Coalition for a Sustainable Delta

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Dear Mr. Dibble:

The Coalition for a Sustainable Delta (Coalition) is writing in response to the Department of Fish and Game's (DFG) request for comments on the draft *Ecosystem Restoration Program Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta Ecological Management Zone and the Sacramento and San Joaquin Valley Regions* (Conservation Strategy). The Coalition is a California nonprofit corporation comprised of agricultural, municipal, and industrial water users, as wells as individuals in the San Joaquin Valley. The Coalition and its members depend on water from the Sacramento-San Joaquin Delta for their continued livelihood. Individual Coalition members frequently use the Delta for environmental, aesthetic and recreational purposes; thus, the economic and non-economic interests of the Coalition and its members are dependent on a healthy and sustainable Delta ecosystem. The Coalition urges you to consider these comments before issuing a final Conservation Strategy.

I. Introduction

DFG explains at the outset of the draft Conservation Strategy that it is intended to serve three purposes: (1) identify biologically promising ecosystem restoration opportunities in the Delta and Sacramento Valley and San Joaquin Valley regions, (2) provide rationale for restoration actions in each region, and (3) provide a conceptual framework and process that "will guide the refinement, evaluation, prioritization, implementation, monitoring, and review of the CALFED Ecosystem Restoration Program (ERP) actions." (Conservation Strategy, p. 1.) In order to realize these purposes, DFG must conduct a comprehensive review and critical assessment of the relevant data, analyses, and findings on the factors affecting Delta ecosystems and their native species and incorporate those data, analyses, and findings into the Conservation Strategy. Unfortunately, DFG has failed to do so. As currently drafted, the Conservation Strategy does not include certain readily available relevant data, analyses, and findings and misinterprets other relevant data, analyses, and findings. For this reason it cannot serve as a meaningful framework for future ERP actions.

A key shortcoming of the Conservation Strategy is its failure to consider all the relevant and available data and pertinent studies regarding factors affecting the Delta's ecological communities and at-risk species. For example, the Conservation Strategy does not consider the National Research Council's Report, *A Scientific Assessment of Alternatives for Reducing Water Management Effects on Threatened and Endangered Fishes in California's Bay Delta* (NRC Report), which addresses the biological opinions issued by the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) regarding the operation of the

State Water Project (SWP) and Central Valley Project (CVP). A second key shortcoming stems from DFG's failure to critically assess standing data, analyses, and findings, which can lead to misinterpretation of such scientific information, and compromise the scientific integrity of the Conservation Strategy. For example, in the discussion regarding the putative relationship between the location of X2 in the estuary and the size and trajectory of the population(s) of delta smelt, the Conservation Strategy cites to Feyrer et al. (2007), but does not discuss the shortcomings of this analysis including those described in the above-mentioned NRC Report. Moreover, the Conservation Strategy does not provide a comprehensive analysis of the factors that are affecting the Delta ecosystem and native species. One glaring omission is any discussion of predation and its effect on native species.

This comment letter examines three essential and representative areas in which the Conservation Strategy has not presented a complete analysis and/or excluded key information: (1) the use of X2 as a management metric and surrogate for the habitats of delta smelt and other native species in the Delta, (2) the effect of water diversions on delta smelt and salmonids, and (3) the effect of predation on native species. Due to time and resource constraints, this letter does not represent a comprehensive evaluation of all of the shortcomings of the current draft Conservation Strategy. Rather, it focuses on several key issues that must be addressed if the Conservation Strategy is to succeed in meeting its objectives.

II. The Conservation Strategy Wrongly Concludes that X2 is an Appropriate Metric for Habitat

The Conservation Strategy's discussion of at-risk fishes and the low-salinity zone in the estuary opens with the statement that "[p]elagic habitat quality in the estuary can be characterized by changes in X2. The abundance of numerous species increases in years of high outflow, when X2 is pushed seaward." (Conservation Strategy, p. 18.) The Conservation Strategy briefly summaries six studies that consider the location of X2 in the estuary and fish responses, and concludes that the data and findings "continue to support the conclusion that X2 location (i.e., outflow) is an important metric for the habitat (i.e., for recruitment success) of *several* native estuarine species." (Conservation Strategy, p. 20.) This is unequivocally incorrect. Notably absent from the discussion of X2 are several recent studies that disavow the use of the location of X2 as a responsive metric or valid surrogate for habitat for delta smelt and that show no deterministic relationship between X2 and the abundance of delta smelt.

Furthermore, DFG has misinterpreted the analyses and findings included in available studies. By doing so, it is repeating an error made by the State Board in its Final Report on the Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem. The authors of that report posit that an increase in outflow indexed by the location of X2 benefits longfin smelt and other species. But as Kimmerer et al. (2009) acknowledge "the mechanism chiefly responsible for the X2 relationship for longfin smelt remains unknown." In other words, the mechanism that is driving the correlation seen in the data is not understood. It is possible that longfin smelt abundance is related to floodplain productivity availability rather than outflow, but outflow is masking this relationship. Further critical review of the existing data and analyses is required before making management decisions in the form of the Conservation Strategy.

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A. X2 is Not Habitat a Suitable Habitat Indicator for Delta Smelt

While the Conservation Strategy concludes that X2 is an important metric for the habitat of "several" native species, in truth, only one study, Kimmerer (2009), found the position of X2 in the estuary to determine fish abundance, and that finding applies to just two of eight fish species associated with the low-salinity zone in the Delta during the spring and summer. For delta smelt, X2 is not a valid indicator that can be used to assess the status of delta smelt habitat or predict the direction or magnitude of population size changes. In order for X2 to be a valid surrogate measure for delta smelt habitat, the location of X2 in the Delta must closely match the distribution of delta smelt and the resources upon which the species depends for its survival, but this match is poor. Large portions of the lens of X2 in the Delta are unoccupied by delta smelt much of the time, presumably for reasons related to delta smelt behavior, but also because the X2 salinity condition overlays areas that are otherwise not suitable for delta smelt due to other environmental factors, such as insufficient food, an excess of predators, and suboptimal turbidity conditions. More importantly, delta smelt are frequently found well beyond the boundaries of X2 in the Delta, in areas with salinity conditions both greater and lesser than X2. Delta smelt have been recorded from freshwater areas to estuary areas with salinities of 16 ppt and more. They do not ascend particularly far up the tributaries that feed the estuary, and they rarely occur in the adjacent bay. There is no evidence to indicate that delta smelt are limited by the availability of habitat, and DFG's trawl surveys together with other available data indicate that the majority of delta smelt reside in areas of low salinity and freshwater relatively far from the location of X2 in the estuary.

Furthermore, habitat is the geographic area that supports the physical (abiotic) and biological (biotic) resources upon which a species depends for its survival and recovery. The habitat of a species includes not just the geographic areas it occupies, but also all the natural resources it uses, and the conditional state of those resources. For delta smelt, habitat quality depends on numerous factors, such as the variability in availability of food, shelter from predators, substrates for spawning, and a large number of physical variables including salinity, turbidity, and temperature. The use of X2 as a metric to represent the distribution and quality of delta smelt habitat serves to exclude numerous resources necessary for delta smelt survival; it is not valid and will misdirect conservation efforts that target the fish and other desirable co-occurring species.

B. Feyrer (2007) Contains Numerous Flaws

As support for its conclusion regarding use of the location of X2 as a proxy of habitat of numerous, distinct pelagic species, one of the studies that DFG relies on in the Conservation Strategy is Feyrer et al. (2007). However, the Conservation Strategy does not present an accurate and comprehensive discussion of the study and does not include the other studies that Feyrer and his colleagues have conducted that address the relationship between the location of X2 and delta smelt distribution and abundance. Feyrer et al. (2007) asserted that a relationship between "fall stock abundance" of delta smelt and "water quality" exists and contributes to the decline in the species, and as such can be used to predict delta smelt abundance.

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Feyrer et al. (2007) presented a weak correlation between the presence and absence of smelt at select fall mid-water trawl (FMWT) sampling stations and the levels of three environmental variables—specific conductance (salinity), secchi depth (turbidity), and temperature—which were termed environmental quality, or EQ, variables. Feyrer et al. (2007) found that these variables together explain roughly 26% of the variation in delta smelt presence/absence data. Feyrer et al. (2008) vastly expanded this analysis. First, it used EQ to *define* smelt abiotic habitat, despite the fact that Feyrer et al. (2007) showed that EQ only weakly predicted smelt presence/absence. Then it used habitat modeling based on probabilities of presence/absence to generate "a measure of surface area (ha) of suitable habitat" for delta smelt. Finally, it used X2 to predict the exact extent of "suitable abiotic habitat" down to the hectare.

The second and most important step in the analysis in Feyrer et al. (2008) of the effect of X2 on smelt habitat was defining a total "area of suitable abiotic habitat." This area was defined using a subset of core sampling sites of the FMWT, thereby ignoring large areas of delta smelt habitat that are known to be occupied. Feyrer et al. (2008) also excluded a full third of the core sample sites of the FMWT because they were on the periphery of the sampling grid. Excluding these sample sites was a serious omission because those very locations are necessary to test whether the EQ factors are important determinants of delta smelt presence or absence, and hence whether they can be considered indicators of its habitat. Excluding these sampling sites likely illegitimately amplified the statistical correlation that the authors claim exists between the EQ factors and delta smelt presence/absence.

Finally, the fact that the analysis excluded large areas of known smelt habitat had another important consequence: it meant that the estimations of a decline of available habitat were arbitrary, misleading, and undoubtedly incorrect. For example, Feyrer et al. (2011) developed a "habitat index" based on the amount of "suitable abiotic habitat" available for the smelt. Feyrer et al. (2011) claimed that the modeling showed that over the course of the FMWT monitoring history "the habitat index has declined by 78%." However, as discussed above, the habitat index was based on an arbitrarily small segment of the actual available smelt habitat.

The analyses in each step of the process used in Feyrer et al. (2007), Feyrer et al. (2008), and Feyrer et al. (2011) contained substantial uncertainty, and yet those studies simply assume that the results derived of each modeling exercise can be rolled into the next, as if there were no attending uncertainties in the results of each. These assumptions violate basic tenets of statistics, which require the rigorous examination of all possible sources of error in the analysis. The NRC criticized this process stating "the examination of uncertainty in the derivation of the details of this action lacks rigor. . . . The relationships are correlative with substantial variance being left unexplained at each step." (NRC Report, p. 54.) The NRC Report concluded that there is a weak statistical relationship between the location of X2 and the size of delta smelt populations, and while "the position of X2 is correlated with the distribution of salinity and turbidity regimes the relationship of that distribution and smelt abundance indices is unclear." (NRC Report, p. 5.)

Moreover, Feyrer's investigation is limited to the effects of the location of X2 in the estuary on just one life stage, instead of throughout the complete life cycle of the fish (as would occur with a life-cycle model), and therefore Feyrer's assertion that X2 is a valid surrogate for delta smelt habitat cannot reliably reflect the overall population-level effects of variation in the location of X2 in the fall on the fish. Proper analysis of the effect of an environmental variable

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on a species should include an analysis of its effects on the species' population dynamics. If an environmental variable has a causal relationship with the survival of a species, then the effect of that variable should be measurable in an analysis of one or more of the species' vital rates.
It appears that DFG accepted Feyrer et al. (2007) as the final word on the relationship without critically assessing that study and failed to consider subsequent criticism of the study as well as subsequent studies. The assertion in the Conservation Strategy that X2 is an essential determinant of the ecological suitability of the estuary for delta smelt and other desirable species is inconsistent with the best available scientific information.

C. Quantitative Life Cycle Models Demonstrate No Statistically Significant Relationship between the Location of X2 in the Fall and Delta Smelt Abundance

When considering the effect of the location of X2 on delta smelt population dynamics, it is not sufficient to simply consider where the smelt are located; one must also consider whether the location of X2 actually affects the abundance of smelt. A life cycle model is the best available method for determining the effect of an environmental variable on the population dynamics of a species because it allows scientists to determine to what degree changes in the level or condition of an environmental factor correlate with changes in the population growth rate, thereby allowing identification of the degree to which individual factors drive changes in the population. A life cycle model also captures the full effect of the factors throughout the full life cycle of the species. Therefore, using a life cycle model allows one to understand the effect of the location of X2 on the population of delta smelt from one generation to the next and considers the survival and reproduction of a species over time.

The value of using life cycle modeling has been recognized both by a federal court and by the NRC. In its decision in the litigation challenging the biological opinion for the delta smelt, the federal district court found that it was "undisputed that application of a quantitative life-cycle model is the preferred scientific methodology" for determining the effects of a stressor on the population of a species like the delta smelt, and that "life-cycle modeling is standard practice in the field of fisheries biology." (*Delta Smelt Consol. Cases v. Salazar,* 760 F. Supp. 2d 855, 885 (E.D. Cal. 2010).) In addition, the NRC recognized the importance of a life cycle model and recommended that "the development of such models be given a high priority within the agencies" because life-cycle models are uniquely capable of assessing "population level responses" in fish species such as the delta smelt: "Nonlinear and compensatory relationships between different life-history stages are common in many fish species. Moreover many life-history traits exhibit significant patterns of autocorrelation, such that changes in one life-history trait induce or cause related changes in others. These patterns can most effectively be understood through integrated analyses conducted in a modeling framework that represents the complete life-cycle." (NRC Report, p. 32.) The Conservation Strategy does not discuss three life-cycle models that have all concluded that there is no statistically significant relationship between the location of X2 in the fall and delta smelt abundance: Maunder and Deriso (2011), MacNally et al. (2010), and Thomson et al. (2010).

Maunder and Deriso (2011) is a state-space multistage life-cycle model that analyzes delta smelt populations at every life stage using data from multiple seasonal surveys of delta smelt abundance. It is capable of utilizing an array of surveys, allowing for closely tailored

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testing of candidate environmental factors that may affect the survival and performance of each life stage. This model was structured so that it could test explicit hypotheses concerning the effects of individual environmental factors to determine if they were important in accounting for changes in the population growth rate. Maunder and Deriso (2011) demonstrated that the most critical factors impacting the delta smelt population dynamics are food availability, predator abundance, temperature, and density dependence. Maunder and Deriso (2011) concluded that the average location of X2 in the fall did not predict subsequent delta smelt abundance. MacNally et al. (2010) used a different statistical technique called multivariate autoregressive modeling to determine the effects of 54 different environmental covariates on delta smelt, and similar to Maunder and Deriso (2011), found that the average location of X2 in the fall was not an important cause of delta smelt population declines. Thomson et al. (2010) used Bayesian change point analysis to determine the effect of a number of covariates on delta smelt abundance. Thomson et al. (2010) concluded that while X2 and other abiotic variables explained some variation in the abundance of Delta fishes over the time species, no individual environmental covariates could explain the post-2000 changes in abundance for delta smelt, longfin smelt, striped bass, and threadfin shad. Each of these now-published life cycle models used different combinations of fish population index data, different environmental covariates and different modeling approaches, and all three came to the conclusion that, in contrast to the assertion in the Conservation Strategy, the location of X2 in the estuary in the fall does not have a statistically significant effect on delta smelt abundance.

III. The Conservation Strategy Fails to Consider Relevant Data Regarding the Effect of CVP and SWP Exports on Native Species

The ERP Plan's vision for water diversions is to reduce the adverse effects of water diversions, including entrainment, by in part, reducing the volume of water exported. (Conservation Strategy, p. 45.) The Conservation Strategy identifies the largest water diversions in the Delta as the CVP and SWP and that "[w]hile it remains very difficult to quantify the relative contribution of export operations on fish declines (Kimmerer and Nobriga 2008), there is a growing body of evidence that indicates water exports are having a significant contribution through a combination of entrainment as well habitat effects (USFWS 2008, NMFS 2009a)." (Conservation Strategy, p. 46.) Export operations, "may result in net reverse flows in Old and Middle Rivers." (Conservation Strategy, p. 46.) "Changes in hydrodynamics, notably reverse flows, have direct effects on fish . . . increasing their risk of entrainment." (Conservation Strategy, p. 46.) The Conservation Strategy then cites several studies that have purportedly concluded that the CVP and SWP contribute to fish declines for both delta smelt and salmonids.

With regard to delta smelt, the Conservation Strategy states that "[n]et reverse flow in Old and Middle rivers in winter months, a function of San Joaquin River flow into the Delta as well as SWP/CVP pumping rates and tides, is strongly correlated with entrainment of adult delta smelt." (Conservation Strategy, p. 47.) Furthermore, it asserts that analyses for delta smelt show that "pre-spawning adults, as well as larvae and early juveniles, may suffer substantial losses" and "delta smelt losses can be as high as 40 percent of the population throughout winter and spring. (Kimmerer 2008)" (Conservation Strategy, p. 47.) The Conservation Strategy relies heavily upon Kimmerer (2008), but fails to discuss the shortcomings of that study, which are documented in a response article, Miller (2011). Miller (2011) found that lower estimates are actually justified and that eight of the ten assumptions underlying the high estimates in

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Kimmerer (2008) resulted in upward bias. Using alternative assumptions, the highest annual estimates of adult proportional entrainment would have been no more than 13%, possibly even in the range of just 5% to 10%. The life cycle model used by Maunder and Deriso, discussed above, likewise indicated that entrainment is not an important factor in the survival of the species from one generation to the next. DFG failed to even cite – much less critically assess – these published analyses.

The Conservation Strategy also cites to the use of particle tracking model studies that have been used to demonstrate that reverse flows also result in high levels of delta smelt larval entrainment. A particle tracking model typically assumes that delta smelt are represented by neutrally buoyant planktonic particles. However, numerous scientists have acknowledged that the use of particle tracking model results to represent the movement of fish, including delta smelt, is countered by substantial evidence. (Anderson et al. 2010, Kimmerer and Nobriga 2008, Culberson et al. 2004, Bennett, Kimmerer, and Burau 2002, Kimmerer, Burau, and Bennett 2002.) Studies have acknowledged that the use of particle tracking models for late larval stage delta smelt is not appropriate "since delta smelt appear able to maintain their position in the estuary, generally in brackish water, beginning at the late larval stage." (Kimmerer and Nobriga 2008.) Even while the assumption that delta smelt movement patterns are represented by neutrally buoyant planktonic particles may be appropriate for the earliest stages of planktonic delta smelt larvae, it is recognized as not being representative of the movement and behavior of late larvae, juvenile, and adult lifestages. (Anderson et al. 2010.) As larvae grow and develop fins, swimming ability, and air bladders, they are able to maintain their position within favorable habitats rather than being randomly transported with water currents. (Culberson et al. 2004). Without such a mechanism to maintain their position within the estuary, delta smelt would be transported downstream into water with levels of salinity that are lethal for the species.
This misrepresentation of delta smelt ecology in the Conservation Strategy has substantial implications to water resource planning in the Delta.

With regard to salmonids, the Conservation Strategy discusses the use of export to inflow, or E/I ratio and the Kimmerer and Nobriga (2008) study that "evaluated E/I ratio as a predictor of entrainment probability for neutrally buoyant particles to represent larval fish using a two-dimensional model and associated particle tracking model developed by DWR." (Conservation Strategy, p. 48.) The Conservation Strategy recognized that "[t]he E/I ratio was found to be useful as a predictor of entrainment probability for organisms with limited mobility, although the model may be less applicable to more competent swimmers such as salmon smolts." (Conservation Strategy, p. 48.) Particle tracking models typically compile results over 30 to 90 days, which is inappropriate for juvenile salmonids because migrating juvenile salmon do not stay in one place long enough to be subjected to such gradual effects. Particle tracking models use a long period for integrating the fate of particles, which greatly exaggerates the perception of export impacts on juvenile salmonids. Juvenile steelhead are substantially larger than juvenile Chinook salmon on average when they begin their migration to the Pacific Ocean, but both species are effective swimmers at that stage in their life history.

The Conservation Strategy cites to the two biological opinions issued by FWS and NMFS to support the statement that "there is a growing body of evidence that indicates water exports are having a significant contribution [on fish declines] through a combination of entrainment as well as habitat effects." However, the Conservation Strategy omits the significant problems with the analyses in the biological opinions. First, the delta smelt biological opinion does not normalize salvage data, and the federal court found this failure was a failure to use the best available science: "FWS nowhere explains its decision in the BiOp to use gross salvage numbers . . . and does not explain why it selectively used normalized salvage data in some parts of the BiOp but not in others . . . . This was arbitrary, capricious, and represents a failure to utilize the best available science in light of universal recognition that salvage data must be normalized." (*Delta Smelt Consol. Cases*, 760 F. Supp. 2d at 890.) Second, the court also concluded that it was improper for FWS to compare data output from two different models to show the effect of the exports on delta smelt: "In light of the known and material resulting disparity, FWS's decision to use a Calsim II to Dayflow comparison to quantitatively justify its jeopardy and adverse modification conclusions, without attempting to calibrate the two models or otherwise address the bias created, was arbitrary and capricious and ignored the best available science showing that a bias was present." (*Delta Smelt Consol. Cases*, 760 F. Supp. 2d at 907.) The federal court issued a final judgment after it determined that the FWS biological opinion and reasonable and prudent alternative are unlawful. Remarkably, DFG did not even acknowledge the fact that the biological opinion upon which it relies to draw certain conclusions has been set aside as unlawful by a federal court. Nor did DFG address the substantive deficiencies in the biological opinion, which were identified by the court and its court-appointed scientific experts.

DFG also failed to acknowledge or discuss the litigation regarding the NMFS biological opinion. While a decision regarding cross motions for summary judgment is pending in the matter, the federal court did issue a preliminary injunction granting relief from certain elements of the biological opinion and reasonable and prudent alternative to plaintiffs. The court issued extensive findings of fact and conclusions of law that were the basis for the injunction. Among other things, the court concluded that: "Federal Defendants have acted arbitrarily and capriciously in formulating RPA Actions to protect threatened species under the ESA that lack factual and scientific justification, while effectively ignoring the irreparable harm those RPA Actions have inflicted on humans and the human environment," and "Injunctive relief is . . . warranted . . . because, although the general premises underlying Actions IV.2.1 and IV.2.3 [of the reasonable and prudent alternative] find marginal support in the record, the precise flow prescriptions imposed on coordinated project operations . . . are not supported by the best available science and are not explained as the law requires." (*Consol. Salmonid Cases*, 713 F. Supp. 2d 1116, 1171 (E.D. Cal. 2010).) DFG erred by failing to address the substantive issues raised by the court in the Conservation Strategy.

IV. The Conservation Strategy Does Not Include Any Discussion Regarding the Effects of Predation on Native Species in the Delta

Multiple studies have demonstrated that predation is a significant factor that substantially affects the distribution and abundance of native species in the Delta. NMFS has identified predation as a critical stressor on salmonid populations that utilize the Delta. Predation is not considered a principal driver of delta smelt population decline, yet it is a factor known to be suppressing the population and potentially impeding recovery. (IEP 2008.) Recent research suggests that Mississippi silverside predation on larval delta smelt in the estuary could also constitute a significant impact on the species. (IEP 2010.) Despite this data, the Conservation Strategy does not include any discussion regarding the well-know effects of predation on native species in the Delta.

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Predators of native species remain abundant in the Delta, with populations of certain predators tracking upward. The population of striped bass aged 3+ remains above 500,000 individuals (IEP 2010) and the population of striped bass ages 0 to 3 is in the millions. The largemouth bass population has increased dramatically in the Delta since the 1980s, with the catch more than quadrupling in most Delta regions. (Brown and Michniuk 2007.) The Mississippi silversides' abundance has recently increased to its highest level in the Delta ever. (IEP 2010.)

Striped bass predation in tributaries to the Delta appears to be the largest single cause of mortality of juvenile salmon migrating through the Delta. Studies have shown mortality of juvenile Chinook salmon and steelhead in the Sacramento River upstream of the Delta to be approximately 90% in recent years. (MacFarlane et al. 2008, NMFS 2009.) Acoustic tagging studies on the Delta portion of the San Joaquin River have found similarly high rates of predation mortality on Chinook salmon. (Holbrook, Perry, and Adams 2009.) Hanson (2009) analyzed available diet composition data and estimated that striped bass annually consume 21% of juvenile winter-run Chinook salmon production, 42% of juvenile spring-run Chinook salmon production, 7-15% of juvenile Central Valley steelhead production, and 13% of delta smelt production. Consistent with Lindley and Mohr (2003) and NMFS (2009), Hanson (2009) concluded that mortality resulting from striped bass predation is increasing the probability of salmonid extinction and also reducing the probability of species recovery.

NMFS has also identified the significant effect that predation has on salmonids and the action that is necessary to restore the ecosystem. The NMFS (2009) draft Recovery Plan for Central Valley salmon and steelhead concludes that: (1) predation on winter-run Chinook salmon is a "major stressor" with very high importance, (2) restoring the ecosystem for anadromous salmonids will require, among other actions, "significantly reducing the nonnative predatory fishes that inhabit the lower river reaches and Delta," and (3) reducing abundance of striped bass and other non-native predators must be achieved to "prevent extinction or to prevent the species from declining irreversibly." (NMFS 2009, pp. 42, 48, 90, 15, 183, 190.) Nobriga and Feyrer (2007) concluded that "striped bass likely remains the most significant predator of Chinook salmon (Lindley and Mohr 2003) and threatened delta smelt (Stevens 1966), due to its ubiquitous distribution in the estuary and its tendency to aggregate around water diversion structures where these fishes are frequently entrained (Brown et al. 1996)." The failure to consider data, analyses, and findings regarding predation, which is one of a small number of factors that causes direct mortality of species, renders the draft Conservation Strategy unreliable as a resource management tool.

V. Conclusion

The Coalition urges DFG to revise the Draft Conservation Strategy to use the data, analyses, and findings discussed above so that any actions based on the Conservation Strategy will be fully informed. Herein, we have provided just three examples that are representative of a pervasive shortcoming of the Conservation Strategy, namely, the agency's failure to include certain readily available relevant data, analyses, and findings and misinterprets other relevant data, analyses, and findings. DFG must address this issue in order to maintain credibility among stakeholders and to devise a plan that could provide desperately needed benefits for the Delta ecosystems and their native species.

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Thank you for considering the Coalition's comments.

Sincerely,

William D. Phillimore
Board Member

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References

Anderson, J.J., R.T. Kneib, S.A. Luthy, and P.E. Smith. 2010. Report of the 2010 Independent Review Panel (IRP) on the Reasonable and Prudent Alternative (RPA) Actions Affecting the Operations Criteria And Plan (OCAP) for State/Federal Water Operations.

Bennett, W. A., W.J. Kimmerer, and J.R. Burau. 2002. Plasticity in vertical migration by native and exotic fishes in a dynamic estuarine low-salinity zone. Limnol. Oceanogr 47:1496-1507.

Brown, L.R., and D. Michniuk. 2007. Littoral fish assemblages of the alien-dominated Sacramento-San Joaquin Delta, California, 1980-1983 and 2001-2003. Estuaries and Coasts 30:186-200.

Culberson, S.D., C.B. Harrison, C. Enright, and M.L. Nobriga. 2004. Sensitivity of larval fish transport to location, timing, and behavior using a particle tracking model in Suisan Marsh, California, American Fisheries Society Symposium 39:257-267.

Feyrer, F. M.L. Nobriga, T.R. Sommer. 2007. Multi-decadal trends for three declining fish species: habitat patterns and mechanisms in the San Francisco Estuary, California, USA. Canadian Journal of Fisheries and Aquatic Sciences 64:723-734.

Feyrer, F., K. Newman, M.L. Nobriga, T.R. Sommer. 2008. Modeling the effects of water management actions on suitable habitat and abundance of a critically imperiled estuarine fish (delta smelt *Hypomesus transpacificus*). Manuscript in preparation.

Feyrer, F., K. Newman, M.L. Nobriga, T.R. Sommer. 2011. Modeling the effects of future outflow on the abiotic habitat of an imperiled estuarine fish. Estuaries and Coasts 34:120-128.

Hanson, C.H. 2009. Striped Bass Predation on Listed Fish Within the Bay-Delta Estuary and Tributary Rivers, Expert Report, *Coalition for A Sustainable v. Koch*.

Holbrook, CM, R.W. Perry, and N.S. Adams. 2009. Distribution and joint fish-tag survival of juvenile chinook salmon migrating through the Sacramento San-Joaquin River Delta, California, 2008, U.S. Geological Survey Open File Report 2009-1204.

Interagency Ecological Program (IEP). 2008. Interagency Ecological Program 2008 Work Plan to Evaluate the Decline of Pelagic Species in the Upper San Francisco Estuary.

Interagency Ecological Program (IEP). 2010. 2010 Pelagic Organism Decline Work Plan and Synthesis of Results.

Kimmerer, W.J. 2008. Losses of Sacramento River Chinook Salmon and Delta Smelt to Entrainment in Water Diversions in the Sacramento-San Joaquin Delta, San Francisco Estuary and Watershed Science.

Kimmerer, W.J., J.R. Burau, and W.A. Bennett. 2002. Persistence of Tidally-oriented Vertical Migration by Zooplankton in a Temperate Estuary. Estuaries and Coasts 25:359-371.

Kimmerer, W.J. and M.L. Nobriga, 2008. Investigating Particle Transport and Fate in the Sacramento-San Joaquin Delta Using Particle Tracking Model, San Francisco Estuary and Watershed Science.

Lindley, S.T. and M.S. Mohr. 2003. Modeling the effect of striped bass (*Morone saxatilis*) on the population viability of Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*), Fishery Bulletin 101:321-331.

MacFarlane, B.R., A.P. Kimley, S.L. Lindley, A.J. Ammann, P.T. Sandstrom, C.J. Michel, and E.D. Chapman. 2008. Survival and migratory patterns of Central Valley juvenile salmonids: Progress report. NOAA Fisheries, Southwest Fisheries Center, Santa Cruz, California.

MacNally, R., J.R. Thomson, W.J. Kimmerer, F. Feyrer, K.B. Newman, A. Sih, W.M. Bennett, L. Brown, E. Fleishman, S.D. Culberson, and G. Castillo. 2010. Analysis of pelagic species decline in the upper San Francisco Estuary using multivariate autoregressive modeling (MAR), Ecological Applications, 20:1417-1430.

Maunder, M. and R. Deriso. 2011. A state-space multistage life cycle model to evaluate population impacts in the presence of density dependence: illustrated with application to delta smelt (hyposmesus transpacificus), Canadian Journal of Fisheries and Aquatic Sciences, 68:1285-1306.

Miller, W.J. 2011. Revisiting assumptions that underlie estimates of proportional entrainment of delta smelt by state and federal water diversions from the Sacramento-San Joaquin Delta, San Francisco Estuary and Watershed Science.

National Marine Fisheries Service. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead.

National Research Council. 2010. A Scientific Assessment of Alternatives for Reducing Water Management Effects on Threatened and Endangered Fishes in California's Bay Delta

Nobriga, M.L. and F. Feyrer. 2007. Shallow-Water Piscivore-Prey Dynamics in California's Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science.

Thomson, J.R., W. J. Kimmerer, L. R. Brown, K. B. Newman, R. Mac Nally, W. A. Bennett, F. Feyrer, E. Fleishman. 2010. Bayesian change-point analysis of abundance trends for pelagic fishes in the upper San Francisco Estuary. Ecological Applications, 20:1431-1448.