Kings River Fisheries News

Welcome To 'Fisheries News'

These are exciting times on the Kings River. In the 14 decades since the region's use of Kings River water began, never has so much energy been directed toward enhancing the river's fish, wildlife and environmental resources.

Hundreds of thousands of working hours and millions of dollars have been devoted over the past several years to intense scientific study by the California Department of Fish and Game, Kings River Conservation District, Kings River Water Association, U.S. Army Corps of Engineers and other agencies.

This important work has been wide ranging. It has including field investigation, data collection and sophisticated computer modeling. An enormous amount of knowledge about the Kings River and its habitat has been, and continues to be, collected. The effort is laying the groundwork for more effective ways to manage the Kings River's fish and wildlife resources. It's also already resulting in environmental improvements.

The Kings River, valued for its fishery resources, flows northeast of Centerville

KINGS RIVER FISHERIES NEWS will explain important facts about the river's natural history, the Kings' important beneficial uses, and why and how these studies are being conducted.

Our newsletter is a publication of the Kings River Conservation District, with the cooperation and participation of the California Department of Fish and Game and the Kings River Water Association.

Your comments and questions are welcomed. Please write to the Kings River Conservation District at 4886 E. Jensen Avenue, Fresno, California 93725.

Spring 1998

Volume 1, No. 1

Inside this issue...

How Its Development Shaped The Kings River

Understanding the Kings River and its many issues has never been easy. As the river has wound its way through the region's history and development, it has been intertwined with complexities.

No natural component meant more to the settlement and advancement of what are now parts of Fresno, Kings and Tulare counties than the Kings River's water. From a very early time, more than a century ago, most of the Kings River's water was spoken for by those who sought to bring vitality to a thirsty land.

That same water's beneficial use, so vital to life on a mostly rainless prairie, was accompanied by decades of legal and political battles that required long, dif-

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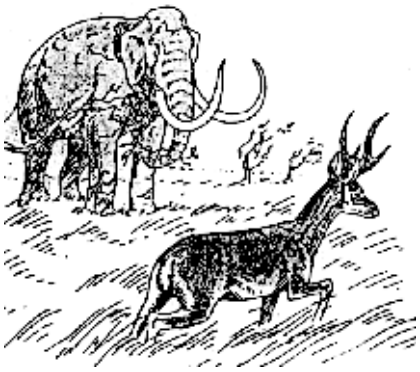
Kings River Fisheries In Historical Perspective

Part I: Setting the Stage

By
Dale Mitchell,
California Department of Fish and Game



Eleven or twelve million years ago, off the shore of a great land mass that is now California, two great ocean-floor masses slowly drew together and collided. At an imperceptibly slow rate, the eastward-moving Pacific Plate began to plunge beneath, and lift up the westward-moving North American Plate, and at the interface, the ocean sediments were scraped up into a pile, just as if a great razor had scraped back the surface of the ocean floor. The sediment scrapings aligned along the seam between the two plates, continuing to grow as the two great plates progressed.

The sediment piles became high enough to emerge above the ocean surface. Rising into a continuous ridge, the Coast Range, they would eventually hold back the ocean and isolate an interior basin to the east. The basin would rise and fill in with sediments, eventually becoming the Central Valley. Originally, its southern end was filled with sea water, along with sharks, clams and other oceanic life forms.

At that time, there was nothing to impede the path of landward-moving storms. They would have crossed the interior lake toward the low mountain range to the east, the early Sierra Nevada. The storms would rapidly erode the Sierra, and deposit their fine sediments, along with fresh water, into what would eventually become a freshwater Tulare Lake.

The lake's saline water gradually became diluted, and fresh water dominated near the river mouths. At these locations, the muddy lakeshore would have borne the tracks of wooly mammoths, strange four-horned antelope, small camels and other early mammals of the Pleistocene Epoch, which aggregated there, seeking the fresh water and its luxuriant vegetation.

On the lake bottom was formed a 150-foot-thick, impermeable clay layer that we now call the "Corcoran clay" or "E-clay". This clay effectively sealed the soils beneath the lake, allowing little or no moisture to percolate downward.

As the Coast Range heightened, its mountains nudged eastward-moving storms northward and, in their growing rain-shadow, rainfall gradually decreased. By then, Tulare Lake had become a great expanse of brackish water. The sharks and other salt-water fishes had disappeared, being out-survived by brackish-water-tolerant species.

Over the next eight million years, the same continental plate collision that raised the Coast Range progressed, causing westward tilting of the Sierra Nevada range and raising its eastern edge to nearly its present height. This was high enough to capture, in seasonal snowfall, the moisture from upper atmospheric storms which had made it over the Coast Range. Gradually increasing fresh water would come down the Kings and other rivers, diluting the brackish lake water. Eventually, with

few exceptions, the brackish fish species gave way to freshwater species. The seasonality of the snow-melt set up annual migratory patterns among the resident fishes of the Tulare Lake and its tributary rivers.

Runoff from the steepening Sierra Nevada slope, aided by the glaciation of several ice ages, eroded the mountains, delivering coarse sediment to Tulare Lake. The Corcoran clay became deeply buried and the lake's area and depth were reduced.

Great alluvial fans formed. Eventually the merged, westward growing fans from the Kings and San Joaquin rivers met the eastward-growing fan from the Arroyo Pasajero, to form a transverse ridge across the valley. Ever since, this ridge has held back the waters of Tulare Lake in all except the wettest years.

In concert with the underlying Corcoran clay, the barrier ridge sealed off the water of Tulare Lake, creating a gigantic evaporation basin. Despite dilution occurring from constant fresh water inflow, the evaporation process, for centuries, continuously deposited prehistoric oceanic minerals and salts into successive layers of lake-bottom soil.

Over this time, the Kings River deposited a delta of sediments that divided its flow into two main valley-floor branches. Its south fork delivered most Kings River water directly into the Tulare Lake, while a more northern branch conveyed a smaller amount of water between the merging Kings River and San Joaquin River alluvial fans, into a small natural lake.

Early California explorers called this the *Summit Lake*. The San Joaquin fan being larger, it deflected most of the overflow from Summit Lake southward into Tulare Lake. In extremely wet years, however; the outflow from Tulare Lake was sufficient to overcome this flow and reverse it. Water would then over-top the transverse ridge and flow to the San Joaquin River.

It would be remiss to discuss Tulare Lake outflow without mentioning the probability that the valley's outlet may not always have been through the Golden Gate, as it is now. It is thought that at times in the geologic past, a major outlet of the Tulare Lake was the Salinas River, flowing into Monterey Bay through a gap in the Coast Range. Evidence of this exists in: (1) similarity of fish species across that landscape, (2) the presence of the San Andreas Fault, (3) the existence of Monterey Canyon, a disproportionately large undersea erosional canyon at the mouth of the Salinas River, (4) linguistic similarities between native people of the coastal and valley areas, and (5) widely consistent legends, handed down through centuries by native Yokuts people, as told to early California explorers.

So, after *eleven-thousand millennia*, the physical stage was finally set for the Kings River fisheries, as we know them today. Our present-day fisheries have occupied only a heartbeat in that incredible geologic life span.

Regardless of its outflow locations, the slow transition of Tulare Lake from salt water, to brackish and then to fresh water, was an important progression, one that affected the natural sorting of fish species that eventually would inhabit the interior lake and its tributary streams.

Relicts of past oceanic influence reappeared sporadically in the Kings River and Tulare Lake fisheries, in the form of occasional invasions by anadromous (ocean-linked) species like salmon or steelhead. As expected, the occurrence of anadromous fishes was mostly a matter of access and timing—whether or not passable water connections existed in any given sequence of seasons.

Trends in climate, changes in the lake's salinity, size or temperature, or historical variations in the barrier ridge always affected access conditions and, thus, determined the presence and importance of anadromous fishes in the basin.

Today, the Kings River still has relict brackish water species; left isolated over geologic time by changing surface topography and hydrology, and then forced to adapt their genetics and behavior in order to survive the ever-changing conditions. These relicts are represented in the fish fauna, and also among clam and mussel species still found in the Tulare-Kern Basin.

Today, the Kings River is still within the Coast Range rain-shadow, and the thrust of most storm systems continues to bypass this watershed to the north. Add to this the existence of the *Mid Pacific High*. This major subtropical high-pressure system annually forms about 1,500 miles southwest of California, and buffers most of the early-spring storm systems northward into Oregon and Washington. This combination renders the Kings River and San Joaquin Valley water-deficient.

The scarcity of early-season rainfall, in most years, leaves snowmelt as the principal Kings River runoff . Most of the river flow arises from mid-April to mid-July. Because stream flows decrease rapidly after the snowmelt, the river's temperatures warm rapidly; particularly at elevations below 1,500 feet. Such seasonal streamflow and temperature flux has, for centuries, imposed limitations on the Kings River's fish habitats and, in so doing, it has selected different species assemblages, or guilds" within its different elevation reaches.

Historically these included: (1) the upper-elevation *cold-water guild*, above the 1,500 foot elevation, which historically included only rainbow trout and sculpins; (2) the *transition guild*, (between 550 feet and 1,500 feet elevation), which included the cold-water species in cold seasons, replaced by native minnow species, such as squawfish and suckers in warm seasons; and (3) the *valley floor guild*, (below 550 feet elevation) principally made up of warm-water-tolerant species, such as Sacramento blackfish, Sacramento perch, and the now-extinct thicktail chub.

In later articles, we will discuss each of these native fish *guilds* in greater detail, along with other introduced species and the changes they have all undergone as the Kings River developed from its prehistoric conditions toward its present-day fisheries.

Storms Take Toll On Trout Egg Planting

It's much too soon to gauge results from this winter's Kings River brown trout egg planting program but runoff unleashed by repeated storms is believed to have caused some project harm.

Kings River Conservation District and California Department of Fish and Game biologists were aware, shortly after the planting occurred, that high flows from this winter's foothill rain and future snowmelt runoff might make full measurement of the total hatch difficult.

Some 100,000 brown trout eggs contained within Whitlock-Vibert boxes were planted in 200 hatch stations created by KRCD and CDFG staff members, and community volunteers, in the Kings River on January 9. The planting took place along a remote section of river northeast of Centerville, 2.2 miles upstream from the Highway 180 bridge and a half mile below Fresno Weir. Fifty emergent traps were also installed to help determine success of fry emergence from the nest sites. The program was timed to take place during what is normally a low flow period.

High flows caused silt build up within the hatch box which may have prevented a successful hatch.

Winter's storms took care of that. "High flows from Mill and Hughes creeks did negatively impact the project," said KRCD Environmental Division staff biologist Jerry Salazar. The two creeks enter the Kings River below Pine Flat Dam. Their flows cannot be controlled.

How big a toll was taken by the high flows can't be measured until next fall when electrofishing and/or snorkeling take place. Those site surveys will determine how many brown trout survived. A final report in the fall will evaluate the project.

The method employed in the project is a popular means of improving a fishery at low cost while helping ensure that trout eggs will have a better chance of survival in the wild during the early stages of the life cycle. Trout eggs planted in the hatch box were buried in the river with some of the 7.5 tons of gravel trucked to the site for use in the process. The hatch box is a two stage incubator. Under normal conditions, the box's unique design greatly reduces loss of eggs due to poor circulation, siltation and predation. The first stage houses eggs and provides circulation. The floor of the top stage is slotted to allow the egg sac fry to drop into the nursery. The incubator's second stage catches and retains the egg sac fry and allows swimup fry to escape.

KRCD supplied manpower from the District's staff biologists, engineers, water management staff and Riverdale-based maintenance crew. Much field support was given by the CDFG and local anglers. KRCD staff members were pleased and encouraged with what they said was excellent support.

Kings River Fishery Feasibility Study Continues

Several possible Kings River fishery enhancement projects, identified during the Corps of Engineers' Pine Flat Fish and Wildlife Habitat Restoration Investigation, are well into a full feasibility study.

Preliminary design work is under way on a multi-level intake structure, a water release temperature controlling device. It would, if developed, be mounted and constructed on the upstream face of Pine Flat Dam, over the power plant penstock intakes. Controlled port openings would admit water to the penstocks from elevations with the water temperature desired by biologists to best meet downstream fishery needs. Cost estimates have not yet been made.

The feasibility study is also examining a proposed pipeline that would connect the western end of the Fresno Irrigation District's canal system and Mendota Pool to permit additional water to be released into the river at times when demands are low.

The water would be diverted into the Fresno Canal and transported through the Fresno Irrigation District system and the new pipeline to supply the Mendota Wildlife Refuge. Like amounts of water would be returned to Kings River users through water exchanges at other times of the year.

Riparian habitat restoration projects are also being studied. The Kings River Conservation District is the study's local cost-sharing sponsor, with assistance from the Kings River Water Association.

KRCD Brings Fishery To Classroom

When rainbow trout are introduced into the classroom, students have the opportunity to care for and witness their early life stages.

The Kings River Conservation District (KRCD), in cooperation with the California Department of Fish and Game (CDFG), has been a local program sponsor for three years.

The program begins each February and lasts about six weeks. Its curriculum can be integrated into science, math, social studies and language arts at any grade level. Students learn about the life cycle of trout, how they reproduce, their feeding habits and the habitat required for the species to survive.

Teachers can integrate other aspects of aquatic and riparian ecosystems into the subject matter so students can better understand the environment. KRCD staff members work with the teacher and school to provide the highest possible educational value to the students. That can include guest lectures, with a slide show and equipment demonstration, or a field trip.

In the field, KRCD staff members help design and set up different stations to help students learn all aspects of the river's ecosystem, including habitat, local fish and wildlife, insect collecting, water quality and water safety.

Equipment involves a 20 gallon aquarium, aquarium chiller or converted refrigerator, power head pump, an under gravel filter, gravel and stones, and a dip net. KRCD provides all necessary equipment. Information packets and materials are provided by the CDFG.

Once the equipment is in place, KRCD staff members will bring eyed eggs from the CDFG San Joaquin Fish Hatchery. About two weeks are needed for the eggs to hatch and four weeks for the young trout to mature enough for release into the river.

Six area schools are working with KRCD this year. They include Edison, Hoover and Riverdale high schools, Tenaya and Ahwahnee middle schools, and Fancher Creek Elementary School.

Power Plant Bypass Is Progressing

Work continues to progress on plans to develop and construct an important Kings River fishery enhancement tool, a turbine bypass system at the base of Pine Flat Dam.

The U.S. Army Corps of Engineers, with the cooperation of the Kings River Conservation District and Kings River Water Association, hopes to award a contract to permit equipment and valves to be fabricated and shipped to the site by the winter months of 1998-99. If all goes well, construction could begin as early as July 1999, although the project is not to interfere with KRCD's Pine Flat Power Plant operations.

The turbine bypass will be a system of pipelines and valves designed to provide better temperature control of water released during the late summer and fall months.

The turbine bypass line will be connected to the power plant's penstocks at the base of Pine Flat Dam.

How Its Development Shaped The Kings, *continued from page 1*

ficult negotiations and complicated agreements to be resolved. For Pine Flat Dam's development, it was more of the same.

In the process, the Kings River's natural order, including the river's fish and wildlife resources, was inevitably changed so its waters could be put to work. Some aspects of today's Kings River are considerably different from what nature provided.

Recent interest in the Kings River's fishery and habitat is a reflection of modern America's greatly heightened concern and caring for environmental resources. Those values for the most part did not exist as we know them today when canals were built and an entire social and economic structure was staked on the reliability of Kings River water.

Ongoing fishery research, field work, planning, computer modeling and a wide range of related efforts add up to a massive attempt to enhance the river's fish and game habitat and populations in the context of long established beneficial uses, and the realities of water facilities, operations and needs of all concerned.

This inaugural issue of KINGS RIVER FISHERIES NEWS begins an examination of Kings River natural and development history, to help define today's conditions and issues.

The River That Nature Provided

How Settlement Has Changed The Kings And Its Country

By
J. Randall McFarland,
Kings River Historian

The river running high as it flows from the foothills in 1898.

From the perspective of its users, the Kings River is perfectly positioned to provide optimum beneficial direct applications — deliveries by gravity over a broad region — of surface water generated in the river's 1,742 square mile Sierra Nevada watershed.

The river's geography and geology also endowed much (although not all) of what is now the river's service area with an ideal aquifer, an underground reservoir that can provide a supply of water when surface supplies are not available. In big water years, ample surface water supplies can be used to recharge the aquifer.

The river's three primary forks all rise in rugged, remote sections of the Sierra Nevada (in what is now Kings Canyon National Park) at elevations of 10,800 feet or more. The uppermost watershed stretches for more than 40 miles along the Sierra crest.

The South Fork is the best known of the watershed branches, flowing through scenic Kings Canyon. The Middle Fork, entirely in designated wilderness, cascades through seldom visited Tehipite Valley. Together, the South and Middle forks account for 80 percent of the river's runoff. Neither is controlled, although dams at several locations were considered at different times over the past 75 years. The smaller North Fork came to be heavily developed with Pacific Gas and Electric Company hydroelectric reservoirs and power plants.

Under natural, pre-settlement conditions, the Kings River flowed undiminished as it roared through the foothills and took a considerably tamer path onto the valley floor.

Its alluvial fan, stretching across the valley, created the fertile land that the river's waters would later irrigate. There was, however, originally little hint of the land's ultimate productive value. Much of the prairie stretching away from the river was popularly called a desert, although in reality it was a seasonal grassland.

Then as now, the river's riparian habitat was lush with growth but the plains stretching away from the river were treeless seasonal grasslands. The valley's earliest explorers and settlers found the river's channel much as it remains today as far downstream as what is now Highway 99.

There, the river's constraining bluffs diminished and began to blend with the surrounding prairie. The result, on its lower end, was that the Kings was much different under native conditions.

The channel hugged an apex of the river's ancient alluvial fan across the northern end of what is now Kings County. From it, a series of natural sloughs broke away from the main channel toward the southwest. Further downstream, north and west of modern Lemoore, the river's mainstem followed toward the southwest and south. Most of the river's flow was discharged into old Tulare Lake.

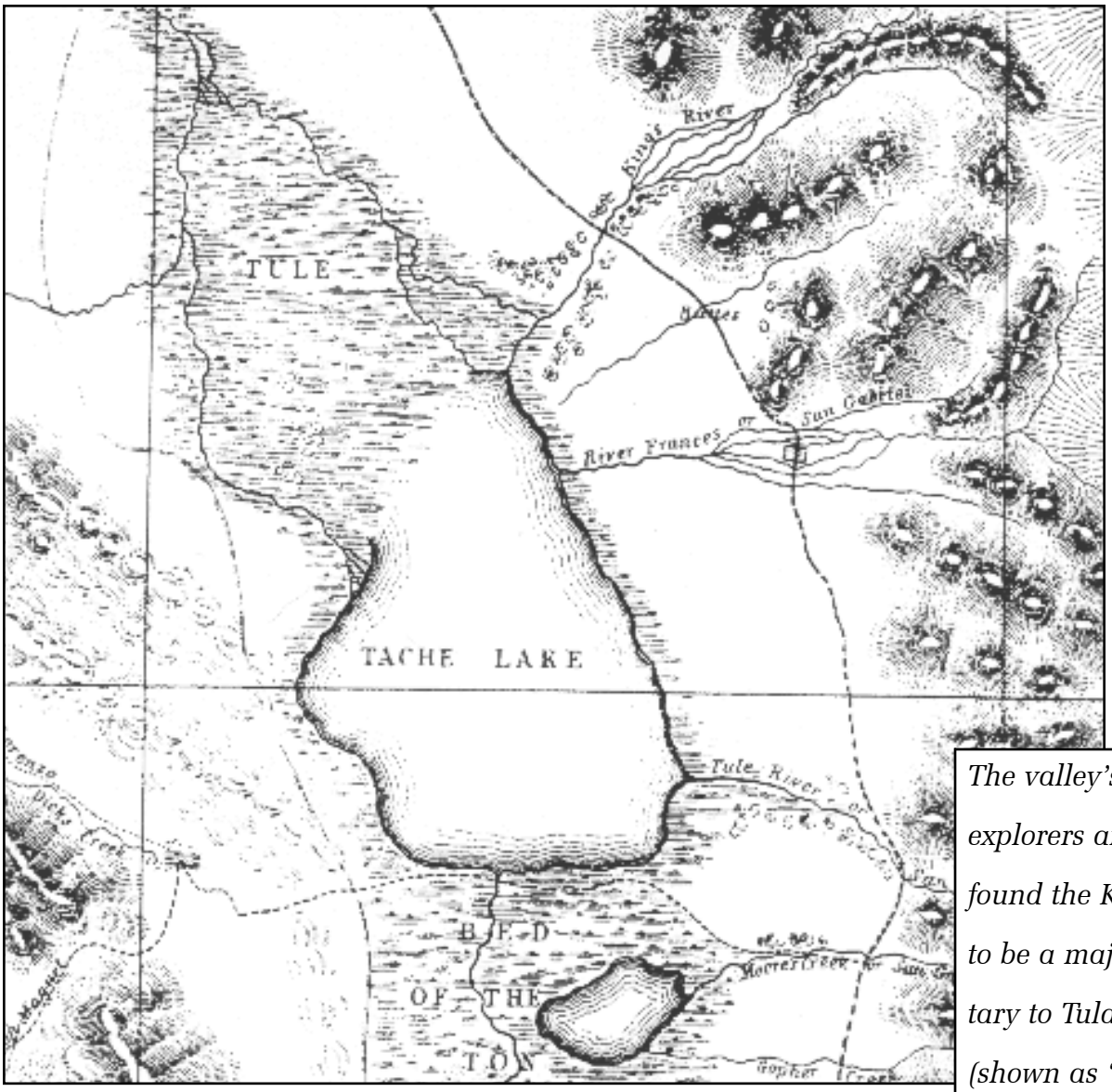
Tulare Lake, then immense, was formed by a natural dam created by alluvial fans of the Kings River from the east and Arroyo Pasajero from the west. The lake was annually replenished by flows of the Kings, Kaweah, Tule and Kern rivers and several lesser streams.

In the biggest water years, Tulare Lake overflowed through this natural "spillway" (what was known as Summit Lake, southwest of modern Riverdale) when it reached an elevation of 207 feet. Only then would water from the Kings and other south valley rivers spill into Fresno Slough, which meandered through the valley's trough northwesterly toward the San Joaquin River.

At other times, small amounts of Kings River water finding their way through various north side channels provided some flow for Fresno Slough, but not enough to provide a consistent fishery connection with the San Joaquin River.

Tulare Lake's last "spill" occurred in 1878. After that, its waters receded rapidly, a result of substantial irrigation development on most of the lake's tributary streams, a series of

The Kings River In 1850



The valley's earliest explorers and settlers found the Kings River to be a major tributary to Tulare Lake (shown as "Tache Lake" in this map from the 1850 expedition of Lt. George H. Derby).

average or below average water years and continuous evaporation. By 1898, Tulare Lake was totally dry for the first time. Its bed was quickly reclaimed for farming.

Upstream on the Kings and other south valley rivers, dozens of canals were constructed by valley pioneers between 1870-1900. Kings River water transformed the "desert" into a garden with amazing swiftness.

These developments were not alone in altering the lower Kings River's natural order. The old sloughs that meandered across what is now northern Kings County were gradually reclaimed and leveled for farming. In 1913-14, the river's North Fork system was enlarged and the James Bypass constructed to divert Kings River flood flows toward the San Joaquin River — as the practice remains today in big water years — rather than into the Tulare Lake bed. In 1954, after several years of construction as a flood control project with water storage benefits, Pine Flat Dam was completed.

Wet, Dry Cycles Are River Management Challenge

The Kings River's natural cycles of wet and dry have an enormous impact on water users and fishery habitat alike.

The Kings is one of the larger rivers draining the southern Sierra Nevada's western slopes. The Kings has a watershed of 1,742 square miles, extending from the foothills to the Sierra crest.

Average annual Kings River discharge is more than 1.7 million acre feet, but "average" is a condition only rarely experienced.

As with all Sierra Nevada rivers, the Kings is prone to radical swings in the amount of runoff it generates, both from season to season and year to year. Results of these highs and lows naturally affect all aspects of the river — from fish and wildlife, habitat and riparian environment to beneficial water diversions. Completion of Pine Flat Dam in 1954 has tempered the most drastic of the river's fluctuations.

Still, Kings River runoff corresponds directly with Sierra Nevada rainfall and snowfall. Lowest of these natural flows occur in late summer and autumn, before the rainy season begins. The highest flows, capable of catastrophic damage, result from big winter rain flood events. Other high flows occur during the annual spring and summer snowmelt.

A wet year, with one big storm after another resulting in a gigantic snowpack, can occasionally result in twice-average runoff. The greatest Kings River discharge of record, 4.476 million acre feet (in 1982-83), was 264 percent of average.

At the other extreme, severe drought conditions have twice (in 1923-24 and 1976-77) limited annual Kings River runoff to little more than 391,000 acre feet, just over 23% of average.

In between are Kings River runoff conditions which more often than not end up below average. In the 102 water years (October 1-September 30) in which records have been kept since 1895, Kings River runoff has been below average in 59 years and in excess of average in 43 years.

In other words, the record shows that any given year is more likely to be dry than wet, with corresponding effects upon all who depend upon the Kings River, including the fishery.

More ominously, the Kings River experiences consecutive dry years much more frequently than it does successive wet years. There have been four episodes of three wet years in a row and (including this year) three streaks of four straight above-average water years. Never in recorded history has the Kings River had five wet years in a row.

On the other hand, there have been six separate streaks of three dry years in a row and four with four below-average runoff years in succession. Twice there have been periods of six consecutive dry years.

Consecutive dry years always compound water supply problems and tend to affect the river fishery with reduced flows and higher water temperatures.

The ability to store runoff from winter and spring for release during the hot months of late spring and summer not only has proven to be a tremendous benefit to water users and timely, efficient crop irrigation, it has also been a boon to the trout fishery in the reach of the river below Pine Flat Dam.

There, the trout fishery, under pre-project conditions, had been seasonal and migratory, depending upon flows and temperature.

Now that reach of river nearly always has much colder water available, and plans are proceeding for new facilities at Pine Flat Dam — a turbine bypass system and multi-level intake structure — that would greatly enhance the river's fishery temperature management capability.

Fisheries News

Published by the Kings River Conservation District, a political subdivision of the State of California, with the cooperation and participation of the Kings River Water Association and California Department of Fish and Game.

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