State Water Resources Control Board - Revised February 23, 2010

Informational Proceeding to Develop Flow Criteria for the Delta Ecosystem - Questions

Party submitting questions:

	Natural Heritage Institute	
Priority[1]	Question	Witness
1	U.S. Dept. Of the Interior testimony makes the statement that "any potential flow criteria must be made conditional upon appropriate concurrent habitat conservation and restoration requirements. Either without the other would not be expected to yield improvements in native species habitat recovery"(page 40). This statement raises the question: Would implementing Delta flow criteria prior to implementing habitat restoration requirements be the idiomatic equivalent of "putting the cart before the horse"? To put it less colloquially: Acknowledging that concurrent development of flow criteria and habitat restoration requirements would be ideal, and also acknowledging the limitations of the current Board proceeding, is development of numeric flow criteria in advance of habitat restoration requirements a scientifically valid approach to protecting the public trust resources of the delta?	Hydrology
2	The State and Federal Water Contractors Testimony makes a compelling argument regarding the need to develop a more refined approach to understanding the causal mechanism behind flow/fishery relationships. It also argues that while this approach is being developed, we should be very cautious about setting specific, numeric flow criteria as our scientific assumptions may be incorrect. The fundamental question raised by this argument is this: Given existing scientific uncertainty, is it more "cautious" (from a scientific standpoint) to change the existing flow regime in an attempt to replicate natural patterns of flow (or at historical patterns correlated with positive fishery conditions, or using other approaches) or to maintain current flow conditions?	Hydrology

3	The Sacramento Valley Water Users Summary of Testimony ends with the admonition to the Board that "any of its actions, including the development of Delta flow criteria in this proceeding, are subject to the prohibition against waste and unreasonable use of water in article X, section 2 of the California Constitution." This statement implies that the development of new flow criteria, that for example limit diversion quantities to better mimic the natural hydrograph for the protection of Delta fisheries, may be considered a wasteful or unreasonable use of water resources. This notion, that letting the waters of the Delta flow as God intended could be considered unreasonable or wasteful, is likely viewed as an anathema to some stakeholders. However, given the ecological changes that have occurred in the Delta (loss of wetlands, invasive species, pollution, etc) it is reasonable to ask the question: Is there a level of disturbance at which point "natural" flow patterns lose their scientific relevance in predicting fishery health? If so, what should management decisions be based on if we can't look to nature as our guide?	Hydrology
4	The National Marine Fishery Service Written Summary encourages the Board to "establish initial flow criteria that provide a margin of safety for fish populations dependant on the Delta" and advised that "[p]rotection of imperiled species in the face of uncertainty requires a precautionary approach" (page 2-3). However, given the central role of Delta exports in California's water supply, the need for a "precautionary approach" cuts both ways; arguing on the one hand for restricting diversions to protect natural flow regimes, and on the other hand for maintaining current diversion rates until the evidence to do otherwise is ironclad. Given the current state of the science, and the current state of Delta public trust resources, what is the best methodology(ies) to use in choosing a "precautionary" level of diversion (e.g. natural flows, historical flows, statistical correlations, mechanistic explanations, weight of evidence, cost-benefit analysis, etc.)? What are the relative risks associated with the respective recommended methodology(ies)?	Hydrology

5	Example One (on page 3) of the State and Federal Water Contractors Summary of Written Testimony, discusses the importance of pulsed flows in inundating floodplain habitat for the benefit of several Delta fishes. Splittail were used in this example, but other testimony (e.g. U.S. Dept. of the Interior) indicates that juvenile salmonids would similarly benefit from access to floodplains. Example One is used to argue against requiring higher Delta outflows under the logic that without structural modifications at the levees to allow floodplain inundation when and where desired, higher flows alone would not generate sought after fisheries benefits and would therefore be an unproductive use of water that could otherwise be diverted for consumptive uses. While this logic makes sense in the context presented, it raises the question: Would the State and Federal Water Contractors and/or other stakeholders support targeted modifications of the hydrograph (e.g. pulsed flows to achieve specific ecosystem goals) if they are linked to structural and habitat modifications that would maximize the benefits of these increased flows	Hydrology - State and Federal Water Contractors & General Pannel
	(e.g. lowering selected weirs/modifying levies to facilitate floodplain inundation)? In short, is the scientific objection presented in State and Federal Water Contractors testimony related generally to implementing flow solutions in response to fisheries declines, or is it an objection to using only flow solutions in response to fisheries declines while non-flow solutions are overlooked?	
1	Given the current condition of pelagic fisheries in the Delta, is the appropriate scientific standard of certainty different for short and long term management decisions?	Pelagic

2	The testimony provided for this proceeding supports the conclusion that we know at least two things about maintaining public trust fisheries in the Delta: 1) that flows are important, and 2) that we cannot claim (at least without controversy) to definitively understand why or how flows are important to maintaining individual fish populations or even many ecosystem processes. A central question for this proceeding is this: Given the alarming decline in pelagic fisheries, does the fact that we don't yet fully understand why or how flows drive fish abundance argue (from a scientific perspective) for or against taking action at this time? If action is warranted, does the current state of the science support a specific methodological approach?	Pelagic
3	The Sacramento Valley Water Users Summary of Testimony repeatedly states that "Delta outflows should be based on reliable scientific evidence addressing what [or how] flows are needed to support a particular public trust resource..." (page 5). The use of the phrase "reliable scientific evidence" raises the scientific equivalent of the legal "burden of proof" concept. Although making decisions based on reliable scientific evidence is always the goal of a management proceeding, the reality is sometimes more complex. Given the declines in both pelagic and anadromous fish populations, and the current state of the science, it is critical address the question: What level of scientific certainty is appropriate for this proceeding? In short, what standard should go in front of the phase "….scientific evidence" (e.g. reliable, reasonable, substantial, weight of evidence, best available, etc)?	Pelagic
1	Given that factors outside of the scope of this proceeding (including ocean and upstream riverine conditions) play a central role in the success of anadromous fisheries, can improved flow conditions in the Delta alone significantly contribute to increasing (or at least stabilizing) populations of anadromous fishes?	Anadromous

2	Given the current condition of anadromous fisheries in the Delta, is the appropriate scientific standard of certainty different for short and long term management decisions?	Anadromous
3	What is the relative importance of flow timing and magnitude (vs. absolute water quantity) in managing salmonid migration into, through, and out of the Delta? To what extent could more coordinated flow and diversion management be effective in increasing salmonid reproduction and survivorship without significantly diminishing total water export quantities?	Anadromous
1	Multiple Delta stressors have been implicated in the decline of fisheries, especially in the Pelagic Organism Decline (POD). How does the existence of these stressors affect the Board's responsibility to set specific, numeric flow criteria for the Delta? On the one hand concurrent stressors not directly related to flow (e.g. invasive species, pollutants) may limit the benefit of increased, "more natural," flows. On the other hand however, diversion is a fully controllable factor that plays a significant, if not completely understood, role in fish population abundance. Given that some non-flow dependant stressors may be extremely difficult if not impossible to control fully (e.g. invasive species), does the existence of these stressors increase or decrease the importance of controllable fisheries management measures such as developing flow criteria into, through, and out of the Delta.	Other Stressors
2	Why are exotic predators and loss of salmon to predation such a problem now. Striped bass, one of the main predators, have been in the estuary since the late nineteenth century. Today, their abundance is relatively low, yet predation by striped bass is a major source of mortality. Is it possible that changes in flow patterns either into the Delta or within the Delta have given predators such as stripped bass an advantage over their prey. Might greater inflows with higher turbidity, higher velocities, and cooler temperatures give outmigrating juvenile salmon a better chance at surviving predation pressures.	Other Stressors

3	Example Three (on page 5) of the State and Federal Water Contractors Summary of Written Testimony, makes the argument (echoed in other testimony such as the Delta Science Center at Big Break and Dept. of Water Resources) that the positive correlation between X2 and fish population abundance masks what is actually a negative correlation between ammonium concentrations and fish abundance. It is theorized that higher flows result in a dilution of ammonium pollution, which results (via shifts in the food web) in greater fish population abundance. In the example, the Water Contractors state that if pollution is the primary stressor "the appropriate management response would not be to increase flows in an attempt to dilute pollution, but to manage the pollution at the source." Although this reasoning appears logical from a long term perspective (why use precious water to dilute pollution when we can simply reduce the pollution at its source), the logic may not hold when viewed from a short to medium-term perspective. This raises the question: Given the severity of the POD, is requiring higher Delta outflows to dilute	Other Stressors
	pollution in the short to medium-term (while pollution sources are in the process of being addressed) a scientifically appropriate management response?	
1	Example Three (on page 5) of the State and Federal Water Contractors Summary of Written Testimony, makes the argument (echoed in other testimony such as the Delta Science Center at Big Break and Dept. of Water Resources) that the positive correlation between X2 and fish population abundance masks what is actually a negative correlation between ammonium concentrations and fish abundance. It is theorized that higher flows result in a dilution of ammonium pollution, which results (via shifts in the food web) in greater fish population abundance. If dilution of pollution is accepted as a causal mechanism behind the X2/fish abundance correlation, does this preclude the existence of other important causal mechanisms driving the observed X2/fish population abundance correlation?	Hydrodynamics

[1]Please identify the top 10 priority questions concerning each participant's testimony or exhibits, with 1 being the highest and 10 being the lowest priority.