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"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND GAME
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TABLE OF CONTENTS

		Page
WILD RICE FOR WILD DUCKS	*W. W. Mackie*	201
CALIFORNIA FISH AND GAME WARDENS—Today and Yesterday	*Walter R. Welch*	204
GAME CONSERVATION IN SOUTHERN CALIFORNIA	*C. S. Bauder*	211
CRAYFISH	*Paul Bonnot*	212
THE FRENCH MACKEREL FISHERY	*Genevieve Corwin*	217
A BIOLOGICAL SURVEY OF CLEAR LAKE, LAKE COUNTY	*George A. Coleman*	221
FEEDING YOUNG PHEASANTS AND QUAIL	*August Bade*	227
CALIFORNIA BLUEFIN TUNA	*S. S. Whitehead*	231
TAI AND CARP	*Lionel A. Walford*	234
LUMINESCENT FISHING	*Milton J. Lindner*	237
EDITORIALS		241
DIVISION ACTIVITIES		262
LIFE HISTORY NOTES		265
COMMERCIAL FISHERY NOTES		267
REPORTS—		
Violations of Fish and Game Laws		273
Fishery Products, January, February, March, 1930		274
Statement of Expenditures		278
Statement of Income		280

WILD RICE FOR WILD DUCKS

By W. W. MACKIE

[With one photograph by the author]

The reduction in the number of wild ducks, according to federal authorities, is due in a large measure to the reduction of their natural feeding grounds. These areas, usually swamps or lakes, have been drained for agricultural purposes, many of them without profit to agriculture. This situation particularly affects the fall and winter feeding grounds of waterfowl. The wild goose is not so seriously affected in his feeding habits as the wild duck, for the goose feeds in the grain fields and uses the lakes and swamps for resting or loafing places between flights. After providing a loafing place, it is largely a

FIG. 61. Wild rice (*Zizania aquatica*). Upper portion of the panicle bears female, or seed, florets only, and the lower portion male, or staminate, florets only. The female florets bloom much earlier than the male.

matter of protection from excessive hunting for him. With the exception of the sprig, or pintail, the ducks do not, to any considerable extent, follow the geese to the grain fields. The baiting of their feeding grounds in protected areas of the gun clubs is therefore an easy way to attract ducks, provided there are sufficient numbers of ducks to be attracted. Large quantities of grain sorghum are fed to ducks by gun clubs during the hunting season, but this does not extend beyond into the protected season. The problem lies in supplying this feed through plants which naturally reproduce themselves. This condition is particularly pertinent for those areas now being set aside by the state for perpetual protection of ducks and similar waterfowl.

The native feeds which support ducks are not sufficiently plentiful or attractive to adequately meet the situation. Many coarse herbaceous plants afford fair to good holding or carrying foods, but they do not provide the concentrated food like seed-producing plants. Sago pond plant, with its bulb-like seeds, frequently affords a good deal of fine feed, especially for Mallard and Canvasbacks, but it demands pond or lake conditions and may be entirely destroyed by excessive numbers of undesirable mudhens.

Millet, the barnyard grass (*Echinoachloa crus-galli*) is good duck feed and is usually found abundantly in rice fields. Cleanings from rice mills furnish cheaply large quantities of this seed, but the continuous swamp condition of the feeding grounds of ducks does not favor the growth of millet. Growing millet in areas adjacent to duck clubs or on state protected areas in the same manner followed in growing rice would produce this feed in abundance, even in localities not adapted to cultivated rice. This procedure, however, calls for the expenditure of money and energy. A naturally self-sown and perpetually reproducing seed plant is desired.

Wild rice (Fig. 61) has frequently attracted Californians in their efforts to secure a self-perpetuating duck food of good quality. The high value placed on wild rice for duck food in the eastern, northern, and even southern states has created a demand for wild rice seed which supports several regular firms of seedsmen. For forty years or more attempts have been made to establish wild rice in California, but entire failure has resulted until recently. These failures were due, we now know, to failure in keeping the wild rice seed cool and moist in transit and until it was sown. If the seed dried out after the first two weeks following harvest its viability is destroyed in a very few days. This is why much of the wild rice purchased in the market will not grow. In the natural habitat of the wild rice the seed shatters and falls into the shallow water just before it has fully matured, much in the fashion of our wild oats. The seed does not rot, but remains fully protected in the mud until the spring season, when it sprouts and grows. Such wild rice fields are covered with water continuously throughout the year.

Experiments made by the author to introduce wild rice into California for the past three years were in part successful.* It was found that wild rice seed secured in Wisconsin, expressed to California packed damp in spagnum moss and kept cool in transit, arrived in good viable condition. The seed which gave the best germination was placed in

* These tests were made possible through the generosity of Major F. R. Burnham, of the State Park Commission of California.

cold storage and frozen at a temperature below 32° F. Water was added from time to time to prevent drying due to the evaporation of the ice. The seed which grew best was sown in May. Wild rice does not stand alkali or very brackish water, or stagnant water covered with green scum or algae. A slight movement or drainage gives the best results. The soil should be muddy and not sandy. The best depth of water is about one foot, but wild rice will grow in less or in greater depths, provided the water is kept continually over the land.

The adaptation of wild rice to California climatic conditions presents some obstacles. Tests made at Davis, Biggs, Williams, Clear Lake, Berkeley, and Shasta County, showed that rice planted in April or May matured very early, beginning in the middle of July and completing development by the latter part of August. The rice seed remains dormant in the mud, even in California, until the next spring, when it sprouts. For many reasons these dates are too early. The species of wild rice tested (*Zizania aquatica*) is indigenous to such northern regions as northern Wisconsin, Minnesota, and Canada, and must therefore mature in a very short season. A later maturing, taller, and somewhat different species (*Zizania palustris*) is found on the Atlantic seaboard in the vicinity of Washington and southward. This variety matures into September, and has grown well at Berkeley. Further experiments with this southern species may solve these difficulties of too early maturity.

Wild rice outcrosses due to the arrangement of the female and male florets in separate spikelets. The female florets mature later than the male, and occupy the upper portion of the head or panicle, therefore necessitating pollination by wind or insects from other adjacent plants. This method of fertilization gives rise to considerable variation through which new forms adapted to the altered conditions in California may be secured.

The various recent attempts to establish wild rice in California have been frustrated mainly by the voracious appetites of mudhens and carp. These pests are always with us. Further attempts to establish wild rice in spite of these disadvantages are being made.

CALIFORNIA FISH AND GAME WARDENS

Today and Yesteryear

By Walter R. Welch

Not many years ago at a session of the legislature of the state of Vermont, a member thereof arose in his place in the House of Representatives and proposed to abolish all the game laws of that state except those which were intended to protect song birds. This was, indeed, an extraordinary manifestation of the spirit of the times, and it is significant of the general lack of information on the subject of wild life protection.

To think that in these days of general diffusion of knowledge, an intelligent and probably conscientious legislator should favor such a proposition is astonishing, and goes to show the absolute necessity of educating the public on the vital problem of wild life protection, and

yet that act was not without its encouraging feature to game protectionists, as it proved that this legislator did appreciate the value of the song and insectivorous birds at any rate, and we may now hope that he has been convinced as to the value of all wild life.

After years of work, struggle, and sacrifice, the advocates of wild life conservation have definitely agreed as to what is the most pressing need at the present time to forward this great movement. That need is the education of the masses of people as to the value of wild life and the necessity of wise laws strictly enforced for its protection and conservation.

FIG. 62. A fish and game deputy (W. H. Armstrong) in 1900 in a costume often worn in those days.

It is difficult to ascertain in what year the first fish and game legislation was enacted by white men on this continent. It is known that the Indians or aborigines long had tribunal laws in force regulating the killing of wild life before the white man arrived here, and so important did their wise chiefs consider such measures that in case of some offenses, such as killing an albino or white deer, which was considered sacred game, the penalty was fixed at death.

Of the Anglo-Saxon settlers, who established the original colonies in Virginia and Massachusetts, we find little on record which tends to prove that at the beginning as a people they considered game legislation necessary. The fact that many of them came to this country for

the distinct purpose of escaping the penalties of the harsh game laws of the mother country, leads to the belief that they despised such measures. In their new homes they found game of all kinds in abundance, and suffice it to say they took immediate advantage of their opportunity and advantage, and soon became a veritable race of hunters and expert marksmen.

The earliest authentic evidence of colonial legislation according to the modern notion of game laws, was that of New Jersey in 1679, when the general assembly of that province prohibited the export of any dressed deer skins from deer killed by Indians.

From that time on, New Jersey continued in the enactment of game laws of various kinds.

In the Massachusetts Bay Colony, an act to protect deer was passed in 1698, and in New York deer received the first attention of the law makers in 1705. In 1769 South Carolina passed an act protecting deer by a regular closed season from January first to July first, while in 1797 Vermont enacted a similar law. In 1774 Tennessee forbade night hunting for deer.

As showing the abundance of game in that state during the early days of its settlement, we have the record of a legislative act of a different character as a living witness. It seems that a portion of the present state of Tennessee had later established itself as an independent, separate state, and was known by its natives as the state of Franklin. In 1788 the legislature of the state of Franklin met. At that time money was scarce with which to pay the officers of the new state, so in October of that year the legislature of the state of Franklin enacted the following law to provide for the compensation of their officers:

> "Be it enacted by the General Assembly of the state of Franklin and it is hereby enacted by the authority of the same, that, from the first day of January, A. D. 1789, the salary of the Civil Officers of this Commonwealth be as follows, to wit:
>
> "His Excellency, the Governor, per annum, one thousand deer skins, his Honor, the Chief Justice, five hundred deer skins, the Attorney General, five hundred deer skins, the Secretary to his Excellency, the Governor, five hundred raccoon skins, the Treasurer of the State, four hundred and fifty otter skins, each County Clerk three hundred beaver skins, Clerk of the House of Commons, two hundred raccoon skins, members of the assembly, per diem, three raccoon skins, Justice fee for signing a warrant, one muskrat skin, to the Constable for serving a warrant, one mink skin.
>
> "Enacted unto the law this 18th day of October, 1788, under the great seal of the State."

The above not only shows the abundance of game which inhabited that section of the country at that time, but also what a race of hunters and trappers the settlers were; in fact, hunting and fishing and trapping seems to have been the principal occupation of the people; also in the absence of proper measures to conserve the supply of wild life, we can readily understand how and whither the wild game has gone from the land.

Fish and game protection, as the term is understood, in this country at this time, consists largely in the enactment and enforcement of laws regulating the time when, the manner and means by which, and the amount of fish or game that may be legally taken, caught, killed, or had in possession by the public.

These laws are enacted by the state legislature and are enforced by recognized officers of the state commonly called game wardens.

While laws for the protection of game in California were enacted as early as 1852, and while as early as 1870, by the creation of a state board of fish commissioners, provision was made for the enforcement of the laws enacted for the protection of fish, and while in 1878, the jurisdiction of the fish commission was extended to include game, it was not until 1895 that a law was enacted providing for the appointment of fish and game wardens by county boards of supervisors. Under the provisions of this law, the salaries of county fish and game wardens was fixed at from $50 to $100 per month, according to the classification of the various counties. In addition to a salary, the wardens were allowed not to exceed $25 per month for expenses.

As an indication of how little the people in general were interested in the protection of fish and game, and in the enforcement of the fish and game laws at that time, we find that during the five years next succeeding the passage of this law, only six counties within the state, viz: Santa Clara, Santa Cruz, Mendocino, Sacramento, Los Angeles, and Fresno, took advantage of it and appointed county fish and game wardens.

To these county fish and game wardens, and about an equal number of regular salaried deputy fish commissioners, employed by the state fish commissioners, augmented by the help of a few men who volunteered their services prior to 1907, and the enactment of the Hunting License Act, were entrusted the enforcement of the fish and game laws in the State of California.

When we recall the fact that prior to 1907, the salary of game wardens in this state did not exceed $100 per month, from which it was necessary for the warden to defray all of his expenses, we must realize that those who sought appointment to the position did so more from their desire to protect wild life than in the hope of increasing their bank account.

In those days it was necessary for game wardens to maintain horses and rigs as a means of transportation, and to camp out in the hills, and cook their meals along the bank of some stream, in order to curtail their expenses.

In the past, the mission of game wardens seems to have been misunderstood. They were criticized, abused, and misrepresented in a shameful manner by the very people who were most benefited by their services, and their work has indeed been onerous and difficult.

In the first place, game wardens, although expected to be on the job day and night in all kinds of weather, are the poorest paid officials in the state, and three-quarters of them receive no compensation whatever for their services.

The work of game wardens is decidedly of the most difficult and strenuous character, and there is no glory in it, either. To be successful, he must possess all the qualities of an accomplished detective and at the same time be tireless, energetic, honest, courageous, and enthusiastic for the cause he represents.

What are some of the handicaps that confront game wardens? We must remember that very few violations of the fish and game laws occur in the cities or populous sections of the state. They are com-

mitted where fish and game are to be found, in the lonely forests and along the isolated streams and lakes. A game warden is necessarily, therefore, an executive and a prosecuting officer in one, for he must secure his evidence and produce his man in court before a conviction can be had.

It is hard to secure evidence of a violation of the fish or game laws in sparsely settled districts. The natives, or "hill billies," in these districts do not like to testify in court against a fish or game law violator, and in many instances are themselves opposed to the fish and game laws in general and sympathize with the violators of these laws, so we find that the game warden must depend almost wholly upon himself in enforcing the law.

FIG. 63. A deputy on patrol—Walter R. Welch, game warden, Santa Cruz County, 1915. Photograph by W. W. Richards.

If a game warden is slow and timid about making arrests for violators of the fish and game laws, he is ridiculed and called "spineless." If the warden is active and enforces the laws rigidly, he is abused by those he prosecutes and is criticised by others for being "overzealous."

While these are some, they are not all of a game warden's troubles, for he must often face violators of the fish and game laws, who are heavily armed, and who would take advantage of him and shoot him down if he is not careful.

If the sportsman, who sits in his comfortable home and complains of the inactivity or incompetence of the game warden, would undertake the enforcement of the fish and game laws himself, he might have a very different story to tell.

As the writer was appointed a volunteer deputy of the State Fish Commission in 1896, county fish and game warden of Santa Cruz County, under a salary of $50 per month in 1900, and Deputy State Fish Commissioner under a salary of $100 per month in 1901, he was among those of the game wardens who pioneered in fish and game law legislation and in the enforcement of these laws in California during the early days, and believes he knows whereof he speaks.

While prior to 1907 there were only about a dozen regular salaried game wardens for the enforcement of the fish and game laws in California, and while at that time the appointment of these wardens was more or less influenced by politics, the activities of a majority of them were not under any direct control or supervision. At the present time there are about one hundred and twenty-five regular salaried deputies of the Division of Fish and Game, including captains.

The regular deputies of the Division are required to pass state civil service examination as to their qualifications to discharge the duties of game wardens and are paid a regular monthly salary and traveling expenses for their services. The regular deputies of the Division of Fish and Game are required to wear a uniform, consisting of suit, hat, shirt, tie, and shoes of like design, color, and material, and are located in sections of the state where their services are most required for the protection of fish and game and the enforcement of the laws.

The activities of the regular deputies of the Division are directed by a chief of patrol through captains, who have control and supervision of the deputies assigned to their respective districts.

In addition to the regular deputies of the Division, there are about eight hundred and fifty volunteer deputies. About five hundred and fifty of these deputies have been selected from the ranks of the sportsmen of the state, their appointment being sponsored by bona fide fish and game protective associations and clubs located throughout the state.

About three hundred of the volunteer deputies are federal forest rangers, their appointment being sponsored by the U. S. Forest Service.

All volunteer deputies, except the federal forest rangers, whose appointments are sponsored by the U. S. Forest Service, are bonded by the state in the sum of $2,500 for the faithful discharge of their duties as game wardens, the premium on the bond being paid by the state.

The status of the volunteer deputies of the Division as fish and game law enforcement officials throughout the state is the same as that of the regular patrol, and the rules which have been established for their control and supervision of their activities are similar to those which apply to the regular deputies of the Division.

The days of the pioneer game wardens of California, whose appointment was secured and maintained through political influence, whose means of traveling the dusty roads and trails was horse and rig, who, in order to be active in the discharge of their duties for the protection of wild life, and in order to curtail expense, were compelled to cook their meals along the bank of some stream or lake, and to camp out in the hills wherever night overtook them, like the days of their pioneer forefathers, are past and gone, and through the advance of time and the progress made in the protection and conservation of wild life, have been cast into the discard, and relegated to the scrap pile.

Today a thorough knowledge of the duties of game wardens and of the fish and game laws, and not political influence, are required to secure appointment, and activity and efficiency are required to maintain the position. Paved highways have taken the place of dusty roads and trails, and the automobile has taken the place of the horse and rig, thus making it possible for the present-day game wardens to wear neat uniforms suitable to their official positions instead of overalls.

FIG. 64. A uniformed and motorized patrol force is the present day contribution to law enforcement.

The progress that has been made during the past thirty-five years through educating the people as to the value of fish, game, song birds and forests, and the necessity of protecting these great natural resources and assets of the state by the enactment and strict enforcement of wise laws, has resulted very beneficially to the cause.

Let us hope that the good work may continue to go forward uninterrupted.

GAME CONSERVATION IN SOUTHERN CALIFORNIA

By C. S. Bauder

It is doubtful if there is a section in the United States which can show such a heavy concentration of hunters and anglers as the fish and game districts in southern California. Los Angeles ranks fourth in population of any city in the United States. Figures published in the biennial reports reveal that during the period from July 1, 1916, to June 30, 1917, there were $7,595 worth of hunting licenses sold in Los Angeles County. During the same period in 1927, there were $48,474 worth of hunting licenses sold in the county. During the calendar year in 1917, there were $1,939 worth of angling licenses sold in Los Angeles County, while during the same period in 1927 there were $46,411 worth of licenses sold in this county. These figures show clearly the increase in the army of hunters and anglers in one county. Our human population has increased, but there is nothing to indicate that our game has increased; in fact, there is abundant proof that it has diminished.

Lands where we formerly hunted quail and doves have been subdivided and their former habitats are now occupied with artistic homes. The innermost recesses of the last remaining game areas have been pierced with a network of highways, and even our game refuge districts echo with the honk of automobiles. Although accurate figures are not available, it is evident that the seasonal kill of upland game birds and the catch of trout have reached such huge proportions that we are faced with a serious problem in keeping abreast of the annual toll upon our fish and game, with artificial means of propagation. If we fail in these efforts it is evident that we shall have to reconcile ourselves to shorter seasons and lower bag limits. It is for these reasons, largely, that special stress has been laid upon the importance of educational work in southern California, for we realize that unless we direct our efforts in every way possible to preventing violations, the amount of game taken lawfully, added to what might be taken unlawfully, would be more than the game would stand, and we would soon be faced with inevitable signs of depletion.

We consider it a privilege as well as a duty to inform the stranger within our gates about fish and game laws and in this manner we add a new recruit to the cause of conservation.

As an example of what may happen we have only to consider the sage hen, which has been reduced in such numbers in Fish and Game District 4½ as to cause alarm. As recent as ten years ago it was not uncommon for riders on some of the ranches in Mono County to dash among a flock of these birds, knocking one over occasionally with a quirt. Today one may walk for miles over the sagebrush covered hills in eastern Mono County without seeing a sage hen. It is safe to predict that unless sage hens are given total protection with a closed season that this grand bird of the purple sage will soon be added to the extinct list—at least as far as Inyo and Mono counties are concerned.

The most urgent need today when the subject of conservation is mentioned is education. We have too many hunters imbued with a desire to kill everything within range of their guns. Too many judges afflicted with sympathetic complexes, and last, but not least, we face a

barrier of indifference with which the general community greets the problem of game protection. Our own Bureau of Education is engaged in a herculean task, and it is largely due to the tireless efforts of Dr. Bryant and his assistants that a growing sentiment in favor of added conservation has been created. But it is up to us as deputies in the field to assist in this work by extending our activities so that the general public will more fully appreciate the importance of protecting our fish and game.

When we succeed in enlisting the active support of the masses to the cause of conservation, we may expect saner laws, a more friendly attitude from the courts and greater degree of cooperation from the public. And not until then can we hope to hand down to posterity more than a remnant of the wild life resources of which we are the guardians.

Our educational endeavors, however, should be extended further than preventing violations and apprehending lawbreakers, for it is only by educating the sportsmen as well as the ardent conservationist that we can avoid past losses of fish planted in waters unsuitable for certain species and stop the waste of game birds liberated in areas where conditions are unfavorable. These losses can be prevented when we learn more of the kind and abundance of fish food in our waters and determine in advance what conditions exist in the field instead of relying upon those whose interests seem to be confined to seeing something liberated instead of making certain that the future will offer them something for their game bags.

CRAYFISH

By PAUL BONNOT

[With three photographs by the author]

The fresh water crayfish is a crustacean, having as its nearest relations the salt water crayfish or "spiny lobster," and the true lobster. Fresh water crayfish are found in all parts of the United States; in Mexico, Central America, Europe and Asia. In the United States the crayfish are divided into two genera. These are geographically separated by the Continental Divide. To the east of the Rocky Mountains are sixty-four species which belong to the genus *Cambarus*. On the western side of the mountains there are five species of the genus *Astacus* (*Potambius*). It is a curious fact that the common European crayfish is also an *Astacus*. Two of the five western species, *A. klamathensis* and *A. nigrescens*, are native to California waters. *A. leniusculus* is a naturalized species, imported from Oregon in times past for culinary purposes and as biological material. The eastern crayfish has been introduced at several different places in California. In the January, 1925, issue of CALIFORNIA FISH AND GAME there is a note to the effect that Professor S. J. Holmes of the University of California took several specimens of *Cambarus clarkii* near Pasadena, California. The western limit of the natural range of this species is western Texas. In Vol. 13 of CALIFORNIA FISH AND GAME is another note bearing the date of August 13, 1926. This states that 15 specimens of *Cambarus blandingii acutus* were taken from the Escondido River in northern San Diego County. It is not generally known that the California law definitely prohibits the importation and planting of certain species of animals. Section 628*h* of the Penal Code reads as follows: "Every person who places, plants, or causes to be placed or planted,

in any of the waters of this state, any live fish or the eggs of any fish, any shellfish, crustacean or mollusk (except oysters), or any other fresh or salt water animal, whether taken within or without the state without first having submitted the same for inspection to and securing written permission from the Board of Fish and Game Commissioners, is guilty of a misdemeanor * * *.

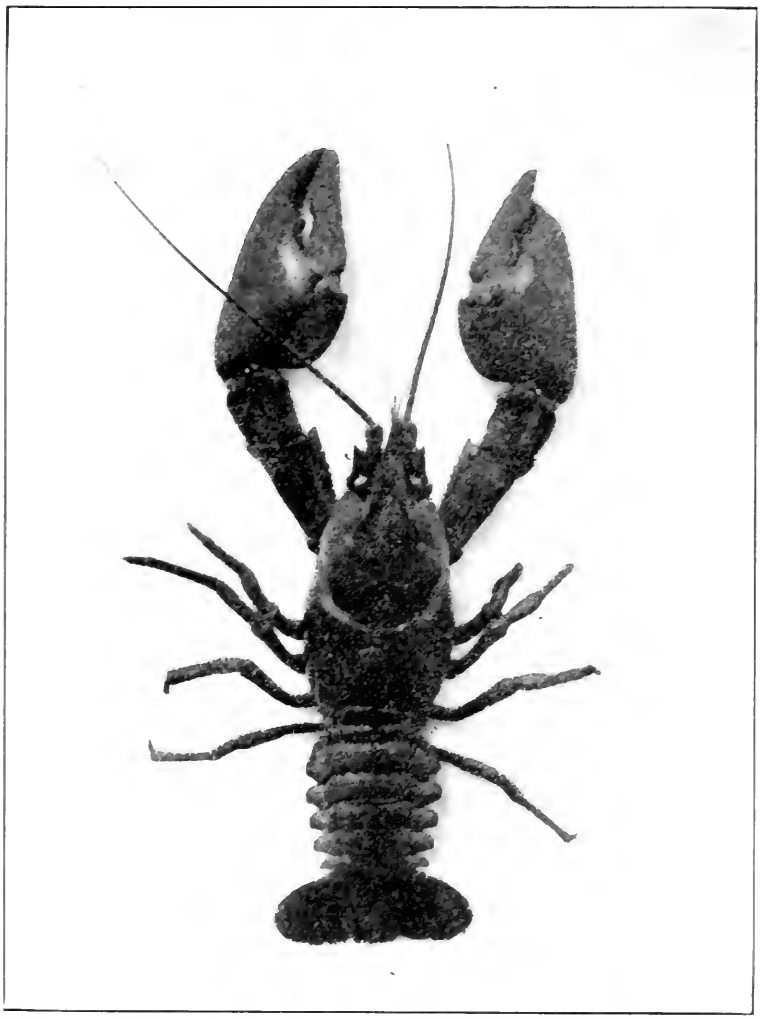

FIG. 65. *Astacus leniusculus* (Dana). Taken in the San Lorenzo River at Brookdale, February 7, 1930. Photograph by Paul Bonnot.

According to Holmes (1900), the distribution of the genus *Astacus* (*Potambius*) is as follows:

Astacus gambelli—Utah, Idaho, Montana, Wyoming.

Astacus nigrescens—San Francisco County to Alaska (near the coast).

Astacus leniusculus—Columbia River, San Francisco County.
Astacus trowbridgi—Columbia River.
Astacus klamathensis—Region about Klamath River and Lake.

The genera *Astacus* and *Cambarus* can readily be distinguished from each other by the following characteristics: The *Astacus* has 18 gills, while the *Cambarus* has but 17. The female *Cambarus* has a false pouch or annulus ventralis, for the reception and storage of the sperm, while the female *Astacus* has the sperm deposited on the posterior part of the thorax in spermatophores.

Crayfish are found in nearly all the fresh water streams of California, but because they are for the most part nocturnal, their presence is not often noticed. They seldom move about during the day time, but hide under logs and stones, or in natural cavities under the stream banks. Some of the eastern *Cambarus* depart from the usual burrowing in stream banks. They live on low lying land and sink their burrows to water level, piling up the mud dug from the burrows about the entrance in towers, or "chimneys." They live at the bottom of their burrows, which always contain enough water to cover them. Some species of crayfish are a great nuisance, as they riddle earth dams and levees with their burrows and greatly weaken them. The chimney builders sometimes are so abundant that they seriously interfere with farming. Their burrows undermine the roots of the growing plants and they eat quantities of the crops.

The California crayfish breed in the fall. The male deposits the sperm on the under side of the thorax of the female, where it remains until spring. The eggs of the female issue from the genital apertures which are situated at the base of each third walking leg. The eggs are covered with a viscous substance which draws out to a fine thread and attaches itself to one of the swimmerets. An adult female will produce from 200 to 400 eggs. The eggs and later the young crayfish are continually supplied with fresh water by the movements of the abdomen.

The eggs hatch in from six to eight weeks. When the egg case splits the young crayfish would fall to the bottom and be lost were it not that a tough thread holds it suspended. This thread is attached at one end to the inside of the ruptured egg case and at the other to the telson or tail fin of the small crayfish. In a few hours the young crayfish climbs up and fastens on to the thread, by which the egg case is attached to a swimmeret, by its chelae or claws. The chelae are tipped with recurved points, which make it difficult for even the crayfish to withdraw the claws after they have once secured a firm hold. As long as the thread attached to the telson remains, the small crayfish is attached at both ends. The thread attachment is lost with the first molt. The young remain hanging to the swimmerets for about four weeks, during which time they shed the shell twice. After the second molt they begin to take short excursions away from the female, returning, however, to the protection of the sheltering abdomen. After gaining a little experience they drift away on their own. During the first five months the young crayfish molt a dozen times and grow to be two inches in length. When molting the chitinous shell is shed in one piece, including the teeth and the lining of the stomach. Females have been recorded carrying eggs when one year old.

As in the case of the majority of the lower forms, crayfish can readily regenerate lost parts. A claw, an antenna, or a walking leg will be entirely replaced in the course of a few months. The younger the animal the more quickly will a lost part be replaced. The claws or walking legs, if injured, are broken off by the crayfish at a natural joint between the second and third segments. This breaking point has a muscular arrangement which acts in the same manner as a diaphram

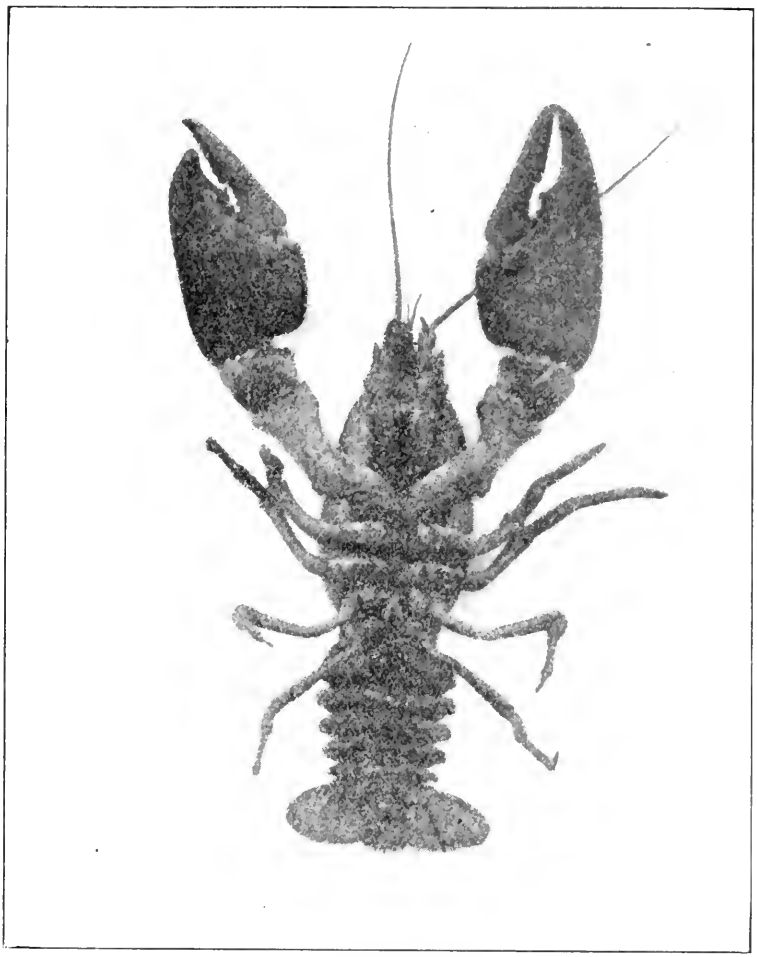

FIG. 66. *Astacus leniusculus* male (ventral). Taken in the San Lorenzo River at Brookdale, February 7, 1930. Photograph by Paul Bonnot.

and closes the open end of the break at once, preventing infection and loss of blood. The new leg or claw which develops from the stump is as large as the lost one.

Crayfish are scavengers as well as consumers of living organisms. They keep the waters they inhabit free from much debris. They will eat anything of an animal or vegetable nature, either alive or dead; fresh or stale. They have been accused of destroying salmon and trout

spawn. They furnish a food supply for many fish, other crayfish, salamanders, snakes, turtles, kingfishes, raccoons, and man.

Crayfish have never figured very extensively in a commercial capacity, both because of a lack of market and their relative scarcity. Some years ago quite a few were consumed in San Francisco, the main source of supply being Coyote Creek near San Jose. A few are still used for culinary purposes and by beginning biological students. Most of these are imported from Oregon. The Russian River figured as a source of supply at one time. In 1915 a fisherman on the Russian River took about 8000 crayfish with hoop nets (crab nets) and shipped them to San Francisco and San Jose. He found that the only bait they would not take was a salt bait of any kind. Until the last meeting of the legislature no legal protection was given to the fresh water crayfish. A law was passed at that time at the behest of interested parties in the southern part of the state, which reads as follows:

> Sec. 628*l*. Every person who in fish and game district number four takes, catches, kills, destroys or has in his possession any fresh water crayfish (Ecrevisse) before the first day of January, 1932, is guilty of a misdemeanor.

As the natural supply of many of our commercially valuable species has decreased before an ever increasing market, attention has been turned to artificially producing those species which can show a profit. Frogs and turtles have been raised experimentally, but as far as I can find out no one has tried to raise crayfish except as a laboratory experiment. If a reliable market could be had it seems to me that there should be little or no trouble in supplying it with artificially reared crayfish. The requirements are simple; plenty of water, either clear or muddy, a food supply and a minimum of enemies. Unlike frogs or turtles which are not marketable for about five years, crayfish are ready for market in a year's time. They are as prolific as the reptiles and it is not necessary to fence them in, as they seldom leave the water, and then only for a short distance. On the other hand, natural enemies and diseases might render an attempt to rear crayfish abortive.

BIBLIOGRAPHY

Andrews, E. A. 1904. Breeding Habits of Crayfish. Am. Naturalist, Vol. 38, No. 447, pp. 165–206.

Chidester, F. E. 1912. The Biology of the Crayfish. Am. Naturalist, Vol. 46, No. 545, pp. 279–293.

Hay, W. P. 1899. Synopsis of North American Invertebrates Astacidae. Am. Naturalist, Vol. 33, No. 396, pp. 957–966.

Holmes, S. J. 1900. Synopsis of Cal. Stalkeyed Crustacea. Occasional Papers of Cal. Acad. of Science, No. 7, 262 pages.

Fig. 67. *Astacus leniusculus* female. Taken in San Lorenzo River at Brookdale, February 7, 1930. This illustrates the regeneration of the right cheloe, which is only about one-third as large as the left. Photograph by Paul Bonnot.

THE FRENCH MACKEREL FISHERY*

By Genevieve Corwin

[With one map]

An interesting paper, by Monsieur L. Bronkhorst, was acquired recently by the library of the California State Fisheries Laboratory and bears the imprint date 1928, and title "La Pêche du Maequereau."

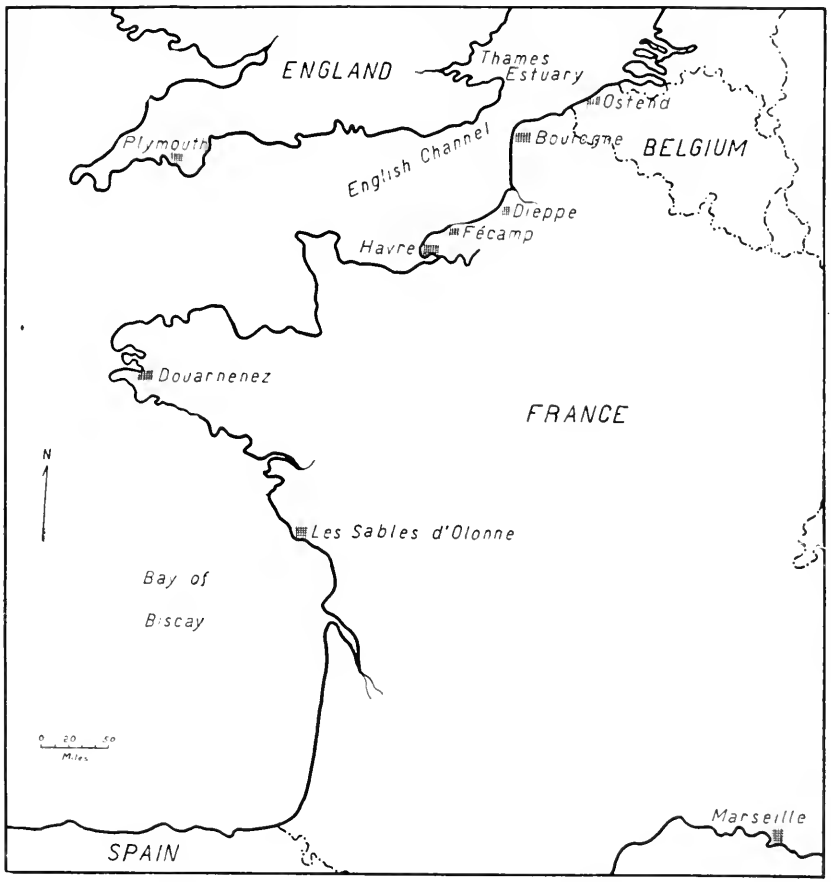

FIG. 68. The important mackerel ports of France. Ostend (Belgium) and Plymouth (England) are also connected with the fishery. Les Sables d'Olonne, although not particularly connected with the mackerel fishery, is indicated on the map because it is an important fishing port.

The author, whose position is administrator of the first class of maritime registry, France, gives an interesting but sketchy account of the French mackerel fishery. Certain points such as the boats called "dundees" and specialized types of gear are not described. Yet we get a good picture of the small scale on which the fishery is operated, the lack of mechanical aids and the resulting laborious work that must be done by hand.

* Contribution No. 88 from the California State Fisheries Laboratory, February, 1930.

Monsieur Bronkhorst states that the average size of the mackerel of French waters is sixteen to twenty inches in length and about two pounds in weight, and that they spawn from May to midsummer in water of 12° C. and of less salinity than where fishing takes place. The eggs, 500,000 to one large female, are first at the surface and gradually sink. Incubation requires four to five days. He says that some individuals spawn at the end of the third summer, but the majority not until they are three or four years old. After they have spawned they are voracious, and at this time the line fishing is most successful. They migrate out to deep water, but probably do not leave the continental shelf. Their return to shallow water is noticed first at Plymouth about the first of April as the shoals pass eastward. Their food in the spring is pelagic crustaceans (small floating shrimp-like organisms), and later they pursue small fish, even their own fry.

The author discusses the fishery under three headings: the great fishery for mackerel, the drift mackerel fishery and the small fishery for mackerel.

The Great Fishery for Mackerel.

At Boulogne and Fécamp the main fishing season begins from March 15 to April 20, and at Douarnenez the end of January. The area fished extends to the coast of Cornwall and up to the Thames estuary. From September first to the middle of October the fishery is in the North Sea and is called the Thames fishery.

The sailboats carry 15 to 24 men, receiving 90 to 95 francs ($3.60) a month, and the steamboats 25 to 30, the men receiving 100 francs ($4) a month. At Fécamp each fisherman receives a bonus of 80 to 120 francs according to the value of his services. Besides the salary and bonus the catch is divided into shares, depending upon the position held by the man in the crew and on how much gear he furnished: for instance, a man contributing 5 double lines is entitled to a half share.

The drift nets are 30 to 32 yards long and 6½ yards wide, of cotton, and have a mesh of 1½ to 1¾ inches. The equipment of one boat consists of 250 to 500 nets. Several of the nets are fastened together and set at the surface with a line of cork floats at the upper edge and weighted on the lower edge by a rope attached by lines 14 yards long, the rope therefore paralleling the net 14 yards below it. The fish are caught by the head as they swim into the meshes, which are too small for them to pass on through. The steamers make seven trips during the season, and the sailboats three, the length of each trip diminishing toward the end of the season.

The fish that are to be salted are cleaned and cut twice transversely and salt rubbed into them. They are placed loose in the hold, except the small ones and those damaged, both of which are packed in barrels. The roe is also salted.

In 1888 a fleet of fishing boats was organized with tenders provided with ice, but on account of international complications this system was discontinued. At present the boats operate separately. The fish that are to be brought in fresh are packed in layers alternating with cracked ice, in wooden boxes containing 40, 80 or 110 fish, according to size.

The port of Boulogne deals in fresh fish, while Fécamp specializes in salted. Some of the drifters sell their catch at Fleetwood (the northwest coast of England), Newlyn (southwest coast of England), Ostend,

Belgium, and Ijmuiden, Holland. The methods of sale are various: by the case, as described above, by 110, by 100, or by weight. It appears that the fish are not canned, but are smoked or salted. The refuse is used by fertilizer factories.

The following table shows the results of the fishery:

Year	*No. of mackerel*	*Francs*	*Equivalent in dollars*
1921	11,000,000	6,000,000	$240,000
1922	9,200,000	6,400,000	256,000
1923	5,276,000	5,900,000	236,000
1924	21,000,000	14,000,000	560,000
1925	23,000,000	20,000,000	800,000

The year 1926 was also a good year, but the figures are not given, nor for 1927, which on the contrary was a poor year.

The Drift Mackerel Fishery in Brittany.

This fishery extends to the coast of Ireland and employs 1500 men. It is not as remunerative as the tuna and sardine fisheries, but is carried on to fill in the time between these seasons. Douarnenez is the most important port, with 75 boats called "dundees," totaling 3279 tons. The season starts in January or February and lasts until the sardine and tuna seasons start (the last of June). The small boats are gradually being replaced by ones of larger size and greater seaworthiness. The loss of life has been reduced 95 per cent since this improvement started. None of the boats have any apparatus for lifting the nets and all of this work is done by the men. Only four of the boats at Douarnenez have an auxiliary motor. The boats are seldom owned by one man, and rarely does the captain ("employer") own a share in the boat.

Here again the fishermen furnish the nets, supplies and ice, and the proceeds are shared accordingly. Sometimes a captain or employer will take a set of seven nets from sick or disabled sailors, widows or orphans and give them half the profit.

The nets are 1000 meshes long and 50 wide (43 by 4 yards), with $1\frac{1}{8}$-inch mesh and the cost is 128 francs ($5.12). To preserve them they are dipped in catechu, a brown tanning substance. When the boats come to the fishing banks the fishermen replace their masts with shorter ones and put up a trysail which causes the boat to progress more slowly. The ends and the middle of the net are marked with an actyelene lamp and the name of the boat. In the morning at 2 or 3 o'clock they begin to lift the nets. The greatest loss to the fishermen is from passing steamers. Each fishing boat makes about 10 trips a season, with 3 to 8 days per trip.

The "dundees" take ice in blocks which are placed on shelves and the fish laid on the blocks, but if the trip is to last not more than 72 hours they do not take ice.

Douarnenez is the largest market in the province of Finistere, with 25 fish dealers, 23 factories and a large refrigerating plant. Up to 1923 the fish were sold by the "baker's" dozen, but now they are sold by the hundred. The sales take place on the wharves by the auction method, except that the captain of the boat starts out with a maximum

price and comes down until he finds a buyer. The fishermen wash the fish and deliver them to the buyer. The season of 1926 brought 4000 francs ($160) per man and 16,000 francs ($640) for the boat.

The Small Fishery for Mackerel.

This is carried on in Morocco, Vendée, Tunis and Algeria. At Dieppe the season is from May to October, between herring seasons, and at Havre from July to September. Floating lines, drag lines, drift nets and seines are all used in the fishery. In certain localities when the weather is calm, set lines are used with nets paralleling them in between. For trolling the lines are of linen or horsehair with two to six hooks baited with marine worms, shrimps, herring, cod tails, or the first mackerel that was caught. Even pieces of red cloth or bits of rubber are used with success. At Bône, Tunis, they use straw or white cloth. On the Moroccan coast they use a piece of corn husk on the barbless hooks. Each boat has several lines each weighted differently in order to place it at a different depth. In some localities a basket of fish refuse is lowered into the water to attract the fish to the spot. In Provence linen lines are used with a wire leader and a one-pound sinker from which hangs a series of hooks baited with crabs. Sometimes a bright shiny spinner with a triple hook is used. The Brittany fishermen usually employ a horsehair line with one hook, baited with mackerel. A good catch is 1100 pounds for the smaller boats, or 1700 to 2000 pounds for the larger.

Pole fishing in the Mediterranean starts with "chumming" or attracting the fish with a meal composed of sardines, herring, beef or mutton spleen, bran, cheese and asafetida.

The "turlutte" is an interesting piece of gear resembling the handle of an umbrella with just one rib on which are soldered several hooks. The fish are "chummed" and the apparatus is dragged through the school to snag the fish. This method has been outlawed in some localities because it tears the fish. The "scoumbrière" used in the vicinity of Marseille is a trammel net of horsehair 40 to 70 fathoms long and widens from 70 to 100 meshes. The lower line carries only five leads to a fathom, while the upper line has a float every two feet. This net consists of three layers or curtains: the two on the outside are of large size mesh and the one in the center of small mesh. The fish pass through the large mesh and shove the small mesh (through which they can not go) on through the third layer of net and in their efforts to push through entangle themselves. At Marseille the fishermen string together 10 nets of 70 fathoms length, or 30 of 40 fathoms. The ends of the net are made of linen, with a rope attached. They are laid in the same way as the drift nets mentioned above, by a boat using a trysail. The season for using this gear is from March to July when the sea is rough. This type of gear is characterized as "very effective," bringing in over half a ton a day. This amount would be quite insignificant compared with our catches of 10 tons a day.

A cone net, 2 feet in diameter, mounted on a wire hoop with ½ to 1½ yard handle, is used successfully by some of the fishermen of Douarnenez.

The expenses and profits are placed on a share basis as in the other fisheries described. The fish are sold in some places "by the tail," by twos, by the whole lot in the catch, by 100 or 1000, or by weight. In most of the northern parts the fish are sold by auction.

Increasing amounts of mackerel are being canned in oil or pickled in white wine. The mackerel of 4 to 5 inches are usually canned whole in olive oil, and the process is much the same as that used for the sardine.

An interesting custom in Sud-Finistere allows the fishermen using the set lines to go fishing for themselves Sundays during the month of October.

Perhaps the most illuminating point brought out by Monsieur Bronkhorst is the small-scale, tradition-bound methods used. The fact that most of the fish is consumed within the country and that new methods of preservation are therefore not in demand may account for the lack of change in the industry. There are many points which the author leaves quite vague, but we are indebted to him for an illuminating article.

A BIOLOGICAL SURVEY OF CLEAR LAKE, LAKE COUNTY

By George A. Coleman
[With one photograph by the author]

Foreword.

During the months of January, February, March and April, 1925, the author made a resident study of the entire Clear Lake District in Lake County, establishing headquarters at Clear Lake Park on the peninsula which separates the two lower arms of the lake.

An intensive survey and study was made on the southwest arm of the lake (formerly called Lower Lake). Soundings and dredgings were made at regular intervals of five hundred feet on survey lines established one thousand feet apart across this arm of the lake for its entire length of nine miles. The dredgings from the bottom were preserved in pint jars as were also the plankton secured by towing plankton nets of various meshes behind a rowboat for regular time intervals of thirty minutes every day, varying the time of each day in order to obtain the full daily cycle, during the entire four months of my residence.

The Clear Lake Park Company kindly donated the use of their engineers' cottage, which proved to be admirably adapted for a small laboratory. Small aquaria and aquarium jars were established here for the life history studies which were carried on simultaneously with the survey. Specimens from the regular morning's dredging and plankton collected were worked up in the afternoon and evenings while still fresh. The company also donated the use of rowboats for my daily use. Other residents of this section of the lake kindly donated the use of private launches for the longer trips to other parts of the lake.

It was soon evident that a small-meshed seine would be necessary to secure specimens of the enormous number of young fish of the various species inhabiting the lake. As none of the regular seines in the market seemed adapted, I designed a special seine of one-fourth inch mesh, one hundred fifty feet in length and eight feet in depth, with a pocket in the middle three by six feet wide by six feet deep. The leadline is double-leaded, and in place of the brail sticks at the end usually used on such a seine, a special leaden weight of five pounds, designed so as to be readily attached and detached with a snap, was used on each lower corner.

Since this seine requires four men to handle it properly, Deputy Dondero kindly volunteered his own services and that of three members of

the Lake County Game Protective Association, which crew worked it very successfully on several occasions, securing many fine specimens of fish, larger crustacean and insect life.

The heavy deposits of diatoms, organic matter, silicious, clay and silt over most of the bottom of this lake made it impossible to use the ordinary dredging nets used for biological work, hence I designed a special heavy dredging tool for this work (see photograph). This dredger is made of three pieces of one-quarter inch by one inch iron, each piece with four teeth, of the same size and weight iron riveted on. Each piece has holes in the lower edge for fastenings of a net and holes at the ends for bolting together at the corners. When bolted together this makes a triangular dredge with teeth, which, no matter how it turns in going to the bottom, always strikes right side up and the teeth of one side take hold on the bottom. Three iron rods, three-eighths inch by three feet, are attached, one at each corner, for the handle. Cotton window cord, 100 feet long, makes an exeellent dredging line. The net can be

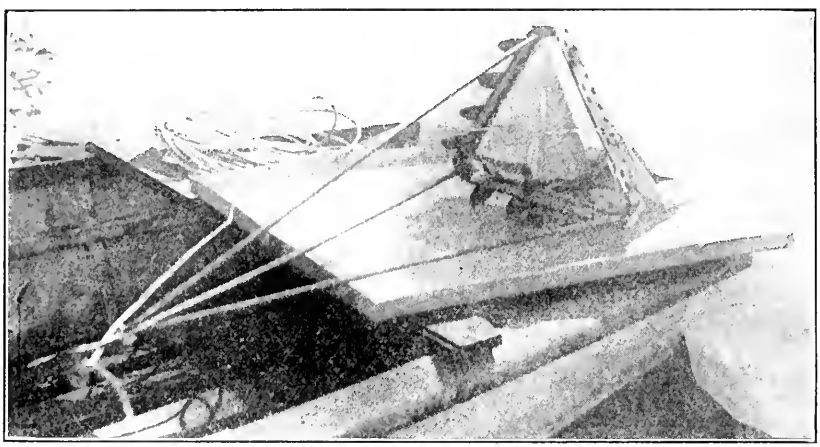

FIG. 69. The Coleman dredge and pan.

made of heavy unbleached muslin, or of light canvas, or other material, depending upon the bottom to be worked over. The net may be sewed fast to the dredge irons with a light fish cord in a few minutes.

Another piece of apparatus which I found indispensable is a special pan made of heavy sheet iron, with the edges and one end turned up for a distance of one inch. This pan is laid across the stern of the boat to receive the dredge with its load. The water drains off outside the boat, leaving the mud, with its specimens of crustaceans, insects, plankton, etc., spread out on the pan, where they can be readily seen and picked up.

With this outfit I accomplished the dredging of this lake single handed without a mishap, except getting lost in the heavy fogs occasionally.

Topography.

Clear Lake occupies the major portion of what was once an extensive volcanic region, with Mt. Knoeti at about the center of the field, the

three largest extinct, craters being now occupied by the three arms of the lake. Blue Lakes is another part of this same series, occupying a narrow gorge in the same mountain system.

Clear Lake, besides being the recipient of the run-off from an extensive watershed surrounding it, is fed by four streams, viz: Kelsey Creek, entering the southeast corner of the Upper Lake, while Scott Creek, Middle Creek and Cold Creek all enter at the upper end of the Upper Lake.

The two lower lakes are fed entirely from the upper lake through "The Narrows," a very narrow and deep passage at the southeast angle of the upper lake. Cache Creek is the only outlet and formerly connected with the Sacramento River. This connection is now, however, intermittent.

Besides these streams there are a great many springs at different points along the shore line, most all of which carry a mineral content: borax, iron, soda and sulfur. In Soda Bay there are a number of boiling soda springs. Entering the lower part of the northeast arm of the lake is a small stream which flows through the old sulfur banks at the Cinabar Mine, which was worked for a great many years for quicksilver and sulfur. This little stream is so strongly impregnated with sulfur, iron and the minerals accompanying quicksilver ore, that it turns the water milky white for some distance from the mouth. In the early summer of 1926 there was an eruption in the bottom of this arm of the lake, not far from the mouth of this little stream, which killed a considerable number of fish. The then resident engineer in charge of the old mine informed me that he made an analysis of the water from the bottom just at the point of this eruption and found it to be strongly impregnated with sulphuric acid. Evidently volcanic chemical action has not entirely ceased in this region.

Shore Line.

The one hundred and thirty-five miles of shore line surrounding these lakes offers a great variety: rocky, gravelly, pebbly, sandy, sandy-silty, and loamy patches which are usually covered with a luxuriant growth of fine salt grass and other plants. In many of the coves and small bays the lake tule grows abundantly. There are a number of islands in each arm of the lake, which exhibit the same variety of shore line as the mainland. This great variety of shoreline offers many small bays and coves with quiet water, in which certain species of fish spawn and where their young find an abundance of food and shelter. The bass are particularly fond of the tules, especially around the islands where they breed.

Bottom.

Extensive dredging of the bottom showed it to be, for the greater portion, almost level and composed of a very fine silt. This silt is made up of volcanic sand, diatomaceous earth, the silicious spicules of the fresh water sponges inhabiting the rocks along the shore and decaying vegetable matter, mostly tule roots and stems. This bottom material was most always heavily stocked with the various species of bacteria which are concerned in the decay of such matter, so that it was rapidly worked over into food for the plankton.

On all points of land extending out into the lake there is a rocky belt, forming a rocky wall along the shore and rocks, varying in size from small pebbles to good sized boulders, extending on the floor of the lake to a distance of fifty to one hundred feet.

The lower end of the lake is a gradual decline from the shore to a depth of fifteen feet at a distance of a mile from the outlet. In general, however, the shore line drops off very abruptly a short distance from the shore to a depth of thirty feet. There are a few depressions toward Mt. Knoeti, in which the depth was found to be forty-five feet. The upper lake bottom is very level, with a gradual slope from the shore to a depth of fifteen feet, with an occasional depression where the depth is twenty to twenty-five feet.

Temperature.

January temperatures of the surface water varied from 45 degrees to 47 degrees F., while the bottom temperatures at thirty feet showed only 2 degrees lower. There being no thermocline, owing to the shallow depth.

A spell of warm weather in February brought the temperature at the surface to 50 degrees F. and for a short time to 52 degrees F. March temperatures averaged 55 degrees F. Warm weather the early part of April brought it up 57 degrees to 60 degrees F.

During the summer and fall, as I have noted on several visits, the temperature varies according to the sea breezes. For the most part it varies between 60 degrees and 70 degrees F., with an occasional spurt up to 75 degrees F. or even 80 degrees F. for a short time.

With the strong daily breezes there is a constant circulation of the water all over the lake and to the bottom.

Dissolved Oxygen, Carbon Dioxide and General Acidity.

During January the dissolved oxygen varied from 100 to 210 per cent saturation, depending upon the circulation caused by the wind. At all times the water showed a very high content of carbon dioxide (general acidity), varying from 15 parts per million to as high as 45 parts per million.

After the winter rains the dissolved oxygen remained stationary at 15 p.p.m as the water showed a general dilution and good circulation, daily started by a strong wind at 11 o'clock a.m.

Rainfall.

For three seasons previous to 1925 there was a general drouth which brought the water level to the lowest point in recorded history of these lakes: 1.7 feet below the lowest level ever recorded.

Exceptional rainfall, however, during the winter of 1924–25, brought the level back up again, raising the general level of the lake eight feet.

There seems, therefore, no reason to worry over the effect of drouths on the fish life in these lakes.

Plankton Survey.

The plankton collected daily from the open waters of the lake consisted of a large number of species. However, the species which are most abundant and upon which the young of the various species of fish will depend for food are limited to about four species of Cladocerca and Copepoda as follows:

Water Fleas—Cladocerca.

Daphnia longispina, var.—This is by far the most abundant species. Towing the No. 6 plankton net for 30 minutes would often result in a half pint of this species and the following, in about equal quantities:

Cyclops bicuspidatus—As stated above, these two species are always associated. At one time this species may be about equal in numbers to the above, but usually it is much less in numbers. Collections of these two species always include them in all stages, showing that they breed almost continuously. They are not confined to any particular section of the lake, but seem to be abundant anywhere in the open water. I have taken them wherever collections of plankton were made.

Copepoda—Copepods.

Diaptomus bakeri—This species is very abundant and was taken in almost every haul of the plankton.

Malacostraca—The Higher Crustaceans.

The most abundant species here is the "scud."

Hyalella knickerbockeri. Bate.—This crustacean was found abundantly all along the entire shore line. It shows a wonderful adaptation to the circumstance of its surroundings. I find it living in the mud in ten feet of water, in the tules, in bunches of algae (particularly in Nitella), in holes in the volcanic tufa along some shore line, on large boulders, and even in the sulfur water coming from the old sulfur mine. It seems to breed equally well in all these places.

I made some extensive breeding experiments and found that it agreed very well here with numbers of generations noted by Prof. Embody at Ithaca, N. Y., but the breeding season is much longer and there seems to be spring and fall crop.

Their main food is the several species of diatoms growing in the lake, with some fresh vegetable matter from tules, or algae. However, they can, on occasion, become good scavengers. During June and July, when the great annual demise of the carp and blackfish takes place and the thousands of bodies of these dead fish wash up on shore, under every fish will be found quantities of "scuds," having a royal feast.

As fish food they are par excellence. I found them in the stomach contents of every species of fish examined, except of the carp.

The main food of this enormous population of water fleas and copepods consists of the various species of diatoms. These are too numerous to name except for a few of the most abundant genera:

Diatomaceae.

Navicula—Common.
Amphora—Scarce.
Stephanodiscus—Very abundant.
Synedra—A few.
Cyclatella—A few.
Coconema—Common.
Nitzschia—Common.

Chlorophyceae.

Pediastrum—Common.
Botrycoccus—Common.
Cyclatella—A few.
Ankistrodesmus—Rare.
Nephryolatium—Rare.

Cyanophyceae.

Gleocapsa—Abundant on rocks
Oscillatoria—Abundant on rocks and sometimes open water.

Rotatoria. The Wheel Animalulae.

Aneura aculeata—The most abundant species.
Notops sp. Common.

Infusoria—The Ciliate Protozoa—Many and abundant species.

Mastigophora—The Flagellate Protozoans—Abundant.

Porifera—Fresh Water Sponge.

Trochospongilla leidy Bowre.

A species of fresh water sponge, which I believe to be the above, is found encrusting the rocks at a distance of about 200 feet from shore, opposite Clear Lake Park, in about ten feet of water. This is a very beautiful little sponge and worthy of an extended study, as to its life history and habits.

Quantitative Survey of Plankton.

The water fleas and copeods are in such quantity in these lakes that it was a very easy matter to secure quantities sufficient to dry and weigh. This amounted to five grams per cubic foot of water sampled. Allowing for variations in quantity at different depths, it is estimated there is at all times in these lakes in the neighborhood of one thousand tons of this food available for young fish, and such adult fish as take this plankton food.

Insect Life.

Caddis Fly—Several species breed among the tules, using the tule tissue for their cases. Several small species also live on the rocks on rocky shore line.

Crane Fly—The larvae of two species were found on rocks, just at the edge of groups of tules.

Chironomus—The red larvae found at the bottom in mud in great abundance. I found these in the stomachs of all catfish examined.

Burrowing Maytly—The larvae of a number of species were found in the mud along grass-fringed shores. The adults appear in quantity in May and June.

Gnats—*A most remarkable flight of gnats occurs during May, June, July and sometimes continues into August. I hesitate to estimate the quantities of these insects which are produced every year. Recently electric light-electric fan traps have been placed at various places around the Upper Lake and a few of these traps in 1929 captured 18 pounds of gnats in a few nights. Mr. Burges, the University of California students in charge, has estimated there are 125,000 gnats to the pound and said that if he had 100 traps he could no doubt capture as many with each one. There are, therefore, literally and truly billions of these gnats produced every year. Mr. Ricker, in charge of the Cold Creek Hatchery, has been feeding them to the young fry in the hatchery with apparent beneficial results.

Tule Gnats—Breed in among the tules and consist of several species. They are in no way to be confused with the above described gnat, which breeds and the larvae are found in countless millions in the open water.

As Fish Food.

The above species of insects furnish great quantities of food for the young of all species of fish existing in the lake. It has been suggested that the introduction of the mosquito fish might help to keep down the gnats. With the enormous numbers of young fish already produced in the lake, it would not seem the addition of the mosquito fish would make such an inroad on the gnats.

Fish.

There seem to be about ten species and varieties of fish which are native to these waters, breeding abundantly:

Native Fish.

Sacramento Perch—*Archoplites interruptus*, Girard.

Abundant, found mostly in shallow coves where they breed, the young appearing the last of March and abundant the first week in April.

The "Hitch" or "Chigh"—*Lavina exilicauda*, Baird and Girard.

The most abundant fish in all these lakes, including Blue Lakes. They run up all the creeks, entering from the lakes in March, spawning on the shallow rillles. They are then so abundant that one can hardly step without stepping on several. They are excellent eating and people should be encouraged to use more of them.

"The Blackfish"—*Orthodon microlepidotus*, Ayres.

This fish grows to a length of 18 inches or more, and although it is very oily, the Indians around the lake esteem it highly and prepare great quantities by drying every year, for food. This is the fish which dies every year in the spawning season. Mr. Dondero says they die before spawning. If this were always true, however, they would soon be extinct.

Sacramento Sucker *Catostomus occidentalis*, Ayres.

This fish seems to be quite abundant. I saw several specimens 12–18 inches in length.

"Chapanl" or "Squawfish"—*Ptychocheilus oregonensus*. Richardson.

This fish, a fair food fish, the meat white and solid, but full of bones, is also very abundant.

"Sacramento Chub"—*Siboma crassicauda*, Baird and Girard.

I saw a fine specimen which was hooked on a catfish line. Fishermen report catching them frequently.

"Split-Tail"—*Pogonichthys macrolepidotus*, Ayres.

(Three color varieties.) Very abundant.

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*NOTE.—Prof. S. Freeborn, of the Agricultural College, University of California, worked on this gnat in 1926 and described it as a new species: *Chaoboris lacustris* Freeborn. (A new Chaoborid Gnat, Stanley, Freeborn; Pan-Pacific Entomologist, Vol. 11, 4, pp. 161–163, April, 1926.)

Minnows—At least three species are abundant, none of which are identified, as far as I know.

Silver Sides—One unidentified species.

Introduced Species of Fish.

European Carp—*Cyrpinus carpio.*

By far the most abundant of any of the introduced species. The breeding of this fish occurs mostly in the shallow waters of the upper lake and the west side of the lower lake. They collect in the tule swamps at the upper end, where they die in great numbers every year along with the blackfish.

Catfish—The Common Sacramento Catfish—*Ameirus nebulosus*, Le Suer.

Very abundant, growing to a length of ten to twelve inches.

The Brown-spotted Cat—Ameirus *platycephalus*, Girard.

A variety known to fishermen which is becoming quite common.

The Great Blue, or Forked-Tail Cat—*Ictalurus furcatus*, Cuv. and Vincen.

These were planted a few years ago and seem to be flourishing. The catfish fishermen report they have caught and thrown back over three hundred during the winter. I saw six specimens in an aquarium in Lakeport, which measured from seven to twelve inches in length. The report of a seven and one-half pound blue cat, I was unable to verify.

The Bass—The Small-Mouthed Black Bass—*Micropterus dolimieu, Lac.*

Expert fishermen report these very scarce and hard to catch. Only live bait will succeed. I caught one specimen which was in fine condition.

The Large-Mouthed Black Bass—*Huro floridana*, Le Seur.

This bass is much more abundant than the small mouth. They breed about the islands and are caught among the tules.

The Calico Bass—*Pomoxis annularis*, Refin.

These are fairly abundant. I caught several in one morning's fishing. It is an excellent pan fish.

"Crappie"—Fishermen report a "crappie" which has not been verified.

Blue Gill—*Helioperca incisor*, Cuv. and Valencen.

These fish are quite abundant in all parts of the lake and were caught in the seine quite often. The young appear in abundance in shallow coves the first week in April.

Trout—European Brown—*Salmo fario.*

A number of different plantings of this trout have been made in the lakes. Fishermen report them to be getting numerous and of large size.

Steelhead—*Salmo irideus*, Gibbons.

Fishermen report having taken good-sized specimens during the early summer.

Further Introductions Recommended.

The Orange Spotted, Red Spotted, or Louisiana Sunfish—*Lepomis humilis.*

This is the special food of the black bass in the eastern and southern states. I believe it would do well in Clear Lake.

FEEDING YOUNG PHEASANTS AND QUAIL

By August Bade

Pheasants—Feeding young pheasants or young game birds of any kind is one of the most important functions of the game breeder. If the birds are not properly started they will never be right, no matter how much time and energy is expended upon them later on.

A number of system have been found that will produce very good results, and these systems are usually varied to suit the climatic condition in which you may be working. Here is a formula or system that will give the best results in this particular climate (California).

For the first thirty-six hours young birds subsist on the yolk of the egg that is contained in the egg sack of the bird. During this period no feed is necessary and the birds need quietness as they are being brooded by the foster mother hen.

At the end of 36 hours give them their first feed of eggs (boiled at a temperature of 180 degrees for 15 minutes), finely grated after removing the shell. This grating is easily done by rubbing the egg through a small mesh screen of hardware cloth. This netting or screen is solidly tacked to a frame work of wood about 10 x 16 inches. You will

find this screen useful in many operations in making good bird food. Cooked liver (a very good substitute for insect life) and cottage cheese are also run through this screen before being placed in the food. This operation makes the food of a nature that the small birds can handle it nicely and it can at the same time be worked into the food mixture in better proportions.

For the first few weeks it is advisable to feed four times a day. Birds of all kinds are early risers and they make their lives conform to certain well-regulated habits. This is a point that it is well for the new breeder to ponder over. If you are irregular in your feeding schedules and disappoint the birds a few times, you will be the next to be disappointed and the results will reflect badly on your judgment.

Most hatching is done in the months of May and June and a good program of feeding times for these two months is as follows: Feed at 6 in the morning; then at 10, 2.30 and 6 in the evening. Here is a good rule to follow in starting with your birds: Feed often but little at a time. A tablespoonful at first is sufficient for a brood of 15 birds.

If you experience difficulty in getting the little fellows to eat, kneel down by the side of the coop and throw bits of feed in front of the coop so that the hen can reach it and she will soon teach the birds to eat. Once they are started there is no more trouble. This is the natural way for the mother hen to feed her brood, and she will usually do her part in the rearing of young game birds.

For the hen, it is well to provide whole corn as a diet, as this is large enough so the little birds can not eat it, and by feeding the hen in this way she will not be so anxious to eat the food that you have prepared for the chicks.

After the little fellows have learned to eat the food prepared for them, place it on a board about a foot square and far enough in front of the coop so the hen can not reach it. Always keep this board clean by using a brush and alternating the board by using one side today and the other side tomorrow.

On the fourth day add to the egg food a little Spratt's Pheasant Meal, No. 12. This meal is prepared by scalding it in boiling water or milk and working it with the hands until every particle is well soaked with moisture. As a rule this meal will absorb quite a bit of moisture. Use three parts of water to four parts meal and this usually gives the right consistency, known to game breeders as "crumbly moist." Don't, at any time, feed sloppy food. If you get your feed too moist, dry it down with corn meal by working the meal into the feed with the hands until you have it the way you want it. Unsalted cracker crumbs can also be used for drying the feed.

Another ingredient that can be added at this time to the food ration is cottage cheese. Make the cheese in the usual way, but do not flavor or color the cheese in any way. Run it through the sieve that you use for preparing the egg and mix it with the feed. And this is a good time to add green food to the menu. Lettuce has been found ideal for young birds. Cut it very fine with a large knife and you can either mix it with the feed or carry it in a separate vessel and place a handful (small) before each brood of birds. In mixing it in with the feed you may get the feed too moist, so the practice of carrying it in a separate vessel works out better.

As the birds grow and develop, add to the amount of feed given at each meal, being careful not to overfeed. Always watch closely to see that all feed is eaten. Keep the coop clean and watch your feed board to see that it does not become dirty.

If the weather is warm begin to give water to the birds. The ordinary quart drinking fountain is a good vessel to use, as it will provide water for the hen as well as the birds. If this drinking fountain is placed on a board it will tend to keep the water cleaner than if placed on the ground. It is well to keep the water fountain shaded and not allow the water to become stale.

Between the age of five and six weeks the birds begin to put on head feathers, and it is at this time that particular attention must be given the feed. If the birds become listless and puny there is sure to be something wrong with the feed. Try to correct it. A setback at this time means slow maturing. As a usual thing a deficiency in insect life or its equivalent (cooked liver or Spratt's Grissel, or meat scrap) is lacking in the food.

The proportion of meat scrap is about 15 per cent and may be increased or decreased according to the condition of your birds. No hard and fast rule can be laid down, but the operator must be guided by conditions as he finds them.

The same may be said of the use of egg in the food. Usually by the end of the fourth week egg is cut out entirely and Spratt's Chic Grain is substituted. All these operations and changes in the food are done gradually and systematically. As one type of food is decreased, another is increased until finally the birds are on a matured diet and being fed but twice a day. System and regularity is the keynote in bird farming and will give the required results in the majority of cases.

Quail—To those who have raised pheasants and other large game birds there comes an additional thrill when tiny Bobwhite or California valley quail hatch out. We know of no small bird more active than a few hours old quail chick. It is small wonder the novice loses them during the first few days. Even the experienced breeder at times has trouble if he is the least bit inclined to be careless in banking the coop and run so the smallest little hole is closed. You can not be too careful in this matter.

FEEDING YOUNG QUAIL

Quail chicks feed sooner than pheasants and will let you know when they are ready for their first meal. As the brooding period ends, they will begin to prospect around the coop and this is the signal for the breeder to prepare some food. The first feed will consist of egg custard or hard-boiled egg finely grated. This food is easily prepared by pressing it through a small mesh screen or hardware cloth. Either the egg or custard should be prepared the day before it is to be used. If you use eggs, do not boil them more than 20 minutes, as too much boiling tends to make the food leathery and it is not so easily digested.

The egg custard is made in the usual way with no seasoning of any kind. Here is a good way to make it: Beat three eggs well and heat to just below the boiling point. Heat one cup of milk to the same temperature and add the three eggs. Continue to keep the mixture at just below the boiling point until the custard hardens. Set it aside to cool and keep in a cool place. When thoroughly cold it is ready to use. A

pint fruit jar and a half-gallon or a gallon vessel of tin makes a good utensil for cooking custard.

COTTAGE CHEESE

Milk and its products have been found valuable in feeding all kinds of animals and birds. Cottage cheese is especially recommended as a good food for quail. Make it in the usual way with no seasoning or coloring, and when it is quite dry pass it through the same sieve or screen that you used for the egg or custard. This breaks it up into small bits and makes it very easy to handle.

About the third day begin to add a little cottage cheese to the egg or custard and gradually increase the amount so that at the end of the week you will be using about an equal amount of each. Finely chopped lettuce can also be used at this time to good advantage. You will get better results with your feed if you use a foot square board as a feeding place. At the beginning of the second week, add to this mixture of egg, custard and lettuce, a small amount of Spratt's Pheasant Meal, No. 12.

SMALL GRIT IS NECESSARY

At the very first feed, place a small amount of clean building sand on the feed board and always remember to keep a supply of this ingredient before the birds. If building sand is not available use small creek sand.

When the birds are three weeks old begin to add a litl chic grain to the food mixture. Spratt's Chick Grain has been found valuable in that it is made up of a variety of small seeds and grains.

By this time you can cut down on the egg or custard and at the beginning of the fifth week leave it out of the food entirely. You will now be using cottage cheese, lettuce, pheasant meal No. 12, chic grain and plenty of fine grit and clean water.

CLEAN WATER VERY ESSENTIAL

For the first week do not give any water at all unless the water is very warm. The watering dish should be small, kept very clean and removed from the coop ten or fifteen minutes after the birds have had a drink. Do not allow the water to become stale from heat. Water may be left in front of the birds a longer time if it is in the shade and the vessel is kept very clean.

FEEDING AT REGULAR INTERVALS

Success in bird raising will depend largely on regular habits of feeding and caring for the birds. To begin with, feed at 6.30, 10.30 and at 2.30 and 5.30 in the afternoon. Hold to this program for the first five weeks, then drop the 10.30 feeding and at the end of eight weeks drop the 2.30 feeding. If your birds have developed normally, two feeds a day at this time will be sufficient. A wet mash of pheasant meal, cottage cheese and a little chic grain in the morning and dry chic grain in the evening. Also see that the birds have ample green food at all times, and do not try to keep too many birds in the same pen. Give them as much room as possible. Remember they are creatures of the open spaces.

CALIFORNIA BLUEFIN TUNA[1]

By S. S. Whitehead

Bluefin tuna (*Thunnus thynnus*) has practically a world-wide distribution. Besides being found in southern California waters it also occurs in the Atlantic as far north as Newfoundland and Loffonden Islands, in the Mediterranean and in Japan. In California waters the range of bluefin in sufficient numbers to be of commercial importance, is very small. The Californian-Mexican boundary line is practically the southern limit and Santa Cruz Island the northern limit (a range of about a hundred miles).

The California bluefin season is short in duration, for it opens around the first of June and closes in September. We know nothing of from where these bluefin come, or where they go when the season is over. They generally appear off San Diego first, then hit Santa Catalina Island a few weeks later, although some years they have missed the San Diego area entirely.

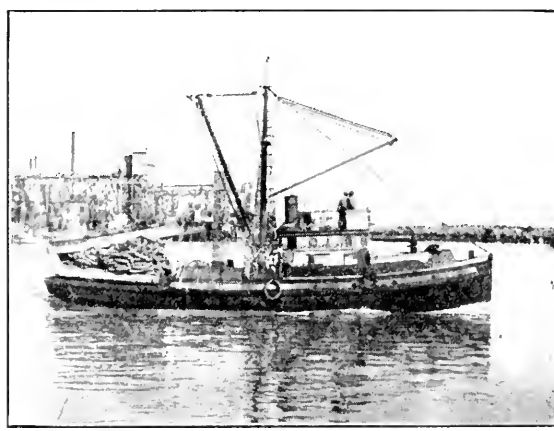

Fig. 70. One of the smaller bluefin purse seine boats. Length 60 feet. Photograph by D. H. Fry, Jr. December, 1928.

Because the bluefin (leaping tuna) are such hard and game fighters when caught on light sporting tackle, sportsmen fish them extensively. In fact anglers come from all over the world to catch these tuna. In order to protect the bluefin and other southern California game fish, the southeast end of Santa Catalina Island has been closed to all commercial fishing.

Bluefin is one of the four tunas canned extensively in southern California. Yellowfin and skipjack in the last three or four years (1926–1929) have ranked first and second, with bluefin third and albacore fourth. The canners since 1928 have depended almost entirely upon importations of frozen albacore from Japan and Hawaii. The catch of bluefin varies widely, for in 1927 it was about 5,000,000 pounds, 14,000,000 in 1928, and 7,500,000 in 1929. Bluefin is the largest strictly California tuna fishery of the four, as most of the yellowfin and skipjack

[1] Contribution No. 93 from the California State Fisheries Laboratory. May, 1930.

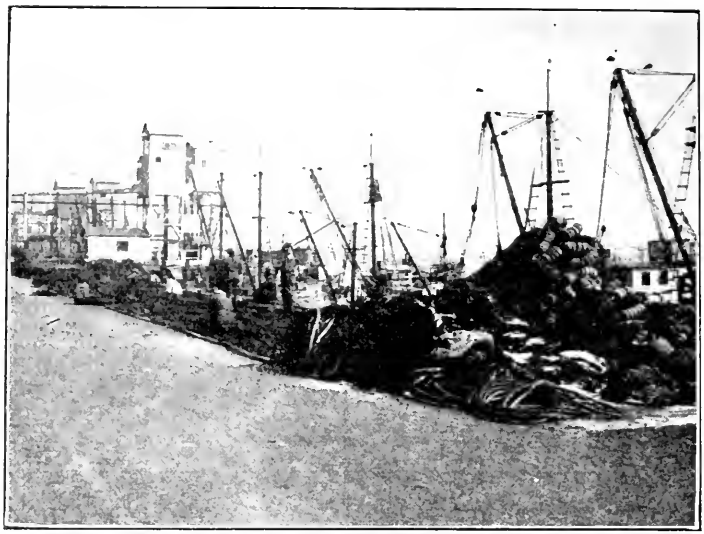

FIG. 71. Mending a tuna purse seine at Terminal Island. Booms in the background are on purse seine boats tied up at the wharf. Photograph by R. S. Crocker. May, 1930.

are caught south of the international boundary, and albacore imported from Japan and Hawaii. By far the greatest part of the catch goes to the canneries, but a small proportion is sold to the fresh fish markets, where it is used in the fresh state.

All commercial bluefin are caught with purse seines, as they seldom bite on live bait or the trolling gig. These purse seine boats are from 60 to 85 feet long, with a hold capacity of 30 to 100 tons, and they all

FIG. 72. Piling the purse seine on the turn table of the boat after being mended. Photograph by D. H. Fry, Jr. June, 1929.

carry the net in the stern on a turntable. The nets are curtain-shaped, about 250 fathoms long and 25 fathoms deep, with 4½ to 6-inch mesh. When a school of bluefin is located it is encircled and the bottom of the net drawn together with a purse line run through purse rings fastened to the bottom of the net. This operation of rapidly pursing the bottom keeps the fish from sounding, and the corks fastened along the top keep the fish from escaping over the top of the net. The bag is then drawn alongside of the boat and the fish transferred from the net into the boat with a mechanical brailing device.

Until 1928 the number of boats engaged in the fishery were fairly constant, with 15 in 1924, 1925, 1926 and 18 in 1927. In 1928 the number mounted to 35, and 36 in 1929.

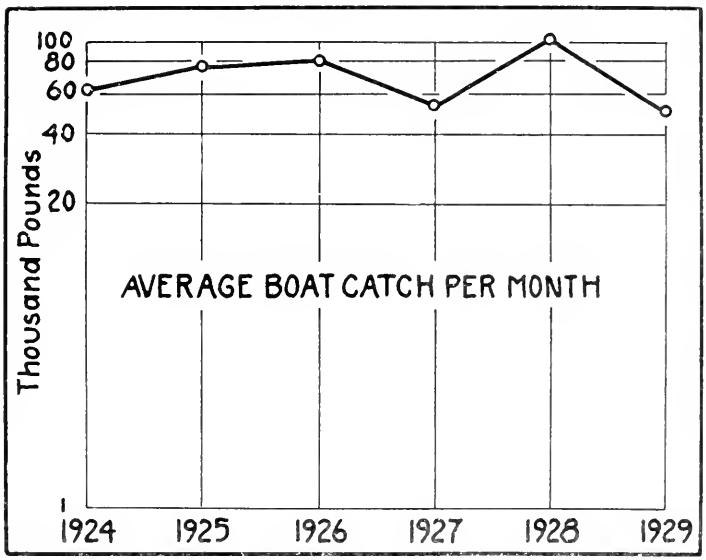

FIG. 73. Trend of the simple arithmetic average boat catch per month of the ten boats. Semi-logarithmic scale used to show actual rate of change from year to year.

In order to determine the status of the bluefin fishery an analysis of the boat catches was made. Ten boats that fished from 1924 through 1929 were used as a sample. A detailed analysis of boat catch per trip and boat catch per month was made. Figure 4 illustrates the method of using average boat catch per month as a criterion of the condition of the fishery. Details of fishing methods for this species and a boat catch analysis will be published in a forthcoming bulletin of the California State Fisheries Laboratory.

Figure 73 indicates that under past conditions of fishing effort, bluefin tuna has not decreased in availability to the fishermen over the period 1924 to 1929. However, a greater degree of fishing effort in future years may cause the fishery to decline.

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TAI AND CARP[1]

By Lionel A. Walford

The importation into California of albacore from Japan, which has been going on since 1925, has ceased to be a novelty. Recently, however, another Japanese fish has been shipped in, this time not a fish of any commercial significance whatever to Americans; in fact, one not even known on this side of the Pacific. This fish is the Japanese *tai* (*Parargyrops edita*), a small fish about the size of a salt-water perch, beautifully colored with red and silver. The porgy family (Sparidae), to which this fish belongs, is represented on this coast by a Mexican *tai* (*Calamus brachysomus*) which is imported during the winter months for the Japansese trade. These fish are distinguished by the very steep

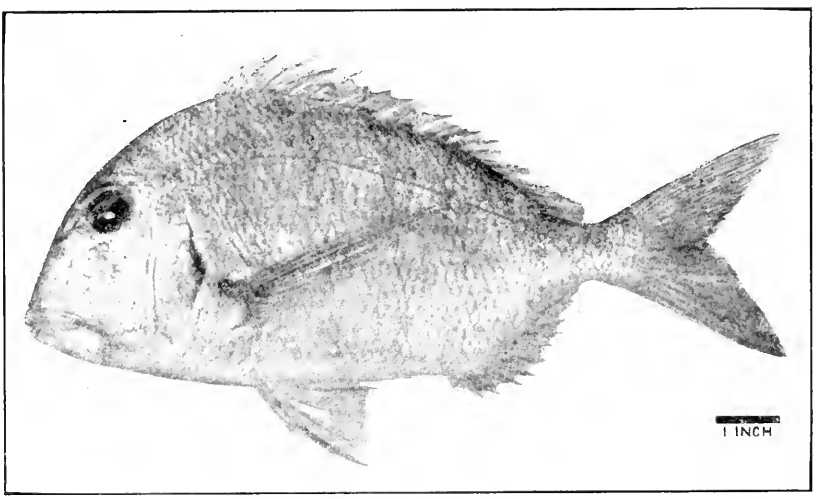

Fig. 74. The Mexican *tai*.

profile of the head; the outermost bone of the upper jaw (maxillary) slipping for most of its length under the edge of the preorbital (large membrane bone in front of the eye); the absence of teeth on the roof of the mouth; the presence of molar teeth on the sides of the jaws. The color of the Mexican form is plain silvery, but the several Japanese species are red, white or black.

It is the red one which is imported into the United States by Japanese people for their own use, for the *tai* in Japan—a land where fish are much respected and revered—is symbolic of happiness. In fact, the last syllable of the Japanese word for *merriment* or *happiness, mendeta'*, is the same as the name of the fish. Moreover, the God of Happiness is always portrayed holding a *tai*. At parties, weddings, carnivals, and other auspicious occasions, this fish is the *pièce de résistance*, not only for its unsurpassed flavor, but also for its brilliant red color—even after cooking. Apart from the fish itself, the colors red and white are also sacred to the Japanese as a symbol of happiness.

[1] Contribution No. 94 from the California State Fisheries Laboratory. May, 1930.

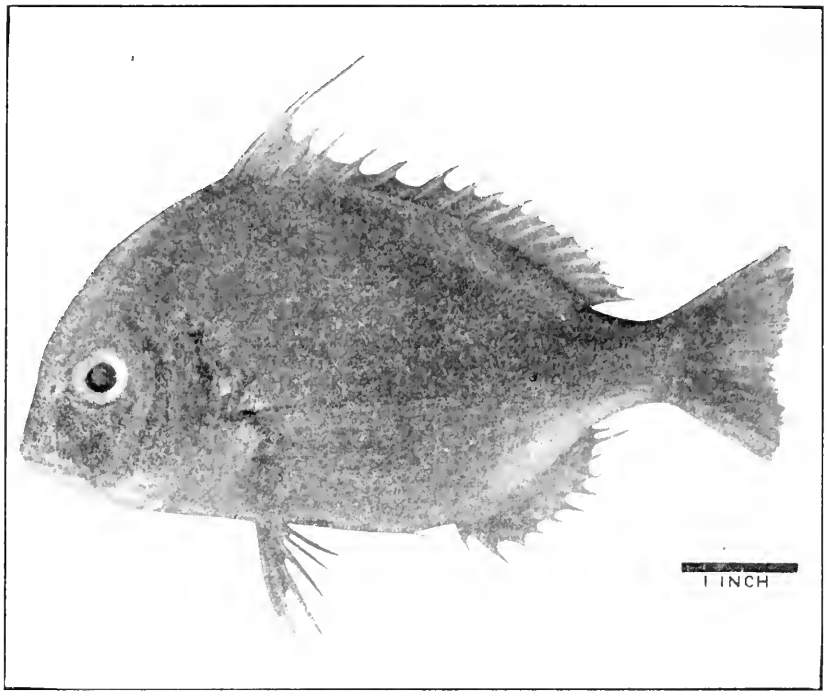

FIG. 75. The Japanese red *tai*, imported from Japan for festivals and parties

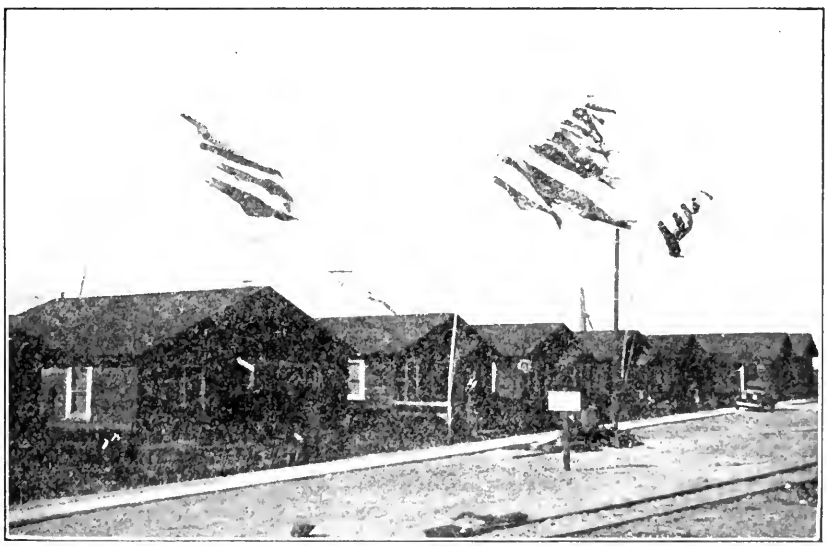

FIG. 76. Cloth flags made to resemble carp fly over each Japanese house where a boy baby has been born during the year. Photograph by R. S. Croker, May 5, 1936.

Japanese ladies, for example, wear white dresses with red ribbons to special parties; newly born babies are dressed in red; even the national flag is composed of red and white. It is said in Japan that if one accidentally catches a *tai* when seeking something else, good fortune will come his way. The black species is rarely used for parties, black being a color symbolic of ominous events.

The subject of Japanese reverence of fish reminds us of the carp, fish despised by so many California sportsmen, but by the Japanese admired and respected. Terminal Island, which forms the east bank of the

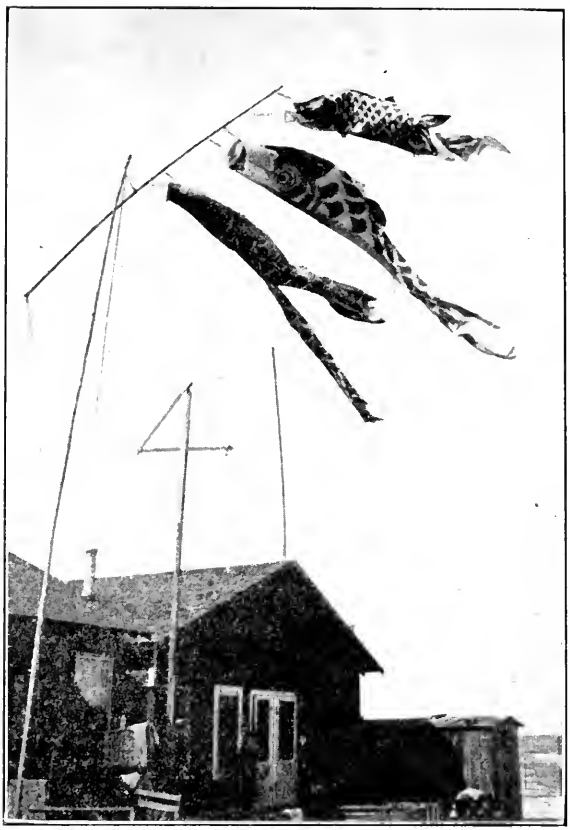

Fig. 77. Close-up view of cloth carp flying over Japanese house. Photograph by R. S. Croker. May 5, 1930.

main channel of Los Angeles Harbor, is the location of an interesting and picturesque Japanese village, and the scene of many exotic Oriental celebrations. Between April 25 and May 5 of each year are seen all over the town hanging high above each house where a boy baby has been born during the year, cloth flags made to resemble carp. These flags, which cost from $2 to $15 each, are the gifts of friends and relatives. Thus, some houses hang out as many as ten or more fish, which doting aunts, cousins, uncles and friends have donated. The flags are there to remind the people of the qualities which they want their boys

to emulate—the splendid qualities of the carp—strength, perseverance, endurance. During this same season the shop windows display arrays of brilliantly dressed dolls which are effiigies of legendary heroes and warriors who have evidently observed the good traits of the carp. Brass-armored, fierce-looking fighters about whom ancient generations have woven tales of great deeds—giant slayings, tiger killings—figure prominently in the displays. A fat naked baby, noted for his prodigious strength, was *Kintoki,* whose image is a prominent feature of the doll collection. Another such baby was *Momotaro,* who achieved his birth by stepping out of a peach which a surprised old lady cut open one day.

Such interesting fish symbolism is not peculiar to Japanese people. Closely woven in the history of the ritualism and architecture of practically all of the religions and churches, including the Christian, and in folklore throughout the world, are bits of symbolism in which fish form an important pattern.

LUMINESCENT FISHING [1]

By Milton J. Lindner

Here we are on the Monterey wharf at 10.30 in the evening with hip boots, slicker and a great number of warm clothes underneath. There is a slight offshore breeze gently fanning our face, stars shining

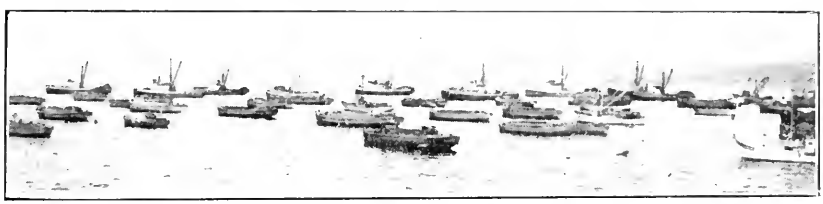

Fig. 78. Fishing boats and lighters anchored near the Monterey wharf waiting for the sun to set so that they may start their search for the schools of sardines. The lighters are the craft in the center foreground of the picture. Photograph by J. B. Phillips, 1929.

brightly overhead, and the moon, a silver crescent, disappearing slowly behind Huckleberry Hill, silhouetting the pines against its faint calm glow. The swells are sliding smoothly by the piles underneath and monotonously pounding themselves out on the white sandy beach at our back. Swarthy, dark-skinned Sicilian and Japanese fishermen are plodding by in their cumbersome boots and long, heavy sheep-skin coats. Now and then a crew is made up and a skiff is launched which soon fades away in the night. Boats are heard chugging out toward the open waters, weaving their way dexterously through the maze of moored launches and lighters.

Finally our crew is complete, thirteen strong, robust men. We are going sardine fishing again tonight, with a Japanese lampara [2] crew this time. Before long we are aboard the 35-foot fishing launch and on our way to pick up the lighter which will carry the night's catch of fish. With the lighter in tow we head out along the beach towards

[1] Contribution No. 92 from the California State Fisheries Laboratory. May, 1930.
[2] "Lampara" is the name given to a type of fishing net introduced by the Italians. It is sometimes referred to as the "Italian round haul net."

Moss Landing. The lights of Monterey gleam brilliantly over the stern of the boat in long, even rows stretching up the hill like a garden of yellow stars planted in perfect furrows. These are soon forgotten as lying in the bow of the boat near the captain, who stands like a dusky statue, with his hands in his pockets, puffing at a rapidly diminishing cigarette and peering intently into the murky waters ahead for a school of fish, we gaze in rapt astonishment at the colorful array of glowing water that is revealed as the boat slashes through the brine, dashing it relentlessly aside, causing millions of minute microscopic plants and animals to flame up in pale green-white luminescent hues.

Marvelous!

No, it is gorgeously uncanny to behold such a sight leap from apparently untenable and inanimate sea water. A newspaper sometimes can be read from the light given off by the glow of these microorganisms. One ponders on the incomprehensible billions of cells that must be living in the sea to cause such an entrancing phenomenon.

Now and then the boat disturbs an occasional mackerel feeding near the surface. Off it dashes, leaving a fiery wake as a tell-tale memento of its size and speed. Everything that moves in the water betrays itself by the ever-present luminiscence. How extremely dangerous this must be to the constantly hunted species, as darkness offers them no refuge. Their least movements are visible to their enemies, who may be lurking in the offing waiting for some sign of prey.

We forge ahead with only the necessary running lights burning, for everything must be as dark as possible in order to see the luminescence to its best advantage, because the sardine schools are located most readily by the luminescence they produce through their movements in the waters. This is the reason the fishing is done only at night and only during the dark of the moon.[3] No seining is carried on through the full-moon period because even with this faint light it is almost impossible to locate the schools. Sometimes if the night is foggy, the men will fish during the light of the moon, but only when there is sufficient darkness so that the luminescence is visible.

Soon a great milky patch looms in the water ahead as though someone had carelessly spilled an enormous bottle of cream highly seasoned with a radium compound. The captain waves his hands as a signal to slow down. Sardines sure enough! A large school several hundred yards in extent lies a trifle to starboard. The captain motions again and the boat slowly plows forward. The school is circled once, then the captain decides now is the time to make the haul. "Yetta" (let her go), he shouts, and one end of the net to which is fastened a buoy and the lighter is cast adrift. The boat is kicked into full speed ahead, the net is paid out rapidly, and soon a circle 1200 feet in circumference is surrounded by netting.

[3] In the early years, before 1919, when sardine fishing was a new occupation, the boats would search during both the night and the day, but as time progressed and the men became better acquainted with the habits of the fish the day seining was discontinued; although the fishermen occasionally still will make a day haul if a school happens near. A school usually may be recognized by the presence of pelicans and sea gulls fluttering about a patch of water. At other times the fish may be seen jumping. Of course these signs often indicate some fish other than sardines, which the crew determines upon arriving at the location. Quite frequently the vessels will pass by a group of sardines rather than make a chance haul during daylight, for it is difficult to determine the extent and compactness of the fish, while at night these can be observed readily.

Now is when the work begins. Six men pull on each wing of the net and one man lowers and raises a searer [4] to discourage the fish from passing under the boat in their attempt at eluding the net. Slowly the circle of corks draws nearer and nearer as the net, each strand glowing like some white-hot molten filament, is piled on deck. The men all heave in unison, gasping a bit with each tug. Although the night is extremely cold and the nets are dripping with water, beads of perspiration begin to appear on everyone's forehead. At last the wings are in and the catch is impounded within the bag. Impossible for an escape now; hence there is a sudden easing off in the rapidity with which the mesh is being hauled aboard the launch. A few more fathoms are gathered in, then the lighter is drawn alongside for the loading of the sardines, which are threshing wildly about in their efforts to free themselves from this prison of twine.[5]

The brailing lights are switched on, revealing hundreds of fish excitedly churning the water in one last desperate effort at release. Innumerable scales are slowly descending into the deep, swinging to and fro, shining cheerfully, as all unmindful of their owner's plight, they disappear from view. We are surprised to behold several seagulls hovering hungrily near waiting for a chance fish. Do they never sleep?

As the lighter is pulled up several men jump aboard to assist in scooping the fish from the net. With each dip of the brail nearly one hundred pounds of squirming, vibrating fish are taken from the bag and thrown into the lighter, where they soon expire through asphyxiation.

This haul was disappointing, hardly more than three tons. "Too much fire," according to the captain. The fish had been frightened by the gleaming net, most of them diving to escape from its folds. On this occasion the luminiscence had been a boon to the sardines.

A few dozen squid also were captured among the fish. These are seized with great pleasure by the fishermen, who halfheartedly clean them and all chew upon these raw cephalopods apparently everyone enjoying the repast, although they are rather glutinous morsels with a sweetish tang.

With the three tons in the lighter and the net piled in the stern of the launch, the lights are doused and off we start to try our luck again. In about 45 minutes of intense searching another school is spotted. Several boats have already laid their nets into the school and one is brailing. The lights of the latter attracted us to this location. As we approach we happen near the net of one of the vessels that is making a haul. The crew sets up a terrific shout to inform us that their gear is in the water close at hand and to keep clear. Some of the

[4] The scarer consists of a number of paddles a foot or two long fastened by one end and about six or eight feet apart on a long rope. While the wings of the net are being pulled in this scarer is lowered over the side of the vessel and jerked up and down. The luminescence caused by the whirling paddles tends to frighten the fish away from the boat, where they might escape by swimming under the hull.

[5] Even the lampara nets are constructed to take advantage of the luminescence. If the entire seine was composed of the small mesh that appears in the bag the weight would be excessive and there would be difficulty in handling. Several more men would be needed to aid in pulling, and this would be expensive. Hence, the wings of the seines are made of very large mesh, in fact, so large that the sardines could easily pass between the strands; but they are frightened away by the bright glare of the fibers. The fish upon approaching the glowing threads become alarmed and turn back toward the center of the net, where they tend to remain until encircled by the bag. Then their escape is impossible.

words are none too complimentary, but such is the way of the fisherman. We veer off and are soon making another attempt at a catch.

On this occasion our success is much better, for when the last scoop of fish has been taken from the bag there are about 37 tons of sardines in the lighter. In other words, we caught about 34 tons in this haul. But for the remainder of the night the fishing is very poor. We make two water hauls, and a third, just as the eastern sky is beginning to turn grey, nets only five tons. Although we lay our net around large schools, the fish are easily frightened by the flaming mesh and dive under the wings, leaving us with an empty bag except for a hundred or two pounds, which are freed because the amount is too small to trouble over.

When the final haul is complete we head back toward Monterey to unload the results of the night's labor. There is a slight mist hanging low over the bay, hiding the distant hills under its veil, and at last I discover why the fishermen call Mulligan Hill "The Island"! There it stands near the beach, the hills in the background shut out by fog, with the shore line invisible through the morning mist. What more could one wish for an enchanted isle; its feet bathed in snowy vapor, a crown reaching to heaven, and billowy white seas all around! But all too soon our reverie is dispersed by the morning sun as it creeps slowly over the hilltops, evaporating the whisps of moisture drops into an invisible nothingness.[6]

[6] A thorough description of sardine fishing methods, boats and nets may be secured from Fish Bulletin No. 19 of the Division of Fish and Game of California, "Sardine Fishing Methods at Monterey, California," by W. L. Scofield. This bulletin may be had free of charge by writing to the California State Fisheries Laboratory, Terminal Island, California.

FIG. 79. Monterey lampara boat unloading its lighter of sardines into a suction pump. The lighter may be seen low in the water between the launch and the suction pump. At the extreme left of the picture is another lighter with about 35 tons of fish. Photograph by J. B. Phillips, January, 1930.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, 510 Russ Building, San Francisco, California.

AUGUST 30, 1930

There is often a difference between what laws the hunter and angler want and what laws are most effective in insuring a state-wide supply of game and fish for the hunter and angler.

VOLUNTEER WARDENS HOLD CONVENTION

The second annual convention of the volunteer deputies of the Division of Fish and Game was held in San Francisco on April 26 and 27, 1930. All parts of the state were represented. The morning session on the opening day was devoted to the registration of deputies and interviews and conferences with bureau heads of the Division of Fish and Game.

In the afternoon a program of lectures and discussion was held in the assembly hall of the Merchants Exchange Building. Various facts of conservation work were presented and the status of volunteer wardens as law enforcement officials explained.

The purpose of this convention was to acquaint the volunteer deputies with their duties in cooperating with the regular patrol force of the Division of Fish and Game and to give them instruction in the best methods for carrying out of these duties.

A fine crowd of over a hundred gathered at the banquet hall at the Commercial Club. Albert Lindley of Stockton acted as toastmaster and addresses were given by Fred G. Stevenot, director of the Department of Natural Resources; I. Zellerbach, president of the Fish and Game Commission; Eugene Bennett, attorney for the commission; Irving Martin, president of the Stockton *Record*, and by several judges who showed their interest by attending.

The convention ended with a competitive pistol shoot held on the morning of April 27 at the Presidio pistol range.

The system of volunteer deputies, inaugurated in 1926, has grown in importance until at the present time there are 550 men engaged in this work, exclusive of the 400 members of the U. S. Forest Service, who are also in the ranks of the volunteer game and conservation law enforcement officers. These men are under the direct control of the Division of Fish and Game, and are required to make regular monthly reports to the captain in charge of volunteer deputies.

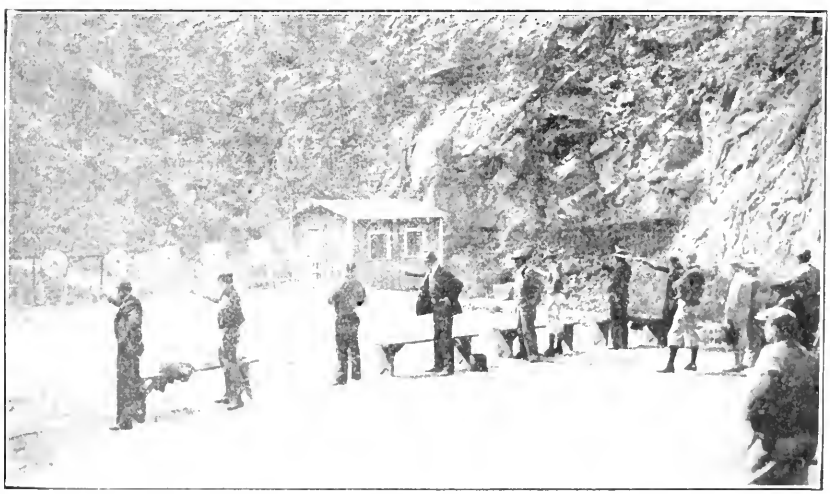

FIG. 80. Volunteer wardens competing at pistol shoot, April 27, 1930. Photograph by E. S. Cheney.

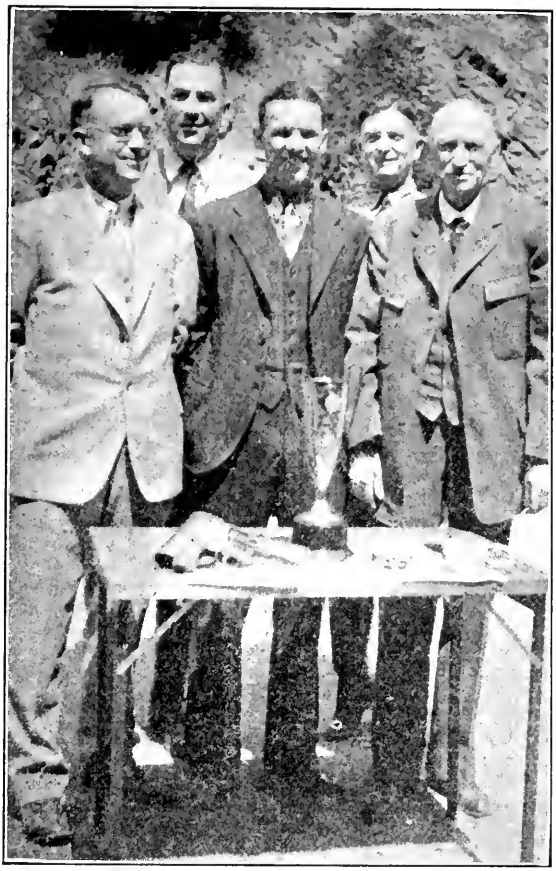

FIG. 81. Winners of volunteer deputies pistol shoot, San Francisco, April 27, 1930, with cup awarded as trophy. Captain Walter Welch, in charge of volunteer wardens, at right. Photograph by E. S. Cheney.

EDITOR ACCEPTS NEW POST

With this number, editorship of CALIFORNIA FISH AND GAME passes into other hands. Dr. Harold C. Bryant, who conceived and developed this magazine, now in its sixteenth volume, has accepted a position as Assistant Director of National Parks and will have in charge the educational and research work for the park system.

Dr. Bryant began work for the California Fish and Game Commission in 1911 when he undertook studies on the economic value of birds. In 1914 he was placed in charge of of educational, research and publicity work. Slowly this phase of conservation work was developed into a strong department with a personnel of eleven. Through the medium of lecturers, publications and motion pictures, Californians have been taught about natural resources and the need for conserving them. Dr. Bryant made his most important contribution to conservation through work in the schools and in summer resorts. Vacationists are hungry for information on fish and game, and the extensive educational program developed in summer resorts is largely traceable to Dr. Bryant. Retaining affiliation with the University of California, he helped to popularize natural history through evening classes and field trips given under university extension.

CALIFORNIA FISH AND GAME carries to the public current news relative to activities and accomplishments. Emphasis has always been placed on the issuance of de-

pendable information in order to closely follow the motto "conservation through education." A new editorship will not alter editorial policy.

BAND-TAIL PIGEONS CAUSE DAMAGE IN VINEYARDS

In the latter part of March word was received that band-tailed pigeons were causing damage to vineyards on the Di Giorgio farm about 15 miles west of Bakersfield, Kern County. The DiGiorgio farm comprises approximately 5000 acres, consisting of fruit orchards and vineyards.

Pigeons first began coming to the vineyards about the middle of December. The numbers increased until it was estimated that there were from 150,000 to 200,000 pigeons feeding regularly in the vineyards. The first flocks arrived at 5.50 a.m. and the flight continued until approximately 9 o'clock. Damage resulted from the legs and feet as the birds alighted on or took off from the vines, in that the new sprouts were only two or three inches long. Damage was restricted to malaga grape vines, since the trellis vineyards were late in sprouting. Wherever the birds fed, there was to be found beneath the vines thousands of broken-off shoots. These shoots form the first crop of grapes and so threatened the crop.

The main attractions in the vineyards were dried-up grapes which had not been harvested the year berore. When the stomachs of pigeons were examined they were found crammed with raisins. The number of raisins found varied from three or four to seventy-six.

It was necessary for the horticultural commissioner, the U. S. Bureau of Biological Survey and the Division of Fish and Game to cooperate with the owners in preventing damage. At first an airplane was retained, but this method proved ineffective. Next the birds were herded from the orchard by using shotguns. Roosting places of the pigeons were located in the neighboring mountainous district and an effort made to hold them near these roosts by artificial feeding. Both raisins and grain were used, but the numbers of birds that remained to take the artificially placed food did not adequately reduce the numbers which persisted in going to the vineyards for food. Failing in this, aid was asked from sportsmen. This produced sufficient man power to keep the birds moving. All control measures were carefully supervised by wardens. What few birds were killed were donated to hospitals.

On April 2 there were still thousands of birds in the air and the situation seemed almost hopeless, but the following day fewer birds appeared, and by April 7 the birds entirely disappeared. They left their roosting places on Bear Mountain at about the same time.

In attempts to control the situation the Division of Fish and Game spent over a thousand dollars and the Di Giorgio farm a similar amount.

Later in the spring reports of damage to prunes came from Santa Clara County. In this instance pigeons were feeding upon the small green fruit. Though it was recognized that a certain amount of thinning is needed, yet the breaking of the new shoots with their attached fruits caused considerable damage.

Band-tailed pigeons were first given total protection by federal law in 1913. It has not been until the last few years that the birds have appeared in noticeable numbers. However, the past two years there have been numerous reports of pigeons having been seen in large numbers in many parts of the state during the winter season. Past reports of damage have been restricted largely to cherry growers. In some instances control measures have necessarily been instituted to handle situations where the birds were destroying crops of cherries.

Eastern newspapers quickly took up the news that pigeons had been found in countless thousands in California and intimated that the extinct passenger pigeon was refound. Numerous letters poured in to verify these newspaper statements. The birds concerned were, of course, western wild pigeons (*Columba fasciata fasciata*) and not the species for which there has been a standing reward of some $3,000 for a number of years.

These reports of severe damage have naturally caused a demand for an open season. Even though it will seem reasonable to many to care for the situation in this way, yet too great pressure on this slow-breeding bird can easily bring back conditions which existed in 1912 and 1913. The band-tailed pigeon is easily killed and it can not withstand a heavy toll. As a rule, it lays but a single egg each year. There is but little evidence that the birds nest more than once, although the nesting season is spread over several months. If the season should be opened, it should be for but a short time in winter and there should be but a small bag limit in order that pigeons may not be diminished to such an extent that it would take another twenty years to bring them back in numbers.

EXPERIMENTAL TEST OF SIZE OF TROUT CONTROVERSY

For the past several years the sportsmen of the state have been advocating the planting of large-size trout, some advocating the holding of trout until they are ten inches in length. On the other hand, others have continually pointed out the disadvantages from the standpoint of cost and loss of wild characteristics. In order to gather data on this important subject, the Division of Fish and Game has planned and built two sets of holding ponds in southern California. It is expected that results from careful experiments will help in guiding future effort. It is quite apparent that conditions vary so in different parts of the state that tests should be made before assuming added costs or changed policies.

NEW PATROL BOAT

The Division's new patrol boat *Bluefin*, one of the most completely equipped boats of its type on the west coast, was launched at San Diego on May 24, 1930. Named for the bluefin tuna, one of the best known game fishes of the waters of southern California, the patrol boat is 86 feet in length, and while designed for carrying on the work of patrolling the ocean fisheries, it is especially equipped for scientific investigations of marine life. The boat was constructed at a total cost of approximately $65,000. The *Bluefin* was built by the San Diego Marine Construction Company.

The new boat will be a most useful addition to the equipment of the Division of Fish and Game in maintaining a patrol in the interest of conservation, particularly in checking up on the pollution of ocean beaches in the southern part of the state.

President I. Zellerbach of the Fish and Game Commission, Commissioner R. G. Fernald, N. B. Scofield, in charge of the Bureau of Commercial Fisheries, and John L. Farley, executive officer of the State Division of Fish and Game, were present at the launching. In the addresses given, the keynote pertained to the utilization, perpetuation and investigation of the fish resources of the sea.

NEW STUDIES ON SALMON AND TROUT PLANNED

The budget for the next fiscal year will carry an item of $7,000 to cover a scientific investigation of the cause of fish depletion in northern California. The migrations of salmon and trout will be studied. Fish will be trapped on both the upward and downward movement and tagged. Censuses covering a number of years will be made in order to determine the trend in abundance. Included also will be studies as to the part played by natural propagation. Racks have already been placed in the Shasta River and preliminary plans laid. Scientists from Leland Stanford Junior University under the direction of Professor J. O. Snyder will conduct these investigations.

QUAIL REFUGES BASIS OF EXPERIMENT

The Fish and Game Commission has approved a plan to test the part played by predatory animals in the abundance of game birds, such as quail. In furtherance of a recommendation by the Game Refuge Advisory Committee two quail refuges will be established in San Diego County. On one predatory animal control will be practiced; on the other no predatory animals will be killed. Censuses will help determine the effect of predators on game. This is an added attempt being made to gather accurate data on game bird problems.

JETTY WORK PROGRESSING

Funds for the construction of the breakwater at the mouth of the Navarro River have now been transferred to the State Department. The plans have been completed and the project was finished early in the summer, in time to prevent any stoppage of fish.

It is hoped the Salinas River project will also be completed though many circumstances have delayed actual start.

The Russian River jetty funds which were partially supplied by the fish and game protection fund has been under construction and will be completed this summer.

All these projects constitute efforts to provide better conditions for fish. Migratory species, like the steelhead and salmon, are often unable to reach their spawning stream during dry years because of bars of sand which form across the mouths of rivers. It has been often shown that the removal of these sand bars allows the fish to enter the streams. Sizable sums were appropriated by the last session of the legislature to remedy conditions at the mouths of these rivers named above.

IMPORTANT SCREEN CASE IN COURT

From May 19 to 22, 1930, inclusive, there was heard before the superior court of Glenn County, Judge H. A. Gans of Tehama County presiding, the case of *People* vs. *Glenn-Colusa Irrigation District*. This was an action brought by the Division of Fish and Game to require the

installation of a fish screen ahead of the intake pumps of this district where water is diverted from the Sacramento River. The matter was submitted on briefs.

The Commission showed that in netting 5 per cent or less of the area of the canal below the pumps that several thousand fish were caught, the varieties being salmon and shad, both adults and fingerlings. Over 50 per cent of the fish netted were either injured or killed in going through the pumps.

Further testimony showed a gradual decrease of salmon in the Sacramento River, with a statement of a witness that much of this decrease was due to unprotected diversions from the river.

Cost of screen installations were testified to by Commission witnesses and also by those of the district, the latter presenting testimony that cost of installation of a screen would be about three times that estimated by the Commission witnesses. The acreage in the district is 122,600 and the water diversion considerable.

Since this action was first filed it has attracted considerable attention, and it has been referred to by certain parties as being a test case with respect to the screen bill. Subsequent to the filing of the action, efforts were made at the last session of the legislature to pass the cost of screen installations on to the Division of Fish and Game, relieving the diverters of water of their obligations in that respect as now covered in the law.

THE COST OF FISH RESTORATION

Nearly $300,000 is spent annually in California in the production of fish for stocking streams. Twenty-six hatcheries and twelve egg-collecting stations are operated. The angling license fund rightly supports half the cost of patrol. The authorized force is composed of 120 deputies. These men receive an average of $150 per month and their average expense is $110. They should receive pay more commensurate with the service demanded. This cost of patrol is therefore approximately $400,000 per annum. Half is justly chargeable to patrol helpful in conserving fish, making a total of $500,000, which is annually budgeted to fish propagation and protection and which is in excess of the income from angling licenses. These figures do not include general administration costs nor the cost of the work on fish screens and ladders, water pollution and other work designed to improve fishing conditions. In the face of these figures, it is apparent that choice must be made between numerous requests for new hatcheries, rearing ponds and an increase in the patrol force, in order that those things will be done which are most potent in improving conditions. Experiments are continually being made which will help in making proper adjustments. It is evident that large increases in expenditure are not justified by the above facts.

THE PROPOSED TOURIST ANGLER'S LICENSE

Due to the tremendous influx of motor tourists who enter California to enjoy the state's varied glories, a tourist license has been proposed. It is estimated that in 1929 approximately one million tourists from other states crossed California's border. This huge figure is based on foreign cars passing through the twenty-three border stations of the Department of Agriculture. During June and July alone a horde of some 65,000 cars bearing out-of-state licenses invaded the southern part of the state, carrying about 208,000 tourists, according to the Automobile Club of Southern California. In September and October the total reached over 57,000 cars and 160,134 persons.

Advocates of the tourist license system see in it an opportunity to hold this tremendous tide of motorists within the borders of the state for a longer period. By granting these persons the special consideration of a permit which would entitle the holder to fish for thirty days at a reduced rate it is thought that motorists would be induced to remain for several days or even a week in a locality they would otherwise pass up. At the same time they see increased revenue from angling licenses.

Through the years the sale of nonresident angling licenses has never been great. For the year 1929 the total number of citizens' angling licenses sold was 224,582, while but 1841 nonresident licenses were sold. This means that less than two thousand out of a total of nearly a million visitors were sufficiently interested in the fishing attractions of the state to take out a license.

It is the contention of those opposed to tourist licenses that the increased revenue would in no wise be sufficient in amount to offset the additional drain on the state's angling resources. Under the theory that every person who takes fish from a stream must make a just contribution for restocking that stream, the tourist who takes as many or more fish than an average resident of the state should not be entitled to pay less for such a privilege. The smallest part of the expense of angling is the cost of a license.

Two dozen flies or an ordinary trout line at least cost $3—the cost of a nonresident angling license.

Another objection against tourist licenses is that they would grant seemingly unfair advantages due to the geographical nature of California. Take the case of a citizen of Nevada who motors out fifty miles to catch trout in Lake Tahoe as against a resident angler in the south who travels some seven hundred miles northward to fish in the Klamath. It seems unjust and discriminatory in the face of such conditions to extend a cut-rate privilege to the Nevada angler.

Whether a tourist license would impair fishing and whether it would increase or decrease revenue are major points to be considered. So few states have tried it that practically no data is at hand to form a basis for even a surmise.

MINNOWS AS BAIT

Fishermen who use minnows as bait for trout are urged to conform to the state law which prohibits the use of such bait except in those cases where the minnows have been taken from waters where the fishing operations are carried on. According to section 632 of the Fish and Game Laws, it is unlawful for any person to use goldfish as bait for the purpose of taking, catching or killing trout or whitefish, and no person shall use minnows for said purpose unless such minnows are native to or have been introduced into the waters so being fished.

It is of the utmost importance that this regulation be strictly enforced, because of the great danger of undesirable species of fish becoming introduced into trout waters. Carelessness in the handling of live minnows, the accidental upsetting of a minnow pail or the thoughtless releasing of surplus minnows after the completion of the fishing trip might result in the introduction of some species, the presence of which might be most detrimental to trout.

MINNOW SEINES ILLEGAL

Black bass fishermen who use live minnows for bait in the Sacramento-San Joaquin Valley streams should remember that the use of minnow seines in the taking of bait is illegal.

Section 636 of the Penal Code of the State of California makes it illegal to use seines for taking nongame fish for bait in the inland waters. Through courtesy to the sportsmen, this provision of the law has never been strictly enforced. Recent flagrant violations have caused officials to demand that the existing law be rigidly enforced.

The greatest damage done by the seiners is the destruction of the nests of spawning spiny-rayed fishes, which include the black bass and perch. These fish spawn in the shallow areas where minnows are most plentiful, and the pulling of seines over the spawning beds results in the destruction of nests.

The enforcement of this law will not work a hardship on the sportsmen who depend upon the use of minnows for bait, because it is legal to use dip nets in taking bait, provided the dip nets are not greater than six feet in greatest breadth and are not baited.

LOANING OF LICENSES DECRIED

At a recent meeting of the Klamath Sportsmen's Association a resolution was passed condemning the practice, which is becoming rather prevalent in that section of the state, of sportsmen owning a California hunter's license loaning it to a friend who desires to go across the state line to hunt.

The practice not only is unsportsmanlike, but it is dangerous, exposing both the borrower and the lender to prosecution if detected. The Klamath sportsmen are to be commended for the action taken, and it is to be expected that they will follow up the resolution with a measurable amount of vigilance to see that those who would thus "accommodate" a friend are shown the error of their ways.—*Western Out-of-Doors*, April, 1930.

PLENARY POWERS FOR DIVISION PROPOSED INITIATIVE MEASURE

During April there was filed with the Attorney General an initiative measure seeking a complete reorganization of the California Fish and Game Commission and the granting of full plenary powers. The measure is sponsored by "California Conservationists." The Associated Sportsmen of California and the Izaak Walton League have combined in supporting the legislation.

Under the terms of the proposed act, a fish and game commission of five, instead of three members, would have the power to shorten the open season in various districts or to declare closed seasons for the conservation of the wild life of the state. General functions such as the power to fix hunting or fishing license fees would be left with the legislature. The maximum limits for open seasons in the various parts of the state would be set by the legislature, but the new Fish and Game Commission would be empowered to alter the limits.

The commissioners, under the act, will be named for six-year terms by the Governor. No person who is connected in any way with any business subject to regulation by the Commission will be eligible to appointment to that body.

To put the proposition on the ballot will require 91,529 signatures, which is 8 per cent of the votes cast at the last general election.

IN MEMORIAM

ALAN G. CURRY

With the tragic passing of Alan G. Curry on April 30, 1930, the Fish and Game Commission lost a young, efficient enforcement officer known and admired by the whole force. A mother and brother in San Francisco mourn his loss.

Alan Curry was born in San Francisco August 15, 1900, and spent his boyhood days in his native city and at Hayward, in Alameda County. Though delicate as an infant, he developed into an active boy interested in animal life and devoted to pigeon raising. Later he became a manufacturer's representative in San Francisco. In 1925 Curry was appointed a volunteer warden and because of his outstanding activity and interest was employed on the regular patrol force in 1928. Through his impartial enforcement of the law he often made a friend out of the violator. He was admired by all for his courage and fearlessness. Judges who tried his cases complimented him on the evidence presented and the manner of conduct of the case.

Everyone admired his unusual energy and unfailing cheerfulness. Few have put more earnestness into the work or made more true friends. One comforting thought is that he died in service doing a work he loved and in which he strongly believed. A thought with opposite import is that his life was sacrificed because a violator did not wish to lose a new $500 net.

GAME WARDENS LOSE LIVES DOING DUTY

It was only two years ago that these pages recorded the death of a deputy fish and game commissioner shot down in cold blood by a violator of game laws recording the sixth murder of a state game warden since 1913. Now there must be added to this list of men who were shot down while in performance of duty two more—Deputy Alan G. Curry of San Francisco and former Deputy John Burke of San Mateo County.

On the night of April 29 Deputy Curry and Burke, as volunteer helper, acting on reliable information that a fisherman, Anton J. Anderson of Crockett, a long-time violator (convicted and fined six times since 1913), was using nets illegally in South San Francisco Bay, secured a skiff and rounded up the violator. Anderson had a new $500 net and so hated to have it confiscated that he killed both officers. Curry was shot in the back twice with a Browning automatic shotgun, apparently while he was attempting to untie the skiff containing the net to take it into South San Francisco. The gun jammed, and, procuring a revolver, Jack Burke was shot once through the heart. Meantime, Anderson was shot four times, twice through the lungs. Anderson, with the two dead bodies and severely wounded himself, drove his launch to Fisherman's Wharf, San Francisco, where he arrived a few hours later. Here he was arrested and removed to the Emergency Hospital, where he showed signs of recovery. In his deposition given San Francisco police, he said that Curry lived for a time and asked for a drink of water and to be taken to the

hospital. Burke was killed instantly. Anderson is a giant in stature and strength. This alone enabled him to reach port. Unfortunately, Anderson is the only living witness of the shooting, and if he recovers San Mateo officials will set a trial.

San Francisco newspapers intimated that the fisherman might have been right and the officers at fault. The law definitely states that it is the duty of the Fish and Game Commission to inspect regularly all boats and receptacles where game or fish may be stored and to confiscate nets used illegally. President Zellerbach issued a statement explaining that Curry was acting in the course of his duty and had a legal right to search the boat and arrest the owner for law violation.

Again it has been shown that though the enforcement of fish and game laws is dangerous, game wardens are fearless and do their duty. The pity is that lives are sacrificed in proving this statement.

CALIFORNIA GAME BREEDERS

An increased interest in the propagation of pheasants in captivity, under license from state authorities, is manifest from recent reports. All breeders of game birds are licensed and are required to make an annual report of their activities.

A check of the returns from licenses granted during the year 1929 discloses that 329 operators in the State of California are engaged in the breeding of game birds for profit. A marked increase has been shown from year to year in the number of applicants for licenses.

Quail, pheasants and ducks are the species most commonly reared in captivity by the breeders. At the end of the 1929 season owners throughout the state had on hand 4240 quail, 5132 pheasants and 1049 ducks. The quail were representative of several species, including the native mountain and valley varieties, as well as many exotic forms. Pheasants in the possession of breeders were chiefly ringnecks, but many of the rarer varieties were also owned by the fanciers.

Most of the owners of ducks confine their attentions to mallards, for a total of 739 birds of that species were reported. In addition, many of the more migratory species were represented. Breeders reported that 75 of the beautiful wood ducks, once so abundant in California, were being held as breeding stock.

In conjunction with the state game farms, the private breeders of game birds are doing a fine work in the restocking of game covers. A majority of the game species sold by the breeders go to landowners who liberate them on their premises for the purpose of restocking shot-out cover.

THE AGE OF STRIPED BASS

The determination of the age of fish by a microscopic examination of the scales is not a new idea, but the adoption of that method to striped bass has only recently been undertaken in California. Frank Lamb, a San Francisco sportsman, recently sent some scales from a forty-four pound striped bass to the Division of Fish and Game to settle an argument as to the age of the fish. The scales were turned over to E. C. Scofield at the California State Fisheries Laboratory at Terminal Island, who made the examination. It was determined that the striped bass from which the scales were taken was in in its seventeenth year. According to the report from Scofield, this fish was one of the oldest that has ever been examined from local waters.

The big striped bass, from the information received through Lamb, was forty-seven and one-half inches long and twenty-eight inches in girth. It was a female and contained two and one-half pounds of roe.

The Division of Fish and Game is particularly interested in this age demonstration of big striped bass, and anglers who forward scales taken from the big fish they have taken will receive a prompt report on the age of the fish.

A SPORTSMAN'S VIEW OF THE DUCK SITUATION

What has become of the ducks? Steward Edward White is of the opinion that overshooting is the main cause. In *The Saturday Evening Post* for May 10, 1930, he writes as follows:

"Far down the long stretch of the valley and the coast are thousands of enticing ponds and sloughs and marshes now inhabited solely by mud hens and grebes and a few spatters. And this is important: In my own knowledge, and only a few years ago, the ducks were as abundant in all these now deserted places as they are at the present concentration points. I know what I am talking about, for I have seen.

"This is a curious situation—an unfortunate one, in that it tends to confuse the issue. Other game, when overshot, thins out. We find our quail distributed over the same country, but in twos and threes instead of in thousands. Ducks we have still in the thousands, but in only a few localities. If we visited only those localities we would believe them to be as

abundant as ever. If we avoided those localities we might conclude there were no ducks at all. The concentrations, by the way, are due partly to reclaiming of large areas of marshland, but mostly to the planting of rice fields and to artificial feeding. Maps shaded to indicate wildfowl population at ten-year intervals would show a shrinkage and a separation of areas analogous to the evaporation of a body of water. To point out the concentration places as indicative of abundance is like pointing to two or three shrunken puddles in the aridity of what had once been a wide, unbroken sea, and saying triumphantly: 'See! The water is just as wet as it ever was!' And as the center of density of the ducks has drawn in and concentrated, where before it was spread evenly over a great territory, so, following them, the army of duck shooters has drawn in and concentrated. Men think nothing of driving hundreds of miles to their blinds. Los Angeles shooters go regularly to points far north of San Francisco. Airplanes are rapidly coming into use. To make it complete, though the numbers of the ducks have decreased, that of the hunters has greatly augmented. When I was a boy only a few men of each community went afield. Now, what with the motor car and fashion—especially fashion—an incredible number of the male and many of the female population go a-ducking, and many of them do not even know what a sportsman is, or care. A hundred now hunt ducks where yesterday was but one; today there is one duck where yesterday there were a hundred.

"It is a campaign of attrition. In overuse of anything the cycle is plain. First we get along on our income. Then there comes a time when, in order to produce our desired quota, we add to the amount of the income a bit of the principal. The reduced principal naturally produces less income next year; so we have to use a little more principal to make up the required sum. And so on. For a while, if we are sufficiently chuckleheaded, things seem all right, and, if questioned, we stoutly maintain our complete solvency. But the process has a disconcerting acceleration to it at a certain point. We seem to go broke over night, so to speak, so that we are dazed by the apparent suddenness of catastrophe, and can not believe it attributable to natural causes. We have been robbed, and we rush about shrieking random accusations."

ARE DEER HUNTERS DETERIORATING?

The deer hunters of the State of California were not such good shots during the season of 1929 as they were during the season of 1928, according to the figures compiled by the Division of Fish and Game from the deer tags returned. Under the state law all hunters who are successful in their efforts are required to make a return to the state agency.

In 1928 the deer hunters of California accounted for 21,515 deer. In the season just passed a total of 21,222 buck deer were killed. Based upon the supposition that each hunter only killed one deer, which is not altogether true, since many shooters were successful in getting the two bucks allowed them by law, one deer was killed by every 4.98 hunters in 1928.

During the season of 1929, however, there was a marked falling off in the success of the hunters. The ratio between the number of deer killed and the number of hunters was one deer to every 5.44 hunters. Since there was no marked difference in the total number of deer killed in the state, the inference would be that the shooters of the entire state were less proficient during 1929 than they were in 1928.

QUAIL REFUGES URGED

In an effort to restock the game fields of the State of California with the native California quail, Capt. Walter R. Welch has appealed to the 550 volunteer workers in his department to aid in the establishment of inviolate sanctuaries throughout the range of these birds.

All volunteer deputies have been asked to call upon the farmers in their communities and to urge them to voluntarily set aside, as a quail sanctuary, at least one ravine, gulch, or canyon on their lands in which quail now exist, and where water, feed and cover for the birds can be found. No shooting is to be done on these sanctuaries for a period of at least three years.

It is believed that if a sufficient number of these quail sanctuaries can be established, and if the birds are afforded water, feed, cover and protection, many acres of suitable quail habitat within the state can be satisfactorily restocked with quail within the next few years without the necessity of changing the present law, or the expense of establishing state quail refuges or farms or importing quail.

If the farmers and landowners will establish quail sanctuaries on their lands

they can maintain a supply of quail, and at the same time enjoy quail shooting on the lands surrounding their sanctuaries. Under these circumstances quail will be an asset to their property.

ADDITIONAL CLAMS NEED PROTECTION

During my boyhood days it was an easy matter to scrape out with a rake a couple of hundred good-sized clams in almost any tidal estuary along San Diego Bay. Today clams are practically extinct, and this appears to be due solely to the invasion of indiscriminate clam diggers—mainly foreigners.

The accompanying photograph is that of 332 *Chione fluctifraga* seized by Deputy E. H. Glidden on March 17, 1930. They proved to be not the species that are protected by law. The law should be extended to include all cockles, regardless of their specific status. All are edible and deserve protection. As it stands, the one called *Paphia staminea* is the only protected species and is incidentally one of the rarest. It will be noted in the picture the extreme size, both largest and smallest, of the specimens taken. Apparently the Japanese, from whom they were taken, spared nothing in the shape of a clam that was turned out by his rake. Such severe combing of the clam population along our sloughs and beaches unquestionably will exterminate all of the species before long, and I feel that this situation should be most strongly voiced to the lawmakers and adequate protection taken for all species, not only protection regulating the size taken, but the season in which they may be taken also. —Laurence M. Huey, San Diego, California.

ANOTHER SHIPMENT OF HUNGARIAN PARTRIDGES RECEIVED

There arrived at the State Game Farm in February 523 Hungarian partridges. Only eleven died en route. It will be remembered that a year ago a large shipment was received at Los Angeles and were distributed by airplane. The present shipment were retained at the Yountville Game Farm and then were released in various suitable localities in the northern part of the state. One shipment of birds was released on the Parrott Grant, west of Chico, and another in the foothills near Oroville.

LARGE TROUT GIVES RECORD NUMBER OF EGGS

It is reported that a large Klamath River rainbow, length 35½ inches, estimmated weight 25 pounds, caught on Beaver Creek and spawned by James L.

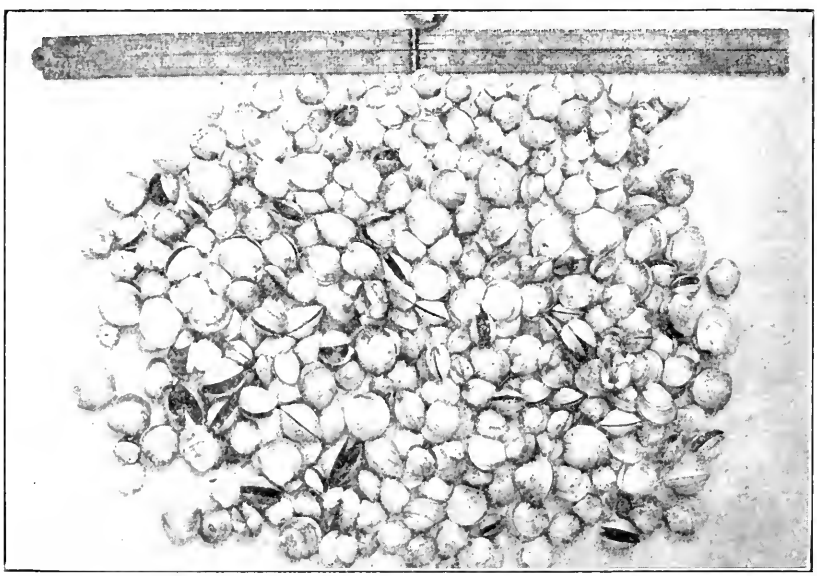

FIG. 82. 332 cockles, *Chione fluctifraga*, confiscated from clam digger, south end San Diego Bay, March 17, 1930, by Deputy E. H. Glidden. Like many other species of clam this will disappear unless better protection is afforded it. Photograph by L. M. Huey.

Stinnett, gave 48 ounces of eggs which at 190 to the ounce makes 9120 eggs. The fish, after being spawned, was returned to the stream.

DEPUTIES ISSUE INFORMATION CARDS

Southern California deputies headed by Capt. C. S. Bauder believe that law enforcement can be improved through education. Suiting action to the word, they have had printed a number of cards, samples of which follow. Placed in the hands of those whom the warden meets they are read, and thought turned in the right direction. The reaction to this endeavor has been most favorable.

Game fish are defined by the Fish and Game Laws of California, as follows: Tuna, yellow tail, jewfish or black sea bass, albacore, barracuda, bonita, rock bass, California whiting (also known as corbina and surf fish), yellow-fin croker, spot-fin croaker, salmon, steelhead and other trout, charr, whitefish, striped bass, black bass, crappie, calico bass, and all varieties of sunfishes. It is a misdemeanor to fish for or catch any of these fish without first having obtained an angling license. Failure to have a license will subject you to arrest. Get a license first and enjoy your fishing trip.

Funds to carry on fish and game conservation work are obtained through the licenses sold. Observe the fish and game laws and help protect the wild life resources.

DEPUTIES OF THE PATROL DEPT.,
CALIFORNIA DIVISION OF FISH
AND GAME.

Tel._____
Tel._____
No. 1

Licensed hunters reported 21,220 legal deer killed in California during the 1929 season. If the fish and game laws of this State are observed, coming generations will enjoy the same sport that we do now. The work of the Division of Fish and Game is carried on with funds obtained through sale of licenses. If you see a violation report it to the office of the Division of Fish and Game, 1119 Associated Realty Building, Los Angeles, or to the nearest deputy.

Your cooperation in apprehending violators will be greatly appreciated by

DEPUTIES OF THE PATROL DEPT.,
CALIFORNIA DIVISION OF FISH
AND GAME.

Tel._____
Tel._____
No. 3

In 1910 the Fish and Game Laws of California provided an open season of four months for hunting valley quail. Today the quail season is limited to one month. WHAT ABOUT TOMORROW? Do you want your outdoor sport confined to croquet and golf?

The Fish and Game Laws must be observed to provide game for the future. If you see a violation, report it immediately to the office of the Division of Fish and Game, 1119 Associated Realty Building, Los Angeles, or to the nearest deputy. Your cooperation in apprehending violators will be greatly appreciated.

DEPUTIES OF THE PATROL DEPT.,
CALIFORNIA DIVISION OF FISH
AND GAME.

Tel._____
Tel._____
No. 4

HUNTERS BAG 3428 KIABAB DEER

It will be remembered that for several years a fight was made to improve conditions on the Kiabab Plateau, where investigators learned that there was an overpopulation of deer and that a severe winter would cause the death of many. It was finally decided to allow hunters to take the surplus of deer. Hunting cabins were established and under the direction of the Forest Service, hunters were permitted to kill two deer. The 1929 season was of ten weeks' duration, and only one of the two deer allowed could be a buck. An extra fee of $1.50 was charged, to be used exclusively for expenses in connection with the proper handling of the hunt and the furnishing of salt for deer. On the day before the opening of the season there were 170 hunters waiting to be checked in at the Ryan checking station. Hunters experienced little difficulty in securing their deer.

There were five camps established for the hunters, and in each camp a forest officer as well as a deputy game warden were in charge. The hunters were enthusiastic about the deer and about the method in which this hunt was conducted, this being the only place in Arizona where supervised hunting is held. The fact that 2372 hunters bagged 3428 deer without a single fatality and with but one accident speaks very well for the efficiency of the management of the hunt. There were hunters from twenty-one different states.

SEEKS BETTER PROTECTION FOR PHEASANTS

C. R. Bell of Los Angeles recently wrote the Division of Fish and Game as follows:

"I am extremely interested in the production of Chinese pheasants, but solely for the purpose of the liberation of the birds. With my brother, in the Owens Valley, just a short distance above Independence, I have liberated 1000 birds within the last three years. And, while our experience was one of disappointment last year, as owing to changeable weather conditions we had a very material loss in young birds, we hope to produce and liberate in excess of 1000 this coming season.

"The thought has occurred to me, however, that with the rapidly increasing number of people who frequent the Owens Valley, especially in the hunting season, and with the large number of hunters who really do not know what a Chinese pheasant or a Hungarian partridge is, it would be a good idea to place some conspicuous sign along the roadside or adjacent to the fields wherein the birds are most abundant, reading something as follows:

WARNING!
CHINESE PHEASANT AND HUNGARIAN PARTRIDGES
Liberated in this District.
Severe Penalty for Killing
at any time.
FISH AND GAME COMMISSION.

Faithful to his promise, Mr. Bell erected roadside signs as indicated in the accompanying photograph. What if everybody took as much interest and followed his words with suitable action! The state is indebted to this friend of birds.

CONCENTRATION LIMITS HUNTING

The results of a survey of migratory wild-fowl conditions prevailing during the last hunting season, made by the American Wild Fowlers, has been compiled and distributed and the information it contains is particularly interesting because of great variation of the reports, says the American Game Protective Association news service. The compilation contains fifty-one reports, forty-two of them being from wardens and other officers concerned with game administration, and nine from club members and others. Of the game officers reporting, ten reported an increase in waterfowl, twenty-two average conditions, and ten a decrease. All others reported a decrease. Reports were received from all parts of the country.

From the far west reports are uniformly discouraging, the only encouragement being a statement that duck sickness, which has been responsible for such a tremendous loss of birds in that region, has not been serious recently. In California several reports coincide in the statement that practically the only marshland left suitable for duck feeding areas is that which is held by duck clubs for shooting preserves. Unfortunately, most of the area formerly used by ducks and now drained

FIG. 83. Sign erected in Inyo County to give better protection to pheasants. Photograph by C. R. Bell.

is used for agriculture and can never be restored. Several club members, referring to the Imperial Valley, say that the decrease in ducks has been tremendous. One writes that they have now about five birds to every hundred we had twenty-five years ago; another puts it as low as three, and a third, more pessimistic than the rest, places the ratio at one to one thousand.

In the middle west region, embracing states east of the Rocky Mountains and west of the Mississippi Valley, reports were general that there was a decrease, except in Montana and a notable exception in Kansas, where birds resorted in countless numbers, probably owing to improved feeding conditions.

In the north central region a more nearly average flight was reported, although a persistent decrease covering a period of years was indicated.

In the southern Mississippi Valley reports were most conflicting. Ducks evidently resorted to especially favorable feeding areas in great numbers, from some of which distressing reports of slaughter have come. A marked conflict occurs in reports from Reelfoot Lake, U. S. game protectors reporting the season's kill at from 125,000 to 150,000 for the season 1927–28, which was reduced to from 100,000 to 120,000 last season, while the state game warden estimated the kill last season at about 300,000.

On the Atlantic coast the reports indicate that good shooting was confined largely to baited grounds. This practice prevails throughout the entire Atlantic coast, on the Illinois River and the southern Mississippi Valley on ground controlled by clubs. Complaints were general that shooting was unsatisfactory on unbaited grounds. It is argued by those who favor baiting that where shooting is done in moderation it is better for wild fowl to find feed than to find none.

These reports are obviously not to be completely relied upon as indicating the waterfowl situation accurately, but they do indicate the general trend toward limiting waterfowl shooting to smaller areas controlled by clubs and individuals.—*The American Field*, September 28, 1929, p. 292.

MOUNTAIN LIONS NOT WHOLLY RESPONSIBLE FOR LOSS OF DEER

Hunters and fishermen who find the carcasses of dead deer in the mountains should not jump at the conclusion that these animals have been killed by mountain lions, according to Jay C. Bruce, lion hunter for the division. During the winter season, when the food supply is necessarily limited, many deer die from natural causes and disease.

The estimate of the state fish and game body on the number of deer in the state is 400,000. It is also estimated that fully one-half of the total number are does, fully protected by law. If the natural lifetime of a deer is ten years, it is assumed that thousands of deer die each year from natural death, aside from those that succumb to disease or die from lack of adequate food.

It too frequently happens that people in the mountains come across the remains of deer that have died from old age or other natural causes and immediately arrive at the conclusion that these animals have been killed by predatory animals. While it is of the utmost importance that the depredations of mountain lions should be reported to hunters at once, unmistakable evidence that lions have been at work should be found before calling for the help of the state lion hunter.

WANTED—A HOME FOR ELK

In 1915 the California Academy of Sciences attempted to better the condition of the remaining herd of California valley elk in Kern County by distributing small herds to some nineteen different parks and reservations in the state. At this time a number of elk were placed on the property of the Pacific Improvement Company at Pacific Grove. Within two or three years continual reports of damage resulted in the capture of twenty of these animals and their removal to the Swanston property, northwest of Woodland. Mr. Swanston, a cattleman, had offered a safe refuge for the animals.

Within the past year this property has changed hands, and the new owner now claims that the eighty head of elk on the property eat so much forage and destroy so much fence that he is anxious to be rid of them.

We hate to believe it, but apparently a fenced refuge, state owned, is the only practical solution of caring for the remnant of dwarf elk still left in the state.

A CODE OF ETHICS ADOPTED

The Plumas-Sierra Fish, Game and Forest Protective Association recently adopted a code of ethics. Each member who voted for its adoption also subscribed to it for his own personal guidance and conduct, and no negative votes were cast. Each new member of the association is presented with a copy with his membership card.

This organization is one having for its main purpose cooperation with the Division of Fish and Game in conserving and propagating fish and game, and the code indicates that by cooperation this organization has in mind the literal application of the term.

CODE OF ETHICS

Realizing that the above purposes and objects can not be attained without the highest standards of true sportsmanship, our membership does hereby adopt and subscribe to the following Code of Ethics for our personal guidance and conduct:

We pledge ourselves:

To obey all fish and game laws;

To prevent violations by others whenever possible;

To report any violations which may come to our attention;

To cooperate with our game wardens in the performance of their duties. (Remember they are protecting our property, working for our interests.);

To keep informed on the fish and game laws and help educate the other fellow;

To always give truthful information regarding fishing and hunting conditions to anyone seeking such;

To never take fish or game that we have no use for (that is, for ourselves or for our friends), and never waste fish or game;

To quit when our limit is taken and never fill out the other fellow's;

To buy a license before going fishing or hunting, and deer tags before going after a buck;

To fish no closed waters;

To return all fish under six inches in length, unless they have been hooked too badly to permit their surviving. (When returning fish, handle them with wet hands.);

To abstain from the use of salmon eggs or any fish roe or spawn as a bait whenever it is possible for us to catch fish on any other lure. (The use of salmon eggs and roe, etc., teaches trout to eat their own eggs, thus cutting down natural reproduction.);

To abstain from fishing spawning beds or taking spawning fish. (Female trout carry from 250 to 12,000 eggs, depending on the species.);

To always kill all snakes, including water snakes. These are the trout's worst enemy;

To refrain from using boats or property of others without first securing permission;

To never shoot at any moving object presuming it to be game. (Be sure, not sorry.);

To shoot only when at a range assuring a kill, trying not to cripple or maim wild game;

To refrain from "cleaning out" a covey or natural game refuge, even though not established by law;

To consider firearms as loaded at all times, and thereby avoid accidents;

To help preserve our forests and prevent fires;

To clean up our camping grounds and put out our camp fires before leaving;

To throw out no cigarettes or cigars from our car or elsewhere when in the forests;

To remember to be a sportsman—a true sportsman—not just a meat hunter.

Remember our slogan: "Sportsmen true, whate'er you do, conserve."

MICHIGAN TROUT TAGGING REPORT

Brown trout are practically nonmigratory; brook trout are conservatory migrants, and rainbow trout are migratory to the point where they are essentially "open-water" fish. These are three of the many conclusions reached by the late Dr. Jan Metzelaar, fisheries expert of Michigan's department of conservation, following a year of experiments with trout tagging. The report was filed but two days before Dr. Metzelaar was drowned in Grand Lake, Presque Isle County, the last week in September.

Since 1928, when the experiments began, 6721 trout were tagged and 129 have been recovered, less than 2 per cent. Of those recovered 60 were brook trout, 25 were brown trout, and 44 were rainbows. Twenty-five records of recovered drowned trout failed to show any migration. Sixty recovered brook trout show that this species "is a very conservative migrant and the extent of its travels bears a certain relation to its age and size."

The most spectacular feature of the experiments occurred during the past summer with the recovery of three rainbows, tagged in the Little Manistee River, on the Wisconsin side of Lake Michigan several hundred miles away. These records tend to show "that the adult rainbows of the Great Lakes are essentially fish of the large open waters where they can obtain abundant food."

Several additional conclusions were obtained by Dr. Metzelaar through the recovery of tagged fish.

"All the rainbow trout were wild fish, trapped while ascending certain streams of western Michigan. On the other hand, the majority of the brook and brown trout used in these experiments were hatchery

reared. All the brown trout and about 350 brook trout were large fish; the balance were yearling brook trout. The 'old' brook trout ranged from thirteen to sixteen inches and were all planted on December 12, 1928, in the Au Sable System," Dr. Metzelaar said in his report, explaining the source of the tagged fish. "The validity of experiments on migration with hatchery fish may, of course, be questioned. We have keenly realized the objections against this method and have tried to duplicate the work with wild fish." Dr. Metzelaar succeeded in tagging 134 wild trout on the spawning bed, but said this method was impractical for wholesale purposes. "Whenever a brook trout was recovered at a considerable distance from the point where it was released, it was invariably a large fish. 'In other words,' said the report, "the fish which had been reared in the hatchery for the longest period showed the strongest migrations. This fact did not prove true with brown trout. Most of the recaptures of tagged fish occurred in heavily fished western Michigan creeks. A single fish was recovered in certain Upper Peninsula streams."

The fact that conspicuously few trout have been recovered from certain streams draining directly into Lake Superior seems to indicate that migrational movements among the trout of these streams are much stronger developed than in streams of lower latitude in Michigan, according to the report.

Detailing migrations of brook trout, Dr. Metzelaar's report shows that, of 60 fish recaptured, 6 were of large trout; 5 of these were caught from one and a half to twelve miles down stream in the Au Sable system; 38 were recovered within one mile from the place where planted, and the remaining 15 fish had either shifted slightly upstream or had moved downstream not more than four miles.

Rainbows ascend certain western Michigan streams to spawn, but just how long the young ones dwell in these streams before following their parents to the lake has not yet been determined, the report indicates. Of 42 rainbows recovered, 29 were males and 13 were females.

The trout were marked with a small number tag of noncorrosive metal, the length of which, when locked, is nine-sixteenths of an inch. Trial attachments of the tag to the caudal fin proved unsuccessful. The majority of the trout were marked on the gill cover, provided the texture of this part permitted the attachment.—*The American Field*, October 19, 1929, p. 377.

SPECIAL COMMITTEE ON WILD LIFE RESOURCES OF THE UNITED STATES SENATE.

A special committee of the United States Senate has been appointed to investigate all matters pertaining to the replacement and conservation of wild life (including aquatic and bird life) with a view to determining the most appropriate methods for carrying out such purposes, together with its recommendations for the necessary legislation.

The committee has been instructed to report its findings to the Senate as soon as possible and not later than the beginning of the first regular session of the next Congress. It has been given full power to call witnesses and take testimony under oath and also to call for the production of all data in connection with the subject. This action by the Senate is the broadest and most comprehensive yet taken to conserve the birds, fish and wild animals of our nation.

The activities of the committee will necessarily cover a vast range of subjects, including federal game reservations, bird sanctuaries, wild life in our national parks and forests, the problem of migratory birds, of upland birds, of predatory animals and of fishes of the Atlantic, Pacific, gulf and inland waters. The study will also have to deal with the seal industry, the fish industry, the fur industry and all others connected with wild animal, aquatic and bird life. The plan of the committee is to make an exhaustive study of all of these problems and of the laws connected with them. To do this they will call upon the Biological Survey and the commissioners of bird sanctuaries and game reservations of the Department of Agriculture; the Bureau of Fisheries of the Department of Commerce; the national parks and national monuments of the Department of the Interior; the state departments of game and fisheries and all national organizations in any way connected with the subject.

This is a research work of very large proportions and will probably require a year or more to assemble, classify and digest in facts. After all recommendations from governmental, individual and private sources have been assembled and studied, it is the intention of the commission to recommend to the United States Senate any changes or additions that they consider necessary in or to existing laws pertaining to conservation.

The committee is strictly nonpartisan. In the appointment of it, Vice President Curtis chose not only those senators

whom he considered best qualified, but he also endeavored to distribute his selection geographically. The Pacific states, the Atlantic states, the mountainous states, the central and southern states, and those adjacent to the Canadian border are all represented.

Senator Frederic C. Walcott is chairman. He was for seven years president of the Connecticut State Board of Fish and Game and was chairman of the State Water Commission. He has been a leader for many years in investigations having to do with the conservation and preservation of game in various parts of the country.

Senator Harry B. Hawes, vice chairman, has been a widely known authority on fish and game for twenty-five years. He is the author of the Upper Mississippi Wild Life, Fish and Game Refuge Bill, which was the first constructive measure involving the direct expenditure of government money for reclamation and conservation of the waters of the upper Mississippi River. He is also the author of various other bills relating to the preservation of fish and game and is a member representing the Senate on the Migratory Bird Commission. As a member of Congress he was spokesman for the Izaak Walton League.

Senators Hawes and Walcott are the authors of the present bill on wild life resources. The other members of the committee are as follows:

Senator Key Pittman, who is now beginning his eighteenth year in the United States Senate, has been identified with national legislation in relation to fish and game conservation throughout his career. Part of his early life was spent in Alaska, where he took prominent part in the gold rush as prosecuting attorney at Nome. He is thoroughly familiar with the national park, national forest and game sanctuaries of America.

Senator Charles L. McNary has uniformly supported wild life conservation. He is the author of the Fish and Wild Life Refuge Bill and the amended Alaska game laws. Senator McNary is chairman of the Committee on Agriculture and has in this capacity become an authority on the farmers' needs in the matter of conservation.

Senator Peter Norbeck is likewise with Senator Hawes on the Migratory Bird Commission. He is author of the bill creating this commission. He was also

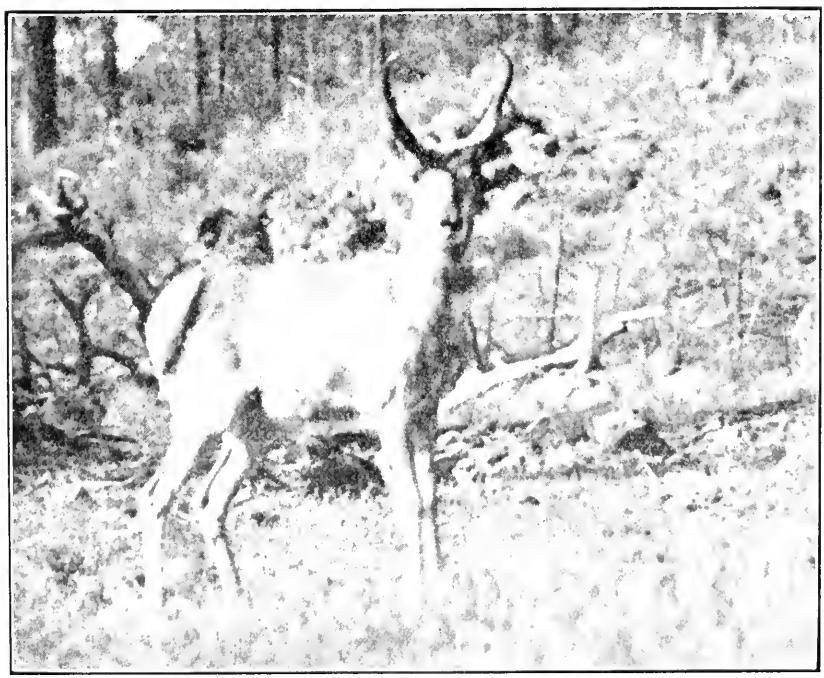

FIG. 84. Prong-horned antelope. Photograph by E. S. Cheney, May, 1929.

the author of the Game Refuge Bill, the Protection of the American Eagle Bill and the Predatory Animal Control Bill.

The committee has chosen as its secretary Morris Legendre, a graduate of Princeton and a Rhodes scholar to Oxford. He has made extensive studies of wild life not only in the United States, but also as a member of scientific expeditions to Africa, Asia, Alaska and the South Seas.

The committee hopes that the exhaustive study it plans to make will enable it to form a national legislative policy for the replacement and protection of wild life resources of the nation that will endure for many years, a policy which has for its purpose the perpetuation of the wild life of our nation so that the future generations may enjoy it.

Organizations and individuals who are interested in this matter should address their inquiries or suggestions to the committee, Room 207, Senate Office Building, Washington, D. C.

SHALLOW-FEEDING WATERFOWL COLLECT LETHAL DOSES OF SPENT SHOT.

Lead poisoning, a deadly affliction besetting wild waterfowl, again showed itself in the coastal region of Louisiana during the latter part of the winter. E. R. Kalmbach, a biologist of the Bureau of Biological Survey of the U. S. Department of Agriculture, recently visited the region and studied the causes of the mortality reported among wild fowl there. His report shows that though less disastrous than the duck sickness of western states, which has made heavy inroads on ducks and other waterfowl during recent years, lead poisoning is in some respects even more unfortunate.

The story is a simple one, he says, yet particularly deplorable. For many years lead in the form of scattered pellets of shot from hunters' guns has been sprayed about favorite shooting stands. These stands naturally are in attractive feeding areas, where the birds, puddling in the mud bottom for seeds and tubers of aquatic plants, come in contact with the shot. To assist digestion they swallow the leaden pellets along with sand and bits of gravel. The lead is slowly ground down by stomach action and they assimilate it.

The slow toxic action may not reveal itself immediately, but when once a bird takes a lethal dose of lead there is no chance that it may escape the effects. The affliction usually lingers and the bird gradually becomes weaker, first losing the power of flight and then the ability to walk. In this helpless condition, even should it be able to survive the ravages of the poison, the bird often becomes the victim of the elements or of our predatory creatures.

With regard to the recent lead-poisoning outbreak in Vermillion Parish, La., the Biological Survey report says there is little doubt that water levels have a distinct significance in the prevalence of lead poisoning in this coastal area. Practically all the ducks succumbing there were shallow-water feeders (pintails and mallards) and in their feeding are able to reach the bottom only when the water is of moderate depth.

Commenting on the condition in which the lead is found in the stomach, the report says "the pellets of lead at times were worn down to mere discs of small size that easily might be overlooked in a superficial examination. By syphoning with an excess of water in a shallow dish these small particles can be separated from other material of lower specific gravity. This condition, in which the lead shot are almost, if not entirely, digested, has raised doubts in the minds of some field observers as to the cause of the mortality. If the bird has eaten only a few shot (3 to 6), it would be necessary that these be ground down almost to the vanishing point before the bird could assimilate a lethal dose. On the other hand, cases arise in which as many as 20 or more shot may be found in a single stomach. In such instances it often will be noted that none of the shot has been worn down to a mere disc. Death is caused by the assimilation of the comparatively thin outer surface worn from all the shot. Since the toxic action of lead is slow and a bird may retain its power of flight for two or three days after having consumed a lethal dose of shot, cases in which an apparently healthy bird is found carrying a considerable number of shot in its stomach are explained."

Continuing, the report discusses field conditions: "To visualize the conditions under which ducks may obtain a lethal dose of lead, even though the shot be widely scattered, one needs only to recall how thoroughly these birds work over an attractive food area. A flock of 200 to 300 ducks may find sufficient food in the stubble of one rice field to hold their attention for successive nights over a period of several weeks. They go over practically every square foot of this area, and any shot overlooked by one bird is likely to be picked up by another. Furthermore, although a duck may find a single shot

only once every third or fourth day, the process of assimilation of the lead is so slow that in the course of a week or two sufficient lead may be accumulated to produce fatal results.

"Any doubts that may exist concerning the prevalence of shot in quantities sufficient to be a menace to wild fowl in this coastal area vanish when it is realized that lead was found in the stomach of every one of 18 birds on which post-mortem examinations were made. The pellets of shot varied from 1 to 24 in number, and in each instance characteristic symptoms of post-mortem aspects of lead poisoning were revealed."

The mortality in Louisiana this year was not so great as last, according to Mr. Kalmbach, and by no means equal to that of 1921, when many thousands of waterfowl died in this region, presumably from lead poisoning. Deplorable as these recurring losses are, the most unfortunate feature of the situation, it is pointed out, lies in the fact that there is still deposited not only in the marshes and shallow waters of Louisiana, but in those of many other states as well, lead shot that will continue to kill waterfowl for many years to come. The Biological Survey called attention to this menace in 1919 and pointed out the hopelessnes sof any remedial measures. As stated at that time, "all that can be done is to call attention to the prevalence of lead poisoning and to describe the cause and symptoms, so that persons finding birds affected may understand."

SKINS WORTH MORE THAN $4,500,000 SHIPPED FROM ALASKA IN 1929

Skins of fur-bearing land animals to the number of 297,448, and valued at $4,513,863.76, were exported from Alaska in 1929, a report from the Alaska Game Commission to the Biological Survey of the U. S. Department of Agriculture shows. This is $215,226.63 more than the amount of the 1928 sales, although 38,629 fewer furs were exported. The larger return during 1929 resulted from increased market value of the individual furs. The report is based on statements that fur shippers are required to file with the agents of the transportation companies handling the shipments, or with postmasters in case shipments are made by parcel post. These in turn must forward the statements to the Alaska Game Commission.

Red fox skins to the number of 21,023 brought a return of $1,042,740.80; blue fox skins, 7976, brought $808,208.08; white fox skins, 12,179, brought $773.-784; mink, 26,695, brought $552,586.50; and lynx, 7575, brought $462,832.50. The number of muskrat skins shipped in 1929 exceeded by far those of any other species. A total of 190,377 muskrat skins brought a return of $194,184.54. Only 1547 beaver skins were exported in 1929 because there was no open season on beavers.

The kinds of skins of which there was a notable increase in number exported during 1929 over the number for 1928 are as follows: Red fox, 5884 increase; white fox, 7646; lynx, 2598; mink, 5658; and weasel (ermine), 7214. Skins of other species showed somewhat of a decrease.

The report also notes that more than 34,000 seal skins were taken on the Pribilof Islands under the supervision of the Department of Commerce, and netted a gross return of $721,000 to the United States as part of the proceeds.

TRAPPING AND HUNTING REGULATIONS FOR 1930-31 APPROVED FOR ALASKA.

New regulations concerning game and land fur-bearing animals, game and non-game birds, and nests and eggs of birds in Alaska have been adopted by Secretary of Agriculture Hyde. The regulations, which were recommended by the Alaska Game Commission and approved by the Bureau of Biological Survey, become effective on July 1, 1930, and have just been published as Circular 7-C of the Alaska Game Commission.

Important among the changes in the regulations is one providing that for residents of Alaska there shall be no close season on large brown and grizzly bears except on certain areas along the Gulf of Alaska and on the Alaska Peninsula. Residents, however, may kill bears at any time when these animals are about to attack or molest persons or property. For nonresidents of the territory the open season on these bears in the restricted area will be from September 1 to June 20. The restriction on the taking of bears within the Kodiak-Afognak group of islands has been removed, and under the new regulations bears may be killed there as elsewhere in the territory.

Under the new regulations, caribou may be taken by residents and natives for food at any time north of the Yukon River, instead of north of the Arctic Circle as heretofore. South of the Yukon River the season will be from August 20 to December 31. The area between longitudes 138 degrees and 141 degrees has been added to the area closed to deer

hunting. The season on buck deer in southeastern Alaska east of longitude 138 degrees is slightly shortened from the period September 1 to November 30 to the period August 20 to November 15. The open season on mountain goats will be extended 12 days—August 30 to December 31, instead of September 1 to December 31. In conformity with recent amendments to the Federal Migratory Bird Treaty Act regulations, the daily bag limits on wild ducks in Alaska have been reduced from 25 to 15; on geese from 8 to 4; and the possession limit of 75 waterfowl was reduced to 50, which, however, may not include more than 30 ducks and 8 geese.

Another amendment, which will facilitate the enforcement of the Alaska regulations, provides for the strict supervision of trapping during the close season on protected fur animals, by requiring permits to trap wolves, coyotes, and other predatory animals. The revised regulations provide also for the trapping of martens, as these animals have recovered sufficiently from their formerly depleted numbers to warrant opening the season (one month), which has been closed since 1923–24. The department calls special attention to the fact that the skins of martens taken during the open season must be tagged with a metal seal issued by the Alaska Game Commission. An amendment to the regulation requires that marten skins imported into the territory must now be tagged in like manner within thirty days after their importation, instead of 90 days as heretofore. Changes in local seasons on mink, land otter, and weasel also have been made, and the use of set guns of any kind for taking game or fur-bearing animals is prohibited.

Copies of Circular No. 7–C of the Alaska Game Commission, which, in addition to presenting the new regulations, contains extracts of the principal provisions of the Alaska game law and other federal and territorial laws relating to game and birds in Alaska, may be obtained on request addressed to the Alaska Game Commission, Juneau, Alaska, or to the United States Department of Agriculture, Washington, D. C.

NOT ALL FOREIGN GAME BIRDS SUITABLE FOR NATURALIZING

Because old-world stock as in the case of the horse, the cow, the pig and most of the high-ranking cultivated fruits, has so often proved superior in hardiness and adaptability, it is natural for one to turn first to Europe and Asia when considering possible sources of game birds for acclimatization in the United States, says W. L. McAtee, senior biologist of the U. S. Bureau of Biological Survey, in a circular on the naturalization of alien birds in the United States, just issued by the U. S. Department of Agriculture.

"The chamois of the Alps, the ibex of the Pyrenees, and the pheasants of densely populated China have maintained their existence in close contact with man for centuries, while similar representatives of American fauna, with uncounted millions of acres to range over, have faded away like mist before the morning sun," says Mr. McAtee. "Although the number of hunters and firearms in the old world has never been very large, the few hunters have customarily taken larger bags, and snaring, trapping, and other methods of securing game have been practiced for ages. The Eurasian game birds and animals doubtless had time through the centuries to develop defenses against man's slowly improving armament and a tolerance for the changes in natural conditions resulting from increase in population. American species, on the other hand, adapted to conditions in a country sparsely populated and primitively armed, were suddenly called upon to face the destructive influences of an effectively armed and ever-growing population." That is the reason why Mr. McAtee believes it is logical, when seeking game birds for transplanting to a country that is now well populated, to utilize species that have been tested and tempered by ages of close association with man.

The ring-necked pheasant and the Hungarian partridge are the two exotic game birds that have responded most successfully to naturalization in this country. The new circular contains maps showing the present ranges of these species in North America. There are other maps showing the world distribution of annual precipitation, natural vegetation of the world, areas of the United States physically suited to forest only, and native vegetation of the United States—factors which the author recommends should be carefully considered when a new game bird is to be tried out, for in the case of a desirable bird, if the rainfall, temperature, and vegetation of its native home can be fairly well matched, other conditions can be so altered and controlled in a given locality as to make them favorable to naturalization of it. Mr. McAttee has used these factors as a basis in pointing out what parts of the United States are best suited for planting various exotic birds. He states that "where native game birds are abundant there is little or no need to plant

exotic species; but where native species do not supply the demand, foreign game birds can well be introduced."

Some of the game birds besides the Hungarian partridge and the ring-necked pheasant recommended in the new circular as suitable for naturalizing in the United States, are Reeves', golden, Lady Amherst, brown eared, Elliot's, and cheer pheasants, all from China; the Japanese pheasant; the Indian peafowl; red-legged partridges from southern Europe and northern Africa; guinea fowls from west Africa; and bustards and sand grouse from Europe, Asia and Africa. Species considered undesirable for introduction are the red grouse of the British Isles; the capercailzie from Europe; the Himalayan snow cock; the migratory European quail; and the European wood pigeon.

The new circular, Circular No. 96–C, entitled "Game Birds Suitable for Naturalizing in the United States," may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents per copy.

OBSERVANCE OF GAME LAWS ESSENTIAL TO FUTURE HUNTING

The only immediate relief that can be given the wild fowl of North America at the present time is to limit the kill by restrictions on the hunting season. Such limitation is one of three methods stated as available to insure the welfare of the migratory game birds of the country, by W. C. Henderson, associate chief of the Bureau of Biological Survey, U. S. Department of Agriculture, in an address in Boston, Massachusetts, January 16 at the annual meeting of the Federation of the Bird Clubs of New England. Other methods are being followed, such as establishing breeding refuges in the North, so as to increase the production of the various species, and providing resting and feeding sanctuaries along migration routes and in wintering grounds of the birds in the southern states, for some measure of protection during the hunting season, said Mr. Henderson. These two methods, however, will require a period of several years, but at present protection can be afforded only by reducing the annual kill, he said. This, he developed, can be accomplished both through necessary amendments to the present regulations and by more adequately enforcing the existing laws.

"While the difficulties of enforcement have greatly increased in the last ten years," said Mr. Henderson, "there has not been a proportionate strengthening of the enforcement arm to keep pace with the increased cost of patrolling and investigational work of the federal game protectors. In spite of an inadequate force of protectors, however, their work has brought about many noticeable benefits.

"Studies made by the Biological Survey in the last three years indicate that wild fowl have not been holding their own, and that additional measures for their protection must be adopted if their numbers are to be maintained. This decrease is due in large measure," he said, "to drainage of wild-fowl concentration areas and limiting of the breeding grounds of birds by agricultural occupation, to the ease with which gunners can reach wild-fowl centers over improved roads and by use of automobiles and motor boats, and to the increasing effectiveness of devices used in hunting.

"It is inevitable that agriculture and human occupation will more and more encroach on the wild-fowl breeding areas. While we are awaiting the establishment of bird refuges, however, we can meet present emergencies by restrictions on hunting.

"The recent amendments to the regulations under the Migratory Bird Treaty Act affecting bag limits, which were made following recommendations of the Biological Survey, will lessen the kill on important winter concentration areas of the birds. During the coming hunting season the effect of the new amendments will be watched carefully by the Biological Survey. It is possible that additional restrictions may be found necessary to safeguard the birds—contingent upon the failure of these new regulations to accomplish the desired result. Among other methods that have received the consideration of the Biological Survey are: Shortening the open seasons, establishing rest days, making further restrictions in the use of devices now allowed in the taking of ducks and geese, and limiting the artificial methods of bringing birds within range of the shooting stands.

"If additional changes should be recommended, the country may be assured that it will be only after the most careful attention to all phases of the situation. In recommending the most recent changes the Biological Survey was governed by this policy, and while extremists on both sides of the question are in many respects inclined to criticize the action taken, it should be borne in mind that it has been necessary for the bureau to proceed conservatively—not so rapidly as some would urge and yet more drastically than many opponents of hunting restrictions desire.

"The decision of the bureau to recommend the changes recently approved was

based on facts carefully gathered and developed. At this time there is no other organization in the country in possession of as much information relating to wild-fowl conditions in North America as the Biological Survey. The opponents of the present regulations and others who are urging still more drastic restrictions can be in possession of only limited information by comparison. The Biological Survey, however, must be acquainted with all phases of the problem—phases that concern the food resources of wild fowl their migratory habits, and their abundance, and other information that can be developed only from reports of agents of the bureau and other reliable observers widely distributed throughout North America.

"We need sound public sentiment in favor of the observance of the law, and willingness on the part of sportsmen and conservationists to adopt all the restrictions that are necessary to the preservation of the wild fowl," said Mr. Henderson.

BIOLOGISTS TO STUDY WILD LIFE IN FORESTS

Two research specialists have been appointed to positions in the Bureau of Biological Survey, U. S. Department of Agriculture, effective at the beginning of the year, in accordance with cooperative plans to place qualified biologists at various experiment stations of the Forest Service. These scientists will study the relation of wild life to the forests, as authorized by the recently enacted McSweeney-McNary Forestry Research Act.

Thomas D. Burleigh, for the last nine years head of the division of forestry of the Georgia State College of Agriculture and one of the appointees, has been appointed to the position of associate biologist and will be stationed at the Appalachian Forest Experiment Station, Asheville, N. C. He is a graduate of Pennsylvania State College and the University of Washington. He has devoted considerable time to the study of the bird life of Georgia.

Oliver L. Austin, Jr., of New York, a graduate of Wesleyan University and who has done three years' graduation work in Harvard University, has been appointed assistant biologist to carry on studies of wild-life and forest relationships at the Lake State Forest Experiment Station, St. Paul, Minn. He spent the summer of 1925 studying jungle ecology in British Guiana, South America, and has made three trips to Labrador to study the distribution of the vertebrate fauna of the region. On his Labrador trips he did notable work in bird banding, particularly with Arctic terns, in cooperation with the Biological Survey. Two of the terns that were recovered, one in France and another in South Africa, established remarkable flight records, the latter flying the longest distance of any banded bird ever recaptured, as far as any known records show.

NEW LEAFLET TELLS HOW TO MAKE A CAT TRAP

Vagrant, unowned house cats are a serious menace to song birds, insectiverous birds, and game birds, to rabbits, squirrels, and other small forms of beneficial wild life, and to poultry, and therefore they should be destroyed, says a leaflet just issued by the U. S. Department of Agriculture on how to make a cat trap.

Stray cats—usually hungry, mangy, and diseased—abound in every city, town, and rural community, and are the most common carnivorous mammals in many places far removed from human habitation, says the leaflet. Usually they have been left unfed by their owners and are forced to get a precarious living by hunting and scavenging. As they are abroad mainly at night they are seldom seen and it is not generally realized that they are as numerous as they actually are. The leaflet says that in 18 months more than 50 stray cats were caught in one trap set in only two locations in a city, and that in one city a humane society put to death nearly a million vagrant cats in four years.

Stray cats can be caught in any well-constructed and baited trap. The one described in the new leaflet, devised by the Bureau of Biological Survey, has proved satisfactory and is easily made. It is merely a box with a drop door that is held up by a projecting wire, one end of which is attached to a false floor or treadle. The weight of the cat on the treadle beyond the fulcrum pulls back the wire and releases the door. The leaflet shows, by picture and text, how to make the trap, and it also tells how to bait the trap and how to dispose of the captured cats.

The Leaflet, No. 50-L, "How to Make a Cat Trap," can be obtained free from the Office of Information, Department of Agriculture, Washington, D. C., as long as copies are available for free distribution.

DIVISION ACTIVITIES

Bureau of Patrol

Captain S. J. Lyons was transferred from the Santa Barbara territory to the Sacramento district, which transfer was made effective February 25, 1930.

Three new appointments of deputies were made in the patrol force during the month of February, namely: Ed. Clements at Klamath, Theo. Jolley, Indio, and J. C. Schneider at King City.

Deputy Alan G. Curry of the San Francisco office and former deputy John Burke of San Mateo County were killed in South San Francisco Bay during the arrest of a commercial fisherman in the early morning hours of April 30, 1930. The fisherman is in a San Francisco hospital with four wounds and has been charged with murder by the San Mateo County authorities.

John Burke worked for the Division in San Mateo County from 1915 to 1928, when he left the service. Deputy Alan G. Curry was appointed a volunteer deputy in 1925, and displayed so much activity and interest that he was employed on the regular patrol force in 1928, working in the San Francisco territory.

Bureau of Commercial Fisheries

The Terminal Island office of the Division of Fish and Game, sold a total of 2179 licenses for the commercial fishing license year. These licenses brought a revenue of $21,790. A total of 36 wholesale shellfish and fish packers' licenses were sold during the same period. This is a gain of 589 commercial fishing licenses over the previous year.

At San Pedro 98 tons of spiny lobsters were taken from local waters during the past season, as compared with 76 tons the season before. The San Diego catch of lobsters by fishermen fishing local waters was reported as unusually poor and San Diego dealers, who get most of their lobsters from Mexico, advocate a two year closed season on local lobsters. The minimum size limit of 10½ inches is supposed to be sufficient protection, but it is a very difficult law to enforce on others than regular dealers.

The International Pacific Salmon Federation met at Stanford University on March 28th and 29th. Fisheries representatives from Canada and the U. S. Bureau of Fisheries, British Columbia, Oregon and California attended this meeting. Of general interest was the resolution adopted recommending that Washington and Oregon adopt the same salmon trolling season as that in effect at the present time in California, which provides a closed season except from June 1st to September 15th.

While doing collecting work at Monterey on April 21st, the patrol boat *Steelhead* struck a submerged rock about half a mile off shore, in the vicinity of Lover's Point, Pacific Grove, and tore two holes in her bilge planking. With the assistance of a passing fisherman, who took the *Steelhead* in tow, the crew managed to keep her afloat by hand bailing until they got her to the Monterey Wharf, where she was hauled out. Repairs were made at once and she was ready for service again on the 25th of April.

Bureau of Finance

The following is a table showing the total amount of deer tag license sales, total number of deer killed and the ratio of the deer killed, assuming that no hunter killed more than one deer, for the past three years.

Year	Total sales	Deer killed	Ratio of deer killed
1927	110,760	19,507	5.67
1928	105,638	21,515	4.91
1929	115,472	21,222	5.44

Bureau of Fish Culture

The collection of rainbow trout eggs from Klamath River stations was very disappointing, particularly in view of the fact that there was an unusually large run of trout in the river, probably larger than for ten years past. This small egg take was due to the fact that there was very little rain along the Klamath during March, although there were good rains in other parts of the country. There was a good fall of snow in the mountains which gradually melted and held the creeks at too low a temperature for any very large runs. During the last week in March the creeks warmed up and the run started in fine shape; then the weather

turned cold again. Low and cold water in the streams caused the April egg taking operations to drop below what had been expected, the fish not ascending to the traps.

George A. Coleman, biologist, made a survey of fishing and conditions in Chico Creek from its mouth to a point twelve miles up stream through Bidwell Park, Iron Canyon and beyond. The Shasta rainbow and the European brown trout were the only trout found. The Shasta rainbow being the trout best adapted to conditions in this stream, is the most abundant, takes the fly readily and is therefore very satisfactory to the fisherman.

Donald D. McLean, investigated reports of damage by elk on the Swanston property northwest of Woodland. Some twenty Elk were moved to this property about 1915 from the Pacific Improvement companies property at Del Monte where elk planted by the California Academy of Sciences were causing considerable damage. It now appears that the Swanston property has changed hands and the new owner feels that the eighty head of elk now on the property are a nuisance and wishes them removed.

Donald D. McLean, E. S. Cheney and E. L. Sumner were sent to San Diego County during the month of March to investigate proposed quail refuges. McLean was in charge of the census, Cheney acted as official photographer and as an aid in census taking, and Sumner investigated predatory animals. Several of the proposed refuges were found unsuitable.

Bureau of Game Farms.

On March 2d, 523 Hungarian partridges were received from New York. The birds arrived in very good condition and were rested for a period of three weeks before being liberated for a period of natural reproduction. These birds were liberated in Surprise Valley, Modoc County; Redding, Shasta County, Chico, Fresno and the Jamieson Canyon District, Napa and Solano counties.

A check on conditions in the Breckenridge Game Refuge made during the month of March showed that out of 54 wild turkeys planted there last fall, 52 are still alive and doing well. This is an excellent showing and the Bakersfield people are talking a real interest in this project. The first young turkeys were hatched at the Yountville Farm this year on March 27th.

Bureau of Game Refuges

Analysis of the reports of game breeders that have been filed show that at the conclusion of the year 1929, breeders who had at the beginning of the year 1929, a

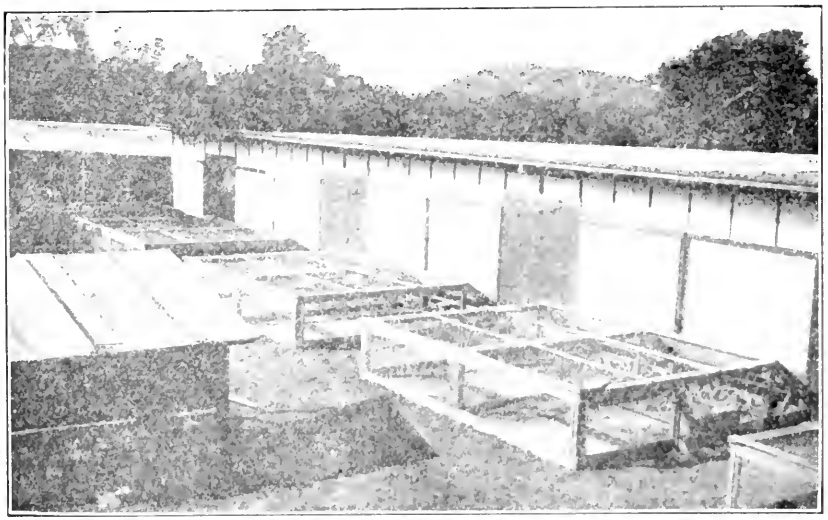

FIG. 85. Section of brooder house, Yountville Game Farm. This equipment recently installed permits the rearing of game birds entirely by electricity.

stock of 2805 ringneck pheasant had sold during the year 2973 birds and had as breeding stock on the 1st of January, 1930, 3932 birds, a net gain of 1846 for the 127 breeders reporting pheasant transactions, or less than fifteen birds on the average. The bulk of the pheasants sold were raised by three breeders who sold respectively 666, 613 and 457 birds.

Quail breeders had on hand the 1st day of January, 1929, 3352 birds and sold during the year 1549; they held for breeding stock 3483, a net gain of 1680 for the 139 breeders reporting sales. The three most successful quail breeders sold respectively 220, 72 and 67 quail. Apparently California game breeders have not yet solved the problem of raising quail in large numbers in confinment.

Volunteer Deputies

The campaign for the establishment of quail sanctuaries through the medium of the volunteer deputy is meeting with state-wide cooperation of farmers, landowners and sportsmen, with the result that many such refuges are being set aside. The volunteer deputies in the San Joaquin County report the establishment of upwards of ten square miles of quail sanctuaries in that county.

Many sportsmen's magazines and newspapers, both city and country, have published articles heartily supporting the quail sanctuary movement.

The second annual convention, banquet and pistol shoot of the volunteer deputies was held in San Francisco, April 26th and 27th. Deputies to the number of about 100 and representing upwards of 25 counties within the state were present at the convention.

LIFE HISTORY NOTES

DEER IN SACRAMENTO VALLEY

One generally figures the whole of the great central valley as being under cultivation and it is difficult to visualize deer as having any chance at survival in this area. However, on several large ranches west of Chico which border on the Sacramento River there is sufficient cover and protection to afford deer a suitable home. On a trip to the Parrott Grant on March 20th two blacktail does were seen drinking in a small stream. Deer tracks lined the levees everywhere.

Deputy A. J. Stanley reports that several hundred deer are to be found in oak timber and willow bottoms in this vicinity.—H. C. Bryant, 510 Russ Building, San Francisco.

BLACK BRANT ON TOMALES BAY

About 1900 to 1905 with a party of fellow sportsmen I made several trips to Bodega and Tomales bays in Marin County after black brant to obtain some specimens, which I had promised to an eastern collector and also for the sport of the shooting. Hunting was done from small boats, one gun to each, anchored before daylight in a line across the narrow strait connecting these two bays. The geese as soon as it was daylight made their morning flight passing across the line of boats at a height of from twenty to one hundred yards above the water. There was a tremendous amount of ammunition expended with but small result; the average for a days outing being two or three birds to the gun.

The black brant were in flocks of one or two hundred; a total of approximately one or two thousand would be seen on the two bays. Since 1905, brant have continued to return more or less regularly to Tomales Bay, some years large flocks as above and some seasons less, but there average continuing practically unchanged.

The Audobon Association of the Pacific keep a check on the bird life in this part of California and report for the winter of 1929 as follows:

Feb. 3, about 2000 black brant seen on Tomales Bay.

Feb. 22, small flocks aggregating from 1000 to 1500 black brant seen on Tomales Bay.

Apr. 7, one migrating flock, about 100 black brant seen on the ocean near the mouth of Russian River, Sonoma County.

San Diego Bay and Mission Bay, which is a large lagoon about a mile north of San Diego Bay, is still visited by an occasional flock of black brant. For the last two winters a flock of about twenty spent the season on Mission Bay which is now a bird refuge, or sanctuary; but the traffic of navy launches on the larger bay keeps the brant moving and they go south to San Quentin and Magdalena bays off Mexico.

The birds in the picture were shot in Magdalena Bay and form a habitat group in the San Diego Museum.—M. Hall McAllister, San Francisco.

PHEASANT NESTS IN ARROYO GRANDE VALLEY

A ring-necked pheasant, evidently from the first plant made above Arroyo Grande in northern Santa Barbara County made a nest under an artichoke bush on the Checcetti Ranch. Mr. Checcetti took precautions to protect the nest.

The accompanying photograph by Frank Petri shows the bird at the nest which contained fifteen eggs on May 11, 1930. When the nest was visited on May 19, the eggs were just hatching.—W. C. Blewett, San Luis Obispo, California.

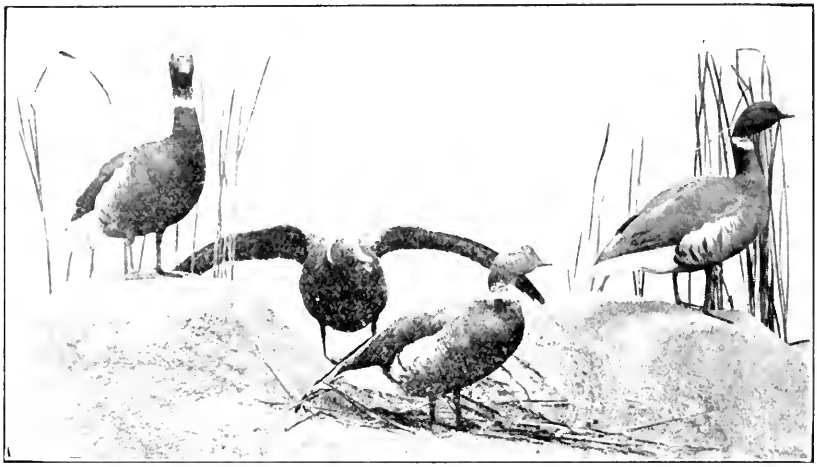

FIG. 86. Black sea brant, San Diego Museum habitat group. Photograph by M. Hall McAllister, May 15, 1929.

FIG. 87. Ring-necked pheasant at nest, Chesetti Ranch, Arroyo Grande Valley, May 11, 1930. Hatched May 19 (15 eggs in nest). Photograph by Frank Petri.

COMMERCIAL FISHERY NOTES

N. B. Scofield, Editor

CALIFORNIA SALMON FOR 1929

Several rather surprising facts present themselves in a review of the 1929 salmon catches. The total catch for the State increased over 1928 by 510,000 pounds only, although the aggregate of the ocean caught fish (troll fish) amounted to slightly over 4,000,000 pounds, a rise over 1928 of 589,000 pounds, while the total river catches (Sacramento, Klamath and Smith rivers) fell off by 83,000 pounds in 1929. We would have expected the river landing to decline and the ocean catches to enlarge, but what was not expected was the sudden change of amounts landed in some of the ocean districts, i. e., Santa Cruz and Monterey. The Monterey catches have increased about 450,000 pounds over 1928 and the Santa Cruz totals have increased by 260,000 pounds in 1929. Dr. J. O. Snyder of Stanford University, in a paper presented before the Pacific Salmon Federation, stated that the 1929 commercial catch consisted to a great extent of small fish of two and three years of age and that this large catch might be the last of profitable salmon fishing in the Monterey region.

As for the other districts of salmon importance: the San Francisco catch (ocean fish) fell off by 150,000 pounds; the localities along the Mendocino coast (Fort Bragg and Shelter Cove) diminished in the 1929 catch by 330,000 pounds; and the results of sea fishing off the coast of Humboldt and Del Norte counties was an increase of about 360,000 pounds over 1928, which obscures the decline for Mendocino.

In the river areas the Sacramento catch dropped 30,000 pounds in 1929 while the Klamath figures climbed over 1928 totals for the region by about 13,000 pounds. The catch of salmon on Smith River, while never very large, fell off by 63,000 pounds.

The small increase for the state totals is readily accounted for when the several regions of salmon fishing are viewed separately, for an increase in one locality is offset by a decline in another. The 700,000 pounds increase of Monterey Bay over 1928 figures and the 360,000 pound gain of the northern counties with the slight rise of the Klamath make the total increases about 1,083,000 in 1929. The decreases are made up of the falling off on the Sacramento River and the Smith River, and the decline of the two ocean districts of Mendocino and San Francisco made a loss of nearly 573,000 pounds for 1929, thus the total increase for the state is only 510,000 pounds.—G. H. Clark, California State Fisheries Laboratory, May, 1930.

WOLF FISH CAPTURED AT MONTEREY

On April 5, 1930, a wolf fish (*Alepisaurus aesculapius*), a species of lancet fish was taken at Fan Shell beach on the seventeen mile drive, between Pacific Grove and Carmel. Mr. C. W. Hibbard caught this rare species of deep sea fish on one of his collecting trips for the Steinhart Aquarium at San Francisco. This fish is taken only when it is forced above its natural deep sea strata. Hibbard waded into the surf up to his waist, in order to capture the wolf fish which he spotted on the crest of a high wave.

FIG. 88. Wolf fish, *Alepisaurus aesculapius*, taken in the surf between Pacific Grove and Carmel, April 5, 1930. Photograph by J. B. Phillips.

The fish appeared exhausted and little trouble was experienced in the capture. Although in a weakened condition, due probably to the great change in pressure, the fish remained alive for sixteen hours.

Because of its deep sea habitat, there are only a few records of the taking of this specimen. Selle reported the capture of a specimen in shallow water at Pacific Grove on July 18, 1925 (Calif. Fish and Game, Vol. 11, p. 188). According to Selle, the earliest report of this fish in California was a specimen reported from Eureka in 1892; another at San Luis Obispo in 1894. In 1920 another specimen was obtained at Pacific Grove, but was apparently not reported.

The specimen taken by Mr. Hibbard was 4 feet 3 inches in length. The scaleless body was bluish violet above, shading to a silvery color on the sides and belly. The high, delicate sail like dorsal fin extended about three-fifths of the length of the body. Each eye was about the size of a silver dollar. A flange-like epidermal keel ran the length of the body on either side. Several of the fang-like teeth were over an inch in length. These teeth, set in huge, pointed jaws, together with the lance-like body indicate that the wolf fish in its natural environment is a voracious, predatory fish.

Inasmuch as the specimen was desired intact by the Steinhart Aquarium, no internal examination was made. Selle, however, made an internal examination of his specimen. He found that all parts of the body were very fragile; the bones quite feeble and loosely connected by ligaments, so that the body could be considerably stretched. Dr. Gunther, a well known ichthyologist states: "This loose connection of the parts of the body is found in numerous deep sea fishes and is merely the consequence of their withdrawal from the pressure of the water to which they are exposed in the depths inhabited by them. When within the limits of their natural haunts, the osseus, muscular, and fibrous parts of the body will have that solidity which is required for the rapid and powerful movements of a predatory fish. That the fishes of this genus (*Alepisaurus*) belongs to the most ferocious of the class is proved by their dentition and the contents of their stomachs." J. B. Phillips, California State Fisheries Laboratory, May, 1930.

LARGE BLACK SEA BASS CAUGHT IN MONTEREY BAY

A jewfish weighing 450 pounds was received by the Higashi Fish Company at Monterey on April 12, 1930. Jewfish is another name for the California black sea bass (*Stereolepis gigas*), found on the Pacific coast, from San Diego north to the Farallones, but in most abundance off Santa Catalina Island. Although this is not the first black sea bass landed at Monterey it is undoubtedly the largest. A jewfish was reported in 1929 and before that an occasional one was landed at Monterey.

The above specimen caught about 1000 yards off the Pacific Grove beach, just north of the bell-buoy, was taken on a rock cod line by a market fisherman in a skiff. The fisherman experienced trouble in handling this monster, and required the aid of a nearby gig launch, which towed both skiff and fish into Monterey. The fish was shipped immediately to a San Francisco market.—J. B. Phillips, California State Fisheries Laboratory, May, 1930.

SARDINE FISHING AT SAN DIEGO

In the past the sardine boats have lost many of their catches when the schools have escaped under the boat, as the net was being pulled in. To overcome this difficulty, a San Diego boat has installed an electric light with a long cable. As soon as the net is out, the light is lowered into the water in the opening of the net. A man stands by the switch, which is located on deck, and when the school is observed travelling towards the boat and the opening between the wings, the light is flashed on and off. Fishermen claim that this is highly successful in keeping the fish within the net.—H. C. Godsil, California State Fisheries Laboratory, March 5, 1930.

1929-1930 SEASON DISASTROUS FOR MONTEREY SARDINE FLEET

A warning that the 1929-1930 sardine season would be disastrous for the Monterey sardine fleet was sounded when the purse-seine boat *San Juan* (Captains A. Stanovich and G. Enea) burned and sank on the night of August 23, 1929, at Monterey. The gasoline engine backfired, resulting in an explosion which ignited the vessel. The boat was valued at $18,000, of which only $5,000 was insured.

On the night of November 8, 1929, the purse-seine boat *Lorenz* (captained by P. Sandanger) went on the rocks just north of Santa Cruz, during a heavy fog. It was pulled off at high tide the following day, and three weeks' repair work, estimated at $3,500, was done on it.

The launch of the S. Russo lampara net crew also went on the rocks on the same night as the *Lorenz*, and in the same vicinity. It was also pulled off at

high tide the following day, and two weeks' repair work, amounting to $2,000, was spent to put it in shape for fishing again.

On November 10, 1929, the purse-seine boat *Mabel* (J. Bernsten, captain) was wrecked on the rocks between Point Ano Nuevo and Pigeon Point during a heavy fog while cruising around looking for sardines. The crew of nine men and Captain Bernsten, after spending six hours aboard the doomed vessel, floated to shore with the incoming tide on the turntable on which the net is piled. The vessel was valued at $12,000 and the net at $2,500.

The purse-seiner *Idaho* (captained by T. Oreb) sank about three miles north of Point Pinos on the morning of December 2, 1929. The *Idaho* had a capacity of sixty-five tons of sardines; this, coupled with the fact that the old vessel was leaky and that the pumps refused to work, was the cause for the sinking. The crew of nine men and Captain Oreb were picked up by the purse-seine boat *Florida* which had been following close by. The loss was estimated at $15,000, the $5,000 net being saved by the *Florida*. The sixty-five tons of sardines would have brought the crew $715 at the canneries.

On December 5, 1929, the launch of O. Crivello No. 2 burned at Monterey, when the gasoline engine backfired upon being started. The loss was placed at $3,200, no net being on board at the time.

When the gasoline engine backfired upon being started, the purse-seine boat *Florida* (captained by M. Vlahov) burned and sank on January 16, 1930 at Monterey. The boat was valued at $15,000, of which $7,500 was covered by insurance. The new purse-seine net, costing $5,000, was also destroyed. The *Florida* was the last of the purse-seine boats at Monterey with a gasoline engine. The remaining purse-seine boats were all powered with Diesel engines.

When the tow line parted, the lighter of T. Kamurie, ring-net fisherman, was wrecked on February 3, 1930, near Pt. Pinos Lighthouse. The lighter was valued at $2,000 and contained a capacity load of forty-five tons of sardines, which would have brought $495 at the canneries.

During this period, the abalone fishing fleet also suffered when the *Nagato* capsized off China (Mussel) Point, after striking some rocks during a heavy fog. The crew of five men, diving equipment, and a load of 250 dozen market abalones were thrown into the water. The men were saved by another boat nearby. The boat was repaired at a cost of $2,600. The 250 dozen abalones would have brought the fishermen $875 at the markets equipped to handle them.

Not so fortunate was the abalone boat *Two Brothers*, which burned at Monterey on December 19, 1929. The burning was due to the gasoline engine backfiring preparatory to starting on a trip down the coast. The total loss was estimated at $12,000, there being no salvage.—J. B. Phillips, California State Fisheries Laboratory, February, 1930.

CHANGE IN FISHING FOR MONTEREY SARDINES

The 1929–1930 sardine season that closed at Monterey on the 15th of February, 1930, saw a decided change in the fishing gear used by the lampara or "round-haul" net fishermen. During the season all but three of the sixty-two lampara or "round-haul" crews changed to the "half-ring" or ring net. The ring net, which is really a semi-purse net, differs from the purse seine mainly in the lighter webbing used and the tapered ends. Whereas the purse-seine net is rectangular in outline, the ring net tapers off at the ends, starting four to twelve fathoms from the end (depending upon the length of wing or large mesh), the lead and cork lines meeting. The ring net works practically as does the purse seine. The net is pursed by means of a rope running through rings suspended along the lead line. The two ends of the pursing rope are quickly reeled in, by means of a gurdy winch powered by the engine, thereby impounding the fish. The net is then drawn in by hand until the fish are all centered in the "sack" or heavier portion of the net, from which they are brailed. The brailing is accomplished by means of a large dip net working from a boom, the winch being used in lifting the dip net.

The cost of a Monterey style ring net when new is between $1,500 and $2,000, the addition of the winch and boom to the launch being $500 to $600 more. Some of the crews used the available webbing from their lampara nets in making the ring net, while others saved their lampara net as a substitute and for squid fishing.

The dimensions of the ring nets now used by the former lampara crews are between 125 and 165 fathoms along the cork line, and between 25 and 32 fathoms deep, stretched mesh. The ring net requires three times as much webbing as the old lampara or approximately 600 pounds. In the neighborhood of 450 pounds of leads are used along the lead

line, and between 25 and 35 six-inch rings are fastened along the lead line by short ropes. The net is buoyed up in the water by means of about 2000 corks, fastened to the upper side of the net.

When handled properly, the ring net is a more efficient and labor-saving type of gear than the old type lampara or "round-haul" net, as all fishermen using them will attest. More fish are captured with fewer hauls and with less effort per haul. The completion of the purse seine was no doubt the compelling factor in this change. During the 1929–1930 season there were twenty-odd purse-seine boats fishing at Monterey. In addition there were from two to four of the purse-seine boats that used ring nets instead of purse seines. These ring nets used on purse-seine boats were similar to the nets used on the smaller boats, except that they were longer, varying from 185 to 200 fathoms in length.—J. B. Phillips, California State Fisheries Laboratory, February, 1930.

SALMON SPAWNING IN DRAINAGE CANALS IN THE SAN JOAQUIN VALLEY.

In December, 1929, a report was received by the Division of Fish and Game to the effect that a number of salmon was stranded in some drainage canals in the San Joaquin Valley in the vicinity of Newman. These canals drain the irrigated land on the west side of the river around Los Banos and Newman and carry the drainage water to the San Joaquin River at a point a few miles below Newman. The river above this point is dry in the late summer and fall; consequently, any salmon which ascend the river during that time have to go up the main canal and into the several branches. All of the canals end in a blind pond; the source of the drainage is seepage. The salmon will not as a rule retrace their route, so must spawn and die in these blind canals. There is a rumor that these trapped salmon do not spawn in these canals, but wait until spring, at which time they are able to reach the main river through a cross-canal, and go up to the natural spawning grounds in the river where they deposit their eggs in the early spring. To the writer's knowledge, no salmon have ever been known to go into a stream unless they were to spawn that year. It will be seen in the following paragraph that these salmon did spawn and die in these canals.

On December 23, 1929, the writer went to Newman to investigate the existing conditions, where he was assisted by Deputies Newsome and Gourley in securing specimens by using a small mesh seine drawn over a distance of two hundred yards at the head of the canal. Of the ten salmon taken all were ripe males except one, a female. The female and only one male were saved; the others were returned to the canal. These two fish were measured from the tip of the snout to the end of the tail, the condition of the reproductive organs (spent, ripe, or very ripe) was noted, and a few scales were taken from each specimen. The female salmon examined was 74 cm. long; the eggs were all loose in the body cavity, indicating that the fish was in a spawning condition; the scales showed that the specimen was in its third year at least, but as the edges of the scales were badly absorbed the fish may have been older. The scales had an ocean type nucleus, denoting that the fish migrated from fresh water to the ocean in its first year. The male salmon measured was 75 cm. long and was in a spawning condition; its scales, also of the ocean nuclear type, indicated that the fish was in its third year, but may have been older as the edges of the scales were also badly absorbed.

In addition to the fish taken alive, about twelve dead female salmon which had spawned were found along the bank of the slough. No male salmon were found dead. The live fish were all in a fair condition.

The drainage canal contained muddy water, as the bank and bottom were made up of very fine sand and soft mud, perhaps two inches deep. A salmon was found spawning on a small portion of very fine sand, but as the mud was constantly moving it is very doubtful if the deposited eggs would ever hatch, since they were soon covered with fine silt and mud, and so may have died for want of oxygen. From this actual spawning fish and the numerous dead, spent female salmon on the bank, a conclusion is derived that the salmon do spawn in these canals and do not wait until the following spring to reach the main river before spawning. It is not known whether the young if hatched could reach the main river and the sea in the spring by way of the drainage canals.

According to Deputies Newsome and Gourley, this same condition existed at the head of all the main and tributary branches of the drainage canal system. Since irrigation is so intensive in the San Joaquin Valley, there is no way by which the fish could be guided up the river to their rightful spawning places.—G. H. Clark, California State Fisheries Laboratory, January 8, 1930.

THE SARDINE FISHING INDUSTRY

The sardine fishery at Monterey, California, in 1918 yielded approximately 5,000,000 pounds as compared to about 220,000,000 pounds landed in 1928, which demonstrates the important status that this industry has reached. In the State of California as a whole, the total catch of sardines exceeds that of any other species of fish exploited in these waters.

Everyone associated with or interested in this important industry will want to read a recent report published in pamphlet form as Fish Bulletin No. 19 of the Division of Fish and Game of the Department of Natural Resources, entitled "Sardine Fishing Methods at Monterey, California," prepared by W. L. Scofield, who is the Director of the California State Fisheries Laboratory. This publication places on record a description of the sardine fishing methods at Monterey and the economic conditions affecting the sardine catch, which can be used as a basis for judging future changes in this steadily increasing fishery. The report deals with the localities where Monterey fishermen have made their catches, statistics and value of the sardine landings, the fishing launches, and the types of nets and methods used in catching sardines. The author also discusses the installation of reduction plants for manufacturing fish oil and meal by utilizing sardine offal and "overage" (fish exceeding the daily canning capacity of a cannery).

This report is now being distributed free of charge, and anyone who wishes to secure a copy can do so by writing to the California State Fisheries Laboratory, Terminal Island, California.

THE COMMERCIAL FISH CATCH OF CALIFORNIA

Of interest to the general public and particularly to those engaged in the business of canning or handling the commercial fish catch of the state is the fact that there has just been released for distribution by the Division of Fish and Game, Fish Bulletin No. 20, "The Commercial Fish Catch of California for the year 1928." This is the second of a series of catch bulletins published by the staff of the Bureau of Commercial Fisheries and developed from the state's statistical records. The object in view is to bring out in a simplified form the outstanding developments in the fisheries during recent years as compared with the earlier years of the industry. In addition to tables giving the monthly figures of the catch by districts, there are graphic pictures comparing the catch of one year, one season, one species or one district with another, or several others, as the case may be. From these graphs even the uninitiated can see at a glance the relative importance of the various species and whether more or less of any particular fish, mollusk or crustacean was taken during 1928 than in former years.

Supplementing the statistical tables and charts there are articles which give in a very pleasing manner a great deal of interesting information concerning specific developments in certain fisheries and something of their history.

Southern California will be particularly interested in "Mackerel" and "The California Spiny Lobster" by Donald H. Fry, Jr., "Swordfish" by Annie Gillespie, "White Sea Bass" and "Yellowtail" by S. S. Whitehead, and "Halibut" by G. H. Clark. The mackerel fishery has had a most rapid development in recent years due to the fact that it has entered the lists of desirable cannery varieties. Swordfish, prized by the sportsmen, is becoming of importance in the commercial catch.

The quest for the tunas has brought about the development of boats of larger size in the southern fishing fleet and has opened questions of international interest. In "The Five Tunas and Mexico," Geraldine Conner tells of the exploitation of the marine resources off the coast of Mexico and as far south as Costa Rica by United States fishermen, and of the shipments of iced albacore from Japan and Hawaii which are packed in the California canneries.

Mr. W. L. Scofield's discussion of the state's most important commercial species, "Sardines," is brief, since that subject has been so thoroughly discussed in former papers; but his story of the "Squid" brings to light the facts about an important but little known fishery at Monterey.

"Shrimps" by G. H. Clark will bring back memories to old residents of the San Francisco Bay region of the fantastic Chinese junks which operated the shrimp nets in the early days. Mr. Clark's article on "Shad, Salmon and Striped Bass" will interest persons familiar with our river fisheries.

Under the title "Crabs," Geraldine Conner gives an interesting history of that choice crustacean which is found from Monterey north to the Oregon line. The catch figures for crabs in the San Francisco region are a fair example of the results of intensive fishing with ideal protection.

A list of scientific names compiled by Dr. Frances N. Clark is appended to the bulletin to make clear exactly what fishes are referred to in the text, and a number of general articles by the members of the staff of the California State Fisheries Laboratory completes the bulletin.

To our knowledge no other state or country has as yet gone so thoroughly into a general analysis of its catch figures or attempted to bring out in a form of interest to the general public so much valuable information concerning the statistics of its fisheries.

Copies of Fish Bulletin No. 20 may be obtained without charge upon application to the California State Fisheries Laboratory, Terminal Island, California.

REPORTS

SEIZURES OF FISH AND GAME

January, February, March, 1930

Abalone	1,170	Deer meat, pounds	675
Abalone, pounds	106	Deer hides and horns	7
Barracuda, pounds	750	Doves	2
Bass, striped	73	Ducks	495
Bass, black	3	Geese	12
Carp, pounds	200	Grouse	1
Clams	1,131	Jacksnipes	53
Crabs	305	Mudhens	2
Herring, pounds	9,530	Non-game birds	212
Lobsters	631	Pheasants	1
Salmon, pounds	2,091	Pigeons	3
Sturgeon, pounds	44	Quail	72
Spear, fish	8	Rabbits	12
Seines, nets	1	Shorebirds	2
Sunfish, perch, crappie	107	Squirrels	2
Trout, pounds	53	Bird net	1
Deer	8		

GAME CASES

January, February, March, 1930

Offense	Number arrests	Fines imposed	Jail sentences (days)
Hunting License Act; violations of	95	$2,335 00	
Deer; closed season; killing does; dogs running deer	47	2,375 00	600
Ducks; selling of; closed season	22	1,215 00	
Geese; closed season	2	50 00	
Mudhens; closed season	1		10
Non-game birds; killing of	20	560 00	
Pheasants; closed season	4	100 00	30
Pigeons; closed season	5	275 00	
Quail, closed season; trapping of	8	370 00	
Rabbits; closed season	6	75 00	
Shore birds; killing of	4	100 00	
Squirrel; closed season	2	205 00	
Firearms in refuge	2	50 00	
Commercial Gun Club License Act	1	55 00	
Nets, bird	2	110 00	
Night hunting	10	250 00	
Shooting from airplane	2	55 00	
Trapping License Act; no license	2	35 00	
Totals	235	$8,215 00	640

FISH CASES

January, February, March, 1930

Offense	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act; violations of	30	$845 00	80
Abalones; small; overlimit; closed season	105	1,840 00	5
Barracuda; small	2	50 00	
Bass, striped; small; oversized	8	285 00	
Bass, black; closed season	1		
Clams; small; overlimit	47	1,235 00	20
Cockles; small	4	75 00	100
Crabs; small	17	615 00	
Commercial Fishing License Act; violations of	40	850 00	
Crappie, perch, sunfish; small	13	325 00	
Halibut; overlimit	1	10 00	
Lobsters; small	8	445 00	
Nets, Seines; illegal	14	1,200 00	
Night fishing	4	200 00	
Pollution	4	600 00	
Salmon; closed season	4	200 00	
Trout; selling of; closed season	42	1,485 00	
Sturgeon; closed season	1	20 00	
Young fish; destroying of	2		
Illegal fishing apparatus	7	215 00	100
Reduction Act	4	25 00	
Totals	358	$10,520 00	305

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1930

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Anchovies							150		120
Barracuda									
Bonito									243
Carp				6,053	9,289	7,898	4,948		
Catfish		34,339		1,001	65,060	20,139			
Cultus Cod	14,664	93,408					156,052	15,336	36,282
Flounders	2,893	4,420				231	85,899	8	
Grayfish							109,346	3,500	280
Hake							2,578		
Halibut	33,276	6,027					6,023	11	8,498
Hardhead		27			11,064				
Herring	67,041	100	202,740				368,530		
Kingfish							840	11,489	31,586
Mackerel							66	1,572	405,012
Mackerel—Horse									295
Mackerel, Spanish									
Mullet									
Perch	17,669		37,596			10	10,517	189	2,862
Pike				199	2,732	757			
Pompano								101	
Rock Bass									
Rockfish	18,556	32,934	145				214,847	264,352	466,953
Sablefish	90,761	44,153					77,483	93,020	17,860
Salmon	4,286		9	3,955	8,093	7,173	6,800		
Sandabs		8,450					90,632	9,870	3,332
Sardines							7,981,843	40,885	96,276,725
Sculpin		224						260	192
Sea Bass—Black									
Sea Bass—White		77	130				1,450	16	425
Shad				302	34	825	420		
Shad—Buck				12,350	3,502	19,718	68		
Shad—Roe				9,692	2,827	15,558	16		
Sheepshead									

Skates							50,466	1,400	6,172
Skipjack									
Smelt	30,510		8,096			930	61,917	1,976	3,512
Sole		24,250					3,477,046	138,109	12,637
Splittail					7,350				
Striped Bass			591	17,702	33,797	126,189	18,906		
Suckers					1,954	32			
Swordfish									
Tomcod						138	4,212		
Tuna—Bluefin									
Tuna—Yellowfin									
Turbot			294				250		
Whitebait	31,294		908				71	31	16
Whitefish									
Yellowtail									
Miscellaneous	1,135	1,369	333		282		5,265	1,122	3,656
Total fish	312,085	249,778	250,842	51,254	145,984	199,598	12,736,641	583,247	97,276,658
Crustaceans:									
Crabs	[1]54,960						[3]591,648	[5]552	
Shrimps			179,668				145,585		
Spiny Lobsters									
Mollusks:									
Abalones									377,850
Clams—Cockle			24,219						
Clams—Mixed	5,848		175						
Clams—Pismo								24	5,799
Clams—Softshell			21,190			6,135	9,901		
Cuttlefish		687					2,419	515	11,089
Mussels							25		
Oysters—Eastern			[2]42,252				[4]116,765		
Oysters—Native			4,596				2,467		
Squid								585	117,651
Totals	372,893	250,465	522,942	51 254	145,984	205,733	13,605,451	584,923	97,789,047

All amounts shown in pounds unless otherwise specified. Skipjack and Albacore cleaned.
[1] 2,290 dozen.
[2] 192,055 Shell Oysters.
[3] 24,652 dozen.
[4] 530,750 Shell Oysters.
[5] 23 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1930—Continued

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into San Pedro.	Fish from south of the International Boundary brought into San Diego.	Total fish from south of the International Boundary brought into California
Anchovies		597			867			
Barracuda		109,058	295	8,217	117,570	122,425	52,751	175,176
Bonito	179	5,730	138	8,474	14,764	57,897	7,173	65,070
Carp					28,188			
Catfish					120,539			
Cultus Cod	127		63		315,932			
Flounders		859	152		94,462			
Grayfish	1,868	33,090	3,578	32,468	184,130			
Hake					2,578			
Halibut	67,957	166,314	19,597	86,440	394,143	60	31,853	31,913
Hardhead					11,091			
Herring	255				638,666			
Kingfish		96,886	239	734	141,774			
Mackerel	36	3,325,218	1,180,401	391,547	5,303,852		545	545
Mackerel—Horse		79,979			80,274			
Mackerel—Spanish						5,157	1,085	6,242
Mullet				86	86	474		474
Perch	630	33,018	66	328	102,885			
Pike					3,688			
Pompano		233			334			
Rock Bass	7,429	26,358	14,708	3,698	52,193	7,751	3,907	11,658
Rockfish	19,872	542,926	26,108	379,837	1,966,530		4,741	4,741
Sablefish		1,260	223		324,760			
Salmon					30,316			
Sandabs		3,488	45		115,817			
Sardines	7,162,198	158,662,715		3,168,946	273,293,312			
Sculpin		8,108	975	12,534	22,293			
Sea Bass—Black		11,788	1,510	5,761	19,059	7,105	28,382	35,487
Sea Bass—White	240	32,380	1,873	8,023	44,614	884	1,095	1,979
Shad					1,581			
Shad—Buck					35,638			
Shad—Roe					28,093			
Sheepshead	7,159	76,376	128	6,983	90,646	212	503	715

Skates	1,825	9,362	453	1,575	71,253			
Skipjack						67,260	1,308,793	1,376,053
Smelt	22,242	66,913	465	9,361	205,922		314	314
Sole	40,839	10,249	478	5,355	3,708,963			
Splittail					7,350			
Striped Bass					197,185			
Suckers					1,986			
Swordfish		227			227			
Tomcod					4,350			
Tuna-Bluefin		434			434			
Tuna—Yellowfin						1,870,165	7,938,092	9,808,257
Turbot					544			
Whitebait					32,320			
Whitefish	135	42,868	867	19,274	63,144	104	5,181	5,285
Yellowtail	84	272		3,628	3,984	227,456	79,906	307,362
Miscellaneous		27,562	1,492		42,216	222,979	42,830	265,809
Total fish	7,333,075	163,374,268	1,253,854	4,153,269	287,920,553	2,589,929	9,507,151	12,097,080
Crustaceans:								
Crabs					[a]647,160			
Shrimps					325,253			
Spiny Lobsters	14,239	30,720	3,455	23,551	71,965		663,725	663,725
Mollusks:								
Abalones					377,850			
Clams—Cockle		7,153	2,196		33,568			
Clams—Mixed					6,023			
Clams—Pismo	22,782				28,605			
Clams—Softshell					37,226			
Cuttlefish		54	18		14,782			
Mussels					25			
Oysters—Eastern					[b]159,017			
Oysters—Native					7,063			
Squid		29,621		1,112	148,969			
Totals	7,370,096	163,441,816	1,259,523	4,177,932	287,778,059	2,589,929	10,170,876	12,760,805

[a] 26,965 dozen.
[b] 722,805 Shell Oysters.

CORRECTION

In the October issue of CALIFORNIA FISH AND GAME, pages 358 and 359, California Fresh Fishery Products Report for Alameda-Contra Costa district should read: Salmon 112,509 pounds, carp 10,642 pounds, total fish 1,327,465 pounds. On pages 360 and 361, there should be added to the total for the state 4,270 pounds of salmon and 295 pounds of carp.

STATEMENT OF EXPENDITURES

For the Period July 1, 1929 to March 31, 1930 of the Eighty-first Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive and legal	$12,614 94		$24 70	$15 40	$12,655 04
Clerical and office	13,838 90	$931 40	733 91	165 99	15,670 20
Printing		9,712 10			9,712 10
Automobiles		188 87	18 00		206 87
Traveling			3,512 74		3,512 74
Postage			3,423 87		3,423 87
Telephone and telegraph			3,474 68		3,474 68
Freight, cartage and express			1,721 11		1,721 11
Rent			12,385 62		12,385 62
Heat, light and power			221 33		221 33
Accident and death claims			3,432 02		3,432 02
Accounting pro rata	3,600 00				3,600 00
Legal			249 75		249 75
Publicity			29 65		29 65
Total administration	$30,053 84	$10,832 37	$29,227 38	$181 39	$70,294 98
Education and research:					
Chief and assistant	$5,466 94		$10 00	$6 46	$5,483 40
Clerical and office	1,542 00	$162 25	168 59	340 01	2,212 85
Traveling			2,389 25		2,389 25
Photographer	900 00		208 75	1,053 15	2,161 90
Librarian	1,440 00	81 48	56 29	248 71	1,826 48
Exhibits			40 00	75 00	115 00
Research	3,012 54	287 90		470 34	3,770 78
State fair	276 00	260 71	800 35		1,337 06
Printing		34 80			34 80
Lecturers	2,145 00				2,145 00
Freight, cartage and express			2 00		2 00
Publicity			38 75		38 75
Total education and research	$14,782 48	$827 14	$3,713 98	$2,193 67	$21,517 27
Publicity:					
Chief of Bureau	$1,650 00		$253 61		$1,903 61
Traveling			39 40		39 40
Total publicity	$1,650 00		$293 01		$1,943 01
Patrol and law enforcement:					
Chief and assistants	$9,485 00			$11 55	$9,496 55
Clerical and office	2,200 00	$109 69	$20 97		2,330 66
Automobiles		2,219 99	1,147 74		3,367 73
Traveling			103,683 00		103,683 00
Captains and deputies	157,733 77	411 12	1,516 10	744 15	160,405 14
Fish planting	1,776 77	542 87	998 00	828 00	4,145 64
Watchman	45 00				45 00
Launches	1,530 00	797 36	427 01	57 54	2,811 91
Volunteer deputies	555 00	38 50	5 00		598 50
Premiums on bonds			3,281 00		3,281 00
Freight, cartage and express			4 77		4 77
Rent			300 81		300 81
Total patrol and law enforcement	$173,325 54	$4,119 53	$111,384 40	$1,641 24	$290,470 71
Commercial fisheries:					
Chief and assistants	$7,875 00			$7 47	$7,882 47
Clerical and office	6,704 39	$152 99	$60 59	31 24	6,949 21
Automobiles		181 91	72 36	506 02	760 29
Traveling			14,575 96		14,575 96
Research	4,877 50				4,877 50
Captains and deputies	11,428 03	122 96	31 07	112 70	11,694 76
Launches	3,735 00	1,416 08	1,285 09	26 90	6,463 07
Statistics	2,205 00	457 98			2,662 98
Laboratory	23,676 08	688 86	1,645 88	389 80	26,400 62
Fish tags		412 50			412 50
Botulism			11,250 00		11,250 00
Hydro-Biological Survey, Monterey Bay			750 00		750 00
Inspectors	28,289 50				28,289 50
Postage			20 00		20 00
Freight, cartage and express			57 71		57 71
Heat, light and power			7 49		7 49
Total commercial fisheries	$88,790 50	$3,433 28	$29,756 15	$1,074 15	$123,054 06

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1929, to March 31, 1930, of the Eighty-first Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Fish culture:					
Chief and assistants	$4,950 00				$4,950 00
Clerical and office	2,925 00	$62 58	$14 00	$3 05	3,004 63
Automobiles		3,535 42	1,632 12	1,771 31	6,938 85
Traveling			9,486 36		9,486 36
Telephone and telegraph			633 59		633 59
Rent			1,005 13		1,005 13
Heat, light and power			620 61		620 61
Hatcheries	95,820 31	41,875 45	2,123 23	2,626 67	142,443 66
Hatcheries—additions and betterments				7,199 49	7,199 49
Special field investigations	8,675 00	18 97	218 08		8,912 05
Fish cars		127 21	1,203 84		1,331 05
Freight, cartage and express			1,035 56		1,035 56
Blue printing			8 00		8 00
Total fish culture	$112,370 31	$45,617 63	$17,980 52	$11,600 52	$187,568 98
Hydraulics:					
Chief and assistants	$4,515 00		$18 37		$4,533 37
Clerical and office		$21 58	27 25		48 83
Automobiles		345 69	125 15		470 84
Traveling			1,102 84		1,102 84
Cooperative research	2,250 00	2 10	38 25		2,290 35
Blue printing			15 88		15 88
Total hydraulics	$6,765 00	$369 37	$1,327 74		$8,462 11
Game propagation:					
Superintendents	$3,635 00				$3,635 00
Automobiles		$241 08	$41 39	$864 51	1,146 98
Traveling			1,826 64		1,826 64
Heat, light and power			318 73		318 73
Laborers	5,488 79				5,488 79
Maintenance		6,858 47	936 09	2,762 38	10,556 94
Telephone and telegraph			106 30		106 30
Freight, cartage and express			16 00		16 00
Total game propagation	$9,123 79	$7,099 55	$3,245 15	$3,626 89	$23,095 38
Fish rescue:					
Chief and assistants	$3,544 00	$3 69	$102 60	$4 10	$3,654 39
Traveling			1,294 72		1,294 72
Rent			99 00		99 00
Total fish rescue	$3,544 00	$3 69	$1,496 32	$4 10	$5,048 11
Game refuge:					
Chief and assistants	$2,999 97				$2,999 97
Clerical and office	1,350 00	$5 27	$1 25		1,356 52
Automobiles		378 74	262 82		641 56
Traveling			999 26		999 26
Lion hunters and trappers	5,309 12				5,309 12
Refuge posting	2,104 71	73 53	49 92		2,227 96
Game refuge supplies		40 58	44 37		84 95
Lion bounties			5,350 00		5,350 00
Total game refuge	$11,763 80	$497 92	$6,707 62		$18,969 34
License commissions			$42,801 71		$42,801 71
Purchase of game refuges					4,334 25
Construction of Russian River jetties					17,750 00
Expenditures to pay claims for return of fish and game licenses					83 50
Expenditure to pay claim of Harry L. Hopper					658 50
Purchase of Hungarian partridges					4,439 73
Prior year					172,684 27
Grand total			$42,801 71		$993,175 91

STATEMENT OF INCOME

For the Period July 1, 1929 to March 31, 1930, of the Eighty-first Fiscal Year

	Detail	Total
License sales:		
Fish breeders' licenses, 1929	$75 00	
Angling, 1930	6,038 00	
Angling, 1929	393,407 95	
Hunting, 1930	10,620 00	
Hunting, 1929	447,716 87	
Wholesale fish packers and shell fish dealers', 1929-1930	1,16› 00	
Wholesale fish packers and shell fish dealers', 1928-1929	20 00	
Game breeders' licenses, 1930	630 00	
Game breeders' licenses, 1929	105 00	
Fish breeders' licenses, 1930	370 00	
Trapping licenses, 1929-1930	4,090 00	
Commercial hunting club, 1929-1930	2,615 00	
Commercial hunting club operators, 1929-1930	755 00	
Deer tag licenses, 1929	115,471 80	
Kelp licenses, 1929	10 00	
Kelp licenses, 1930	30 00	
Market fishermen's licenses, 1929-1930	28,940 00	
Market fishermen's licenses, 1930-1931	890 00	
Fish importers' licenses, 1929	55 00	
Fish importers' licenses, 1930	90 00	
Total license sales		$1,013,094 62
Other income:		
Game tag sales	$34 98	
Court fines	70,047 81	
Fish packers' tax	131,556 87	
Kelp tax	90 52	
Fish tag sales	2,539 29	
Miscellaneous sales	902 03	
Interest on bank balances	4,151 92	
Total other income		209,323 42
Total departmental income		$1,222,418 04

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