



IEP NEWSLETTER

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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 3.44 billion m³ (2,792,000 acre-feet) in 2002, compared to about 2.85 billion m³ (2,319,000 acre-feet) in 2001. During 2002, monthly water exports at the SWP ranged from a low of about 47.4 million m³ (38,455 af) in May to a high of about 510.3 million m³ (414,034 af) in August (Figure 1), higher than the 2001 range of about 13.7 million m³ (11,100 af) to 463.2 million m³ (376,500 af).

Central Valley Project (CVP) water exports totaled about 3.08 billion m³ (2,501,000 af), compared to about 2.79 billion m³ (2,263,000 af) in 2001. Monthly water exports at the CVP in 2002 ranged from a low of about 65.2 million m³ (53,000 af) in May to about 329.0 million m³ (about 267,000 af) in both July and August (Figure 1), similar to the 2001 range of about 64.9 million m³ (52,700 af) to about 313.4 million m³ (254,280 af).

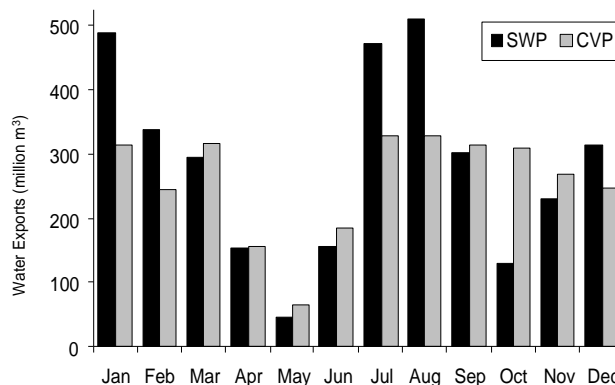


Figure 1 Monthly water exports in 2002 by SWP and CVP.

Fish Salvage

About 4.65 million fish were salvaged at the SWP in 2002, and almost 6.14 million fish were salvaged at the CVP. At both facilities, threadfin shad was the predominant species salvaged. Threadfin shad accounted for 54% of the annual salvage at the SWP (Figure 2) and 79% of the annual salvage at the CVP (Figure 3). There has been a general increase in the annual proportion of threadfin shad in the total salvage, particularly since 1995 (Figure 4).

Density of fish (individuals salvaged per 10,000 m³) was highest at the SWP in July (578) and at the CVP in November (49) (Figure 5). Threadfin shad and striped bass together accounted for much of the salvage in July at the SWP (84%) and threadfin shad made up most of the CVP salvage during November (89%).

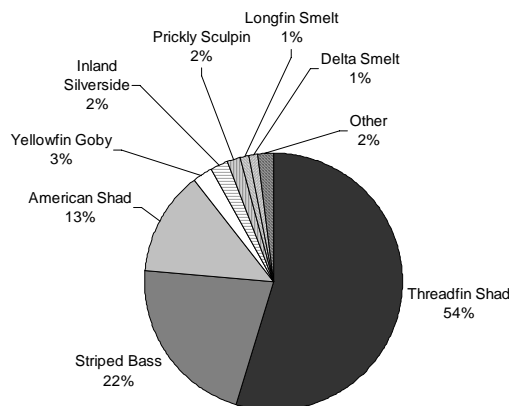


Figure 2 Relative species contribution to 2002 annual salvage at SWP.

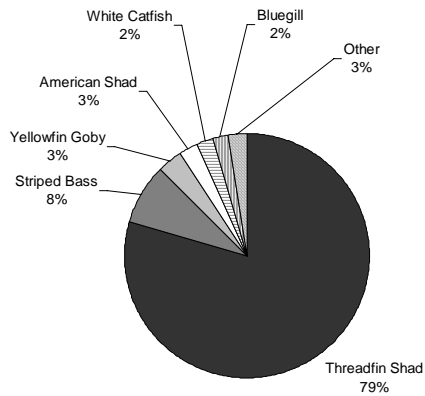


Figure 3 Relative species contribution to 2002 annual salvage at CVP.

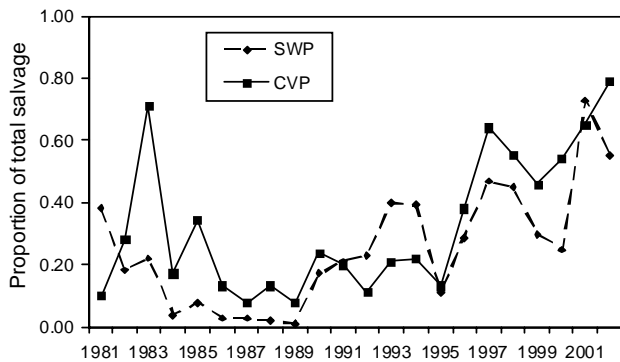


Figure 4 Relative proportion of threadfin shad in salvage at SWP and CVP.

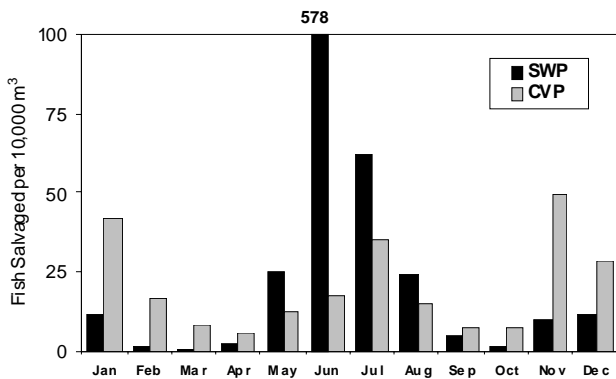


Figure 5 Fish salvage density in 2002 at SWP and CVP.

Delta Smelt

Estimated salvage of delta smelt at SWP in 2002 was 49,823, far more than the 13,219 salvaged in 2001, but still less than in 1999 and 2000 (Figure 6). Almost three

quarters of the delta smelt at the SWP were salvaged during May (Figure 7).

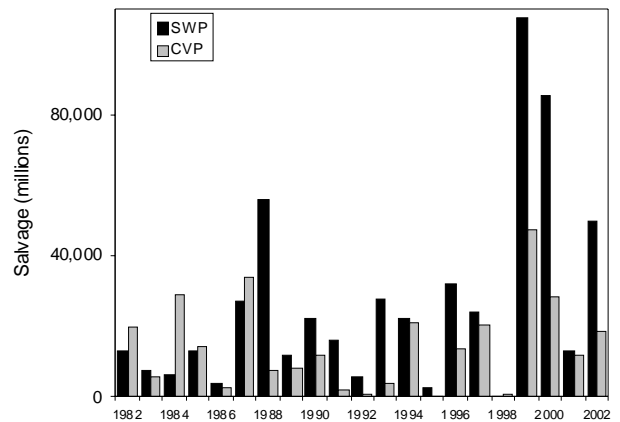


Figure 6 Annual delta smelt salvage at SWP and CVP.

In 2002, 18,396 delta smelt were salvaged at the CVP, more than the 11,700 salvaged in 2001. The highest salvage of adults (1,248) occurred in January (Figure 7) and this total was also the most in that month since 1988. The shift of peak adult salvage from February to January reversed a three-year trend of unusually high delta smelt salvage in February. About 15,700 young-of-the-year (YOY) delta smelt were salvaged in May and June, about double the 2001 YOY salvage, but only 70% of the YOY salvage in 2000.

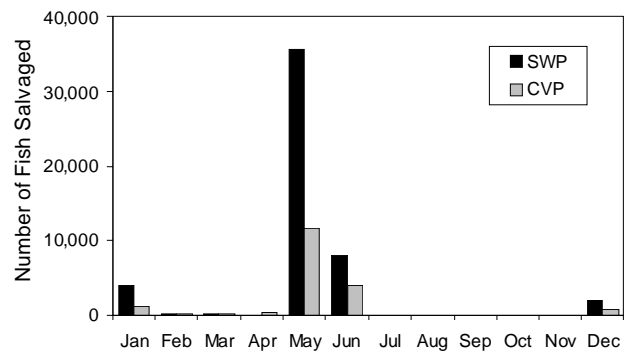


Figure 7 Monthly salvage of delta smelt at SWP and CVP in 2002.

Chinook Salmon

The combined (SWP+CVP) salvage of Chinook salmon was 21,909, lower than the 57,806 salvaged in 2001, much lower than the 1992-2001 annual average (84,950), and far lower than the 1982-1991 annual

average (333,023) (Figure 8). One-third of the salmon salvaged last year were adipose-fin clipped, indicating hatchery origin. Of the naturally-produced salmon, over half (56%) were spring run, 34% were fall run, and the remainder (10%) were winter run (as determined by fork length only) (Figure 9).

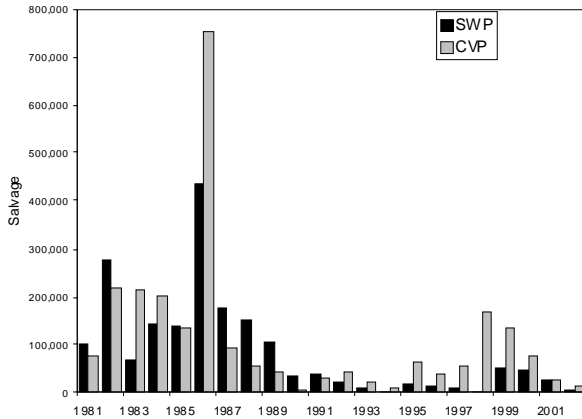


Figure 8 Annual Chinook salmon salvage at SWP and CVP

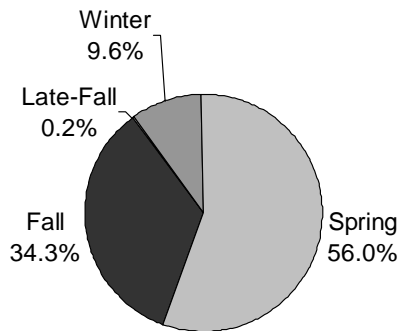


Figure 9 Percent of Chinook salmon runs in 2002 salvage at SWP and CVP. Race determined solely by length.

The CVP facility salvaged more than 3 times the number of Chinook salmon than the SWP facility during 2002 (Table 1). Salmon salvage at the SWP facility peaked in May, a month after it peaked at the CVP; almost 60% of the annual salmon salvage at the CVP came in April (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 2002 was 39,256, more than twice the salmon salvage. Approximately 42% of the salmon lost were adipose fin clipped, compared to only 5% in 2001.

SWP loss was much higher than CVP loss (Table 2), reflecting the high predation mortality rate (75%) in Clifton Court Forebay.

Table 1 Wild Chinook salmon salvage at CVP and SWP in 2002.

Race	SWP	CVP	Total
Fall	1,384	3,626	5,010
Late-fall	14	12	26
Winter	606	794	1,400
Spring	1,267	6,910	8,177
Total	3,271	11,342	14,613

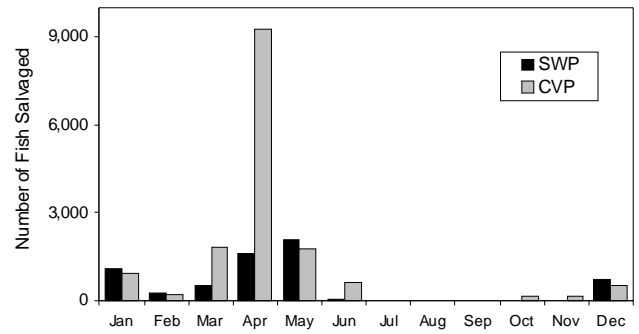


Figure 10 Monthly salvage of Chinook salmon at SWP and CVP in 2002.

Table 2 Wild Chinook salmon loss at CVP and SWP in 2002.

Race	SWP	CVP	Total
Fall	6,418	2,658	9,076
Late-fall	59	11	69
Winter	2,685	537	10,206
Spring	5,641	4,565	3,222
Total	14,803	7,771	22,573

Steelhead Trout

Steelhead salvage at both facilities in 2002 was much lower than in the previous two years (Figure 11). The SWP salvaged 2,181 steelhead, almost one-fourth of the 2001 total and about half of the 1992-2001 mean of 4,157 per year. The CVP salvaged 1,656, far below the 1992-2001 mean of 3,190 per year. Steelhead salvage was highest during March at both facilities (Figure 12).

About 68% of the steelhead salvaged at the SWP were adipose fin clipped, indicating hatchery origin, and about

42% of CVP salvaged steelhead were clipped. In 2001, about 65% of both SWP and CVP salvaged steelhead were hatchery-bred.

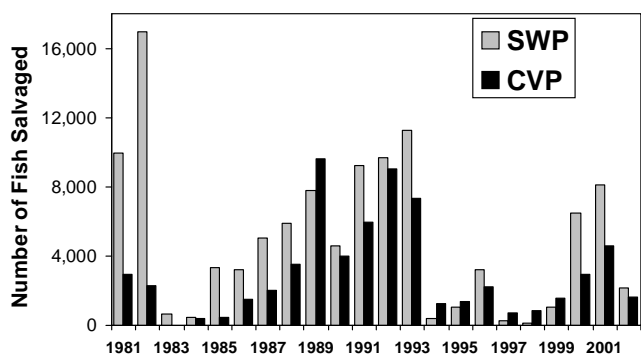


Figure 11 Annual steelhead salvage at SWP and CVP in 2002.

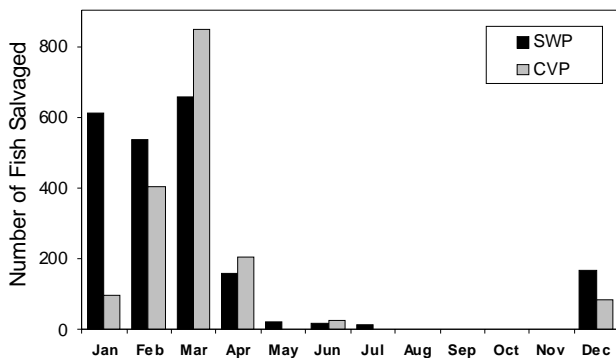


Figure 12 Monthly salvage of steelhead at SWP and CVP in 2002.

Striped Bass

In 2002, the SWP salvaged over 1 million striped bass, about half the 1992-2001 average of 2.07 million per year (Figure 13). At the CVP, almost 500,000 striped bass were salvaged, less than half the 10-year average of 1.24 million per year. Striped bass salvage peaked in June at the both facilities (Figure 14).

American Shad

About 608,000 American shad were salvaged in 2002 at the SWP and about 156,000 at the CVP, both lower than the 1992-2001 averages (Figure 15). The 2002 total at the CVP was the lowest since 1992. Monthly salvage of American shad at the SWP peaked at just over 200,000 in August. In contrast, relatively few American shad were salvaged in August at the CVP (about 12,000). At the

CVP, salvage of American shad was highest in December. Since 1981, there has been a general trend of higher American shad salvage at both facilities (Figure 15).

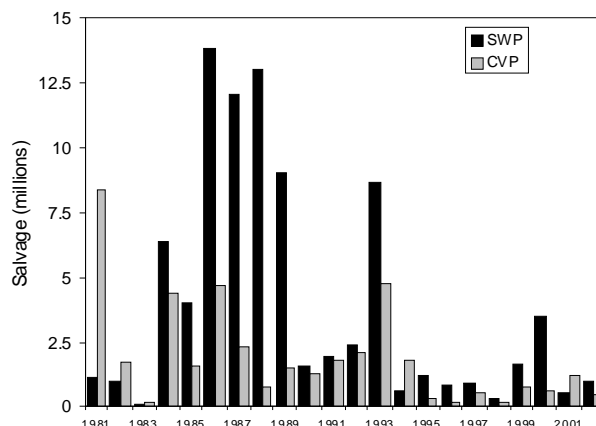


Figure 13 Annual striped bass salvage at SWP and CVP.

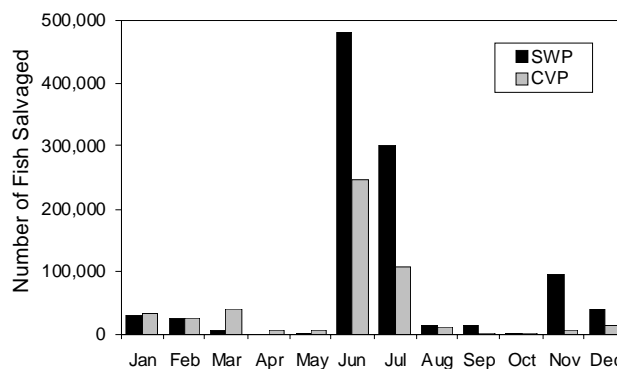


Figure 14 Monthly salvage of striped bass at SWP and CVP in 2002.

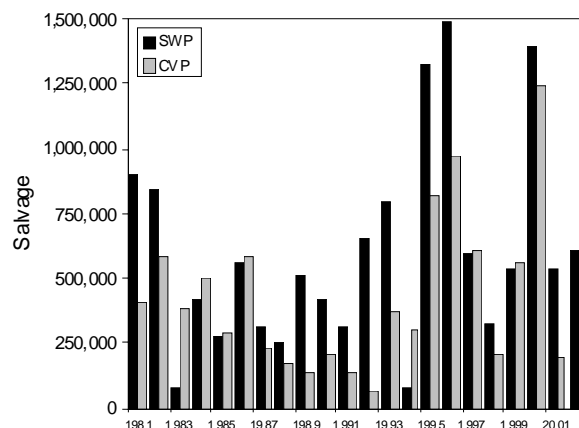


Figure 15 Annual American shad salvage at SWP and CVP.

Splittail

Combined splittail salvage (SWP + CVP) was slightly more than half of the 2001 combined total, and was also lower than every other year since 1980, except 1994 (Figure 16). Splittail salvage totals in 1986, 1995, and 1998 dwarf the salvage totals for 2002 and all other years since 1980.

Splittail salvage in 2002 showed an atypical pattern in which adult splittail salvage during January through April was much higher than YOY salvage in the early summer (Figure 17). Adult salvage was highest at the SWP in January (Figure 17), historically a month with proportionally fewer adults salvaged.

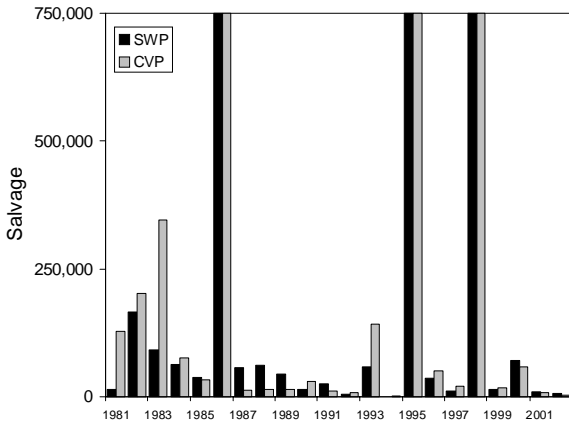


Figure 16 Annual splittail salvage at SWP and CVP. Columns for 1986, 1995, and 1998 were truncated for scale considerations.

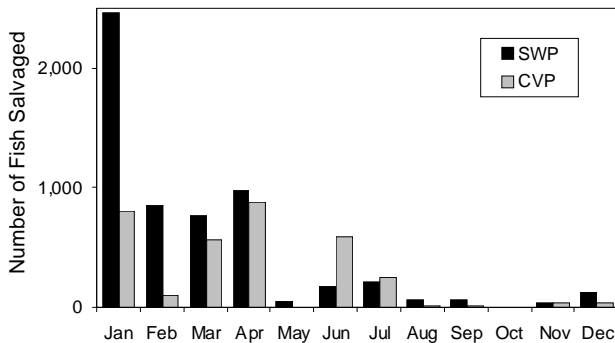


Figure 17 Monthly splittail salvage at SWP and CVP in 2002.

Longfin Smelt

Almost 98,000 longfin smelt were salvaged at the fish facilities in 2002, more than any other year in the last

22 years, except 1988. At the CVP, many more longfin smelt were salvaged in 2002 than in any year in the last 22 years; over 43,000 were salvaged in 2002 compared to about 24,000 in the previous high salvage years, 1988 and 1990. Most of the salvage occurred in May at the SWP and in April at the CVP 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 September 9, at least two weeks later than usual. CVP daily crab numbers peaked on October 4, when about 190 crabs entered the facility (Figure 18). In 2002, about 1,191 crabs entered the holding tanks and an additional 1,259 crabs were removed by the traveling screen control device, for a total of 2,450. The 2002 seasonal total of crabs was much lower than any of the last five years. Including the traveling screen counts, about 82% of the crabs were male, a much higher percentage of males than in 2001 (66%).

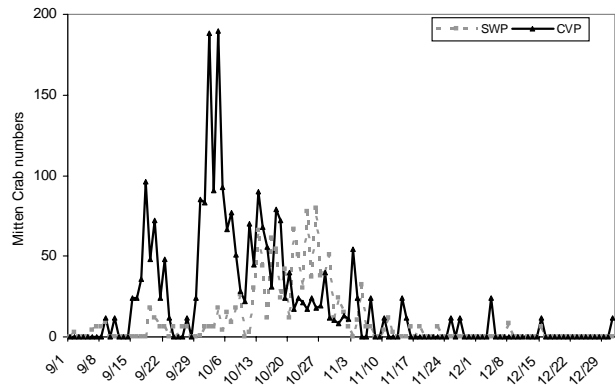


Figure 18 Daily mitten crabs counted at SWP and CVP in 2002.

At the SWP, only 1,178 mitten crabs entered the holding tanks during the 2002 fall season. This total was less than half the number estimated at the CVP and it resulted from a SWP export curtailment during the height of the migration in October. SWP water exports were about 40% of CVP water exports during October.

Crab control devices have been designed and used at both facilities with the goal of excluding crabs from the

fish holding tanks. A traveling screen, originally designed to remove debris (Siegfried 1999, White and others 2000), has been placed in the secondary channel at the CVP. The traveling screen device has undergone many modifications since it was first tested in 1998, but consists of a belt of vertical plastic-coated cables held in place by horizontal rods (White and others 2000). As they grasp the cable, crabs are lifted from the channel by the rotating belt and, after being dislodged by a high-pressure water stream, are deposited into a hopper and then moved by conveyer to a disposal container. Crabs are then counted and their sex determined.

In 2002, the traveling screen was in operation from September 30 through November 3. The traveling screen was successful in removing about 72% of the crabs entering the secondary channel during October 1 through November 2, even though the screen was down for maintenance for brief periods during that time. No crab control device was installed at the SWP in 2002.

Water Temperatures

The mean annual water temperature at the CVP facility was 17 °C, compared to almost 18 °C in 2001. The temperature recorder at the SWP facility was malfunctioning for much of the year, so data is not presented. Water temperatures peaked approximately July 10, at about 27 °C. The coolest temperatures occurred near February 1 and again in the last week of December, when they fell to about 8 °C (Figure 19).

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

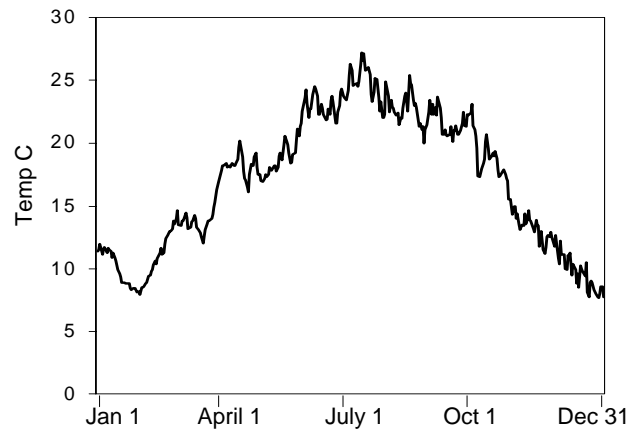


Figure 19 Daily water temperatures at SWP and CVP fish facilities.

References

- Siegfried S. 1999. Notes on the invasion of the Chinese mitten crab (*Eriocheir sinensis*) and their entrainment at the Tracy Fish Collection Facility. IEP Newsletter 12(2):24-25.
- White R, Mefford B, and Liston C. 2000. Evaluation of mitten crab exclusion technology during 1999 at the Tracy Fish Collection Facility, California. USBR Tracy Fish Collection Facility Studies California, Vol. 14.