



# Chapter 10



## Sampling With Toxicants



# Historical Perspectives on Use of Toxicants in Fisheries

- Used to
  - Sample fish communities
    - (all species and sizes= unbiased sample)
  - Remove undesirables and non-natives
    - (ex. rainbow trout from Western streams)



# Use of Toxicants in Fisheries (cont.)

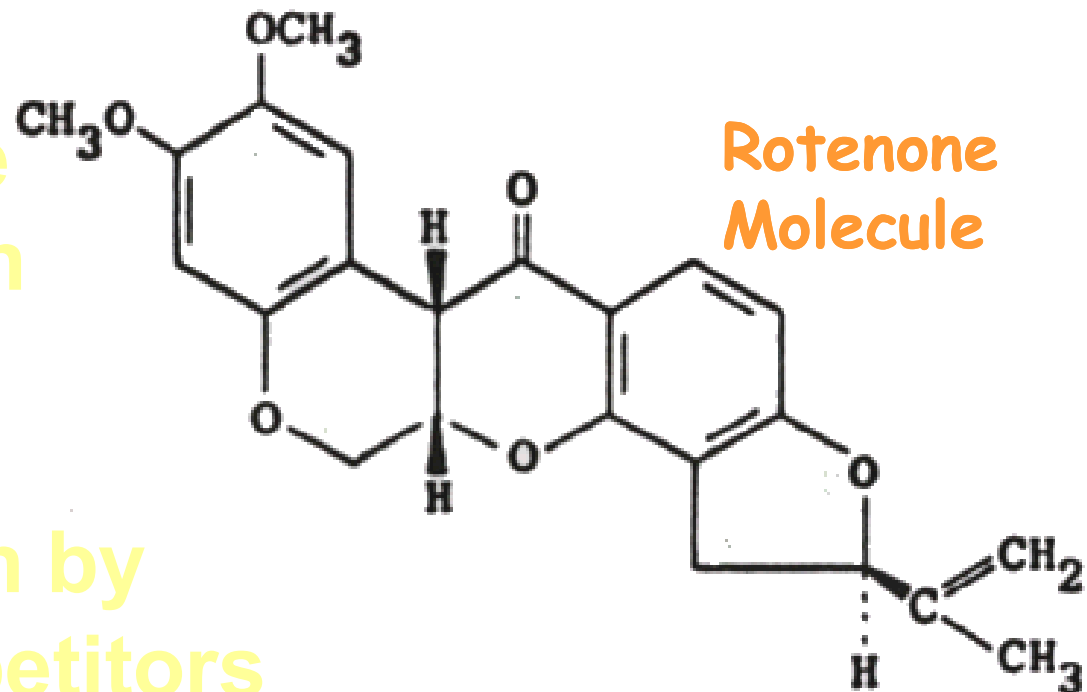


- Use limited by
  - public opinion
  - other technologies (hydroacoustics & trawls)
  - regulatory pressures



# Rotenone

- Natural piscicide
- Used to eliminate some or all fish in aquatic ecosystem
- Improve sportfish by eliminating competitors
- Sample cryptic species on coral reefs (prohibited now)



# Rotenone Examples:

- Remove white suckers and cyprinids from Michigan trout streams



- Remove overcrowded gizzard shad and bluegill



# Antimycin

- Antibiotic with piscicide properties
- Preferred over rotenone for stream work



# Lampricides

- Kill sea lamprey larvae
- TFM (3-trifluorimethyl-4-nitrophenol)
- Bayluscide (nitrosalicylanilide salt)





# Using Toxicants to Sample

- Gained momentum in the 1950's
- Use of Rotenone surveys widespread by the 1960's
- Advanced technology has decreased use
- Still common in shallow habitats like coves





# 10.2 Toxicants: Past and Present

- **Only 4 legal for use:**
  - Rotenone
  - Antimycin
  - TFM
  - Bayluscide

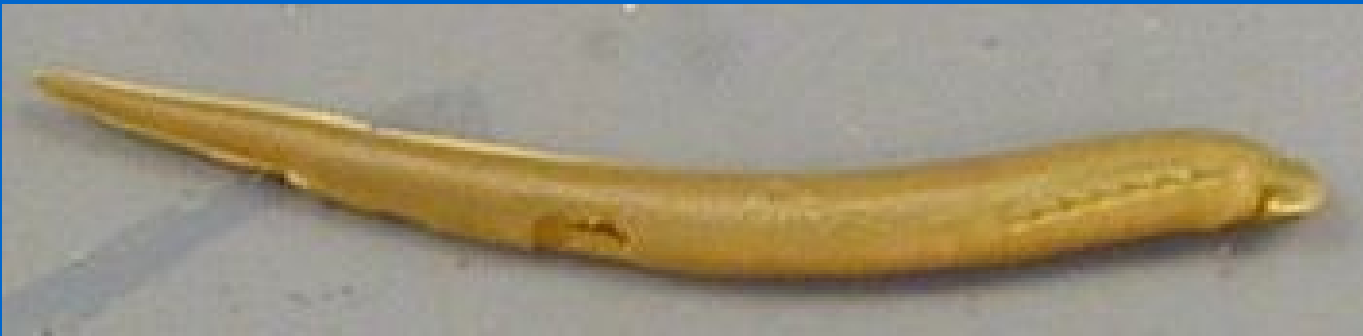
# Works but not Legal

- Copper sulfate
- Sodium cyanide
- Toxaphene
- Squoxin (for squawfish)



# How Lampricides Work

- Irritate or kill ammocetes (lamprey larvae)



- Bayluscide on sand goes deep
- Ammocetes come up off bottom

# 2% Bayluscide & TFM Work Together

- 0.8 mg TFM/L (40 mg/L alkalinity)
- 7.0 mg TFM/L (200 mg/L alkalinity)
- Contact times = 8-10 hours

# Rotenone

- Made from roots of Derris or Lonchocarpus
- Disrupts cellular respiration



# Rotenone (cont.)

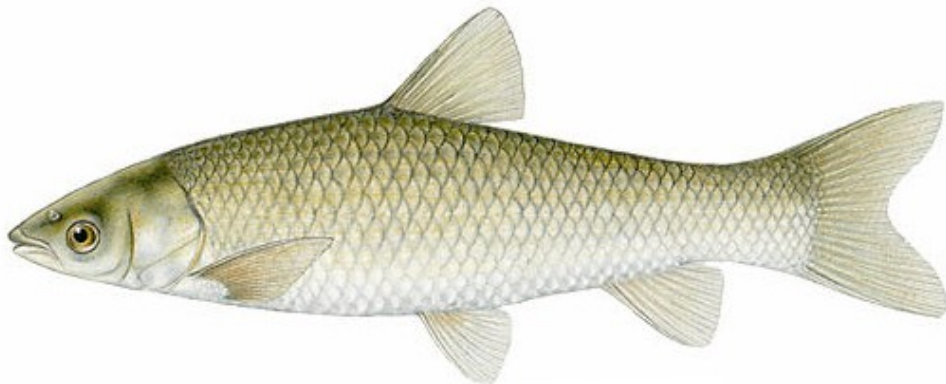
- **1.0 mg/L of 5% powdered formulation (complete kill)**
- **0.05 - 0.10 mg/L of 5% formulation (partial kill)**

# Rotenone (cont.)

- **Least susceptible - gar, bullhead, bowfin**



- **Most susceptible - shad, grass carp**
  - also susceptible - amphibians, crustacean zooplankton





# Rotenone (cont.)

- More toxic in water that is

- acidic

pH ↓

- warm



- clear

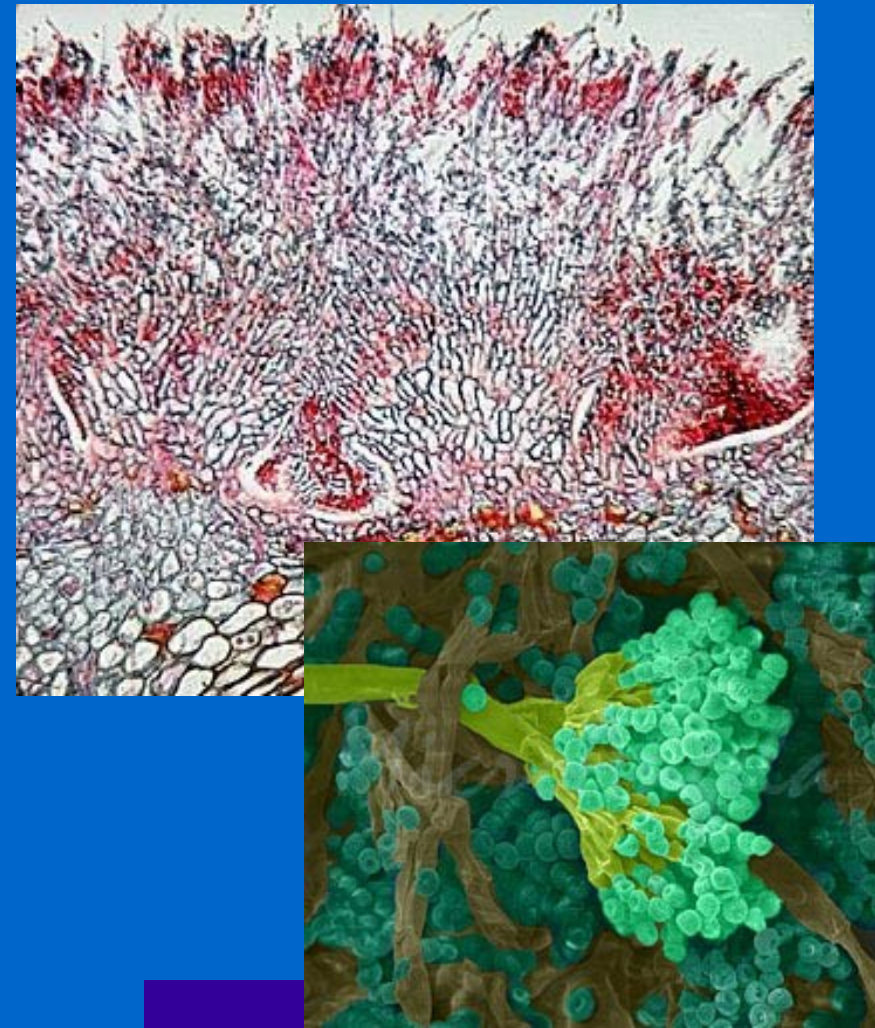


# Rotenone (cont.)

- Long half-life in cool (<10 C) water
- Antidote potassium permanganate
- Powder usually mixed and applied as slurry

# Antimycin

- Made from mold (like penicillin)
- Also blocks cellular respiration
- 5-10 micrograms/L active ingredient
- 1 mg/L potassium permanganate antidote



# Antimycin (cont.)



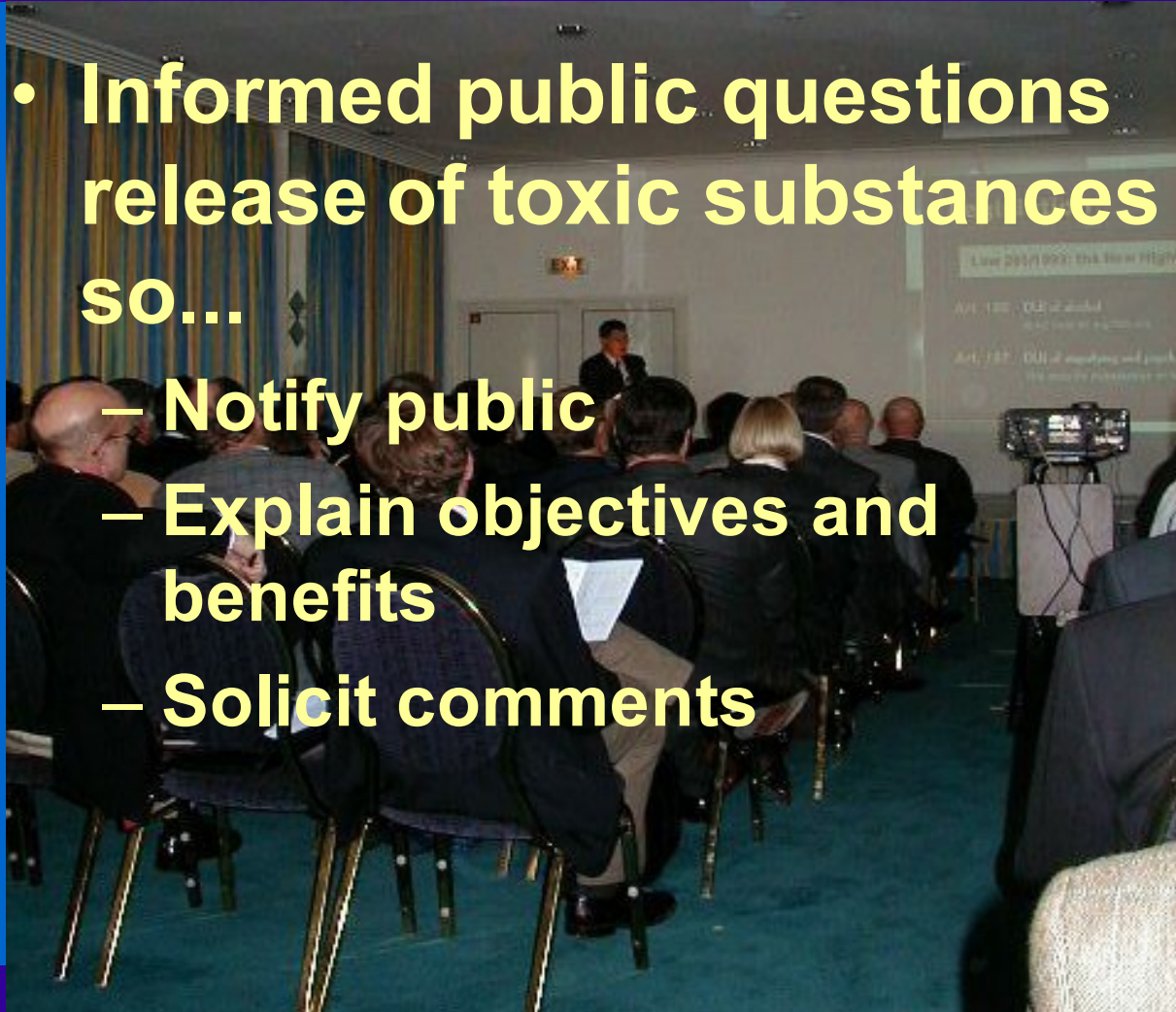
- 20% a.i. solution
- Mixed with Diluent to 10% a.i.
- Mixed with 20 L of water, then applied
- Or bound to sand - as sand sinks, antimycin is released



# 10.3 Public Relations and Regulatory Concerns

- Informed public questions release of toxic substances  
so...

- Notify public
- Explain objectives and benefits
- Solicit comments



# Concerns

- Loss of agency credibility
- Certification to apply rotenone
- Proper disposal of fish
  - Bury
  - Dump
  - Distribute to hungry



# 10.4 Use of Toxicants in Research/Management Surveys

- Use of toxicants to sample fish is decreasing (66% of agencies surveyed)
  - Poor public opinion
  - Expense
  - Regulatory pressure to find other techniques
- Does benefit outweigh cost?





# Cove Sampling



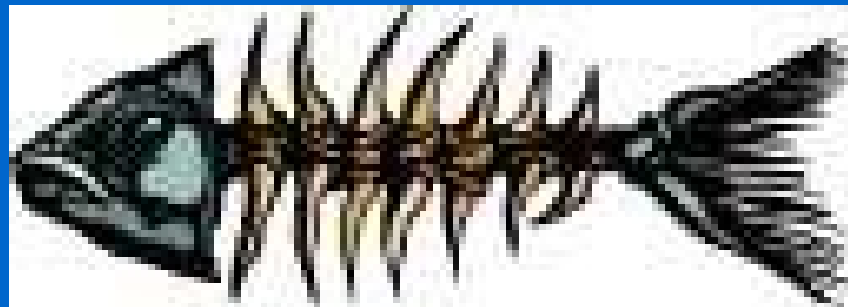
- Usually mid-summer (more toxic, degrades fast)
- Pick representative cove (depth, cover, vegetation)
- Block net (100 m x 6-9 m; 6mm bar mesh)
- Net must reach to bottom

# Cove Sampling (cont.)

- Determine the area enclosed
- Run transects to determine average depth
- Calculate total volume enclosed
- Calculate the amount of rotenone required

# Rotenone required

- Lethal concentrations range from 0.05 to 0.15 mg actual rotenone/L
- Formulations are usually 5%
- So... 1-3 mg formulation/L would provide rotenone in the lethal range



# Calculating rotenone amounts

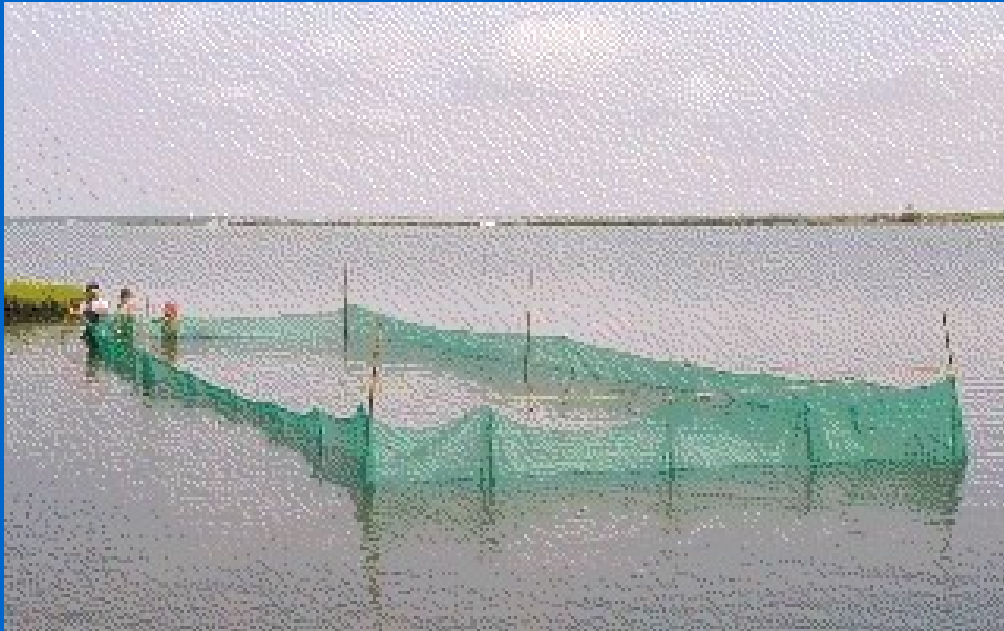
- **Kg of formulation =**
  - lake volume (m<sup>3</sup>) \*
  - 1000 (L/m<sup>3</sup>) \*
  - 0.05 - 0.15 (mg actual rotenone/L) \*
  - 100/ percent concentration  
(mg of formulation/mg actual rotenone) \*
  - 0.01 (kg of formulation/mg of formulation)

# Primary purpose of cove sampling

- Estimate total number and total weight of each species
- Describing size structure of each population is secondary goal



# Block net sampling



- Used to enclose an area when there are no coves
- Pick-up and processing procedures similar to cove sampling

# Wegener Ring

- Ring thrown out by two people from shoreline or boat
- Rotenone is sprayed into enclosed area
- Best for small fish
- Allow more precise estimates in heavily vegetated habitats





# Shoreline Sampling

- Used primarily for juvenile bass in SE US reservoirs
- Small area enclosed with small-mesh block net
- Rotenone applied and fish collected with dipnets and block net used as seine



# Navigation Locks

- Provide an enclosed area
- Must have cooperation to stay closed for 2 days
- Treated at lowest water level to reduce amount of Rotenone needed
- Samples not easily replicated



# Rivers and Streams

- No longer common in North America
- Information often not worth risk of downstream kills
- Now is done mostly for reclamation
- Repeat treatments usually required



# Estuarine Habitats

- Procedures same as fresh water
- Tidal flows can cause fish kills outside sample area
- Bird predation is a problem



# 10.5 Data Analysis and Biases

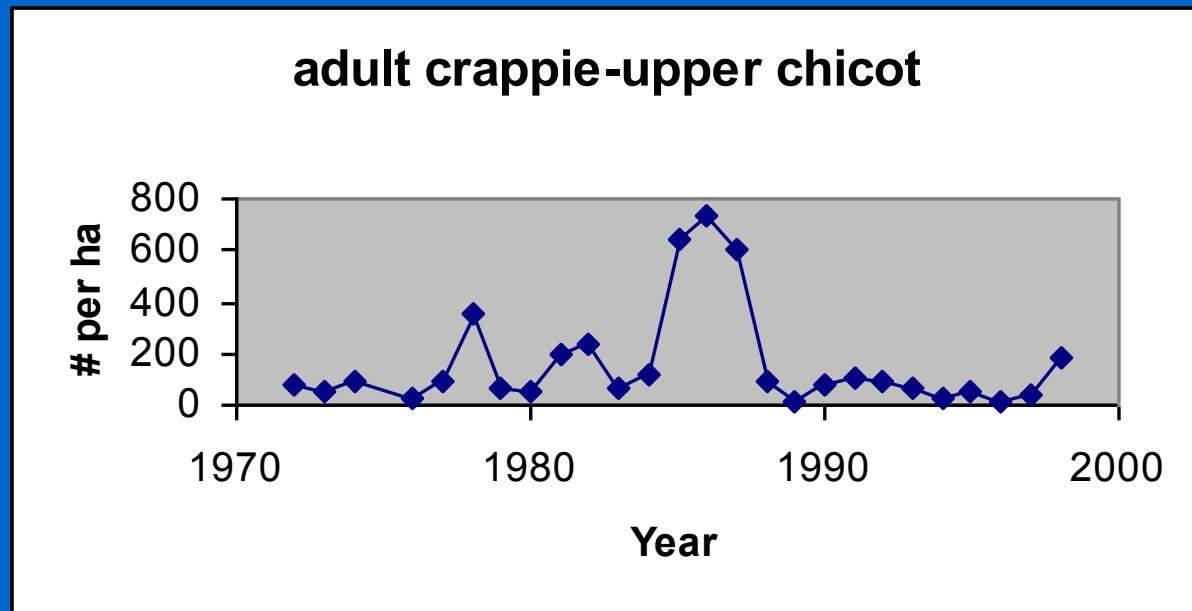
- Standing crop or density
  - Kg/hectare
  - Fish/hectare

1 Acre



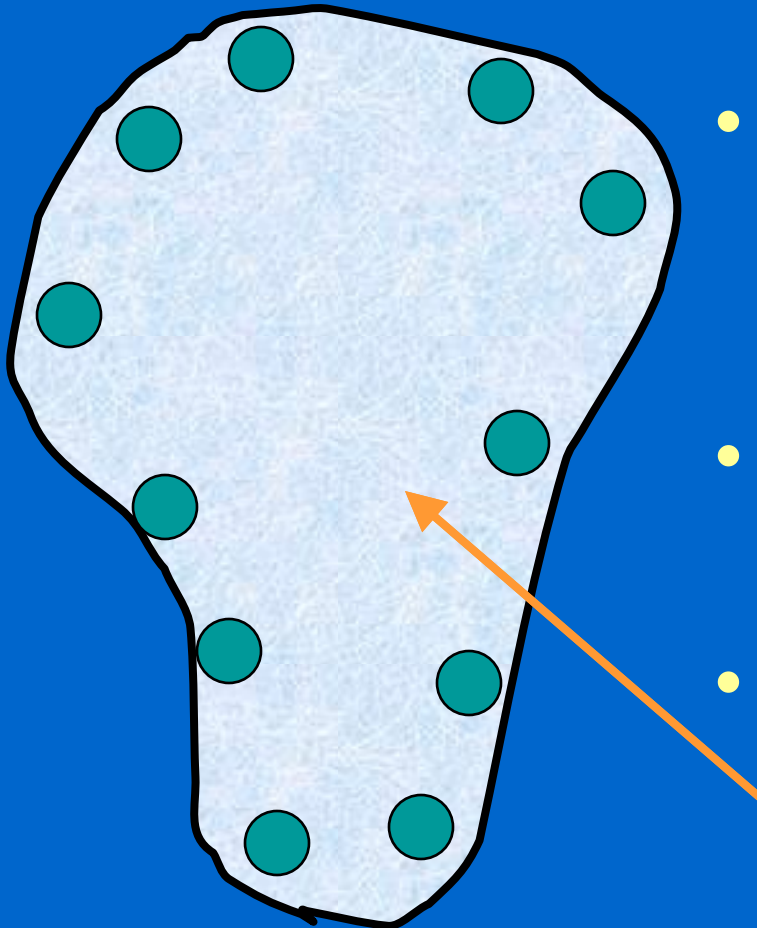
# Data Analysis

- Precision
  - One toxicant sample has no error bars
  - Are future changes real or noise?
- Consistent
  - Same cover each year
  - Repeated measures of ANOVA





# Biases

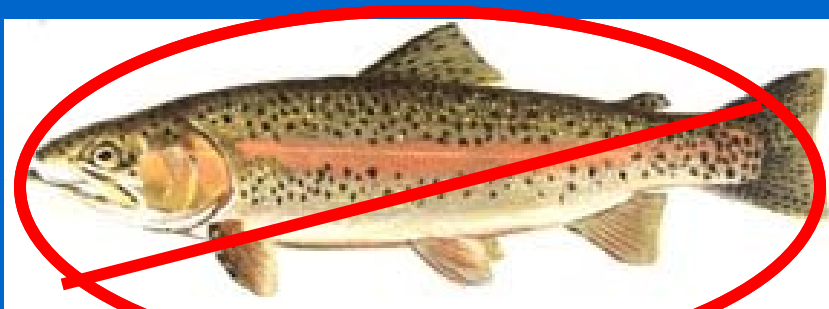


- **Over or underestimates for whole Lake**
  - Adjustment factors
- **Seasonal changes in habitat**
- **Low sample size**
  - Lots of smaller samples



# Reclamation and Fish Control

- Use of toxicants to eliminate/reduce non-game fish now uncommon
- Have been used in recent years to eliminate non-native species
  - native species then reintroduced



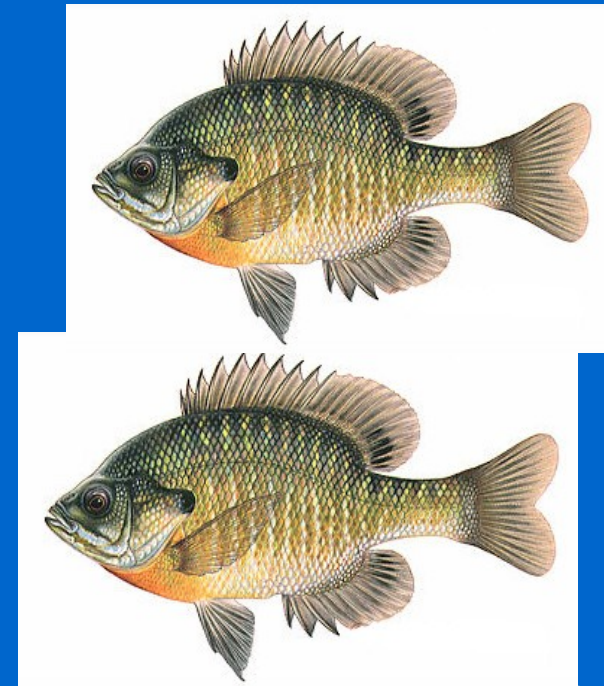
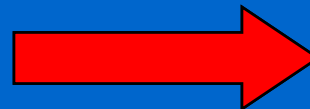
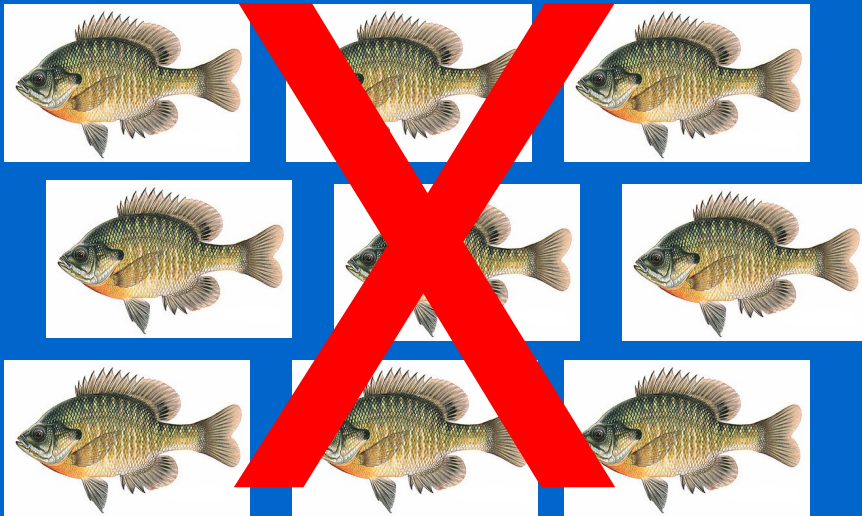
# Selective Removal of Target Species

- Recent interest focused on controlling common carp
  - poisoned feed pellets
  - fish lured in with untreated pellets in feeders first



# Selective Removal of Target Species (cont.)

- Rotenone sometimes used to reduce density of bass or bluegill
  - improve growth or recruitment



# Whole Lake Reclamation

- Lakes that have been seriously degraded
- Lake Chicot, AR good example
  - watershed corrections made
  - lake was partially reclaimed with rotenone
  - lake was then restocked
  - shows importance of taking remedial actions first



Lake Chicot

# 10.7 Comments on Future Use

- Will continue when alternatives are unavailable or inappropriate
- No other technique is less biased in several key areas