

PROPOSED outline for electrofishing literature review
28 May 2015

Proposed budget: \$50,000

- I. Executive Summary
 - a. Purpose
 - b. Summary of each section
 - c. Recommendations

- II. Introduction
 - a. Electrofishing development
 - i. Theory
 - ii. Equipment evolution
 - iii. Unpulsed vs. pulsed dc
 - b. Standard fisheries technique
 - i. Research
 - ii. Monitoring
 - iii. Collections
 - iv. Stream typing---consultants, non-profits, Tribes, agencies, etc.

- III. Effectiveness in streams and wetlands
 - a. Physical constraints
 - i. Electric field
 - 1. Size
 - 2. Shape
 - 3. Area of influence
 - a. depth
 - b. area
 - ii. Complex habitat and cover
 - 1. Size of habitats
 - a. wetlands
 - b. streams
 - 2. Characteristics
 - a. wetted depth
 - b. velocity
 - 3. Water quality
 - a. visibility
 - b. conductivity
 - c. temperature
 - 4. Cover
 - a. organic
 - b. inorganic
 - b. Biological constraints
 - i. Species
 - 1. Taxis

- 2. immobilization
 - ii. Size
 - 1. Taxis
 - 2. Immobilization
- IV. Direct harm
 - a. Hemorrhaging
 - b. Branding
 - c. Vertebrae damage
 - d. Delayed effects
 - i. Predation
 - ii. Growth
 - iii. Reproduction
 - e. Precautions
 - i. Equipment
 - ii. Reducing and avoiding harm (e.g., spawners/redds)
 - iii. Fish handling/processing BMPs
- V. Population level effects
 - a. Abundance
 - i. Probability of detection
 - ii. Effective population size
 - b. Productivity
 - i. Life stage specific survival
 - ii. Delayed effects
- VI. Permitting
 - a. State
 - b. Federal
 - i. USFWS
 - ii. NOAA
- VII. Best management practices for the use of electrofishing in protocol surveys
 - a. One of many different protocol methods
 - i. Common practice
 - ii. Simple to use
 - b. Effectiveness
 - i. Physical constraints
 - ii. Biological constraints
 - c. Direct harm
 - i. Settings are important
 - ii. Environmental variables are important
 - iii. Fish handling is perhaps the most important factor
 - d. Population level effects
 - i. Individuals in population
 - ii. Site specific strategies to avoid population effects

- e. Permitting
 - i. WDFW SCP
 - 1. Reporting requirements
 - 2. Data availability
 - ii. ESA Sxn 10
 - 1. Reporting
 - 2. Electrofishing log requirement
 - 3. Data availability
- f. How the data are used in Forest Practices
 - i. FPA
 - ii. WTMF

VIII. Discussion

- a. Important tool for active capture in streams and wetlands
 - i. Efficiency
 - ii. Reliability
 - iii. bias
- b. Effectiveness
 - i. Many factors are important in evaluating its effectiveness
- c. Effects can be mitigated
 - i. Individual
 - ii. Population
- d. Permitted activity for T&E species
- e. Can be used in protocol surveys

IX. Recommendations

- a. Precautions to minimize harm to fish and amphibians
- b. Reduce the need for electrofishing by being judicious in the issuance of electrofishing permits
 - i. WDFW
 - ii. NOAA
 - iii. USFWS
- c. Require reporting that is informative for agencies and the public
 - i. Electronic database
 - ii. Location: coordinates and stream number
 - iii. Date
 - iv. Size, species, and number of individuals observed
 - v. Condition of permit
- d. Share data from e-fishing/other permitted activities across agencies
 - i. WDFW and Tribes
 - ii. NOAA
 - iii. USFWS
- e. Update fish distribution model with most current data and refine at scheduled intervals
 - i. Inform model with protocol survey data
 - 1. Non-changes to stream typing are **IMPORTANT** findings

2. All surveys need to be reported
- ii. Refine data with data as they are available
 1. Species specific information
 2. Remote sensing data
 3. Lidar coverage
 4. Physical habitat survey data
 5. Road abandonment and fish passage improvement

X. Literature Cited