# A Report on the Electrofishing Workshop
## Quincy, Illinois April 25 -27, 1989

Too many things went on in the three days of the workshop for me to even try to relate them all. Instead, I'll try to go over the action in about the order it happened, and then spend some time going over some of the main points of discussion that went on during the workshop.

I was very impressed with the interest shown by the people who attended. So much so, that I have been suffering from a very sore throat, doubtless brought on by all the talking I did during those three days. I was really glad to have split the responsibility with Steve Malvestuto, as either one of us would have been overwhelmed by all the questions asked during the session.

We were met by Dave Pederson, from Fort Snelling, who came to the workshop in Michael Vanderford's place. He got everybody registered, collected money for the munchies, and took care of seeing that the necessary projectors and blackboard, plus handouts made it to the meeting room. With the details attended to, he turned the workshop over to Steve Malvestuto and me.

Steve Malvestuto began by taking input from the attendees on those questions they particularly wanted answered. We got a fairly long list, having to do with safety, wiring, electrical isolation, shape and size of electrodes, and so on.

I was up next, and began with the published schedule, talking about basics of electricity and electronic hardware. After a couple of hours, it was pretty clear that the questions put up at the start indicated the most interest of the group, so I pretty much left off the schedule and dealt with questions.

After lunch, I went back to the schedule, but ran through the parts on shocker boxes and electric fields briefly. More questions came up, and the rest of the afternoon was spent on them, and covering the original questions that Steve asked for on the beginning.

Happy hour was a great relief, but the questions didn't go away for some time. This was an interested bunch. Both Steve and I caught questions during breaks and meals.

The next morning started with safety in general. Why isolating the ac wiring was safer, how to insure against shock in the boat, and how to check for electrical safety. Steve took over after the break, and talked about the electric field in the water, and how it affects fish. About an hour before lunch, we went out in the parking lot for some practical poking around on some of the boats that had come to the workshop.

We went over a couple of rigs, while the basic use of a meter got demonstrated. The main checks were for isolation of the generator output, and how to check for problems in the boat. After lunch, we went to Kessler Park, to look at things with the rigs in the water.

At Kessler Park, things got pretty busy. I had brought along a wand made from plastic pipe, hoping it might be used to measure the field around a shocker boat. We wanted to put all the rigs in the water to try this out. And it actually worked pretty well. I've drawn up the wand in figure 1 of the illustrations accompanying the report.

The city sent out a tv crew, and the Quincy Herald-Whig sent a newspaper reporter. They filmed and interviewed while rigs were in the water running their shockers, and it was quite a crowd scene for several hours. After the first few boats, I took a break for a bit, and the boat crews took over the meter and wand to use it themselves, so there was some good hands-on experience as well.

All in all, we checked out about 8 or 9 boats, an electric stream seine, and a backpack shocker. There were some surprises. The backpack unit's output was pulsed, and the meter couldn't measure it. Several of the rigs were ac only, and the field in the water they produced was just huge. Even the little seine made a good-sized field all around it. I'll discuss these results more thoroughly in the topics sections.

About the only disappointment to the day was finding that everybody had been too tired to stay up and watch the 10:00 pm news to see the report. I did get a copy of the paper, though, and have put in a copy of the article from the Herald-Whig in case anyone missed it. Andy Warhol was right, by golly; we were all famous for a few minutes there. We can hope that the interest in the activities means that there is a better level of awareness about the environment, and that people are prepared to support the wildlife biologists efforts in looking after it.

The last day was mostly Steve's. I caught a few questions at the beginning, dealing with the checkout in the park. Then Steve talked about sampling, and how to use the data to determine the validity of that sampling. He showed that, short of draining the water and counting the total population, electrofishing produced the best results when sampling fish, largely because it is reasonably easy to take enough samples from the area of investigation to have a truly representative sample.

Steve went over the statistical math, showing how to establish the validity of the sample, and of the methodology of sampling. Given how busy things get during the season, thse looked to be good tools to use to insure everybody's efforts are maximumized when out in the field. Especially by making it possible to establish that the results are valid and representative.

Just as an aside here, I will mention that all the statistical functions are easily done on a computer, using BASIC. I have done something of the same stuff on an Apple, although this computer isn't really suited for large-scale usage, due to limitations of storage on disk, and memory. But any office with access to an IBM computer could use the spreadsheet in Lotus 1 2 3 to do the math, or maybe find someone to do a program in BASIC.

We wrapped up the workshop with a few last questions, and got people to sign up for more materials from Steve, and this bulletin. It was a long three days, but I think we all got a lot out of it. Sure felt like time well spent.

## Topics at the Workshop

### 1. Safety

Electrofishing is dangerous. The voltage produced by the generator is more than enough to present a lethal shock hazard to the boat crew. Eliminating the likelihood of shock needs to be a priority.

The most effective method of reducing the shock hazard is to make sure everything in the boat is tied together electrically. Done properly, this will make it impossible to receive a shock while in the boat. Metal objects that are in electrical contact have to be at the same electrical potential, and so cannot shock the crew.

Items to pay particular attention to are the generator and the motor. With the output isolated, and the frame electrically tied to a point on the hull, the generator will always be safe to touch. The motor is often insulated by grease in the gudegons, and can pick up a charge from the field in the water. Isolating the generator output will greatly reduce this potential, but wiring the motor to the hull with a flexible lead will prevent any such hazard.

It is also good practice to use a wire to attach any other metal object to the hull. No matter how unlikely it may be that they will become electrically hot, it's always good practice to do so. The stock tank is too large to avoid should it somehow become charged. And the gas tanks present an explosive hazard should a spark occur. A wire jumper eliminates either hazard.

Missouri is also adding an additional safety switch to the boats. The safety enhancement of a switch that will only allow the electrodes to become charged by a conscious effort by the netman speaks for itself. But, as he is reaching into a dc field that may prevent him from getting off the switch if he gets shocked, the extra switch, under the control of the operator, gives an important extra measure of safety. Both switches are wired in series, so that both must be operated before the electrodes are charged.

The location of equipment in the boat can also be a safety concern. Making good passageways for the crew, keeping the wiring in conduits up next to the hull, and keeping loose items from cluttering the passageways reduce more ordinary accidents. Tripping over something loose is not an acceptable hazard, especially when it can land you on a hot muffler. A clean boat will let the crew do its job with more confidence.

### 2. Isolating the ac wiring.

While safe on land, having the ac wiring a part of the grounding in a boat is dangerous. The hull becomes a major electrode, and results in a lethal potential between the hull and either electrode. Trying to place the generator on a base so that it is isolated from the hull results in it's becoming a shock hazard to the crew while it is running. Isolating the wring, or "floating the output" is the only safe solution.

The isolation is done by removing the wiring at the outlets that connect the ac common wires to the ground lugs and generator frame. Generally speaking, removing the green wires should accomplish the isolation. Using a meter set to ohms, and checking that there is no reading between the frame and the wiring will verify that the output is isolated.

People expresed concern about the safety of lights and plug-in equipment if used with an isolated generator. In the case of both, the hull is now the protective ground, and as long as the wiring is not exposed, will give the same protection as in a conventional dry land situation. Should a wire come loose and contact the reflector of a lamp, or the case of a drill, the charge will affect the whole boat. Since no potential difference will result, no shock hazard is created, although the hull will be an electrode, and the field in the water will be affected.

3. The electric field.

One pleasant surprise from the use of the measuring wand was that the electric field in the water is more evenly distributed than we were prepared to see from the examples in the printed material. I did not collect the measurements gathered, as the method was very rough and ready, and really should be done where distances are measured rather than estimated.

However, some pretty clear results did show up, at least for the dc boats. The ac boats showed a very even potential virtually everywhere, and the wand only found a gradient directly on a line between electrodes. Probably, the artificial fish (shown in figure 2) will have to be used to accurately measure the field around an ac boat.

But, for dc, things looked very good. In all cases, the field gradient was a lot more even than we expected. One boat had a line of cathodes hung in front of the hull, and another line of anodes mounted in a line about six feet ahead. The field looked very even, and no hot spots around the anodes showed up. The field voltage extended down almost four feet at the canter before it began to fade.

The boats with side-hung cathodes did almost as well. There was a very small gradient until the bow was reached, which indicates that the hull spreads the emission from the cathodes pretty evenly. Again, the gradient from the end of the hull to the anodes was very even, and pretty linear.

One possible conclusion to draw from these results is that things are different in the water than in a labratory tank. To be fair, though, we were measuring over an unknown bottom, which might have had steel rebar in it, being close to boat ramps. And the docks the boats were alongside of had steel straps around them at the waterline. They may have had an effect on the field measurements.

On the other hand, it may also turn out that the spherical electrodes used in the lab work have the worst characteristic for producing steep gradients at the electrodes. At least the rigs at the workshop looked as if they were putting nicely graded fields in the water.

4. Electrodes.

One prediction I made was that electrodes might cause problems due to poor conduction. We saw that in the wand tests. The effect shows up in a large voltage drop at the electrode, where the voltage measured at the conductor is much higher than the voltage in the water right at the anode droppers.

The worst drop we saw was in a boat using spring clips to attach the droppers. We measured 117 volts at the support, but only 45 volts in the water at the droppers. Almost 2/3rds of the potential for the field was lost in the resistive anode contacts.

This is a good thing to be aware of in the field. Water conductivity measured 330 micromohs in the river, and most rigs stunned the odd fish. But in low conductivity water, a rig that loses a portion of the voltage in the connections probably won't take fish, even if the meter on the control box indicates a good voltage. This is one valuable use of the measuring wand, as it can tell you if you are having problems with dropper connections.

A couple of things come to mind here, too. The field acts somewhat differently from the predictions out of the books. For one thing, we couldn't see any difference in field linearity in boats with the anodes arranged in rings and those with a straight line of droppers. Probably only the number of droppers is significant at the anode. With some investigation, it may turn out that as long as there are enough droppers in the water, then the field will remain pretty well-distributed, and not have any hot spots near the anodes.

And if a simplified anode arrangement still won't allow you to attach the droppers permanently (the one boat with braised anode droppers showed no voltage drop in the water), then the suggestion from one person was to try using air hose quick disconnects instead of spring clamps or chains and hooks. The quick disconnects should make a pretty good mechanical and electrical joint.

The rule of thumb in the books is to use about 10 times the area in the cathodes as in the anode. This seems to be fairly unimportant if using side mounted cathodes. The hull spreads the field very evenly. and prevents the field from bunching up. On boats at the workshop, we saw about a 10 - 15 volt drop at the cathodes, possibly due to corrosion and losses at the connections. Going foreward with the wand, the field would only measure about 20 - 25 volts at the bow, and then start to show a greater gradient after passing the bow. The hull measured almost the same as the drop at the cathodes. So it looks as if the hull will keep the field well distributed, even if the cathode area is fairly small.

One of the boats dropped its cathodes inside the hull to see what happened if the hull alone was the cathode. Remember that with the generator output isolated, and the gear in the boat strapped, there was no shock hazard created. Like a bird on a power line, everything and everybody took the same potential. The control box showed a higher amperage for the same voltage setting, so the hull make a good cathode.

About the only hesitation I would have about using the hull this way is that the possibility of mishap seems to be increased. The difference in the hull being a passive part of the field, and an electrode is probably not all that significant, but it feels a bit more unsafe. There is also the possibility that the hull would lose a lot of metal due to electrolysis if used as an electrode.

I guess the best arguement against charging the hull directly is that there would be no way to decrease conduction in high-conductivity water. With individual cathode droppers, some can be removed to increase the gradient. That's obviously impossible with the hull as the cathode.

5. Measuring Wand and Artificial Fish

Both these devices were discussed at the workshop, and the wand was used out at Kessler Park. The wand will allow measuring the field gradient, and the artificial fish wiil let you explore the field more thoroughly.

The wand (figure 1) is no more than a means of placing one meter lead in the water, while insulating the user. The other lead ends in a big alligator clip, and is attached to the cathode, so the meter will measure the voltage change from the cathode out to the anode. I used a connector in the end of the wand at the workshop, but the easiest way to make it is with a long wire that will plug in the meter without an interim connection. The wires need to have 600 volt insulation, and be flexible, but can have a small conductor inside (22 ga is plenty big).

As I said in the electrode section, the wand can also tell you if the connections to the droppers are good. If you put the screw against the conductor the droppers hang from, and measure more voltage there than in the water next to the droppers, then the connections are dropping voltage. In marginal conditions, like low conductivity water, this can explain why you aren't taking fish. Even with good conductivity, a boat with a big drop like the one described might not work very well.

The artificial fish will show you how much voltage a fish in that part of the field will feel. The 20 cm dimension is probably a good average length, and the voltage should pretty much scale with length (if the 20 cm probe has 10 volts across it, a 30 cm fish at the same place should have 15 volts across it). People who go after one species especially might want to make theirs to the same average length as the fish.

Steve mentioned that the average resistance of a fish was on the order of 1000 ohms. So the resistor in the pipe is there to simulate the effect of the fish's conductivity.

The artificial fish can be used to map the part of the field that should take fish. Used between boats in a region, it can be used to let crews adjust their droppers so that everybody has the same field distribution and gradient. This should help to make every boat's unit of effort the same, and regularize the sampling efforts.

The artificial fish needs to be horizontal while measuring the field. It might be most convenient to push the vertical pipe through a foam float, so it always hangs a foot or two below the surface. Then, another length of pipe (or the measuring wand) can safely push it to different positions in the field.

## 6. Meters & Metering

Any old meter will do, but the digital ones are easier to read. Above the $80 level, they tend to be autoranging, which means you don't have to keep messing with the switch to get the right range. Also, the digital meters will read a voltage of either polarity without swapping leads, which is also nice. It's much easier to be able to just read the meter, than to have to fiddle with it constantly.

The leads that come with it will be goog for checking wiring and such. They will be sharp enough to make good connection with the hull or wiring when using the ohms scale to check continuity or shorts. If using a meter with ranges, always check continuity on the lowest range (looking for 0 ohms). While checking for, say, no connection, like the ac wiring, always use the highest range, and look for no reading at all. Remember that the meter will read through you, so check that before tearing the generator apart.

Get in the habit of turning the meter off between measurements. That may save you from leaving it set to ohms and checking voltage. The meter will be damaged if you do. Most are protected, so that trying to read a high voltage on a low range won't hurt it, though.

FIGURE 1

# MEASURING WAND

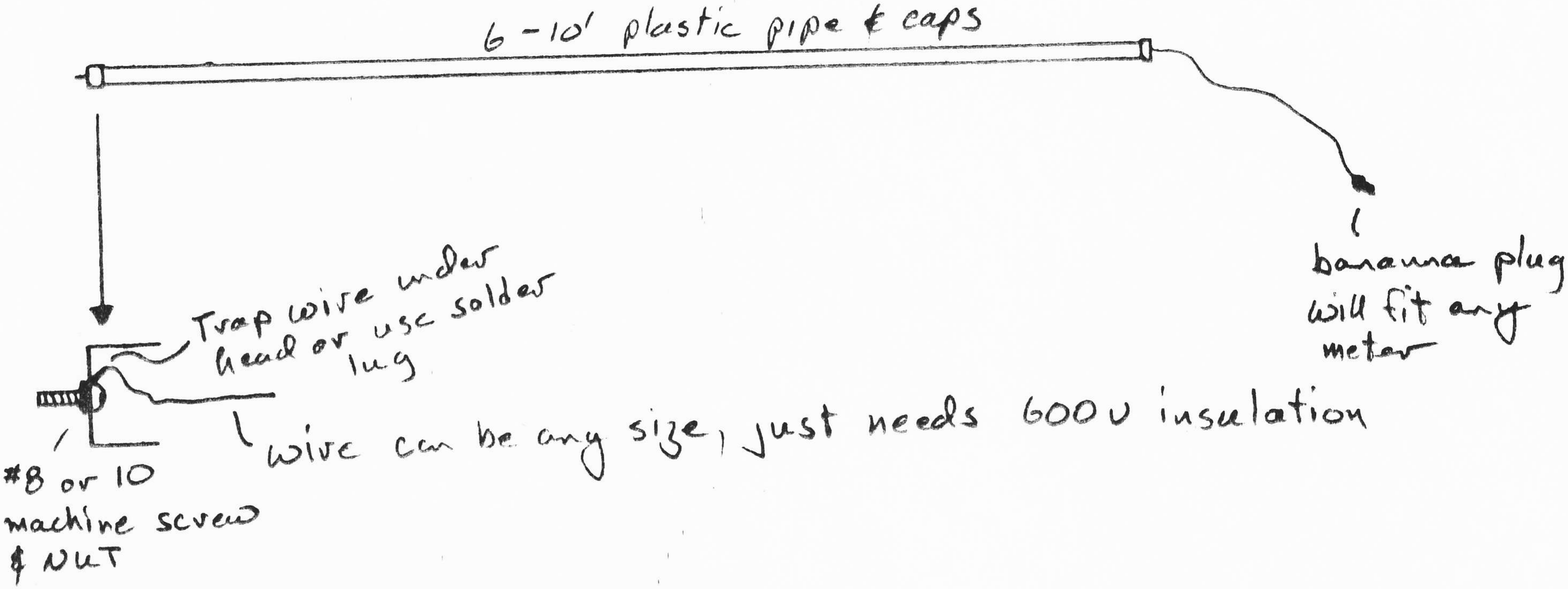
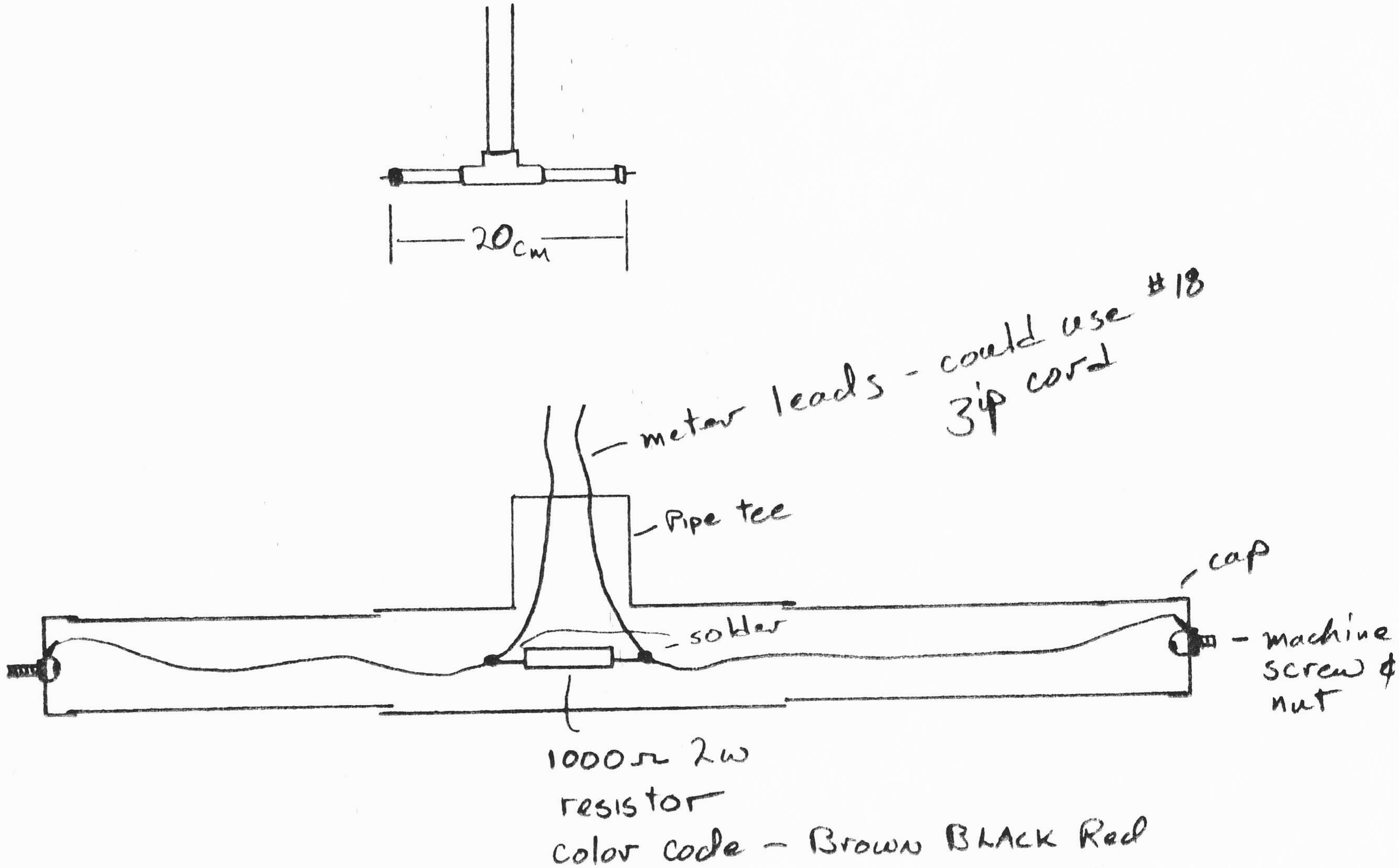


FIGURE X

# ARTIFICAL FISH



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Azotea entered the secretarial field during World War II, moving from Quincy to Washington, D.C., where she began working for the Federal Bureau of Investigation. "I loved it."

After returning to Quincy, Azotea raised a family, but explained that once her three children were grown she wanted to return to the office. But first, she took two years of courses at Gem City before joining Quincy Soybean in 1967.

She has continued her secretarial education and became a certified secretary in 1986. "You have to keep abreast with changes in the field because things changes so rapidly," Azotea said.

listed, of 1400 N. 16th. Raymond is charged with three counts of unlawful delivery of cannabis, one count of unlawful distribution of cannabis without a cannabis tax stamp, two counts of unlawful delivery of a controlled substance and one count each, unlawful distribution of a controlled substance without a controlled substance tax stamp and narcotics racketeering stemming from June 6 through Sept. 16, 1988, incidents.

two counts of unlawful delivery of cannabis, one count of unlawful delivery of a controlled substance and one count of narcotics racketeering stemming from incidents between Aug. 17 and Oct. 28, 1988.

A June 13 jury trial has been set for Donald Dasch Jr., 26, of 136 Locust. Dasch is charged with two counts of unlawful delivery of cannabis stemming from July 21 and Aug. 28 incidents.

# Biologists learn about using electricity as fish-testing tool

By Edward Husar
Herald-Whig Staff Writer

Fisheries biologists have been using electricity as a fish-testing tool for more than 40 years, but relatively little is known about the practice.

"It's a science, but it's still in an early stage," said David Pederson, a fisheries biologist for the U.S. Fish and Wildlife Service in Minnesota.

Pederson coordinated a three-day electro-fishing seminar in Quincy this week for 56 fisheries biologists from Illinois, Missouri and Iowa.

Most of the participants work for state conservation agencies and use electro-fishing to learn about fish in lakes, rivers and streams in their jurisdictions. The seminar focused on how electro-fishing works and its impact on fish.

In electro-fishing, electric current is sent into the water, stunning nearby fish and causing them to float to the surface. The fish are then netted and placed in aerated tanks until they are examined, measured, weighed and sometimes tagged. The fish are then released, usually unharmed.

Biologists use electro-fishing to determine what species are present, their abundance, their age and rate of growth, and what diseases, if any, are causing problems.

Fisheries management decisions are often based on these findings. Scientists might recommend creel limits or length limits to protect slow-growing species, or they might call for other remedies to help troubled fish populations.

Electro-fishing is a helpful tool, but it's an enigma of sorts.

"We're just starting to learn about it," said Steve Malvestuto, a biologist with Fishery Information Management Systems of Auburn, Ala.

Malvestuto was one of the featured speakers at the seminar, which began Tuesday and included a session Wednesday at Quincy Bay, where equipment used by field biologists was evaluated.

Another speaker, Bill Bennett of the Univeristy of Missouri's Electronic Instrument Lab, said most of the textbooks on electro-fishing were written before 1970, and much of the information is questionable or not applicable to many field biologists.

He said an array of different generators and electrodes are employed, and there is little uniformity in the amount of current used. Too much current can hurt fish or kill them.

Seminar participants learned ways to control the electricity so the most suitable amount is used for the type and size of fish being tested. Water clarity, depth and conductivity also must be taken into account.

"This conference has been a real eye-opener in a lot of ways," Bennett said. "We're finding there's less uniformity (in the use of electro-fishing techniques) than anyone realized."

Malvestuto said fish in most cases are not harmed by the electricity, but a recent study involving large trout showed that a large percent suffered some damage to their vertebrae when a heavy current was discharged.

He said the study illustrates the need for biologists to be careful when using electro-fishing equipment.

How much power is enough?

"No one really knows," Bennett said. That's why seminars like this are useful, he said, because the exchange of information will help establish more effective standards.

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musical along with Gershwin's "Strike Up the Band," "Rhythm of Life" from "Sweet Charity," and "Since I Fell For You," first released by Neil Sedaka and recently re-recorded by Al Jareau.

Music by Randall Thompson will highlight the Chamber Choir's program, including "The Road Not Taken" and "Choose Something Like a Star." Two Newfoundland folksongs, "Feller From Fortune," and "I'se the B'y" and the spiritual "Ezekiel Saw the Wheel" will round out the Chamber Choir's repertoire.

Members of the QC Madrigal Ensemble will shift gears to become the Vocal Jazz Ensemble complete with a contemporary program. Selections will include two Beatles tunes, "Here, There, and Everywhere," "Lady Madonna" and the Woody Herman and Joe Bishop composition "Woodchopper's Ball."

## series ends Thursday

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Presence and

Absence in Petrarch's 'canzoniere'," Meyer will discuss Laura's power to inspire Petrarch's poetry and to affect his sense and experience of time past, present and future."

Meyer is the son of Mr. and Mrs. Ted Meyer of Marthasville, Mo., and will graduate from Quincy College in May. He is vice president of Rho Rho Chapter of Sigma Tau Delta, English honor society.

The public is invited to attend and participate in the lecture and discussion. There is no charge.