

THE NEW RIVER LAGOON: MONITORING AND ASSESSMENT

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In 2004 a group of Defiance College science faculty and students initiated what became known as the Watershed Analysis: Targeting Engagement through Research Project or WATER Project (Mavroidis, 2006). This project was the seed that established a connection between Defiance College and Belize. Although the acronym is catchy and nicely describes the general goals of the project, it was no coincidence. Water is a unifying substance at many biological levels. At its most basic level, all life requires water and water influences all life.

Any population (either plant or animal) that grows unchecked will ultimately have a negative impact on its environment. Humans are no exception. How do humans impact water quality? Many human activities can have negative impact on water quality. Some of the obvious are industrial and agricultural practices. But it's not a one-way interaction. Although there is an inverse relationship between population growth and water quality, there is a direct relationship between water quality and human quality of living. For example, drinking water contaminated with various chemicals or other pollutants increases spread of various diseases and parasites. And often, as a population increases, water and sanitation services lag behind, especially in less developed regions of the world.

The Belizean economy is driven by four major forces: industry (clothing and citrus fruit processing), tourism, agriculture (sugar cane, citrus, and banana), and fishing (shrimp and lobster). The largest of the four is tourism, which has increased to nearly 250,000 visitors annually according to the Belize Tourism Board. Although tourism, and specifically ecotourism, is a much needed industry and is shaping the Belizean economic landscape, it may have a negative impact on the environment both physically and culturally. Such influences may originate from the "tourists themselves, as well as from infrastructure and accommodation facilities" (Balngy & Mehta, 2006).

The New River Lagoon is the largest fresh body of water (176,400 acres) in Belize and drains into the second largest barrier reef system in the world. Human influences include two villages (Indian Church and San Carlos) on the northwestern shore of the lagoon. The main tributaries that feed the lagoon drain broadleaf and pines savannah forests and extensive wetlands (Meerman, 2006). This study contributed to the water quality assessment of the New River Lagoon.

There are two main instruments for assessing the health of a body of water: biological indicators (e.g., microbiological, aquatic invertebrates, animals, and plants) and physical and chemical properties (e.g., dissolved oxygen, pH, and nitrates/nitrites). A portion of the New River Lagoon is under the protection of Programme for Belize (PFB). Under the guidance and funding of the Nature Conservancy, PFB initiated a five-year program to gather water quality baseline data as one assessment method. My study contributed to this database which will provide historical data for future comparisons in determining changes and trends.

My specific objectives were to make various water quality measurements, such as dissolved oxygen, pH, phosphates, nitrates/nitrites, and laboratory measurements of heavy metals. Water samples were collected from nine locations from various tributaries that empty into the New River Lagoon.



Overall, the values for the various parameters for which I measured fell within the “normal” range indicating a healthy system. One site, however, was found to have elevated phosphate levels and was re-sampled to verify the validity of the initial measurements. The second samples, although lower than the first, also had elevated phosphate levels. Elevated levels of this nutrient may result in increased algal growth in water, which can have a negative impact on overall water quality. The source of the high phosphate levels cannot be easily ascertained because this particular tributary drains the pine savannah forest, which does not have obvious

human influences. Further investigation was suggested to PFB to determine the frequency of these phosphate spikes and to determine the impact on the immediate aquatic ecosystem. Water analysis for lead and copper found negligible amounts.

Other studies conducted in northern Belize and the New River Lagoon, specifically, have examined for contaminations of organochlorine pesticides (e.g., DDT and DDE) and heavy metals (e.g., mercury) in Morelet's crocodiles (*Crocodylus moreletii*) (Rainwater et al., 2007; Wu et al., 2006; Pepper et al., 2004). These crocodiles are found mainly in northern Belize, with a large population in the New River Lagoon, a body of water that "is of critical importance for the survival of this species in Belize" (Meerman, 2006). All animal samples tested positive, suggesting some level of contamination in this ecosystem.

OVERALL ASSESSMENT OF THE NEW RIVER LAGOON

The monitoring efforts conducted by PFB and various external researchers, such as Defiance College, have resulted in the first significant step toward assessing and continued monitoring of Belize's largest fresh water ecosystem. Review of this data and most of the literature indicates that the New River Lagoon ecosystem appears to be healthy. The low levels of mercury and pesticide contamination present in the lagoon should result in continued monitoring to determine potential sources, especially since other key species of interest (e.g., Caribbean Manatee, neotropical river otter, and the jabiru) occupy this body of water (Meerman, 2006). Influx of nutrients and fertilizers from surrounding agricultural fields appears to be minimal. Nonetheless, future monitoring should be conducted, especially following any significant changes in human population or agricultural practices on the periphery of the lagoon.



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