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ABSTRACT

Drawdown is a common lake management technique, which involves a controlled water level reduction. I studied the effects of a six vertical feet drawdown on the Hanover Pond ecosystem in Meriden, CT, where a new hydroelectric dam was being installed. Abiotic and biotic data were collected in the form of water quality measurements and avian community observations. The water quality measurements focused on conductivity and salinity, and avian community data comprised species richness and species abundances of year-round birds.

I found that during drawdown, conductivity and salinity increased, and species abundance and richness decreased. What was particularly interesting was the significant change in water quality within a short time span of 4 months. This finding alone emphasizes the potential temporary negative effects that drawdown may bring on a freshwater ecosystem.

INTRODUCTION

Water level drawdown is a lake management practice widely used across the world for the construction/repair of hydropower apparatus, to control invasive plants, protect shorelines from erosion, and many other reasons (1). Drawdown is the process of lowering the water level of a lake through means of opening a dam or gates. The potential effects of drawdown can be changes in water quality, and major fluctuations in wildlife and aquatic life populations due to temporary habitat loss (1).

Drawdown was used in Hanover Pond—a 70 acre man-made pond that is a part of the Quinnipiac River watershed—in Meriden, CT (Fig. 1). It is inhabited by many species of birds, drawing the attention of many birders. In September 2016, six vertical feet of water were drawn out of the pond via the opening of a dam, for the purpose of a hydropower project (Fig. 2). Concerns were voiced by the community about potential harm to wildlife that inhabit the pond.

Working with the Quinnipiac River Watershed Association and Cheshire Land Trust, I assessed the impacts of drawdown on abiotic (water quality) and biotic (avian community structure) aspects of the pond. I predicted that the drawdown would cause a decrease in water quality and a decrease in the number and abundance of birds using the pond.



Fig 2. (Top Left) Hanover Pond before drawdown. (Top Right) Hanover Pond one week after drawdown; the pond was reduced to two major pools of water and two small, shallow streams. (Lower Left) Former dam at Hanover Pond. (Lower Middle) Taking water quality measurements using a YSI. (Lower Right) Construction of the Archimedes Screw hydropower dam, which was the reason for the drawdown.

METHODS

- Study was conducted at Hanover Pond (Figs 1 & 2) from September to December of 2016.
- Data were collected before the drawdown (Sept 13), twice during the drawdown (Sept 22, Oct 12) and once after water levels returned (Dec 4).
- Data were recorded at 3 different locations (Fig. 1): south side, center of the pond, and north side.
- During each survey period and at each survey location the following data were collected:
 - Water quality—conductivity, salinity, pH, DO, and water temperature were recorded using a YSI meter (Fig. 2).
 - Avian community—10 minute point count survey was conducted in which species and relative abundance was recorded for year-round birds (excluding song birds; Fig. 5).

WATER QUALITY RESULTS

- pH remained unchanged with readings ranging from 8.72-8.79.
- Dissolved oxygen decreased sharply from 13.70 mg/L (Sept 13) to 7.38 mg/L (Sept 22) shortly after the drawdown, but increased with time to 11.99 mg/L (Dec 4).
- Conductivity increased shortly after drawdown, but decreased with time (Fig. 3a).
- Salinity increased during drawdown as well (Fig. 3b; note: large jump in salinity at point 3 may be due to road salts from nearby parking lot); salinity not recorded in December.

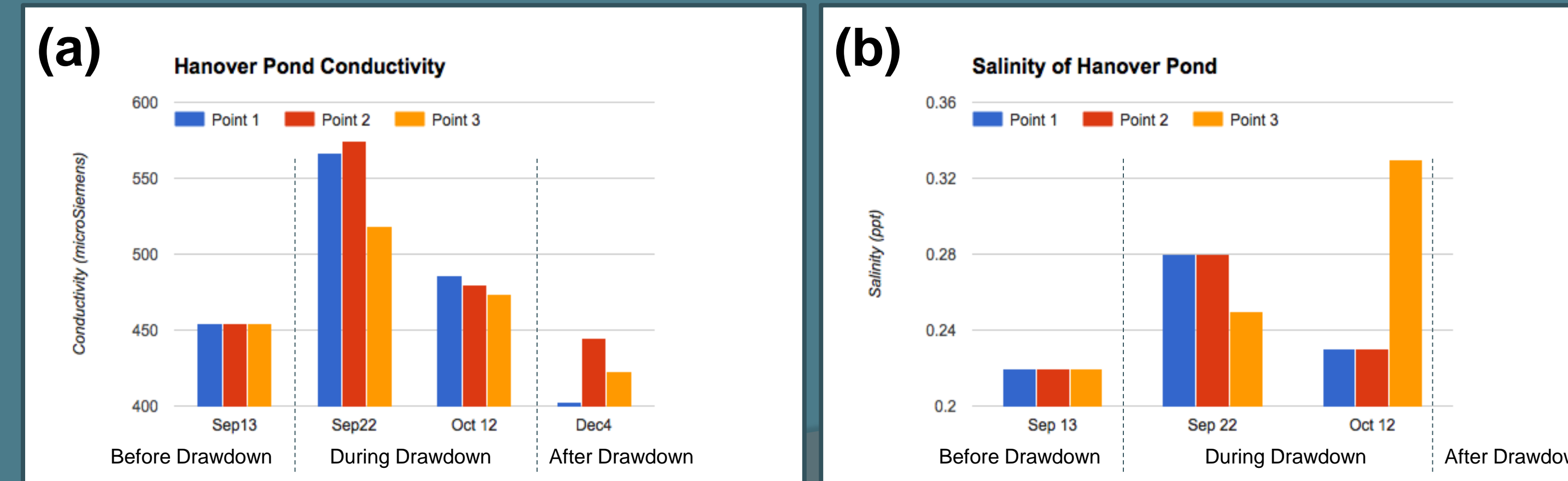


Fig 3. (a) Conductivity of Hanover Pond taken at 3 locations before, during and after drawdown. (b) Salinity of Hanover Pond taken at 3 locations before and during drawdown.

AVIAN COMMUNITY RESULTS

- Shortly after the drawdown, species abundance was at its highest, but declined over time (Fig. 4a)
- Species richness also decreased with over time (Fig. 4b)

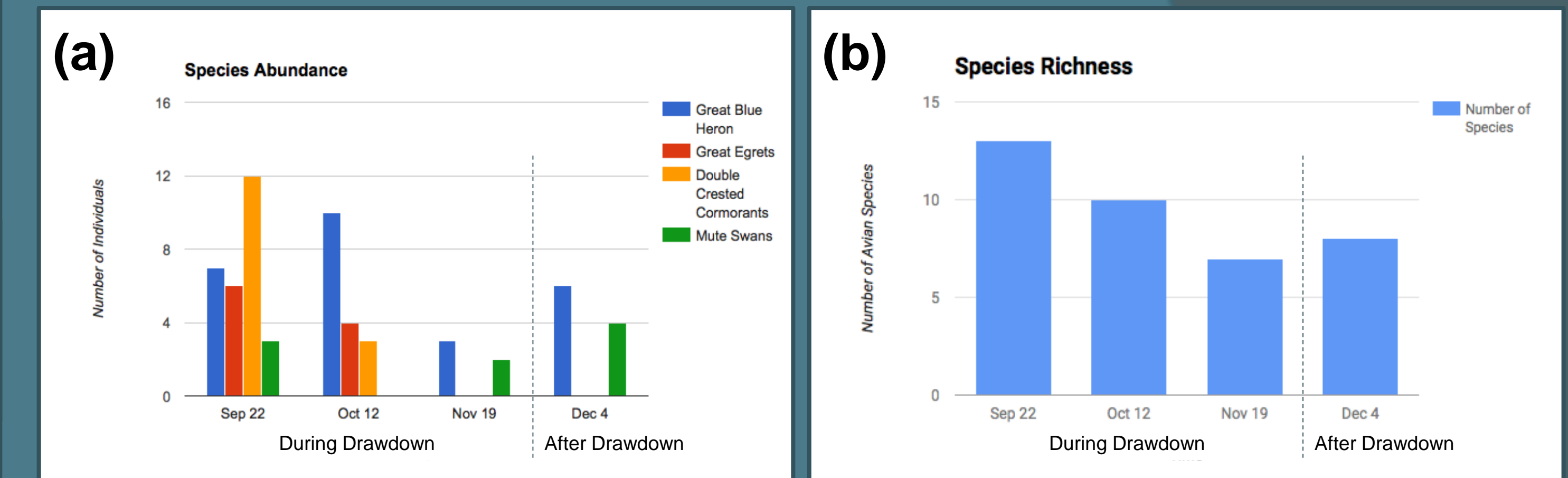


Fig 4. (a) Species abundance of the four most common bird species during and after drawdown. (b) Species richness of all observed bird species (excluding songbirds) during and after drawdown.



Fig 5. (a) Great Blue Heron at Hanover Pond. (b) Bald Eagle at Hanover Pond. (c) Great Egret, a species often seen at Hanover Pond.

CONCLUSIONS

- Salinity and conductivity was slightly higher during drawdown.
 - All measurements were within the typical range for freshwater systems and lower than brackish water (2).
 - High conductivity and salinity can cause stress and death for some organisms (2).
- The increase in species abundance of the avian community after drawdown was most likely due to fish being more densely congregated into the smaller pockets of water.
- The subsequent decline in species abundance can be attributed to decline in prey from the increased predation after drawdown.
- Both the slight decrease in water quality and species abundance of the avian community show that drawdown did lead to temporary negative effects in Hanover Pond; accordingly, duration of drawdowns should be minimized if possible.

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1. Washington State Department of Ecology. 2016. Control - Water Level Drawdown. [accessed 25 January 2017] <<http://www.ecy.wa.gov/programs/wg/plants/management/drawdown.html>>
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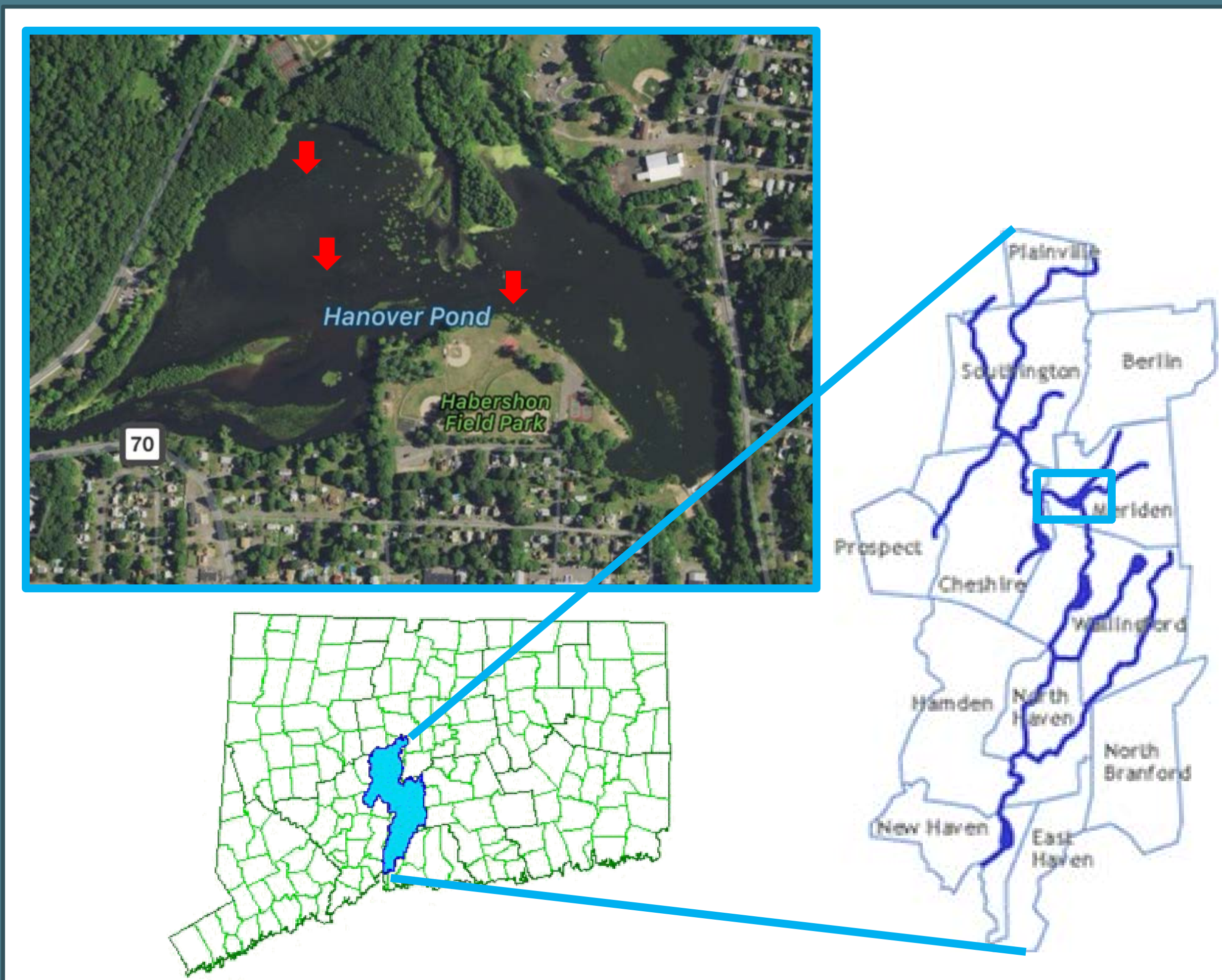


Fig 1. Hanover Pond (aerial image in upper left corner) is located in Meriden, CT in the Quinnipiac River Watershed (map to the right). The Quinnipiac Watershed is located in central-south central CT (map in lower left corner). Red arrows indicate data collection points.