

**Welcome and introduction to the
Sea Grant Annual Science Symposium: The Shallow Marine
Ecosystems of Southern Rhode Island
*Part One: Hydrology, Nutrients, and Bacteria Dynamics***

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The world is in the midst of the "greatest human migration of all time."

Millions of people are moving from rural, inland areas to coastal cities.

By 2015, the United Nations estimates there will be 27 mega-cities of 10 million or more people—23 of them in economically developing countries—and most located on the coast.

Coastal margins and oceans are the most heavily used and modified areas of the planet, suffering disproportionate amounts of habitat destruction and pollution.

Humans are now the most important biogeochemical and evolutionary forces on the planet—and—with the momentum of human population growth, together with the imperative for further economic development in most of the world, our dominance will increase.

Let me give a few examples.

- The Army Corps of Engineers is the largest island-maker, not ocean currents.
- Land-based sources of nutrients to the coastal zone from development and agriculture are major sources of nitrogen flow in the global nitrogen cycle.
- Humanity is the major driving force in the Earth's hydrological cycle, using more than half of the available freshwater runoff. Most of the world's rivers are dammed. There are 36,000 dams and counting. Only 2 percent of rivers in the USA run free. The Colorado, Nile and Ganges are so heavily used that little or no water reaches the sea.

- Human activities contribute the major flow of carbon in the biogeochemical carbon cycle. The three major natural flows of carbon are: a net flux from ocean to atmosphere; a net release from terrestrial ecosystems; and a net storage in biomass and organic matter in soil. All of these natural flows are smaller than current flows of carbon dioxide from fossil fuel emissions. Carbon dioxide accumulation in the atmosphere is being blamed for a nearly one degree C rise in the global average temperature since the mid-1800s. That may not sound like much, but in a warmer world where global temperatures were 1-3.5 degrees C higher, hippopotamuses lived in Britain! The huge forest fires in Indonesia that burned for months late in 1997 released as much carbon dioxide into the atmosphere as is released naturally from all of Europe in a full year.
- And, we are the major evolutionary force on the planet. Rates of extinctions are 100 to 1000X greater than natural rates of extinctions. Extinction rates are even higher on remote islands, such as Hawaii.

Peter Vitousek and his colleagues in a classic 1997 paper in *Science* stated that "Our activities are causing rapid, novel, and substantial changes to Earth's ecosystems. They state that "There is no clearer illustration of the extent of human dominance of Earth than the fact that maintaining the diversity of "wild" species and the functioning of "wild" ecosystems will require increasing human involvement".

Massive coastal population growth has changed forever the environmental management agenda. Twenty years ago we could solve America's coastal crisis by pointing fingers at—and dealing with—industrial, point sources of pollution. Today, most of our coastal problems result from our collective, *individual* behaviors: failing septic tanks, fertilizers from suburban lawns and pet wastes are now major sources of aquatic pollution and diseases. Our marine ecosystems and coastal communities are suffering a terrible “death of a million cuts.”

We are changing the Earth faster than we are able to understand it. And, by implication, any scientific study of the Earth's ecosystems must include human influences, or it will be incomplete, and less than relevant.

These massive forces of change at work on both the global and individual levels are the primary drivers for organizing and operating a Rhode Island

Sea Grant Program at the University of Rhode Island. America needs its environmental agencies—ones that haven't worked well together in the past—to work more closely than ever before. Constructive change will not come about by pointing fingers. We're *all* responsible for the world's coastal environmental crisis. Sea Grant is conducting management critical, place-based research important to coastal stakeholders. The Network is trying to construct an applied research agenda that emphasizes holistic, ecosystem-based approaches.

Rhode Island Sea Grant believes that the grand environmental challenges of the 21st century require us to look for champions, and join with traditional and non-traditional partners who can help us respond collectively to these complex problems in a manner beneficial to America's economy, its environment, and quality of life in new, visionary ways.