

IMPACTS OF THE 1976-77 DROUGHT ON NORTHERN NEVADA FISHERIES

Patrick Coffin
Nevada Department of Fish & Game
Elko, Nevada

Abstract.

Evaluation of the drought impact upon Nevada waters entails an area of 110,000 square miles and 900 waters.

Analysis of six key hydrographic regions including the Snake River Basin, Humboldt River Basin, Isolated River Basins, and Truckee, Carson, and Walker River Basins of Western Nevada provided data concerning the drought impact within Nevada. The Snake River Basin of Northeastern Nevada was lightly affected by the drought with below average precipitation only in 1977. The Humboldt River Basin was lightly involved in the drought in 1976 and seriously involved in 1977. Eighty-six percent of the streams checked had higher or similar population levels to those found in 1957.

The Central Nevada Isolated Basins have no major streams although 195 small streams are present

Streamflows were below average in 1976 and 1977, but the impacts on the stream fisheries were minimal.

The Truckee, Carson, and Walker River Basins were the most seriously impacted in Nevada. Streamflows from the Sierra Nevada Range into Nevada were much below normal in both 1976 and 1977. Many reservoirs were drained or drawn to minimum pool. Streamflows were low and water temperatures high by late summer. This increases predation by birds and man. The drought of 1976-77 was not as serious as the droughts of 1959-60-61 and 1953-54-55. Trout stocking programs were carried out earlier than usual in 1977. Stome stocking was cancelled in anticipation of problems.

INTRODUCTION

When I agreed to give this report on the impacts of the 1976-77 drought in Nevada I did not fully anticipate the scope of the project. Nevada is a large state of 110,000 square miles with an estimated 900 fishable waters. Time limitations made it necessary to drastically compress the report. The data presented in this report will relate to the northern two-thirds of the state from 38° Latitude through 42° Latitude and encompassing about 64,000 square miles. The southern portion of the state is generally dry and the primary waters encompass the Colorado River Basin which has its source outside Nevada. The application of the term "Great Basin" has been used to describe

this large segment of Northern Nevada with interior drainage stream systems. The area consists of a series of north-south oriented block-fault ranges with interlying valleys. The mountain ranges are 50 to 100 miles in length and frequently have peaks in excess of 10,000 feet elevation. Most of the valley bottoms range from 4,000 feet in the south to about 6,000 feet in the north.

Along the northern margin of Nevada we find the Columbia Plateau sweeping into Nevada and providing several significant stream systems which supply water to the Snake River System. This area differs from the Great Basin in several respects including mountain formation and water quality.

In West-central Nevada the state is invaded by the Sierra Nevada Range providing the state with several peaks in excess of 10,000 feet elevation and creating a "rain-shadow" which has a dramatic effect upon the precipitation just east of the Sierras.

Nevada is the most arid state with precipitation ranging from less than five inches per year in the southern valleys to about 12 inches per year in the northern valleys. Precipitation is lightest over the lower parts of the western plateau, a series of long valleys extending from the State border opposite Death Valley northward to the Idaho State Line. Nevada's precipitation generally occurs during the winter season as snow and is heaviest in the western and northern mountains. This mountain snowpack forms the main source of water for annual streamflow (Brown, 1960). The segment of Nevada being evaluated within the 64,000 square miles north of the 38° Latitude has 872 surveyed fishable waters. Six hundred sixty-two of these fishable waters are streams of which 634 have less than 15 cfs average minimum flow (August-October). Another 29 streams have average minimum flows in excess of 15 cfs and these are all located in extreme Western and Northeastern Nevada (McNeely Jr., 1973).

In attempting to find a way to evaluate the varying areas of Nevada I found the drought itself varied considerably by area. An evaluation by hydrographic region appeared to have the most promise for tying logical water units together. Nevada has 14 hydrographic regions and these are divided into 232 hydrographic areas or sub-basins. Emphasis will be placed on six hydrographic regions and three of these will be evaluated as one complex because of their relationship to the Sierra Nevada Mountains. The hydrographic regions which will be evaluated for drought impacts include: Hydrographic region 3, Snake River Basin of Northeastern Nevada; Hydrographic region 4, Humboldt River Basin of Northcentral Nevada; Hydrographic region 10, all of Central Nevada's small isolated interior drainages; Hydrographic regions 6, 8, and 9, which include the Truckee, Carson, and Walker River Basins (McNeely Jr., 1973).

DISCUSSION

Hydrographic Region 3 - Snake River Basin

This hydrographic region encompasses 5,230 square miles along the Idaho-Nevada State Line with a total population of about 1,700 in five small communities and isolated ranches. (Nevada Department Human Resources, 1975). This segment of the Columbia Plateau has 124 fishable streams and 21 lakes, primarily irrigation supply reservoirs. Only six of the streams have average flows in excess of 15 cfs minimum flow (August-October) and the largest lake is 72,500 acre-foot Wildhorse Reservoir.

Most of the 118 small fishable streams within the region flow into one of the six larger streams either in Nevada or in Idaho. Water discharge stations for five of these larger streams indicate they have an average annual discharge of 91,114 acre-feet and an average flow of 125 cfs. (USGS, 1977) Streamflows for these key streams in 1975 was 239% of average, 1976 was 125% of average, and 1977 was 50% of average. This data indicates the drought did not impact the Snake River Basin of Northeastern Nevada until 1977. The normal low flow period is July, August, and September on these streams. Streamflows within this region showed little impact from the drought except in the smallest desert streams, which are frequently intermittent even on normal water years. The fish populations remain viable by surviving in the small pools which are present in the intermittent stream sections and the continuously flowing upper reaches which frequently provide less than 1 cfs of flowing water.

The largest and most significant reservoir in the basin is Wildhorse Reservoir which has historically provided some of the best trout fishing in all of Nevada. This maximum capacity 72,500 acre-foot reservoir has a general winter storage level of approximately 52,000 acre-feet. The storage in 1976 was down about 10% below average and in 1977 the storage dropped to 20,000 acre-feet by October 1 or 38% of average. (USGS, Unpub.) This storage provides adequate habitat for fish and still maintains the quality of the fishery.

Twenty other small reservoirs within the basin had approximately 20 to 50% of their storage remaining by October 1, 1977, and no known fish losses occurred.

Hydrographic Region 4 - Humboldt River Basin

The Humboldt River Basin encompasses most of North-central Nevada with an area of about 17,000 square miles or about 15% of the state and a population of about 25,000. (Nev. Div. of Water Resources, 1974) This region has 165 fishable streams and 43 lakes.

Six streams are present which have an average minimum flow of more than 15 cfs. The largest stream in the hydrographic region is the Humboldt River which has an average flow of 213,000 acre-feet or 294 cfs near Winnemucca.

Water discharge stations for six of the major tributaries of the Humboldt River indicate they have an average annual discharge of 43,348 acre-feet and an average annual flow of 59.8 cfs. Streamflows for these key streams in 1975 were 127 to 235% of average, 1976 was 75 to 97% of average, and 1977 was 15 to 50% of average. The drought did not have a serious impact upon the streams of the Humboldt River Basin in 1977 even though low flows during July, August, and September produced some losses in the smallest of the streams flowing less than 3 cfs. Some of the 159 small feeder streams are intermittent to dry through lower reaches of their course annually. Stream surveys were conducted on small streams in this basin in 1977 as part of a statewide stream habitat survey and population inventory project. Comparison of data on fish populations with data found in our original stream survey project in the mid-1950's revealed that fish populations were generally higher in 1977 than earlier. About 57% of the streams had higher populations, 29% were similar status to the 1950's and 14% had decreased. One low population stream in 1957 had no fish in 1977, and fish were observed dying and in distress in intermittent sections of another stream which had a high population (up 400%). Although total fish populations were higher in the streams, the catchable

(6"+, 15.2 cm) segment was frequently lower than in the previous study. About 71% of the streams had less catchables than in 1957. Some areas of streamflow loss occurred on the alluvial fans at the foot of the mountains and populations in these areas either moved or were lost.

Analysis of long term water flow records indicate the drought of 1959, 60, 61 had much more impact both in total streamflow and the seasonal low flows in July, August, and September. This was then followed by the drought of 1953-55 in severity. September mean streamflows were lower in both these droughts than during the current drought for the Humboldt Basin.

The region has 43 reservoirs, lakes, and ponds, but only 13 had more than 500 recreational visitors in 1970. The largest water is Ryepatch Reservoir near Lovelock with a usable irrigation capacity of 172,000 acre-deet. Storage on October 1, 1977, was about 50,000 acre-feet or 56% of the 15 year average storage of 89,000 acre-feet. Most of the smaller reservoirs in the basin were drawn to low levels, but not critical for fish survival. One reservoir had a die-off of carp, but no reported gamefish losses, and one is expected to have winterkill from low water levels.

Hydrographic Region 10 - Isolated Central Basins

The Central Nevada BASins have an area of about 44,770 square miles or over one-third of the state and has a population of 17,000. The entire region is composed of many small, closed basins in which water flowing from the mountains becomes trapped in the valleys and is subsequently lost through evaporation and transpiration. (Nev. Bureau Env. Health, 1975) There are no major streams and there is no surface water flow between adjoining valleys. There is only one large fishable lake, the 13,500 acre Ruby Marshes. A total of 195 small streams are present within the region, all of which have an average annual discharge of less than 10 cfs. These small mountain streams are swift, and clear in their upper reaches, but slow considerably upon leaving the mountain and frequently disappear on the alluvial fans after the completion of spring runoff. Small reservoirs and ponds have been constructed in many cases to contain water for later irrigation in these basins. A total of 40 small lakes and reservoirs occur within the region which provide fishing, and only six have more than 500 visitors days per year.

Water discharge stations for five key streams within the region indicate they have an average annual discharge of 6,076 acre-feet and an average annual flow of 8.38 cfs. In 1975 these small streams produced above average flows to the point of extensive flooding. In 1976 streamflow was below normal and in 1977 the streamflow was 35 to 40% of normal.

Water flow measurements on 26 of the small streams within this region during July-December 1977 indicated that late flows were generally near normal despite the drought. The major flow losses were during spring runoff. Fish populations in these small mountainous streams showed little impact from the drought, although some areas of streamflow loss occurred earlier than normal on the alluvial fans. A fish population decrease of 25% was observed in one stream where electro-shocking has been conducted every year. The water is closed to fishing. The population decrease primarily occurred on the alluvial fan.

The one large lake in the region, Ruby Marsh, showed no fish loss although water levels were down about $1\frac{1}{2}$ feet by fall. The small irrigation reservoirs were utilized extensively, but most have fish survival pools present. Only a few documentations of fish loss occurred. One reservoir outlet gate was closed in November and fish from the reservoir were stranded in the stream below and a second reservoir was drained during the summer and trout died. Loss of fish by these problems can be an annual occurrence and probably were increased only slightly by the drought.

Hydrographic Regions 6, 8, & 9 - Truckee, Carson, and Walker River Basins

These three hydrographic basins of West-central Nevada entail the primary water areas of a nine county segment of Western Nevada with a large cosmopolitan population centered around Reno, Sparks, and Carson City. The principal stream drainage is from the east slope of the Sierra Nevada Range into West-central Nevada lakes and marshes.

The total number of waters involved within this area is not large, but the size of the streams and the total volume of water is the largest in Northern Nevada. The largest stream in the system is the Truckee with an average discharge of 800 cfs at Farad, while the Carsons and Walkers all have average flow ranging from 145 to 400 cfs. An additional 66 small streams with an average minimum flow of less than 15 cfs are present in addition to the 16 large streams.

Water discharge stations for seven of the largest streams indicate they have an annual average discharge of 234,850 acre-feet and an average annual flow of 324 cfs. Streamflows for these key streams in 1975 were 127 to 159% of average, 1976 flows were 7 to 35% of average, and 1977 were 3 to 24% of normal. The drought impact in Nevada as related to streamflow was by far the most serious in the Sierras and the waters influenced by this snowpack.

Average low flow periods for the Truckee River are later than observed in most waters in Nevada with low discharge in the period December through February. Evaluation of long-term flow records for the Truckee River is indicative of other Western Nevada streams and they indicate the drought of 1976-77 was not as serious as the drought of 1959 through 1961 nor the drought of 1953 through 1955. Total flow and low flows were both lower in the previous droughts than the one just past. As a matter of record the drought of 1959 through 1961 continued on the Truckee system with below average water through 1964, encompassing a six year period of below normal water. In 1961 total flow from the Truckee River in acre-feet was less than occurred in 1977 and flows in 1959, 1960, 1962, and 1964 were less than what occurred in 1976. (Hofman, 1963)

The small streams which feed the major waters showed no serious impact. Flows were below normal, but no fish loss was reported. Impacts upon some of the larger streams were evident during the low flow period of July-August-September. Flows were generally continuous, but less than average, water temperatures were elevated, and population sampling indicated fish numbers were down. Water temperatures were measured at 81°F. (27.2°C.) in the West Walker River, but trout were evident. Most streamflows were actually higher than anticipated. (Personal communication Ted Frantz) The most direct impacts observed were related to irrigation supply reservoirs and overflows from irrigated areas.

With a two year water shortage in Western Nevada most usable irrigation water was depleted. Weber Reservoir on the Walker River was completely lost while Topaz and Lahontan were very low. Areas using irrigation overflow for fisheries were seriously impacted. Large sections of Stillwater Marsh east of Fallon were dry. Approximately 10 small ponds on the Mason Valley Wildlife Management Area were dry, and Little Washoe Lake between Reno and Carson City was dry. These waters had a reported angler harvest of 58,446 fish in 1976. In addition, several thousand fish were lost when water was diverted between channels on Sweetwater Creek. Several reservoirs in California were also drained this year, providing direct impacts upon Nevada streams and lakes. Hatchery trout stocking in Nevada lakes and streams was carried out earlier than normal this year in anticipation of serious drought impacts in late summer. Early angler harvest of these fish probably minimized losses by predation during the low flow periods when the fish were crowded in the few pools available. In review the most serious impact in Nevada occurred in the Westcentral basins where two severe drought years depleted irrigation reservoirs. Fish loss was most serious in marshes and small ponds where water was not available as an overflow from irrigation. Irrigation storage reservoirs without minimum survival pools were lost such as Weber and Bridgeport Reservoirs, and most with storage pools were drawn to or near these levels. Lake Tahoe was drawn below the flow level for the first time since October 1961 and Lahontan Reservoir near Fallon had 7% of average storage. Reviewing nine key lakes and reservoirs either in Nevada or associated with Nevada waters the storage as of October 1, 1977, ranged from 0 to 38% of average levels, with the higher levels in the Northeast.

CONCLUSIONS

The two year drought in Westcentral Nevada with its high demands for domestic and irrigation water seriously impacted reservoir storage and irrigation overflow fisheries. Streamflows were low, but continuous resulting in minimal fish losses in the streams. In reviewing the total water supply picture in Nevada the following conclusions are evident.

1. Westcentral Nevada reservoir storage was severely depleted from the two year drought causing very significant fish losses.
2. Spring runoff flows were most severely altered by poor snowpack and streamflows during late summer periods were not significantly lower than average.
3. The drought of 1976-77 was not as serious in Nevada as the drought of 1959-60-61 when many fisheries throughout the state were lost.
4. The 200% of average runoff of 1975 is considered more harmful to fish and their habitat in the long run than was the 1976-77 drought.
5. Hatchery stocking programs can be adjusted readily to work around drought problems.

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