Fisheries and Water Quality

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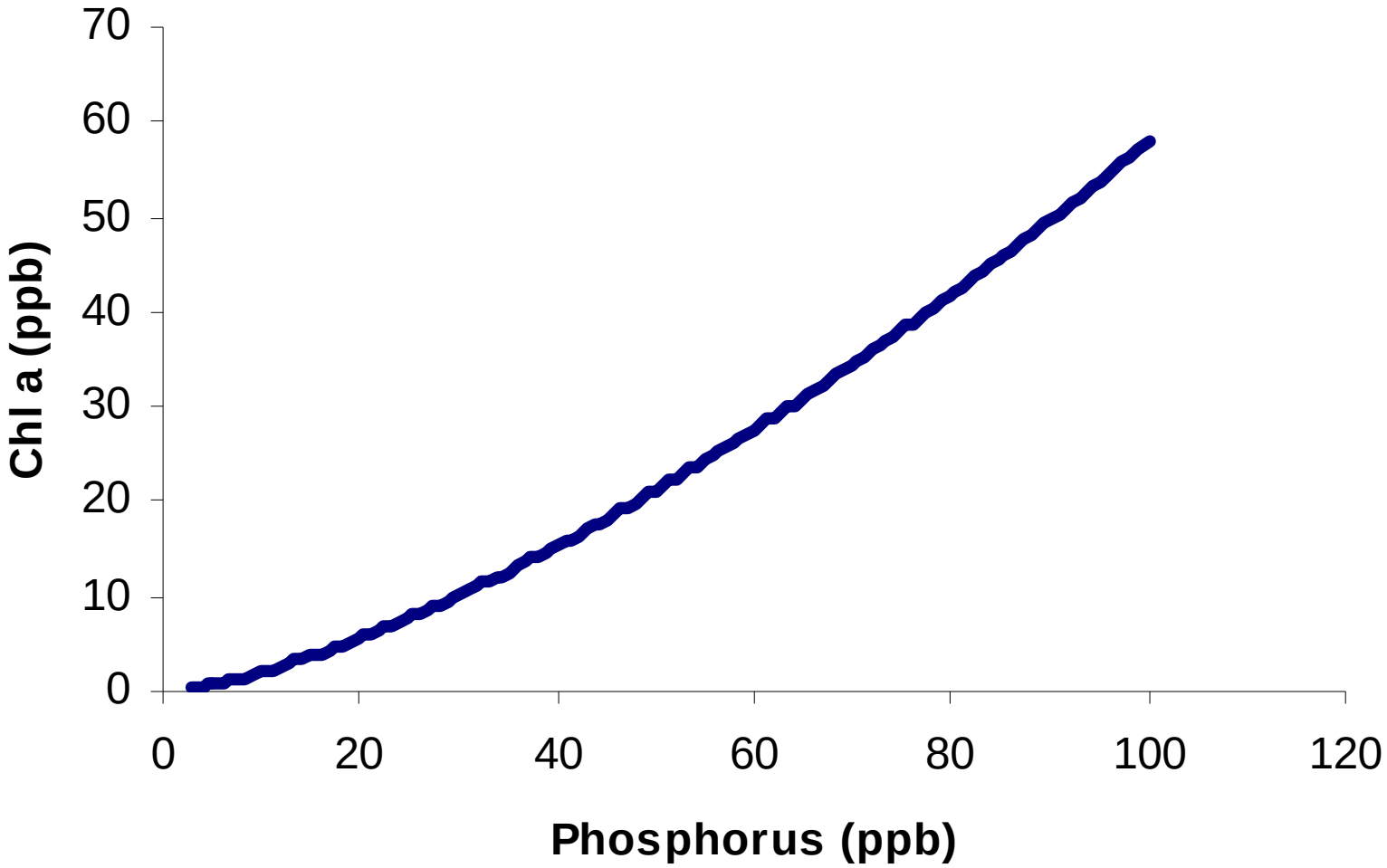
Outline

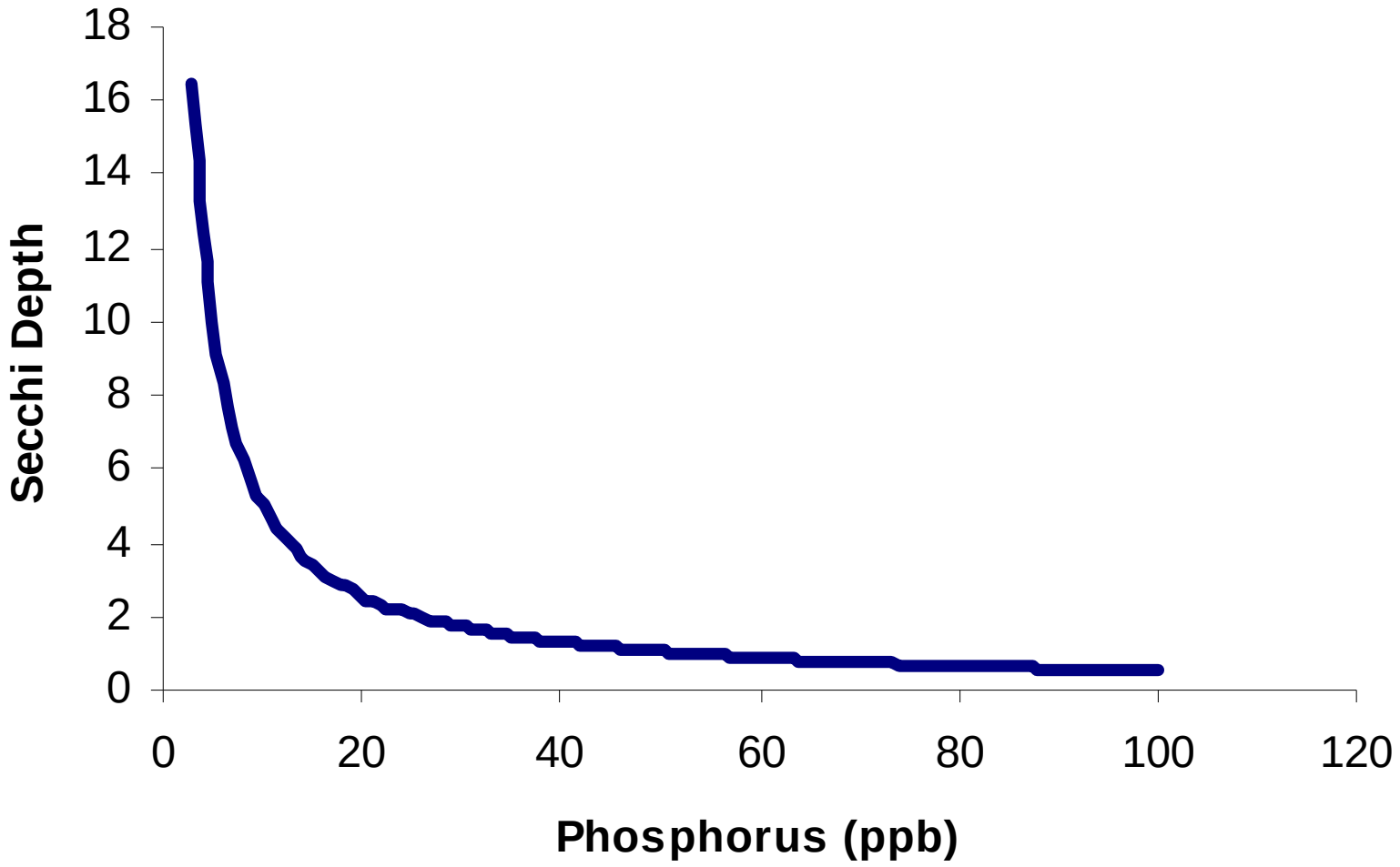
- Nutrients and Water Quality
- Nutrients and Aquatic Plants
- Nutrients and Fish
- Challenges to Management

Phosphorus and Chlorophyll



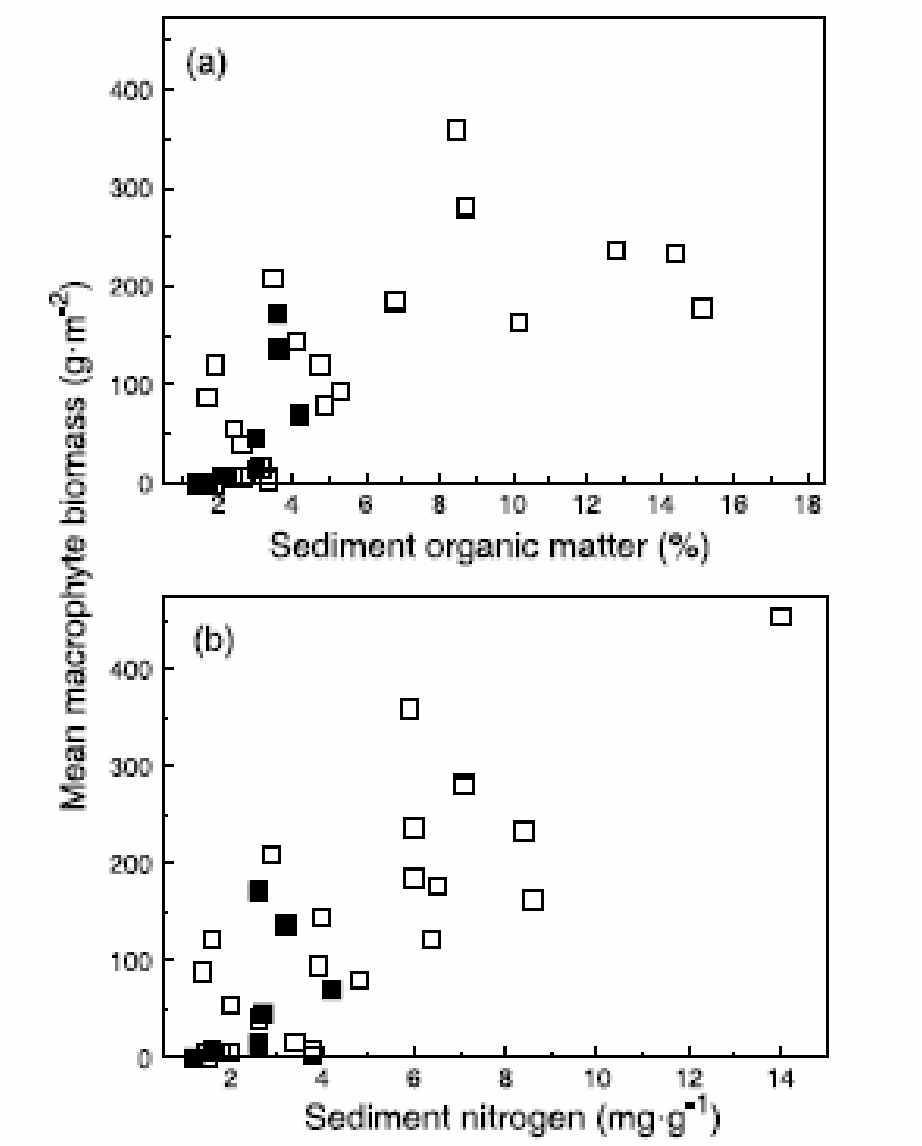
Carlson 1977 A trophic state index for lakes

Phosphorus and Water Clarity



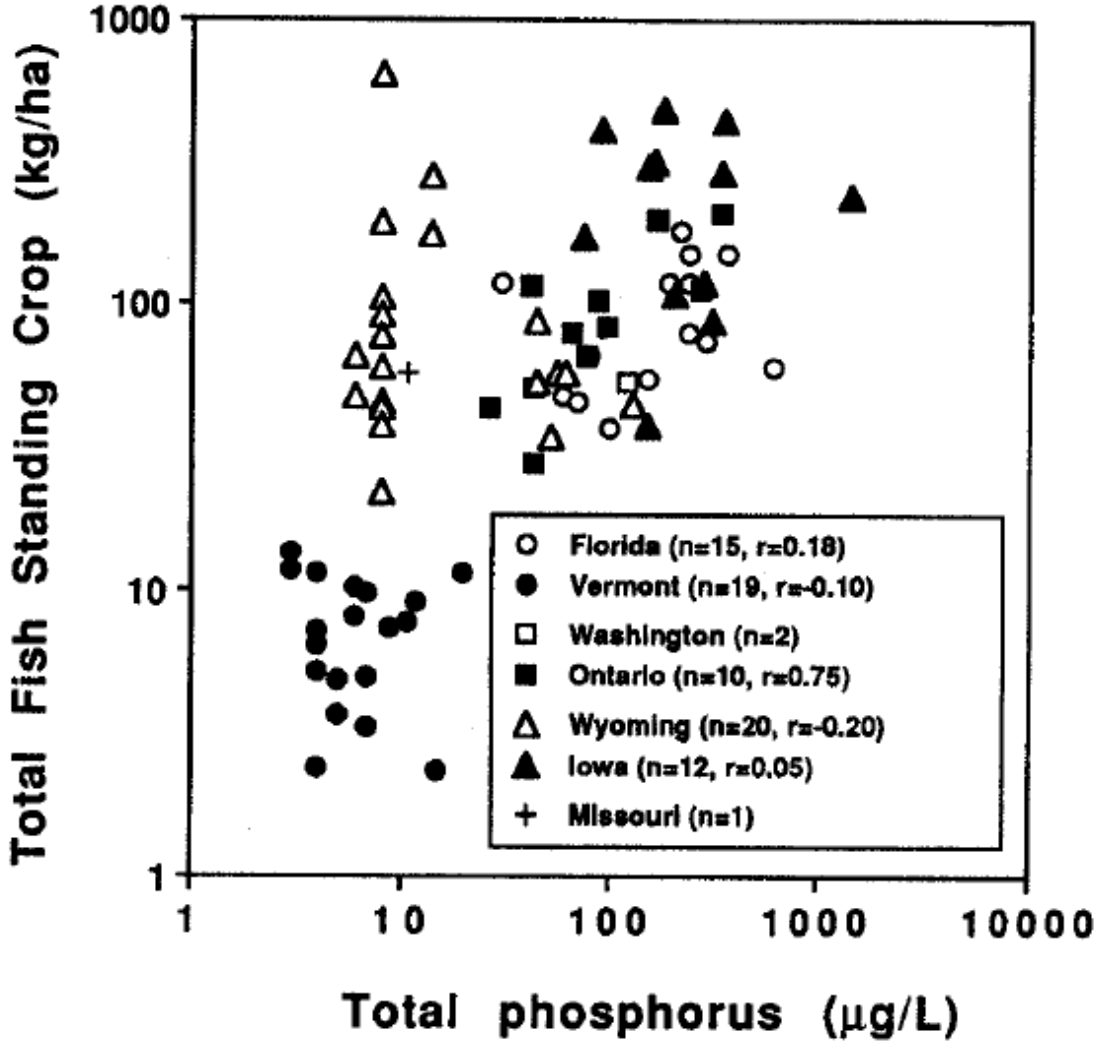
Carlson 1977 A trophic state index for lakes; Dillon and Rigler 1974

Nutrients and Macrophyte Biomass



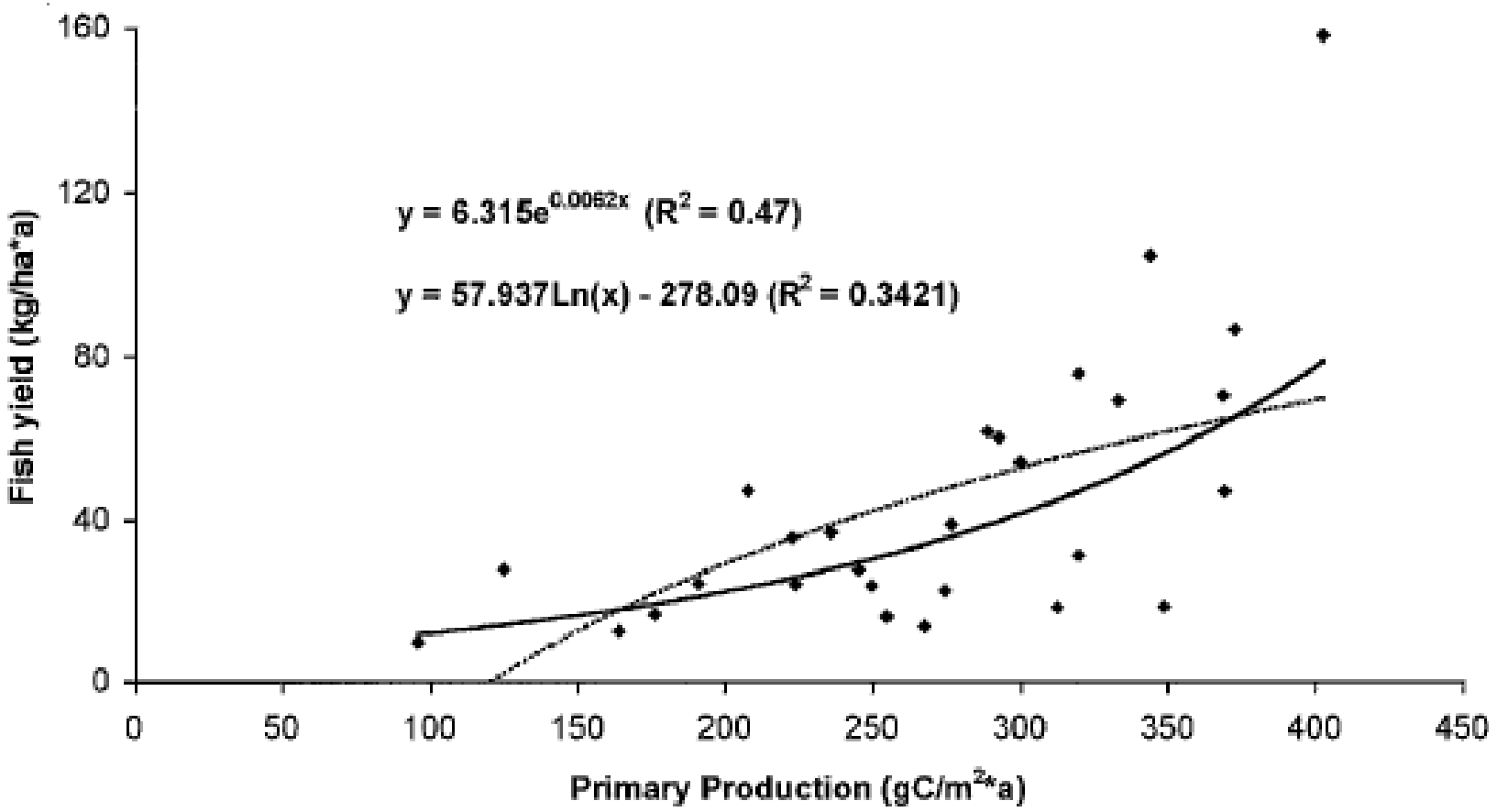
Margaret M. Squires and Lance F.W. Lesack. 2003. The relation between sediment nutrient content and macrophyte biomass and community structure along a water transparency gradient among lakes of the Mackenzie Delta

Fish Standing Stock in Streams



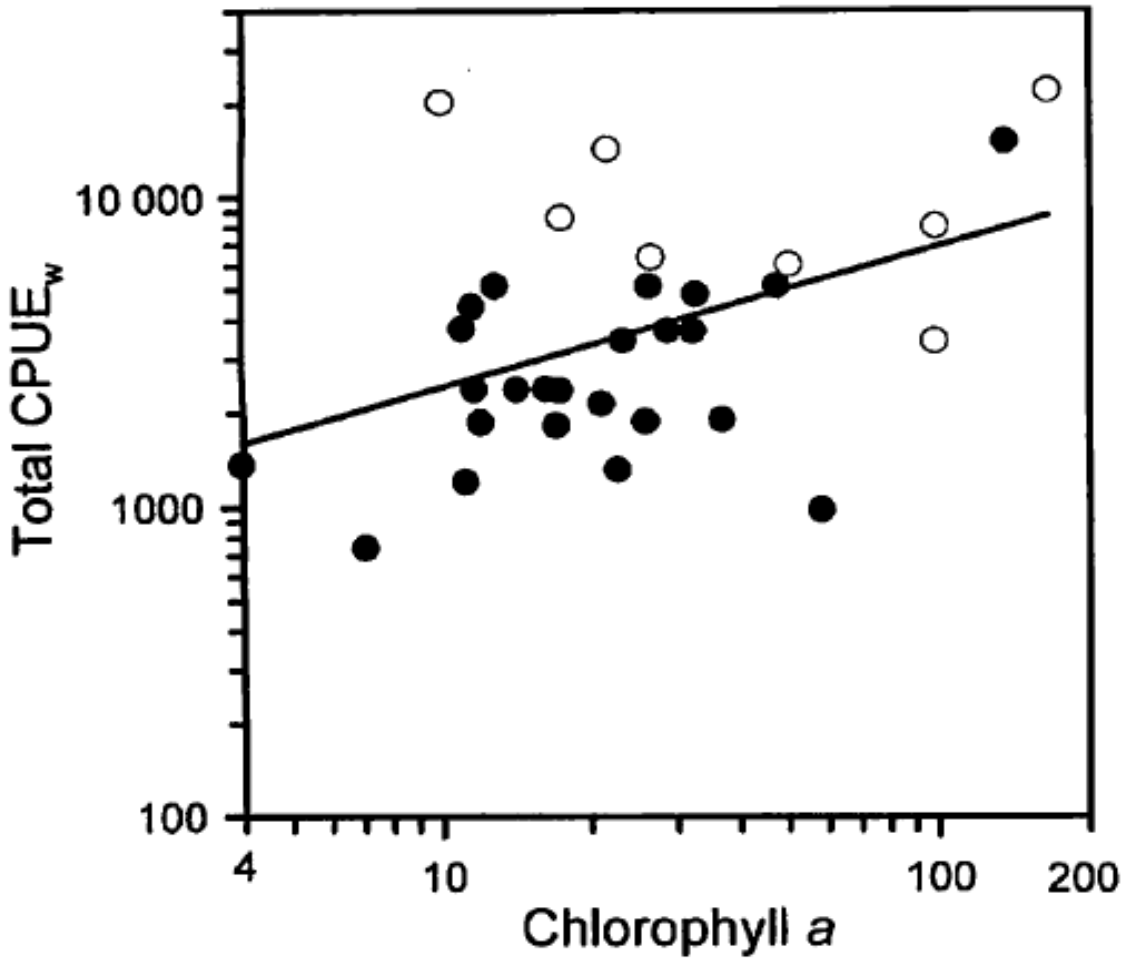
Hoyer and Canfield. 1991. A phosphorus-fish standing crop relationship for streams?

Fish Yield and Primary Production



Bramick and Lemcke. 2003. Regional application of a fish yield estimation procedure to lakes in north-east Germany

Fish Catch and Chlorophyll



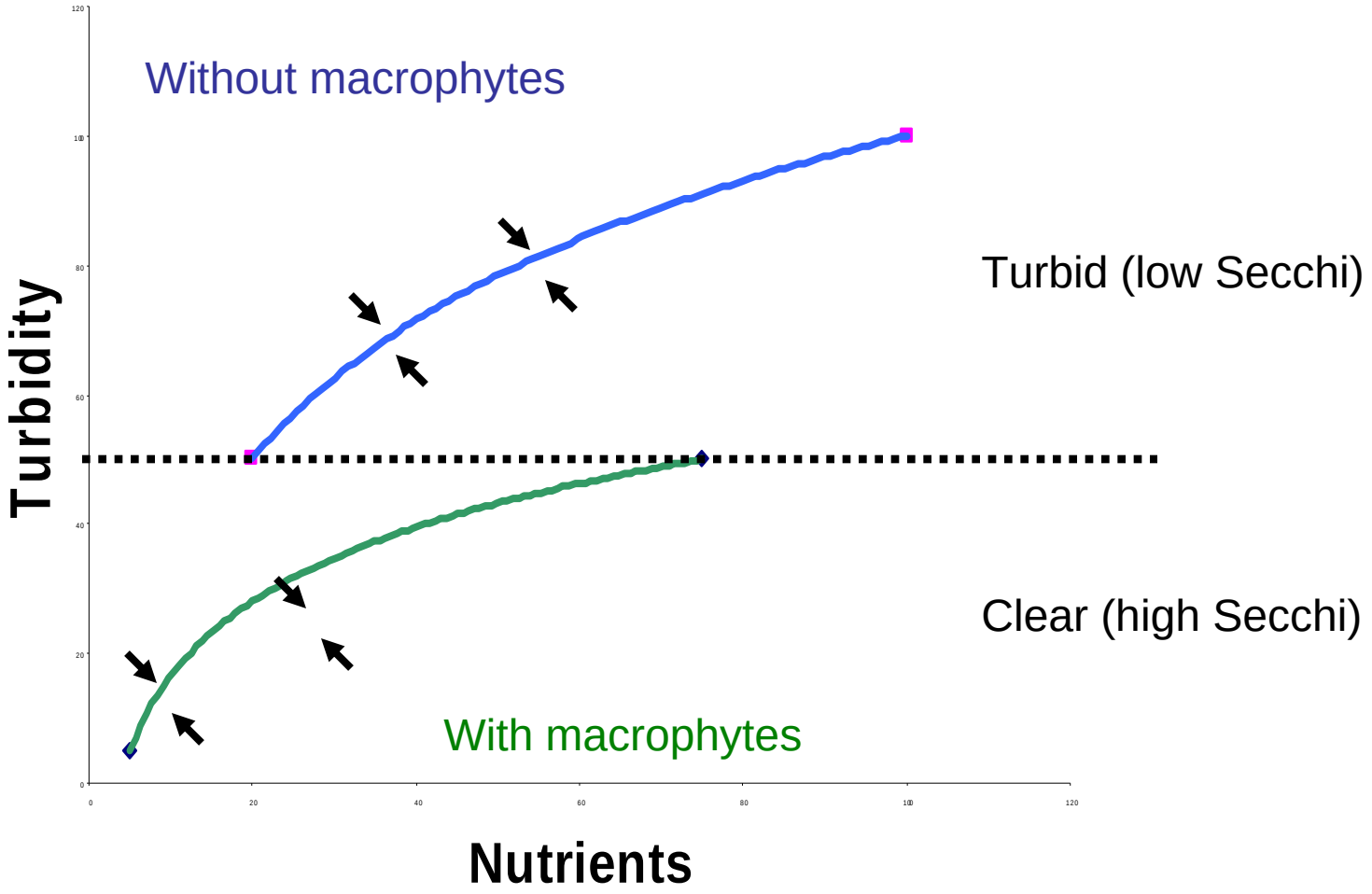
Egertson and Downing. 2004. Relationship of fish catch and composition to water quality in a suite of agriculturally eutrophic lakes

Ecological Complexity

- So far, we've focus on single factor at a time
- Many other physical and chemical factors important
  - Lake size, lake depth
  - Stratification
  - etc.
- Biological interactions also important

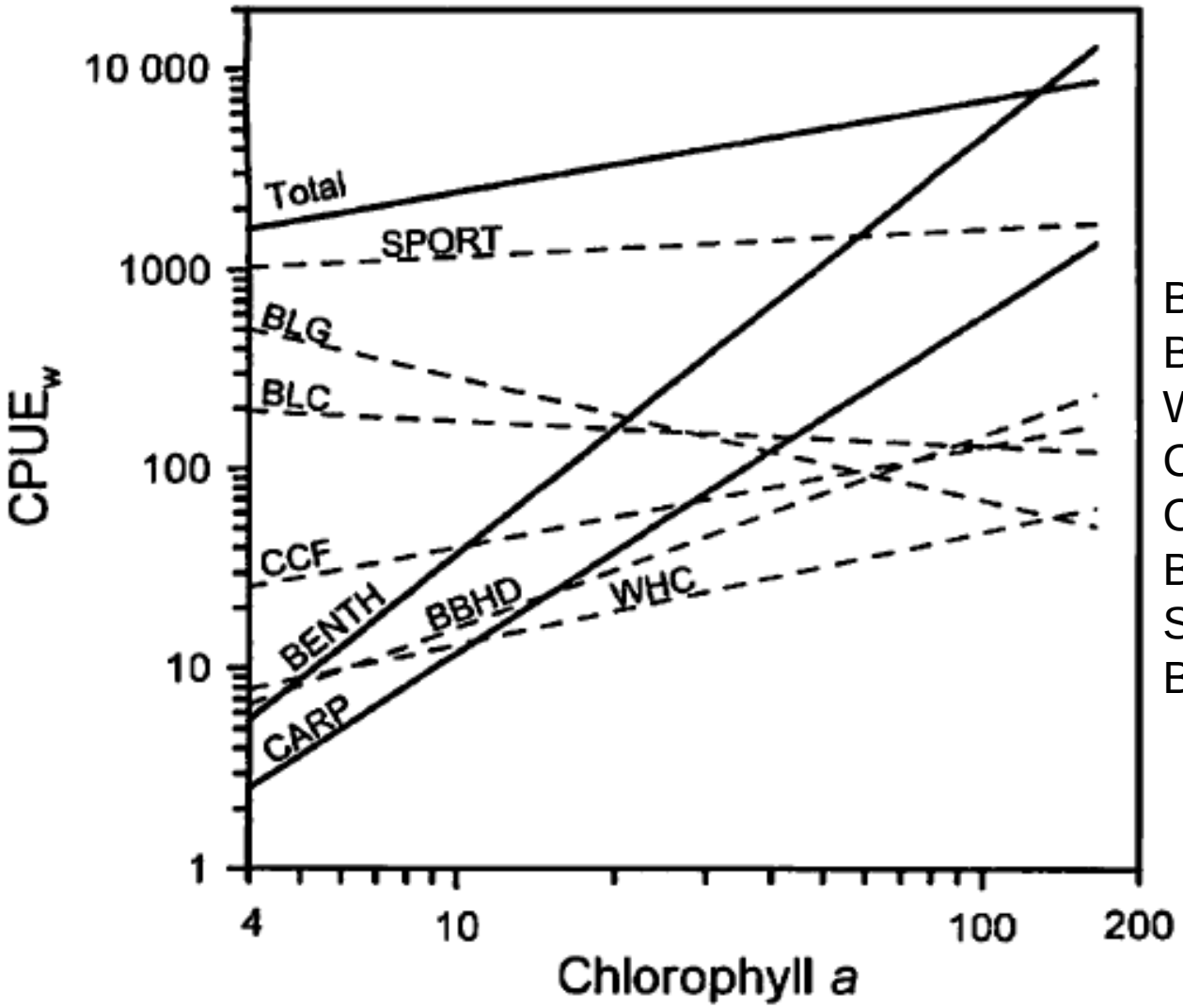
Regime Shifts

Phytoplankton vs macrophytes



Based on Jackson, LJ. 2003. Macrophyte-Dominated and Turbid States of Shallow Lakes: Evidence from Alberta Lakes

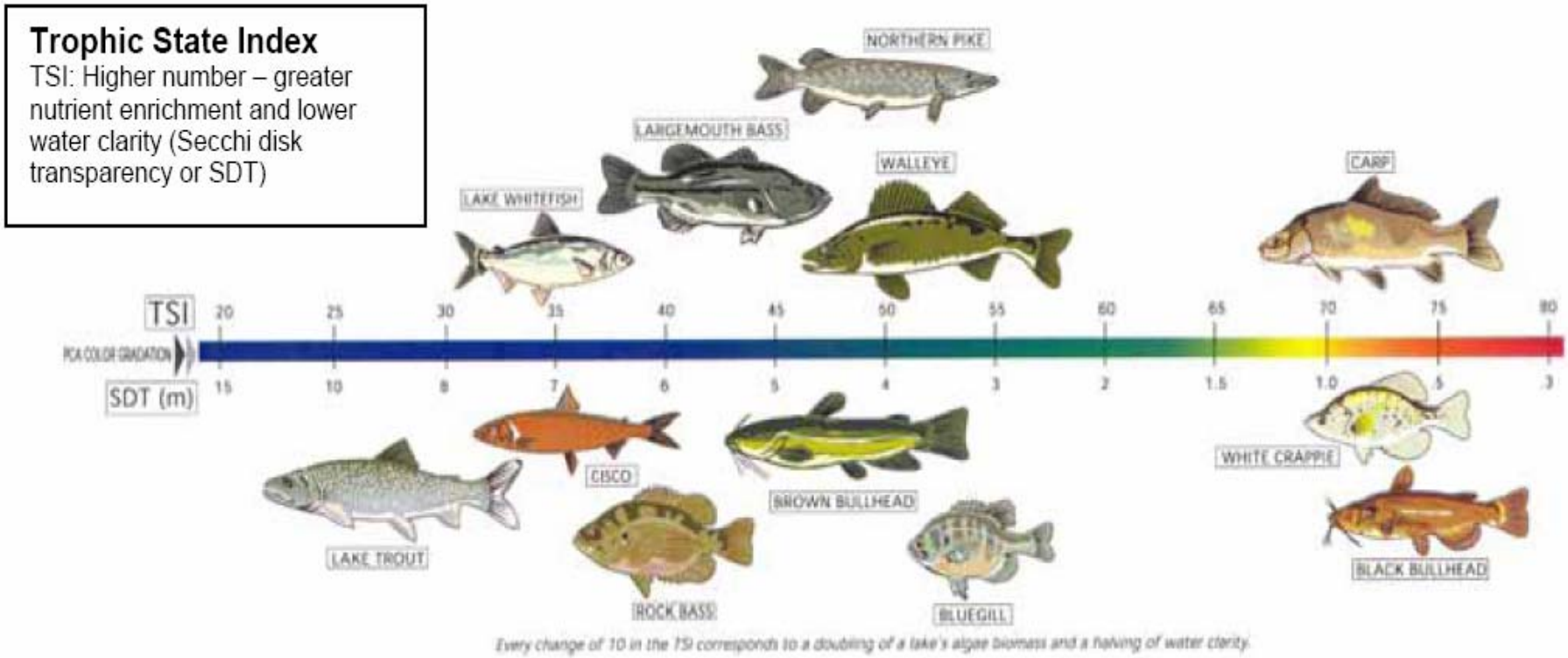
Fish Catch and Chlorophyll



BLC: black crappie
BLG: bluegill
WHC: white crappie
CCF: channel catfish
CARP: common carp
BBHD: black bullhead
SPORT: sport fish group
BENTH: benthivore group

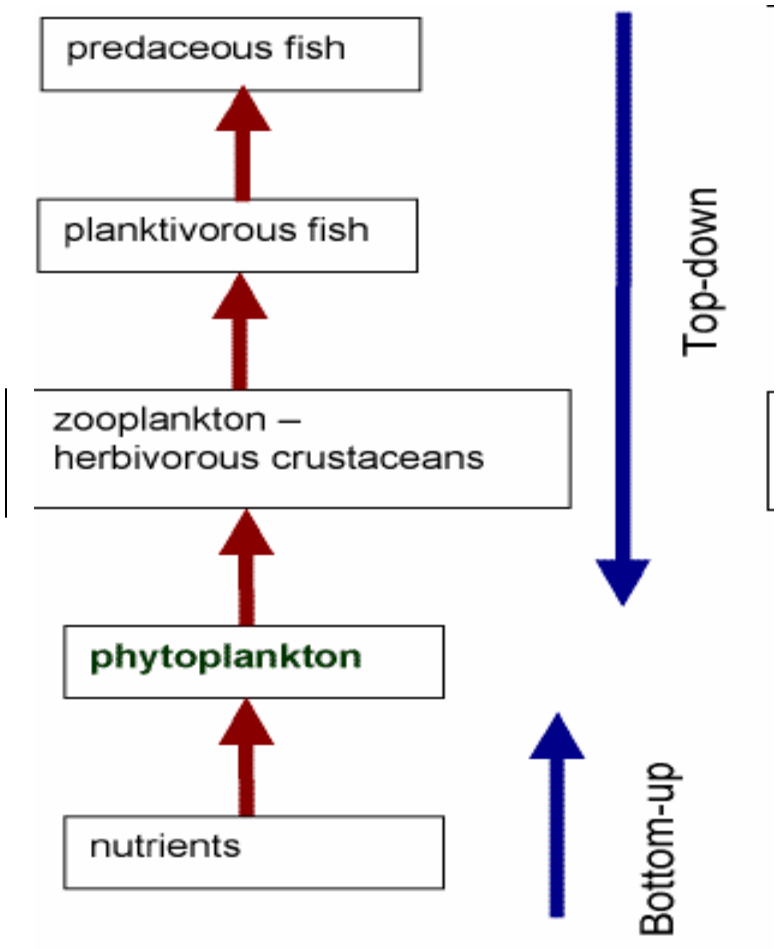
Egertson and Downing. 2004. Relationship of fish catch and composition to water quality in a suite of agriculturally eutrophic lakes

Fish Community Changes



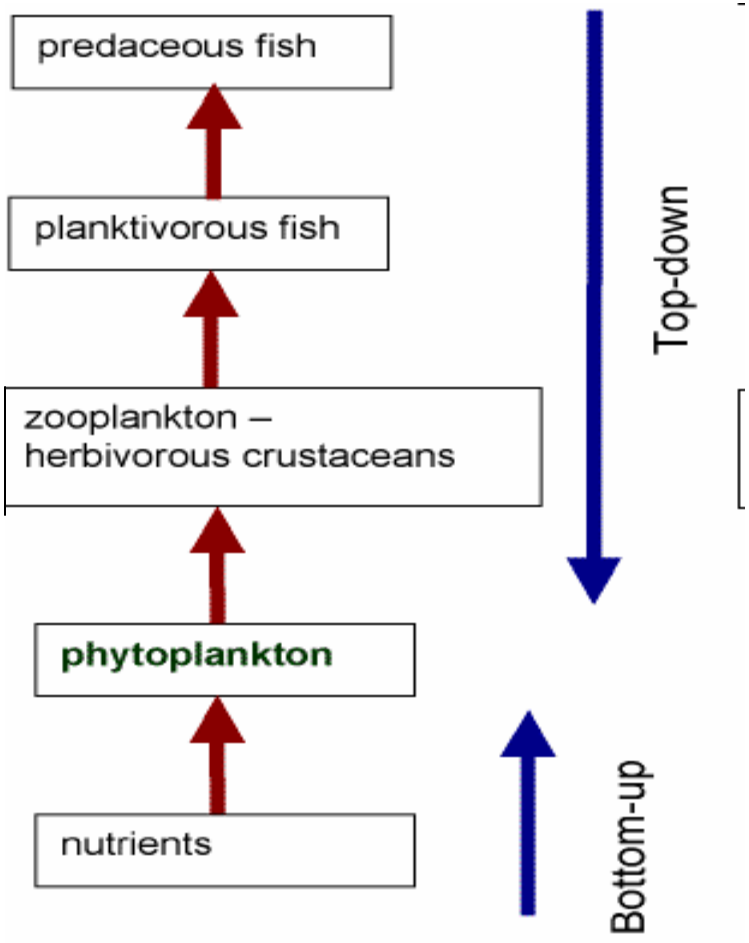
MN Pollution Control Agency. 2008. Nutrients: Phosphorus, Nitrogen Sources, Impact on Water Quality - A General Overview

Trophic Cascades



http://science.kennesaw.edu/~jdirnber/limno/LecBio/LecBio.html

Trophic Cascades



If we harvest top predators
- -planktivores increase
- -zooplankton decreases
- -phytoplankton increases

If we increase nutrients
- -all levels above generally increase

http://science.kennesaw.edu/~jdirnber/limno/LecBio/LecBio.html

Macrophytes and Littoral Zone

- The role of macrophytes in lake functioning have been underappreciated. There's still a lot to learn!
- Zebra mussels add a new twist to the situation in many lakes – shift in nutrient cycling

Other Water Quality Issues: Mercury

- Not usually of concern for drinking or swimming, but…

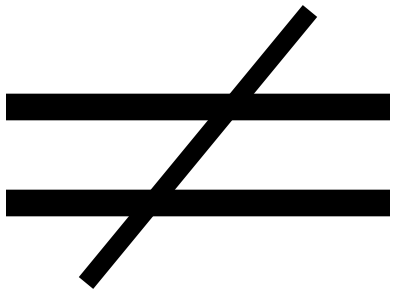
Other Water Quality Issues: Mercury

- No one should eat
  - more than one meal a week of rock bass, yellow perch or crappie over 9 inches in length from inland lakes, reservoirs or impoundments in Michigan.
  - more than one meal a week of largemouth bass, smallmouth bass, walleye, northern pike or muskellunge of any size from inland lakes, reservoirs or impoundments in Michigan.

- Women and Children:
  - should not eat more than one meal per month of rock bass, yellow perch or crappie over 9 inches in length from inland lakes, reservoirs or impoundments in Michigan.
  - should not eat more than one meal per month of largemouth bass, smallmouth bass, walleye, northern pike or muskellunge of any size from inland lakes, reservoirs or impoundments in Michigan.

Key Points

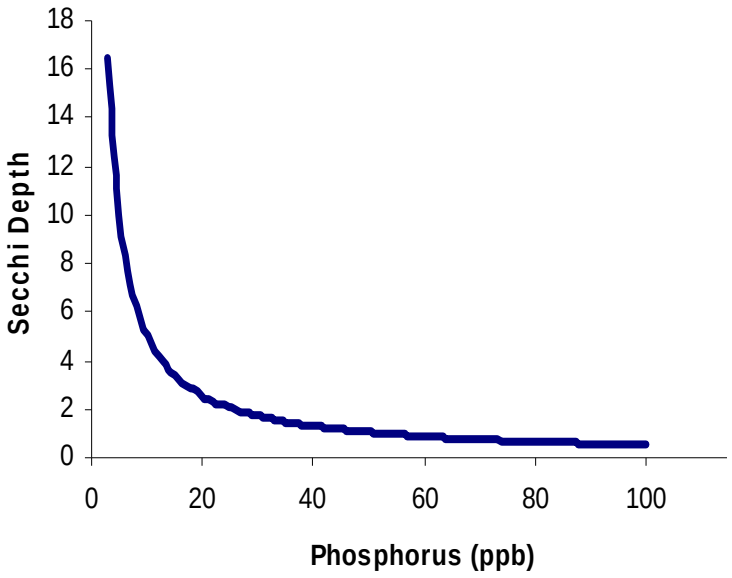
Human perception of water quality

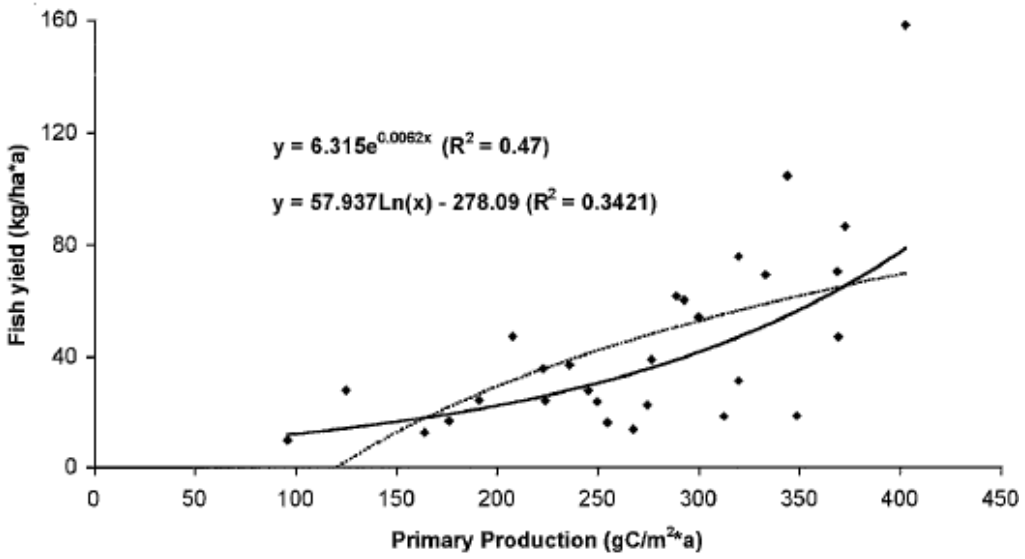


Fish perception of habitat quality

Tradeoffs

- More nutrients increase fish production (to a point), but decrease water quality for other uses





Tradeoffs

- Trade offs incorporate human values
  - Clear water (or lots of fish) is important mainly because it is something humans value
  - A lake's trophic condition is to some extent a choice
    - How much nutrient addition to allow
    - How much fish harvest to allow
    - What types of fish to harvest or stock
    - Reduce macrophytes or not?

Tradeoffs

- Highlights need to clearly define GOALS and OBJECTIVES based on human values and tradeoffs that occur due to the way lake systems work

Questions?