

(Swan, et al, 1999)

## THERMAL, MIXING, AND OXYGEN REGIMES OF THE SALTON SEA, 1997-1999

**Brandon K. Swan, James M. Watts, Mary A. Tiffany, and Stuart H. Hurlbert**  
**Center for Inland Waters and Department of Biology**  
**San Diego State University, San Diego, CA, 92182, USA**

Among the environmental factors having greatest impact on the organisms that live in and on the Salton Sea are water temperature, the mixing of surface and bottom waters, and concentration of dissolved oxygen. Here, we report the results of our 1997-1999 monitoring of the thermal, mixing, and oxygen regimes of the Sea, interpret them in relation to weather and climatic variables, and discuss the numerous ways in which these processes may be affecting plankton, benthos, fish, and aquatic birds of the Sea.

Temperature and dissolved oxygen were measured at three mid-lake stations at 2-5 week intervals from January 1997 to December 1999. Two additional near shore stations were added in January 1999. Measurements of conductivity were begun in July, 1998 and hydrogen sulfide measurements were made in July - September, 1999. Daily weather data was obtained from 4 meteorological stations surrounding the Salton Sea.

The lake has a warming period from early January to July-September, followed by a 4-5 month cooling period. Thermal stratification exists during most of the warming period but this is interrupted by periodic wind-driven mixing events, especially in early spring. Mixing events are less frequent in the summer, but when they occur they sometimes result in the entire water column becoming anoxic with measurable quantities of hydrogen sulfide in surface waters. These may be responsible for crashes in plankton populations often observed at these times. During stratification anoxia and high concentrations of hydrogen sulfide, up to 5 mg/L, are found in bottom waters. For a large part of the warming period, few fish are found in midlake and macroinvertebrates are absent over most of the lake bottom as a result of these conditions. By the end of the warming period mean water column temperature in midlake is 31-34°C. During the cooling period, convective circulation in the water column supplements wind-generated turbulence and the whole water column mixes more or less daily. Oxygen levels during this period are almost always >3 mg/L at all depths. By the end of the cooling period mean midlake water column temperature is 13-15°C. Lake hydrodynamics are complex, influenced by freshwater inflows at the south end and a double-gyre current system. Dissolved oxygen profiles differed markedly with distance from shore. In general, during the warming period the well-oxygenated layer is thicker in nearshore areas than in midlake. Salinity gradients have been found in the southeastern sector of the lake, upcurrent from the New and Alamo River inflows. Such gradients will inhibit mixing of bottom and surface waters wherever they occur.