PREDICTING SALINITY IN FLORIDA BAY

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Biotic and chemical proxies for salinity in Florida Bay show that salinity values for the last century are strongly correlated with climate, specifically, rainfall (Brewster-Wingard and others, 1998; Cronin and others, 1998). Elemental chemistry of ostracode shells provides a methodology to discern salinity values of the past (Dwyer and Cronin, 1999). Adult tests of the ostracode *Loxoconcha matagordensis* are grown essentially instantaneously in the late spring and early summer. For the purpose of this paper, salinity values derived from adult *Loxoconcha matagordensis*, generally grown between May and July each year, serve as proxies for June salinities. Because *Loxoconcha matagordensis* growth shows a very tight normal distribution, population studies from one sample can provide data on salinity changes occurring at the beginning of the rainy season (usually June). The purpose of this study was to establish if a relation exists between rainfall and Mg/Ca derived salinities, and if so, to mathematically express this relation. In this initial attempt, the record from the Russell Bank Core (Brewster-Wingard and others, 1997) was utilized. Russell Bank has a long record and relatively abundant Loxoconcha matagordensis. Biotic indicators were analyzed from every other 2-cm sample and elemental chemistry of the ostracodes was performed on every sample. The calculated sedimentation rate of the core is 1.22 cm + 0.05, each sample represents about 1.5 to 2 years.

The assumptions and values for the model:

Monthly rainfall information is available from NOAA (www.ncdc.noaa.gov) dating back to 1895. The eastern part of Florida Bay is influenced by rainfall and surface run-off. To compare rainfall to salinity values on a monthly basis, averages of the three southern districts (southwest (Everglades), southeast coast, and Bay and Keys) were taken, because rainfall to all three may influence salinity in Florida Bay. Because the focus is June salinity, rainfall from the five preceding months was examined to establish a relation. During El Nino years, high winter rainfall is usually recorded in January; therefore, January rainfall was included in the data set to indicate the occurrence of these events.

Age models for specific cores can be very good for the latter half of the century because ^{210}Pb derived ages can be calibrated to the cesium spike of the early sixties caused by atmospheric nuclear testing. Some historical salinity data is available dating back to 1955. So for these two reasons, samples from 1955 to the date the core was taken (1994) were examined.

January-May total rainfall and Mg/Ca-derived salinity values for a given calculated year correlate extremely well for the period 1955-1970, showing a strong negative correlation of –0.90. The regression line provided a formula for predicting salinity, given the January-May rainfall for a specific year (fig. 1).

For 1971-1994, January-May total rainfall showed little correlation to the Mg/Ca derived salinity values (fig. 1). The relation was a weak positive correlation which was certainly counter-intuitive and suggested disruption. The core could possibly have been mixed, but comparison to historical monthly salinity data compiled for the eastern zone of Florida Bay by M.B. Roblee (USGS, written commun., 2000) matched well with the Mg/Ca-derived salinities for June over this time span, suggesting that there was a strong disconnect between rainfall and salinity post-1971 compared to pre-1971.

Initial results are promising in that pre-1971 strong correlations between salinity and January-May rainfall provide a predictive tool for salinity that appears to represent a relation prior to disruption of the system.

References

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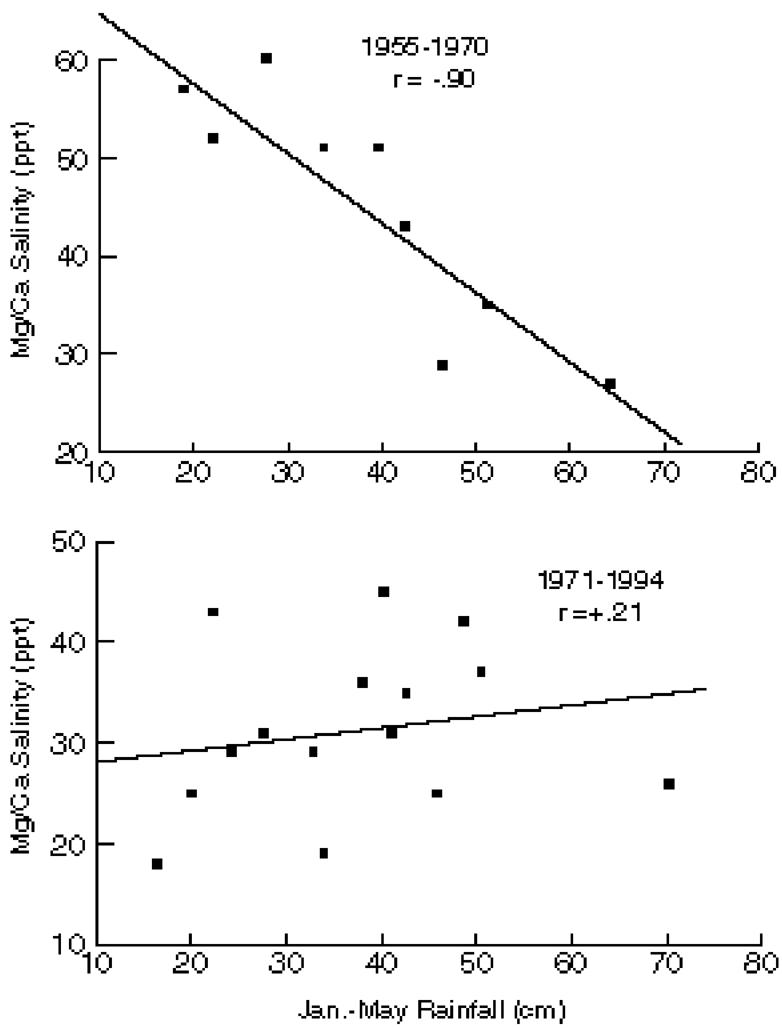

Figure 1. Scatter plots of the relation of Mg/Ca salinity derived from Loxoconcha matagordensis tests from the Russell Bank Core 19B and total average rainfall for January-May for South Florida for the years 1955-1970 and 1971-1994 including the least squared means correlation (regression) line and r value of correlation (Pearson correlation).