

CASPAR CREEK ECOLOGY PROJECT

Annual Report, 1969-70

by

Roger A. Barnhart
California Cooperative Fishery Unit
Humboldt State College
Arcata, California 95521

During the 1969 summer a Humboldt State College senior biology student was hired for the Caspar Creek Project. His work emphasized collection of data on insect, drop, stream temperatures, and solar radiation. An attempt was made to utilize a sampling regime identical to certain selected previous years which had yielded rather complete data.

DROP INSECTS

Graduate student Lloyd Hess finished thesis this on Caspar Creek drop insects December, 1969. The title is "The effects of logging road construction on insect drop into a small coastal stream." Mr. Hess and I are currently working on a manuscript to be submitted as a U.S.D.A. Forest Service Research Note. In summary, a significant increase in total insect numbers occurred in areas which had considerable streamside disturbance resulting in canopy removal and increased sediment yield. The greatest increases occurred in those adult insects having aquatic immature stages, particularly the midge family, Chironomidea. Many true terrestrial insect groups showed decreases, presumably due to the removal of overhanging canopy,

Ness predicted a drop in the number of insects collected per sampling day with a reversion of the habitat toward its previous state. This then may account for the decrease in organisms from an average of 63 per sampling day in 1968 to 39 organisms per sampling day in 1969 on South Fork Caspar Creek. In 1966, prior to road construction the average number of insects collected per sampling day was 33.

Midges exhibited a fifteen-fold increase in numbers from 1966 to 1968. Hess attributed much of this increase to a change in stream bottom composition through the introduction of large amounts of fine sediment. Midges often occur in large numbers in such sediments.

During the 1969 sampling season drop insects were collected at the same stations used for insect collections in 1966 on both forks of Caspar Creek. Table 1 presents the percentages that the various orders make up of the total numbers of insects and spiders collected during 1969 at various collecting dates. Table 1 is presented in this manner to allow comparison with a similar table presented in the 1966-67 Caspar Creek Ecology Project by DeWitt. I have duplicated DeWitt's table and included it in this report as Table 2. Probably the most significant change is the increased importance of the order Diptera. In 1966, of the total insects collected, Diptera made up 63 per cent on North Fork and 59 per cent on South Fork Caspar Creek. In 1969, Diptera had increased in importance to 91 per cent on the North Fork and 90 per cent on the South Fork Caspar Creek. Hess (1969) reported that Diptera made up an average of 82 per cent on the South Fork during the summer of 1968.

Comparison of average numbers of Diptera collected pair sampling day gives some additional information on drop insect changes. In 1966 the number of Diptera collected per sampling day on the North Fork was 15, and 19 on the South Fork. In 1969 the no./p.s.d. dropped to 11 on the North Fork while on the South Fork the no./p.s.d. was 39.

It is interesting to note that the North Fork Caspar Creek has generally had a higher yearly suspended sediment discharge and annual sediment yield than the South Fork. However, the effect of road construction in 1968 on South Fork is revealed by a 360 percent increase in suspended sediment discharge in 1968 over the average discharge 1963-1967. A 73 per cent increase in the amount of sediment deposited behind the South Fork weir in 1969 over 1968

probably also indirectly reflects road construction effects. The suspended sediment was back down to normal ranges in 1969. Burns (1970) also noted that the volume of sediments smaller than 0.8 mm in size in South Fork Caspar Creek increased 13.6 immediately after construction but by the next summer it had returned to the normal level.

The fact that Dipterans were collected at a rate of 63 per sampling day in 1968 probably does indicate a true effect due to increased fine sediments and increased solar radiation through canopy removal.

Certain sources of variability regarding insect collections on Caspar Creek should be pointed out. The collecting sites, length of individual collection times, and season of the year when collections were made vary considerably from year to year. Furthermore, weather conditions, stream flow, and stream temperatures were not included in analysis of insect changes. An examination of the data indicates a trend toward increased insect production as the summer progresses with a peak in late August and early September. Most fishermen are aware of the effect of warm days on insect hatches. Increased summer flows and water temperatures would be expected to increase aquatic insect production on Caspar Creek also. Future investigations should attempt to include as many of these variables as possible in sampling methods and analyses.

WATER TEMPERATURES

Stream temperature data were collected by recording thermographs near the lower ends of the two study sections approximately from May through November, 1969. The thermograph on South Fork Caspar Creek was partially damaged by vandalism twice during the summer. Table 3 presents the data as taken from the charts. Some of the temperatures shown are suspect and probably reflect malfunctions of the instruments.

Thermograph data collected for the past few years from both forks of Caspar

Creek are difficult to interpret. Data collected during the winter from the weir ponds reveal no significant changes. The weir ponds tend to mask any charges occurring upstream. Considerable thermograph data has been collected in a random pattern at various stations upstream. Long term effects are not revealed by these data.

There is however a considerable volume of thermograph data and within this body of information certain trends exist. In 1966 the North Fork averaged 2-3 degrees warmer than the South Fork. This is also shown by earlier data. In 1967 this trend was reversed, the South Fork having slightly higher average stream temperatures than the North Fork. In 1968 and 1969, this trend continued.

Considerable hand measured temperature data taken station-to-station were collected each year. As I reported in the 1968 progress report, sharp increases in water temperatures which correlated rather well with degree of canopy removal were revealed. I also pointed out the difficulty in comparing these data year-to-year due to varied sampling techniques. We set out maximum-minimum thermometers on certain sections of South Fork Caspar Creek in 1969 to verify these increases in water temperature. Definite repeatable increases in water temperature occurred in water flowing from shaded to open areas. However, changes were in the 3-4 degree range rather than the 8-10 degree range reported for previous hand measured data. No large rapid increases in stream temperatures occurred in our 1969 station-to-station hand measured data. Station-to-station hand measured temperatures were taken on a hot day (73°F) in early August, 1970. Due to a dry hydrologic season stream flow was very low and actually intermittent at some of the upper stations. Several instances of water temperatures exceeding 70° were found where the stream was well exposed.

Block cutting of the timber on South Fork will result in nearly total canopy removal from the watershed. This may have an additional effect on stream

temperatures. Sampling sites and techniques should be selected carefully to eliminate as many variables as possible.

SOLAR RADIATION

Solar radiation data were again collected in 1969 by pyroheliographs. I made no attempt to analyze these data. In general, solar radiation readings remained about the same as those taken since road construction. Most of the new plant growth along the South Fork is herbal or shrubby and should not significantly affect pyroheliograph readings. For example, in 1968 station 44, a highly disturbed area had average daily readings of 450 langley's in July. In July 1969, with the addition of some vegetation the average was approximately 430 langley's/day. The solar radiation data collected over the years provides a basic index on the effects of canopy removal along South Fork Caspar Creek. Factors which might be altered by changes in solar radiation are water temperature, aquatic plant growth, oxygen production and utilization, and cover. All these factors indirectly influence the productivity of the stream for fish. DeWitt, 1968 reported significant increases in solar radiation reaching the South Fork Caspar Creek after logging road construction and consequent canopy removal. Presently we have a fairly good idea (and quantitative data) concerning the effects of increased solar radiation on stream temperatures of South Fork Caspar Creek. To-date we have no quantitative data on changes in the other factors mentioned above.

SUMMARY

The work accomplished to-date on the Caspar Creek stream ecology project has centered around three factors: water temperature, solar radiation, and insect drop. The effect of logging road construction and associated changes has been to increase solar radiation readings significantly (40-226%, DeWitt, 1968), average summer stream temperatures a few degrees, and to increase,

temporarily at least, the average number of certain important salmonid food organisms dropping onto the stream surface. The real effect of these changes on salmonid production has not been demonstrated.

South Fork Caspar Creek is scheduled for logging in 1971, 1972, and 1973. Future ecological investigations on this stream should be carefully planned and coordinated to eliminate variables experienced in previous data collections in order to provide the maximum amount of useful data.

LITERATURE CITED

- Burns, James. 1970. Spawning bed sedimentation studies in northern California streams. Calif. Fish & Game Jour., 56(4): 253-270.
- DeWitt, John. 1968. Annual report 1966-67 - Stream ecology phase, Caspar Creek Project. Humboldt State College. 18pp.
- Ness, Lloyd. 1969. The effects of logging road construction on insect drop into a small coastal stream. M.S. Thesis, Humboldt State College. 58pp.

Table 2. Percentages that the various orders represent of the total numbers of insects and spiders collected in drop boxes along the south and north forks of Caspar Creek, June - August, 1966.

ORDER	JUNE 11-13		JUNE 22-25		JULY 12-13	JULY 25-29		AUGUST 8-12		SUB- TOTALS		TOTALS
	N.F.	S.F.	N.F.	S.F.	N.F.	N.F.	S.F.	N.F.	S.F.	N.F.	S.F.	
COLEOPTERA	13.0	10.5	11.0	10.3	8.4	5.0	7.3	3.8	10.3	7.0	9.7	8.5
DIPTERA	58.7	70.6	55.5	48.4	55.0	58.5	46.3	72.4	64.1	63.2	59.2	61.0
EPHEMEROPTERA	1.8	1.2	2.5	-	1.5	2.3	2.1	1.6	1.1	1.9	1.3	1.6
HEMIPTERA	1.4	1.5	-	1.9	-	1.5	2.5	-	1.5	0.9	1.7	1.4
HOMOPTERA	-	3.3	3.5	11.0	3.1	1.8	8.8	1.5	4.5	1.8	6.1	4.2
HYMENOPTERA	-	-	2.2	2.3	3.1	5.3	2.7	1.2	3.3	2.3	2.7	2.5
ORTHOPTERA	9.4	-	8.5	1.3	4.6	1.5	-	-	-	3.7	-	1.9
PLECOPTERA	2.2	1.2	-	2.3	-	2.7	2.5	2.8	2.1	2.6	2.1	2.4
PSOCOPTERA	-	3.6	2.2	7.4	16.0	10.6	17.5	4.9	6.9	5.8	8.7	7.5
TRICHOPTERA	-	-	-	2.3	1.5	4.8	4.0	3.7	-	2.6	1.5	2.0
ARACHNIDA	10.5	4.5	10.4	9.0	3.8	3.8	4.4	4.7	2.7	6.3	4.1	5.0
OTHERS	3.0	3.6	4.2	3.8	3.0	2.2	1.9	2.4	3.5	1.9	2.9	2.0

(From DeWitt, 1967)

TABLE 3. Caspar Creek Thermograph Data - 1969

North Fork		South Fork	
Date	Min-Max F ^o	Date	Min-Max F ^o
5/16-5/21	50-60	5/15-5/21	54-56
5/22-5/28	50-61	5/22-5/28	54-53
5/29-6/5	53-63	5/29-6/4	56-61
6/6-6/11	52-57	6/5-6/11	56-57
6/12-6/18	52-65	6/12-6/17	55-61
6/19-6/25	53-64	6/18-6/24	57-61
7/19-7/16	55-65	7/11-7/16	57-61
7/17-7/22	50-63	Thermograph Broken	
7/24-7/30	50-61	7/23-7/31	54-62
7/31-5/7	50-60	7/23-7/31	54-62
8/8-8/14	48-60	Thermograph Broken	
8/14-8/21	48-58	10/8-10/15	64-69*
8/22-8/28	47-57	10/23-10/30	65-68*
9/7-9/14	48-55		
9/9-9/10	50-57		
10/1-10/7	45-52		
10/23-10/29	44-50		
10/30-11 /4	46-51		
11/5-11/13	43-48		
11/19-11/25	39-42		

*Due to mechanical failure of the thermographs several of the recorded temperatures may be incorrect