The Bay Institute

Protecting and Restoring San Francisco Bay from the Sierra to the Sea

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January 18, 2005

Arthur G. Baggett, Jr., Chair
State Water Resources Control Board
P. O. Box 100
Sacramento, CA 95812-0100

RE: BAY-DELTA PLAN PERIODIC REVIEW/EXPORT LIMITS

Dear Mr. Baggett,

This letter is submitted as the opening comments of the Bay Institute regarding Workshop Topic 6 (Export limits) for the State Water Resources Control Board's (SWRCB) public workshops to consider potential amendments or revisions of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan).

We recommend that the SWRCB:

1. Adopt new export limits for the March 15 - June 15 period that adequately protect estuarine habitat and San Joaquin Basin Chinook salmon outmigration.

2. Retain the current inflow metric for calculating the Export/Inflow ratio in the Bay-Delta Plan.

3. Review the status of efforts to upgrade the CVP and SWP fish protective facilities, and condition consideration of changes in export capacity on resolution of the entrainment problem.

1. <u>The Bay-Delta Plan's current March 15 - June 15 export limits should be revised to more adequately protect estuarine habitat and San Joaquin Chinook salmon outmigration</u>.

During the ecologically important February - June period, the Bay-Delta Plan limits exports to 35% of total Delta inflow (i.e., the Export/Inflow, or E/I, ratio) and, during a 31-day period during April and May, to a maximum of 1500 cubic feet per second (cfs) or 100% of San Joaquin River flow at Vernalis, whichever is

greater (Bay-Delta Plan, Table 3, Footnote 22). This period coincides with peak juvenile outmigration for Sacramento and San Joaquin Basin fall-run Chinook salmon, much of the Central Valley steelhead outmigration period, and the early development and juvenile rearing period for delta smelt as they move from the upper Delta towards Suisun Bay (Figure 1).[1] Compliance with the Bay-Delta Plan's export limits has generally improved conditions by reducing hydraulic alterations in the central and south Delta, reducing overall entrainment losses at the CVP and SWP pumps, and increasing Delta outflows in excess of the outflow objective. In and of themselves, however, the current limits have not been sufficient to provide adequate estuarine conditions, prevent continuing high levels of entrainment for migrating salmon and for delta smelt, and reverse the population declines exhibited by these species during the past several years.

Following adoption of the Bay-Delta Plan, more stringent export limits for the April 15 – May 15 pulse flow period were implemented, first by the U.S. Fish and Wildlife Service in the 1995 Biological Opinion (BO) for delta smelt (USFWS, 1995) limiting exports to 50% of Vernalis flow, and later as part of the San Joaquin River Agreement (SJRA) limiting exports even further[2]. Under the SJRA, these more stringent export limits are implemented in conjunction with increases in San Joaquin River flows (although the flow levels are somewhat less than those required in the Bay-Delta Plan's April 15 – May 15 Vernalis flow objective) according to the ratios contained in the Vernalis Adaptive Management Plan (VAMP) (Figure 2). The delta smelt BO and VAMP flow and export regimes are specifically intended to facilitate downstream movement and improve survival of larval and juvenile delta smelt and juvenile San Joaquin basin Chinook salmon. Furthermore, following the 2000 CALFED Record of Decision assets of the Environmental Water Account (EWA) have been used to reduce exports in the two-week period immediately following the 31-day pulse flow.[3]

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[1] Although the February-June period during which exports are limited as described above coincides with the outmigration of fall-run Chinook salmon, it does not overlap well with the outmigration for the three other runs of Chinook salmon (late-fall, winter, and spring) that are presently at greater risk and whose populations are far below the doubling goals required by both the Bay-Delta Plan and the Central Valley Project Improvement Act. Therefore, for these at-risk Sacramento basin runs, alternative protection measures such as additional closures of the Delta Cross Channel gates may be even more important and necessary to achieve the doubling objective (see also our October 27, 2004 comment letter to the SWRCB regarding workshop topics 2 and 3).

[2] The SJRA is implemented in part through the SWRCB's Water Right Decision 1641, which evaluated the rationale for and effects of the VAMP's export ratios. The Bay Institute was a negotiator of the SJRA but did not become a signatory because of disagreements regarding the appropriate source of funding for the SJRA.

[3] In 2001, CVPIA "(b)(2)" water was used to curtail CVP exports and EWA assets were used to cut SWP exports during the two-week post-VAMP period. Since then (2002-2004), CVPIA (b)(2) water has not

Flow and hydraulic conditions in the south Delta during the April 15 – May 15 period have markedly improved in the years following implementation of the Bay-Delta Plan, the delta smelt BO, the VAMP regime, and the EWA (Figure 3). Prior to 1995, Delta exports regularly exceeded total San Joaquin River flows (at Vernalis) by 200 to 700% and the San Joaquin River flow to export ratio (SJR:Export) rarely exceeded 1:1 (i.e., exports at 100% of SJR flows). Since 1996, the SJR:Export ratio has exceeded 2:1 (i.e., Vernalis flows at ≥200% of exports) in all years during this 31-day period. However, during the weeks immediately before and after the 31-day VAMP, the SJR:Export ratio remains extremely low, the combined result of low flows in the lower San Joaquin River and high export rates (Figure 4; and see Figure 2). In fact, March and early April flow conditions in the lower San Joaquin and southern Delta, as measured by the SJR:Export ratio, appear to have worsened in recent years. (For the past three consecutive years, the Central Valley Project (CVP) has sometimes violated the objectives for February – June Vernalis flow outside of the pulse flow period).

Flow and export conditions during the weeks preceding and after the 31-day pulse flow period are as, and for some species possibly more, important to estuarine and migratory species as the pulse flow period itself. For example, young delta smelt are present in the southern Delta as early as March but, because they are smaller than 20 mm in length, they are not salvaged or counted at the fish facilities. Figure 5 shows results from the California Department of Fish and Game's (CDFG) 20 mm survey (which samples larval and juvenile fish) for the first week in April 2002. Large numbers of young delta smelt were present in the southern Delta and, with export rates averaging more than 7500 cfs and greater than 400% of lower San Joaquin flow (see also Figure 2), many of these fish, which averaged just 8 mm in length, were likely entrained and lost.[4] Recent analyses by CDFG indicate that loss of these uncounted fish negatively affects population abundance measured for the species later in the season (Fleming, 2004). Figure 6 shows the negative effect of high export rates during the March-May period on delta smelt population abundance measured later in the summer: when March May exports are high, delta smelt abundance measured a few months later is low. In addition, measured entrainment losses of delta smelt at the fish protective facilities typically increase dramatically

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been available to provide this protection and EWA assets have been used to curtail exports at both facilities during this period.

[4] Results from the particle-tracking module of the Delta hydraulics model, DSM2, indicate that virtually all particles (a surrogate for larval and small juvenile fish with limited swimming abilities) in the southern Delta are entrained into either the CVP of SWP diversions within two weeks (Fleming, 2004).

immediately following the 31-day VAMP period and (if implemented) post-VAMP actions to reduce export (see Figure 9, next section) and have in the past greatly exceeded Endangered Species Act-mandated take limits.[5]

San Joaquin Basin fall-run Chinook salmon are also adversely affected by high levels of export during the spring. Even with the pulse flows in the San Joaquin tributaries and the month-long period of higher flow in the lower San Joaquin, juvenile salmon in the basin do not restrict their downstream migration to the 31-day VAMP period. In many years the fish begin migrating downstream and arrive at the Delta earlier than mid-April; in other years fish may still be moving downstream in late May or June. As Figure 4 shows, even after implementation of the VAMP, flow and export conditions during the month prior to VAMP and the two weeks following it have been extremely poor. Our analysis indicates that these conditions during the juvenile outmigration are correlated with population declines for San Joaquin basin salmon. Figure 7 shows the "return ratio", the ratio of the number of adult fish that returned to the river (i.e., escapement) to the number of adult fish that produced them (i.e., escapement three years earlier), plotted against the March-June SJR:Export ratio for the year that these fish migrated through the Delta (i.e., three years earlier; for more information on the return ratio calculation, please see our October 27, 2004, comments on workshop topics 2 and 3). In 95% of years in which the March – June SJR:Export ratio is >1.0 (i.e., exports≤100% of SJR flow), the return ratio was greater than 1.0, indicating a positive population growth. In contrast, in 63% of years with a March – June SJR:Export ratio that is less than 1.0, when exports exceed Vernalis flows, the return ratio was negative, indicating population decline.

Recommendation: Based on these analyses, as well as the evidence of critically low and declining fish populations of these and other species in the past five years (see our January 11, 2005, comments on workshop topic 5), we recommend that the SWRCB adopt more protective export limits, specifically related to Vernalis flows, during the March 15 – June 15 period, including the export ratios contained in the VAMP. These proposed new export limits are described in Table 1. In conjunction with these export limits, we will also propose revised objectives for San Joaquin River flow at Vernalis in our comments on workshop topics 8 and 9.

[5] Take limits for delta smelt were exceeded in May, June and July, 1999, and May and June, 2000.

Table 1. Proposed export limits for the protection of estuarine habitat and resident and migratory fishes.

March 15-31	Exports limited to 200% of Vernalis flow or 35% of total inflow, whichever is lower.
April 1-14	Exports limited to 100% of Vernalis flow or 35% of total inflow, whichever is lower.
April 15 – May 15	VAMP export rates, as determined by the Hydrology Group of the San Joaquin River Technical Committee.
May 16-31	Exports limited to 100% of Vernalis flow or 35% of total inflow, whichever is lower.
June 1-15	Exports limited to 200% of Vernalis flow or 35% of total inflow, whichever is lower.

2. The current Inflow metric for the Export/Inflow ratio in the Bay-Delta Plan is important for protecting habitat conditions and fisheries.

The California Department of Water Resources (DWR) and U.S. Department of the Interior (DOI) have proposed modifying the E/I ratio to allow the projects to choose between either of two compliance metrics for the inflow component of the objective, a 3-day or 14-day running average of Delta inflow (SWRCB, 2004). Presently the objective requires use of the more conservative 14-day running average under all conditions except when the CVP or State Water Project (SWP) are making storage withdrawals for export (Bay-Delta Plan, Table 3, Footnote 23). The project operators argue that such a change would allow them greater flexibility in their export operations and claim that such a change would have no adverse impacts to the fishery. The supposed benefits of flexibility in choosing the Inflow metric are not justified, however, when weighed against the effects of such a change on monthly and annual Delta outflow; monthly and springtime X2 location (including averages and variances); and monthly and annual entrainment losses.

The effect of the 14-day average is to prevent rapid increases in exports in response to sharp increases in Delta inflows that may follow a storm event. These peak flow events into the Delta and downstream into the Bay are a physically and ecologically important component of the estuary's hydrograph, one that has already been impaired by upstream and in-Delta water management operations, particularly during the ecologically sensitive February-June period (Mount, 1995; TBI, 2003). Application of a 3-day average inflow criterion to the E/I objective

would allow the CVP and SWP to increase export rates under these conditions (Figure 8), with resultant decreases in Delta outflow and increases in entrainment of resident and migratory fish species at the CVP and SWP pumps. Alternatively, as inflows decrease on the declining limb of a storm hydrograph, a condition that would likely ultimately prompt the CVP and SWP to make releases from storage to support exports (triggering the requirement to use the 3-day average inflow under the current E/I objective), use of the 14-day average inflow criterion for the E/I ratio would again allow the project to increase exports, thereby decreasing outflows and increasing entrainment. Overall, increasing permissible exports by allowing the CVP and SWP discretion in regards to the Inflow metric used in calculation of the E/I ratio would result in reduced Delta outflow (particularly for outflows in excess of the current springtime Delta outflow objective), higher average springtime X2 values, and reduced abundance and/or survival of estuary-dependent species (see our January 12, 2005, comments regarding workshop topic 5). Furthermore, losses of resident and migratory fishes to entrainment are likely to increase as exports increase on both the ascending and declining limbs of the hydrograph.

Recommendation: Footnote 23, Table 3, in the Bay-Delta Plan regarding calculation of the Inflow metric for the E/I ratio objective should be retained in its current form.

3. The inadequate and deteriorating condition of the CVP and SWP fish protective facilities reduces the effectiveness of the current export limits, and renders them completely insufficient if export capacity increases.

The Bay-Delta Plan's export limits are intended to protect estuarine habitat and reduce entrainment losses of both resident and migratory fish species. Each year the CVP and SWP fish facilities "salvage" millions of fish that are entrained in water drawn towards the pumps and then diverted into holding tanks by a series of fish "screens". From there the fish are loaded into trucks and transported to the central Delta for release. Based on their life histories and use of the Delta habitat, different species tend to be taken at the facilities at different times of the year. Figure 9 shows average monthly loss for Chinook salmon and delta smelt.[6, 7]

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[6] In addition to these two Endangered Species Act listed species, many other "at-risk", priority, and harvested species are lost at the facilities, including steelhead, Sacramento splittail, longfin smelt, striped bass, and sturgeon.

[7] For salmon, "loss" numbers estimate the number of fish killed at the facilities, not the number that are "salvaged" and returned to the Delta. For delta smelt, all fish that enter the facilities are counted as lost.

The fish facilities in use today were designed and constructed 30 to 50 years ago (depending on the facility). The principal species targeted for protection were striped bass and Chinook salmon, both relatively sturdy and robust fish compared to smaller, more delicate species such as delta smelt and longfin smelt that are now at risk in the estuary. Research conducted by the U. S. Bureau of Reclamation (USBR) indicates that the louver design of the fish screens at both facilities is inefficient for diverting small fish like these: under many flow and environmental conditions, more than half of entrained juvenile delta smelt (>20 mm in length, the size at which the fish are monitored and counted at the CVP and SWP facilities) pass through the louvers and are sucked into the pumps (Bowen et al., 2004). Bowen et al. (2204) also showed that, in terms of louver efficiency, the CVP facility is deteriorating: the proportions of entrained fish that are successfully diverted away from the pumps into holding tanks has declined during the past forty years. Other studies have shown that, at the SWP facility, predation loss of fish in Clifton Court Forebay exceeds 75%: most juvenile Chinook salmon entrained into the forebay do not reach the fish salvage facility but are instead consumed by the large population of predators attracted to the artificial forebay environment (Gingras, 1997). In addition to these problems, a number of other alterations have occurred in the Delta environment that affect the function of the facilities, including establishment of a number of invasive aquatic weed species that regularly clog the trashracks and louvers at the facilities, adversely affecting fish salvage operations.

Upgrades to both facilities have been in the planning and research stages for more than a decade. The requirement that the facilities be improved was included in the Central Valley Project Improvement Act and the CALFED Record of Decision. However, these upgrades have been indefinitely delayed by the CALFED agencies, citing high costs and interest in exploring alternative strategies for reducing entrainment (SDFFF, 2004). Alternatives to upgrading the facilities may prove to be viable. In the interim, however, entrainment losses continue to be high despite the Bay-Delta Plan's export limits, and higher losses are certain if the current export pumping capacity is expanded to 8,500 cfs and then 10,300 cfs as proposed by the projects.

Recommendation: The SWRCB should review the status of efforts to upgrade the inadequate and ineffective project fish protective facilities, and consider measures to address the high levels of entrainment losses, perhaps by imposing new conditions on the water rights permits of the CVP and SWP to address entrainment. If progress toward resolving this problem is not made by a certain

date, the SWRCB should revisit the Bay-Delta Plan's overall E/I ratio limits. Furthermore, any future consideration of increases in the permitted capacity of the export pumping facilities should be conditioned on resolution of the projects' fish protective facility problems.

Thank you for considering our recommendations regarding potential amendments and revisions to the Bay-Delta Plan objective for export limits, and regarding related actions that the SWRCB should consider. Please contact us if you have any questions regarding these comments.

Sincerely,

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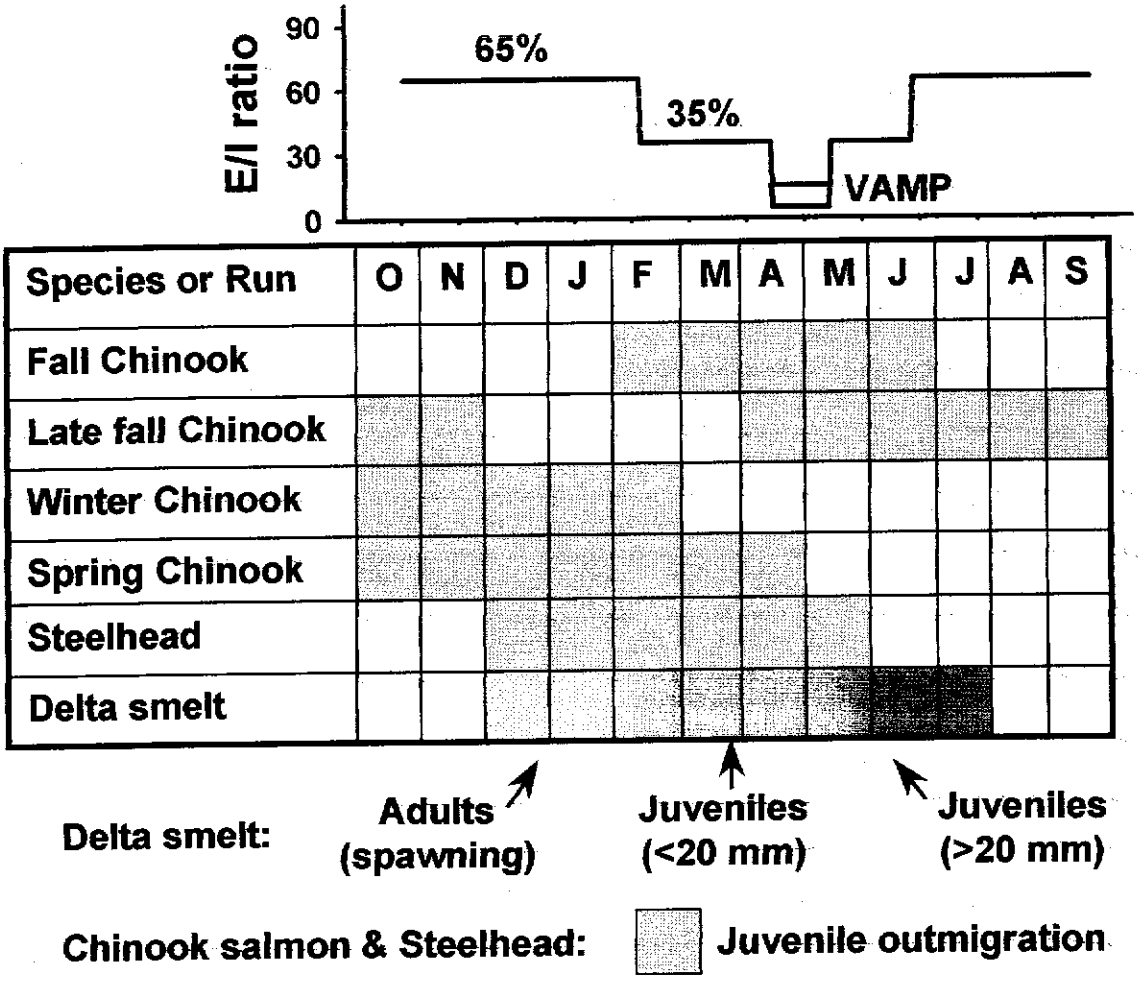

Figure 1. Comparison of the timing of life history stages of Chinook salmon and Central Valley steelhead (juvenile outmigration) and delta smelt (spawning and early rearing) that are vulnerable to the CVP and SWP export operations with the Bay-Delta Plan's monthly Export/Inflow limits. Fish smaller than 20 mm are not counted at the CVP and SWP fish facilities. Data sources: Vogel and Marine, 1991; USBR, 2004.

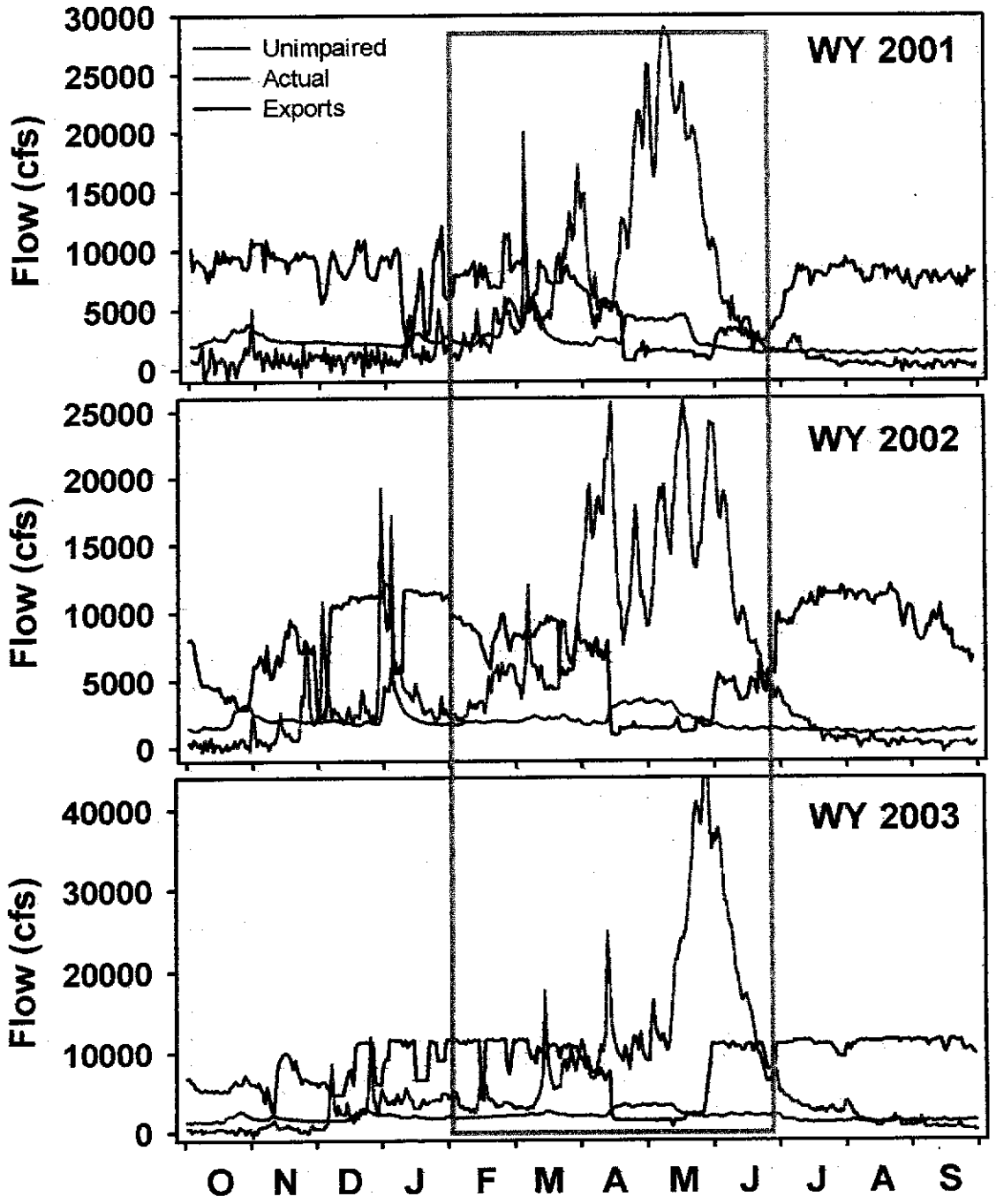

Figure 2. Unimpaired runoff from the San Joaquin basin compared to actual flow in the lower San Joaquin River (Vernalis) and Delta exports. Unimpaired runoff is calculated as the sum of unimpaired runoff from the Stanislaus, Tuolumne, Merced and San Joaquin Rivers reported by the California Data Exchange Center (CDEC). Vernalis flows and exports (calculated as the sum of CVP and SWP exports) are from Dayflow (California Department of Water Resources). Upstream water management operations have drastically reduced flow in the lower San Joaquin River year-round. Except during the April 15-May 15 VAMP, Delta exports consistently exceed Vernalis flows by two- to seven-fold. The green box highlights the ecological sensitive spring period when many fish species are rearing and migrating through the Delta.

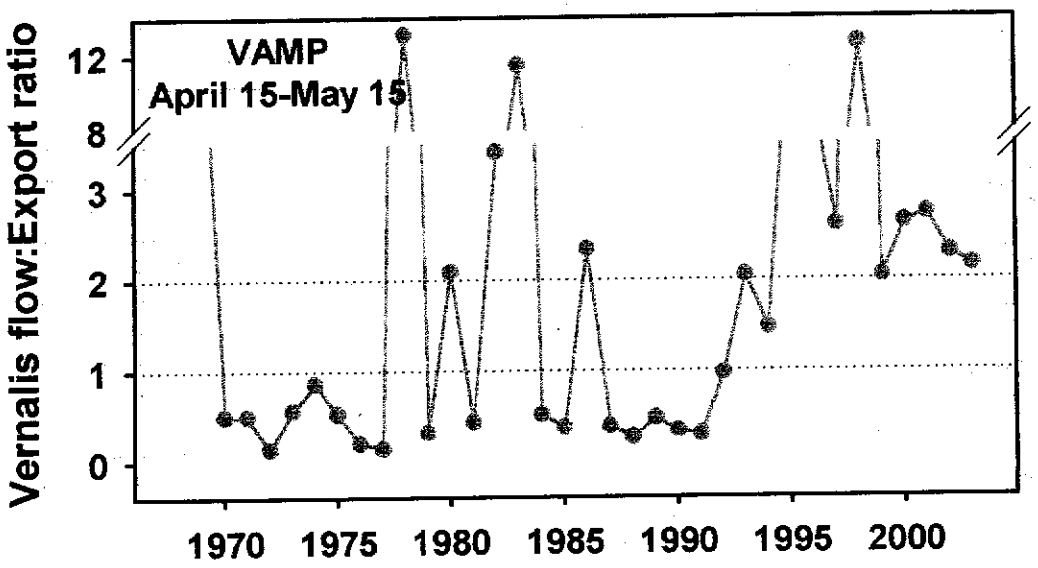

Figure 3. The ratio between San Joaquin River flow (Vernalis, 3-day running average, cfs) and combined exports (CVP + SWP, cfs) during the April 15-May 15 "VAMP" period, 1969-2003. Since the 1996, when the the delta smelt biological opinion, Bay-Delta Plan, and the VAMP were implemented, the ratio has been consistently greater than 2.0 (i.e., 2:1 San Joaquin River:Exports) even in drier years. Data sources: California Department of Water Resources, Dayflow.

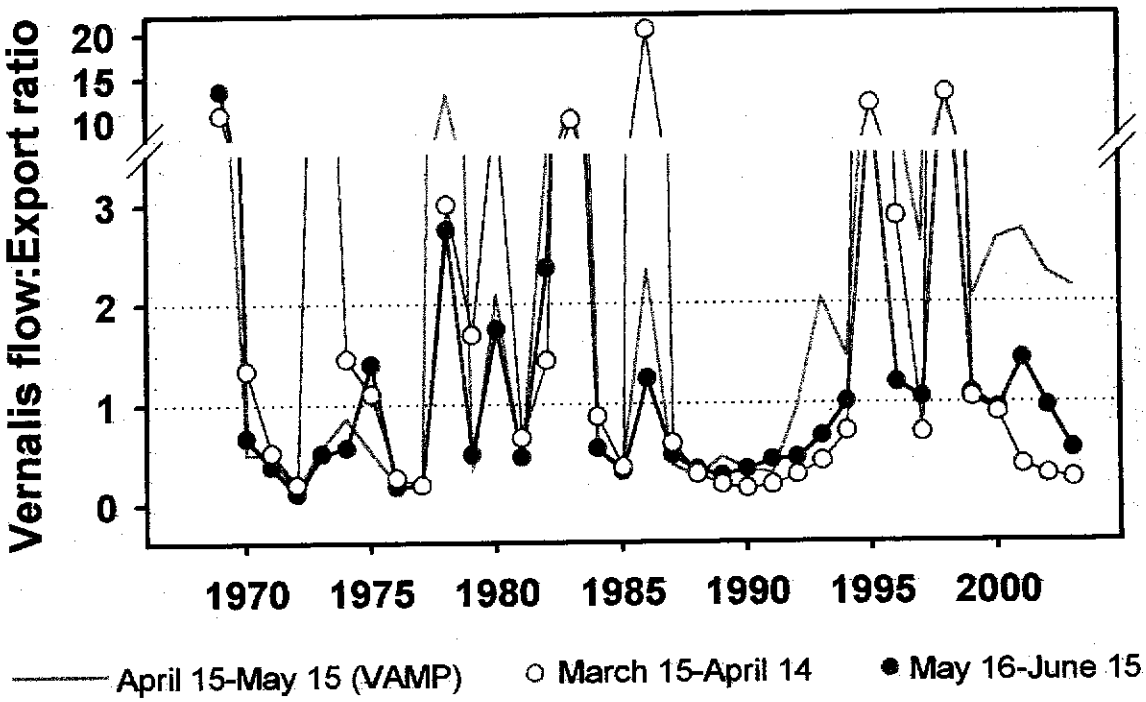

Figure 4. The ratio between San Joaquin River flow (Vernalis, 3-day running average, cfs) and combined exports (CVP + SWP, cfs) during the April 15-May 15 "VAMP" period (green line), the one-month period before VAMP (March 15-April 14, open blue circles), and the one-month period after VAMP (May 16-June 15, closed red circles), 1969-2003. While the flow ratio during the VAMP period has improved substantially, flows immediately before and after the 31-day period remain critically low. Data sources: California Department of Water Resources, Dayflow.

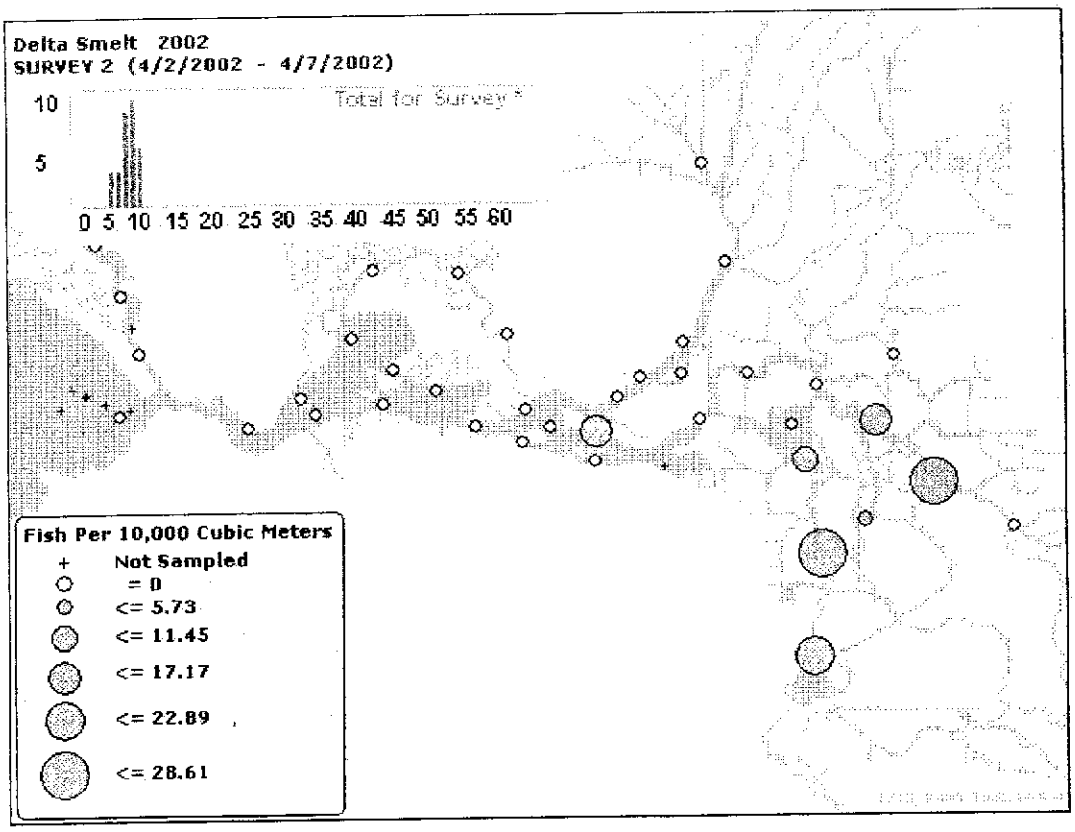

Figure 5. Results for the California Department of Fish and Game 20 mm survey, which samples larval and small juvenile fishes, conducted April 207, 2002. The plot shows presence and abundance of larval delta smelt (green circles). The small graph inset in the top left corner shows the size distribution of the fish collected. In early April of 2002, two weeks before the VAMP export reduction and San Joaquin River flow increase, young delta smelt were concentrated in the southern and central Delta. Particle tracking modeling indicates that virtually all of these fish would likely be entrained at the CVP and SWP export facilities.

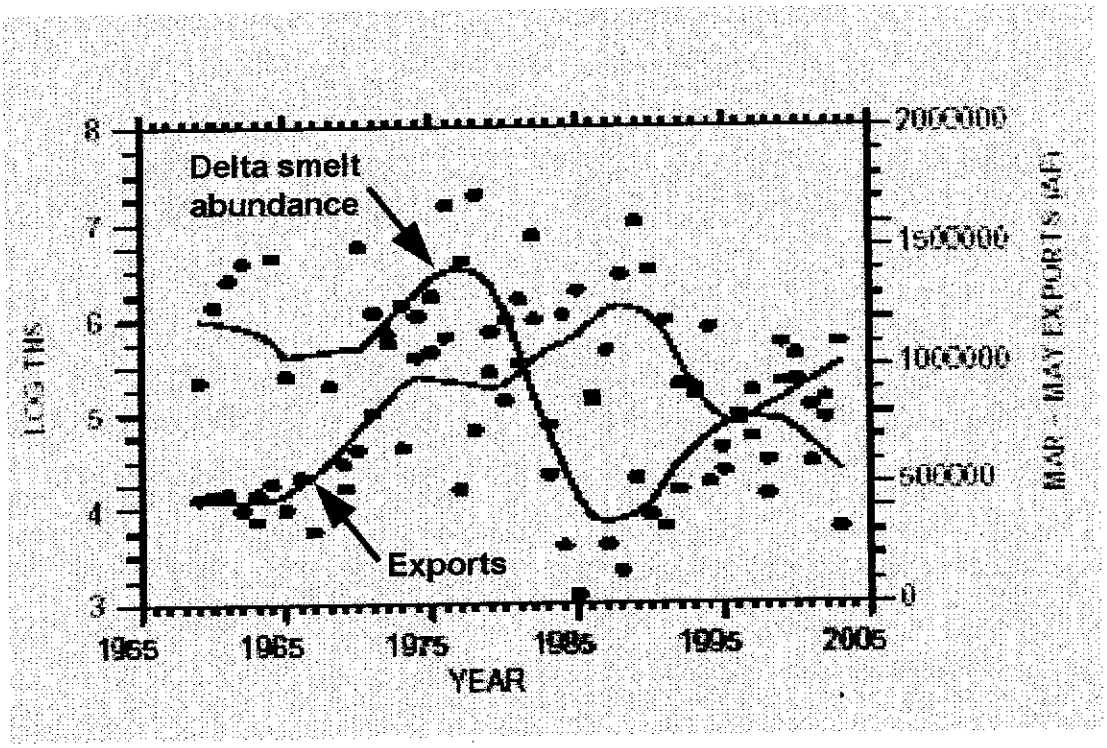

Figure 6. Comparison of population abundance of juvenile delta smelt measured by CDFG Summer Townet survey (black line and symbols) with March-May exports (acre-feet, blue line and symbols). The decline in the delta smelt population during the 1980s, as well as decline during the most recent several years, corresponds with increases in exports during the early rearing period (March-April, see Figure 1). At this time of the year, most juvenile delta smelt are smaller than 20 mm in length and therefore most fish entrained into the fish facilities are not salvaged or counted. Source: K. Fleming, California Department of Fish and Game, presentation at the 2004 Environmental Water Account Science Review.

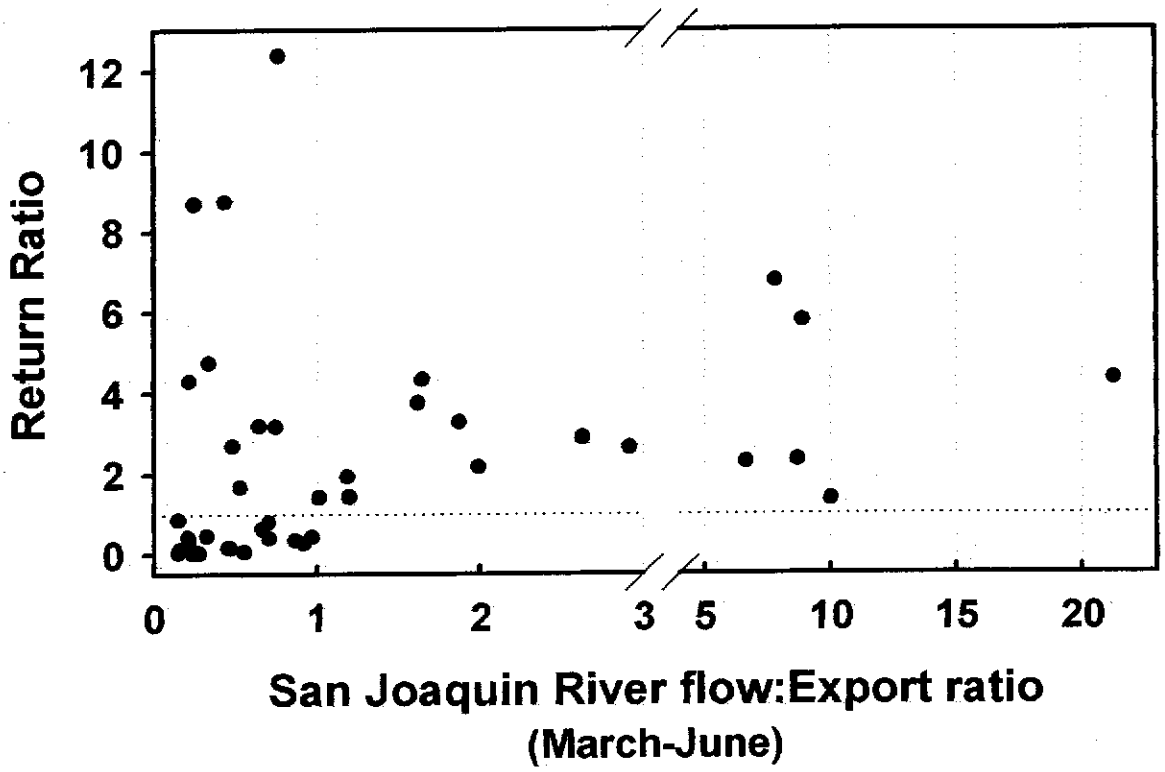

Figure 7. The Return Ratio of San Joaquin basin fall-run Chinook salmon plotted against the average March-June San Joaquin River (SJR) flow to export ratio. Return ratios below 1.0 indicate declining salmon populations; return ratios greater than 1.0 indicate increasing salmon populations. In 95% of years in which the SJR:Exports ratio was greater than 1.0, the return ratio for San Joaquin Chinook salmon was greater than 1.0. In 63% of years in which the SJR:Exports ratio was less than 1.0, San Joaquin salmon populations declined. Data sources: California Department of Fish and Game, "Grandtab"; California Department of Water Resources, Dayflow.

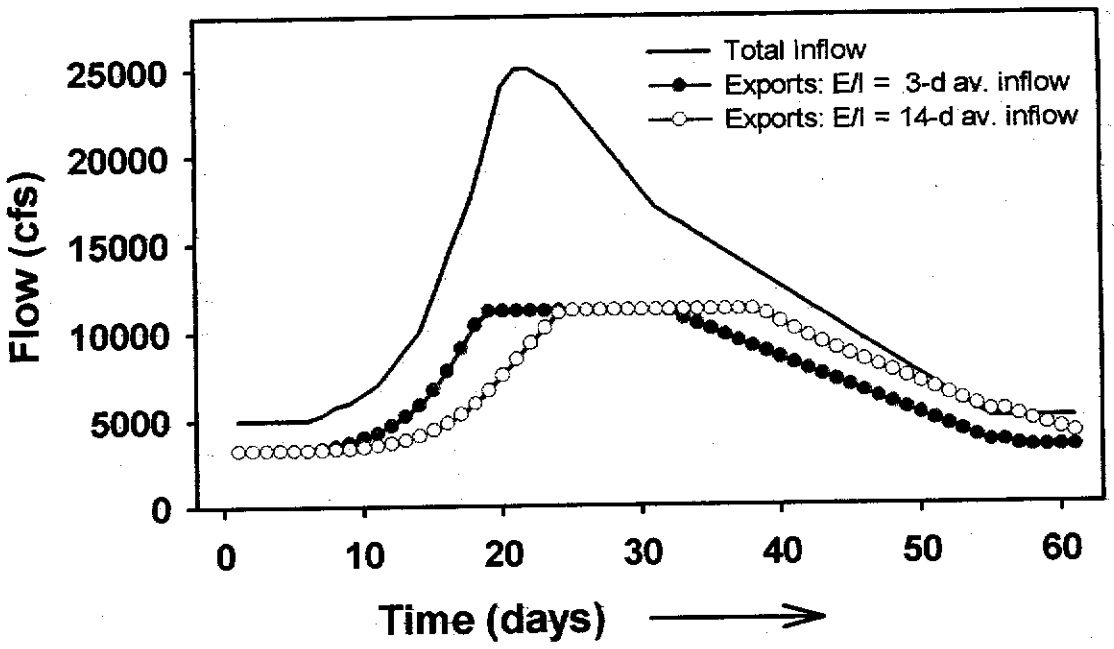

Figure 8. Hypothetical hydrograph showing Delta inflow (black line) and maximum exports as limited by a 65% E/I ratio (and maximum allowed pumping capacity) calculated using the inflow metric as the 3-day running average (solid red circles) and as the 14-day running average (open blue circles). During the ascending limb of the hydrograph, greater exports are allowed if inflows is calculated using the 3-day average. As flows decline, greater exports are allowed if inflows are calculated using the 14-day average.

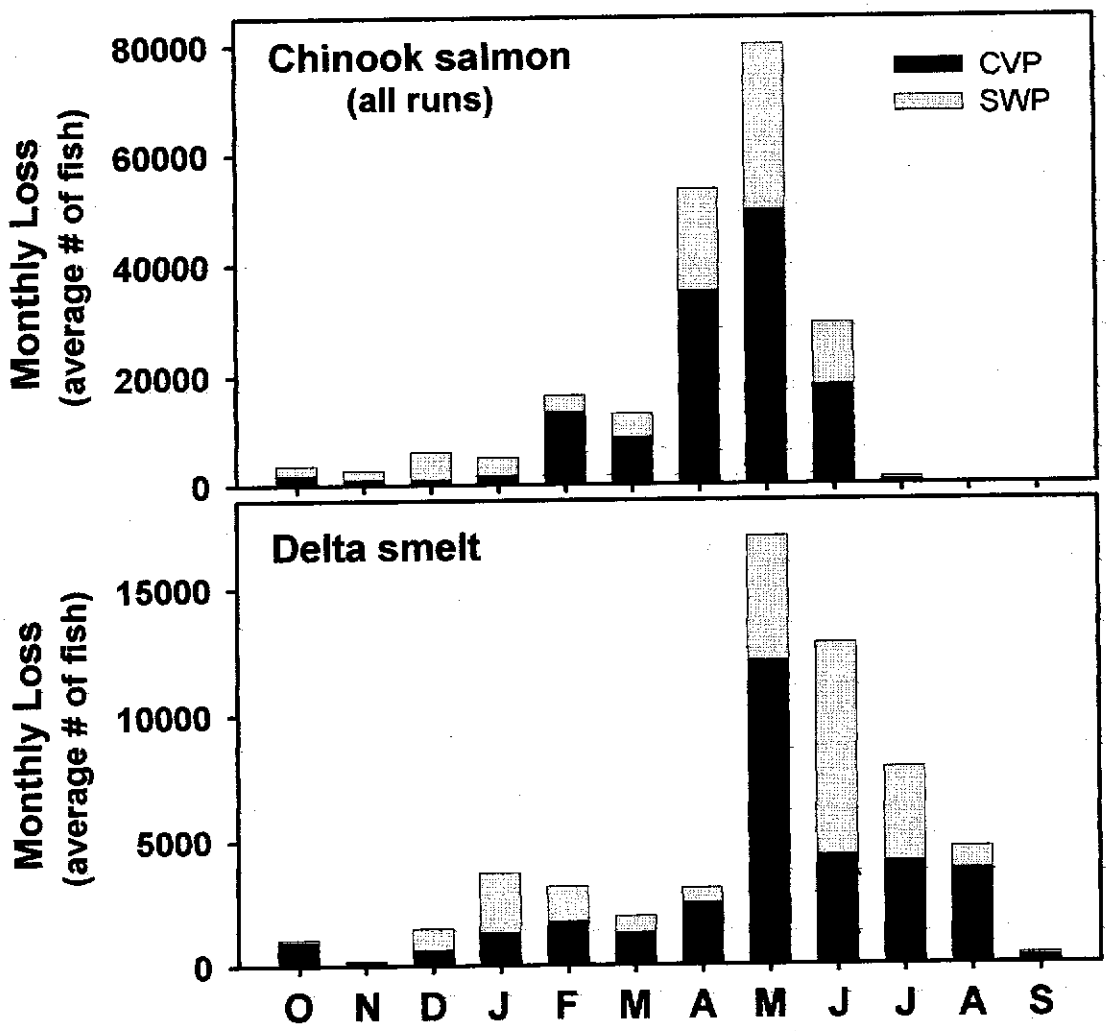

Figure 9. Average monthly loss of juvenile Chinook salmon and delta smelt at the CVP and SWP export facilities. High losses of Chinook salmon during the spring (April-June) reflect the much larger population size of fall-run Chinook salmon compared to the other three runs. For delta smelt, fish lost during the winter months (December-March) are predominantly adults and fish lost later in the year are juveniles. Large numbers of larval and juvenile delta smelt (<20 mm in length) are entrained and lost during the early spring (March-April) but these smaller fish are not salvaged or counted. Chinook salmon data provided by D. Odenweller; delta smelt data are from California Department of Fish and Game.