



Welcome Rotary Club!

USGS Great Lakes Science Center



Russ Strach

Director

June 7, 2017



Are The Great Lakes Bigger Than You Think?

SIZE FACTS

Total area of lakes and drainage basin = 295,000 sq mi.

Total water surface area = 95,000 sq mi.

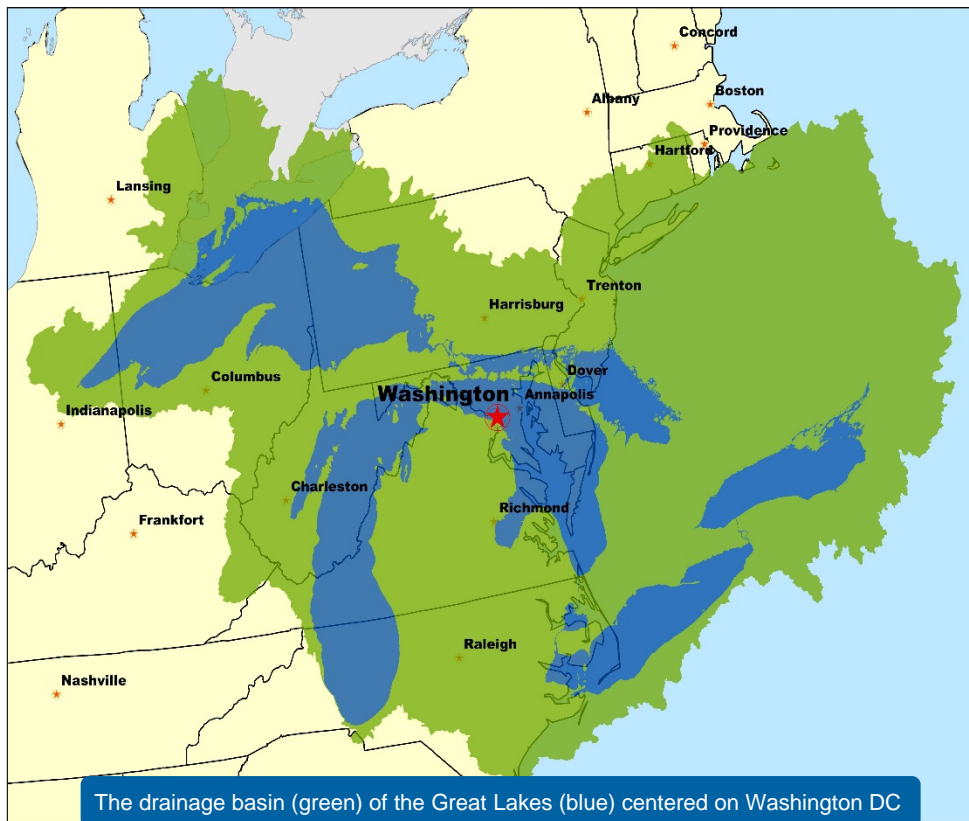
Total volume of water = 5,473 cubic mi or **6 quadrillion gallons** (6,000,000,000,000,000) of water.

Total coastline = 10,900 mi.

The deepest part of the Great Lakes is in Lake Superior at a depth of 1,335 ft.

DID YOU KNOW?

1 out of every 10 Americans live in the Great Lakes Basin. That's 25 million people!



SIZE COMPARISONS

Chesapeake Bay holds 18 trillion gallons of water. **The Great Lakes could fill Chesapeake Bay 333 times.**

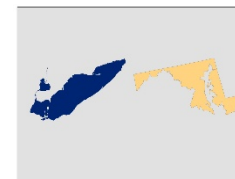
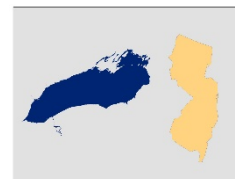
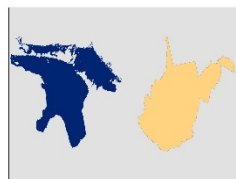
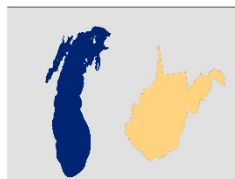
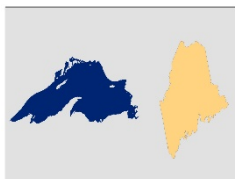
You could submerge the Empire State Building in Lake Superior.

Spread evenly across the continental U.S., the Great Lakes would submerge the country under about 9.5 feet of water.

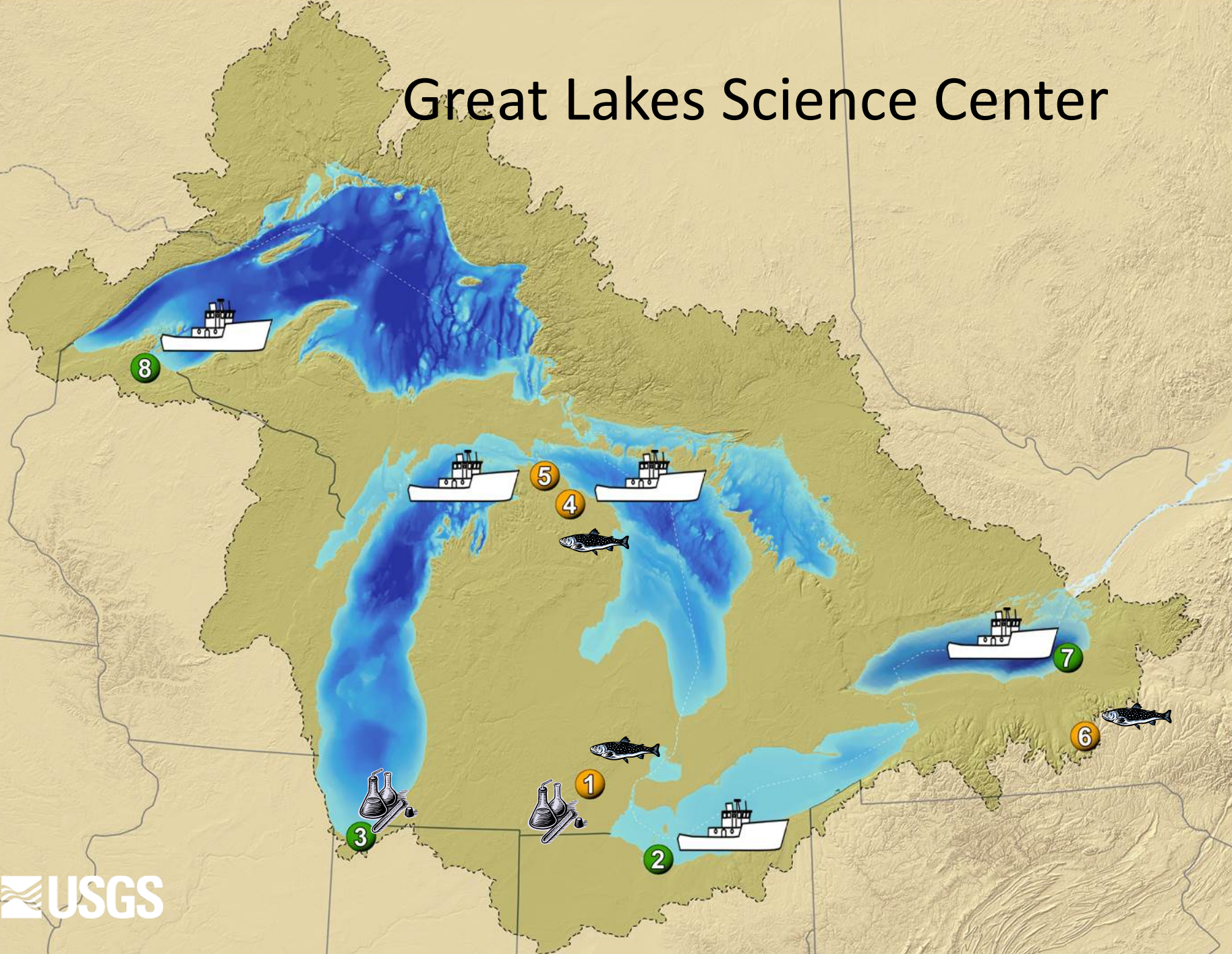
If the water in the Great Lakes were distributed evenly among Earth's population, **everyone would get about a million gallons of water.**

DID YOU KNOW?

The Great Lakes hold 95% of the United States fresh surface water!



Great Lakes Science Center



GLSC by the numbers:

30 research scientists across 1,000 miles

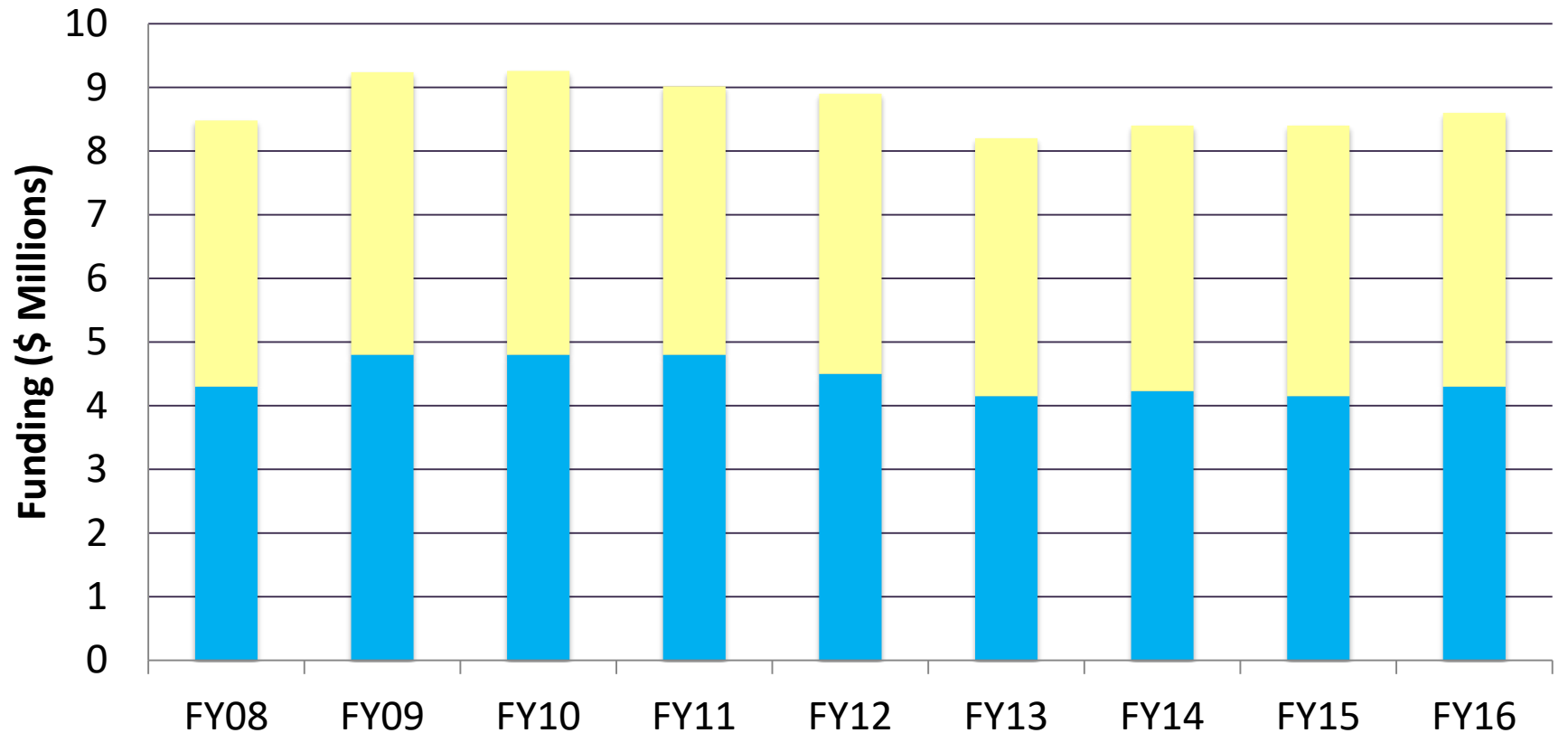
125+ research projects

100+ papers/yr.

dozens of collaborative efforts and partnerships



GLSC Base Science Funding



\$8.4M

\$8.6M

USGS Regions

**Business
&
regional
science
collaboration**

Southeast

Northeast

Midwest **GLSC**

Alaska

Northwest

Pacific

USGS Mission Areas

Climate and land use change

Core science systems

Ecosystems **GLSC**

Energy and minerals

Environmental health

Natural hazards

Water

Science
funding
&
national
priorities

Brief History

1940



1957

Bureau of Sportfish
& Wildlife

Bureau of
Commercial
Fisheries

1970



**NOAA
FISHERIES**

*“ . . . **except** the Great Lakes . . . ”*



Fisheries Science



**NOAA
FISHERIES**



**Great Lakes
Science Center**



**Magnuson–Stevens
Fishery Conservation
& Management Act**

Authority

Funding



**Great Lakes Fishery
Research Authorization
Act of 2016**

Authority

Funding

**Introduced Feb 2016
Supported by many partners**



2. What is driving GLSC science?

DOI legal obligations

Oversees development of 23% of US **energy** supplies

Largest supplier and manager of **water** in the 17 western states

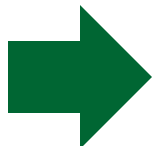
Maintains relationships with 566 federally recognized **tribes**

Provides services to > 1.7 million American Indian and Alaska Native people

Manages 1/5 of all US **land**

Laws: **Endangered Species** A., **Migratory Birds** A.,

National Wildlife **Refuge System** Improvement A., etc.



USGS is their science branch

OMB's recurring questions:

Why is this ***federal science***?

vs state, academic . . .

If it is federal science, ***why USGS***?

vs EPA, NOAA . . .

If USGS, ***why GLSC***?

What is Federal science? . . .

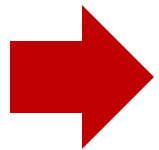
A. “Era without earmarks”

2010-11

USGS Mission Area Science Strategies

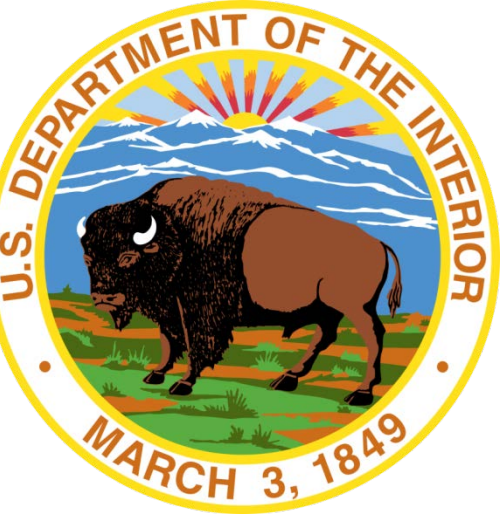
2012

Congressional earmarks eliminated



Substantial shift in budget influence to Office of Management and Budget (OMB)

OMB Controls: *Funding (“fiscal efficiency”)
National science strategy*



Management

Science



*"The science branch
of the DOI"*



Implications:

Local/regional applications with national significance

Science for management (not “discovery”)

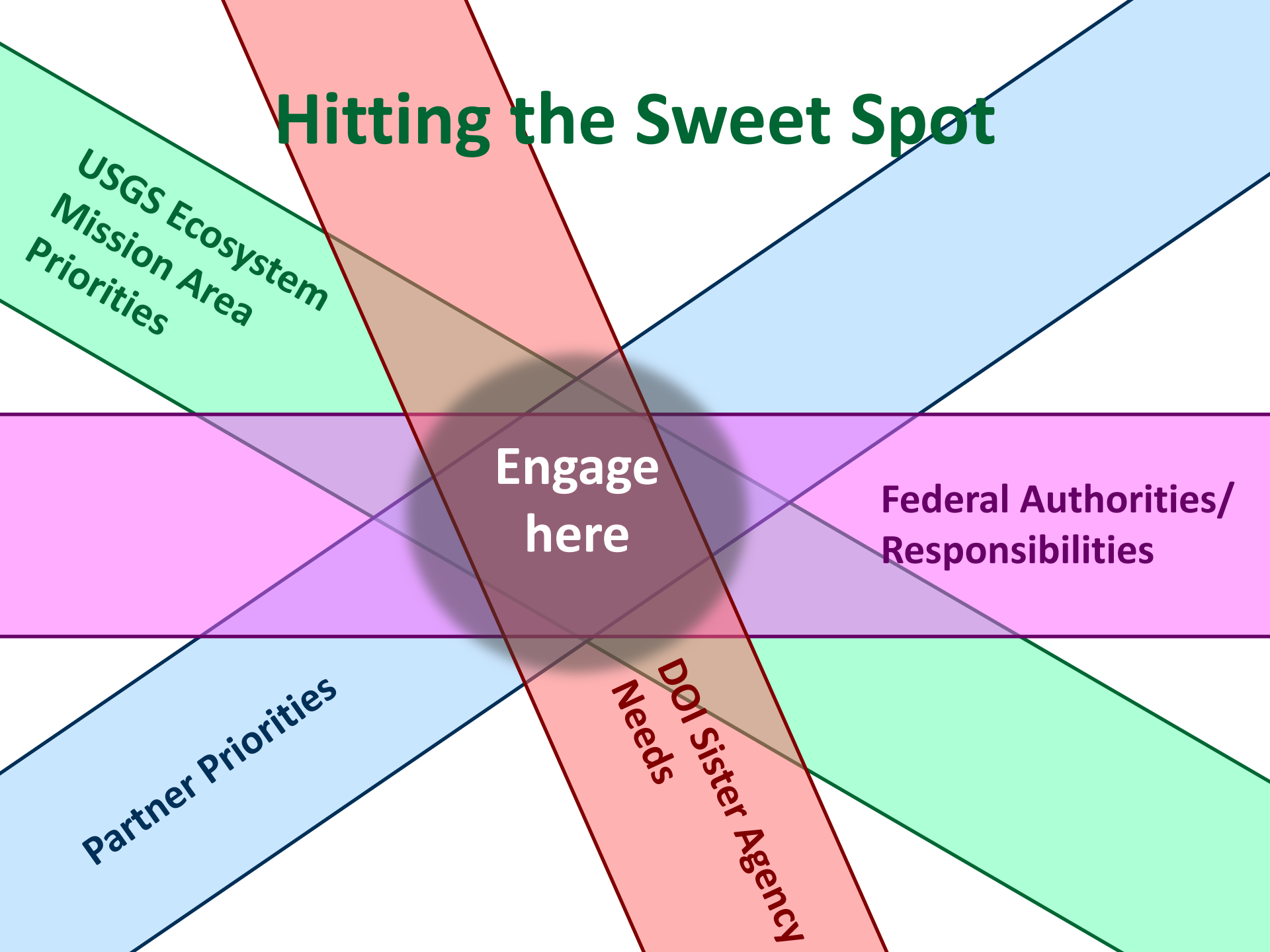
Cross-disciplinary and collaborative (“efficiency”)

Phragmites, HABs, Mussels Collaboratives; Coll. Impact

*** “Trust resources”**

Species, tribes, lands

Hitting the Sweet Spot



USGS Ecosystem
Mission Area
Priorities

Engage
here

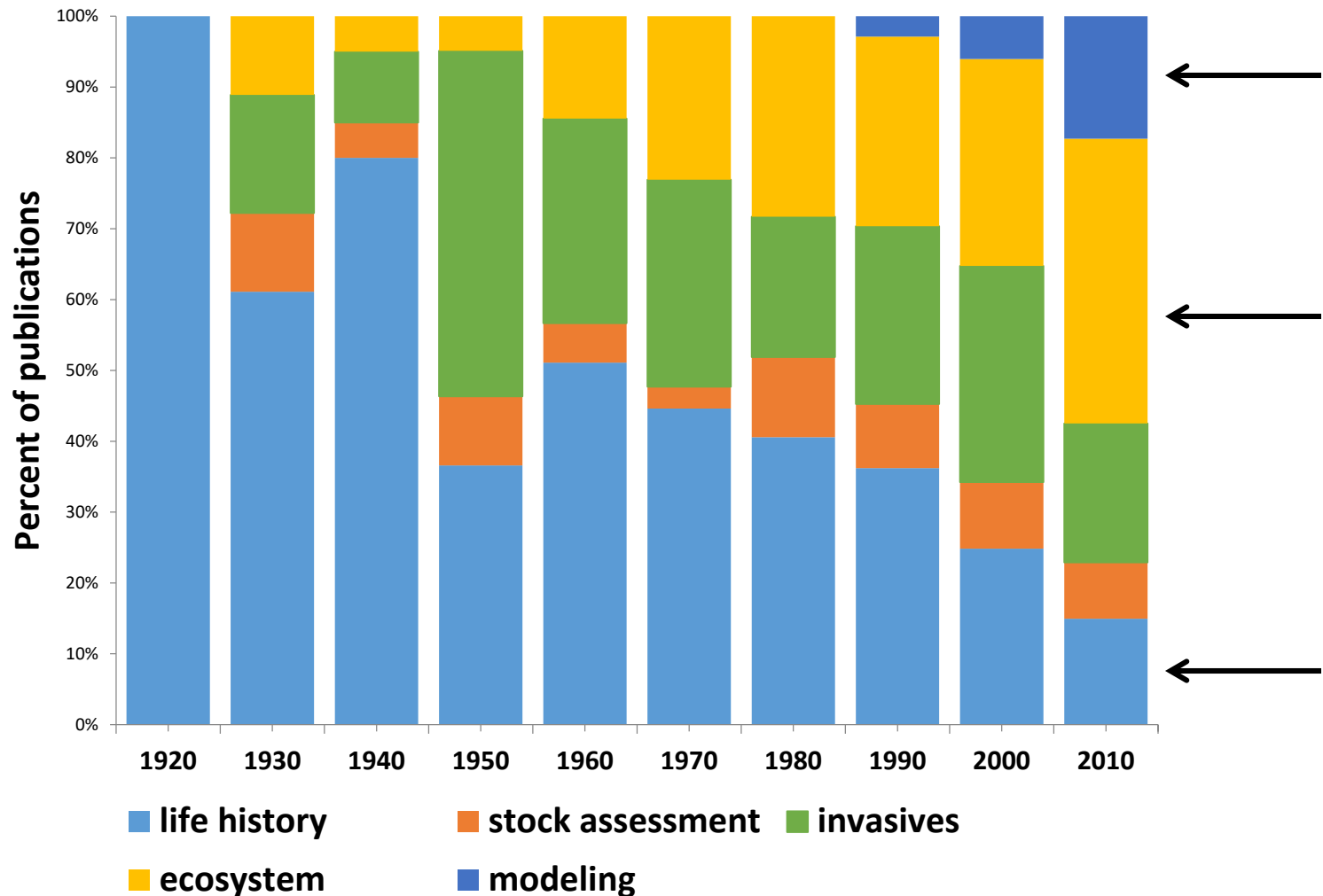
Federal Authorities/
Responsibilities

Partner Priorities

DOI Sister Agency
Needs

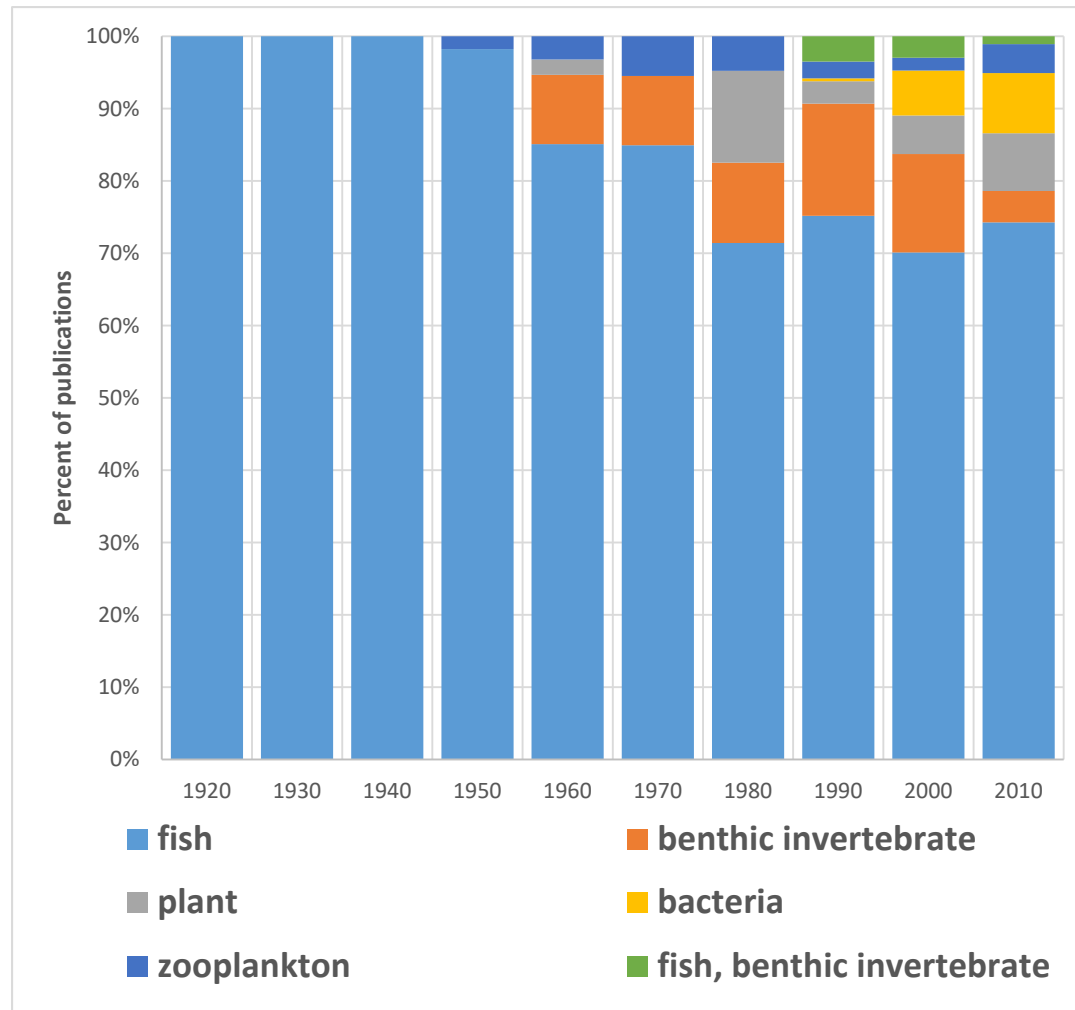
2. What is GLSC doing?

Papers by Research Focus by decade



From Schaeffer, Vinson, Hansen presentation to MWWF Conference 2016

Papers by Phylum by decade



From Schaeffer, Vinson, Hansen presentation to MWWF Conference 2016

A. Fisheries (60-70 % of budget)

Lake Committee process

Monitor and assess

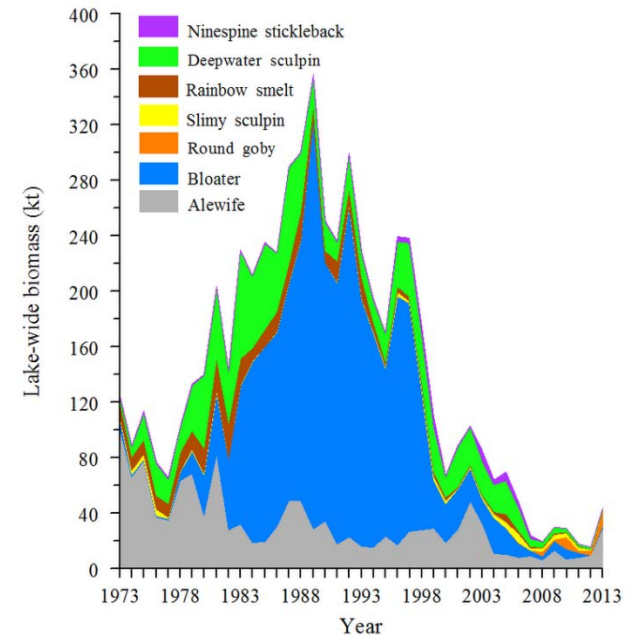
Prey fish, lake trout recovery,
sea lamprey status

Understand the food web

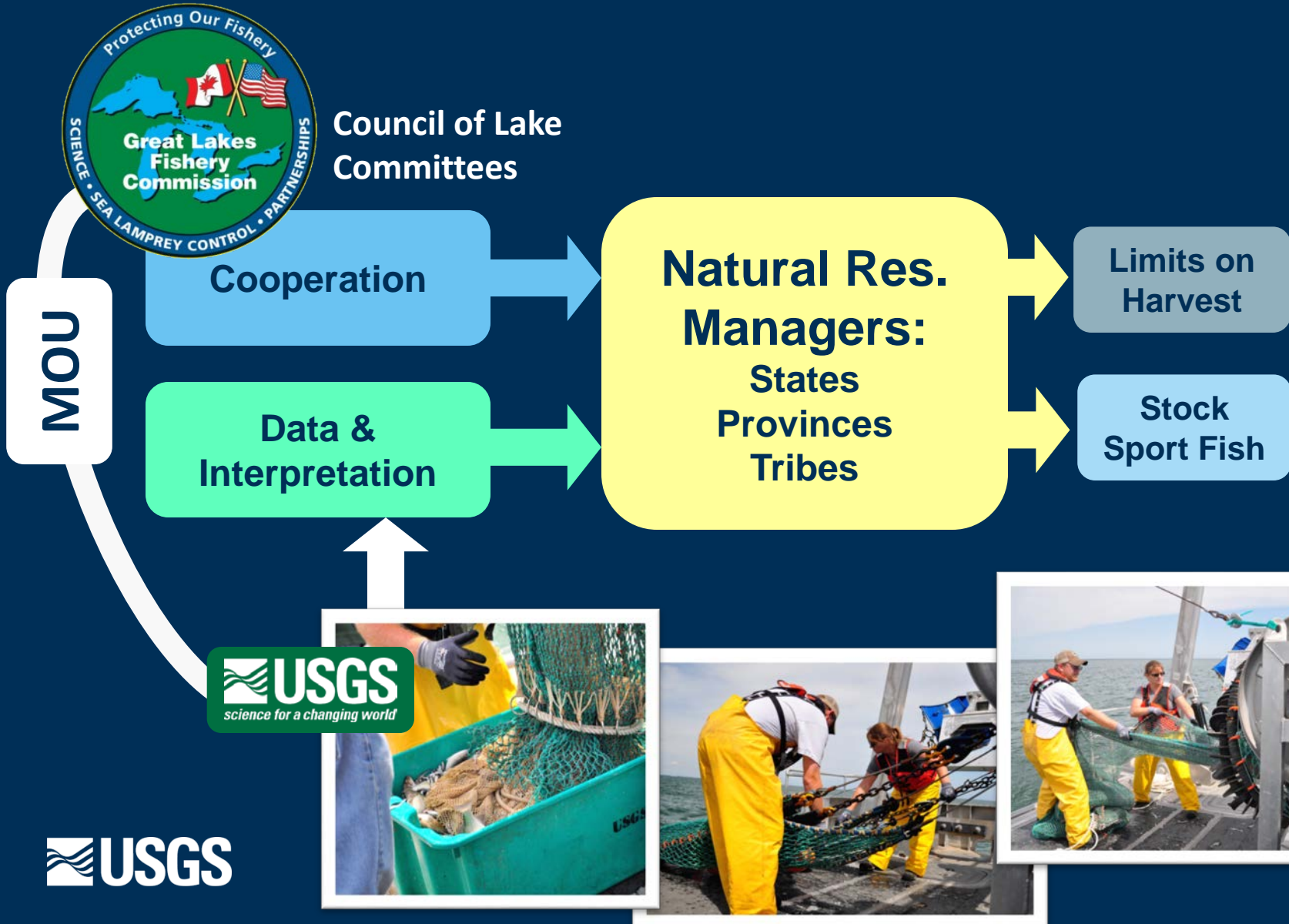
Top-down vs bottom-up



Lake Michigan prey fish



Lake Committee Process



GLSC research vessel fleet

R/V Muskie
Lake Erie



R/V Kiyi
Lake Superior



R/V Kaho
Lake Ontario



R/V Sturgeon
Lake Mich-Hur



R/V Arcticus
Lake Mich-Hur



Small vessels



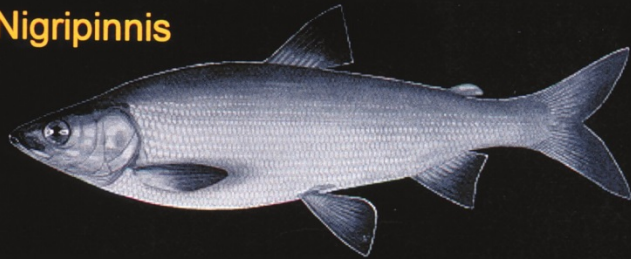
Coregonid restoration

Fishery

Energy transfer

Deepwater Ciscoes of the Great Lakes

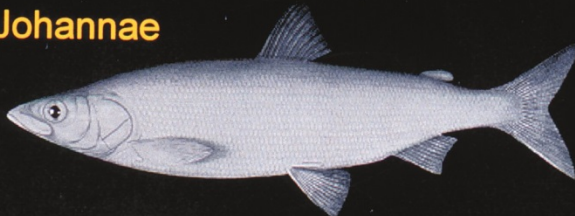
Nigripinnis



Reighardi



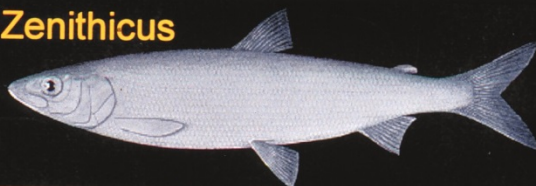
Johannae



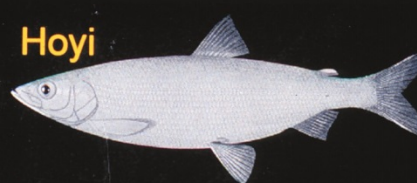
Kiyi



Zenithicus



Hoyi



25 CM

From: Koelz, 1929

Cisco

Artedi





Historical occurrences (Muir et al. in prep)

Superior

Michigan

Huron

Erie

Ontario



nigripinnis
(blackfin)

X

X



johannae
(deepwater)

X

X



zenithicus
(shortjaw)

X

X

X

X



reighardi
(shortnose)

X

X

X



kiyi

X

X

X

X



hoyi* **
(bloater)

X

X

X

X



artedi
(cisco)

X

X

X

X

X



Contemporary occurrences (Muir et al. in prep)

Superior

Michigan

Huron

Erie

Ontario



nigripinnis
(blackfin)



johannae
(deepwater)



zenithicus
(shortjaw)



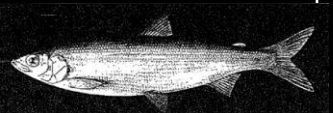
reighardi
(shortnose)



kiyi



hoyi* **
(bloater)



artedi
(cisco)

X

X

Extinct

X

X

X

X

X*

X

X

X

X

X

Coregonid restoration

Rearing & stocking techniques

Two experimental fish rearing labs



Ann Arbor, MI



Cortland, NY

Jim Johnson, Solomon David



Coregonid restoration

Cisco (*coregonus artedii*)

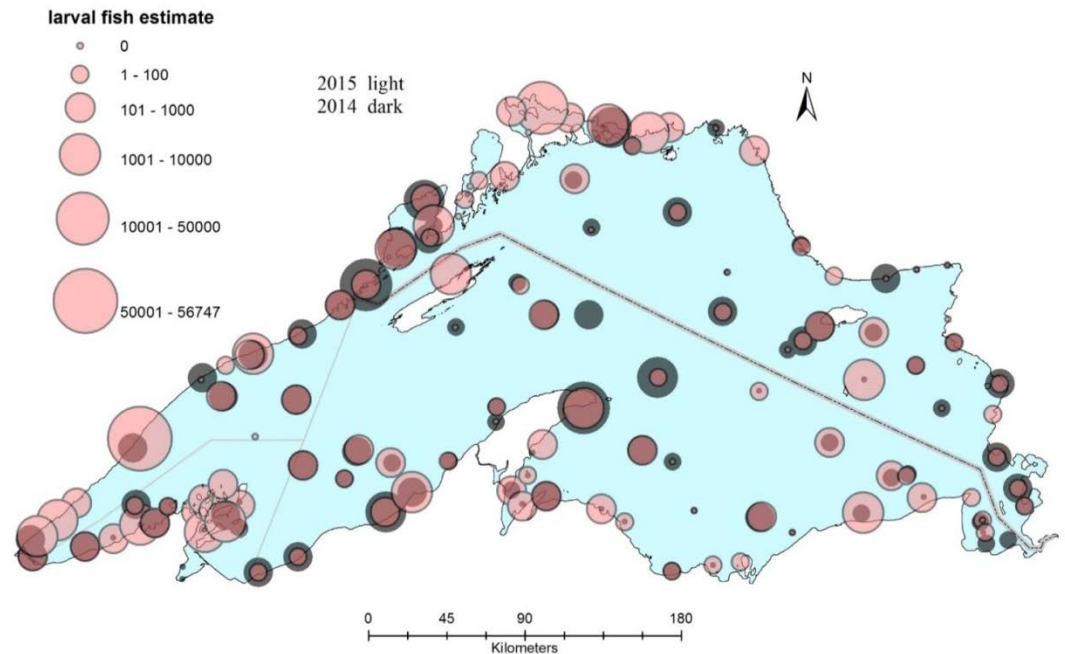
Life history, recruitment dynamics and habitat requirements

(Mark Vinson, Dan Yule, Brian Lantry)



Larval cisco

2014 - 2015 USGS Surface Water Tows

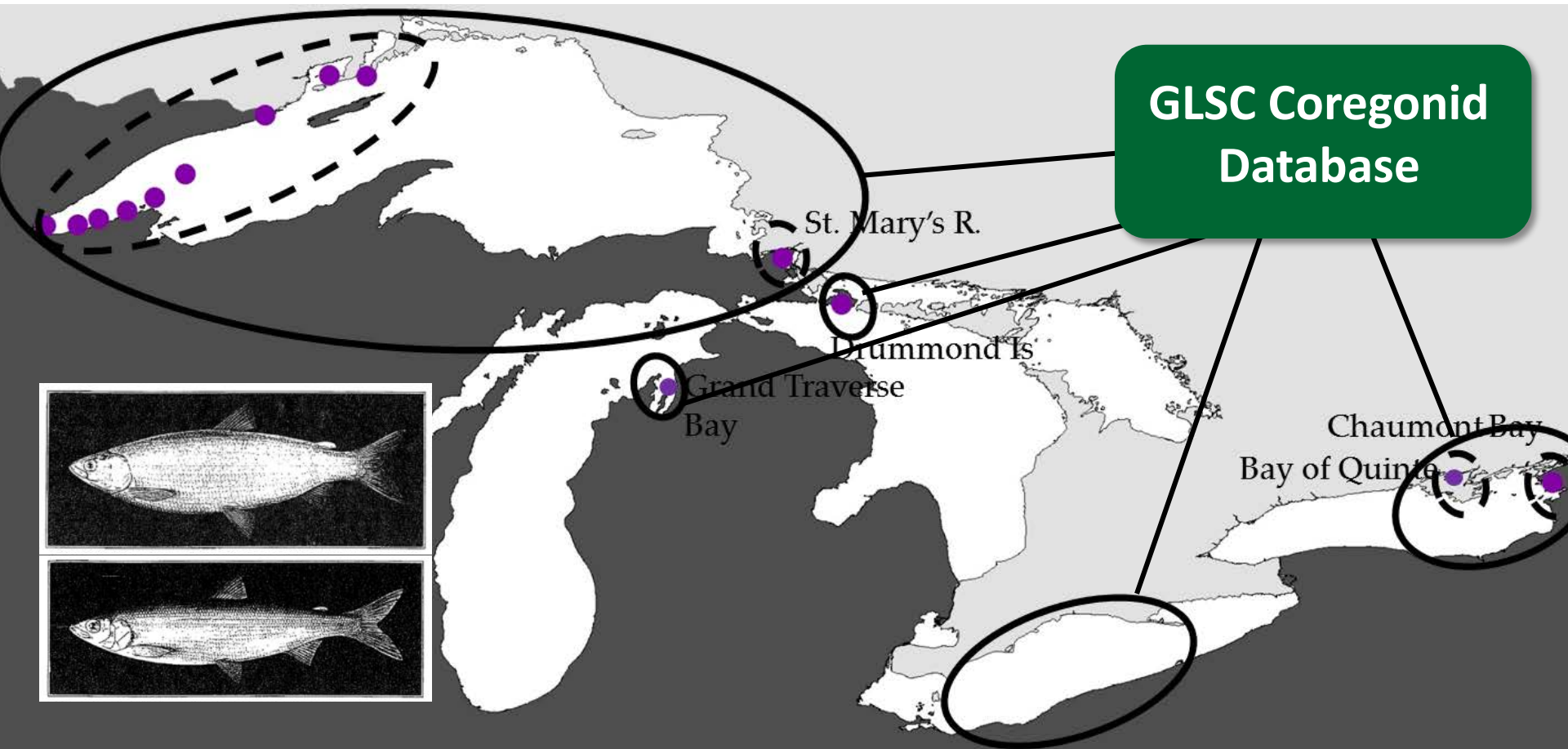


Coregonid restoration

Cisco (*coregonus artedi*)

Genetics and morphology

(Wendy Stott, Dan Yule)



Acoustic Telemetry

Sea lamprey

Lake sturgeon

Lake trout

National Animal Telemetry Network via
Integrated Ocean Observing System



Sea lamprey control technology



**Selective fish passage
in GL streams**

Sea lamprey attractants/repellants
DC current guidance
Acoustic walls
Pheromones

**Restoration of
native species**

3kPZS

Pacific lamprey



American eel



Alarm cue: risk information



Lake trout restoration

Life history of morphs
Spawning habitat

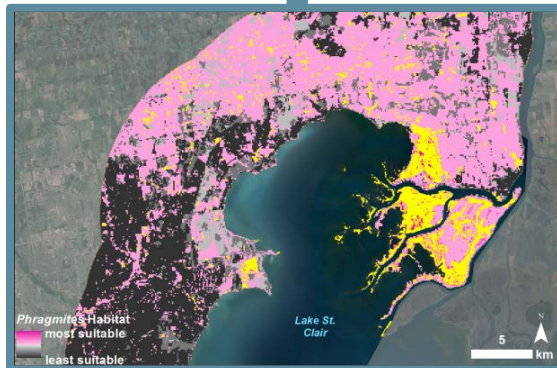


Phragmites Integrated Pest Management

1. Map



2. Forecast Vulnerability



3. Control

Gene Silencing
Microbial symbiosis

4. Coordinate

*Collaborative
for Microbial
Symbiosis*



Kurt Kowalski

Asian carp: tracking the invasion front

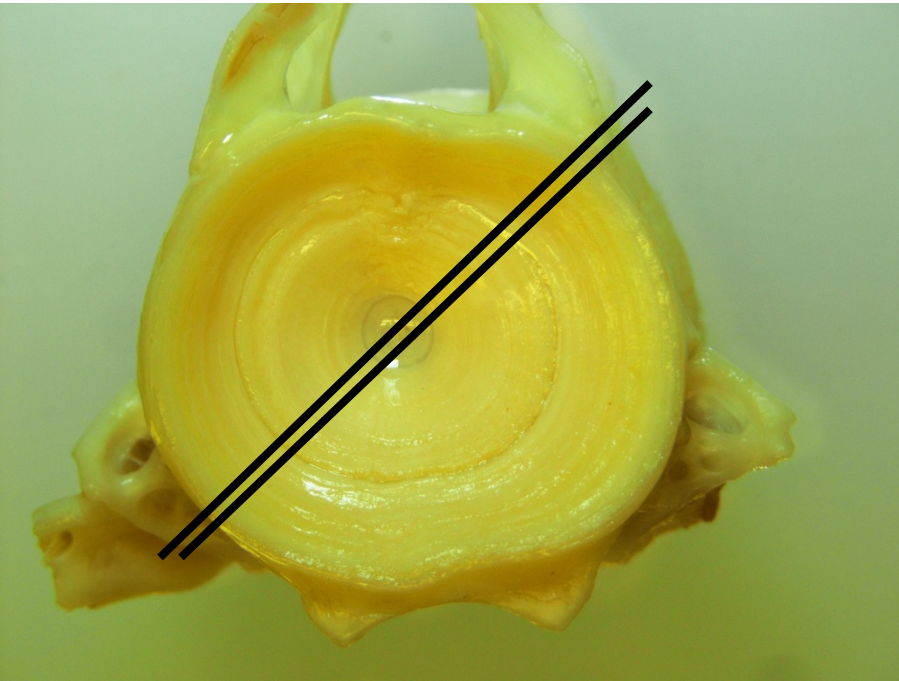
How old is it?

Was it born here?

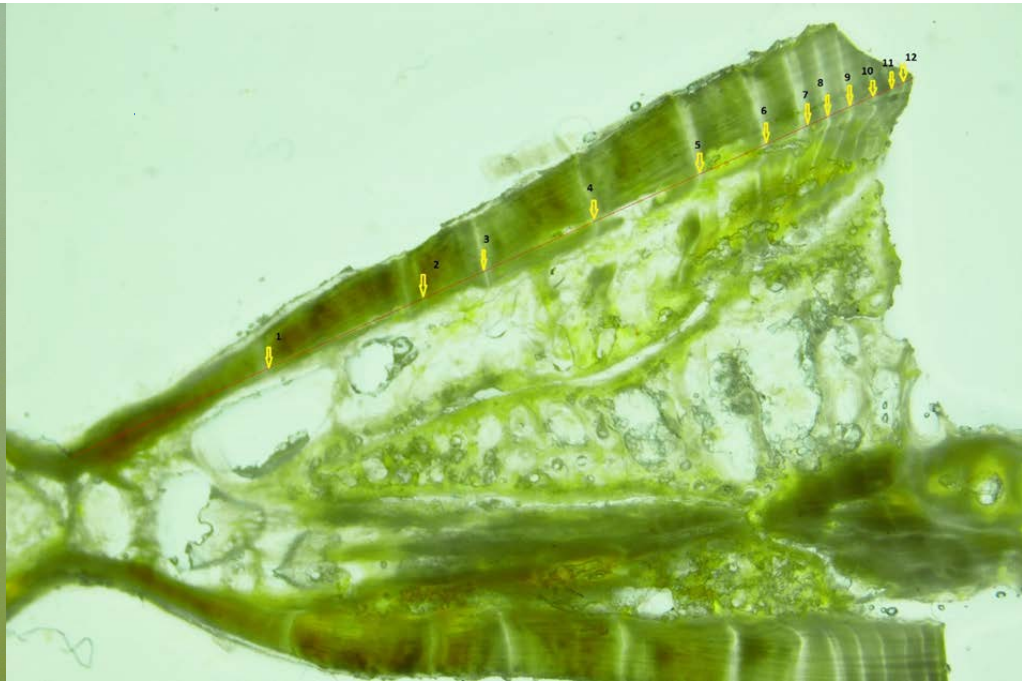


Patrick Kocovsky

Remove various boney
structures



Annuli easily identified



A. Fisheries

B. Invasive species

C. Restoration ecology

Pollinators

Monarch butterfly

Karner blue butterfly

Native bees

Monitoring plan

Habitat and phenology

Inventory



Pitcher's thistle

Status
Threats
Dune ecology



Noel Pavlovic



Oak savanna

Management approaches

Impact on species



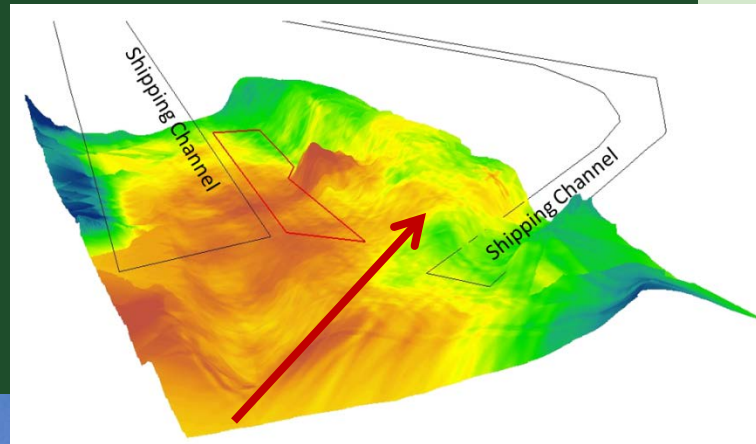
Noel Pavlovic

Image: Steepcone, wikimedia commons ([link](#))

Restored spawning reefs

Reef siting
Pre/post monitoring

*Detroit River
Habitat destruction to 2003*



*Proposed site for reef
restoration*



Reef construction



Western Lake Erie Restoration Assessment

WLERA

Justin Saarinen
Kurt Kowalski
Ryan Keeling



A. Fisheries

B. Invasive species

C. Restoration ecology

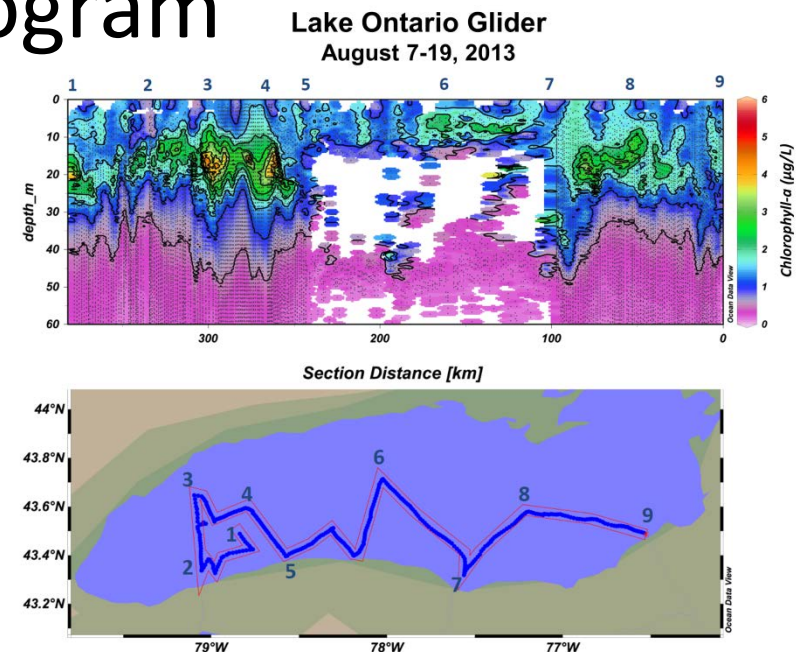
D. Advanced Technology

Unmanned Aerial Vehicles (UAV)

Ground-truth remotely sensed data

Autonomous gliders

USGS Advanced Tech program



And much more . . .

Thank you

- Audience: Staff and scientists, varying levels of understanding;
- Purpose: Begin a more formal relationship (not provide THE summary of GLSC research)
- My background
- My role: 30 research scientists across 1,000 miles; 125+ projects; 100+ papers/yr.; dozens of collaborative efforts; 1.25 FTE communications staff
- Who is GLSC? : How we aren't like you
 - "Science branch of the DOI"
 - USGS Mission Areas vs. Regions
 - EMA is the ecosystem science branch of the DOI (FWS → NBS → NBS → USGS EMA)
 - Lellis' timeline
 - Executive Order 1970: "except the Great Lakes"
 - GLFRA Act
- What is driving GLSC science? : How to engage with us
 - Era without earmarks → EMA Science Strategy
 - Federal science agency:
 - For management (not curiosity)
 - Cross-disciplinary and collaborative ("efficient")
 - Phragmites, HABs, Mussels
 - CESUs with MSU, UT, Wayne State
 - Trust resources
 - "Hitting the sweet spot"
 - "Unbiased" science facilitator: collaboratives, collective impact
 - Regional science-management initiatives:
 - GL WQA
 - 1 AOC technical support
 - 2 Lakewide management: Nearshore Framework (with 7)
 - 4 Nutrient load recommendations in 2015/2016
 - 7 Habitat baseline survey 2016, GLAHF
 - 10 Science: adaptive management
 - GLRI
 - LCC
- What is GLSC doing?
 - Schaeffer's GLSC pubs stuff
 - Themes throughout: restoration, native species, landscape ecology
 - Fisheries (~60+% of budget):
 - Lake committee process – MOU, technical committees
 - Vessels
 - Monitoring & assessment: prey fish and lake trout/lamprey
 - Understand the food web: bottom up vs. top down
 - Coregonids
 - Rearing techniques: 3 aquatic research laboratories