

THE INTRODUCED FISHES OF NEVADA, WITH A HISTORY OF THEIR INTRODUCTION

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ABSTRACT

At least 39 species and subspecies of fishes have been introduced into the waters of Nevada since 1873. Of these, 24 kinds are now known to occur in the state. A thorough survey of the exotic fishes has not been made, but specimens or records of introduced species have been kept in the course of rather extensive collecting of the native fish fauna from 1934 to 1943. Consequently it is believed that the number of introduced species herein enumerated approaches a complete tabulation. Some additions among the sunfishes and catfishes may be expected.

The annotated list is divided into two parts: species now present in the state, and species introduced but never established. The established kinds constitute about two-thirds of the total number of known native species, but are far outnumbered by the indigenous fishes when all the local subspecies (Hubbs and Miller, in press) are included.

The stocking of cutthroat trout and rainbow trout in the same creek should be discouraged since these two species hybridize extensively and the cutthroat trout are speedily eliminated. Brook trout and cutthroat trout, however, do not hybridize. A suggested practice would be to select separate streams when planting rainbow and cutthroat species, a procedure greatly simplified by the presence of many isolated creeks throughout the state.

The further distribution of the green sunfish, *Lepomis cyanellus*, is not recommended as this species is a serious competitor and does not reach a size suitable for game fishing.

INTRODUCTION

Since 1872, the year after the U. S. Fish Commission was established, fishes native to parts of this and foreign countries have been widely introduced into waters of the American West. The history of early plantings in Nevada is meager but, according to published reports and local testimony, some of the first successful introductions took place between 1873 and 1877 when cutthroat trout were planted in central and eastern Nevada, and catfish and Sacramento perch were stocked in Washoe Lake. In succeeding years attempts have been made to establish at least 31 species (39 kinds) in public or private waters and 24 of these varieties are now known to occur in the state. These figures include three species (four forms) which are, or were, native to Nevada.

Most of the information relating to the history of introductions

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which we present was obtained from the Reports, Bulletins, and Statistical Digests of the U. S. Fish Commission, later the U. S. Bureau of Fisheries and now the U. S. Fish and Wildlife Service, and reports of the Fish Commissioner of the State of Nevada covering the years 1877 to 1894, inclusive, the Nevada Fish Commission (1895-1896 and 1907-1916), and the Nevada Fish and Game Commission (1917-1942). Reports for the period 1897 to 1906, inclusive, could not be found and the authors understand that the Nevada State Fish Commission did not exist during these years.

The annotated list is divided into two parts: First, those species known to occur in the state at the present time, and second, species which according to reports have been introduced, but have never become established. The distribution given for many of the species is not to be considered complete since no extensive survey of the introduced fishes of the state has yet been made. The history of introductions will probably never be completely known because transplants made by private individuals and by the counties generally have not been recorded. In Nevada the county commissioners carry on much of the local administration. Some of the state records give only the total number of fish planted, making no mention of the genera or species involved. Other reports list the fish under the names of bass, bream, and sunfish, which do not admit of specific identification.

Jordan and Evermann (1898: 2818-2819) have been followed in the classification of cutthroat trouts, a practice adhered to by most ichthyologists. The common name Lahontan cutthroat trout (*Salmo clarkii henshawi*) is used in preference to that of Tahoe cutthroat trout, since this subspecies has been found throughout the streams draining into the basin of Pluvial Lake Lahontan. Eddy and Surber (1943: 89) used this name (though misspelling it Lahonton). In the general classification Hubbs and Lagler (1941) have been followed.

The authors are grateful to various officials of the Nevada Fish and Game Commission for helpful information. Dr. Carl L. Hubbs has made valuable suggestions and has permitted the publication of his field observations. Mr. William A. Dill of the California Division of Fish and Game has read the manuscript and offered critical data on the history of introductions. Full cooperation has been received from the Division of Fish Culture of the U. S. Fish and Wildlife Service and from the U. S. Forest Service.

I. INTRODUCED SPECIES NOW KNOWN TO OCCUR IN NEVADA

SALMONIDAE (TROUTS)

1. *Salmo trutta fario* Linnaeus. **Brown trout.** This species occurred in the Truckee River about 1906 (Anonymous, 1907: 44) and was again recorded from that river in 1911-1912 by Snyder (1917: 85). *Salmo trutta* has been planted extensively in the Tahoe area, and Mr. Dill writes that the first plant of this species which could have entered

Nevada took place in July 1895, when 250 Loch Leven trout, about 3 inches long, were deposited by the California Commission in Webber Lake, Sierra County, California (Smith, 1896: 433). The outlet of this lake is the Little Truckee River, a tributary of the Truckee River. During 1929-1930, 150,000 eggs and fish were received by applicants in Nevada (Leach, 1931: 1181). In 1930 a total of 50,000 "Loch Leven trout" were planted in Smith Creek, Big Creek and Birch Creek, all located in southern Lander County (Anonymous, 1931: 37). Shipments of eggs and fish were again made in 1932-1933 and 1935-1936. In 1941, 210,000 "Lockleven trout" were planted in Churchill (40,000), Douglas (61,000), Nye (55,000), and Washoe (54,000) counties (Anonymous, 1942: 14-15).

The brown trout is now known from the Reese, Carson, Truckee, and Walker Rivers and numerous mountain streams. Owing to the hatchery practice of mixing the strains of brown and Loch Leven trout (*Salmo trutta levenensis*), we are unable to distinguish the two subspecies and refer them both to the above form. It is very doubtful that a pure strain of the Loch Leven variety has been maintained anywhere in the United States.

2. *Salmo clarkii henshawi* Gill and Jordan. Lahontan cutthroat trout. Although this subspecies is native to the hydrographic basin of Pluvial Lake Lahontan, it has been widely introduced into streams, rivers, and lakes throughout the state. It has also been distributed to other western and eastern states.

The history of early plantings is known in detail only for Big Smoky Valley, in Nye and Lander counties. The following account is taken directly from the field notes recorded by Dr. C. L. Hubbs on August 9, 1938, when he interviewed pioneer resident George Schmidlein on his ranch in Big Smoky Valley.

In August, 1873, George and his brother Henry, with a neighbor named Smiley, hired an Indian and his wife with a pack train to stock Kingston Creek with trout from the Reese River system. The native trout occurred in Reese River and ran into Big Creek, Washington Canyon, San Juan Creek, and other tributaries on the western slope of the Toiyabe Range. They turned the little stream and caught 139 fish, none over 6 inches long, and put them in syrup and vinegar kegs. Those in the syrup kegs died but those in the vinegar kegs "thrived." The fish were packed across three summits for four days with changes of water and retention of the fish overnight in small, dammed ponds. Finally 39 fish were brought through and put in a dammed pond where they were fed for a week. The planting was successful, for despite some dynamiting two years later and turning of the creek rather regularly, the trout multiplied rapidly, and there was good fishing in three years. From Kingston Creek the trout were soon planted in nearby streams on the eastern side of the Toiyabes (Birch Creek, Clear Creek, Ophir Creek, Twin Rivers, etc.), and also into Peavine Creek at the southern end of the range. Further plants were made in Grass

Valley, northeast of Austin, in one stream on the east side of Big Smoky Valley (in the Toquina Mountains), in Stoneberger Creek over the mountains, and in Roberts Creek near Eureka.

In the season of 1910 a total of "1,500,000 spawn of the Black spotted trout" was taken by the Nevada Fish Commission from the Truckee River (Anonymous, 1911b: 7). Between 1920 and 1927, over 390,000 blackspotted trout (presumably *S. c. henshawi*) were stocked in the waters of the Nevada National Forest and some adjoining streams (data furnished through the courtesy of G. W. Southwick, Acting Forest Supervisor of the Nevada National Forest). Collections continued almost annually until 1929 when "operations for the collection of blackspotted trout eggs at the Pyramid Lake field station resulted in a take of some 3,000,000 eggs within a period of 12 days during 1929" (Anonymous, 1931: 25). To our knowledge, no eggs of this subspecies were taken after 1930 from the Truckee River or Pyramid Lake.

The distribution of this fish and of the Yellowstone cutthroat trout, *S. c. lewisi*, by the Nevada Fish and Game Commission was made under the heading of "blackspotted trout." Information available indicates that, for the most part, the largest proportion of such trout distributed were of the *henshawi* variety.

Almost every county in the state has, at some time prior to 1930, received large numbers of this fish. In 1910 the Nevada Fish Commission distributed 1,347,151 "blackspotted trout" in Nevada. These fish went to Elko, Humboldt, Washoe, Lander and White Pine counties.

The existence in Nevada today of pure strains of the Lahontan cutthroat trout is uncommon or rare because of the hybridization between *Salmo clarkii lewisi* and *Salmo clarkii henshawi* and the artificial and natural crossing of cutthroat and rainbow trout. For this reason it is extremely difficult to identify with certainty the subspecies of *Salmo clarkii* now present in Nevada.

3. *Salmo clarkii lewisi* (Girard). Yellowstone cutthroat trout. This is the "blackspotted trout" of fish culturists which has been widely introduced throughout the West. During the fiscal year 1918, 50,000 eggs of this subspecies were sent to the Nevada Fish and Game Commission at Ely (O'Malley, 1919: 9, 29). We have found no record of the hatching and distribution of these fish but assume they were hatched at the Ely hatchery for distribution in White Pine County. The fish hatched from the 150,000 eggs received by Nevada from Yellowstone Park, Wyoming, during 1925 were distributed along with the Lahontan cutthroat trout into Mineral (Walker Lake), Elko, Washoe and Lander counties (Anonymous, 1927: 18-21). In the same year applicants in Nevada received 8,400 fish and eggs (Leach, 1927: 376). Between 1930 and 1937, 2,023,500 fish and eggs were sent from federal hatcheries to the Nevada Fish and Game Commission and to applicants in Nevada. Biennial reports of the Nevada Fish and Game Commission make no

mention of blackspotted or cutthroat trout for the fiscal years 1931-1942, inclusive.

During the fiscal years 1940 and 1941 and the calendar year 1941, 308,740 "fry, fingerlings, etc.", were introduced into waters of the Humboldt National Forest, and in 1941, 13,000 "fry, fingerlings, etc.", were shipped to the Nevada National Forest. In the calendar year 1941, 50,000 were sent to the Toiyabe National Forest, and over the same period, 652,840 eggs and fish were received by the State Commission and by applicants (Leach, James, and Douglass, 1941: 563, 569, 603; 1942: 6, 10, 24; and 1943: 6, 11, 25).

No information has been obtained concerning the disposition of the fish reportedly sent to the Humboldt National Forest, but G. W. Southwick writes that plants of "native" trout were made in a number of creeks of the Nevada National Forest in 1941. Further, Mr. Jay L. Sevy, Acting Forest Supervisor of the Toiyabe National Forest, wrote that cutthroat trout have not been planted in waters of this forest (main divisions in central Nevada) over the period 1936 through 1942. In the northern or Santa Rosa Division of this forest, in Humboldt County, cutthroat trout were formerly present. However, as they did not do well there, later plantings have all consisted of rainbow trout, the only salmonid now present (data kindly supplied by S. R. Justice, District Forest Ranger). Additional introductions were made into Walker Lake in 1941 and 1942 (statement of County Clerk Buckingham of Mineral County).

The hatchery source for Yellowstone cutthroat trout is the Springville Hatchery near Utah Lake, Utah, which receives its stock from Yellowstone Park.

4. *Salmo clarkii utah* Suckley. Utah Lake cutthroat trout. This subspecies, native to the basin of Pluvial Lake Bonneville in Utah and adjoining areas, was introduced prior to 1881 into Cleve Creek, Spring Valley, White Pine County, by pioneer settlers, and it subsequently has been distributed to many of the tributaries of that valley (statement given to Carl L. Hubbs on August 22, 1938, by "old-timer" John Yelland of Ely, Nevada). The fish are supposed to have come either directly or indirectly from Trout Creek, Juab County, Utah.

According to testimony given to Dr. Hubbs, on July 26, 1942, by Mr. Moorman and ranch hands at Moorman Ranch (= Illipah), Jakes Valley, 33 miles by U. S. Highway 50 west of Ely, "speckled trout" were stocked near the ranch in 1876. Illipah Creek, the only live stream entering Jakes Valley, rises in a large, permanent mountain spring in the White Pine Mountains, known as Waterworks Spring, because of its use many years ago as the water supply for the great Hamilton mining district. In 1876 large tanks then in use on the top of the mountain were stocked with the trout by mine owners. Later, when the water system was abandoned, the trout were turned loose into Illipah Creek as the initial plant. Several other kinds of introduced trout recently have been introduced into the stream, and prob-

ably none of the original strain is left. It is not known from where the first fish were obtained, but there is a good possibility that they too came originally from Trout Creek, Utah. On the other hand, they may have been Lahontan cutthroat trout, brought in from the stock in Big Smoky Valley or from the South Fork of the Humboldt River to the north.

A pure strain of this subspecies may no longer exist in Spring Valley or along the eastern border of Nevada because of subsequent plantings of rainbow trout and cutthroat trout (presumably *S. clarkii lewisi* and *S. clarkii henshawi*), according to data submitted by G. W. Southwick.

5. *Salmo gairdnerii irideus* Gibbons. Coast rainbow trout. This subspecies of rainbow trout has now become widely established. The Shasta rainbow trout (or McCloud River trout) of fish culture, *Salmo gairdnerii shasta* (also recorded as *Salmo stonei* and *Salmo gairdnerii stonei*) was the form stocked for many years from McCloud River, California. Early in fish-cultural work, however, the purity of this subspecies was affected by admixture with other forms, principally from the Klamath River, and later from the Rogue River, Oregon (Coker, 1920: 6-7). The tendency to mix hatchery stocks is well known, as pointed out by Smith and Needham (1942: 24). It is probably impossible to determine when *irideus*, rather than *shasta*, began to be utilized for stocking, but all of the rainbow trout from Nevada which we have collected (since 1938) are referable to *irideus*.

In 1879-1880, 2,500 eggs of the "M'Cloud River Trout," furnished by the U. S. Fish Commission, were successfully hatched and placed in tributaries of the Carson River (Parker, 1881:4). This record appears to be the earliest of the rainbow trout in Nevada. Parker (1883: 9) said that he hatched this trout in western Nevada in 1881-1882 for distribution into waters of the State. In 1893-1894, the U. S. Fish Commission shipped 40,000 rainbow trout eggs to the Nevada Fish Commission (Anonymous, 1896: 67, 79). During the next 3 years a total of 141,614 eggs were shipped by the U. S. Fish Commission.

In May 1895, 75,000 rainbow trout eggs were shipped from the Berwick Fish Commission Station of California to Nevada, and another shipment of 125,000 eyed ova was received by the Nevada Fish Commission from the Berwick Station on March 6, 1896 (Mills, 1897: 5, 12). About this time, the Shasta rainbow trout had evidently become established in the Truckee River as Jordan and Evermann (1896: 502) remarked that this subspecies (listed by them as *Salmo irideus shasta*) had been introduced into that river.

In 1904-1905, 2,500 fingerlings, yearlings, and adults were planted in the Humboldt River at Elko (Anonymous, 1906: 19). According to Sumner (1940: 220), rainbow trout were introduced into the Truckee River in 1907 or 1908. However, the Truckee River was used for the taking of spawn for the greater portion of "rainbow trout" distributed in the year 1907 by the Nevada Fish Commission (Anonymous, 1909: 5). Since 1908, shipments of rainbow trout have been

made to Nevada each year, by the Federal Government. The total number of eggs and fish allotted to Nevada amounted to more than 11,000,000 during the period 1908-1941. A complete list of localities where rainbow eggs were procured is not available, but since 1920 the Nevada Fish and Game Commission has obtained additional rainbow trout eggs from: The Nevada Consolidated Copper Corporation, Ely, Nevada; U. S. Bureau of Fisheries, Springville, Utah; Meader Trout Farm, Pocatello, Idaho; F. V. Klinke, Fortine, Montana; Crystal Lakes Fish Hatcheries (no address given); Cape Cod Trout Company, Wareham, Massachusetts; Wild Rose, Wisconsin; Saratoga, Wyoming; Cedar Island Lodge, Brule, Wisconsin (Anonymous, 1921: 9; 1923: 11; 1927: 14; and 1938: 6).

This species is now widespread in mountain streams and rivers, in many of which it has brought about the disappearance of the native cutthroat trout (*Salmo clarkii henshawi*), as well as of other subspecies, through extensive hybridization. Snyder (1917: 85) indicated that the native trout gave way to rainbow trout in the rivers and lakes. Moreover, the two species have been artificially crossed and the hybrids liberated in various streams. Rainbow trout are known also from several lowland springs in the state.

6. *Salmo gairdnerii irideus* × *Salmo clarkii henshawi*. **Hybrid trout.** Prior to 1911 the Nevada Fish Commission experimented "for some five years with Hybrid trout, a cross between the Lake trout (*Salmo mykiss henshawi*) and the Rainbow trout (*S. iridius*)" (Anonymous, 1911b: 13). Between June 7 and August 15, 1910, 131,785 fry of this hybrid combination were planted (Anonymous, 1911b: 44-45) as follows:

Clear Creek, Ormsby Co.	3,000;
Stoney Lake, Ormsby Co.	5,000;
Truckee River, Washoe Co.	123,785.

In 1913 hybrids were planted in the Humboldt River near Elko and Golconda and in the Truckee River. An additional lot of 14,000 eggs was shipped to the fish hatchery near Ely in White Pine County, for distribution in that area (Anonymous, 1915: 28-30). No mention is made of hybrids from 1914 to 1919 inclusive but in 1920, hybrids of rainbow trout and blackspotted trout were distributed in the Humboldt River near Carlin and Elburz in Elko County (Anonymous, 1921: 17).

7. *Salvelinus fontinalis fontinalis* (Mitchell). **Common or eastern brook trout.** The circumstances of the early introduction of this species into Nevada seem to be obscure. Eastern brook trout were planted in Prosser Creek, in Nevada County, California, in 1875 (Smith, 1896: 434). Since this stream is a tributary of the Truckee River, some of these fish or their progeny could have entered Nevada. Smith stated further that brook trout had become acclimated in Marlette Lake, on the northeastern side of Lake Tahoe, by 1892; apparently the first plant in Nevada took place about 1880. Mills (1891: 4) re-

ported the seining of eastern or "red spotted" trout from Marlette Lake in the fall of 1889 and in 1890 for the purpose of obtaining eggs for the hatchery located at Carson City. In 1883, fry were planted in the Carson, Walker, Truckee, and Humboldt rivers and in Washoe Lake, with very good results. Large plants were again made in these streams (except Walker River) and in Lake Tahoe in 1891, 1892, and 1893. Since the turn of the century the species has been widely stocked. A total of 3,474,345 eggs and fish was received by Nevada from federal hatcheries between 1901 and 1941. In addition to these, many eggs have been purchased from other hatcheries and additional millions of eggs have been obtained from fish seined in Marlette Lake.

This species is now one of the most common and widespread of the trouts in Nevada and is especially common in the higher mountain streams.

8. *Cristivomer namaycush namaycush* (Walbaum). Common Lake trout or Mackinaw trout. In 1885, 100,000 eggs of this species were sent to the Nevada Fish Commissioner and apparently about three-fourths of these arrived in good condition (Smith, 1896: 433). It is probable that some of these were planted, but no accurate account of their fate is available. The first definitely recorded plant was made in 1889, in and around Lake Tahoe, and a later plant was made there in 1895 (Smith, *loc. cit.*). Mills (1897: 22) wrote that on May 28, 1896, 48,000 Mackinaw trout were planted in Lake Tahoe, Douglas County. This fish is now very abundant in Lake Tahoe (Curtis, 1942: 6) where it is accused of having greatly reduced or virtually eliminated the Lahontan cutthroat trout, *Salmo clarkii henshawi*, and the royal silver trout, *Salmo regalis*, particularly the latter species. In 1907-1908, 27,245 fry of this species were introduced into Walker Lake, Truckee River, and Lake Tahoe (Anonymous, 1909: 18-19).

CYPRINIDAE (MINNOWS)

9. *Cyprinus carpio* Linnaeus. Carp. The first definite record of the introduction of carp into Nevada is for 1881, when fish were distributed to two counties in the state (McDonald, 1884: 1126). Between 1882 and 1891, 2,763 fish were planted. Cary (1887: 8) said that carp were distributed to persons in Washoe, Eureka, Churchill, Lyon, Douglas, Lander, Ormsby, Humboldt and Elko counties in 1885 and 1886. After 1891 the introduction of this species was apparently terminated. As is well known, however, the damage had already been done. There is the possibility that carp were introduced as early as 1873 (or between 1873 and 1878) from California, since Poppe (1880: 665) stated that young of the carp established in California in 1872 were "sold to farmers throughout California and adjacent States. . ."

Many of the introductions made between 1882 and 1891 were very successful. In an early report Mills (1891: 5) stated, "Several years ago the U. S. Fish Commissioner very generously allotted carp to this

state. Both of my predecessors made the distribution as directed by the Commission. . . . I am informed that in several private ponds and reservoirs they have multiplied so rapidly that they have come to stay. . . . Another carp grower, Mr. Thomas Oliver, of Carson City, Ormsby County, was the recipient of one of these shipments. At his ponds, one mile south of Carson City, they multiplied so rapidly and grew so fast that he not only supplied his friends, but generously drew on his ponds for young carp to fill orders addressed to the Nevada Fish Commissioner, Mr. Parker. Mr. Oliver had made arrangements to enlarge his ponds when the earthquake of June 3, 1887, wound up business by leaving him without water or carp."

The high esteem in which carp were held in the early days is attested by the words of Pasco (1882) who wrote to the U. S. Fish Commissioner urging that carp be stocked in the streams around Belmont, Nye County, and who used his influence in restraining neighbors from planting cutthroat trout from Reese River. "When I tell you that last winter trout [presumably *Salmo clarkii henshawi*] came from Truckee and Walker Rivers embalmed in snow and ice, and sold for 37½ cents per pound, you will see that we have reason to be anxious about the matter. The big thing is to get a good start (to get the fish), get them to breeding and we will supply and stock the country. I would give \$5 for a pair that are big enough to spawn now. . . Last season I persuaded the man above me on my stream not to go to Reese River after trout, because I hoped sooner or later to get carp, and I did not want trout in the stream to eat the young."

This species is now very abundant in lower river courses, warm lakes (including Lake Mead), sloughs, and isolated springs throughout the state. It ascends the Humboldt River at least as far as Deeth, Elko County. Hall (1925: 158) and Bond (1940: 247) recorded carp as a food item of the white pelican in Pyramid Lake. Alcorn (1943: 35-36) found them in the stomachs of these birds in the vicinity of Fallon, Churchill County. This species was observed in excessive numbers in the Carson River between Dayton and the Lahontan Reservoir, and in the Walker River between Wellington and Walker Lake, in the latter part of August 1942. The "mirror" (partly scaled) and "leather" (few or no scales) varieties are not uncommon.

10. *Carassius auratus* (Linnaeus). Goldfish. Apparently there are no early records of the introduction of this fish into Nevada, although it is known that goldfish were introduced into the West before the turn of the century (1884 or earlier). Its widespread use as an ornamental aquarium fish suggests a means by which this species may have entered the waters of Nevada. Rather than kill their pets, owners have probably dumped them into the nearest water on many occasions; others have deliberately introduced them into ponds and springs. The utilization of this species as live bait may also account for its distribution in Nevada. In 1917 goldfish were planted in a reservoir near Las Vegas (Anonymous, 1919: 13).

This species has been taken in Big Shipley Spring, on the west side of Diamond Valley, Eureka County; in the upper spring ditch on Dairy Ranch just below McGill, White Pine County; and in the spring and outlet on Campbell Ranch, about 18 miles north of Ely, White Pine County—all in August 1938. Goldfish were present in 1939 in a spring-fed reservoir on Steve Collins' ranch in Ash Meadows, southern Nye County. This species was also noted by Hubbs in a small reservoir fed by a hot spring, 1.3 miles south of Cherry Creek (old town), in northern White Pine County. Goldfish are to be expected at other scattered localities throughout the state.

11. *Gila atraria* (Girard). **Utah chub.** This minnow was introduced by Mormon settlers into springs at Shoshone, Spring Valley, White Pine County, and on the Geyser Ranch in Duck (or Lake) Valley, northern Lincoln County, according to the testimony of John Yelland, old-timer at Ely. The same species occurs in springs on Murphy Ranch, along the western side of Steptoe Valley, White Pine County, almost surely as the result of another introduction (Hubbs and Miller, in press). The Utah chub is native to Nevada within the hydrographic basin of Pluvial Lake Bonneville, along the extreme eastern border of the state.

AMEIURIDAE (CATFISHES)

12. *Ictalurus lacustris punctatus* (Rafinesque). **Southern channel catfish.** Information on the early introduction of the channel catfish into the West is vague. In Nevada, this species is known only from the Colorado River drainage. It occurs in Lake Mead and below Boulder Dam (Moffett, 1942: 82; and 1943: 182) and also in Moapa (Muddy) River and probably in the lower Virgin River, both northern tributaries of Lake Mead. The earliest date of introduction into the Colorado River appears to be 1892-1893, when 722 adults and yearlings were received by the Arizona Fish Commission (Worth, 1895: 127). We have been unable to determine what happened to these fish. According to Game Warden Frank Wait of Las Vegas, this species was first introduced into the lower Colorado River about 1906 (personal interview). Channel catfish are now common in the lower Colorado River.

13. *Ictalurus catus* (Linnaeus). **White catfish.** This species may possibly have been introduced into Nevada with *Ameiurus nebulosus* in 1877. If it was, it did not become established.

About 1938 Mr. William A. Powell, Jr., Secretary of the Nevada Fish and Game Commission, caught on hook and line 39 large white catfish from Clear Lake (near Kelseyville), Lake County, California, and transplanted them to the vicinity of Fallon (personal interview). In 1939, 500 "blue catfish" were transferred from the California State Central Valleys Hatchery to the State of Nevada (Anonymous, 1941b: 88-89). Mr. Dill informs us that these fish were *Ictalurus catus*. According to Mr. Powell, he obtained 500 "rescued" fish of

was taken from the Elk Grove Hatchery, California, in 1939, and planted them in the vicinity of Fallon, both above and below the Lahontan Dam.

We have seen only two specimens of this catfish from Nevada. One was taken 6 miles north of Stillwater, Churchill County, on April 5, 1943, by J. R. Alcorn and V. L. Mills; the other specimen was collected by Alcorn in a drainage ditch 1 mile north of Stillwater, on August 15, 1941. Both were caught on hook and line. Vernon L. Mills, State Game Warden, reports that fishermen, as well as himself, have taken a number of the small white catfish.

Since this species is particularly adapted to large rivers, any further plants in Nevada should be made in large reservoirs. This species is called the "fork-tail catfish" in California.

14. *Ameiurus melas catulus* (Girard). Southern black bullhead. Two young of this subspecies were taken in Las Vegas Creek at Las Vegas, Clark County, on August 30, 1938. No information regarding their introduction is available.

15. *Ameiurus melas melas* (Rafinesque). Northern black bullhead. We have seen no records of the early introduction of this bullhead, unless some were mixed with shipments of the brown bullhead. This fish is now abundant in the Carson River below the Lahontan Dam, and in irrigation canals in the vicinity of Fallon. It occurs also in the lower Walker and Humboldt rivers, and was introduced in 1942 by V. L. Mills into the Reese River, about 10 miles west-southwest of Austin, from near Fallon.

16. *Ameiurus nebulosus nebulosus* (LeSueur). Northern brown bullhead. This species was one of the first fishes introduced into Nevada. According to Jordan and Evermann (1896: 140), *Ameiurus nebulosus* was first introduced into the Humboldt River about 1877. This statement is in agreement with Parker (1879: 3), who wrote that he planted the "Schuylkill River" variety of catfish in Washoe Lake in August 1877 and that in the same year he also stocked the Truckee, Carson, and Humboldt rivers. Those planted in the Humboldt River were placed not over 10 miles from Elko and also near Lovelock. Smith (1896: 385) erroneously attributed Parker's "Schuylkill catfish" to a different species, *Ictalurus catus*, because the common name "Schuylkill" was originally applied to that species. However, the California commissioners misapplied this common name to *nebulosus*, as shown in Smith (1896: 383), and apparently they passed the error on to Parker. The subsequent accounts (Smith, 1896: 385) of the remarkably rapid increase of the catfish introduced by Parker and of their size (1 to 1½ pounds) indicate without question that the species which became established was *Ameiurus nebulosus*.

Within two years the fish introduced by Parker had increased to such numbers that "other waters were stocked from the supply furnished in Washoe Lake" (Mills, 1891: 6). Federal shipments of

4,800 individuals of this and possibly other species were made to Nevada between 1908 and 1935.

This bullhead is rather abundant in the lower Humboldt, Truckee, Walker, and Carson Rivers and in Pyramid Lake (Snyder, 1917: 85; Hall, 1925: 158; Bond, 1940: 247). Some of the catfish (*Ameiurus*) recorded by Alcorn (1943: 35-36) from the Fallon area are probably of this species. This bullhead was also taken in Hiko Spring, Pahrangat Valley, Lincoln County, in August 1938. It is especially abundant in sloughs and reservoirs where it attains a length of one foot or more.

POECILIIDAE (TOP MINNOWS)

17. *Gambusia affinis affinis* (Baird and Girard). **Western mosquitofish.** This little viviparous fish, now one of the most widely distributed species in the world, was introduced from the vicinity of Los Angeles into the lower Carson River about 1934, by J. H. Kispert (personal interview). Vernon L. Mills told us that he also brought in a stock from the Sacramento Valley in 1934 or 1935. From Fallon they have been transplanted to Lyon and Douglas counties. The mosquitofish is also common in the Moapa River and along the shore of Lake Mead near the mouth of the Moapa River (observations of 1938-1942—in the last year by Carl L. Hubbs). Moffett (1943: 182) has recorded this fish from Lake Mead. A large sample was collected by Hubbs from a spring about 6 miles southwest of Las Vegas, Clark County, in August, 1938. This species was abundant in the outflow of Hinds Hot Springs, about 10 miles north of Wellington, Lyon County, in August, 1942. It does well in the many sloughs and shallow drainage ditches in the Fallon area where the people of that region consider it valuable in controlling mosquitoes and gnats and as food for large-mouth bass and other game fishes.

PERCIDAE (PERCHES)

18. *Perca flavescens* (Mitchill). **Yellow perch.** The earliest record of introduction into Nevada of this well known species is 1930, when 27 yellow perch were planted in the West Carson River near Genoa (Anonymous, 1931: 23, 37). This same report stated that 100 yellow perch, 5 to 6 inches long, were on hand at Verdi for distribution. Later reports made no mention of these fish. In 1930-1931, 150 fish were sent to applicants in Nevada (Leach, 1932: 683).

This species and the Sacramento perch (a true sunfish) have often been confused. The yellow perch is now common in Lahontan Reservoir and the lower Carson River drainage.

CENTRARCHIDAE (SUNFISHES)

19. *Micropterus dolomieu dolomieu* Lacépède. **Northern smallmouth black bass.** According to Smith (1896: 443), this species was first stocked in 1888 in Carson River, Washoe Lake, and a private reservoir

near Carson City. The attempted introduction was apparently unsuccessful and the species has been mostly replaced by the largemouth bass. The report of the Nevada Fish Commission (Anonymous, 1909: 11-12) made no mention of the smallmouth bass even though it gave a list of introduced bass and trout occurring in the state. This report mentioned only "Bass (Wide Mouth) *Micropterus salmoides*." The first account of the smallmouth bass in reports of the Nevada Fish Commissioner or the Nevada Fish Commission was for 1913, when 400 were sent to Stone Cabin, Nye County, on August 12, 1911 (Anonymous, 1913: 32). In this same report "Black-bass" are listed in the same column with, but under, "Small-mouth." This may indicate that all the black bass in this column are smallmouth. If so, smallmouth bass were planted in the Humboldt River near Winnemucca and Comins Lake, White Pine County, in October, 1911.

In 1885 Parker wrote, ". . . the species I have introduced which are now so plentiful and popular originally came from Lake George, New York. For a few years an erroneous opinion was entertained by many that it was the Sacramento perch but on comparing ours, weighing from three pounds, with the river perch the difference was apparent." This is the "white bass" of which he speaks. The true white bass is *Lepibema chrysops*, but, according to Greeley (1930: 72), only smallmouth bass occur in Lake George. Parker may have introduced yet another kind of fish but we are unable to identify his "white bass" and refer it tentatively to *Micropterus*.

Dr. Hubbs reports seeing this species along the shore of Lake Mead, near the mouth of Moapa River, on July 28, 1942. So far as known, this is the only recent record of smallmouth black bass in Nevada.

20. *Huro salmoides* (Lacépède). Largemouth black bass. It is not known when this fish was first introduced into Nevada. Cary (1889: 4) stated that black bass were planted in Washoe Lake and in the Carson River in 1887-1888. These fish were obtained from the Spring Valley Water Company of San Francisco, California. Although black bass were frequently mentioned in the early reports, no mention was made of the species involved. Many persons associate the name black bass with *Micropterus dolomieu*, the smallmouth bass, but after reading reports of the Nevada Fish Commissioner and Nevada Fish Commission, there appears to be no confusion here. The earliest publication (Anonymous, 1909: 6, 20) which distinguishes between the two species of bass indicated that 600 "Black Bass (Big Mouth)" were obtained from the California Fish Commission and along with 1,200 adults seined from two ponds near Reno were distributed in Esmeralda, Douglas, Lander, Washoe, Elko, White Pine, Churchill, Humboldt and Lyon counties in 1907 and 1908. Largemouth bass have been abundant in many parts of Nevada since 1910, and perhaps since 1900. During the period 1909-1941, 195,050 eggs and fish were sent by the federal government to Nevada. In the year 1939 alone, 80,000 fingerlings were planted in Lake Mead (Leach, James, and Douglass, 1940: 572).

In the same year 295 largemouth bass were transferred from the California State Central Valleys Hatchery to the State of Nevada (Anonymous, 1941b: 88-89).

This bass is now common in the lower portions of the Walker, Carson, Truckee, and Humboldt rivers. It is known also from the Colorado River in Lake Mead and below Boulder Dam (Moffett, 1942: 82; and 1943: 182), and in Moapa River.

21. *Lepomis cyanellus Rafinesque. Green sunfish.* In 1939, 300 green sunfish were transferred from the California State Central Valleys Hatchery to the State of Nevada (Anonymous, 1941b: 88-89). We have found no other record of introduction and no statement is available concerning the disposition of these fish. The green sunfish may well have been introduced along with or in place of bluegills, by error in identification.

Two specimens of this species were collected by Vernon L. Mills on May 25, 1943, from the Carson River at Coleman Dam, 2 miles northwest of Fallon. It was taken also in the Virgin River, Clark County, near the Utah border (September, 1938), in Moapa River (1942), and was seen by Carl L. Hubbs (July 28, 1942) along the shore in Lake Mead, near the mouth of Moapa River. Since this species is a serious competitor and does not grow to a large size, its further spread is not to be recommended.

22. *Lepomis macrochirus macrochirus Rafinesque. Common bluegill.* In 1909-1910, 150 fingerlings, yearlings, and adults of this species were planted in Olsen's Lake at Ely (Anonymous, 1911a: 102). This is the earliest record of introduction into Nevada which we have seen. In 1918-1919, 150 fish were stocked in Cottonwood Cañon Creek, near Fallon (Leach, 1920: 69). It is not known definitely that these fish were bluegills but presumably they were. Another plant was made in 1929-1930, and 640 fish, 4 to 7 inches long, were placed in the West Carson River near Genoa in 1930 (Anonymous, 1931: 23-37). Introductions of bluegills have been made into the lakes and reservoirs along the Carson, Humboldt, and Walker Rivers and in many other localities within recent years. According to a letter from O. Lloyd Meehan, the 280,000 sunfish sent to Nevada in 1940 and 1941 (Leach, James, and Douglass, 1941: 569, 603; 1942: 10, 24; and 1943: 14, 25) were of this species, and most if not all of those shipped between 1924 and 1938 were also bluegills.

One specimen was taken on January 28, 1943, from the stomach of an American merganser collected from the lower Carson River, where bluegills apparently are not abundant. We have not seen specimens from elsewhere in the state, although this species is common in Lake Mead (Moffett, 1943: 182).

23. *Archoplites interruptus (Girard). Sacramento perch.* This species, along with catfish, was one of the first exotic fishes planted in Nevada. Parker (1879: 3) stated that he stocked "Washoe Lake, in 1877, with Sacramento River Perch." Also, he "distributed in 1880

catfish and Sacramento river perch in Washoe, Humboldt, Churchill, Lander, Eureka, and Elko Counties" (Parker, 1881: 5).

According to Sumner (1940: 220), this species was introduced into Pyramid Lake in 1889 or 1890. It is quite likely, however, that the plants made in 1877 included Pyramid Lake as Mills (1891: 5) stated that "Walker, Pyramid, and Washoe Lakes are now fully stocked with Sacramento river perch." He wrote further, "They grow to about four pounds weight. . . . As yet but few have reached the weight named, but every year shows their increase in size and numbers."

Sacramento perch are rather common in the drainages of the lower Carson and Truckee rivers and in Walker, Washoe, and Pyramid Lakes (Snyder, 1917: 86; Hall, 1925: 158; Bond, 1940: 247; and Alcorn, 1943: 35-36). A sample of this species was taken in Big Blue Spring, on the west side of Big Smoky Valley, Nye County, in August, 1938. It was also common at that time in a lowland slough at Lusetti Ranch, about 16 miles north of Ely. This species is native to California.

24. *Pomoxis nigro-maculatus* (LeSueur). Black crappie. Although we have no specimens of this fish from waters in Nevada, it is known to occur in Lake Mead (Moffett, 1943: 182) and crappies have been introduced into the state on several occasions since 1924. Its inclusion in this list is therefore justifiable. In the reports of introductions, the U. S. Bureau of Fisheries listed only "crappie," a name which includes the white crappie (*Pomoxis annularis*) as well as *P. nigro-maculatus*. Five hundred crappies were liberated in the West Carson River near Genoa in 1930 and 250, 3 to 5 inches long, were on hand at Verdi for distribution in Nevada in 1930. Later reports made no mention as to the distribution of these fish (Anonymous, 1931: 37). A planting of 2,200 was made in 1924-1925; 750 in 1930-1931; and 500 in 1932-1933. No data are available regarding the fate of these plants. The record for Lake Mead is based on a single specimen collected by R. K. Grater on September 12, 1940, at Temple Bar, Arizona, and deposited in the museum of the Boulder Dam National Recreational Area. This specimen was examined by the senior author through the courtesy of Superintendent Robert H. Rose.

II. SPECIES UNSUCCESSFULLY INTRODUCED

THYMALLIDAE (GRAYLINGS)

1. *Thymallus signifer tricolor* Cope. Montana grayling. According to Leach, James, and Douglass (1942: 10; and 1943: 6) 50,130 eggs of this species were sent to the Nevada Fish and Game Commission in 1941.

By inquiry to the U. S. Fish and Wildlife Service, we learned that these eggs were shipped from Yellowstone Park and received by the Elko County Fish Hatchery at Ruby Valley, Nevada, on June 20, 1941. Mr. Don Griffith, Hatchery Superintendent, writes in a letter

dated January 9, 1944, that 15,000 of the original 50,000 eggs were planted in a large spring near the hatchery, and that part of this planting may have survived as the spring empties into Ruby Lake. However, he and Mr. Herbert Dill, Refuge Manager of the Ruby Lake National Wildlife Refuge, have no evidence that this initial plant was successful. Another attempt to establish grayling is planned for a later time.

Mr. W. A. Dill has called our attention to a publication (Anonymous, 1907) in which the statement is made (p. 43) that fry hatched in California from a shipment of Montana grayling eggs received in 1906 were planted, among other places, "... in the Tahoe region...". It is therefore possible that grayling were planted on or near the Nevada-California line about 1906.

No characters have been found to distinguish the Montana and Michigan grayling and therefore both are referred to the same subspecies.

CLUPEIDAE (HERRINGS)

2. *Alosa sapidissima* (Wilson). **Common shad.** During 1884, 1885, and 1886, relatively large plantings of shad were made in the Colorado River in a vain effort to establish this species (Smith, 1896: 406-407). The introductions were made at "The Needles," Arizona, probably about 15 miles below the present town of Needles and only a short distance below the Nevada boundary. Hence it is assumed that some of these fish once occurred in that portion of the Colorado which marks the southern border of Nevada. Apparently none of the fish liberated have ever been recaptured and no later plants have been made.

COREGONIDAE (WHITEFISHES)

3. *Coregonus clupeaformis clupeaformis* (Mitchill). **Great Lakes whitefish.** According to Smith (1896: 394), this fish was introduced into Lake Tahoe in 1877 and again in 1879. Parker (1879: 5) wrote that the U. S. Fish Commissioner shipped 250,000 Lake Michigan whitefish spawn to Nevada in February, 1877, but the spawn, on arrival, "was found to be literally cooked," and a total loss. During the season of 1880, the U. S. Fish Commission sent 25,000 eggs to Eureka, but no records of hatching and distribution are available. Results of later introductions were apparently nil and the species has not been taken in subsequent years.

SALMONIDAE (TROUTS)

4. *Salmo salar sebago* Girard. **Landlocked salmon.** This is the subspecies of Atlantic salmon propagated in Maine. It was reported to be formerly abundant in Nevada after its early introduction into Lake Tahoe in 1881 and into the Truckee and Carson rivers in 1883 and 1891 (Smith, 1896: 431). Mills (1891: 7) reported that he received 25,000 eyed ova of this fish on March 5, 1889, from the U. S. Fish Commissioner. He does not say where they were planted after hatch-

ing. The last shipment of eggs was received at Carson City on March 7, 1892. This species has not been recorded in recent years.

5. *Salmo clarkii stomias* Cope. **Greenback cutthroat trout.** During the season of 1892-1893, 4,925 adults and yearlings of cutthroat trout were planted in the Humboldt River near Elko, Nevada (Worth, 1895: 132). The only trout of this species (then called *Salmo mykiss*) propagated by the U. S. Fish Commission during the fiscal year 1893 were raised at the Leadville Station, Lake County, Colorado. Worth (1895: 116) indicated that the stock came from streams and lakes in the region (presumably solely from the Arkansas River drainage). This subspecies, originally described from the South Platte River, was common in 1889 in the upper tributaries of the Arkansas River and in Twin Lakes, Lake County, Colorado (Jordan, 1891: 12-13). Another form, the yellowfin cutthroat trout (*Salmo clarkii macdonaldi*), also occurred at that time in Twin Lakes, but the records given by Worth clearly indicate that these two fish were handled separately. It is, however, entirely possible that *macdonaldi* may have been included in the shipment to Nevada or even that another subspecies (such as the Colorado River cutthroat trout, *Salmo clarkii pleuriticus*) was introduced. The available evidence points most logically to *stomias*. Whatever form was planted evidently either did not become established or was thoroughly intermixed (and thus largely excluded) by crossing with the then abundant native cutthroat trout, *Salmo clarkii henshawi*.

6. *Salmo gairdnerii gairdnerii* Richardson. **Columbia River steelhead trout.** This subspecies is presumably the fish introduced in 1904-1905 and 1908-1909 under the name of steelhead trout, and again during the fiscal years 1923 and 1924 under the name of steelhead salmon. We have seen no specimens referable to this subspecies.

7. *Salmo aqua-bonita* Jordan. **Golden trout.** Shebley (1919: 38) reported that, "A shipment of golden trout was planted in Lake Tahoe. . .". This planting was made in 1918. During the summer of 1919, 250,000 eggs of the golden trout were shipped from the Mount Whitney Hatchery in Owens Valley, California, to the Lake Tahoe Hatchery. "The resulting fry were carefully reared and planted in the streams flowing into the lake, where conditions appeared to be most favorable for them. If the golden trout thrive in the waters of Lake Tahoe, it will mean much to the anglers of the state, who enjoy the fishing in this region." (Shebley, 1921: 33).

So far as is known, no golden trout have since been caught in Lake Tahoe or in the Truckee River below the lake, where some plants may also have been made.

Mr. Dill kindly supplied the information on golden trout.

8. *Oncorhynchus keta* (Walbaum). **Chum or dog salmon.** During the fiscal year 1939, 252,000 eggs of this species were sent by the Federal Government to the Nevada Fish and Game Commission (Leach, James, and Douglass, 1940: 565). These fish were successfully hatched and planted in 1939 as follows: 200,000 in Churchill County (probably Lahontan Reservoir), 30,000 in Mineral County (probably Walker

Lake), and 10,000 in Washoe County (probably Truckee River) (Anonymous, 1941a: 15). No records of the occurrence of this species in the state are known and none are to be expected.

9. *Oncorhynchus tshawytscha* (Walbaum). **Chinook or Quinnot salmon.** In March 1879, 250,000 eggs of this species were sent from the hatchery on McCloud River, California, to Nevada. Of these, 50,000 were lost in hatching and transportation so that only 200,000 young fish were actually introduced. Of this number 190,000 were distributed from Reno into Truckee River and 10,000 from Carson City into Carson River (Smiley, 1884: 835, 883). One lot of "Royal Chinook spawn" was received by the Nevada Fish Commission on October 1, 1908. A second lot of 100,000 of the spawn of these fish was received on October 28, 1909, and a third shipment of 100,000 spawn arrived on November 4, 1910. All of these three shipments were donated to the State of Nevada by the State of Oregon (Anonymous, 1911b: 12, 13). After hatching they were planted in Tahoe, Pyramid, and Walker Lakes, and in the Truckee River. Although Snyder (1917: 79, 85) reported the capture of a king salmon in 1911 in the Tahoe region, the plants were obviously predestined to failure.

10. *Oncorhynchus kisutch* (Walbaum). **Silver or Coho salmon.** This member of the Pacific salmon was planted in the lower Truckee River on June 27, 1913 (Snyder, 1917: 85) from a shipment of 50,000 eggs sent to Verdi during 1912-1913. At the same time, 50,000 eggs were received at Carson City and plants were presumably made in the Carson River. This plant met with no more success than the previous attempts to establish species of *Oncorhynchus*.

11. *Oncorhynchus nerka* (Walbaum). **Sockeye or red salmon.** In 1936, 60,000 of these fish were distributed in Churchill County (Lahontan Reservoir) and 40,000 in Mineral County (Anonymous, 1936: 12). In the fiscal years 1936-1938, inclusive, 280,000 were distributed to Churchill County, 45,000 to Lyon County, and 70,000 to Mineral County (Anonymous, 1938: 17). In 1938 an additional 170,000 were sent to Churchill County and 100,000 were distributed in Douglas County (Anonymous, 1941a: 15). We have seen none of these specimens and the species is unknown to fishermen in the area.

CYPRINIDAE (MINNOWS)

12. *Tinca tinca* (Linnaeus). **Tench.** In February 1885, 20 individuals of this European minnow were sent to a private applicant in Virginia City (Smith, 1896: 403). No other record of introduction is known to us and this species has never been recorded from any waters of Nevada.

CYPRINODONTIDAE (KILLIFISHES)

13. *Cyprinodon nevadensis* Eigenmann and Eigenmann. **Amargosa pupfish.** Between December 31, 1940, and February 18, 1941, 20 specimens of a *Cyprinodon* collected near Las Vegas were sent for identification to the University of Michigan Museum of Zoology. At first they were believed to represent an undescribed form, but on thorough

study their identity with *nevadensis* became certain. This species is confined to the Amargosa River basin of eastern California and southwestern Nevada (Miller, 1943). The specimens were all taken from a "spring" on the Las Vegas golf course in Clark County. An intensive search for additional specimens was made at this locality in October, 1942, but none could be found. The so-called spring is a seepage area fed in part by artesian overflow and in part by overflow from ponds at the Las Vegas Station of the U. S. Fish and Wildlife Service, just to the west. Presumably, this small species was introduced from the Amargosa basin, California, as a forage fish for bass and sunfish propagated at the station.

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