THE TULE PERCH FROM CENTRAL CALIFORNIA--A LIVEBEARER

by Alfred D. Castro, San Francisco, California

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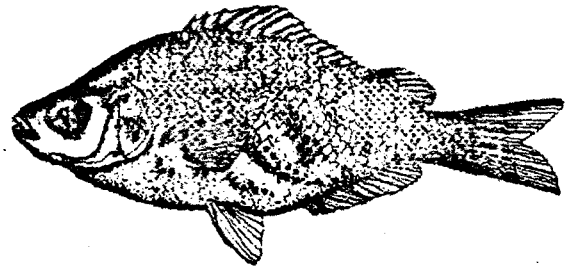


--from the Atlas of North American Freshwater Fishes

We who live in the Greater San Francisco Bay area (including the Delta region) have a local livebearing fish unlike any other freshwater livebearer in the world. Can you think of it? I'll give you a hint: it is a member of the family Embiotocidae, the surfperches.

This family of livebearing fish has about twenty species; three occur in the water surrounding Japan, while the rest inhabit the shallow coastal waters of the Pacific Ocean along the coast of North America. While generally considered marine fishes, several embiotocids are found in brackish lagoons, and one species, the subject of this article, occurs exclusively in fresh water: the Tule Perch (Hysterocarpus traski).

The 6" Tule Perch--only fully freshwater member of an otherwise marine family and endemic to central California--deserves special consideration. Until recently, this species was considered the bane of freshwater aquarists; but the work and the sharing of experiences and knowledge of area hobbyists has made it possible to maintain the species successfully.

History, Nomenclature, & Systematics

First I should give you a little history of the beast. It was first described by W.P. Gibbons in 1854 in "Descriptions of four new species of viviparous fish, read before the California Academy of Natural Sciences, Monday evening, May 15, 1984, by Dr. W. P. Gibbons," published by the San Francisco

Daily Placer Times and Transcript on May 18, 1854, on page 2. The type locality was given as "freshwater lagoons of the Scramento River, and from the river where they are found as high up as the fishermen have yet been."

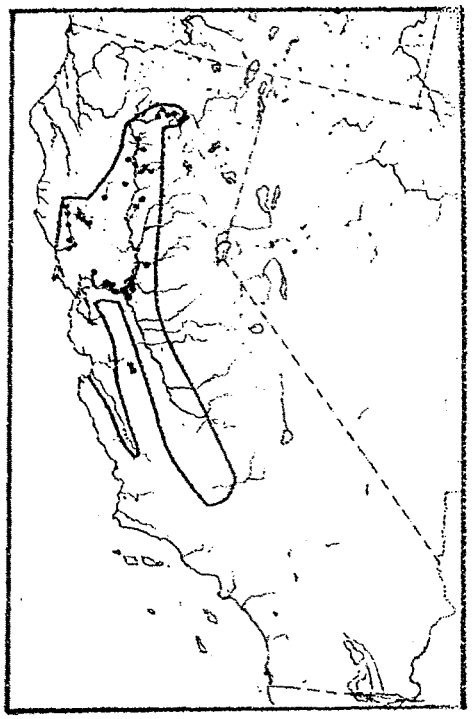
Its name is derived from hystero-carpus, meaning "womb-fruit" [fruit of the womb?--Ed.], referring to live birth; traski honored Dr. J. B. Trask, who sent Dr. Gibbons his first specimens. The common name "Tule Perch" refers to the habitat with which it is commonly associated. William I. Follett, Curator Emeritus of the Department of Ichthyology of the California Academy of Sciences, gave it that name when, in the presence of an august body of renowned naturalists, he quipped, "[S]ince we have a tule elk, tule mouse and tule frog, we might as well call it a tule perch." I must admit that this is only a rumor, but it comes from a very reliable source, and I only add it to show how easy it is sometimes to give something a good (or bad) "common" or everyday name.

In 1973, John D. Hopkirk described two new subspecies: Hysterocarpus traski pomo, the Rusian River Tule Perch, and Hysterocarpus traski lagunae, the Clear Lake Tule Perch, leaving the name Hysterocarpus traski traski to the form from the Sacramento and San Joaquin River systems. This was published in "Endemism in Fishes of the Clear Lake Region of Central California" in University of California Publications in Zoology, Volume 96, pp. 83-92.

In 1974, Clark Hubbs took exception to the validity of these new subspecies in "Review of J.D. Hopkirk, Endemism in Fishes of the Clear Lake Region" in Copeia, 1974 (3), pp. 808-809. As the concept of species is so poorly understood (or conceived to be so many different things by so many different people), I tend to side with Hopkirk because I can recognize a difference between live Russian River Tule Perch and Sacramento River Tule Perch (I have never seen a live Clear Lake representative, though I've searched for them on many occasions). I also use the subspecific name for the population because it gives an indication of where the form originated; far too few aquarists retain locality information with their fish, while they will keep a subspecific name. And now, since the systematics of this species are a little turbid, we will switch to the ecological information known about the Tule Perch. It is much clearer (or maybe I should say that it is clearly a little turbid! Or maybe I should just forget the whole thing! NO! Because it is important to understand the ecology to maintain a fish properly!)...

Habitat

The Tule Perch inhabits low-elevation rivers and streams in central California. Since its common name is derived from its association with tules, or bullrush, we know that it is found in areas with only moderate-at-best current. On the few occasions when I have collected it in areas of more-than-moderate current, it has been found in the lee of boulders or logs which



Map from the Atlas. Area enclosed in line is orig. range; dots are recent records.

have broken the major stream velocity. But, while the tule beds are found on a soft soil or mud substrate, the Tule Perch seems to prefer the peripheral areas where there is a slight current and a sand or gravel bottom.

An analysis of the waters in which a fish is found is very important in that it gives an indication of the water quality needed to maintain the species successfully in captivity; but be careful where the Tule Perch is concerned. The waters in central California fluctuate dramatically depending on the season. During late summer and fall, the mountain snow pack is almost gone so there is little water velocity to the streams, the temperature rises (often hitting 80°F,or 27°C), the hardness and the pH go up (hardness of 200 ppm $CaCO_3$ and a pH of 8.3-8.4 is not uncommon), and there are increases in dissolved organic matter. During winter and spring, you will find drastically different conditions. An analysis of the same area can find water with these factors: temperature of 35-40°F (1 to 4.5°C), a hardness of 12-15 $CaCO_3$, a pH of 6.2, and no dissolved organic material. As you can see, the Tule Perch is tolerant of a wide variety of conditions in nature, but it is difficult to keep in the aquarium. One peculiar fact that shows up in my collecting data is that,although the Tule Perch derives from a marine form, it seldom enters brackish water, but does inhabit areas that receive infrequent tidal influxes; therefore it does have an ability to withstand increases of salinity. Keep this point in mind for later!

The feeding habits of the Tule Perch are easy to describe. They feed on small invertebrates that live in or on the aquatic plants associated with the tules, and they feed on zooplankton. An interesting late-spring afternoon can be spent on the Russian River of California watching through a face mask as the Tule Perch hover in an eddy, darting into the current like hummingbirds as they feed on "bugs " (But be sure to wear a wet-suit as the water is extremely cold!). Interestingly enough, during

feeding time the Tule Perch band together, but they are normally territorial, the males defending particular calm spots behind rocks or logs.

Courting & Breeding

As I have already stated, the Tule Perch is a livebearing fish. There follows a basic idea of how the life cycle takes place in the wild. It all starts in the summer. The Tule Perch is different from your average poeciliid or goodeid that is always ready and willing to breed. During July, August, and September, when the water is at its warmest and water motion is at its least, the males stake out small territories. The reason for this is a little unclear, but it appears to be an effort to attract the attention of the females. Nevertheless, non-courting males are quite successful with the ladies also. A courting dance is undertaken and occasionally a receptive female enters the arena. The male "attacks," and, when the female does not flee, the pair spends some time "getting acquainted" by pecking at each other's opercular region. They frequently interrupt the pecking to go head-to-tail and swim in tight circles. It has been reported that the pair will often go mouth-to-mouth, as Kissing Gouramis do, but I have not witnessed this. In any event, the actual spawning soon follows. The pair assumes a side-to-side position, facing in the same direction. The caudal areas are pressed together and the fish tilt to bring the anal fins together. I must admit that the rest of the act is conjecture because it is hard to see what is happening from the surface. The male's anal fin, modified to act as an intromittent organ, is pressed against the female's vent and injects sperm into her. The actual act takes place very rapidly, in 10-15 seconds from the time they start to take the head-to-head position. The entire process, starting with the "getting acquainted," is repeated two or three times; then the male chases the female out of the nest area.

The female Tule Perch undergoes a delayed fertilization process. The sperm is stored away from the eggs until January or February before it enters the ovaries, where the eggs are fertilized. Since we have been successful in maintaining the Tule Perch, we have been able to ascertain that this delayed process is also utilized in the aquarium, where conditions are stable. This gives a good indication that it is an inherited trait, as opposed to an environmentally induced trait.

The embryology of embiotocids is a fascinating study. And while I admit that I know only the basics, I will try to share them with you. If you are interested in more information on the embryology of the Tule Perch, I suggest that you try to get a copy of D.S. Bundy's M.S. thesis from University of Pacific, Stockton, California, entitled "Reproduction and growth of the tule perch, Hysterocarpus traski Gibbons, with notes on its ecology."

We know from our work with poeciliids that the egg develops within the female but receives little or no nutrition from the mother and is born at approximately the same weight as the

unfertilized egg. This method of reproduction has certain advantages because the fry are generally large; for all practical purposes, they are about one month old, and better able to cope with the environment when they make their appearance. Goodeids have carried this process a little further, and possess trophotaeniae--modified rectal processes of the embryo--which "connect" the young to the mother and are associated with respiration and nutrition. These trophotaeniae allow the embryo to spend more time in the female and to advance much further; thus the baby fish emerge as very large individuals very well adapted for survival. After all, they are already about two months old when they are born.

The embiotocids do much the same thing, but instead of having trophotaeniae, they use hypertrophied fins that are heavily vascularized and contain capillary tufts in skin flaps that fit into the highly pleated or folded ovarian cavity. These hypertrophied fins aid both respiration and nutrition, but apparently the advanced young also gain much nutrition by feeding on the ovarian fluid and epithelial cells sloughed from the ovarian walls. The embryos develop for four or five months within the female and are born in May or June. Perhaps some of you remember how the May, 1977 meeting of the San Francisco Aquarium Society, held in Steinhart Aquarium, was interrupted--or perhaps I shoud say disrupted--to allow members to witness the birth of several Tule Perch. Most of the young were born head first, but an occasional individual came out tail first. Luckily, no one wanted to adjourn the meeting until the "birthing" was over. It took three days for the 60-plus young to be delivered! The young, varying in size from 1¼" to 1½" SL when born, are capable of eating most aquatic insect larvae immediately. Although growth is relatively slow, young-of-the-year males are active (though not very successful) in the July breeding arenas, but the females seem to wait a year before they breed.

Aquaristics

Maintenance in the aquarium is relatively simple, but for some inexplicable reason the Tule Perch has been considered an "impossible" species. Dr. Earl S. Herald, the late Director of Steinhart Aquarium, set a personal goal of establishing the Tule Perch as an aquarium species, but, at the time of his death in 1973, the longest period that it had survived was a month. He tried-everything that he or anyone he knew could think of, including digging up the substrate over which the fish was found and transferring a section of the actual habitat to the aquarium. Nothing worked! But, towards the end of 1976, several S.F.A.S. members had the fish in their personal collections and were maintaining them satisfactorily. But they were doing it "all wrong!" They were keeping small quantities of salt in the aquaria. If they could do it, so could I.

In November, 1976, I set up a 50-gallon tank, added a dolomite filter and approximately 20 percent seawater, then added some Tule Perch. By December, 1979, I was still maintaining

some of the same fish. I had observed a few births and several courtings, and was awaiting my first second-generation tank-raised young. When they arrived, I felt confident that the "secret" was the small amount of seawater. But I still had more to learn!

Feeding has proved very simple for aquarium specimens. Live brine shrimp, white worms, and tubifex are nice for "treats," but the staple food is frozen krill, a euphausid shrimp commercially available from aquarium stores. (They will eat freeze-dried krill, but do not thrive on this as they do with the frozen food.) Tule Perch also eat prepared dry foods.

I no longer have the ready access to seawater that I previously had, but I still have had success in maintaining Tule Perch. I found that San Francisco tapwater, treated with Epsom salts at 1 teaspoonful per 5 gallons plus Bicarbonate of Soda at 1 tablespoon per 10 gallons, buffered with a commercial marine buffer such as Sea-Lab #28,works equally well. Perhaps the real "secret" is the trace elements found in seawater, and not the salinity as previously thought. Since I no longer have a collecting permit that allows me to catch California fishes, I cannot do any more experiments on Tule Perch. Maybe at some time in the future I will again be able to work with this fascinating species.

Prospects

That is, assuming that there <u>are</u> Tule Perch in the future. The Tule Perch has been extirpated from much of its original range by pollution (especially agricultural) and habitat degradation, and has withstood a serious drought that caused havoc for all aquatic life. The California Department of Fish and Game has taken notice of the problem and has undertaken an active role in a recovery project. The Pajaro River system, habitat of a now-extinct population, has had a re-introduction of the Russian River form, some of which were collected from Lake Merced within the city limits of San Francisco (obviously a previously introduced form). When the outcome of this transplant is finally known, perhaps other transplants will be tried or perhaps--just perhaps--wildlife preserves will be set up to insure critical habitat for all three known forms <u>before</u> the Tule Perch--a unique form of livebearing freshwater fish--has to be put on the endangered-species list.

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