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Warden Don Jacobs November l8, 1977

- Region 3 Russian Gulch Creek,

Sonoma County - Report of Investigation

On October 6, 1977 Sally Spingla, Laboratory Assistant II, Valli Boccone, Seasonal Aid and I accompanied you and Lt. Bob Hawks to the Middle Fork of Russian Gulch Creek. You stated that a Mr. Tom Finn had established a salmon rearing facility at the site and had constructed an earthen dam upstream from the salmon tank in order to collect and divert water to the tank.

Upon observation we all noted that dam construction had resulted in severe erosion of soil into the creek and had left large sections of stream embankment exposed to future erosion problems which would be caused by rains and increased stream flow. There was also evidence that heavy equipment had been brought through the stream as part of the earth moving activities.

We then attempted to establish the degree of siltation in the stream and its possible effects on the salmonids present.

Methods and Materials

Spingla and Boccone visually surveyed about 3/4 mile of stream for fish and aquatic insects, while I attempted to characterize the amount of stream siltation for about a half mile of stream. Sample station locations are indicated on the attached map (figure 1).

Substrate collection was performed using a 15.24 cm (6 inch) diameter stainless steel cylinder, similar to one described by McNiel and Ahnell (1964) and later modified by Burns (1970). Tyler screens with openings of 26.67 mm (1.050 in), 3.327 mm (0.131 in.) and 0.833 mm (0.0343 in.) were used to separate the samples into four size classes with the smallest size retained by a pan. These class sizes were selected because they have been found to be detrimental to salmonid eggs and fry. As the volume of material less than 25 mm increases, chances of survival decreases. Materials from 1 to 3 mm impede fry emergence, and sediments smaller than 0.8 mm greatly reduce streambed permeability and reduce egg survival (Hall and Lantz, 1969). Each class size was converted to a percentage of the total volume obtained.

After the substrate was sorted to size, substrates were measured volumetrically in a 1-liter nalgene graduated cylinder filled with 500 ml of clear water. Total displacement was measured and recorded. The fine sediments caught in the bottom pan were placed in the graduated cylinder and left to stand ten minutes for settling and measuring.

Results and Discussion.

There appeared to be an average of 10 juvenile salmonids for every 100 feet section of stream upstream from the dam site and three for every 100 feet downstream. It must be emphasized that these numbers are based on only visual estimates.

Each size of streambed sediments was calculated as a percentage of the whole sample. The three samples per location were averaged to find the mean size distribution for that location. Results as recorded on the attached data sheet (Table A) and graph (figure 2) indicate that Station #3, immediately below the dam site, had 20% more fine sediment (< 0.0348) than the upstream stations #1 and #2, respectively, while downstream station #4 had 22% and 24% more fine sediment than station 1 or 2, respectively. Substrate greater than 0.0348" seemed to decrease in the downstream riffles. These results indicate that the occurrence of fine sediments (<0.0348" dia.) dramatically increased from the dam to about 1/4 mile downstream.

Sedimentation is one of the most severe problems occurring in stream habitats, especially in streams utilized by steelhead. It may adversely affect fish in several ways, some of which are not readily apparent. Increased turbidity allows more of the sun's rays to be absorbed into the water, thereby increasing water temperatures. This can raise the stream temperature to a level which is unsuitable for cold water fishes such as salmon and steelhead. Increased sedimentation is moat damaging during dropping or low water flows. The amount of material which a stream can transport is directly related to water velocity. Thus, if a streambed is disturbed at low flows, the fine sediment drops out of the water rapidly (Cordone and Kelley, 1961). This material then settles into downstream spawning gravels, causing several problems. Developing fish eggs, for example, are soon smothered as the deposition of sediment stops the flow of water through the gravels depriving the eggs of oxygen and eliminating the flushing of toxic metabolic wastes. Also, as the fine sediment and sand settle into the gravels, they "cement" the gravels together. Once the gravels become cemented, adult fish are no longer able to dig nests to lay their eggs. It may take as long as five to ten years for gravels to recover their original spawning potential once this has occurred (Calhoun, 1967).

Sedimentation also results in the filling in of pools, important for resting and nursery areas. Fish, for the most part, cannot swim all the time. If they do not have pools or relatively quiet waters in which to rest, they will eventually die of exhaustion. Many of the pools downstream from the dam were heavily sedimented.

Although adult fish are difficult to kill by direct clogging of the gills with fine suspended sediments, the smaller the fish, the more susceptible they are to this problem. Thus, with extremely heavy sedimentation the younger, smaller fish will probably die first.

Filling in the spaces between the gravels with sand and silt also smothers out most of the aquatic insects which form the bulk of the food for the stream fishes. Unembedded or partially embedded cobble is an important substrate component in a viable diversely-productive mountain stream. Loosely compacted cobble permits maximum inhabitation by aquatic insects. Insect habitat could be altered greatly by the addition of fine particles to the stream, thus lowering the availability of food organisms for trout (EIFAC, 1964; Brusven and Prather, 1974). Study time was not available to quantify observations on insect lire but in the course of field investigations, observations did indicate a reduced insect population below the dam site as compared to above.

Conclusion

On the basis of our investigation the construction of the dam, exposure of the embankments and the presence of heavy equipment in this area has caused erosion problems which could severely increase with winter rains unless the dam is removed and the embankments are stabilized with natural plant cover.

James G. Lemieux
Aquatic Biologist
Region 3

Attachments

JGL:tk

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Table A

Russian Gulch Creek

Weather: Sunny and clear
Air T - 63°F   Water T - 56°F

STATION 1: About 1/4 ml. upstream from the dam site; characterized by large rocks and boulders and very little exposed embankments

Sample Displacement (ml)

Sieve #	A (% total)	B (% total)	C (% total)	Average (% total)
1	820 (38)	940 (37)	750 (33)	837 (36)
2	450 (21)	520 (21)	510 (23)	493 (21)
3	730 (34)	850 (34)	810 (36)	797 (35)
Pan	150 (7)	210 (3)	190 (8)	183 (8)
Total	2150 (100)	2520 (100)	2260 (100)	2310 (100)

Average pan = 8%, average #3 plus pan = 43%

STATION 2: About 50 yards upstream from the dam site; characterized by some large rocks and exposed embankments

Sample Displacement (ml)

Sieve #	A (% total)	B (% total)	C (% total)	Average (% total)
1	750 (33)	890 (36)	1100 (41)	913 (37)
2	510 (22)	550 (23)	610 (22)	557 (22)
3	790 (34)	820 (33)	850 (32)	820 (33)
Pan	250 (11)	190 (8)	130 (5)	190 (8)
Total	2300 (100)	2450 (100)	2690 (100)	2480 (100)

Average pan = 8%; average #3 plus pan = 41%

Table A (cont.)

STATION 3: Directly below the dam site; characterized by large rocks and completely exposed embankments

Sieve #	Sample Displacement (ml) A (% total)	B (% total)	C (% total)	Average (% total)
1	100 (4)	150 (6)	210 (9)	153 (6)
2	530 (22)	1200 (45)	620 (25)	783 (31)
3	1350 (57)	1050 (39)	1230 (53)	1227 (49)
Pan	410 (17)	270 (10)	320 (13)	333 (14)
Total	2390 (100)	2670 (100)	2430 (100)	2496 (100)

Average pan - 14%, average #3 plus pan = 63%

STATION 4: Almost adjacent to the salmon rearing tank; characterized by exposed banks and large heavily silted pools

Sieve #	Sample Displacement (ml) A (% total)	B (% total)	C (% total)	Average (% total)
1	180 (7)	100 (3)	120 (4)	133 (5)
2	620 (24)	1120 (34)	940 (34)	873 (34)
3	1410 (54)	1640 (50)	1180 (43)	1410 (49)
Pan	390 (15)	430 (13)	510 (19)	443 (16)
Total	2600 (100)	3290 (100)	2750 (100)	2880 (100)

Average pan - 16%; average #3 plus pan - 65%