



# Habitat quality for river herring in the tidal freshwater Chowan River

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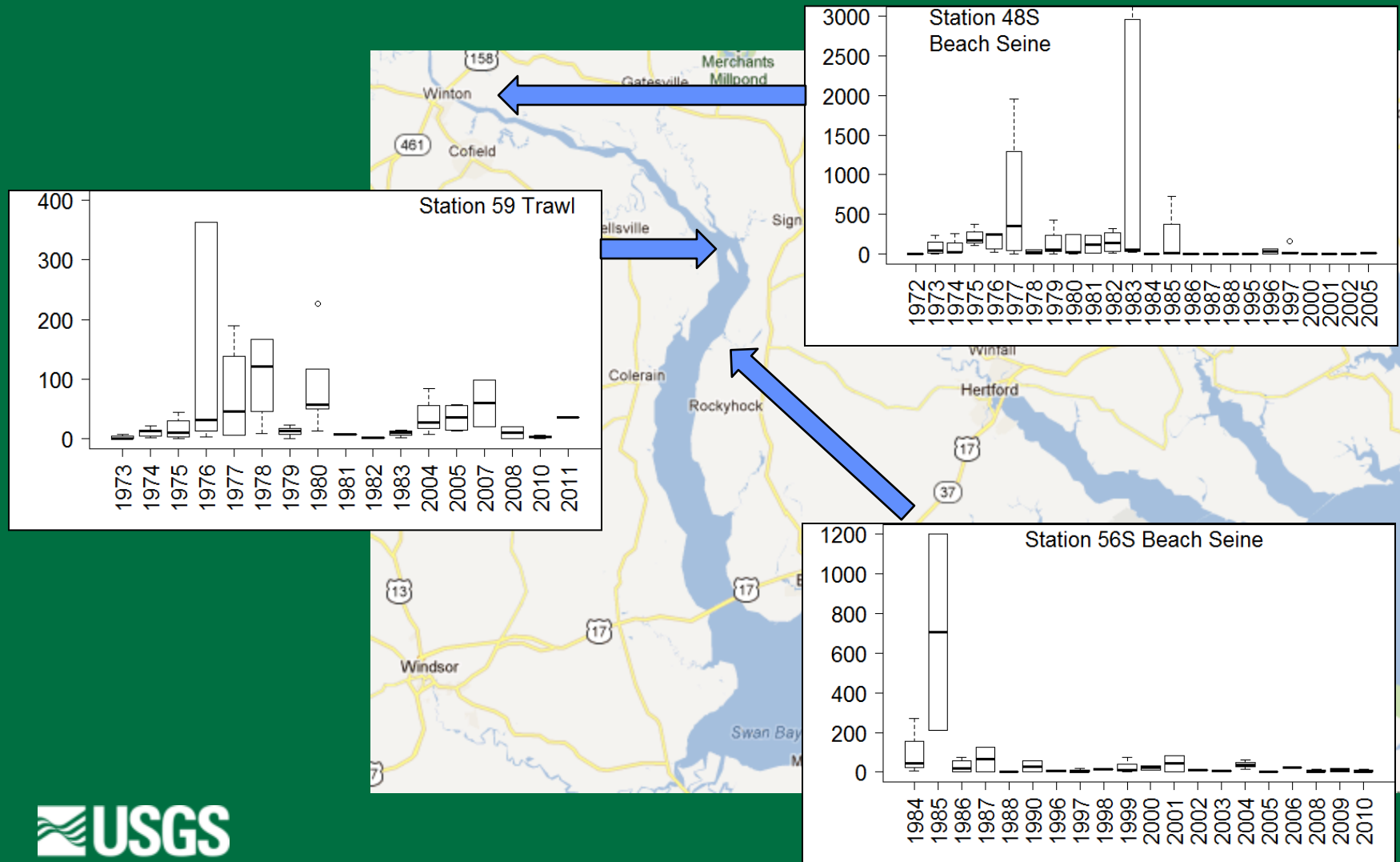
Herbert and Bobby Byrum

NC SeaGrant FRG

#08-EP-06/09-EP-03



# River herring have declined dramatically in the upper Chowan River.



# **Food availability for river herring is a concern for river herring restoration.**

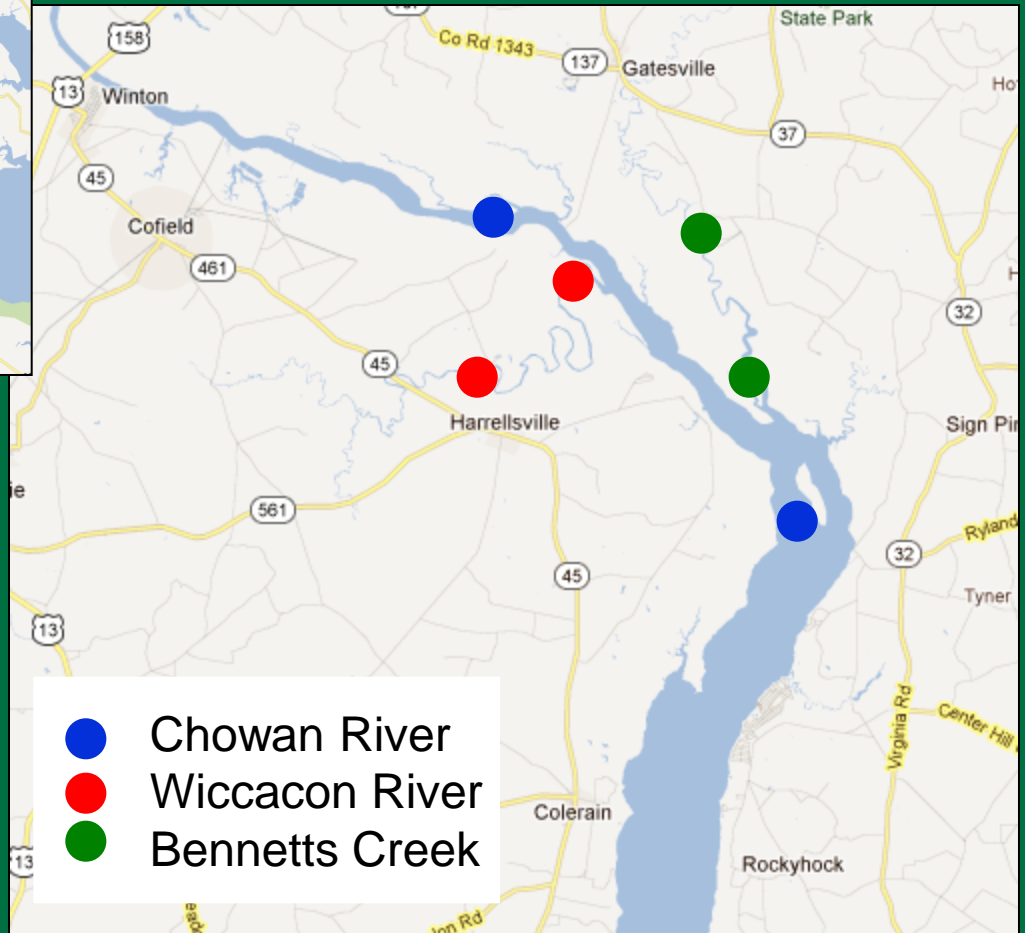
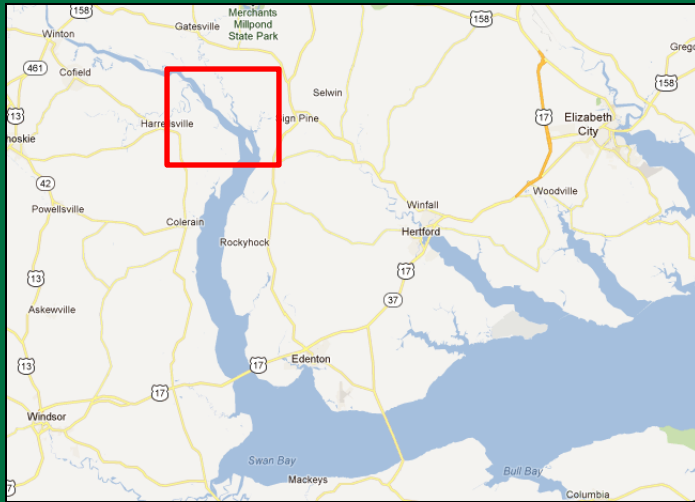
## **“Identify trophic linkages for river herring”**

**High priority research need identified at the meeting “Next Generation of River Herring Research: Emerging Issues and Unanswered Questions”, hosted by EDF and Pew Charitable Trusts.**

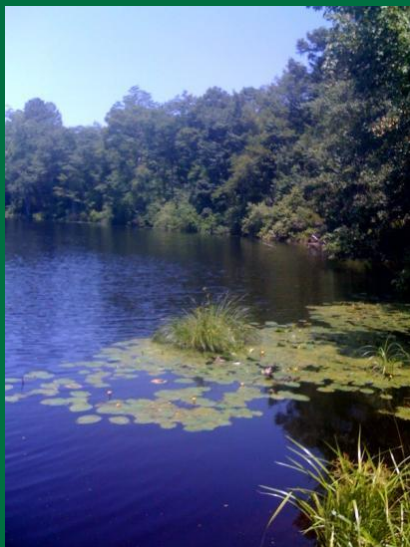
## **“Identify what limits restoration success – availability of food or nursery habitat”**

**High priority research need identified during the development of the North Carolina River Herring Fishery Management Plan.**

# A two year study of zooplankton and water quality was conducted in the tidal freshwater Chowan River.



Four sites were accessed by boat and two sites were accessed by truck.



Bennetts  
Creek

Wiccacon  
River



Herbert (left) and Bobby (right) Byrum on  
the Chowan River near Holiday Island

# Sampling was conducted monthly and bi-weekly from April 2008 – May 2010.



- 20-40 L duplicate samples
- surface and bottom
- 63  $\mu\text{m}$  mesh,
- immediately fixed with formalin



Sampling was conducted monthly and bi-weekly from April 2008 – May 2010.

- temperature, conductivity, **salinity**, turbidity
- light attenuation
- nitrate, ammonium, orthophosphate, total nitrogen, dissolved organic carbon
- **chlorophyll a**



# Dominant species:

## Cladocera



*Bosmina longirostris*



*Chydorus sphaericus*



*Diaphanosoma brachyurum*

## Copepoda



*Cyclops vernalis*



*Eurytemora affinis*



nauplii  
larvae

## Rotatoria



*Keratella crassa*



*Polyarthra dolichoptera*



*Ploesoma lenticulare*

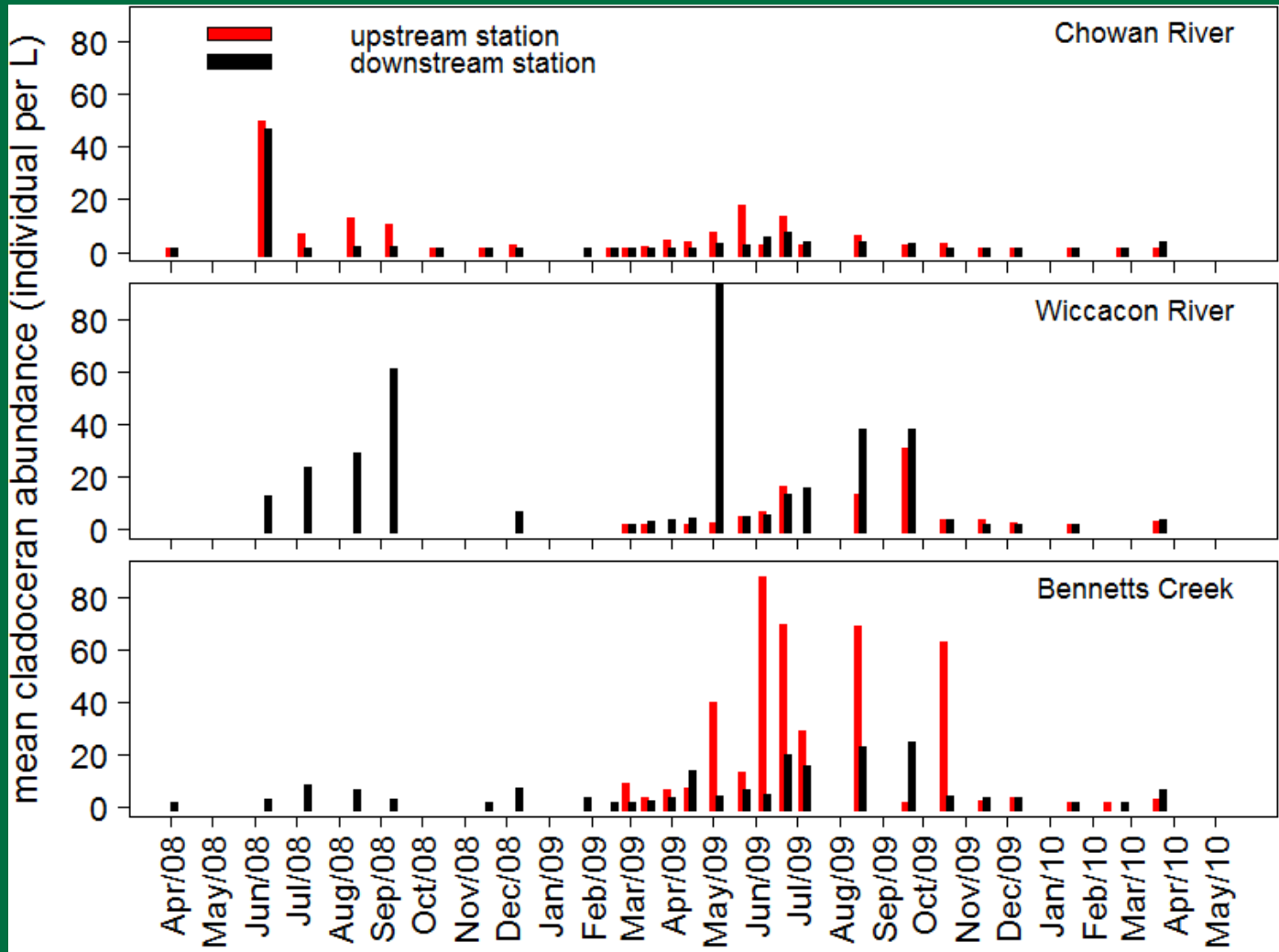


# Cladocerans were most abundant in Bennetts Creek, followed by Wiccacon and Chowan Rivers.

upstream =  
downstream

upstream =  
downstream

upstream >  
downstream

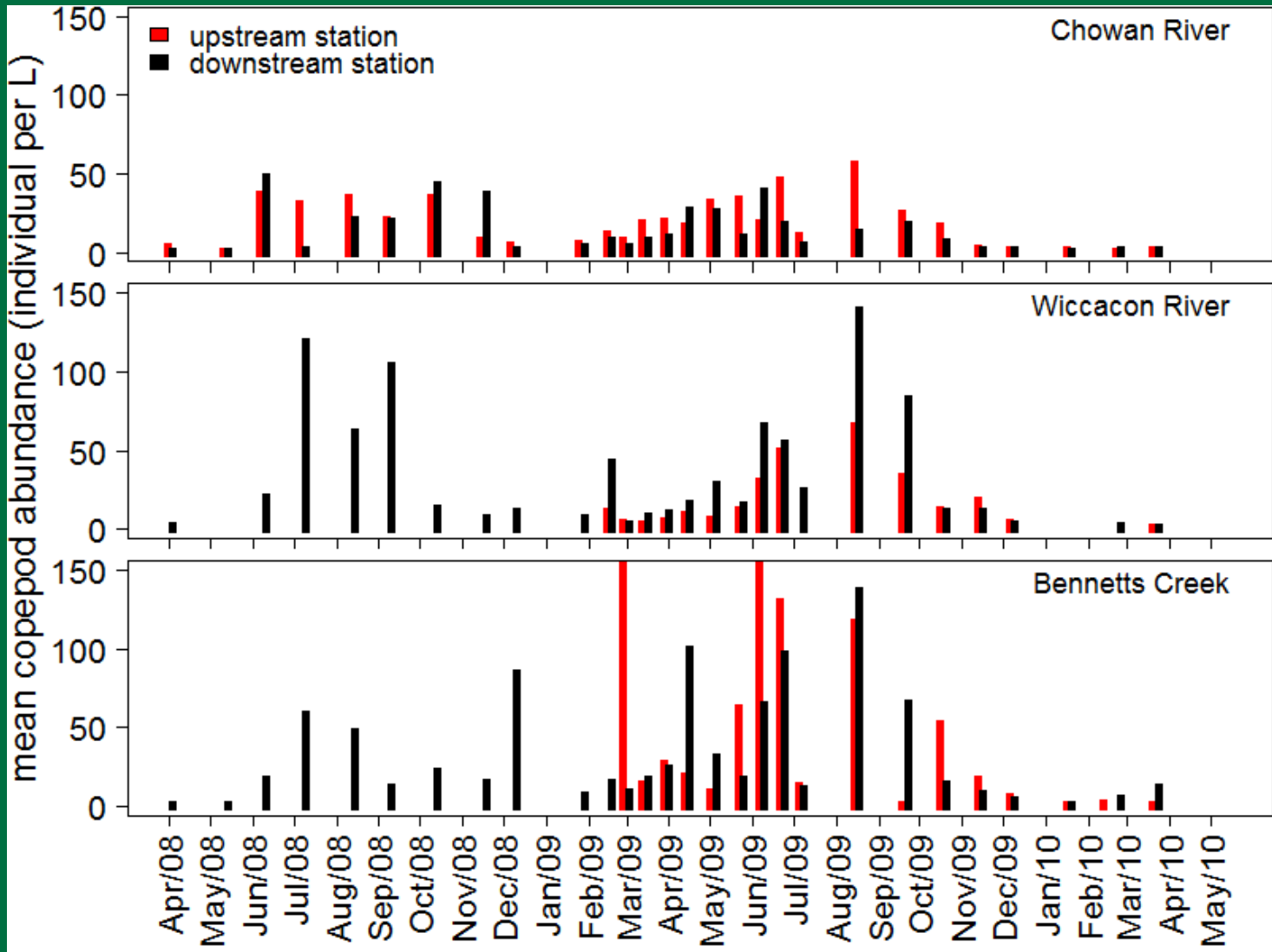


# Copepods were most abundant in Bennetts Creek.

upstream =  
downstream

upstream =  
downstream

upstream =  
downstream

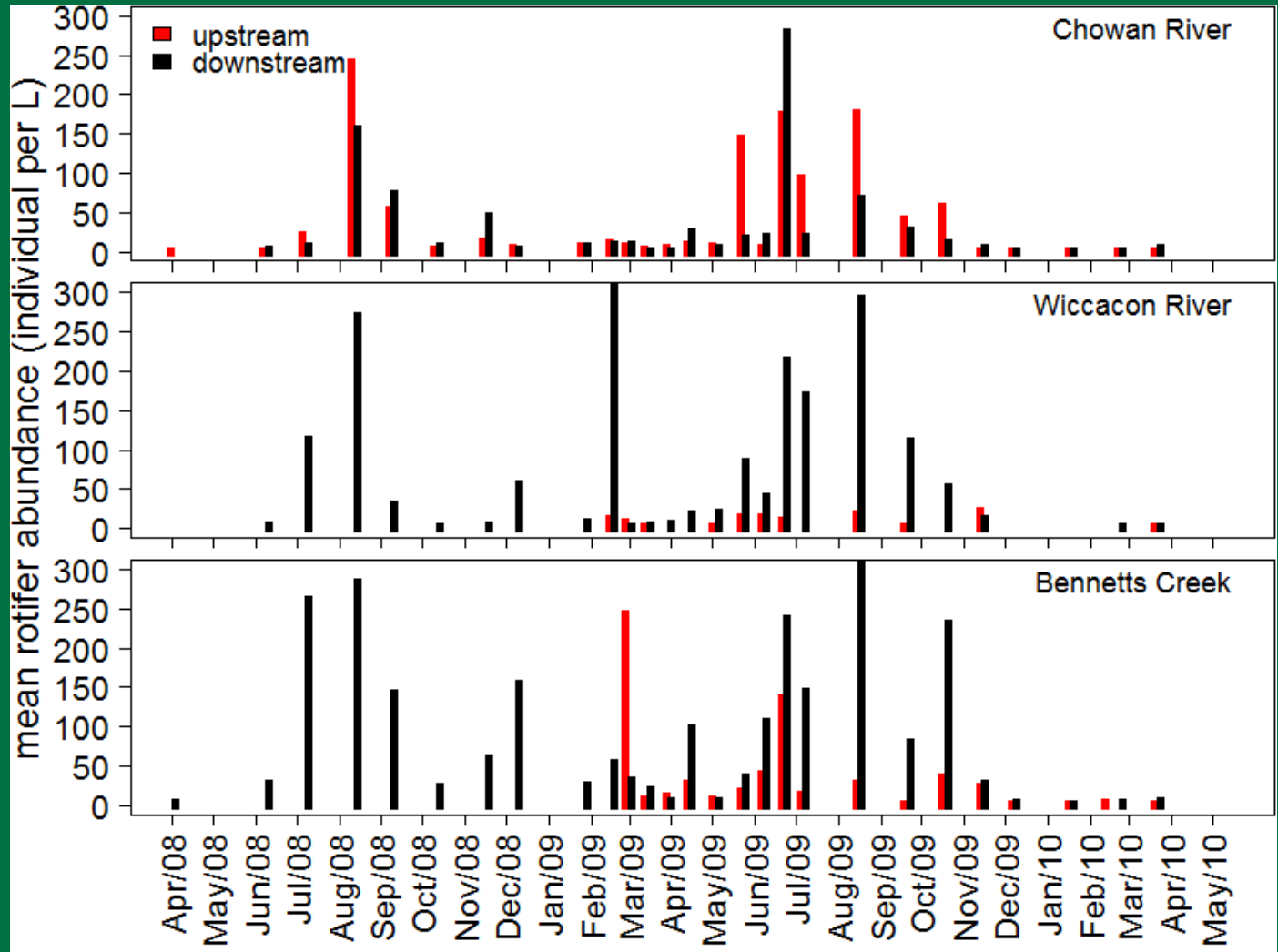


# Rotifers were most abundant in Bennetts Creek.

upstream =  
downstream

upstream <  
downstream

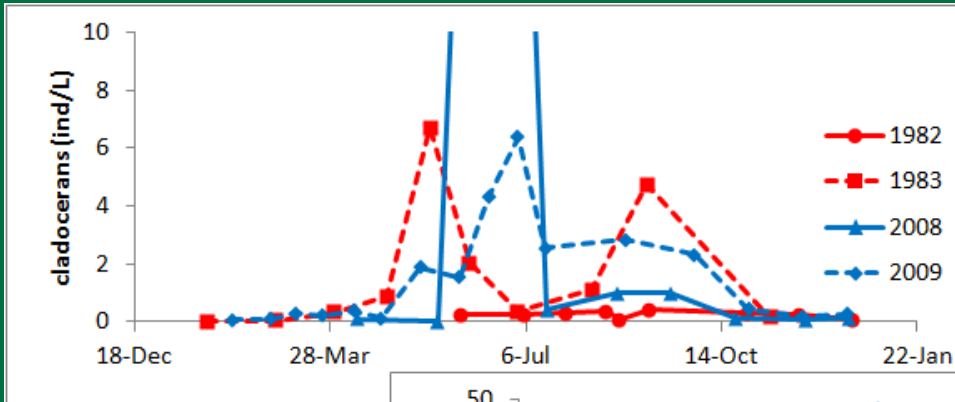
upstream =  
downstream



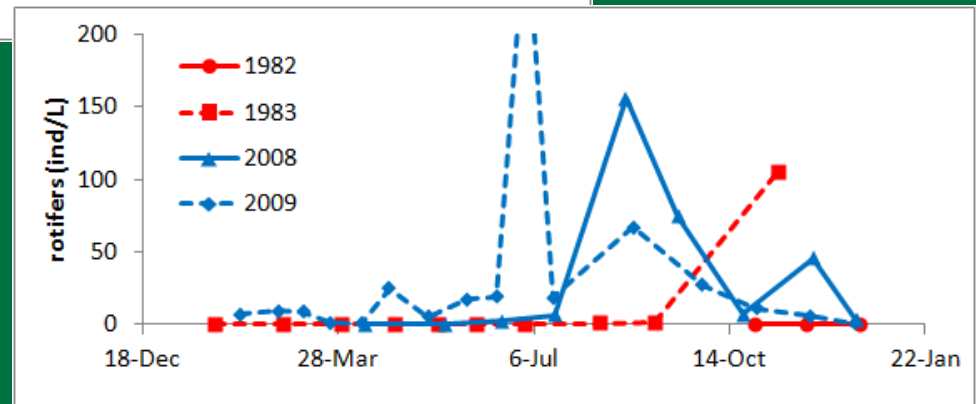
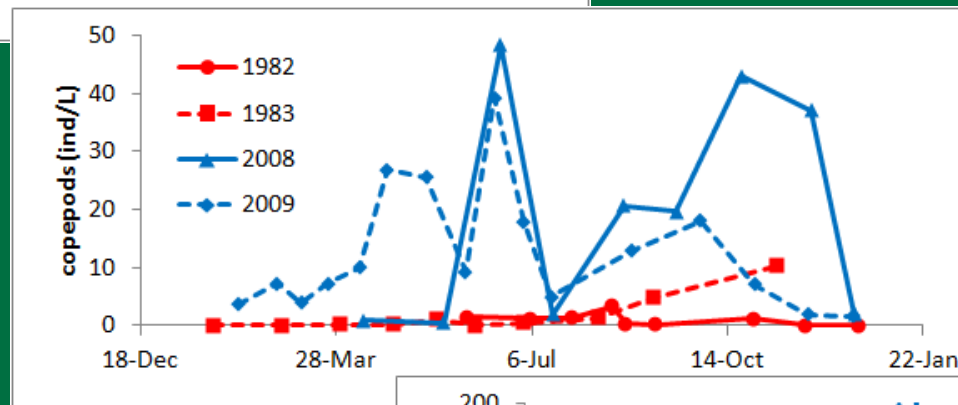
## Summary of zooplankton data:

- Rotifers were the most abundant zooplankton, followed by copepods and cladocerans.
- Bennetts Creek and Wiccacon River had higher zooplankton abundance than the Chowan River.
- Downstream Wiccacon River had more copepods than upstream, and downstream sites on both Wiccacon River and Bennetts Creek had more rotifers.

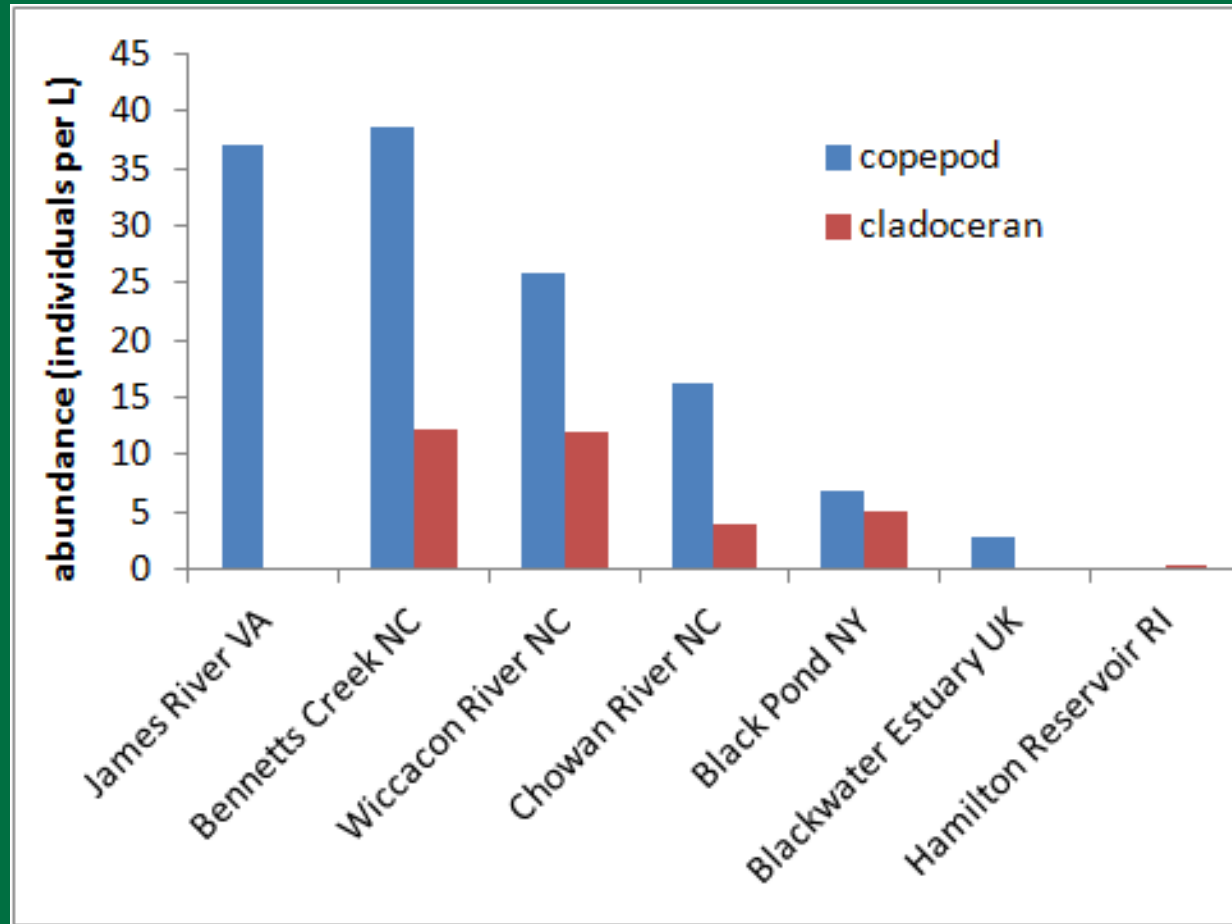
# Zooplankton in the lower Chowan River were more abundant in 2008-2009 than in 1982-1983.



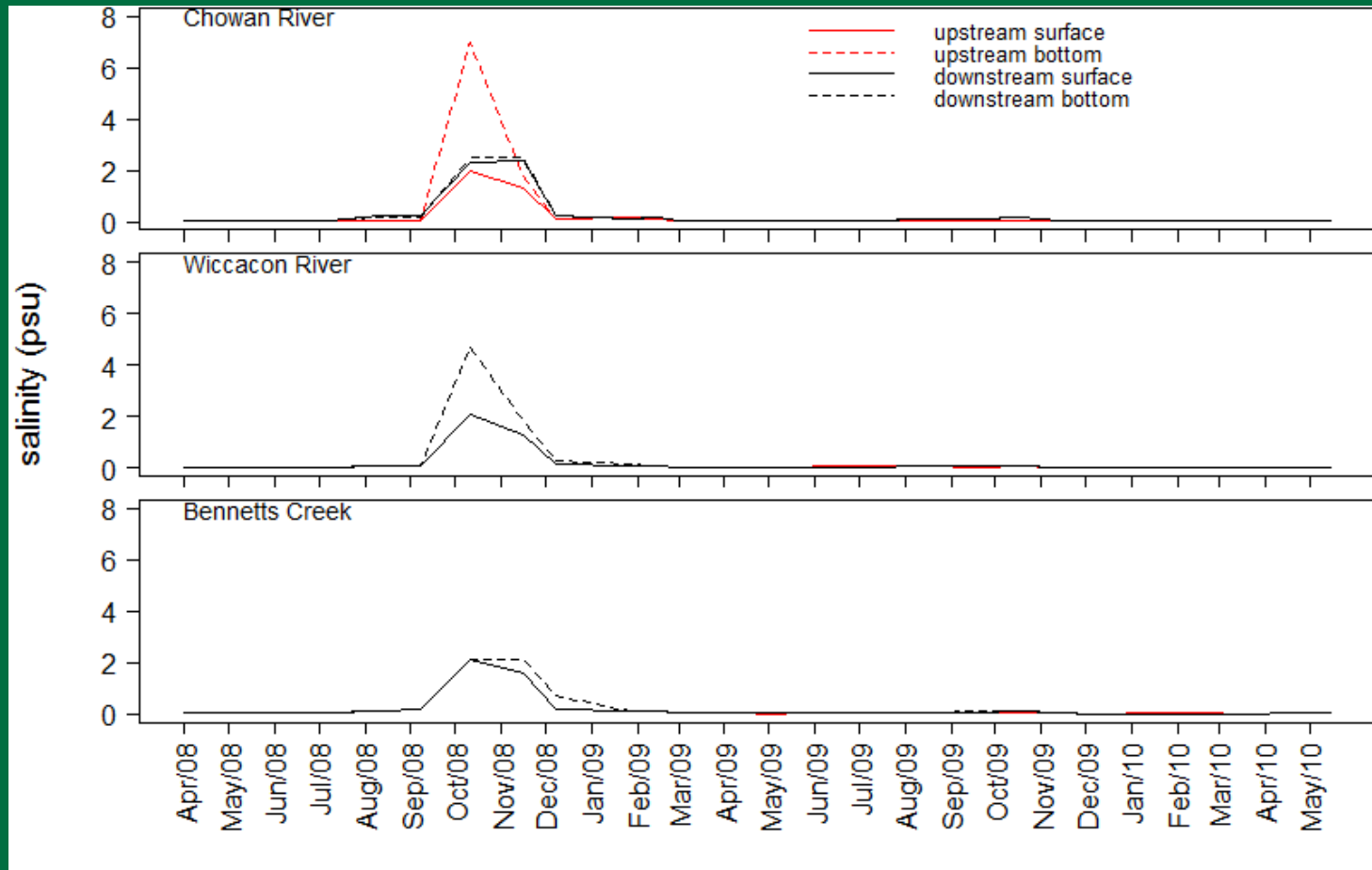
1980s data from Winslow, Mozley, and Rulifson 1985 (Project AFCS-22)



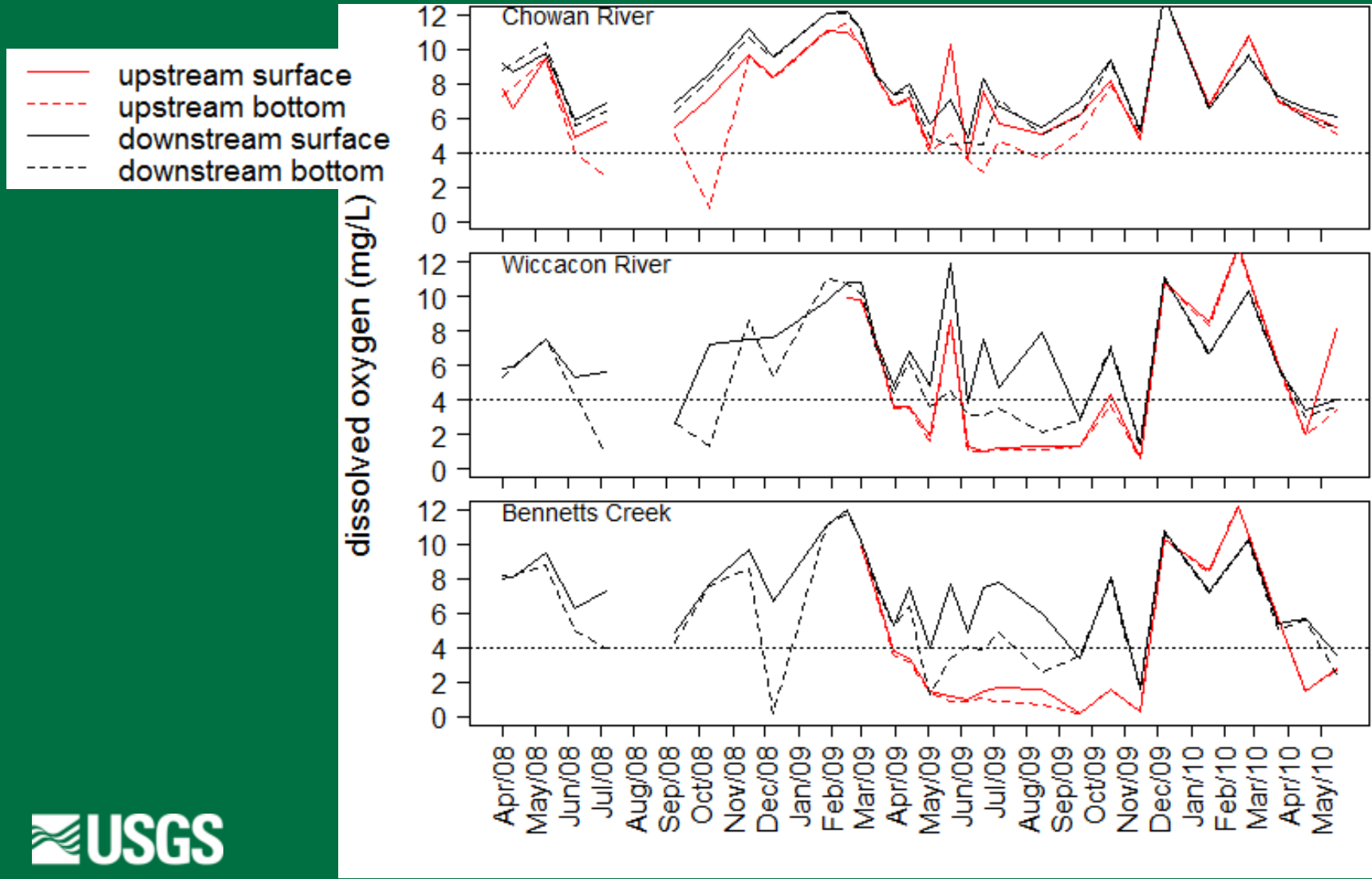
Zooplankton in the Chowan River was within the range of abundances reported for lakes and rivers containing herring.



# All locations were freshwater except during fall and winter 2008.

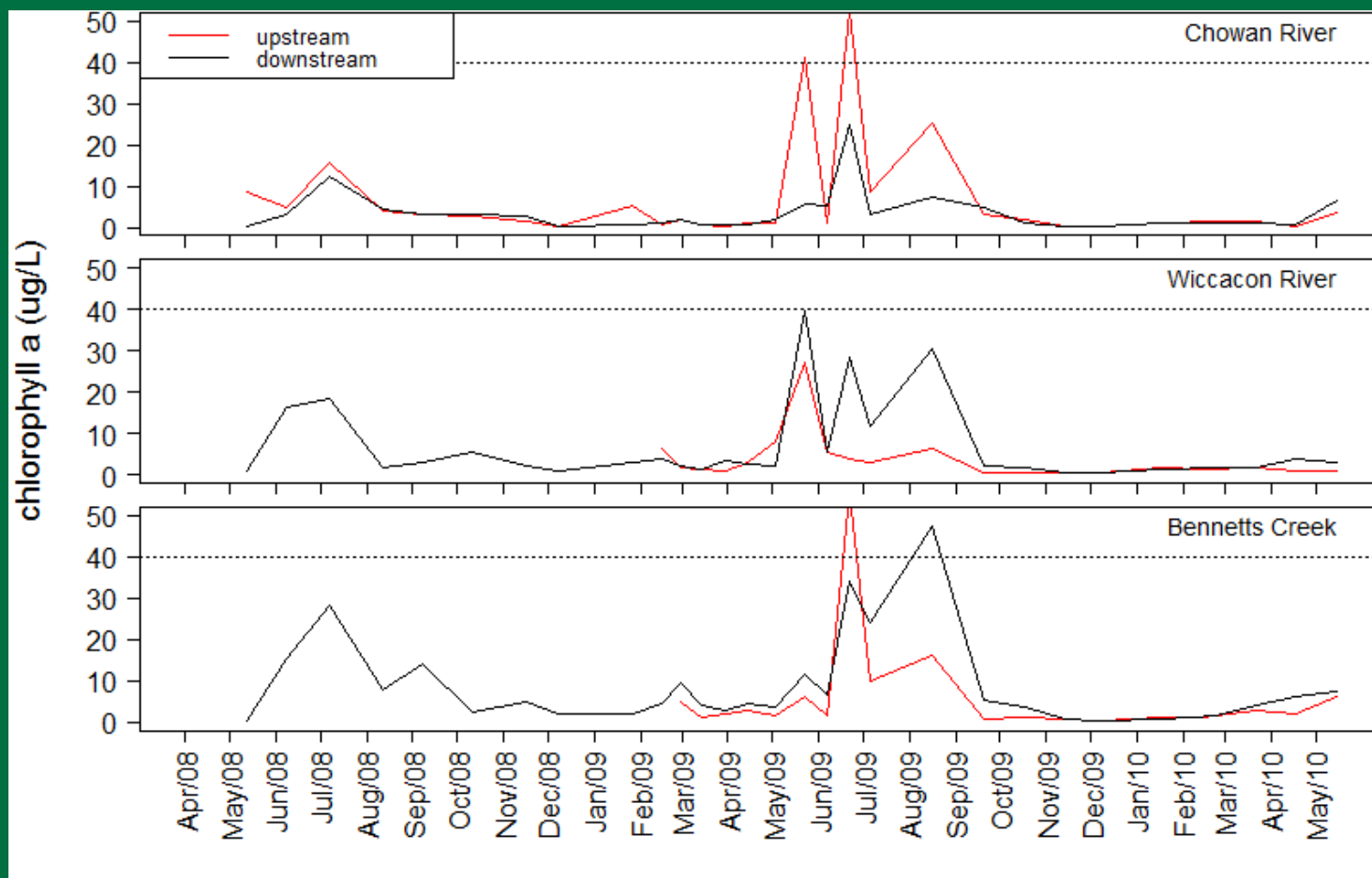


# Dissolved oxygen was periodically less than the NC water quality standard except in the lower Chowan River.

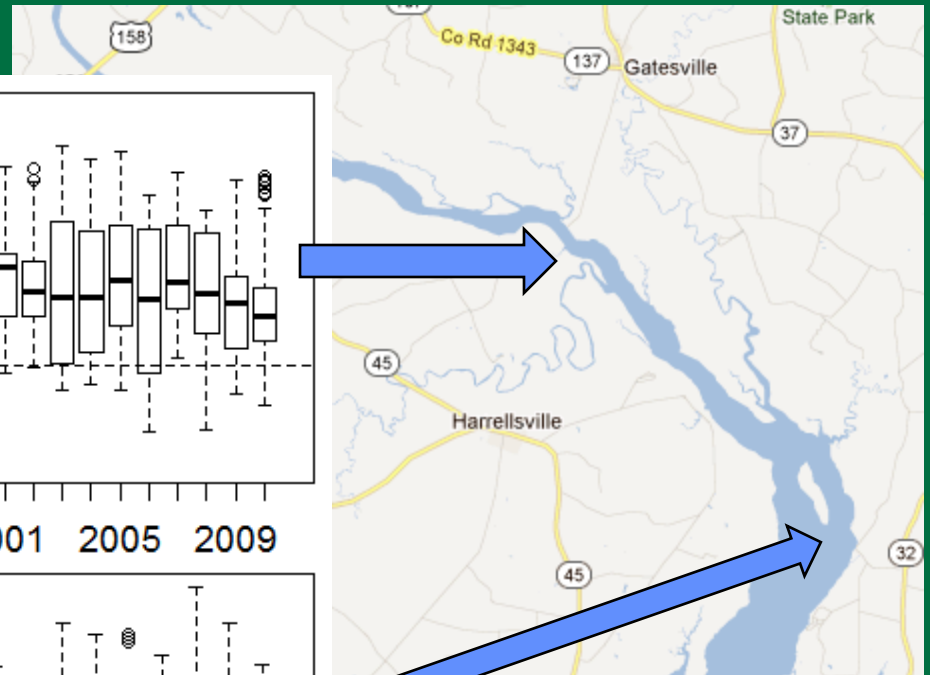
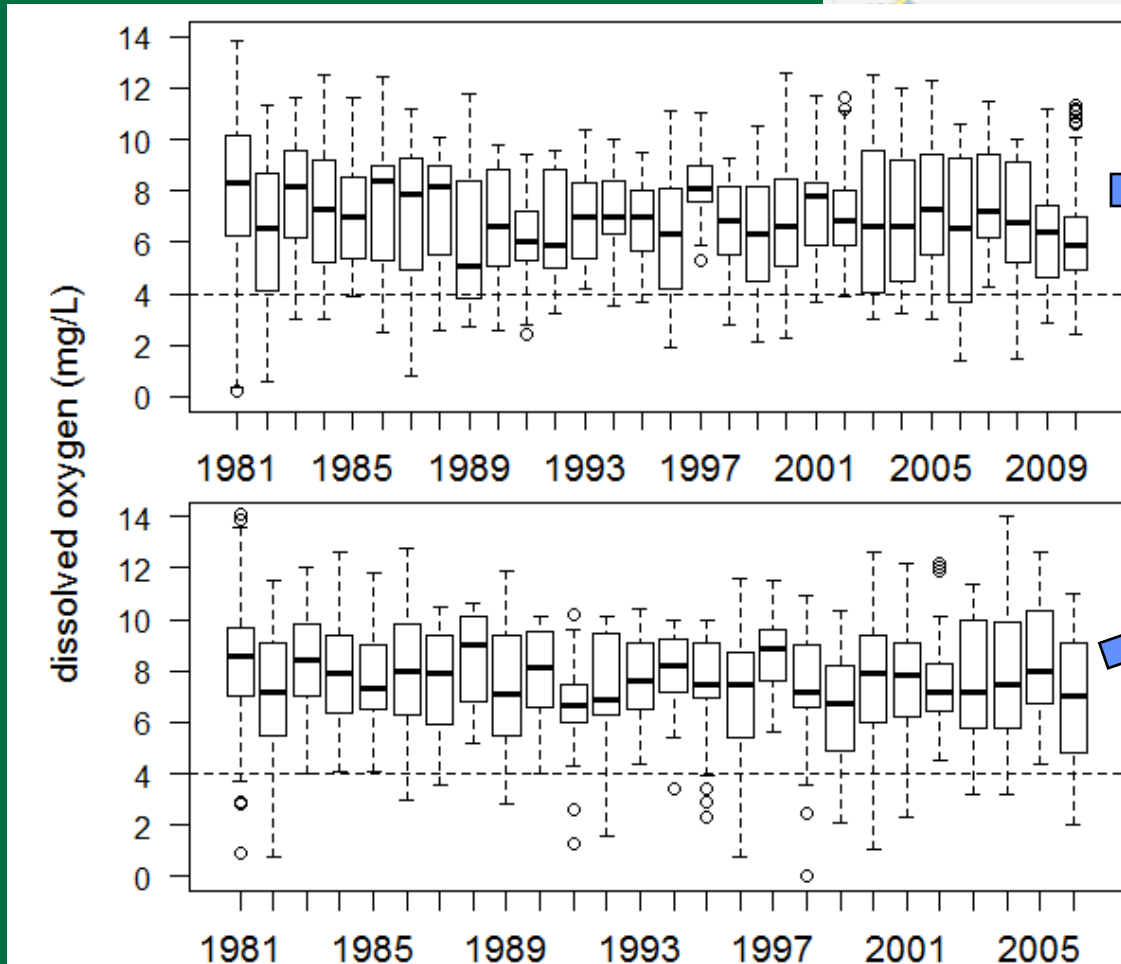




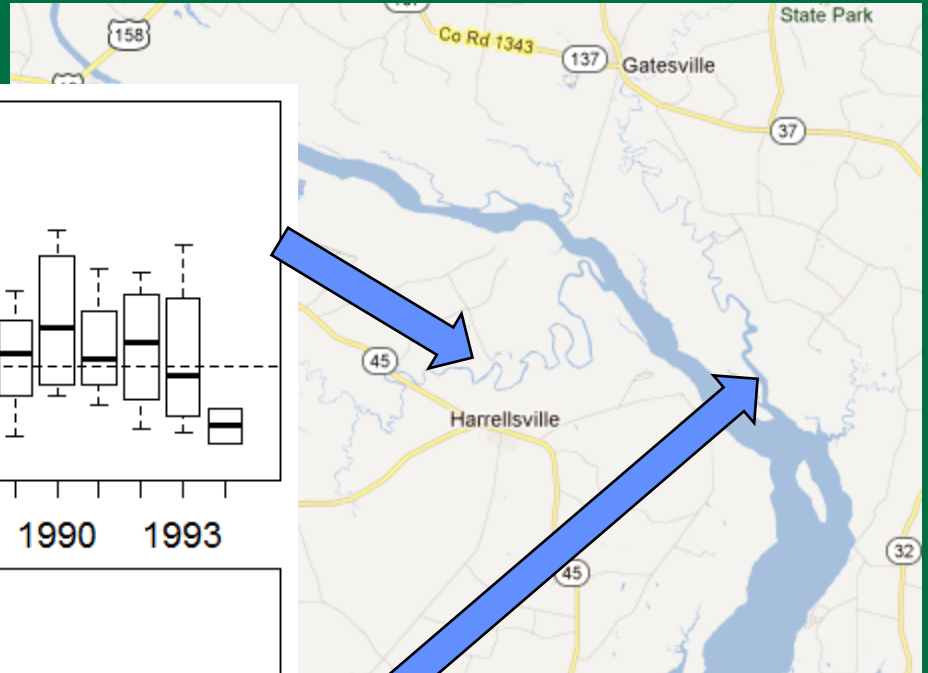
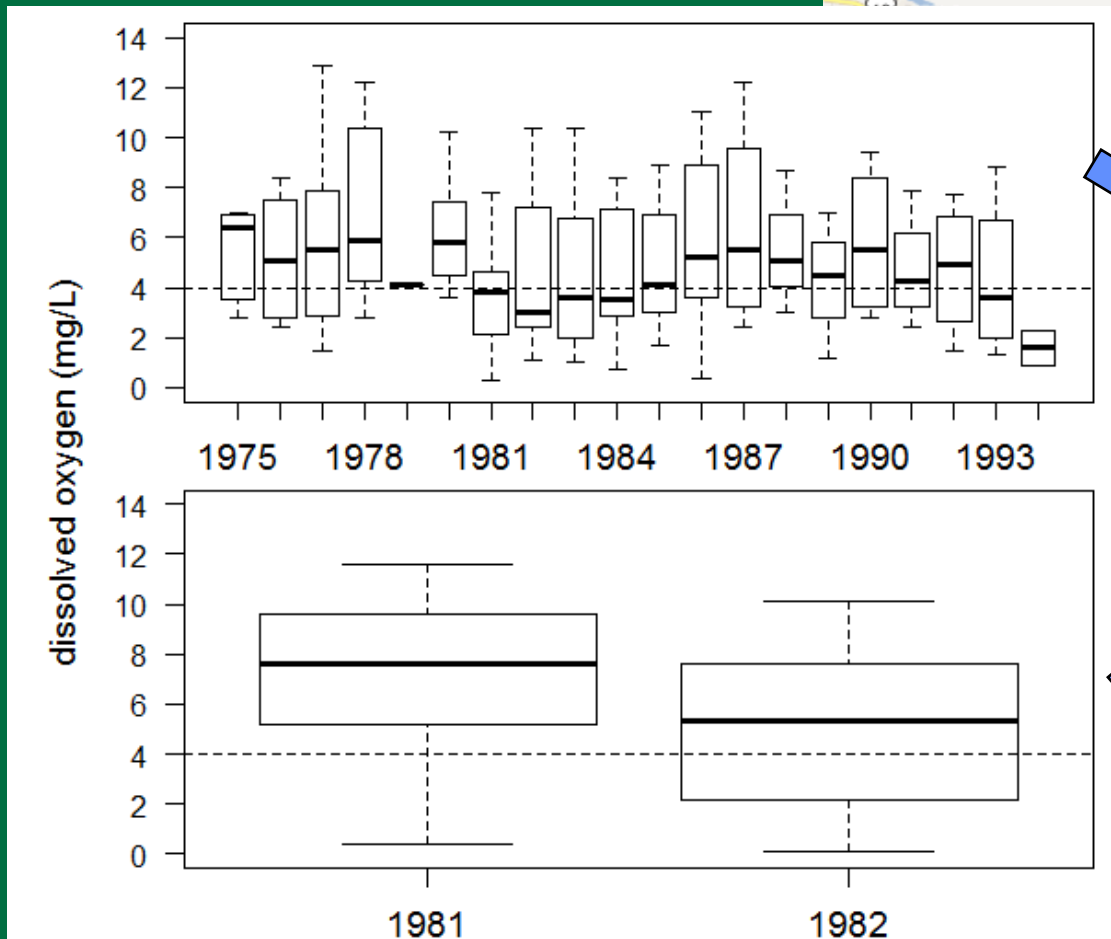
# Chlorophyll a exceeded the NC water quality standard at the upper Chowan River and Bennetts Creek in 2009.



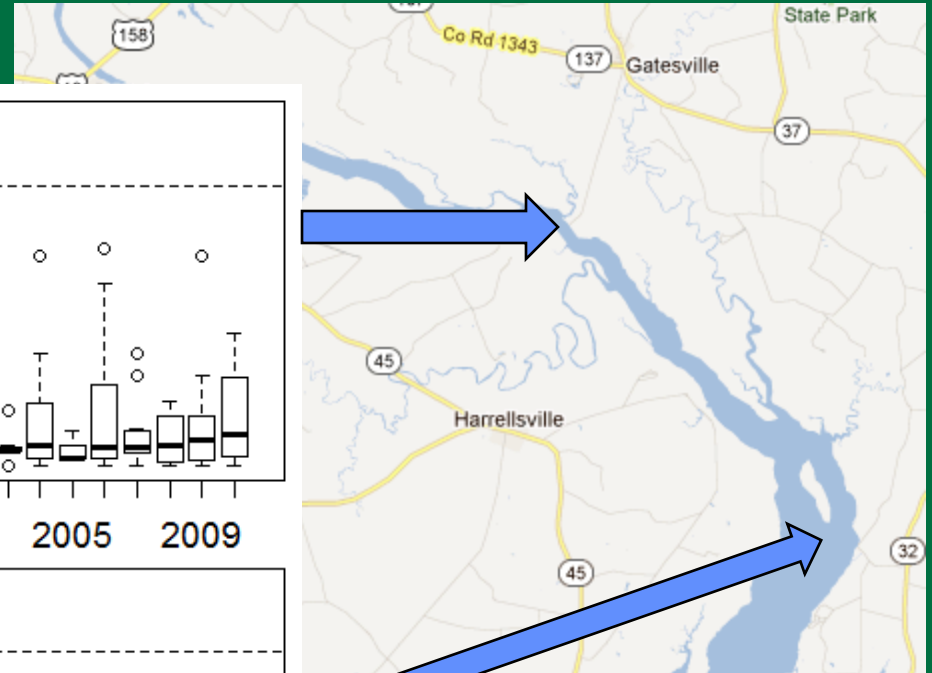
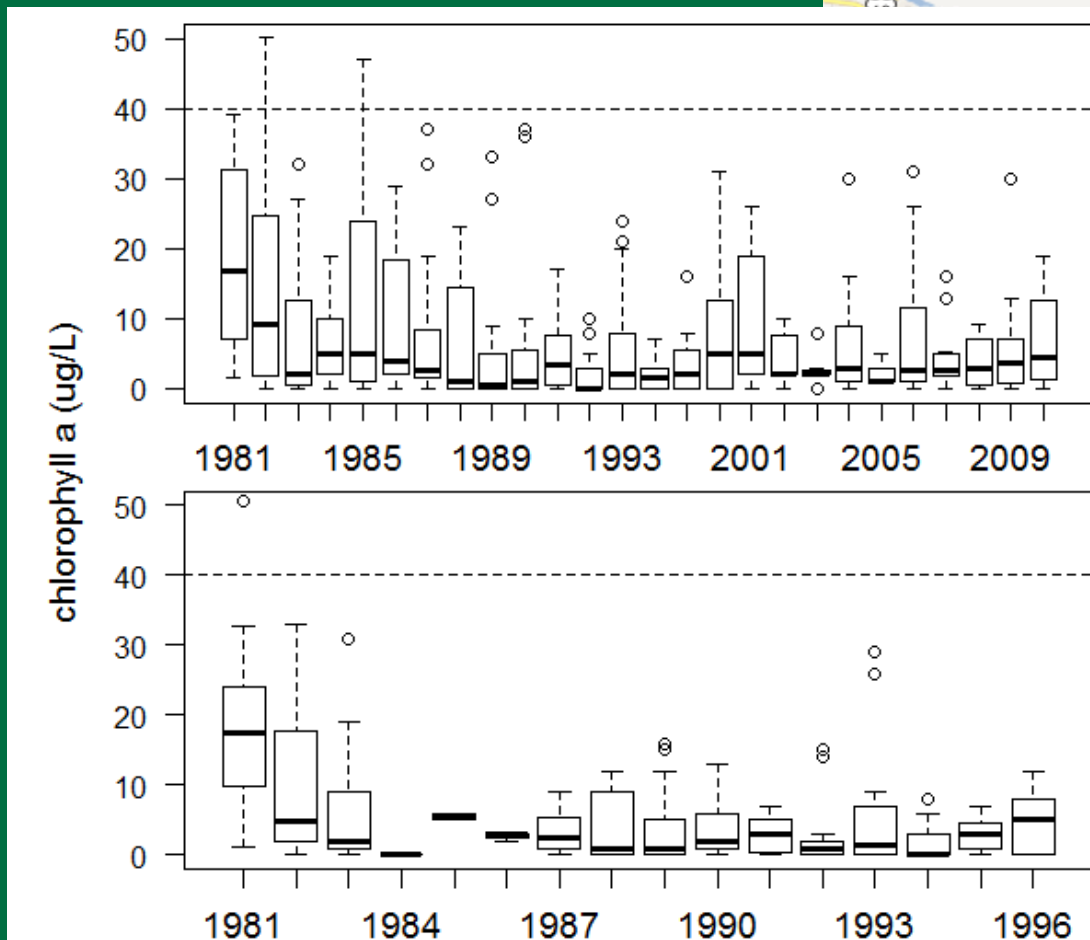
# Dissolved oxygen in the Chowan River has historically been low.



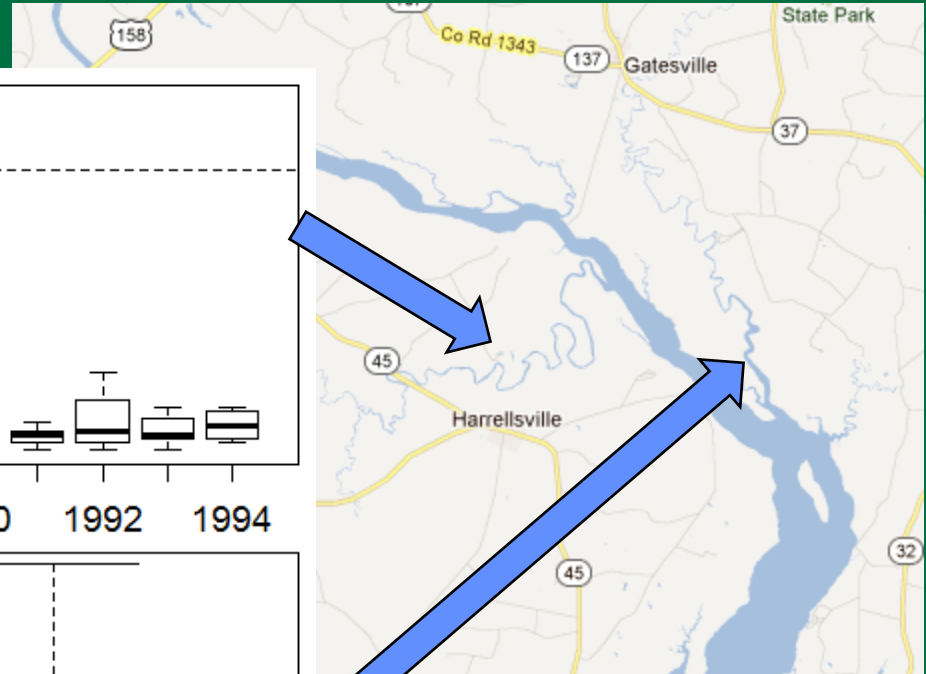
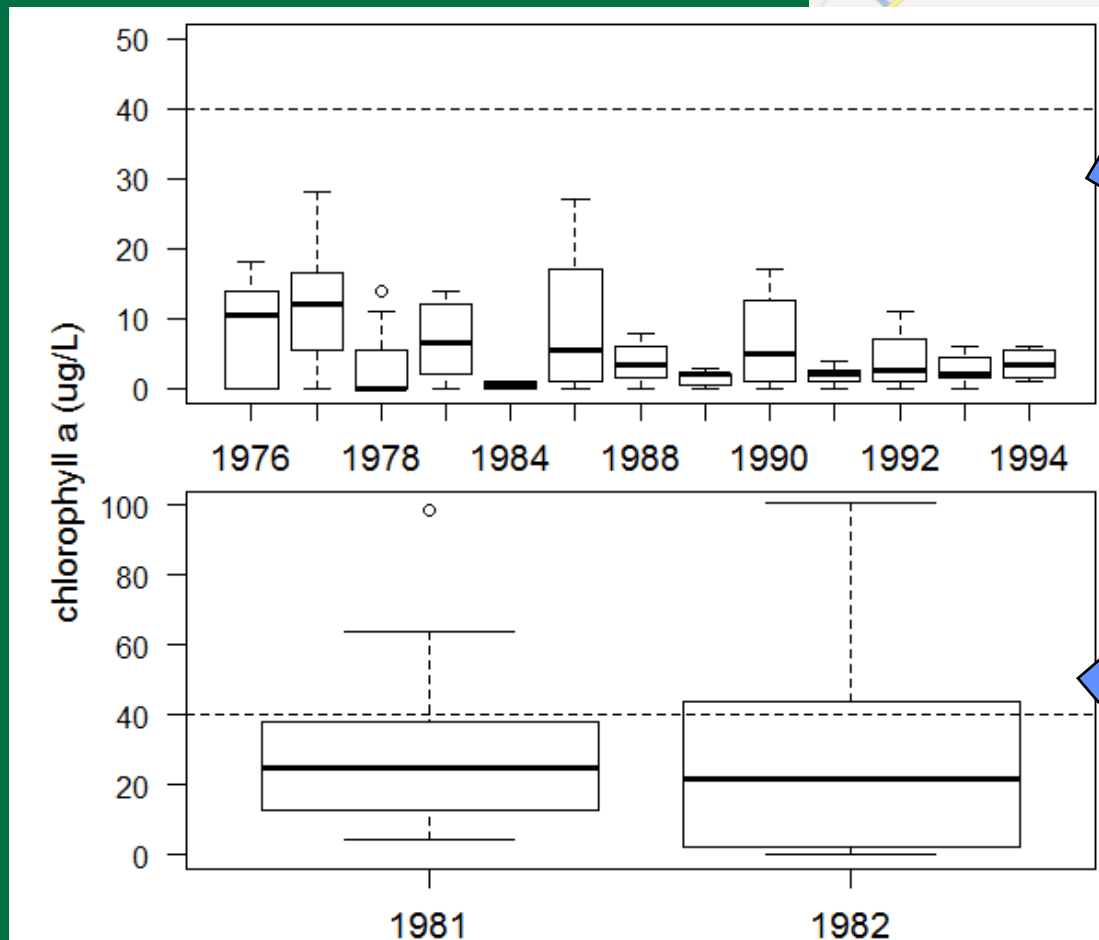
# Dissolved oxygen in the tributaries has also been low.



# Phytoplankton biomass has decreased over time in the Chowan River.



# Phytoplankton also decreased in the Wiccacon River.



## Conclusions

- Zooplankton abundance is similar (or greater) to the early 1980s, and to other rivers containing river herring.
- Tributaries generally contain greater zooplankton abundance, but also have more prolonged periods of hypoxia.
- D.O. may limit habitat quality for river herring and other fin fish.
- Historical data indicate that hypoxia has been a long-standing problem in this system, but that chlorophyll a has declined since the 1980s.

## Continuing and future research:

- How do river herring (and other planktivorous fish) affect zooplankton abundance in the Chowan River system?
- What are the relative influences of resource availability (e.g., light, nutrients) versus zooplankton grazing on control of phytoplankton growth?
- How will changing river flow regimes affect flushing times of tidal rivers and associated hypoxia events?
- To download our SeaGrant project report, go to: [www.ncseagrant.org/home/research/core-research/](http://www.ncseagrant.org/home/research/core-research/) and search for “ZAP”