Migratory Behavior of Sockeye Salmon Fry and Smolts[1]

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ABSTRACT

Considerable new data on the characteristics of sockeye fry and smolt migrations, direct underwater observations of migrating smolts, and a review of the literature are presented here with a synthesis, evaluation, and interpretation of possible survival advantages of these phenomena. Most fry migrations from spawning areas to nursery lakes take place in the spring, when harsh winter conditions in lakes are moderating and the growing season is beginning. Smolt migrations to salt water closely follow spring breakup of the ice and warming of the lake water. The time of smolt migration is correlated closely with latitude: migration is earlier in southern streams than in northern streams. The duration of seasonal migration appears to be strongly related to travel distance to the trunk river outlet. The smolt exodus is rapid and regular in single-lake systems but irregular and extended in multilake or multibasin systems. The frequency distribution of smolts migrating from two-lake or two-basin systems is usually bimodal. Most migrations commence as water temperatures near 40 F and are over when temperatures approach 50 F. Migrations of smolts and especially fry are mainly confined to the darkest hours of the night. In general, in any one season, the oldest and the largest smolts in each age-group migrate first. Other factors, such as the thickness of the ice, effectiveness of solar radiation in melting ice and warming water, and daily weather (including sunlight and wind), also influence seasonal and diel migration patterns. Underwater observations of smolts at night during migration show that they are schooled, travel in the upper water levels in shallow rivers and deeper (but not near the bottom) in deeper rivers, and usually face downstream and swim as they migrate. During migrations, fry and smolts are both often subjected to a depensatory mortality from intense predation by birds and fish. A factor disporportionately affecting different smolt populations is the length and number of restricted passages along the route to the ocean. Smolts migrating in multilake systems must encounter heavier predation than smolts migrating from single-lake systems. Predation is probably minimized en route because of innate migratory behavior patterns. Exceptions to the general migratory behavior of fry and smolts are described to show the wide range in behavioral response to variable environmental situations.

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