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Population Dynamics of the Utah Chub, *Gila atraria*,
in Two Ocean Lake
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Project Number 88

The aim of the field work during the summer of 1957 was 1) to obtain a more refined estimate on the percentage of deformities among the chub in Two Ocean Lake and at the same time to get a measure of the distribution of deformities in the lake and 2) to find out whether the deformity is inherited or caused by other non-genetic factors.

Results:

The fork length of all chub (19,952) in 16 samples captured in trap nets were recorded and from this total scales from 548 normal chub were collected for determination of their ages. The deformed chub were identified according to the day of capture and were aged and preserved for other examinations.

An age-length frequency curve was constructed from the data on normal, aged fish and the proportions obtained were taken as the basis for estimating the age composition of the total measured sample.

Age Composition of Total Measured Sample

Age	2	3	4	5	6	7	8	9
Percentage	2.43	21.58	29.88	24.92	13.78	5.26	1.43	0.53

The total percentage of deformed chub from the sample of 19,952 was 0.65 percent. Broken down into deformities per year class or age group, the percentages were as follows:

Age	2	3	4	5	6	7
Percentage	0.65	0.47	0.86	1.14	0.72	1.01

The distribution of deformed chub in the lake varied through about the same values from one station to the next. There was some indication that the percentage of deformities was lower at stations where fish had been removed last year than it was at stations fished for the first time this year. However, a much larger number of samples would be needed before this indicated trend could be tested adequately; the percentages of deformities per sample at some of the newest stations were lowest of all.

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During the spawning season, eggs were artificially fertilized and reared in a temperature control bath at the laboratory. The eggs from a particular mating were reared in separated containers each supplied with an aeration device, but not running water. Thus, temperature fluctuations were eliminated and the oxygen supply was consistently adequate. In all, 47 matings were made: 13 involving normal parents; 18 involving 1 deformed and 1 normal parent; and 6 involving 2 deformed parents. Where possible, the same deformed fish in a mating were mated with normals and these normals in turn with other normals.

The abnormal larval fish were classified as anomalies, curved anomalies and vertebral curvatures otherwise normal. Total deformities were calculated as a percentage of the total numbers of eggs in each mating (1000-2000). The average percentages indicate no differences: Parents: Normal 7.8% deformed

Normal x Deformed 7.7% "
Two Deformed 6.0% "

Eggs from some matings of normal parents were reared in two kinds of water: 1) cotton-filtered lake water and 2) conditioned artesian water. The results are presented, but cannot be evaluated because the variations all fall within the normal range of expectation for samples of this size (1000-2000).

<u>Set</u>	<u>No.</u>	<u>Normal larvae</u>	<u>Deformed larvae</u>
1) Lake water (3)	73.4	3.9	
Artesian (25)	77.0	3.9	
2) Lake water (8)	79.8	5.7	
Artesian (28)	82.0	3.8	
3) Lake water (9)	83.0	5.1	
Artesian (29)	85.0	3.3	

All other eggs were reared in conditioned artesian water.

Conclusions:

It seems adequately established now that the percentage of deformed chub in Two Ocean Lake is not greater than 1% and is probably closer to 0.5%. This answers one of the original questions proposed in this project--to get an estimate of the percentage of deformed members of the population. Unless the conditions have changed considerably in recent years, these results show that earlier workers were over-enthusiastic in describing the numbers of deformities (all earlier estimates were made at a glance, as far as is known).

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It is not practical to attempt either distribution studies or predator-prey studies on this population because the low percentage of deformed fish (the index that would have been used) requires an overwhelming expenditure of energy to obtain an adequate sample.

The estimated age composition of fish probably does not reflect the correct proportions for the lake but only for the fish caught in the traps. Fish less than four years of age do not intermingle to a very large extent with older fish and tend to concentrate in shallow regions where other types of fishing gear must replace the trap. Consequently, the results being from different types of gear cannot be added.

Results from mating experiments were successful in demonstrating that if the deformities are inherited, they are not inherited in accord with a simple pattern. With what is now known, it is not possible to say whether or not the deformities are of a genetic origin. However, they seem not to be caused by either temperature fluctuation, low dissolved oxygen, or some chemical in the water of Two Ocean Lake. Further mating experiments in which Two Ocean Lake chub are compared with chub from other waters should throw some useful light on the problem.

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Metabolic Differences Associated with Altitude

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This project is concerned with certain physiological aspects of altitude, particularly as they act to limit the range of or isolate populations and species of animals. It has now run through the summers of 1955, 1956 and 1957. The results of the studies of the first two summers have been summarized in a paper which is being published in the October 1957 issue of *Physiological Zoology*. The work of this report dealt primarily with the effect of differences in altitude on the rate of oxygen uptake in two species of arthropods and has been summarized in previous reports.

In the summer of 1957 an attempt was made to widen the scope of the experiments in line with the original aim of the study. Using Tribolium confusum as a subject, cultures were established in three experimental situations designed to make a preliminary survey of the effect, if any, altitude may have on the lengths of the larval and pupal stages of this flour beetle. The cultures were started with day old larvae and maintained in flour medium according to the following schedule: