As an observation, the runoff patterns this year are more nearly the kind to be expected in a globally warmer world if climate change did occur. Such a change would produce more winter runoff, possibly more winter floods, and a reduction in spring snowmelt runoff, particularly in the northern Sierra. The climatologists are still debating whether Earth's climate is actually warming. The signals are mixed. One has to weigh our warm weather this year with the very cold and snowy winter in the upper Midwest. The recent warm months in much of California are probably associated with a large patch of warmer-than-usual surface water — up to 3°C above average in May — off the California coast. We don't believe this warm water offshore is linked to El Niño in the equatorial eastern Pacific.

Unusually early warming was noted in May in the tropical eastern Pacific Ocean. Assuming the usual progression of ocean warming (El Niño events usually peak in late fall or winter) the National Weather Service has predicted a large El Niño event this fall and winter, with worldwide impacts on weather. Expected consequences are dry conditions in northeastern Australia, Indonesia, northern India, northeastern Brazil, and the Pacific Northwest and wetter than average conditions in California, the American Southwest and Gulf States, Chile, and Peru. It remains to be seen whether the Pacific warming will continue or whether something else will happen. For large El Niño events, the signal is stronger in Southern California, less in Northern California and the northern Sierra. Some El Niño years have been dry in Northern California. If the warmth off the California coast persists, it could lead to more tropical storm penetration into California during August and September.

Predicting Evolution of Shallow-Water Habitat Ecological Function from Restoration of Managed Delta Islands

Zachary Hymanson, DWR, and Charles Simenstad, University of Washington

Interagency Program staff will be collaborating on an interdisciplinary, consortium-based research project to investigate the timing and type of ecological benefits gained from shallow-water habitat restoration in the delta. The project, approved as a 1996 Category III project, will be led by Charles "Si" Simenstad from the University of Washington, School of Fisheries, Wetland Ecosystem Team.

The project aims to determine the potential for wetland restoration to provide aquatic resource functions and habitat thought important to improving the ecological health of the delta. Results will provide critical information necessary to predict whether breached-dike restoration strategies contemplated in the CALFED planning process will provide the expected ecosystem benefits to aquatic resources dependent on the delta. Further, the study is expected to provide information useful to restoration projects in progress on Prospect, Sherman, and Decker islands.

The study will assess the long-term prognosis of restoring function to former wetlands now existing as managed islands through a *space-for-time substitution* approach. Rather than depending on long-term ecological databases on tidal wetland development, which are essentially unavailable for the region, a space-for-time substitution approach will compare the habitat and function of historically breached islands of various ages to several natural reference sites. These comparisons will be used to predict the patterns and rates of habitat and function development of shallow-water restoration projects.

Objectives of the project include:

- Assess hydrological, geomorphological, biogeochemical, and ecological indicators of flooded agricultural islands of various ages;
- Complete comparisons between the previously flooded islands and adjacent reference sites using indices of habitat quality for fish, invertebrates, and other flora and fauna; and
- Using various indicators, compare the state of wetland functions at the flooded islands to the functions of natural marsh sites.

Ultimately, the information will be used to develop conceptual models describing the shape and rate of development of trajectories for fish and wildlife habitat functions in flooded delta islands.

DWR will conduct the fish study element of the project through the Interagency Program. DWR staff in the Environmental Services Office will lead the planning and implementation of the fish study element, completing the data analyses and reporting the results. Coordinating the fish study element with the IEP project work teams will also be the responsibility of DWR.

The University of Washington and Metropolitan Water District are nearing completion of the required project contract. Subcontracts will then be developed between the university and the other partners in the study, including DWR, Philip Williams and Associates, and LUMCON. In addition, DWR staff are securing project permits from USFWS, NMFS, and DFG. The partners will begin final study design late this summer and begin the study this fall. Contact Zach Hymanson (916/227-7543) for more information.

Effects of Reduced Wastewater Phosphate Concentrations in South San Francisco Bay

Steve Hager and Larry Schemel, USGS

Wastewater from municipal treatment plants is an important source of freshwater and chemical species to the lagoonal southern reach of the San Francisco Bay estuary (South Bay; Figure 1). Observations over almost four decades have shown that the chemical composition of the wastewater strongly influences longitudinal concentration gradients of dissolved nutrients, particularly in the shallow, landward reach south of the San Mateo Bridge (cf. Harris *et al* 1961; Conomos *et al* 1979; Schemel and Hager 1996). It follows that changes in wastewater treatment that cause changes in the chemical composition of wastewater could affect distributions of dissolved nutrients in South Bay. We previously showed an example of this with respect to a 1979 upgrade to tertiary treatment by the San Jose/Santa Clara Water Pollution Control Plant, which resulted in decreased concentrations of ammonium and increased concentrations of nitrate in the landward reach (Hager and Schemel 1996). Here, we show the effects of a decrease in phosphate loading by two wastewater treatment plants that discharge into the landward reach of South Bay.

In late 1992 and early 1993, phosphate loading south of Dumbarton Bridge was rapidly reduced by more than 50% from its previous 3-year mean value (Figure 2). This reduction was due to significant reductions in phosphate concentrations in effluent from two wastewater treatment plants and apparently did not result from decisions to reduce phosphate loadings. For example, in May 1993, the plants began using alternating anoxic and oxic zones in some activated sludge ponds to control the growth of filamentous algae without using more chlorine. This mode of operation also increases biological phosphorus removal (Alex Ekster, SJ/SC WPCP, personal communication, March 21, 1997). As a result, phosphate concentrations in the effluent were reduced to about 40% of previous values. Causes of a smaller reduction in phosphate concentrations in the effluent of the Palo Alto Municipal Wastewater Treatment Plant over a period of months beginning in late 1992 have not yet been resolved.

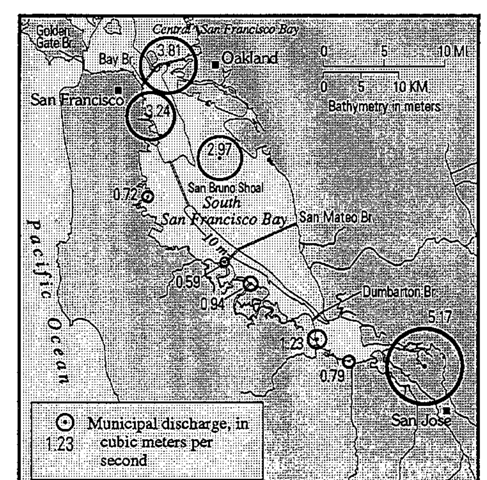

Figure 1
LOCATION MAP FOR SOUTH BAY
Diameters of circles are proportional to volumes of wastewater.
Data from Hager and Schemel 1996, Table 3.

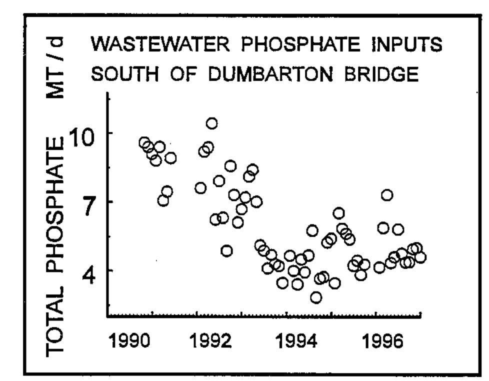

Figure 2
RECENT HISTORY OF MONTHLY LOADINGS OF TOTAL PHOSPHATE SOUTH OF DUMBARTON BRIDGE
(Metric Tons per Day)
Data from monthly reports by the wastewater treatment plants to the Regional Water Quality Control Board.

For much of an average year, wastewater plants south of Dumbarton Bridge are also the only sources of freshwater to that part of the bay. Thus, transect plots of wastewater-derived substances versus salinity may have zero-salinity intercepts equal to the wastewater concentration and slopes determined by mixing this wastewater with bay water. Because the volume of wastewater discharged daily south of Dumbarton Bridge is only about 0.7% of the mean tide volume of that part of the bay, observations during our routine sampling program did not show reduced slopes and intercepts until fall 1993. Data from November 1993 showed a reduced slope extending to Coyote Hills Slough (seaward of Dumbarton Bridge, 22 km from the plant). By February 1994, the reduced slope extended to just seaward of the San Mateo Bridge (34 km from the plant). Over the next 3 years, however, concentrations of phosphate were also lowered by freshwater inflow to South Bay, by exchange with the freshened water of central San Francisco Bay, and by spring phytoplankton blooms. As a result, phosphate concentrations in the landward reach after the major change in phosphate loading (circles) were not consistently lower than those before the change (plus signs), even when referenced to salinity (Figure 3). Only when data are selected for times when freshwater inputs and phytoplankton populations were low (eg, November) do reduced slopes and intercepts stand out in a phosphate/salinity plot (Figure 4). Clearly, other sources also influence these slopes, and we are developing numerical models to quantify the influence of the small mid-bay wastewater input, the larger more northerly wastewater input, and benthic fluxes.