DWR 1995. HRB

APPENDIX-1

COMMENTS ON DRAFT DELTA SMELT AND SACRAMENTO SPLITTAIL BIOLOGICAL OPINION

333

GENERAL COMMENTS

Delta Smelt

The fundamental assumption of the Draft Biological Opinion is that juvenile and larvae smelt must be transported to Suisun Bay to ensure the survival of the fish to adulthood. Many of the conclusions expressed in the Opinion and all of the "Reasonable and Prudent Alternative" are based on this assumption. The opinion cites the following points as support:

1. There is a statistically significant, positive relationship between the number of days the 2 parts per thousand isohaline (X2) is in Suisun Bay during April and the abundance of delta smelt in the fall midwater trawl surveys (p. 23 para. 3 & p. 29, para. 4).

2. There is a positive correlation between the summer townet index and Delta outflow or X2 (p. 21 para. 4, p. 22 para 1 and p. 23, para. 1).

3. Suisun Bay contains more shallow water habitat than upstream areas within which the smelt can forage and grow (p. 18, para. 2).

4. The upper estuary is deeper, narrower, and therefore has lower productivity and less food than Suisun Bay (p.18 , para. 2: p. 30, para. 1).

5. Flow needs to transport young delta smelt to Suisun Bay during the February-August period in order for the fish to ensure their ability to survive to adulthood (p.29, para. 5).

Comments on Point 1

Although a statistical relationship exists between the fall adult delta smelt abundance index and the February through June outflow (as represented by the number of days the 2 ppt salinity (X2) is in Suisun Bay), the outflow can account for less than 25% of the variation in the abundance index. The weakness of this relationship was illustrated with a "response" analysis by Buell (1994). If the lines connecting sequential years in the response diagram form a detectable pattern, then a consistent response to the independent variable is indicated. Although Buell found consistent patterns using this analysis for other species, none emerges for delta smelt (Figure 1). The variability in the abundance index is highest when X2 is between Honker Bay and Suisun Bay, however.

In summary, although there exists a positive relationship between the number of days X2 is in Suisun Bay during February through June and the abundance of delta smelt, the relationship is weak as indicated by the highly variable response of delta smelt to outflow (as expressed by X2 position). The reasons for this are not clearly understood by the scientific community. As noted in the Draft Biological Opinion (p. 23, para. 2) X2 days in Suisun Bay do not necessarily produce a high delta smelt fall abundance index. Therefore, USFWS should not assume that "if X2 were placed at the confluence.. (this would) increase both smelt abundance and distribution" (p. 22, para. 3). 1994 is a good example. Based on the number of days that X2 was in Suisun Bay this last spring, we would expect this fall's index to be about 500, well below the measured index of 101.

Comments on Point 2

The Draft Biological Opinion suggests that the relationship between the percent Suisun Index and Delta outflow discussed in DWR and Reclamation (1994) demonstrates that the "summer townet index increased dramatically when outflow was between 34,000 and 48,000 cfs placing X2 between Chipps and Roe Islands". Moreover, the Draft Biological Opinion concludes that "consistently low levels (of the summer townet index) correlate with the 1983 to 1992 mean location of X2" (Page 23, para. 1). These conclusions are incorrect.

The relationship described in DWR and Reclamation (1994) shows that a greater percent of the smelt population may be distributed into Suisun Bay in wetter years -- it does not show that overall juvenile abundance is correlated with outflow or X2. In fact, DWR and Reclamation (1994) found no statistically significant relationship between the summer townet index and Delta outflow or X2. While outflow, and hence X2, clearly affect the distribution of delta smelt, a relationship with juvenile abundance has not been demonstrated.

Comments on Point 3

The Draft Biological Opinion states that Suisun Bay is more favorable to delta smelt rearing because it contains a larger amount of shallow water habitat than the upstream areas, within which delta smelt can forage and grow. Two issues are addressed here. The first is the assumption regarding the relative quantity of shallow water habitat in the Delta and Suisun Bay. The second is the assumption regarding the delta smelt's preference for shallow water habitat.

DWR recently both reviewed available literature delineating wetland habitat and used navigation charts to measure the amount of shallow areas in Suisun Bay and the Delta. We defined shallow as being at a depth of 4 meters or less at mean low tide as did

Moyle et al. (1992). Our "ballpark estimate" from navigation maps showed that the amount of shallow water habitat in the Delta was higher that we expected based on statements in the opinion and Moyle. The Delta was estimated to contain about 10,700 acres of the shallow, open-water habitat while Suisun Bay contains about 15,000 acres (see Attachment E, Appendix E-2). San Francisco Estuary Project (1991) also reports that the Delta has about 8,200 acres of vegetated tidal marsh, while Suisun Bay has 10,700 acres. The relative importance of shallow, open water areas versus vegetated tidal marsh to delta smelt is not known, however it is apparent that both are well-represented in the Delta.

If delta smelt prefer shallow water habitat over deep water, and if shallow water habitat limits the abundance of delta smelt in the Delta, then we would expect the catch of adult delta smelt in Suisun Bay to be higher than in the Delta during "good" years. However, our analysis indicates that, on the average, more adult delta smelt have been caught in the Delta than in Suisun Bay (Figure 2). This occurred even when just the "good" years are analyzed. (Midwater trawl results show an average of 37% of the delta smelt are caught in Suisun Bay and 63% in the Delta for the period 1967-1980). An analysis of the townet summer index during the "good" period of 1969-1981 also shows that an average of 45% of the smelt reared in Suisun Bay while 55% reared in upstream areas (Figure 3). These findings suggest that shallow water habitat in the Delta may not be limiting delta smelt abundance as much as suggested in the draft opinion.

The assumption that delta smelt prefer shallow water habitat, as Moyle et al. (1992) concluded, has not been clearly established. Moyle et al. base their conclusion on sampling conducted in Suisun Bay, which contains more shallow than deep water area. However, on June 16, 1994 the Interagency Ecological Program conducted deep and shallow water sampling in the San Joaquin River off Twitchell Island, the Sacramento River off Decker Island, and in Suisun Bay. Delta smelt densities were not significantly different between shallow and deep water areas within the San Joaquin River and Suisun Bay. However, densities were significantly different between shallow and deep water habitats in the lower Sacramento River (see Attachment E, Appendix E-3). Results of this these studies are not conclusive and additional sampling is needed within the Delta and Suisun Bay over a range of smelt life stages.

Comments on Point 4

Available data does not support the draft opinion's assertion that the Delta is marginal habitat for delta smelt. As noted above, upstream areas contain a significant amount of shallow water habitat. Neither the catch of delta smelt nor the abundance indices show any indication that the Delta is "shallow

water limited." Figures 4 and 5 show that Delta habitat was used as much in the "decline" years as in the "good" years. If upstream habitat were highly marginal, then we would expect to see a downward trend during the period of smelt decline when compared to the "good" years. At the least, during the "good" years fewer adult fish should be caught in these areas than in Suisun Bay. However, no such decline is evident in these figures, and as indicated above, more fish are caught on the average in the Delta during the "good" years than in Suisun Bay.

Comments on Point 5

In support of the habitat arguments discussed above, the Draft Biological Opinion concludes that it is critical that young delta smelt are distributed into Suisun Bay, that this distribution determines their ability to survive to adulthood, and that this survival results in a higher abundance index. If this assertion is correct, then there should exist a significant relationship between the percent of juvenile delta smelt rearing in Suisun Bay in the spring and summer and the fall mid-water trawl index. Dr. Charles Hanson (Hanson Environmental 1994) analyzed data from the California Department of Fish and Game summer townet and fall mid-water trawl surveys (see Attachment E, Appendix E-1). He found no relationship between the percentage distribution for juvenile delta smelt downstream of the Sacramento-San Joaquin River confluence (Suisun Bay area) during the summer rearing period and the corresponding index of adult delta smelt abundance during the fall and early winter. The evidence simply does not support the theory that a greater percentage of fish distributed into Suisun Bay from upstream areas will result in a higher abundance index. This information correlates well with DWR's own analysis presented earlier which shows that a large percentage of delta smelt are always found in upstream areas, both during high and low fall abundance indices.

In summary, none of the evidence supports the opinion's assumptions that habitat upstream of Suisun Bay is too deep for delta smelt; that Suisun Bay habitat is essential for rearing delta smelt; or that the distribution of young fish into Suisun Bay determines their ability to survive to adulthood.

However, the evidence does suggest that a significant portion of shallow water habitat exists upstream of Suisun Bay; that young and adult delta smelt are always found in this upstream habitat; and that no significant relationship exists between the percentage of juvenile delta smelt caught in Suisun Bay and the subsequent fall adult index.

REFERENCES

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DWR and Reclamation. 1994. Biological Assessment. Effects of the Central Valley Project and State Water Project of delta smelt and Sacramento splittail.

Laprise, R. and J.J.Dodson. 1989. Ontogeny and importance of tidal vertical migrations in the retention of larval smelt Osmerus mordax in a well mixed estuary. Mar. Ecol. Prog. Ser. 55: 101-111.

Miller, L. 1991. 1990 Working Papers of the Food Chain Group. Interagency Program Working Papers 1-6. FCG-1990. 71 pp.

Figure 1

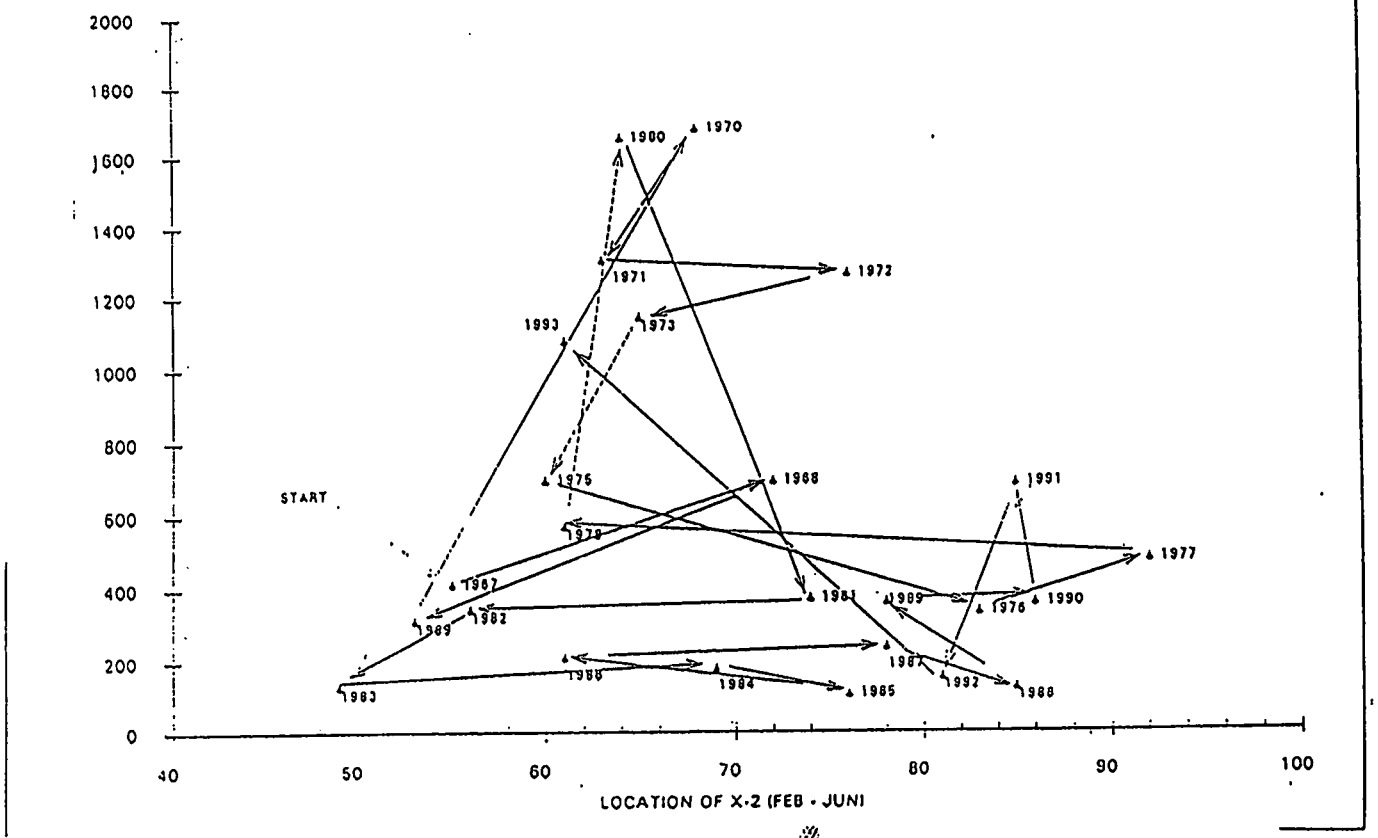


Figure 1

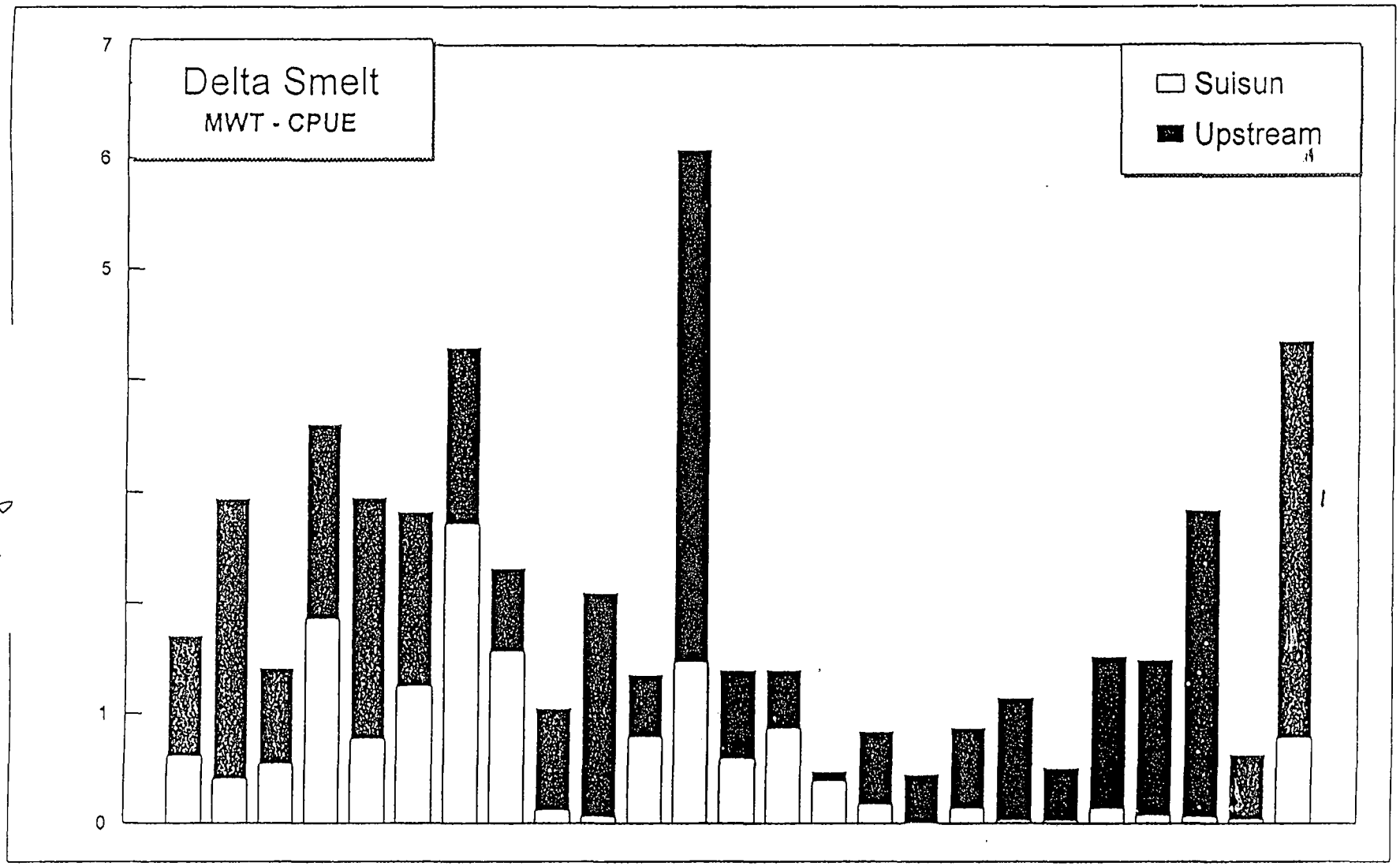
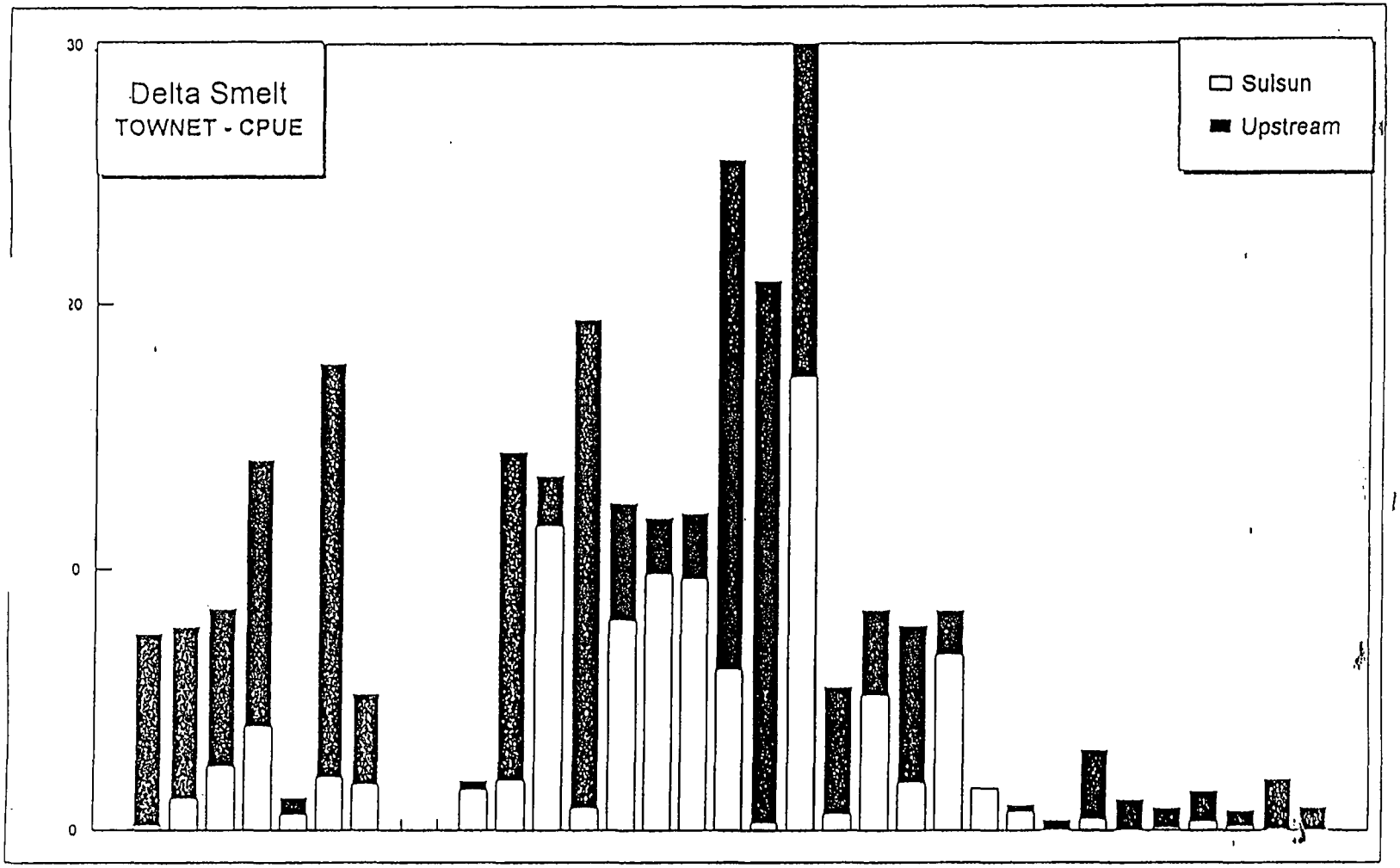


Figure 2

Year	67	68	69	70	71	72	73	75	76	77	78	80	81	82	83	84	85	86	87	88	89	90	91	92	93
% Suisun	36	14	39	51	26	44	63	68	11	3	59	24	43	63	80	20	3	15	2	5	9	5	2	5	18
% Upstream	64	86	61	49	74	56	37	32	89	97	41	76	57	37	20	80	97	85	98	95	91	95	98	95	82

Figure 3



Year	59	60	61	62	63	64	65	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
% Suisun	2	15	29	29	45	12	34			82	13	86	4	65	83	80	24	1	56	11	62	23	80	99	71	3	13	3	8	19	18	3	2
% Upstream	98	85	71	71	55	88	66			18	87	14	96	35	17	20	76	99	44	89	38	77	20	1	29	97	87	97	92	81	82	97	98

Figure 4

Delta Smelt MWT - CPUE
Upstream Stations Only

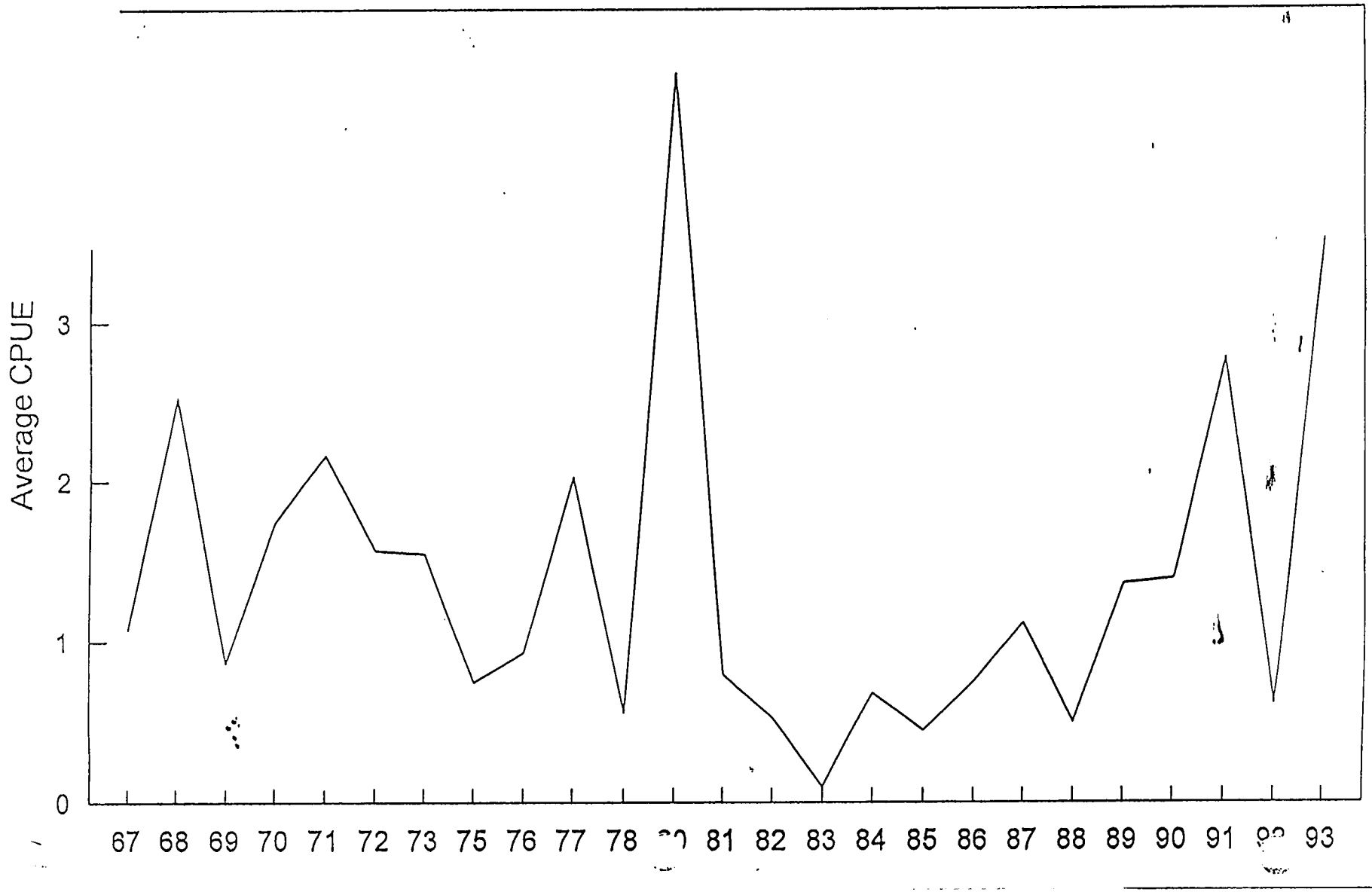


Figure 5

Delta Smelt Fall Midwater Trawl Survey
Annual Abundance at Upstream Stations