http://www.delta.dfg.ca.gov/baydelta/monitoring/delta.asp

http://www.delta.dfg.ca.gov/gallery/dsmelt.asp

THE DELTA SMELT

The Bay-Delta is the West Coast's largest estuary, with 14 communities and an approximate population of 515,264 * along its banks. The Delta provides drinking water for approximately 25 million people in California and supports a $27 billion dollar agricultural industry.

Serving as the primary water supply in the state of California, the Delta is continuously the crucial topic of discussion and debate when discussing water issues.

However controversial the Delta may be, there is yet one tiny little fish that has the attention of us all. One of the smallest of creatures residing in the Delta that could limit the water supply to Southern California just by not existing any longer. It is the Delta Smelt, or *Hypomesus transpacificus*.

The Delta smelt is a tiny, slender-bodied fish with a typical adult size of 2-3 inches that is found only in the Sacramento-San Joaquin Estuary (the wide part of a river where it nears the sea; fresh and salt water mix). Historically, it was one of the most common species in the Estuary; however, the population declined dramatically in the early 1980's, and continues to do so today.

Delta smelt are considered environmentally sensitive because they only live one year, have a limited diet, and reside primarily on the edge of salt and freshwater (brackish).

The Delta smelt population is affected by the amount of outflow from the Estuary (which varies from year to year) due to the amount of rainfall and water management.

It has been observed that the Delta smelt population does better when outflow is allowed to flow downstream and create a nursery habitat for Delta smelt in Suisun Bay. The Suisun Bay is a shallow tidal estuary located in central California, USA. It lies at the confluence of the Sacramento and San Joaquin Rivers, thus forming the entrance to the Sacramento-San Joaquin River Delta, (an inverted river delta). Suisun Marsh is the tidal marsh land located to the north of the bay, and is the largest marsh in California.

The Delta is the habitat for so many fish, birds, mammals and plants, that it would seem unlikely that one little tiny species of fish could stop the flow (and pumping) of a major water supply in California; but it has.

The Delta Smelt is listed as a threatened species under the Federal and State Endangered Species Acts, and these agencies have taken immediate and considerable measures to protect the species.

The sudden critical decline of these fish, including the decline of their associated food organisms, referred to as the Pelagic Organism Decline (POD) is of grave concern to the scientists studying the Delta waterways. They have recently documented a major and unexpected decline (approximately 90 percent) in young Delta smelt produced this

season. Although quite disturbing, the location of the young fish is an even greater concern. They were found in the channels within the influence of South Delta diversions, including the State and Federal pumping plants. And as if that were not bad enough, there have been several observed incidents of toxic waters in the nursery area of the baby smelt. Collections of Delta smelt juveniles in the estuary are the lowest on record.

So we ask, “What can be done to save these small “minnow-sized” fish?” That was temporarily answered for us!

In response to this situation, the Department of Fish and Game (DFG) asked the Department of Water Resources (DWR) Director to “cease pumping” water at the Harvey O. Banks facility, (to the maximum feasible extent consistent with health and safety), and still maintain agricultural barriers in the South Delta.

The Harvey O. Banks facility is a pumping station located at the beginning of the 444 mile California Aqueduct. The aqueduct is the central artery of the State Water Project, (one of three major aqueduct systems in the state of California.) Water is drawn out of the Sacramento River Delta through this plant, and begins its journey

through the largest aqueduct system in the world, finally ending up in Los Angeles. This aqueduct system supplies water to the agricultural communities for most of Southern California.

Additionally, the Department of Fish and Game also notified other Delta diverters, including agricultural users, intake facilities and energy diverters to “voluntarily cease or substantially reduce your diversions from the south Delta channels, as your operations will allow”.

The Interagency Ecological Program (IEP) also directed that all “non-essential” projects must cease fish sampling upstream of the Carquinez Bridge and downstream of Sacramento on the Sacramento River and downstream of Vernalis on the San Joaquin River”; (areas on all sides affecting the Delta.)

Moreover, DFG is also working with the Regional Water Quality Control Board, the Department of Pesticide Regulation and the Department of Food and Agriculture to determine the source, impacts, and potential remedies for observed toxicity in the system.

The Delta Smelt has been referred to as the “canary in the mines” so to speak. If the Delta Smelt is disappearing, there’s cause for

concern. It is an indication that the entire ecosystem of the Delta may have a problem. They are an annual species. Because they do not have overlapping generations, delta smelt must exhibit some level of recruitment each year (key life stages - meaning the adult fish) to maintain persistence of the population. This contributes to their marked fluctuations over time and increases the importance of chance environmental (flood) or human-induced (toxic spill) mechanisms on annual abundance. Delta smelt population dynamics, therefore, are dominated by the recruitment process.

The Life Cycle of the Delta smelt is as follows:

1. Spawning - Delta smelt spawn adhesive eggs in freshwater habitat under tidal influence typically from late February to early June, although neither the quality nor quantity of this habitat has been documented. (Mager 1997, J. Lindberg. *Pers. Comm*.)
2. Growth effects - In aquatic systems, the probability of mortality decreases with size, such that accelerated growth reduces the cumulative effect of mortality on a cohort (Houde 1987). Several recent modeling studies indicate that cohorts with higher average individual growth rates or higher variability among individuals in growth exhibit higher recruitment success (Rice et al. 1993, Cowan et al. 1996). In addition, these studies indicate

that small changes in growth rate can translate into dramatic differences in recruitment success. Because the mean length of adult delta smelt has fallen markedly since 1990, effects on growth rate are likely occurring. Several factors can affect growth:

- Predators – (defined as killing and eating among potential competitors) several lines of reasoning and analyses of IEP monitoring data suggest Silversides may be preying on the young larvae of the Delta Smelt.
- Toxicity - While catastrophic mortality due to toxic runoff is possible, detected levels of dissolved contaminants in the delta smelt habitat are typically much lower than those producing mortality in fish bioassay studies (A test used to determine such strength or activity). (Bennett 1996). However, pulses of toxic-runoff have been detected in the Delta at levels sufficient to kill zooplankton, thus potentially depleting local food supplies for fish (Kuivilla and Foe, 1995).
- Feeding habits - Reductions in production of preferred food during low-outflow years may be an important factor influencing growth and mortality throughout the annual cycle.

- Entrainment - Mortality estimates between the egg and juvenile stage correlate with the percent of outflow diverted; suggesting entrainment may be an important factor for fish when it comes to their survival (entrapment mechanisms).
- Risk spreading - Potential sources of mortality are more prevalent at certain times or in particular areas. For example, entrainment effects are presumably greater for smelt in the south Delta than elsewhere, and potential predation by exotic fishes is higher for larvae in the Delta than Suisun Bay. As noted above, the timing and degree of freshwater outflow influences the transport of larval smelt. Delta smelt abundance increases (but not always) and exhibits a broader distribution only in years with higher outflow during late spring.
- Water Transport - Estuarine hydrodynamics while not directly affecting growth can influence recruitment in several ways, including retention of larvae in the Low Salinity Zone (LSZ).

It has been stated that there are many causes of the decline in this little fish species such as; (as stated above); toxics, invasive species,

and diversion can be some of them, but there are not too many remedies within our control; however, shutting off the pumps happens to be one thing we *can* do.

In early 2005, the Interagency Ecological Program (IEP) first identified the decline in these pelagic fish (Surface feeding or free swimming fish). Since that time the state has initiated costly and all-embracing studies to determine the causes for the decline in the Bay/Delta Estuary.

Earlier in the year, from January to May 2007, the State Water Project (SWP) modified its operations and 300,000 acre-feet of water was used to reduce exports to help protect the Delta smelt, and during that time, there were no Delta smelt recorded in the SWP fish salvage operations. Also in Mid-May, exports were reduced again due to distribution of Delta smelt in areas that made them even more susceptible to pumping. Gradually the Delta smelt began to appear at these pumping locations and the numbers have increased in recent days, which triggered a more critical action.

The pumping action at the Harvey O. Banks facility was stopped on May 31st, 2007. Some water deliveries were made to South San

Francisco Bay users from supplies already in the aqueduct. However, on June 10th, the Department of Water Resources resumed limited pumping to meet critical water supply needs. The pumping facilities increased pumping once again on June 17th.

That decision was based on more favorable tidal conditions for Delta smelt, rising water temperatures that will push the fish into cooler regions of the Bay-Delta and of course, the growing water demands in Southern California, as summer heats up the earth and water use is naturally increased during this season. Each spring, mammoth pumps (supplying the state and federal aqueducts with water) rev up to meet demand. The pumps are so powerful that they can reverse the flow of water in nearby delta channels. The Delta Smelt are not strong enough to swim away, and therefore perish. As the Delta water warms in late spring to temperatures considered lethal to smelt, the fish typically flee to colder water near San Francisco Bay where they would be out of the range of the pumps, but this year, the native fish have lingered, probably because cooler weather in the Central Valley and cold releases from upstream reservoirs have kept delta water temperatures lower.

The Director of DWR stated that although the pumps have been turned back on, they will continue to do everything possible to protect this little fish. The Delta smelt will continue their seasonal migration downstream with as many of them as possible, (or as little that are left) in hopes of surviving their struggle in the Delta for another year.

Governor Schwarzenegger has proposed a wide-ranging resolution to employ a long term Delta sustainability plan, as well as new surface and groundwater storage, restoration programs and additional conservation measures.

Whatever the outcome, the smelt predicament has cast a spotlight on the fate of the delta, considered by environmentalists to be an ecosystem in collapse. A congressional subcommittee has planned a Bay Area hearing to address the Delta's environmental troubles and the movement of water between Northern and Southern California.

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