



*To advance the economic, social and environmental sustainability of Northern California  
by enhancing and preserving the water rights, supplies and water quality.*

September 27, 2011

*Via Electronic Mail*

Mr. Chad Dibble  
Department of Fish and Game  
830 S Street  
Sacramento, CA 95811

**RE: Comments on the Ecosystem Restoration Program Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta Ecological Management Zone and the Sacramento and San Joaquin Valley Regions**

Dear Mr. Dibble:

The Northern California Water Association (NCWA) submits the following comments to the Department of Fish and Game (Department) with respect to the “Ecosystem Restoration Program Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta Ecological Management Zone and the Sacramento and San Joaquin Valley Regions.” As you review comments on this document and further develop Department policies in this arena, we urge you to think about and consider the larger context in which the Department develops and implements its policies, particularly with respect to two resources of international significance in the Great Central Valley: the **anadromous fisheries** and the waterfowl and other birds along the **Pacific Flyway**. It appears that the Department is currently focused on the political imperatives in the Bay-Delta at the expense of improving and maintaining these resources of international significance in the Sacramento Valley. The Department has an opportunity, in its Conservation Strategy, to change this dynamic and develop a “single-blueprint” to “ensure coordination between all resources management, conservation, and regulatory actions affecting the Bay-Delta ecosystem.”

As you know, NCWA and water resources managers in the Sacramento Valley are undertaking ongoing efforts to foster regional sustainability in the Sacramento Valley. These efforts include partnering with federal and state agencies and conservation partners to improve migratory corridors and habitat for anadromous fish and the migratory waterfowl and other birds (including shorebirds, riparian songbirds and raptors) utilizing the Pacific Flyway within the region.

## Anadromous Fisheries

To further these efforts and advance our scientific understanding of the fisheries in the Sacramento River hydrologic region, water resources managers throughout the region commissioned fisheries biologist Dave Vogel to prepare a scientific report investigating the reasons for the fish population declines and, more importantly, how to improve anadromous fisheries in the Sacramento Valley. The detailed scientific report entitled, *Insights into the Problems, Progress and Potential Solutions for Sacramento River Basin Native Anadromous Fish Restoration* is available at <http://www.norcalwater.org/wp-content/uploads/2011/07/vogel-final-report-apr2011.pdf>. In summary, the report includes the following key conclusions:

- Despite the enormous, unprecedented actions to improve fish production in the upper watersheds, there has been remarkable lack of focus or progress to fix the serious predation and habitat problems in the Delta, through which all Sacramento Valley anadromous fish must migrate. Overall, predation is likely the highest source of mortality to anadromous fish in the Delta. Despite the fact that in-Delta problems of predation at a variety of locations have been well-known for many years, very little progress--in many instances, no progress--has been made. Ironically, some measures implemented under the auspices of improving fish habitats have likely increased predation of anadromous fish in the Delta. The best available evidence indicates that in-Delta predation and habitat problems have gotten worse during recent decades.
- Until significant progress is made on correcting the habitat problems and largely site-specific sources of native juvenile anadromous fish mortality in the Delta, it is likely that many of the benefits of upstream actions are, and will continue to be, negated. Although many studies over decades have demonstrated low survival of anadromous fish in the Delta, more such studies continue and are proposed, but are not oriented to determine site-specific in-Delta mortality sources. Re-focused study efforts in the Delta are sorely needed with the objective of locating and fixing fish mortality sites. Overall, until major predation problems in the Delta are corrected, difficulties for anadromous fish restoration will remain.
- Other in-Delta and ocean-related actions also could significantly benefit the Sacramento Valley's salmonid populations. Appropriately-designed restoration of shallow-water rearing habitats in the Delta should be aggressively pursued because they would have a high probability of success. There may also be alternative ocean harvest methods that would increase salmonid populations by increasing the fecundity, or reproduction capacity, of the salmonids that spawn in the Sacramento Valley.
- There are still opportunities to improve salmon habitat upstream of the Delta in the Sacramento Valley. Building on the recommendations in Dave Vogel's report, Sacramento Valley water resources managers are developing an action plan to improve salmon and prioritize recovery actions in the Sacramento Valley. We are coordinating these efforts with the National Marine Fisheries Service (NMFS) and its recovery plan and we look forward to coordinating with the Department.

- The State Water Resources Control Board and the Department have recently prepared reports describing flow criteria that would result in high reservoir releases to attempt to ameliorate problems in the Delta. If implemented as proposed, without considering the risk of drastically reducing reservoir levels in some years, cold-water storage may be depleted, resulting in devastating impacts on anadromous fish egg incubation at critical times. Additionally, improperly timed high flows could provide unfavorable conditions for mainstem rearing fish. Implementation of the flows described in the SWRCB and Department reports would have a high potential of largely undoing decades' progress in restoring conditions for salmonids in the Sacramento Valley. We previously provided comments to this report. Development of opportunities to reduce site-specific Delta stressors through non-flow measures is warranted and overdue.

We encourage you to carefully review and consider this report in further refining your Conservation Strategy and also consider the detailed comments to the August draft that are enclosed.

### **Pacific Flyway**

With respect to the Pacific Flyway, we encourage you to review the Central Valley Joint Venture's 2006 Implementation Plan ([www.centralvalleyjointventure.org](http://www.centralvalleyjointventure.org)), which describes the important efforts and partnerships that will be necessary for the Pacific Flyway.

The 2006 Implementation Plan is a comprehensive analysis of the status and habitat needs of waterfowl, shorebirds, waterbirds and riparian songbirds. This detailed analysis distinguishes between the different needs of wintering and breeding populations for the different bird species. The Implementation Plan also links plan objectives with the continental-level goals contained in the *2004 North American Bird Conservation Initiative Strategic Guidance* document.

According to the 2006 Implementation Plan, it "relies on both quantitative and qualitative approaches for establishing bird-group conservation objectives. Where possible, the Implementation Plan seeks a direct relationship between bird population objectives and habitat needs when establishing bird-group conservation objectives, because it allows these objectives to be expressed quantitatively (e.g., acres)."

These goals include water supply needs for the different basins located in the Central Valley, as well as conservation objectives for the six bird groups identified in the Implementation Plan (wintering waterfowl, breeding waterfowl, wintering shorebirds, breeding shorebirds, waterbirds, and riparian songbirds). These conservation objectives are also integrated in the plan to provide overall acreage and water supply objectives for seasonal wetland restoration, seasonal wetland enhancement, semi-permanent wetland restoration, riparian restoration, winter flooded rice, waterfowl-friendly agriculture, and agricultural easements (2006 Implementation Plan, pp. 239-252).

We encourage the Department to utilize the *2006 Implementation Plan* as a guidance document for establishing programs and actions that will enhance bird habitat in the Delta and the entire Central Valley. The Implementation Plan also identifies the habitat values and objectives that could be jeopardized if flow objectives or other Delta-specific plans are implemented.

## Update State Policies

As the Department revises its Conservation Strategy, we also encourage you to look at the need to update the state's general policies to assist you in this regard. This includes the state's salmon policies (Fish and Game Code §§6900 *et seq.* and 2760 *et seq.*), which simply do not provide relevant guidance for resources managers today. Similarly, the state lacks policies that provide the necessary attention to the Pacific Flyway as a resource of world-wide significance. We have raised these issues in our August 19, 2011 comments to the Strategic Vision process and urge you to consider legislative options we believe are necessary for sustainable anadromous fish and the Pacific Flyway.

We appreciate the opportunity to work with the Department in your Conservation Strategy. We will schedule a time to meet with you to further to discuss the analysis and recommendations set forth in our comments. If you have any questions, please call me.

Sincerely,

A handwritten signature in black ink, appearing to read "David J. Guy", written in a cursive style.

David J. Guy  
President

Enclosures

cc: John Laird  
Gerald R. Meral, Ph.D  
Chuck Bonham  
Mark Cowin  
Joe Grindstaff  
Kevin Hunting  
Carl Wilcox

## **Comments on the July 2011 Draft Conservation Strategy for Restoration of the Sacramento – San Joaquin Delta Ecological Management Zone and the Sacramento and San Joaquin Valley Regions**

The Draft Conservation Strategy states in the Foreword:

“This Conservation Strategy describes Stage 2 restoration of the Sacramento-San Joaquin Delta Ecological Management Zone (EMZ) and the Sacramento Valley and San Joaquin Valley Regions<sup>1</sup> (CALFED 2000h). It responds to analysis of Stage 1 research, restoration, and monitoring activities that determined the CALFED through-Delta conveyance alternative has not achieved sufficient progress in sustaining viable populations of endangered and threatened aquatic species. Findings of Stage 1 ERP implementation are presented in this document only to the extent they inform scientific understanding of the system since the certification of the ROD in 2000.”

However, the document does not adequately describe restoration measures implemented to date and why there has not been sufficient progress achieved in restoring and sustaining endangered and threatened aquatic species. For those relevant restoration measures described, the document often provides a “one-sided” discussion. Also, the document is highly repetitive, fragmented and, in some instances, is contradictory on topics which significantly distracts the reader from the Draft Strategy’s most salient points. The following provides further details on these conclusions.

The Draft Restoration Strategy has largely overlooked or given little attention to the enormous, unprecedented restoration measures amounting to more than \$1 billion that have been implemented in the Sacramento River basin. Despite these efforts, significant upward trends in fish populations have not been realized. Given the importance, the document should focus on this critically important problem.

Portions of the document should be reorganized. For example, in each section, discussions about the species should precede discussions about the species habitats and stressors. Much of the Draft Conservation Strategy has simply repeated extensive verbiage from the 2000 Ecosystem Restoration Program Plan (ERPP). This is not necessary. The relevant points from the 2000 ERPP should be incorporated by reference without the voluminous “cut and paste”. In places, the document repeats entire discussions on topics which are distracting and not needed. For example, on pages 117 ó 118, the Red Bluff Diversion Dam is discussed, but then on page 142, and again on pages 274 ó 275 the same verbiage is repeated. A discussion of fish screens is provided on pages 142 ó 143 and the same is repeated on pages 275 ó 276. The Fish Passage Improvement Program is discussed on page 143 then recurs on page 203. Numerous other examples exist. Also, nearly identical discussions are provided under the topics (e.g., species) in each geographic region which is not necessary and only adds redundant wording to the document. Additionally, Appendix C simply repeats the same information provided in the main body of the document. An editor should review the document and eliminate all repetitive discussions.

It is important that the Draft Conservation Strategy provide scientifically balanced discussions. For example, Clear Creek is frequently discussed (with highly repetitive wording) as a purported successful restoration project (pages 99 ó 100, pages 116 ó 117, page 128, pages 146 ó 149, pages 278 ó 280). However the topic is one-sided, largely describing the achievement but not reporting the contrary findings such as a recent peer review panel on the CVPIA restoration which included Clear Creek:

“CVPIA implementation in Clear Creek has turned into an experimental effort to create and sustain spring-run chinook habitat on an unusual stream and topography template. The agencies are engaged in a largely unprecedented experiment with little or no scientific merit to create and sustain a short stretch of spring-run chinook spawning habitat below 1000 feet of elevation, largely through the use of cool water releases from Whiskeytown Dam and other habitat manipulations, especially gravel additions.”

“Clear Creek does not appear to have been a big producer of fall-run chinook in historical terms. Population information indicates that the 7,000 fall-run chinook target may in fact be in the range of the creek’s historical fall-run chinook production capacity in the lower stretches of the creek.”

“The recent 12,000 average adult count may be well *above* Clear Creek fall-run chinook spawning and rearing capacity, as further indicated by the fact that the data shows that Clear Creek fall-run chinook *juvenile* production and productivity has not risen to match the increased adult counts and has been declining since 2000. One hypothesis is that natural production of fall-run chinook is not rising in Clear Creek, but instead that *hatchery origin* adult fall-run chinook are showing up in Clear Creek counts, attracted by cool water releases. These fish may not necessarily be contributing to Clear Creek fall-run chinook spawning. Sustaining any of the fall-run chinook increase is questionable, as adult fall-run chinook numbers declined again sharply in the last two years, down to an estimated 5,000 in 2007.” (Cummins et al. 2008)

Although removal of Saeltzer Dam on Clear Creek has provided spring-run Chinook access to cold-water upstream reaches, for unknown reasons, the fish do not necessarily migrate far enough upstream early in the season to avoid undesirable later-season temperature problems. The latter issue may be caused by interbreeding between spring-run and fall-run due to a lack of sufficient spatiotemporal separation in the runs (Vogel 2011). It is noteworthy that the Department of Fish and Game believes the stock purity of spring-run Chinook is questionable (DFG 1996).

Some discussions in the document are contradictory. For example, the document states: “In particular, upstream sediments are needed to maintain and restore Delta intertidal and subtidal habitats”, but also has an objective to reduce fine sediment loadings. The document states that the benefits of increasing deep water habitats in the Delta have not been established. However, the Draft Conservation Strategy has conflicting statements on the potential benefits of creating

more deep water habitats and yet discusses the detriments of deep water habitats. These conflicting discussions should be reconciled.

The reference to a rise in sea level of approximately 55 inches over the next 50-100 years attributed to Cayan et al. (2009) is not an accurate depiction of the authors' findings. A rise of 55 inches is derived from the most extreme prediction for 100, not 50, years. The authors predict by 2050, sea level rise relative to the 2000 mark ranges from 11.8 to 17.7 inches (Cayan et al. 2009).

The document gives considerable attention to the topic of mimicking natural flow patterns to cue and facilitate upstream and downstream migration of fishes. However, the document implies that the Sacramento River basin lacks those flow patterns. To the contrary, the magnitude and timing of Sacramento River flows very frequently provide those environmental cues.

There are several instances in the document where it is suggested that increased salinity in the Delta may be beneficial. Given the present-day freshwater conveyance through the Delta and in-Delta uses of freshwater, how realistic is that measure? The document should avoid discussions on topics that have no practicality.

Despite discussions in the document relating the Draft Conservation Strategy to other planning efforts, it appears there remain major overlaps, redundancies, and conflicts between the various state and federal programs. The document needs to provide a clearer description of this issue. For example, the Draft Conservation Strategy emphasizes the importance of coordination between programs. However, on page 138 it admits that coordination has been lacking, but will seek to develop a structure for regional implementation and effectiveness monitoring without describing how.

The Sacramento Valley restoration priorities described are fragmented and incomplete. For instance, why is Chinook salmon identified as a priority (page 143), but not other listed species (e.g., steelhead and green sturgeon)? Why is Deer Creek identified as a priority (page 148) but not Mill Creek? The Draft Conservation Strategy's list of Sacramento River basin restoration priorities is surprisingly short compared to the large number provided in the CVPIA Anadromous Fish Restoration Program (AFRP) and the NMFS Recovery Plan. Why?

The document frequently refers to the Bear River as a high priority watershed for restoration. However, the CVPIA AFRP website reveals that no AFRP projects have been implemented in the Bear River. Conversations with AFRP staff have indicated that the Bear River is actually a low-priority river for restoration activities. The Bear River is hostile to anadromous fish spawning and incubation because of silted riverbed substrates, high water temperatures, and unsuitable rearing habitats due to river channels formed by very high and frequent winter-time flows (SWRCB 2000). Clark (1929) reported that the Bear River "has never been known to be a salmon stream as only occasional salmon have been observed there."

The document frequently cites the flooding of Liberty Island as an example of a successful restoration project in the Delta. However, there have been undesirable impacts caused by such levee breaches which should be reported in the document:

There have likely been significant adverse, unintended consequences of breaching levees in the Delta. There is a high probability that site-specific conditions at the breaches have resulted in hazards for juvenile anadromous fish through the creation of favorable predator habitats. The breaches have changed the tidal prisms in the Delta and can change the degree in which juvenile fish are advected back and forth with the tides. Additionally, many of the breaches were narrow which have created deep scour holes favoring predatory fish. Sport anglers are often seen fishing at these sites during flood or ebb tides. Breaching the levees at Liberty Island is an example. Recent acoustic-tagging of striped bass in this vicinity confirmed a high presence of striped bass. (Vogel 2011)

The document frequently discusses the need to focus restoration efforts in the Delta by creating habitats for native fish species while simultaneously avoiding habitats dominated by undesirable species. Despite all the funds expended on projects and research on Delta restoration, the document provides no practical guidance on how this can be accomplished. In fact, recent research has indicated some projects have done the opposite and achieving that objective will be difficult. For example, fish sampling of the habitats created by flooding Prospect Island indicated that the expected benefits may not have been realized due to an apparent dominance of non-native fish (Christophel *et al.* 1999). Studies of the shallow water habitats at flooded Delta islands showed that striped bass and largemouth bass represented 88 percent of the individuals among 20 fish species sampled (Nobriga *et al.* 2003). Given the importance of this issue, it would indicate that the Draft Conservation Strategy should address this serious problem.

The Draft Conservation Strategy describes the undesirable impacts of non-native species on native fishes. Given this fact, why is maintaining fisheries for striped bass and non-native warm water game fishes an objective of the Strategy (page 265)?

The vast majority of Targets for the ERP Performance Measures are listed as to be determined. This suggests that the Draft Restoration Strategy document is premature. How can there be a strategy if the targets for restoration are unknown?

A recent report (Vogel 2011) provides the following recommendations of additional highly relevant actions for native anadromous fish restoration; some are identified in the Draft Conservation Strategy. However, many of these actions are not identified in the Draft Conservation Strategy and should be included:

### **Adult Fish Upstream Migration**

- Research on the potentially serious problem with fish passage barriers in the Delta should be conducted or continued and, where warranted, remedial actions should be implemented as soon as possible to assist in restoring depressed fish populations. In each instance, engineering solutions or operational measures to correct the problem are likely to be feasible. For example, short-duration pulses of relatively low-volume, but high-velocity flows can attract fish into bypasses. Elimination of these migration barriers through the installation of fish passage facilities or operational measures presents a

significant restoration opportunity. (Fremont Weir: High Priority Action; Other Barriers: Medium Priority Study)

- There still remain additional opportunities to improve conditions for upstream migrating fish in some tributaries, particularly for spring-run Chinook. For example, sufficient spring flows in Mill and Deer creeks could be improved (particularly during drought years) to ensure unimpeded access and the migration of late-arriving fish to upstream holding and spawning areas. (High Priority Action)
- Some new fishways to provide access for spring-run Chinook to upper reaches of Big Chico Creek have yet to be constructed and should be implemented as soon as feasible. (High Priority Action)
- All existing fishways on important anadromous fish tributaries should be continually maintained and periodically examined to ensure conditions are optimal for fish passage. (High Priority Action)
- Government agencies should continue to work cooperatively with watershed groups in Butte, Mill, Deer, and Big Chico creeks (and other watershed organizations) to protect adult spring-run migrating up through lower reaches of those streams where the fish are highly vulnerable to illegal harvest. (Medium Priority Action)
- Because Butte, Mill, and Deer creeks likely possess the only true remaining wild spring-run in the entire Central Valley, both State and federal law enforcement presence in the watersheds should be maintained or increased as a deterrent for illegal harvest. Low-cost, digital infrared motion-detecting cameras could be installed at locations where adult fish are highly vulnerable to illegal harvest or human disturbance. (High Priority Action)
- There remain some flow and temperature problems in some small tributaries, particularly for spring-run Chinook, that should be closely examined to determine appropriate remedial measures to ensure the runs are protected. (High Priority Study)

### **Adult Fish Holding Habitat**

- The relatively few and small holding areas where over-summering adult spring-run Chinook are exposed and highly vulnerable to human recreational activities in the summer months should be better protected. (High Priority Action)
- Greater scrutiny of snorkeling surveys in spring-run Chinook holding areas or development of alternative survey techniques should occur through the ESA 4(d) or Section 10 research provisions to minimize and perhaps eliminate that risk to the populations. (Medium Priority Action)
- Because spring-run Chinook prefer shade and cover during over-summering in small tributary pools, greater protection of riparian corridors in holding areas should be

provided. In some areas, such as in Butte Creek, adult spring run are highly exposed and could benefit from structural measures to provide shade and cover. (High Priority Action)

- Formal seasonal refuges at critical areas, akin to that historically provided for bald eagle nesting areas, should be provided to protect adult spring run and minimize human disturbance. (High Priority Action)
- Government agencies should continue to work cooperatively with watershed groups in Butte, Mill, Deer, and Big Chico creeks and other streams (*e.g.*, Battle Creek, Clear Creek) to protect adult spring-run and other species holding in the upper reaches of those streams where the fish are highly vulnerable to illegal harvest and human disturbance. (Medium Priority Action)
- Because Butte, Mill, and Deer creeks likely possess the only true remaining wild spring-run in the entire Central Valley, both State and federal law enforcement presence in the watersheds should be maintained or increased as a deterrent for illegal harvest. Low-cost, digital infrared motion-detecting cameras could be installed at holding locations where adult fish are highly vulnerable to illegal harvest or human disturbance. (High Priority Action)

### **Spawning and Incubation**

- Because of the biological importance and high probability of success, spawning gravel introductions should continue and be significantly expanded downstream of all major dams. (High Priority Action)
- Gravel extraction on some tributaries should be closely examined to ensure adverse impacts to anadromous fish are not occurring. (Medium Priority Study)
- Detailed data on spawning habitat quantity and quality in many tributaries are limited, but because of their importance, those habitats should be examined to determine potential restoration measures; such studies are easy to conduct and relatively low in cost. Gravel replenishment projects in important spawning areas lacking sufficient natural gravel recruitment would undoubtedly benefit anadromous fish. (Medium Priority Study)
- Proposed plans to extract spring-run Chinook fertilized eggs from Mill or Deer Creek should be held in abeyance until the populations recover from currently depressed levels. Butte Creek would be a more-appropriate egg source for a donor stock to be used elsewhere. (High Priority Action)
- Detailed modeling studies should be conducted of the effects of the high flow regimes contemplated by SWRCB (2010) to determine impacts to water supplies and the thermal regime as those factors affect anadromous fish spawning and incubation. (High Priority Study)

## **Fry and Juvenile Rearing**

- Instream studies should be conducted to determine the quantity and quality of favorable rearing habitats. (High Priority Study)
- Projects to replenish coarse substrates (*i.e.*, gravels, boulders) and woody debris in the upper portion of the mainstem river in key locations should be implemented because of the high probability of improving and expanding mainstem rearing habitats. (High Priority Action)
- Pilot projects to create new rearing habitats should be conducted, and if found feasible, be expanded in reaches immediately downstream of dams. (High Priority Study)
- Modeling studies should be conducted of the impact of the high flow regimes contemplated by SWRCB (2010) to determine impacts to water supplies, the thermal regime, and the physical attributes of rearing habitats as those factors affect anadromous fish fry and juvenile rearing. (High Priority Study)
- Attempts to create anadromous fish rearing habitats in the lower Sacramento River through placement of woody debris structures and other measures should be closely scrutinized to determine if those efforts are inadvertently creating favorable predatory fish habitats at the expense of anadromous fish. (Medium Priority Study)

## **Fry and Juvenile Outmigration**

- Instream studies of potential predation problems immediately downstream of Daguerre Point Dam on the Yuba River and ACID dam on the Sacramento River should be conducted; if necessary, remedial actions should be developed and implemented. The issue may be particularly important at the ACID dam because of the high concentration of winter-run fry in the vicinity during the period the diversion is in operation. (High Priority Study)
- A variety of solutions to the periodic reverse flow condition at Verona Dam have been contemplated and measures to correct this potentially serious problem should be implemented. (High Priority Action)
- New study approaches in the Delta should be designed and implemented to determine exactly where mortality is occurring in the Delta and how to ultimately fix the problems. (High Priority Study)
- Potential solutions to avoid predation at breached levees should be developed and implemented. For example, feathering back these levees over a much wider area instead of keeping the narrow channels would reduce high water velocities, reduce scour hole formation, and reduce predation opportunities as tides flood and ebb. (High Priority Study)

- Significant efforts should be implemented to re-create shallow-water rearing habitats for anadromous fish in the Delta. However, those restoration sites should be designed to minimize predation. (High Priority Action)
- Studies should be conducted of the channel geometry at key locations in the Delta where predatory fish are concentrated and remedial actions, where warranted, should be developed and implemented to reduce predation losses of anadromous fish. (High Priority Study)
- An aggressive predator removal program at Clifton Court Forebay and Tracy Fish Facilities should be designed and implemented. The removal should be either lethal or relocation to waters not connected to the Delta. (High Priority Action)
- The technology is available to determine the presence of predatory fish and survival of juvenile anadromous fish moving with the flow under in-Delta structures (e.g., telemetry, sonar camera). Depending on site-specific findings, measures to reduce predatory fish habitats or localized predatory fish control measures could be implemented. (High Priority Study)
- Plans for future structures, including habitat restoration projects, contemplated in the Delta should recognize and avoid the potential hazards for anadromous fish. (High Priority Action)
- Detailed modeling studies should be conducted of the impact of the high flow regimes contemplated by SWRCB (2010) for fish outmigration to determine impacts to water supplies and the thermal regime. (High Priority Study)

### References

- California Department of Fish and Game. 1996. Status of actions to restore Central Valley spring-run Chinook salmon. A special report to the Fish and Game Commission. Inland Fisheries Division. February 1, 1996. 56 p.
- Cayan, D., M. Tyree, M. Dettinger, H. Hidalgo, T. Das, E. Maurer, P. Bromirski, N. Graham, R. Flick. 2009. Climate change scenarios and sea level rise estimates for the California 2009 Climate Change Scenarios Assessment. California Energy Commission. CEC-500-2009-014-F.
- Christophel, D., G. Lawley, and L. Winternitz. 1999. Prospect Island fish sampling results ó some thoughts on shallow water habitat restoration. Interagency Ecological Program for the Sacramento-San Joaquin Estuary Newsletter 12(1). Winter 1999.
- Clark, G.H. 1929. Sacramento-San Joaquin salmon (*Oncorhynchus tshawytscha*) fishery of California. Calif. Fish Game Bull. 17:73.

Cummins, K., C. Furey, A. Giorgi, S. Lindley, J. Nestler, and J. Shurts. 2008. Listen to the river: an independent review of the CVPIA Fisheries Program. Prepared for the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service. December 2008. 51 p. plus appendices.

Nobriga, M., M. Chotkowski, and R. Baxter. 2003. Baby steps toward a conceptual model of predation in the Delta: preliminary results from the shallow water habitat predator-prey dynamics study. Interagency Ecological Program for the San Francisco Estuary Newsletter 16(1). Fall 2002/Winter 2003.

State Water Resources Control Board. 2000. Order WR 2000-10 in the Matter of Implementation of Water Quality Objectives for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; A Petition to Change Place of Use, Point of Diversion, and Purpose of Use of Water Right Licenses 11120 and 11118 of South Sutter Water District. July 20, 2000.

State Water Resources Control Board. 2010. Development of flow criteria for the Sacramento ó San Joaquin Delta ecosystem. Prepared pursuant to the Sacramento ó San Joaquin Delta Reform Act of 2009. August 3, 2010. 178 p.

Vogel, D.A. 2011. Insights into the problems, progress, and potential solutions for Sacramento River basin native anadromous fish restoration. Prepared for the Northern California Water Association and the Sacramento Valley Water Users. Natural Resource Scientists, Inc. April 2011. 154 p.