



# Weekly Indian River Lagoon Harmful Algal Bloom Observations

## Project Summary

Report Date	Project Name	Prepared By
May 23rd to 29th, 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 Kameronosky, 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 23<sup>rd</sup> – 29<sup>th</sup> 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**

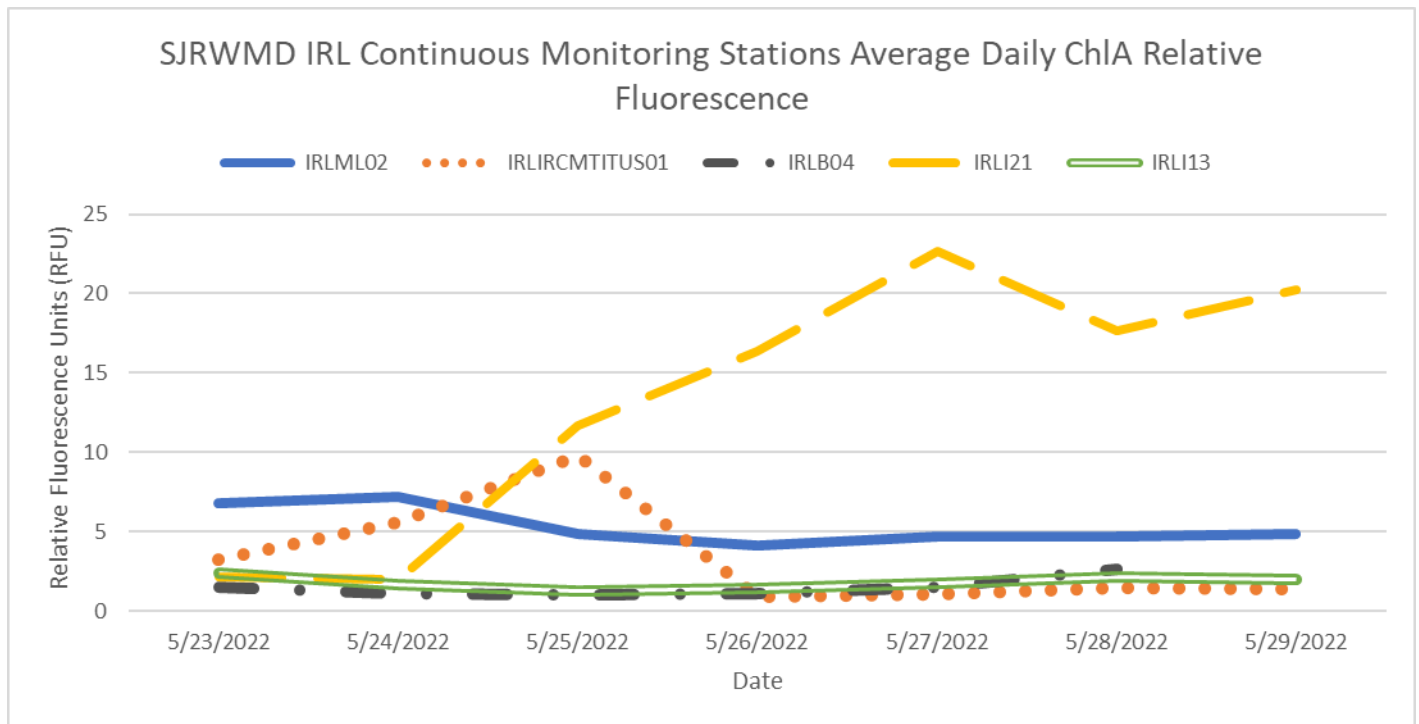
Date	S2 - A	S2 - B	S3 - A	S3 - B
23-May-22	Y - C	N	N	Y - C
24-May-22	N	N	N	Y - G
25-May-22	N	Y - P	Y - G	N
26-May-22	N	N	Y - C	N
27-May-22	N	N	N	Y - C
28-May-22	N	Y - C	N	Y - C
29-May-22	N	N	Y - G	N

### Summary of Harmful Algal Bloom (HAB) Activity

There was no HAB activity detected across the lagoon for the week of May 23<sup>rd</sup> to 29<sup>th</sup>, 2022. The St. John River Water Management District (SJRWMD) Continuous Monitoring (CM) station IRLI21 had an increasing trend in Relative Fluorescence Units (RFU) from 2.0 on May 24<sup>th</sup> to 22.6 on May 27<sup>th</sup> (**Figure 1, Table 2**). The IRLIRCMTITUS01 station also had an increase in RFUs from 3.2 on May 23<sup>rd</sup> to 9.8 on May 25<sup>th</sup>, however the next day it dropped to 0.9. IRLI13 which is between these two stations did not show any increases in RFU, suggesting this may have been two localized events.

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 (ChIA) readings from May 23<sup>rd</sup> to 29<sup>th</sup>, 2022.**



**Table 2 - St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring Station Chlorophyll A (ChIA) Relative Fluorescence averages from May 23<sup>rd</sup> to 29<sup>th</sup>, 2022.**

Date	IRLML02	IRLIRCMTITUS01	IRLB04	IRLI21	IRLI13
23-May	6.8	3.2	1.5	2.1	2.4
24-May	7.2	5.6	1.1	2.0	1.7
25-May	4.9	9.8	1.0	11.7	1.3
26-May	4.1	0.9	1.1	16.4	1.4
27-May	4.6	1.1	1.5	22.6	1.7
28-May	4.7	1.5	2.6	17.7	2.1
29-May	4.8	1.3		20.2	2.0

HAB's observed by this project are defined as over 80 Micrograms/Liter ( $\mu\text{g/L}$ ) Chlorophyll A (ChIA) (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 ChIA 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  $\mu\text{g/L}$  of ChIA. The Sentinel 3 equation has an  $R^2$  of 0.92 and a RMSE of 9.92  $\mu\text{g/L}$  ChIA. The RMSE is a measure of the accuracy of a model in estimating values, ChIA 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 ChIA =  $297.36(\text{NDCI})^2 + 313.98(\text{NDCI}) + 36.152$
- S3 Estimated ChIA =  $437.07(\text{NDCI})^2 + 348.98(\text{NDCI}) + 33.928$

Due to the high cloud coverage over the IRL during the past week, only 4 Sentinel scenes were usable for the detection of HAB activity. Of these, the Sentinel 3A imagery from May 25<sup>th</sup> and May 29<sup>th</sup> were selected for further analysis due to lowest cloud cover over the lagoon.

The highest mean estimated ChlA concentration observed on May 25<sup>th</sup> using Sentinel 3A imagery was of 23.2 µg/L and occurred at the Mosquito Lagoon station (**Table 3**). On May 29<sup>th</sup> the highest mean ChlA concentration was observed at station IRLI13 with a value of 14.7 µg/L using Sentinel 3A imagery (**Table 4**). While the SJRWMD monitoring station showed an increase in RFU at IRLI21 towards the end of the week (**Figure 1, Table 2**), this increase is not reflected in the satellite imagery which produced an estimated mean ChlA concentration of 9.4 µg/L on May 25<sup>th</sup> and 8.9 µg/L on May 29<sup>th</sup> using Sentinel 3A imagery (**Table 3, Table 4**). In the area around IRLI21, there was a maximum estimated ChlA concentration of 52.9 µg/L at the mouth of the Eau Gallie River on May 29<sup>th</sup>. This cell was at 34.7 µg/L on May 24<sup>th</sup> and then 15.0 µg/L on May 17<sup>th</sup>. This may be an area of concern and will be further investigated.

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 3A estimated Chlorophyll A (ChlA) statistics in Micrograms/Lter (ug/L) for May 25, 2022, over the St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring Stations.**

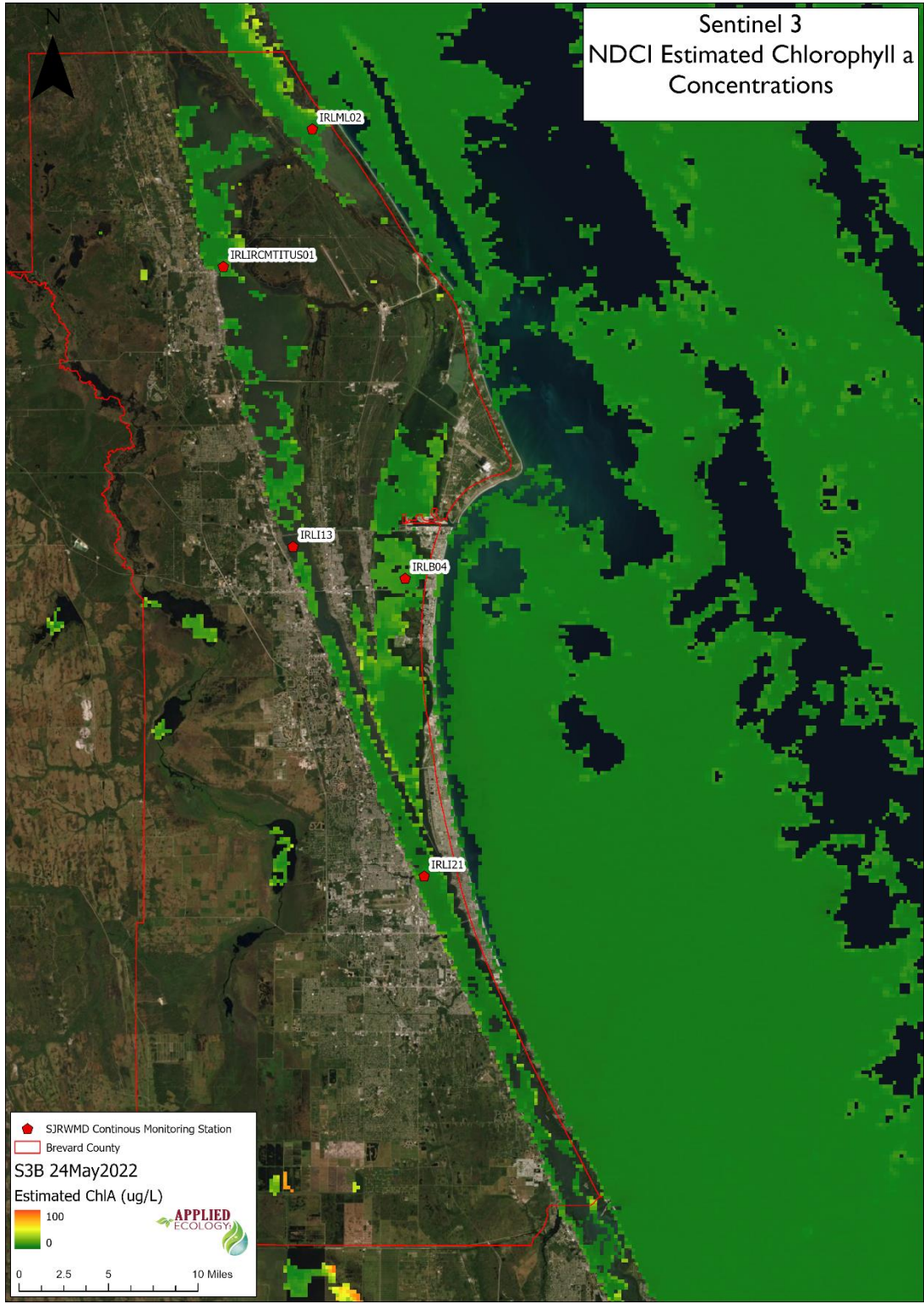
Station	Min ChlA	Max ChlA	Mean ChlA
IRLB04	8.6	11.8	9.8
IRLI13	11.9	27.6	18.6
IRLML02	22.0	24.6	23.2
IRLTITUS	12.2	26.8	18.2
IRLI21	8.7	10.3	9.4

**Table 4. Sentinel 3A estimated Chlorophyll A (ChlA) statistics in Micrograms/Liter (µg/L) for May 29, 2022, over the St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring stations.**

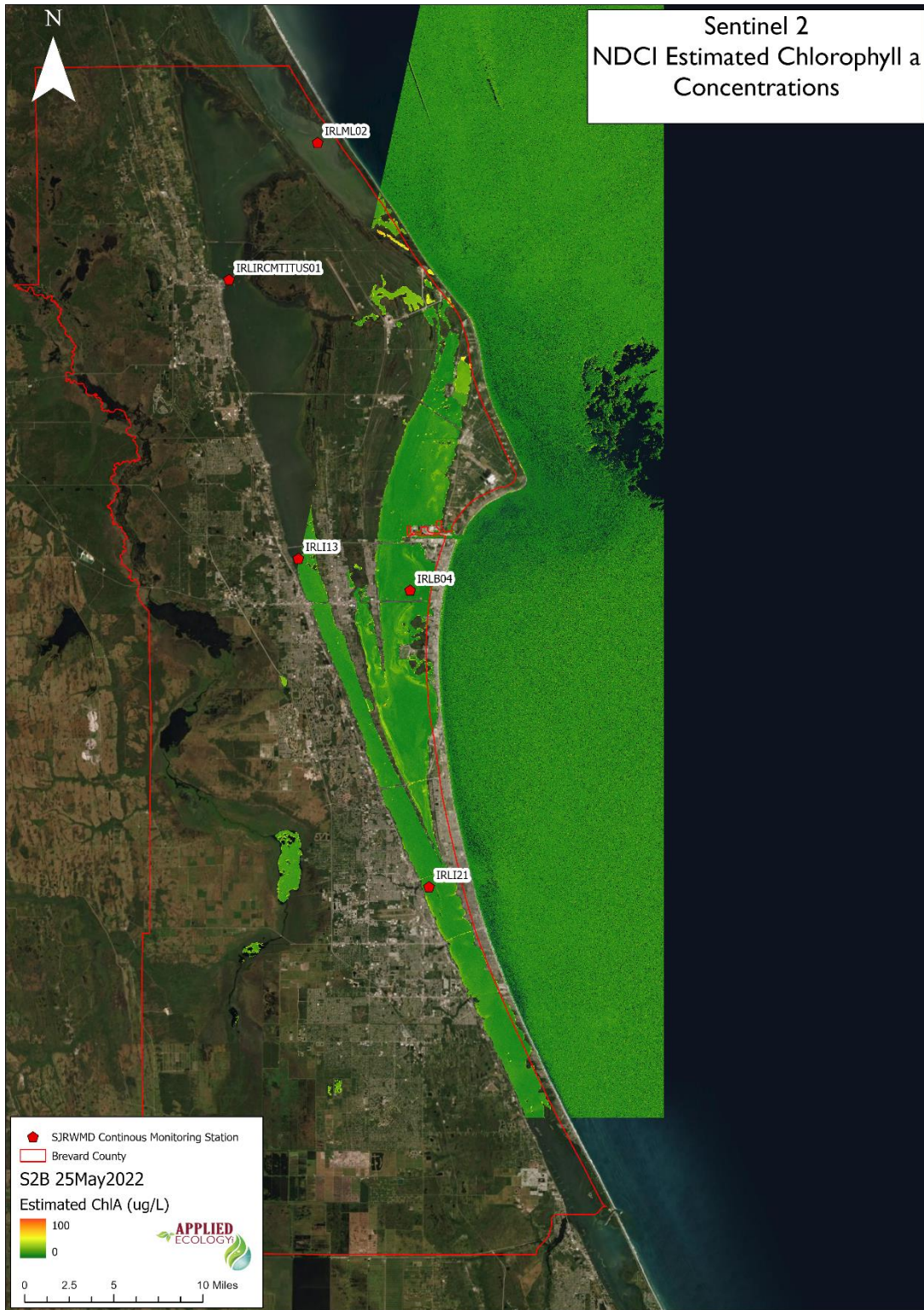
Station	Min ChlA	Max ChlA	Mean ChlA
IRLB04	2.4	6.0	4.1
IRLI13	1.9	52.9	14.7
IRLML02	6.4	9.7	7.7
IRLTITUS	4.6	21.8	10.0
IRLI21	6.1	11.8	8.9

## Processed Imagery

24 May 2022- Sentinel 3B

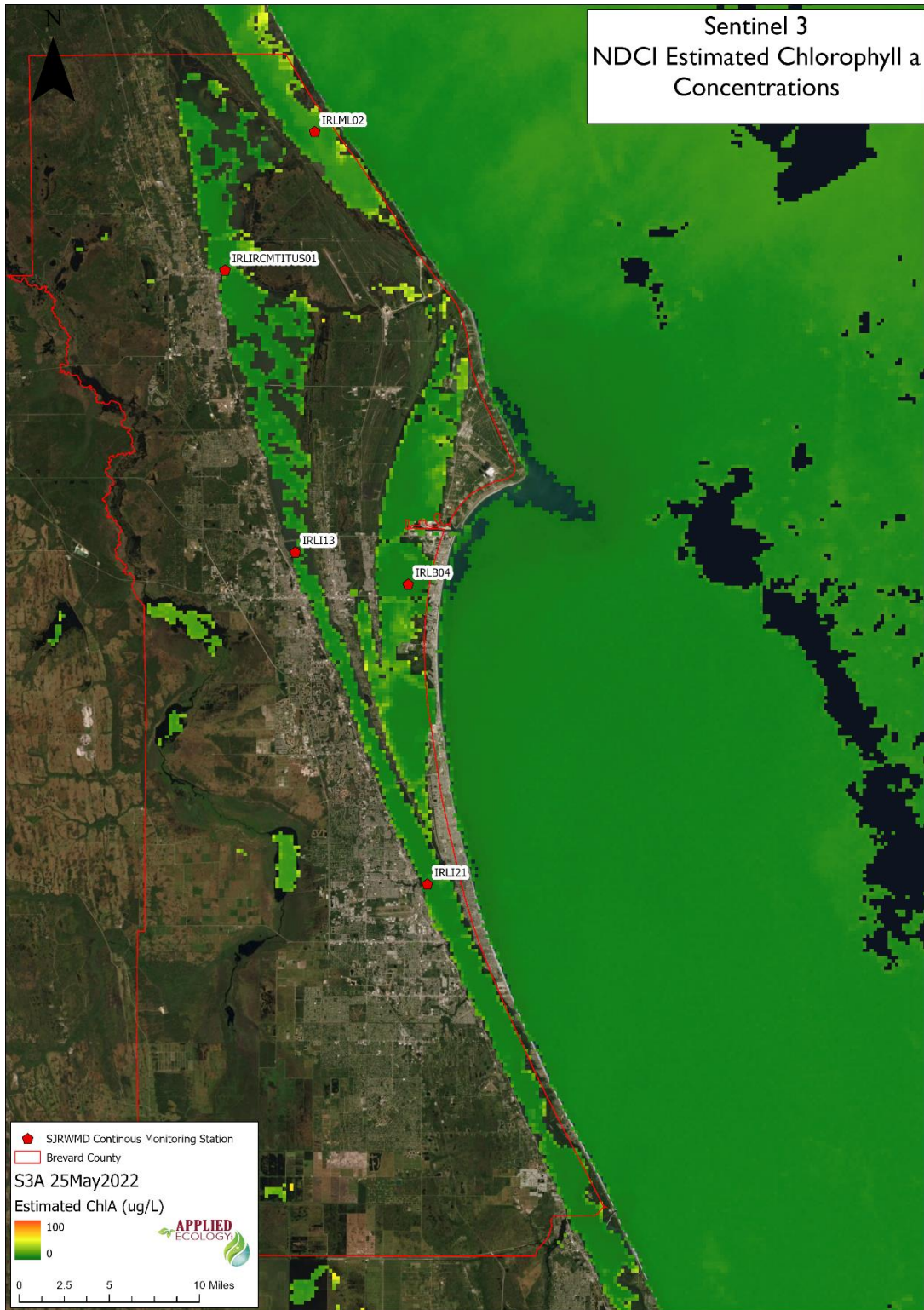


25 May 2022- Sentinel 2B





25 May 2022- Sentinel 3A



29 May 2022- Sentinel 3A

