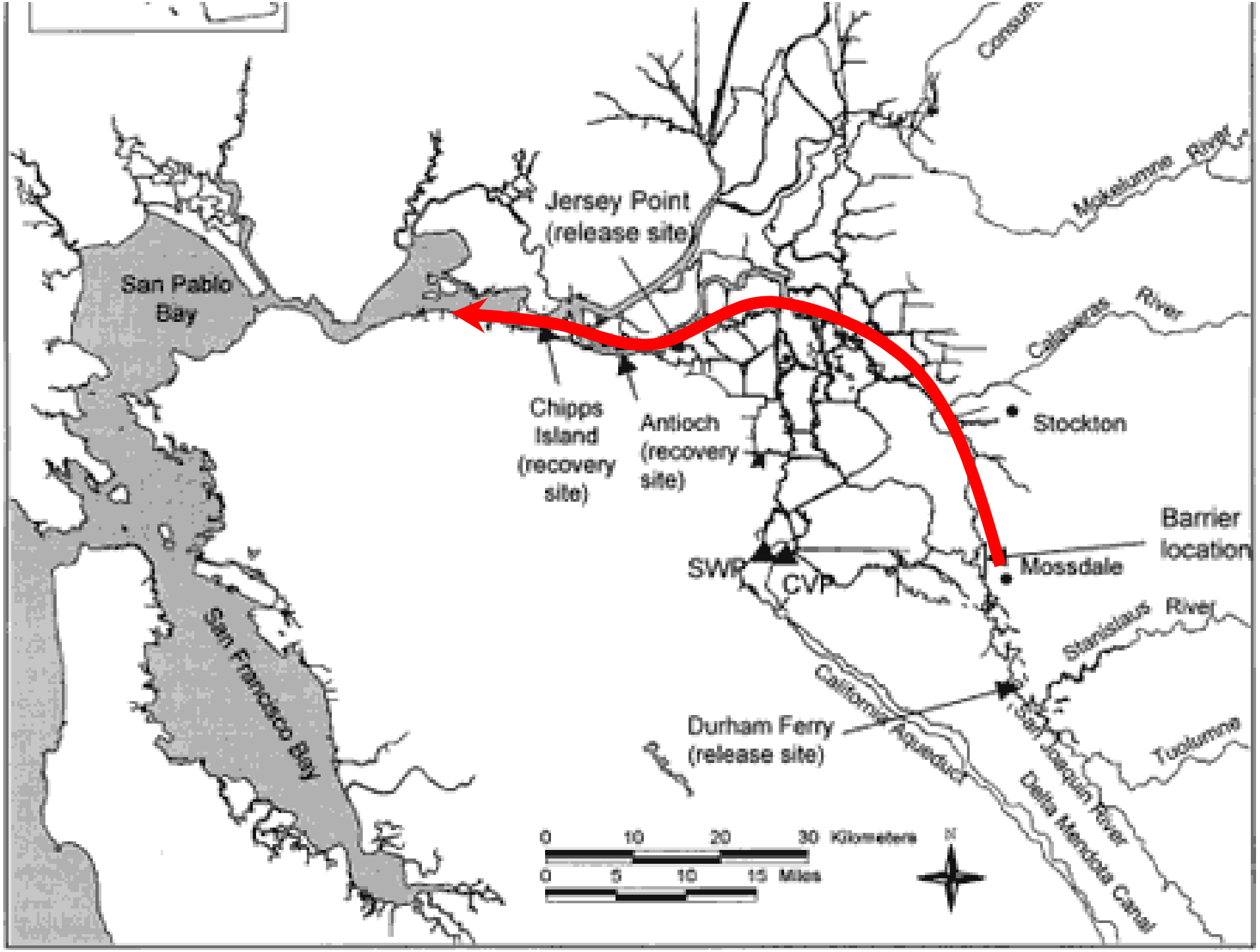
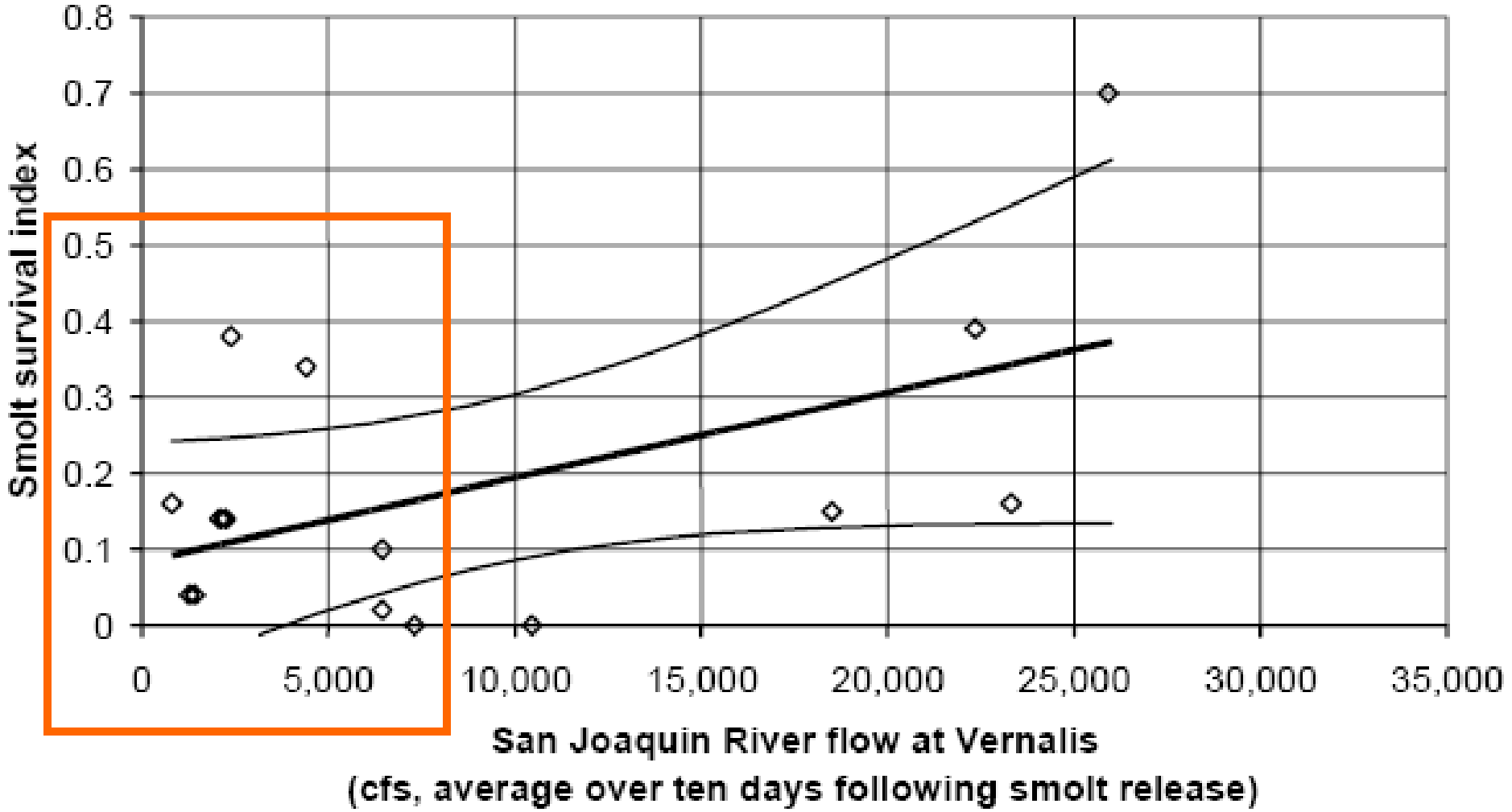
Science and Management: The Vernalis Adaptive Management Program (VAMP)

Bruce Herbold USEPA
on behalf of the
VAMP Technical Team

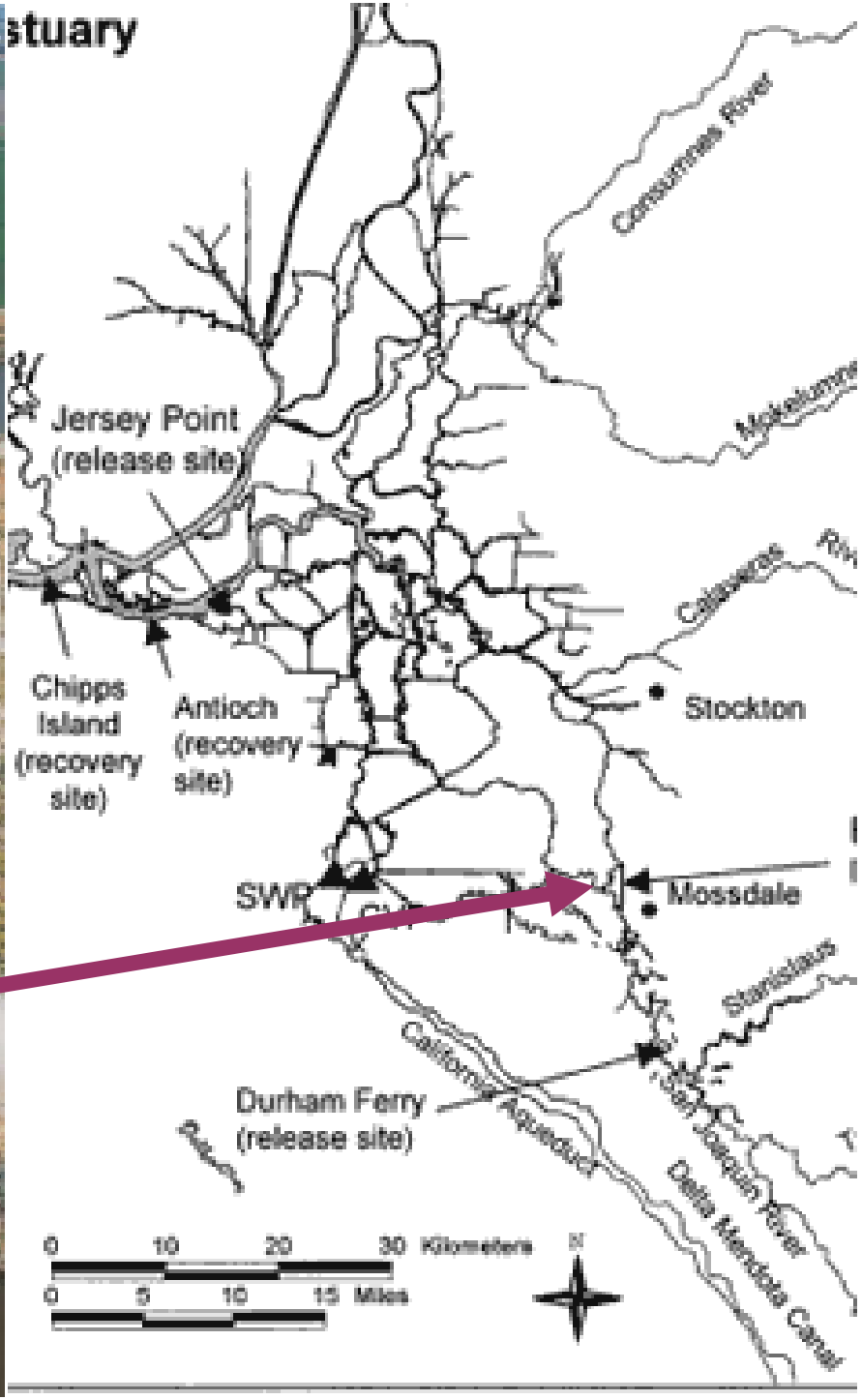

MAP
SAN JOAQUIN, SACRAMENTO
AND
TULARE VALLEYS
STATE OF CALIFORNIA


Redding
Sacramento
San
Francisco
Fresno


Jersey Point
(release site)
San Pablo
Bay
Chipps
Island
(recovery
site)
Antioch
(recovery
site)
Stockton
Mokelumne River
Calaveras River
Barrier
location
Mossdale
SWP
CVP
Stanislaus River
San Joaquin River
Tuolumne
California Aqueduct
Delta Mendota Canal
Durham Ferry
(release site)
San Francisco Bay
0 10 20 30 Kilometers
0 5 10 15 Miles
N


Smolt survival index
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
San Joaquin River flow at Vernalis
(cfs, average over ten days following smolt release)


Head of Old River Barrier


stuary
Consumnes River
Mokelumne
Jersey Point
(release site)
Chipps
Island
(recovery
site)
Antioch
(recovery
site)
Stockton
SWP
Mossdale
Stanislaus
California Aqueduct
Durham Ferry
(release site)
San Joaquin River
Delta Mendota Canal
0 10 20 30 Kilometers
0 5 10 15 Miles
N

VAMP

- 12 year study on delta survival
- 9 years done (2 flood outs)
- 5 experimental flow/export combinations
- Midwater trawl, Kodiak trawl and adult ocean captures supply data

Design Parameters

- Old River Barrier only at < 7000 cfs

- Smelt opinion requires:

Exports < .5 Vernalis flow

- Minimal Exports = 1500 cfs

VAMP Target conditions

Flow at Vernalis (cfs)

Exports (cfs)	3200	4450	5700	7000
1500	***A***	***B***		***C***
2250			***D***	
3000				***E***

Selecting the Condition (1)

- Single Step if base flow
- < 3200 → 3200
- < 4450 → 4450 etc.

- But…

Selecting the Condition (2)

- Critical = 1; Wet = 5
- Add current + last year
- If > 7, then **Double Step:**
- <3200 → 4750
- <4750 → 5700 etc.
- But…

Selecting the Condition (3)

- Critical = 1; Wet = 5
- Add current + last year
- If < 4, then **Offramp:**
- No additional water required
- 2008 critical so if 2009 not above average
- …

Actual VAMP flows

San Joaquin River near Vernalis

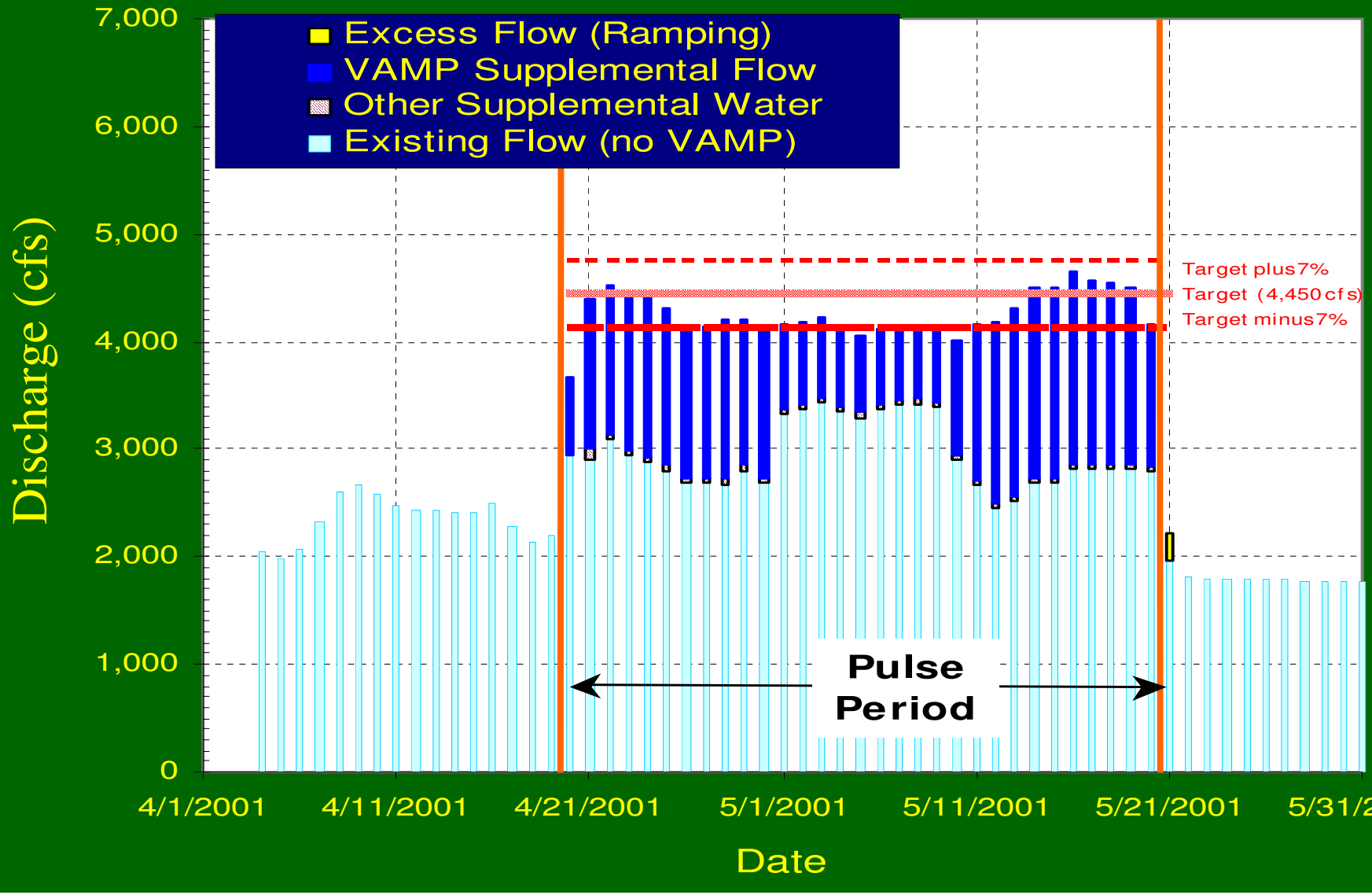


Figure 2-4
2007 VAMP: San Joaquin River near Vernalis
With Lagged Contributions from Primary Sources

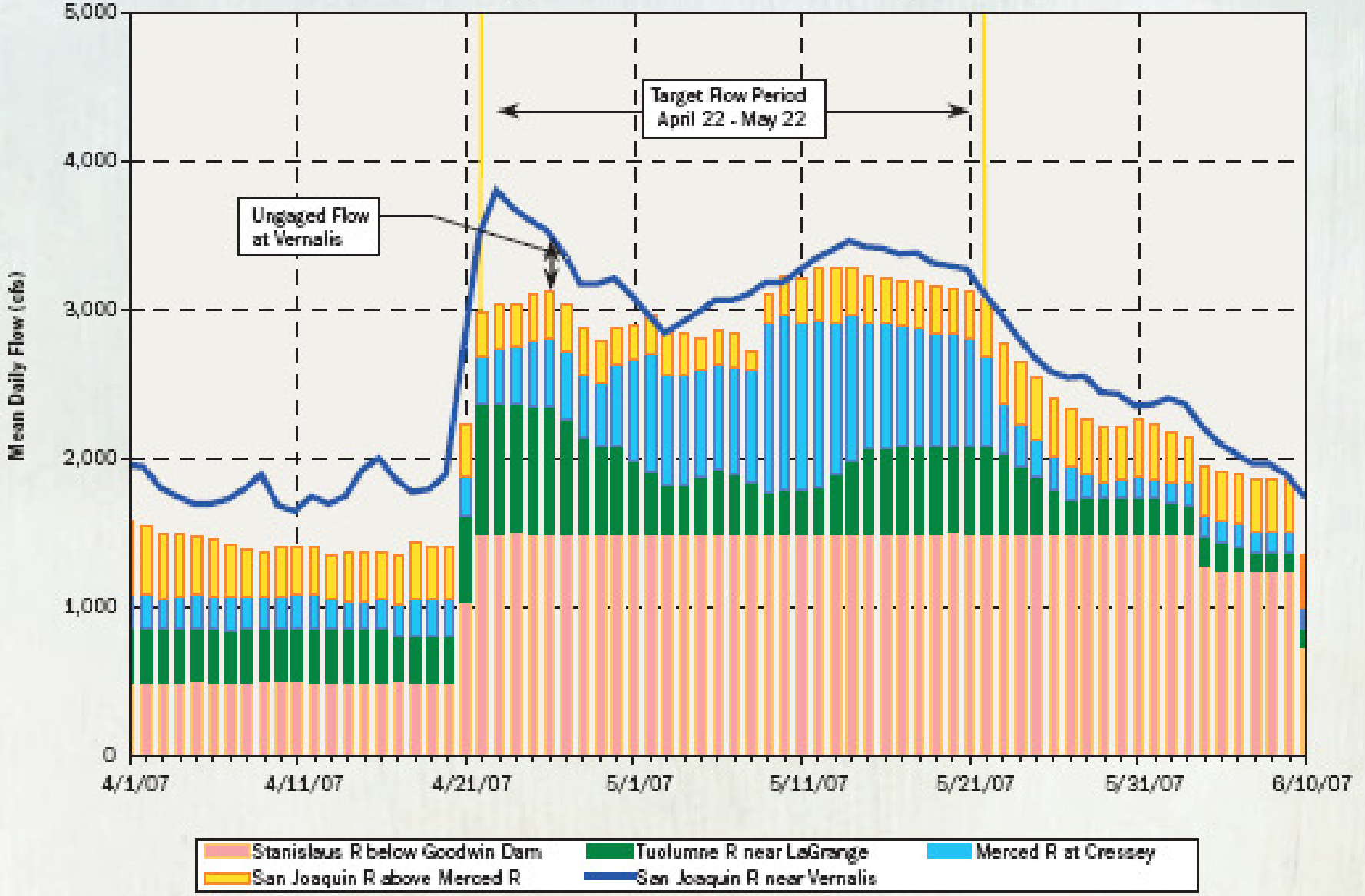
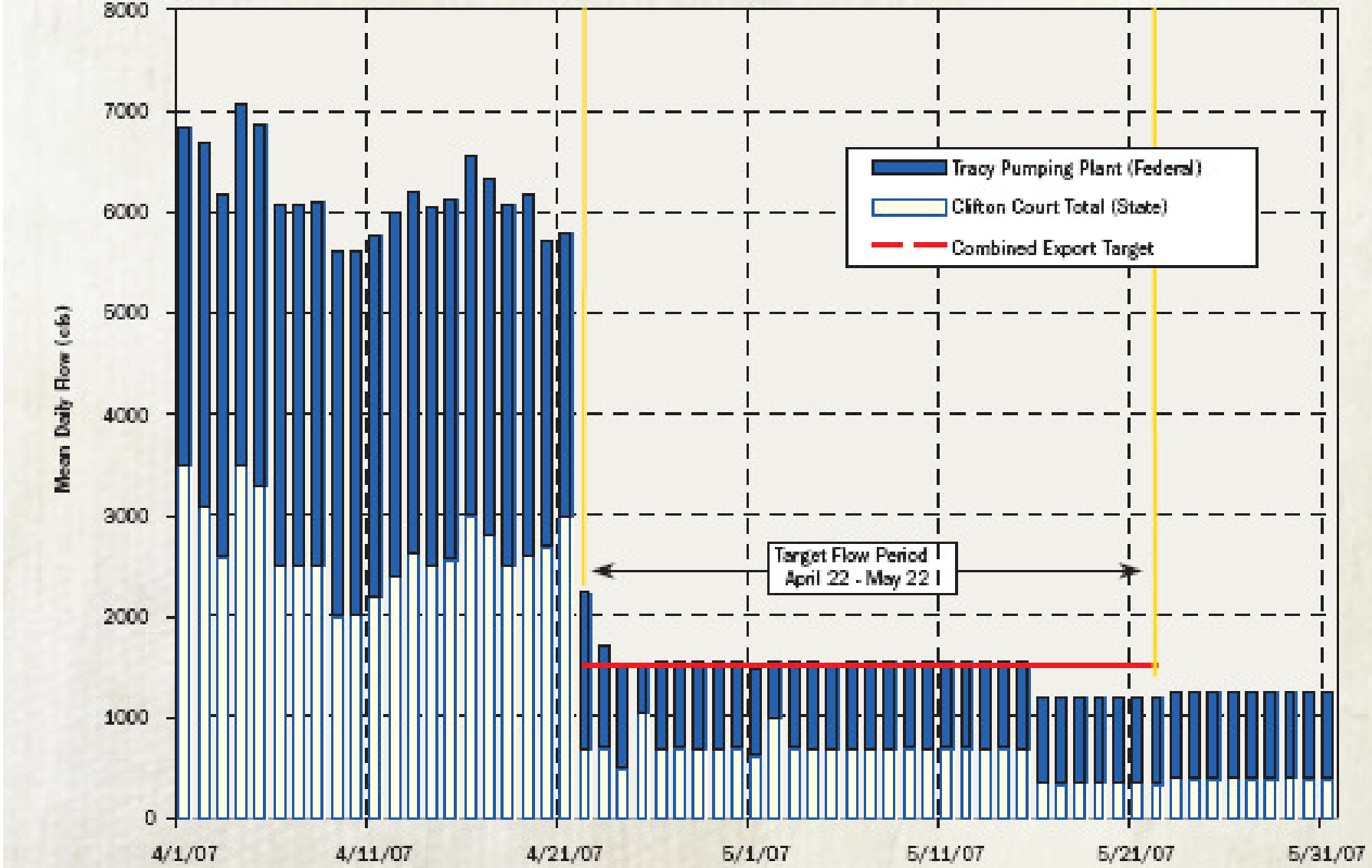


Figure 2-9
2007 VAMP - Federal and State Delta Exports



VAMP Conditions (so far)

Exports \ Flow at Vernalis	3200	4450	5700	7000
1500	2002 2003 2004 2007 2008	2001		***C***
2250			2000	
3200				***E***


CALIFORNIA
LIVE
FISH
15530


Sacramento-San Joaquin Estuary
Sacramento River
American River
Sacramento
Consumnes River
Jersey Point (release site)
Chipps Island (recovery site)
Antioch (recovery site)
Stockton
SWP
CVP
Mossdale
Durham Ferry (release site)

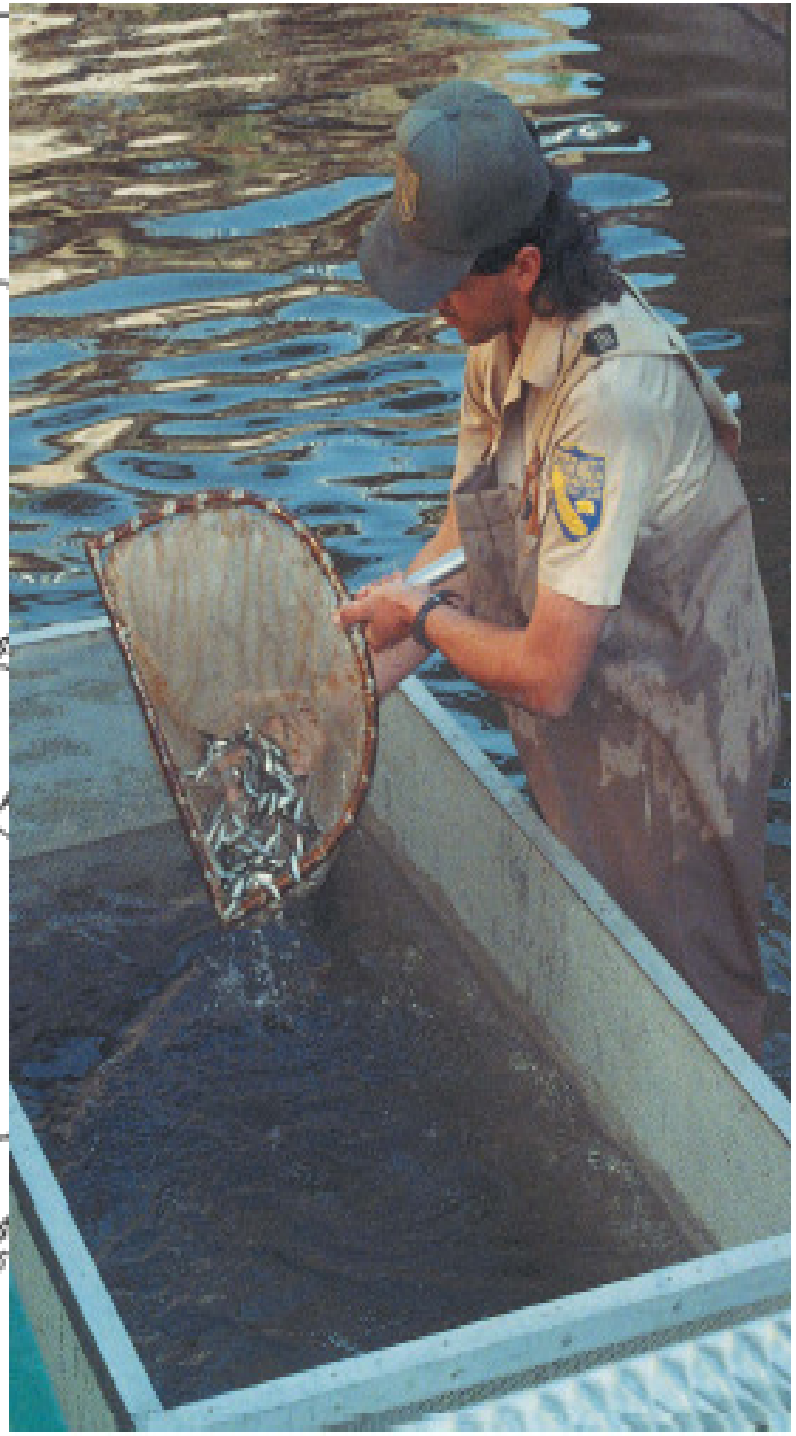
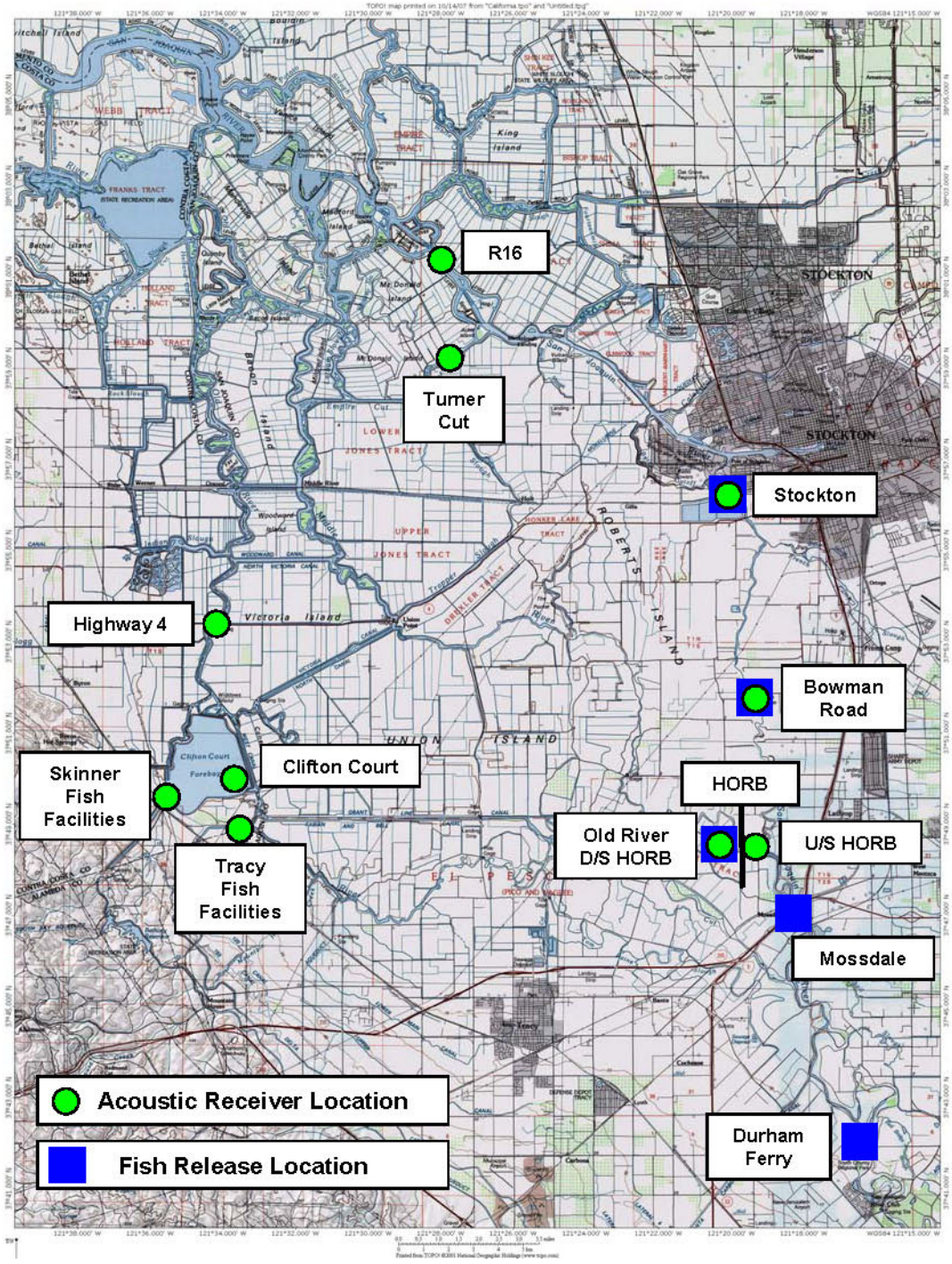


Table 5-5
Chinook salmon smolt recovery information at Antioch, Chipps Island, and the fish facilities for VAMP 2006 releas

				Antioch Recoveries					
Tag Code	Release Site	Release Date	Corrected or Effective Release number	First Day Recovered	Last Day Recovered	Number Recovered	Recovery Effort (minutes sampled)	Percent of Time Sampled	Survival Index
06-47-13	Mossdale		24,703	5/10/06	5/10/06	5	580	0.403	0.036
06-47-14	Mossdale		24,315	5/11/06	5/16/06	4	3255	0.377	0.031
	Total	**5/4/06**	**49,018**	**5/10/06**	**5/16/06**	**9**	**3835**	**0.380**	
06-47-16	Dos Reis	5/5/06	25,602	5/10/06	5/12/06	3	1760	0.407	0.021
06-47-15	Jersey Point	5/8/06	26,192	5/8/06	5/13/06	26	3245	0.376	0.190
06-47-21	Mossdale		25,105	–	–	0	0	0.000	–
06-47-22	Mossdale		24,008	–	–	0	0	0.000	–
~~06-47-23~~	~~Mossdale~~		~~25,066~~	~~5/24/06~~	~~5/24/06~~	~~1~~	~~580~~	~~0.403~~	~~0.007~~
	Total	**5/19/06**	**49,113**			**0**	**~~580~~**	**~~0.403~~**	
06-47-24	Jersey Point	5/22/06	23,980	5/22/06	5/29/06	14	4160	0.363	0.116

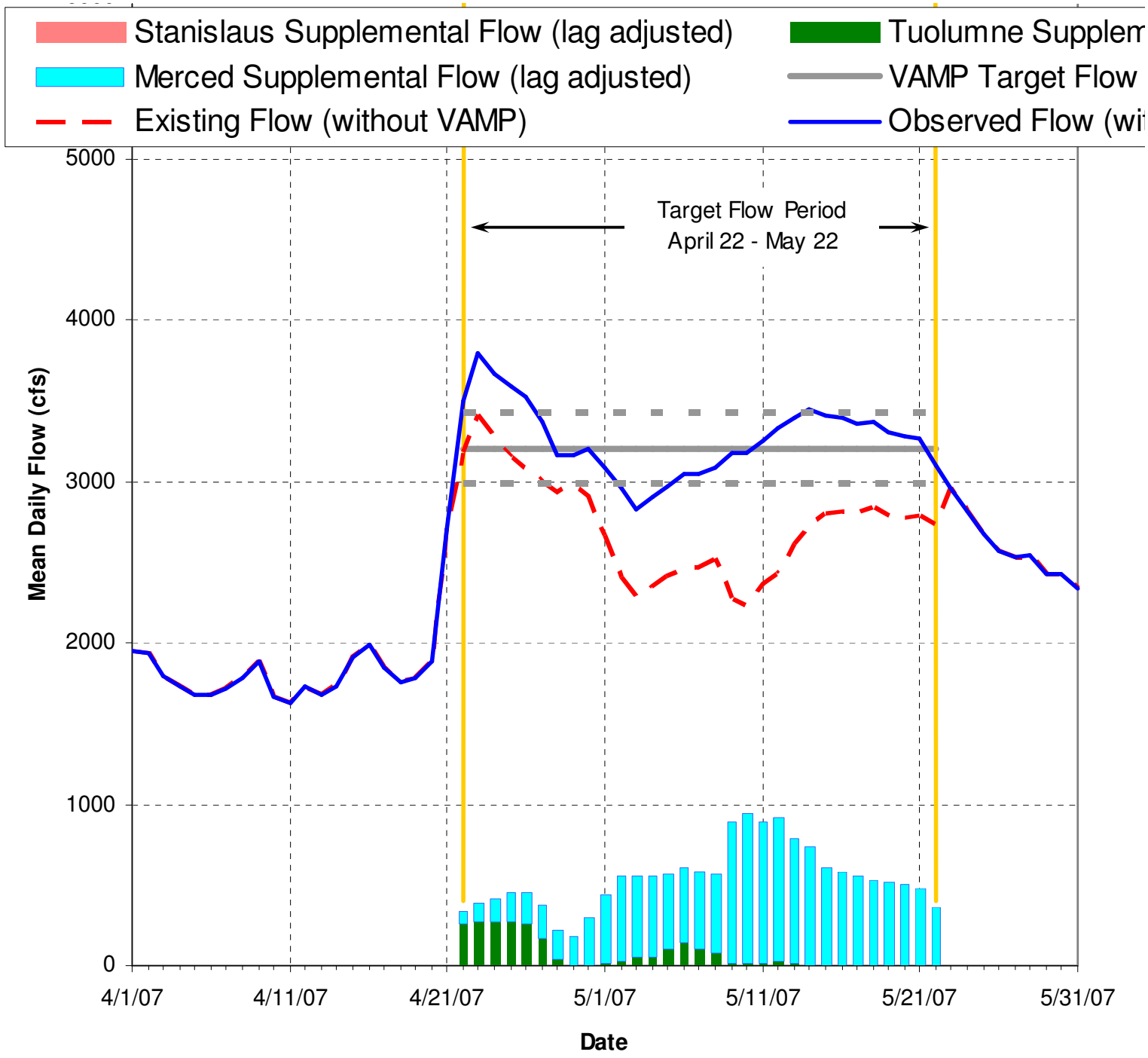

Incision with 2 sutures


R16
Turner Cut
Stockton
Highway 4
Bowman Road
Clifton Court
Skinner Fish Facilities
HORB
Old River D/S HORB
U/S HORB
Tracy Fish Facilities
Mossdale
Durham Ferry
Acoustic Receiver Location
Fish Release Location
STOCKTON
Victoria Island
UNION ISLAND
ROBERTS ISLAND


Stockton Deep-Water Ship Channel
Area of High Fish Mortality
San Joaquin River
Gilmore Ave
Luce Ave
Edwards Ave
Davis Ave
W Fyffe St
McCloy Ave
Pinter Ave
Gillies Ave
Embarcadero
Port Rd A
Port Rd C
Port Rd K
Port Rd L
W Washington St
W Sonora St
W Scotts Ave
Navy Dr
Volpi Dr
Stark Rd
Daggett Rd
N Hoppel St
John Tuck Rd
© 2007 Navteq
© 2007 Europa Technologies
Google
Pointer 37°56'27.90" N 121°20'23.02" W elev 3 ft
Streaming 100%

Conclusions

- Actual adaptive management
- Successful system level experiment
- No Barrier & few fish requires changes
- New technology offers new options


Stanislaus Supplemental Flow (lag adjusted)
Tuolumne Supplem
Merced Supplemental Flow (lag adjusted)
VAMP Target Flow
Existing Flow (without VAMP)
Observed Flow (wi
Target Flow Period
April 22 - May 22
Mean Daily Flow (cfs)
5000
4000
3000
2000
1000
0
4/1/07
4/11/07
4/21/07
5/1/07
5/11/07
5/21/07
5/31/07
Date