Delta Smelt Investigations

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The 1997 water year was characterized as "wet," however the majority of inflow to the estuary occurred early in the year. After January, there was a very quick transition to low and stable outflow conditions (Figure 1). By April, conditions in the estuary resembled a dry water year and delta smelt responded in a similar manner. In contrast, the 1996 water year (an above normal water year) had peak outflows in February and an additional outflow event in May.

Delta smelt distribution in spring 1997 was limited to the eastern estuary with most of the spawning occurring in the central delta (Figure 2). By mid-May, distribution had shifted to the western delta, although a portion remained in the central delta which became vulnerable to entrainment at the CVP and SWP (Figure 3). By mid-June, distribution resembled that of a typical dry with the majority of delta smelt in the lower Sacramento River. By mid-July, distribution had shifted downstream to include Suisun Bay (Figure 4). No delta smelt were observed in the Napa River this year as had been observed in 1995 and 1996.

Delta smelt abundance indices from both the summer townet survey and the fall midwater trawl survey vary dramatically from year to year and do not necessarily track each other (Figures 5 and 6). The 1997 summer townet abundance index was 4.0, which is relatively low. The 1997 fall midwater trawl index was 360.8, which is near average, however it is lower than the other "odd" years in the 1990s (e.g., 1991, 1993, 1995). This phenomenon of higher index values in recent odd years has been noticed, although its significance is unexplained.

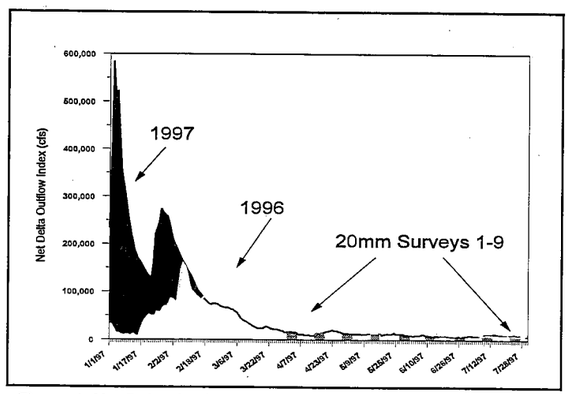


Figure 1. Net Delta Outflow Index for January-July 1996 and 1997. Vertical bars represent the dates of the nine 20 mm surveys.

Salvage of delta smelt at the CVP and SWP was similar to 1996. A total of 85,791 delta smelt was salvaged at both the facilities in 1997 (Figure 7), compared to 91,447 in 1996 (Figure 8). The 1996 salvage exhibits the two characteristic peaks of delta smelt salvage; a small peak in January or February resulting from adult delta smelt moving upstream into fresh water to spawn, and a larger peak from May through July of young-of-the-year delta smelt. The 1997 salvage does not exhibit the early peak of pre-spawning adults in January and February, presumably due to high outflows and reduced exports during that period. The monthly delta smelt take limit of 9,769 for May was exceeded threefold and exports were restricted in late May and early June, although exports were allowed to exceed the 35% export/inflow ratio in late June (see Fall 1997 IEP Newsletter article "*Delta Smelt Concerns Result in Changes in SWP/CVP Operations*"). A special reconaissance 20mm survey was completed on May 20 which was designed to evaluate the potential to take large numbers of delta smelt at the facilites (Figure 9). The survey found densities of delta smelt in front of the CVP five times higher than the densities observed at the facility, however this portion of the population was disjunct from the main population in the western delta.

Directed studies of delta smelt research resulting from the delta smelt workshop held in May 1996 were initiated in 1997. Dietary analyses of all life stages of delta smelt and juvenile growth based on otolith analyses were completed and results were reported in the Winter 1998 IEP Newsletter as well as at the 1998 annual conference at Asilomar. Key findings are: (1) delta smelt larvae have the highest electivity towards the copepod, *Eurytemora affinis*, and might be limited by food supply; (2) juvenile and adult delta smelt feed primarily on juvenile and adult copepods primarily *E. affinis* and *Psuedodiaptomus forbesi* and the electivity for *E. affinis* continues throughout its life; and (3) as delta smelt grow older they move farther down the estuary.

The investigation of the utilization of shallow water by larval delta smelt completed its first year of sampling. Preliminary results suggest: (1) larval delta smelt are mainly surface oriented, (2) juvenile delta smelt are exclusively surface oriented, and (3) larval delta smelt are not found in significantly higher densities along the shore. These results are preliminary and more analyses and additional sampling are needed to confirm these results.

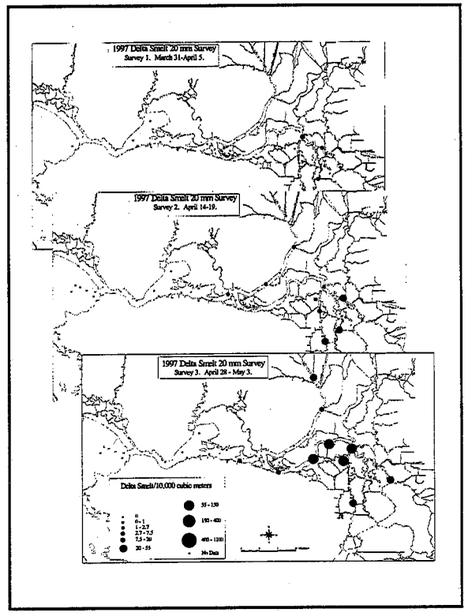


Figure 2. Delta Smelt Density and Distribution in 20 mm Surveys 1-3 in 1997. Circles represent the average density (delta smelt/10,000m^3) at each station sampled three times every two weeks.

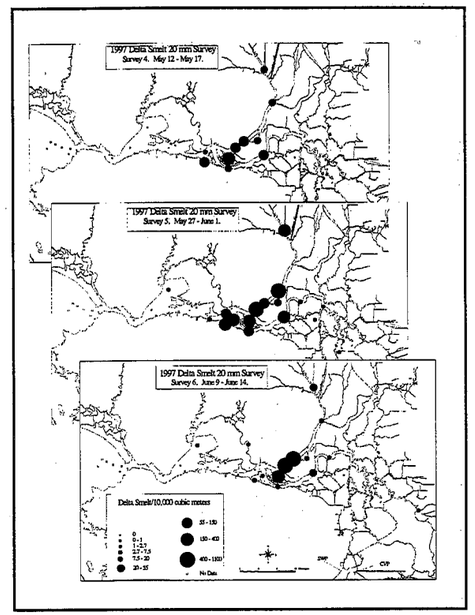


Figure 3. Delta Smelt Density and Distribution in 20 mm Surveys 4-6 in 1997. Circles represent the average density (delta smelt/10,000 m^3) at each station sampled three times every two weeks.

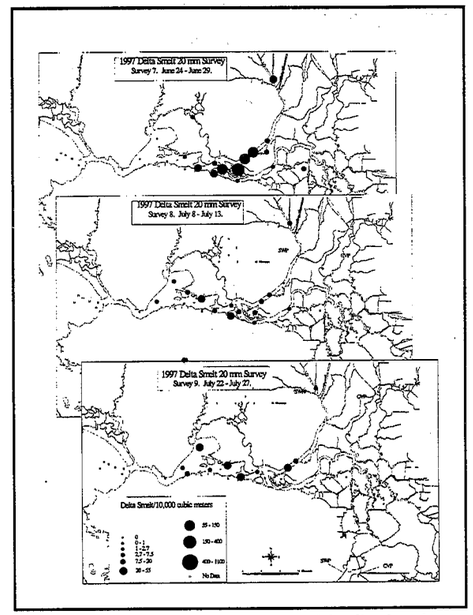
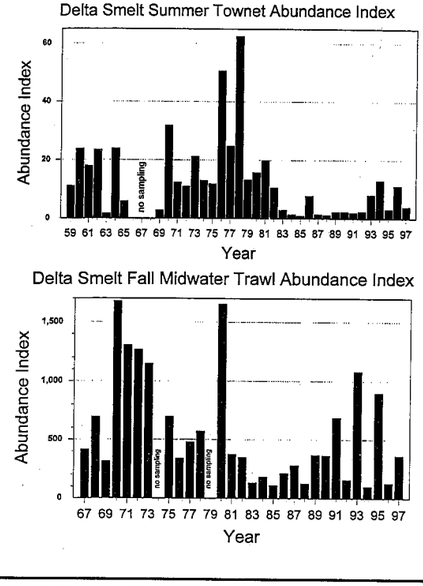
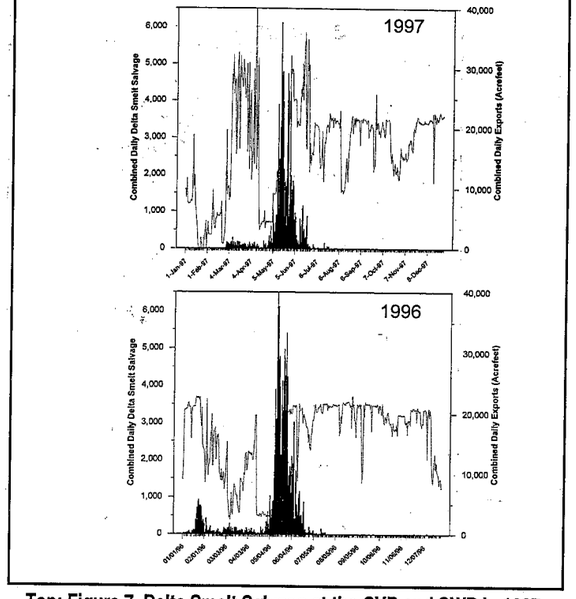


Figure 4. Delta Smelt Density and Distribution in 20 mm Surveys 7-9 in 1997. Circles represent the average density (delta smelt/10,000m^3) at each station sampled three times every two weeks.



Top: Figure 5. Summer Townet Abundance Index for Delta Smelt. Values represent the sum of volume-weighted means of 8 sampling areas. The average of the first two surveys is used. No sampling in 1969-1996.

Bottom: Figure 6. Fall Midwinter Trawl Abundance Index for Delta Smelt. Values represent the sum of volume-weighted means of 17 sampling areas sampled monthly, September through December. No sampling in 1974 and 1979.



Top: Figure 7. Delta Smelt Salvage at the CVP and SWP in 1997. Bars represent combined daily salvage of delta smelt. Line representss combined daily exports in acre-feet.

Bottom: Figure 8. Delta Smelt Salvage at the CVP and SWP in 1996. Bars represent combined daily salvage of delta smelt. Line represents combined daily exports in acre-feet.

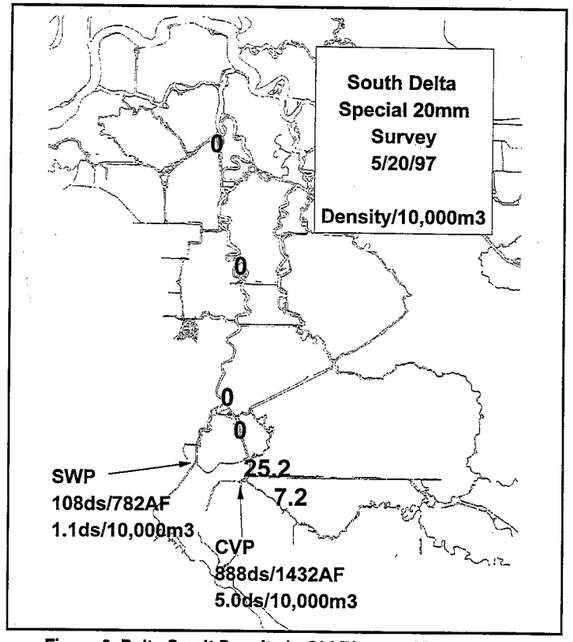


Figure 9. Delta Smelt Density in Old River on May 20, 1997. Numbers represent the average density (delta smelt/10,000 m^3) at each station sampled.

Splittail and Longfin Smelt, Winter 1998

Randall Baxter

Splittail

Splittail abundance (all ages combined) declined for the second year in a row in the 1997 Fall Midwater Trawl Survey — only a single young-of-the-year (YOY) splittail was collected (Figure 1). This was the third lowest index since 1967, only 1976 and 1977 were lower. Similar declines in YOY splittail abundance were detected by the Bay Study after record indices in 1995 (Figures 1 and 2). During the 1997 index period, the Bay Study midwater trawl collected only one YOY and the otter trawl collected none. These indices were comparable to or lower than many dry-year indices. The Suisun Marsh YOY index peaked at 1.18 fish per trawl in 1996, slightly above 1995, then declined in 1997 (Figure 2). Age groups were not separated for reporting in 1997, but the combined YOY- adult index was 0.99 fish per trawl. Considering there were good YOY indices in 1995 and 1996, the 1997 index was probably composed mostly of age-1 and adult fish. The 1995 and 1996 YOY indices were still below those of the early 1980s.

Most evidence of YOY splittail recruitment in 1997 came from non-index stations and post-index period sampling. The Bay Study otter trawl collected four YOY from new (since 1991) non-index stations in the Delta and another three were collected after October, the last month of the index period. A few additional YOY splittail were captured in both Bay Study Midwater Trawl and Fall Midwater Trawl surveys after their index periods.

Bay Study indices indicated good recruitment of the 1995 year-class to age-1 and adult in 1996 and 1997, respectively (Figures 1 and 2). Both indices of age-1 abundance reached record high levels in 1996. Adult indices in 1997 were not similarly high. The Bay Study Midwater Trawl index was higher than drought and post-drought indices except 1993, whereas the Otter Trawl index was lower than 1988, 1989 and 1993 indices, but higher than other indices since 1987. Similar to YOY, additional adults were collected by the Bay Study from non-index stations in the delta. Nine adults were collected at MWT index stations and an additional four at non-index stations; three adults were collected at OT index stations and an additional six at non-index stations.

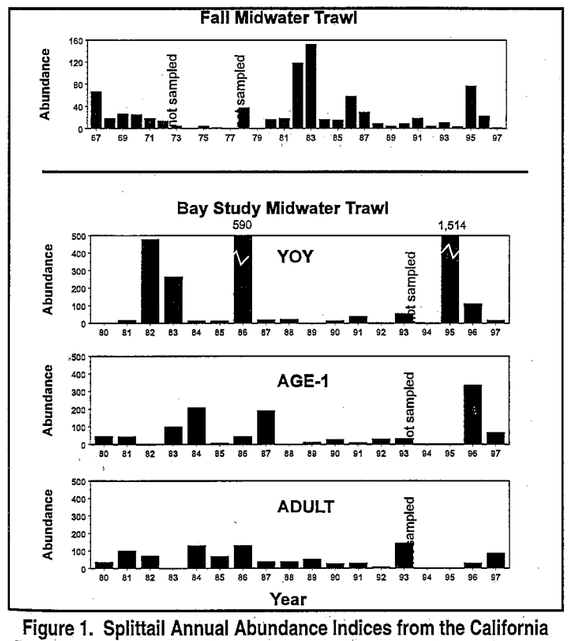


Figure 1. Splittail Annual Abundance Indices from the California Department of Fish and Game Fall Midwater Trawl Survey (all ages combined) and Delta Outflow-San Francisco Bay Survey Midwater Trawl (age groups separated)

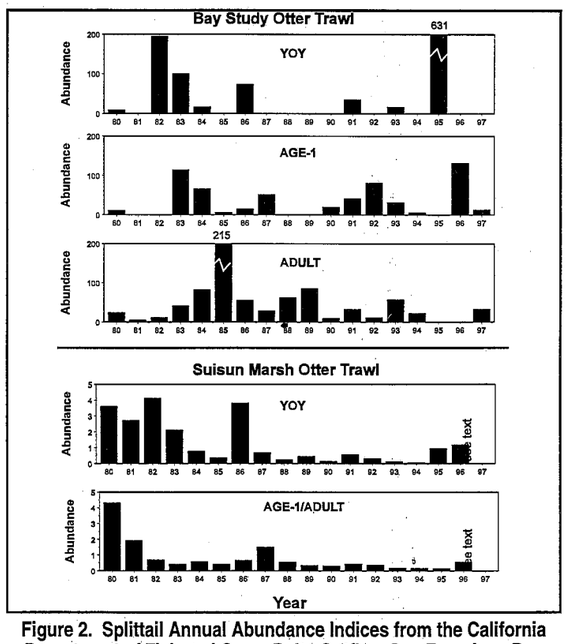


Figure 2. Splittail Annual Abundance Indices from the California Department of Fish and Game Delta Outflow-San Francisco Bay Survey Otter Trawl (age groups separated) and the U.C. Davis Suisun Marsh Otter Trawl Survey (YOY separated from age-1 and adults except in 1997)