

# Great Rivers – Troubled Waters



Richard Sparks  
University  
of  
Illinois

What is a large floodplain river?

The value of large floodplain-  
rivers ...

Effects of development

Hope for the future

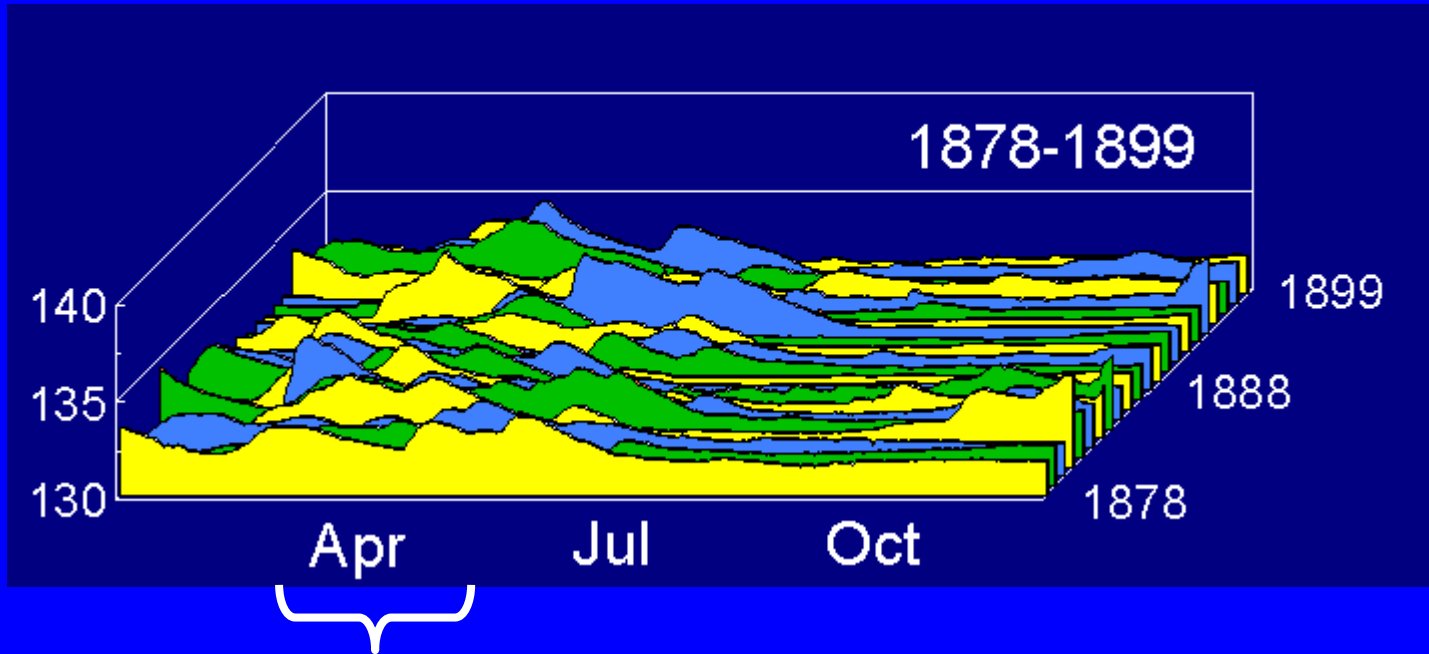
The Mississippi, Missouri and Illinois rivers belong to a **world class** of 79 large floodplain rivers, including the Nile and the Amazon, where biological productivity is enhanced by predictable, seasonal floods on large, low-lying floodplains.

Fish production: in 1908, 2,000 commercial fishermen harvested 24 million pounds. **The Illinois River once was one of the most biologically productive rivers in the U.S.**



# Water regime pre-1900: Predictable spring flood

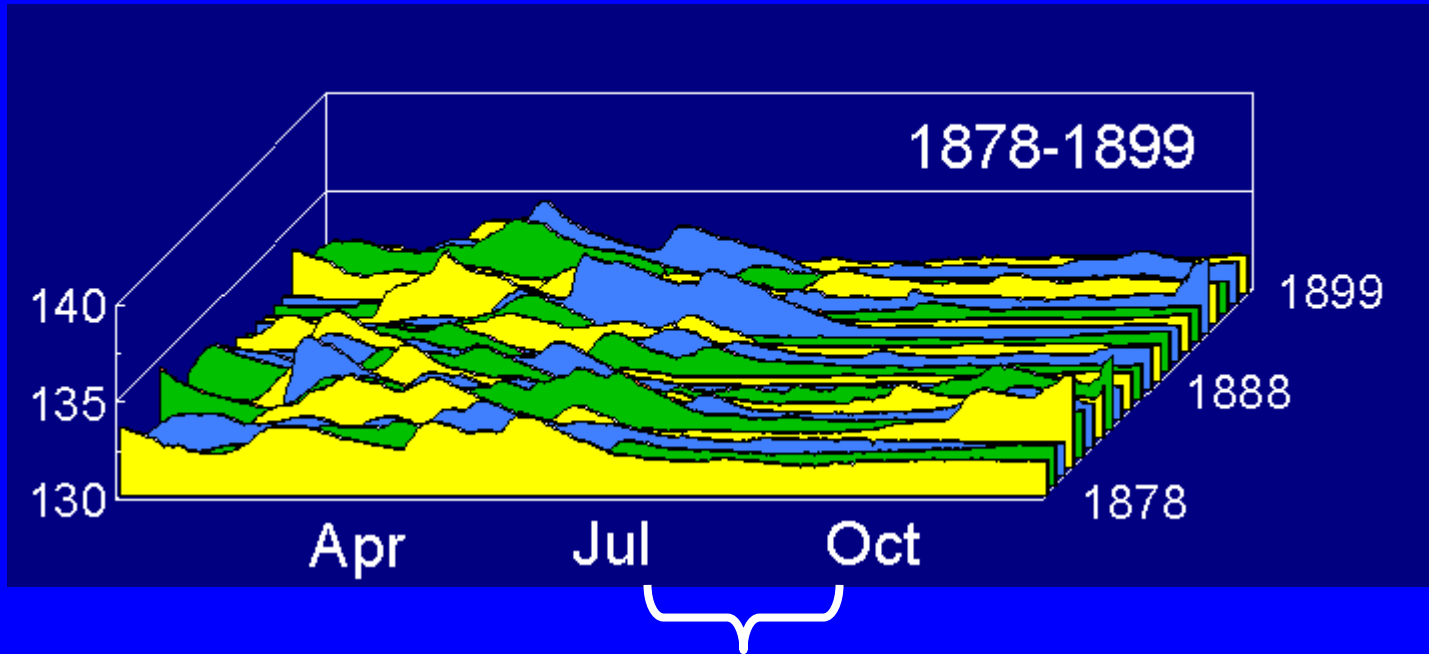
Water level  
(meters above mean sea level)



Flood season. Fish have access to spawning and nursery areas on the flooded floodplain and in the expanded backwaters and lakes.

# Water regime pre-1900: Predictable summer low level

Water level  
(meters above mean sea level)



Growing season. Flood recedes. Vegetation grows on moist soil and in the permanent lakes and backwaters, provides food for fall migration of waterfowl.



The quintessential  
Floodplain plant:

federally-listed  
decurrent false  
aster,

*Boltonia*  
*decurrrens*

# Floodplain: the time-share condominium for wildlife

**Wet Season**

**Fish, ducks,  
herons, egrets,  
cormorants**

**Dry Season**

**Deer, squirrels,  
turkeys**

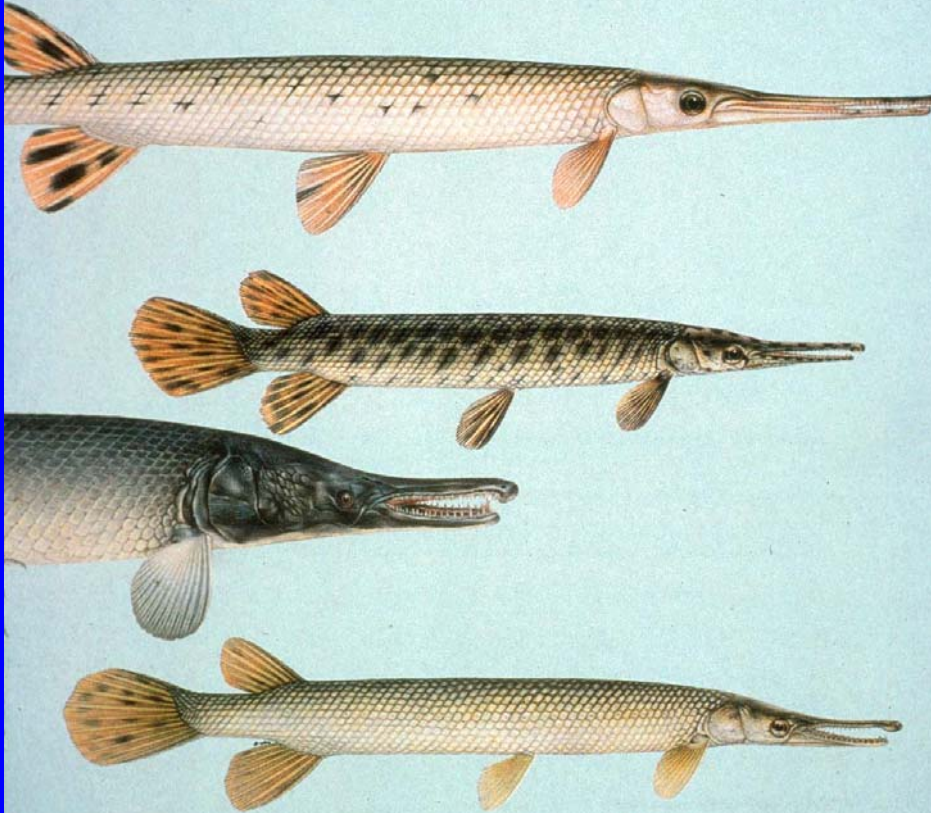


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# FISHERIES

A Bulletin of the American Fisheries Society



1993 First Call for Papers: Page 40

Adaptations  
to life in the  
hypoxic  
zones of  
floodplains ...

What should  
the D.O.  
standard be?



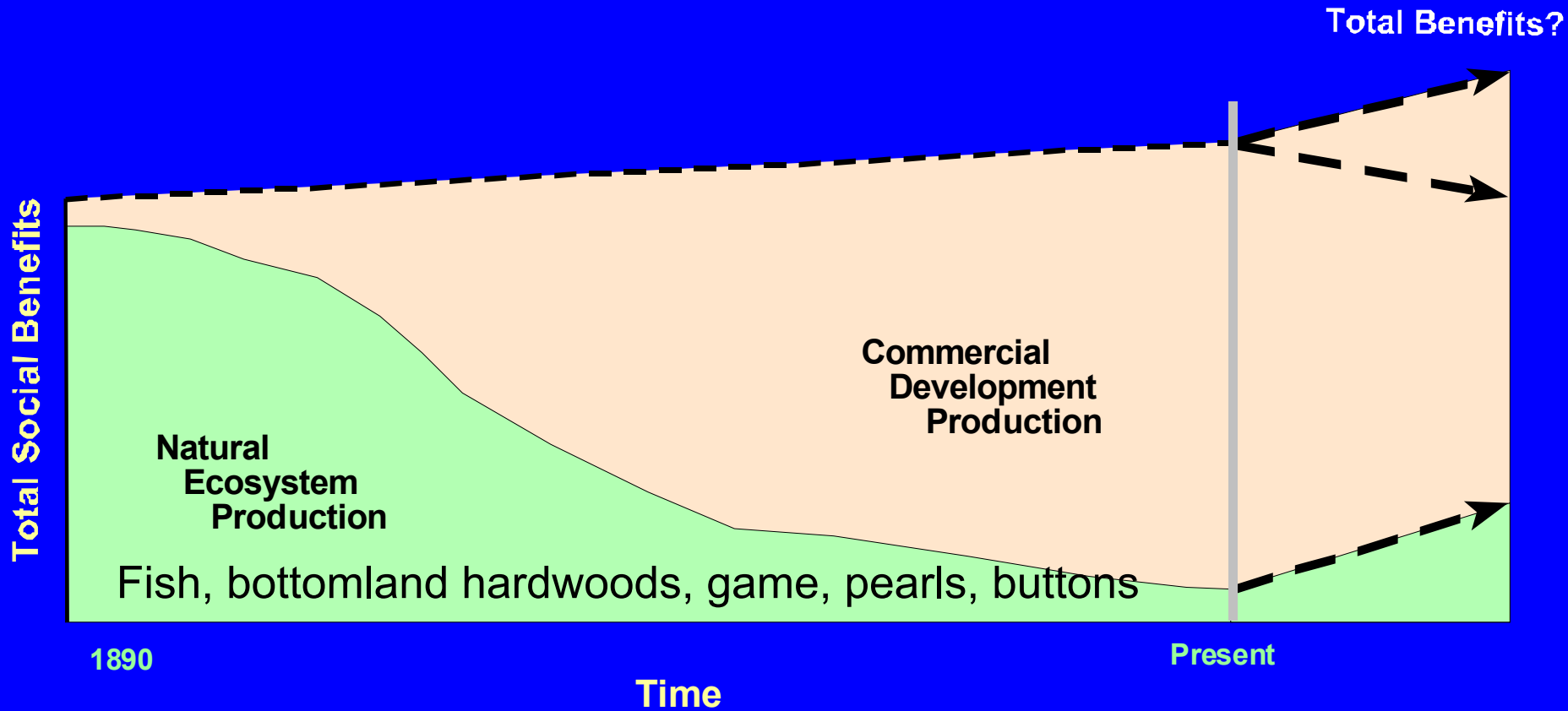
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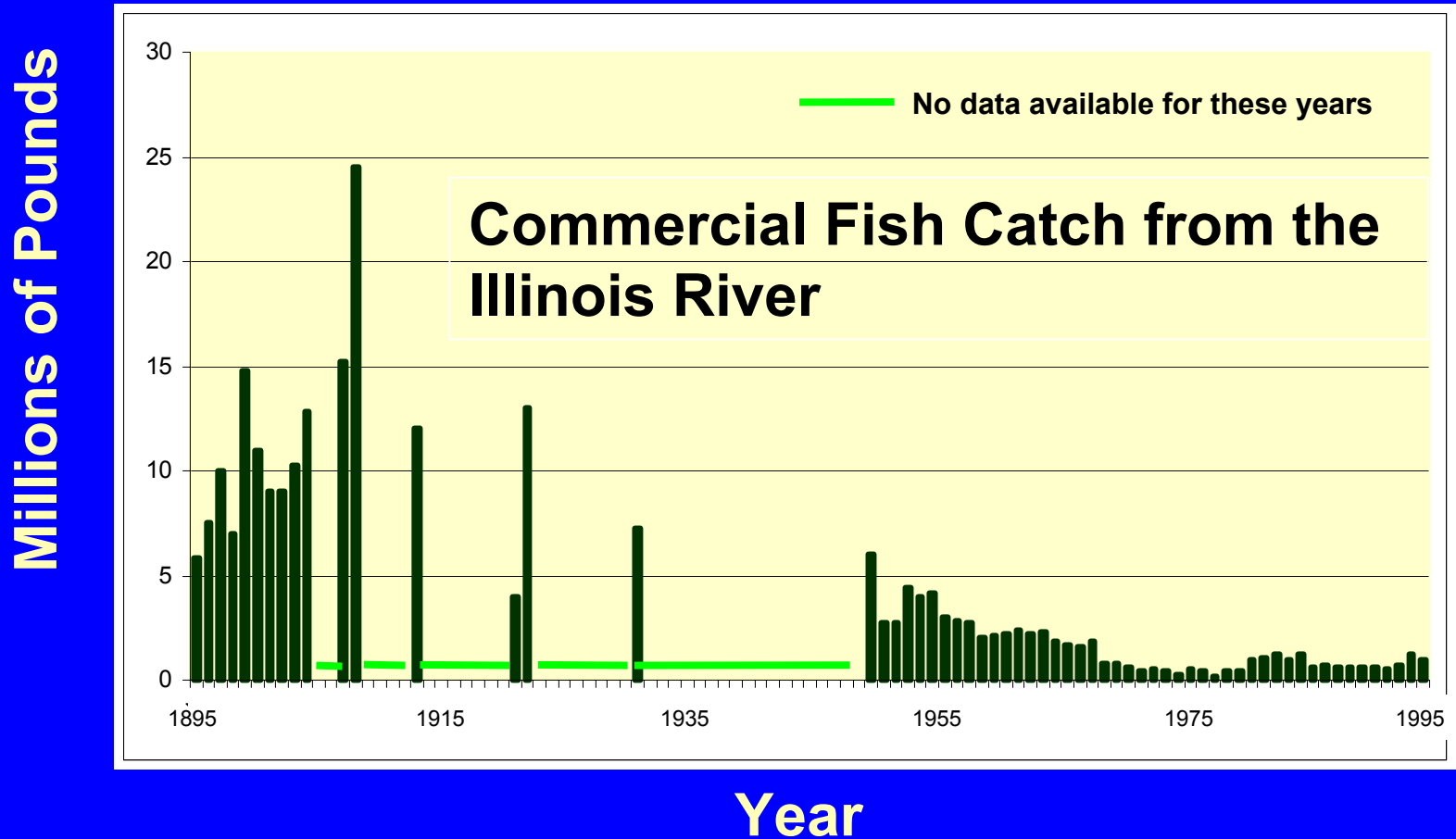
Hope for the future

# Historic Flow of Social Benefits from Illinois River and Its Floodplain (Conceptual)



Green services: flood reduction, nutrient absorption, sediment storage

Productivity declined as the river and its basin were commercially developed.



In the 1890s-1910, a 200-mile reach of the river produced 10 % of the total U.S. catch of freshwater fish -- more than any other river in America.

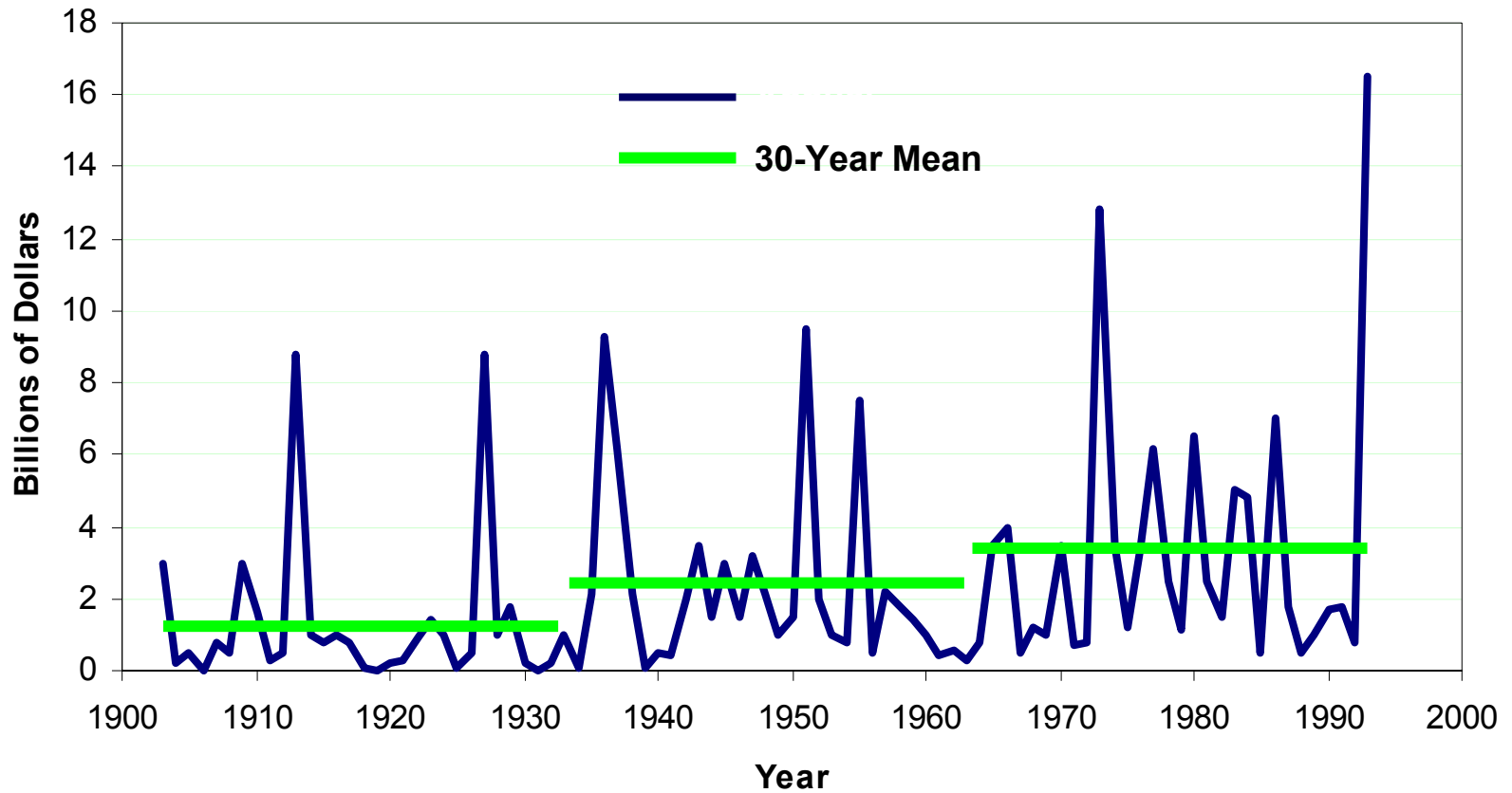
# Trading fish for corn

Leveeing and draining the floodplain removed the spawning grounds and nurseries for fishes.

The rivers still  
reclaim their  
floodplains: 1976,  
1993, 1995



# National Annual and 30-Year Mean Flood Damages (adjusted to 1993 dollars)



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# N-S Gradient in Degree of Alteration and Public Opinion

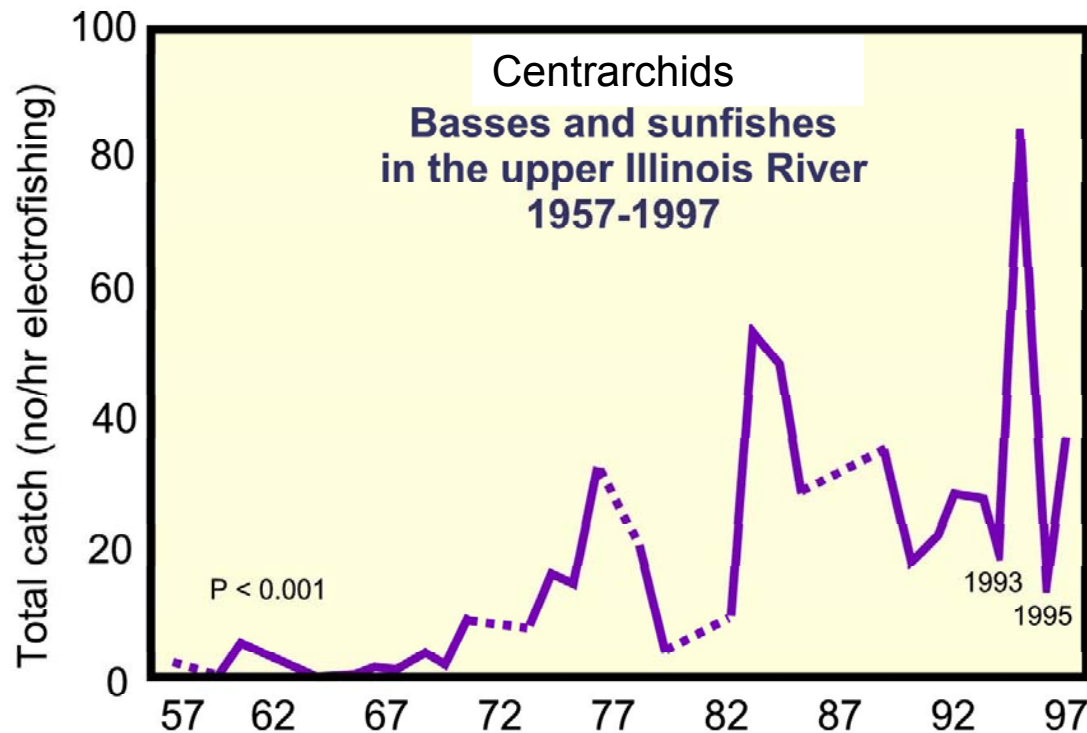
Segment	% Leveed <sup>1</sup>	Public Opinion <sup>2</sup>
Headwaters	<0.01	Recreational area, teeming with fish and wildlife. More natural, less commercial.
Upper MR, north	3	
Upper MR, south	53	
Middle MR	82	Polluted, treacherous for boaters, dangerous floods. More commercial, less natural.
Lower MR	93	
Delta	96	

<sup>1</sup> Delaney & Craig 1997

<sup>2</sup> Qualitative, Ray, McKnight Foundation; quantitative, UMR only, Carlson 1998

Misconception: 75% feel water quality has gotten worse or stayed the same in the river segment they are most familiar with.

Carlson 1998

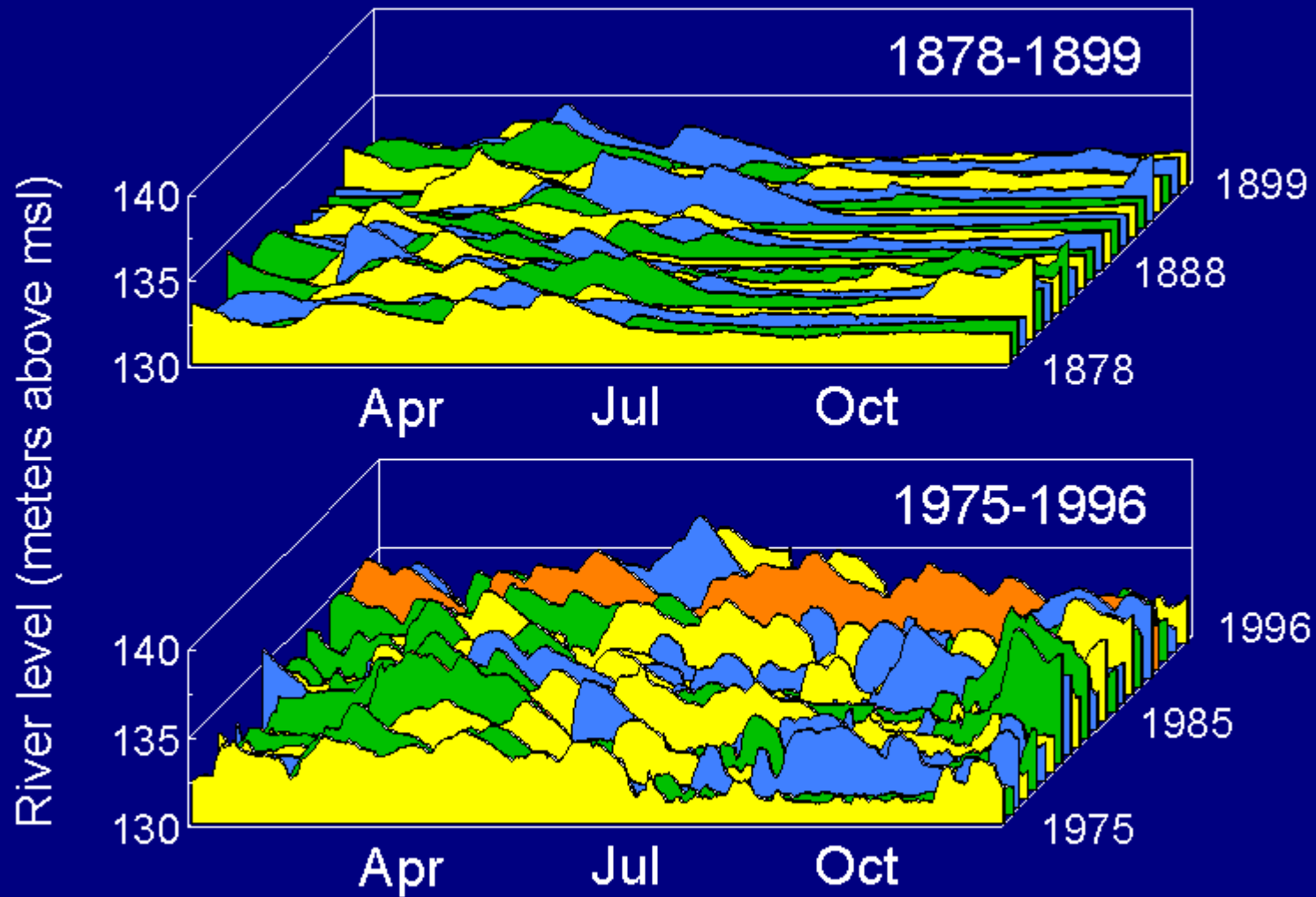


The Clean Water Acts, 1968-1972 enabled native fishes to recover in the Illinois River near Chicago, once the most polluted section of the river.

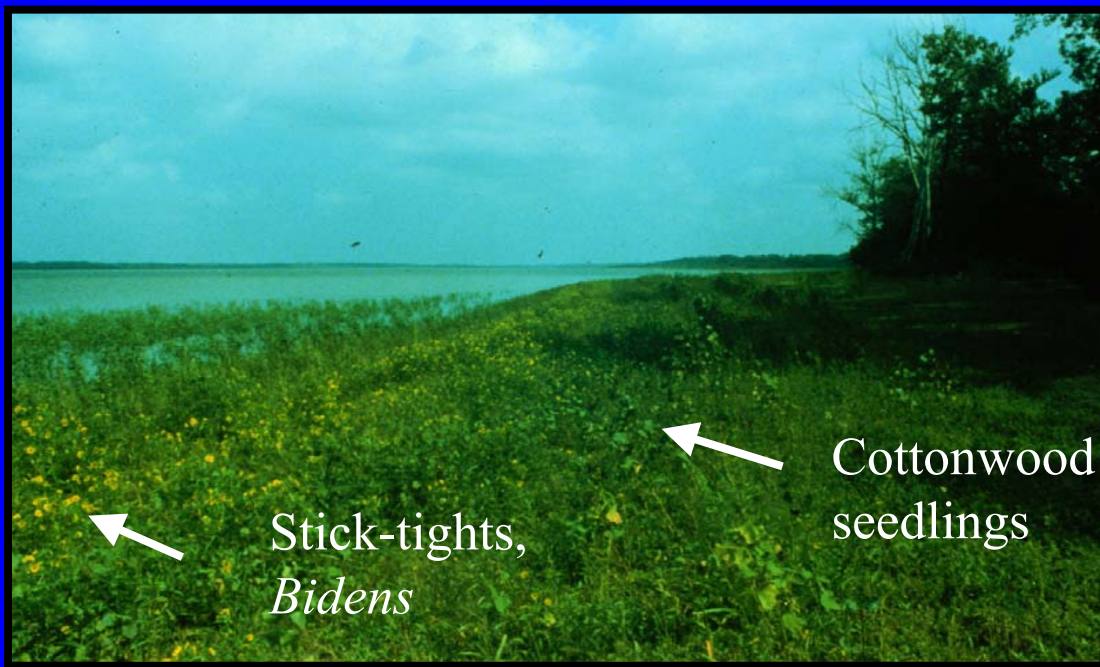
Lerczak & Sparks 1995; INHS LTEF 1995-1997



After a century of human alteration:



Post-dam: "chaos"

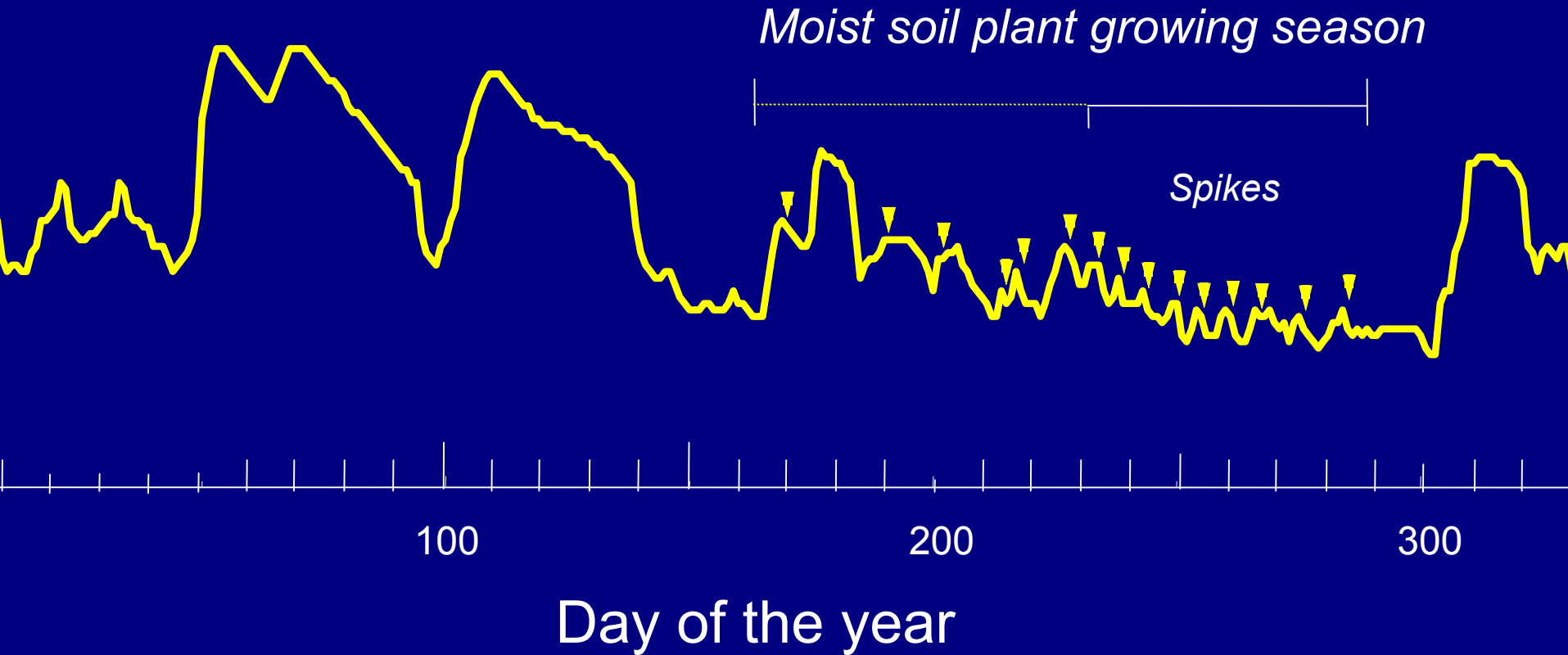


A. Moist soil vegetation grows when water levels are low and stable during the summer growing season.

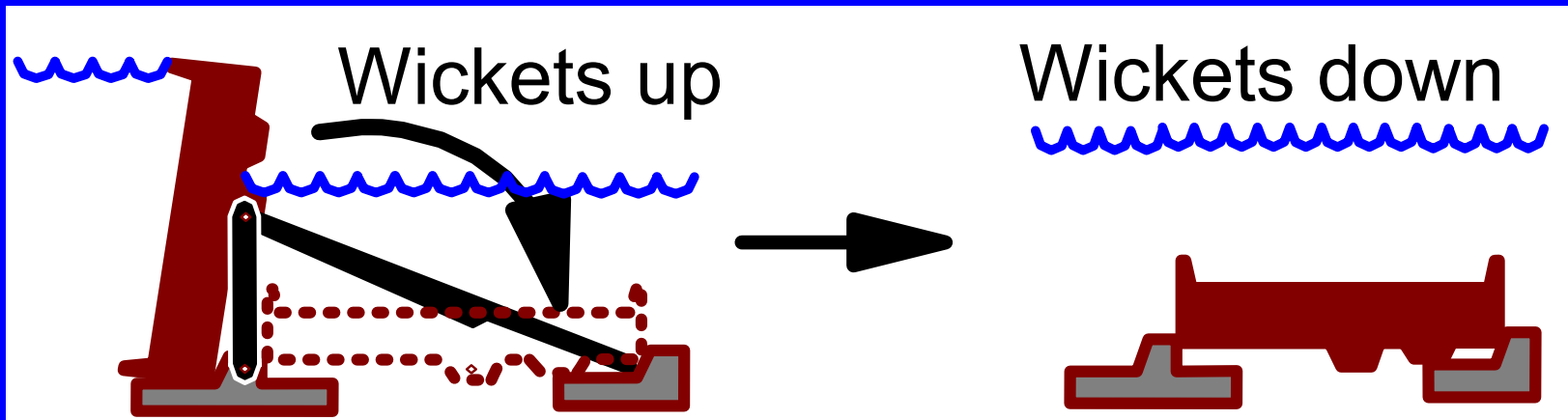
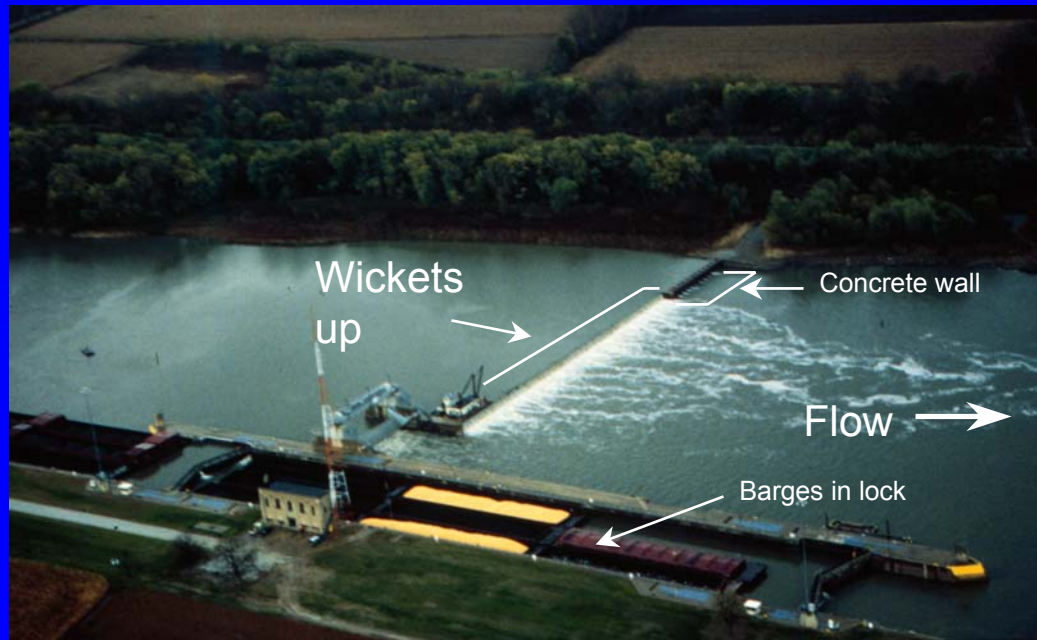


B. The result of excessive water level fluctuations

# Effects on Plants



# La Grange Lock and Dam, Illinois River



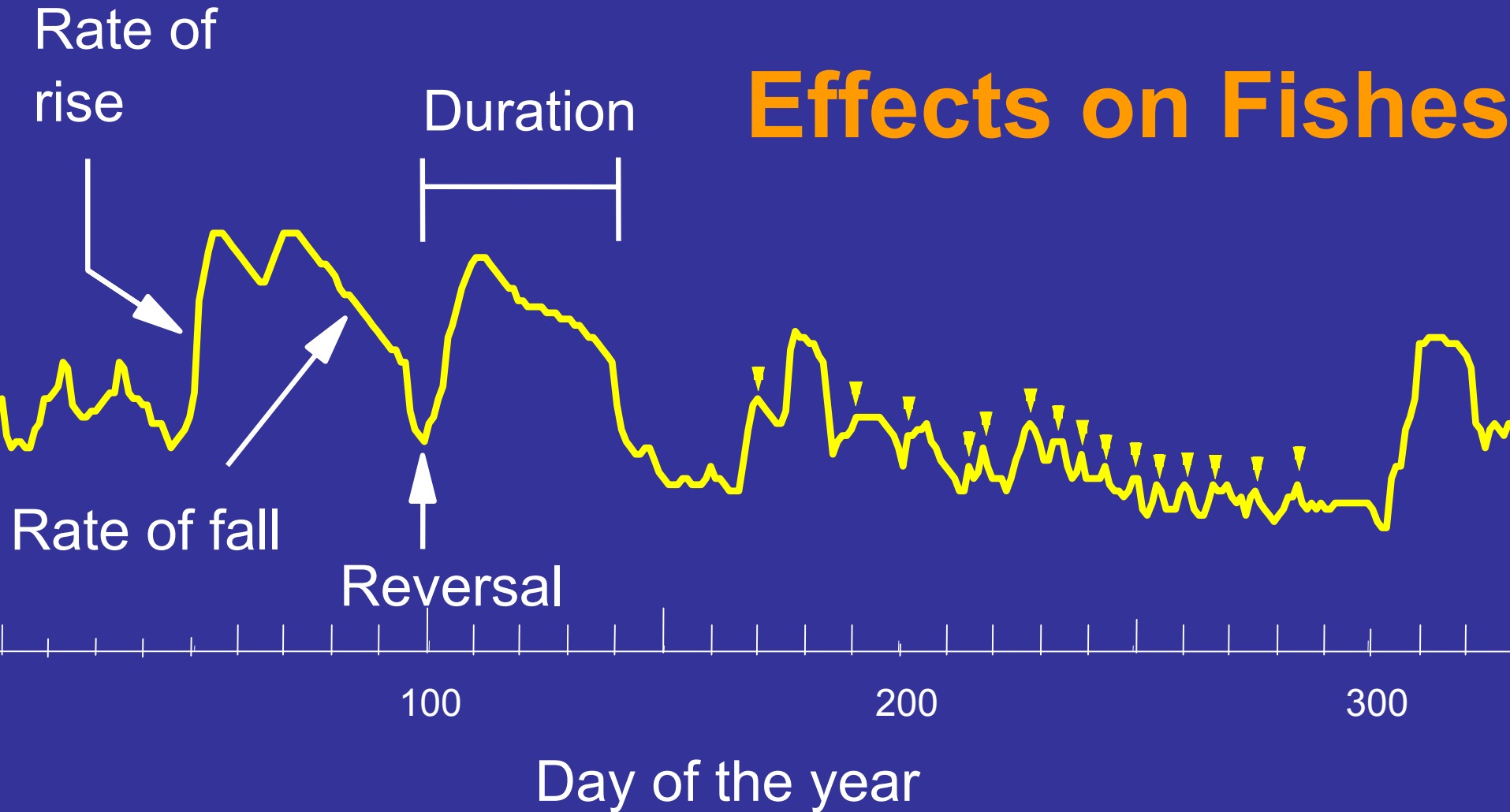
# Conclusion

- Moist soil and submersed **vegetation** is limited by unnatural, frequent little floods during the growing season.

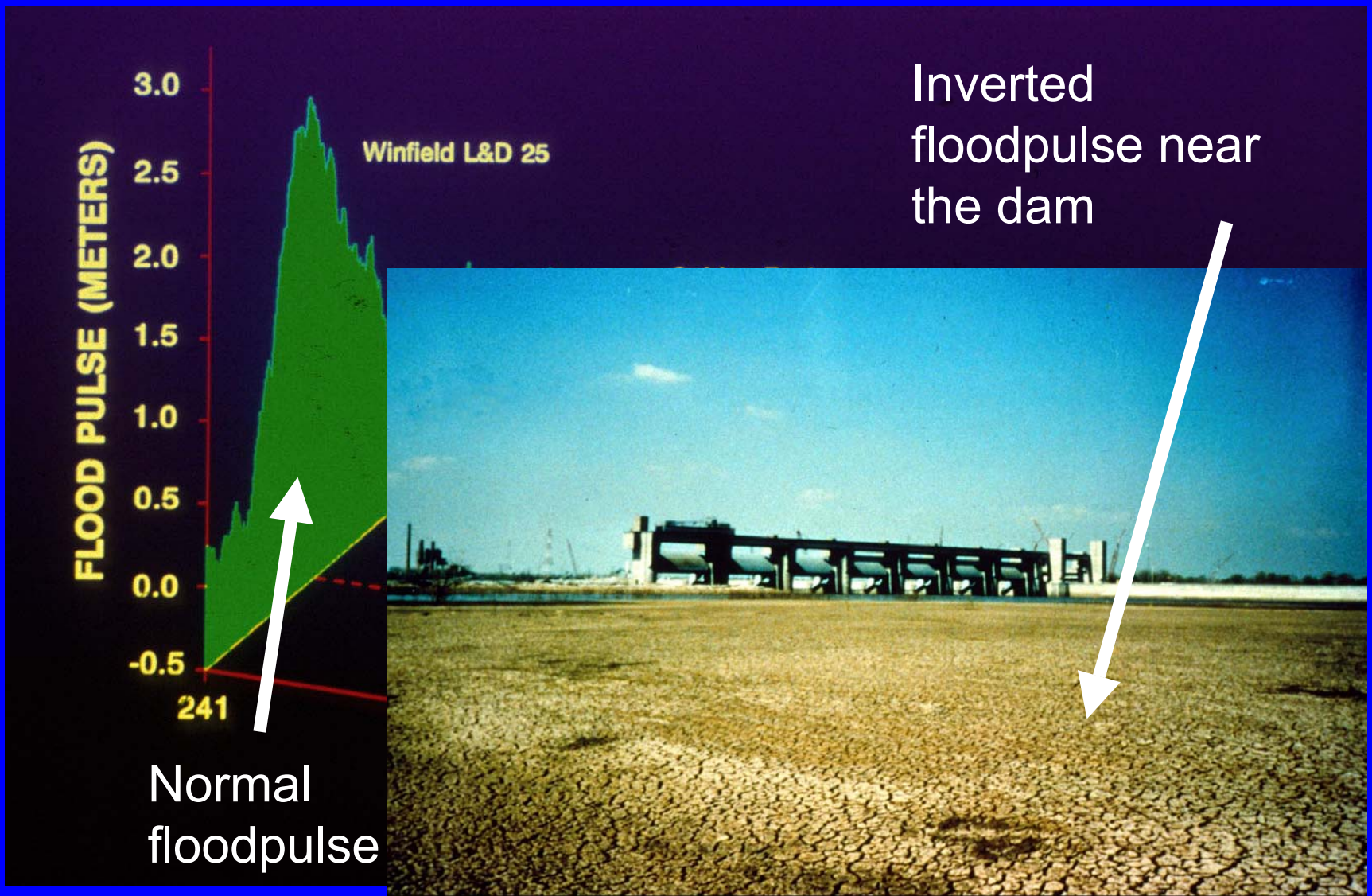
## Hypotheses:

- Biological productivity and diversity of navigable rivers can be improved by dam operations that will not impede navigation or increase flood damage.
- Benefits will: occur within one year, over an entire reach, and will be less costly than managing water levels within leveed compartments on the floodplain. BUT, natural events will override dam operations in some years.

# Effects on Fishes



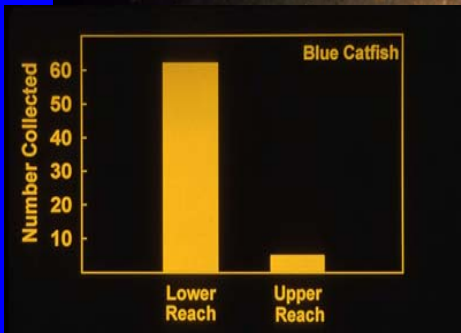
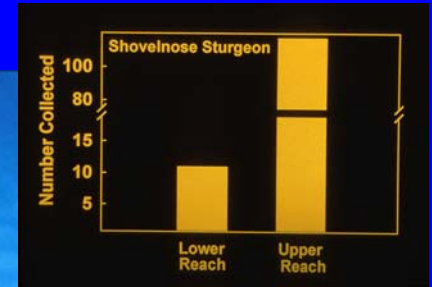
Indicators of Hydrologic Alteration (IHA, Richter et al. 1996): 42 biologically meaningful hydrologic parameters for eight gage sites along the Illinois River.



**Operation of Dam 26 near St. Louis inverts the normal floodpulse**

# Sturgeon

Upper portion  
of navigation  
reach



Blue Catfish

Lower portion



Correspondence between annual catch of young-of-the-year fish and water level indices.

- 26 sampling sites along the Illinois River, 1957-1999

Natural, protracted floods, slow recession favored native species.

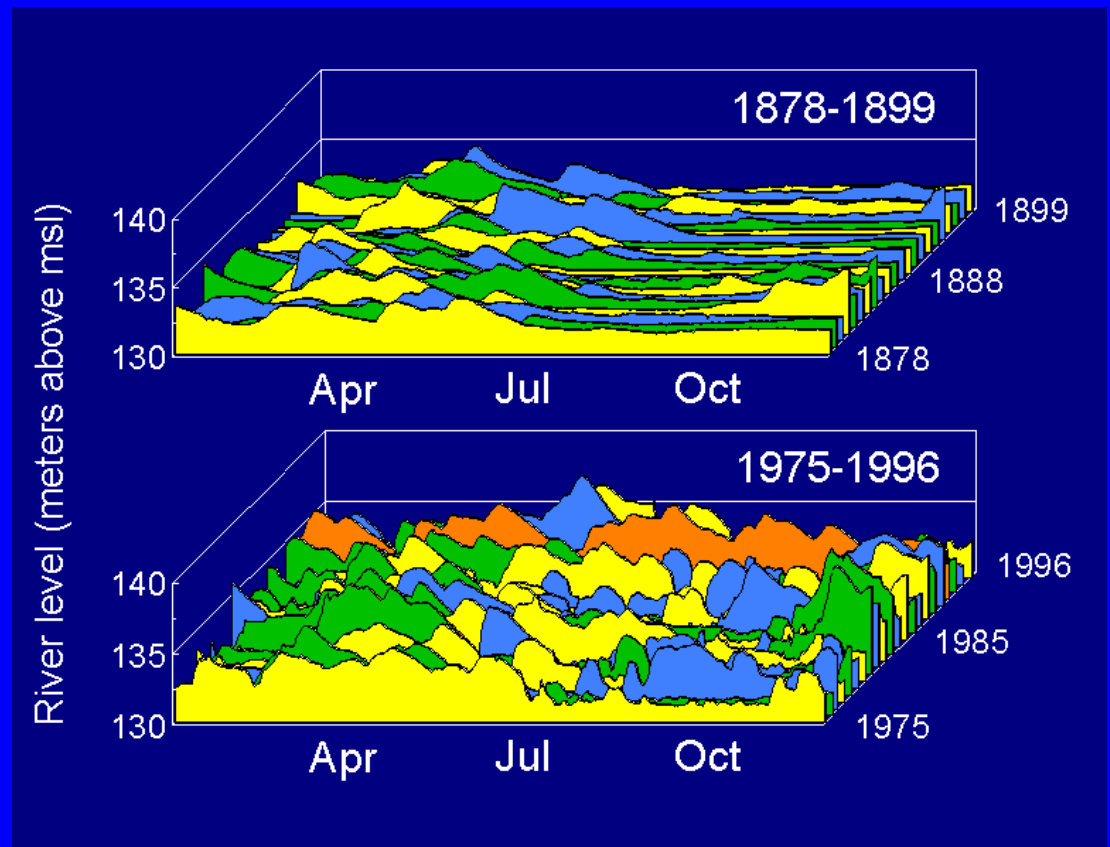


Young-of-the-year fishes

Unnatural, rapid water level fluctuations favored non-native carp and goldfish.

## Comparison of pre-1900 and current water regimes:

- \*no. of water level reversals has increased
- no. of major recessions has increased
- rate-of-rise increased
- rate-of-fall increased
- duration of major floods about the same



# Recommendations for Naturalization

<b>Parameter</b>	<b>Current</b>	<b>Recommend</b>
<b>Water level reversals</b>	70/yr	25-48/yr
<b>Floods during summer</b>	2-3/yr	1/10 yrs
<b>Rate-of-fall</b>	-0.35 ft/day	<-0.18 ft/day

## Conclusions

- Several species of native fishes -- water regimes that approximate the pre-1900 regime
- Introduced carp and goldfish -- short duration, frequent small floods
- Moist soil and submersed vegetation destroyed by unnatural, frequent little floods during the growing season.

### Hypotheses:

- Biological productivity and diversity of navigable rivers can be improved by dam operations that will not impede navigation or increase flood damage.
- Benefits will: occur within one year, over an entire reach, and will be less costly than managing water levels within leveed compartments on the floodplain. BUT, natural events will override dam operations in some years.

## Conclusions

- Several species of native fishes are favored by water regimes that approximate the pre-1900 regime and are adversely affected by unnaturally frequent and rapid water level fluctuations
- Introduced carp and goldfish are favored by short duration, frequent small floods
- Moist soil and submersed vegetation is limited by unnatural, frequent little floods during the growing season.

## Hypotheses:

- Biological productivity and diversity can be improved by dam operations that will not impede navigation or increase flood damage.
- Benefits will: occur within one year, over an entire reach, and will be less costly than managing water levels within leveed compartments on the floodplain. BUT, natural events will override dam operations in some years.

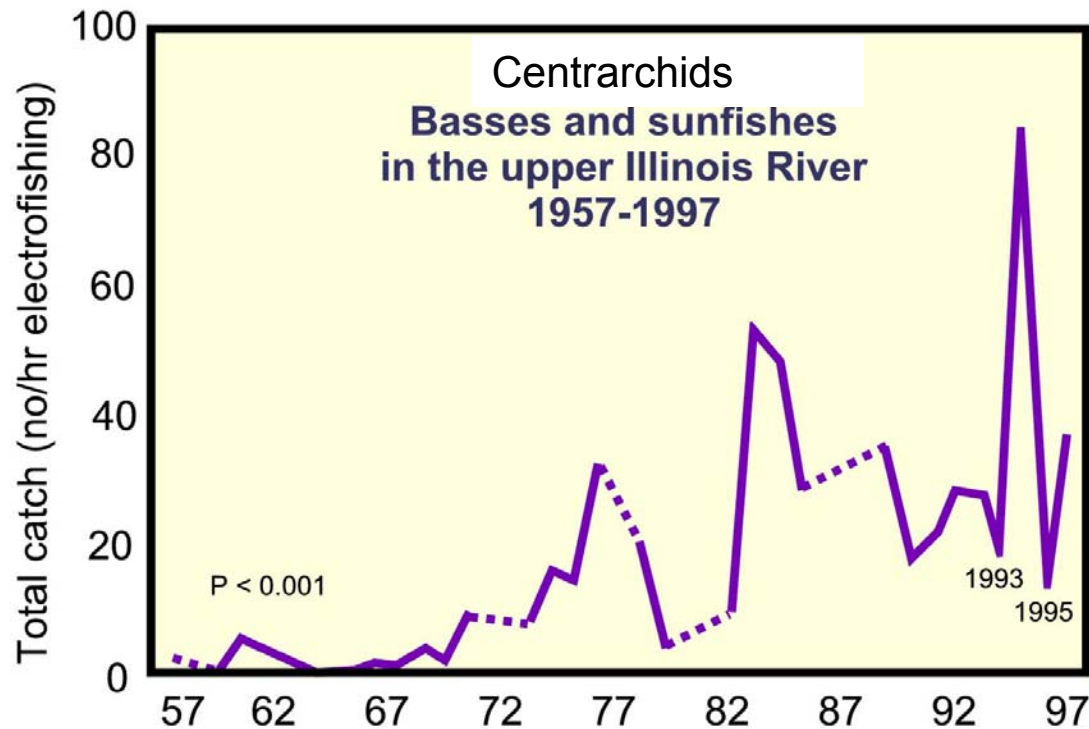
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# Rivers can recover!



The Clean Water Acts, 1968-1972 enabled native fishes to recover in the Illinois River near Chicago, once the most polluted section of the river.

Lerczak & Sparks 1995; INHS  
LTEF 1995-1997

**"A naturally diverse and productive Illinois River ... sustained by natural ecological processes ... "**

**"compatible social and economic activities"**

Lt. Gov. Bob Kustra's Illinois River Strategy Team. 1997. Integrated management plan for the Illinois River Watershed. Technical Report. P.



# Integrated Management Plan for the Illinois River Watershed (page 4)

“The Integrated Management Plan is a call for a new concept of our home, our town, our county and our role in the watershed as stewards not only of the landscape, but also as **stewards of the water.**”

“The river still has a **chance to heal**, with our help.”

“We possess the **collective will** to solve economic and environmental problems.”

34 specific recommendations detailed in the technical report.

# Ecotourism



The Canadian-American-Caribbean Line

“Small ships, big adventure”

**There is hope for the future  
and we can learn from the  
past.**

Other civilizations have lived  
sustainably with their large  
floodplain rivers ...

for thousands of years.

Mediterranean Sea

Nile Delta

Floodplain

“Red Lands”



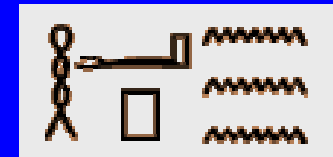
# The Negative Confessions: *I did not ...*

21st Dynasty Book of the Dead 3,000 years BP



*divert water running in a canal*

***hinder the  
waters of the  
inundation***



**Hapy, god of the  
inundation**



## The Great Pyramid at Memphis ...

Tennessee (on the Mississippi), not the Nile

# Sustainable Use?



Water, sediment, nutrients, contaminants, energy

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