EFFECT OF LIGHTED CONDITIONS AT A SURFACE BYPASS ON THE VERTICAL DISTRIBUTION OF FINGERLING SALMONIDS IN A TURBINE INTAKE (SUMMARY)

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SUMMARY AND INTERPRETATION

In 1961, a cooperative study was conducted at McNary Dam with the University of Washington to determine the potential of a lighted bypass at the forebay surface for attracting and collecting fingerling salmonids from flows entering a turbine intake (Fields et al., 1961). The results of these experiments provided data for examination of the effect of light conditions at the bypass on the vertical distribution of fingerlings in the turbine intake.

The surface bypass was created by lowering the ice and trash sluice gate at turbine intake 6-B, approximately 16 inches below the forebay surface to form an overfall weir. The width of the bypass equalled that of the intake, a distance of 20 feet. Fish were captured by an inclined plane screen trap that strained the entire flow.

Vertical distribution of fish in the intake directly below the surface bypass was sampled with six fyke nets on a vertical frame installed through the intake gatewell. These nets strained approximately the center one-third of the flow in the intake from the ceiling (net no. 1) to within 3 feet of the floor (net no. 6), a vertical distance of 50 feet. During installation and removal of the frame, flows through the intake were stopped to prevent the capture of fish while the nets were being lowered or raised. A more complete explanation of the procedures used with this equipment is made by Long. (See "Day-night occurrence and vertical distribution of juvenile salmonids and lamprey ammocoetes in turbine intakes", Long, vol. 4, Review of Progress, Fish-Passage Research Program.)

The test conditions included a lighted and darkened surface bypass and water flows of about 2,600 and 4,200 cubic feet per second into the turbine intake. These intake flows (approximately one-third of the total flow into a turbine) were obtained by setting the turbine discharge at 8,000 and 12,500 c.f.s., respectively. The experiment was designed to test a different combination of light and flow conditions each night for 4 consecutive nights. These conditions were replicated four times with 4-day intervals between each series of tests.

The effect of the light conditions at the bypass on vertical distribution in the intake was determined by comparing the percentages of fish caught in each fyke net in the intake during light and dark periods. A comparison was also made of the distribution between the number of fish captured in the

intake and in the trap in relation to the light conditions. Chi-square tests for significance at the 5 percent level were applied to the data.

The data presented in this summary include only salmonids over a year old captured during the higher flows. Species represented were chinook salmon (Oncorhynchus tshawytscha), sockeye salmon (O. nerka), and steelhead trout (Salmo gairdneri). The results indicated that:

1. The vertical distribution of each species in the turbine intake was not significantly different between nights when the bypass was lighted or darkened (table 1).

2. Distribution of steelhead trout between the surface trap and the intake nets was different from that of chinook and sockeye salmon when the trap was lighted (fig. 1). Steelhead were strongly concentrated in the surface trap (58 percent) while chinook and sockeye were concentrated in the intake nets (52.6 and 60.3 percent, respectively).

3. Significantly more fish of each species were caught in the surface trap when it was lighted than when it was darkened (table 2).

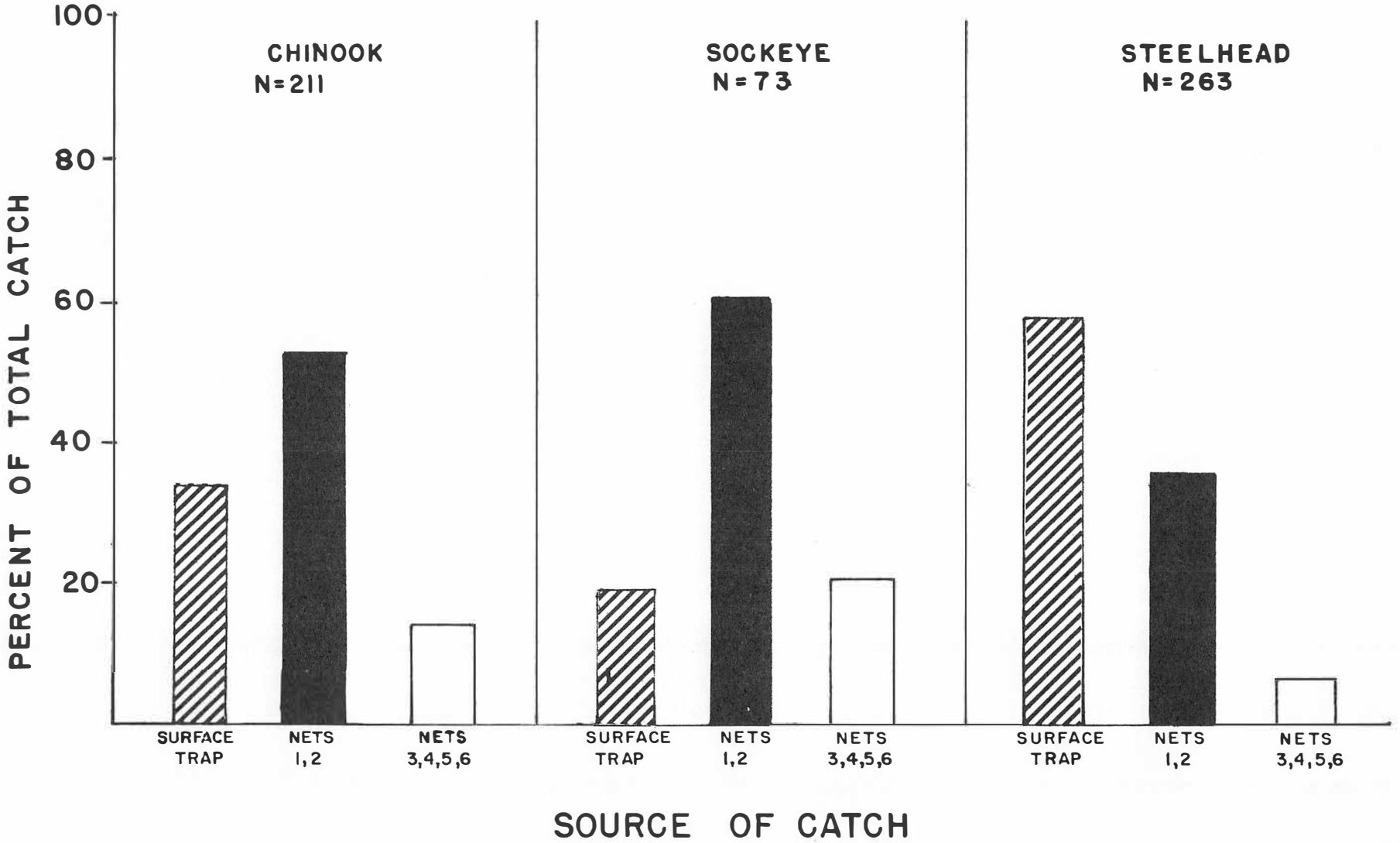

Figure 1.--Distribution of fish over a year old when the surface bypass was lighted.

Table 1.--Numbers and percentages of downstream migrants over a year old distributed in vertical fyke nets within turbine intake 6-B in relation to light conditions at a surface bypass at the entrance of the intake.

Intake nets (top to bottom)	Chinook salmon				Sockeye salmon				Steelhead trout			
	Light		Dark		Light		Dark		Light		Dark	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Net 1	83	59.3	54	46.2	34	57.6	38	55.9	71	64.0	26	66.7
Net 2	28	20.0	32	27.4	10	16.9	14	20.6	23	20.7	6	15.4
Net 3	16	11.4	15	12.8	8	13.6	6	8.8	12	10.8	3	7.7
Net 4	7	5.0	9	7.7	4	6.8	5	7.3	5	4.5	2	5.1
Net 5	4	2.9	5	4.3	1	1.7	4	5.9	0	0.0	2	5.1
Net 6	2	1.4	2	1.7	2	3.4	1	1.5	0	0.0	0	0.0
Total	140		117		59		68		111		39	

Table 2.--Numbers of fish over a year old captured in a surface trap at the entrance to turbine 6-B and in fyke nets within the turbine in relation to light conditions at the trap.

Source of catch	Chinook		Sockeye		Steelhead	
	Light	Dark	Light	Dark	Light	Dark
	Number	Number	Number	Number	Number	Number
Surface trap	71	13	14	1	152	9
Intake nets (1 to 6)	140	117	59	68	111	39

INTERPRETATION

1. Although the surface trap caught significantly more fish of each species when it was lighted, there was no indication that significant numbers of fish were attracted upward from the flows entering the intake immediately below the surface trap. Apparently, the light was attracting fish from the surface flows on either side of intake 6-B.

2. A lighted surface bypass may be more effective for attracting steelhead trout than for chinook or sockeye salmon.

LITERATURE CITED

Fields, Paul E., Richard Gregory, Richard Lichtenheld, Richard Snyder, and Don Kenoyer.
1962. Guiding migrant salmon. University of Washington, College of Fisheries, Contribution No. 139 (March), p. 19-22.