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A PRELIMINARY COMPARISON OF THE NANNOPLANKTON AND NET PLANKTON OF THE COLUMBIA RIVER

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A PRELIMINARY COMPARISON OF THE NANNOPLANKTON AND NET PLANKTON OF THE COLUMBIA RIVER

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Biology Section

September 10, 1953

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

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ABSTRACT

Plankton collected from the Columbia River by the net method and by the centrifuge method were compared. The centrifuged plankton (nannoplankton) exceeded the net plankton in weight, in abundance of organisms and in radioactivity. Similar seasonal trends were present in both types of plankton.

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A PRELIMINARY COMPARISON OF THE NANNOPLANKTON AND NET PLANKTON OF THE COLUMBIA RIVER

INTRODUCTION

Previous work on the Columbia River[1] utilized conventional plankton nets for sampling and required a minimum of equipment. From investigations on lakes in the past[2], however, it is known that a substantial proportion of the smaller organisms known as nannoplankton[3] pass through the mesh openings of the plankton net. With the recent availability of additional facilities and equipment, it was possible to investigate the quantity and radioactivity of the nannoplankton. Because of other investigations in progress at the time only limited effort could be devoted to this problem. Consequently the data obtained may be regarded as a preliminary appraisal of this phase of the river ecology.

METHODS

Net plankton and nannoplankton samples were collected from inshore water near the south bank of the Columbia River at Hanford. Collection of net plankton samples and their laboratory treatment with the exception of increased weighing accuracy, is the same as previously described[1].

Water for nannoplankton samples was strained through plankton nets (173 meshes per inch, 0.076 mm aperture size), then transported to the laboratory in 20 liter carboys. A Foerst[3] centrifuge consisting of a bowl revolving at 20,000 rpm was used for separation of the water and nannoplankton fractions. The nannoplankton-bearing water enters at the top, the water is thrown over the rim of the bowl and the nannoplankton collects on the inside perimeter of the bowl. Twenty liters were processed for activity density samples while the water volume for gravimetric and numerical abundance samples ranged between 20 and 60 liters. These

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volumes were judged necessary to obtain a sufficient quantity of nannoplankton for accurate data. The small capacity of the Foerst centrifuge made preliminary concentration advisable. The entire volume was therefore treated with three per cent formaldehyde, allowed to settle for 24 hours, the supernatant siphoned off without disturbing the sediment, and the residue centrifuged. In the case of activity density samples, the nannoplankton was washed from the centrifuge bowl onto stainless steel plates, dried under infra-red lamps, and then counted with a thin mica end window g. m. tube and conventional scaler. All of the customary corrections were made in converting to d/m. Gravimetric and numerical count samples were preserved with six per cent formaldehyde in vials. Subsequent processing was identical with net plankton treatment[1] except that a 20 power ocular was used for numerical counting in place of the customary 10 power ocular giving a magnification of 200 diameters.

Crushing of soft bodied organisms by the centrifuge method was not considered of great importance in the river plankton which consists principally of siliceous diatoms.

RESULTS AND DISCUSSIONS

Fig. 1 shows the quantities of dry organic weight of net plankton and nannoplankton present in the river water during the period of study. The dry organic weight (loss on ignition) of plankton is influenced less by inorganic sediments carried in suspension than is the total dry weight and is therefore used as the basis for quantitative weight comparisons. Similar seasonal trends are apparent in both types of plankton. Beginning in April and continuing through most of the warmer portion of the year, a rapid plant growth produces an increase in organic weights per unit volume of water. A decrease occurs during the peak freshet months of June and July when the river flow is at maximum and high silt turbidity prevails.

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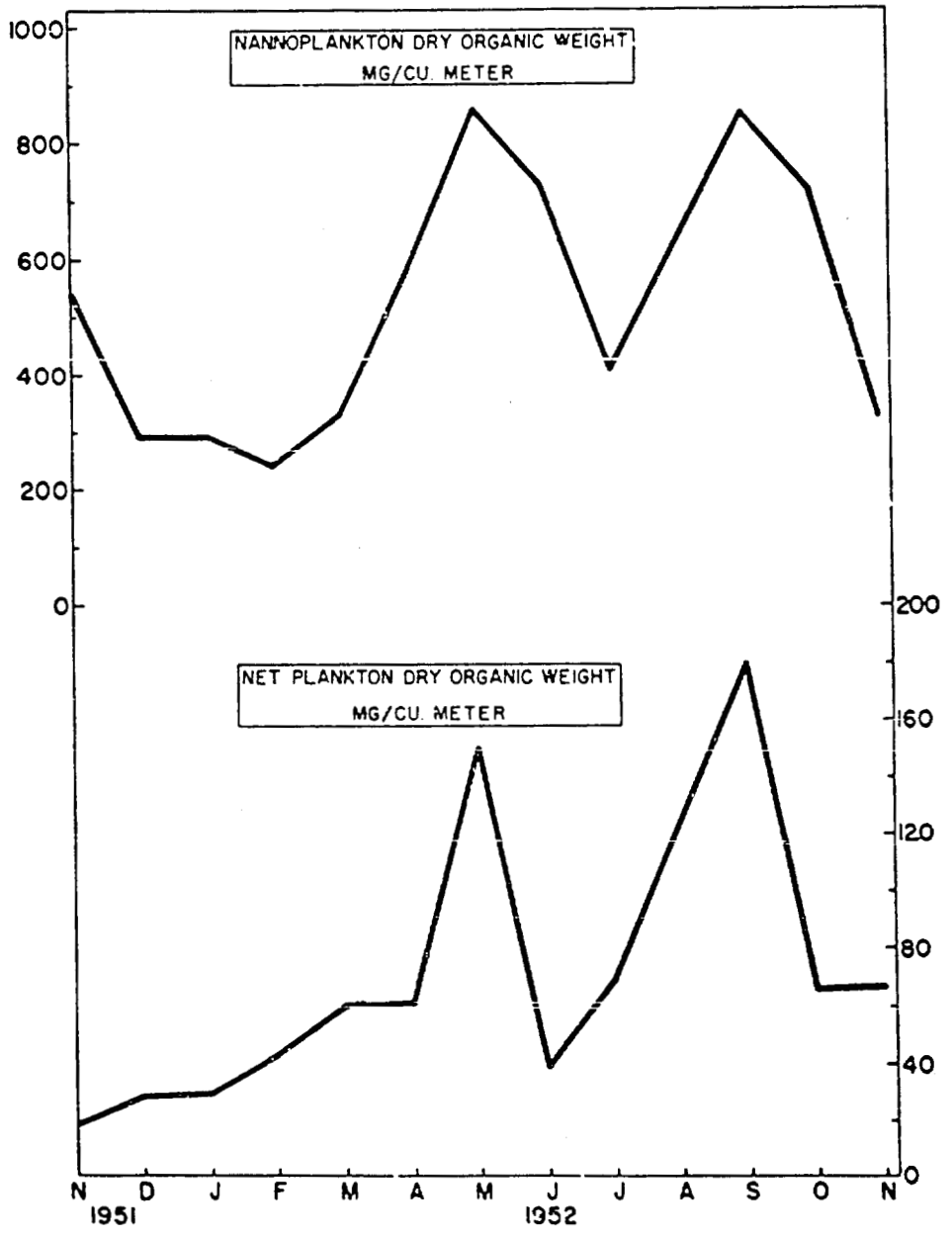

FIGURE 1
GRAVIMETRIC RESULTS FOR COLUMBIA RIVER
NET AND NANNOPLANKTON

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A previous presentation of net plankton data[1] has shown that activity densities of plankton are highest during the winter low-water season, when water activity densities are highest. A repetition of this pattern in the present study is apparent in both types of plankton as shown in the upper portion of Fig. 2. If, however, the activity per ml of water due to the plankton is plotted as in the lower part of Fig. 2, the influence of the abundance of plankton alters this picture. An increase in organic weights during the warmer portion of the year more than compensates for the decrease in activity which occurs at this time as a result of increased river flow and decreased water activity density. Therefore, a period of maximum activity per volume of water due to the plankton prevails during the warmer season. Consequently, peaks in radioactivity and in dry organic weight occur in both types of plankton during May preceding the freshet and during September following the freshet. Data were not obtained for nannoplankton during August but on the basis of net plankton results the points would fall intermediate between July and September.

Over the period of sampling, nannoplankton exceeded the net plankton in dry organic weight by a factor of eight and in radioactivity by a factor of 16 (Table 1).

Table 1

Comparison of Net and Nannoplankton
Average Values of all Samples

	Net Plankton	Nannoplankton
Dry organic wt. g/m^3	0.061	0.510
Microcuries/ml	13×10^{-9}	220×10^{-9}

Radioactive decay of nannoplankton samples followed a curve similar to that of the net plankton, which indicated a similarity in radioisotope composition.

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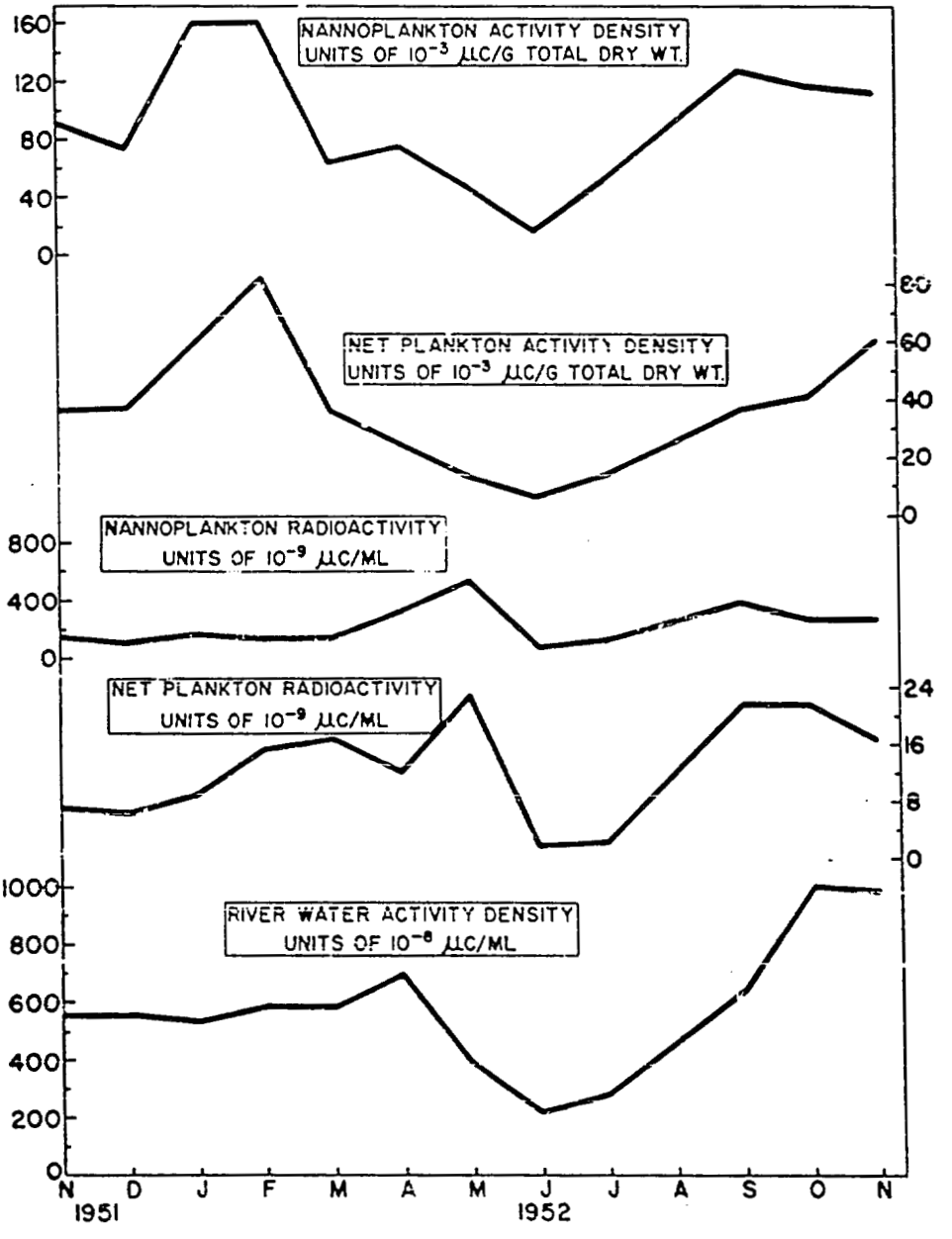

FIGURE 2

RADIOACTIVITY OF COLUMBIA RIVER NET PLANKTON, NANNOPLANKTON AND WATER

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A comparison of the numerical abundance of nanno- and net plankton organisms was made on six of the samples collected over a period from late November 1951 to early April 1952. An average of 500 nannoplankters per ml of river water were present compared to 60 net plankters per ml. The nannoplankton diatoms have passed through the plankton net mesh and consequently their size is smaller. Fragilaria, Melosira and Asterionella diatoms were, nevertheless, the predominant genera common to both types of plankton. This may account for the close agreement between the increase in nanno- over net plankton by a factor of nine in numerical abundance and eight in dry organic weight. However, the presence of a substantial amount of organic detritus in both types of plankton makes direct comparisons difficult.

SUMMARY

A preliminary comparison of the net plankton and nannoplankton of the Columbia River was made from November 1951 to November 1952.

The nannoplankton exceeded the net plankton in weight by a factor of eight and in radioactivity by a factor of 16. Similar seasonal fluctuations occurred in the two types of plankton in both weight and activity.

The period of maximum plankton radioactivity contained in a ml of water and maximum dry organic weight per cubic meter coincided with the warmer season prior to and following the freshet period.

The same genera of diatoms were the dominant organisms in both types of plankton. The nannoplankton diatoms were smaller and nine times more abundant than in the net plankton.

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