

WORKING PAPER NO. 13

COLUMBIA RIVER BASIN PROJECT
For Water Supply and Water Quality Management

BIOLOGICAL INVESTIGATION - YAKIMA RIVER
September, 1961

Feb. 28, 1962

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This working paper contains preliminary data and information primarily intended for internal use by the Columbia River Basin Project staff and cooperating agencies. The material presented in this paper has not been fully evaluated and should not be considered as final.

BIOLOGICAL INVESTIGATION - YAKIMA RIVER
September, 1961

As a part of a more comprehensive investigation of the Yakima River, including physical, chemical and biochemical tests, a biological investigation was made on September 14 and on September 19-20, 1961.

The following stations are on the Yakima River except as indicated:

<u>River Mile</u>	<u>Description</u>	<u>Type Sample</u>
190	Above Easton	Sample lost
173.5	Above Cle Elum	Bottom Fauna
153.5	Above Ellensburg Rotary Club camp ground	Bottom Fauna
--	Below Wilson Creek	Plankton
138.5	Below Ellensburg Unnamed camp ground	Bottom Fauna
109.5	Naches River near jct. with Yakima at bridge on Hwy. U.S. 410	Bottom Fauna
98	Near Sunnyside Diversion Dam	Bottom Fauna
85.3	Zillah-Toppenish Bridge	Bottom Fauna
78	Granger Bridge	Bottom Fauna
--	Mabton-Sunnyside Bridge	Plankton
--	Kiona-Benton City Bridge	Plankton

NANOPLANKTON

To determine the effects of pollution and the addition of nutrients to the waters of the Yakima River upon the drifting microscopic plants and animals, three nannoplankton samples were collected and analyzed in the laboratory. By "nanno" is meant "dwarf" plankton, as against the mesoplankton or net plankton, such as would be collected in a Clarke-Bumpus or Wisconsin net.

All three of the samples were collected from the main stem of the Yakima River. The sample from Wilson Creek mouth above Ellensburg represents the relatively unpolluted condition of the river. At Mabton-Sunnyside the river has received most of its polluttional discharges and the major portion of return irrigation flows as well. The third station for plankton was at Kiona-Benton City which is about 25 miles above the mouth.

The following table presents some salient results from the plankton analysis with certain data on nutrient content of the waters from the physico-chemical investigation of the same time.

TABLE I
NANNOPLANKTON IN RELATION TO CERTAIN PHYSICO-CHEMICAL
CHARACTERISTICS OF THE WATER
SEPT. 19-20, 1961

Test	Below Wilson Creek	Mabton- Sunnyside	Kiona- Benton City
Conductance	49	280	310
Potassium Mg./L	0.8	3.5	3.7
Nitrate Mg./L	0.1	2.22	2.56
Phosphate Mg./L	0.045	0.22	0.215
Calcium Mg./L	5	27.5	26
Magnesium Mg./L	4	14	12
Total Nannoplankton/L	182,000	502,000	220,000
Blue-green Algae	Few	Abundant	Decreased
Total Genera-species	25	18	16

These data indicate a decrease in nannoplankton in the lower river despite the maintenance of most nutrients at a high level. Reasons for this may become evident in subsequent investigations.

The following Table II presents the complete counts of the nannoplankton.

TABLE II
RESULTS OF NANNOPLANKTON ANALYSES
YAKIMA SURVEY
NUMBERS/LITER
SEPT. 19-21, 1961

Organism	Below Wilson Creek	Mabton-Sunny- side Bridge	Kiona-Benton City Bridge
<u>Blue-green Algae</u>			
Anabaena sp.			300
Oscillatoria sp.	300	136,000	21,000
<u>Green Algae</u>			
Anristrodesmus falcatus	1,200		
Cosmarium sp.	300		
Pediastrum boryanum			300
Scenedesmus quadricauda	300	1,200	11,700
<u>Diatoms</u>			
Achnanthes sp.	2,400	1,800	1,200
Asterionella gracillima	40,000		900
Amphora ovalis	1,500	1,200	2,400
Cocconeis sp.	15,600	19,800	2,400
Ceratoneis sp.	600		
Cyclotella sp.	300	1,200	23,000
Cymatopleura solea	300	1,200	600
Cymbella sp.	1,800	2,400	300
Diatoma vulgare	47,700	7,200	900
Eunotia sp.	1,800		
Fragilaria capucina	900	6,000	
Fragilaria crotonensis		1,200	
Gomphonema acuminata	5,100	1,200	
Gyrosigma sp.			300
Melosira sp.	2,700	600	
Navicula sp.	35,100	248,000	84,000
Nitzschia sp.	900		
Pinnularia sp.	37		
Stephanodiscus sp.	1,200		
Surirella sp.	1,800	600	600
Synedra sp.	4,500	72,000	70,000
<u>Miscellaneous</u>			
Chironomid larva		present	
Dinobryon sertularia	14,700		
Gymnodinium sp.	300		
Nematode		present	
Total	181,337	501,600	219,900

(Cont'd.)

Predominant Genera:

Wilson Creek - Asterionella gracillima
Diatoma vulgare

Mabton-Sunnyside- Oscillatoria sp.
Bridge Navicula sp.

Kiona-Benton City-Oscillatoria sp!
Bridge Navicula sp.
Synedra sp.

BOTTOM FAUNA

Collections of bottom fauna, primarily insects, were made at six stations in the Cle Elum to Kiona reach of the main stem Yakima River on September 14 and 21, 1961. The complete record is presented in Table III. A summarized interpretative treatment is shown in Table IV.

In terms of total production of animal matter, the collections showed a trend similar to nanoplankton production - that is, high in the section from Zillah to Mabton and falling off by the time Kiona is reached. The heavy production at Zillah-Toppenish of 8.21 grams/square foot was comprised of caddisfly larvae, *Macronemum* sp., for the most part. This is four times the production generally referred to as rich from the standpoint of fish food production for streams throughout the country.

TABLE III

YAKIMA RIVER - BOTTOM FAUNA - NO. ORGANISMS/SQ. FT.

Organism	Cle Elum	S T A T I O N				
		1/4 mi. upstream from Ellensburg	1/2 mi. below Wilson Creek	Zillah-Toppenish Bridge	Granger Bridge	Kiona-Benton City Bridge
Coleoptera						
Amphizoidae		2				
Diptera						
Orthoclaadiinae	3		54	54	215	1 chiron. 4
Simuliidae			3	2	10	22
Tipulidae	1					
Ephemoptera						
Baetidae						
Ameletus		2		80	24	99
Baetis	7		31			(Caenis 5
Ephemerella	1	1	2	7		(4
Heptageriidae						
Cinygmula	3		9	9		
Ironodes				4		
Lepidoptera						
Pyralididae						
Elophila				14		51
Odonata						
Coenagrionidae						
Amphiagrion						12
Plecoptera						
Perlidae						
Acroneuriinae						
Acroneunia		3				
Neoperla	4	12	7	16		

TABLE III (Cont.)

Organism	Cle Elum	S T A T I O N				
		1/4 mi. upstream from Ellensburg	1/2 mi. below Wilson Creek	Zillah-Toppenish Bridge	Granger Bridge	Kiona-Benton City Bridge
Nemouridae						
Brachyptera			43			
Tricoptera						
Brachycentridae						
Brachycentrus	1	7				
Hydrosychidae						
Macronemum		10		1349	28	117
Arctopsyche		9		6		118
Cheumatopsyche				26		
Tricoptera						
Psychomyiidae						
Psychomyia	26		8			
Total number of organisms per sq. ft.	46	46	189	1535	277	443
Vol. of organisms per sq. ft. cc.	.07	1.1*	.8	6.8	1.3	1.8
Wt. of organisms per sq. ft. gms.	.07	1.05*	.75	8.21	4.04	.9

* Total sample based on reconnaissance.

TABLE IV

SUMMARY OF BOTTOM FAUNA - YAKIMA RIVER, WASHINGTON - INSECTS

Station	Date Coll.	Gm/ ft ²	cc/ ft ²	Tot. #	o/o OF TOTAL NUMBER						INDICATION OF POLLUTION o/o OF TOTAL NUMBER			
					Coleoptera	Diptera	Ephemeroptera	Lepidoptera	Odonata	Plecoptera	Trichoptera	Pollutional	Facultative	Cleaner
Cle Elum	9/14	.07	.07	46		8.70	23.92				8.69	58.69	91.31	8.69
1/4 mi. upstream from Ellensburg	9/14	Recon.		46	4.35		6.50				33.62	56.53	62.03	37.97
1/2 mi. below Wilson Creek	9/19	.75	.8	189		30.38	22.05				26.43	21.14	73.57	26.43
Zillah-Toppenish Bridge	9/14	8.21	6.8	1535		3.64	6.51	.92			1.04	87.89	98.96	1.04
Granger Bridge	9/14	4.04	1.3	277		81.02	8.07					10.91	100.00	
Kiona-Benton City Bridge	9/21	.9	1.8	443		6.06	24.32	11.51	2.70			53.04	97.30	2.70

RECOMMENDATIONS

Investigations should be continued on the Yakima and principal tributaries including the main irrigation drains. It is suggested that besides the biological sampling described herein, an additional study should be made to determine the rate and speciation of the accumulation of organic matter and algae on the river bed. This may be done in various ways: (1) the smaller (4-inch) tile box, (2) respiration method used at Oregon State University using wire baskets filled with stream gravel and held in the stream for given periods of time, and (3) submerged glass microscope slides.

It is suggested that the study of algae on the river bed be started immediately after the spring freshet has subsided and before heavy accumulations of algal material have had an opportunity to develop.