Interagency Ecological Program for the Sacramento-San Joaquin Estuary

Newsletter

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For information on the Interagency Ecological Program, visit our home page on the World Wide Web (*wwwiep.water. ca.gov).*

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.

Interagency Program Quarterly Highlights

These Quarterly Highlights summarize significant activities and findings of the Interagency Program during the past 3 months.

Delta Flow Measurement

Rick Oltmann

All ten UVM continuous flow monitoring sites were generally operational throughout the past quarter. A replacement transducer cable was deployed for the Sacramento River at Rio Vista left bank UVM on April 11; for the most part, both UVMs at the Rio Vista site have been operational since about April 12. Cross-sectional area versus stage relationships were developed for the Rio Vista and Dutch Slough sites, but velocity relationships have not yet been completely developed. Several calibration flow measurements were made at both sites in addition to the San Joaquin River at Jersey Point site. Additional measurements are required before satisfactory ratings can be obtained and tidal flows computed for these three sites. The San Joaquin River at Stockton site is only partially calibrated; we have been unable to make flood tide flow measurements because high flows over the past several months have eliminated upstream tidal flows; we need flood tide flow measurements to complete the velocity rating. Once calibration is completed, USGS should be able to provide flow data at all ten UVM sites for most of the quarter. Flow data from this UVM network will be available soon from the IEP file server.

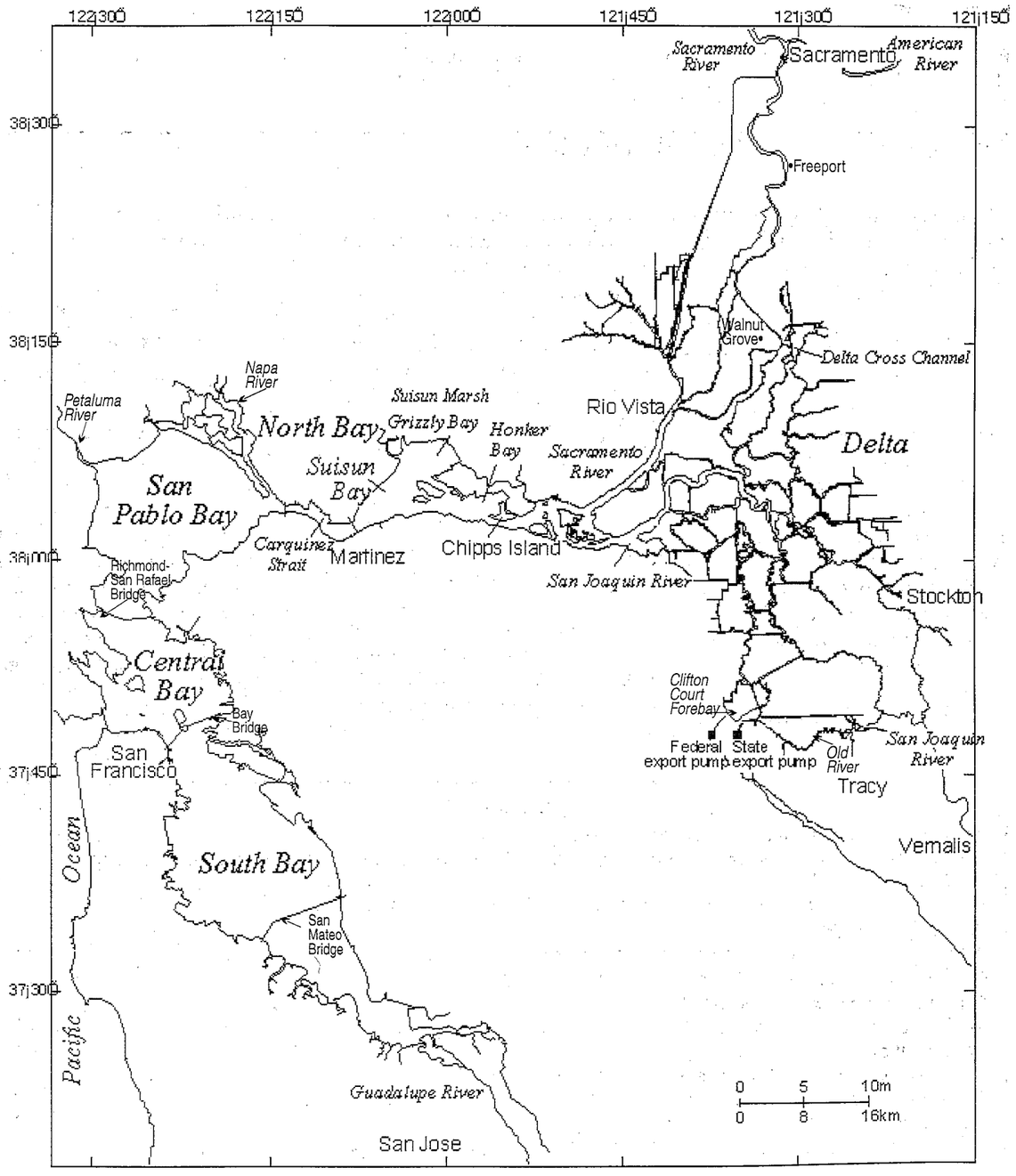
Delta 1-Dimensional Hydrodynamic Model

Rick Oltmann and Kamyar Guivetchi

The IEP Delta Model Project Work Team has developed irregular channel cross sections for almost the entire domain of the model, which includes the Sacramento-San Joaquin Delta, Suisun Bay, and Suisun Marsh. Data from several sources were used to develop the cross sections for simulating delta channels. Rectangular cross section data will be used for the few secondary channels for which field data were not available.

CONTENTS

SACRAMENTO-SAN JOAQUIN DELTA AND SAN FRANCISCO BAY ESTUARY



In June, the DWR Delta Modeling Section released a preliminary, non-calibrated version of its Delta Simulation Model 2 (DSM2) to the project work team for review. This version contains irregular cross section data for only 22 of the 496 channels that form the model grid. DWR plans to include all of the irregular cross section data in its next release of the model.

The project work team has met several times to discuss items such as how to use the model, model calibration strategies and procedures, and plans for sensitivity testing of the model.

Zooplankton

Jim Orsi

The native copepod *Eurytemora* was the second most abundant copepod captured during surveys in Suisun Bay and the delta in April. The most abundant species was *Limnoithona tetraspina*, a copepod introduced in 1993 that replaced its congener, *L. sinensis*, as most abundant. Neither copepod was as abundant as in 1995. Most copepods, cladocerans, and rotifers were less abundant in 1996 than in 1995, in spite of similar outflow. No new zooplankton or mysid species have been detected since 1993.

Eurytemora was most abundant in Disappointment Slough in winter and spring, as it was last year, but in the drought years *Eurytemora* abundance was highest in the San Joaquin River at Stockton. The shift in location was probably due to the high San Joaquin River flow in 1995 and 1996, which would have prevented a buildup of copepods in the San Joaquin River.

Adult Striped Bass

Dave Kohlhorst

Scheduled biennial tagging of adult striped bass was conducted this spring. We captured fish with two gill-netting boats in the western delta and fyke traps in the Sacramento River near Knights Landing. Our tagging program was impacted by actions to protect adult winter-run chinook salmon; this included alterations in permissible netting locations in the delta, prohibition of fishing the traps over weekends, and prohibition of fishing the traps in the first half of June due to capture of at least two salmon identified by NMFS as winter-run. Additionally, the traps could not be fished for much of the normal sampling period due to high streamflow.

In spite of these problems, we tagged 4,601 bass on the gill-netting boats and 2,620 bass from the fyke traps. The traps fished for only 18 days, so striped bass apparently were abundant in the Sacramento River this year. This was also reflected in tagging in the delta, where catches were highest in the lower Sacramento River and few bass were caught in the San Joaquin River. The total number of striped bass tagged in 1996 (7,221) is similar to other years in the 1990s, which have ranged from 4,612 in 1992 to 8,375 in 1991. This compares with 14,000-18,000 bass tagged annually in the early 1970s.

Legal-sized striped bass population estimates were updated with recapture data from the fall 1994 creel census. The preliminary 1994 estimate is 712,000, similar to abundance estimated for other years in the 1990s.

Juvenile Salmon

Mark Pierce

Monitoring for juvenile chinook continued, with midwater trawling 3-7 days/week at Sacramento and 1-7 days/week at Chipps Island. Weekly beach seining continued on the lower Sacramento River, lower San Joaquin River, and in all reaches of the delta. The last winter-run-sized juvenile seen at Sacramento was on April 2, and the last captured at Chipps Island was on May 22.

The pilot Knights Landing effort continued, with daily rotary screw trapping and fyke netting and monthly Kodiak trawling. This site is above the confluence of the Feather and American rivers and out of the range of tidal influence. We hope this effort will allow us to better estimate relative abundance of smolts (particularly winter run) entering the delta from the upper Sacramento River.

The south delta barrier evaluation using hatchery-reared, coded-wire-tagged, fall-run smolts was altered drastically due to delays in installing the head of Old River barrier because of high flows. On various dates, about 650,000 Feather River Hatchery smolts were released in the San Joaquin River at Mossdale, Dos Reis, Jersey Point, and above Turner Cut. Two releases were made at Mossdale and one at Dos Reis without the barrier at low (1,500 cfs) total exports, and two releases were made at Dos Reis with a partial barrier in place at low (1,500 cfs) and moderate (3,100 cfs) exports.

An efficiency study at the real-time monitoring trawl site in Turner Cut (conducted along with the Turner Cut smolt releases) met with difficulties. On the first try, night fell before all the fish were recovered, and on the second try a tidal change intervened. Still, a rough estimate of the

trawl efficiency will be developed and applied to the number of coded-wire-tagged fish recovered from the Turner Cut release to estimate the absolute number of fish diverted off the San Joaquin and into Turner Cut. Analysis is pending completion of tag processing.

An additional 100,000 coded-wire-tagged fall-run smolts were released at Sacramento (on April 25 and May 6) by the CVPIA-AFRP program to index survival on the Sacramento River under low export/high outflow conditions. These releases coincided with in-river production releases from the Feather River Hatchery.

More than 1,200 coded-wire tags were recovered at Chipps Island, and processing the backlog of tags continues. Preliminary results and survival indices should be available next quarter. Through May 23, no tagged hatchery-reared winter run had been recovered at Chipps, but two tagged wild spring run have been recovered. Concerns about the high numbers of delta smelt captured during salmon trawling at Chipps Island led to a sharp sampling cut-back in early June, after the bulk of the released coded-wire-tagged smolts had passed. We will continue to limit sampling there through the summer if delta smelt catches remain high.

A special study was conducted to evaluate temperature shock and post-release mortality of coded-wire-tagged fish. Subsamples of fish from the Feather River and Merced River hatchery releases at Dos Reis were held for 48 hours in live pens, where water temperature was 63°F on May 1 and 62°F on May 16. After 48 hours, the fish were evaluated on several physical condition factors and general vigor. Water temperature differed by up to 11.5°F between the transport trucks and the river, yet of 618 fish evaluated, only one (which was wounded) appeared to be in less than extremely good condition. This is evidence that temperature shock in itself does not account for significant mortality within 2 days of release. Also, Feather River stock appeared to fare as well as fish from within the San Joaquin basin.

Delta Smelt

Dale Sweetnam

Larval fish densities have been monitored in the Barker/Cache Slough region of the estuary to reduce delta smelt entrainment losses at the North Bay Aqueduct. Sampling has been conducted every other day since February 14 and continued through July 15. Under the 1995 Delta Smelt Biological Opinion, diversions at the NBA are restricted to a 5-day running average of 65 cfs for 5 days when delta smelt densities exceed a set threshold in surrounding sloughs. So far, the threshold level has not been exceeded this year, and pumping has not been restricted. It appears that there was no concentrated spawning effort in the Cache Slough area, as in previous (usually drier) years. Sampling is also being conducted near Prospect Island, which has been proposed for restoration. To date, over 53,000 larval fishes have been identified from the eight stations in this survey. A total of 285 larval delta smelt have been collected, with highest catches in Miner Slough, near Prospect Island. Of the total larvae identified, 71 percent have been prickly sculpin (37,608), but this percentage has been declining as threadfin shad and striped bass larvae have increased in the May-June catches.

The 20mm survey started April 10 and will continue through July. Each survey samples 42 stations throughout the estuary every 2 weeks. The main purpose of the survey is to obtain an indication of post-larval delta smelt distribution. This information can be used to make better informed decisions concerning operation of the SWP/CVP diversions in the southern delta. This year, the information was used to assess the relative threat to the entire delta smelt population as the SWP and CVP approached their take limits for May and June. Delta smelt has been widely distributed this year due to the wet water year and increased flows on the San Joaquin River for the past two years. Spawning locations, inferred by the presence of prolarvae, appeared to be concentrated in three general areas: the San Joaquin River, Montezuma Slough region, and Napa River. A much smaller proportion of spawning appears to have been in the Sacramento River and Cache Slough areas this year than in previous years. We have concentrated sampling effort on the Napa River, because spawning apparently did take place there this year. We have observed adults in the river since last year, and larval delta smelt were collected as far as 23 kilomeeters upstream, out of the influence of strong currents near the mouth that can transport larvae and debris from the estuary into the river. With five surveys completed, over 57,000 larval and post-larval fishes have been identified. Of these, 2,587 have been delta smelt, making up 4.5% of the total catch. The largest catches have been of longfin smelt (16,884; 29.3%), shimofuri gobies (14,041; 24.3%), and striped bass (8,386; 14.5%).

Effects of Contaminants

Leo Winternitz

The Contaminant Effects project work team has reviewed five proposals addressing the effects of contaminants on selected aquatic resources and has selected two:

- "Herbicide Concentrations and Potential Effects on Phytoplankton Photosynthesis and Primary Productivity in the Bay-Delta Ecosystem" (J. Edmunds, K.Kuivila, and J. Cloern of USGS).
- "Reproductive Success and Larval Growth in Declining Fish Populations of Upper San Francisco Bay and Delta in Relation to Trace Organic Compounds" (R. Spies of Applied Marine Sciences).

Work is pending approval by the IEP Coordinators.

We are working on a 5-year plan and strategy that will direct development and selection of research work and proposals. A draft plan should be available within the next 2 months.

Resident Fish

Ted Sommer and Leo Winternitz

Present IEP monitoring includes stations in all major regions of the estuary. Most sampling has been concentrated in channel or shoal areas conducive to seining or trawling for fish living in shoreline habitat types including riparian, floating, submergent, and emergent vegetation. (An exception is DFG electrofishing surveys in 1980-1983 and starting again in 1995.) In 1996, as part of an ongoing effort to examine the habitat of native fishes such as delta smelt and splittail, the Resident Fish project work team initiated monthly field trips to sites not traditionally been sampled. The primary focus of the sampling to date has been flooded islands or completed restoration sites. The surveys are not intended to be a detailed study but to help select sites deserving further research.

Overall, the surveys have shown an impressive diversity of species, particularly in the Yolo Bypass. Sampling in Liberty Island and Little Holland Tract found anadromous and resident fish, but the configuration of the system may create stranding problems. Further studies are recommended to examine habitat use and stranding risks in this part of the delta.

Three Yolo Bypass sites were sampled using beach seines: Liberty Island, Little Holland Tract, and Greens Lake. Liberty Island and Little Holland Tract receive seasonal inflow from the Yolo Bypass in the north and tidal flow from unintentional levee breaks in the south, and both have been discussed as possible restoration sites. Little Holland Tract had the highest diversity of native species. Seven one-year-old splittail were captured, suggesting that this region is a rearing area for the species. The highlight of the Liberty Island visit was the collection of 10 winter-run-sized chinook salmon stranded in a small pond formed by receding waters at the northwest corner of the island. Greens Lake is a permanently flooded basin about a mile south of the Yolo Causeway. Diversity of native species was relatively low, perhaps due to high (80°F) water temperature. However, this is valuable baseline data for a site that has not, to our knowledge, been sampled previously by fisheries biologists.

In 1986, the USACE created about 23 acres of island using dredge material at Venice Cut Island. USACE beach seine monitoring during the following 3 years showed that the site was increasingly used by fish, with 20 species noted over the course of the study. Recent IEP beach seine hauls found four species, all of which had been reported by USACE.

The Resident Fish team organized an all-day workshop focusing on results of delta smelt research and special studies over the past 3 years. In addition to raising the common level of knowledge among scientists and managers, the workshop provided direction on the types of studies that should be pursued over the next several years. We have collated comments and summarized and prioritized proposed work. Delta smelt study proposals for the next fiscal year were developed using this information. The summary paper, "Recommended Areas of Emphasis for Delta Smelt Research — May 1996" will be on the IEP home page toward the end of July.

Splittail Spawning

Randall Baxter

Near potential spawning areas, 49 adult splittail were captured and radio tagged, then tracked regularly from the air and by boat. Most were tagged in mid-March coincident with high water. Fish were captured and tagged at Liberty Island (north of Cache Slough, at the south end of the Yolo Bypass), at Miller Park on the Sacramento River, and in the lower 5 miles of the Sutter Bypass.

Little upstream movement of tagged fish was observed. Most remained near the tagging site for a week or two before moving downstream. Downstream movement coincided with a rapidly declining hydrograph. In the Sutter Bypass before emigration, many fish were tracked to a strip of riparian vegetation on the west edge of the bypass, between the bypass and the main drainage canal. This area was later sampled for splittail larvae to confirm spawning. Due to high fresh-water outflow in April, it was possible to track some of the adult fish to the delta and beyond. Of fish tagged in the Sutter Bypass, two were located in Honker Bay, one in Suisun Slough, and one at Decker Island. Of those tagged at Miller Park, one was tracked to Suisun Slough, one to Grizzly Bay, one to Honker Bay, one to Montezuma

Slough, two to Sherman Lake, and one to the Sacramento River at Rio Vista. These data suggest that splittail spawning in the Sacramento River disperse throughout the delta, Suisun Marsh, and Suisun Bay and may have originated from this broad area. High specific conductance made tracking fish impossible on the San Joaquin River or the south side of Suisun Bay and the Sacramento River channel, so tagged fish moving into these areas were lost.

Larval sampling began April 2, after most of the tagged adults had moved downstream. Rapidly dropping water levels made plankton tows in the bypass potentially dangerous. Instead, flooded riparian and open-water areas were sampled using larval light traps and a larval hand net.

The larval light traps were constructed by Andy Rockriver of the DFG Bay-Delta Division for his masters thesis project, and I thank him for their use. The Plexiglas light traps are about square, with four 1.6-mm-wide slots running vertically the height of the trap at the ends of shallow fykes. They float, and use battery-powered lights to attract larvae. Each trap drained into a detachable gallon jar with 500 micro mesh window, which allows collected larvae to be poured into preservative. The light traps were set at dusk in or adjacent to flooded vegetation and fished 1-2 hours before retrieval. The larval light traps worked well. Sixty-three larval splittail were collected in 18 sets, most in vegetation near where adults had been tracked. Given the turbidity (secchi depths 15-25 cm) and initially deep water (1.8 to 2 meters), it was impressive that splittail larvae were caught at all in the relatively short sets. Moreover, the samples were clean of debris, and the larvae were in perfect condition for identification; this is not often the case for any other gear used to date. Splittail larvae collected were as small as 7.9 mm — close to the size at hatching — and as large as 17.5 mm. More work needs to be done to confirm that the smallest larvae are attracted to light and capable of moving to it. Capture of yolk-sac larvae is needed to suggest that spawning occurred nearby.

The larval hand net is a 50x50-cm aluminum net frame attached to a 2-meter aluminum pole, with 500 micron mesh tapering into a liter cod-end jar. The net is pushed ahead of a person wading or off the front of a boat. The larval hand net was effective for capturing larval splittail, and efficiency improved as the water level dropped below 1 meter. The hand net allowed sampling both vegetated and open-water areas and was used to complement the passive sampling of the light traps. In 46 hauls, the hand net captured 122 splittail larvae from 8.2 to 27 mm. More larvae appeared to come from vegetated areas than from open water. When pushed hard, the larval hand net appears to be efficient at capturing splittail as large as 20 mm or more.

A full report on these activities will be available in December.

Contra Costa Canal Intake Entrainment

Jerry Morinaka

During April and May, we used a sieve-net to sample fish entrainment every other day on the discharge side of Pumping Plant 1 at the Contra Costa Canal. In June, we sampled every fourth day. During April through June, we captured 31 juvenile chinook salmon, two of which were winter-run size. We captured 8 juvenile splittail, all in May and June. No adult or juvenile delta smelt were captured in the sieve-net. However, larval delta smelt (fork length <20mm) were captured during three plankton-net sampling efforts conducted in April and May to assess the efficiency of the sieve-net in capturing small juvenile delta smelt and splittail.

In April and May, we monitored every other week in the Mallard Slough Pumping Plant intake channel and in the Sacramento River outside the intake channel. Sampling was conducted using tows with an egg and larval net and a modified tow-net. During both egg and larval net sampling efforts in May, sampling indicated delta smelt were more abundant in the river than in the intake channel. Egg and larval net sampling in early April indicated longfin smelt were more abundant in the river than in the intake channel. The egg and larval net sampling in early May also indicated longfin smelt were more abundant in the river, but tow-net sampling on the same date indicated that longfin smelt were more abundant in the intake channel.

Georgiana Slough Acoustic Barrier

Darryl Hayes

The evaluation of the acoustic barrier's fish guidance capability was completed the last week of May. Seven weeks of Kodiak trawl sampling in Georgiana Slough and in the Sacramento River below the slough (2 days of sampling per week when the sound was on verses 2 days sampling when it was off) was used to evaluate the system during the juvenile fall chinook salmon emigration. Preliminary estimates of barrier efficiency varied from week to week and ranged from -27% to +57%. A statistical analysis of the data is underway to determine what factors influenced the results and if they were significant.

This year's effort by DFG, DWR, and Hanson Environmental was coordinated with the Real-Time Monitoring Program effort. The evaluation also included: two intensive round-the-clock sampling efforts; two paired, marked salmon release/recapture studies (200,000 fish); acoustic mapping of the underwater signal; and flow monitoring. Summary reports are available.

The barrier operated in extreme debris and flow conditions (flow at Freeport was as high as 82,000 cfs). A portion of the array was damaged in these conditions near the end of the study.

Fish Treadmill Studies

Darryl Hayes

Construction of the prototype 13-foot-diameter, circular screened flume is nearing completion at the UC-Davis Hydraulic Laboratory. Several improvements have been implemented to control the large volume of water into the facility (up to 25 cfs) and to dampen noise and vibrations. The large tank is now connected to the water supply, and preparations are underway for biological testing, which should start in late summer. Two of the study's planned 3-year program elements have received funding, including funding for renovations at the laboratory to accommodate fish holding facilities, state of the art monitoring equipment, and testing of many delta fish species.

In a related effort, a review is underway of swimming performance data collected in the past by DFG, NMFS, and the University of Washington. Agencies are investigating the relationship of juvenile salmon swimming performance to fish screen bypass requirements and spacing issues.

Clifton Court Forebay Predator Movement

Maureen McGee and Marty Gingras

From February 22 to June 20, an additional 52 striped bass were fitted with externally mounted sonic tags to document the movement of adult and subadult striped bass into and out of Clifton Court Forebay. A total of 181 fish have been tagged during this 1-year study. The fish have been monitored at two sites adjacent to the radial gates and one site upstream of the logboom at the Skinner Fish Facility.

Tagging sessions this quarter were spread out over April and May, deploying no more than 10-12 tags per week. Catch-per-unit-effort was quite high. A total of 28 tagged fish were found dead or were caught by anglers during this quarter — many more than in any previous quarter. Thirteen tagged fish were found dead at the Skinner Fish Facility trash racks shortly after Komeen was applied to Clifton Court Forebay on June 11, 1996.

We collected 27 fish for another control group study, this time investigating what effect increased temperature and different forebay conditions had on tagged fish. We held these fish for a month and a half. Due to a high mortality rate, we were unable to maintain the group as long as the fall/winter control group. A total of eight tagged fish and ten untagged fish were sacrificed and processed (weight, length, sex). A total of 32 fish were tracked moving out of Clifton Court Forebay, and eight were later observed again in Clifton Court Forebay. Most of the movement was early in the quarter, when export levels were reduced. Exports increased toward the end of this quarter.

Of the 181 fish tagged during this study, 37 were found dead or were caught by anglers and 75 made transits through the gates. Of the fish that survived, 52% made transits through the gates. It is apparent from this preliminary review of the data that Clifton Court Forebay is an open system in which adult and subadult striped bass move in and out when the radial gates are open.

Entrapment Zone Studies

Wim Kimmerer and Tim Hollibaugh

We accomplished two things in the last quarter: the draft final report of our 1994 entrapment zone study, and our 1996 field work.

The 1994 study will be quite a hefty IEP Technical Report. It includes sections on hydrodynamics, bacteria and microzooplankton, phytoplankton, zooplankton, and larval fish. It has been written like a book, with different chapters written by different authors. The report is now being reviewed by IEP and the Science Advisory Group. Once it has been reviewed and revised, several chapters of the report will be submitted for publication in professional journals.

We conducted three cruises in the entrapment zone in early to mid-June. In all three cruises we had R/V *San Carlos* in the main channel of Suisun Bay, and R/V *Turning Tide* either at the Mothball Fleet or in Suisun Cut. R/V *Compliance* simultaneously made numerous runs up the channels for CTD drops and longitudinal profiles of salinity and temperature. Many IEP personnel contributed substantially to this effort in terms of sampling design, organization, staffing, preparation, and fieldwork.

These cruises differed from previous entrapment zone studies in that we

sampled at fixed stations instead of moving with the tide. We were able to do this because during the previous studies we learned that there was not much difference in response of zooplankton and larval fish among waters of different salinity, so differences in time at a fixed station could be assumed to be due mainly to tide or time effects, not salinity effects. This greatly simplified our sampling program, since we were working in water of nearly the same depth all the time. We further simplified it by taking all our plankton and larval fish samples with fixed nets of 200 micron mesh, sampled near the surface, near the bottom, and at an intermediate depth.

It will take about a year to work up the samples from the 1996 entrapment zone study. Data from the 1995 study are nearly ready for analysis, which should be finished this fall.

In addition, we have participated in monthly cruises on the RV *Polaris* since the beginning of the year, with sampling focused at three stations: Station 18 (Alcatraz Island, marine end-member), 2-5 PSU (EZ), and Rio Vista (fresh water end-member). Measurements have included particle size determinations by microscopy and particle counter, dissolved organic C, particulate organic C and N, chlorophyll, biochemical characterization of particles (total carbohydrate, protein, lipid), and abundance, productivity, metabolic characteristics, and phylogenetic diversity of particle-associated and free-living bacteria.

Initial findings are as follows. Dissolved organic C distribution seems to follow a conservative mixing curve, *ie,* only a small fraction of it is precipitated in the turbidity maximum. Particle-bound populations appear distinct by some metabolic characteristics, but surprisingly not by phylogenetic analysis. As found in our previous entrapment zone studies, a large fraction of the microbial biomass and production is associated with particles in the turbidity maximum.

Since most of our samples are from high-flow periods with no distinct turbidity maximum, we will continue sampling during the summer. In addition, we will be examining grazing by copepods on free-living and particle-bound bacteria to determine whether these particles are an important pathway for the transfer of bacterial production to higher trophic levels.

Estuarine Ecology Team

Wim Kimmerer

In the last quarter, the Estuarine Ecology Team finished a draft report on the so-called "fish/X2" relationships, which we broadly defined to include all relationships of abundance or survival of estuarine fish or invertebrates to X2, outflow, or streamflow. The purpose of the report was to describe what we believe to be the most likely causes underlying these relationships, with the ultimate aim being to design field programs to determine the causes. In addition, this provided a good opportunity to say what we know and what we believe to be true about these relationships, and also to exclude a lot of potential causes that we believe are probably not important. This report was submitted for consideration as an IEP technical report.

In addition, the Estuarine Ecology Team attempted to summarize the evidence regarding likely impacts of various limiting factors on diverse ecological features of the delta. Two tasks were completed with general consensus among the team:

- An assessment of whether there was evidence of an impact on each selected species for food limitation, contaminant concentrations in waterways, entrainment at pumping plants and elsewhere, and habitat limitation.
- Prioritization of each factor of its likely role in limiting recovery.

The resulting draft report has will be submitted to IEP Coordinators for approval and eventual transmittal to CalFed and others.

Data Available through the Internet

Karl Jacobs and Chuck Armor

Most of the program elements now have data on the IEP file server. Data are available using a web browser (URL http://www.iep.ca.gov/). Other data relevant to the Interagency Program also have been added to the server, and efforts are underway to place CVPIA/CAMP (Comprehensive Assessment and Monitoring Program) data on the server. A prototype of the CAMP database/home page, containing anadromous fish estimates for delta tributaries should be available soon.

We have made presentations to several project work teams and other bay/delta groups. Individuals and groups can take an active role in the file-server project by suggesting additional data that should be accessible on the server and improvements in data accessibility. We are working on comments received at previous presentations and have begun providing more data. We are also working on a database design that will improve data access. If you are interested in a presentation or information about the server, contact Murray Ng (916/227-1309 or mdng@water.ca.gov).

The Data Utilization Work Group meets monthly to provide a forum where biologists, engineers, and hydrologists can interact with computer technical staff and have an active role in data management.

Identification of Smelt Species and Their Interspecific Hybrids in the Sacramento-San Joaquin Estuary by Allozyme Analysis

Bernie May, UC-Davis

One potential threat to long-term survival of the endemic, endangered delta smelt (*Hypomesus transpacificus*) in the Sacramento-San Joaquin estuary is habitat encroachment of the introduced Japanese wakasagi smelt (*H. nipponensis*). Although wakasagi were originally introduced into six warmwater reservoirs in California, far removed from the estuary, they now occur in large numbers in Lakes Folsom, Almanor, and Oroville and have been observed in Cache Slough, the lower American River, the Mokelumne River, and in the CVP/SWP salvage facilities (see Sweetnam 1995).

Wakasagi and delta smelt are difficult to tell apart morphologically. Allozymes have been used to confirm the identity of morphologically cryptic individuals and have, in fact, revealed two F1 hybrids between delta and wakasagi smelt (Trenham *et al* 1995). The relative proportions of wakasagi amidst delta smelt remained unknown because most samples for prior work were not drawn randomly but were, rather, chosen for difficulty in morphological identification. This current study was initiated to estimate the proportion of wakasagi and the delta-by-wakasagi smelt hybrid in the estuary.

Methods

DFG personnel collected three random samples of 100 smelt each from near Chipps Island, from Decker Island to Cache Slough, and from SWP. Additionally, FWS collected 4 morphologically cryptic smelt from near Chipps Island, 9 from the mouth of the American River, and one from an unknown location in the estuary. For comparative purposes, 5 wakasagi and 14 longfin smelt were also collected. Fish were placed on dry ice and shipped to the Genomic Variation Laboratory in the Department of Animal Science at UC-Davis.

All smelt were analyzed for allozyme variability by horizontal starch gel electrophoresis (May 1992). Allozymes are different forms of an enzyme (*eg,* lactate dehydrogenase) coded by a single genetic locus. Variations in allozyme banding patterns among individuals can be interpreted and genotypes assigned for single Mendelian loci, similar to the ABO blood group system (*eg,* A, B, O, AB).

Results

Initially, 21 smelt from Chipps Island, 5 wakasagi from the Feather River, and the 14 unknown samples were analyzed for 23 loci in eye, muscle, and liver extracts. All remaining samples were analyzed for eight loci in muscle, which distinguish the smelt species (Ac-1, Ac-2, Ada, Ck-1, Gpi-1, Ldh-1, Mdh-2, Pgd). All of the 300 randomly sampled smelt were delta smelt except one delta-by-longfin smelt F1 hybrid (Figure 1) from above Decker Island. Among the 14 smelt that were morphologically difficult to identify, those from near Chipps Island were three delta-by-longfin smelt F1 hybrids and one wakasagi, the nine from the mouth of the American River were all wakasagi, and the smelt from an unknown location was a delta-by-longfin smelt F1 hybrid (Table 1).

Discussion

The primary finding of this study was that wakasagi or their hybrids with delta smelt currently compose a small proportion of the overall smelt population in the estuary (*ie,* none observed in the 300 randomly sampled individuals). A single wakasagi was found in a morphologically cryptic individual near Chipps Island, and more were found at the mouth of the American River. At this time, the wakasagi would not seem to be impacting the delta smelt in the estuary as a whole.

Unexpectedly, hybrids between delta smelt and longfin smelt were encountered in this study. One reason for the existence of delta-by-longfin smelt hybrids may be the dramatic increase in longfin smelt available to spawn in 1995 (Baxter

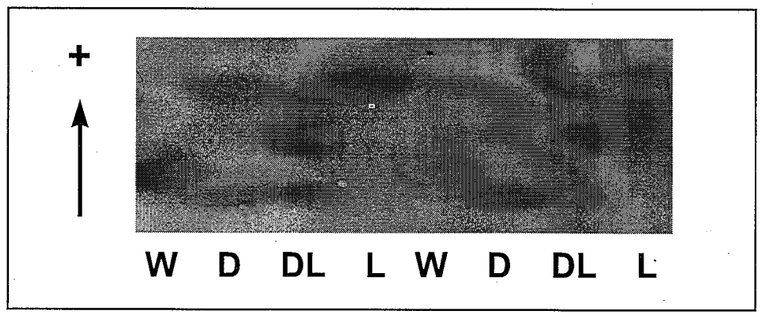


Figure 1
Creatine kinase activity in muscle extracts of wakasagi (W), delta smelt (D), delta smelt-by-longfin smelt F1 hybrid (DL) and longfin smelt (L).
All three species of smelt possess different alleles that code for alternate forms of the enzyme (allozymes), that is, the different allozymes migrate to different positions on the gel. Hybrid individuals are readily scored for this locus and other enzyme coding loci for which the parental species possess different alleles. Note how the DL hybrids share the L and D specific bands plus a heteromeric band.