GIS-BASED MODELING OF SPAWNING HABITAT SUITABILITY FOR WALLEYE IN THE SANDUSKY RIVER, OHIO, AND IMPLICATIONS FOR DAM REMOVAL AND RIVER RESTORATION

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Paper Outline

- Introduction
- Study location and species description
- Methods
- Results
- Conclusion

Introduction

- Habitat Concerns
- Habitat Suitability Index (HSI) Modeling
- Modeling for Hydrology
- GIS and HSI Modeling

Study Objectives

- To develop a habitat suitability model that is user-friendly and can be transferred to other river systems in an ArcGIS V 9.0 format.
- To produce GIS maps of habitati suitability and record the total availability of habitat for the study reach for each time step of the hydraulic model.
- To validate the model using in situ data on depth, velocity and egg density collected during the 2004 spawning season in the Sandusky River.

Study Area and Target Species

- Sandusky River in North Central Ohio
- Walleye (*Sander vitreus*)
- Dam Influences on Regional Habitat

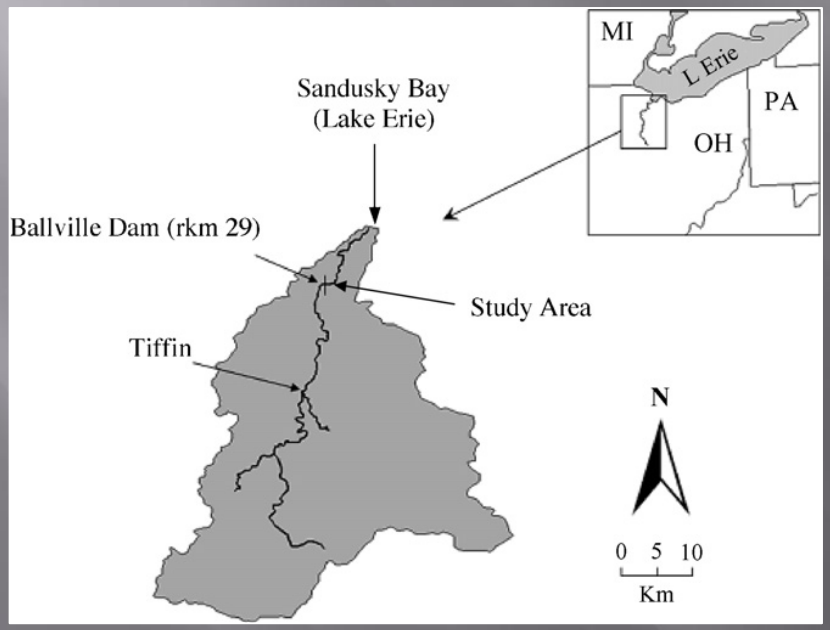

Fig. 1 – Map of the Sandusky River watershed.

http://www.fishfry.com/seawolf/sw-02195a.JPG

Fig. 2 – Aerial photograph of the Sandusky River between river kilometer (rkm) 29 and 27 showing the location of the study area relative to the Ballville Dam.

Methods

- Input Data
  - Channel and floodplain survey
  - Hydraulic measurements
  - DEM creation
  - Suitability Curves for important habitat variables
- Model Development
  - Depth module
  - Velocity module
  - HSI module
- Weighted usable area
- Validation/Calibration

$$Manning's\ n = \frac{d^{2/3} \times S_o^{1/2}}{u}$$

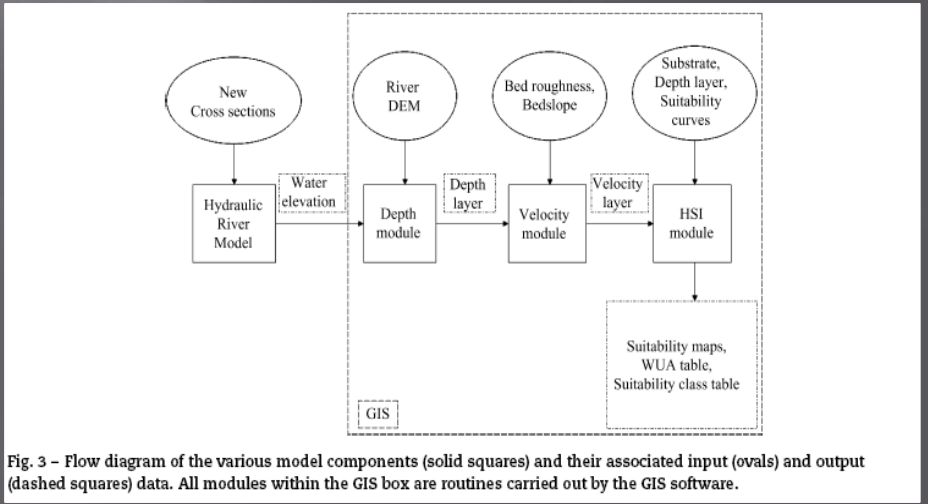

Fig. 3 – Flow diagram of the various model components (solid squares) and their associated input (ovals) and output (dashed squares) data. All modules within the GIS box are routines carried out by the GIS software.

Results

- Calibration
- Validation
- New Velocity Suitability Curve Developed

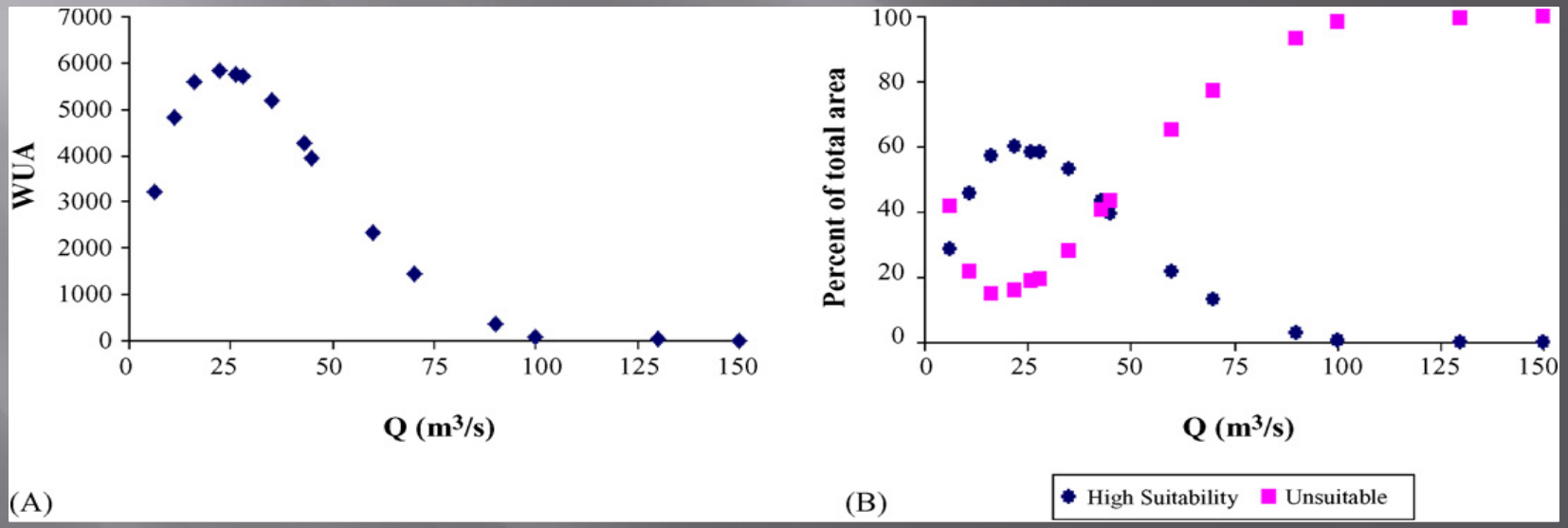

Fig. 8 – (A) The relationship between WUA and discharge in the study area. (B) The relationship between the percent of the total habitat area in the high suitability and unsuitable classes for a given discharge.

Results continued

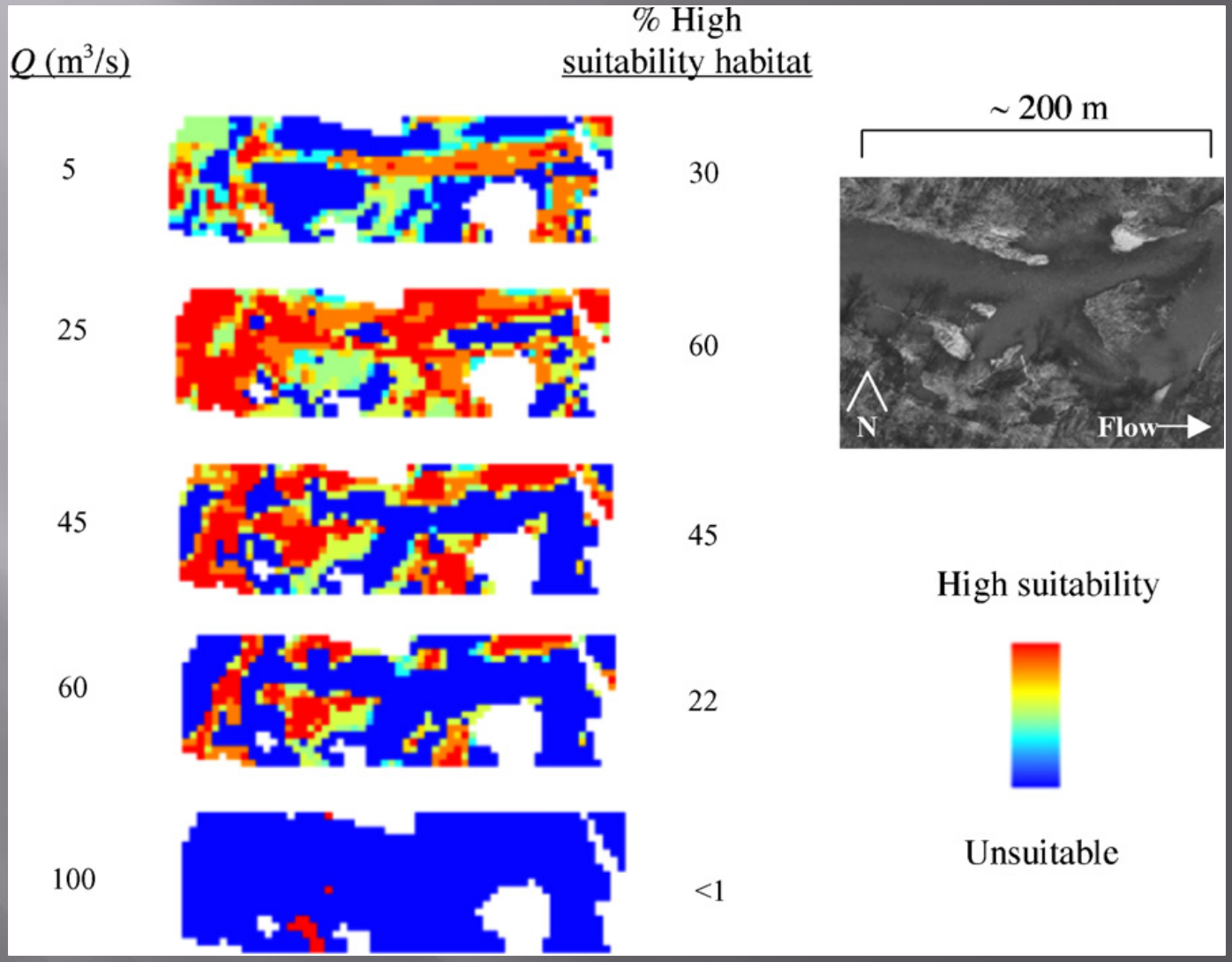

Fig. 9 – HSI maps of the study area (shown in the inset photograph) produced by the model for a range of discharges.

Conclusion

- Evaluation
  - Overall module automation
  - 1-D hydraulic model integration
  - Depth module
  - Velocity module
  - HSI module
- Sources of error
  - Complex geometry vs cell size
  - Manning's n calibrated at lower depths than validation
  - 2-D models
  - Weak depth correlation
  - Spawning season floods

Questions?