WASHINGTON DEPARTMENT OF ECOLOGY
ENVIRONMENTAL INVESTIGATIONS AND LABORATORY SERVICES

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SUBJECT: Ceriodaphnia Bioassay Results from the Chehalis and Humptulips Rivers

Studies done by Washington Department of Fisheries (Seiler, 1986) indicated adult returns of Coho Salmon were lower in the Chehalis River than in the Humptulips River. Both rivers discharge to Grays Harbor. A suspected reason for poor survival of the Chehalis River stock was increased mortality of smolts as they migrate through the lower Chehalis River and inner Grays Harbor, where municipal and industrial discharges may be degrading water quality.

The objective of this series of bioassays was to test for possible toxic influences upstream of the discharges and compare between the two watersheds. Toxicity was determined by the difference in survival or reproductive rates for the test organisms (Ceriodaphnia) between the river samples and a control comprised of diluted mineral water.

METHODS

Samples were collected on four occasions (February 17, 1987, June 24, 1987, September 29, 1987, and February 2, 1988) from the two rivers to test for toxicity during different seasons and flow regimes. Samples were collected in two liter cubatainers, packed on ice, and shipped overnight to the EPA Environmental Research Laboratory in Duluth, Minnesota. Bioassays were initiated immediately upon arrival of the samples.

Sampling locations are shown in Figure 1, they include:

Location	River Mile
Chehalis River at Dryad	98.3
Chehalis River at Centralia	66.9
Chehalis River at Porter	33.3
Chehalis River at Montesano	11.6
Satsop River at Satsop	2.2
West Fork Humptulips	36.4
Humptulips at Humptulips	23.6
Humptulips at the mouth	1.5

The toxicity of the samples was tested by placing assay organisms in the sample water for a seven day period. Acute mortality was calculated as percent survival of the organisms over the seven day period. Chronic effects were estimated based on reproduction (the number of young produced per female).

RESULTS

Contrary to expectations, the first set of samples (February 1987) resulted in higher mortality and lower reproduction in the Humptulips River samples, while Chehalis River samples had no significant measured effect. Toxicity appeared to increase with distance downstream in the Humptulips. A second set of samples was collected from the Humptulips during June, at that time reproduction was excellent and there was no significant mortality. Samples were collected from both rivers again in late September during the low flow period. Reproduction and survival were good in the Humptulips samples. The samples collected furthest upstream in the Chehalis (Dryad RM 98.3) and near the mouth of the Satsop (RM 2.2) exhibited 0 percent survival. In the former case, all organisms died early in the assay, thus, reproduction was also zero. In the latter cas,e although reproduction was low, especially compared to the other river samples, it was not significantly different from the control sample results. A last set of samples was collected in February 1988. Survival and reproduction were excellent at all stations on both rivers.

DISCUSSION

Although the bioassary results do not clearly indicate toxicity in the rivers samples, some general hypotheses can be offered. A toxic affect was measured in the Chehalis River at the upstream station (RM 98.3) during low flow. Survival appeared to improve with distance downstream until Montesano (RM 11.6), when survival decreased again. Since the Satsop River flows into the Chehalis upstream of Montesano (RM 20.2), and the Satsop River station also exhibited toxic affects, the decreased survival at Montesano could be an indication of impact from the Satsop. Land use near RM 98.3 is primarily rural/agriculture. Application of fertilizers or manure to adjacent fields could cause a toxic impact if large quantities reach streams. This is especially true during low flow conditions when there is less stream water available for dilution.

The reverse is true of the results from the Humptulips River where toxicity was observed during winter high flow conditions. The toxicity was not replicated the following year during the same time period. However, drought conditions were in affect during February 1988, therefore, runoff related pollutants may have been lower than under typical wet weather conditions.

The bioassay results did not provide any additional evidence as to possible cause for the poor survival or return rates of Coho salmon in the Chehalis. Although a toxic affect was measured in the Chehalis during the late September sampling, there was no significant decrease in percent survival throughout the lower 70 miles of stream. Furthermore, a toxic response was also measured in the Humptulips, a river with very good Coho salmon return rates. This inconsistency in bioassay results (between rivers and seasons) eliminates the ability to draw conclusions from the data.

REFERENCE

Seiler, D. 1986. Grays Harbor, Its Impact on Salmon Production. Washington Department of Fisheries, Harvest Management Division. February 4, 1986.

LS/JPM:pb
Attachment

Table 1. Ceriodaphnia Bioassay results from the Chehalis and Humptulips Rivers. Control water was diluted mineral water.

DATE	2/17/87			6/24/87			9/29/87			2/2/88		
STATION	YOUNG PER FEMALE	95 PERCENT CONFIDENCE INTERVAL	SEVEN DAY PERCENT SURVIVAL	YOUNG PER FEMALE	95 PERCENT CONFIDENCE INTERVAL	SEVEN DAY PERCENT SURVIVAL	YOUNG PER FEMALE	95 PERCENT CONFIDENCE INTERVAL	SEVEN DAY PERCENT SURVIVAL	YOUNG PER FEMALE	95 PERCENT CONFIDENCE INTERVAL	SEVEN DAY PERCENT SURVIVAL
Control	14.8	12.5-17.1	100	20.5	18.4-22.6	90	18	14.0-21.9	90	25.50	22.2-28.8	100
Humptulips												
36.4	18.9	15.3-22.5	70	28.5	25.3-31.7	100	24	16.6-32.0	100	29.70	26.0-33.4	90
23.6	13.6	9.6-17.8	50	29.5	27.2-31.8	80	32	29.2-34.8	90	22.40	17.0-27.8	100
1.5	10.3	---	0*	24.2	19.0-29.4	100	17	11.2-23.4	90	27.70	24.8-30.6	90
Chehalis												
98.3	23.7	20.0-27.4	100				0*	---	0*	24.50	21.5-27.5	100
66.9	19.0	17.9-20.1	100				27	20.8-33.9	70	29.60	26.8-32.4	100
33.3	16.8	15.0-18.6	100				25	21.8-27.3	90	32.20	30.3-34.1	100
11.6	21.6	19.1-24.1	90				29	24.2-32.7	70	30.30	28.2-32.4	100
Satsop												
2.2**	19.9	17.0-22.8	90				15	4.0-(std. dev)	0*	26.40	23.4-29.4	100

* Represents a significant difference when compared to the Control.

** The Satsop River enters the Chehalis at River Mile 20.2.

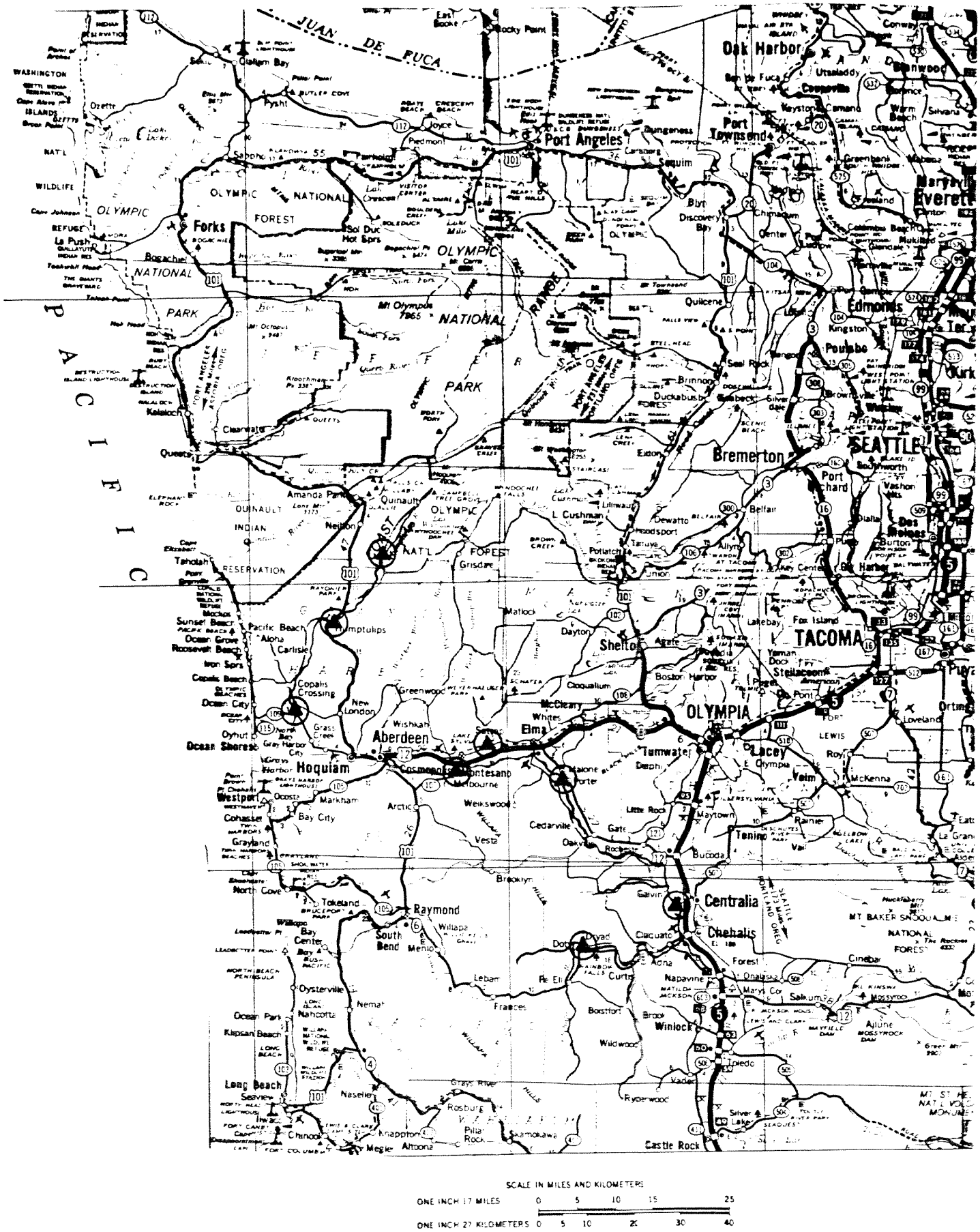

Figure 1. Sampling locations used for Ceriodaphnia bioassays in the Chehalis and Humptulips Rivers. ▲