squared (*eg*, the horizontal Richardson number) provides a possible explanation for the absence of gravitational circulation in the spring in Suisun Bay and its occurrence in the fall. Although there have been very few data collected in Suisun Bay from which horizontal salinity (density) gradients can be calculated, we hypothesize that the density gradient in the spring may be too weak to drive the gravitational circulation (*eg*, the horizontal Richardson number is less than its critical value in the spring). During the summer, salinities and the horizontal salinity gradient increase until the horizontal Richardson number exceeds its critical value, and gravitational circulation occurs.

(4) A semi-permanent null zone (and possibly a turbidity maximum) is probably located near the Benicia Bridge in the spring. At the very least, net near-bed currents are significantly reduced in the channels of western Suisun Bay from what they are in Carquinez Strait. A null zone probably moves from near the Benicia Bridge into Suisun Bay and possibly as far as the Western Delta sometime during the late summer when the horizontal density gradients become strong enough to overcome tidal mixing.

Management Implications

This revised conceptual model has significant implications to proposed dredging in Suisun Bay and to the generally accepted hydrodynamic explanation for the turbidity maximum and the entrapment zone.

If the depths near the Benicia Bridge are significantly lowered (dredged from 11m deep and 92m wide to 14m deep and 183m wide) as part of the John F. Baldwin and Stockton ship channel dredging projects (USACOE 1989), the bathymetric control that reduces the strength of the gravitational circulation in Suisun Bay from what it is in Carquinez Strait will be moved from the vicinity of the Bridge into the interior of Suisun Bay (Point Edith). This change in bathymetry could result in elevated salinities in Suisun Bay and the Western Delta. A detailed hydrodynamic study in the area adjacent to the Benicia Bridge is needed, however, to verify the importance and extent of this topographic control.

Given that gravitational circulation was not measured in Suisun Bay in the spring of 1992 and 1994, what does this imply about the existence of a turbidity maximum or entrapment zone based on existing conceptual models? Numerous publications (Arthur and Ball 1979; Peterson *et al* 1975; and others) have explained the turbidity maximum and entrapment zone as resulting from a hydrodynamic null zone. The lack of measured net up-estuary bottom currents in Suisun Bay in the spring suggests that if a turbidity maximum or entrapment zone does exist in the spring, a mechanism other than gravitational circulation must be responsible for it.

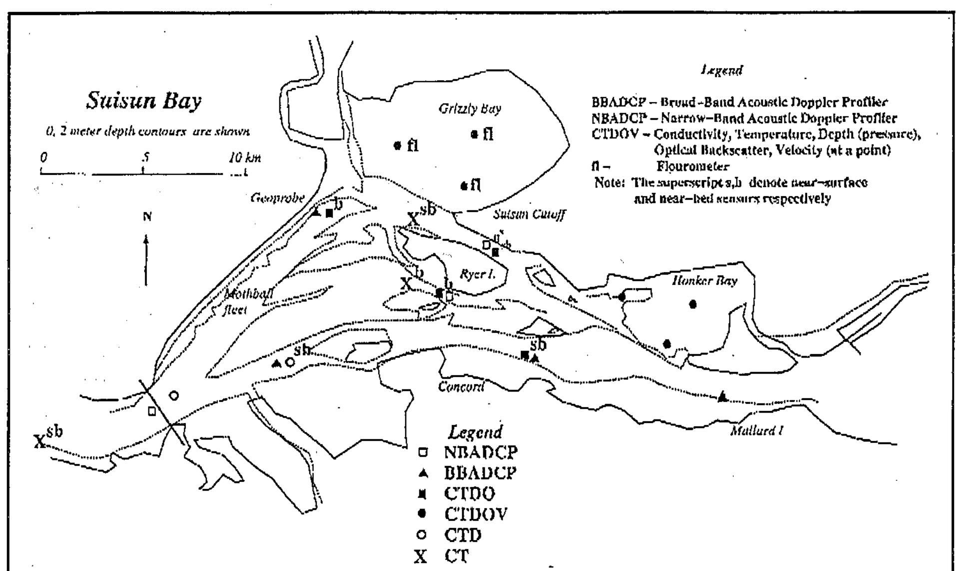

Figure 8
POSITIONS OF *IN SITU* INSTRUMENTS IN 1995
Channel stations were deployed the first week of June; shallows stations were deployed the first week in July.

Conclusions and Ongoing Research

It is not surprising that a gravitational circulation/null zone based model of entrapment persisted, because much of the hydrodynamic data were collected in the fall when gravitational circulation has been observed in Suisun Bay (Figure 6). The horizontal Richardson number accounts, at least qualitatively, for the observed spatial and temporal variations in the gravitational circulation. However, before the revised conceptual model presented in this article can be accepted, a long-term (spring through fall) study is needed in which all of the parameters in the horizontal Richardson number are directly measured. This study is now under way. Seven ADCP-CTDs were deployed in Suisun Bay in late May 1995. The location of other *in situ* hydrodynamic instrumentation (Figure 8) was carefully chosen to measure all of the relevant parameters in the horizontal Richardson number along the axis of the northern reach. Moreover, because gravitational circulation does not appear to dominate spring-summer residual transport in the southern reach of Suisun Bay, shallows/channel exchange is likely to play a significant role. Therefore, six current meters with CTDs were deployed in the shallows of both Grizzly and Honker Bays in early July 1995 to address shallows residence times and shallows/channel exchange processes. Most of the instruments in this study were recovered in mid-September; the rest were recovered in mid-October 1995.

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Sacramento Coordinated Water Quality Program Includes Interagency Program Representative

Harlan Proctor, Department of Water Resources

A description of the Interagency Program's comprehensive monitoring plan was presented at an October 16 of the Sacramento Coordinated Water Quality Program. The coordinated monitoring program was organized by a coalition of the Sacramento Regional County Sanitation District, City of Sacramento, and Sacramento County Water Agency. Its initial goal was to determine ambient concentrations of trace elements in the American and Sacramento rivers so reasonable limits on NPDES permit requirements could be developed. Biweekly sampling at four sites has been conducted for the past 3 years. In addition to a general discussion of program results, the committee was seeking areas for collaboration with other ongoing monitoring. Since coordinating resources is also one of the primary objectives of the revised Interagency Program, we will have a representative on the technical review subcommittee to comment on water quality management goals, exchange data, and propose mutually beneficial program modifications.