

Safety

Tab 12

# Session Objectives

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- Appreciate need for safe working environment
- Discuss the value of safety policy documents
- Describe approaches to improve safety at electrofishing projects (including an employee safety program)

# It doesn't take much current...

(the "1 - 10 - 100 rule")

## *Estimated Effects of 60 Hz AC Currents*

1 milliAmp	Barely perceptible
16 milliAmps	Maximum current an average adult male can grasp and "let go"
20 milliAmps	Paralysis of respiratory muscles
100 milliAmps	Ventricular fibrillation threshold
2 Amps	Cardiac standstill and internal organ damage
15/20 Amps	Common fuse or breaker opens circuit

Contact with 20 milliamps of current can be fatal.

# Is it Possible to be Exposed to a Lethal Level of Amperage?\*

Use Ohm's Law:

Dry skin resistance ~ 100,000 Ohms

Apply 100 V;  $I = (100V)/(100,000) = 1\text{mA}$  (barely perceptible)

Wet skin resistance ~ 1000 Ohms

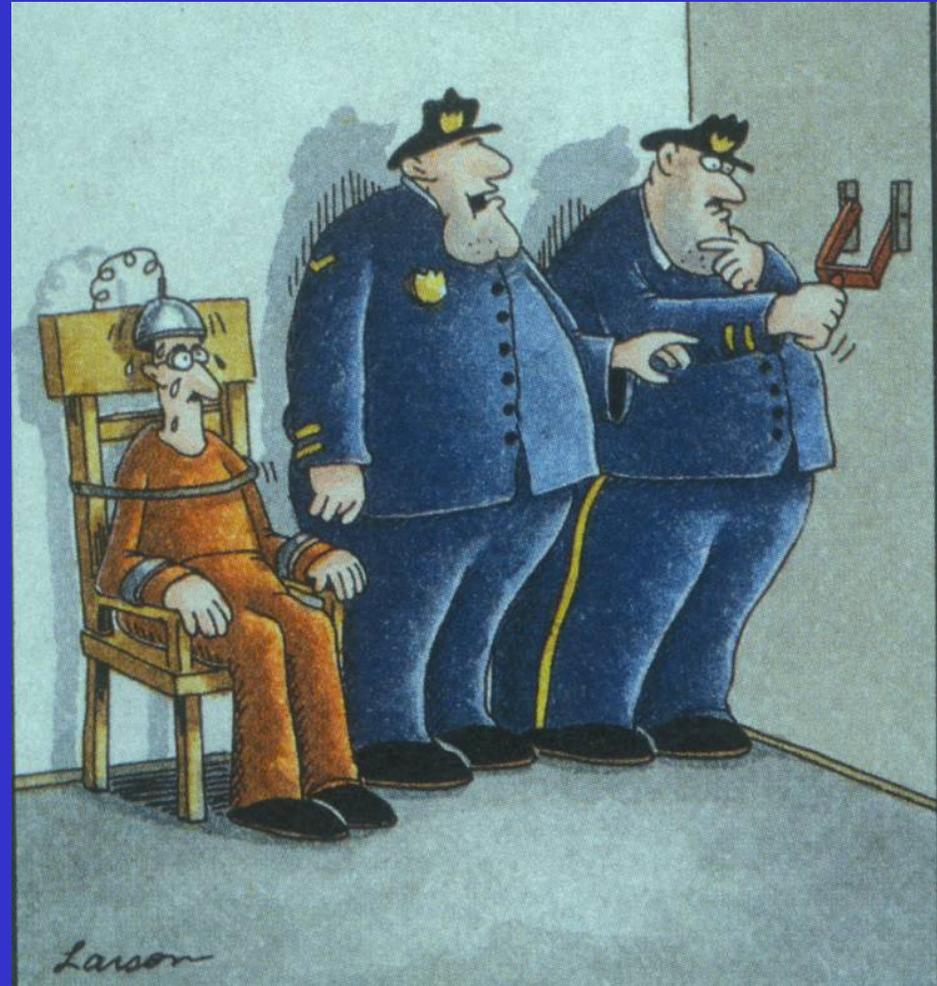
Apply 100 V;  $I = (100V)/(1,000) = 100\text{mA}$  (ventricular fibrillation threshold)

\*AC, 60 Hz, that runs through the chest (as from arm to arm or arm to leg)

# 50 - 60 Hz AC Appears More Hazardous to Humans than DC

Electric chair protocols use high voltage (2,000 V) to break down skin resistance. Dry skin has high resistance and gloves greatly add to the safety factor.

Human nerves are sensitive to 60 Hz AC. Automatic external defibrillators (AED's) often use a 60 Hz "biphasic" (= AC) waveform to stop fibrillation.



“The contact points must be dirty... just click it up and down a few times.”

Even if the shock itself doesn't hurt someone...

- the shock instead may cause the crew member to fall against equipment, a hard surface, into the electric field, etc.

# We need to...

- elevate safety concerns to our top priority (Is any piece of data really worth serious injury?)
- base our operations on safety principles; truly make it “Safety First” (for instance, put safety gear at the top of the equipment checklist)

# Primary Motivators for Agency Concern

(Page 12-1)

1. Safety of workers
2. Potential litigation

# Safety Policies

- *A definition:* written safety guidelines binding to employees
- More agencies in U.S. developing safety policies (beginning in the 1980's)
  - Federal (FWS initial policy was in 1985), state, universities
  - FWS policy used as a basis for some other federal and state agency policy development
- Safety policy document
  - Safety **information transfer** tool
  - **Decision-making** tool

# If Your Agency Does Not Have a Policy...

- Recommend to administration that agency temporarily adopt USFWS regulations
  - Action requires sign-off by directorate
- If cannot get sign-off, adopt USFWS or some other agency policy as your office policy (page 12-23)
  - Put adopted policy along with a cover letter of explanation in files
- Australia: Code of Practice
  - Discussion on Friday afternoon

# Technique or Procedure Not Covered in Safety Policy

- Write memo to file explaining procedure and detailing safety precautions

# Nugget

- Have a written safety policy to guide your electrofishing operations

# Safety policy panel

Biologists (practical experience, “risk-taking”)

Electrical engineers (technology experts, “risk-adverse”)

Safety officers (policy and legal experts, likely “risk-adverse”)

Need a panel to develop and review the agency electrofishing safety policy at regular intervals (3 yrs., 5 yrs. ?)

Various perspectives and expertise of panel members a strength but policy discussions often a tug-of-war



# Safety Program

(Page 12-2)

- First step: adopt written safety guidelines
- Next step: institute an employee safety program
  - Three elements: training, equipment, and operations (page 12-8)

# Employee Safety Program

- Three elements: training, equipment, and operations (page 12-8)
- Training
  - materials: policy, Chapter 12, can use this powerpoint and other parts of manual but might need to develop a specific powerpoint or video for staff safety training
  - documentation (page 12-10)
  - awareness: very low current levels can seriously injure

# Employee Safety Program Training

- Explain system components, function, operation, and safety features in a non-working environment

Joe Coeffelt



# Employee Safety Program Training

- Demonstrate gear functioning and safety features in a non-working (fishless) environment



# Employee Safety Program Training

- New staff observe actual use of equipment, sampling protocols, and safety procedures



# Employee Safety Program Training

- In-water probe can demonstrate the extent of the electric field



# Employee Safety Program Training

- CPR & First Aid: important for at least 2 crew members to have certification

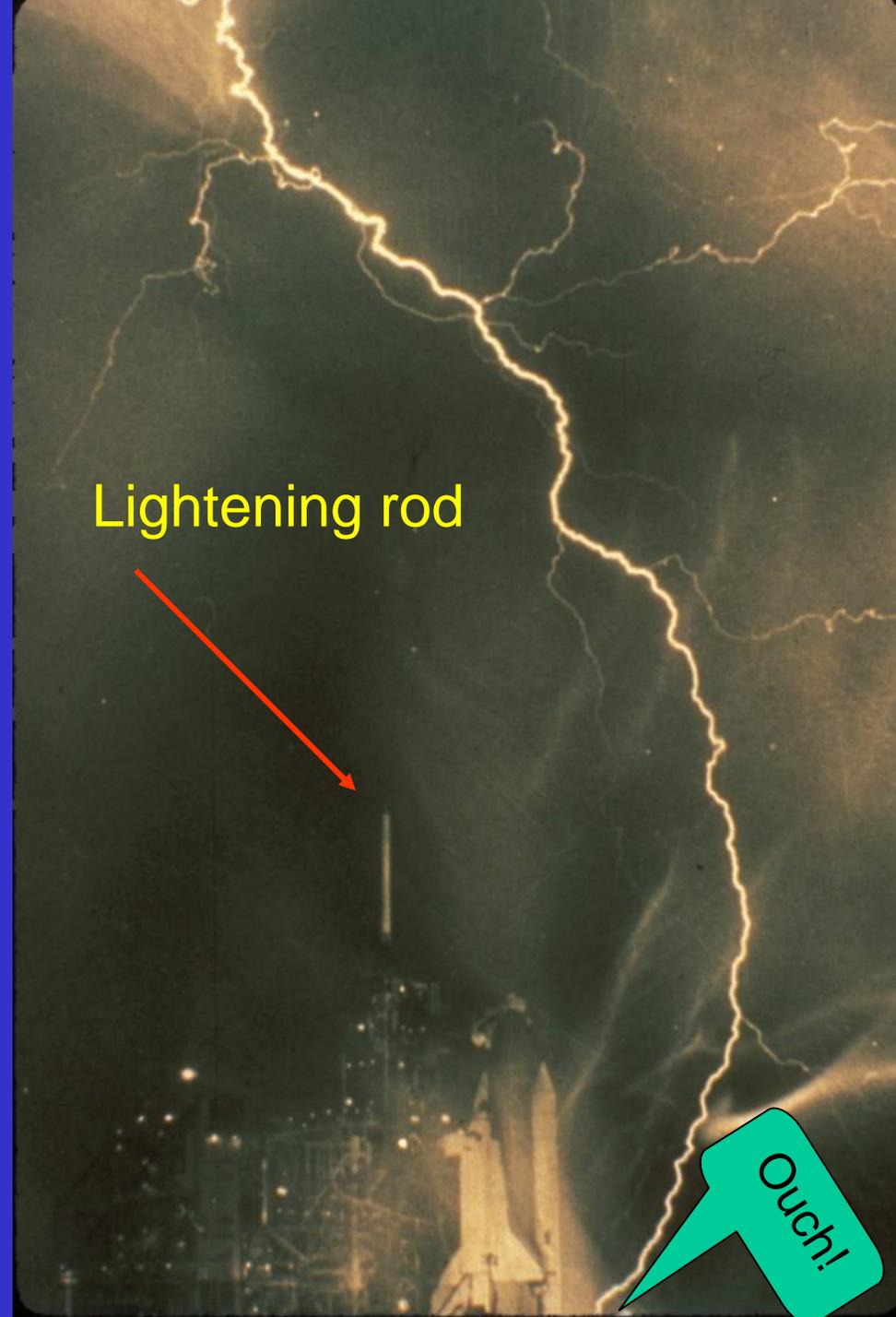


# Employee Safety Program Training

- Also consider...
  - Wader safety training in a swimming pool
    - Video by Utah State University
  - Practice emergency actions when suddenly become submerged with a backpack shocker (in a swimming pool)
    - This type of training done by provincial fisheries agency in Alberta, Canada

# Equipment

- Equipment built to code and with adequate safety devices/precautions have protected biologists from injury
- However, do not blindly depend upon a single safety device (e.g., do not depend upon a safety switch functioning properly to handle “live” electrodes); have backup devices or approaches



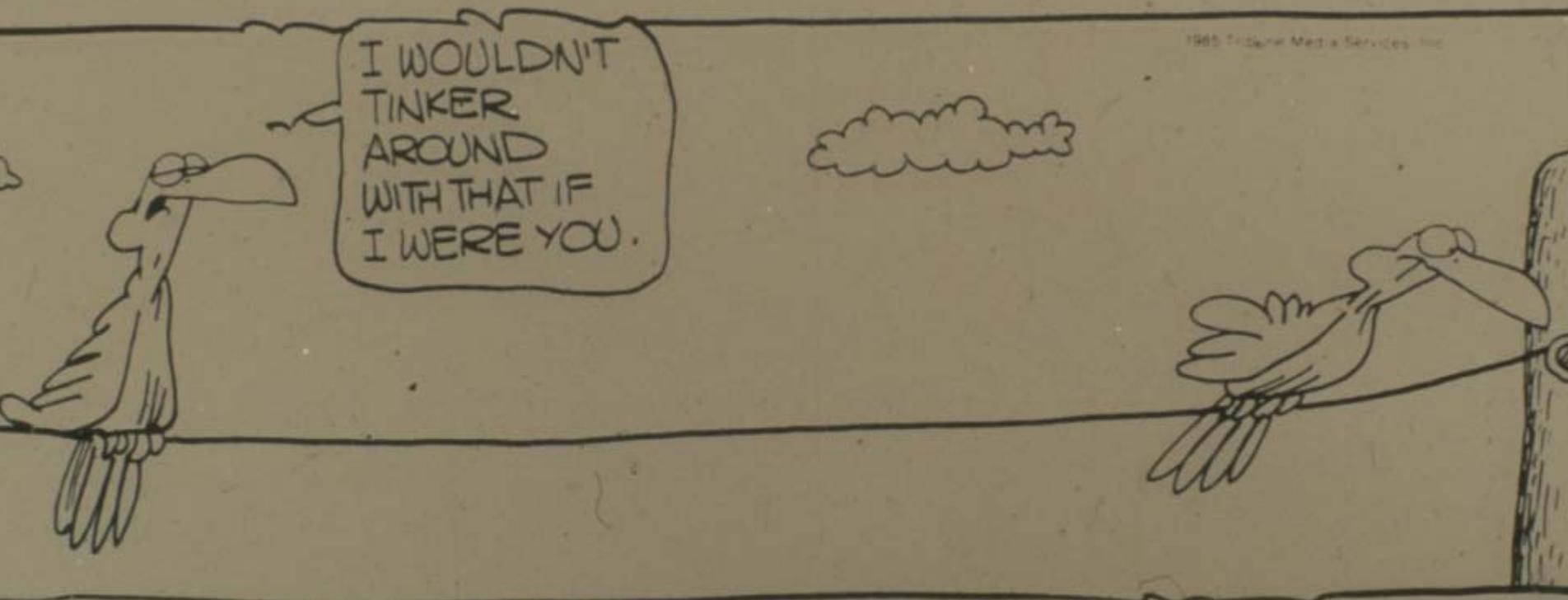
Lightening rod

Ouch!

# Equipment

- Specific equipment safety features have been discussed already in the *Electrofishing Systems* session.
- However, we will talk about establishing equipotential surfaces in boats and accessory equipment that is worn by team members.

CRACKERS



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In an electrofishing boat, you want to be a “bird-on-a-wire”, surrounding yourself with metal surfaces at the same voltage potential (“equipotential”)

- Checking for equipotential surfaces; a multimeter should read less than one Ohm between significantly-sized pieces of metal
- In a metal-hulled boat, reference all metal to the hull
- Objects generating a charge (generator, pulsator) should be hard-wired to the hull



- In rafts, reference all metal surfaces to the metal rowing frame



# Proper "Clothing"

## Life jackets



Type II bulkier, has a "collar", and will turn most unconscious people face-up in water



Type III

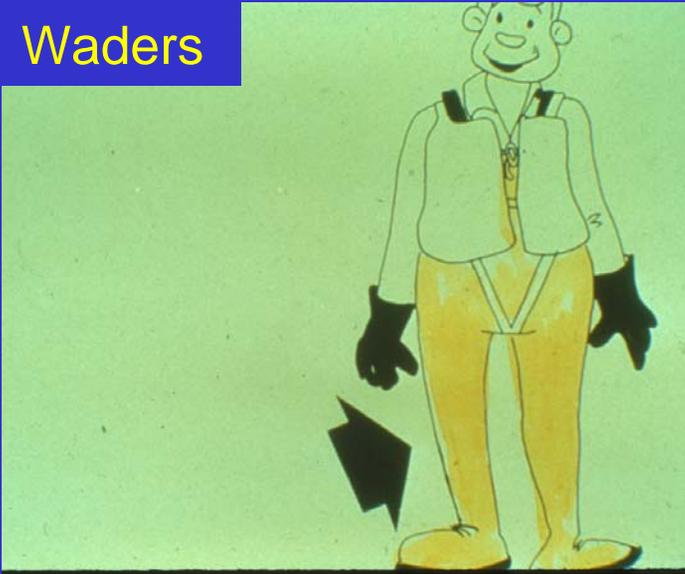
# Life Jackets



Suspender-type PFDs self-inflate when become wet; a new trigger mechanism is being developed that inflates PFD when 30 cm of water depth pressure is sensed

# Waders

Waders



On boats, recommend a minimum of shin-high rubber boots

Waders are not electrically rated. However, the light-weight “breathable” waders may not protect from shock when the water depth is above the knees and long pants are not worn underneath waders.

# Gloves

Rubber gloves



Leather over-gloves are designed to be worn on linesman gloves



Neoprene gloves



Linesman gloves not necessary.  
Good sturdy neoprene or like  
material gloves sufficient (see FWS  
policy)

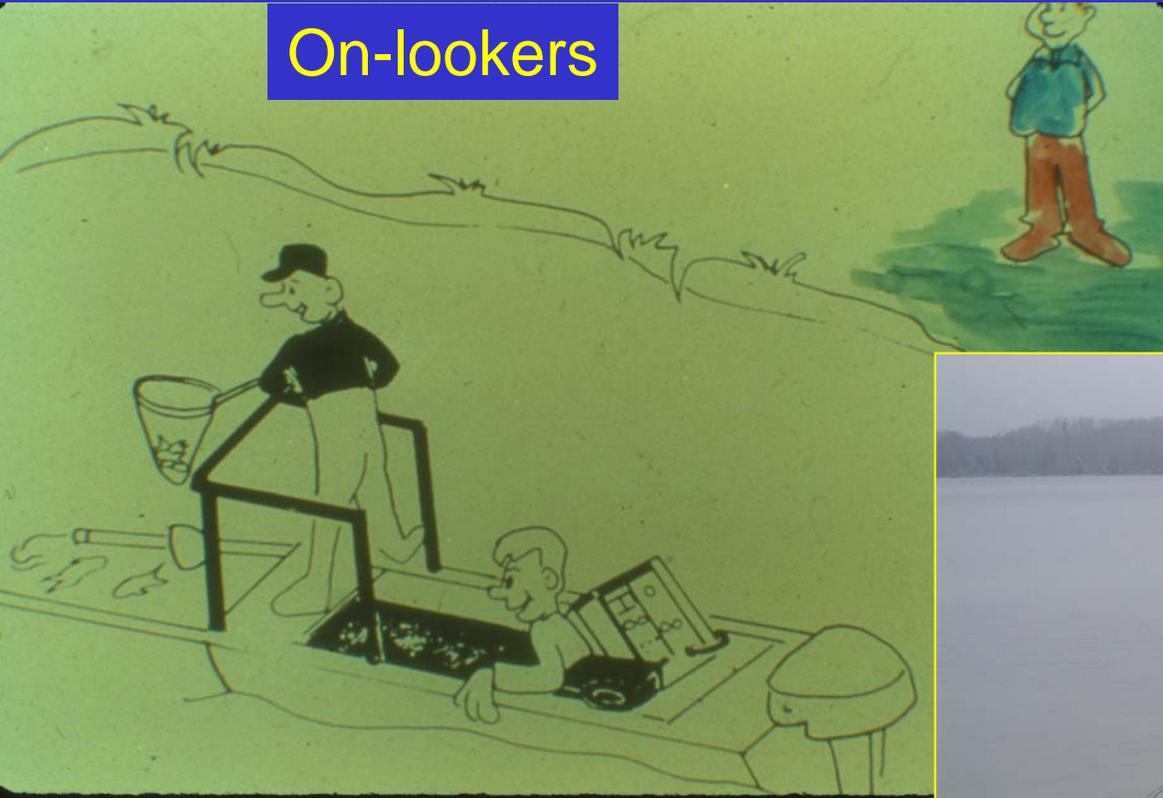
# Operations



Make sure all team members know when the power is on and off

# Operations

On-lookers



Detecting extent of field helps determine safe zone



Protect the public

FWS policy: public within 30 m,  
power is shut-down

# Operations

Bad weather



Stop fishing during heavy rain or thunderstorms

If light rain/mist, can fish until all surfaces covered in an unbroken sheen of water

# Operations

*Large crews and/or the public. What do you do as a team leader?*

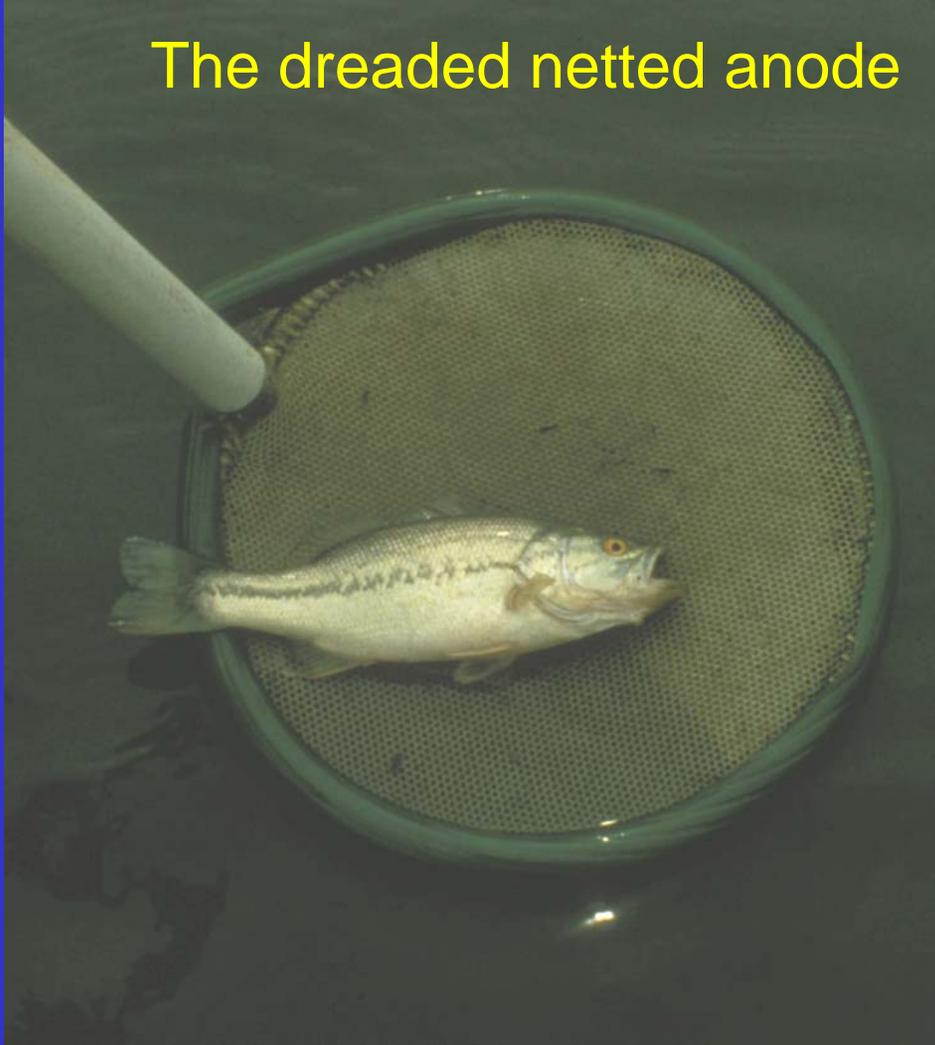


# Operations

Stop participating in collecting fish and supervise

# Operations

The dreaded netted anode



Advantage is that the electrode handler can net fish.

Disadvantages are:

- can't clean electrode surface
- could accidentally engage a team member into the circuit
- anode out-of-water switch may not protect (30 mA threshold)
- two jobs for the electrode handler
- fish exposed to most intense part of the field

**WE'VE ALL DONE IT (SHHHH!)**

# Operations

A shock delivered by a netted anode could cause a crew member to fall against a hard surface and be injured

No gloves



And as Jim says: if you can't be safe, at least do it in style



# Generator Grounding

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