2006 Tampa Bay Tidal Tributary Habitat Initiative Project:
Overview & Synthesis

Tampa Bay Estuary Program
BASIS 5: Tidal Tributary Studies
October 21, 2009
Project Partners

Project Management
Holly Greening, Tampa Bay Estuary Program

Database Management, GIS and Quality Assurance
Greg Blanchard, Manatee County Environmental Protection Division
Kathleen O’Kiefe, FFWC Fish and Wildlife Research Institute

Water and Benthic Quality, Watershed Characterization and Assessment
Ed Sherwood, Environmental Protection Commission of Hillsborough Co. (now with the Tampa Bay Estuary Program)
Gerold Morrison, EPCHC (now with BCI Engineers, Inc.)
Eric Fehrmann, Pinellas Co. Department of Environmental Management
Andy Squires, Pinellas County Department of Environmental Management
Mark Flock, Pinellas County Department of Environmental Management
Greg Blanchard, Manatee County Environmental Protection Division
Bob McConnell, Tampa Bay Water

Fish and Fish Habitat Characterization
Marin Greenwood, FFWC FWRI (now with ICF Jones & Stokes)
Bob McMichael, FFWC Fish and Wildlife Research Institute
Tim MacDonald, FFWC Fish and Wildlife Research Institute
Ed Matheson, FFWC Fish and Wildlife Research Institute
Frank Courtney, FFWC Fish and Wildlife Research Institute
Justin Krebs, US Geological Survey
Carole McIvor, US Geological Survey

Fish Diet and Food Source (isotopic analyses)
Bob McMichael, FFWC Fish and Wildlife Research Institute
Ernst Peebles, Univ. of South Florida College of Marine Sciences
David Hollander, Univ. of South Florida College of Marine Sciences
Elon Malkin, Univ. of South Florida College of Marine Sciences

Interpretation and Management Strategy
Holly Greening, Tampa Bay Estuary Program
Lindsay Cross, Tampa Bay Estuary Program
Ed Sherwood, Tampa Bay Estuary Program
Overview

- Premise of the Study
- Tidal Tributaries Studied
- Monitoring Elements
  - Fisheries Use
  - Nitrogen Pathways (Isotopic)
  - Water, Sediment, and Benthos
- Integrated Results
- Management Actions
- Products
- Next Steps
Premise: Filling in the Gaps

- There is extensive, long-term sampling of the bay and main stem of tidal rivers by several agencies.
- Smaller, tidal tributaries are under-sampled or missed entirely.
- >100 Tidal Tributaries in Tampa Bay Watershed.
Project Objectives

Improve protection and management of fish populations in the Tampa Bay system by:

1) Determining the relative importance of tidal tributaries as fish habitat in Tampa Bay;

2) Determining effects of habitat parameters (watershed condition, water quality, structural habitat) on fish habitat use in impacted and unimpacted tidal tributaries.
3) Developing measurable goals, management recommendations, and a pilot Tidal Tributaries Management Strategy based on study results;

4) Communicating results to managers and the public to support informed decision-making regarding preservation or restoration of tidal tributary habitats.
Study Sites: We compared creeks ("inside" or "trib") with adjacent outside areas ("outside" or "main").
Results Driven By System Type & Estuarine Position

- **Tidal Tributary Types**
  - Tributary
  - Creek
  - Dredged Inlet

- **Distance from the bay’s tidal extent** influenced observed abiotic & biotic responses

Malkin et al. (USF)
Nekton Community Use Was Variable

- Variation in nekton community structure:
  - Among Creeks > Month >> Inside vs. Outside Creek

![Graph showing ANOSIM R Value (Degree of Species Composition Difference)]

- Data Source: FWRI
• Nekton & benthos abundance, nekton & benthos richness, & water quality varied widely by creek.
Common Snook Use Was An Indicator

- Juvenile common snook were much more abundant inside creeks than in adjacent outside habitats, and were rarely or never collected from some creeks. Absence of snook could indicate disturbance of a creek system.

Data Source: FWRI
Nitrogen Pathways Supporting Nekton

- Benthic microalgae (BMA) appeared to be a dominant food source in tidal creeks and was seasonally abundant.
Fish isotopes varied in a predictable manner among creeks; some species appeared to have highly localized habitat fidelity, whereas others had recently spent time outside the creeks.
A number of abiotic indicators of eutrophication increased with increasing landscape development intensity (LDI).

**Graph 1:**
- **Equation:** $y = 3.3034x - 7.5063$
- **$R^2 = 0.688$**
- **$r = 0.83$**

**Graph 2:**
- **Equation:** $y = 8.922x - 11.331$
- **$R^2 = 0.5193$**
- **$r = 0.72$**

**Sediment Relationships**
- Silt-Clay Percentage (+), Heavy Metals (+), PAHs (+), total PCBs (+), Pesticides (+)

**Water Quality Relationships**
- D.O. (+); Turbidity (+), Total N (+), Total P (+)

Data Source: EPCHC
Biotic–Landscape Associations Weak

- Biotic measures (benthos & nekton species richness & abundance) did not correlate with LDI or % impervious cover.
- Benthic species richness & diversity did not vary with LDI.
- Exotic fishes possibly favored disturbed habitats.
- FWRI biologists proposed that inclusion of more strongly altered watersheds would have revealed stronger alteration-related responses by nekton.

Data Source: FWRI
Estuarine Linkages Under Varying Inflows

Low Inflows:
- DIN
- Phytoplankton deposits
- Deposition
- Nitrogen flow
- Denitrification loss

Phytoplankton deposits:
- Trophic intermediates
- Juvenile fish

High Inflows:
- DIN
- Nitrogen recycling

Denitrification loss:
- A
- B
- C
- D

Malkin et al. (USF)
Resulting Management Actions

- Maintaining system connectivity to promote nutrient flux, water flow, and fish movement.
- Reducing “flashiness” of water flow to tidal tributaries.
• Tracking uniqueness of Tampa Bay tidal tributaries (we’ve studied 9 of the 100+)

• Improving public education & stewardship of tidal tributaries
Initial Products

- Technical Summary Document
  - Individual Technical Reports
  - QA Plan
  - Associated Databases
  - Additional Analyses

- 4-Page Full Color Newsletter for General Audience

- [http://www.tbeptech.org](http://www.tbeptech.org)
Next Steps

• Fully Develop Actions & Incorporate into Tampa Bay Habitat Master Plan
  – Tampa Bay Estuary Program Technical Advisory Committee Acceptance
  – Tampa Bay Estuary Program Management Board & Policy Board Approval

• Implement Actions with a Pilot Salinity-Barrier Removal Project

• Scientific Publications
Synthesis of Tidal Tributary Processes

- **Primary Production Pathways**

![Diagram showing sunlight, deposition, and primary production pathways.](image)

- **Scenario A:** Phytodinophagia bloom absent. Benthic microalgae grow deeper. Hypoxia less likely.
- **Scenario B:** Phytodinophagia bloom present. Benthic microalgae restricted to shallows. Hypoxia more likely at depth.
- **Scenario C:** Water color (CDOM) elevated. No blooms. Benthic microalgae restricted to shallows. Hypoxia less likely.
Synthesis of Tidal Tributary Processes

- **Major Trophic Linkages**

---

**Scenario 1.** Benthic microalgal community (BMAC). Scenario is dependent on benthic normoxia and nitrogen from benthic recycling (e.g., middle estuary during dry season).

**Scenario 2.** Benthic microalgal community (BMAC). Scenario is dependent on benthic normoxia and nitrogen from the water column. Assumes CDOM shading at depth (e.g., upper estuary during wet season).

**Scenario 3.** Phytoplankton-based benthic community (PBBC). Requires water-column nutrients, a depositional environment and benthic normoxia (e.g., middle estuary during wet season).

**Scenario 4.** Phytoplankton-based water-column community (PBWC). Requires water-column nutrients; causes benthic hypoxia (e.g., near river mouth during floods). Some nitrogen is removed via denitrification.
Estuarine Linkages Under Low Inflows

- Phytoplankton
- Phytoplankton deposits
- Deposition
- Nitrogen flow
- Denitrification loss
- Benthic microalgae
- Nitrogen recycling
- Trophic intermediates
- Juvenile fish
- DIN
- \( \text{NO}_3^- \) & \( \text{NH}_4^+ \)

Low Inflows

1. Deposition of phytoplankton and phytoplankton deposits.
2. Nitrogen flow from the environment.
3. Denitrification loss of DIN.
4. Hypoxia development due to low oxygen levels.

Phytoplankton deposits contribute to nitrogen flow, which can lead to hypoxia and denitrification loss in estuarine ecosystems under low inflows.
Estuarine Linkages Under High Inflows

- Phytoplankton
- Phytoplankton deposits
- Deposition
- Nitrogen flow
- Denitrification loss
- Benthic microalgae
- Nitrogen recycling
- Trophic intermediates
- Juvenile fish
- DIN, NO₃⁻, NH₄⁺

Diagram showing the interaction of different environmental factors under high inflows, including phytoplankton, nitrogen recycling, and denitrification loss.