Early Detection of Invasive Fishes in Lake Superior

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AIS are a Priority

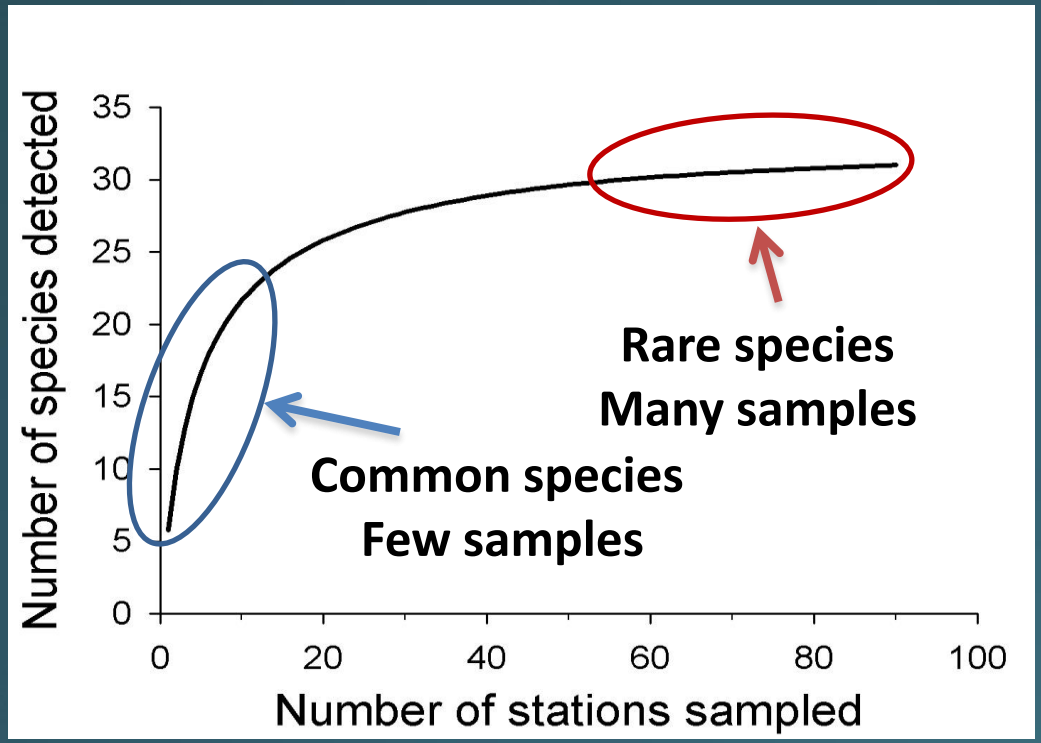
- CSMI priority project for 2011 and issue for 2016
- Lake Superior Lakewide Management Plan
- Lake Superior Aquatic Invasive Species Comp. Prevention Plan
- Lake Superior Fish Community Objectives (2003)

GLRI Action Plan: *"A comprehensive program for detection and tracking newly identified invasive species in the Great Lakes is developed and provides up-to-date critical information needed by decision makers for evaluating potential rapid response actions"* and Objective: *"By 2014, a basinwide surveillance program with shared sampling protocols and methodologies to provide early detection of non-native species will be operational."*

What are we trying to accomplish with early detection?

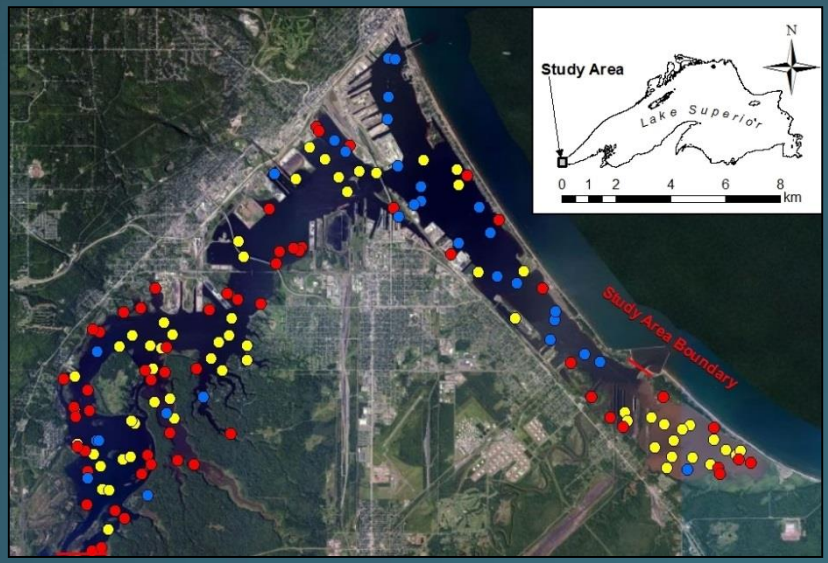
- Rare species = intensive effort / patchy distribution

- Which species arrives next?
- Use native/non-native community to quantify effort for rare species



Process for Efficient Sampling

1. Determine high risk locations for introductions
    1. Vectors and species risk assessments
    2. Prioritize locations
2. Experimental sampling to accumulate a dataset on the area
    1. Gears work in habitats
    2. Gears can catch non-natives at high risk
    3. Random sampling/depth strata



Process for Efficient Sampling

3. Evaluate the dataset:
    3. Gear mixtures
    4. Effort amount
    5. Species diverse habitats
4. Adjust sampling to maximize detections

Adaptive Monitoring

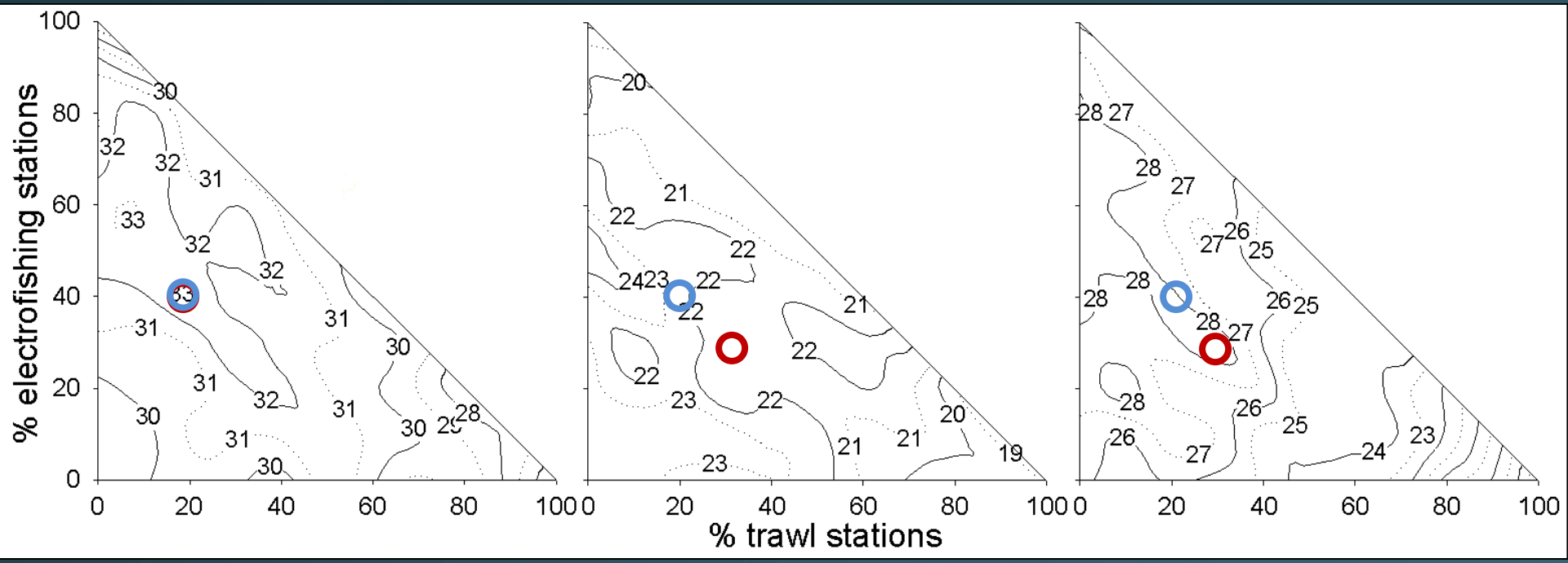
Monitoring Progress

- August-September
- Random allocation of sample locations

Sampling gear	St. Louis River		Upper St. Marys/Thunder Bay	
	# stations/year	Depth strata (m)	# stations/year	Depth strata (m)
Fyke net	20	0-1	15	0-1.8
Electrofishing	20	1-2	15	0-1.8
Trawling	10	>2	15	>1.8

Gear mixtures to maximize richness?

St. Louis River Upper St. Marys Thunder Bay



– Randomly selected 0, 2, 4, …, 20 fyke net records and added 0, 2, 4, …, 20 electrofishing and 0, 2, 4, …, 20 trawl records to reach a total of 20 stations (66 possible gear combinations)

– Plotted mean richness from 10 random draws of each gear combination

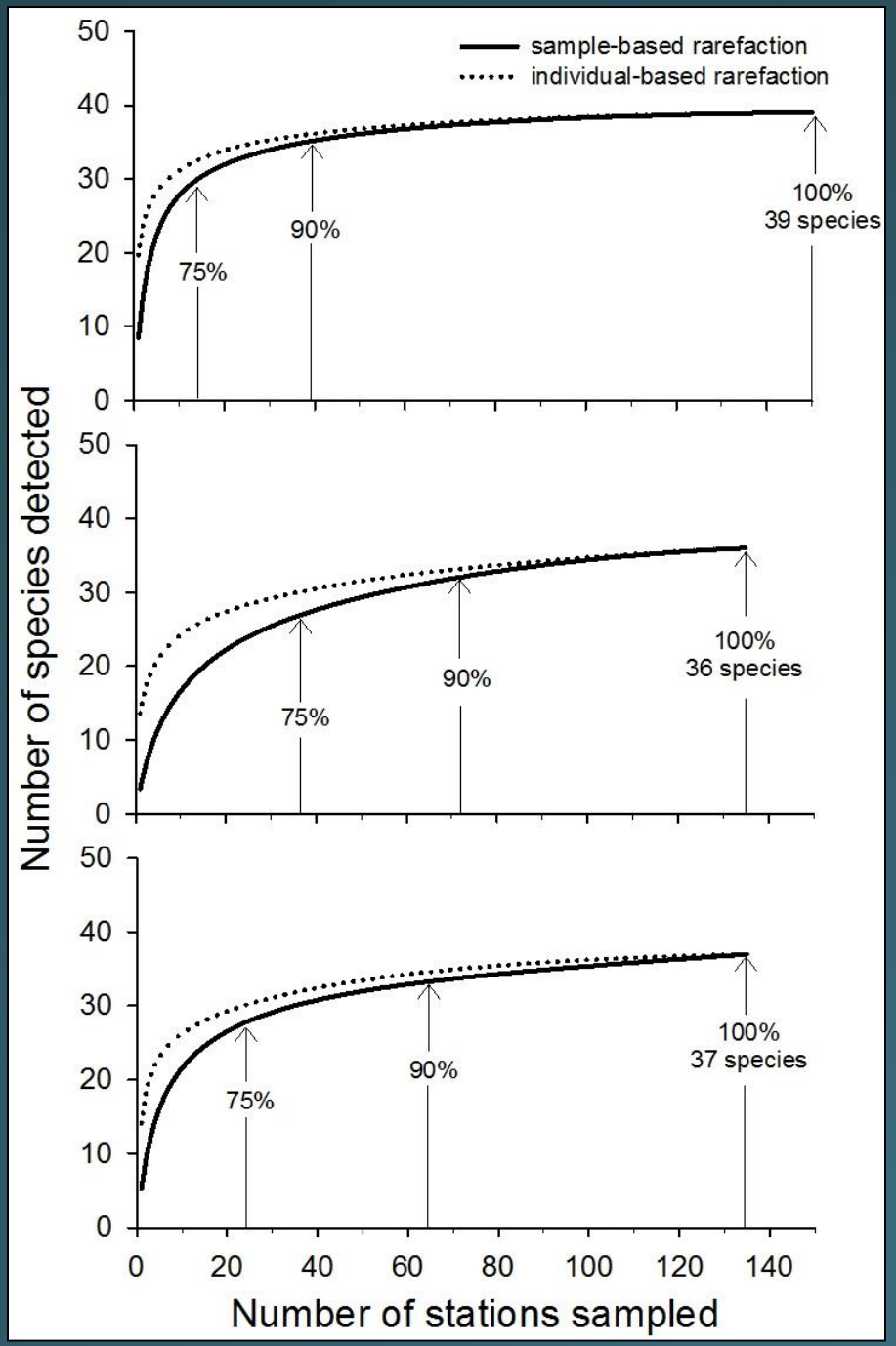
Rarefaction

St. Louis River

Upper St. Marys River

Thunder Bay

(EstimateS software)



Estimated Species Richness

Parameters: total fish, singletons, doubletons (EstimateS)

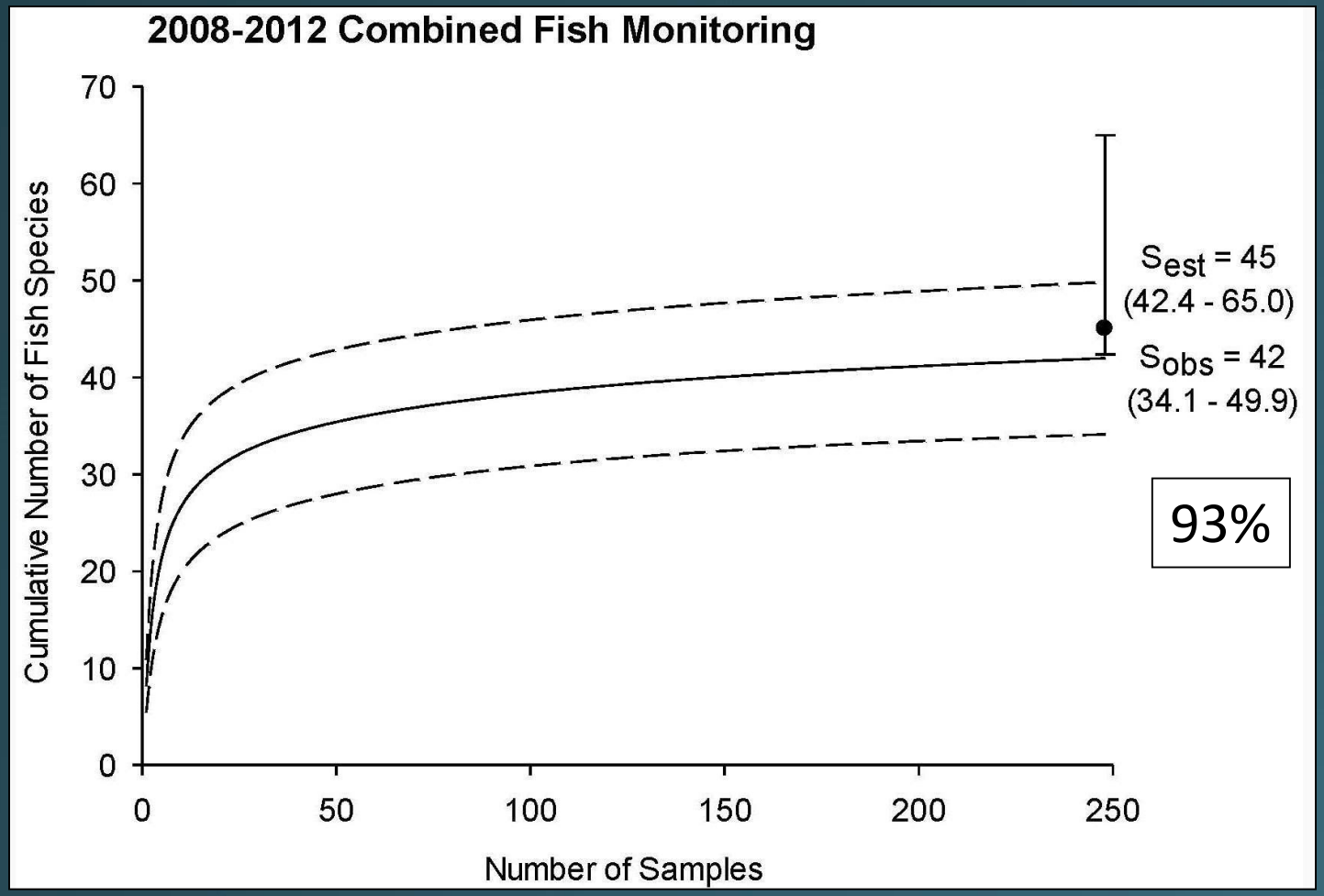
Location	# Species observed	# Species estimated	Additional Samples	
			100%	95%
St. Louis River	39	39.0	0	0
Upper St. Marys	36	37.2	202	4
Thunder Bay	37	37.3	84	0

Chao et al. (2009) Sufficient sampling for asymptotic minimum species richness estimators. Ecology

Hoffman et al. (2011) Effort and potential efficiencies for aquatic non-native species early detection. Canadian Journal of Fisheries and Aquatic Sciences

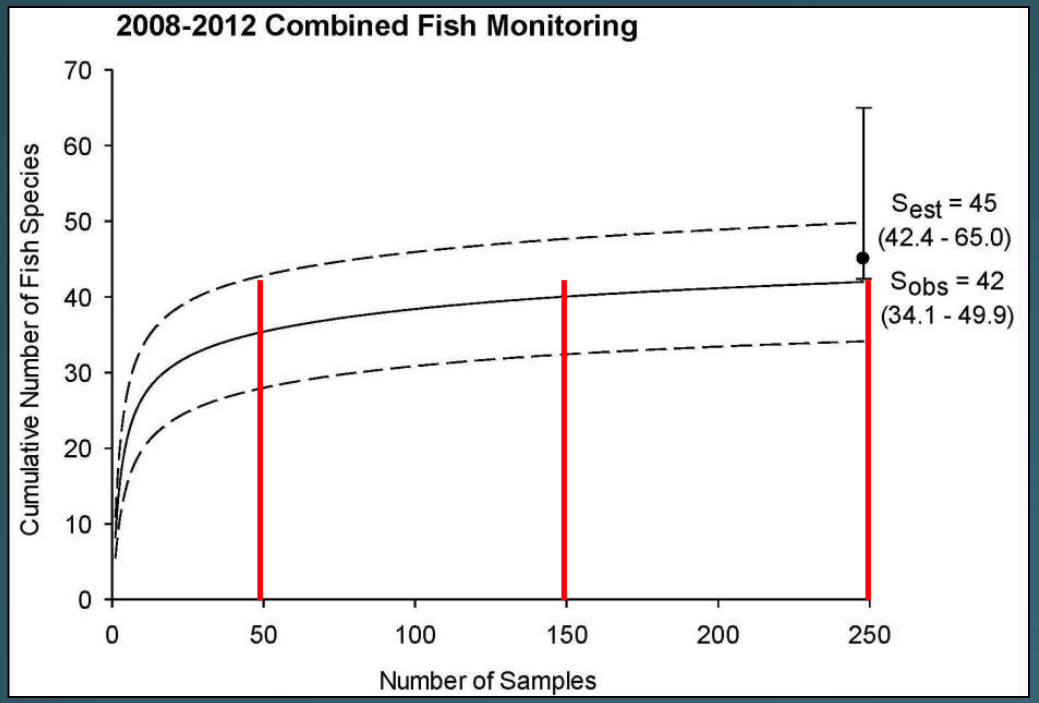
Expanded Time Series

St. Louis River



What qualifies as early detection (success)?

- 95% or 100%?
- 5, 3, or 1 years?
- What does no new detections mean?



Need High Certainty in Sampling!
Balance Effort and Risk!

Continued Monitoring

- Strategy has been successful on Superior
- With Coordination among partnering agencies on Superior (Great Lakes) these efforts could expand and increase our Lake-wide ability to detect new non-native species early


Questions?