

**General Electric Company
Albany, New York**

**STRATEGY FOR COMPLETION OF THE HUDSON RIVER
RRI/FS: Central Pole of Quantitative Modeling**

**Prepared for GE/USEPA Meeting
December 2, 1997**

HydroQual, Inc.

ROLE OF MODELING IN THE HUDSON RIVER RRI/FS

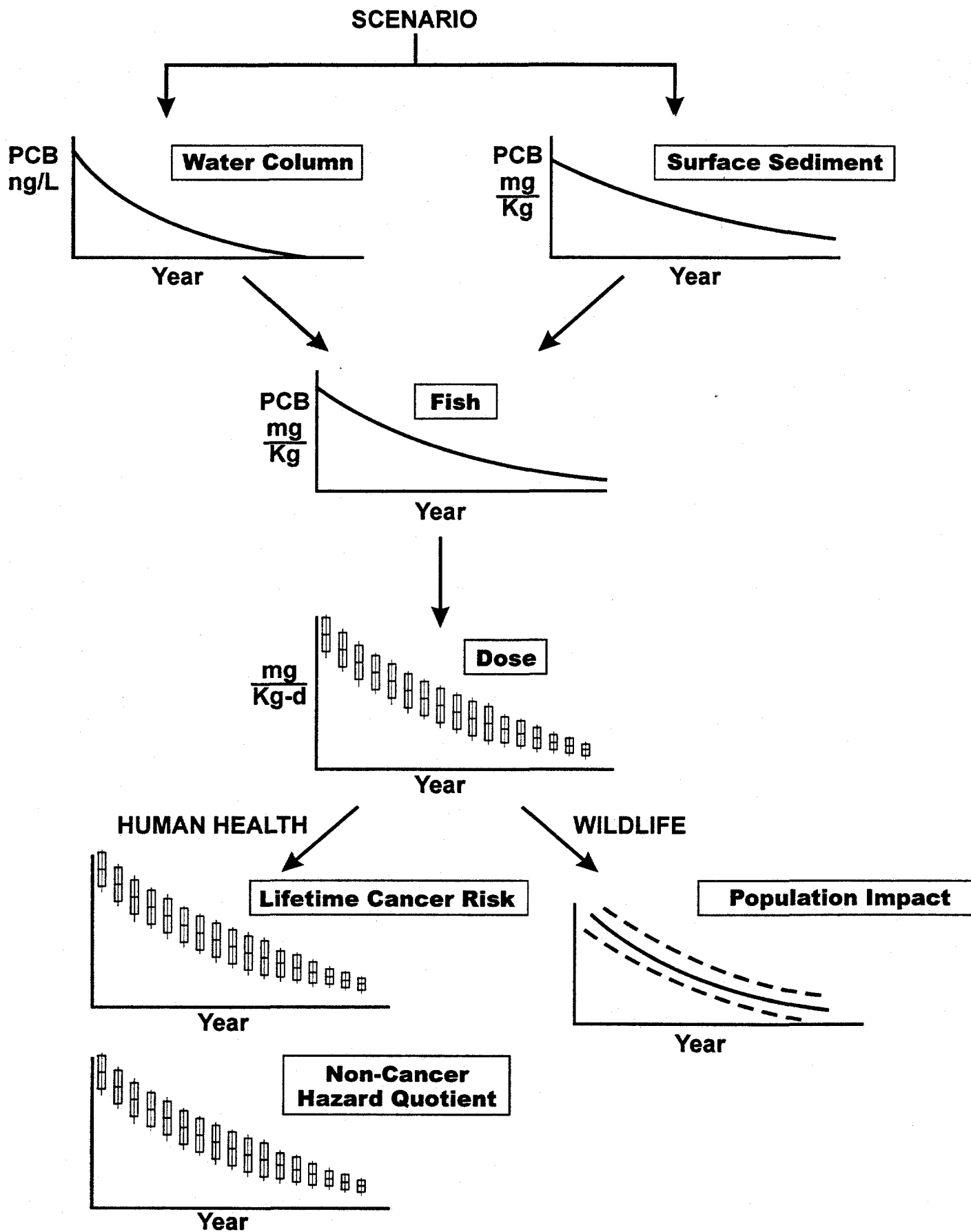
- Provides the only means to *fully* test the qualitative conclusions of the Data Interpretation Report
- Provides a means to integrate:
 - 1) our full scientific understanding of relevant environmental mechanisms and;
 - 2) the totality of relevant Hudson River field data

to provide the **most scientifically reliable** answers to the questions that form the basis of the RRI/FS:

- ☐ When will PCB levels in Upper Hudson River fish recover to levels meeting human health and ecological risk criteria under continued No Action?
- ☐ Can remedies other than No Action significantly shorten the time required to achieve acceptable risk levels?
- ☐ Are there sediments now buried and effectively sequestered from the food chain which are likely to become "reactivated" following a major flood, resulting in an increase in contamination of the fish population?

WHERE THE MODELING FITS IN THE RI/FS PROCESS

- The models predict PCB concentrations in water, sediment and biota under continued No Action and with specified remediation
- These concentrations allow the calculation of dose to humans and wildlife, from which risk may be estimated
- The risk estimates may be used in the Feasibility Study to compare with cost, effectiveness and reliability of the considered remedial options



Technical Challenges for Model Development

TASK	IMPORTANCE	GE APPROACH
■ depth of particle mixing in the sediments ■ sedimentation rate	controls the natural recovery rate	■ congener fingerprinting ■ solids loading & TSS calibration
■ relationship between river flow and sediment erosion	impacts fate of PCBs (i.e., burial versus downstream transport)	■ field erodability data
■ PCB flux from sediments within and below the TIP	impacts PCB sources to biota and PCB flux to the lower river	■ calibration to float surveys and floods
■ Reconcile the historical and project water column and sediment PCB data	needed to establish long-term data set for model calibration	■ review USGS chromatograms ■ collect unbiased TI Dam data
■ impact of the Allen Mill event on downriver sediment PCB levels	necessary for interpretation of 1990s data	■ comparison of pre- and post event data
■ predictions for the lower river?	ensure that any remedy in the Upper River will not adversely affect the Lower River	■ estimate PCB flux to the Lower River

Necessary Components of Model Calibration/Validation

Solids Balance

- spatial patterns of TSS during low flow
- temporal and spatial patterns of TSS and water column PCBs during flood events
- annual average solids loading passing Schuylerville, Stillwater and Waterford

PCB Fate

- spatial patterns of water column PCBs during low flow
- spatial changes in water column PCB composition

Natural Recovery Rate

- long-term temporal changes in surface sediment PCB levels
- vertical profiles of PCBs in sediment
- PCB inventory in sediment
- annual average flux of PCBs passing Schuylerville, Stillwater and Waterford

Bioaccumulation

- long-term temporal changes in PCB levels in predatory and forage fish at the TIP and Stillwater
- short-term temporal changes in PCB levels in predatory and forage fish at the TIP and Stillwater due to the Allen Mill failure

Status of GE Modeling Efforts

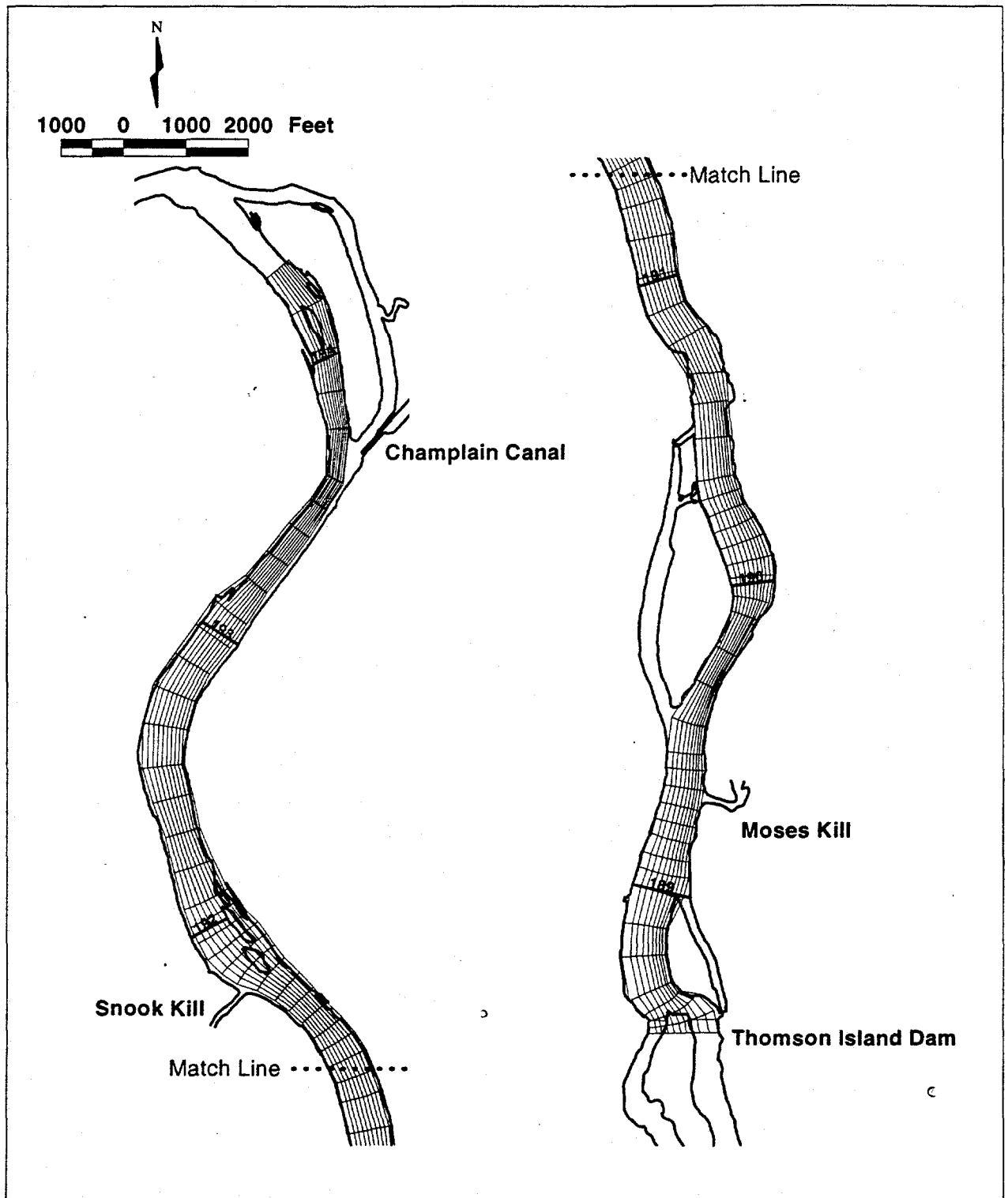
- State-of-the-art hydrodynamic/sediment transport model developed and nearly fully calibrated/validated
 - addresses sedimentation and erosion issues
- Total PCB fate model developed and initially calibrated to data from 1977 to 1991
 - addresses particle-mixing and PCB flux from sediments issues
 - will be recalibrated with adjusted USGS data and unbiased TI Dam data
- Fate model calibration to be extended to 1997 after issue of sampling bias at Thompson Island Dam is solved
 - PCB flux from sediments may be revised based on float survey data and corrected TI Dam concentrations
- State-of-the-art bioaccumulation model developed and being calibrated/validated
 - food web structure may be refined based on fall field sampling
- Two dimensional TIP PCB fate model under development to more accurately evaluate the "hot spot" issue

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Sediment Transport Model Grid

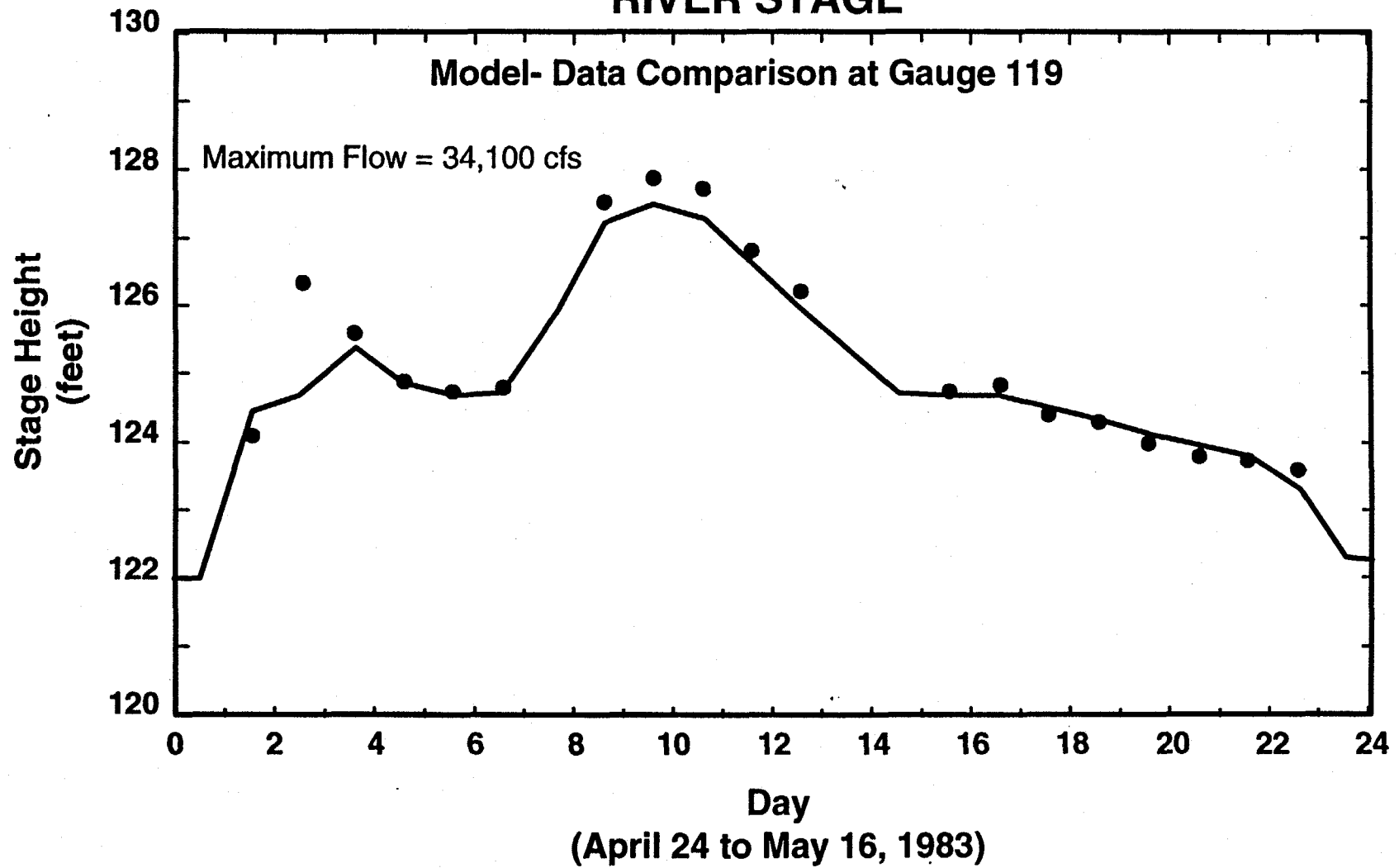
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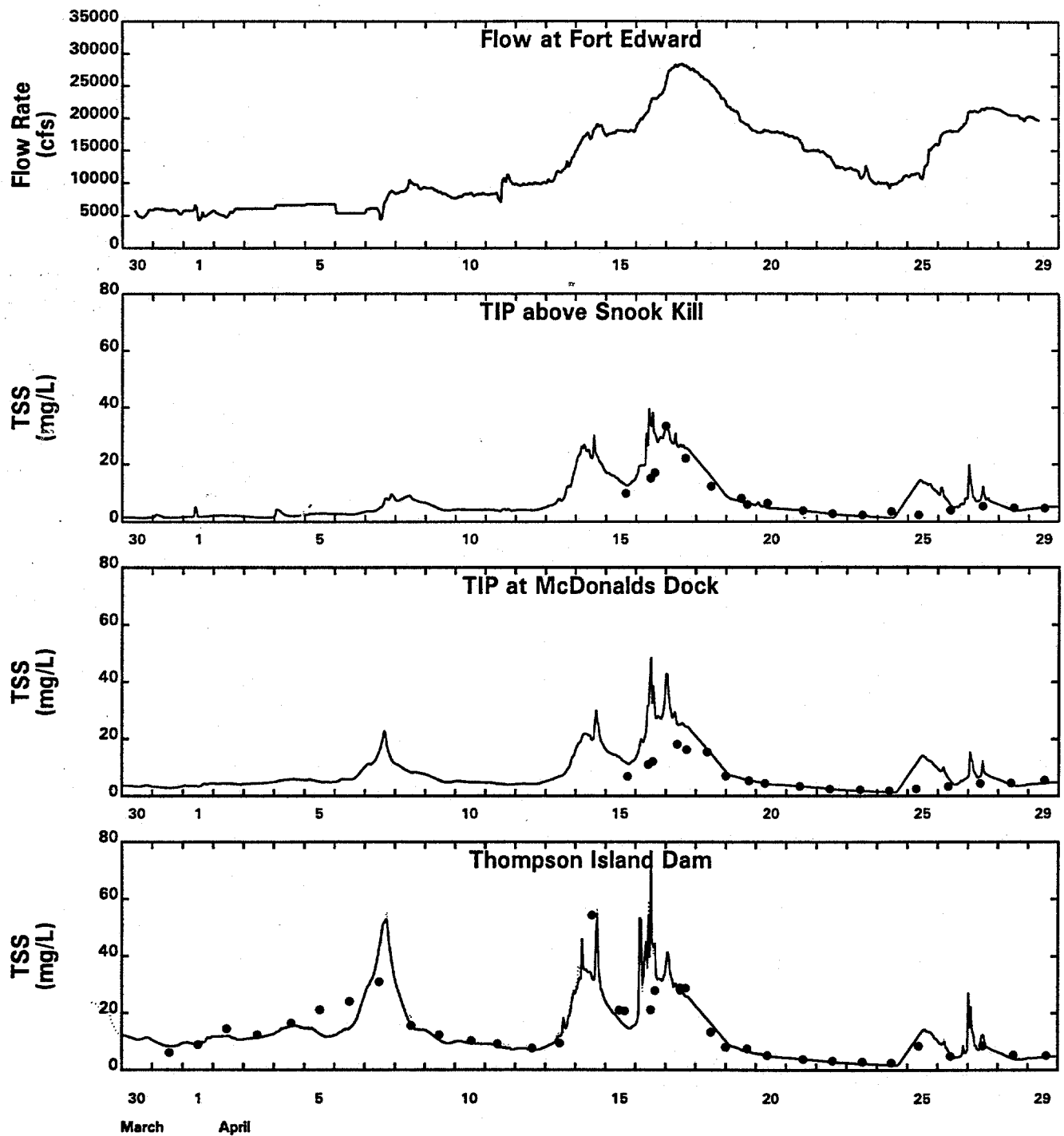
November, 1997



RIVER STAGE

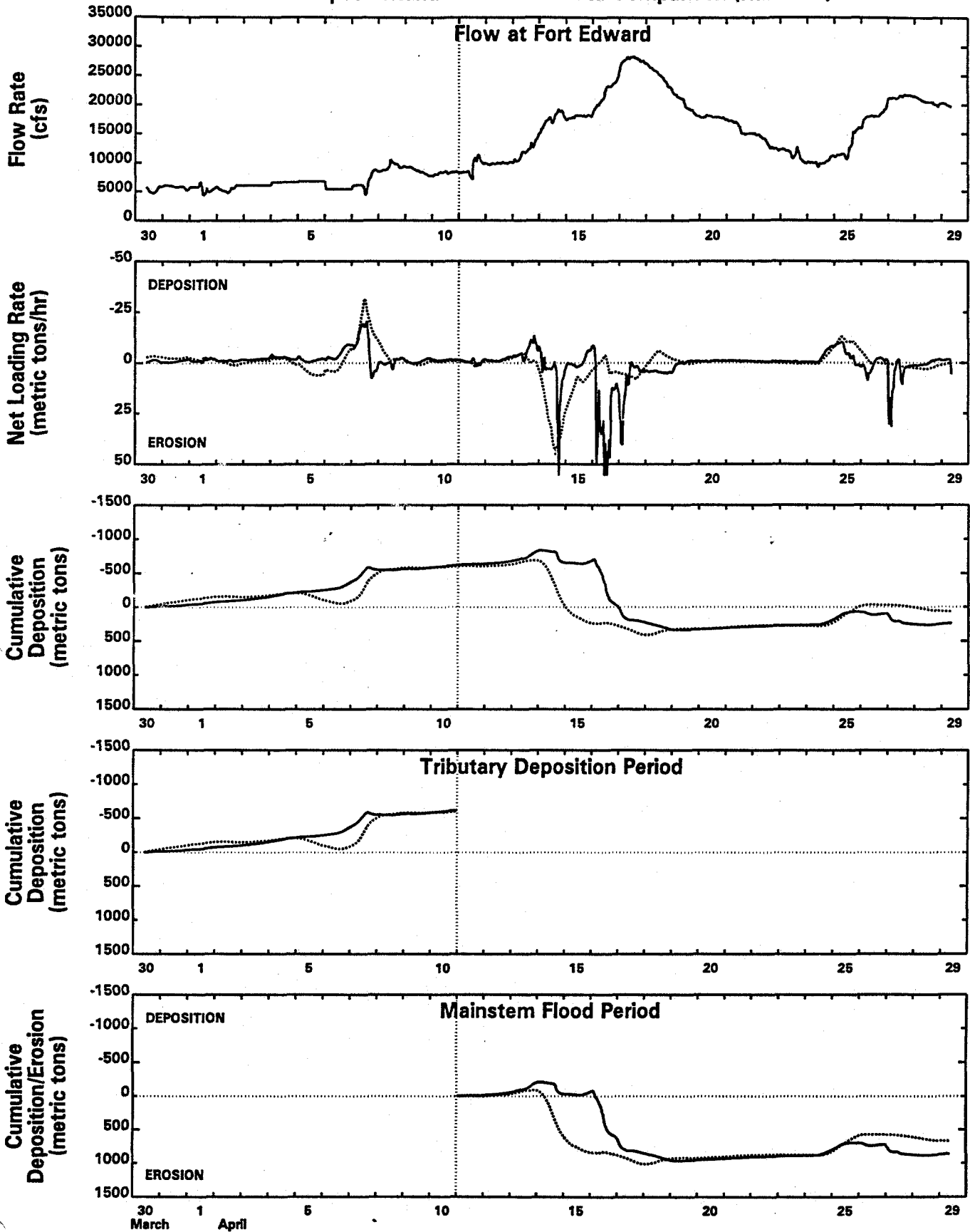
Model- Data Comparison at Gauge 119





March 30 - April 29, 1994

Thompson Island Pool Model-Data Comparison (Run 473)



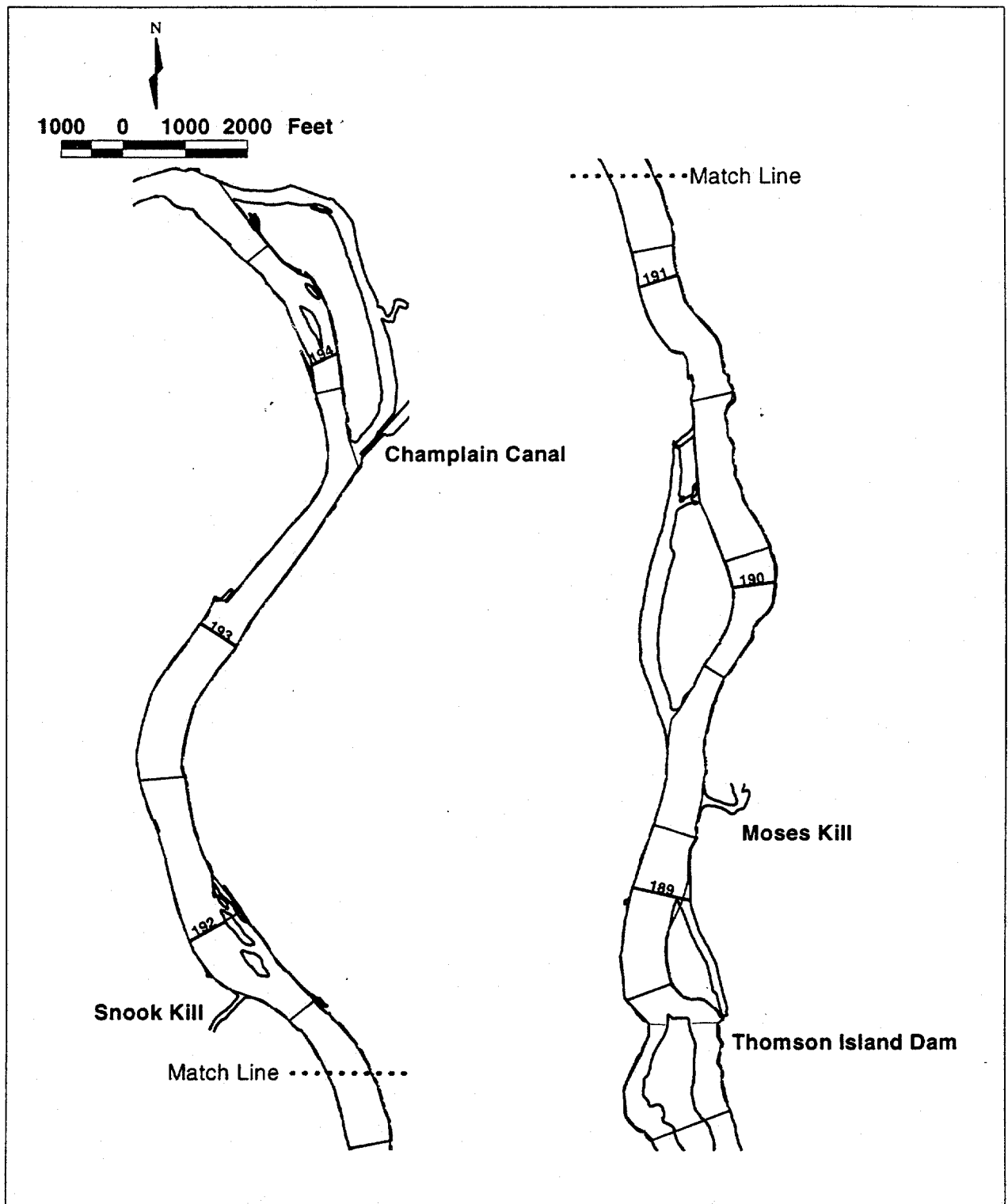
March 30 - April 29, 1994

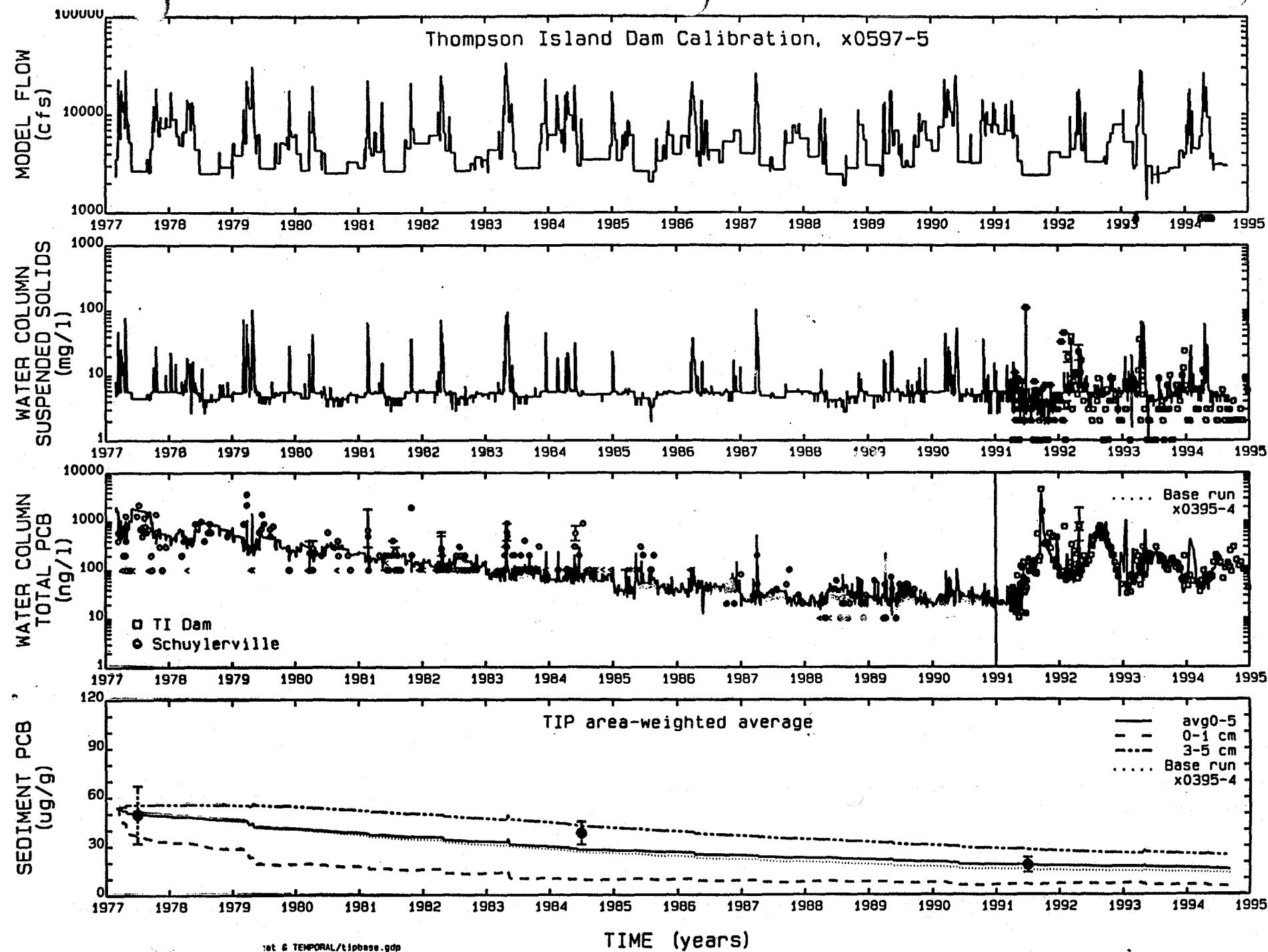
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1-D Water Quality Model Grid

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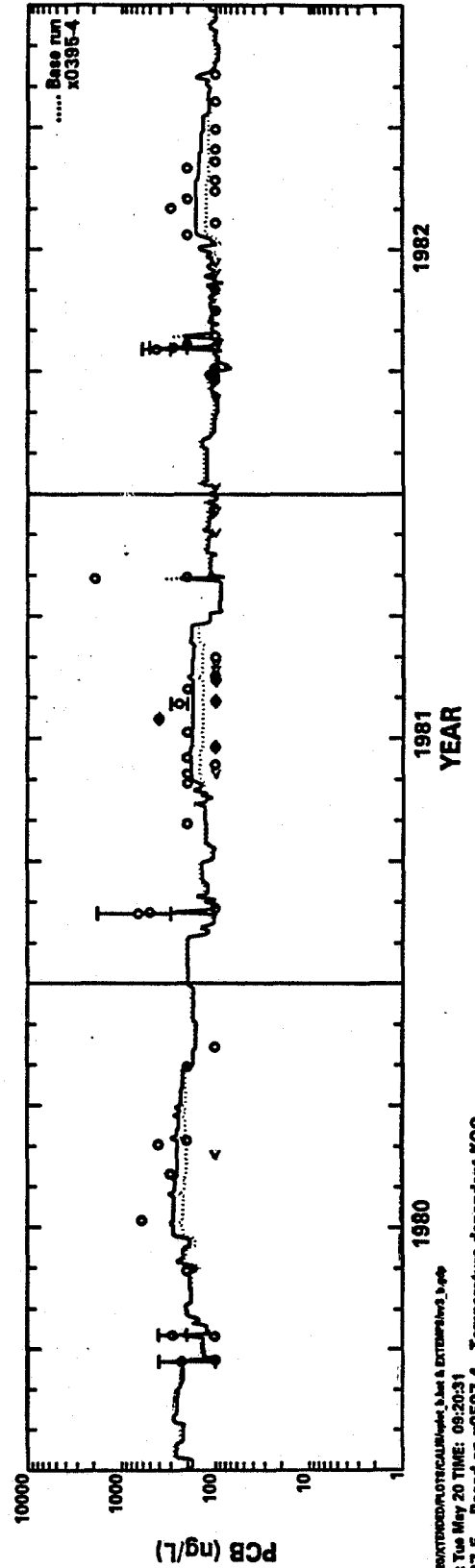
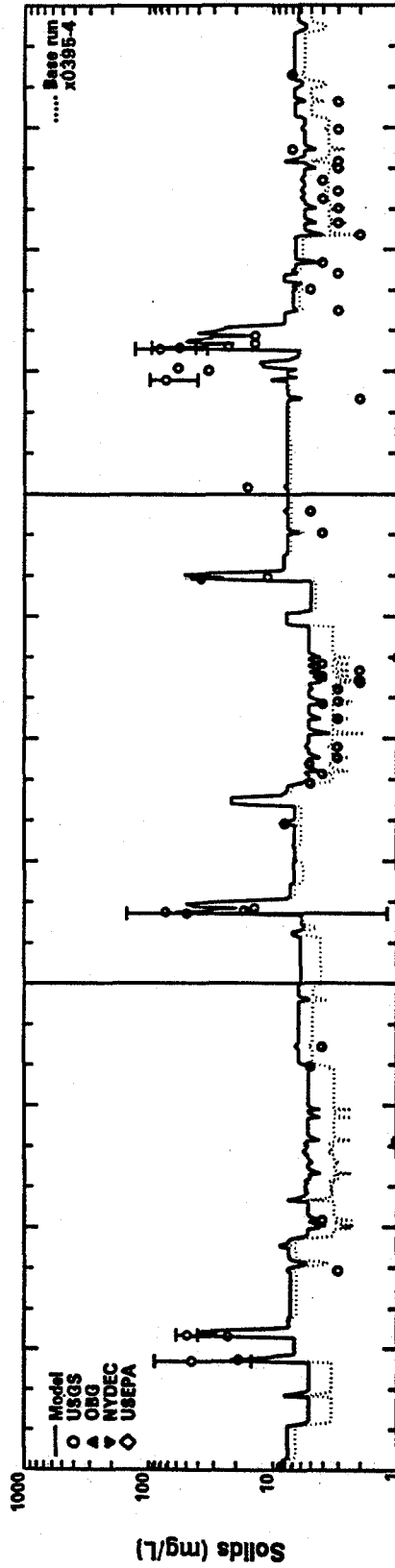
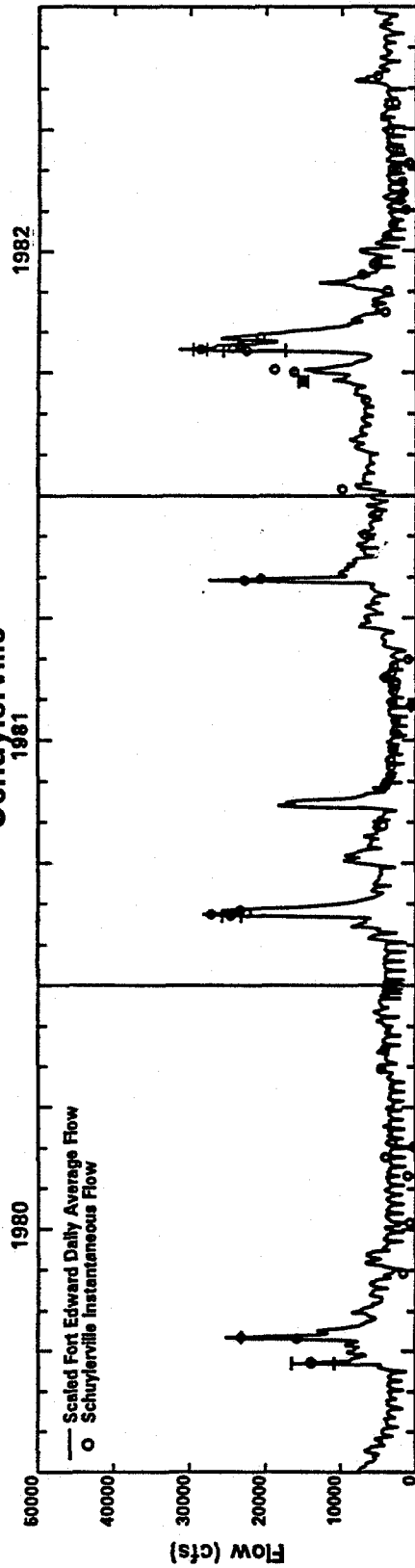




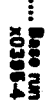
set 6 TEMPORAL/tipbase.gdp
03:35
x0597-5 Based on x0597-4. Temperature-dependent KOC.

312702

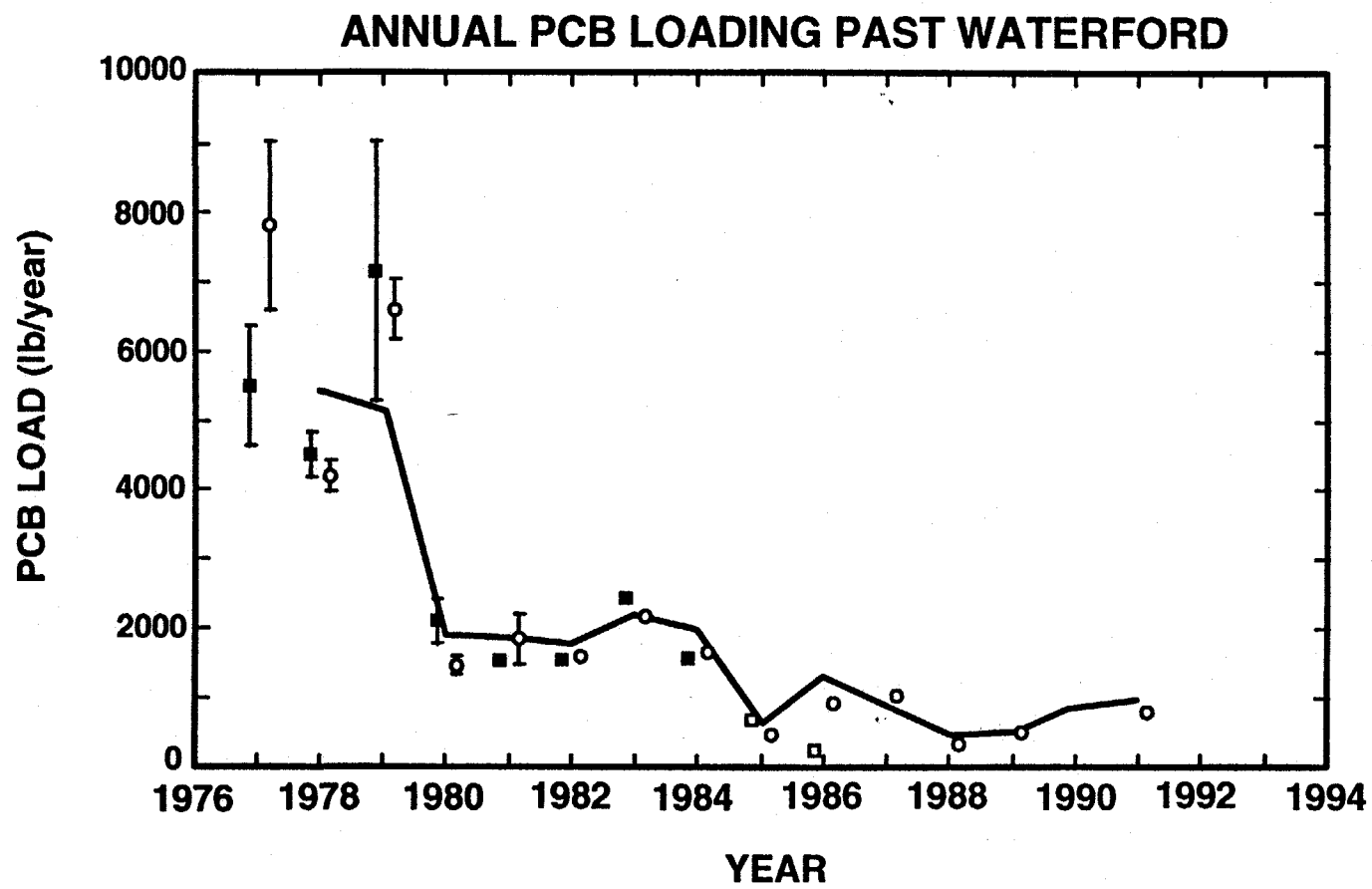
1980



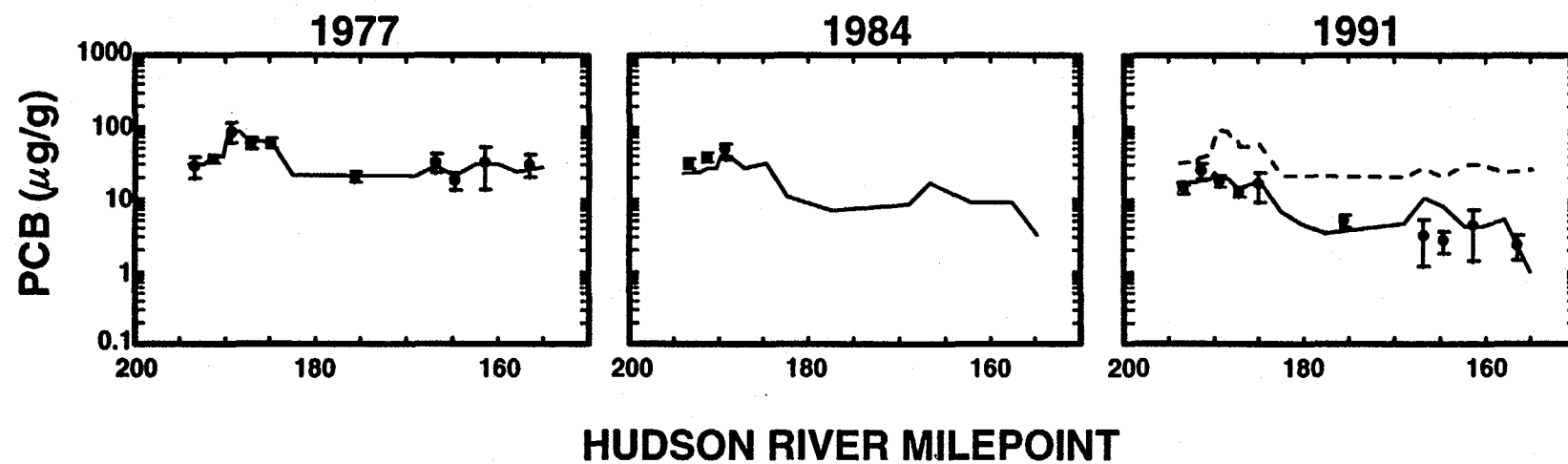
1991

1990
YEAR

1991



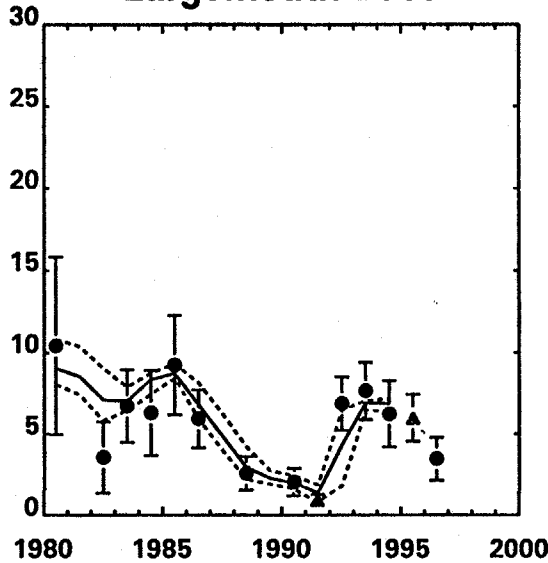
COMPARISON OF MEASURED AND MODEL COMPUTED SURFACE SEDIMENT PCBs



0-5 cm sediments

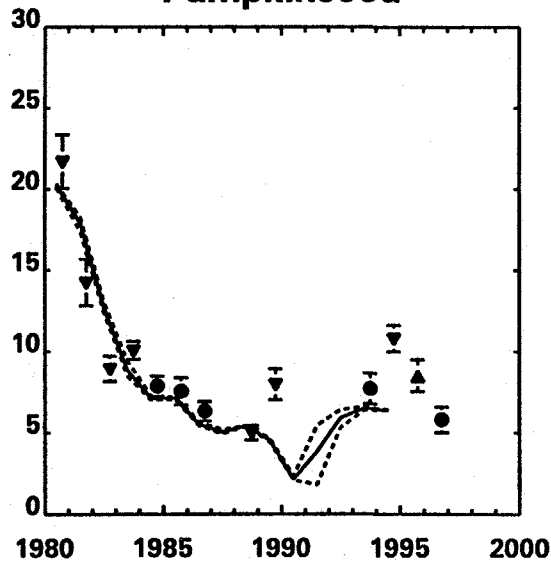
Largemouth Bass

ug/g wet weight
fillet



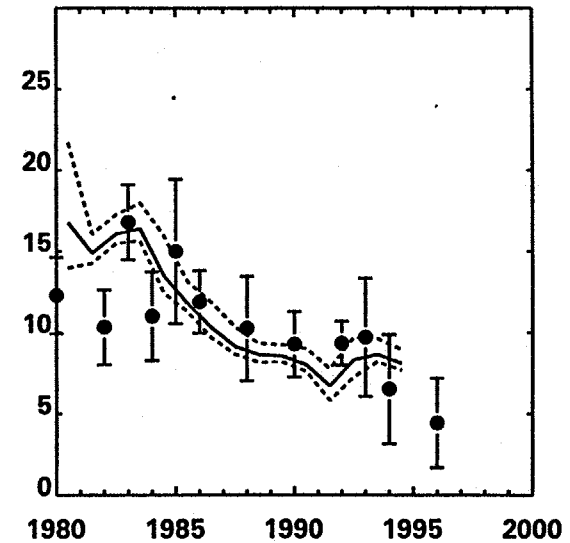
Pumpkinseed

ug/g wet weight
whole body



Brown Bullhead

ug/g wet weight
fillet



Symbols - data +/- 2 std err of mean.

Lipid-based plots: all tissues

Wet weight-based plots:

- fillet
- ▼ whole body
- ▲ tissue unknown

Pumpkinseed data: Fall, model: Fall Yearling

x0597-5h.5.in x0597-5g, LMB eats BB

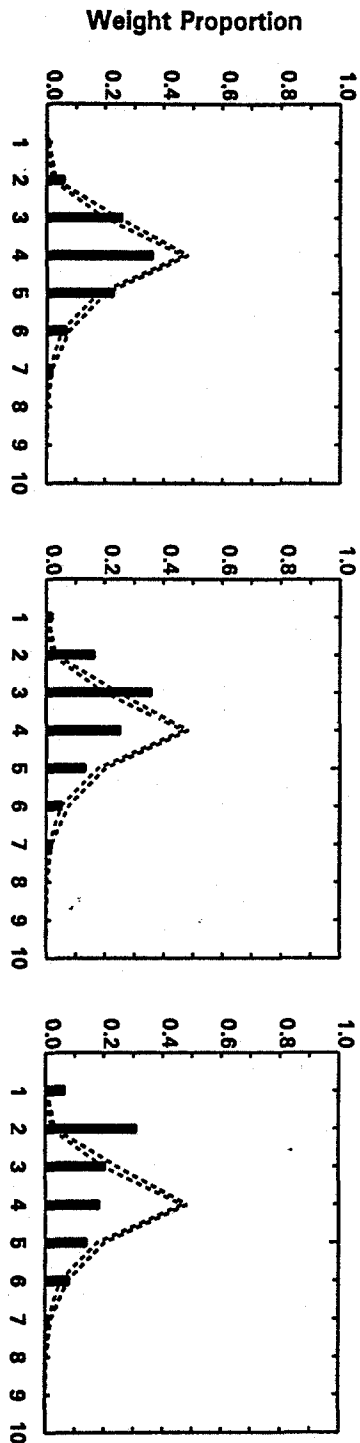
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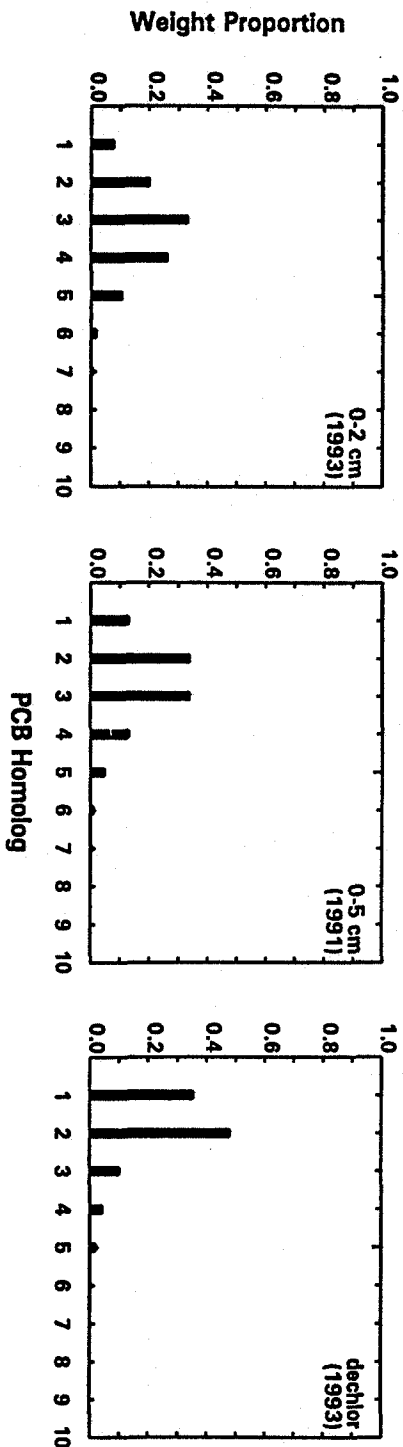
FOOD WEB MODEL - TOTAL PCB AT STILLWATER

fed

Pumpkinseed



Sediment



STEADY STATE FOOD WEB MODEL PUMPKINSEED IN THOMPSON ISLAND POOL

Data: after 1989

dashed lines: TI Pool pumpkinseed, +/- 2 std errs

Model: Age 3 Pumpkinseed

Tue Aug 19, 1997 16:32:26

/power2/geco0330/FULL/50 (fcpion3junk)

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Runs 24,23,25

PLANNED DATA COLLECTION

- Routine water column sampling at Rogers Island, Below the TI Dam and at Schuylerville
- Spring fish PCB and stomach content analysis