Analysis of the Movement of Vessels Through the Chicago Area Waterway System (CAWS) in Support of Research Concerning Invasive Asian Carp

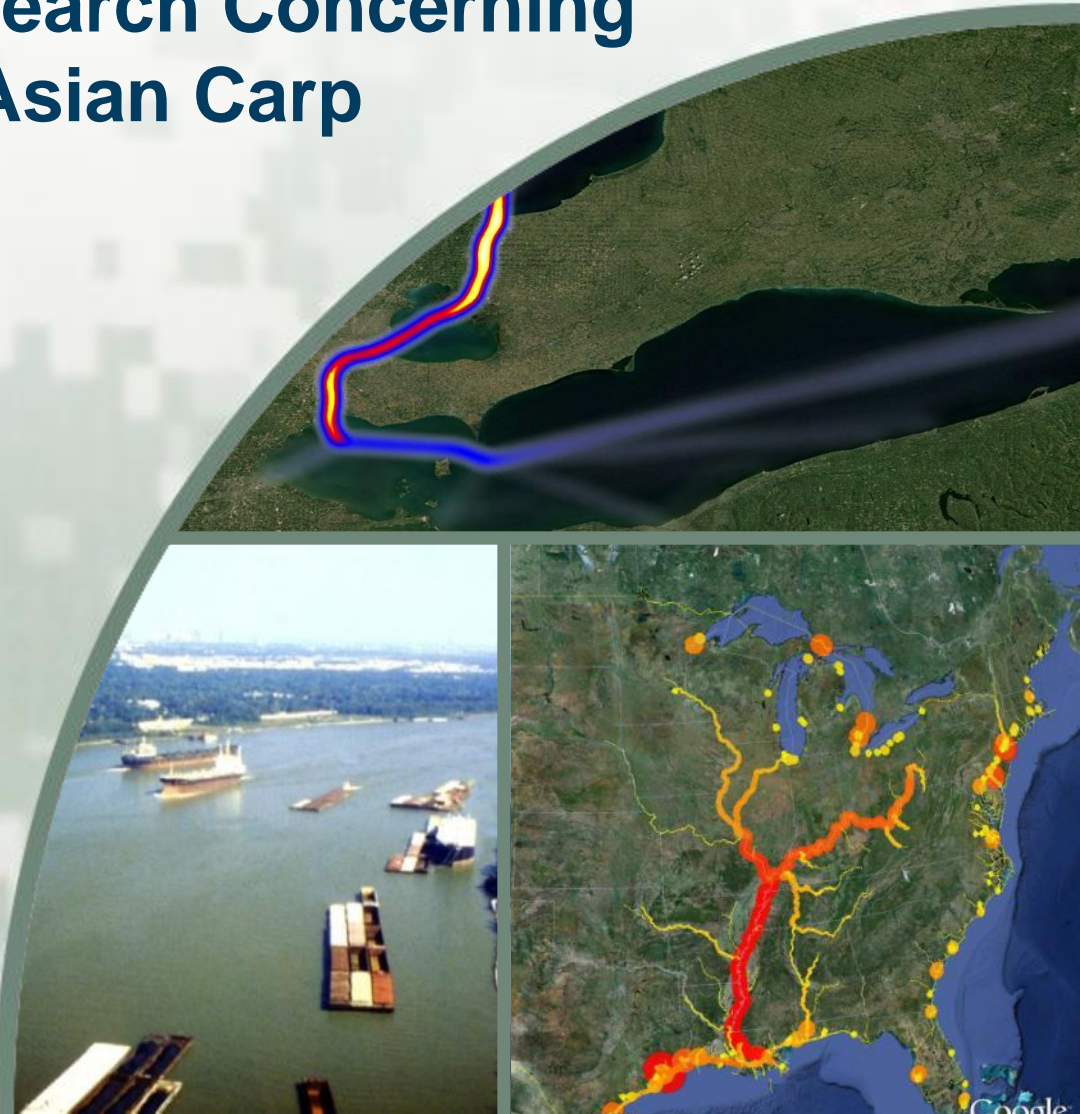**Patricia DiJoseph, PhD**

June 24, 2014

US Army Corps of Engineers®

ERDC
Engineer Research and Development Center

Motivation for Study

- USACE's mission includes providing vital public engineering services for:
  - water resources,
  - ecosystem restoration,
  - marine navigation.
- Asian carp are an invasive species detrimental to ecosystems.
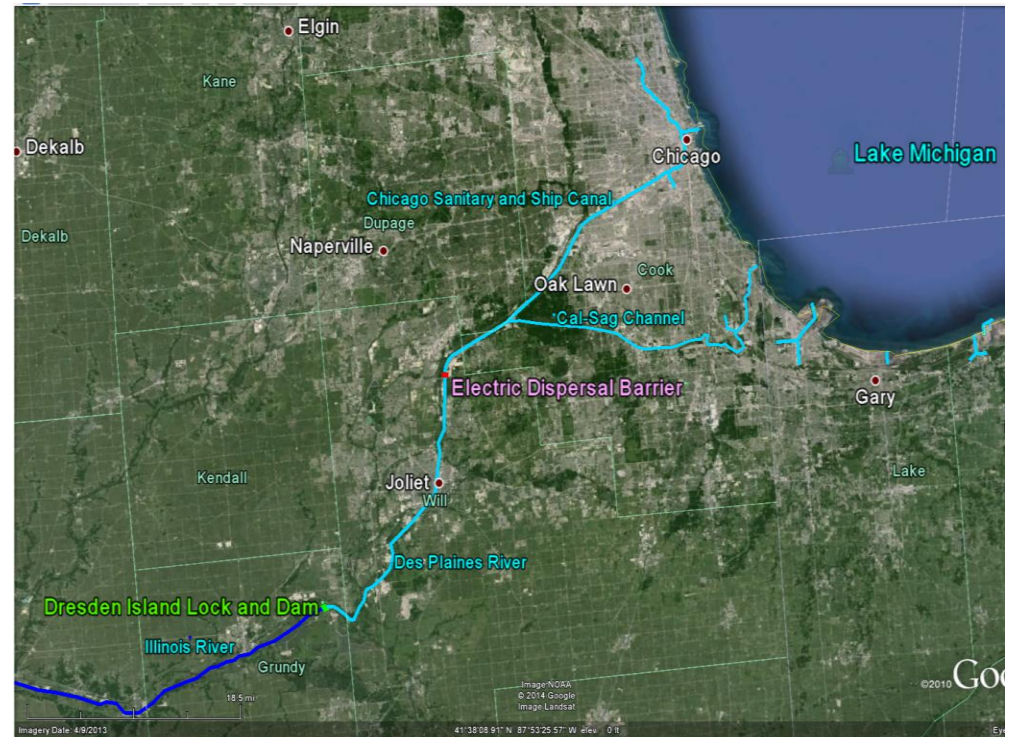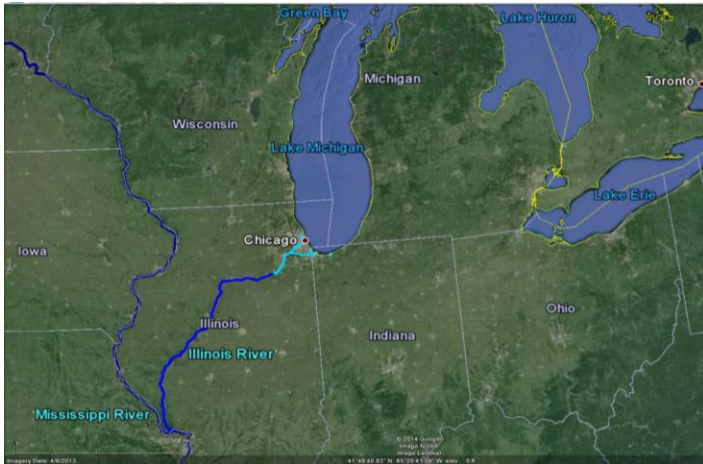

Silver Carp
nas.er.usgs.gov

Bighead Carp
nas.er.usgs.gov

Motivation for Study Continued

- Asian carp are currently located at the Dresden Pool.
- eDNA is routinely detected in the CAWS.
- But, last sighting there was June 22, 2010.

# Study Objectives

For each reach determine the following:

1. Direction of vessels through the reach.

2. Whether the vessel was downstream of Dresden Lock.

3. Whether the vessel was downstream of the electronic fish barrier (FBA).

4. Dates and times vessels were in the reach.
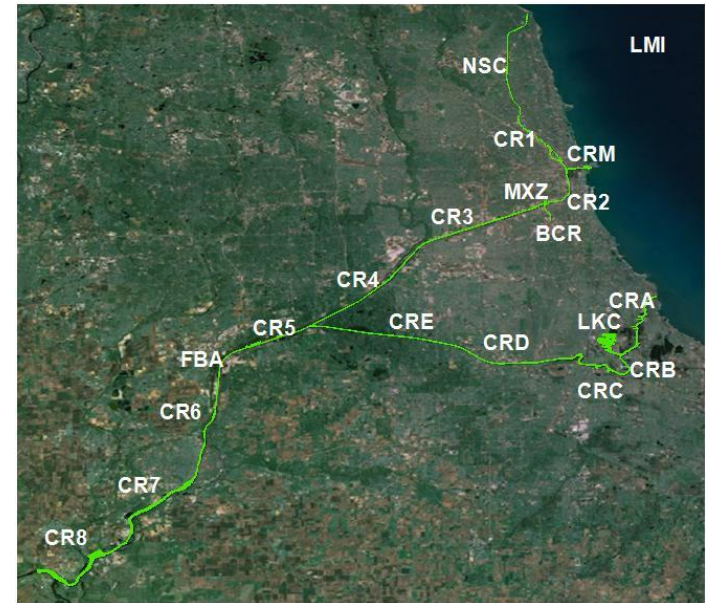
Data Source

National Automatic Identification System (NAIS)

- AIS-equipped vessels transmit:
    - vessel identification number
    - location (longitude and latitude)
    - time stamp
    - heading
    - speed
- Transmit up to every 6 seconds.
- Primarily used in real-time for safety and security.
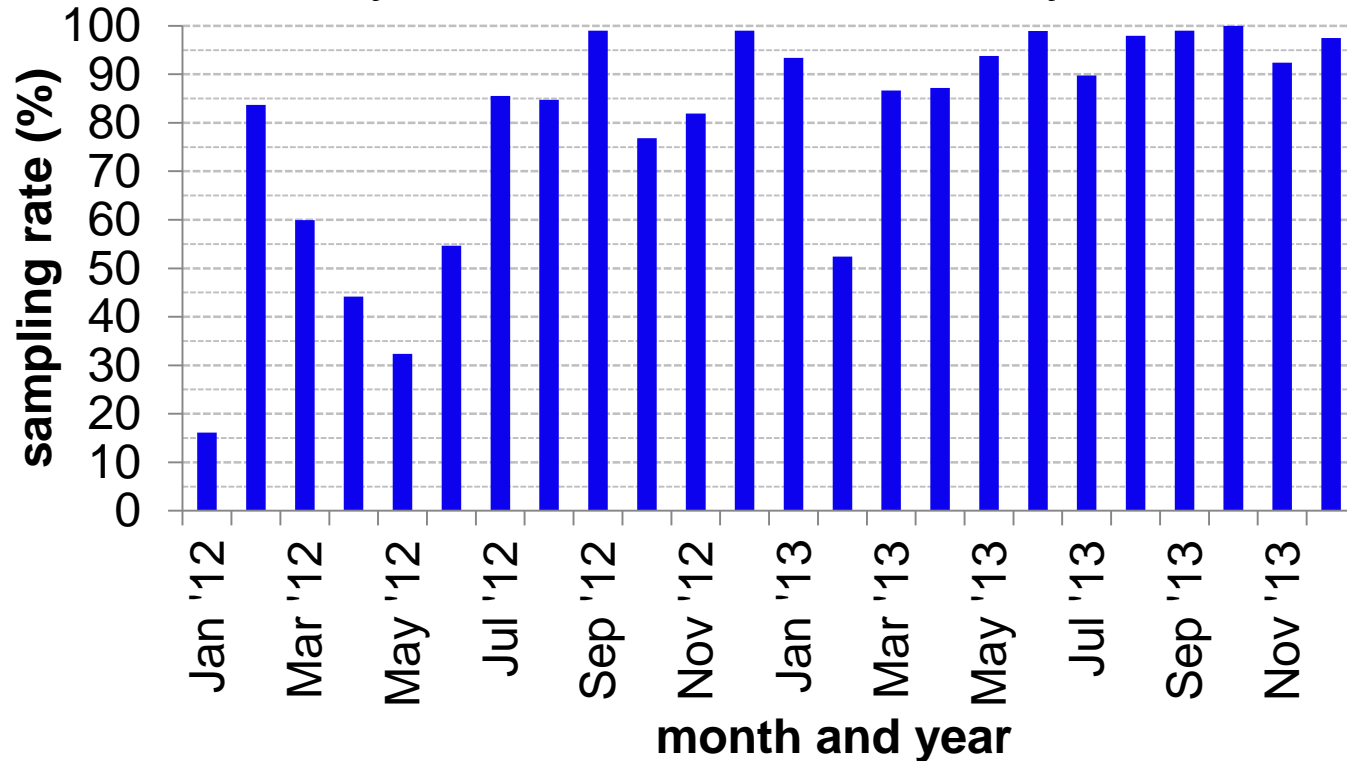- Data is collected and stored.
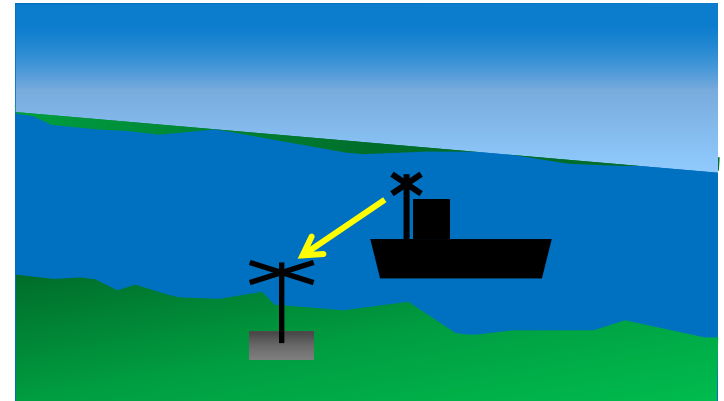
ID	TX_DTTM	LAT	LON
11	5/14/2013 14:30	39.3457	-81.3456
11	5/14/2013 14:35	39.3476	-81.3421
11	5/14/2013 14:40	39.3509	-81.3369
11	5/14/2013 14:45	39.3537	-81.3331
11	5/14/2013 15:00	39.3587	-81.3241
11	5/14/2013 15:05	39.3593	-81.3231

Disadvantages of Data Source

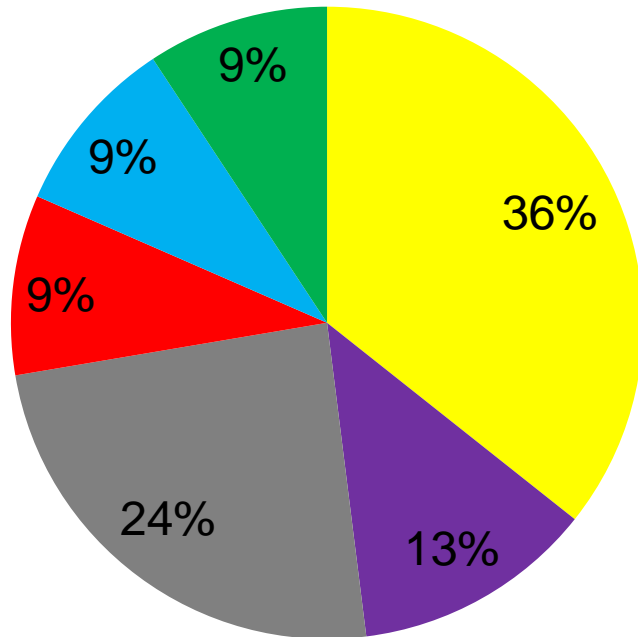- Can miss signals.
- Not mandatory for the inland waterways.

Percentage of vessels captured by AIS at Dresden Lock by month and year.

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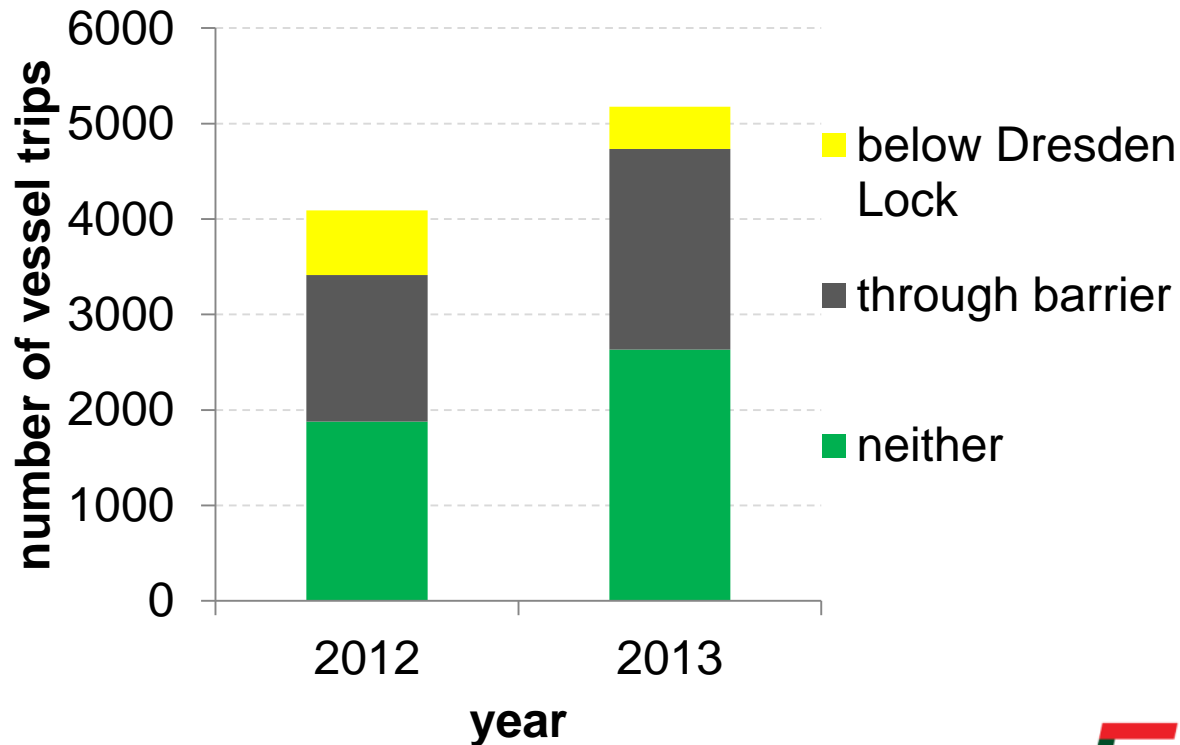
Data Analysis Example 1: Direction of Vessel Through Reach CR5

Pie chart:
- FBA to CR4 (yellow): 36%
- FBA to CRE (purple): 13%
- CR4 to FBA (gray): 24%
- CR4 to CRE (red): 9%
- CRE to FBA (blue): 9%
- CRE to CR4 (green): 9%

Data Analysis Example 2: Number of Vessels that Travel Below Dresden Lock and Through the Electric Dispersal Barrier within 48 hours of entering CR5

Data Analysis Example 3: Dates and Times Vessels Entered CR5
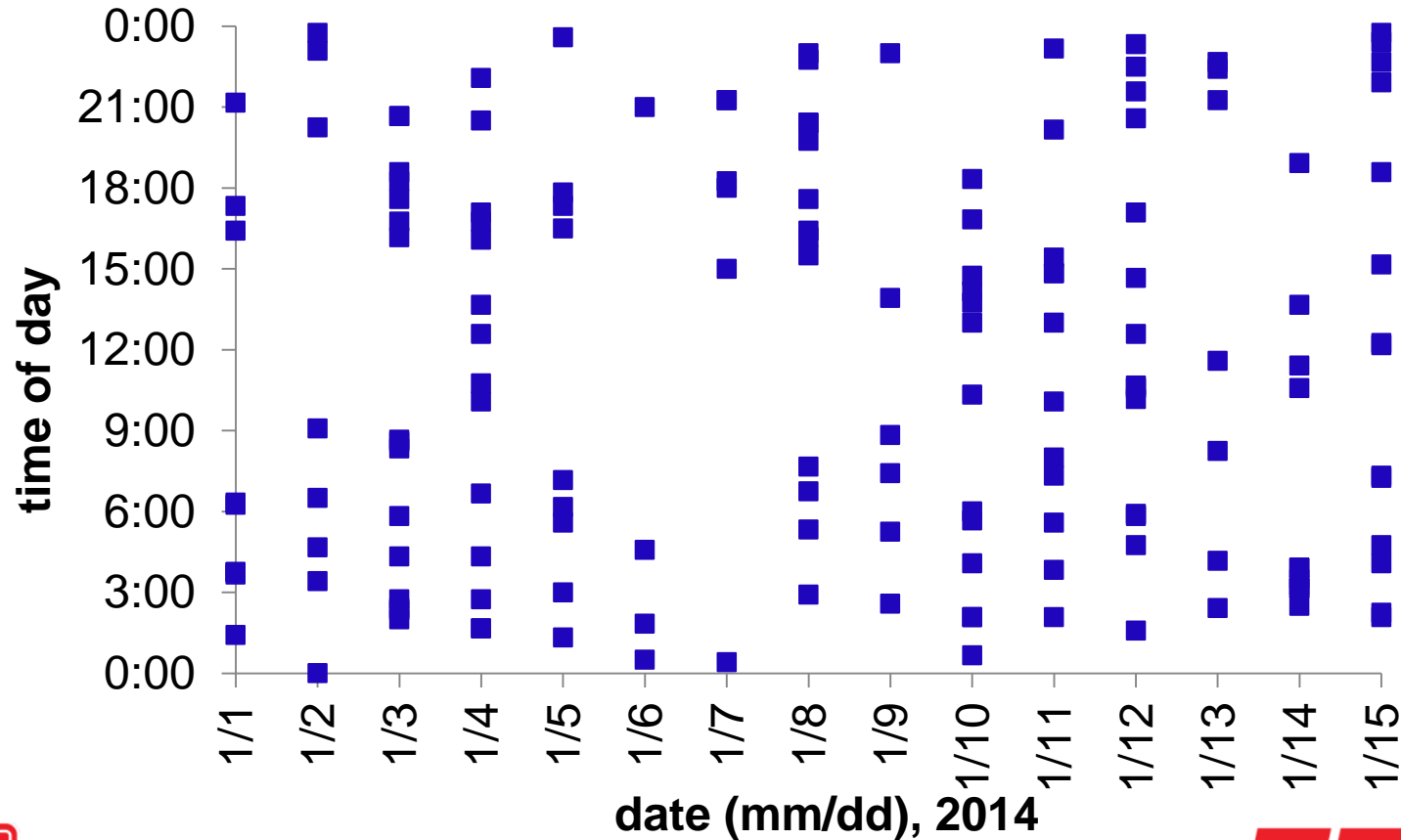
Study Conclusions

- NAIS data can be analyzed to determine vessel movements through waterways, including:
    - vessel paths,
    - locations vessels did/did not visit within a given time frame,
    - and time spent in specified regions/ waterway sections.
- NAIS captures up to 95% of vessel traffic.

Future Research

- Correlate the data to eDNA positive test sample times and locations.
- Research vessel movement through Dresden Lock.
- Determine more applications of the data.
- Find more locations / case studies to apply vessel movement analysis via NAIS data.

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Thank You.

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