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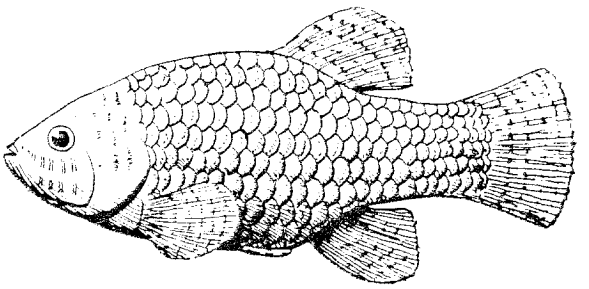

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GROWTH & POPULATION STRUCTURE OF THE MOJAVE CHUB

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ABSTRACT. In an attempt to establish a refugium for the Mojave Chub (Gila bicolor mohavensis), sixteen chubs were transplanted from their site at the Fort Soda pond near Baker, California to a 30-square meter pond at the Desert Research Station, 26 km. west of Barstow, California. This initial parent stock rapidly established a sizable population within the first year of its introduction.

From February, 1981 to January, 1982 the chub population was monitored weekly. A Lincoln-Peterson Index was used to estimate the population of chubs from 4 to 11 cm. in size. Two hundred fish were tagged and their lengths and weights were monitored from May, 1981 to January, 1982.

The data indicated that the Mojave Chub population ranged from a high of 2516 fish during late summer to a low of 880 during late winter. Chubs gained weight in May, but from June to October lost up to 35% of their body weight. During November the fish again started to gain weight. Possible reasons for summer weight loss are reviewed.

INTRODUCTION

Sixteen Mojave Chubs (Gila bicolor mohavensis) were introduced

into the pond at the Desert Research Station on December 12, 1978. By May, 1979 fry appeared and in September, 1979 research work began on the chub population and growth rates.

Very little research has been conducted on this endangered species. Snyder (1918) examined the external morphology of the fish. Hubbs and Miller (1942) examined the theory that Mojave chubs once occurred in the Mojave River and subsequently hybridized with the Arroyo chub (Gila orcuttii). Vicker (1973) researched some of the aspects of the Mojave chub's life history. The only complete habitat evaluation of the Fort Soda (Zzyzx Springs) area was done by Soltz (1978).

Vicker (1973) examined 113 specimens taken from Fort Soda and assigned them to age classes based on annuli development. His research has been the only work done on the growth rates of Mojave chubs.

Soltz (1978) made four population estimates of the Fort Soda population. Karner (1980) examined the Mojave chub population at Lark Seep Lagoon on a one time basis.

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STUDY AREA

The Desert Research Station is located approximately 26 km. northwest of Barstow, San Bernardino County. California. The Station is located on a 48 hectare site leased from the Bureau of Land Management and operated by the Barstow Unified School District. The station serves academically talented students, providing advanced training in the sciences.

The site contains a small pond that is approximately thirty meters square and 80 centimeters deep. Approximately half the pond surface is covered with cattails (Typha dominguez). Ditch grass (Ruppia maritama) also occurs in the pond. The pond community contains few potential predators to the chubs. Dragon fly nymphs occur and may take chub fry. In addition a small population of bullfrogs (Rana castesbeiana) live in the pond. Occasional piscivorous birds occur as transients.

Pond temperatures range from 28^{o} C to 2^{o} C. The pond salinity

is 1.7 parts per thousand and dissolved oxygen ranges from 14 to 2.6 parts per million approximately 2 cm. from the surface. Pond pH is approximately 7.2. The Mojave Chub is the only fish species in the pond.

METHODS

The first attempt at examining growth rates was done by placing fin-clipped chubs in forty liter aquariums and feeding them tropical fish foods. Later, fin-clipped chubs were placed in a 75 square centimeter cage in the pond, so the fish could take advantage of natural food sources. To provide a larger sample size for study, an attempt was made to freeze brand the chubs using a mixture of dry ice and acetone. This technique was not successful on this size fish.

To permit long range studies on population size and growth rates tags were inserted into two hundred chubs. The tags were approximately one-half centimeter long and sequentially numbered. Fish were randomly selected and ranged from 4.5 to 17.0 centimeters in length. The fish's standard length was measured to the nearest millimeter. An Ohaus Model 300 electronic balance measured weight to the nearest 0.01 gram. Captured fish were tranquilized with Alka-Seltzer, after which a hypodermic needle was passed through the musculature just anterior to the dorsal fin. A small piece of stainless steel surgical wire with a tag attached was passed back through the needle and the needle was removed. The

needle was again passed through the musculature anterior to the previous puncture, the wire again passed through and the two ends were twisted tight with hemostats. The fish were placed in an aquarium containing Wide Spectrum Tonic, an anti-infection agent, and Shieldex, a compound designed to help restore the fish's natural mucous coating. After three days to one week the fish were returned to the pond.

A weekly monitoring of the chub population was started during the first week in February, 1981. At least once a week ten minnow traps were set in the pond using bread for bait. Population estimates were made using the standard Lincoln-Peterson Index. Captured chubs were fin-clipped on different parts of the caudal fin approximately every three months and released back into the pond. The standard length of the fin-clipped fish ranged from 3.0 to 12.5 centimeters and at least 25 percent of the population was fin-clipped.

The population indices and confidence limits were calculated using a Radio Shack TRS-80 Model 1 microcomputer.

RESULTS AND DISCUSSION

Figure 1 shows the length distribution of Mojave chubs at the Fort Soda Lake and Pond (Soltz, 1978) and at the Desert Research Station for September, 1979 through May, 1980 and from February, 1981 through October, 1981. The mode size class for the Fort Soda Lake is 8.0-8.9 centimeters, while the mode for the Fort Soda pond is 4.0-4.9 centimeters. The mode for the Desert Research

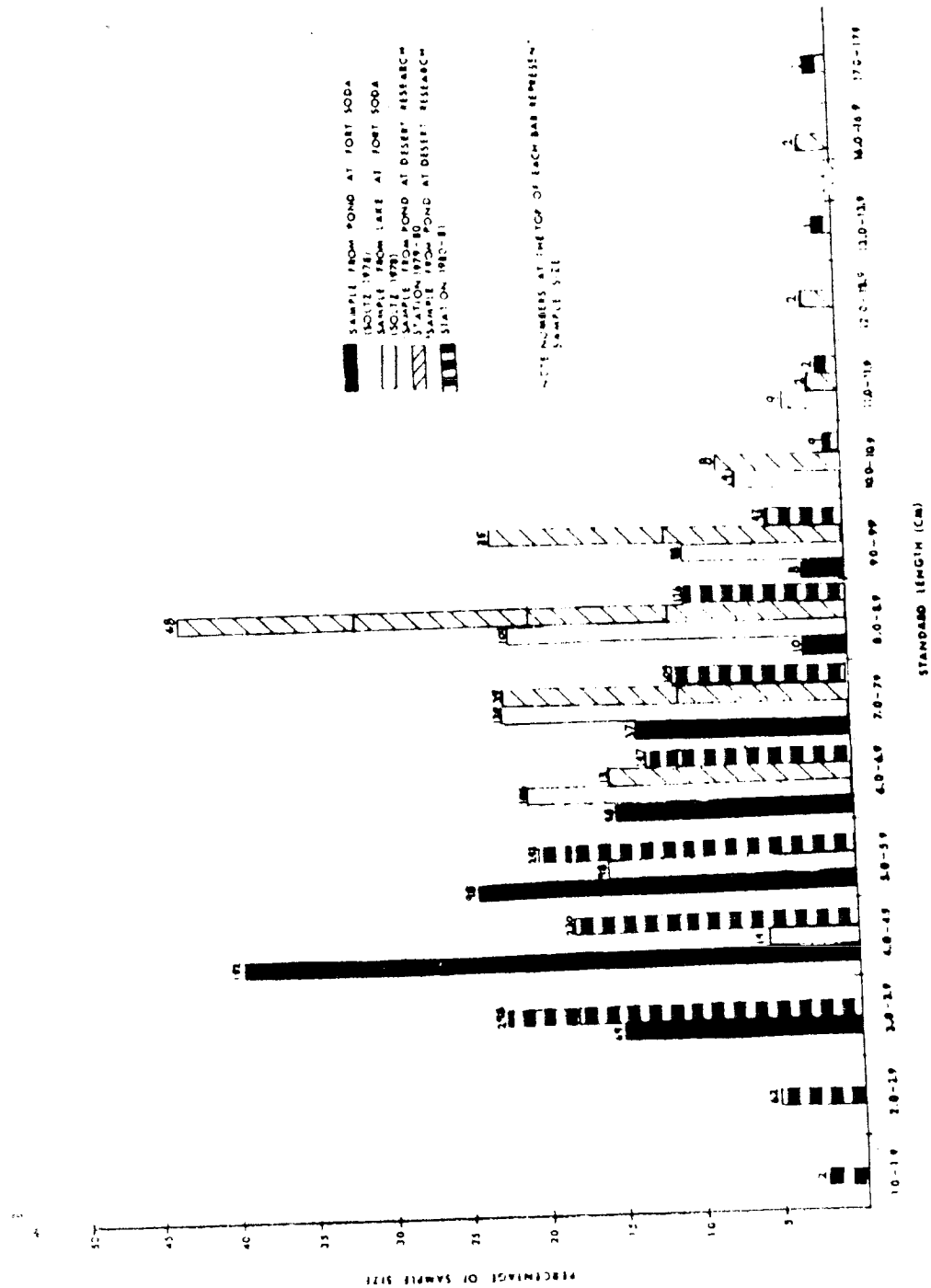

FIG. 1. Length distribution of four populations of Mojave Chubs.

Station pond during 1979 to 1980 period was 8.0-8.9 but during the 1981 sampling period the mode had dropped to 6.0-6.9. This might be a response to overcrowding. Of the three bodies of water the Fort Soda Lake is the largest and has the largest size class mode. During the 1979-1980 sampling period the Desert Research Station size class mode was the same as that at the Fort Soda Lake, even though this is the smallest of the three bodies of water. At that point in time the chub population had been in the pond for only about one year and it may not have reached an equilibrium. The figure also shows an increase in the number of fish in the 8.0-8.9 size class from the 7.0-7.9 size class for the Desert Research Station pond for the 1981 smapling period indicating a residual population of fish in that size class from the previous year. Kimsey (1954) reported catching Tui chubs (Gila bicolor) in Eagle Lake, a 15,000 acre body of water, that were 35 centimeters in length.

Figure 2 shows a weight-length distribution of the Desert Research Station chub population. It appears to compare well with the weight-length distribution of the Eagle Lake Tui chubs even through they are separate subspecies (Kimsey 1954). Except for a current study by the California Department of Fish and Game on the Fort Soda chub population that will include length-weight distributions no other length-weight distributions for the Mojave chub could be found in the literature.

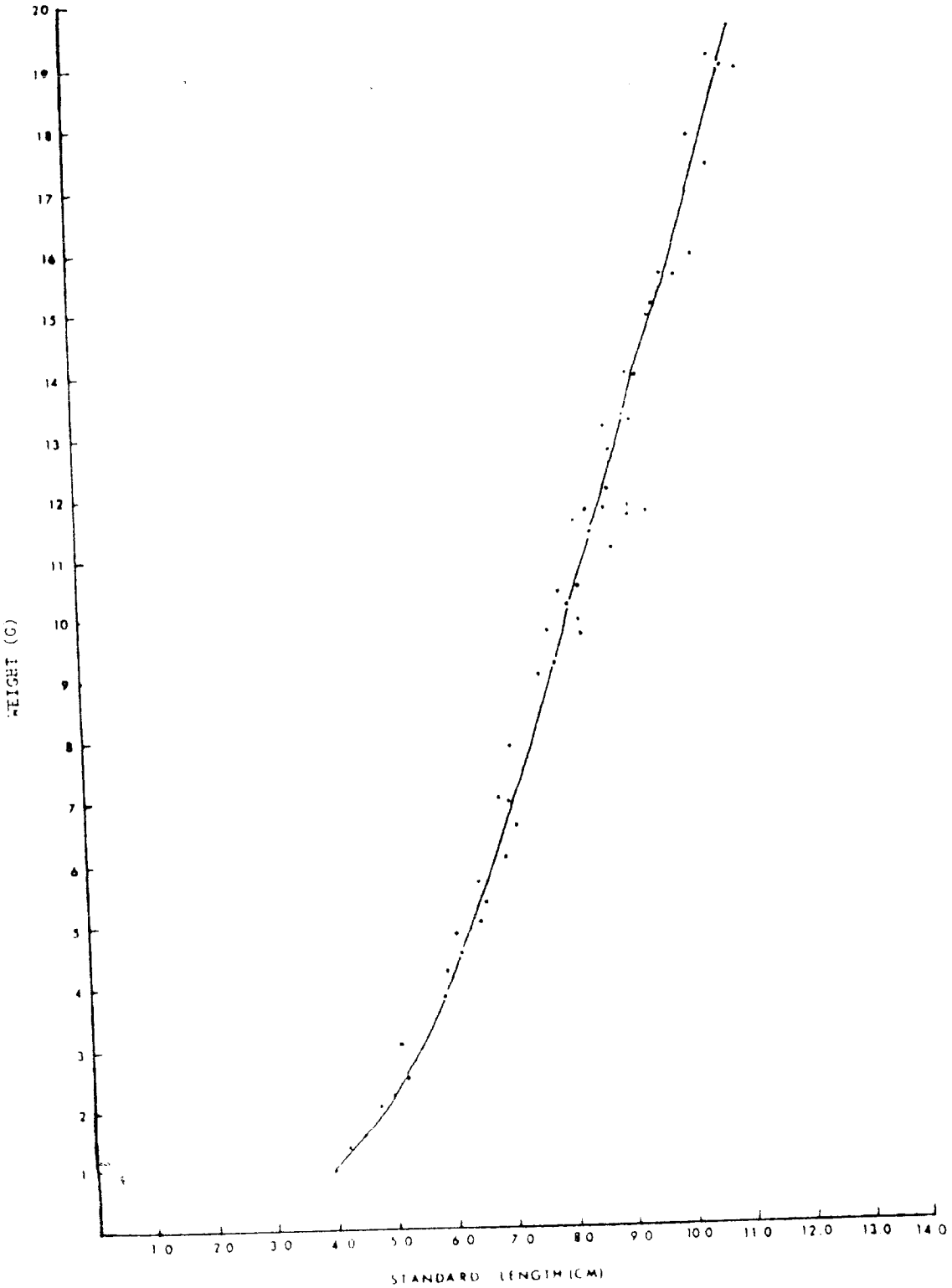

FIG. 2. Weight-length distribution of Mojave Chubs.

Figure 3 deals with the growth of the Mojave chub. During May the chubs were gaining weight at the rate of 0.03 percent of their body weight per day. However, during June the fish lost 0.7 percent of their body weight per day. The rate of loss decreased during the months of July and August with the rate of loss increasing slightly during September. By October the chubs were gaining weight at the rate of 0.006 percent of their body weight per day. This increase continued during November and in December again decreased to 0.14 percent of their body weight lost per day.

Table 1 shows the weight data for some selected fish. Some individuals lost as much as 35 percent of their body weight during this period. Only two tagged fish gained any weight during the summer months.

It is possible that the loss of weight is due to higher metabolic rates during the summer combined with a possible reduction in planktonic biomass. Normally it would be expected that plankton biomass would increase during the summer months, however, it is possible that high water temperatures might effect plankton production adversely. During the entire sampling period there was no significant length gain by the tagged population.

Figure 4 shows the weekly population estimates for the Mojave chub along with the confidence limits. The population seems to increase from February through the beginning of April. This might be a function of recruitment into the size class that was being sampled. A slow decrease occurred from April through the middle of May and

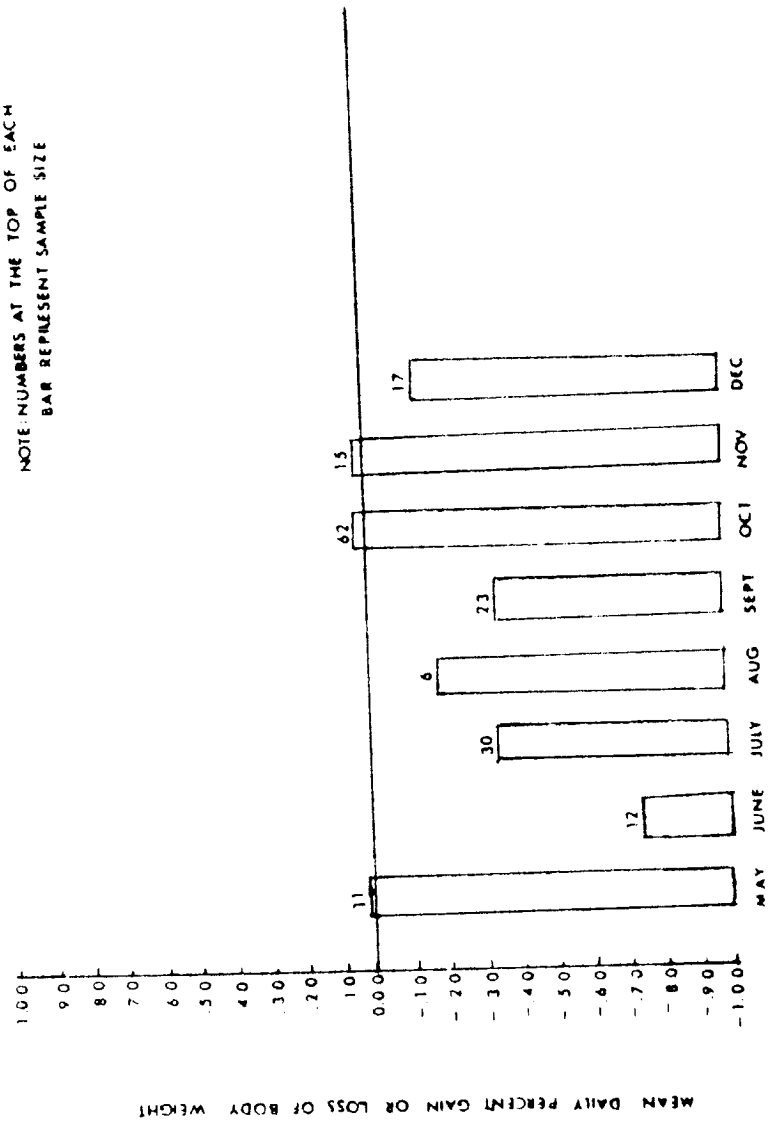

FIG. 3. Mean daily percent gain or loss of body weight of Mojave Chubs over an eight month period.

TABLE 1. Growth data on four selected Mojave Chubs.

TAG NUMBER	BEGINNING DATE	ENDING DATE	NUMBER OF DAYS BETWEEN DATES	WEIGHT (G)	STANDARD LENGTH (CM)	MEAN WEIGHT GAIN OR LOSS PER DAY (G)	PERCENT GAIN OR LOSS OF BODY WEIGHT
3400	6/8	6/29	21	11.48	8.4	+.0067	+1.2%
3400	6/29	7/6	7	11.62	8.4	-.0129	-0.8%
3400	7/6	7/27	21	11.53		-.0605	-1.0%
3400	7/27	10/14	79	10.26	9.4	-.0047	-3.6%
3400	10/14	10/20	6	9.89	9.4	+.0300	+4.8%
3400	10/20	10/26	6	10.07	9.4	+.0033	+0.2%
3400	10/26	11/1	6	10.09	9.4	+.1450	+8.6%
3400	11/1	11/25	24	10.96	9.4	-.0221	-4.8%
3400	11/25	12/16	21	10.43	9.4	-.0371	-7.5%
3395	5/1	5/12	11	13.52	9.6	-.0173	-1.4%
3395	5/12	7/13	62	13.33	9.6	-.0382	-17.8%
3395	7/13	7/20	7	10.96	9.6	-.0343	-2.2%
3395	7/20	10/6	78	10.72	8.6	-.0122	-8.9%
3395	10/6	10/14	8	9.77	8.6	-.0912	-7.5%
3395	10/14	10/26	12	9.04	8.6	+.0150	+2.0%
3399	7/13	7/20	7	17.01	9.8	-.1500	-6.2%
3399	7/20	9/16	58	15.96	9.8	-.0143	-5.2%
3399	9/16	10/3	17	15.13	9.8	-.0588	-3.8%
3493	7/20	9/13	55	9.41	7.7	-.0155	-9.0%
3493	9/13	10/3	20	9.56	7.7	-.0165	-3.9%
3493	10/3	10/13	10	9.23	7.8	+.0430	+5.2%
3493	10/13	11/2	20	8.66	7.8	-.0156	-3.6%
3493	11/2	11/10	8	8.35	7.8	+.0425	+4.1%
3493	11/10	11/25	15	8.69	7.8	+.0073	+1.3%
3493	11/25	12/9	14	8.80	7.8	+.0029	+0.5%
3493	12/9	12/16	7	8.84	7.8	-.0271	-2.1%

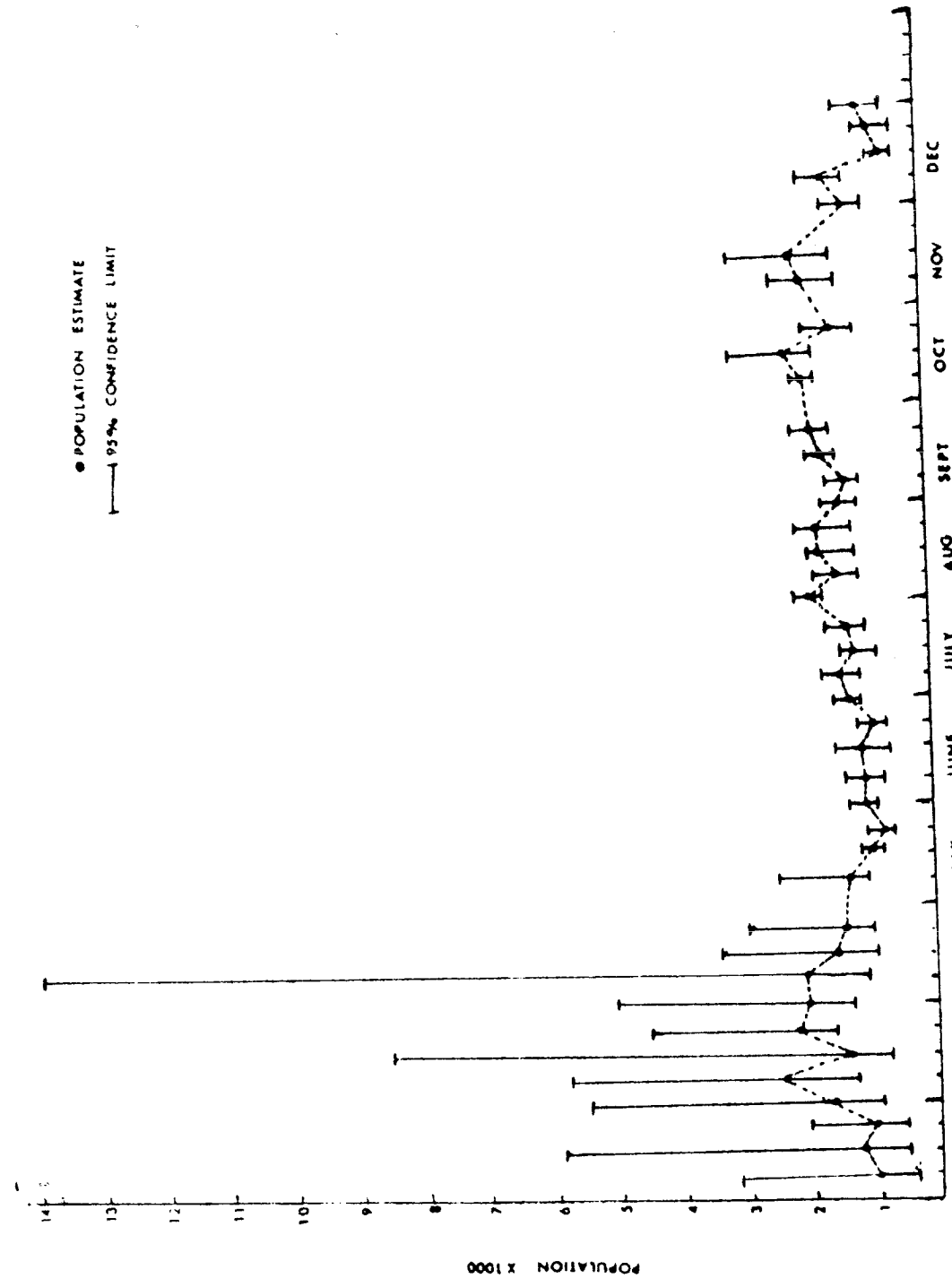

FIG. 4. Weekly population estimates of Mojave Chubs over an eleven month period.

then the population stablized around 1100 individuals. In July the population again started to increase through October. This may also be a function of recruitment of the previous spring's hatch. By early December the population decreased through the first part of January.

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