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Comments

Of

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On the Draft BDCP and on the Draft Environmental Impact Report/Environmental Impact Statement

Submitted to

BDCP Comments

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The Effectiveness of the Bay Delta Conservation Plan in Restoring Endangered Populations of Delta Smelt, *Hypomesus transpacificus*.

My name is James F. Carlson, and I am an Environmental Studies senior at California State University, Sacramento. I was born and raised in the San Francisco Bay Area's west and east bay. During most of my teenage years and into my mid-twenties, I lived in the east bay on the Sacramento-San Joaquin Delta in the cities of Antioch and Oakley. I lived in Sacramento for a small period of time when I was a child, and again now as I finish school. I consider the Sacramento-San Joaquin Delta my home because it has played a major role in my life and has provided me with many first time experiences and opportunities. It is the first place I ever took my son J.P. fishing, on a jet ski, and to the beach where we built our first sand castle together. I am a regular traveler on CA Highway 160 and have friends and family in Isleton and Rio Vista. What happens to the delta ecosystem affects me and many of my loved ones.

The Sacramento-San Joaquin Delta is in the midst of an ecological crisis. Anthropogenic alterations over the past 150 years have claimed 85% of the delta's riparian, and 95% tidal wetland habitat, mostly for agricultural land use (Hart, 2004).The once naturally meandering and free flowing system is now simplified. Over 1300 miles of levees contain flows and keep the river from changing its path (Hart, 2004). Upstream dams control the flow of water throughout the valley and into the delta. Traces of mercury left over from gold mining can still be found in the delta's waters, along with many other pollutants, including pesticides and herbicides used in agriculture carried by runoff into the rivers. This altered and simplified ecosystem along with pollution and altered flow regimes has left many species endangered and threatened. Perhaps the most notable example is the delta smelt.

Delta smelt have been the focus of many studies over the years (Sommer *et al*., 2007, Grimaldo *et al*., 2009, Maunder & Deriso., 2011, Manly *et al*., 2012). Since 1999, smelt, along with other pelagic fishes has suffered from a drastic drop in numbers as part of the Pelagic Organism Decline (POD) (Sommer *et al*., 2007). Currently, delta smelt are federally listed as threatened, and state listed as an endangered species (U.S. Fish and Wildlife Services, 2013). There have been extensive investigations into the cause(s) of POD, and delta smelt specifically, by leading experts in the field. Some experts attribute the problem to changes in nutrient concentrations, and top down effects such as entrainment and predation (Grimaldo *et al*., 2009). Others have investigated the population impacts on delta smelt and found that temperature (indicates the length of spawning period) and density dependent factors (predator and prey dynamics) had the largest impacts (Maunder & Deriso, 2011). Other studies have focused on the effects the State Water Project (SWP) and the Central Valley Project (CVP) have on delta smelt and found the pumping plants have direct and indirect effects on delta smelt stock recruitment, habitat availability and quality, food availability and quality, and entrainment (Sommer *et al*., 2007). State and federal pumping plants also have adverse effects on smelt survival due to high numbers of juvenile entrainment in the summer (Manly *et al*., 2012). Furthermore, pumping plants and associated water diversions alter the natural flow regime, which has proven to have effects on food web productivity, contaminants, and water quality (Grimaldo *et al*., 2009). Although there may be some debate over the leading cause of the delta smelt's drastic decline, most would agree the contributions are numerous, interconnected, and complex.

There are countless environmental, political, and social factors contributing directly and indirectly to the problems in the delta. Unfortunately, it is difficult to balance goals of economic efficiency, social equity, and environmental quality. In California, this balancing act is challenging because of the difficulties associated with providing reliable water to all users while maintaining environmental quality in the watershed in a state where water demand often exceeds water supply. When we consider all the facts, it seems a daunting task to achieve goals of restoration in the delta ecosystem while providing reliable water to all users in the state. However, the Bay Delta Conservation Plan (BDCP) has been put forth with these very goals.

I offer my comments on several **Conservation Measures** (**CM**) put forth by the BDCP and assess how well the plan will alleviate these documented stressors on delta smelt. Not all **CM's** are included in this analysis. A **CM** was not included if: (A) it did not have significant impact on smelt stressors, (B) it shares similar impact on smelt stressor as another **CM** included in this analysis, but to a lesser extent.

Comment 1: Conservation Measure 1-Water Facilities and Operations- CM1 involves the construction of state of the art pumping facilities and fish screens. CM1 is proposed to help improve conditions for the delta smelt by alleviating or minimizing several water flow related issues currently affecting the species such as; "reverse flows in Old River and Middle River, entrainment, salvage, predation due to south delta intakes, delta cross channel effects on fish migration, salinity, flow, habitat in Suisun Marsh, flow modification effects in the Sacramento River, and effects on delta outflows" (BDCP, 2013).

This new facility is to be used in conjunction with current water pumping facilities. The intention of CM1 is to greatly reduce entrainment in the south delta pumping plant by utilizing the new pumping facility located in the north delta. Furthermore, it is the intention of the BDCP that CM1 will help reduce altered flow patterns. Pumping out of the south delta pulls the water from north to south, as opposed to the natural east to west caused by tidal pulses coming into the bay from the ocean, and freshwater flows into the bay from the rivers. By moving the primary pumping location into the north delta, the BDCP proposes this will alleviate this southward flow by bypassing south delta facilities. The BDCP claims this will keep salinity levels low in critical smelt habitat zones, prevent salt water intrusion into the delta, and prevent reverse flows in Old and Middle Rivers. South delta pumping creates a congregation of the delta smelt around the south intakes leaving them vulnerable to predation, so the use of the north delta pumping facilities may alleviate predation stressors on smelt (BDCP, 2013). However, predation vulnerability in the north delta pumping facility may become a factor for smelt, but the magnitude is not known.

Manipulation of water diversion is the most "readily manageable" stressor on smelt populations based on the fact water diversions can be altered to reduce fish losses (Grimaldo *et al*., 2009).Water diversions have been linked to several stressors on smelt populations such as; entrainment and salvage, changes in suitable habitat, alterations to the food web, and effects on stock recruitment. Most of the smelt are lost during winter months when there is a greater water export out of the south delta pumping facilities, thereby causing Old and Middle River reverse flows (Grimaldo *et al*., 2009). Interestingly, operations of the Central Valley Project (CVP) and State Water (SWP) Project reportedly caused these reverse flows in the early 2000's, which coincides with the timing of the Pelagic Organism Decline (POD) (Grimaldo *et al*., 2009). Changes in suitable habitat for smelt have been attributed to the amount of freshwater outflow into the delta in the winter; therefore, keeping salinity levels suitable for the delta smelt larvae and juveniles around Suisun Bay and Montezuma Slough (Sommer *et al*., 2007). Smelt require a certain range of turbidity and water temperature to survive, which are both affected by water diversions. According to the effect analysis (Chapter 5) of the BDCP, the implementation of CM1 will cause a decrease in turbidity, therefore increasing predation risks for smelt at any given stage in their life cycle. In addition, salinity encroachment into the delta caused by excessive freshwater pumping at the south intakes, along with introduced species affects the pelagic food web by lowering primary productivity in the Suisun Bay region (Sommer *et al*., 2007). Studies have shown phytoplankton has decreased over the last 40 years, shifting species composition and lowering productivity in Suisun Bay (Sommer *et al*., 2007).The biomass of zooplankton (calanoid copepods), another essential food source for juvenile and larval smelt has been sharply reduced, although reasons are not fully understood, it is thought changes in water quality conditions due to south delta water diversions alters the species composition, thereby changing interactions between species and increasing competition for resources (Manly *et al*., 2012). In addition, an introduced species of zooplankton (*Limnoithana tetraspina*) that does not provide smelt with proper nutrition is found throughout the delta and competes with the zooplankton that smelt normally feed upon (Manly *et al*., 2012). Finally, water diversions can affect stock recruitment by changing the migration patterns of the adult smelt trying to reach the low salinity zones to spawn. South pumping facilities divert flows southward, which suck migrating adults (attempting to spawn) into the pumps where they become entrained. These adult smelt never make it to spawning habitat, therefor reducing stock recruitment.

CM1 has the potential for restoration because the new water pumping facilities can beneficially modify flows in ways that will alleviate stressors on smelt. According to the BDCP, "approximately 50% of the exported water will be from the new north Delta intakes, and average monthly diversions at the south delta intakes would correspondingly decrease" (BDCP, 2013). Considering over a 15 year period, 110 million fishes were salvaged at the SWP screens (Baxter *et al*., 2008); it is likely a 50% reduction will drastically benefit smelt populations. Operating the north delta facility also has the potential to greatly reduce reverse flows in Old and Middle

Rivers by decreasing south facility use. Decreasing the amount of reverse flows at the south pumps may help with alleviating entrainment and salvage, changes in suitable habitat, food web alterations, and stock recruitment. The BDCP effect analysis states CM1 will cause increased water clarity; however, this could have impacts on smelt because they require certain levels of turbidity to survive.

Turbidity is an important habitat characteristic for delta smelt and is directly related to larval feeding success, as well as juvenile distribution (Manly *et al*., 2012). Additionally, turbid waters decrease the chance smelt will be preyed upon because some predators have difficulty locating smelt through the suspended particles (Manly *et al*., 2012). Chapter 5 (Effect Analysis) of the BDCP states, "Implementation of dual conveyance under CM1 Water Facilities and Operation was estimated to result in around 8 to 9% less sediment entering the Plan Area" (BDCP, 2013). A decrease in turbidity would have negative impacts on smelt during most of their life. CM1 has many potentially positive effects on smelt populations; however, the success will rely completely upon manipulation of flows, which will benefit and take into account all covered species. When you add the biological complexities into successful timing, frequency, and duration of water export, success seems nearly impossible. Finally, it is a possibility that changing turbidity (habitat) will have adverse effects on the food web, altering species composition and predator prey relationships even further.

CM1 has potential to reduce smelt entrainment and aid in maintaining suitable salinity levels, flow and other habitat related requirements for smelt survival. CM1 is a good attempt to alleviate several documented stressors, and is a great starting point for future restoration goals. However, CM1 will not be beneficial for delta smelt because it may cause a significant change to smelt distribution and habitat quality throughout the plan area due to decreased turbidity.

Comment 2: Conservation Measure 2-Yolo Bypass Fisheries Enhancement– The main goal of CM2 is to improve habitat and passage at the Fremont weir for covered fish species. Measures also involve an increase in flows going into the Yolo Bypass to increase "frequency, duration, and area of floodplain inundation" (BDCP, 2013). The BDCP predicts these actions will increase primary productivity in the Yolo Bypass, which will benefit aquatic species.

Delta smelt are usually found downstream from the Yolo Bypass and do not use this area for any substantial length of time during their life cycle. However, there are ways CM2 can benefit smelt. The BDCP claims increasing floodplain inundation will increase production and therefore food availability for smelt downstream. This is accurate for a few reasons. First, "seasonally inundated floodplains are productive components of their freshwater system" (Benigno & Sommer, 2008). The Yolo Bypass in particular has a high production of zooplankton and macro-invertebrates during periods the Bypass is flooded (Benigno & Sommer, 2008). Secondly, invertebrate drift is greater in the bypass than in the main channel of the Sacramento River (Benigno & Sommer, 2008). Inundating the floodplain has the potential to export phytoplankton, zooplankton, other invertebrates and organic material into the delta providing smelt with more food resources. However, studies have shown the importance of "first flush" (an initial flood event) events in increasing turbidity, which is thought to be a cue for an adult smelt to begin migration (Burau & Bennet, 2011).

It is possible that increasing flood events in the bypass may trigger altered migration patterns for smelt because of localized increases in turbidity. In addition, macro-invertebrates in the floodplain come out during the first flush, but if CM2 operations plan to increase frequency and duration of floodplain inundation, this could decrease the amount sediment and food resources being flushed out over time. Temporary aquatic environments provide habitat for larvae of the Dipteran family Chironomidae, which is the most abundant invertebrate in the Yolo Bypass (Benigno & Sommer, 2008). Larvae are suspended in the sediments during the summer dry season, but large numbers of active larvae emerge from rehydrated sediment in the beginning of the wet season (Benigno & Sommer, 2008). Periods of non-flooding in the Yolo Bypass are an important component in the Chironomidae life cycle because dry sediment is necessary for successful larvae production (Benigno & Sommer, 2008). Therefore, increasing floodplain inundation may have negative effects on Chironomidae abundance, which may decrease food availability for smelt.

CM2 will, therefore, not be beneficial for delta smelt because it fails to substantially alleviate stressors on the smelt population. In the short term, an increase in food availability and turbidity downstream of the Yolo Bypass has the potential to benefit smelt. However, the quantity of food and quality of habitat conditions (turbidity) will reach a point of diminishing returns.

Comment 3: Conservation Measure 4- Tidal Natural Community Restoration– CM4's main goal is to restore 65,000 acres of tidal natural communities and upland transition habitat. "CM4 will be implemented within the Suisun Marsh, Cache Slough, Cosumnes/Mokelumne, West Delta, and South Delta" (BDCP, 2013). The purpose is to create a mosaic of natural tidal communities around the plan area to support foraging needs for covered species by increasing productivity contributing to the local food web (BDCP, 2013). The successful restoration of these tidal communities collectively may cause an increase in suitable habitat for covered fish species (BDCP, 2013).

The restoration of natural tidal communities in Cache Slough and Suisun Bay may affect delta smelt because these areas are in the smelt's range. "Delta smelt spawning has never been observed in the wild," and actual spawning locations are unknown (Bennett, 2005). In 1976, Peter Moyle noted spawned smelt eggs are adhesive making them suitable for substrata such as vegetation, rocks, gravel beds, and possibly sand near shore (Moyle P. B., 2002). If assumptions regarding smelt spawning habitat are correct, then CM4 may benefit smelt by increasing the amount of suitable spawning habitat (BDCP, 2013). In addition, the restoration of natural tidal communities in Cache Slough and Suisun Bay may increase primary and secondary production adding to resource availability, therefore benefiting smelt (BDCP, 2013).

CM4 will benefit smelt by alleviating habitat and food availability stressors. CM4 doesn't directly benefit smelt, unless assumptions regarding smelt spawning habitat are correct. Increasing productivity within smelt habitat through the restoration of natural tidal communities will benefit smelt by making more resources available.

Comment 4: Conservation Measure 6– Channel Margin Enhancement- The purpose of CM6 is to improve migratory corridors, habitat conditions, and prey resources for covered fish species (BDCP, 2013). Channel margin enhancement includes setbacks of levees and the restoration of 10 miles of riparian habitat along channels (BDCP, 2013). Setting back the levees gives migrating fish more habitat and space. Restoring riparian habitat and vegetation along the channels will result in particulate organic matter (leaves, wood, etc…) inputs into the stream, which contributes to aquatic habitat complexity (Baxter *et al*., 2005). Overhanging riparian vegetation contributes small invertebrates that drop into the stream providing high quality food recourse for fish (Cloe & Garman, 1996). The importance of energy and resource transfer between riparian and aquatic habitats for fish assemblages is well documented, and may relieve food availability and quality stressors on smelt in this situation (Naiman & Latterell, 2005).

There is a reciprocal relationship between riparian and aquatic habitats. Aquatic food resources usually originate out of the stream, and aquatic environments are essential for riparian organisms (Naiman & Latterell, 2005). Terrestrial arthropods are a significant food resource for fishes (Cloe & Garman, 1996). Arthropods occupying overhanging riparian vegetation contribute to the aquatic food web when they fall into the water column (Cloe & Garman, 1996)). The quantity of arthropods contributed to underlying streams is proportional to the amount of overhanging vegetation (Cloe & Garman, 1996). Therefore, restoring 10 miles of riparian habitat along the rivers could significantly relieve food availability stressors for delta smelt. Additionally, riparian cover also has effects on underlying stream water temperature (Ryan *et al*., 2013).

Temperature is a critical habitat component for aquatic species. Studies show even a small portion of riparian cover can have significant impacts on stream temperature (Ryan *et al*., 2013). Riparian cover acts as a buffer for short-wave radiation, thereby regulating stream temperatures to suitable levels for aquatic species (Ryan *et al*., 2013). With the threat of climate change, uncertainties regarding the delta's future challenges restoration, mitigation, and other future planning efforts. Numerous fish species in the delta like the delta smelt and salmon are at a heightened risk of temperature changes because of their specific habitat requirements. Certainly, the buffering capabilities of riparian habitats would aid in reducing effects of possible temperature changes on aquatic fish species.

CM6 will be beneficial for delta smelt because it has the potential to relieve food availability and habitat quality stressors. Riparian vegetation acts as a temperature buffer and is a significant source of arthropods and other macro-invertebrate's essential to the aquatic food web.

The successful restoration of 10 miles of riparian habitat along the channels may provide substantial inputs of food resources for smelt in the long term.

Comment 5: CM13– Invasive Aquatic Vegetation Control– The purpose of CM13 is to remove Invasive Aquatic Vegetation (IAV) from the plan area. CM13 may reduce predation risk for covered species in three ways. First, removing IAV may cause an increase in turbidity, which decreases predation risk for some fish including smelt (BDCP, 2013). Second, removing IAV decreases habitat quality for nonnative predatory fish, thereby decreasing predation risk for fishes. Lastly, removing IAV that is a food source for predators may help reduce predation risk for fishes (BDCP, 2013).

April through June has been observed as the season of high delta smelt loss from predation (Manly *et al*., 2012).During these months, water clarity is at its peak in the estuary and there is an abundance of predator fish, such as inland silversides (Menidia beryllina) and largemouth bass (Micropterus salmoides) (Manly *et al*., 2012). Inland silversides are an introduced species and share delta smelt range but is often found in near shore vegetation (Brown, 2003). Silversides are an efficient predator of larval smelt and contribute greatly to their decline (Bennett, 2005). Reducing habitat availability for silversides has the potential to greatly reduce predation of smelt larvae.

Invasive Aquatic Vegetation (IAV) often competes with native aquatic vegetation (NAV) in the delta (BDCP, 2013). The spread of IAV results is a reduction in biotic diversity overall. Reducing biodiversity in an ecosystem creates instability for all species (Kricher, 2011). As IAV moves in, NAV is forced out. Species that feed upon NAV may also need to relocate to habitats with food sources resulting in a widespread change in the species composition of the delta.

CM13 will be beneficial for smelt. A reduction in optimal predator habitat will alleviate predation stressors on smelt. Furthermore, smelt will greatly benefit from CM13 because removing IAV may have restorative effects to the delta ecosystem and species composition, thus improving habitat conditions.

Comment 6: Conservation Measure 18– Conservation Hatcheries– CM 18 consists of two programs:

1-The development of a conservation hatchery by the United States Fish and Wildlife Service (USFWS) to house captive populations of the delta smelt (BDCP, 2013). Captive fish will provide a continued source for research (BDCP, 2013).

2.-To expand the current refugial population of the delta smelt (BDCP, 2013)

Delta smelt have been declining overall since the 1980's (Bennett, 2005). The threat of extinction may not fall under the stressor category; however, reaching low numbers can put populations at increased risk of extinction. Keeping significant populations in stock can help maintain a base population level to guard smelt from extinction. There is still much to learn through experimentation about smelt reactions to different stressors. If experiments are successful, knowledge gained can aid in delta smelt conservation efforts and management plans.

Captive breeding programs could be effective in conserving genetic variability within an endangered population that is sharply declining. The USFWS currently runs the Livingston Stone hatchery located at the base of Shasta Dam in Redding, California (U.S. Fish and Wildlife Services, 2013). Also, delta smelt refugial populations were established in 2008 at the University of California, Davis Fish Conservation & Culture Laboratory (FCCL) in Byron, CA, as a result of the record low delta smelt counts (Newman, 2008).Smelt hatcheries have been successful in maintaining captive populations, however, there is much debate over effectiveness in maintaining genetic variability.

There are some major concerns with fish hatcheries, and it is difficult to apply strategies to conserve genetic diversity due to these issues. Common issues include inbreeding, which leads to reduced viability and fecundity and a decreased population size (Burton *et al*., 2013). These issues affect the supplemental wild populations by decreasing their fitness (Burton *et al*., 2013). However, the fish hatchery mortality rates of delta smelt are very low (Burton *et al*., 2013). Mortality rates of delta smelt in the wild are very high because of the numerous stressors acting upon the population, therefore, hatcheries provide a significant safeguard against the uncertainties of anthropogenic alterations to smelt habitat.

CM18 will be beneficial to smelt because it will help keep smelt population sizes at adequate levels. Losing any species has drastic impacts on the ecosystem and needs to be avoided if possible. Hatcheries are already in operation and have established successes and shortcomings, which will aid in the development of management and operation strategies in the new hatchery facilities. Furthermore, controlled and focused experiments regarding the way smelt react to different stressors will aid in future conservation strategies as knowledge is gained. The problems with captive breeding pale in comparison to issues related to smelt extinction. Therefore, a captive breeding program is not only beneficial, but essential for smelt.

Comment 7: Conservation Measure 19- Urban Stormwater Treatment- The purpose of CM19 is to reduce contaminants entering the delta by effectively managing storm water runoff (BDCP, 2013). CM 19 intends to accomplish its goals by slowing runoff, filtering and removing particulates and pollutants (BDCP, 2013). CM 19 goals will be achieved by constructing retention ponds to hold runoff, create a network of vegetated buffer strips to slow runoff velocities, and by constructing curb extensions next to commercial businesses to carry oil and grease away from waterways (BDCP, 2013). Storm water runoff can carry sediments, grease, oils, metals, pesticides, and other toxic chemicals into neighboring waterways, which affects processes relating to fish condition and population abundance (Bennett, 2005).

Exposure to contaminants can have drastic effects on smelt biology. Pyrethroid pesticides and other synthetic compounds used in agriculture and lawn care pose a significant threat to delta smelt (Bennett, 2005). Pyrethroids were found in 79% of tested urban runoff throughout the delta (Weston & Lydy, 2010). Studies show delta smelt contaminated with extremely low doses of synthetic compounds had cancer cells, and suffered from fragmented deoxyribonucleic acid (DNA), which interferes with endocrine development (Bennett, 2005).

CM19 will be beneficial for smelt because it will reduce contamination stressors. Contaminants are abundant in the delta and affect all life within the ecosystem, although the extent to which contaminant exposure affects the smelt population is uncertain, it is known that these compounds negatively impact the delta (Bennett, 2005).

Comment 8: Conservation Measure 2- Recreational Users Invasive Species- CM 20 is intended to reduce the number of invasive clam species (Corbicula fluminea, Corbula amurensis and Potamocorbula) from entering the estuary. Program actions involve routine inspections of recreational watercraft, trailers, and other equipment, as well as education and outreach information provided to recreational water users. Inspections on the ground will be done by various agencies including California Fish and Wildlife Service, the implementation office (BDCP), Reclamation, and local water districts (BDCP, 2013). Boats and other water bound vehicles are common vectors of invasive clams, facilitating there migration throughout the delta (BDCP, 2013).

The Sacramento-San Joaquin delta is relatively unproductive compared to other estuaries (Baxter *et al*., 2008). Food availability (phytoplankton biomass) for smelt has been declining over the past few decades (Baxter *et al*., 2008). Smelt caught for research purposes had low glycogen levels in their livers indicating there was a limitation in food availability (Bennett, 2005). Studies have shown the decrease in phytoplankton biomass can be partly attributed to the introduction of the invasive clam, an effective pelagic filter feeder able to out compete with smelt for food (Baxter *et al*., 2008). These clams have the ability to filter twelve times the water column present above them each day (Baxter *et al*., 2008). These clams can tolerate a wide range of habitat conditions, making them prevalent throughout the estuary. Unfortunately, these clams share the same habitat and prey needs and are constantly competing for resources. The overbite clam reduces food availability for smelt; however, its relative influence is not known (Baxter *et al*., 2008).

CM 20 will not significantly alleviate food availability stressors for delta smelt. Slowing the spread of invasive clams can reduce the likelihood competition with smelt will intensify in the future, but it does not remove clams already present in the estuary. Furthermore, it is likely the clams only represent a small portion of factors effecting food availability stressors on smelt.

Conclusion

A century and a half of anthropogenic alterations to waterways and landscapes have compromised the stability of the delta. California's hydrologic regime is almost completely artificial. Urban and agricultural developments have spread through the state, increasing the demand for water. Stakeholders with opposing views are locked in a battle over water that only intensifies with the risk of floods, droughts, earthquakes and climate change. Environmentalists, developers, water districts, farmers, and government constantly oppose one another, which affects water reliability for many users. For example, the Central Valley Project and State Water Project pumps are required to turn off during salmon runs, which decreases the amount of water received by downstream users. Delta smelt and other species in the delta are innocent bystanders in the human induced chaos they are experiencing. For this reason, numerous monitoring and restoration programs are in place to restore smelt habitat and population size. The newest edition of these plans is the BDCP, a comprehensive delta conservation strategy.

The BDCP is a good start, but there are many uncertainties to the plan that need to addressed before moving forward. Reducing the effects from years of anthropogenic alterations with more alterations doesn't seem wise. However, something needs to be done to restore the delta. The proper decision making needs to be based on scientific facts, with goals of improved ecosystem structure, function, and longevity; rather than the short term monetary or political interests.

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