Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary

NEWSLETTER

December 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.

Acoustic Doppler Current Profiler Used to Investigate Gravitational Circulation

A key objective of the Interagency Hydrodynamics study is to investigate the magnitude and extent of density-driven gravitational circulation within San Francisco Bay as related to freshwater inflow. Gravitational circulation is important in the movement of invertebrates, small marine and anadromous fish, and sediment-bound contaminants within the estuary.

A longitudinal gradient in water density, resulting from the longitudinal difference in salinity concentration within an estuary, produces a landward pressure force acting on the water mass that increases linearly with depth below the water surface. Depending on the intensity of the longitudinal density gradient, this force can be strong enough in the deepest parts of a cross section to measurably slow down ebb currents and speed up flood currents.

If tidal variations are removed from velocity profiles measured under these conditions, the form of the mean velocity profile will often appear bidirectional, with bottom currents directed landward and surface currents directed seaward. The resultant profile is referred to as *gravitational circulation*, because it represents the force of gravity driving a current, tending to position water masses of equal density along horizontal planes.

Because gravitational circulation is defined by tidally averaged (residual) currents, it cannot be measured directly in the field. Continuous measurements of velocity profiles over many tidal cycles are needed so that tidal-averaging or low-pass filtering can be used to remove the tidal variation.

To collect time-series of velocity data at several locations within the water column, USGS purchased an upward-looking acoustic Doppler current profiler with funds provided by the San Francisco District of the U.S. Army Corps of Engineers. During March 1988, the ADCP was deployed on the estuary bottom at a depth of 16.8 meters (referenced to mean lower-low water) at the west end of Carquinez Strait, near Crockett, California. The ADCP was mounted on a platform constructed of copper-nickel alloy (monel), which held the ADCP fixed at 0.7 meter above the channel bottom.

The ADCP operates by projecting upward into the water column four acoustic beams positioned 90 degrees apart and directed 30 degrees from vertical. Part of the transmitted acoustic energy is reflected back toward the transducers by particulate matter (scatterers) moving with the water. The frequency of these reflected signals is Doppler shifted, and the magnitude of the frequency shift is a function of the speed of the scatterers along the axis of the acoustic beam and relative to the transducer assembly.

The ADCP converts these frequency shifts into water speeds and, by using simple trigonometry and water speeds for adjacent beams (rotated 90 degrees), can resolve both water speed and direction.

The ADCP samples reflected signals from each beam at discrete time intervals during progress of the advancing acoustic wave front; this allows horizontal water velocities to be determined at 1-meter intervals (bins) throughout about 75 percent of the water column.

For the Carquinez Strait deployment, the ADCP was able to resolve 12 bins, beginning with bin 1 centered at a depth of 2.1 meters above the channel bottom, then bin 2 at 3.1 meter, and so on.

Data from the ADCP were transmitted via telemetry cable to an on-shore computer. AC power was also supplied to the ADCP via this cable. The on-shore computer calculated and stored 10-minute velocity averages for each bin, derived from averaging nearly 2,200 individual velocity measurements.

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The ADCP system at Carquinez Strait operated flawlessly for more than 7 months before it failed in November. When retrieved in January 1989, the ADCP was found to be partially flooded. Electrolytic corrosion had produced a pin-hole-sized leak at one end of the ADCP that allowed saline water to reach the electronics and eventually short circuit the power supply. The ADCP is now being repaired by the manufacturer.

The ADCP at Carquinez Strait provided an extremely clean data set from March 28 to November 4, 1988. The data set was separated by bin into individual time series for use in plotting and harmonic analysis and for input to digital filters for calculation of residual currents.

As expected, velocities associated with the measured 10-minute averaged currents are dominated by the tides and are an order of magnitude larger than the residual currents. Tidal velocities increase with distance from the bottom, where bin 1 has a root-mean-square current speed of 50 centimeters per second, compared to 80 cm/s near the surface for bin 12.

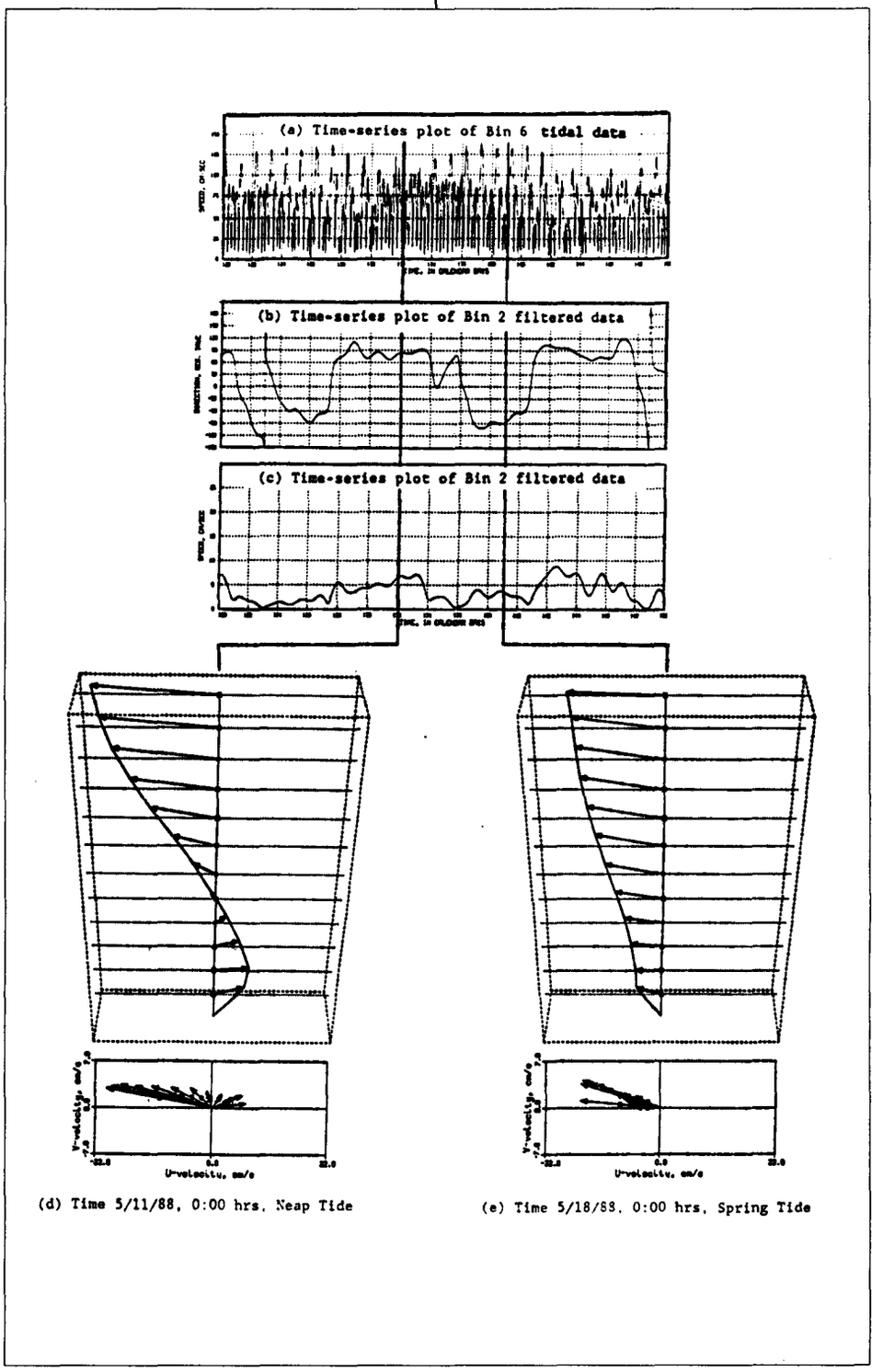
The currents show the typical twice-daily bidirectional flow pattern typical of the flood and ebb cycles of the tides. They also show the 14-day spring and neap tide variations caused by the canceling and reenforcing of tidal components caused by frequency differences among the components.

For the bottom residual currents (bins 1-5), flow directions change roughly in concert with the spring/neap cycle. Flow near the bottom is generally up-estuary during neap tides and down-estuary during the more energetic spring tides, as shown in the figure. During the neap tide, the cross-over location in the vertical from up-estuary to down-estuary residual flow typically occurred near bin 5 or 6 (6.1 to 7.1 meters above the bottom). Toward the surface, the upper bins become increasingly unidirectional.

During the 7 months the ADCP at Carquinez Strait was operating, variability in freshwater inflow to the bay was small. Therefore, little was learned with regard to the effect of changes in freshwater inflow on the magnitude of gravitational circulation.

USGS is preparing a report that will describe deployment and operation of the ADCP, explain data processing and analysis procedures, and present the data. The report will include time series plots of both tidal and residual currents for each bin for March 28 to November 4, 1988.

For further information on the profiler, contact Richard Oltmann at the USGS California District Office in Sacramento (916/978-4648).



TIME SERIES AND PROFILES OF VELOCITY DATA COLLECTED WITH ACOUSTIC DOPPLER CURRENT PROFILER

(a) 30-Day Time Series of Tidal Current Speed at Bin 6
(b) and (c) Filtered Time Series of Direction and Speed for Bin 2
(d) and (e) Typical Neap and Spring Residual Velocity Profiles

Figure below each profile shows projection of velocity vectors onto horizontal plane.

Results of 1989 Juvenile Salmon Experiments

The Interagency Program continued its Chinook salmon mark/recapture experiments in the Sacramento/San Joaquin Delta during spring 1989. Salmon smolt survival study methods and results from previous years were reviewed in the September 1989 issue of the *Newsletter*.

In 1989, tagged salmon were released:

- At three temperature levels (60-63, 67-69, and 70-73°F) to help quantify effects of water temperature.
- Above and below the Delta Cross-Channel to help quantify diversion impacts.
- In Sutter and Steamboat sloughs and in the Sacramento River to compare survival via different migration routes.

Tags recovered by midwater trawl at Chipps Island yielded indices of smolt survival for each release group. Results indicated that two of the groups of smolts released above Walnut Grove and exposed to diversion into the central Delta via the Delta Cross-Channel and Georgiana Slough had lower survival than those released below the cross channel.

In one paired release, survival of fish released above the cross channel was higher than for the group released below. This result has not been seen in the 10 paired tests since 1983. During 1983-1989, the ratio of survivals of smolts released below and above the cross channel has ranged from 0.06 to 0.80, with a mean of 0.56; that is, on the average, survival of smolts to Chipps Island is reduced by about 50% by diversion through the Delta Cross-Channel and Georgiana Slough.

Data from 1989 continued to support a linear and negative relationship between smolt survival indices and water temperature. Survival ranged from 0.85 to 1.19 for 60-62°F and from 0.16 to 0.21 at 70-73°F. The linearity of the relationship appears to reflect sublethal temperature effects, since temperatures below about 78°F are generally not lethal to juvenile Chinooks. Sublethal temperature effects may be caused by increases in physiological stress, metabolic demands, predation, and disease, which may be positively related to temperature.

Survival indices of smolts planted in Sutter and Steamboat sloughs at relatively high temperatures (68 to 70°F) were greater (0.91 and 1.11) than for those released in the Sacramento River between Walnut Grove and Sacramento (0.21) even though temperatures at all release sites were comparable. These limited data infer that smolts migrating through the Delta via Steamboat Slough or Sutter Slough have a greater survival rate than those exposed to the Delta Cross-Channel and Georgiana Slough.

We used 1978-1989 coded wire tag data to construct a multiple-regression model to predict fall-run Chinook smolt survival through the Sacramento River Delta. To predict smolt survival between Sacramento and Chipps Island, the model uses water temperature in the Sacramento River at Freeport, fraction of Sacramento River flow diverted at Walnut Grove, and total CVP and SWP Delta exports.

Smolt survival studies in the southern Delta were expanded in 1989. This work is coordinated effort between Interagency staff and DFG Region 4. Tributary streamflow releases and Delta operations were coordinated to establish test conditions.

Tagged smolt survival was evaluated under high exports (~ 10,000 cfs) and low exports (~ 1,800 cfs, CVP only) and under stabilized San Joquin River inflows. Water available in San Joaquin Valley reservoirs for the 1989 evaluation was limited, and test flows at Vernalis averaged only 2,150 cfs.

Tag recoveries at Chipps Island indicated that smolt survival was low at both high and low export levels. We thought reducing exports would reduce direct and indirect project impacts to tagged smolts, speed their travel to the lower estuary, and improve survival. Closing the Clifton Court radial gates would eliminate predation and screening losses associated with SWP operations. Reverse flows in the western Delta were eliminated.

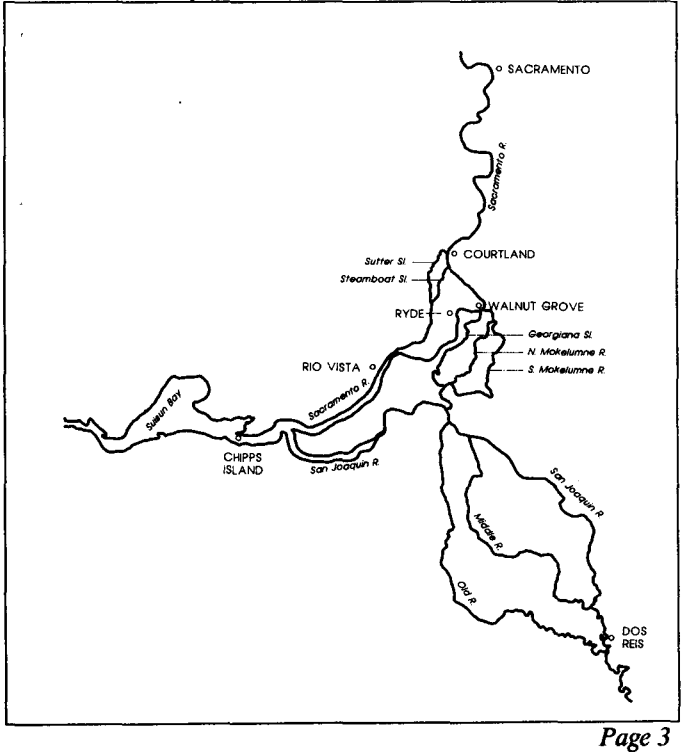
Initial evaluation suggests that the 7-day low export period, in conjunction with the low San Joaquin River inflow, was insufficient. Some of the tagged fish were still in the Delta when high level exports resumed. It appears that the benefit of decreased exports was overridden by both direct and indirect mortality in southern Delta channels.

As indicated by previous studies, keeping smolts in the San Joaquin River was beneficial to their survival. For tagged smolts released in the San Joaquin just below its split at the head of Old River, survival was better (0.14 and 0.14) than for those released in upper Old River (0.05 and 0.09).

CVP and SWP fish salvage facility recoveries of tagged smolts released in upper Old River were low (2% and 7%) during the high and low export periods. In the past, 25% to 74% of the released smolts have been recovered. Review of operational and biological factors is underway to evaluate this result.

Finally, the 1989 data indicate that the high smolt mortalities likely occurred in the southern Delta channels and San Joaquin River upstream of Jersey Point, as additional tagged smolts released at Jersey Point survived very well (0.88 and 0.96) under both the high and low export conditions.

Reports on the 1989 salmon studies and smolt survival model are available from USFWS, Fisheries Assistance Office, Stockton (209/466-4421).
(Marty Kjelson, USFWS)



UNIT OF THE MONTH
DWR's Bay/Delta Environmental Studies Section

The objective of the Bay/Delta Ecological Studies section is to develop understanding of basic environmental requirements of fish and wildlife of the Sacramento-San Joaquin estuary so that impacts of State Water Project operations can be minimized. We do not work exclusively on Interagency efforts, but four of our programs do contribute significantly to the Interagency Ecological Study Program.

» Fishery Studies Program
- → Fisheries data analysis for Article 7 negotiations.
- → Input for planning future Delta facilities.
- → Suisun Marsh fish monitoring projects.
- → Work (with USFWS) to develop the Delta salmon smolt model.

» Water Quality Studies
- → Data analyses for the Food Chain Committee.
- → Annual *DAYFLOW* report.
- → Analysis of benthic data generated by the Decision 1485 Monitoring Program.
- → General data management activities, including *STORET.*
- → Activities resulting from the newly formed Pollutant Studies Committee.

» Fish Facility Program
- → Annual striped bass egg and larvae entrainment survey in the southern Delta.
- → Improvements to the Skinner Fish Facility (CEQA activities for additonal holding tanks).
- → All activities on the Interagency Fish Facilities Committee. In 1990, we will dismantle the fish study facility at Hood.

» San Francisco Bay Program
- → Continuous monitoring program, which generates continous electrical conductivity data for the Interagency mathematical modeling.
- → Selenium monitoring program, which provides selenium levels in municipal and industrial discharges, as well as dissolved concentrations in San Francisco Bay and in the Delta.
- → Cooperation with USBR and USGS in a field program that provides vertical and horizontal specific conductance data and temperature profiles from the Golden Gate to Rio Vista.
- → Interaction with the Bay Area Dischargers Association and the Aquatic Habitat Institute.

Our Staff

BELLORY FONG, Environmental Specialist IV, oversees activites of the section. Her duties include fiscal and personnel management, project coordination, and report preparation and review. Bellory has a B.S. in Biological Science from CSU, Sacramento.

PEGGY LEHMAN, Environmental Specialist IV, is responsible for the Striped Bass Habitat Program. Her research focuses on interactions among phytoplankton, zooplankton, larval striped bass, and environmental factors and description of these interactions using statistical models. Peggy has a B.S. in resource science and an M.S. and Ph.D. in ecology from UC, Davis.

RON LUNSFORD, Associate Engineer, is responsible for design, installation, and maintanence of all the facilities required for our water quality and fisheries efforts. Ron is a registered engineer, with a B.S. from the Citadel.

STEPHANI SPAAR, Fisheries Biologist, works on salmon and striped bass issues in the Bay and Delta, including winter-run salmon, monitoring egg and larva losses at the Delta pumping plants, and tracking fishery data for impact assessment in Suisun Marsh. Stephani has a B.A. from Lycoming College and an M.S. in fisheries from Humboldt State.

SHEILA GREENE, Environmental Specialist, is working with USFWS to develop the Delta salmon smolt survival model. Her dual background in computers and biology has been directed toward evaluating operations models, *IFIM* efforts, and data management. Sheila has a B.S. in limnology from UC, Davis, and expects to complete an M.S. in biology at CSU, Sacramento, next year.

DEBORAH CONDON, Environmental Specialist, is analyzing benthic data generated by the Decision 1485 Monitoring Program. She is also developing an Interagency library of technical reports written on the Bay and Delta. Deborah has an A.B. in botany from UC, Berkeley.

PAM CASSELMAN, Junior Engineering Technician, works on all of our field surveys and data entry and is responsible for the annual *DAYFLOW* report. She is attending classes at Yuba City Junior College.

Hydroacoustics in Fisheries Research

Hydroacoustics is use of a sonar system to obtain information about underwater objects by observing the *echos* from transmitted sound. Applying sonar to fisheries research has been made possible by recent advances in electronics technology and the understanding of acoustics. Hydroacoustics integrates a calibrated, accurate system of sonar instrumentation with knowledge of acoustic principles and the biology of fish. Research objectives have evolved from "finding" fish to quantifying fish distribution, direction and rate of movement, abundance, behavior, and size.

Basic operation of a sonar system relies on known physical properties of sound in water (i.e., generation, transmission, and propagation) to detect the presence and approximate location of underwater objects. A simple sonar system is composed of a transmitter, a transducer, a receiver, and a display device. The transmitter generates electrical pulses that are mechanically converted by the transducer into sound waves for radiation into the water. An object in the path of a sound wave reflects some of the wave's energy (echo) back to the transducer, where it is reconverted into an electrical signal. The receiver conditions the signal for output by the display device. The precision with which electrical or acoustic energy is applied determines the type of information that can be obtained.

Sonar systems for fisheries research are designed for accurate metering and quantification of energy directed toward and received from specific *targets*. Transmitters control the characteristics (power, duration, repetition) of generated electrical pulses according to distances over which targets are to be detected and the resolution of detection desired. Transducers produce a composite of sound waves that is concentrated and directed into a *beam* in which detection and range of targets can be defined with relation to acoustic energy.

Added versatility and detection is possible by using a variety of transducer beam configurations and multiple transducer arrays. Increased sampling capability can be achieved through simultaneous interrogation of pairs of transducers. Receivers amplify returned signals by adjusting for distance-dependent energy losses, then convert those signals into an appropriate form for examination.

Display devices, typically paper charts or magnetic tape recorders, compile permanent records of target signals, which can be processed and analyzed with microcomputers.

For the most part, two sampling techniques are used in hydroacoustical fisheries assessments:

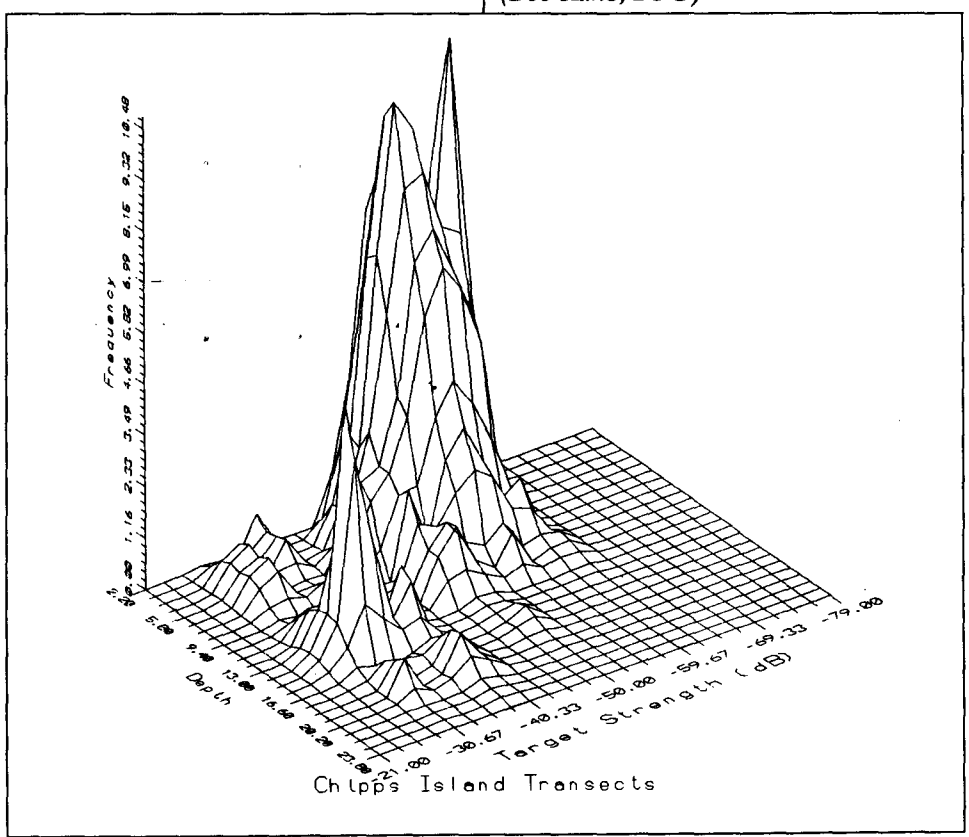
» The *fixed aspect* technique, primarily directed at echo counting, involves stationary positioning of transducers relative to an area through which fish passage is of interest. This method is typically used near structures such as dams, turbine intakes, fish ladders, and weirs. Fish are detected as they move through the volume *ensonified* by the transducer beam. Objectives of the technique are to determine fish behavior, distribution, direction, and rate of passage in the specified area.

» In the *mobile survey* technique, the ensonified volume is moved over a series of sampling transects. This technique is primarily directed at echo integration and is used to estimate fish abundance. Mobile sampling can also yield information about vertical and horizontal fish distributions.

Both sampling techniques typically employ single-beam transducers, but dual-beam transducers are also used to measure the echo-reflecting power of a fish (or other target). This is referred to as *target strength*, or *TS*. Target strength is important for accurately scaling the output of an echo integrator to obtain absolute estimates of fish biomass or abundance. It is also used for establishing the minimum detection threshold of an echo counting system.

Fish TS is related to fish length. Correlation is high between TS frequency distribution and length frequency distribution from fish captured by nets. Plots of individual fish TS, by depth, can reveal important biological information, such as multi-modal distribution stratified by depth, as illustrated below.

To estimate loss rates of juvenile fish crossing Clifton Court Forebay, the Fish Facilities Unit of DFG's Bay/Delta Project is developing sonar techniques to measure rates of fish entering and leaving the forebay. Other intended applications include: determining how fish distribute themselves when encountering a flow split along their migration route; determining diel and tidal variations in horizontal and vertical distribution patterns of fish; determining the effect of water development structures on fish passage; and determining screening efficiencies.
(Bob Kano, DFG)



Larval Striped Bass Feeding Studies

Year class strength of striped bass may be determined by the success of first-feeding larvae. Larval feeding success may depend not only on prey abundance, but on differences among prey types. Recently, planktonic food of the Sacramento-San Joaquin estuary have changed due to ballast water introductions of copepods and to environmental changes. At the same time, striped bass stocks have declined by 50-60 percent.

A study is underway at the University of California, Davis, under contract to the Interagency Program, to determine differences in success of larval bass feeding on native copepods (*Eurytemora affinis* and *Cyclops* spp.) and introduced copepods (*Sinocalanus doerrii* and *Pseudodiaptomus forbesi*).

Laboratory tests used 2-liter beakers containing 1 liter of water, four 7-mm fish, and 60 copepods (30 of each species in the 2-species tests). Food was withheld from the fish for 24 hours before the tests. Copepods were added to the beakers for a 2.5-hour feeding period. Beaker contents were then poured through a fine net and contents preserved in 70% ethanol. Fish stomachs were analyzed, and species and numbers of copepods eaten were recorded. Counts of uneaten prey verified results of stomach analysis.

Paired species tests, single species tests, and tests to evaluate the mechanism underlying selection – presence of egg sacs, size, and visibility – were done. Female *Eurytemora*, 30 with and 30 without egg sacs, were used to examine the effects of egg sacs. Size selection was evaluated in tests with 30 male and 30 female *Eurytemora*. In this species, there is a size difference between sexes of about 0.25 mm. Visibility tests were done by comparing bass feeding on dyed and undyed *Pseudodiaptomus*.

All paired combinations produced significant differences between species except the *Eurytemora/Cyclops* and *Eurytemora/Pseudodiaptomus* combinations. Order of feeding preference was: *Cyclops, Eurytemora, Pseudodiaptomus, Sinocalanus*. *Cyclops* was always preferred, and there was little difference in selection between *Eurytemora* and *Pseudodiaptomus*. Only two *Sinocalanus* were eaten during the 2-species tests.

Single-species tests supported results of the 2-species tests. *Cyclops* was the most preferred copepod, followed by *Eurytemora* and *Pseudodiaptomus*. No *Sinocalanus* were eaten during the single species tests. Observations indicated that the mechanism underlying selection is the difference in swimming and escape behavior of the copepods.

In the estuary, *Eurytemora* has been the most important food for larval striped bass. Although *Cyclops* was preferred by larvae in these tests, it is a freshwater species relatively uncommon in the Delta, and it is available only early in the season or during years of high outflow.

The bass' apparent lack of preference between *Eurytemora* and *Pseudodiaptomus* suggests that *Pseudodiaptomus* may be used as food by the larvae. However, *Pseudodiaptomus* is a warmwater species and does not become abundant until late June, which is too late for most of the bass. Since it is a recent introduction (1987), *Pseudodiaptomus* may supply some nourishment for larval bass if its habitat expands in the future.

Sinocalanus was rarely eaten in these tests, and field data show relatively low occurrence in gut contents of striped bass larvae.

A complete study of the larval striped bass food supply must include analysis of differences among prey types as well as abundance. *Cyclops'* constant spiralling motion increases its visibility and the predator's reactive distance. The snapping, leaping escape response of *Sinocalanus* may make it difficult for young fish to catch. *Eurytemora* and *Pseudodiaptomus* glide slowly, and only occasionally dart about. Apparently, their slow movement makes them more vulnerable to predation.

More work is needed to understand the mechanisms underlying the success of first-feeding larvae and their effects on larval survival. Future projects may include predation experiments in large rearing aquaria and videotaping larvae/copepod feeding encounters to better observe mechanisms underlying selection. Tests to demonstrate differences among prey types will be supplemented by tests to establish optimum prey densities for larval striped bass growth and survival.

(Lesa Meng, U.C. Davis)

White Sturgeon Management Plan for Western States

A coastside white sturgeon management plan is being developed under the auspices of the Pacific States Marine Fisheries Commission . Dave Kohlhorst of the DFG Bay/Delta Project recently attended two meetings with sturgeon researchers and managers from Oregon, Washington, Idaho, and British Columbia. Both meetings were in Portland.

In August, there was a 2-day workshop at which biologists presented the latest information on life history and population dynamics for all white sturgeon populations in the Western States.

The second meeting, in late November, was a scoping and planning session for the management plan. Participants prepared an outline of the plan, adopted a tentative schedule and deadlines, and discussed hiring someone to actually write the plan. A writer will be hired in early January, and a draft of the plan will be completed by the end of 1990.

Although not binding on the cooperating states, the plan should be a valuable white sturgeon management document.

Staff Notes

- Holly Yue recently joined DFG's staff as a Laboratory Assistant on the young striped bass project. Holly had worked on the project as a graduate student assistant for several years. She has extensive experience in both laboratory and field aspects of the project. Holly joined the staff as Holly Hulse, but on October 15 she married Brian Yue, a former DFG employee.
- Vicki Van Kouwenberg recently joined the USFWS office in Stockton as a clerk/typist. Vicki previously worked for the General Service Administration.
- DWR's Suisun Marsh Planning Section hired Reynaldo Ballesteros and Sal Edora to operate the boat lock at the Suisun Marsh Salinity Control Gates. Until December 1, the boat lock was operated by Central District staff. These new hires will allow staff to resume normal work assignments.

NOTEWORTHY

- Copies of recently released Interagency Program 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,* are available by calling 916/322-6226.

- DWR has purchased a new 25-foot aluminum hull boat for use in Suisun Marsh and the Delta. The work boat, which replaces the 20-year-old *Beowulf*, will be ready for use in January. Primary uses will be for water quality sampling in the marsh and for spring striped bass egg and larva sampling in the southern Delta.

- DFG's Bay/Delta Project also has two new research vessels, one each for the Striped Bass Egg and Larva Unit and the Delta Fish Facility Study Unit. The vessels were designed by Bay/Delta Project staff and custom built in Chico, California. The custom design of the vessels gives them multidimensional sampling capabilities, with extra work and storage space. Each vessel, when properly rigged, can be used for gillnetting off the bow, otter and midwater trawling, striped bass egg and larva sampling, and townet sampling. The Delta Fish Facility Study vessel has two additional capabilities. It can house and run mobile hydroacoustic surveys, and it can be rigged with a pushnet for sampling in shallow or high velocity flows such as those in Clifton Court Forebay. Both vessels will be put in service this spring.

- In November, DFG planted about 200,000 fingerling striped bass in the Bay and Delta. The fish were salvaged from State fish screens last summer and reared to 3-4 inches long in tanks near the screens. Miniature magnetic tags were placed in the cheeks of these juvenile bass, and field crews will be looking for these tags 3 to 4 years from now, when the survivors enter the fishery. Comparison of survival of fall fingerlings to that of fish allowed to grow to yearling size will help determine the most effective stocking strategy.

- The fall midwater trawl survey for striped bass was completed December 12. Although the final trawl index won't be calculated until January, sampling in September, October, and November indicates that the index will be low. DWR's Pam Casselman and Deborah Condon assisted DFG in the field work.

- As requested by the Agency Directors at their August meeting, a technical briefing on various program components is scheduled for January 19, 1990. Although not completely set, the agenda will probably include updates on progress in striped bass and salmon studies, consideration of a hydrodynamic study of the Carquinez Strait area, Delta fish protective facilities, and integration of the DWR water quality monitoring programs with the Interagency Program.

- The annual striped bass workshop will be held February 5 and 6. Staff from the various agencies and invited experts in the fields of fisheries, toxicology, and population dynamics will meet for 2 days to discuss results of this year's program and to make suggestions for the next field season. Scientists from Oak Ridge National Laboratory will discuss progress in developing an individual-based population model using data from the Bay/Delta, the Hudson River, and South Carolina reservoirs.

- During November, Don Stevens (DFG) met with striped bass experts from the Oak Ridge National Laboratory, Maryland, New York, and South Carolina. The purpose of this meeting, which took place in Washington, DC, was to develop coordinated work plans for the Sacramento-San Joaquin, Hudson River, and Santee-Cooper (South Carolina) striped bass populations. This planning is part of the ORNL striped bass population modeling being sponsored by the Electric Power Research Institute's COMPMECH program. The Interagency Program's striped bass data base will provide major support for ORNL's striped bass model. Although the major thrust of the COMPMECH program is to evaluate powerplant impacts, the striped bass population modeling also will apply to evaluating impacts of water project entrainment losses and will help in evaluating factors responsible for the Sacramento-San Joaquin striped bass population decline.

Annual Interagency Workshop

January 7-9, 1990
Asilomar Conference Center
Pacific Grove, California

Interagency Ecological Study Program
NEWSLETTER
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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

Edited by:

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

AGENDA

1990 INTERAGENCY WORKSHOP
Asilomar Conference Center

Sunday, January 7, 1990

1500	Begin Registration at the Administration Building (see map). Full payment for lodging and meals will be required at this time. There will be a small additional fee ($5 to $10) to cover Social Hour refreshments.
1800	Dinner

Monday, January 7, 1990

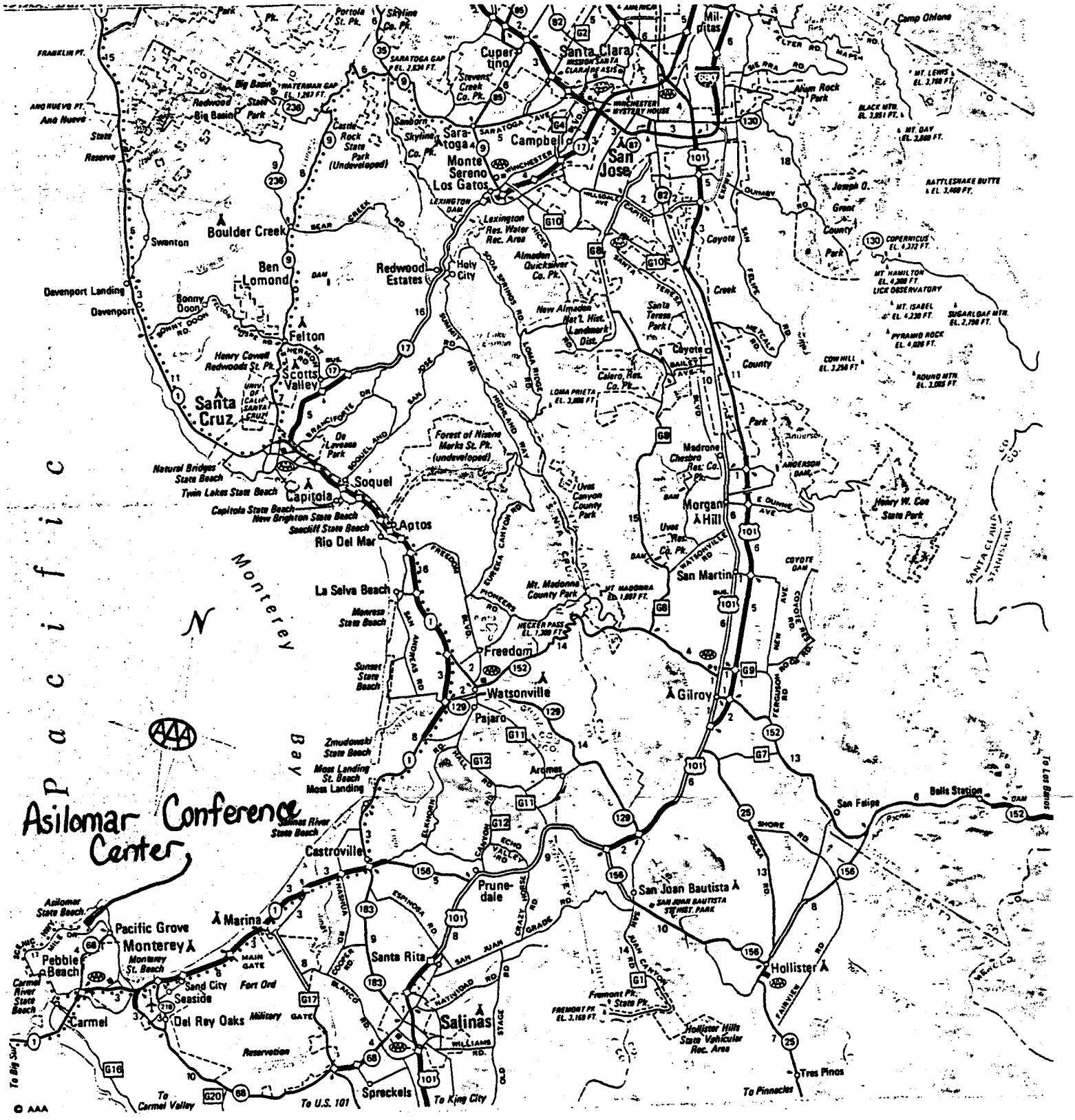
0830	**Welcome and Introduction**	Pete Chadwick, DFG
0845-1030	**Perspective of Interagency Activities**	Perry Herrgesell, DFG, Moderator
15	Water Resources Control Board	Don Maughn, SWRCB
15	Environmental Organizations	Bill Davoren, Bay Institute
15	Fish Advocacy Organizations	Jim Brennan, United Anglers
15	Scientists	Don Kelley, Don Kelley and Associates
15	Water Contractors	Dave Schuster, State Water Contractors
1030-1050	**Break**	
1050-1200	**Bay/Delta Hearings and Management Issues**	Marty Kjelson, USFWS, Moderator
15	Bay/Delta Hearings	Dave Beringer, SWRCB
15	Five-Agency Salmon Committee	Marty Kjelson, USFWS
15	Article 7, Two-Agency Fish Agreement	Pat Coulston, DFG
15	Article 10H, Coordinated Operation Agreement	John Budd, USBR
1200-1300	**Lunch**	
1300-1415	**Changes in Species Using the Delta**	Bellory Fong, DWR, Moderator
15	Winter Run Salmon	Dave Vogel, USFWS
15	Delta Smelt	Peter Moyle, UC, Davis
15	*Potamocorbula amurensis*	Fred Nichols, USGS
15	Zooplankton	Wim Kimmerer, BioSystems Analysis Inc.
1415-1445	**Striped Bass Developments**	Jim Arthur, USBR, Moderator
25	Food Chain Activities	Don Kelley, Don Kelley and Associates
1445-1505	**Break**	
1505-1615	**Striped Bass Developments** (continued)	
20	Larval Bass Toxicity	Chris Foe, RWQCB, Region 5
20	Striped Bass Decline	Don Stevens, DFG
20	Continuous Monitoring, Larval Bass	Jim Arthur, USBR
1630-1815	**Social Hour / Poster Boards**	
1830	**Dinner**	

AGENDA

1990 INTERAGENCY WORKSHOP
Asilomar Conference Center

Tuesday, January 9, 1990

0730-0830	**Breakfast**	
0830-0945	**Water Quality Perspectives**	Jim Sutton, SWRCB, Moderator
10	Dredging in San Francisco Bay	Tom Wakeman, Army Corps of Engineers
10	AHI Monitoring Proposals	Joe O'Connor, Aquatic Habitat Institute
10	Regional Board Monitoring Program	Mike Carlin, RWQCB, Region 2
10	SWRCB Pollution Policy Development	Leo Winternitz, SWRCB
10	Mathematical Model Developments	Peter Smith, USGS
1000-1020	**Break**	
1020-1130	**Contributed Papers**	Rick Oltmann, USGS, Moderator
20	Delta Zooplankton	Jim Orsi, DFG
20	San Francisco Bay Shrimp	Kathy Hieb, DFG
20	Soil Salinity in Suisun Marsh	Karl Jacobs, DWR
1130-1200	**Check Out**	
1200-1300	**Lunch**	
1300	**Depart**	


Asilomar Conference Center
Pacific
Monterey
Bay
Santa Cruz
Scotts Valley
Felton
Ben Lomond
Boulder Creek
Davenport
Davenport Landing
Swanton
Redwood Estates
Holy City
Soquel
Capitola
Aptos
Rio Del Mar
La Selva Beach
Watsonville
Freedom
Pajaro
Moss Landing
Castroville
Marina
Pacific Grove
Monterey
Pebble Beach
Carmel
Seaside
Del Rey Oaks
Sand City
Fort Ord
Prunedale
Santa Rita
Salinas
Spreckels
Gilroy
San Martin
Morgan Hill
San Juan Bautista
Hollister
San Felipe
Bells Station
Tres Pinos
Aromas
Castroville
Los Gatos
Monte Sereno
Saratoga
Campbell
San Jose
Santa Clara
Cupertino
Milpitas
Coyote
Madrone
Calero Res. Co. Pk.
Uvas Canyon County Park
Mt. Madonna County Park
Henry W. Coe State Park
Fremont Pk. State Pk.
Hollister Hills State Vehicular Rec. Area
To Big Sur
To Carmel Valley
To U.S. 101
To King City
To Pinnacles
To Los Banos
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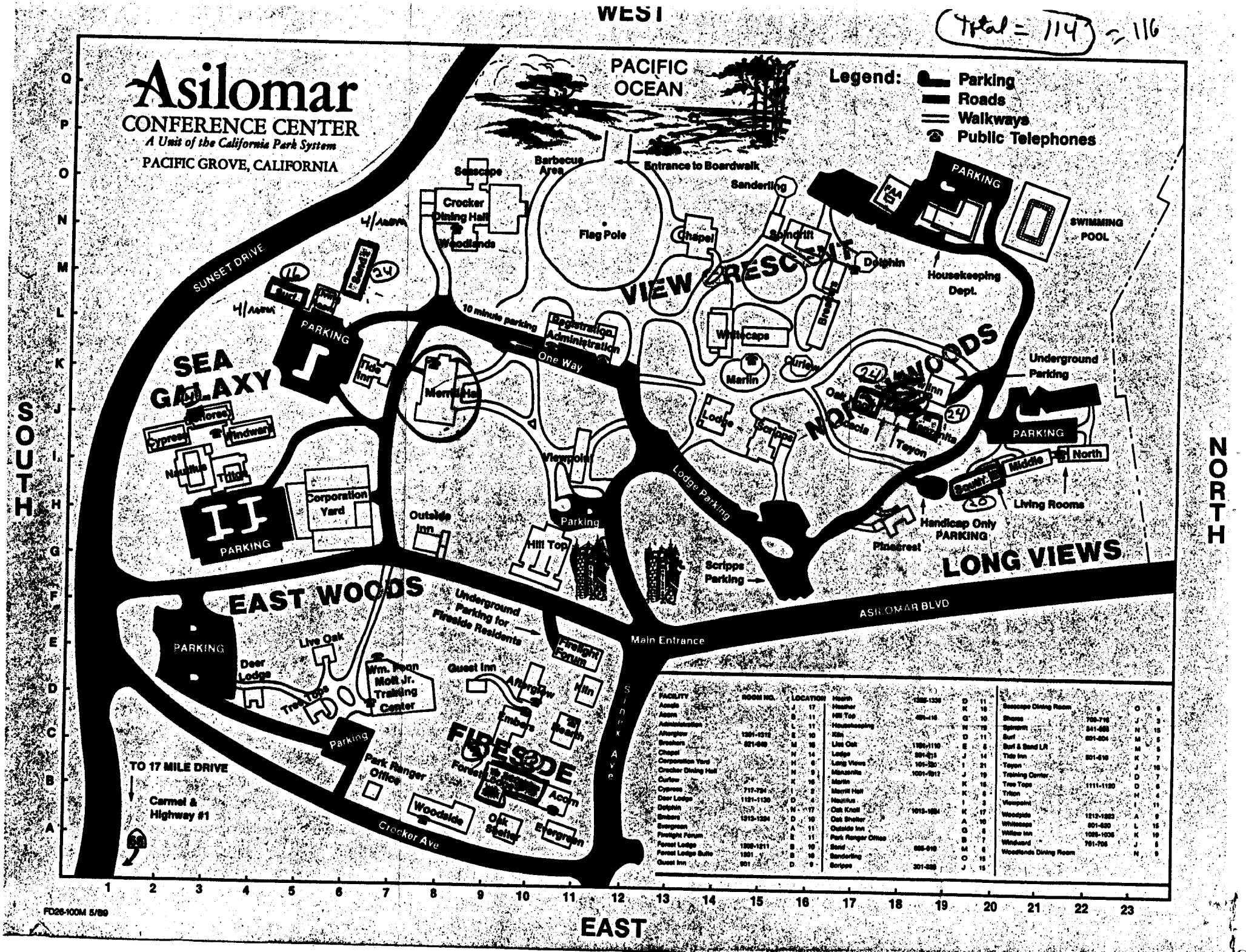
WEST
Total = 114 = 116
Asilomar
CONFERENCE CENTER
A Unit of the California Park System
PACIFIC GROVE, CALIFORNIA
PACIFIC OCEAN
Legend:
Parking
Roads
Walkways
Public Telephones
Seascape
Barbecue Area
Entrance to Boardwalk
Sanderling
Crocker Dining Hall
Woodlands
Flag Pole
Chapel
Sundrift
Dolphin
PARKING
SWIMMING POOL
Housekeeping Dept.
SUNSET DRIVE
VIEW CRESCENT
10 minute parking
Registration Administration
One Way
Whitecaps
Breakers
Underground Parking
SEA GALAXY
Marin
Curlew
Tide Inn
Merrill Hall
Lodge
Scripps
NORTH WOODS
Oak Knoll
Oak Shelter
Inn
Tryon
Cypress
Redwood
Windsor
Natchez
Triton
Corporation Yard
Viewpoint
Lodge Parking
PARKING
South
Middle
North
Living Rooms
Outside Inn
Parking
Hill Top
Handicap Only PARKING
Pinecrest
Scripps Parking
LONG VIEWS
EAST WOODS
Underground Parking for Fireside Residents
Firelight Forum
ASILOMAR BLVD
Main Entrance
PARKING
Live Oak
Deer Lodge
Wm. Penn Mott Jr. Training Center
Guest Inn
Aftergrow
Ember
Hearth
Hitn
Parking
Park Ranger Office
FIRESIDE
Forest Lodge
Acorn
Evergreen
Woodside
Oak Shelter
Sinex Ave
Crocker Ave
TO 17 MILE DRIVE
Carmel & Highway #1
SOUTH
NORTH
EAST
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Q P O N M L K J I H G F E D C B A
FACILITY | ROOM NO. | LOCATION
Health | 1305-1339 | D 11
Hostess | | K 10
Hill Top | 401-416 | G 10
Housekeeping | | N 10
Inn | | D 11
Live Oak | 1100-1110 | E 6
Lodge | 501-513 | J 14
Long Views | 101-120 | I 21
Manzanita | 1001-1012 | J 19
Marlin | | K 15
Merrill Hall | | K 6
Nautilus | | I 3
Oak Knoll | 1015-1024 | K 17
Oak Shelter | | A 10
Outside Inn | | G 6
Park Ranger Office | | B 7
Sand | 605-610 | M 6
Sanderling | | O 15
Scripps | 301-338 | J 15
Seascape Dining Room | | O 9
Shores | 705-716 | J 3
Spinnaker | 841-880 | N 15
Surf | 601-604 | M 5
Surf & Sand LR | | M 5
Tide Inn | 601-618 | K 7
Tryon | | J 10
Training Center | | D 7
Tree Tops | 1111-1120 | D 6
Triton | | H 4
Viewpoint | | I 11
Woodside | 1212-1223 | A 9
Whitecaps | 601-630 | L 15
Willow Inn | 1085-1036 | K 19
Windward | 701-706 | J 5
Woodlands Dining Room | | N 9
FD26-100M 5/89