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Mid-Columbia River Zooplankton

Abstract

Zooplankton samples were collected from the Columbia River at the Hanford Site, Washington, from June 1973 through March 1980. Samples were collected at river kilometer (Rkm) 611 and Rkm 566. Crustacean-zooplankton numerically dominated most samples. *Bosmina*, *Diatomus*, and *Cyclops* were the dominant genera observed. Zooplankton densities generally followed a trend of winter minimums and late-spring, early-summer maximums.

Introduction

Zooplankton samples were collected from the Columbia River at Hanford (Fig. 1) from June 1973 through March 1980. Samples were collected at river kilometer (Rkm) 611 from June 1973 through June 1974 and at Rkm 566 from December 1974 through March 1980 for the Washington Public Power Supply System's Columbia River aquatic ecological studies (Page *et al.* 1976; Gray *et al.* 1976; Gray and Page 1977, 1978, 1979a, 1979b; Beak 1980). Study objectives included identification of Columbia River zooplankton at Hanford and determination of their relative abundance and seasonal distribution.

Methods

River Kilometer 611

Weekly zooplankton samples were taken between June 1973 and June 1974 from depths at three stations across the river. Five samples were taken on the night following a day sample. Samples were collected with a Clarke-Bumpus plankton sampler equipped with a Number 10 (158μ) plankton net. Because of a strong current in the Columbia River, it was possible to operate (in effect, tow) a Clark-Bumpus sampler from the stern of an anchored boat. Often, however, it was necessary to drift downstream to avoid sampling velocities beyond the capability of the sampler. Bottom samples were taken within 1 m of the bottom, and mid-depth samples were taken about halfway between the surface and the bottom. Surface samples were taken with the sampler just below the water surface. The sampler was towed for 3 to 5 min. Material collected was washed into a sample jar and preserved in 4 percent formalin. Aliquots from the sample jar were microscopically examined in the laboratory to determine the number and species of organisms present.

River Kilometer 566

A 153μ mesh net with a 30-cm diameter mouth and a 5:1 length to diameter ratio

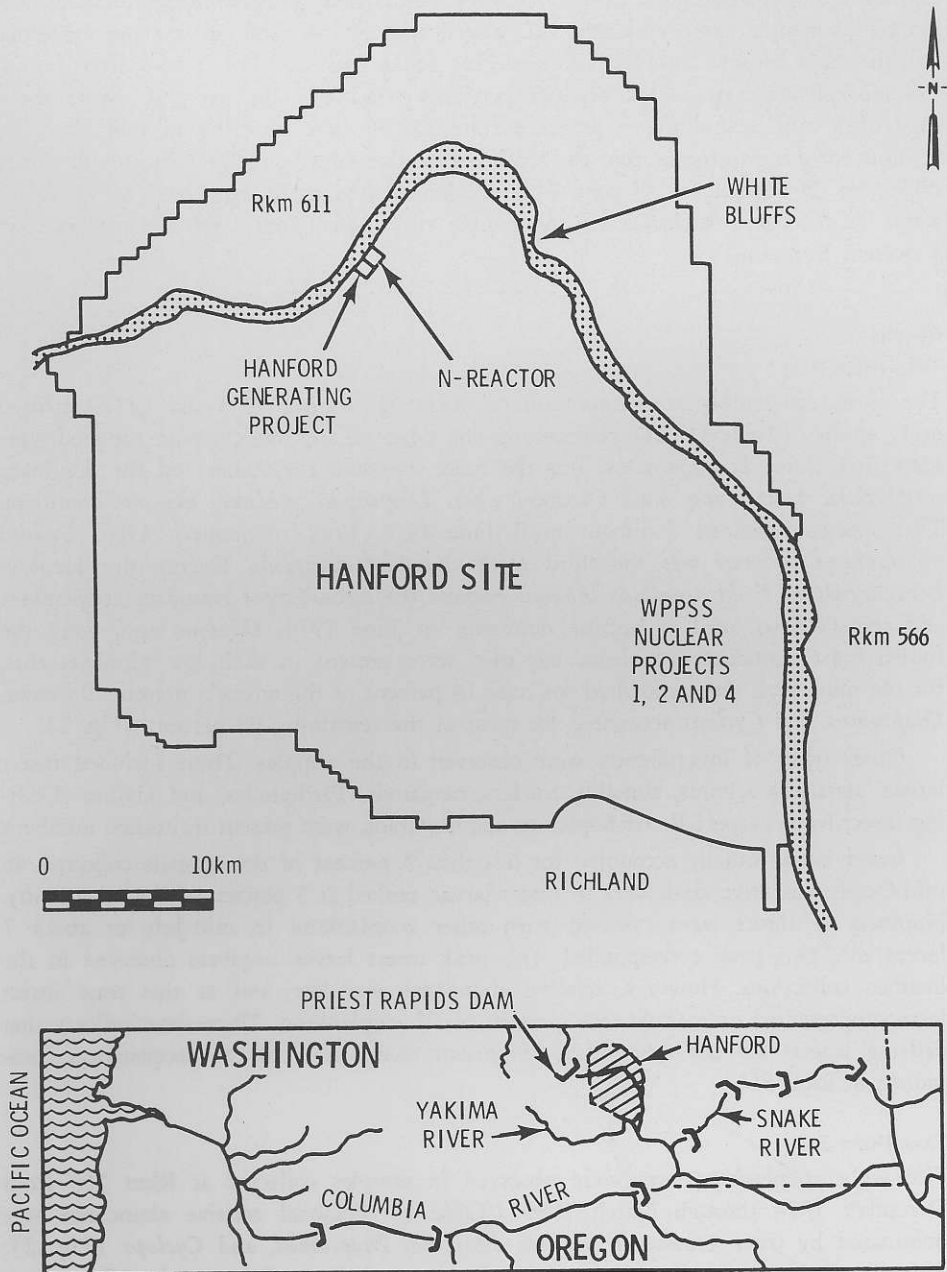


Figure 1. Map of the Hanford Site, southeastern Washington.

was used to collect samples at Rkm 566. Samples were taken once in 1974, six times in 1975, quarterly in 1976, and once each month from 1977 through March 1980. Duplicate stepped-oblique zooplankton tows were taken. This sampling method integrated the sample over depth. Vertical stratification of zooplankton was not examined in this study because samples, taken weekly for a year at Rkm 611, indicated mid-Columbia River zooplankton are not vertically stratified. The net was towed for a total of 3 min by holding it at the surface for 1/2 min, lowering to mid-depth for 1/2 min, lowering to the bottom for 1 min, raising to mid depth for 1/2 min and finally raising to the surface for 1/2 min. This usually resulted in filtering of 5 to 5.5 m³ of water. The net was retrieved and the sample was washed into a jar and preserved in 4 percent formalin.

Results

Taxa (Rkm 611)

The crustacean-zooplankton community at Rkm 611 during 1973 and 1974 consisted of 12 species (Table 1). Ten cladocerans, one calanoid, and one cyclopoid copepod were identified. *Bosmina longirostris* was the most abundant cladoceran and the dominant zooplankton from June until October, when *Diaptomus ashlandi* became dominant. This species remained dominant until June 1974. Prior to January 1974, *Cyclops bicuspidatus thomasi* was the third most abundant organism. During the January-February thaw, *C. bicuspidatus thomasi* became the second most abundant zooplankton and remained so until it became dominant in June 1974. *Daphnia* spp. were the fourth most abundant organisms, but they were present in such low numbers that, for the most part, they accounted for only 10 percent of the animals present. *Bosmina*, *Diaptomus*, and *Cyclops* accounted for most of the remaining 90 percent (Fig. 2).

Other types of invertebrates were observed in the samples. These included insect larvae, aquatic arachnids, annelids, rotifers, nematods, Tardigrades, and Hydras. Drifting insect larvae, especially trichopteran and dipteran, were present in limited numbers.

Insect larvae usually accounted for less than 5 percent of the animals collected. In mid-October, relative abundance of insect larvae peaked at 5 percent of the community. Numbers of insect larvae peaked with other zooplankton in mid-July at about 7 larvae/m³. This peak corresponded with peak insect larvae numbers observed in the benthos collections. However, relative abundance was low, and at this time insect larvae represented only about 0.08 percent of all zooplankton. These data indicate that drifting insects are not numerically important components of the zooplankton community at Rkm 611.

Taxa (Rkm 566)

Fifty-eight zooplankton taxa were observed in samples collected at Rkm 566 from December 1974 through March 1980 (Table 1). Seasonal relative abundance was dominated by three crustacean genera: *Bosmina*, *Diaptomus*, and *Cyclops* (Fig. 2). *Bosmina* generally dominated the July, August, and September samples. *Diaptomus* dominated December and January samples. *Cyclops* dominated March and June samples. In the late-winter, early-spring of 1977, rotifers dominated the samples. Insect larvae were only numerically significant in samples collected in March 1975 and September 1976.

TABLE 1. Zooplankton taxa collected in samples from the Columbia River at river kilometer 611 and 566 from June 1973 through March 1980. (1 = Rkm 611, 2 = Rkm 566, 3 = observed at both sites.)

Coelenterata		<i>Macrothrix</i> spp.	(2)
Hydra spp.	(3)	<i>Ilyocryptus</i> spp.	(2)
Bryozoa		Chydoridae	
Ectoprocta		<i>Pleuroxus</i> spp.	(2)
Paludicellidae		<i>P. denticulatus</i>	(1)
<i>Paludicella articulata</i>	(2)	<i>Alona costata</i>	(1)
Annelida		<i>A. quadrangularis</i>	(1)
Oligochaeta	(3)	<i>A. gutiata</i>	(1)
Hirudinea	(3)	<i>A. rectangula</i>	(1)
Aschelminthes		Chydorus spp.	(2)
Nematoda	(2)	Eurycereinae	(2)
Rotifera		<i>Eurycerus lamellatus</i>	(1)
Brachionidae		Ostracoda	
<i>Kellicottia longispina</i>	(2)	Copepoda	
<i>K.</i> spp.	(2)	Calanoida	
<i>Keratella cochlearis</i>	(2)	Temoridae	
<i>K. quadrata</i>	(2)	<i>Epischura</i> spp.	(2)
<i>Brachionus</i> spp.	(2)	Temoridae copepodid	(2)
<i>Euchlanis</i> spp.	(2)	Diaptomidae	
Lecanidae		<i>Diaptomus</i> spp.	(2)
<i>Lecane</i> spp.	(2)	<i>D. ashlandi</i>	(3)
Synchaetidae		Cyclopoida	
<i>Synchaeta</i> spp.	(2)	Cyclopidae	
<i>Polyarthra</i> sp.	(2)	<i>Cyclops</i> spp.	(2)
Testudinellidae		<i>Bleuspilatus thomasi</i>	(3)
<i>Testudinella</i> spp.	(2)	Harpacticoida	(3)
Arthropoda		Amphipoda	(3)
Tardigrada	(3)	Acari	(3)
Crustacea		Insecta	
Cladocera		Collembola	(2)
Leptodoridae		Ephemeroptera	(2)
<i>Leptodora kindtii</i>	(3)	Trichoptera	
Sididae		Rhyacophilidae	(2)
<i>Sida crystallina</i>	(2)	Hydropsychidae	(3)
<i>Latona</i> spp.	(2)	Diptera	
<i>Diaphanosoma</i> spp.	(2)	Chironomidae	(2)
Daphnidae		Simuliidae	
<i>Daphnia</i> spp.	(2)	<i>Simulium</i> sp.	(2)
<i>D. pulex</i>	(1)	Platyhelminthes	
<i>D. middendorffiana</i>	(1)	Turbellaria	
<i>Ceriodaphnia</i> spp.	(2)	<i>Dugesia</i> sp.	(2)
Bosminidae		Protozoa	
<i>Bosmina longirostris</i>	(3)	<i>Vorticella</i> sp.	(2)
Macrothricidae			

Density (Rkm 611)

Numbers of zooplankton ranged from 1500 organisms/m³ in mid-July to <30 organisms/m³ in November and December (Fig. 3). The yearly average was 607 organisms/m³. Numbers of zooplankton declined steadily from a July peak to a November/December low. A minor peak occurred in January and February, which corresponded with an early thaw and upstream flooding and may have represented organisms washed from upstream reservoirs.

Density (Rkm 566)

Zooplankton densities at Rkm 566 generally followed a trend of winter minimums and late-spring, early-summer maximums (Fig. 3). Average numbers of zooplankton per cubic meter (No/m³) ranged from less than 10 in December 1974 to 4702 in June 1977.

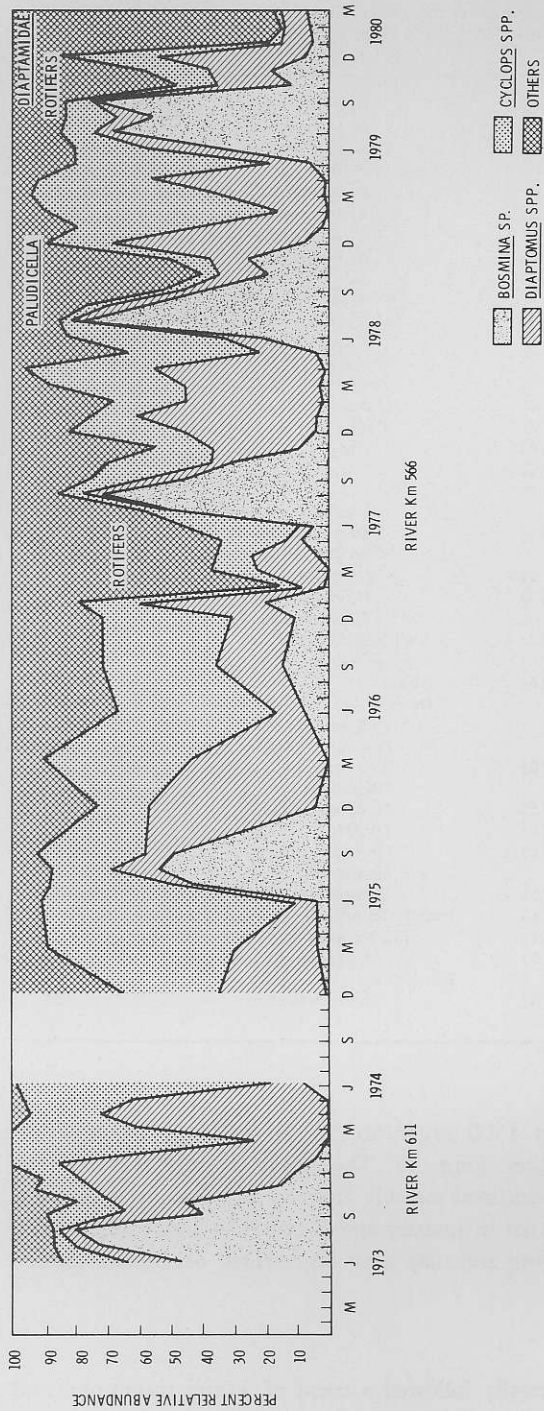


Figure 2. Relative abundance (percent of mean total number) of the three dominant zooplankton organisms collected at Rkm 611 and Rkm 566, June 1973 to March 1980 (modified from Beak 1980).

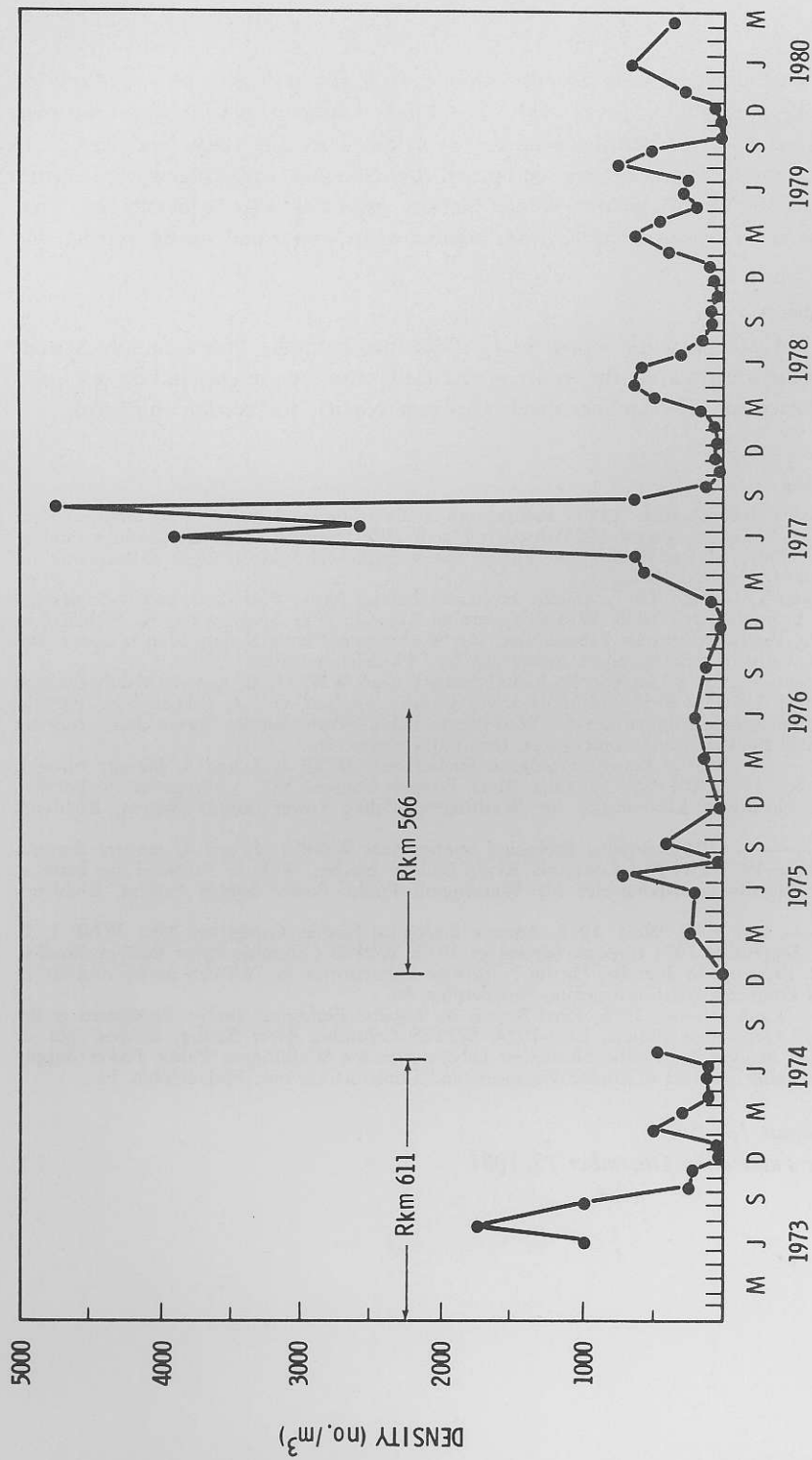


Figure 3. Number of Columbia River zooplankters per m³ collected at river kilometer 611 and 566.

Summary

Crustacean zooplankters dominated most samples collected at Rkm 611 and Rkm 566 from June 1973 through March 1980. The three dominant genera were *Bosmina*, *Diaptomus*, and *Cyclops*. Density estimates were lowest in the winter and highest in the summer. Summer peaks were dominated by *Bosmina* and ranged to densities greater than 4500 organisms/m³. Winter density estimates were generally less than 50 organisms/m³. *Diaptomus* and *Cyclops* dominated in winter and spring, respectively.

Acknowledgments

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Literature Cited

- Beak Consultants Incorporated. 1980. Preoperational Environmental Monitoring Studies Near WNP 1, 2, and 4, August 1978 through March 1980. WPPSS Columbia River Ecology Studies. Vol. 7. Prepared for Washington Public Power Supply System by Beak Consultants Incorporated, Portland, Ore.
- Gray, R. H., and T. L. Page. 1977. Aquatic Ecological Studies Near WNP 1, 2, and 4, September 1975 through March 1976. WPPSS Columbia River Ecology Studies. Vol. 3. Prepared by Battelle, Pacific Northwest Laboratories, for Washington Public Power Supply System under contract to United Engineers and Constructors, Inc., Philadelphia, Pa.
- , and ———. 1978. Aquatic Ecological Studies near WNP 1, 2, and 4, March through December 1976. WPPSS Columbia River Ecology Studies. Vol. 4. Prepared by Battelle, Pacific Northwest Laboratories for Washington Public Power Supply System under contract to United Engineers and Constructors, Inc., Philadelphia, Pa.
- , and ———. 1979a. Aquatic Ecological Studies near WNP 1, 2, and 4, January through December 1977. WPPSS Columbia River Ecology Studies. Vol. 5. Prepared by Battelle, Pacific Northwest Laboratories for Washington Public Power Supply System, Richland, Wash.
- , and ———. 1979b. Aquatic Ecological Studies near WNP 1, 2, and 4, January through December 1977. WPPSS Columbia River Ecology Studies. Vol. 6. Prepared by Battelle, Pacific Northwest Laboratories for Washington Public Power Supply System, Richland, Wash.
- , ———, and E. G. Wolf. 1976. Aquatic Ecological Studies Conducted Near WNP 1, 2, and 4, September 1974 through September 1975. WPPSS Columbia River Ecology Studies. Vol. 2. Prepared by Battelle, Pacific Northwest Laboratories for WPPSS under contract to United Engineers and Constructors, Philadelphia, Pa.
- , ———, and ———. 1976. Final Report on Aquatic Ecological Studies Conducted at the Hanford Generating Project, 1973-1974. WPPSS Columbia River Ecology Studies. Vol. 1. Prepared by Battelle, Pacific Northwest Laboratories for Washington Public Power Supply System under contract to United Engineers and Constructors, Inc., Philadelphia, Pa.

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