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COMMERCIAL FRESHWATER FISHERIES OF CALIFORNIA¹

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INTRODUCTION

Seven species of freshwater fishes are taken commercially in California (Table 1). They may descend at times into brackish waters of bays and estuaries, but all are essentially freshwater fishes.

Five species—hardhead, hitch, Sacramento blackfish, splittail and western sucker—are native to California. Sacramento blackfish are sometimes called "hardhead" and lumped with "true" hardhead in catch statistics published by the California Department of Fish and Game. Carp, hardhead, hitch, Sacramento blackfish and splittail are minnows, family Cyprinidae, while bigmouth buffalo and western sucker are suckers, family Catostomidae. Two of the seven species, bigmouth buffalo and carp, were introduced into California.

Carp first were introduced into our waters from Holstein, Germany in 1812 when five individuals were placed in private ponds in Sonoma Valley (Poppe, 1880). Their forefathers were introduced into Europe

TABLE 1

Common and Scientific Names of Commercial Freshwater Rough Fish in California

<i>Common name</i>	<i>Scientific name</i>
Blackfish, Sacramento -----	<i>Orthodon microlepidotus</i> (Ayres)
Buffalo, bigmouth * -----	<i>Ictio bus cyprinella</i> (Valenciennes)
Carp* -----	<i>Cyprinus carpio</i> (Linnaeus)
Hardhead -----	<i>Mylopharodon conocephalus</i> (Baird and Girard)
Hitch -----	<i>Lavinia exilicauda</i> (Baird and Girard)
Splittail -----	<i>Pogonictis macrolepidotus</i> (Ayres)
Sucker, western -----	<i>Catostomus occidentalis</i> (Ayres)

* Introduced into California waters.

in 1227 from Asia. In 1872 carp were popular and were recommended as valuable food fishes that would thrive in all warmer ponds, lakes and streams of California. At that time, carp sold so rapidly that no ponds were overstocked. Ten years after their introduction into California, they were so plentiful that the market price declined to 1.5 cents per pound (Hallock, 1949). In the early 1900's, carloads of carp were shipped east; however, at present they are transported to California from nearby states to help meet consumer demand.

How and when bigmouth buffalo were introduced into California is not certain. They may have come from any of several sources, since

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commercial seiners travel widely throughout nearby states to obtain them for fresh fish markets of larger cities. Los Angeles fish markets commonly receive shipments of buffalo from Arizona and Utah. Although known facts are lacking, some commercial operator may have brought them here to provide a local market supply. If this is true, they probably were introduced from the Roosevelt Dam Impoundment in Arizona, where several local commercial seiners have operated. About 1942, the first bigmouth buffalo were noted in the aqueduct system in upper and lower San Fernando Reservoir. At present they are reportedly found in 11 reservoirs of the Los Angeles Aqueduct system (Evans, 1950).

PRESENT AREAS FISHED

In 1960, California lakes and reservoirs yielded 91 percent of all commercial rough-fish landings with rivers and irrigation canals supplying the remainder.

The only producer in northern California is Clear Lake in Lake County which contributed 279,835 of the 494,706 pounds landed statewide in 1960.

In central California, fishermen trap small amounts of carp in the Sacramento River and adjoining sloughs near Rio Vista in Solano and Sacramento Counties. Small quantities of splittail are also taken in the river near Sacramento with hook and line. Thirty-four percent of the 1960 rough-fish catch came from reservoirs, irrigation canals and rivers in the San Joaquin Valley. Waters within this area include the San Joaquin River in Stanislaus, San Joaquin and Merced Counties; Modesto and Turlock Reservoirs in Stanislaus County; and Yosemite Lake, Bear Creek and Mud Slough in Merced County.

In southern California, small poundages of carp, bigmouth buffalo and western sucker are netted in Bouquet, Chatsworth, Fairmont and San Fernando Reservoirs in Los Angeles County; and Haiwee Reservoir in Inyo County.

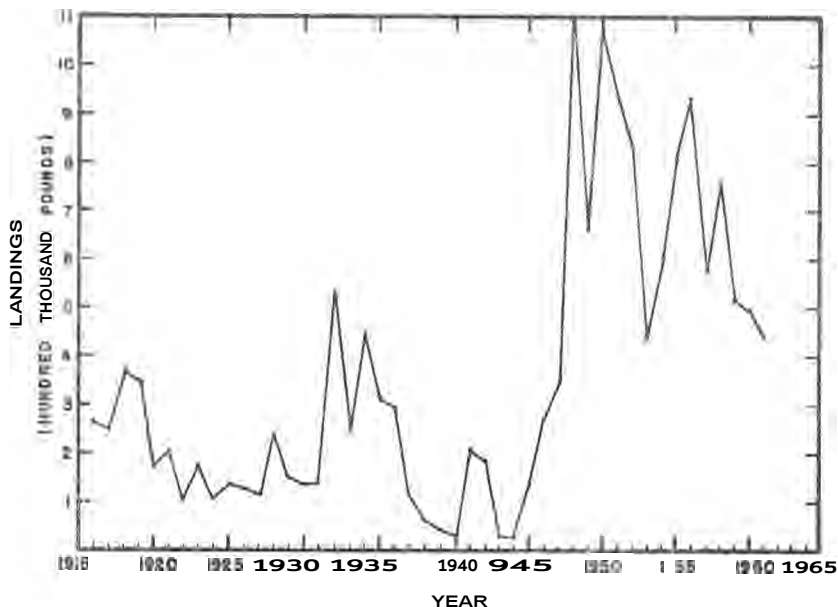


FIGURE 1. Annual rough-fish landings in California 1916-61.

ANNUAL LANDINGS

Rough-fish landings declined markedly following World War I and remained fairly constant from 1922 through 1931 with the Sacramento-San Joaquin Delta furnishing the bulk of the catch (Figure 1). Increased landings between 1932 and 1936 mainly were due to heavier fishing at Clear Lake. Landings at Clear Lake gradually declined and in 1937, the Sacramento-San Joaquin Delta again was principal producer.

The sudden rise in 1941 and 1942 was due to increased fishing in the Los Angeles area where 211,766 pounds of carp were netted.

Following 1944, landings rose rapidly to a peak of over one million pounds in 1948 when fishing resumed at Clear Lake and began at Lake Almanor in Plumas County. During the six years, 1950 through 1955, Lake Almanor yielded the bulk of the catch when Smith-Ferrari Fishmeal Company obtained a permit to seine carp and reduce them to fish meal for animal food supplements. When Lake Almanor operations ceased in 1955, Clear Lake resumed leadership and has been the main producer to the present time.

Rough-fish landings in 1960 amounted to nearly one-half million pounds worth about \$55,000 to the fishermen. Carp, although first in poundage during 1960, was second in value to Sacramento blackfish from Clear Lake which yielded 29 percent by poundage, but 59 percent of the total value (Table 2). Hardhead, hitch and splittail have brought the same price as blackfish but contributed only small poundages to the fishery.

TABLE 2

Landings and Value of Freshwater Commercial Fish in California, 1960 *

<i>Species</i>	<i>Pounds by area</i>		<i>Total pounds</i>	<i>Total value</i>	<i>Percent value by pounds</i>	<i>Percent by value</i>
	<i>Lakes</i>	<i>Rivers</i>				
Carp	274,352	44,247	318,599	\$15,193	64	28
Blackfish,						
Sacramento	145,010	---	145,010	32,699	29	59
Splittail	---	875	675	236	1	<1
Miscellaneous t	30,422	---	30,422	6,860	6	13
Total	449,784	44,922	494,706	\$54,988	100	100

* Values for 1961 not compiled; similar data for previous years not available.
 t Includes hardhead, hitch and suckers.

FISHING METHODS

Shore seines, traps, and hook and line are used to take rough fish in California waters.

Shore Seines

Shore or beach seines catch the largest portion of rough fish in inland waters. In 1961 they took 394,988 pounds (90 percent of the catch).

Fishermen operate under a special permit issued by the Department of Fish and Game to seine rough fish considered harmful to sport species. Three such permits were issued in 1961. Permittees must possess a valid commercial fishing license and register their boats with the Department. These fishermen provide the Department with an advance schedule of fishing operations. Their activities are subject to close supervision by Fish and Game Wardens to insure that all inci-

dentally caught sport fish are returned to the water unharmed. At times, the Department may transfer the sport fish to more desirable waters.

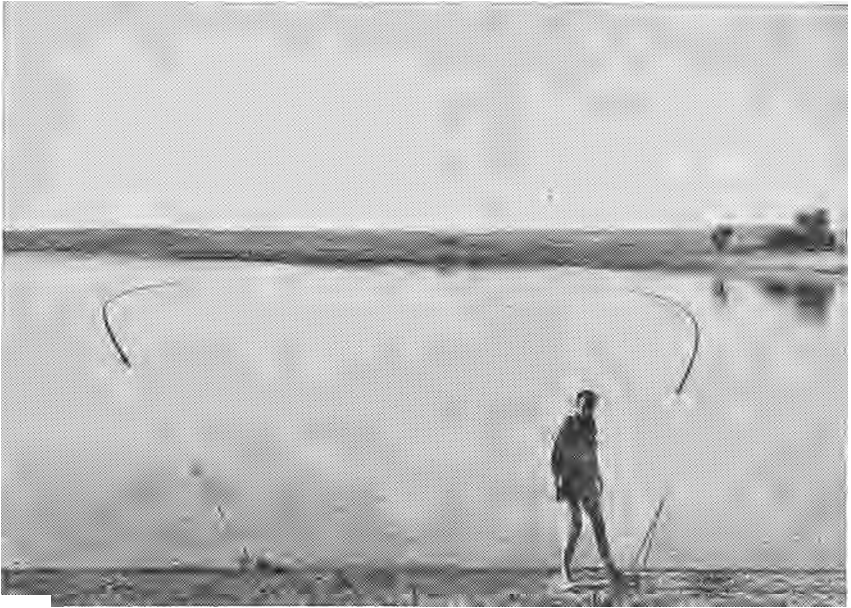


FIGURE 2. The net moving closer to shore. Photographed *by the author, September 1961.*



FIGURE 3. A power winch used for pulling net. Photographed *by the author, December 1961.*

Equipment used by these fishermen includes shore seines, live-holding pens and tanks, homemade flat-bottom skiffs and outboard motors (Davis, 1962). Flatbed trucks haul boats, nets and other gear to the fishing area.

To make a set, a 300- to 1200-foot shore seine is piled into a skiff and payed out in a large semicircle offshore (Figure 2). The net is towed into shallow water by two motor boats (one on each end) ; by a combination of one motor boat and man on shore ; or by a makeshift winch

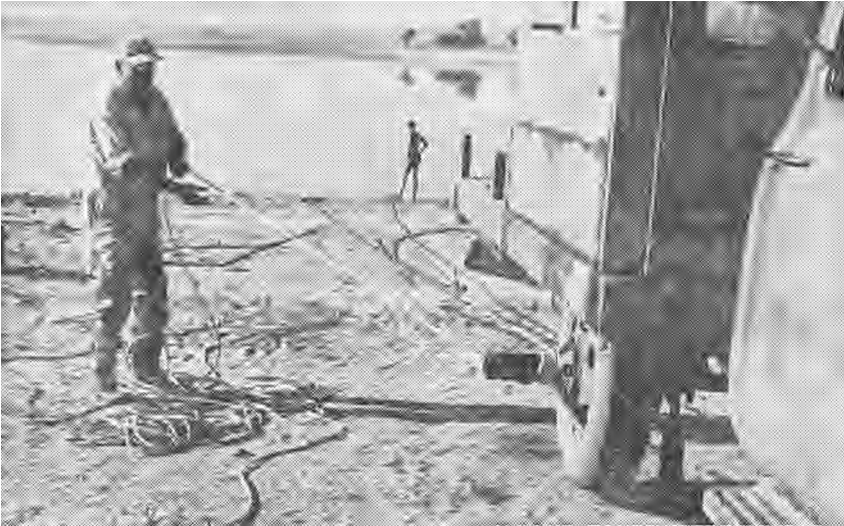


FIGURE 4 A makeshift winch used for pulling net. Photograph by the author, September 1961.



FIGURE 5. Live-holding pens and skiff used for sorting fish. Photograph by the author, September 1961.

bolted to the rear wheel of a truck. The wings are pulled ashore either by hand, by a power winch mounted on one of the boats (Figure 3) or by a makeshift winch on the truck axle (Figure 4). The last portion of the net is hauled in by hand, forcing the catch into the bag or pocket of the net.

A skiff and live-holding pens are used for sorting fish (Figure 5). Sacramento blackfish, hardhead, hitch, splittail and small silver-colored carp weighing less than three pounds are placed in wire live-holding pens before transporting them to market alive. Large carp, bigmouth buffalo and suckers are held in the boat and later iced in boxes (Figure 6).



FIGURE 6. Bigmouth buffalo (left) and carp (right) taken with shore seine. Photograph by the author, December 1961.

Generally, 800 to 1,000 pounds of live blackfish from Clear Lake are taken to market at one time ; but as many as 2,000 pounds, depending on demand, may be trucked. A metal hatchery-type tank truck with a spray aerator is used to transport these fish.

San Joaquin Valley fish are hauled to market in a watertight wooden box built on the forward portion of a truck bed. Up to 1,000 pounds of live fish are transported at one time. Water is aerated by a circulating pump and a mechanical agitator suspended in a bucket (Figure 7).

Traps

Traps, the second most important gear for rough fish, took 42,801 pounds of carp in 1961 or 10 percent of all commercial rough fish.

Traps may be used throughout the year to take carp in any district with the provision that all fish other than carp are returned at once to the water.

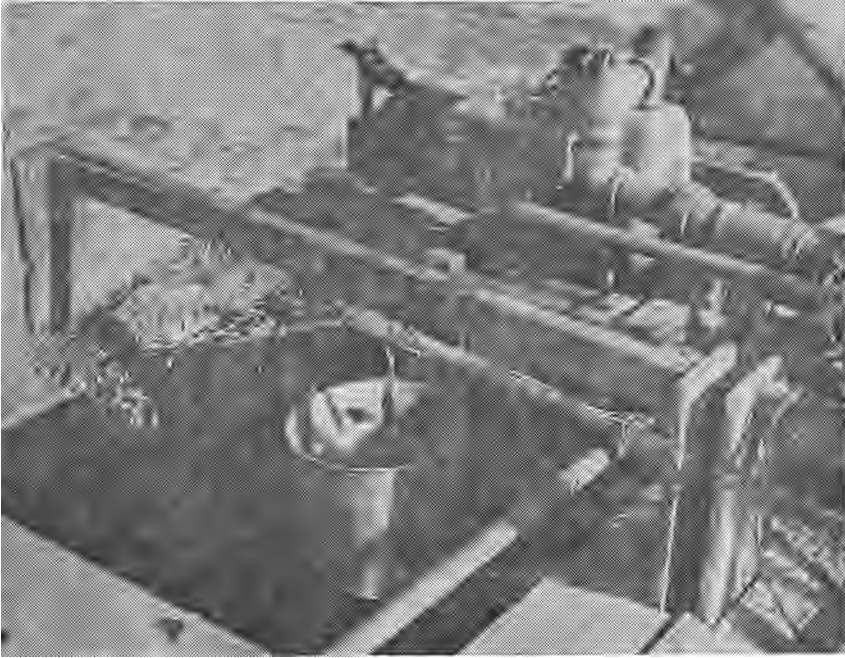


FIGURE 7. Looking down into live-holding tank on the truck. A mechanical agitator in the bucket and a water-circulating pump aerate the water. Photograph *by the author, September 1961.*

Fishermen currently trap carp in the Sacramento River and sloughs near Rio Vista. In other years, they have fished throughout the Delta.

Carp traps measure about 5 feet in diameter at the larger hoop (bottom) and 3 feet in diameter at the smaller hoop (top) and cost about \$12 each to construct (Figure 8). Each is baited with 5 to 6 pounds of rolled barley (wet weight) tied in a fine-mesh bag within the funnel of the trap. Carp feeding on the barley crowd into the mouth of the funnel and are forced into the trap by other fish.

The trap's unique construction usually prevents fish other than carp from entering. The opening in the top allows carp which are down feeders (they feed head down and tail up) to enter from the top. Many species feed with their body parallel to the stream or lake bottom and would enter a trap only through a side opening.

One trap in a new area will yield an average catch of 150 to 200 pounds of carp in a two-night set. Each trap is marked with a wood float and is left from overnight up to 5 days but generally is lifted every 2 days. The fish are held in live pens in the lower Sacramento River. Twice a week, a wholesale fish dealer from Richmond takes 700 to 1,000 pounds of fresh carp to markets in Oakland and Richmond.

Hook and line

In 1961, hook and line fishermen took 765 pounds of carp and split-tail or less than 1 percent of all commercial rough fish. These were taken in the Sacramento River near Sacramento and sold to wholesale fish dealers in the area.



FIGURE 8. Henry Rauch with a carp trap he developed. Photograph by *the author*, September 1961.

FISHING SEASONS

Shore Seines

The best season for seining blackfish in Clear Lake is from October to April when they are feeding in shallow water near shore. During the rest of the year, they are believed to retreat to deeper, cooler water and cannot be taken readily with a shore seine. Throughout the winter, an average of 12,000 pounds of Clear Lake blackfish is delivered to markets monthly.

One fisherman is building a live-holding pond in Rodman Slough north of Clear Lake. He plans to stock the pond with blackfish in winter when fishing is good and, thus, supply markets the year around.

Carp sometimes are taken in late summer when irrigation canals in the Turlock and Modesto Irrigation Districts are drained. One permittee in southern California fishes in Washington and Idaho in the summer and seines carp in Los Angeles County reservoirs during winter when his summer waters are frozen.

Hardhead, hitch, splittail and silver-colored carp of the Modesto area are more easily captured in fall when the reservoirs are shallow.

Traps

Carp are taken more readily by trap from August through November. In December and January, when water temperatures drop, fish become semi-dormant and are less susceptible to trapping.

Hook and Line

No seasonal pattern is evident for best hook and line fishing since the catch varies more by whim of the fishermen than by season.

UTILIZATION

Blackfish, hardhead, hitch, splittail and small silver-colored carp are trucked alive to Chinatown, San Francisco and held in large aquariums (Figure 9). Fishermen supply filters, aerators and other accessories for the aquariums.

Chinese, the main consumers, will purchase only live fish. They pay up to 80 cents per pound for blackfish, hardhead, hitch, splittail and silver-colored carp since they resemble favorite species in their native land (Table 3). Silver colored carp and large goldfish *Carassius auratus* (Linnaeus), are in demand because they are good luck symbols.



FIGURE 9. Live rough fish are retailed from aquariums in Chinatown, San Francisco. Photograph by the author, June 1962.

Catch of rough fish in California during 1947: 10,200 pounds; (5,700); (3,500). Juvenile people catch of rough fish during 1947: 1,000 pounds. Fish. M. J. L. A. N. 25 to 30 cents. Total catch of rough fish during 1947, 200,000 pounds, sold for 100,000 pounds. Total catch of rough fish during 1947, 200,000 pounds, sold for 100,000 pounds. Total catch of rough fish during 1947, 200,000 pounds, sold for 100,000 pounds.

TABLE 3
Paid for Freshwater Rough Fish in 1961

Species	Average price per pound		Remarks
	To fisherman	Retail	
Bullhead, Sacramento	\$0.40	\$0.80	Sold alive
Buffalo, bigmouth	.15-.20	.30	
Carp	.04-.10	.25-30	
Carp (with silver coloring)	.40	.80	Sold alive
Hardhead	.40-.45	.80	Sold alive
Hitch	.40	.80	Sold alive
Sucker, western	.40	.80	Sold alive
Sucker, western	.12	.30-.60	
Mixed (sold for pet foot)	.01		

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