

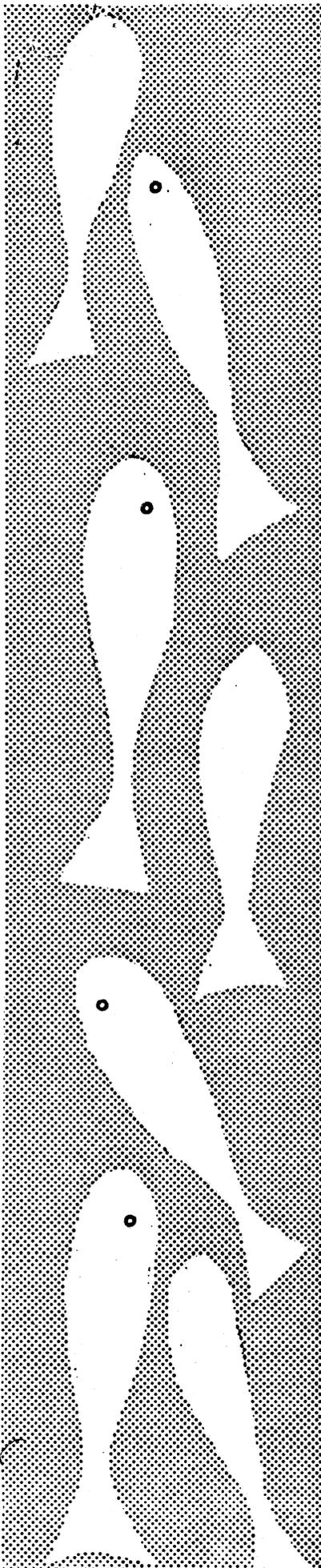
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COLUMBIA RIVER THERMAL EFFECTS STUDY

SURVIVAL OF EULACHON EGGS (Thaleichthys pacificus)
AT DIFFERENT WATER TEMPERATURES

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INTRODUCTION

The eulachon or Columbia River smelt (Thaleichthys pacificus) enter the Columbia River and its tributaries during the winter when temperatures range from 4 to 10 C (Smith and Saafeld, 1955). Eulachon spawn in the lower Columbia River and in several tributaries including the Cowlitz, Kalama, and Lewis Rivers (Figure 1). Occasionally, runs have entered other streams farther upstream. Larvae and eggs displaced downstream from spawning areas could be diverted through cooling water systems of thermal electric plants proposed and under construction in this section of the river (see Figure 1).

In 1969, eggs were incubated and tests conducted to determine the effect of increased water temperature on the survival of developing eulachon eggs.

PROCEDURE

Test fish were captured with dip nets (Figure 2) from the Cowlitz River and transported to the Prescott Laboratory by tank truck. The eulachon were held pre-test (41 days) at ambient river temperatures in holding tanks (Figure 3) through which Columbia River water was circulated.

Mature eulachon were spawned artificially; the sex products from a male and female were mixed and equally divided into two 235-milliliter glass incubation jars. The jars

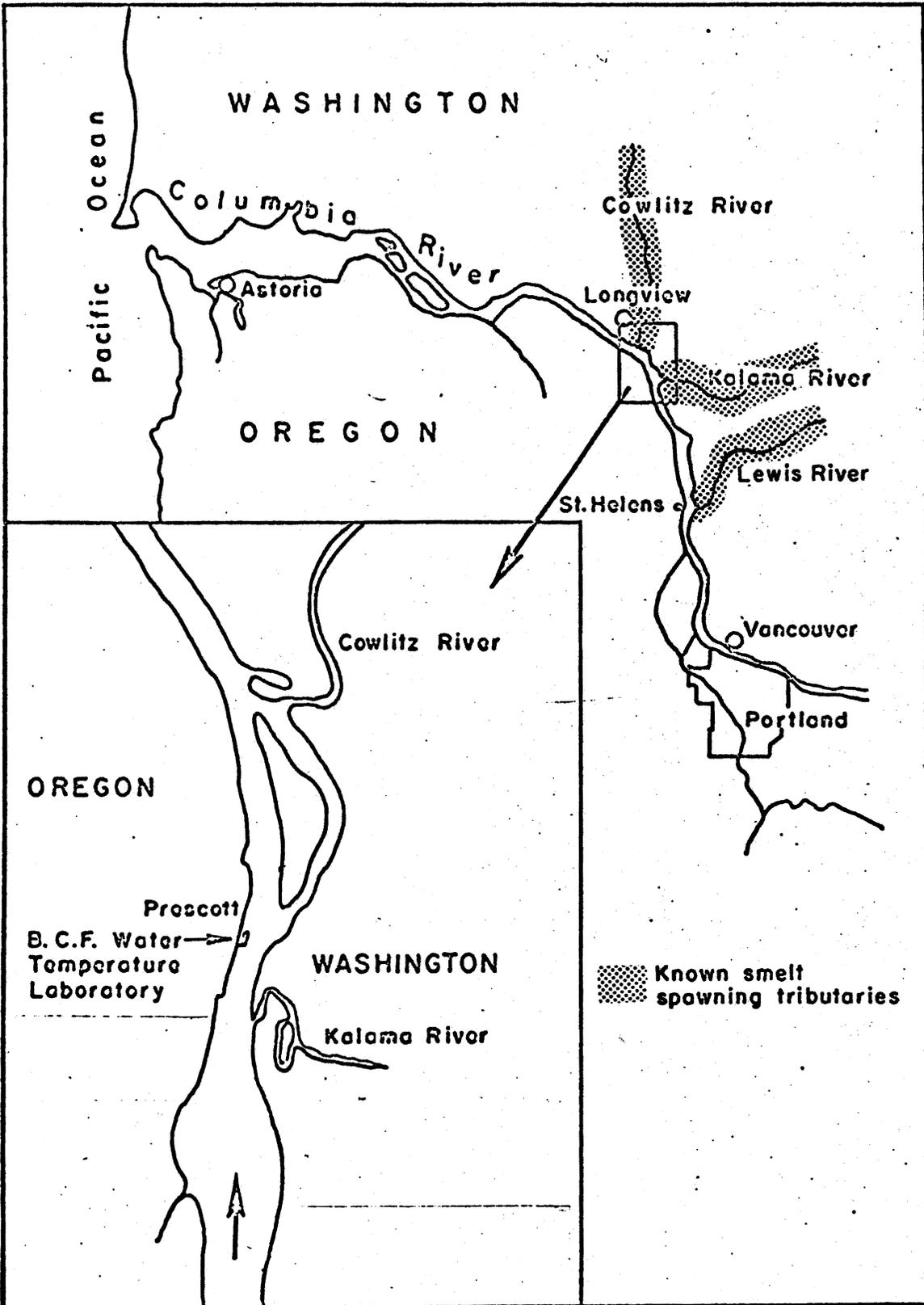


Figure 1.--Location of eulachon spawning areas in relation to BCF water temperature laboratory.

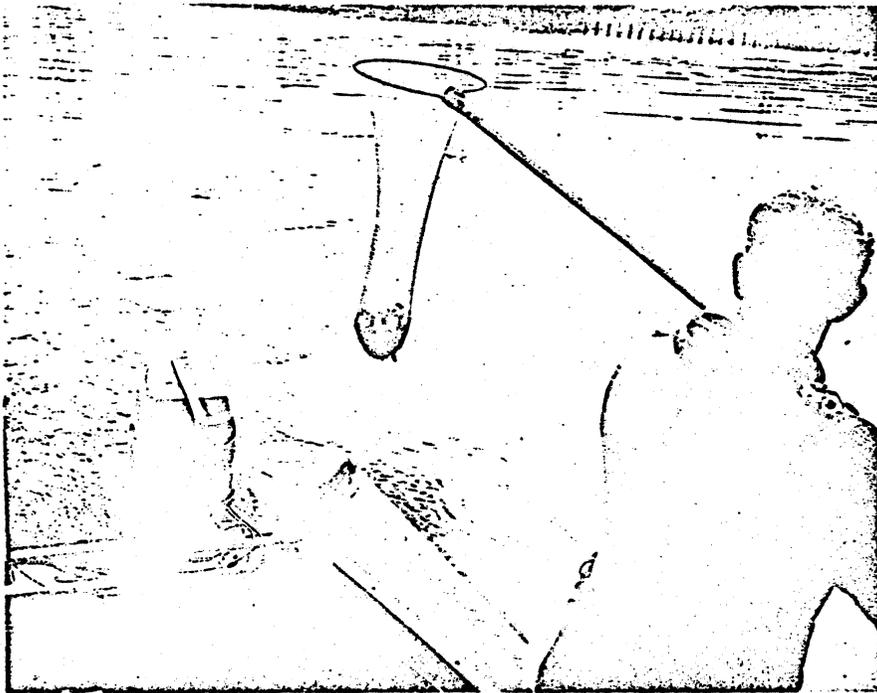


Figure 2.--Dipping eulachon in the Cowlitz River.

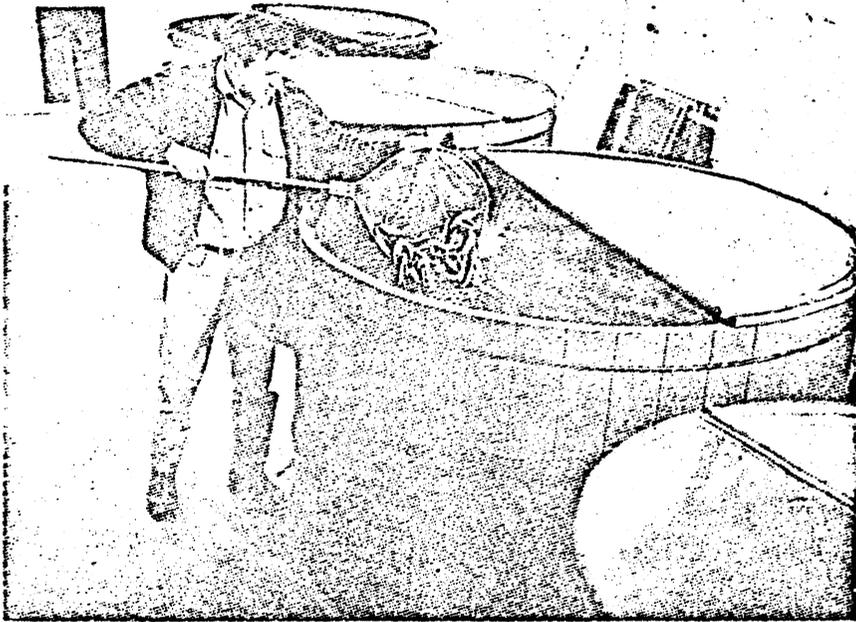


Figure 3.--Placing adult eulachon in holding tanks.

were then immersed for 1 hour (in a 227-liter tank) at ambient river temperature (4.5 C) to allow fertilization. One jar from each cross was then placed in a tank (Figure 4) containing water at a pre-adjusted test temperature; the other jar remained at ambient river temperature as a control. This procedure was duplicated and replicated for each temperature. Temperatures were held constant at 8, 11, 14, 17, 20, 23, and 26 C; the control temperatures varied with the ambient river temperature.

Time to death of eggs was determined by periodically counting the number of dead eggs (opaque) inside a circle (1 cm) inscribed on the base of each jar.

EGG DEVELOPMENT

A microscopic examination was made of each egg lot during development. Normal development, as described by Parente and Snyder (1969) was observed at temperatures of 4-8 C (control), 11, and 14 C. At 17 C the eulachon eggs failed to hatch, and at 20, 23, and 26 C cleavage did not occur (Table 1). At the higher temperatures, yolk sacs ruptured after the eggs were introduced into the test tanks. Normal and abnormal development of the eulachon egg is shown (Figure 5). Survival decreased with increasing water temperatures; a 100% mortality occurred at all test temperatures above 14 C (Table 2).

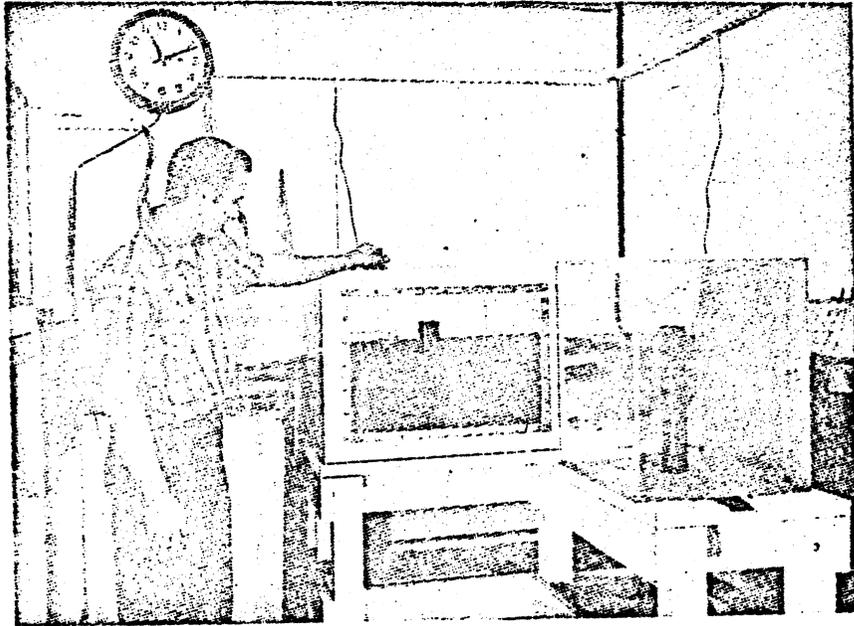


Figure 4.--Test tank with egg containers.

Table 1.--Time required to reach various stages of eulachon egg development at different test temperatures.

Temperature	Occurrence of cleavage	Stage of larval development within egg		
		Eye	Heartbeat	Hatching
<u>Centigrade</u>			<u>Hours</u>	
4-8 (control)	Yes	186	381	618
8	Yes	144	239	501
11	Yes	119	165	357
14	Yes	74	119	237
17	Yes	49	114	-- <u>1</u> /
20	No	--	--	--
23	No	--	--	--
26	No	--	--	--

1/ All eggs failed to hatch.

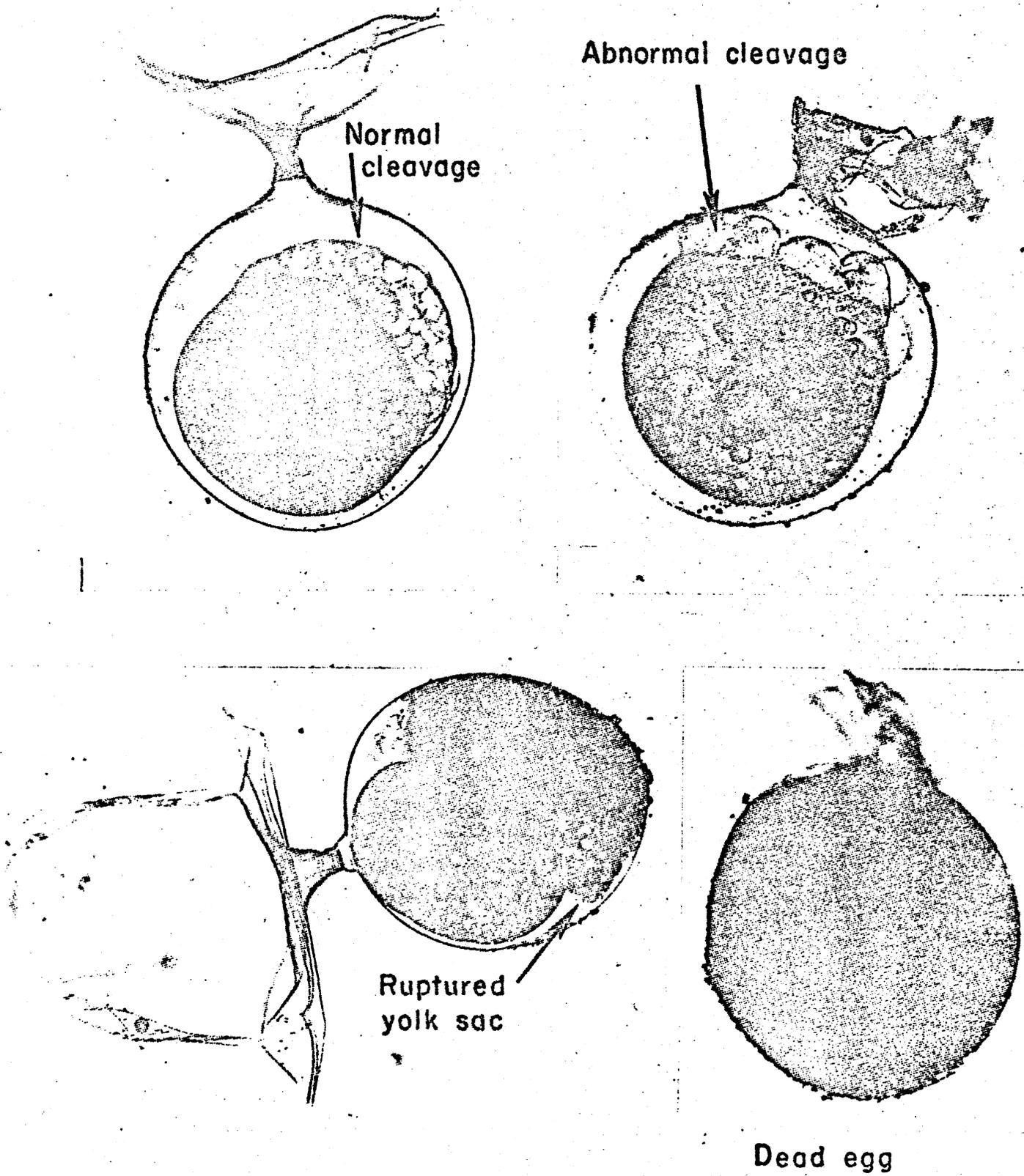


Figure 5.--Normal and abnormal development of the eulachon egg (from Parente and Snyder, 1969).

Table 2.--Time to death (50% and 100% mortality) of eulachon eggs at various water temperatures.

Temperature	Time to 50 and 100% mortality	
	50%	100%
<u>Centigrade</u>	<u>Hours</u>	
4-8(control)	None	None
8	"	"
11	"	"
14	"	"
17	42.0	132.0
20	19.0	19.0
23	15.0	15.0
26	2.5	2.5

LITERATURE CITED

Parente, William D. and George R. Snyder. 1970. A pictorial record of the hatching and early development of the eulachon (Thaleichthys pacificus). Northwest Science. Vol. 44, No. 1, p. 50-57.

Smith, Wendell E. and Robert W. Saafeld. 1955. Studies on the Columbia River smelt (Thaleichthys pacificus). Fish Res. Papers, Wash. Dept. Fish. 1(3):3-26.