

# FISH COMMUNITY STUDIES

## Distributions of Predatory and Forage Fish in Lake Winnipeg Affects of Abiotic Factors

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### OBJECTIVES

- To determine the distributions of predatory and forage fish in waters with varying oxygen and light conditions in Lake Winnipeg.
- To compare results with similar research conducted coincidentally in Delta Marsh.

### METHODS

#### Fish Collection

Fish were collected by trawl from waters ranging from normoxic to hypoxic and from turbid to clear.

Species were sorted on-board and counts of large fish (predators and large grazers) were recorded. Abundances of forage species were determined in the lab since on-board counts were impossible owing to the size of some catches.

Collections of large fish totaled one to two hundred individuals across all three cruises (counts and lengths were recorded for large predators and then individuals were released) while several thousand forage fish were captured, frozen and counted (this was a combined effort with Franzin and Watkinson above).

#### **Gear comparison - side-beam trawl vs. gillnets** (June 11<sup>th</sup>, 2003) – George's Island.

The strong northward current east of George's Island provided uniform levels of oxygen (mean +/- 1.96 SE: 12.3 +/- 0.03 mg/L) and turbidity (7.67 +/- 0.04 NTU) in which to compare the two gears. At each of 3 sites (north-east, east and south-east of George's Island), a gillnet (2 h duration) was set running east-west, across the current, in mid to deep waters. While the gillnet fished, 3 trawls (30 min duration each), 1 shallow, 1 mid-water, 1 deep-water (when a deep trawl was considered unsafe it was randomly re-assigned as either a shallow or mid trawl) were run beside and perpendicular to the gillnet beginning either north or south such that the gillnet was directly abeam in mid-trawl.

#### **Turbidity study** (June 14, 2003)

This involved a series of trawls in the South basin of Lake Winnipeg in a line running north-west from Victoria Beach to Gimli harbour. Nine trawls were completed (3 groups of 3 trawls, each consisting of 1 shallow, 1 mid and 1 deep trawl) with the first 3 occurring in turbid water (~20 NTU), the second 3 in moderately turbid water (~10 NTU) and the final 3 in very clear water (~0 NTU).

**Physical and chemical water parameters** (temperature, turbidity, dissolved oxygen (DO)) were continuously quantified and will permit examination of the effects of abiotic factors on the distributions of predatory and prey fish to a lake-wide level (this was a combined effort with Stainton, see water chemistry), providing a scalar expansion upon similar research conducted coincidentally in Delta Marsh, Manitoba.

A YSI 6920 data sonde and a submersible camera were mounted in the center of the top bar of the side-beam trawl during the second cruise and remained in use for the entire third cruise. The data sonde collected continuous temperature, turbidity and DO data at the mouth of the trawl for comparison with the on-ship data collection. The camera was mounted to provide a view of the water immediately in front of the trawl mouth to detect trawl avoidance by large piscivores. The

majority of the video footage was non-informative because of high turbidity levels but several instances of trawl avoidance were noted in clear water.

## **RESULTS**

Trawl collections have been analyzed and reported in Franzin and Watkinson above.

### **Differences in Species Distributions**

North basin

- Forage species were dominated, both in numbers and biomass, by rainbow smelt. Occasionally other forage species were collected, including emerald shiners, nine-spine sticklebacks and troutperch.
- Predators and large grazers included walleye, sauger, yellow perch, cisco, longnose sucker, white bass, whitefish and goldeye.

South basin

- Forage species were dominated by emerald shiners with occasional appearances of rainbow smelt and troutperch. Large numbers of young-of-year emerald shiners were collected in the South basin during the second cruise.
- Predators and large grazers included walleye, sauger, cisco, goldeye, yellow perch, white bass, drum and black crappie.

### **Gillnets vs Trawls**

Gillnets

- caught greater numbers of piscivores (walleye, sauger) and benthic grazers (whitefish, not caught in trawls)

Trawls

- collected prey species (rainbow smelt, emerald shiners) as well as smaller piscivores (yellow perch).

### **Turbidity**

Emerald shiners accounted for the vast majority (by numbers and biomass) of the catch in each of the trawls. The turbid waters were characterized by large numbers of small emerald shiners in the surface trawl with numbers declining with depth. As turbidity decreased, the size of the emerald shiners increased (fewer YOY were caught) and the abundant catches shifted from the surface to the mid-water trawl.

Vertical chemical and physical profiles during the second cruise found stable thermal stratification of waters in the northern basin of Lake Winnipeg with hypoxic bottom waters (14 – 16 m depth).

## **CONCLUSIONS**

The data from the side-beam trawl will be used in conjunction with physical parameter values to examine the relationship between distributions of various fish species (predators and prey) and environmental factors (temperature, turbidity, dissolved oxygen). These results are part of a larger project involving field manipulations at the University of Manitoba Delta Marsh Field Station and lab experiments conducted at the University of Manitoba, all of which address the effects of abiotic factors on predator prey interactions.