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Limited Warm Water Access Leads to Major Manatee Die Offs

Studying Lipids and Metabolites can to Lead to Better Understanding of and Reduce the Occurrence of Cold Stress Syndrome in Manatees

In 2017 alone, 538 Florida manatee mortalities occurred and only 88 of those were due to natural causes. One of the major problems that faces these manatees is cold stress syndrome, or CSS. Every year, Florida manatees migrate to warmer waters during the winter months. In the past, they have used locations such as springs, layers of coastal warm water created by salinity anomalies, and even the effluents from coastal power plants to stay warm. Unfortunately, new developments and recreational activities are taking over the natural warm water sources and most of the power plants are shutting down, so manatees have no haven for warm water.

When water temperatures fall below 68 °F, Florida manatees become susceptible to CSS, which is a breakdown of normal biological and immunological processes that often leads to death. CSS encompasses a wide variety of symptoms including skin lesions, decreased blubber, slowed metabolism, and limited immune function

CSS plays a major role in manatee die off events and the number of cases is projected to increase as manatees lose more and more warm water refuges to development and recreation. Past research has shown that exposure to cold decreases lymphocyte, or white blood cell, proliferation, but details about the pathogenesis, or how CSS progresses, is unknown making early detection and treatment very difficult.

Kaylie Costa, an undergraduate student at the University of Miami is participating in the NSF Research Experience for Undergraduates (REU) program at the College of Charleston, Hollings Marine Laboratory. Costa is working with chemists, Dr. John A. Bowden and Dr. Michael P. Napolitano, to expand the current scientific knowledge of CSS. By analyzing the lipids and metabolites in the plasma samples of healthy manatees versus those with CSS, they hope to learn more about metabolism changes caused by this condition, to create therapeutic solutions to help Florida manatees.

Lipids and metabolites include a vast array of compounds that serve as indicators for cellular processes and function of the biological system. Detecting and measuring those compounds may allow for the discovery of stress-induced biomarkers that code for a particular disease or

accumulation of toxins in an organism. These biomarkers may then be used for monitoring manatee health and for further studies on environmental health causes and impacts.

Costa is using liquid chromatography and mass spectrometry to find changes among the hundreds of lipids and metabolites in response to CSS. This data will lead to a better understanding of how CSS progresses in manatees and help scientists work toward better treatment options. Discovery of major differences in specific lipids and metabolites in plasma between healthy manatees and those with CSS could indicate a biomarker, which may provide a minimally-invasive way to diagnose CSS and could play a crucial role in protecting Florida manatees.

According to Napolitano, "The method developed at the Hollings Marine Laboratory using mass spectrometry has allowed for the measurement of thousands of biological molecules independent of sample or source. I'm grateful that we were able to apply this method toward the diagnosis of an unfortunate syndrome in such a unique and interesting species."

Protecting Florida manatees is important for many reasons. Firstly, the US Endangered Species Act listed the Florida manatee as endangered in 2001, but recently reduced their status to only threatened in 2017. Without intervention, this species could easily return to its endangered status. Secondly, marine mammals are great sentinels to model how environmental changes will impact human health due to their physiological similarities, long life spans, and thick blubber's ability to store large amounts of contaminants. Thirdly, manatees play a crucial role in food webs serving as a control on the primary producer population, which allows the ecosystems around them to thrive. Lastly, manatees support economies through ecotourism. This research is necessary to protect Florida manatees from this understudied condition.

For more information on this project and the NSF Fort Johnson REU program see http://reu.cofc.edu/ and their summer research blog website at https://blogreu.wordpress.com/.

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Caption 1: Manatee rescued with cold stress syndrome from a lake in Leesburg, Fl (Photo credit: https://www.savethemanatee.org/wp-content/uploads/2016/09/cb_Leesburg_rescue_2-14-16_2.jpg)