# Pond Water Quality

# Pond Water Quality

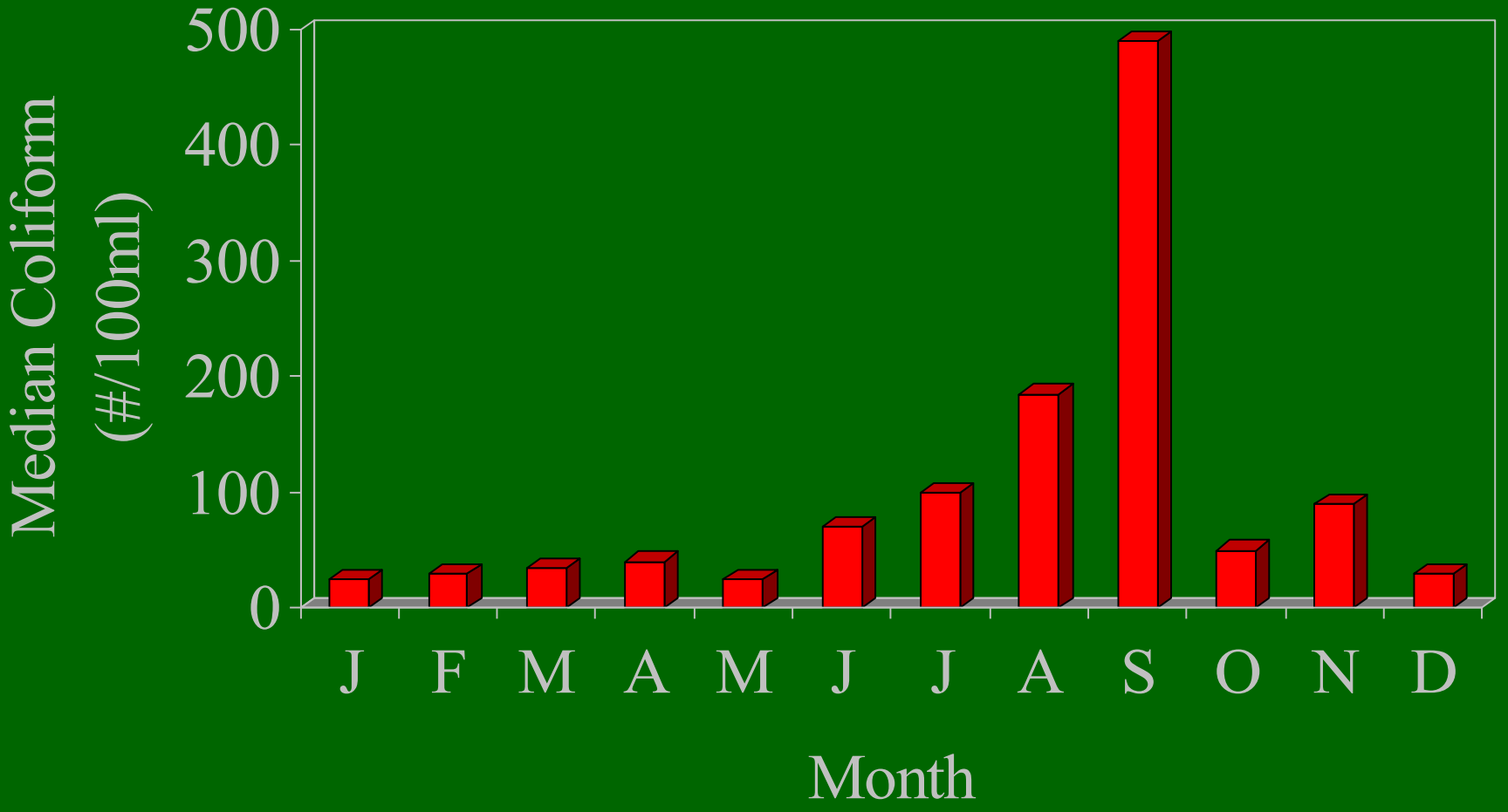
- controlled by:
  - source of water (spring, stream, surface runoff)
  - geology, soils
  - land-use and other nearby activities **
- water quality requirements depend on pond use
  - human or animal drinking water
  - swimming
  - fishing
  - aesthetics

# Ponds for Drinking Water

- not a common source of drinking water in PA
- all ponds will require treatment for drinking
- coliform bacteria occur in all ponds
  - from soil, septic system, animal waste, wildlife
  - some bacteria may cause gastrointestinal illnesses
  - disinfection is necessary

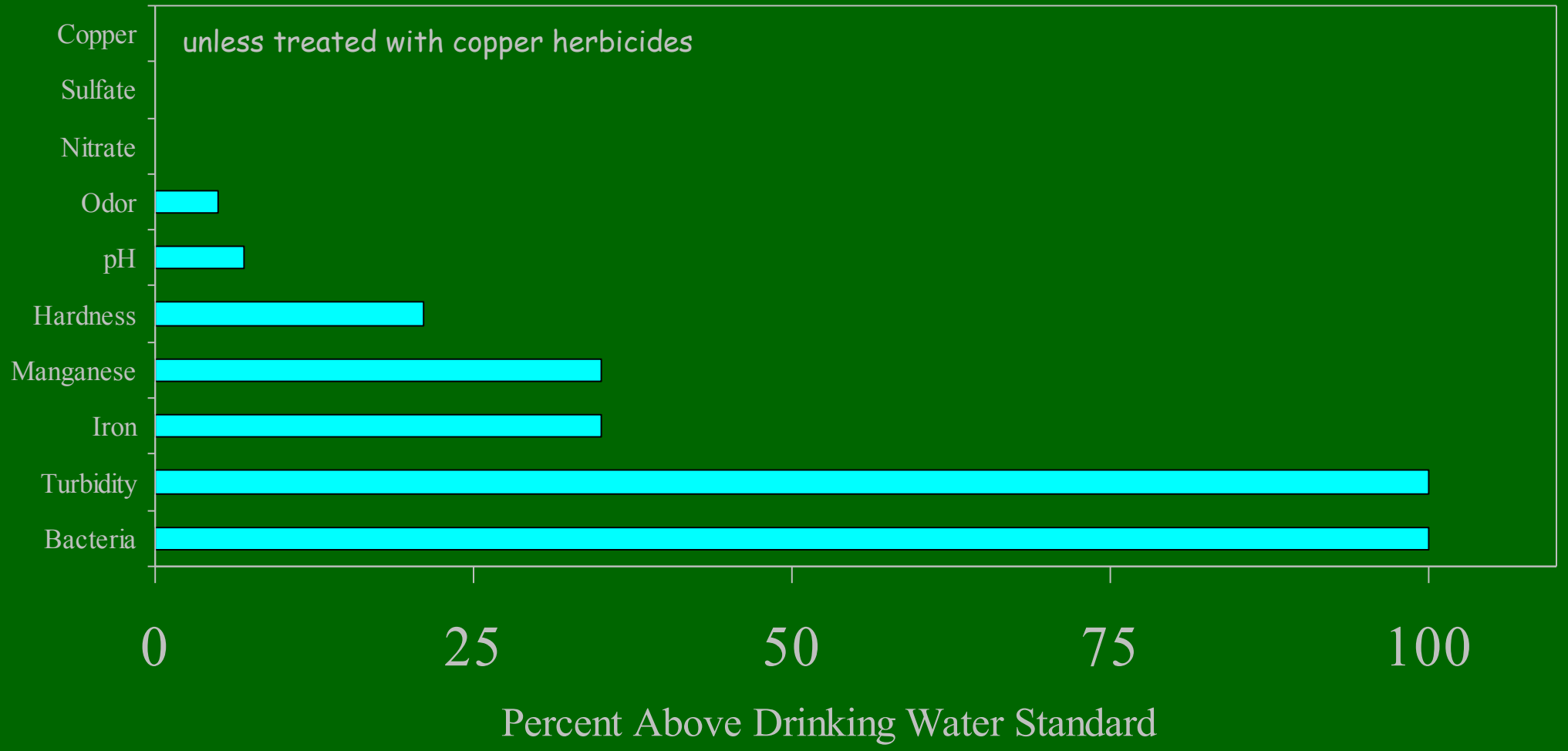
# Median Coliform Bacteria in Ponds

(Hill et al. 1962)



# How Common are the Problems?

(Hill et al. 1962)



# Ponds for Drinking Water

- protozoans
  - giardia, cryptosporidium
- nitrate
  - from fertilizers, manure, septic systems
  - drinking water standard = 10 mg/L as $NO_3$-N
- pesticides
  - highest during or shortly after application due to drift or surface runoff
- blue green algae
  - treat with algacide but follow label directions

# Aesthetic Drinking Water Problems

- odor and taste
  - usually due to decay of organic material
- muddy water
  - find source, chemical additions, or filtration
- metals (iron, manganese)
- pH
  - recommend 6.5 to 8.5 (low more common than high)
  - low pH may cause corrosive water
- hardness
  - calcium and magnesium (especially high pH ponds)

# Ponds for Animal Watering

- similar problems but less stringent standards
- nitrate-N should be less than 100 mg/L
- fecal coliform bacteria
  - <10 per 100 ml for adults, absent for calves
- blue-green algae - toxins
- pH should be 5.1 to 9.0 for dairy cows
- watch use of aquatic herbicides (copper)
- iron and manganese - taste problem
- sulfate < 250 mg/L (mining)

# Pond Water Quality for Fish

- temperature
  - all fish have temperature preferences and lethal thresholds
  - Difficult to control - match fish to temperature regime
  - used to determine fish spawning times
- dissolved oxygen
  - normal = 10-15 mg/L
  - warmwater fish like D.O. > 3 mg/L
  - coldwater fish like D.O. > 5 mg/L
  - depletion caused by decay of organic matter
  - most common cause of fish kills in ponds

# Pond Water Quality for Fish

- pH
  - can be treated with occasional chemical additions
  - warmwater fish (pH 6 to 9), coldwater (pH 5 to 9)
  - low pH may cause stunted growth of fish
- aquatic herbicides
  - can be toxic to fish (especially young fish)
  - obtain a permit and read the label carefully
- herbicide runoff
  - some very toxic to fish
  - especially high following first rain after application

# Pond Water Quality for Swimming

- coliform bacteria
  - 2000 total coliform bacteria per 100 ml of water
  - 200 fecal coliform bacteria per 100 ml
- odor
- turbidity
- swimmers itch
  - free swimming parasite
  - controlled with copper sulfate

# Water Quality for Aquatic Herbicides

- hardness
  - affects dose of some chemicals
- temperature
  - some labels recommend temperature
  - 60 to 75 F
  - can be used to predict fish spawning

# Pond Water Quality for Aesthetics

- odor
  - occurs in about 5% of ponds usually during summer
  - increases with depth water taken from
  - usually from anaerobic decay of plants, algae
- muddy water
  - most common problem, especially in new ponds
  - other causes - muskrats, crayfish, fish, livestock, waterfowl, zooplankton and wind action
  - control - remove the source?
  - If control is not possible, chemicals may work (ground limestone, hydrated lime, gypsum, alum)

# Water Testing Options

- use DEP certified labs
- drinking (human or animal)
  - coliform bacteria, pH, nitrate, hardness, pesticides?
- swimming
  - fecal and total coliform bacteria
- fishing
  - temperature, dissolved oxygen, pH,  pesticides?
- aquatic herbicides
  - hardness, temperature

# What Can You Do?

- strictly limit activities on pond watershed
  - maintain vegetated buffer strip around pond
  - limit fertilizer, manure and pesticide use near pond
  - properly site and maintain septic systems
- use diversion ditches and land grading to divert contaminated surface water
- use aquatic herbicides with care
- aeration may be helpful in some cases
- water treatment works in some cases
- get water tested

# Water Quality - Summary

- Use of water critical!
- Temperature
  - affects spawning and provides clue of when newly hatched fish are present
  - vital for trout
  - important for use of chemicals (60°F - 75°F)
- Dissolved Oxygen
  - critical for fish survival
  - normal = 10-15 mg/L, fish require 3 to 5 mg/L
  - low DO - fish gulp at surface, snails/crayfish leave water

# Water Quality - Summary

- pH
  - less important than DO
  - optimum = 6.5 to 8.5, fish survive in 5 to 9
  - low pH linked to stunted growth of fish
- Nutrients
  - cause plant and algae growth
- Hardness
  - influences effectiveness of herbicides
- Agricultural Chemicals
  - drift or runoff of especially insecticides a problem
  - proper timing of spraying and buffer strips help

# Nutrient Management

- N and P cause increased plant and algae growth
- Sources
  - runoff from barnyards, cropland, feedlots
  - sewage systems
  - managed turf (golf courses, developments)
- Control (BMP's) - impact will not be immediate!
  - redirect runoff
  - reduce fertilizer use
  - buffer strips (tall grass or forests)
  - maintain on-lot septic systems

Nutrient Input