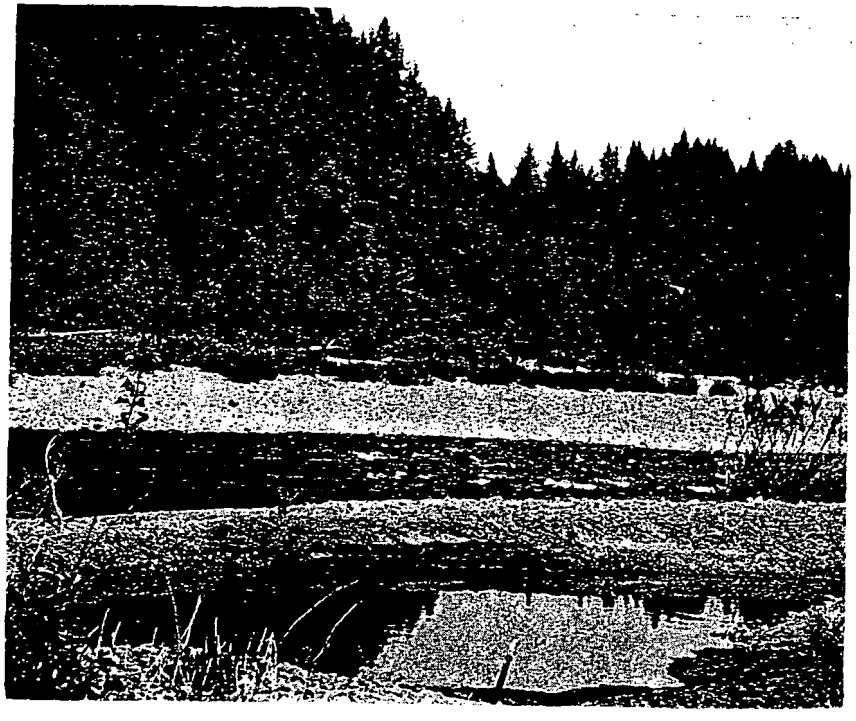
FIG. 33. A typical pool in the Central Valleys in need of fish rescue. Near Patterson, California.



PHOTOGRAPHS

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FISH RESCUE IN CALIFORNIA[1]

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Fish rescue has become of increasing interest in California because it affords a means of conservation through the transplanting of stranded fish into safe waters. During the past six years the State Division of Fish and Game has salvaged over eight million fish annually. This work is necessitated by the geographical and meteorological conditions in two large areas in the state, the coastal region and the central valleys.

Along the coast the streams flow through low rolling mountains. Due to the normal absence of summer rains, many streams that support runs of spawning salmon and steelhead trout during the winter and spring dry up in summer into a series of pools that become uninhabitable for the young fish.

In the central valleys, the run-off from the Sierra Nevada snow pack floods the already saturated ground during May, June and July. Many warm-water fishes seek out the shallows to spawn during this period, and thus become spread over enormous areas, sometimes miles away from the natural stream beds. When the waters recede, thousands of fish may be stranded in small pools or temporary ponds which, in the summer heat, turn into stagnant holes. Here the fish are trapped, unable to return to fresh water, beset by predatory birds, and vulnerable to disease, so that even if the pools do not dry up completely, great losses occur. There may also be local migrations into the inundated areas by young fish seeking better forage, for newly flooded lands are often producers of abundant plankton—the food of fry and young fingerlings. Thus the entire central portion of the state—the Sacramento-San Joaquin Valley—becomes a field of spiny-rayed fish rescue operations.[2] The season usually extends from June through October, although occasional work may be necessary at any time during the year.

To provide for efficient fish rescue operations the Bureau of Fish Conservation has inaugurated a systematic procedure for the work. Rescue districts have been designated in southern California, the coastal area, and the central valleys. A seasonal supervisor and his crew generally return to the same district year after year. The rescued fish are distributed as best indicated by stream surveys. The present scheme has shown gratifying results in the way of operating efficiency, and of improved angling in many of the regions where intensive work has been carried on for a period of years.

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[2] The term "spiny-rayed fish" as used in California includes all the warm water sport fishes, i.e., black basses, crappies, sunfishes and catfishes, as distinguished from the salmonoids.

History

Fish rescue has been employed as a conservation measure by the Division of Fish and Game since about 1904. At first its principal function was to extend the range of the spiny-rayed fishes, all of which, with the exception of the Sacramento Perch, are aliens to this state. A great many were imported from east of the Mississippi during the period 1871-1908, but it was manifestly impractical to transport enough across the continent to stock all our suitable waters. Early "fish rescue" therefore, utilized the localities in which these fishes were first

FIG. 35. A small group of representative fishes rescued in the Central Valleys.

placed as natural hatcheries, sources from which to redistribute them into unstocked waters. The records indicate that 507 lots of rescued fish were transplanted by the state in this way between 1904 and 1912.

As the introduced fishes increased in numbers and spread out into regions subject to inundation and drying, fish salvage began to receive serious thought. From 1913 on, fish rescue became a method of increasing the productivity of streams and lakes by returning fish directly to the same waters from which they had strayed during the floods, and transplantation became a secondary consideration. The early work was carried on largely by fish and game wardens and interested citizens who were called upon for assistance. By 1928 fish rescue had become so important that Mr. George Neale, a pioneer in the work, was placed in charge of all such operations throughout the state, and continued in

this capacity until his retirement in 1934, at which time the Bureau of Fish Conservation took over. Central valleys rescue is now under the direction of the foreman of the state bass hatchery located near Sacramento. Trout rescue is usually directed by the foreman of the trout hatchery nearest to the scene of operations.

The number of fish rescued declined somewhat from 1934 to 1936, but has increased sharply since then as shown in Table 1. Tables 1 and 2 give figures only from 1936 on as a new system of fish rescue work has become state-wide since that date. It should be noted that Table 2 is not a true picture of the relative abundance of each species

FIG. 36. Planting rescued fish from a pickup truck equipped with a 250-gallon fish tank. The aerating pump unit is located forward on the upper right part of the truck bed. This entire fish planting unit was suggested and built by members of the California Bureau of Fish Conservation.

in California as it is a result of selective rather than of random sampling. Most of the rescue work is done in the large central valleys portion of the state containing only warm, sluggish waters meandering through broad plains. Therefore, fish from this type of water—Large-mouthed Black Bass, sunfishes, catfishes—are better represented in the table than those from other parts of the state. The mountain creeks and those portions of larger streams flowing through the foothills, while subjected to floods also, lie in restricted valley troughs where rescue is unnecessary, and the fish of those habitats—the Small-mouthed Black Bass, the Spotted Bass, and the trout and young salmon—fail to appear in the lists.

Methods

In California, fish rescue is carried on by two-man units, one or more of such crews operating in a designated area. Each crew is equipped with a pickup truck; burlap covered milk cans or a 250-gallon insulated tank; mechanical aerator and emergency hand aerators; dip nets, buckets, tubs, tools, seines, seine mending kits, and thermometers; also the necessary maps of the district to be worked. Seines range from 10 feet by 3 feet to 100 feet by 8 feet, depending on the work, and in mesh from fine bobbinet to 1 inch stretched measure.

It has been found highly desirable for each supervisor to make a reconnaisance of his area a short time before the season's work begins,

FIG. 37. Completing the seining of a pond. The rescue net is brought in as indicated.

to be supplemented, if possible, by an aerial survey once he has become familiar with his district. These observations permit him to locate new ponds, roads, and routes, and to make notes on such important points as water turbidity (muddy or roily water usually indicates the presence of fish); character of the terrain (pools in light soils will drop rapidly as the water table falls, while those in heavier soils will hold up for some time); routes which will permit the quickest transportation of rescued fish to safe waters; conditions in the particular pools which will determine types of net to use and need of brush clearing or other preliminary work; and sources of pure, cool, fresh water for use in the fish cans or tanks, the water from the stagnant holes from which the fish are rescued being very undesirable, if not dangerous, for this purpose.

Aside from the official fish rescue crews, local wardens are of great help in locating and planting stranded fish and local sportsmen's clubs often give information and lend assistance.

In the actual conduct of fish rescue operations the general object is to secure as many fish as possible without undue waste of time and effort. Choice of the proper net for the work in hand is an important factor in achieving this end; in general, the net must be about 30 per cent longer and deeper than the section of water to be seined. Blocking nets are used in big pools to obviate long hauls or the use of large nets. Special techniques are used to avoid the various kinds of obstacles encountered in the work. Netting in any pool is continued until the

FIG. 38. Rescued fish are impounded in a portion of the net for sorting.

yield per haul falls to the point where the work seeems no longer justified; then that pool is abandoned, to be revisited later for further seining after a drop in the water level has again concentrated the remaining fish.

Once enough fish have been obtained to form a load for the truck, one thought is dominant in the minds of all workers—the *safe* transportation of the fish to *safe* waters. In hot weather the rescue work must be done in the cool of the early morning. Care must be taken not to overload the equipment. Under normal operating conditions, a fifteen-gallon milk can may carry 100 to 250 ounces of spiny-rayed fish, with mechanical aeration and water temperatures of not over 70° Fahrenheit; however, different species and sizes have different requirements. Holding ponds are sometimes available for retention of the fish

until their condition is improved, as rescued fish, due to the conditions under which they have been living, are often in a weakened state; but often they must be transported directly to the water into which they are to be stocked. Care is taken to avoid placing them in localities where their enemies are numerous. Waters free from large fish are given preference, and shelters from predatory fishes and birds are sought. Rough fish, unless definitely undesirable, are rescued and transplanted with the game fish in order to provide forage. Records are kept of the waters from which fish are taken, of those into which they are placed, and of the numbers of fish so handled, the adults being counted by tally, the fingerlings by comparing a counted sample with total displacement or total weight.

FIG. 39. Seining a portion of a long pool by the use of a blocking seine. The foreground net is used as a block, and the working seine will be pulled up to it and will be beached. The operator on the right will work along the block, while the other will only pivot to complete the beaching process.

At the end of each day a very important piece of work is the care of equipment, the cleaning and drying of all nets, metal instruments, etc., as without this attention they quickly go to pieces.

The Future of Fish Rescue

The future of fish rescue work has become unpredictable since the inception of the United States Bureau of Reclamation's Central Valleys Project. No doubt the Shasta Dam on the Sacramento River and the Friant Dam on the San Joaquin will reduce flooding from these streams,

but their tributaries below the dams will probably continue their seasonal inundations and necessitate rescue work.

The great canal systems of the Central Valleys Projects will probably harbor many resident or transient fish. Surely, new fish rescue problems will arise from the draining or flushing of various portions of the system. However, the large lakes formed by the dams may have a beneficial effect on the production of warm water fishes.

The coastal streams may be altered by the increasing number of small diversion dams within the limits of trout and salmon water. These dams will necessitate an increased fish rescue program; they not only divert water, but they produce unnatural conditions in the lower reaches of the streams by reducing water flows, thus increasing fish vulnerability to predators and in some cases increasing the water temperature above the limit of trout tolerance.

New problems will arise, demanding new solutions. Very possibly the yearly total of fish rescued will be somewhat reduced, but the numerical aspect is not the only one. The great numbers of fish handled make fish rescue an important method of controlling fish populations. It is thus an effective tool in the management of the inland "warm water" fisheries which, with the continuing rise in the number of anglers, will become of increasing importance as a source of food and recreation.

TABLE 1

NUMBERS OF FISH RESCUED ANNUALLY, 1936-1941

Species	1936	1937*	1938*	1939	1940	1941	1936-1941
Trout	0	36,273	41,354	686,739	907,280	471,973	2,143,619
Salmon	0	85,707	169,685	108,119	200,248	50,700	614,459
All others	39,238	11,378,736	15,393,455	6,044,174	6,456,983	6,713,264	46,025,850
Totals	39,238	11,500,716	15,604,494	6,839,032	7,564,511	7,235,937	48,783,928

* Abnormally high water flows account for the large numbers of fish in 1937 and 1938.

Turn page for Table 2.

TABLE 2

FISH RESCUED DURING THE 1936-1941 PERIOD, ENUMERATED BY SPECIES

Species: Common Name	Scientific Name	Years rescued	Total number
Square-tail Catfish	*Ameiurus nebulosus*	1937-1941	16,504,112
Large-mouthed Black Bass	*Huro salmoides*	1936-1941	9,010,602
Green Sunfish	*Lepomis cyanellus*	1937-1941	6,013,333
Bluegill Sunfish	*Lepomis machrochirus*	1936-1941	5,093,917
Fork-tail Catfish	*Ictalurus catus*	1937-1941	4,245,576
Black Crappie*	*Pomoxis nigro-maculatus*	1936-1941	3,756,347
Steelhead Trout	*Salmo gairdnerii* (coastal streams)	1937-1941	2,061,038
Small-mouthed Black Bass	*Micropterus dolomieu*	1936-1941	639,131
Warmouth Bass**	*Chaenobrytus coronarius*	1937-1941	527,325
Silver Salmon	*Oncorhynchus kisutch*	1937-1941	309,367
King Salmon	*Oncorhynchus tschawytscha*	1937-1941	219,385
Sacramento Perch	*Archoplites interruptus*	1937-1941	100,067
Channel Catfish	*Ictalurus lacustris*	1940	40,000
Striped Bass	*Roccus saxatilis*	1937-1941	39,802
Rainbow Trout (other than steelhead)	*Salmo gairdnerii* (inland streams)	1939-1941	35,912
Common Shad	*Alosa sapidissima*	1937-1941	25,821
Eastern Brook Trout	*Salvelinus fontinalis*	1939-1941	4,400
Loch Leven or Brown Trout	*Salmo trutta*	1938-1941	3,774
Cutthroat Trout	*Salmo clarkii*	1938-1941	2,222
White Sturgeon***	*Acipenser transmontanus*	1941	5
Mixed Salmon	*Oncorhynchus* sp	1937	85,707
Mixed Trout	*Salmo* sp and possibly *Salvelinus* sp	1937	36,273
Mixed Game and Rough Fish	? species	1936-1941	29,812
Grand total			48,783,928

Summary:		
Catfish		20,789,688
Sunfish (Bluegill and Green Sunfish, Crappie, Warmouth Bass, and Sacramento Perch)		15,490,989
Black Bass		9,649,733
Trout		2,143,619
Salmon		614,459
Striped Bass		39,802
Miscellaneous		55,638
Grand total		48,783,928

* Apparently the range of the White Crappie *Pomoxis annularis* is limited to the Colorado River district, where very little fish rescue is done.

** May include a very few Rock Bass *Ambloplites rupestris*.

*** May include the Green Sturgeon *Acipenser acutirostris*.

ANATOMICAL DIFFERENCES BETWEEN THE RING-NECKED PHEASANT AND THE DOMESTIC CHICKEN AS AN AID IN LAW ENFORCEMENT [1]

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The ring-necked pheasant is by far the most eagerly hunted of the upland game birds in California. It is large, plump and tasty, and quite abundant in many parts of the state. It finds its optimum in agricultural areas rather than in waste brushlands, and is therefore most plentiful in regions frequented by the migrant worker and the lower class farm hand. The consequence is that the ring-neck forms the illegal piéce de resistance of many a meal of these needy humans. However, farm labor is not alone in breaking laws pertaining to pheasants. City hunters, honest enough perhaps in original intent, can not always resist the temptation afforded by a "chink" which explodes underfoot, especially if the doves are not flying, or if the quail or rabbits have been few that day. The hunter goes out for legal shooting, but if there is a dearth of game, some forbidden meat is not beyond acceptance.

If the warden comes upon the violator in the field with the pheasant in his possession there should be little difficulty in identifying the bird, especially if the head or feathers are still in place. Unfortunately, many pheasants reach home with the violator and are cleaned, dressed and the head and feathers destroyed. Then, through information supplied from divers sources, the warden learns that Joe Doakes has killed a pheasant. The warden goes to the local justice of the peace for a warrant, and searches the Doakes' house. No, there is no pheasant there, but he does find a "chicken," according to Doakes, either on the stove stewing, or in the oven. Doakes swears that it is a chicken. The warden's tip-off (which is probably anonymous), says Doakes killed a pheasant. As the bird is cooked, it has lost its distinguishing features. Should Doakes be arrested on the chance that the tip-off was correct, and that he can be bluffed into an admission that the bird is a pheasant? Or should he be released due to uncertainty as to the bird's identity, thereby losing future cooperation of the informant? The possession of irrefutable evidence to support the warden's position, both at the time of making the arrest and in court, would add to the official prestige of the state's employee.

Relationship of Pheasant and Chicken

All living things are systematically classified according to structure into groups which are more or less distinct. Our domestic poultry in all its varieties has taken its origin from the Red Junglefowl, a pheasant

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