Interagency Ecological Studies Program for the Sacramento-San Joaquin Estuary

NEWSLETTER

Autumn 1992

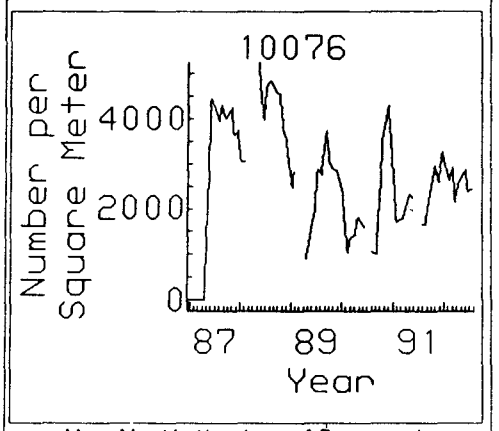
Readers are encouraged to submit brief articles or ideas for articles. Correspondence, including requests for changes in the mailing list, should be addressed to Randy Brown, California Department of Water Resources, 3251 S Street, Sacramento, CA 95816-7017.

UPDATE ON THE STATUS OF *POTAMOCORBULA AMURENSIS*

Long-term benthic monitoring by DWR has provided a nearly continuous time series of *Potamocorbula amurensis* abundance from select locations in the upper estuary. Data from Grizzly Bay (Site D7) show clam concentrations were highest between 1987 and 1988 (see figure). Peak concentrations have since declined, and the magnitude of annual fluctuations has decreased. During 1991 and 1992, abundance fluctuated between 1,500 and 3,500 clams per square meter. The data also show abundance of *P. amurensis* generally peaks in summer or fall and reaches lowest levels in winter.

The spread of *P. amurensis* is well documented. Spatially intensive sampling efforts show the clam is firmly established in San Pablo Bay, Suisun Bay, and Suisun Marsh, and it occurs marginally in the western Delta. Additional studies show *P. amurensis* is having a major effect on benthic and pelagic communities in the northern reach of the bay.

Benthic monitoring by DWR has not detected *P. amurensis* east of Sherman Island, in the western Delta. This suggests something is preventing upstream migration of this clam. Lower salinity in the Delta may be one factor. Although drought conditions have dominated this region since introduction of *P. amurensis*, more normal seasonal weather patterns may alter the distribution and abundance of this clam.



Mean Monthly Abundance of *P. amurensis* in Grizzly Bay (Site D7)

Bibliography

Alpine, A.E., and J.E. Cloern. 1992. Grophic interactions and direct physical effects control phytoplankton biomass and production in an estuary. *Limnology and Oceanography* 37:946-955.

Carlton, J.T., J.K. Thompson, L.E. Schemel, and F.H. Nichols. 1990. Remarkable invasion of San Francisco Bay (California, USA) by the Asian clam *Potamocorbula amurensis*. I. Introduction and dispersal. *Mar Ecol Prog Ser* 66:81-94.

Hymanson, Z.P. 1991. *Results of a spatially intensive survey for Potamocorbula amurensis in the upper San Francisco Bay estuary*. Interagency Ecological Studies Program for the Sacramento-San Joaquin Estuary. Technical Report 30.

Nichols, F.H., J.K. Thompson, L.E. Schemel. 1990. Remarkable invasion of San Francisco Bay (California, USA) by the Asian clam *Potamocorbula amurensis*. II. Displacement of a former community. Mar Ecol Prog Ser 66:95-101.

Urquhart, K.A., F.K. Regalado, J. Carlson, P.S. Hofmann, L. Puckett, F.G. Wernette, J.R. White. 1991. Selenium verification study 1988-1990. 91-2 WQWR. State Water Resources Control Board.

Zachary Hymanson, DWR

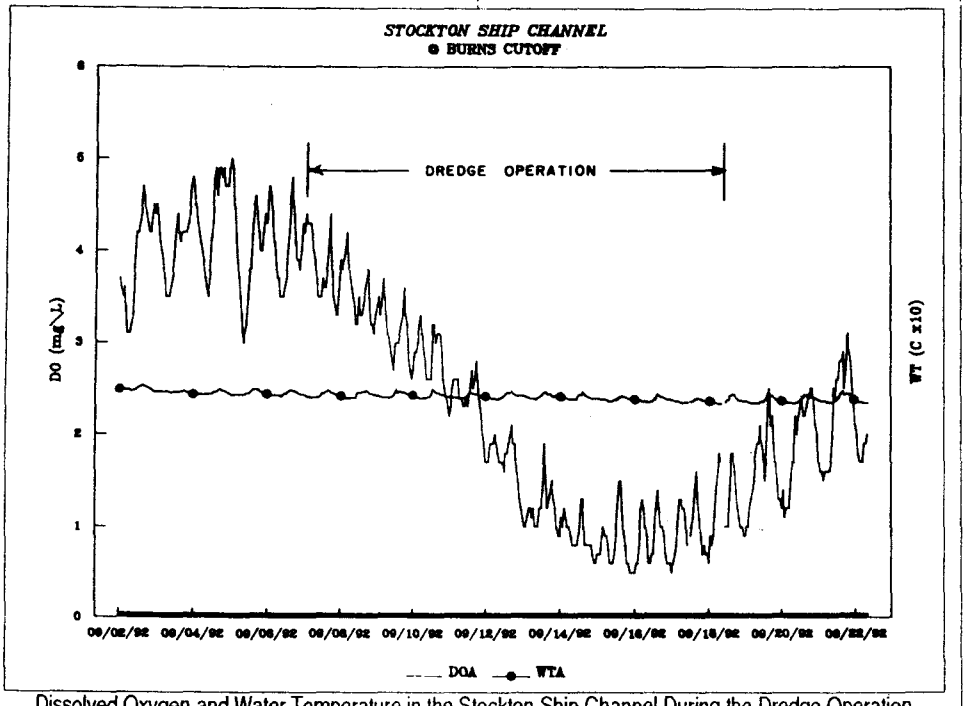
CONTENTS

STOCKTON SHIP CHANNEL DISSOLVED OXYGEN PROBLEM

Intensified monitoring of the Stockton Ship Channel and lower San Joaquin River associated with placement of a barrier at the head of Old River revealed a dissolved oxygen sag near Rough and Ready Island. Although dissolved oxygen levels in the area have been suppressed throughout the summer, a severe sag began to develop during the second week of September. Diel conditions before the sag ranged from 3.3 to 4.8 mg/L, but within days they fell to a range of 0.5 to 1.5. Data were collected from the DWR continuous, multiparameter recorder on Rough and Ready Island and from profile runs conducted with continuous instrumentation aboard the *San Carlos*. Field personnel reported a dredger was operating during the time of the sag, and large plumes of turbid water and offensive odors seemed to be related to the dredging. The dredging, part of routine maintenance for the Ship Channel, was completed on September 18, and by September 21 the dissolved oxygen diel range had increased to 1.5 to 3.1 mg/L.

Since there were no significant variations in San Joaquin River outflows or water temperatures during the sag period, the dredging was probably a major contributor to formation of the sag. Dredging probably disrupted deposits of highly organic material, known to be on the channel bottom. The plumes of suspended organic matter create an extensive BOD loading that could quickly cause a severe dissolved oxygen deficit in already depressed conditions. Discontinuation of the dredging operation, placement of the Old River barrier, and seasonally lower water temperatures should help the area to begin recovering. Extended monitoring will continue, and results will be submitted to appropriate regulatory agencies for immediate review.

Harlan Proctor, DWR



Dissolved Oxygen and Water Temperature in the Stockton Ship Channel During the Dredge Operation

DELTA MODELING

During the first week of June, USGS hosted a workshop for USBR and DWR Delta modeling personnel to present a branched 1-dimensional model code called "Four-Point". Lew Delong, David Thompson, and Jon Lee, from the East Coast conducted the 5-day program. The Four-Point model is the potential basis of the new Delta model being implemented for the Interagency Program. Prior to the workshop, the DWR Delta modeling group successfully used the algorithms to make coarse-grid simulations of the Delta.

Larry Smith, USGS

BAY FISH

Of the 18 species of fish the Bay Study tracks on a monthly basis, only 5 had average or above average catches: white croaker, bay goby, yellowfin goby, speckled sanddab, and California halibut. The catch of 0+ white croaker was about twice the average catch for 1980-1991. The bay goby catch was slightly above the average for the quarter, but only 25 percent of the 1991 catch. The catch of 0+ yellowfin gobies was the highest since 1986 and increased significantly from the summer quarter of 1991 (369 in 1992, 1 in 1991). Speckled sanddab catches were average for the quarter but declined significantly from May to July as fish emigrated from the bay. California halibut have been increasing in numbers since the late 1980s as we continued to collect juveniles from the strong year classes of 1987 and 1990.

Kathy Hieb, DFG

INTERAGENCY PROGRAM/ESTUARY PROJECT RESEARCH ENHANCEMENT PROGRAM

The 49 proposals submitted for this year's research enhancement program were reviewed by outside experts in the technical fields covered by the proposals. More than 200 detailed written evaluations were received from the reviewers. A local peer review panel and Interagency and Estuary Project staff made the selections from those proposals ranked highest by the scientific community. Because of the overall high quality of proposals this year, the selection process was particularly difficult. Research proposals selected for funding this year are:

- Channel-Shoal Exchange of Particles in North San Francisco Bay
  — *D.A. Jay and F.G. Prahl*
- An Interspecific Comparison of Metal Bioavailability in San Francisco Bay: Comparison of Solute and Particulate Source Terms.
  — *N.S. Fisher and S.N. Luoma*
- Ecology and Potential for Control of the Invasive Alien Saltmarsh Cordgrass, *Spartina alterniflora*, in San Francisco Bay.
  — *D.R. Strong*
- Research Projects on the Biogeochemical Cycles of Trace Elements in the San Francisco Bay Estuarine System.
  — *A.R. Flegal*
- An Investigation of the Effects of Elevated Water Temperature on Some Aspects of the Physiological and Ecological Performance of Juvenile Chinook Salmon *(Oncorhynchus tshawytscha)*: Implications for Management of California's Central Valley Salmon Stocks.
  — *J.Cech and K. Marine*
- Reproductive Cycle and Gametogenesis of Delta Smelt, *Hypomesus transpacificus*.
  — *S. Doroshov*

STRIPED BASS CAUGHT 8 YEARS AFTER TAGGING

In 1984, DFG biologist Betsy Bolster began her master's thesis by surgically implanting radio transmitters in 31 adult striped bass. The fish were monitored routinely from fall 1984 through 1985 to determine movement patterns of striped bass in Clifton Court Forebay. Almost 8 years later, on July 28, 1992, an angler caught tagged fish number 430 in the San Joaquin River upstream of Mossdale. The transmitter was implanted in this fish on October 22, 1984, was tracked in Clifton Court Forebay for 85 days, and was last located on January 14, 1985. When released, number 430 measured 453 millimeters (fork length) and weighed less than 4 pounds. By the time it was caught, the striper had grown to 30 inches total length (709 mm fork length) and weighed 20 pounds.

EVALUATION OF JOHN E. SKINNER DELTA FISH FACILITY

In mid-May, construction of the new holding tank facilities at Skinner Fish Facility was completed, and testing has begun. So far, the evaluation has revealed two concerns needing more study. The first has to do with the way the tanks fill. After the fish in a tank are counted, the tank must be refilled. During the 10- to 15-minute refilling period, flows into the other holding tanks increase to greater than acceptable levels. It is not clear what, if anything, can be done about this problem.

On August 6 and 9, the Banks Pumping Plant operated for several hours with the old and new collection and holding facilities operating simultaneously. Pumping rates were 6,400 cfs on August 6 and 9,790 cfs on August 9. During this test, fish were salvaged at roughly double the rate in the new holding tank building (fed by the old [louver] secondary system) as in the old holding tank building (fed by the new [perforated plate] secondary system). This difference in salvage between systems raises questions about the relative efficiency of the two secondary systems and how to estimate salvage when both collection systems are operating.

Scott Barrow, DFG

NEOMYSIS ABUNDANCE

Neomysis abundance is at an all-time low this summer. Water temperature has been unusually high since the drought began, and the *Neomysis* population has declined. Female size in summer has been smaller thanbefore the drought; smaller females carry fewer eggs. Unless higher temperatures accelerate egg development, reduced fecundity will result in slower population growth rates. Low outflow also plays a part. Two-layered flow tends to break down at low outflows, and mysids are no longer concentrated in the entrapment zone by the bottom density current. Food supply also has been low, but it is not clear whether *Neomysis* is food-limited.

Jim Orsi, DFG

MONITORING PROGRAM EVALUATION

During the recent water right phase of the Bay/Delta hearings, SWRCB was informed that representatives of the Interagency Program have been evaluating the Decision 1485 compliance monitoring program. SWRCB staff is receptive to reviewing new concepts and modifications to the program presented in the May 1991 Water Quality Control Plan.

The goal of the Interagency evaluation committee is to consolidate and streamline the water quality, phytoplankton, zooplankton and benthos monitoring programs so resources can be redirected to special studies and still maintain baseline surveillance. This evaluation has included a review of sampling locations and frequencies using discrete and continuous monitoring data collected over the past 20 years.

Discrete sampling locations were addressed using cluster analyses of field sampling data. The analyses were used to group 21 stations into regions for which monthly average water quality conditions were similar between 1974 and 1990. Water quality variables included: chlorophyll, dissolved oxygen and nutrient concentration, Secchi disk depth, turbidity, specific conductance, pH, and air and water temperature. Following cluster analyses computed for various time periods, sampling stations in the downstream bays and Delta were grouped into seven study regions: northern Delta, central Delta, southern Delta, lower San Joaquin, western Delta, Suisun Bay, and San Pablo Bay.

Comparisons were made between discrete water quality measurements taken during 1983 through 1990 in the center of the channel and continuous monitors located near shore. In general, continuous measurements were not significantly different from discrete field measurements within regions isolated by the cluster analyses. These results suggested that a strategically located continuous monitor supplemented by one or two discrete sites could adequately describe trends over time within each region.

Sampling frequency analyses for parameters common to continuous and discrete measurements suggested monthly sampling would capture most of the variation in the estuary. Sampling frequency was addressed by comparing the mean and coefficient of variation at different time intervals for continuous monitoring and discrete field samples using analysis of variance. In general, variation at weekly through monthly intervals was not significantly different for the continuous data, and variance at monthly through quarterly intervals was not significantly different for the discrete field data. Analysis of means demonstrated similar patterns.

Similar statistical analyses are being applied to the benthos and zooplankton datasets to determine appropriate study regions and sampling frequencies. When analyses are complete, the various program elements will be superimposed to maximize collection efficiency and provide synoptic sampling of all parameters.

Peggy Lehman, DWR

PUBLICATIONS

Two Interagency Program technical reports are or soon will be ready for release:

- IATR 32, *Long-Term Trends in Zooplankton Distribution and Abundance in the Sacramento-San Joaquin Estuary* (S. Obrebski, J. Orsi, and W. Kimmerer)
- IATR 33, *An Evaluation of Existing Data in the Entrapment Zone of the San Francisco Bay Estuary* (W. Kimmerer)

For copies, contact Mary Gilleland, 916/323-7203 (FAX 916/322-0273).

NEW EARTHQUAKE MOTION PREDICTION METHOD

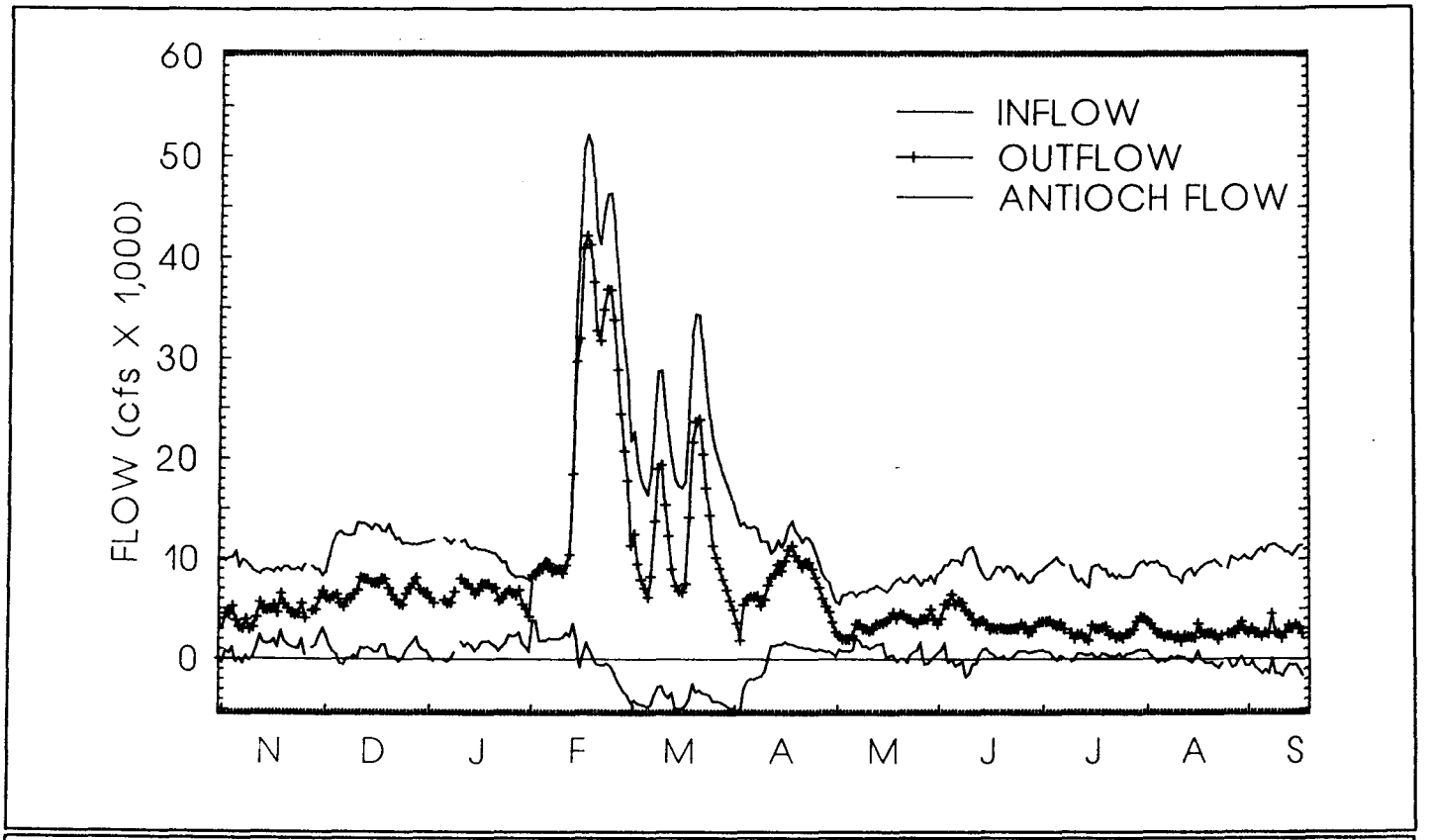
Lawrence Livermore Laboratory recently installed seismic instruments and recorders in the DWR/USGS monitoring station at Old Dumbarton Bridge. The instruments measure motion caused by small to moderate earthquakes. Sensors are located on the New Dumbarton Bridge, and CALTRANS will be drilling through the old bridge for installation of one near-surface sensor and another at bedrock (about 600 feet).

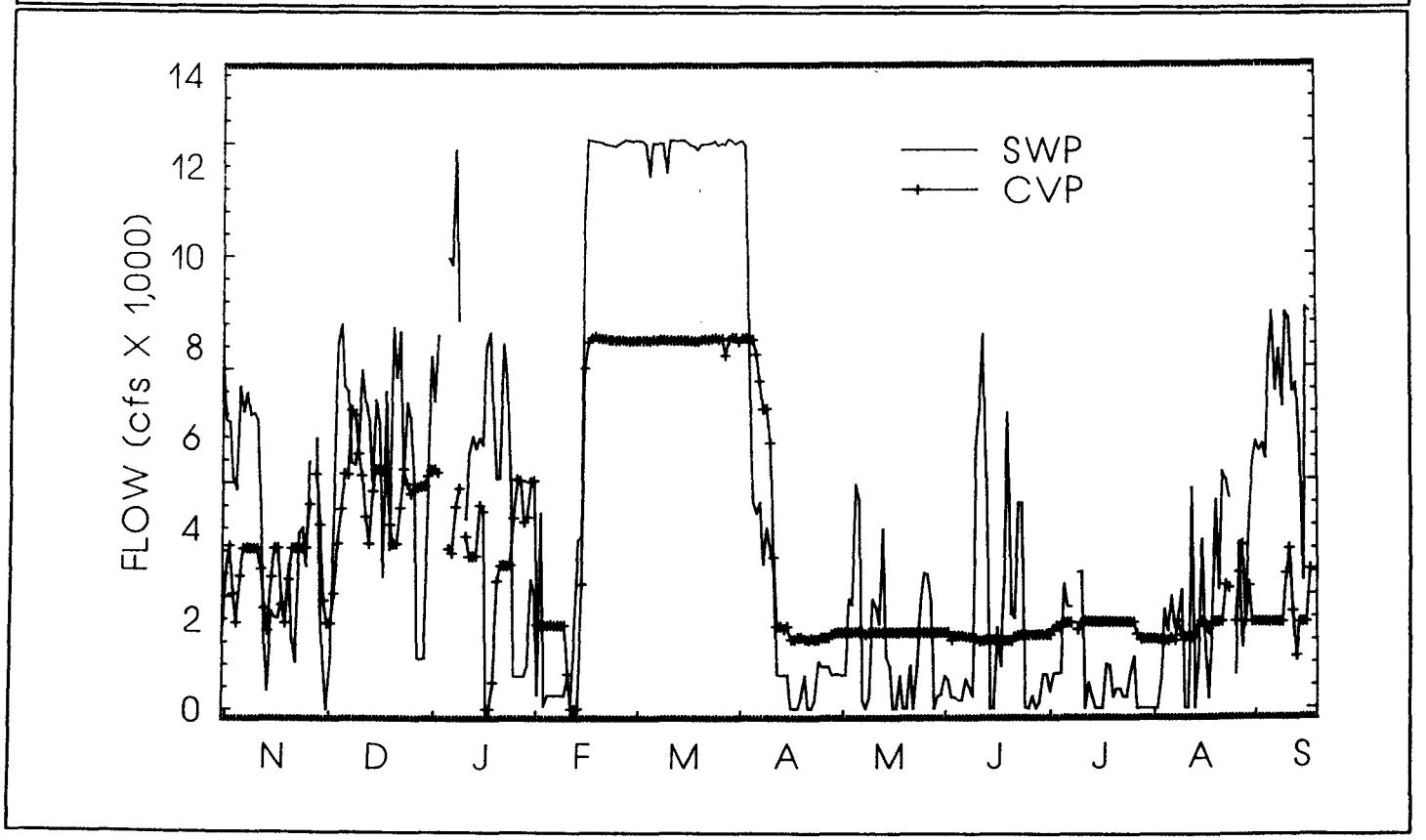
The objective is to predict motion caused by large earthquakes along major bay area faults. According to scientists at Lawrence Livermore Lab, geologic-substrate information is not sufficient to predict the response of structures to earthquakes. By measuring ground and structure motion during small and moderate earthquakes, scientists plan to develop transfer functions that relation motion to a range of earthquake magnitudes and locations. Modal analysis and other techniques will be used to scale these transfer functions so they can be used to predict motion cuased by large earthquakes.

Larry Schemel, USGS, Menlo Park

DELTA HYDROLOGY

The figures below, from the DWR daily dispatcher's report, illustrate recent trends in Delta hydrology and pumping. As expected, Delta inflow has been relatively constant during the summer and due almost exclusively to releases from storage on the Sacramento River system. Recent pumping increases are due to transfers of the 1992 water bank water.





RECENT USBR ACTIVITIES

Since 1989, USBR has been evaluating physical and operational changes that might help transport striped bass eggs and larvae to Suisun Bay more quickly without adversely affecting other uses of the estuary. USBR has also been studying ways to reduce fish losses at Tracy Fish Collection Facility. Results of the two programs for 1992 are summarized below.

Abundance of Striped Bass Eggs and Larvae in the Upper Sacramento River During Spring 1992

Results indicate striped bass spawning above Sacramento was unusually low this year.

Objectives of the 1992 study were to learn more about factors influencing bass spawning and to improve sampling equipment design to make sampling easier, to minimize mutilation of eggs and larvae retained in the nets for long periods, and to make use of new meters that operate adequately under the extremely low-flow drought conditions.

The nets were fished for about 12-hour periods again this year, but sampling gear was modified and downsized. Sampling began in late March and continued until the equipment was vandalized in early June. Based on past results and the unusually high water temperatures in May, most of the spawning is believed to have occurred before June.

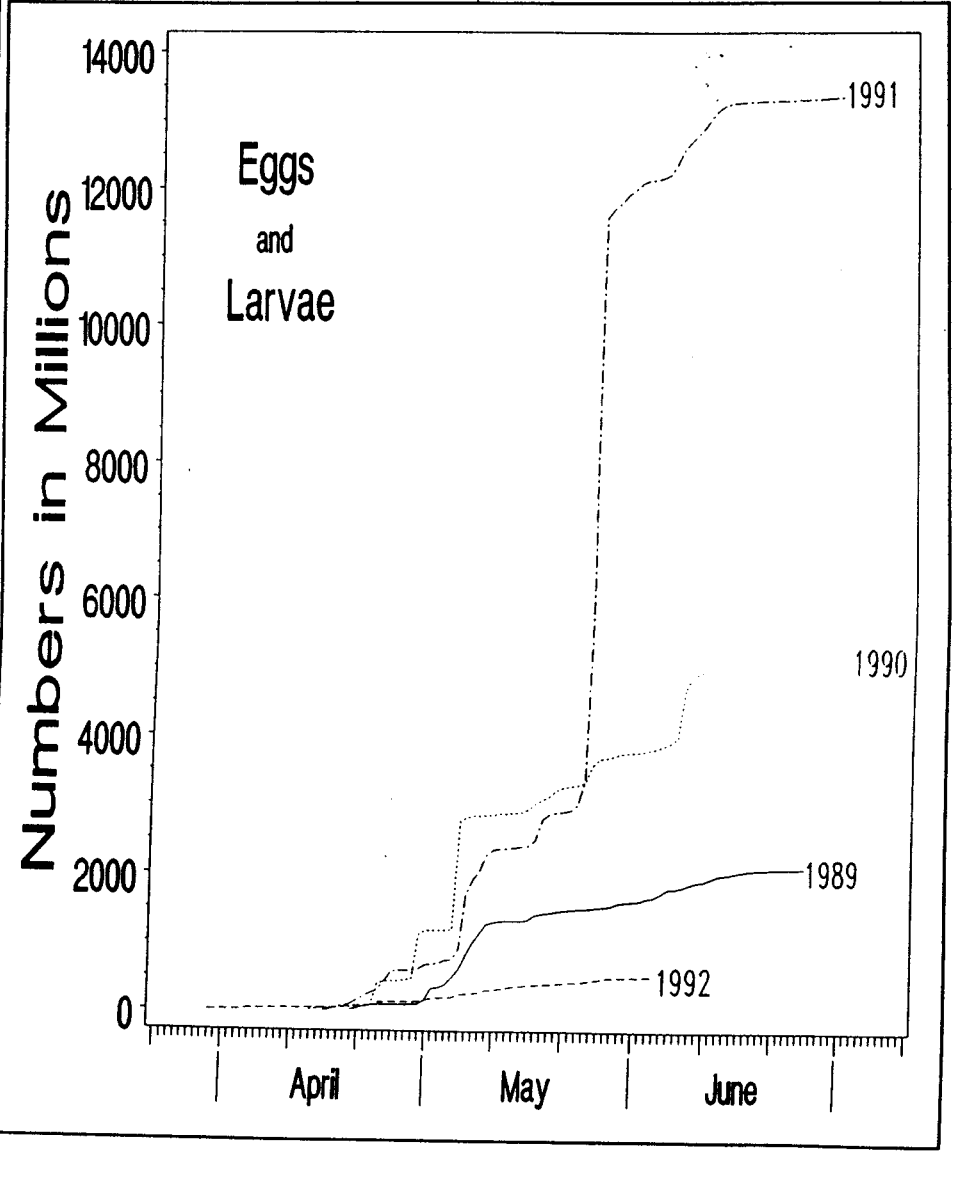
Low-velocity flowmeters were placed in the nets to measure Sacramento River flow, which was at times the lowest since the drought began. These more sensitive flowmeters are factory-mounted in 5-inch-diameter tubular housings, which also provided an ideal surface for attaching a net with a 1-inch smaller diameter than previously used. The 5-inch flowmeter and smaller net opening collected ample volumes for the samples.

For routine samples in 1992, we used a 330-micron mesh net. Several comparisons were made with the standard 500-micron nets used in the past, with variations in fishing duration.

Increase in water temperature within certain ranges was still the factor most consistently related to large peaks of bass spawning. Spawning started very early again in 1992 due to early warming of the river water.

Striped bass spawning in the Sacramento River above Sacramento dropped significantly this year. Only a few hundred million eggs and larvae were detected, compared to several billion in the previous 3 years. This is in contrast to DFG's 1992 striped bass young-of-the-year index, which was nearly double indexes in previous years of this drought. The improved index indicates better early survival of the bass larvae in the estuary.

Questions arise as to why the data indicate such a great reduction in spawning. Could the bass have spawned in the river below Sacramento or in the central Delta this year? Bass eggs and larvae are extremely fragile at the time of hatching and at higher temperatures. Could the stage of development at the time the eggs and



larvae entered the Sacramento, combined with high water temperatures, have influenced their retention in the nets? Rice field pesticides also have been a concern. However, after pesticide application this year, rice field water was, for the most part, held on the fields and not released back to the river, so pesticides should not have caused any problems this year.

Research and Evaluation at Tracy Fish Collection Facility

Efforts at Tracy Fish Collection Facility are summarized in the following sections.

Predator Removal

Systematic removal of fish predators has been the primary focus of studies in 1991 and 1992. During quarterly sampling in 1991, 1,925 striped bass and 531 white catfish were removed. During 1992, removal efforts were monthly from February through June and will continue monthly from September through December. Results show fish predators can be kept at low levels by regular trapping and removal programs. In addition, we are acquiring data on other species and analyzing stomach contents of various sizes of striped bass and white catfish.

Local Fish Resources

In 1991 and 1992, fish in the Delta-Mendota Canal intake channel adjacent to and immediately below the Tracy Fish Collection Facility are being assessed. Each quarter, standard fyke- and gill-nets are set and lifted both day and night. In 1991, there was limited electrofishing along the intake channel shorelines. Plans for 1993 are to redirect field efforts to evaluations of fish salvage efficiencies.

In 1991, gill-net samples captured 365 fish of 15 species. Overnight gill-net sets produced far greater numbers than day sets. Striped bass and white catfish were the most abundant species. Striped bass numbers increased regularly through the year and peaked in December. White catfish were the most abundant species in May, but were not caught in December.

Splittail (Family Cyprinidae), a large minnow considered uncommon in the Delta, was the third most abundant fish in the samples.

Fyke-netting was relatively unproductive in 1991, except in May, when 10 samples contained 385 white catfish but no other species. Fishing time varied from about 8 hours during the day to about 18 hours overnight. Only 12 catfish were taken in day samples, compared to 373 in overnight collections.

Entrainment of Fish Eggs and Larvae

An automated pump sampling device has been developed for real-time monitoring of eggs and larvae at the intake area. The device acquires hourly concentrated ichthyoplankton samples and automatically preserves them to minimize in-sample predation and decomposition. To check efficiency of the device, plankton nets are often deployed near the pump orifice. The pump sampler was operated continuously from April 28 to June 15, 1991, and again from February 15 to June 7, 1992, with few shut-downs. In analyzing the data, emphasis will be on two major areas: estimation of species-specific entrainment rates of early life stages of fish with comparisons to environmental variables, and evaluation of pump sampler efficiency with comparisons between simultaneous plankton net and pumping data.

Advanced Flow Instrumentation

USBR's Denver office has been studying the latest technology in automated flow instrumentation that might apply at Tracy Fish Collection Facility in the future. If acceptable, new instrumentation will be installed at key sites early in 1993. The instrumentation will enhance future research on salvage efficiency studies, and routine operations should benefit as well.

Techniques for Estimating Fish Numbers and Sizes

Combined efforts of USBR and scientists at Israel Oceanographic and Limnological Research, Ltd., have resulted in transfers of technologies for sampling fish populations with "single beam" hydroacoustic devices linked with computer software developed at the University of Oslo, Norway. These new techniques are being applied at the Tracy Fish Collection Facility with the aid of Dr. Paul Walline of IOLR. The system worked well under operational conditions tested during the first week in June.

Fish Salvage Efficiencies

The predator removal program is an initial step toward improvement of fish salvage capabilities at Tracy Fish Collection Facility. Acquisition of field data in December 1992 will complete field programs for this phase. Tentative plans for 1993 include:

- Continuing monthly predator removal programs.
- Continuing entrainment estimates for fish eggs and larvae.
- Refining sieve-netting techniques to quantify losses of fish through the louver systems.
- Refining identification (taxonomy) and counting procedures.
- Initiating hydroacoustic studies at fish stocking sites in the Delta to determine the extent of predator concentrations.
- Experimenting with released and recovered fish (young salmon and striped bass) to determine survivorship in the holding tanks and efficiencies of the secondary louver system.

Jim Arthur, USBR

Interagency Ecological Studies Program
NEWSLETTER
3251 S Street
Sacramento, CA 95816-7017

DEPT OF FISH AND GAME
ATTN: PERRY HERRGESELL
4001 NORTH WILSON WAY
STOCKTON CA 95205

Interagency Ecological Studies Program for the Sacramento-San Joaquin Estuary

NEWSLETTER

A Cooperative Effort of:

California Department of Water Resources
State Water Resources Control Board
U.S. Bureau of Reclamation
U.S. Army Corps of Engineers
California Department of Fish and Game
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S. Environmental Protection Agency

Editors:
Randy Brown, Department of Water Resources
Perry Herrgesell, Department of Fish and Game
Vera Tharp, Department of Water Resources