# Protection of low flow periods critical for fish production

**Summary of technical documents by Brad Caldwell, Washington State Department of Ecology**

Many studies in the Pacific Northwest have documented that the higher the 30 or 60-day low summer flow the greater the number of returning adult coho salmon years later. Mathews and Olson, 1980 found that the relationship of more summer flow for coho juveniles equaling more returning adults 2 years later still holds strong as did Neave 1949, McKernan et al 1950, Wickett 1951, Smoker 1955, Lister and Walker 1966, Pearson et al 1967. This relationship was reaffirmed in Hartman and Scrivener 1990, and Quinn and Peterson 1996. The summer low flow is still used today by Washington Department of Fish and Wildlife to predict the number of returning coho adults in Puget Sound 2 years later as described in Zillges 1977 and Seiler 2001.

This relationship between low streamflow and salmonid survival has also been shown for steelhead. In the Green River in 1979, Dr. Hal Beecher (WDFW) found the higher the low summer flow the greater the number of returning wild steelhead adults 2.5 years later. For low summer flow he used the lowest daily flow recorded during the summer.

Ecology has previously found in other streams and rivers that a 1% loss of streamflow during the low flow month, usually September, corresponds to around a 1% loss of fish habitat. For example: Ecology and WDFW biologists used weighted useable area data (representing fish habitat) from the PHABSIM/IFIM fish habitat model to calculate the 1% loss of habitat for steelhead rearing and chum spawning in the Big Quilcene River during the September low flow. The agency biologists found that a 1% loss of habitat would be a 1.1 % loss of flow for the Big Quilcene River.

Ecology found for the mainstem Stillaguamish River a 1.1% loss of flow from the September 90% exceedance flow (its low flow month) was a 1% loss of steelhead juvenile habitat using the Instream Flow Incremental Methodology (IFIM) to quantify fish habitat.

Ecology found for the South Fork Stillaguamish River a 0.9% loss of flow from the September 90% exceedance flow (low flow month) was a 0.6 % loss of steelhead juvenile habitat and a 1.3 % loss of chinook spawning habitat. It's not exactly a 1% loss because multiple fish species and life stages are present.

Ecology found for the North Fork Stillaguamish River a 0.94% loss of flow from the September 90% exceedance flow (low flow month) was a 0.7 % loss of steelhead juvenile habitat and a 1.0 % loss of chinook spawning habitat.

F.W. Olson in 1983 summarized the relationship between low summer streamflow and coho run size in a Draft EIS for the South Fork Skokomish River Hydroelectric Project.

the correlation between coho production in Puget Sound and the WDF low-flow index for a composite of streams indicates that a tripling of the stream flow during the critical summer period could be expected to nearly triple the adult coho run (Figure 3-8).

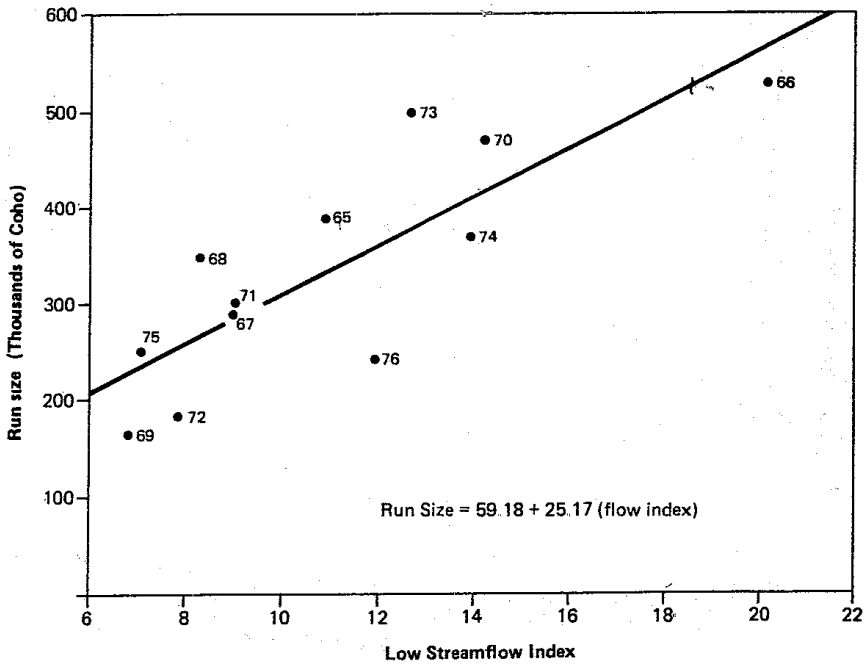
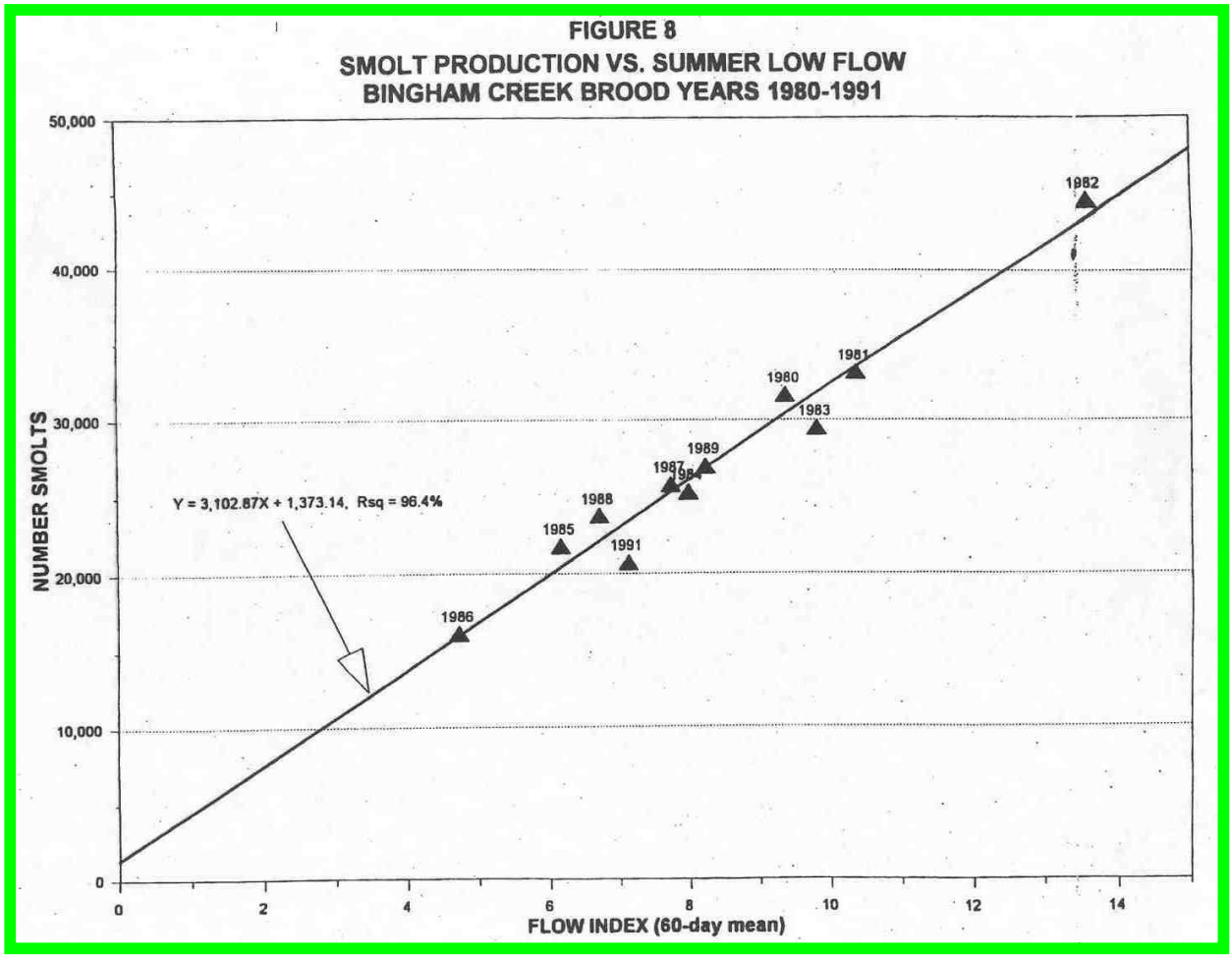



Figure 3-8
**Relationship between Puget Sound Coho Run Sizes and Summer Low Flow**

Summer Flow Enhancement

Numerous studies have shown that coho salmon smolt production and resulting adult returns are positively correlated with minimum summer discharge levels (Neave, 1949; Wickett, 1951; Smoker, 1955). Other studies of stream-carrying capacities for coho have found direct relationships between summer flows and coho production (Lister and Walker, 1966; Pearson et al., 1967). The strength of this relationship for Puget Sound streams is evidenced by its continued high correlation from 1935 (Mathews and Olson, 1980). Currently, the preseason run size prediction of Puget Sound wild coho is based on the relationship between the 60 lowest consecutive days of flow during year i and the return in year i + 2 (Zillges, 1974 and 1977).

Dave Seiler's studies on Bingham Creek for 1980-1991 found more summer flow equals more coho smolts migrating out the following spring.




Seiler (2001) used the Zillges 1977 document (Tech. Memo 28, WDFW) to estimate wild coho smolt production. Zillges 1977 contained estimates of the amount of coho juvenile habitat at summer low flow by using the 60 consecutive day low flow. The flow was averaged over 12 years was called the Puget Sound Summer Low Flow Index (PSSLFI).

When Seiler mapped coho smolt production versus PSSLFI for Puget Sound streams he found a strong positive correlation between the previous summer's flow and the population of smolts the following spring. On Bingham Creek, Seiler stated: "for this low gradient stream, the relationship between smolt production and flow the previous summer is clear: production is a positive and proportional function of flow – water equals fish" (p 14).

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