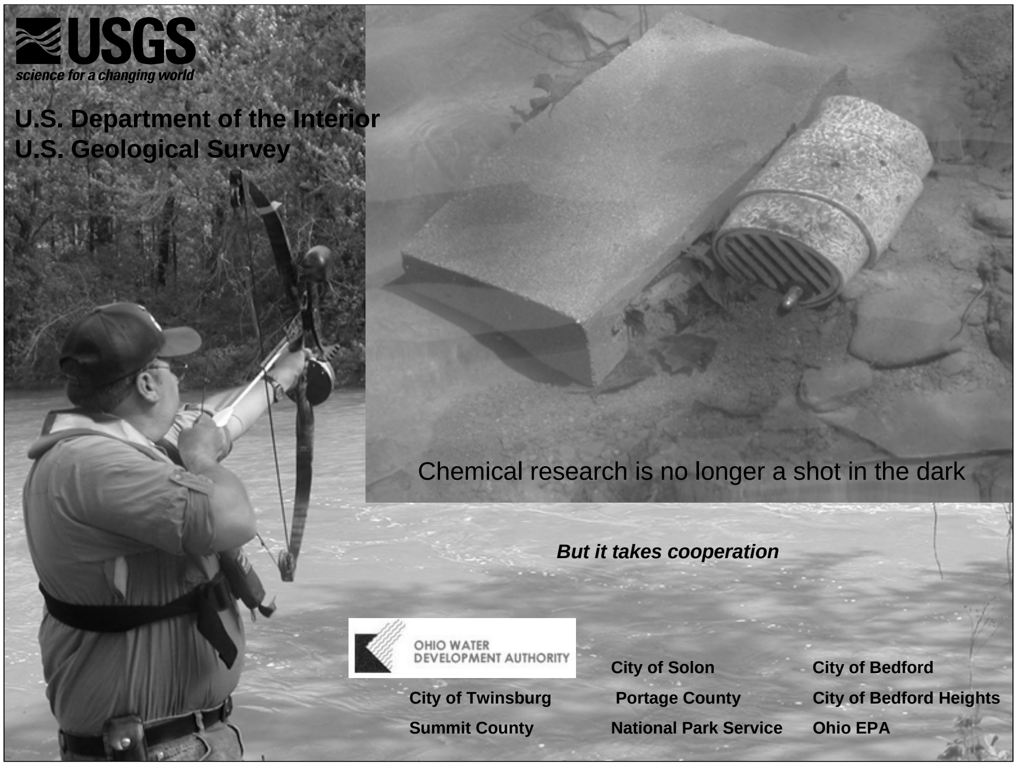
Investigating Chemicals from Wastewater Discharges in Tinkers Creek—*Practical approaches to a successful field deployment*

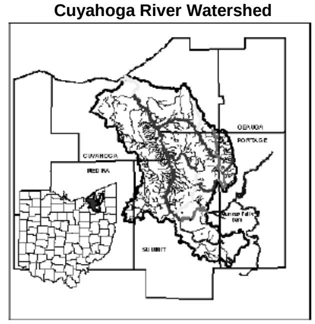

Tinkers Creek above Dunham Road

John Tertuliani
David Alvarez
Edward Furlong
Michael Meyer

U.S. Department of the Interior
U.S. Geological Survey


USGS
science for a changing world
U.S. Department of the Interior
U.S. Geological Survey
Chemical research is no longer a shot in the dark
But it takes cooperation
OHIO WATER DEVELOPMENT AUTHORITY
City of Solon
City of Bedford
City of Twinsburg
Portage County
City of Bedford Heights
Summit County
National Park Service
Ohio EPA

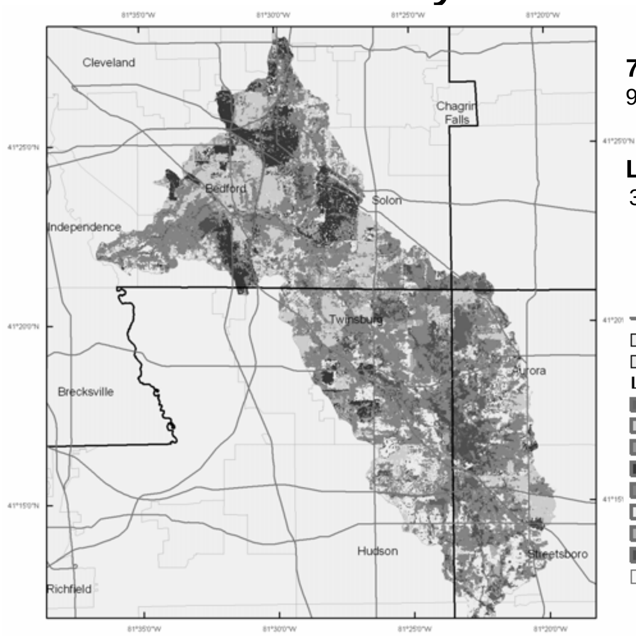
Tinkers Creek



The largest tributary to the Cuyahoga River

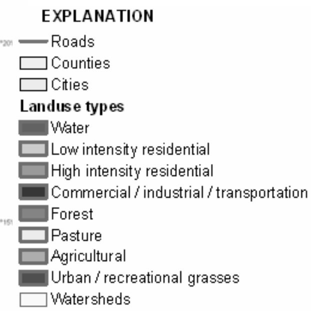
3

A textbook study area



7 WWTPs
96 mi^2 drainage

Landuse
34% commercial and residential



4

Why study Tinkers Creek?

TMDL for the Cuyahoga River reported unknown sources of impairment in Tinkers Creek, recommended a study to determine sources of impairment

(Fish population did not exploit available habitat)

5

WWTP effluent as flow

Percent of effluent in Tinkers Creek

- 75% during low flow
- 27% mean annual flow

27 mg/d discharge from the 7 WWTPs

6

Strategy: What is coming to the stream?

Sample the known sources—bracket the WWTPs

Downstream station

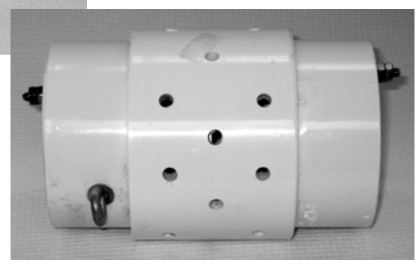
Upstream station

7

Polar Organic Chemical Integrative Sampler (POCIS)

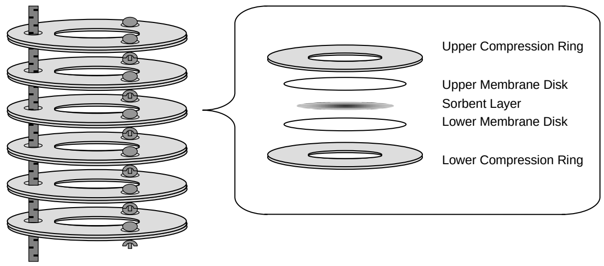
4-inch Schedule 40 PVC

Length @ 10.5 inches



8

A standard POCIS device has 41 cm^2 of effective sampling surface area



Two configurations are typically used:

Pharmaceuticals
Generic (for most pesticides, hormones, etc.)

Why use POCIS?

- Logistics: Cannot duplicate application with field crews
- Timing: Peak-flow and WWTP capture guaranteed
- Ease: No moving parts or adjustments
- Concentrates trace levels of chemicals
- Time-weighted concentrations
  - Important for risk assessment determinations

10

Disadvantages

- Vandalism: Can be a problem in popular areas
- Deployment: Anchoring in position
- Chemical analyses: Limited by target chemicals, available methods, and laboratories

Deployment

POCIS position critical when collecting a sample below the outfall

Complete mixing is obvious here

But what about here?

Substrate can make deployment difficult

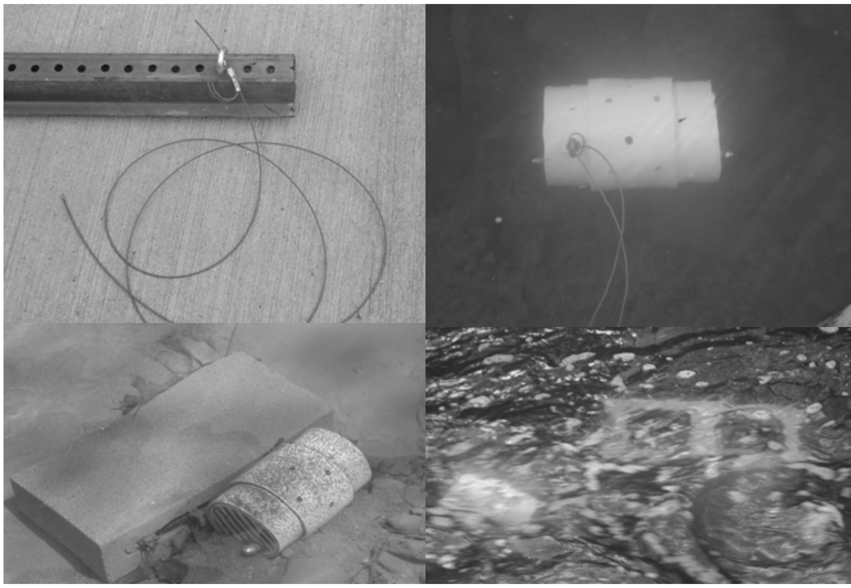
Bedrock and boulder substrates are the most challenging places to deploy a monitoring device for an extended period

Anchoring is next to impossible

Swift water can be unmanageable

13

Anchoring the device



14

Exposed roots and dead stumps

Trees offer a solid point to attach cable, but the cable can be a liability during high water; it will pull the device to the bank

15

Boulders and riprap

Mid-channel anchor best option

16

Cable length

Longer cables exert greater tension on the canister, allow greater movement

17

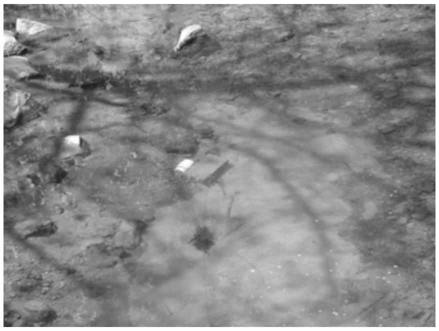
Depth

Can limit sampling opportunities

Smaller streams may become too shallow in the summer

18

Device will move with an increase in flow



To the bank

To the depositional area

19

Steep banks favorable

Device less apt to rest on bank shelf when water recedes (if cable is short)

20

Debris

Branched trees worse

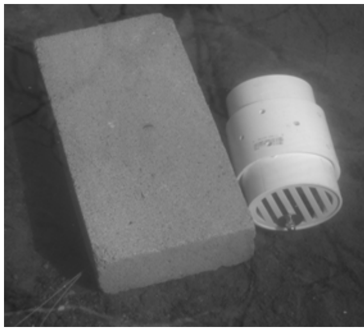
The threat of debris restricts cable placement, safety is also a concern

Use two separate cables, one from each bank, the shorter cable should break

21

Vandalism possible

Because the device is visible



Visible from every direction

22

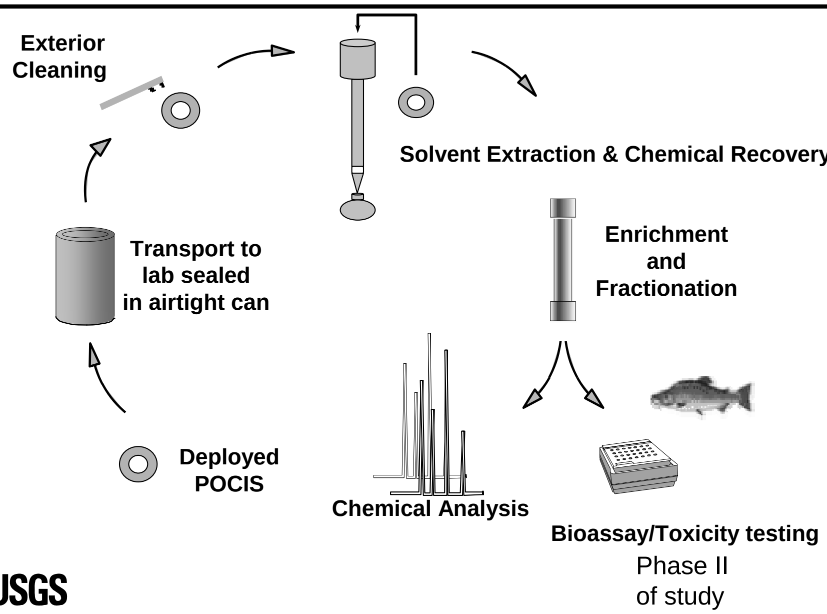
Retrieval

Placed in air-tight can and shipped with ice packs

Smaller can is a field blank (POCIS ring and semi-permeable membrane device)

23

General processing scheme for POCIS



USGS

24

What is next for Tinkers Creek?

Tissue study on fish

Future R&D?

- Compare cold water data to warm water data

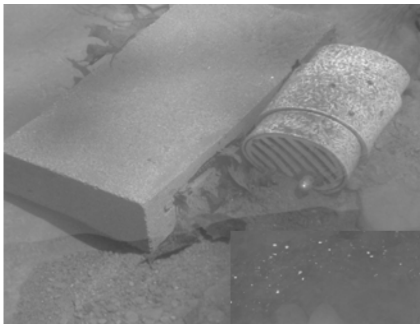
25

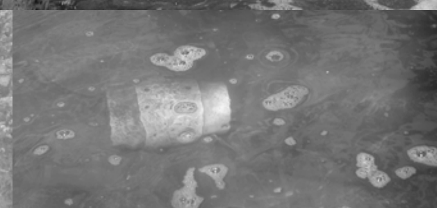
What to consider for your study?

- Timing
  - Stream size, other data collected, school year
- Canister placement
  - Mixing, anchoring for high water
- Tissue study on fish
- Target chemicals

26

John Tertuliani	David Alvarez
tertulia@usgs.gov	dalvarez@usgs.gov





Questions?