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JOB COMPLETION REPORT

INVESTIGATIONS PROJECT

State of Montana

Project No. F-20-R-8 Name South Central Montana Fisheries Study

Job No. III Title Stream Sediment Investigation

Period Covered July 1, 1962 through September 30, 1963

Abstract:

Average monthly temperatures on Bluewater Creek varied from a maximum of 76°F to a minimum of 34°F. The extremes occurred in the lower two stations. Monthly average flow varied from a low of 2 cfs to a high of 75 cfs. The extreme in flows in the lower two stations is due to irrigation diversions and returns and spring runoff. Monthly average sediment loads varied from 0.3 tons/day to a high of 358 tons/day. The high sediments were caused by spring runoff and irrigation returns. The highest sediments all occurred at station 5.

Grayling egg mortalities varied from 66% to 100% from station 1 to station 4. Longnose sucker egg mortality varied 0.5% to 7% from station 2 to station 5.

The trout population declined progressively from over 95% trout in station 1 to less than 1% in station 5.

Recommendations:

No recommendations for management will be made until the study is completed on June 30, 1964.

Objectives:

The objective of this study is to determine the relationships between the sedimentation in a stream and trout production. Specifically, the effects of sediment on the trout population, egg incubation and bottom fauna are being measured plus the effects of discharge and water temperature on the trout population.

Techniques Used:

The experimental design and methods utilized to obtain sediment, discharge, temperature and fish data are described in F-20-R-5, Job No. III. Artificial redds used for fish egg incubation data were constructed by evacuating approximately a 3-foot square hole by 20 inches deep in a riffle portion of the stream bed at each station. These holes were then filled with washed rock varying in diameter from 0.75 - 1.5 inches. Freshly spawned grayling eggs planted on May 23, 1963 and longnose sucker eggs planted on June 13, 1964 were counted into plastic vials and Vibert boxes, and placed 2 - 4 inches into the gravel of the artificial redds. Each plastic vial contained 50 eggs, and each Vibert box contained 100 eggs. A plastic vial was removed from the artificial redds every third day to determine the egg mortality rate. The Vibert boxes were left in the artificial

redds until the end of the incubation period to determine final egg mortality. The Mark VI groundwater standpipe was operated in artificial redds each time a plastic vial was removed. The standpipe apparatus aids in determining the seepage rate and dissolved oxygen content of the groundwater within the gravel.

Findings:

No attempt to interpret the findings will be made in this report because the study will not be completed until June 30, 1964. The following tables summarize the data collected during the report period.

TABLE I

MEAN MONTHLY MAXIMUM AND MINIMUM TEMPERATURE (°F) AT

EACH STATION ON BLUEWATER CREEK FROM JULY, 1962 THROUGH SEPTEMBER, 1963

PERIOD	STATIONS									
	1		2		3		4		5	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1962										
July			65	44	71	53	74	66	69	58
August			61	43	64	50	68	59	67	56
September			56	41	58	47	58	51	56	46
October			53	45	55	47	57	50	51	41
November			53	45	51	42	50	43	47	40
December			48	40			43	40	38	34
1963										
January			51	43	45	41	48	42	38	34
February			51	43	50	42	48	40	42	36
March			56	45	54	43	51	44	47	40
April			58	47	58	46	57	46	51	44
May	58	48	61	49	64	47	63	48	58	51
June	60	43	62	51	67	48	70	48	62	54
July	60	43	62	49	69	49	76	45	67	59
August	61	45	64	50	68	48	75	45	68	58
September	62	47	60	50	62	48	67	48	63	54

TABLE II

MEAN MONTHLY DISCHARGE (CFS) AT EACH STATION

ON BLUEWATER CREEK FROM JULY, 1962 THROUGH SEPTEMBER, 1963

	STATIONS				
PERIOD	1	2	3	4	5
1962					
July	10	24	12	5	29
August	10	25	18	10	39
September	10	27	20	18	65
October	10	26	25	24	75
November	10	26	26	24	52
December	10	27	26	26	27
1963					
January	10	28	27	27	22
February	10	28	25	26	28
March	9	28	25	26	27
April	9	29	31	32	42
May	9	27	27	21	53
June	10	26	17	9	54
July	10	24	10	2	15
August	10	25	8	3	17
September	9	29	18	9	58

TABLE IV

GRAYLING EGG MORTALITY IN PLASTIC VIALS RELATED TO TOTAL ACCUMULATED SUSPENDED SEDIMENT LOAD, APPARENT VELOCITY AND DISSOLVED OXYGEN

Days after eggs planted	STATIONS 1				2				3				4				5			
	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM
1	25	1	228	9.2	43	8	51	8.2	100	33	39	9.2								
2													71	24	75	9.0	44	144	70	9.4
4	47	3	74	9.2	78	15	22	8.2	100	79	12	7.0								
5													100	67	37	8.5	96	442	34	9.0
7	77	4	55	9.0	85	33	36	8.5	36	144	8	5.7								
8													94	80	30	7.8	87	507	11	4.8
10	61	5	148	9.0	83	45	18	8.0	100	165	9	4.6								
11													100	84	28	7.5	100	838	27	7.8
13	63	8	141	9.4	80	68	13	5.3	96	278	8	2.9								
14													100	128	12	8.5				
15																	98	1643	19	8.0
16	68	9	92	9.2	94	101	5	8.7	100	326	7	3.9								
17													100	156	12	5.3	100	2247	48	8.7
19	66	10	70	9.0	76*	130	11	7.8	91*	365	14	5.1								
20	66*	11											100*	197	21	4.1	92*	2792	12	6.1

*Based on 400 eggs contained in 4 Vibert boxes.

TABLE III

MEAN MONTHLY SEDIMENT CONCENTRATIONS (PPM) AND SEDIMENT LOADS (TONS/DAY) AT EACH STATION ON BLUEWATER CREEK FROM JULY, 1962 THROUGH SEPTEMBER, 1963

PERIOD	Mean Sediment (PPM) STATIONS					Mean Sediment Load (Ton/day) STATIONS				
	1	2	3	4	5	1	2	3	4	5
1962										
July	11	54	47	54	241	0.3	3.3	1.5	3.4	22
August	14	59	179	133	449	0.4	4.7	8.6	10	54
September	20	52	86	52	452	0.5	4.0	4.4	3.8	93
October	19	109	123	160	203	0.7	5.0	7.0	10	48
November	41	100	86	125	136	0.7	5.0	6.0	8.1	18
December	14	32	53	126	67	0.7	1.5	3.4	7.6	7.0
1963										
January	49	144	236	331	224	0.6	10	15	20	12
February	22	140	886	586	483	0.6	10	21	33	22
March	23	183	160	267	226	0.6	13	11	18	15
April	23	93	112	612	1147	0.6	7.2	14	30	358
May	18	104	253	265	542	0.5	6.9	20	27	116
June	21	103	214	206	591	0.4	4.7	10	6.3	118
July	16	49	85	65	185	0.7	1.5	3.1	0.3	9.0
August	26	134	254	128	206	0.7	3.3	4.1	1.8	8.6
September	43	188	480	528	1892	0.7	11	20	8.6	154

TABLE V

LONGNOSE SUCKER EGG MORTALITY IN PLASTIC VIALS RELATED TO TOTAL ACCUMULATED SUSPENDED SEDIMENT LOAD, APPARENT VELOCITY AND DISSOLVED OXYGEN

Days after eggs planted	STATIONS 1				2				3				4				5			
	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM	Egg mortality %	Acc. sediment load tons	App. vel. CM/hr.	O_2 PPM
2	2	1	X	9.4	20	12	50	9.9	0	19	75	9.2								
3													6	14	75	7.9	10	459	70	8.4
5	2	2	X	9.4	4	23	19	10.2	44	44	71	9.7								
6													42	28	14	3.0	22	901	21	6.4
8	8	3	X	8.9	4	64	28	7.9	10	58	33	6.4								
9													2	38	12	2.0	8	1073	15	7.4
11	8	6	X	8.9	2	71	20	8.4	8	61	40	9.9								
12													2	41	19	0.07	14	1151	12	3.0
14	2	7	36	8.2	2	78	21	8.4	4	65	28	10.9								
15													2	42	4	2.0	4	1168	7	2.0
16	3*	8			0.5*	85			5*	68			1*	42			7*	1172		

[X] Apparent velocity greater than standpipe capacity which is 200 CM/hr.

* Based on a total of 400 eggs at each station contained in 4 different Vibert boxes.

TABLE VI

NUMBER OF TROUT AND ROUGH FISH COLLECTED BY ELECTROFISHING THREE 4,000 SQUARE FOOT SECTIONS AT EACH STATION DURING SEPTEMBER - NOVEMBER, 1963 IN BLUEWATER CREEK

Section	1		2		3		4		5	
	Trout	Rough fish	Trout	Rough fish	Trout	Rough fish	Trout	Rough fish	Trout	Rough fish
1	164	15	165	0	139	358	8	936	2	1237
2	126	2	172	15	51	195	11	1079	1	334
3	115	2	163	20	43	1195	16	1157	3	773
Average	135	6	167	12	78	583	12	1057	2	781

TABLE VII

POPULATION ESTIMATES OF TROUT BY TAG AND RECAPTURE IN BLUEWATER CREEK

Stations	Actual number of trout caught by electrofishing	Estimated total number of trout without separation by inch-size classes	Estimated total number of trout separated by inch-size classes
1	164	203 (81)	203 (81)
2	172	313 (55)	344 (50)
3	139	156 (89)	161 (86)
4	11	13 (85)	12 (92)
5	1	1 (100)	1 (100)

( ) Ratio of actual to estimated number of trout.

Prepared by Donald R. Bianchi Approved by George D Holton

Date December 9, 1964