APPENDIX E

Ken Bovee's summary of the CIFSG analysis of habitat data on spikedace and loach minnows collected from Aravaipa Creek and the Gila River, New Mexico

INSTREAM FLOW FISH DATA

SPECIES: Ilaroga cobitis

Stream: Gila River, East Fork
Station: Riffles within 1 KM stretch above confluence with main fork.

Collector: Britt (1982)-NMSU
Date: 6/1/79

Meter: Pygmy

LIFE STAGE	DEPTH (cm)	VELOCITY (cm/s)	COBBLE DIMENSIONS(cm)	NUMBER OF EGGS
Egg	3	1.5	-----	28
Egg	76	15.2	14.0 X 18.0	160
Egg	6	9.1	-----	74
Egg	76	15.2	11.5 X 13.5	30
Egg	15	16.0	19.5 X 21.5	90

Stream: Gila River
Station: Gila River 2 KM downstream of U.S.180 Bridge near Cliff, N.M.

Collector: Britt (1982)-NMSU
Date: 6/6/79

Meter: Pygmy

LIFE STAGE	DEPTH (cm)	VELOCITY (cm/s)	COBBLE DIMENSIONS(cm)	NUMBER OF EGGS
Egg	6	39.6	20.0 X 21.0	75
Egg	3	35.8	14.0 X 27.6	55
Egg	3	46.5	17.0 X 24.3	35
Egg	6	26.7	11.5 X 18.0	9
Egg	3	9.1	6.9 X 8.0	20
Egg	9	11.4	11.0 X 11.0	13
Egg	9	6.1	11.5 X 20.0	120
Egg	12	23.6	10.0 X 12.0	40
Egg	18	38.1	16.0 X 21.0	80
Egg	12	31.2	12.0 X 12.0	100

Stream: Gila River
Station: Gila River 2 KM downstream of U.S.180 Bridge near Cliff, N.M.

Collector: Britt (1982)-NMSU
Date: 5/13/80

Meter: Pygmy

LIFE STAGE	DEPTH (cm)	VELOCITY (cm/s)	COBBLE DIMENSIONS(cm)	NUMBER OF EGGS
Egg	12	-----	12.5 X 17.0	29
Egg	12	-----	12.5 X 18.0	66
Egg	14	-----	11.0 X 19.5	39
Egg	5	-----	17.0 X 19.0	100
Egg	5	-----	7.5 X 19.0	39
Egg	10	-----	19.0 X 22.0	11
Egg	15	-----	14.0 X 19.0	260

Britt, Kenneth B. 1982. The reproductive biology and aspects of life history of Ilaroga cobitis in southwestern New Mexico. M.S. thesis, New Mexico State University, Las Cruces, New Mexico. 56pp.

Memorandum

Drake Creekside One
2625 Redwing Road
Fort Collins, Colorado 80526

O: Jon Souder, FWS, Ecological Services
Albuquerque, NM

FILE: 1200.8a

I: Ken Bovee, Hydrologist, IFG

DATE: April 14, 1982

: Analysis of Species Data

We have examined the data for Tiaroga cobitis, Meda fulgida, Catostomus clarki, and C. insignis as you requested in your memo of April 2, 1982. We ran the data through the multivariate statistical package developed by IFG, but unfortunately, we were unable to get a complete set of output. We did not have enough data on the suckers to get a good run.

I have enclosed three separate pieces of information for the loach minnow and spikedace: histograms, scattergrams, and marginal probability plots. The histograms are simple one-dimensional frequency plots of your data. The scatter grams are two-dimensional frequency plots. The marginals are curves derived by making a two-dimensional projection of the multivariate probability density functions. We got the multivariate fit to work but couldn't get it plotted out. The marginal is virtually the same as a preference curve, except you'll have to normalize it.

A few observations regarding these data:

1. Reviewing the histograms for the loach minnow and spikedace, you can see that the functions for depth and velocity are pretty well defined for both species. It's quite obvious that a curve fit to the histograms would be bell shaped. The depth histogram for the loach minnow and the velocity histogram for the spikedace have a couple of discontinuities that we try to avoid. The loach minnow depth plot has a hole in the middle of it at about .4 ft. The spike dace plot has an unexpected mode at about .5 fps. These discontinuities don't really hurt the curve fit too much, but may indicate that the entire range of environmental conditions was not sampled with proportional effort. The small interval used for the depth histograms may give the appearance of a discontinuity where none really exists. The extra bump on the velocity curve is probably due to sampling bias.

2. You can see from the dominant particle size and percent fines histograms that we really have a problem with substrate. I've drawn two curves on each histogram. The red curve is what I think the curve should look like and the blue line is what the computer is going to try to fit to the data. The problem is that large gravel is unrespresented as a dominant particle

size, either because it is absent in this river or it always occurs in association with larger materials. Likewise, we seem to either have no fines, or about 30% fines in the matrix. This is possibly due to the way substrate information was recorded. Sometimes the percent fines were recorded, and sometimes not. You'll notice that you didn't get marginals plotted out for substrate of any kind. That's because whenever we tried to get the computer to fit the red lines, it blew up. I don't believe these blue lines for a minute. I believe we can eliminate the problem with dominant particle size by coalescing a couple of the gravel size classes and just have one code for gravel. (The codes used are recorded next to the substrate histogram for the loach minnow). Looking at the histograms for percent fines, it looks like the loach minnow prefers a clean substrate. The spike dace, on the other hand, is more tolerant of a sandy substrate. I feel that any substrate code you develop for PHABSIM should contain information on percent fines, especially if the loach minnow is one of your evaluation species. You might not need it for the spike dace.

3. The scattergrams really only show one thing of any importance. Notice that I've sketched an oval on each scattergram. This is the approximate shape of a bivariate function: depth-velocity; velocity-dominant particle size; or dominant particle size - percent fines. The axes of both depth-velocity scattergrams are really skewed. This means that there is a high degree of correlation between the two variables in this stream. Mike Prewitt has seen hundreds of these things, and he says this kind of correlation is a dead giveaway that there is a large environmental bias in the data. What you're seeing is not the fish's actual preferences, but its tolerances within a small range of environmental conditions. The only way to correct this is to have some measure of the availability of different microhabitats at the flows the fish were observed at. Basically, it means you need to collect PHABSIM type data for these sites and simulate the stream at the flows occurring during the fish observations. That's the bad news.

The good news is that the marginals we are sending you are as good or better than the trout curves people have blithely been using for years (especially your depth and velocity curves). The curves we have provided generally agree with Minckley's descriptions in Fishes of Arizona. As long as you stick to streams about the size of the one's these data came from, you should be all right. I wouldn't try to extrapolate to larger rivers, but Minckley says these species are pretty much restricted to small streams anyway. If corrections are made for environmental/sampling bias, it is probable that both the peaks and the tails of the curves

will shift. This basically means that these curves are not transferrable to streams that are very much different from the ones the fish were observed in. Ultimately, the decision to use the curves in an analysis is up to the biologist responsible for the study. We can only help this decision by saying these curves are as good as most of the curves on FISHFIL.

If you have any questions regarding the data or our analysis, please call me at FTS 323-5320.

Ken Bovee

P.S. I'd like to keep your data in case we figure something out to correct the environmental biases. Will keep you posted.