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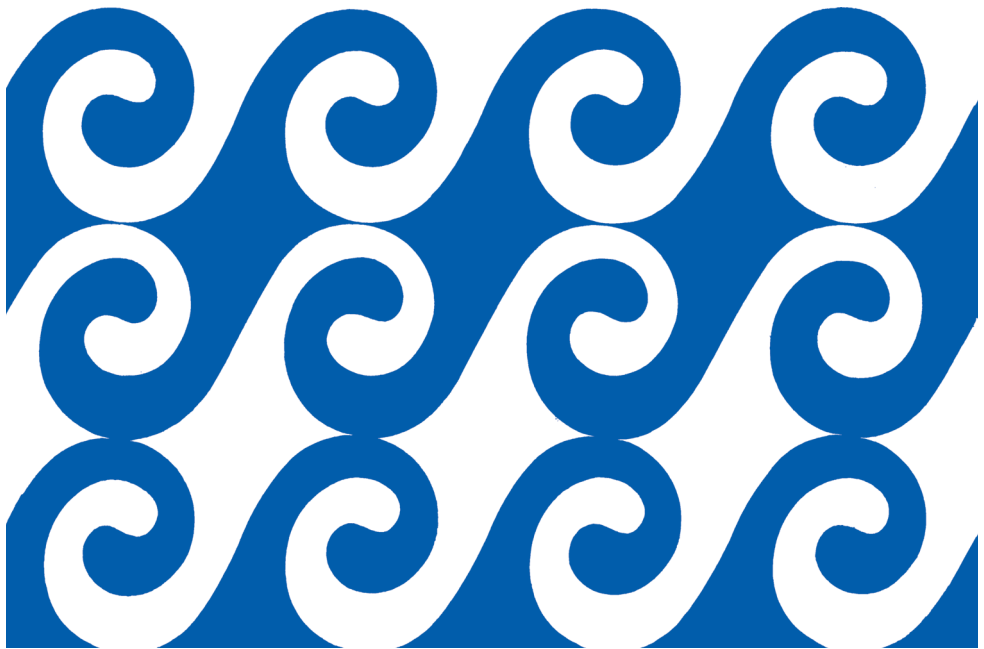
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Journal of Marine Research Classic Articles

Gravitational circulation in straits and estuaries

by **Donald V. Hansen and Maurice Rattray, Jr.**

Originally published May 15, 1965, in the *Journal of Marine Research* 23(2), 104–122.

EDITOR'S COMMENTARY

For decades, people understood the rudiments of how idealized estuaries work: fresh water flows outward above saltier water that intrudes into the estuary. At the same time, mixing smooths out contrasts, so that the ultimate shallow outflow water is much saltier than the upstream riverine inflow had been. But, this vision is qualitative, so that it is hard to predict or diagnose flow structures or the outflow salinity. Hansen and Rattray provided a major step forward in an age before any sophisticated numerical models could deal simultaneously with the many competing effects.

The authors ask the right question. Rather than trying to explain the entire estuarine circulation, they pick a site partway between the river inflow and the outflow to the ocean. They assume that the downstream pressure gradient is given, and then formulate a pseudo-one dimensional model. The beauty of the model is that it makes quantitative predictions about the flow structures that are associated with the pressure gradient, with wind stress and with both vertical and horizontal mixing.

The results are quantitative predictions of flow or salinity profiles given a few simple parameters. Although their model does not answer all the questions, it serves as a useful, comprehensible, quantitative point of reference right up to this day. Others have since dealt with, for example, time dependence and variable mixing, but the underlying framework remains.

—*Kenneth H. Brink*