Lake Hopatcong Harmful Algal Bloom: Field Sampling Locations, Results and Aircraft Remote Sensing Information

9/18/19

The DEP's advisory remains in effect for all areas of the lake except Indian Harbor, Henderson Cove, Byram Cove, Byrum Bay to Halsey Island, and, as of 9/6, the area surrounding ST-14 (S.E. of State Park beach) in the southern part of the lake (see map).

On 8/8, 8/12 and 8/15, beaches in this area of the lake were sampled and results are included in the tables below. As per the DEP/DOH Harmful Algal Bloom (HAB) Freshwater Recreational Response Strategy, two subsequent samples below the health advisory guidance thresholds are required for reopening of a regulated Public Recreational Bathing facility. Based on the data, DEP/DOH has approved the local health department to re-open the following beaches: as of 8/13 Pebble Beach, Sand Harbor, Bass Rock Beach, Sperry Springs Beach, Beck Lane Beach and CAPP Beach, and as of 8/16, Byram Bay Community Club Beach and Clearwater Beach.

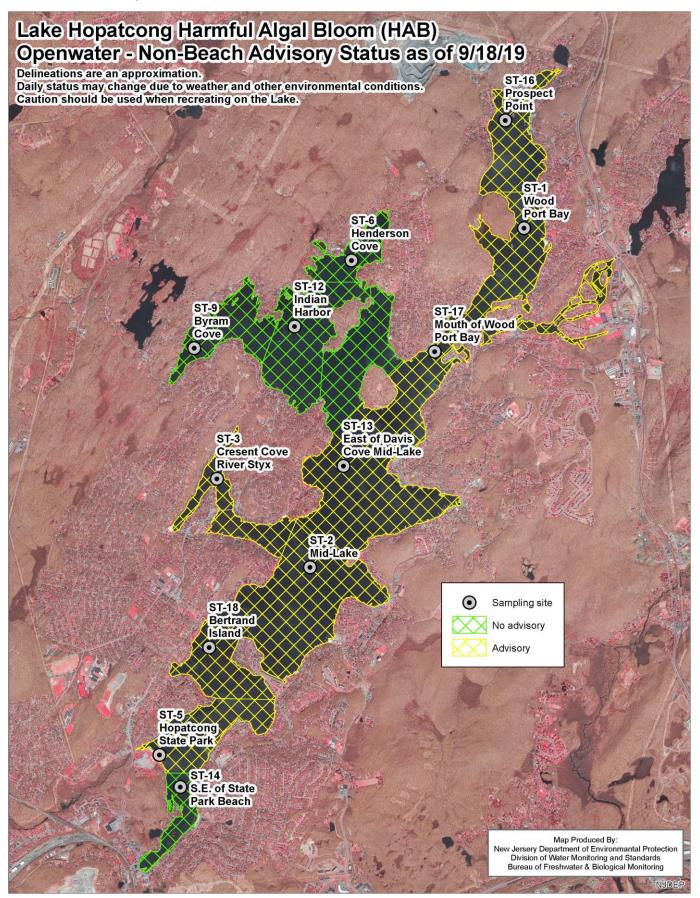
The DEP urges the public to avoid swimming or water sports that may result in contact with the water, such as water-skiing, tubing, canoeing, paddle boarding and kayaking. There is no recommended limitation on fishing or passive recreational boating that does not have the potential for splashing. However, fish caught should not be eaten. The public is further advised that pets should not be allowed in the water or to drink it.

Since the initial report of an algal bloom on 6/17/19, the DEP Bureau of Freshwater and Biological Monitoring has been sampling and analyzing the waters in Lake Hopatcong to identify the algal species and to determine whether cell count levels or cyanotoxins are present above NJ Health Advisory Guidance Levels. HAB response has been conducted in accordance with NJ's Cyanobacterial Harmful Algal Bloom (HAB) Freshwater Recreational Response Strategy, which is a unified interagency approach for responding to HABs Sampling will be conducted on Tuesdays and Thursdays with results posted on the following days. Flights will continue once a week.

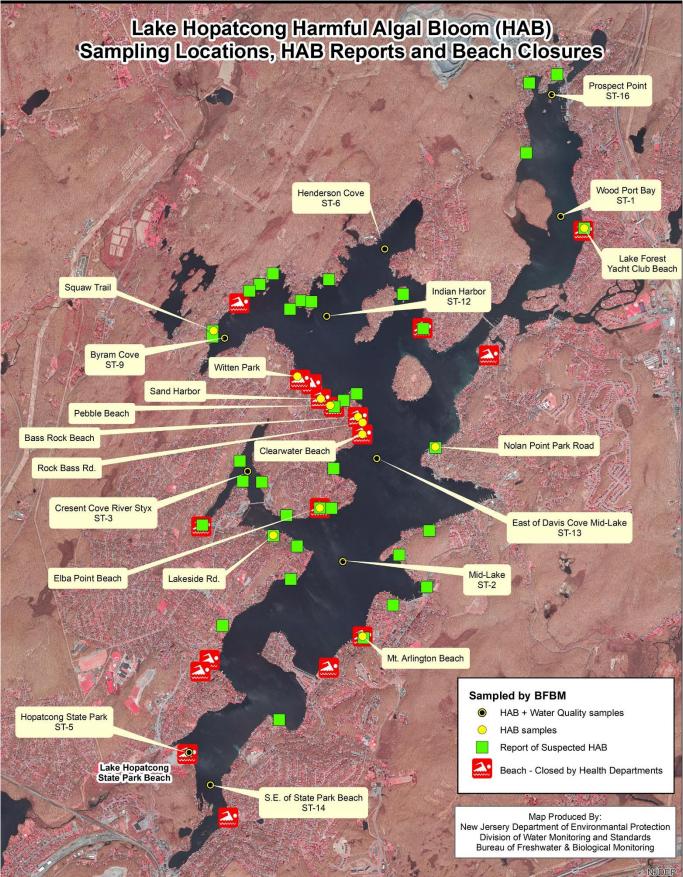
Due to the widespread nature of this bloom, based on field sampling, laboratory results and aircraft remote sensing, on 6/27, 7/3 and 7/12 DEP issued <u>press releases</u> advising the public to avoid swimming in or contact with Lake Hopatcong water. In addition to some beaches already being closed due to visual, field or lab results, as a precaution, DEP recommended that local health authorities close all public swimming beaches along the lake. On 7/26, DEP issued a press release lifting the advisory in the Indian Harbor area of the lake. On 8/1, DEP lifted the advisory in Henderson Cove, on 8/9 the advisory was lifted in Byram Cove, and as of 8/13 and 8/16 the advisory in Pebble Beach, Sand Harbor, Bass Rock Beach. Sperry Springs Beach, Beck Lane Beach and CAPP Beach was lifted – see advisory status map below. Other swimming beaches remain closed.

Bloom reports and sampling locations, as well as the results from sampling events can be found in the sampling locations map and results table below. NJ Health Advisory Guidance Levels include cell counts \geq 20,000 cells/ml and microcystin levels \geq 3µg/L. While many HAB cell counts in Lake Hopatcong have been above NJ Health Advisory Guidance Levels, measurable microcystin levels have been below the guidance. DEP will continue to monitor the lake until the HAB subsides to levels below all NJ Health Advisory Guidance triggers.

Non-Beach Advisory Status



Sampling Locations, HAB Reports and Beach Locations



Potential Health Effects and Results

Exposure to cyanobacteria can cause a range of health effects, including rashes, allergy-like reactions, flu-like symptoms, gastroenteritis, respiratory irritation and eye irritation. Exposure to a HAB which is actively producing cyanotoxins may result in more serious health effects including liver toxicity and neurological effects. HABs may begin to produce cyanotoxins at any time.

In order to be classified as a harmful algal bloom, NJ first identifies the presence of cyanobacterial species and then performs analyses for cell counts and/or toxins. The chart below details the sampling that has occurred since 6/18/2019, as well as the results to date. Due to the characteristics of the lake, as the bloom progresses, some areas may test higher on some days than previous days. This variability is expected due to the shift in cyanobacteria populations, wind or water currents moving the blooms around the lake.

Results from sampling conducted on 9/17/19 show continued cell counts above advisory levels for locations as highlighted in the first table below. Toxin levels are shown in the second table.

Lake Hopatcong Harmful Algal Bloom (HAB) Samples and Results as of 9/17/2019

Cell Counts

Site name	Station# (where applicable)														Суа	nobacter	ia Counts	cells/ml	L*											
		Date Sampled																												
Bathing Beach Sites		6/18/2019	6/21/2019	6/26/2019	6/27/2019	9 6/28/2019	7/1/2019	7/2/2019	7/5/2019	7/9/2019	7/11/2019	7/16/2019	7/19/2019	7/23/2019	7/25/2019	7/30/2019	8/1/2019	8/6/2019	8/8/2019	8/12/2019	8/15/2019	8/20/2019	8/22/2019	8/27/2019	8/29/2019	9/3/2019	9/5/2019	9/10/2019	9/12/2019	9/17/201
ebble Beach		57000					95000	16850		19300				24750					15250	18625										
and Harbor	S	51375	-				9250	27800		17750				24500		1(***)			12750	13500										
earwater Beach	2		8750	***	-		21000	13000	220	33375				13000			-		21000	16 250	18500									
ass Rock Beach			35812	***			330.30	53450		24125			***	26750			***		12000	17250	-					(and				
ake Forest Yacht Club Beach	2			9750			115000	4400		21250			-	45000																
Iba Point Beach			-	37125			18500	29090	-	12875				24000					***		-									
Arlington Beach				***	179000		12750	14125		25875			***	30500					***			***								
opatcong State Park	ST-S	5	-	***		24250	7750	0	17125	32000	46750	35000	48000	47250	71000	35000	63000	57250	27250	18250	18 375	45000	45000	31 250	31375	15625	35000	16500	24000	32750
perry Springs Beach													***	32500					6500	9750		***								
yram Bay Community Club Beach	1			***										38250					21250	16750	17250		8		1					
eck Lane Beach	8			***										55500					13750	17000	(and a				222	100				
APPBeach														42750					5250	4500										
ast Shore Beach														15625																
opatcong Homestead Beach	3													29250																
agram Cove														18500																
rescent Cove Beach														45750	198000		160000				1000			1443		8				
hore Hills Beach											-					5444					(1995)							20/250	32500	215 25
ther take Sites																1000														
Jolan Point Park Road		12500					12500	11900																						
ock Bass Rd.	-		9750			1.44					5 															3				
iquaw Trail	-		11875			-					-	-						-					-	-			-			
akeside Rd.	2		10281																											
Nitten Park	<u> </u>				14500																									
Wood Port Bay	ST-	1				34000		8000	20475	30500	9525	15000	18000	78000	19750	59500	96750	54750	40000	55750	17250	60250	42125	53000	44750	87500	95250	91375	136375	51000
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collected at surface 0.5, 1.0, and 2	ST-	2				36000		65750	22750	at 0.1	31500 at 3.02	19000 at 0.1	21000 at 0.1	60750 at 0.5	33250 at 0.1	35000 at 1	47500 at 0.1	56125 at 0.1	37750 at 1	53000 at 1	67000 at 1	30875 at 1	44125 at 1	25375 at 1	34250 at 0.1	23750 at 0.1	27500 at 1	25500 at 1	22375 at 0.1	33500 at 3
meters Highest results listed)	01	•	200000	2004031	1000	at 1 meter	5	at 2 meters	5	meters	meters	meters	meters	meters	meters	meters	meters	meters	meters	meters	meter	meters	meters	meters	meters	meters	meters	meters	meters	meter
resent Cove River Stox	ST-	3				34500		2000	35500	79000	37000	52000	43000	45500	205500	65 250	84000	80 750	50625	148000	62875	60625	40750	22750	29750	28250	31000	19125	32625	6000
en derson Cove	ST-I					28,280		19000	13000	18500	15000	32000	26000	40000	17250	11250	19750	15000	17375	12250	02015		40750		2/100	202.00	51000		32025	
Avram Cove	ST-					10250		28000	37000	29000	47500	28000	22000	43250	50050	25500	18000	13750	17500	14500										
ndian Harbor	ST-1	_				22000		39750	10000	8000	16000	8000	9000	19000	18500	17750	14250	11750	17250	17250										
ast of Davis Cove Mid-Lake	ST-1					18500		19000	7000	18500	60000	13000	18000	49000	38 750	31500	44000	38 250	22500	42750	48 250	26500	26750	24500	35125	25000	18750	30500	23250	17250
E. of State Park Beach	ST-1					34000		21100	17500	18500	10000	6000	14000	49000	53825	49500	44000	41500	24250	42/50	48 250 54500	27000	257500	30500	26500	9500	18750	30500	23250	1/20
rospect Point	ST-1					34000		5150	37000	6000	10000	10000	14000	18750	34500	49500	63000	41500	29250	73000	42250	27000	27500	30500	26500	55250	49750	72500	53500	32400
To spect Point Nouth of Wood Port Bay	ST-1 ST-1							5150	3/000	6000	10000	10000	14000	18750	34500	41/50	63000	30000	28000	73000	42250	27000	29000	28 250	49125	29750	49750	35000	24750	13500
ertrand Island	ST-1						-			-		-		-				-	-	-	43000	39/250	36750	28 250	22000	21750	22375	19000	29/50	
eru anu isianu	21-12			***					-												56125	26/250	36750	2/500	2200	21/50	223/5	13000	220	19375
					mt																									

<u>Toxins</u>

Site name	station# (where applicable)											Micro	cystins	μg/I (lowest	t Repo	rting L	evel 0.	15µg/	l)*										
															Date S	Sample	ed													
Bathing Beach Sites		6/18/19	6/21/19	6/26/19	6/27/19	6/28/19	7/1/19	7/2/19	7/5/19	7/9/19	7/11/19	7/16/19	7/19/19			7/25/19		8/6/19	8/8/19	8/12/19	8/15/19	8/20/19	8/22/19	8/27/19	8/29/19	9/3/19	9/5/19	9/10/19	9/12/19	9/17/19
Pebble Beach		0.83					0.15	0.16	.,	0.17	.,,		.,	0.25	.,,	.,			0.29	0.23										
								Courses Courses															-							
		1.35	1000		1222201	1000	0.17	< Reporting		0.21	(1000)	1000	(222)	0.22	12220	11222015	100000	1000	0.26	0.15	1222	10000		(222)	(202)		(222)	(6222)	10000	
Sand Harbor		1000000					12502221	Level		- 12798942.5				0200301					008080223	CORRECTOR OF										
			0.44				< Reporting			0.24				0.00					0.00	0.00	0.10									
Clearwater Beach		S	0.16	((1999)		Level	0.18		0.24				0.23	2000	10000	((ana))		0.23	0.29	0.12	()	(1000)		(444)	1000				
Bass Rock Beach		00000	0.21	1007261	19550	10000	0.08	0.16	1000000	0.23	045760	1000	(770)	0.25	10000	10000	10000	1000	0.30	0.18	1999	196550	1000	(777)	15550	105550	19930	6775	100225	1555
Lake Forest Yacht Club Beach		S		0.38			0.24	0.35		0.29				0.42		(***)	See.)			(internal)					(eee)					
1				< Reporting			0.19	< Reporting		0.19				0.34																
Elba Point Beach		1000000	135,225	Level	Calebra and	1022030	0.15	Level	10007/63	0.15	1000000	16255	(2553)	0.54	Section .	100000	(Beer)	0.363	20031	(2253)	35357	1352201	05550	8255	(56536)	10235230	1000	(0866)	1022245	10000
		10000	-		0.15		< Reporting	0.16		0.32	100000	1.00	1000	0.18	1000	(para)	100000			10000		10000	1000	(222)	1000	0.000		1000	12220	
Mt. Arlington Beach		2			0.40		Level	0.10		0.52				0.10						1,000										
ar an anna ann an an an an an an an an an	ST-5					< Reporting	< Reporting	0.15	< Reporting	0.24	0.24	0.24	0.39	0.42	0.36	0.61	0.375	0.30	0.36	0.60	0.22	0.47	0.26	0.6	0.6	0.4	0.35	0.36	0.41	0.37
Hopatcong State Park	0.14					Level	Level	UTRO	Level	. Digit	0.121	- Of LIT	0100	0.112	0100	- Citra		0100			U.L.L		01E0	010	010		0100	0100	0.112	0101
Sperry Springs Beach		10000										1222		122.20					0.16	0.17					12221	1000	1222	1222	1000	
Byram Bay Community Club Beach		1.0000		1000	0.975.0		1000	1000	10000	100000	100000		(1775)	1000		100000	1.975.0		0.26	0.19	0.17									
Beck Lane Beach		1000			1000		1944	1000	1000				(202)	1000	1000	1999	1000		0.17	0.16			-	(222)	(222)	1000		(100)	1000	
CAPP Beach		100000		2000000	10000	1000	10000	100220	100000	25550	10000	(877)	055	1055561	100000	10000	10000	1553	0.27	0.19	10000	1000	1000	(254)	15556	105520	10000	1570	1000000	
East Shore Beach				(1997)					(***)		(1998)												(1996)							
Hopatcong Homestead Beach				122279.		1000		1.000		1222	5 an 1					5222				1444										
Ingram Cove				1.000	0778.4	1775		10000	12758		11 12556	322	1000	177.5					1000	1000		1977	1775	1000	(225)	17770	1000	(277)	1273	
Crescent Cove Beach				.u							<u>(</u> 0			0.62	1.29		1.947						(100)							
Shore Hills Beach				1000		1000				1020													1000					0.47		0.36
Other LakeSites		-		-			2			-	-		-				-			-			-				-			
		< Reporting			1004000	12220	< Reporting	< Reporting	12726-011	12220	10000	1000	1000	100000	1222	100000	1000000	1000	-	12221	10001	1000001	10021		122461	100000		12221	122201	1000
Nolan Point Park Road		Level					Level	Level																			· · · · · ·			
Rock Bass Rd.			0.23																											
Squaw Trail			0.16													(
Lakeside Rd.		19222	0.17		10000							1222	(12.5)	12220	1999	1222	100	222	1227	(22.2)	1220			(222)	12220	10000	1222	12220		1000
		-	0.47		< Depending	1		1										1		-				-				1		
		100000		100000	< Reporting Level	1000		1000		0.000		1000	1000	100000	10000			1000	10000	1000	1000	10000	1000	(555)	17770	100000	1000	675	100000	
Witten Park																		-												
Wood Port Bay Mid-Lake	ST-1			1000	1,000	0.34		0.38	0.42	0.41	0.41	0.38	0.59	0.65	0.41	0.33	0.366	0.30	0.30	0.37	0.34	0.36	0.38	0.38	0.48	0.23	0.26	0.27	0.23	0.17
(collected at surface, 0.5, 1.0, and 2										0.22	0.19 at 0.1	0.23 at 4	0.36 at 0.1	0.30 at 1	0.32 at 1	0.24 at 1	0.168 at 1	0.22 at 1	0.23 at 1	0.36 at 0.1	0.94 at 0.1	0.32 at 0.1	< Reporting	0.19 at 1	0.26 at 1	< Reporting	0.17 at 13	0.18 at 1	0.19 AT 13	200010-00010
	ST-2	19655471	1965201	22665283	(1999)	0.15	0000000	0.16	0.15	at 0.1 meters	meters	meters	meters	meters	meters	meters	meter	meters	meters	meters	meters	meters	Level	meters	meters	Level	meters	meters	meters	0.15
meters. Highest results listed)																														
Create the Discourse Share	ST-3	192220	100000	10002380	1992254	0.18	03022267	< Reporting	< Reporting	0.26	0.29	0.32	0.48	0.25	0.39	0.42	0.28	0.30	0.49	0.54	0.43	0.41	1.24	0.63	0.60	0.55	0.51	0.18	0.4	< Reportin
Cresent Cove River Styx	0.0000							Level	Level			C. C									UNIT SERVICE	100.00.00			The second of th		1000000000		1.000	Level
lundaria cara	ST-6	10000	1000	100000	12442	< Reporting	10000	0.15	0.18	< Reporting	< Reporting	0.18	0.25	0.25	0.35	0.22	0.185	0.22	0.25	0.25		1000	1222	(222)	(222)	0.000	1	(122)	122201	
Henderson Cove			-			Level				Level	Level < Reporting			1.12200722			10 W00000	2010/2040	Service of the	1925150							· · · · · · · · · · · · · · · · · · ·	-	-	
Byram Cove	ST-9	10000	10000	10000	(1975))	0.2	10000	< Reporting Level	0.16	0.18	Level	0.18	0.18	0.37	0.24	0.19	0.244	0.44	0.22	0.15		10000	(((1000)	10000	0.000	(10000	
Byrain cove			-			< Depending		Level	0.10	0.10	Leve	0.10	0.10	<u> </u>														-	-	
Indian Harbor	ST-12	10000		10000	10000	< Reporting Level		0.32	0.16	0.19	0.15	0.26	0.24	0.29	0.23	0.21	0.253	0.16	0.29	0.17	1000	10000	1000	(555)	15550	100000	10000	675	100000	1000
			-			Leve	-	<u> </u>				-											-	-				-		
						< Reporting		< Reporting	0.28	0.45	0.17	0.18	0.32	0.18	0.13	0.23	0.162	0.16	0.23	0.42	0.31	0.22	0.22	0.22	0.16	< Reporting	< Reporting	< Reporting	0.34	< Reportin
1		1000000	1992	100000	0888697	Level	1992200	Level	0.26	0.45	0.17	0.18	0.32	0.16	0.15	0.25	0.102	0.10	0.25	0.42	0.51	0.22	0.22	0.22	0.10	Level	Level	Level	0.54	Level
Fast of Davis Court Mid Lake	ST-13						-	< Reporting	< Departing		-	-							-	<u> </u>	-					-		-	-	-
East of Davis Cove Mid-Lake	\$1-13	<u> </u>	-						< Reporting		0.22	0.25	0.22	0.34	0.24	0.32	0.476	0.53	0.41	0.44	0.44	0.23	0.54	0.53	0.57	0.41	0.35		1000000	1000
	\$1-13 \$T-14				100000	0.16	100000																							
East of Davis Cove Mid-Lake S.E. of State Park Beach		(2553)		1999	00000	0.16	(1993)	Level	Level	-				-									-		-			-		Common common
	ST-14	0.00000000			Carponer -		1000000	Level		0.28	0.45	0.57	0.42	0.61	0.43	0.2	0.192	0.27	0.40	0.29	0.21	0.22	0.21	0.26	0.26	0.22	0.20	0.29	0.24	
		0.00000000				0.16			0.31	0.28	0.45	0.57	0.43	0.61	0.43	0.3	0.192	0.37	0.40	0.39	0.31	0.23	0.31	0.26	0.26	0.23	0.20	0.23	0.34	< Reportir Level
S.E. of State Park Beach	ST-14	0.00000000			Carponer -		1000000	Level		0.28	0.45	0.57	0.43	0.61	0.43	0.3	0.192	0.37	0.40	0.39	0.31	0.23	0.31	0.26	0.26	0.23	0.20	0.23	0.34	
S.E. of State Park Beach	ST-14 ST-16	0.00000000			Carponer -		1000000	Level		0.28	0.45	0.57	0.43	0.61	0.43	0.3	0.192	0.37	0.40	0.39	Construction		< Reporting		122288401	< Reporting	< Reporting	g < Reporting		< Reportin
S.E. of State Park Beach Prospect Point	ST-14	0.00000000						Level 0.35	0.31		1556625	- Totalore -		10000075				1000-0420		0.022803424-0	0.31 0.20	0.23 0.21	11/12/2004	0.26 0.24	0.26 0.24	111061221		0.000000000	0.34 0.17	Level
S.E. of State Park Beach	ST-14 ST-16	0.00000000						Level 0.35	0.31		1556625	- Totalore -		10000075				1000-0420		0.022803424-0	Construction		< Reporting Level		122288401	< Reporting	< Reporting	g < Reporting	0.17	Level
S.E. of State Park Beach Prospect Point	ST-14 ST-16	0.00000000						Level 0.35	0.31		1556625	- Totalore -		10000075				1000-0420		0.022803424-0	Construction		< Reporting		122288401	< Reporting	< Reporting	g < Reporting		Level

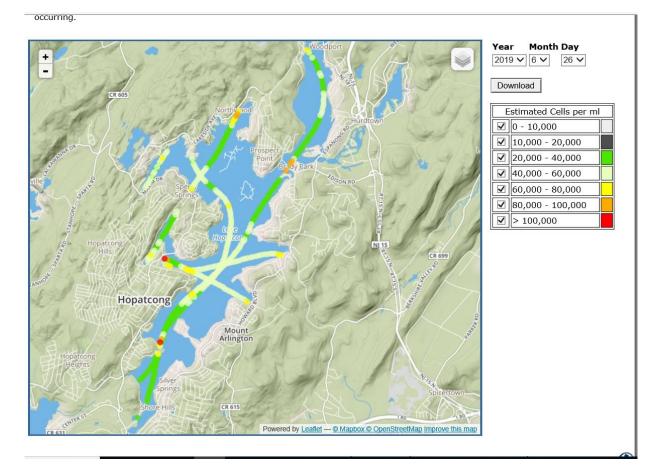
Cell Count 2 20,000 cells/ml; Microcystins 2 3µg/L

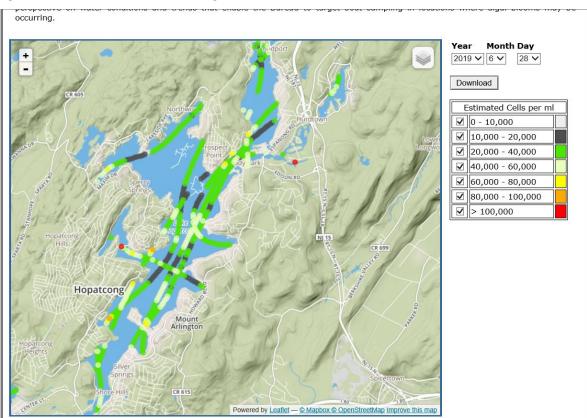
Aircraft Remote Sensing Information and Results

In addition to the response to Harmful Algal Bloom visual reports, field sampling and laboratory analyses described above, the DEP has developed aircraft remote sensing capabilities for general cyanobacteria detection and tracking. A sensor is used to pick up wavelengths of light specific to the cyanobacteria pigment phycocyanin in a waterbody. This advanced monitoring method provides immediate feedback on the presence and relative cyanobacteria cell counts, and can serve as a screening method to target waters for sample collection. While laboratory analyses serve as the definitive determination of whether results exceed NJ Health Advisory Guidance levels, remote sensing data provides useful information on the general extent and trends of a bloom.

Remote sensing flights were conducted over Lake Hopatcong on 6/26, 6/28, 6/30, 7/3, 7/10, 7/17, 7/24, 7/30, 8/9, 8/20, 8/27, 9/3, 9/11 and 9/17. The scale below estimates the pigment concentrations and cell counts; the bright yellow to red is estimated to be over 20,000 cells/ml or higher, light green denotes an area of concern where cell counts may be near 20,000 cells/ml and dark gray denotes low levels or non-detect. Images are available below for six of the flights. Samples results are needed to confirm sensor estimates.

On 6/26/2019, the flight data shows elevated levels of the phycocyanin pigment covering almost the entire lake.

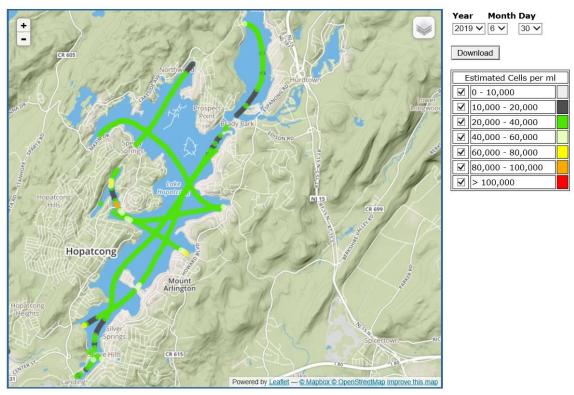


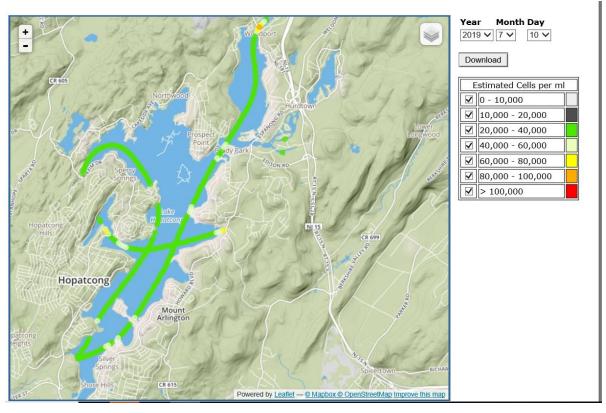


On 6/28/2019, the bloom still covers a large section of the lake, with the coves to the north showing signs that the bloom was diminishing.

On 6/30/2019, the intensity of the bloom appears to be diminishing, but there are still areas of concern in many coves and by the State Park Beach.

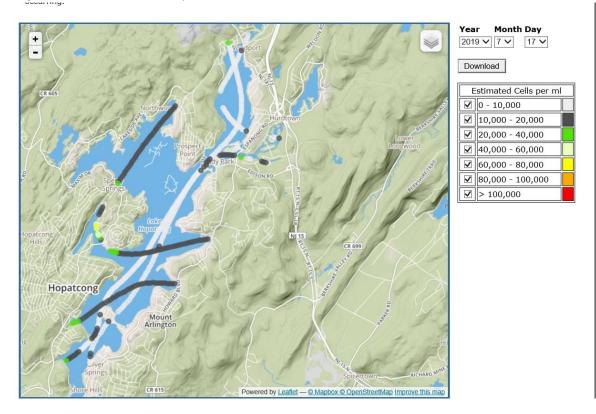




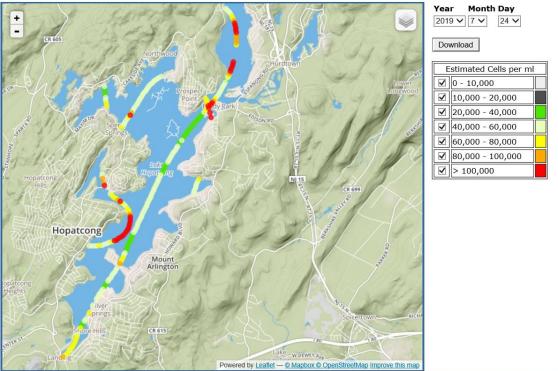


On 7/10/19, phycocyanin levels have increased over a large portion of the lake.

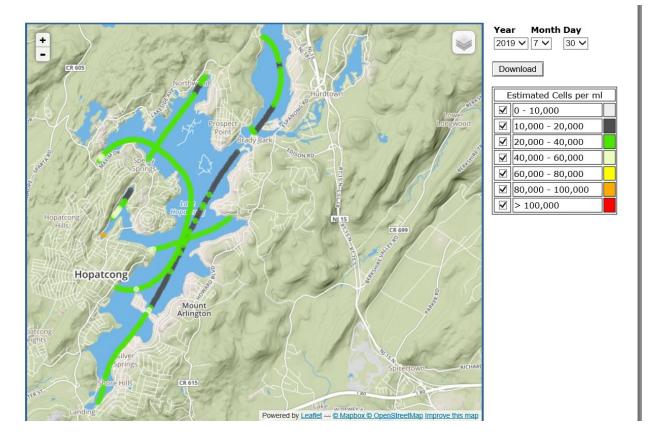
On 7/17/19, the flight shows the phycocyanin levels seem to have significantly decreased in spatial coverage. The highest levels are in River Styx.



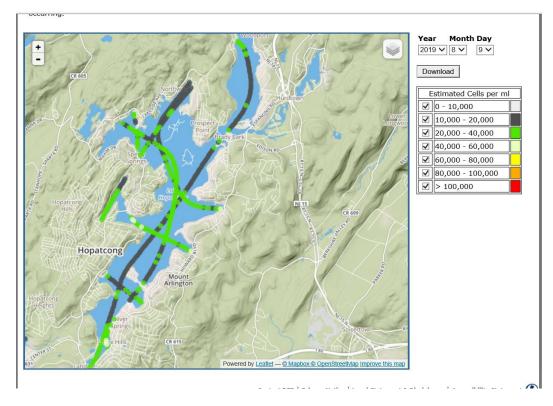
The 7/24 flight shows that the phycocyanin levels seem to have significantly increased in intensity and spatial coverage. The bloom appears to be lake wide.



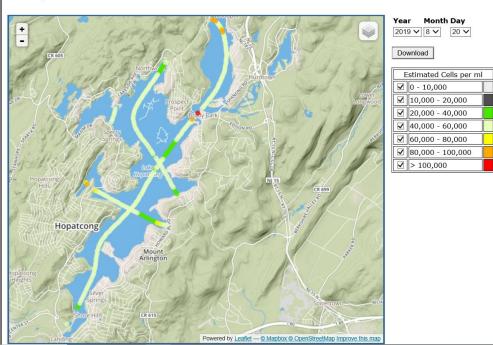
On 7/30 the phycocyanin levels seem to have decreased in intensity and spatial coverage. The bloom is still present in pockets with one near the buoy at ST-14.



On 8/9, the Lake Hopatcong the phycocyanin levels seem to have remained at the same intensity but the spatial coverage seems to be diminishing. The bloom is still present in pockets with higher levels in the south near the buoy at station ST-14.

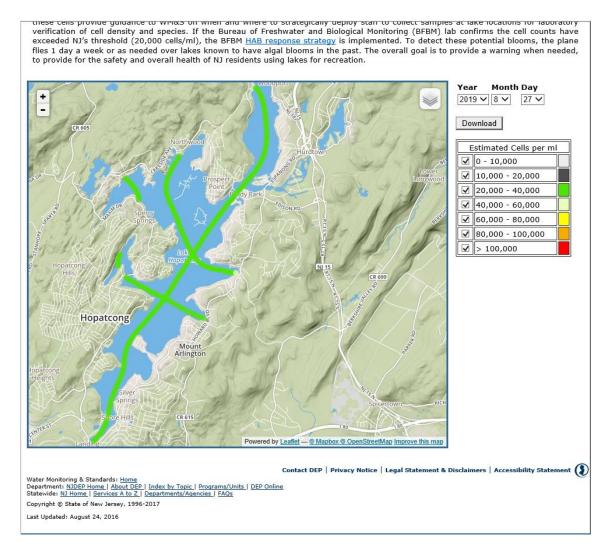


On 8/20, the phycocyanin levels were elevated lakewide, above 20,000 cells/ml. The flight confirmed the decrease in the bloom at the 2 buoy stations mid lake and in the south, but the bloom was still present lakewide with higher levels in the River Styx Crescent Cove area and in the extreme northern section. This flight shows an increase in intensity from the last flight on 8/9/2019.

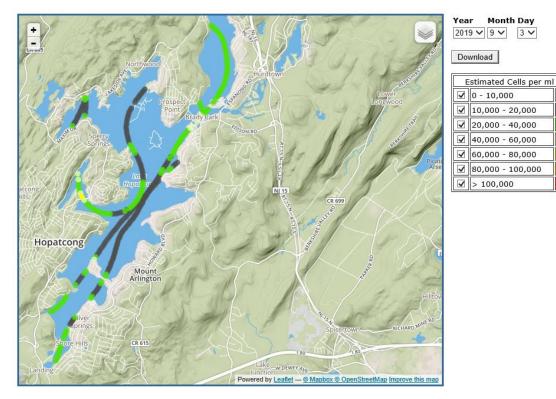


during the summer months, in ravorable weather conditions, over the coastal waters or New Jersey. These hights provide a valuable perspective on water conditions and trends that enable the Bureau to target boat sampling in locations where algal blooms may be occurring.

On 8/27, the phycocyanin levels were elevated lake wide, above 20,000 cells/ml. The flight data showed a general decrease in the intensity since last week, but the bloom was still present lake wide. Cloud cover may have been limiting the cyanobacteria to deeper depths and not at the surface where the aircraft sensor detects the reflectance.

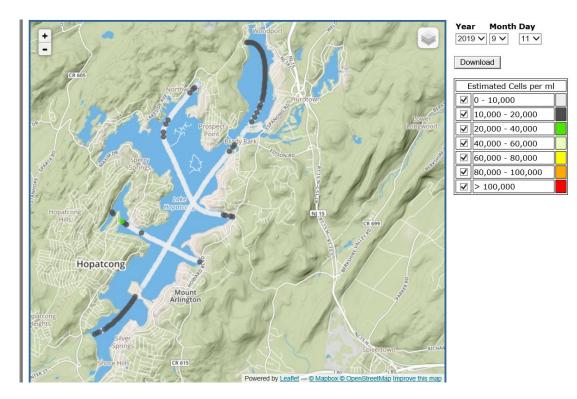


On 9/3, the phycocyanin levels were elevated in the northern and southern sections and were the highest in River Styx - all of those areas were above 20,000 cells/ml. The flight data shows a general decrease in the intensity and spatial distribution since last week, but the bloom is still present in areas. However, large areas were estimated to be below 20,000 cells/ml.

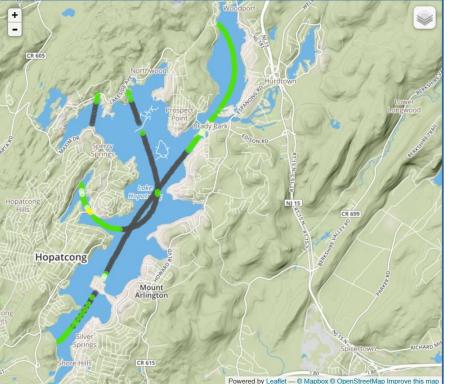


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On 9/11, the phycocyanin levels have significantly declined. The flight data shows a general decrease in the intensity and spatial distribution since last week, with large areas estimated to be below 20,000 cells/ml. Confirmation will come from sample collection.



The phycocyanin levels have significantly declined over the last month. The 9/17 flight data shows a bloom is still present in areas and large areas are estimated to be below 20,000 cells/ml. The River Styx area has higher estimated levels.





E	stimated Cells per ml
\checkmark	0 - 10,000
-	10,000 - 20,000
-	20,000 - 40,000
-	40,000 - 60,000
-	60,000 - 80,000
	80,000 - 100,000
•	> 100,000