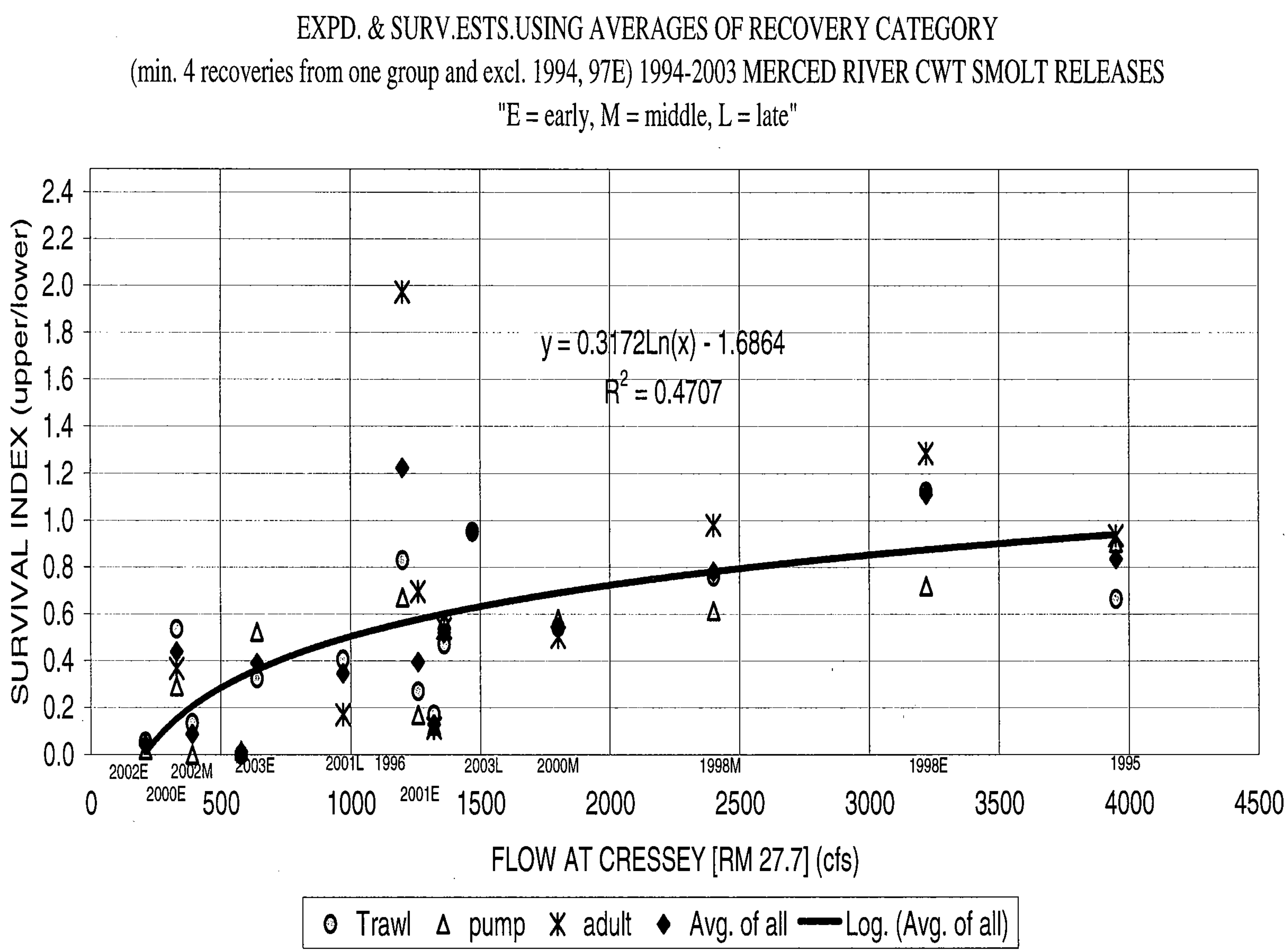
Tuolumne – CWT survival estimates using averages, plotted at "adjusted" test flows



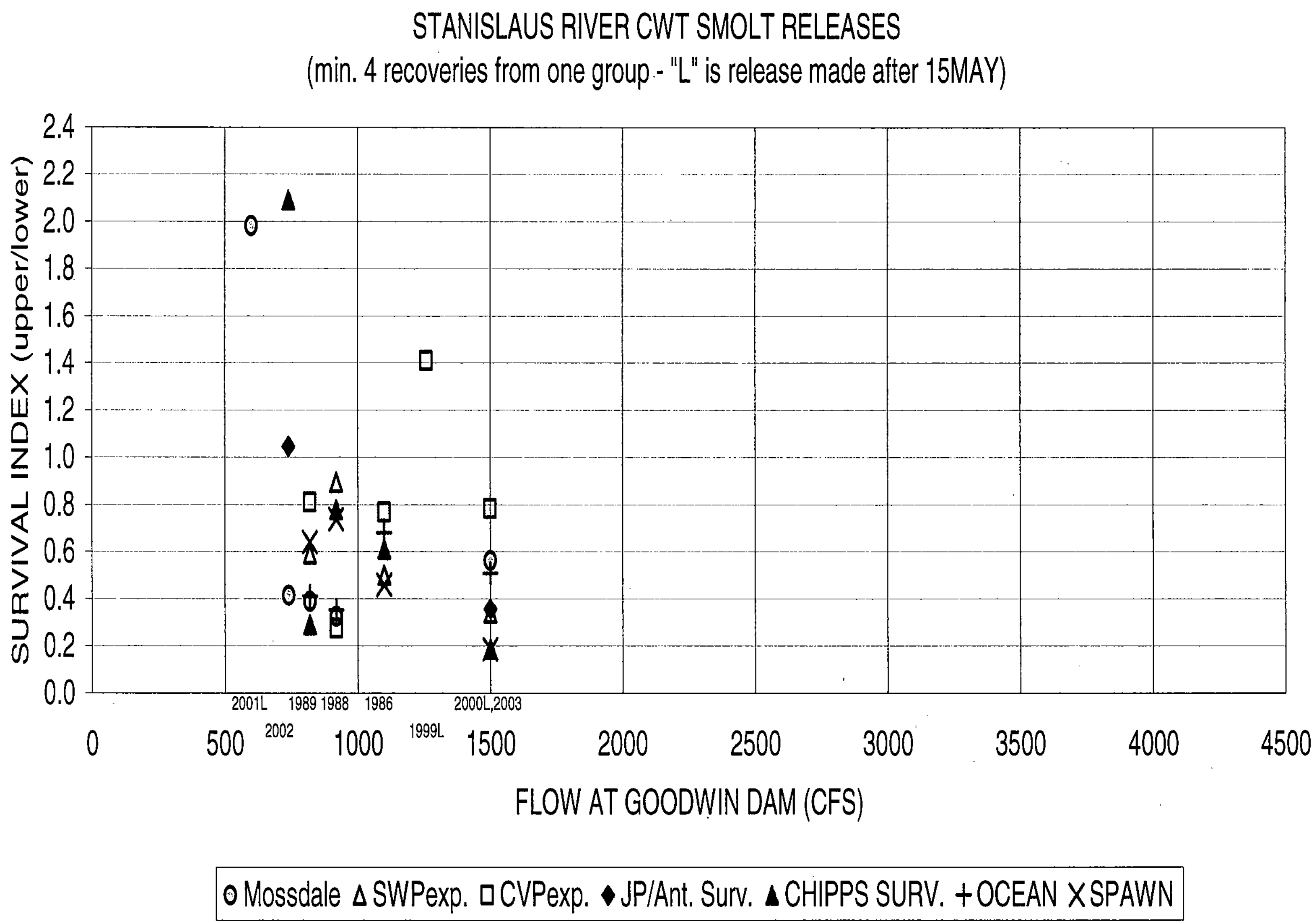
Merced – CWT survival estimates (ratio of upper to lower recoveries)



Merced – CWT survival estimates using averages



Stan. – CWT survival estimates (ratio of upper to lower recoveries)



Tuolumne River

RELEASE YEAR	TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	RIVER WT	RELEASE SITE	DATE	SMOLT RECOVERIES PUSHNET/ RS TRAP	MOSS-DALE	SWP PUMPS	EXPAND. SWP	CVP PUMPS	EXPAND. CVP	JERSEY PT (ANTIOCH)	JERSEY(ANT) SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	OCEAN CATCH EXPD.	SPAWN
1986	06-46-54	49,630			OLGB	14APR86	-	-	131		183		-	-	16		226	976	60
LG FLOW:	06-46-55	49,518			OLGB	14APR86	-	-	135		205		-	-	18		210	929	58
6600 cfs	06-46-56	51,300			MAPES	14APR86	-	-	159		255		-	-	10		219	969	54
w/o HORB	06-46-57	52,174			MAPES	14APR86	-	-	155		238		-	-	10		231	1037	50
TOTAL	UPPER	99,148	81	51	OLGB	RM diff.	-	-	266	6573	388	3312	-	-	34	0.40	436	1905	118
TOTAL	LOWER	103,474	80	51	MAPES	= 50	-	-	314	7351	493	3465	-	-	20	0.27	450	2006	104
1987	06-46-60	29,953			OLGB	16APR87	97	47	20		44		-	-	2		10	32	2
	06-46-61	30,609			OLGB	16APR87	137	47	23		48		-	-	0		6	37	1
LG FLOW:	06-46-62	29,037			OLGB	16APR87	120	34	22		46		-	-	3		7	31	5
560 cfs	06-46-63	30,703			RDP	16APR87	374	109	184		71		-	-	4		25	142	12
w/o HORB	06-45-01	31,869			RDP	16APR87	339	91	213		62		-	-	5		25	141	8
	06-45-02	30,937			RDP	16APR87	353	117	204		79		-	-	8		23	82	9
TOTAL	UPPER	89,599	85	55	OLGB	RM diff.	354	128	65	593	138	1648	-	-	5	0.05	23	100	8
TOTAL	LOWER	93,509	82	64	RDP	= 38	1066	317	601	5685	212	2569	-	-	17	0.18	73	365	29
1990	H601110201	23,494			OLGB	30APR90	-	19	40		23		-	-	1		0	0	0
	H601110202	21,766			OLGB	30APR90	-	12	27		11		-	-	1		0	0	0
LG FLOW:	H601110114	24,134			OLGB	30APR90	-	21	45		25		-	-	1		2	12	0
600 cfs	H601110115	24,259			OLGB	30APR90	-	11	34		18		-	-	1		1	5	0
w/o HORB	H601110203	27,263			MAPES	01MAY90	-	47	29		26		-	-	1		1	1	0
	H601110204	26,067			MAPES	01MAY90	-	47	21		21		-	-	0		1	17	0
	H601110205	24,905			MAPES	01MAY90	-	75	2		27		-	-	0		0	0	0
TOTAL	UPPER	93,653	83	52	OLGB	RM diff.	-	63	146	878	77	440	-	-	4	0.04	3	17	0
TOTAL	LOWER	78,235	72	66	MAPES	= 50	-	169	52	463	74	316	-	-	1	0.01	2	18	0
1994	0601110302	27,803			OLGB	23APR94	-	85	2	7	1	12	-	-	2		24	86	39
LG FLOW:	0601110303	27,803			OLGB	23APR94	-	62	2	40	1	12	-	-	1		23	86	44
1200 cfs	0601110304	27,802			OLGB	23APR94	-	60	2	4	0	0	-	-	0		24	81	31
w/ HORB	0601110305	25,029			MAPES	24APR94	-	47	0	0	3	48	-	-	1		28	110	46
	0601110306	25,029			MAPES	24APR94	-	25	2	14	2	24	-	-	1		15	43	27
TOTAL	UPPER	83,408	85	51	OLGB	RM diff.	-	207	6	51	2	24	-	-	3	0.03	71	253	114
TOTAL	LOWER	50,058	82	62	MAPES	= 50	-	72	2	14	5	72	-	-	2	0.04	43	153	73

Tuolumne River

RELEASE YEAR	TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	RIVER WT	RELEASE SITE	DATE	SMOLT RECOVERIES PUSHNET/ RS TRAP	MOSS-DALE	SWP PUMPS	EXPAND. SWP	CVP PUMPS	EXPAND. CVP	JERSEY PT (ANTIOCH)	JERSEY(ANT) SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	OCEAN CATCH EXPD.	SPAWN
1995	H61110311	29,989			OLGB	04MAY95		22	28	474	48	510	-	-	8		87	290	50
LG FLOW:	H61110312	28,988			OLGB	04MAY95		16	13	177	43	461	-	-	5		96	337	59
7700 cfs	H61110313	30,287			OLGB	04MAY95		20	17	277	55	572	-	-	8		108	373	54
w/o HORB	H61110314	27,770			SERVICE	05MAY95		23	19	236	57	607	-	-	5		91	315	67
	H61110315	29,139			SERVICE	05MAY95		23	19	203	67	707	-	-	7		96	310	82
TOTAL	UPPER	83,549	86	48	OLGB	RM diff.	11	58	58	928	146	1543	-	-	21	0.25	291	1000	163
TOTAL	LOWER	53,298	89	51	SERV.RD	= 41.5	11	46	38	439	124	1314	-	-	12	0.22	187	625	149
1996	H61110506	21,501			OLGB	26APR96		25	2	18	14	192	-	-	0		1	3	2
LG FLOW:	H61110507	22,761			OLGB	26APR96		16	2	8	7	84	-	-	2		2	9	2
2600 cfs	H61110508	22,893			OLGB	26APR96		23	4	24	11	132	-	-	1		3	8	5
w/o HORB	H61110509	22,715			SERVICE	27APR96		67	2	24	13	180	-	-	1		3	10	4
	H61110510	27,745			SERVICE	27APR96		89	2	0	17	240	-	-	3		4	13	5
TOTAL	UPPER	67,155	88	49	OLGB	RM diff.	222	64	8	50	32	408	-	-	3	0.04	6	20	9
TOTAL	LOWER	50,460	90	57	SERVICE	= 41.5	133	156	4	24	30	420	-	-	4	0.07	7	23	9
1997	H61110607	35,004			OLGB	22APR97	4	8	1	12	7	84	1		1		3	6	18
	H61110608	33,695			OLGB	22APR97	5	12	3	16	16	204	2		0		7	29	11
LG FLOW:	H61110609	27,622			OLGB	22APR97	4	10	1	8	8	96	3		1		8	30	7
2800 cfs	H61110610	8,882			OLGB	22APR97	0	2	0	0	1	12	0		1		1	3	2
w/ HORB	H61110604	31,739			SERVICE	23APR97	52	14	4	28	4	48	19		6		25	83	55
	H61110605	32,297			SERVICE	23APR97	66	22	3	14	6	72	13		2		21	84	46
	H61110606	27,075			SERVICE	23APR97	43	20	2	6	7	84	7		4		11	46	26
TOTAL	UPPER	93,501	71	48	OLGB	RM diff.	13	32	5	36	32	396	6	0.01	3	0.04	19	68	38
TOTAL	LOWER	72,464	75	56	SERVICE	= 41.5	161	56	9	48	17	204	39	0.11	12	0.17	57	213	127
1998	61110703	32787			OLGB	15APR98		51	1	6	26	284	26	0.14	25	0.42	31	94	22
	61110704	26633			OLGB	15APR98		40	0	0	22	280	4	0.03	5	0.09	24	75	21
LG FLOW:	61110705	27404			OLGB	15APR98		30	1	6	25	312	8	0.05	19	0.36	32	104	27
6400 cfs	61110706	7234			OLGB	15APR98		9	2	22	7	84	0	0.00	2	0.13	14	45	8
w/o HORB	61110707	25754			OFC(SJR)	16APR98		34	0	0	17	212	13	0.09	17	0.35	12	44	10
	61110708	22006			OFC(SJR)	17APR98		30	0	0	18	220	5	0.05	19	0.45	11	41	14
TOTAL	UPPER	94058	83	51	OLGB	RM diff.		130	4	34	80	960	38	0.05	51	0.25	101	318	78
TOTAL	LOWER	47760	86	59	OFC(SJR)	= 53.5		64	0	0	35	432	18	0.07	36	0.40	23	85	24

Tuolumne River																			
RELEASE		EFFECT.	AVG.	RIVER	RELEASE		SMOLT RECOVERIES											OCEAN	
YEAR	TAG NO.	RELEASE	FL (mm)	WT	SITE	DATE	PUSHNET/ RS TRAP	MOSS-DALE	SWP PUMPS	EXPAND. SWP	CVP PUMPS	EXPAND. CVP	JERSEY PT (ANTIOCH)	JERSEY(ANT) SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	CATCH EXPD.	SPAWN
1999	06-46-01	25534			OLGB	17APR99		10	56	355	41	339	6	0.05	3	0.07	23	85	26
	06-46-02	25679			OLGB	18APR99		17	67	475	58	542	6	0.05	2	0.05	28	91	36
LG FLOW:	06-46-03	25008			OLGB	19APR99		18	61	390	62	538	3	0.03	2	0.05	28	86	35
2000 cfs	06-46-04	25121			OFC(SJR)	18APR99		49	78	426	83	883	11	0.10	11	0.27	30	92	49
w/o HORB	06-46-05	25836			OFC(SJR)	19APR99		115	94	559	52	466	15	0.12	9	0.21	32	93	43
TOTAL	UPPER	76221	86		OLGB	RM diff.	202	45	184	1220	161	1419	15	0.04	7	0.06	79	262	97
TOTAL	LOWER	50957	85		OFC(SJR)	= 53.5		164	172	985	135	1349	26	0.11	20	0.24	62	185	92
2000	06-45-56	23603			OLGB	13APR00		17	13	59	1	12	5	0.05	6	0.13	23	72	34
	06-45-57	22096			OLGB	15APR00		15	4	22	2	24	2	0.02	1	0.02	24	81	24
LG FLOW:	06-45-58	26975			OLGB	15APR00		8	10	59	0	0	3	0.03	5	0.11	22	68	29
3800 cfs	06-45-59	23071			OFC(SJR)	16APR00		33	27	116	1	12	12	0.12	4	0.09	44	141	50
w/ HORB	06-45-60	21698			OFC(SJR)	14APR00		49	20	95	1	12	10	0.10	5	0.12	34	104	51
TOTAL	UPPER	72674	74		OLGB	RM diff.	241	40	27	140	3	36	10	0.03	12	0.09	69	221	87
TOTAL	LOWER	44769	74		OFC(SJR)	= 53.5		82	47	211	2	24	22	0.11	9	0.10	78	245	101
2001	06-44-12	24600			OLGB	22APR01		38	0	0	0	0	2	0.02	2	0.04	2	7	6
	06-44-13	22758			OLGB	22APR01		40	0	0	1	12	6	0.05	2	0.04	4	23	2
LG FLOW:	06-44-14	21527			OLGB	22APR01		32	0	0	0	0	10	0.09	4	0.09	5	15	1
620 cfs	06-44-43	22051			OFC(SJR)	28APR01		165	0	0	0	0	35	0.30	13	0.28	12	40	13
w/ HORB	06-44-44	24393			OFC(SJR)	26APR01		262	2	12	1	12	25	0.19	12	0.23	16	56	15
TOTAL	UPPER	68885	82	52	OLGB	RM diff.	109	110	0	0	1	12	18	0.05	8	0.06	11	45	9
TOTAL	LOWER	46444	84	68	OFC(SJR)	= 53.5		427	2	12	1	12	60	0.25	25	0.26	28	96	28
2002	06-44-06	24976			OLGB	24APR02		65	2	12	1	12	3	0.020	1	0.020			
	06-44-67	24813			OLGB	24APR02		63	2	12	0	0	5	0.037	7	0.141			
LG FLOW:	06-44-68	25220			OLGB	24APR02		51	2	18	1	12	3	0.023	0	--			
1300 cfs	06-44-61	25701			OFC(SJR)	26APR02		116	1	6	0	0	1	0.007	6	0.111			
w/ HORB	06-44-69	23870			OFC(SJR)	29APR02		25	2	15	1	12	2	0.015	3	0.063			
TOTAL	UPPER	75009	86	54	OLGB	RM diff.	1008	179	6	42	2	24	11	0.026	8	0.053			
TOTAL	LOWER	49571	86	62	OFC(SJR)	= 53.5		141	3	21	1	12	3	0.011	9	0.087			

MERCED RIVER JUVENILE SALMON CWT RELEASES AND RECOVERIES																					
RELEASE		EFFECT.	AVG.	FLOW	RELEASE		SMOLT RECOVERIES											EXPAND	SPAWN	SPAWN	SPAWN
YEAR	TAG NO.	RELEASE	FL	CRESSEY	SITE	DATE		MOSS-	SWP	EXPAND.	CVP	EXPAND.	JERS.PT.	J. PT.	CHIPPS	CHIPPS	OCEAN	OCEAN	MERCED		
			(mm)	(cfs)			RS TRAP	DALE	PUMPS	SWP	PUMPS	CVP	/ANT.	SURV.	IS.	SURV.	CATCH	CATCH	HATCH.	OTHER	TOTAL
1994	0601110210	24946		985	MRH	22APR94	-	39	3	3	2	24			1	0.07		54			32
	0601110211	24946			MRH	22APR94	-	47	1	1	4	48			1	0.04		149			39
	0601110212	24946			MRH	22APR94	-	37	2	4	4	24			2	0.07		80			34
	0601110213	24946			MRH	22APR94	-	24	0	0	2	24			1	0.05		48			22
	0601110214	27349		(3)	MRMOUTH	22APR94	-	136	2	2	2	24			0	0		102			42
	0601110215	27349			MRMOUTH	22APR94	-	129	3	6	4	48			2	0.08		43			39
	0601110301	27349			MRMOUTH	22APR94	-	89	0	0	0	0			0	0		86			36
TOTAL	UPPER	99784	88		MRH		-	147	6	8	12	120			5	0.06		331	123	4	127
TOTAL	LOWER	82047	87		MRMOUTH		-	354	5	8	6	72			2	0.02		231	116	1	117
1995	H61110401	28972		3950	MRH	03MAY95	-	24	12	102	37	313			5	0.17		230			130
	H61110402	28576			MRH	03MAY95	-	31	19	124	24	255			3	0.1		213			100
	H61110403	27429			MRH	03MAY95	-	10	18	157	38	423			4	0.14		143			90
	H61110404	28757			MRH	03MAY95	-	17	13	139	32	351			6	0.20		115			81
	H61110405	28437			HATFIELD	04MAY95	-	23	19	137	32	341			7	0.24		225			97
	H61110406	28776			HATFIELD	04MAY95	-	42	17	123	46	475			4	0.13		224			91
	H61110407	29203			HATFIELD	04MAY95	-	41	26	130	43	418			7	0.23		194			94
TOTAL	UPPER	111289	84		MRH		-	82	62	522	131	1342			18	0.15		701	375	26	401
TOTAL	LOWER	83016	82		HATFIELD		-	106	62	390	121	1234			18	0.2		643	240	42	282
1996	H61110408	25561		1200	MRH	25APR96		25	1	0	3	48			0	0		11			0
	H61110409	25632			MRH	25APR96		23	2	6	1	12			0	0		8			0
	H61110410	27541			MRH	25APR96		30	0	0	10	132			1	0.04		5			5
	H61110411	26391			MRH	25APR96		34	1	0	8	108			0	0		0			8
	H61110503	26405			HATFIELD	26APR96		22	0	0	4	60			1	0		1			0
	H61110504	26787			HATFIELD	26APR96		43	1	0	5	48			1	0.04		8			3
	H61110505	25077			HATFIELD	26APR96		37	1	8	12	180			0	0		3			1
TOTAL	UPPER	104068	80		MRH			112	4	6	22	300			1	0.01		24	13	0	13
TOTAL	LOWER	78268	93		HATFIELD			102	2	8	21	288			2	0.01		12	4	0	4
1997 (1)	0601110511	26045			MRH	20APR97		8	2	18	0	0	10	0.06	1	0.04		21			20
	0601110512	27683			MRH	20APR97		10	1	3	3	24	4	0.02	3	0.10		11			25
	0601110513	31930			MRH	20APR97		4	0	0	3	36	8	0.04	1	0.03		8			19
	0601110514	24880			MRH	20APR97		5		0		0	7	0.04	0	0.00		14			19
	0601110515	24398		(3)	HATFIELD	22APR97		27	4	18	2	24	23	0.14	6	0.23		39			49
	0601110601	29011			HATFIELD	22APR97		16	4	12	6	72	26	0.15	3	0.10		81			60
	0601110602	25761			HATFIELD	22APR97		17	1	2	2	24	11	0.06	7	0.25		58			32
	0601110603	25317			HATFIELD	22APR97		17	1	4	3	36	17	0.11	0	0.00		59			32
TOTAL	UPPER	110,538	77	1420	MRH			27	3	21	6	60	29	0.04	5	0.04		54	83	0	83
TOTAL	LOWER	104,487	75	756	HATFIELD			77	10	36	13	156	77	0.13	16	0.14		237	173	0	173

MERCED RIVER JUVENILE SALMON CWT RELEASES AND RECOVERIES

RELEASE YEAR	TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	FLOW CRESSEY (cfs)	RELEASE SITE	DATE	SMOLT RECOVERIES RS TRAP	MOSSDALE	SWP PUMPS	EXPAND. SWP	CVP PUMPS	EXPAND. CVP	JERS.PT. /ANT.	J. PT. SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	EXPAND OCEAN CATCH	SPAWN MERCED HATCH.	SPAWN OTHER	SPAWN TOTAL
1997 (2)	0601110611	28,031			MRH	12MAY97		0	0	0	1	12			0	0		0			0
	0601110612	27,915			MRH	12MAY97		0	0	0	0	0			0	0		0			0
	0601110613	10,561			MRH	12MAY97		0	0	0	0	0			0	0		0			0
	0601110614	33,064			HATFIELD	14MAY97		44	1	8	15	180			0	0		0			1
	0601110615	28,294			HATFIELD	14MAY97		34	3	18	14	168			1	0.03		5			1
	0601110701	24,943			HATFIELD	14MAY97		25	0	0	8	84			0	0		0			0
	0601110702	5,856			HATFIELD	14MAY97		3	0	0	2	24			0	0		3			1
TOTAL	UPPER	66507	76	578	MRH			0	0	0	1	12			0	0		0	0	0	0
TOTAL	LOWER	92157	67	433	HATFIELD			106	4	26	39	456			1	0.01		8	3	0	3
1998 (1)	64523	35800			MRH	12APR98		44	1	4	19	212	10	0.05	25	0.34		82			31
	64524	36289			MRH	12APR98		29	0		29	364	11	0.05	24	0.32		66			41
	62520	27973			MRH	12APR98		28	2	4	22	276	4	0.02	15	0.26		53			47
	62521	34805			HATFIELD	14APR98		38	0		42	524	9	0.05	21	0.31		69			29
	62522	30857			HATFIELD	14APR98		29	0		23	280	9	0.05	18	0.27		46			29
	62523	8447			HATFIELD	14APR98		6	0		7	76	1	0.02	2	0.12		4			9
TOTAL	UPPER	100062	83	3220	MRH			101	3	8	70	852	25	0.04	64	0.31		201	115	4	119
TOTAL	LOWER	74109	85	3470	HATFIELD			73	0	0	72	880	19	0.04	41	0.23		119	57	10	67
1998 (2)	61110709	28248			MRH	03MAY98		26	1	6	19	228	10	0.07	8	0.16		128			96
	61110710	25482			MRH	03MAY98		32	0	0	15	180	3	0.02	6	0.11		98			81
	61110711	25220			MRH	03MAY98		23	3	30	16	192	3	0.02	5	0.10		94			71
	61110712	25046			MRH	03MAY98		20	3	18	20	240	5	0.04	10	0.20		58			67
	61110502	49873			HATFIELD	05MAY98		79	4	21	66	840	12	0.04	18	0.18		216			146
	61110713	25314			HATFIELD	05MAY98		27	4	32	33	396	6	0.05	16	0.31		97			63
TOTAL	UPPER	103996	85	2390	MRH			101	7	54	70	840	21	0.04	29	0.14		378	304	11	315
TOTAL	LOWER	75187	89	2760	HATFIELD			106	8	53	99	1236	18	0.04	34	0.24		313	198	11	209
1999 (1)	06-45-28	25462			MRH	14APR99		24	57	321	28	263	4	0.03	3	0.06		48			32
	06-45-29	25445			MRH	14APR99		21	38	237	29	292	7	0.06	5	0.09		67			30
	06-45-30	25221			MRH	15APR99		28	46	304	25	234	3	0.03	4	0.10		48			29
	06-45-31	24123			HATFIELD	16APR99		28	57	335	75	805	10	0.08	14	0.35		142			47
	06-45-32	24640			HATFIELD	16APR99		39	53	341	66	715	16	0.13	7	0.17		75			50
TOTAL	UPPER	76128	82	1360	MRH			73	141	862	82	789	14	0.04	12	0.09		163	90	1	91
TOTAL	LOWER	48763	85	1410	HATFIELD			67	110	676	141	1520	26	0.11	21	0.26		217	86	11	97
1999 (2)	0601110714	24075			MRH	05MAY99		4	6	48	8	45			0			4			2
	0601110801	25923			MRH	05MAY99		0	6	60	4	26			1	0.02		9			3
	0601110802	23868			MRH	06MAY99		2	6	39	6	45			0			4			5
	0601110803	23936			MRH	06MAY99		1	9	101	8	57			0			10			4
	06-45-34	24337			HATFIELD	07MAY99		9	54	595	41	344			1	0.02		72			35
	06-45-35	23215			HATFIELD	07MAY99		12	38	478	32	280			2	0.04		68			22
	06-45-36	23436			HATFIELD	07MAY99		9	34	264	45	402			0			65			24
TOTAL	UPPER	97802	80	1320	MRH			7	27	248	26	173			1	0.005		27	13	1	14
TOTAL	LOWER	70988	81	1730	HATFIELD			30	126	1337	118	1026			3	0.02		205	78	3	81

MERCED RIVER JUVENILE SALMON CWT RELEASES AND RECOVERIES

RELEASE YEAR	RELEASE TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	FLOW CRESSEY (cfs)	RELEASE SITE	DATE	SMOLT RECOVERIES RS TRAP	MOSS-DALE	SWP PUMPS	EXPAND. SWP	CVP PUMPS	EXPAND. CVP	JERS.PT. /ANT.	J. PT. SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	EXPAND OCEAN CATCH	SPAWN MERCED HATCH.	SPAWN OTHER	SPAWN TOTAL
2000 (1)	06-45-39	25313			MRH	4/12-4/13		9	5	20	0	0	2	0.017	5	0.098		23			21
	06-45-40	25507			MRH	4/12-4/13		7	11	51	0	0	9	0.077	3	0.063		14			19
	06-45-41	25318			MRH	4/12-4/13		14	8	41	1	12	2	0.015	4	0.074		10			24
	06-45-42	25395			MRH	4/12-4/13		12	10	47	1	12	2	0.016	5	0.099		59			23
	06-45-43	24525			HATFIELD	4/13-4/14		45	28	146	1	12	8	0.07	5	0.103		110			38
	06-45-44	24490			HATFIELD	4/13-4/14		51	25	128	0	0	9	0.08	6	0.115		79			47
	06-45-45	24432			HATFIELD	4/13-4/14		41	29	127	1	12	8	0.07	2	0.038		137			42
TOTAL	UPPER	101533	78	330				42	34	159	2	24	15	0.033	17	0.083		106	84	3	87
TOTAL	LOWER	73447	76	330				137	82	401	2	24	25	0.074	13	0.088		326	121	6	127
2000 (2)	06-45-49	25433			MRH	24APR00		5	2	9	0	0	3	0.02	5	0.098		39			18
	06-45-50	27042			MRH	24APR00		10	2	12	3	36	2	0.013	6	0.11		36			21
	06-45-51	24378			MRH	24APR00		8	6	24	0	0	8	0.068	1	0.019		19			26
	06-45-52	25293			MRH	24APR00		6	0	0	1	12	7	0.058	4	0.078		26			34
	06-45-53	25794			HATFIELD	27APR00		24	12	57	0	0	13	0.107	5	0.099		63			40
	06-45-54	26189			HATFIELD	27APR00		26	20	90	1	12	5	0.039	4	0.082		97			58
	06-45-55	25444			HATFIELD	27APR00		23	16	78	2	24	10	0.085	6	0.12		40			38
TOTAL	UPPER	102146	76	1789				29	10	45	4	48	20	0.041	16	0.077		120	97	2	99
TOTAL	LOWER	77427	81	1573				73	48	225	3	36	28	0.076	15	0.098		200	131	5	136
2001 (1)	06-44-15	25107			MRH	21APR01		59	0	0	0	0	3	.023.	3	0.057		13			5
	06-44-16	24270			MRH	21APR01		39	1	6	0	0	10	0.079	3	0.059		29			13
	06-44-17	24537			MRH	21APR01		48	1	6	0	0	1	0.008	1	0.019		25			7
	06-44-18	24229			MRH	21APR01		49	0	0	0	0	7	0.055	0			16			8
	06-44-19	24974			HATFIELD	26APR01		164	3	18	0	0	11	0.081	8	0.151		46			6
	06-44-20	24989			HATFIELD	26APR01		154	3	18	2	24	17	0.126	6	0.113		52			6
	06-44-21	24916			HATFIELD	26APR01		153	3	18	0	0	24	0.178	17	0.322		39			15
TOTAL	UPPER	98143	81	1259				195	2	12	0	0	21	0.041	7	0.034		83	32	1	33
TOTAL	LOWER	74879	85	1250				471	9	54	2	24	52	0.128	31	0.195		137	27	0	27
2001 (2)	06-44-22	25311			MRH	08MAY01		39	0	0	0	0	10	0.071	2	0.038		0			0
	06-44-23	24685			MRH	08MAY01		51	0	0	0	0	9	0.072	1	0.019		0			0
	06-44-24	26534			MRH	08MAY01		36	0	0	0	0	12	0.082	1	0.018		0			1
	06-44-25	23641			MRH	08MAY01		57	0	0	0	0	7	0.067	0			6			0
	06-44-26	23074			HATFIELD	11MAY01		138	0	0	0	0	19	0.199	1	0.02		11			0
	06-44-27	23186			HATFIELD	13MAY01		122	0	0	0	0	20	0.182	1	0.02		8			1
	06-44-28	23387			HATFIELD	13MAY01		116	1	6	0	0	14	0.121	4	0.085		6			0
TOTAL	UPPER	100171	83	971				183	0	0	0	0	38	0.08	4	0.019		6	1	0	1
TOTAL	LOWER	69647	85	1380				376	1	6	0	0	53	0.154	6	0.053		25	1	0	1
2002 (1)	06-44-63	23188			MRH	31MAR02		2	1	6	1	12	1	0.01	1	0.02					
	06-44-64	23915			MRH	31MAR02		0	0	0	0	0	0		0						
	06-44-65	23775			MRH	31MAR02		0	0	0	0	0	0		0						
	06-44-66	23185			MRH	31MAR02		2	0	0	0	0	0		0						
	06-44-51	24380			HATFIELD	4/3-4/5		118	9	47	40	480	10	0.086	2	0.039					
	06-44-52	24228			HATFIELD	4/3-4/5		140	6	34	41	492	1	0.008	1	0.024					
	06-45-48	24890			HATFIELD	4/3-4/5		146	9	55	44	528	3	0.024	3	0.087					
TOTAL	UPPER	94063	74	208				4	1	6	1	12	1	0.002	1	0.005					
TOTAL	LOWER	73498	77	180				404	24	136	125	1500	14	0.04	6	0.045					

MERCED RIVER JUVENILE SALMON CWT RELEASES AND RECOVERIES

RELEASE YEAR	TAG NO.	EFFECT. RELEASE	AVG. FL (mm)	FLOW CRESSEY (cfs)	RELEASE SITE	RELEASE DATE	SMOLT RECOVERIES RS TRAP	MOSS-DALE	SWP PUMPS	EXPAND. SWP	CVP PUMPS	EXPAND. CVP	JERS.PT. /ANT.	J. PT. SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	EXPAND OCEAN CATCH	SPAWN MERCED HATCH.	SPAWN OTHER	SPAWN TOTAL
2002 (2)	06-44-82	22522			MRH	21APR02		4	0		0		0		0						
	06-44-83	23086			MRH	21APR02		11	0		0		1	0.008	0						
	06-44-84	23140			MRH	21APR02		10	0		0		0		0						
	06-44-85	22183			MRH	21APR02		9	0		0		0		0						
	06-44-86	23349			HATFIELD	4/26-4/29		44	1	6	1	12	2	0.015	2	0.045					
	06-44-87	23363			HATFIELD	4/26-4/29		50	2	12	0		5	0.038	0						
	06-44-88	23639			HATFIELD	4/26-4/29		50	1	6	0		2	0.015	1	0.02					
TOTAL	UPPER	90931	71	391				34	0	0	0	0	1	0.002	0						
TOTAL	LOWER	70351	73	418				144	4	24	1	12	9	0.023	3	0.022					
2003 (1)	06-44-89	22677			MRH	13APR03			1	6	2	24	3	0.025	1	0.021					
	06-44-90	22816			MRH	13APR03			0	0	0	0	1	0.008	1	0.021					
	06-44-91	22946			MRH	13APR03			1	6	0	0	2	0.016	0						
	06-44-92	21725			MRH	13APR03			1	6	0	0	0		1	0.022					
	06-44-93	23274			HATFIELD	16APR03			3	18	1	12	6	0.049	4	0.08					
	06-44-94	23872			HATFIELD	16APR03			2	9	1	12	2	0.015	1	0.02					
	06-44-95	23833			HATFIELD	16APR03			0	0	1	12	4	0.032	4	0.079					
TOTAL	UPPER	90164		637					3	18	2	24	6	0.012	3	0.016					
TOTAL	LOWER	70979		678					5	27	3	36	12	0.032	9	0.06					
2003 (2)	06-44-96	24232			MRH	25APR03			0		0		0		0						
	06-44-97	23869			MRH	25APR03			0		0		0		0						
	06-44-98	23757			MRH	25APR03			0		0		1	0.08	0						
	06-44-99	23950			MRH	25APR03			0		1	12	0		0						
	06-45-64	24545			HATFIELD	29APR03			0		0		0		0						
	06-45-65	24483			HATFIELD	29APR93			0		0		0		2	0.042					
	06-45-66	24358			HATFIELD	29APR03			1	6	0		1	0.007	0						
TOTAL	UPPER	95808		512					0	0	1	12	1	0.002	0						
TOTAL	LOWER	73386		510					1	6	0	0	1	0.002	2	0.014					
2003 (3)	06-27-77	23590			MRH	04MAY03			0		0		0		1	0.02					
	06-27-78	23862			MRH	04MAY03			0		1	12	0		0						
	06-44-49	23512			MRH	04MAY03			0		1	12	1	0.009	1	0.02					
	06-44-50	24330			MRH	04MAY03			1	6	0		0		2	0.038					
	06-45-46	22603			HATFIELD	07MAY03			0		0		0		1	0.021					
	06-45-47	22714			HATFIELD	07MAY03			0		0		2	0.015	0						
	06-45-72	22649			HATFIELD	07MAY03			0		0		0		2	0.041					
TOTAL	UPPER	95294		1470					1	6	2	24	1	0.002	4	0.02					
TOTAL	LOWER	67966		1525					0	0	0	0	2	0.005	3	0.021					

Merced Smolt Survival Index -- Based on recoveries >= 4 in one group and removal of questionable tests (1994, 1997)

RELEA:YEAR	CRESSEY (cfs)	VNS (cfs)	ᐣUSHNET RS TRAP	MOSS-DALE	SWP PUMPS	SWP EXPD.	CVP PUMPS	CVP EXPD.	JERSEY POINT	J. PT. SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	SPAWN	Trawl average	Pump average	Adult average	Avg. of all
1994	985																	
1995	3950			0.58	0.75	1.00	0.81	0.81			0.75	0.75	0.81	1.06	0.67	0.91	0.94	0.84
1996	1200			0.83	1.50	0.56	0.79	0.78					1.50	2.44	0.83	0.67	1.97	1.22
1997	1420																	
1997	578			0.00	0.00	0.00	0.04	0.04							0.00	0.02		0.01
1998	3220			1.02			0:72	0.72	0.97	1.00	1.16	1.35	1.25	1.32	1.12	0.72	1.29	1.11
1998	2400			0.69	0.63	0.74	0.51	0.49	0.84	1.00	0.62	0.59	0.87	1.09	0.76	0.62	0.98	0.78
1999	1360			0.70	0.82	0.82	0.37	0.33	0.34	0.36	0.37	0.35	0.48	0.60	0.47	0.58	0.54	0.52
1999	1320			0.17	0.16	0.13	0.16	0.12					0.10	0.13	0.17	0.13	0.11	0.13
2000	330			0.22	0.30	0.29			0.43	0.45	0.95	0.94	0.24	0.50	0.54	0.29	0.37	0.44
2000	1800			0.30	0.16	0.15	1.01	1.01	0.54	0.54	0.81	0.79	0.45	0.55	0.54	0.58	0.50	0.54
2001	1260			0.32	0.17	0.17			0.31	0.32	0.17	0.17	0.46	0.93	0.27	0.17	0.70	0.40
2001	970			0.34					0.50	0.52	0.46	0.36	0.17		0.41		0.17	0.35
2002	210			0.01	0.03	0.03	0.01	0.01	0.06	0.05	0.13	0.11			0.06	0.02		0.04
2002	390			0.18	0.00	0.00			0.09	0.09					0.13	0.00		0.09
2003	640				0.47	0.52			0.39	0.38	0.26	0.27			0.32	0.52		0.39
2003	510																	
2003	1470										0.95	0.95			0.95			0.95

	Trawl average	Pump average	Adult average	Avg. of all
Avg. high flow (1995, 1998)	0.85	0.75	1.07	0.91
Avg. mod. flow (96,99,2000-2,2001,2003-3)	0.52	0.42	0.67	0.59
Avg. low flow (97-2,2000-1,2002,2003-1,2)	0.21	0.17	0.37	0.19

STANISLAUS RIVER JUVENILE SALMON CWT RELEASES AND RECOVERIES																			
RELEASE		EFFECT.	AVG.	FLOW	RELEASE		SMOLT RECOVERIES						Antioch/					EXPAND.	
YEAR	TAG NO.	RELEASE	FL	GDWN	SITE	DATE	PUSHNET/	MOSS-	SWP	EXD.	CVP	EXPD.	JERSEY	J. PT.	CHIPPS	CHIPPS	OCEAN	OCEAN	SPAWN
			(mm)	(cfs)			RS TRAP	DALE	PUMPS	SWP	PUMPS	CVP	POINT	SURV.	IS.	SURV.	CATCH	CATCH	
1986	06-46-48	31,120		1100	KNIGHTS	28APR86	-	-	40		109				17	0.55		390	13
	06-46-49	31,148			KNIGHTS	28APR86	-	-	36		113				12	0.33		431	11
	06-46-50	24,751			KNIGHTS	28APR86	-	-	32		90				4	0.15		336	12
	06-46-53	21,254			KNIGHTS	28APR86	-	-	29		77				5	0.22		299	8
	06-46-45	31,491			AM.TRAIL	29APR86	-	-	85		115				17	0.48		639	29
	06-46-46	31,310			AM.TRAIL	29APR86	-	-	73		112				18	0.54		507	24
	06-46-47	30,530			AM.TRAIL	29APR86	-	-	88		10				20	0.66		649	32
	06-46-52	12,768			AM.TRAIL	29APR86	-	-	39		42				6	0.44		295	9
TOTAL	**UPPER**	**108,273**			**KNIGHTS**				**137**	**4832**	**389**	**3518**			**38**	**0.34**		**1456**	**44**
	LOWER	**106,099**	**89**		**AM.TRAIL**				**285**	**9385**	**279**	**4455**			**61**	**0.56**		**2090**	**94**
1988	B6-11-05	36,769		920	KNIGHTS F	26APR88	76	143	292	2166	78	874			6	0.08		35	1
	B6-11-06	34,906			KNIGHTS F	26APR88	79	137	256	1952	75	838			5	0.07		63	9
	B6-11-03	35,249			AM.TRAIL	26APR88	270	415	268	2116	232	2905			6	0.08		154	6
	B6-11-04	33,539			AM.TRAIL	26APR88	278	411	297	2303	267	3072			7	0.1		113	7
TOTAL	**UPPER**	**71,675**	**75.2**		**KNIGHTS F**	**26APR88**	**155**	**280**	**548**	**4118**	**153**	**1712**			**11**	**0.07**		**98**	**10**
	LOWER	**68,788**	**79.6**		**AM.TRAIL**	**26APR88**	**548**	**826**	**565**	**4419**	**499**	**5977**			**13**	**0.09**		**267**	**13**
1989	B6-14-09	52,445		820	KNIGHTS F	20APR89	-	227	104	1325	39	416			3	0.05		17	7
	B6-14-10	51,506			KNIGHTS F	20APR89	-	244	99	1060	37	408			4	0.07		17	2
	B6-01-01	25,525			AM.TRAIL	19APR89	-	315	103	1152	22	260			11	0.40		24	8
	B6-14-11	48,695			AM.TRAIL	19APR89	-	545	170	1754	41	468			6	0.12		35	2
	B6-14-12	*47,992*	*72.4*	*1270*	*NACOWEST*	*2-3MAY89*	-	*173*	*15*		*58*				*0*			*12*	*4*
TOTAL	**UPPER**	**103,951**	**77.4**		**KNIGHTS F**			**471**	**203**	**2385**	**76**	**824**			**7**	**0.06**		**34**	**9**
	LOWER	**74,220**	**76.5**		**AM.TRAIL**			**860**	**273**	**2906**	**63**	**728**			**17**	**0.21**		**59**	**10**
1999	06-45-37	23,358		1260	KNIGHTS F	01JUN99			0		7							6	1
	06-45-38	23,532			LOWER SR	01JUN99			1		5							0	1
TOTAL	**UPPER**	**23,358**	**88**		**KNIGHTS F**				**0**		**7**							**6**	**1**
	LOWER	**23,532**	**85.6**		**LOWER SR**				**1**		**5**							**0**	**1**
2000	06-44-07	25,511		1500	KNIGHTS F	19MAY00		66	18	99	17	204	0		3			7	1
	06-44-08	25,786			KNIGHTS F	18MAY00		77	21	144	12	144	0		1			4	0
	06-44-09	26,140			KNIGHTS F	18MAY00		71	17	117	13	156	0		0			3	1
	06-44-10	25,712			TWO RIVERS	20MAY00		91	52	471	23	276	0		4			12	4
	06-44-11	24,835			TWO RIVERS	20MAY00		157	32	219	12	144	0		0			6	3
TOTAL	**UPPER**	**77,437**	**84**					**214**	**56**	**360**	**42**	**504**	**0**		**4**	**0.018**		**14**	**2**
	LOWER	**50,547**	**84.5**					**248**	**84**	**690**	**35**	**420**	**0**		**4**	**0.063**		**18**	**7**
2001	0601110804	24,273		600	KNIGHTS F	22MAY01		51	0	0	2	24	0		0			11	
	0601110805	24,225			KNIGHTS F	22MAY01		69	0	0	2	24	0		0				
	0601110715	25,634			TWO RIVERS	25MAY01		32					0		0				
TOTAL	**UPPER**	**48,498**	**90**					**120**	**0**	**0**	**4**	**48**	**0**		**0**			**11**	
	LOWER	**25,634**	**94**					**32**	**0**	**0**	**0**	**0**	**0**		**0**			**0**	
2002	06-44-46	23,745		740	KNIGHTS F	01MAY02		76	0	0	1	12	1	0.008	2	0.043			
	06-44-47	24,236			KNIGHTS F	01MAY02		82	1	6	0	0	5	0.037	2	0.055		4	
	06-44-48	24,646			TWO RIVERS	04MAY02		196	0	0	0	0	3	0.022	1	0.022			
TOTAL	**UPPER**	**47,981**	**82**					**158**	**1**	**6**	**1**	**12**	**6**	**0.023**	**4**	**0.046**		**4**	
	LOWER	**24,646**	**84**					**196**	**0**	**0**	**0**	**0**	**3**	**0.022**	**1**	**0.022**		**0**	
2003	06-45-67	25,599		1500	KNIGHTS F	25APR03			0	0	0	0	1	0.007	0				
	06-45-68	26,226			KNIGHTS F	25APR03			0	0	0	0	0		1	0.018			
	06-45-69	26,136			KNIGHTS F	25APR03			0	0	0	0	1	0.007	0				
	06-45-70	26,101			TWO RIVERS	27APR03			0	0	0	0	1	0.007	0				
	06-45-71	26,632			TWO RIVERS	28APR03			0	0	0	0	3	0.021	0				
TOTAL	**UPPER**	**77,961**							**0**	**0**	**0**	**0**	**2**	**0.005**	**1**	**0.006**			
	LOWER	**52,733**							**0**	**0**	**0**	**0**	**4**	**0.014**	**0**				

Stanislaus River
Min. 4 recovs in one group

YEAR	GDWN FLOW	VNS FLOW	PUSHNET RST	MOSS-DALE	SWP PUMPS	EXPD. SWP	CVP PUMPS	EXPD. CVP	J. Pt.	J. PT. SURV.	CHIPPS IS.	CHIPPS SURV.	OCEAN CATCH	SPAWN
1986	1100				0.47	0.50	1.37	0.77			0.61	0.61	0.68	0.46
1988	920		0.27	0.33	0.93	0.89	0.29	0.27			0.81	0.78	0.35	0.74
1989	820			0.39	0.53	0.59	0.86	0.81			0.29	0.29	0.41	0.64
1999	1260						1.41	1.41						
2000	1500			0.56	0.44	0.34	0.78	0.78			0.186	0.186	0.51	0.186
2001	600			1.98										
2002	740			0.41					1.027	1.045	2.055	2.091		
2003	1500								0.338	0.357				

actual recovs.

REPORT 2003-4

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District	)	
	)	
and	)	Project No. 2299
	)	
Modesto Irrigation District	)	

2003 LOWER TUOLUMNE RIVER ANNUAL REPORT

Report 2003-4

Review of 2003 Summer Flow Operation

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March 2004

Review of 2003 Summer Flow Operation

Introduction

The Don Pedro Project fish flow year volume, used to determine instream flow requirements for the lower Tuolumne River, increased following the initial APR 1 basin index forecast as a result of wetter than average conditions for the APR-MAY2003 period. The APR 1 runoff forecast was used to first establish the volume allocated to the spring pulse flow period of mid-APR to mid-MAY, with the nominal summer flow being 50 cfs starting in JUN.

Near the end of the spring pulse flow period, the DWR May 13 forecast update (available on 15MAY) had APR-JUL runoff forecasts of 7-10% higher than the 01MAY forecast for the Stanislaus to San Joaquin Rivers (the four San Joaquin basin index streams). The 60-20-20 basin index at that time was up to 2.9746, indicating a total fish flow year volume estimated at about 239,700 acre-feet, up 90% from the 126,064 acre-feet (AF) based on the April 1 forecast. The TRTAC was notified of the current situation on 16MAY.

The minimum flow schedule was scheduled to go down to 150 cfs on May 18. The Districts, CDFG, and USFWS quickly decided to revise the flow schedule to help address the additional water and have as few days at the 150 cfs level as possible. The schedule was increased on 20MAY to 250 cfs or more through 12JUN (a small pulse flow to 550 cfs occurred in late MAY).

First Variable Flow Decision

The DWR forecast updates declined after the 13MAY forecast. By the 10JUN update, the estimated fish flow year volume was down to about 202,700 AF. An interim decision of the parties was reached on 13JUN, to be revisited at the TRTAC meeting on 24JUN. Interest was in attempting to adaptive manage the flow operation to provide more water temperature (WT) benefits than would be provided by a steady flow. That decision included:

- A flow reduction to 180 cfs would apply until at least 24JUN, the date of the next TRTAC meeting, unless modified by other agreement.
- The applicable flow schedule will go up to 220 cfs for any days that the National Weather Service (NWS) forecast for Modesto maximum air temperature (AT) is 100 degrees F or greater. This was an initial attempt to adjust to changing air temperature conditions - the current NWS forecast had no 100+ days anticipated during the next week.
- A more refined approach would be considered at the 24JUN TRTAC meeting and associated monitoring was discussed.
- DFG would provide some recently downloaded thermograph data
- Previous thermograph data of the Districts would be reviewed
- Turlock air temperature data, which was readily available, would be provided
- The SWS model output material sent out in MAR would be reviewed.
- The first "standard" snorkel survey of the season was planned for the next week
- Additional snorkel survey work was discussed for early JUL.

Second Variable Flow Decision

There were no 100-degree days leading up to the 24JUN TRTAC meeting. By that time, the recent flow schedule of 180 cfs and the latest DWR basin index update had resulted in a "default" flow level for the remainder of the summer period through 30SEP of 205 cfs, subject to further determination of a final basin index after 31JUL. After reviewing and discussing several handouts, the decision was made to adjust from the interim decision previously reached on 13JUN. The new decision included:

- The new criteria was a schedule at 195 cfs, except 235 cfs applied on days when the NWS prior day forecast for Modesto maximum air temperature is 96 degrees or greater.
- The schedule would return to 195 cfs on the second consecutive day with a forecast less than 96 degrees.
- An assumption is this operation would result, under average temperature conditions, in a schedule for the period averaging reasonably close to 205 cfs.
- TID (Monier) would take a closer look at these specific criteria, as they had not been analyzed, so some further refinements may be need to be considered.
- The Districts would make a good faith effort to implement this variable schedule, although some operational procedures remained to be established.
- The Districts would notify the parties should unforeseen problems occur and may endeavor to provide e-mail updates (weekly?) of temperature and flow conditions.
- The net difference (from a steady 205 cfs schedule) the operation plan intended is to have 30 cfs more during the warmest periods, with 10 cfs less the rest of the time.
- The current AT forecast was higher than 95 degrees, so the schedule would be at 235 cfs in the near term.

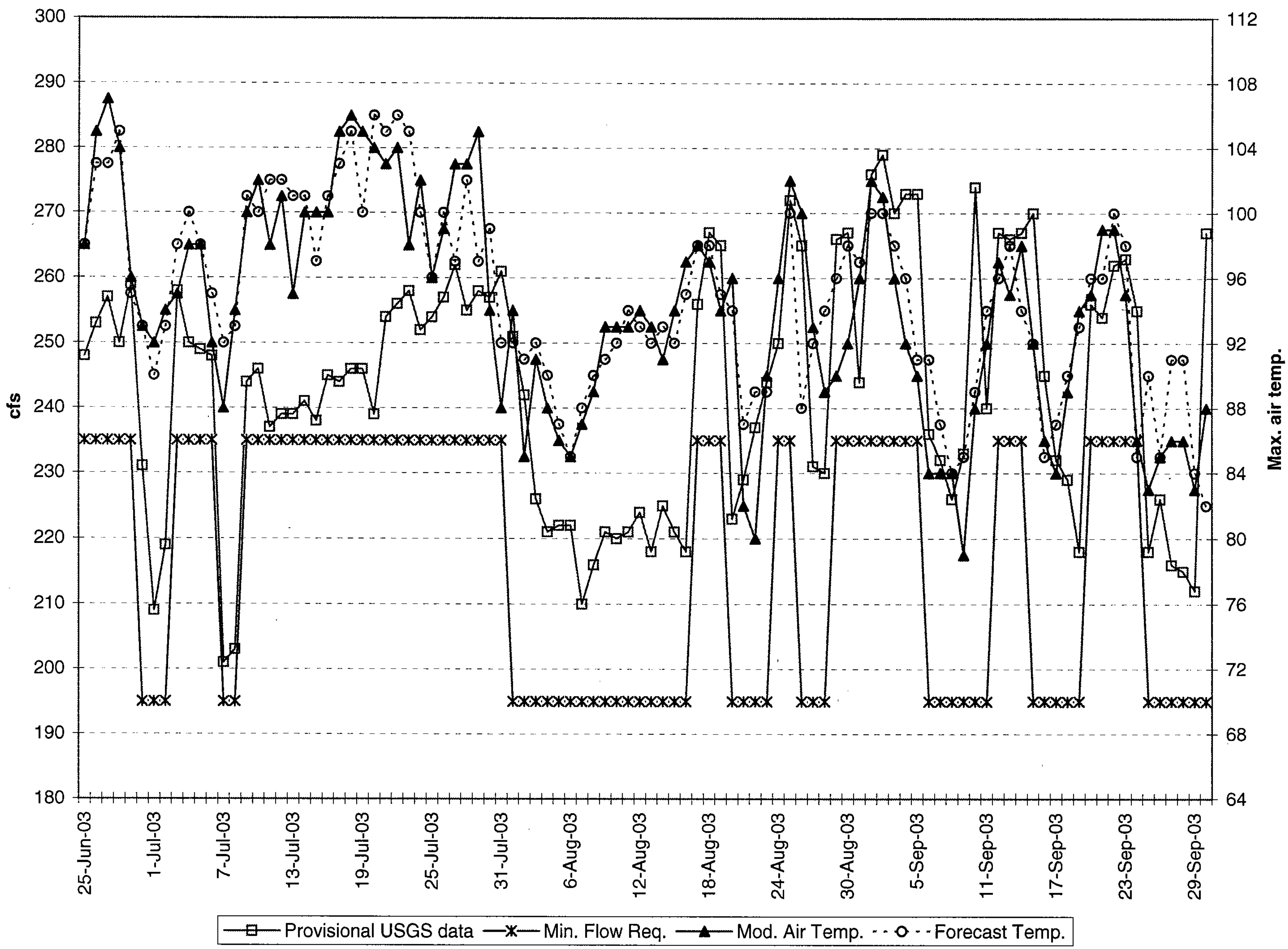
The La Grange rating table handout indicated the difference in river height at the 195-235 cfs range is less than 2 inches.

Implementation

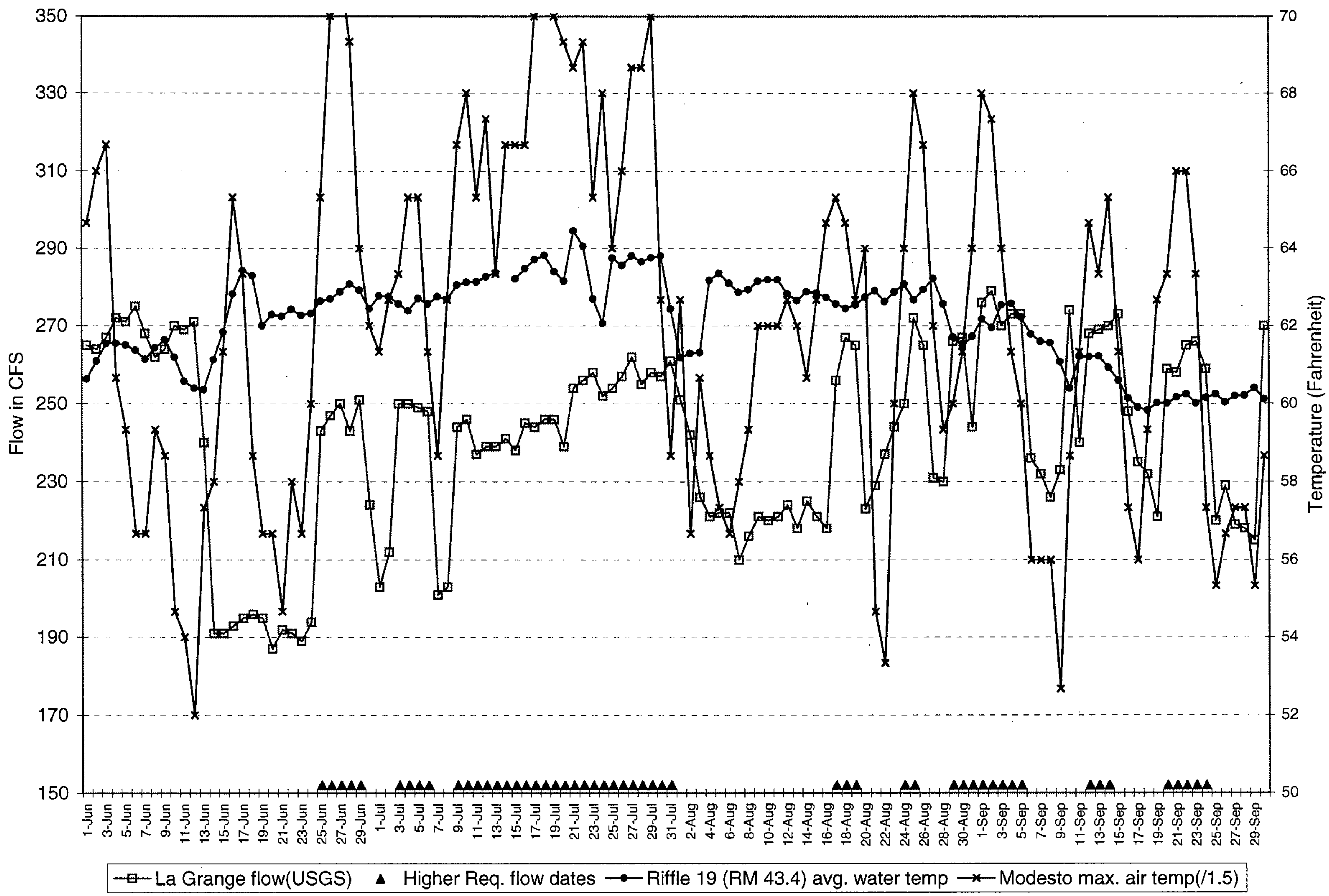
The operation went reasonably smoothly and updates were provided on a frequent basis. The summer turned out to be hotter than average, with an extended heat wave during most of JUL, and several hot periods in AUG and SEP.

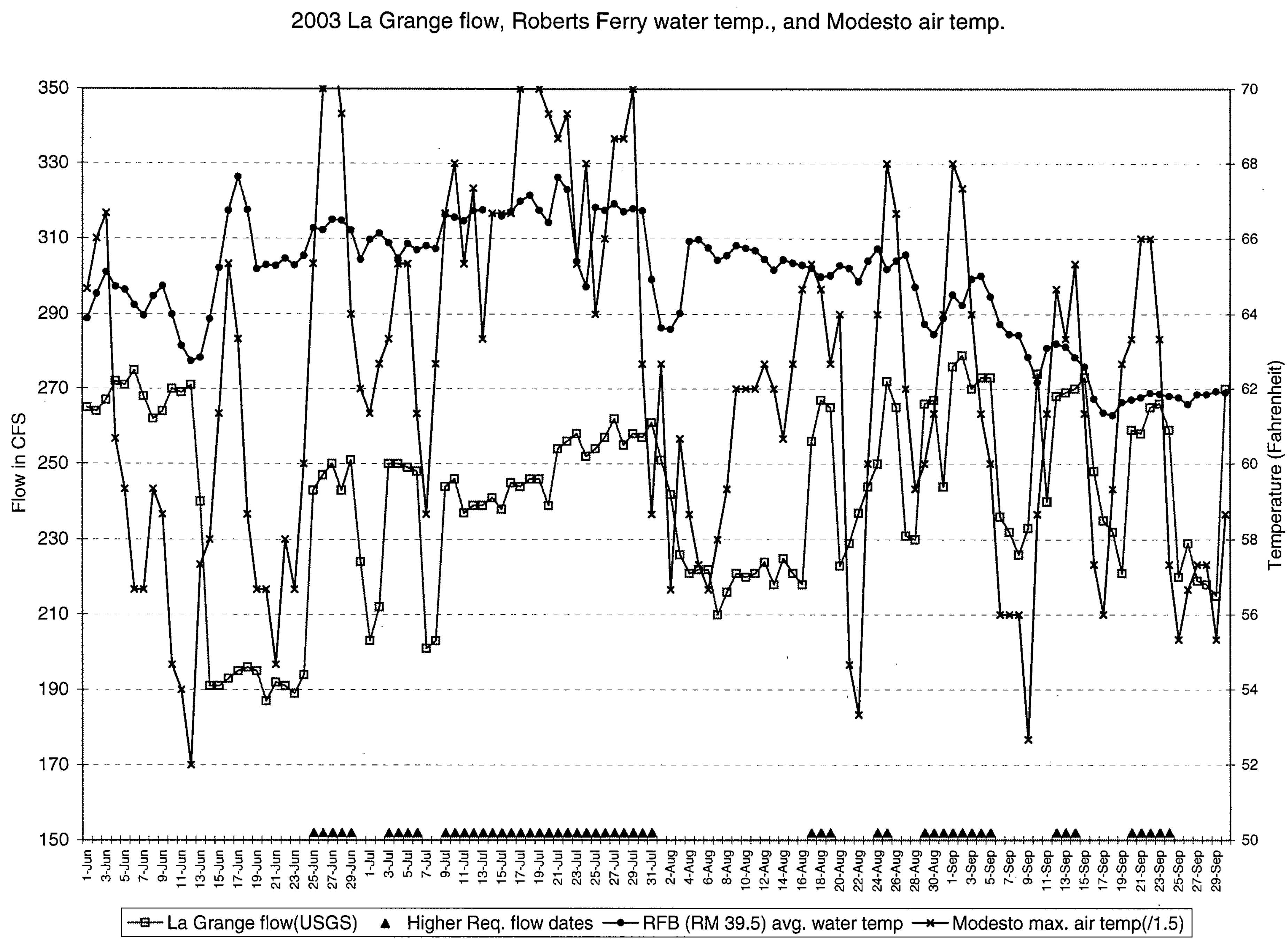
Data

The first graph shows the forecasted and actual max. AT with the applicable minimum flow required and the actual flows from 25JUN-30SEP. The second set of figures depicts the flow, maximum AT, and WT dynamics during JUN-SEP for 3 downstream stations ranging from about 9-15 miles below La Grange Dam. Comparable data for two other recent years with the most similar flows: 1997 (R19 and Ruddy Gravel) and 1999 (R19, Roberts Ferry, and Ruddy Gravel) are included. The third set of figures compares the individual parameters for those years. The table includes the forecast data used for determining the flow schedule. One consideration for further analysis of the results of this operation is to use a multivariate approach to examine the relationship of the three variables of flow, WT, and max. AT. This may help elucidate the degree to which this operation affected the WT downstream.

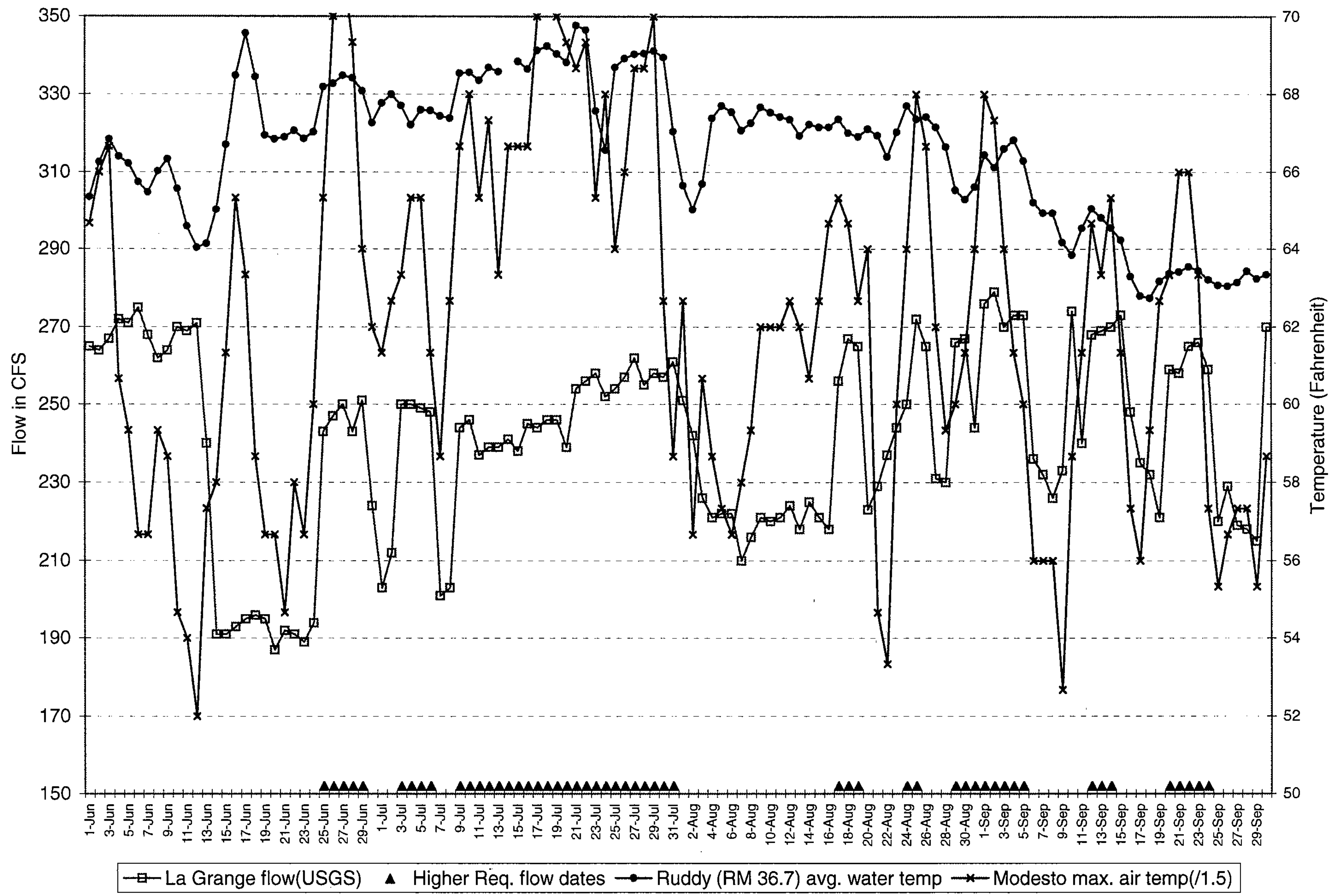

cfs
Max. air temp.
300
290
280
270
260
250
240
230
220
210
200
190
180
112
108
104
100
96
92
88
84
80
76
72
68
64
25-Jun-03
1-Jul-03
7-Jul-03
13-Jul-03
19-Jul-03
25-Jul-03
31-Jul-03
6-Aug-03
12-Aug-03
18-Aug-03
24-Aug-03
30-Aug-03
5-Sep-03
11-Sep-03
17-Sep-03
23-Sep-03
29-Sep-03
Provisional USGS data
Min. Flow Req.
Mod. Air Temp.
Forecast Temp.

2003 La Grange flow, Riffle 19 water temp., and Modesto air temp.

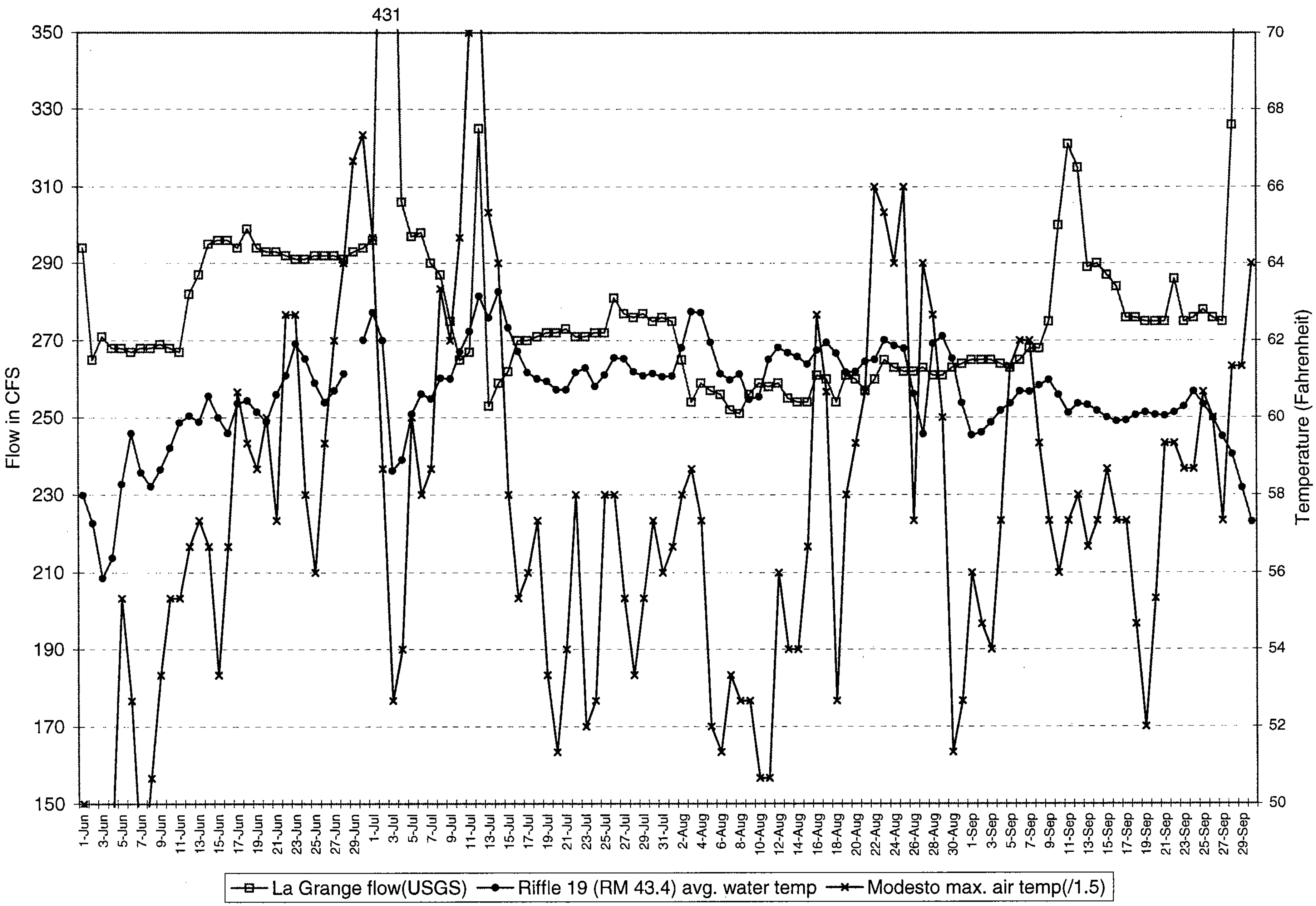



2003 La Grange flow, Roberts Ferry water temp., and Modesto air temp.
Flow in CFS
Temperature (Fahrenheit)
350
330
310
290
270
250
230
210
190
170
150
70
68
66
64
62
60
58
56
54
52
50
1-Jun
3-Jun
5-Jun
7-Jun
9-Jun
11-Jun
13-Jun
15-Jun
17-Jun
19-Jun
21-Jun
23-Jun
25-Jun
27-Jun
29-Jun
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
2-Aug
4-Aug
6-Aug
8-Aug
10-Aug
12-Aug
14-Aug
16-Aug
18-Aug
20-Aug
22-Aug
24-Aug
26-Aug
28-Aug
30-Aug
1-Sep
3-Sep
5-Sep
7-Sep
9-Sep
11-Sep
13-Sep
15-Sep
17-Sep
19-Sep
21-Sep
23-Sep
25-Sep
27-Sep
29-Sep
La Grange flow(USGS)
Higher Req. flow dates
RFB (RM 39.5) avg. water temp
Modesto max. air temp(/1.5)

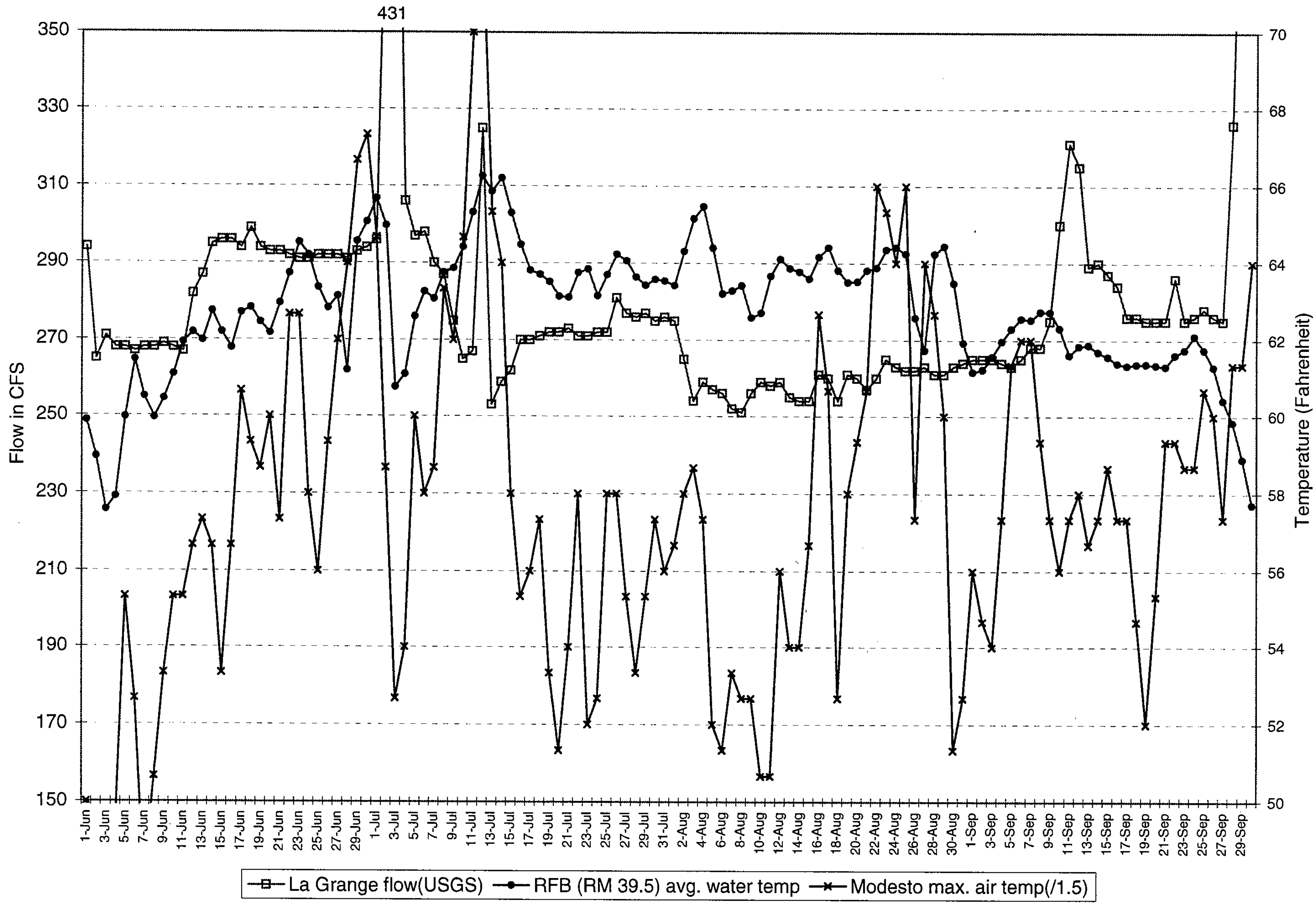
2003 La Grange flow, Ruddy Gravel water temp., and Modesto air temp.



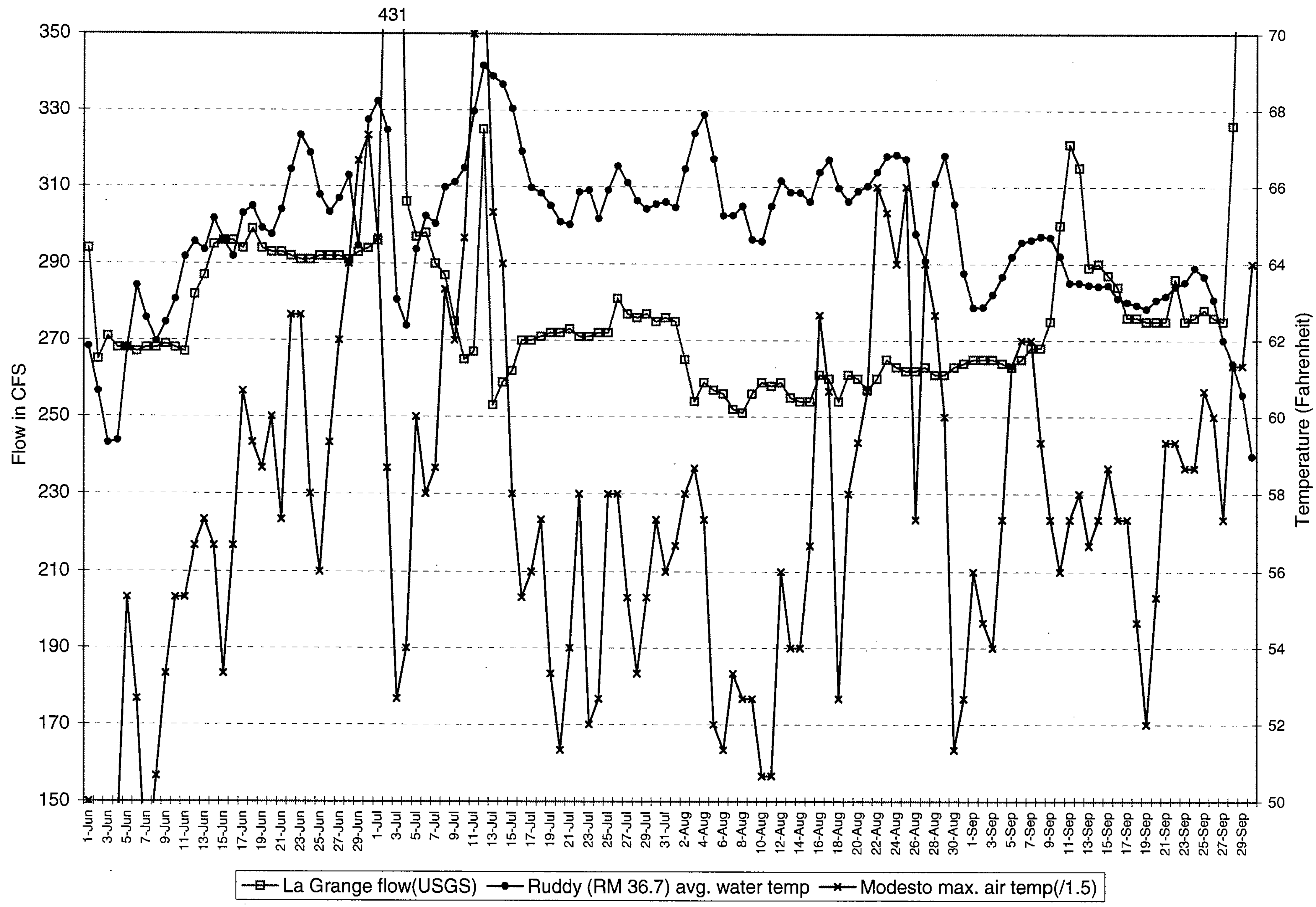
1999 La Grange flow, Riffle 19 water temp., and Modesto air temp.



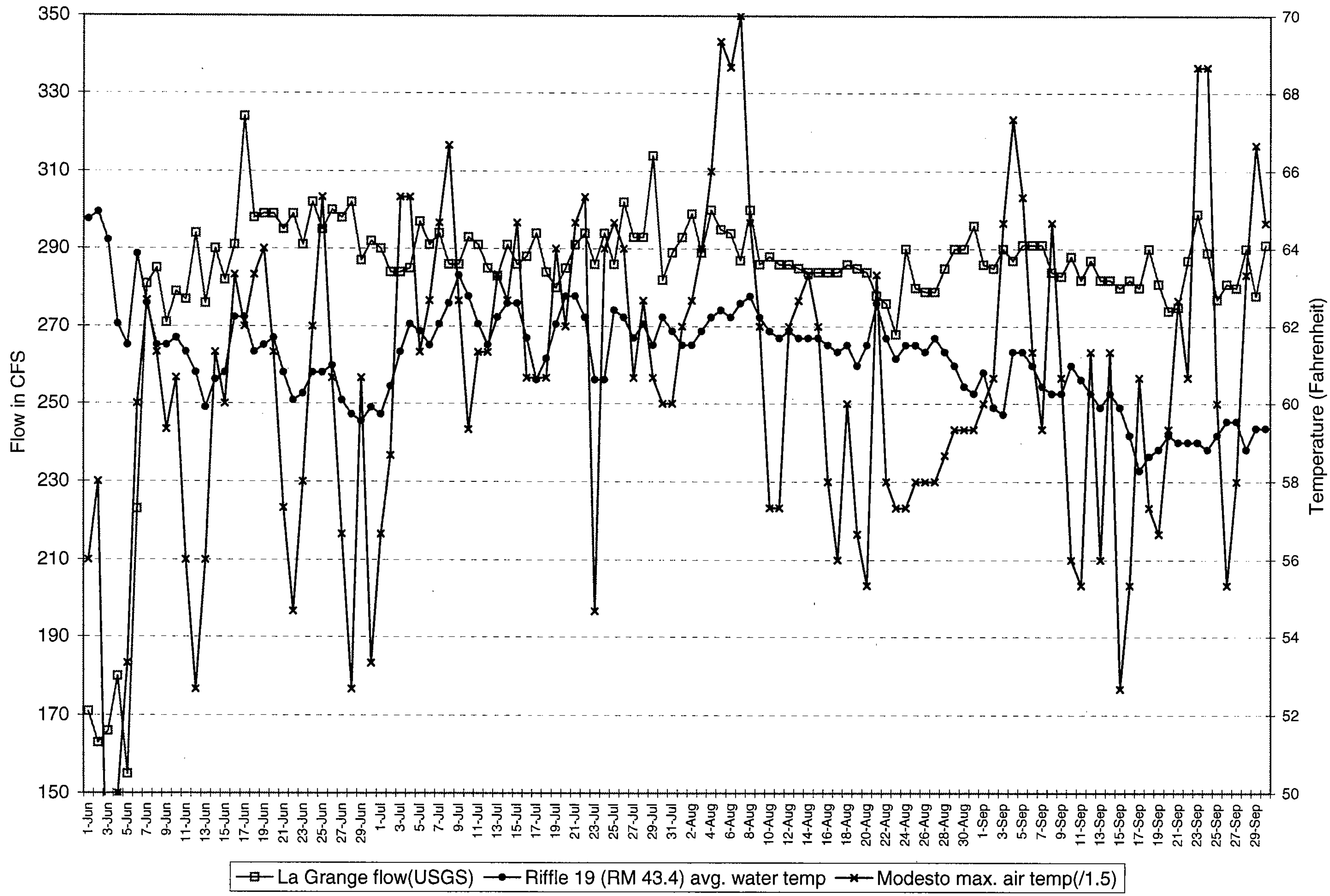
1999 La Grange flow, Roberts Ferry water temp., and Modesto air temp.



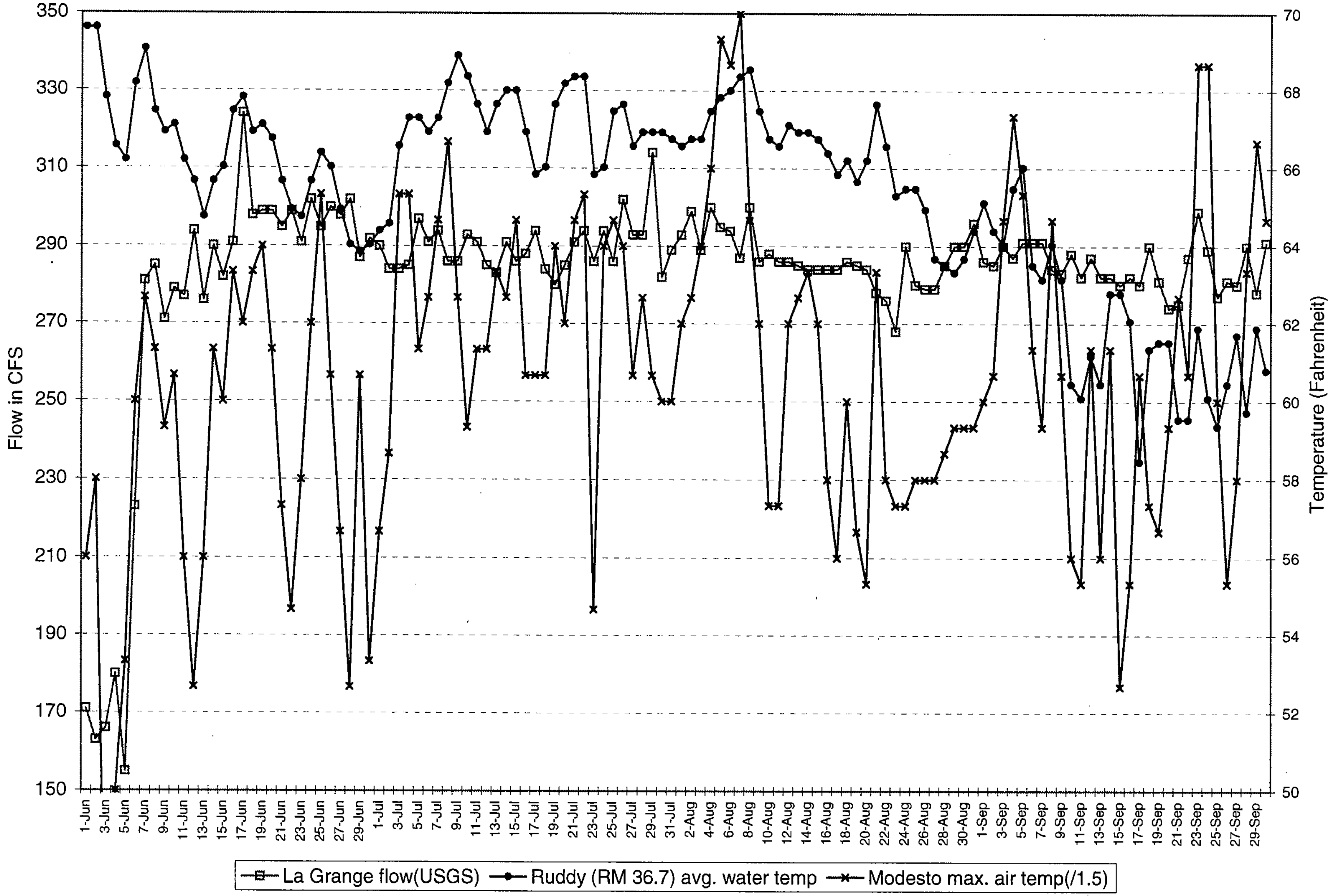
1999 La Grange flow, Ruddy Gravel water temp., and Modesto air temp.

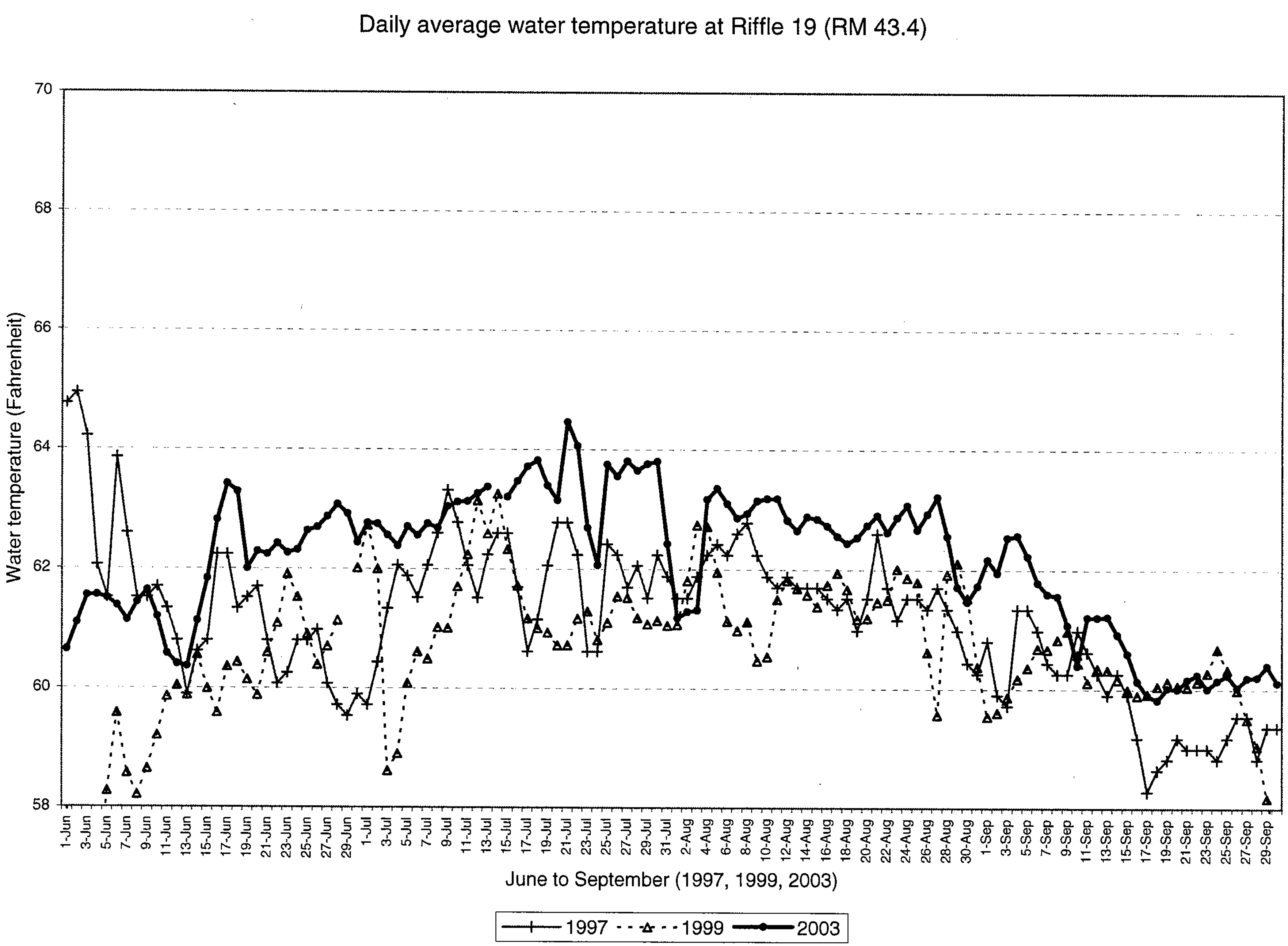


1997 La Grange flow, Riffle 19 water temp., and Modesto air temp.

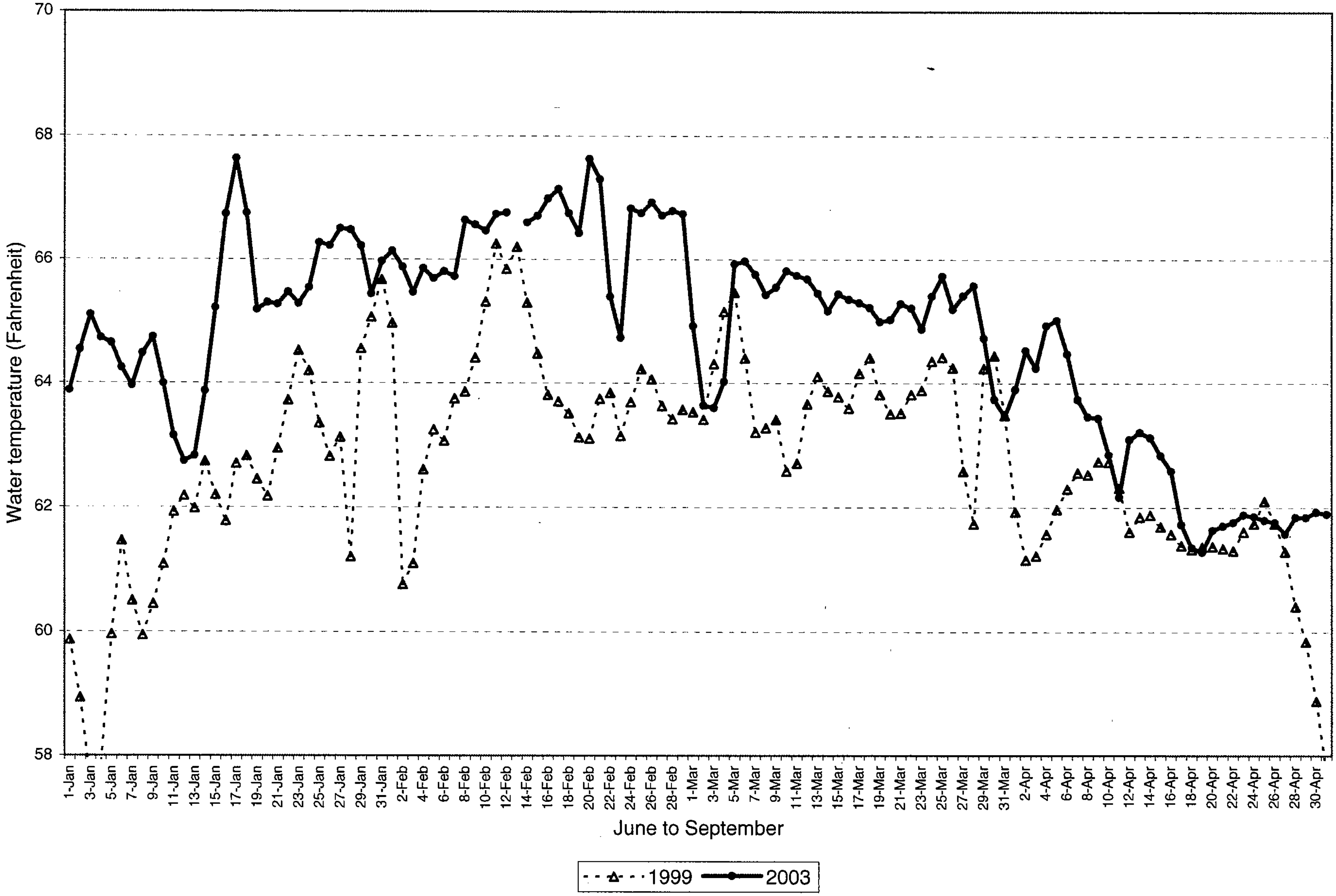


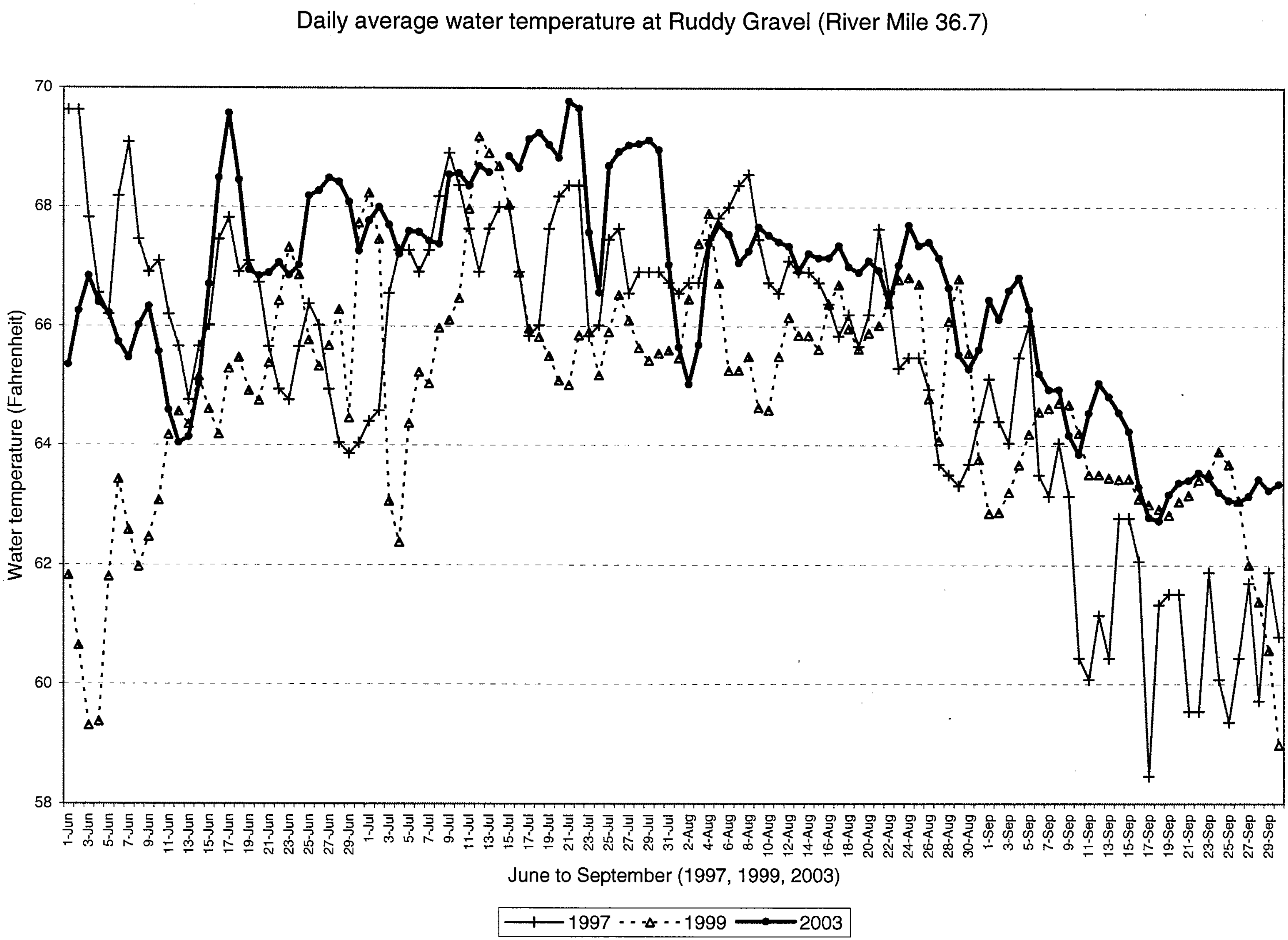
1997 La Grange flow, Ruddy Gravel water temp., and Modesto air temp.

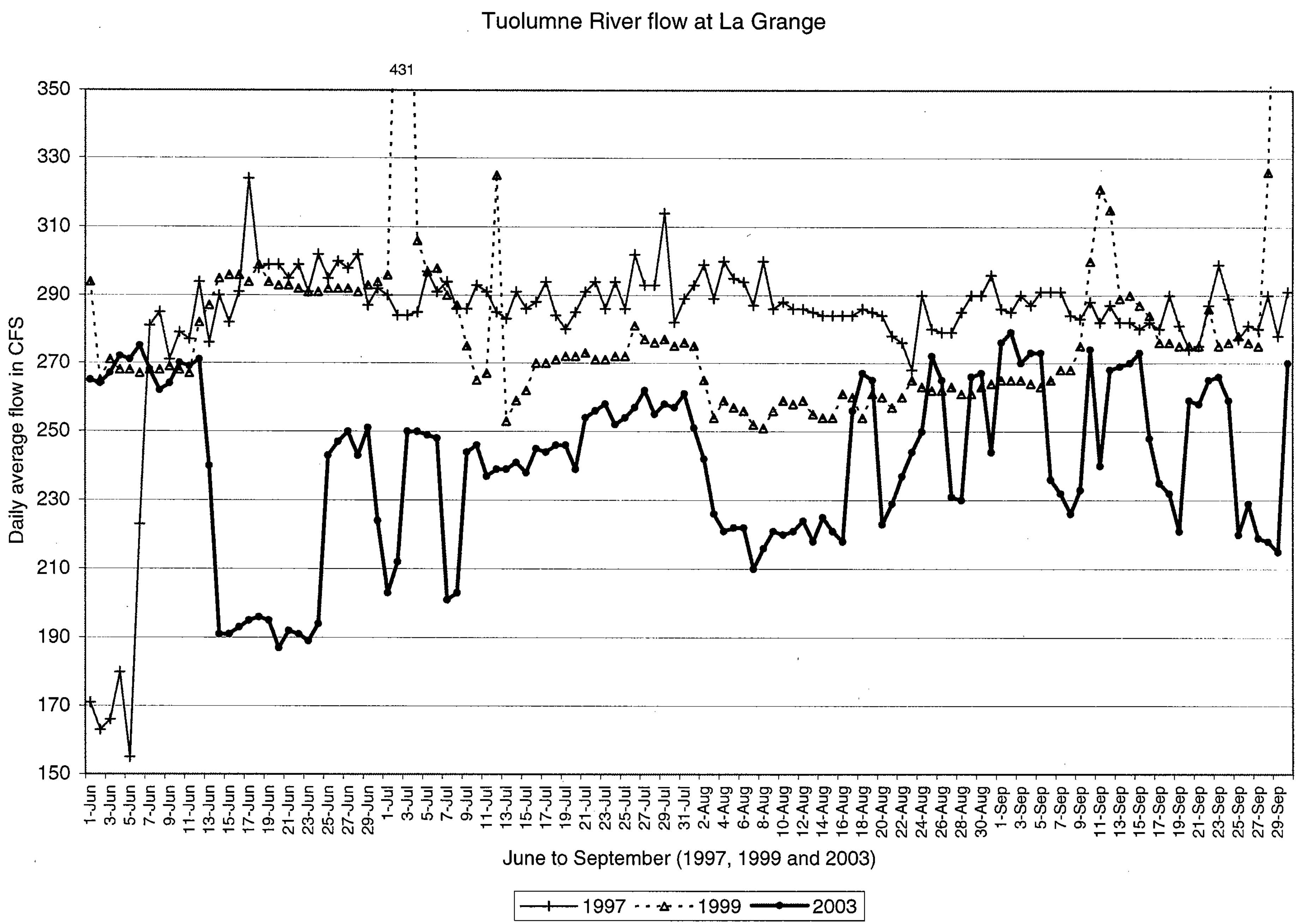



Daily average water temperature at Riffle 19 (RM 43.4)
Water temperature (Fahrenheit)
70
68
66
64
62
60
58
1-Jun
3-Jun
5-Jun
7-Jun
9-Jun
11-Jun
13-Jun
15-Jun
17-Jun
19-Jun
21-Jun
23-Jun
25-Jun
27-Jun
29-Jun
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
2-Aug
4-Aug
6-Aug
8-Aug
10-Aug
12-Aug
14-Aug
16-Aug
18-Aug
20-Aug
22-Aug
24-Aug
26-Aug
28-Aug
30-Aug
1-Sep
3-Sep
5-Sep
7-Sep
9-Sep
11-Sep
13-Sep
15-Sep
17-Sep
19-Sep
21-Sep
23-Sep
25-Sep
27-Sep
29-Sep
June to September (1997, 1999, 2003)
1997
1999
2003

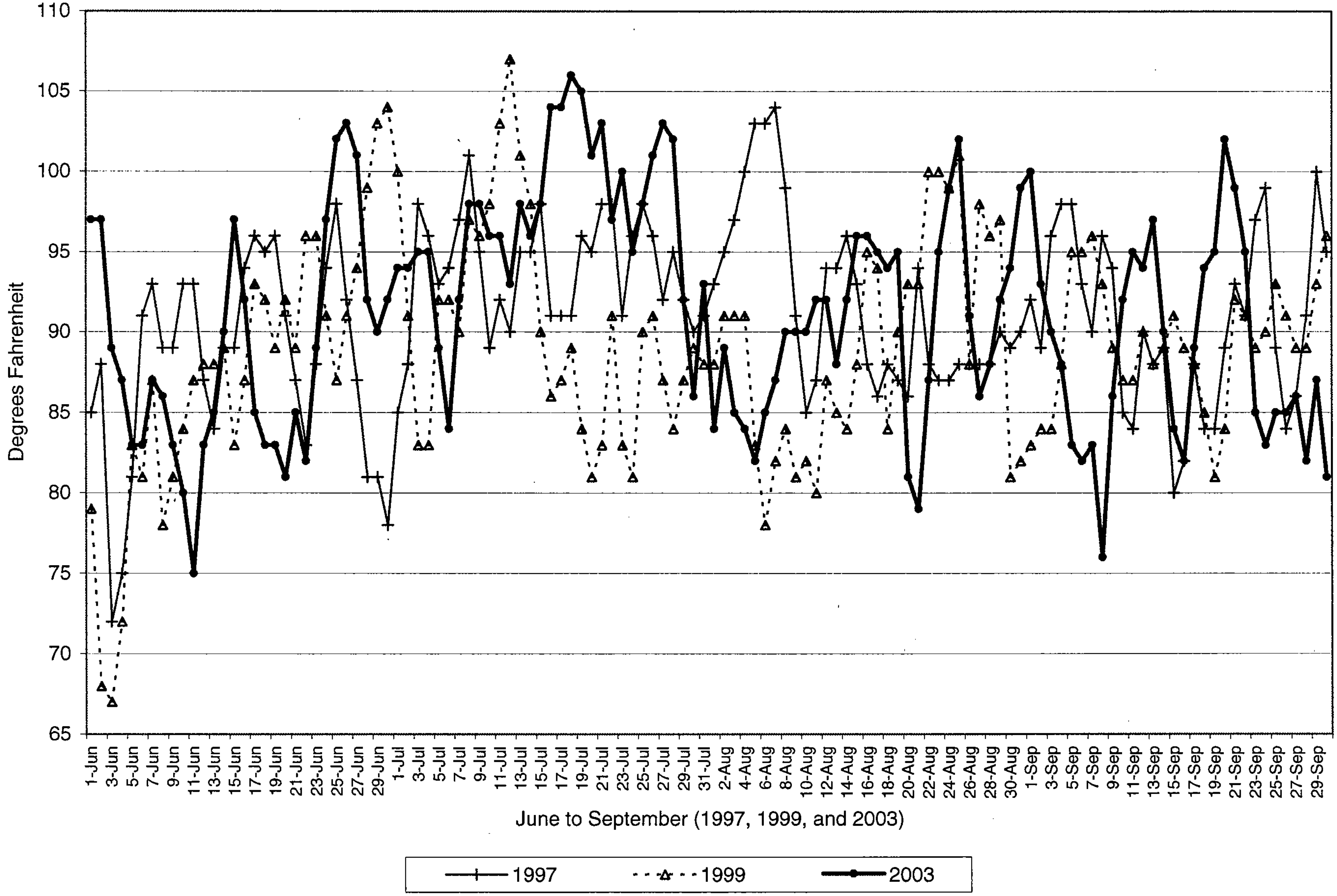
Daily average water temperature at Roberts Ferry (RM 39.5) 1999 and 2003




Daily average water temperature at Ruddy Gravel (River Mile 36.7)
Water temperature (Fahrenheit)
70
68
66
64
62
60
58
1-Jun
3-Jun
5-Jun
7-Jun
9-Jun
11-Jun
13-Jun
15-Jun
17-Jun
19-Jun
21-Jun
23-Jun
25-Jun
27-Jun
29-Jun
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
2-Aug
4-Aug
6-Aug
8-Aug
10-Aug
12-Aug
14-Aug
16-Aug
18-Aug
20-Aug
22-Aug
24-Aug
26-Aug
28-Aug
30-Aug
1-Sep
3-Sep
5-Sep
7-Sep
9-Sep
11-Sep
13-Sep
15-Sep
17-Sep
19-Sep
21-Sep
23-Sep
25-Sep
27-Sep
29-Sep
June to September (1997, 1999, 2003)
1997
1999
2003


Tuolumne River flow at La Grange
431
Daily average flow in CFS
350
330
310
290
270
250
230
210
190
170
150
1-Jun
3-Jun
5-Jun
7-Jun
9-Jun
11-Jun
13-Jun
15-Jun
17-Jun
19-Jun
21-Jun
23-Jun
25-Jun
27-Jun
29-Jun
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
2-Aug
4-Aug
6-Aug
8-Aug
10-Aug
12-Aug
14-Aug
16-Aug
18-Aug
20-Aug
22-Aug
24-Aug
26-Aug
28-Aug
30-Aug
1-Sep
3-Sep
5-Sep
7-Sep
9-Sep
11-Sep
13-Sep
15-Sep
17-Sep
19-Sep
21-Sep
23-Sep
25-Sep
27-Sep
29-Sep
June to September (1997, 1999 and 2003)
1997
1999
2003

Maximum daily air temperature at Modesto (MID)



NWS forecasted high temperature at Modesto
(prototype forecast is for 7-9 days)

[bold text signifies temp. forecasts >95 degrees and the higher flow requirement]
[shaded cells indicate determining forecasts and required min. flow]
[underlined temperatures are day following last >95 day and higher min. flow applies]

	Forecast Date ==>				6/25	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
		Actual	Forecast																																	
Date	Day of Week	Temp.	Used	Diff.																																
25-Jun-03	Wednesday	98	98	0	98																															
26-Jun-03	Thursday	105	103	2	98	103																														
27-Jun-03	Friday	107	103	4	98	104	103	107																												
28-Jun-03	Saturday	104	105	-1	96		101	105																												
29-Jun-03	Sunday	96	95	1	93			95	95																											
30-Jun-03	Monday	93	93	0	86			91	==>	91	93																									
1-Jul-03	Tuesday	92	90	2	86			87			90	91																								
2-Jul-03	Wednesday	94	93	1	86			86			89	93	94																							
3-Jul-03	Thursday	95	98	-3				87			88	91	98	97																						
4-Jul-03	Friday	98	100	-2				89			92	93	99	100	98																					
5-Jul-03	Saturday	98	98	0				89			93	93	97	100	98	97																				
6-Jul-03	Sunday	92	95	-3							92	91	94	96	95	95	95																			
7-Jul-03	Monday	88	92	-4							92	88	91	94	94	93	92	89																		
8-Jul-03	Tuesday	94	93	1								92	90	95	95	92	92	93	91																	
9-Jul-03	Wednesday	100	101	-1								88	90	92	92	91	95	100	101	99																
10-Jul-03	Thursday	102	100	2									90	87	88	91	99	107	102	100	100															
11-Jul-03	Friday	98	102	-4											87	91	94	108	102	102	102	102														
12-Jul-03	Saturday	101	102	-1											87	93	93	106	100	102	101	102														
13-Jul-03	Sunday	95	101	-6													91	101	97	95	95	101	101	100												
14-Jul-03	Monday	100	101	-1														93	96	95	97	100		101	100											
15-Jul-03	Tuesday	100	97	3															96	98	97	99		98	97											
16-Jul-03	Wednesday	100	101	-1															87	98	97	98		96	94	94	101									
17-Jul-03	Thursday	105	103	2																	95	99		97	97		103	106								
18-Jul-03	Friday	106	105	1																		98		99	99		105	105	104							
19-Jul-03	Saturday	105	100	5																				97	97		99	104	100							
20-Jul-03	Sunday	104	106	-2																				97	97		98	98	106	106						
21-Jul-03	Monday	103	105	-2																					97		98	98	104		105	106				
22-Jul-03	Tuesday	104	106	-2																							95	95	105		105	106	107			
23-Jul-03	Wednesday	98	105	-7																							97	96	102		104	104	105	102		
24-Jul-03	Thursday	102	100	2																								96	100		101	100	104	100	97	
25-Jul-03	Friday	96	96	0																									101		102	99	97	97	96	100
26-Jul-03	Saturday	99	100	-1																											101	99	99	97	97	100
27-Jul-03	Sunday	103	97	6																											103	101	101	99	96	97
28-Jul-03	Monday	103	102	1																												100	100	101	99	99
29-Jul-03	Tuesday	105	97	8																														99	99	98
30-Jul-03	Wednesday	94	99	-5																														103	92	97
31-Jul-03	Thursday	88	92	-4																																96
1-Aug-03	Friday	94	92	2																																
2-Aug-03	Saturday	85	91	-6																																
3-Aug-03	Sunday	91	92	-1																																
4-Aug-03	Monday	88	90	-2																																
5-Aug-03	Tuesday	86	87	-1																																
6-Aug-03	Wednesday	85	85	0																																
7-Aug-03	Thursday	87	88	-1																																
8-Aug-03	Friday	89	90	-1																																
9-Aug-03	Saturday	93	91	2																																
10-Aug-03	Sunday	93	92	1																																
11-Aug-03	Monday	93	94	-1																																
12-Aug-03	Tuesday	94	93	1																																
13-Aug-03	Wednesday	93	92	1																																
14-Aug-03	Thursday	91	93	-2																																
15-Aug-03	Friday	94	92	2																																
16-Aug-03	Saturday	97	95	2																																
17-Aug-03	Sunday	98	98	0																																
18-Aug-03	Monday	97	98	-1																																
19-Aug-03	Tuesday	94	95	-1																																
20-Aug-03	Wednesday	96	94	2																																
21-Aug-03	Thursday	82	87	-5																																
22-Aug-03	Friday	80	89	-9																																
23-Aug-03	Saturday	90	89	1																																
24-Aug-03	Sunday	96																																		
25-Aug-03	Monday	102	100	2																																
26-Aug-03	Tuesday	100	88	12																																

NWS forecasted high temperature at Modesto
(prototype forecast is for 7-9 days)

Forecast Date ==>

Date	Day of Week	Actual Temp.	Forecast Used	Diff.	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26
25-Jun-03	Wednesday	98	98	0																																
26-Jun-03	Thursday	105	103	2																																
27-Jun-03	Friday	107	103	4																																
28-Jun-03	Saturday	104	105	-1																																
29-Jun-03	Sunday	96	95	1																																
30-Jun-03	Monday	93	93	0																																
1-Jul-03	Tuesday	92	90	2																																
2-Jul-03	Wednesday	94	93	1																																
3-Jul-03	Thursday	95	98	-3																																
4-Jul-03	Friday	98	100	-2																																
5-Jul-03	Saturday	98	98	0																																
6-Jul-03	Sunday	92	95	-3																																
7-Jul-03	Monday	88	92	-4																																
8-Jul-03	Tuesday	94	93	1																																
9-Jul-03	Wednesday	100	101	-1																																
10-Jul-03	Thursday	102	100	2																																
11-Jul-03	Friday	98	102	-4																																
12-Jul-03	Saturday	101	102	-1																																
13-Jul-03	Sunday	95	101	-6																																
14-Jul-03	Monday	100	101	-1																																
15-Jul-03	Tuesday	100	97	3																																
16-Jul-03	Wednesday	100	101	-1																																
17-Jul-03	Thursday	105	103	2																																
18-Jul-03	Friday	106	105	1																																
19-Jul-03	Saturday	105	100	5																																
20-Jul-03	Sunday	104	106	-2																																
21-Jul-03	Monday	103	105	-2																																
22-Jul-03	Tuesday	104	106	-2																																
23-Jul-03	Wednesday	98	105	-7																																
24-Jul-03	Thursday	102	100	2																																
25-Jul-03	Friday	96	96	0																																
26-Jul-03	Saturday	99	100	-1																																
27-Jul-03	Sunday	103	97	6	97																															
28-Jul-03	Monday	103	102	1	==>	99	102																													
29-Jul-03	Tuesday	105	97	8			97	103																												
30-Jul-03	Wednesday	94	99	-5			97	99	98																											
31-Jul-03	Thursday	88	92	-4			96	97	96	92																										
1-Aug-03	Friday	94	92	2			94	94	93	92	93																									
2-Aug-03	Saturday	85	91	-6			95	91	92	93	91																									
3-Aug-03	Sunday	91	92	-1			97	90	92	91	92	92																								
4-Aug-03	Monday	88	90	-2			96	90	91	90	90	==>	90	86																						
5-Aug-03	Tuesday	86	87	-1				92	91	89	88			87																						
6-Aug-03	Wednesday	85	85	0					91	92	90			89	89	85																				
7-Aug-03	Thursday	87	88	-1						93	92			90		88	89																			
8-Aug-03	Friday	89	90	-1							94			91		89	90	88																		
9-Aug-03	Saturday	93	91	2										92		91	91	91																		
10-Aug-03	Sunday	93	92	1										86		92	92	92	92																	
11-Aug-03	Monday	93	94	-1												93	90	90	==>	90	94															
12-Aug-03	Tuesday	94	93	1												90	87	87			93	93														
13-Aug-03	Wednesday	93	92	1												90	90	87			93	92	93													
14-Aug-03	Thursday	91	93	-2													92	92			89	92	93	94												
15-Aug-03	Friday	94	92	2														89			91	94	97	92	93											
16-Aug-03	Saturday	97	95	2																	94	95	95	94	95											
17-Aug-03	Sunday	98	98	0																	95	97	96	98	98	98										
18-Aug-03	Monday	97	98	-1																	96	95	95	99	101	==>	101	98								
19-Aug-03	Tuesday	94	95	-1																		95	95	98	99			95	96							
20-Aug-03	Wednesday	96	94	2																			93	96	96			95	94	93						
21-Aug-03	Thursday	82	87	-5																				96	94			92	92	87	87					
22-Aug-03	Friday	80	89	-9																					93			88	89	89	89					
23-Aug-03	Saturday	90	89	1																								89	89	89	89	89				
24-Aug-03	Sunday	96																										91	91	91	91					
25-Aug-03	Monday	102	100	2																								94	94	95	95				100	
26-Aug-03	Tuesday	100	88	12																									94	94	94				88	92

NWS forecasted high temperature at Modesto
(prototype forecast is for 7-9 days)

Date	Day of Week	Actual Temp.	Forecast Used	Diff.
	Forecast Date ==>			
27-Aug-03	Wednesday	93	92	1
28-Aug-03	Thursday	89	94	-5
29-Aug-03	Friday	90	96	-6
30-Aug-03	Saturday	92	98	-6
31-Aug-03	Sunday	96	97	-1
1-Sep-03	Monday	102	100	2
2-Sep-03	Tuesday	101	100	1
3-Sep-03	Wednesday	96	98	-2
4-Sep-03	Thursday	92	96	-4
5-Sep-03	Friday	90	91	-1
6-Sep-03	Saturday	84	91	-7
7-Sep-03	Sunday	84	87	-3
8-Sep-03	Monday	84	84	0
9-Sep-03	Tuesday	79	85	-6
10-Sep-03	Wednesday	88	89	-1
11-Sep-03	Thursday	92	94	-2
12-Sep-03	Friday	97	96	1
13-Sep-03	Saturday	95	98	-3
14-Sep-03	Sunday	98	94	4
15-Sep-03	Monday	92	92	0
16-Sep-03	Tuesday	86	85	1
17-Sep-03	Wednesday	84	87	-3
18-Sep-03	Thursday	89	90	-1
19-Sep-03	Friday	94	93	1
20-Sep-03	Saturday	95	96	-1
21-Sep-03	Sunday	99	96	3
22-Sep-03	Monday	99	100	-1
23-Sep-03	Tuesday	95	98	-3
24-Sep-03	Wednesday	86	85	1
25-Sep-03	Thursday	83	90	-7
26-Sep-03	Friday	85	85	0
27-Sep-03	Saturday	86	91	-5
28-Sep-03	Sunday	86	91	-5
29-Sep-03	Monday	83	84	-1
30-Sep-03	Tuesday	88	82	6
25JUN-30SEP	avg.	94.1	94.8	-0.7
	max.	107.0	106.0	12.0
	min.	79.0	82.0	-9.0

Date	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26
27-Aug-03																										94	94				92	92
28-Aug-03																															92	94
29-Aug-03																															95	95
30-Aug-03																															95	95
31-Aug-03																															87	87
1-Sep-03																															89	87
2-Sep-03																																87

NWS forecasted high temperature at Modesto
(prototype forecast is for 7-9 days)

Forecast Date ==>

Date	Day of Week	Actual Temp.	Forecast Used	Diff.	8/27	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27
27-Aug-03	Wednesday	93	92	1																																
28-Aug-03	Thursday	89	94	-5	94	91																														
29-Aug-03	Friday	90	96	-6		96	92																													
30-Aug-03	Saturday	92	98	-6		95	98																													
31-Aug-03	Sunday	96	97	-1		94	97	97	97																											
1-Sep-03	Monday	102	100	2		93	96		100																											
2-Sep-03	Tuesday	101	100	1		90	94		98	97	100																									
3-Sep-03	Wednesday	96	98	-2		92	92		92		95	98																								
4-Sep-03	Thursday	92	96	-4		87	91		92	91	95	95	96																							
5-Sep-03	Friday	90	91	-1		88	87		94	89	97	97	94	91																						
6-Sep-03	Saturday	84	91	-7					91	89	89	91	91	91	91																					
7-Sep-03	Sunday	84	87	-3					91	89	89	87	87	87	==>	87																				
8-Sep-03	Monday	84	84	0						87	87	85	85	85			84																			
9-Sep-03	Tuesday	79	85	-6							87	87	87	87			85	81																		
10-Sep-03	Wednesday	88	89	-1								87	87	87			89	89	89																	
11-Sep-03	Thursday	92	94	-2										87			93	94	94	94																
12-Sep-03	Friday	97	96	1										87			95	95	95	96	97															
13-Sep-03	Saturday	95	98	-3													95	92	92	95	98															
14-Sep-03	Sunday	98	94	4													92	91	91	93	94	94														
15-Sep-03	Monday	92	92	0													89	89	91	88	88	==>	88	92												
16-Sep-03	Tuesday	86	85	1														86	89	86	86			85	85											
17-Sep-03	Wednesday	84	87	-3															86	85	88			86	87											
18-Sep-03	Thursday	89	90	-1																87	87			91	90	90	92									
19-Sep-03	Friday	94	93	1																	91			94	91		94	93								
20-Sep-03	Saturday	95	96	-1																				96	94		95	96								
21-Sep-03	Sunday	99	96	3																				94	94		95	96	96							
22-Sep-03	Monday	99	100	-1																				90	92		97	93	==>	93	100					
23-Sep-03	Tuesday	95	98	-3																							89	89			98	98				
24-Sep-03	Wednesday	86	85	1																							87	87			94	94	85			
25-Sep-03	Thursday	83	90	-7																							88	88			92	92	91	90		
26-Sep-03	Friday	85	85	0																											91	91	94	93	85	
27-Sep-03	Saturday	86	91	-5																											90	90	95	96	91	
28-Sep-03	Sunday	86	91	-5																											88	88	93	91	91	91
29-Sep-03	Monday	83	84	-1																											87	87	90	88	84	==>
30-Sep-03	Tuesday	88	82	6																													86	86	84	
25JUN-30SEP	avg.	94.1	94.8	-0.7																																
	max.	107.0	106.0	12.0																																
	min.	79.0	82.0	-9.0																																

NWS forecasted high temperature at Modesto
(prototype forecast is for 7-9 days)

	Forecast Date ==>				**9/28**	**9/29**
		Actual	Forecast			
Date	Day of Week	Temp.	Used	Diff.		
27-Aug-03	Wednesday	93	92	1		
28-Aug-03	Thursday	89	94	-5		
29-Aug-03	Friday	90	96	-6		
30-Aug-03	Saturday	92	98	-6		
31-Aug-03	Sunday	96	97	-1		
1-Sep-03	Monday	102	100	2		
2-Sep-03	Tuesday	101	100	1		
3-Sep-03	Wednesday	96	98	-2		
4-Sep-03	Thursday	92	96	-4		
5-Sep-03	Friday	90	91	-1		
6-Sep-03	Saturday	84	91	-7		
7-Sep-03	Sunday	84	87	-3		
8-Sep-03	Monday	84	84	0		
9-Sep-03	Tuesday	79	85	-6		
10-Sep-03	Wednesday	88	89	-1		
11-Sep-03	Thursday	92	94	-2		
12-Sep-03	Friday	97	96	1		
13-Sep-03	Saturday	95	98	-3		
14-Sep-03	Sunday	98	94	4		
15-Sep-03	Monday	92	92	0		
16-Sep-03	Tuesday	86	85	1		
17-Sep-03	Wednesday	84	87	-3		
18-Sep-03	Thursday	89	90	-1		
19-Sep-03	Friday	94	93	1		
20-Sep-03	Saturday	95	96	-1		
21-Sep-03	Sunday	99	96	3		
22-Sep-03	Monday	99	100	-1		
23-Sep-03	Tuesday	95	98	-3		
24-Sep-03	Wednesday	86	85	1		
25-Sep-03	Thursday	83	90	-7		
26-Sep-03	Friday	85	85	0		
27-Sep-03	Saturday	86	91	-5		
28-Sep-03	Sunday	86	91	-5		
29-Sep-03	Monday	83	84	-1	84	84
30-Sep-03	Tuesday	88	82	6		82
25JUN-30SEP	avg.	94.1	94.8	-0.7		
	max.	107.0	106.0	12.0		
	min.	79.0	82.0	-9.0		