Biology 353
Aquatic Ecology Lab
S. Fennessy

Stream Sampling Field Trip

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Watershed land use has been shown to influence stream ecosystems; in particular, agricultural (Fitzpatrick et al. 2001) and urban (Fitzpatrick et al. 2005) land uses have been shown to negatively affect fish biological integrity. Some studies (e.g. Wang et al. 2002) have shown that natural *riparian* (streamside) vegetation can buffer the effects that human land uses have on streams, suggesting that preserving the riparian corridor may be a key to preserving streams. Other studies have found that stream fish community structure, diversity and biomass are primarily determined by *in-stream habitat* features (Gorman and Karr 1978), which may only be determined by watershed and riparian characteristics on a gross scale (Wang et al. 2003). On our field trip, we will collect data that will allow testing of hypotheses addressing the relative importance of these different scales of influence.

We will collect detailed information about the fish species assemblages at several sites in t he watershed, including the number of each species, and their length and weight. These data can ow testing of hypotheses on the relationships between environmental characteristics and aspects of the fish community. They can also be used to look at biological interactions within the fish community, such as predation (Wootton and Power 1993) and competition (Schlosser et al. 2000).

In this lab you will learn how to collect fish using a backpack electrofisher and measure habitat variables at different scales. You should be making observations and thinking about a hypothesis you can test using the data we collect. The following sections describe the field methods we will use.

Fish Sampling

We will collect fish from The Kokosing River using an electroshocker. This device produces a current of electricity in the water that causes either *galvanotaxis*, where induced muscular contractions cause fish to move either toward or away from the source of the current, or *galvanonarcosis*, which is electrically-induced unconsciousness. Fish are then netted and put in buckets to be identified and measured. If done properly, electrofishing does not kill fish and is safe for the people involved. However, the following **safety precautions** must be observed:

People

1. All people who are in the water near (within 30 feet) the electrofisher must wear electrically-insulating gear (waders and rubber gloves).
2. Do not touch the electrodes when the current is on; even wearing rubber gloves, you may receive a painful shock.
3. The electrofisher is equipped with a safety switch, which stops the flow of current if the operator is incapacitated.
4. The electrofisher has a tilt-activated kill switch; if the backpack is tilted too far from vertical, it will stop emitting current.
5. The electrofisher makes a beeping noise when the current is on.

Fish

1. The electric field is stronger close to the electrodes.
2. Do not touch fish with the electrodes – it may kill them.
3. Large fish are affected more by the current than small fish.

Electrofisher operation instructions will be provided at our field sites.

We will collect fish from a 30 m reach of stream using two 10 minute passes. Each end of the reach will be blocked with a net, so by the end of the three passes, most of the fish will have been captured. The electrofishing crew (electrofisher operator, 2 netters, and a bucket wrangler) will move from the downstream end of the reach to the upstream end, in a zig-zag pattern. Fish tend to be concentrated in areas that have "cover", such as undercut banks, large rocks, logs, etc. An effective way to capture fish from these areas is to approach them quietly with the current off, then quickly stick the electrode near the cover feature, and turn on the current.

All fish will be identified and measured for length before they are released back into the stream. While working with fish on shore, especially if it is cold, be careful to minimize handling time and exposure to air. In general we should do everything we can to minimize stress and to avoid killing the fish!

Habitat

We will collect habitat variables on the same 30 m reach where fish are collected. The first job of the habitat crew is to measure the reach, then place marker flags at the ends and every 10 m within the reach. These flags will be used as endpoints for transect measurements. A stream transect is a line that extends across the channel, perpendicular to the direction of flow. You will measure the following variables at each transect.

Stream Width
Measure the width of the stream at the water surface, perpendicular to the direction of flow. Once you have the meter tape set, leave it in place until you are done collecting all the in-stream habitat data for that transect.

Depth
Measure water depth at three points across each transect. Divide the stream width by 3 and take a depth measurement with the meter stick in the middle of that $^1/_3$ of the stream. (For example, if the stream is 9m wide, $^1/_3$ of the stream is 3m. Take depth measurements at 1.5m, 4.5m, and 7.5m.)

Flow Velocity
We'll use the standard procedure using the flow meter.

Dominant Substrate
Look at the area under the meter tape. What is the **dominant** substrate type you see:
silt, sand, gravel, cobble, boulder (categories in increasing size, left to right).

Dominant Riparian Land Cover
Visually estimate 30 m away from each bank along each transect. Note the dominant land cover: cropland, pasture, urban, residential, grassland, forest, wetland.

Width of Natural Buffer
Estimate the width of natural land cover (grassland, forest, wetland) adjacent to the stream on each side.

Undercut Bank Length
Measure the length of bank between transects that is undercut (overhanging).

Tree Canopy Cover
Extending the transect along a vertical plane, estimate the percentage of the sky that is obscured by tree canopy.

References

Fitzpatrick, F. A., B. C. Scudder, B. N. Lenz, and D. J. Sullivan. 2001. Effects of multi-scale environmental characteristics on agricultural stream biota in eastern Wisconsin. Journal of the American Water Resources Association 37:1489-1507.

Fitzpatrick, F. A., M. W. Diebel, M. A. Harris, T. L. Arnold, M. A. Lutz, and K. D. Richards. 2005. Effects of urbanization on the geomorphology, habitat, hydrology and fish index of biotic integrity of streams in the Chicago area, Illinois and Wisconsin. Pages 87-115 in L. R. Brown, R. H. Gray, R. M. Hughes, and M. Meador, editors. *Effects of Urbanization on Stream Ecosystems.* American Fisheries Society, Symposium 47, Bethesda, Maryland.

Gorman, O. T., and J. R. Karr. 1978. Habitat Structure and Stream Fish Communities. Ecology 59:507-515.

Schlosser, I. J., J. D. Johnson, W. L. Knotek, and M. Lapinska. 2000. Climate variability and size-structured interactions among juvenile fish along a lake-stream gradient. Ecology 81:1046-1057.

Wang, L. Z., J. Lyons, P. Rasmussen, P. W. Seelbach, T. P. Simon, M. J. Wiley, P. Kanehl, E. Baker, S. Niemela, and P. M. Stewart. 2003. Watershed, reach, and riparian influences on stream fish assemblages in the Northern Lakes and Forest Ecoregion, U. S. A. Canadian Journal of Fisheries & Aquatic Sciences 60:491-505.

Wootton, J. T., and M. E. Power. 1993. Productivity, Consumers, and the Structure of a River Food-Chain. Proceedings of the National Academy of Sciences of the United States of America 90:1384-1387.