August 2024

1950 Study of Plankton Populations of Lakes & Streams in Rocky Mountain National Park

Floyd J. Brinley
University of Toledo

845

	SUPERINTENDENT	
3	SUPERINTENDENT	
1	ASST. SUPT.	
	CHIEF CLERK	
	ADMIN. AID	
	CHIEF RANGER	
2	NATURALIST	
	ENGINEER	
	LANDS, ARCH.	
	REPAIR SHOP	
	PLUMBING SHOP	
	CARPENTER SHOP	
	FILE	

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
REGION TWO
OMAHA, NEBRASKA

NOV 3 1950

Memorandum

To: The Director

From: Regional Naturalist

Subject: Final report of Dr. Brinley's zoological studies

We are enclosing two copies of the report "Plankton Population of Certain Lakes and Streams in the Rocky Mountain National Park, Colorado" by Dr. Floyd J. Brinley, of the University of Toledo, who was a collaborator in Rocky Mountain National Park during the summer of 1949. We are pleased to have the reprints of his article since they will serve as valuable reference material. We are forwarding one copy each to Grand Teton, Yellowstone, and Glacier since they may wish to refer to this article in considering the plankton populations in their areas.

Signed

Carl R. Swartzlow
Regional Naturalist

In duplicate

Attachments 2

Copy to: Supt., Yellowstone w/c report
Supt., Grand Teton w/c report
Supt., Glacier w/c report
Supt., Rocky Mountain

8 45

Reprinted from the OHIO JOURNAL OF SCIENCE
Vol. L, No. 5, September, 1950

PLANKTON POPULATION OF CERTAIN LAKES AND STREAMS IN THE ROCKY MOUNTAIN NATIONAL PARK, COLORADO

FLOYD J. BRINLEY,
University of Toledo, Toledo, Ohio

An extensive survey of the plankton population of the streams in the Ohio River watershed was made from 1939–1942 (Brinley and Katzin, 1944). This study revealed the fact that the northern tributaries of the Ohio River support a much larger phytoplankton population in species and numbers than the southern tributaries. This difference in plankton distribution is attributed to the fact that the northern streams flow through densely populated areas, the farm lands are fertile and the surface waters are generally polluted with human and industrial wastes. The southern streams, on the other hand, pass through sparsely populated regions where the soils are poor and the streams are less likely to be enriched with organic pollution. The algae population seems to be directly correlated with the amount of decomposed organic matter in the stream. Studies of the White (Brinley, 1942a) and the Cumberland Rivers (Brinley, 1942b) clearly showed that isolated sources of heavy organic pollution greatly increased the growth of algae, in numbers and species, in the stream below the entrance of the sewage.

It is desirous to obtain more information on the relation of stream fertility to the plankton population by studying streams which are free from organic pollution. Such streams do not exist in the state of Ohio so it seemed advisable to study the problem in sparsely populated mountain districts where the streams are free from human wastes and where the decomposition of natural organic matter, vegetation, leaves, humus, etc., is at a minimum.

Permission was freely given by the National Park Service to conduct these studies in the Rocky Mountain National Park. The writer wishes to express his appreciation to David Canfield, Superintendent, J. Barton Herschler, Chief Ranger, and Edwin C. Alberts, Park Naturalist, for all facilities of the Park which were so graciously given.

METHODS AND PROCEDURE

The present studies were made in the Park from June 13 to July 22, 1949. In the beginning of the study, samples of water were collected in wide mouth bottles and an attempt was made to make qualitative and quantitative determinations of the population of plankton and to express the quantitative results in parts per million as recorded in the previous publications (Brinley, 1942). However, it was soon found that the plankton population of these streams and lakes was so low that collections of small samples yielded very few individuals and the volume was less than one part per million as compared with several parts per million as found in the Ohio River Basin. It was decided, therefore, to discontinue the small sample collections and to use a plankton net. Approximately ten to twenty gallons of water were filtered through the net by sweeping the net through quiet water or allowing running water to flow through the net. The fifteen milliliters of catch were then concentrated to one ml. by centrifuging. This method was largely qualitative and thus no volume determinations were made. The lake samples were taken from the shore line on the leeward side of the lake. Samples from the streams were largely taken from boulders along the shore by allowing the water to flow through the net.

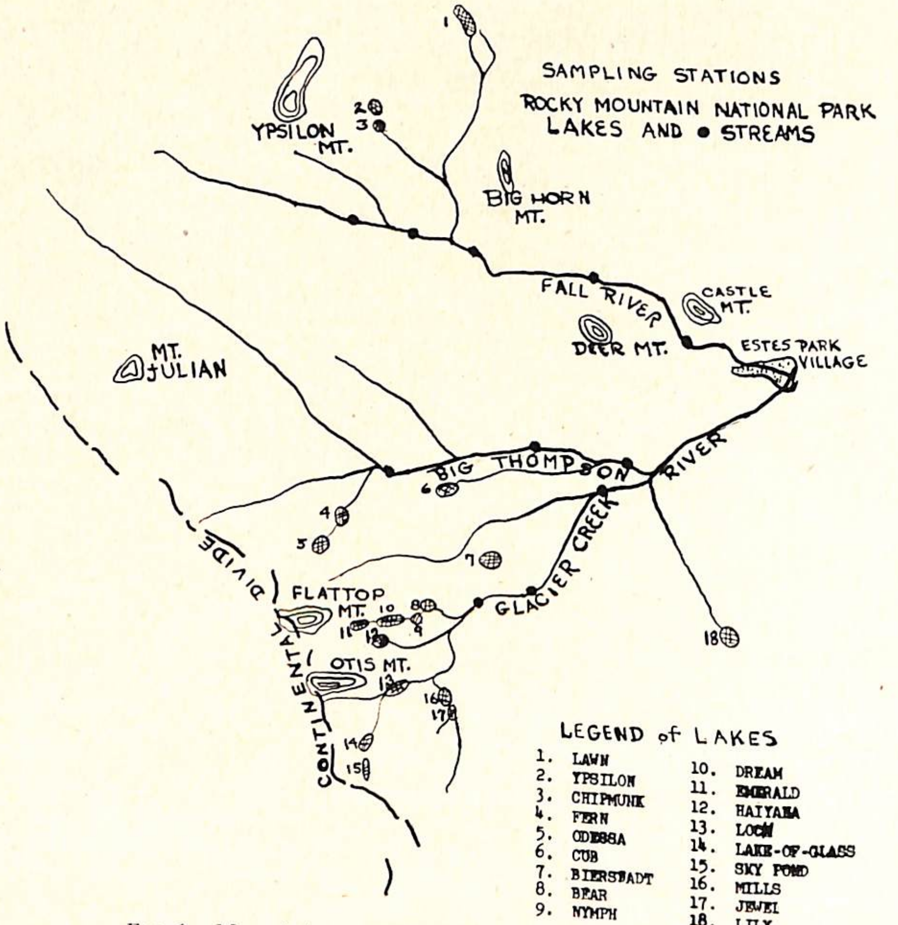

FIG. 1. Map of the area from which collections were made.

The stream beds and lakes in the Park were glacier formed and thereby in many cases two to four lakes are terraced up the gorges and during high water these lakes are connected by a flowing stream. The lakes studied were conveniently arranged in related groups as they occur in the common valley (see map tracing). In most cases the lakes had stony bottoms and were partly filled with loose boulders that had descended from rocky ledges above. The rocks along the shore line were covered with unidentified filamentous algae and a layer of silt of various depths covered the bottom between the rocks and boulders. During the month of June, snow banks extended to the edge of the water in most of the lakes of high elevations.

The typical mountain streams flowed over rocky valley floors and during high water in June the samples collected contained large amounts of sand which seriously interferred with the plankton determinations. Unidentified filamentous algae covered the rocks.

DISTRIBUTION OF PLANKTON

LAKES

GROUP I

Lake	Elevation Ft.	Temp. C.	Plankton	Relative Population	Date
Bear	9,600	10	DIATOMS		
			Asterionella gracillima	abundant	6/18
			Diatoma vulgare	few	
			Navicula sp.	few	
			Cymbella sp.	few	
			Synedra	scarce	
			DESMIDS		
			Closterium subcostatum	scarce	
			Staurastrum sp.	scarce	
			GREEN ALGAE		
			Cryptomonas ovalis	scarce	
			Volvox	scarce	
			PROTOZOA		
			Peridinium	scarce	
			COPEPODS		
			Cyclops	few	
		16	DIATOMS		7/15
			Asterionella gracillima	abundant	
			Diatoma vulgare	few	
			Navicula sp.	few	
			DESMIDS		
			Closterium sp.	few	
			GREEN ALGAE		
			Dinobryon sp.	abundant	
			Volvox	one colony	
			Cryptomonas ovalis	scarce	
			CLADOCERA		
			Daphnia pulex	abundant	
Nymph	9,800	17	DIATOMS		6/30
			Navicula sp.		
			Diatoma vulgare	abundant	
			DESMIDS		
			Penium closterioides	few	
			Micrasterias radiosa	few	
			Staurastrum sp.	few	
			COPEPODS		
			Cyclops	few	
			ROTIFERS		
			Anuraea	abundant	
Dream	10,000	7	DIATOMS		6/30
			Asterionella	abundant	
			Diatoma vulgare	few	
			Synedra	few	
			GREEN ALGAE		
			Cryptomonas erosa	scarce	
		8	DIATOMS		7/8
			Asterionella	abundant	
			Diatoma vulgare	few	
			DESMIDS		
			Microsterias radiosa	few	
			COPEPODS		
			Cyclops	scarce	
			ROTIFERS		
			Anuraea	scarce	

DISTRIBUTION OF PLANKTON—(*Continued*)

LAKES

Lake	Elevation Ft.	Temp. C.	Plankton	Relative Population	Date
Group I—Continued					
Emerald	10,200	8	Diatoms		7/8
			Asterionella	abundant	
			Diatoma vulgare	few	
			Desmids		
			Micrasterias radiosa	few	
			Green Algae		
			Cryptomonas erosa	scarce	
Group II					
The Loch	10,700	8	Diatoms		7/11
			Diatoma vulgare	few	
			Green Algae		
			Volvox	abundant	
			Cryptomonas erosa	few	
			Copepods		
			Cyclops	few	
Lake-of-Glass	10,800	6	Diatoms		7/11
			Asterionella	abundant	
			Green Algae		
			Volvox	abundant	
			Cryptomonas erosa	few	
			Copepods		
			Cyclops	few	
			Rotifers		
			Noteus	few	
Sky-Pond	11,100	6	Diatoms		7/11
			Asterionella	few	
			Green Algae		
			Volvox	abundant	
			Cryptomonas erosa	few	
Group III					
Mills	11,500	9	Diatoms		7/18
			Navicula	few	
			Desmid		
			Cosmarium	few	
			Rotifers		
			Anuraea	few	
Jewel	11,600	9	Diatoms		7/18
			Navicula sp.		
			Diatoma vulgare		
Group IV					
Fern	9,500	7	Diatoms		6/25
			Navicula sp.	abundant	
			Diatoma vulgare	many	
			Synedra	few	
			Green Algae		
			Cryptomonas erosa	few	
Odessa	10,000	5	Diatoms		6/25
			Navicula sp.	few	
			Rotifers		
			Anuraea	few	
Group V (Miscellaneous)					
Bierstadt	9,500	13	Diatoms		6/19
			Diatoma vulgare	many	
			Navicula		
			Desmids		
			Cosmarium constrictum	few	
			Closterium subcostatum	few	
			Green Algae		
			Euglena viridis	few	
			Phacus pyrum	very few	
			Protozoa		
			Vorticella	very few	

DISTRIBUTION OF PLANKTON—(*Continued*)

LAKES

Lake	Elevation Ft.	Temp. C.	Plankton	Relative Population	Date
Group V—Continued					
Cub	8,600	17	Diatoms		6/21
			Diatoma vulgare	few	
			Cladocera		
			Daphnia pulex	very abundant	
			Rotifers		
			Anuraea	abundant	
Chipmunk	9,900	17	Diatoms		6/23
			Diatoma vulgare	few	
			Navicula sp.	few	
			Desmids		
			Euastrum abruptum	few	
			Cosmarium constrictum	few	
			Closterium subcostatum	few	
			Cladocera		
			Daphnia pulex	few	
			Rotifers		
			Anuraea	abundant	
			Polyarthra	few	
Lily	9,900	18	Diatoms		6/24
			Navicula	abundant	
			Desmids		
			Micrasterias radiosa	few	
			Green Algae		
			Chlamydomonas sp.	few	
			Volvox	few	
			Euglena sp.	very few	
			Protozoa		
			Ceratium	very few	
			Cladocera		
			Daphnia pulex	many	
			Copepods		
			Cyclops	few	
			Rotifers		
			Anuraea	few	
			Noteus	few	
Haiyaha	10,700	6	Diatoms		7/8
			Asterionella	few	
			Diatoma vulgare	few	
			Green Algae		
			Cryptomonas ovata	very few	
			Rotifers		
			Anuraea		
			Noteus		
			Copepods		
			Cyclops	few	

STREAMS

Streams	Location	Temp. C.	Plankton	Relative Population	Date
Big Thompson	Below "Pool"	6	Diatoms		6/18
			Navicula	many	
			Synedra acus		
			Desmids		
			Closterium subcostatum		
		8	Diatoms		7/10
			Navicula	many	
			Nitzschia	few	
		9	Diatoms		7/20
			Navicula	few	

DISTRIBUTION OF PLANKTON—(*Continued*)

STREAMS

Stream	Location	Temp. C.	Plankton	Relative Population	Date
	Stead's Hotel	8	DIATOMS		7/3
			Navicula sp.	few	
			Diatoma vulgare	few	
			DESMIDS		
			Closterium sp.	few	
			ROTIFERS		
			Anuraea		
		8	DIATOMS		7/10
			Navicula	few	
		11	*Navicula*	few	7/20
	Moraine Park	8	DIATOMS		6/27
			Navicula	few	
			Diatoma vulgare	few	
			DESMIDS		
			Cosmarium constrictum	few	
			Closterium subcostatium		
			PROTOZOA		
			Loxodes		
		8	DIATOMS		7/10
			Navicula sp.	few	
			Diatoma vulgare	few	
			Closterium subcostatium	few	
			Cosmarium constrictum	few	
		11	DIATOMS		7/20
			Diatoma vulgare	few	
			Navicula sp.		
			DESMIDS		
			Cosmarium constrictum		
			Closterium subcostatum		
Glacier Creek	Below Bear Lake	8	DIATOMS		7/2
			Asterionella	many	
			Navicula	many	
			Nitzschia	few	
			Synedra	few	
			GREEN ALGAE		
			Cryptomonas erosa	very few	
	Sprague's Lodge	8	DIATOMS		7/2
			Asterionella	many	
			Navicula	few	
			Nitzschia	few	
			Diatoma vulgare	few	
			DESMIDS		
			Closterium	few	
	Mouth of Mill Creek	8	DIATOMS		7/2
			Asterionella	few	
			Navicula	few	
			Nitzschia	few	
			GREEN ALGAE		
			Cryptomonas erosa	very few	
		10	DIATOMS		7/15
			Asterionella	few	
			Navicula	few	
			DESMIDS		
			Micrasterias radiosa	few	
Fall River	Chasm Falls	5	DIATOMS		7/9
			Navicula	very few	
		8	DIATOMS		7/16
			Navicula	few	
	End-of-Valley Camp	8	DIATOMS		7/9
			Navicula sp.	few	
			Diatoma vulgare	few	
		9	DIATOMS		7/16
			Navicula sp.	few	

DISTRIBUTION OF PLANKTON—(*Continued*)

STREAMS

Stream	Location	Temp. C.	Plankton	Relative Population	Date
	Fall River Lodge	5	DIATOMS		7/6
			Navicula sp.	few	
			Diatoma vulgare	few	
			ROTIFERS		
			Noteus	very few	
			PROTOZOA		
			Actinosphaerium sol	very few	
		8	DIATOMS		7/9
			Navicula sp.	few	
			Diatoma vulgare	few	
			DESMIDS		
			Closterium sp.	few	
			PROTOZOA		
			Cyclidium		
	Highway Bridge U. S. 34	7	DIATOMS		6/28
			Navicula	few	
			Diatoma vulgare	few	
		8	DIATOMS		7/9
			Navicula sp.	very few	
			PROTOZOA		
			Cyclidium	very few	
	Below Sheep Lake	7	DIATOMS		6/28
			Navicula	few	
			GREEN ALGAE		
			Tetraspora	few	
	Above Estes Park		DIATOMS		6/28
			Navicula	few	
			Diatoma vulgare	few	
			DESMIDS		
			Cosmarium rostratum	few	

DISCUSSION AND SUMMARY

A study of the data presented shows that the diatoms were the most abundant group of planktons in both the lakes and streams, followed in numbers by the desmids and an occasional green flagellate and protozoan. In some lakes Daphnia, Cyclops and rotifers were abundant. The small number of species may in a large part be due to the low temperature, in most cases below 10 degrees Centigrade. The species found in the Park as listed in this paper are the typical cold water forms that occur in the Ohio Basin (Brinley and Katzin 1942). The total plankton volume in the mountain streams is much lower than the volume of the same species in the Ohio River Basin under similar temperature conditions, which I believe can be attributed to the fertilizing action of the organic pollutants in the Ohio stream.

A comparative study of the streams and lakes in the Park showed no specific differences in the plankton algae, however, the population density of individual species were generally higher in the lakes. Daphnia and Cyclops were abundant in Bear, Cub and Lily lakes. Rotifers were numerous in Chipmunk, Cub, and Lily lakes. Hellgrammites and leeches were abundant in the latter lakes and these lakes also supported a heavy population of water lilies.

A careful study of the distribution records indicates a possible similarity in the plankton algae in closely related lakes. The lakes in group one, Bear, Nymph, Dream and Emerald are all located in the Tyndall Glacier Gorge. The characteristic specie of algae found in three of these lakes is the diatom, *Asterionella*. It is also interesting to note that this diatom was widely distributed in Glacier Creek which receives the outlet from Bear Lake and Glacier Gorge. The individual specimens of this fragile diatom in Glacier Creek were always broken which indicates that the origin of this specie was in the lakes and not a direct product of the stream. A few *Asterionella* were, however, found in Lake Haiyaha, Lake-of-Glass, Sky Pond, and The Loch. Volvox was found abundantly in the Loch Vale Lakes (group 2); The Loch, Lake-of-Glass and Sky Pond, and only occasionally elsewhere.

The stream plankton was typically diatoms. There is a tendency for the desmids to increase in the Big Thompson River as it flows through the meadows in Moraine Park.

REFERENCES

Brinley, F. J., and **Katzin, L. J.** 1944. Report of the U. S. Public Health Service, Ohio River Pollution Control. Suppl. to Part 2, pp. 1279–1368.

Brinley, F. J. 1942 (a). The effect of pollution upon the plankton population of the White River, Indiana. Investigation of Indiana Lakes and Streams, 2, 137–143. Indiana Department of Conservation.

Brinley, F. J. 1942 (b). The effect of sewage from Nashville upon the plankton population of the Cumberland River. Jour. of the Tenn. Acad. of Science 17: 179–183.

Brinley, F. J., and **Katzin, L. J.** 1942. Distribution of stream plankton in the Ohio River System. Am. Mid. Naturalist 27, No. 1, 173–182.

845

November 1, 1950

Dr. Floyd J. Brinley
University of Toledo
Toledo, Ohio

Dear Dr. Brinley:

Many thanks for your gracious gift of several copies of the plankton paper, the result of your work with us in 1949.

We are forwarding copies of this to the respective higher authorities who, I am sure, will be as pleased with it as we are.

Cordially,

Edwin C. Alberts
Park Naturalist

ECA:skh