Boating in Arizona
ca. 1912

Speaker Resume: Fuller

- Navigability Studies
  - Arizona: 1992-2014
    - All Major River Systems
    - 30,000+ Small & Minor Watercourses
  - Alaska, Rocky Mountain States, East Coast
- Professional Experience (30 yrs in Arizona)
  - Hydrologist (PH)
  - Civil Engineer (PE)
  - Geomorphologist (RG)
- Boating Experience
  - Canoe, Kayak, Raft
  - AZ (Gila, Salt, Verde, Virgin, San Francisco, Colorado)
  - NM, CO, UT, CA, AK, NC, GA, SC, TN, NY, MI, WI

Introduction

- Federal Standard for Title Navigability (Daniel Ball Test)
  - Ordinary & Natural
  - Used or Susceptible
  - Highway for Commerce
  - Trade & Travel on Water
  - Customary Modes

"Navigable" or "navigable watercourse" means a watercourse that was in existence on February 14, 1912, and at that time was used or was susceptible to being used, in its ordinary and natural condition, as a highway for commerce, over which trade and travel were or could have been conducted in the customary modes of trade and travel on water.

A.R.S. § 37-1101(5)

Introduction

- Ordinary & Natural
  - Discussed in other ASLD presentation
  - Prior to human disturbance of river system
- On Water
  - Boats, watercraft
  - NOT: wagon, hoof, or feet on streambeds

Introduction

- Trade and Travel on Water
  - Trade (exchange of commodities)
  - Travel (go on as if on a trip or tour)
- Susceptible to Trade and Travel
  - Sufficient depth of flow
  - Actual historical use not required
- Customary Modes
  - Boats available at statehood

"Navigable" or "navigable watercourse" means a watercourse that was in existence on February 14, 1912, and at that time was used or was susceptible to being used, in its ordinary and natural condition, as a highway for commerce, over which **trade and travel** were or **could have been** conducted in the **customary modes** of trade and travel on water."

A.R.S. § 37-1101(5)

Trade & Travel on Water ca. 1912

- Typical Trade/Travel Uses ca. 1912
  - Hauling Goods
  - Hauling Passengers
  - River Guiding
  - Exploration
  - Military
  - Ferries
  - Fishing
  - Trapping/Hunting
  - Survey
  - Travel
  - Carrying Mail

General Boat Types Used			
Large	Steamboat	Flatboat	Canoe
√	√	√	√
√	√	√	√
		√	√
	√	√	√
√	√	√	√
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Historical Boat Types, ca. 1912

- Boats Available in & Near Arizona ca. 1912
  - Steamboats
  - Flat boats, Skiffs, Scows, & Rafts
  - Canoes
  - Rowboats, Dories & Riverboats
  - Ferries
  - Many Others Available
    - Inflatable, Motor, Kayaks, Dugouts
  - Boats were adapted to fit specific rivers & uses

Historical Boats: Example

- Early Boating in Western States
  - "Commercial boating limited to canoes, flatboats & keelboats."
  - Example:
    - Lower Missouri River (MS, KS, IA, NE, SD, ND, MT) is clearly navigable.
    - 27 yrs required to acquire skills and develop the type of boats needed to navigate the Missouri.
    - Sand bars were a challenge… but were overcome with time.

"Before 1830, **commercial boating in the West was limited to canoes, flatboats and keelboats**. In that year the first steamboat left St. Louis headed up the Missouri River. Within three years, steamboats had reached the junction of the Yellowstone River in eastern Montana, though **it would take another 27 years to "evolve the boats, the experience and the maneuvers required to navigate the Missouri**." The principal difficulty going upriver was in getting off or over sand bars. Often the freight would have to be unloaded, or some of it towed on a barge behind the boat."

Source: River Boats in America, 1966

Historical Boats: Example

- Adapted Uses: Sweep Scows
  - Unique boat types for each river
    - Salmon River – rocky, fast current
  - Downstream use only
  - Hauled freight
  - Hauled tourists
  - Boat sold for lumber at river's end

Sweep boat, or scow used on the Salmon River, a variant of the Mississippi River flatboat, 16 to 35 ft. long, 5 to 10 feet wide, with sidewalls 3 to 4 ft. deep. They had no power source other than the river current, and long sweep oars at bow and stern to steer. These craft appeared on the Salmon River in ***1872*** and were used through the 1920s. Like the flatboats, these were cheap but sturdy boats intended for hauling freight down a river. ***At the completion of the voyage, the boat would be sold for scrap***. "By ***1900***, Harry Guleke had adopted sweep boating as his trade and, like the old flatboat men, would work his way downstream buying, selling, trading and delivering many tons of goods, ***always selling the boat for lumber*** at the end of the journey. Guleke took the trade a step farther by ***taking tourists through the gorge***."

Source: Anderson, 2013

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Salmon River is Navigable

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Source: Anderson, 2013

Historical Boats: Example

- Special Master Report, Utah Riverbed Case, 1931
  - "The watercraft most commonly used in commercial navigation have been row boats of 16-18′ in length, drawing 6-12", row boats 18-22′ long, drawing 14-18", steel rowboats 18′ long, drawing 7-19", motor boats of 20-27′ length drawing 10"-2′, rowboats 16-18′ length, propelled by outboard motors drawing 15-18"; scows 32′x8′ and 24′x6, drawing 8", and rafts."
  - Canoes – exploration, cargo, trapping, hunting

Historical Boat Materials, ca. 1912

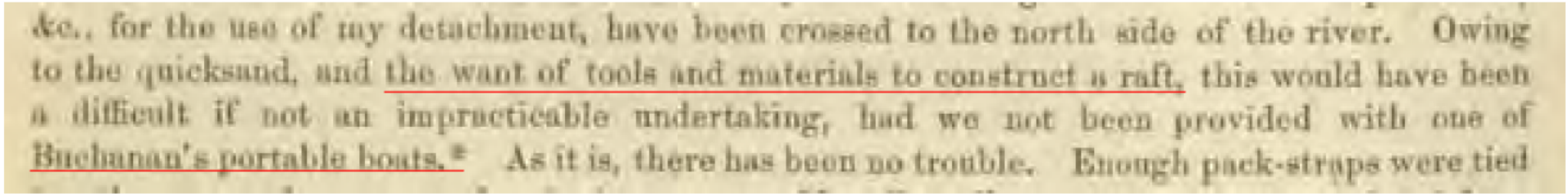
Material	When 1st Used
Wood	B.C.
Metal (copper, steel, aluminum)	1800's
Canvas	1800's
Skin	B.C.
Rubber	1800's
Composite	1800's

- Other (frame, wicker, reed, inflatable, pottery) materials were used by indigenous people centuries before western expansion of USA.

Historical Boats, ca. 1912

Lt. Joseph Ives: Report on the Colorado River (1861)

- Experienced boatman (Steamboat Exploration)
- Little Colorado River (Flax River)
- Lacked materials to build boats
- Standard military issue canvas boats (Buchanan's)
- Some other common boat types didn't fare well when packed/stowed in the heat.



&c., for the use of my detachment, have been crossed to the north side of the river. Owing to the quicksand, and the want of tools and materials to construct a raft, this would have been a difficult if not an impracticable undertaking, had we not been provided with one of Buchanan's portable boats.* As it is, there has been no trouble. Enough pack-straps were tied

* This admirable invention was patented by Colonel R. C. Buchanan, 4th infantry, in 1857. The boat consists of a portable skeleton frame, sheathed with *unproved* canvas, secured to the framework by lashing. It was first used during the campaign in Southern Oregon against the Rogue River Indians, in 1856.

Expecting to carry everything, during my land explorations, upon pack-mules, I had a boat made of smaller dimensions than had been before constructed. It was eleven feet long, five feet wide, and about two feet deep. The frame was of pine, and the whole weight, including the canvas and cords, but 150 pounds—a light load for a single animal. Twelve men could cross a river in it with perfect safety. It could be unpacked and put together in about ten minutes.

A few years before I had had experience, while in the same country, and under much the same circumstances, of one of the ordinary pontoon boats. Its liability to rot, to get stuck together when packed and carried under a hot sun, and to be injured by the attrition of pack-ropes, other packs, and branches of trees, rendered it, after a short time, almost valueless.

The Buchanan boat was found to be free from these objections. After being packed for four months over a rough and wooded country, it was found in a perfectly serviceable condition. The canvas covering I used when required to protect the packs from rain. This rendered it unnecessary to carry a tarpaulin.

My experience has convinced me that the boat is admirably adapted for field service, and will be found to possess the advantages of lightness, durability, and staunchness, in a superior degree to any now in use.

Description:

- Canvas over pine frame
- 150 lbs
- Packed on mule
- Assembled in 10 minutes
- Light, durable, staunch
- Used in Indian wars

Historical Boating Accounts in AZ

- Types of Boats Used in Arizona
  - Steamboats (Colorado River, Lower Gila River)
  - Flatboats (Salt, Gila, Verde)
  - Ferries (Salt, Gila)
  - Rowboats (Salt, Gila, Verde)
  - Canoes (Salt, Gila, Verde)

  - Floating Logs (Gila, Salt, Verde)

Historical Boating Accounts in AZ

- Seasons Boated
  - Throughout the Year — Spring-Summer-Fall-Winter
- Flow Rates Boated
  - Normal low water: — Yes
  - Normal high water: — Yes
  - Floods — Not ordinarily
- Boats Were Available When Needed
  - If rivers weren't boatable, why did people have boats?

Historical Boat Types

- Steamboats
  - Large Vessels
    - Adapted for river conditions
    - Used on major rivers
  - Colorado River, 1865-1908
    - Ended with Imperial Dam
    - Competition from Railroad
  - Gila River
    - Segment 8
    - Occasional use

Yuma Landing, 1885

Historical Boat Types

- Steamboats

  See Lingenfelter, 1978

  - Specifications: ~60-150 ft
  - Draw: ~19" (fully loaded)
  - Typical Uses
    - Shipping, Passengers, Exploration, Military, Travel, Mail
  - Availability – in Arizona prior to 1912
  - Use on Arizona Rivers
    - Colorado, Gila

Historical Boat Types

The "Cochan" on the Colorado River near Yuma, 1900

Historical Boat Types

- Steamboats in Arizona
  - Traffic dried up after railroad in 1877, p. 49
  - Imperial Dam was obstruction to thru-boating
  - Draw: 30" fully loaded, p. 37. Later 19"
  - Technique for sandbars, p. 49
    - "Crawfish" – stern 1st, use paddle wheel to claw through

Source: Swanson & Altschul, 1989, Cultural Resources Investigations of the Yuma Quartermaster Depot.

Historical Boat Types, ca. 1912

- Steamboats Used on the Navigable Colorado
  - Navigable in high stage
  - Boulders, snags & sandbars
  - Navigation difficult & dangerous
  - Remote
  - Powerful floods
  - Steamboat use mostly ended when Imperial Dam built above Yuma
    - Use not compatible with irrigation diversions & dams

Sources: Arizona Territorial Legislature (1866); Steamboats on the Colorado (1978)

Historical Boat Types

1875

FORT YUMA COLORADO RIVR CALA

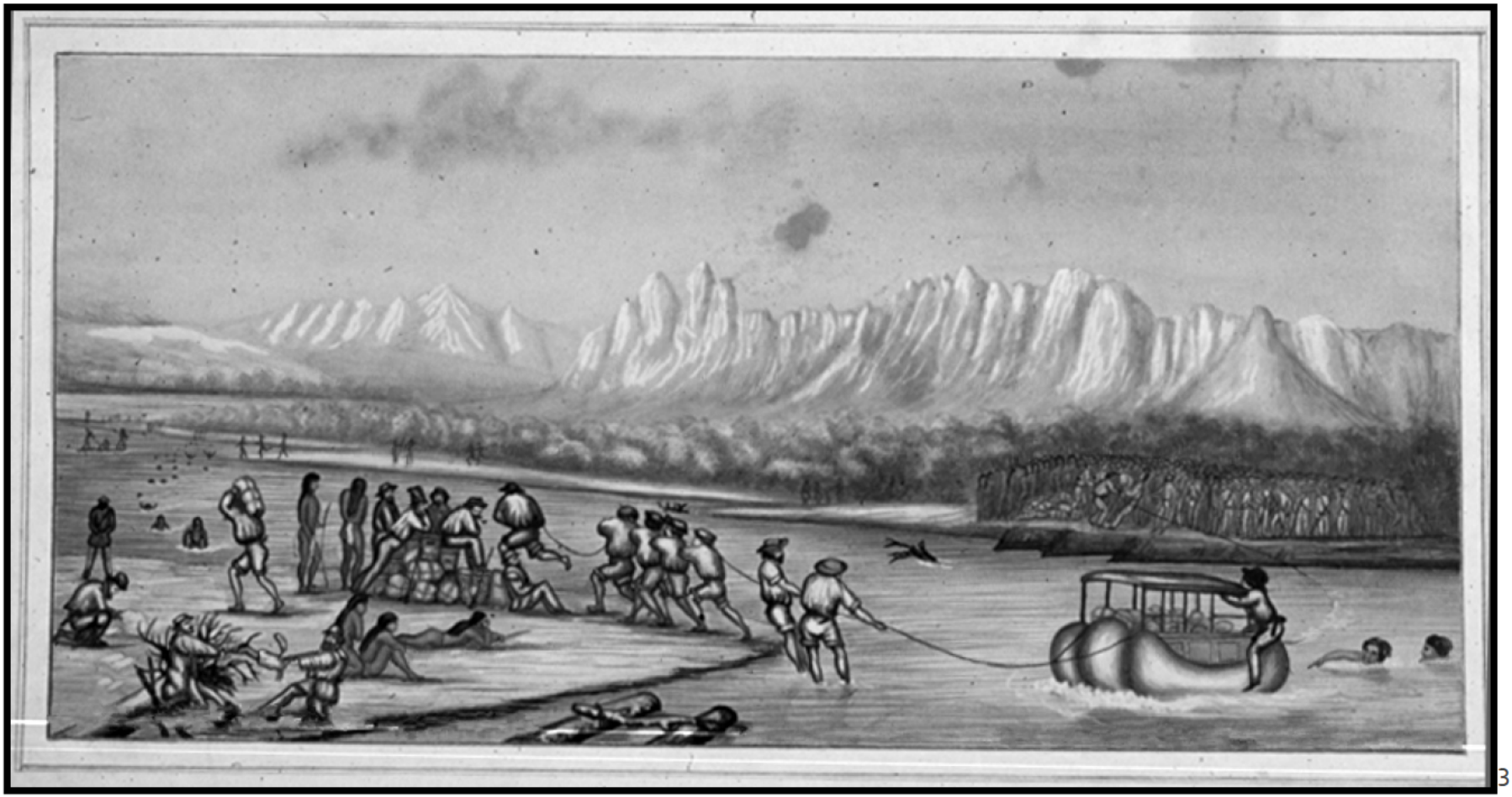
Historical Boat Types

- Ferries

Hayden's Ferry – Salt River @ Tempe

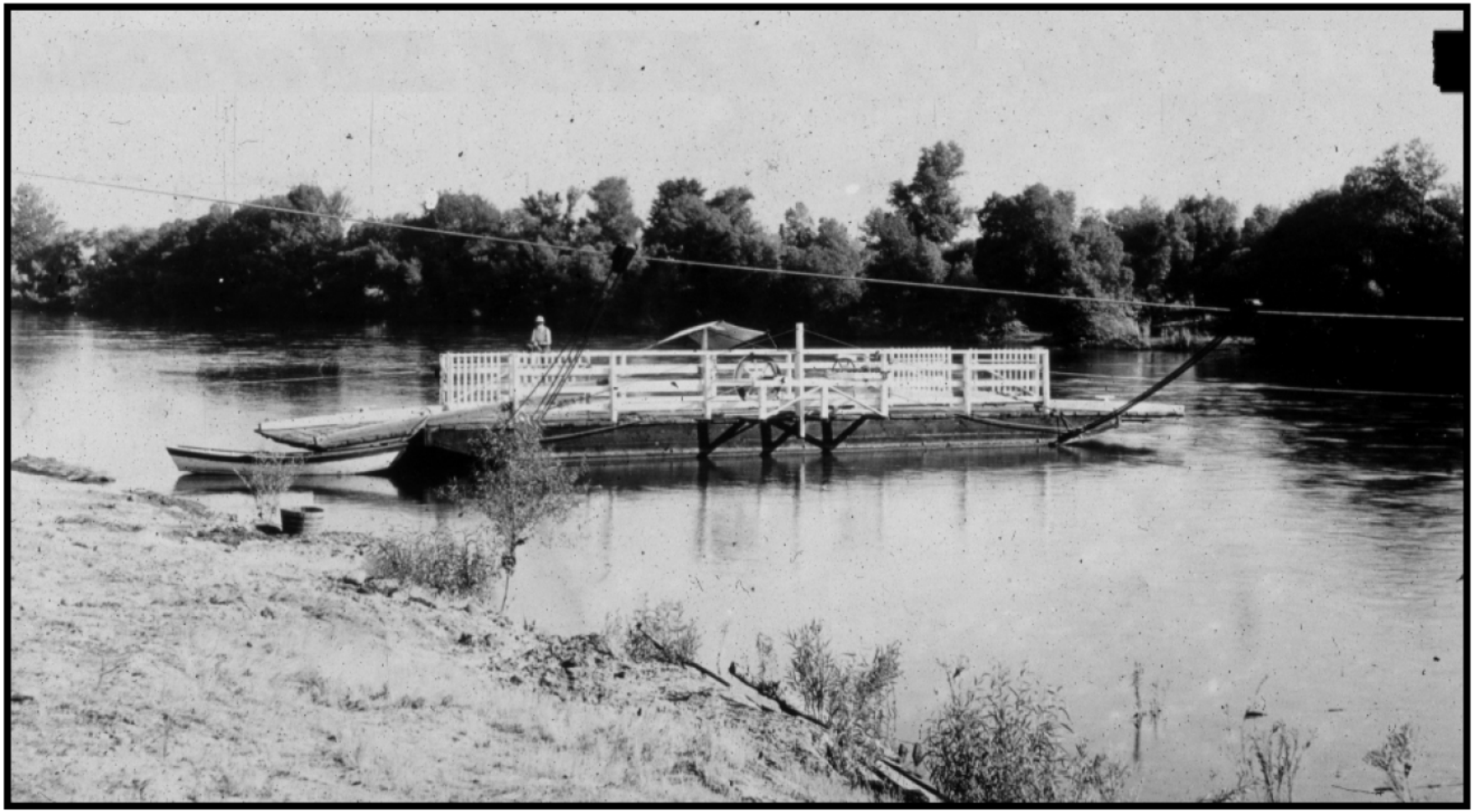
Historical Boat Types

- Ferries



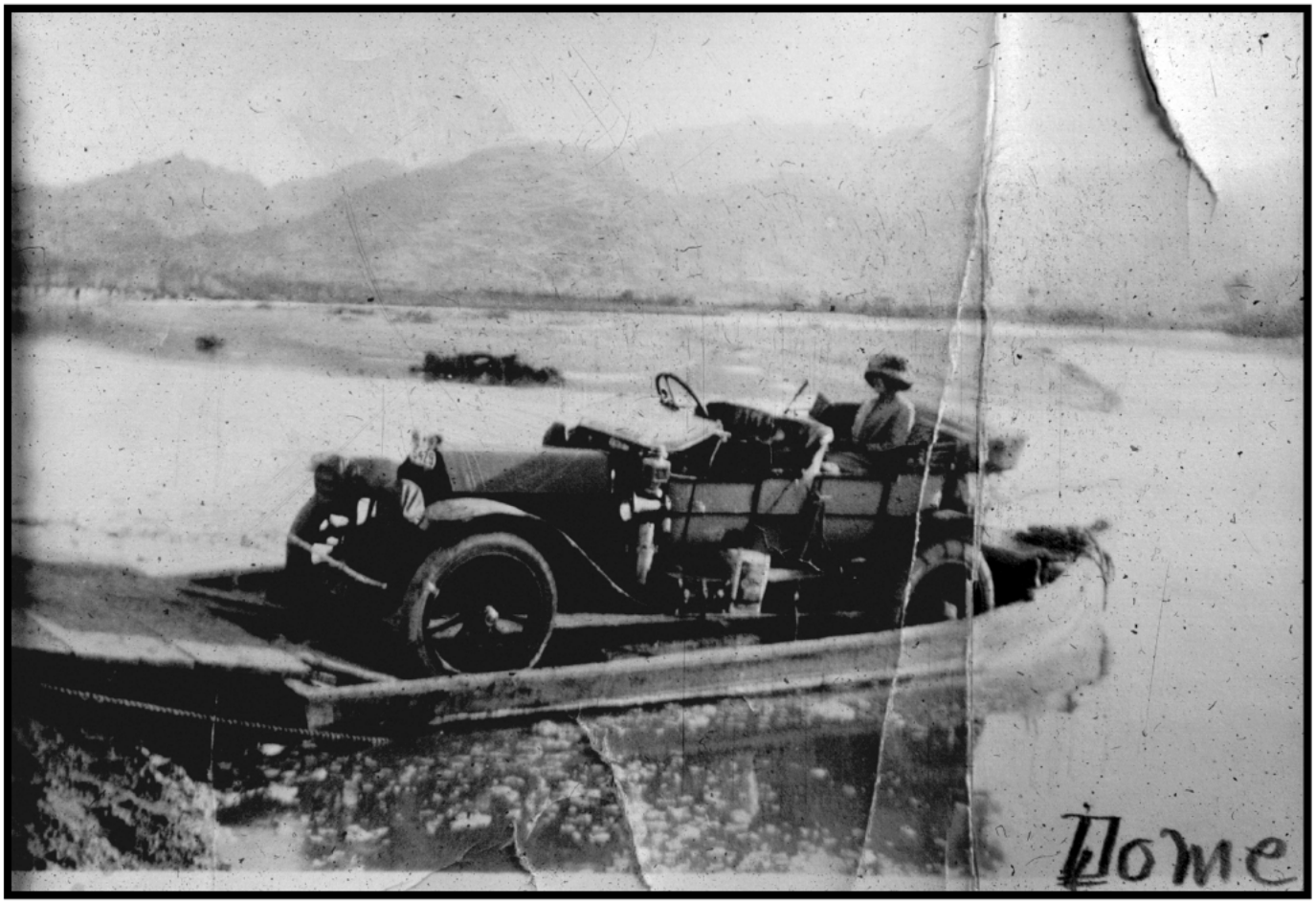
Historical Boat Types

- Ferries



Historical Boat Types

- Ferries



Historical Boat Types

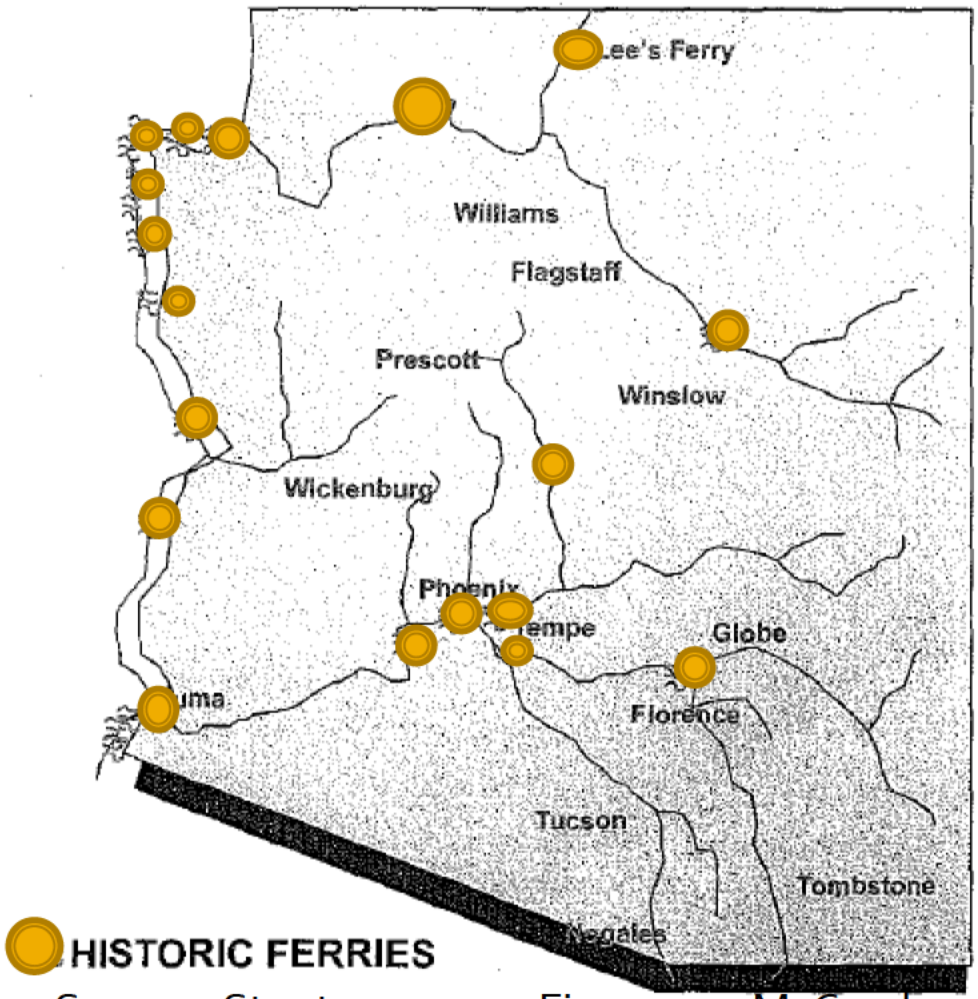
- Ferries

Historical Boat Types

- Ferries
  - Specifications: Vary widely (6-35 ft)
  - Minimum Depth of Flow: 2 ft*
  - Typical Uses
    - Commercial, Passengers, Travel, Military, Mail
  - Availability: In Arizona
  - Use on Arizona Rivers
    - Actual Historical (Salt, Gila, Verde, Colorado, LCR)

*Ferries only needed if rivers couldn't be easily forded

Historical Boat Types



Source: Stantec, 2005 – Figure 3.1; McCroskey, 1989

Ferry Use in Arizona

- Used to Cross Rivers
  - Not downstream/upstream
- Ferry types, size, & shape vary
  - Barge-like
- Materials
  - Reeds, clay, hide, wood, steel
- Some used seasonally
  - Seasons of high water
  - Others used year round
- Eventually replaced by bridges

- **Demonstrate susceptibility to boating**
  - **Sufficient depth for large boats**

Historical Boat Types

- Ferries

Gila River Ferry, 1913

Historical Boat Types

- Flat Boats, Skiffs, Rafts
  - Specifications: Sizes vary widely (8-30 ft)
    - Often homemade
  - Minimum Depth of Flow: ~1 ft.
    - Shallow draft boats
  - Typical Uses
    - Hauling goods, travel, passengers, exploration, ferries
  - Availability: In Arizona
  - Use on Arizona Rivers
    - Actual Historical (Salt, Gila, Verde)

Historical Boat Types

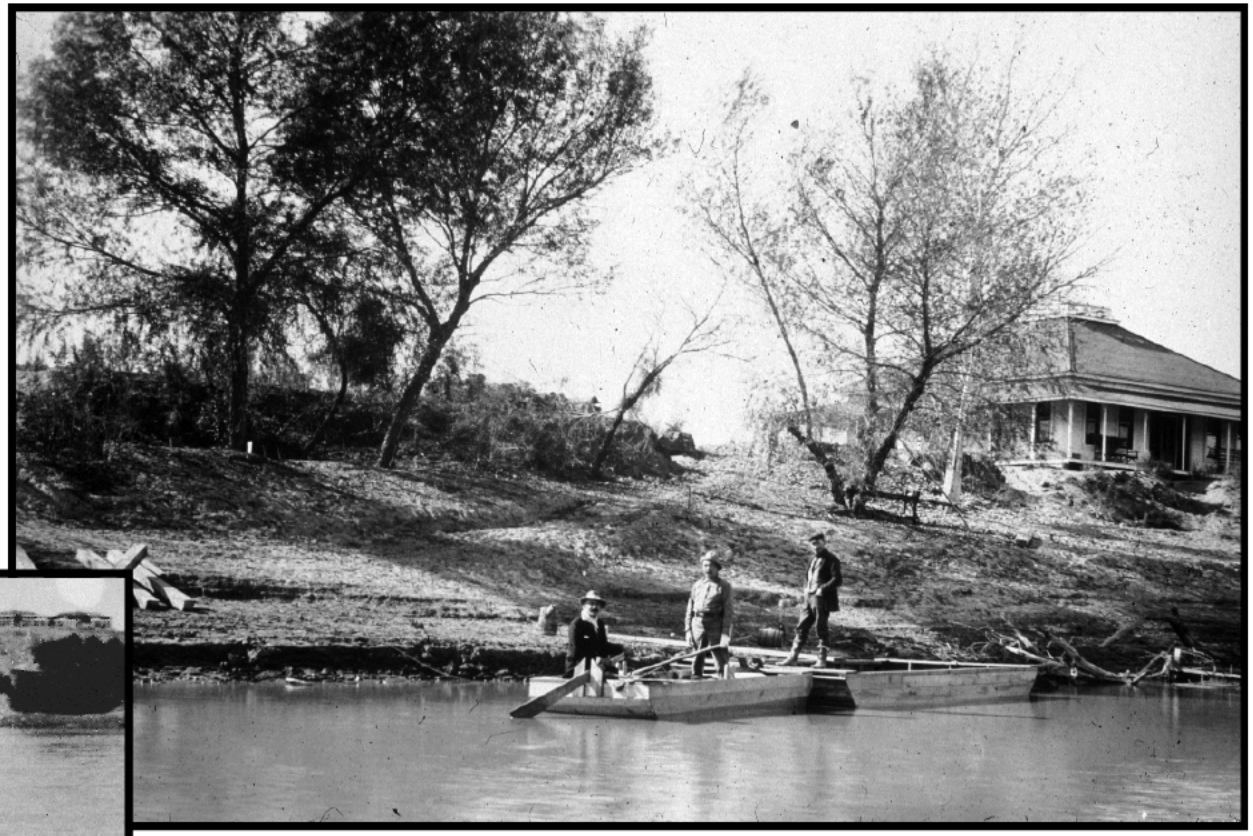
- Flat Boats, Skiffs & Rafts
  - Strip Skiff (15′ long, 3′ wide)
  - Board Skiff (2 board bottom & sides, common)
  - Canvas Skiff (over wood frame)
- Propelled by Poles, Oars, Current
  - Without oars & experience, these boats are difficult to control
  - Uncontrolled boats experience more difficulties

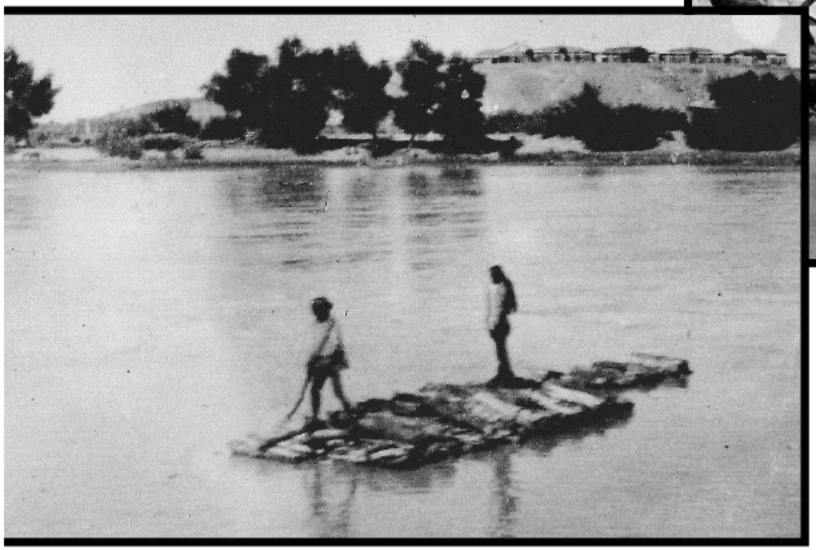
Historical Boat Types

Historical Boat Types

Recreating the James White Grand Canyon Story

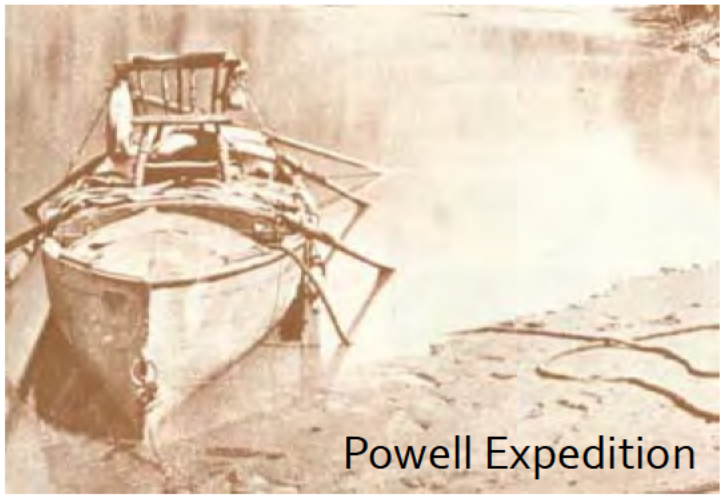
Historical Boat Types





Historical Boat Types

- Rowboats & Dories


Powell Expedition


Powell Replica Boat

Historical Boat Types

- Rowboats & Dories
  - Specifications Sizes vary widely (6-22 ft)
  - Minimum Depth of Flow: 3 inch to 2.5 ft
  - Typical Uses
    - Hauling Goods, Passengers, Recreational, Exploration, Travel, Trapping/Hunting, Survey, Mail
  - Availability: In Arizona
  - Use on Arizona Rivers
    - Actual Historical (Salt, Gila, Verde, Colorado)

Historical Boat Types

BOATS AND SUPPLIES. *Note—Freight Rate on Boats Is Four Times First Class.*

Flat Bottom Fishing Boats.

15-Foot Smooth Skin Double Pointer Boat.

Square Stern Clinker Row Boat.

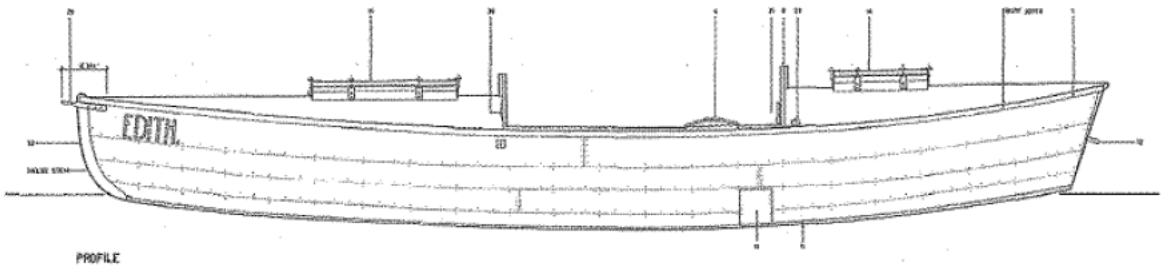
Rowboats available from 1912 Sears Catalog

1895 Montgomery Wards Catalog:

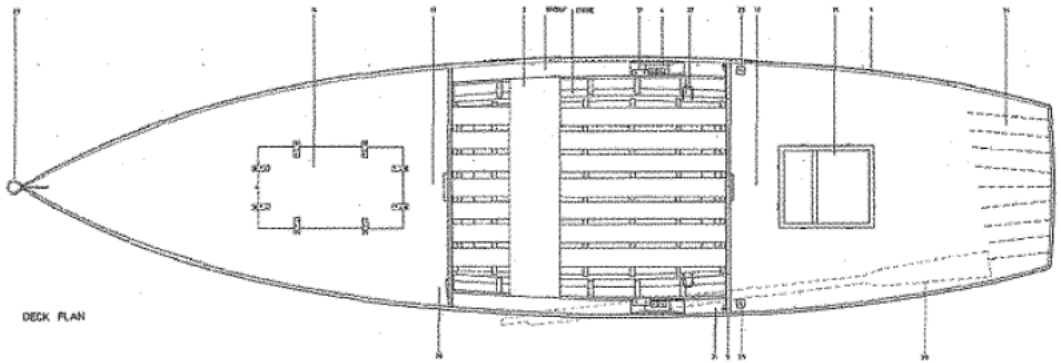
- Wood & Canvas Rowboats
- Mail order availability

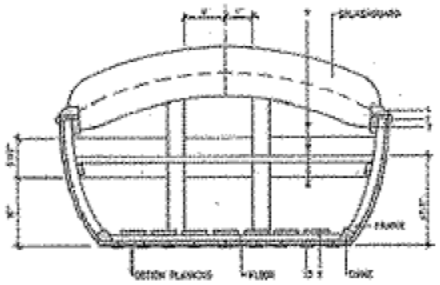
The "Edith" in GCNP collection, Kolb brothers 1911

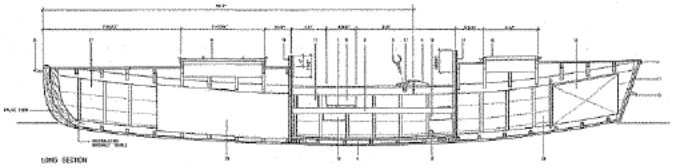
Wood Boat Specifications: Edith (ca. 1911)

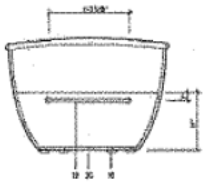


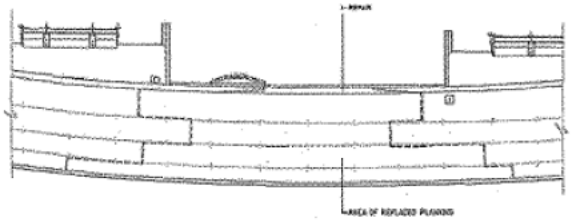
PROFILE


DECK PLAN


MID-SHIPS SECTION LOOKING FORWARD




TRANSOM-PROJECTED


STARBOARD REPAIR

Used by Kolb Brothers
Draw: < 1 ft
Load: 2,000 lbs

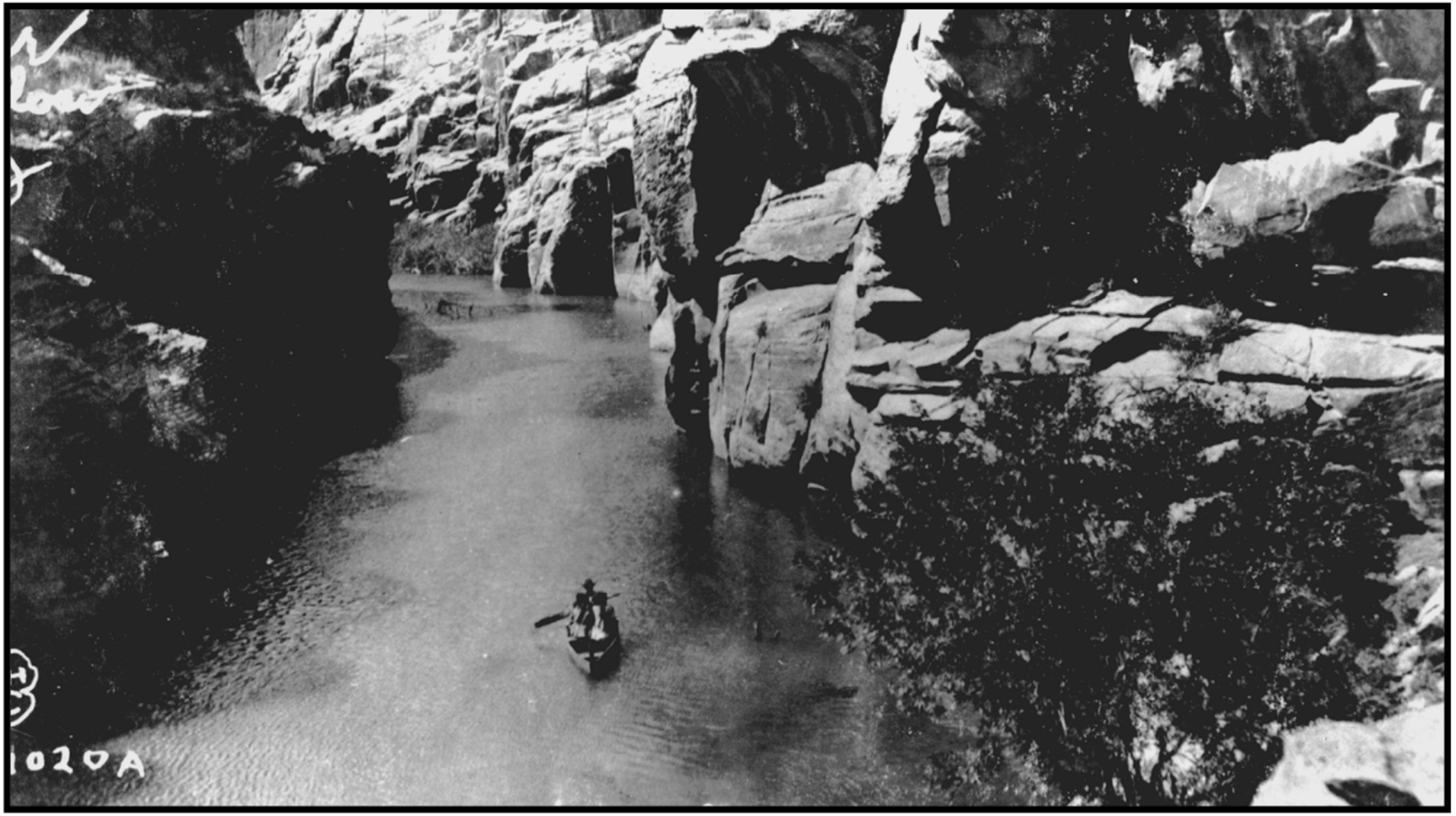
Historical Boat Types

Relict Homemade Rowboat on Green River

Historical Boat Types

Historical Boat Types

Historical Boat Types



Historical Boat Types

- Canoes

Historical Boat Types

- Canoes

Kolb Brothers

Historical Boat Types

- Canoes

Kolb Brothers

Historical Boat Types

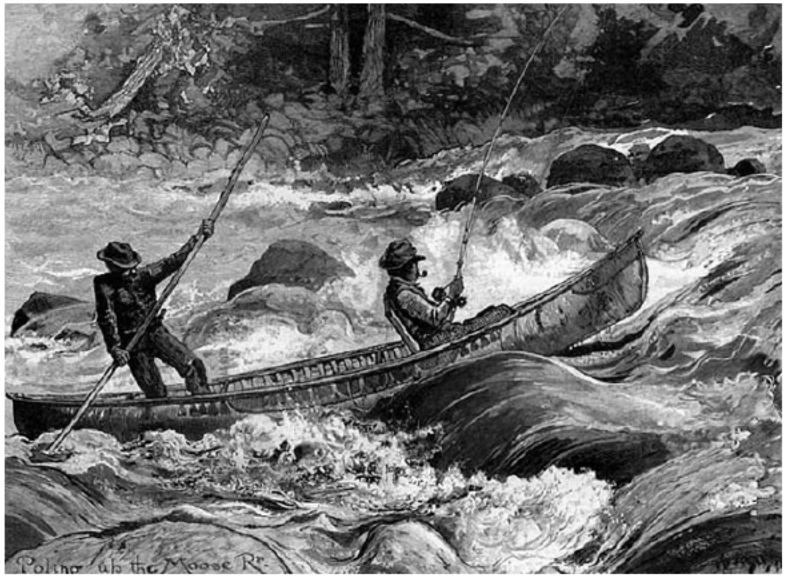
- Canoes
  - Specifications Sizes vary widely (8-25 ft)
  - Minimum Depth of Flow: 6 inches
  - Typical Uses
    - Hauling Goods, Passengers, River Guiding, Exploration, Military, Fishing, Trapping, Travel, Mail
  - Availability: In Arizona
  - Use on Arizona Rivers
    - Actual Historical (Gila, Salt, Verde)

Historical Boat Types

- Canoes
  - Dugouts – single log
  - Strip – fitted wood pieces
  - Canvas – metal or wood ribs
  - Upstream travel (poling)
  - Many other types of canoes available, modified for the type of water & intended use.

Country Life Magazine, 1908

Historical Boat Types



Historical Boat Types

- Canvas Folding boats
  - Specifications: 5-12 ft
  - Minimum Depth of Flow: 3 inches
  - Typical Uses
    - Hunting, Fishing, Trapping, Travel, Military, Exploration
  - Availability: In Arizona
  - Use on Arizona Rivers
    - Actual Historical (Gila, Verde, Salt)

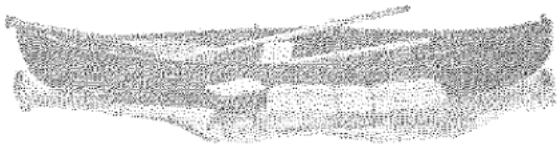
Historical Boat Types: Folding Canoes & Rowboats

King Folding Boat Co, ca. 1880's
Canvas over wire frame

Kolb brothers & others in canvas canoe

LIFE SAVING FOLDING CANVAS BOAT.

Made by Life Saving Folding Canvas Boat Co., Kalamazoo, Michigan.



These boats are splendid for hunters, trappers, fishermen or pleasure, safe and steady, the **12 foot regular** 37 inch beam, 12 inches deep, 20 inches at ends, with jointed oars or double paddles, carrying case, thwart seats and spreaders, air chambers and camp chair, capacity 700 pounds. Weight 55 pounds, package is 4 feet by 9 inches by 11 inches. Price $33. This boat will carry three persons nicely. Given for EIGHTY-FIVE New Subscribers.

The **9 foot boat,** suitable for a trapper or hunter, 32 inch beam, 10 inches deep, 16 inches at ends, with jointed oars or double paddles, carrying case, thwart seat and spreaders, air chambers, capacity 350 pounds, package is 3 feet by 8 inches, weight 30 pounds, price $25. Given for SIXTY New Subscribers.

Always mention the HUNTER-TRADER-TRAPPER when writing to advertisers.

Hunter-Trader-Trapper Magazine, 1908

Historical Boat Types

Historical Boat Types

- Canvas Canoes, 1911 Publication
  - "In years past, 1000's of streams could not be reached [until] the folding canvas boat.."
  - 9 ft boat: carries 350 lbs, costs $25
  - 20 ft boat: carries 3,000 lbs, costs $65.
  - Described as more reliable than inflatable boats.

Source: Outing with Portable Equipment, 1911

Hunter-Trader-Trapper, 1912
Guaranteed, Outlast Wood or Steel boats, Safe

Historical Boat Types

- Canvas Canoes
  - Numerous manufactures, shipped anywhere
  - Elastic rigidity (deflects snags & rocks)
  - Very low draft (clears 1" depths)
  - Military usage (more durable than wooden boats)
    - Ives' Account
    - Fort Verde

Outing with Portable Equipment, 1911

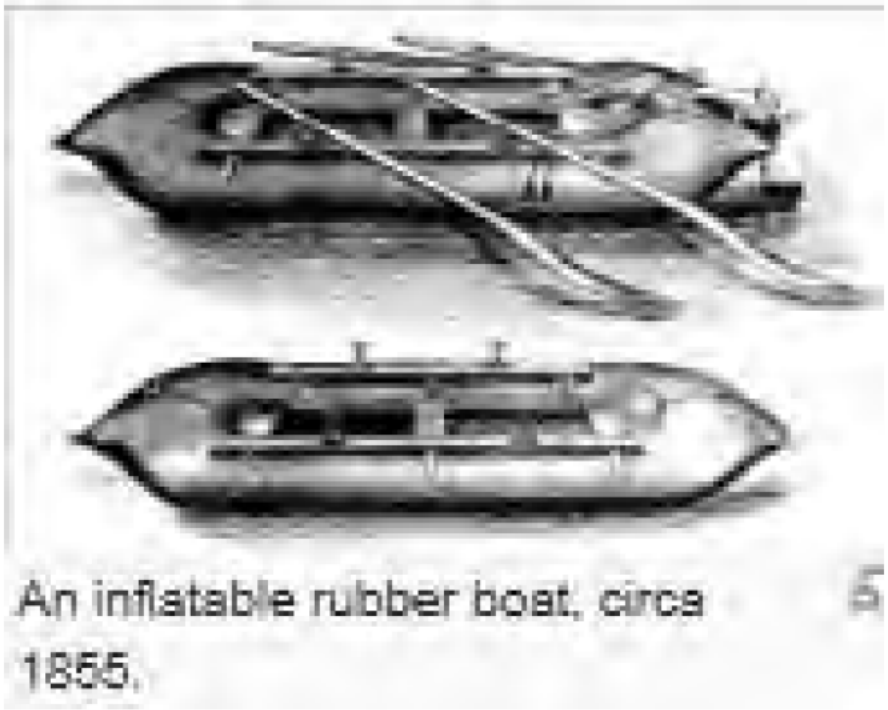
Historical Boat Types

- Inflatables
  - Specifications: Varies (8-30 ft)
  - Minimum Depth of Flow: 1 ft.
  - Typical Uses
    - Passengers, Exploration, Ferries, River Guiding, Military, Fishing, Travel
  - Availability: In Southwest
  - Use on Arizona Rivers
    - Actual Historical (Colorado)

Historical Boat Types

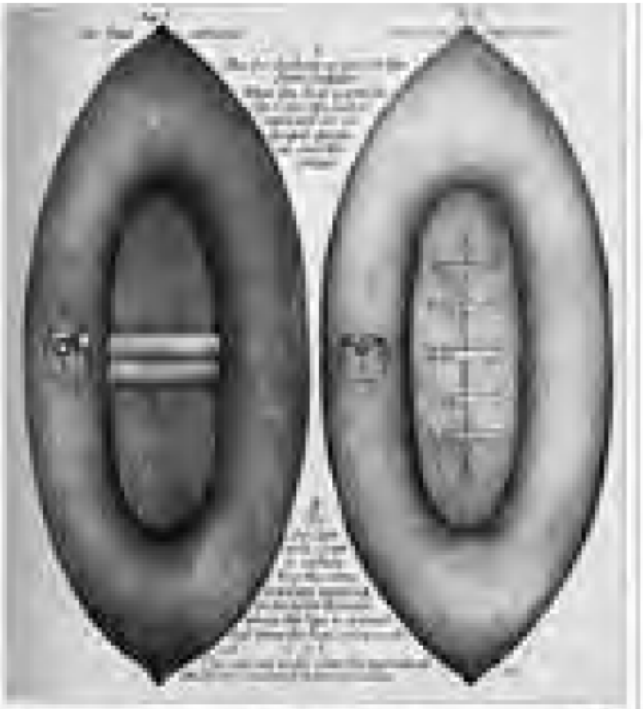
- Inflatables
  - 1837: First rubber boat invented
  - 1842: Fremont uses Day raft for Platte River survey
  - 1846: Horace Day patents rubber raft
  - 1851: Goodyear rubber pontoon
  - 1853: Whipple crosses Colorado in inflatable raft
  - 1866: Atlantic Ocean crossing in inflatable raft
  - 1900: Durability of rubber improved
  - 1937: First Grand Canyon inflatable trip

Historical Boat Types



An inflatable rubber boat, circa 1855.

Used in Mexican-American War (1848)

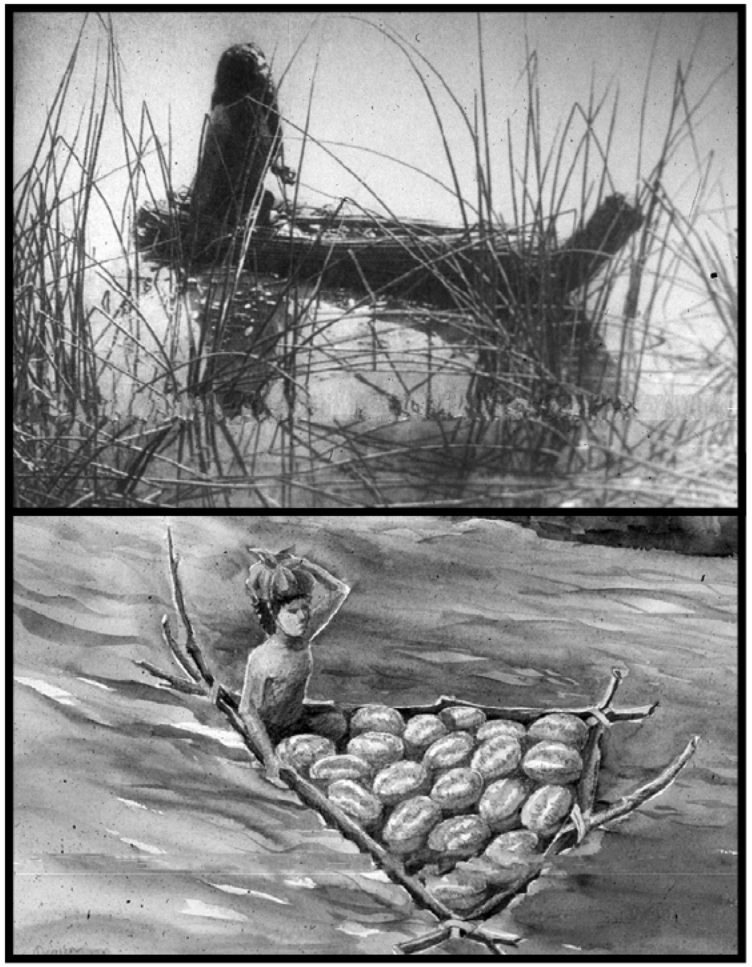


A two-man Halkett boat, with and without its canvas cover

Used by Royal Navy, 1845

Native American Boating

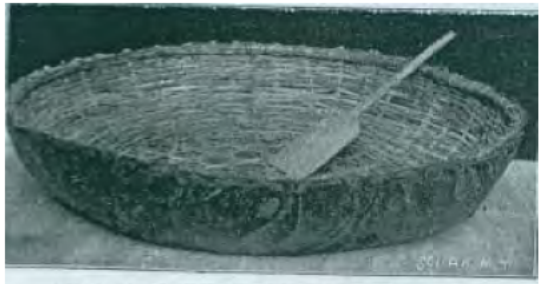
- Yuman Tribes, Gila & Colorado Rivers
  - Fishing, Ferrying
  - Rafts made from Tule bundles
  - Unshaped logs (Maricopas)
  - Catamarans (for high water)
  - Hand paddled or poled
- Halchidhoma, Mohave
  - Clay Pots



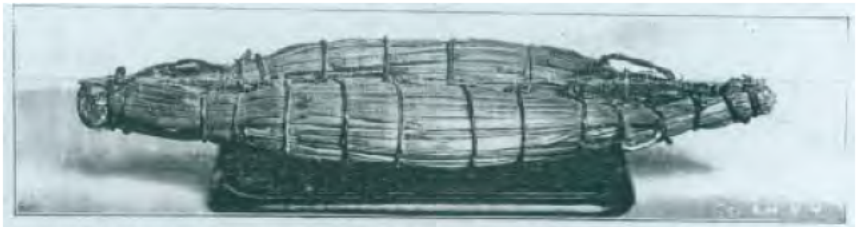
Source: Yuman Tribes of the Gila River, 1970

Native American Boating

- Interior Tribes
  - Limited record of boating
  - Apaches – wicker baskets
  - Canoe in Hohokam canal (F. Cushing)
- Tohono Mythology
  - Montezuma & the Flood – Canoe story



SKIN-COVERED, BASKET CORACLE



RAFT CONSISTING OF BUNDLES OF RUSHES LASHED TOGETHER.

Native American Boating

- Disposable Canoes & Boats
  - Bark or Skin over wood frames
  - Used short term & abandoned
  - Willow basket boats waterproofed with sap
  - Rafts made from reeds or agave stalks
  - Poorly preserved

Sources:

- The Bark Canoes & Skin Boats of North America, 1938
- Crossing the River: Ferries & Other Small Boats in Arizona, 1999

Native American Boating

- Reasons for Limited Record of Boating
  - Boat materials not well preserved
  - Alternative modes more suitable
  - Cultural beliefs about rivers

"The present day Indians, the Navajos and the Utes, probably owing to old superstitions and legends, have not navigated these rivers in boats and do not now navigate them except to cross at fords" p. 25-26
Report of Utah Special Master

"W.E. Medenhall: "We could never get Navajo Indians to go down with us into the canyon. They hear the rocks rolling down there and they say it is the Great Spirit…The Indians seem to believe the canyons are inhabited by spirits…Their tradition is that they fought the Cliff-dwellers and defeated them repeatedly…and rather than be captured the Cliff-dwellers jumped into the River and were turned into what is called the hump-backed fish and that reason has kept them from ever eating or catching a fish" p. 26, Report of Utah Special Master

Why Weren't There More Boating Accounts on AZ Streams?

- The Basic Paradox:
  - When the rivers had the water, Arizona didn't have the population.

Arizona Population by Decade (US Census Bureau)		
1870	9,658	0.08 /sq. mile
1880	40,440	0.4 /sq. mile
1890	88,243	0.8 /sq. mile
1900	122,931	1.1 /sq. mile
1910	204,354	1.8 /sq. mile
2011	6,482,505	57 /sq. mile

* Arizona is currently the 33rd least densely populated state. (#1 – NJ – 1,210/mi2)

Why Weren't There More Boating Accounts on AZ Streams?

- The Basic Paradox:
  - When the rivers had the water, Arizona didn't have the population.
  - When Arizona had the population, the rivers no longer had the water.

Why Weren't There More Boating Accounts on AZ Streams?

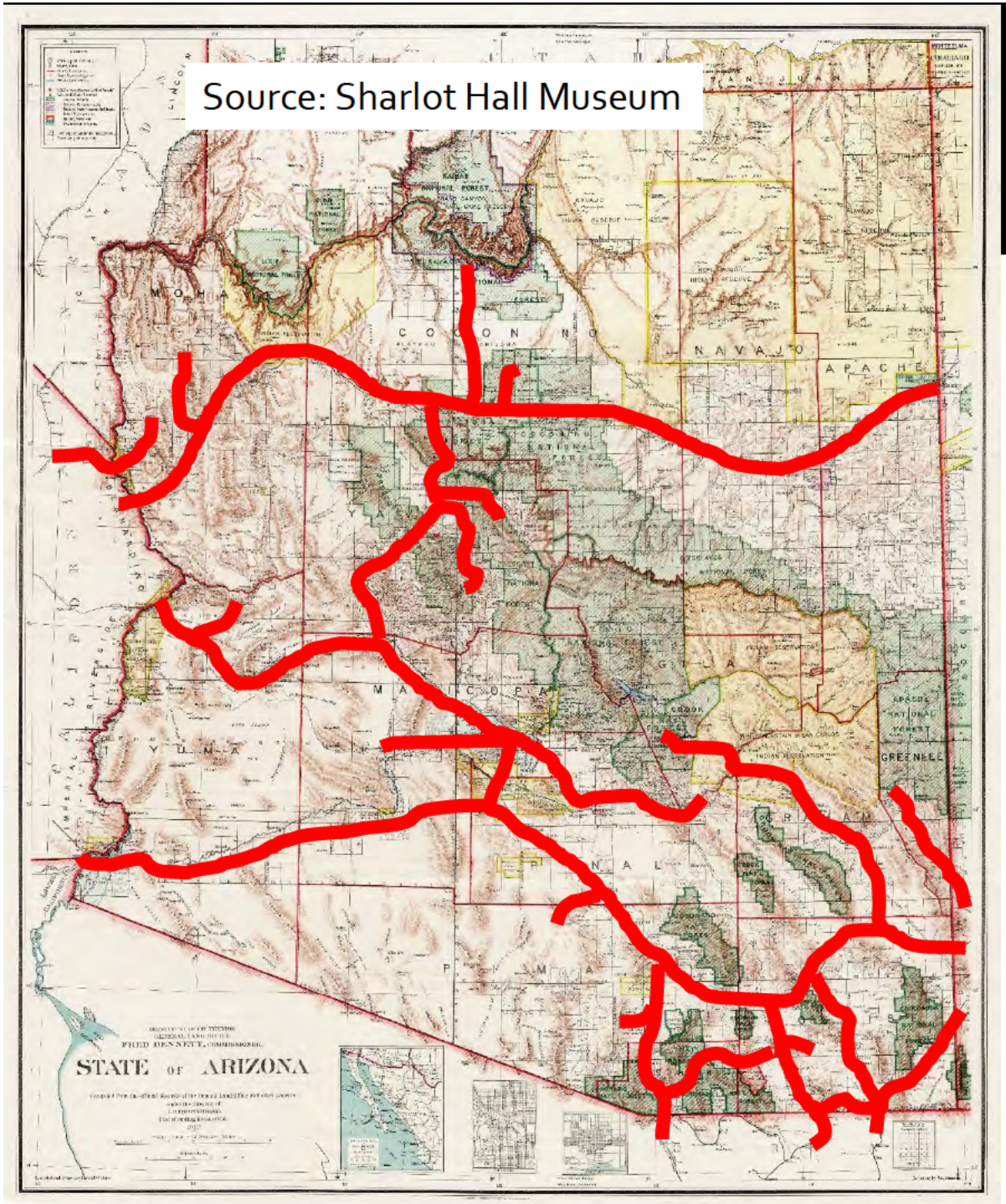
- Boating may not have been newsworthy
  - Only unusual or extraordinary trips were "news"
  - In 1871, when the railroad arrived, there were < 10,000 English readers in the entire state.
- There may be more published boating accounts
- River Boating Requires
  - Specialized equipment
  - Specialized skills

Why Weren't There More Boating Accounts on AZ Streams?

- Other Reasons:
  - Many early AZ population centers weren't on the "wet" rivers
    - Prescott, Tucson, Tombstone, Wickenberg, Flagstaff, Forts
  - Modern Transportation Routes not on Rivers
    - Except parts of Gila
      - Which was in Mexico until 1853
      - Apache threat until 1886
    - Verde aligned North-South, Travel routes primarily East-West

Why Weren't There More Boating Accounts on AZ Streams?

- Other Reasons:
  - Alternatives Available
    - Railroads (1870's)
    - Roads: Wagon & Horseback (1500's)
    - Roads: Automobiles (1900's)
    - Alternative modes required to get into & out of Arizona



AZ Railroads ca. 1912

Arizona City Populations, 1910

Bisbee (9,019)
Clifton/Morenci (9,884)
Douglas (6,437)
Flagstaff (1,633)
Globe/Miami (8,473)
Jerome (2,393)
Mesa (3,330) .....**Salt R.**
Nogales (3,514)
Phoenix (11,134) .....**Salt R**.
Prescott (5,093)
Maricopa (1,473)
Safford/Thatcher (3,490) ..**Gila R**.
Tempe (3,073) .....**Salt R**.
Tombstone (1, 582)
Tucson (13,193)
Winslow (2,381)
Yuma (2,914) .....**Colorado R**.

Why Weren't There More Boating Accounts on AZ Streams?

- Some Segments of Arizona Rivers
  - Not conducive to carrying major tonnage (e.g., ore)
  - Not easy to travel upstream (possible, but hard work)
- Rivers were diverted & dammed before Statehood

Reasons Why Not to Boat a Navigable River

- Faulty Logic: If the river was navigable, people would have regularly boated it.

- Many Factors Involved:
  - Flow depth
  - Need
  - Cost
  - Speed of Travel
  - Skills
  - Location

"All the men interviewed state that …it was possible to drive a wagon nearly anywhere one desired." Ciolek-Torrello & Welch, 1994

Reasons Why Not to Boat a Navigable River

- You don't own a boat
- You don't know how to build a boat
- There are no materials to build a boat
- It takes too long to build a boat
- You don't know how to pilot a boat
- You already own a wagon, car, horse, etc.
- Wagon, horse, car, railroad etc. are faster
- It's too cold. Or hot. Or rainy. Or windy….
- You are afraid of boating
- You can't swim

Reasons Why Not to Boat a Navigable River

- The river doesn't go where you want to go
- The boat won't carry what you want to carry
- You need a car, horse, etc. when you get there
- Going upstream is too much work or expense
- You can't risk capsizing
- The river was remote – no access in 1912
- You don't live/work near the river
- The river is unexplored, unknown
- You don't need to go anywhere.
  - Self-sustained communities
- Someone built a dam or removed all the water

Trains vs. Boats

- Advantages of Trains over Boats, 1912
  - Trains are faster
    - Steamboat: 240 miles/12 days
    - Steam Engine: 20-50 miles/hour
  - Trains carry more cargo
    - Canoe: 500 lbs
    - Steamboat: 50 tons
    - Train: 50 tons/ore car
  - Trains can move 24 hrs/day
  - Trains go uphill, onto & through mountains
  - Trains not affected by weather, drought, flood
- Why are railroads located along rivers?
  - Flat terrain

Floating Logs as Navigability

- Floating Logs Requires:
  - River located in forest (source of logs)
  - Population (market for logs)
  - River located in market (delivery point)
  - Sufficient river flow to float logs
  - Wide & straight enough river to prevent log jams
- Some accounts of log-floating in AZ

Historical Boating: Summary

- Instances of Historical Boating
  - Gila, Salt & Verde River
  - Throughout the year, during ordinary conditions
- Primarily
  - Low Draft Boats
  - Downstream Travel
- **NOTE**: Actual ***historical boating is not required*** to demonstrate title navigability. Only ***susceptibility*** to boating is required.

What Type of Boat is Required?

- Federal Standard for Boat Type for Navigability
  - US v. Holt (1926) "…navigability does not depend on the particular mode in which such use is or may be had - whether by steamboats, sailing vessels or flatboats…but in the fact…that the stream in its natural and ordinary condition affords a channel for useful commerce"
  - No required type of boat.

Susceptibility to Trade & Travel

- It's All About Flow Depth & Obstructions
  - Requirements vary with the type of boat
  - Width generally not a limiting factor
- Navigability Requirements
  - Not susceptible to every type of boat
  - Long enough stream segment
  - Minor obstacles not important
  - Some difficulty not important

Boating Requirements

- Federal Minimum Standards for Boating

Table 8-1
Minimum Required Stream Width and Depth for Recreation Craft

Type of Craft	Depth (ft.)	Width (ft.)
Canoe, Kayak	0.5	4
Raft, Drift Boat, Row Boat	1.0	6
Power Boat	3.0	6

Source: US Fish and Wildlife, 1978 (as cited in ASLD, 2003)

Boating Requirements

- State Standards for Boating
  - Arizona:
    - Presumptions of Non-Navigability Struck Down by Arizona Courts; Particularized Assessment Required
  - Alaska:
    - Criterion Craft – Powered boat + 1000 lbs (Gulkana)
  - Washington:
    - Depth Classification (Probably Not, Maybe, Probably)
  - Oregon:
    - Floating logs – Clear Channel
    - Dugout canoes

Obstructions & Obstacles

- Obstructions to Navigability
  - Depends on the Type of Boat
    - River Barges vs. Trapper Canoes
  - Depends on Boater's Experience
  - Depends on Flow Rate
  - Obstruction ≠ Obstacle, Challenge
  - Some commercial enterprises require "obstacles"

Obstructions & Obstacles

Obstruction?	Barges	Canoes
Rapids	Yes	No (I-V)
Beaver Dams	No	No
Waterfalls	Yes	Some
Sand Bars	Only if river wide	No
Strainers / Sweepers	No	No
Marshes	Yes, if no clear channel	If shallow
Braiding	No, unless shallow	No
Shallow Flow	< 10 ft.	< 0.5 ft.

On Gila, Salt & Verde Rivers, continuous, regular shallow flow is the only real obstruction to boating

Obstructions & Obstacles

- Rapids
  - Defined as: A section of a river where there is an increase in water velocity & turbulence.
  - Some rapids (not all):
    - Slope increase
    - Shallow or exposed rocks
    - Whitewater
  - Most rapids are obstacles, not obstructions
    - Depends on boat type, suitability for rapids
    - Long, continuous, major rapids could be obstruction
  - International Rating Scale for Rapids (I-VI)

Obstructions & Obstacles

- Elements of Rating Rapids
  - Ease of passage & route finding
  - Size of waves
  - Need to maneuver
  - Complexity of maneuvers, skills required
  - Danger to swimmers
  - Need for group assistance, difficulty of self-rescue
  - Need for scouting
  - Power of current
  - Length & complexity of rapid
- Can be subjective, seasonal, annual

Obstructions & Obstacles

- Rapids & Navigability in Arizona
  - Class I-V are Navigable (by definition)
    - There are very few Class III-VI rapids on the Salt, Gila, and Verde Rivers (mostly I-II)
    - The ***navigable*** Colorado River has some of the largest rapids in North America
  - Rapids are minor parts of the rivers' lengths
    - Vast majority (>95%) = Class I or Pools

Obstructions & Obstacles

River	Percent of River's Length				
	Class II	Class III	Class IV	Class V	All Rapids
Gila	0.2%	0.03%	0	0	0.2%
Salt	1.8%	2.7%	0.3%	0	4.8%
Lower Salt	0	0	0	0	0
Verde	Measurements not completed yet				<5% (est.)

Obstructions & Obstacles

- International Scale - Rapids Classification
  - Class I: Fast Moving Water **Pre-Novice**
    - Riffles, easily navigated with little training
  - Class II: Straightforward Rapids **Novice**
    - Wide, clear channels, easy with training
  - Class III: Rapids **Intermediate**
    - Boat maneuvering required
    - Moderate waves, tight channels, powerful currents

Class I Rapids in Arizona

Verde River, Unnamed Class I Rapid @ 122 cfs

- Video:
  - Clay Bank Rapid, Verde River

Class II Rapids in Arizona

Gila River, Above Needle's Eye Rapid, Class II @ 220 cfs

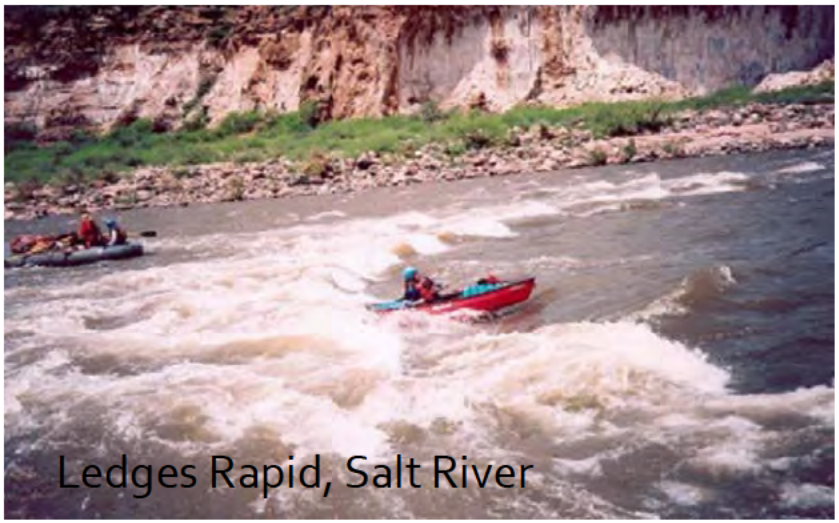
- Video:
  - Needle's Eye, Gila River

Class III Rapids in Arizona

- Video: Upper Salt River

Class III Rapids in Arizona

Eye of the Needle Rapid, Salt River

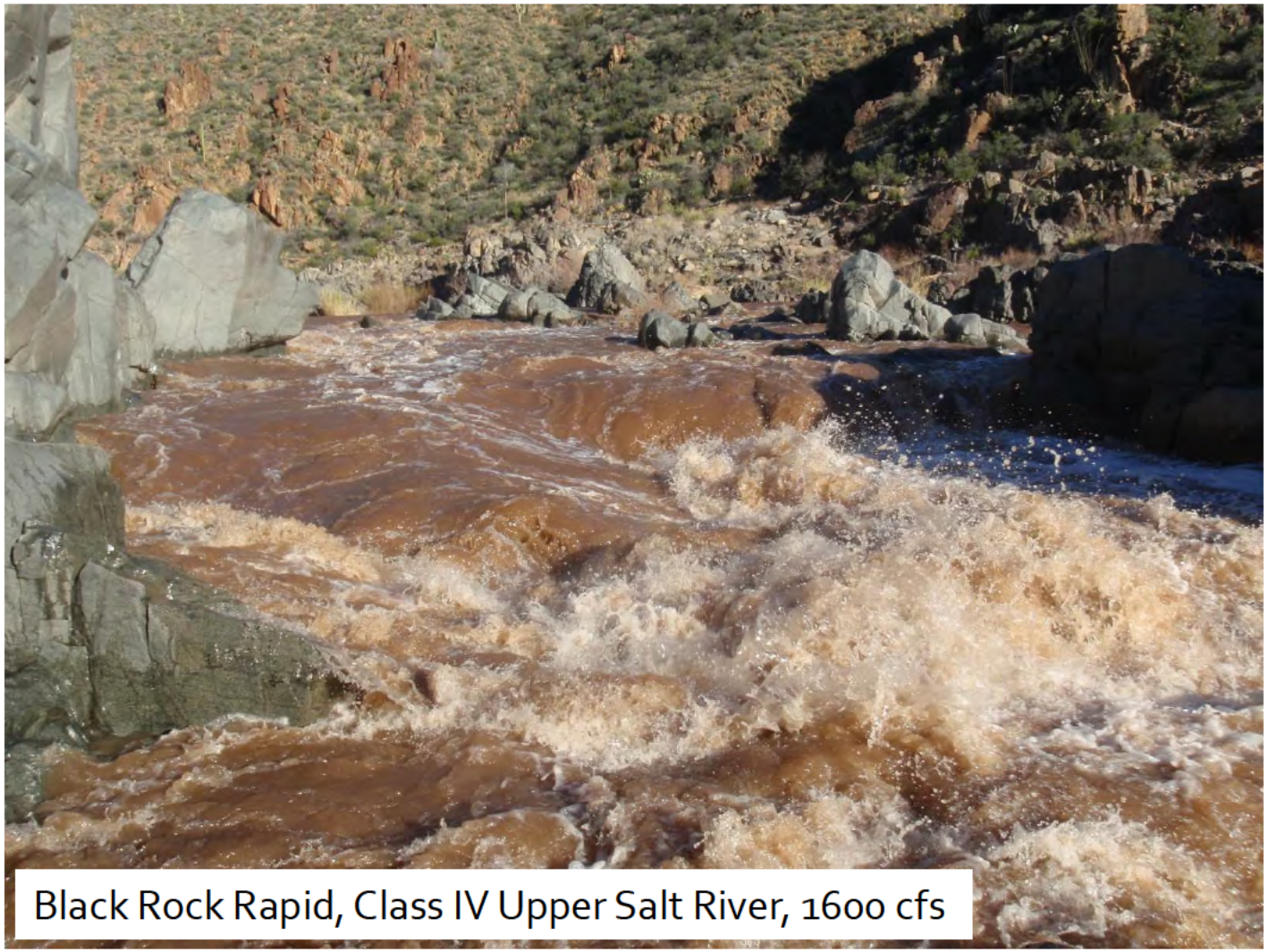


Ledges Rapid, Salt River

Obstructions & Obstacles

- International Scale of River Difficulty
  - Class IV: Rapids — **Advanced**
    - Powerful, intense, predictable rapids
    - Moderate to high risk if capsized
  - Class V: Rapids — **Expert**
    - Complex, violent, demanding
    - High risk, difficult rescue
  - Class VI: Obstacles — Extreme
    - Unrunnable for most boaters

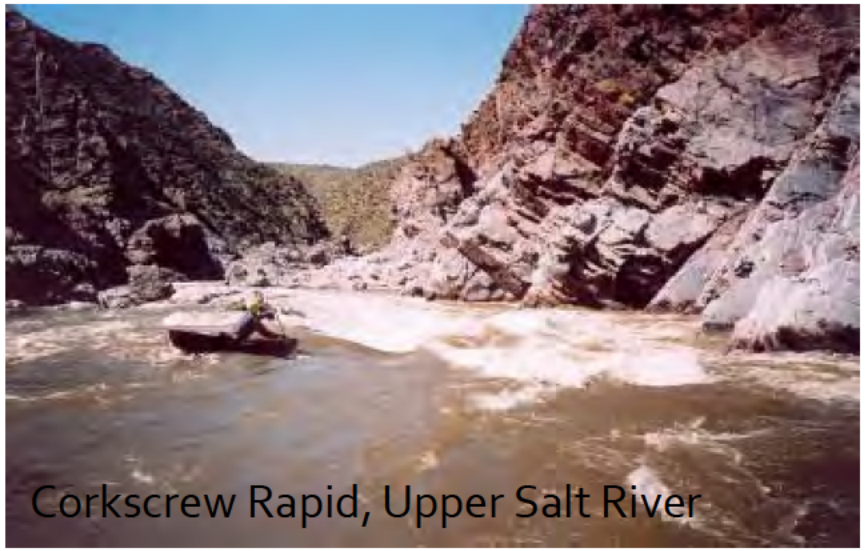
Class IV Rapids in Arizona



Black Rock Rapid, Class IV Upper Salt River, 1600 cfs

Class IV Rapids in Arizona

Quartzite Falls, Upper Salt River



Corkscrew Rapid, Upper Salt River

Class IV Rapids in Arizona

- Video: Upper Salt River

Black Rock Rapid, Class IV Upper Salt River, 1600 cfs

Class V Rapids in Arizona

- No Class V or VI Rapids on:
  - Salt River
  - Gila River
  - Verde River
- Only Class V Rapids in Arizona:
  - Colorado River:* Navigable
  - Small Rivers: East Verde, Burro Creek, etc.

*Grand Canyon rapids are rated on a 1-10 scale

Obstructions & Obstacles

- Beaver Dams
  - Not on major river main channels
    - Small river feature
    - Removed by seasonal high flow
  - Not necessarily dams
    - Bank dens or lodges
  - Not obstructions to small boats
    - Obstacle at dam itself (sluice or carry)
    - Raises water depths upstream of dams

Obstructions & Obstacles

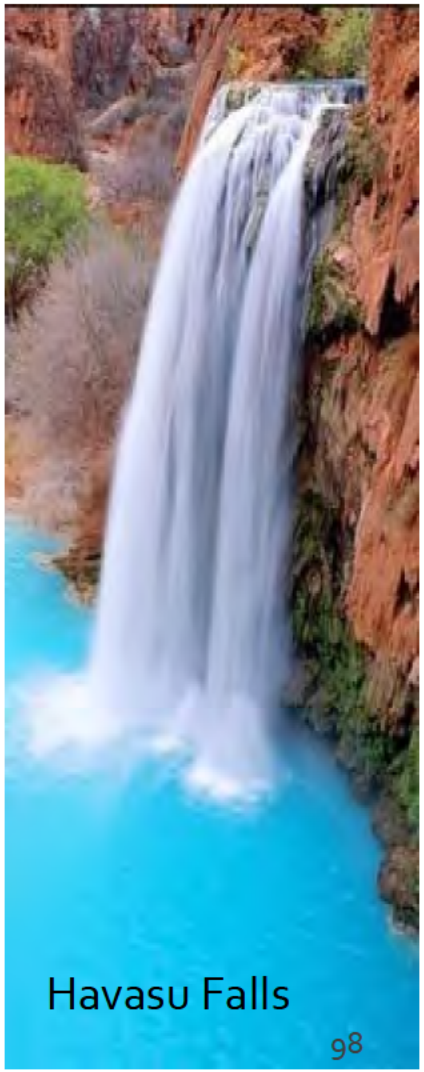
Mid-channel beaver lodge on the Gila River, Segment 7, February 2003

Obstructions & Obstacles

- Waterfalls:
  - Definition: River flow over a vertical drop.
  - Not drowned out at high flow
  - Permanent feature
  - Rapids are less steep, may be drown out
  - None on Gila, Salt, or Verde River in AZ
    - Some Rapids are named "falls"

Apache "Falls", Salt River Canyon

Verde "Falls"



Havasu Falls

Obstructions & Obstacles

- Waterfalls
  - There are none on the Gila, Salt, Verde
  - Verde "Falls" is a rapid (Class III-IV) & is often run by canoes, kayaks & rafts

Obstructions & Obstacles

- Sand Bars
  - Raised area of sand at or near the water surface
  - Occupies part of the stream bed channel

Gila River
near Apache Grove

Colorado River
near Bullhead CIty

Cimarron River
Oklahoma

Obstructions & Obstacles

- Sand Bars
  - Occur on all major rivers.
    - Colorado & Mississippi.
    - Do not preclude navigability
  - Obstacle at low flow
  - Boats go around sand bars

Gila River, Segment 1, 39 cfs

Historical Photographs

October 1871– Upstream travel on the Colorado River in Black Canyon. Trip extended to Diamond Creek through many large rapids. (Wheeler Expedition – flat boats)

Photos shows large sand bars in river.

Source: Webb et. al., 2007

Obstructions & Obstacles

- Strainers & Sweepers
  - Fallen trees in channel
  - Overhanging bank vegetation
  - Removed by Floods, Time
    - Worse after dams built
  - Hazardous to Unprepared
  - = Obstacle, Not Obstruction
    - Easily removed
    - Easily avoided


Gila River, Segment 4, 220 cfs

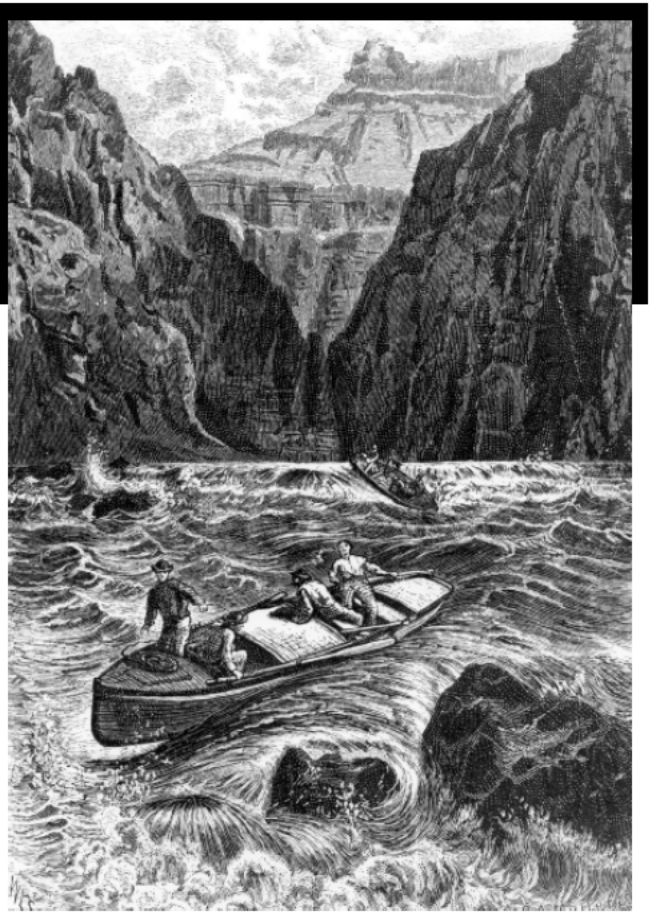
Obstructions & Obstacles

- Boating around Obstacles
  - Avoid the obstacle – just go around it
  - Lining, Scooting, Dragging
  - Depends on
    - Skill of boater
    - Knowledge of river

Obstructions & Obstacles

- Portaging
  - Carrying the boat over land
  - Short Hauls
  - Long Hauls
  - Around non-navigable segment
    - Then back to navigating the river
  - Trapper Routes
- Deciding to portage, line or run an obstacle
  - Weather, Consequence, Fatigue, Skill, durability of craft

Obstructions & Obstacles



- First Descent Obstruction = 2nd Trip Obstacle
  - John Wesley Powell
    - Lined and portaged 62 of 476 rapids
    - Damaged & sunk several boats
  - 2013 Replica Trip
    - Same boats, more skill & knowledge
    - Portaged one rapid (to replicate)
    - Ran the rest
    - No significant damage reported

Obstructions & Obstacles

- Not Obstructions
  - Remoteness
    - In 1912, the entire State of Arizona was "remote."
  - Deep Canyons
    - Canyon depth is not a river feature
  - Narrow Rivers
    - Wide enough for a boat
  - Manmade features
    - Dam, road, mine, channelization, fences
- Obstacles are Not Obstructions to Navigability
  - US v. Holt (1926) "…nor on an absence of occasional difficulties…"

Modern Recreational Boating

- Montana PPL v. Montana Criteria
  - Modern watercraft are meaningfully similar to those in customary use at time of statehood.
    - Can modern boats go where historical boats couldn't?
  - River's post-statehood condition is not materially different from statehood physical condition.
    - Has the river changed to substantially improve boating?
    - Less torrential in high flow periods?
    - Less shallow in low flow periods?

Modern Recreational Boating

- Meaningfully Similar to Historical Boats?
  - Draw is the same (canoes, flatboats, rowboats)
    - Same depth needed for historical & modern boats
    - Weight of canoes about the same
  - Design is essentially the same
    - Performance improvements in specialty boats

<< Historic

Modern >>

Modern Recreational Boating

- Meaningfully Similar to Historical Boats?

A B. N. Morris wood-and-canvas canoe built approximately 1912

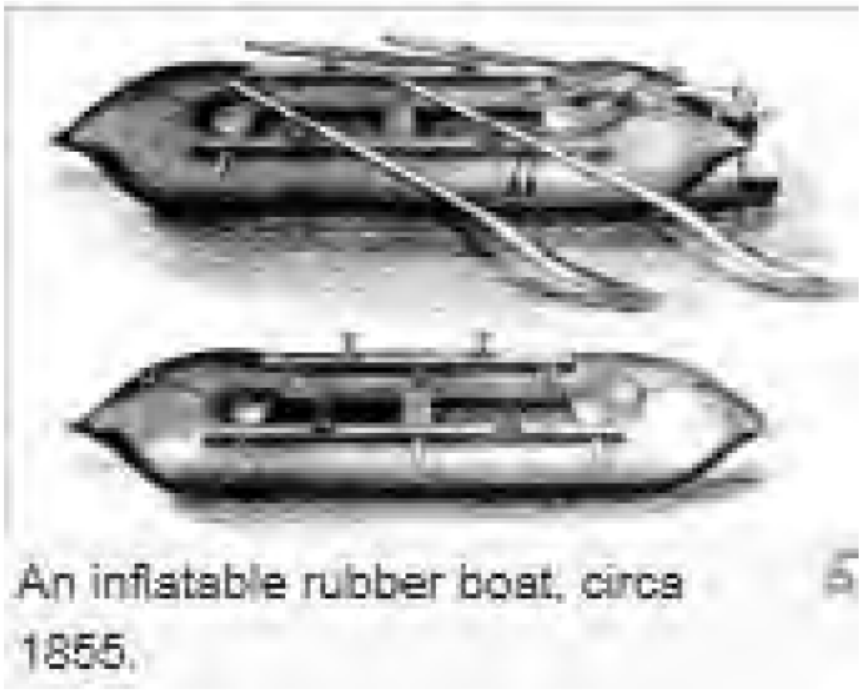
2014 Old Town Wood Canoes

Modern Recreational Boating

- Meaningfully Similar to Historical Boats?

Kolbs in "Edith" in 1911
Replica boating in the Edith in 2013

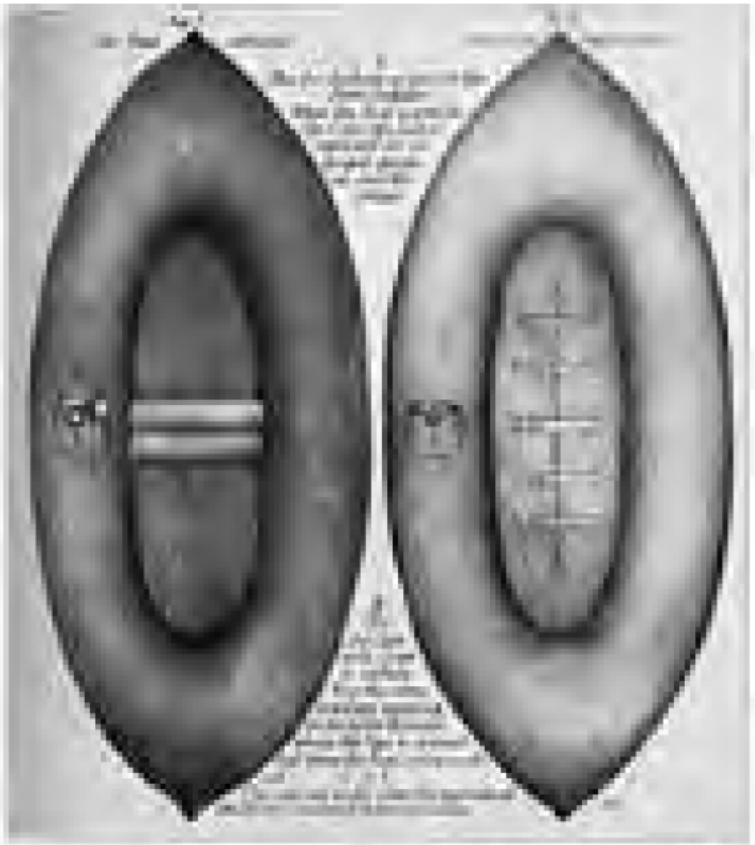
Modern Recreational Boating



An inflatable rubber boat, circa 1855.

Avon Inflatible Raft, 2014

Modern Recreational Boating



A two-man Halkett boat, with and without its canvas cover

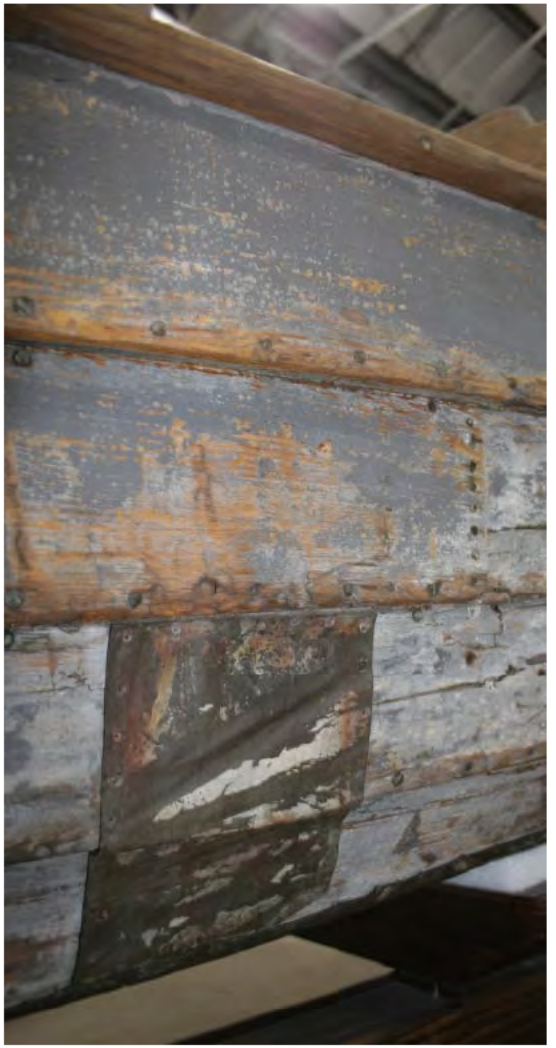
Modern Recreational Boating

- Meaningfully Similar to Historical Boats?
  - Durability is improved (plastic, hypalon, etc.)
    - Less skill needed
  - Low durability was an expectation
    - Repair – canvas, wood
    - Extra care & time in selecting route

Modern Recreational Boating

Emery Kolb repairing the Edith, Christmas 1911, in Grand Canyon

Durability & expectations differ.

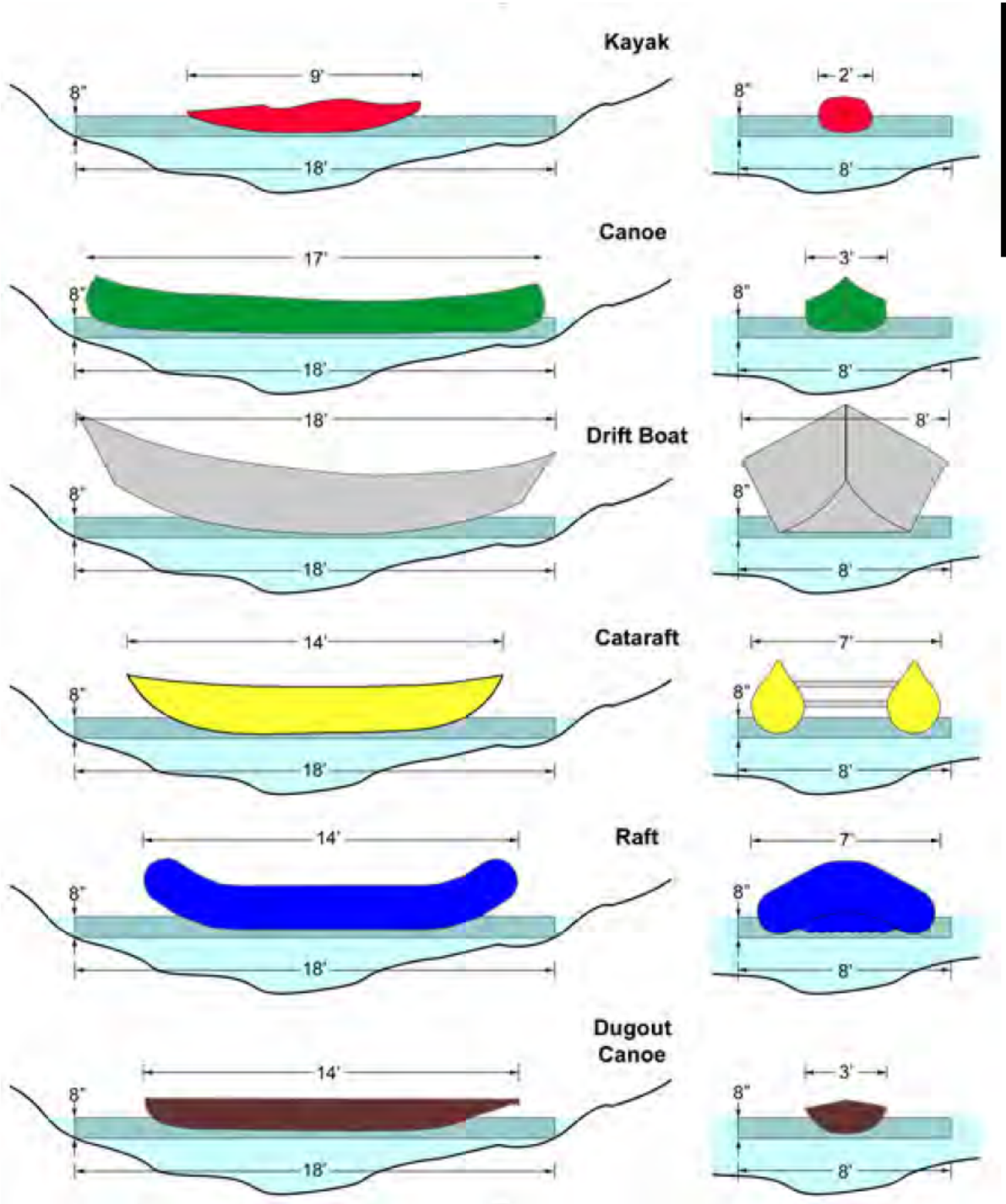


Modern Recreational Boating

Historical & Modern Boat Flow Depth Requirements		
Boat Type	**Required Depth**	**Source**
Modern Canoe	0.3-0.5 ft	USFWS, Slingluff, Cortell
Canvas Canoe	0.2 ft	1910 Sears Catalog, Hunter/Trapper
Drift Boat	1.0 ft	Cortell
Duck Boat	0.2 ft	1910 Sears Catalog
Kayak	0.15-0.5 ft	Brosius, USFWS
Rowboat	1.0 ft	USFWS

As reported in Stantec (Tellman), 2005

Historical v. Modern Boats



Similar Depths Needed for Historical Boats & Modern Recreational Boats

Source: Shelby, Whittaker & Donahue, 2011

Modern Recreational Boating

- Has River Condition Improved?
  - Since Ordinary & Natural Condition Existed
  - Discussed in Specific River Presentations
  - Generally: No!
    - Flow rates significantly depleted
    - Flow depths lower
    - Invasive species due to altered flow regime
    - Fences, diversion dams, channelization, mining

Modern Recreational Boating

- Demonstrates Susceptibility
  - Can be boated given opportunity, time & motive
- Is Travel ("travel on water"…Daniel Ball test)
- Recreation is Commercial
  - Commercial river touring existed in 1912
  - Tourism-based economies
  - Boat rental, supplies, guiding, outfitting

"The Government's assertion as to lack of commercial possibilities fails to recognize one source of commerce which in the future will undoubtedly develop to a considerable extent-the use of these Rivers for the transportation of tourists for hire, to view the natural scenic wonders and explore the archaeological features of these regions"

Utah Special Masters Report, p. 117).

Modern Recreational Boating

- In Arizona
  - Federal monitoring & regulation
  - Commercial outfitters
  - Published river guidebooks
  - Boat rentals
  - Websites
  - Paddling clubs
  - Boat races & events
  - Shuttle services

Modern Recreational Boating

- Commonly Boated for Recreation In Arizona
  - Gila Box (Segment 2)
  - Gila Coolidge Dam to Ashurst Hayden (Segments 4-5)
  - Gila River Downstream Phoenix (Segment 7)
  - Salt River Canyon (Segment 2-4)
  - Salt River Segment 5
  - Verde River (all)
  - Colorado, San Francisco, Virgin, Little Colorado, Black, Bill Williams

Modern Recreational Boating

- Summary – Modern Boating Occurs:
  - Wherever river flow has not been altered
  - Wherever public access is not prevented
  - Most often in scenic or exciting river reaches
  - Year-round & seasonally, depending on flow rates

Boating Summary

- Boats Were Available in Arizona at Statehood
  - Wide Variety – Primarily Low Draft
- Boats Were Used on Arizona Rivers
  - Many Accounts Despite Flow Depletion
- Boats Are Still Used on Arizona Rivers
  - Modern Recreational Boating
- Modern Recreational Boats are Meaningfully Similar to Historical Boats