Stock assessment and restoration of the Afognak Lake sockeye salmon run

Afognak Lake sockeye salmon Oncorhynchus nerka runs declined substantially in 2001 and subsequent escapements from 2002 to 2004 were well below the escapement goal. Responding to concerns from local subsistence users, the Alaska Department of Fish and Game began investigations of the lake's rearing environment. With successful completion of a one-year mark-recapture feasibility study to estimate smolt abundance in 2003, a three-year study (2004-2006) to continue the smolt abundance estimates and assess rearing and spawning habitats was funded. This report summarizes the fishery and limnological results from the 2004 to 2006 season and compiles all of the available historical data associated with the Afognak Lake system. During 2006, 43,824 sockeye salmon smolt were captured using a Canadian fan trap operated from 16 May to 29 June. Using mark-recapture techniques, we estimated that 205,153 sockeye salmon smolt (95% C.I. 180,952 – 229,353) emigrated from Afognak Lake. The population was composed of 146,527 age-1. and 58,626 age-2. smolt. Age-1. smolt had a mean weight of 3.0 g, a mean length of 70.8 mm, and a mean condition factor of 0.83. Age-2. smolt had a mean weight of 3.8 g, a mean length of 79.6 mm, and a mean condition factor of 0.75. Five limnology surveys were conducted in Afognak Lake from May to September, 2006. Seasonal water chemistry and nutrients concentrations were consistent with historical data collected from Afognak Lake. Afognak Lake is considered phosphorus limited. Seasonal zooplankton density averaged 117,614 animals per m^{-2}, and cladocerans comprised 62.4% of the zooplankton sampled. The cladoceran *Bosmina* was the most abundant zooplankter, while *Epischura* was the most abundant copepod. Rearing conditions within Afognak Lake appear to be stable or improving since lake water chemistry and nutrients were similar to historic levels, and zooplankton abundance did not suggest overgrazing. Favorable rearing conditions were also reflected in the relatively high condition factor of the smolt (>0.75) that enabled most juveniles to emigrate at age-1.

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