

A HABITAT PREFERENCE ANALYSIS OF THE VIRGIN SPINEDACE IN
ZION NATIONAL PARK

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Objectives

Distribution, abundance, and habitat utilization of the Virgin Spinedace, Lepidomeda mollispinis mollispinis, is being studied at 12 stations in and near Zion National Park, Utah, and one at Lytle Ranch, Utah. Fish are being collected by seining and electroshocking, and associated habitat parameters of water depth, current velocity, substrate type, cover, and water conductivity are being measured. Suitability index curves for spinedace are being developed for depth, substrate, and current velocity.

Methods

Fish were sampled from 16 stations in or near Zion National Park, Utah, and one station at Lytle Ranch, on Beaver Dam Wash, in the far southwestern corner of Utah. For ease in computer manipulation of data, stations were numbered with the last two digits of the River Mile Index number for each location (Water Management Technical Subcommittee, 1974).

Stations fit into one of five groups: North Fork Virgin River, East Fork Virgin River, Mainstream Virgin River below confluence of East and North Forks, upper tributaries to the Virgin River, and Beaver Dam Wash, which, although a tributary, has characteristics different from the other creeks.

Each station was evaluated visually and characterized with a general description, descriptions of bank type, gradient, riparian and aquatic vegetation, and clarity. Six to seven sporadic measurements were taken to obtain mean depth, width, and substrate type. Stations were also characterized by regularly spaced observations of percentage of each of 10 different habitat types (Ken Bovee, personal communication).

The Virgin River is characterized by flooding events that reshape the local substrate and channel structure regularly, so that any detailed characterization of a site is bound to be changed in a matter of years, if not weeks. Pools silt in to become sandbars, riffles erode to become pools or meanders, and large boulders sink or disappear downstream. The

general gradient within a particular stretch of river is relatively constant, and dictates the effects of erosional events.

Sampling was accomplished with either a 12'x6'x1/8" mesh hand seine or with a back pack electroshocker. Specific microhabitats were sampled by a depletion method where repetitive seining or electroshocking without replacement continues until the final sample contains less than 10% of the largest number obtained in any sample. After seining or electroshocking, fish were kept in a bucket until the final sweep through the microhabitat was completed. All fish were enumerated, measured (mm Total Length) and examined for breeding coloration, ectoparasites, and malformations, etc. If an adjacent microhabitat was to be sampled, fish were retained in a separate bucket until completion of that sample. All fish were returned to their site of capture.

Microhabitats were defined as units of stream area with a characteristic, uniform set of habitat parameters. Each microhabitat was characterized as pool, riffle or run, and varied in size from 1 to 150 square feet, depending on the homogeneity of the area. Habitat parameters were measured either in two transects, or at several representative points within the microhabitat. These parameters included depth, current velocity, substrate, temperature of water and air, cell length and width, and presence of cover (i.e. emergent vegetation, undercut banks, large boulders). Conductivity of the water was measured at some stations, primarily to determine an effective and safe combination of current and voltage for use of the electroshocker.

All data were entered into the Physical Habitat Simulation (PHABSIM) program on the Zenith microcomputer in order to generate habitat utilization curves. Dr. Thom Hardy of Utah State University and Twelve Nine, Inc., and the author of the modified PHABSIM program being used, has refined the data files and performed the analyses reported here.

Results and Conclusions

A total of 240 samples were obtained from 17 stations within the Virgin River Basin. A total of 82.5 percent of the samples contained fish, and of these 62.12 percent contained spinedace. The data base was partitioned into four separate categories as follows: East Fork, North Fork, Beaver Dam Wash and Tributaries. Multiple mean comparisons of total population density showed no significance ($F=0.67$, $\alpha=0.05$) between sites while densities of spine dace were significantly different ($F=2.86$, $\alpha=0.05$). Densities of spine dace within the North Fork are significantly higher than the East Fork. It should be pointed out that these results are based on lumping collection data over seasonal changes including spawning and recruitment. Comparisons of seasonal differences are being examined. Spinedace comprised between 8 and 48 percent of the resident fish populations sampled from each site. The large percentage of "Other" species reported for the North Fork and Tributaries were primarily composed of unidentified young-of-the-year. These data are

still being verified against raw collection forms and have been smoothed by aggregating lengths into class intervals of .013 ft. TL. In general these data would suggest 2 to 3 year classes of spinedace at each station and that reproduction and recruitment have occurred in 1987 and 1988.

A multiple analysis of variance was performed on the depth and velocity utilization between the respective stations. Depths were statistically lower at Beaver Dam Wash than at other sampling stations ($F=5.1$, $p=0.80$). Velocities were statistically different between all stations ($F=25$, $p=0.80$) and only Beaver Dam Wash and the North Fork were similar. A chi-square analysis of the substrate utilization among stations showed that East Fork and the Tributaries are significantly different ($\alpha=0.05$) than Beaver Dam Wash and North Fork.

Size specific differences in depth and velocity utilization show the average depth and velocity associated with each size measurement of spinedace. These data would suggest that a shift in habitat use occurs at about .16 ft. TL. This phenomenon may be indicative of data aggregation errors, sample bias, or an actual shift in habitat use with maturity. At present, the total data set was utilized in the development of utilization curves, and no partitioning among size was attempted. Further analysis will be performed after verification of the length measurements. Clarity or turbidity of the water is highly variable, with each fork of the river independently changing according to the upstream rain and flooding events within the last 2-3 weeks. After a major flood event, the water is extremely turbid for a week, and then gradually clears up for the next 2-3 weeks before reaching maximum clarity, about 4.5 ft. visibility. Significant differences in depth utilization by spinedace have been found between the North Fork and Beaver Dam Wash. Significant differences in velocity utilization by spinedace occurred between all stations except North Fork and Beaver Dam Wash. It appears that spinedace prefer depths greater than .5 foot, current velocities of 1-2 ft. At issue is whether spinedace do not utilize depths over 2.2 ft., or whether sampling bias accounts for this observed decline in the utilization data. The preliminary Suitability Index curve developed from a more limited data set was modified to remain at a utilization of 1.0 beyond 2.2 ft. This issue is being explored as part of the ongoing data analyses.

The frequency of observations for each of the six substrate classifications were normalized to unity. The resulting utilization function for substrate essentially ignores mud, silt and rock substrate in relative weighing, as these substrates are not present to any large degree in the parts of the Virgin river system being investigated.

Further Work

Data collections during the second year will proceed as they did during the first year, with attempts to gather more data points now that

collection techniques have become established. A greater quantity of habitat suitability data will be collected in the second half of the second research year to refine the preference curves and define the needs of the Virgin Spinedace in Zion and throughout the Virgin River watershed. Refining the suitability indices and preference curves will be accomplished as more data points become available. Habitat utilization at critical phases such as winter and during larval and juvenile development will be investigated. A thermal shuttle box will be used to determine preferred temperature, and ecologically lethal thermal minima will be determined in the laboratory, to attempt to describe habitat needs during different seasonal extremes.

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