### Exploring the Chicago River Science, Policy, Ethics, and Sustainability





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#### **Environmental Studies Program**

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**Context:** urban nature and the Chicago River

Exploration: connecting with the river

Science: assessing water quality

**Policy:** tackling the Asian carp controversy

Ethics: thinking like a watershed



Postcard depiction of the mouth of the Chicago River



Chicago in 1857



Postcard depiction of the mouth of the Chicago River, c. 1906



A chicken stands upon Bubbly Creek, c.1911 (Chicago Historical Society)



North Branch of the Chicago River, spring 2010 (M. Bryson)



Jardine Water Filtration Plant on Chicago's downtown lakefront



WMRD's Racine Avenue Pumping Station, headwaters of Bubbly Creek Chicago, May 2009 (M. Bryson)



The Stickney Wastewater Treatment Plant, SW of Chicago (MWRD)

### **Transformations of the Chicago River**



### **Transformations of the Chicago River**



### The CAWS

Chicago Area Waterway System

rivers canals locks control structures

## **Discussion: What's in a Name? (CAWS vs. River)**



The Des Plaines River in my hometown of Joliet IL, part of the Illinois Waterway transportation system which connects the Great Lakes to the Gulf of Mexico

### **Exploring the River: a Multidisciplinary Endeavor**



Understanding the river as a modified natural ecosystem (natural sciences)

Developing conservation policies (social and natural sciences) Representing the river as a cultural resource (arts and humanities) Restoring the river: water quality, biodiversity, riparian zone integrity, citizen access and recreation (all disciplines)

### **Sense of Place | Urban Sustainability**

### **Canoeing the Upper North Branch**



Paddling the West Fork of the Upper North Branch: portage around a fallen tree in the Cook County Forest Preserve (October 2012)

### **Canoeing the Confluence**



Heading south into the Loop where the branches meet; Wolf Point in the background (October 2011)

### **Canoeing the South Branch**



The mouth of Bubbly Creek, an industrialized tributary of the South Branch of the Chicago River (May 2009)

### **Canoeing the South Branch**



Heading upstream on Bubbly Creek (Oct 2010)

### **Cleaning up Bubbly Creek**



Hauling trash from the banks of Bubbly Creek (Feb. 2013)

## **Hiking the Continental Divide**



Exploring the woods at the Chicago Portage National Historic Site, a few miles SW of Chicago (Feb. 2013)

## **Science: Assessing Water Quality**

Temperature

pН

Turbidity

Dissolved oxygen (DO)

Nutrients (nitrate, phosphate)

Bacterial indicators (coliform)

Metals and organic contaminants (lead, copper, benzene, PCBs, hexavalent chromium)

Emerging contaminants (pharmaceuticals, synthetic hormones, flame retardants)





### **Science: Assessing Water Quality**



Sampling macro-invertebrate benthos in the North Branch (May 2010)

### **Science: Assessing Water Quality**



Identifying macro-invertebrates from the North Branch (May 2010)

# Biodiversity Meets Policy: Asian Carp, the River, & the Great Lakes





**Left**: RU senior SUST major Kristina Lugo catches a Common Carp from her secret spot on the North Branch of the Chicago River

Above: a Bighead Carp from the Illinois River



Since their introduction to the US in the 1970s, Asian Carp have become widespread within the Mississippi, Missouri, and Ohio River basins. Chicago is the gateway to the Great Lakes watershed. (Map: NPR)

## Policy: Asian Carp, the River, & the Great Lakes

- The **Silver and Bighead Carp** are nonnative species introduced in the US to control algal growth in aquaculture ponds in the 1970s
- They **escaped confinement** and have spread rapidly throughout the Mississippi River basin during the 1990s and 2000s
- These **fast-growing species** grow rapidly to a large size (50+ lbs) and consume up to 40% of their body weight in plankton per day; they also reproduce rapidly
- Environmental impacts include disruption of food chain, displacement of native fish species, danger to boaters (the silver carp jump when disturbed)
- **Current crisis**: the impending invasion of Asian Carp into the Great Lakes watershed via the Chicago and Calumet Rivers



Photo: Great Lakes Fisheries Commission



Silver Carp leaping from the Illinois River, where they are very numerous along with Bighead Carp. Such behavior poses a significant boating hazard. (Photo: Great Lakes Fisheries Commission)



Watch yourself: bow-hunter on the Illinois River being hit by a silver carp (photo: *Daily Mail*, UK). Asian Carp are now being harvested for sport and commercial processing in Illinois.

### A river reversed, a problem created

The Chicago and Calumet rivers were once tiny waterways that trickled into Lake Michigan. Begining in 1900 the city dug a series of canals that reversed their flows so they could carry the city's waste into the Mississippi River basin, and away from the lake – the city's drinking water source. A push is now under way to engineer a system to re-establish the natural hydrological divide between Lake Michigan and the Mississippi.

Sources: Great Lakes Fishery Commission



Journal Sentinel

These maps from the Great Lakes Fisheries Commission show the pre-1900 hydrology of the Chicago-area waterways; note the continental divide. The right map shows current flows, location of locks and water treatment plants, and A. carp sightings as of summer 2010.

MAN-MADE

Chicago's

WATERWAYS

SITES TESTING POSITIVE FOR

Cal-Sag Channel

ASIAN CARP DNA OR FISH

WATER TREATMENT

PLANTS

Q

Wilmette

pumping station

> Chicago River controlling works FLOW

> > FLOW

Calumet

Grand

Calumet

FLOW

Chicago

Lake Calumet LOCKS

Lake Michigan

### **Invasive Species of the Great Lakes**



**Sea Lamprey** *Petromyzon marinus* 

Origin: Atlantic ocean Introduced: 1835 (Lake Ontario) Impacts: Parasite on fish; devastation of whitefish, lake trout, chub in '40s and '50s; in all the Great Lakes, esp. Huron Costs: \$13 million / year for control



**Zebra Mussel** Dreissena polymorpha

Origin: Caspian Sea Introduced: 1988

**Impacts**: Displacement of native clams and mussels; clogging of water intake pipes; has spread to all GLs, Mississippi River, and inland lakes

Costs: Several hundred million \$ / year

## **Policy Debates: Asian Carp Discourse**

### State vs. State



### **Environment vs. Industry**



### Fishing vs. Shipping



The debate about Asian Carp occurs along these three axes, which makes it particularly complex. <u>Great Lakes states have lined up against Illinois</u> politically and legally to try to force the US Army Corps of Engineers to close the locks providing access to the Great Lakes from the CAWS, so far unsuccessfully. But the debate also pits different industries against one another, given the value of the GLs sport and commercial fisheries.

### Electric fish barrier tested for safety

COOK COUNTY

DUPAGE COUNTY

O-USGS

Romeoville

**Electric shock** 

hazard area

gauge

WILL

Although a \$9 million electric barrier to protect the Great Lakes from giant Asian carp was constructed in early 2006, the Coast Guard and Army Corps of Engineers are still conducting safety tests for barge operators and haven't put it into permanent operation. The carp, which could transform the Great Lakes' fishery and make the lakes far less

appealing to boaters, are only a two-day swim from Lake Michigan.





Potential pathways for Asian carp to reach Lake Michigan Middle Fork LAKE COUNTY

CHOHIE

North Branch Chicego Rive

Chicago

Sanitary & Ship Canal

Little Calumet

**River North** 

Wilmette

pumping station

North Shore Channel

Chicago River

Chicago River

Calumet River

ANA

Lake

Calumet

controlling works

South Branch Chicago River

Grand Calumet Rive

Little Calumet River South

South Fork South Branch

West

Des Plaines River

Calumet-Sag Channel

FOR

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Lake Michigan

**River entrances** 

to Lake Michigan

### **Proposed Solution: Watershed Separation**



# Future Impacts of Asian Carp: Sources of Uncertainty

- The validity of <u>eDNA detection techniques</u> pioneered by David Lodge of the University of Notre Dame, which provide a costeffective tool to detect the presence of carp in waterways
- The experimental nature of the electric barrier at Romeoville on the Sanitary and Ship Canal, which provides no guarantee of keeping the carp at bay
- The timing of the carp's entry into Lake Michigan scientists mostly agree that this it not a matter of if, but when, though they cannot predict when that will be
- The environmental and economic **impacts upon Great Lakes ecosystem**, perhaps the toughest things to estimate of all
- The **potential efficacy of watershed separation**, since localized flooding could still provide a temporary avenue to the Lakes

Background image: David Lodge's eDNA lab at the Univ. of Notre Dame (Gary Porter, Milwaukee Journal-Sentinel)

## Discussion: Science, Uncertainty, & Environmental Policy



Lake Michigan as seen from Milwaukee, WI (Milwaukee Journal-Sentinel)

## **Environmental Ethics & Sustainability**



### In a Sustainable Future:

Environmental resources are conserved for both future human generations as well as non-human biota.

**Economic development** occurs not at the expense of the natural environment, but in a way to mitigate ecological costs and impacts.

**Equity** – social, economic, and environmental justice – governs the process of sustainable development.









Chicago's Northwest Suburbs / Busse Woods Forest Preserve

### **Connections: Water / Green Infrastructure**



John Egan Wastewater Treatment Plant, Schaumburg IL / Busse Woods

### **Connections: Water / Urban Land Use / Food**



Growing Power's Iron Street Farm in Chicago, on the west bank of Bubbly Creek (2012)

## **Discussion: What about Your Watershed?**



Sources: USGS (bottom map), Catawba Landcare (top)

### **Discussion: What about Your Watershed?**



## **Thank You**



The Chicago River: photo by Ryan Hodgson-Rigsbee