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April 25, 2011

Ms. Erin Foresman
U.S. Environmental Protection Agency
75 Hawthorne Street, WTR-3
San Francisco, CA 94105

Re: San Joaquin River Group Authority Comments on the Environmental Protection Agency's Advanced Notice of Proposed Rulemaking for Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary

Dear Ms. Foresman:

We reviewed the Advanced Notice of Proposed Rulemaking for Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (ANPR) published by the Environmental Protection Agency (EPA). The ANPR includes science and cites authority that are, in part, outdated and insufficient. Specifically, the ANPR section on Fish Migration Corridor contains science that is invalid and cites authorities that are unsupported.[1] We provide the following comments and supporting materials in order to assist the EPA in updating the science in the ANPR. We provide this information in hopes that the EPA can update and amend its scientific information, and with the caution that any rulemaking or regulatory action based on the current information, at least in the Fish Migration Corridor section, would not be defensible.

<u>Natural Flow Regime</u>

The ANPR cites the State Water Resources Control Board's Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives ("Draft Technical Report") as a document that endorses a "higher and more naturally variable inflow regime."[2] As the ANRP recognizes, the Draft Technical Report is a draft staff document not approved by the State Water Resources Control Board.[3] In its draft form, the Draft Technical Report is critically deficient and does not provide adequate scientific disclosure or evaluation. The conclusion that natural flows will benefit endangered species is particularly lacking sufficient support.[4] The Draft Technical Report cites four documents in support of its promotion of natural flow regime – none of which actually support the conclusion that natural flow will benefit listed species. First, the Draft Technical Report cites the California Department of Fish and Game document titled "Flows Needed in the Delta to Restore Anadromous Salmonid Passage from the San Joaquin River at Vernalis to Chipps Island." This document and its

[1] ANPR, at 57-60.
[2] *Id.*, at 60.
[3] *Id.*
[4] Draft Technical Report.

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conclusions regarding flow were affirmatively rejected in peer review. [5] The Draft Technical Report also cites the Anadromous Fish Restoration Program's Recommended Streamflow Schedules to Meet the AFRP Doubling Goal in the San Joaquin River Basin and The Bay Institute and Natural Resources Defense Council written testimony - both advocate flows based on oversimplified correlations and neither are peer reviewed.[6] Finally, the Draft Technical Report cites Baker and Morhardt 2001, which was peer reviewed. This report, however, does not support the conclusion that a natural flow regime is warranted, but states the relationship between flow and increased survival of fish species is "not well quantified."[7]

Not only unsupported, the Draft Technical Report's focus on returning to a natural flow regime is exceedingly over-simplistic and not scientifically defensible. The Delta has undergone a total transformation over the past 150 years. Nothing in the Delta is similar to what it once was – the geography has changed with reclamation and levees, the geomorphology has changed with channelization and flood control measures, turbidity has changed with altered sedimentation and dams, the foodweb has changed due to nutrient ratios, the fish communities have changed due to invasive species and predation, the quality of water has changed due to toxins and contaminants, the influence of the tides has changed due to levee infrastructure and climate change, and the floodplain and marsh habitat has changed due to development. The proposition that a natural flow regime will provide benefit in such an unnatural system is not supported. Science simply does not support the idea that changing one component while ignoring the other multitudes of change will restore the ecosystem or otherwise result in benefit to native species.

The geographical and geomorphological changes to Delta channels frustrate the proposal that the Delta can be restored by a natural flow regime. The Delta used to be a system of fairly shallow dendritic channels and sloughs (think intricate branching of a live oak).[8] This system offered a variable habitat and provided longer residence times for fish. Today, water moves through the Delta in large, deep, rip-rapped channels that loop (think water park slides).[9] This change in geomorphology results in less varied habitat, shorter residence time for fish, and, perhaps most importantly for this discussion, nullification of reasonably varied flows. Sending a variety of different flows down today's deep, hexagonal channels produces little, if any, benefit to habitat, temperature, turbidity, predation, or the food web. Not surprisingly, science does not support the idea that throwing increased flows or even "natural" flows down unnatural channels will improve fish survival and abundance.[10] In fact, the recent VAMP Peer Review concluded

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[5] Panel Review of the CA Department of Fish and Game's Quantifiable Biological Objectives and Flow Criteria for Aquatic and Terrestrial Species of Concern Dependent on the Delta.
[6] Draft Technical Report, at 52.
[7] Draft Technical Report, at 52; Baker, P.F., and J.E. Morhardt. 2001. Survival of Chinook salmon Smolts in the Sacramento-San Joaquin Delta and Pacific Ocean. Contributions to the Biology of Central Valley Salmonids, Fish Bulletin 179(2)163-182.
[8] "Review of Stressors on the Delta Ecosystem" Title of IEP Lead Scientist Talk to NRC 12/8/2010 Interagency Ecological Program 2010 Pelagic Organism Decline Work Plan and Synthesis of Results.
[9] Simenstad, C. A., and S. M. Bollens. 2003. Into the BREACH: Tidalmarsh restoration in the San Francisco Estuary. Coastal and Estuarine Research Federation Newsletter. Winter 2002/2003 issue.
[10] Jon Burau Presentation: Variable Delta A Hydrodynamic Perspective; Junk et al. 1989; Junk and Wantzen 2003; Effect of Increased Flow in the San Joaquin River on Stage, Velocity, and Water Fate, Water Years 1964 and 1988. Paulsen et al. 2008.

the opposite was true. The peer review team stated "simply meeting certain flow objectives" is "unlikely to achieve consistent rates of smolt survival through the Delta over time."[11] The team further explained, "the complexities of Delta hydraulics in a strongly tidal environment, and high and likely highly variable impacts of predation, appear to affect survival rates more than the river flow, by itself, and greatly complicate the assessment of effects of flow on survival rates of smolts."

Contaminant Discharges

The ANPR concludes that four factors may have been involved in the collapse of pelagic and salmonid fisheries; water project operations since 2001, invasive species, ocean conditions and contaminants. The ANPR describes the programs EPA has with regard to contaminants and concludes that in-Delta discharges, especially those from in-Delta agriculture, are unknown and could be significant.[12] EPA should be encouraged to utilize its resources to evaluate these and determine whether further action by EPA or the State is needed to control this significant threat to salmon survival. EPA has the programs to focus on these sources and should do so in cooperation with the State. If the existing Irrigated Lands Program of the State is insufficient, EPA should cause it to be supplemented to determine the extent of this contamination.

Dissolved Oxygen

The information on dissolved oxygen provided in the ANPR is outdated and insufficient. The ANPR states that since the "1970's blockage of adult salmonid migration due to low dissolved oxygen has received much scientific attention."[13] The ANPR does not provide science that explains the nature or extent to which dissolved oxygen impacts salmonids abundance or migration. In fact, dissolved oxygen conditions in the Deep Water Ship Channel have improved dramatically and there is no record of fish blockages due to low dissolved oxygen.

The ANPR's discussion on the Central Valley Regional Water Quality Control Board's total maximum daily load (TMDL) limit for dissolved oxygen levels is incomplete. The ANPR notes that the TMDL was issued in response to elevated levels of dissolved oxygen at the Stockton Deep Water Ship Channel on the lower San Joaquin River and on Old and Middle Rivers. However, the ANPR does not provide information about the monitoring and compliance, which have largely alleviated the dissolved oxygen impacts. Since the TMDL was implemented in 2001, a monitoring station was set up at Rough & Ready Island which monitors dissolved oxygen in the Ship Channel at 15-minute intervals. A recent report from the Department of Water Resources analyzed the collection methods and performance of Rough & Ready Island monitoring station and concluded the data was representative of dissolved oxygen conditions in

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[11] The Vernalis Adaptive Management Program (VAMP): Report of the 2010 Review Panel.
[12] ANPR, at 8.
[13] *Id*., at 59.

the Ship Channel.[14] This monitoring data is readily available at the California Data Information Exchange Center.

Since the TMDL was issued and monitoring has been in place, dissolved oxygen levels have increased and stabilized. When the aeration facility was planned for the Stockton Deep Water Ship Channel, it was assumed that the facility would need to be operated continuously during certain periods of the year but this has not been the case. The current drops in dissolved oxygen are minor compared to the 1970s and are easily corrected with the present aeration facility. Currently, the TMDL levels have been satisfied and dissolved oxygen levels are in full compliance with the TMDL. These improvements are due, in large part, to the Stockton Regional Wastewater Control Facility's installation of nitrifying biotowers and wetlands, which reduced its ammonia discharge by 90 percent.[15] The ANPR should be amended to include the monitoring and compliance data.

<u>Temperature</u>

The ANPR states that temperatures in the San Joaquin River and its tributaries "frequently exceed" the EPA temperature guidance criteria for protecting salmon.[16] This statement is misleading. The criteria the ANPR is referring to is the EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards ("Region 10 Guidance"). The Region 10 Guidance does not set temperature criteria, but recommends criteria for which the states in Region 10 may adopt.[17] California is in Region 9, and therefore the recommendations included in the Region 10 Guidance do not apply.[18] The current temperature requirements applicable to the San Joaquin River are set forth in the Water Quality Control Plan for the Sacramento River and San Joaquin River Basin, which sets a narrative temperature standard based on the temperature of the natural receiving water.[19] The San Joaquin River and its tributaries comply with this requirement.

The ANPR states that the Department of Fish and Game and the National Marine Fisheries Service have recommended listing the San Joaquin River as an impaired waterbody due to temperature levels. In addition, the EPA notes it is considering adding the San Joaquin River and its tributaries to the 303(d) list due to elevated temperatures. Listing the San Joaquin River and its tributaries as impaired due to elevated temperatures is not supported and premised on two faulty assumptions: (a) temperatures in the San Joaquin River are higher than historical

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[14] California Department of Water Resources, Demonstration Dissolved Oxygen Aeration Facility 2008 Operations Performance Report, at ii (April 2010) (http://www.sjrdotmdl.org/library_folder/op-report-041910.pdf).
[15] Central Valley Water Quality Control Board Order No. R5-2008-0154, Waste Discharge Requirements for the City of Stockton Regional Wastewater Control Facility, San Joaquin County, at 25; City of Stockton's Written Summary in Response to the Key Issue and Associated Questions for the Delta Flow Criteria Informational Proceeding, at 1.
[16] ANPR, at 60.
[17] EPA Region 10 Temperature Guidance.
[18] Central Valley Water Quality Control Board Final Staff Report on Recommended Changes to California's Clean Water Act section 303(d) List, at 28 (December 14, 2001).
[19] Water Quality Control Plan for the Sacramento River and San Joaquin River Basin, at III-8.00.

temperatures; and (b) temperatures can be controlled or lowered through flow. The ANPR does not include any science that supports these assumptions.

Actual measurements of "historic" or "natural" temperatures are rarely available. Modeling is generally required and accepted to determine historic natural temperatures. A San Joaquin River Basin-Wide Water Temperature Modeling Project ("SJR Basin Temperature Model") began in 2005 as an extension of the HEC-5Q Stanislaus– Lower San Joaquin River Water Temperature Modeling and Analysis Project. The SJR Basin Temperature Model is capable of accurately identifying "natural" or "historic" temperatures.[20] The model was developed with the participation of the DFG and the DFG endorsed the SJR Temperature Model, recommending National Marine Fisheries Service ("NMFS") use the model in drafting the Biological Opinion for the Central Valley Project/State Water Project Operations Criteria and Plan.[21]

The SJR Basin Temperature Model compared historic conditions on the San Joaquin and Stanislaus Rivers with current conditions and found simulated historic temperatures were higher than current measured temperatures.[22] Further, these historic "natural" temperatures would fail to meet numeric temperature criteria recommended by the DFG in the Stanislaus River and the San Joaquin River.[23] The ANPR should include this modeling information and any other available information that would inform the issue of historic temperatures on the San Joaquin River and the tributaries thereto.

The SJR Basin Temperature Model also modeled the effect of flow releases on water temperature. The simulation used hydrology from 1995 through 2005, maintained historical storage and eliminated diversions by rerouting them back to the reservoirs. The simulation determined that flow even if New Melones, Don Pedro, McClure Reservoir, and Millerton Lake were full and emptied all of their storage immediately, the enhanced flow would still fail to achieve the DFG's recommended temperature criteria sufficiently often to avoid water quality limited segment identification.[24] This information suggests temperature cannot be reasonably controlled through flow regulation. The ANPR should be amended to consider this information and any other data that evaluates the relationship between flow and temperature in the San Joaquin River.

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[20] AD Consultants, Temperature Modeling for the San Joaquin River, at 3-4 (Nov. 19, 2007) (The SJR Basin Temperature Model generated "historic" temperatures by removing New Melones Dam and reservoir, installing the original Melones Dam and reservoir, and using historical flow and operation criteria for Melones Dam and reservoir. Similarly, the "actual" temperatures, which assumed the existence of New Melones Dam and reservoir and the Interim Plan of Operation as the operating criteria for the period 1967-1982, were also derived from the model. Once the simulation was completed, the results were compared with temperature data collected at Vernalis and downstream of Goodwin Dam. The comparison indicated that the model under-predicted the observed temperatures slightly, indicating that the model results are conservative from a temperature increment standpoint).
[21] Dean Marston to J. Stuart@NMFS, electronic mail re Another Tool for OCAP Terms & Evaluation (Jan. 17, 2009).
[22] AD Consultants, Temperature Modeling for the San Joaquin River, p. 3 (Nov. 19, 2007).
[23] *Ibid.*
[24] *Id.*, at 5, 21-22.

Non-Natives/Predation

The ANPR states that the survival of salmonids is likely affected by many stressors, including high predation rates. The ANPR provides no further discussion or information on non-native predation of native listed species. The ANPR should include more information on predation because it is recognized as one of the leading factors contributing to the decline of native species. The National Marine Fisheries Service's Public Draft Recovery Plan for the Evolutionary 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 identified "predation of Chinook salmon and steelhead from introduced species such as striped bass and black bass" as one of the four important stressors on those species.[25] Non-native predators in the Delta include largemouth bass, smallmouth bass, green sunfish, warmouth, black crappie, and striped bass.[26]

High predation losses at the State Water Project (SWP) are particularly detrimental to salmon populations. Predation rates in the Clifton Court Forebay (CCF) are as high as 66-99% of salmon smolts.[27] Striped bass are generally associated with the bulk of predation in the CCF, since their estimated populations have ranged between 30,000 and 905,000;[28] however, six additional invasive predators have also been documented in the CCF (i.e., white catfish, black crappie, largemouth bass, smallmouth bass, spotted bass, redeye bass).[29]

In an evaluation of the effects of the Vernalis Adaptive Management Plan (VAMP) on juvenile Chinook salmon, Vogel (2010) found that predation was so pervasive and devastating to the juvenile Chinook populations that it made tracking surviving juveniles difficult. Specifically, Vogel estimated that approximately 50 percent of all acoustic tagged juvenile Chinook fell victim to predation and were consumed by non-native species before they were able to make it out of the Delta. Further detail by predator is included below.

Striped bass

Since the 1960s, various studies have shown that striped bass in the Sacramento-San Joaquin Delta and tributary rivers eat salmon.[30] Additional evidence suggests that predation in

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[25] Draft Recovery Plan, at ES-2 (NMFS 2009a).

[26] McBain and Trush Inc. 2002. San Joaquin River Restoration Study Background Report. Prepared for Friant Water Users Authority, Lindsay, CA, and Natural Resources Defense Council, San Francisco.

[27] Gingras, M. 1997. Mark/recapture experiments at Clifton Court Forebay to estimate pre-screening losses to juvenile fishes 1976-1993. IEP Technical Report 55; Kimmerer, W. and R. Brown. 2006. A Summary of the June 22 -23, 2005 Predation Workshop, Including the Expert Panel Final Report. for Johnnie Moore CALFED Lead Scientist. May 2006.

[28] Healey, M. P. 1997. Estimates of Sub-Adult and Adult Striped Bass Abundance in Clifton Court Forebay: 1992-1994; Cohen, A. N. and P. B. Moyle. 2004. Summary of Data and Analyses Indicating That Exotic Species Have Impaired the Beneficial Uses of Certain California Waters. San Francisco Estuary Institute.

[29] Kano, R. M. 1990. Occurrence and Abundance of Predator Fish in Clifton Court Forebay, California. Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary Technical Report .

[30] Stevens, D. E. 1966. Food Habits of Striped Bass, Roccus Saxatilis, in the Sacramento-San Joaquin Delta.in J. L. Turner and D. W. Kelley, editors. Ecological Studies of the Sacramento-San Joaquin Delta, Part Ii: Fishes of the Delta. California Department of Fish and Game; Thomas, J. L. 1967. The Diet of Juvenile and Adult Striped Bass, Roccus Saxatilis, in the Sacramento-San Joaquin River System. California Fish and Game 53:49-62; Pickard, A., A.

the tributaries may reduce the number of outmigrating juvenile salmon before they even make it to the Delta,[31] because the narrow and relatively shallow channels concentrate predatory fish.[32] At an abundance of roughly one million adult striped bass, there is an estimated 9 percent chance of an individual juvenile Chinook salmon being predated upon in the Sacramento River.[33] In addition to predation on salmonids, striped bass prey on all four Pelagic Organism of Decline (POD) species, "[h]owever, a paucity of properly designed striped bass food habit studies has precluded the direct estimation of the number of [POD species (i.e.,] delta smelt, longfin smelt, threadfin shad, and juvenile striped bass [)] consumed by striped bass during the POD years".[34]

Predation of salmonids varies both seasonally and spatially, with higher levels of predation documented in the spring, in areas of anthropogenic influence, such as near water diversion structures and dams.[35] Striped bass are highly mobile and are often recorded in the spring passing upstream of fish counting weirs on San Joaquin River tributaries. In recent years, it has become clear that predation by striped bass may significantly limit salmon recovery efforts. The NMFS draft recovery plan (2009a) for Chinook and Central Valley steelhead stated that "predation on juveniles from all populations rearing and migrating through the Sacramento River and Delta" is one of the most important stressors.[36]

Grover, and F. A. H. Jr. 1982. Evaluation of Predator Composition at Three Locations on the Sacramento River. Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary, Stockton, CA; Edwards, G. 1997. Draft: Food Habits of Striped Bass, White, and Channel Catfish in Clifton Court Forebay During 1983-84 and 1993-1995; Tucker, M. E., C. M. Williams, and R. R. Johnson. 1998. Abundance, Food Habits and Life History Aspects of Sacramento Squawfish and Striped Bass at the Red Bluff Diversion Compex, Including the Research Pumping Plant, Sacramento River, California, 1994-1996. Prepared for U. S. Bureau of Reclamation Red Bluff Fish Passage Program, Red Bluff, CA; Merz, J. E. 2003. Striped Bass predation on juvenile salmonids at the Woodbridge Dam afterbay, Mokelumne River, California. East Bay Municipal Utility District; 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 5.

[31] Jager, H. I., H. E. Cardwell, M. J. Sale, M. S. Bevelhimer, C. C. Coutant, and W. Van Winkle. 1997. Modelling the Linkages between Flow Management and Salmon Recruitment in Rivers. Ecological Modelling 103:171-191; Demko, D. B., C. Gemperle, S. P. Cramer, and A. Phillips. 1998. Evaluation of Juvenile Chinook Behavior, Migration Rate and Location of Mortality in the Stanislaus River through the Use of Radio Tracking. Prepared for the Tri-dam Project, Oakdale. December 1998.

[32] Hanson, C. H. 2009. Striped Bass Predation on Listed Fish within the Bay-Delta Estuary and Tributary Rivers. 9 October 2009.

[33] 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.

[34] Baxter, R., R. Breuer, L. Brown, L. Conrad, F. Feyrer, S. Fong, K. Gehrts, L. Grimaldo, B. Herbold, P. Hrodey, A. Mueller-Solger, T. Sommer, and K. Souza. 2010. Interagency Ecological Program 2010 Pelagic Organism Decline Work Plan and Synthesis of Results. Sacramento. 6 December 2010.

[35] Gingras, M. and M. McGee. 1997. A telemetry study of striped bass emigration from Clifton Court Forebay: Implication for predator enumeration and control. Interagency Ecological Program for the San Francisco Bay/Delta Estuary, a cooperative program of California Department of Water Resources and California Department of Fish and Game; Tucker, M. E., C. M. Williams, and R. R. Johnson. 1998. Abundance, Food Habits and Life History Aspects of Sacramento Squawfish and Striped Bass at the Red Bluff Diversion Compex, Including the Research Pumping Plant, Sacramento River, California, 1994-1996. Prepared for U. S. Bureau of Reclamation Red Bluff Fish Passage Program, Red Bluff, CA; Merz, J. E. 2003. Striped Bass predation on juvenile salmonids at the Woodbridge Dam afterbay, Mokelumne River, California. East Bay Municipal Utility District.

[36] NMFS Draft Recovery Plan.

Dr. Charles H. Hanson's expert report titled "Striped Bass Predation on Listed Fish Within the Bay-Delta Estuary and Tributary Rivers" stated:

> Striped bass predation in rivers tributary to the Delta appears to be the largest single cause of mortality of juvenile salmon migrating through the Delta. The high rates of striped bass predation within the Sacramento River are supported by, inter alia, striped bass diet studies and recent survival studies that have shown high mortality of salmon and steelhead -- approximately 90% before they reach the Delta.

Additionally, the National Marine Fisheries Service estimated that striped bass predation accounts for a loss of between 15 and 30 percent of all outmigrating winter-run smolts.[37]

Largemouth bass

Largemouth bass are known to be a 'keystone predator' due to their flexible foraging strategies, size and gape, 'voracious' appetite, and tolerance for a wide variety of environmental conditions.[38] During Fish and Game electrofishing surveys in the San Joaquin River, largemouth bass were common in lower reaches and found upstream as far as Reach 1B.[39] Largemouth bass predation on salmonids in the Sacramento-San Joaquin Delta tributaries is facilitated by deep pits created during gravel mining which provide ideal habitat, with low water velocities, warm water, and aquatic vegetation.[40] On the Tuolumne River, a diet study of largemouth bass found in mining pit habitats revealed significant predation upon outmigrating juvenile Chinook salmon, especially hatchery fish.[41]

Smallmouth bass

Smallmouth bass feed on insects, crustaceans amphibians and other fishes; they may compete with native species (e.g., hardheads) for food resources such as crayfish.[42] In the Tuolumne River, they were also found to prey on outmigrating Chinook salmon in pool habitats created by gravel mining.[43]

Other bass species

In recent years, both spotted bass and redeye bass have invaded the Delta. Spotted bass are common in the lower reaches of the San Joaquin River according to Fish and Game electrofishing surveys.[44] Redeye bass populations now dominate the fish fauna of the Cosumnes River basin, where bass have had a substantial effect on shaping the current species

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[37] Memorandum from Alec D. MacCall to Lisa Holsinger at NMFS (April 1996).
[38] Moyle, P. B. 2002. Inland Fishes of California. 2nd edition. University of California Press, Berkeley.
[39] San Joaquin River Restoration Program 2010.
[40] McBain and Trush Inc. 2002. San Joaquin River Restoration Study Background Report. Prepared for Friant Water Users Authority, Lindsay, CA, and Natural Resources Defense Council, San Fransisco.
[41] EA Engineering Science and Technology 1992b; as cited inMcBain and Trush Inc. 2002.
[42] Moyle, P. B. 2002. Inland Fishes of California. 2nd edition. University of California Press, Berkeley.
[43] EA Engineering Science and Technology 1992b; as cited inMcBain and Trush Inc. 2002.
[44] San Joaquin River Restoration Program 2010.

assemblage.[45] McBain and Trush (2002) cautioned that the "[c]reation of holding pools or other types of spring and fall Chinook salmon habitat may improve habitat conditions for redeye bass. . . Redeye bass, if established in the San Joaquin River, could become important predators of native fishes."

Temporal or Lifecycle Analysis

The ANPR specifically asks whether temporal characteristics should be considered in relation to the survival of salmon.[46] The answer is yes. The ANPR recognizes that San Joaquin Valley salmonid populations have suffered a long-term decline due to a variety of interrelated factors.[47] The ANPR further indicates that the decline in salmon abundance cannot be attributed to a single factor. In order to identify the factors that most critically affect salmonid abundance and survival, lifecycle or temporal analyses must be performed.[48] The broad field of candidate causes must be evaluated and narrowed by looking at the point in the life cycle where abundance becomes unusually low, and matching this low point with causal factors that were at unusual levels. In this way, life-cycle analysis will identify the most likely cause(s) of decline by identifying the unusual level of causal factors with the unusual change in abundance.[49]

Ocean Conditions

Consistent with a temporal approach, the ANPR must be amended to include science on the effect of ocean conditions on anadromous listed species. Salmon spend a significant part of their life in the ocean and ocean conditions are consistently noted as one of the most influential factors in the survival and abundance of salmon populations.[50] Despite this recognition of

[45] Moyle, P. B., P. K. Crain, K. Whitener, and J. F. Mount. 2003. Alien Fishes in Natural Streams: Fish Distribution, Assemblage Structure, and Conservation in the Cosumnes River, California, U.S.A. Environmental Biology of Fishes 68:143-162.
[46] ANPR, at 61.
[47] *Id*., at 57.
[48] CALFED Independent Review of a Draft Version of the 2009 NMFS OCAP Biological Opinion. January 2009; National Research Council Committee on Sustainable Water and Environmental Management in the California Bay-Delta (2010). "A Scientific Assessment of Alternatives for Reducing Water Management Effects on Threatened and Endangered Fishes in California's Bay Delta"; Satterthwaite, W. H., M. P. Beakes, et al. (2010). "State-dependent life history models in a changing (and regulated) environment: steelhead in the California Central Valley." Evolutionary Applications 3(3): 221-243; Scheuerell, M. D., R. Hilborn, et al. (2006). "The Shiraz model: a tool for incorporating anthropogenic effects and fish-habitat relationships in conservation planning." Canadian Journal of Fisheries and Aquatic Sciences 63(7): 1596-1607.
[49] S. T. Lindley, et. al. March 18, 2009. What caused the Sacramento River fall Chinook stock collapse? Pre-publication report to the Pacific Fishery Management Council.
[50] Wells, B. K., J. C. Field, J. A. Thayer, C. B. Grimes, S. J. Bograd, W. J. Sydeman, F. B. Schwing, and R. Hewitt. 2008. Untangling the relationships among climate, prey and top predators in an ocean ecosystem. Marine Ecology Progress Series 364:15–29; California Fish and Game Commission Statement of Proposed Emergency Regulatory Action, 2008; Pacific Fishery Management Council. Review of 2007 ocean salmon fisheries; Pacific Fishery Management Council. Review of 2008 ocean salmon fisheries; William T. Peterson, Cheryl A. Morgan, Edmundo Casillas, Jennifer L. Fisher and John W. Ferguson. Ocean Ecosystem Indicators of Salmon Marine Survival in the Northern California Current. April 2010. Fish Ecology Division Northwest Fisheries Science Center National Marine Fisheries Service.

substantial influence, the impact of ocean conditions is often isolated and under-analyzed compared to the focus on estuarine impacts and life stages. A good example of this ignorance is the significant salmon harvest authorized by commercial fishing regulations. If the ANPR is to be considered a comprehensive scientific document, it must include analysis and information on the impact of ocean conditions in the lifecycle of listed fish species. In doing so, the ANPR should specifically evaluate the impacts allowing commercial harvest of salmon on salmon survival and abundance.

Very truly yours,

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