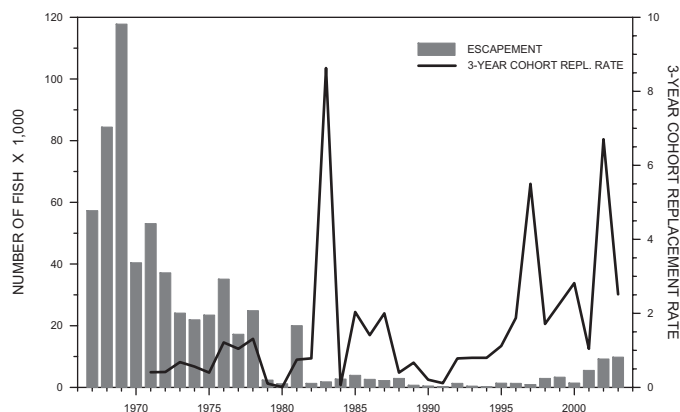




# IEP NEWSLETTER

VOLUME 17, NUMBER 2, SPRING 2004

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**Figure 11 Annual winter run escapement and the three-year cohort replacement rate to the upper Sacramento River, 1967-2003.**

NMFS and DFG have used carcass surveys as an alternative method of estimating escapement since 1996. In 2003, NMFS and DFG estimated the winter run escapement at about 9,500 using the carcass survey, which is a 42% increase from the escapement in 2000. Currently the two methodologies are under review by NMFS, DFG, and PFMC.

### Acknowledgements

Most of the data presented in this article is published in the PFMC's *Review of the 2003 Ocean Salmon Fisheries* report. A copy of the report is available by calling (503) 820-2280 or online at <http://www.pcouncil.org>. I thank Colleen Harvey Arrison (DFG) for providing the spring run Chinook escapement data for Mill and Deer creeks and Tracy McReynolds (DFG) for providing the spring run Chinook escapement data for Butte Creek.

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## Fish Salvage at the State Water Project and Central Valley Project Fish Facilities

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### Introduction

Two large fish salvage facilities in the Sacramento-San Joaquin Delta, the Central Valley Project's Tracy Fish Collection Facility (TFCF) and the State Water Project's Skinner Delta Fish Protective Facility (SDFPF), divert (salvage) fish from exported water. Both facilities use a louver-bypass system to collect entrained fish, which are then transported to release sites in the Delta. The TFCF began operation in 1957 and the SDFPF in 1968. The number of transported fish (salvage) is estimated from sub-samples of fish collected at least every two hours while water is being pumped.

### Exports

State Water Project (SWP) water exports totaled about 4.37 billion m<sup>3</sup> (3,546,000 acre-feet) in 2003, compared to about 3.44 billion m<sup>3</sup> (2,792,000 acre-feet) in 2002. During 2003, monthly water exports at the SWP ranged from a low of about 66.5 million m<sup>3</sup> (53,956 af) in May to a high of about 527 million m<sup>3</sup> (427,610 af) in August (Figure 1), similar to the 2002 range of about 47.4 million m<sup>3</sup> (38,455 af) to 510.3 million m<sup>3</sup> (414,034 af).

Central Valley Project (CVP) water exports totaled about 3.42 billion m<sup>3</sup> (2,776,000 af), compared to about 3.08 billion m<sup>3</sup> (2,501,000 af) in 2002. Monthly water exports at the CVP in 2003 ranged from a low of about 110.8 million m<sup>3</sup> (90,000 af) in May to about 329.4 million m<sup>3</sup> (about 267,000 af) in March (Figure 1), compared to the 2002 range of about 65.2 million m<sup>3</sup> (53,000 af) to about 329.0 million m<sup>3</sup> (about 267,000 af).

### Fish Salvage

About 4.25 million fish were salvaged at the SWP in 2003, and almost 7.49 million fish were salvaged at the CVP. At the SWP facility, American shad was the predominant species salvaged, whereas threadfin shad was by far the most abundant at the CVP. American shad accounted for almost 48% of the annual salvage at the SWP (Figure 2) and threadfin shad accounted for about 84% of the annual salvage at

the CVP (Figure 3). There has been an increase in the annual proportion of threadfin shad in the total salvage at both facilities in recent years (Figure 4), which is particularly evident at the CVP facility since 1995.

Density of fish (individuals salvaged per 10,000 m<sup>3</sup>) at the SWP was highest in July (34) and at the CVP in November (97) (Figure 5). American and threadfin shad together accounted for much of the salvage in July at the SWP (82%) and threadfin shad made up most of the CVP salvage during November (91%).

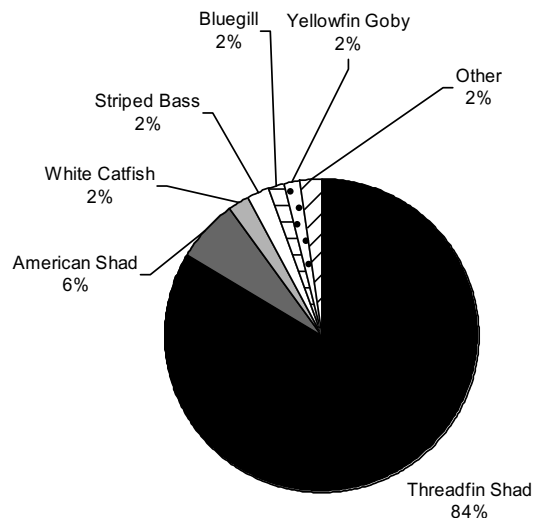


Figure 3 Relative species contribution to 2003 annual salvage at CVP.

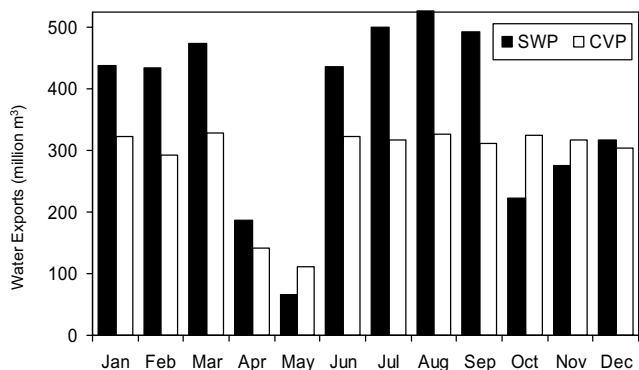


Figure 1 Monthly water exports in 2003 by SWP and CVP.

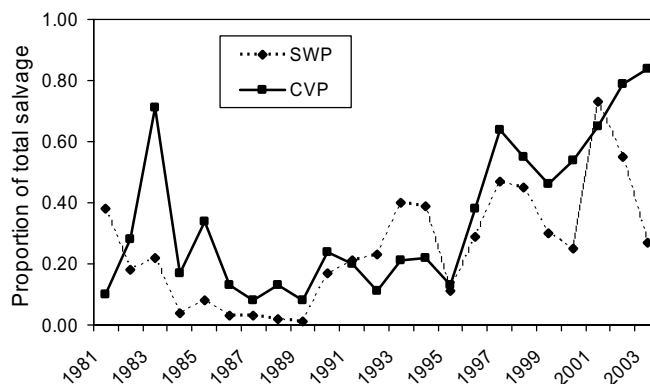


Figure 4 Proportion of threadfin shad in total salvage at SWP and CVP.

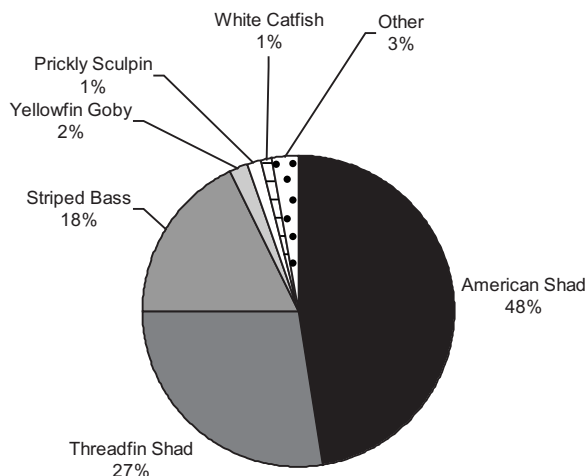


Figure 2 Relative species contribution to 2003 annual salvage at SWP.

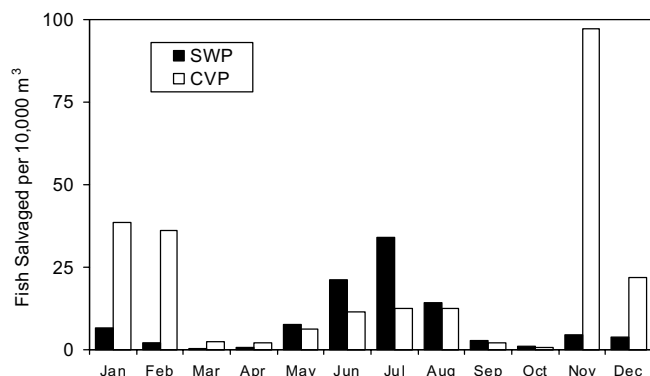


Figure 5 Monthly fish salvage density in 2003 at SWP and CVP.

### Delta Smelt

Estimated salvage of delta smelt at the SWP in 2003 was 21,248, fewer than the 49,823 salvaged in 2002, and much fewer than in 1999 and 2000 (Figure 6). An unusually high percentage of the delta smelt were adults (39%), mostly salvaged during January (Figure 7).

In 2003, 16,662 delta smelt were salvaged at the CVP, only slightly fewer than the 18,396 salvaged in 2002. Although only 23% of the delta smelt salvage was adults, the 3,756 adults salvaged in January were the most in that month since 1988. This is the second consecutive year that peak adult salvage has occurred in January. Previous to 2002, there had been a 3-year period of high delta smelt salvage in February.

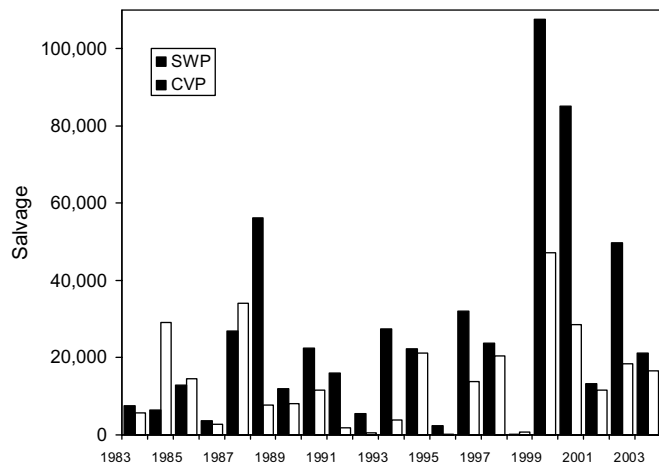


Figure 6 Annual delta smelt salvage at SWP and CVP.

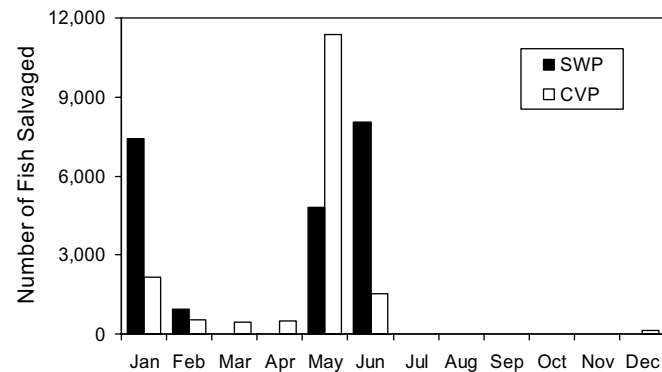


Figure 7 Monthly delta smelt salvage at SWP and CVP in 2003.

### Chinook Salmon

The combined (SWP+CVP) salvage of Chinook salmon was 33,989, more than the 21,909 salvaged in 2002, but less than the 1993-2002 annual average (80,753), and far less than the 1983-1992 annual average (289,553) (Figure 8). About 28% of the salmon salvaged last year were adipose fin clipped, indicating hatchery origin. Of the naturally-produced salmon, almost two-thirds (65.4%) were spring-run, 26% were fall-run, and the remainder (8%) were winter-run (as determined by fork length only) (Figure 9).

The SWP facility salvaged slightly more Chinook salmon (clipped and unclipped combined) than the CVP facility during 2003, reversing a long term trend of higher salvage at the CVP. Salmon salvage at both facilities peaked in May, but an unusually high proportion of the total salmon salvage came in January (Figure 10).

Salmon loss, an estimate of the mortality resulting from entrainment at the export facilities, is based on estimates of pre-screen loss (predation), louver efficiency, and handling and trucking mortality. Total salmon loss (SWP+CVP) in 2003 was 84,766, more than twice the total salmon salvage. Approximately 32% of the salmon lost were adipose fin clipped, compared to 42% in 2002. SWP loss was much higher than CVP loss (Table 1), reflecting the high predation mortality rate (75%) in Clifton Court Forebay.

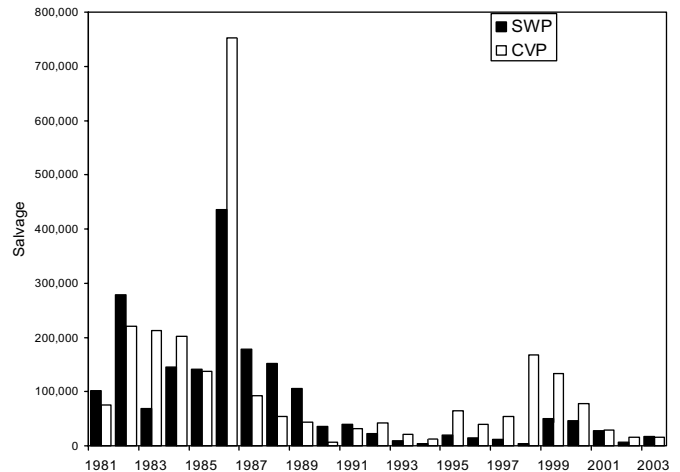
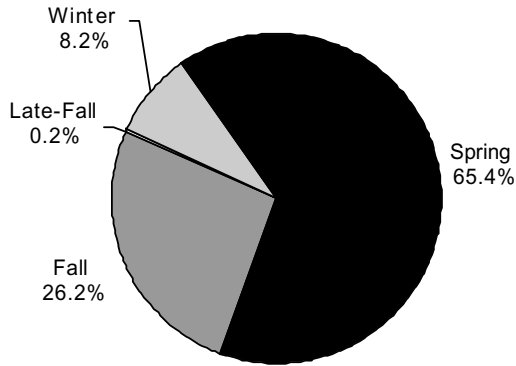
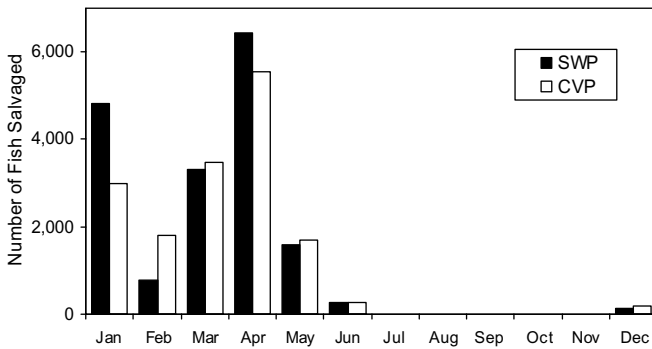


Figure 8 Annual Chinook salmon salvage at SWP and CVP.



**Figure 9** Percent of Chinook salmon runs in 2003 salvage at SWP and CVP. Race determined solely by length.



**Figure 10** Monthly salvage of Chinook salmon at SWP and CVP in 2003.

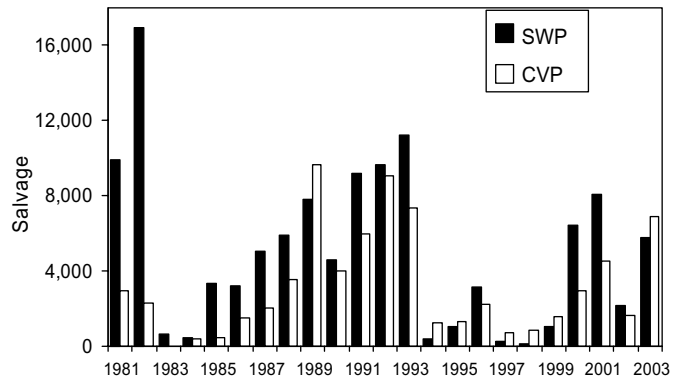
**Table 1** Wild Chinook salmon loss at CVP and SWP in 2003.

Race	SWP	CVP	Total
Fall	8,482	2,948	11,430
Late-fall	133	8	141
Winter	5,164	528	5,692
Spring	35,565	4,818	40,383
Total	49,345	8,301	57,646

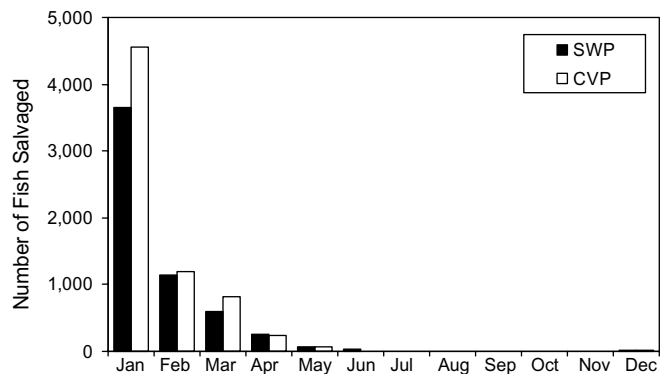
## Steelhead Trout

Steelhead salvage at both facilities in 2003 was higher than in 2002 (Figure 11). The SWP salvaged 5,766 steelhead, more than double the 2002 total and higher than the 1993-2002 mean of 3,407 per year. The CVP salvaged 6,871, the most in any year since 1993 and far above the 1993-2002 mean of 2,449 per year. Steelhead salvage was highest during January at both facilities (Figure 12).

About 86% of the steelhead salvaged at the SWP were adipose fin-clipped, indicating hatchery origin, and about 78% of CVP salvaged steelhead were clipped. This proportion of hatchery steelhead was the highest of any year since 1997, when fin clipping of all hatchery fish began.



**Figure 11** Annual steelhead salvage at SWP and CVP.



**Figure 12** Monthly salvage of steelhead at SWP and CVP in 2003.

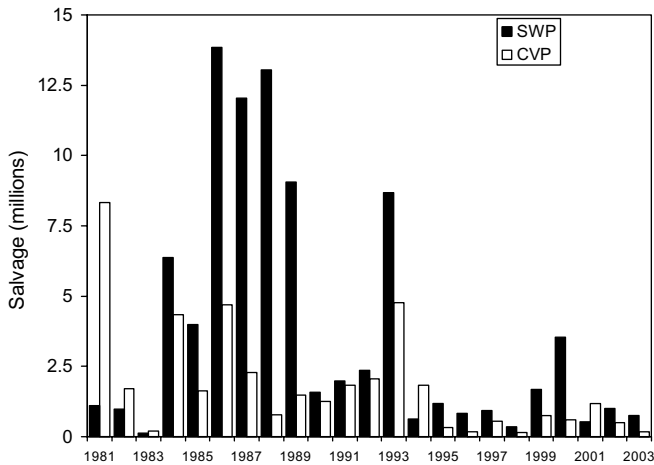


Figure 13 Annual striped bass salvage at SWP and CVP.

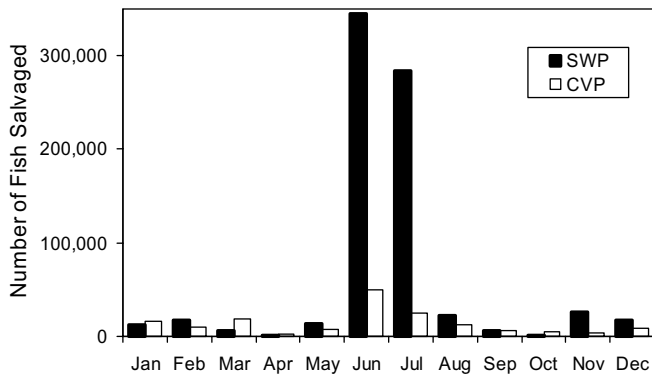


Figure 14 Monthly salvage of striped bass at SWP and CVP in 2003.

**Striped Bass**

In 2003, the SWP salvaged only 753,555 striped bass, about 40% of the 1993-2002 average of 1.94 million per year (Figure 13). At the CVP, about 165,000 striped bass were salvaged, only a small percentage of the 10-year average of 1.09 million per year. Striped bass salvage peaked in June at the both facilities (Figure 14).

**American Shad**

More than 2 million American shad were salvaged in 2003 at the SWP and about 486,000 were salvaged at the CVP. The SWP total was much higher than the 1993-2002 average of 768,000 (Figure 15) and was the highest of any year since at least 1981. Monthly salvage of American shad at the SWP peaked at just over 1.1 million in July. In contrast, the bulk of American shad at the CVP were salvaged in November (about 203,000). Since 1981, there has been a

general trend of higher American shad salvage at both facilities (Figure 15).

**Spittail**

The 2003 combined (SWP+CVP) spittail salvage was almost 20,000, which was slightly more than double the 2002 combined total (Figure 16). Spittail salvage totals in 1986, 1995, and 1998 dwarfed the salvage totals for 2003 and all other years since 1980. Spittail salvage in 2003 was dominated by young-of-the-year (YOY) salvage during June (Figure 17).

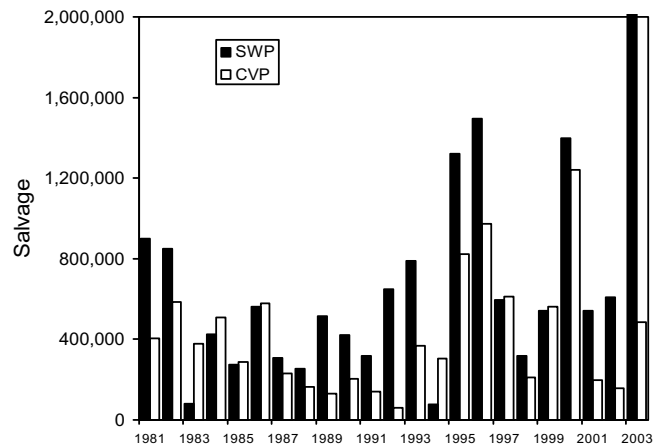


Figure 15 Annual American shad salvage at SWP and CVP.

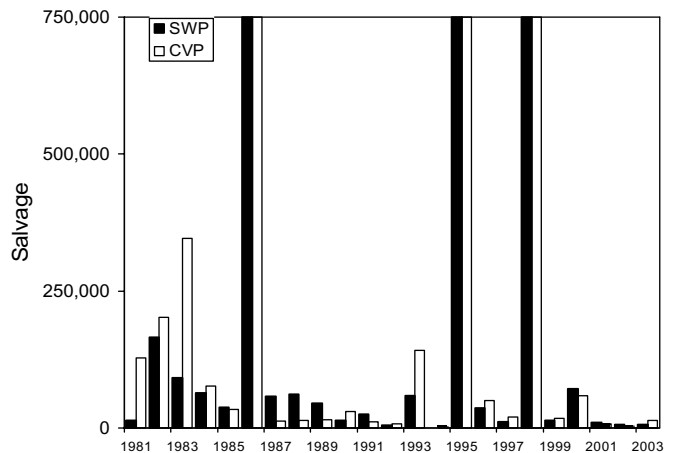
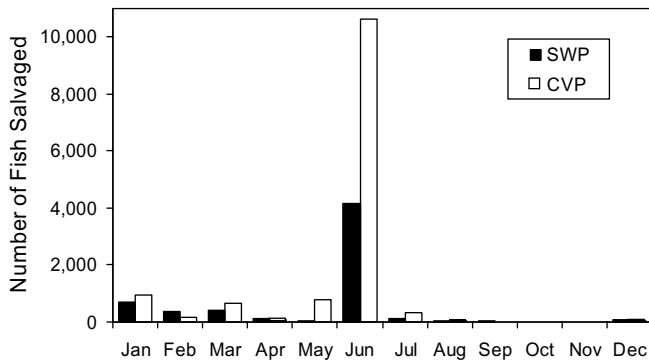


Figure 16 Annual spittail salvage at SWP and CVP. Columns for 1986, 1995, and 1998 were truncated for scale considerations.



**Figure 17 Monthly splittail salvage at SWP and CVP in 2003.**

### Longfin Smelt

Longfin smelt salvage was slight compared to the near record 2002 salvage total of 98,000. In 2003, most of the longfin were found at the CVP (about 87% of the 5,268 total). Almost all of the salvage occurred in April and May and was made up of YOY fish.

### Chinese Mitten Crab

The highest numbers of adult mitten crabs at the fish facilities occur during September through December, during their downstream migration for reproduction. Mitten crabs are considered a nuisance at the fish facilities because they interfere with the effective salvage of fish.

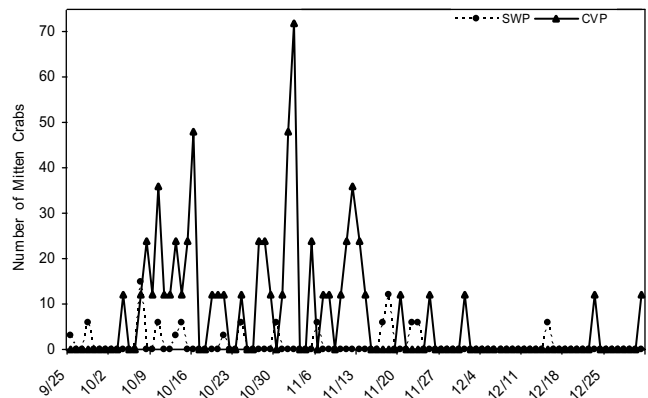
At the CVP, the first adult mitten crab of the fall migration appeared on October 4, about 1 month later than usual. The delay in migration may have been due to higher than normal autumn water temperatures. CVP daily crab numbers peaked on November 2, when an estimated 72 crabs entered the facility (Figure 18). In 2003, an estimated 672 crabs entered the holding tanks. The 2003 seasonal total of crabs was much lower than any of the last 6 years. In contrast to other years since 1999, the traveling screen control device was not deployed due to low numbers of crabs. About 60% of the crabs were male.

Although mitten crabs appeared at the SWP 9 days earlier than at the CVP, only 90 entered the holding tanks during the 2003 fall season. No crab control device was installed at the SWP in 2003.

### Water Temperatures

The mean annual water temperature in 2003 at the CVP facility was 17 °C, equal to the mean temperature in 2002. The temperature recorder at the SWP facility was faulty for part of the year, so data are not presented. Water temperatures peaked approximately July 27, at about 27.3 °C. The coolest temperatures occurred near January 1, when they fell to about 8 °C (Figure 19). The most notable feature of the 2003 temperatures was the warm autumn; temperatures in late October, for example, were up to 4 °C warmer than the same time in 2002.

Salvage data can be obtained from DFG’s Central Valley Bay-Delta Branch website (<http://www.delta.dfg.ca.gov/data/salvage>).



**Figure 18 Daily mitten crabs counted at SWP and CVP in 2003.**



**Figure 19 Daily water temperatures at SWP and CVP fish facilities.**