Overview of the Great Lakes Mass Marking Program

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Who started this anyway?

First suggested by states, tribes, and Ontario in 2003.

Council of Lakes Committee, Great Lakes Fishery Commission directed a multiagency Task Group to investigate mass marking technology for a basin-wide program.

A Joint Strategic Plan for Management of Great Lakes Fisheries

Great Lakes Fishery Commission

What is it?

A comprehensive, coordinated fish tagging/marking and data recovery program involving all state, tribal, federal, and provincial agencies that stock char and salmon into the Great Lakes and its tributaries.

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What will the program accomplish?

Provide tagging/marking services for 22 million lake trout and salmon raised annually at all U.S. hatcheries across the Great Lakes basin, and a system to collect, process, and cooperatively analyze return data to assist agencies in evaluating the economic and biological impact of their stocking programs.

What information will be gained?

- Natural reproduction of all salmonines
- Inter-jurisdictional movement
- Contribution to sport, tribal commercial and tribal subsistence fisheries

- Identify genetic strains, hatcheries, and stocking locations that have greatest returns to the fishery or population
- Accurate year-class information
- Improved estimates of growth, survival, and exploitation.

Why is this information important?

- Great Lakes fisheries worth more that $7 billion annually plus a $12 billion boating industry!

- Great Lakes states and tribes spend $20 million annually to stock fish and monitor/manage the fisheries

- Stocking rates in the past have taxed forage fishes, making outcomes of management decisions unpredictable

- Wild and hatchery fish from species of restoration and conservation significance (i.e., lake trout, brook trout) must be distinguished

- Inter-jurisdictional populations require lake/basin wide coordinated efforts to get the right answers!

What techniques were considered?

- Automated CWT marking
- Manual CWT marking
- Thermal marking
- OTC marks
- Passive Integrated Transponder tags
- Isotope analysis
- Manual clipping
- Genetic

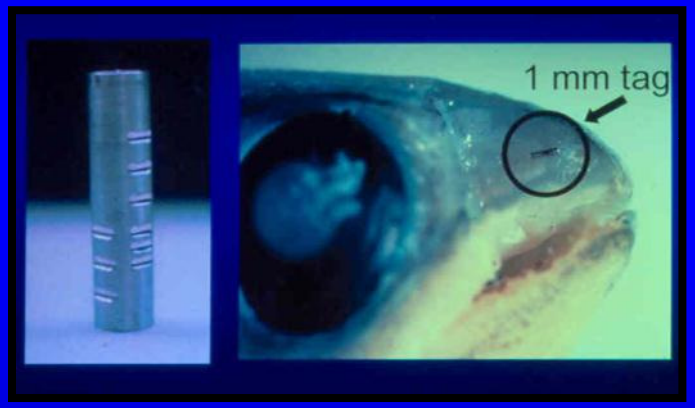
Most were not selected because of high cost, limited ability to discriminate groups or to answer priority management questions, low processing rates, or ambiguous results.

What tagging/marking technique will be used and why?

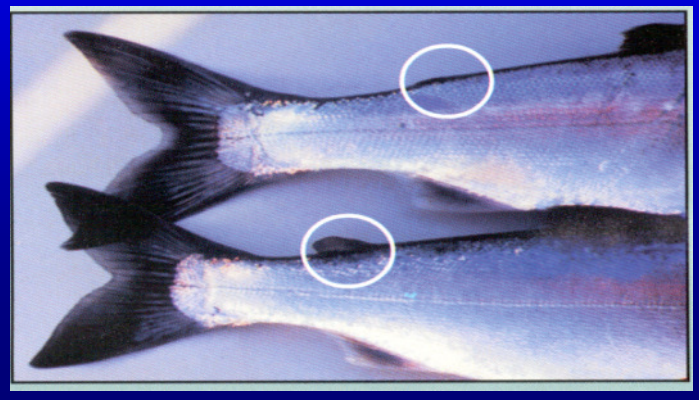
Coded-wire tags/adipose fin clips can answer many important management questions. Return data is unambiguous.

Coded-wire tag

Coded-wire tag in a salmon snout



Adipose fin-clip



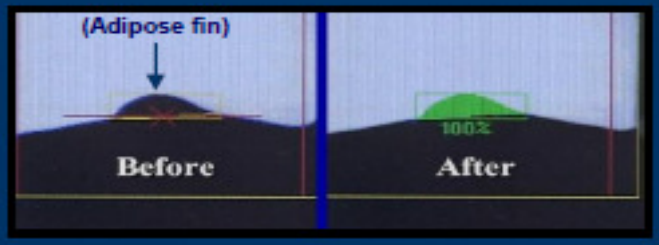
How does it work?

- process up to 8,500 fish/h
- fish are never dewatered
- 96.5% or better tag retention at release
- 99% or better Ad clip
- faster and more precise than manual methods
- accurate counts of fish stocked

Fish are loaded into a tank in the trailer from raceways

Each fish is optically scanned & sorted to 0.1 mm and distributed to one of 6 lines

Volitional entry devices at the sorter and tagging lines use water and air currents to stimulate fish movement through the system.



Fish receive an adipose clip and a CWT at a rate of over 8,500 fish and hour and ejected to a raceway.

A typical tagging schedule (2014)

Chinook salmon (3.0 million), lake trout (6.4 million);
Atlantic salmon (0.2 million)

Agency	Hatchery	Species	Number	Dates
ILDNR	Jake Wolf	CHS	265,000	Mar 11 – 16
INDNR	Mixsawbah	CHS	202,000	Mar 18 – 22
WIDNR	Kettle Moraine	CHS	103,000	Mar 31 – Apr 2
MIDNR	Wolf Lake	CHS	236,000	Mar 24 – Apr 2
WIDNR	Wild Rose	CHS	721,000	Apr 8 – 17
MIDNR	Thompson	CHS	446,000	Apr 23 –29
MIDNR	Platte River	CHS	979,000	Apr 22 – 30
MIDNR	Platte River	ATS	154,000	Aug 6 - 9
USFWS	Jordan River	LAT	2,510,000	Aug 11 – Sep 23
MIDNR	Marquette	LAT	225,000	July 16 - 20
USFWS	Iron River	LAT	1,356,000	Sep 17 – Oct 1
USFWS	Pendill's Creek	LAT	1,152,000	Aug 11 - 25
USFWS	Allegheny	LAT	1,169,000	Aug 22 – Sep 12

Primary objectives of the program

- Determine the degree of natural reproduction for lake trout and Chinook salmon

- Evaluate factors contributing to patterns of lake trout and Chinook salmon movement and survival (e.g., stocking location, genetic strain)

- Compare survival of pen-released and truck released Chinook salmon

Data collection, tag recovery, tag extraction in addition to surveys.

Deployment of technical staff to fishing ports

- 2 Milwaukee, WI
- 1 Zion, IL
- 2 Charlevoix, MI
- 2 Michigan City, IN
- 2 Green Bay/Sturgeon Bay, WI
- 2 Alpena, MI
- 2 Lake Ontario

Tag and Data Recovery

Collected on each fish:

- Species
- Capture date and location (management unit and grid)
- Length, weight, sex and maturity
- Fin clips
- Presence/absence of CWT
- Lamprey wounding (A and B rating system)
- Year class membership (for Chinook and lake trout) via CWT or calcified structure
- Collection method (e.g., tech, angler return)
- Interview source (i.e., angler, charter, tournament)
- Sample completeness

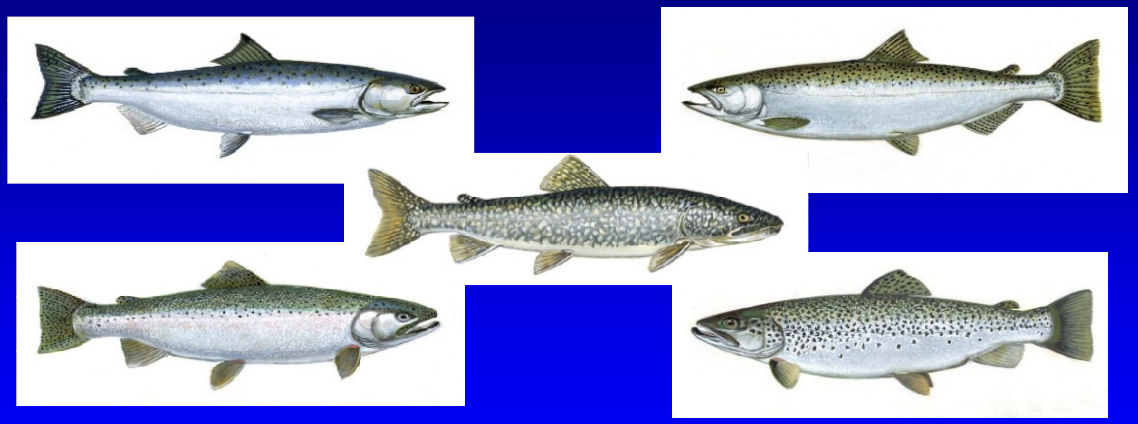
Collected in 2014 – 2016 for related studies

- Muscle tissue (stable isotopes)
- Belly tissue (fatty acid analysis)
- Stomachs (gut content analysis)

Tag Extraction and Reading

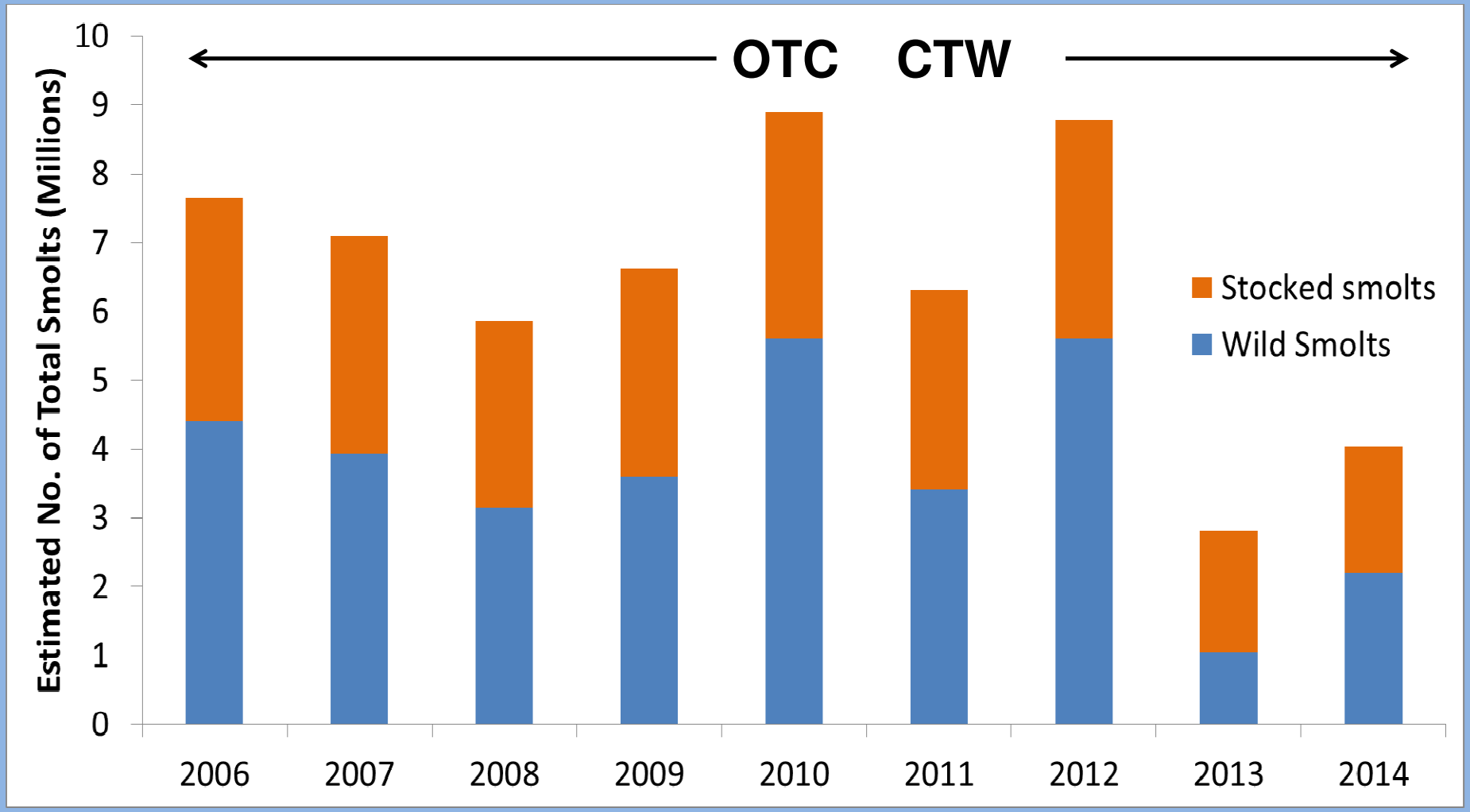
- Skilled technicians extract each tag by hand and read each code under a microscope
- Over 65,000 snouts (15,560 in 2015) have been processed, with more than 60,000 CWTs recovered through January 2016.

Added-Value Objectives



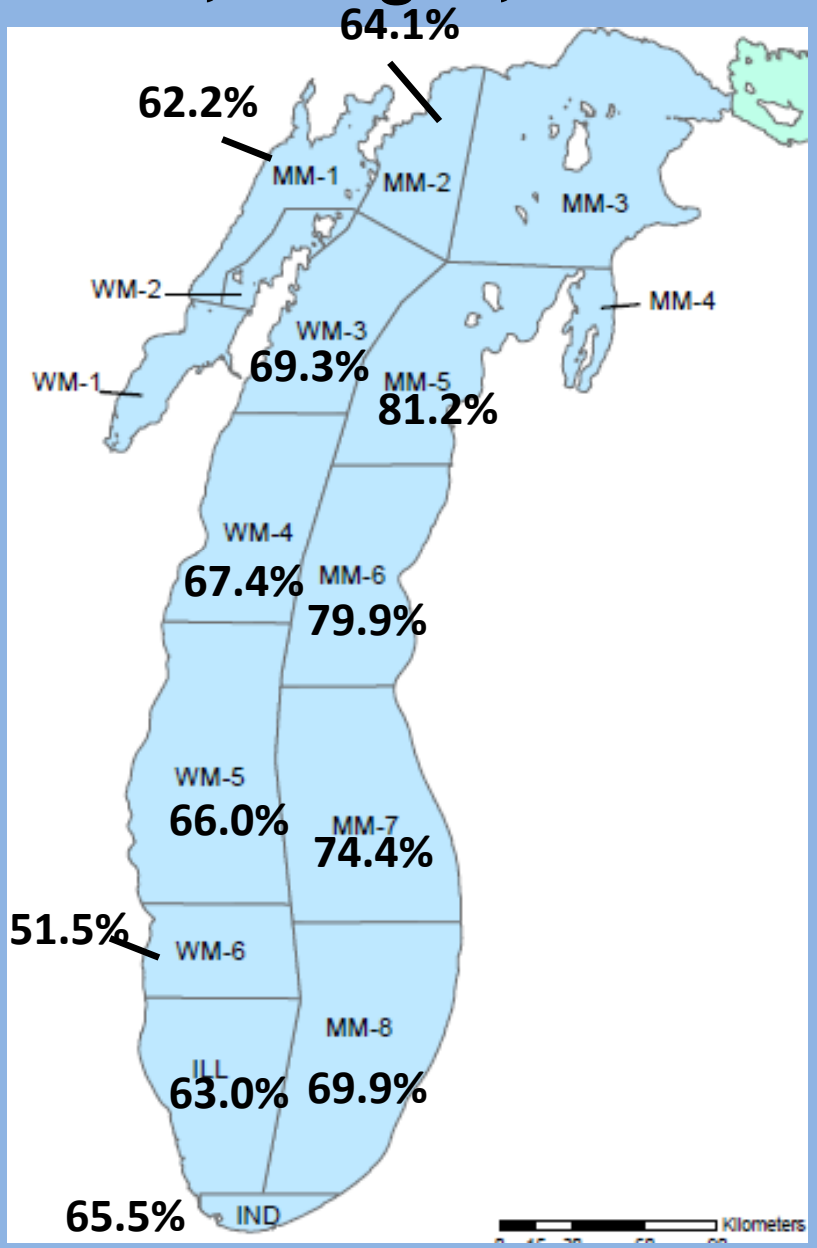
- Assess competition among all salmon and trout species using stable isotopes
- Evaluate sea lamprey wounding on all salmon and trout species
- Monitor location-specific growth and maturity rates of Chinook salmon and lake trout
- Contribute to other lake-wide research questions (e.g., natal origins of wild steelhead, bioaccumulation of mercury)

Stocked and wild recruits of Chinook salmon 2006-2014 year classes at age 1

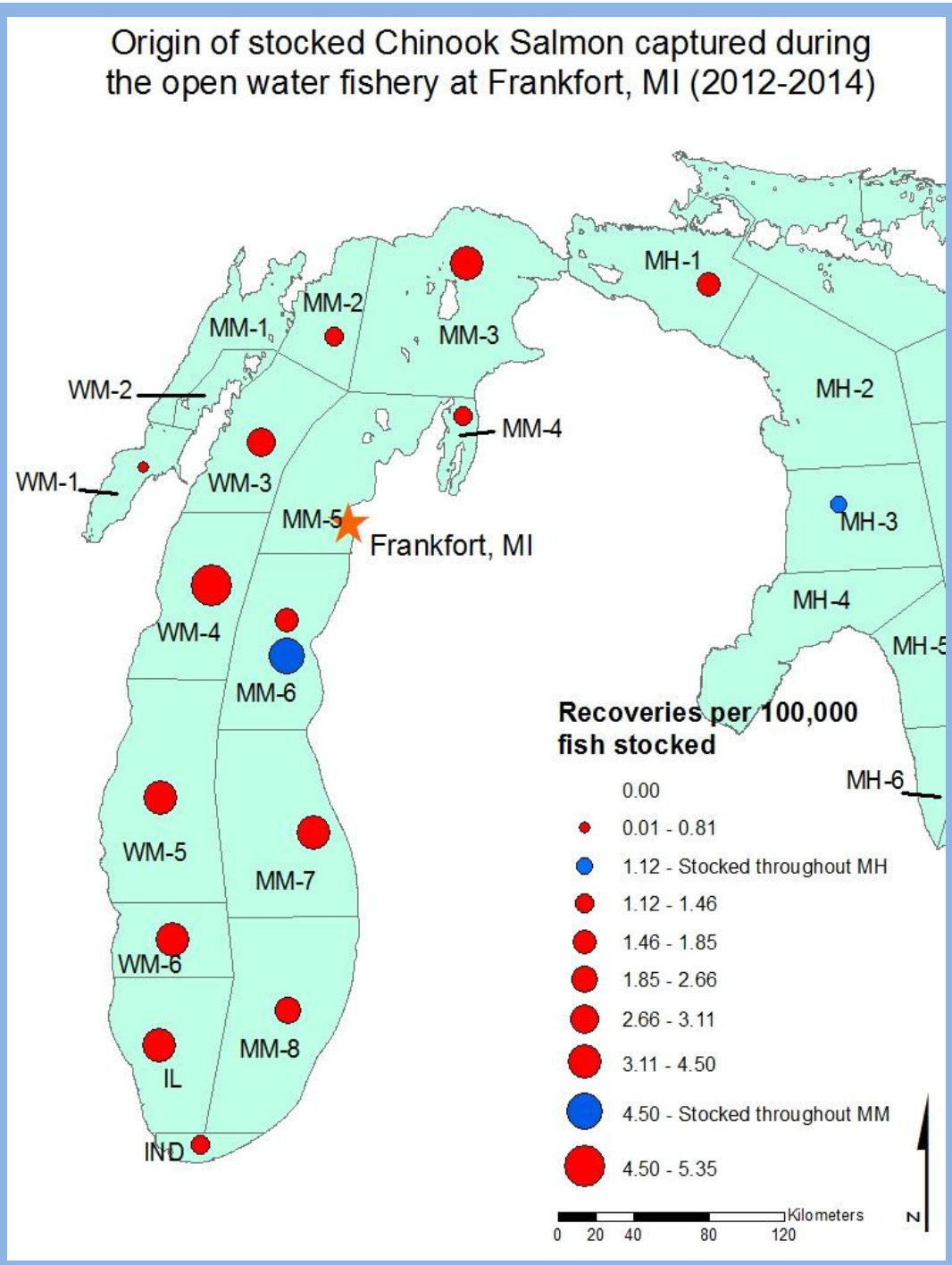


% Wild Chinook captured in the sport fishery salmon by stat district, all ages, 2015

Overall 62% wild

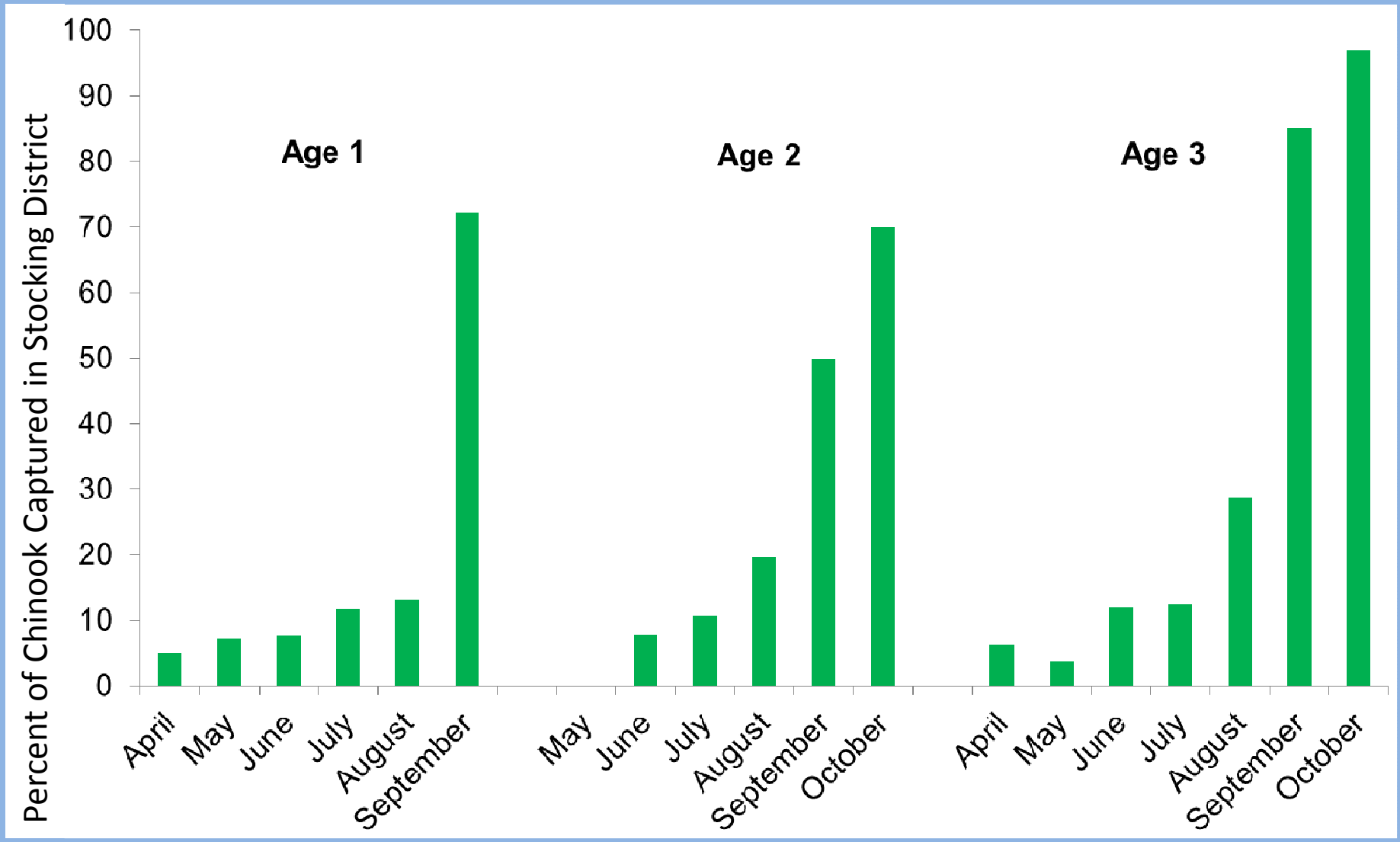


Origin of Chinook Salmon caught at Frankfort, MI



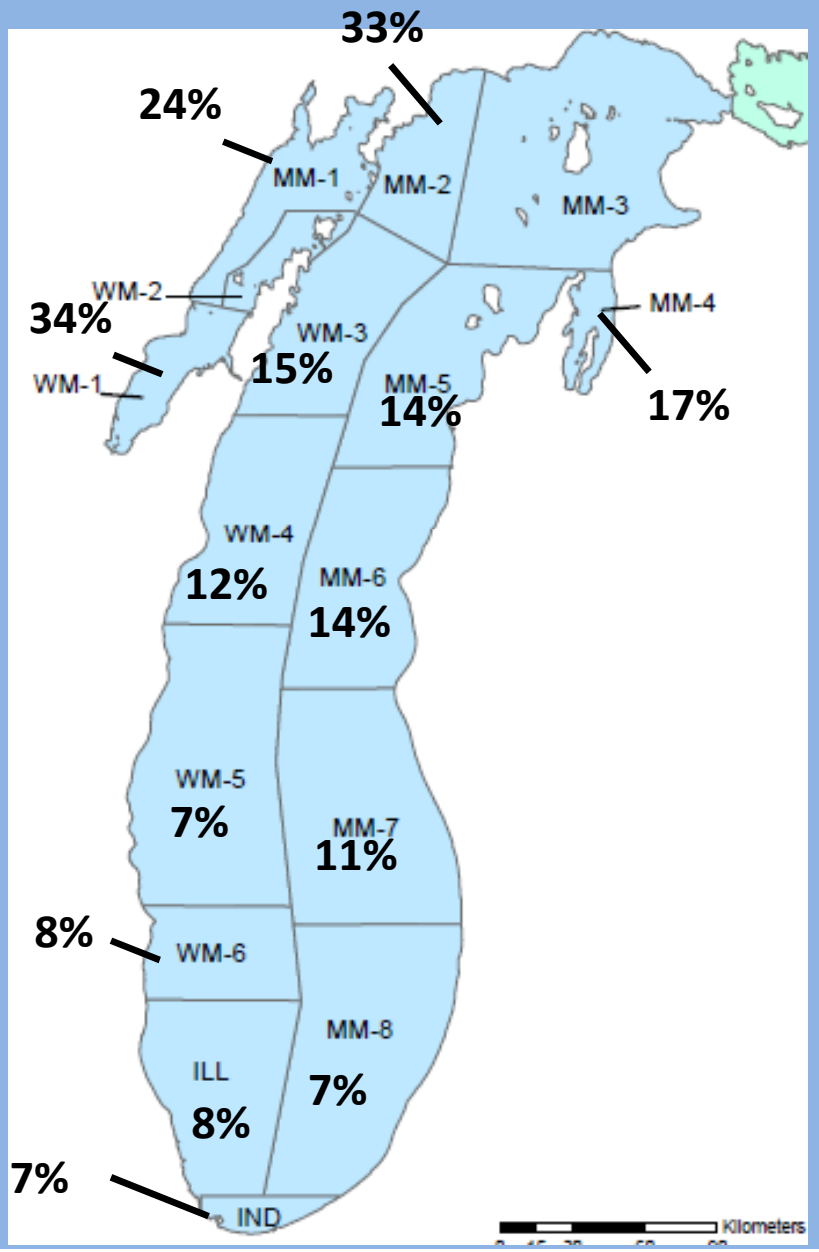
Return of Chinook to stocking district

2011 Year Class Only



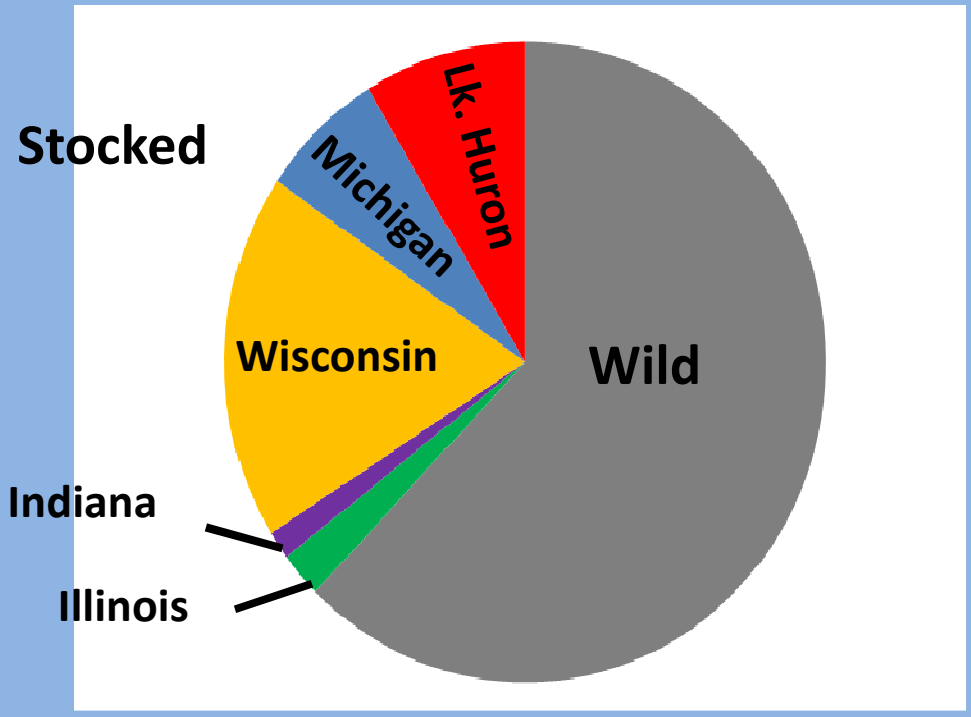
Contribution of Lake Huron stocked Chinook salmon to the Lake Michigan Fishery

- Percent of Chinook salmon CPUE by district comprised of fish stocked in Lake Huron. 15% overall average.
- Average lake-wide contribution is about 9% once wild fish are considered.



Origin of Chinook Salmon Captured in Lake Michigan

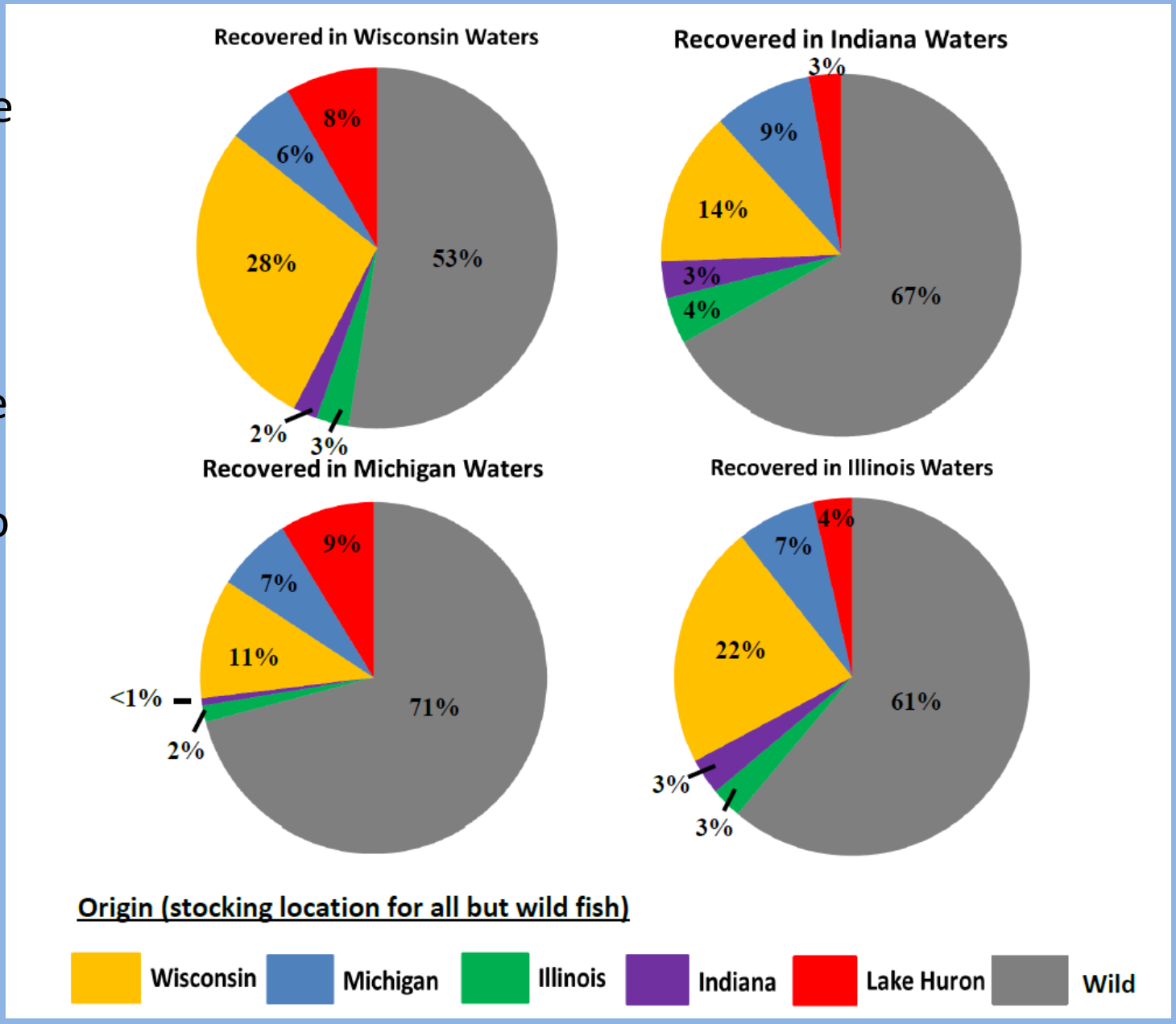
- Pooled data from 2014 and 2015
- Based on CPUEs (catch corrected for effort)



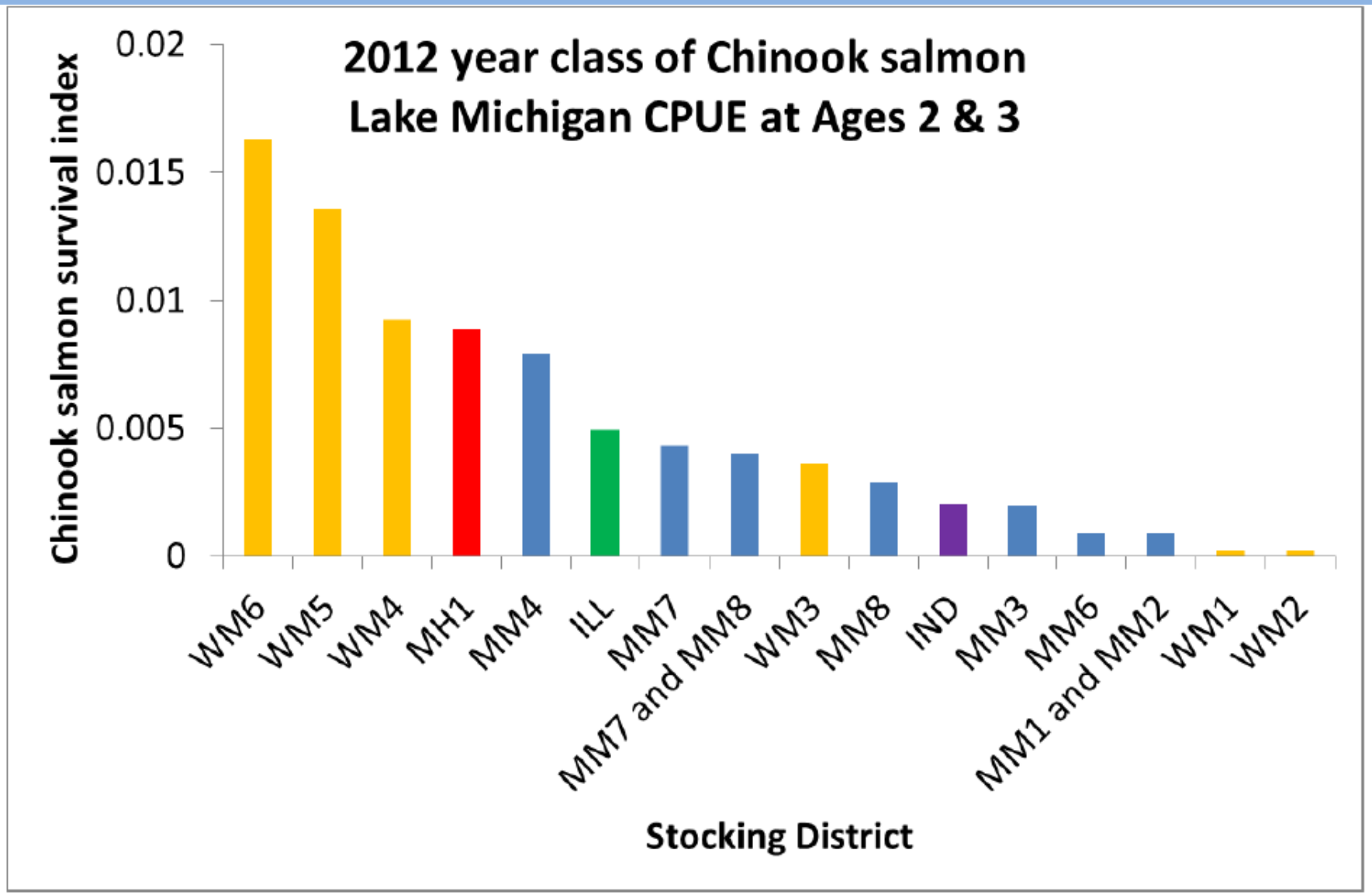
Origin	Percent of Lake Michigan fishery
Wild	62%
Wisconsin	19%
Michigan	7%
Lake Huron	9%
Indiana	1%
Illinois	2%

Origin of Chinook Salmon Captured by State, April - September

- Consistent with lake-wide mixing
- Wisconsin-stocked fish contribute the most of all stocked fish to all state fisheries
- Based on CPUEs (catch corrected for effort), 2014-2015

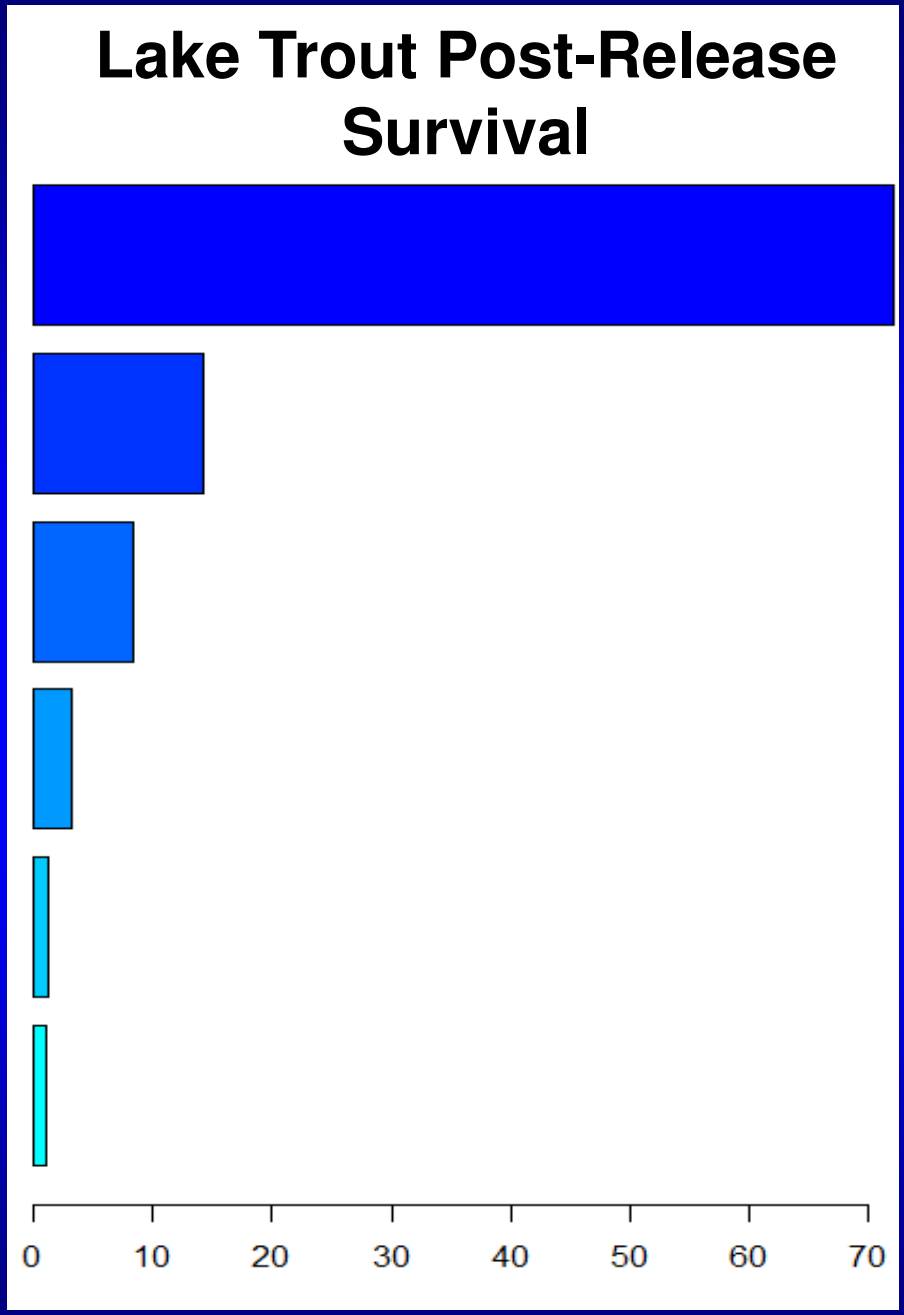


Relative survival Chinook salmon by stocking district



Wisconsin Michigan Illinois Indiana Lake Huron

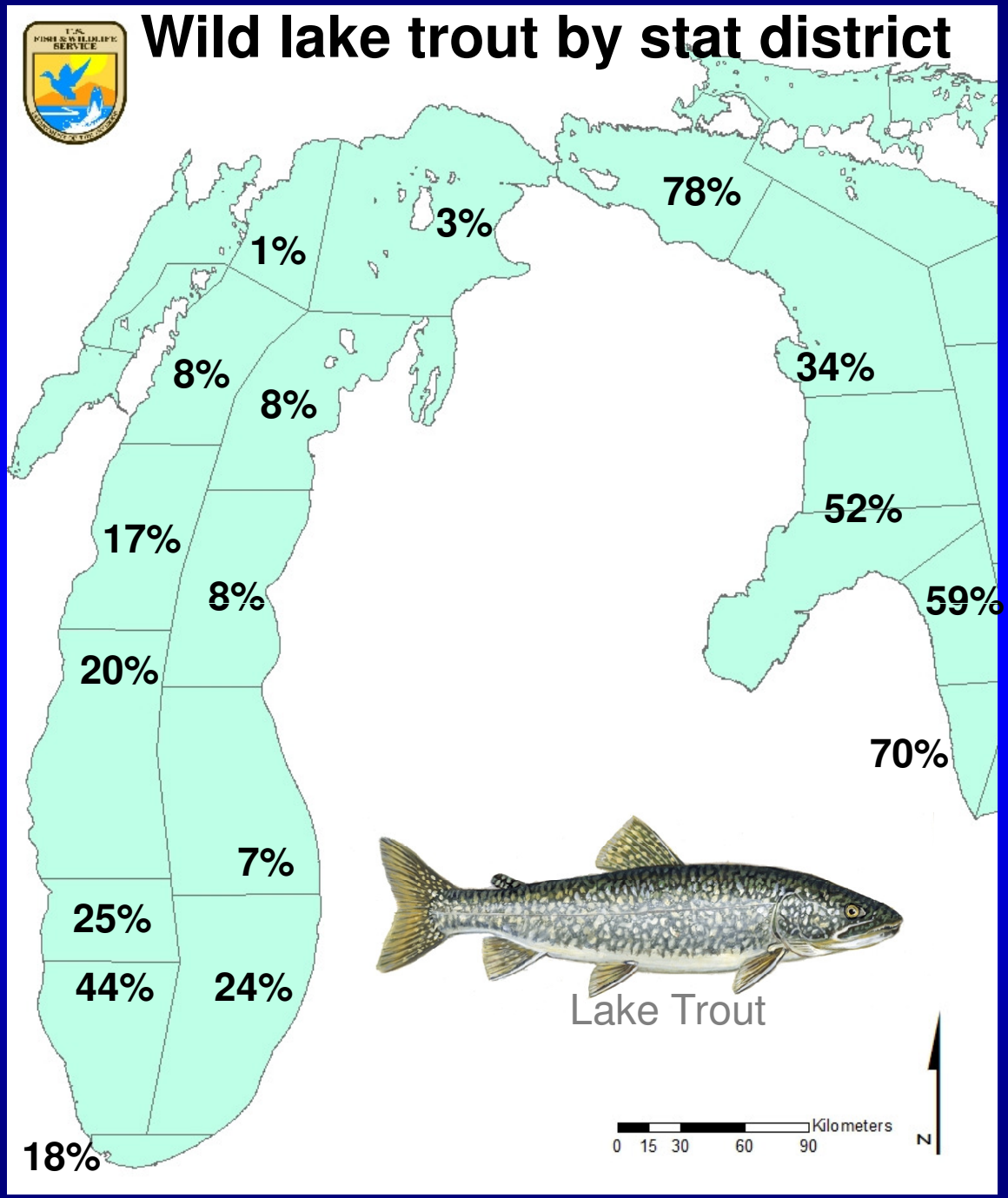
Lake Trout Post-Release Survival



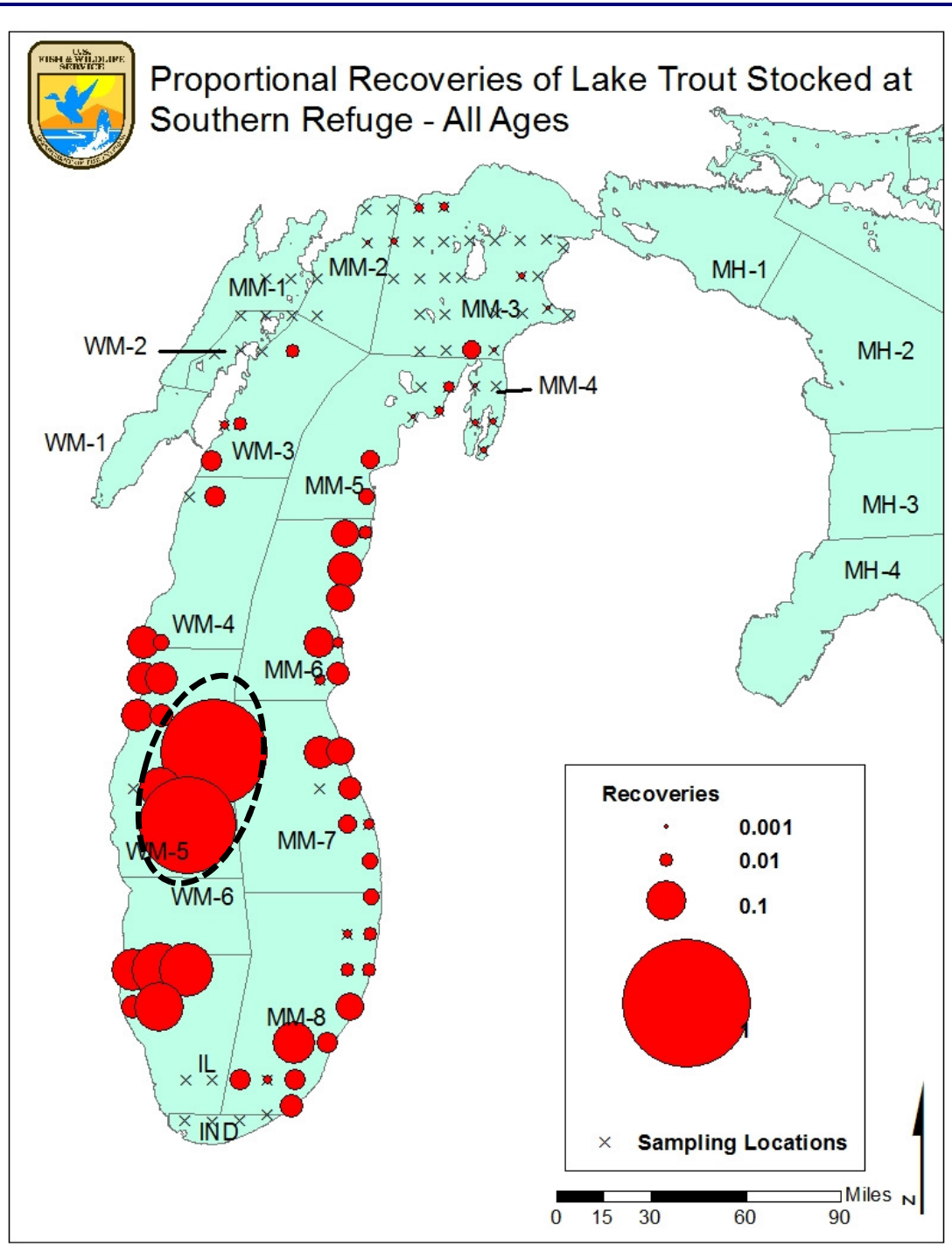
Lake-wide averages

L. Michigan = 17%

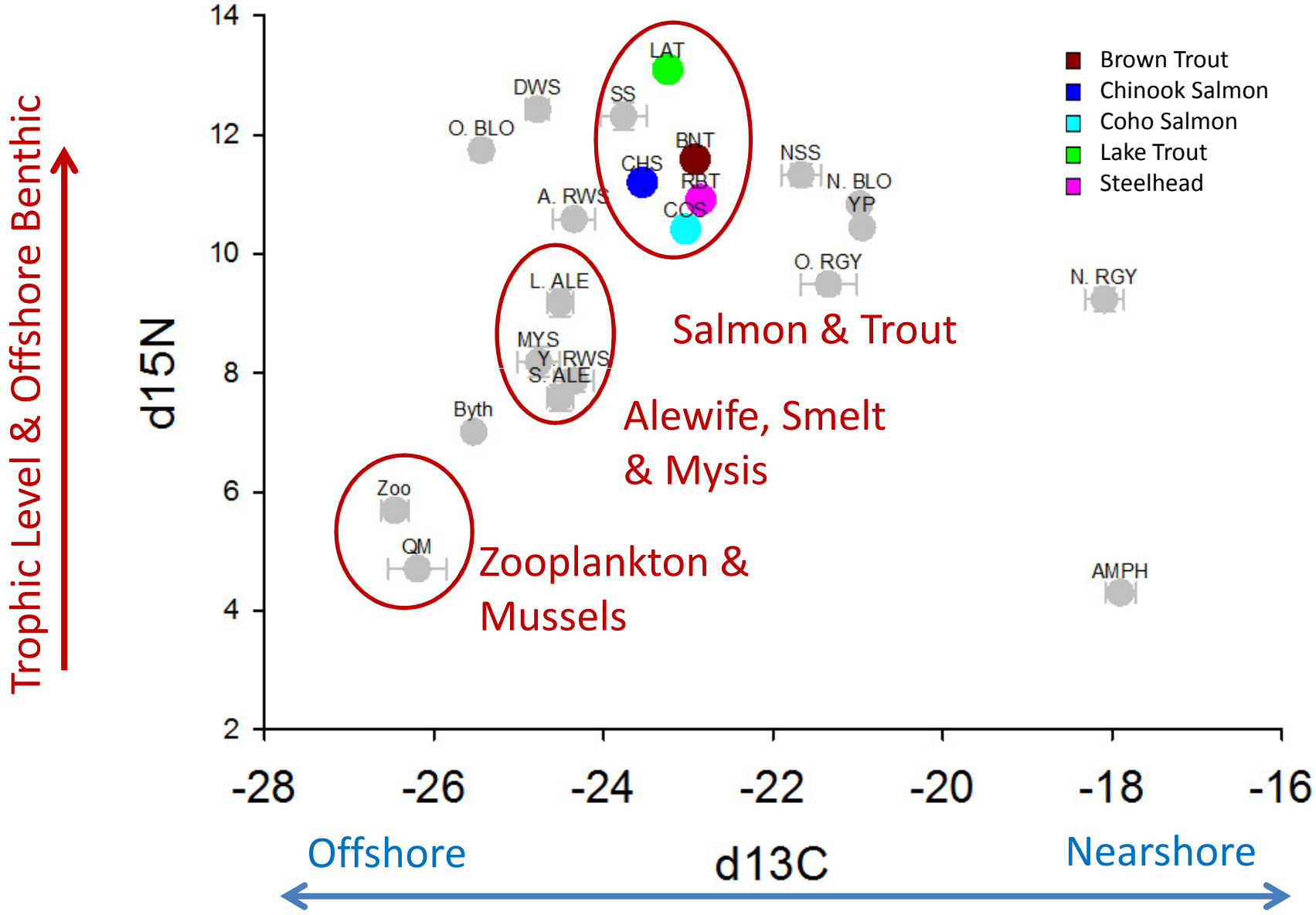
L. Huron = 53%



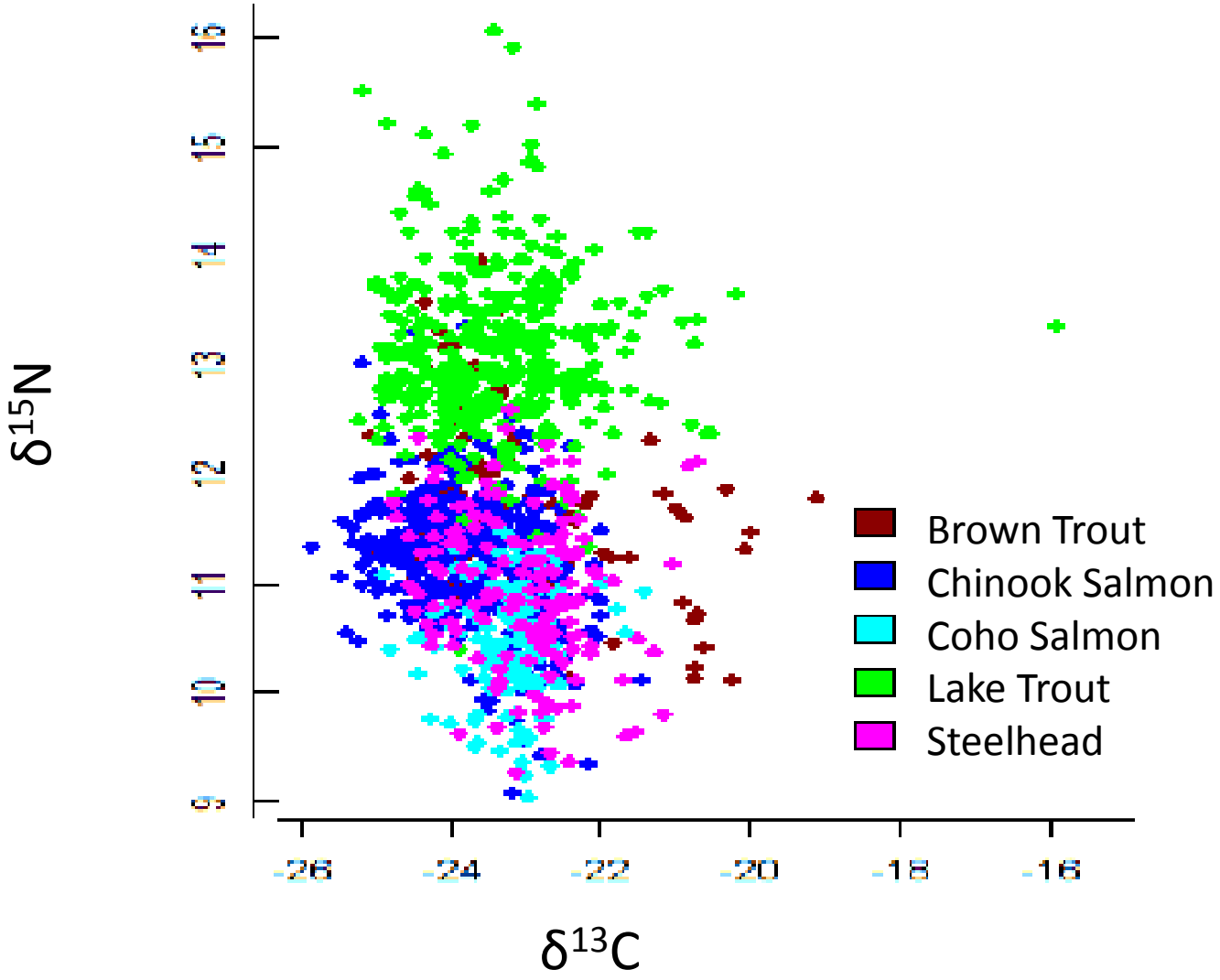
About 50% of fish stocked in the Southern Refuge were recovered nearshore



Stable isotopes carbon and nitrogen in Lake Michigan fishes



Bi-plot of isotope data as an indicator of diet overlap for Lake Michigan salmon and trout



Great Lakes Mass Marking Program 2008-2016 Federal (non-base) Funding

Funding Cuts Proposed for 2017-2018

Fiscal 2008: $1.7 million for equipment (Approp)
Fiscal 2009: $1.5 million for equipment (Approp)
Fiscal 2010: $1.0 million for operations (Approp); $2.6 million for equipment (GLFWRA/GLRI)
Fiscal 2011-13: $1.5 million/year for operations (GLRI)
Fiscal 2014: $1.0 + $0.5 million (LT/LS) for operations (GLRI)
Fiscal 2015-16: $0.8 + $0.5 million (LT/LS) for operations (GLRI)
Fiscal 2017: $800K + $600K(FY16)
Fiscal 2018: $500,000 proposed @ $250 million level

Great Lakes RESTORATION

Thank you for your attention

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