Use of Thermal Mark Technology for the In-Season Management of Transboundary River Sockeye Fisheries

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The transboundary Stikine and Taku Rivers originate in British Columbia and flow through Southeast Alaska before entering the Pacific Ocean. Stikine and Taku salmon are harvested in commercial, recreational, personal use, and subsistence fisheries in the U.S. and Canada. Discrete wild stocks exist in both rivers and are intensively managed based on abundance and on harvest sharing guidelines in the Pacific Salmon Treaty. In 1989 a joint U.S./Canada fry-planting program was implemented to increase the sockeye salmon available to fisheries in both countries. Both countries agreed that some quantifiable method of assessing salmon production from this program was desired and that thermal marking of the planted fish and recovery of marks from catches and escapements would likely provide the best assessment method. Canada collects gametes from spawners in Tahltan Lake in the Stikine system (Fig. 1) and Tatsamenie Lake in the Taku system (Fig. 2) and transports them to a U.S. hatchery at Port Snettisham. The U.S. incubates the eggs, thermally marks the eggs and alevins, and backplants the resultant fry into Tahltan and Tatsamenie lakes. Tahltan origin fry are also planted into Tuya Lake in the Stikine system (Fig. 1) above a migration barrier to adult anadromous salmon. Both countries collect and process otoliths at various times from rearing juveniles, emigrating smolts, fisheries that harvest returning adults, and spawning escapements. This paper focuses on using thermal mark technology for in-season management of transboundary river salmon fisheries.

Fishery managers recognize two groups of wild Stikine sockeye, the Tahltan stock and the Mainstem stock conglomerate in addition to the planted Tahltan and Tuya stocks. The primary U.S. harvest of Stikine stocks along with four other major stock groups occurs in Districts 106 and 108 gillnet fisheries while the Canadian harvest of Stikine fish occurs in inriver gillnet fisheries located near the U.S./Canada border and around Telegraph Creek, B.C. (Fig. 1). Inseason management of fisheries is based on catches, catch per unit effort, stock composition estimates, and migratory timing. Rapid identification of thermal marks from sampled fisheries allows managers to estimate the relative abundance of planted fish in the various fisheries. The U.S. initially uses historical stock composition estimates to estimate catches of Tahltan and Mainstem fish. Canada uses inseason analysis of egg diameters to separate the Tahltan and Tuya fish, which have small eggs from the Mainstem fish, which have large eggs. Otolith samples are collected from U.S. and Canadian sockeye catches; immediately after each fishery closure they are shipped to Juneau, Alaska for analysis. Generally preliminary estimates of thermal mark prevalence in the catches are available to managers with 24 to 48 hours of fishery closures. This information yields the number of planted Tahltan and Tuya fish in the U.S. and Canadian catches. The incidence of thermal marks correlated with the egg diameter measurements from inriver catches are used to estimate the relative abundances of the planted Tahltan and Tuya fish to the

Fig. 1. The Stikine River and U.S. and Canadian Fisheris.

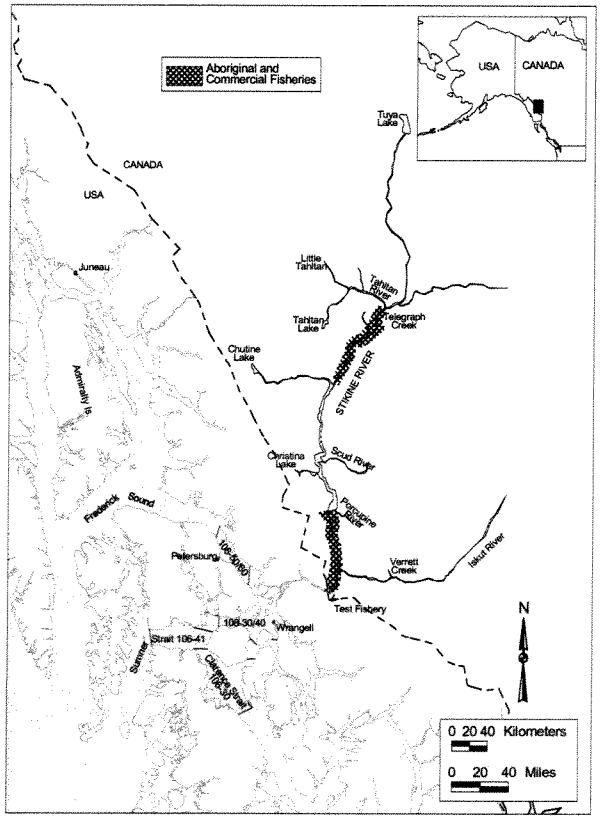

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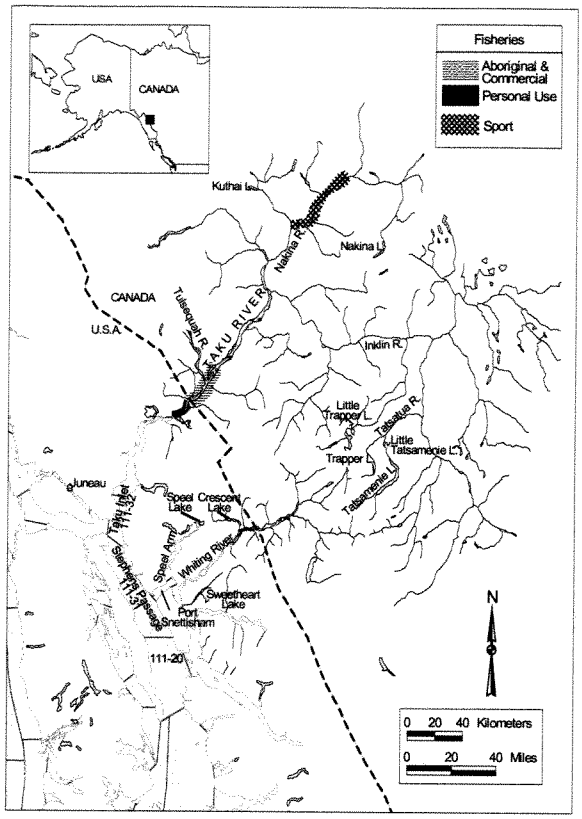
Fig. 2. The Taku River, Port Snettisham, and U.S. and Canadian Fisheries.



wild Tahltan and Mainstem stocks. The inriver ratio of thermally marked Tuya fish to the wild Tahltan and Mainstem stocks is applied to the marine catch of thermally marked Tuya fish to revise the initial weekly marine harvest estimates of these stocks. These inseason stock composition estimates are combined with historical migratory timing information to project the total runs of all three stocks. Scale pattern analysis is combined with thermal marks and egg diameters postseasonally to estimate harvests and reconstruct runs of Tahltan, Tuya, and Mainstem sockeye salmon. Planted Tahltan and Tuya sockeye salmon have contributed an annual average of 25,000 fish to U.S. catches and 23,000 fish to Canadian catches since 1994.

Fishery managers recognize four groups of wild Taku sockeye salmon, the Kuthai, Trapper, Mainstem, and Tatsamenie stocks (Fig. 2). In addition there are two major wild stocks from Crescent and Speel Lakes in Port Snettisham and a stock produced at Port Snettisham hatchery that are also harvested in U.S. marine fisheries. The primary U.S. harvest of Taku and Port Snettisham sockeye stocks occurs in the District 111 gillnet fishery while the primary Canadian harvest of Taku fish occurs in an inriver gillnet fishery above the U.S./Canada border. The abundance of the Taku stocks is estimated inseason from a mark-recapture program in which tags are applied to fish live-captured downstream of the U.S./Canada border and recoveries are made in the Canadian inriver fishery. Contributions of planted Tatsamenie fish and the Port Snettisham hatchery stocks are estimated inseason from analysis of thermal marks. Matched scale, otolith, and parasite samples are collected from the marine fishery and unmatched otolith and scale samples are collected from the inriver fishery. As with Stikine area fisheries the otoliths from Taku area fisheries are processed and analyzed within a day or two after fishery closures. This information allows fishery managers to estimate the relative contributions of wild and hatchery fish to both U.S. and Canadian catches. Postseason analysis of scale patterns provides stock composition estimates for wild sockeye stocks from inriver catches and is combined with parasite prevalence analysis for the marine stock composition estimates. Planted Tatsamenie and Trapper stocks have contributed an annual average of 2,300 fish to U.S. and 700 fish to Canadian catches since 1995. In addition, Port Snettisham hatchery fish have contributed and average of 12,000 fish to U.S. catches during this period.

Collecting and processing otoliths from commercial fisheries in and near the Taku and Stikine Rivers has become an integral part of stock composition estimation and fisheries management. During the 1994 season the Juneau otolith lab processed 4,700 otoliths inseason and 4,700 otoliths postseason, with 378 marks recovered from 55 strata from these fisheries. This last year the numbers had grown to 7,000 otoliths processed inseason of a total of 14,000 otoliths processed with 3,400 marks recovered from 84 strata. Inseason analysis of thermal marks allows fishery managers to determine the relative abundance of hatchery and wild sockeye salmon. This inseason information is critical to shape fisheries to maximize the harvests of the hatchery fish while minimizing the risk of overharvesting wild stocks.