Lake Champlain Basin Program

State of the Lake - 2012

Vermont EPSCoR Annual Meeting

16 August 2012

William G. Howland, LCBP Manager

Lake Champlain Basin Program

STATE OF THE LAKE

AND ECOSYSTEM INDICATORS REPORT

2012

The Lake Champlain Basin

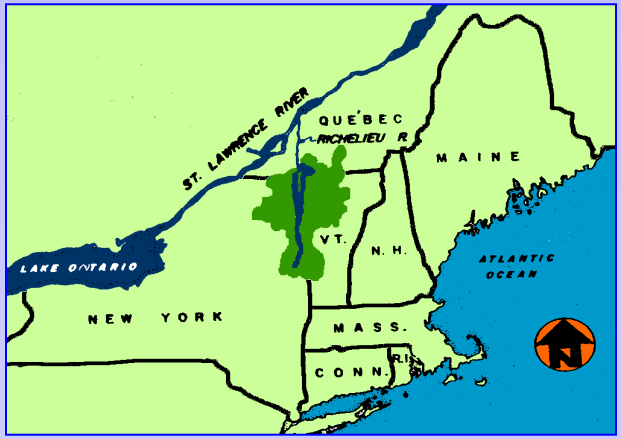
The Basin: 21,326 square kilometers.

- The Drainage Basin is 18.9 times as large as the Lake

The Lake: 1,127 square kilometers

- Over 122 meters deep
- 193 kilometers long

The Richelieu River: – Lake Champlain waters enter the Richelieu River and flow north to the St Lawrence River.



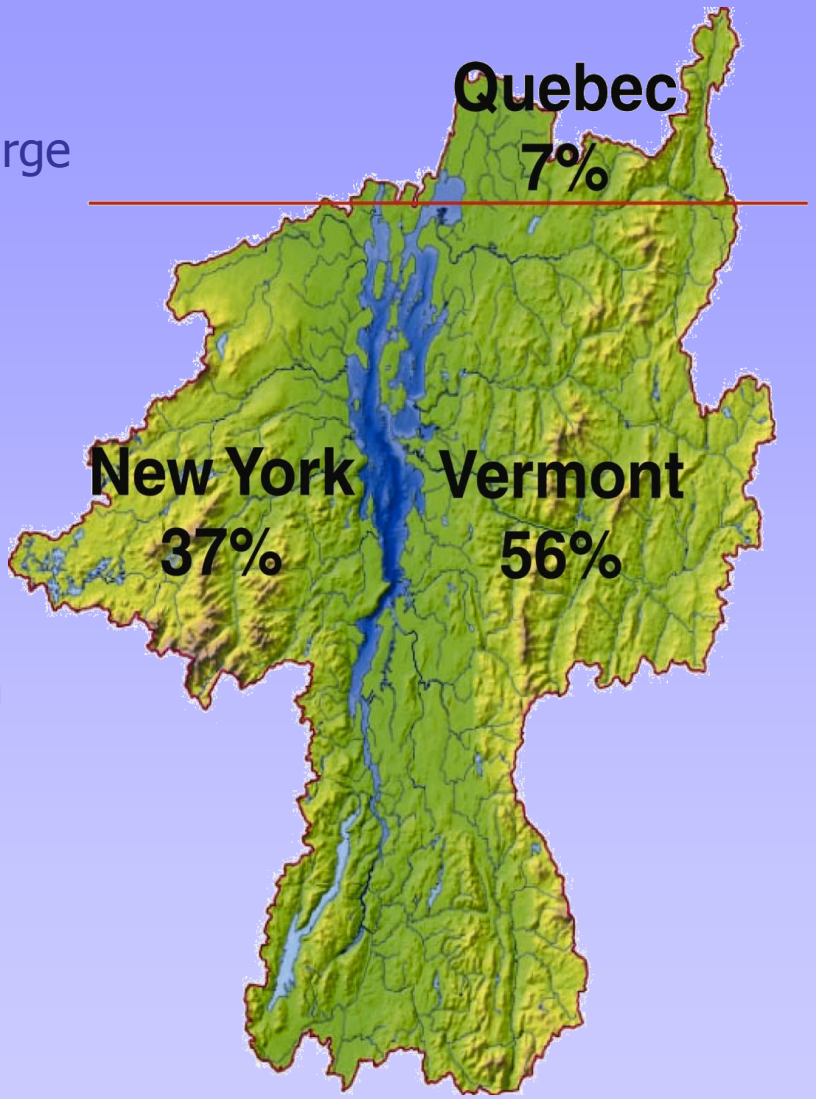
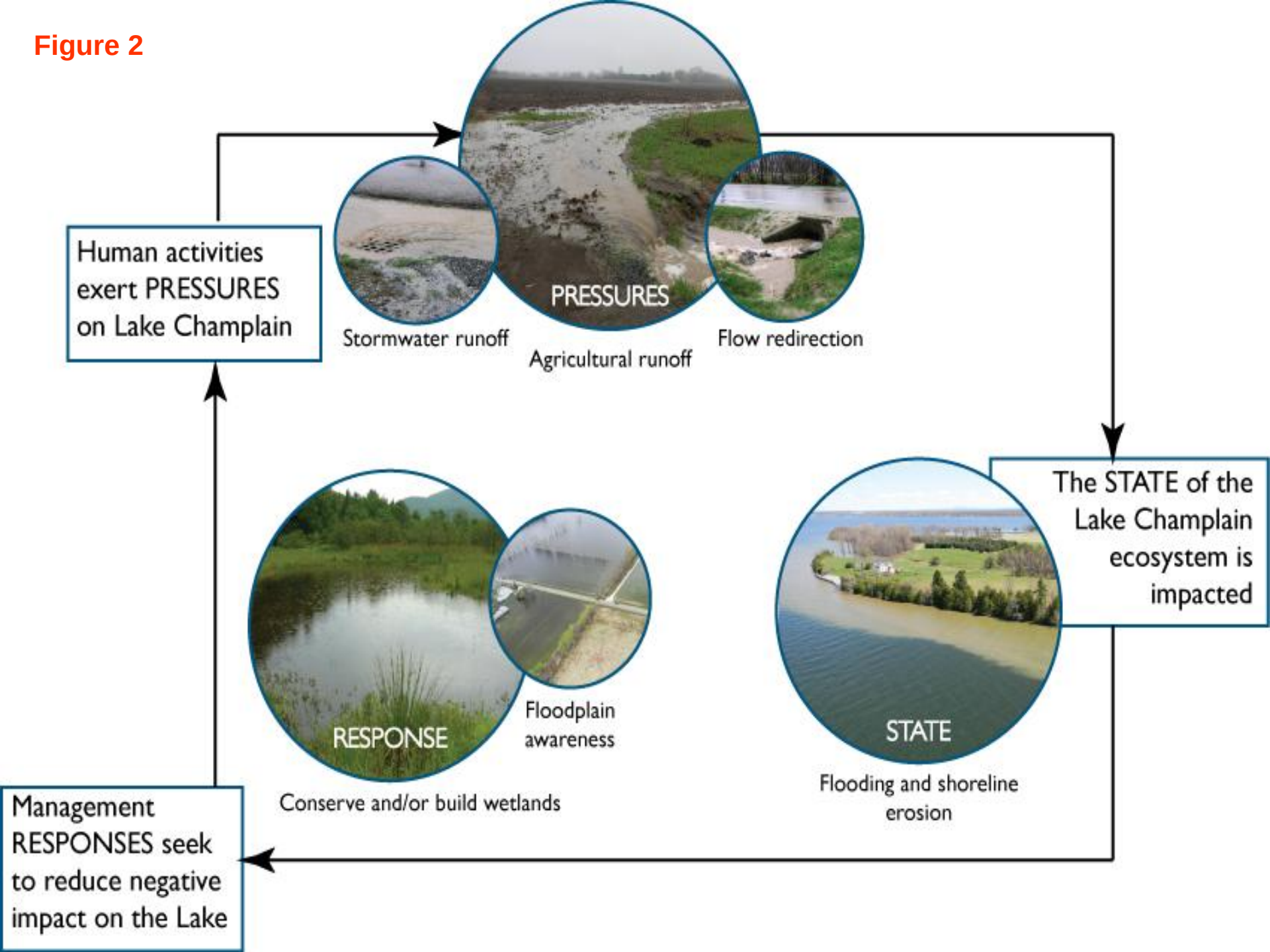


Figure 2


Human activities exert PRESSURES on Lake Champlain
PRESSURES
Stormwater runoff
Agricultural runoff
Flow redirection
The STATE of the Lake Champlain ecosystem is impacted
STATE
Flooding and shoreline erosion
Management RESPONSES seek to reduce negative impact on the Lake
RESPONSE
Floodplain awareness
Conserve and/or build wetlands

Pages 20 & 21

INDICATORS by LAKE SEGMENT

		MISSISQUOI BAY		NORTHEAST ARM	
		STATUS	TREND	STATUS	TREND
PHOSPHORUS	Phosphorus in Lake (p. 5)	●	↓	●	↓
	Nonpoint source loading to Lake (p. 7-8)	●	~*	○	○*
	Wastewater facility loading to Lake (p. 10)	●	↑	●	↑
		*The Pike R. has improved, but no other rivers show a trend.		*There are no monitored tributaries in the NE Arm.	
HUMAN HEALTH & TOXINS	Beach closures^ (p. 12-13)	●	○	●	○
	Cyanobacteria blooms* (p. 14)	●	○	●	○
	Fish advisories for toxins* (p. 14)	●	○	●	○
BIODIVERSITY & AQUATIC INVASIVE SPECIES	Sea lamprey wounds* (p. 26)	●	↑	●	↑
	Aquatic invasive species arrivals (p. 27)	●	↓	●	~
	Water chestnut infestations (p. 30)	●	↑	●	~

^ *Because beach closures are weather dependent, data is not appropriate for trend analysis.*
* *These indicators are lake-wide; therefore, scores are the same across all lake segments.*

		MALLETTS BAY		MAIN LAKE		SOUTH LAKE		
		STATUS	TREND	STATUS	TREND	STATUS	TREND	INDICATORS by LAKE SEGMENT
PHOSPHORUS	Phosphorus in Lake (p. 5)	●	↓	●	↓	●	~	
	Nonpoint source loading to Lake (p. 7-8)	●	~	●	~*	●	~	
	Wastewater facility loading to Lake (p. 10)	●	↑	●	↑	●	↑	
				*The LaPlatte R. has improved, but no other rivers show a trend				
HUMAN HEALTH & TOXINS	Beach closures from bacteria^ (p. 12-13)	●	○	●	○	○*	○	
	Cyanobacteria blooms* (p. 14)	●	○	●	○	●	○	
	Fish advisories for toxins* (p. 14)	●	○	●*	○	●	○	
				*Special advisories have been lifted for Cumberland Bay, NY.		*The South Lake has no monitored public beaches.		
BIODIVERSITY & AQUATIC INVASIVE SPECIES	Sea lamprey wounds* (p. 26)	●	↑	●	↑	●	↑	
	Aquatic nuisance species arrivals (p. 27)	●	~	●	~	●	↓	
	Water chestnut infestations (p. 30)	●	~	●*	↑	●	↑	
				*Water chestnut is hand-pulled between Little Otter Creek and Crown Point; the rest of the Main Lake has no infestation.				

^ *Because beach closures are weather dependent, data is not appropriate for trend analysis.*
* *These indicators are lake-wide; therefore, scores are the same across all lake segments.*

STATUS
- ● GOOD
- ● FAIR
- ● POOR
- ○ NO STATUS DATA IS AVAILABLE

TREND
- ↑ IMPROVING
- ~ NO TREND (neither improving nor deteriorating)
- ↓ DETERIORATING
- ○ NO TREND DATA IS AVAILABLE

2012 ECOSYSTEM INDICATORS SCORECARD

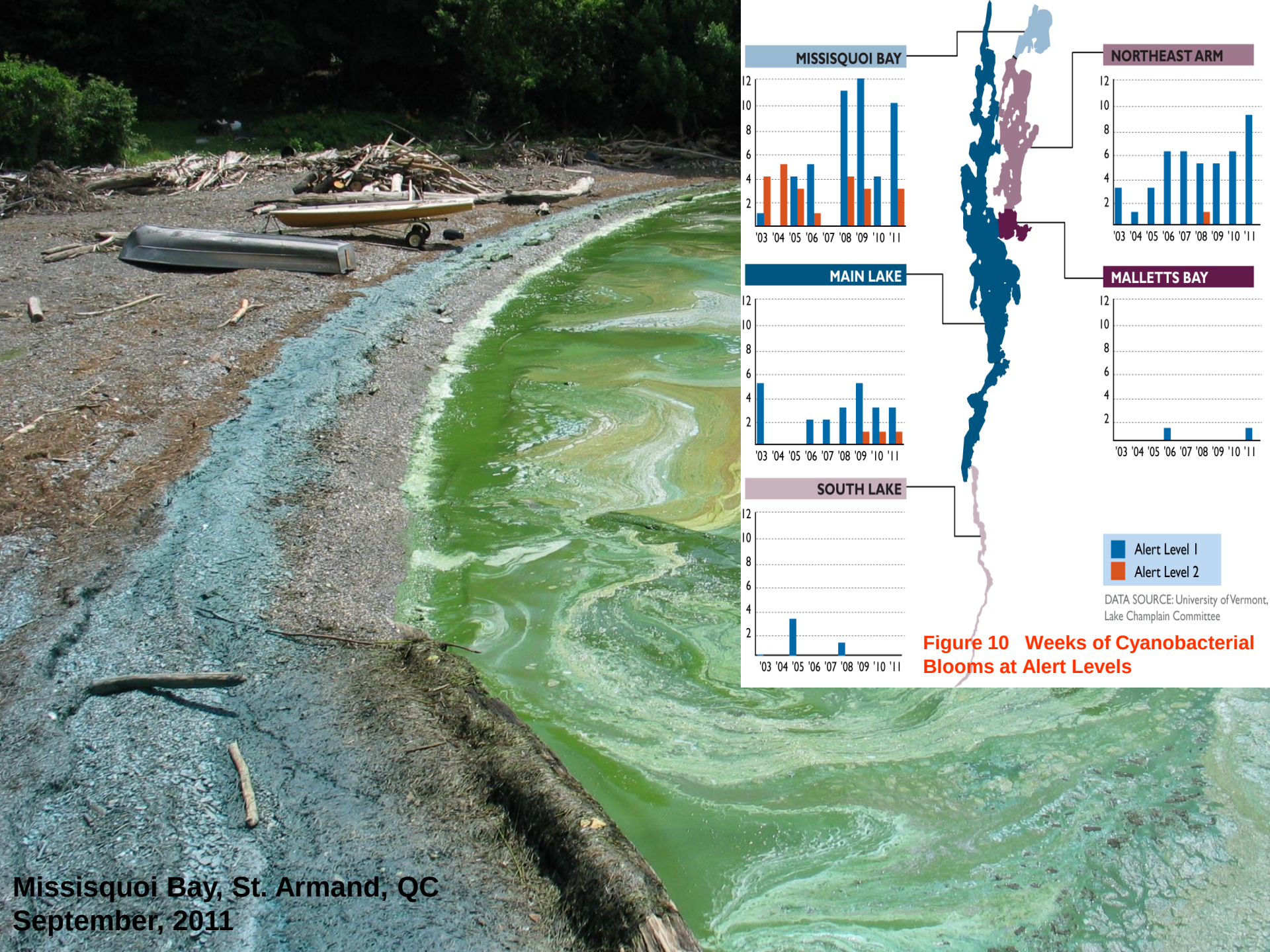


Figure 10 Weeks of Cyanobacterial Blooms at Alert Levels

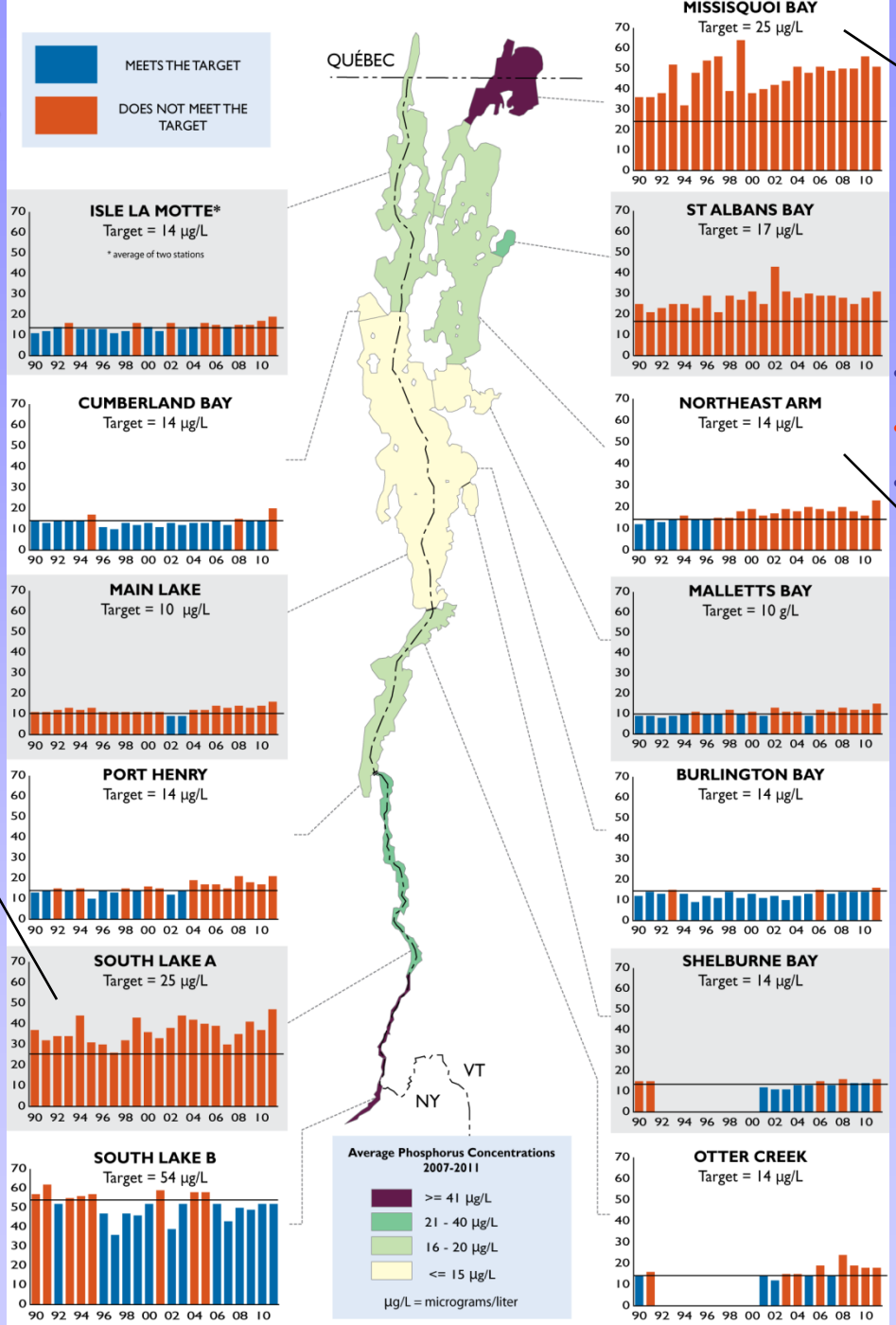
Missisquoi Bay, St. Armand, QC
September, 2011

Phosphorus Concentrations By Lake Segment

Figure 3

South Lake

- Exceeds P targets
- Excess weed growth
- Water chestnut and Eurasian watermilfoil
- Much of the watershed is intensively farmed



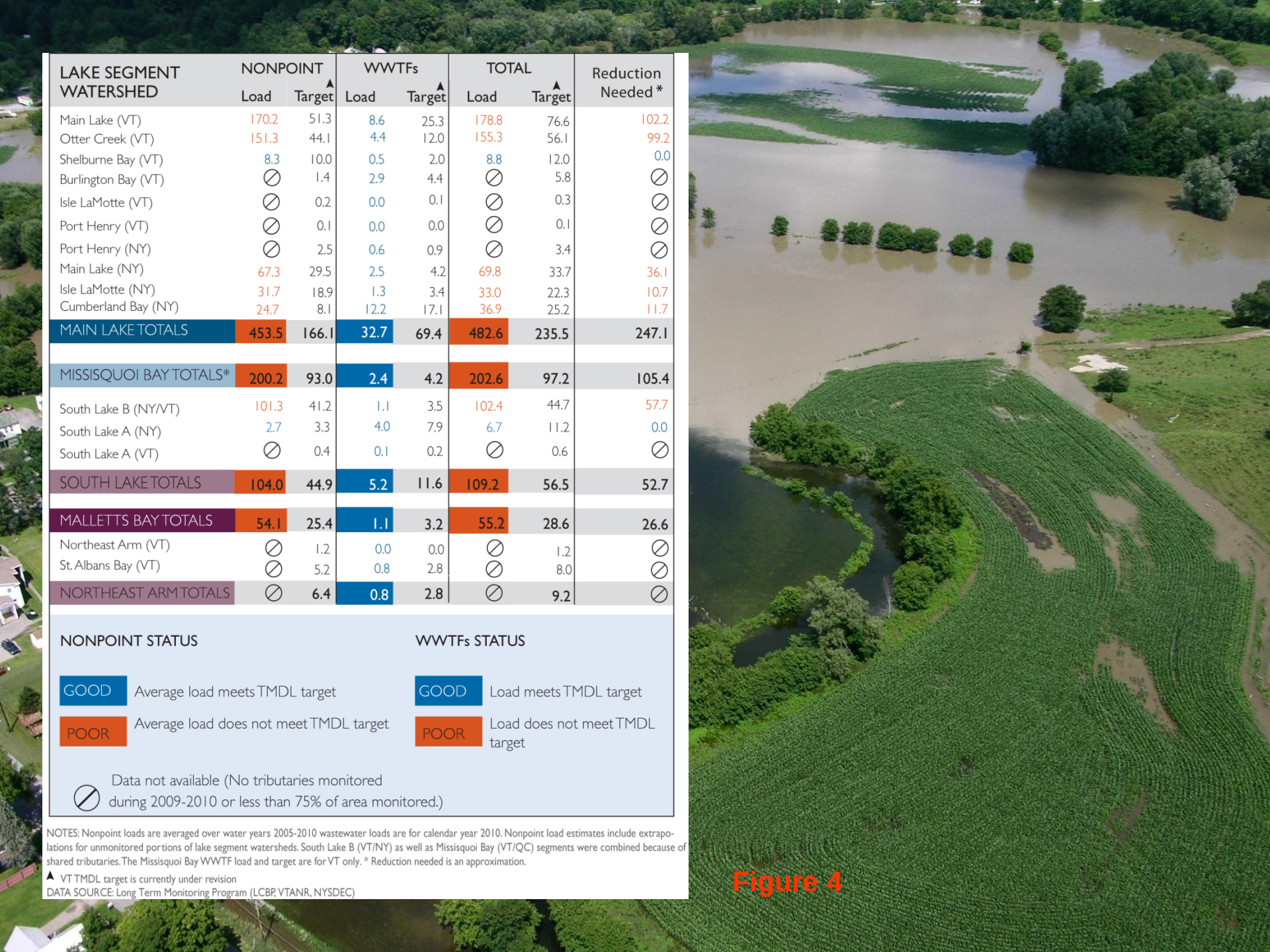
DATA SOURCE: Long Term Monitoring Program (LCBP, VTANR, NYSDEC)

Missisquoi Bay

- Greatly exceed P target
- Seasonal BGA blooms
- Extensive agriculture

Northeast Arm

- Exceeds P targets
- Seasonal BGA blooms
- Eurasian watermilfoil
- Extensive agriculture and urban areas



LAKE SEGMENT WATERSHED	NONPOINT Load	NONPOINT Target ▲	WWTFs Load	WWTFs Target ▲	TOTAL Load	TOTAL Target ▲	Reduction Needed *
Main Lake (VT)	170.2	51.3	8.6	25.3	178.8	76.6	102.2
Otter Creek (VT)	151.3	44.1	4.4	12.0	155.3	56.1	99.2
Shelburne Bay (VT)	8.3	10.0	0.5	2.0	8.8	12.0	0.0
Burlington Bay (VT)	⊘	1.4	2.9	4.4	⊘	5.8	⊘
Isle LaMotte (VT)	⊘	0.2	0.0	0.1	⊘	0.3	⊘
Port Henry (VT)	⊘	0.1	0.0	0.0	⊘	0.1	⊘
Port Henry (NY)	⊘	2.5	0.6	0.9	⊘	3.4	⊘
Main Lake (NY)	67.3	29.5	2.5	4.2	69.8	33.7	36.1
Isle LaMotte (NY)	31.7	18.9	1.3	3.4	33.0	22.3	10.7
Cumberland Bay (NY)	24.7	8.1	12.2	17.1	36.9	25.2	11.7
MAIN LAKE TOTALS	453.5	166.1	32.7	69.4	482.6	235.5	247.1
MISSISQUOI BAY TOTALS*	200.2	93.0	2.4	4.2	202.6	97.2	105.4
South Lake B (NY/VT)	101.3	41.2	1.1	3.5	102.4	44.7	57.7
South Lake A (NY)	2.7	3.3	4.0	7.9	6.7	11.2	0.0
South Lake A (VT)	⊘	0.4	0.1	0.2	⊘	0.6	⊘
SOUTH LAKE TOTALS	104.0	44.9	5.2	11.6	109.2	56.5	52.7
MALLETTS BAY TOTALS	54.1	25.4	1.1	3.2	55.2	28.6	26.6
Northeast Arm (VT)	⊘	1.2	0.0	0.0	⊘	1.2	⊘
St. Albans Bay (VT)	⊘	5.2	0.8	2.8	⊘	8.0	⊘
NORTHEAST ARM TOTALS	⊘	6.4	0.8	2.8	⊘	9.2	⊘

NONPOINT STATUS

GOOD — Average load meets TMDL target

POOR — Average load does not meet TMDL target

WWTFs STATUS

GOOD — Load meets TMDL target

POOR — Load does not meet TMDL target

⊘ Data not available (No tributaries monitored during 2009-2010 or less than 75% of area monitored.)

NOTES: Nonpoint loads are averaged over water years 2005-2010 wastewater loads are for calendar year 2010. Nonpoint load estimates include extrapolations for unmonitored portions of lake segment watersheds. South Lake B (VT/NY) as well as Missisquoi Bay (VT/QC) segments were combined because of shared tributaries. The Missisquoi Bay WWTF load and target are for VT only. * Reduction needed is an approximation.

▲ VT TMDL target is currently under revision

DATA SOURCE: Long Term Monitoring Program (LCBP, VTANR, NYSDEC)

Figure 4

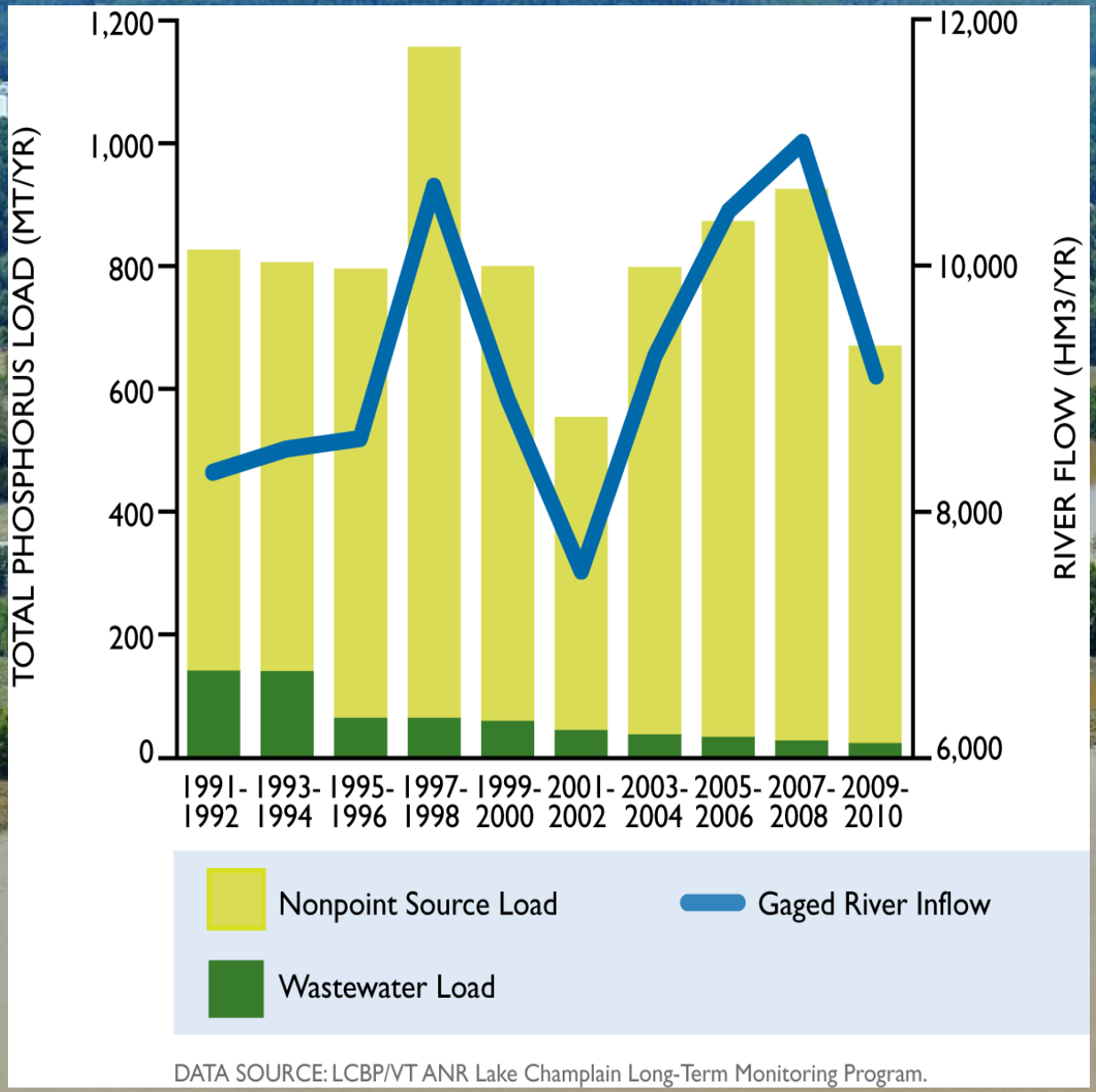

TOTAL PHOSPHORUS LOAD (MT/YR)
1,200
1,000
800
600
400
200
0
RIVER FLOW (HM3/YR)
12,000
10,000
8,000
6,000
1991-1992
1993-1994
1995-1996
1997-1998
1999-2000
2001-2002
2003-2004
2005-2006
2007-2008
2009-2010
Nonpoint Source Load
Gaged River Inflow
Wastewater Load
DATA SOURCE: LCBP/VT ANR Lake Champlain Long-Term Monitoring Program.

Figure 5

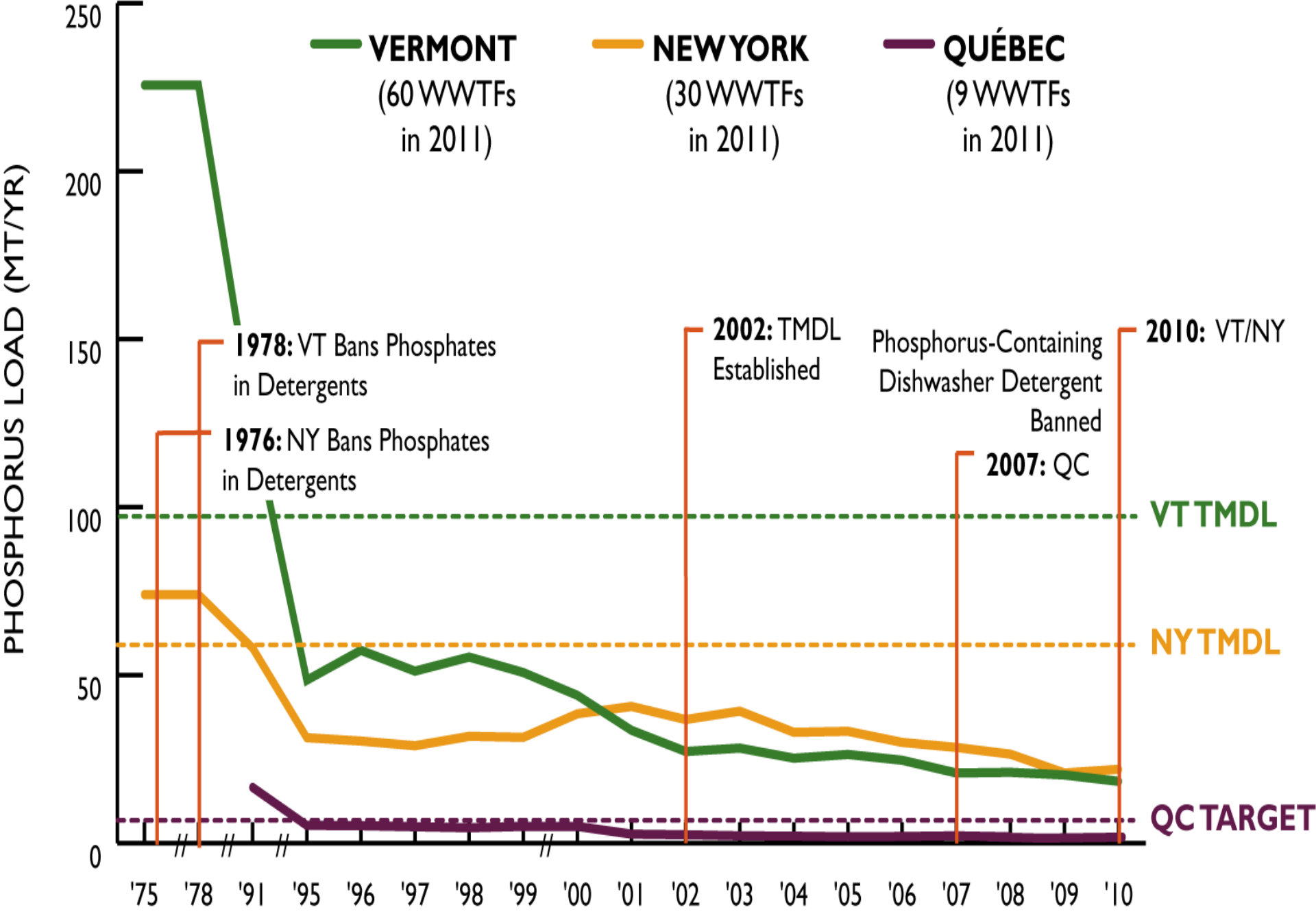


Figure 8

DATA SOURCE: VTANR, NYSDEC, MDDEP

Figure 6


Flow
Urban Downstream
Rural Upstream
Storm Events
Flow (cfs)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
July 6
July 7
July 8
July 9
DATA SOURCE: Joel Nipper, UVM

Sediment Plume, Winooski River Delta
Colchester/Burlington, VT


St. Jean-sur-Richelieu, 2011

Figure 24

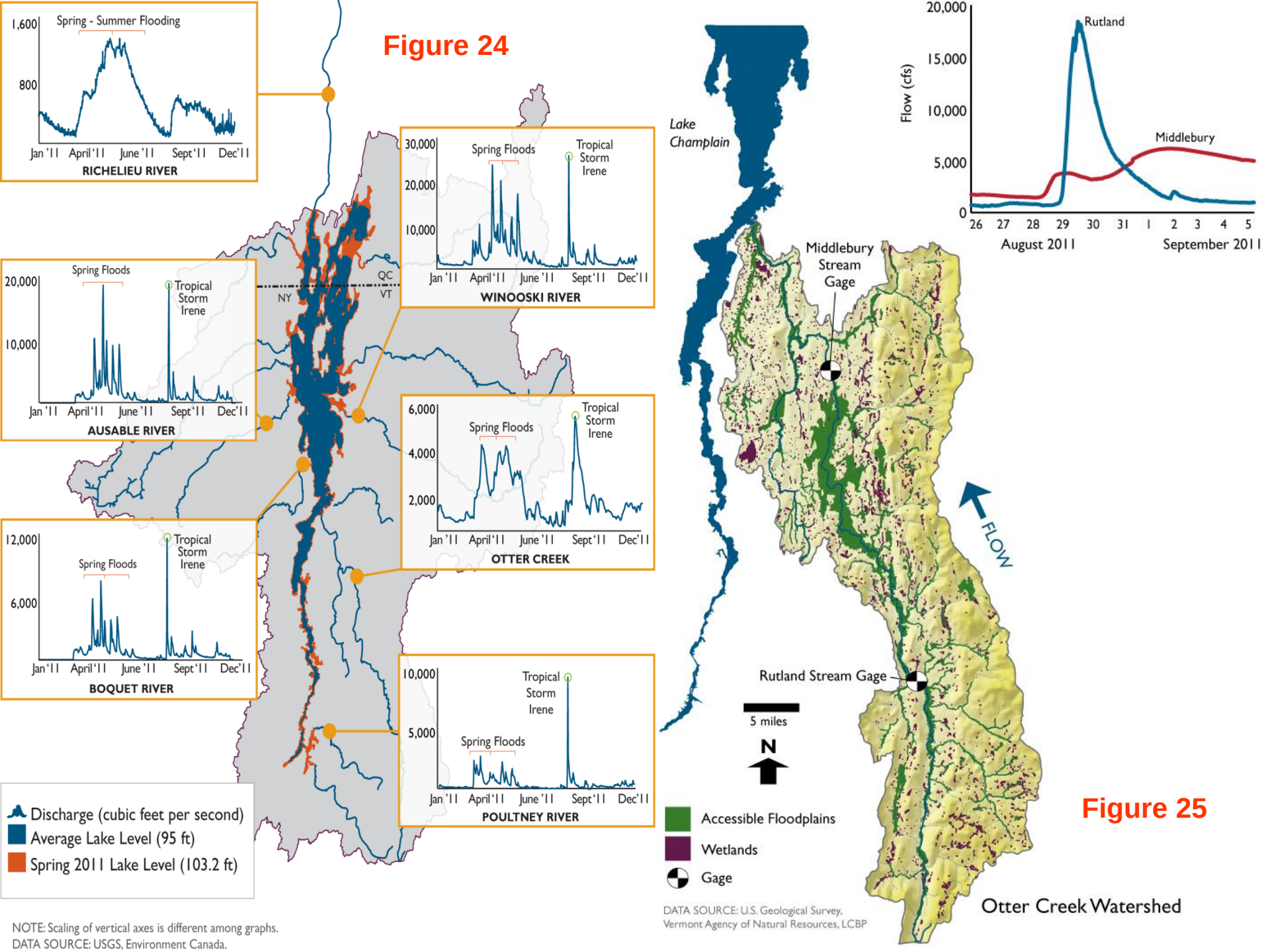
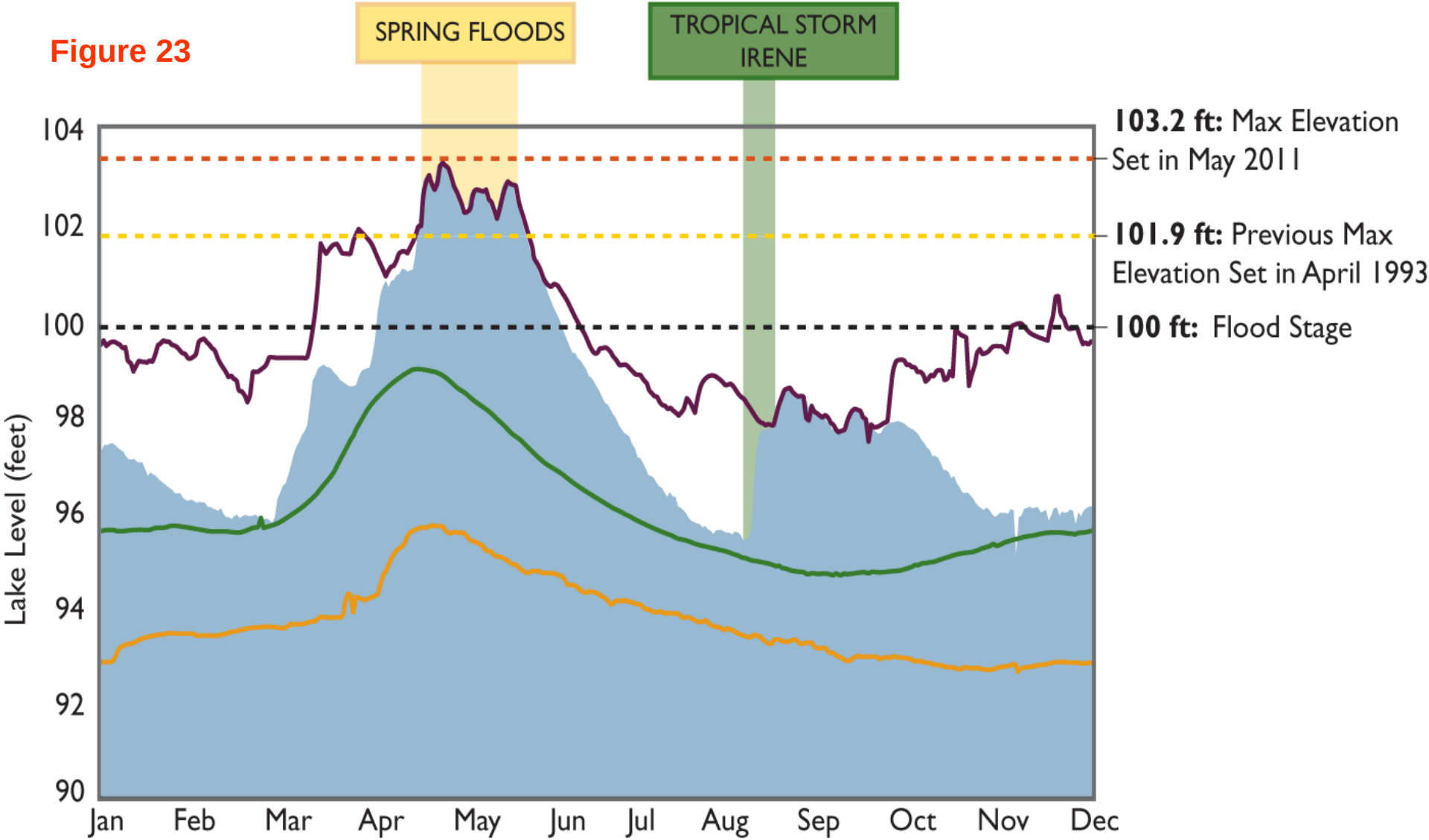


Figure 25

IRENE: Rt 100 Near Mendon, VT credit: Lars Gange & Mansfield Heliflight


IRENE: Otter Creek Sediment Plume

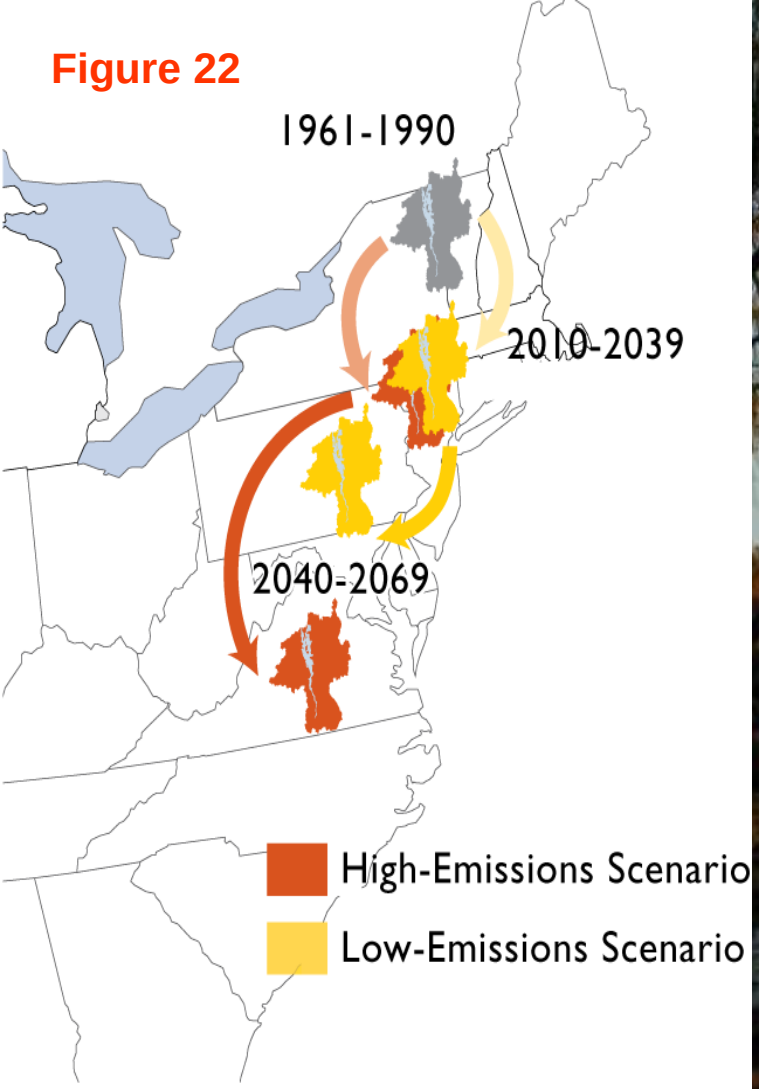
Figure 23



NOTE: The average lake level elevation is determined by averaging all records between 1908 (when elevations were first recorded) and 2011 for any given day. Elevations are at Burlington, VT.

DATA SOURCE: NOAA

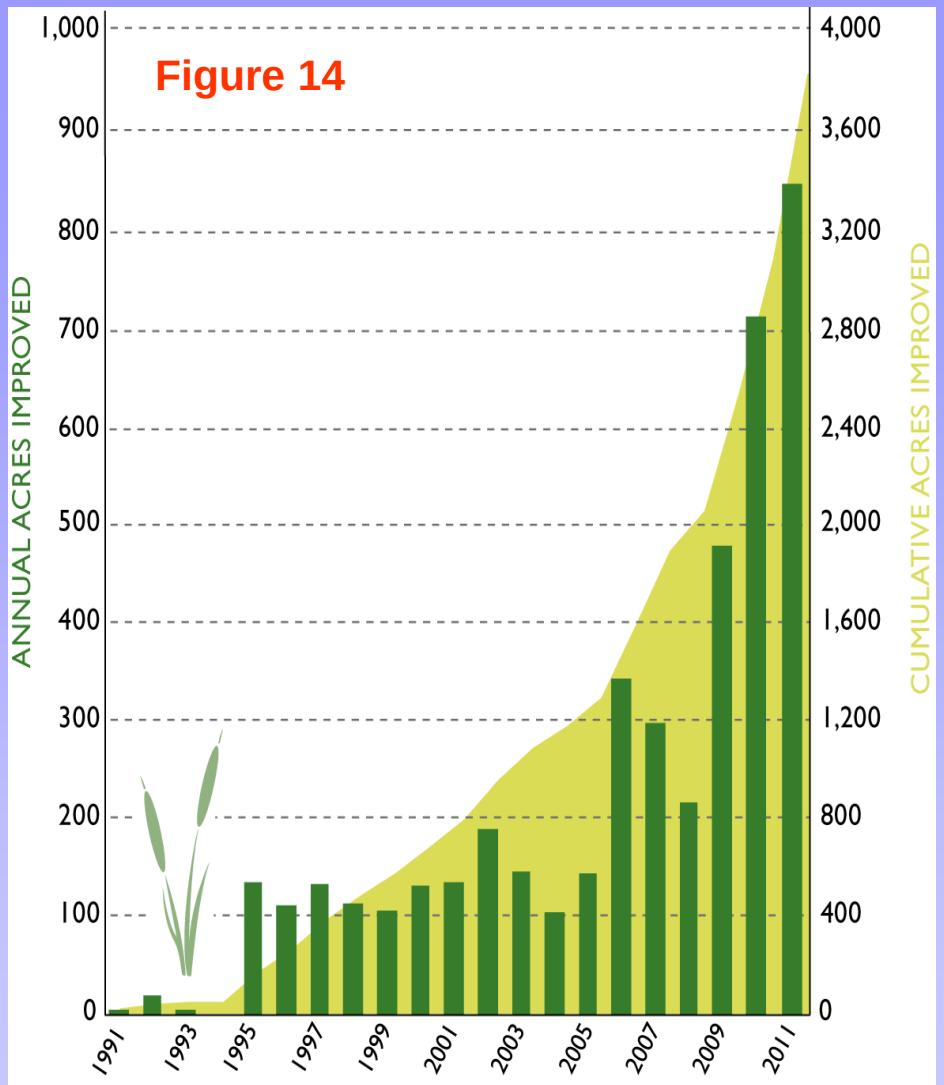
Figure 22



Red arrows track the shift in the Lake Champlain Basin's summer climate over the next 60 years if we continue under a high-emissions scenario. Yellow arrows track the shift under a low-emissions scenario.

DATA SOURCE: Adapted from Union of Concerned Scientists.

Figure 14

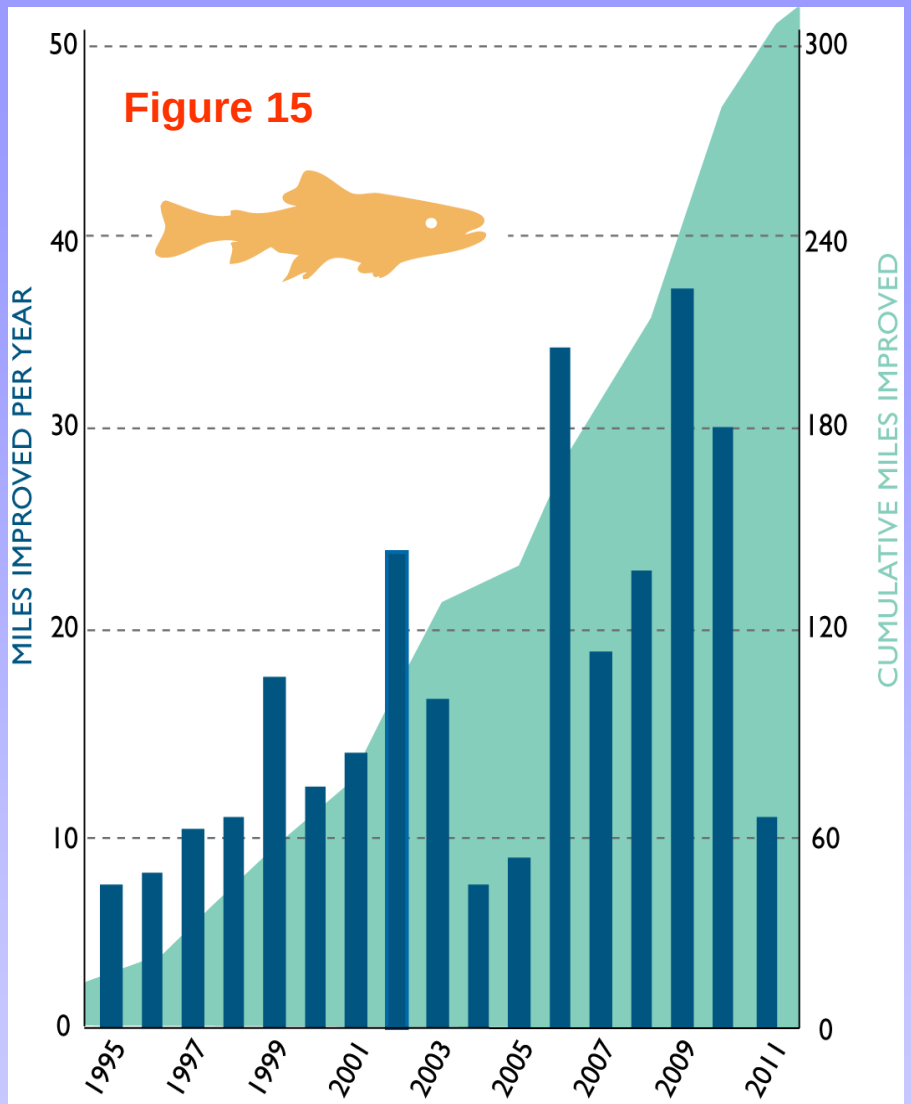


Acres of wetland habitat restored, enhanced and managed through the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program. Accomplishments reflect the Service partnership with local landowners, other Federal and State agencies and numerous other non-governmental conservation groups.

NOTE: No wetlands were improved in 1994 in the Lake Champlain Basin.

DATA SOURCE: US Fish and Wildlife Service

Figure 15



Miles of riparian habitat restored and enhanced in the Lake Champlain Basin through the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program. Accomplishments reflect the Service's partnership with local landowners, other Federal and State agencies and numerous other non-governmental conservation groups.

DATA SOURCE: US Fish and Wildlife Service

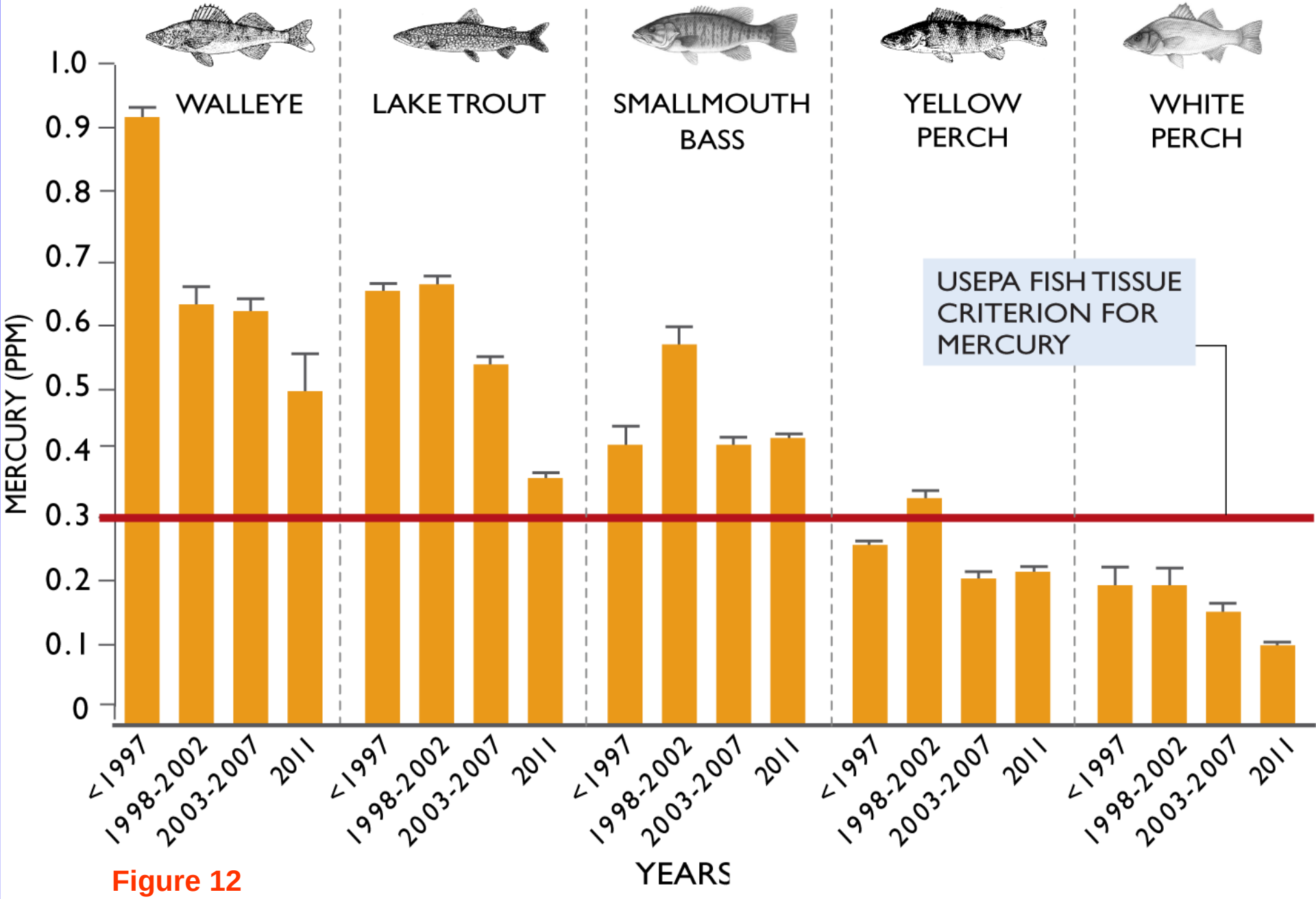
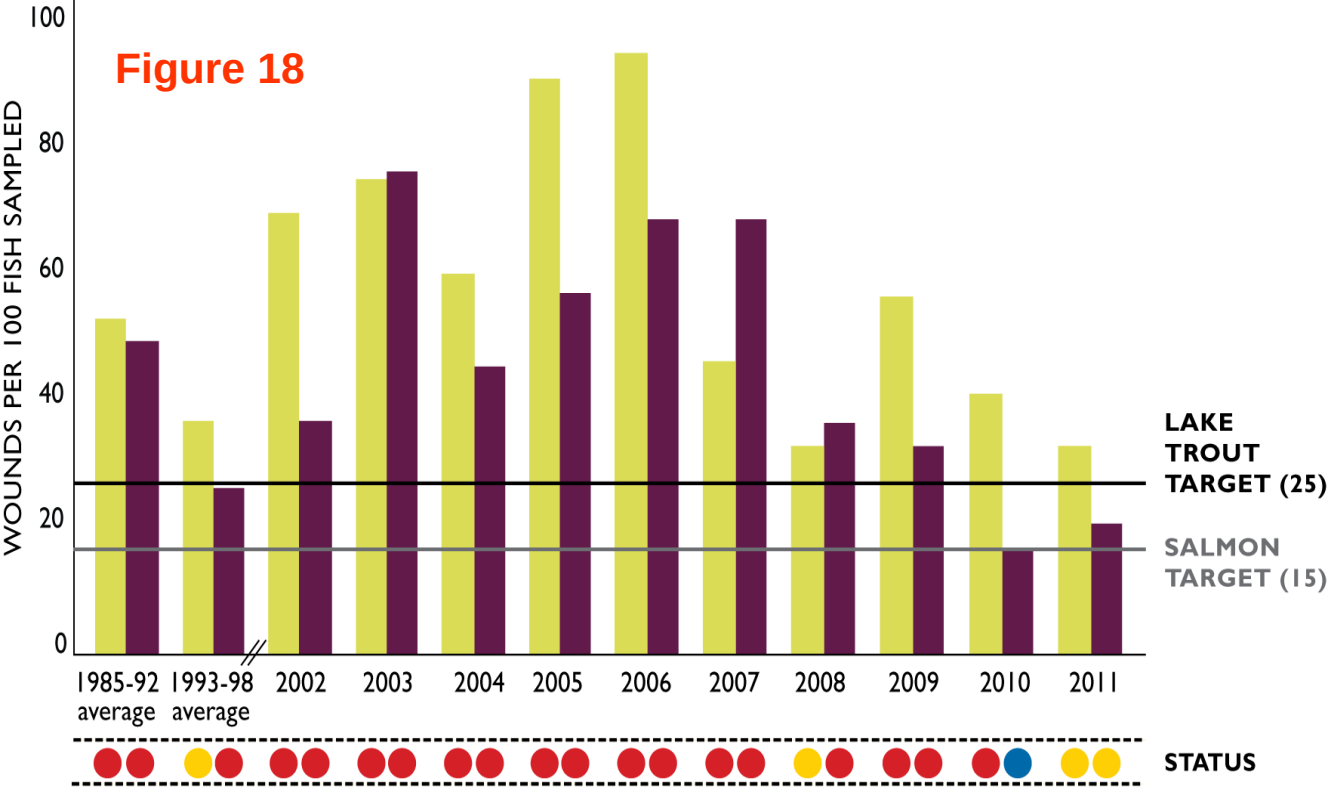


Figure 12

NOTE: The values are mean mercury concentrations, normalized to the average length of the fish. Bars show standard errors.
DATA SOURCE: Vermont Agency of Natural Resources; 2011 data from Biodiversity Research Institute.

Figure 18



LAKE WIDE STATUS BY YEAR

GOOD Meets target for lake trout (25 wounds per 100 fish sampled) or salmon (15 wounds per 100 fish sampled)

FAIR Within 50% of meeting the target for lake trout and salmon

POOR Exceeds target by more than 50% for lake trout and salmon

LAKEWIDE TREND

Positive: Lamprey wounds decreased from 2007-2011

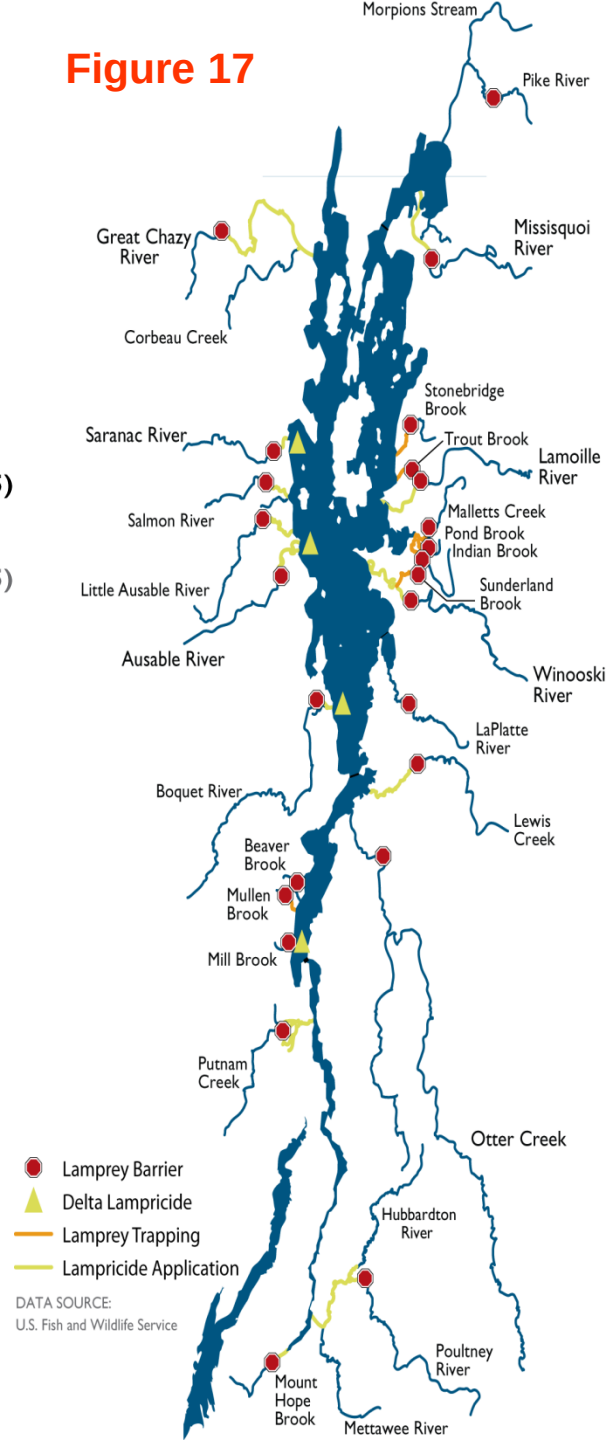
LAKE TROUT

ATLANTIC SALMON

NOTES: Lake trout were 533-633mm (21-25 in) in length. Salmon were 432-533 mm (17-21 in) in length. 1982-92 was pre-control and experimental control was during 1993-98.

DATA SOURCE: Lake Champlain Fish and Wildlife Management Cooperative

Figure 17



May, 2011 Lake Champlain Flood

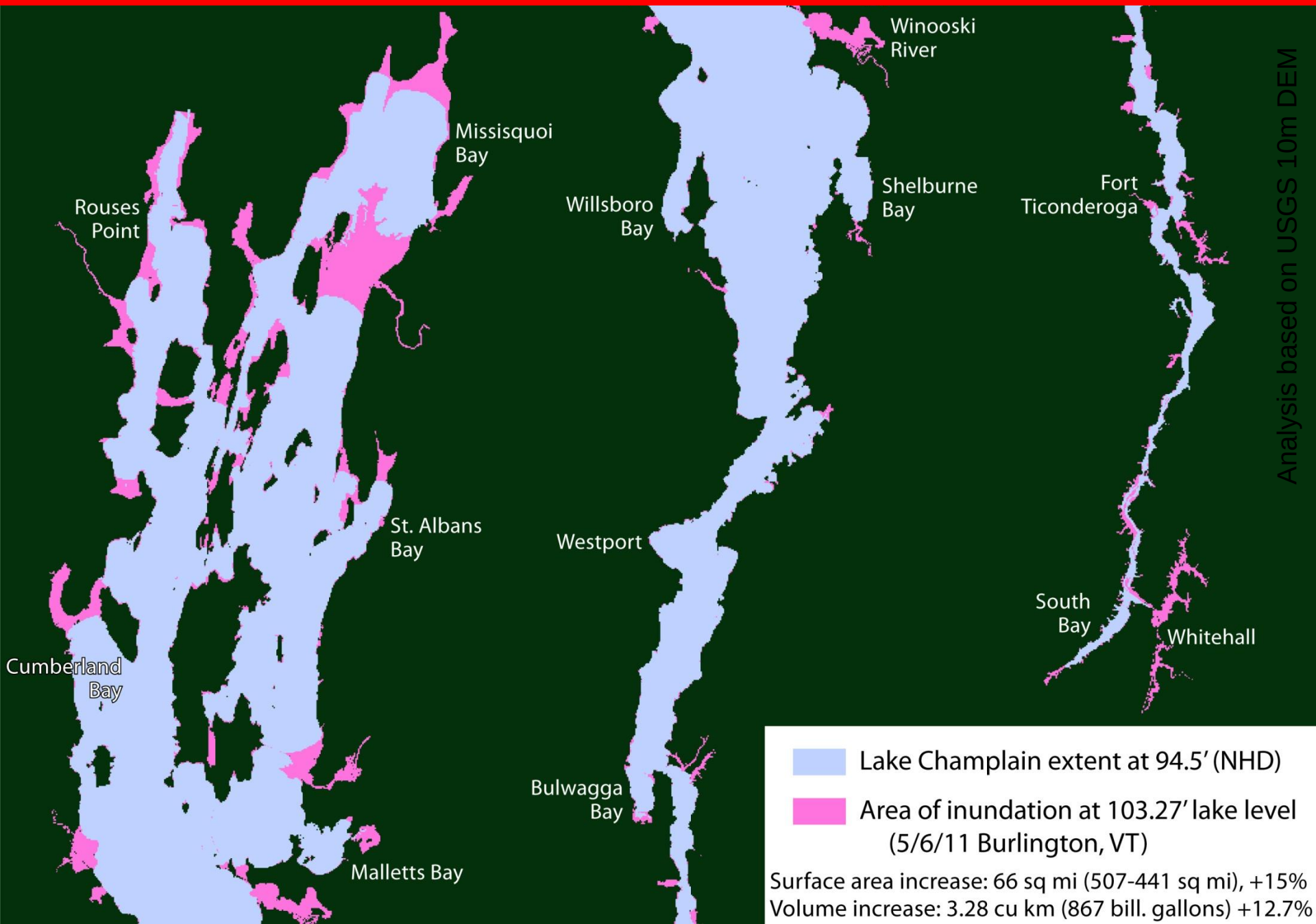
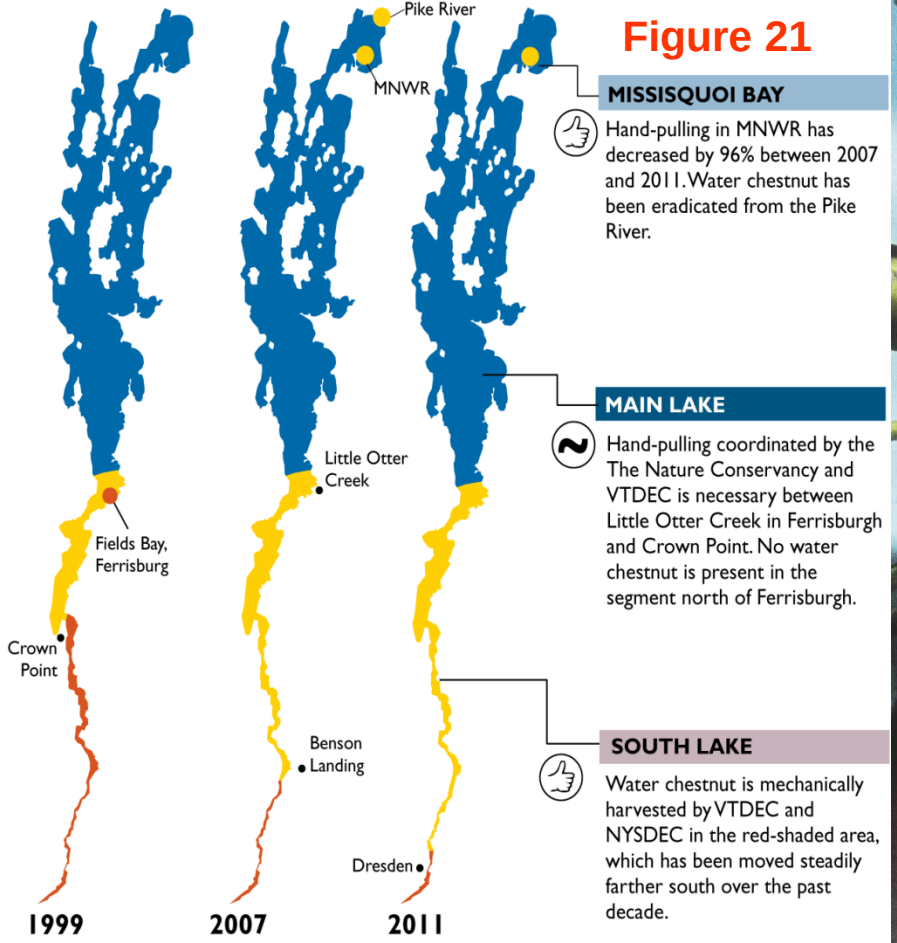


Figure 21



MISSISQUOI BAY

Hand-pulling in MNWR has decreased by 96% between 2007 and 2011. Water chestnut has been eradicated from the Pike River.

MAIN LAKE

Hand-pulling coordinated by the The Nature Conservancy and VTDEC is necessary between Little Otter Creek in Ferrisburgh and Crown Point. No water chestnut is present in the segment north of Ferrisburgh.

SOUTH LAKE

Water chestnut is mechanically harvested by VTDEC and NYSDEC in the red-shaded area, which has been moved steadily farther south over the past decade.

STATUS

GOOD — No water chestnut present and no management needed

FAIR — Water chestnut present with less than 25% coverage (typically managed hand-pulling)

POOR — Water chestnut present with greater than 25% coverage (typically managed by mechanical harvesting) in an area covering greater than 10% of the segment

TREND

Improving: water chestnut is decreasing

No trend: neither improving nor deteriorating

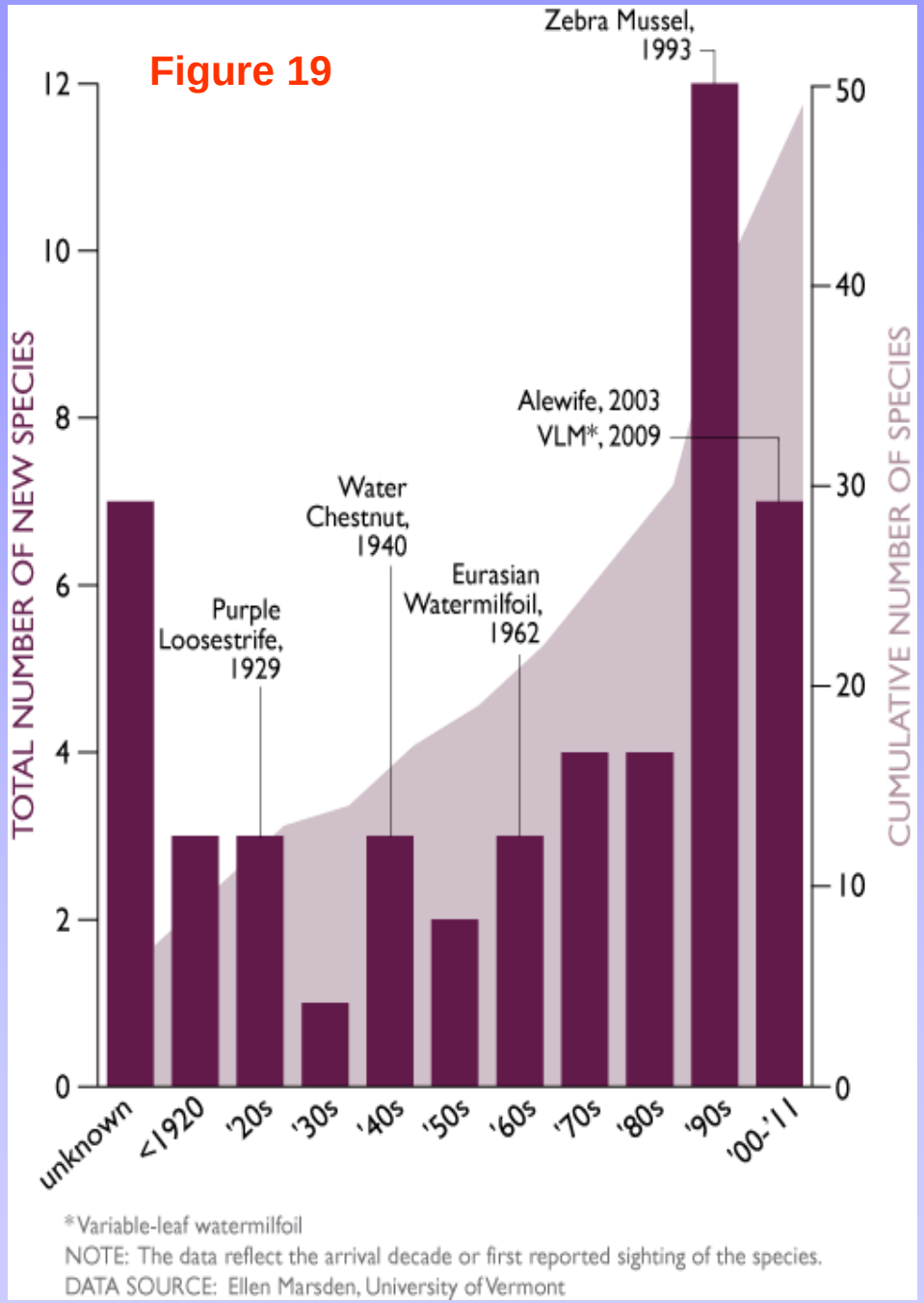
Deteriorating: water chestnut is increasing

No trend data is available

DATA SOURCES: VTDEC, NYSDEC, QC MDDEP


L. Johnson

Figure 19

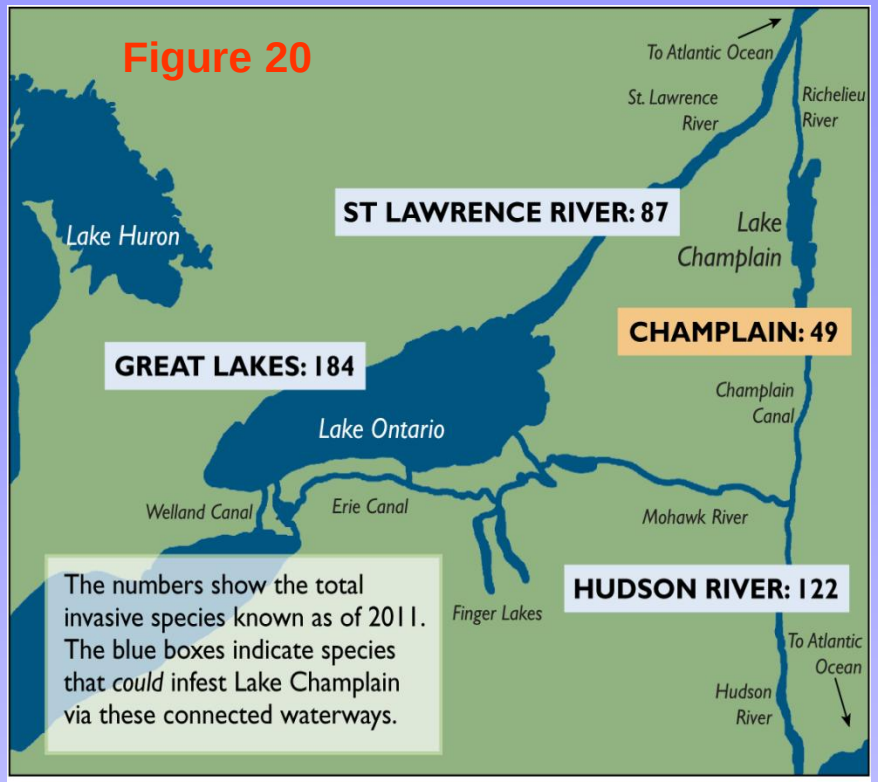


*Variable-leaf watermilfoil

NOTE: The data reflect the arrival decade or first reported sighting of the species.

DATA SOURCE: Ellen Marsden, University of Vermont

Figure 20



DATA SOURCE: UVM, Lake Champlain Sea Grant, Great Lakes Environmental Research Laboratory, Lafontaine and Costan 2002, and Strayer 2012.

Lake Champlain Basin Program

STATE OF THE LAKE

AND ECOSYSTEM INDICATORS REPORT

2012