California. Dept. of Fish and Game.
Biennial Report 1950-1952.

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STATE OF CALIFORNIA

DEPARTMENT OF FISH AND GAME

FORTY-SECOND BIENNIAL REPORT

OF THE

DEPARTMENT OF FISH AND GAME

FOR THE YEARS 1950-1952

January, 1953

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COMMISSIONER

E. L. MACAULAY
FORMER EXECUTIVE OFFICER

LETTER OF TRANSMITTAL

To His Excellency, Earl Warren
Governor of the State of California
Sacramento, California

Sir: We have the honor to submit herewith the Forty-second Biennial Report, covering the period July 1, 1950, through June 30, 1952.

The report covers the period during which the agency went through the transition stage from a division of the Department of Natural Resources to full departmental status. Toward the end of the biennium the new department was undergoing reorganization to a decentralized form of administration. Both of these changes are described herein.

The report contains as well accounts of the activities of the various branches of the department in fostering the conservation of fish and game in California.

Also included is a summary of important policy statements of the Fish and Game Commission and of legislative action affecting fish and game.

Respectfully submitted,

Director

REPORT OF THE DIRECTOR

"With the population increase California experienced since 1940, and is still experiencing, it is plain that the California Department of Fish and Game has been forced to deal with problems of a magnitude that can scarcely be realized.

"Four million people have come to California during this time, and not a single one brought with him a fish, or a game bird, or a drop of water." *

These two striking sentences from an address by Honorable Carl F. Wente, member of the Fish and Game Commission, dramatically epitomize some of the pressing challenges which confront the Department of Fish and Game in California today.

Our angling license sales exceeded the million mark for the first time, with no recession in sight; deer, pheasant, waterfowl and bear hunters were afield in record numbers.

Demands from the public for more game birds, more fish, and more places to pursue them, seriously strained the facilities of the department.

Reorganization of the agency, including the transition from divisional to departmental status, was started during the second year of the period under review. It began slowly, but by the end of the biennium the path ahead was clear. New men were on new jobs, and the task of planning for the future had high priority alongside the routine chores of keeping the wheels turning.

In dollar values, except in the case of sardines, California's commercial fishing industry maintained, and in some phases surpassed, its unprecedented records of recent years.

Efforts of the Wildlife Conservation Board to provide capital construction projects for the improvement of fish and game began to be felt as project after project was completed and turned over to the Department of Fish and Game for administration and operation.

The new Federal Aid in Fish Restoration Act—a companion to the Pittman-Robertson Act—became effective in 1951, and California took advantage of these federal funds by inaugurating five new projects designed to improve sport fishing.

To meet the challenges of the two-year period, a record high number of 783 regular employees were on the job at the end of the biennium. More license revenue funds were budgeted for the task, and the cooperation of other state and federal agencies, sportsmen's groups, and civic organizations assured a concerted attempt to cope with the problems.

More than two-thirds of the director's time was taken in conferences relative to departmental reorganization and attendance at meetings with sportsmen's organizations, legislative committees, and other state and federal officials. Important matters affecting California were presented

* From an address to the International Association of Game and Fish Commissioners, Dallas, September 11, 1952.

DEPARTMENT OF FISH AND GAME
ADMINISTRATIVE REGIONS

in conferences with Secretary of the Interior Chapman in March, 1952; the North American Wildlife Conference in Miami, Florida, March, 1952; and the Western Association of State Game and Fish Commissioners, at Glacier Park, Montana, June, 1952.

In the belief that battles are won only with trained soldiers, regional employee in-service training conferences were inaugurated by Executive Officer E. L. Macaulay early in 1951. This step toward unifying the outlook and experience of our own personnel, and presenting the opportunity for better service to the public, is being continued on an annual basis.

DEPARTMENTAL REORGANIZATION PROGRESS

The departmental reorganization program, pursuant to the Charles Brown Fish and Game Reorganization Act of 1951, was initiated on September 22, 1951. On that date the status of the former Division of Fish and Game, a branch of the Department of Natural Resources since 1927, was changed to a Department of Fish and Game, with a director, appointed by the Governor, in full charge of all administrative operations and personnel.

The new law clearly stipulates that the Fish and Game Commission shall continue to exercise all of its highly important policy making and regulatory functions, and that the director shall administer the department in conformance therewith.

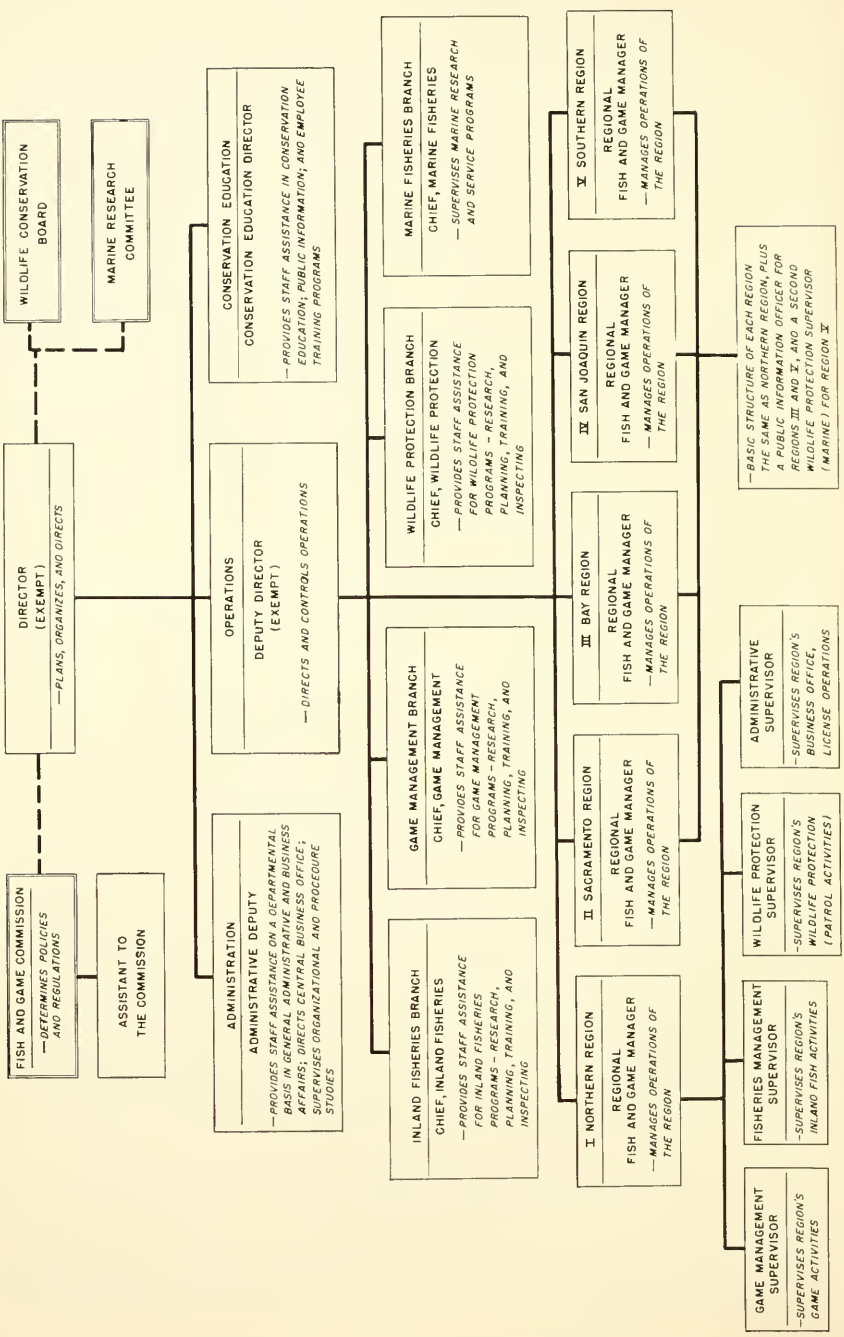
Although in effect for only the last nine months of the biennium, many major provisions of the act had been carried out. Seth Gordon, for three years consultant to the California Wildlife Conservation Board, was drafted by Governor Earl Warren, effective September 22, 1951, to serve as the new agency's first director.

Pursuant to the mandate of the Legislature (Chapter 195, Statutes of 1951, Senate Concurrent Resolution No. 84), the director immediately upon assuming office solicited the aid of the Department of Finance, the State Personnel Board, and the Legislative Auditor in the development of reorganization plans designed to decentralize operations, to more clearly define responsibility for results, and especially to assure better coordination on the field operating level.

The administrative analysts of the Department of Finance, who were in charge of the study, worked in close cooperation with representatives of the other agencies named and the Department of Fish and Game over a period of many weeks. On March 3, 1952, Honorable James S. Dean, Director of the Department of Finance, submitted his department's findings and recommendations. They were immediately transmitted to both houses of the Legislature, and the new plan of operation was pushed to the limit in order to expedite the transition. *(See Reorganization Plan in the Appendix)**

In the meantime, the director had appointed two of the top aides in the new department. Walter Shannon, veteran employee in the old Division of Fish and Game, was named deputy director, an exempt post.

* In the biennial report for the period ending June 30, 1950, it will be found that the Fish and Game Commission had agreed to regionalize operations. It contemplated five districts, but through an error, an alternate plan for 11 districts was published in the report.



Organizational Chart of the Department of Fish and Game

Harry R. Anderson, seasoned Department of Finance employee, became administrative deputy, in charge of finances, personnel, licenses, office administration, engineering and construction, and other "housekeeping" duties.

At the close of the biennium, plans had been worked out with the Personnel Board and the Department of Finance for filling other positions brought about by the Reorganization Act, including regional managers, and regional fisheries management, game management, and business management supervisors.

As in prior periods, the Department of Natural Resources continued to handle, on a contractural basis, the department's accounting and personnel services. Some time during the next fiscal year these services will be taken over by the Department of Fish and Game.

There were indications that the department would be operating through five integrated regional units by December, 1952.

Because of a shortage of suitable office space in Sacramento, the moving of Departmental headquarters from San Francisco to the Capitol City, as requested in a 1951 Legislative resolution, had not yet been accomplished at the end of the biennium.

RESERVE FUNDS SHRINKING

The means taken by employees of the Department of Fish and Game, to keep pace with the needs of an estimated 2,000,000 California sportsmen, are recorded elsewhere in this report under the individual bureau functions. They have done a creditable job, and are fast securing recognition for the department as one of the Nation's finest groups of conservation workers.

But the vast program of fish and game administration in California from July 1, 1950, to June 30, 1952, also includes the cooperation of many related agencies, organizations, landowners, and many other individuals.

Statements of revenues, expenditures, and fund sources will be found in Appendix "A." A review thereof will indicate the trend of income and expenditures, and the effect on the fund balance.

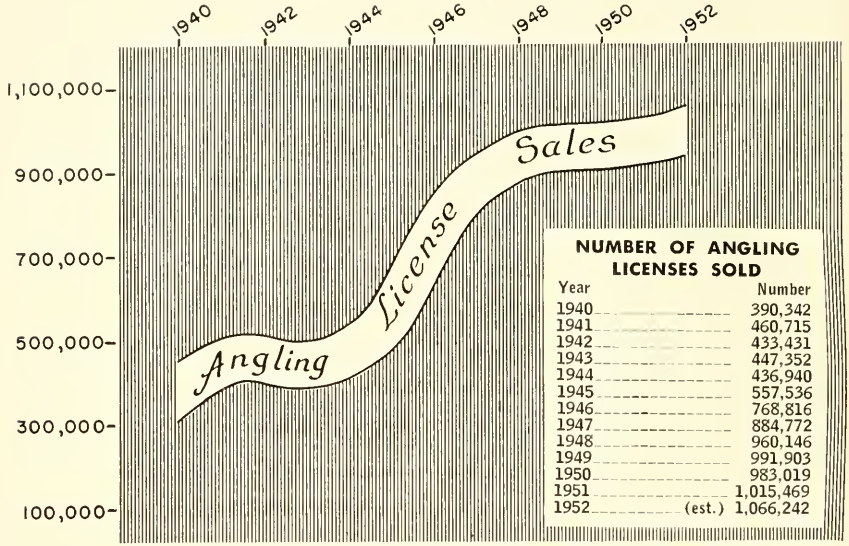
Dollar-wise our revenues have increased because more Californians are hunting and fishing, but due to inflation and greatly expanded operations our revenues are not keeping pace with the expenditures.

The department's dollars, just like those of individuals, simply do not buy the same services, equipment, and supplies they did a few years ago. The drain on our accumulated reserves is reflected in a decreasing balance.

During the Fiscal Year 1951-52, expenditures exceeded income by $246,355. Although this is the first year this has occurred in recent times, it appears to be the beginning of a trend where expenditures will materially exceed revenues, especially if the present and projected expansion programs of the department are continued, unless additional revenue is made available. Conservatively estimating, and assuming we will not be confronted by further inflation, it now appears that by June 30, 1955, the accumulated reserve will be used up. Then, unless the department's income is increased in a material way, a curtailment of activities must be effected.

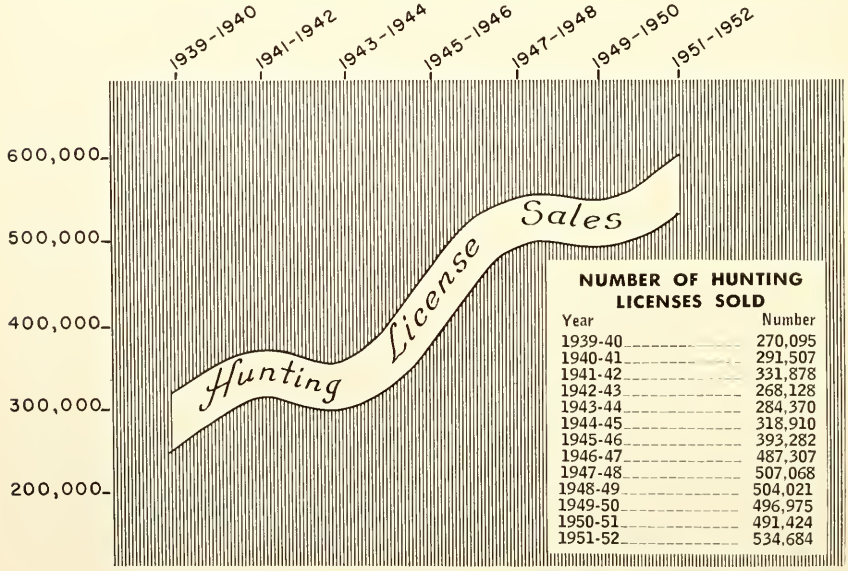
COMPARATIVE STATEMENT OF REVENUES, EXPENDITURES AND FUND RESOURCES

	1950-51 Fiscal Year	*1951-52 Fiscal Year*
Accumulated surplus, July	$5,737,501	$5,978,444
Revenues	5,418,152	5,792,033
Expenditures	5,177,209	6,038,388
Revenue in excess of expenditures	+$240,943	—$246,355
Accumulated surplus June 30	$5,978,444	$5,732,089



NUMBER OF ANGLING LICENSES SOLD

Year	Number
1940	390,342
1941	460,715
1942	433,431
1943	447,352
1944	436,940
1945	557,536
1946	768,816
1947	884,772
1948	960,146
1949	991,903
1950	983,019
1951	1,015,469
1952 (est.)	1,066,242



NUMBER OF HUNTING LICENSES SOLD

Year	Number
1939-40	270,095
1940-41	291,507
1941-42	331,878
1942-43	268,128
1943-44	284,370
1944-45	318,910
1945-46	393,282
1946-47	487,307
1947-48	507,068
1948-49	504,021
1949-50	496,975
1950-51	491,424
1951-52	534,684

THE FISH AND GAME COMMISSION

Without question the boldest forward step taken by the five-man Fish and Game Commission during the biennium was the implementation of a new deer management policy adopted at the close of the preceding biennium. Since inauguration of the buck law in 1907, California's deer herds have increased to the point where the annual surplus is not being properly harvested. The waste of this resource, when hunters report taking around 5 percent of the population of a million-plus deer, while other western states crop 20, 25 and as high as 33 percent annually, can be imagined.

Simply, the 14-point policy aims to eliminate waste in the management of California's deer herds by bringing deer numbers into balance with the carrying capacity of their ranges, to the advantage of the hunters as well as the neighboring ranchers.

The first antlerless deer hunting season on the California mainland was declared by the commission in 1950. Under a lottery permit system, hunters removed surplus deer which had overbrowsed their range. Subsequent special hunting seasons, complying with the basic deer management provisions, met with varying public reaction. It became evident that an intensive educational program is needed to show the need for immediate inauguration of deer management practices comparable to those long applied by ranchers engaged in the successful production of domestic livestock.

Another much-needed action was taken by the commission in 1951 with the definition of an inland fisheries management policy. This master plan for better fishing was drafted under the guidance of Alan C. Taft, former chief of the Bureau of Fish Conservation, who retired toward the close of the biennium.

Both the deer and inland fisheries management policies appear in Appendix F.

In 1950, sportsmen and residents along the Southern California coast became aroused over the loss of fish caused by offshore blasting in the underwater search for oil deposits. There seemed reason to believe that the seismic charges were injurious to fish life, and the commission withheld all further seismic permits.

Following tests made by the Scripps Institution of Oceangraphy, experimental permits were issued in order to test the effects of black powder, instead of dynamite, charges. Results showed the new technique harmless to fish life, and limited permits were again issued.

The crisis in the sardine industry was something the commission and its employees had warned of as early as 1939. The inability of various factions of the industry to get together caused the commission to appoint the director of the department as chairman of a representative committee with the primary assignment of recommending legislation to aid the sardine fishery. At the end of the biennium the differences had not yet been resolved.

In postwar years, enlightened sportsmen had been following more closely the expenditure of their license dollars for widespread planting of game birds. With the mounting cost of feed, the cost of raising and releasing each pheasant, for example, totaled as much as two or three dollars. Adding the expected field loss, the protection of hens and other

factors, the total cost of each cock in the hunter's bag was considerably higher.

Commissioners adopted a far-reaching plan which eventually will cut by 50 percent the State's former game farm output of more than 100,000 young birds a year. Hereafter adult birds only will be planted in suitable habitat, and where the wild breeding stock is below capacity. Much like the deer management plan, the bold, unprecedented steps appear drastic, but they can only result in better hunting and a better accounting of the sportsman's license dollar.

Among the many actions taken by the commission during the biennium, two others must be mentioned. Commissioners went on record in opposition to the reduction of anchovies into commercial oils and meals, and set up a new policy governing the harvest of kelp off the Southern California coast which protects both fish life and the kelp beds.

At the start of this biennium, the members of the California Fish and Game Commission were:

Harvey E. Hastain, President	Brawley
Lee F. Payne	Los Angeles
Paul Denny	Etna
Edwin L. Carty	Oxnard
William J. Silva	Modesto

Following the resignation of Edwin L. Carty on September 6, 1950, the Governor appointed Carl F. Wente of San Francisco to fill the vacancy.

At the close of the biennium, the membership of the commission was as follows:

Paul Denny, President; Lee F. Payne, Harvey E. Hastain, William J. Silva, Carl F. Wente.

E. L. Macaulay served as executive officer of the commission until September 22, 1951, when the Charles Brown Reorganization Act became effective. At that time, he returned to his permanent civil service position as Chief of the Bureau of Patrol and Law Enforcement.

William J. Harp left his post as Assistant Chief of Patrol and Law Enforcement in May, 1952, to accept the appointment as assistant to the commission, an exempt position.

THE CALIFORNIA LEGISLATURE

Perhaps in no other legislative session during the last 75 years have so many significant bills affecting California fish and game and its administration been passed as in 1951. Legislators made notable progress in the fields of sportsman conduct and safety, protection of the rights and property of landowners, administrative operation of the outmoded Division of Fish and Game, and the controversial licensed game bird club laws.

The late Lester T. Davis, Assemblyman from the Second District, contributed much toward safer hunting in California and improved relations with ranchers by his successful sponsorship of bills to punish offenders for carrying of loaded guns in vehicles, hunting while intoxicated, causing property damage while hunting or fishing, shooting

within 150 yards of dwellings and outbuildings, and the wounding or killing of another person while hunting.

The concrete expressions of good will toward landowners and the new code of hunter conduct puts California abreast of other progressive states in legislation of this type.

The law prohibiting the sale of deer hides, which was temporarily lifted during the last war to permit the manufacture of warm gloves for airmen and troops engaged in combat in the colder regions, was permanently removed inasmuch as there is no longer sufficient profit in the traffic of deer hides to induce hunters to devote the time and effort necessary to collect marketable quantities.

Laws governing the former misnamed game management areas, subject to much debate among operator and sportsman partisans, were more closely defined in the 1951 legislative session, to the apparent satisfaction of all parties. The areas will be known in the future as private licensed game bird clubs.

A great new fishing industry was born when the Legislature passed a law making it possible for the first time to net prawns and shrimp in quantity in ocean waters. Initial reports from the new fishery are encouraging.

It is still too early to evaluate fully bills affecting ocean angling licenses and further restricting inland commercial fishing. Bitter opposition from commercial fishing people, accompanied by jubilation from sports fishing segments, marked the new law which removed gill nets from the Sacramento-San Joaquin Delta.

The first reaction from the public to the new law which allows free ocean angling from all public piers might be compared to the effect of finding an imaginary $3 bill on the sidewalk. Many informed sportsmen, in reconsidering the free pier fishing law have come to believe that there was a dangerous hook in this legislative generosity, because a reduced income in the marine fisheries field means reduced services.

In view of the present heavy pressure on California's ocean fisheries, an extension of free fishing privileges is an invitation to disaster.

In other actions, the Legislature continued for two years the regulatory powers of the Fish and Game Commission; made it illegal to possess striped bass in bait shops, markets and restaurants; adopted a strong law against artificial barriers or log jams in north coastal streams; and vastly improved the law with reference to the installation and maintenance of fish screens in the smaller water diversions.

Outstanding among the progressive actions of the 1951 session was the adoption of the Senator Charles Brown Reorganization Act, which removed the Division of Fish and Game from the Department of Natural Resources and made it an independent department.

CONSERVATION EDUCATION AND PUBLIC INFORMATION

All activities of the public information section were stepped up during the biennium to meet the demands of license buyers, the press, sportsmen's groups and the public for information concerning the activities and policies of the Department of Fish and Game, Fish and Game Commission, Wildlife Conservation Board and related groups.

In June, 1951, an editorial assistant was employed on a permanent basis. He was assigned to primary public information duties concerning the marine fisheries field and as an aide in all other fields.

This section is concerned primarily with the mass media, such as newspapers, radio, exhibits, and pamphlets. In all such fields, except radio and television, the section's output was considerably increased.

In October, 1951, the section took on the added duty of editing and issuing the department's *Monthly Progress Report*. This new version of the old monthly report is mailed to registered sportsmen's clubs, department personnel, interested individuals, and representatives of the press.

Information media representatives receiving *Outdoor California*, the press release issued each week, were placed on a first-class mailing list, while others remained on the second-class mailing list.

A series of cartoon-type mats, describing phases of conservation, was requested by more than 300 California publications. The mats, issued monthly, are available in two- and three-column sizes.

Exhibit material capable of transportation in the standard passenger car was designed and offered by the information section to sportsmen's groups and department personnel for standardized official exhibits in local shows and fairs.

For the first time since 1947, the department was represented in the State Fair in 1951, as the result of a legislative budget addition.

THE WILDLIFE CONSERVATION BOARD

The far-sighted Wildlife Conservation Act of 1947, by which the Legislature created the Wildlife Conservation Board to direct the expenditure of $9,000,000 worth of state pari-mutuel proceeds for capital construction projects, was again given a boost by legislators in 1951.

When it became obvious that the original $3,000,000-a-year-for-three-years financial basis was inadequate for the tremendous task of keeping ahead of the State's growing need for conservation projects, an additional $3,000,000 was allocated in 1951, at the rate of $1,000,000 annually.

When the board's consultant, Seth Gordon, became the first director of the new Department of Fish and Game, Everett E. Horn was named as wildlife projects coordinator. Horn had served as one of the board's special consultants in 1949, and was nationally recognized as an outstanding administrator in the conservation field.

During the biennium, 17 new projects were approved by the board; 18 projects were completed; and 13 projects were canceled as not feasible because of physical or biological difficulties. As of June 30, 1952, more than $9,525,000 had been allocated to 78 projects:

Fish hatchery and stocking projects (16)	$4,118,023
Warm-water and other fish projects (9)	134,500
Flow maintenance and stream improvements projects (17)	404,953
Screen and ladder projects (13)	404,603
State game farm projects (4)	105,644
Other upland game projects (4)	441,077
Waterfowl management projects (11)	3,806,310
General projects (4)	110,040
Total (78 projects)	$9,525,150

In addition to the specific allocations above, the following reserves were established: (1) Mendocino National Forest Stream Improvement and Flow Maintenance Program—$15,000, and (2) Colorado River Recreational Development—$50,000.

Completed Projects

Black Rock Rearing Ponds: Inyo County. Completed January, 1951; cost: $30,000.

Experimental Pond Construction: state-wide. Experimental ponds for test purposes costing $12,000. Completed June, 1951.

Fish Springs Rearing Ponds: Inyo County. $400,000 plant completed April, 1952.

Kern River Hatchery: Kern County. $48,000 plant completed May, 1952.

Mt. Shasta Hatchery: Siskiyou County. $251,250 plant completed June, 1952.

Flow Maintenance and Stream Improvement Projects

Crystal Lake Level Maintenance: Los Angeles County. Completed November, 1950; cost: $12,700.

Fish Screen and Ladder Projects

Burnt Ranch Falls Fish Ladder: Trinity County. Completed October, 1950; cost: $4,326.

Canyon Creek Fish Ladder: Trinity County. Dam removed October, 1951, with consent of owners, eliminating need for new ladder. Unexpended balance of $10,000 allocation to be recovered.

Central Headquarters for Stream Improvement: Sacramento County. Completed October, 1950; cost: $10,114.

Daguerre Point Fish Ladders: Yuba County. Completed September, 1951; cost: $64,640.

Sawyer's Bar Auxiliary Dam: Siskiyou County. Improvements to existing ladder eliminated need for auxiliary dam. Completed September, 1951; cost: $373. Balance of $3,500 allocation recovered.

Sutter-Butte Fishway: Butte County. Completed November, 1951; cost: $55,000.

Other Upland Game Projects

Doyle Winter Range: Lassen County. Additional $2,000 allocated June 6, 1951 (total $14,250). Completed December, 1951.

Waterfowl Projects

Honey Lake Waterfowl Management Area: Lassen County. Completed June, 1951; cost: $21,463.

Imperial Valley Waterfowl Management Area: Imperial County. Completed June, 1951. $20,000 allocated; $1,762 recovered June 6, 1951. Additional balance to be recovered.

Madeline Plains Waterfowl Management Area: Lassen County. Completed June, 1951; cost: $30,868.

General Projects

Airplane Hangar: Sacramento County. Completed April, 1951; cost: $25,000.

Delta Fish and Game Operations Base: Contra Costa County. Completed November, 1951; cost: $27,000.

PERSONNEL CHANGES

Deaths

Samuel R. Gilloon, assistant chief of patrol (retired)	October 26, 1950
Charles W. Ledshaw, hunter and trapper	December 24, 1950
Herbert F. Jordan, senior account clerk	February 18, 1951
Peder Stockland, netman and boatswain	May 22, 1951
Donald D. White, fish hatchery assistant	June 17, 1951
Paul Bonnot, associate marine biologist	August 1, 1951
William Hoppe, warden (retired)	September 22, 1951
Nelson Poole, warden	November 28, 1951
O. R. Shaw, supervising hunter and trapper	April 11, 1952

Retirements

Bessie W. Kibbe, senior librarian	July 1, 1950
Thomas J. Smith, warden	July 1, 1950
George H. Hammack, hunter and trapper	July 28, 1950
Alice Rankin, senior account clerk	September 1, 1950
Ross McCloud, fish hatchery foreman	October 1, 1950
John R. Wallace, supervisor of predatory animal control	January 1, 1951
Theodore Jolley, warden	April 1, 1951
Harry E. Cole, fish hatchery foreman	May 1, 1951
Tate Miller, captain of patrol	June 1, 1951
John Harbuck, warden	July 1, 1951
LaRue F. Chappell, chief, bureau of patrol	October 1, 1951
Alan C. Taft, chief, bureau of fish conservation	May 1, 1952
Russell L. Reedy, assistant game manager	June 1, 1952

BUREAU OF FISH CONSERVATION

Charged with the management of the State's inland waters, the Bureau of Fish Conservation continues to carry on a fisheries management program based on sound biological investigations, research and fact finding.

With additional water required each year for the needs of irrigation, hydroelectric power development, industrial and domestic use due to a population increase of nearly 1,000 persons per day and already having a population of 11,000,000 and boasting of over one million licensed anglers, the managing of California's approximately 5,000 lakes and 25,000 miles of fresh-water streams in order to provide satisfactory fishing is indeed a very complex problem. In carrying on a long-range program of fisheries management the Bureau of Fish Conservation is faced with the continuously increasing task of a program of fisheries investigations, propagation, pollution control, fish screens, fish rescue, flow maintenance and stream improvement. A summary of each of these activities follows.

HATCHERY OPERATIONS

The ever-increasing demand for catchable fish to satisfy a greater number of anglers each year has been partly met by bringing into production one new hatchery and by remodeling and enlarging several of our older units in order to better adapt them to the rearing of larger fish. Trout and salmon produced by hatcheries during the period covered by this report amounted to 1,109,013 pounds as compared to 952,768 pounds during the previous biennium. This increase was made possible by bringing into operation our new Fish Springs Hatchery, Inyo County, and by improvements at Mt. Shasta and Crystal Lake Hatcheries. While fingerling trout are required for airplane stocking of remotely located lakes where fishing pressure is comparatively light, the trend toward planting larger fish continues and each year finds our hatcheries producing less fingerlings while increasing the number of catchable sized fish.

Unprecedented storms ranging throughout Northern California and extending as far south as the Tehachapis during November, 1950, caused stream flows to reach flood stage and considerable flood damage was experienced at Prairie Creek, Mt. Tallac, Kern River, Kaweah and Yuba River Hatcheries. At the latter two locations, damage was so extensive that repairs could not be made, and since both of these locations were outmoded installations and suitable for rearing fingerlings only, they were permanently closed and all reclaimable material salvaged.

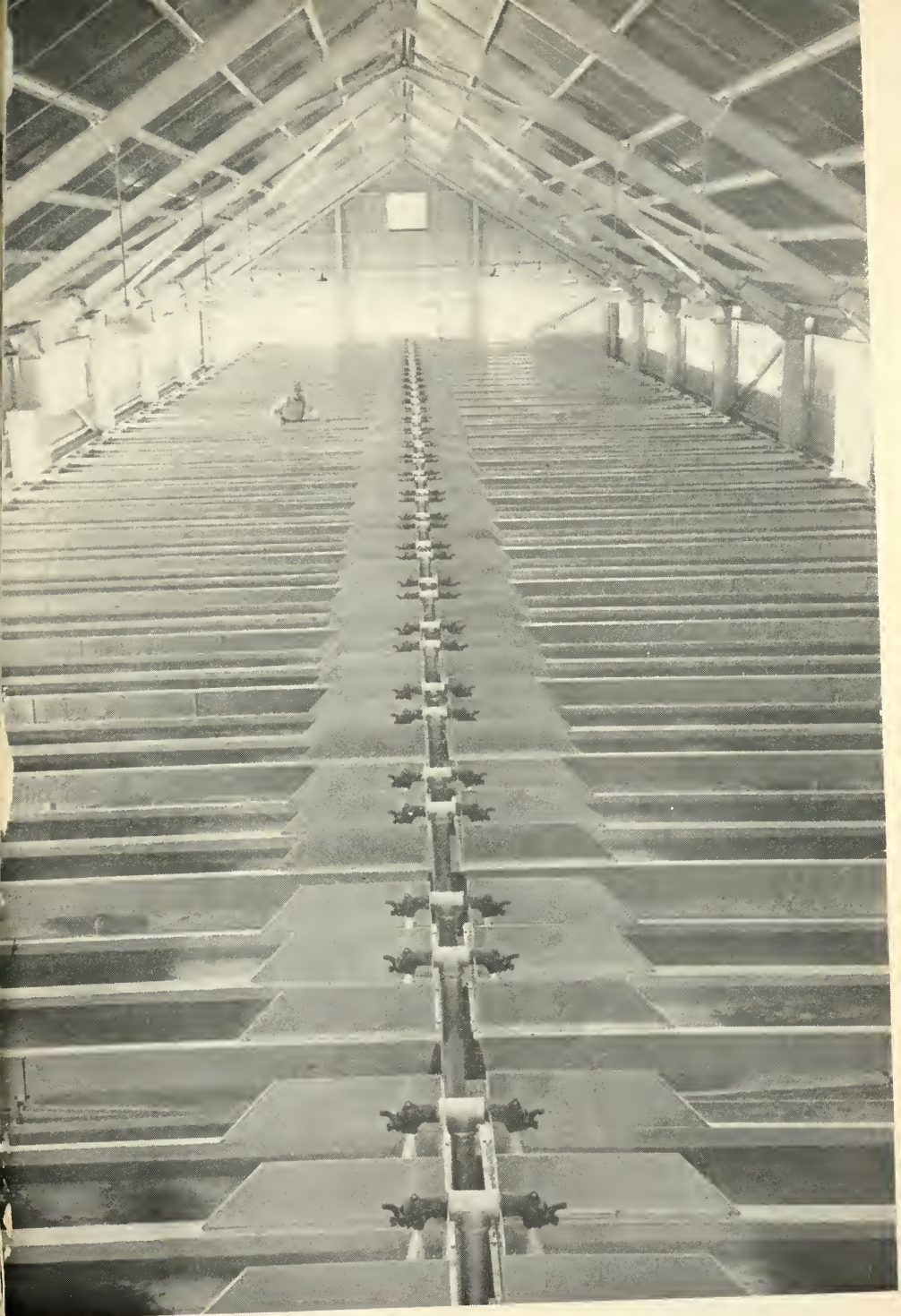
Fish hatchery construction projects, some of which have been planned since 1940, did not get under way as rapidly as expected during the forepart of this biennium. This was mostly due to slowdowns occasioned by unsettled world conditions brought about by the Korean situation involving our national defense program. Many materials used in normal construction work were brought under government control and materials

Rehabilitation of the Mt. Shasta Hatchery, in continuous operation since 1888 and California's oldest fish-rearing station, was completed early in 1952. Modernization of this old hatchery to fit it into a new hatchery expansion program was made possible through allocation of $240,000 from the Wildlife Conservation Board. Improvements include 16 new earth-fill raceway ponds with concrete dividing dams, the new 124-trough hatchery building (left) and a new food preparation building. This is a fine example of modernization of an old unit to fit a new program.

such as steel and copper were not available in amounts great enough to permit undertaking any sizable projects. Routine procedures were time-consuming and resulted in considerable delays. Furthermore, all construction projects financed with funds made available by the Wildlife Conservation Board came to an abrupt halt in February, 1951, when the legality of the Wildlife Conservation Board was questioned, and a favorable court decision in this matter was not handed down until May of that year.

It is encouraging to report that at the close of this biennium, contracts for a considerable amount of new hatchery construction were let, particularly at Darrah Springs, Crystal Lake and Mojave River Hatcheries. Even though these projects consisted mostly of earth moving such as roughing in ponds and placing roadways, where only a minimum amount of critical materials is required, completion of these projects will be speeded up since they can be completed in a short time when necessary materials become available.

Airplane fish planting, using the department's twin-engined airplane in stocking high mountain lakes, has become a regular part of our fish planting program. During the 1951 planting season alone, 2,556,000



or of the new Mt. Shasta Hatchery Building. The construction is all metal. The building is of steel truss construction with corrugated aluminum roof and siding; the troughs are aluminum.

fingerlings were dropped into 610 lakes. Very gratifying reports are being received from anglers fishing these lakes and from our field personnel working in the areas planted.

Tables showing the number of fish and varieties reared and rescued during the fiscal year periods July 1, 1950, through June 30, 1951, and July 1, 1951, through June 30, 1952, will be found in Appendix B.

Fish hatcheries operated during the period covered by this report are as follows:

El Dorado County

Mt. Tallac Hatchery near Camp Richardson, 52 troughs, 18 tanks, 4′ x 16′ x 30″. (Seasonal.)

Fresno County

Huntington Lake Hatchery near Lakeshore last operated 1950. (Permanently closed.)

Kings River Hatchery, 56 miles east of Fresno, between Trimmer and Balch Camp. 100 troughs. No tanks or ponds.

Humboldt County

Prairie Creek Hatchery on Highway 101, 4 miles north of Orick. 80 troughs, five redwood tanks, 4′ x 16′ x 30″.

Inyo County

Mt. Whitney Hatchery near Independence. 120 troughs. Nine rearing ponds, used largely for spring-spawning rainbow brood stock. Two concrete brood fish tanks.

Black Rock Springs Rearing Ponds, approximately 10 miles north of Independence. Three large rearing ponds and two raceways.

Fish Springs Hatchery on Highway No. 395, 6 miles south of Bigpine. Six large earth-fill rearing ponds. Hatchery completed and dedicated June 27, 1952.

View showing a portion of the pond system at the new Fish Springs Hatchery located near Bigpine, Inyo County. Two parallel series of ponds are employed, each series a little over 1,700 feet long. The ponds have a total capacity of nearly 1,000,000 catchable trout annually. The Fish Springs Hatchery is ideally situated to serve an area of extremely heavy fishing pressure.

Kern County

Kern River Hatchery, 6 miles north of Kernville, 20 troughs, six redwood tanks 14′ in diameter, 30″ deep. Eight concrete ponds 80′ x 12′ x 36″. 13 earth raceways. Length of each raceway about 300′, average width about 6′, depth of water 14″.

Lassen County

Lake Almanor Hatchery near Westwood. 96 troughs, eight redwood tanks, 4′ x 16′ x 30″, located in hatchery building, and three cement ponds approximately 8′ x 30′ x 30″.

Los Angeles County

Whittier Hatchery. Last operated 1951. (Permanently closed.)

Madera County

Madera Hatchery near Bass Lake. Four troughs, 10 tanks, 16′ x 4′ x 30″. (Seasonal.)

Mariposa County

Yosemite Hatchery at Happy Isles, Yosemite National Park. 52 troughs, six round concrete tanks, one aquarium room and one display pond.

Mono County

Hot Creek Hatchery on Highway 395, 35 miles north of Bishop. 64 troughs, 39 rearing ponds, 3 brood fish ponds, 12 concrete tanks.

Napa County

East Side Reservoir, water capacity 9,000,000 gallons, within the city limits of Napa.

Placer County

Tahoe Hatchery near Tahoe City. 64 troughs, one pond.

Plumas County

Feather River Hatchery near Clio. 60 troughs, 4 circular ponds, 20′ in diameter, concrete construction. (Seasonal).

The food preparation building, Fish Springs Hatchery. With a refrigerated storage capacity of 100,000 pounds of frozen food and utilizing the latest ice-making and food-processing equipment, this building will go a long way in reducing the manpower requirements at this installation. A building of similar style houses an office for the foreman, the shop and repair department, vehicle storage and public rest rooms. The hatchery represents an investment of nearly $400,000 of Wildlife Conservation Board funds.

Sacramento County

Central Valleys Hatchery near Elk Grove. 19 rearing ponds, 19 daphnia tanks. This hatchery devoted mainly to the propagation of warm-water fish and fish rescue activities; trout are reared only during the winter months.

San Bernardino County

Mojave River Hatchery near Victorville. 20 ponds. 20 additional ponds and other facilities are presently under construction at this location.

Santa Cruz County

Brookdale Hatchery near Brookdale. 40 troughs, six circular concrete ponds 16′ in diameter. One rectangular pond, concrete construction, approximately 35′ long, 12′ wide.

Shasta County

Crystal Lake Hatchery near Cassel. 24 rearing ponds.

Darrah Springs Hatchery, 27 miles east of Red Bluff, near Manton. Five brood ponds.

Sierra County

Yuba River Hatchery. Last operated November, 1950. (Permanently closed).

Siskiyou County

Mt. Shasta Hatchery, one mile west of Mt. Shasta City. 372 troughs, 16 earth-fill rearing ponds, 8 concrete tanks, and one brood fish pond. Completely remodeled during 1950-52 biennium.

Tulare County

Kaweah Hatchery, near Three Rivers. Last operated November, 1950. (Permanently closed).

Moorehouse Spring Hatchery on Highway No. 190 between Springville and Camp Nelson. Six redwood tanks 14′ in diameter, 18 raceway ponds, naturally formed of lime deposits.

Sequoia Hatchery near Visalia. Ten redwood tanks 14′ in diameter, one raceway pond, 200′ long by 6′ wide.

Tuolumne County

Basin Creek Hatchery near Tuolumne. Eighty troughs, nine tanks 16′x4′x30″.

Ventura County

Fillmore Hatchery near Fillmore. Twenty-four troughs, eight circular tanks, 30 rearing ponds.

Two of the six pumice-block dwellings at the new Fish Springs Hatchery. It is necessary for the department to provide living quarters at remote stations.

ACTIVITIES OF THE BIOLOGICAL STAFF

Despite the continuing removal of fishing waters and the ever heavier pressure on existing waters, the state-wide angling picture during the biennium provided grounds for optimism. The catches of fresh-water and anadromous fishes made in 1951 and those made in 1949, calculated on the basis of statistically tested postal card surveys, are shown in Table 1.

Catchable sized hatchery reared trout play an important role in providing angling in heavily fished waters near large population centers and popular recreational areas, and fingerling hatchery trout contribute significantly toward the maintenance of angling in many lighter fished lakes in which natural reproduction is inadequate. Nevertheless, the great majority of trout and salmon caught by California anglers, and practically all of the other sport fishes, are the product of natural reproduction.

The above facts point up the tremendous need of maintaining suitable habitat conditions in the State's waters. This task has been one of the principal objectives of the biological staff of the Bureau of Fish Conservation. Its members have attempted to fulfill this objective by means of a comprehensive program of investigation leading to recommendations for the protection, preservation, and improvement of the inland fisheries and an applied fisheries management program consisting of fish rescue, habitat improvement, and screening of water diversions.

During the 1950-52 Biennium the Bureau of Fish Conservation continued its operations through a central staff and eight administrative districts, with a biologist in charge of all fresh-water fisheries investigations and an assistant hatchery supervisor in charge of all hatchery activities in each district.

TABLE 1. CATCHES OF LEADING INLAND SPORT FISHES IN 1949 AND 1951

	1951		1949	
	Total	Mean catch per angler	Total	Mean catch per angler
Trout	18,600,000	43.3	16,700,000	38.7
Striped bass	1,490,000	10.4	1,750,000	10.6
Black bass	1,280,000	11.9	1,160,000	10.0
Crappie	2,380,000	31.3	2,430,000	23.1
Sunfish	4,800,000	47.1	4,020,000	35.3
Catfish	4,710,000	27.5	3,930,000	24.4
Salmon	564,000	7.2	298,000	4.4

As in the past, heavy reliance was necessarily placed on temporary employees, consisting of Fish and Game Seasonal Aids, and Student Biologists, to assist the permanent staff members in various phases of both the investigative and applied phases of fisheries management. Permanent employees from the hatchery staff were also assigned as needed to carry out mainly such fact-finding work as counting spawning runs of salmon and steelhead and such applied management work as fish rescue, stream and lake improvement, and screening of diversions.

STREAM AND LAKE SURVEYS

Biological surveys are the building blocks on which all sound management programs are based. As rapidly as other duties permit, initial surveys are being made of all the streams and lakes in California. In addition, rechecks are being made on waters of particular concern for management purposes.

The following list shows the principal initial surveys carried out during the biennium in each district. Many rechecks and partial observations were also made, and several aerial reconnaissance surveys were conducted.

Shasta District. Seventy-four lakes in Trinity County were surveyed for inclusion in the "Anglers' Guide" series.

Lassen District. During the summer of 1951 surveys were completed of 15 lakes, including 13 in the Thousand Lake Primitive Area in Shasta County. In Plumas County, 16 lakes in the Gold Lake area were surveyed during the summer of 1950 and nine in the Spring Valley Lake area in 1951. Twenty-two lakes were surveyed in Lassen County.

Tahoe District. Surveys were made of 209 lakes and 33 streams in Alpine, Amador, El Dorado, Nevada, Placer, Sierra, and Tuolumne counties.

Coast District. During the biennium 166 streams and 9 lakes were surveyed.

San Joaquin District. Survey work was highlighted by the inclusion of 82 waters in the Humphreys Basin and French Canyon drainages. In all, 106 lakes and 27 streams were surveyed.

Mt. Whitney District. During the biennium 142 lakes and 26 streams in Mono, Inyo, Madera, Fresno, and Tulare counties were surveyed.

Southern District. Approximately 40 streams and 15 reservoirs were surveyed.

STUDIES ON SPECIAL WATERS

In addition to the foregoing surveys to provide general basic information, special studies were carried out on the following waters, exclusive of Wildlife Conservation Board Projects, which are discussed in a separate section of this report:

Castle Lake, Siskiyou County. A complete census of all angler catches has been maintained since 1941 to determine the relative effectiveness and costs of planting such mountain lakes with various species and sizes of trout. During the biennium eastern brook trout (*Salvelinus fontinalis*) were tested and hatchery plants yielded high survivals to the creel.

Sacramento River Test Stream, Siskiyou County. The survivals of catchable and fingerling rainbow trout (*Salmo gairdneri*) planted in the South and Middle Forks of the Sacramento River are being compared with the catches of native trout.

Klamath River Investigation, Siskiyou County. This program consists of a long-range study of the factors affecting the survival of salmonids in the Klamath River system. One year is being devoted to the study of each principal supposed factor.

Fall Creek Salmon Study, Siskiyou County. Different numbers of king salmon (*Oncorhynchus tshawytscha*) are being permitted to spawn in this stream each year, in order to determine the number of adults which will produce the highest spawning efficiency. In 1950-51, 7 percent of the eggs of 750 females produced fingerlings and in 1951-52, 10 percent of the eggs of 500 females produced fingerlings.

Eagle Lake, Lassen County. This study is designed to find ways to prevent the extinction of the unique Eagle Lake trout (*Salmo gairdneri aquilarum*) and to restore trout fishing. Migrants to and from the lake were counted at a weir near the mouth of its tributary, Pine Creek.

Lake Almanor, Plumas County. The study of the yield to anglers of hatchery fingerlings planted in the lake was concluded in 1951. The second phase will not be started until catchable trout for planting in the lake are available in large numbers.

Echo Lake, El Dorado County. Studies to determine the reasons for the poor angling success in this lake continued during the biennium, with emphasis placed on ascertaining the extent of game fish exodus from the lake through the outlet stream and the diversion canal. This was accomplished through the annual planting of 25,000 trout marked for future identification and trapping of downstream migrants. The fish trap on the outlet stream was operated continuously except for short periods during flood stages, and fyke netting operations were conducted on the diversion canal during the diversion period of 1951. These studies showed that there is a negligible loss of game fish from the lake through the outlet stream and diversion canal.

Donner Lake, Nevada County. Observations were conducted on the spawning runs of kokanee red salmon (*Oncorhynchus nerka kennerlyi*) in 1950 and 1951 and studies made of scales and other data in connection with the management of the fishery.

Lake Tahoe, El Dorado-Placer Counties. Studies were concentrated on the introduction of kokanee salmon to this lake. Potential lake shore and tributary stream spawning areas were located and plotted. Allotments of salmon were carefully planned for the various available spawning areas to take advantage of any possible homing instinct on the part of the salmon. Field checks failed to confirm authentic catches of kokanee during the biennium.

Salt Springs Valley Reservoir, Calaveras County. In the fall of 1951, a population study of the fish in this lake was made, using the Schnabel mark and recapture method. Results will be published in *California Fish and Game.*

Lake Merced, San Francisco County. Evaluation of the results of catchable trout stocking in this lake was carried on throughout the biennium.

Clear Lake, Lake County. Standard test seine hauls for checking fish of the year were made annually at five stations. No significant increase or decrease was noted in any of the important game species, although forage species continued to be scarce. A continuing check on forage minnow spawning was maintained on the tributaries; the 1952 spawning run of hitch (*Lavinia exilicauda*) was the largest noted for many years.

Upper Blue Lake, Lake County. A study of this lake was begun in 1952 to determine which species are best fitted for it and to learn what management techniques might be applied to increase its productivity. A temporary barrier to rough fish was installed at the outlet in 1952.

Mad River, Humboldt County. A controlled program to study the economics of planting king salmon, silver salmon (*O. kisutch*), and steelhead trout (*Salmo g. gairdneri*) artificially reared to varying ages was started. Marked fingerlings are released in the stream and examined as returning adults at the Sweasey Dam counting station and in the sport catch. Approximately 10 percent of all salmon taken in the California commercial catch are being examined for marks by the Bureau of Marine Fisheries, so that the contribution of the Mad River salmon to the commercial fishery will be included in the study. A biological survey of the entire river system is also being made as part of the study.

Millerton Lake, Fresno-Madera Counties. An intensive study of the Millerton Lake warm-water fishery, as a typical example of the large fluctuating reservoirs along the west slope of the Sierra Nevada, was started in 1949. Since 1951 emphasis has been placed on environmental and fish population studies. Intermediate levels in the normal food chains are weak and it is possible that introduction of forage fish, which will be carried out at an early date, may help to fill the gaps. Considerable time was devoted to preparing material from the earlier work for publication.

Rush Creek Test Stream, Mono County. Operation of the project during the trout fishing season was continued through the biennium. Results confirmed earlier indications of returns of 70 percent or more to the angler from in-season plants of catchable rainbow trout in streams. Minor stream improvement work in the nature of additional pool construction appeared to benefit the stream during the 1951 summer, when the flow was extremely low.

San Vicente Reservoir, San Diego County. A largemouth blackbass-bluegill (*Micropterus salmoides-Lepomis macrochirus*) tagging study was completed.

Vail Reservoir, Riverside County. A fish population study was conducted, a management plan prepared, and a catch record system established.

Lake Wohlford, San Diego County. A catch record system was devised, records analyzed annually, and management recommendations submitted.

Big Bear Lake, San Bernardino County. The values of a warm-water fishery *vs.* a trout fishery were studied, management recommendations prepared, and a catch record system outlined.

Los Angeles City Park Lakes, Los Angeles County. Population composition and age-growth studies were carried out and management recommendations submitted.

Crystal Lake, Los Angeles County. A study was made of trout removal rates.

Colorado River Studies. Creel checks were operated periodically at strategic points along the river. In addition, at Lake Havasu age and growth, food, and population studies were carried out. The following action was taken regarding the bait minnow problem: decision on acceptable species; preparation of regulations; registration of dealers; periodic inspection of dealers; aid in providing desirable species for propagation, especially golden shiners (*Notemigonus crysoleucas*) and fathead minnows (*Pimephales promelas*). A study of possible forage fish species for introduction was also made. Projects of the Bureau of Reclamation were investigated and reports prepared on the Needles-Topock and Cibola Valley areas.

Salton Sea, Imperial County. The introduction of marine game and forage fishes was continued. Several thousand fishes obtained from the Gulf of California at San Felipe, Mexico, in the course of three trips were planted in the sea. At least one species, a croaker (*Bairdiella icistia*), has survived and reproduced in numbers. Tests of tolerances of various fishes to Salton Sea water were arranged cooperatively with the Scripps Institution of Oceanography.

STATE-WIDE ANGLING SURVEY

An intensive analysis of state-wide sport catch and angling trends in 1951 was made on the basis of a postal card survey carried out in the manner of previous surveys.

Trout and striped bass angling had not changed appreciably since 1949. Catches of black bass and other warm-water fishes declined, presumably because of drought conditions in Southern California. Catfish angling took a slight upward trend. The salmon catch showed a very large increase.

CREEL CENSUSES

Creel censuses are a recognized method of finding out the results being obtained from stocking, of measuring the trends in the quality of angling in a given water, and of obtaining similar information of use in fish management. During the biennium, principal creel censuses were carried out on the following waters:

Name of water	*County*
Klamath River	Siskiyou County
Shasta River	Siskiyou County
Shovel Creek	Siskiyou County
Shasta Lake	Shasta County
Lake Almanor	Plumas County
Bucks Lake	Plumas County
Truckee River	Nevada County
Upper Truckee River	El Dorado County
Donner Lake	Nevada County
Boca Reservoir	Nevada County
Silver Fork American River	El Dorado County
Lake Merced	San Francisco County
Salt Springs Valley Reservoir	Calaveras County
Stevens Creek Reservoir	Santa Clara County
Klamath River (mouth)	Del Norte County
Eel River	Humboldt County
Clear Lake	Lake County
Lake Hennessey	Napa County
Milliken Reservoir	Napa County
Sequoia Lake	Fresno County
Hume Lake	Fresno County
Millerton Lake	Fresno and Madera Counties

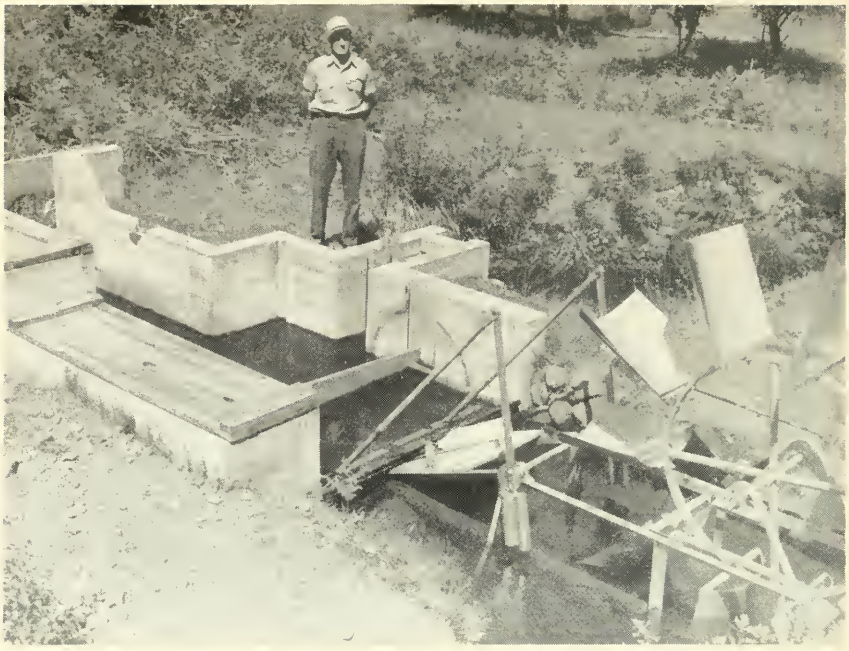
Name of water	*County*
Crowley Lake	Mono County
June Lake	Mono County
San Luis Rey River	San Diego County
Lake Wohlford	San Diego County
Deep Creek	San Bernardino County
Santa Ana River	San Bernardino County
Big Bear Lake	San Bernardino County
Jenks Lake	San Bernardino County
Bear Creek	San Bernardino County
Lake Havasu	San Bernardino County
Holy Jim Creek	Orange County
Crystal Lake	Los Angeles County
Fulmor Lake	Riverside County
Coldwater Creek	Riverside County
Vail Reservoir	Riverside County
Ramer Lake	Imperial County
Colorado River	Imperial and Riverside Counties

Creel checks have accuratey measured angler success at Fulmor Lake, Riverside County. This lake, which does not exceed seven surface acres, provides immense recreational value in Southern California. Here we see a student biologist recording the catch of two anglers at the lake.

TEST WATERS

Several years ago Castle Lake in Siskiyou County, Rush Creek in Mono County, and the upper Sacramento River in Siskiyou County were established as "test" waters on which to try out and check on the results of different types of stocking.

Complete records are kept of the catches made at these waters. A summary of results obtained at Castle Lake and at other lakes in California was published in the April, 1951, issue of *California Fish and Game.*



This is a perforated plate fish screen with gear drive. The perforated plate has been inserted into the downstream end of a form originally built far a revolving drum screen. Young trout and salmon descend the irrigation ditch as far as the screen, then are diverted back to the parent stream through the bypass channel directly in front of Fish Hatchery Foreman E. W. Murphey, the inventor of the perforated plate screen. Siskiyou County, 1951.

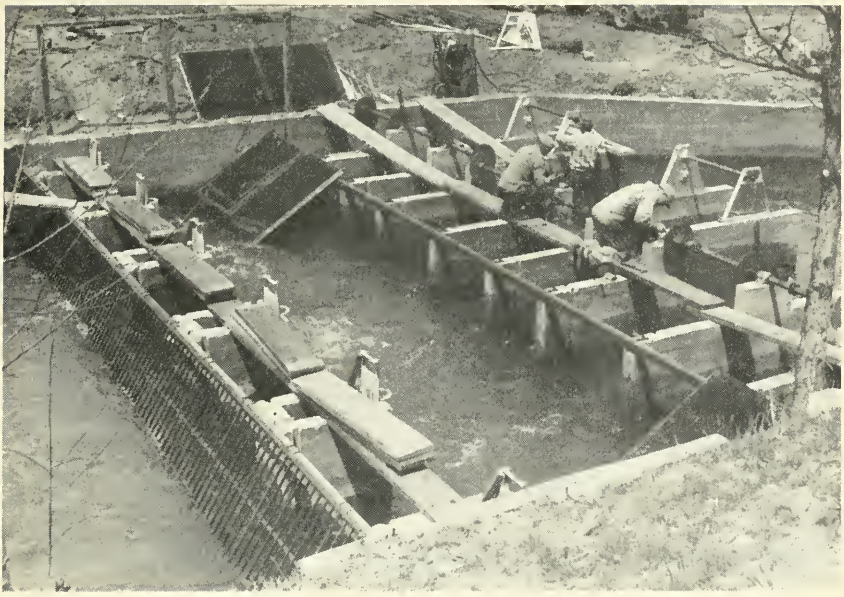
STREAM AND LAKE IMPROVEMENT

Fish Screens

For many years California laws required owners of water diversions to install and maintain fish screens as required by the State. The results were not satisfactory. It was difficult and expensive for each owner to have his screen made to order, and many times the device was of poor quality. In 1952 the State Legislature amended the fish screen laws to provide that the Department of Fish and Game will install, maintain, repair, and replace screens in nonpower ditches under 250 second-feet in capacity.

Fish screen construction, installation, and maintenance by the Bureau of Fish Conservation was again centered at its stream improvement headquarters at Yreka, Siskiyou County, and at its smaller shop at Weaverville, Trinity County. Two successful modifications of the perforated plate screen were developed at these shops during the biennium. The "submerged plate" type is particularly successful in stopping very small steelhead fingerlings, while the "diagonal plate" type permits a large capacity screen to be constructed in a narrow ditch.

Five new perforated plate screens were installed in Trinity County and eight in Siskiyou County.



Fish and Game crews building the largest screen yet constructed in the Klamath drainage. It is of the latest design, incorporating a 5/32-inch perforated steel plate 36′ x 6′ set at an incline across the canal and cleaned by wiper bars moved up and down over the face of the plate by paddle wheels.

Fishways

Personnel from the Yreka stream improvement headquarters constructed three fishways over dams on the Salmon River, Siskiyou County. The same personnel blasted several pools in bedrock to form a fishway at Burnt Ranch Falls on the Trinity River, Trinity County (Wildlife Conservation Board Project 44-2). In Mono County, flood damage to the embankments around the fishway at Lower Twin Lake was repaired.

Barrier Removal

The removal of abandoned dams to permit salmon and steelhead to reach important spawning areas continued very satisfactorily in the Klamath River drainage, with five dams in Trinity County removed during the biennium. In addition, six log jam barriers were removed from tributary streams. The general stream clearance program in the Coast District, started in 1950, also showed good progress. In the entire State, seven dams were removed, six barriers were reduced, and 11 log jams were removed during the biennium. In addition, channel clearance and brush and debris removal was carried out in a number of streams, principally to facilitate the upstream passage of spawning fish.

Rock masonry check dams in Coldwater Canyon Creek, Riverside County, stream improvement program. Eight such dams were constructed with county fine money, under supervision of the fisheries biologists in the stream improvement program. Average cost per dam, including labor and materials, was $119.18. These are now providing adequate pool areas where catchable rainbow trout have been planted. Prior to this time, suitable trout habitat was lacking.

Improvement Devices

Again several counties appropriated funds from their share of fish and game fine moneys for stream improvement. Some of these funds were used to construct small loose rock and masonry dams in Southern California streams, principally to create pool areas. Our personnel cooperated with local interests in the design and construction of these dams. Rock masonry projects consisted of 35 dams on Holy Jim and Trabuco Creeks, Orange County, and eight dams on Coldwater Creek, Riverside County. Loose rock dams were built as follows: Holy Jim Creek, Orange County, 40-50 dams; Cucamonga Creek, West Fork, San Bernardino County, 45; Silverado Creek, Orange County, 50; Soldier Creek, Los Angeles County, 30; Coldwater Creek, Riverside County, 30; Santa Ana River, South Fork, San Bernardino County, 40.

Aquatic Weed Control

Although aquatic weeds do not form a problem in the great majority of California fishing waters, members of the biological staff were called upon for advice and assistance in several troublesome instances. At Chubb Lake, Nevada County, personnel of District 3 successfully reduced heavy growth of aquatic plants by treatment with sodium arsenite during June, 1952. On November 5-9, 1951, Lower, Middle, and Upper

At Twin Lakes (Mammoth), Mono County, dense growths of aquatic plants choked the waters. Here we see Middle Twin Lake being sprayed with sodium arsenite solution to destroy the excessive plant growth.

Twin Lakes near Mammoth, Mono County, were treated with a total of 900 gallons of sodium arsenite to control excessive growths of aquatic plants.

Wildlife Conservation Board Stream and Lake Improvement Projects

In addition to the work described above, considerable stream and lake improvement was carried out with funds allocated by the Wildlife Conservation Board, including construction of seven flow maintenance dams at the outlets of lakes. These rock and masonry dams were constructed by a Department of Fish and Game five-man construction crew. Information on this construction work is tabulated below. For further detail, refer to the section on Wildlife Conservation Board Projects.

Name	*Date completed*	*County of location*	*Water storage in acre feet*	*Total cost of dam*	*Miles of stream directly benefited*
Middle Velma Lake	8- 8-50	El Dorado	148.4	$2,514.82	
Lois Lake	9-20-50	El Dorado	85.4	523.92	49
Schmidell Lake	9-20-50	El Dorado	203.6	2,357.64	
High Emigrant Lake	8-24-51	Tuolumne	67.0	2,283.09	3½
Middle Emigrant Lake	8-24-51	Tuolumne	79.0	1,713.60	2
Susie Lake	9- 5-51	El Dorado	99.0	561.84	5¼
Heather Lake	9-24-51	El Dorado	141.7	2,398.40	5¾
Gold Lake *	10-16-51	Sierra	1,447.0	2,316.93	6½
			2,271.1	$14,670.24	72

* Bureau of Fish Conservation financed project.

CHEMICAL TREATMENT AND REHABILITATION OF LAKES

The chemical treatment of lakes and reservoirs to rid them of rough fish which have so overrun these waters that sport fishing is virtually eliminated forms an important phase in the management of California's inland waters.

Incomplete kills have been obtained in some instances and further knowledge is needed to insure total elimination of undesirable fishes. Such incomplete kills and the reintroduction of rough fish by thoughtless anglers who use them illegally as bait means that many waters will have to be re-treated periodically.

Approximately 943 acres of lake area were chemically treated and subsequently restocked with game fish during the biennium. Some of the waters were reservoirs which had been drawn down considerably below their normal levels, so that in effect a much greater amount of fishing water was rehabilitated than is shown in the following tabulation:

Name of water	County	Surface area in acres	Date
Abbott Lakes, Upper and Lower	Monterey	18	Aug. 1-2, 1950
Lower Twin Lake*	Mono	375	Sept. 7-8, 1950
Lower Sunset Lake	Alpine	15	Sept. 28, 1950
Rainbow Lake (Messelbach Dam)	Shasta	300	Oct. 17, 1950
Water Supply Reservoir, City of Mariposa	Mariposa	15	April 12, 1951
Hughes Lake	Los Angeles	50	May, 1951
Starkweather Lake	Madera	4	July 10, 1951
Spring Valley Lake	Plumas	21	Aug. 27, 1951
Chubb Lake	Nevada	20	Sept. 16, 1951
Puddingstone Reservoir	Los Angeles	100	Oct. 1, 1951
Silver Lake	Shasta	25	Oct. 27, 1951
		943	

* Two and one-half miles of Robinson Creek were also treated on December 1, 1950.

Repairs were made to the Miller Lake (Placer County) barrier dam, which was damaged by the 1950 floods.

FISH RESCUE

The rescue of game fish from drying waters and their transfer to safe waters is carried on as needed throughout the State. Unusual or isolated cases are assigned to crews recruited from hatcheries or are cared for by state wardens or sportsmen in cooperation with the Bureau of Fish Conservation. In certain areas, however, extensive fish rescue is required each year and forms a regular part of the Bureau's program. This holds true in some of the steelhead and salmon waters, and here this work has been placed under the supervision of the biological staff. The fish rescued are tabulated in Appendix 3.

FISH INTRODUCTIONS

The temptation to introduce some exotic species into a body of water which is not producing angling up to expectations is alluring and great. Indiscriminate introductions are fraught with danger, however, for the

introduced species may prove to be more of a detriment than an asset through competition with or predation on existing game fish. The wise course is first to seek other means of producing satisfactory angling and to introduce a new kind of fish only if the facts indicate that it will fit positively into the economy of the water.

In several instances available evidence has indicated that addition of new species would improve angling and during the biennium the following important introductions were made:

Golden shiners (Notemigonus crysoleucas) were introduced into several central and northern California reservoirs in order to provide a more suitable forage fish, especially for black bass. During the biennium 100,000 were planted in Clear Lake, Lake County. In 1950 golden shiners were also stocked in Salt Springs Valley Reservoir, Calaveras County; in 1951 in Shasta Lake, Shasta County; Coyote Reservoir, Santa Clara County; East Park Reservoir, Colusa County; in 1952 in Turlock Reservoir, Stanislaus County.

Smallmouth black bass (Micropterus dolomieu) were planted in the following waters: North Fork of Feather River, Plumas County; Antelope Creek, Tehama County; North Fork of American River, Placer County; Upper Blue Lake, Lake County; Arroyo Seco Creek, Monterey County; Colorado River, Riverside and San Bernardino counties. The purpose of these introductions was to provide a good game species in waters of doubtful ability to produce trout fishing.

Kokanee red salmon (Oncorhynchus nerka kennerlyi) were introduced into Lake Almanor, Plumas County, and Eagle Lake, Lassen County, to serve both as a forage and a game species in problem waters. The planting of kokanee in Lake Tahoe, Placer and El Dorado counties, started in 1949 to provide forage for the lake trout (mackinaw), was continued. Beginning in 1951 kokanee were also planted in Shasta Lake, Shasta County, by local sportsmen with the aid of the U. S. Fish and Wildlife Service and the Department of Fish and Game to provide forage for the recently introduced Kamloops rainbow trout.

White crappie (Pomoxis annularis), brought from southern California, were stocked in East Park Reservoir, Colusa County, and Coyote Reservoir, Santa Clara County. It is hoped that they will occupy a niche unfulfilled by the black crappie *(Pomoxis nigromaculatus)*.

WATER USE PROJECTS

During the last two years the Department of Fish and Game has realized that the problem of water has become of major importance in the management of fish and game in California. The current competition for water by all groups interested in economic development is causing our streams and waterfowl habitat to disappear at a very rapid rate and we know that once water is appropriated for another use there is very little hope that it can ever be regained for fish and game.

The Department of Fish and Game is handicapped because water for fish and game has been assigned an extremely low priority in comparison with the other legally recognized "beneficial" uses.

During the last two years an unprecedented number of irrigation and hydroelectric projects has been proposed for practically every stream in California, both by private interests and agencies of the Federal Government. As these projects are constructed the amount of water available in the streams for recreation and fish and game will be reduced.

In the past we have been most concerned with utilizing the available waters to the fullest extent and until recently there have always been relatively untouched rivers and lands available to make up for the losses resulting from any one power or irrigation project. Within the last few

years, however, we have realized that there are no more streams that are not already being extensively used by anglers.

Even under natural conditions in California, the critical period for fish and game occurs during the long season of no rainfall, when stream flows are at a minimum. This dry season is also critical to our present economy and it is necessary to build dams to store winter runoff in order to have water for irrigation and power during summer and fall.

The demands for water will become increasingly acute as our population continues to increase. It is now estimated that California's population will double in the next 20 years. The rate of water project construction will have to keep pace with the population increase. At the present time 30 major water projects are under active study by the Department of Fish and Game and new dams are constantly being proposed.

In addition to planning for these major projects, the Department of Fish and Game has been called upon to review a great number of the other proposed land and water use programs that will affect our fish and wildlife resources. The U. S. Department of Agriculture, for example, has been studying various watersheds in California with a view towards broad soil and water conservation programs. On the Santa Ana and San Gabriel watersheds in Southern California, for example, an extensive cover improvement, fire prevention, and stock watering program has been proposed.

The Department of Fish and Game is also entering more and more into the preconstruction planning of water projects and has embarked upon an aggressive program to have the protection and wherever possible the development of fish and wildlife included as an integral part of planning.

During the last two years considerable time was spent in preparing recommendations to be submitted to the State Division of Water Resources for inclusion in the forthcoming California Water Plan, which will be the ultimate water use plan for the State. If the water needs of fish and wildlife are not recognized in this plan it will probably not be possible to secure additional water in the future. The Department of Fish and Game has made recommendations for the minimum flows to be maintained on every major stream in California for the preservation of our fisheries resources.

The following are some of the major developments which are under active study by the department. Many of these streams contain salmon and steelhead that will be cut off from spawning areas by dam construction. The biggest problem in all cases is to keep some water flowing in the stream, rather than in irrigation or power conduits.

Klamath River, Siskiyou County. The Department of Fish and Game initiated legal action against the California-Oregon Power Company to reduce the fluctuation of the river level and the resulting stranding of salmon and steelhead and hazards to fishermen along the river. This action is based on a study that has been made by Bureau of Fish Conservation biologists over the past four years.

Trinity River, Trinity County. The U. S. Bureau of Reclamation proposes two large dams to divert flows of the Trinity River into the Sacramento River in Shasta County. The Department of Fish and Game is concerned with ways of preserving the present salmon and steelhead runs of the Trinity River, since a large portion of the spawning area of the Trinity River will be cut off by construction of the dams.

McCloud River and Squaw Creek, Shasta and Siskiyou Counties. Both the California-Oregon Power Company and the Pacific Gas and Electric Company are interested in constructing large hydroelectric projects on the McCloud River and Squaw Creek. Four or five dams and powerhouses are planned and would have far-reaching effects upon these outstanding trout streams.

Pit River, Shasta County. The Pacific Gas and Electric Company is undertaking the construction of the Pit 4 and Pit 6 developments. The Pit 4 project in particular will adversely affect a section of the Pit River which is going to be extensively developed by the U. S. Forest Service for recreational use. The utility of the river for recreation and fishing will be lost unless adequate flow releases can be secured.

Feather River, North Fork, Plumas County. The Pacific Gas and Electric Company is undertaking the construction of the Butte Valley-Caribou No. 2 project immediately and the Belden and Poe projects in the near future. The Department of Fish and Game is currently involved in negotiations in order to secure adequate flow releases in the diverted sections of the river.

Feather River, South Fork, and Slate Creek, Butte, Plumas, and Yuba Counties. During 1951 a study was made of the proposed Oroville-Wyandotte Irrigation District multiple power and irrigation development and an agreement which provides for release of water for fish into the streams to be affected by the proposed dams was negotiated.

Sacramento River Canals, Tehama, Butte, Glenn, and Colusa Counties. The U. S. Bureau of Reclamation has proposed canals along the east and west sides of the Sacramento Valley, with the Red Bank Diversion Dam near Red Bluff. It is necessary that screen and fishway facilities be provided, as well as an adequate flow release to maintain the downstream spawning beds. Fishing possibilities in the 120 miles of canals have been studied.

Silver Creek, El Dorado County. The Bureau of Reclamation has proposed several dams and powerhouses, as a part of its Union Valley Project, which will adversely affect Silver Creek and the flows of other streams in the South Fork of American River drainage.

American River, El Dorado County. The Sacramento Municipal Utility District has recently filed application with the Federal Power Commission for a power project in the upper headwaters of the Rubicon and American Rivers, an area that has been used almost exclusively for recreational fishing in the past.

Sly Park Creek, El Dorado County. The Bureau of Reclamation has started construction of the Sly Park Dam, as well as diversion dams on other streams in upper El Dorado County. The Department of Fish and Game has recommended that minimum flows be maintained for fish life in all streams that will be diverted.

American River, South Fork, El Dorado County. The Pacific Gas and Electric Company is rebuilding the Chute Camp Dam and the Department of Fish and Game is recommending that a permanent flow be maintained in the South Fork of the American River below the dam. This portion of the river has been dried up during the summer since the dam was built 30 years ago.

American River, Sacramento County. The Folsom Project, which is being built by the Corps of Engineers and the Bureau of Reclamation, has been one of the major water planning activities of the Department of Fish and Game for the past year. The construction of Nimbus Dam will eliminate about 70 percent of the salmon and steelhead spawning area in the American River and an extensive program has been undertaken to conserve these runs. The program consists of securing water releases and improving downstream riffles plus a hatchery installation.

Putah Creek, Solano County. Although no anadromous fishes will be affected by the construction of Monticello Dam, a Bureau of Reclamation project, the Department of Fish and Game is preparing plans for the management of the reservoir.

Stanislaus River, Middle Fork, Tuolumne County. The South San Joaquin and Oakdale Irrigation Districts are undertaking the construction of three dams and powerhouses on this river. The Beardsley and Donnels Dams will store and divert most of the water in the upper portion of the stream and the Tulloch Dam farther downstream will have an adverse effect upon the salmon run of the Stanislaus River, particularly if sufficient water is not released during the spawning season.

Stanislaus River, North Fork, Tuolumne County. The Department of Fish and Game has completed its investigations and submitted recommendations to the Federal Power Commission regarding the relicensing of the existing dams at Alpine, Utica, and Hunter Reservoirs.

Truckee River, Nevada County. The State of Nevada is extremely anxious to develop additional water on this drainage and at least three plans for dam construction have been proposed. The Department of Fish and Game believes that the present summer flows of the river are inadequate to develop the fishing potential of this stream and is attempting to secure additional water.

East Carson River, Alpine County. The Bureau of Reclamation has proposed a large storage reservoir in Hope Valley and a powerhouse at Woodfords. The Department of Fish and Game has submitted recommendations to maintain the stream through the lower Hope Valley recreational area adjoining Highway 88.

Tuolumne River, Tuolumne County. The expansion of the Hetch Hetchy Project proposes additional storage and the diversion of Cherry and Eleanor creeks in this drainage. The Department of Fish and Game has submitted recommendations for flows to be maintained in the streams to be affected.

Middle Fork of Eel River, Mendocino County. The Mendocino County Water Conservation District has proposed a diversion of 350 cubic feet per second and 715,000 acre-feet per annum from the Middle Fork of Eel River and 30,000 acre-feet per annum from its tributary Short Creek. The Department of Fish and Game submitted recommendations for the protection of fish life.

Mono Creek, Fresno County. The Southern California Edison Company is proposing to build a dam in Vermilion Valley which would flood out one of the finest trout streams in the State. The Department of Fish and Game is attempting to secure compensation for this loss by securing an increased flow release through the recreational area along the South Fork of San Joaquin River below Florence Lake Dam.

San Joaquin River, Fresno/Madera Counties. The Southern California Edison Company has completed its San Joaquin No. 4 and No. 7 projects below and now proposes to construct the Mammoth Pool Dam. In all of these instances, the Department of Fish and Game has conducted investigations and negotiations in order to secure flow releases.

Kings River, Fresno County. The U. S. Corps of Engineers is now building Pine Flat Dam, principally for flood control, which will directly affect the lower portion of the Kings River. Upstream hydroelectric projects will be possible after this dam is completed and the entire drainage may be developed with adverse effects insofar as fish and game are concerned. The Department of Fish and Game has recommended that a permanent recreational pool be created behind Pine Flat Dam, but has not been able to secure a firm right to water.

Kings River, North Fork, Fresno County. The Pacific Gas and Electric Company, U. S. Bureau of Reclamation, and Fresno Irrigation District have all applied for licenses to construct hydroelectric projects in this drainage. The entire North Fork of Kings River would be greatly affected by these developments.

Kings River, Middle and South Forks, Fresno County. Both the City of Los Angeles and the U. S. Bureau of Reclamation are interested in building dams and powerhouses in these drainages. This is the one case where the Fish and Game Commission has gone on record as opposing *any* dam construction because of the tremendous loss of recreational area that will result if the reservoirs are built. The available sites are in the meadows of Kings Canyon National Park and at Cedar Grove and in Tehipite Valley. Although the total area is relatively small, it comprises almost all the available recreational space in the region.

Kaweah River, Tulare County. The U. S. Corps of Engineers is preparing plans for the Terminus flood control and irrigation project on the lower portion of this river.

Tule River, Tulare County. The U. S. Corps of Engineers is also preparing plans for the Success flood control and irrigation project on this river, which would greatly affect the flows of this stream.

Kern River, Kern County. The U. S. Corps of Engineers is building the Isabella Dam on this stream, for flood control and irrigation. The Department of Fish and Game has made recommendations for a permanent recreational pool to be maintained in the reservoir, but has not yet obtained a firm guarantee of water.

Owens River, Inyo and Mono Counties. The City of Los Angeles has completed the so-called Gorge Power Project and the famed section of the Owens River through the Gorge will be greatly affected by the reduced flows when the project is put into full operation.

Santa Ynez River, Santa Barbara County. The construction of Cachuma Dam by the Bureau of Reclamation creates a barrier across this steelhead stream and the storage of all the available water will prevent these fish from utilizing the lower portions of the stream in most years. We are working out fish and game management plans for the reservoir.

Santa Maria River, Santa Barbara County. The construction of the Vaquero Dam by the Bureau of Reclamation will also cut off the steelhead spawning areas of this stream and in compensation the Department of Fish and Game is attempting to secure a minimum recreational pool, as well as other wildlife benefits.

Of smaller individual proportions than the above major projects, but in the aggregate of considerable importance to fish life, are the numerous small diversions from our streams and rivers. All new applications to appropriate water are filed with the State Division of Water Resources and are reviewed by the Department of Fish and Game. In cases in which there is definite threat of injury to fish, the Department of Fish and Game enters a protest, with a statement of the conditions under which the protest may be dismissed. In most instances these conditions consist of the release of a certain flow of water to the stream below the diversion for the preservation of fish life. The disposition of protests made by the Department of Fish and Game during the biennium and during the preceding biennium is shown in Table 2.

TABLE 2. DISPOSITION OF PROTESTS BY CALIFORNIA DEPARTMENT OF FISH AND GAME AGAINST APPLICATIONS TO APPROPRIATE WATER IN 1948-50 AND 1950-52

	1948-50	1950-52
Total number of applications to appropriate water	1,248	1,116
Number of applications protested by Department of Fish and Game	71	80
Disposition of protested applications:		
Protests upheld	58	65
Applications canceled	6	7
Protests withdrawn after further investigation	3	3
Informal hearings—settlement by agreement	3	4
Informal hearings—action pending	0	1
Formal hearings—compromised	1	0

POLLUTION CONTROL

The water problems of the Department of Fish and Game apply to the quality as well as to the quantity of our waters. The increasing population and industrialization of California have resulted in polluted waters that are as useless to fish life as dry streams. It is essential that these polluted waters be restored and that all sewage and industrial wastes be adequately treated before discharge.

In 1949 the State Legislature established the State Water Pollution Control Board and nine regional boards for the purpose of coordinating all pollution control activities. It is now mandatory that any person desiring to discharge sewage or industrial waste file a report of proposed waste discharge with a regional board. The board then establishes water quality requirements that must be maintained in the receiving waters

by the operator of the disposal system. The various agencies concerned with water pollution submit their recommendations to the pollution control boards before these requirements are set. The Department of Fish and Game has the responsibility of furnishing any technical information on the fish and wildlife aspects of any waste discharge requested by the regional boards and within the last two years submitted over 700 recommendations.

In addition, the creation of the pollution control boards imposed a new function upon the Department of Fish and Game, one of conducting extensive biological pollution investigations at the request of the boards. During the last two years we were asked to undertake 21 biological pollution surveys, mostly in waters in which quality improvement seems to be indicated.

In many of these areas, especially bays and harbors, similar work had never before been undertaken. For example, surveys were completed of San Diego, Newport, and Los Angeles Harbors in Southern California, as well as of San Francisco Bay and other areas where fish and wildlife is jeopardized by inadequate waste treatment. These studies dealt with unhealthy environments, in contrast with the usual post-mortem investigations of fish mortalities. This program is the most extensive ever undertaken by a state agency and nationwide interest has resulted.

Because the necessary technical assistance was not available from the regular staff of the Department of Fish and Game, it was decided wherever possible to carry out these biological pollution investigations under contract with academic personnel. The University of California, University of Southern California, and University of San Francisco have participated in this work, with extremely satisfactory results. Costs were kept at a minimum and we have been able to develop an appreciation of the importance of fish and game in the water pollution control program in many agencies, schools, and industry groups. In addition, the universities are beginning to develop the pool of trained personnel necessary for any long-range program of water pollution abatement.

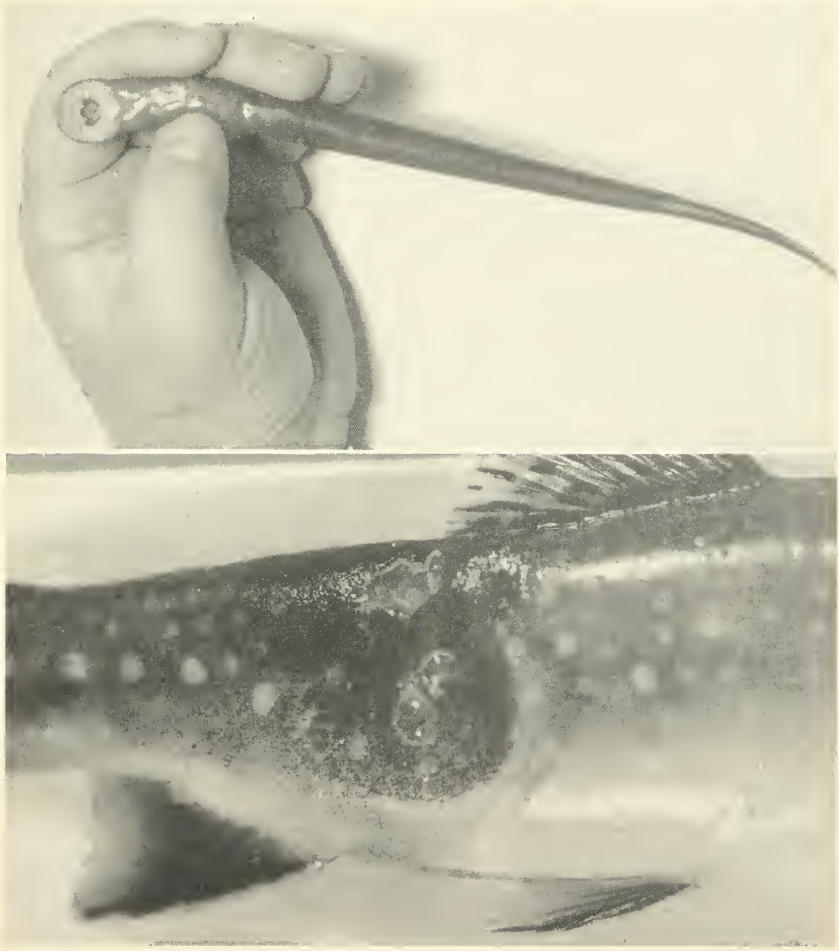
This shift of emphasis from purely enforcement type activities to planning before the pollution occurs reflects the increasing responsibility of the Department of Fish and Game in virtually all of our major activities and the emphasis that must be placed upon public relations and education.

There still exist many pollution problems of concern to the Department of Fish and Game, particularly in the Central Valley salmon rivers, such as the Tuolumne, the Mokelumne, and the San Joaquin. However, partial treatment facilities and careful control made it possible to avoid fish mortalities during the past two years.

Additional treatment facilities are still badly needed to completely protect the fisheries resources, particularly at Modesto, Stockton, and Sacramento. The increasing industrialization in the Martinez-Antioch area is also creating an increasingly serious pollution threat to the Central Valley salmon and striped bass. The Regional Water Pollution Control Boards have recognized the fisheries resources as the primary use to be protected in all areas where these resources are jeopardized.

The Department of Fish and Game has also intensified its independent pollution control program, including both law enforcement and technical investigation.

One example of our long-range survey program is on the Tuolumne River, where the Department of Fish and Game has undertaken a biological study of the effects of the Modesto pollution on the Tuolumne River. The objective of this study is to secure a sound basis of information on which to evaluate the damage being done to this river and others of its type by domestic and cannery pollution. The physical, chemical, and biological characteristics of a 15-mile stretch of river above Modesto



(TOP) Pacific lamprey, nine inches long, trapped in Fall Creek as it was descending to the Klamath River, Siskiyou County. This is the so-called fresh water parasitic stage of this lamprey. It is assumed that after the young lampreys emerge from the mud of the stream bed they undergo a metamorphosis and enter the stage shown in this photo. They then attach themselves to almost any fish that they can find and feed upon them until ready to go to the ocean. In the ocean they continue to feed on marine fishes until ready to return to the streams to spawn and die. In the Klamath River these lampreys are very serious predators on many species of fish, being particularly noticeable on the king salmon. (BOTTOM) This nine-inch eastern brook trout was attacked and killed when placed in a large experimental aquarium with several 10-inch lampreys. Note the three holes rasped in its side.

are being compared with these same characteristics of a 15-mile stretch below the source of pollution. It is planned to carry on this study through all seasons for a period of about three years, so that reliable information on both seasonal and annual variations will be available.

Another example of the continuing pollution control program is furnished by the copper pollution situation on the upper Sacramento River. Several tributaries of Shasta Lake and the upper Sacramento River are badly polluted by the drainage from abandoned copper mines and slag deposits. Within the last year, investigations have been started to determine the exact sources of this pollution and to find out to just what extent they affect the Sacramento River. In addition, an experimental program of abandoned mine sealing and waste treatment has been initiated, to reduce the amount of copper entering the river if at all possible. It is believed that these discharges are not endangering the Sacramento River salmon and steelhead runs with the present flows, but serious problems could result if the flow were reduced during a period when there was considerable discharge from Spring Creek in Shasta County.

FISH DISEASE AND NUTRITION STUDIES

During the biennium 116 cases of diseased fish were investigated, either during field trips or by examination of specimens submitted to the laboratory. In the majority of cases specific treatments were recommended for control of the diseases following diagnosis.

The diseases diagnosed are placed into five groups as follows:

Protozoan	28
Helminths	34
Bacterial	23
Nutritional	18
Miscellaneous	13
Total	116

The miscellaneous category includes tumors, cancer, copepods, lamprey parasitism, poisoning, and salpingitis.

Of the 116 fish disease cases investigated, 51 were from State fish hatcheries, 24 were from commercial fish hatcheries, and 41 involved wild fish.

In addition to the diagnostic work, research projects involving disease and nutrition were carried on as follows:

1. *Screening of drugs and chemicals for fish disease control.* Work under this project has resulted in the screening and standardization of the dosage of Phenothiazine used in controlling intestinal protozoan infections. Continued drug screening involves Chloromycetin and various sulfa drugs.
2. *A continued study of Cryptobia sp., a blood and tissue protozoan parasite of fishes.* The investigation includes a study of its life history, cytology, and histopathology.
3. *Development of hatchery food diets.* Accompanying the expanding trout production is the problem of obtaining hatchery fish foods. Several new diets using vegetable and meat meals in pellet form have been formulated and are in use at most of the State hatcheries. Field trials are being carried on with the objectives of attaining lower costs and dietetically improved formulae.

INTERSTATE WATERS

Lake Tahoe and the Colorado River and its impoundments are the principal waters in connection with which cooperative interstate action has been taken. A Tri-State Fisheries Group, composed of representatives from Arizona, Nevada, and California was formed and held meetings at irregular intervals to formulate solutions for common problems. Also, a California representative served as chairman of the Fisheries Task Group of the Great Basin Subcommittee. This group conducted joint field surveys and compiled a report on fisheries problems of the lower Colorado River.

WILDLIFE CONSERVATION BOARD PROJECTS

Under the Wildlife Conservation Act of 1947 the State Legislature has appropriated considerable sums from horse racing operations to the Wildlife Restoration Fund, administered by the Wildlife Conservation Board. This fund is available for capital expenditures.

The Wildlife Conservation Board receives proposals for projects from sportsmen's and other conservation groups, federal and state agencies, and individuals and passes on their worth. Approved projects are allocated funds which are then transferred to the Department of Fish and Game for actual construction. Maintenance is carried on either by the Department or by local interests, depending largely upon the type of project.

As projects involving inland sports fisheries, other than hatchery projects, have been submitted the members of the biological staff have conducted field investigations, planning, and preparation of reports and recommendations.

The following is a report of the progress that has been made on the various nonhatchery wildlife conservation projects during the biennium.

Project 1. El Dorado Flow Maintenance Dams

Surveys and plans for all of the feasible flow maintenance dam sites in the El Dorado National Forest were completed during the biennium. In addition, check dams were completed at Lois, Schmidell, Middle Velma, Susie, and Heather Lakes during 1950 and 1951.

Project 2. Deep Creek Stream Improvement

Engineering surveys failed to disclose a suitable site for the proposed Holcomb Creek flow maintenance dam. Subsequently the Wildlife Conservation Board canceled the project and recovered the unexpended funds. The Little Bear Creek Access Trail was constructed as a part of the comprehensive program undertaken jointly by the State Division of Beaches and Parks and the U. S. Forest Service. The Wildlife Conservation Board provided $250 to construct this trail. The Mojave Camp Ground Trail was dropped as impractical because no pack stock was available for stocking.

Project 4. Pine Creek Stream Improvement

Counts and studies of migrating fish were carried out during 1950 and 1951. In 1952 the Department of Fish and Game carried out the necessary engineering surveys, prepared plans, and let a contract for the construction of a diversion channel which will bring overflow waters of Pine Creek into its natural channel.

Project 7. Grizzly Creek Dam

The Wildlife Conservation Board allocated $5,000 in June, 1952 to initiate construction. Construction depends upon a lease which must be negotiated between the Pacific Gas and Electric Company and the U. S. Forest Service.

A stream flow maintenance dam. This dam is at the outlet of Stony Ridge Lake, El Dorado County. The impounded water is released during summer and fall months to maintain good stream flows in six miles of Meeks Creek, a tributary to Lake Tahoe.

Project 12. Mendocino Forest Stream Improvement

The experimental streamside planting and investigations which were undertaken by the University of California have been completed, and the final report on the project is expected shortly.

Project 16. Emigrant Basin Flow Maintenance Dams

One dam at High Emigrant Lake and two dams at Middle Emigrant Lake were completed in 1951. Surveys and plans at the other sites have been completed and construction will be carried out during succeeding years.

Project 41-1. Granite Creek Flow Maintenance Dams

These dams are to be constructed by the U. S. Forest Service. The lowest bid received, however, exceeded the funds which are available for this work. Plans and specifications have been drawn up and it is hoped that this work may be undertaken directly, rather than under contract.

Project 41-2. Marsh Lake Level Maintenance

This project was found to be infeasible and was then canceled by the Wildlife Conservation Board.

Project 44-2. Burnt Ranch Falls Fish Ladder

This project consisted of the creation of a fishing ladder by blasting pools out of bedrock. The project was completed on October 6, 1950.

Project 44-3. Bennett Smith Fish Ladder

This dam was washed out in the October, 1950, flood and the fishway was no longer needed. The Wildlife Conservation Board subsequently canceled the project.

Project 49. Tahoe Forest Flow Maintenance Dams

Plans and specifications have been prepared for the flow maintenance dams proposed for this forest. The construction program was initiated in 1952 and the dam on Big Downey Lake was finished.

Project 51. Sequoia National Forest Flow Maintenance Program

The Department of Fish and Game turned over $39,900 to the U. S. Forest Service for construction. Dams are planned at the Indian Basin and Millwood sites. At the end of the biennium surveys of the dam sites were just being completed.

Project 57. San Diego River Flow Maintenance and Development Program

Test borings indicated that foundation conditions were unsatisfactory for the development of warm-water fish ponds. The Wildlife Conservation Board canceled the project in June, 1952.

Project 58. San Diego County Flow Maintenance Program

Surveys failed to disclose any suitable dam sites and the project was canceled and the funds recovered in June, 1951.

Project 61. Shasta River Fish Counting Dam

The Division of Architecture estimates were well over the amount allocated by the Wildlife Conservation Board and possibilities of reducing construction costs are being explored.

Project 62. Canyon Creek Fish Ladder

The owners agreed to the removal of the dam, thus eliminating the need for a fish ladder. The project was completed in October, 1951, when the dam was removed by the Department of Fish and Game.

Project 63. Sawyer's Bar Auxiliary Dam

The Department of Fish and Game made improvements to the existing ladder which were satisfactory to serve the project. This project was completed in September, 1951.

Project 67. Sacramento River Weir (Rough Fish Control Barrier)

Additional studies showed that this project was infeasible and the project was cancelled in June, 1951.

Project 72. Ramer Lake

This project is being constructed under the supervision of the Bureau of Game Conservation. Roads are now being built and water controls installed.

Project 73. Crystal Lake Level Maintenance

This project was completed in November, 1950.

Project 74. Coachella Valley Public Fishing Areas

Preliminary plans and estimates for the construction of two lakes indicated that the cost would be excessively high. Alternate sites are now being studied, with attention being given to Five Finger Lake, where a lease has been negotiated with the Indian Service.

Project 77. Lindo Lake Public Fishing Area

The final contracts for the completion of this project were let in June, 1952 by the County of San Diego.

Project 81. San Bernardino National Forest Stream Improvement

Test dams which were constructed during the dry years stood up very well during the heavy run off of 1951. Plans are now under way to employ a stream improvement crew to carry out the program.

Project 82. Dry Lake Level Maintenance

The U. S. Forest Service has packed in the necessary material and construction will be undertaken during the summer of 1952.

Project 83. Bixby Slough Public Fishing Area

The tentative allocation of funds for this project was withdrawn by the Wildlife Conservation Board, but surveys to determine the feasibility of the project are still under way. Land acquisition depends upon the results of current bond issues.

Project 86. San Antonio Creek Public Fishing Area

The re-activation of Camp Cooke made this site unavailable and funds were re-allocated in June, 1951.

Project 87. Snake Lake

A cooperative agreement with the U. S. Forest Service for the construction of this project has been drawn up and funds transferred so that the Forest Service may carry out this construction in the near future.

Project 88. Charlton Flats Public Fishing Area

Engineering surveys and other studies have been carried out by the Division of Water Resources and its report with plans and specifications is being awaited.

Project 89. Chilao Campground Public Fishing Area

The Division of Water Resources is preparing plans and specifications for this project.

Project 91. Elizabeth Lake Canyon Creek

The Division of Water Resources has conducted engineering surveys and is now preparing plans and specifications for this project.

Project 92. Biscar Reservoir Level Maintenance

Funds have been made available for engineering surveys by the Division of Water Resources and its report is being awaited.

Project 94. Turlock Reservoir

The cost estimates for this project exceeded $100,000. Other possibilities are being studied, since this amount is believed to be excessive.

Project 97. Saulter Lake

Preliminary engineering surveys have been made by the Division of Water Resources, and it is now preparing its report.

Project 98. Sand Creek

Preliminary engineering surveys have been made by the Division of Water Resources, which is now preparing its report.

Project 99. Chiquito Lake

Preliminary engineering surveys have been made by the Division of Water Resources, which is now preparing its report.

Project 100. Hume Lake Dam

Funds have been made available to the Forest Service to carry out engineering surveys to determine the feasibility of repairing this dam.

Project 1010. Delta Fish and Game Operations Base

The much needed operational base at the south end of the Antioch Bridge was completed in November, 1951 and is serving as a field headquarters for fisheries and patrol activities in the Delta.

STEELHEAD AND SALMON

One of the main goals of the Bureau of Fish Conservation has been to acquire as rapidly as possible the essential facts necessary for the preservation and management of our steelhead and salmon sport fisheries in an expanding and changing economy. These fisheries represent a tremendous resource under constant threat from large-scale water use projects.

The present applied steelhead and salmon management program of the bureau includes removal of log jams, abandoned dams, and other obstructions; rescue of fish from drying streams; construction of fishways; and stocking with hatchery fish. The activities of the biological staff in connection with these phases of the program are described elsewhere in the report. Some of the more important special fact-finding investigations carried on during the biennium are summarized herewith.

For some years the Bureau of Fish Conservation has carried out counts of spawning runs of steelhead and salmon at various stations. Such counts provide a basis for legislative and management programs and for recommendations in connection with proposed large dams. The following stations were operated during the past biennium:

Station	*Stream*	*County*	*River system*
Klamathon Racks	Klamath River	Siskiyou	Klamath River
Fall Creek	Fall Creek	Siskiyou	Klamath River
Shasta Racks	Shasta River	Siskiyou	Klamath River
Sweasey Dam	Mad River	Humboldt	Mad River
Benbow Dam	Eel River, South Fork	Humboldt	Eel River

A graduate college student employed as a student biologist completed a study of the efficiency of natural propagation of steelhead and king and silver salmon and the factors affecting it. This study was carried out in the Prairie Creek drainage, Humboldt County.

Another study which in part complements the above was started at Fall Creek, Siskiyou County, in 1949 and continued during the biennium. In this study different numbers of king salmon are allowed to enter and spawn in Fall Creek each year. The resulting offspring are then counted on their downstream migration to the Klamath River. From known numbers of parents and known numbers of offspring we hope to determine the most effective number of king salmon for a spawning tributary such as Fall Creek.

INLAND TROUT

Although the great majority of the trout caught by anglers in California as a whole still result from natural propagation, the hatcheries of the State play a very important role in supplying fish to a number of waters incapable of producing satisfactory angling through natural propagation.

In this program it is one of the principal functions of the biological staff to make the necessary initial surveys of waters and then to check them as necessary in order to keep stocking and other management practices in tune with existing conditions. The records and policies for each managed water are kept current by means of a state-wide system of "hatchery management binders". These are permanent records in loose-leaf binder form kept at each hatchery, with duplicate copies at the district office, which show the essential survey data for the managed water, a summary record of past stocking, and the basic stocking and other management policies as determined in conference between the district biological and hatchery staffs.

Special investigations dealing with the inland trout fisheries carried on by the biological staff include studies of hatchery diets and fish diseases, test water programs, and studies of important individual bodies of water. These are described elsewhere in this report.

Fish rescue trap designed by G. R. Holman. The whole flow of a small tributary stream which has dried up in its lower portion is diverted into a mesh box placed at the terminal end of the flow. The downstream migrating fingerlings are trapped and removed each morning. Fish rescue is an incidental program of the crew working in the North Coast area. During May and June, 1952, a total of 19,400 steelhead and 3,998 silver salmon was rescued.

WARM-WATER FISHES

The reproductive potential of the warm-water fishes (principally the black basses, sunfishes, and catfishes) is generally recognized to be so great that stocking for maintenance is unnecessary, and may actually be harmful. The warm-water fisheries program of the Bureau of Fish Conservation is consequently directed toward finding ways of increasing production in existing waters and creating new fisheries.

Yorba Linda Reservoir, Orange County, is owned by the Anaheim Union Water Company, which allows no public fishing, but permits the Department of Fish and Game to operate the reservoir as a brood pond. In this photograph warm-water game fishes are being seined for use in restocking Puddingstane Reservoir, Los Angeles County. Puddingstane had previously been treated chemically to rid it of rough fish by department personnel.

Intensive studies were made on several selected waters, especially Clear Lake in Lake County, Millerton Lake in Fresno and Madera Counties, and waters in the Colorado River Basin. These were supplemented by widespread sampling of the populations of young fish in a large series of reservoirs throughout the State. Results generally indicated adequate largemouth black bass reproduction but inadequate forage for the bass of the year's hatch, resulting in low survival of bass fingerlings.

To correct this situation, forage fishes, principally golden shiners, were introduced into a number of waters, as listed in the section on "Fish Introductions." It is too early to evaluate the effects of these introductions. Meanwhile, studies of other species of forage fishes have been made. At present, the threadfin shad (*Signalosa*) and fathead minnow (*Pimephales promelas*) appear to hold considerable promise. In addition, investigations have been conducted of the suitability of white bass (*Morone chrysops*) and other predator species for introduction into California waters, especially our large fluctuating reservoirs. Other work in connection with the warm-water fisheries is described elsewhere in this report.

STRIPED BASS

The complex problems ordinarily involved in the management of a large fishery are being aggravated, in the case of striped bass (*Roccus saxatilis*), by the rapid industrialization of the San Francisco Bay area.

The Fish and Game boat *Striper* (1) is used for tagging striped bass. The gill net in which the fish are caught is rolling out over the stern in (2). In (3) the catch is being brought in and in (4) the fish are being removed from the net. A bass is being tagged in (5), and (6) shows the fish prior to release.

This fishery is entering a critical phase. The great influx of newcomers into California during and after the war is being reflected in sharp increases in fishing pressure, industrial pollution, and water diversions from nursery grounds. Striped bass activities during the biennium centered principally around these three threats to the future welfare of California striped bass.

The increase in bass anglers raises questions about the adequacy of present regulations, such as length of season, bag limit, and minimum size. These questions cannot be answered without knowing roughly how many of the available fish are being caught each year. The striped bass tagging program, aimed at estimating this, was continued actively, with more than 3,000 fish over 12 inches long being tagged during the biennium.

Special field and aquarium studies to improve tagging methods were continued, since it became obvious early in this program that tags which had been used in previous studies were unsatisfactory.

Pollution work included a detailed study of striped bass waters from Richmond to Antioch, aimed at evaluating the effects of waste discharges upon the small food animals present. The field phase of this project was completed during the biennium. The results will enable us to tell how much harm the industrial plants are now doing. They will also provide a valuable record of present conditions for future comparisons.

Water diversions from the Sacramento-San Joaquin nursery grounds have presented the greatest immediate challenge. A successful quantitative survey was made in 1951 to estimate the actual number of bass fry during July and to determine their distribution in relation to the Tracy Pumping Plant of the U. S. Bureau of Reclamation and the Contra Costa and Pittsburg Steam Plants of the Pacific Gas and Electric Company. This was done in cooperation with the Bureau of Reclamation and the U. S. Fish and Wildlife Service. Simultaneously, our staff worked closely with the P. G. and E. Company in solving the difficult fish salvage problems at the Contra Costa Steam Plant, and remarkable success was attained.

In conjunction with the above activities, the catch record program has been maintained, providing a continuous, up-to-date index of what is occurring in the fishery.

FARM PONDS

During the biennium 521 applications for stocking of private ponds were processed, 175 ponds were visited, and 439 ponds were stocked with fish. During the preceding biennium, 467 applications were processed, 222 ponds were visited, and 325 ponds were stocked.

It is the policy of the Department of Fish and Game to supply an initial stock of warm-water fishes to private ponds too small to support public fishing and which meet certain other requirements. Trout for such ponds must be purchased from a licensed domestic fish breeder.

The usual warm-water species stocked consist of largemouth black bass, bluegill, and brown bullhead (*Ameiurus nebulosus*). Several other kinds have been tried on an experimental basis.

The biologists process applications for fish and inspect a pond if there is doubt as to its qualifications or there is possibility of escape of undesirable warm-water species into trout waters. Fairly frequently they are also called upon to assist a pond owner with various problems, such as an overgrowth of aquatic plants or dying fish.

LEGISLATION AND REGULATIONS

Recommendations for changes in fishing laws and regulations, based on survey data and on their general knowledge, were submitted by members of the biological staff as occasion required.

PUBLIC INFORMATION

Members of the biological staff participated extensively in the public information program. About 250 talks were given before sportsmen's clubs and other conservation groups, and at least 10 radio and three television appearances were made. Conservation motion pictures were shown many times at these meetings. Exhibits were prepared for fairs and other public gatherings.

The printed material consisted of published articles, which are listed in the following section, mimeographed information leaflets, press releases, and fishing maps. The latter, issued as folders with the map on one side and informational material on the other, have continued to be very popular.

The "Anglers' Guide to the Lakes and Streams of the Marble Mountains Wilderness Area" was first published during the biennium; revised editions of the "Striped Bass Fishing Map" and the "Anglers' Guide to the Lakes and Streams of the Trinity Divide" were issued; maps of the Colorado River area and of black bass fishing waters will be issued shortly.

PUBLICATIONS AND ADMINISTRATIVE REPORTS

A list of publications by staff members is included in Appendix II.

Titles and abstracts of unpublished administrative reports appear in Appendix I.

BUREAU OF MARINE FISHERIES

Responsible for the conservation and administration of ocean fisheries, the Bureau of Marine Fisheries conducts research on the sport and commercial fishing industries and recommends laws and regulations for maintaining maximum sustained production.

Most important of the bureau's investigations concern salmon, bottom fish, sardine, tuna, mackerel, kelp bass, abalone, and crab. The bureau maintains biological and statistical staffs to gather and analyze data upon which recommendations for conservation measures are based. The bureau has laboratories at Terminal Island, Stanford University, Pacific Grove, and Eureka. A stream improvement headquarters is located at Elk Grove. Three research vessels and one small boat are operated, and another vessel is used jointly with the Bureau of Fish Conservation.

In the last six months of the biennium federal aid funds became available for cooperative studies of sport fisheries. Two projects concerned with marine problems were established. These are discussed in the section on Federal Aid in Fish Restoration.

Highlights of the bureau's work are to be found in the following pages. Details are given in the various publications listed in Appendix H.

SALMON

After the peak years of 1945-1946, the California commercial salmon catch dropped to about the average of the annual landings since 1916. The 1949 catch was the lowest of the postwar period.

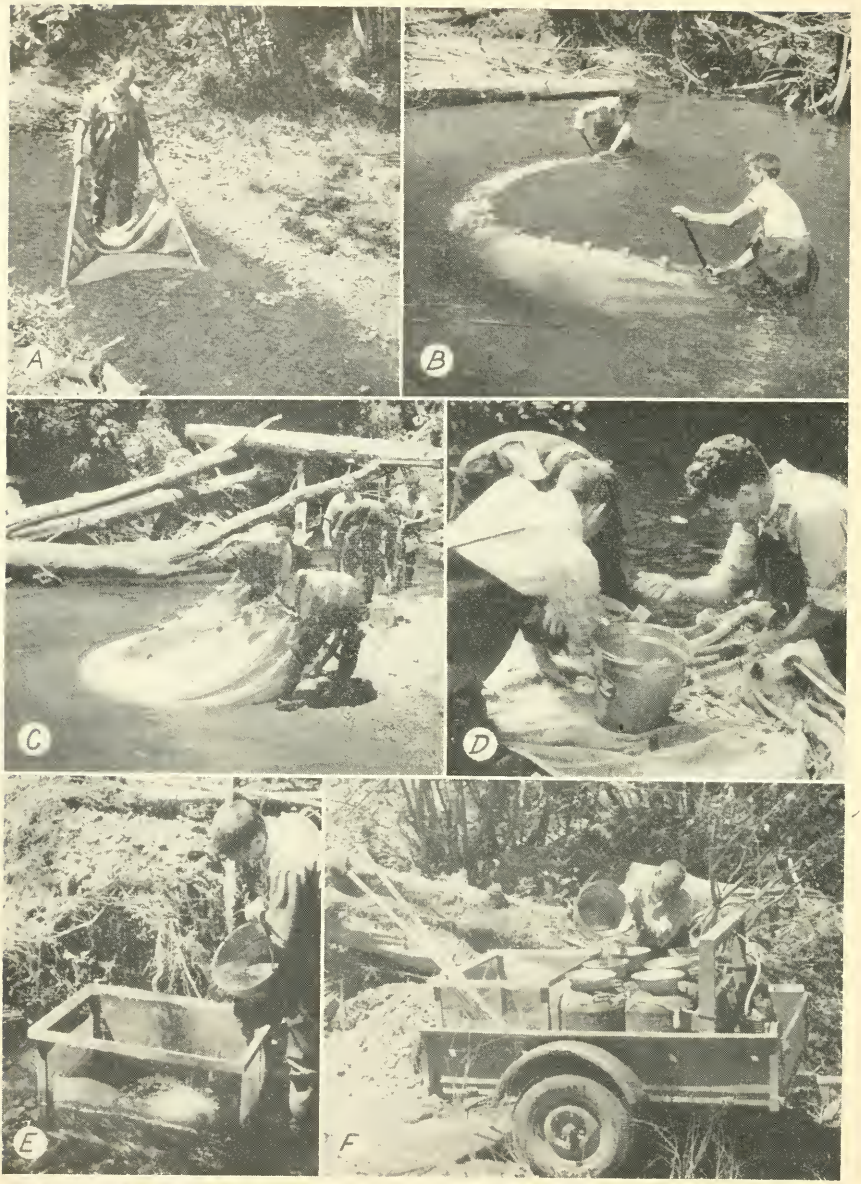
The most important occurrence in the California salmon fishery during the biennium was the closure of much of the Sacramento-San Joaquin River gill net fishery by the State Legislature. This law did not go into effect until shortly before the end of the 1951 season, but its full impact will be felt in 1952. The net fishery is now confined to the area between the Carquinez Bridge and a line drawn from Stake Point to Chipps Island, near Pittsburg.

Since 1948, cooperative salmon tagging operations have been conducted in the ocean off the coasts of California, Oregon, and Washington as part of a program intended to determine enough about the habits of these fish to make better management a possibility. The Tri-State tagging operation was drawing to a close in 1951, but some additional tagging has been done in California.

Salmon Tagging and Tag Development

In 1951 some ocean salmon tagging was done aboard a chartered commercial trolling boat; the remainder was on sportfishing boats during two "tag" days—one in February and one in November.

The Golden Gate Sportfishers, a group of sportfishing skippers in the San Francisco Bay area, offered to the department free use of a boat each week day during the 1952 season for salmon tagging off the Golden



Part of the coastwise salmon migration study—seining young silver salmon for marking. A—A one-man seine as used in small pockets under banks, etc. B—A two-man seine in operation. The men had little trouble herding silver salmon across large pools with nets which seemed much too small for the job. C—Beaching a two-man seine. A second seine crew has just appeared, and on this occasion the two groups will combine forces to transport their catches to the hatchery for marking. D—Sorting the catch. In this stream only silver salmon and trout were present. E—Pouring a bucket of fish into the live box. F—Loading fish onto the trailer for transportation to the hatchery. The gasoline-powered aerator pump can be seen at the forward end of the trailer.

TABLE 1. OCEAN SALMON TAGGING AND RECOVERY JULY, 1950, THROUGH JUNE, 1952

	Number tagged	Ocean Recoveries							River Recoveries							
		Calif. south of Pt. Arena	Calif. north of Pt. Arena	Oregon Coast	Washington Coast	Puget Sound	W. Coast Vancouver Island	Total ocean recoveries	Sacramento-San Joaquin River System	Eel River System	Klamath River System	Smith River, Calif.	Oregon coastal streams	Columbia River System	Total river recoveries	Total recoveries
King Salmon, *Oncorhynchus tshawytscha*																
North Point Arena	350	48	12	6	10	1	1	78	18	6	9	------	1	2	36	114
South Point Arena, total July 1950 through June 1952	2,898	426	34	9	4	------	------	473	330	8	20	------	2	3	363	836
Total	3,248	474	46	15	14	1	1	551	348	14	29	------	3	5	399	950
Returns from King Salmon tagged prior to July 1950	----------	24	8	10	3	------	1	46	25	1	4	1	------	4	35	81
Silver Salmon, *Oncorhynchus kisutch*																
North Point Arena	125	1	2	------	------	------	------	3	------	------	------	------	1	------	1	4
South Point Arena	10	1	------	------	------	------	------	1	------	------	------	------	------	------	------	1
Total	135	2	2	------	------	------	------	4	------	------	------	------	1	------	1	5

Gate, five days a week all season. A mutually acceptable arrangement was made whereby the department furnished a man to do the tagging and paid part of the expenses, while each participating skipper furnished his boat, time and gear, and organized the fishermen who were to catch the fish for tagging. Many salmon were tagged, and the favorable public relations and good will generated by this program made it highly successful from the viewpoint of both the department and the sportfishers. The fishermen thoroughly enjoyed the free trips even when their "big one" was thrown back with a tag on its back.

This voluntary tagging program stimulated efforts to develop a new, more satisfactory salmon tag. To realize the most benefit from a tagging program, a tag must be found that: can be put on small salmon and yet not be adversely affected by their rapid growth; is not affected by sea water, the fish's body tissues, or by electrolysis; is not toxic to the fish; does not handicap a tagged fish as compared to an untagged one, or make it more easily caught, as, for example, in the gill net fishery; is readily seen by the fishermen and has adequate instructions for its return; can be applied with practical uniformity and ease by taggers of varying degrees of experience and aptitude. No such tag exists. In an effort to develop a tag closer to the ideal, a new design was tried out in early 1952. Results to date indicate that it is neither better nor worse than the disk tag that has been used in the past; however, results will not be conclusive until after the close of the 1953 season.

In essence, the new tag is a sealed tube of plastic that passes through the base of the dorsal fin and forms a loop when the ends are fastened together with a stainless steel clamp. The tag number and return information is sealed inside the transparent tube.

TABLE 2. KING SALMON TAGGED IN THE SACRAMENTO-SAN JOAQUIN RIVER DELTA

Time tagged	Number tagged	Number recovered
July 1, 1950, to Dec. 31, 1950	473	68
King Salmon tagged in the Sacramento River near Knights Landing		
July 1, 1950, to Dec. 31, 1950	242	39
Jan. 1, 1951, to Dec. 31, 1951	722	159
Jan. 1, 1952, to June 30, 1952	49	1
	1,013	199
Steelhead tagged in the Sacramento River near Knights Landing		
July 1, 1950, to Dec. 31, 1950	3	0
Jan. 1, 1951, to Dec. 31, 1951	428	116
Jan. 1, 1952, to June 30, 1952	0	0
	431	116

To test the relative value of the new tag as compared to the more standard Peterson disk, fish were tagged in the following sequence: first fish—disk tag; second fish—tube tag; third fish—both tags. Single-tagged-fish returns give a direct comparison of "returnability" of each tag—that is, these returns indicate the rate of recovery and whether or not a tag is seen and sent in to the department. Supplemental to the

TABLE 3. MARKED FINGERLING SALMON RELEASED FEBRUARY, 1950, TO JUNE, 1952

Year marked and released	Date of release	Species	Brood year	Origin of eggs or fish	Where marked	Where released	Fins removed	Number marked	Number released
1950	Feb. 17-Mar. 13	King (captured)	1949	Sacramento River at Red Bluff	Coleman Station	Sacramento River at Jelly's Ferry	Dorsal and left ventral	237,797	235,248
1950	March 31	King (hatchery)	1949	Battle Creek, Coleman Station	Coleman Station	Battle Creek at Coleman Station	Dorsal and right ventral	238,021	235,466
1950	May 4-May 18	King (hatchery)	1949	Mad River at Sweasey Dam	Prairie Creek Hatchery	Big River, Mendocino County	Anal and left ventral	137,396	132,734
1951	July 19-Aug. 2	King (hatchery)	1950	Mad River at Sweasey Dam	Prairie Creek Hatchey	Mad River at Sweasey Dam	Left ventral	79,341	75,826
1951	May 11-July 21	Silver (captured)	1949	Del Norte and Humboldt Counties	Prairie Creek Hatchery	Del Norte and Humboldt Counties	Adipose and both ventrals	1,784	1,772
1951	May 14-July 22	Silver (captured)	1950	Del Norte and Humboldt Counties	Prairie Creek Hatchery	Del Norte and Humboldt Counties	Adipose and right ventrals	166,578	164,423
1952	Mar. 11-Mar. 27	King (hatchery)	1951	Battle Creek, Coleman Station	Coleman Station	Battle Creek at Coleman Station	Dorsal and adipose	523,417	505,933
1952	Apr. 9-Apr. 23	King (hatchery)	1951	Klamath River at Fall Creek	Prairie Creek Hatchery	Klamath River at Hiway 101 Bridge	Adipose and left ventral	202,226	199,730
1952	May 1-May 12	King (hatchery)	1951	Klamath River at Fall Creek	Mt. Shasta Hatchery	Klamath River near Klamathon	Adipose and right ventral	206,470	202,778
1952	June 10-June 11	King (hatchery)	1951	Mad River	Prairie Creek Hatchery	Mad River near Hiway 101 Bridge	Adipose and anal	102,451	99,300
								1,895,481	1,853,210

above comparison are the double-tagged-fish returns which show when a fish has retained one tag and lost the other.

A great stimulus to the return of salmon tags has been the "bonus" awards of from five to one hundred dollars offered by the San Francisco Tyee Club for the return of certain "lucky-numbered" salmon tags. During the biennium the top reward was increased from $50 to $100.

Tagging in inland waters has been conducted in the Sacramento-San Joaquin Delta and in the Sacramento River itself. This work was done to obtain data on the movements of salmon through the delta and population estimates in the upper river. The delta tagging was done with gill nets from the Fish and Game research boat STRIPER. In the Sacramento River the salmon were caught by the use of gill nets and large fyke nets. These fyke nets are a chicken-wire-covered cylindrical trap 10 feet in diameter and 18 feet long. When properly placed in the river, they prove highly effective in catching salmon and steelhead trout. The steelhead were taken incidentally but were also tagged and released.

To obtain quantitative information on the movements of king and silver salmon and to determine the quantities of fish contributed to the ocean fisheries by various important river systems, the Pacific Marine Fisheries Commission recommended a large scale marking experiment as a supplement to the tagging experiment. This work was started in the previous biennium, but Table 3 gives a summary of all the marking done in California from the inception of this experiment. Comparable numbers of king salmon have been marked in Oregon and Washington, and the silver salmon marked in the two northern states have far exceeded those marked in California. (Silver salmon are relatively unimportant in California.)

The hatchery fish marked at Coleman Station have in each instance been provided by the United States Fish and Wildlife Service, but the marking was done by the California Department of Fish and Game. The wild fish marked at Coleman Station were captured by fish and game employees in fyke nets in the Sacramento River. They were transported to the hatchery, marked, and returned to the river after marking.

The king salmon marked at Prairie Creek Hatchery and released in Big River were from eggs taken from Mad River fish. It was the original intention to return the marked fish to Mad River, but the Bureau of Fish Conservation was previously committed to planting king salmon in Big River and the number of eggs obtained was so low as to make it impractical to plant in both places; hence the entire release was made in Big River.

Wild silver salmon marked in Prairie Creek Hatchery were taken from the streams of Del Norte and Humboldt Counties by seining crews. The crew would send one man to scout streams until he found a suitable source of silver salmon, whereupon a three- to four-man crew would rapidly progress from pool to pool making innumerable hauls with small seines. The silver salmon were separated from other species of fish and held in live boxes until near the end of the day's work, at which time they would be transferred to milk cans and taken to Prairie Creek Hatchery for marking. After marking they were usually returned to the stream from which they were taken. If there were any likelihood of the stream drying up, all salmon and trout captured would be taken

Clipping a ventral fin from a wild silver salmon fingerling. Note the bobbinet glove covering the thumb and two fingers of the marker.

to the hatchery and after the salmon had been marked, they would be released in some stream with an adequate flow of water.

The recoveries of marked salmon which were from the 1949 brood year kings should reach their peak in 1953. However, there were a few returns of two-year-olds in 1951, and large quantities of returns of three-year-olds in 1952. It should be possible to make a fairly comprehensive analysis of the mark returns of 1949 brood year salmon after the 1952 season. Additional analyses of this brood year will be required for the 1953 and 1954 returns.

In order to obtain reliable figures of the proportion of marked fish in the ocean catch, the Department of Fish and Game has had samplers examining the salmon catch in key fishing ports from Crescent City to Monterey, and in the Sacramento-San Joaquin River fisheries. These men keep records of the numbers of unmarked fish seen, and the numbers of fish with each different mark seen. Scales are taken from all marked fish recovered, and each such fish is measured. The number and weight of fish landed is determined for as many boat landings as is feasible. Length frequency samples are taken at frequent intervals. Scale samples are taken for an age analysis of the salmon.

Floods and Droughts

A great deal of damage was done to the Central Valley salmon runs by the floods of November, 1950. Many rivers were swollen torrents during the peak of the salmon spawning season. The fish spawned near the edges of these streams in order to avoid the excessively fast and deep water near midstream. When the floods receded, tens of thousands of

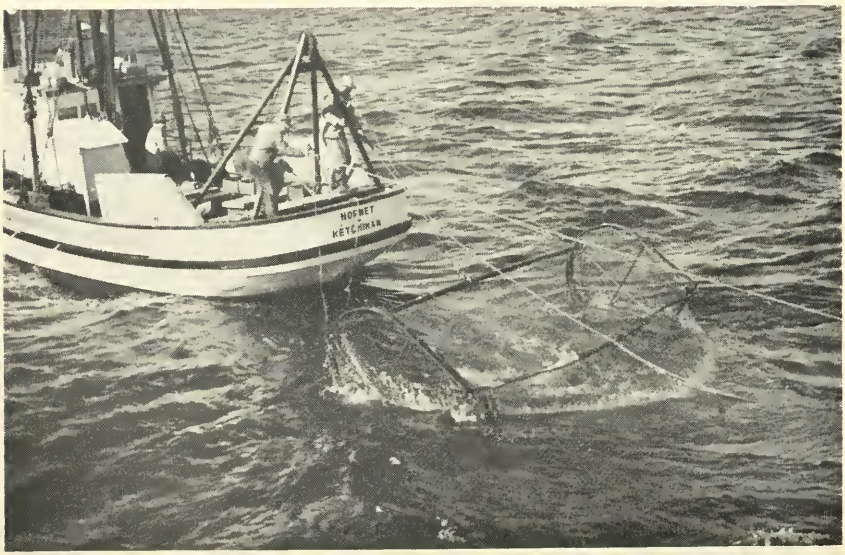
salmon nests were left high and dry. This should have a very serious effect on the spawning run of 1954. The most damage was in the Tuolumne River. North of the Feather River there was high water but little or no real damage. The main Sacramento River run was not affected.

A drought in early 1948 was so serious that almost the entire flow of the Tuolumne River at Don Pedro was stored for future irrigation needs. The flow below the La Grange Dam was so low that almost all the previous fall's salmon nests were dry at hatching time. As a result the 1951 spawning run in the Tuolumne River was a complete failure.

This means that for two successive years the best salmon stream in the San Joaquin Valley has had its salmon run almost wiped out. The handicap will be very difficult to overcome.

BOTTOM FISHERIES

Increased catches characterized the bottomfish industry of the State during this biennium. The increment was due to the continued expanding utilization of dover sole. This species now constitutes the backbone of the sole fillet production in the State, with the port of Eureka supplying by far the greatest amount of packaged fillets. Out of the northern region of the State, a fleet of 37 to 50 trawlers fished each month and from the Monterey and Santa Barbara regions, an average of about seven or eight. A sizable industry is supported by the activity of these boats, their landings of fish adding greatly to the wealth of the communities from which they operate. The bulk of the catch landed by the trawl fleet is dover sole, with English sole and petrale sole following in importance (*Microstomus pacificus*, *Parophrys vetulus* and *Eopsetta jordani*). The



The boat *Hornet* off Morro Bay bringing up the shrimp beam trawl used in the fishery off that port, June, 1952. This is a new fishery made possible by the department's discovery of previously unknown shrimp beds.

species making up the majority of the otter trawl bottomfish catch can be taken successfully only by the trawl fishery. No other means of fishing can economically capture these bottomfish.

This fishery takes some species that are not at present utilized by the industry. These include skates, rays, and unwanted varieties of soles, hake, etc. This nonutilization is a result of lack of cultivation of taste and development of new markets and products by the industry. Our fisheries' selective utilization can be contrasted to the situation in Europe where close to 100 percent of the catch is utilized.

However, irrespective of the effect of market conditions on the demand for certain species, it should be emphasized that there would be no sole taken, a very small percentage of the rockfish catch, and an almost complete waste of the bottomfish population without the efforts of the trawl fishermen. A fishery that has yielded over 25 million pounds of fish annually is an important segment of our marine resources and State's wealth, and the interests of this industry should be guarded judiciously.

Further returns from the tagging program on the bottomfish yielded additional information on the migratory habits of some of the bottomfish. Of the English sole tagged in the Eureka region, 25 fish moved an average distance of 95 miles south, and 26 fish moved an average distance of 25 miles north, with 15 fish remaining close to the area of tagging. Of

A bag load of shrimp being landed aboard the shrimp trawler *Grace H* out of Morro Bay. There are about 800 pounds, almost 100 percent shrimp, in this bag.

the English tagged in the San Francisco region, 11 moved an average distance of 54 miles north, 17 stayed within 12 miles of tagging, and one moved 25 miles northwest. Dover sole tagged off Eureka showed 16 fish moving about 30 miles north, with 39 fish staying within 10 miles of tagging. Six petrale sole moved 35 miles north from the point of tagging in the Eureka region, and 19 stayed within 10 miles of release.

The general pattern of migration indicates that the majority of the soles are nonmigrants. Only a small interchange of English sole between the Eureka and San Francisco region occurs with a slight northward migratory trend in both regions for dover and petrale sole.

The study of trawler boat logs was continued by the Bureau of Marine Fisheries to follow changing trends in species caught, fishing localities, depths, and fishery progress from year to year. The logs indicate that many boats are now fishing in waters of depths of 300 fathoms and over with good success. The general trend of the fishing effort is toward the offshore deeper water.

A new industry is born. Processing and picking shrimp at the American Refrigeration Company in San Luis Obispo, California, June, 1952.

Of the research work done on the bottom fisheries, the exploratory work on the N. B. Scofield during this biennium has yielded results of considerable importance to the State of California. The exploratory work was directed towards the discovery and determining the extent of the latent shrimp and prawn (genus *Pandalus*) resource off the California coast. Several exploratory and census trips were made on the N. B. Scofield, and portions of the waters from the Santa Barbara Channel to the Oregon border were explored. Beds of shrimp off Pt. Buchon, Bodega Bay, Shelter Cove, and Pt. St. George, comprised about 200 square miles upon which shrimp were known to exist. Much of the area off the coast still remains to be explored, as only the most promising regions were worked on the previous surveys.

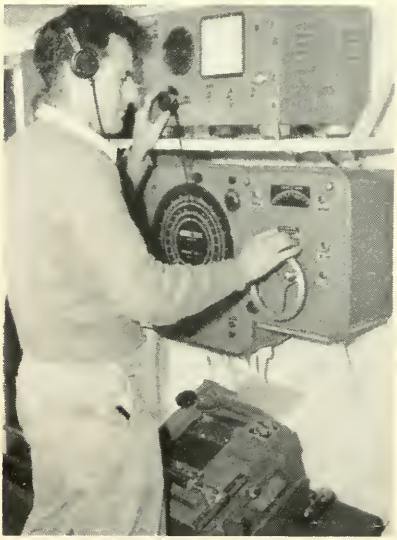
Legislation sponsored by the Department of Fish and Game fostered the development of a new industry in this field where formerly none had existed. Regulatory measures to insure the perpetuation of the fishery were established, and the industry was born under modest circumstances. The fishing gear used by the industry was patterned after that developed by the department personnel in the exploratory work. Two boats were at work on the beds off Pt. Buchon at the close of the biennium, and were averaging better than 500 pounds per hour of trawling. Introductory attempts were being made on the Bodega and Pt. St. George areas. The industry has established itself in Morro Bay and San Luis Obispo where about 75 people are engaged in the production of the finished product. Through the exploratory work of the department, a new industry and new wealth has been added to the State's resources. The catch as of June 30, 1952, only three months after opening of the season, has amounted to over 89,000 pounds.

SARDINES

At the close of the last biennium (1949-50) the sardine (*Sardinops caerulea*) industry was experiencing a slight recovery from the poor fishing of 1947-48 and 1948-49. This recovery continued through the next season, 1950-51, but in 1951-52 the catch again dropped to the level of 1947-48 and at the close of the present biennium the outlook for this fishery is poor indeed.

Investigations of the sardine population are being continued by the California Cooperative Sardine Research Program which represents the joint efforts of California Department of Fish and Game, California Academy of Sciences, Hopkins Marine Station, Scripps Institution of Oceanography, and U. S. Fish and Wildlife Service. In the cooperative program our department made assessments of the abundance of sardines by age groups during the fall of 1950 and 1951 in the waters off California and Baja California. These indicated a scarcity of sardines resulting from spawnings in 1949, 1950 and 1951, which accounts, in a large measure, for the renewed decline of the catch in 1951-52. The results of these measures of abundance were published in Fish Bulletin No. 87.

In addition to these surveys of population abundance, the routine studies of size of sardines in the catch and average monthly catch of the fishermen have been continued. In cooperation with the U. S. Fish and



The M. V. *Yellowfin* is used chiefly for assessing abundance of sardines. She carries a wide variety of specialized equipment, including sonar (bottom left) as an aid in locating fish schools and such standard aids in navigation as radar (bottom right).

Wildlife Service, the age composition and numbers of fish in each season's tonnage have been ascertained. During the present biennium the fishery relied, in a large measure, on sardines spawned in 1946, 1947, and 1948. These year classes were fished intensively when two and three years old and seriously reduced in numbers before they had grown to the larger sizes which reach the more northern fishing grounds. As a result, there was no sardine fishing in the Pacific Northwest, practically none off

San Francisco and very little off Monterey. In 1951-52 the entire California fishing fleet moved to Southern California waters. The catch from this area was largely processed by the southern plants although small tonnages were trucked to San Francisco and considerable amounts to Monterey.

The numbers of sardines taken by locality and age group were compiled for the 1950-51 and 1951-52 seasons and published in the July, 1951 and July, 1952 issues of *California Fish and Game*.

TUNA

The industry faced a period of general uncertainty during the biennium. The increasing competition of canned tuna from foreign sources and increasing domestic production drove processors' inventories to high levels at times, and forced processors to reduce the rate of delivery of raw fish by the fishing fleet. The situation was further complicated by the processors' purchase of raw fish from foreign sources. Seriously concerned, all components of the industry united in an effort to effect the increase of the tariff on canned tuna in brine and to impose an import duty on raw fish.

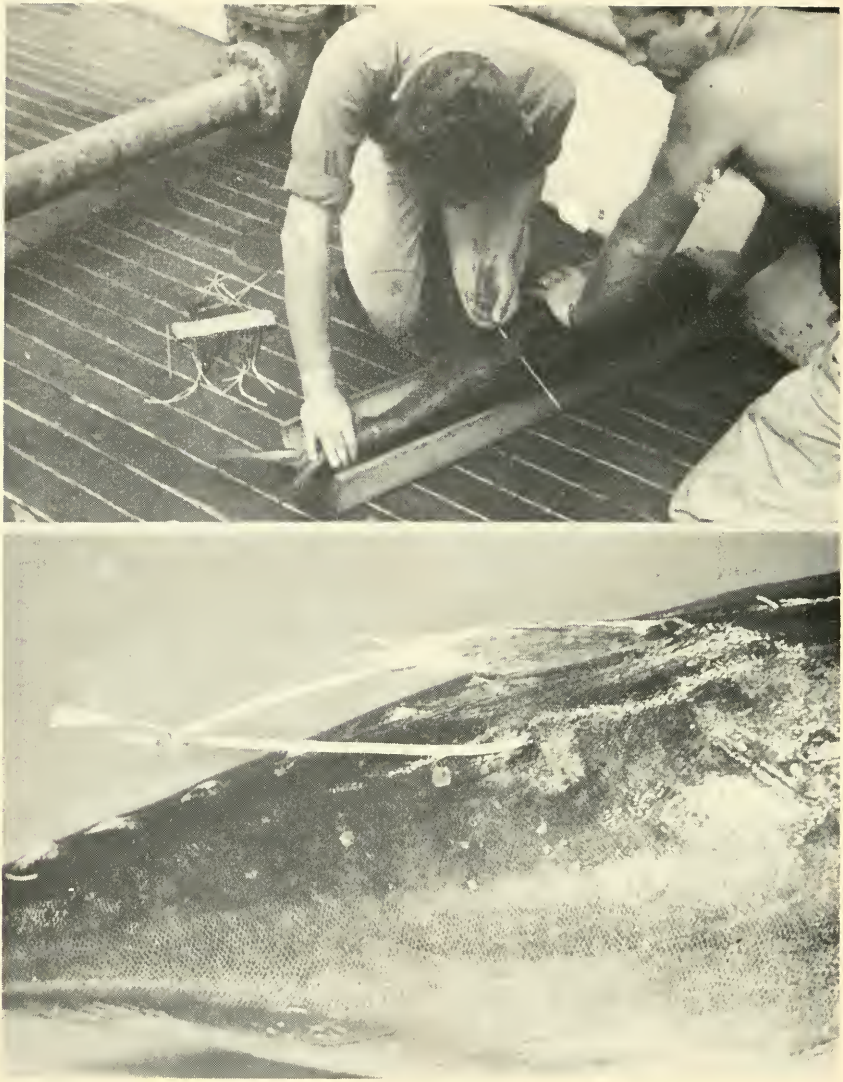
Price at the end of the biennium was $350 per ton for albacore, $320 per ton for yellowfin tuna and $260 per ton for skipjack.

The tuna fleet, especially the larger vessels, expanded southward in the latter part of 1951 to new fishing grounds off the coast of Ecuador. Further expansion southward was blocked by the policy of the Government of Peru which does not permit American vessels to fish in Peruvian waters.

The research program was revised and augmented during the period. During the earlier part of the biennium, new publications presented further evidence that the yellowfin tuna populations of the Eastern Pacific and the Central Pacific are separate nonintermingling stocks, and that the Australian, California and New England bluefin tuna are probably separate species. In the latter part of the biennium, programs were inaugurated to determine:

a. The age and rate of growth of Eastern Pacific yellowfin tuna, skipjack, and albacore (*Neothunnus macropterus, Katsuwonus pelamis, Thunnus germo*).
b. The age composition of the commercial catch of yellowfin tuna, skipjack, and albacore.
c. Study of the migration pattern, if any, of yellowfin tuna, skipjack, and albacore by means of marking.
d. Proper level for exploitation of yellowfin tuna by analysis of the catch-effort relationship.

It appears, from recoveries of tagged yellowfin tuna, that a successful tag for the tunas has been developed, and the investigation is undergoing the transition from experimental tagging to a large-scale effort to determine migration by means of tags. The tag is a piece of vinylite plastic, about the diameter of a piece of spaghetti, attached to the fish by a loop through the tissue of the back, just posterior to the second dorsal fin.



A major accomplishment during the biennium was the development of a very promising tuna tag. The tag is made of plastic tubing. Top, applying the tag. Bottom, the tag in place.

PACIFIC MACKEREL

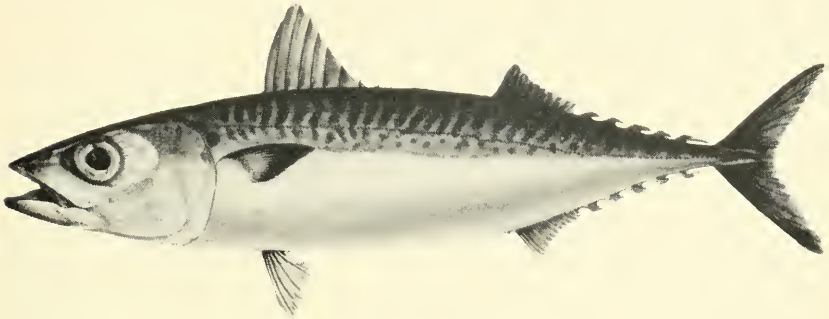
The catch of Pacific mackerel (*Pneumatophorus diego*) dropped, during the biennium, to the lowest level in 19 years.

Age work on the Pacific mackerel was completed for the 12-season period 1939-40 through 1950-51 and the results of this study were published (Fish Bulletin 83). This study showed that old fish comprising reserve spawning stock are so reduced in numbers that the present-day fishery, in order to maintain itself, depends upon each year's hatch. As

there has not been a really good hatch since 1947, the catch has dropped to its present low of slightly more than one-fifth the peak 1935-36 season.

Also completed and published during the biennium was a study of the races or populations of Pacific mackerel (Fish Bulletin 84). This included detailed comparisons of fish taken between British Columbia and the Gulf of California. Statistical analysis of the data revealed the probability of two distinct populations within this range with the California fishery drawing upon the mackerel population from Canada to central Baja California.

Routine sampling of the commercial catch continued without interruption. Most of the basic information for the numerous biological studies is acquired from this sampling.



The Pacific mackerel once supported a lucrative fishery but catches in recent years have declined seriously.

JACK MACKEREL

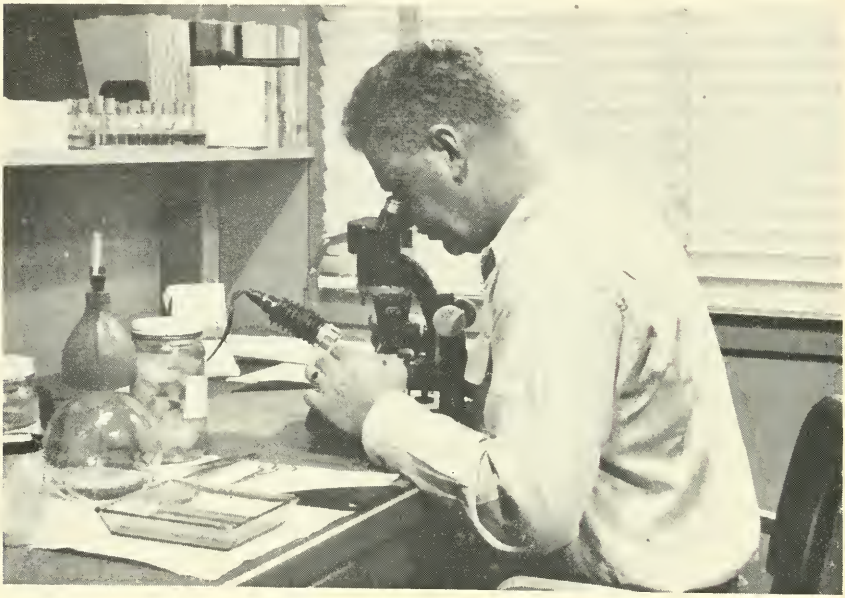
The jack mackerel catch in the Los Angeles region was considerably higher during this biennium than the last. Slightly more than 100 million pounds were landed here during the 1950-51 season and nearly 69 million pounds during 1951-52. Monterey reported the second highest catch, but only in September, 1950, when some 27 million pounds were taken, did monthly landings exceed five million pounds at that port.

Biological work which originally consisted of routine sampling and age analysis was expanded during the biennium to include studies of maturity and egg production, food habits, and a racial or population investigation.

In conjunction with the food analysis work, two short trips were made on the department's research boat, YELLOWFIN. These trips were necessary in order to obtain stomachs from daytime-caught mackerel to compare the contents with food organisms from stomachs of jack mackerel caught at night.

Studies of fishing methods included rides in a plane, which was used by the fishermen during the spring of 1952 to locate schools of jack mackerel during daylight hours. Much useful information was obtained on methods for identification of schools of sardines, anchovies, and jack mackerel.

A short paper detailing the differences between jack mackerel (*Trachurus symmetricus*) and Mexican scad (*Decapterus hypodus*) was published in 1952. This paper was needed to relieve the confusion among fishery workers on the status of these two genera in California and to clear the way for future population studies.



Fecundity and food analysis studies on the jack mackerel require many long and tedious hours at the microscope.

OCEAN SPORTFISHERY

Creel census work which commenced in 1947 was completed in the latter part of 1951. The catches of 11,175 fishermen on 588 boats were checked. The records as rendered by these boats were determined to be within 4 percent of the actual number of fish counted on the checks. The more important species of game fish were generally listed on the catch records in numbers much closer to the actual than were the less desirable fish such as mackerel and kingfish. The average throughout the five years that the creel census work was carried on has indicated that bag limits imposed on ocean sportfishing must be related to the area where the catches are made. Bag limits in Southern California should, and do, vary from the limits that are imposed in Central and Northern California. Creel census work has been the basis of the liberalization of the Southern California catch limits.

Ocean sportfishing still continues to rise in popularity. Boat records indicate that during 1948-1950 an average of 525,000 fishermen per year were carried on sport boats operating for hire, not including San Francisco Bay striped bass boats. During 1950-1952, the state-wide average increased to 577,000 fishermen passengers.

In Southern California, catches of kelp bass (*Paralabrax clathratus*), a very popular and relatively abundant fish, gave some indication that overexploitation was taking place in specified areas. A tagging program was started in 1950, lagged during 1951, but was renewed in 1952. A total of 4,000 kelp bass has been marked, mostly in Southern California, although more than 400 bass have been released in Mexican waters. At the present time, evidence shows that kelp bass grow slowly, are not inclined to move to a great extent and are, of course, subject to high fishing pressure in localized areas. The sportfishing industry in Southern California has already responded to this information, as some fishermen and boatmen are now releasing small bass. On the other hand, some "meat fishermen" are proclaiming that a mess of bass six to eight inches in length makes the finest eating to be found. An education program will undoubtedly follow the conclusion of the tagging program.

The life of the biologist cannot all be spent in the field. This man is keeping books on the number of fish taken by marine sport fishermen.

LIVE BAIT FISHERY

The live bait fishery studies are designed to procure records of the bait catch with respect to species, area, and effort involved. The records are made out on the boat and do not come to the attention of an official weighmaster as do the regular commercial fish catches; therefore, their accuracy is dependent upon the cooperation of the fisherman. This necessitates that good relationships be maintained. To do this, a member of the laboratory staff attempts to accompany as many of the live bait boats as feasible during the fishing season. On such trips, several scoops of bait are weighed to determine a factor for converting scoops of bait to pounds. All records are submitted in scoops; the conversion to pounds is made by the Department of Fish and Game.

The survey of the State's abalone resources is carried on by divers working on the bottom of the sea. Actual diving is done from the boat *Mollusk* which is shown returning from a survey (Anacapa Island in background). The first abalone divers along the California coast were the Japanese and this extremely maneuverable boat is copied after their design.

One of the most interesting features of the live bait fishery is the record of occurrence of young sardines or "firecrackers," as they are known more commonly. "Firecrackers" are recorded in number of scoops by these boats, which operate from San Diego to Port Hueneme. This is the first visible indication of the spawning success of sardines in local waters. During this biennium "firecrackers" have been rare.

The past two years have brought an increased demand for live bait to meet the needs of the expanding ocean sport-fishing industry of Southern California. This need has been met through greater efficiency of gear. The number of boats and fishermen engaged in the fishery has remained relatively stable.

The two main species comprising the live bait catch are the sardine and the anchovy (*Engraulis mordax*). During the biennium the anchovy and sardine catches have shown an increase of more than 35 percent over the previous two-year period.

ABALONES

The catch of abalones for commercial use has increased since the previous biennium. This can be attributed to the taking of a previously unutilized species (the black abalone, *Haliotis cracherodi)* in the Santa Barbara and Los Angeles areas and to a period of exceptionally good weather in the Morro Bay region. The sports fishery also harvested a great number of abalone. Until 1951, the extent of this sport fishery was largely speculative. All concerned seemed to agree that the abalone were not to be found on the beaches in the quantities previously noted and the question arose, "Where have the abalone gone?"

Placing the helmet on the diver. Note the weights on the diver's chest and back. The large black hose carries both the diver's air supply and his telephone line. Diver is in communication with the surface at all times via the two-way telephane. *Photo by Gene Tupper, Palo Alto Times.*

A survey recently conducted by the Department of Fish and Game has revealed some interesting information which throws a little light on this problem. Briefly, the results are as follows: In 1951, approximately 4 percent of the 1,015,000 sport-fishing license buyers fished for abalone; they averaged between 12 and 13 abalone per fisherman or approximately 513,000 abalone. No single year's total commercial catch from 1938 through 1946 exceeded this figure. Furthermore, this sport catch is equal to more than half the commercial catch for 1951. When the limited area fished by the sportsmen is considered, the question becomes, not where have the abalone gone, but how have they managed to last as long as they have.

Because of the interest in the abalone, both by the commercial and sports interests, the Department of Fish and Game intensified its abalone program and obtained two vessels, complete with crew, to expedite the project. The untimely death of Paul Bonnot, the biologist originally assigned to the project, delayed this expansion. A new biologist was appointed who had to learn the skills of deep-sea commercial abalone diving so that he could observe the abalone in their natural habitat. This man has developed underwater diving techniques and has spent considerable time on the bottom of the sea making observations and surveying much of the coastal area previously unexplored for abalones.

A private citizen and a warden cooperate with Marine Fisheries personnel in measuring and tagging abalone which have been sent to the surface by the diver. After the abalone have been tagged and their measurements recorded, they are returned to the diver who replaces them back on the rocks.

By far the greatest single problem is to determine how the population of the beach is replenished. The first approach to this has been to tag a number of abalone and release them in various depths. When sufficient returns have been received, it should be possible to determine from which depths the intertidal populations of abalone are derived. Some people have contended that the offshore commercial fishery tends to take abalone which would normally move onto the beaches and thus contributes to the decline of the sport fishery. When all facts are assembled, it should be possible to assess the effect of commercial fishing and its relation to the sport catch. Other valuable biological information will be revealed by tagging, such as growth, rate and extent of migrations along shore and into deeper waters, population pressures in the various depths, rate of survival, rate of exploitation, both commercial and sport fishing, and many other factors necessary to understand the dynamics of this important resource.

Even though the deep-sea aspect of the project has been in operation only a few months, it is apparent that there are abalone in untold numbers in the offshore waters. In suitable unexploited habitats, the abalone population is so dense that the available bottom is literally covered by these animals, and competition for living room is severe. However, in the areas where they have been fished commercially, the supply of legal size abalone is almost exhausted.

In the north coastal region, where no commercial diving is permitted, several spot dives were made. Abalone in great numbers were found in the reefs offshore from San Francisco to Fort Bragg, especially in the Fort Bragg area. Additional survey work in this area will be conducted as soon as weather permits. Extended tagging experiments will be carried on also.

Some difficulty has developed with the pins used in tagging; electrolysis has been observed on pins as was noted on those used on salmon and striped bass, and some of the tags have undoubtedly been lost. However, this is a minor technical problem which should be soon solved.

The greatest limiting factor on the investigation is the weather. The sea must be calm for safe diving operations. Since favorable weather conditions are encountered along the Northern California coast only during the summer months, operations in this area are limited to only a few months of each year.

CRABS

Present crabbing methods are so efficient and fishing activity is so great, that each season the percentage of crabs (*Cancer magister*) taken during the first few months has been increasing. More than 80 percent of the crabs landed at San Francisco in the 1950-1951 season were landed

A raking dredge with a fine meshed collecting net as used for catching very young crabs.

Although the crab resource is apparently holding up well under extremely heavy fishing pressure, it is necessary to watch it carefully to observe any sign of possible overfishing. This eight-foot beam trawl is used in crab sampling operations.

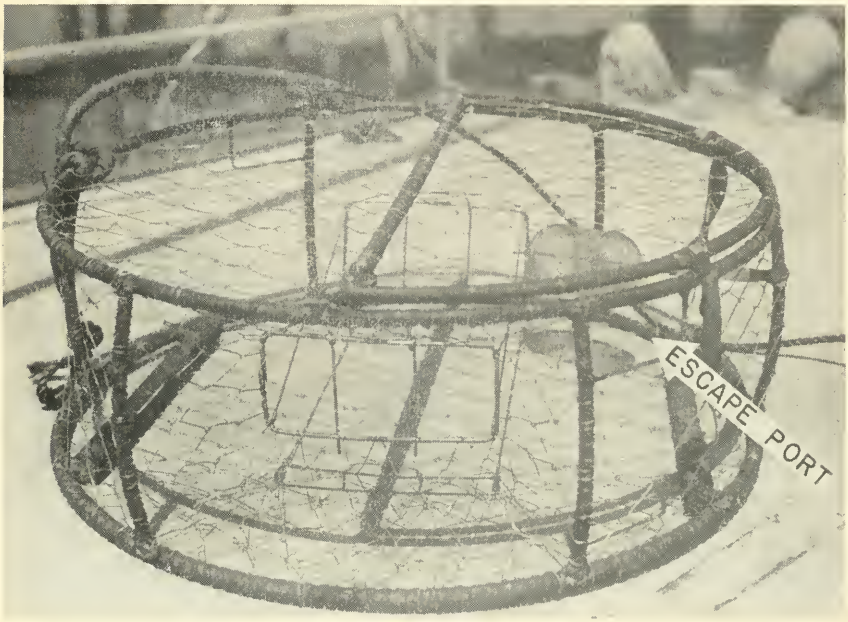
during the first three months of the season. In Eureka the trend is in the same direction, being nearly 60 percent in the 1950-1951 season, as compared to about 35 percent in the 1948-1949 season.

Through biological research, the rate of growth and sizes at sexual maturity in bay and ocean waters are being obtained. Investigations are also under way to determine the biological interrelationships that have bearing on the industry as a whole. Savings gear experiments are being conducted to secure information for bases of recommendations which will materially increase the take per unit of effort as well as give added protection to the small crabs now trapped in the gear commonly used throughout the State.

Specially designed traps are being tested. These traps have escape openings to allow undersized male crabs and females to leave traps and thus escape injury from large crabs in traps and from necessary handling by fishermen. Such a trap has been on public display in Steinhart Aquarium, San Francisco, for several months and has clearly demonstrated that it serves the purpose for which designed.

With the securing of the BROADBILL, a state research vessel of a size compatible to shellfish investigations in shallow waters near shore, the research staff has for the first time been able to sample market crabs with gear specially designed for that purpose. In preliminary work off

Central California, it became evident that very small crabs less than one year of age were abundant on the sandy bottoms off Marin County. This is good news for it is this population of young that will supply in a few years the replacements to the size groups harvested so thoroughly by the intense fishing effort and efficient crab traps used by the San Francisco crab fishing fleet.

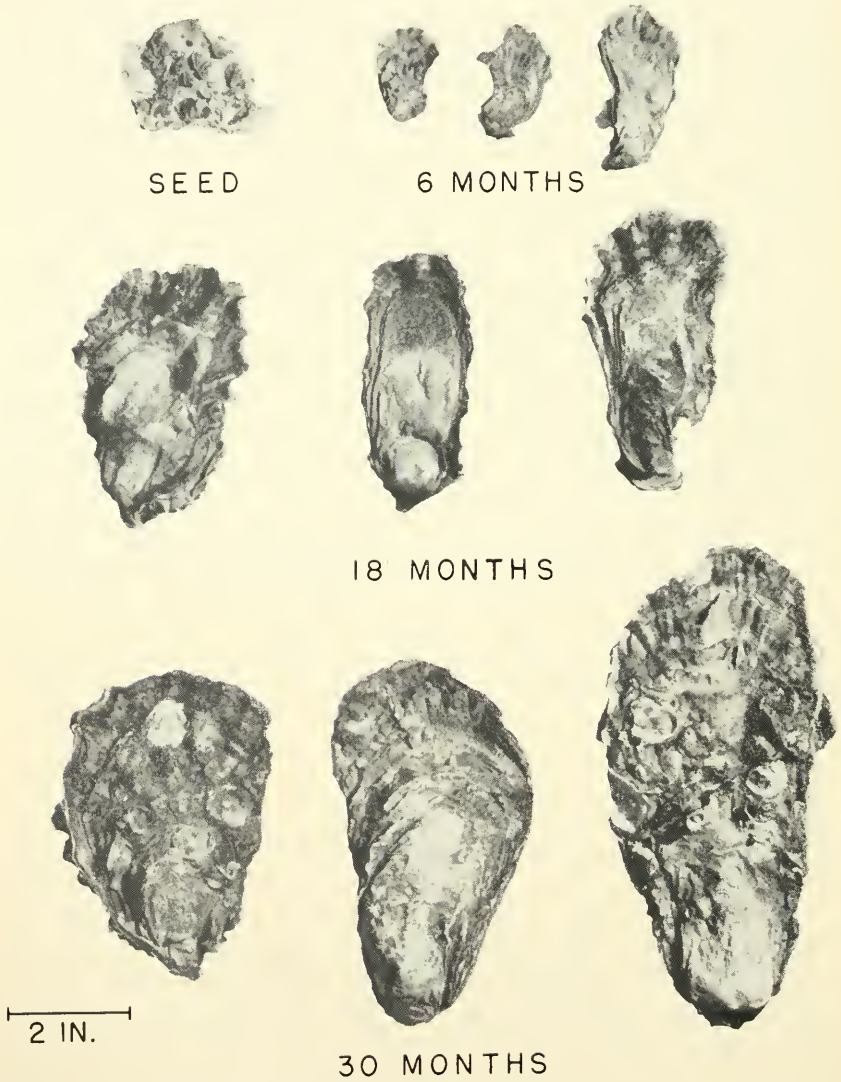


An experimental crab trap with openings to allow escapement of crabs under legal size. The small crabs have a much better chance to survive if they can escape while still on the bottom instead of being hauled to the surface and thrown overboard.

OYSTERS

Renewed interest and activity in oyster culture has resulted in a "rebirth" of the industry which has scarcely held its own in recent years. The effort is directed primarily for the production of marketable Pacific giant oysters grown in California bays from plantings of very young "seed" oysters imported from Japan. There are now 12 allotments of water bottoms for the purpose of oyster culture in bays where previous to 1948 there were but five. California bays have been demonstrated to be very satisfactory for growing these oysters which normally require four years to attain marketable size in Japan. The general practice is to harvest only 18 to 24 months after planting in California waters. Morro Bay has very recently received plantings of Pacific seed in quantity far greater than ever before. Harvestings from this area were restarted this year, and barring natural phenomena resulting in excessively high mortality, California should enjoy landings of these oysters far in excess of any heretofore received.

Importations of the seed oysters from Japan and full grown oysters from the Atlantic Coast being from areas infested with oyster-drilling snails, it has become necessary for the State to inspect such shipments for the pests. In past years when there were but a few oyster growers, the inspections and procedures for proper issuance and improvements of oyster allotments was a small part of the oyster program. It has become necessary, however, since the industry has expanded, to develop a policy



Pacific giant oysters cultured in Tomales Bay, California. The growth of these oysters is truly phenomenal. Because they do not reproduce in California waters, the industry depends upon imports of spat from Japan. *Photo by Berton Crandall, Palo Alto.*

to insure complete understanding among the departmental staff and representatives of the industry. It is believed that with a firm, workable policy, we can better obtain full utilization of our natural resources which are so favorable to oyster production. Through biological investigations, the research staff is determining growth rates of oysters under various conditions, testing different methods of oyster culture, and advising oyster growers of cultural practices and methods of pest control.

CLAMS

During the biennium many photographs and large quantities of information on habits and habitats of our most common edible clams, mussels, and scallops were amassed for use in a proposed fish bulletin. In conjunction with this project several short trips to various clamming localities and a longer trip to the Humboldt Bay area were made from the Terminal Island laboratory.

Pismo clam censuses were conducted at both Pismo Beach and Morro Bay during November in 1950 and 1951. These censuses indicate a shortage of young clams at both localities. This lack of young clams is apparently the result of very poor sets during the past several seasons.

The department has conducted regular surveys of the Pismo clam resource off the Pismo Beach area since 1925. Here clams are being measured and aged, after which they are replanted.

RESEARCH VESSELS

Broadbill

With the acceleration of the abalone program, it was necessary to obtain a boat to be used exclusively for diving operations. The Bureau of Patrol's 36-ft., 15-ton vessel, the Broadbill, which had proved unsatisfactory for patrol work, was acquired by Marine Fisheries for use in the abalone investigation. An air compressor was installed, several minor changes made, and diving operations were attempted. Subsequent trials indicated that the Broadbill is not entirely satisfactory as a diving boat. It lacks the maneuverability essential for close inshore operations where the greater portion of the diving must be done. Another boat, the Mollusk, was obtained from which the actual diving is being done, and the Broadbill is now principally used as a mother ship and to tow the diving boat to the scene of operation.

The Broadbill came from Patrol equipped with a Hudson Invader engine, which although supplying the necessary power to drive the heavy steel hull, unfortunately consumed a great amount of fuel, thus making any long runs impractical. The Hudson motor was replaced with a Chrysler Crown, 104 h. p., with reduction gear, which supplies sufficient power and cuts gasoline consumption to less than half.

Sea trials of the new motor revealed that several alterations were necessary on the external hull—namely, a larger rudder and a new skeg to support it had to be constructed and installed. Because of the reduced horsepower of the new motor, it was found advisable to change the pitch of the existing propeller; this resulted in an increase in motor revolutions with a subsequent increase in speed.

It was found that with some adaptations the Broadbill could be utilized for several types of marine research. A hydraulic system was installed to drive auxiliary equipment which would operate gear to be used in various investigations. The vessel has now a hydraulic winch which is used by the crab and dragging investigators, hydraulically driven salmon gurdies, and a hydraulic air compressor which can be used by the diver when conditions are satisfactory for diving from it. Since the boat was originally designed for operations in the Delta region, it was thought advisable to add several navigational aids that would be of value if the boat were to operate safely in the coastal waters. A radio transmitter and receiver, an automatic radio direction finder, an automatic pilot, and a Bendix recording fathometer were installed. The interior of the cabin was altered, additional bunks were installed, and the living accommodations in general were improved by the addition of shelves and lockers. The Broadbill now carries in reasonable comfort a crew of three and a biologist, and enough provisions, water, etc., for approximately a week at sea.

The Broadbill has been used by the crab investigation, working the waters off Bolinas Bay area and in San Francisco Bay. It has recently completed a trip to the North Coast region as far as Fort Bragg, where it was used in the abalone investigation as a mother ship for living quarters and to tow the smaller diving boat.

The department's newest research vessel, M. V. *Broadbill*. The *Broadbill* is 36 feet long, 15 tons net weight, powered by a Chrysler Crown 106 horsepower engine and has a cruising speed of approximately eight knots. The boat can be controlled from the topside (note wheel in crewman's hand) or from inside the cabin. Salmon gurdies and pulleys are visible at the stern. The *Broadbill* is used in the abalone, crab and salmon studies.

N. B. Scofield

The work at sea of the research vessel N. B. SCOFIELD during the biennium carried the vessel from the northern border of California southward along the coast to the Equator and offshore halfway to the Hawaiian Islands.

The basic versatility of the vessel suited her for use by many investigations, as follows:

Dates	*Operating Area*	*Purpose of Cruise*
May 15-July 20, 1950	Central California	Salmon tagging, trawl exploration
Aug. 23-Sept. 12, 1950	Southern and Baja Calif.	Albacore exploration
Sept. 28-Oct. 26, 1950	Central California	Trawl exploration
Nov. 3-Nov. 20, 1950	Central California	Trawl exploration
Jan. 15-Jan. 30, 1951	Offshore, Southern Calif.	Oceanographic survey
Feb. 13-Feb. 26, 1951	Southern California	Trawling exploration
March 2-March 11, 1951	Central California	Trawling exploration
April 5-April 18, 1951	Southern California	Rockfish investigation
April 19-May 16, 1951	Central and Northern Calif.	Salmon tagging
May 21-May 29, 1951	Southern California	Bass tagging
June 11-July 9, 1951	Northern California	Trawl exploration
Aug. 20-Sept. 19, 1951	Baja California	Tuna exploration
Oct. 9-Dec. 3, 1951	Central America	Tuna exploration
Jan. 18-Jan. 31, 1951	Baja California	Yellowtail tagging
Feb. 15-March 13, 1952	Mexico	Tuna tagging
April 7-May 7, 1952	Mexico	Tuna tagging
May 22-June 15, 1952	Baja California	Yellowtail tagging

Yellowfin

The work of the M. V. Yellowfin was devoted chiefly to the sardine investigations. She took part in some of the routine oceanographic cruises of the California Cooperative Sardine Research Program when detailed physical, chemical, and biological oceanographic data were collected. The remainder of her time was used in assessing the abundance of fish populations, chiefly sardine, off the coast of California and Baja California and in measuring environmental conditions where fish are found. Cruises made during the biennium were:

Date	*Locality*	*Investigation*
50-Y-7		
July 18-Aug. 4, 1950	Central Baja California	Assess sardine abundance
50-Y-8		
Aug. 14-24, 1950	Northern Baja California	Same as 50-Y-7
50-Y-9		
Sept. 5-22, 1950	Southern California	Same as 50-Y-7
50-Y-10		
Oct. 2-9, 1950	Central California	Same as 50-Y-7
50-Y-11		
Nov. 8-22, 1950	Southern California	Measure environmental conditions where sardines were found; food studies of jack mackerel and tag kelp and sand bass
50-Y-12		
Dec. 1-15, 1950	Central California	Measure abundance of sardine population and environmental conditions and food studies of sardine and jack mackerel
51-Y-1		
Jan. 9-19, 1951	Southern California	Same as 50-Y-12
51-Y-2		
Jan. 29-Feb. 10, 1951	Southern California	Same as 50-Y-12
51-Y-3		
Feb. 26-Mar. 9, 1951	Southern California	Same as 50-Y-12
51-Y-4		
Mar. 26-Apr. 13, 1951	Baja California	Same as 50-Y-12
51-Y-5		
Apr. 29-May 13, 1951	Baja California	Sardine fecundity studies and collect oceanographic data on inshore waters not covered by routine cruises
51-Y-6		
May 25-June 11, 1951	Southern California and northern Baja California	Occupy stations in routine oceanographic cruise
51-Y-7		
Aug. 7-13, 1951	Southern California	Measure environmental conditions and sardine and jack mackerel food studies
51-Y-8		
Aug. 20-Sept. 12, 1951	Central Baja California	Assess sardine abundance
51-Y-9		
Sept. 23-Oct. 12, 1951	Northern Baja California and Southern California	Same as 51-Y-8
51-Y-10		
Oct. 19-Nov. 8, 1951	Southern and Central California	Same as 51-Y-8

Date	*Locality*	*Investigation*
51-Y-11		
Nov. 18-Dec. 6, 1951	Southern and Central California	Occupy stations in routine oceanographic cruise
52-Y-1		
Jan. 7-28, 1952	Southern California	Conduct special oceanographic tests for measuring ocean currents
52-Y-2		
Feb. 11-Mar. 5, 1952	Southern California	Survey abalone beds and make jack mackerel fecundity studies
52-Y-3		
Mar. 19-Apr. 7, 1952	Baja California	Assess abundance of sardine and other fishes and measure environmental conditions
52-Y-4		
Apr. 15-27, 1952	Baja California	Same as 52-Y-3
52-Y-5		
May 12-23, 1952	Southern California	Assess abundance of sardine and jack mackerel and survey clam beds on the Channel Islands
52-Y-6		
June 1-14, 1952	Northern Baja California and Southern California	Occupy stations in routine oceanographic cruise

FISHERIES STATISTICS

The work of the statistical unit of the Bureau of Marine Fisheries has continued without interruption or radical change. In this interval the volume of catch and production have remained relatively constant, but the complexity of the work has greatly increased. Statistics on the commercial fisheries are shown in Appendix C.

To handle the increased volume of work the organization of the statistical unit has been extensively modified. Routines adopted in earlier years, adapted to those times, have been surveyed and where necessary, changed to conform to present and anticipated future conditions. Thus the system of compiling the voluminous sport catch records has been completely revised. An entirely new inventory system was instituted to maintain a detailed record of available and outstanding fish receipt books and their contained receipts. Likewise a fourth copy was added to each set of receipts so that dealers could keep a duplicate record of their fish purchases for branch-office accounting. The routine procedure followed in compiling and reporting the production of the processing plants was thoroughly reviewed and revised in the interest of accuracy and efficiency. Many of the forms in use have been changed and simplified.

Early in 1952 an entire routine was developed for the management of the incipient ocean shrimp fishery which was opened for the first time on April 1st. Provision was made to compile at two-weekly intervals the current catch in each region and transmit this data on prepared forms, with the individual receipts and accompanying logs, to the San Francisco office where the state-wide catch is kept up to date, so that the season could be promptly closed when the catch limit had been reached.

A new field office was opened at Eureka to meet the urgent need of closer contact with and better coverage of the important fisheries of the

To keep an accurate account of the State's fisheries is an extremely complex job requiring the services of a trained staff. This is the machine room of the statistical unit. The tabulating machine is in the foreground, with the sorter, key-punch and verifying machines against the walls. *Photo by Herb Phillips, San Pedro.*

north. The office selected was large enough to provide a local headquarters for other bureaus of the Department, with the result that there has been a unification of the activities of all concerned, to the benefit of all.

This reorganization of the work has entailed only a nominal increase in the staff. In the biennium two clerical positions and one supervisory position have been established and the total staff in the statistical unit now numbers 23. We have not had the full benefit of this number, however, because of an appreciable turn-over in help and the difficulty of securing competent, permanent employees. The supervisory position was requested in order to centralize responsibility for the machine operations.

A single major change in equipment has sufficed to accomodate the work. Both tabulating machines have been increased in capacity by the addition of 15 numeric type bars, 24 additional counters and a subtraction unit which gives us greater flexibility in the resulting reports.

A major improvement concerns the coordination of the statistical routines with the field offices, the field biologists and the patrol force. At a number of conferences statistical problems have been presented and discussed with patrol, laboratory and office personnel and their interest and cooperation elicited. As a consequence there is now better integration of the work and the resulting record has improved considerably.

In the biennium three publications were issued by the statistical unit. Circulars number 25 and 26 present the annual statistics of fresh and canned fishery products, while Fish Bulletin No. 80 presents the complete commercial fish catch for the years 1948 and 1949. A historical record and a complete description of current statistical routine is in process of compilation and will be published in a forthcoming bulletin.

In the preparation of the Fisheries Treaty with Japan this unit supplied an analysis for the yellowfin tuna and skipjack fishery for the guidance of the U. S. representatives. Likewise during the recent tariff hearings concerning the importation of canned and frozen tuna, the statistical unit compiled and supplied the most authoritative statistics on the domestic catch and the importations of tuna into California.

These changes in equipment, routine and organization within the statistical unit have adequately adapted it to the work of the immediate future. Present policies, with slight additonal reorganization, will continue. An increase in the staff assigned to the analysis of the catch records would increase greatly the value of the statistics. While it will remain the primary function of the unit to make available to the separate biological investigations an analysis of the catch records of these species, no additional work of this nature can be undertaken until projects now in progress have been completed. Current problems requiring immediate action have delayed the analytical work, and prevented us from maintaining a more complete current analysis of the commercial species.

SCREENS AND LADDERS

The fish screen and ladder program has been expanding steadily. Two panel trucks equipped as mobile repair shops are working out of the stream improvement headquarters at Elk Grove. All necessary power equipment to do wood or metal work is available at this shop.

At present, the most successful type of screen appears to be a series of vertical perforated plates set in the stream channel at an angle above the canal heading. These plates are cleaned by parallel vertical bars which move back and forth along the face of the screen. As the water flow passes the face of the screen at an angle, debris dislodged by the wipers passes on down the stream.

In the past, much friction with the water diverters existed due to the necessity of operating a bypass to permit fish to get from the ditch back to the stream. Wherever we can eliminate the need for a bypass, better relations with the water users are possible. These new screens are prefabricated as far as practicable at the shop, which reduces the amount of field work necessary. This style of screen was developed by Mr. E. Murphey of the department's shop at Yreka. Experimentation is now going on to develop a hydraulic system powered with a water wheel to operate the cleaning mechanism for this type of screen.

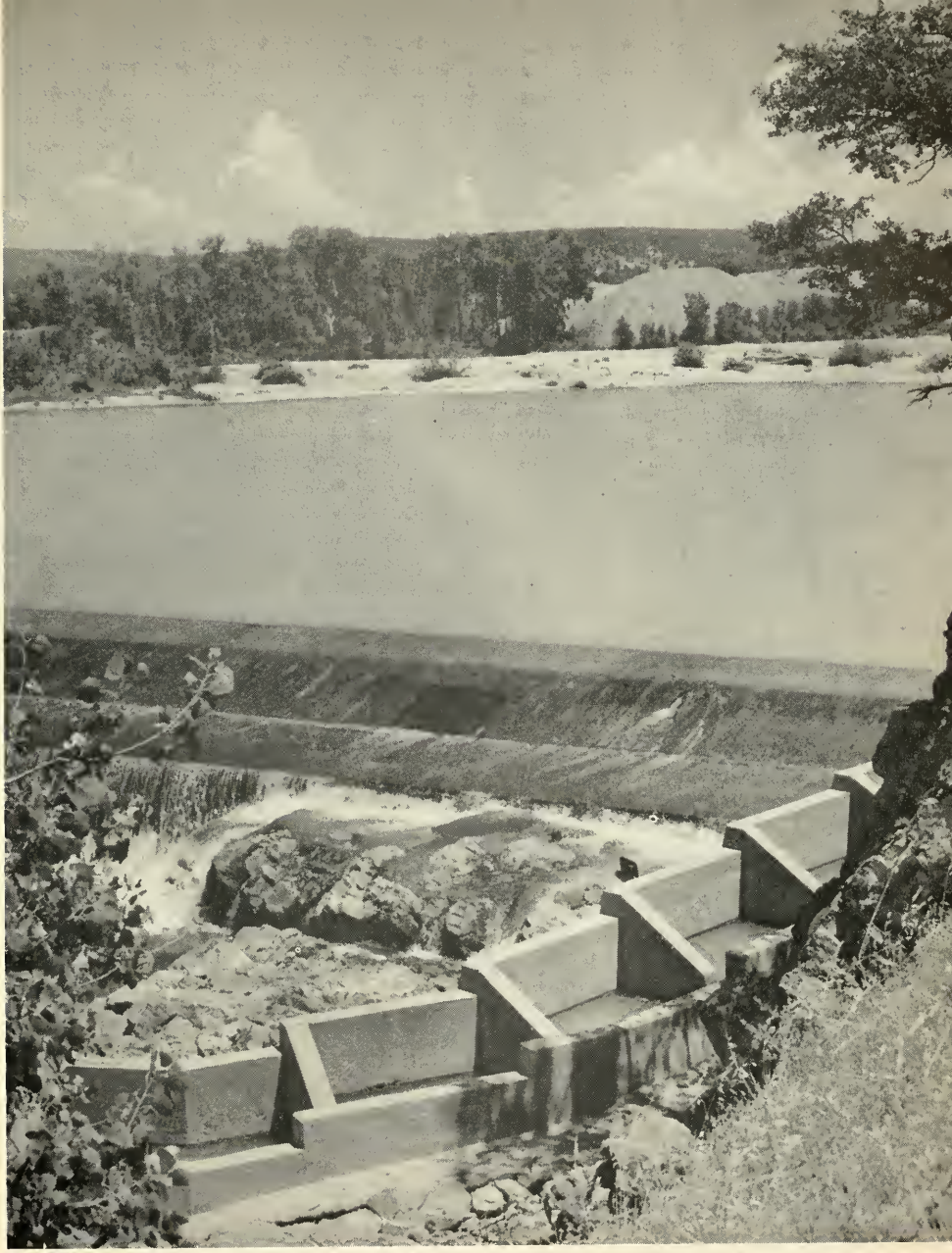
Construction of a large steam-powered electrical generating plant at Antioch by the Pacific Gas and Electric Company brought up a serious problem. The flow of cooling water for this plant was found to be diverting large numbers of small fish out of the river. However, an immediate attack was made on the problem by the Bechtel Corporation acting for the Pacific Gas and Electric Company. A test flume was set up where experiments were run on the small fish of several species. These tests

determined the maximum velocity at which small fish could keep clear of a screen and also their ability to recover after being caught against a wire mesh by fast flowing water. At the same time various bypass arrangements were tried to recover the fish from the intake wells leading to the power plant. A new type of trash pump built by the Fairbanks Morse Company was found to pass most fish up to 12 inches long without harming them. These experiments carried on at Antioch advanced tremendously the basic knowledge necessary for large fish screen construction. The experiments were conducted jointly by personnel of the Bechtel Corporation and the bureaus of fish conservation and marine fisheries.

Two new fish ladders were completed on the Daguerre Point Dam on the Yuba River which is located about 10 miles above Marysville. These fishways are being used by numbers of migrating fish to gain access to about 15 miles of largely barren spawning area.

A new fish ladder on the Sutter Butte Dam which is about 10 miles below Oroville was completed. Many salmon were observed using this fishway within a few hours of its completion. Funds were provided by the Wildlife Conservation Board both for this project and the Daguerre Point ladders.

Engineering surveys and plans have been made for fish ladders on Upper Deer Creek Falls and the McCormick-Saeltzer Dam on Clear Creek. Funds have been allocated for these projects by the Wildlife Conservation Board, but construction permission has not been cleared by all parties concerned. It is expected this work will be completed during the next season.



The Daguerre Point Dam blocked the salmon from 15 miles of spawning beds on the Yuba River until twin fish ladders were built with Wildlife Conservation Board funds. With ladders at both ends, the fish have no difficulty negotiating this barrier at any water stage. Sometimes a straight line fishway is effective, as at left; in other cases, the fish must follow a winding course.

The crews working out of the shop at Elk Grove have repaired several old or inefficient fish ladders. This work has been materially speeded up by the recent acquisition of trailer-mounted cement mixer, electric welder, and air compressor. These light but mobile units greatly facilitate the work on out-of-the-way jobs.

UNDERSEA OIL EXPLORATION

By mid-July, 1949, the commission had terminated, until 1952, the permits for the use of explosives in marine underwater oil explorations, due to fish kill. As a result the oil companies sought for new methods which would permit continued exploration without killing fish. In March, 1951, the commission granted a permit to the Union Oil Company to conduct experiments with various explosives. These experiments were directed by Scripps Institution of Oceanography with a representative from the Bureau of Marine Fisheries present at all times. Former explorations had been made with dynamite and further experiments with this explosive did not result in decreased fish kill. Further experiments showed that black powder, however, killed practically no fish and gave satisfactory seismic records for the oil companies.

Consequently, in September, 1951, the commission again issued permits for oil exploration with black powder and the work has continued with almost no kill of fish. In June, 1952, our diver biologist conducted underwater observations before and after test shots were fired. He found that the explosions did not harm numerous rockfish in the immediate vicinity of the shots. It thus appears that two of California's major industries, oil and fishing, can be carried on side by side without injuring or hampering either activity. A representative of the Bureau of Marine Fisheries continues to observe all oil explorations work with the oil companies refunding to the Fish and Game Preservation Fund the cost of such observations.

MARINE RESEARCH COMMITTEE

This committee was created by the California Legislature in 1947 and administers funds collected through a special tax. Until July, 1952, this tax comprised 50 cents per ton on all sardines landed in California. Since the latter date the special tax has been one dollar a ton on sardines, anchovy, Pacific mackerel, and jack mackerel due to action of the 1952 legislative session. Five members of the committee represent the fish processors, one the public at large, and the remaining three members are the President of the Fish and Game Commission, the Director of the Department, and the Chief of the Bureau of Marine Fisheries.

The committee helps to coordinate the work of the organizations carrying on sardine investigations and expends its funds to supplement their budgets. Until 1951 four agencies, California Academy of Sciences, California Department of Fish and Game, Scripps Institution of Oceanography, and United States Fish and Wildlife Service were engaged in the studies of the sardine and the oceanic waters where this fish occurs. Early in 1951 the Hopkins Marine Station of Stanford University joined in the investigations and is concentrating its work in Monterey Bay.

During the 1950-51 Fiscal Year the committee budgeted $129,550 to these agencies and in 1951-52, $138,000. A progress report of the research work was published in December, 1950, and a second report, covering the findings in 1951 and the first six months of 1952, was prepared and sent to press at the close of the biennium.

In the past three years the cooperative sardine investigations have accumulated much valuable data on physical, chemical and biological

conditions in the oceanic waters off the California coast. These data are being related to all phases of the life of the sardine and to all aspects of the fishery. In addition much information relative to other marine fishes is being obtained and similarly used.

PACIFIC MARINE FISHERIES COMMISSION

The Pacific Marine Fisheries Commission has continued to lead the way to the better conservation of Pacific Coast fisheries resources. The commission was formed in 1947 as the result of an interstate compact entered into by California, Oregon and Washington.

The objectives of the compact are to promote the better use of fisheries which are of mutual concern to the three states and to develop a joint conservation program. The fisheries research agencies of the three states act together as the commission's staff. Although membership in the commission is limited to California, Oregon and Washington, the fisheries departments of Alaska and Canada, as well as the United States Fish and Wildlife Service, participate in all meetings and their research programs are integrated into those of the member states.

The commission met three times during the biennium: at Bellingham, Washington, in July, 1950; San Francisco, California, in December, 1950; and Portland, Oregon, in October, 1951. In addition, the Research Committee held several meetings to plan the investigations sponsored by the commission and to formulate recommendations on regulations.

As a result of commission recommendations, the salmon troll fishery regulations have been coordinated the length of the Pacific Coast, not only in the three states but in Alaska and Canada also. As the biennium ended, the staff had under its consideration improved regulations for the trawl fishery and sablefish and further changes in the salmon laws, all on a coast-wide basis.

Commission-sponsored research programs include intensified investigations of the sablefish and trawl fisheries which are producing valuable results. Most sensational of the programs, both in scope and results, is the tagging and marking of salmon to determine the river sources of the coastal salmon supply. Thousands of adult salmon have been tagged from Monterey to Alaska and the recoveries have shown that the salmon move freely all along the coast. At the same time, millions of small salmon have been liberated in their native streams after being marked by fin clipping. The first year of expected recovery at sea was 1952, and already numerous marked fish have been observed by sampling crews at the various ports.

The migration studies on salmon have shown that fish from the Sacramento River enter into the catches of Canadian and Washington fishermen, and Columbia River fish move into many fishing areas. This proves that any water or hydroelectric projects on any important salmon rivers affect fishermen along all the coast. Hence the Pacific Marine Fisheries Commission has played an active role in insisting that the preservation of fishery resources be taken into account in project planning. A representative was sent to Washington, D. C., to testify before the Federal Power Commission in protest against a dam that would destroy the salmon

runs in the Cowlitz River, Washington. A representative also testified at a hearing concerning a proposed dam on the Deschutes River, Oregon, in accordance with a resolution opposing the dam.

The Federal Security Agency granted the commission funds to conduct a study of the effect of pulp and paper mill pollution on young salmon and the organisms on which they feed.

A representative of the commission was a member of the United States delegation that negotiated the North Pacific Fisheries Treaty with Canada and Japan in Tokyo during November and December, 1951.

Most important contribution of the Pacific Marine Fisheries Commission has been to bring together the fisheries administrators, research workers and fishing industry advisers to discuss and solve their mutual problems. Although much has been accomplished in the first few years of operation, a great deal remains, but we are confident that improved interstate and international relations have resulted already. And all can agree that the conservation of Pacific Coast fisheries is making progress.

FEDERAL AID IN FISH RESTORATION

(DINGELL-JOHNSON)

In telling you the story of our Dingell-Johnson program we are going to describe a group of seemingly unrelated and diverse fisheries. However, in California fishing *is* diversified. One can fish for golden trout in lakes 12,000 feet high; or for channel catfish in the Imperial Valley at 200 feet below sea level. On our northern streams the steelhead angler wades the broad riffles or dunks his bait in a likely hole. In Southern California, yellowtail fishermen jostle for space at the rails of the ocean party boats, while the solitary surf fisherman may cast his line almost anywhere along a thousand miles of coast.

Here is a state famed for its recreational resources, and still regarded —even by most of its native sons—as a bountiful land where every fisherman should be able to tap this resource and get his limit. Actually, we are a state where the population has doubled in two decades, where the angling pressure has skyrocketed, and where our fishing waters are fast being decreased through the economic encroachment of industry, pollution, hydroelectric plants, and irrigation diversions. What, then, should such a state do when new federal aid funds suddenly become available?

Such funds did become available to us in 1951 as a result of the Federal Aid in Fish Restoration Act which had been passed by Congress in August, 1950. Better known as "Dingell-Johnson," this act was designed to finance cooperative programs with the states to investigate and manage their sport fisheries. The funds are derived from a 10 percent excise tax on fishing tackle: rods, reels, flies, lures, baits and creels. The moneys are then allotted to the states in direct proportion to their size and the number of fishing licenses they sell.

By a state enabling act (Ch. 1173, Stats. 1951) the State of California assented to the provisions of the federal act, and the Fish and Game Commission was authorized to conduct cooperative fish restoration projects. The Federal Government pays 75 percent of the project costs; the State 25 percent.

Our actual apportionment for the first fiscal year (1951-52) was not known until October 9, 1951. We then received $128,745.53 to which the State added $42,915.17, giving us a total of $171,660.70 for the first year of operations. The funds were allocated to our two fisheries bureaus: Fish Conservation and Marine Fisheries. An over-all coordination was established. The Department of Fish and Game had started its D-J program.

Our first question was, "How can we best use these funds?" Should we utilize the moneys for routine surveys or for over-all evaluations of fisheries problems—as some states have done? We thought not. Most aspects of such work had been well under way for some years. While valuable, this would merely be more of the same. Should we quickly dissipate our funds by the construction of a few artificial lakes or some

similar investments? Again, we thought not. Unlike most states, California has had available to it for some years several millions of dollars, derived from pari-mutuel or racetrack funds, for use in capital investment projects for fish and game. With these funds (and in addition to their use for game projects) the State Wildlife Conservation Board is constructing hatcheries, fishways, flow maintenance dams, and artificial lakes. The addition of D-J funds for such purposes would be insignificant.

We decided therefore to complement—rather than supplement—our existing program by concentrating on certain research and developmental projects which would fill in some major gaps. These are jobs which we had needed to do for some time, and the contribution of federal aid would now enable us to do them.

The oldest D-J project is only six months old; the youngest only three months. Obviously we do not have a long list of accomplishments. We shall simply describe the background of each current project and then explain what we are doing and intend to do. Two years from now we shall be able to give you a much fuller report on what has been accomplished.

THE PROJECTS

Project F-1-R—Study of the Yellowtail Fishery

This is one of the few D-J projects in the Nation devoted to the betterment of an ocean fishery, and it is certainly one of the most extensive ones. The yellowtail (*Seriola dorsalis*) is the largest carangid or jack found in California, and is one of our most prized sport fishes. While generally less than 15 pounds in weight it has been known to reach 80 pounds, and anglers will travel hundreds of miles to fish for

One of the most important features of the yellowtail study (Dingell-Johnson Project F-1-R) is the tagging program which is designed to give information on the migrations of these fish. Here a specimen is being marked aboard the department's research vessel *N. B. Scofield.*

it. Once plentiful along the entire Southern California coast, it is now seldom taken except in the San Diego area.

Since it is a commercial as well as sport fish, our Bureau of Marine Fisheries has made some catch analyses. These, as long ago as 1933, have indicated a decline. More recent studies of the sport catch have also shown a downward trend.

Following the first analyses the State began to restrict the commercial catch by regulating seasons, gear, size, and quantity of catch. Despite these restrictions the downward trend has persisted; apparently they have failed. These regulations are actually based on a very meager knowledge. We do not know if they are really compatible with the biology of the species or if they are well designed to give us the highest sustained yield. We must first work out the life history of the yellowtail. For example, we need to know whether we are entirely dependent upon resident fish or whether they move from areas of abundance to our own heavily fished grounds. Their size at maturity, spawning season, and fecundity should be determined, and their spawning and nursery grounds should be discovered. Their age and rate of growth should be known. The relationship between oceanographic conditions and their abundance is important.

Towards such ends does the project move. We plan to tag at least 10,000 fish, and as preliminary work are devising suitable tags and techniques. The Fish and Wildlife Service in cooperation with the University of Washington has tested the staying qualities of various tags in their water tunnel. Other tests are being run in aquaria at the Scripps Institution of Oceanography. Three sea voyages have already been made to Baja California to tag yellowtail under field conditions.

Project F-2-R—A Study of the Catfish Fishery of California

Catfish were introduced into California in 1874. Through successive transplants and other introductions we now have five species established: three bullheads (*Ameiurus*), the channel catfish (*Ictalurus punctatus*), and the white catfish (*I. catus*), which is probably the most abundant of all.

As early as 1880 the State decided that they were so numerous and so well distributed that the Fish Commission should turn its attention to some "other equally valuable fish." At the same time, however, there were frequent criticisms of these newcomers by an articulate public which claimed that the "hated catfish" would destroy our native fish and which even disallowed the edibility of these "old toughs."

The early antipathy has been softened by passing years and few today would term them "hated." In fact, the sport fishery is now one of the most important in California. In 1948, for example, it is estimated that more than a quarter million anglers fished almost two million days for catfish and caught more than five and a half million. Sport fishing is concentrated in three areas: the Sacramento-San Joaquin Delta (where about 50 percent of the catch is made), in Clear Lake, and along the Colorado River. However, there is hardly a county in the State where catfish are not to be found.

Tagging catfish was one of the first steps in Dingell-Johnson Project F-2-R. It is being done to determine migrations, to estimate fishing pressure and to obtain information about growth rates.

A commercial fishery, primarily for white catfish and using fyke nets, is also centered in the delta region. In recent years there have been decided increases in the size and number of nets used and in the number of fishermen. The landings have fluctuated quite widely, being around 400,000 pounds in 1951.

There is now evidence of a general sort that the fishery has declined. A real possibility exists that the species are being overfished by the combined commercial and sport fishery, but adequate data are not at hand either to substantiate or refute this hypothesis. Various forms of restrictive regulations (such as setting of size limits, seasons, and control of gear) are continually being proposed. Again, we simply do not have enough factual information to evaluate either the need for, nor the usefulness of, these or other measures.

In addition to the need for adequate information on possible depletion, and life history information which can be used for management, we need to evaluate the effect of environmental changes caused by economic encroachment. These include pollution and the effect of stream diversion and impoundment.

Our D-J project is now concentrating on the collection of such information. We have started a tagging program intended to tag about 10,000 fish over a three-year period in order to determine movements, estimate fishing pressure, and obtain information on growth rates. During the first six months we tagged 3,466 catfish in the delta and had 73 tags returned. An over-all history of the fishery and past regulatory practices is being compiled. Life history material is being collected. Catch records are being studied, and experiments on the effect of commercial gear will soon begin.

Water samples are taken from a high mountain lake by a back-country survey crew. Second Dinkey Lake, Fresno County.

Project F-3-R—Experimental Back-country Fish Management

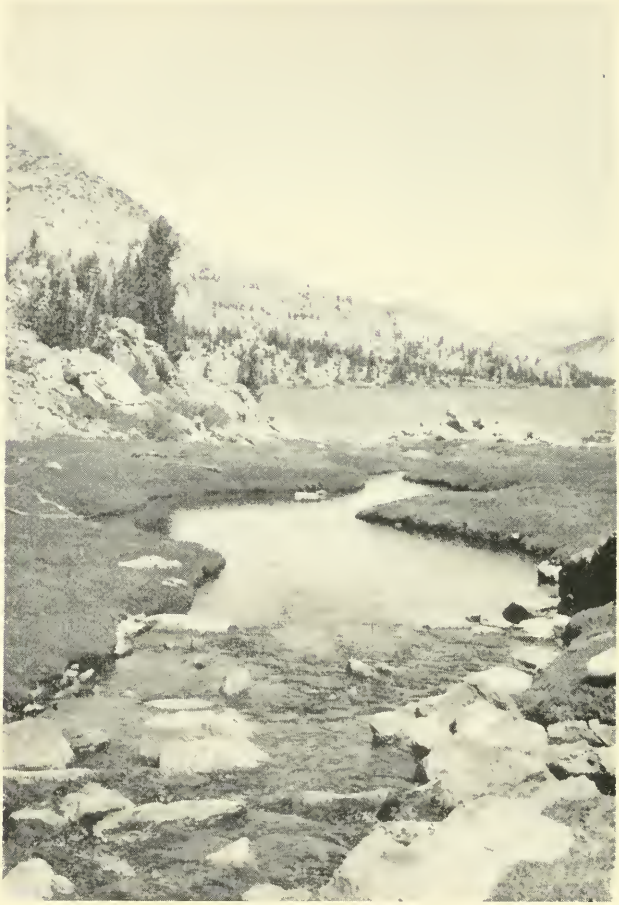
Unless one has flown over the Sierra Nevada ranges, or has spent months back-packing or traveling by pack train, it is impossible to realize that California contains several thousand high-country lakes. Usually clustered in groups, their average size is small; less than 10 acres in the southern Sierra, for example. They all lie at high altitudes, and most of them are accessible only by trail. Primarily of glacial origin, most of them were originally barren of trout because of their origin and because of waterfalls in their outlets, which prevented the natural ascent of fishes.

However, the majority have now been stocked with trout: especially eastern brook and rainbow, with lesser numbers of golden, brown, and cutthroat. The early planting was started by stockmen and has been carried on by sportsmen, wardens, and finally today by our hatchery crews.

The early workers expected natural reproduction to replace the stock and usually transplanted only a few individual trout. Later it was found that many of the lakes lacked suitable spawning grounds. This resulted in a rather heavy stocking program of fingerlings, but for many years it was a hit or miss program. Some waters were stocked too frequently; others went unstocked for years even after the population had died out.

In 1934 our first modern lake surveys were conducted by several parties of the then U. S. Bureau of Fisheries, and since that time routine initial surveys have been made of some hundreds of lakes by our own staff.

In 1945 we started the California management binder system. One of the major features of this system was to set up a "basic management policy" for each lake. The policy stated whether or not the lake was to be stocked and, if so, specified the species, number, size, frequency, and time of year. It also specified other measures, such as special regulations and the type of improvement work to be done.



Inlet to a high Sierra lake, Rose Lake, Fresno County. The improvement of such streams is a function of our experimental back-country fish management crew working on Dingell-Johnson Project F-3-R.

However, even in the case of waters for which we had good initial data on which to base a policy, we soon found that initial surveys were not enough for continuous management. Ten years after a survey had been made, some factor such as fishing intensity may have changed so much that the original yearly stocking allotment no longer provided good fishing. Or, our original choice of species or estimate of the number of trout to be planted may have been faulty and should have been changed. But, and this is one of our basic problems, we usually didn't know that the policy should be changed, simply because we hadn't visited the lake again and because no one had told us that the lake needed attention.

Now, if you have only a few lakes to manage you can check them frequently and adjust your management to changing conditions. But our problem lies in trying to manage hundreds of waters without having

adequate sources of continually incoming information, and without adequate proof that the management measures which we are taking are actually successful. At one time we at least had the help of observant fish planters who went in with packstock and often had time enough to collect information. But the airplane is now replacing the packtrain and we are thus losing one of our best sources of information.

We have worried with this problem for years, and have at last decided that the only way we can keep up with these changes—and vary our management program accordingly—is to have our own traveling crews make repeated appraisals of the waters and their populations. We can never begin to approach 100 percent efficiency; there are simply too many lakes and too little time. On the other hand a good many lakes will go along pretty well for many years simply by continuing our present management. Such lakes need be visited at only infrequent intervals and we can concentrate on the others. Furthermore, very rapid inspections will often suffice and a man may have to spend only a few days in any one lake basin. The establishment of a closer liaison with packers, certain key sportsmen, and our own wardens can also give us a great deal of information.

Our F-3-R project is designed as a pilot project to evaluate the success of current management and to work out systems for the rapid evaluation of "how a lake is doing." At the same time—since the men are on the spot—we intend to carry out minor stream and lake improvement, mostly of the sort for which only hand tools need be used.

As methods are developed, we plan to place our original men in other areas to act as instructors. Eventually, the entire work should be turned over to the local regions and it will become management in a true sense.

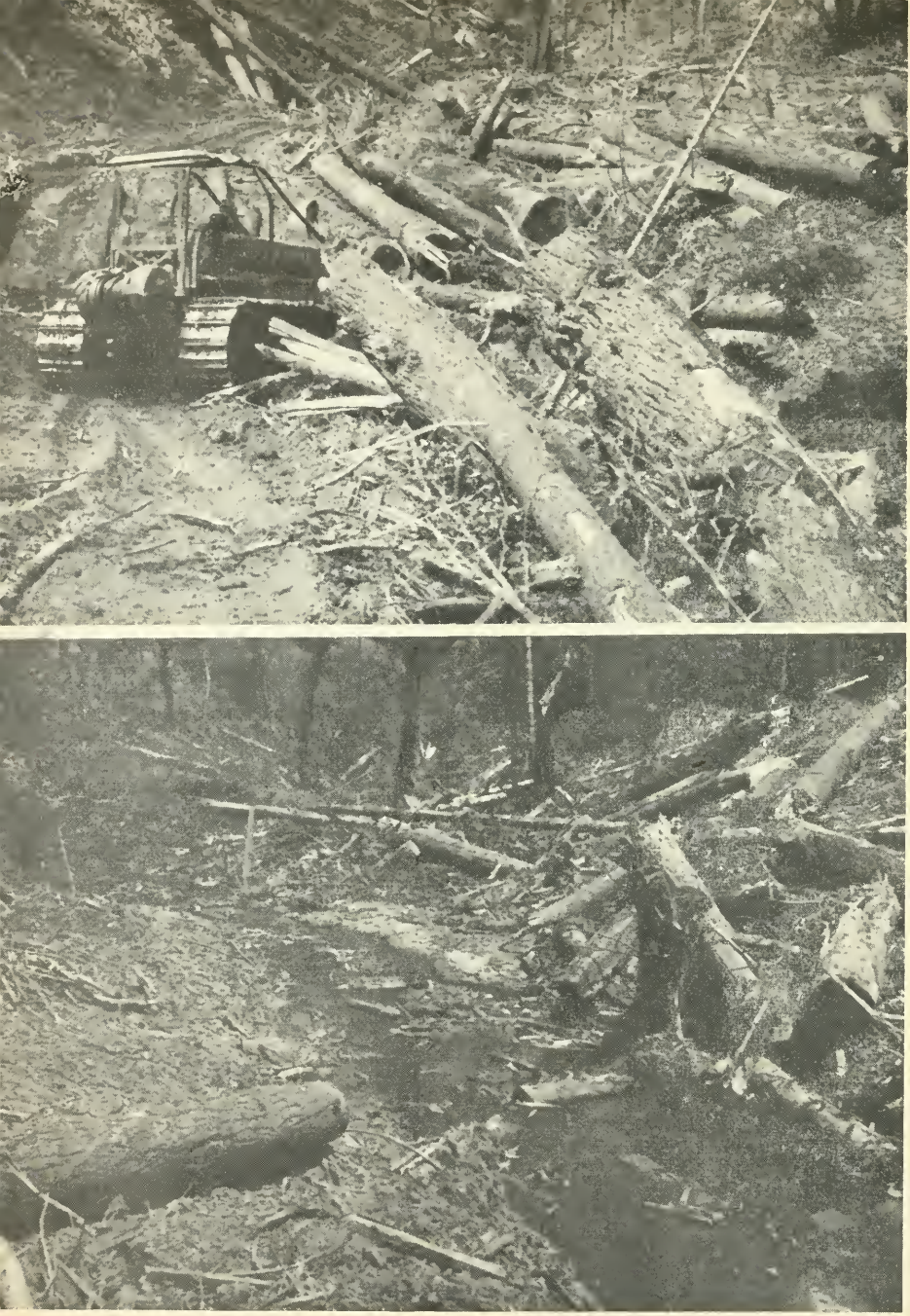
Many of these areas already receive comparatively heavy use. Furthermore, the economic development of the State is quickly lessening the value of or destroying our more accessible waters. These back-country lakes and streams may well constitute the bulk of California's trout fishing waters in the future.

As the biennium closed this project had been in existence for only three months. The crew was busy checking lakes on the east slope of the Sierra.

Project F-4-D—North-Coastal Stream Restoration and Improvement

The north-coastal streams of California support runs of several species of anadromous salmonids: primarily king and silver salmon, and steelhead and cutthroat trout. Artificial propagation is considered to be of little value in supporting these runs. If sufficient escapement from fishermen is provided (through regulation), the habitat kept intact or restored, and free access to and from the spawning grounds assured—the runs should be self-sustaining.

These are the primary bases upon which our anadromous fish program is established. Unfortunately, both natural and man-made barriers (such as dams) block or impede migration. Recent activities of man, especially lumbering, have created log or debris jams which block the streams and do not allow full utilization by spawners, and have caused abnormal



Poor logging practices leave a stream in the condition shown at the top. Blocked by logs and debris, it is impossible for salmon and steelhead to ascend. This is Bear Creek, Mendocino County, in April, 1952. Below is same area in June, 1952, after the channel had been bulldozed clear of debris. Such work forms part of Dingell-Johnson Project F-4-D, North-Coastal Stream Restoration.

erosion which fills in pools, spoils spawning grounds, and hastens the closure of stream mouths during low water. Some stream beds have been widened excessively through floods or channel shifts. Water temperatures have increased. Insufficient flows have impeded migration and caused fish losses in dried-up or cut-off pools.

In order to remedy the situation, we have started a developmental project with the following objectives: (1) to remove barriers; (2) to improve flows; (3) to improve habitat and spawning areas; (4) to salvage stranded fingerlings and return them to safe waters.

At the present time we believe that the removal of natural barriers such as waterfalls may be the most profitable. Some of these have always blocked the runs of fish; others are the result of fairly recent landslides. One such barrier which we intend to remove will open up 84 miles of new stream on the Mad River.

A rather difficult part of the work will be the removal of heavy log jams. Some of these are a thousand feet long and contain logs up to eight feet in diameter. Bulldozers, high lines, dynamite, and possibly fire will be used.

A new California law (Sec. 482.5 of the Fish and Game Code) passed in 1951 requires removal of log jams and other types of obstructions by the persons causing them. We plan to remove only those barriers the responsibility for which cannot be fixed. For example, some log jams are known to have been in existence for 40 years and it would be difficult to find the "owners."

During the four months that this project has been in operation, surveys have been made of numerous streams reported to need barrier removal. A log jam on Larabee Creek, Humboldt County, was blasted out. Logs and debris on McDonald Creek, the stream tributary to Stone Lagoon, were removed. Most notable was the removal of the main log barrier in the North Fork of the Mad River block, assuring access to 16 additional miles of spawning stream.

Flows can be improved by narrowing and deepening of channels and by the consolidation of tributaries and distributaries. Such work is planned for the Eel River in late summer.

By the end of June, 1952, the D-J crew had already rescued over 40,000 steelhead and silver salmon. Fish rescue or salvage work by netting is a well-established practice in California. A new wrinkle this year was the experimental use of fish traps for the same purpose.

The area intended for development extends from the Oregon border to well south of the Golden Gate, but most work will be concentrated in the northernmost area. Preliminary estimates indicate that it may take about ten years to accomplish the major restoration.

Project F-5-R—Surf Fishing Investigation

Surf fishing is readily available to the masses of people living along the coast, especially in Southern California, and is an increasingly popular low cost sport. Anglers claim that as their numbers increase, their catches are decreasing. However, surf fishing is a very personalized sport. The fishermen tend to be individualized, are often rather solitary,

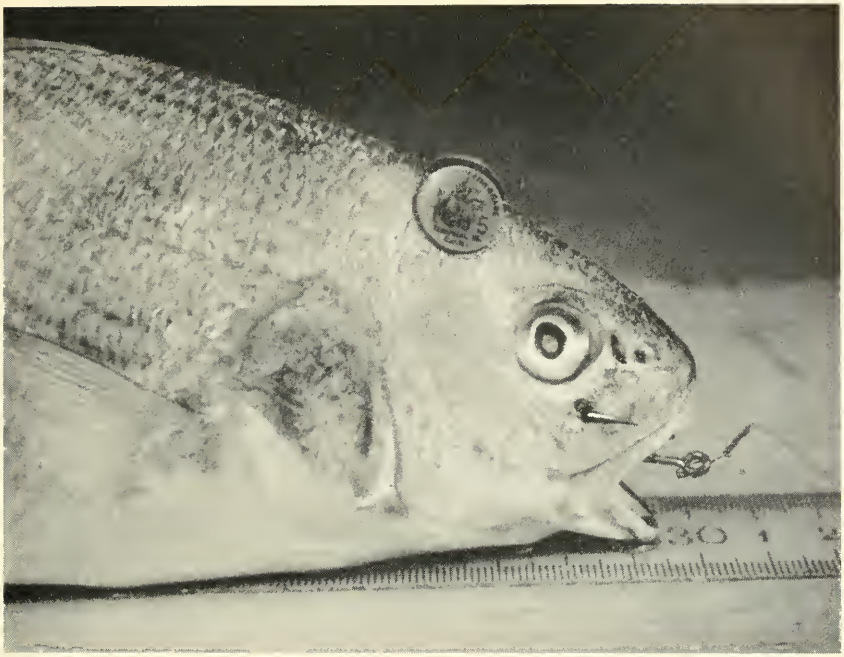
Fish for tagging and for laboratory study are caught in beach seines by the staff of the Surf Fishing Investigation, Dingell-Johnson Project F-5-R. Unwanted specimens are returned to the water alive. A tagging table stands in the left foreground.

and their comings and goings make it difficult to collect catch statistics or to follow the progress of the fishery. As was pointed out before, they may be scattered along a thousand miles of coast which adds to the difficulties of an inventory.

We know very little about the quality or quantity of the catch. We know very little about the biology of the major surf species. Until we gain a better knowledge of these and the influence of environmental conditions on the catch, we are in no position to evaluate the fishery or to recommend measures for improvement.

The principal species sought include: California corbina (*Menticirrhus undulatus*), yellowfin croaker (*Umbrina roncador*), spotfin croaker (*Roncador stearnsi*), opaleye (*Girella nigricans*), and barred perch (*Amphistichus argenteus*). The project plans to study the life histories of these and other species and to determine their abundance. Catch statistics will be obtained and fluctuations in fishing success will be measured. Of necessity, such statistics will have to be obtained largely through voluntary returns from individual fishermen and clubs, and so far the response has been excellent. Several hundred record books have been distributed and good returns are coming in.

Through such studies as these and an attempted correlation with environmental conditions, we may be able to provide answers to the problem.



A yellowfin croaker recaptured after two months, 1½ miles from the place it was released. The fisherman sent in not only the fish but also the hook that caught it. (The ruler is marked in centimeters.) The tag consists of two plastic disks held by two nylon lines. This species is tagged through the top of the head where a bony ridge holds the nylon line firmly in place.

THE FUTURE

One of the most important projects to get under way during the next biennium will be a detailed study of the effect of water diversions on salmon and steelhead trout in the Central Valley. Other projects have been proposed. Some are very worthwhile and will become realities as soon as moneys become available. They, too, will fill further gaps in our knowledge, and help develop California's fisheries program.

BUREAU OF GAME CONSERVATION

During the biennium the Bureau of Game Conservation carried on the usual routine matters of maintenance of waterfowl refuges, investigation and control of game depredations, trapping and transplanting beaver, game range examinations, maintenance of winter deer ranges, raising and stocking of game birds, and conducting of field trials. The more important developments such as operation of waterfowl management areas, cooperative hunting areas, Wildlife Conservation Board projects, Pittman-Robertson projects, and the conducting of special hunting seasons are given more in detail further along in this report.

Other happenings of note included the severe winter of 1951-52 in the Sierra mountains and the northeastern part of the State. Heavy losses of deer occurred in some sections, but in general these losses were in areas where large surpluses of deer existed, and the number of animals was out of balance with the carrying capacity of the winter range.

Management of waterfowl in the Pacific Flyway was helped by the organization of the Pacific Waterfowl Flyway Council. This group made up of representatives of the western states will work with the U. S. Fish and Wildlife Service in setting hunting seasons and solving the various waterfowl problems in the flyway.

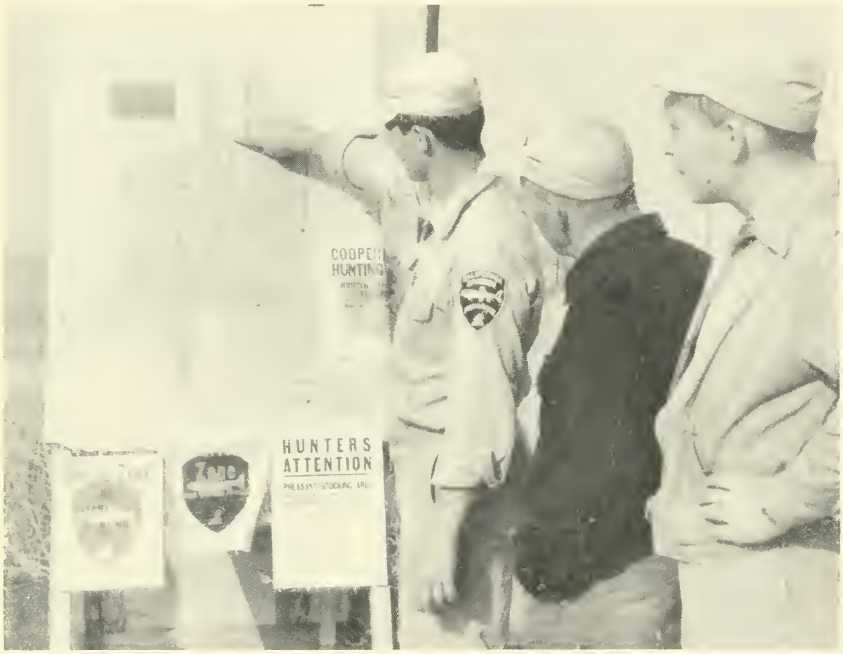
Publications by staff members are included in Appendix H.

COOPERATIVE HUNTING AREAS

The cooperative hunting area program which was initiated in 1948 was greatly expanded during the past biennium. This program was undertaken to furnish California's unattached hunter with lands upon which to hunt pheasants. An experimental pheasant study area, the Sartain ranch, organized by bureau game biologists, was instrumental in the development of regulated hunting on private lands in California. Hunting on this ranch was successfully controlled in 1947 and 1948 by the bureau in cooperation with the landowner. The experience gained during these two years led to the development of a cooperative hunting plan in 1949. During that year Senate Bill No. 667 establishing cooperative hunting was passed by the State Legislature and was included in the Fish and Game Code as Section 1159. Rules and regulations for the management and control of these areas were then drawn up by bureau employees and adopted by the Fish and Game Commission.

In order to minimize the problem of supervision and control, and at the same time to accommodate a large number of hunters, it was required that on any prospective area a minimum of 5,000 acres in a continuous tract be open to public hunting. A provision was made to allow the landowner to collect a daily fee not to exceed $2 per hunter if he so desired, with the stipulation that 25 percent of the total collected was to be used for wildlife maintenance and habitat improvement. Three types of zones were provided for in 1949: closed zones (for protection of crops, buildings and livestock) on which no hunting was permitted; restricted zones, on which permission to hunt was granted solely by landowners; and open

zones, which were open to public hunting by permit. Restricted zones were limited in size to 20 percent of the total area; open zones had to be either a 5,000-acre tract or 50 percent of the entire cooperative hunting area, whichever was larger. The maximum number of hunters allowed at any one time was one per five acres of open land, with the stipulation that the number of hunters could be decreased as conditions warranted.



These hunters, ready to make use of a cooperative hunting area, are being briefed by a checking station attendant, who shows them an area map and the signs designating various zones.

During the 1949 pheasant hunting season, six cooperative hunting areas were established by the bureau. By maintaining checking stations on each area, bureau personnel were able to control hunting, issue permits, and gather pertinent information regarding the pheasant kill. These six areas provided 58,450 acres open to hunting and accommodated 41,166 hunters. By 1951 the program had been expanded to 11 areas with 115,835 acres and 54,701 hunters accommodated. This type of hunting has found favor not only with the hunters, but the landowners have also indicated satisfaction with the plan. Further expansion of the cooperative hunting area program is contemplated. Table 1, Appendix D, lists the areas with the amount of land open to hunting, and it shows the number of hunters using these areas and their hunting success.

WATERFOWL MANAGEMENT AREAS

The program to furnish the unattached hunter with a place to shoot, and to provide waterfowl with areas where they could feed and rest was considerably expanded during the biennium. The number of acres open

Hunters being registered at a checking station prior to shooting on a waterfowl management area. The state waterfowl areas supply hunting opportunities to the unattached sportsmen.

to hunting was increased from 10,105 in 1949 to 15,939 in 1951. During the same period the number of hunters accommodated on these areas increased from 2,834 to 21,708. Most of the expansion in this program can be attributed to the addition of three new areas, which include Grizzly Island, Colusa and Merced. Grizzly Island, an 8,600-acre area purchased with Wildlife Conservation Board funds, is the most recently acquired

state-owned area. The Colusa and Merced areas are Federal Lea Act lands under state control for hunting purposes.

Development of the state-owned areas is carried on by bureau personnel and includes construction of roads, dams, levees, ponds and canals. Water control structures have to be installed; wells drilled where needed; and some land has to be leveled. Management practices on the areas vary with the locality, but all are carried on to attract waterfowl. Regardless of where the area is located, its crops and physical features will resemble that of the adjacent crop lands. All of these crop lands will draw in waterfowl, but the management area with its absence of revolving lights, grenades and gun fire, offers an invitation that is readily accepted by the birds.

Portions of each of these areas are open to hunting. Hunters are offered their choice of two types of shooting grounds as follows:

1. Fully developed areas with blinds for a fee of $5 per shooter.
2. Partially developed or natural areas with no blinds and no fee.

Hunting success varies with weather conditions and the waterfowl migration, but on the whole hunters expressed satisfaction with the plan. The waterfowl management areas and the extent of their use by hunters are listed in Table 2, Appendix D.

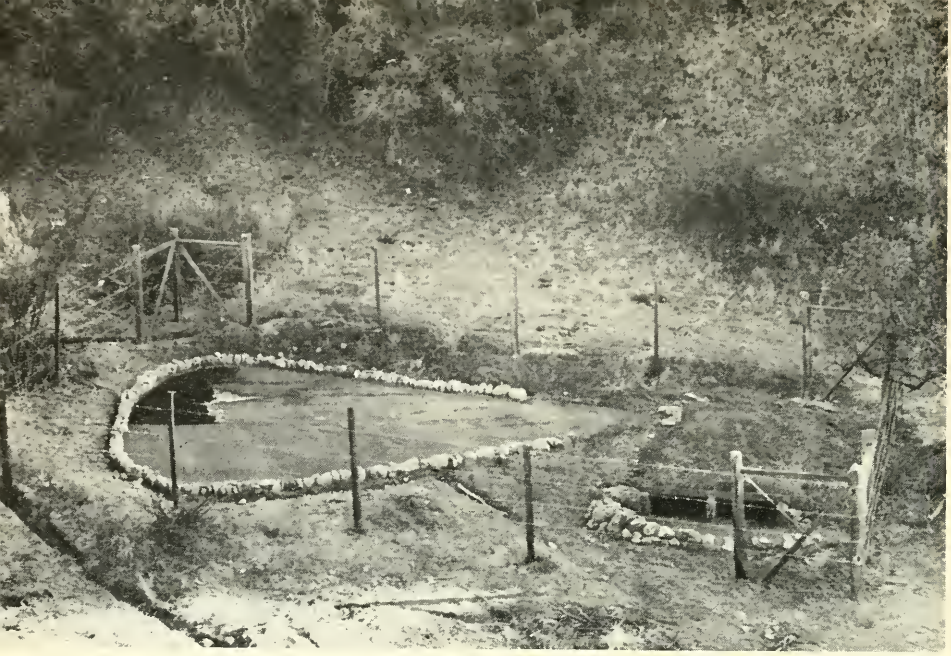
WILDLIFE CONSERVATION BOARD PROJECTS

The Wildlife Conservation Act authorized by the 1947 State Legislature provided for a recreation program, and for the acquisition of lands and construction of facilities for the propagation and conservation of wildlife. The Legislature also provided for the creation of the Wildlife Conservation Board to formulate a conservation program. Once the plans for state-wide projects had been drafted, it became the responsibility of the Department of Fish and Game to put the program into effect by constructing, operating, managing and maintaining the projects. All projects that entail game conservation activities are administered by the Bureau of Game Conservation.

Originally the Wildlife Conservation Board was to operate for a period of three years, but operations have been extended so as to complete the program. Listed below with their current status are the projects being managed by the bureau.

Game Farm Projects

Project No.	*Name, location*	*Status*
519–7	Chico Game Farm (Butte County)	Project completed. Accounts closed with end of 1949-1950 Fiscal Year.
519–8	Marysville Game Farm (Yuba County)	Project completed. Accounts closed with end of 1949-1950 Fiscal Year.
519–9	Porterville Game Farm (Tulare County)	Project completed. Accounts closed with end of 1949-1950 Fiscal Year.
519–10	Brawley Game Farm (Imperial County)	Project completed. Accounts closed with end of 1949-1950 Fiscal Year.



To provide water for quail in otherwise suitable country, the department has built numerous "gallinaceous guzzlers." The apron collects rain water for storage in an underground tank at lower right.

Quail obtaining water at mouth of the guzzler tank. No quail hunting was available in this area before the installation of this device.

Other Upland Game Projects

Project No.	*Name, location*	*Status*
549	Coast Counties Quail Habitat Improvement (Central Coast Counties)	Project completed. Merged with No. 554.
503	Desert Quail Development (Desert region of Southern California)	Project completed. Merged with No. 554.
521	Owens Valley Pheasant and Quail Development Areas (Inyo County)	This project has been canceled due to opposition by lessees on City of Los Angeles lands. Project funds of approximately $45,000 have been restored to working balance of WCB.
554	Quail Habitat Development (all of California south of U. S. Highway 40, with major emphasis south of the Tehachapi)	Equipment, materials and supplies for this project are purchased by WCB. Salaries, travel and vehicle mileage are paid from federal aid in wildlife restoration funds. As of June 30, 1952, 1744 "guzzlers" were completed, numerous brush piles were constructed and springs developed for quail use.
515	Doyle Winter Range (Lassen County)	Project completed.

Waterfowl Projects

Project No.	*Name, location*	*Status*
507	Butte Sink Waterfowl Management Area (Colusa County)	Area not yet acquired. Acquisition in hands of Public Works Board.
550	Delta Waterfowl Management Area (Solano County)	Land purchased March 30, 1950. Equipment ordered. Supervisory personnel hired. Federal aid development project California 40D approved effective July 1, 1950.
523	Honey Lake Waterfowl Management Area (Lassen County)	Project completed. Further developments currently being made with federal aid funds. (California FA 38-D-2.)
536	Imperial Waterfowl Management Area (Imperial County)	Project completed. Further developments currently being made with federal aid funds. (California FA 36-D.)
548	Lower Butte Creek Waterfowl Management Area (Butte County)	Area not yet acquired.
506	Lower San Joaquin Waterfowl Management Area (Merced County)	Area not yet acquired.
522	Madeline Plains Waterfowl Management Area (Lassen County)	Project completed. Further development with federal aid funds.
532	Madera Waterfowl Management Area (Madera County)	Area not yet acquired.
551	Upper San Joaquin Waterfowl Management Area (Kern County)	Area not yet acquired.
72	Ramer Lake Public Fishing Area (Imperial County)	Development of warm-water fishing lake by construction of proper dikes and deepening to provide approximately a 275-acre lake. The boat landing ramp and anchors are completed. Roads and dikes are under construction and water controls being installed. Since this project is on the State-owned Imperial Waterfowl Refuge, it is being administered by the Bureau of Game Conservation.

To provide ponds for waterfowl often requires construction of levees on management areas. Such work requires the use of heavy equipment.

GAME INVENTORY POLLS

The same procedure that was used in 1948 to determine the state-wide game kill was used again during the past biennium. This process, as recommended by the Opinion Research Center of the University of Denver, consists of taking a 2 percent random sample of hunting license buyers and mailing each hunter selected a double post card questionnaire. The number of cards returned from this sample are divided into the number of hunting licenses sold to obtain the correction factor that is used to determine the state-wide kill figures. Listed below for comparison are the state-wide game kill figures for the years 1948-1950.

	1948	*1949*	*1950*
Pheasants	586,100	388,700	398,100
Ducks	3,077,000	2,282,800	1,966,300
Geese	356,000	254,900	229,400
Quail	1,714,391	1,132,800	1,129,100
Doves	2,572,400	1,886,300	1,756,200
Band-tailed pigeons	314,800	88,300	178,400
Bears	2,112	2,950	5,700
Cottontail and brush rabbits	597,300	357,900	304,400
Jackrabbits	875,400	573,900	683,200
Tree squirrels	74,200	21,100	45,000

It will be noted that for most species the 1950 kill figures approximate those for 1949. Field reports indicated a better population of pheasants in 1950 than in 1949, but the kill was nearly the same for the two years, reflecting the unfavorable weather conditions that were experienced during the 1950 hunting season. The 1950 kill of band-tailed pigeons was double the 1949 kill, and reflects the larger pigeon flight that was noted in 1950. However, both the 1950 pigeon flight and resulting kill did not approach that experienced in 1948.

Data on California's deer kill are obtained from the deer tag report cards which are mailed in by successful hunters. The annual deer kill is shown in Table 4, Appendix D. As a check on the validity of the post

card survey each hunter sampled was asked to indicate if he purchased a deer tag. The actual sale of 1950-51 deer tags was 312,652 while the survey indicated a sale of 308,500 deer tags for the same period—a close correlation. Further checks with known data are being incorporated into future surveys.

LICENSED GAME BIRD CLUBS

Up until this biennium licensed game bird clubs were known as game management areas. This change in name, along with modifications in the length of the hunting season, license fees, and size of the areas was brought about by the State Legislature in 1951.

Originally the plan for these areas was adopted by the 1939 State Legislature to stimulate the landowners' interest in the game crop. Through this plan it was intended to foster and increase the supply of upland game through land management and stocking of game farm birds. Backers of the plan believed that the income derived from the game crop would provide an incentive to the landowner to manage his land for game production. Since these areas were to be open to any licensed hunter, the income from the game produced was to be obtained by charging hunters up to a designated maximum fee for shooting privileges. Actually the income received from the game crop could not compete with the high prices being paid for farm crops which these areas could produce. The landowners also found it too difficult to control the public on these areas.

In 1947 the State Legislature modified the plan to allow for noncommercial areas where the public was excluded. These private areas are now supported by season memberships, or by a share-the-cost arrangement with the operator. Most operators are now satisfied with the plan. There are now 63 operators who control 53,403 acres of land. During 1951 they liberated 32,127 pheasants and killed 19,855 in 9,069 man-days of hunting.

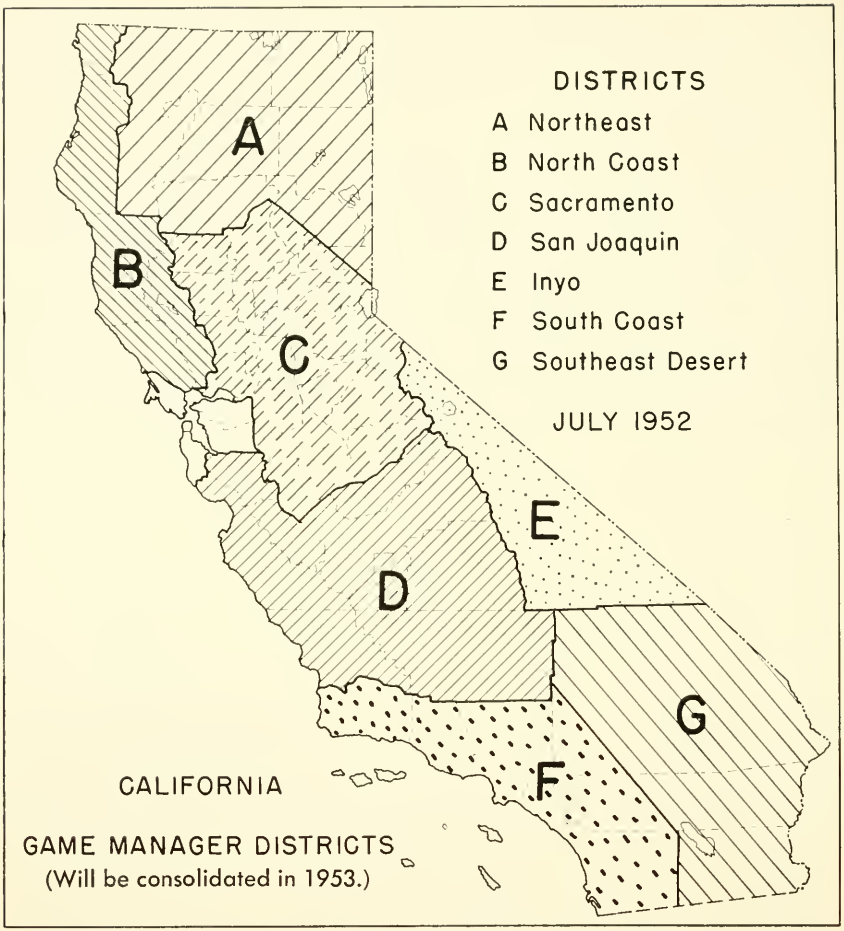
GAME MANAGEMENT

During the biennium the bureau's state-wide game management activities were conducted through the seven districts shown in the accompanying figure. It is the responsibility of the game manager in each district to supervise habitat development, control game populations, administer bureau installations within the district, and investigate game problems in general and apply corrective measures. A supervising game manager coordinates the efforts of the district managers into a common program. These districts will be merged under the new regional plan of administration.

California Fish and Game Lands Other Than Game Farms

Tehama Winter Deer Range with 42,896.90 acres was purchased from 1943 to 1950, inclusive, to protect winter range from natural food depletion by heavy stock grazing.

Doyle Winter Deer Range with 13,503 acres was purchased from 1948 to 1951, inclusive, to protect winter range from natural food depletion.



Honey Lake Waterfowl Management Area with 5,473 acres was purchased from 1942 to 1951, inclusive.

Imperial Waterfowl Management Area with 535.24 acres was purchased in 1948.

Madeline Plains Waterfowl Management Area with 5,816 acres was purchased from 1945 to 1951, inclusive.

Gray Lodge Waterfowl Refuge with 2,541.51 acres was purchased in 1931-32. Additional acreage being purchased.

Imperial Waterfowl Refuge with 2,064.43 acres was purchased in 1931-32.

Los Banos Waterfowl Refuge with 3,000 acres was purchased in 1929. Additional acreage being purchased.

Suisun Waterfowl Refuge with 1,887 acres was purchased in 1932.

FEDERAL AID IN WILDLIFE RESTORATION
(Pittman-Robertson)

During the past biennium the Pittman-Robertson program in California continued to operate at near the maximum apportionment that is allotted to any one state. For the fiscal year 1950-51 California received $399,138.03, and for the fiscal year 1951-52, $785,791.52 was received. California's contribution, as required by the act, brought the total available for expenditure during the biennium to $1,579,906.07.

A total of 22 projects was in operation during all or part of the biennium. Of these, nine were of the surveys and investigations category, seven were development projects, four provided for the acquisition of lands, one was a maintenance project, and one a coordination project which directed and supervised the other projects. Following is an account of the various projects.

Surveys and Investigations

Project 22-R. The Life History and Management of the Ring-necked Pheasant in California. This project is evaluating the effects of agricultural practices on pheasant populations, especially in the Butte Sink area. Also, the survival of released game farm pheasants raised from wild stock is being compared with pheasant releases made from regular game farm stock. Management practices being tested include food and cover plantings, water development, and trapping wild pheasants in heavily populated areas for restocking depleted areas. Hunters are checked during the pheasant hunting season to determine hunting pressure, the pheasant kill, crippling loss, and the survival of released and wild birds. At the same time hunting season controls as they apply to hunters and land uses are being studied to facilitate farmer-sportsmen relationships. Chester M. Hart is the leader of this project.

Boxes like this provide nesting sites for wood ducks in areas that have a scarcity of natural cavities in trees. Sportsmen have indicated interest in the construction and installation of these boxes as conservation projects.

Project 25-R. A Study of the Food Habits of California Game Birds and Mammals and Species Affecting Their Welfare. As an integral part of wildlife management studies now in progress in California, it is necessary to obtain information as to the food preferences of game and predatory species. C. M. Ferrel is leader of this project.

Project 30-R. A Study of Production, Migration and Wintering Areas of Waterfowl in California. An evaluation is being made of the production and wintering grounds of the principal waterfowl areas of the State, which includes Suisun Marsh and the Sacramento-San Joaquin Delta, the Inyo-Mono and Owens Valley area, and the northeastern section of California. These studies include large scale trapping and banding operations of resident and migratory waterfowl. Also, an investigation is being conducted on the effects of reclamation projects and land uses on waterfowl populations. A. W. Miller is the leader of this project.

Trapping and banding waterfowl not only provides information on migration, but also shows rates of harvest for various species.

Project 31-R. A Study of the Effects of Brush Removal on Game Ranges in California, will determine sound methods for management of brush areas for wildlife habitat improvement. The project is under service agreement with the University of California, with Dr. H. A. Biswell as leader.

Project 33-R. An Evaluation of Quail Development and Management Practices in California. Studies are being conducted to determine the effects of cover planting and water development on quail populations. Types of construction and the value of artificial roosts are being tested. Also, the effects of cover removal, grazing, cultivation, controlled burning, rodent control, predator control, and hunting pressure on quail populations are being investigated. This project is under the leadership of Wallace G. Macgregor.

Project 35-R. A Study of Diseases of Wildlife Species in California, is concerned especially with those diseases which are of definite known importance in respect to wildlife, and which appear to offer possibilities of being controlled by management practices. Merton Rosen is leader of this project.

Project 41-R. California Deer Herd Studies. This project conducts studies of deer populations in specific areas throughout the State, and includes appraisals of management problems, particularly range conditions, deer numbers, and agricultural and livestock conflicts. William P. Dasmann is leader of this project.

Project 42-R. The Life History and Management of the Band-tailed Pigeon in California. A detailed state-wide study of the life history and habits of the band-tailed pigeon is being made with special emphasis on season setting, bag limits and agricultural depredations. This project is under the leadership of Walton A. Smith.

Project 44-R. Chukar Survey. This project is conducting a state-wide survey to determine distribution, numbers, habitat requirements and possible management practices for chukar partridges in California. Donald D. McLean is leader of this project.

This mobile laboratory, built on a one-ton panel truck, enables technicians to diagnose wildlife diseases rapidly in the field.

Development Projects

Project 9-D. Suisun Waterfowl Refuge, involves 1,887 acres of land to provide waterfowl feeding and resting areas by construction of levees, ditches and tide gates.

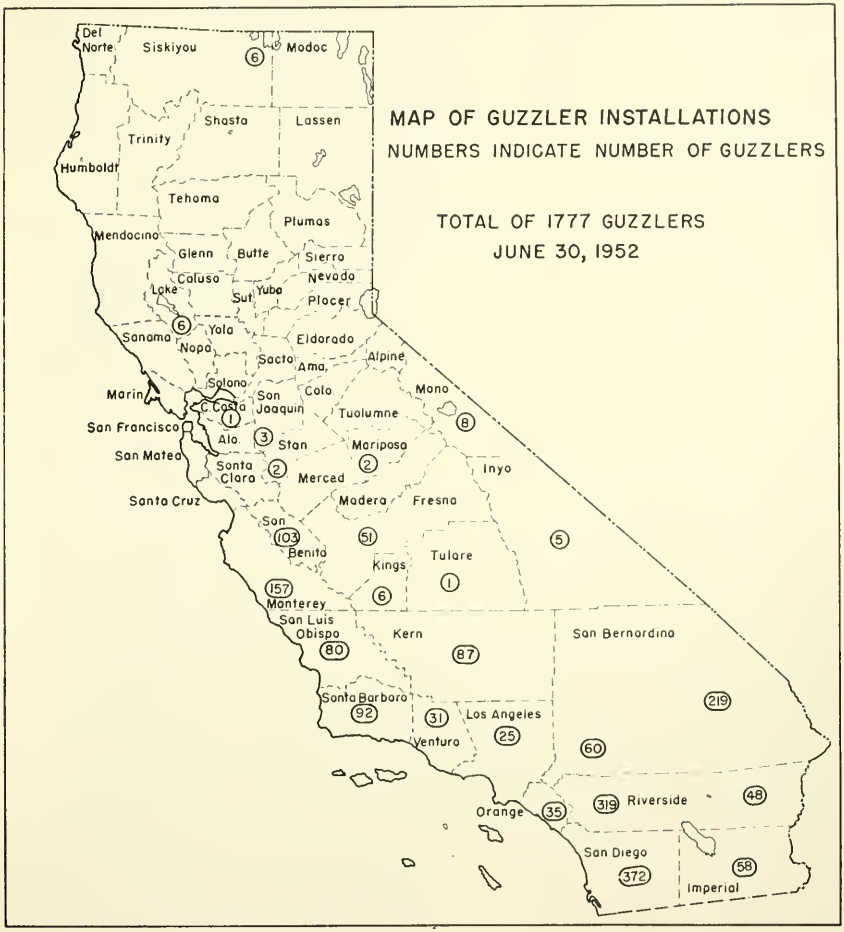
Project 13-D. Gray Lodge Waterfowl Refuge, involves 2,542 acres of land to provide waterfowl feeding and resting areas by construction of levees, ditches, roads and buildings.

Project 26-D. The Restoration of Valley Quail, Gambel Quail and Mountain Quail in California. This project represents the major effort in habitat development for California quail, and includes plantings for food and cover improvement, the erecting of artificial quail roosts, and the construction of "gallinaceous guzzlers" or rain catchment basins for providing quail with water. Through this habitat development program, many areas that were formerly unsuitable as quail range are now producing quail for California's hunters. The program has received help through financial aid from county fine moneys, and physical labor from sportsmen and other interested groups.

Quail need a place to get off the ground away from predators. The department constructs artificial roosts in areas where trees are scare, or where they are not dense enough to provide good winter roosting cover for quail. Left, the metal framework. Right, the completed roost.

The "gallinaceous guzzler" program has been accelerated by the use of prefabricated plastic basins and glass mat (asphalt emulsion) catchment aprons. The installation of the plastic model requires about one-fifth the time needed for the construction of the concrete type of guzzler. Another advantage gained by using the plastic model is that it can readily be moved to a new site, if the original location proves unsatisfactory.

During the biennium 1,010 guzzlers were installed, bringing to 1,744 the number now in operation.



Project 36-D. Development of Imperial Waterfowl Management Area, involving 12,000 acres of land, provided waterfowl feeding, resting, public shooting areas and facilities for the proper managment of the area by the construction of levees, ditches and buildings, and by the development of the land for farming of waterfowl food crops.

Project 38-D. Development of the Honey Lake Waterfowl Management Area, involves 3,520 acres of land for the provision of waterfowl feeding, resting and nesting areas and facilities for the proper management of the area by construction of levees, ditches, roads and buildings.

Project 40-D. Development of the Los Banos Refuge, involving 3,000 acres, provided waterfowl feeding, resting and nesting areas, and facilities for the proper management of the area by construction of levees, ditches, roads and buildings.

Ducks coming in to feed on millet raised for them on a waterfowl management area in an effort to reduce crop depredation.

Project 43-D. Development of Grizzly Island Waterfowl Management Area involves 8,600 acres that are being developed to provide waterfowl feeding, resting, nesting, and public shooting areas by the construction of levees, ditches, roads and by farming operations.

Land Acquisition

Project 10-L. Tehama Winter Deer Range.
Project 11-L. Honey Lake Waterfowl Management Area.
Project 17-L. Madeline Plains Waterfowl Management Area.
Project 21-L. Doyle Winter Deer Range.

The above land acquisition projects were initiated during the decade 1940-50. Acquisition of lands for management purposes on each area is virtually complete. A small amount of money is available to round out any one of these areas, should the need arise and should land be available for this purpose.

Maintenance

Project 37-M. This project inspects and maintains the installations that have been developed to provide cover, water and food for quail.

Coordination

Project 29-C. It is the responsibility of this project to select, plan, direct and supervise the other Pittman-Robertson projects and make certain that these projects are productive of results.

DISEASE LABORATORY

Evaluation of all diseases that have been found to occur in wildlife has resulted in the determination of the most important causes of mortality. As a result, the emphasis has been placed on studies conducted both in the laboratory and the field on these disease entities, and have been classified as separate projects. Listed below are the more important projects that

Diagnosis of diseases in the laboratory determines the important causes of wildlife mortality.

received attention during the past biennium. Each project has been aimed at ascertaining the facts relative to the sources of the diseases and the practical methods of bringing these diseases under control through the use of various management practices.

Fowl Cholera:

It was determined that the source of Fowl Cholera in waterfowl occurring in south San Francisco Bay was directly traceable to a garbage dump. Litigation subsequently abated the garbage dump as a nuisance.

Several small outbreaks of fowl cholera occurring in the Suisun Delta region were brought under control through elimination of all gulls in the immediate vicinity, thereby preventing spread of the disease.

Necropsy (Post Mortem Examinations):

Each winter, losses of deer are apparent throughout most of California. Laboratory examination reveals parasitism, hemorrhagic septicemia, pyogenic infections, and terminal pneumonias as direct causes of mortality. The majority of the deaths are the indirect result of undernutrition. The laboratory has undertaken a study for determination of a standard of condition in deer. With the knowledge of the condition of a deer herd, the management of that herd may be more intelligently handled. A few of the results of this study, involving complete examination of 368 animals, includes the standard blood picture of deer, condition factor evolved from measurement of adipose tissue, physical measurements and parasitism.

Stomach Worms:

A survey of the north coastal counties was undertaken to obtain geographical distribution, species, and effect, and to determine possible control measures that might be effective against stomach worm parasites of deer. Total worm burdens of individual deer from several areas are being ascertained. The results of the survey disclosed that those sheep and cattle ranches practicing good range management have low levels of parasitic infection. Correlations between parasites and livestock in relation to management practices should be similar to that correlation being established between parasites and deer.

Foot Rot:

Research has been undertaken on the most serious bacterial disease affecting deer, namely, foot rot. It constitutes a serious threat to the continued existence of deer in the Coastal Ranges of California. The Priest Valley herd was seriously decimated by it during the late summer of 1951. Cooperative effort by agricultural authorities as well as wildlife agencies is needed for control of the disease in livestock and in deer. It has been determined that the source of this entity is related to seeps and muddy waterholes. The only known methods of control that have been practiced have been spring development, or eradication of mudholes through bulldozing or fencing.

Botulism:

Positive control of botulism in pheasants at State Game Farms has been effected.

SPECIAL HUNTING SEASONS

Antelope Hunt

During the biennium one antelope hunting season was held. In 1950 aerial surveys showed the number of adult male antelope was not sufficient to warrant a hunting season. However, in 1951 the population had increased and a controlled hunt for bucks only was held in Modoc, Lassen and Shasta Counties. As in previous hunts, permits selected by lottery were issued to 500 hunters. A check of all hunters showed that 415 actually hunted and 280 antelope were shot. Results of the 1951 hunt and previous special antelope hunting seasons are shown in Table 3, Appendix D.

Mineral King Deer Hunt

The Mineral King National Game Refuge in the Sequoia National Forest of Tulare County with an overpopulation of deer suffered from extreme overbrowsing. In 1950 after investigational work had shown that the range was being seriously damaged, the California Fish and Game Commission and the U. S. Forest Service at the request of Central California sportsmen's groups, took the necessary steps to declare the refuge open to controlled deer hunting.

A total of 960 permits was drawn by lottery from a list of hunter applicants. To relieve the overcrowded hunting conditions, the 30-day season was divided into eight hunting periods with 120 permittees eligible to hunt during each period. A total of 870 hunters appeared for the hunt and took 677 deer for an average success of 78 percent.

Devils Garden Deer Hunt

The Devils Garden interstate deer herd is made up of Rocky Mountain mule deer that summer principally on the Fremont National Forest in Oregon and winter on the Devils Garden area in the Modoc National Forest in California. With many key forage species practically eliminated on large areas, a deer-livestock food problem had been recognized on this range for a number of years by the Interstate Deer Herd Committee. This committee is composed of members of the Oregon Game Commission, the U. S. Forest Service, the California Department of Fish and Game, and representatives of organized sportsmen and livestock growers associations. The first step that was taken to help solve this range problem was to reduce the number of livestock permitted on the area. The next step was to bring deer numbers into closer balance with the supply of forage. An increased harvest of the deer on this range was accomplished by two special deer hunts that were held during the biennium.

In 1950 a total of 1,509 permits was issued by lottery. From this number, 1,398 hunters appeared for the hunt and bagged 1,319 antlerless deer for an average success of 94 percent.

In 1951 a total of 1,818 permits was issued by lottery, and 1,716 hunters used their permits. These hunters shot 1,504 antlerless deer for an average success of 88 percent.

Santa Barbara Deer Hunt

In order to alleviate deer damage to agricultural crops and reduce the number of deer on an overbrowsed range, three large ranches in Santa Barbara County, cooperating with the Department of Fish and Game, opened their lands for a controlled deer hunt in 1951. A total of 600 permits was issued on a first-come, first-served basis at Lompoc. Of this number, 543 hunters took part in the hunt. To prevent an undue concentration of hunters, permit holders were assigned to specific ranches and allotted certain hunting periods. These hunters shot 265 antlerless deer for an average success of 49 percent.

Grass Valley Special Hunt

Similar to the Santa Barbara hunt, ranchers near Grass Valley in Nevada County cooperated with the Department of Fish and Game in opening their lands for a controlled deer hunt in 1951. Here, too, a large deer population was overbrowsing its range and causing damage to surrounding agricultural crops. For this hunt 350 permits were issued at Grass Valley on a first-come first-served basis. A total of 281 hunters used their permits and shot 188 antlerless deer for an average success of 67 percent.

Lassen-Washoe Special Hunt

Since 1948 representatives of the Nevada Fish and Game Commission, the Bureau of Land Management, the U. S. Forest Service, and the California Department of Fish and Game have conducted investigations of the mule deer herd which winters along the state line in Lassen County, California, and Washoe County, Nevada. These studies have shown that this winter deer range was being damaged by a large deer population and numerous cattle. To help prevent further depletion of the better browse plants and perennial grasses, livestock grazing was reduced, and in 1951 an antlerless deer hunt was held to insure an increased harvest of the deer herd.

For this hunt 1,413 permits were issued by lottery, and 1,356 hunters took part in the hunt. These hunters shot 1,268 deer for an average success of 94 percent.

Results of all special deer hunts and the annual deer kill for the regular hunting season appear in Appendix D.

UPLAND GAME BIRD PRODUCTION

The production of upland game birds by state game farms reached an all-time high record during the biennium when a total of 205,521 birds was liberated. Of this number 200,626 were ring-necked pheasants, 426 Reeves pheasants, 2,093 chukar partridge, 2,273 valley quail and 103 wild stock turkeys. A summary of game bird liberations will be found in Table 5, Appendix D.

Most of the increase in upland game bird production can be attributed to more efficient operation of the game farms. Then too, the weather during the two breeding seasons of the biennium was nearly ideal for raising birds.

Pheasants are being released through the commission policy for distribution of pheasants. This policy not only provides for planned releases to be made on areas open for public hunting, but also includes lands that will be closed to all pheasant hunting for five years; these closed lands are to be considered as seed stock areas. It further states that releases will not be made on lands regarded as totally unsuitable pheasant habitat.

A great deal of time was spent by game farm personnel inspecting the large number of private game farms, and checking the operation of the increasing number of licensed game bird clubs. The work on these licensed game bird clubs consisted of inspection of each area, and the banding and liberation of birds on these areas.

PREDATOR CONTROL

During the biennium a total of 5,317 coyotes and 2,436 bobcats was taken by the predatory control staff. A total of 9,205 lesser predators was also taken during the same period. A summary of the predator catch will be found in Table 6, Appendix D.

Mountain Lion Control

A total of 227 mountain lions was bountied during 1950, and 133 during 1951; for a grand total of 360 lions during the two-year period. Of these 360 lions, 116 were taken by state lion hunters and 244 were bountied by private persons. State hunters operate where there have been complaints by stock ranchers, which usually means they get into country that is not readily accessible to the general public. A summary of the number of mountain lions bountied is shown in Table 7, Appendix D.

The patrol boat *Pompano*, added to our fleet during the biennium, operates in Southern California waters to supplement our larger patrol vessels. Small high-speed boats of this type maintain constant radio communication with the larger boats, providing complete coverage of coastal waters.

The patrol boat *Bonito* is newest of the three 63-foot vessels operoted by the department in ocean waters. Radar equipment on these boats and on the larger *Albacore* has been of great value in night patrol work and especially during foggy weather. *Photo courtesy of General Electric Company.*

BUREAU OF PATROL AND LAW ENFORCEMENT

L. F. Chappell served as Chief of the Bureau of Patrol and Law Enforcement until September 20, 1951, and E. L. Macaulay returned to his former position as Chief of Patrol when the former Division of Fish and Game assumed departmental status. Mr. Chappell retired on September 30, 1951. No increase in the total number of employees has been made over the previous biennium and the general administrative program, consisting of six patrol districts, each in charge of an Assistant Chief of Patrol, has been continued.

The warden reserve force has been increased by the addition of units in Tulare and Kern Counties. Valuable assistance, particularly during the busy periods at the commencement of the seasonal openings, has been given by these public-spirited individuals.

An additional airplane, a Cessna Model 170, was purchased during the biennium and stationed at San Bernardino. This aircraft is used principally by patrol personnel in Southern California but is available for other assignments as required.

During the biennium the BONITO, another 63-foot air-sea rescue vessel was added to our marine patrol fleet. The BONITO is equipped with radar,

All patrol cars are equipped with two-way radio communication. This equipment enables the wardens to keep in touch with headquarters, other patrol cars, boats and aircraft and has praved invaluable in controlling violations. The cartop boat is for use in waters inaccessible to larger vessels.

direction finder, and depth recorder and is stationed at San Francisco. A small twin-screw cruiser, the POMPANO, was acquired for use in the Santa Monica Bay area.

Our two-way radio communication equipment has been increased and, while this equipment is costly and the maintenance charges are high, its value cannot be overestimated.

Total arrests for the biennium were 11,936 and the average fine amounted to $39.79. Our percentage of cases dismissed by the courts was extremely low, amounting to slightly over six-tenths of 1 percent. During the biennium several sections intended to prevent hunting accidents were added to the code; one of these sections prohibits the carrying of loaded guns in vehicles on highways or other public ways open to the public. Despite the wide publicity given to this new regulation since it was approved by the 1951 Legislature, several hundreds of arrests have been made for violations of this provision. It is a sad commentary on the conduct of a small percentage of sportsmen when laws have to be enacted to protect them from their own carelessness.

Mobile radio repeater station, with self-contained power plant. This equipment is used in remote areas, where power is not available, to permit continuous transmission and reception.

BUREAU OF LICENSES

In addition to conducting the regular duties of maintaining a license distribution system and collecting license moneys amounting to approximately $5,100,000 yearly, several drawings were held for special deer and antelope hunts.

The sale of licenses continues to increase each year. In 1951 the number of angling licenses exceeded 1,000,000 for the first time.

The department maintains five branch offices from which licenses are distributed throughout the State. There are approximately 3,100 license agents and the average amount of bond for each agent is $1,100. The actual amounts vary from $500 to $30,000 each.

On March 1, 1952, the department opened a branch office at Eureka, where licenses were placed on sale to the public. This office does not distribute licenses to agents.

CHANGES MADE IN LICENSE LAWS

A new sportfishing license permits any citizen of the United States to fish in the waters of the Pacific Ocean for a period of three days.

No license is required when a person is fishing from a public pier in the waters of the Pacific Ocean.

The Archery Hunting License Law was repealed. Archery hunters are now required to purchase the archery deer tag with a regular hunting license.

The former game management license was changed to a game bird club license. The new law provided for three licensed areas: commercial areas, fee of $50; private licensed areas of less than 500 acres, $25; and private licensed areas in excess of 500 acres, $50.

SPECIAL HUNTS

During the past two years the Fish and Game Commission authorized a number of special antelope and deer hunts. Each of these special hunts required a drawing. These hunts were as follows:

Antelope

On August 8, 1951, a drawing was held at Sacramento. There were 12,393 applications accepted. Of this number 550 were entitled to apply for permits, and 416 were issued permits.

Deer

Mineral King Area—Tulare County

A drawing was held at Visalia on August 28, 1950.

Number of applications accepted	7,449
Number of applications rejected	1,173
Number of applications received	8,622
Number of permits issued	861

Devil's Garden—Modoc County

The drawing was held at Sacramento on October 13, 1950.

Number of applications received	16,166
Number entitled to receive permits	1,800
Number of permits issued	1,509

Santa Barbara County

The drawing was held at Lompoc on July 21, 1951. Permits were issued on a first come, first served basis. 550 permits were issued.

Grass Valley Area—Placer County

The drawing was held at Grass Valley on September 12, 1951, and permits were issued on a first come, first served basis. 350 permits were issued.

Devil's Garden Area—Modoc County

The drawing was held at Sacramento on October 9, 1951.

Number of applications received	26,491
Number entitled to receive permits	2,300
Number of permits issued	1,830

Lassen-Washoe Area

The drawing was held at Sacramento on October 9, 1951.

Number of applications received	27,232
Number entitled to receive permits	1,700
Number of permits issued	1,420

LICENSE SALES

The following tabulation shows the value of the various types of licenses sold in recent years:

Hunting

Year	*Value*	*Number*
1950-51	$1,430,800	491,424
1951-52	1,553,095	534,684

Angling

Year	*Value*	*Number*
1950	$2,993,698	983,019
1951	3,083,976	1,015,469

Deer Tag

Year	*Value*	*Number*	
		Citizen	*Nonresident*
1950	$318,223	312,033	619
1951	348,795	342,245	655

Pheasant Tag

Year	*Value*	*Number*
1950	$160,661	160,661
1951	188,765	188,765

Archery Hunting

Year	*Value*	*Number*
		Citizen
1950-51	$2,838	946
1951-52	3,969	1,323

Drawing the lucky numbers for the special deer hunt at Devil's Garden, 1951.
Photo courtesy of Rudy Hickey, Sacramento Bee.

Archery Deer Tag

Year	*Value*	*Number*	
		Citizen	*Alien*
1950-51	$1,068	928	14
1951-52	1,428	1,318	11

Commercial Fishermen

Year	*Value*	*Number*
1950-51	$146,200	14,620
1951-52	131,950	13,195

Trapping

Year	*Value*	*Number*	
		Citizen	*Alien*
1950-51	$1,056	1,050	3
1951-52	1,042	1,030	6

Fish Dealers and Fish Packers

Year	Value	Number	
		Citizen	Alien
1950-51	$2,635	523	1
1951-52	2,900	568	3

Bird Club

Year	Value	Number
1950-51	None	None
1951-52	$2,100	6 under 500 acres 35 over 500 acres 1 commercial

Game Management

Year	Value	Number
1950	$560	56
1951	560	56

Waterfowl Area Permits

Year	Value	Number	
		Adults	Junior
1950	$5,045	989	40
1951	None	None	

Controlled Hunting Club

Year	Value	Number	
		Adults	Junior
1950-51	None	None	
1951-52	$20,020	3,913	182

Commercial Hunting Club

Year	Value	Number
1950-51	$775	31
1951-52	525	21

Commercial Hunting Club Operators

Year	Value	Number
1950	$230	46
1951	145	29

Game Breeders

Year	Value	Number
1950	$4,200	840
1951	4,860	972

Fish Breeders

Year	Value	Number
1950	$820	164
1951	1,015	203

Fish Importers

Year	Value	Number
1950	$120	24
1951	155	31

Fishing Party Vessel Permit

Year	Value	Number
1950	$874	874
1951	978	978

APPENDICES

APPENDIX A

STATEMENTS OF REVENUE AND EXPENDITURE

EXHIBIT A

DEPARTMENT OF FISH AND GAME AND MARINE RESEARCH COMMITTEE FISH AND GAME PRESERVATION FUND

Statement of Revenues, Fiscal Year Ended June 30, 1951

For the Department of Fish and Game, license sales		*1950–51*	
Angling		$2,986,248.70	
Archery—hunting		2,841.00	
Archery—deer tag		1,069.00	
Commercial hunting club		775.00	
Commercial hunting club operator		230.00	
Deer tags		318,274.00	
Fish breeder		990.00	
Fish importer		185.00	
Fish dealers and fish packers		3,347.57	
Fish tags		21,468.10	
Fishing party boat permit		948.00	
Salmon tags		140.74	
Game breeders		4,785.00	
Game management tags and licenses		1,197.50	
Game tags		902.34	
Hunting		1,433,262.20	
Kelp		40.00	
Market fishing		147,750.00	
Trapping		1,054.00	
Deer meat permits		9,443.50	
Deer meat agents—wardens		1,211.00	
Waterfowl shooting permits		5,045.00	
Pheasant tags		161,812.50	
Special deer hunts		8,502.00	
Totals, license sales			$5,111,522.15
Less: Commissions retained by agents selling licenses			—246,680.11
Net revenues from license sales			$4,864,842.04
Court fines		$103,796.62	
Taxes:			
Fish packers and fish dealers tax	$322,951.91		
Salmon tax	37,800.23		
Kelp harvester tax	2,155.72	$362,907.86	
Interest on surplus money investment fund		49,341.63	
Miscellaneous:			
Lease of kelp beds	$1,312.00		
Miscellaneous revenue	21,205.73		
Confiscated fish and nets	14,746.22	37,263.95	553,310.06
Total, department of fish and game			$5,418,152.10
For marine research committee, fish packers and fish dealers tax			180,482.32
Total revenues, 1950-51 Fiscal Year			$5,598,634.42

EXHIBIT B

DEPARTMENT OF FISH AND GAME, FISH AND GAME PRESERVATION FUND

Statement of Expenditures, Fiscal Year Ended June 30, 1951

	Salaries and wages	Operating expenses	Equipment	Total expenditures	Reimbursements	Expenditures
Department of Fish and Game						
Support						
Administration						
Divisional administration	$102,775.83	$310,442.11	$5,986.20	$419,204.14		
Conservation education and public information	24,331.43	52,239.73	1,599.57	78,170.73		
Patrol and law enforcement	864,059.47	493,603.22	109,341.27	1,467,003.96		
Marine fisheries	337,256.91	147,454.43	36,646.07	521,357.41		
Fish conservation	604,812.51	430,948.12	45,455.36	1,081,215.99		
Game conservation	571,005.05	332,344.63	32,379.21	935,728.89		
Licenses	50,623.96	91,323.81	2,304.59	144,252.36		
Totals—Support	$2,554,865.16	$1,858,356.05	$233,712.27	$4,646,933.48	$94,530.89	$4,552,402.59
Other current expenses						
Game management in cooperation with Federal Government—Pittman-Robertson Act				$437,808.57	$328,717.89	$109,090.68
Pacific Marine Fisheries				12,500.00		12,500.00
Board of Control claim				3.96		3.96
Total expenditures—Current operations				$5,097,246.01	$423,248.78	$4,673,997.23
Capital outlay						
Minor construction, improvements, repairs and equipment				$197,291.01		$197,291.01
Contributions to Retirement System				315,533.63	$9,613.03	305,920.60
Totals				$5,610,070.65	$432,861.81	$5,177,208.84
Marine Research Committee						
Support						
Salaries and wages				$13,627.58		$13,627.58
Operating expenses				120,416.09		120,416.09
Equipment				1,509.70		1,509.70
Totals—Support				$135,553.37		$135,553.37
Total all expenditures				$5,745,624.02	$432,861.81	$5,312,762.21

EXHIBIT C

DEPARTMENT OF FISH AND GAME, WILDLIFE CONSERVATION BOARD, WILDLIFE RESTORATION FUND

Statement of Expenditures, Fiscal Year Ended June 30, 1951

Support:		
Salaries and wages	$8,770.60	
Operating expenses	18,183.19	
Total—support		$26,953.79
Contributions to retirement system		905.48
Capital outlay projects:		
Fish hatchery and stocking projects	$1,250,783.28	
Warmwater and other fish projects	11,390.00	
Flow maintenance and stream improvement projects	130,467.96	
Fish screen and ladder projects	147,713.92	
Game farm projects	105,641.32	
Upland game projects for quail habitat and pheasant development	291,153.25	
Waterfowl projects for acquisition and improvement of feeding and shooting grounds	885,620.29	
General projects of acquisition and construction	51,934.30	
Totals—Capital outlay projects—All fiscal years	$2,874,704.32	
Less: Expenditures from appropriations, available prior to 1950-51 Fiscal Year	—1,660,157.79	
Expenditure from 1950-51 Fiscal Year appropriation		1,214,546.53
Total expenditures		$1,242,405.80

EXHIBIT D

DEPARTMENT OF FISH AND GAME AND MARINE RESEARCH COMMITTEE FISH AND GAME PRESERVATION FUND

Statement of Revenues, Fiscal Year Ended June 30, 1952

For the Department of Fish and Game			
License Sales			
Angling		$3,217,002.90	
Archery—hunting		3,966.00	
Archery—deer tag		1,427.00	
Commercial hunting club		525.00	
Commercial hunting club operator		145 00	
Deer tags		348,749.50	
Fish breeder and importer		1,225.00	
Fish dealers and fish packers		2,890.00	
Fish tags		22,556.87	
Fish boat party permits		1,035.00	
Salmon tags		45.17	
Game breeders		5,610.00	
Game management tags		718.05	
Game management license		40.00	
Game tags		1,015.74	
Hunting		1,551,990.00	
Kelp		30.00	
Market fishing		112,010.00	
Trapping		1,042.00	
Deer meat agents—locker permits		12,219.50	
Deer meat agents—wardens		1,827.00	
Waterfowl shooting permits		20,020.00	
Pheasant tags		188,771.00	
Antelope permits		2,912.00	
Game bird clubs		2,575.00	
Special hunt permits		17,106.00	
Totals, License Sales			$5,517,453.73
Less: Commissions retained by agents for selling licenses			—266,139.64
Net revenues from license sales			$5,251,314.09
Other revenues			
Court fines		$118,363.85	
Oil royalties		7,728.53	
Taxes			
Fish packers and fish dealers tax	$183,936.80		
Salmon tax	36,092.73		
Kelp harvester tax	5,019.39		
		225,048.92	
Interest on surplus money			
Investment fund		133,951.36	
Miscellaneous			
Lease of kelp beds	6,947.74		
Confiscated fish and nets	19,991.37		
Miscellaneous revenue	28,686.87		
		55,625.98	540,718.64
Totals, Department of Fish and Game			$5,792,032.73
For Marine Research Committee			
Fish packers and fish dealers tax			63,046.58
Total revenues, 1951-52 Fiscal Year			$5,855,079.31

EXHIBIT E

DEPARTMENT OF FISH AND GAME AND MARINE RESEARCH COMMITTEE FISH AND GAME PRESERVATION FUND

Statement of Expenditures, Fiscal Year Ended June 30, 1952

	Salaries and wages	Operating expenses	Equipment	Total expenditures current operations	Reimbursements	Total expenditures
Department of Fish and Game						
Support						
Administration	$109,014.98	$370,409.77	$4,061.94	$483,486.69		
Conservation education and public information	28,130.29	62,077.43	20,850.15	111,057.87		
Patrol and law enforcement	974,234.42	494,352.93	104,734.03	1,573,321.38		
Marine fisheries	418,750.95	204,788.68	65,113.37	688,653.00		
Fish conservation	672,373.82	468,430.20	56,462.09	1,197,266.11		
Game conservation	651,657.07	369,913.19	133,054.88	1,154,625.14		
Licenses	58,416.97	74,548.40	522.53	133,487.90		
Totals—Support	$2,912,578.50	$2,044,520.60	$384,798.99	$5,341,898.09	$115,660.33	$5,226,237.76
Other current expenses						
Game management in cooperation with the Federal Government under Pittman-Robertson Act				$570,535.50	$427,765.40	$142,770.10
Fisheries management in cooperation with the Federal Government under Dingell-Johnson Act				29,447.53	22,085.66	7,361.87
State cooperation with Pacific Marine Fisheries Commission				15,100.00		15,100.00
Board of Control claim				1,139.95		1,139.95
Contribution to Retirement System						
Regular				303,433.77		303,433.77
Pittman-Robertson				17,481.04	13,110.78	4,370.26
Dingell-Johnson				738.47	553.85	184.62
Totals—Other current expenses				$937,876.26	$463,515.69	$474,360.57
Capital outlay						
Property acquisition						$950.00
Major construction, improvements, repairs and equipment						140,000.00
Minor construction, improvements, repairs and equipment						195,889.57
Total capital outlay						$336,839.57
Total expenditures, 1951-52 Fiscal Year, Department of Fish and Game						$6,037,437.90
Marine Research Committee						124,638.19
Total Expenditures, 1951-52 Fiscal Year						$6,162,076.09

EXHIBIT F

DEPARTMENT OF FISH AND GAME, WILDLIFE CONSERVATION BOARD, WILDLIFE RESTORATION FUND

Statement of Expenditures, Fiscal Year Ended June 30, 1952

			Expenditures—1951-52 Fiscal Year
Support			
Salaries and wages			$19,884.00
Operating expenses			12,347.05
Equipment			143.88
			$32,374 93
Claim of Secretary, Board of Control			2,995.14
Contributions to Retirement System			1,978.24
Capital outlay projects	Total to date	Less prior years	
Fish hatchery and stocking projects	$2,329,181.39	$1,250,783.28	$1,078,398.11
Warm water and other fish projects	44,329.09	11,390.00	32,939.09
Flow maintenance and stream improvement projects	200,237.68	130,467.96	69,769.72
Fish screen and ladder projects	156,029.22	147,713.92	8,315.30
Game farm projects	105,644.49	105,641.32	3.17
Upland game projects for quail habitat and pheasant development	392,981.99	291,153.25	101,828.74
Waterfowl projects for acquisition and improvements of feeding and shooting grounds	2,936,436.18	885,620.29	2,050,815.89
General projects of acquisition and construction	51,648.84	51,934.30	—285 46
Totals, Capital Outlay Projects	$6,216,488.88	$2,874,704.32	$3,341,784.56
Total Expenditures 1951-52 Fiscal Year			$3,379,132.87

With the advent of summer vacation time a young man's (and woman's) fancy turns to fishing. So, the County of Los Angeles staged this one-day "Huck Finn" event at Alondra Park Lake in 1948. The wire enclosure contained state-stocked fish. Young Tom Sawyers and Becky Thatchers worked in relays to remove the fish.

APPENDIX B

FISH DISTRIBUTION AND RESCUE

TABLE 1. FISH PLANTED—JULY 1, 1950, TO JUNE 30, 1951 (INCLUSIVE)

Hatchery Reared Fish Planted in Each County

County	Trout					Salmon		Total number of fish
	Rainbow	Steelhead	Eastern brook	Brown	Cutthroat (Lahontan)	King	Kokanee	
Alpine	128,053		134,662		173,432			436,147
Amador	51,998		20,000					71,998
Butte	331,881		15,000					346,881
Calaveras	209,704		4,001					213,705
Colusa	5,040							5,040
Del Norte		483,938						483,938
El Dorado	725,243		450,532				190,136	1,365,911
Fresno	869,764		165,262					1,035,026
Glenn	15,120							15,120
Humboldt	94,324	544,900				50,031		689,255
Inyo	445,917		83,055	67,302				596,274
Kern	260,518							260,518
Lake	15,145							15,145
Lassen	364,309		73,000	18,100				455,409
Los Angeles	162,790							162,790
Madera	453,987		164,091					618,078
Marin	64,396							64,396
Mariposa	754,082		24,240					778,322
Mendocino	4,000					115,300		119,300
Modoc	41,811							41,811
Mono	774,281		707,898	459,422				1,941,601
Monterey	31,341	8,465						39,806
Napa	61,009							61,009
Nevada	415,975		308,450					724,425
Orange	3,500							3,500

TABLE 1. FISH PLANTED—JULY 1, 1950, TO JUNE 30, 1951 (INCLUSIVE)—Continued

Hatchery Reared Fish Planted in Each County

County	Trout					Salmon		Total number of fish
	Rainbow	Steelhead	Eastern brook	Brown	Cutthroat (Lahontan)	King	Kokanee	
Placer	414,102		84,997				359,304	858,403
Plumas	892,047		118,700					1,010,747
Riverside	44,304							44,304
San Bernardino	362,368							362,368
San Diego	27,400							27,400
San Francisco	89,242							89,242
San Luis Obispo	63,650							63,650
San Mateo	21,002	46,490						67,492
Santa Barbara	19,000							19,000
Santa Clara	42,620							42,620
Santa Cruz	75,967	118,557						194,524
Shasta	367,738		10,935	65,000				443,673
Sierra	781,015		143,205					924,220
Siskiyou	295,883		166,677			213,200		675,760
Solano	5,503							5,503
Tehama	88,604							88,604
Trinity	229,883		56,091					285,974
Tulare	797,682		20,960					818,642
Tuolumne	817,166		195,666				19,680	1,032,512
Ventura	105,470							105,470
Yuba	46,250							46,250
Grand totals	11,871,084	1,202,350	2,947,422	609,824	173,432	378,531	569,120	17,751,763

TABLE 2. HATCHERY REARED WARM-WATER FISHES—JULY 1, 1950 TO JUNE 30, 1951 (INCLUSIVE)

	Number of fish
Smallmouth black bass	5,500
Largemouth black bass	98,534
Sacramento perch	600
Bluegill	18,918
Total	123,552

TABLE 3. FISH RESCUED AND TRANSPLANTED—JULY 1, 1950 TO JUNE 30, 1951 (INCLUSIVE)

Trout		Warm-water fishes	
Rainbow	3,399	Smallmouth black bass	39,299
Eastern brook	4,800	Largemouth black bass	188,367
Steelhead	715,908	Warmouth	1,141
Brown	395	Green sunfish	11,484
Cutthroat (Lahontan)	2,059	Sacramento perch	900
		Bluegill	303,809
Total	726,561	White crappie	1,176
		Black crappie	6,220
Salmon		Striped bass	14
King	241,989	Bullhead	43,594
Silver	26,270	Golden shiner	143,632
Total	268,259	Total	739,636

TABLE 4. FISH PLANTED—JULY 1, 1951, TO JUNE 30, 1952 (INCLUSIVE)

Hatchery Reared Fish Planted in Each County

County	Trout					Salmon		Total number of fish
	Rainbow	Steelhead	Eastern brook	Brown	Cutthroat (Lahontan)	King	Kokanee	
Alpine	122,333		86,332		110,670			319,335
Amador	186,199		17,000					203,199
Butte	293,376		15,000					308,376
Calaveras	102,680		2,016					104,696
Colusa	10,591							10,591
Del Norte		236,970				507,250		744,220
El Dorado	939,135		453,891				310,932	1,703,958
Fresno	545,023		33,680					578,703
Glenn	1,689							1,689
Humboldt	1,920	126,761				175,128		303,809
Inyo	595,341		33,112	62,923				691,376
Kern	160,356							160,356
Lake	20,055							20,055
Lassen	77,983		15,000	8,600			77,400	178,983
Los Angeles	146,224							146,224
Madera	341,620		2,190					343,810
Marin	57,350		13,035					70,385
Mariposa	629,629		40,410					670,039
Mendocino	11,000					88,240		99,240
Modoc	58,455							58,455
Mono	1,260,822		265,629	370,120	9,750			1,906,321
Monterey	82,625	10,022						92,647
Napa	98,260							98,260
Nevada	528,685		264,161				90,090	882,936
Orange	11,170							11,170

Placer	465,590		80,376				512,538	1,058,504
Plumas	259,980		45,000				334,200	639,180
Riverside	50,310							50,310
San Bernardino	267,514							267,514
San Diego	27,940							27,940
San Francisco	177,242							177,242
San Joaquin	100							100
San Luis Obispo	37,630							37,630
San Mateo		47,074						47,074
Santa Barbara	26,975							26,975
Santa Clara	42,416							42,416
Santa Cruz	22,725	112,893						135,618
Shasta	324,564		30,004	80,000				434,568
Sierra	385,958		113,831					499,789
Siskiyou	210,079		43,936			585,608		839,623
Solano	13,020							13,020
Tehama	88,247							88,247
Trinity	123,148		8,200					131,348
Tulare	540,945		32,500					573,445
Tuolumne	471,752		106,129				19,610	597,491
Ventura	51,735							51,735
Yuba	41,990							41,990
Grand totals	9,912,381	533,720	1,701,432	521,643	120,420	1,356,226	1,344,770	15,490,592

TABLE 5. HATCHERY REARED WARM-WATER FISHES—JULY 1, 1951 TO JUNE 30, 1952 (INCLUSIVE)

	Number of fish
Smallmouth black bass	40,750
Largemouth black bass	109,757
Bluegill	26,300
Crappie	21,980
Golden shiner	129,175
Total	327,962

TABLE 6. FISH RESCUED AND TRANSPLANTED—JULY 1, 1951 TO JUNE 30, 1952 (INCLUSIVE)

Trout		Warm-water fishes	
Rainbow	2,908	Smallmouth black bass	29,049
Eastern brook	1,000	Largemouth black bass	28,464
Steelhead	664,797	Warmouth	130
Brown	540	Green sunfish	6,963
Cutthroat (Lahontan)	14,272	Bluegill	45,970
		White crappie	2,356
Total	683,517	Black crappie	29,604
		Striped bass	7,964
		Shad	1,156
		Catfish	679
Salmon		Bullhead	297,363
King	34,973	Golden shiner	22,058
Silver	207,096	Greaser blackfish	152
Total	242,069	Total	471,908

APPENDIX C

MARINE FISHERIES STATISTICS

TABLE 1. CALIFORNIA FISHERIES PRODUCTION

	1950	1951	Total
Total landings, pounds	1,366,596,282	904,088,178	2,270,684,460
Cases of fish canned	17,359,751	13,595,879	30,955,630
Tons of fish meal produced	70,769	41,498	112,267
Gallons of fish oil produced	7,202,130	2,735,590	9,937,720
Gallons of liver oil produced	32,189	65,163	97,352

TABLE 2. POUNDS AND VALUE[1] OF COMMERCIAL FISH LANDINGS IN CALIFORNIA

Species	1950		1951	
	Pounds	Value	Pounds	Value
Yellowfin tuna	190,446,000	$29,399,000	173,669,000	$26,834,000
Skipjack	128,041,000	18,344,000	118,638,000	16,942,000
Albacore	66,124,000	12,557,000	48,436,000	7,680,000
Sardine	714,522,000	12,140,000	328,893,000	7,247,000
Salmon	7,759,000	2,115,000	8,601,000	2,476,000
Jack mackerel	133,256,000	2,572,000	89,838,000	2,016,000
Crab	11,723,000	1,421,000	11,568,000	1,622,000
Sole	23,893,000	1,156,000	18,227,000	1,254,000
Pacific mackerel	32,650,000	794,000	33,518,000	932,000
Rockfish	8,116,000	409,000	10,994,000	655,000
Bluefin tuna	2,847,000	438,000	3,865,000	604,000
Spiny lobster	2,230,000	798,000	1,470,000	562,000
Yellowtail	3,532,000	315,000	4,691,000	445,000
White sea bass	1,533,000	322,000	1,547,000	367,000
Abalone	3,955,000	369,000	4,084,000	365,000
Barracuda	2,258,000	329,000	2,135,000	361,000
Squid	5,995,000	157,000	12,383,000	336,000
Sablefish	1,920,000	127,000	2,887,000	230,000
California halibut	1,093,000	225,000	867,000	198,000
Lingcod	1,915,000	135,000	1,747,000	154,000
Pacific halibut	258,000	65,000	596,000	151,000
Anchovy	4,879,000	84,000	6,955,000	144,000
Grouper	296,000	56,000	584,000	117,000
Broadbill swordfish	28,000	13,000	228,000	100,000
Bonito	696,000	68,000	784,000	75,000
Shark	717,000	56,000	842,000	70,000
Smelt	591,000	40,000	1,096,000	69,000
Shrimp	913,000	59,000	931,000	64,000
All other	14,406,000	660,000	14,014,000	751,000
Totals	1,366,592,000	$85,223,000	904,088,000	$72,821,000

[1] Value to the fishermen.

TABLE 3. TOTAL ANNUAL LANDINGS AND SHIPMENTS INTO CALIFORNIA OF COMMERCIAL FISH, MOLLUSKS AND CRUSTACEANS

Includes Sardine Deliveries to Reduction Ships During 1930 Through 1938

Year	Pounds	Year	Pounds
1916	95,002,695	1934	1,390,798,650
1917	209,876,670	1935	1,448,016,584
1918	261,134,265	1936	1,764,900,136
1919	266,270,240	1937	1,362,983,717
1920	222,004,376	1938	1,310,595,651
1921	135,347,826	1939	1,486,534,906
1922	182,343,333	1940	1,297,517,441
1923	253,874,581	1941	1,529,147,645
1924	340,445,919	1942	1,173,414,078
1925	437,502,232	1943	1,234,049,119
1926	394,964,393	1944	1,459,445,859
1927	487,166,143	1945	1,216,467,433
1928	583,526,751	1946	919,850,476
1929	856,854,055	1947	795,498,998
1930	702,188,795	1948	900,540,206
1931	502,389,875	1949	1,135,325,345
1932	556,139,053	1950	1,366,596,282
1933	821,805,007	1951	904,088,178

TABLE 4. COMMERCIAL FISHING FLEET

Home port	1950-1951	1951-1952
Eureka	447	450
Sacramento	371	301
San Francisco	846	846
Monterey	448	471
Santa Barbara	253	232
Los Angeles	2,288	2,279
San Diego	880	857
Alaska, Washington, Oregon	569	398
Other registry	1	3
Total number of boats	6,103	5,837

TABLE 5. RESIDENCE OF LICENSED COMMERCIAL FISHERMEN

Region of residence	Number of fishermen, 1950-1951	Number of fishermen, 1951-1952
Eureka	826	836
Sacramento	577	497
San Francisco	1,448	1,401
Monterey	1,383	1,182
Santa Barbara	555	485
Los Angeles	5,388	4,809
San Diego	3,174	2,977
Alaska, Washington and Oregon fishermen licensed in California	1,206	929
Mexican nationals licensed in California	43	77
Totals	14,600	13,193

APPENDIX D

GAME STATISTICS

TABLE 1. COOPERATIVE HUNTING AREA OPERATIONS

Area	Acreage open to hunting			Scheduled seasonal shooter capacity*			Actual number hunters using the area			Number of pheasants shot			Percent of successful hunters†		
	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951
Staten Island	7,500	6,820	6,745	6,000	5,000	5,000	5,717	4,323	3,283	1,556	996	1,286	27	23	39
Williams	5,000			5,000			3,906			1,193			31		
Sutter Basin	8,900	7,674	12,671	9,000	8,000	8,000	6,726	4,590	6,484	2,330	1,689	3,047	35	37	47
Natomas	8,800	16,994	16,684	16,000	13,600	12,000	10,922	9,144	10,810	2,122	2,764	3,006	19	30	28
Grimes	15,800	18,653	19,213	16,000	18,000	18,000	9,377	8,612	8,757	3,518	4,375	4,261	38	51	49
Sartain	12,450	10,700	12,530	23,000	11,500	11,500	4,518	1,691	1,849	2,733	898	1,187	60	53	64
Ryer Island		10,207	11,288		6,650	6,650		4,069	4,225		1,449	1,849		36	44
Butte Creek		10,138	8,612		11,500	11,500		6,413	5,460		2,095	1,710		33	31
Meridian		8,982	8,556		6,000	6,300		2,630	3,174		1,362	1,917		52	60
Los Banos		7,091	6,116		3,200	3,200		2,648	2,778		1,068	980		40	35
Firebaugh		6,954	7,700		4,250	4,500		3,769	4,205		1,853	1,653		49	39
Twitchell			5,720			3,500			3,676			885			24
Totals	58,450	104,213	115,835	75,000	87,700	90,150	41,166	47,889	54,701	13,452	18,549	21,781	33	39	40

* Minimum number of hunters that could be accommodated for the season. No correction is made for hunters that hunt only part of a day and are then replaced by other hunters.
† Derived by dividing the number of pheasants shot by the number of hunters. No correction is made for hunters shooting two pheasants (the daily limit).

TABLE 2. WATERFOWL MANAGEMENT AREA OPERATIONS

Area	Acreage open to hunting			Scheduled seasonal shooter capacity*			Actual number hunters using the area			Number of waterfowl shot			Average number of waterfowl per hunter		
	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951
Imperial†	3,580	3,904	4,339	11,440	16,500	21,780	2,201	2,523	5,285	4,510	4,332	11,802	2.1	1.7	2.2
Honey Lake	1,750	1,000	3,000	2,000	2,500	3,400	558	1,003	3,611	518	1,029	3,881	.9	1.0	1.1
Madeline Plains‡	4,775	2,400	2,400	4,800	6,000	7,200	75	16	111	161	6	144	2.2	0.3	1.3
Grizzly Island		3,897	4,000		7,500	8,700		4,564	9,574		4,897	17,577		1.1	1.8
Colusa		1,090	1,000		1,325	1,725		1,647	2,398		2,445	3,594		1.5	1.5
Merced			1,200			1,920			729			860			1.2
Totals	10,105	12,291	15,939	18,240	33,825	44,725	2,834	9,753	21,708	5,189	12,709	37,858	1.8	1.3	1.7

* Minimum number of hunters that could be accommodated for the season. No correction is made for hunters that hunt only part of a day and are then replaced by other hunters.
† Includes Poe, Pumice, Hazard and Imperial Refuge areas.
‡ Principally a breeding ground—offers little shooting.

TABLE 3. CONTROLLED HUNTS—SPECIAL SEASONS

Game hunted	Area	Date	Number of permits issued	Number of permits used	Number of animals taken			Percent successful hunters	Remarks
					Male	Female	Totals		
Antelope	Modoc, Lassen, Shasta Counties	1942	500	452	405		405	90	Hunting open only for bucks with horns longer than ears.
Antelope	Modoc, Lassen, Shasta Counties	1943	500	452	362		362	80	Hunting open only for bucks with horns longer than ears.
Antelope	Modoc, Lassen, Shasta Counties	1944	500	445	322		322	72	Hunting open only for bucks with horns longer than ears.
Antelope	Modoc, Lassen, Shasta Counties	1945	500	440	307		307	70	Hunting open only for bucks with horns longer than ears.
Antelope	Modoc, Lassen, Shasta Counties	1949	500	464	349		349	75	Season closed 1946, 1947, 1948, and in 1950.
Antelope	Modoc, Lassen, Shasta Counties	1951	500	415	280		280	67	
Elk	Owens Valley, Inyo County	1943	75	75	43		43	57	Hunting open only for bulls.
Elk	Owens Valley, Inyo County	1949	125	119	61	46	107	90	Permits issued for taking 50 cows and 75 bulls.
Deer	Catalina Island, Los Angeles County	11-1-49 to 1-31-50	1,950	724	246	231	477	66	Season open for either sex.
Deer	Mineral King National Game Refuge, Tulare County	9-16 to 10-15-50	960	870	394	283	677	78	Season open for either sex.
Deer	Devils Garden, Modoc County	11-4 to 11-12-50	1,509	1,398	169	1,150	1,319	94	Season open only for antlerless deer.
Deer	Santa Barbara County	8-11 to 9-16-51	600	543	60	205	265	49	Season open only for antlerless deer.
Deer	Grass Valley, Nevada County	10-8 to 10-21-51	350	281	30	158	188	67	Season open only for antlerless deer.
Deer	Devils Garden, Modoc County	11-3 to 11-11-51	1,818	1,716	129	1,375	1,504	88	Season open only for antlerless deer.
Deer	Lassen-Washoe, Lassen County	11-3 to 11-11-51	1,413	1,356	92	1,176	1,268	94	Season open only for antlerless deer.

TABLE 4. ANNUAL DEER KILL COMPILED FROM HUNTER'S DEER TAG REPORT CARDS

County	Yearly average	Number killed annually				
	1927-46*	1947	1948	1949	1950	1951
Alameda	329	354	441	356	386	580
Alpine	316	928	1,251	1,522	1,306	1,755
Amador	175	315	323	272	242	316
Butte	361	767	817	820	794	785
Calaveras	255	398	447	430	421	417
Colusa	322	432	427	410	442	574
Contra Costa	38	128	141	117	130	178
Del Norte	26	33	48	56	53	41
El Dorado	741	1,277	1,049	934	863	1,071
Fresno	1,401	2,407	2,050	1,721	1,733	2,280
Glenn	617	786	757	715	719	712
Humboldt	1,068	1,335	2,083	1,962	1,770	2,313
Imperial	3	11	19	14	10	8
Inyo	403	686	467	375	303	718
Kern	332	468	515	518	558	558
Kings	10	12	9	32	31	38
Lake	1,204	1,835	2,120	2,182	1,942	2,155
Lassen	1,047	2,368	2,019	2,894	2,243	4,499
Los Angeles	710	634	509	720	571	633
Madera	472	556	662	554	508	623
Marin	453	488	634	597	554	767
Mariposa	219	296	215	178	202	240
Mendocino	1,988	3,067	3,627	3,354	2,927	3,665
Merced	82	114	102	157	199	252
Modoc	1,634	2,262	2,022	2,772	2,230	6,077
Mono	327	1,416	1,090	1,405	1,494	1,973
Monterey	842	1,188	1,154	1,624	1,705	2,057
Napa	608	899	1,027	1,020	952	983
Nevada	455	1,241	1,216	1,219	939	1,327
Orange	85	104	53	106	112	134
Placer	389	597	624	678	449	655
Plumas	1,348	1,995	2,322	2,311	1,820	2,255
Riverside	391	389	334	423	380	406
Sacramento	5	12	8	11	16	18
San Benito	360	544	538	783	861	1,217
San Bernardino	236	307	221	230	210	285
San Diego	387	680	568	827	767	734
San Joaquin	23	21	18	33	23	54
San Luis Obispo	608	775	319	1,046	1,103	1,389
San Mateo	105	114	119	151	144	135
Santa Barbara	679	593	252	550	651	815
Santa Clara	558	528	559	764	763	939
Santa Cruz	112	131	91	106	106	101
Shasta	883	1,344	1,686	2,151	2,154	2,880
Sierra	512	1,370	1,360	1,421	947	1,126
Siskiyou	1,506	2,712	2,865	3,490	2,845	4,035
Solano	64	83	95	88	102	78
Sonoma	802	1,151	1,505	1,269	1,138	1,447
Stanislaus	123	212	138	210	221	311
Sutter	1	2	3	3	5	4
Tehama	1,167	1,632	1,806	1,672	2,060	3,710
Trinity	789	1,243	1,576	1,518	1,398	1,119
Tulare	1,160	1,296	1,315	1,062	889	985
Tuolumne	519	1,178	1,135	1,147	569	998
Ventura	544	976	477	671	728	673
Yolo	219	348	356	284	269	264
Yuba	76	123	188	147	171	257
County not given	2	17	17			
Totals	30,091	47,178	47,789	52,082	47,128	64,619

* Detailed figures for this period can be obtained in previous biennial reports.

TABLE 5. GAME BIRD RELEASES

Liberation of Game Farm Birds, January 1, 1950, Through December 31, 1951

County	Ring-neck	Reeves	Turkey	Chukar	Valley Quail	Total
Alameda	1,205					1,205
Amador	1,797					1,797
Butte	13,075	426				13,501
Calaveras	13					13
Colusa	7,341					7,341
Contra Costa	1,998					1,998
Fresno	14,283					14,283
Glenn	5,859					5,859
Humboldt	500					500
Imperial	10,479					10,479
Inyo	5,186					5,186
Kern	4,938					4,938
Kings	3,903					3,903
Lake	232					232
Lassen	1,704					1,704
Los Angeles	3,253				185	3,438
Madera	5,145					5,145
Mendocino	180					180
Merced	14,769					14,769
Modoc	2,748					2,748
Mono	321					321
Monterey	1,806		35			1,841
Napa	2,044					2,044
Placer	1,582					1,582
Riverside	7,025		28			7,053
Sacramento	9,764					9,764
San Bernardino	6,958			1,644	344	8,946
San Diego	3,072			449	1,744	5,265
San Joaquin	12,288					12,288
San Luis Obispo	283					283
Santa Barbara	2,187					2,187
Santa Clara	631					631
Shasta	1,355					1,355
Sierra	673					673
Siskiyou	5,240					5,240
Solano	9,198					9,198
Sonoma	1,571		40			1,611
Stanislaus	4,695					4,695
Sutter	11,086					11,086
Tehama	2,449					2,449
Tulare	8,847					8,847
Ventura	992					992
Yolo	4,901					4,901
Yuba	3,050					3,050
Totals	200,626	426	103	2,093	2,273	205,521

TABLE 6. PREDATORY ANIMAL CATCH BY COUNTIES

County	January 1-December 31, 1950				January 1-December 31, 1951				Total for period
	Coyote	Bobcat	Other predators	Total	Coyote	Bobcat	Other predators	Total	
Amador	44	23	151	218					218
Butte	155	22	500	677	55	9	218	282	959
El Dorado	26		17	43	37	9	115	161	204
Fresno	101	40	401	542	110	35	81	226	768
Humboldt	18	75	86	179	4	39	76	119	298
Imperial	10	6	63	79	5	1	62	68	147
Inyo	279	26	89	394	193	26	83	302	696
Kern	237	47	33	317	179	116	83	378	695
Lake	48	16	132	196	41	37	206	284	480
Lassen	142	28	67	237	57	17	74	148	385
Los Angeles	59	30	129	218	38	54	94	186	404
Madera	45	25	23	93	44	19	51	114	207
Mariposa					31	9	138	178	178
Merced					1	2	171	174	174
Modoc	3		1	4	35	18	54	107	111
Mono			4	4					4
Monterey	104	178	890	1,172	28	190	646	864	2,036
Nevada	39	4	4	47	3		46	49	96
Orange	8	35	48	91					91
Placer					10	2	160	172	172
Plumas	177	58	119	354	200	45	123	368	722
Riverside	148	40	225	413	95	43	331	469	882
Sacramento	1		5	6	27	3	184	214	220
San Benito	29	177	524	730	26	185	694	905	1,635
San Bernardino	287	105	270	662	226	118	149	493	1,155
San Diego	127	48	148	323	177	41	83	301	624
San Luis Obispo	21	20	31	72	16	27	36	79	151
Santa Barbara	7	4	8	19		1	1	2	21
Santa Clara	1	15	50	66		7	27	34	100
Shasta	151	40	125	316	218	37	140	395	711
Sierra					25	6	7	38	38
Siskiyou	119	43	55	217	206	76	72	354	571
Stanislaus	24	4	129	157					157
Tehama	53	4	29	86	27	8	22	57	143
Trinity					19	9	36	64	64
Tulare	50	20	104	174	88	23	82	193	367
Tuolumne	122	29	50	201	128	24	40	192	393
Ventura	158	19	15	192	78	6	47	131	323
Yuba					97	13	248	358	358
Totals	2,793	1,181	4,525	8,499	2,524	1,255	4,680	8,459	16,958

	January 1-December 31, 1950	January 1-December 31, 1951
Average number of trappers	35	36
Miles of trapline	335,529	279,629
Number of sets	400,067	349,296
Number of days	9,228	7,674

TABLE 7. NUMBER OF MOUNTAIN LIONS BOUNTIED BY DEPARTMENT OF FISH AND GAME

County	*Total bountied	Yearly average	Number bountied annually					Totals
	1907–46	1907–46	1947	1948	1949	1950	1951	
Alameda	11		4	5	1	8	4	33
Alpine	3							3
Amador	26	1	1					27
Butte	69	2		1	2	6	2	80
Calaveras	62	2						62
Colusa	76	2	3	3	1	3		86
Contra Costa				1				1
Del Norte	212	5	1		8			221
El Dorado	221	6		4	5	4		234
Fresno	172	4	6	7	1	3	8	197
Glenn	233	6	12	5	11	7	2	270
Humboldt	1,020	26	24	6	17	18	8	1,093
Imperial	2							2
Inyo	22	1	1			2	1	26
Kern	415	10	6	11	14	21	7	474
Kings	1							1
Lake	474	12	7	5	11	7	4	508
Lassen	13							13
Los Angeles	179	4	7	1		1	6	194
Madera	103	3	1			2		106
Marin	3							3
Mariposa	145	4	1	2	1	2		151
Mendocino	664	17	7	18	12	7	7	715
Merced	6			2		2		10
Modoc	6							6
Mono	17		3	2	1	15	2	40
Monterey	567	14	18	29	34	34	24	706
Napa	4							4
Nevada	35	1			1		1	37
Orange	16							16
Placer	117	3			1			118
Plumas	18					2		20
Riverside	104	3	1	1	1	1		108
Sacramento	1							1
San Benito	66	2	1			1		68
San Bernardino	168	4	4	3	1			176
San Diego	251	6	8	10	8	4		281
San Francisco								
San Joaquin	2							2
San Luis Obispo	231	6	1	9	6	7	2	256
San Mateo	1							1
Santa Barbara	433	11	1		4	2	3	443
Santa Clara	125	3	2	7	11	14	6	165
Santa Cruz	4							4
Shasta	651	16	22	15	12	7	9	716
Sierra	42	1	1					43
Siskiyou	514	13	5	17	6	7	7	556
Solano								
Sonoma	35	1		1				36
Stanislaus	24	1					2	26
Sutter	1							1
Tehama	419	10	11	2	6	7	5	450
Trinity	891	22	22	16	18	21	7	975
Tulare	461	12	14	15	8	12	11	521
Tuolumne	185	5						185
Ventura	166	4		1			4	171
Yolo	3							3
Yuba	45	1					1	46
Totals	9,735	244	195	199	202	227	133	10,691

* Detailed figures for this period can be obtained in previous biennial reports.

APPENDIX E

ARRESTS, FINES AND SEIZURES

TABLE 1. TOTAL ARRESTS FOR PERIOD OF 52 YEARS

1902-1904	550	1928-1930	5,388
1904-1906	774	1930-1932	5,237
1906-1908	1,192	1932-1934	3,795
1908-1910	1,771	1934-1936	4,535
1910-1912	2,063	1936-1938	6,382
1912-1914	1,993	1938-1940	7,444
1914-1916	2,087	1940-1942	7,262
1916-1918	1,797	1942-1944	4,298
1918-1920	1,891	1944-1946	5,902
1920-1922	2,258	1946-1948	11,331
1922-1924	2,715	1948-1950	12,947
1924-1926	3,207	1950-1952	12,802
1926-1928	4,390		

TABLE 2. ARRESTS AND CONVICTIONS—RECAPITULATION

	1950–1951	1951–1952
Fish cases—		
Number of arrests	3,715	3,422
Fines	$109,072.36	$101,181.50
Jail sentences	1,412 days	412½ days
Game cases—		
Number of arrests	2,406	3,259
Fines	$121,976.00	$151,360.50
Jail sentences	2,196½ days	5,056 days
Totals—		
Number of arrests	6,121	6,681
Fines	$231,048.36	$252,542.00
Jail sentences	3,608½ days	5,468½ days

TABLE 3. FISH CASES

Offense	July 1, 1950 to June 30, 1951			July 1, 1951 to June 30, 1952		
	Number of arrests	Fines imposed	Jail sentences (days)	Number of arrests	Fines imposed	Jail sentences (days)
Abalone: Overlimit; undersize; out of shell; using undersize for bait; using another's license; failure to show license; no license; failure to show on demand; diving in District 19A; taking for commercial purposes in District 19A; closed area; selling abalone taken on sport license; possessing abalone not legally taken; using illegal instrument; failure to have accurate measuring device	461	$13,036.00		435	$13,398.00	
Angling: No license; possession gaff within 300 ft. of stream; using another's license; fishing closed stream; snagging; 2 lines; 2 poles; failure to show license on demand; using more than one pole; spearing; fishing within 150 feet of lower side of Mendota Dam; false statement to secure license; night fishing; using 7 poles; closed district; set lines; treble hook; operating fish trap; predated license; fish trap; attempting to shoot fish; injuring and obstructing fish ladder; fishing from dam; taking fish by hands; nonresident using resident license; attempting to spear on spawning bed; possession fishing equipment in refuge; seining; transfer of license; taking fish from spawning bed; angling within 250 feet of fishway; using more than 2 attractor blades; alien angling without license; using 7 hooks; fishing from fish ladder; unattended pole; taking fish other than by angling; using 2 poles and handline; using compressor to take fish; fishing in inlet; chumming with vegetable matter; taking game fish with net	1,422	20,087.00	510	1,379	21,467.50	133
Barracuda: Selling fish taken on sport boat; overlimit taken on sport boat; selling undersize; taking with roundhaul net and taking overlimit	5	137.50		2	75.00	
Bass: Overlimit; taking with spear; selling; no license; undersize; failure to show fish on demand; using undersize for bait; taking at night; possession on commercial boat; taking closed season; buying; hiding undersize fish; taking by means other than angling; possession for sale; taking in nets; possession in restaurant	367	11,911.50	12	298	10,277.00	4
Catfish: Taking by means other than angling; undersize; overlimit; taking without license; taking at night; selling undersize; operating set line; disturbing catfish nets; using more than one pole; taking by fish trap; netting	54	1,157.00		37	1,230.00	
Carp: Taking with gaff and clubs; no license; taking with seine	4	155.00		5	200.00	
Clams: Pismo, cockles, big neck, Washington: closed season; overlimit; undersize; failure to show; failure to return undersize to holes; clamming on refuge; clamming without license; noncitizen taking without license; night clamming; out of shell; selling; transportating out of shell; possession digging instruments on clam preserve	184	15,388.50	109½	550	15,270.00	256½
Commercial: Dragnet closed season; no commercial license; no boat registration; failure to make out forms correctly; early net on Sunday; taking overlimit on commercial boat; illegal use roundhaul net closed area; operating purse seiner in District 118.5; operating gill net District 19A; selling undersize catfish; possessing unpunched lobsters; taking striped bass with trawl net; illegal operation of trawl net; using dragnet less than 25 fathoms in District 17; no party boat permit; selling untagged packaged trout; failure to make fish receipts for halibut; wastage of fish; taking and delivering undersize sardines; selling fish taken on party boat; set net; failure to procure license plates; drag net in 13½ fathoms at Monterey; failure to obtain fish packer's license; failure to keep and return log book on drag						

TABLE 3. FISH CASES—Continued

Offense	July 1, 1950 to June 30, 1951			July 1, 1951 to June 30, 1952		
	Number of arrests	Fines imposed	Jail sentences (days)	Number of arrests	Fines imposed	Jail sentences (days)
boat; over 500 lbs. on drag boat of crab; failure to issue pink slips; no dealer's license; possession undersize crabs; taking crabs closed season; overlimit rock bass; possession undersize lobsters; operating in District 10 with trawl net; failure to post bag limits on party boat; possessing sturgeon and striped bass on party boat; diving for abalone without permit; failure to declare and possession of illegal trout; lobster traps closed season and closed area; sale undersize yellowtail; failure to deliver fish receipts to Commission; predating licenses in bait shop; offering undersize tuna for sale; restaurant possessing undersize lobsters; commercial fisherman possessing female crabs; no tag and weight returns filed; processor possessing undersize abalone; set net in District 12; gill net in District 3; canning sardines for bait; possession beam trawl; bringing fish ashore in condition in which size and species could not be determined; no importer's license; failure to record species on market ticket; license agent selling citizen license to aliens knowingly; allowing crabs to deteriorate and waste; selling fish without license; packing fish in excess of 10 percent for pet food	428	$18,931.00	623	297	$22,362.50	9
Crabs: Taking undersize; possession live crabs in closed season; taking females; selling female; selling undersized; taking without license; overlimit; alien taking with illegal license	19	1,145.00	5	13	490.00	
Frog: Closed season; undersize; overlimit; taking with spear; shooting at night; taking at night	29	755.00		6	130.00	
Grunion: Closed season; failure to show fish	5	95.00		2	30.00	
Lobster: Pulling traps, taking undersize; resisting arrest; operating traps closed area; taking in closed season; possession unstamped lobster; no license; snagging	44	1,509.50	2½	9	250.00	
Pike: Taking without license	1	10.00				
Pollution: Sawdust; oil; tin cans and hog swill; mill refuse; rotary mud; cattle spray; bluestone; explosives; beet sugar residue	34	2,800.00		45	5,000.00	
Rockfish: Overlimit; failure to show license; using another's license	4	25.00		3	40.00	
Salmon: Spearing; no license; undersize; serving salmon in restaurant taken on sport boat; taking with 2 rods; mutilated; taking after hours; before hours; with gaff; shooting in spawning area; possession spears on spawning beds; taking with hands; spearing and blocking stream	50	1,615.00	150	60	2,205.00	
Shad: Closed season; offering for sale; taking with nets	5	150.00				
Sturgeon: Taking fully protected fish; on commercial boat; no license	2	137.50		2	60.00	
Sunfish: Closed season; no license; netting; overlimit; closed waters; taking with net in District 2; using 2 lines; operating fish trap to take; at night; failure to show on demand; selling young; set lines	69	1,975.00		75	2,082.00	
Trout: Closed season; no license; alien using citizen's license; snagging; overlimit; taking with 2 lines; from closed stream; using 5 attractor blades; possession treble hooks; taking within 150 ft. lower side of dam; chumming; shooting with rifle; importing without tags; possession trout and gaff hook; spearing, transporting untagged; transporting illegal trout into California; unattended rod trout fishing; taking from private pond	222	6,860.00		203	6,604.50	10
Tuna: Yellowfin, yellowtail; taking without license, selling undersize	3	112.50		1	10.00	
Yellowfin croaker: Possession overlimit	3	127.00				
Totals	3,715	$98,120.00	1,412	3,422	101,181.50	412½
Sale of seized fish		10,952.36				
Grand Total		109,072.36				

TABLE 4. GAME CASES

Offense	July 1, 1950 to June 30, 1951			July 1, 1951 to June 30, 1952		
	Number of arrests	Fines imposed	Jail sentences (days)	Number of arrests	Fines imposed	Jail sentences (days)
Antelope: Taking female; illegal possession of meat; illegal possession; illegal transportation; no license	2	$125.00		3	$200.00	
Bear: Closed season; taking with trap closed season	3	135.00		3	125.00	
Beaver: Closed season	3		200			
Coots: Closed season; taking with .22 rifle; no license; shooting and not retrieving; shooting from moving vehicle (powerboat)	18	420.00	17½	1	50.00	
Deer: Closed season; taking doe; using artificial light; unauthorized possession; spike buck; possession spotlight and gun while hunting; night hunting; untagged deer; forked horn; attempting to take overlimit; possession illegally taken deer; shooting from auto; allowing dogs to chase deer in closed season; possession spotted fawn; failing to retain antlers and hide; failure to have tags countersigned; taking another's deer; mutilating tag; taking with .22 rifle; taking with shotgun; using illegal ammunition; possession wife's tags; using rimfire rifle; failure to mail in tag; hunting without tags; discharging gun and taking deer in game refuge; using No. 2 tag in No. 1 district; hunting without nonresident license; transfer of tags; California resident possessing deer on Utah license; transferring tag; shooting from public road and within 150 yds. dwelling; refusing to show game on demand; hunting again before tagging deer; illegal transportation; removing sex evidence; hunting deer in both archery and regular season; taking spike buck during doe hunt; false statement to obtain tags and license; permitting dogs to kill	383	38,468.00	806	585	51,435.50	3,342½
Deer Meat: Possession unstamped meat; closed season; purchasing unstamped meat; selling; failure to mark shipped meat; illegal transportation into California	105	11,658.00	166	119	12,493.00	981
Dove: Closed season; using unplugged gun; bringing in from Mexico in closed season; overlimit; no license; shooting from auto; early shooting; late shooting; failure to show on demand; possession in closed season; shooting with .22 rifle; transfer of license and shipping tags; using another's license; bringing overlimit in from Mexico	140	4,950.00	32	208	6,365.00	30
Duck: Hunting, no license; possession of gun in refuge and late hunting; overlimit from Mexico; using unplugged gun; overlimit; using .22 rifle and no license; taking at night; possession of undeclared ducks; operating powerboat for shooters; shooting in refuge; transferring license tags; shooting from powerboat; attempting to shoot from auto with rifle; taking with pistol; using live duck decoys; trespassing on shooting grounds; herding on refuge; rallying with power boat; taking without stamp; leaving cooperative area without checking out; transporting without permit	413	13,669.50	41½	424	17,212.00	25
Elk: Killing fully protected animal; killing 2 elk; bringing illegally into California; illegal transportation; illegal license; no tags; failure to declare	5	700.00		6	625.00	
Goose: Closed season and shooting from auto; early shooting; overlimit; improperly plugged gun; offering overlimit for shipment; hunting without license; late shooting; receiving and accepting overlimit for shipment; hunting on refuge; driving with powerboat; shooting in refuge; taking with rifle; illegal possession; shooting from power boat	57	1,638.00		39	1,177.50	

TABLE 4. GAME CASES—Continued

Offense	July 1, 1950 to June 30, 1951			July 1, 1951 to June 30, 1952		
	Number of arrests	Fines imposed	Jail sentences (days)	Number of arrests	Fines imposed	Jail sentences (days)
Hunting: Possessing gun in refuge; possessing gun and light at night; no permit; night hunting; falsifying license; discharging gun in refuge; no license; hunting in restricted zone; unplugged gun; early shooting; hunting in Federal refuge; failure to show license; shooting from road; from auto; from powerboat; destroying State and Federal signs; using another's license; loaded gun while crossing refuge; trespassing; crossbow in refuge; loaded gun in car; trapping without license; predating hunting license; hunting on co-operative without permit; removing trap belonging to licensed trapper; disturbing State trap line	543	$19,485.50	273½	1,191	$32,387.00	331
Mudhen: Late shooting; closed season; using .22 rifle; shooting from powerboat; no license and using unplugged gun; hunting on cooperative without permit	1	25.00		8	210.00	
Muskrat: Trapping closed season and no trapper's license	1	10.00				
Nongame Birds: Taking meadow larks; barred owl; seagull; grebes; taking from motorboat; taking plover; rail; killdeer; jacksnipe; sparrow hawk; monkey-faced owl; woodpecker; wild swan; shore-birds; golden eagles; robin; titmouse; towhees; junco; lark sparrow; blue heron; yellowhammer; western piper; saudhill crane; godwit; glossy ibis	37	995.00		35	1,270.00	
Nongame Animal: Killing mountain sheep				1	250.00	
Pheasant: Closed season; hen pheasant; early shooting; shooting from powerboat; failure to tag; no game-breeder's license; taking closed zone cooperative area; taking with unplugged gun; possession without tags; taking with .22 rifle; shooting from public road; over-limit; shooting from car; no license; using another's tags; possessing 2 sets of tags other than those legally issued to him	266	14,574.00	627	312	15,673.00	194
Partridge: Closed season				3	260.00	
Pigeon: Closed season; overlimit; taking without license; hunting with loaded gun in car	6	275.00		10	280.00	
Quail: Closed season; overlimit; possession gun and light in quail area at night; bringing into State from Mexico in closed season; using unplugged gun; early shooting; failure to show on demand; hunting without license; taking with .22 rifle; late shooting; possession and transportation of illegal quail; taking in refuge	51	2,245.00	15	54	2,680.00	25
Rabbit: Taking without license; closed season; night hunting; spotlight; using unplugged gun; failure to show license; taking in refuge; early shooting; shooting from auto; transfer of hunting license; shooting from public road; hunting with another's license; overlimit; hunting with loaded .22 in auto; shooting in safety zone	358	12,053.00	18	233	7,337.50	127½
Sagehen: Closed season; taking overlimit; taking with unplugged gun; taking in refuge	7	275.00		16	1,080.00	
Squirrel: Closed season, taking tree squirrels; possession parts in closed season; taking in closed district; taking gray squirrels	7	275.00		8	250.00	
Totals	2,406	$121,976.00	2,196½	3,259	$151,360.50	5,056

TABLE 5. SEIZURES OF FISH AND GAME

	July 1, 1950, to June 30, 1951		July 1, 1951, to June 30, 1952		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Fish:						
Abalone	5,622	3½	2,582	97	8,204	100½
Barracuda	109	491	20	209	129	700
Bass	1,535	10,507	1,306	53	2,841	10,560
Cabrilla				6,342		6,342
Carp	501	25½	31	80	532	105½
Catfish	289	78½	1,252	1,419	1,541	1,497½
Clam	28,028	416	9,688	3	37,716	419
Crab	933	870	493	8,151	1,426	9,021
Frog	292		273		565	
Grunion	205		21		226	
Halibut		405	2	621	2	1,026
Lobster	545	3,096	813	7,980	1,358	11,076
Mackerel		127,450				127,450
Perch			14		14	
Pike	3				3	
Rockfish	58		46		104	
Salmon	62	903	148		210	903
Sardine	6	708,500		3,707	6	712,207
Shad	9	1,489			9	1,489
Sole			14		14	
Sturgeon	3		3		6	
Sunfish	1,428		1,398		2,826	
Trout	1,640	113	1,600		3,240	113
Tuna	96	16,527	16	24,390	112	40,917
Yellowfin croaker		24				24
Yellowtail		304		220		524

TABLE 5. SEIZURES OF FISH AND GAME—Continued

	July 1, 1950, to June 30, 1951		July 1, 1951, to June 30, 1952		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Game:						
Antelope	1		1		2	
Bear	2		1		3	
Beaver	1				1	
Beaver skins	4				4	
Chukar partridge			4		4	
Coots	35		3		38	
Deer	246		321		567	
Deer meat		1,721		1,896		3,617
Dove	1,192		1,503		2,695	
Duck	935		1,295		2,230	
Elk	4		1		5	
Elk meat		30		230		260
Goose	111		55		166	
Mudhen	3		28		31	
Muskrat	5				5	
Nongame birds	57		54		111	
Pheasant	247		418		665	
Pigeon	21		12		33	
Quail	121		145		266	
Rabbit	435		312		747	
Sagehen	19		16		35	
Squirrel	10		13		23	

APPENDIX F

COMMISSION POLICY STATEMENTS

DEER MANAGEMENT POLICY FOR CALIFORNIA

1. To produce and maintain a maximum breeding stock of deer on all wild lands of California, public and private, consistent with other uses of such lands, and to utilize, through public hunting, the available crop of deer produced annually by this breeding stock.

2. To maintain for deer the best possible range conditions in conformance with other interests and uses; to expend funds for the improveemnt of deer ranges wherever such ranges are open to public hunting, and to aid and encourage private landowners to improve their deer ranges even though hunting is limited.

3. To keep deer populations in balance with local forage supplies and conflicting uses.

4. To assure a carryover of a maximum breeding stock of deer consistent with the forage available on each local unit of range.

5. To permit the harvest of all surplus animals, of either sex, over and beyond what the range can carry in healtby condition.

6. To limit the acquisition by the State of deer lands, access roads thereto or rights of way to those cases where unusual benefits will derive from the expenditure of moderate sums.

7. To control populations of deer that are rendering appreciable damage to valuable crops, orchards, vineyards, or gardens, by regulated public hunting where possible; elsewhere permit shooting will be relied upon.

8. To work out with other interested parties an equitable allocation of forage for deer and livestock where conflict or competition exists, and thereafter to regulate the deer herd according to such agreements.

9. To give primary consideration to deer in allocation of forage where the demands of deer and other big game species, native or introduced, may conflict.

10. To manage deer herds on the basis of natural forage without recourse to artificial feeding.

11. To reopen to deer hunting, following prescribed legal procedures, such existing refuges as are not actually needed to protect depleted herds, and when need for special local protection arises, to close such areas temporarily.

12. To hold local public hearings in any area where the commission intends to apply deer herd management regulations. Notice of such hearings will be given in papers of local distribution. The opinions of local groups of sportsmen, ranchers, and other interested parties will be heard and given consideration before final adoption of rules and regulations for any special hunt for deer.

13. To regulate the numbers of deer predators on the basis of local deer needs concentrating control efforts on understocked ranges or ranges where hunters are fully harvesting an annual deer crop.

14. To make impartial objective surveys of the deer herds annually in order that the commission may be supplied with authentic information for its guidance in establishing hunting regulations and planning other aspects of deer management.

15. To inform the public concerning the mechanics of deer management and the requirements to maintain healthy and productive herds.

Adopted June 27, 1950.

INLAND WATER FISHERIES

The basic objective shall be to supply the best possible fishing for the greatest number of anglers with the minimum of restrictions and regulations necessary to insure a continued supply, fair distribution, and proper utilization.

The following are regarded as the principal and essential elements necessary to obtain this objective in view of present knowledge:

A. MAINTENANCE OF WATERS FOR THE ANGLER AND FOR THE FISH

1. It will be the constant endeavor to keep as much water as possible open and accessible to the public for the purpose of fishing.
2. The primary objectives in habitat work will be the maintenance of natural conditions in natural waters, the adaption of impounded waters for fishery purposes, and the creation of new fishing waters. Stream and lake improvement which involves the building of artificial devices for the improvement of food or shelter is not economically feasible on a large scale and the benefits are questionable on the basis of present knowledge.
3. The quantity and quality of waters will be maintained so as to produce maximum numbers of fish. Other uses of water are recognized as necessary, but recreational use by one million anglers is also of prime importance. It will therefore be the objective to obtain assignment and protection of water for fishery purposes on an equitable basis with other uses. No single use or combination of uses need exclude others under proper planning and management. As impoundments and canals are created, every effort will be made to adapt or manage them for fishery purposes.
4. Waters may be extended or flows improved through use of storage, either constructed solely for fishery purposes or for other uses.
5. Since the quality of waters will be subject to impairment as the State grows industrially and in population, an aggressive program for the prevention and correction of pollution will be carried out.
6. Fish must be protected as fully as possible from the hazards created by the other uses of water. Fish ladders or other devices will be required to permit fish to reach spawning or feeding grounds, and screens will be required to prevent losses in diversions. Ladders shall be provided and maintained by the owners of the dams as required by law. Fish screens as specialized mechanical devices are more economically and efficiently constructed and kept in repair by a single agency of the State. Owners will be required to assist in operating the screens, and screens on power and large diversions shall be both installed and maintained by the owners, as now required by law. By-pass water to return fish to the stream below the diversion shall be provided by the owner of the diversion where necessary.

The new Delta Field Base, on the San Joaquin River near the Antioch Bridge, was built during 1951 with Wildlife Conservation Board funds. The building contains adequate storage and working space for the various delta activities of the department, including berths for three boats, the *Striper*, *Rainbow*, and *Minnow*.

7. The movement of steelhead and salmon in streams is often obstructed by barriers resulting from logging, mining, and road building, and it is only proper that the owners or operators be required to prevent or remove such obstructions.
8. Proper conditions for fish production can also be destroyed by the filling of lakes and streams with the products of erosion, and every assistance will be given to agencies directly concerned with the control of erosion and pollution.
9. Constant vigilance will be maintained to prevent the introduction, either officially or unofficially, of plants, fishes, or other animals which might prove harmful to existing fishes, either directly or indirectly. At the same time, continuing studies will be made to discover new introductions which could be made safely to improve the productivity of certain waters.

California was naturally endowed with an excellent supply of trout and salmon in the cooler waters. Fishes suitable for warmer reservoirs, lakes and streams were few in number. A wide variety has been introduced by the Fish and Game Commission over the years. On the whole, these introductions were useful, but some mistakes were made. Introduction of other game and forage fishes may be desirable in the future but new fishes will not be brought in unless all available evidence indicates that the benefits will be substantial and the hazards few. Initial introductions would be made where spread to other waters in the State can be controlled.

B. TROUT POLICY

1. Since the majority of trout caught are the result of natural propagation, everything possible will be done to aid and protect natural production. Assistance will in large part consist of the protection and improvement of habitat, but will also include protection from disease and predators. Research will be carried out as needed to solve management problems.
2. Artificial propagation is a useful and important part of trout management and will be used where necessary and helpful. It is not, however, a universal answer to all fishery problems and will be subject to constant checks to determine the results obtained.
3. Present evidence indicates that in heavily fished waters the planting of trout of catchable size increases the angler's take and resultant satisfaction, but is expensive. This type of planting will be developed only as rapidly as funds are available from those enjoying that type of trout angling.
4. Fingerling trout plants have but slight value in most streams already containing trout. The major use of fingerlings will be in naturally barren waters, in those waters where the population has been destroyed, and in the small and lightly fished lakes.
5. The planting of catchable trout is most effective in easily accessible roadside waters, especially lakes, and they will therefore be given first priority. Due to the cost of catchable trout, they shall not be planted unless a large number, usually over 50 percent, will be taken by anglers. Waters only seasonably suitable for trout shall not be planted except in those areas of the State where the potential fishing pressure is extremely high because of a lack of more suitable waters. Even there they should not be planted unless the fishing pressure is heavy enough to remove at least 50 percent while water conditions are favorable for trout.
6. In the setting of open seasons for trout and salmon special protection will be be given to spawning fish and the young of steelhead and salmon before migration to the ocean.

C. WARM-WATER FISHES

1. The great variation in the productiveness of our warmer waters indicates that additional knowledge as to the controlling factors is more likely to increase the production than is random planting. Management founded on basic facts will therefore be the method of attack.
2. Native warm-water game fishes were few in California waters, and of those introduced years ago, black bass, sunfish, and catfish have prospered in certain waters. They supply part of the angling for about 30 percent of California anglers. Where conditions were suitable production has been satisfactory with

little subsequent planting. Based on that evidence, and similar experience elsewhere in the United States, it is not deemed necessary nor worth while to produce large numbers of the warm-water fishes for repeated plantings. After an initial plant, success is more dependent on food and water conditions. Even where conditions limit spawning success, the planting of a few thousand fry year after year can hardly be useful in view of the great number of small fish required for warm-water fish production. Successful warm-water fish production requires much greater numbers of young fish than can possibly be produced artificially. Hatchery production of warm-water fishes shall therefore be limited to the amount needed for stocking barren waters, above what can be obtained through rescue work. When these fish are established in suitable waters, no further stocking is necessary. It is not practical to rear bass or other warm-water fishes to catchable size for planting since they require large amounts of natural food. The only fish of that size available for stocking are those obtained in rescue work.

3. The principal losses of warm-water species, such as sunfishes, catfish, and rough fish, are in drying reservoirs and canals. These fishes are very prolific under favorable conditions, and the addition of rescued stock to well established populations may do more harm than good, or at best, supply a temporary increase in food for existing fish. Rescue of warm-water fishes will therefore be carried on mainly to obtain stock to be used in establishing these fishes in waters in which they are absent.

D. PRIVATE FISHING LAKES

1. California in comparison with other states has few farm ponds but all that we have should be utilized to their full capacity. The present policy of the commission, to supply an initial stocking of fish for most ponds under 25 acres without requiring that they be open to publish fishing, will be continued. Such small ponds can only supply a very limited amount of public fishing. However, use under angling license by the owner and his friends may relieve the burden on other waters. The productiveness of farm ponds in California is limited due to seasonal fluctuations, the frequent use of the water for irrigation, and often a reluctance on the part of the owner to manage them properly. Every effort will be made to develop the full productivity of farm ponds for fishery purposes. However, the amount of time and effort to be spent on farm pond work should be realistically proportionate to the results that can be expected.
2. Present regulations of the commission require that reservoirs over 25 acres in area and lakes and streams of all kinds be open to public fishing in whole or in part if they are to be managed or planted by the State. Planting of reservoirs over 25 acres or of streams and lakes, of which one-third is open to the public without charge by the owners is allowed under permit. These policies shall be continued since the fish naturally present in streams and lakes and in the larger reservoirs are the property of the people of the State, whose rights to use and enjoy them should be protected and extended, consistent with the proper protection of the landowner in the use and enjoyment of his property.

E. STEELHEAD AND SALMON

1. Evidence accumulated over the years in the Pacific states and Canada indicates that little or no benefit is derived by taking eggs for hatchery processing of steelhead and salmon from fish which would spawn naturally. Any benefits derived therefrom would be prohibitive in cost. Intensive hatchery work with these fishes shall be limited to areas where it is necessary to salvage the eggs of fish which no longer have adequate or suitable spawning areas.
2. The production of the two hatcheries now existing in the coastal area will be used primarily for experimental work looking toward the development of better and cheaper methods for using hatcheries to supplement the natural production of steelhead and salmon and the rehabilitation of barren streams.
3. Steelhead and salmon management will therefore be concentrated on the maintenance of an adequate breeding stock and on maintenance of suitable spawning and natural rearing of the young to migratory size.
4. Research to determine the factors limiting salmon and steelhead and methods of improving production will be vigorously prosecuted.
5. No stream can be expected to produce large numbers of young steelhead and salmon to migratory size and at the same time produce or support a crop of

resident fish. Evidence to date shows that it is futile to attempt to combine the two types of fishes. The greatest productivity of the coastal streams can be attained by using them as rearing areas for young fish which will migrate to sea, grow rapidly and return to the stream to supply greater sport as well as more pounds of fish. Resident fish will therefore not be planted or developed in steelhead and salmon streams.

6. The impermanency of many streams in California causes heavy losses of fish each year. All steelhead and salmon possible will be rescued, but it is recognized that salvage is difficult or impossible in many cases.

F. STRIPED BASS

1. Striped bass are an outstanding example of the tremendous productive potential of fishes under favorable conditions. In spite of more and more anglers, the fishery is stabilized and in good shape. Management will therefore be directed towards maintaining continuing statistical measures of the status of the fishery, in order to assess the effects of impending changes in their habitat and increase in the number of anglers. So far as possible, the adverse effects of these changes will be anticipated and prevented.

G. COMMERCIAL UTILIZATION OF FRESH-WATER FISHES

1. Salmon, shad, and catfish are still taken commercially from inland waters and carp and mullet are utilized under permit. The use of fishes for both food and recreation in combination is a higher use than for food alone. Where the supply is inadequate for both commercial and sports use in inland waters, the commercial use should be restricted or eliminated. However, full and proper utilization should be provided for. At present carp are not utilized by sportsmen as food, and therefore the increasing commercial use of this fish shall be encouraged and permitted.

H. REVISION OF POLICIES

1. All management policies shall be based on collection of factual information and research, and shall be modified in accordance with the findings made. The foregoing policies will therefore be regarded as a guide to ever improving and expanding principles for the management of the inland water fisheries of California, based on new facts developed through research and experience.

Adopted July 20, 1951.

APPENDIX G

REORGANIZATION PLAN FOR DEPARTMENT OF FISH AND GAME

The reorganization plan which was prepared by the Department of Finance and submitted to the Legislature pursuant to Chapter 195, Statutes of 1951 (Senate Concurrent Resolution No. 84) is reproduced below.

This plan formed the basis for the reorganization which the Department of Fish and Game is now undergoing. The regional boundaries as suggested by the proposed plan were followed, as shown on the map accompanying the director's report. The organizational set-up differs only in minor respects from the following proposal, principally in terminology of positions (see chart accompanying director's report).

March 3, 1952
A. N. 475

To: Honorable James S. Dean
Director of Finance
Subject: Department of Fish and Game—Organization Study

This report presents general findings and recommendations relating to the organization of the new Department of Fish and Game which came into existence September 22, 1951, under the Charles Brown Fish and Game Reorganization Act.

The report is submitted in response to Chapter 195, Statutes of 1951 (Senate Concurrent Resolution No. 84), dated June 1, 1951, and to a request of the Director of Fish and Game, dated October 31, 1951. The Senate resolution directed the Department of Finance to assist the Director of Fish and Game in preparing a plan for the organization of the new department on a regional basis, to be presented to the Legislature at the 1952 Budget Session.

General findings and recommendations relating to organization are presented here. More detailed recommendations may be presented later in discussion with the Director of Fish and Game.

Under the form of organization prevailing in the superseded Division of Fish and Game, the division operated its several programs with insufficient organizational provision for close coordination of game conservation, fish conservation, marine fisheries, and law enforcement at or near the local level. Field personnel assigned to a particular program often were insufficiently informed about other programs in their particular localities. While several bureaus within the division were organized by districts to which varying degrees of administrative authority had been given, the boundaries of these one-program districts did not coincide. Thus there was no one person in a particular area in charge of the operation of all fish and game programs with whom local sportsmen and other citizens could deal effectively.

To correct this condition, Chapter 195 directed that the administration of fish and game by the new department be organized on a regional basis.

The current report's organization plan calls for decentralizing fish and game operations to not to exceed five regions, each operating a composite fish and game program, and each under administrative control of a regional head. Yet the plan provides for sufficient central control to achieve reasonable uniformity and efficiency throughout the State. In addition, it concentrates administrative responsibility in the director and provides a clear line of authority throughout the department.

SUMMARY OF RECOMMENDATIONS

It is recommended that:

1. Administrative authority of the Department of Fish and Game be concentrated with the director as the law clearly intends.
2. Responsibility for general policies and regulations be concentrated with the Fish and Game Commission as the law clearly intends.
3. Actual line operations of fish and game programs be decentralized to not to exceed five regions to be administratively created.
4. The headquarters office of the department retain control over administrative policies and exercise general direction over the regional operations to achieve uniform and efficient fish and game programs throughout the State.

5. The over-all organization of the department be as described below.
6. The actual administration of marine law enforcement activities and personnel as indicated be transferred to the appropriate regions.

REASONS FOR RECOMMENDATIONS

1. Functions of the Director

The recommended organization plan calls for concentration of administrative authority in the director's hands.

In the past, under the Division of Fish and Game, administrative direction of fish and game activities has fluctuated among the commission members themselves, the executive officer, and bureau chiefs, and sometimes a combination of all three. Naturally administrative difficulties resulted from such changing leadership. Without the coordinating influence of an authoritative single executive, the heads of individual fish and game programs naturally had difficulty in coordinating their operations into one unified fish and game program.

Legislation creating the new department corrects this condition through concentrating administrative responsibility in the director, appointed by the Governor. Use of such authority as contemplated will help develop the well planned, coordinated, and smoothly operating single fish and game program that is desired.

2. Functions of the Commission

The legislation creating the department continues the power of the Fish and Game Commission to determine policies and to regulate the taking of fish and game. It also continues the requirement that the commission hear the recommendations and objections of interested citizens and groups. Administrative responsibility is delegated to the director.

This division of responsibilities between the commission and the director represents a substantial improvement over the previous administrative commission form of organization. Administrative actions are better performed by one executive and, conversely, policy formulation and promulgation of regulations are often delegated to boards and commission. Concentration of the commission's attention upon policy formulation and regulations, and further development of a tradition of noninterference in administrative actions will contribute substantially to successful functioning of the new department.

To assist in its work the commission will have a new exempt position of secretary subject to its appointment. When the commission is not meeting, day-to-day supervision of the secretary should be made a responsibility of the Director of Fish and Game.

A summary of the secretary's proposed duties follows:

Represent the commission at meetings of sportsmen's organizations, etc.

Obtain for the commission facts on which decisions on matters relating to policies and regulations can be based.

Supervise the commission's civil service secretarial position.

Make decisions regarding replies to correspondence addressed to the commission which ordinarily can not be handled by the civil service secretary.

Supervise the assemblying of material for the use of the civil service secretary in the preparation of the agenda for meetings of the commission.

Assist the commission in the conducting of meetings, especially in presentation of items on the agenda.

Confirm actions of the commission in writing to all parties affected.

During legislative sessions, aid in keeping the commission and the director informed regarding action on fish and game bills, resolutions, etc.

Investigate and report on complaints specifically addressed to the commission and relating to commission rules and regulations and policy matters. To promote coordination, copies of his reports on such complaints should in all cases go to the director. (Complaints received by the director, including those forwarded by the Governor's office, should be handled by the department.)

Every effort should be made to insure that the secretary's duties will be harmonious with the functions of the commission and with the activities for which the director must be primarily responsible. The department, rather than the commission secretary, should make *administrative* surveys and recommend improvements. This distinction

is necessary to avoid diffusion of administrative authority. It is important that the secretary's duties not conflict with the responsibilities of the director, not only now but even more so for the future, as it cannot be assumed that future directors and commission members will always have the same basic objectives and aims.

3. Decentralization

This report recommends that actual line operations of fish and game programs be decentralized as much as possible to five regions. As later indicated, this will not radically change the marine fisheries work.

Decentralization of operations is clearly needed in a state as large as California, with its extensive fish and game programs. Confusion has developed in the past because different fish and game programs and complements of personnel have been separately controlled by different officials in the headquarters office. Game conservation employees, fish conservation and marine employees, and patrol employees in given geographical areas have each reported separately to different officials in the headquarters office.

No one key employee has been at or near the local level to coordinate all fish and game operations. Each group has operated in some ignorance of what the others were doing. Moreover, local sportsmen and other citizens had no one person at the regional level to whom they could go to discuss game, fish, and law enforcement problems. Often they were forced to negotiate with headquarters, which usually was too far away for early and satisfactory contacts. As a result, unnecessary misunderstandings frequently developed.

To correct these conditions, Chapter 195 directed that the administration of fish and game operations be organized by the new department on a regional basis. Implementing that general plan, this report suggests decentralization of fish and game operations to the maximum extent practicable. In charge of each region will be one man with administrative responsibility for programs and personnel *within* the scope of established policies and programs. The fish and game public can deal with regional managers and obtain satisfaction without referring all matters to headquarters. This form of organization will give better service and assure better understanding by the people of the region.

This report suggests that there be not more than five composite regions, with the exact boundaries to be developed by the department. This form of organization will give improved service and assure better understanding.

At the present time, one bureau has five administrative districts; another seven; and a third eight. The Bureau of Marine Fisheries has operated on a coastwise and principal river system basis without defined districts. Study indicates that all factors considered, more than five composite regions are not needed. Five regions will bring fish and game administration close to the sportsmen and the general public. More than five regions would lead to substantially greater and continuing administrative expense.

The specific boundaries of regions must be determined administratively so as to permit changes to be made quickly when indicated.

As mentioned above, the organization plan contemplates that all functions and activities that can be handled advantageously by the regions should be given to them. More specifically it is suggested that, subject to central office control, the regions be responsible for supervision of operations such as the following:

Fish management: Hatchery operations; fish planting; rough fish control; fish allocation according to a state-wide plan; construction and maintenance of fish screens and ladders; lake and stream improvement; assistance in fish surveys and inventories; fish rescue operations.

Game management: Operation of game farms; predator control, habitat development; game inventories; waterfowl areas; public shooting areas; cooperative hunting areas; management of game refuges.

Wildlife protection: Land and marine law enforcement; reserve patrol; crop damage investigation and control.

Conservation education: Information to the regional public on fish and game problems, policies, programs, laws, and regulations.

Other: Business functions including regional record keeping; licenses—direct sale over counter, distribution to agents, accountability for licenses distributed to agents.

Operational phases of federal-aid fish and game programs, exclusive of research projects.

4. Central Office Functions and Activities

This report recommends that the central office retain control over administrative policies and exercise general direction over regional operations so as to promote efficient and uniformity of fish and game programs throughout the State.

While decentralization of operations to regions along lines described above should result in giving better fish and game service, care must be exercised to avoid creating five little "administrative kingdoms" with as many separate and varying fish and game programs. To avoid this possibility, the central office must establish administrative policies and exercise effective direction over operations of the regions. On the other hand, the central office must refrain from repressive tactics in dealing with field leaders. The concept of authority consistent with responsibility delegated should be observed.

The central office should be responsible for the following functions and activities:

a. Planning of fish and game programs, i.e., study of needs and the resources and facilities required to meet those needs;

b. Presentation of recommendations on program and policy matters such as seasons, bag limits, etc., for consideration by the Fish and Game Commission;

c. Inspection of field operations to assure compliance with policies and procedures and to ascertain means of improving operations;

d. State-wide, coastwise, or inter-region research in fish and game programs; correlation of the findings of research on fish and game management from field sources; laboratory investigations; statistical studies; state-wide censuses of game, etc.;

e. State-wide coordination of conservation education and public information;

f. Federal-aid fish and game programs—liaison with federal agencies, planning, approval and inspection of projects;

g. Planning and general control of investigations of the effects on fish life of present and proposed water control projects (dams, etc.), with recommendations for changes to adjust to fish requirements;

h. Development of a state-wide plan for planting fish and game by the regions;

i. Procurement of fish food, fish eggs, game stocks, etc.;

j. Inspection and coordination of patrol boats assigned to individual regions;

k. Staff training programs;

l. License work—estimating requirements; supervision of printing; allocation to region for sale and distribution to agents; controlling and auditing the distribution of licenses to agents;

m. Formulation of programs governing regional construction and maintenance and the necessary engineering supervision;

n. Direction of department's air service and communications system.

Further study should be made of the respective roles of the central office and of the regions in connection with scientific studies of the fish and game biologists. Additional study also should be made of respective spheres of the central office and of the regions in construction and maintenance work. These subjects represent two of the more difficult problems in converting to the composite regional basis of operation. Careful advance planning in these areas will contribute substantially to the success of the regional form of operation, since they potentially contain seeds of jurisdictional misunderstanding.

5. Over-all Management

This report recommends that the over-all organization of the Department of Fish and Game be as described immediately below.

The proposed organization structure is designed to accomplish the objectives previously described. That is, to concentrate program, policy, and regulatory authority upon the commission; to give full administrative authority to the director; to decentralize operations to the field; and yet, to retain sufficient central control to bring about a high degree of uniformity and efficiency of regional operations.

In the proposed organization there will be a direct line of command between the central office and the regions.

This is in harmony with a basic principle of good organization—namely, that no individual should be responsible to more than one immediate superior. Failure to apply this principle in organizations is a frequent cause of misunderstanding, with resulting confusion and lowered work production. This is particularly important in an agency as geographically dispersed as the Department of Fish and Game, since distance complicates problems of resolving conflicting orders.

The proposed plan is a line-and-staff type of organization. Line officers include the director, the deputy director, and the five regional managers responsible for operations in their respective localities. Headquarters employees, who are primarily staff officers in relation to the regions, include the administrative officer, the conservation education officer, and four chief staff positions.

As staff officers, headquarters employees will not issue direct orders to operations employees of the regions. To do so would result in multiple lines of command from the headquarters office to the regions.

With respect to the regions, the headquarters staff officers will advise in their respective areas of responsibility. They will give staff assistance in research, planning, inspecting, and training for their fields of responsibility—i.e., business affairs, conservation education, marine fisheries, inland fisheries, game management, and wildlife protection (patrol and law enforcement). It will be their responsibility to direct state-wide research programs and to correlate the findings of research and management from field sources in order that suggestions for programs, policies, and regulations may be formulated for presentation to the director, and through him to the commission as required. They also should ascertain whether policies and programs are carried out in an effective and uniform manner by the regions, reporting their findings to their respective superiors.

Position titles used in the following discussion of the organization are illustrative rather than official, since establishing classifications and titles is a Personnel Board function.

Fish and Game Commission: Responsibility for determining fish and game policies and regulations will rest with the commission.

Secretary to Commission: See above.

Director: It is the director's responsibility to submit recommendations to the commission relative to fish and game policies and regulations. Responsibility for administration of the department, including development and application of administrative programs and policies, will rest with the director.

Reporting to the director will be three employees: the deputy director, the administrative officer, and the conservation education officer.

Deputy Director: Reporting to the director will be the deputy director, an exempt position, in whom will be lodged direct responsibility for planning, coordinating, and directing the general operations of the department for the director. In the absence of the director, he will assume charge of the department.

All key positions except the administrative officer and conservation education officer will report to the deputy director. These include four chief staff positions for special subject matter areas plus the proposed regional managers, which will mean that the total number reporting to him will not exceed nine.

Administrative Officer: The former Division of Fish and Game has not maintained a complete "business administration" unit of its own since it became a part of the Department of Natural Resources more than 20 years ago. Most of the services normally performed by such a unit were handled by the latter department.

Presently the Department of Natural Resources is continuing to handle, under contract, the fiscal and related work of the new Department of Fish and Game until the latter's own organization is perfected and equipped to take over such functions.

Recently the director obtained the approval of both the Department of Finance and the State Personnel Board to establish a top administrative position under the title of "Administrative Officer," who will be in charge of planning and organizing the "housekeeping functions" of the new agency. He should be responsible for planning, organizing, and directing the central office administrative and business services of the department. These services include accounting, budgeting, personnel, auditing of fish processors books, license distribution, engineering, and possibly the radio systems work. In addition to directing these activities, the administrative officer will act as business adviser to the director and will have responsibility for directing organizational and procedural studies.

The administrative officer will have a wide responsibility for business management activities both in headquarters office and in the field. His business management responsibilities in the field should be carried out in the name of the director and through the regional managers in order to eliminate the possibility of dual supervision.

There will be six persons reporting directly to the administrative officer: A new departmental accounting officer, a present position of senior accountant, a supervisor of fish and game licenses (now Chief, Bureau of Licenses), a personnel officer, an administrative assistant, and a senior engineer. In addition, there may later be an employee in charge of radio communications.

The departmental accounting officer, a new position, will be in immediate charge of accounting and budget work for the department. He will have a group of assistants, a number of whom will transfer from the Department of Natural Resources.

The senior accountant now budgeted to the Bureau of Marine Fisheries, should be on the staff of the administrative officer, to handle auditing and related work in connection with tax returns of fish processors throughout the State. He is to report directly to the administrative officer. This placement is tentative subject to further consideration. Experience may indicate that the position should report to the departmental accounting officer or to the head of the license (revenue) section.

A supervisor of fish and game licenses (now Chief, Bureau of Licenses) will be immediately responsible for the central office's license and permit activities. These activities include estimating license requirements, planning printing, allocating licenses to regions for their direct sale and distribution to agents, and controlling and auditing the distribution and returns.

A new position of personnel officer reporting to the administrative officer will be in immediate charge of developing and administering the department's personnel program. For some time to come there will be a large amount of personnel follow-up work in connection with the organization of the new department. In addition, there will be continuing departmental personnel work involving classification, recruitment, pay, counseling, and liaison with the Personnel Board. He also will participate in the departmental training program. To handle the clerical record keeping phases of personnel work he will have reporting to him an existing supervising clerk position.

An existing administrative assistant position, which will report to the administrative officer, will have two primary responsibilities. Its incumbent will be the immediate supervisor of general office activities at headquarters, and conduct such administrative studies as may be assigned. General office management activities at headquarters will include central stenographic service, files, mail, messenger, mimeographing, automotive control, etc. Administrative studies will include organizational and procedural work, time and cost studies, the preparation of manuals, etc. In a changing department, covering a wide geographical area, with diverse activities, there will be need for such work on a continuing basis.

A senior civil engineer position, currently budgeted to administration, will be responsible for general engineering work for the department and for liaison with the Division of Architecture and other state agencies. It is practical and economical for the department to do much more of its construction work than has been the case in the past.

Engineering positions currently budgeted under fish conservation and game conservation should be transferred to the senior civil engineer. Study must be given to the problem of determining the sphere of the headquarters engineering office and its relations to the respective regions in construction and in the pooling of heavy equipment.

The administrative officer ultimately should be responsible for planning and follow through on radio systems activities of the department, including liaison with the Division of Communications, Department of Finance. For the time being, however, the Fish and Game Department desires to retain this function under the wildlife protection activity. This appears to be a proper arrangement during the developmental period of the communications system. However, it is believed that in the long run the activity fits best with the administrative officer's responsibility for staff advice in business administration.

There are two possible locations for placing responsibility for operations of the air service, and its four pilots and equipment: with the administrative officer, or with the chief wildlife protection officer. Further study is suggested for this problem.

The administrative officer through his staff will be assigned responsibility for various office activities now being performed by headquarters employees of the present bureaus. Further study should be made to determine which clerical positions should be transferred to the jurisdiction of the administrative officer to handle such work. A study also should be made to determine if headquarters' clerical positions could be transferred to the regions.

Conservation Education Officer: This is a new civil service position to be in immediate charge of the central office's public information and conservation education activities. He is to report directly to the director because of the close relation of his work to the director's work—preparing manuscripts and reports, receiving visiting sportsmen and others, investigating complaints of service, etc. Reporting to the conservation education officer will be currently budgeted positions of supervisor of conservation education, a public information officer, an editorial assistant, and the senior librarian, responsible for the department's general library.

Also reporting to the conservation education officer will be a training officer position immediately responsible for the department's employee training program, which should be broadened and deepened. While the training officer will not directly instruct in more than general phases of the training program, he will organize it and have many other training responsibilities. He will help draft a long-term training program, work out its details and timing, select suitable experts as part-time teachers, help such teachers prepare their lectures, assist in discovering and preparing written study materials, schedule training sessions, arrange for meeting places and obtain secretarial coverage of such sessions. In summary, he will be the planner, organizer, expediter—the sparkplug—of the department's training program. The presently budgeted position of Assistant Chief, Fish and Game Patrol, which has been performing this function for the department should be used in conjunction with this activity.

Four Chief Staff Officers: This report proposes that four present bureau chief positions, with combined line and staff responsibilities, be changed to staff status. It is suggested that the titles of these positions be changed, subject to State Personnel Board approval:

Present	*Proposed*
Chief, Bureau of Marine Fisheries	Chief Staff Officer, Marine Fisheries Branch
Chief, Bureau of Inland Fisheries	Chief Staff Officer, Inland Fisheries Branch
Chief, Bureau of Game Conservation	Chief Staff Officer, Game Management Branch
Chief, Bureau of Patrol and Law Enforcement	Chief Staff Officer, Wildlife Protection Branch

The chief staff officers will require staff assistants, the number needed depending upon the size of the particular job to be done. The bureau chiefs currently have technical assistants located at headquarters. Some of these subordinate positions will continue to be required at headquarters, but it is believed that several may be transferred to the regions for direct work there, in view of the transfer of responsibility for line operations to the regions. Through such transfers and other personal adjustments the number of new positions required to put the recommended plan into operation can be kept to a minimum.

Of the four present bureau chiefs, the least change in actual working relations resulting from change to the staff status will occur for the Chief of Marine Fisheries. This is because the function of marine fisheries has been predominantly research, statistical, and advisory in nature, and will continue on that basis.

The marine fisheries organizational branch will operate its programs directly rather than through the regions. While the activities of the three other present bureaus can be divided advantageously between the central (staff) office and the regional (line) offices, this cannot be done effectively for the marine fisheries branch. This is because its work is predominantly research, fact-finding, and statistical in nature—staff work calling for centralized administration. Moreover, its operations are along the entire coast, from Crescent City to San Diego, rather than on land. Therefore, its operations should remain controlled or directly operated by headquarters.

However, there is one important exception. Present marine fisheries activities and personnel dealing with stream improvement and fish screens and ladders on inland streams (notably of the central valley) should be transferred to the appropriate regions involved.

On the other hand responsibility for handling such activities as maintenance of the marine fisheries installations at Terminal Island and at Monterey may advantageously be left with the branch, rather than be transferred to the regions. These supporting activities represent such a small part of its total work and yet can have such a direct effect upon the success of its work that it will prove advantageous to have the branch continue handling them, at least for some time to come.

Regional Organization Structure: A new position of regional fish and game manager will be in complete charge of operations and personnel in each region.

The regional managers will play a most important role in the new department. Much of the department's success will depend upon their capacity and performance. Their task will be to weld separately operating fish and game programs—wildlife protection, game conservation, and fish conservation, and parts of these programs—into one

integrated program operated by a unified team in accordance with departmental policies. They should have substantial capacity for leadership and administration. While primarily they should be men with general administrative ability, technical training and experience in one of more specialized fish and game subject matter areas would be desirable.

Reporting to the regional manager in all regions will be four persons who will be immediately responsible for as many phases of the work: Game management, inland fisheries, wildlife protection (patrol and law enforcement), and office management. In two more populous regions there will be a fifth person to be responsible for conservation education work. Later, a person for conservation education work might be added in one or more of the remaining regions, if the need is demonstrated.

The plan proposes that new positions of supervising game manager and supervising fisheries manager be established to be in immediate charge of game and inland fisheries programs. These positions will have higher stature than the current positions of game manager, assistant supervisor of fish hatcheries, and district fisheries biologist in order to effectively supervise subordinate employees. It is suggested that in so far as possible the new positions be obtained through reclassification of lower positions, rather than through the budgeting of additional positions. Likewise, the new regional positions to be in charge of office management should, wherever possible, be obtained through transfer and reclassification rather than through the budgeting of additional positions.

Informal proposals have been advanced by departmental officials for establishing a public information position at the regional level. This report suggests that a conservation education position be established in regional offices at San Francisco and Los Angeles as it is believed that conservation education employees assigned to those regions will contribute substantially to the success of fish and game programs through better public understanding.

6. Marine Patrol

This report recommends that the regions along the coast assume direct responsibility for marine patrol operations.

Under the present organization, the Bureau of Patrol and Law Enforcement operates both land and marine patrol and law enforcement units. Line control over both land and marine patrol units is maintained from the state headquarters office. Under the recommended organizational plan, actual operations of both land and marine patrol activities and forces will be taken over by the regions.

The Marine Patrol enforces laws applying to marine, commercial, and sport fishing. Its staff consists of marine wardens along the coast who are land based and marine personnel who are assigned to law enforcement boats.

It is suggested that marine patrol be handled as far as possible on a regional basis for several reasons. Since the department will be organized by regions, as many activities as possible should be assigned to the regions to take full advantage of what this form of organization offers. By having marine wardens and land wardens under the control of the same regional manager, more flexibility will be obtained in the shifting of personnel during periods of increased hunting and fishing. Wardens will obtain broader experience, which will increase their usefulness to the State and also enhance their chances for promotion. Moreover, the recommended plan will bring land and marine patrol groups closer together, and result in a more integrated patrol force. If marine patrol were handled on a state-wide basis a wide cleavage might develop between marine and land patrol employees, which would have a detrimental effect on the department's work.

Therefore, this report proposes that the regions along the coast assume responsibility for actual operation of the marine patrol. There probably will be three such regions—the southern, headquartered in Los Angeles, the coastal, headquartered in San Francisco, and the northern, headquartered in Redding. If this assumption proves correct, it is probable that in the southern region, where marine patrol activity is heaviest, there will be two supervising wildlife protection officers (now assistant chiefs, patrol), one in charge of land law enforcement and the other in charge of marine law enforcement.

It is suggested for the coastal region, headquartered in San Francisco, that reporting to the supervising wildlife protection officer, there should be both land and marine captains stationed at strategic points to direct the activities of marine law enforcement personnel and boats.

It will be one of the most important responsibilities of the regional managers at Los Angeles and San Francisco, through their respective supervising wildlife protection officers to insure close coordination, and where desirable to interchange land patrol and marine patrol operations and staffs. It also will be important that certain statistical activities now conducted by marine patrol personnel in the field be maintained effectively, as the data furnished are of basic importance to scientific studies.

There is need for a marine specialist in the Wildlife Protection Branch at headquarters to furnish advice and technical guidance on marine enforcement activities and problems.

Reviewed and Approved:

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APPENDIX H

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This Cessna model 170 airplane was purchased during the biennium for potrol and survey work, assigned to Southern California. It is radio equipped in order to provide continuous communication with ground personnel.

APPENDIX I

TITLES AND ABSTRACTS OF ADMINISTRATIVE REPORTS SUBMITTED BY THE BIOLOGICAL STAFF OF THE BUREAU OF FISH CONSERVATION

July 1, 1950, to June 30, 1952

Abell, Dana L.

A review and proposed revision of the investigational and management program for Millerton Lake, Fresno/Madera counties. Submitted November 28, 1951. 20 p., plus one figure.

ABSTRACT: A brief review of prevailing conditions of the fishing and limnology of Millerton Lake and a program of study and management for the next five years is given. The investigational part includes a series of cove and shoreline studies, a littoral transect, a general survey, continued creel census, and tagging. Emphasis in management is indefinite as yet, but will probably be directed at improving shelter and basic fertility, controlling wave erosion, and regulating mixed populations of fish and other organisms to benefit the fishing maximally. Public relations and reports will also receive emphasis with an eye toward describing the true value of this type of reservoir as a fishing lake.

Beck, Ralph V.

Preliminary report on the Owens River development project (Inyo County). Submitted September 13, 1950. 19 p., including 1 table and 2 figures.

ABSTRACT: The section of the Owens River from Birchim Canyon to the Los Angeles aqueduct intake is about 150 miles long with an estimated average flow of about 400 c.f.s. Survey work has been carried on intermittently, including two canoe trips down parts of the river. This river section is comparatively lightly fished, chiefly by local anglers. Most of the fishing pressure is from "Five Bridges" upstream to Birchim Canyon. Dense streamside cover limits the "bank fishermen" and swift and turbulent currents limit boat fishermen. High summer temperatures and abundance of mosquitoes discourage fishing. However, temperatures at the river are several degrees cooler than in surrounding areas. Mosquito control measures may prove feasible. River characteristics are as follows: extremely meandering; cover dense with occasional open areas; margins chiefly "cutbank" type with some swampy areas; gradient even with few riffles or pool and no falls; bottom composed of fine gravel, sand, mud, and silt; moderately turbid; temperatures vary from 42° F. in January to 67° F. in June (higher summer temperatures probably occur). Fishes known to be present include rainbow trout, brown trout, suckers, carp, chubs, and mosquito fish. Work remaining to be done is outlined and tentative recommendations are made.

Bell, Robert R.

Creel check at Holy Jim Creek, Orange County, 1951. Submitted August 29, 1951. 9 p., including 3 tables.

ABSTRACT: Covers data, discussion and analysis of a creel check on a small trout stream. The stream offers only one mile of fishing water and is supported by hatchery plantings. Results:

1. Fifty percent of the planted fish were returned to the angler in three weeks, with the catch declining to less than 1 percent at the end of this period.
2. The wild trout take was less than 10 percent of the total catch, with no holdover of previous year's planting.

Calhoun, A. J.

Lake Merced (San Francisco County) catch records for 1950. Submitted March 30, 1951. 18 p., including 3 tables, 1 figure, 5 appendices.

ABSTRACT: 1950 catch records, weight-length data, and stocking records outlined. 40,000 angler days yielded an estimated 16,000 rainbow trout, average weight 21.4 ounces. The initial plant following chemical treatment averaging 3 ounces in January 1950 when stocked attained an average weight of 2 pounds ten months later. Cost and recreational values are discussed.

Chandler, Harry P.

Report on the lake and stream openings at Bucks Lake, Plumas County, California, 1950. Submitted January 12, 1951. 9 p.

ABSTRACT: An investigation was made to aid in settling a controversy as to whether or not Bucks Lake should be made another exception, like Lake Almanor and Butt Lake in Plumas County, and open at the same time as southern and valley counties, or whether it should open at the same time as the rest of Plumas County. The lake was visited on the two opening dates and a comparison made of road conditions; fisherman use by locals, summer home owners, resort patrons, and campers; fishing conditions; fishing pressure; and the biological effects on the fish.

Chandler, Harry P., and Harry A. Hanson

Equipment used for the chemical treatment of Blue Lake, Lassen County, California. Submitted January 12, 1951. 4 p., including 6 photos.

ABSTRACT: A brief illustrated description of the equipment used to chemically treat Blue Lake. An air cooled outboard motor was used for mixing. Mixing was done in a 150-gallon fish planting tank supported by two rubber rafts. Water was supplied by 1½ H.P. gasoline pump.

Coots, Millard H.

Creel census—April 28, 1951, Klamath River, Siskiyou County. Submitted May 2, 1951. 3 p.

ABSTRACT: Inclement weather and roily water affected angling activity on the Klamath River on opening day. 138 anglers counted and 67 interviewed from Copco to the Scott River. Distance checked: 55 miles. Average catch: 3.8 trout/angler. Average catch per hour: 1.15. Estimated total catch: 524. Species: steelhead rainbow trout (mostly immature). Mean length: 6.73 inches.

Pumpkinseed (*Lepomis gibbosus*) and largemouth black bass (*Micropterus salmoides*) in the upper Klamath River. Submitted July 10, 1951. 2 p.

ABSTRACT: Notes on the above species and a list of other non-native fishes in the upper Klamath River, which are: brown trout (*Salmo trutta*), brown bullhead (*Ameiurus nebulosus*), yellow perch (*Perca flavescens*), green sunfish (*Lepomis cyanellus*), and bluegill (*Lepomis macrochirus*).

Klamath River creel census, Siskiyou County, 1949-1950. Submitted November 26, 1951. 56 p., including 5 figures, 2 plates, 11 photos, and 6 tables.

ABSTRACT: A creel census was undertaken on the Klamath River in District No. 1 from September, 1949 through August, 1950. An estimated total of 20,933 angler days was spent on the river for this period, divided as follows: 7,853 days in the "summer trout" fishery, which consisted of angling principally for young steelhead rainbow trout, and 543 days of angling for adult salmon. The estimated catch was 48,952 trout, 11,378 adult steelhead, 204 adult king salmon, and 45 adult silver salmon. Fork length frequencies of fish measured, analysis of angling success, fishing tackle, anglers' residences, and physical conditions of the river are included in this report.

Creel census—May 3, 1952, Klamath River, Siskiyou County. Submitted May 19, 1952. 4 p., including 2 tables.

ABSTRACT: The annual Klamath River creel census was taken from Copco to the mouth of the Scott River. 153 anglers were counted and 70 interviewed. The average catch per angler hour was 1.24 trout. The average catch per angler was 5.9 trout. The estimated total catch in this section of the river for the day was 903 fish. The majority of the catch consisted of immature steelhead rainbow trout. Some adult steelhead, both spent and unspent, were caught. The mean length of the 101 trout measured was 6.88 inches.

Creel census—Shovel Creek, Siskiyou County, May 30, 1952. Submitted June 26, 1952. 6 p., including 2 tables, plus one map and one photo.

ABSTRACT: The second annual creel census on lower Shovel Creek was taken on the opening day, May 30, 1952. The estimated number of anglers for the day was 90. Twenty-six who were interviewed had fished 93½ hours and had caught 175 trout, including 165 rainbow and 10 brown. The estimated catch for the day was 653 trout. Only one ripe female rainbow was observed among the fish examined.

Dill, William A.

A preliminary report on the status of the golden trout fishery of California. Submitted September 25, 1950. iii plus 28 p., including 2 figures.

ABSTRACT: Prepared for use as Appendix I in the California Fish and Game's "A report on the golden trout fishery of California" submitted to California Fish and Game Commission December 1, 1950. The most inclusive report yet prepared on golden trout (*Salmo agua-bonita*). Covers systematic status, desirability of the species, natural range and its extension, hatchery program, abundance, factors affecting depletion, protective measures, recommendations. The bibliography contains the major references on the species.

The Dingell-Johnson program in California. Submitted June 16, 1952. 8 p.

ABSTRACT: Describes five current projects together with their background. F-1-R, a study of the yellowtail fishery. F-2-R, a study of the catfish fishery of California. F-3-R, experimental backcountry fish management. F-4-D, north-coastal stream restoration. F-5-R, surf fishing investigation. Other prospective projects include a study of the effect of diversions on salmon and steelhead, and integrated studies of both trout and warm-water fisheries.

Dill, William A.; Elden H. Vestal; and J. C. Fraser.

A partial list of waters in California known or reported to contain golden trout. Submitted September 25, 1950. 6 p.

ABSTRACT: Prepared for use as Appendix II in the California Division of Fish and Game's "A report on the golden trout fishery of California," submitted to the California Fish and Game Commission on December 1, 1950. The most complete list of this nature yet prepared. Records present distribution in California outside the National Parks (Yosemite, Sequoia, and Kings Canyon) insofar as can be determined from the easily available records.

Douglas, Philip A.

Lake Wohlford, San Diego County—catch record analysis 1947-48-49. Submitted April 24, 1951. 11 p., including 3 tables.

ABSTRACT: During the three-year period 1947-1948-1949 an average of about 15.8 percent of all the registered fishermen at Lake Wohlford were checked and daily catch records maintained. The lake was opened to fishing between April and September of each year.

The average angling success was about 3.3 fish per angler per trip (a trip comprised 3.76 hours of fishing). This is approximately 45 percent better than the returns on Norris Reservoir in 1940, and 23 percent poorer than the San Diego City Reservoirs indicated for the 20-year period, 1929-1948.

The yield, measured in pounds per surface acre, was estimated to average about 200, which is more than twice the expectancy of production on lakes in the rest of the country. It is also on a par with the 200 pounds-per-acre-yield found in unfertilized waters in Alabama.

Catch composition varied somewhat during the three years of these records, but the average as shown in Table III would indicate that the catfish were doing better than the other game fish species in this water. Bluegill show a good average return, with crappie and bass giving the poorest results.

Farm pond investigation—Southern District No. 8, report No. 2, June 1949. Submitted August 20, 1951. 11 p., plus 1 figure and 2 tables.

ABSTRACT: Covers data, discussion and analysis of a farm pond recheck in the Antelope Valley area, Los Angeles County. Five ponds were seined and partial chemical analyses made. It was found that heavy water fluctuations during the spring, a low poundage ratio (1:2) of predator to forage fish, a high average pH, and low fish removal by angling, provided poor fish production.

Recommendations:

1. That small, less than ½ acre, fluctuating irrigation reservoirs not be stocked with bluegill-largemouth black bass combinations.
2. That a straight stocking of black bass be carried out on an experimental basis.
3. That a "use-education" program be inaugurated to utilize this fishery, and maintain sufficient water levels to provide suitable spawning conditions and normal habitat.

Evans, Willis A.

A preliminary analysis of the fisheries value of the Santa Ana River drainage, California. Submitted November 15, 1950. 19 p., including 5 photos.

ABSTRACT: A comprehensive study is being made of the Santa Ana River drainage in relation to existing water use problems by various state and federal agencies. This report by the Division of Fish and Game, as a cooperating agency, consists of an inventory of all waters of the drainage and their importance to fishing recreation. The five lakes and 33 trout streams composing the drainage are described with information on relative size, flows, fish life present, and value for fishing.

Fisher, Charles K.

An evaluation of bluegill spawning subimpoundments in fluctuating reservoirs. With special reference to the 1949 operation of a pilot structure at Millerton Lake, Fresno/Madera counties. Submitted June 20, 1950. 9 p., including 5 figures.

ABSTRACT: Since the success of bluegill spawning in Millerton Lake had declined considerably due to rapidly dropping water levels, it was reasoned that spawning ponds which would catch and retain lake water during midsummer high levels and in which bluegill fingerlings could be reared for planting in the lake might be constructed along the shoreline. Accordingly, a pilot dam was built in March, 1949, but due to an inadequate lake level, it was necessary to fill the subimpoundment by pumping from the lake. By July 23, 1949, 75 adult bluegill had been placed in the pond. Only 9,000 small fry were harvested in September, 1949, and placed in the lake. This low production is believed to have resulted from the entry of about 300 carp fry with the pumped lake water. The carp grew to 8-inch length in two months, and greatly diminished food organism production by their muddying activity. Thus, it was found that such mud-bottomed subimpoundments are of little use in bluegill production in the presence of carp. Even though carp could probably be screened out of pumped lake water, a varying maximum lake level each year would demand that a number of dams be distributed vertically, so that some would be carp-free each year. The magnitude of such a program would be economically infeasible. Therefore, it is recommended that the building of such subimpoundments under these circumstances be discouraged.

Progress report No. 2 on the fishery of Millerton Lake, California. Submitted August 3, 1951. 42 p., plus 16 figures.

ABSTRACT: Millerton Lake is the fluctuating impoundment created by the construction of Friant Dam on the San Joaquin River. The river was first controlled in 1941, and in this year and the next the developing reservoir was planted to largemouth black bass, bluegill, and green sunfish. Good fishing was obtained in the initial open season of 1945 and in 1946. As is generally true with this type of reservoir, fishing quality soon dropped off. In 1949 bass fishing quality had declined to a little over half of its 1945 level, while the bluegill fishing decline was to a little less than half its 1945 level. An intensive study of the lake from 1949 to date attributes this decline to lowered fish populations resulting from the loss of nutrients in the lake. Causal factors have been fluctuation, wave action, and large discharge of river water through the lake. It is concluded that a shortage of sunfish and other forage fishes has in turn caused a decline in the bass population. Recommendation is therefore made that effort now be directed toward the introduction of additional kinds of forage fishes for the bass which will not overly compete with the bluegill population.

Annual Truckee River Sierra-Nevada Counties, creel census, May 26, 1951. Submitted March 12, 1952. 8 p., including 3 tables.

ABSTRACT: The fifteenth annual opening day creel census on the Truckee River revealed that the 97 anglers interviewed caught 184 trout in 315 hours of fishing, for an average catch of 0.58 trout per angler hour. This rate of catch compares favorably with the over-all average of 0.50 trout per angler hour for previous years of census. Rainbow constituted 80.4 percent of the catch, with the remainder browns. This represents an upswing in a rather cyclic fluctuation of the two species toward each other. A breakdown of angler success by county reveals that the natives outfish the travelers from a distance.

Fraser, J. C.

1950 and 1951 Lake Tahoe party boat catch records (Placer and El Dorado counties). Submitted December 7, 1951. 4 p., plus 5 tables.

ABSTRACT: The 1950 and 1951 catch made by guide-operated fishing boats on Lake Tahoe are presented with a summary of the 1947 to 1949 data for comparison. Five operators reported in 1950 but only 3 reported in 1951, when reports were submitted voluntarily.

	1950	*1951*
Average weight lake trout caught	3.5	3.5
Average catch per angler	1.7	1.3
Average catch per hour	.40	.32

The annual Truckee River, Nevada County creel census, May 27, 1950. Submitted March 12, 1952. 7 p., including 4 tables.

ABSTRACT: The annual opening day creel census resulted in 49 anglers being interviewed which was the lowest number for any of the censuses. Eighty-four trout were caught in 136 hours of fishing for an average catch per angler hour of 0.62 which is the highest rate of catch since 1943. Seventy-five percent of the catch were rainbow and 25 percent were brown trout. Nevada residents comprised 59.2 percent of the anglers and caught 66.7 percent of the trout recorded.

German, Eugene R.

A preliminary report on a new surface sampler. Submitted January 29, 1951. 5 p., plus appendix including 6 figures.

ABSTRACT: Ideas are put forth on methods and equipment to sample the surface of a lake or reservoir. The construction of a sampler is described, and plans for further tests and use discussed.

German, E. R. and J. H. Wales

Castle Lake trout investigation 1950 season—second phase: eastern brook trout. Submitted January 29, 1951. 22 p., including 17 tables.

ABSTRACT: A report of the fourth year of the eastern brook trout phase. 5,255 trout taken in 1,358 angler days at an average of 3.9 per day and 1.36 per hour. Most angler days since census started in 1941, but lowest catch per day since start of eastern brook trout phase in 1947. Fish planted as yearlings have yielded 48 percent return. First fingerling plant (1947) has yielded 28 percent; indications are that second fingerling plant (1948) will exceed 30 percent return. This is a very high return for fingerling plants. Even though the population was smaller in 1950, the eastern brook trout failed to attain much size.

Hanson, Harry A. and Robert R. Harry

Report on experimental fish screen, Rock Creek, Plumas County. Submitted July 17, 1951. 4 p., including 2 figures and 1 table.

ABSTRACT: The purpose of the screen and trap on Rock Creek was to determine how many rainbow trout fingerlings could be salvaged from the stream as the stream dried up. The fingerlings were natural reproduction in the stream, progeny of a run of rainbow trout that migrates each spring upstream from Lake Almanor. About 6,000 were intercepted by the screen between July 27 and August 27, 1950.

Johnson, William C.

The reliability of the striped bass party boat catch records. Submitted January 9, 1951. 14 p., including 4 tables, 1 figure and 1 exhibit.

ABSTRACT: Striped bass party boats were observed during the months of August, September, and October 1950, the most important months for striped bass fishing. The number of passengers and the number of striped bass were counted on the individual boats and then these data were compared with the reports submitted by the party boat operators to determine the reliability of reporting. It was found at the completion of the survey that the party boat records that are kept by the permanent operators are reliable, and they are the operators who make up the backbone of the fishery.

Analysis of 1950 striped bass party boat fishing effort. Submitted May 31, 1951. 8 p., plus appendix.

ABSTRACT: A routine report analyzing the fishing effort of the striped bass party boat operators during 1950. The analysis was made from the daily logs that the operators submitted and personal observations of the party boat fleet fishing.

Kimsey, J. B.

Notes on kokanee (*Oncorhynchus nerka kennerlyi*) spawning in Donner Lake, Nevada County, 1949. Submitted June 30, 1950. 18 p., including 6 figures.

ABSTRACT: Spawning kokanee and their nests were observed periodically from November, 1949 to February, 1950. Drawdown of lake by power and irrigation companies exposed nests. Most of eggs were killed by prolonged freezing. Some eggs which were frozen for only short periods continued development as did eggs in seepage areas. It appears successful natural reproduction of kokanee in Donner Lake is possible, providing water levels can be manipulated reasonably. Discussion of possible remedies, including moving gravels into deeper water.

Upper Truckee River creel census (El Dorado County), July 1, 1950. Submitted June 27, 1952. 8 p., including 4 tables.

ABSTRACT: The 1950 creel census was the seventh in a series started in 1939. The average catch per angler was lower than usual (.94 fish per angler) as was the average catch per angler hour (.5 fish). This was due primarily to the high water and it is believed by the author more amateurs were fishing than usual because of the excellent weather. The section from the bridge above Meyers through the campground at the Luther Pass bridge was censused for the first time since 1943 and produced mostly eastern brook trout at a rate of 2.4 per angler and 1.4 per angler hour. Many rainbow spawners were still in the stream but few were taken.

Loeber, Thomas S. (Student Biologist)

A report of an investigation of the temperature and salinity relationships of striped bass and salmon in connection with the Reber Plan. Submitted July 2, 1951. 16 p., plus 25 tables and 2 figures.

ABSTRACT: Experiments were carried on at Steinhart Aquarium to evaluate the tolerance of juvenile striped bass and salmon to changes in temperature and salinity. The upper maximum temperature tolerated by fingerling striped bass was approximately 95 degrees, in salt water. Similar tests in fresh water failed because of the inability to hold these fish in the aquarium supply of fresh water at any temperature. Fingerling and yearling bass were readily transferable from fresh to salt water direct, usually without any mortality. The change from salt to fresh water, even when made gradually, led to loss of appetite and heavy mortality, on the order of 75 percent. A condition of shock commonly followed this latter type of transfer. Experiments with salmon were hampered by disease. Small king salmon were readily changed over with 100 percent survival from fresh to salt water by keeping them for a few days in water of about 50 percent salinity.

Meacham, Charles H. (Student Biologist)

Power development of Kings River drainage, Fresno County, California. Report number 4: Headwater storage possibilities on the North Fork, Kings River. Submitted July 20, 1951. 24 p., including 9 tables and 3 figures.

ABSTRACT: Gives brief description of drainage, briefly discusses proposed water development, lists data examined, encompasses four drainage basins with a total of 24 lakes. Each basin handled as a unit, hydrographic information bulk of report. 13,774 acre-feet of water made available by installation of drain pipes and dam construction, provides flow of 231 c.f.s. for 30 days or 58 c.f.s. for 120 days. Fish management information included.

Murphy, Garth I.

An analysis of the operation of Sweasey Dam fish ladder, Mad River, Humboldt County. Submitted May 9, 1951. 8 p., plus 3 appendices including 18 figures and 5 tables.

ABSTRACT: This report details the flow records and fish counts over the past 5 years. The material is arranged in the form of an operational analysis. All important water stages are illustrated with photographs. The ladder was found to be satisfactory until the spring of 1951, at which time a large sand bar above the dam, which had formed the preceding winter, deflected water into the low water entrance so that fish could not enter it at flows above 1.5 feet (as opposed to 2.2 feet before the sand bar formed).

Murphy, Garth I., and Herbert E. Pintler.

The 1949 fishery of Conn Valley Reservoir, Napa County. Submitted July 12, 1950. 9 p., including 6 tables.

ABSTRACT: Conn Valley Reservoir, an artificial lake created in 1945, has a depth of 110 feet, a surface area of 790 acres and a volume of 31,000 acre-feet when full. Although rainbow trout and green sunfish continue to constitute the only "game" fish present, limnological data indicate that ecological conditions are barely tolerable for rainbow trout in summer and early fall. The rainbow trout catch per unit of effort in 1949 was practically identical with 1948, but was composed of about 33

percent "wild" trout. Thus, although twice as many rainbow trout were planted in the spring of 1949 as compared with the previous spring, the return to the angler of hatchery rainbow trout was considerably less than the year before. A detailed record of the 1949 rainbow trout catch is given and factors influencing the catch are discussed and compared with surveys made in 1947 and 1948.

Pelgen, David E.

Folsom Reservoir project fisheries improvement devices. Submitted July 31, 1950. 10 p., including 5 figures and 2 tables.

ABSTRACT: An assessment of the value and possibility of the construction of fishery improvement devices such as brush shelters and a subimpoundment to Folsom Reservoir, which is under construction at this time.

Soule, Scott M.

Power development of Kings River drainage, Fresno County, California. Report number 3: Junction development of the Kings River and its Middle and South Forks. Submitted March 31, 1951. vi plus 25 p., including 1 table, plus 3 figures.

ABSTRACT: Gives brief resumé of proposed power development for Kings River drainage, describes Kings River and Middle and South Forks and excellent trout fishery of these waters, illustrates present recreational use by the 180,000 man-days use in 1950 at Cedar Grove area alone. Describes power development plans of City of Los Angeles, U. S. Bureau of Reclamation and F. N. Dlouhy. Discusses potential damage to recreational use of area—from 60 to 40 miles of stream plus important staging areas for recreational use are threatened. Concludes that the question whether or not power development should be permitted, should be decided by public airing; and that if permitted, the fishery should be protected by minimum pools in reservoirs to be 1/10 maximum area of reservoir and stream releases to be mean minimum flows, and that roads and trails to permit recreational accessibility be replaced if damaged. Recommends action by Division of Fish and Game on above conclusions to safeguard fishery and recreational use.

Vestal, Elden H.

A new chemical treatment apparatus. Submitted November 20, 1950. 12 p., including 8 figures.

ABSTRACT: A new chemical treatment apparatus designed by the writer is described and figured. Apparatus consists of a tube, equipped with a V-hopper at the intake end and two air-cooled outboard motors mounted in tandem near the outlet end. The tube is suspended just beneath the water surface between pairs of plywood assault boats, pinned stern to stern at transom corners. A crew of 3 men is required for operation and the apparatus simultaneously mixes and distributes rotenone powder at an average rate of 50 pounds or more per minute. Estimated total cost is $223.28.

Vestal, Elden H., and Robert R. Ehlers

Improvement of debris jam at Gilman Lake, Mono County, California. Submitted November 6, 1950. 4 p., plus 2 figures and 3 photos.

ABSTRACT: A debris jam completely blocking the outlet stream of 16-acre Gilman Lake, Mono County, was improved with 75 pounds of high explosive. Technique is described. The only suitable spawning areas for the lake were located in the stream for 500 yards below the jam.

Improvement of the inlet barrier at Cabin Lake, Madera County, California. Submitted November 9, 1950. 3 p., plus 2 figures.

ABSTRACT: A rock ledge, 4½ feet high and 25 feet long, preventing access to spawning areas above the inlet by trout in 6-acre Cabin Lake, tributary to Shadow Creek, Madera County, was improved by bulldozing with 80 pounds of high explosive. Utilization of spawning areas now available in 350 yards of stream above the lake will obviate any further planting.

Wales, J. H.

Second report on the effect of the Klamath River water fluctuation upon the salmonid fishes. Submitted October 19, 1950. 4 p., 2 tables.

ABSTRACT: Prior to 1950 it was assumed that young salmonids were stranded in the section from Copco dam to a point 75 miles downstream. This assumption was strengthened by finding stranded steelhead fingerlings 96 miles below Copco. Two Fish and Game seasonal aids measured the exposed river bed in the 74-mile section at 1,064 points and computed that the average width on each side of the river was 10.1 feet. The number of "harmful" water drops made in a year was computed according to set specifications. Tables 1 and 2 set forth all pertinent data correlated with the above measurements.

Wales, J. H.

Management of king salmon spawning in the Klamath River, Siskiyou County. Submitted November 10, 1950. 10 p., including 4 figures and 3 tables.

ABSTRACT: Discussion of the number and location of spawning king salmon in the upper Klamath River below Copco dam in 1950. Plans are submitted for future management of these spawners. List of king salmon spawning tributaries of Klamath is submitted, with possible spawning runs.

Klamath River fish count, Klamathon racks, Siskiyou County. Submitted December 14, 1950. 8 p., including 3 tables.

ABSTRACT: Tables show the daily counts of fish going through the Klamathon racks between August 27 and October 27, 1950. The dead fish drifting onto the racks were sexed and presence of eggs recorded. Comments are made on these counts of king and silver salmon and steelhead. The total king salmon count was 21,584, the second highest in 17 years.

Recommendations for management of the Trinity River, Trinity County, Part 2. Recommended action. Submitted January 16, 1951. 8 p., including 2 tables.

ABSTRACT: Presents recommendations for course of action in connection with proposed water use projects of U. S. Bureau of Reclamation.

The decline of the Shasta River king salmon run. Submitted April 10, 1951. 82 p., including 17 figures and 13 tables.

ABSTRACT: The several phases of the life cycle of the king salmon run in the Shasta River has been considered with respect to the factors which may have contributed to the decline of the run. It is presumed by the writer that the commercial and sport fishing has been the most important factor. The Copco power dams with their attendant river flow fluctuation, the irrigation use of the Shasta River water, and possible predation by lampreys are also considered to be major causes of the decline.

Creel census, Shasta River, Siskiyou County. Submitted April 28, 1951. 2 p.

ABSTRACT: On the opening day, in the lower seven miles of the river 223 anglers count 0.65 fish per hour or 2.6 fish per day for a total of 580 steelhead, 10 percent one-year; 80 percent two-year; 10 percent three-year olds.

Sacramento River experimental stream for 1950. Submitted May 30, 1951. 21 p., including 11 tables, plus 3 figures.

ABSTRACT: From returns to date it appears that the anglers will catch from 5-8 percent of the hatchery planted fingerlings in the South and Middle Forks. However, these fish average less than 6 inches in length. There has been an 84 percent return of a plant of yearling rainbow trout. The trout population was determined by planting marked rainbow trout fingerlings one day and shocking representative sections the following day. In the Middle Fork it is estimated that per mile there were on August 20 the following: Wild rainbow trout—1,658 fingerlings, 858 yearlings, 74 two-year olds, 16 three-year olds. Hatchery rainbow trout—1,056 fingerlings, 74 yearlings. Total rainbow trout per mile—3,736.

Efficiency of king salmon spawning in Fall Creek, Siskiyou County. Submitted September 28, 1951. 54 p., including 13 figures and 10 tables.

ABSTRACT: 750 male and 750 female king salmon were allowed to spawn in Fall Creek in 1950. From computations of the total eggs contained and from the computed number of fingerlings migrating downstream into the Klamath River it was found that the spawning efficiency was 6.8 percent.

1951 Klamath River fish count—Klamathon racks, Siskiyou County. Submitted January 2, 1952. 9 p., including 3 tables.

ABSTRACT: The total number of king salmon counted through the Klamathon racks from August 10-October 29, 1951, was 17,857. Of this total 61 percent were females and 39 percent males. Of the latter 4 percent were grilse. This is the third largest run of kings recorded at this station since 1925. Of 213 dead king salmon females removed from the racks 49 percent had not spawned. Up to the time of the removal of the racks 331 silver salmon and 1,002 steelhead had also been counted.

Creel census, May 3, 1952—Shasta River, Siskiyou County. Submitted May 5, 1952. 5 p., including 2 tables.

ABSTRACT: An estimated 300 anglers caught 1,815 one- to three-year old steelhead. Average 6.0 per day. Average length of fish 7.3 inches.

Wales, J. H., and Harry A. Hanson

The effect on the fishery of the North Fork of the Feather River, California, of proposed hydroelectric developments with special reference to Cresta and Rock Creek projects. (Second revision June 1952). Submitted June 1, 1952. 31 p., including 4 figures, 3 tables, 2 maps, and copies of 2 other reports on same subject (U. S. Department of the Interior on Fish and Wildlife Resources and report to Federal Power Commission on water application by Pacific Gas and Electric Company).

ABSTRACT: The two projects considered herein directly affect 16 miles of stream. This is a heavily used recreational area. In 1946 the angler days were estimated to be 36,000 and the trout caught estimated at 108,000. Eleven commercial resorts and 6 Forest Service camps will be affected. The mean river flow in this section was 2,710 c.f.s. Recommendations for water releases were recommended for these projects by the authors. A copy of the report to the Federal Power Commission, giving the final release requests, is attached to subject report.

Wales, J. H.; E. W. Murphey; and John Handley.

Perforated plate fish screens. Submitted October 4, 1950. 13 p., including 7 figures.

ABSTRACT: The general type of perforated plate fish screen and modifications of this type are described together with a comparison of its value with earlier types of screens. The capacity of perforated plate to pass water and the velocities of different volumes are described. The value of the bypass is emphasized. Possible uses of perforated plate screens are listed.

Wohlschlag, Donald E. and Chester A. Woodhull

The determination of fish populations in a medium-sized warm-water reservoir. Submitted April 29, 1952. 77 p., including 18 figures.

ABSTRACT: A report of the fish population study of Salt Springs Valley Reservoir, Calaveras County, California, a pilot study of methods and application as a warm-water fisheries management tool. The report covers detailed discussions of the use of traps and seines for the "mark and recapture" method and application of the Schnabel type of fish population estimate. A method of determining recruitment, mortality and growth rates is discussed. Suggestions for the procedure of future fish population studies in warm-water fish lakes are included.

Woodhull, Chester

The white bass *Lepibema chrysops* (Rafinesque): Its life history and some factors influencing its possible introduction into California waters. Submitted July 12, 1951. 9 p.

ABSTRACT: Briefly reviews the life history, habitat, and habits of the white bass. Briefly discusses factors of food and possible reduction of striped bass population if planted in the Central Valleys waterways. Planting of white bass in California is not recommended at the present time.

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