

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.

## Dungeness Crabs in San Francisco Bay

The Dungeness crab, *Cancer magister*, is a commercially important species that uses San Francisco Bay as a nursery area. The San Francisco Bay/Delta Out-flow Study has collected data on Dungeness crab abundance and distribution in the Bay since 1980 and has identified it as one of eight representative species for further study. Data for these analyses are from our monthly otter trawl and ring-net samples.

Dungeness crab are found along the west coast of North America and range from Pt. Conception, California, to the Aleutian Islands. In California, two substantial populations occur: one in northern California from Ft. Bragg to Crescent City, and one in central California around San Francisco to Bodega Bay.

The commercial fishery is limited to male crabs with a minimum size of 6.25 inches (or 159 mm) carapace width. There is also a small sport fishery for Dungeness crabs, but it is illegal for sport fishermen to keep any Dungeness crabs caught in San Francisco Bay.

The northern California commercial landings have been cyclic, but landings in the San Francisco/Bodega Bay area have declined since the late 1950s (Figure 1). Several hypotheses have been proposed to explain the long-term

decline. The three most widely accepted hypotheses are:

- Major changes in the ocean climate, specifically warmer water temperatures and intensification of the Davidson Current, have resulted in lower reproductive success.
- Increased predation of megalops, the last larval stage, by hatchery-raised coho salmon has resulted in a decrease of the number of juvenile Dungeness crabs.
- Survival of crabs reared in San Francisco Bay has been reduced, possibly by increased pollutants in the Bay.

Dungeness crab larvae hatch in December and January in the Gulf of the Farallones. The larvae are planktonic for about 3 months. Most Dungeness crabs move into the Bay from the near-shore area as small juveniles (less than 10 mm cw) during April and May. Juvenile crabs stay in the Bay for a year to 18 months before migrating back to the ocean as adults (Collier 1983). A DFG study in the mid-1970s estimated that 38 to 85 percent of all juvenile crabs in the Gulf of the Farallones and San Francisco Bay used the Bay as a nursery area (Tasto 1983).

Bay-reared Dungeness crabs grow about twice as fast as their ocean-reared

counterparts. This is thought to be a result of Bay water temperatures, which are an average of 5°C warmer than ocean temperatures, and the presence of more food, primarily crustaceans in the Bay (Tasto 1983). Bay-reared crabs are available to the fishery a year or two sooner than ocean-reared crabs. They reach legal size 3 to 4 years after hatching; ocean-reared crabs take 4 to 5 years. The increase in commercial landings in the 1987-88 fishing season was probably partly due to the large 1984 Bay-reared year class.

There are large differences in annual abundance of juvenile Dungeness crabs in the Bay (Table 1). The lowest annual abundance indices were in 1983 and 1986; the highest were in 1984, 1985, and 1988.

Table 1  
Cancer magister Abundance Indices

Year	May-July (Otter Trawl)	August-December (Ring-Net)
1980	0.8	*
1981	2.0	*
1982	6.8	6.4
1983	0	0.1
1984	69.3	10.6
1985	90.9	18.6
1986	0.2	1.1
1987	5.8	3.2
1988	315.6	5.6
1989	15.1	1.0

\* The ring-net survey did not start until May 1982.

## CONTENTS

Dungeness Crabs in San Francisco Bay.....	1
1990 Interagency Workshop Held at Asilomar.....	3
Pacific Climate (PACLIM) Workshop.....	3
Unit of the Month — Fish Facilities Program.....	4
Continuous Monitoring of Striped Bass Eggs and Larvae.....	5
Water Quality Program Review.....	5
University Research Involvement Program.....	5
Striped Bass Workshop.....	6
Personnel Notes.....	6
Striped Bass Midwater Trawl Index.....	6
1989 Phytoplankton Productivity in the Delta.....	7
Adult Striped Bass Health.....	7

The ratio of the fall ring-net index (August to December) to the summer otter trawl index (May to July) is also variable. It appears that in some years crabs survived better than in others, but we have not yet calculated survival rates for Bay-reared crabs.

Numbers of Dungeness crabs were low in years of low and years of high Delta outflow, but numbers were never high in years of high outflow (Figure 2). Some believe that in years with intense, frequent storms, larvae are carried far from the near-shore area by the estuarine plume or ocean currents (Lough 1976; Reilly 1983; Johnson et al. 1986).

The timing, relative strength, and duration of the Davidson Current are probably important to distribution of Dungeness crab larvae along the central California coast and to subsequent abundance of juveniles in San Francisco Bay. The relationship between the winter upwelling index and subsequent juvenile Dungeness crab abundance in the Bay supports this hypothesis (Figure 3).

Years with negative upwelling indices are associated with a relatively strong south-to-north Davidson Current. Years with positive upwelling indices have a weak Davidson Current. These are the years that crab larvae remain in the Gulf of the Farallones and juveniles settle close to the mouth of the Bay. It has been reported that abundance of Dungeness crabs in San Francisco Bay is directly related to abundance of megalops earlier that year in the near-shore area (Tasto 1983).

Not only does the number of Dungeness crabs using San Francisco Bay vary from year to year, but their distribution in the Bay varies by water year type. In 1982 — a year with relatively high Delta outflow — no Dungeness crabs were collected upstream of San Pablo Bay. In 1987 — a year with similar abundance as 1982 but with low Delta outflow — Dungeness crabs were collected in both San Pablo Bay and Suisun Bay. (We have collected Dungeness crabs at all our monitoring sites except in the lower San Joaquin River, but San Pablo Bay and Suisun Bay are important nursery habitat.)

There is also a seasonal difference in distribution of juvenile Dungeness crabs in San Francisco Bay. After the small juveniles enter the Bay, they migrate upstream to brackish water and to shallow, protected areas. Most juvenile crabs are found at salinities ranging from 15 to 25 ppt in summer and early fall. As out-

flow increases and salinities decrease in late fall and early winter, crabs move downstream. They congregate in the channels before they emigrate from the Bay in late winter and spring (Tasto 1983).

Male Dungeness crabs become larger and grow faster than females (Figure 4). Most crabs more than 100 mm cw that we collect are males.

There is also evidence that the growth rate of Bay-reared crabs differs by year. In 1988 growth rate was significantly slower than in 1984 or 1985, based on the slope and intercept of the regression

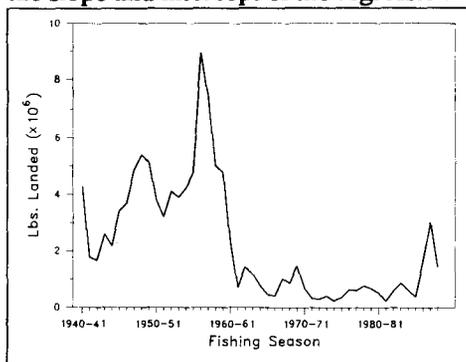


Figure 1. COMMERCIAL LANDINGS OF DUNGENESS CRABS IN THE SAN FRANCISCO BAY AREA. (Includes the ports of Princeton, San Francisco, and Bodega Bay.)

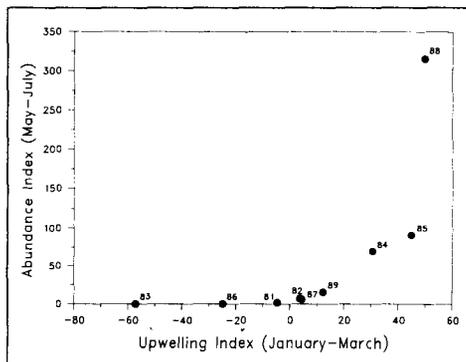


Figure 3. MEAN MONTHLY UPWELLING INDICES (36° and 39° North) VERSUS THE ABUNDANCE OF JUVENILE DUNGENESS CRABS.

#### Literature Cited

- Collier, P.C. 1983. Movement and growth of post-larval Dungeness crabs, *Cancer magister*, in the San Francisco Area. In: Life history, environment, and mariculture studies of the Dungeness crab, *Cancer magister*, with emphasis on the central California fishery resource. P.W. Wild and R.N. Tasto, eds. CA Dept Fish and Game Fish Bul 172:125-134.
- Johnson, D.F., L.W. Botsford, R.D. Methot Jr., and T.C. Wainwright. 1976. Wind stress and cycle of Dungeness crab (*Cancer magister*) catch off California, Oregon, and Washington. Can J Fish Aquatic Sci 43:838-845. Puget Sound, WA. Pacific Science. 18:3-33.
- Lough, R.G. 1976. Larval dynamics of the Dungeness crab, *Cancer magister*, off the central Oregon coast, 1970-71. Fish Bul 74(2):353-376.
- Reilly, P.M. 1983. Dynamics of Dungeness crab, *Cancer magister*, larvae off central and northern California. In: Life history, environment, and mariculture studies of the Dungeness crab, *Cancer magister*, with emphasis on the central California fishery resource. P.W. Wild and R.N. Tasto, eds. CA Dept Fish and Game Fish Bul 172:57-84.
- Tasto, R.N. 1983. Juvenile Dungeness crab, *Cancer magister*, studies in the San Francisco Bay area. In: Life history, environment, and mariculture studies of the Dungeness crab, *Cancer magister*, with emphasis on the central California fishery resource. P.W. Wild and R.N. Tasto, eds. CA Dept Fish and Game Fish Bul 172:135-154.

lines for each year. Tasto (1983) also found significant difference in growth of Bay-reared crabs between years.

We plan to add sampling programs in 1990 and 1991 that will provide data we can use to better calculate annual growth and survival rates of Bay-reared crabs. A pilot tagging program was started in fall 1989; more than 1000 juvenile Dungeness crabs have been tagged with standard 2-inch-long anchor tags. So far, not enough tagged crabs have been recaptured to allow us to calculate a growth rate.

(Kathy Hieb, DFG)

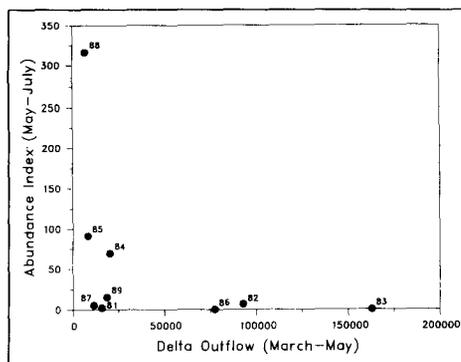


Figure 2. MEAN MONTHLY DELTA OUTFLOW AT CHIPPS ISLAND (cfs) VERSUS THE ANNUAL ABUNDANCE OF JUVENILE DUNGENESS CRABS.

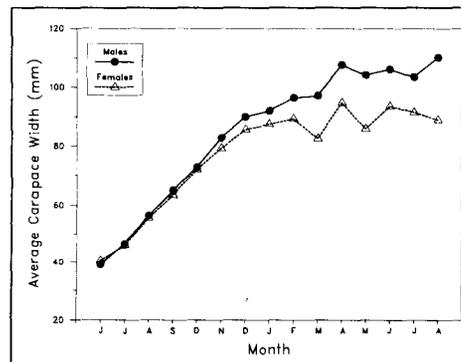


Figure 4. AVERAGE CARAPACE WIDTH OF MALE AND FEMALE BAY-REARED DUNGENESS CRABS, BY MONTH (1980-1988).

## 1990 Interagency Workshop Held at Asilomar

At the annual workshop, January 7-9, Interagency staff and managers were updated on activities and studies of member agencies. They also reported findings and results developed by their own projects. The workshop was held at the Asilomar Conference Center, which has excellent facilities and enjoyable surroundings.

Following registration on Sunday, the workshop got underway Monday morning with the first of six working sessions. At the end of the first day, a social hour afforded much professional and personal interaction. A meaningful part of this was a poster presentation contributed by eight participants from the various agencies. This was a "first", and it will be part of future workshops.

At the first session, "Outside Perspective of Interagency Activities", five speakers representing regulators, environmentalists, fishery advocates, scientists, and water users reviewed Interagency Program activities and made critical observations or recommendations. Recommendations included:

- Interagency Program staff must develop a process that ensures that technical findings are routinely made available to decision makers in a form they understand.
- Mainly because each member agency has its own objectives and constituency, there is no constituency for the Interagency Program itself. Staff should evaluate the desirability of consensus building and an enhanced advo-

cacy role and potential impact of these changes on a program constituency.

- Interagency Program participants must begin working together objectively and stop apparent interagency bickering.
- Interagency Program staff must be willing to make decisions and recommendations based on available information. They must also be held accountable for these decisions and recommendations.
- Since the Bay/Delta system has changed so much (and is still changing), past data may not be adequate to explain present and future conditions. Further, Interagency Program participants are being asked to restore fishery resources and protect the system without reducing exports or building the Peripheral Canal. This may be impossible. In light of these facts, the Interagency Program should at least seek information necessary to:  
(1) determine if standards are being met, (2) detect changes occurring in the system, and (3) suggest ways to improve the system. Failing this, data should provide us with a general sense of direction for system management.
- The Interagency Program needs an intensive and open annual technical review by outside scientists and engineers.
- Interagency Program staff must develop schedules for reporting findings and making recommendations that are realistic in terms of staff resources and that recognize the need for management decisions at certain times. Once established, staff should make every effort to meet those schedules.

- The Interagency Program should provide for studies that may result in more water for biological resources and not focus as much on facilities.

- Interagency Program member agencies must be willing to compromise and realize that there are no simple or final solutions that resolve complex fish and wildlife protection and water management issues. These compromises can only be achieved through increased program flexibility.

- The Interagency Program should move away from its perceived emphasis on striped bass and chinook salmon and toward evaluating the environmental requirements of the numerous other species, such as Delta smelt, that inhabit the Bay/Delta system.

These recommendations were presented to the Interagency Directors for their consideration and the Coordinators will work on implementation.

The other five sessions highlighted Bay/Delta hearings and water management issues, as well as technical findings related to changes in species using the Delta (winter-run salmon, Delta smelt, *Potamocorbula amurensis*, and zooplankton); recent striped bass developments; and water quality investigations. The final session included reports on Delta zooplankton, San Francisco Bay shrimp, and soil salinity in Suisun Marsh.

About 115 people attended the workshop, which ended with lunch on Tuesday. The 1991 workshop will also be held at Asilomar Conference Center. (Perry Herrgesell, DFG)

## Pacific Climate (PACLIM) Workshop

The seventh annual PACLIM workshop will be held April 10-13 at the Asilomar Conference Center. The workshop is cosponsored by Monterey Bay Research Institute, Southern California-Edison, USGS, National Oceanic and Atmospheric Administration, American Geophysical Union, DWR, U.S. Environmental Protection Agency, and U.S. Forest Service.

Julio Betancourt (USGS) is coordinating the workshop, which brings climate modelers and scientists together to discuss the general theme of climate variability in the eastern North Pacific and western North America. Session topics include: models-simulations vs. observations; climate dynamics; surface hydrology; and productivity and upwelling in the eastern Pacific.

Proceedings of last year's workshop, published as Interagency Technical Report 23, will be available at the 1990 workshop or by calling 916/322-6225.

## UNIT OF THE MONTH — Fish Facilities Program

The Fish Facilities Program was established to evaluate existing fish protective facilities and to research new facilities for the State and Federal water projects in the estuary. In the past, our staff included several DWR employees, but at this time it is mostly DFG employees, with one engineer from DWR contributing a portion of his time to the program. The program is under the general guidance of the Fish Facilities Technical Committee: Dan Odenweller (DFG), Barry Collins (DFG), Marty Kjelson (USFWS), Bellory Fong (DWR), Lloyd Hess (USBR), and Roger Wolcott (NMFS).

At this time the Fish Facilities Program is evaluating several water project facilities in the Delta, including the North Bay Aqueduct intake in Barker Slough, the salinity control gates in Montezuma Slough, and Clifton Court Forebay. The purpose of these evaluations is to provide understanding of factors influencing the behavior of fish at the various facilities so that we can find ways to reduce any losses of fish.

We are developing hydroacoustic sampling techniques to help accomplish our objectives. We use several boats in our work. Our newest boat, described in the December 1989 *Newsletter*, was designed to support a variety of sampling gear types.

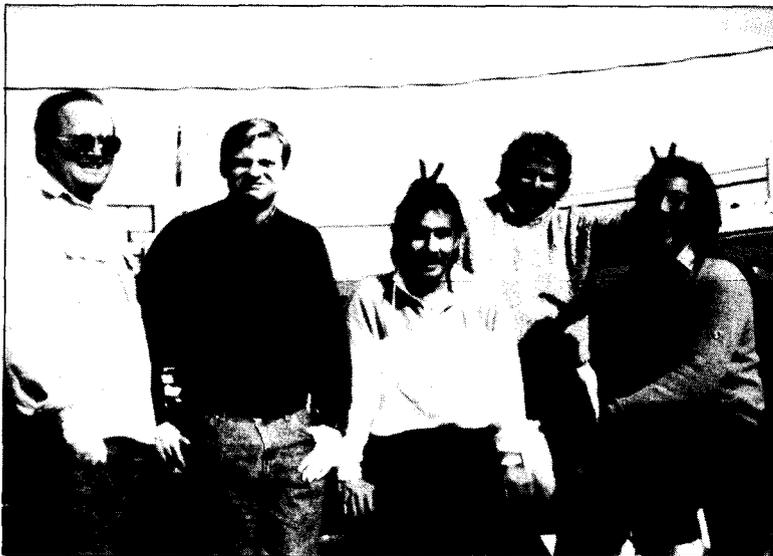
Recent reports of the Fish Facilities Program include Interagency Technical Report 19, *Effects of Handling and Trucking on Chinook Salmon, Striped Bass, American Shad, Steelhead Trout, Threadfin Shad, and White Catfish Salvaged at the John E. Skinner Delta Fish Protective Facility*, by Paul Raquel, and a draft *Fish Facilities Report* prepared for the Delta Team of the 5-agency salmon effort associated with Bay/Delta water right hearings now in progress.

The Fish Facilities Program is proud of its informal academic involvement program to supplement the college education of staff members. Both Dennis McEwan and Jennifer Bull are pursuing Masters degrees at California State University, Sacramento. Dennis is completing work on microhabitat selection by the Owens tui chub in the Hot Creek headsprings. Jennifer is working on fish (striped bass and chinook salmon) hydroacoustic target strength measurements.

Former students who have benefited from our informal program include:

- Charles Hanson (TENERA, Inc.), whose doctoral work at UC, Davis, was done under partial sponsorship of the program.
- Jim White (DFG), John Norton (SWRCB), and Carla Markmann (SWRCB), all of whom worked on their Masters degrees at UC, Davis.
- Betsy Bolster (DFG), who received her Masters degree at CSU, Sacramento.

(Dan Odenweller, DFG)



FISH FACILITIES PROGRAM STAFF (left to right):  
Dan Odenweller, Barry Collins, Paul Raquel, Dennis McEwan, and Bob Kano

### Our Permanent Staff

- Barry W. Collins, Associate Fishery Biologist, has a BS in Biology from CSU, San Diego, and an MS in Fisheries from CSU, Humboldt. Barry supervises the Fish Facilities Program and also the Fish Salvage Operations staff. He is also responsible for calculating the annual mitigation losses for the "Four Pumps" agreement.
- Robert M. Kano, Fishery Biologist, has a BA in Biology and an MS in Animal Behavior from the University of the Pacific.
- Dennis R. McEwan, Fishery Biologist, has a BS in Biological Science and is working on an MS in Biological Sciences from CSU, Sacramento.
- Dan B. Odenweller, Fisheries Management Supervisor, has a BS in Zoology and an MA in Biology from CSU, Long Beach. He has overall responsibility for the Fish Facilities Program, the Fish Salvage Operations program, annual mitigation loss estimates for the "Four Pumps" agreement, the Suisun Marsh study, Contract Services Unit activities, and the Upper Sacramento River Instream Flow study.
- Paul F. Raquel, Fishery Biologist, has a BA in Biology from CSU, San Francisco.
- Our permanent staff is assisted by Jennifer Bull (Graduate Student Assistant) and Cindy Holst (Scientific Aide).

## Continuous Monitoring of Striped Bass Eggs and Larvae

As reported in the June 1989 issue of the *Newsletter*, the Bureau of Reclamation has developed and tested three types of gear for continuously sampling striped bass eggs and larvae. The primary objective is to continuously measure striped bass spawning so that daily abundance estimates can be used to "trigger" protective measures. A secondary objective is to quantify the numbers of striped bass eggs that are spawned in the upper Sacramento River and will enter the Delta.

We need to know exactly when striped bass spawn upstream on the Sacramento River so we can implement measures that will facilitate the transport of eggs and larvae out of the Delta and into Suisun Bay. Such measures include:

- Closing the Delta Cross Channel gates so eggs and larvae will be transported through the Delta by the shortest possible route.
- Installing gates in Georgiana Slough for the same purpose.
- Increasing flows for a short time to "pulse" the eggs and larvae through the Delta.

Sampling gear tested included two pump systems (an "upflow tank" and a "stilling box") and a small-diameter plankton net. All three met the primary objective, but for estimating egg abundance, the net system appears to be about 5 times more effective than either of the pump systems. The reason is unknown, and will be studied this spring.

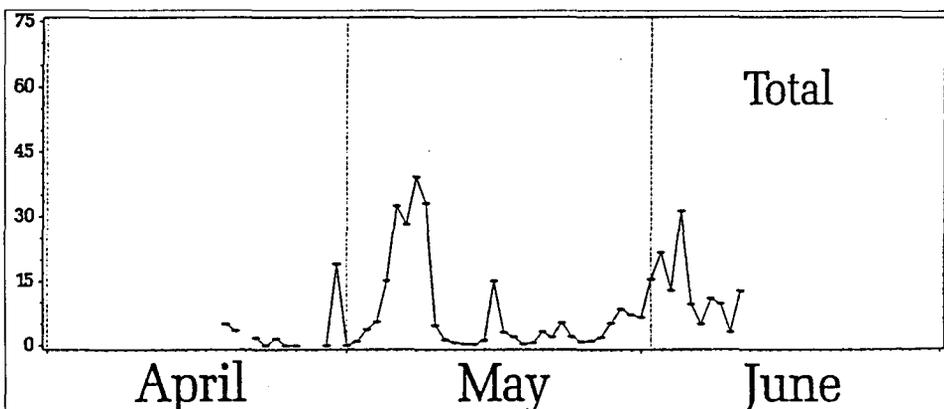
The figure below shows that 1989 striped bass spawning on the Sacramento River occurred in two peaks in May. In this case, a relatively short closure of the gates might have been effective in moving the developing fish through the Delta.

Sampling at Sacramento will continue this year, and we recently installed a pump sampling system at the Central Valley Project export facilities near Tracy. In addition, depending on water conditions, we may close the Delta Cross Channel gates while eggs and larvae are passing so we can evaluate that management option. We are beginning to evaluate pulse flow requirements during different water year types for both the Sacramento River and the San Joaquin River. We have also recommended sampling in the San Joaquin River spawning grounds and finding ways to prevent striped bass eggs and larvae from entering Old River and Middle River, where they are likely to be drawn to the Federal and State export pumps.

Sorting and counting the eggs and larvae collected are time consuming, and the Bureau of Reclamation's Denver office is now developing faster and better methods. The Denver office will also help develop, install, and test gear to sample eggs and larvae spawned in the San Joaquin River.

A report, *Continuous Monitoring of Striped Bass Eggs and Larvae in the San Francisco Bay/Delta Estuary - A Potential Management Tool*, should be available in April. For a copy, contact Jim Arthur, U.S. Bureau of Reclamation, 2800 Cottage Way, Sacramento, CA 95825-1898.

(Jim Arthur, USBR)



TOTAL NUMBER (in millions) OF STRIPED BASS EGGS AND LARVAE DRIFTING DOWN THE SACRAMENTO RIVER (as determined by the "upflow tank" sampling gear).

## Water Quality Program Review

Representatives of DWR, DFG, and USBR are evaluating the zooplankton and water quality compliance monitoring programs. The goal is to streamline basic data collection and to conduct more intense, special studies. Merging Interagency Program objectives with the long-term surveillance needs of the estuary should result in a more useful data collection and interpretation process.

A first step will be to integrate the zooplankton and water quality field sampling so all information is gathered simultaneously at each site by a single crew and vessel. DWR's vessel, *San Carlos*, will be used in the open waters of San Pablo and western Suisun Bay; smaller boats will be used in the Delta. Features added to the boats will include a net-towing frame, hydraulic winch system, additional automated continuous recording instruments, and on-board computerized data processing.

Interagency Program staff will also be working with the San Francisco Estuary Project, Regional Water Quality Control Boards, and others to develop and implement an estuary-wide monitoring program. The new Interagency program could be an integral part of the broader program.

## University Research Involvement Program

Through a University Research Involvement Program sponsored jointly by San Francisco Estuary Project and the Interagency Program, \$150,000 annually will be available for grants to researchers at institutions of higher learning to study physical, chemical, and biological aspects of the Bay and Delta. A recently published brochure describes the program and tells how to obtain a grant application package. For a copy, call 916/322-6225.

## Striped Bass Workshop

On February 5 and 6, DFG hosted the annual striped bass workshop – a forum for reviewing program results and suggesting modifications for the next field season.

Several consultants from California, Oak Ridge National Laboratory, and the East Coast attended and acted as an informal peer review panel. The agenda included:

- A review of an individual based striped bass model (Oak Ridge National Laboratory),
- Status of the Chesapeake Bay striped bass population (Chesapeake Biological Laboratory),

- Santee-Cooper population status (South Carolina Wildlife and Marine Resources Department),
- Causes for decline in Bay/Delta striped bass (DFG),
- Food in the Delta as limiting juvenile striped bass in the Bay/Delta (University of California, Davis),
- Toxicity (Regional Water Quality Control Board and DFG),
- California's striped bass stocking programs (DFG).

Program changes resulting from this meeting were:

- Sample adult population closer to spawning grounds. This will be done this year by moving the fyke nets farther upstream on the Sacramento River. These nets are fished in spring to capture adults for the mark/

recapture program used to estimate total population and age structure.

- Measure quality of eggs by sampling at several times during spawning season. The measure may involve something as simple as caloric content.
- Expand research on histology and morphology of hatchery and wild larval bass. These data, combined with measures of daily growth determined by counting rings in ear bones will help determine if food is limiting striped bass growth.

The Interagency Program and Consolidated Edison will jointly fund a post-doctoral fellow, Jim Cowan of the Chesapeake Biological Laboratory, to work on developing an individually based striped bass model.

Those interested in notes from the workshop can call 916/322-6225.

## Personnel Notes

Field work intensifies with the coming of spring, and several Interagency crews are out sampling or making preparations to sample. Some of the programs and some of the people involved are:

- Adult striped bass sampling – Dave Kohlhorst (DFG)
- Striped bass egg and larva survey – Lee Miller and Dale Sweetnam (DFG)
- South Delta striped bass entrainment – Stephani Spaar and Pam Casselman (DWR)
- Striped bass egg and larvae sampling gear evaluation – Jim Arthur, Doug Ball, Lloyd Hess, and George Collins (USBR)
- Zooplankton – Jim Orsi and Gregg Schmidt (DFG)
- Phytoplankton and water quality – Steve Hayes, John Baker, Zach Hymanson, Shig Katsumata, and Kitty Triboli (DWR)
- Suisun Marsh – Karl Jacobs, Kent Scovel, Joe Nardella, Woody Hunziker, Dick Wada, and Brenda Grewell (DWR) and Frank Wernette (DFG)
- Delta salmon survival studies – Marty Kjelson, Pat Brandes, and Dennis Hood (USFWS)
- Hydrodynamic intensive field study in Carquinez Strait (although not an Interagency Program study, results will help our modeling efforts) – Ralph Cheng (USGS) with Australian collaborators
- Clifton Court predation study – Barry Collins, Paul Raquel, and Bob Kano (DFG)
- Sturgeon radiotelemetry – Ray Schafter (DFG)
- Bay fish collections – Chuck Armor, Kathy Hieb, Gina Moran, Randy Baxter (DFG)

The field work is only accomplished with the help of several boat operators and numerous seasonal aids. Skippers are: Dick Fenner, Santos Tobar, Mike Silva, and Curtis Hagen (DFG) and Lloyd Brenn (DWR). Doug Ridgeway (DFG) was recently hired to keep equipment working and occasionally pilot boats.

The hard work of organizing and conducting field and laboratory work often is not recognized, but these programs provide the data we need to develop and understand factors controlling the abundance of estuarine organisms.

## Striped Bass Midwater Trawl Index

The midwater trawl survey, conducted monthly from September through December to measure fall abundance of young-of-the-year striped bass, was completed as scheduled. The index for the year class was 431, the lowest since the survey began in 1967. The second lowest was 498, in 1988. Before 1988, the range was 747 to 21,091.

Low fall abundance indices corroborate the low abundances obtained by the mid-summer tow-net survey, which indexes striped bass abundance when fish caught average 38 millimeters in length. These 38 mm indices, which are of a different scale than the fall indices, were 4.6 in 1988 and 5.1 in 1989. These are also the lowest indices since the fall measurements began in 1959. Production of young striped bass is now at a historical low point.

(Lee Miller, DFG)

## 1989 Phytoplankton Productivity in the Delta

There were three distinct algal blooms in the Delta in 1989 – in late spring, in late summer, and in early fall. The spring and fall blooms were dominated by the filamentous diatom *Melosira granulata*; the summer bloom was dominated by green algae and miscellaneous diatoms.

Chlorophyll levels in the central Delta reached 31 micrograms/liter during the spring bloom and 45 ug/L during the fall bloom. During the summer bloom, levels of this algal pigment reached 65 ug/L in the San Joaquin River near Vernalis. By early October, levels had returned to background levels of 10 ug/L in all areas.

A special phytoplankton study of the central and western Delta was con-

ducted during a May 2-9 curtailment of CVP and SWP exports. This study was to help determine whether export curtailment resulted in changes in the kinds and abundance of algae in the Delta. Study results indicated little difference between the algal levels before and after export curtailment and supported previous evidence that short-term curtailment does not necessarily lead to increases in phytoplankton standing crop.

---

## *Shall we keep you on our mailing list?*

If you find the *Newsletter* useful, we'd like to keep sending it to you. But – if it's just more junk mail, we'll save the postage.

If you want to **continue** to receive the *Newsletter*, please **return this page** or call 916/322-6225. Please indicate any changes to your name or address as they appear on the reverse.

---

---

If you want us to **remove** your name from our mailing list, **do nothing**.

---

## Adult Striped Bass Health

In October 1989 and January 1990, Interagency staff met with a panel of experts to review the Adult Striped Bass Health Monitoring Program.

Although recommendations are not final, the direction is to scrap the past program (in place in some form since 1978) of necropsics and chemical tests on 40 prespawning females. A less complex and less time consuming health classification will replace the former program in the 1991 spawning season.

The panel consisted of Joe O'Connor (Aquatic Habitat Institute), Gary Chapman (Environmental Protection Agency), Ron Goede (Utah Division of Wildlife Resources), Bob Spies (Lawrence Livermore Laboratory), and Dave Hinton (University of California, Davis).

---

## Bay Salinity/Temperature Stations

Under the direction of Steve Anderson, the USGS district office will soon assume responsibility for maintaining the Bay continuous salinity and temperature recorders at Pt. San Pablo, Bay

Bridge, San Mateo Bridge, and Ft. Point. Larry Schemel of the Menlo Park office will continue to maintain the old Dumbarton Bridge recorder. DFG funds this activity as part of the hydro-

dynamic element of the San Francisco Bay program. The change-over will include equipment upgrades to improve data reliability, and possibly remote access by satellite.

Interagency Ecological Study Program  
**NEWSLETTER**  
3251 S Street  
Sacramento, CA 95816

Perry Herrgesell  
Dept. of Fish and Game  
4001 North Wilson Way  
Stockton, CA 95205

---

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

Edited by:

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

---