Applied Ecology, Inc.
2200 Front Street, Suite 300
Melbourne, FL 32901
o. 321-499-3336

# Weekly Indian River Lagoon Harmful Algal Bloom Observations

## Project Summary

| Report Date | Project Name | Prepared By |
|---|---|---|
| May 30th to June 5th, 2022 | Florida Department of Environmental Protection Grant INVO14: Remote Sensing of Harmful Algal Blooms in the Indian River Lagoon and Connected Waterways in Brevard County | Andrew Kamerosky, Iulia Bibire |

## Status Summary

### Available Sentinel 2 and 3 Imagery

The availability and usability of satellite imagery is contingent upon both the satellite being overhead and low cloud cover. The orbits of the Sentinel satellites will on occasion cover a portion of the Indian River Lagoon. Likewise cloud cover can also result in only portions of the Indian River Lagoon (IRL) being visible.

**Table 1** below lists the availability of Sentinel imagery and its usability for Harmful Algal Bloom (HAB) analysis.

**Table 1. Sentinel-2 and 3 imagery availability for May 30th – Jun 5th 2022**

**N - Imagery Not available**

**Y - C – Imagery Available, Cannot Use Due To Cloud Cover**

**Y - P – Imagery Available, Only Partial Imagery of IRL**

**Y - G – Imagery Available, No Issues Over The IRL**

| Date | S2 - A | S2 - B | S3 - A | S3 - B |
|---|---|---|---|---|
| 30-May-22 | Y - P | N | Y - C | N |
| 31-May-22 | N | N | N | Y - G |
| 01-June-22 | N | N | N | Y - C |
| 02-June-22 | Y - C | N | Y - G | N |
| 03-June-22 | N | N | N | N |
| 04-June-22 | N | N | N | Y - C |
| 05-June-22 | N | N | Y - C | Y - C |

## Summary of Harmful Algal Bloom (HAB) Activity

There was no HAB activity detected across the lagoon for the week of May 30th to June 5th, 2022. The St. John River Water Management District (SJRWMD) Continuous Monitoring (CM) station IRLI21 had a decreasing trend in Relative Fluorescence Units (RFU) from the previous week with values of 27.4 on May 30th to 5.1 on June 1st (**Figure 1**, **Table 2**).

Current and historical data are added to the SJRWMD's database continuously; subsequent visits may reflect such additions or revisions. SJRWMD provides no warranty as to the accuracy, reliability, or completeness of these data.

**Figure 1 – St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring Station Relative Chlorophyll A (ChlA) readings from May 30th to June 5th, 2022.**

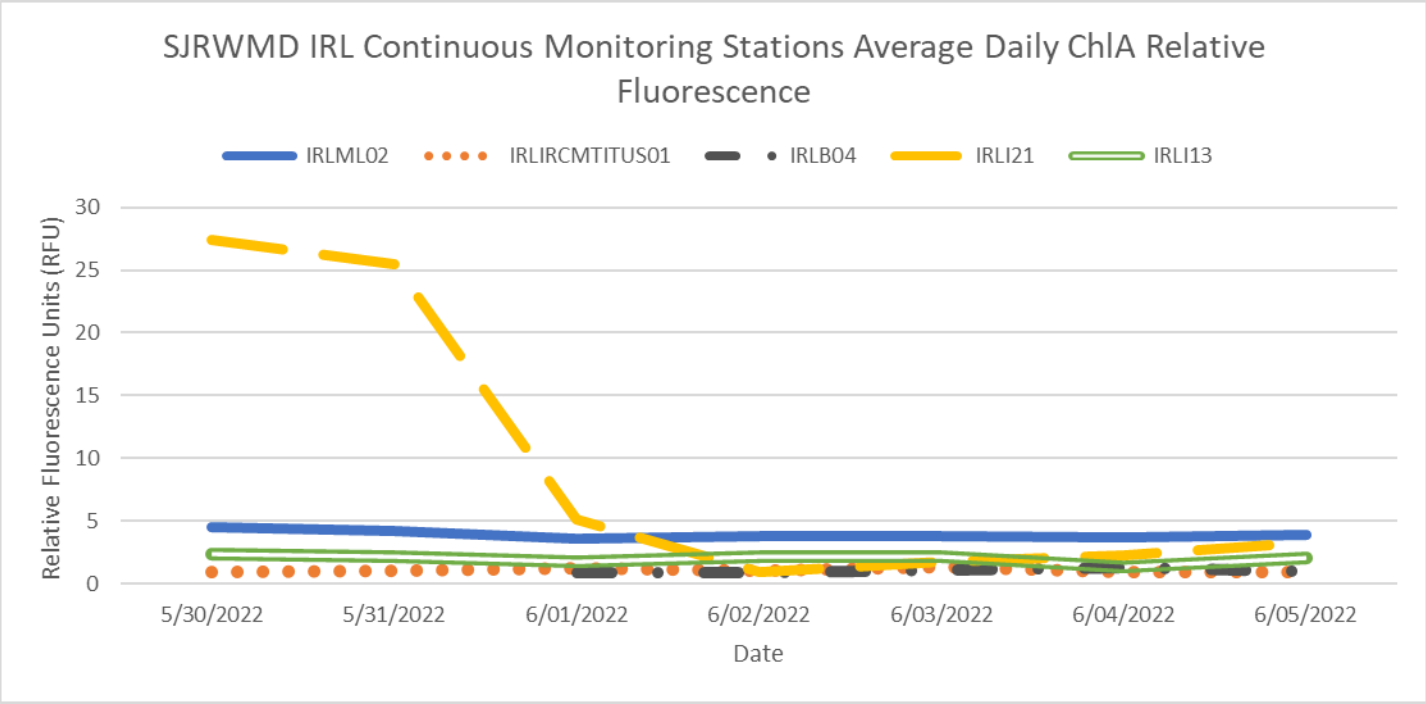



**Table 2 - St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring Station Chlorophyll A (ChlA) Relative Fluorescence averages from May 30th to June 5th, 2022.**

| Date | IRLML02 | IRLIRCMTITUS01 | IRLB04 | IRLI21 | IRLI13 |
|---|---|---|---|---|---|
| 30-May | 4.5 | 0.9 | | 27.4 | 2.4 |
| 31-May | 4.2 | 1.0 | | 25.4 | 2.2 |
| 01-June | 3.6 | 1.3 | 0.9 | 5.1 | 1.8 |
| 02-June | 3.8 | 1.1 | 0.9 | 1.0 | 2.2 |
| 03-June | 3.8 | 1.3 | 1.1 | 1.7 | 2.2 |
| 04-June | 3.8 | 0.9 | 1.3 | 2.3 | 1.3 |
| 05-June | 3.9 | 1.0 | 1.0 | 3.3 | 2.1 |

HAB's observed by this project are defined as over 80 Micrograms/Liter (µg/L) Chlorophyll A (ChlA) (as estimated by a calibrated Normalized Difference Chlorophyll Index (NDCI)) and persistent across the week in review. The algorithms that transform the NDCI index value to estimated ChlA concentrations were developed using a second order polynomial equation. The Sentinel 2 equation has a Root Square ($R^2$) of 0.81 with a Root Mean Square Error (RMSE) of 14.14 ug/L of ChlA. The Sentinel 3 equation has an $R^2$ of 0.92 and a RMSE of 9.92 ug/L ChlA. The RMSE is a measure of the accuracy of a model in estimating values, ChlA in this instance, where a lower value is indicative of higher accuracy. It does not identify if the model consistently over or underestimates the modeled values. The equations are below:

- S2 Estimated ChlA = $297.36(\mathrm{NDCI})^2 + 313.98(\mathrm{NDCI}) + 36.152$
- S3 Estimated ChlA = $437.07(\mathrm{NDCI})^2 + 348.98(\mathrm{NDCI}) + 33.928$

Due to the high cloud coverage over the IRL during the past week, only 3 Sentinel scenes were usable for the detection of HAB activity. Of these, the Sentinel 3B imagery from May 31st and Sentinel 3A imagery from June 2nd were selected for further analysis due to lowest cloud cover over the lagoon.

The highest mean estimated ChlA concentration observed on May 31st using Sentinel 3B imagery was of 18.5 µg/L and occurred at station IRLI13 (**Table 3**). On June 2nd the highest mean ChlA concentration was observed at the Titusville station with a value of 26.9 µg/L using Sentinel 3A imagery (**Table 4**). Satellite imagery portrayed a similar decreasing trend as that observed at station IRLI21 by the SJRWMD continuous monitoring, with an estimated mean ChlA concentration of 12.9 µg/L at the start of the week (using Sentinel 3B imagery from May 31st) and 6.7 µg/L a few days later on June 2nd (using Sentinel 3A imagery) (**Table 3**, **Table 4**).

There are several areas throughout the IRL which continue to have high estimated ChlA which correspond with shallow locations that likely have Submerged Aquatic Vegetation (SAV) or emergent vegetation. These locations will be evaluated and determined if they can be filtered out for the high estimated ChlA not being caused by algae.

**Table 3. Sentinel 3B estimated Chlorophyll A (ChlA) statistics in Micrograms/Lter (ug/L) for May 31, 2022, over the St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring Stations.**

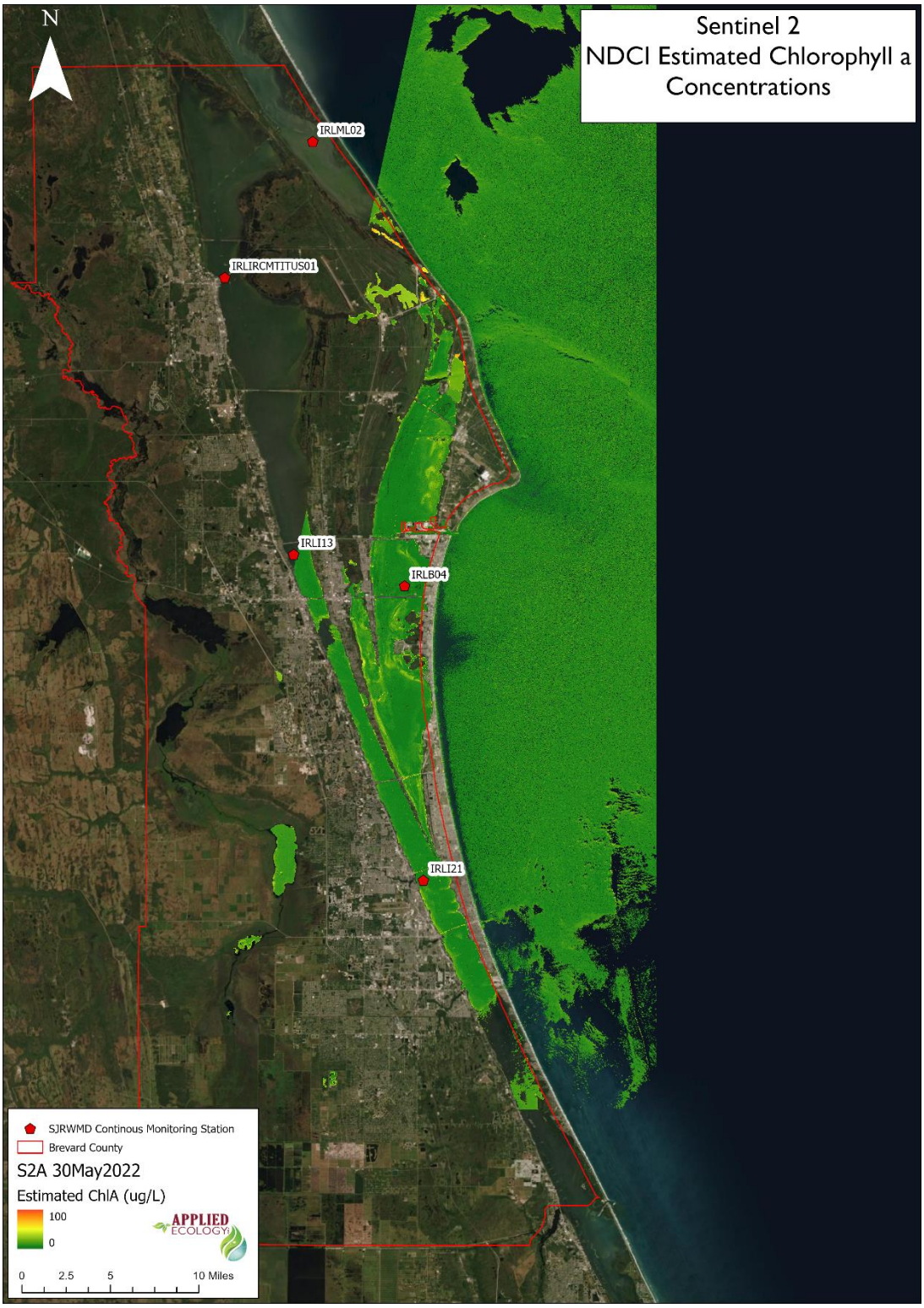
| Station | Min ChlA | Max ChlA | Mean ChlA |
|---|---|---|---|
| IRLB04 | 1.6 | 20.4 | 8.6 |
| IRLI13 | 10.7 | 40.8 | 18.5 |
| IRLML02 | 14.9 | 18.2 | 16.4 |
| IRLTITUS | 9.9 | 17.8 | 13.7 |
| IRLI21 | 12.2 | 13.2 | 12.9 |

**Table 4. Sentinel 3A estimated Chlorophyll A (ChlA) statistics in Micrograms/Liter (µg/L) for June 2, 2022, over the St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring stations.**

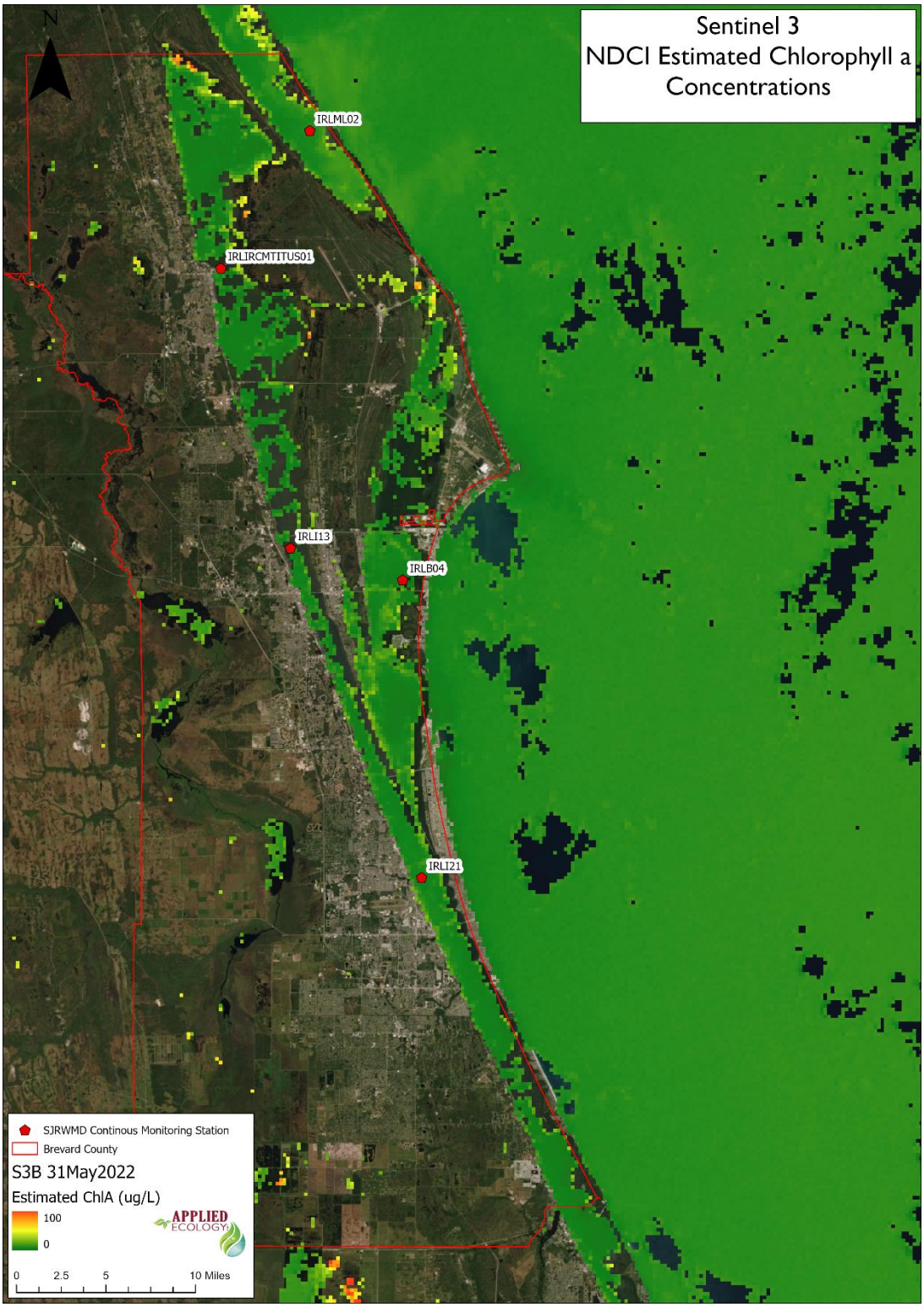
| Station | Min ChlA | Max ChlA | Mean ChlA |
|---|---|---|---|
| IRLB04 | 0.8 | 3.4 | 2.5 |
| IRLI13 | 1.7 | 8.8 | 3.6 |
| IRLML02 | 5.0 | 6.0 | 5.5 |
| IRLTITUS | 26.0 | 27.8 | 26.9 |
| IRLI21 | 0.0 | 18.4 | 6.7 |

## Processed Imagery

### 30 May 2022- Sentinel 2A



## 31 May 2022- Sentinel 3B



## 02 June 2022- Sentinel 3A