

## Middle Fork Salmon River

### **General Information**

The study reach is about a 3,760 ft length of river near the Geological Survey (USGS) gage 13309220 (Middle Fork Salmon River at Middle Fork Lodge near Yellow Pine, Idaho) in the Salmon-Challis National Forest. The study reach is about 1.25 miles downstream from the gaging station at the Little Creek pack bridge (Figures 1 and 2). The site is on land administered by the Forest Service at an elevation of about 4,350 ft. The drainage area upstream of the gage location is 1,040 mi<sup>2</sup> and the geology of the watershed is predominantly intrusive igneous and mixed volcanic.

Sediment transport measurements were made from the Little Creek pack bridge by Utah State University personnel predominantly during the spring snowmelt flows of 1997. Additional information collected at this site includes a survey of the stream reach, pebble counts of the surface substrate and core samples of the subsurface substrate material.



Figure 1. Middle Fork Salmon River looking downstream from the pack bridge.

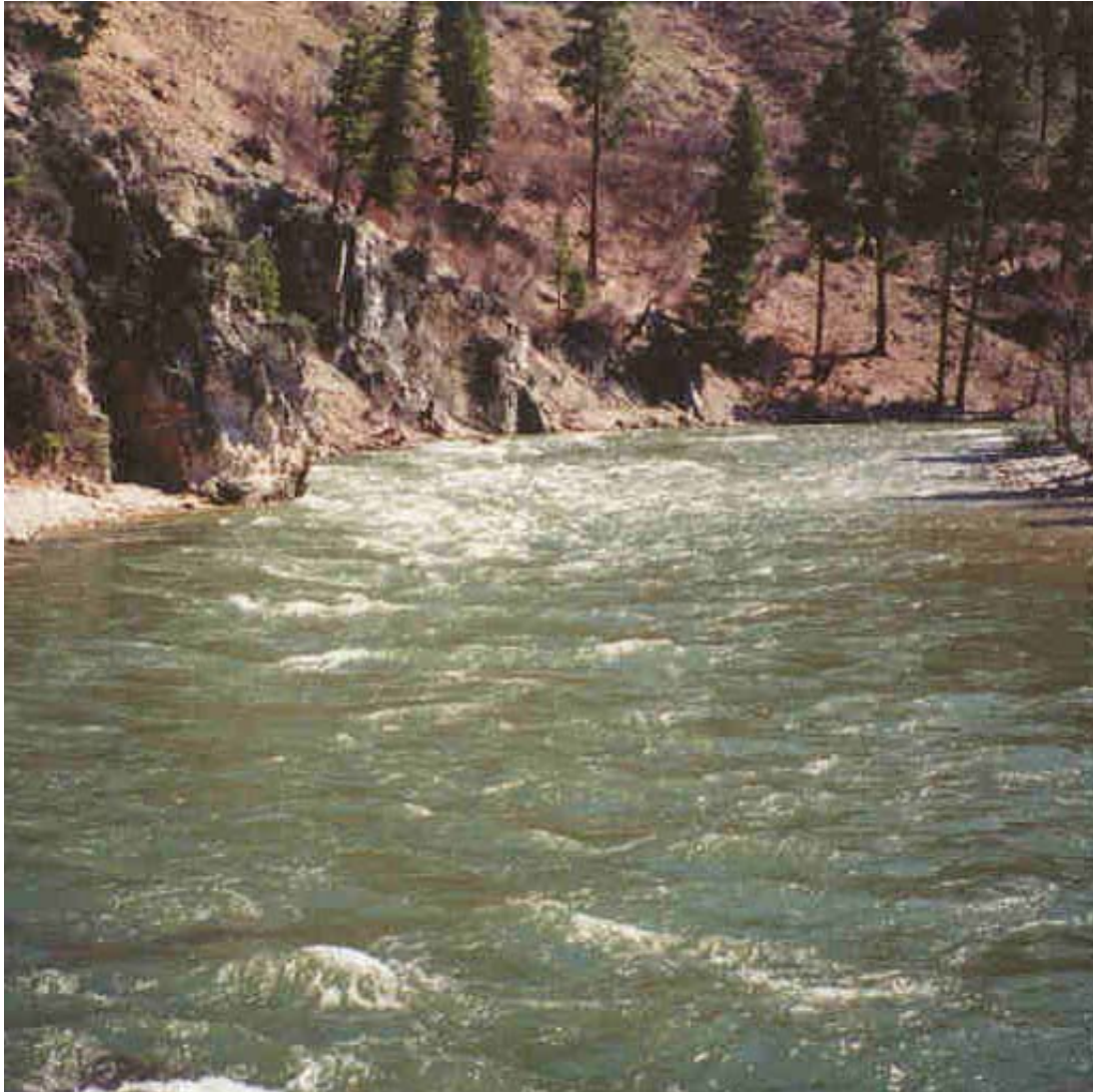


Figure 2. Middle Fork Salmon River looking upstream from the pack bridge.

Streamflow has been recorded from April 1973 through September 1981 and March 1999 to present. Average annual streamflow ( $Q_a$ ) for the period of record is 1,395  $\text{ft}^3/\text{s}$  and the 1.5 year return period discharge ( $Q_{1.5}$ ) is estimated at 7,550  $\text{ft}^3/\text{s}$ . The highest flow recorded was 20,900  $\text{ft}^3/\text{s}$  on June 16, 1974.

## Cross-Section

Figure 3 shows the cross-section at Little Creek pack bridge, 1.25 miles downstream of the USGS gage. The average gradient for the study reach is 0.0041 ft/ft. All sediment transport measurements were made at the bridge cross-section.

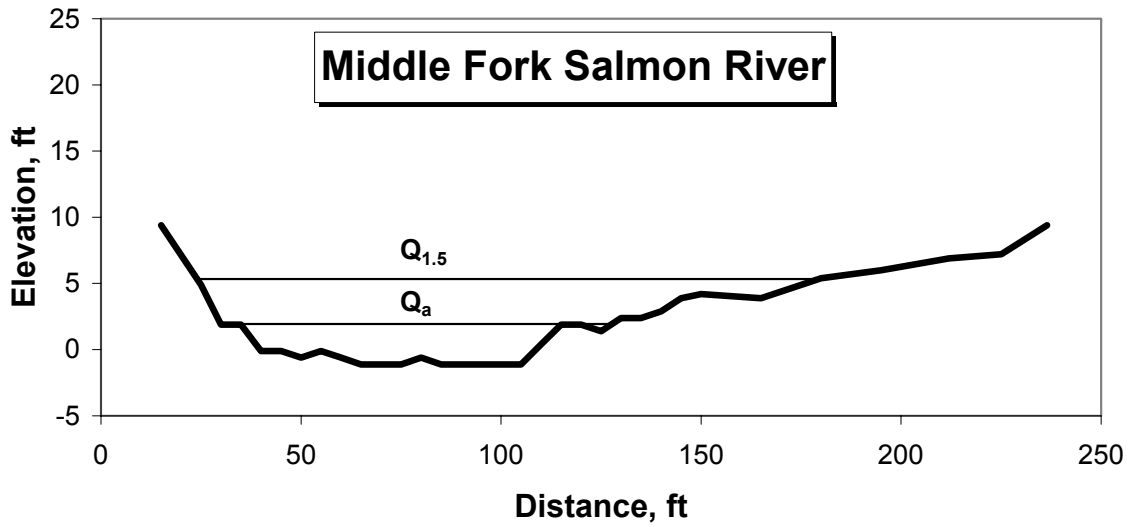


Figure 3. Cross-section of the Middle Fork Salmon River at the Little Creek pack bridge.

## Channel Geometry

The station geometry relationships for the cross-section at the Little Creek pack bridge are shown in Figure 4. Information for all 1997 discharge measurements were used to develop the power relationships with discharge. Over the range of discharges when sediment transport was measured (2,950 to 15,300 ft<sup>3</sup>/s) estimated stream width, estimated average depth and estimated average velocity varied from 172.9 to 223.9 ft, 3.12 to 6.37 ft, and 5.5 to 10.7 ft/s, respectively. The average reach slope is 0.0041 ft/ft.

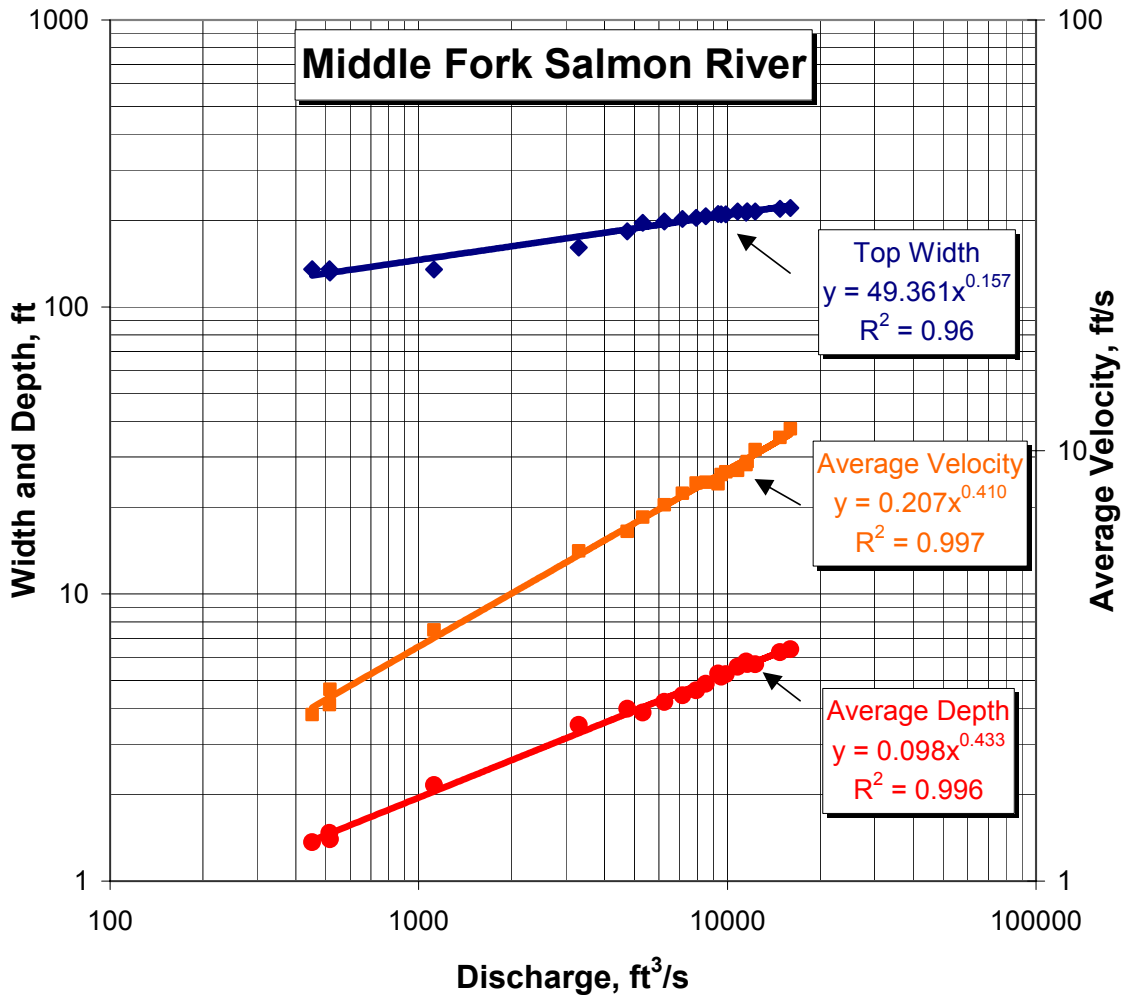


Figure 4. Width, average depth and average velocity versus stream discharge at the Little Creek pack bridge cross-section on the Middle Fork Salmon River.

## Channel Material

Surface pebble counts were made in July 2000 at three cross-sections and three cores of surface and subsurface material were collected, one at each cross-section. The  $D_{50}$  and  $D_{90}$  for the combined pebble counts in the reach are 146 mm and 370 mm, respectively (Figure 5). About 2% of the surface material is sand (2 mm) size or smaller. The average  $D_{50}$  and  $D_{90}$  for the combined surface cores are 128 mm and 221 mm, respectively. The average  $D_{50}$  and  $D_{90}$  for the subsurface combined cores are 36 mm and 174 mm, respectively.

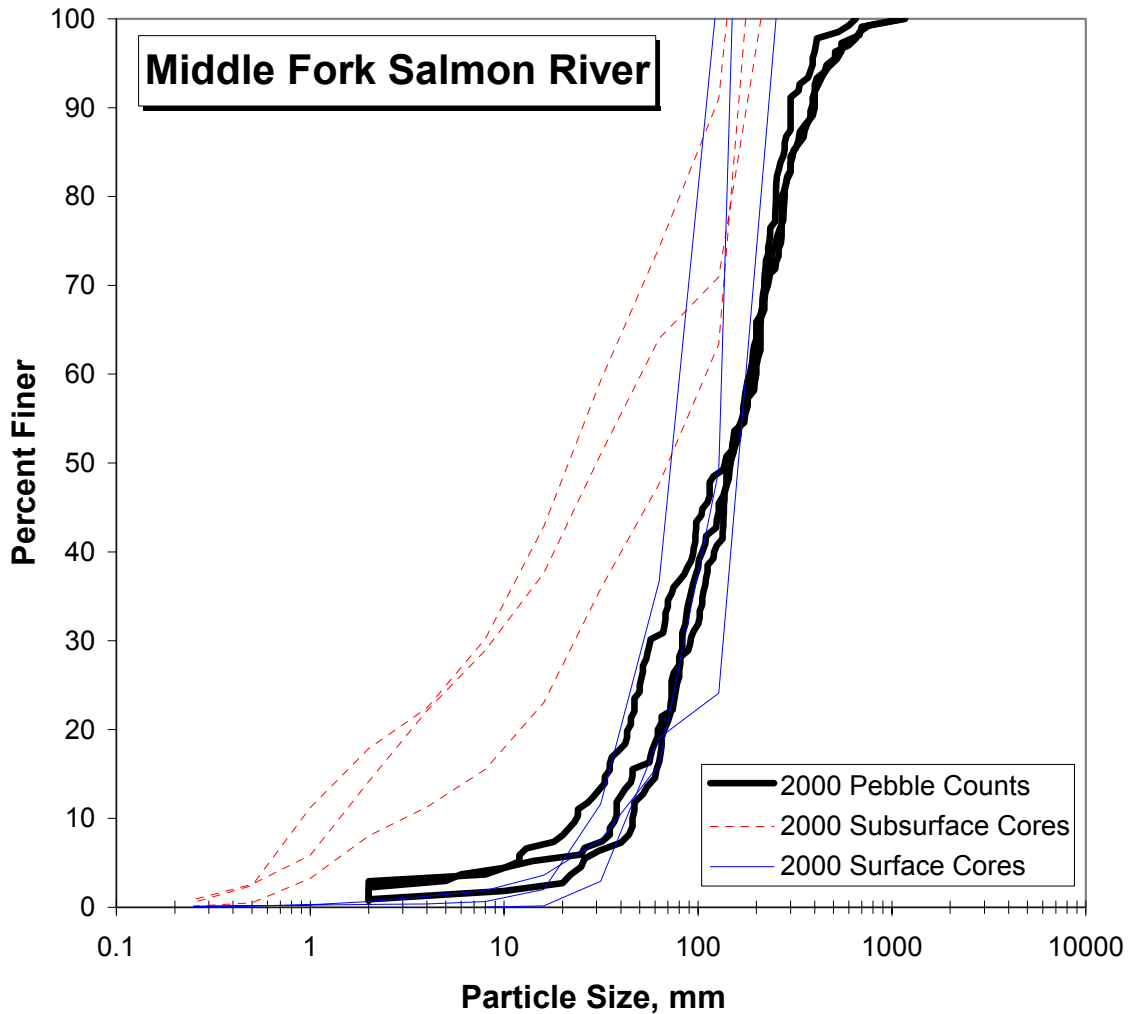


Figure 5. Particle size distribution for surface and subsurface material samples in the Middle Fork Salmon River.



## Sediment Transport

The bedload and suspended load measurements in water years 1997 includes 64 measurements of bedload transport and 31 measurements of suspended sediment. Sediment transport measurements spanned a range of stream discharges from 2,950 ft<sup>3</sup>/s (1.99Q<sub>a</sub>) to 15,300 ft<sup>3</sup>/s (10.34Q<sub>a</sub>). Bedload transport ranged from 0.272 to 4,130 t/d and suspended transport ranged from 80.4 to 20,100 t/d. Over the range of measured discharges, suspended transport accounts for the majority of the material in transport with over an order of magnitude greater suspended transport at the lower range of sampled discharges and a three to four times greater rate at the higher discharges (Figure 6).

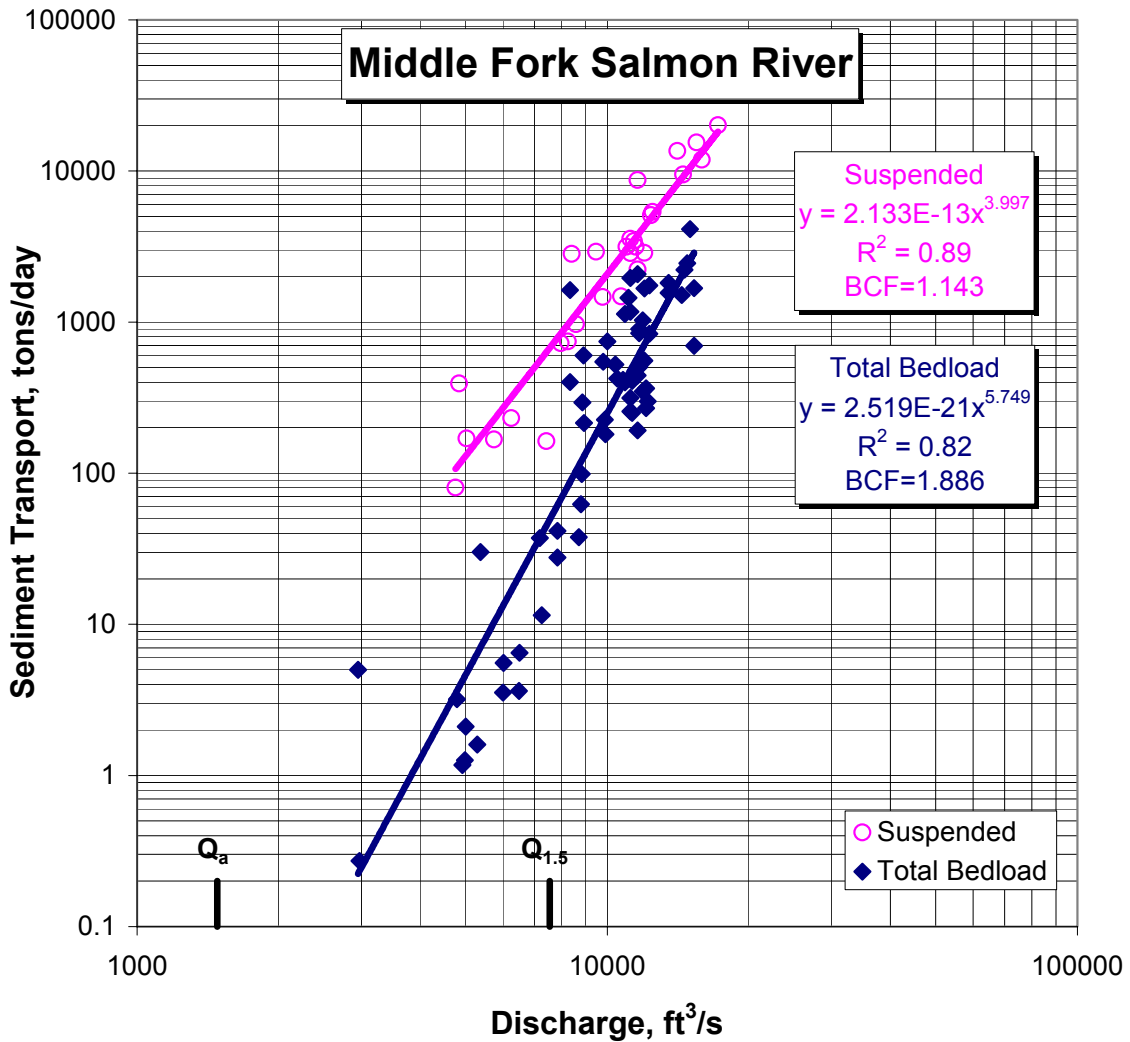


Figure 6. Bedload and suspended load transport rate versus discharge.

The bedload transport rates by size class (Figure 7) shows that the larger rates are associated with material 0.5 to 2 mm diameter. However, at discharges larger than about 8000 ft<sup>3</sup>/s, material larger than 8 mm diameter is well represented in the sample.

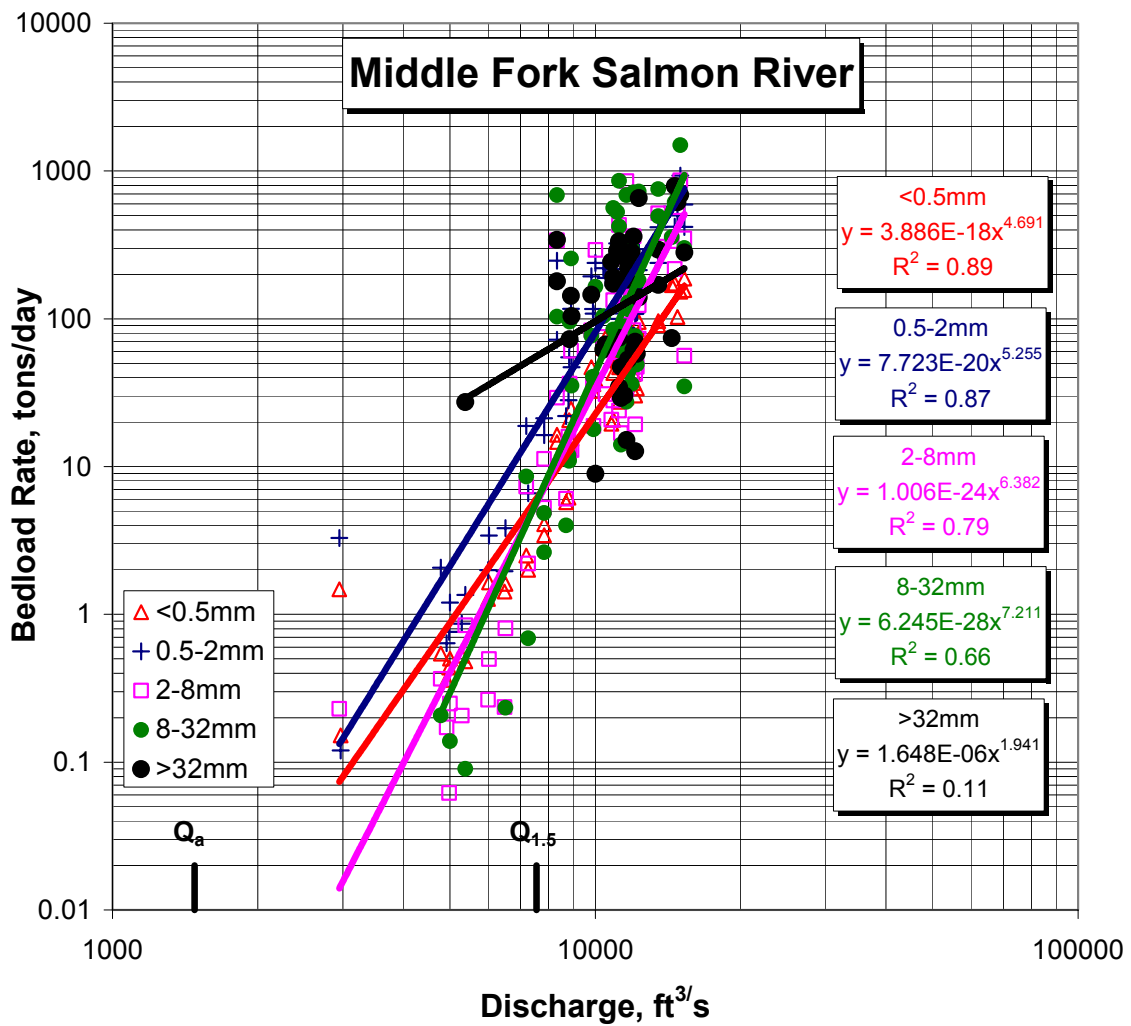


Figure 7. Bedload transport rate versus discharge for selected size classes.

The largest particle in the bedload sample increased with discharge (Figure 8). The largest particle measured in a bedload sample was 83 mm at a discharge of 11,900 ft<sup>3</sup>/s. The median diameter of the bedload sample also increased with discharge. The largest median diameter of a bedload sample was 43.7 mm for a sample collected at a discharge of 5,380 ft<sup>3</sup>/s. The relationship between discharge and the largest particle in the bedload sample suggests that discharges above the 1.5 year return interval discharge are needed before some material about the median size of the surface material is in motion.

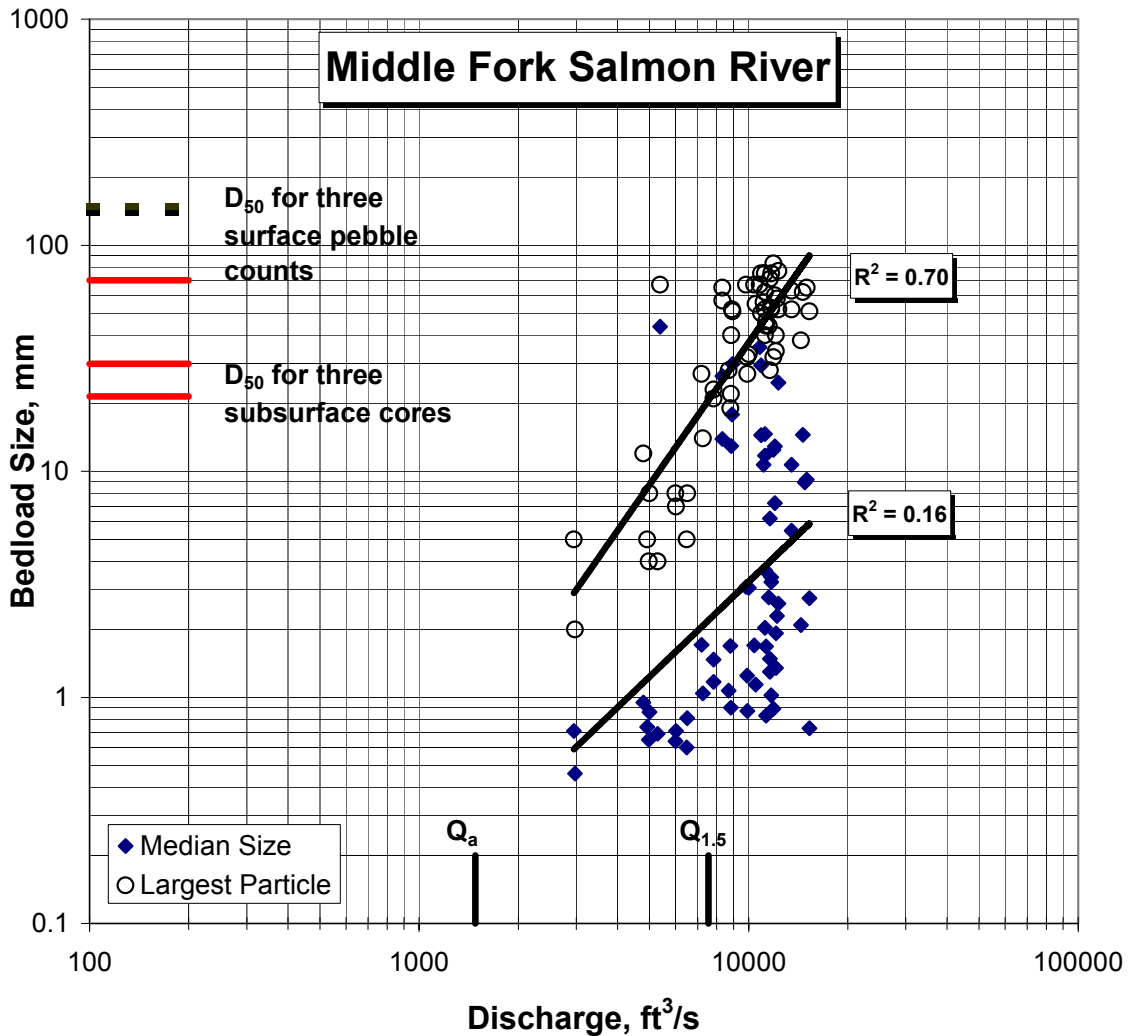


Figure 8. Largest particle in the bedload sample and median size of the sample versus stream discharge for the Middle Fork Salmon River.