

Biodiversity and Non-Native Species Introductions in the St. Lawrence River

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The Biodiversity Portrait of the St. Lawrence

- **A New Tool available on the Web**
- <http://www.qc.ec.gc.ca/faune/biodiv/>
- **A synthesis of information & a georeferenced database**
 - 28 000 sites
 - 465 000 entries
 - 5 000 species
- **To aid developing a conservation strategy of the St. Lawrence River ecosystem**

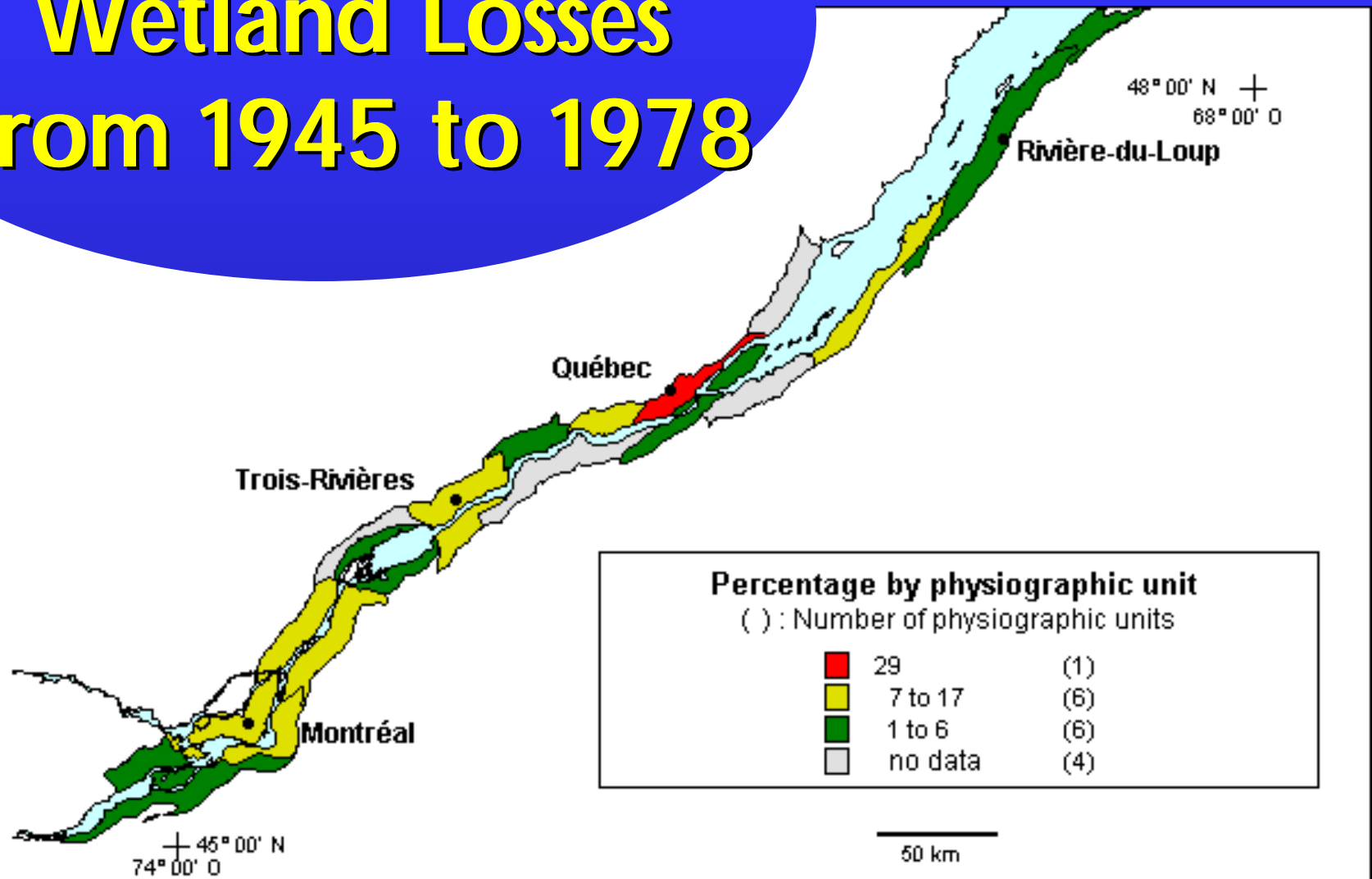
Habitat Losses Along the St. Lawrence River

- ~50% of shoreline modified by agriculture and urbanization
- 25% of shoreline subjected to erosion
 - 1 500 ha of island habitats lost since 1950 !
- Possible scenario :
 - Decline in river flow : 40% of wetlands lost over the next 50 yrs !
 - 4 000 ha of island habitats under stress !

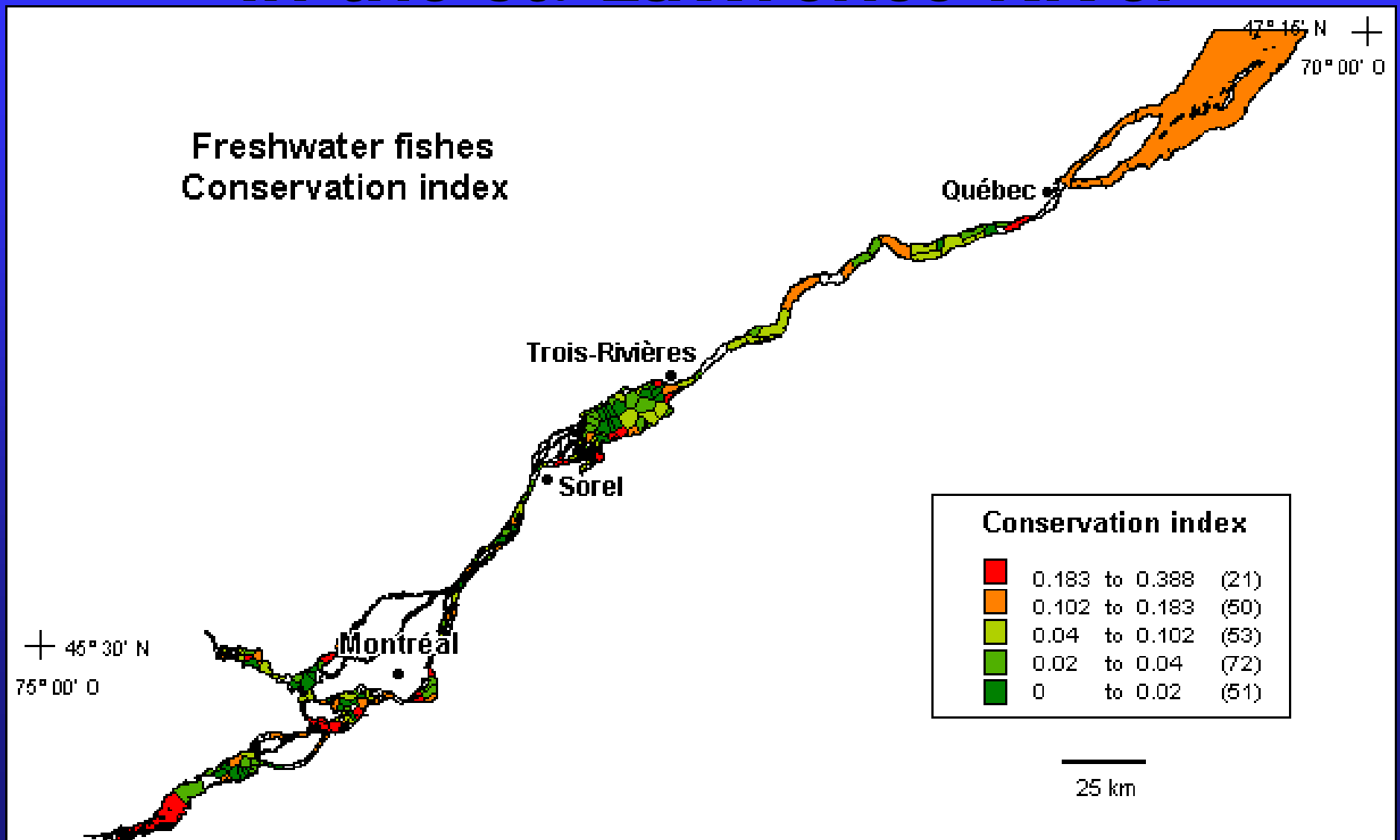
Wetland Distribution Along the St. Lawrence River

	Total Wetlands (ha)	Submerged Vegetation	Marsh	Wet Meadow	Swamp
Fresh water	63000	30260	12600	7540	12600
Fluvial estuary	11940	-	7630	4070	240
Marine sector	4760	?	950	3810	-
Total	79700	38 %	27 %	19 %	16 %

Percentage of Wetland Losses From 1945 to 1978



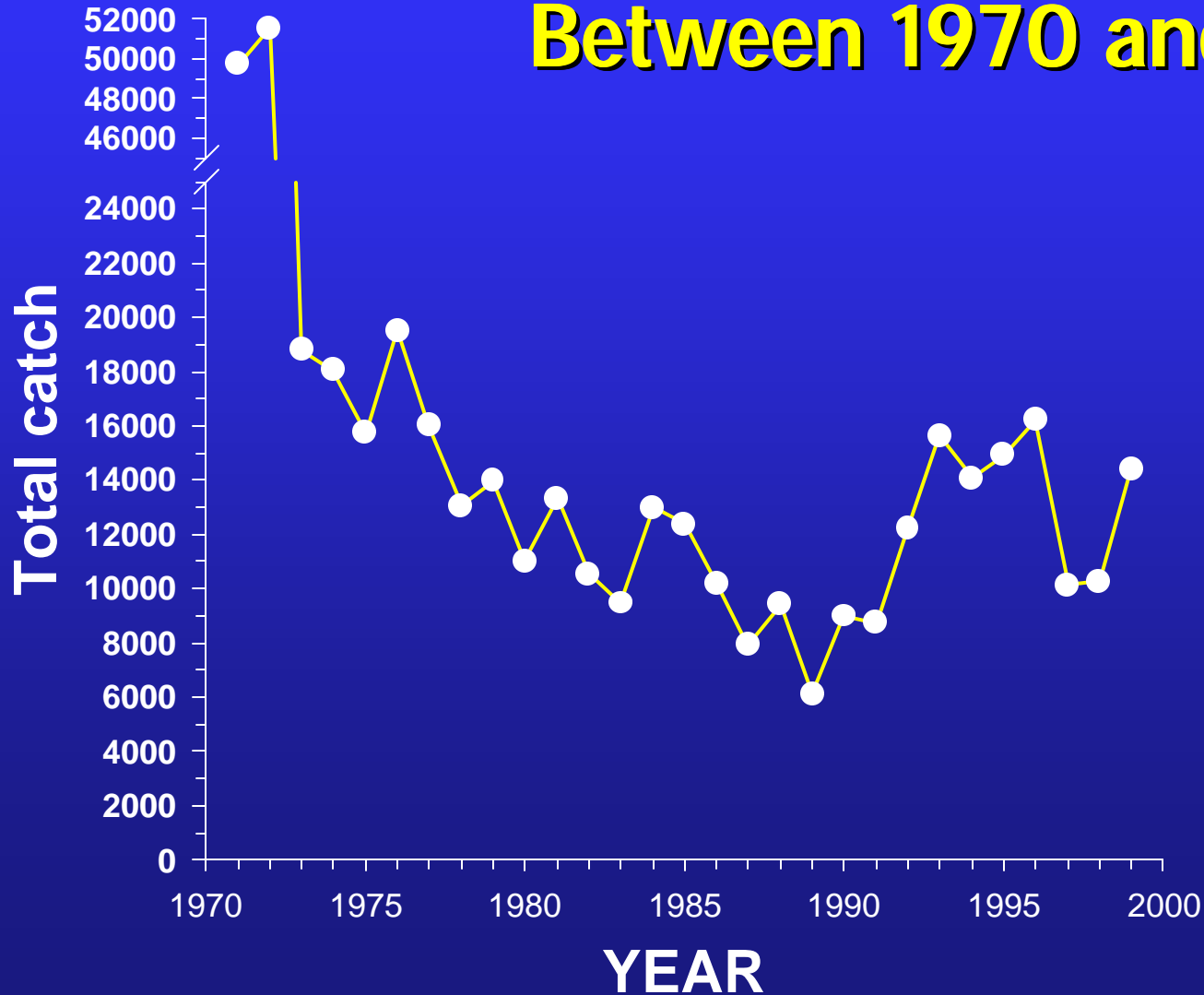
Freshwater Fish Biodiversity in the St. Lawrence River



Impact on the St. Lawrence
freshwater fish community ?



Freshwater Fish Decline at the St-Nicolas Experimental Fishery Between 1970 and 1999





Species introductions in the St. Lawrence River

Foreign Shipping (1978-1996)

Destination	Ship arrivals		Ballast capacity	
	(No. yr ⁻¹)	%	(10 ⁶ MT yr ⁻¹)	%
Great Lakes	249 ±39	19	2.3 ±0.5	17.5
St. Lawrence River	1048 ±104	81	10.8 ±2.3	82.5
<i>Montreal</i>	735	70	6	60
<i>Quebec</i>	179	17	3	27
<i>Other harbours</i>	135	13	1.8	13

from Bourgeois, Gilbert & Cusson 2000

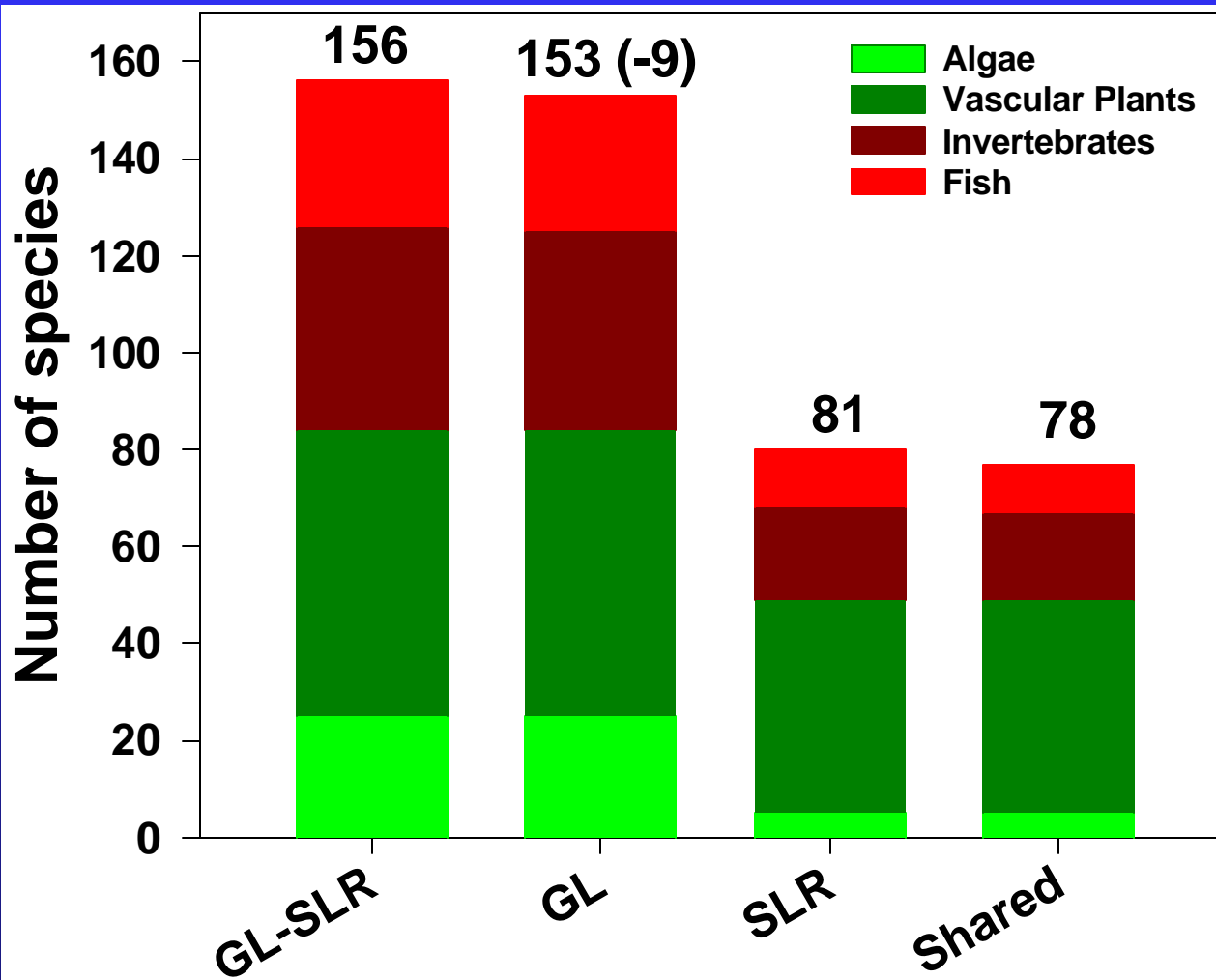
Objectives

- List of species introduced in the St. Lawrence River
- Evaluate the transfer of species between the Great Lakes and the river
- Assess the spatial distribution and temporal trend of introduced species

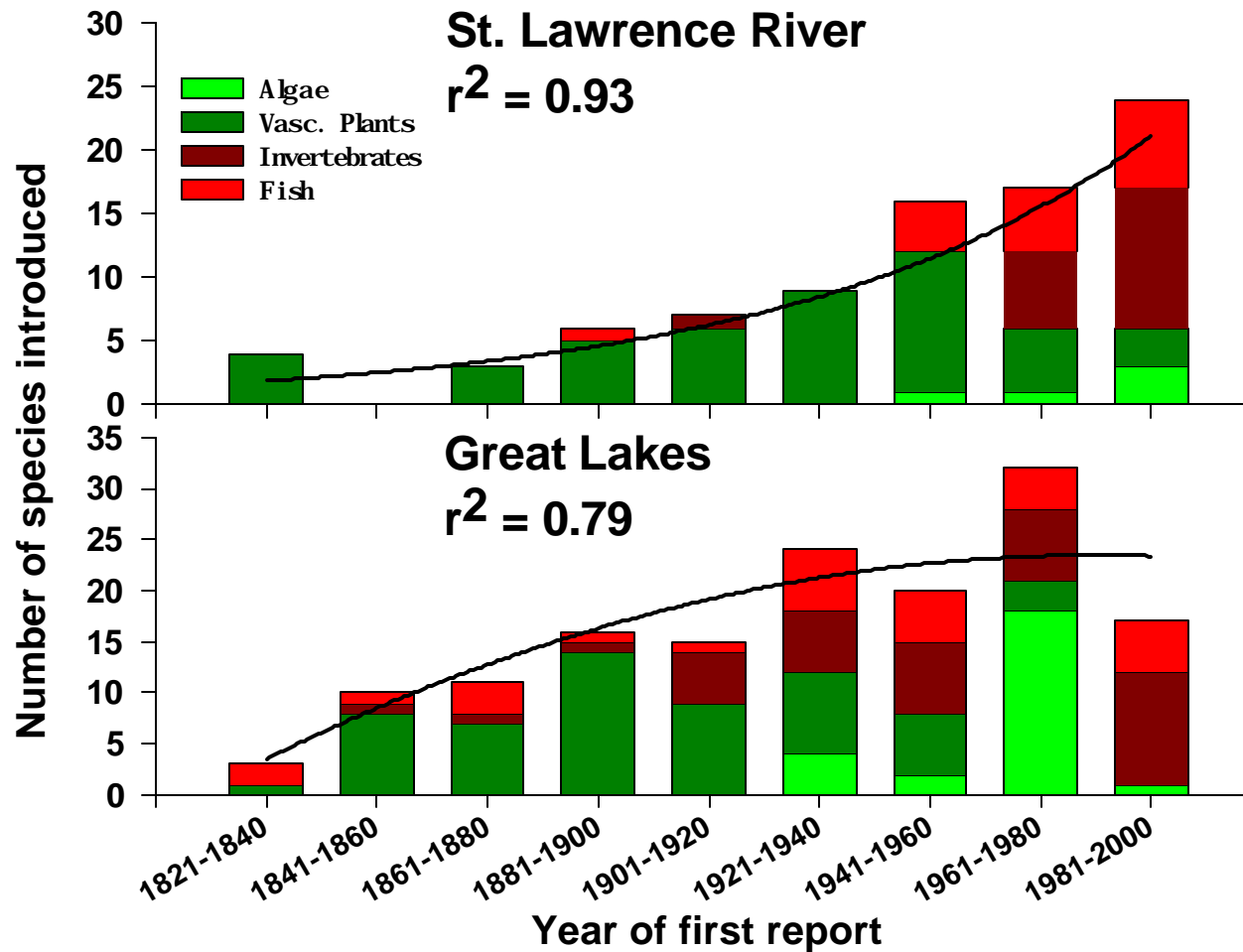
Methods

- Literature search
 - Scientific papers
 - Technical reports
 - Computerized databases
 - Web sites
 - Museum collections
- Database information
 - Species name
 - Year of first report
 - Site of first report
 - Origin of species
 - Vector of introduction
 - Distribution in river
 - Density (in progress)

Alien species in the Great Lakes - St. Lawrence River



Half the
non-
indigenous
species have
been reported
in the St.
Lawrence
River



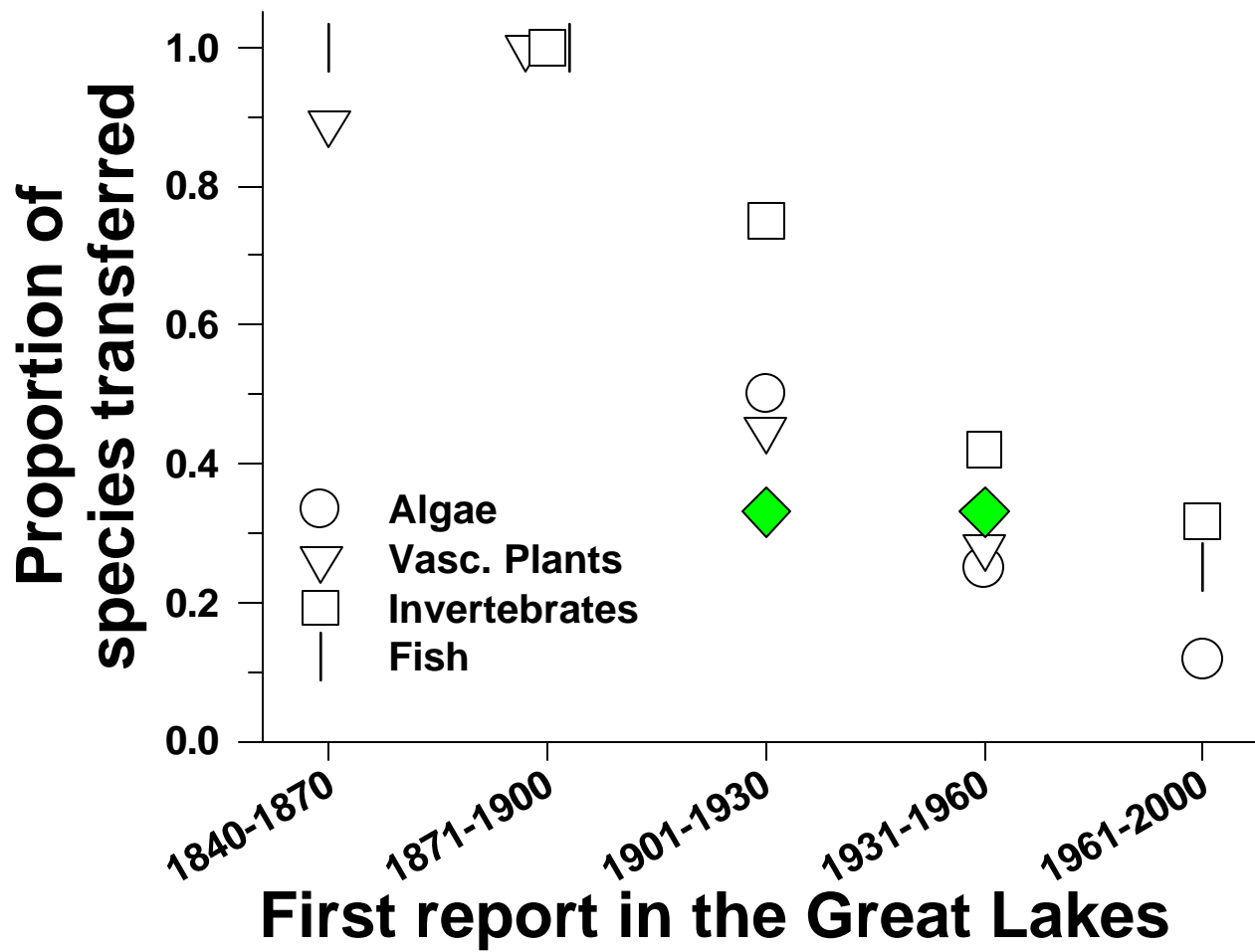
Average rate
 ~ 1 species
 per year

**Trend in species introductions
 since 1820**

Time for Transfer of non-native Species Between the Great Lakes and the St. Lawrence River

Taxonomic Groups	Species (n)	Time difference (years)		
		Mean	Min.	Max.
Algae	4	32.0	17	69
Vasc. Plants	32	50.0	2	123
Invertebrates	16	40.6	2	95
Fishes	10	39.6	7	96
Vasc. Plants (upstream transfer)	12	-25.2	-3	-129

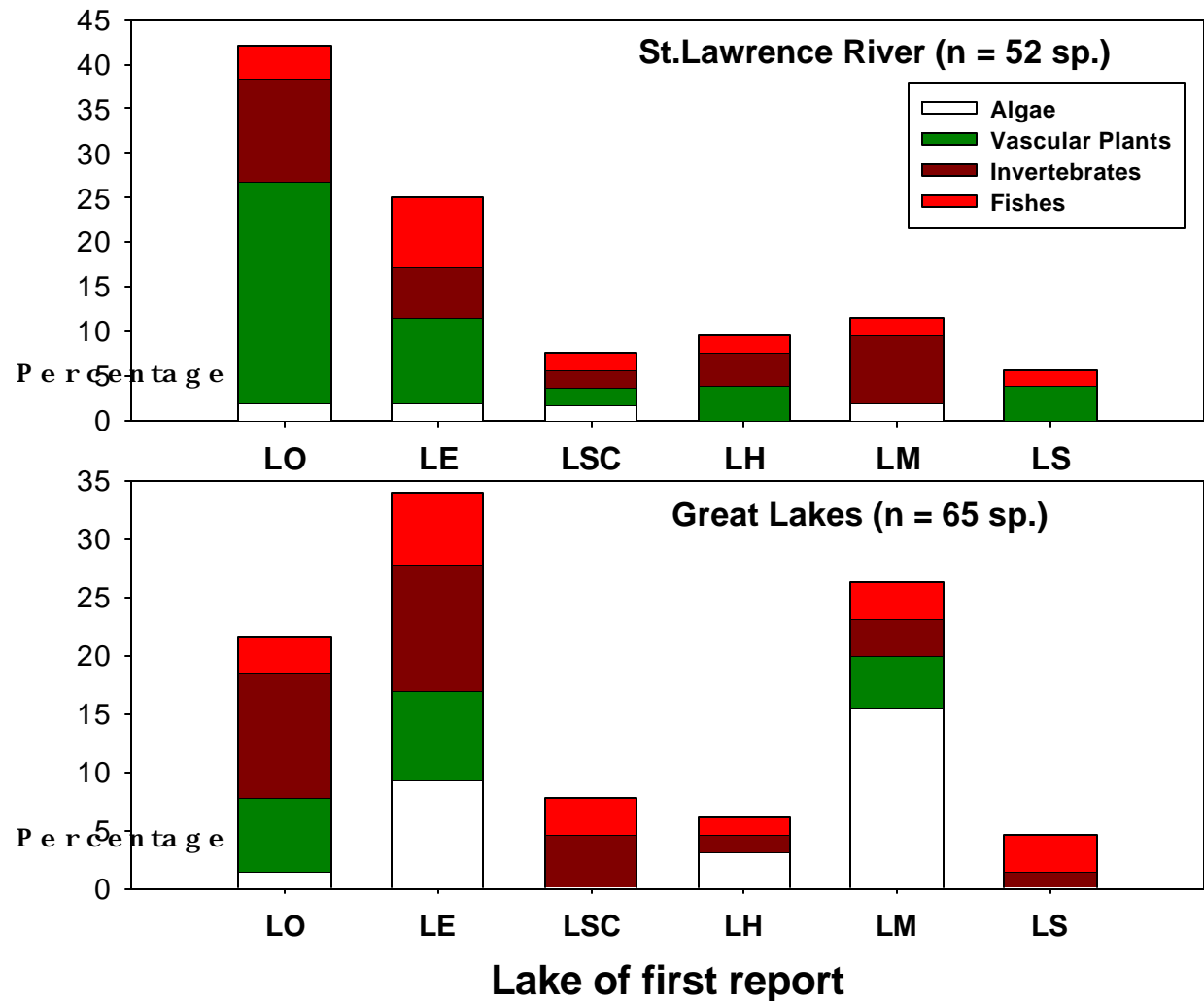
Proportion of species transferred over time



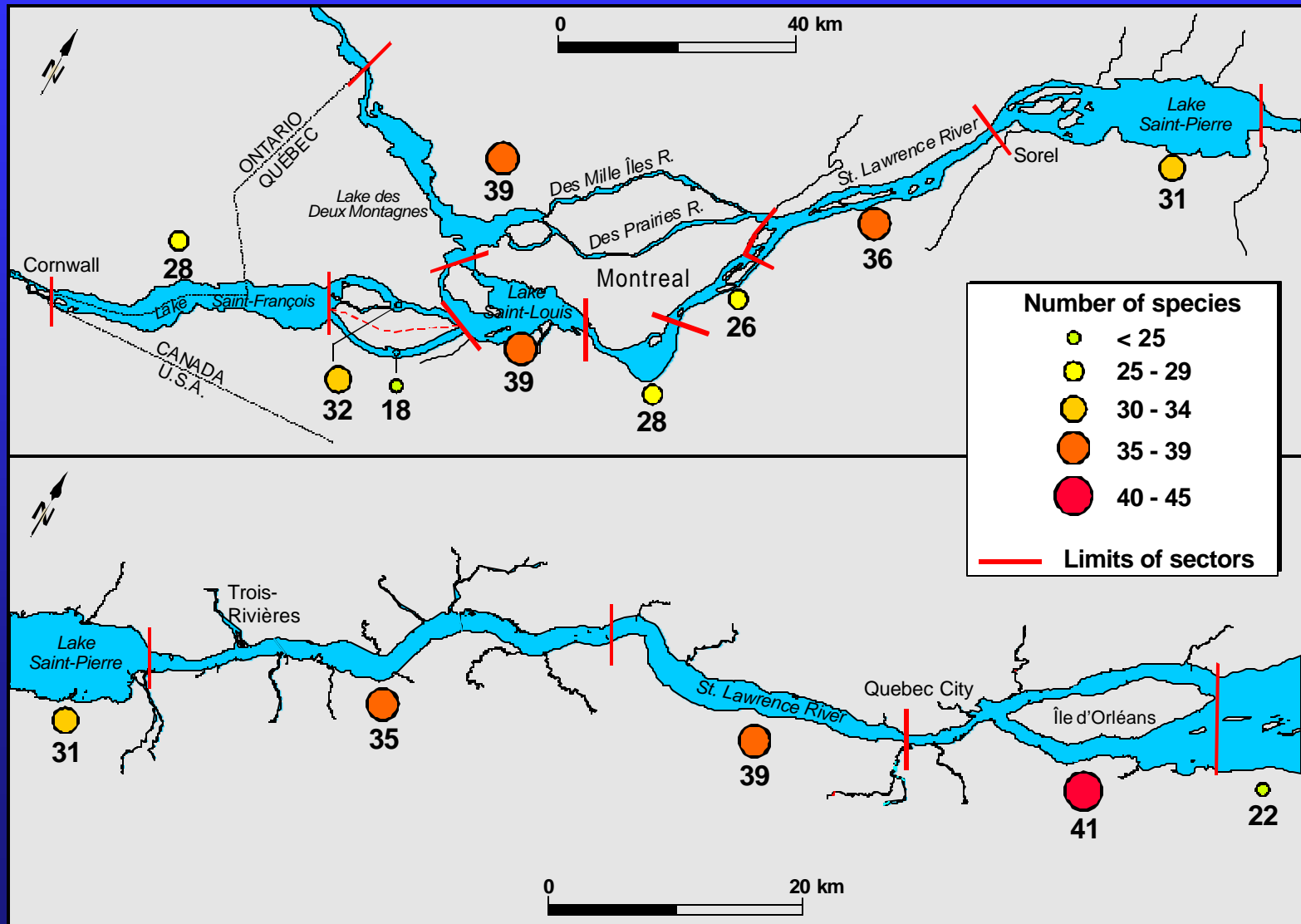
Species transfer takes time !

Species Transfer in Relation to the Site of First Report

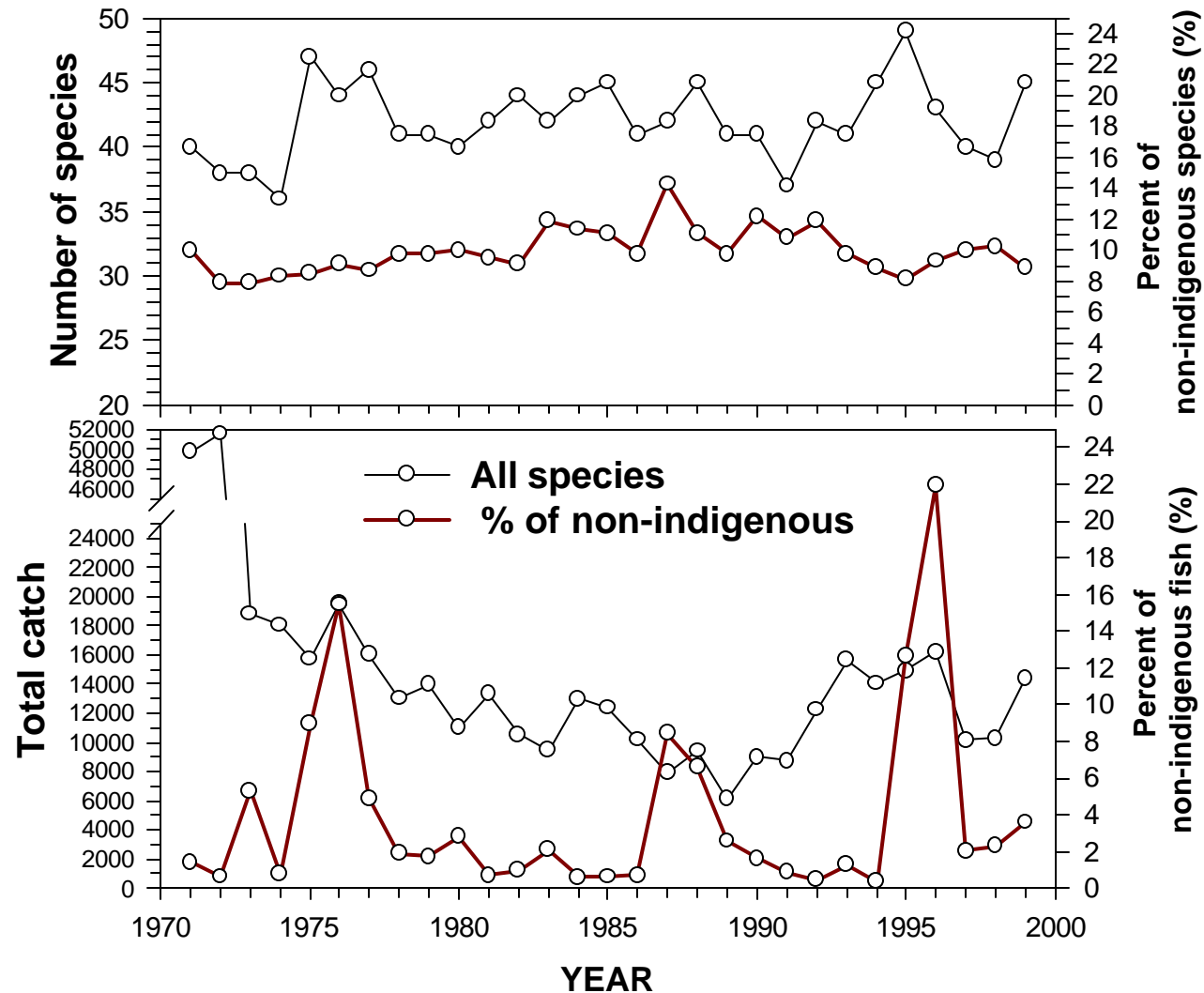
Species transfer is inversely related to distance of lake site of introduction



Hot spots of non-native species along the St. Lawrence River



Non-indigenous Fish in the SLR Fish Community Near Quebec City



Species invasion: a probabilistic process

- ~50% of the species introduced in the Great Lakes reported in the St. Lawrence River
- Introduction rate : ~ 1 sp. per year
- Downstream transfer - main source of introduction in the St. Lawrence River
- % of species transfer increased with time

Reports of introduced species in the St. Lawrence River will remain high over the next decade

Guidelines for Water Ballast Exchange Should Be Rigorously Applied and Compliance Should Be Enforced for the St. Lawrence River

Time period	Species introduced			Total
	Shipping	Others	Unknown	
1901-1910	2	5		7
1911-1920	1	8		9
1921-1930	1	7	2	10
1931-1940	5	9		14
1941-1950	2	5	4	11
1951-1960	2	6	2	10
1961-1970	10	4	1	15
1971-1980	10	4	3	17
1981-1990	9	2	1	12
1991-2000	4	0	2	6

Perspectives

- Upstream transfer - a non-negligible source of species introductions in the GL (~10%)
- Insufficient data to assess or predict potential impact of non-indigenous species in the river
- Validate the information on non-indigenous species presence and distribution

If you give them time they will invade

- The Biodiversity of the St. Lawrence River is under stress
- The problem of exotic species introductions is getting worse due to downstream transfer from the Great Lakes