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Occurrence of delta smelt (*Hypomesus transpacificus*) in the lower Sacramento River near Knights Landing, California

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The delta smelt (*Hypomesus transpacificus* [McAllister 1963]), is a small, slender-bodied smelt (Family Osmeridae) endemic to the San Francisco Estuary, California. These near-annual fish typically grow to a length of 55-70mm FL and will rarely grow to lengths exceeding 80mm (Moyle et al. 1992). Delta smelt, though able to withstand a wide range of salinities, typically reside in the upper region of the estuary, where fresh water from the Sacramento and San Joaquin rivers and the Sacramento-San Joaquin Delta's (Delta) brackish water mix, leading to a low level of salinity ranging from 2-7 ppt (Moyle et al.1992, Swanson et al. 2000, Moyle 2002). The location of these areas in the water system fluctuates annually, and is impacted by changes in incoming fresh water flows (Moyle et al. 1992). During times when there is a low influx of fresh water, the mixing zone will be found higher in the river systems. During times of high fresh water influx, however, the mixing zone will occur further into the Delta and can, in extreme floods, be found outside the Golden Gate. Changes in mixing zone location will also lead to changes in the locality of the delta smelt (Stevens et al. 1983, Moyle et al. 1992, Moyle 2002, Swanson et al. 2000).

During the months of September and October, spawning adults will migrate from the waters of the lower estuary into freshwater systems upstream (Stevens et al. 1983, Moyle 2002). Spawning occurs only in fresh water in sloughs and shallow edge waters of channels in the upper Delta and in the Sacramento River above Rio Vista (Moyle 2002).

There has been a dramatic decrease in delta smelt numbers associated with a variety of environmental factors, including a long-term decline in carrying capacity, with recent studies showing that it is one of four pelagic fishes in the Delta whose indices of abundance declined rapidly to record lows starting in 2002 (Feyrer et al. 2007, Baxter et al. 2008). This species was listed as "threatened" under the Federal Endangered Species Act in March 1993, and under the California Endangered Species Act in December 1993.

A recent study analyzing data from several monitoring programs provided a comprehensive description of the current range and temporal and geographic distribution of

delta smelt by life stage in the San Francisco Estuary (Merz et al 2011). The most upstream location was found to be the confluence of the Sacramento and Feather rivers at the Verona Marina, Sutter County (Verona; Figure 1).

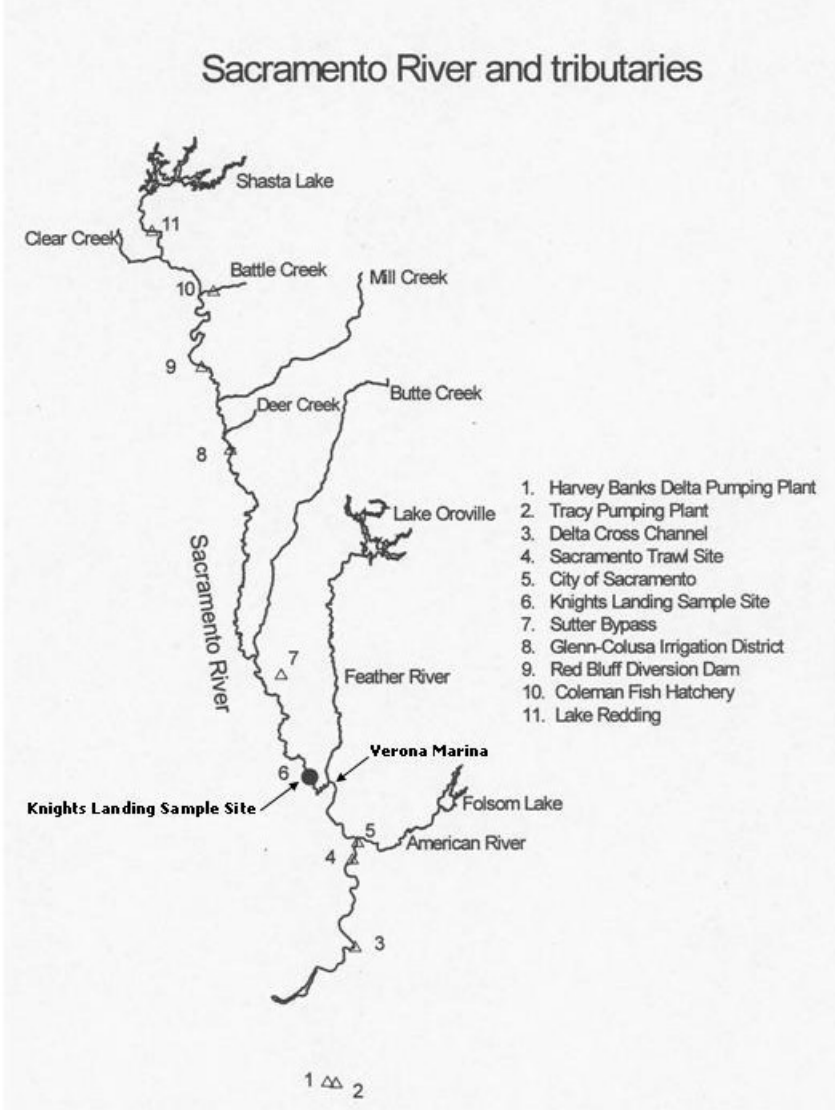

Figure 1.—Relative location of the Knights Landing, Yolo County, monitoring site in the upper Sacramento River, California.

On 24 March 2010, a delta smelt (Figure 2) was captured in a rotary screw trap located 0.8 km downstream from Knights Landing, California on the lower Sacramento River at river km 142 (38° 47' 45" N, 121° 41'33" W). The two, 2.4-m diameter rotary

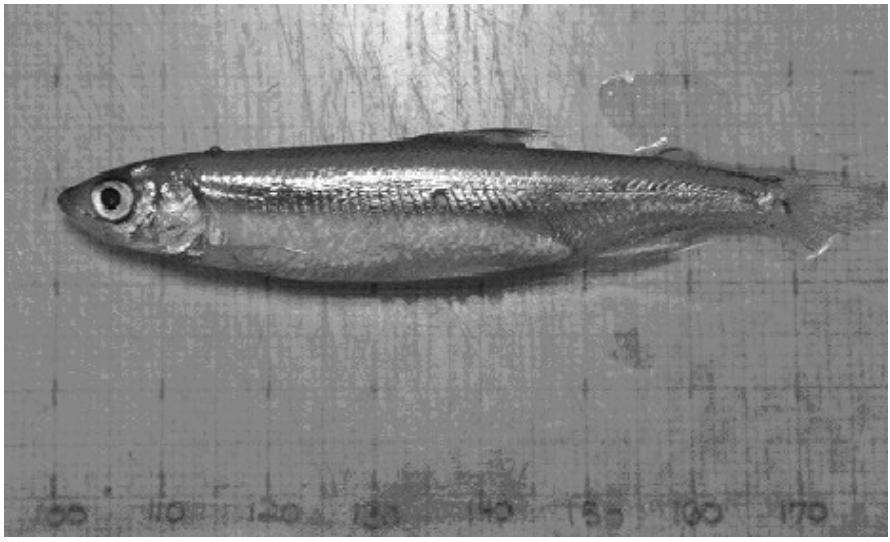

Figure 2.—Specimen of delta smelt collected at Knights Landing, Yolo County, California on 24 March 2010; photo by the authors.

screw traps, operated by the California Department of Fish and Game (CDFG), are in place to monitor the timing and abundance of emigrating juvenile salmonids from the upper Sacramento River basin (e.g., Snider and Titus 2000). During the sampling interval in which the specimen was collected, the water temperature was 17.2° C, river flows were 207 cms, and turbidity was measured at 9.4 NTUs. The specimen measured 80mm TL and weighed 3.22g. A trained CDFG crew observed the specimen during normal monitoring procedures and verified its identification. This specimen was collected 13 km further upstream than previously recorded at Verona (rkm 129).

Adult delta smelt spawn during the late winter and spring months, with a gradual, diffuse migration landward to the freshwater portions of the Delta. In dry years delta smelt spawn primarily in the north Delta region, while in wet years spawning is more evenly distributed among regions, including the Napa River (Bennett 2005). As of 1 March, The Department of Water Resources categorized early 2010 as a dry year (http://www.water.ca.gov/drought/docs/DroughtUpdate-033010.pdf), meaning less fresh water coming down into the Delta, and that situation could have driven delta smelt higher into the system while seeking suitable spawning habitat. We cannot ascertain exactly what conditions led this (and possibly other) delta smelt to migrate far enough up the Sacramento River to be entrained in the rotary screw traps at Knight's Landing.

Interagency Ecological Program (IEP) beach seine monitoring has been ongoing since 1977 including locations in the Sacramento River at Verona and further upstream (Merz et al 2011). During these surveys, no delta smelt were observed at sites above Verona, which may indicate that there is no suitable habitat for delta smelt spawning, or that Verona may be the uppermost limit of delta smelt freshwater tolerances. In the future, observations of delta smelt further upstream from Verona may help address questions on the geographic distribution and habitat use of this species, and what effects this finding may have on future water management decisions.

Acknowledgments

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Literature Cited

Baxter, R., R. Breuer, L. Brown, M. Chotkowski. F. Feyrer, M. Gingras, B. Herbold, A. Mueller-Solger, M. Nobriga, T. Sommer, and K. Souza. 2008. Pelagic organism decline progress report: 2007 synthesis of results. [Internet]. California Department of Fish and Game, Stockton, USA. Available at http://www.science.calwater.ca.gov/pdf/workshops/POD/2007_IEP_POD_synthesis_report_031408.pdf

Bennett, W. A. 2005. Critical assessment of the delta smelt population in the San Francisco Estuary, California. [Internet]. San Francisco Estuary Watershed Science 3(2). Available at: http://www.escholarship.org/edu/uc/item/0725n5vk.

Feyrer, F., M. L. Nobriga, and T. R. Sommer. 2007. Multidecadal 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.

McAllister, D. E. 1963. A revision of the smelt family, Osmeridae. Bulletin of the National Museum of Canada 191.

Merz, J. E., S. Hamilton, P. S. Bergman, and B. Cavallo. 2011. Spatial perspective for delta smelt: a summary of contemporary survey data. California Fish and Game 97:164-189.

Moyle, P. B. 2002. Inland fishes of California. University of California Press, Berkeley, USA.

Moyle, P. B., B. Herbold, D. E. Stevens, and L. W. Miller. 1992. Life history and status of delta smelt in the Sacramento-San Joaquin Estuary, California. Transactions of the American Fisheries Society 121:67-77.

Snider, B., and R.G. Titus. 2000. Timing, composition and abundance of juvenile anadromous salmonid emigration in the Sacramento River near Knights Landing, October 1998-September 1999. Stream Evaluation Program Technical Report No. 00-6. California Department of Fish and Game, Sacramento, USA.

Stevens, D. E., and L. W. Miller. 1983. Effects of river flow on abundance of young chinook salmon, American shad, longfin smelt, and delta smelt in the Sacramento-San Joaquin River system. North American Journal of Fisheries Management 3:425-437.

Swanson, C., T. Reid, P. S. Young, and J. J. Cech Jr. 2000. Comparative environmental tolerances of threatened delta smelt (*Hypomesus transpacificus*) and introduced wakasagi (*H. nipponensis*) in an altered California estuary. Oecologia 123:384-390.

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