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WESTBROOK RACING

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SPACE SOLUTIONS

Delivery Report

Plastic litter detection and Water Quality Monitoring in Lake Como, Italy

Date: April 30, 2026 | **Client:** ESA/Westbrook Racing

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MONITORING OVERVIEW

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WESTBROOK RACING

JEDDA | LAKE COMO | DUBROVNIK | MONACO | LUANDA | LAGOS | MIAMI | BAHAMAS

6 WEEKS MONITORING PERIOD
16 MARCH
28 APRIL

FLOATING PLASTIC LITTER

TURBIDITY

CHLOROPHYLL

SECCHI DEPTH

HARMFUL ALGAE BLOOM

ANALYSED SCENES 24

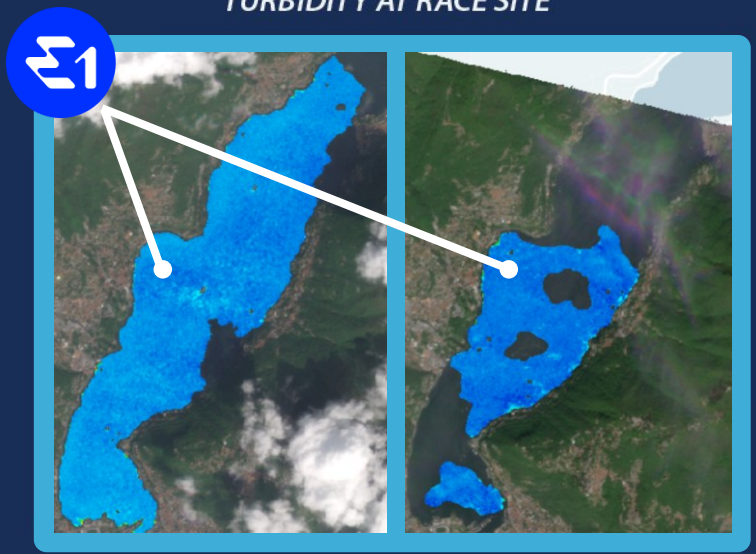
MONITORING RESULTS

0.27 ha
FLOATING PLASTIC LITTER

subsequent analysis indicates submerged vegetated debris instead of plastic litter

BATHING WATER INDEX AT RACE SITE

TURBIDITY AT RACE SITE



20 APRIL *26 APRIL*

TURBIDITY TREND

20 APRIL *26 APRIL*

No clear difference can be observed between turbidity levels before and during the race event.

CONTENTS

1 Location

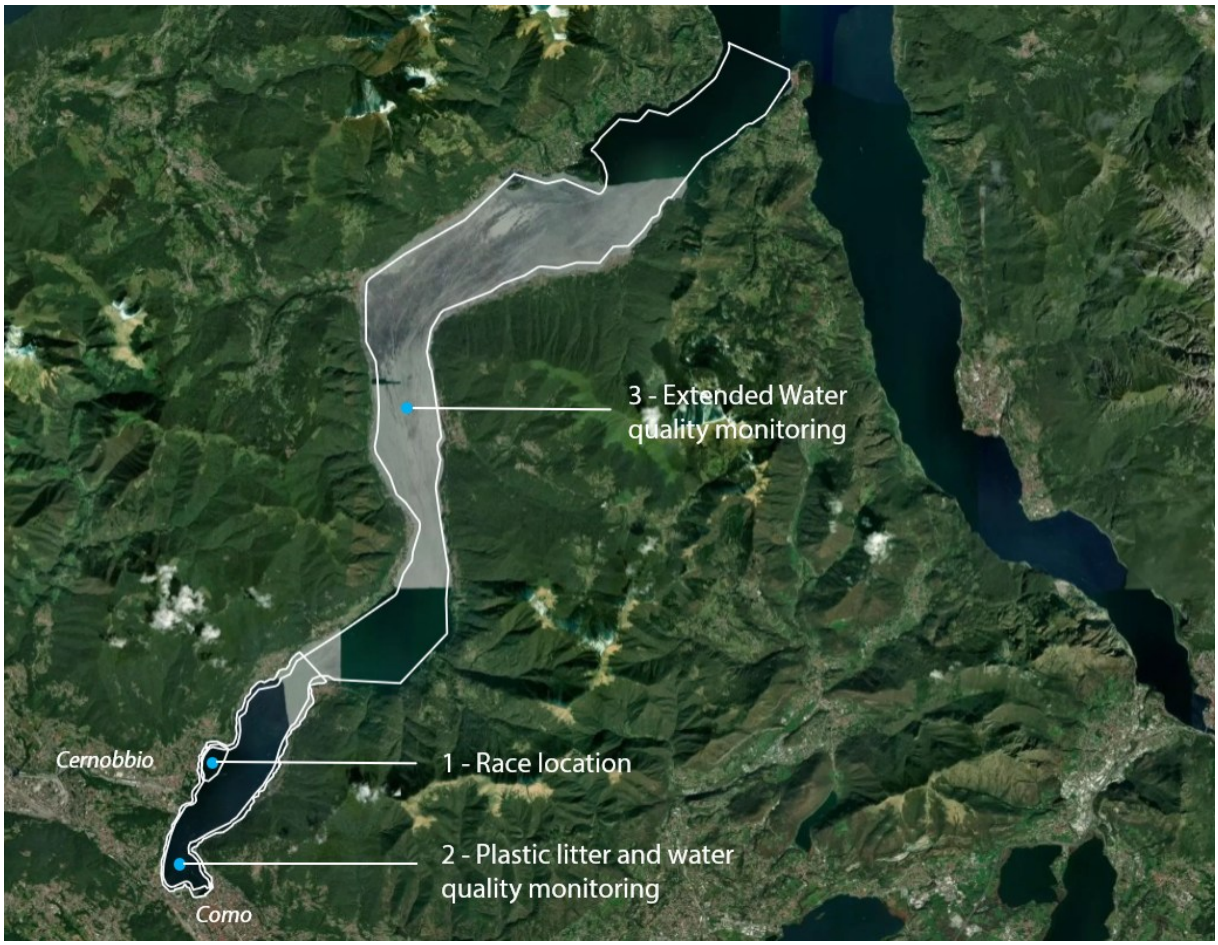


Figure 1: Southern part of Lake Como with marked areas for plastic litter detection, water quality monitoring, and the race course.

The race location is at **Lake Como in Italy**, within the **western basin** of the lake, north of the provincial capital Como.

3 Monitoring sites: The white polygons in Figure 1 indicate the primary race area at the shore of Cernobbio (Race AOI, 1 - Figure 1). Very high-resolution (VHR) monitoring of plastic litter and water quality was conducted in the extended race location between Cernobbio and Como (Como AOI, 2 – Figure 1), as well as across the entire western basin of Lake Como from Como to the confluence of the two lake branches at Bellagio - Griante (Western Basin, 3 - Figure 1), to support extended water quality monitoring and obtain the big picture.

Coordinates of the race location: 45°50'32.8"N, 9°04'59.5"E

2 Data and time frame

Monitoring time frame: 16th March – 28th April 2026

Planet Super Doves: The Planet data have a spatial resolution of 3m (VHR) and a daily repetition rate. The data was used for plastic litter and water quality monitoring in the Cernobbio AOI Como to the North of Cernobbio.

Sentinel-2 and Landsat-8/9: Sentinel-2 data have a spatial resolution of 10 m and a revisit frequency of 3 to 5 days and are distributed through the European Copernicus Service. Landsat-8 and Landsat-9 data, provided by NOAA, have a spatial resolution of 30 m and a combined revisit time of approximately 8 days. These datasets were used for water quality monitoring across the Western Basin AOI.

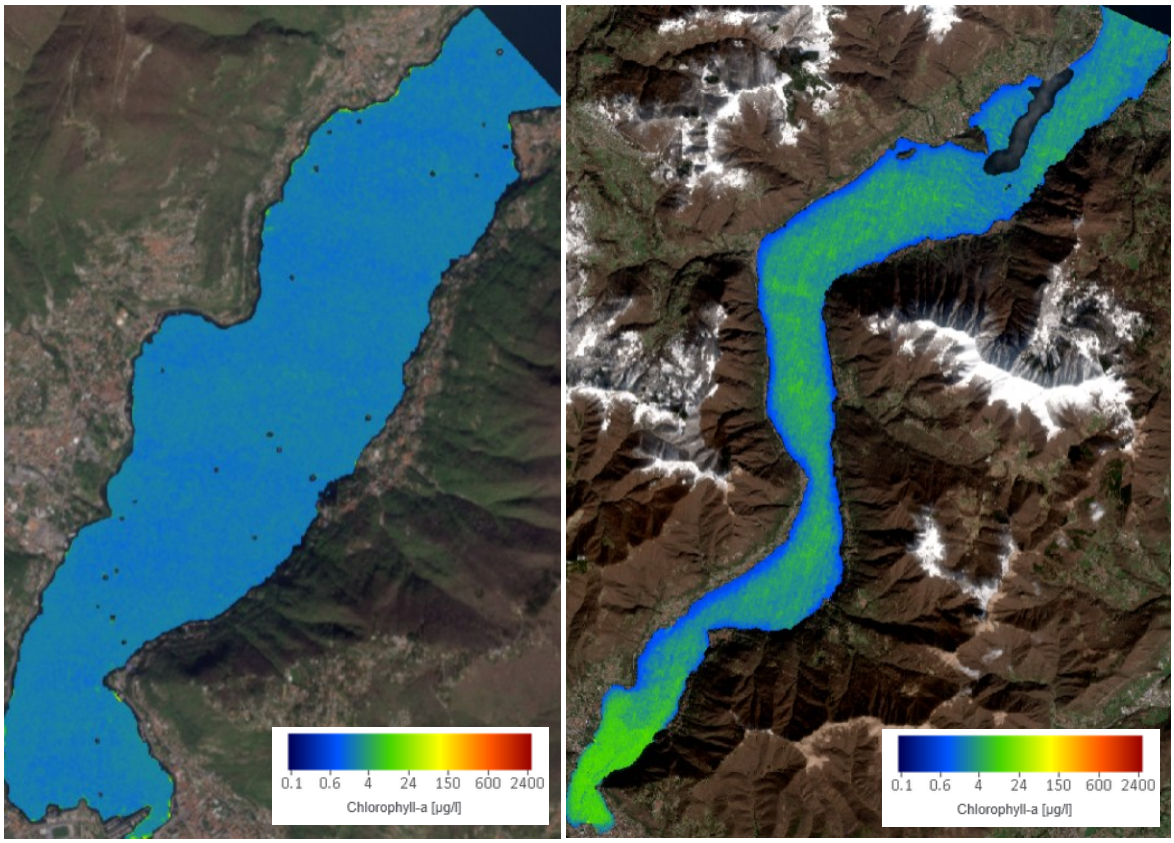


Figure 2: Left: Planet scene from 6th April 2026, 10:48 (UCP) in the core monitoring area for plastic litter and water quality with the Chlorophyll product laid on top of the imagery. Right: Sentinel-2 scene from 16th March 2026, 10:28 (UCP) with the Chlorophyll product laid on top of the Southwestern part of Lake Como in the extended monitoring region.

Table 1 shows the collected satellite data scenes at Lake Como.

Table 1: Collected scenes for the race location at Lake Como

Sensor	Date, Time (UCP)	Sensor	Date, Time (UCP)
Planet Super Dove	24.03.2026, 10:54	Sentinel-2/ Landsat-8/9	24.02.2026, 10:28
	31.03.2026, 10:49		16.03.2026, 10:28
	03.04.2026, 10:17		31.03.2026, 10:28
	04.04.2026, 10:54		02.04.2026, 10:28
	06.04.2026, 10:48		05.04.2026, 10:28
	07.04.2026, 10:22		15.04.2026, 10:28
	09.04.2026, 11:11		20.04.2026, 10:28
	11.04.2026, 10:51		25.04.2026, 10:28
	17.04.2026, 10:57		26.04.2026, 10:28

Sensor	Date, Time (UCP)	Sensor	Date, Time (UCP)
Planet Super Dove	19.04.2026, 10:51		
	20.04.2026, 10:20		
	23.04.2026, 10:19		
	24.04.2026, 10:51		
	25.04.2026, 10:18		
	26.04.2026, 10:58		

3 Plastic litter detection

Plastic litter detection was conducted within the Como AOI (Figure 1 – number 2) and is based on Planet data. Across most of the analysed time steps no plastic litter detections were identified - indicated by the blue dots at the 0-axis in Figure 3. **A single detection** was found on 3rd April 2026, represented by the blue dot above the 0-axis. The corresponding area is outlined by the red polygon in Figure 4. Detailed spectral analysis of this object suggests, with high probability, that the detected signal originates from submerged debris, predominantly **composed of vegetated material**. Consequently, it is highly likely that this polygon does not represent plastic litter.

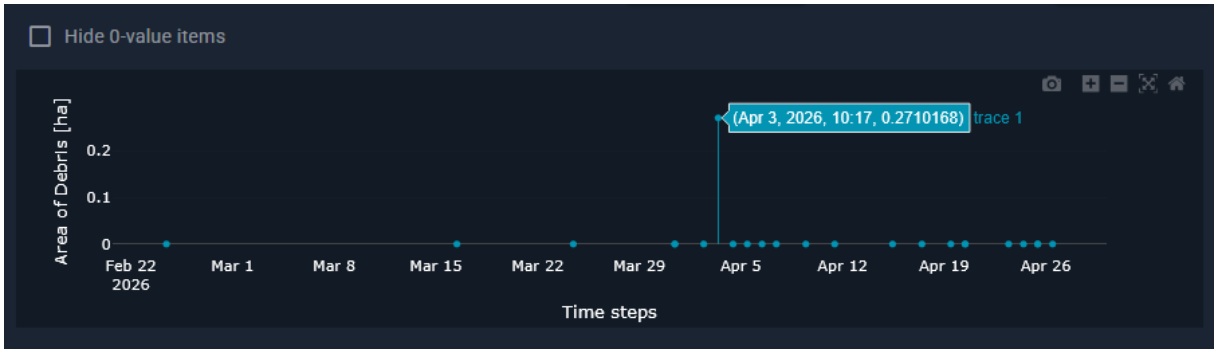


Figure 3: Plastic litter statistic across the monitoring time series.

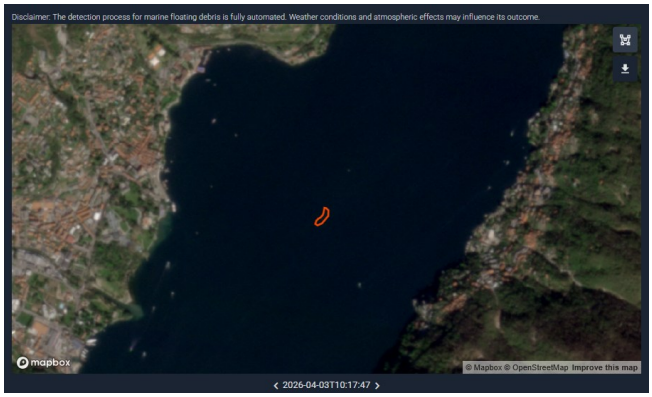


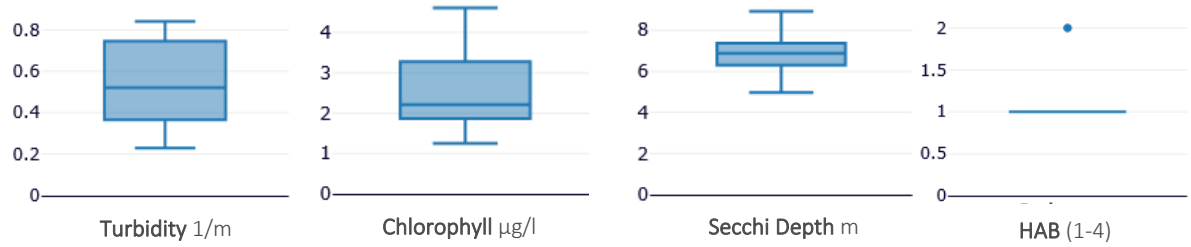
Figure 4: Identified detection from 3rd April 2026 indicated by a red polygon.

4 Water quality monitoring

Water quality monitoring was conducted in all three AOIs. While Planet satellite data are available only for the Race and Como AOIs, Sentinel-2 and Landsat-8/9 data cover the entire Western Basin AOI. For all time steps, the parameters chlorophyll (algae), turbidity, depth of visibility (Secchi Depth), and the Harmful Algal Bloom (HAB) indicator were derived.

RESULTS

Boxplot diagrams for the Como AOI (2 in Figure 1) for the 4 parameters indicate a **high fluctuation for turbidity and chlorophyll**.



The four plots below present the temporal evolution of these parameters over the full monitoring period. Each plot shows three different spatial aggregations representing the three monitoring AOIs Race, Como and Western Basin. For each aggregation, the median pixel value of all pixels within the corresponding AOI was calculated.

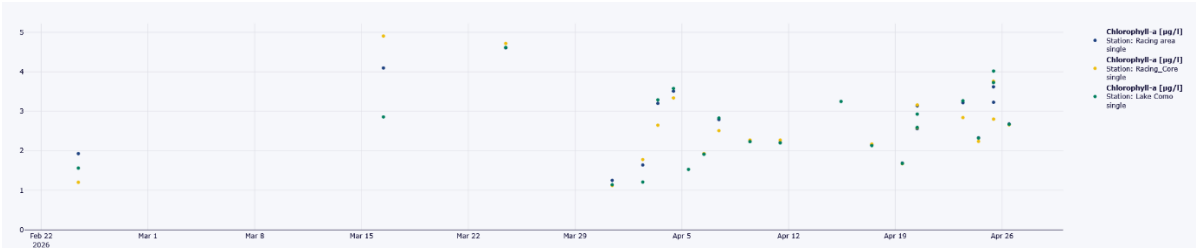


Figure 5: Time series plot for Chlorophyll aggregating the measurements for the southern part of the western basin and the entire western basin.

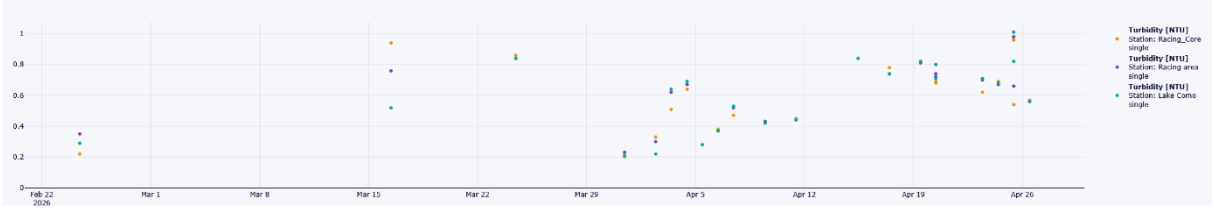


Figure 6: Time series plot for Turbidity aggregating the measurements for the southern part of the western basin and the entire western basin.

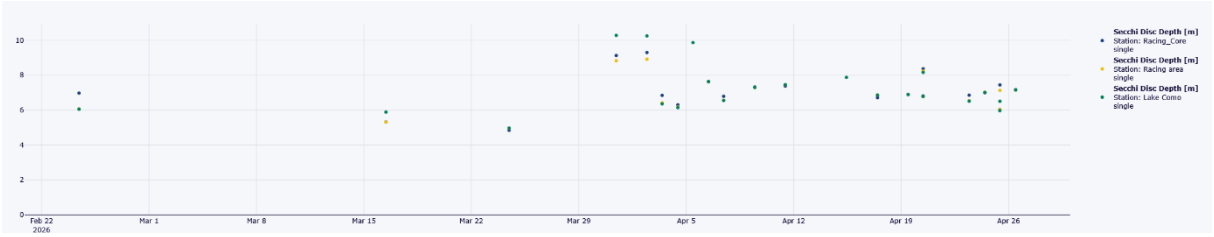


Figure 7: Time series plot for depth of visibility (Secchi-Depth) aggregating the measurements for the southern part of the western basin and the entire western basin.

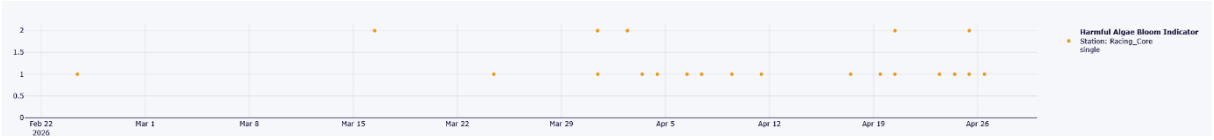


Figure 8: Time series plot for Harmful Algae Bloom Indicator aggregating the measurements for the southern part of the western basin and the entire western basin.

MAPS - Single scene examples

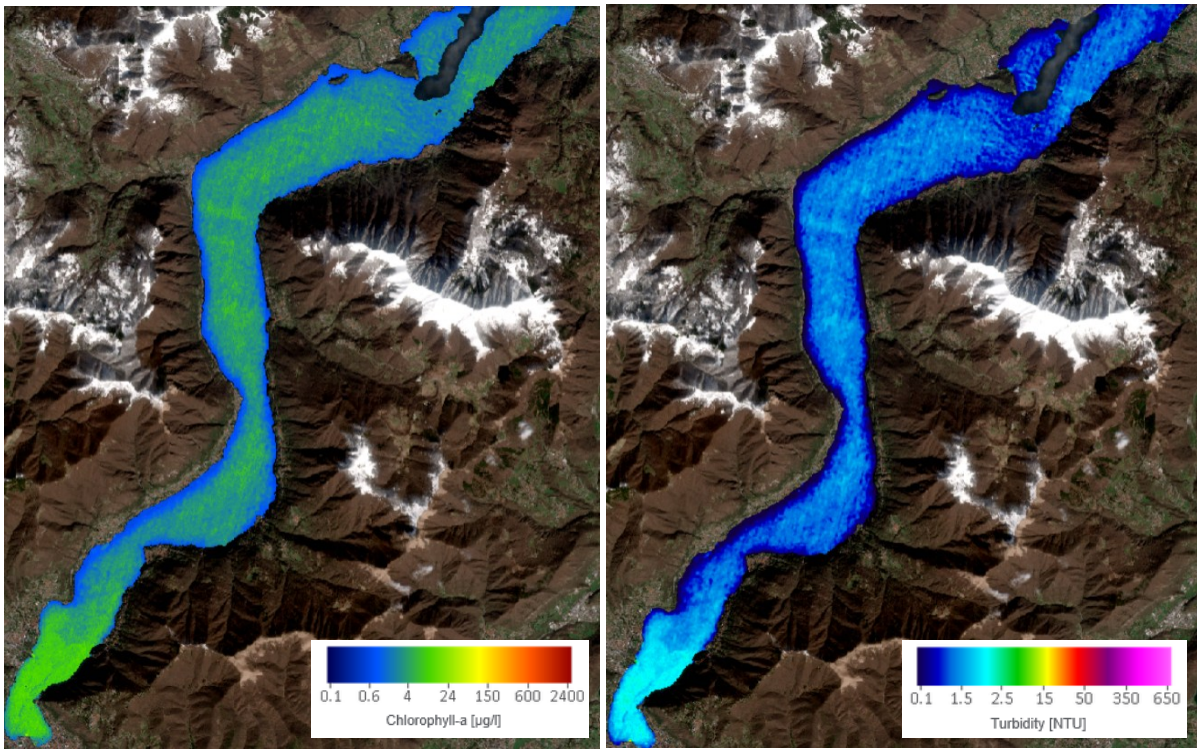


Figure 9: Chlorophyll (left) and turbidity (right) measurements from 16th March 2026. On that day, elevated values were registered for the southern part around Como

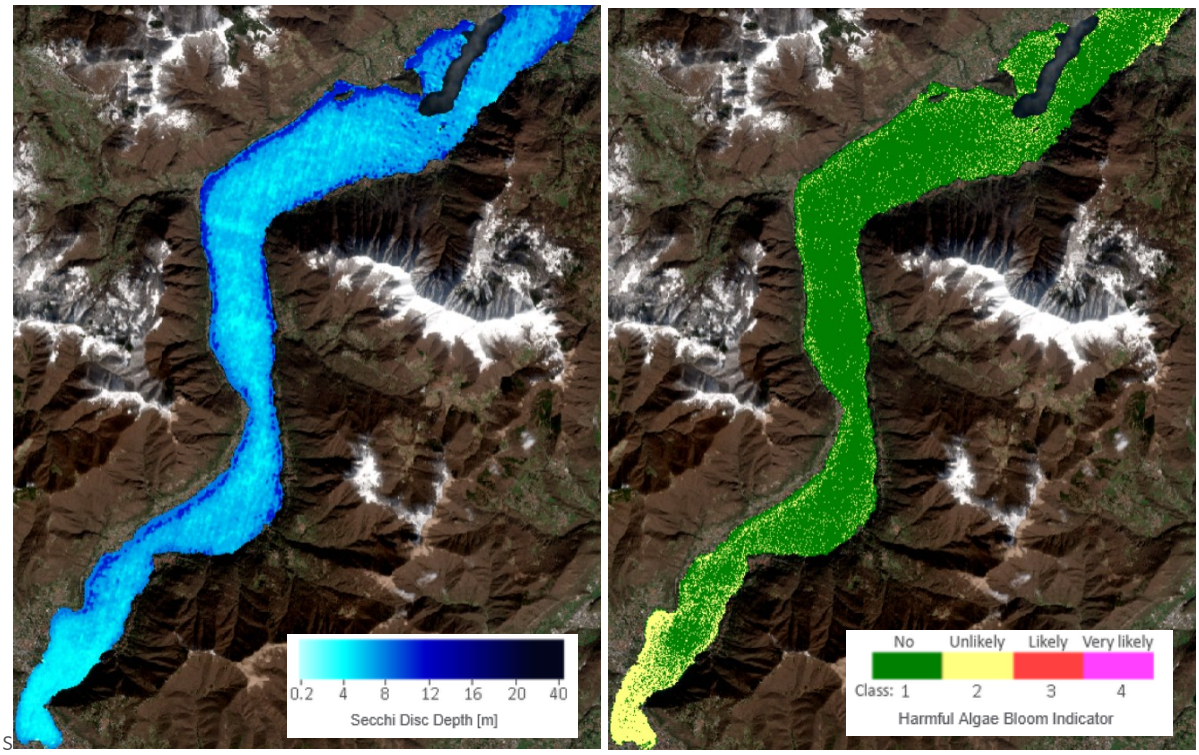
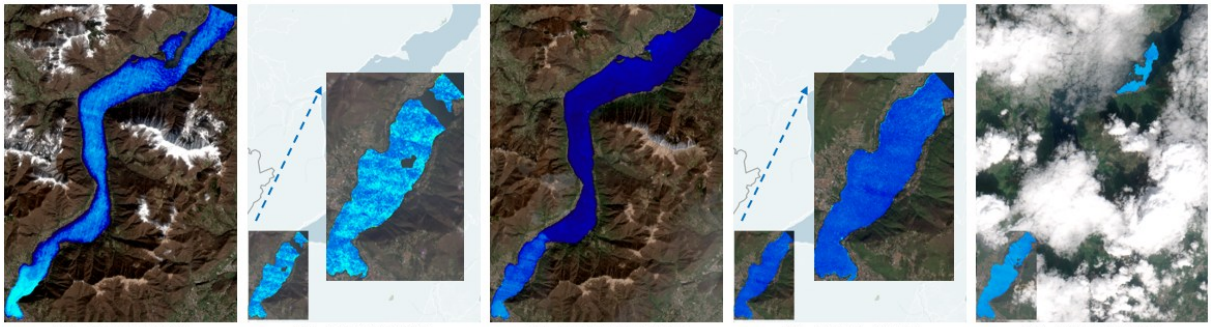


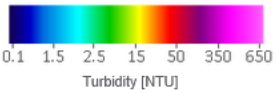
Figure 10: Secchi-depth (left) and HAB (right) from 16th March 2026.

MAPS - Turbidity weekly

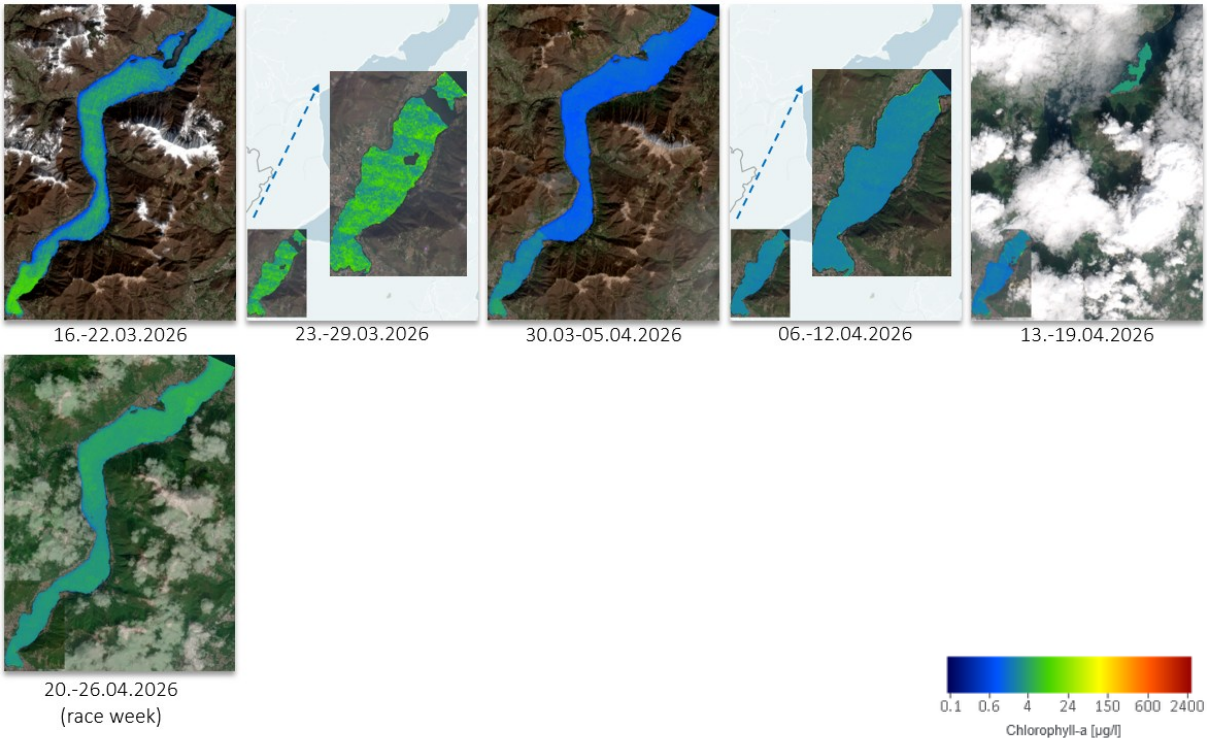


16.-22.03.2026 23.-29.03.2026 30.03-05.04.2026 06.-12.04.2026 13.-19.04.2026

20.-26.04.2026
(race week)



MAPS - Chlorophyll weekly



DISCUSSION

Chlorophyll

The chlorophyll content for the majority of scenes lies around 2,5µg/l. Between mid-March and begin of April higher contents were recorded, specifically in the Southern part close to Como, with values ranging between 3,5 and 4,5µg/l. Enhanced algae growth can happen after days of bad weather due to nutrient inflow from the Breggia river and wind activity mixing water layers.

Turbidity

Turbidity measurements exhibit a pattern similar to that of chlorophyll, with slightly elevated values between mid-March and early April, reaching approximately 1 NTU, and lower values of around 0.4 NTU during the remaining observation periods. This pattern reflects the relationship between turbidity and algal growth, as chlorophyll pigments contribute to increased water turbidity. In contrast to chlorophyll, turbidity becomes elevated after mid-April, indicating that these increases are not driven by phytoplankton growth than by other factors, most likely sediment inflow. Like for chlorophyll, on 16 March the southern part of the western basin shows higher turbidity values compared to the rest of the basin. In general the variation in turbidity and maximum values are low.

Visibility

The average visibility depth is approximately 6 m, while at the beginning of April it reached around 10 m, particularly in the northern parts of the western basin.

Harmful Algae Indicator (HAB)

The HAB indicator showed a low probability of the presence of toxic algae in the lake. At two time steps, moderate HAB values were observed in the southern part of the lake, and at one time step across the entire western basin. Nevertheless, these results indicate that the occurrence of toxic algae, such as cyanobacteria, is unlikely, supporting the conclusion of generally good water quality.

Bathing Water Index (BHI)

The Bathing water index considers chlorophyll (total amount of algae in water), depth of visibility and HAB as input parameters. It classifies pixels into four classes: good – fair – poor – critical. The conditions in the Como AOI are good or fair in weeks of precipitation with nutrient inflow from rivers.

Race implications - turbidity

To assess the potential impact of the race on water turbidity, four monitoring stations were established at which turbidity values were evaluated (Figure 11). The results are presented in Figure 12. Across all stations, average turbidity values are around 0.5 NTU, with maximum values reaching approximately 1 NTU. **No clear difference can be observed between turbidity levels before and after the race event**. This finding is consistent with the time series analysis and weekly maps of turbidity. Consequently, the race event at Lake Como did not have had a measurable impact on turbidity, Secchi depth, or chlorophyll concentrations.

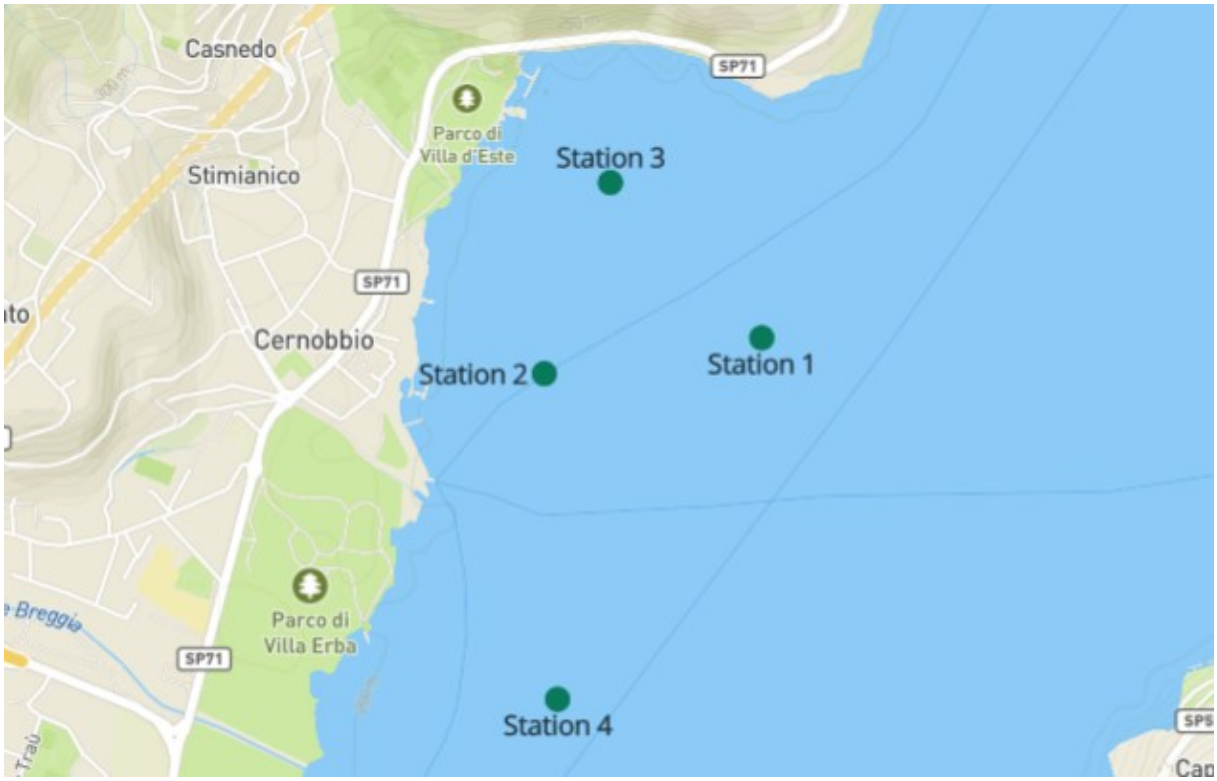


Figure 11: Map indicating the measurement stations for turbidity in the race area

Figure 12: Turbidity measurements at 4 points in the actual race location. The order of panels follows following order from top to bottom: Station 1, Station 2, Station 3, Station 4

List of Figures

List of Tables

Acronyms

Acronym	Description
AOI	Area of Interest
HAB	Harmful Algae Bloom

Contact

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