

Application of the Cowell Index to Monthly Streamflow Analysis

Robert T Milhous¹

Hydrologist, Torries Peak Analysis, Fort Collins, Colorado 80526

Abstract. Temporal patterns of streamflows are important in the fluctuating physical and biological environment of rivers. Colwell proposed two measures of predictability: constancy, and contingency. The measures are based on the mathematics of information theory. The Colwell Index, predictability, is the sum of the two measures. A consistent method of calculating the Colwell Index for monthly streamflows data was developed and is 1) use monthly discharge time steps, 2) uses 12 discharge classes with the 12th class being all monthly discharges larger than the 11th class boundary, 3) use the equation $B(i) = 0.015625 (2)^{\alpha} Q_m$ where $\alpha = i-1$ from $i = 1, 2, \dots, 11$ and Q_m is a reference discharge to define the discharge class boundaries, 4) use the median monthly discharge as the reference discharge. The Colwell Indices for eight rivers are presented. The rivers were selected because they show the variation in the index that is possible. The eight rivers represent a wide range of watershed types and climates. The range of the Colwell Index for the eight rivers was from 0.21 to 0.84, of consistency 0.10-0.46 and of contingency 0.09-0.44. The contingency is a measure of the seasonal predictability of streamflows. The Gunnison River in Colorado has three periods with difference in the water management. The Cowell Indices was calculated for each of the periods. The consistence increased in all three periods but the contingency was reduced. The principle value of the Colwell Index is in making comparisons, between rivers and water management actions, of the uncertainty of the variable stream environments. This ability to use one index to make a comparison of uncertainty may make the Colwell Index a valuable tool in the analysis of environmental flow needs.

¹ Hydrologist. Torries Peak Analysis.
1812 Marlborough Court
Fort Collins, Colorado USA
Phone: 970 484 9760 email: r.milhous@att.net