

**STATEMENT OF INTEREST  
SOUTH FLORIDA-CARIBBEAN CESU  
W912HZ-19-SOI-0022  
PROJECT TO BE INITIATED IN FY2019**

**Project Title: Understanding Harmful Algal Bloom Dynamics in Lake Okeechobee**

Responses to this Request for Statements of Interest will be used to identify potential investigators for a project to be funded by the U.S. Army Corps of Engineers (USACE) Engineer Research and Development Center, Environmental Laboratory. Approximately \$400,000 is expected to be available to support this project for one (1) year. Additional funding may be available for continuation of this research, at a rate up to \$400K/yr for two (2) additional option years based on future R&D needs, for a total of \$1200K over 3 years for the full project.

**Background:**

Harmful Algal Blooms (HABs), largely caused by cyanobacteria (also known as blue-green algae), are a serious risk to aquatic ecosystems. While freshwater HAB events can and do occur naturally, anthropogenic activities such as nutrient loading and pollution, modified hydrology, as well as introduced species exacerbate their occurrence. There is documented evidence that HAB events are increasing both in frequency and magnitude throughout the United States, including Corps managed reservoirs.

While cyanobacteria have important ecological roles in freshwater environments, where they contribute significantly to nitrogen fixation and global carbon flux, many cyanobacteria can biosynthesize potent environmental toxins that can cause ecosystem degradation, wildlife mortality, and human health issues. Toxin production has been documented in several benthic and pelagic freshwater cyanobacteria (CyanoHABs), including species of *Dolichospermum* (*Anabaena*), *Lyngbya*, *Microcystis*, and *Nodularia*. Several novel freshwater cyanoHABs have recently been classified, which sometimes are transported into estuarine or even marine systems. However, it is common for blooms to consist of multiple cyanobacterial species without a visual mechanism to distinguish toxic species and non-toxic species. New approaches using the presence of cyanotoxin genes, such as microcystin synthetase, common to at least three genera, allow insights into the potential of a bloom to produce toxins and can be coupled with generic cyanobacteria and a few genus-specific markers. As additional organisms that form blooms are added to the genetic database, this approach may assist in the integration of potential toxin production and early detection/rapid response to a cyanoHABs in a water body.

The freshwater aquatic systems of Florida have experienced an increase of eutrophication due to extensive use of fertilizers in agriculture and horticulture.

The distribution and abundance of cyanoHAB events are expected to increase with climate change and other human-induced environmental changes; however, little is known about which cyanobacteria taxa will be favored, and therefore which toxins may be produced. This increases the need for robust detection methods for taxa, toxins, and characterization of the principal precursors to a bloom. The dynamics of cyanobacteria and toxin production may be conferring additional competitive advantages to their producers. However, it is largely unknown how environmental changes will affect microorganisms associated with the cyanobacteria and, consequently, the formation of cyanoHABs.

### **Objectives:**

The objectives of the proposed effort include:

Objective 1: To improve our understanding of the dynamics and key drivers of harmful algal blooms (HABs) in Lake Okeechobee.

Objective 2: Assess and characterize the biodiversity of cyanobacteria and associated heterotrophic microbial communities before, during and after collapse of a cyanobacteria bloom events in Lake Okeechobee.

Objective 3: Utilize the metagenomic data analyses to determine if key pathways are vulnerable to manipulation that may translate into management action.

Objective 4: Utilize the meta-transcriptomics data to understand short-term environmental influences on bloom dynamics.

Tasks for meeting the objectives include:

- Water samples collection and analysis over time from Lake Okeechobee. Approximately 205 samples will be field-collected on an annual basis and require analyses for whole community metagenomics and 16s rRNA gene sequence analyses to understand the organism identification and metabolic dynamics that lead to a cyanobacteria bloom. Biweekly sampling will increase to weekly over bloom periods.

- Provide metagenomics and meta-transcriptomics analysis of water samples (approximately 110 samples) collected from manipulated mesocosm experiments conducted by USGS in collaboration with USACE.
- Obtain and utilize water quality data from Florida Department of Environmental Protection (FDEP) and the South Florida Water Management District (SFWMD) for data analysis/interpretation of metagenomic data.
- Provide overall data analysis and interpretation of results.
- Participate in organized stakeholder meetings and internal project reviews to disseminate and discuss research results.

**Public Benefit:**

A solid scientific approach and thorough understanding of the key drivers of harmful algal blooms in the Lake Okeechobee waterway system is critical for developing future mitigation strategies that reduce environmental, socio-economic, and human health and wildlife impacts caused by toxic algal bloom events. This project will provide much needed data to enable prediction of cyanobacteria growth, dynamics, and an understanding of the key drivers that cause algal blooms and expression of algal toxins. The data will benefit the public, by enabling managers to make well-informed decisions that will protect human and wildlife health and safety.

**Vendor Requirements:**

Vendor must be a non-federal partner of the South Florida-Caribbean CESU

Unit and be willing to accept the negotiated CESU indirect cost rate of 17.5%. Successful applicants should have expert knowledge and previous work experience in metagenomics and transcriptomics related to bacteria, cyanobacteria or the associated aquatic microbial communities in response to environmental variables. The candidate should have access to appropriate laboratory facilities/equipment, including facilities to handle potential toxins contained in water samples, and prior experience with molecular methods, genomic sequencing, and phylogenomic analyses from water samples.

**Government Participation:**

The Government will work in cooperation with the selected investigator to design protocols, coordinate field collection and transfer of water samples for meta genomic and meta-transcriptomics analyses, share sample collection information (location, water quality data, etc.), and provide information on the identify and quantity of algae and cyanobacteria in the samples based on morphology. The USACE will coordinate and provide technical review of all deliverables (reports, journal articles, etc.) and will facilitate and coordinate meetings with local, state and federal partners as needed to disseminate results from these studies.

**Materials Requested for Statement of Interest/Qualifications:**

Please provide the following via e-mail attachment to:

Deberay.R.Carmichael@usace.army.mil Maximum length: 2 pages, single-spaced 12 pt. font).

1. Name, Organization and Contact Information

2. Brief Statement of Qualifications (including): a. Biographical Sketch

b. Relevant past projects and clients with brief descriptions of these projects

c. Staff, faculty or students available to work on this project and their areas of expertise

d. Any brief description of capabilities to successfully complete the project you may wish to add (e.g. equipment, laboratory facilities, greenhouse facilities, field facilities, etc.)

**Note:** A proposed budget is NOT requested at this time.

**Review of Statements Received:** Based on a review of the Statements of Interest received, an investigator or investigators will be invited to prepare a full study proposal. Statements will be evaluated based on the investigator's specific experience and capabilities in areas related to the study requirements. Additionally, the evaluation method and selection criteria for research and development awards must be: (1) The technical merits of the proposed research and development; and (2) Potential relationship of the proposed research and development to the Department of Defense missions.

**Please send responses or direct questions to:**

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**Timeline for Review of Statements of Interest:** Review of Statements of Interest (SOI) will begin after the SOI has been posted on the CESU website for 10 working days.