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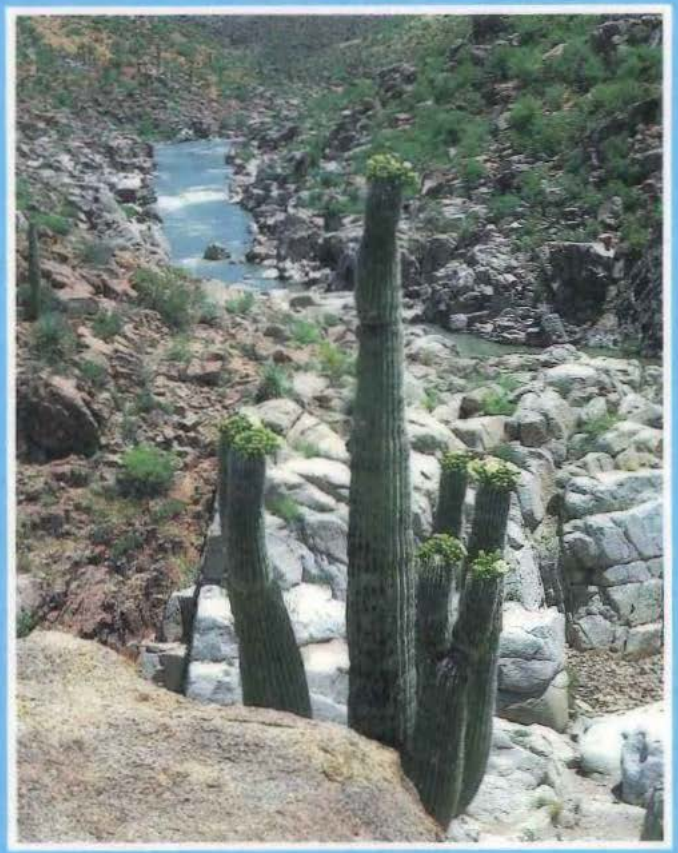
A Guide to SALT RIVER CANYON Natural History and River Running

Water Resistant



A Guide to
SALT RIVER CANYON
Natural History and River Running

Edited by Glenn Rink

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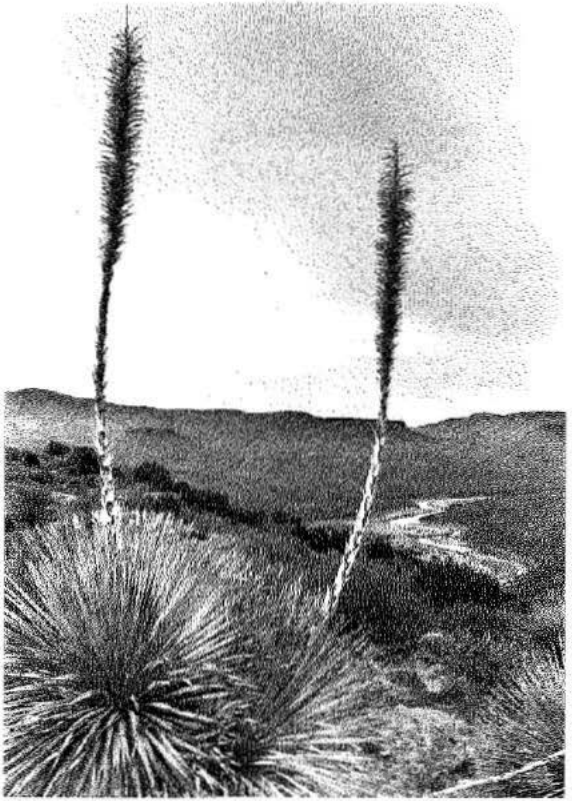

Sotol below Gleason Flat

Bob Rink

PUBLISHER'S FOREWORD

Like all rivers the Salt River has unique characteristics. Its outstanding beauty and grandeur are partly a result of its location on the southern edge of the Colorado Plateau. The Salt River is host to a vast quantity of life forms that depend on this ecosystem to survive and thrive. It offers a recreational opportunity to us with its many rapids and diversity. The Salt River Canyon is truly a treasure.

This guide is the product of many people's energy, enthusiasm and knowledge. Their love for this exceptional area shows in this guide. I thank them all. I especially thank Glenn Rink for his untiring efforts to make this project a reality.

This guide is by no means complete. Much information has been deleted due to space considerations. Much information remains to be gathered. Your input is desired. Please call or write to give us your criticism, comments, and information. The next edition will reflect your help.

This treasure, the Salt River Canyon, is yours to enjoy and protect. Southwestern riparian communities are a tapestry of life woven with delicate strands. Your presence can affect this fragile ecosystem. Please practice low impact visitation and camping. Please be vigilant and guard the river and canyon against misuse and abuse. Thank you.

George A. Marsik

George A. Marsik, President
Worldwide Explorations, Inc.

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RIVER JOURNEYS

Traveling on rivers is dangerous and Arizona's Salt River is no exception. Salt River Canyon is in a land of extremes. You could be baking in the sun one day and the next day be bundling up in a freezing snowstorm. During intense desert storms the river can reach dangerous high levels in just a few hours. The Salt River is a Class IV whitewater river that drops over 20 feet per mile for over 50 miles through rocky, inaccessible canyons. It is not a suitable river to begin your whitewater experience.

You can learn whitewater technique by contacting your local whitewater club. Those in Flagstaff, Phoenix, and Tucson sometimes offer inexpensive lessons or outings to teach beginners the ways of the rivers. Contact:

Northern Arizona Paddlers Club
PO Box 1224
Flagstaff, AZ 86002

Central Arizona Paddlers Club
18 West Main Street
Mesa, Arizona 85201

Univ. of Arizona
Whitewater Explorers
PO Box 20734
Tucson, AZ 85720

Worldwide River Running & Guide School
PO Box 686
Flagstaf, AZ 86002
800-2PADDLE or
(602) 774-6462

Or contact commercial outfitters that take people down the Salt River. As of 1989 these were:

Desert Voyagers
PO Box 8792
Scottsdale, AZ 85252
(602) 998-RAFT

Far Flung
Box 31
Terlingua, TX 79852
(915) 371-2489

Salt River Canyon Raft Trips
2319 East Apache Blvd.
Tempe, AZ 85281
(602) 461-9494

Cimarron River Company
6925 Fifth Avenue, Suite E6
Scottsdale, AZ 85251
(602) 994-1199

Worldwide Explorations
PO Box 686
Flagstaff, AZ 86002
800-2PADDLE or
(602) 774-6462

For an updated list contact Globe Ranger District, Route 1, Box 33, Globe, AZ 85501, (602) 415-7189.

BOATING LOGISTICS

Using the Maps

The river maps start at the end of this guide. They progress downstream reading from the right side of the page to the left. This layout allows north to remain more or less up. And it allows a boater to read the maps while facing downstream. Note that the river mile numbers proceed backwards from mile 60 at the Highway 60 bridge to mile 7 at the take-out just above the diversion dam near Highway 288. These mile numbers were retained to conform with other guides. The maps were derived from the U.S. Geological Survey

7½-minute topographic series. Upstream to downstream, the topographic maps are: Beckers Butte, Mule Hoof Bend, Picacho Colorado, Haystack Butte, Rockinstraw Mtn. NE, Rockinstraw Mtn. NW, and Rockinstraw Mtn.

Permits

The Salt River runs through Apache Indian reservations, Tonto National Forest, and private lands. Permits are required on the Fort Apache Reservation, cost $10, and are sometimes obtainable at the store (closed on Tuesdays) on the north side of the river near the Highway 60 bridge. Contact: White Mountain Game and Fish Department, PO Box 220, White River, AZ 85941, (602) 338-4385. As of this writing, the Forest Service was contemplating requiring permits for private boaters to run the Salt River. Human waste carryout methods and firepans are now required. Send your comments on river management to Globe Ranger District; Route 1, Box 33; Globe, AZ 85501. Group size is limited to 25 people between Highway 60 and Gleason Flat. From Gleason Flat, mile 40, to Pinal Creek, mile 8.3, is part of the national wilderness system. Group size in this area is limited to 15 people.

Access

There are four main river access points. The seven miles of river from Highway 60 to Cibecue Creek is a good Class III day-run. A road parallels the river on the north side for most of this section, with a good put-in and camping area just downstream of the Highway 60 bridge. The lower campground, mile 54, and Cibecue Creek, mile 53, are good access points. Another access point is just below Salt River Draw at mile 50.5. Boaters should avoid using the access point just above the Salt Banks to lessen disturbance to bald eagles.

The run to Gleason Flat, mile 40, is Class III. Dirt roads lead to Gleason Flat from the north and the south. They often require four-wheel-drive vehicles. Forest Service roads 96 and 303 are poorly maintained.

From Gleason Flat to Horseshoe Bend at mile 21 the river is Class IV with one Class V rapid, Quartzite Falls. Access to Horseshoe Bend is on a 12-mile dirt road (FS 219) from Highway 88. Horseshoe Bend is privately owned. To keep this access point open, we need to treat this land with as much respect as the wilderness river. Park well above the gate and carry gear to and from the river down the 0.2-mile trail.

The 13 miles of Class II/III from Horseshoe Bend to Highway 288 is part of the Salt River Canyon Wilderness Area and passes through more open country that abounds with wildlife.

Special Whitewater Safety Considerations

This guide uses the International Water Classification System. Rapids are rated from easiest, Class I, to extremely dangerous, Class V. Rapid ratings, however, are only a guide. Some rapids (Black Rock, for instance) become increasingly difficult at low flows. Others get worse at high water. When in doubt, scout! References to left and right are always from a boater's point of view, looking downstream.

Fast water and rapids precede Eye-of-the-Needle Rapid (Class III) at mile 38.4. To scout Eye-of-the-Needle stop 1/4 mile upstream on the left.

We do not advocate running Quartzite Falls (Class V) at mile 28.2. River runners have drowned in the recirculating reversal at the

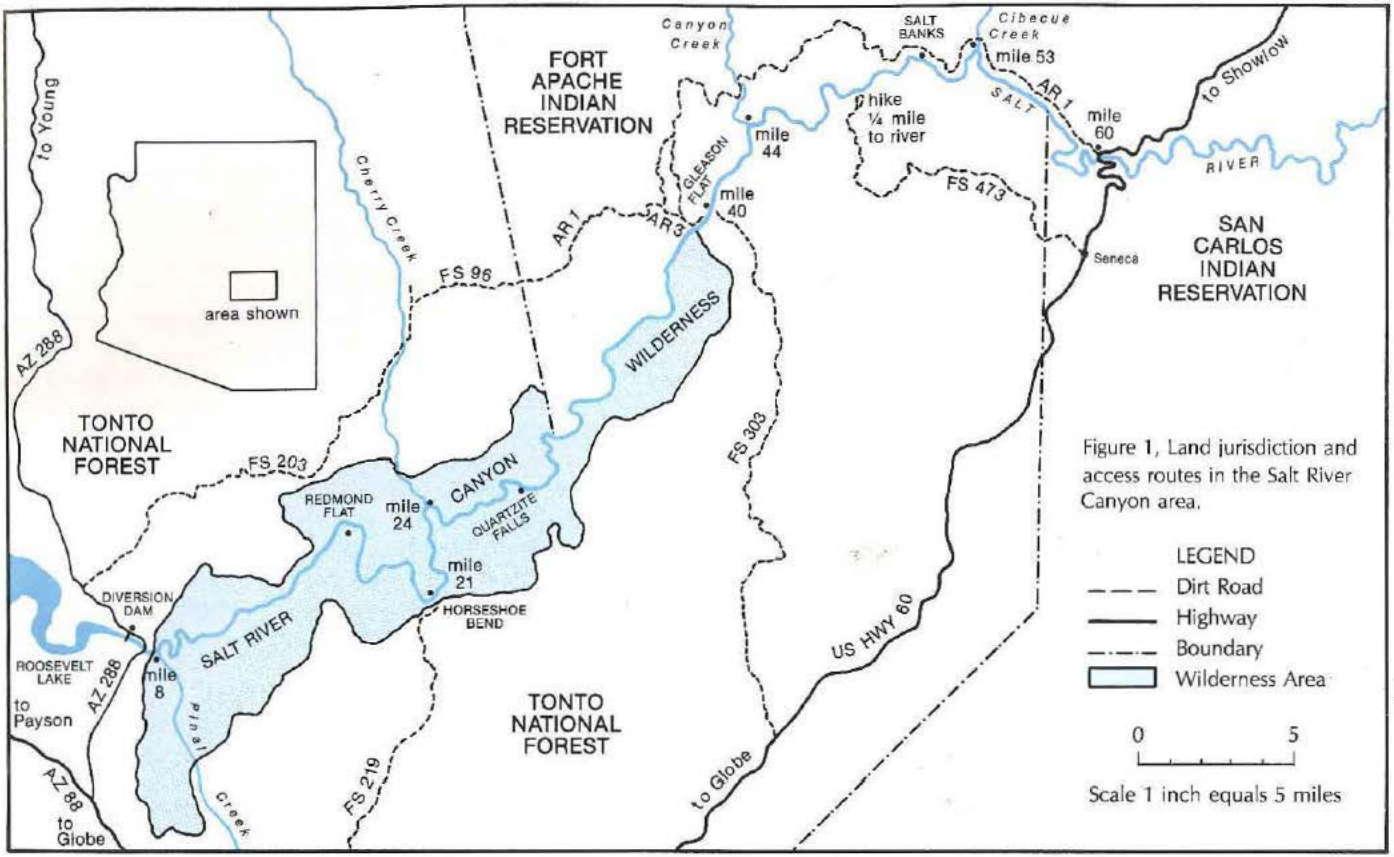


Figure 1, Land jurisdiction and access routes in the Salt River Canyon area.

bottom. Fast water and rapids, including Corkscrew (Class IV), below the falls make for a dangerous swim. Eddying out above the falls can be difficult, especially if other boats are already in the eddies. Normally, you can eddy out on river left at the sign, "Danger, Falls 1/4 mile," and scramble up the rocks to get a good view of Quartzite Falls and the eddies above the falls. At low water levels it is advisable to boat down and stop on the cobble bar above the rapid on the right to keep your options open, because from the lower left eddy it is difficult, if not impossible to get back to river right above the falls. Rafters often line on river right at lower water levels, or portage on river left. Quartzite can take several hours to line or portage, so it is best to arrive early in the day.

At least five people have drowned in the recirculating reversal caused by the diversion dam below the Highway 288 bridge. The

Attempted helicopter rescue of rafters caught in recirculating hole below diversion dam in 1979 *Roger Henderson*

dam was modified in the fall of 1989 for safety reasons. A permanent take-out upstream of the dam on river left will be built by 1991. The interim take-out is on river right 200-300 feet above the dam. Be sure to take the right channel around the island above the dam.

The flow of the Salt River is unregulated and may come up unexpectedly. Camp high during times of rainy weather. Rescues in Salt River Canyon are handled by the Gila County Sheriff. In an emergency call the dispatcher at (602) 425-4449.

Other Hazards

You may encounter rattlesnakes, coral snakes, or Gila monsters along the Salt River. These poisonous reptiles should be observed from a safe distance and left alone. Bites from these animals are rarely fatal, but the venoms cause intense pain and severe tissue damage next to the bite, even when excellent medical care is at hand. On the river, many hours can lapse between the bite and proper care.

Scorpions and black widow spiders are also present. To avoid an unpleasant experience, roll out your sleeping bag just before going to bed and check your shoes and clothes before putting them on in the morning. Mammals can carry rabies. Avoid mammals that are acting strangely.

Water Levels

Dedicated open canoe and inflatable kayak paddlers commonly run the Salt River at 250 cubic feet per second, *cfs*. At least this much water flows year-round most years. Dedicated rafters take 13-foot rafts down the Salt River when it is running only 600 cfs. But rafting is best between 1000 and 7000 cfs. Call the Salt River Project at (602)

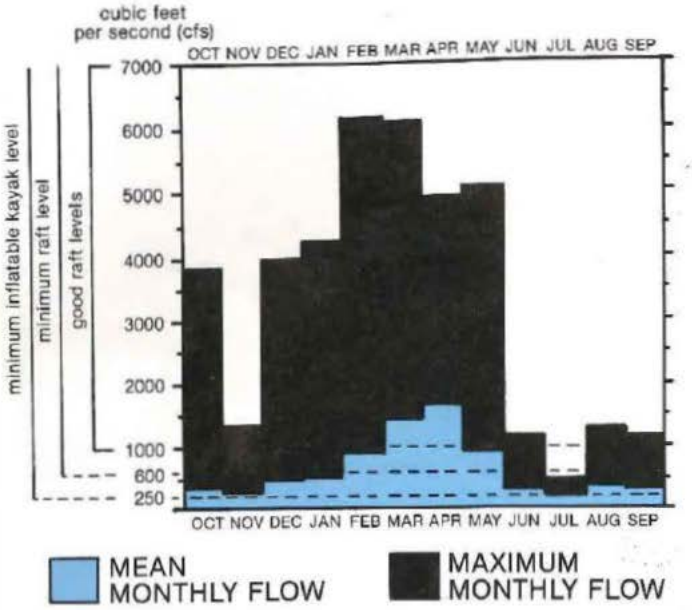


Figure 2. Discharge information from Chrysotile gauge at the Highway 60 bridge (1925-1986).

236-5929 for current flow information. Remember that flows on the Salt River can change hourly.

The mean monthly flow shown in Figure 2 is a good indicator of flow dependability. Thus April is the month with the most dependable flows for rafting the Salt River. Maximum monthly flow is a good indicator of high flows caused by fall and winter storms. Thus February and March are the best months to catch exceptionally high flows. It is not uncommon to run trips at 3000 to 6000 cfs during this time. But be aware that flows greater than 40,000 cfs have flooded the Salt River several times during the 1900s. These floods usually do not last long. After one of these flood peaks, the river almost always drops to a runnable level within one to three days.

Weather

Precipitation records have been kept at the store near the Highway 60 bridge, mile 60, and near the diversion dam, mile 7. Figure 3 summarizes this data.

There are no temperature records for the Salt River Canyon. However, temperatures in the canyon are likely to fall somewhere between the temperatures of the nearby towns of Globe and Roosevelt. At Globe (elevation 3541 feet) the hottest and coldest temperatures ever recorded were 113° F in June 1970 and 5° F in December 1974. At Roosevelt (elevation 2205 feet) the hottest and coldest temperatures ever recorded were 116° F in July 1949 and

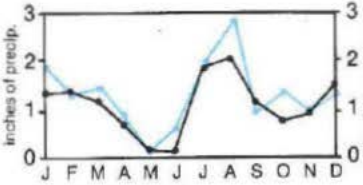


Figure 3. Precipitation means at the diversion dam, mile 7, 1906-1952 in black and at the Salt River Canyon Store, mile 60, 1941-1966 in blue. Totals: 13.19"/yr. and 15.46"/yr. respectively.

18° F in December 1908. The figures below show monthly mean extreme maximum and minimum temperatures for these stations.

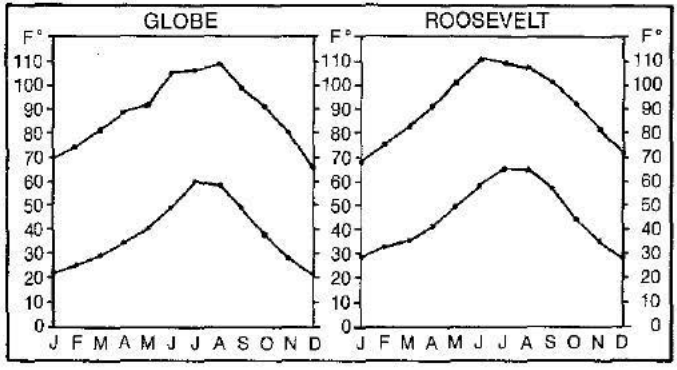


Figure 4, Globe.

Figure 5, Roosevelt.

NATURAL HISTORY

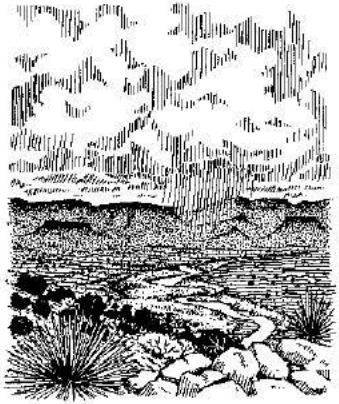
The whitewater section of the Salt River described in this guide is a unique wilderness river of the Southwest. It is the last free-flowing section of river that runs from the Transition Zone down through the Sonoran Desert. This area remains close to its natural state.

In the chapters that follow, where the Salt River or the Salt River Canyon are referred to, the 52-mile section from Highway 60 to Highway 288 is implied. These 52 miles are broken into three parts: the upper Salt refers to the 20-mile section from Highway 60 to Gleason Flat, the middle Salt refers to the 19-mile section from Gleason Flat to Horseshoe Bend, the lower Salt refers to the 13-mile section from Horseshoe Bend to Highway 288.

We hope this guide will help your journeys through, as well as heighten awareness and appreciation of, the Salt River Canyon. Let's enjoy and learn about this river, and do our best to preserve it for the future.

BASIN, CLIMATE, and RUNOFF

Wayne D. R. Ranney



Pat Langmade

Veteran Salt River boaters have learned through the years to make themselves aware of the river basin's characteristics that affect its variable weather, unique climate, and runoff.

THE BASIN

The Salt River originates in the White Mountains in east-central Arizona at an elevation of nearly 11,000 feet. The two rivers that form the Salt drain the slopes of Mt. Baldy, the highest volcano in the White Mountains and the second highest mountain in Arizona. The White River begins on Mt. Baldy's western slopes and the Black River begins on its eastern slopes. These two drainages

converge about 40 miles west of Mt. Baldy to form the Salt River.

Other northern tributaries, such as Carrizo, Cibecue, Canyon, and Cherry creeks, originate below the Mogollon Rim at lower elevations than the White Mountains. The Mogollon Rim is a prominent erosional escarpment that divides Arizona into the northern plateau country and the southern desert basins. About half of the Salt's runoff comes from the Mogollon Rim and an equal amount comes from the White Mountains. Little runoff enters the Salt River from the south; Pinal Creek at mile 8.3 is the largest of the southern tributaries.

CLIMATE and RUNOFF

First, climate should not be confused with weather. Weather is the day-to-day condition of the atmosphere. Climate on the other hand, is the long term *composite* of weather conditions in a particular region. Thus the climate of an area can only be determined by long-term observations of weather through a number of seasons.

Climate in any region is related to the lay of the land. The extreme relief of the Salt River basin affects and even creates much of the local climate. As we have already seen the Salt River drains the White Mountains and Mogollon Rim. These landforms act as *orographic* or mountain barriers to moving moisture in the atmosphere. When warm, moist vapor encounters these high-standing landforms, it moves up, cools, and condenses into liquid moisture. Ninety-five percent of all of the water that enters the Salt River comes from the Mogollon Rim and White Mountains.

The Salt River Canyon area has two distinct seasons of precipitation: winter rain and snow, and the summer monsoon.

Winter precipitation is the most important climatic factor for most Salt River boaters. Winter storm systems originate in the Gulf of Alaska or the Pacific Ocean as huge low pressure cells that ride the jet stream to the east over North America. Occasionally one of these systems crosses central Arizona and dumps significant amounts of snow on the Mogollon Rim and White Mountains and rain or snow at lower elevations. The gauging station near the Highway 288 take-out has recorded floods caused by winter storms of 91,000 cfs in January 1916; 60,200 cfs in March 1941; and 77,200 cfs in March 1978.

Temperature is another climatic factor important to boaters because it determines when the spring runoff will begin. And ironically, it is the nighttime temperatures that deserve our attention. It is not enough to have beautiful, warm days if the nights are cold enough to hold back the snow. When temperatures during successive nights begin to stay above freezing in the higher parts of the basin, runoff increases. Most of this runoff comes down the White and Black rivers between mid March and early May. Major winter storms, which can cross the Salt River Canyon during peak spring runoff in March or April, can very quickly either increase or decrease flows in the river, depending on the temperatures associated with the storm. Be prepared!

Seasoned Salt River boaters are aware that in some years snowfall and resulting spring runoff are so light that there may not be much of a raftable season. During the winter and spring of 1977, for example, the following maximum flows were recorded: January 1977—250 cfs; February—258 cfs; March 382 cfs; April—1390 cfs; and May—540 cfs. There was more runoff during September of 1977 (1920 cfs) than there was at any time during

the previous winter season. The Salt River is an unpredictable entity worthy of being classified as wild.

The summer monsoon begins in July and ends in late September or early October. It is caused by warm, subtropical moisture coming north to Arizona from the Gulf of Mexico and the Sea of Cortez (Gulf of California). This summer moisture is known as the *monsoon,* an Arabic word which originally described a change in the predominant wind direction over the Indian Ocean. Its use in Arizona is justified because of the different sources of summer and winter moisture.

Most of the time, the first significant landforms that the summer moisture encounters as it moves across the southern deserts is the Mogollon Rim and White Mountains. Spectacular thunderstorms are common in the area during this time, creating our world-famous Arizona skyscapes. Intense, local thunderstorms can quickly turn any of the Salt's tributaries into rivers of mud and water. If the thunderstorms are widespread, numerous side streams will contribute runoff in a short time and the Salt River will become a torrent of mud, vegetative debris, and water.

During the monsoon, the Salt River is an unpredictable drainage where low flows one day can be followed by record runoff the next. Two examples of monsoon-related floods are 53,900 cfs in October 1972; and 49,200 cfs in October 1983. The months just prior to the monsoon are the driest in Arizona. Record low flows in the Salt are 76 cfs in June 1892; 45 cfs in July 1900; and 59 cfs in July 1955.

If it were as easy as simply measuring precipitation to determine runoff in any drainage, most of us could be experts in predicting ideal boating conditions. However, many other factors play into the runoff picture. For example, two inches of rainfall in early July may not yield as much runoff as one inch during the fall. This is because of the level of soil saturation at any given time. If there has been significant rainfall for an extended period, or even earlier the same day, the soil may be saturated and there will be more surface runoff. Soil saturation is a factor in why the most intense summer floods occur late in the monsoon season; note the month of the two peak flows mentioned earlier—October. Other factors such as plant cover and *slope aspect,* the direction a slope faces, play into the intricate runoff prediction scenario.

Firsthand accounts of large floods on the Salt River only extend back about 100 years. However, several silt and sand deposits above the river downstream from Horseshoe Bend have been studied to determine how big the river can get. The sediments were deposited during huge floods which occurred on the Salt before the arrival of Europeans. Most of the deposits are located downstream from bedrock narrows or constrictions, and they obviously were laid down in giant eddies. This evidence suggests that the Salt flowed at 162,000 cfs sometime within the last 1000 to 2000 years. This runoff may be close to the maximum that the Salt River is capable of carrying, the limiting factor being the size of its drainage area.

References and Recommended Reading

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GEOLOGY

Glenn Rink

The Salt River Canyon traverses the Transition Zone of central Arizona (Figure 6). Thus, at the Highway 60 bridge you can see flat-lying sedimentary rocks, a characteristic of the geology of the Colorado Plateau Province. The character of the rocks changes

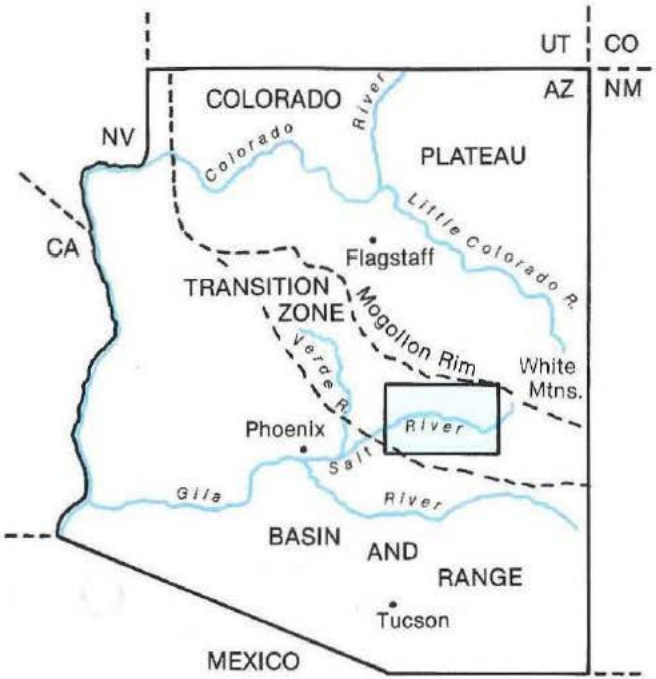


Figure 6, Geomorphic provinces of Arizona. Shaded area detailed in Figure 8.

downstream until at the Highway 288 bridge you can see massive tilted blocks of crust overlain by gravels only a few million years old, a characteristic of the Basin and Range Province.

For ease of discussion, the geology of Salt River Canyon can be divided into three sections. Therefore this chapter is organized in three parts, arranged in the order that the rocks are exposed downstream from the Highway 60 bridge. The oldest rocks are exposed in the second section. So, if you prefer to read a *chronological* geohistory, begin with section 2, then read section 1, and finish with section 3. For nongeologists, here are some simple geologic terms and concepts.

GEOLOGIC TERMS

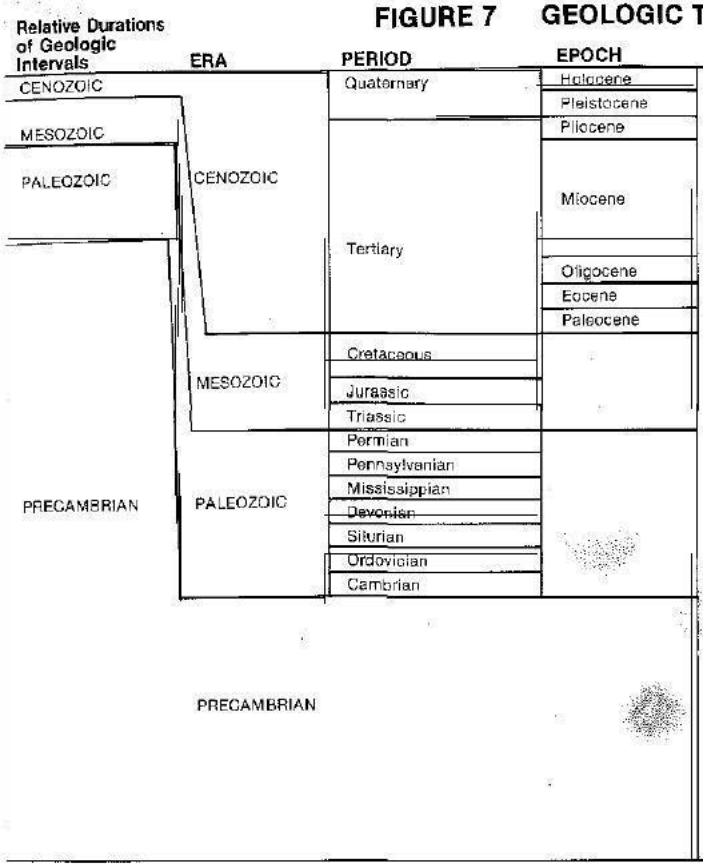
Most of the rock units in the Salt River Canyon were deposited by rivers and oceans and are called *sedimentary* rocks. Limestone, shale, sandstone, and conglomerate are sedimentary rocks that you will see in the Salt River Canyon. *Limestone* is composed of calcium carbonate ($CaCO_3$) that precipitated out of an ocean. *Shale* is composed of fine silt and clay that settled out of slow-moving water. Clay is composed of various disc-shaped minerals. *Sandstone* is composed of sand and silt that settled out of moving water. Sand and silt are composed of small particles of quartz (SiO_2). *Conglomerate* is composed of gravels deposited where fast-moving water or gravel-carrying mud began to slow down.

Some of these sedimentary rocks (and some volcanic rocks) were buried deep in the earth's crust where heat and pressure changed their texture and mineral composition. Rocks so altered in a solid state are called *metamorphic*. *Slate* is metamorphosed shale and *quartzite* is metamorphosed sandstone.

Rocks that crystallize from *magma* (molten rock) are called *igneous*. Tuff, basalt, diabase, and granite are igneous rocks that crop out in the Salt River Canyon. *Tuff* results when hot volcanic ash settles to the ground and welds itself together after a violent volcanic explosion. *Basalt* (dark, homogeneous rocks) forms when magmas extrude onto the surface of land and cool quickly, freezing the magma into small crystals. *Diabase* is frozen magma that filled cracks in rocks near the surface and cooled more slowly than basalt; medium-sized crystals are formed, giving this rock a rubbly texture. *Granite* is created when magmas cool slowly deep in the earth, thus forming large, light-colored crystals of quartz, feldspar, and small, dark crystals of biotite, which gives it a characteristic salt-and-pepper texture.

The sedimentary rocks (and some of the volcanic rocks) were originally deposited in layer-cake fashion with the oldest layers on the bottom and the youngest layers on top. However, structural events (faulting and folding) in the earth's crust during and after deposition moved the layers up and down relative to one another. Much of this up and down movement has occurred on the Canyon Creek and Cherry Creek faults, which are good dividing lines for the three geology sections described in this guide (Figures 8 and 9). Hence, on a trip down the Salt River we first see younger Precambrian rocks (between 1400 and 1100 million years old) in section 1, then older Precambrian rocks (between 1660 and 1400 million years old) in section 2, and finally the much younger Tertiary rocks (65 to 2 million years old) in section 3. Figure 7 at right is a geologic time scale and summarizes associated events in the Salt River Canyon area.

FIGURE 7 GEOLOGIC TIME SCALE AND EVENTS



ERA	PERIOD	EPOCH	MILLIONS OF YEARS AGO	
CENOZOIC	Quaternary	Holocene	.01	Boaters enjoy Salt River
		Pleistocene	1.6	
	Tertiary	Pliocene	5	Salt River evolves
				Coon Creek Conglomerate
		Miocene		12–14mya down-to-west faulting
				14–20mya *Chalk Creek formation*
				20mya *Apache Leap Tuff*
				Whitetail Conglomerate
		Oligocene	25	Down-to-west faulting transforms ancient canyon to internal basin
		Eocene	37	Northeast-flowing drainage forms ancient canyon, deposits *"Rim gravels"*
		Paleocene	55	Northeast tilting and uplift
			65	Extinction of dinosaurs; *Laramide Orogeny* begins
MESOZOIC	Cretaceous			First flowering plants
	Jurassic		140	First birds
	Triassic		210	First mammals
PALEOZOIC	Permian		245	Mass extinctions
	Pennsylvanian		285	First reptiles
	Mississippian		320	First trees
	Devonian		360	First amphibians
	Silurian		410	First land plants
	Ordovician		440	First fish
	Cambrian		500	"Explosion" of life forms
			570	*Troy Quartzite* deposited
PRECAMBRIAN			1100	*Diabase* intruded
				Apache Group deposited
			1400	*Ruin Granite* intruded
			1600–	*Mazatzal Orogeny* folded, faulted, and metamorphosed Redmond Formation and Hess Canyon Group
			1650	*Hess Canyon Group* deposited
			1660	*Redmond* volcanism
			2200	Oldest crust in Arizona
			3500	First life
			4600	Earth forms

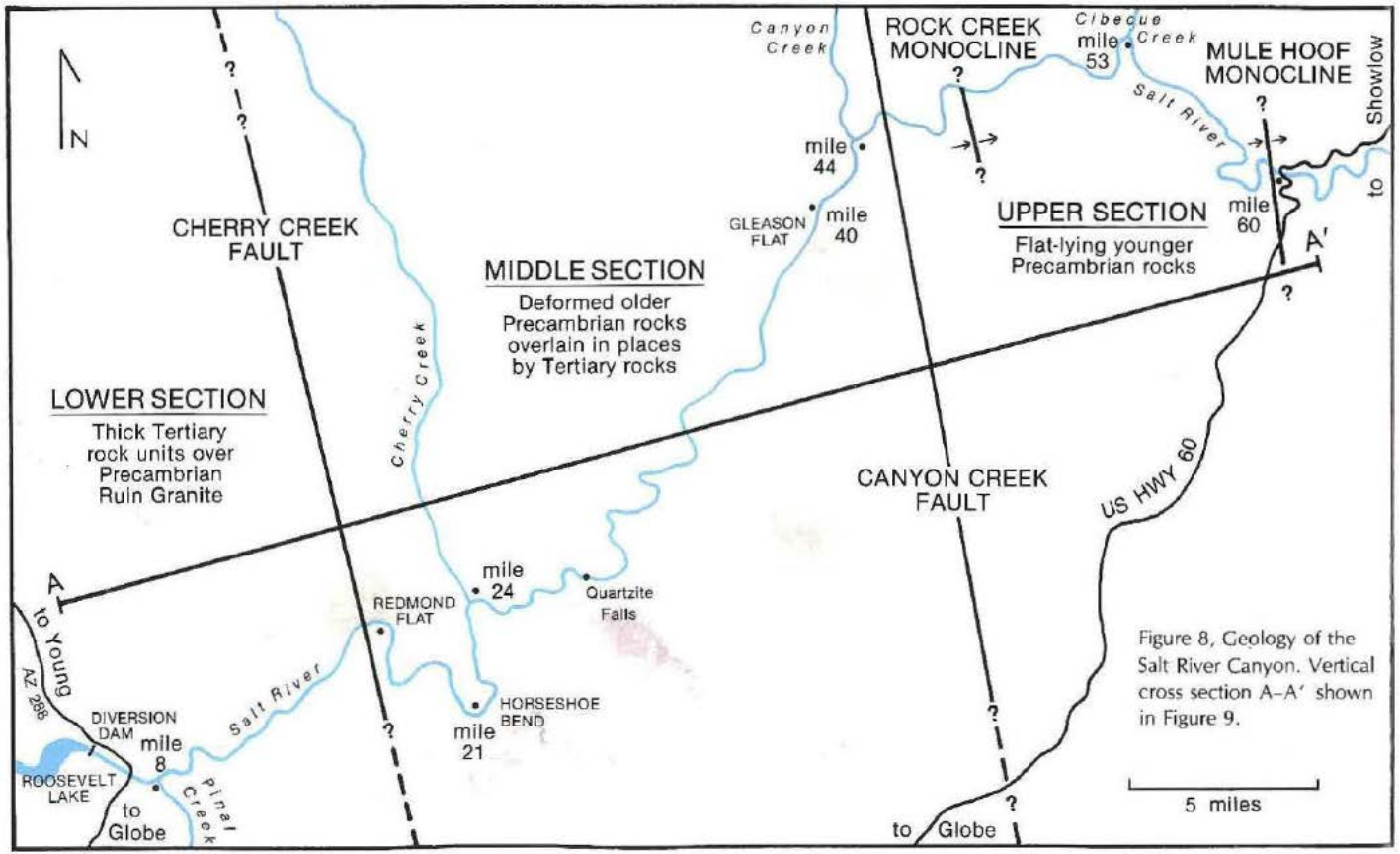


Figure 8, Geology of the Salt River Canyon. Vertical cross section A–A′ shown in Figure 9.

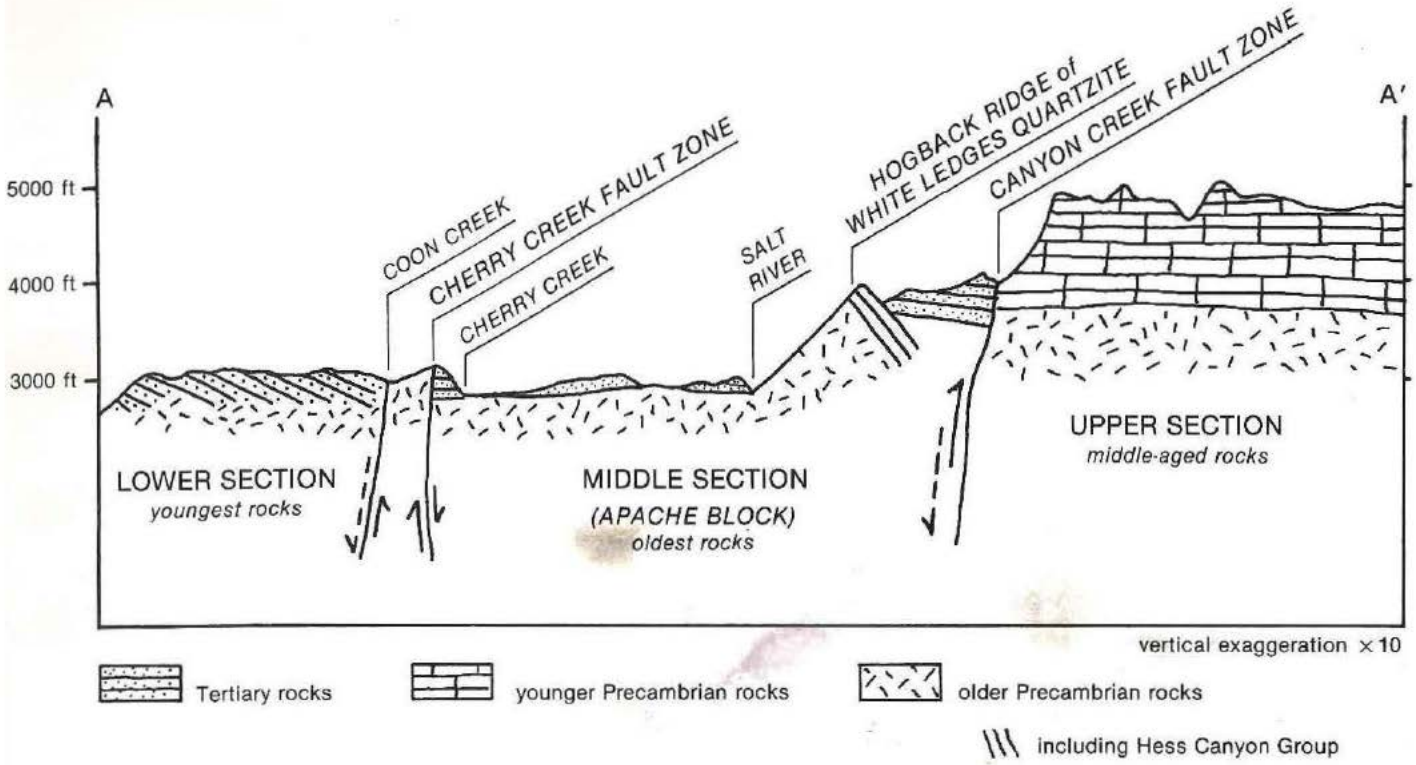
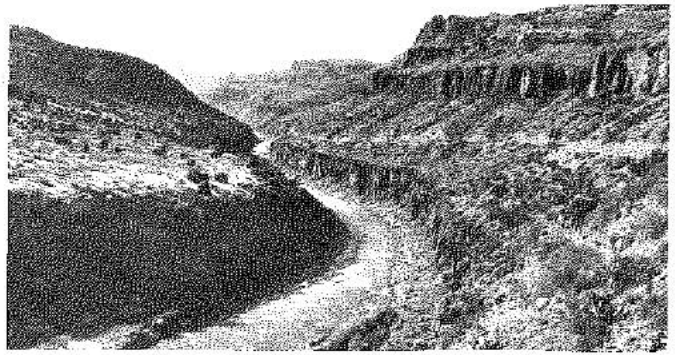


Figure 9, Schematic cross section (A–A' from Figure 8) of the Salt River Canyon region showing major rock types and faults. The middle section moved up as shown by the solid arrows during the Laramide Orogeny 40-80 million years ago. Western sections moved down as shown by the dashed arrows after 35 million years ago.

Section 1
GEOLOGY of the UPPER SALT RIVER CANYON

mile 60 to mile 48 (Figure 10)

Stair-stepped cliffs of flat-lying sedimentary rocks and dark diabase form the sides of Salt River Canyon from Highway 60 to the Rock Canyon monocline at mile 48. These younger Precambrian rocks may have been deposited in a basin created by *rifting*, or pulling apart, of two parts of the continent. The rifting may have been induced by a large spreading mass of material rising up towards the crust from deep within the earth. Gravel, sand, and clay transported into this basin from surrounding high areas eventually formed the Pioneer Shale, Dripping Spring Quartzite, Mescal Limestone, together known as the Apache Group, and the Troy Quartzite.



Upper Salt River Canyon — *Glenn Rink*

Apache Group

Pioneer Shale forms slopes of soft red to gray siltstone and mudstone. These layers were deposited on an uneven surface and then later eroded, thus they are unevenly distributed. The Pioneer Shale is well exposed in Canyon and Butte creeks, but is poorly exposed or absent next to the river.

Dripping Spring Quartzite forms prominent cliffs of tan to dark-colored quartzite. An island of Dripping Spring Quartzite

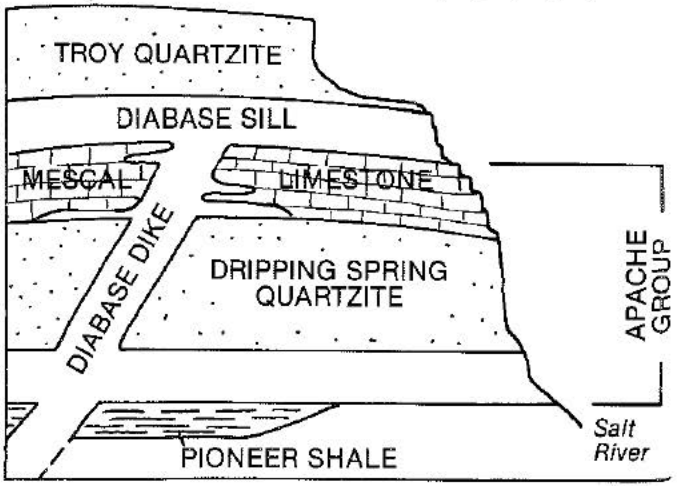


Figure 10. Vertical cross section of younger Precambrian rock units exposed in the upper section of Salt River Canyon. Relatively flat-lying sedimentary rocks were intruded by diabase *dikes* which cross-cut the sedimentary rocks and *sills* which run parallel to the sedimentary rocks.

splits the river at Island Rapid, mile 59.5. The Dripping Spring is probably the source of salt at the Salt Banks, mile 49.3, and may be the source of uranium for which many mining claims were filed in the 1950s.

Mescal Limestone forms cliffs and slopes of light gray to tan limestone and dolomite with some chert layers. Magmas intruded the Apache Group rocks 1.15 billion years ago and formed diabase. Heat and fluids from this intruding magma altered nearby rocks, leaving chrysotile-asbestos deposits in the Mescal Limestone. Diabase sills up to several hundred feet high form cliffs and slopes parallel to and below Dripping Spring Quartzite and both within and above Mescal Limestone (Figure 10). Boulder bars primarily of diabase boulders have made many of the rapids along this upper section of the Salt.

At the Rock Canyon Monocline, mile 48, the younger Precambrian rocks angle skyward. Downriver, they are only exposed high and far from the river.

Section 2
GEOLOGY of the MIDDLE SALT RIVER CANYON

mile 48 to mile 16 (Figure 11)

The middle section of Salt River Canyon is uplifted relative to the upper and lower sections. This uplift exposed the older Precambrian rocks.

Ruin Granite forms a four-mile-long gorge with many technical and continuous rapids starting with Rat Trap Rapid, mile 46.3. This granite intruded much older metamorphosed ash deposits and

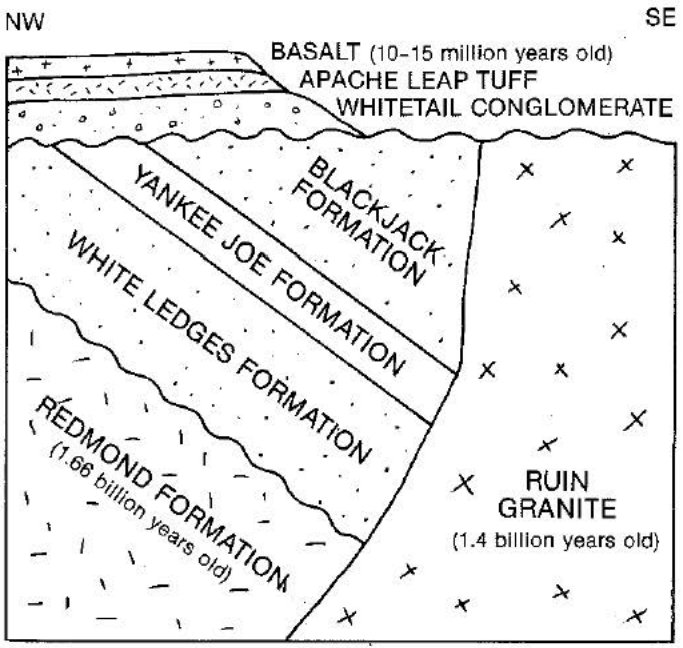


Figure 11, Vertical cross section of older Precambrian rock units exposed in the middle section of the Salt River Canyon. The Redmond Formation and overlying Hess Canyon Group were tilted and metamorphosed 1650-1600 million years ago, then intruded by the 1400-million-year-old Ruin Granite. Substantial amounts of time passed before the Tertiary rocks were deposited.

sedimentary rocks 1.4 billion years ago. During the last phases of Ruin Granite intrusion, it in turn was intruded by fine-grained dikes called *aplites* made up of quartz and feldspar, and coarse-grained dikes called *pegmatites* made up of quartz, feldspar, and biotite (a black, platy mineral). Ruin Granite weathers into rounded boulders and coarse, gravelly fragments of feldspar and quartz, called *grus*. Slopes covered with grus are frustrating to walk on due to their ball-bearing effect underfoot.

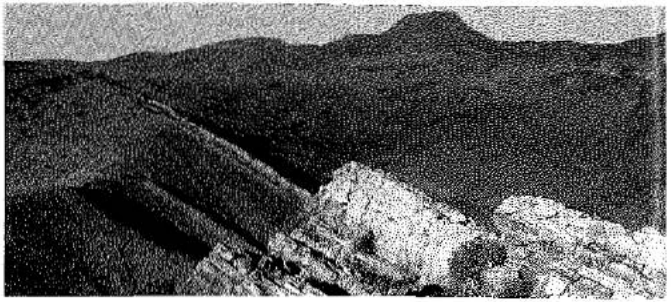
At Gleason Flat, mile 42, the river runs through young gravels and volcanic rocks. These rocks (also exposed from mile 37.5 to mile 30.5) are well exposed in lower Salt River Canyon, mile 16 to mile 7, and are discussed in section 3.

The *Redmond Formation* forms a gorge starting just below Gleason Flat. It is the oldest rock exposed in the Salt River Canyon, dated at 1.66 billion years, some of the oldest rock found anywhere in the Southwest. The Redmond Formation was deposited during repeated explosive volcanic eruptions similar to those of Mt. St. Helens in 1980. The ash, debris flows, and cinders from these eruptions solidified into a cohesive unit several thousand feet thick. Typically the Redmond Formation is a dark-reddish brown to green or gray *porphyry* (a rock with a fine-grained matrix enclosing larger crystals called *phenocrysts*). In other words, it has the color and texture of chocolate ice cream with vanilla chips. Bedrock and fallen blocks of Redmond Formation constrict the river at Eye-of-the-Needle Rapid, mile 38.4. The Redmond Formation is the most common rock exposed next to the river from Eye-of-the-Needle to where the canyon opens up above Horseshoe Bend at mile 22.

A period of erosion followed Redmond volcanism. Then 3000 feet of *Hess Canyon Group* sediments were deposited along what was then a marine shoreline.

Hess Canyon Group

The *White Ledges Formation* forms a resistant hogback ridge southeast of the river downstream of Gleason Flat. River runners get their best feel of the White Ledges Formation at Quartzite Falls where the river is constricted by a resistant ledge and pours over blocks of quartzite. The White Ledges Formation is the lowest and oldest unit in the Hess Canyon Group. Its white color contrasts sharply with the dark slates of the overlying Yankee Joe Formation.



Ridge of White Ledges Quartzite *Glenn Rink*

The dark shales of the *Yankee Joe Formation* are best exposed at the mouth of Blackjack Wash, mile 29. Notice ripple marks made by ancient wave action.

The *Blackjack Formation* is the uppermost and youngest unit in the Hess Canyon Group. The quartzites and slates of the Blackjack Formation are not exposed close to the river.

Hess Canyon Group sediments were metamorphosed to quartzites and slates during the *Mazatzal Orogeny*, an ancient mountain-building event. Mountain-building events like this occur when a segment of ocean floor slams into and slides under the edge of a continent. This collision can form a subduction zone as shown in Figure 12. A subduction zone like this presently is building the Cascade Mountains in the Pacific Northwest.

The Mazatzal Orogeny caused many changes in the older Precambrian rocks in addition to metamorphosing the sediments

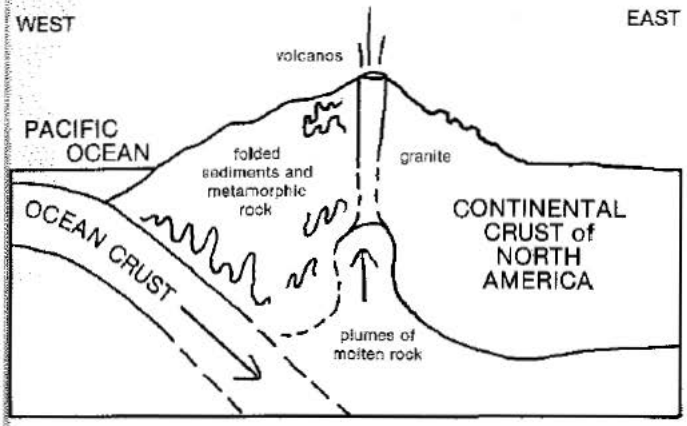


Figure 12, Model cross section of the subduction zone at the western edge of North America during the Laramide Orogeny.

of the Hess Canyon Group. The ashes and cinders of the Redmond Formation were recrystallized by heat and pressure to form the durable porphyry we see today. The stresses caused by this plate collision tilted and folded Hess Canyon Group rocks deep within the earth. These rocks were eventually exposed as the tilted hogback ridge we now see to the southeast of the Salt River and at Quartzite Falls.

The Mazatzal Orogeny ended by 1.6 billion years ago. Another 200 million years passed before the Ruin Granite was intruded 1.4 billion years ago.

Section 3
GEOLOGY of the LOWER SALT RIVER CANYON

mile 16 to mile 7

A billion years of geologic record in Salt River Canyon is missing after the younger Precambrian rocks were deposited. To the north and south of the canyon thick units of Paleozoic and Mesozoic sediments were deposited during this time. Some of these sedimentary rocks probably were also deposited in the Salt River Canyon area but were later eroded.

This section describes the known geologic history of the Salt River Canyon area during the last 80 million years, starting toward the end of the Mesozoic Era. The geology of the lower Salt River Canyon is complex, due to the interplay of crustal shortening which began toward the end of the Mesozoic Era and crustal extension which began about 35 million years ago. During the last 80 million years preexisting faults were reactivated and thick units of conglomerate were deposited.

Late Cretaceous and early Tertiary Events and Rocks

80 to 35 million years ago

The subduction of the Pacific Plate under the west coast of North America at the close of the Mesozoic Era induced the *Laramide Orogeny* in western North America. The Rocky Mountains and the monoclines of the Colorado Plateau arose during the Laramide Orogeny. The Mule Hoof and Rock Canyon monoclines, mile 59.3 and mile 48, of the Salt River Canyon were also created at this time. The Laramide Orogeny gently raised and tilted the southern margin of the Colorado Plateau (and the Salt River Canyon area) to the northeast. Thus, the Transition Zone rose higher than the Colorado Plateau. Large granitic intrusions and volcanoes in the Globe-Superior region may have formed an imposing highland to the south of the Salt River Canyon. The Apache Block (Figure 9) between the Cherry Creek and Canyon Creek faults rose in relation to surrounding terrain.

A large ancient canyon was eroded into Precambrian rock southwest of, and within, the Apache Block. Gravels derived from Precambrian rocks in this ancient canyon can still be found where they were deposited on the Mogollon Rim and adjacent to Flying-V Canyon northeast of the Highway 60 bridge. These gravels indicate that the river in this ancient canyon flowed to the northeast, opposite the flow direction of the present-day Salt River. Phoenix would be very different today if crustal forces had not brought about a drainage reversal over the ensuing 35 million years.

Middle Tertiary Events and Rocks

35 to 14 million years ago

Crustal extension in the Basin and Range Province caused renewed movement on the Canyon Creek and Cherry Creek faults. This down-to-the-west movement brought the Salt River Canyon area below the Mogollon Rim and Flying-V Canyon areas, transforming the ancient canyon into a large, internal basin. The Whitetail Conglomerate, Apache Leap Tuff, and Chalk Creek formation were deposited in this internal basin (Figure 13).

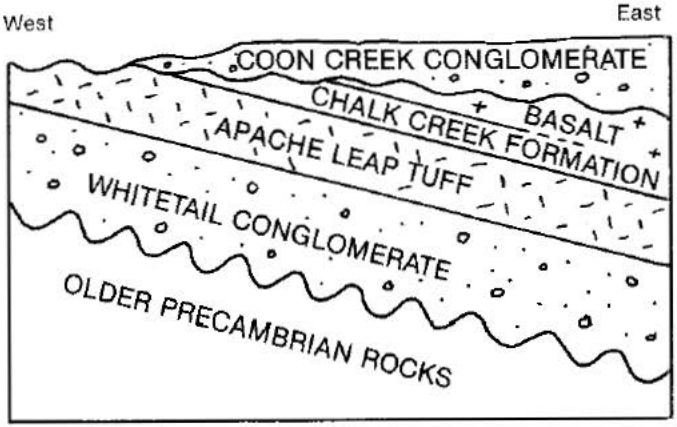


Figure 13, Vertical cross section of Tertiary rock units exposed in the lower section of Salt River Canyon. Precambrian rocks existed for over a billion years before the Tertiary Period. The Whitetail Conglomerate, Apache Leap Tuff, and Chalk Creek formation were tilted by faulting before the Coon Creek conglomerate was deposited.

The *Whitetail Conglomerate* varies in appearance depending on the local source area of the gravels. In the Horseshoe Bend area where the Ruin Granite underlies it, the Whitetail is mostly made up of grus. There the conglomerate is tan to light orange and only 60 feet thick. Upstream, below Black Rock Rapid and at Lower Corral Rapid, and downstream in the area of Pinal Creek, mile 8.5, the Whitetail is light to dark gray, composed mostly of angular fragments of Precambrian-age rock, and is more than 600 feet thick. The distinguishing feature of the Whitetail Conglomerate is a lack of volcanic fragments.

Twenty million years ago a huge, explosive volcanic eruption southwest of the Salt River Canyon near Superior blew volcanic ash and pumice over the region. This ash may form much of the Superstition Mountains. As much as 300 feet of ash accumulated in the Salt River Canyon west of the Canyon Creek Fault. Precambrian rock fragments and boulders were swept along in the lower portion of the ash as it flowed rapidly over the land. The hot ash welded together and formed a cohesive unit called the *Apache Leap Tuff*. The prominent cliffs of Black Mesa north of the river below Redmond Flat are largely made up of Apache Leap Tuff.

Surrounding high areas continued to shed conglomerates into the ancient basin after tuff deposition. The resulting *Chalk Creek conglomerate* differs from the underlying Whitetail Conglomerate in that it contains volcanic rock fragments from the Apache Leap Tuff. Another pulse of volcanism occurred 14 to 16 million years ago. One volcanic plug was intruded on the south side of the river at mile 18.3 and another one was emplaced one-half mile to the south. The southern plug forms a high prominent hill called Shendaby, an Apache word meaning "to scout" or "look around." Magmas from volcanic vents along the Canyon and Cherry Creek faults flowed over the land and formed basalt. Basalts also flowed from a volcanic center near Coon Creek (mile 16) and dammed up what was probably a small, northeast-flowing stream. This natural dam formed a four-square-mile lake. In the vicinity of Chalk Creek, mile 15, you can still see *dolomite* (sedimentary rock similar to limestone) that formed in this lake.

Late Tertiary Events and Rocks

14 to 2 million years ago

A second episode of down-to-the-west faulting occurred 12 to 14 million years ago, reactivating the Canyon Creek and Cherry Creek faults along with other north-south oriented faults. This faulting ultimately caused the Salt River's present southwest-flowing course. Characteristics of these faults change from northeast to southwest in two ways: (1) the amount of displacement increases and (2) the fault planes become less steep. The fault planes are probably curved, becoming less steep with depth. These characteristics combine to tilt the overriding rocks to the northeast (Figure 14). This tilt is readily apparent at Black Mesa where from mile 15

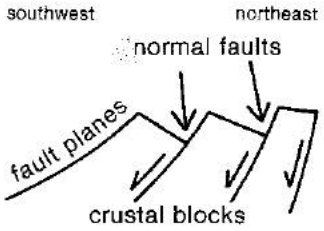


Figure 14, Schematic vertical cross section of late Tertiary faulting in the lower section of the Salt River Canyon.

to mile 12 the rock units are progressively higher and farther from the river.

Increasing displacement of faults to the southwest caused the Tonto Basin to the west to become the deepest basin in the area. This ended the period of internal drainage in the ancient basin of the Salt River Canyon. Sediments from the Salt River Canyon area began to be transported to the west into the Tonto Basin.

As the Tonto Basin filled, gravels of the *Coon Creek conglomerate* were deposited in the lower Salt River Canyon area. These gravels collected in small fault-bounded basins and are best exposed next to the river at the margins of Redmond Flat. The Coon Creek conglomerate is commonly gray to tan and contains many angular volcanic and Precambrian rock fragments. It has not been deformed or tilted much by faulting indicating that little fault movement has occurred along the lower Salt River Canyon during the last several million years.

The Salt River evolved as a through-going drainage past the Tonto Basin in the last few million years. This early Salt River left several gravel terraces as much as 500 feet above the present-day river. These gravels can be distinguished from earlier Tertiary gravels because the cobbles are more rounded and are poorly cemented.

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PLANTS

Peggy E. Pollak

Cottonwoods Tom Brownold

The Salt River Canyon encompasses an incredible diversity of plants in the short space of 52 miles. *Riparian* (riverbank) habitat is dominated by mesquite, tamarisk, willow, seep willow, and cottonwood trees, with ash, sycamore, black walnut, and box-elder trees in the side canyons. The riparian communities are especially diverse, creating a haven for birds and other wildlife.

Plant communities upslope from the river range from piñon-juniper woodland at Highway 60 to Sonoran desertscrub with saguaro, palo verde, creosote bush, and crucifixion thorn at Highway 288.

Please do not collect plants. Because of heavy recreational use, negative impact on plant populations will occur even if each person picks only a few flowers. Any mention of a plant's historical or medicinal use should not to be taken as an endorsement that such use is beneficial or even safe.

The first part of this chapter discusses factors affecting plant communities and the second part describes specific plants you will find as you travel downriver.

FACTORS AFFECTING PLANT COMMUNITIES

A plant community consists of those plants found together because, in order to grow and reproduce, they require similar physical conditions or *habitat*.

Biologist C. Hart Merriam developed the life zone concept in 1890 to describe plant communities at different elevations and latitudes. He noted that plants growing at high elevations near the equator are similar to those found in low lying areas in southern Canada. Merriam described five distinct zones of vegetation in Arizona characterized by specific plant communities and associated animals. Two of these exist in Salt River Canyon: the Lower Sonoran Zone which in this guide we call Sonoran desertscrub and the Upper Sonoran Zone which in this guide we call piñon-juniper woodland.

Abiotic conditions, those not related to living organisms, that affect plant communities include light, moisture, temperature, and soil type. Amount of usable light can be affected by shading and by *slope aspect*, the direction a slope is facing. Factors which reduce moisture availability include low precipitation, sandy soils and steep slopes which hold water poorly, frozen soil from which plants cannot absorb water, and high temperatures which hasten water loss from plants and from the soil. Bottom lands and clay or loamy soils hold water well. Each plant species has optimum temperature requirements. Some plants, like saguaro cactus, cannot tolerate low temperatures while others cannot tolerate high temperatures. Steep slopes and rocky soils tend to be low in plant nutrients. Organic debris accumulating in low lying areas enriches

soil nutrients. Desert plants of the lower Salt River are adapted to high light, high temperature, alkaline and nutrient poor soil, and low water availability. Higher elevations and the riverbank are occupied by plants adapted to cooler and moister conditions.

Grazing is a biotic factor that affects plant communities along the Salt River. Animals graze selectively, removing palatable species and leaving unpalatable ones to thrive. They prefer to graze on tender young seedlings which reduces *recruitment*, the replacement of old members of a community by young members. Grazing animals trample plants and compact the soil leading to reduced water-holding capacity. Cattle differ from native grazers in that they are heavier and congregate in herds, concentrating their impact. Native grazers are smaller and more evenly distributed so their impact on plants is less intense.

PLANTS at SELECTED SITES

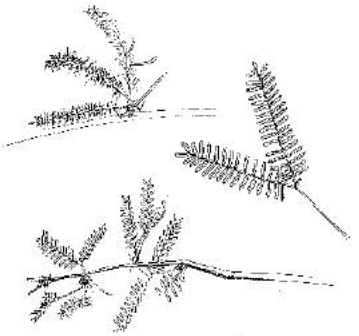
Highway 60 Bridge—mile 60

Ponderosa pines grow on the slope at river left, indicating that this north-facing slope is cool. The south-facing slope on river right is sunnier so plants adapted to dryness grow there.

Prickly pear cacti grow at river right. Be careful not to touch them because, even if you avoid the conspicuous spines, tiny, almost invisible hairs, called *glochids*, are hard to remove and are very irritating. Prickly pear have large flat pads, each projecting at an angle from the one below. They flower in spring in various shades of yellow, peach, pink, and red. The red fruits, borne in a row at the edge of the pads, ripen in late summer and can be made into a good jam. The pads are edible too, and are sometimes sold in grocery produce sections as *nopales*. Prickly pear is common throughout the Southwest and is used by all native southwestern peoples.

Mesquite and catclaw acacia grow along the river banks. Both are members of the legume (pea) family and bear their seeds in pods. Both have bipinnate leaves (each leaf is made up of two rows of leaflets opposite each other) and thorny stems. Mesquite is usually larger, more treelike, and has larger leaves than acacia. Mesquite can survive in the desert because it has a taproot that reaches the upper edge of the water table, sometimes more than 40 feet deep. Such plants are called *phreatophytes*. Mesquite pods, and less often the extremely hard seeds, provide food for many desert rodents, birds, coyotes, and people. Indians throughout southern Arizona grind the pods into a meal that is mixed with water and eaten raw or cooked.

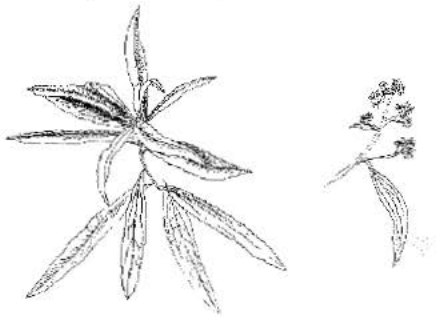
Prickly pear cactus *Michael Collier*



Mesquite leaf *Ruth Ann Border*

Yuccas occur on both sides of the river. During spring and summer they send up a flower stalk that towers 10 to 15 feet above the main body of the plant which consists of stiff pointed leaves emanating from a central base. Yuccas depend on a single genus of moth, *Pronuba*, for pollination. Apache women gathered and roasted the fruit, chucking the seeds and fibery exterior before serving. Soap can be made from the roots. Yucca is also called needle-and-thread plant because Indians sewed with the sharp, stiff point of the leaf and leaf fibers.

Other plants live close to the river where water is more available, but high light and temperature levels require adaptations to reduce water loss. Desert broom is a shrub with stout, bright green stems that appear leafless in some species. They reduce water loss by having small leaves or no leaves at all. Seep willow is a shrub that is closely related to desert broom. Though it looks like willow, it is not in that family. Seep willow leaves are toothed and



Seep willow leaves *Ruth Ann Border*

slightly wider than true willow leaves. Live oak is an evergreen shrub with tough leathery leaves, another adaptation to prevent water loss. Each lobe of the oak leaf ends in a sharp spine that deters browsers. Barberry resembles live oak but has yellow flowers in the spring and produces blue berries, while oak has inconspicuous flowers and produces acorns. Acorns, a staple of Apache and Yavapai Indians, are prepared by leaching out the acid, grinding the kernel, and mixing the meal with other flour to form cakes which are then roasted or fried.

Ocotillo looks like a bunch of tall, bare, sinuous and lifeless sticks bearing distinct spines. After a rain the plant quickly develops green leaves which it loses during dry times. The stems bear terminal clusters of pendulous red flowers in the spring. Fences made of ocotillo stalks continue to produce leaves for years after the stalks are cut.

Fortunately for boaters, the spring flowering season coincides with the boating season on the Salt River. The herbaceous flowering plants include desert marigold, a yellow daisylike flower with notched petals and woolly grey-green foliage. Caltrop is a creeping plant with five orange petals per flower. Clammy weed, in the caper family, has white or yellow summer-blooming flowers with four petals and long pink or purple stamens, elongated seed pods, and large cloverlike leaves. Chuparosa, or desert honeysuckle bears orange flowers that have four petals which curve sharply back toward the base of the flower, like a miniature tiger lily. The leaves are simple, linear, and occur in pairs on the stem. Spiny goldenweed flowers look like small daisies on a shrubby plant. Sideoats grama is the delicate grass with all the florets (or spikelets) on one side of the stem.

Cibecue Creek—mile 53

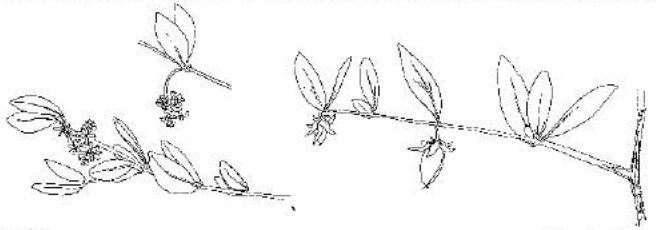
Mesquite and yucca, as well as piñon pine and juniper, grow in open areas on river left. Piñon pine has needles in bundles of two. The cones, which drop in the fall, are short, wide, and resinous. Piñon groves produce bumper crops of seeds every three to seven years. Apaches collect the seeds in late fall by spreading skins or cloth under the tree and shaking the seeds out of the cones. They cure the seeds in salt water, sometimes roast them, and eat or sell them, producing an important cash crop for these people. The raw seeds have a sweet, nutty flavor.

Juniper is sometimes incorrectly called cedar. The leaves look like small green branches with scales and, when dried, are made into a tea by Apaches to relieve coughs and to relax muscles during childbirth. The bitter, blue juniper berry is a staple in bear diets but is eaten only as a "starvation food" by native peoples.

Ocotillo, prickly pear, yucca, juniper, and agave cover the right slope. Agave looks like yucca, but has broader fleshier leaves. The other common name for agave, century plant, derives from its reproductive strategy; once in its lifetime, of 20 to 100 years, it flowers in a magnificent display of yellow, orange, or pink blooms on a stalk 15 to 20 feet tall. Then the plant dies. Just before flowering, when the plant has stored the maximum amount of nutrients, native people harvest its *crown*, at the base of the plant by peeling and cutting back the leaves. They wrap the crowns in leaves, place them in a deep pit lined with charcoal and red hot rocks, covered with grass and a thick layer of earth, and bake them for as long as 15 days. The sweet fibrous cakes can be stored for months. Apaches formerly produced *tiswin*, an intoxicating beverage, from fermenting crowns.

Mistletoe is a parasite that grows in both juniper and mesquite trees. It appears as round, odd-looking balls of foliage among the branches of the host plant. The same plant that earns you a kiss at Christmastime weakens and eventually kills its host.

Acacia, mesquite, barberry, and several newcomers live closer to the river. Jojoba is a shrub with paired, grey-green upright leaves that look like a series of small rabbit ears lined up along the stem.



Jojoba *Ruth Ann Border*

Female plants produce pendulous, hard, brown fruits rich in oil that can be substituted for sperm whale oil, and jojoba is now grown commercially to extract this oil. Apaches use the oil in cosmetics and shampoo. Jimson weed, or sacred datura, has large, deep green leaves, a large, white, trumpet-shaped flower, and round, brown, spiny fruit. It contains a dangerous narcotic; its hallucinatory effects led native Americans to use datura in rituals. Sunflowers also bloom here in the summer.

Mesquite, willow, seep willow, and tamarisk grow alongside the river. Tamarisk, also known as salt cedar, is a shrub or small tree with leaves that resemble juniper leaves, though tamarisk is not an evergreen. Commonly called "tammies," they bear terminal clusters of pink flowers in the spring that fade to white later in the

season. Tammies were introduced to this country from the Mediterranean before 1900 for erosion control and have become an undesirable weed in many places, though tamarisk thickets do provide habitat for birds and other wildlife.

Other riparian species inhabit the side canyons of the Salt River. Sycamore is a large tree with white peeling bark and large maplelike leaves. Arizona grape entwines other plants. It has five-lobed leaves and fruits that can be made into jelly, juice, or wine. Large cottonwood trees often shade out other species, creating grassy parklike areas. Cottonwood leaves are shaped like hearts and the bark is rough and brown. Tree tobacco is a tall plant with single or multiple stems bearing large leaves and topped by clusters of tubular yellow flowers. Native people throughout Arizona smoked it and used it as an analgesic poultice. It likely was introduced into this area from South America by Indian trading. Maple, walnut, and ash also grow in shady side canyons.

Four miles downstream from Cibecue, Sonoran desertscrub takes over with the first appearance of saguaro cactus. Saguaro is a branched giant or single green pillar with distinct ribs. The fragant white flowers bloom at night in early spring and are pollinated by moths and long-nosed bats. Saguaros grow slowly and are protected as the Arizona state flower. Native people harvest the sweet fruits for food. Palo verde, like mesquite and acacia, is a tree in the pea family. The Spanish translation, "green stick," describes the smooth green bark that allows the trees to photosynthesize since they lack leaves most of the year. Palo verde trees produce yellow pealike flowers in the spring and the fruit is a pealike pod. Rodents and birds eat the seeds, and honeybees collect nectar from the flowers.

Saguaro cactus *Larry Stevens*

Palo verde *Michael Collier*

Cherry Creek—mile 24

Plant communities on the slopes above the river change little from this point downstream. You will see few piñons or junipers. The flora is dominated by drought-tolerant plants such as mesquite, saguaro, ocotillo, and yucca. Barrel cacti and several species of cholla also occur. Barrel cacti look like short saguaro with beautiful variously colored flowers in the spring.

The dominant plant in the riparian zone is either seep willow or tamarisk, probably depending on which happened to become established first. Stay away from the plant called stickleaf, also known as blazing star, which is abundant at Cherry Creek. It has beautiful creamy white to yellow starlike flowers in the summer and attractive dry fruit cups in the fall, but the leaves have sharp irregular teeth that make them frustrating to remove from clothing. Burrobrush is a sweet-smelling herb with yellow flower cluster

and linear leaves. Desert marigolds are also abundant here. Desert catalpa looks like willow, except its leaves are thin, long, and droopy.

Horseshoe Bend—mile 21

Desert broom dominates the flora on the bank along this part of the river. Heronbill, with purple flowers that have a protruding "beak," grows in the sand. Monkey flower, with yellow, asymmetrical snapdragon-like flowers can be found in the mud at river's edge. A variety of monkey flower with red blossoms is less common here.

Take a short hike away from the river to see barrel cactus, prickly pear, yucca, sotol, and other spiny plants like crucifixion thorn and catclaw. Several stately tree tobacco plants and clumps of paper flower grow here. Yellow daisy-shaped paper flowers dry up but do not fall off after they bloom. These plants flower during April and May to create a striking display.

Chalk Creek and Coon Creek—mile 15 1/2

A large mesquite *bosque*, or forest, provides excellent bird habitat, with both cover and food, so this is the place to see birds. During spring when the cottonwoods bloom, the "cotton" fibers that aid in seed dispersal pile several inches deep so that the ground appears to be covered with snow. You can find horsetail, maidenhair fern, elderberry, and several species of penstemon near the waterfall and pool in Chalk Creek. Horsetail resembles a ribbed green stick about a foot tall and has no true leaves. The stems contain silica and were used by the Apache and pioneers to clean dishes so it is sometimes called scouring rush. Maidenhair fern is a delicate water-loving plant. Elderberry fruits are consumed by people and birds. Yerba-santa grows here and is used by herbalists, based on traditional Indian use, as a tea for lung problems.

Klondyke Butte—mile 9

At the end of the journey is a typical Sonoran desertscrub community dominated by palo verde, mesquite, jojoba, saguaro, and creosote bush. Creosote bush is a shrub with small leathery leaves. Sonoran desert tribes use it externally as a medicine for athlete's foot and other fungi, and as a deodorant. Taken as a tea, it is a treatment for diabetes. The oldest reported creosote bush from the Sonoran desert is 1100 years old. Tamarisk is the dominant species at the edge of the river. The handsome tall grass is common reed.

CONSPICUOUS PLANTS of the SALT RIVER CANYON

Common Name	Scientific Name
	Trees
Catclaw acacia	*Acacia greggii*
Ash	*Fraxinus* spp.
Cottonwood	*Populus fremontii*
Desert willow	*Chilopsis linearis*
Box-elder	*Acer negundo*
Juniper	*Juniperus* spp.
Mesquite	*Prosopis juliflora*
Shrub live oak	*Quercus turbinella*

Palo verde	*Cercidium* spp.
Piñon pine	*Pinus edulis*
Ponderosa pine	*Pinus ponderosa*
Sycamore	*Platanus wrightii*
Tamarisk or salt cedar	*Tamarisk pentandra*
Black walnut	*Juglans major*
Coyote willow	*Salix exigua*
Goodding willow	*S. gooddingii*

Shrubs

Barberry	*Berberis* spp.
Creosote bush	*Larrea tridentata*
Crucifixion thorn	*Canotia holocantha*
Desert broom	*Baccharis sarothroides*
Arizona grape	*Vitis arizonica*
Jojoba	*Simondsia chinensis*
Manzanita	*Arctostaphylos* spp.
Mormon tea	*Ephedra* spp.
Seep willow	*B. glutinosa*
Squawbush	*Rhus trilobata*

Succulents

Barrel cactus	*Ferocactus* spp.
Century plant	*Agave* spp.
Cholla	*Opuntia* spp.
Fishhook cactus	*Mammalaria* spp.
Hedgehog cactus	*Echinocereus* spp.
Ocotillo	*Fouquieria splendens*
Prickly pear	*Opuntia* spp.
Saguaro	*Cereus giganteus*
Sotol	*Dasylirion wheeleri*
Yucca	*Yucca* spp.

Herbaceous Plants

Arrowweed	*Tessaria sericea*
Beardtongue	*Penstemon* spp.
Brittlebush	*Encelia farinosa*
Buckbrush	*Ceanothus greggii*
Desert buckwheat	*Eriogonum densum*
Burrobrush	*Hymenoclea salsola*
Caltrop	*Kallstroemia grandiflora*
Camphor weed	*Heterotheca psammophila*
Cattail	*Typha* spp.
Clammyweed	*Polanisia* spp.
Clematis	*Clematis drummondii*
White sweet clover	*Melilotus alba*
Yellow sweet clover	*M. officinalis*
Cocklebur	*Xanthium strumarium*
Desert honeysuckle, chuparosa	*Anisacanthus thurberi*
Devils claw	*Proboscidea parviflora*
Dock, wild rhubarb	*Rumex hymenosepalus*
Elderberry	*Sambucus mexicana*
Evening primrose	*Oenothera* spp.
Fleabane	*Erigeron* sp.
Desert four o'clock	*Allionia incarnata*
Globe mallow	*Sphaeralcea* sp.
Goldenweed	*Haplopappus* sp.
Heronbill	*Erodium texanum*
Indian root	*Aristolochia* sp.
Jimson weed	*Datura meteloides*
Knotweed	*Polygonum* sp.
Desert marigold	*Baileya multiradiata*
Fetid marigold	*Pectis* sp.
Mint	*Mentha* spp.
Mistletoe	*Phoradendron* sp.
Monkey flower	*Mimulus* spp.
Paper flower	*Psilostrophe cooperi*
Peppergrass	*Lepidium* sp.
Poison ivy	*Toxicodendron radicans*
Prickly poppy	*Argemone platyceras*
Ragweed	*Ambrosia psilostachya*
Snakeweed	*Gutierrezia sarothrae*
Stickleaf, blazing star	*Mentzelia* sp.
Sunflower	*Helianthus* sp.
Tickseed	*Coreopsis californica*
Desert tobacco	*Nicotiana trigonophylla*
Tree tobacco	*N. glauca*
Winter fat	*Eurotia lanata*
Wolfberry	*Lycium* spp.
Yarrow	*Achillea lanulosa*
Yerba del venado	*Porophyllum gracile*
Yerba-santa	*Eriodictyon angustifolium*

Grasses and Sedges

Red brome	*Bromus rubens*
Side-oats grama	*Bouteloua curtipendula*

Bermuda grass	*Cynodon dactylon*
Common reed	*Phragmites australis*
Sedge	*Carex* spp.
Three-awn	*Aristida* spp.
Ferns and Allied Plants	
Cloak fern	*Notholaena* sp.
Maidenhair fern	*Adiantum capillus-veneris*
Horsetail, scouring rush	*Equisetum* sp.

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BIRDS

Bryan Brown

Raven — Marion Sharp

The large number of bird species that can be seen along the Salt River, in excess of 200, is the result of both geography and habitat diversity. The river corridor spans the biogeographic gap between the mountainous region of the Mogollon Rim and the lower areas of the Sonoran Desert. As a result, mountain and desert birds may be seen only a few miles apart along the river. The diverse habitats present along the river include open water, shoreline, cliff, riparian woodland and forest, piñon-juniper woodland, and Sonoran desertscrub; together, they provide a diversity of environments, each with its own particular group of bird species.

HABITATS AVAILABLE TO BIRDS

Most birds occur in specific places where the environment is most suitable to their needs. Birds are found in their preferred habitat in predictable patterns, especially during the nesting season of spring and early summer. Some birds occupy more than one habitat, while birds such as the common raven and house finch are seen in virtually all habitats. This brief summary of general habitats in the Salt River Canyon and the birds most commonly found in them may help you develop an awareness of birds and the habitats they occupy along the Salt River.

Riparian Habitats

Open Water—The river channel, eddies and backwaters attract nesting or migrating waterfowl such as geese, ducks, teal, and mergansers. Belted kingfishers, swifts and swallows are often seen foraging over open water.

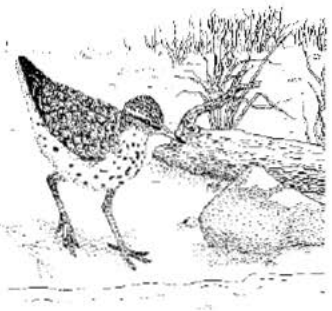
Shoreline—Sandy beaches and cobble bars along the water's edge are the preferred habitat of shorebirds and wading birds such as great blue herons, spotted sandpipers, and killdeer. Black phoebes are frequently seen at the water's edge or fluttering over the river.

Scrubland and woodland—Low, dense, riverside stands of mesquite, tamarisk, willow, or desert broom are home to doves, black-chinned and rufous hummingbirds, ash-throated flycatchers, Bewick's wrens, blue-gray gnatcatchers, northern mockingbirds, northern cardinals, phainopeplas, Bell's vireos, Lucy's and yellow warblers, common yellowthroats, yellow-breasted chats, blue grosbeaks, and lesser goldfinches; mostly small songbirds.

Cottonwood or sycamore forests—Large cottonwood or sycamore trees, especially where they form a closed canopy forest over smaller mesquite trees, exhibit the greatest density of birds of any habitat along the river. Screech owls, woodpeckers, and orioles are seen here, together with those species associated with riparian scrubland and woodland. Large numbers of migratory birds are attracted to these riparian forests in the spring.

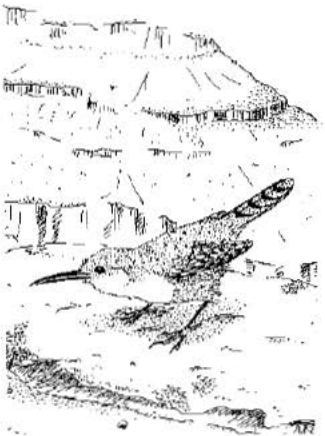
Upland Habitats

Cliffs—Vertical rock faces are the preferred nest sites of cliff swallows and rough-winged swallows which build large colonies of mud nests on riverside cliffs. Black phoebes and canyon wrens also nest on cliffs, as do bald eagles and red-tailed hawks.



Spotted sandpiper *Marion Sharp*

Great blue heron *Marion Shar*



Canyon wren *Marion Sharp*

Blue-gray gnatcatcher *Marion Shar*

Gambel's quail and roadrunner
Ali Partridge

Cactus wren *Marion Sharp*

Bell's vireo *Marion Sharp*

Black-throated sparrow *Marion Sharp*

Piñon-juniper woodland and chaparral—From the Highway 60 bridge downstream to approximately Cibecue Creek, the vegetation above the floodplain is dominated by piñon pine, juniper, and several species of evergreen shrub collectively referred to as chaparral. Common poorwill, pinyon and scrub jays, are characteristic birds of this habitat.

Sonoran desertscrub—Below Cibecue Creek the upland vegetation is mostly Sonoran desertscrub dominated by saguaro cactus, ocotillo, jojoba, catclaw, crucifixion thorn, and creosote bush. Sonoran desertscrub supports Gambel's quail, roadrunners, elf owls, lesser nighthawks, Costa's hummingbirds, Gila woodpeckers, verdin, cactus wrens, curve-billed thrashers, black-tailed gnatcatchers, brown towhees, and black-throated sparrows.

HOW to SEE BIRDS

Birds are most vocal and visible during the spring and early summer breeding period, especially in the morning. Songs advertise for mates or aid in the defense of a nesting or feeding area.

Birding boaters are fortunate that the height of bird activity corresponds with the height of the river running season. You will encounter myriad songs and calls that will challenge even the most highly developed curiosity. Some birders make "pishing" and "pssst" sounds to draw birds in. Once you see a bird, note its behavior. A bird that is regularly chasing other individuals of the same species is either defending a territory or is involved in courtship. A bird with grasses, twigs, or other inedible things in its bill is probably involved in nest construction. A bird with its bill stuffed with insects is surely feeding young at or near the nest.

CONSPICUOUS BIRDS of the SALT RIVER CANYON

This checklist contains only those species that are regularly seen in the Salt River Canyon. Other species that are rare, occur irregularly, or are vagrants (far from their normal range) have not been included here, though they are occasionally seen along the river.

Key to Symbols:

AB—Abundance: A = abundant, C = common, U = uncommon

ST—Status: B = breeding/nesting, M = migrant, T = transient

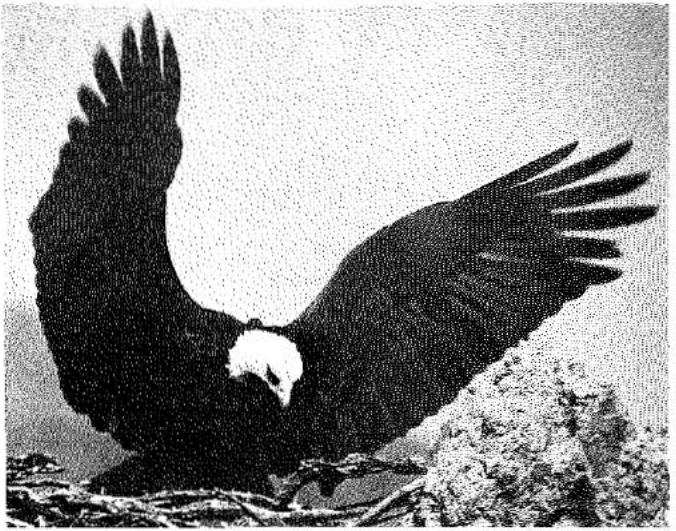
SN—Season: S/F = spring/fall, W = winter, S = summer, Y = yearlong, (species that occur in winter or summer usually are present as migrants in spring and fall.)

Common Name	Scientific Name	AB	ST	SN
Green-backed heron	*Butorides striatus*	U	B	Y
Great blue heron	*Ardea herodias*	C	T	W
Snowy egret	*Egretta thula*	U	M	S/F
Canada goose	*Branta canadensis*	U	M	W
Mallard	*Anas platyrhynchos*	C	T	Y
Green-winged teal	*A. crecca*	C	M	S/F
American wigeon	*A. americana*	C	M	W
Blue-winged teal	*A. discors*	C	M	S/F
Cinnamon teal	*A. cyanoptera*	C	M	S/F
Redhead	*Aythya americana*	U	T	W
other ducks		U	T	Y
Common merganser	*Mergus merganser*	C	T	W
Turkey vulture	*Cathartes aura*	C	B	S
Cooper's hawk	*Accipiter cooperii*	U	B	Y
Red-tailed hawk	*Buteo jamaicensis*	C	B	Y
Swainson's hawk	*B. swainsoni*	C	M	S/F
Harris' hawk	*Parabuteo unicinctus*	C	B	Y
Golden eagle	*Aquila chrysaetos*	U	B	Y
Bald eagle	*Haliaeetus leucocephalus*	C	B	Y
Osprey	*Pandion haliaetus*	U	M	S/F
American kestrel	*Falco sparverius*	U	B	Y
Gambel's quail	*Callipepla gambelii*	A	B	Y
American coot	*Fulica americana*	U	T	Y
Killdeer	*Charadrius vociferous*	C	B	Y
Spotted sandpiper	*Actitis macularia*	A	B	Y
White-winged dove	*Zenaida asiatica*	A	B	S
Mourning dove	*Z. macroura*	A	B	Y
Greater roadrunner	*Geococcyx californianus*	C	B	Y
Western screech-owl	*Otus kennecottii*	C	B	Y
Great horned owl	*Bubo virgianus*	U	B	Y
Elf owl	*Micrathene whitneyi*	C	B	S
Common poorwill	*Phalaenoptilus nuttallii*	C	B	S
Lesser nighthawk	*Chordeiles acutipennis*	C	B	S
White-throated swift	*Aeronautes saxatalis*	C	B	S
Black-chinned hummingbird	*Archilochus alexandri*	C	B	S
Costa's hummingbird	*Calypte costae*	C	B	S
Rufous hummingbird	*Selasphorus rufus*	C	M	S/F
Belted kingfisher	*Ceryle alcyon*	C	T	Y
Common flicker	*Colaptes auratus*	C	B	Y
Gila woodpecker	*Melanerpes uropygialis*	C	B	Y
Yellow-bellied sapsucker	*Sphyrapicus varius*	U	T	Y

Ladder-backed woodpecker	*Picoides scalaris*	U	B	Y
Brown-crested flycatcher	*Myiarchus tyrannulus*	C	B	S
Ash-throated flycatcher	*M. cinerascens*	C	B	S
Western wood-pewee	*Contopus sordidulus*	C	B	S
Black phoebe	*Sayornis nigricans*	A	B	Y
Say's phoebe	*S. saya*	C	B	Y
Vermilion flycatcher	*Pyrocephalus rubinus*	U	B	S
Violet-green swallow	*Tachycineta thalassina*	C	M	S/F
Northern rough-winged swallow	*Stelgidopteryx serripennis*	C	M	S/F
Cliff swallow	*Hirundo pyrrhonota*	A	B	S
Purple martin	*Progne subis*	U	B	S
Pinyon jay	*Gymnorhinus cyanocephalus*	U	T	W
Scrub jay	*Aphelocoma coerulescens*	U	T	W
Common raven	*Corvus corax*	C	B	Y
Mountain chickadee	*Parus gambeli*	A	T	W
Bridled titmouse	*P. wollweberi*	U	T	W
Common bushtit	*Psaltriparus minimus*	U	T	W
Verdin	*Auriparus flaviceps*	A	B	Y
Bewick's wren	*Thryomanes bewickii*	C	B	Y
Cactus wren	*Campylorhynchus brunneicapillus*	C	B	Y
Canyon wren	*Catherpes mexicanus*	C	B	Y
Rock wren	*Salpinctes obsoletus*	C	B	Y
Northern mockingbird	*Mimus polyglottos*	C	B	Y
Curve-billed thrasher	*Toxostoma curvirostre*	C	B	Y
American robin	*Turdus migratorius*	U	M	S/F
Blue-gray gnatcatcher	*Polioptila caerulea*	C	B	Y
Black-tailed gnatcatcher	*P. melanura*	C	B	Y
Ruby-crowned kinglet	*Regulus calendula*	C	T	W
American dipper	*Cinclus mexicanus*	U	T	W
Phainopepla	*Phainopepla nitens*	C	B	S
Bell's vireo	*Vireo bellii*	A	B	S
Orange-crowned warbler	*Vermivora celata*	A	M	S/F
Lucy's warbler	*V. luciae*	A	B	S
Yellow warbler	*Dendroica petechia*	C	B	S
Yellow-rumped warbler	*D. coronata*	A	M	W
Common yellowthroat	*Geothlypus trichas*	C	B	S
Yellow-breasted chat	*Icteria virens*	C	B	S
Red-winged blackbird	*Agelaius phoeniceus*	U	B	Y
Hooded oriole	*Icterus cucullatus*	C	B	S
Great-tailed grackle	*Quiscalus mexicanus*	U	B	S
Brown-headed cowbird	*Molothrus ater*	A	B	S
Western tanager	*Piranga ludoviciana*	C	M	S/F
Summer tanager	*P. rubra*	U	B	S
Northern cardinal	*Cardinalis cardinalis*	C	B	Y
Black-headed grosbeak	*Pheucticus melanocephalus*	C	M	S/F
Blue grosbeak	*Guiraca caerulea*	C	B	S
House finch	*Carpodacus mexicanus*	A	B	Y
Lesser goldfinch	*Carduelis psaltria*	C	B	Y
Green-tailed towhee	*Pipilo chlorurus*	U	T	W
Brown towhee	*P. fuscus*	C	B	Y
Brewer's sparrow	*Spizella breweri*	C	M	S/F
Black-throated sparrow	*Amphispiza bilineata*	C	B	S
Dark-eyed junco	*Junco hyemalis*	A	T	W
White-crowned sparrow	*Zonotrichia leucophrys*	A	T	W

DESERT BALD EAGLES

Arizona supports a small and unique resident population of endangered bald eagles. Currently there are only 27 known breeding areas in Arizona that constitute the entire known population of desert nesting bald eagles in the United States. Four of these breeding areas occur along the Salt River between the U.S. Highway 60 bridge and Roosevelt Lake. Observant boaters making a Salt River Canyon trip in the spring are almost certain to see our national symbol in a wilderness setting, an inspiration not soon to be forgotten.



Bald eagle approaching nest

Roger Weber

The bald eagles of the Salt River Canyon begin courtship activities near the nest site as early as November. A clutch of one to three eggs is laid in January or February; the young eaglets normally hatch in March and make their first flight from the nest in May or June. These young eaglets are dark in color and resemble golden eagles for about five years until they reach sexual maturity, when they develop the characteristic white head and tail.

Bald eagle nests along this portion of the Salt River are located on inaccessible high cliffs, but this does not make them immune to human disturbances. The normal peak of the river running season coincides with the peak of bald eagle nesting activity. This can lead to conflicts between river runners and bald eagles, conflicts that can be harmful to the nesting bald eagles. Human activity on land within one-quarter mile of a nest can disturb nesting activities, cause stress in adult bald eagles, and interrupt the delivery of food to the young eaglets. At worst, these disturbances could lead to the failure of the nest. In contrast, boats floating quietly downriver cause little disturbance to nesting bald eagles.

It is vital that special care be taken to avoid disturbing bald eagles. When floating through areas where bald eagles are active, please refrain from making loud noises, pulling ashore, camping, or hiking. The high activity areas for bald eagles along the Salt River are from miles 52.7-51.8, 50-49, 19-17, and Pinal Creek at mile 8.3.

Bald eagle nests are protected during the breeding season by U.S. Fish and Wildlife Service Nest Watchers. Anyone approached by an official nest watcher and asked to cease an activity or leave a designated area should comply immediately.

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MAMMALS

Glenn Rink and James Bain

Most of the mammals along the Salt River are active at night, so visitors must make special efforts to observe the rich mammal life that occurs here. Walk softly in the dark on moonlit nights. Hold a flashlight level with your head and look for eyeshine. Stand quietly away from camp at dawn and dusk and look among the vegetation. Listen for rodents shuffling about in leaf litter on their nightime errands. Take time to watch the bats at dusk. Drift quietly on flat water and watch the bank, especially when the sun is low in the sky.

Signs of animal activity are common along the river. Rake the sand in camp before turning in, and study the tracks left in the morning. Moist sand and mud flats are prime spots for mammal tracks mixed with the tracks of shore birds, especially the long three-toed tracks of great blue herons. When you stop to look at a rapid, see if any aquatic mammals have been hauling out to portage.

You will see some mammals, such as beaver, otter, and muskrats, only in or near the river, since they spend a large part of their time in the water. Others, such as porcupines, raccoons, coatis, and ringtails, as well as some bats and mice, spend time close to the river. Short walks away from the river, especially in the morning and evening, will provide opportunities to see deer, javelina, and rabbits.

CHANGING MAMMAL LIFE of the SALT RIVER CANYON

Many large mammals that lived in the Southwest during the Pleistocene Epoch more than 10,000 years ago are now extinct. Some of these are the Shasta ground sloth, Harrington's mountain goat, brush ox, flat-headed peccary, saber-toothed cat, mammoth, and mastodon. Others, such as the native horse, camel, and tapir are extirpated in the Southwest.

More recently, hunting and destruction of habitat have extirpated many mammals that in the late 1800s lived along the Salt River or passed through the area. Native elk, wolves, grizzly bears, and jaguars are gone now because of direct human persecution.

Cattle grazing is the most important of man's recent impacts on mammals of the Salt River Canyon. The species of mammals, their

quantity, and distribution in any given area are strongly influenced by plant communities. Some mammals live only in grasslands. Others prefer woodlands or chaparral. Cattle grazing has affected the species, quantity and distribution of plants, and therefore has altered the quantity and distribution of mammals.

NATURAL HISTORY of the MAMMALS of the SALT RIVER CANYON

Few studies have been done along this section of the Salt River, so, many of the mammal ranges are inferred from studies conducted outside the area.

Bats

Bats comprise a large proportion of the species and individuals of mammals that live along the Salt River. From April through October, you may see over 20 different species of bats near the Salt River.

Big brown bat W.W. Goodpaster

Bats feed mostly on insects and other arthropods. During the winter, when insects are scarce, some bats migrate south, some as far as central Mexico; some move to lower elevations in southern Arizona and feed on warmer nights; others reduce their metabolic rate and hibernate. The winter habits of some species are entirely unknown.

Many bats arrive back in the Salt River Canyon area during April. They typically roost in trees, caves, mines, tunnels, abandoned buildings, under bridges, or in cracks in cliffs. The Yuma myotis sometimes waits for cliff swallows to abandon their mud nests and then takes them over. Look for stains, culled insect parts (like moth wings), and bat droppings, which, unlike rodent feces, crumble into coarse, glistening flakes of insect exoskeleton.

The casual observer can recognize three general classes of bats. The small bats that often emerge before sunset and feed in the shaded canyon bottoms are *Pipistrelles* (pipi-strello, "piper of the stars"). Kestrels and other birds feed on them. They weigh little more than a nickel, and are the smallest bats in North America. Roosting in rock crevices by day, they congregate at night to socialize while digesting insects.

The abundant, smallish bats that emerge at dusk are mostly bats of the genus *Myotis* (mys-otis, "mouse-eared").

The third prominent genus, the pallid bat, *Antrozous*, is a relatively large, pale animal that buzzes campfires and often feeds on the ground. For decades, cowboys and biologists were perplexed by piles of scorpion tails left under overhangs. These sites are the temporary feeding roosts of *Antrozous*. Roosting in crevices and small caves by day, they roost in more exposed sites while processing food or resting at night. Look for piles of insect parts from large, terrestrial insects such as katydids, crickets, and scorpions under such shelters.

Though bats are probably the most abundant mammals along the Salt River in the warmer months, they have suffered serious

declines in Arizona and elsewhere. Pesticides build up in the fat that some bats store prior to migration. When they use these fat reserves for their migratory flight, many bats die. Some species are now threatened with extinction. All Arizona bats are protected by law. They are fun to watch, but please do not disturb roosting individuals.

Bats, like other carnivorous wild mammals, are capable of transmitting rabies. While there is little need to fear a bat in a normal setting (roosting, feeding), do not handle bats found on the ground.

Cottontails and Jackrabbits

Eastern and desert cottontails along the Salt River are indistinguishable. Black-tailed jackrabbits have longer ears and are much larger than cottontails, and they inhabit more open country and are better runners and jumpers. They can outrun a single coyote and maintain a speed of 35 mph for at least a half mile. Prehistoric hunters ate many jackrabbits though contemporary hunters believe the meat to be too tough.

Rodents

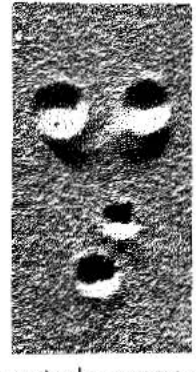
Squirrels—Shy Arizona gray squirrels spend most of their time in the trees along canyon bottoms. You will see the two species of ground squirrel along the Salt River by looking for the source of their high-pitched alarm whistle. Rock squirrels are the largest ground squirrel found in Arizona, and have mottled gray sides and a bushy gray tail which they hold out horizontally while running. As their name implies, they enjoy rocky habitats. You may see Harris' antelope squirrels standing on their hind legs on top of a rock while getting a view and sunning. Once startled, they run off with their tail straight up, then stop and flip their tail while checking for further danger. Antelope squirrels are slightly larger than chipmunks, have similar white stripes on their sides, but are active year-round.

Cliff chipmunks distinguish themselves from antelope squirrels by holding their tails curved up over their backs. Like rock squirrels, they are likely to be seen scrambling around rocks, but are inactive during much of the winter.

New World Mice and Rats—The four species of white-footed mice that live here are hard to distinguish even for experts. They occupy slightly different habitats and eat seeds and some insects.

Three species of woodrat (packrat) may live along the river. All eat foliage and are mutually intolerant. Mexican woodrats live in the piñon-juniper zone and above. Stephen's woodrat occupies rocky, piñon-juniper country and nests in and eats juniper almost

Deer mouse *John Running*



Cactus mouse tracks *Ralph Heinz*

exclusively. White-throated woodrats are the most widespread species. They build huge houses (*middens*) out of sticks, cow dung, bones, and garbage. Find their middens within clumps of cacti or yucca, under palo verde trees, or in cliffs in the piñon-juniper zone and below. The middens can be over eight feet in diameter and are often used for generations, becoming glued together with sticky urine, and then preserved for thousands of years. Woodrat middens have been an interesting source of data on past climates and plant communities.

Beavers—Beavers are bulky rodents, about three feet long, and weigh 40 to 60 pounds. Beaver was the main reason that English-speaking white men first explored the Southwest. Although trappers and encroaching civilization almost extirpated them in the 1800s, beavers have increased in numbers since then. On small streams, beavers build their lodges behind dams that they construct of trees and shrubs. Along the Salt River they live in burrows dug into the banks from below the water line. Steep pathways, called "beaver slides," leading up from the river and the chewed stumps of trees and shrubs are the two most common signs of beaver activity.

Muskrats—Muskrats live below the diversion dam on the lower Salt River, and like beaver, build their burrows in river banks. But muskrats are much smaller than beaver, only about two feet long and weighing two to three pounds.

Porcupines—Porcupines are bulky animals, two to two and one-half feet long. When attacked, they throw their spine-covered tail into the face of their enemy. Their barbed quills can work their way deep into a victim, perhaps penetrating a vital organ and causing death. They have poor eyesight and sometimes waddle about without apparent fear of humans. Porcupines live in forested and riparian areas, denning in rockpiles, caves, and mineshafts, sometimes occupying the same den for generations. They shred and eat the bark and needles of pine trees, the leaves and acorns of oak trees, fungi, cactus fruit, seeds, roots, and flowers.

Carnivores

Bears—During the early 1800s, large, light-colored grizzly bears roamed the desert foothills of the Southwest. Grizzly bears were probably never abundant in Arizona, and they disappeared by the early 1900s due to human pressure.

Black bear track

Steve Carothers

Black bears are much more timid and secretive than grizzlies and, perhaps for this reason, they still live along the Salt River from its headwaters downstream to the area around the Highway 288 bridge. Seeing bears is unlikely, but looking for their sign is fun. Bear feces looks like human feces, but is full of ants, bees, berries, bark, and dirt. Bears roll over large rocks and tear up rotten logs looking for food. Look for their claw marks on tree trunks.

Dogs—The coyote is the largest native dog still living in Arizona. Coyotes are highly adaptable, preying mostly on small mammals, but eating almost anything including plants, birds, fruit, fish, insects, and deer. They typically have a home area of about four square miles, but may travel hundreds of miles in search of food. Between 1915 and 1945, 1,672,604 coyotes were killed by U.S. Fish and Wildlife Service hunters. Despite human's attempts to eradicate coyotes in Arizona, they are doing quite well.

Gray foxes and kit foxes live along the Salt River and eat small mammals, birds, lizards, insects, and plants. Gray foxes are larger, weighing over five pounds, and are more common in and above the piñon-juniper zone. Kit foxes weigh less than five pounds and live in desertscrub.

Skunks—Four different species of skunks may live along the Salt River. When frightened, all are capable of spraying a nasty smelling scent which can linger for days. Western spotted skunks and striped skunks are most likely to be seen. Spotted skunks are small and slender, about the size of a tree squirrel, and are black with irregular white spots and stripes. Striped skunks are stocky, about the size of a large house cat, and are black with a forked white stripe that runs from head to tail.

Skunks are bold nighttime camp thieves. They will even go into tents. Spotted skunks sometimes wake people by pulling on their hair. When a spotted skunk stands on its forepaws, stand back, because it is taking aim and about to spray. Skunks are not easily frightened away, but left alone they will go about their business and then go on their way.

Otters—The only confirmed Salt River area record for the southwestern subspecies of this otter is a skull found by Pete Weinel of the U.S. Forest Service in Cherry Creek in 1970. During the 1950s and 1960s there were at least 10 reports of tracks, an individual shot, and others seen swimming in the Salt River and its tributaries. A few native otter still possibly live along the Salt River and are just being elusive.

Otters are dark-colored, sleek animals three to four feet long from nose to tail tip. Their tracks may be confused with beaver and raccoon, but are more circular, about three inches across and show five toe prints. The web between the toes seldom shows. Fishy-smelling scats containing fish scales and bones left on top of midriver rocks are telltale sign. The best time to see an otter is when the river is low and running clear. If you see an otter or otter sign, please report location and descriptive information to the Nongame Branch of Arizona Game and Fish Department (602-942-3000).

Cats—You may find cat tracks (lacking claw marks) or the covered remains of a bobcat or lion kill along the Salt River. Lions will drag a deer a quarter mile over rough terrain to hide it under a tree or shrub and cover it with dirt and leaves. They also scratch up piles of dirt and leaves in which they urinate repeatedly leaving their scent, probably as a territory marker. This predictable trait has led to many mountain lion deaths since ranchers have often set traps

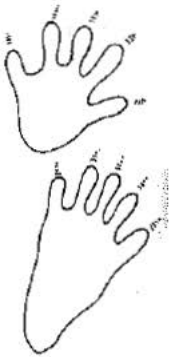
next to these piles. Bobcats usually eat rodents, rabbits, or reptiles, but sometimes will take larger game. Mountain lions prefer deer but will also take smaller game. When game is scarce they may resort to domestic stock. A mountain lion will eat a deer every six to ten days, so it requires a large home range.

Raccoons and their Relatives—Raccoons, coatimundis, and ringtailed cats may be common but are rarely seen along the Salt River. They are usually found close to water. All have dark- and light-colored rings around their tails, though these are less pronounced on coatis. All are good climbers. Raccoons and ringtails are notorious nighttime camp robbers. Coatis are more active during the day. All three are opportunistic omnivores that will eat almost anything including small mammals, lizards, snakes, insects, fruit, nuts, cactus, and carrion. Raccoons are bulky and about three feet long. Their tracks are unmistakable and can almost always be found in the mud next to the river. Coatis, smaller and thinner than raccoons, are tropical mammals that reach the northern limit of their range in Arizona. Females sometimes forage with young in bands of thirty or more animals. Ringtails are even smaller and thinner, though they reach lengths of two and one-half feet. Their long tails are crucial to their catlike agility. They walk in their own tracks (which are catlike) forming impressions that sometimes show six to seven toes.

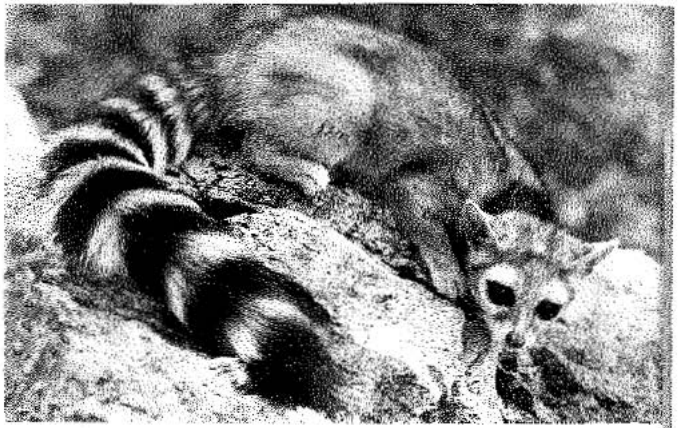
Hoofed Mammals

Deer—Both white-tailed and mule deer live on slopes above the Salt River. White-tailed deer have large, bushy tails that are white underneath. They elevate their tails when alerted or running, so usually the first and last thing seen is their waving flaglike tail. Mule

Raccoon *Glenn Rink*



Raccoon tracks



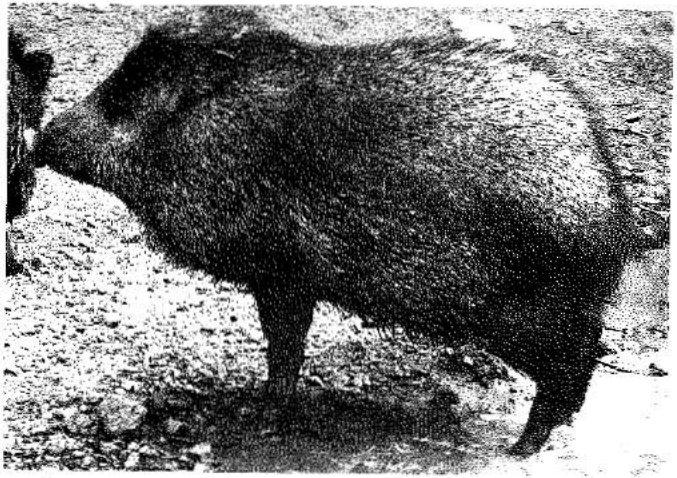
Ringtailed cat *W.W. Goodpaster*

Coatimundi *Rose Houk*

Ringtailed cat tracks *Ralph Heinz*

deer are larger than white-tails, have large ears from which their name is derived, and have black or black-tipped tails. Mule deer sometimes "stot" away from danger with stiff-legged jumps.

Javelina—Javelina, or collared peccaries, are abundant along the lower Salt River. They often move in bands browsing on prickly pear cactus. They also eat jojoba, agave, catclaw, palo verde, juniper, saguaro seeds, and grasses. They have a keen sense of smell but poor eyesight, so on windless days it may be easy to get close without startling them. The best sign of javelina in an area is chewed-up prickly pear cactus. Their tracks resemble small deer tracks.

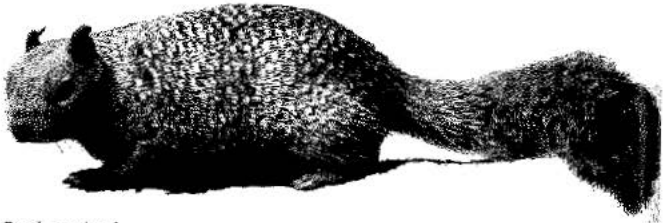


Javelina *Glenn Rink*

LIST of PROBABLE MAMMALS

Key to Symbols:
CM—Comments
* = under study for threatened/endangered status
C = common U = uncommon

Common name	Scientific name	CM
Desert shrew	*Notiosorex crawfordi*	
California leaf-nosed bat	*Macrotus californicus*	*
Yuma myotis	*Myotis yumanensis*	
Cave myotis	*M. velifer*	
Arizona myotis	*M. occultus*	*
Long-eared myotis	*M. evotis*	U
Southwestern myotis	*M. auriculus*	
Fringed myotis	*M. thysanodes*	C
Long-legged myotis	*M. volans*	
California myotis	*M. californicus*	
Western pipistrelle	*Pipistrellus hesperus*	C
Big brown bat	*Eptesicus fuscus*	C
Red bat	*Lasiurus borealis*	U
Southern yellow bat	*L. ega*	U
Hoary bat	*L. cinereus*	U
Spotted bat	*Euderma maculatum*	U
Allen's lappet-browed bat	*Idionycterus phyllotis*	U
Townsend's big-eared bat	*Plecotus townsendii*	
Pallid bat	*Antrozous pallidus*	C
American free-tailed bat	*Tadarida brasiliensis*	
Pocketed free-tailed bat	*T. femorosacca*	U
Big free-tailed bat	*T. macrotis*	
Western Mastiff bat	*Eumops perotis*	
Eastern cottontail	*Sylvilagus floridanus*	
Desert cottontail	*S. audubonii*	
Black-tailed jackrabbit	*Lepus californicus*	
Arizona gray squirrel	*Sciurus arizonensis*	
Rock squirrel	*Spermophilus variegatus*	



Rock squirrel

Tom Brownol

Harris' antelope squirrel	*Ammospermophilus harrisii*
Cliff chipmunk	*Eutamias dorsalis*
Pocket gopher	*Thomomys bottae*
Arizona pocket mouse	*Perognathus amplus*
Bailey's pocket mouse	*P. baileyi*
Rock pocket mouse	*P. intermedius*
Desert pocket mouse	*P. penicillatus*
Ord's kangaroo rat	*Dipodomys ordii*
Merriam's kangaroo rat	*D. merriami*
Beaver	*Castor canadensis*
Western harvest mouse	*Reithrodontomys megalotis*
Deer mouse	*Peromyscus maniculatus*

White-footed mouse	*P. leucopus*	
Brush mouse	*P. boylii*	
Cactus mouse	*P. eremyscus*	
Northern grasshopper mouse	*Onychomys leucogaster*	
Southern grasshopper mouse	*O. torridus*	
Mexican woodrat	*Neotoma mexicana*	
Stephen's woodrat	*N. stephensii*	
White-throated woodrat	*N. albigula*	
Muskrat	*Ondatra zibethicus*	
Porcupine	*Erethizon dorsatum*	
Coyote	*Canis latrans*	
Gray fox	*Urocyon cinereoargenteus*	
Kit fox	*Vulpes macrotis*	
Black bear	*Ursus americanus*	
Raccoon	*Procyon lotor*	
Coatimundi	*Nasua nasua*	
Ringtailed cat	*Bassariscus astutus*	
Badger	*Taxidea taxus*	
Western spotted skunk	*Spilogale gracilis*	
Striped skunk	*Mephitis mephitis*	
Hooded skunk	*M. macroura*	U
Hog-nosed skunk	*Conepatus mesoleucus*	U
Otter	*Lutra canadensis*	U
Mountain lion	*Felis concolor*	
Bobcat	*F. rufus*	
Javelina (collared peccary)	*Tayassu tajacu*	
Elk	*Cervus elaphus*	
White-tailed deer	*Odocoileus virgianus*	
Mule deer	*O. hemionus*	

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FISH

William Leibfried

NATIVE FISH

Colorado squawfish taken at the mouth of Cherry Creek, mile 24, about the turn of the century

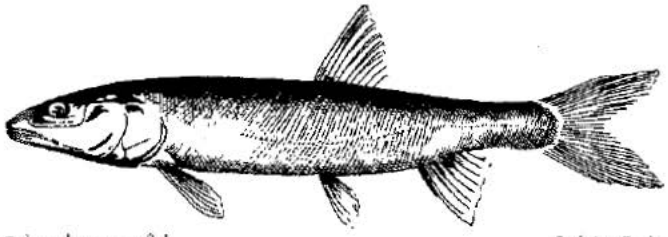
As a wild free-flowing river, the Salt River provides habitat for several unique and unusual native fish species found only in the desert Southwest. Historically, as many as 15 species of fish were native to the Salt River. Today, only five species remain: Gila and mountain suckers, longfin and speckled dace, and roundtail chub. The Gila and bonytail chub, loachminnow, spikedace, Colorado squawfish, razorback sucker, woundfin, Gila topminnow, and Arizona or Apache trout are extirpated from the Salt River.

These native fishes adapted to the rigors of desert rivers through thousands of years of evolution. The flow in desert rivers may vary from less than 100 cubic feet per second during dry periods to thousands of cfs during floods which can carry many tons of silt. Swift currents and high sediment loads required that the fish minimize frictional resistance to maintain their position in the river. Streamlined body shapes, tiny or few scales, and broad fins are common features of native fish. Razorback suckers have a sharp hump or keel at the top of their heads which probably gives them stability in fast flood water. During flash floods native fish may have the instinctive ability to find eddies and slack water quickly while nonnative fish are washed downstream.

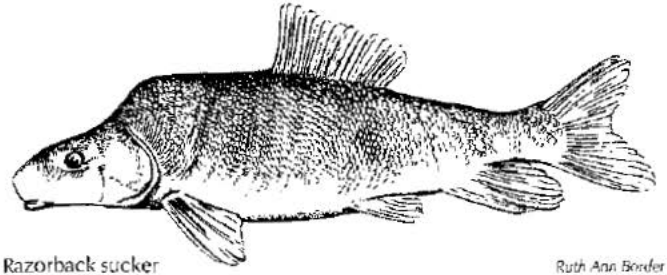
The Colorado squawfish is the largest member of the minnow family in North America growing up to six feet and weighing nearly 100 pounds. They were the top aquatic carnivore in the Colorado River system, which includes the Salt River. Squawfish have large mouths with no teeth and swallow their prey whole. They were locally known as "river salmon" and were piled into wagons along with razorback suckers as hog feed and fertilizer by early settlers of Phoenix and Tempe. These fish found their way into irrigation canals where farmers pitchforked them onto their fields. Degradation of habitats and introduction of exotic fish caused the extirpation of these and other once-common native fish in the Salt River and other southwestern rivers. The last recorded specimens of Colorado squawfish in the Salt River were taken at the Highway 60 bridge in 1958. If you mistakenly hook any of these fish, please release them with extra caution.

The Arizona Game and Fish Department and the U.S. Fish and Wildlife Service are reestablishing razorback suckers and Colorado squawfish into the Salt River and its tributaries. The goals of this effort are to learn about life histories and habitat preferences by studying reintroduced fish, and eventually to maintain stable populations of both species. Small razorbacks and squawfish are being stocked into sidestreams in hopes of avoiding large predators, like catfish, that live in the mainstream.

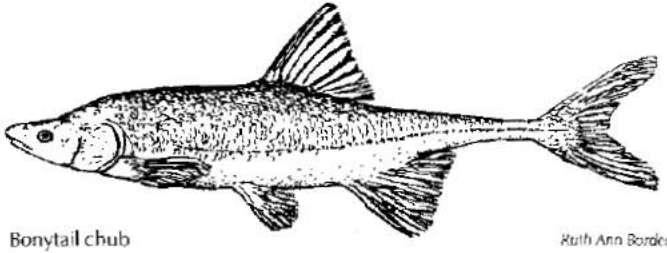
Gila and mountain suckers, longfin and speckled dace, and roundtail chub maintain healthy populations in the Salt River Canyon today.



Colorado squawfish — Ruth Ann Border



Razorback sucker — Ruth Ann Border



Bonytail chub — Ruth Ann Border

NONNATIVE FISH

The introduction of nonnative sportfish into southwestern streams and reservoirs contributed to the decline of native fish. Catfish and bass eat native fish. Baitfish like the red shiner and fathead minnow compete with native minnows for food and breeding territories and have probably contributed to the extirpation of loachminnow and spikedace in the Salt River.

Channel and flathead catfish, smallmouth bass, rainbow trout, and green sunfish are found in the Salt River and are popular with most anglers in Arizona. Sportfishing in the Salt River is good, especially for catfish. Although smallmouth bass inhabit the Salt River, muddy water conditions most of the year make angling for these fish difficult. Channel and flathead catfish are common in the Salt River and grow to large size. Flathead catfish weighing over 35 pounds have been caught here. The common carp is the most abundant introduced fish in the Salt River. It was imported from Asia around the turn of the century, and because it thrives in any aquatic habitat has proliferated throughout the West.

HABITATS

The various fishes occupy specific habitats that can be readily observed. Rapids, riffles, and pools are the most obvious, but quiet river margins and calm, slow moving channels are less apparent habitats that are critical to healthy fish populations.

Quiet areas are the most important habitat for fish reproduction. Some fish build nests, called *redds*, for their eggs to hatch in. Others release eggs into the water to settle to the bottom or adhere

to vegetation to incubate. In either case, too much turbulence or current could carry eggs to unfavorable habitats where they would not hatch. After hatching, young fish, called *fry*, must find refuge from strong currents and predators. Rocks and vegetation in river margins, eddies, and slow moving channels provide protection from predators. Algae and small invertebrates that settle into these slack water habitats provide food for young fish. Adult speckled and longfin dace, red shiners, and fathead minnows, which rarely grow longer that four inches, live in these areas too, though dace are most common in tributaries. Adult suckers and carp feed on algae and bottom debris in these quiet areas too. Catfish inhabit the deeper holes next to cutbanks and cliff faces.

Swift water at the base of rapids is where predatory fish wait for prey to drift downstream to them. Squawfish, roundtail chub, and bass also hide out in protected areas where they can catch unwary prey.

FISH SPECIES LIST

Key to Symbols:
P = Present, population stable or growing
E = Extirpated, no longer present in the Salt River
R = Reintroduced, stocked as an experimental population

Common Name	Scientific Name	Status
Native Fish		
Razorback sucker	*Xyrauchen texanus*	R
Gila sucker	*Catostomus insignis*	P
Mountain sucker	*Pantosteus clarki*	P
Colorado squawfish	*Ptychocheilus lucius*	R
Spikedace	*Meda fulgida*	E
Loachminnow	*Tiaroga cobitis*	E
Woundfin	*Plagopterus argentissimus*	E
Longfin dace	*Agosia chrysogaster*	P
Speckled dace	*Rhinichthys osculus*	P
Roundtail chub	*Gila robusta*	P
Bonytail chub	*G. elegans*	E
Gila chub	*G. intermedia*	E
Gila topminnow	*Poeciliopsis occidentalis*	E
Apache trout	*Oncorhynchus apache*	E
Introduced Fish		
Fathead minnow	*Pimephales promelas*	P
Red shiner	*Notropis lutrensis*	P
Common carp	*Cyprinus carpio*	P
Green sunfish	*Lepomis cyanellus*	P
Smallmouth bass	*Micropterus dolomieui*	P
Channel catfish	*Ictalurus punctatus*	P
Yellow bullhead	*Ameiurus natalis*	P
Flathead catfish	*Pilodictis olivaris*	P
Mosquitofish	*Gambusia affinis*	P
Rainbow trout	*Oncorhynchus mykiss*	P

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AMPHIBIANS and REPTILES

Linn Montgomery

Amphibians and reptiles are among the most obvious animals you will see during late spring and summer along the Salt River. Because they retain little internally produced heat, their body temperatures vary with environmental conditions. Thus many know them as "cold-blooded," although they may be quite warm on clear sunny days. Most tend to be inactive during cool weather or cool times of day.

AMPHIBIANS

Amphibians inhabit both water and land, but return to water to reproduce because their eggs cannot survive drying. Adult frogs and toads, and salamanders, are carnivores feeding mostly on insects. In contrast, the young of most frogs and toads (tadpoles) feed on plants.

Tiger salamanders may live in stock ponds close to the Salt River. They hatch as small larvae with feathery gills along the sides of their head. Although larvae in many populations metamorphose into the adult form (lacking external gills), in some areas they sexually mature and reproduce in the larval body form. Two larval forms exist, sometimes in the same pond. One feeds mostly on insects while the other, with a larger head and different tooth pattern, is a cannibal! Both forms are dark, often with light blotches over the body. They are hard to spot in the water because they often remain submerged.

Toads have stout limbs, wide waists, and relatively dry skin with raised bumps which distinguish them from frogs. True toads of the genus *Bufo* live mostly in moist areas, but may be found far from standing water. Toad tadpoles live mostly in small tributaries or quiet backwaters where fish predators are rare. The two toads you will likely see in the Salt River Canyon are the Woodhouse toad and the smaller red-spotted toad. Like other toads and frogs, they gather around ponds or streams during reproductive seasons when males call to females, particularly during twilight and at night.

Spadefoot toads, whose name comes from a hard, usually black, "spade" on the bottom of the hind feet, are well adapted to inhabit arid zones. They often appear as if by magic in desert pools

following summer rains. As these ponds dry up, spadefoots burrow deep into the sand and mud where they surround themselves in a cocoon of mucus and sloughed skin cells. So protected, they enter a state of inactivity termed *estivation*, when their metabolism is greatly reduced. This allows them to survive until, eventually, low atmospheric pressure and the low-frequency sounds of heavy raindrops cause them to emerge.

Frogs have long, thin legs, narrow waists, and smooth, moist skin. Unlike toads, frogs live in aquatic or at least very damp habitats at all stages of their lives. Bullfrogs are the largest North American frog. Canyon tree frogs are small but their call is loud, sounding like a rivet gun for one-half to three seconds. They live along small tributaries or near springs. Leopard frogs, named for the patterns of blotches covering their bodies, are nonnative, but now inhabit ponds and tributaries of the Salt River.

REPTILES

Reptiles evolved into the first truly terrestrial vertebrates about 300 million years ago. The reptile egg is their greatest advance over amphibians, for it can be laid on land. Reptiles also have thick, dry, scaly skin which reduces water loss.

Turtles and Tortoises

The Sonoran mud turtle lives in quiet water and in tributaries. The bottom of its shell is hinged front and back so that when the turtle withdraws its head, feet, and tail, the front and rear raise to form partial protective doors. These turtles often look like a rock because their shell becomes covered with algae. They produce unpleasant, musky odors when disturbed.

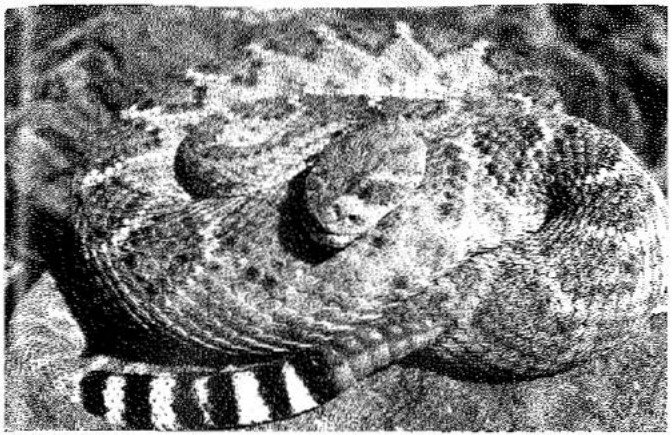
You might see a desert tortoise in dry areas away from the lower Salt River. They mostly eat plants and commonly dig and inhabit burrows during winter and reproductive seasons. In some parts of the Southwest tortoises have become rare due in part to human disturbance. Watch them, then leave them undisturbed.

Lizards

Each habitat harbors its own suite of lizards. Zebra-tailed and greater earless lizards live along the river. Both wave their tails over their backs as they run, displaying distinct black and white bands on their underside. This probably diverts predatory attacks to the tail which can be cast off, leaving the predator with a wriggling item to be consumed, while the original owner lives on to regenerate another tail. You might see eastern fence, side-blotched, or spiny lizards in open rocky areas or boulder fields, while tree lizards dart about the branches of mesquite and other trees and shrubs. These lizards are well known for their territorial and courtship displays, a series of rapid pushups. Individuals performing these displays are often hesitant to leave their perches on rocks and limbs, making them easy to approach. Whiptail and alligator lizards, and skinks live on the ground and forage in leaf litter below trees and shrubs. Some populations of whiptails have no males; eggs produced by females develop without fertilization and produce clones of the female parent.

Snakes

Snakes are harder to find than lizards for several reasons. First, many snakes seek large prey (lizards, other snakes, mammals, and birds), and species that feed on larger prey tend to occur in lower



Western diamondback *Michael Collier*

densities. Second, many snakes are sit-and-wait predators. They remain coiled and inactive, and therefore almost invisible, until an unsuspecting prey item wanders by their lair. Third, many snakes are not active during the day.

Among the more obvious snakes are coachwhips and whipsnakes, which forage in foliage along the lower Salt. Their long thin bodies with large obvious eyes are distinctive. Garter snakes live in moist habitats along waterways where they feed on fishes, frogs, and other animals. Gopher snakes and the common kingsnake occur in a wide variety of habitats, feed on a diversity of prey, and like the whipsnakes and coachwhips, subdue larger prey by constricting them between coils of the body.

A number of other snakes are small and secretive, making encounters unlikely without serious searches through rock and wood piles or leaf litter. Among these is the weakly venomous night snake. Two others are distinctly banded in red, black, and yellow (or white). These are the venomous, but shy western coral snake and the Sonoran mountain kingsnake, a completely harmless predator on small mammals. Learn their color patterns! The red and yellow bands of the kingsnake are separated by black bands, while the red and yellow bands of the coral snake make contact: "Red on yellow, kill a fellow."

Western, western diamondback, black-tailed, and Mojave rattlesnakes inhabit slopes and canyons along the Salt River. Rattlers are primarily active from dusk to dawn. They are sit-and-wait predators that coil in crevices, shaded leaf litter, or under bushes. They strike and inject venom into small animals, then wait for the prey to expire.

All rattlesnakes should be considered dangerous, but a little common sense and care taken as you explore the area will ensure your safety. Look carefully ahead as you pass through brushy areas or next to crevices in rocky areas. Move deliberately and with a firm step and carry a walking stick, passing it from side to side in front of you. Rattlers detect large animals, such as humans, through ground vibrations and will often move away. The rattle ranges from a single click or two to a steady buzz. They do *not* always rattle before they strike. If you hear a rattlesnake and can control your first impulse to take to the air, pause and locate the snake. Remember that rattlesnakes, like most other snakes, tend to be shy and will try hard to avoid interactions with large animals. They are a beautiful and well-adapted component of a complex ecosystem and should not be harmed.

DANGEROUS REPTILES

Arizona has the greatest diversity of venomous reptiles in the U.S., but only thirteen are truly dangerous to humans. The most common are rattlesnakes, but you might also see western coral snakes or Gila monsters. The Gila monster is one of only two poisonous lizards in the world.

Poisonous reptiles should be observed from a safe distance and not disturbed. Bites are rarely fatal, but the venoms can cause severe pain and tissue damage adjacent to the bite, even when excellent medical care is at hand. On the river, many hours are likely to separate the bite and proper care.

LIST of PROBABLE AMPHIBIANS and REPTILES

Common Name	Scientific Name
Amphibians	
Tiger salamander	*Ambystoma tigrinum*
Couch spadefoot toad	*Scaphiopus couchii*
Southern spadefoot toad	*S. multiplicatus*
Southwestern toad	*Bufo microscaphus*
Woodhouse toad	*B. woodhousei*
Sonoran desert toad	*B. alvarius*
Red-spotted toad	*B. punctatus*
Canyon treefrog	*Hyla arenicolor*
Bullfrog	*Rana catesbeiana*
Lowland leopard frog	*R. yavapaiensis*
Chiricahua leopard frog	*R. chiricahuensis*
Reptiles	
Desert tortoise	*Gopherus agassizii*
Sonoran mud turtle	*Kinosternon sonoriense*
Desert night lizard	*Xantusia vigilis*
Western banded gecko	*Coleonyx variegatus*
Desert iguana	*Dipsosaurus dorsalis*
Chuckwalla	*Sauromalus obesus*
Lesser earless lizard	*Holbrookia maculata*
Greater earless lizard	*Cophosaurus texanus*
Zebra-tailed lizard	*Callisaurus draconoides*
Long-nosed leopard lizard	*Gambelia wislizenii*
Common collared lizard	*Crotaphytus collaris*
Clark's spiny lizard	*Sceloporus clarkii*
Desert spiny lizard	*S. magister*
Eastern fence lizard	*S. undulatus*
Tree lizard	*Urosaurus ornatus*
Side-blotched lizard	*Uta stansburiana*
Short-horned lizard	*Phrynosoma douglassii*
Regal horned lizard	*P. solare*
Great plains skink	*Eumeces obsoletus*
Many-lined skink	*E. multivirgatus*
Desert grassland whiptail	*Cnemidophorus uniparens*
Western whiptail	*C. tigris*
Little striped whiptail	*C. inornatus*
Gila spotted whiptail	*C. flagellicaudus*
Plateau spotted whiptail	*C. velox*
Madrean alligator lizard	*Gerrhonotus kingii*
Gila monster	*Heloderma suspectum*
Ringneck snake	*Diadophis punctatus*

Western patch-nosed snake	*Salvadora hexalepis*
Striped whipsnake	*Masticophis taeniatus*
Sonora whipsnake	*M. bilineatus*
Coachwhip	*M. flagellum*
Gopher snake	*Pituophis melanoleucus*
Glossy snake	*Arizona elegans*
Common kingsnake	*Lampropeltis getulus*
Sonoran mountain kingsnake	*L. pyromelana*
Long-nosed snake	*Rhinocheilus lecontei*
Black-necked garter snake	*Thamnophis cyrtopsis*
Narrow-headed garter snake	*T. rufipunctatus*
Western terrestrial garter snake	*T. elegans*
Ground snake	*Sonora semiannulate*
Night snake	*Hypsiglena torquata*
Southwestern black-headed snake	*Tantilla hobartsmithi*
Western coral snake	*Micruroides euryxanthus*
Lyre snake	*Trimorphodon biscutatus*
Black-tailed rattlesnake	*Crotalus molossus*
Western rattlesnake	*C. viridis*
Western diamondback	*C. atrox*
Mojave rattlesnake	*C. scutulatus*

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PEOPLE in the SALT RIVER CANYON

ANCIENT PEOPLES

John W. Hohmann and Glenn Rink

In the past, as in the present, the human struggle to survive in the harsh southwestern deserts has been closely associated with the few rivers and streams that flow year-round, like the Salt River. The camps of early man and the ruins of past civilizations can still be found in the majestic canyons and diverse habitats along the Salt River, a river that continues to supply life-giving water to modern civilization.

There have been no archaeological excavations in Salt River Canyon. Only the surface indications of past cultures have been studied here. By relating these surface finds to more detailed studies of artifacts found outside the Salt River Canyon, a prehistoric picture can begin to be drawn. Our knowledge will improve as more work is carried out at pristine sites. Unfortunately much information has been lost due to vandalism by pot hunters. But now federal, state, and tribal antiquities laws are stronger and more diligently enforced than in the past.

It is critical that we, as casual visitors, keep our impact on prehistoric sites to a minimum by not climbing on walls or walking on fragile deposits. We should leave artifacts where we find them and not leave modern trash.

PaleoIndian, before 5500 *B.C.*

The first humans entered the Southwest about 12,000 years ago. Little evidence of their existence has been found. They led a mobile lifestyle, had insubstantial houses, and did not accumulate many material possessions. Shifting sands and time have eliminated all but the most durable traces of their existence. We do know that they used spears to kill large animals such as giant woolly mammoths, mastodons, native American horses and camels, tapirs, and giant ground sloths that once roamed the American Southwest. A number of sites are located throughout the region where spear points are found associated with the bones of now extinct mammals. PaleoIndians also left other stone tools and numerous scatters of chipped stone where they made their tools.

Archaic, 5500 *B.C.* to *A.D.* 300

As the most recent Ice Age drew to a close about 10,000 years ago, the climate of the Southwest warmed and became drier. Plant and animal communities, as well as the people who depended on them, changed with this warmer, drier climate. Many large mammals such as the mammoths, mastodons, horses, camels, tapirs, and sloths became extinct or were extirpated in the Southwest.

After these extinctions, Archaic people probably subsisted largely from gathering wild plants. But they still hunted small game animals such as rabbits and squirrels, as well as herd animals such as deer. New hunting strategies led to new tools. They extended the range of their spears by the use of a launching stick called the atlatl. The atlatl was a flat, slender, flexible piece of hardwood that was used to throw a five- to six-foot dart with a removable foreshaft. The stone points used on these foreshafts were smaller than the large, earlier points. The very late Archaic people may have also hunted with the bow and arrow. But the small points used with the bow and arrow are only found in great numbers at sites dated later than *A.D.* 700.

Small family groups of Archaic people moved with the changing seasons, primarily following the seasonal availability of edible plants. They gathered and ate gourds, acorns, grass seeds, roots, and other plants. Archaic people may have encouraged the growth of some wild plants by spreading seeds, but a true agricultural lifeway was not adopted until two thousand years ago. By 300 *B.C.* some people in select areas had begun to use corn and squash. Beans were introduced as a food crop several centuries later. By *A.D.* 300 to 500, people in different areas of the Southwest adopted agriculture as a major part of their subsistence base. Agriculture required spending more time in specific places where crops were grown. As the people settled to tend their fields, they constructed more permanent shelters. The energy they put into agriculture resulted in an expanded food supply, increased population, and new forms of social organization. The extended single family, the basic unit of nomadic lifestyles, gave way to larger groups which took up more permanent residence near their crops. Because these people had more permanent residences, they were able to accumulate more possessions. They made, used, and broke pottery that we now see, in the form of sherds, on the surface of so many sites.

Different groups in different areas developed their own ceramic forms and designs. They also developed unique approaches to and traditions in agriculture, housing, and social organization. The

pottery fragments and other artifacts that these people left behind allow archaeologists to distinguish several different cultures which developed out of (or replaced) Archaic peoples. Some of the people belonging to these distinct cultural groups lived along the Salt River in Salt River Canyon.

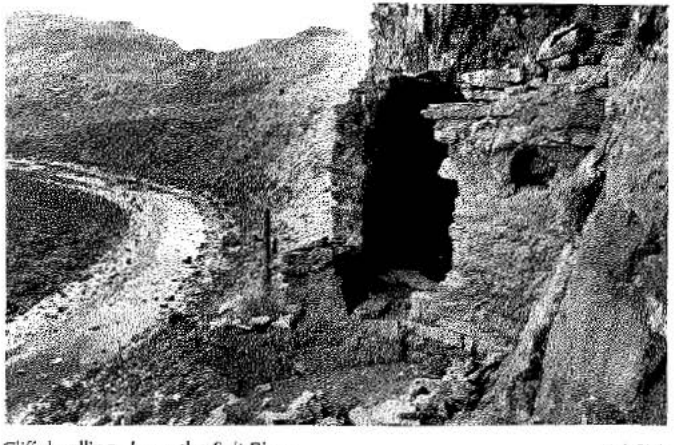
Mogollon

The Mogollon people lived in eastern Arizona and western New Mexico, with some populations settled along the north banks of the Salt River.

Perhaps as early as *A.D.* 300, and definitely by *A.D.* 500, Mogollon people built pithouses, buried their dead, and made well-polished brown ceramics. In addition to growing corn, beans, and squash, they gathered and ate piñon nuts, Indian rice grass, mariposa lily bulbs, walnuts, acorns, prickly pear, wild tomato (wolfberry), and sunflower seeds. They hunted and ate rabbit, deer, turkey, and muskrat. Hunting, gathering, and farming all made major contributions to the early Mogollon food supply. However, after *A.D.* 900 farming became the most important method of obtaining food. They irrigated some fields and dry-farmed others. They built field houses near their dry-farmed fields along terrace tops after *A.D.* 1100. During these later times they made more masonry structures and built pueblo-style room blocks. Some large villages contained large ceremonial rooms called great kivas and community rooms. By this time, the Mogollon were building their villages along streams in valley bottoms.

For the next 100 years their population increased and dispersed. They farmed more and built massive masonry pueblos and cliff dwellings. They traded decorated ceramics and jewelry. By *A.D.* 1250 the Mogollon population began to decrease. They did less dry-farming and obtained a larger portion of their food by hunting and gathering. In reduced numbers, they occupied only a few large pueblos and cliff dwellings along streams. Many of the ruins along the upper Salt River were occupied at this time. The cliff dwellings high on river right at mile 47.5 were built in the late 1300s.

About *A.D.* 1400 the Mogollon abandoned the Salt River Canyon area. Archaeologists do not fully understand the reasons for this abandonment. It probably had to do with loss of habitat due to extended droughts, perhaps coupled with destructive land-use practices.



Cliff dwelling above the Salt River *Bob Rink*

Vosberg

Some archaeologists distinguish a group called the Vosberg Tradition within the larger Mogollon area. Vosberg people built distinctive pithouses and made unique plain ceramics. From *A.D.* 500 to 1100 they built deep circular pithouses. Later pithouses were not as deep, were square to rectangular, and were surrounded by adobe or masonry causeways. They also built check dams and rock terraces to control rainwater runoff. Their two main pottery types were Flying-V Brown, a thin finely made brownware, and Vosberg Brown, a thick, heavy brownware containing fragments of ground-up diabase.

The Vosberg people began to abandon the upper Salt River Canyon starting around *A.D.* 1300. The upper Salt River Canyon was probably not used extensively by other people from this time until the Apache arrived in the late 1500s or mid-1600s.

Hohokam

By *A.D.* 300 the Hohokam, living along the rivers of central and southern Arizona, had enough distinctive traits to be recognizable. They built their houses in shallow pits, made buff-colored pottery, and cremated their dead. After *A.D.* 1100 they built and lived in large adobe compounds.

Probably no other prehistoric group in the Southwest was so dependent on large rivers. By *A.D.* 700 these people had built an extensive irrigation farming system in the Gila and Salt River valleys. Among other domestic plants, the Hohokam grew corn, cotton, and various types of beans and squash. But they also augmented their food supply by gathering wild plants, especially saguaro fruit and mesquite beans.

The Hohokam were distinctive for reasons other than their extensive irrigation systems. They built large courts probably used for playing team games with rubber balls. Their expertly carved stone and shellwork artifacts are evidence that they were skilled artisans. Archaeologists also find mirrors made of pyrite crystals pieced together onto stone discs. No doubt they were influenced a great deal by cultures from southern Mexico and Central America. Their carvings, mirrors, pottery forms and designs, and ball courts are all similar to those made earlier by other cultures in Mexico. The Hohokam were well organized politically and socially which enabled them to build massive village complexes and ball courts, and to irrigate thousands of acres of Arizona desert.

The Hohokam core was located in the Phoenix area, but after *A.D.* 700 Hohokam colonists moved up the Salt River and settled in the Tonto Basin. These colonists grew in number. Sites dated after the mid-1100s in the Tonto Basin contain artifacts that are different from those of earlier sites. The people of the Tonto Basin may have changed due to a large influx of Anazasi people from the north or due to the restructuring of local society and trade relationships with outside groups. They were certainly influenced by Mogollon people to the east.

Salado

Salado is Spanish for salt, so archaeologists apply this name to the group that occupied the Salt River's Tonto Basin and surrounding areas. The Salado can be recognized as a distinct cultural group by *A.D.* 1200. Salado sites exhibit traits which are typical of all three major cultures of the Southwest: Hohokam, Anasazi, and Mogollon. One of their most distinctive traits is their

multicolored pottery. They also wove large cotton blankets and made fine shell and stone carvings.

The Salado became one of the most politically and economically advanced groups in the Southwest during the fourteenth century. Some people lived in room clusters within a surrounding wall (called compounds) or in large, multistoried masonry pueblos. Others lived at small, relatively simple sites. The Salado built large ceremonial platform mounds whose function still remains a mystery. Some of the dead were buried with the body extended, often with elaborate funeral offerings, possibly indicating the elite rulers of Salado society.

The Salado irrigated fields along the Salt River, Tonto Creek, and Pinal Creek. They grew corn; pumpkins, gourds, and other squash; lima, kidney, tepary, and jack beans; amaranth; and perhaps cotton. They also exploited wild plants—gathering cactus fruit, mesquite beans, yucca stalks, agave hearts, and grass seeds. They hunted rabbits, deer, bighorn sheep, and birds.

By the fourteenth century the Salado had reached their peak. They occupied dozens of large towns and ceremonial complexes spaced about three miles apart along the Salt River from near the present Highway 288 bridge downstream to the Verde River. They had developed local native resources such as salt, turquoise, and glassy obsidian nodules called Apache tears. They traded these native resources as well as finely carved stone and shell work, textiles, polychrome pottery, and painted arrow shafts, for beautiful banded cherts from Kansas, shell from the Sea of Cortez, and copper bells from Mexico.

The Salado abandoned the area or died off around *A.D.* 1450. No one knows where they went, but their disappearance left the Tonto Basin devoid of humans until the Apache arrived during the late 1500s or 1600s.

Apache

The arrival of the Apache into eastern Arizona coincides with or may even postdate the Spanish entrada into the American Southwest. Though the early Spanish explorers knew of the "Rio Salado," they had little use for the remote landscape.

The area surrounding the upper Salt River was home to the "Coyotero" Apaches. The Apache groups which settled around the Salt River Canyon include the Cibecue bands (in and around upper Cibecue Creek), the Pinaleno (near the Pinal Mountains), the San Carlos bands (in the Globe/Miami area) and the southern Tonto bands (within the Tonto Basin). Yavapai people migrated from the lower Colorado River Basin and intermarried with the southern Tonto Apache. Both these groups lived in pole and brush houses that they called *gowa'* and used baskets for storage. They did not use much pottery.

Like the late Archaic people who lived two thousand years before, the Apaches followed a seasonal round of food gathering, growing, and hunting. In late spring, they moved to farming sites along the White River, Carrizo Creek, and Cibecue Creek where they planted corn, beans, and pumpkins. Young, old, and disabled people stayed with the crops to protect them from destructive birds and animals while others hunted or gathered wild plants such as cactus fruits, mesquite beans, yucca, and acorns. In the fall, they harvested their fields and gathered pinon nuts and juniper berries. During the winter, when food was scarce, some groups resorted to raiding.

MODERN HUMAN HISTORY

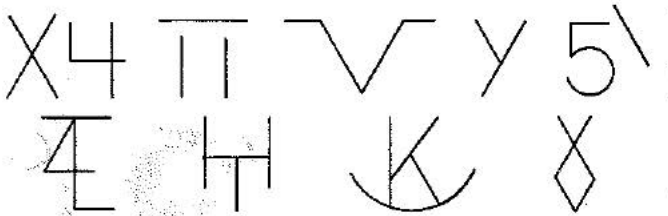
Nancy Nelson

Outside the Salt River Canyon, Apache-Anglo conflicts increased during the late 1800s. The rugged terrain and lack of discovered mineral deposits delayed Anglo settlement of the Salt River Canyon, so conflicts with Apaches here were few.

The San Carlos and Fort Apache Indian reservations were established in 1871 and 1872. Then the U.S. cavalry launched a campaign to round up the Apaches still living free. Salt River Canyon provided a hiding place for native warriors. Apache elders tell of braves sitting high in caves above the river, watching the soldiers in the canyon below unsuccessfully trying to locate them. Under a federal centralization policy, 1600 White Mountain Apache were sent to live at San Carlos in 1875. They were not prepared for life in the desert, desperately wanted to return to their homeland, and after four years convinced the cavalry to let them return. The Apache are still the dominant presence along the upper Salt River, proud of their heritage and strongly attached to the land.

Early Anglo settlers in the Salt River Canyon area included cavalry soldiers once stationed at Fort Apache. Some of these ex-soldiers remained in the region to prospect after their discharge. Discoveries of precious metals in Gila County prompted the development of the Salt River area. In 1876, a very hung-over ex-soldier, Charlie McMillan, crawled under a ledge to sleep. His patient companion, Dore Harris, used the time to examine some rocks close by. The ledge Charlie chose to sleep under proved to be a ten-mile vein of silver they dubbed the "Stonewall Jackson." McMillanville, a typical southwestern boom town, sprang up near the mine, about 15 miles due south of Gleason Flat. McMillan eventually drank himself to death, and as the silver ran out, McMillanville busted. Other boom towns in the Salt River area remained, including Globe, the Gila County seat. Also the result of a silver discovery, Globe was once a wild and woolly frontier town with saloons, whorehouses, gunfights and posses.

Cowboying in the late nineteenth century meant little pay, long hours, hard work, and loneliness, yet ranching spread throughout the canyons. During the early 1900s perhaps 2000 head of cattle roamed the ranges near Salt River under the brands X Four, Bar Eleven, Flying V, Straight Y, Five Rail, T Four E, HE Over T, Rocking K, and X Diamond. Though few ranchers actually lived on or near the

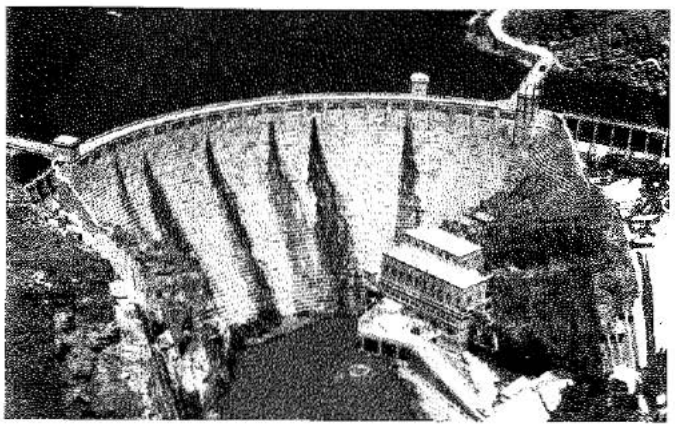


river, many of their names are fixed to landmarks in the area, such as "Rockinstraw Mountain," after a German immigrant named Roggenstroh. Blackjack Wash may have been named after a dark-skinned cowboy of the late 1800s.

Ranching meant braving the outlaw threat and the extremes of Mother Nature. In November 1898, three cowboys on a roundup became snowed in near the river at what became known as Storm Canyon, mile 21.5. Their horses lost, the trio walked through snow

six feet deep to get to McMillanville. Visible reminders of the cowboy presence in the Salt River Canyon include the cabin at Cherry Creek, built in the early 1900s, and the corral at Gleason Flat, made of World War I surplus barbed wire.

Downstream of Salt River Canyon, the Phoenix area grew rapidly, irrigating ever more farmland with Salt River water. By 1900, Maricopa County had 113,000 acres of irrigated farmland. Speculators estimated that with more water, five times that amount of land could be productive. To this end, the Maricopa County Board of Supervisors financed an exploratory expedition to locate damsites on the Salt and Verde rivers. Surveyor William Breackinridge "discovered" the perfect dam location at the junction of Tonto Creek and the Salt River. He reported, "It would be impossible to find anywhere in the arid region a storage project in which all conditions are as favorable as for this one."



Roosevelt Dam

Michael Collier

However, the expense of the dam project prevented its construction until funds became available through the Reclamation Act of 1902. Construction of Roosevelt Dam began in 1907. The diversion dam at mile 7 was built to divert water to generate power for the construction effort. Italian stonemasons quarried enough local bedrock for a structure 284 feet high and 680 feet wide. Roosevelt Dam was dedicated by President Theodore Roosevelt in 1911. In the 1990s, the dam will be raised; it will flood several more miles of prime riparian habitat.

The building of U.S. Highway 60 was a federal project which provided much-needed jobs for 100 local men during the Great Depression in the 1930s. Work progressed slowly; the crew and their families lived in a moving tent city along the highway route, cooking outdoors, even in winter. This project completed the first coast to coast highway.

Another phase of mining swept the Salt River Canyon region during the early twentieth century. Prior to 1900, mining was limited to metals production in the Globe and McMillanville areas south of the river and the production of salt from the Salt Banks at mile 49.3, which was used for silver milling at McMillanville. Prospectors discovered asbestos in the Salt River Canyon in 1872, but did not exploit this resource greatly until 1911. The town of Chrysotile, named for the type of asbestos found there, boomed five miles southwest of the Highway 60 bridge from 1911 until 1933. The Regal Mine, high on river left above Mule Hoof Bend, became the largest and best developed asbestos mine in the U.S., producing steadily from 1912 to 1948. Asbestos mining was a

major industry in the Salt River Canyon area until the mines were shut down because of perceived health hazards. Many asbestos mines are still visible from the river, including the Fiber King above the Salt Banks, and the Apache at mile 52. Other mining activity included manganese extraction, warranting the operation of a mill on river right at Gleason Flat during the 1950s.

Before 1960 the economic pattern of the Salt River Canyon area was predominated by booms and busts of federal projects and mining, with ranching as a common thread. The river was viewed as a water resource for mining, ranching, and farming, and as a source of hydroelectric power. But a shift was occurring in the collective mind of America. A renewed sense of adventure and a revolution in the technology and availability of outdoor equipment heralded a new sport and commercial industry in the Southwest: whitewater boating. The Salt River, which previously had been thought of as a barrier to travel, came to be thought of by many as a recreational opportunity and a means of access to a prime wilderness area.

The first people to boat the Salt River did not do it to be the first, nor to seek acclaim or profit. They ran the river for fun and adventure, and they found both. The Theodore Roosevelt Council of the Boy Scouts of America and the Sierra Club began organizing Salt River trips in the late 1950s. Lacking maps, fancy equipment, and experience, groups often ran the river without serious mishap, though upsets and swimming were common. Overboard Rapid was named when Dr. John Ricker went overboard there in 1966. The early adventurers used Army or Air Force surplus rafts, running the river at water levels as low as 400 and as high as 3000 cubic feet per second.

Early boaters were brave, but certainly not stupid; they routinely portaged Quartzite Falls. A drowning at Quartzite in 1969 prompted an increased focus on the river by the National Forest Service. Pete Weinel, of Tonto National Forest, joined a rafting trip to investigate the dangers of the river. He plotted rapid locations, noted techniques for running them, and printed a river map with this information, available to the public. River use has now increased to the point that the Forest Service requires firepans and human waste carry-out methods. Private use permits may soon be required.

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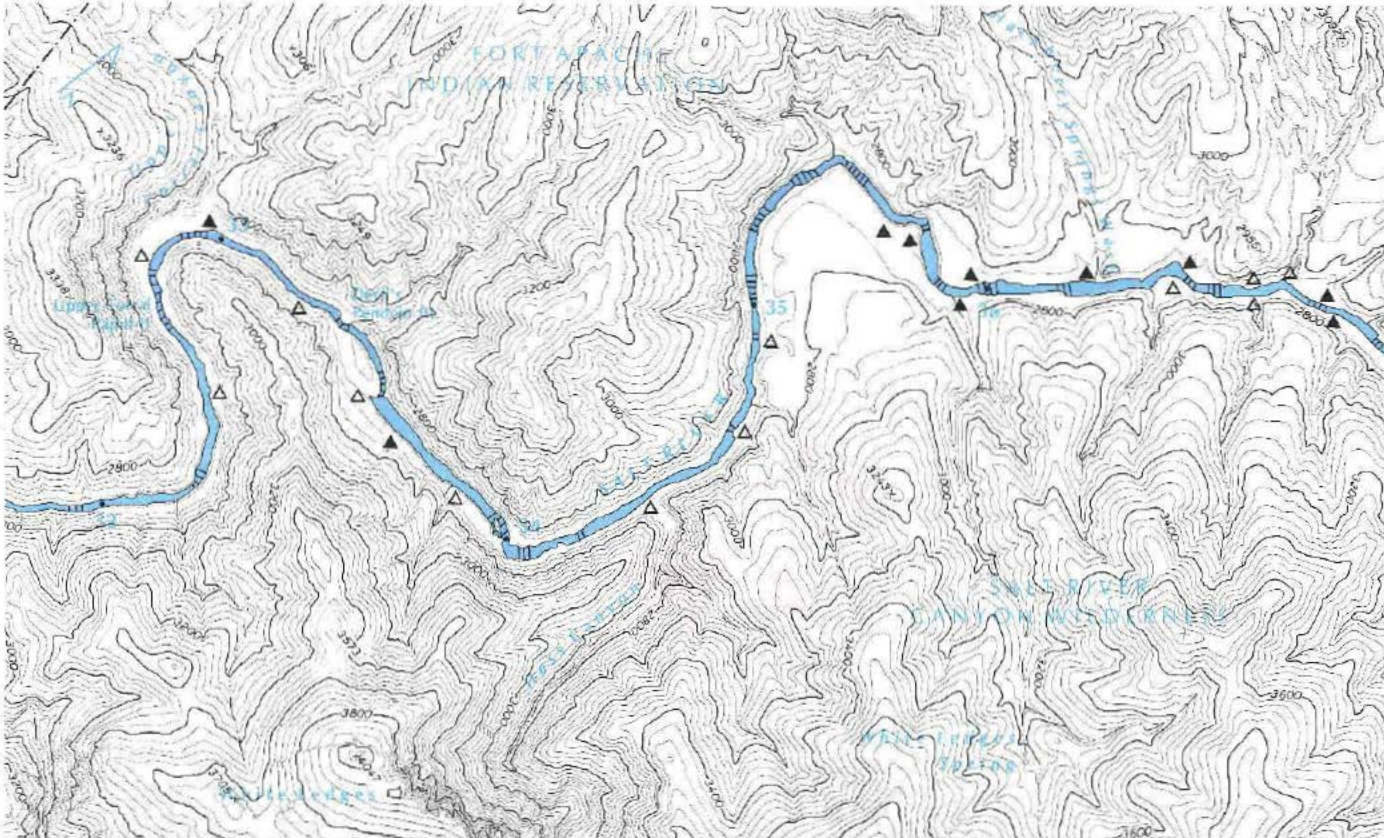
Hedgehog cactus
Glenn Rink

Pool at Chalk Creek *Glenn Rink*

Ruins of stone cabin at the mouth of Cherry Creek *Bob Rink*

Quartzite Falls at low water *Glenn Rink*


FORT APACHE
INDIAN RESERVATION
SALT RIVER
CANYON WILDERNESS
32
34
35
2800
3000
3200
3600
3800

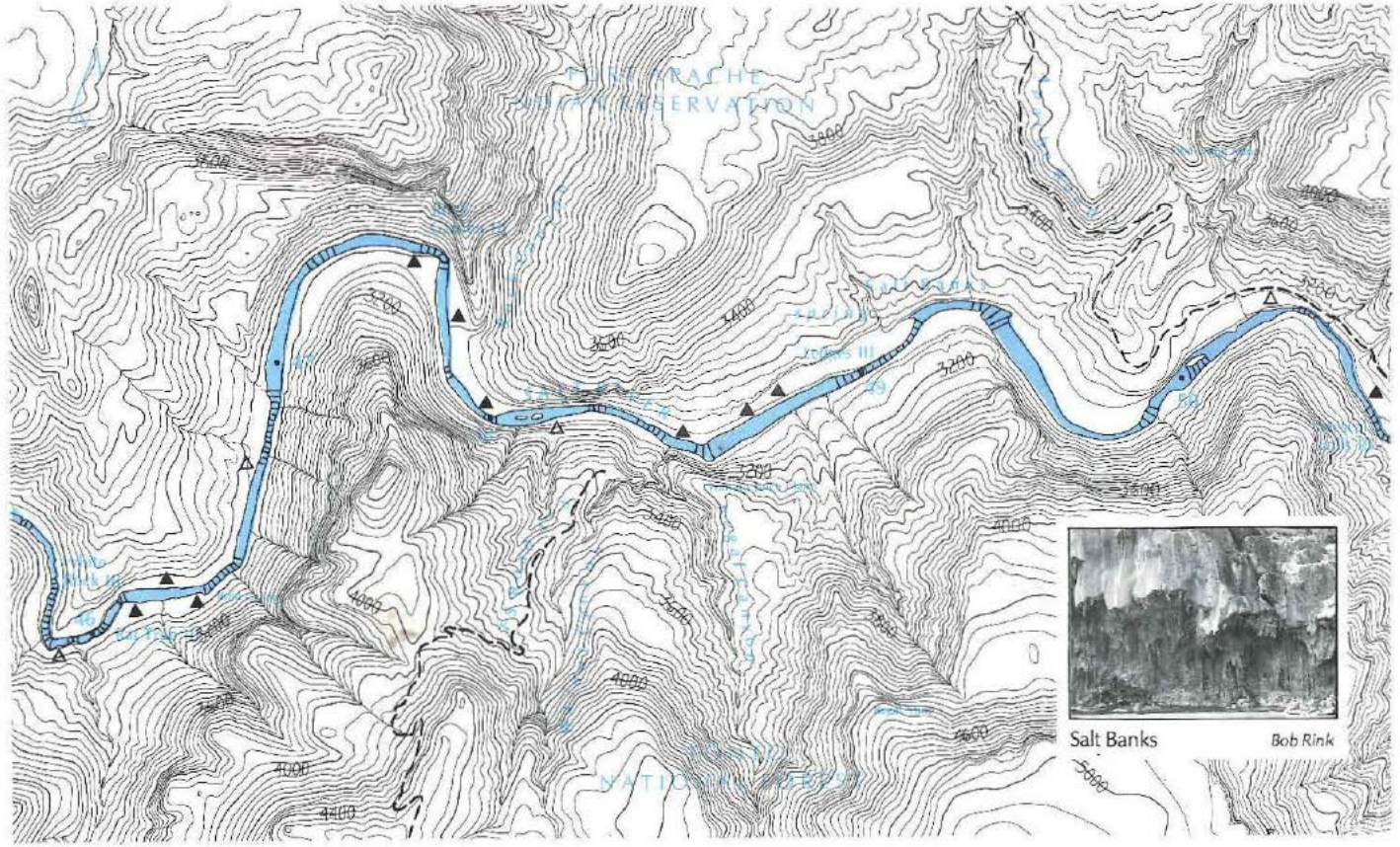
Sotol below Gleason Flat *Bob Rink*

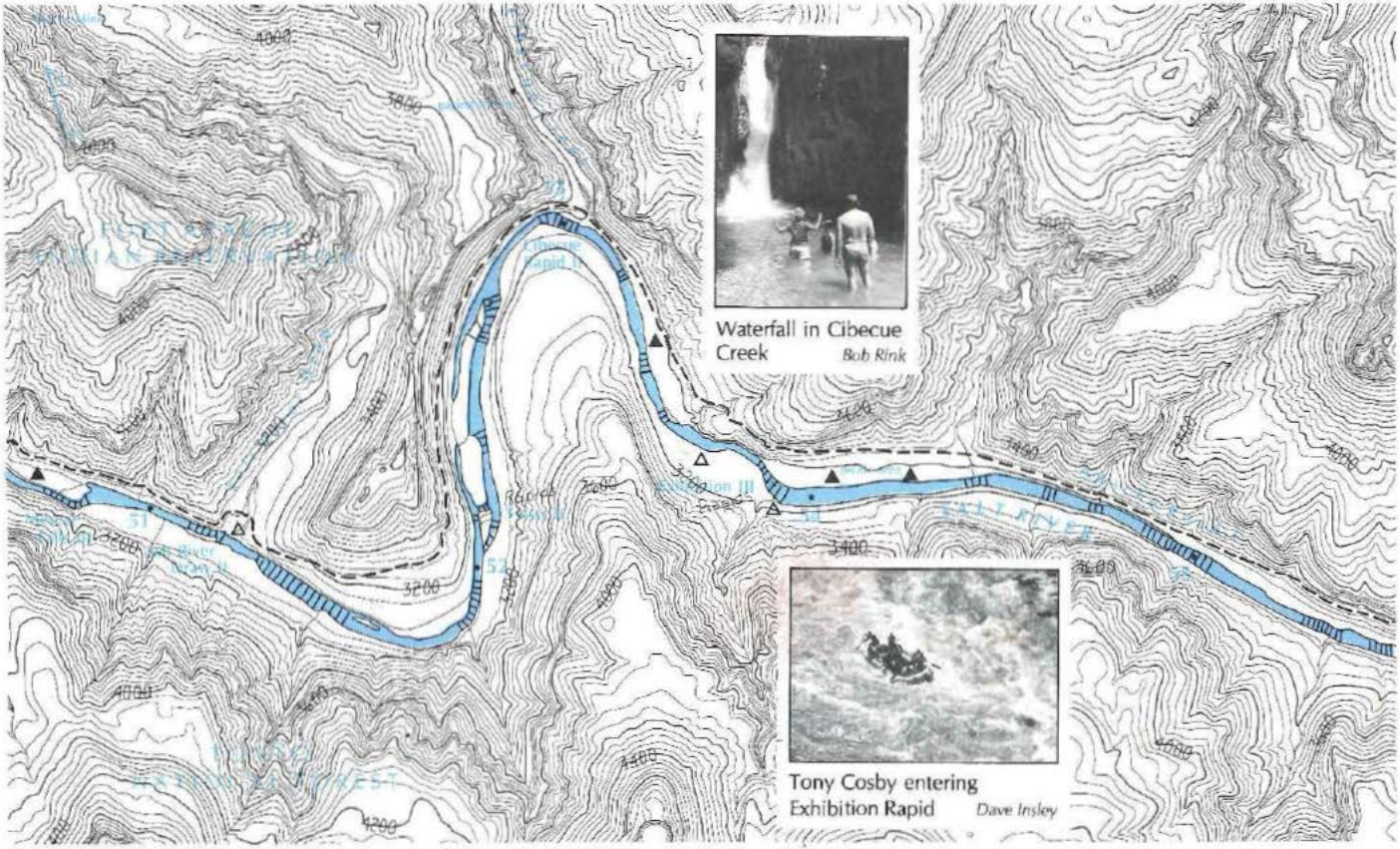
Manganese mill at Gleason Flat

Glenn Rink

Crested saguaro

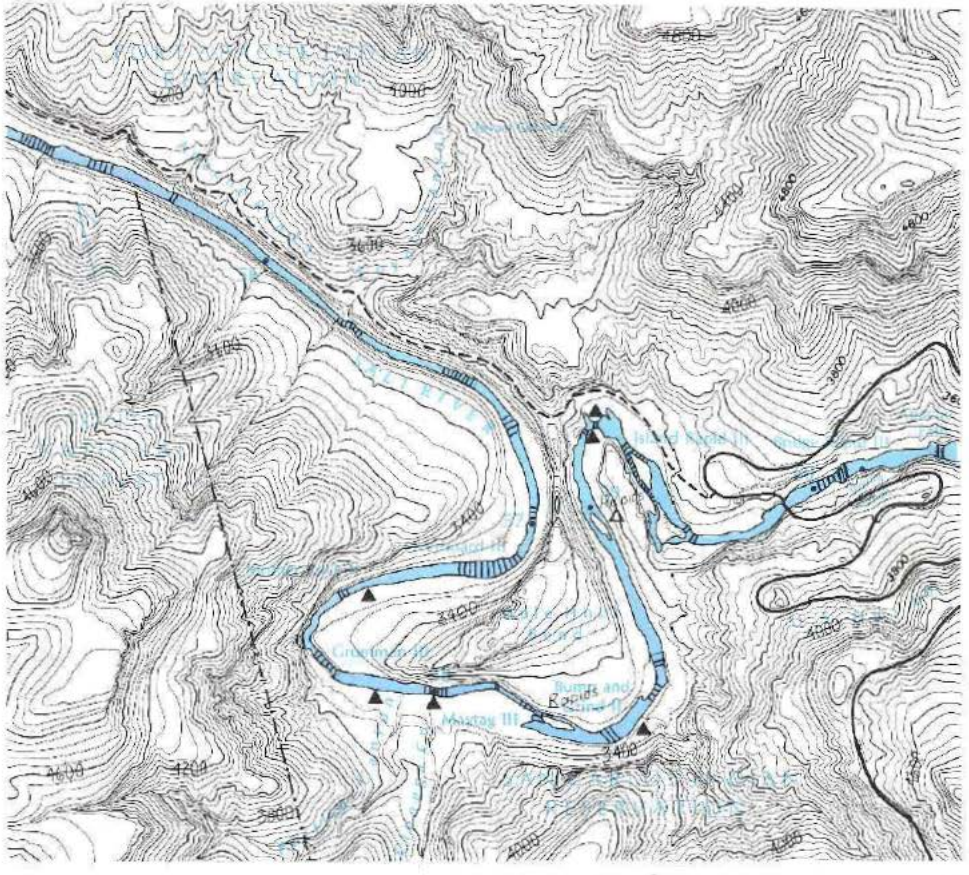
Bob Rink

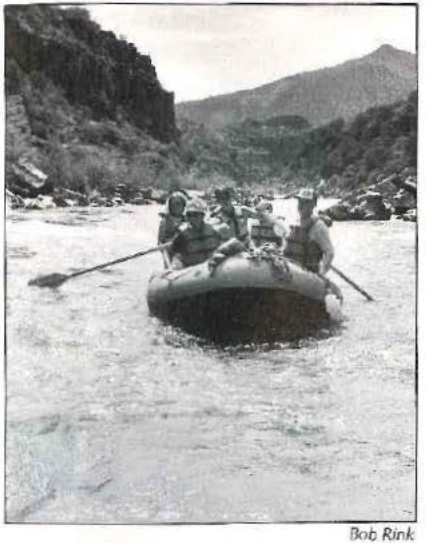

Salt Banks
Bob Rink



Waterfall in Cibecue Creek *Bob Rink*

Tony Cosby entering Exhibition Rapid *Dave Insley*





Bob Rink

LEGEND

Riffle or Rapid

△ Small Camp 1–8 People

▲ Large Camp 8–15 People

Contour Interval 40 Feet

0 ½ 1 mile

Scale 1:29000

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