Interagency Ecological Program for the Sacramento-San Joaquin Estuary

Newsletter

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For more information about the Interagency Ecological Program, visit our home page on the World Wide Web (www.iep.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 Randall Brown, California Department of Water Resources, 3251 S Street, Sacramento, CA 95816-7017.

Interagency Program Quarterly Highlights

Delta Flow Measurement (April to June 1998)

Richard N. Oltmann

The San Joaquin River at Stockton and Sacramento River above the Delta Cross Channel UVM sites have been repaired and are again operational. These sites were non-operational due to transducer problems resulting from high flows. The other UVM stations successfully collected data throughout the quarter.

On April 1, USGS deployed velocity measuring equipment (ADCPs and one S4) in the south delta at the sites listed below as was done during spring 1997. The ADCPs will provide a continuous velocity-profile record and the S4 a point-velocity record which will be used to provide additional flow time-series data to augment the UVM flow network. ADCPs were deployed at the same six locations as last spring; the seven velocity monitoring sites are:

1. San Joaquin River between Turner and Columbia Cuts
2. Turner Cut
3. Middle River between Columbia Cut and Connection Slough
4. Victoria Canal
5. Old River between Clifton Court Forebay intake channel and Grantline Canal

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6. Grantline Canal east of Tracy Road Bridge
7. Old River east of CVP intake channel (S4 site)

The velocity monitoring equipment is scheduled to be retrieved June 29.

During the three-month data collection period, numerous flow measurements have been made at each site with a downward-looking ADCP flow measuring system for use in developing velocity calibration curves necessary in converting the ADCP/S4 measured velocities to mean cross-sectional velocities, and in computing continuous flow records for each of the sites.

On April 16, another tracer-dye study was initiated on the San Joaquin River at Mossdale by USGS in conjunction with the release of salmon smolts by USFWS and CFG. USBR and DWR graciously provided the 155 liters of dye, and also provided personnel to assist with the operation of the automatic samplers that were used to track the dye, and the procesing of the water samples in the lab. At the time of the release, San Joaquin River flow was about 25,000 cfs and there was no barrier installed at the head of Old River. As expected, the dye concentration hydrographs produced for each of the ten sampling sites showed that the high flows quickly moved the dye through the south Delta and to the north.

On May 20, USGS began testing a new two-beam, side-looking ADCP that can measure water velocity throughout a horizontal plane extending 50 feet into the water flow from the head of the transducer. The ADCP has been deployed at the Threemile Slough UVM site and the initial results are promising. This new ADCP may provide a less expensive means for monitoring tidal flows relative to a UVM.

DWR and USGS are planning a cooperative hydrodynamic study of the confluence area for the Sacramento and San Joaquin rivers, including New York Slough and Sherman Lake. Velocity data will be monitored at ten locations using ADCPs and S4s from September through November 1998. Numerous measurements will be made throughout the tidal range at each site and used to compute time series of tidal flows in the same manner as done in the spring south delta study described above. The flow data will be used to learn about the hydrodynamics of this area and provide data for model calibration.

Adult Striped Bass Population Parameters (April-June, 1998)

Dave Kohlhorst

As scheduled, biennial tagging of adult striped bass was conducted this spring. We captured fish with two gill-netting boats in the western delta, but for the first time since this program began in 1969, we could not fish the fyke traps in the Sacramento River because of continued high flow.

We tagged 4,968 bass on the gill-netting boats. This compares with 4,601 bass tagged from the gill nets in 1996, the last year we tagged. Creel census observations show excellent fishing occurred in the Sacramento River above Grimes this spring, and suggest that striped bass were abundant there, so we probably would have made good catches if we could have fished the traps. Because the fyke traps were not fished, the number of striped bass tagged in 1998 is lower than in most 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.

Our tagging program was minimally impacted by actions to protect adult winter-run chinook salmon because most of these actions involve alterations in the way we fish the fyke traps. We caught 13 adult chinook salmon in the gill nets, all of which were bright and unlikely to be winter-run.

Legal-sized striped bass population estimates were updated with recapture data from the 1996 fall creel census. The preliminary 1996 estimate is 775,000, similar to abundance estimated for other years in the 1990s.

Neomysis/Zooplankton Study

Jim Orsi

Neomysis abundance was low during the spring quarter, never rising higher than 3/m^3 at any station. May and June have been historically the months with the highest *Neomysis* abundance so the low spring values indicate that few will be taken for the rest of the year. *Acanthomysis bowmani* reached a record high of nearly 400/m^3 in the entrapment zone in May. The entrapment zone was in Carquinez Strait at that time. In June, *A. bowmani* abundance declined sharply. This is surprising since *A. bowmai* abundance is usually higher in June than in May.

Another record was set by *Limnoithona tetraspina*, a small cyclopoid copepod introduced from China in 1993. This species set a record high of 155,000/m^3 in April in the entrapment zone, then broke that record with a new high of 315,000/m^3 in May in San Pablo Bay. We do not know what this species eats, but apparently there was a lot of it in the water. Its nauplii were also numerous, reaching highs of over 2 million/m^3 in San Pablo Bay in May. June pump data has not yet been processed, so we do not know if this species became still more abundant in June as it usually does. *Limnoithona* generally peaks in fall but may not do so this year if conditions related to high outflow caused the unusual spring peak.

Rock Slough (Contra Costa Canal) Fish Monitoring Program

Jerry Morinaka

A study plan was developed in 1997 to provide pre-screening, baseline biological data for evaluating the performance of the future fish screening facility at the Rock Slough intake of the Contra Costa Canal. Because the study area was relocated from the previous three-year fish entrainment program study site, re-authorization for the incidental take of juvenile winter-run chinook salmon was required. An amendment has been submitted to cover the program under the IEP Biological Opinion, and once approved, the sampling program will be initiated.

Old River Fish Screen Facility (Los Vaqueros) Monitoring Program

Jerry Morinaka

Fish entrainment sampling behind the fish screens was initiated in late March at Contra Costa Water District's Old River fish screen facility. The entrainment sampling is part of a long-term monitoring program to evaluate the efficiency and effectiveness of the fish screens. A large sieve net constructed of 1/8-inch nylon mesh is used to capture any fish that may pass through the fish screens.

Preliminary fish sampling, conducted in March and April, was used to resolve problems with properly deploying the sieve net in the bays behind the fish screens. One shimofuri goby (*Tridentiger bifasciatus*) measuring 89 mm (fork length) was captured behind the fish screens in April. We sampled up to three times per week in May and June, excluding periods when facility maintenance prevented sampling. A total of six larval and small juvenile fish were captured in May and June, including splittail (*Pogonichthys macrolepidotus*), threadfin shad (*Dorosoma petenense*), bigscale logperch (*Percina macrolepida*), and prickly sculpin (*Cottus asper*). One bluegill (*Lepomis macrochirus*) measuring 62 mm and one largemouth bass (*Micropterus salmoides*) measuring 218mm were also captured in the sieve net behind the fish screens in May.

Mallard Slough Monitoring Program

Lee Mecum

The Mallard Slough monitoring program changed to an entirely different sampling method for 1998. Instead of sampling in the intake channel, samples are now taken from the bypass structure downstream from the pumps. This procedure permits us to sample water immediately after it comes through the pumps, thus giving an accurate picture of what fish are being entrained, as opposed to what species are in the intake channel. One fourth to one third of the pumped water is diverted into a flume and then through a net with .505 mm mesh.

Sampling started on May 26 and will continue approximately once per week until the salinity level becomes too great for CCWD to operate the pumps. To date, most fish taken have been fathead minnows (12, mean fork length 66.5 mm). Four striped bass (mean fork length 13.5 mm), one logperch (23 mm) and one prickly sculpin (8 mm) were also taken.

North Bay Aqueduct Larval Entrainment Monitoring

Heather McIntire

The 1998 larval entrainment monitoring began March 1, two weeks late due to extremely high outflow and boating restrictions in the estuary. Four stations in Barker and Lindsey Sloughs are sampled with a sled-mounted plankton net every other day and an additional four stations are sampled every fourth day in Cache and Miner sloughs. Sampling is scheduled to continue through July 17. Sampling results from the three stations closest to the North Bay Aqueduct pumping station are posted on the Bay/Delta home page (http://www.delta.dfg.ca.gov).

A total of 36,162 larvae have been collected and identified; 85% were prickly sculpin. As of June 15, no delta smelt larvae have been collected at the three criteria stations in Barker Slough. 1995, also a wet year, had a similar pattern. Forty delta smelt have been collected in the deep water shipping channel and Lindsay and Miner sloughs.

Delta smelt catch responded to varying water temperature fluctuations. Water temperature increased from 11°C to 19°C during the first three weeks of March. By March 31 temperatures dropped to 10°C, remained below 13°C for one week and stayed below 16°C until April 18. This drop in water temperature likely delayed spawning during this period.

Four Pumps Mitigation Calculation Program Updated

Jane Arnold

The four pumps mitigation calculation programs developed in the 80's have been updated for today's faster computers. The programs were developed in the days of the VAX and took four software programs including SAS, Lotus, dBase, and GWBasic. Calculating loss for salmon, steelhead, and striped bass involved multiple and repetitive steps in each type of software, an onerous and rather dull task for the person running the programs. The calculation has been reprogrammed to run entirely in PC SAS which with modern computers takes 20 seconds rather than hours upon hours to provide a final product. Both methods of calculation produce results can only differ slightly because of rounding.

Fish Treadmill Investigations Update

Ted Frink

UC Davis Hydraulics Laboratory is conducting research on juvenile and small-size delta fishes' swimming ability and behavior during exposure to complex flow regimes in front of a simulated large screened diversion in a large circular flume, referred to as the "Fish Treadmill." The Fish Treadmill is designed to provide controlled flow, temperature, and light conditions in clear water to allow continuous, detailed observation and video tape recording of swimming performance and behavior during the experiments. To date, more than 100, 2-hour long experiments using delta smelt, splittail, and chinook salmon (all under daylight conditions, 12 and 19°EC) have been completed. Nighttime tests with small young-of-the-year splittail at the 19°EC water temperature will start in July.

In January 1998, UC Davis prepared and distributed for review an annual progress and status report of the last year's research efforts and *preliminary* results of the 1997 experiments. The interim report is titled: *Performance, Behavior and Physiology of Delta Fishes in Variable Two-Vector Flows – Progress Report to Department of Water Resources.* Some copies are still available through DWR-ESO.

In June, UC Davis submitted a draft QAPP (Quality Assurance Program Plan), following IEP direction, detailing investigation and data acquisition QA/QC procedures. Copies of the draft document are available through UC Davis Fish Physiology Group or DWR-ESO.

Also, on June 17, DWR convened an annual review meeting with the program consultants Ken Bates (Washington Department of Fish and Wildlife), Ned Taft (Alden Research Lab), and Rick Wantuck (NMFS) to review the program and discuss current and future research direction of the Fish Treadmill project. The DFG Bay/Delta Special Water Projects Division personnel participated in the meeting as well, and have continued to provide support throughout the program.

The UC Davis researchers and Technical Advisory Group for the Treadmill Project submitted a proposal on April 29, 1998, to DWR for funding continuing research. The draft proposal was distributed for review to interagency personnel and program consultants; some comments have been received and incorporated. Continuing research is proposed for an additional 1.9 years, to be completed in the year 2000.

Juvenile Salmon Monitoring Program

Erine Sauls

Beach seining was conducted at various sites on the Sacramento River, San Joaquin River and Delta area during the spring. No winter-run sized chinook were captured between April 1 and June 30. Twenty-one late-fall sized chinook were captured during this time as compared to only one captured last year over the same period.

In an effort to increase raw recovery numbers of coded wire tagged chinook this spring, two daily shifts of trawling were conducted at Chipps Island from April 16 - May 30, effectively doubling our effort of past years. Including the VAMP recovery effort at Jersey Point and recoveries at the south delta pumping facilities almost

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Thoughts on Adaptive Management

John G. Williams

"Adaptive management" has entered California hydrospeak. Whatever it means, it sounds good. After all, who would want to practice nonadaptive or maladaptive management? Unfortunately, the meaning of the term has been diluted in proportion to its popularity, so some have questioned whether any useful meaning remains, and a term that means different things to different people can only lead to misunderstandings. I argue that the term does have an important meaning, so either that meaning must be resurrected for adaptive management, or a new term must be devised.

If "adaptive management" means anything, then it must distinguish one kind of management from other kinds. I propose that adaptive management has two essential attributes: (1) it is a response to uncertainty about the system being managed, and (2) actions are designed, at least in part, to provide new information about the system. Other attributes can and should vary according to the system being managed and its political context.

This definition distinguishes adaptive management from "real-time" management, or management with a flexible, trial and error approach, although many people use the term with just those meanings. It also distinguishes a narrow meaning of adaptive management from an elaboration of the concept known as "Adaptive Environmental Assessment and Management," or AEAM, that involves a particular approach to implementing adaptive management. AEAM seems appropriate for the Bay/Delta, so it is tempting simply to call it adaptive management, and indeed the two terms are sometimes used interchangeably in the literature (e.g., Holling 1978; Walters 1986, 1997). However, the importance of maintaining a focus on uncertainty justifies distinguishing the two and introducing yet another term. The distinction is well explained in an excellent article by Volkman and McConnaha (1993), describing the application of adaptive management to the Columbia River:

> In 1984, Professor Kai Lee, then a member of the [Pacific Power Planning] Council, suggested that the [Columbia River salmon] problem lent itself to the idea of adaptive management: the notion that fish and wildlife measures should be seen as a series of experiments, with formal experimental designs to help answer critical questions about the interactions of humans and the ecosystem. By structuring salmon recovery measures as experiments, the Council could acknowledge scientific uncertainty, act on reasonable hypotheses, and learn from the results.

Adaptive management can be a radical doctrine. With traditional management, action is based on existing knowledge and established modes of operation. The course is altered if it appears unproductive, but information is not sought aggressively or strategically, and when it is gathered, it is drawn from a relatively narrow range of conditions. In contrast, adaptive management implies an active search for key hypotheses and a commitment to test them. In fisheries, adaptive management has been developed and applied largely within the harvest arena. Populations might be deliberately over- or under-harvested, for example, to examine the population's response to harvest pressures.

In principle, the need to learn more about the effects of other human activities on salmon recovery seemed no less compelling. It was apparent, however, that the Council could not apply an unadorned form of adaptive management even to the most critical uncertainties involved in salmon recovery. Applying the theory on a smaller scale, to harvest problems, is difficult; but it is at least limited to a single constituency (harvesters) and distinct population groups (chinook salmon off the coast of British Columbia, for example). The idea of extending the concept to an ecosystem, particularly an intensively-developed ecosystem such as the Columbia River Basin, promised a mare's nest of controversies.

The solution proposed by Dr. Lee was based on a modification of adaptive management called Adaptive Environmental Assessment and Management (AEAM), developed by C.S. Holling and his colleagues (Holling 1978). Holling's notion stressed explicit integration of scientific, economic, and social concerns into efforts addressing resource problems. Computer modeling and simulation would demonstrate the potential effects of alternative management actions and scientific uncertainty. Scientists, managers, policy makers, and the public, all bringing their own political, economic, and cultural concerns, would come together in an analytical process aimed at identifying appropriate cases for scientific probing. No one would be forced to pretend that she lives in a world where science alone matters. To the austere principles of adaptive management, then, Holling added a social process — a group conversation conducted with the help of computer models, focusing on data, but mindful that dogma is not far behind.

The Importance of Uncertainty

The concept of adaptive management of living resources developed through the application of ideas from engineering and decision theory, particularly to the regulation of salmon harvest in the Pacific Northwest. As described by Walters and Hilborn (1976) in a seminal paper, "Adaptive control of fishing systems:"

> This paper addresses the question of how harvesting decisions should be modified to take account of statistical uncertainty. In seeking a formal framework for dealing with this question, we have been drawn to the literature on control system theory, where