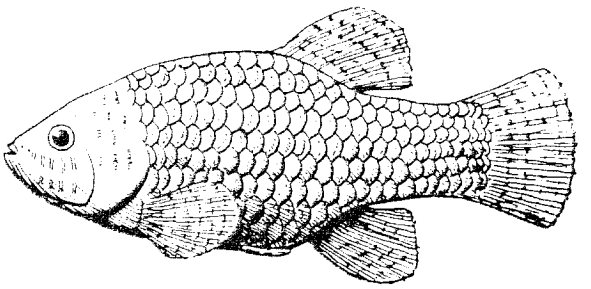
Desert Fishes Council



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NATURAL RESOURCES OF THE LARK SEEP SYSTEM (CHINA LAKE, CA) WITH SPECIAL EMPHASIS ON THE MOHAVE CHUB (*Gila bicolor mohavensis*)

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ABSTRACT

In 1971 Mohave chub were introduced into the lagoon at Lark Seep, a small marsh formed by leakage from the sewage treatment ponds on the China Lake Naval Weapons Center. Since the introduction the Lark Seep marsh system has become enlarged due to increases in the capacity of the sewage system.

In order to access the present chub population and its habitat the U.S. Navy sponsored a natural resources survey of the entire aquatic ecosystem at Lark Seep with a special emphasis on the Mohave chub (a species listed as endangered by the U.S. Fish and Wildlife Service and the State of California).

A field survey of the Lark Seep System was conducted during 1983 with major sampling periods in March, May, late June and late August. Sampling included water chemistry, primary production, plankton, benthic invertebrates and fishes.

Another purpose of the study was to determine habitat requirements for the Mohave chub in order to predict what affects alteration of the existing habitats would have upon this endangered species.

Field investigation of the chubs included studies in distribution, feeding, reproduction and parasites. Also physiological measurements such as thermal tolerance, osmoreglatory ability and energy metabolism were conducted.

FISHERIES STUDIES

The general habitat at Lark Seep consists of a main channel through which water flows to the lagoon-marsh system. The lagoon is approximately 10 acres in size and is relatively shallow (less than 50 cm). Water drains from the marsh and flows into a long channel which leads out onto the China Lake playa.

Distribution

Although the transplant was made into the lagoon the fish appear to prefer the deeper water of the channels. During mid and late summer, fish occurred throughout the entire channel system.

In 1982 the channels were dredged to remove emergent vegetation and the fish quickly colonized these newly enlarged habitats so that the

majority of the population (greater than 90 percent) now live in the channels.

The population was censused in spring as well as early, mid and late summmer using baited traps, umbrella nets and minnow seines. In March and May chubs were readily seined and trapped from the channel which flows into the marsh but they were not observed or captured from the channel flowing toward the playa. In the mid and late summer sampling periods the fish were found to be numerous and distributed throughout the channel system, although the presence of cover (cattails and bulrushes) appeared to be important. Some chubs including young of the year, were present in the mid and late summer samples from the lagoon.

Reproduction

Gonosomatic indices indicate that spawning occurred between May and June. Fish were found to be ripe in May and were spent by late June. Large numbers of juvenile chubs (25-50 mm) were observed in several habitats during the latter sampling period. Recruitment of young of the year fish in the August sample substantiate this early summer spawning.

Food Habits

Gut analyses indicated that the Mohave chub population at Lark Seep is an opportunistic omnivore with stomach contents which include detritus, vascular plants, Spirogyra and animals. The latter categories included fish (young chub), Daphnia, chironomids, amphipods and trichopteran cases.

Plankton samples taken from the lagoon and the channels yielded low numbers of zooplankton. Benthic samples (Ekman grab) produced numerous aquatic invertebrates (insects and amphipods) especially in areas vegetated with Ruppia.

Parasites

In the samples of fish taken from the lagoon in late August the incidence of parasitism exceeded 75 percent. The parasite (a nematode) was located in the body cavity and was present mainly in young of the year fish. Parasitism of fish of the same age class from the flowing channel environments was much lower, while the frequency among all adult fish was even lower (less than 9 percent). The latter finding suggests that the nematode could be an important source of mortality for the lagoon population.

PHYSIOLOGICAL STUDIES

In order to determine specific habitat requirements related to water temperature and salinity extremes, various laboratory experiments were conducted.

Thermal Tolerance

Using standard techniques to measure thermal tolerance, critical thermal maxima and critical thermal minima were found to be dependent upon on thermal acclimation. Fish acclimated to 18C had a CTMax of 33.5C, while those acclimated to 30C had a CTMax of 36.2C. CTMin ranged from 2.8C for fish acclimated to 18C while CTMin rose to 7.2C when the

acclimation temperature was elevated to 30C.

Salinity Tolerance

The Mohave chub was able to tolerate salinities up to 7.5 ppt without an increase in blood osmolarity. When acclimated to a salinity of 10 ppt, a significant rise (17 percent) in blood osmolarity occurred. In 12.6 ppt, blood salt concentration increased another 7 percent and fish became listless and began to lose equilibrium. In the latter concentration, body water decreased which is another indication that this species is unable to osmoregulate in salinities greater than 10 ppt.

Energy Metabolism

When placed in a water tunnel-respirometer Mohave chub demonstrated the ability to swim in currents up to 87 cm/sec. Metabolic rate at rest was temperature dependent rising from 0.03 to 0.07 ml/g/hr in test temperatures ranging from 18-30C. When exercised, oxygen consumption rose to 0.1 ml/g/hr and was temperature independent, indicating maximum energy expenditure.

At 18C the maximum swimming speed was 45 cm/sec and in temperatures below 18C some fish were unable to swim. The maximum speed of 87 cm/sec was reached in 30C.

Significance of Present Study (Habitat Requirements)

Chubs were found over a wide range of habitats in both channels and lagoon areas. Food requirements are very general but plant material was predominate in gut samples. The fish appear to prefer deeper channel habitats and thermal tolerance experiments indicate that this species has a considerably lower CTMax than other fish inhabiting desert habitats (eg. Cyprinodon). The inability of chub to swim in a water tunnel at temperatures lower than 18C probably explains our difficulty in trapping or seining fish from the channels below the lagoon in March. In cooler temperatures common in much of the habitat at Lark Seep during the winter months chubs must remain relatively inactive.

Salinity tolerance data indicate the chub are capable of tolerating slight elevations in salt concentration in their environment such as would occur in a pool or playa lake during dry summer periods. Salinities greater than 10 ppt (30 percent sea water) probably can only be tolerated for short periods of time.

Habitat requirements for this endangered species would thus appear to include the need of some emergent vegetation for cover, water of low salinity and pond or channel configurations which allow cooler waters to be present during the hot summer months. Small, shallow ponds without vegetation or circulation would appear to be unsatisifactory refugia for Mohave chub.