SEDIMENT EMBEDDEDNESS OF FISHERIES

When sediment, especially sand, packs tightly (embeds) into spaces between stones and gravels in the river bed, it smothers stream insects and fish eggs. Many aquatic insects that fish depend upon for food live between substrate gravels or tunnel into the river bed. When sand packs into, and covers, these areas, insects are deprived of oxygen. If too much sand covers a redd (a gravel covered "nest" of fish eggs), the eggs are smothered. Fisheries biologists claim that 40% embeddedness of a river's substrate is severe. At 50% it is doubtful that trout and salmon can naturally reproduce. Sediment can also fill in deep pool areas of a river that are used by fish to over-winter in an ice free environment.

With training from DEC, BRASS measured embeddedness primarily in riffle areas with 1-2 feet per second velocities along the Boquet and E. Branch of the AuSable River. Good invertebrate or fish food production occurs in rifle areas with these velocities. Although fish spawning areas are at the tail end of pools with slower velocities, if streambeds in faster moving water are embedded in sand then spawning sites would suffer even more. When BRASS looked at areas with less than 1 foot per second velocities, we tried to compare these with other similar reaches in terms of depth, velocity, and streambed make-up.

Procedure for Study

Embeddedness surveys were performed at five locations across the river at each site (3-6' from each bank, as well as at 25%, 50%, and 75% of the width). At each location the depths and velocities were measured and recorded, and the area within a 4' diameter steel hoop was assessed with a water scope for the dominant particle size and percent embeddedness. (The dominant particle is the size of stone - or sand grain - most prevalent in the location.) At least a dozen dominant stones were picked up within each 4' diameter and measured for embeddedness with calipers. (Typically, the boundary area of a stone between being embedded or free from sand can be assessed both by sight and feel, because there is a thin layer of periphytin (algae) on rock areas with water contact.

Results of Studies

As seen from the charts, nearly all areas studied on the Boquet's main stem, the Branch, and the North Branch, are at a critical 40% embeddedness. The E. Branch of the AuSable fares slightly better for fisheries habitat. In nearly all cases, the amount of embeddedness measured in ‘94 was similar to that in ‘93, which brings up several questions:

- Are sands packed so tightly that floodwater cannot flush sand out of the spaces between stones? If so, why was there not a percentage increase the following year?
- Are sands flushed from the interstices with floodwater, and re-packed by an equivalent amount the following year?

- How many years did it take to reach this level of embeddedness?
- Is the sediment load to the river remaining steady?

Riffle areas with fast flowing water are not usually where sediments get deposited. Generally, sediments transported by a river get deposited when the current is no longer competent to carry them. But other factors enter in like gradient, depth to bottom, discharge volume, increased sediment load, curvature of a river, and different sized substrate materials. The chart shows B-8 (behind the cemetery in Elizabethtown) to be the highest area of embeddedness of those studied by BRASS. It also is an area where the velocity is under 1' per second. Average depth at this reach is 1.4 feet, the dominant particle size is sand-size to 4" cobble, and the gradient is less than between any other studied reach.

Site A-2 (Lacy Road to Styles Brook on the E. Branch of the AuSable), highest in embeddedness of the AuSable areas, has a good gradient (0.027' drop for every linear foot) but has slow velocities near both banks and evidence of both bank scour and road sand contributions.