

NEWSLETTER

September 1989

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.

Agency Directors' Meeting

On August 31, the Interagency Program Directors met with coordinators and staff to review progress and to recommend program changes. Directors in attendance were:

- Pete Bontadelli, DFG
- Don Maughan, SWRCB
- David Kennedy, DWR
- John Kleine, USGS
- Marv Plenart, USFWS
- Larry Hancock, USBR

Some of their decisions that will affect the organization or conduct of the Interagency Program are summarized below.

Study Manager

The Directors approved the coordinators' recommendation to establish a full-time study manager. This position will be within DFG, and the manager will have supervisory authority over DFG employees at Stockton working on the Interagency Program and coordination responsibility for other program participants. This position could be filled in January 1990, but budget problems may delay its establishment until July 1.

Corps of Engineers

There has been contact at the staff level regarding inclusion of the Corps of Engineers in the Interagency Program, particularly in the hydrodynamic component of the San Francisco Bay element. Staff was directed to pursue this option.

Because of the timing of the budget process, it is unlikely the Corps could participate financially before Federal fiscal year 1992, which begins October 1, 1991.

Suisun Marsh Element

The Directors agreed to delete the Suisun Marsh element from the Interagency Program. The main reasons are that the Marsh program is in the implementation phase and it has a separate mid-level management group. Results of Marsh activities will continue to be included in the *Newsletter* and in Interagency Program annual reports.

Academic Involvement

The Directors supported interagency involvement in a program to fund two or three graduate students or post-doctoral fellows to work on Bay/Delta issues of particular interest to funding agencies. The Interagency Program and the San Francisco Estuary Project will jointly fund this activity, with the California Academy of Sciences helping to develop and implement a proposal review process. This effort will be coordinated with the University of California's Water Resources Center. The target is to award grants for the 1990 academic year.

Striped Bass Program

The basic field data collection program was approved as submitted. As in the

past, this program involves indexing striped bass abundance at various life stages and attempting to identify periods and causes of significant mortality. Oak Ridge National Laboratory has proposed that our data collection efforts and two similar programs on the East Coast be standardized for 4 years. Data from all three efforts would be used to develop a striped bass population model. Staff was asked to determine what additional work this would entail.

Additional sources of funding for the striped bass work are needed. USFWS will look into using the Federal Emergency Striped Bass Fund for California. (So far this fund has been used solely for East Coast studies.) If California's striped bass stamp is extended, there may be funding available for specific striped bass studies in the Bay/Delta.

San Francisco Bay Program Element

The Bay program element is divided into two sub-elements, fisheries and hydrodynamics.

With regard to the fisheries element, the Directors agreed to reduce routine monitoring. Staff will continue a thorough analysis of the existing 9 years of data and will plan studies that focus on five or more key fish and invertebrate species. DFG expects to finish a draft of a Bay fish bulletin by January 1, 1990. The focused studies probably would not begin until fiscal year 1991-92.

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No decisions were requested on the hydrodynamic element. This field data collection and mathematical modeling effort is in the final year of a 5-year program. During this fiscal year, staff will develop recommendations for additional study.

Fish Facilities Element

The Directors agreed that this program element would focus on estimating sources of mortality and other fish losses between the time fish are entrained into Clifton Court Forebay and the time screened fish are returned to the Delta. In addition, staff will work to improve fish-counting procedures at the State's Delta fish screens and will collect field data to help evaluate fishery impacts of State Water Project Delta facilities such as the North Bay Aqueduct and the Montezuma Slough Control Gates.

Entrapment Zone Study

Although no entrapment zone study was submitted for approval, there is considerable interest in such a study. Staff will be working with consultants to develop a study plan by early January, with implementation in the spring of 1990. There is no funding for specific entrapment zone studies allocated in the present budget.

Budget

The Directors accepted the budgets submitted for fiscal years 1989-90 and 1990-91. Fiscal year 1989-90 is essentially balanced, although funding for Fish Facilities does not represent a level program. In 1990-91 there is about a \$200,000 shortfall.

Briefings

The Directors were briefed on results of Delta salmon survival and the biological and hydrodynamic elements of the San Francisco Bay program. Staff was asked to schedule additional briefings on specific aspects of the Interagency Program.

Experiments Quantify Juvenile Salmon Survival in the Delta

In 1978, the Interagency Program began mark/recapture experiments designed to estimate survival of fall-run chinook smolts during their spring migration through the Delta. Experimental results have indicated that survivals can vary widely, depending on environmental conditions. Smolt survival levels can directly influence adult production, as reflected in the sports and commercial catch and spawners. Hence, Delta habitat can be an important determinant of adult chinook salmon abundance.

During these studies, smolts from Feather River Hatchery and Merced River Fish Facility were tagged using 1 mm coded wire nose tags and released in groups of from 50,000 to 100,000 at various release sites in the northern, central, and southern portions of the Delta. Tagged salmon are recovered through midwater trawling (netting) at Chipps Island and in the ocean commercial catch. These recovery methods yield two independent measures of survival for each tag group released. Over the years, total numbers of tagged smolt released have ranged from about 200,000 to more than a million annually.

These studies have primarily evaluated the influence on survival of smolts through the Delta of:

- » Streamflow
- » Percent diverted off the Sacramento River
- » Water temperature
- » Flow direction
- » Export rate

Results through 1987 indicated that smolt survival was positively correlated with flow and negatively correlated with percent diversion and water temperature. However, we could not define the relative importance of each of these three variables due to the correlations between temperature and diversion and flow. Other data, however, indicated that smolt mortalities at similar temperatures were greater for fish exposed to

the major diversion channels off the Sacramento River, such as the Delta Cross Channel and Georgiana Slough, and off the San Joaquin River at the head of Old River (near Mossdale) than for those that were not diverted.

During the springs of 1988 and 1989, studies in the Sacramento River Delta were designed to distinguish the effects of diversion and temperature from those of flow. These efforts have required water projects to modify operations to establish the necessary experimental conditions.

- Streamflow levels were held fairly constant during periods when tagged smolts were released. Since tagged fish were released during cool and warm periods, with relatively constant flows, only temperature was the experimental variable.
- Releases were made when Delta Cross Channel gates were opened and closed to better define the impact of diversions via that facility.

Results indicate that diversion level and water temperature are two major mechanisms that explain the correlation between smolt survival and flow. Flow continues to be a means to decrease the percent diverted.

In spring 1989, the Interagency Program conducted a major new smolt tagging experiment in the southern Delta, in cooperation with DFG, Region 4. The work compared smolt survivals at a low export rate (total 1,800 cfs) with that of high export rate (total 10,000 cfs). Delta inflow from the San Joaquin River was about 2,000 cfs. During the experiment, State pumping was essentially stopped for about a week, and Federal export rates were decreased substantially.

This study required extensive coordination between the water project operators, irrigation district managers, and agency biologists. Results, now being analyzed, will be summarized in the next edition of this *Newsletter*.
(Marty Kjelson, USFWS)

Upcoming Articles

- » Hydroacoustics - Use of sound waves to detect fish.
- » Upwards Looking Doppeler - Uses sound waves to estimate water velocities.
- » Striped Bass Egg and Larva Monitoring - Results of 1989 USBR sampling.
- » Chinook Salmon Delta Survival Studies - Results of 1989 USFWS studies.

Discovering Pattern Amid Chaos

Time series analyses are statistical techniques that can help isolate patterns within and among highly variable time series.

Striped bass abundance within the Bay and Delta dropped sharply in 1977 and has not recovered. The decline is of concern because of the ecological importance of striped bass and economic importance of the striped bass sport fishery.

In recent years, researchers have noted that the decline in striped bass abundance was accompanied by a decline in abundance of some organisms in the striped bass food chain. Therefore, food limitation has been suggested as one possible explanation for the decline.

Part of the reason we are often unable to isolate which factors cause changes in the distribution and abundance of organisms is our inability to isolate meaningful patterns from highly variable data. The Interagency and DWR compliance water quality monitoring programs have about 20 years of environmental and biological data collected at monthly or 2-week intervals from sampling sites throughout the Delta. A continuous data set for one environmental or biological variable over time is called a *time series*. Each time series contains variation from random events (often called *noise*); seasonal, yearly, or long-term cycles; and trends or changes over time.

San Carlos Renovation

The DWR research vessel *San Carlos* was recently put in dry dock for extensive renovation that included replacing cracked and peeling fiberglass, mechanical and electrical repairs, and redesigning the laboratory area to accommodate a new computer system.

The primary purpose of the new system will be to expedite processing of the discrete water quality information and recording and storage of continuous data from the on-board multiparameter instrument package.

About 400 discrete parameters are manually tabulated during a normal monitoring run, and 200 measurements of 6 water quality parameters are recorded every hour on continuous strip charts. Once entered into the new computer system, this information will be fed

With all these sources of variation, significant patterns within the data can be masked, and sorting them out is no small task.

Problems in interpreting the environmental and biological data are further confounded when we compare two time series. Periodic changes within time series create problems in data analysis because of *autocorrelation*, meaning individual data values within a time series are correlated with each other. For example, air temperatures during June are warmer than those in December. As a result, two time series with matching periodic changes appear to be correlated even though they are not. In addition, making comparisons among time series is difficult because of delayed or lagged effects. It may take a month or more before changes in environmental variables will affect the abundance of organisms.

Because they require long-term data sets collected at reasonably constant intervals, time series analyses are well suited to the data bases available for the Delta. Time series analyses include techniques such as spectral analysis, ARIMA modeling, cross-correlation functions, and transfer function models.

For the Delta, ARIMA and spectral analyses are being used in an attempt to isolate periodic changes in the data produced by seasonal, yearly, or long-term cycles. Cross-correlation functions are being used to describe possible associa-

through a series of computational and editing software programs, electronically stored, and returned to headquarters for final processing and entry into a mainframe archive.

Hardware is also proposed that will allow data from towed submersible instrumentation to be processed and stored with the other information. Additional hardware could also interface with existing on-board instruments to provide storage and display of sample locations and of the vessel's operational system.

The increased automation provided by this system should minimize the need for new personnel, expedite data processing, and reduce the time needed to make the information useable.

Harlan Proctor, DWR

tions among different time series and with the goal of enabling prediction of changes in the abundance of organisms from changes in environmental conditions.

Using time series analyses, we have already determined that algal production is associated with streamflow and nutrient concentration during the previous month and regional climate 2 months before. Time series analyses have also enabled us to generally predict changes in zooplankton abundance from algal production and environmental factors. Information such as this may eventually help us to determine causes of the decline in striped bass abundance.

Peggy Lehman, DWR

NOTEWORTHY

- » The 1989 midwater trawl index at Chipps Island for fall-run chinook smolts was 19 fish/tow. This reflects natural and Coleman Fish Hatchery smolt abundance for April through June. This is higher than for 1987 (16) and 1988 (12), but slightly lower than the mean index of 23 for 1978 to 1988 (range 12-48).
- » The Interagency Program will be holding a workshop for all participants in February 1990. The agency coordinators will nominate an organizing committee to select a site and develop an agenda. If you have ideas on location or agenda, please contact any of the agency coordinators listed in the June issue of the *Newsletter*. Agenda items will probably include review of program results, plus presentations by others working on Bay/Delta problems.
- » The report, *Factors Affecting Striped Bass Abundance in the Sacramento-San Joaquin River System*, has been reprinted. The report was originally submitted as Exhibit 25 to SWRCB's Bay/Delta hearings in 1987. For a copy of the report, call 916/322-6226.
- » Zach Hymanson of the DWR water quality monitoring staff has completed two vegetation surveys designed to detect the noxious water weed *Hydrilla*. Once established, *Hydrilla* is almost impossible to eradicate and could quickly choke Delta channels. No *Hydrilla* was collected in the fall 1988 and spring 1989 surveys. The twice-yearly surveys will continue indefinitely.

UNIT OF THE MONTH

DFG's Delta Outflow/San Francisco Bay Study Biological Component

The purpose of the Delta Outflow/San Francisco Bay Study is to determine the importance of freshwater outflow to beneficial uses in downstream portions of the estuary. Specifically, those working on the project are trying to quantify impacts of freshwater inflow as related to combined activities of State, Federal, and local water projects.

The outflow study consists of two components: hydrodynamic and biological. Work is coordinated through a technical coordinating committee chaired by DFG's Perry Herrgesell. Elements of the hydrodynamic component are funded and carried out by USGS, DWR, USBR, and SWRCB. The biological component is supported by DWR and USBR and carried out by DFG biologists at the Bay/Delta Project in Stockton.

A typical monthly field sampling program consists of an open-water or boat survey and a ring-net survey.

For the boat survey, we use the 42-foot research vessel *LONGFIN* to sample 42 sites. At each site, we collect samples with a midwater trawl, an otter trawl, and an egg and larval net. In addition, the crew takes a profile of electrical conductivity and temperature of the water column. We sort, identify, and count adult and juvenile fish and crabs on board, then return them to the water. Shrimp, larval fish, and unknown adult fish are taken to the laboratory for identification.

For the ring-net survey, we spend 2 or 3 days collecting samples of crabs from ring-nets at nine piers. We identify and measure the crabs, determine the sex of each, and return them to the water. The data are entered into *dBASE* files on microcomputers in the Stockton office, the *NOMAD* data base at the Teale Data Center, and into EPA's national *STORET* system.

Biological field sampling began in January 1980. The staff is now working on a Fishery Bulletin that will describe its efforts through 1988. The bulletin promises to be one of the most comprehensive treatments of San Francisco Bay fishes and invertebrates. Next year we will do special studies to identify study revisions that will provide information the SWRCB will need during the next round of water right hearings.

Perry Herrgesell, DFG

Our Staff

Perry Herrgesell, Environmental Services Supervisor, is in charge of the field work, sample processing, equipment maintenance, data analyses and interpretation, and report preparation. Perry has a B.A. in Natural Science (Fresno Pacific), an M.A. in Biology (Fresno State), and a Ph.D. in Ecology (UC, Davis). In addition, he supervises DFG efforts associated with selenium studies and water project impact negotiations.

Charles Armor, Associate Fishery Biologist, is responsible for day-to-day supervision of the study and for preparing budgets and reports. His research interest lies in the field of community dynamics of estuaries, and he conducts all community level analyses. Chuck has a B.A. and an M.A. in Biological Sciences, both from CSU, Chico.

Randall D. Baxter, Fishery Biologist, monitors trends in abundance and distribution of cottids, flatfish, smelt, and other species in the bay. He is especially interested in factors influencing flatfish use and abundance. Randy has a B.S. in Fisheries (Humboldt State) and expects to earn an M.S. next year.

Kathy Hieb, Fishery Biologist, analyzes data on shrimp, crabs, and selected fish species. Her research involves reproductive strategies of marine and estuarine invertebrates and fish, with emphasis on larval retention and dispersal. Kathy holds an A.B. in Biological Sciences from UC, Berkeley.

Sonia Hamilton, Fishery Biologist, interprets data for white croaker, surf perch, elasmobranchs, clupeid, and anchovy. As an undergraduate, Sonia received a grant from NSF to study freshwater bryozoans. She has a Masters in Marine Science from Moss Landing Marine Laboratories.

Gina E. Moran, Laboratory Assistant, identifies and measures larval fish and adult crabs, but her real interest is in upland game. She is also responsible for daily operation of the laboratory. Gina has an A.B. in Biological Sciences from UC, Berkeley.

Teresa Le Blanc, Fish and Wildlife Assistant, supervises activity in the stern during the boat surveys. Along with the mate, she is responsible for general maintenance of the *LONGFIN*. Teresa has a B.S. in Resource Sciences from UC, Davis.

Seasonal Aids **David Gonzales** and **Toni Thomas** sort fish eggs and larvae, and **Diana De la Rosa** helps out wherever she's needed.

1989 Striped Bass Index

The annual count of young striped bass in the Sacramento-San Joaquin estuary is the second lowest in the 30 years that DFG has surveyed striped bass spawning success. This continues the trend toward low bass production that began in 1977.

DFG's survey of the abundance of young-of-the-year striped bass, completed July 14, produced an index of 5.2. The average index was 66.6 for 1959-1976 and 23.1 since 1977. The lowest young striped bass index (4.6) was just last year. The highest (117.2) was in 1965.

Abundance of young striped bass is estimated each summer by DFG as part of the Interagency Program. Field measurements consist of towing nets at specific locations in the Delta, Suisun Bay, and San Pablo Bay and counting and measuring the collected striped bass. The index takes into account the volume of water represented by the net tows and reflects the abundance of young bass when they reach an average length of 1½ inches.

These surveys have shown that young bass abundance is correlated with:

- » The amount of streamflow passing through the Delta in spring and early summer and
- » The amount of water diverted from the Delta by water projects, industry, and local farmers.

In this respect, a low index was expected because of the low flows last spring. However, as in all but one year since 1977, this year's young bass abundance was lower than predicted based on the flows and water diversions.

Interagency biologists and consultants continue to evaluate possible causes for the decline in abundance.

Don Stevens, DFG

1988 Program Critique

In July 1988, the Interagency Program staff and other San Francisco Bay workers met in Tiburon with a group of 14 estuarine scientists and engineers from around the country to review the Bay Program element. Dr. Jerry Schubel (State University of New York, Stony Brook) chaired the group and was responsible for compiling recommendations. A workshop summary and recommendations for program changes can be obtained by calling 916/322-6226.

Aquatic Habitat Institute's Information System

With funding from the San Francisco Estuary Project and the SWRCB, the Aquatic Habitat Institute has developed an on-line information system about the Bay and Delta. The system, which can be accessed from any personal computer equipped with a modem, includes the testimony from Phase 1 of the water right hearings, a Bay/Delta bibliography, and the Estuarine Data Index. EDI contains detailed summaries of 70 research projects (completed or on-going) on the ecology of the Estuary. All three systems are "user friendly" and can be searched using subjects chosen by the user. The system is available free (except for the phone call) at 415/643-7485 (ATSS 415/583-7485).

More information, including detailed log-on instructions and technical support for those unfamiliar with computer telecommunications, is available from the Aquatic Habitat Institute at 415/231-9539.

Andy Gunther, AHI

STAFF NOTES

- » **Ken Lentz** has been named agency coordinator for USBR. Ken is replacing **Jim Arthur**, who will remain as the USBR program manager and will now devote considerable time to developing and evaluating procedures for collecting striped bass eggs and larvae at selected points in the Delta. Jim is also heading up a task group looking at the DWR/USBR compliance water quality monitoring program.
- » **Robert Fujimura** is leaving for DFG's Aquatic Toxicology Laboratory in Elk Grove. Since starting with DFG in 1987, Bob has tested gear and hypotheses regarding young striped bass and zooplankton distribution in the Delta and Suisun Bay. In 1988 and 1989, he supervised the striped bass egg and larva survey to measure abundance of striper in the early life stages. Bob also completed a major editing of the egg and larvae computer data bases

collected since 1968. The new edited files are being restored into the *STORET* data management system used by the Interagency Program.

- » **Susan Herrgesell**, a Word Processing Technician at DFG's Stockton office, has accepted a promotion with DFG's *Project Wild* in Sacramento. Susan previously worked in DFG's Environmental Services Division and at the State University and College Chancellor's Office in Long Beach.
- » **Jerry Wise**, a Fishery Habitat Supervisor, will retire from DFG about November 1. During 16 years with the Bay-Delta Project, Jerry supervised research vessel and equipment maintenance and construction. He plans to move to Oregon. We'll miss him.
- » **Fran Spinelli** has recently been hired by DFG's Bay-Delta Project as a Word Processing Technician, replac-

ing **Anne Eden**. Fran most recently worked for the Lodi Unified School District.

- » **Brenda Grewell** will soon join DWR's Environmental Studies Branch. Brenda is completing her M.S. degree in Water Science at UC, Davis, where she received her bachelor's in Physical Geography/Geology. Her new duties will focus on Suisun Marsh and will include determining relationships between the quality of applied water and resulting vegetation on managed wetlands, defining soil characteristics, and recording water management practices.
- » **Pat Brandes** (USFWS) had a baby boy, Nathaniel, on May 28. Mom, Dad, and Baby doing fine. **Dennis Hood** (USFWS) is assisting in the Stockton salmon studies while Pat is on maternity leave.

Interagency Ecological Study Program
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Interagency Ecological Study 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

California Department of Fish and Game
U.S. Fish and Wildlife Service
U.S. Geological Survey

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