**Guana Nutrient Metadata Report**

**July 2017 – December 2019**

**Latest Update**: March 7, 2024

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact Dr. Nikki Dix ([Nikki.Dix@FloridaDEP.gov](mailto:Nikki.Dix@FloridaDEP.gov)) with any additional questions.

**I. Data Set and Research Descriptors**

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1. **Research Objectives**

Nutrient analyses were performed on water samples collected monthly at ten sites within Guana Lake and River. The objective of this effort was to quantify spatial/temporal variability of selected water quality parameters within the Guana system. Water quality observations in this system have been very limited historically and this study aimed to develop a baseline survey of water quality conditions over a variety of seasonal conditions and a spatial gradient. Besides the spatial gradient objective, sites were selected at Mickler’s weir and either side of Guana dam to study hydrologic connections.

1. **Research Methods**

Initially, five sites were designated as sampling stations: Micklers, Lake Middle, Lake South, River North and Guana River. Five additional sites (Guana Lake 1, Guana Lake 2, Guana Lake 4, Guana River 1, Guana River 3) were included in July of 2018 for a total of 10 stations. Monthly surface water (0.3 m depth) samples were collected at each station within the Guana River system. All grab samples were obtained during the same ebb tide of each sampling day and within one to two days of the GTMNERR monthly collections for nutrient analyses at the System-Wide Monitoring Program stations. No distinction was made between neap and spring tide conditions. Efforts were made to allow for an antecedent dry period of 72 hours prior to sampling. All water samples were collected in 1-Liter Nalgene sample bottles that were double-acid washed with 10% Hydrochloric acid and deionized water and were rinsed with ambient water prior to collection of the sample following Florida Department of Environmental Protection (DEP) Surface Water Sampling Procedures (FS 2100).

Total Phosphorus, Total Kjeldahl Nitrogen, Total Suspended Solids, Chlorophyll a, and Pheophytin samples were immediately placed on ice. Nitrite+Nitrate, Total Phosphorus, Total Kjeldahl Nitrogen, Dissolved Total Kjeldahl Nitrogen and Dissolved Ammonia samples were also acidified to a pH of 2 using Sulfuric Acid. Fecal Coliform and Enterococcus samples were preserved with sodium thiosulfate upon collection. Chlorophyll *a* and Pheophytin samples were collected in a dark Nalgene bottle and were filtered immediately upon returning to the ALS Environmental laboratory in Jacksonville. Once in the laboratory, samples were shaken and processed for nutrients, chlorophyll *a* and solids analyses.

At the time of sample collection, water temperature, salinity, dissolved oxygen concentration and pH were measured with YSI hand-held that was calibrated prior to measurement. Wind speed, wind direction, and air temperature were measured with a Kestrel device. Light attenuation was estimated using a Secchi disk. Water depth was measured with a depth sounder at GL1, GL2, Lake Middle, GL4, River North, GR1, Guana River, and GR3. Water level was recorded from staff gauges at Lake South and Micklers.

1. **Site location and character**

All stations are collected within the Guana River Marsh Aquatic Preserve in the northern section of the GTMNERR. The GTMNERR (North section [NW and SE corners]: 30.1632º N, 81.3447º W and 29.9698º N, 81.2488º W; South section: 29.8295º N, 81.3294º W and 29.6017º N, 81.1936º W), located in the Florida upper east coast drainage basin, includes over 24,281 ha of publicly owned forested uplands, tidal wetlands, estuarine lagoons and offshore seas. Geographically separated by the greater St. Augustine area, the Reserve is associated with the riverine systems of the Tolomato and Guana River estuaries to the north and the Matanzas River estuary to the south.

The headwaters of the Guana River originate in the Diego Plains drainage area in Ponte Vedra Beach. This drainage basin encompasses approximately 7,800 acres (3,157 hectares). The Guana River runs parallel to the Tolomato on the seaward side, with the two lagoons joining 7 miles (11.3 km) north of the St. Augustine Inlet. The natural hydrology of the Guana system has been somewhat altered by water control structures, including dikes, inland wells, drainage ditches and a dam across a portion of the Guana River. In addition, the Intracoastal Waterway traverses both the Tolomato and Matanzas estuaries. Guana Lake receives water from the north at Mickler’s weir and water periodically exchanges with Guana River through the Guana dam depending on water level management and tidal conditions. As such, there was often a distinct latitudinal gradient in salinity within the lake. There was also a spatial salinity gradient in the river (lower salinities closer to the dam), but it was less pronounced than in the lake. Water temperatures in both the lake and the river follow similar seasonal patterns and do not diverge too much between waterbodies.

The six lake sites are situated within Class III Estuarine Waters (Waterbody ID 2320C). Water depth and salinity in the lake sites vary depending on tides and lake-level management by Florida Fish and Wildlife Conservation Commission (FWC).

The four river sites are situated within Class II Estuarine Waters (Waterbody ID 2320). Water depth in the river sites is tide-dependent, ranging from approximately 1.5 m over a tidal cycle. Numerous oyster reefs are located along the river.

The climate of northeast Florida is classified as humid subtropical and is characteristic of the Gulf and Atlantic coastal plain of the southeastern United States. The average annual rainfall is approximately 52 inches (132 cm) per year, with the wet season extending from June through September. Seasonal variation in temperature within the Reserve follows that of rainfall with a summer period of high temperatures between June and September and a cooler period extending from December through March. The annual mean air temperature within the Reserve is approximately 21°C.

**Station Descriptions**

*Lake Sites*

The **Micklers** (GTMMKNUT) station is located at the water control structure at the head of Guana Lake (30.16073611°, -81.36027778°) just south of the intersection of Florida A1A and Mickler Road. Average water depth observed from July 2017-June 2019 was 1.37 m. The waters here tend to freshwater, never exceeding 0.50 ppt during the sampling period. Average salinity during this period was 0.36 ppt.

The **Guana Lake 1** (GTMGL1NUT) station is located approximately 1.19 kilometers south of the Micklers station (30.1504°, -81.3604°). The station is near the west bank of the lake where a residential housing area is situated. Average water depth observed from July 2018 - May 2019 was 0.38 meters. Salinity levels here are similar to the Micklers site. Average salinity during the sampling period was 0.39 ppt. Bottom type is soft, muddy sand. Water here tends to be somewhat clear, and submerged aquatic vegetation is abundant.

The **Guana Lake 2** (GTMGL2NUT) station is located approximately 0.87 kilometers northwest of Six Mile Landing boat launch (30.1161°, -81.3511°). Average water depth observed from July 2018 – June 2019 was 0.68 meters. Average salinity over the sampling period was 2.52 ppt; however, levels did reach 9.85 ppt. Bottom type? Floating aquatic vegetation, mainly duckweed, accumulates at this site.

The **Lake Middle** (GTMOLNUT; GTMLMNUT) stations are in the middle of Guana Lake east of the Guana Wildlife Management Area’s observation tower (30.08302°, -81.34286°). Average water depth observed from June 2017 - June 2019 was 0.82 meters. Water at this site is predominantly brackish with an average salinity of 5.80 ppt.

The **Guana Lake 4** (GTMGL4UT) station is located on the westside of the lake near (30.0451°, -81.3351°). Average water depth observed from July 2018 - June 2019 was 0.94 meters. Brackish water type with an average salinity of 11.20 ppt.

The **Lake South** (GTMDNNUT; GTMLSNUT) stations are located at the Guana Lake water gauge 30 meters north of the Guana Dam off Guana River Road (30.023763°, -81.327928°). Average water depth observed from July 2017 - June 2019 was 1.05 meters. The FWC prefers to maintain marine-like waters at this site. Salinity levels ranged from 6.91 to 37.16 with an average salinity of 14.89 ppt during the sampling period.

*River Sites*

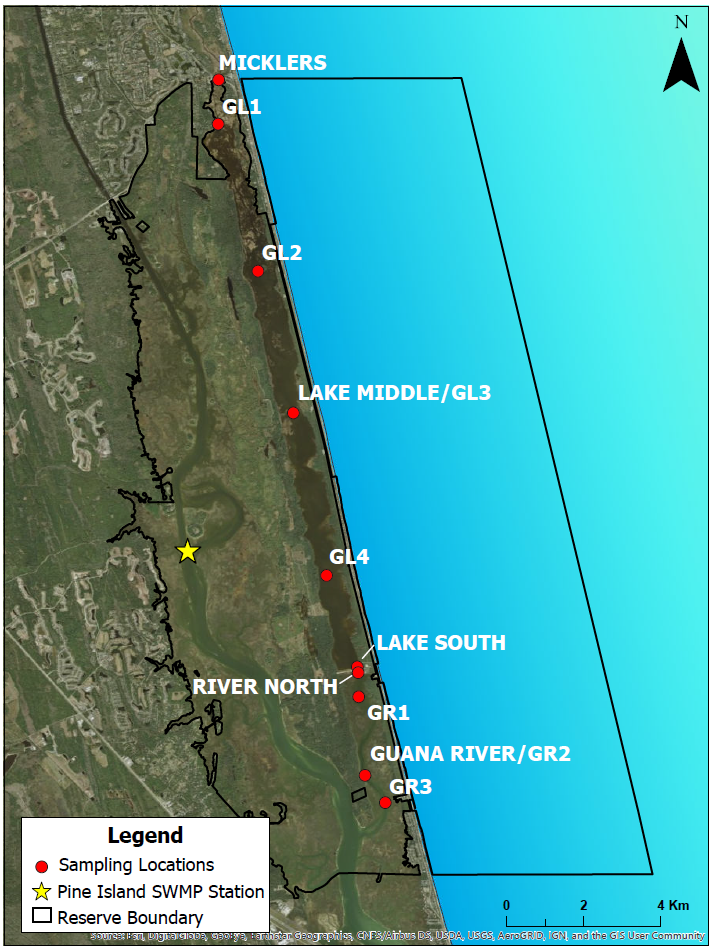
The **River North** (GTMDSNUT; GTMRNNUT) stations are located at the Guana River boat ramp 20 meters south into the river (30.022421°, -81.327722°). Average water depth observed at the River North site from July 2017 – June 2019 was 1.39 meters. Average salinity level over the sampling period was 22.63 ppt.

The **Guana River 1** (GTMGR1NUT) station is approximately 0.62 km south of the River North site (30.0168°, -81.3276°). Average water depth observed from July 2018 – June 2019 was 1.72 meters. Average salinity measured 25.06 ppt.

The **Guana River** (GTMGRNUT) station is in Guana River approximately three kilometers south of the Guana dam (29.998466°, -81.326133°). Average water depth observed from July 2017 - June 2019 was 4.73 meters. Average salinity during the sampling period was 27.00 ppt.

The **Guana River 3** (GTMGR3NUT) station lies farthest south on Guana River, approximately 2 kilometers from the mouth of the river, which flows into the Tolomato River (29.9921°, -81.3214°). Average water depth observed from July 2018 - June 2019 was 3.34 meters. Average salinity was 30.06 ppt.

|  |  |  |
| --- | --- | --- |
| Site | Station Code(s)\* | Location |
| Micklers | GTMMKNUT | 30.16073611°, -81.36027778° |
| Guana Lake 1 | GTMGL1NUT | 30.1504°, -81.3604° |
| Guana Lake 2 | GTMGL2NUT | 30.1161°, -81.3511° |
| Lake Middle | GTMOLNUT; GTMLMNUT | 30.08302°, -81.34286° |
| Guana Lake 4 | GTMLSNUT | 30.0451°, -81.3351° |
| Lake South | GTMDNNUT; GTMLSNUT | 30.023763, -81.327928 |
| River North | GTMDSNUT; GTMRNNUT | 30.022421°, -81.327722° |
| Guana River 1 | GTMGR1NUT | 30.0168°, -81.3276° |
| Guana River | GTMGRNUT | 29.998466°, -81.326133° |
| Guana River 3 | GTMGR3NUT | 29.9921°, -81.3214° |
| \*if two station codes are associated with one site, the latter is the current nomenclature. | | |



1. **Data collection period**

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| --- | --- | --- | --- | --- |
| Micklers |  | |  | |
| Station | **Collection Date** | | **Time** | |
| GTMMKNUT | 7/20/2017 | | 12:05 | |
| GTMMKNUT | 8/3/2017 | | 11:24 | |
| GTMMKNUT | 9/20/2017 | | 9:06 | |
| GTMMKNUT | 10/18/2017 | | 12:52 | |
| GTMMKNUT | 11/2/2017 | | 13:11 | |
| GTMMKNUT | 12/13/2017 | | 15:15 | |
| GTMMKNUT | 1/17/2018 | | 13:46 | |
| GTMMKNUT | 2/14/2018 | | 11:38 | |
| GTMMKNUT | 3/28/2018 | | 12:10 | |
| GTMMKNUT | 4/24/2018 | | 10:56 | |
| GTMMKNUT | 5/30/2018 | | 14:30 | |
| GTMMKNUT | 6/11/2018 | | 11:47 | |
| GTMMKNUT | 7/11/2018 | | 15:20 | |
| GTMMKNUT | 8/8/2018 | | 12:41 | |
| GTMMKNUT | 9/6/2018 | | 14:57 | |
| GTMMKNUT | 10/22/2018 | | 13:55 | |
| GTMMKNUT | 11/7/2018 | | 13:39 | |
| GTMMKNUT | 12/5/2018 | | 14:22 | |
| GTMMKNUT | 1/22/2019 | | 15:15 | |
| GTMMKNUT | 2/4/2019 | | 16:10 | |
| GTMMKNUT | 3/4/2019 | | 13:50 | |
| GTMMKNUT | 4/2/2019 | | 14:37 | |
| GTMMKNUT | 5/2/2019 | | 14:20 | |
| Guana Lake 1 | |  | |  | |
| Station | | **Collection Date** | | **Time** | |
| GTMGL1NUT | | 7/11/2018 | | 12:50 | |
| GTMGL1NUT | | 8/8/2018 | | 10:23 | |
| GTMGL1NUT | | 9/6/2018 | | 11:32 | |
| GTMGL1NUT | | 10/22/2018 | | 11:50 | |
| GTMGL1NUT | | 11/7/2018 | | 12:03 | |
| GTMGL1NUT | | 12/5/2018 | | 11:57 | |
| GTMGL1NUT | | 1/22/2019 | | 13:25 | |
| GTMGL1NUT | | 2/4/2019 | | 12:53 | |
| GTMGL1NUT | | 3/4/2019 | | 11:40 | |
| GTMGL1NUT | | 3/4/2019 | | 12:03 | |
| GTMGL1NUT | | 4/2/2019 | | 12:36 | |
| GTMGL1NUT | | 5/2/2019 | | 12:14 | |
|  | |  | |  | |
| Guana Lake 2 | |  | |  | |
| Station | | **Collection Date** | | **Time** | |
| GTMGL2NUT | | 7/11/2018 | | 12:22 | |
| GTMGL2NUT | | 8/8/2018 | | 9:50 | |
| GTMGL2NUT | | 9/6/2018 | | 10:48 | |
| GTMGL2NUT | | 10/22/2018 | | 11:23 | |
| GTMGL2NUT | | 11/7/2018 | | 11:40 | |
| GTMGL2NUT | | 12/5/2018 | | 11:29 | |
| GTMGL2NUT | | 1/22/2019 | | 13:04 | |
| GTMGL2NUT | | 2/4/2019 | | 12:24 | |
| GTMGL2NUT | | 3/4/2019 | | 11:40 | |
| GTMGL2NUT | | 4/2/2019 | | 12:14 | |
| GTMGL2NUT | | 5/2/2019 | | 11:47 | |
| GTMGL2NUT | | 6/3/2019 | | 13:03 | |

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| Lake Middle |  |  |
| Station | **Collection Date** | **Time** |
| GTMOLNUT | 7/20/2017 | 10:05 |
| GTMOLNUT | 8/3/2017 | 9:32 |
| GTMOLNUT | 9/20/2017 | 10:32 |
| GTMOLNUT | 10/18/2017 | 9:38 |
| GTMOLNUT | 11/2/2017 | 10:39 |
| GTMLMNUT | 1/17/2018 | 12:06 |
| GTMLMNUT | 2/14/2018 | 10:25 |
| GTMLMNUT | 3/28/2018 | 10:23 |
| GTMLMNUT | 4/24/2018 | 9:38 |
| GTMLMNUT | 5/30/2018 | 12:52 |
| GTMLMNUT | 6/11/2018 | 10:25 |
| GTMLMNUT | 7/11/2018 | 11:45 |
| GTMLMNUT | 8/8/2018 | 9:30 |
| GTMLMNUT | 9/6/2018 | 10:15 |
| GTMLMNUT | 10/22/2018 | 11:06 |
| GTMLMNUT | 11/7/2018 | 11:21 |
| GTMLMNUT | 12/5/2018 | 11:02 |
| GTMLMNUT | 1/22/2019 | 12:42 |
| GTMLMNUT | 2/4/2019 | 12:00 |
| GTMLMNUT | 3/4/2019 | 11:01 |
| GTMLMNUT | 4/2/2019 | 11:50 |
| GTMLMNUT | 5/2/2019 | 11:21 |
| GTMLMNUT | 6/3/2019 | 12:42 |

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| Guana Lake 4 |  |  |
| Station | **Collection Date** | **Time** |
| GTMGL4NUT | 7/11/2018 | 11:10 |
| GTMGL4NUT | 8/8/2018 | 9:09 |
| GTMGL4NUT | 9/6/2018 | 9:48 |
| GTMGL4NUT | 10/22/2018 | 10:45 |
| GTMGL4NUT | 11/7/2018 | 11:00 |
| GTMGL4NUT | 12/5/2018 | 10:36 |
| GTMGL4NUT | 1/22/2019 | 12:20 |
| GTMGL4NUT | 2/4/2019 | 11:39 |
| GTMGL4NUT | 3/4/2019 | 10:44 |
| GTMGL4NUT | 4/2/2019 | 11:30 |
| GTMGL4NUT | 5/2/2019 | 10:58 |
| GTMGL4NUT | 6/3/2019 | 12:21 |

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| Lake South |  |  |
| Station | **Collection Date** | **Time** |
| GTMDNNUT | 7/20/2017 | 8:42 |
| GTMDNNUT | 8/3/2017 | 10:16 |
| GTMLSNUT | 9/20/2017 | 9:47 |
| GTMLSNUT | 10/18/2017 | 11:33 |
| GTMLSNUT | 11/2/2017 | 11:14 |
| GTMLSNUT | 12/13/2017 | 13:26 |
| GTMLSNUT | 1/17/2018 | 11:29 |
| GTMLSNUT | 2/14/2018 | 9:51 |
| GTMLSNUT | 3/28/2018 | 9:16 |
| GTMLSNUT | 4/24/2018 | 8:44 |
| GTMLSNUT | 5/30/2018 | 12:26 |
| GTMLSNUT | 6/11/2018 | 9:57 |
| GTMLSNUT | 7/11/2018 | 10:55 |
| GTMLSNUT | 8/8/2018 | 8:54 |
| GTMLSNUT | 9/6/2018 | 9:28 |
| GTMLSNUT | 10/22/2018 | 10:19 |
| GTMLSNUT | 11/7/2018 | 10:41 |
| GTMLSNUT | 12/5/2018 | 10:17 |
| GTMLSNUT | 1/22/2019 | 12:02 |
| GTMLSNUT | 2/4/2019 | 11:22 |
| GTMLSNUT | 3/4/2019 | 10:26 |
| GTMLSNUT | 4/2/2019 | 11:07 |
| GTMLSNUT | 5/2/2019 | 10:41 |
| GTMLSNUT | 6/3/2019 | 12:06 |

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| River North |  |  |
| Station | **Collection Date** | **Time** |
| GTMDSNUT | 7/20/2017 | 8:35 |
| GTMDSNUT | 8/3/2017 | 10:31 |
| GTMRNNUT | 9/20/2017 | 12:09 |
| GTMRNNUT | 10/18/2017 | 11:18 |
| GTMRNNUT | 11/2/2017 | 11:40 |
| GTMRNNUT | 12/13/2017 | 12:52 |
| GTMRNNUT | 1/17/2018 | 10:51 |
| GTMRNNUT | 2/14/2018 | 9:21 |
| GTMRNNUT | 3/28/2018 | 8:50 |
| GTMRNNUT | 4/24/2018 | 8:03 |
| GTMRNNUT | 5/30/2018 | 11:28 |
| GTMRNNUT | 6/11/2018 | 9:30 |
| GTMRNNUT | 7/11/2018 | 10:20 |
| GTMRNNUT | 8/8/2018 | 8:29 |
| GTMRNNUT | 9/6/2018 | 8:51 |
| GTMRNNUT | 10/22/2018 | 9:46 |
| GTMRNNUT | 11/7/2018 | 10:15 |
| GTMRNNUT | 12/5/2018 | 9:43 |
| GTMRNNUT | 1/22/2019 | 11:30 |
| GTMRNNUT | 2/4/2019 | 10:49 |
| GTMRNNUT | 3/4/2019 | 10:00 |
| GTMRNNUT | 4/2/2019 | 10:32 |
| GTMRNNUT | 5/2/2019 | 9:54 |
| GTMRNNUT | 6/3/2019 | 11:25 |

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| --- | --- | --- |
| Guana River 1 |  |  |
| Station | **Collection Date** | **Time** |
| GTMGR1NUT | 7/11/2018 | 9:59 |
| GTMGR1NUT | 8/8/2018 | 8:21 |
| GTMGR1NUT | 9/6/2018 | 8:34 |
| GTMGR1NUT | 10/22/2018 | 9:37 |
| GTMGR1NUT | 11/7/2018 | 1:05 |
| GTMGR1NUT | 12/5/2018 | 9:27 |
| GTMGR1NUT | 1/22/2019 | 11:18 |
| GTMGR1NUT | 2/4/2019 | 10:34 |
| GTMGR1NUT | 3/4/2019 | 9:48 |
| GTMGR1NUT | 4/2/2019 | 10:20 |
| GTMGR1NUT | 5/2/2019 | 9:42 |
| GTMGR1NUT | 6/3/2019 | 11:16 |

|  |  |  |
| --- | --- | --- |
| Guana River | | |
| Station | **Collection Date** | **Time** |
| GTMGRNUT | 7/20/2017 | 9:15 |
| GTMGRNUT | 8/3/2017 | 8:39 |
| GTMGRNUT | 9/20/2017 | 11:39 |
| GTMGRNUT | 10/18/2017 | 10:39 |
| GTMGRNUT | 11/2/2017 | 11:58 |
| GTMGRNUT | 12/13/2017 | 12:04 |
| GTMGRNUT | 1/17/2018 | 10:22 |
| GTMGRNUT | 2/14/2018 | 8:57 |
| GTMGRNUT | 3/28/2018 | 8:29 |
| GTMGRNUT | 4/24/2018 | 7:32 |
| GTMGRNUT | 5/30/2018 | 11:09 |
| GTMGRNUT | 6/11/2018 | 9:08 |
| GTMGRNUT | 7/11/2018 | 9:35 |
| GTMGRNUT | 8/8/2018 | 8:05 |
| GTMGRNUT | 9/6/2018 | 8:11 |
| GTMGRNUT | 10/22/2018 | 9:25 |
| GTMGRNUT | 11/7/2018 | 9:51 |
| GTMGRNUT | 12/5/2018 | 9:06 |
| GTMGRNUT | 1/22/2019 | 11:00 |
| GTMGRNUT | 2/4/2019 | 10:10 |
| GTMGRNUT | 3/4/2019 | 9:30 |
| GTMGRNUT | 4/2/2019 | 9:58 |
| GTMGRNUT | 5/2/2019 | 9:25 |
| GTMGRNUT | 6/3/2019 | 11:02 |

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| --- | --- | --- |
| Guana River 3 |  |  |
| Station | **Collection Date** | **Time** |
| GTMGR3NUT | 7/11/2018 | 9:03 |
| GTMGR3NUT | 8/8/2018 | 7:50 |
| GTMGR3NUT | 9/6/2018 | 7:48 |
| GTMGR3NUT | 10/22/2018 | 9:09 |
| GTMGR3NUT | 11/7/2018 | 9:42 |
| GTMGR3NUT | 12/5/2018 | 8:42 |
| GTMGR3NUT | 1/22/2019 | 10:41 |
| GTMGR3NUT | 2/4/2019 | 9:47 |
| GTMGR3NUT | 3/4/2019 | 9:12 |
| GTMGR3NUT | 4/2/2019 | 9:41 |
| GTMGR3NUT | 5/2/2019 | 9:10 |
| GTMGR3NUT | 6/3/2019 | 10:49 |

1. **Complementary monitoring**

Plankton samples were collected alongside water quality samples at all sites. Whole water grab samples were collected from the surface and preserved with Lugol’s iodine solution in amber glass bottles. Samples are archived at the GTMNERR and plankton community composition is being identified as time allows.

As part of the national System Wide Monitoring Program (SWMP), the GTMNERR collects water quality and weather data. Water quality is measured at four stations: one in the Tolomato River, two in the Matanzas River, and one in Pellicer Creek. Measurements include monthly analyses for nutrients, chlorophyll, bacteria, and solids from grab samples and 15-min salinity, temperature, dissolved oxygen, turbidity, and pH using YSI data sondes. Weather parameters (air temperature, humidity, photosynthetically active radiation, wind speed, wind direction, and rainfall) are measured at one station near the mouth of Pellicer Creek. All SWMP data undergo a rigorous, standardized QAQC process and are available for download through the Centralized Data Management Office at [www.nerrsdata.org](http://www.nerrsdata.org).

GTMNERR has periodically surveyed oyster reefs in Guana River since 2014. Metrics such as percent cover, density, and size are indicators of oyster reef condition.

<https://www.gtmnerr.org/oysters/> .

Florida Department of Agriculture and Consumer Services regularly collects samples for bacteria concentrations for public health considerations related to shellfish harvest in Guana River. <https://www.freshfromflorida.com/Business-Services/Aquaculture/Shellfish-Harvesting-Area-Classification>.

Northeast Florida Aquatic Preserves and the GTMNERR began bi-weekly diel seining around Guana dam for juvenile fish in June 2018. Seining was performed during incoming tides during daytime hours and nighttime hours.

Since 2001, Florida Fish and Wildlife Conservation Commission and University of North Florida have conducted fisheries-independent monitoring at Guana dam for American eel (*Anguilla rostrata*) glass eels every winter season for approximately 3 months. This sampling occurs during nighttime incoming tides for a minimum of 3 hours. For more information on this and other projects, contact Nikki Dix ([Nikki.Dix@FloridaDEP.gov](mailto:Nikki.Dix@FloridaDEP.gov)).

**II. Physical Structure Descriptors**

1. **Entry verification**

Nutrient results were sent to the GTMNERR in .pdf format and were entered into Microsoft Excel spreadsheets from the documents received from ALS Environmental. GTMNERR staff and volunteers entered and reviewed the data entries. Data entry, verification and chain of custody procedures follow those specified in the Florida Department of Health NELAP QA/QC certification plan (<http://www.floridahealth.gov/licensing-and-regulation/environmental-laboratories/environmental-laboratory-certification/index.html>).

All data obtained during the study was internally QAQC’ed and formatted in accordance to Florida Department of Environmental Protection (DEP) Watershed Information Network (WIN) guidelines and subsequently uploaded to WIN after the conclusion of the project in September 2018.

1. **Parameter titles and variable names by category**

Required NOAA/NERRS System-wide Monitoring Program nutrient parameters are denoted by an asterisks “\*”.

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Category** | **Parameter** | **Variable Name** | **Units of Measure** |
| Phosphorus |  |  |  |
|  | \*Orthophosphate, Filtered | PO4F | mg/L as P |
|  | Total Phosphorus | TP | mg/L as P |
| Nitrogen |  |  |  |
|  | \*Nitrite + Nitrate, Filtered | NO23F | mg/L as N |
|  | \*Nitrite, Filtered | NO2F | mg/L as N |
|  | \*Nitrate, Filtered | NO3F | mg/L as N |
|  | \*Ammonium, Filtered | NH4F | mg/L as N |
|  | Total Kjeldahl Nitrogen, Filtered | TKNF | mg/L as N |
|  | Total Kjeldahl Nitrogen | TKN | mg/L as N |
|  | Dissolved Inorganic Nitrogen | DIN | mg/L as N |
|  | Total Nitrogen | TN | mg/L as N |
|  | Total Organic Nitrogen | TON | mg/L as N |
| Plant Pigments |  |  |  |
|  | Uncorrected Chlorophyll a | UncCHLa\_N | µg/L |
|  | \*Chlorophyll a | CHLA\_N | µg/L |
|  | Pheophytin a | PHEA | µg/L |
| Carbon |  |  |  |
|  | Dissolved Organic Carbon | DOC | mg/L as C |
| Other Lab Parameters |  |  |  |
|  | Total Suspended Solids | TSS | mg/L |
|  | Fecal Coliforms | FECCOL\_CFU | cfu/100 mL |
|  | Escherichia Coli | ECOLI\_MPN | mpn/100 mL |
| Field Parameters |  |  |  |
|  | Salinity | SALT\_N | ppt |
|  | Secchi disk depth | SECCHI | m |
|  | Dissolved Oxygen | DO\_N | mg/L |
|  | Water Temperature | WTEM\_N | degrees Celsius |
|  | pH | PH\_N | standard units |

**Notes:**

* 1. Time is coded based on a 2400 clock and is referenced to Standard Time.
  2. Reserves have the option of measuring either NO2 and NO3 or they may substitute NO23 for individual analyses if they can show that NO2 is a minor component relative to NO3.

1. **Measured or calculated laboratory parameters**
   1. **Parameters measured directly**

Nitrogen species: NH4F, NO2F, NO23F, TKN, TKNF

Phosphorus species: PO4F, TP

Carbon species: DOC

Other: CHLA\_N, UncCHLa\_N, PHEA,  
 TSS, FECCOL\_CFU, ECOLI\_MPN

* 1. **Calculated parameters**

NO3 (NO23F\*Df) – (NO2F\*Df)

Df=Dilution factor

DIN NO23F + NH4F

TON TKN – NH4F

TN TKN + NO23F

1. **Limits of detection**

The Florida Department of Environmental Protection’s Central Laboratory defines the MDL as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from a method blank. A minimum of seven method blanks and seven laboratory fortified blanks (LFB) in three independent batches are prepared and the LFBs are spiked at one to five times the estimated MDL concentration. The blanks and LFBs are processed through the entire analytical method. The MDL or LFB cannot be prepared for some biological methods (e.g., BOD and chlorophyll); a substitute with at least seven replicates of a standard solution is used for these samples. The method blanks and LFBs are then distributed and analyzed on three separate days in three independent analytical runs.

Two MDL values are then derived, one based on the standard deviation and average concentration of the method blanks (MDLb) and the second based on the standard deviation of the LFBs (MDLs). The detection limit is then derived using the Student’s t value appropriate for a 99 % confidence level and a standard deviation estimate with n - 1 degrees of freedom where n is the number of each type of blank. The larger of the two MDLs is set as the MDL for the method. In cases where the calculated MDL is more than 10 times lower than the concentration level of the LFB’s the study may be performed again using a lower spiking level. For details, refer to the FDEP Quality Manual and Chapter 40, Part 136 Appendix B of the Code of Federal Regulations for “Definition and Procedure for the Determination of the Method Detection Limit—Revision 2 (August 2017)”.

1. **Florida Department of Environmental Protection Data Qualifiers**

*These are the located in the F\_[Parameter abbrev.] columns and were determined by ALS Environmental.*

**B** - Results based upon colony counts outside the acceptable range.

**D -** Measurement was made in the field.

**H** - Value based on field kit determination; results may not be accurate.

**I** - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

**J** - Estimated value (one of the following reasons is discussed in the project case narrative).

1. The result may be inaccurate because the surrogate recovery limits have been exceeded.

2. No known quality control criteria exists for the component.

3. The reported value failed to meet the established quality control criteria for either precision or accuracy.

4. The sample matrix interfered with the ability to make any accurate determination (e.g., primary and confirmation results show greater than 40% RPD).

5. The data is questionable because of improper laboratory or field protocols (e.g., GC/MS Tune did not meet method criteria).

**K** - Off scale low. The value is less than the lowest calibration standard but greater than the method reporting limit (MRL).

**L** - Off scale high. The analyte is above the upper limit of the linear calibration range.

**M -** The MDL/MRL has been elevated because the analyte could not be accurately quantified due to matrix interference.

**N** - Presumptive evidence of the analyte. Confirmation was not performed.

**Q** - Sample held beyond the accepted holding time.

**T** - Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only.

**U** - Indicates that the compound was analyzed for but not detected.

**V** - Indicates that the analyte was detected in both the sample and the associated method blank.

**Y** - The laboratory analysis was from an improperly preserved sample.

**Z** - Too many colonies were present (TNTC). The numeric value represents the filtration volume.

1. **Laboratory Methods**

|  |  |
| --- | --- |
| Parameter | Method Reference |
| CHLa\_Mono | SM 10200 |
| CHLa\_Tri | SM 10200 |
| CHLb\_Tri | SM 10200 |
| CHLc\_Tri | SM 10200 |
| OD664b/OD665a | SM 10200 |
| PHEA | SM 10200 |
| TN | Calculation |
| TKN | EPA 351.2 |
| DTKN | EPA 351.2 |
| DON | EPA 350.1 |
| TP | EPA 365.1 |
| NO23 | EPA 353.2 |
| FECCOL | SM 9222 D |
| ENTERO | ASTM D6503-99 |

**Parameter: Dissolved Organic Nitrogen (DON)**

**Method Reference:** U.S. Environmental Protection Agency (EPA), 1993, Determination of Ammonia Nitrogen by Semi-Automated Colorimetry, EPA Method 350.1 Revision 2.0. Cincinnati, OH and OI Analytical Method 327152 utilizing gas diffusion.

**Method Descriptor:** The sample pH is raised to a pH of >11. The ammonia molecules generated at this pH pass through a gas diffusion membrane and are absorbed into an alkaline hypochlorite solution to form chloramine. The chloramine reacts with salicylate to form indophenol blue in an amount that is proportional to the ammonia concentration. Sodium nitroferricyanide intensifies the blue color. The absorbance is measured at 660 nm.

**Preservation Method:** Samples are filtered through 0.7 µm pore size glass-fiber filters in the field and preserved with H2SO4 to a pH ≤ 2, stored on ice and shipped. Samples are analyzed within 28 days of collection.

**NOTE:** This method measures total ammonia, NH3 is considered negligible

**Parameter: Nitrate+Nitrite (NO23)**

**Method Reference:** U.S. Environmental Protection Agency (EPA), 1993. Nitrogen, Nitrate-Nitrite (Colorimetric, Automated, Cadmium Reduction), EPA Method 353.2 Revision 2.0. Cincinnati, OH and Seal Analytical AQ2 method EPA-137-A Rev. 1.

**Method Descriptor:** A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that originally present plus that reduced to nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye which is measured colorimetrically. Separate, rather than combined nitrate-nitrite, values are readily obtained by carrying out the procedure first with, and then without, the Cu-Cd reduction step.

**Preservation Method:** Samples are filtered through 0.7 µm pore size glass-fiber filters in the field. NO23 samples were preserved with H2SO4 to a pH ≤ 2, stored on ice and shipped, and analyzed within 28 days of collection. NO2 samples are filtered through 0.7 µm pore size glass-fiber filters in the field, stored on ice and shipped, and analyzed within 48 hours.

**Parameter: Total Kjeldahl Nitrogen (TKN)**

**Method Reference:** U.S. Environmental Protection Agency (EPA), 1993. Determination of Total Kjeldahl nitrogen by Semi-Automated Colorimetry, EPA Method 351.2 Revision 2.0. Cincinnati, OH and AQ2 method No: EPA-111-A Rev.4.

**Method Descriptor:** The sample is heated in the presence of sulfuric acid, H2SO4 for two and one half hours. The residue is cooled, diluted to 25 mL and analyzed for ammonia. This digested sample may also be used for phosphorus determination. Total Kjeldahl nitrogen is the sum of free-ammonia and organic nitrogen compounds which are converted to ammonium sulfate (NH4)2SO4, under the conditions of digestion described. Organic Kjeldahl nitrogen is the difference obtained by subtracting the free ammonia value from the total Kjeldahl nitrogen value. Reduced volume versions of this method that use the same reagents and molar ratios are acceptable provided they meet the quality control and performance requirements stated in the method.

**Preservation Method:** Whole water samples are collected and preserved with H2SO4 to a pH ≤2, stored for a maximum of 28 days and stored at 4oC.

**Parameter: Total Phosphorus (TP)**

**Method Reference:** U.S. Environmental Protection Agency (EPA), 1993. Determination of Phosphorus by Semi-Automated Colorimetry, EPA Method 365.1 Revision 2.0. Cincinnati, OH and Bran+Lubbe method G-146-95 Rev. 3.

**Method Descriptor:** A sample is appropriately treated to convert all phosphorus of interest to reactive orthophosphate. Ammonium molybdate and antimony potassium tartrate are added to the treated sample reacting with orthophosphate in an acidic medium to form an antimony-phospho-molybdate complex. This complex is reduced to an intensely blue-colored complex by ascorbic acid. The concentration of the orthophosphate is measured by detecting the absorbance of the complex with a spectrophotometer.

**Preservation Method:** Samples are filtered through 0.7 µm pore size glass-fiber filters in the field, preserved with H2SO4 to a pH ≤2, stored at 4oC, and run within 48 hours.

**Parameter: Chlorophyll a (CHLA), Uncorrected Chlorophyll a (UncCHLa), Pheophytin a (PHEA)**

**Method References:** APHA (American Public Health Association), 2001. Standard Methods for the Examination of Water and Wastewater, (SM 10200H). 20th Edition, Baltimore, Maryland: United Book Press, Inc. and U.S. Environmental Protection Agency (EPA), 1993. In Vitro Determination of Chlorophylls a, b, c1+c2 and Pheopigments in Marine and Freshwater Algae by Visible Spectrophotometry, EPA Method 446.0 Revision 1.2. Cincinnati, OH.

**Method Descriptor:** Phytoplankton containing chlorophyll *a* in a measured volume of sample is concentrated by filtration through a glass fiber filter. The photo-pigments are extracted from the phytoplankton by grinding the filter with a tissue grinder and steeping the filter slurry in 90% aqueous acetone solution overnight. The filter slurry is then centrifuged to clarify the solution and then the supernatant is transferred to a glass spectrophotometric cell. For the pheophytin corrected chlorophyll *a*, the sample’s absorbance is measured at 750 and 664 nm before acidification and 750 and 665 nm after acidification with .1 N HCl. No calibration of the instrument is required. Absorbance values are entered into a set of equations in the computer that utilize the extinction coefficients of the pure pigments in 90% acetone. Concentrations are reported in ug/L.

**Preservation Method:** Samples are collected as whole water samples and stored in a dark sampling bottle. Samples are filtered onto 0.45 µm pore size glass-fiber filters in the laboratory and run immediately upon receiving samples.

**Parameter: Fecal Coliforms (FECCOL)**

**Method References:** APHA (American Public Health Association), 1999. Standard Methods for the Examination of Water and Wastewater (SM9222D-1997). Baltimore, Maryland: United Book Press, Inc. APHA (American Public Health Association), 1999.

**Method Descriptor:** Samples are collected as whole water samples in a sealed sterile sampling bottle. The water sample is filtered through a membrane that has a 0.45 μm pore size to capture bacteria. The membrane filter is placed on an mFC dish, which is a selective medium for fecal coliforms. The dish is then incubated for 24 hours at 44.5°C. Positive colonies have a blue color and are counted and recorded.

**Preservation Method:** Whole water samples are filtered and analyzed within 24-48 hours of collection.

**Parameter: Enterococcus (ENTERO)**

**Method References:** ASTM D6503-99, Standard Test Method for Enterococci in Water Using EnterolertTM, ASTM International, West Conshohocken, PA, 1999, [www.astm.org](https://www.astm.org/)

**Method Descriptor:** Contents of one Enterolert pack is added to 100 mL of sample water in a sterile vial. Sample/reagent mixture is shaken, poured into a Quanti-Tray, sealed and placed in a 41±0.5°C incubator for 24 hours. Following incubation, number of fluorescent, positive wells are enumerated, recorded and referenced to a MPN table to obtain a Most Probable Number.

**Preservation Method:** Whole water samples are in a sealed sterile sampling bottle preserved with sodium thiosulfate. Samples are incubated within 8 hours.

1. **QAQC Flag Definition**

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter’s associated flag column (header preceded by an F\_). QAQC flags are applied to the nutrient data during secondary QAQC to indicate data that are out of sensor range low (-4), rejected due to QAQC checks (-3), missing (-2), optional and were not collected (-1), suspect (1), and that have been corrected (5). All remaining data are flagged as having passed initial QAQC checks (0) when the data are uploaded and assimilated into the CDMO ODIS as provisional plus data. The historical data flag (4) is used to indicate data that were submitted to the CDMO prior to the initiation of secondary QAQC flags and codes (and the use of the automated primary QAQC system for WQ and MET data). This flag is only present in historical data that are exported from the CDMO ODIS.

-4 Outside Low Sensor Range

-3 Data Rejected due to QAQC

-2 Missing Data

-1 Optional SWMP Supported Parameter

0 Data Passed Initial QAQC Checks

1 Suspect Data

4 Historical Data: Pre-Auto QAQC

5 Corrected Data

1. **QAQC code definitions**

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the sample or sample collection, sensor errors document common sensor or parameter specific problems, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point. However, a record flag column (F\_Record) in the nutrient data allows multiple comment codes to be applied to the entire data record.

General errors

GCM Calculated value could not be determined due to missing data

GCR Calculated value could not be determined due to rejected data

GDM Data missing or sample never collected

GQD Data rejected due to QA/QC checks

GQS Data suspect due to QA/QC checks

GSM See metadata

Sensor errors

SBL Value below minimum limit of method detection

SCB Calculated value could not be determined due to a below MDL component

SCC Calculation with this component resulted in a negative value

SNV Calculated value is negative

SRD Replicate values differ substantially

SUL Value above upper limit of method detection

Parameter Comments

CAB Algal bloom

CDR Sample diluted and rerun

CHB Sample held beyond specified holding time

CIP Ice present in sample vicinity

CIF Flotsam present in sample vicinity

CLE Sample collected later/earlier than scheduled

CRE Significant rain event

CSM See metadata

CUS Lab analysis from unpreserved sample  
 CUF Lab analysis from unfiltered sample

1. **Other Remarks/Notes**

Data may be missing due to problems with sample collection or processing. Laboratories in the NERRS System submit data that are censored at a lower detection rate limit, called the Method Detection Limit or MDL. MDLs for specific parameters are listed in the Laboratory Methods and Detection Limits Section (Section II, Part 12) of this document. Concentrations that are less than this limit are censored with the use of a QAQC flag and code, and the reported value is the method detection limit itself rather than a measured value. For example, if the measured concentration of NO23F was 0.0005 mg/l as N (MDL=0.0008), the reported value would be 0.0008 and would be flagged as out of sensor range low (-4) and coded SBL. In addition, if any of the components used to calculate a variable are below the MDL, the calculated variable is removed and flagged/coded -4 SCB. If a calculated value is negative, it is rejected and all measured components are marked suspect. If additional information on MDL’s or missing, suspect, or rejected data is needed, contact the Research Coordinator at the Reserve submitting the data.

**Note 1:** The way below MDL values are handled in the NERRS SWMP dataset was changed in November of 2011. Previously, below MDL data from 2007-2010 were also flagged/coded, but either reported as the measured value or a blank cell. Any 2007-2011 nutrient/pigment data downloaded from the CDMO prior to November of 2011 will reflect this difference.

NERRS SOP allows nutrient samples to be held for up to 28 days (CHLA for 30 days) at -20°C, plus allows for up to 5 days for collecting, processing, and shipping samples. Samples held beyond that time period are flagged suspect and coded CHB. The sample hold times for 2018 are listed below. The NAs reported in the sample hold time tables represent missing and/or optional parameters that were not collected.

***Sample Holding Times***

The FDEP Laboratory follows the EPA preservation and holding times (published in 40 CFR Part 136.3). NO2, NO3, and PO4 are preserved at 4°C (wet ice) and have holding times of 48 hours. Samples that are shipped overnight from the field on the day of collection are almost always received in time for analysis without concerns for expirations. Diel samples are processed immediately upon receiving due to the expiring hold times. The first diel sample is almost always received beyond its sample hold time for NO2, NO3 and PO4. These samples are flagged 1 CHB, but unless otherwise noted were still processed within allowable NERRS hold times.

1. **See Metadata (CSM)**

July 2017

1. GTMDSNUT
   1. Suspect FECCOL on 07/20/2017 8:35; Results based on colony counts outside acceptable range.
2. GTMDNNUT
   1. Suspect FECCOL on 07/20/2017 8:42; Results based on colony counts outside acceptable range.
3. GTMGRNUT
   1. Suspect FECCOL on 07/20/2017 09:15; Results based on colony counts outside acceptable range.
4. GTMOLNUT
   1. Suspect FECCOL on 07/20/2017 10:05; Results based on colony counts outside acceptable range.