

# Pyramid Lake and its Cutthroat Trout

by Robert J. Behnke



Pyramid Lake and its giant cutthroat trout have been the subject of numerous magazine articles. Many of these articles are characterized by misinformation and hyperbole. The true story of Pyramid Lake, its enormous cutthroat trout, and their fate is indeed fascinating, but requires no fanciful embellishments. It is the intent of this endeavor to right some obvious wrongs and clear up any misconceptions concerning this extraordinary fishery.

The Great Basin of the western United States encompasses a large region south of the Columbia River drainage in Oregon, west and north of the Colorado River basin of Utah and Nevada, and east of the Sierra Nevada of California. Within this region, streams run from the mountains out onto the desert or into sumps, such as Great Salt Lake, Utah, and Pyramid Lake, Nevada. No running water escapes to the ocean. During the last glacial epoch (from about ten thousand to seventy thousand years ago), there were periods when the climate was cooler and wetter than it is now, and large lakes formed in numerous separate basins. For example, a lake formed in the Lahontan basin that was slightly larger than Lake Erie. The Lahontan basin of Nevada, as well as northeastern California, was invaded by an ancestral cutthroat trout at an unknown time. It is commonly assumed that this cutthroat-trout ancestor gained access to the Lahontan basin from the Columbia basin at the beginning of the last glacial period or about seventy thousand years ago, but it may have been much earlier. Fossil trout bones, several million years old, have been uncovered in the Lahontan basin, and they are similar to the bones of the Lahontan cutthroat trout, *Salmo clarki henshawi*.

In any event, this ancestral trout was the only large predatory fish among

numerous species of minnows and suckers that established themselves. It evolved into an efficient predator and may have attained a large size in order to make use of the large stocks of forage fishes. The most common Lahontan minnow, the tui chub, commonly attains a maximum size of fifteen to eighteen inches, certainly more than a mouthful for a pan-sized trout, but a mere appetizer to a subspecies of trout whose weight averages twenty pounds.

Approximately ten thousand years ago, when the climate became warmer and drier, Lake Lahontan rapidly declined in size. About a thousand years later, it desiccated considerably and left two sump lakes, Walker Lake and Pyramid Lake. But, only Pyramid Lake maintained continuity and retained a full complement of Lahontan fishes. This allowed the Lahontan cutthroat trout to continue without interruption its evolutionary specialization as a large, predatory trout. In addition to the populations in Walker and Pyramid lakes, the Lahontan cutthroat trout survived in mountain rivers and lakes, such as Lake Tahoe, but these environments and their associated fish faunas were vastly different from Pyramid Lake, and these populations were subjected to evolutionary pressures distinctly different from those affecting the cutthroat of Pyramid Lake; other Lahontan cutthroat trout introduced into Pyramid Lake never approached the maximum size of the native trout. Although all Lahontan cutthroat trout populations that have been isolated from each other for about nine thousand years (since the desiccation of Lake Lahontan) exhibit little morphological differentiation and are all classified as the same subspecies, *henshawi*, they have all evolved different life-history specializations, and none were so finely adapted to make such efficient use of the Pyramid Lake environment as was the native Pyramid Lake trout—thus their enor-

mous size.

What happened to the original Pyramid Lake cutthroat trout is an interesting case history of a conflict of values between settlers in the area and native Americans, particularly as this conflict relates to values associated with water. While the dating of artifacts indicates that the first native Americans appeared on the shores of Lake Lahontan about twelve thousand years ago, the present Paiute Indian culture at Pyramid Lake began only about six hundred years ago. The Pyramid Lake Paiutes developed great skills as fishermen and established a relatively stable, advanced society. The first nonnative Americans to visit Pyramid Lake were John C. Fremont, his scout Kit Carson, and their exploration party. Fremont had traveled south from Oregon to explore the Great Basin and to search for the mythical Buenaventura River that ancient maps depicted as draining the Great Basin to the Pacific Ocean. On January 10, 1844, Fremont and his party crested a ridge north of Pyramid Lake and were astonished at the sight of a vast sea existing in the midst of a great expanse of desert. Fremont's party camped near the mouth of the Truckee River where it entered Pyramid Lake and soon came in contact with the Paiute Indians. The initial contact was friendly. In fact, the Paiutes brought freshly caught trout to Fremont and his party. Fremont remarked, "Their flavor was excellent—superior, in fact, to that of any fish I have ever known. They were of extraordinary size—about as large as the Columbia River salmon—generally from two to four feet in length." Unfortunately, in less than a hundred years from the time Fremont first saw these giant cutthroat trout, this magnificent fish was actually exterminated from the waters of Pyramid Lake.

The California gold rush of 1849 and the Nevada mining boom of the 1850s brought many settlers to the Pyramid

Lake area. There were conflicts with the Paiute Indians, but during the 1860s a peace treaty was negotiated. The treaty established the Pyramid Lake Indian Reservation and gave ownership of Pyramid Lake and its fishes to the Paiutes. However, the Indians were given no control over the Truckee River, the only stream flowing into the lake that is suitable for the spawning of the cutthroat trout, and the major water supply for the lake.

The rapidly increasing population centers of western Nevada and eastern California created a great demand for lumber. Numerous lumber mills were set up on the Truckee River in California in the 1860s. As the stumps in the watershed were lumbered, massive amounts of sawdust were dumped into the river, and in 1869 a Reno newspaper reported that "millions" of spawning trout were killed in the Truckee River as a result of sawdust pollution. During spring runoff, the sawdust deposits were transported to the mouth of the Truckee River, sometimes in such quantity that the spawning runs of trout from the lake were completely blocked. By 1875, dams blocked the river near Reno, effectively reducing potential spawning habitat by about seventy-five percent. From 1899 to 1930, a paper mill at Floriston, California, dumped up to a hundred fifty thousand gallons per day of highly toxic wastes into the Truckee River, eliminating all fish life for a considerable distance downstream. In addition, numerous unscreened irrigation ditches must have led to the destruction of millions of young cutthroat trout in the river as they migrated downstream to Pyramid Lake.

In 1868, the railroad was extended to Wadsworth, Nevada, a short distance from Pyramid Lake; this provided the opportunity to ship trout to distant markets and resulted in a tremendous increase in commercial exploitation of the resource. During their spawning runs, the trout were netted, snagged, speared, clubbed, and dynamited. It is incredible that even with all these adversities the Pyramid Lake cutthroat trout lasted as long as they did. They must have been a superbly adapted fish because they not only persisted but managed to remain abundant until the 1920s when successful spawning became rare.

The ultimate demise of the Pyramid Lake cutthroat trout began in 1903 when a new government agency, the Reclamation Service (now the Bureau of Reclamation) announced plans for its first project: the Newlands Project. It would divert water from the Truckee River to the Carson River in order to irrigate desert lands and make them bloom. The early history of the Newlands Project is one I am sure the present Bureau of Reclamation would prefer to forget, as it was an incred-

ibly unwise use of a natural resource. The first Commissioner of Reclamation, Frederick Newell, drummed up support for the Newlands Project with speeches to Nevada audiences in which he frequently emphasized the philosophy of the department: "Fish have no rights in water law." This is still a popular cliche among western water-users.

The gates on Derby Dam, about thirty miles above Pyramid Lake, were closed June 7, 1905, in a grand ceremony highlighted by the dewatering of the Truckee River below the dam and resulting in the stranding of numerous, large cutthroat trout.<sup>1</sup> Derby Dam was constructed with a fish ladder, but the ladder was poorly designed and cheaply constructed. It was essentially a failure as a fish-passage device. Between 1905 and the early 1920s, there was a sufficient surplus flow in the Truckee River so that trout could spawn below the dam and even get over the fish ladder in some years. The trout population in Pyramid Lake remained relatively high, and their enormous size attracted presidents, supreme-court justices, and movie stars who had an interest in the gentle art. In the 1920s, the Bureau of Reclamation added an electrical generating facility to its Newlands Project, as it seemed utterly foolish to let surplus water flow out into a desert lake (only to evaporate) when it could be diverted through turbines that generated electricity and additional income. Thus additional water was diverted out of the Truckee River to the Carson basin, and cutthroat trout spawning became more infrequent. The last major, successful spawning run occurred in 1927, with some reproduction reported in 1928 or 1929. Some artificial propagation and stocking occurred in 1930. A high flow in 1928 allowed some trout to get above Derby Dam all the way to Reno. The people of Reno had not seen the Pyramid Lake trout that far up the river for so long they forgot its correct classification and the mayor of Reno mistakenly declared Rainbow Day in honor of the cutthroat trout. In 1938 the offspring from this spawning run made the last attempt to spawn in the Truckee River, but the flow was shut off and the fish and their spawn perished. Thus ended the era of the world's largest cutthroat trout and probably the largest trout native to western North America.

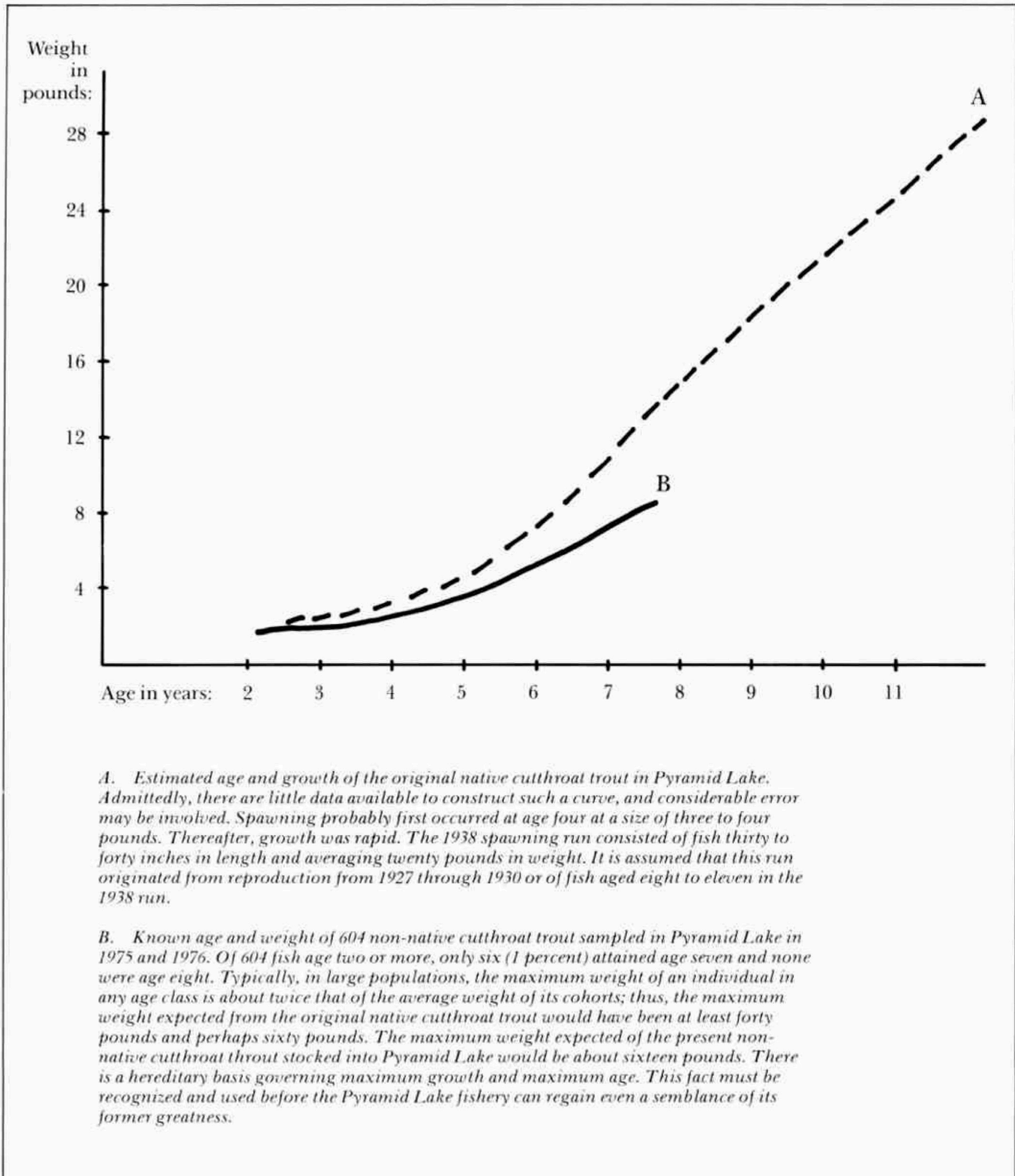
Stories relating that the native cutthroat trout did not completely perish from Pyramid Lake but were able to reproduce in springs on the lake bottom have persisted. But all known springs in Pyramid Lake have temperatures or chemistry lethal to trout eggs. I know of no evidence suggesting that the native trout did not become extinct in Pyramid Lake.

The data gathered on the 1938 spawning run is truly amazing. The Indians harvested 1,069 trout in their commercial

fishery. When a United States Fish and Wildlife Service biologist weighed a sample of 195 fish from the run, the average weight was twenty pounds! He measured 321 trout taken from the 1938 spawning run; about ninety percent of these ranged from thirty-two to thirty-eight inches, with a few fish of forty inches. No maximum weights were given in this report, but extrapolation from a length-weight curve suggests that a forty-inch trout would weigh between thirty and thirty-five pounds.

How abundant was the original Pyramid Lake cutthroat trout, and what was its maximum size? These questions can never be known with any degree of certainty. In the 1880s, long after most of the upstream spawning and nursery areas were blocked or polluted in the Truckee River, commercial shipments of trout from Wadsworth ranged from two hundred to two hundred fifty thousand pounds per year. Records for another commercial fishery point at Verdi are not available. An unknown quantity of trout were transported by wagon to towns in Nevada and were consumed on the Indian reservation as well. I would estimate that even under the conditions of a declining fishery of the 1880s, the annual catch then was probably about five hundred thousand pounds, and the actual biomass of trout in Pyramid and Winnemucca lakes was in excess of two million pounds. The official world record cutthroat trout of forty-one pounds was caught in 1925 by a Paiute Indian, John Skimmerhorn, but there were reports of larger specimens taken by the Indian commercial fishery. Mr. Fred Crosby, the agent for the tribal fishery, claimed to have seen a cutthroat trout of sixty-two pounds in 1916!

The Nevada Fish and Game Department began to plant trout in Pyramid Lake in 1950 on an experimental basis. Rainbow trout were stocked at first, but it was soon found that the Lahontan cutthroat trout from available stocks in Heenan Lake, California, and Summit Lake, Nevada, grew faster and survived better than the rainbow trout. The advantage of Lahontan cutthroat trout over all other species and subspecies of salmonid fishes stocked into Pyramid Lake was most likely due to their tolerance to high alkalinity, or more specifically, to the concentration of carbonate and bicarbonate ions in the water. As salts and various ions are transported into Pyramid Lake each year via the Truckee River, evaporation and the lack of any outflow concentrates salts. Pyramid Lake water, in recent years, has exhibited an average salinity of about 5,400 parts per million or about fifteen percent of the salinity of ocean water (35,000 ppm.). Of the total (5,400 ppm. total salts) carbonate and bicarbonate ions average more than 1,100 ppm. Most



fish species are physiologically stressed at carbonate-bicarbonate levels greater than 1,000 ppm. The pH of Pyramid Lake averages 9.2.

The stocking of Lahontan cutthroat trout from Heenan Lake or Summit Lake into Pyramid Lake, first by the Nevada Fish and Game Department, then by the United States Fish and Wildlife Service

and by the Paiute Indian Tribe, can be considered successful in that a popular fishery for large cutthroat trout has been reestablished. Many more pounds of hatchery trout have been stocked, however, than have been caught in this fishery during the past thirty years. On the average, it takes fifteen to twenty hours of angling to catch a legal-sized

trout. But a small group of Pyramid Lake "experts," fishing during winter months, have had considerably better angling success—and the exploits of these anglers have been the subject matter of several magazine articles. The present fishery pales in comparison to the fishery that was established when the trout were able to spawn in the Truckee River. Valid

creel-census data are lacking for the Pyramid Lake fishery. Various estimates during the past ten years indicate an annual catch of legal-size fish of four thousand to twenty thousand, averaging about twenty inches in size, or an annual harvest of about ten thousand to forty-five thousand pounds. Minimum legal lengths have ranged from fifteen to nineteen inches, and the present minimum is set at eighteen inches, with only flies and lures allowed. The annual catch of cutthroat from Pyramid Lake during the past ten years is probably less than five percent of the catch of a hundred years ago. In comparison, the maximum size and maximum life span of the nonnative cutthroat trout falls considerably short of the native Pyramid Lake trout. The graph compares the age and growth of the nonnative cutthroat trout stocked into Pyramid Lake with that of the native trout (the latter data is estimated from historical records). The maximum life span of the original strain was probably eleven years in Pyramid Lake. Adequate reconstruction of an age-growth curve of the original Pyramid Lake trout is hampered by lack of precise data. All that is known is that a run of trout from thirty to forty inches in length occurred in 1938 averaging twenty pounds, with a maximum weight of about thirty to thirty-five pounds. It is assumed that all of these trout resulted from spawning from 1928 through 1930. That is, they were eight to eleven years old. Nonnative cutthroat from Heenan Lake and Summit Lake origins have a maximum life span of seven years when they average eight pounds in weight. A hereditary-based difference between the native Pyramid Lake cutthroat trout and the stocks of Heenan and Summit lakes resulted in different life histories, influencing maximum size and age, which is predicted from evolutionary theory. The nonnative stocks of Lahontan cutthroat trout evolved in isolation from the past ten thousand years or more without large stocks of relatively large forage fishes in their environment. Thus, they did not obtain the size of the cutthroat trout in ancient Lake Lahontan.

It is interesting to note that from 1976 to 1978, several trout weighing more than twenty pounds were caught in Pyramid Lake. Twenty-pound trout were not caught before or since that time. What differentiated these large trout from the other nonnative cutthroat trout in Pyramid Lake? They could be the result of the size of the trout stocked, the time of year they were stocked, a particular stocking site (environmental factors), or a different origin of the planted fish (hereditary factor). I examined records of all of the trout stocked into Pyramid Lake from 1950 to 1977. In 1970, the Nevada Fish and Game Department stocked forty-eight hundred

two-year-old Lahontan cutthroat trout of Walker Lake origin. Since 1948 the Walker Lake cutthroat trout have been maintained in a hatchery, but of all Lahontan cutthroat trout, the Walker Lake stock continued to evolve (until 1948 at least) as a predator on tui chub in an environment most comparable to Pyramid Lake. I suspect that the exceptionally large trout caught in the 1976 to 1978 period were eight- to ten-year-old Walker Lake cutthroat trout. I suggest that the hereditary factor be given more recognition if the Pyramid Lake fishery is to regain a semblance of its original glory.

I bring this matter up because in 1979 I published a paper with Terry Hickman that reported the discovery of what we believe to be the original Pyramid Lake cutthroat trout—still existing in a small stream on the Nevada-Utah border.<sup>2</sup> Mr. Hickman was attempting to locate populations of the rare Bonneville basin cutthroat trout at the time, when he found an unusual trout in a tiny stream draining Pilot Peak on the Nevada-Utah border. The characteristics of the newly found cutthroat trout unmistakably identified it as the Lahontan basin subspecies *henshawi*. The small stream on Pilot Peak is in the Bonneville basin, so the trout had to be introduced by man. Cutthroat trout were known from the stream prior to 1950 (when Lahontan cutthroat trout from Heenan Lake were first available for stocking). We determined that Pyramid Lake cutthroat trout were the only source of Lahontan cutthroat trout propagated in Nevada (beginning in 1883) before the propagation of trout from Heenan and Summit lakes, thus the Lahontan cutthroat trout on Pilot Peak probably had its origin from the original stock native to Pyramid Lake. The existence for many generations of a small population in a tiny stream, in such a completely different environment from Pyramid Lake, has undoubtedly altered the genetics (heredity) of the only known living descendants of the native cutthroat

trout of Pyramid Lake. However, I believe that the Pilot Peak population and the Walker Lake stock of Lahontan cutthroat trout might offer genetic diversity for larger maximum size and longer life span than is presently found in the Heenan Lake and Summit Lake stocks. By stocking large numbers of genetically diverse Lahontan cutthroat trout into Pyramid Lake, then continually selecting the oldest and largest spawners that survive in Pyramid Lake to reproduce the next generation (no significant natural reproduction is likely to occur in the Truckee River in the foreseeable future), a trout approximating the maximum size and age of the native trout might be obtained. By experimenting to determine the best rearing techniques, the most opportune size, time, and locations for stocking, and by producing sterile fish with no gonad development (which will increase growth and life span), it is probable that the annual catch of Pyramid Lake trout could be increased by fourfold to fivefold over current levels, and a new world-record cutthroat trout might be in the offing. This is all predicated, however, on a sufficient flow of water (about four hundred thousand acre feet per year) in the Truckee River to maintain the Lake at its current level. In 1983, after a long legal battle, the Supreme Court of the United States ruled that the Pyramid Lake Indian Tribe is legally entitled to only thirty thousand acre feet of water each year from the Truckee River for irrigation and that they have no legal claim to the water for Pyramid Lake or its fishes. I can only hope that there are public officials with an innate sense of justice and decency who will attempt to work out a compromise on water use in the Truckee River basin so that flow adequate to maintain the present lake level can be achieved. I also hope that some of the ideas and theories discussed herein will be applied in an effort to restore the greatness of the Pyramid Lake trout fishery. §

1. Water diverted from the Truckee River lowered the lake level by eighty-five feet, most of the decline coming after 1920. Evaporation rates are high in this desert region—about four feet per year. If no inflowing water were to enter Pyramid Lake from the Truckee River for one year, the lake level would drop by four feet minus the relatively few inches of precipitation falling directly on the lake and the very minor input of a few springs and ephemeral dry washes. The surface area of Pyramid Lake and connecting Winnemucca Lake was about two hundred thousand acres until around 1910. Since then the lake has shrunk to little more than one thousand surface acres.

2. T. J. Hickman and R. J. Behnke, *The Progressive Fish-Culturist* (1979), 41, 135.

*Robert Behnke is a professor of fisheries biology in the department of Fishery and Wildlife Biology at Colorado State University, Fort Collins, Colorado. In addition to numerous professional articles, he writes a regular column for Trout magazine. He has also written the section on salmoniformes for the Encyclopedia Britannica. We would like to add a note of thanks to Bob Berls, John Mingo, and Chip Clark, who were instrumental in obtaining the color photographs of Hudson's paintings of the cutthroat trout that illustrate this piece.*