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A Method for Counting Atlantic Salmon (*Salmo salar*) Smolt Without Handling During Downstream Migration

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**A METHOD FOR COUNTING ATLANTIC SALMON (*Salmo salar*)
SMOLT WITHOUT HANDLING DURING DOWNSTREAM MIGRATION**

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ABSTRACT

Hambrook, M. J., and T. G. Lutzac. 1992. A method for counting Atlantic salmon (*salmo salar*) smolt without handling during downstream migration. Can. Tech. Rep. Fish. Aquat. Sci. No. 1859: 5 p.

A counting weir was developed to enumerate Atlantic salmon smolt without handling on their downstream migration. The weir includes a trap with counting channel, free exit and a deflector barrier designed to concentrate salmonids. Smolt mortality was less than one fish per 100 counted.

RÉSUMÉ

Hambrook, M. J., and T. G. Lutzac. 1992. A method for counting Atlantic salmon (*salmo salar*) smolt without handling during downstream migration. Can. Tech. Rep. Fish. Aquat. Sci. No. 1859: 5 p.

Afin de dénombrer les saumoneaux de l'Atlantique lors de leur migration d'avalaison, sans avoir à les manipuler, un barrage de dénombrement a été mis au point. Cette structure comprend une trappe avec canal de comptage et sortie libre, ainsi qu'un déflecteur conçu pour concentrer les salmonidés. La mortalité des saumoneaux a été de moins d'un poisson par 100 individus comptés.

INTRODUCTION

The enumeration of smolt on their downstream migration to the ocean has been valuable in the development of stock-recruitment relationships for Atlantic salmon (Chadwick, 1982; 1984). Problems in counting-weir design and operation however, may place additional stress on juvenile salmon undergoing smoltification. Prolonged migration time, scale loss due to high velocities and turbulence in traps, and the additional stress of removal from the water by dip nets may lead to immediate or delayed mortalities. This report describes a counting weir which permits the accurate enumeration of Atlantic salmon smolt without handling the fish or delaying migration.

MATERIALS AND METHODS

The counting-weir is a modification of the design of Anderson and MacDonald (1978) and features an enlarged trap containing a counting channel with free exit and a deflector barrier modified to operate on gravel substrates. The trap design is such that smolt may leave the trap at will by swimming in an upstream direction. This design was developed for the fish counting fence (Figure 1) on the Bartholomew River at Blackville, Northumberland County, New Brunswick. The Bartholomew River is a low gradient stream with few areas of stable substrate in its lower reaches.

The deflector barrier (fence) design was modified from that of Anderson and MacDonald (1978) to operate on a stream bed of clay covered with 0.3 to 0.6 m of small cobble and gravel. The bottom became unstable during intervals of high stream discharge. The various ways to secure the fence on this type of substrate are shown in Figure 2.

The designated path of the fence was first covered with a 1.8 m wide galvanized 1.3 cm² mesh wire weighted down with large flat stones. The stones covered all of the screen when the fence installation

was complete. The weighted screens prevented gravel washouts and undermining of the weir structure during periods of high water.

A 1.5 m length of 2.5 cm rebar was then driven into the substrate every 3.0 m at the centre mark for each standpipe. Approximately 15 cm of rebar was left protruding to fit into the bottom of each pipe. This acted as a pin to prevent movement when strong force was exerted against the fence. Below the fence, at each pipe, a pair of steel angle iron legs was driven at an angle 0.3 - 0.4 m into the substrate in a downstream direction. Legs were bolted separately near the top of the pipe forming a tripod. Legs formed angles of 45 degrees to the pipe and 30 degrees to each other. Three metres upstream from the fence, on a line running parallel to it, 1.5 m lengths of 2.5 cm rebar were driven almost completely into the substrate midway between tripod pipes. Two lengths of 6 mm wire rope ran from the top of this rebar to the tops of the two closest tripod pipes, securely anchoring them to the substrate.

The stringers were attached to the tripods by first placing them on the angle iron seats as described by Anderson and MacDonald (1978). Solid nickel steel rods rather than conduit pipes were used to hold the stringers in place on the angle iron seats to prevent crimping caused by small displacements of fence components.

The trap portion of the counting fence (Figure 3) was a wooden frame structure measuring 4.9 m x 2.5 m x 1.1 m which fitted in a cribwork keyed into the river bank. The cribwork side of the trap consisted of a 19 mm plywood wall and the river side contained removable galvanized screens of 13 mm² mesh, framed in wood. The wooden floor was covered with close-fitting concrete patio slabs painted white. These anchored the trap and permitted observation of fish movements within.

Due to the trap location, flow at the trap entrance was reduced by the dissipation of much of the river's discharge through the 55 m length of the single-winged fence. Smolt backed downstream moving laterally along the fence into the reduced flow adjacent to shore and then entered the elongated trap at "A". As the water flowed into the trap, it came primarily from one direction. This decreased back pressure at the trap entrance. Flow was dissipated here through perforated plywood and a screened baffle which directed fish through gate "B". Water velocity and turbulence further decreased as smolt moved down the large raceway to "C". Fish next crossed into the resting area at "D". They then moved upstream through the counting channel at "E". This was formed using a glass-bottomed insert which extended from the top of the trap to 20 cm above the trap floor. The channel measured 61 cm long by 30 cm wide. The white patio stone covering the floor had several black bands painted at right angles to the current. This served as a reference point, simplifying the enumeration process. The trap was illuminated from "B" through "E" by electrical flood lights. This was necessary as smolt migration and enumeration occurred primarily during the hours of darkness. A wood-framed plastic shelter covered the counting area of the trap to provide protection for staff from inclement weather.

The counting channel had an adjustable gate at the entrance which could be closed during periods when smolt were not moving. A flow regulator "F" was used to attract salmonids through the counting channel. It was constructed of one section of fence containing a variable number of conduit. Flow was modified by adding or removing conduit at this location. Strong swimmers such as salmonids moved upstream through the counting channel and exited through an open section of the flow regulator to continue their seaward migration. Weak swimmers such as Atlantic rainbow smelt (*Osmerus mordax*) and minnows (*Cyprinidae*) moving downstream

collected in the trap at "D". They were removed by dip net and returned to the river below the fence when smolt were not present.

RESULTS

In 1985 and 1986 this counting weir was installed in the Bartholomew River immediately after ice cover had left and it held in place during spring freshets. No loss in fishing time due to flood damage occurred. The facility operated with a mortality factor of less than one smolt per 100 counted.

ACKNOWLEDGEMENTS

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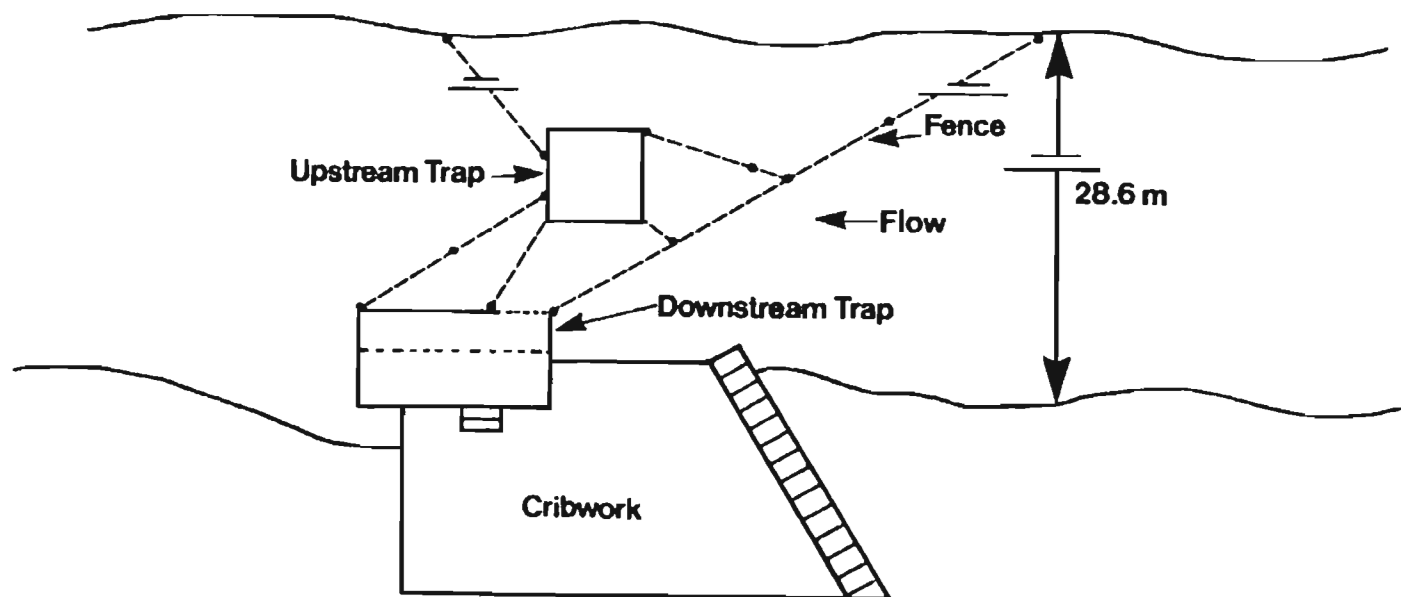


Figure 1. Schematic diagram of the fish counting fence on the Bartholomew River at Blackville, Northumberland County, New Brunswick.

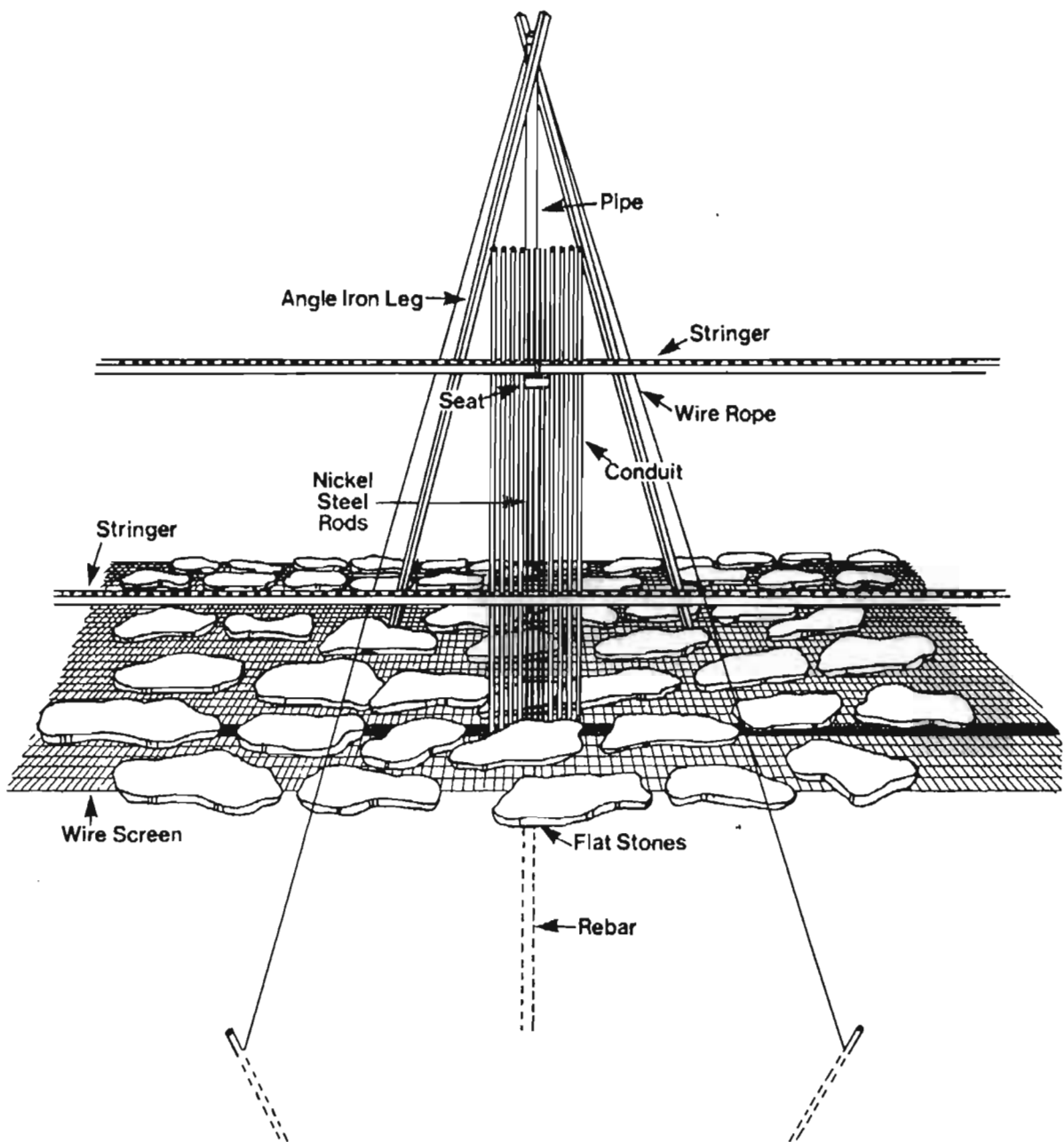


Figure 2. Schematic diagram of the fish fence showing attachments to substrate.

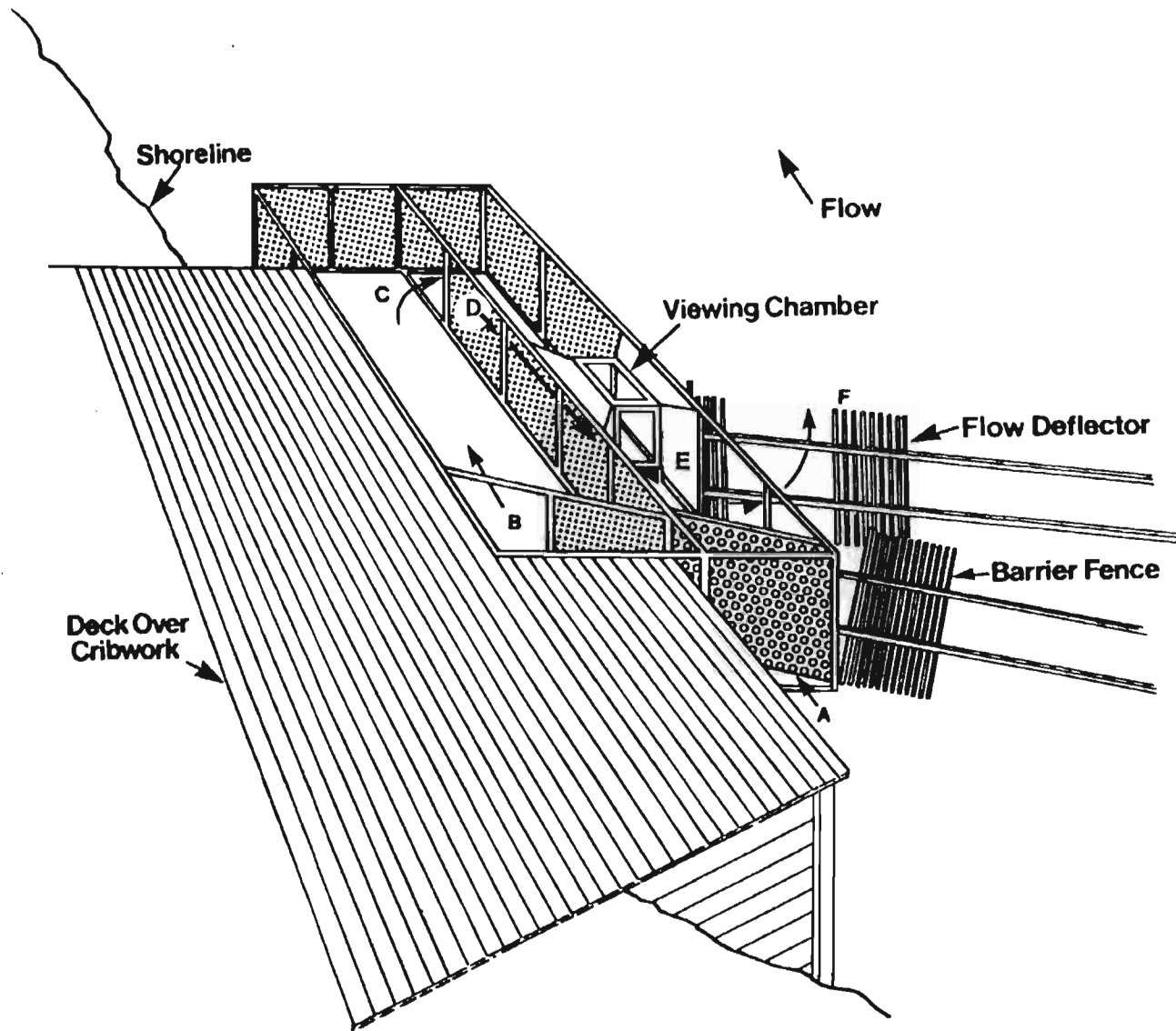


Figure 3. Schematic diagram of the trap showing counting channel with free exit.