Gulf of Mexico oysters

Long-term changes in distributions of disease and contaminant body burden

Yungkul Kim

The eastern oyster, *Crassostrea virginica* (Gmelin 1791), is probably one of the most studied marine species in the Gulf of Mexico due to its wide distribution and economic importance. Sessile, filter-feeding oysters accumulate and concentrate contaminants from surrounding water without metabolizing or releasing them in significant quantities. This makes them preferable as bioindicators, and scientists use oysters to monitor coastal water quality.

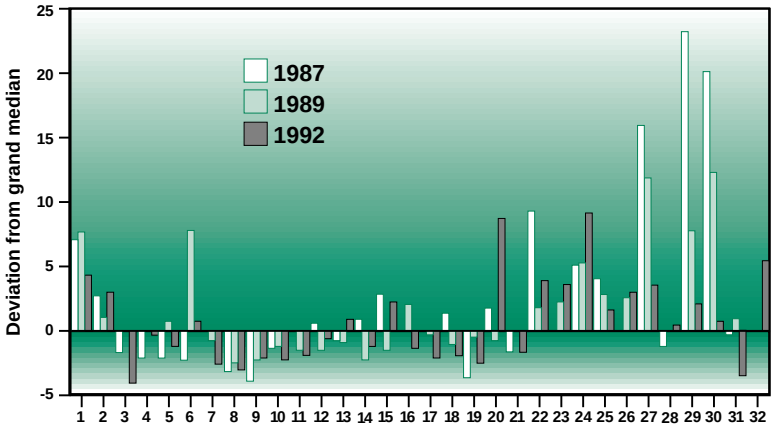
One of the most important parasites of Gulf of Mexico oysters is the protozoan *Perkinsus marinus* which often produces widespread mortality in oyster populations. Analysis of *P. marinus* can help us determine the health of oyster populations. The prevalence of this parasite and the intensity of infections are influenced by environmental factors such as the salinity and temperature of the surrounding waters.

My research, a part of the National Status and Trends Mussel Watch Program, was funded by the National Oceanic and Atmospheric Administration (NOAA). My goals were to examine the spatial and temporal distribution of contaminant concentrations in oysters at selected sites along the Gulf of Mexico coast, characterize the spatial and temporal variation in oyster health and relate this to the presence of contaminants. I also assessed the environmental controls on amounts of contaminants in oysters (body burden) and biological variables, such as their infection intensity and physical characteristics, in terms of both local and large-scale environmental phenomena.

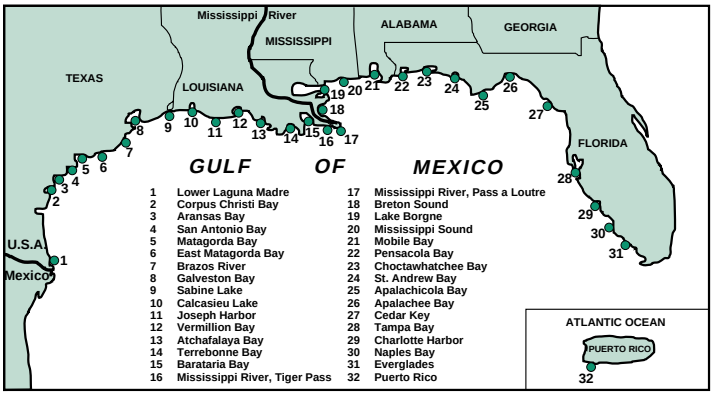
Oysters sampled throughout the Gulf of Mexico coastline each winter for eight years (1986-1993) were tested for body burdens of various contaminants (trace metals, polycyclic aromatic hyrdocarbons, chlorinated pesticides) and analyzed for a series of biological variables. I analyzed the distribution of data to determine if body burdens and biological characteristics of oysters from adjacent bays were more similar than would be expected by chance.

I found that the concentrations of arsenic, cadmium, mercury, nickel and selenium, and the length of oyster specimens were similar among bays up to 400 kilometers apart, forming positive spatial autocorrelation (i.e., patchy distribution). I also observed that bays within 300 to 600 kilometers of one another displayed one of three types of concordant interannual patterns depending on their location in the southern, northwestern, or north-central gulf. I discovered that frequently, the influences of local and climatic forcing varied spatially and temporally. More importantly, however, shifts in large regional weather patterns over the gulf caused by the El Niño/ Southern Oscillation (ENSO) cycle affected salinity and temperature by altering rainfall and river runoff, and subsequently influenced biological characteristics of oysters. Thus strong shifts in climate were necessary to exert climatic control on most of the variables measured in this work.

Body burdens were not simply functions of the introduction of contaminants where oysters live (source loadings). Climatic factors, frequently through intermediary biological factors, substantially influenced contaminant body burden. The results of my study suggest that to interpret spatial status and long-term trends in coastal contamination we will need a better understanding of mechanisms by which climate change affects the source loadings, which in turn control contaminant exposure, as well as the biological factors controlling uptake and elimination or degradation of contaminants.



Levels of arsenic present in each bay compared to the medians for each of three years. See map (right) for bay locations.



Sampling locations for this part of the National Status and Trends Mussel Watch Project in the Gulf of Mexico.

Editor's note: Yungkul Kim graduated with his M.S. in August 1995. He is currently working toward a Ph.D. at the Institute of Marine and Coastal Sciences at Rutgers, the State University of New Jersey. He intends to research the factors controlling larvae recruitment of the coastal invertebrates, and the relationship between their environmental conditions, contaminant body burden, and disease.