STREAM MEASUREMENT

Assignment #1

WFS 443

INTRODUCTION

The object of this exercise is to learn techniques used to measure basic physical characteristics of a fish sampling site on a stream. You will determine mean width, surface area, discharge, and proportions of the habitat types present. Chapter 9 of your text discusses stream habitat and its management, so you should read through it before completing this exercise.

Calculation of a site's surface area (length x mean width) permits fish population data to be expressed in a standardized format. Thus, population and biomass estimates can be converted to densities (number of fish per hectare) and standing crops (total weight of fish per hectare). Densities and standing crops are typically calculated for each species present at the site, and sometimes for different age groups within a species. Data standardized in this manner can then be compared among streams, among years, before and after a particular management program, etc.

Discharge or streamflow is essentially the cross-sectional area of water at a given point multiplied by the velocity at which the water is flowing. However, since velocity typically varies substantially within the channel, discharge estimation requires that the

channel be divided into several sections to account for these differences. Fish sampling is typically conducted when flows are seasonally low (summer and early fall in the Southeast). Changes in discharge can affect habitat quality and quantity, and can alter surface area at a sampling site.

Habitat refers to the various combinations of conditions and objects that fish require for food, protection from predators, spawning, etc. Where other factors are not limiting, habitat quantity and quality is often positively correlated with fish densities, standing crops, and diversity. It is important in quantitative fish population surveys to sample all habitat types present. Basic habitat units (pools, riffles, boulder complexes, etc.) are typically identified and quantified as part of a fish survey.

PROCEDURE

Your team will chose a small stream to be the "study stream". Any small stream will be fine but limit yourselves to a stream of width less than 3 or 4 meters and a **depth not exceeding 1 meter**. Pick a stretch of stream that is relatively accessible and has minimal overhanging vegetation and other hazards so the stream may be sampled effectively without excessive difficulty. Once the site is chosen, measure off 100 m of the stream. Mark the beginning and end with surveyors tape (flagging).

Beginning at the downstream end of the site, measure the width (perpendicular to the flow) of the stream. At the same place the width measurement was taken, at

approximately 1/4, 1/2 and 3/4 of the way across the stream, use the meter stick to measure the depth. At the time the depth is taken, you will classify the substrate (bottom) type as having one of seven types as a dominant and subdominant substrate in a circle around the measuring point of approximately 0.5 m radius. The substrate types are (1) organic (logs, leaf packs, etc.), (2) silt, (3) sand, (4) gravel (larger than sand but < 2.5 cm dia.), (5) cobble (> 2.5 cm and < 10 cm), (6) boulder (> 10 cm) and (7) bedrock. First, classify the dominant substrate and then assign a percentage greater than or equal to 50% in 10% increments (50%, 60%, etc.). Secondly, assign a subdominant substrate type which will then constitute the remaining percentage of substrate at that site. (A subdominant substrate will not be assigned when the dominant is classified as being 100%.)

From the starting point, measure off 10 m intervals and repeat the width and depth measurements and substrate classification for the entire section. Additionally, for each 10 m section, classify it as pool or riffle (A pool consists of a relatively unbroken surface and a riffle contains much unbroken surface). When completed you should have 11 sets of data each set containing a width, 3 depths 3 substrate classifications and 10 classifications as pool or riffle..

Lastly, measure the flow velocity using an orange (one may be purchased at any local grocery store) and timing it as it flows with the current through a 10 m section. Randomly pick three section numbers and measure the velocity in each.

CALCULATIONS

From the data taken you should be able to calculate mean width, mean depth, surface area via two methods, flow and discharge rates, and percent substrate types for the 100 m study site. Mean depth (cm) and width (m) are simply the average of all of the measurements. Surface area (m^2) can be calculated (1) by taking the mean width times the length of the section or (2) by treating each 10 m segment as a trapezoid with a height of 10 m and the bases are the width measurements above and below the segment. Flow (m/s) is simply the average of the three trials. Discharge can be calculated by finding the cross-sectional area (m^2) of the stream, using mean depth and width, and multiplying it by the flow rate giving your answer in CMS (m^3/s). Each substrate percentage is calculated by summing all of the percents of that particular substrate type (i.e. silt) and dividing it by the sum of all percent values for all substrate types. The sum of the seven types should total 100%.

QUESTIONS

Along with the original data answer the following (show work for calculations):

1. What is mean stream width for the site? What is the mean depth?

2. What is the surface area for the site (in m^2 and hectares) using both methods? Is there a substantial difference between the two methods?

3. How many transects are located in pools? In riffles?

4. What percentage of the site (based on length) is composed of pools?

5. What percentage of the site (based on length) is composed of riffles?

6. Give the pool:riffle ratio (units of pool per unit of riffle, the riffle number should be 1, another words acceptable answers would look like 3.1:1 or 0.76:1).

7. What is the mean flow rate? What is the mean cross-sectional area? Using these, calculate discharge. Give results in both CMS (m^3/sec) and CFS (ft^3/sec).

8. List the seven substrate types and their percentage composition.

Note: All students must be able to do these calculations on the midterm. Also, arithmetic mistakes count off substantially on this assignment, so it is wise to have each team member make the calculations independently and compare results.

**Addendum: Also do an alkalinity test (instructions in box) and report as mg/L as CaCO3 in report.