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Weekly Indian River Lagoon Harmful Algal Bloom Observations

Project Summary

Report Date	Project Name	Prepared By
June 13th to 19th, 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 June 13th – 19th 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
13-June-22	N	N	Y – G	N
14-June-22	N	Y - P	Y - C	N
15-June-22	N	N	N	Y - C
16-June-22	N	N	N	Y – G
17-June-22	N	Y - C	Y – G	N
18-June-22	N	N	Y - C	N
19-June-22	Y - C	N	N	Y - C

Summary of Harmful Algal Bloom (HAB) Activity

There was no HAB activity detected across the lagoon for the week of June 13th to 19th, 2022. The St. John River Water Management District (SJRWMD) Continuous Monitoring (CM) stations showed no values above 7.4 Relative Fluorescence Units (RFU) (**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 June 13th to 19th, 2022.

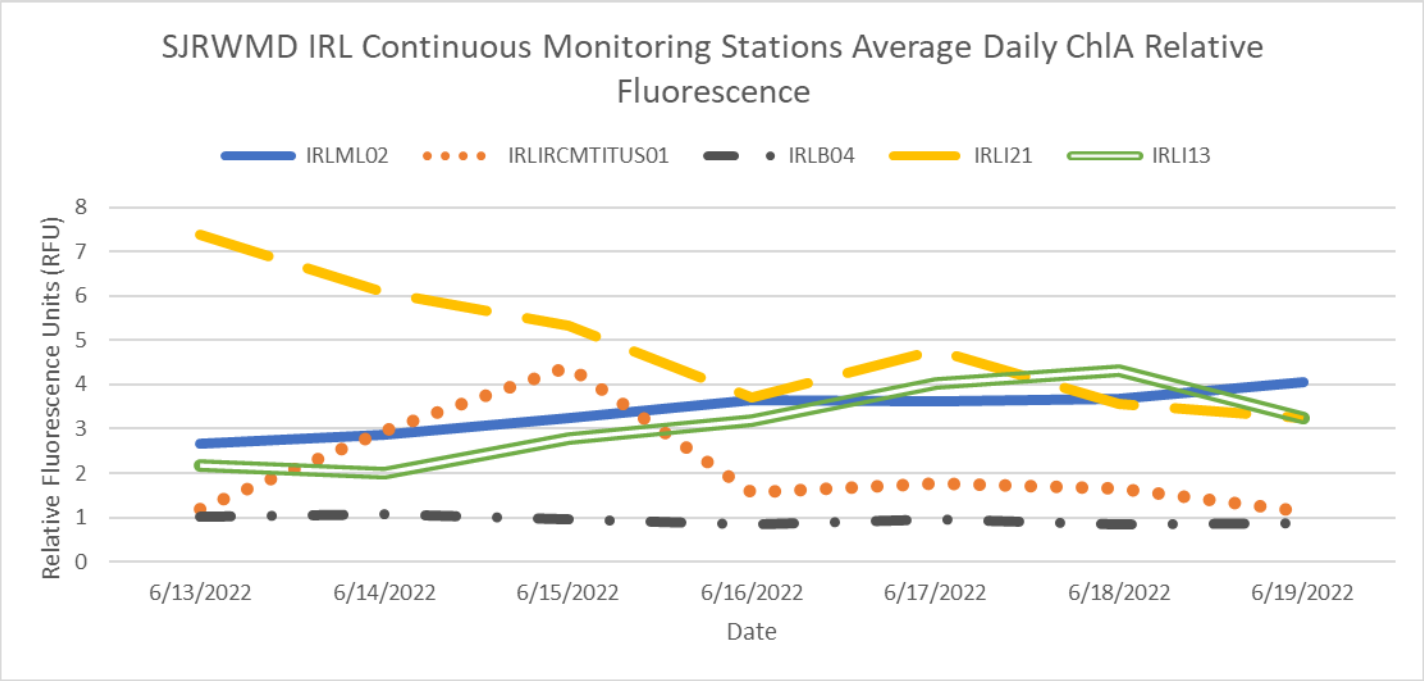


Table 2 - St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring Station Chlorophyll A (ChlA) Relative Fluorescence averages from June 13th to 19th, 2022.

Date	IRLML02	IRLIRCMTITUS01	IRLB04	IRLI21	IRLI13
13-June	2.7	1.2	1.0	7.4	2.2
14-June	2.9	3.0	1.1	6.1	2.0
15-June	3.2	4.4	0.9	5.3	2.8
16-June	3.7	1.6	0.9	3.7	3.2
17-June	3.6	1.8	1.0	4.8	4.0
18-June	3.7	1.7	0.8	3.6	4.3
19-June	4.1	1.1	0.9	3.2	3.2

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 4 Sentinel scenes were usable for the detection of HAB activity. Of these, the Sentinel 3A imagery from June 13th and the Sentinel 3B imagery from June 16th were selected for further analysis due to lowest cloud cover over the lagoon.

The highest mean estimated ChlA concentrations were observed at station IRLI13 on both June 13th using Sentinel 3A imagery and June 16th using Sentinel 3B imagery, with values of 22.7 µg/L and 27.2 µg/L respectively (**Table 3, Table 4**). The decreasing trend in relative fluorescence observed at the SJRWMD IRLI21 monitoring station from June 13th to June 16th is reflected in the Sentinel data which portrayed a decrease in mean ChlA value from 19.5 µg/L on June 13th (using Sentinel 3A imagery) to 11.8 µg/L on June 16th (using Sentinel 3B 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 3A estimated Chlorophyll A (ChlA) statistics in Micrograms/Liter (ug/L) for June 13, 2022, over the St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring Stations.

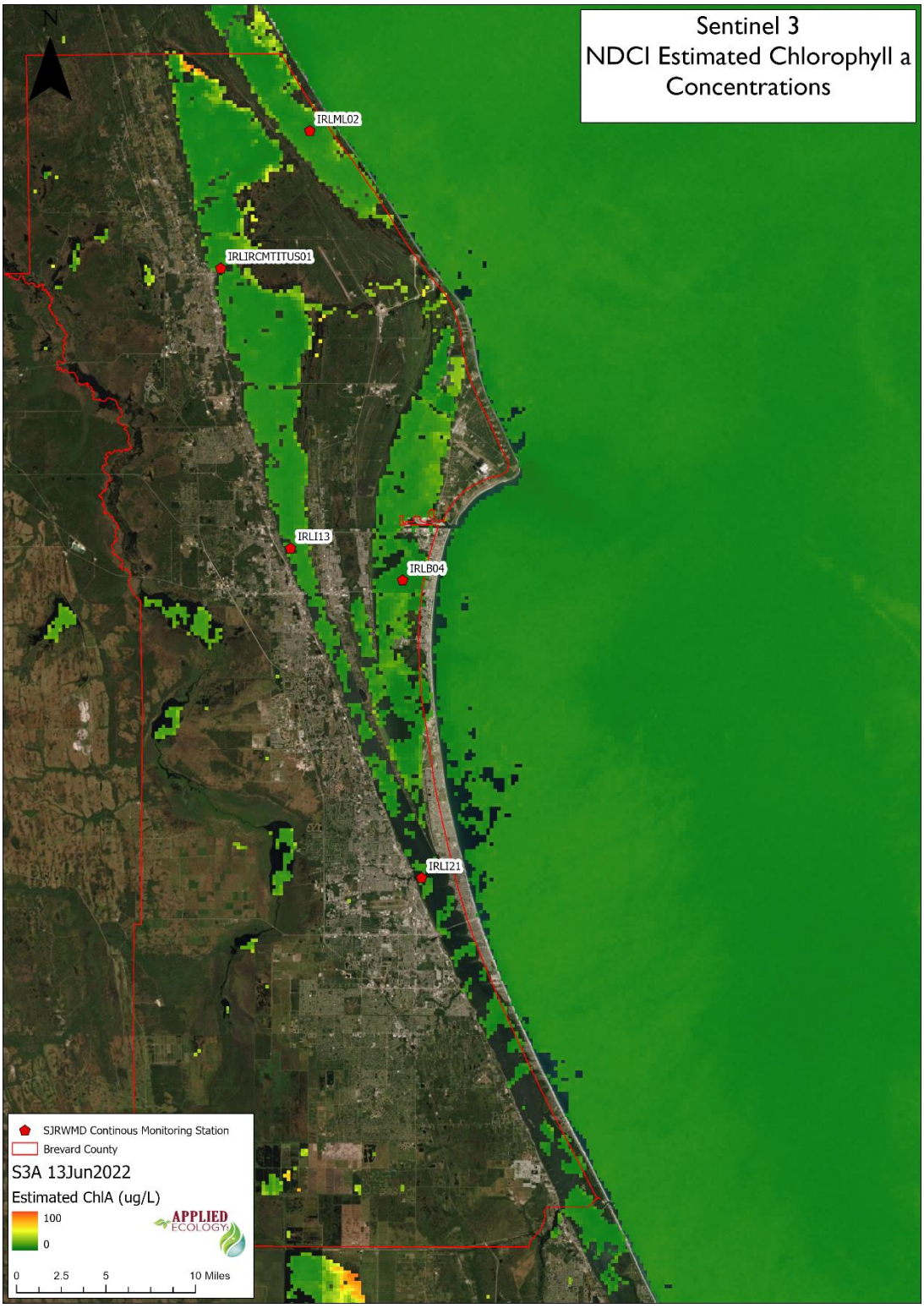
Station	Min ChlA	Max ChlA	Mean ChlA
IRLB04	11.1	15.8	13.9
IRLI13	18.3	32.3	22.7
IRLML02	14.9	17.2	16.4
IRLTITUS	17.3	18.9	18.0
IRLI21	15.3	22.1	19.5

Table 4. Sentinel 3B estimated Chlorophyll A (ChlA) statistics in Micrograms/Liter (µg/L) for June 16, 2022, over the St. John River Water Management District (SJRWMD) Indian River Lagoon (IRL) Continuous Monitoring stations.

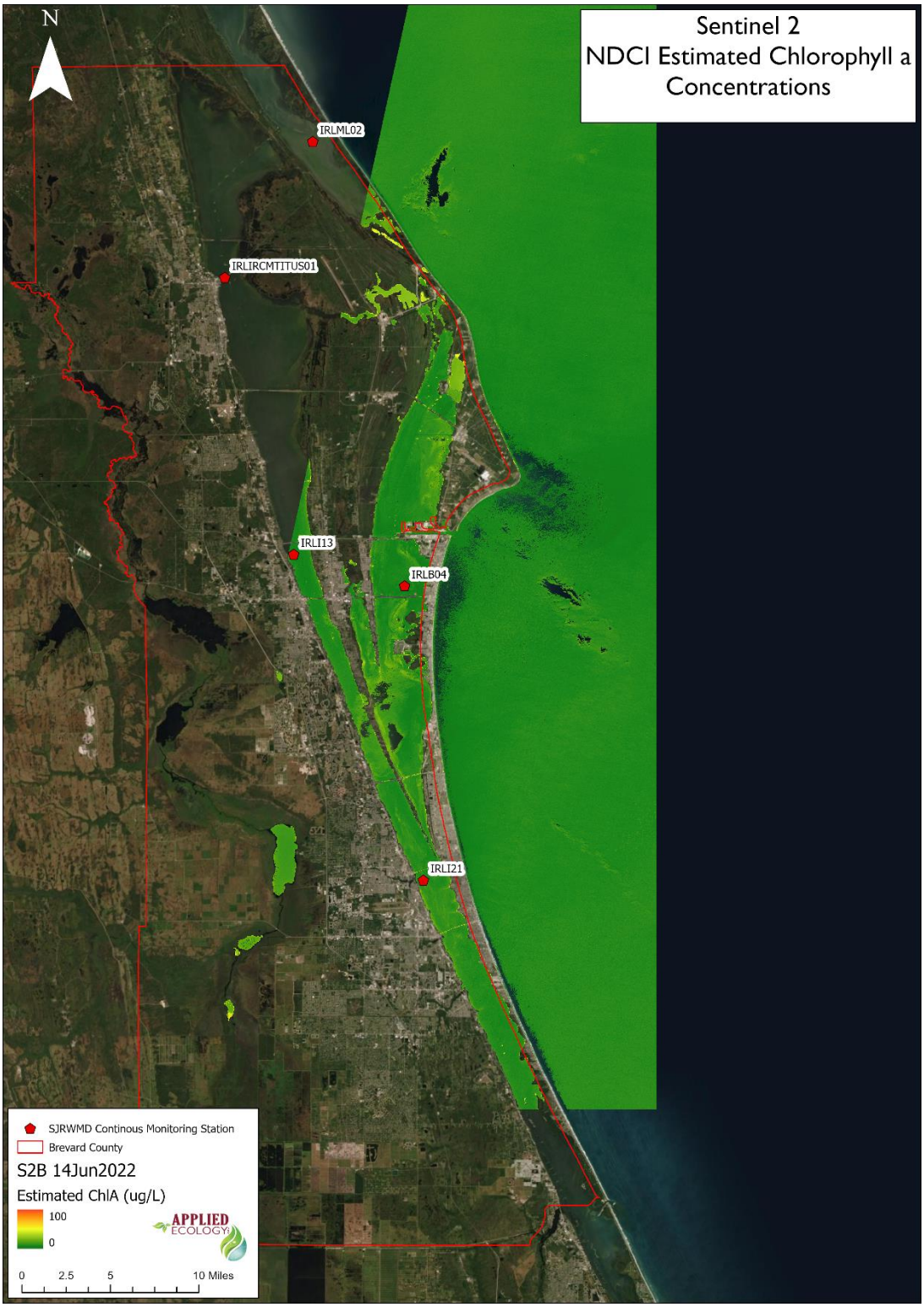
Station	Min ChlA	Max ChlA	Mean ChlA
IRLB04	4.4	7.1	5.7
IRLI13	10.3	43.7	27.2
IRLML02	15.3	16.8	15.9
IRLTITUS	23.7	24.7	24.2
IRLI21	9.9	14.4	11.8

Processed Imagery

13 June 2022- Sentinel 3A



14 June 2022- Sentinel 2B



16 June 2022- Sentinel 3B

17 June 2022- Sentinel 3A