

**Lake Champlain Ecosystem Indicators June 2008**  
**Lake Champlain Basin Program**

The following is a list of indicators developed by the Ecosystem Indicators Workgroup, the Technical Advisory Committee and many other partners. Indicators were developed for different issue areas following the management plan *Opportunities for Action*. These indicators served as a basis for the *State of the Lake Ecosystem Indicators Report* and are continually under development. Data from many indicators were used to formulate the narrative portion of the report, whereas others are reported directly in the narrative or as graphics. Data is currently not available to support all indicators in all jurisdictions. Future editions of the *State of the Lake* may include these and other indicators as data becomes available.

<b>Phosphorus</b>			
<b>Indicator</b>	<b>Pressure/State/Response</b>	<b>Suggested Measures</b>	<b>Reported as a Graphic or in the Narrative in 2008</b>
Population	P	Population by state/province	
		Population by lake segment/subwatershed	
Developed land	P	Percent developed land by subwatershed	Graphic p. 7
		Percent impervious surface	
		Number of structures (E911)	
Agricultural land	P	Percent ag land by subwatershed	Graphic p.7
		Change in soil test P in the same set of farms over time	Graphic p.8
Animal units by type	P	Amount of P per hectare	
Phosphorus load and trend	P	Annual mean tributary P load by lake segment	Graphic p.5 (for lake segment watershed)
P in water column	S	Annual mean P concentration by lake segment. Update as is	Graphic p. 4
P in sediment	S	Concentration of total P in top 10cm of lake sediment.	
Chlorophyll a	S	Lake segment annual average chl-a	
		Number of weeks of blue-green algae blooms	Graphic p. 13
Dissolved Oxygen	S	DO concentration in bottom water	
Aquatic plants	S	Biomass/m <sup>2</sup> for areas less than 30m deep	
Farm BMPs	R	Percent of Ag land with NRCS 590 Standard NMP	Graphic p. 10
		Percent of farmsteads that have enhanced NMP	Graphic p. 10
		Buffer by type (CRP and CREP participation)	
Wastewater treatment	R	Lake segment P load from WWTF	Graphic p. 5
Urban BMPs	R	Acres requiring upgrade in treatment (number of redevelopment permits, number of impaired watershed permits)	
		Percent of towns with good water quality protection plans/zoning	
		Backroads (number of remediation projects)	
Education	R	Number of teachers trained through CBEI and Watershed Alliance	Narrative p. 32
		Number of school visits and field days	

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<b>Lower Food Web</b>			
<b>Indicator</b>	<b>Pressure/State/ Response</b>	<b>Suggested Measures</b>	<b>Reported as a Graphic or in the Narrative in 2008</b>
P and N in water	P	Total N: total dissolved P > threshold by lake segment	
Invasions	P	Number of new species (phytoplankton, zooplankton, fish, plants)	Graphic p. 27
Phytoplankton community	S	Taxonomic composition and relative abundance	
		Percent potential toxin producing cyanobacteria at bellwether locations	
Blue green algae toxins	S	Toxin concentrations (range and median) by selected lake segment	Graphic p. 13
Zooplankton community	S	Taxonomic composition and relative abundance	
		Average size of zooplankton	
		Ratio of phytoplankton biomass to zooplankton biomass	
Zebra mussels	S	Biomass/m <sup>2</sup> for areas less than 30 m deep	
Fish	S	Mean biomass smelt/trawl	Narrative p. 23
		Biomass smelt/biomass alewife	Narrative p. 23
Beach closure	R	Days of beach by type (bga versus coliform)	Graphic p. 12
Phosphorus load reduction	R	Total phosphorus load reduction	

<b>Bacteria</b>			
<b>Indicator</b>	<b>Pressure/State/ Response</b>	<b>Suggested Measures</b>	<b>Reported as a Graphic or in the Narrative in 2008</b>
Population	P	Number of homes on shoreline and 1 km upstream that drain to the lake that are on septic.	
		Percent of homes on septic adjacent to shoreline that have failed.	
		Location and number of times combined sewers overflow	
Agriculture	P	Acres of farm land on shoreline and 1 km upstream	
Bacteria levels	S	percent of water samples that exceed a standardized unit based on EPA recommendations for allowable risk (8 in 1000)	
Beach closure	S/R	Days of beach closure at Champlain beaches	Graphic p.12
Farm BMPs	R	Percent of agriculture on shoreline, and 1 km up stream that have CNMPs	
		CREP acreage along shoreline	
		Number of farms in a livestock exclusion program	
Urban BMPs	R	Percent of communities with pet ordinances	
		Remediation of failed septic (permits)	

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<b>Mercury</b>			
<b>Indicator</b>	<b>Pressure/State/ Response</b>	<b>Suggested Measures</b>	<b>Reported as a Graphic or in the Narrative in 2008</b>
Atmospheric load	P	Annual mean Hg load to LC from atmospheric deposition	
Hg in Sediment	S	Total Hg concentration in dated sediment cores at indexed locations	
Hg in Fish*	S	Mean Hg concentration in indicator fish at normalized size, in index locations	Graphic p. 19
Consumption advisories	R	NY and VT fish consumption advisories	Graphic p. 18
Reductions in mercury release	R	Mercury Collection in Municipal Programs (lbs/yr)	Graphic p. 20

<b>Water Chestnut</b>			
<b>Indicator</b>	<b>Pressure/State/ Response</b>	<b>Suggested Measures</b>	<b>Reported as a Graphic or in the Narrative in 2008</b>
Area Infested with water chestnut	P	Total number of infested acres	Graphic p. 30
		Number of acres < 25% surface coverage	Graphic p. 30
		Location of mechanical harvesting: Miles north of Whitehall NY	Graphic p. 30
		Number of Lake Segments infested	Graphic p. 30
Aquatic plant competition	S	Proportion of native / water chestnut / milfoil	
Management resources	R	Dollars spent on management	Narrative p. 30
Mechanical Management implementation	R	Tons of water chestnut removed through mechanical harvesting	
Hand Pulling Management implementation	R	Tons of water chestnut removed through hand-pulling	Narrative p. 30
		Number of hand-pulling hours	

<b>Fish</b>			
<b>Indicator</b>	<b>Pressure/State/ Response</b>	<b>Suggested Measures</b>	<b>Reported as a Graphic or in the Narrative in 2008</b>
Lamprey wounds	P	Atlantic Salmon and Lake Trout average wounds per fish	Graphic p. 25
Alewife	P	Map locations found and number (number/year)	Narrative p. 23
Invasive Species	P	Number of species (fish only, not including diseases that affect fish)	Graphic p. 27
Sea Lamprey	S	Miles of tributaries supporting lamprey population	
Fishway returns	S	Number of fish passing at Boquet and Winooski fishways	
Smelt	S	Age structure	
Angler Catch	S	Top 10 weight by species in LCI and Rotary derbies	Narrative p. 24
		Catch rates and size distributions	Narrative p. 24
Salmon Stocking Rate	R	Number of smolts, number of fry	
Lamprey Control	R	Number of successfully controlled tributaries (with barriers, traps, TFM)	Narrative p. 26

<b>Cormorants</b>			
<b>Indicator</b>	<b>Pressure/State/ Response</b>	<b>Suggested Measures</b>	<b>Reported as a Graphic or in the Narrative in 2008</b>
Cormorant nests	P	number of nests	Narrative p 26
Colony Nesters	S	# nests/time of species TBD (including cormorant nests)	Narrative p 26 (for caspian tern)
Cormorant control	R	number of birds removed by: harassment, eggs oiled, birds shot	

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<b>Wetlands and Rivers (In Progress)</b>			
<b>Indicator</b>	<b>Pressure/State/ Response</b>	<b>Suggested Measures</b>	<b>Reported as a Graphic or in the Narrative in 2008</b>
Encroachment	P	Rivers that have lost access to floodplain	
Wetland Loss: Wetlands permitted for conversion	P	acres of shoreline, riparian and floodplain wetlands permitted for conversion	
River corridors available for protection	S	acres of river corridor available for protection by municipal ordinances	
Wetlands available for protection and restoration	S	acres of shoreline and riparian wetlands available for protection and restoration	
Stream disequilibrium	S	% of streams in disequilibrium	
Protected river corridors	R	acres of river corridor protected by municipal zoning	
Wetland conservation/ restoration	R	acres of wetlands restored/conserved	
Conserved land with stream/ wetland protection and management restriction	R	% conserved land with specific stream/wetland protection and channel management restrictions	
Acres of river corridor restoration	R		