Watervliet Dams Removal Monitoring

A Case Study for In-situ Ecological Monitoring In a Complex Non-Wadable River

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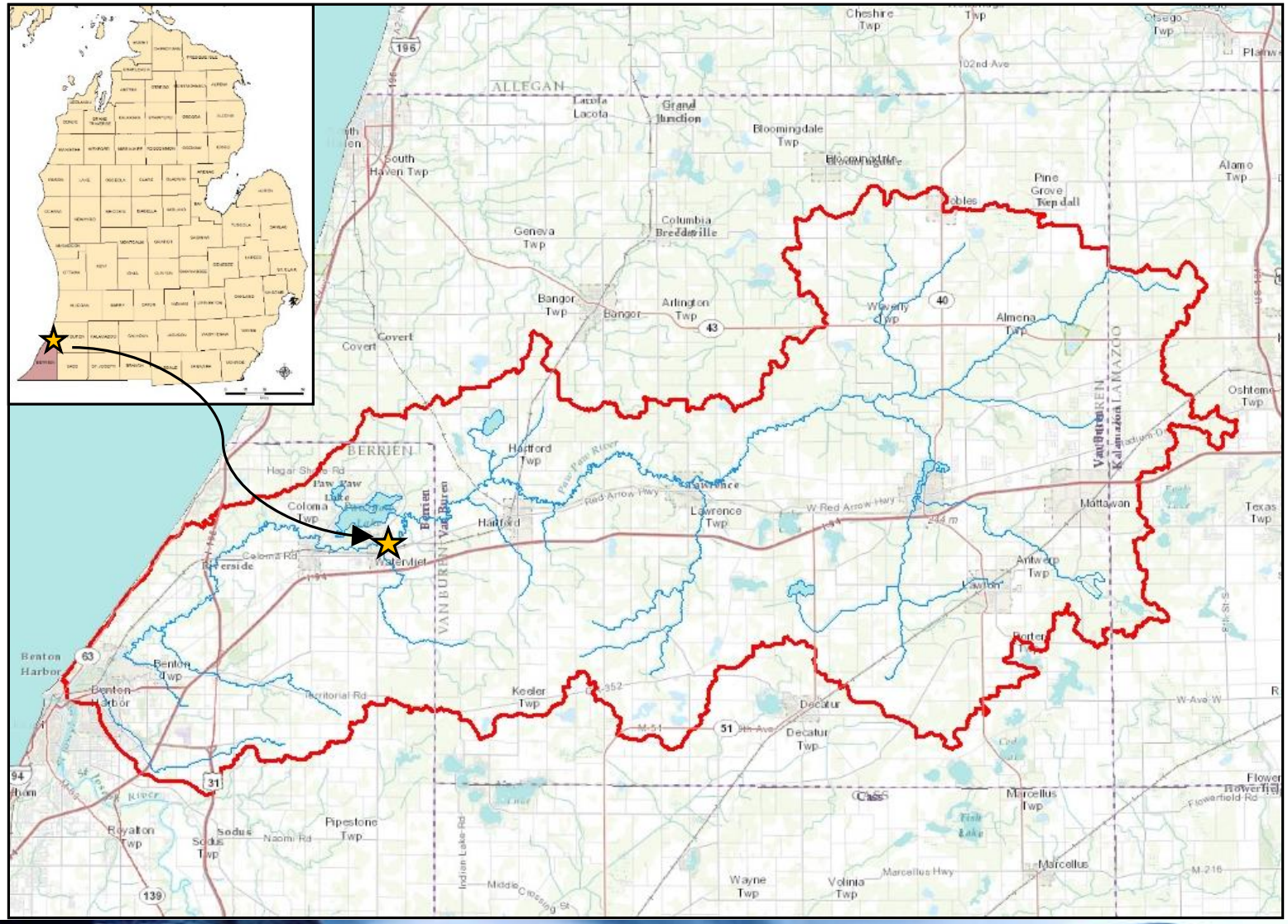
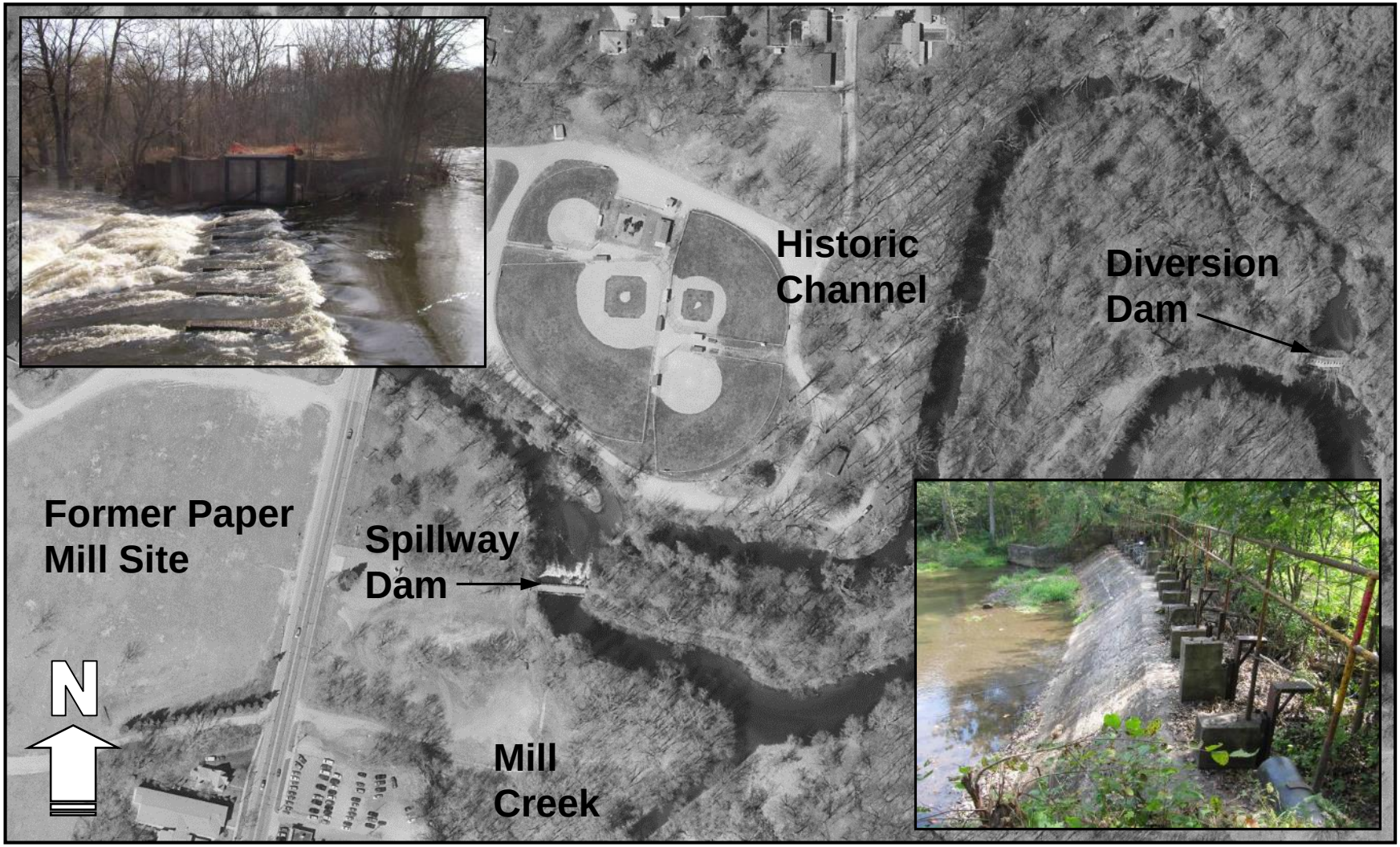
Project Overview

- **Removal of 2 related dams on the Paw Paw River in 2011**
- **Incorporated fish passage and stream restoration**
- **Removal of the second dam restored 2,000 feet of abandoned channel**
- **1 year pre-construction and 2 years of post-construction monitoring**

Project Location



Project Site



Monitoring Overview

- **Fish passage: mark-recapture**
- **Historic channel fish community**
- **Planning**
- **Execution**
- **Evaluation**
- **Adaptive Response**

Purpose

NOAA Habitat Restoration Monitoring

"It is important to monitor and assess restoration projects to ensure that the money, time, and effort invested are being efficiently and effectively spent."

- **Confirm fish passage**
- **Measure historic channel fish community response**
- **Focus on data reliability and power**

Planning

- Scientific Method
- Restoration Targets and Endpoints
- Literature Review
- Quantitative Methods
- Sampling Methods
- Standard Operating Procedures
- Stakeholder Involvement
- Monitoring Plan

Execution

- Maintain consistency with planning
- Standard Operating Procedures
- Staff expertise and training
- Equipment maintenance and calibration
- Thorough preparation
- Field audits
  - Preparation
  - Data completeness

Data Evaluation

- Completeness
- QA/QC
  - Verify accuracy of data entry
  - Verify data completeness, identify missing data
- Adaptive response
  - Reach length could not be achieved
  - Low catch rates
  - Community under represented

Fish Community Monitoring

- **Quantitative Methods**
  - Shannon-Wiener
    - *Hutcheson's (1970) Student's t-test; α = 0.10*
    - *Assumption: Equal sampling effort*
    - *Control sampling distance and time*
  - Species richness
  - Evenness
  - Similarity
  - Effective number of species
  - Species composition

Fish Passage Monitoring

- **Evaluation of Mark-Recapture Methods**
  - White sucker recaptured spring of 2012 2.3 miles upstream of Lake Michigan
  - Marked spring 2011 at M-140; ~25 miles upstream

Fish Community Results

- **Sampled in June of 2011, 2012, & 2013**
- **Number of sucker species increased: 2 (2011) → 5 (2012) → 6 (2013)**
- **2011 and 2012 diversity significantly different**
  - t100 = -1.991, $p < 0.05$, $\alpha = 0.1$
- **2011 and 2013 not significantly different**

Fish Community Results

	2011	2012	2013
Species richness	14	15	14
H'	2.20	2.51	2.27
$e^{H'}$	8.98	12.34	9.67
Evenness	0.83	0.93	0.86
	2011-2012	2012-2013	2011-2013
Sørensen's S	0.48	0.69	0.36

- **2011 and 2012 diversity significantly different**
  - t100 = -1.991, $p < 0.05$, $\alpha = 0.1$

Conclusions

- **Dominant species shift from lotic to lentic - required 2 years**
- **Number of sucker species increased: 2 (2011) → 5 (2012) → 6 (2013)**
- **2011 and 2013 have similar diversity**
- **Species composition quite dissimilar**

Conclusions

- **11 of the 14 species in 2013 were new species**
- **Dominant species shift:**

2011	2012	2013
Bluegill (22%) Pumkinseed (19%) Spotted sucker (15%)	Golden redhorse (20%) Bluegill (11%) White sucker (11%)	Golden redhorse (20%) Shorthead redhorse (18%) White sucker (18%)

Lessons Learned

- **Habitat complexity**
- **Fish sampling efficiency**
- **Multiple sampling years**

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- **My colleagues at ECT**

Contact Information

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In memory of Gary Crawford – always a friend, before anything else.