Central Valley Salmon Workshop

Randall Brown

The Interagency Program's Central Valley Salmon Team convened a 2-day workshop in mid-September to review juvenile salmon monitoring efforts in the estuary and the watershed. The agenda also included a discussion of a salmon model being developed Wim Kimmerer and others with funding from the Central Valley Project Improvement Act. About 40 biologists representing state and federal fish and wildlife agencies and private consultants attended, and most of the attendees made presentations on their individual programs. The principal workshop objective was to increase communication and coordination among the biologists working on Central Valley chinook salmon (and steelhead) runs.

Speakers at the workshop are providing abstracts of their presentations for compilation into a workshop summary, which will be available after October 21 from Lisa Batiste (916/227-7541; lbatiste@water.ca.gov).

A couple of points from the workshop presentations and panel discussion may be of general interest — one involving coordination/communication and the second about data/information. With regard to coordination and communication, it has long been evident that there is not enough of either in monitoring and special studies related to Central Valley salmon. With the concurrence of DFG management, the Interagency Ecological Program recently established the Central Valley Salmon Team to help achieve coordination through more of a life history approach to salmon studies; that is, follow the fish from the spawning grounds through the estuary and the ocean and back to the natal streams. Individual studies may continue to focus on individual life history components (emigration from the American River, for example); the team will endeavor to ensure that information about all the components is adequate to yield a coherent picture of the entire life history.

The Central Valley Salmon Team is led by Alan Baracco (DFG) and includes Jim Smith (USFWS), Marty Kjelson (USFWS), Gary Stern (NMFS), Ken Lentz (USBR), and Randy Brown (DWR). The team will meet at about monthly intervals (at least for the first year) and has or will establish issue-specific, working-level groups for geographic areas (*eg*, upper Sacramento River), races (*eg*, spring and winter run groups), or technical issues (*eg*, use of DNA to identify races). The team will also sponsor or encourage technical workshops as needed to foster communication (such as the annual workshop described here) and to address tough questions. Two workshops now being considered deal with the importance of estuarine rearing to Central Valley salmon stocks (tentatively scheduled for early December) and methods of estimating spawning escapement. The team will also sponsor semi-technical meetings for stakeholders and managers.

A second major area of concern identified at the meeting deals with the generally low rate at which salmon data are being converted to information. An ancillary problem is that most Central Valley salmon studies are designed strictly to index the abundance of a particular life stage — not to address cause-and-effect questions. The problem is the result of a combination of many factors, including lack of funding, lack of consistent electronic data storage and retrieval capabilities, emphasis on races of commercial importance (*ie*, fall chinook), and the lack of time (and agency encouragement) to publish interpretive reports in the open literature. One goal of the new Central Valley Salmon Team is to overcome many of the past obstacles that have hindered conversion of data to information useful to salmon biologists and managers.

There are many positive signs indicating that the goal of more effective information collection and dissemination can be achieved. The Central Valley Project Improvement Act (including the Comprehensive Analysis and Monitoring component), the CALFED process (including Category III), and increased stakeholder involvement will result in more funding for well-designed studies. The Interagency Program's relational data management system located on the WorldWideWeb can greatly assist in making the salmon and ancillary data available in a useful format. The CVPIA's salmon modeling program can help researchers focus their studies on issues critical to management. Finally, Central Valley Salmon Team members will work with cooperating agencies to allow staff sufficient time for data analysis, interpretation, and reporting in venues such as this *Newsletter*, agency reports and peer-reviewed literature. The ultimate success of these efforts will depend on how well individuals, agencies, and stakeholders work together to understand and manage Central Valley salmonid stocks.

Low Striped Bass Index for 1996

Lee W. Miller and Stephen F. Foss, Department of Fish and Game

The summer tow-net survey measures an index of striped bass index abundance when the population mean size is 38mm. In 1996, the index was 2.1, the lowest since DFG began measuring the index in 1959. The previous low index was 4.3 in 1990, a drought year (Figure 1). The 1996 index is lower than expected based on the high mean April-July delta outflow of 50,000 cfs in 1996 (Figure 2). If this looks familiar, it is because this year was much like 1995, when we reported a similar unusually low young bass index for the water year type (Foss and Miller 1996). This article explores three possible causes of the lower-than-expected index: a mid-spawning-season storm causing either high mortality or sampling bias; low food availability; and low egg production.

A storm in mid-May, after spawning had commenced, increased outflow and decreased water temperature and may have pushed young striped bass downstream, where they were poorly sampled by the tow-net. The temperature drop (Figure 3) probably interrupted spawning and curtailed recruitment. This was reflected in decreased young striped bass density in the fourth 20mm survey (Figure 4), which is conducted twice a month to examine the distribution and density of larval and post-larval fish. (For more information, see Bay-Delta Home Page; http://www.delta.dfg.ca.gov). Mortality of striped bass may have exceeded normal levels, although it is difficult to ascertain if there was a population effect.

Shift of the population distribution downstream, where sampling effort is limited, also may have contributed to the lower density. Striped bass distribution shifted downstream between 20mm surveys 3 (early May) and survey 5 (early June), but after the storm the distribution was similar to what it was previously except for the increase in the Napa River and Carquinez Strait (Figure 5). In August or September, striped bass were not caught in San Pablo Bay or Carquinez Strait in either the tow-net survey or the fall midwater trawl survey, which samples 29 sites in the area. Three striped bass were caught in the Napa River in August. The September midwater trawl abundance index was 56, the lowest monthly index of record, corroborating the low tow-net index. The range of September midwater trawl abundance index before 1996 is 106-12,111. We conclude that the tow-net index was not biased by under-sampling downstream areas.

To evaluate the hypothesis that low food supply caused the low tow-net survey striped bass index, we examined the density of zooplankton available to young striped bass during May and June and found that zooplankton was not markedly lower in 1996 relative to other years (Figure 6). Density of mysids, *Neomysis* and *Acanthomysis*, in 1996 was high relative to recent years, although their density has been lower than it was before 1990. Since food supply has not been the apparent cause of low abundance in other recent years, (for example, the 1993 index was 23.4), it is unlikely the cause of the low abundance in 1996.

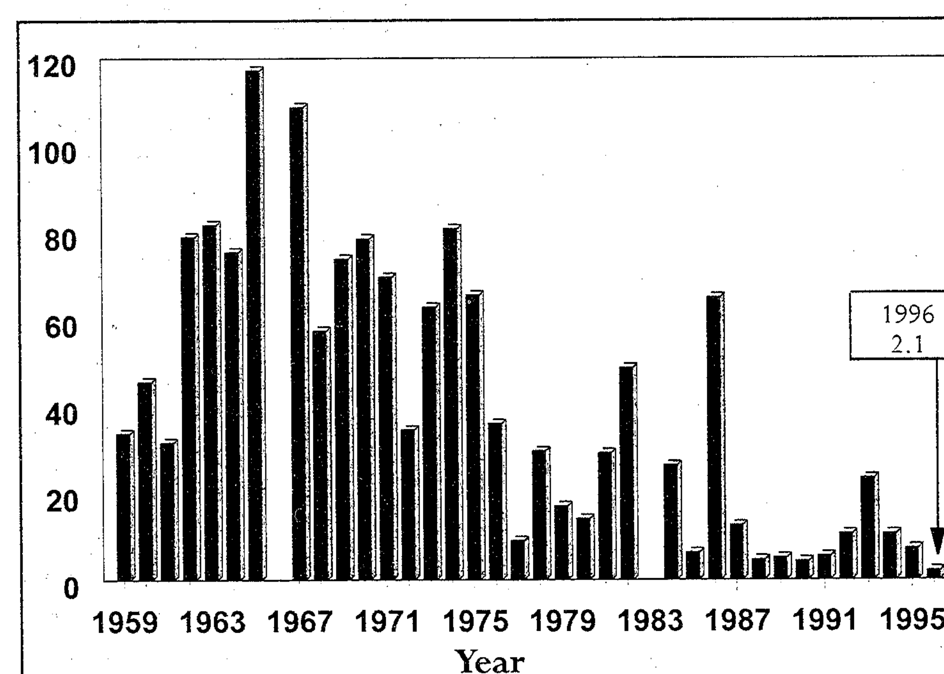

Figure 1
ANNUAL ABUNDANCE INDICES FOR STRIPED BASS WHEN THE MEAN SIZE OF THE TOW-NET SURVEY CATCH IS 38mm

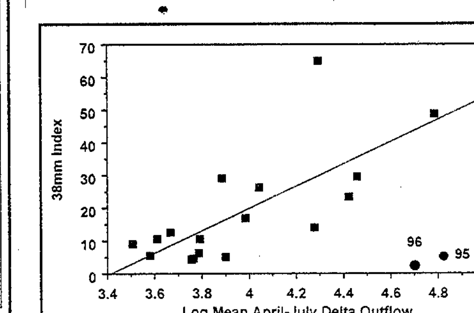

Figure 2
RELATIONSHIP OF THE 38mm STRIPED BASS ABUNDANCE INDEX TO LOG_{10} OF MEAN APRIL-JULY DELTA OUTFLOW SINCE 1977 (EXCEPT 1983)

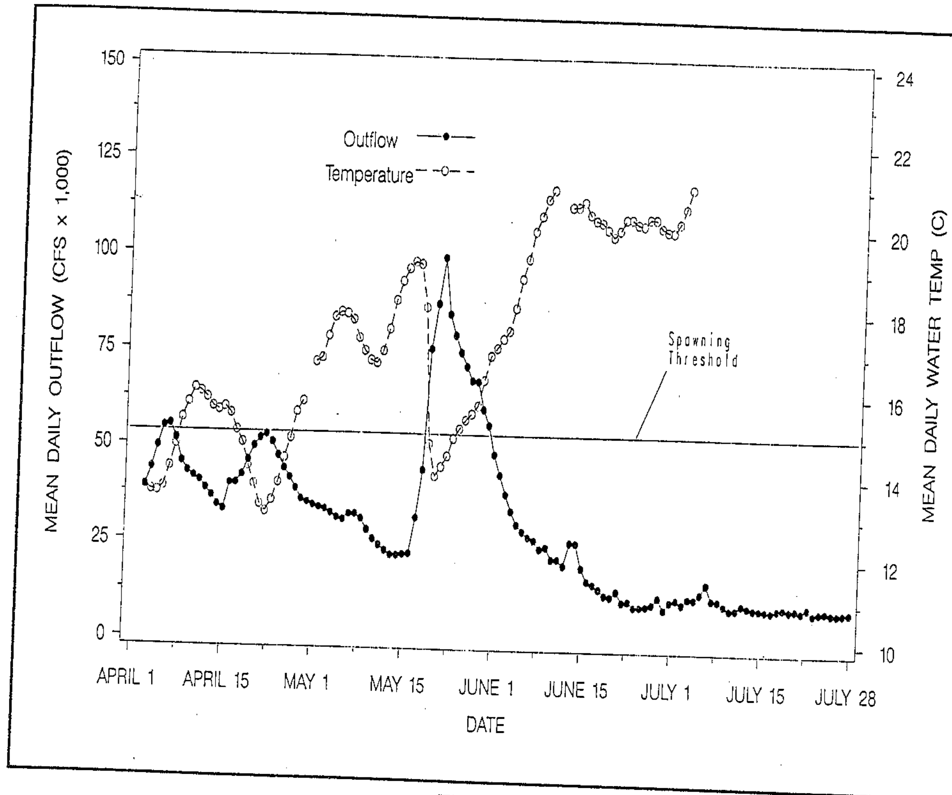

Figure 3
TRENDS IN DAILY WATER TEMPERATURE AT RIO VISTA AND DAILY OUTFLOW AT CHIPPS ISLAND IN 1996
The horizontal line at 15°C indicates approximate striped bass spawning threshold.

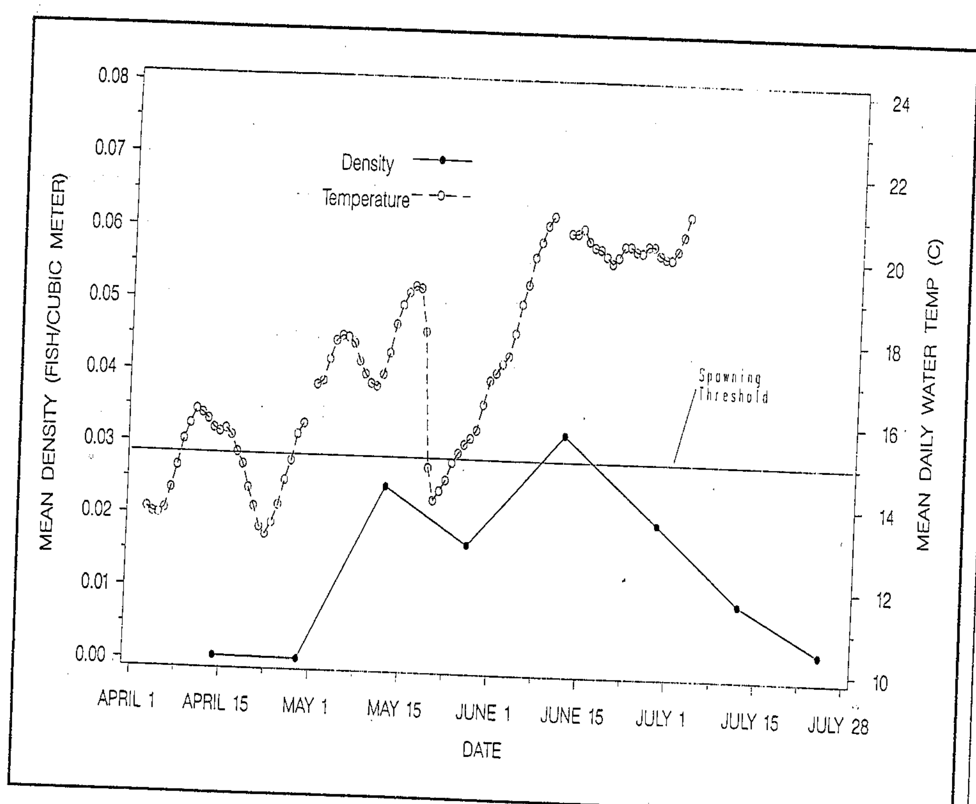

Figure 4
MEAN DENSITY OF YOUNG STRIPED BASS IN THE 20mm SURVEY AND AVERAGE DAILY TEMPERATURE AT RIO VISTA

Finally, we examined the hypothesis that further declines in spawning stock may have caused the low tow-net index. This explanation is reasonable, because several years of low young-of-the-year production during the 7-year drought reduced recruitment. Stocking of hatchery-reared fish has also been curtailed since 1991, reducing supplements to the adult stock. Additionally, the older, more fecund striped bass (those >age 5), have declined more than younger fish in recent years (Figure 7). This has been the result of an unexplained increase in the natural mortality rate of adults since the early 1970s (DFG, unpublished data). These trends support low egg production as one likely cause of low young striped bass abundance in 1995 and 1996. However, the 1996 adult abundance estimates, which are used to estimate egg production, cannot be made until 1997 when the tagged:untagged ratios become available.

There is further cause to believe egg production is limiting. The decline in egg production is generally reflected in lower abundance of 6-10 mm larvae of our egg and larva survey data over the years, although in years of low outflow, such as 1968 and 1977, survival was obviously poor between the egg and 6mm stage (Figure 8). Low flow has been identified as one factor affecting survival between eggs and 6mm (Miller and Arnold 1994).

Is there a reasonable level of egg production that would explain the low 38mm abundance? To answer this question, we used an indirect approach. Survival between egg production and 38mm is related to outflow (Figure 9). Using the estimate of 1994 egg production as a surrogate for 1995 and 1996 egg production, a regression of survival index on outflow produced residual

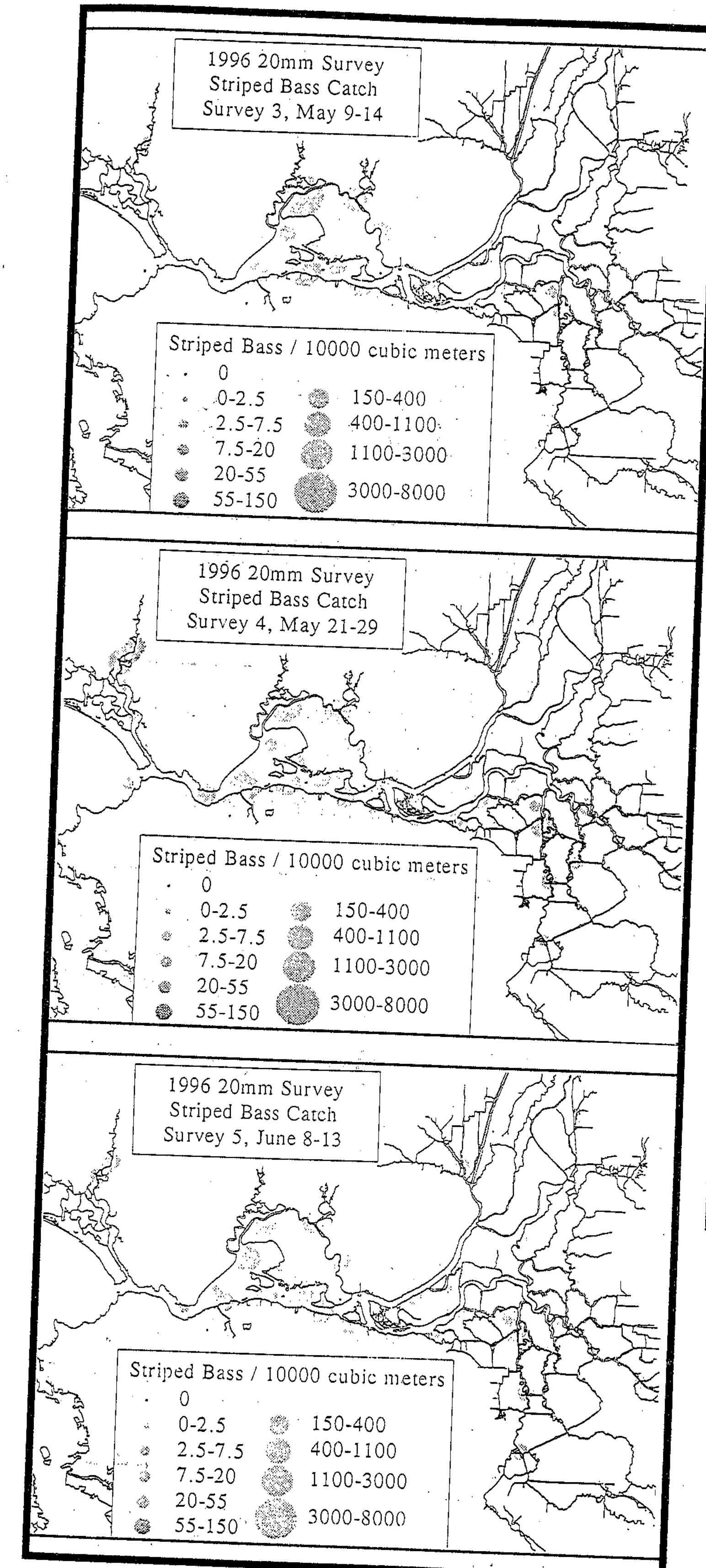

Figure 5
DISTRIBUTION OF YOUNG STRIPED BASS IN THE THREE 20mm SURVEYS CLOSEST TO THE MID-MAY 1996 STORM
Survey 3 distribution was before the event, Survey 4 was during high outflow, and Survey 5 was after flow returned to pre-event levels.

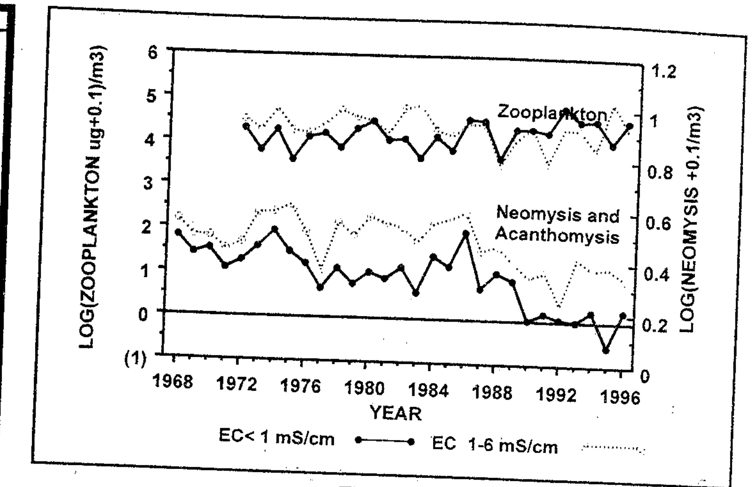

Figure 6
MEAN LOG_{10} DENSITY OF ZOOPLANKTON AND MYSIDS FOR MAY-JUNE IN TWO SPECIFIC CONDUCTANCE RANGES FOR ALL YEARS OF RECORD

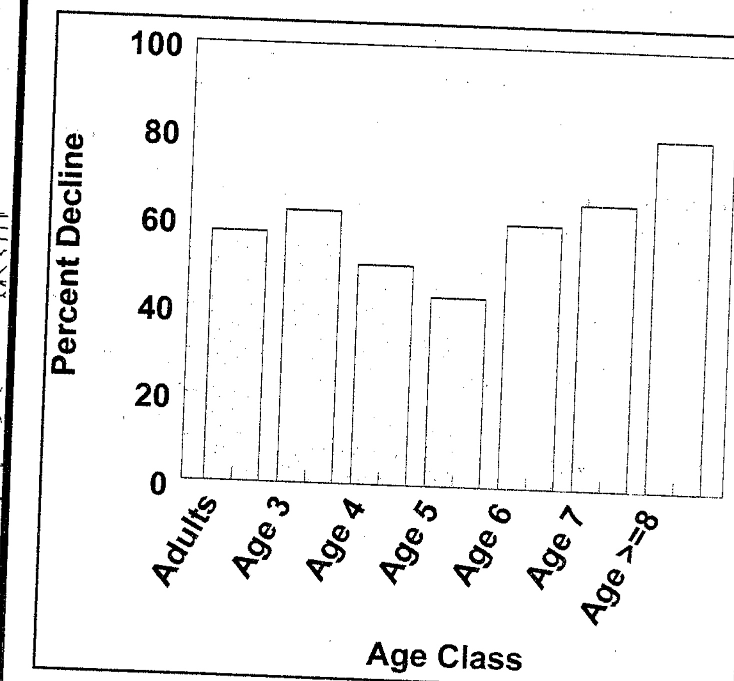

Figure 7
PERCENTAGE DECLINE OF AGE GROUPS OF STRIPED BASS, 1969-1973 AND 1989-1993
Provided by David Kohlhorst, DFG

variation in 1996 survival outside of the historical relationship, suggesting either egg production was much lower than in 1994 or some other factor caused the poor survival. What level of egg production would be required to bring the 1996 residual within the historical range of residual variation? The 1996 egg production would have had to decline to about one-third of the 1994 egg production just to be at the limits (2 standard deviations) of the historical variation. Is that a believable decline in egg production over the past 2 years? Although dramatic, it is plausible if the lack of stocking and increased mortality have sharply reduced abundance of older, more fecund spawners. When the 1996 abundance estimates are available, we can determine if egg production was low enough in 1995 and 1996 to explain the low young bass indices.

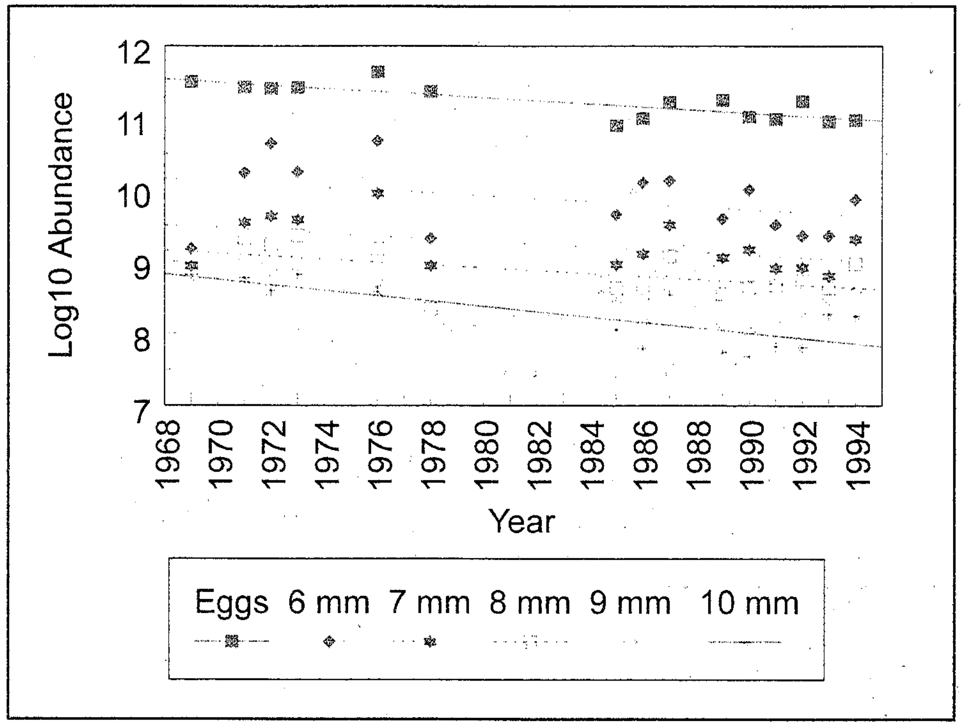

Figure 8
REGRESSION TRENDS FOR THE EGG PRODUCTION INDEX AND 6-10mm LARVAE FOR EGG AND LARVAL SURVEY
For years of record where valid indices are available.
We used the 1969 estimate of egg production for 1968.

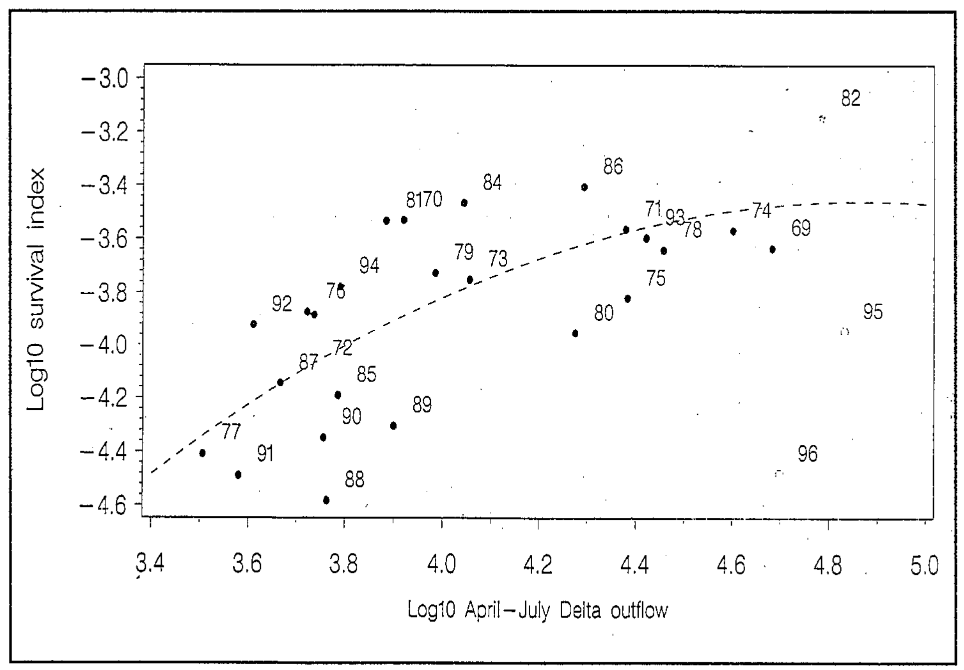

Figure 9
RELATIONSHIP BETWEEN THE LOG10 OF THE SURVIVAL INDEX (38 mm/egg production) AND THE LOG10 OF THE MEAN APRIL-JULY OUTFLOW FOR YEARS OF RECORD, 1969-1994
Survival was estimated for 1995 and 1996 using the 1994 estimate of egg production.

References

Foss, S.F., and L.W. Miller. 1996. Summer Tow-Net Survey: 1995 Young-of-the-Year Striped Bass Index. IEP *Newsletter* (9)3:11.

IESP. 1991. *1990 Annual Report*. 123 pp.

Miller, L.W., and J. Arnold. 1994. Striped bass egg and larva survey. Pages 31-42 in *1992 Annual Report*. Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary. 126 pp.

New Publication

- *Stress Proteins in Amphipods as Biomarkers of Sediment Pollution in San Francisco Bay*. Ingeborg Werner, Kurt F. Kline, James T. Hollibaugh. Technical Report 48.

For a copy, contact Lisa Batiste (916/277-7541; lbatiste@water.ca.gov)

1995 Splittail Spawning Investigations

Randall Baxter, William Harrell, and Lenny Grimaldo

In 1995, several projects were conducted to provide information on splittail spawning: a recreational angler survey near Sacramento; boat electrofishing in a flooded riparian area in the lower Sutter Bypass; and larval sampling in tributary mouths and in the Yolo and Sutter bypass outflows. These studies provided information on the status of a recreational fishery for splittail, on splittail migration and spawn timing, and on spawning locations. A key finding was the relatively high number of splittail larvae collected in the Yolo Bypass outflow, indicating the importance of the area for splittail spawning.

Recreational Angler Survey

On 17 days between February 17 and April 6, 1995, we conducted a splittail creel census on the Sacramento and Feather rivers. Anglers were interviewed about splittail catch and time spent fishing. With anglers' consent, fish were measured to the nearest millimeter fork length and checked for ripeness. In some cases, anglers would not allow investigators to measure the splittail, but catch counts were obtained. In a few cases, investigators relied on angler-reported splittail catches when fish were not available for examination. The survey was conducted primarily on the Sacramento River near the Sacramento, but some anglers were contacted farther upstream and downstream on the Sacramento River and on the lower Feather River.

On the Sacramento River, investigators interviewed 363 anglers and counted 447 splittail. Investigators interviewed 12 anglers on the Feather River, with a total of 12 splittail. Anglers were observed with splittail from Hood at river mile 38 upstream to Verona (RM 75) on the Sacramento River and downstream of the Highway 99 bridge on the Feather River (RM 7, 9; Figure 1). Most contacts were between Hood and Discovery Park on the Sacramento River (Table 1). A few splittail were also caught in the lower Feather River, but fishing effort (and survey effort) was minimal.

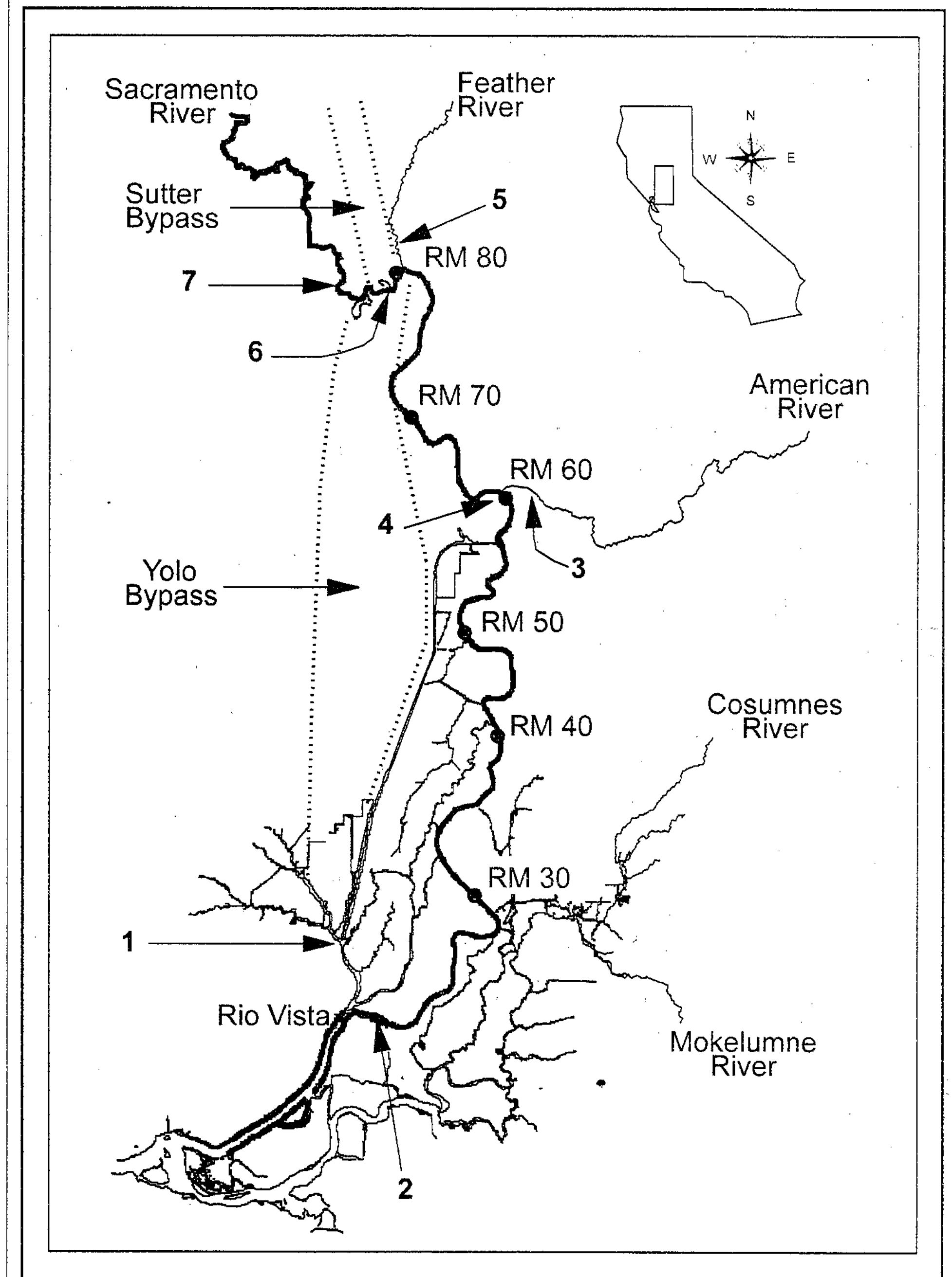

Figure 1
SAMPLING LOCATIONS, 1995 SPLITTAIL SPAWNING INVESTIGATIONS
Electrofishing was conducted primarily in the Sacramento River at the lower end of the Sutter Bypass. Larval sampling locations were: (1) Cache Slough at the south end of Prospect Island; (2) Sacramento River near Isleton; (3) American River upstream of Highway 5 crossing; (4) Sacramento River on the west side across from the mouth of the American River; (5) Feather River upstream of the confluence with the Sutter Bypass; (6) Sacramento River at the confluence with the Sutter Bypass; (7) Sacramento River upstream of the confluence with the Sutter Bypass.