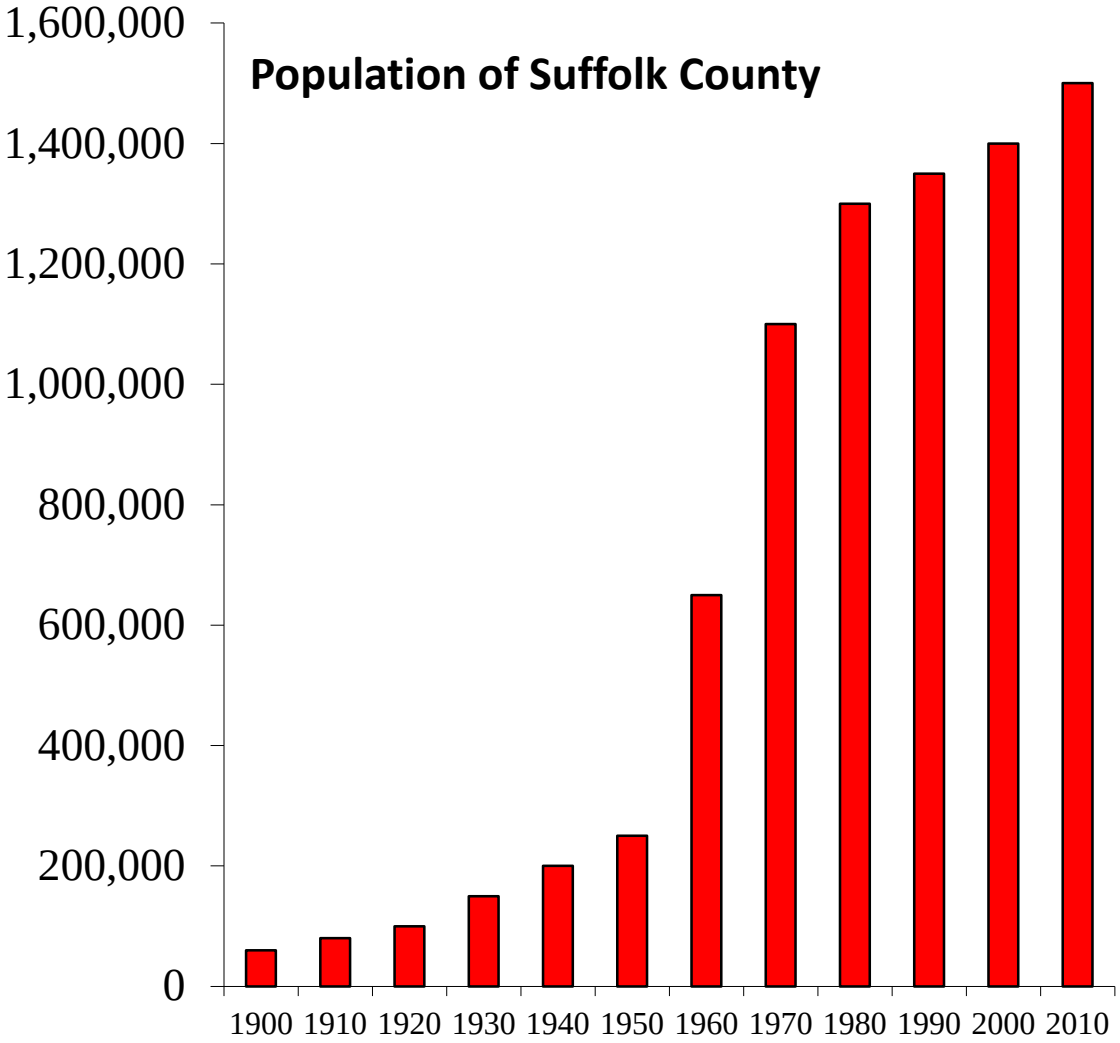
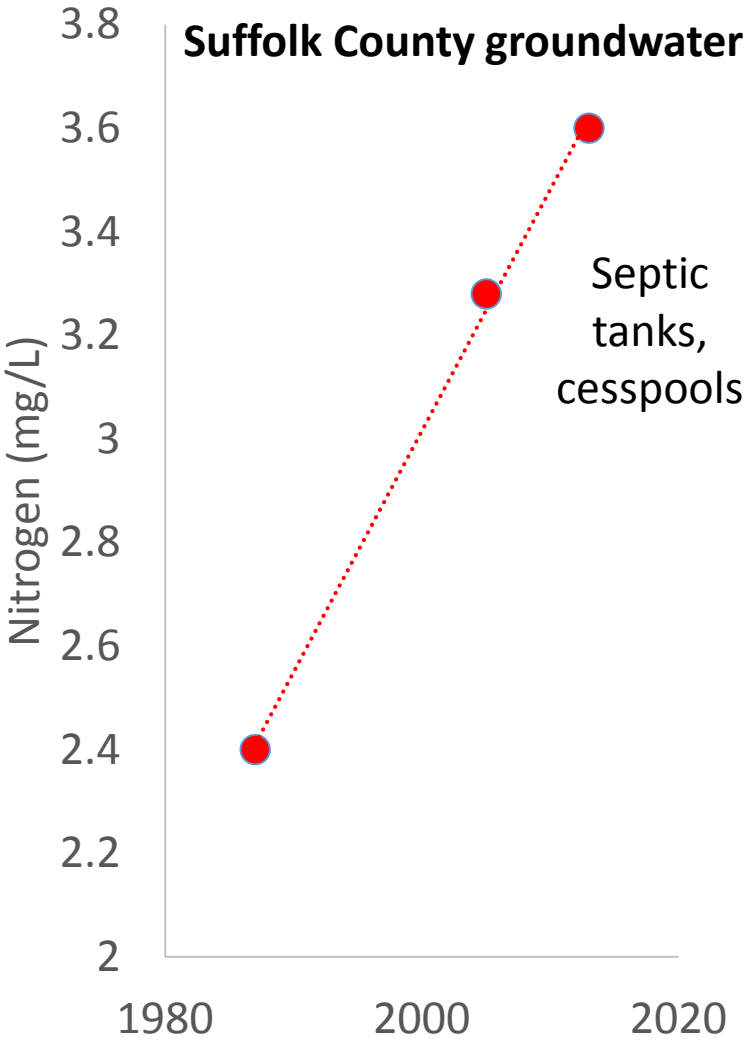
Nitrogen pollution in Long Island's coastal waters – impacts and solutions

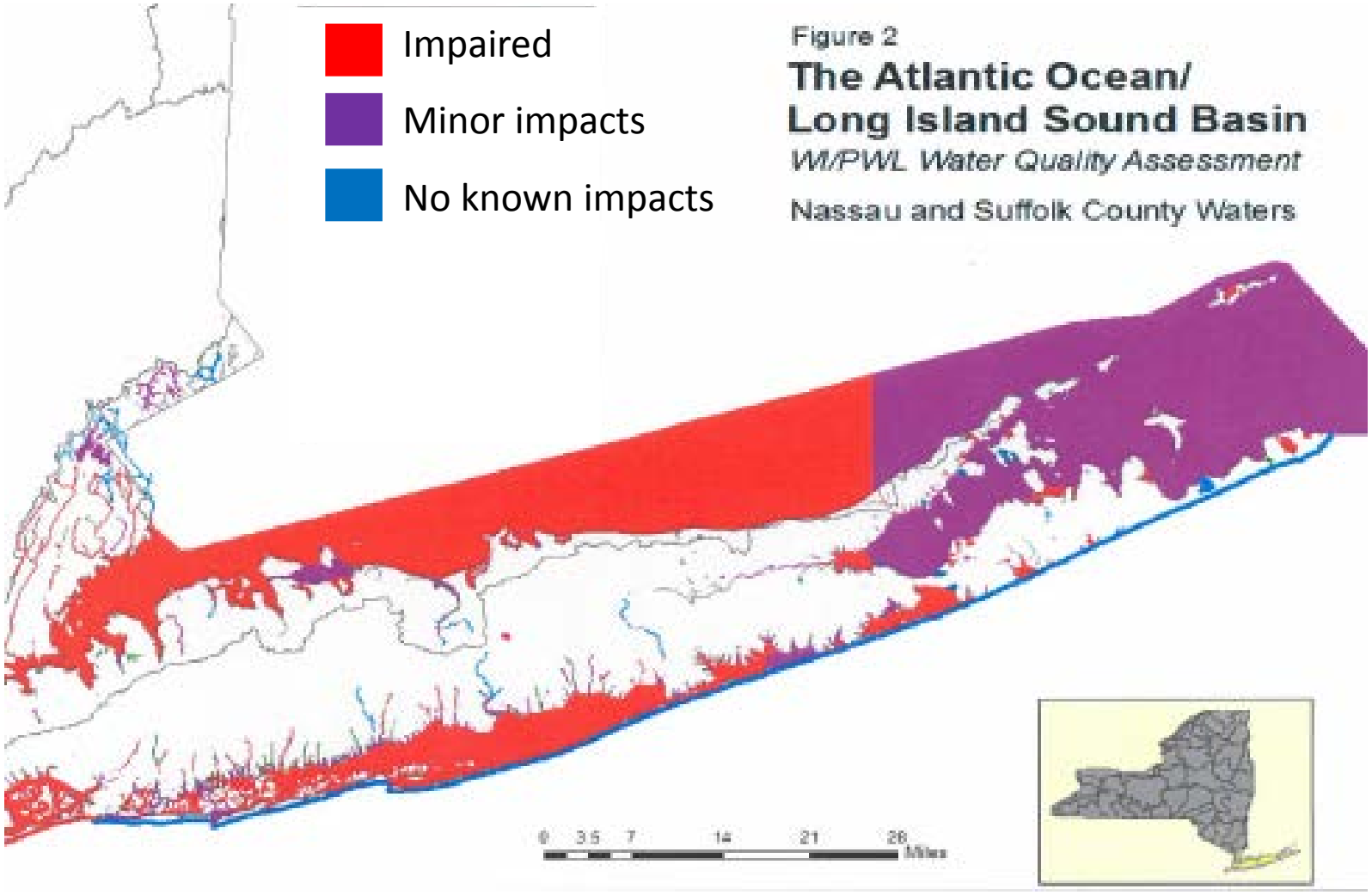
Stony Brook University

Expanding population, nitrogen levels



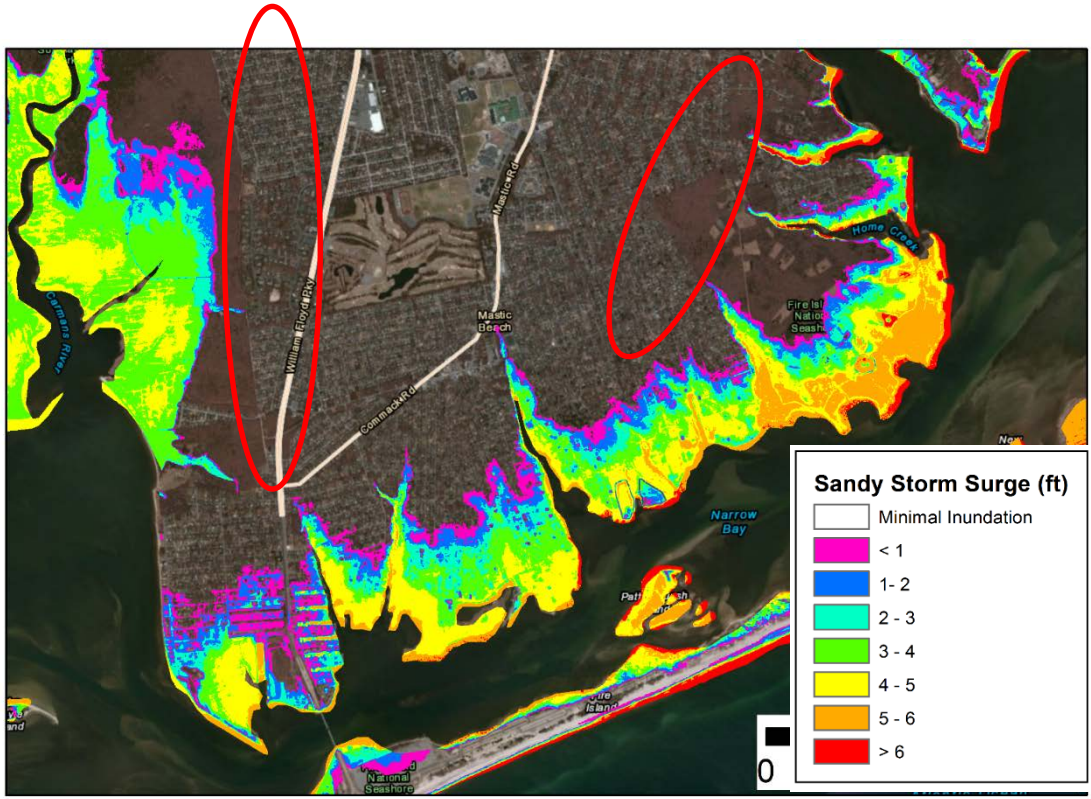


Many impairments associated with nitrogen overload

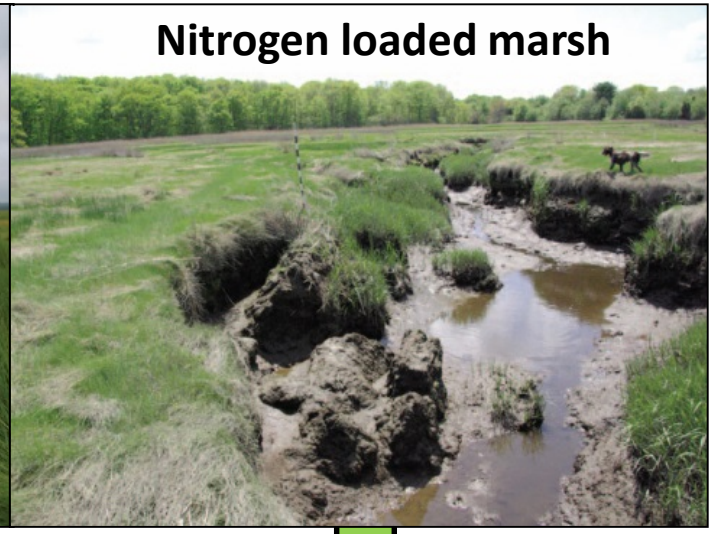


Salt marsh ecosystems

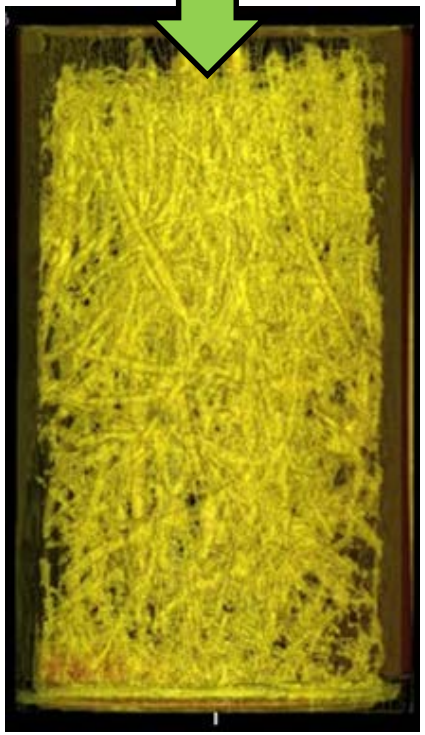
Salt marshes protect coastlines



“Coastal eutrophication as a driver of salt marsh loss”, Deegan et al 2012, Nature

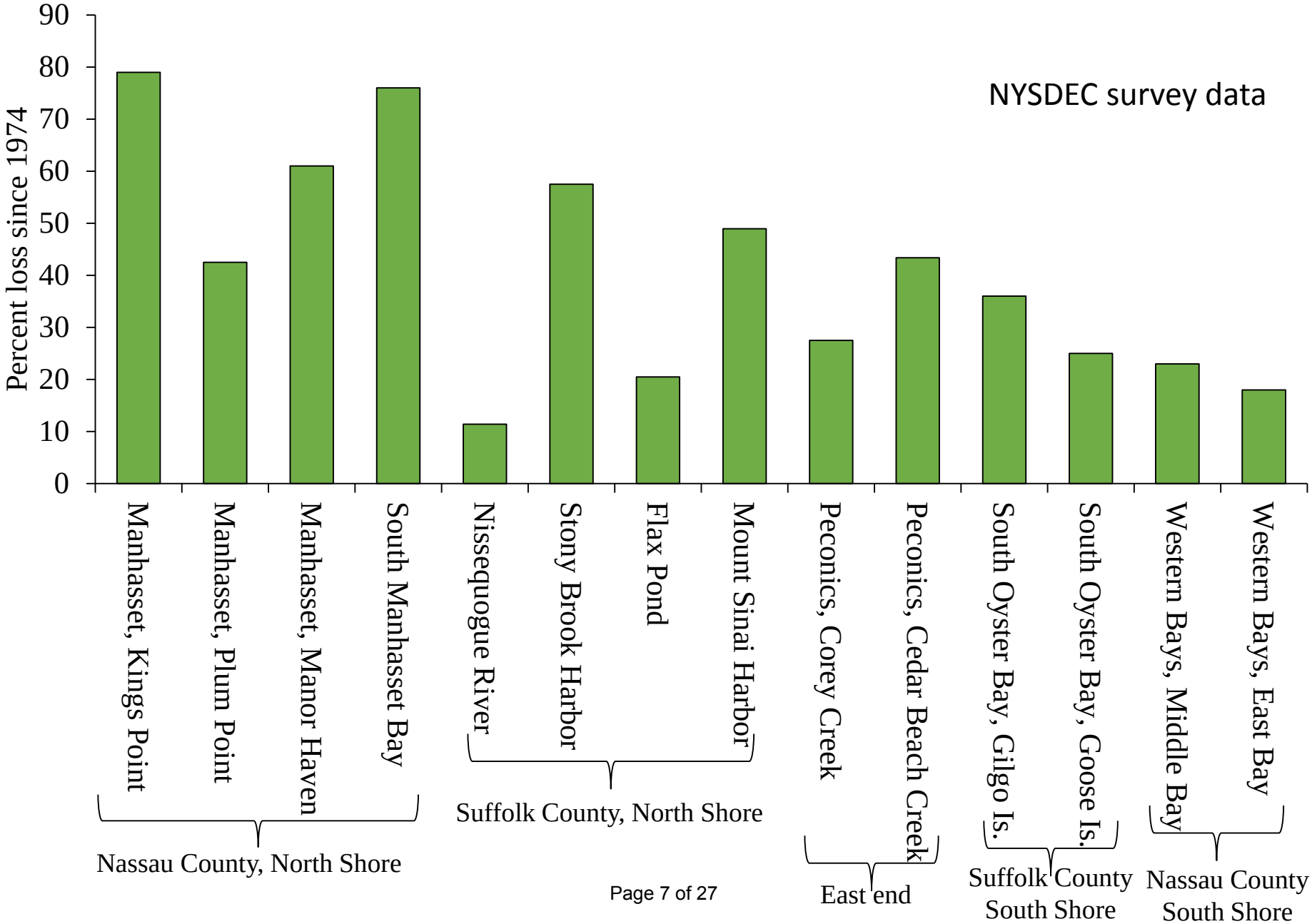


Dense, strong roots



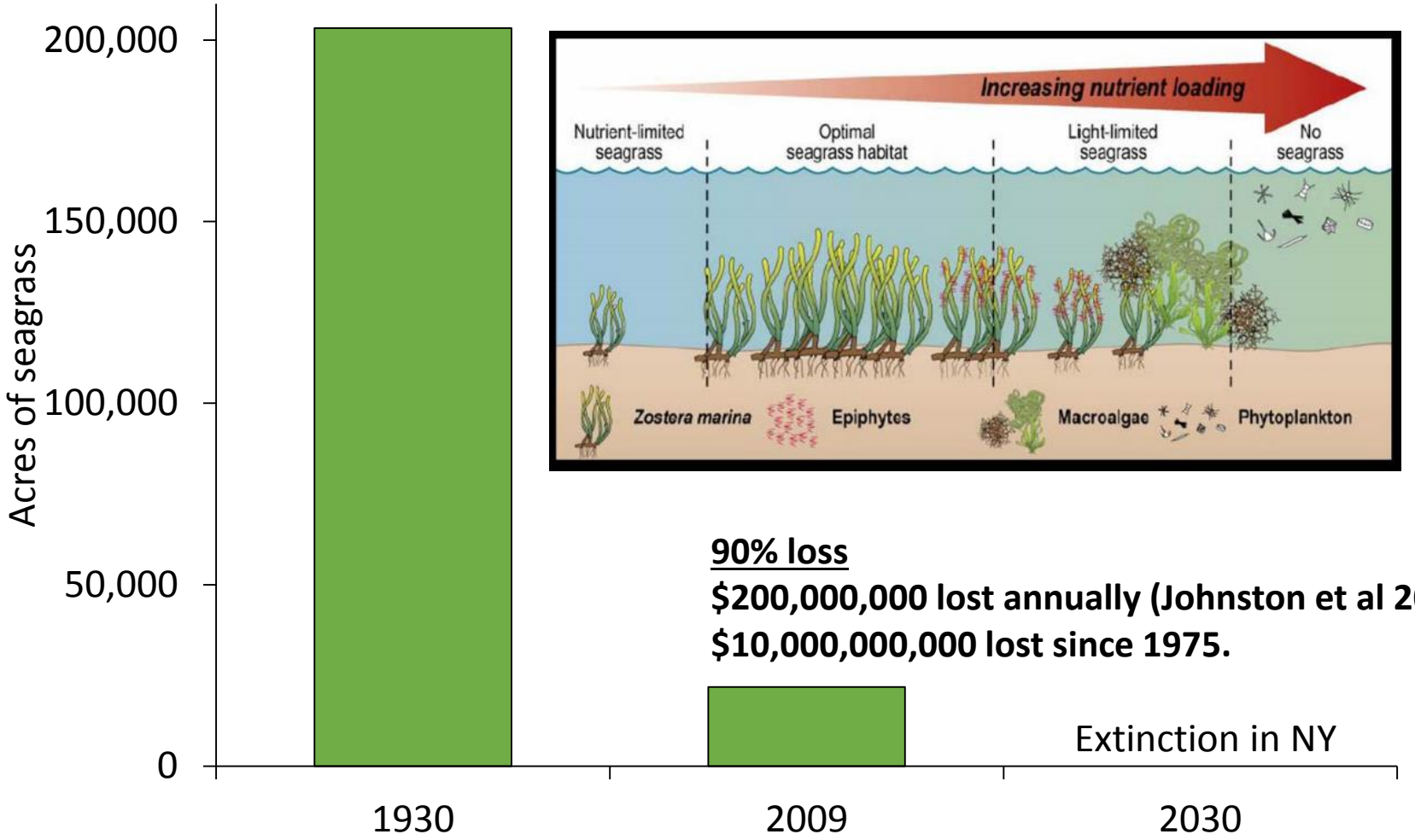
Nutrient weakened, roots

Loss of wetlands on Long Island, since 1974

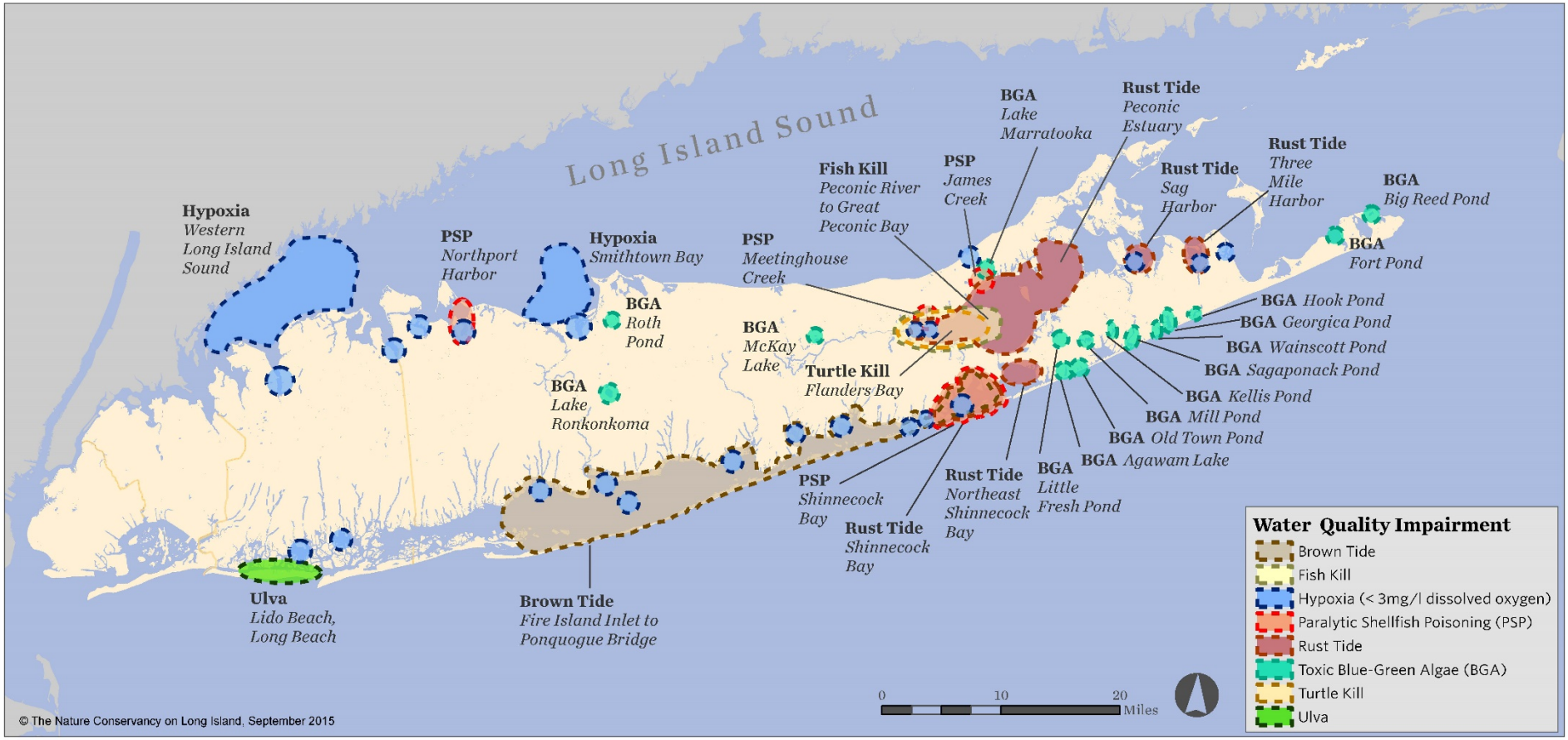


Seagrass: Critical habitat for fish and shellfish

NYS seagrass, 1930 - 2030



NYSDEC Seagrass Taskforce Final Report, 2010; Suffolk County assessment, 2014



Nitrogen promotes in the water impairments: algal blooms, low oxygen

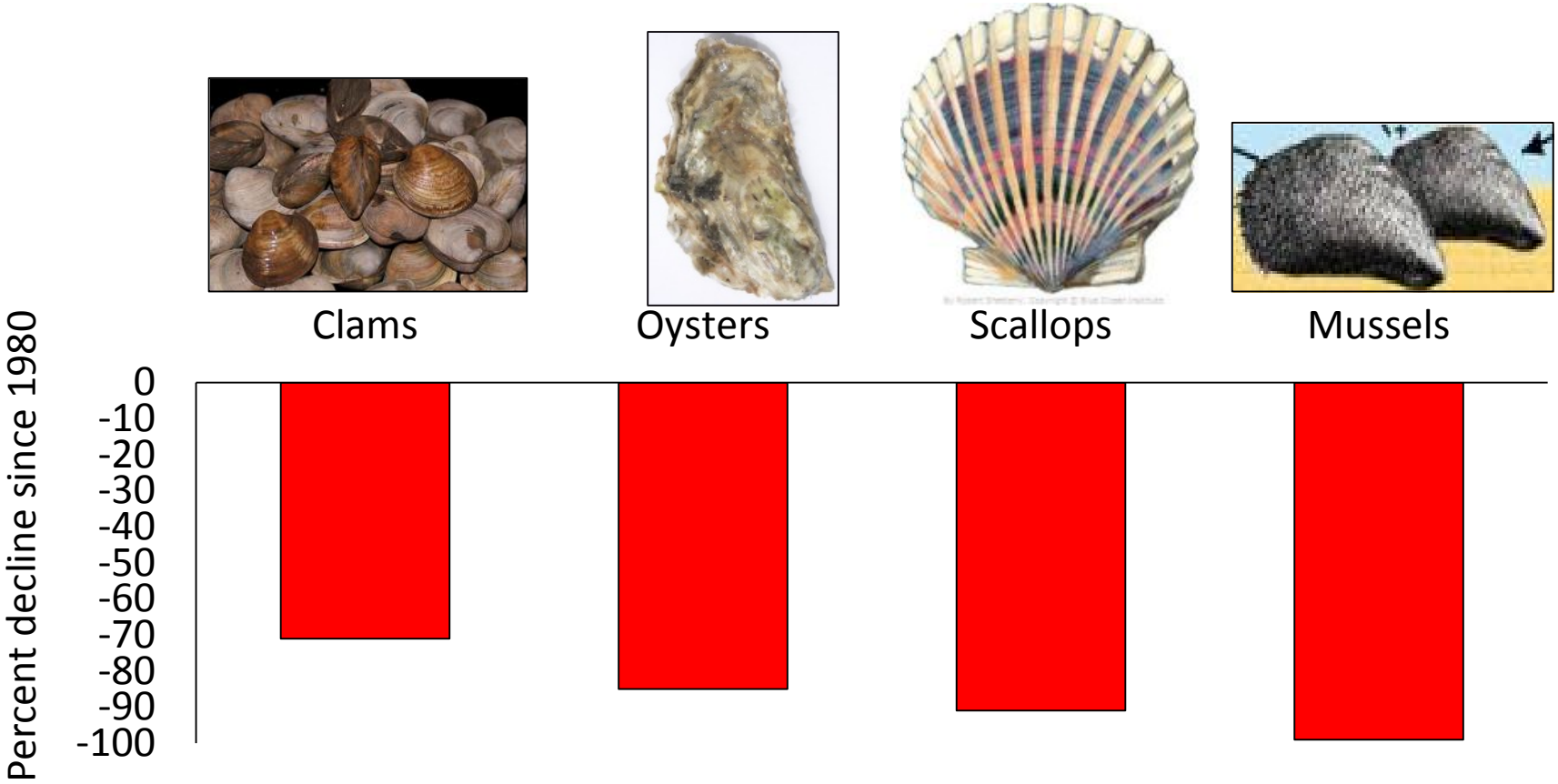
Riverhead turtle die-off, May 2015, linked to red tide, saxitoxin

Riverhead fish kill, June 2015, linked to nitrogen loading, algal blooms, low oxygen

Brown tide, south shore, July 2015, linked to shellfish mortality

Great Peconic Bay, rust tide, September 2015, linked to fish mortality

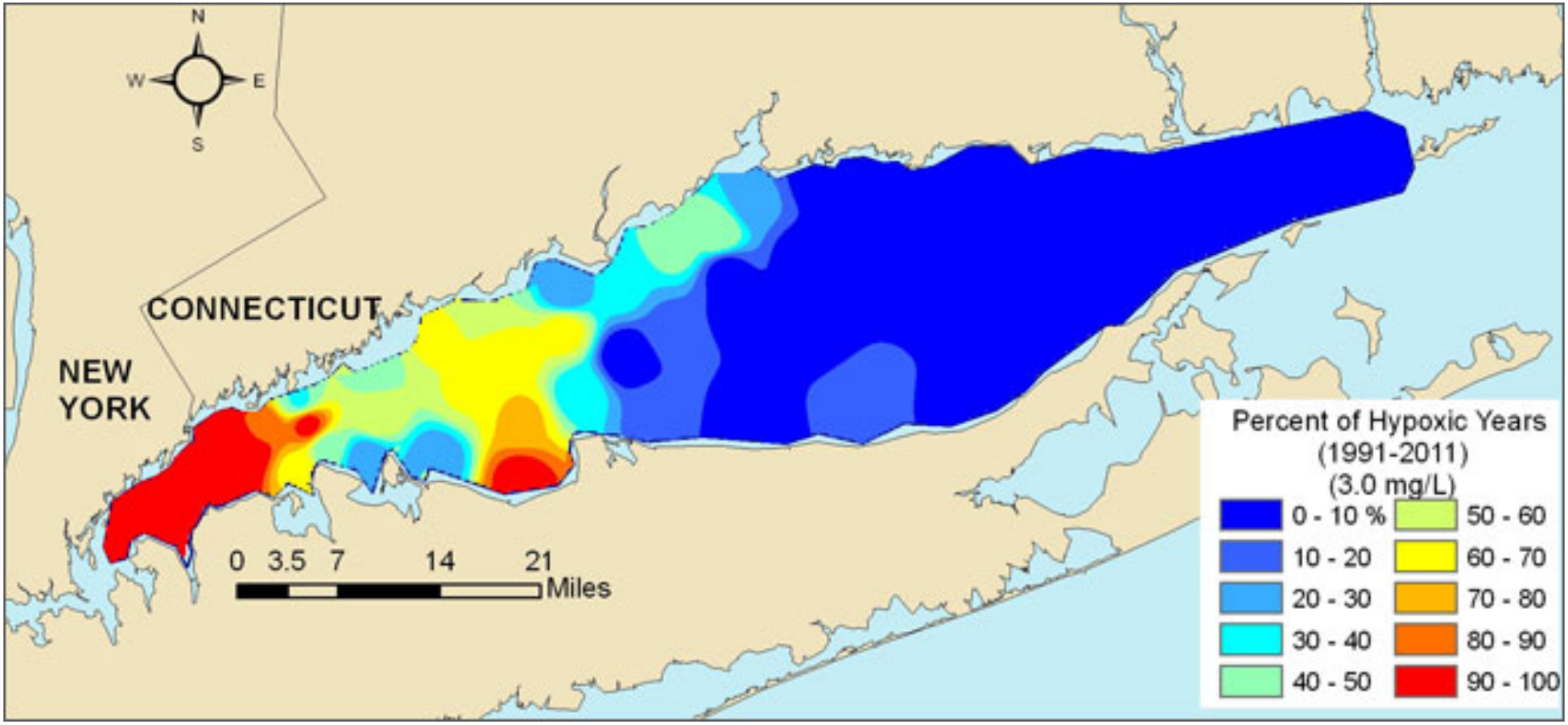
NYS landings of shellfish, 1980 – 2010



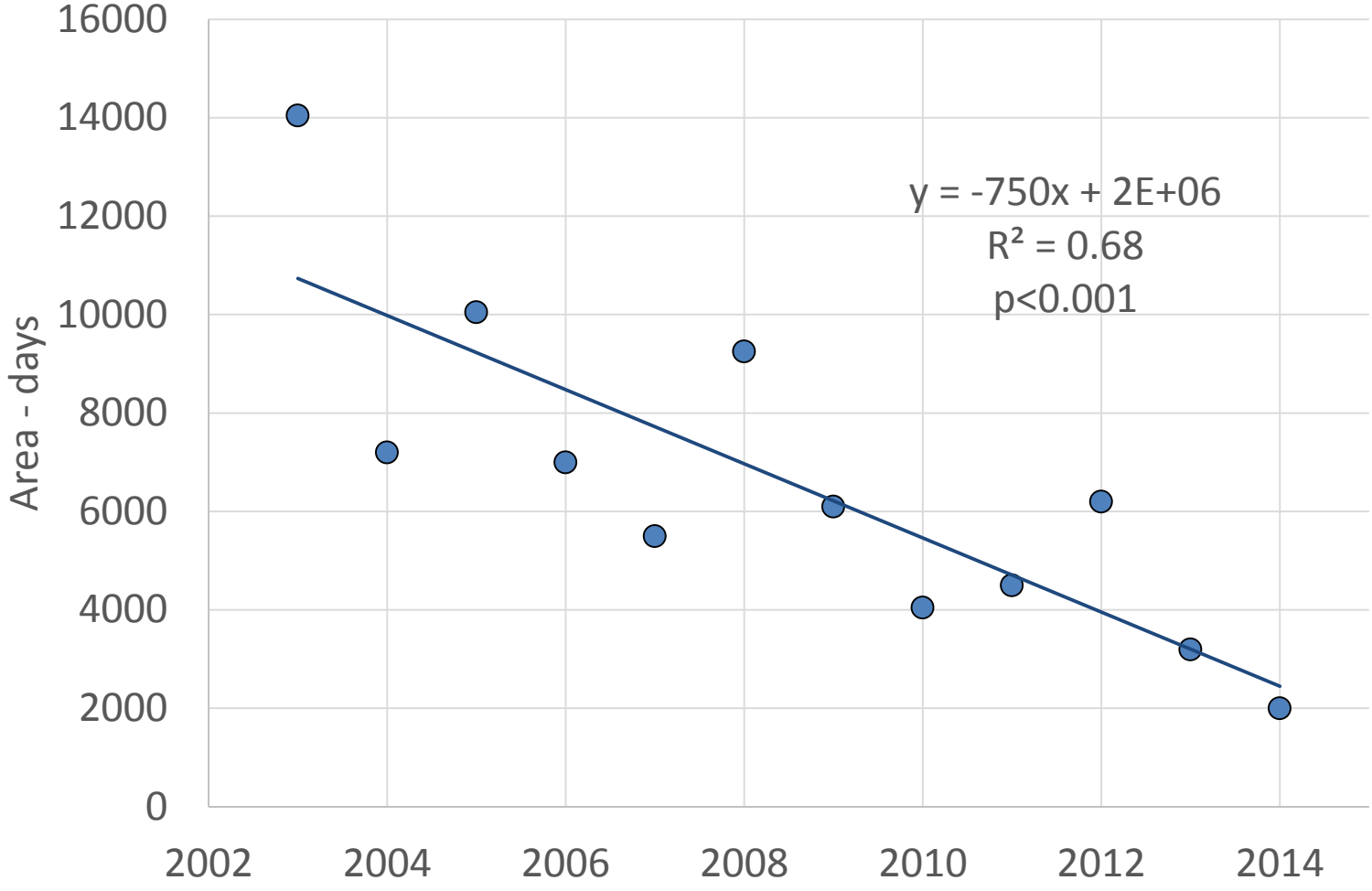
Losses due to **nitrogen driven** harmful algal blooms, seagrass loss, and water quality degradation.

Has nitrogen mitigation helped hypoxia in Long Island Sound?

- Goal in 1994 to reduce N loads by 58.5%
- In 2014, close to reaching this goal.
- Ecosystem response?



Long Island Sound, 12-year trend in hypoxia area - days



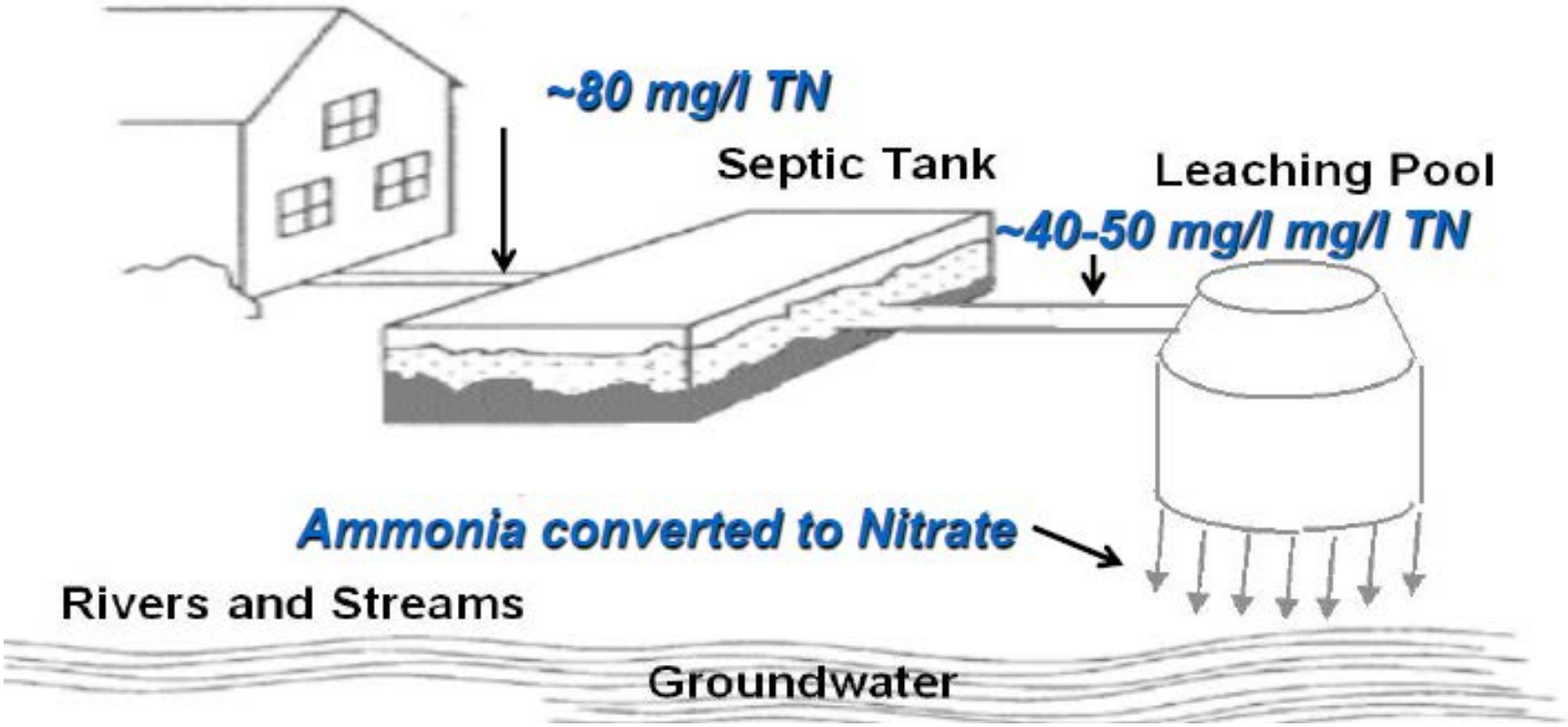
Center for Clean Water Technology

Stony Brook University

On-site wastewater disposal

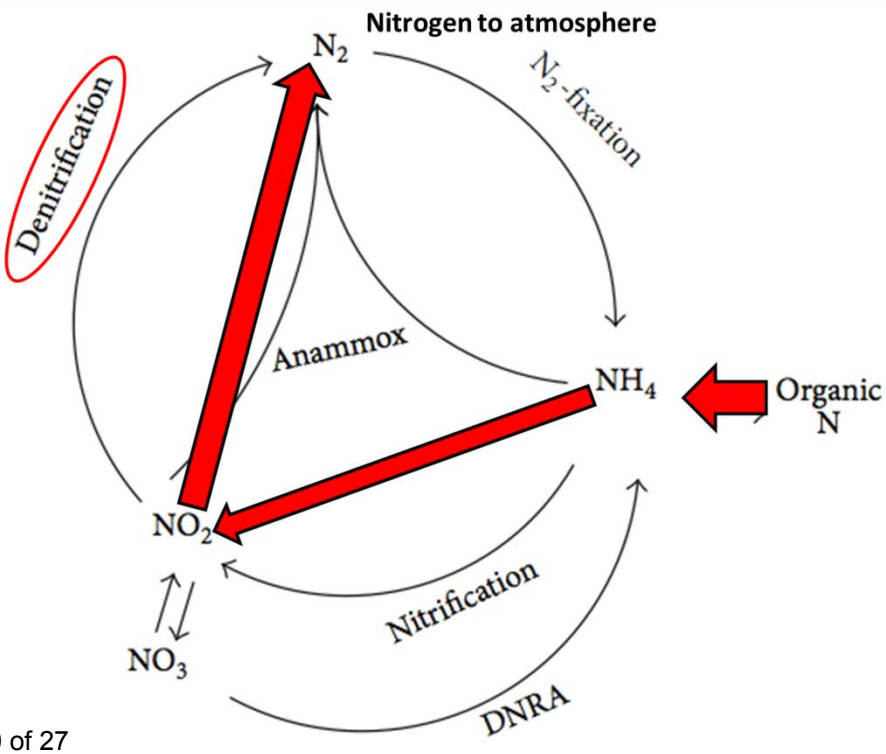
…*Engineering a solution…*

Coupled septic tanks and leaching pit



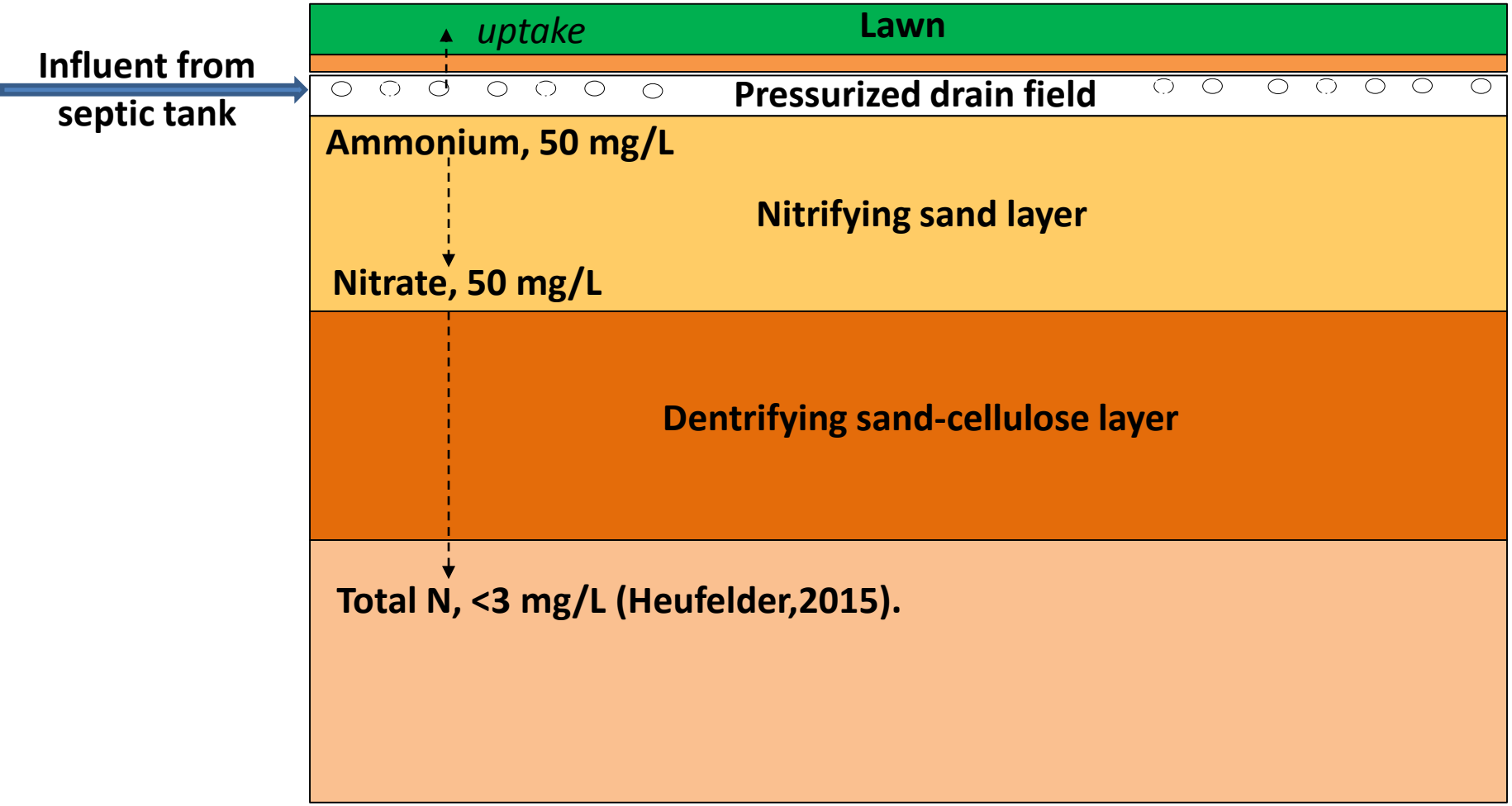
CCWT Mission

- Develop and commercialize the next generation of nitrogen removal technology for septic systems
  - Improve efficiency of nitrogen removal
  - Reduce system costs
  - Minimize maintenance
  - Shrink the infrastructure



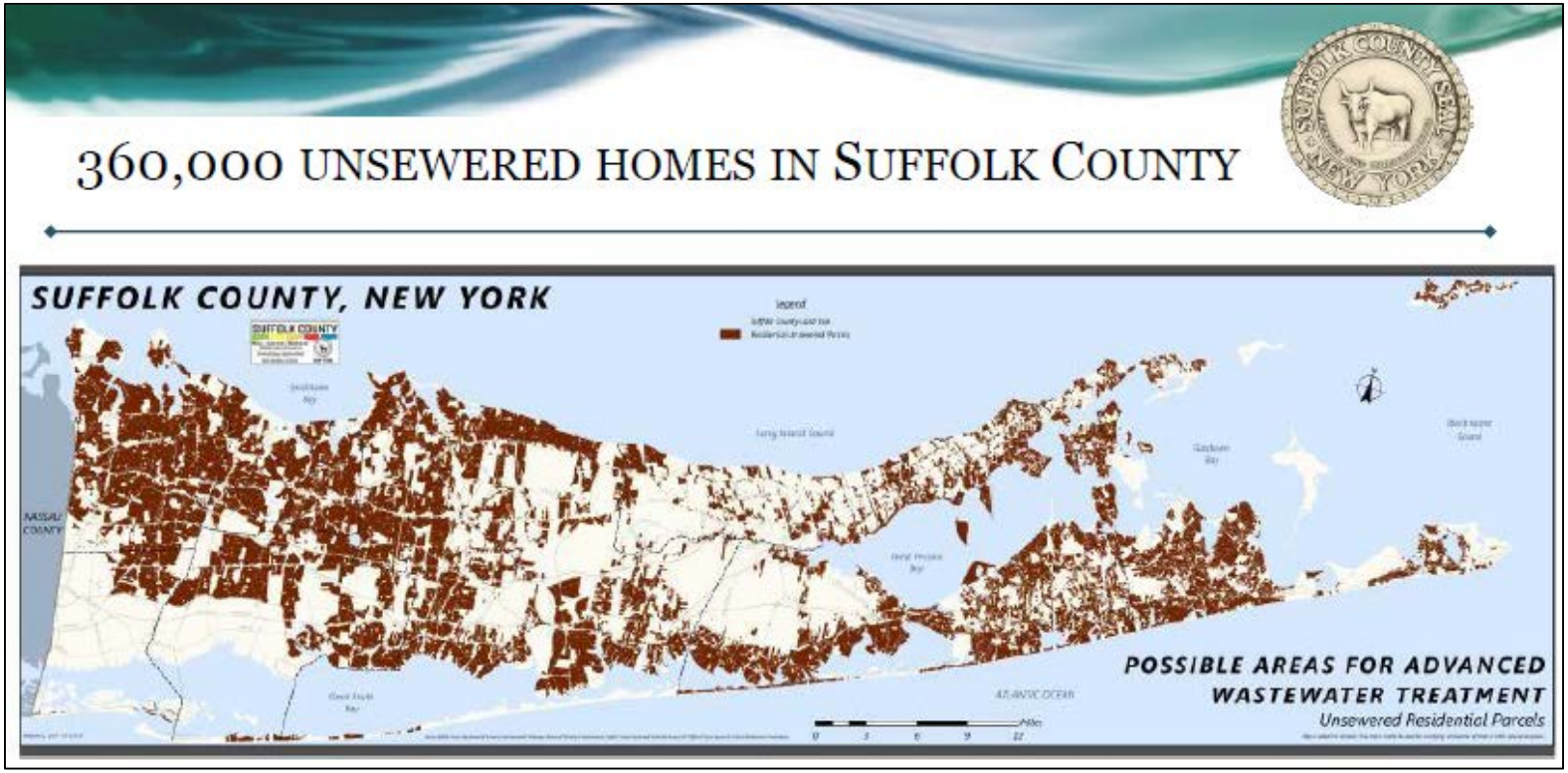
Alternative septic systems

Non-proprietary systems: Pressurized, denitrifying drainfields

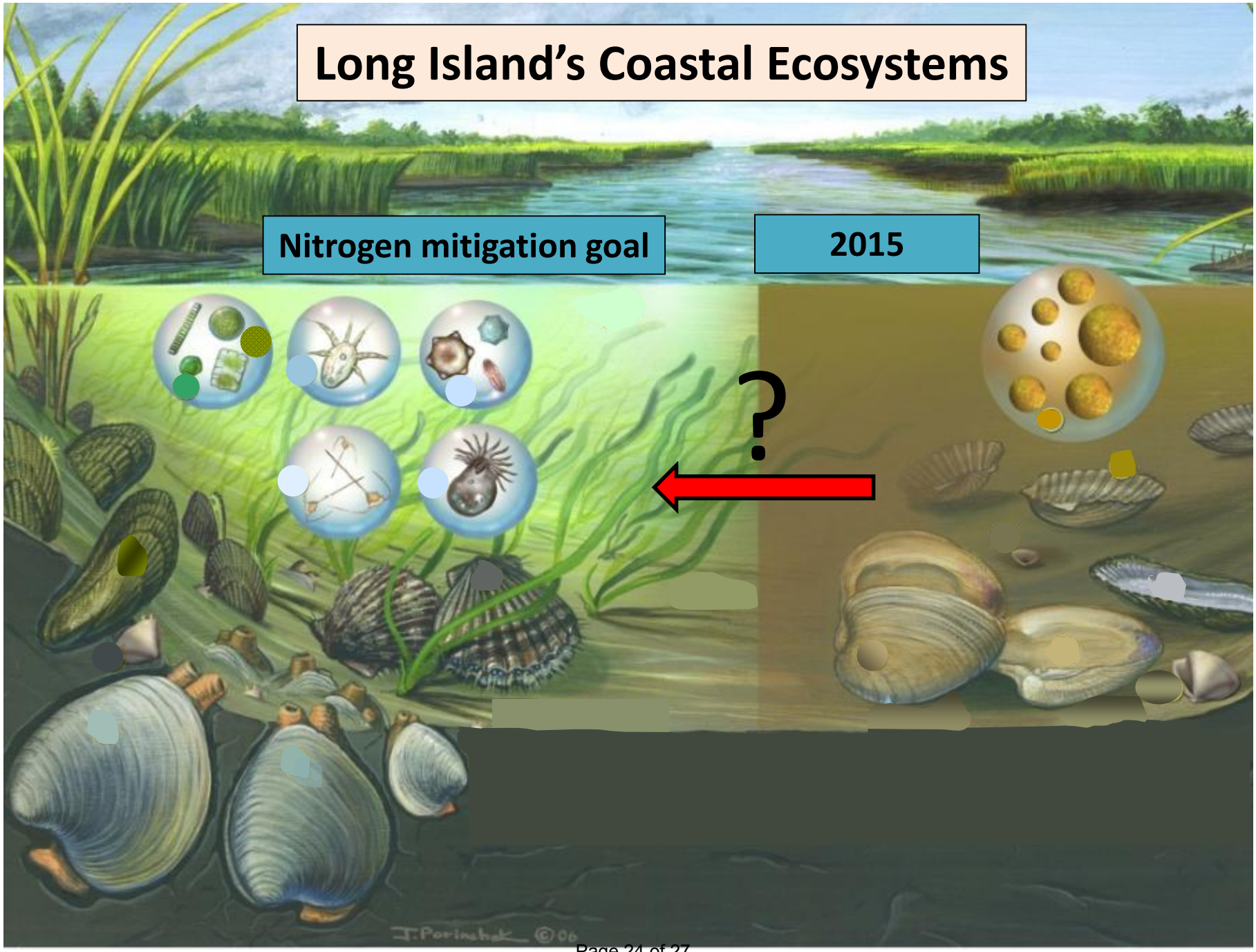


360,000 septic tank question(s):

- **Long Island nitrogen management and mitigation plan**
- **<u>Where</u>** should nitrogen removal begin?
- **<u>How much</u>** do levels need to be reduced to improve environmental conditions?



Long Island's Coastal Ecosystems



Nitrogen management is needed on a <u>watershed-by-watershed</u> basis.

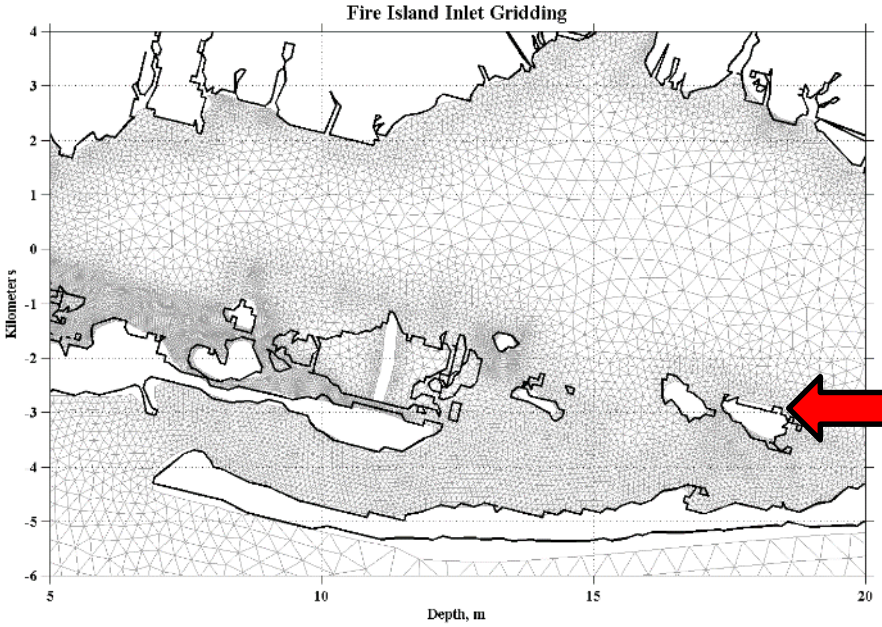
Long Island watersheds and receiving water bodies differ regarding:

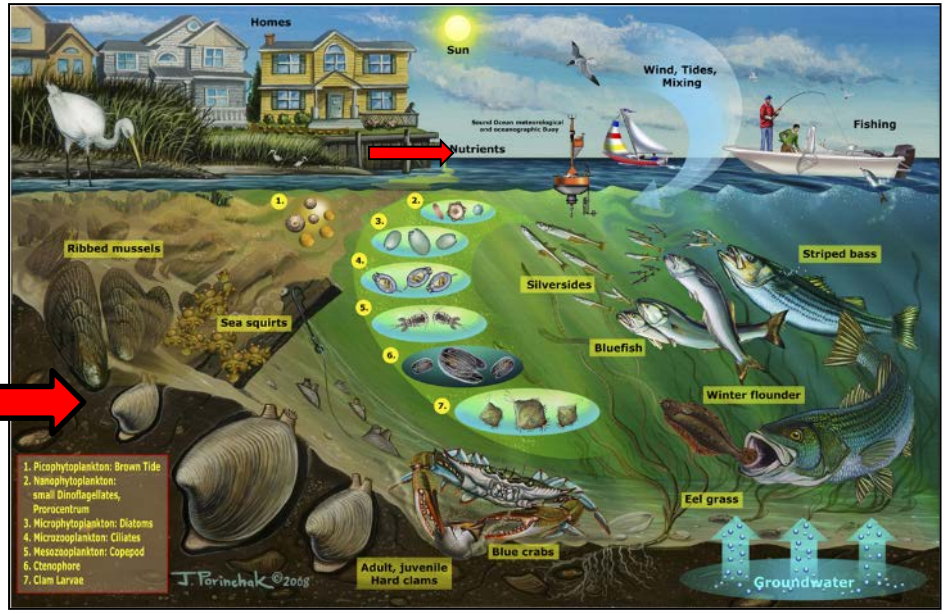
- **Nitrogen load**
- **Residence time**
- **Volume of water from land and in sea**
- **Impairment**

How much nitrogen is too much?

- Models must be developed that combine **watershed nitrogen loading, surface water hydrodynamics, plankton dynamics, and ecosystem responses (eelgrass, bivalves)**.

- Targeted studies may be needed to refine our understanding of the relationship between nitrogen loading and ecosystem response.





Conclusions

- Excessive nitrogen loading is causing ecosystem and economic harm.
- The Clean Water Technology Center has begun to determine the most effective ways to reduce nitrogen.
- Studies are now needed to determine how much nitrogen loading must be reduced within every watershed across Long Island.