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Prepare for extinction of delta smelt

Posted on [March 18, 2015](#) by [UC Davis Center for Watershed Sciences](#)



An adult delta smelt caught in a survey of fish in the Sacramento-San Joaquin Delta. *Photo: UC Davis*

By Peter Moyle

I saw my first delta smelt in 1972, during my first fall as an assistant professor at UC Davis. I was on a California Department of Fish and Wildlife trawl survey to learn about the fishes of the Sacramento-San Joaquin Delta. The survey then targeted young striped bass, but the trawl towed behind the boat captured large numbers of the native delta smelt.

I remember a single haul with a couple hundred of these iridescent finger-length fish being

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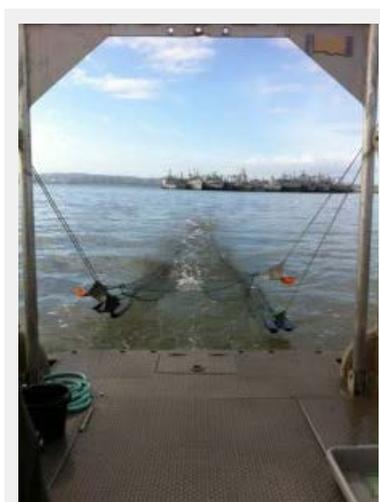
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dumped into a container on deck. I decided to study smelt biology because these fishes were so abundant and yet so poorly studied. I would have no trouble collecting enough of them for my research.

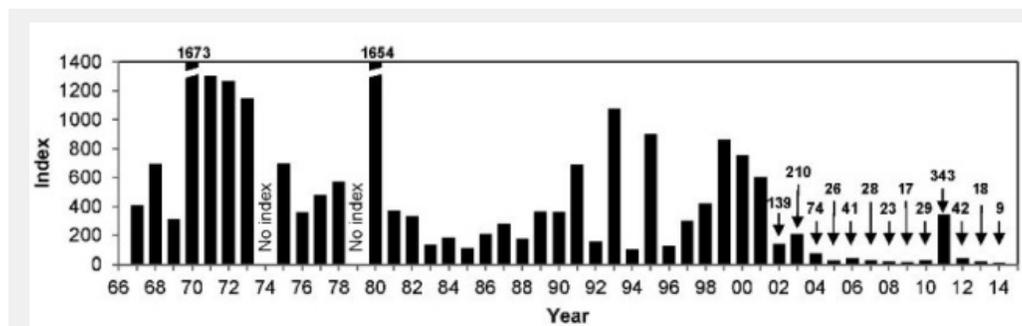
Lee Miller, the biologist in charge of the surveys, started preserving the smelt catches for me. Each year for three years a pickup loaded with quart bottles of delta and longfin smelt would arrive at my laboratory. For a diet study alone, my technician and I dissected 1,055 delta smelt.

Today, few delta smelt remain in the wild. Researchers get their samples from special labs where the smelt are bred in captivity.

The state's 2014 fall mid-water trawl survey showed the lowest number of delta smelt in 47 years of recordkeeping (See chart below). Last week, the state conducted its annual spring Kodiak trawl survey, which is designed to capture delta smelt as they aggregate to spawn. They caught only six smelt — four females and two males [1] [2].

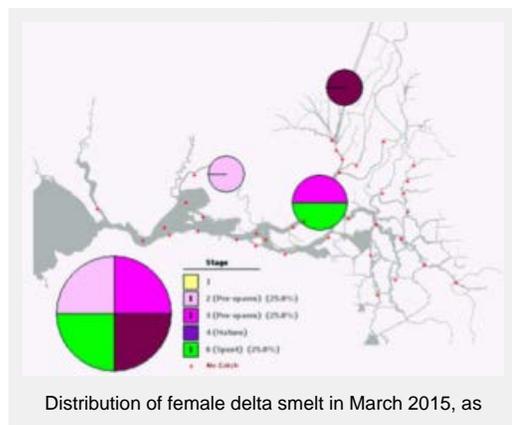


A mid-water trawl used in fall surveys of Delta fish. Photo: California Department of Fish and Wildlife



Delta smelt annual abundances as determined by fall mid-water trawl surveys. Source: California Department of Fish and Wildlife

The dismal catch prompted me to advise the state's Delta Stewardship Council [on Monday](#) that delta smelt appear to approaching the point of no return, with extinction in the wild possible in the next year or two.



Distribution of female delta smelt in March 2015, as

I say “in the wild” because there are two captive populations of smelt. The U.S. Fish and Wildlife Service manages a backup population at its fish hatchery below Shasta Dam, and UC Davis produces smelt for experimental and conservation purposes at a lab in the Delta, just south of Stockton. Both facilities raise hundreds of smelt at a time through their entire life cycle. Each fish is tagged and its genetics recorded

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determined by the annual spring Kodiak trawl survey.
Source: California Department of Fish and Wildlife

for precise mating, to maximize genetic diversity. Each year a few wild smelt are brought in to mix their genes with those of the captive brood stock.

- August 2011 (5)
- July 2011 (4)
- June 2011 (5)
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We don't know what the minimum population size has to be for successful reproduction to occur in the wild. But it must be hard for males and females to even find one another today, and even harder to find partners that are in the right stage of maturity for spawning. Most of these fish have a one-year life cycle, apparently dying after spawning. A few live two years. This means a bunch of them have to spawn successfully every year to maintain a viable population.



Delta smelt rearing tanks in captive breeding facility run by UC Davis near Stockton. Photo by Dale Kolke California Department of Water Resources

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We don't know with absolute certainty that wild delta smelt will disappear within the next couple of years. But the likelihood is high enough that we should be prepared for it. We need to start answering questions like these:

- How do we know when the delta smelt is truly extinct in the wild? Who makes the decision? It is worth noting that the last [thicktail chub](#) was caught in the Delta's Steamboat Slough in 1957 but not recognized as extinct for at least 30 years — and without an official declaration.
- Should the last of the delta smelt be captured so their genes can be added to the captive population, as was done for the California condor?



Counting delta smelt eggs. One inch in the tube means 1000 eggs. Photo by Dale Kolke, California Department of Water Resources

- Can captive populations be used to restore the delta smelt in the wild? This is not easy to answer. Obviously, this would not work as long as conditions that caused the smelt to decline remain. These conditions include competition and predation by alien species, altered food supply, multiple water contaminants and water exports upstream and within the Delta. The extended drought presumably has worsened these conditions and pushed the smelt over the edge of the extinction cliff, or at least close to it [3].
- How does management of the Delta change if delta smelt are extinct in the wild? It is hard to do anything water-related in the Delta without considering its impacts on delta smelt, particularly operation of state pumping facilities and wastewater treatment plants. For example, in the past year federal fish officials placed no restrictions on pumping from the South Delta because the smelt

were mostly not there.

Presumably, protecting delta smelt has benefited other native fish because it is the species most sensitive to changes in the Delta's waterways. Other listed fish species that affect and are affected by Delta management include winter- and spring-run Chinook salmon, longfin smelt, green sturgeon and Central Valley steelhead.

We need to prevent more fish from achieving the cliff-hanger status of delta smelt. We need to extend proactive management from species already listed to those headed in that direction, including hitch, blackfish, splittail, tule perch and white sturgeon. This requires learning more about their requirements and managing parts of ecosystem specifically for their benefit, including tidal marshes.

I hope we still have enough smelt and enough time to keep the species from altogether disappearing from the Delta. But, as my geologist colleague [Jeffrey Mount](#) is fond of saying, "Hope is not a strategy." We need to be planning for delta smelt extinction and, perhaps, its resurrection.

Peter Moyle, a professor of fish biology, is associate director of the Center for Watershed Sciences at UC Davis.

[1] Numbers were much higher in 2002 – 2014 (e.g., [Bennett 2005](#)). Intensive Kodiak trawl surveys near the state and federal water projects (Jersey Point) in 2014 caught so few fish that the U.S. Fish and Wildlife Service placed no restrictions on Delta pumping that year. In 2013, this survey captured 329 smelt in 737 tows of the trawl, with 78 percent of the tows catching no fish. This may seem like a high number but the high-intensity sampling spanned a two-month period when smelt populations should be at their peak. Presumably few, if any, of the highly sensitive fish survived the experience.

[2] The numbers of delta smelt are only a fraction of what they were in 1993 when both the state and federal governments listed the species as "threatened" with extinction.. The designation occurred because its numbers were a small fraction of those in the early 1980s when the population decline began..

[3] At the very least, reintroduction would have to wait until we had some wet years with lots of inflow from the rivers. But if we wait too long for reintroduction, the smelt may not be capable of living on their own in the wild. Having multiple generations in captivity tends to alter behavior and general 'fitness' of fish. The problems hatchery salmon have surviving in the wild are a reflection of this lack of natural selection.

Further reading

Bennett WA. 2005. "[Critical assessment of the delta smelt population in the San Francisco Estuary](#)," California. *San Francisco Estuary & Watershed Science*

Quinton, A. 2015. "[Endangered delta smelt may be extinct](#)." Capital Public Radio. March 16, 2015

Ruyak B. 2015. "[UC Davis fish biologist: delta smelt 'functionally extinct'](#)." Capital Public Radio, Insight with Beth Ruyak. March 18, 2015