**Research Review 9: Hypoxia**

**Summary:**

This research looked at the issues associated with coastal hypoxia and oxygen minimum zones over the last 115 years. Hypoxia has a direct impact on biodiversity, food webs and ecosystem function and is a serious issue that appears to be affecting larger pelagic ecosystems. The study conducted here was done to look at hypoxia occurring in the Baltic Sea. It utilized water column oxygen and salinity profiles to create patterns of past stratification and oxygen conditions going back over one hundred years. It compared anthropogenic and climate forcing and its effects on hypoxia. The expansion of these hypoxic zones has been attributed to global warming and more nutrient flow from both the atmosphere and the land.

The study covered a temporal scale of over 100 years so how they got their data was important to the validity of the outcomes. The study utilized both discrete and continuous profiles of oxygen, salinity and temperature that had been gathered from past cruises and monitoring programs. The data came from 21,712 sampling locations. The data from before 1960 was noted as being lower than the data collected after this point in time and was mostly taken from research cruise vessels. There were a total of 36,379 salinity profiles and 16,690 oxygen profiles taken from areas of deeper depth. Due to the low number of profiles the researchers used spatial and seasonal structure to look at oxygen conditions and halocine properties between 1898 to 2012.

The study found an increase in hypoxia of ten times previous levels mostly due to the increase of nutrients from land sources. They also found higher levels of respiration from a rise in temperature and noted this as an important issue.

**Discussion:**

This study was well done especially its use of past data as a way to understand how nutrient input and climate change have played a role in the current state of hypoxia in the Baltic Sea. Their findings were important as this is a very serious issue that researchers could build upon in a number of ways. The first way would be to develop future research utilizing more computational modeling about how oxygen minimum zones could spread and the effects this could have on both pelagic and terrestrial environments. Second, future research could expand both the temporal and spatial scales of this research and link it to other changes that are occurring. The third area of future research could be working to develop solutions to these problems. I feel this would be a more interdisciplinary area of research that could combine scientists from disciplines like Biological Oceanography, Statistics, Computer Science, Engineering and Public Policy.

I don’t think I would change much in how this research was conducted given the availability of past data they utilized. It was well put together and it seemed every sentence had important, concise and well researched information. In spite of all the complex information it was presented in a fairly readable format.

**Citations:**A. Toseland, S. J. Daines, J. R. Clark, A. Kirkham, J. Strauss, C. Uhlig, T. M. Lenton, K.

Valentin, G. A. Pearson, V. Moulton, and T. Mock. "The Impact of Temperature on Marine Phytoplankton Resource Allocation and Metabolism." Nature Climate Change 3.11 (2013): 979-984.

Carstensen, Jacob, Andersen, Jesper H., Gustafsson, Bo. G., and Conley, Daniel J.

"Deoxygenation of the Baltic Sea during the Last Century.(ECOLOGY)(Author Abstract)." Proceedings of the National Academy of Sciences of the United States 111.15 (2014): 5628-5633.

**Important Terms:**

Eutrophication- Excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen

Halocline- A cline based on difference in water salinity

Thermocline– A cline based on difference in water temperature

Chemocline- A cline based on difference in water chemistry

Pycnocline– A cline based on difference in water density