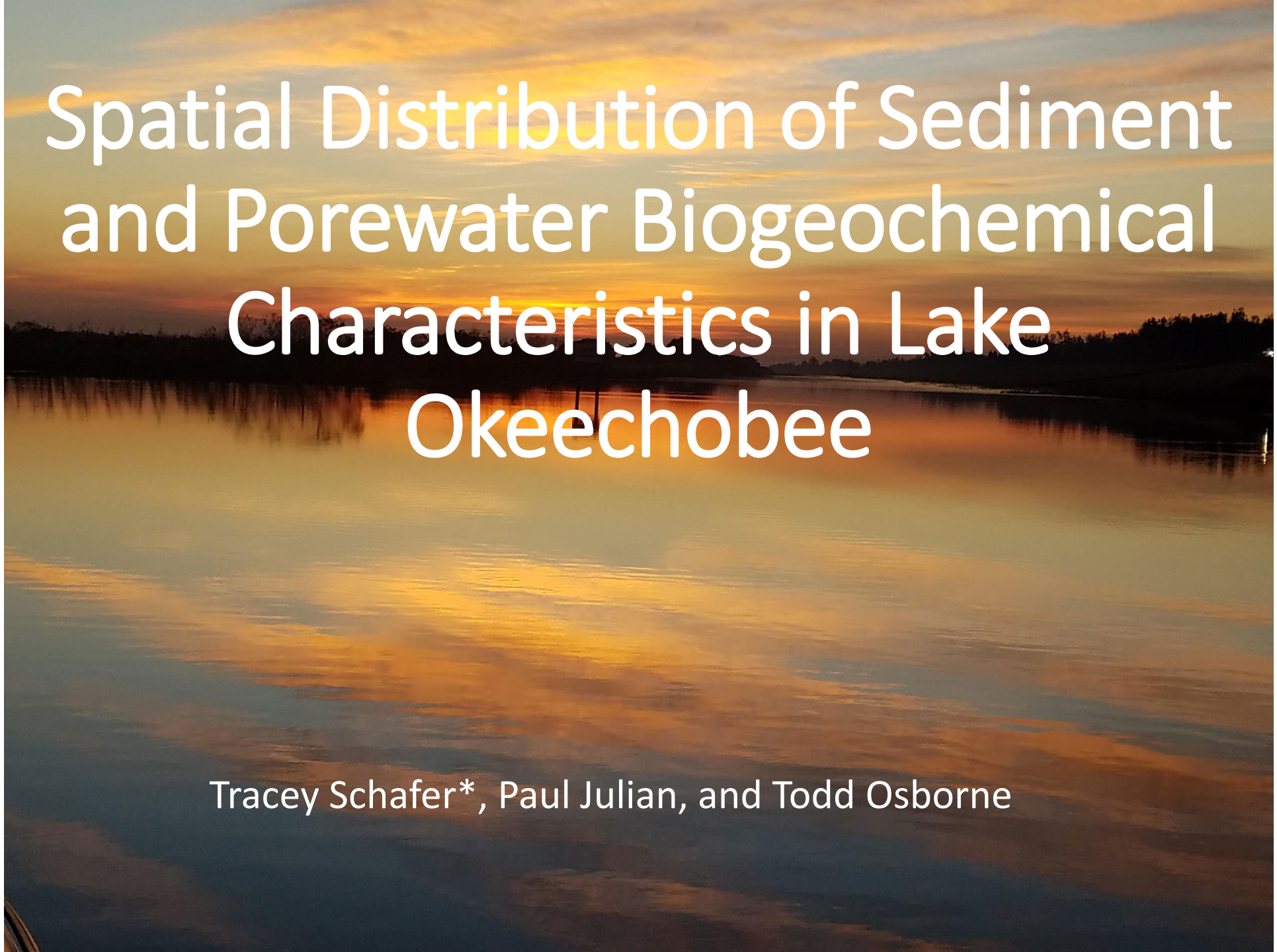


Spatial Distribution of Sediment and Porewater Biogeochemical Characteristics in Lake Okeechobee

Tracey Schafer*, Paul Julian, and Todd Osborne

Lake Okeechobee

- Lake area = 730 mi^2
- Formed 6000 years ago when ocean waters receded
- Average depth = 9 ft (water level has been anthropogenically manipulated and altered naturally over time)
- In past 100 years, urban and agricultural runoff have polluted the lake- approximately 600 metric tons of P/ yr

Project History

- Lake Okeechobee mapping conducted in **1988**, 1998, 2006, and 2020
- **Questions:**

1) What is the extent and change in mud sediment throughout Lake Okeechobee?

2) What are the current pools of some forms of P and nitrogen (N) in the sediments?

3) What is the extent and change of sediment nutrients throughout Lake Okeechobee?

Project History

- Lake Okeechobee mapping conducted in **1988**, **1998**, 2006, and 2020
- **Questions:**

1) What is the extent and change in mud sediment throughout Lake Okeechobee?

2) What are the current pools of some forms of P and nitrogen (N) in the sediments?

3) What is the extent and change of sediment nutrients throughout Lake Okeechobee?

Project History

- Lake Okeechobee mapping conducted in **1988**, **1998**, **2006**, and 2020
- **Questions:**

1) What is the extent and change in mud sediment throughout Lake Okeechobee?

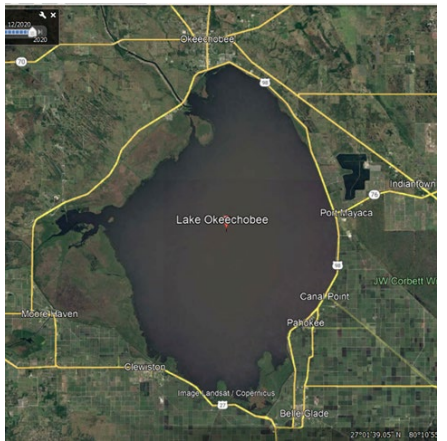
2) What are the current pools of some forms of P and nitrogen (N) in the sediments?

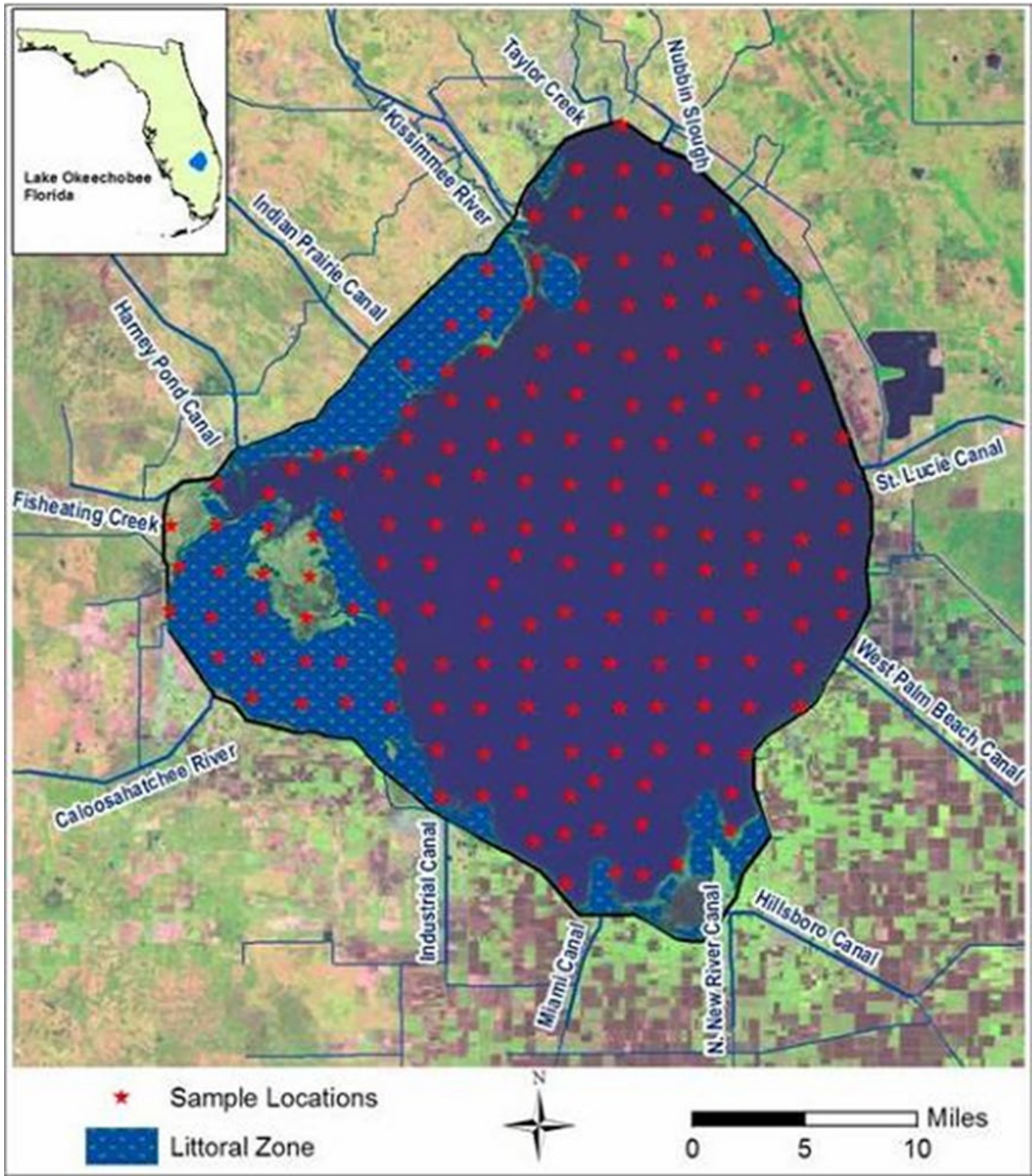
3) What is the extent and change of sediment nutrients throughout Lake Okeechobee?

Project History

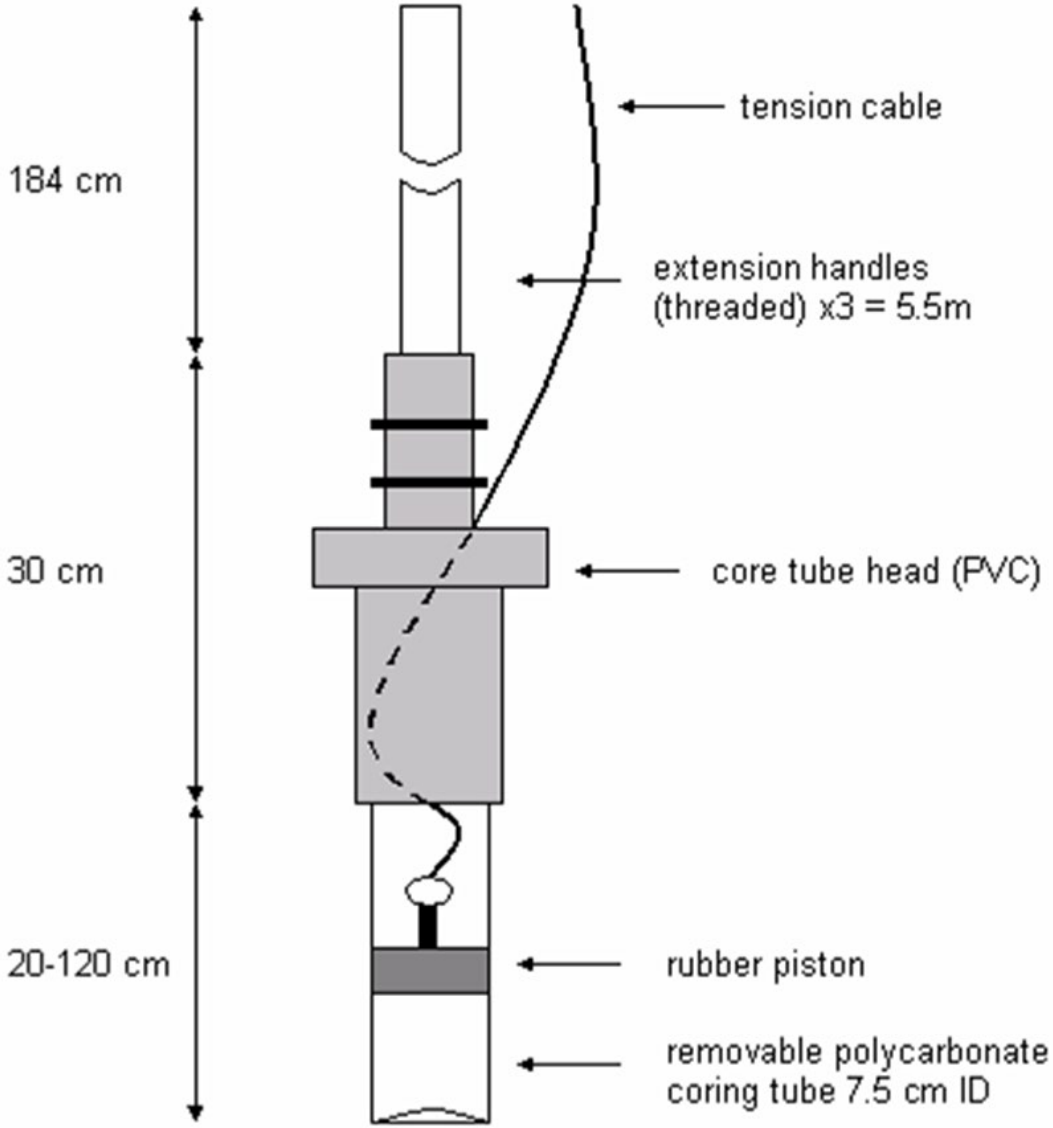
- Lake Okeechobee mapping conducted in **1988**, **1998**, **2006**, and **2020**
- **Questions:**

1) What is the extent and change in mud sediment throughout Lake Okeechobee?
2) What are the current pools of some forms of P?
3) What is the extent and change of sediment nutrients throughout Lake Okeechobee?




Lake Okeechobee
Florida
Taylor Creek
Nubbin Slough
Kissimmee River
Indian Prairie Canal
Harney Pond Canal
St. Lucie Canal
Fisheating Creek
West Palm Beach Canal
Caloosahatchee River
Industrial Canal
Miami Canal
N. New River Canal
Hillsboro Canal
Sample Locations
Littoral Zone
N
Miles
0
5
10

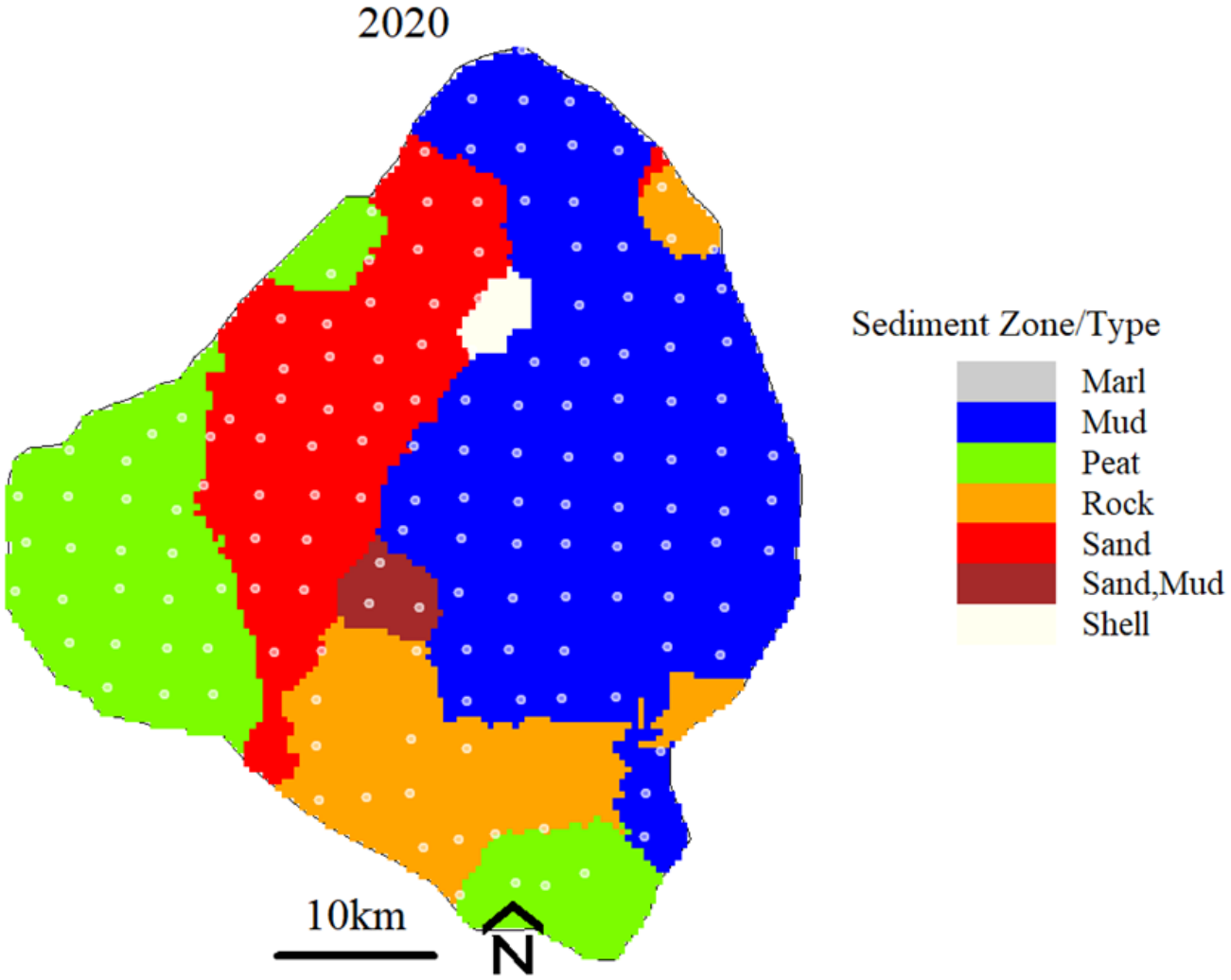
n = 180 sites


184 cm
30 cm
20-120 cm
tension cable
extension handles
(threaded) x3 = 5.5m
core tube head (PVC)
rubber piston
removable polycarbonate
coring tube 7.5 cm ID

Lab Methods

- Cores were extruded in anaerobic hood (N_2 saturated environment)
- Porewater extracted and analyzed for TDP, Tca, and Tfe
- Sediment samples were dried and ground before analysis for a variety of analytes including TP, Tca, and Tfe

Distribution of sediment type



- 6 sediment types total
- Broken down to 4 primary types:
  - Mud- light and mobile
  - Sand
  - Rock/ marl/ shell
  - Peat

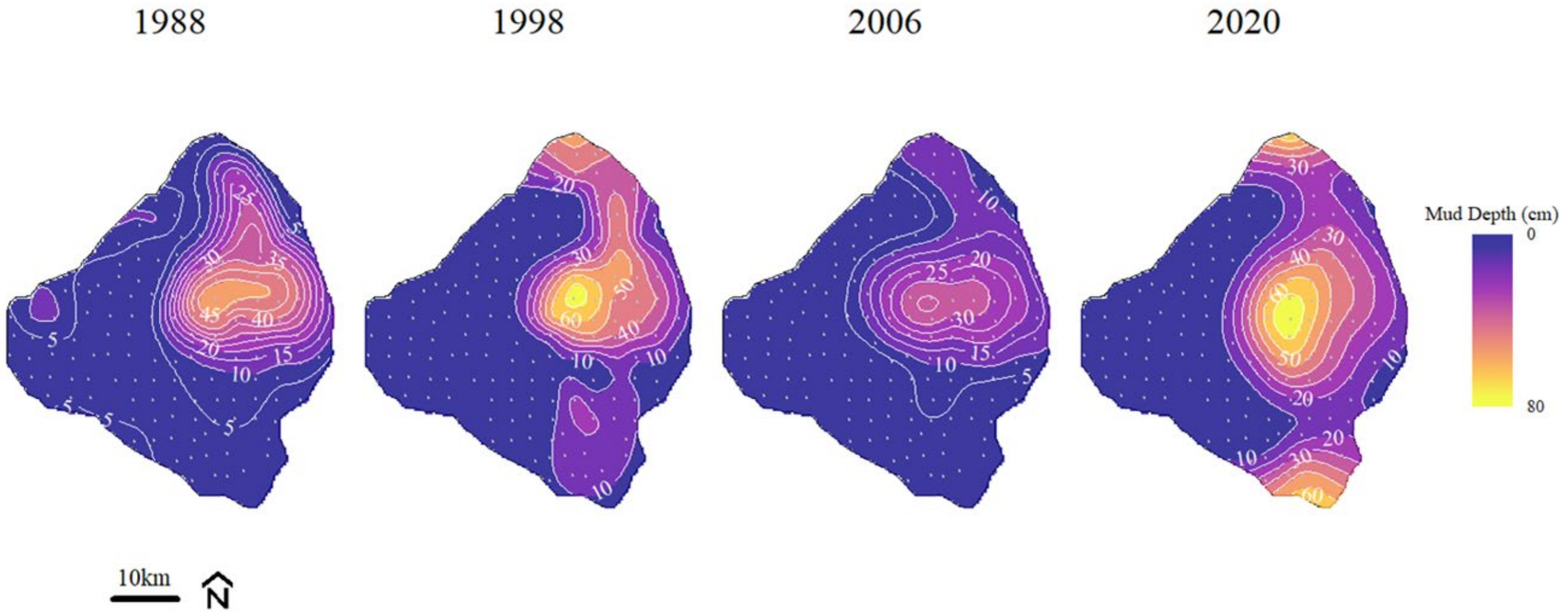

WESTCOTT

Consolidated sediment

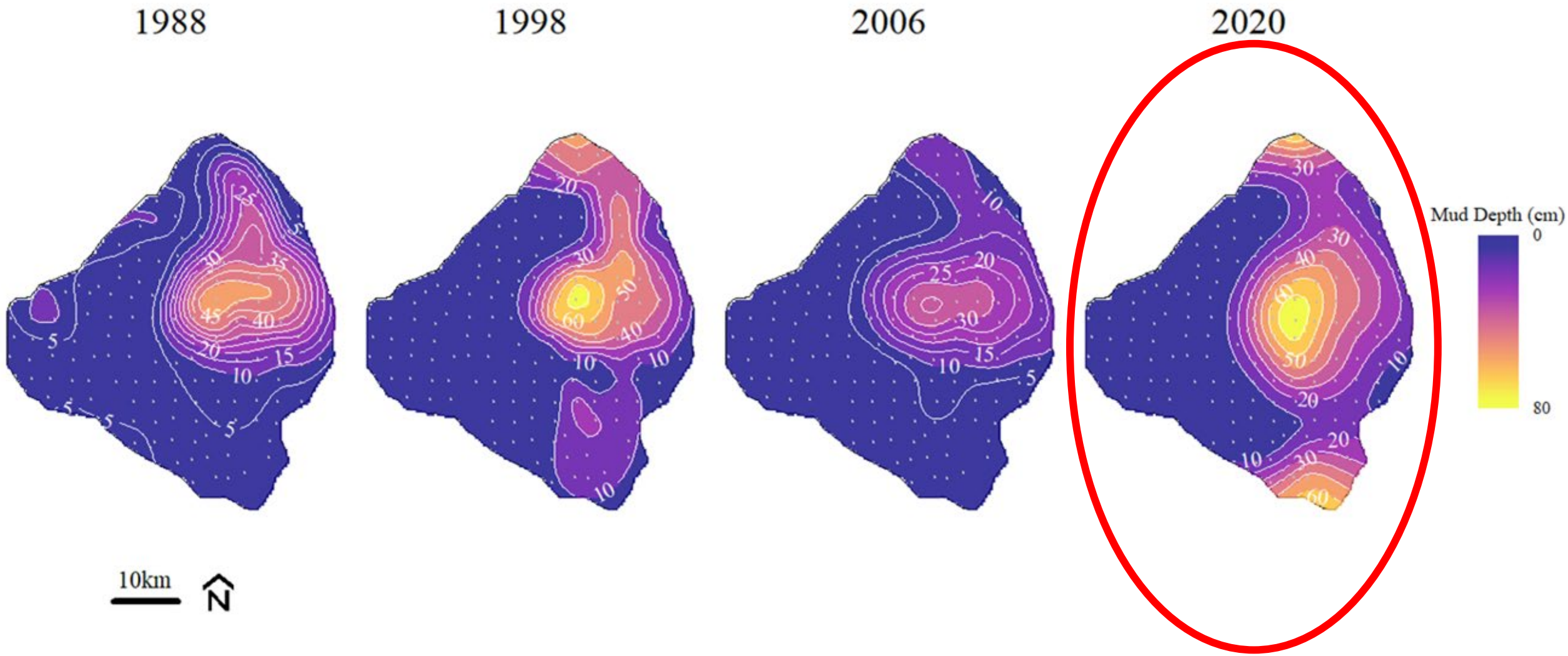
Mobile Mud

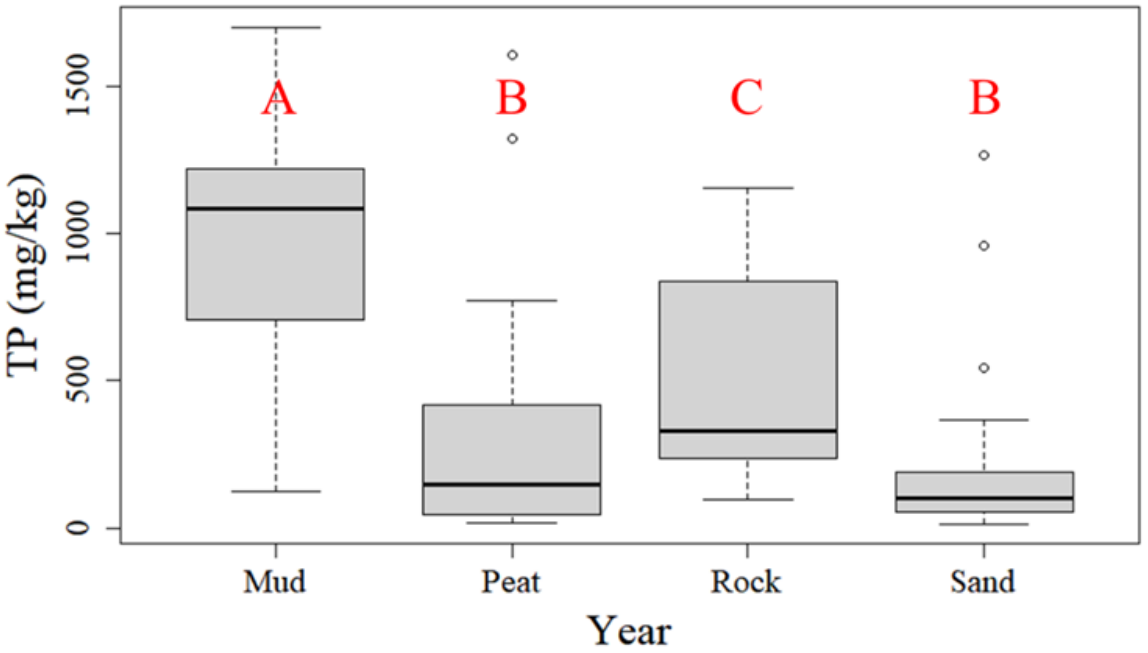
Consolidated sediment

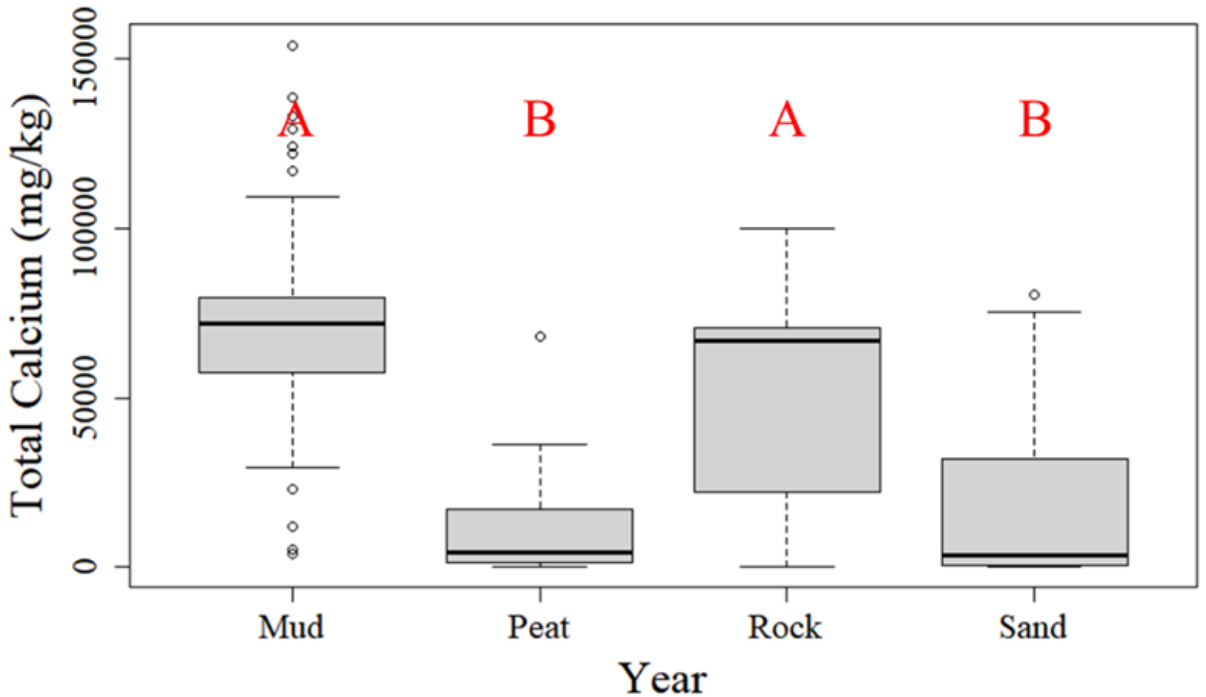
Mud Depth

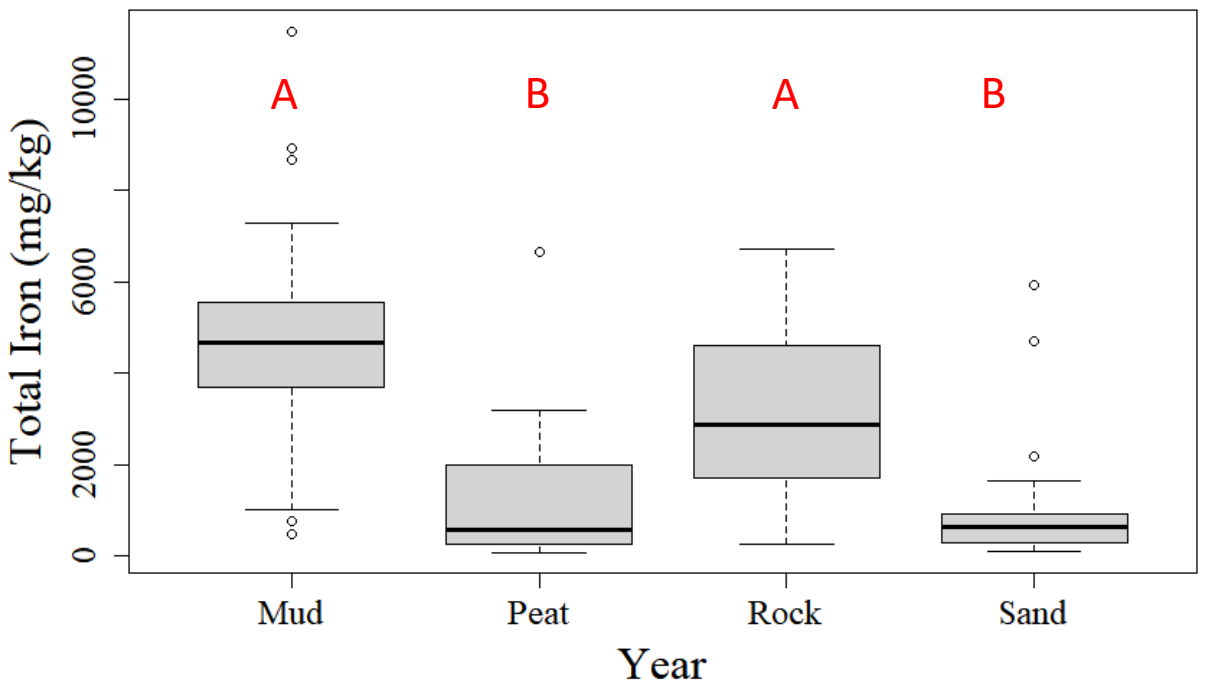


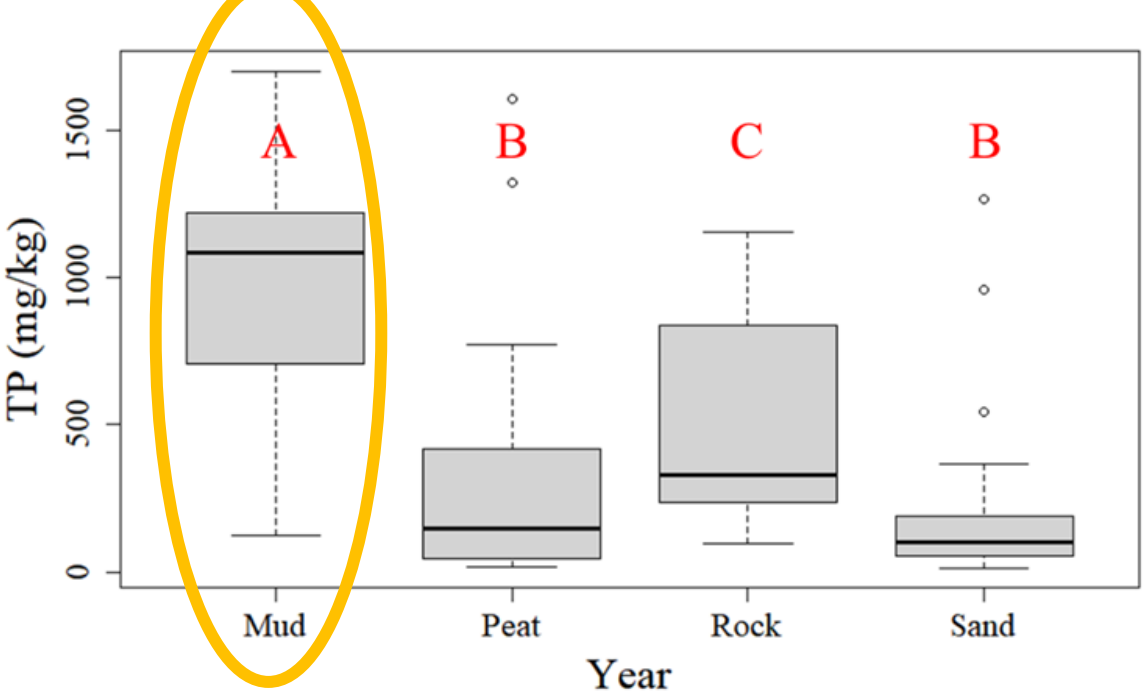
Mud Depth

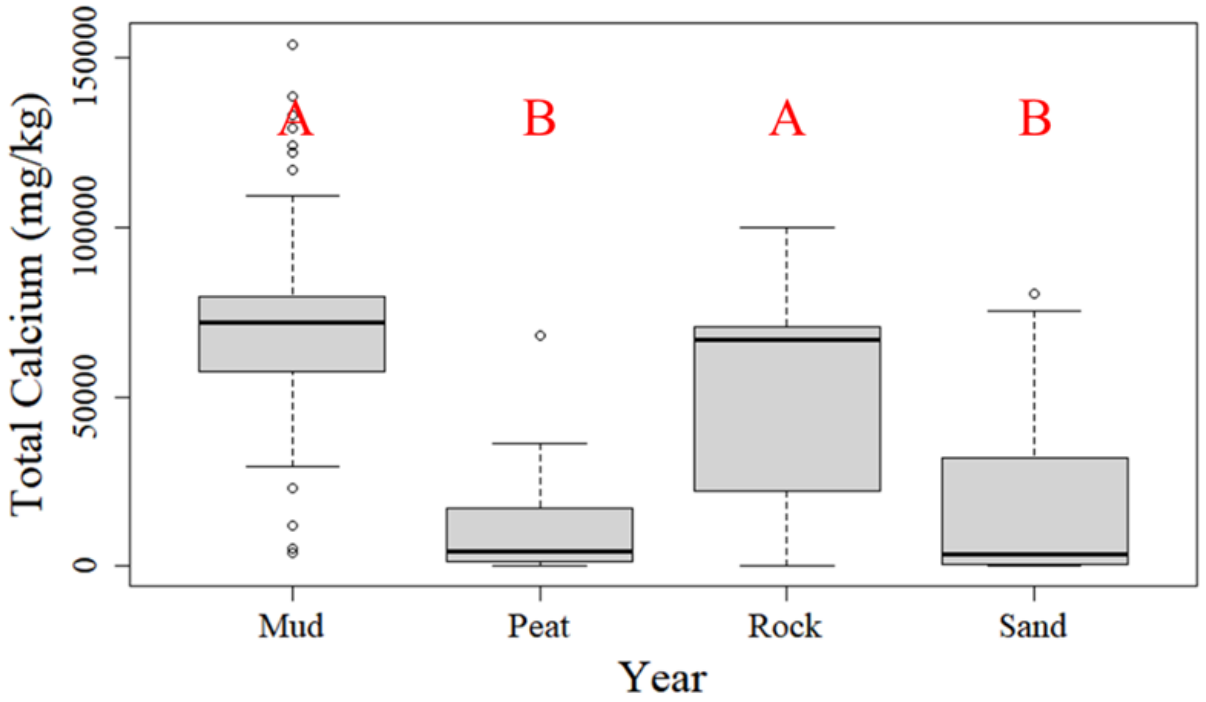


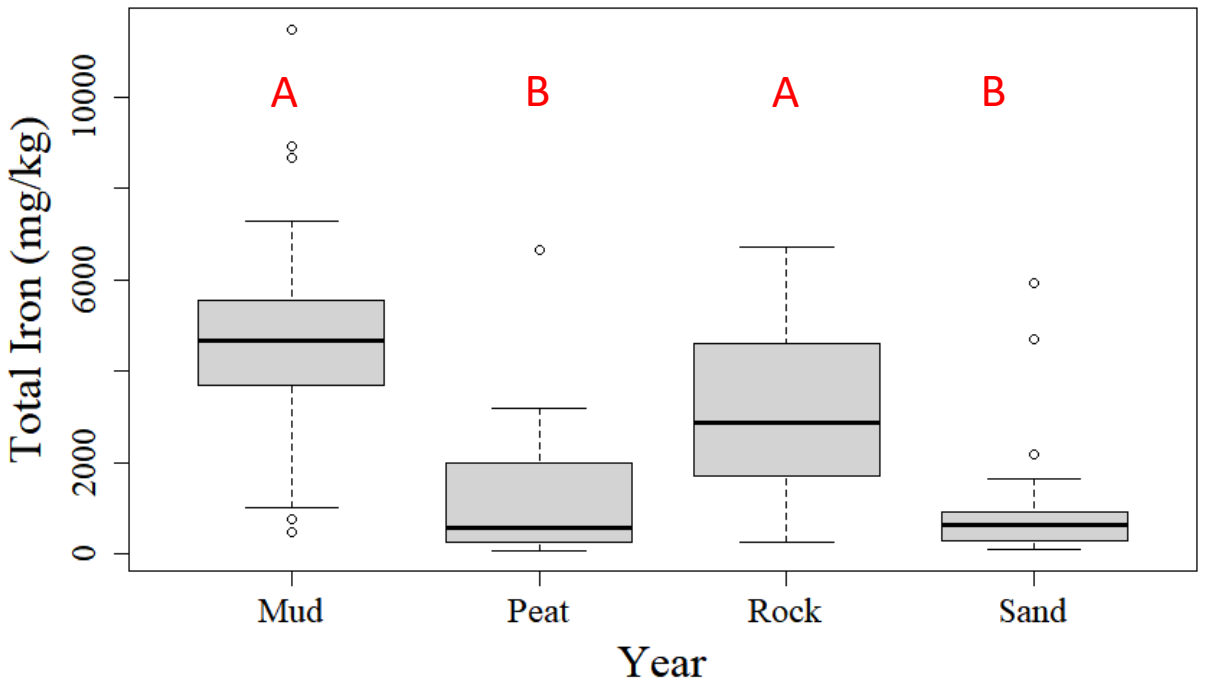

TP (mg/kg)
0
500
1000
1500
A
B
C
B
Mud
Peat
Rock
Sand
Year


Total Calcium (mg/kg)
0
50000
100000
150000
A
B
A
B
Mud
Peat
Rock
Sand
Year

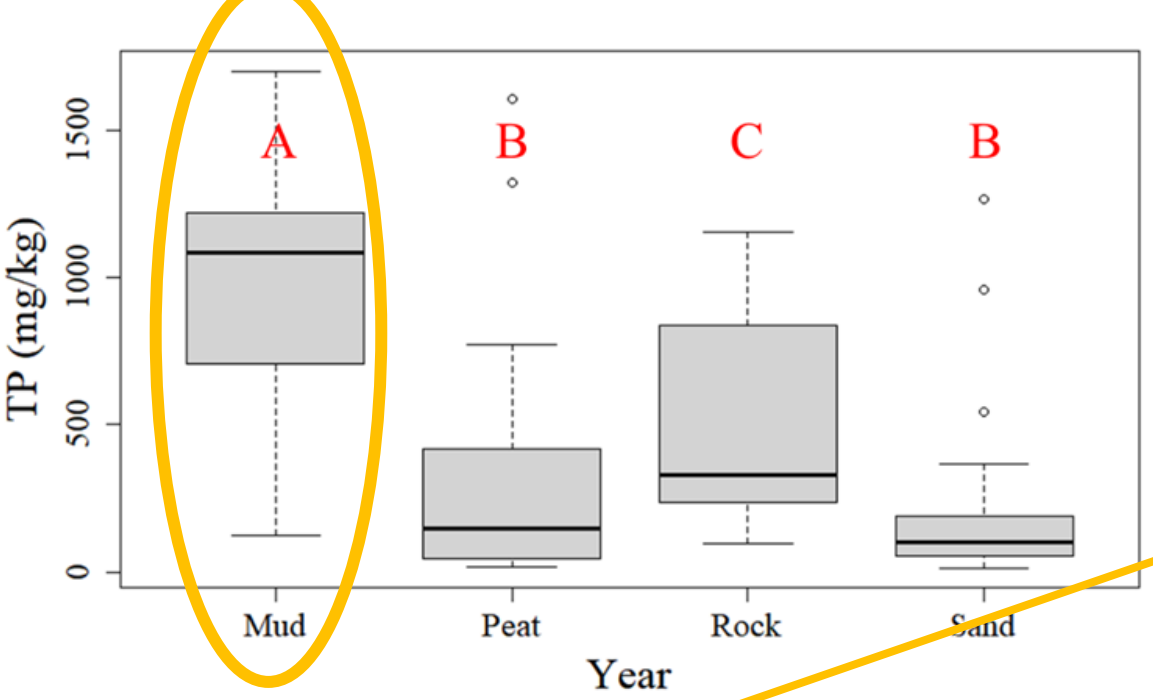

Total Iron (mg/kg)
0
2000
6000
10000
A
B
A
B
Mud
Peat
Rock
Sand
Year

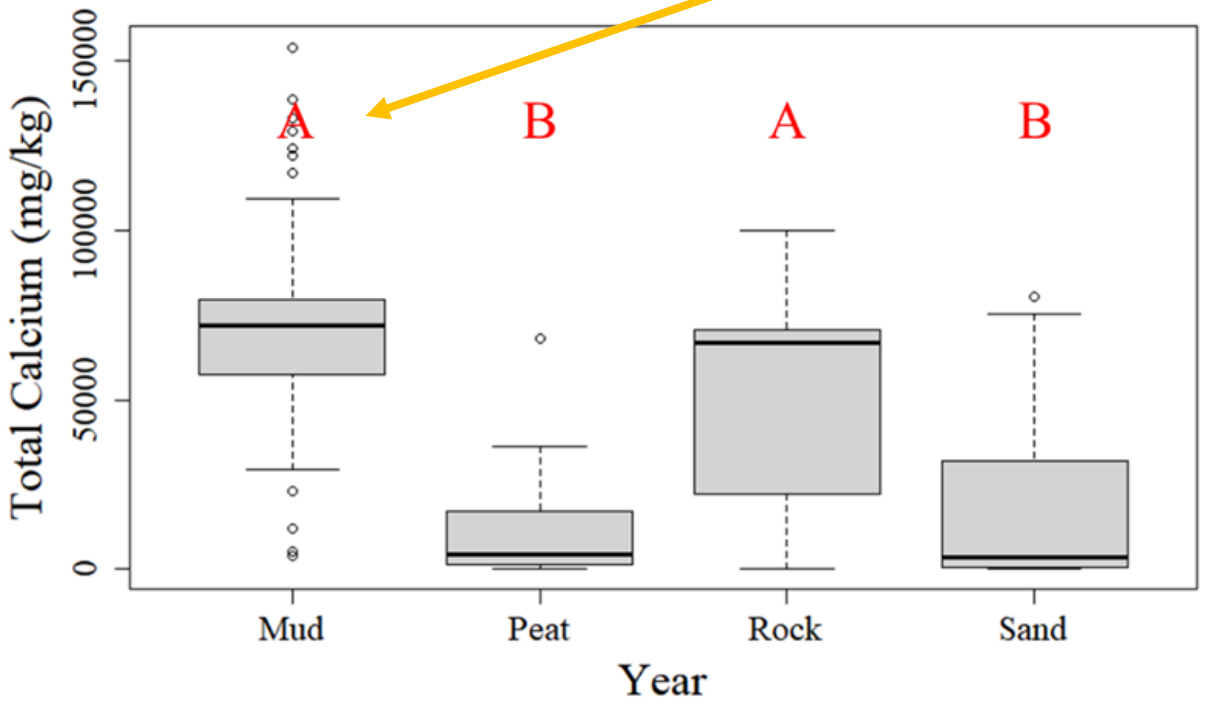

TP (mg/kg)
0
500
1000
1500
A
B
C
B
Mud
Peat
Rock
Sand
Year

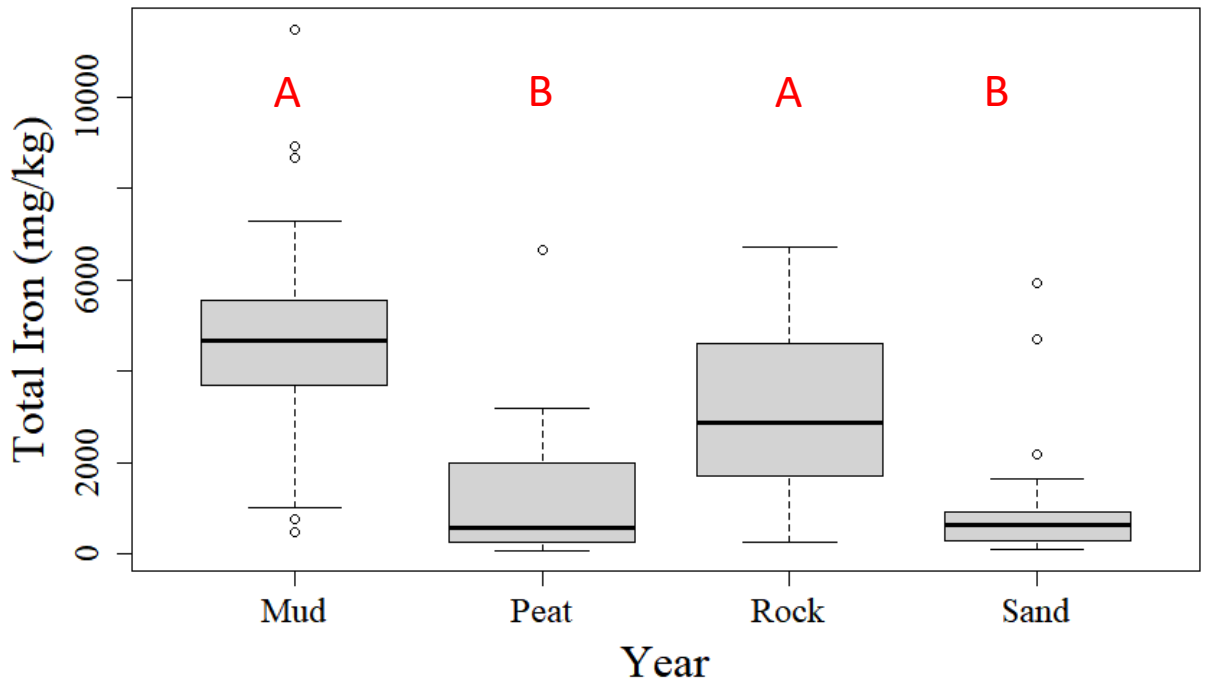

Total Calcium (mg/kg)
0
50000
100000
150000
A
B
A
B
Mud
Peat
Rock
Sand
Year

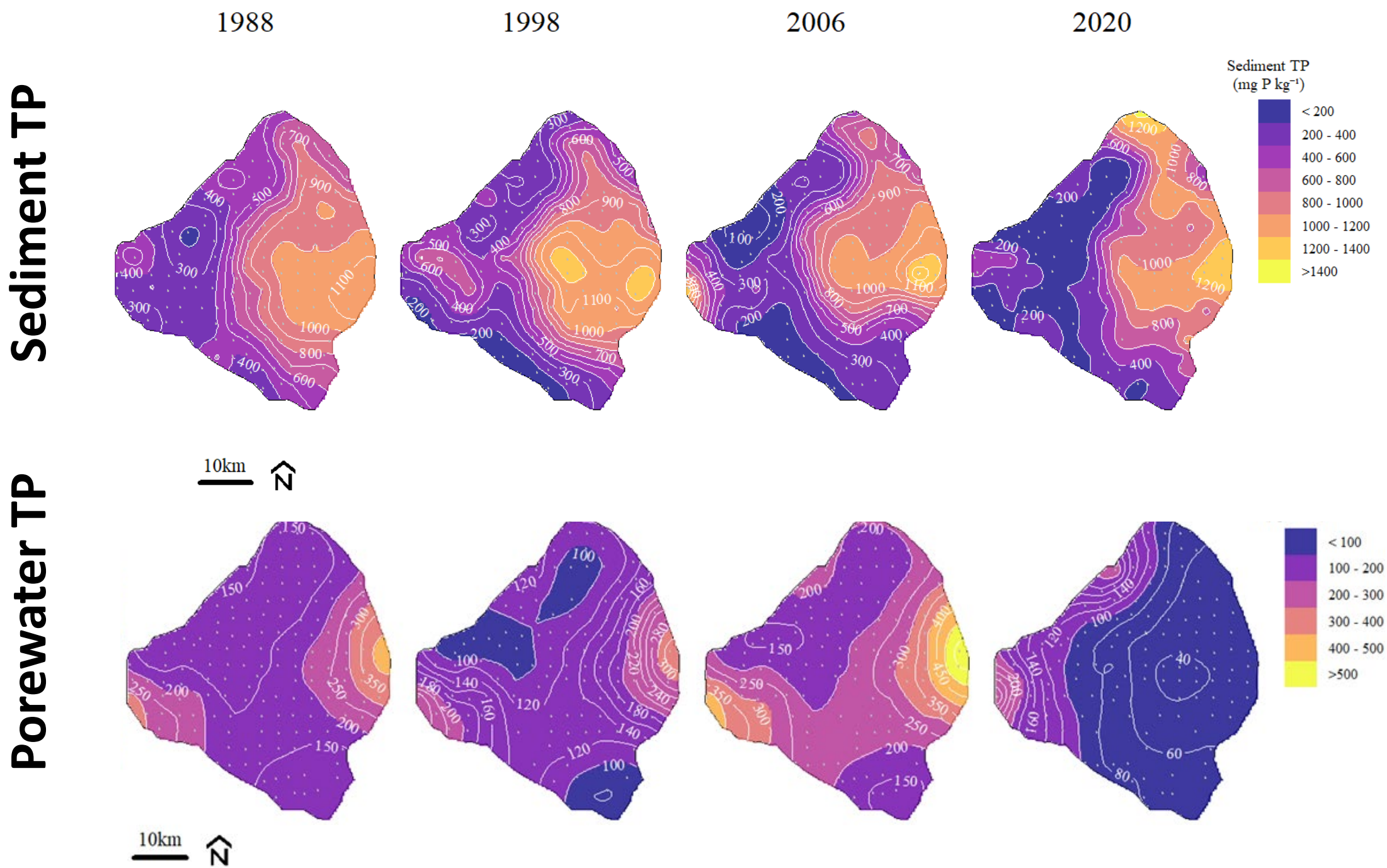

Total Iron (mg/kg)
0
2000
6000
10000
A
B
A
B
Mud
Peat
Rock
Sand
Year

Highest Concentrations of P, Ca, and Fe in mud (Al as well)

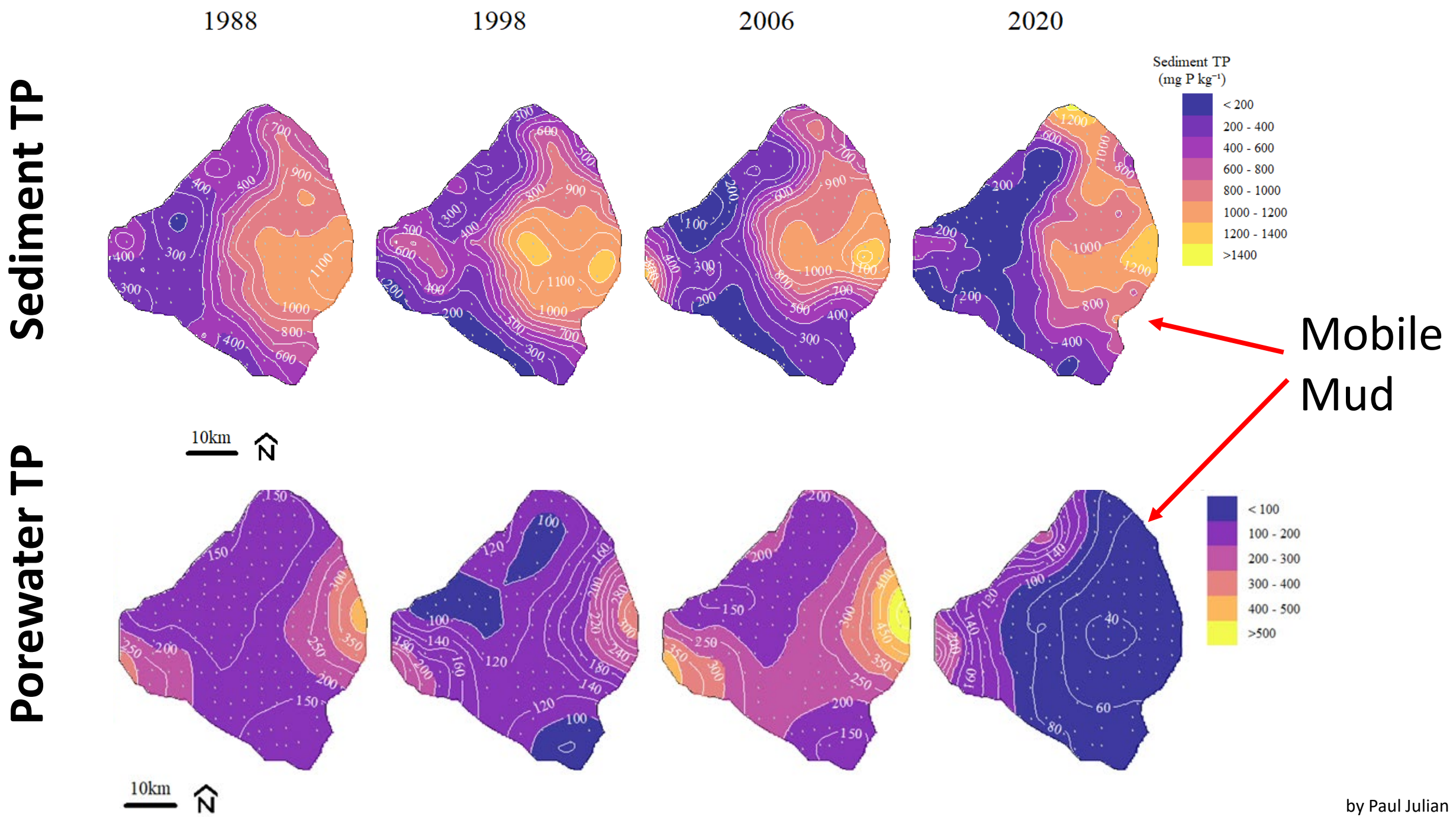


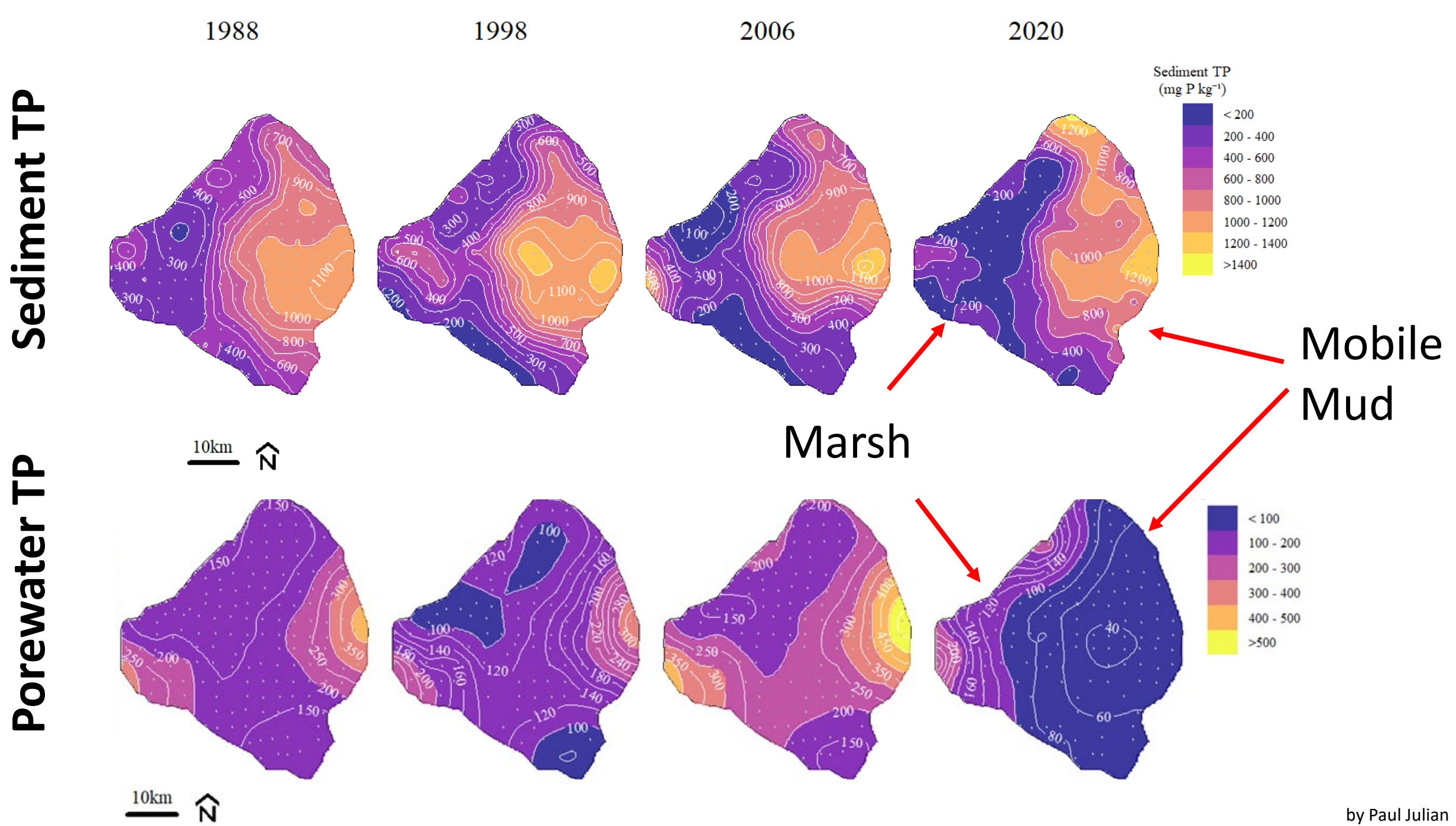






by Paul Julian


1988
1998
2006
2020
Sediment TP
Porewater TP
Sediment TP (mg P kg⁻¹)
< 200
200 - 400
400 - 600
600 - 800
800 - 1000
1000 - 1200
1200 - 1400
>1400
< 100
100 - 200
200 - 300
300 - 400
400 - 500
>500
10km
N
10km
N
Mobile Mud
by Paul Julian


1988
1998
2006
2020
Sediment TP
Porewater TP
Sediment TP (mg P kg⁻¹)
< 200
200 - 400
400 - 600
600 - 800
800 - 1000
1000 - 1200
1200 - 1400
>1400
< 100
100 - 200
200 - 300
300 - 400
400 - 500
>500
10km
N
Mobile Mud
Marsh
by Paul Julian

Conclusions

- Mud Depth has increased in Okeechobee on eastern side of lake over the past 30 years
- Mud is mobile Ca, Fe, and Al- oxides keep P bound on eastern side of lake due to mobility of sediments and bioturbation (high sed TP, low porewater TP)
- Veg growth on western side of lake has likely assimilated more P into biomass (decrease in sed TP over time)- more variable TP porewater
- Caveat- possibly highly variable depending on stage and seasonality

Thank You

Osborne Lab Members:
Anna Beard
Taryn Chaya

Field Support:
Brandon Mellin
Maria Mellin

Lab Analysis:
Patrick Inglett

Funding:
South Water Management District