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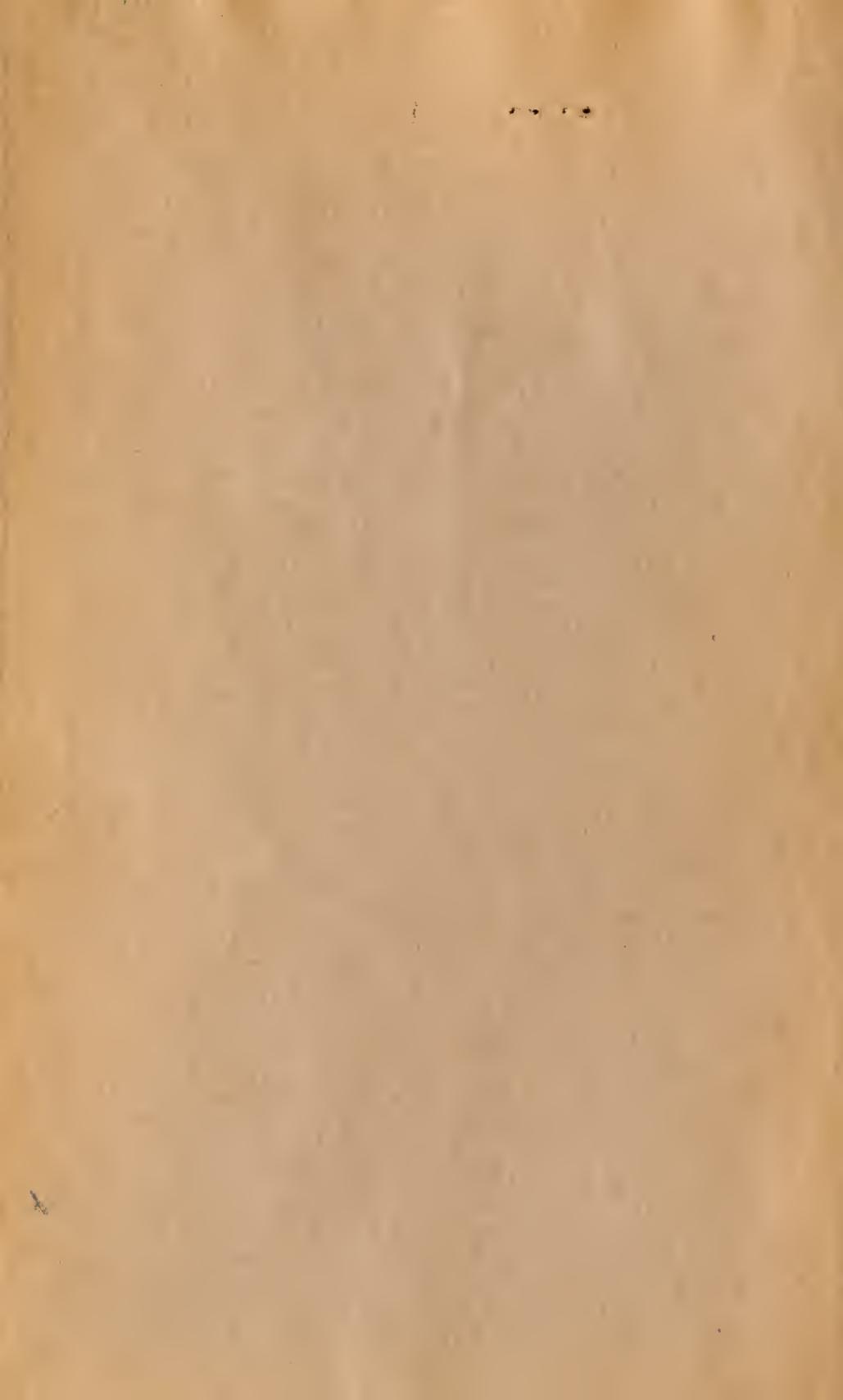
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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION."

Volume 14

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Number 1

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THE SEA LIONS OF CALIFORNIA.

By PAUL BONNOT.

(With eight photographs and two maps by the author.)

Most of the larger mammals of California have been extensively studied. As a result of these studies, a few have been reduced to the point of extermination because it has been shown that they are detrimental to man. The majority, however, are protected by law as they do not conflict with man's commercial pursuits, and in some cases are rated as beneficial. The sea lions have not been studied to any extent

and very little is known about them. Nevertheless, determined efforts have been made from time to time to exterminate them. Late in 1926, the fishing industries complained to the Fish and Game Commission regarding the depredations of the sea lions, and asked that their numbers be reduced. The writer was detailed by Mr. N. B. Scofield, head of the Department of Commercial Fisheries of the Division of Fish and Game, to make a survey of the marine mammals of the state, to investigate the claims made by the fishermen and to determine the present status of these animals. This survey will be continued for several years. This year's work has resulted in a great deal of authentic data and several interesting conclusions, some of which are dealt with in the present article.

There are two species of sea lions found on the coast of California:



FIG. 1. An adult bull California sea lion at Flea Island. This animal seemed unafraid of the photographer. June 13, 1927.

Steller's sea lion (*Eumetopias stelleri*) and the black or California sea lion (*Zalophus californianus*).

Steller's sea lion is found from Bering Sea to Santa Cruz Island. The breeding range is from Bering Sea to Santa Rosa Island. They are found the year round throughout their range, though the bulls, for the most part, disappear during the winter and spring. The general opinion seems to be that the bulls migrate to Alaska during this time. The animals are light gray in color when wet, which turns to light brown when dry. The bulls are much larger than the cows. A full-grown bull will weigh between 1500 and 2000 pounds, while the cows will weigh between 600 and 1000 pounds.

The California sea lion is found from the Farallon Islands south to central Mexico. The breeding range is from Point Piedras Blancas to an unknown point in Mexico. In the past, the California sea lion

was fairly abundant and probably maintained rookeries as far north as the Farallons. They have been recorded as far north as Puget Sound. At the present time, they are rare north of Point Piedras Blancas, in San Luis Obispo County. The California sea lion is dark brown in color when wet, and an ochre yellow or brown when dry. The bulls weigh from 800 to 1000 pounds, and the cows from 500 to 700 pounds. The skull of the bull has a high keel which gives the profile of the face a concave outline.

Sea lions are polygamous animals, one bull generally taking care of from five to twenty cows. They begin to collect on the rookeries during May. The pups are born from June to the middle of July. They must be taught to swim and are generally not proficient in the water for about six weeks. By the end of August or middle of September, the bulls leave and the rookery is broken up. A few animals may be found on the regular rookeries at all times.

Some General Habits of Sea Lions. As sea lions pass most of their lives in the water, they would naturally be expected to be fine swimmers. In the water the front flippers are used for swimming, the hind ones trailing behind. They can swim readily on either the belly, sides or back. A favorite method of progression seems to be to rotate slowly on the long axis. I have seen yearlings jump clear of the water, make a graceful arc and go in head first, like a porpoise. I have never seen an adult do this. Mr. N. B. Scofield tells me he has seen adult sea lions, at the mouth of the Klamath River, riding the surf in the same manner as men using surf boards. The animals repeated this again and again, and were evidently doing it for amusement. The adults, when landing on a steep bank, will sometimes shoot up from a wave as much as five or six feet. In moving on land they are clumsy, yet they can move with surprising speed. The front flippers are used as a base, the hind ones drawn under and the animal springs forward on them, the front flippers being hitched forward at the same time. They will dive into the water from considerable heights; and I once saw a Steller bull leap from a rock down ten or twelve feet to a gravel beach, where he landed on his chest and continued his course to the water, apparently none the worse.

Sea lions can see a moving object very well, but do not seem to clearly see a stationary object. I have on several occasions stood or sat in full view, using my glasses and making notes, and no notice was paid to me by animals thirty or forty feet away. When I started to move off or rose to my feet, however, nearly every animal in sight saw me at once.

They do not seem to have a very keen sense of smell. They use this sense as a means of identifying one another, as do dogs, but give little indication that it is useful for distant odors.

Their hearing is also rather poor. On several occasions I have walked up to blind animals, taking no particular pains to remain quiet, and though they seemed to sense my presence, it did not seem to be through the sense of hearing.

On the hauling grounds and rookeries, the sea lions practice no sort of sanitation, as do some animals. The places frequented by them are rocky and uneven, and therefore catch debris, such as excreta and dead animals. These are trampled underfoot and left. In consequence,

a sea lion rookery is very dirty underfoot and, at close range, very evident to the olfactory nerve.

Sea lions are both diurnal and nocturnal. It is not easy to observe their comings and goings at night but, from the continual uproar, they are as active by night as by day. When on the rookeries at the breeding season, they seem to spend a great deal of their time sleeping on the rocks. At other seasons they move up and down the coast a short distance, swimming in small schools and fishing. On two occasions I watched several fishing at night, their movements being easily followed by the line of phosphorus in the water, and their loud "whosh" when they came up to blow.

At Ano Nuevo the rookeries seem to be conducted as are the rookeries of the fur seal. That is, a large bull, by right of might, collects a



FIG. 2. A blind, young bull California sea lion at Point Bennett. Blindness is occasionally encountered and may be counted a natural check on abundance. June 10, 1927.

varying number of cows, drives off all other bulls and manages his "harem" himself. He will fight desperately for his small piece of territory or to retain his cows, maintaining his stand for the whole breeding season, not even leaving to eat. At all other rookeries I visited, however, this does not apply. I saw no evidence of the so-called harems. The bulls, old and young, were mixed up indiscriminately on the rookeries. There was little or no fighting. I saw only one California bull who was cut about the chest as though he had been fighting. The nearest approach to fighting was a more or less continual wrangling among the cows, which, though noisy, seemed never to go beyond the point of making a few passes at each other.

In this regard, it might be well to mention that the Ano Nuevo rookery is unique in another way. The animals there are evidently more used to man and have enjoyed protection for so long that they do not act toward him as at other places. At all other places it was necessary to "sneak" up to the animals in order to count and observe them; but at Ano Nuevo, although most of the cows and some of the bulls will "unload" upon the appearance of a man, the big herd bulls will not only stand their ground but will actually chase a man who gets too close. Generally, they will not press the matter, but as they look as big as an ox and weigh close to 2000 pounds, it behooves the investigator to respect their dignity and give them room.

The cows will sometimes form what are known as "rafts." They lie together in the water in small or large bunches, apparently asleep, swinging with the action of the water. Here and there in the compact group a flipper will be elevated. The rafts seem to be formed by cows nearing the pupping time. Each cow has but one pup a year. The pup can not swim for several weeks after birth, but even when first born, it has a natural instinct for the water. I have seen a young pup go overboard and get a mauling from the breakers but, upon stranding on the beach, half-drowned, it not only met my attempts to help with a defiant squall but plunged back into the next wave. On such occasions they desperately work their flippers up and down, but until the use of the flipper is learned and breathing is coordinated, they are more helpless in the water than the average terrestrial animal. The bulls pay no attention whatever to the pups, and the cows seem only interested in their own. I have several times seen a bull, while stampeding or love-making, step on a pup that happened to be in the way, and its frantic squalls were lost in the uproar of the occasion. The cows seem to know their own pups, and when coming ashore will hunt their own. Another's pup, however, is treated rather roughly. I have seen a cow pick up a pup in her mouth and throw it at least 10 feet with a vicious side jerk of her head. On two occasions, while examining and photographing pups, a cow called just outside the breaker line. Her call sounded exactly like an ordinary domestic cow calling her calf. The pup, at my feet, evidently recognized the cow, as it stiffened up and answered the call with a high-pitched squall.

Sea lions are gregarious animals but I would not call them social. They ordinarily travel about in small groups, and collect, of course, in large numbers on the rookeries; but they seem to conduct themselves toward their fellows on a strict *laissez faire* basis. When lying about on shore, there is a continual snarling and growling and if, in moving about, one animal happens to tread on another there is at once an uproar. These disturbances seldom amount to anything, but there is little that is amiable about them.

There seems to be little or no definite communication among sea lions. Mr. Alvin Seale, of the Steinhart Aquarium, first called my attention to the fact that they seem to communicate by touching their noses together. The sea lions at the aquarium do this. I watched for it on the rookeries and saw it many times. Each animal has, no doubt, a definite scent, and they either use this habit of touching noses as a means of identification, as everyone has seen dogs do, or there may be a more definite exchange of ideas. At Seal Harbor, San Clemente

Island, I saw a half-drowned pup, squalling and splashing a hundred feet from the beach. Several cows swam up to it, touched its nose and then, evidently finding it not their own, went on their respective ways and left it. Evidently its own mother was beyond the sound of its call, as its cries went unheeded until it drowned.

Each species has several distinctive calls but none of them seems to convey much intelligence to other members of the same herd. After stampeding into the water when alarmed by a landing party, the animals swam up and down the rookery, just outside the breakers, roaring or barking, according to the species. There were generally several individuals too sleepy or too lazy to leave with the herd, and these paid no attention whatever to the loud uproar kept up by their fellows in the water. They only departed, in great haste, when touched.



FIG. 3. Sea lion pups after a little handling become fairly tame. Gull Island. June 14, 1927.

Once, several of us sneaked up on a sleeping bull, the photographer focused his camera, and then with a touch of the foot, the bull was awakened to furious haste.

The call of the Steller sea lions consists of a deep, hoarse roar. Both sexes have this, the bull's roar being deeper and louder. The cows "baa" for the pups, and the pups answer with the same sound, about two octaves higher.

The California sea lions make a "honking" bark, repeated steadily. They also make a smooth howl that sounds exactly like a hound. The cows and pups call as do the Stellers.

Both species snarl and growl when angry or frightened. When suddenly awakened from a sound sleep and finding themselves sur-

rounded by several men, both species of all ages emit a loud, quavering "Ah" of surprise and fear.

In captivity, sea lions do very well. They are docile, intelligent and fairly hardy. They are subject, to some extent, to pulmonary disorders. The cows only are used for exhibition purposes and for performing acts. These are, for the most part, California cows, but occasionally a Steller cow is put on exhibition. The bulls are too large and pugnacious to be readily handled. California bulls have been taken but an adult Steller bull has never been captured.

The impression of the rookeries most vividly remembered is the continual uproar of sound. This is seldom or never absent. While on the rookery, talking in an ordinary tone of voice is heard with difficulty. The sound ebbs and flows like the roar of the surf, with here and there a sudden breaking through of sharper sound by some individual that happens to be close at hand or that has been trodden on by one of its fellows and voices its protest.

History of Sea Lions in California. Before 1860, sea lions were extremely numerous along the California coast. During the sixties, they were commercially valuable and their numbers therefore steadily decreased until the late seventies, when the products gained from them (oil and hides) were bringing such a low price that it was unprofitable to hunt them.

Seammon, in 1874, says, "A few years ago great numbers of sea lions were taken along the coast of upper and lower California, and thousands of barrels of oil obtained. The number of seals slain exclusively for their oil would appear fabulous when we realize the fact that it requires, on an average, throughout the season, the blubber of three or four sea lions to produce a barrel of oil. Their thick, coarse-grained skins were not considered worth preparing for market, in a country where manual labor was so highly valued. At the present time, however, they are valuable for glue stock, and the seal hunter now realizes more comparative profit from the hides than from the oil."

In 1899, the sea lion question in California became acute. At the behest of the fishing industries, the Fish and Game Commission called a meeting in San Francisco to discuss the situation and to decide on a course of action. The fishing industries were represented and several scientific men attended. The conclusions arrived at by this conference were that the sea lions were too numerous, that they were destructive to the fishing industries and that their numbers should be reduced. As most of the large rookeries were located on lighthouse reservations, the Commissioners wrote to the Honorable Lyman Gage, Secretary of the Treasury, for permission to kill sea lions on the federal lighthouse reservations. This request was granted on April 27, 1899. The Commission sent two men to the Farallone Islands and two to Ano Nuevo Island, both lighthouse reservations, but before any killing had been done the permission was revoked by wire, on May 31st.* On June 9th, a letter from the Treasury Department gave the information that the suspension was due to protests from the United States Fish Commission, the Secretary of the United States Department of Agriculture,

* Mr. Walter Welch, Field Agent for the Fish and Game Commission, tells me that in 1899 he was a deputy for the Commission in Santa Cruz County and that before the Lighthouse Board canceled the permission to kill sea lions on the reservation, several thousand were killed at Ano Nuevo.

the New York Zoological Society and various others. The California Commission stated its case at greater length, and the United States Commissioner of Fisheries withdrew his opposition. The other prot-estants, however, could not be induced to withdraw their opposition and the Lighthouse Board refused to cancel the suspension.

While this controversy was at its height, in the summer of 1899, Professor L. L. Dyche, of the University of Kansas, made examinations of sea lion stomachs at Monterey and found only squid contained therein, although at the time salmon and other fish were plentiful in the bay. Dr. C. H. Merriam, in *Science*, May 17, 1901, uses this work of Dyche's in an article in support of the contention that the sea lions are not detrimental to the fishing industry.

In 1900, the Lighthouse Board still refusing to grant permission to kill sea lions on the federal reservations, the California Commission asked for the appointment of a special commission to investigate the matter thoroughly. This commission was appointed. It consisted of Cloudsley Rutter, chairman; R. E. Snodgrass, named by the California Fish and Game Commission, and E. C. Starks from the California Academy of Sciences. This commission studied the sea lions in California and its findings were published in the Commissioner's Report of the United States Commission of Fish and Fisheries for 1902. They came to the conclusion that little damage was done to fishing gear by the sea lions. In regard to food, they arrived at the conclusion that the Steller sea lion is largely a fish consumer and the California sea lion is largely a squid eater. "It seems apparent, however, that either species feeds on whatever is most convenient."

Although the California Commission could not kill sea lions on the federal reservations, they were so confident of the correctness of their stand that several of their deputies were ordered to hunt sea lions and a great many were killed. Their report of 1901-1902 states, "The action of this Commission in causing a reduction of the sea lion herds, the killing of which was carried on for a few weeks in the spring of 1899, also in 1900, because of the inroads made on the supply of food fish, particularly salmon, has been the subject of more or less newspaper criticism. It arose chiefly from the groundless fear that one of the picturesque features of San Francisco the Seal Rocks, would be destroyed.* When our methods, scene of operation, and reasons therefor were made known, the criticism quickly subsided. Though no seals have been killed for more than two years, it is a fact that not since that time have they been seen in any numbers in the bays and rivers, and complaints about damage to nets and taking of fish have been very infrequent."

Between 1902 and 1909 little was heard of the sea lions. Captain H. B. Nidever, of San Pedro, has supplied me with the information that in 1907 and 1908 several men systematically hunted sea lion bulls at San Miguel Island and killed practically all the bulls of breeding age.

In 1909 the sea lions had been so reduced that several natural history societies and interested parties sponsored a bill for their protection, "forbidding the killing, maiming or capturing of sea lions in the waters

* Mr. John Rowley, of the Los Angeles Museum, has in his possession a picture taken in 1889 which shows a flourishing rookery of Steller sea lions on the Seal Rocks at San Francisco. This place is and has for a long time been only a hauling ground.

of Santa Barbara channel and on land adjacent thereto, or in fish and game district nineteen." This was primarily to prevent the extermination of the California sea lion.

Since 1909 there has been no organized killing, though a small but steady drain has been acting on the herds. Several individuals add to their incomes by killing the breeding bulls for the penis and testicles, known to the trade as "trimmings." These are sold to the Chinese, who manufacture a medical preparation supposed to rejuvenate the aged. A number of California sea lions are taken annually to be used for exhibition purposes in zoological gardens and circuses. This species is used almost exclusively, as the Steller is too large and difficult to handle.

In 1927 the fishing interests of San Pedro and Santa Barbara sponsored a bill (Senate Bill No. 547, introduced by Senator Charles W.



FIG. 4. Bull sea lion trimmings hung up to dry on San Miguel Island. When dried they are sold to the Chinese who manufacture from them a medical preparation supposed to rejuvenate the aged. June 16, 1927.

Lyon, of Santa Barbara), which would have repealed section 637c of the Penal Code, the law of 1909. If this had passed, it would have taken all protection from the sea lions in California. This was subsequently withdrawn. Another bill (Assembly Bill No. 820, introduced by Assemblyman Morgan Keaton, of Long Beach) would have given the Fish and Game Commission power to control the seals and sea lions "where it determined such reduction was necessary." This also was withdrawn. A third bill relating to sea lions (Assembly Bill No. 199, introduced by Assemblyman T. R. Finley, of Santa Barbara), which passed both houses and was signed by the Governor May 17, 1927, affords protection to the California sea lion only, in fish and game

districts 19, 20 and 20A. This is approximately the same territory covered by the old law, but is more definite as to boundaries and includes Catalina Island, which was not in the previous law. This law became effective July 29, 1927.

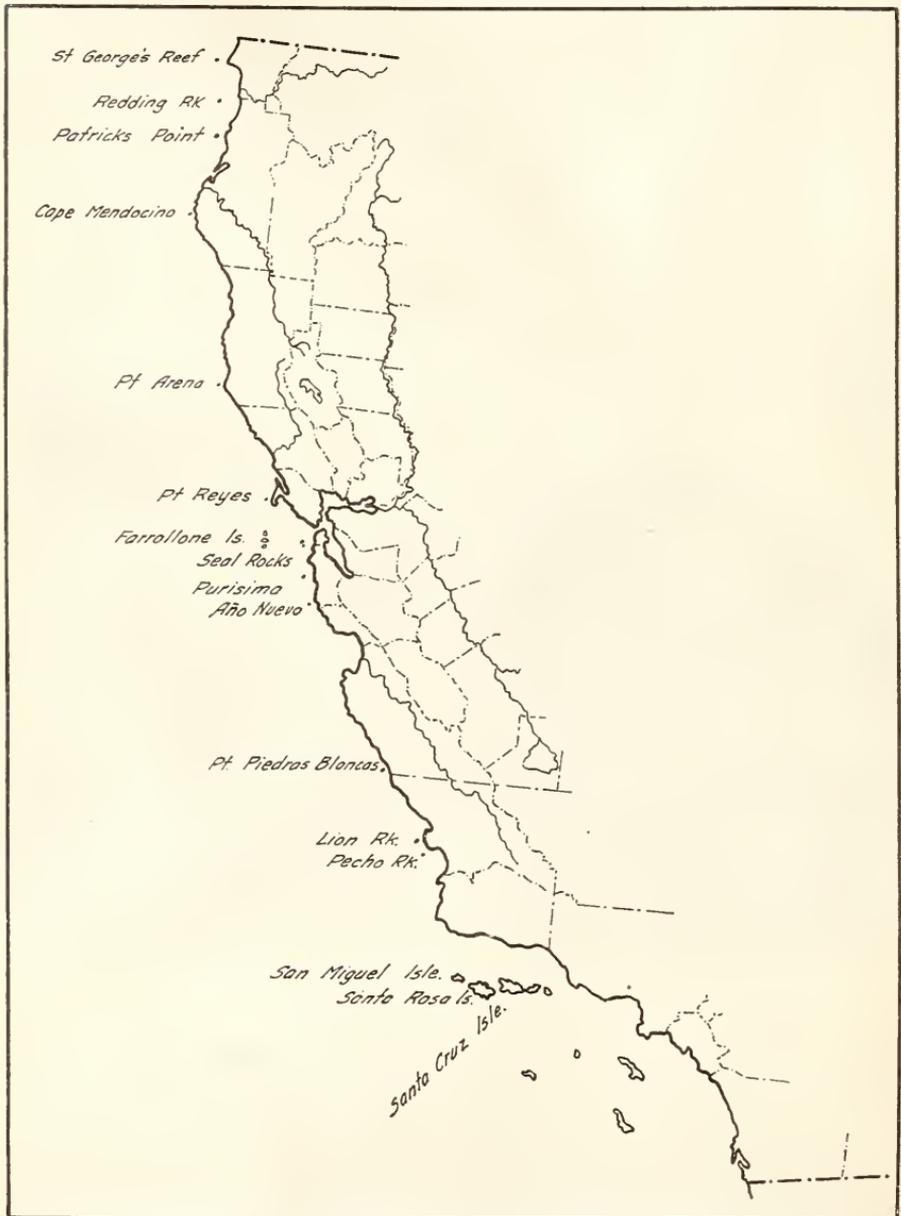


FIG. 5. Rookeries and hauling grounds of the Steller sea lion, *Eumetopias stelleri*, on the coast of California.

For the last twenty years, the information concerning sea lions has been confined to short notes by scientific men and to complaints of fishermen. The scientific man, with little authentic data, is cautious

when expressing an opinion. The fisherman, however, talks of thousands, and a vast amount of damage. The facts show that the numerical strength of the sea lion herds has been greatly exaggerated. The fol-

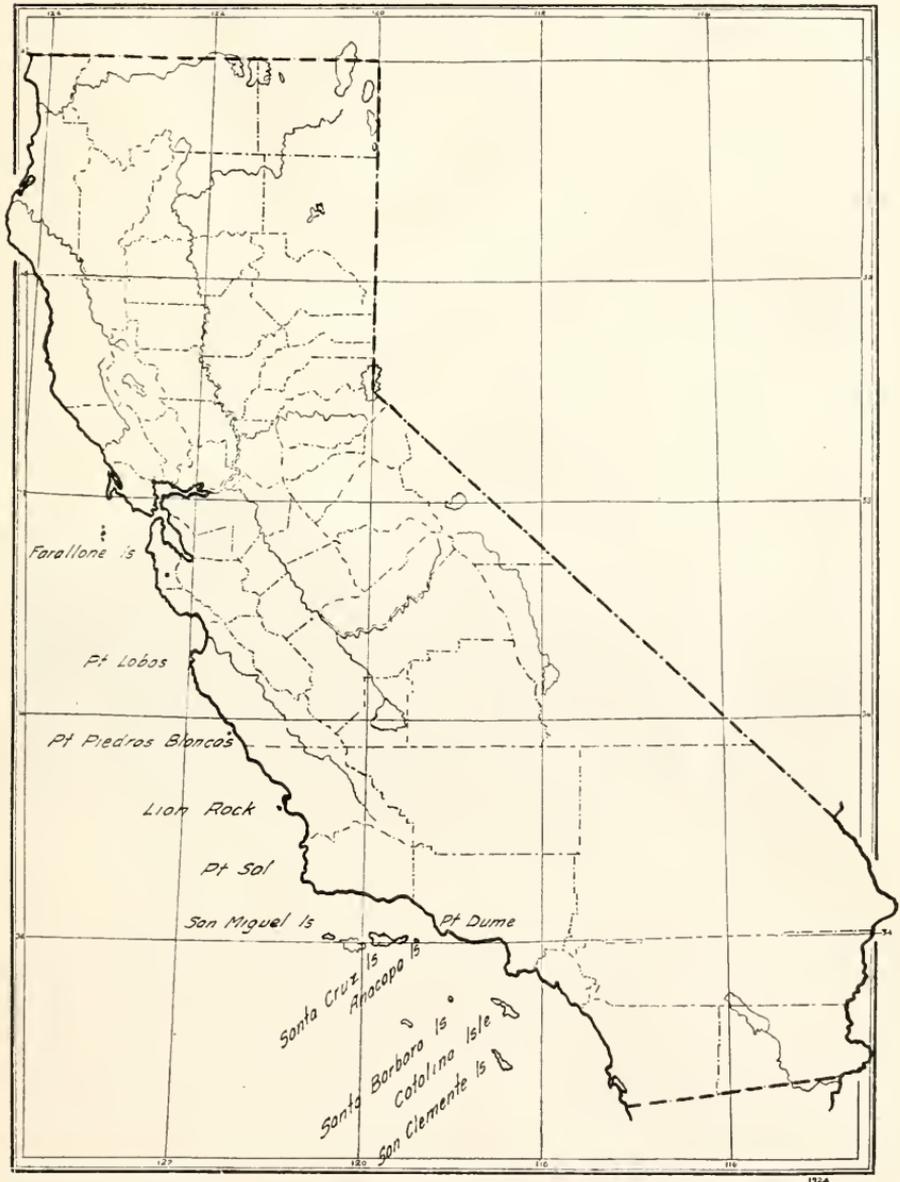


FIG. 6. Rookeries and hauling grounds of the California sea lion, *Zalophus californianus*, on the coast of California.

lowing maps and table will show more clearly than a written explanation the present status of population of the sea lions:

<i>Rookery</i>	<i>Steller</i>	<i>California</i>
St. George Reef-----	1500	---
Redding Rock-----	200	---
Patrick's Point-----	200	---
Cape Mendocino-----	700	---
Point Arena-----	300	---
Point Reyes-----	15	---
Farallon Islands-----	700	6
Purisima-----	150	---
Año Nuevo-----	1500	---
Point Piedras Blancas-----	212	86
Lion Rock (San Luis Obispo County)-----	86	21
Pecho Rock-----	135	7
Point Sal-----	---	10
Point Dume-----	---	11
Point Bennett-----	31	42
Offshore Rock-----	41	---
Lion Rock-----	8	---
Flea Island-----	275	107
Richardson Rock-----	199	---
Wilson Rock-----	41	---
Sandy Point-----	49	---
Frazer Point-----	2	63
Gull Island-----	18	145
Tyler Bay-----	---	5
Anacapa Island-----	---	34
Santa Barbara Island-----	---	125
Catalina Island-----	---	15
Castle Rock-----	---	29
Seal Harbor-----	1	235
Totals-----	6363	941

Point Bennett, Offshore Rock, Lion Rock, Flea Island, Richardson Rock and Wilson Rock are located about the west end of San Miguel Island. Sandy Point is at the west end of Santa Rosa Island. Frazer Point and Gull Island are at the west end of Santa Cruz Island. Castle Rock is at the southwest end of San Clemente Island, and Seal Harbor lies on the south side of San Clemente.

Present Economic Status. That the sea lions eat fish is, I think, a statement which few men at present will question. There is no doubt in my own mind that they do eat fish. They also eat squid and octopii, crustacea and "occasionally birds."* The fact that the sea lions eat fish does not seem to me to carry a great amount of weight in contending that they should be destroyed. Their fish diet is not confined to any one species. They eat, indiscriminately, commercially valuable fish and worthless ones. Having such a catholic taste; they destroy quantities of such fish as dogfish and morays, mollusks such as squid and octopii, and crustacea such as deep-water crabs which have little or no commercial value. The dogfish, morays and octopii are predacious and interfere to a greater or lesser extent with commercial fishing, having little commercial value themselves.

The sea lions may also be holding in check organisms of which we know nothing, which, if allowed to develop unchecked, through the

* I am rather skeptical in regard to this bird-eating habit, as I have seen no indication of it. Some of the sea lion rookeries are on rocks which also support large bird rookeries. The bird rookeries are close to, and easily accessible to, the sea lions, but I have seen nothing that would indicate that the sea lions ever raided them.

extermination of the sea lions, might be far more destructive to fishing than the sea lions are at present, and a great deal more difficult to deal with.

The fishing industries are not, at the present time, suffering from the depredations of the sea lions to such an extent that any extensive reduction in their numbers is necessary.

Natural Enemies of Sea Lions. Sea lions have a number of natural checks on their increase acting at all times. The rate of mortality among the pups is very high. Numbers of them are drowned each year; they are crippled or killed outright by being trodden on by the adult members of the herds; and some starve, as when they become lost, the cows do not make any prolonged search for them, and another cow will have nothing to do with them. The greatest enemy of the adults are the killer whales (*Orca*). Several men have described to me the

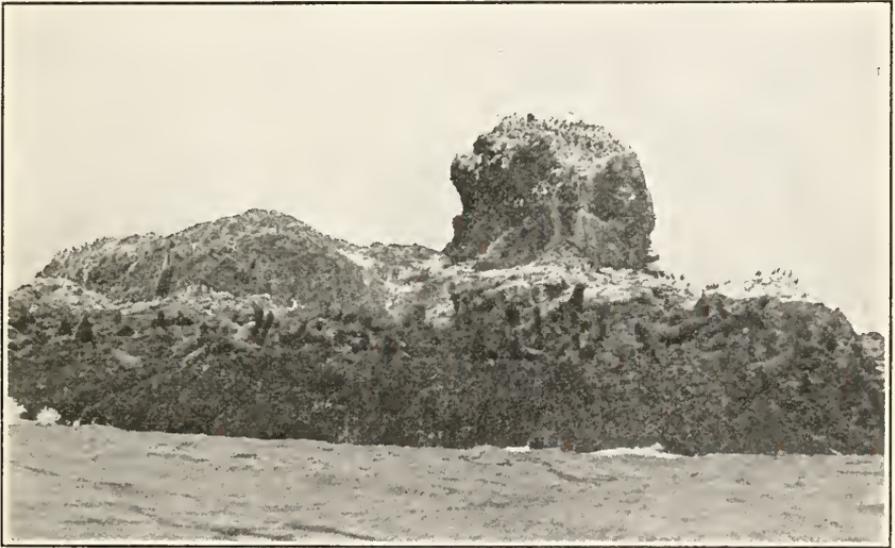


FIG. 7. Part of the Piedras Blancas rookery of sea lions. Both species are present. June 5, 1927.

panic which runs through a sea lion herd on the appearance of these savage animals. An orca which was killed at the Pribilof Islands some years ago contained eight adult fur seals. Their capacity and ability to capture such fast-swimming animals as eared seals can be gauged from this. Large sharks no doubt get a few sea lions. In 1925, while I was at Monterey, California, a cow fur seal (*Callorhinus*) was brought to me for identification. It had been found on the beach north of Monterey, in a dying condition. It was still warm when I saw it. It had been bitten through the body just anterior to the hind flippers and the backbone was broken. The bite was undoubtedly that of a shark.

Sea lions seem to be fairly free from disease. During the survey three animals were observed which were blind. These were all California sea lions. A young bull was the first observed at Point Bennett, San Miguel Island, on June 10th. At Frazer Point, on June 14th, there

was a full grown bull, and at Gull Island on the same date was another, both totally blind. These animals were all in good condition, the conclusion being that the diseased condition was of recent origin. It was possible to observe these animals at close range. The disease seems to be an infection of the conjunctiva, leaving the eye covered with a bluish white film. Whether the eye itself is affected or whether the animal recovers before falling prey to some of its enemies I do not know. Animals with a handicap of this sort do not long survive in the natural environment. Whether this represents an epidemic or a usual condition will be an interesting future study.

Prof. G. F. Ferris, of Stanford University, tells me there are two species of sucking lice found on both species of sea lions.



FIG. 8. Part of the Flea Island rookery of sea lions showing both species. June 13, 1927.

Man can also be included among the enemies of the sea lions. Every year a number (just how many is not now known) are taken for exhibition and scientific purposes. These are almost always California sea lions. The Stellers are too large to be conveniently handled in anything but a large, permanent tank. The trained "seals" exhibited in circuses are practically always California sea lion cows. Since the sea lions were first known in California, the bulls have been killed for the "trimmings." This effectively eliminates most of the bulls of breeding age, and has no doubt been a large item in the decrease of the herds. This year (1927) another factor has been added to the numerous checks already acting on the sea lions. The professional hunter has come to California and, by various subterfuges, is endeavor-

ing to have the hunting of sea lions legalized.* Some of these hunters killed sea lions along the coast, during June of this year, without consulting the authorities. They later endeavored to interest the fishermen's organizations in raising a fund to pay a bounty, but nothing was accomplished in this direction.

A large number of sea lions were killed at San Miguel Island in violation of the law protecting sea lions in district 19. The methods used by these men would exterminate the sea lions in a few seasons. Bulls, cows and pups were killed indiscriminately, and only the scalps and "trimmings" removed. The carcasses were left to rot on the beaches. As sea lions shot while in the water, in most cases, sink at once, a great many animals probably went to the bottom without benefiting the hunters. The beach at Flea Island (San Miguel Island)

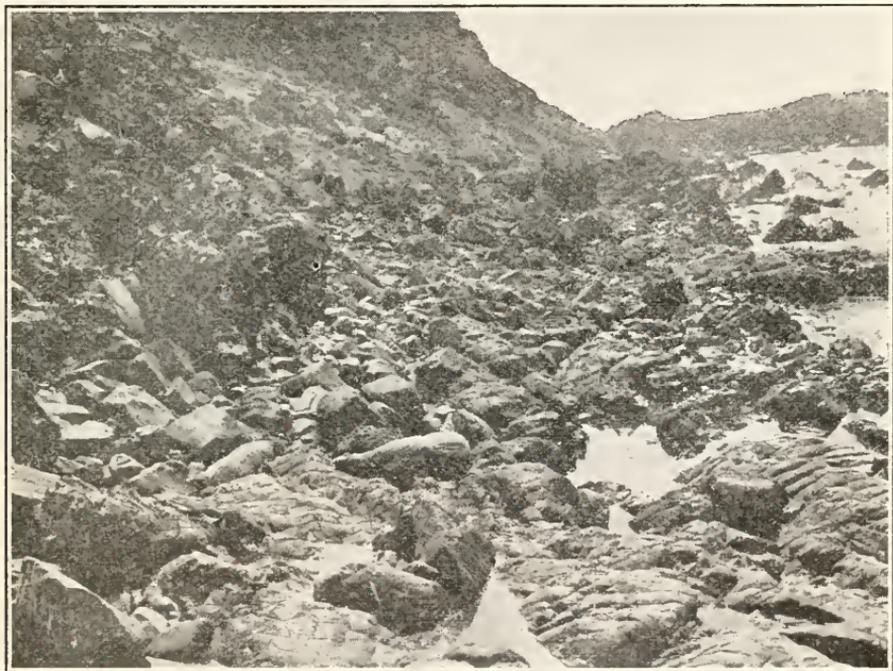


FIG. 9. Flea Island after a visit of the scalp hunters. Numerous dead animals litter the beach. The scalps were taken by law violators who turn them in to those states which pay a bounty on sea lions. June 16, 1927.

supported a mixed rookery of nearly 400 sea lions when I visited it on June 13th. Two days later I again landed there. In the meantime, the sea lion hunter had done his work. Every pup on the rookery was dead, and of the 400 animals which I counted on my first visit, a pitiful remnant of 30 or 40 was swimming timidly about in the surf. (Compare Figs. 6 and 7.) The beach was covered with dead animals and pools of stagnant blood.

These are not the methods for controlling our native fauna which will be conducive to the best interests of all concerned. This sort of

* In some other parts of the country, sea lions have been hunted for a number of years under a bounty system. Sea lions in these places have become so scarce that the hunters are forced to look for more prolific hunting grounds and are coming to California.

thing is comparable to the wasteful and useless slaughter of the bison, to the ruthless killing of the egrets by the Florida plume-hunters and to the extermination of the sea otter. A few men realize a quick profit for a few seasons—and one of our most interesting and least known mammals will be numbered among the animals of the earth which have passed, through the ignorance and greed of man.



FIG. 10. A dead bull California sea lion with the trimmings removed. About 700 pounds of meat, hide and oil are wasted every time a large sea lion is wantonly killed. San Miguel Island, June 16, 1927.

THE SMELTS OF THE SAN PEDRO WHOLESALE FISH MARKETS.¹

By FRANCES N. CLARK.

Although the smelt fishery of California can not be classed as a major fishery of the state, the total number of pounds landed exceeds that of the striped bass or the sable fish, and ranks eleventh among fishes sold exclusively for the fresh fish trade.

Smelts are caught along the entire coast of California and landed in varying amounts at all ports. The ports of Los Angeles County, however, exceed any other region in the total amount of smelts landed. During the past nine years, 29 per cent of the total catch of the state passed through these ports. Within Los Angeles County, practically all the smelts are delivered to the wholesale fish markets at San Pedro, consequently, nearly one-third of the smelt catch of California is handled at this one port.

¹ Contribution No. 67 from the California State Fisheries Laboratory of the Division of Fish and Game, October, 1927.

Unfortunately, the name smelt is applied to fishes of two different families comprising several genera, and the above statistics give no information about the catch of any one variety of smelt. Since the San Pedro fish markets occupy a position of major importance in the smelt fishery, the following survey was undertaken to determine what species of smelt pass through these markets, and the relative importance, throughout the year, of each form.

The families of fishes known popularly as smelts are, the true smelts, *Osmeridae*, and the silver-sides, *Atherinidae*. The true smelts are readily separated from the silver-sides by an adipose dorsal fin which does not occur in the latter family. The *Osmeridae* are taken only in the more northern waters of California and do not occur south of Monterey. The silver-sides, on the other hand, are found along the entire California coast, and consequently contribute to the northern fishery and, south of Monterey, comprise the entire smelt catch. In the waters adjacent to San Pedro, the *Atherinidae* are represented by four species, the jack smelt, *Atherinopsis californiensis*; the panzarotti, *Atherinops affinis littoralis* and *Atherinops insularum insularum*; and the grunion, *Leuresthes tenuis*. Of these three genera, the jack smelt attain the largest size and are of the greatest commercial importance; the grunion are the smallest, and the panzarotti occupy an intermediate position between the other two.

Some confusion exists in the common names applied to these fish, especially to that of *Atherinops*. *Leuresthes* is always known as grunion and the larger individuals of *Atherinopsis* are termed jack smelt. The smaller *Atherinopsis* and *Atherinops* are often confused and called variously, silver smelts, bay smelts, least smelts, and panzarotti. Panzarotti,² an Italian term, meaning broken belly, is applied by the fishermen most frequently to *Atherinops*. Since it is a distinctive name, and the one always recognized and most commonly used by the fishermen and dealers, panzarotto has been adopted in this article to designate *Atherinops*. At least two species of *Atherinops* are found in the San Pedro markets, but they are here grouped under the name panzarotti.

While the species and subspecies within the genus *Atherinops* are difficult to determine, the three genera, represented by jack smelt, grunion and panzarotti, can, with a little practice, be readily separated. The grunion is easily distinguished by its small size, slender form, and freely protractile maxillary. The teeth are minute or entirely absent, and the origin of the first dorsal is posterior to the vent. The largest jack smelt can be separated by their size, and all jack smelt are recognizable by their small scales, about 77 in the lateral line, deeper body, simple teeth, and first dorsal originating anterior to the vent. In the panzarotti the snout is blunt, the scales large, 52-56 in the lateral line, the teeth forked, and the origin of the first dorsal posterior to the vent.

To determine the relative amounts of these three forms of smelt landed at San Pedro, the survey on which this report is based, was conducted for a year. From October, 1926, to October, 1927, the

²In literary Italian, pure Tuscan, this word would be *panciarotto*, plural *panciarotti*. Since pure Tuscan is not the native tongue of any of the peoples along the Italian coast, the form *panzarotto*, plural *panzarotti*, has been adopted here. *Panزارotto* is the form used by the fishermen, and has thus come into current usage. These philological notes were kindly furnished by Dr. H. H. Vaughan of the University of California.

markets were visited three times a week. With the exception of February, March and April, when the survey was carried on by Carl R. Jackson, the observations were made by the writer. In the winter months, the visits were made between 7:30 and 8:30 a.m., as the largest percentage of the fish was landed at that time. In the summer, the fishermen returned to port later in the morning and the observations

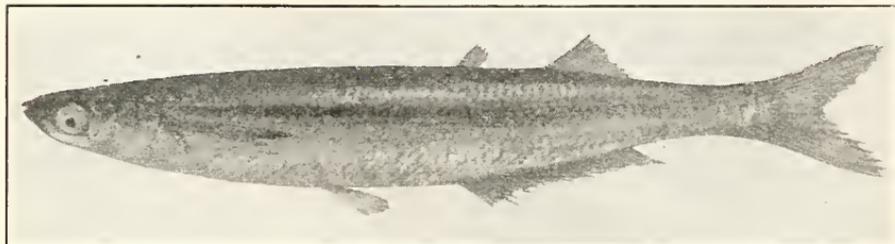


FIG. 11. Grunion, *Leuresthes tenuis*, from the San Pedro wholesale fish markets.

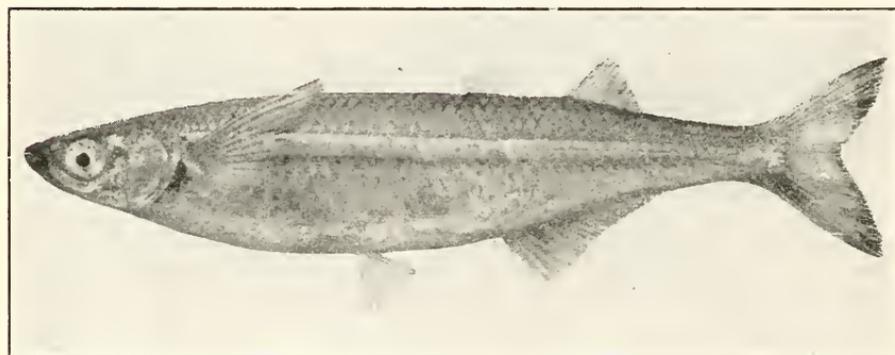


FIG. 12. Panzarotto, *Atherinops affinis littoralis*, from the San Pedro wholesale fish markets.

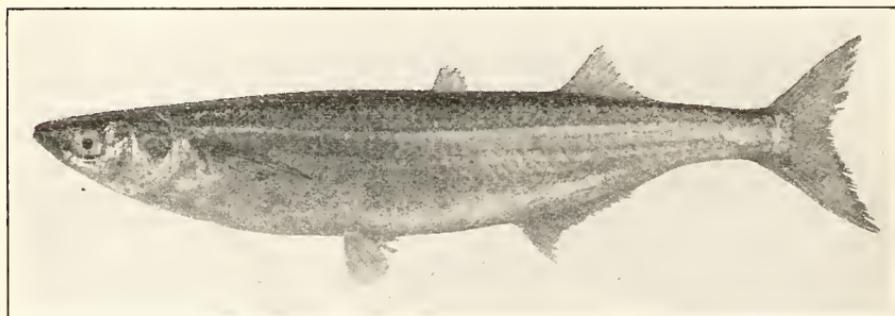


FIG. 13. Jack smelt, *Atherinopsis californiensis*, from the San Pedro wholesale fish markets.

were made from 8:30 to 9:30. In a few instances, if no smelts were seen in the morning, a second trip was made to the markets late in the afternoon, but this gave little added information.

The smelts are delivered to the markets in boxes averaging approximately 175 pounds each. Every box of smelt found in the markets during an observation was examined and recorded as containing either

jack smelt, panzarotti or grunion. If more than one form was found in a box, the fish were counted out at random until twenty of the predominating species had been counted. The box was then recorded as containing the resulting proportion of each species. For example, the record for March 2, 1927, is as follows:

1 box, all jack smelt.

1 box, proportion 9 jack smelt; 4 panzarotti; 20 grunion.

$\frac{1}{2}$ box, proportion 20 jack smelt; 0 panzarotti; 2 grunion.

$\frac{1}{3}$ box, proportion 20 jack smelt; 3 panzarotti; 0 grunion.

$\frac{1}{4}$ box, proportion 20 jack smelt; 0 panzarotti; 6 grunion.

From these field data the monthly and quarterly percentages of each variety were calculated.³

By multiplying the number of boxes by 175, the average weight per box, the approximate number of pounds of fish that had passed under observation was determined. To find what percentage of the total catch had been examined each month, the number of pounds seen was divided by the total monthly catch. The results, given in the last column of Table I, show a variation from 11 per cent to 54 per cent.

TABLE I.

Observed Proportions of Each Species of Smelt in the San Pedro Wholesale Fish Markets and the Percentage of the Total Catch Represented by the Observed Data.

Date	Percentage			Approximate number of pounds*	Per cent of total catch
	Jack smelt	Panzarotti	Grunion		
1926—					
October.....	99.9	0.1		4,244	11
November.....	99.6	0.4		13,650	42
December.....	98.9	1.1		23,625	50
1927—					
January.....	95.9	1.4	2.7	17,719	48
February.....	71.4	8.3	20.3	5,206	18
March.....	94.2	2.7	3.1	6,912	17
April.....	99.4		0.6	5,163	16
May.....	89.1	5.8	5.1	5,534	33
June.....	97.0	2.8	0.2	14,306	34
July.....	93.3	6.4	0.3	4,998	19
August.....	97.0	2.9	0.1	6,584	22
September.....	94.5	5.3	0.2	15,444	54
October, November, December, 1926	99.2	0.8		41,519	35
January, February, March, 1927	91.2	2.9	5.9	29,837	27
April, May, June, 1927	95.7	2.9	1.4	25,003	27
July, August, September, 1927	94.9	4.9	0.3	27,026	32

*Calculated on basis of 175 pounds per box.

While more extensive observations might have been desirable in some instances, the data are considered sufficiently reliable to justify their use as a basis for determining the amount of each variety of smelt landed at San Pedro.

Tables I and II and Figure 14 show the results of the year's observation. With the exception of February and May, over 90 per cent of the smelts delivered to the San Pedro markets were jack smelt. The

³ The percentage of each form in each box was calculated from the field data. These percentages, when multiplied by the number of boxes, if more than one box contained the same percentages, summed, and divided by the total number of boxes for the day, gave the day's percentages. The percentages for each day were again multiplied by the number of boxes observed on that day, summed, and divided by the number of boxes seen in a month. This gave the monthly percentages. In the same manner, the quarterly percentages were derived from the monthly percentages.

TABLE II.

Number of Pounds, by Species, of Smelt Landed in Los Angeles County, Based on the Observed Percentage of Each Species.

Date	Jack smelt	Panzarotti	Grunion	Total*
1926—				
October.....	37,667	38		37,705
November.....	32,659	131		32,790
December.....	47,071	524		47,595
1927—				
January.....	35,178	514	990	36,682
February.....	20,982	2,439	5,966	29,387
March.....	40,172	1,151	1,322	42,645
April.....	33,158		200	33,358
May.....	14,730	959	843	16,532
June.....	41,287	1,192	85	42,564
July.....	24,958	1,712	80	26,750
August.....	28,921	865	30	29,816
September.....	26,946	1,511	57	28,514
Totals.....	383,729	11,036	9,573	404,338

*From statistics gathered by the Division of Fish and Game of California.

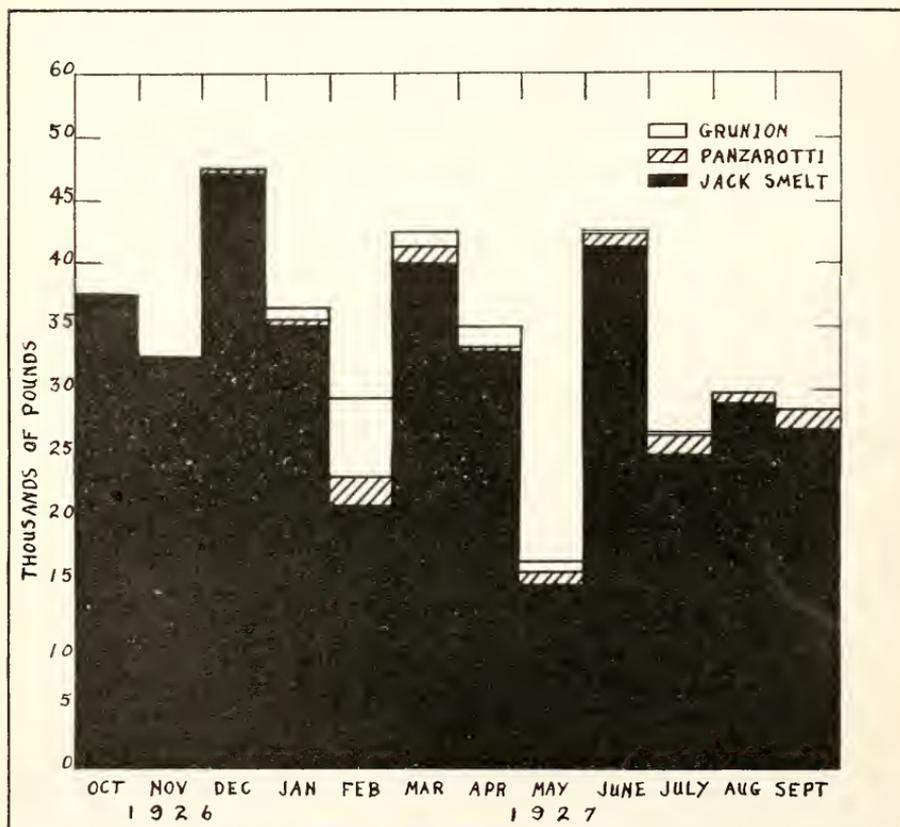


FIG. 14. Number of pounds, by species, of smelts landed in Los Angeles County, based on the observed percentage of each species.

lowest percentage of jack smelt occurred in February, when this fish comprised only 71 per cent of the whole, but since the percentage was high in January and again in March, it would seem that the drop in February was due to a chance variation, and not to a seasonal fluctuation in the fishery. Grouping the data by quarters brings the percentage of jack smelt above 90 throughout the whole year. This grouping makes the data comparable with statistics published quarterly by the Division of Fish and Game.

Panzarotti occurred in small quantities throughout the whole year, but the data suggest a slight increase in percentage during the summer months. The grunion catch was most concentrated in the late winter and spring months, and negligible during the remainder of the year. It seems probable that no great significance should be attached to the unusually high percentage of grunion taken in February.

The spawning season for the jack smelt occurs during the winter months, for the grunion, during the spring, and for the panzarotti, during the summer. Since the maximum percentage of each species corresponds roughly with the months of spawning, there may be a slight correlation between time of spawning and the amount of jack smelt, grunion or panzarotti taken by the fishermen. However, such indications are exceedingly slight, and the great preponderance of jack smelt at all times of the year entirely overshadows any significant fluctuations in the relative amounts of the three forms. If the year in which the observations were made is typical, the smelt fishery at San Pedro is composed almost exclusively of jack smelt.

HOW A NATURAL RESOURCE IS BEING ADMINISTERED.*

By W. L. SCOFIELD.

In an offhand way we will agree that research work is a good thing, even necessary perhaps, but why should any department of the Division of Fish and Game of California establish a research laboratory as an integral part of its organization? Would such a laboratory actually be of direct and practical aid to a department, and could we be justified in calling research necessary to the extent of providing it a place in a state department on a par with administration or law enforcement? The Commercial Fisheries Department in its organization places research on such a parity. It is rather unique in this respect. Other organizations express interest in research but in actual practice the scientific work is considered a side issue, and it is hoped that the results of the investigations may be of use indirectly or possibly of direct use at some time in the future. A passing interest in scientific work and a dependence upon research are two very different things. The Commercial Fisheries Department expects its

* Contribution No. 66 from the California State Fisheries Laboratory, October, 1927.

research work to be of direct and immediate practical value in addition to laying a foundation for the future development of the department. What is the laboratory doing to justify this confidence in research?

By straining a point we may say that the work of the Commercial Fisheries Department falls under three heads—Administration, Research, and Law Enforcement—but such a classification is artificial because there is no definite dividing line for any one type of work. Each is so dependent on the others and so interlocked with the other two that no one activity of the department can be singled out and called purely administration, research or law enforcement. This appears to be an exaggeration, but in practice the research workers are dependent on the patrol department and the law enforcement officers are dependent on the laboratory staff, while the administration of the department is dependent on, coordinates and directs the patrol and research. Almost every action of a member of the department involves more than one of the above functions.

The department as a whole is assigned the duty of applying conservation practice to a state resource, the commercial fishes, aquatic animals and marine life of California. This means that the state must receive the benefit to be derived from the wise use of this resource, the fullest utilization possible. Since fish constitute a resource that is capable of reproducing itself, full utilization means continuous and perpetual use rather than a brief period of over-utilization resulting in a depleted resource. A radical reduction in resource means less use or even no utilization whatever as in the case of the sturgeon in California. Halibut and salmon are examples of resources depleted to the extent that utilization is now only a small fraction of what it should be.

It is impossible to even discuss proper utilization of a resource without some knowledge of its extent. You can't make even a sensible guess at how much interest is due you at the bank if you haven't the remotest idea of what the principal is. If you are foolish you can make a wild guess at it for a year or so but sooner or later you are shocked into realizing that you are overdrawn. In withdrawing interest it is bad to guess at the principal but it is doubly foolish to keep no record of the interest drawn. Some resources, including some fisheries resources, are handled just that way, but fortunately California adopted more business-like methods and conservation practice is being applied to our commercial fisheries. It should be obvious in applying a policy of continuous use to a resource such as fish that what we need most is to know something of the total supply and of the amount caught each year. Chiefly we wish to know whether the yearly catch is more than it should be or less than it could be with safety for the future. Other considerations are secondary. In the case of ocean fish, the answers to these questions are exceedingly difficult to arrive at, but the difficulty of solution does not lessen their importance nor is sensible administration of the resource any less dependent on fundamental knowledge as to extent of the supply and the rate at which it is being utilized. We need not crow about recognizing the obvious, but California deserves great credit for doing something after the obvious needs were recognized. The Commercial Fisheries Department set itself the task of answering the most important questions first instead of postponing them in favor of less important but more spectacular work. Proper

administration of the resource should not be based on guess work, so it was decided that knowledge of the resource should be substituted for assumptions and should serve as the foundation of the department.

Research workers were called upon to aid the department in learning something of the fundamentals of the fish supply to be administered and the State Fisheries Laboratory was established. The staff was asked to make accurate observations as to the resource, check these observations to be sure they were dependable, make an orderly arrangement of the observed facts, and as a final step to draw conclusions based on facts rather than on assumptions. That procedure is the essence of the scientific method. It might be called systematized common sense. When the Ford is missing you go over it and trace the



FIG. 15. California State Fisheries Laboratory, Terminal Island, California. October, 1927. Photograph by G. H. Stone.

trouble down to a blackened spark plug rather than oil the timer on suspicion, and to that extent you apply the scientific method without wearing your hair long or using a microscope.

The program of the laboratory then is clear cut and definite; to aid the department in getting the necessary information as to fish supply, to estimate how heavily the supply of each species may be drawn upon, to discover any changes occurring in the supply, and to determine at what point depletion begins to show itself. This is a large program but it is the proper one. The complete fulfillment of such a program will require many years of the concentrated effort of the best brains that can be applied to these questions, but complete fulfillment is not

immediately necessary. In the meantime every fact learned supplants a guess. Each year the administration of the resource is increasingly effective as more facts are available and assumptions are discarded.

Before any such program could be put into effect, it was necessary to survey the whole field for possible methods that might be applied and to determine what line of approach promised to lead toward the goal set. In this field of research the methods and details of procedure have not been worked out, so that we of necessity are having to determine the value of methods by trying them out and this adds to the difficulties and delays. We are suffering all the hardships and experiencing all the thrills of discovery that go with pioneering.

One of the first and one of the most important steps taken by the department in learning about the fish supply was to establish a complete and accurate system of statistical records that would show the daily catch of each species of fish for each boat for each fishing region of the state. It is hard to run any large business with no system of bookkeeping, and these total catch records are of great value in understanding what is happening in each fishery, in determining questions of relative importance, in determining seasons, and in tracing the effects of legislation. Important as these questions are, they are secondary when compared to the real object of establishing this system of catch records, that is, determining changes that may occur from year to year in the supply of fish. The system was designed so that we might have the daily catch of each boat. The catch of one boat for a day may be accepted as a measure of the return in fish for a definite unit of fishing effort. It is a measure of the availability of fish. From these records a group of certain boats may be selected and their daily catches followed through a series of years in order to determine whether the trend of their success is declining, remaining constant or possibly showing an increase. Other things than the supply of fish affect the boat catch so that allowing for and discounting them is not a simple operation. This analysis of the catches of individual boats is one of the two chief methods we have selected as promising to give us knowledge of changes in the supply of fish.

Another method is to sample the commercial catch at regular intervals to determine the normal proportion of age classes appearing in the catch and to watch for any future change in this proportion. This is based on the theory that depletion, if it occurs, will show itself in a drop in the proportion of older fish. We all know of the irritating scarcity of big trout in an over-fished stream as compared with a virgin stream. Such a method involves adequate sampling of the commercial catch and this means many laborious hours examining and measuring specimens from the catch. Although this is a long and slow process extending over a series of years, we expect it finally to yield results that are more complete and give us greater knowledge of the supply than are possible by a boat catch analysis alone.

The program as outlined so far is given first consideration, but it is only part of the story. Suppose we find that a certain species is being depleted, then we should know what we are going to do about it. Why guess at the remedy? We need to know how a certain remedy is going to affect this particular species. The effect of any one protective law is apt to depend on some peculiarity in the life history of this

particular fish. At the same time that we are working on questions of fish supply it is necessary to carry on work aimed at giving us the necessary knowledge of the life history and behavior of each species that we are considering. It is by no means possible to tell beforehand just what piece of information as to life history is going to prove necessary. The more we know of the habits and behavior of a species the more confidently we may venture to predict how it will be affected by a protective measure that might be applied.

The research work of the Commercial Fisheries Department is not a desirable or even necessary side issue. It is the basis upon which the department is organized, and it is so interwoven with the work of the department that it would be difficult to clearly define its boundaries and impossible to segregate the purely investigative work from the other activities of the department. It is obvious then that such work must be conducted by the state department rather than depend on by-product fisheries investigations from some other organization such as a university or independent marine station. The very nature of the work involves state legislation and department regulation. In administering our fisheries, the department is endeavoring to determine the point of full utilization for each fishery, and to discover over-utilization before it becomes serious depletion of the supply. It would be easier and cheaper to guess at this, but the department is basing its work on dependable information rather than surmise. The research laboratory is assisting the department in determining the facts.

SALMON INVESTIGATION.

By J. O. SNYDER, Stanford University.

Believing that measures intended to conserve a fishery can not be intelligently devised and applied until the life history of the species is well known, an investigation of California salmon was begun some years ago, and is still in progress.

Along with other work of a statistical nature the Division of Fish and Game has been keeping a very accurate account of all salmon taken by the commercial fishermen wherever they have been operating. An examination of this reveals an alarming decline in the fishery, and points to the need of even more restrictive measures than have as yet been applied.

Observations of the catch have been made at many places, both along the coast and in the rivers. These include the close scrutiny of thousands of individuals in an effort to determine sex, age, and certain phases of ocean and stream history. A microscopic examination of the scales reveals certain pertinent features of the life history of the fish, and the results of many of these are now available. Active field work has resulted in the collection of a vast amount of material such as scales, young fish, anatomical parts, field notes, photographs, drawings, etc., which are now stored in the Division's laboratory. It is expected that papers bearing on the investigation of this material will appear in due time.

Some observations of an interesting and valuable nature have been made on young fish caught at sea and in the main channels of the rivers.

During the seasons of 1927 and 1928 an effort was made to place metal tags with distinctive marks on fish which were caught at sea. It was thought that the recapture of the released fish would contribute something worth while to what we know of ocean migration. Difficulties encountered were so great as to put a very definite limit on the undertaking, and the results to date are not very encouraging.

Much work of an experimental nature has been carried on in an attempt to answer questions or solve problems relating to the life history of the king salmon. One of these experiments, for example, was so planned as to make a test of the parent stream theory, and also to determine as far as possible the extent of ocean migration. It is hardly necessary to say that the parent stream theory has a direct bearing on artificial propagation, while the extent of ocean migration obviously has to do with the problem of regulating the marine fishery.

The parent stream theory involves the presumption that on maturity, salmon return to the stream from which they previously migrated to the ocean. Much evidence which favored the theory had accumulated in the past, but sufficient experimental tests were lacking. The fact that adult king salmon would return to the stream into which they had been introduced when young, regardless of where the eggs which produced them had been taken, was not fully established, nor was it known whether mature fish on their upstream migration would seek out and enter the particular tributary in the waters of which they had been reared.

A description of one or more field experiments, and a summary of the results may be of interest. The preliminaries of an experiment were described in CALIFORNIA FISH AND GAME for July, 1920, and the results were published in the same magazine at later dates. In brief, the work was performed as follows: A large number of king salmon eggs, taken in Mill Creek, a tributary of the Sacramento River, were transferred to Fall Creek Hatchery which is located on a branch of Klamath River. The fry which came from these eggs were placed in rearing ponds near the hatchery and there held until they were of sufficient size for marking purposes. The marking of young fish is a process of fin mutilation, the reliability of which has been amply demonstrated. In this particular case the adipose and right ventral fins were removed from 25,000 small fish. When the slight wounds were completely healed, the fish were allowed to pass into Klamath River. They entered the main stream at a point north of Mount Shasta, from where they passed down the river and eventually entered the sea.

Fishes from this planting were later captured in the ocean at points as far south as Monterey Bay, thus proving beyond doubt that salmon while at sea range very far from the mouths of their native streams. It is scarcely necessary to point out with this information in mind, that any procedure relating to the protection or conservation of Klamath salmon will involve a regulation of fishing at sea as well as in the river. It is not known to what extent Klamath salmon migrate to the northward, but since marked Sacramento salmon have been observed as far north as Fort Bragg, one may perhaps be allowed to infer that Klamath fish also migrate northward in search of food. None of these fish was taken in any stream other than the Klamath, where they returned in numbers, a fact indicating that salmon will

return upon their nuptial migration to the stream in which they passed their early life, rather than to that of their real parentage. It also appeared that these pond-reared fish behaved much as did those which had lived in the stream under natural conditions, that they eventually reached a similar size at a given age, and that in other respects they were like fish bred under natural conditions. A counter experiment performed in the Sacramento River produced similar results, thus confirming that of the Klamath.

It having been demonstrated that salmon, when mature, enter the streams from which they at first migrated, the Division attempted to determine just how far this homing instinct would obtain with regard to particular tributaries of a river system. Since king salmon

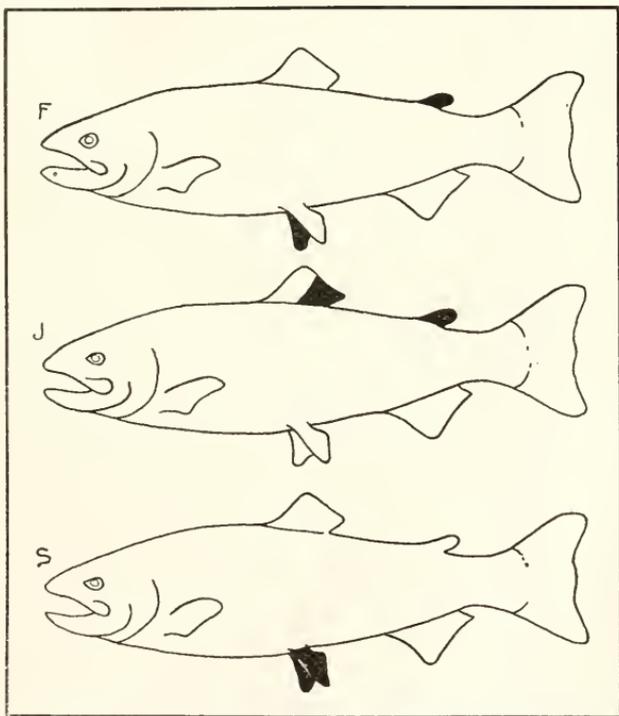


FIG. 16. Diagram showing how various lots of salmon were marked in experiments on the Klamath River.

in the Klamath mature at from three to six years of age, it will be appreciated that any experiment having to do with them must extend over a considerable period of time. Cooperation among observers, officials, packers, anglers and commercial fishermen enters largely into the work, and lack of interest on the part of someone may cause partial or entire failure.

A test of the homing instinct with regard to tributaries of a river was initiated in the fall of 1923 in the Klamath. The preliminaries of this experiment were fully described in CALIFORNIA FISH AND GAME for January, 1924. The returns are not complete at this writing, but enough observations have been made to establish certain facts.

As in the previously described experiment, the work centered about Fall Creek Hatchery, which is located about one mile above the junction

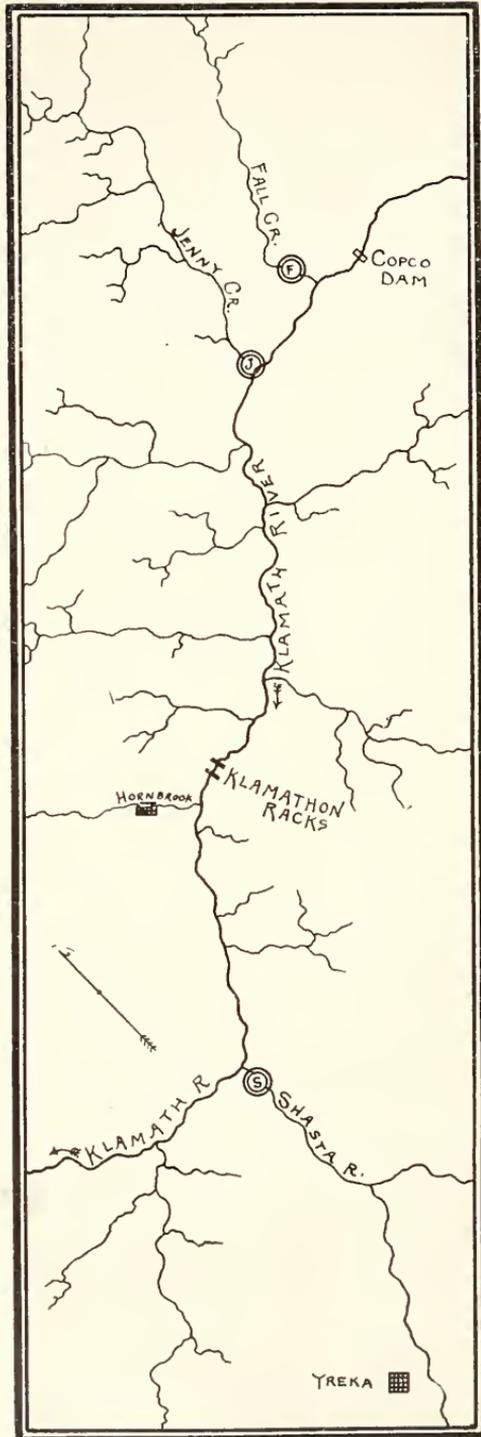


FIG. 17. Map showing location of salmon spawning and marking experiments on the Klamath River.

of the creek and the main channel of Klamath River. Fish to the number of 75,000 were marked as shown in the accompanying diagram. Each 25,000 of these was given a distinctive mark. These were carefully kept in three separate groups, each of which was eventually introduced into a separate tributary. One group, that with the right ventral and adipose removed, was allowed to leave the breeding pond and pass down Fall Creek. Another lot, minus the adipose and anterior half of the dorsal, was put into Jenny Creek at a point a few hundred feet above its mouth. The latter stream enters the main channel somewhat over two miles below the mouth of Fall Creek, and a long distance above the racks. The third planting, the fish of which were distinguished by the absence of both ventrals, was made in Shasta River about a mile above the mouth. On the following year an exactly similar planting was made. The racks near Hornbrook act as a trap, which enables one to catch and examine all fish which attempt to pass that place. Traps in Fall Creek and Jenny Creek made possible the capture of fish entering those streams.

Numerous adult fish with each of these marks have already been caught at sea and also in Klamath River, thus demonstrating the success of the plantings. Fish bearing the Jenny Creek and Fall Creek marks came to the racks in numbers, while the Shasta River mark was represented there by but two individuals. Several of the latter were caught in Shasta River by spearmen. Some of those with the Fall and Jenny Creek marks were allowed to pass beyond the racks and on up stream, where they were later recaptured. The results of this experiment, although it is not yet complete, seem to indicate that none of these fish entered any river other than the Klamath, that those bearing the Fall Creek mark returned to that stream when given an opportunity, and that the brief exposures given to fish in the other tributaries, while causing the return of some of the fish, was not sufficient to operate in all cases.

Along with the examination of king salmon, considerable information relating to silver salmon, steelheads and stream trout has come to hand. Enough material relating to the rainbow trout of the Klamath has been collected to give us a fair picture of the more salient features of the life history of this fish.

STRIPED BASS STUDIES.

By E. C. SCOFIELD.

The striped bass is one of the few combined sport and commercial fishes that we have in California. About 800,000 pounds are caught annually by the commercial nets and marketed to the people of California only. There is also a large amount caught by the sportsmen anglers for which no figures are available. However, the combined commercial and sport catch is certainly well over a million and a quarter pounds annually. Such a large catch appears startling, in view of the fact that the striped bass have had only 48 years of existence on our California coast. They were introduced from the east coast in 1879 and 1881, when two shipments were made, a total shipment of about 450 small bass. Ten years had not elapsed before they were being caught

for market purposes. The Division of Fish and Game was swift to act in obtaining legislation to limit the size and number of striped bass caught. They wished the new species to be protected sufficiently to survive the nets and hooks and increase its numbers annually.

Today we are confronted by the same question: How are we going to keep the striped bass on the increase in face of the hundreds of nets and thousands of anglers that appear as a barrier across the road to conservation? The popularity of the species demands that it be saved from a possible extermination by overfishing. The Division of Fish and Game, as a state institution maintained to regulate such matters, has taken steps to prevent such an occurrence to this valuable fish. The Commercial Fisheries Department, in whose hands lies the destiny of our commercial fishes, has launched a systematic, scientific study of the striped bass, knowing that the results obtained will form a basis for legislation and their future conservation.

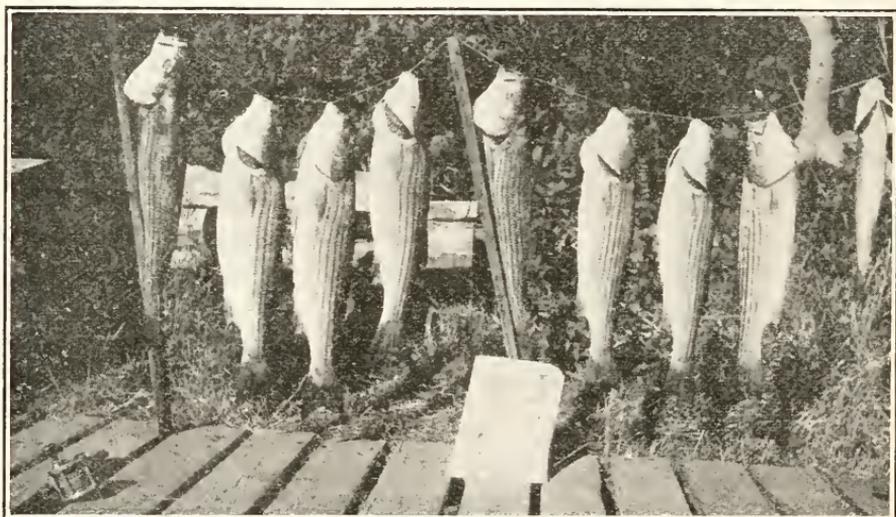


FIG. 18. Catch of striped bass from Salinas River by party of three men. Photograph by G. A. Clark, 1921.

One of the most important activities of the department is to measure the abundance of the commercial fish species by means of data which have been gathered of the commercial catch. These data, provided by commercial fish dealers, are required by state law and are detailed and accurate. They have been gathered now for a period of seven years. From these data, it is possible to determine the average yearly catch of any species for a given unit of effort. Such a measurement has been made of the striped bass, and the result shows that these fish have been increasing in abundance during the past seven years.

Problem. Next to measuring the abundance of a fish, or any animal for that matter, the most important information to be obtained for proper legislation is the knowledge of the life history of the species. Such a study of the bass will show us how old they are at various lengths, how fast they grow, how old they are when they begin spawning, where they migrate, what they eat, and many other facts entering

into their life cycle. It is, therefore, the intent of this article to show how the work of obtaining the life history is carried on.

A life history study will include such studies as the spawning, development of the egg, hatching, growth, migrations, food, habits and so forth. We realize that it would be next to impossible to follow a group of bass throughout their entire life cycle in order to obtain the above facts. It is necessary, therefore, that we study only one question at a time.

Age. The first question is the determination of the age of the striped bass. - It is imperative that we speak of the bass in ages rather than in sizes, for it is more accurate. Nature has provided a simple means of

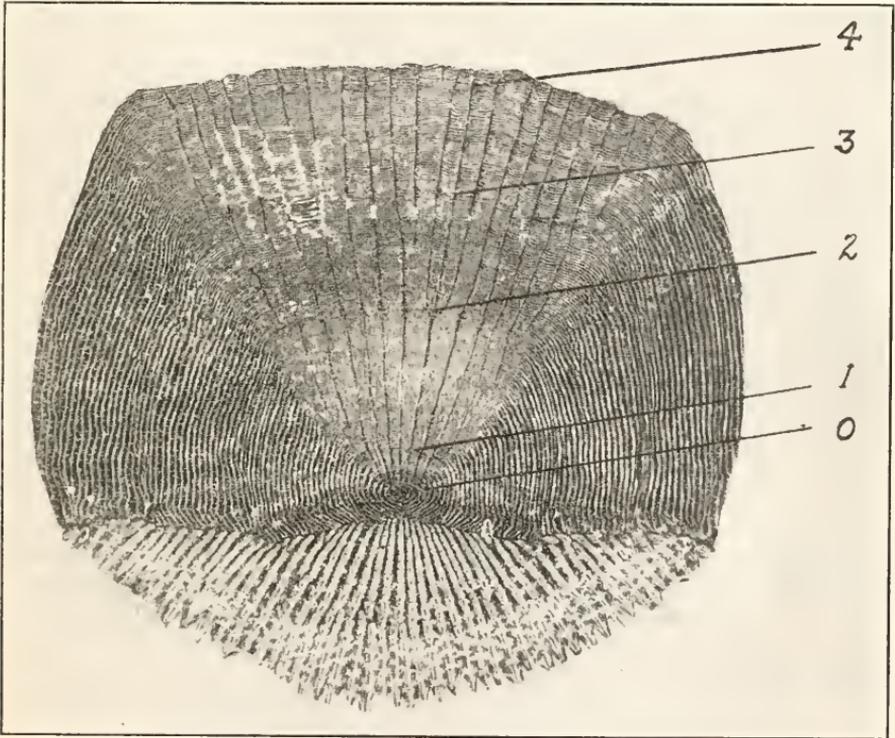


FIG. 19. Microscopic photograph of a striped bass scale. The particular bass from which this scale was taken had just passed its fourth winter; therefore, it was in its fifth year. 0 indicates the center of the scale, 1, the first winter annulus or check, 2, the second winter check, etc. Photograph by E. C. Scofield. 47 centimeters. June 1, 1927.

obtaining the age of most fishes, and that is by the markings that form on almost all hardened parts of a fish. On the striped bass, we have used the scale for age determination. A microscopic image of a scale shows a great number of rings, somewhat similar to a cross-section of a tree stump. (See Fig. 19.) For every ring in a tree stump, a year's growth is represented. A scale, however, will have from twenty to thirty rings per year, but during the winter months the bass go through a dormant stage when these rings are formed very close together. About April or May, normal growth commences again and the rings are formed much wider apart. Where the crowded rings

on the scale meet the widened rings, there is a decided mark, or check, as we call it. Because this check is formed once a year, we call it the "annual check," and the age of the bass can thus be determined.

We also find this annual check formed on other hardened parts of the body of a bass. The opercle, or cheek bone, shows the markings very distinctly when it is boiled and cleaned of its scaly surface. The markings are not so plain as those on a scale, but one can see them without the aid of a microscope by simply holding them up to the light. Another part of the body that is frequently used for age reading is the otolith, a small cradle-shaped bone that occurs in the inner ear of most fishes. To obtain best results with these, they must be examined immediately after they are removed from the fresh fish. After they are removed, they are ground down on a stone until they are so thin that a light will penetrate them. A microscopic image of the otolith at this stage will show the annual checks, as does the cheek bone. Many investigators prefer this ear bone for age determination, holding that it is less influenced by natural or artificial disorders that may affect the scales or other parts of the outer regions. The work of removing them and grinding them down is very tedious; so in the case of the present investigation, they have only been removed at random, to be aged and used as a check on the scale method of age determination.

Rate of Growth. An important obstacle in the study of the life history of the striped bass has been overcome by the determination of their age. Next, we are confronted by the problem of solving their rate of growth. It is important to learn how much a bass grows in each year of its life. The simplest method of determining this is the periodical sampling of the bass and the application of the frequency curve. Although this may seem difficult to understand, it is very simple when explained. We will assume that the bass spawn in the spring of each year. The bass that hatch from each of these yearly spawnings should grow at about the same rate. Some individuals may grow more slowly and others more rapidly. Now, if two hundred or so bass are measured, which is a good representative sample of a spawning that occurred two years ago, we obtain something like the following table:

0 bass at	7 inches
5 bass at	8 inches
20 bass at	9 inches
45 bass at	10 inches
75 bass at	11 inches
40 bass at	12 inches
10 bass at	13 inches
5 bass at	14 inches
0 bass at	15 inches

If this table is plotted in a curve with the base measured off in inches and the height in number of fishes as in figure 20 the result is what we call a frequency curve.

Now, if we measured all the bass that have hatched since the spawning that took place, say four years ago, we would have four groups, representing bass from one to four years of age. If these data were plotted in a simple frequency curve, we would see, as a result, four distinct humps, one for each year or age group, as is seen in Figure 21. Of course, it is impossible to catch and measure all the bass which have been spawned, even for one year, but it is possible to obtain a liberal sample of the fish which is representative of the bass population in San Francisco Bay. However, it has not proved easy to obtain this representative sample, for commercial fishermen are not allowed to use a net with smaller mesh than $5\frac{1}{2}$ inches, and they catch very few bass under five years of age. It is necessary, therefore, to use a large seine with small mesh, and to do this an experienced seine fisherman must be hired. It is also required that a special permit be obtained to take the bass for scientific purposes.

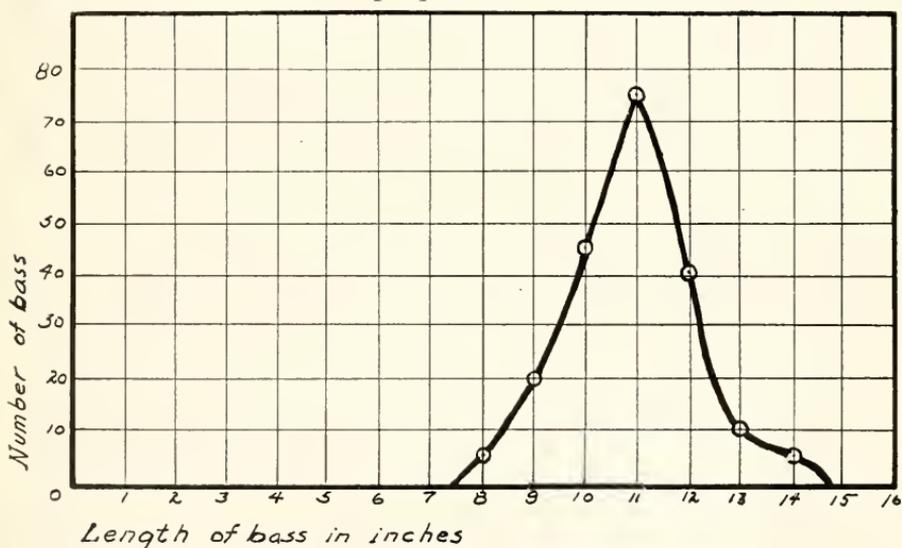


FIG. 20. A typical length-frequency curve of the two-year group of striped bass. The points on the curve represent the number of bass at a certain length. The first point to the left shows that there are five bass of eight inches in length, and the second point shows that there are twenty bass of nine inches in length, etc. The mode, or highest point, indicates that the majority of the two-year old bass are eleven inches in length.

If the sampling of the bass population, as described in the preceding paragraph, is done periodically, say every month, we would expect to gather larger bass each time, as a result of growth. This proves to be true, for when the material is measured and plotted in frequency curves, we observe a movement of the various humps to the right, showing an increase in size as time progresses. This is well illustrated in Figure 21. In this manner we can obtain a very accurate record of the growth of striped bass throughout the first few years of their life, at least.

Another important use of the frequency curve is the checking of the age reading from scales. The frequency curve shows us that a bass is from eight to fourteen inches in length at the end of its second year. The scale reading method, therefore, should show that a two-year old

bass is from eight to fourteen inches in length. Any results to the contrary would expose an error, either in the scale reading or in the formation of the frequency curve.

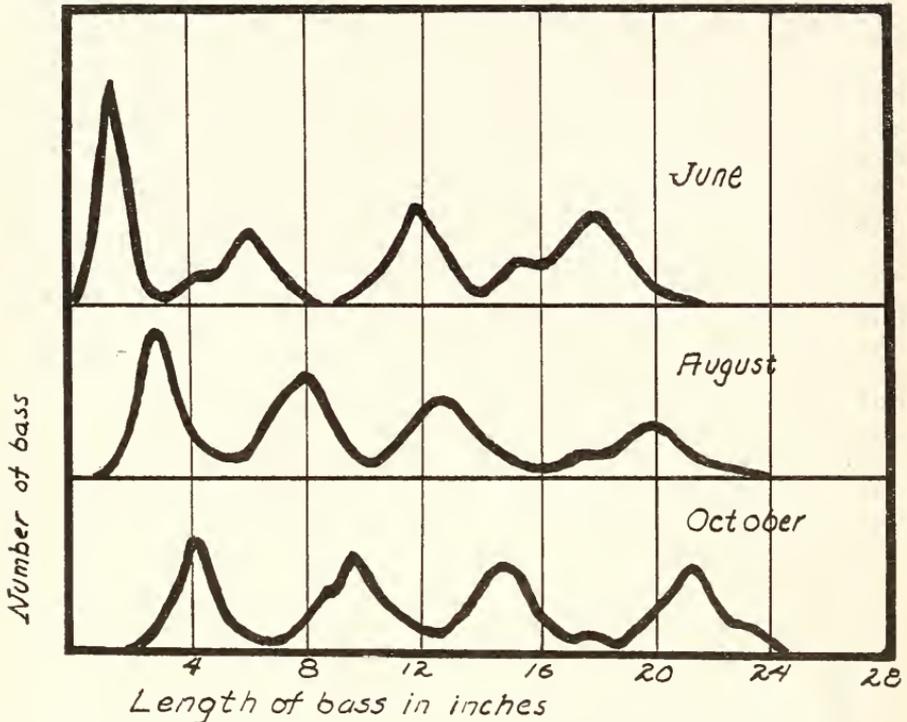


FIG. 21. Ideal length-frequency curve of four age groups of striped bass, showing their respective advances in growth over a period of four months. Each peak of the various humps, or age groups, for August and October shows a decided advance to the right as compared with June. This illustrates growth, and is the method employed to determine the rate of growth of striped bass.

A series of lengths which were computed from a group of bass scales has given us a rough, yet interesting, chart of the average lengths of bass at various ages. The results are in the following table:

1 year old bass average	4 inches
2 year old bass average	10 inches
3 year old bass average	15 inches
4 year old bass average	18 inches
5 year old bass average	20 inches
6 year old bass average	23 inches
7 year old bass average	28 inches
8 year old bass average	32 inches
9 year old bass average	36 inches
10 year old bass average	39 inches
11 year old bass average	41 inches
12 year old bass average	42 inches

Age of Maturity. The age and rate of growth having been solved, we next turn to the question of the age at which the striped bass mature and spawn. This question is one of the primary studies of

this investigation. The results will show the percentage of spawning bass that are, and those that are not, protected by the present sized fishing gear or nets. For example, we will say that the bulk of the commercial catch is made up of bass that are in their fifth and sixth years. If it is discovered that the majority of the bass spawn for the first time in their fourth year, then that spawning group is protected from the nets and should spawn unmolested. Such a condition in any fishery should result in the maintenance of the present abundance of that species. The method being followed is to test the bass ovaries for their degree of maturity or immaturity prior to and during the spawning season. A thousand or so specimens from two to ten years of age are examined in this manner. A hundred or so individuals representing each age should show the percentage of bass that spawn for the first time in their respective ages. The difficulty encountered in this method was the inability to get the desired material. We were obliged to gather our own material by using a seine, as previously stated, and our results were unsatisfactory. Because of this difficulty, we have resorted to the commercial catch entirely for our material, in spite of its selectiveness. It is believed that we can obtain good results in this manner, for once the age of maturity of the commercial group is obtained, it will be comparatively simple to determine the younger ages of maturity.

Migrations. We have determined the age of the striped bass, as well as their rate of growth. We are now working on the problem of age of maturity. Only two important features of this investigation, then, remain untouched. These are the migrations and the food of the bass. The migrations are a problem that can be partially solved through close observation and individual information. However, the more accurate way would be to carry on an extensive marking experiment within San Francisco Bay. The small striped bass can be obtained by the thousands in the summer time. If these were caught and marked by removing one or more fins and then liberated, they would later be caught by anglers or net fishermen and reported to deputies of the Division of Fish and Game. If the return of these marked bass was large enough, we could obtain a fairly good conception of their migrations, for we could undoubtedly get cooperation from the net fishermen within the bay, the anglers on the flats and on the sloughs, and from casters along the beaches from Monterey to Point Reyes. Information of this sort would tell something of the migration of the bass in the ocean and within the bay. This plan has not been included in the present investigation, but will probably be carried on as a separate work later. Information, however, can always be readily secured from fishermen as to movements of the bass within the bay and along the coast. We have learned from them, and from our own experience, that during the warm summer months, and perhaps early fall, the bass will school close to the shores, following the rise and fall of the tide. Their favorite grounds during these months are the mud flats where the temperature ranges from 60 to 70 degrees Fahrenheit.

The most exciting incident that we ever witnessed in regard to the bass schooling on the flats occurred early in July of this year. Our collecting boat had been scouting the bay for two days, without a sign

of bass. Weather conditions for their capture had been poor, but on that afternoon the wind had changed to the northeast, and the northern shore of San Francisco Bay was very calm. It was fine weather for the bass to be schooling on the flats, so we headed our boat for Black Point. The sunset marked our arrival. The surface of the water was as smooth as glass, for there was not a breath of wind. As our boat glided through the shining water, we suddenly became aware of a few jumping bass in the shallow water beyond. In a moment we were surrounded by splashing bass. The captain of our collecting boat had witnessed such scenes before; so for our benefit, he took a long boat hook and hit the water a resounding smack with it. The result was as if some unseen hand had hurled a ton of rock over the surface of the water in all directions. Striped bass from one-half to six pounds in weight splashed and squirmed in the shallow water, in their frantic efforts to escape danger. The water was a boiling mass of fish. In a few minutes they had subsided and the surface gradually became smooth and finally resumed its silvery tint. The captain estimated that at least twenty tons of striped bass were in that one school.

We see nothing of this sort when the cold weather sets in. The bass leave the flats and seek the depths of the channels and sloughs. At times they rise to the surface, but never do they in schools approach the flats which formerly had been their habitat. In the channels of the bay the movements of the bass occur at lower depths. Surface nets are discarded and submerged nets are employed almost entirely. A net of this sort is a typical gill net, except that it is heavily leaded so that when placed vertical in the water it will sink below the surface. Buoys, however, with twelve-foot ropes tied to them and to the top of the net allow the net to sink only twelve feet below the surface. By this method a fisherman can use a regular drift gill net at lower depths where the bass are. Should the law allow, the fishermen would fish the bottom of the channels, for there they claim the bass can be found in larger quantities in the winter months.

The sloughs afford a great habitat for wintering bass, especially the larger ones. Occasionally a big one is landed by a skilful angler but the bulk of the bass refuse the baited hook at this time of the year. The bass are there, however, because we have made successful experimental catches during the coldest months, namely December and January.

The ocean fishermen have also given valuable information in regard to ocean migration of striped bass. They have told us that during the winter and early spring months, the fishing is very poor. About the last of July the bass are caught in large numbers. This run lasts until early fall, about October, at which time the biting practically ceases. These facts seemingly indicate a seaward migration immediately after their spawning, which occurs in the spring months. From October to March their diet lightens considerably. They appear to seek the deep water and the rivers that enter the ocean, where they lie practically dormant save for intervals when they take nourishment. Spring sees them stirring around for food and, as a result, a few are taken on hook and line off the beaches and in the rivers. We must take into consideration, also, that the amount of bass caught by anglers off the beaches and in the rivers does not necessarily form an accurate basis on which

to determine their migrations. If linked with accurate methods of migration study, such material would be valuable; but if used alone, it would be valueless as far as accurate scientific research is concerned.

Food. Closely related to the migrations is the food of the bass. We have found that the migrations or movement of the bass within the bay and along the coast are largely dependent upon the food they are seeking. During the warm summer months the bass school on the mud flats. There, also, is the small feed of these ravenous eaters. In the fall, when cold weather sets in, they leave the flats, and with them go the smaller fishes. We have seen occurrences similar to this in the ocean. We have watched the Salinas River all through the ebb tide, without seeing a sign of bass. At the first of the flood tide, however, they school into the river's mouth, seeking their favorite food—the Portuguese man-of-war, which drift in with the tide.

Because the food of the bass is so closely related, in many ways, to their migrations, we have undertaken a detailed study of this question. By systematically examining stomach contents of bass at random throughout the year, we have been able to determine their food in the various localities and seasons. A wide variety of foods has been found in their stomachs. Crabs and shrimps are their main diet, but we have found that they eat almost anything they can get into their mouth lengthwise. Any food that is plentiful, such as crab and shrimp, appears to be their favorite. Small smelt occur in great numbers in the summer months and they are ravenously eaten by the bass. We once extracted a thirteen-inch splittail from a nineteen-inch bass. Exceptionally large crabs, smelt and bullheads are not uncommon in their stomachs. They eat their own young in great quantities. Other varieties of food removed from their stomachs are softshell crabs, clams, periwinkles, piling worms, herring, gobies, minnows, sticklebacks, sand fleas and grass. Bass will follow a school of fish for miles if the water is clear. Where there are sea gulls and pelicans flying over the water, one is sure to find a school of small fish, and there also will always be a school of feeding bass.

Final Report. As soon as this work is completed, a final report will be issued. It will be detailed and accompanied by charts and tables. The studies of this report on the life history of the striped bass will consist of age, rate of growth, age of maturity and facts relating to migrations.

CATCH FIGURES AND FISH SUPPLY.*

By JOE A. CRAIG.

The necessary and fundamental information which a person must have in order to intelligently manage a business of any sort, is a knowledge of the amount of capital that the business possesses and the income derived from the investment. Certainly a competent executive would not pay out as dividends part of the capital needed to maintain a business. Nor would the manager of a cattle ranch sell a great many more cattle than the natural increase of his herds, and so cut down his breeding stock to a dangerously low level.

* Contribution No. 68 from the California State Fisheries Laboratory, November, 1927.

The Department of Commercial Fisheries of the Division of Fish and Game is in much the same position as an executive employed for the purpose of managing an investment belonging to other people; the capital invested being represented by the population of crustaceans, mollusks and fishes of commercial importance, belonging to the people of the state, and the dividends derived from that investment being the catches taken from this population. The department, at a very early date in its organization, realized the importance of having accurate information concerning the size of catch of the various species of fish and the question of whether or not the amount taken was depleting the supply or breeding stock to such an extent that future profitable returns were endangered. Therefore, we find it provided by a state law, enacted in 1919, that "It shall be the duty of the Fish and Game Commission to gather data of the commercial fisheries and to prepare the data so as to show the real abundance of the most important commercial fishes." There are also provisions made for the biological investigation of depletion, but we shall mention only that portion of the study of abundance of commercial fishes concerned with the collection and use of statistical data.

It is also legally provided that all fish dealers, canners or other persons buying fish direct from fishermen must fill out a triplicate form, furnished by the Division of Fish and Game, showing what species and amounts were bought, date of purchase, name, number and owner of boat that caught the fish, and price paid for the fish. One copy of this record is kept by the buyer, one is given to the fisherman selling the fish and the third copy is sent to the Department of Commercial Fisheries. In this way that department procures a complete record of every catch of fish sold in the state.

It is a simple matter to add up these records of individual catches and secure a total yearly catch for each species. The relative size of total yearly catch of a species is supposed by many to be a satisfactory method of judging the abundance of a fish over a period of years. In fact, it is a very unreliable and usually misleading basis for detecting depletion.

This is so because there are a great many factors, other than the abundance of a fish, that determine the size of the total yearly catch. As an example, a species of fish may be seriously depleted, but be very much in demand so that the price rises and consequently more men go into that fishery, with the result that the total catch stays at a high level or actually increases, because more effort is being expended on the fishery, while the abundance of the species is rapidly decreasing. Improvements in gear or fishing methods may also cause an increase in total catch while depletion is taking place. Of course after depletion has proceeded to a great extent, the total catch will fall off in spite of greatly increased fishing effort, but then it is often too late to recoup the losses and get the fishery back on a paying basis.

Also the total catch may decrease while the abundance of the species is constant or even increasing. This may be due to a falling off in demand for a certain fish, or an increased demand for another species, causing less effort to be expended in the taking of the species in question. A strike of a fishermen's union or storms may also cut down the number of fishing days available to the fishermen and cause a decrease

in their fishing effort and total catch, while the abundance remains unchanged or increases. A closed season or legislation prohibiting the use of some particularly effective gear may decrease the total catch, while these protective measures are really causing an increase in abundance.

Evidently then, the catch data must be carefully analyzed and changes in fishing effort, gear and available fishing days discounted by some means before authentic information concerning the relative abundance of a species of fish can be obtained. A boat catch analysis is a procedure which, as far as is possible, accomplishes this, and in brief gives us the return for a constant unit of fishing effort and gear over a period of years.*

In a general way the method of making a boat catch analysis is as follows: As has been explained, the Department of Commercial Fisheries receives tickets which are complete records of every catch of fish sold in the state. These tickets are sorted and filed by boat at the State Fisheries Laboratory. This means that we have a record of each catch of every commercial fishing boat filed in chronological order. Also, each boat owner is required by law to register his boat each year, giving gear used, sort of fish caught during the previous year, number in the crew and a complete description of the boat.

When it is decided to conduct a boat catch analysis of a certain fishery, the first step is to go through the tickets and select a number of boats operating continuously in that fishery during the years to be included in the investigation. The registration cards of these boats are then gone through and checked over to see if there has been any marked change in gear or personnel which would change the efficiency of any of the boats. The catches of any boats having changes in gear or marked changes in crew number should be discarded since they do not represent the product of a constant unit of gear. A large enough number of boats should be secured to insure a good sample of the catches of the fishery being investigated. The catches of the boats selected are then tabulated by days, that is, each daily landing or catch is recorded with date upon which it was sold. This is done for each boat separately. This process of selection of boats and tabulation of catches gives us a day-to-day record of the output of a constant unit of gear and fishing personnel employed over the period of time to be included in the analysis.

The records of all of the boats selected can then be combined and the average daily catch computed for each year, or shorter period of time if desired. There are several different sorts of averages that can be used for this purpose, and a careful analysis of the data and fishery is necessary to decide upon the best form of average to use and how it should be computed. This then gives us the relative result of a constant unit of fishing effort and gear used for a constant unit of time. In other words, the final result is the daily average catch of a fixed unit of fishing effort and gear computed in yearly periods or shorter units of time over an interval of several years.

* The first work undertaken in North America on catch returns per unit of gear, as far as we know, was done by Mr. W. F. Thompson on the halibut of British Columbia, and published by the British Columbia Fisheries Department in 1915. Mr. Thompson also made a boat catch study of the albacore fishery during the time he was Director of the California State Fisheries Laboratory.

These results when considered as yearly averages would be indicative of the yearly fluctuations in abundance, or at least the availability to the fishermen of the species studied, if no changes in economic, weather or biological conditions had taken place during the time included in the boat catch study. However, some change, such as adverse weather for the best catches, or a great demand for another fish, taken perhaps with the same gear as the one studied, may have caused the fishermen to make only small incidental catches of the one in question, and fluctuations would result in the average boat catch so that it is not an absolutely accurate measure of the abundance or availability of the fish to the fishermen. Also the appearance of the offspring of an unusually successful spawning season in the commercial catch may cause a temporary increase in abundance, which would not be especially significant if the study of abundance extended over a long period of time.

Therefore, when the average daily catch per year has been computed, the problem of a person undertaking a boat catch analysis is by no means completed. All available data on economic, weather and

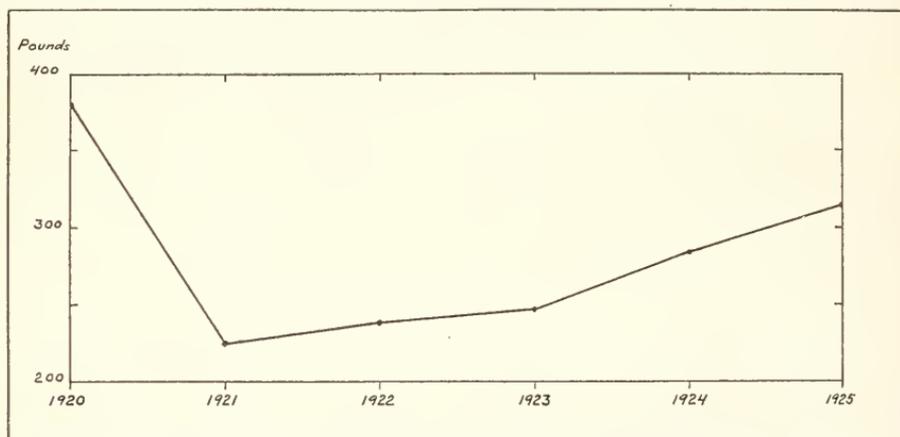


FIG. 22. Graph showing the average daily boat catch of shad of twenty boats fishing in the San Francisco bay district for the years 1920-1925, inclusive.

biological conditions that may affect the fishery should be carefully analyzed and applied to the boat catch analysis results, before the final result is said to be indicative of the state of abundance or availability of the fish in question. When there is added to this the fact that different fisheries may require different statistical methods of deriving the boat catch averages, it can at once be seen that a boat catch analysis is not a simple problem.

The solid line in figure 22 shows the average daily boat catch of shad in each year from 1920 to 1925, inclusive, of twenty boats fishing in San Francisco Bay and its tributaries, and will serve as an example of the result of a simple boat catch analysis. Briefly, the average daily boat catch for each year was computed as follows: First, from the boat registration and ticket files, the names of twenty boats were taken which had fished for shad continuously during the years in question and had not changed their personnel or gear. This gave a constant unit of fishing gear with which to work. The daily catches of each boat were then tabulated, the record of each boat being kept separately.

As soon as the catches were tabulated, it was evident that some boats had catches which averaged much larger than the catches of others. This was due to some boats being larger, having larger nets or crews, or being operated by more skillful fishermen. Then if the catches as recorded had been combined and averages taken, the boats with the large catches would have had a much greater influence in determining the final averages than the boats with small catches. This is not desirable, since small fluctuations in catches of a boat which habitually makes small catches should be as indicative of the availability of fish to the fishermen as greater fluctuations in catches of a boat which regularly makes larger catches.

In order to give all boats equal weight in determining the final results, the catches of all of the boats were raised to a level so that their averages corresponded to the average of the boat having the highest average catch through the six-year period. This was accomplished by finding a factor for each boat, by which all catches of each boat were multiplied and thereby raised to an equal basis with the catches of the boat having the largest catches.

Since the catches of all of the boats were raised to a common level, the records of all twenty boats were combined and an average of the daily catches per boat computed for each year. This was done by dividing the sum of all catches of all of the boats for one year by the total number of catches occurring in that year. This procedure was followed with the data for each of the six years. The result is shown by the solid line in figure 22. The actual size of each catch for each boat, after being multiplied by its respective factor, and number of catches of each boat were used in computing the yearly averages, so each boat had a weight or influence on the final yearly averages in direct proportion to the number of catches that it made in each particular year. This is as it should be, because a boat making a hundred catches in a year furnishes twice as reliable a sample as a boat making only fifty catches in that year.

The final result then is the average catch per day or trip of a constant unit of fishing effort and gear for each of several years.

At this point it may be well to say that this paper does not pretend to be a complete discussion of the abundance of shad in our state. The graph shown in figure 22 is presented merely as an illustration of a boat catch method, and the statements that follow are in the nature of suggestions to show what can be done with boat catch data. The shad boat catch analysis was made in the course of an investigation of the abundance of striped bass, and we do not feel that enough work has been done on the shad data to warrant definite conclusions being drawn concerning the subject.

The boat catch curve indicated by the solid line in figure 22 shows that there was a sharp decrease in average boat catch from 1920 to 1921 and then a steady increase up to the close of 1925. This indicates that there was an increase in abundance of shad from 1921 to 1926. In order to verify this curve the economic conditions of the shad fishery during these years should be investigated. Prices for the different years and data on market conditions should be gathered and correlated with the boat catch curve.

Also, since salmon and striped bass are taken by the same boats on the same days that shad are caught, the condition of these fisheries should be studied, particularly prices, because a rise in shad prices and a drop in the prices paid for the other two fish might result in more fishing in places favorable for taking shad and so raise the size of the shad catches.

Another interesting phase of the problem is that in 1918 a protective measure, making a closed season on shad during part of their spawning season, went into effect. Therefore it may be that the first fish spawned in that protected spawning season returned in 1922 and helped to cause the rise in boat catch from 1922 to 1925, inclusive. Of course work to determine the age at which shad first appear in the commercial catch should be done to verify that supposition.

A boat catch analysis then is not a simple problem, but when carefully done and all of the biological and economic factors that might affect it are also worked out, it is a procedure that will yield the information desired by the Department of Commercial Fisheries and persons interested in the fisheries, and will furnish a definite measure of the abundance of the species of fish involved in the investigation.

AN HISTORICAL REVIEW OF THE LEGAL ASPECTS OF THE USE OF FOOD FISH FOR REDUCTION PURPOSES.

(Continued from CALIFORNIA FISH AND GAME, Vol. 13, No. 1, p. 17.)

By B. D. MARX GREENE, Attorney, California Fish and Game Commission.

At the conclusion of the previous article, certain cases were still pending in court. The owners of the two purse seine boats which had diverted food fish to the "Peralta" were contending that we had no right to condemn their purse seines. In the superior courts, however, of both Monterey County and Santa Cruz County, judgment was given in favor of the Fish and Game Commission condemning the nets. Thereupon, the owners of the two nets immediately filed petitions for writs of supersedas in the Supreme Court to prevent the court below from enforcing the judgment of condemnation. The two matters came on for hearing before the Supreme Court on May 3, 1927, and after argument, it was stipulated, owing to the perishable character of the nets, that they should be sold under an order of the court and the proceeds deposited with the court, pending the final determination of the right of condemnation. Subsequently, however, the petitioners consented to a dismissal of the actions and the nets were sold back to the original owners for the sum of \$1,450.

At the conclusion of the first installment of this article, the Alameda County court still had under consideration the injunction hearings brought by the Commission against the "Lake Miraflores." In this matter the temporary restraining order was finally dissolved and the defendant's demurrer sustained on the ground that the location of the vessel was beyond the three-mile limit and outside the jurisdiction of the courts of the State of California. This did not at all upset the theory of law enunciated by the Supreme Court and the United States District Court, but was decided upon the question of fact as to whether

or not the body of water in which the boat was anchored was a bay within the meaning of the constitution.

In December, 1926, the Globe Cotton Oil Mills of Los Angeles, which was in the business of manufacturing edible oil out of sardines, filed a petition in the Supreme Court for a writ of mandate against the Fish and Game Commission to compel it to hold a hearing to determine whether a permit should be issued to petitioner to use sardines for such purpose. The Commission had refused to hold such hearing, basing its refusal upon the language of the decision of Judge Stephens (CALIFORNIA FISH AND GAME, January, 1927, p. 11), which seemed to deprive the Commission of all its judicial powers, including that of holding hearings. The Supreme Court, however, decided in favor of petitioner, and handed down the following decision:

S. F. No. 12323. In Bank. January 20, 1927. *Globe Cotton Oil Mills, Petitioner vs. I. Zellerbach, M. H. Connell and Ralph H. Clock*, members of the Fish and Game Commission of the State of California, Respondents.

Application for writ of mandate prayed to be directed to respondents as members of the Fish and Game Commission to require them to act upon the application of petitioner for a permit authorizing it to use in its plant a designated quantity of fish. Writ granted.

For Petitioner—Warren H. Pillsbury, John L. Dyer.

For Respondents—B. D. Marx Greene.

BY THE COURT.

Upon submission of the cause in open court the chief justice announced the decision of the court as follows:

The petitioner, owning and operating a fish reduction plant at Terminal Island, San Pedro Harbor, seeks a writ of mandate to compel the respondent Fish and Game Commission to set for hearing and to act on the application filed with the Commission by petitioner for a permit authorizing it to use in its plant the quantity of fish designated in the application, for the purposes therein specified. The Commission has refused to entertain jurisdiction of the application upon the ground that it is a nonjudicial body, and that to act as requested by the petitioner would be to exercise judicial functions. In assuming this position the respondent relies upon *Van Camp Sea Food Co. vs. Fish and Game Commission*, 49 Cal. App. Dec. 38, in which it was held that a commission like the Fish and Game Commission, which is one having a state-wide jurisdiction, as distinguished from a local board, can not be invested with judicial functions, for the reason that, "except for local purposes," section 1 of article VI of the constitution confines all judicial power to certain specified courts.

This court is of the view, however, that admitting that the Fish and Game Commission can not be granted any power which constitutionally belongs exclusively to the judicial department of the state government, the granting of power to hold hearings and determine facts incidental to the regulation of fish and game, and to the granting of permits to take and use fish, is valid as an administrative or regulatory power, and in no wise transgresses upon the judicial functions of the judicial department.

Let the writ of mandate issue as prayed for.

This decision of the Supreme Court, while technically a defeat for the Commission, was in reality one of its greatest victories, because it restored to the Commission the right to hold hearings and determine quasi-judicially matters entrusted to it by the legislature in various acts.

Relying, therefore, upon this decision, the Commission immediately told all of the sardine packers in California that it would be necessary for them to file applications to have their capacities determined. Most

of the packers in southern California refused to comply with the order of the Commission, basing their refusal upon the former decision of Judge Stephens. The Commission thereupon commenced an injunction suit against the Van Camp Sea Food Co., Inc., alleging that they were operating their reduction works and using fish therein without having had the capacity of their canning plant determined. The matter came on before Judge Stephens upon an order to show cause, and was argued and submitted to the court upon a general demurrer filed by the defendant. On November 14th, Judge Stephens handed down his decision overruling the demurrer of the defendant and sustaining fully the position of the Fish and Game Commission. In effect, this second decision of Judge Stephens in the Van Camp case expressly overrules his former decision heretofore quoted.

The law therefore is now settled that all canners must apply to the Fish and Game Commission to have their capacity determined. There is, however, no method left in the law by which the Fish and Game Commission is to determine such capacity, for the arbitrary allowance of 150 tons for each line of one-pound oval can closing machinery has been declared unconstitutional by the appellate court.

In the meantime, the Fish and Game Commission, in the orders determining capacity which it has heretofore made during the present season, has set out that the capacity of each canning plant is the amount of fish actually taken into such plant and canned. Each packer is, therefore, allowed to use for reduction purposes 25 per cent of his actual catch and not 25 per cent of a theoretical capacity of a plant. Furthermore, the Commission, in order to make the matter doubly certain, has adopted its General Order No. 6, defining waste of sardines, and in this order it determines that any use of sardines will be considered a waste unless a packer obtains out of each ton of sardines received by him at least fifteen cases of one-pound oval cans of sardines. Inasmuch as a packer can obtain twenty cases of such one-pound oval cans of sardines out of each ton of fish received, if the entire amount is fit for canning, it necessarily follows that this General Order No. 6 of the Commission allows the packer the leeway or margin of 25 per cent contemplated by the law.

After the decision on the demurrers in the Van Camp Sea Food case, the Commission filed injunction proceedings against three other packers at San Pedro who had ignored the Commission's order to have their capacity determined and had gone ahead with the operation of their plants. Temporary restraining orders were issued against these three packers and they were all kept closed for a period of days. Thereupon, all of the packers in southern California filed with the Commission their applications to have their capacities determined and appealed to the Commission to dismiss the pending litigation, agreeing that they would abide by the rules and regulations of the Commission and cooperate with it to the fullest extent. The Commission heeded the pleas of the packers and ordered the pending cases dismissed—and for the first time, practically, in the history of the state, there is now complete accord and amity between the California Fish and Game Commission and the sardine packers.

BIOLOGICAL REQUISITES FOR LAKE TROUT.*

By GEORGE A. COLEMAN.

The lakes of California range from nearly sea level to almost 12,500 feet in altitude. A great variety of conditions are produced as a result of such changes in elevation. Lakes lying in the lowlands are rarely if ever frozen while those in the high Sierra are beleaguered by the powers of winter for a great part of the year. Even lakes located at the same level above the sea vary. They have different depths and this factor, too, has a bearing upon the food supply of fishes and the conditions under which they live. Often sportsmen wonder when fish are planted in a lake why they are not forthcoming by the thousands. The reason is not so much a mystery as it would seem at first blush, for either the lake is unsuitable for fishes to breed in or the food in it is not adequate to support them.

The wind in passing over the surface of a lake sets up a wave action and produces a circulation that reaches a depth of from 25 to 40 feet. Hence, a lake with a depth of 25 feet has a circulation entirely to the bottom. Lakes of this character, where the whole body of water is influenced by the wind, are classed as shallow. Lakes of this type are also influenced by fluctuations of daily temperature. However, the deep lakes, those whose depth exceeds 40 feet, are subject only to seasonal changes in temperature. When a depth of 170 feet is reached the temperature varies only one degree Fahrenheit. Below this depth it is constant even though the surface may be 10 degrees warmer.

In general, the food of fishes is produced in a narrow fringe around the edge of the lake. The only place where plants and insects flourish is in the rocky or sandy margins where a strong wave action occurs. This area rarely extends more than 10 feet from shore so that the growth within the lake of plant and insect food for fishes is accordingly limited to a small portion of the water area.

Water insects and plants very seldom occur at a depth of greater than 25 feet. Occasionally they are found in deep water but not often. Light sensibly affects the growth of life in water as well as the other factors previously mentioned. At a depth of 250 feet only the lowest forms of plants have so far been discovered. Below this there is practically no light and darkness and lifelessness hold sway.

The United States Bureau of Fisheries made some experiments in keeping fishes at different depths. Pressure, of course, increases with depth and this represents another controlling factor in the well being of fishes. For instance, the bureau found that ordinarily fish will not live below 50 feet. Yet, in the face of this, fish have been caught in Lake Tahoe at a depth of 150 feet. This all goes to show that there is much undiscovered country in this field and that there is much we do not know about the habits of our lake fish.

Reproduction will not occur unless there is a sizeable breeding ground where the water is two to six feet in depth and conditions are right for breeding. Some fish require lake margins of a sandy nature, others prefer rocky situations. There must also be an adequate area

* Address given at Second Annual Convention, California Fish and Game Commission Employees, San Francisco, February 8, 1927.

where the young fish may feed. This must contain submerged and emerging vegetation and consist of some of the simplest and lowest forms of plants which will support the insect and microscopic life that serves as food for young fish. The area must be free from decay. Where there is decay there is disease. The perfect breeding and rearing ground is where production and consumption of waste are equal.

Oxygen is as necessary to a fish as it is to living forms out of water. Carbon dioxide is equally indispensable and must be present in a certain amount. In fact, the amount of carbon dioxide in the water is an index of its suitability and governs in no small degree the possibility of fish existing in this medium. By this, it must not be inferred that fish can not endure water slightly alkaline. They do best, however, in water slightly acid and poorest in water perfectly neutral. Curiously enough, if a fish is put in distilled water, which is perfectly neutral, it will die.

A hard and fast law of nature is that fish either must eat or be eaten. All their lives they are busily engaged in blithely devouring one another in order to preserve and continue their existence. Their appetites on the whole are very hearty and it takes a prodigious quantity of food to keep a fish in good health.

Of the plants that afford food, the algae are probably the most prominent. On the basis of color the fresh water algae fall into a general group called blue-green algae. These include the yellow-green and brown algae. These plants are of great economic importance as they supply oxygen for fish. They depend upon nitrogen in water for their growth, and certain microscopic forms, the diatoms and protozoa, in turn depend upon the abundance of the algae. A scarcity of the latter invariably results in a scarcity of the former. Nor is this the end of the chain for the invisible plankton, on which minnows live, depends on the diatoms and protozoa. Only a few of the crustaceans are important as fish food, though there are thousands of species and varieties. The fairy shrimps and the water fleas are the most noteworthy. Another item in a fish's bill of fare, besides water insects, is scuds. In the main, scuds are scavengers, living on decaying matter. Go around Clear Lake, where numbers of dead fish can be seen, and on examination it will be discovered that every fish is covered with thousands of scuds.

Tiny trout feel the hunger urge almost before the egg sac is absorbed. They begin to jump at gnats on the surface of the water and to take the larvæ of small insects as well as to devour the microscopic forms. Experiments have shown that trout but ten days old will take as many as twenty-five gnats in a single day. As they grow in size they take larger insects and their consumption of various sized prey is only governed by the size of their mouths. From the start they are cannibalistic. At first they will eat any other fish smaller than themselves. It makes no difference whether they be minnows, bass or trout as long as they can be captured. As they grow older, however, trout become more selective.

There is a constant trading around between bass and trout. Bass take great numbers of trout and trout devour bass up to a size that their mouths will permit. Due to the large size of the mouth of the bass it can take a trout almost as large as itself. In this respect the trout

is not so fortunate and must confine its attentions to bass much smaller than itself. There is no doubt that if a trout could swallow a bass as large as itself it would do it. Nature usually makes provision for this by producing a sufficient number of individuals so as to afford food for the various species that live off one another.

In conclusion it can readily be seen that no small problem is involved in planting trout in a lake and supplying them with an environment insuring their proper growth. At all times natural conditions must be obtained. If the balance of nature is upset or if conditions are not right for the plant, it can not possibly be successful.

PROGRESS IN HALIBUT INVESTIGATIONS.*

By RUTH MILLER THOMPSON.

Presenting a most absorbing account of the alarming depletion in the North Pacific halibut fishery, and of what is being done to save the industry, the *Pacific Fisherman* (July to October, 1927) devotes four major articles to a description of the scientific work being carried on for the International Fisheries Commission by Mr. W. F. Thompson and his associates. The author of this unsigned series speaks of this investigation as "without doubt the most thoroughgoing and valuable ever carried out in the field of commercial fisheries." Again, he refers to the "inconceivable mass of statistical and biological data" collected by the Commission's scientific staff, and says, "Though highly scientific in method, the investigation is along intensely practical lines, and is marked by close adherence to facts and avoidance of unsupported theory or speculation." This is high praise indeed, from anyone, and especially from a publication which is of the "trade organ" rather than of the "scientific journal" type.

It reflects great credit upon the judgment of both the commissioners themselves, in their executive capacities, and of those who framed the scientific program, that their work has been kept strictly relevant to their aims. It is also significant that in spite of the fact that the future recommendations of the Commission will very likely affect adversely various sections of the industry, the Commission's staff maintains the friendliest relations with fishery operators.

That quite the reverse of this situation has been and still is usual in fishery investigations undertaken in other countries could easily be demonstrated. There has often been a great gulf of misunderstanding between the "industry" and "science." This is despite many efforts on the part of investigative bodies to explain their endeavors to "practical men." In other days and places many articles have been printed and many public meetings held, similar to those conducted during November and December in Ketchikan, Prince Rupert, Vancouver and Seattle, by the International Fisheries Commission staff. Doubtless much of the unfortunate antagonism that has existed in some countries is due to the greater complexity of scientific problems presented by older fisheries, or to other factors beyond the control of scientists. However this may be, it is certain that the cooperation between research

* Contribution No. 69 from the California State Fisheries Laboratory, November, 1927.

and industry on the Pacific Coast points to an intelligent comprehension of each other's problems. If anything can prolong indefinitely the life of the halibut fisheries, this spirit ought to be able to find the way.

That California has made a large contribution to saving the halibut is a tribute to the vision of Mr. N. B. Scofield, head of the Department of Commercial Fisheries of the Division of Fish and Game. He was first to start scientific fishery investigation in this state and his continued enthusiasm made possible the employment of Mr. W. F. Thompson and the establishment of the California State Fisheries Laboratory under the latter's charge.

While Mr. Thompson was well fitted for his present work by previous training and temperament, and had gained valuable experience by conducting a preliminary investigation of the halibut in 1912-1913 for the government of British Columbia, it was as director of research for the California State Fisheries Laboratory that he developed his scientific talents. Undoubtedly his work on the sardine and albacore in California was a fine preparation for his return to the halibut research, and enabled him to think through its intricate problems with a masterly clearness.

Mr. W. C. Herrington, also trained at the California State Fisheries Laboratory, has recently been added to Mr. Thompson's staff.

While the basic facts of the halibut situation have already been unfolded, the conclusions presented in the *Pacific Fisherman* articles are of a tentative character. The commissioners have as yet made no report to their respective governments, and have reserved their recommendations until after the previously mentioned conferences with men from the industry. The commissioners, namely Mr. J. P. Babcock of Victoria, chairman, Mr. Henry O'Malley of Washington, Mr. Miller Freeman of Seattle, and Mr. W. A. Fould of Ottawa, have always taken a very active interest in the work of their scientific staff, and planned to be present at the public hearings.

Data indicating the actual abundance of fish on the banks which have been available to the Commission, include what is described as a "remarkably complete record of the commercial landings for the last twelve years," and logs kept by fishermen. During the course of the investigation, the system of record keeping has been still further improved and extended through the efforts of the scientific staff. The truly scientific character of the work may be judged from the emphasis placed on the necessity of adequate and continuous statistical records to the proper control of the fishery. This emphasis will recall the similar insistence that accurate and complete statistical records of catch are essential, which marked Mr. Thompson's work in California. Undoubtedly his appeal that research was futile without adequate statistics aroused the agitation which resulted in establishing the now famous "pink ticket" system in California.

Results obtained from a study of catch records and logs have been checked with painstaking thoroughness by comparison with data from other sources. Chief among these stand the observations of the Commission's employees aboard chartered vessels. For this work, a large and powerful halibut schooner, the "Dorothy," has recently been reconditioned and newly equipped to replace the "Scandia," which was

wrecked last February. The winter's studies of maturity, spawning, eggs and larvæ, and races have already begun.

The biological investigations based on all types of data have yielded harmonious results. That depletion has been very marked, though uneven, is clear. South and east of Cape Ommaney conditions are worst. Unmistakable signs of overfishing are: greatly reduced catch per unit of gear, a marked westward shift of fishing operations, and the preponderance of small fish in the catch. It is apparent that on the southern grounds the number of spawning fish is greatly reduced so that the present fishery is here a heavy drain on the immature population.

That the halibut stock of any bank is independent of the stocks on other banks, and must be protected by its own set of regulations, has been demonstrated. Studies of migration by means of tagging, of races by means of measurements of body proportions, and of age in relation to growth by means of "reading" the number of year rings on ear stones, give the chief evidences for the independence of fish stocks. Much remains to be discovered, especially concerning the large fish, before it will be possible to predict with certainty the effect of every proposed protective measure on the fish of each locality.

From the point of view of the actual ultimate needs of the fishery as scientifically determined, the essential part of any adequate regulatory law is provision for increasing or at least maintaining the number of spawning fish. Some "baby" halibut nurseries and spawning grounds in every general fishing area must eventually be closed. Each area must be handled as a unit in itself with its own conservation measures. Furthermore, to be effective, protection must continue for a long period of time, even permanently in some cases. Whatever legislation is adopted must be regarded as experimental. Therefore, not only must it be flexible and easily revoked should this be desirable, but its effects must be carefully followed. The necessity for adequate statistics is again apparent. If records are poor there will be no test of the value of regulation.

The study of the halibut is only half completed. To define the precise extent and degree of restriction needed on each bank will require considerable further work. Even when this is done, to determine the true results of regulation will be a task requiring the highest degree of scientific skill. It is to be hoped that the two governments will see the great value of the work that has been so ably begun and will realize that discontinuance would cause irreparable loss not only to the halibut industry, but to the future of fisheries research and to the cause of rational conservation.

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All material for publication should be sent to H. C. Bryant, Postal Telegraph Bldg., San Francisco, California.

January 30, 1928.

Consider your need, not your greed.



**EUGENE D. BENNETT, NEW
EXECUTIVE OFFICER.**

On December 1, 1927, Mr. Eugene D. Bennett of San Francisco became executive officer and attorney of the Division of Fish and Game, Department of Natural Resources. Although born in Kansas, Mr. Bennett came to California as a boy, where he learned to fish and hunt. During the World War he was a commissioned officer in the Ninety-first Division and a member of the division rifle team. His marksmanship was also demonstrated when he won a place on the

California state rifle team in 1924 and entered the national competition at Camp Perry.

Mr. Bennett has taken an important part in American Legion work, being past commander of San Francisco County Council and was formerly chairman of the Americanization Committee of the state department of this organization.

For nearly ten years Mr. Bennett has practiced law in San Francisco. During the past two years he has been chief deputy United States Attorney of northern California.

Even since childhood Mr. Bennett has fished and hunted and a definite interest in fish and game matters has long smoldered. In the acceptance of his new position this interest has been a determining point. Mr. Bennett believes that "never before has such responsibility rested upon the Division of Fish and Game as at present. It is of the utmost importance that the Division keep pace with the present rapid strides of its progressive development to the end that the state's great commercial fishing industry and also its outdoor and recreational resources of fish and game may be preserved and developed to take care of the state's ever-growing population."

THE RETIRING EXECUTIVE OFFICER.

To Mr. B. D. Marx Greene was given the important problem of reorganizing the work of the Fish and Game Commission, beginning January, 1926. To this work he brought administrative ability and boundless energy. In retiring he leaves the working force of the Commission acting under various departments and bureaus manned by competent men and the whole financed under a budget system.

Other administrative accomplishments include the reorganizing of the patrol force under a chief, two assistant chiefs and captains, and putting the warden force in uniform; the organizing and bringing to efficiency of a volunteer warden system; the establishment and maintenance of one of the largest game farms in the United States; efficient handling of pollution and screens and ladders; enlarged educational, research and publicity programs; a system of holding ponds and tanks for the ageing of trout; and the publication of a Service Bulletin and the holding of an annual convention for the education and stimulation of employees.

Mr. Greene's more recent interests have been centered in the development of a new and better system of fish distribution and in the use of a short wave radio in keep-

ing the patrol force in constant touch with the head office.

In all of the above accomplishments, Mr. Greene took an active part and his ability in better organizing the working force will be long remembered. Mr. Greene on December 1 assumed the position of attorney for the Department of Commercial Fisheries.

SPECIAL FISH PLANTING TRUCK.

During September a new Graham truck was especially equipped with ice boxes and aerating system for use in fish distribution. On its initial trip it proved so satisfactory that more emphasis will be given this mode of planting in the future. The first trip during the first eight days of October was in Mono

2. Those in charge can leave the fish to secure meals without danger of losing the fish. The reserve compressed air tank will continue to furnish air to the fish for thirty minutes, even when the engine is not running.

3. With fish in good condition, plenty of time can be given to proper distribution at the terminal.

The truck has continued to operate successfully from the Mount Whitney Hatchery.

A CORRECTION.

Due to the fact that the author of the article, "The Deer of California," which appeared in the October number of CALIFORNIA FISH AND GAME (Vol. 13, No. 4), did not see figures or legends for figures

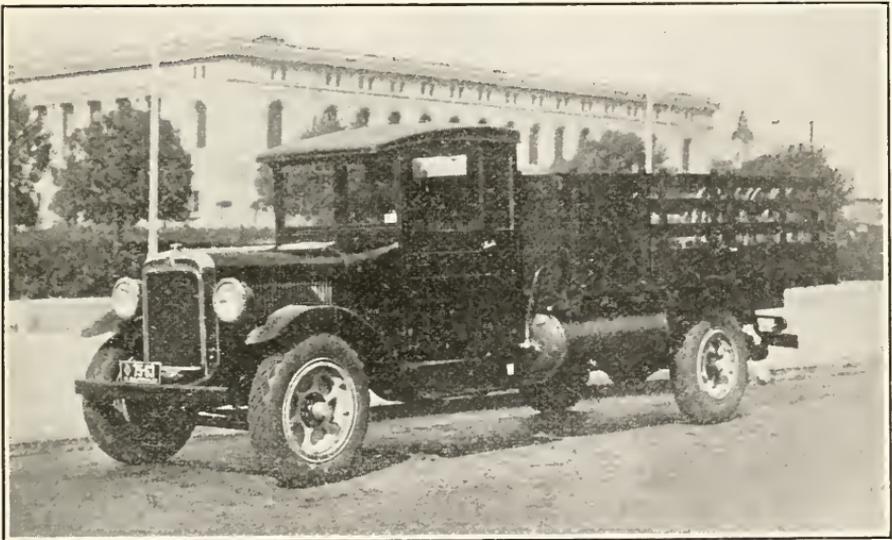


FIG. 23. New fish distribution truck. Air tank on side filled by air compressor furnishes aeration to shipping cans. Photograph by H. C. Bryant.

County. The truck traveled over steep mountain roads and conveyed forty cans of black-spotted trout to Searles Lake, Alpine County. The shipment was on the road for nineteen hours. The distance covered was 255 miles. In some of the cans there were no dead fish at all. Apparently fish will travel any reasonable distance very satisfactorily under the conditions afforded by this truck. The outstanding advantages of this method of transporting fish are:

1. When properly iced, fish can be transported over a smooth highway as easily as over a rough road. Jogging produced by a rough road is necessary to furnish proper aeration when compressed air is not available.

in the proof stage, several errors appeared in the article.

Page 237. Transpose legends for figures. That is, for 52 read 53 and for 53 read 52.

Page 238. Lines two and three, "tailed deer and the white-tailed deer. The latter, the range of which is not shown on the distribution map, occurs in winter and only infre-" should read, "tailed deer and white-tailed deer. The latter occurs in winter and only infre." Thus, the phrase, "the range of which is not shown on the distribution map," is to be omitted. Line four, word "northwestern" should read "northeastern." Also on page 238, the last line, "the state. (Range not shown on distribution map.)" should

read, "the state. (See distribution map, Fig. 57, p. 239.)"

Page 239. In legends to distribution map (Fig. 57), "*Odocoileus c. scaphiotus*" should read "*Odocoileus c. scaphiotus*." "5. Burro deer. *Odocoileus h. californicus*." should read "5. Burro deer. *Odocoileus h. eremicus*."—E. Raymond Hall.

COMMERCIAL DUCK CLUBS LICENSED.

At the 1927 session of the legislature a commercial gun club license act was passed in an endeavor to control the many commercial gun clubs that had been established where fees for hunting were

assured that these clubs will cooperate in the enforcement of the game laws.

Only a few commercial gun clubs are operating in southern California, the greater number being located in the Gustine-Los Banos district of the San Joaquin Valley and again in the vicinity of Colusa and Willows in the Sacramento Valley.

The following regulations have been issued by the Division of Fish and Game:

GENERAL ORDER No. 9.

REGULATIONS UNDER WHICH COMMERCIAL
DUCK CLUBS MAY BE OPERATED.

REGULATION No. I.

Shooting days limited to three days a

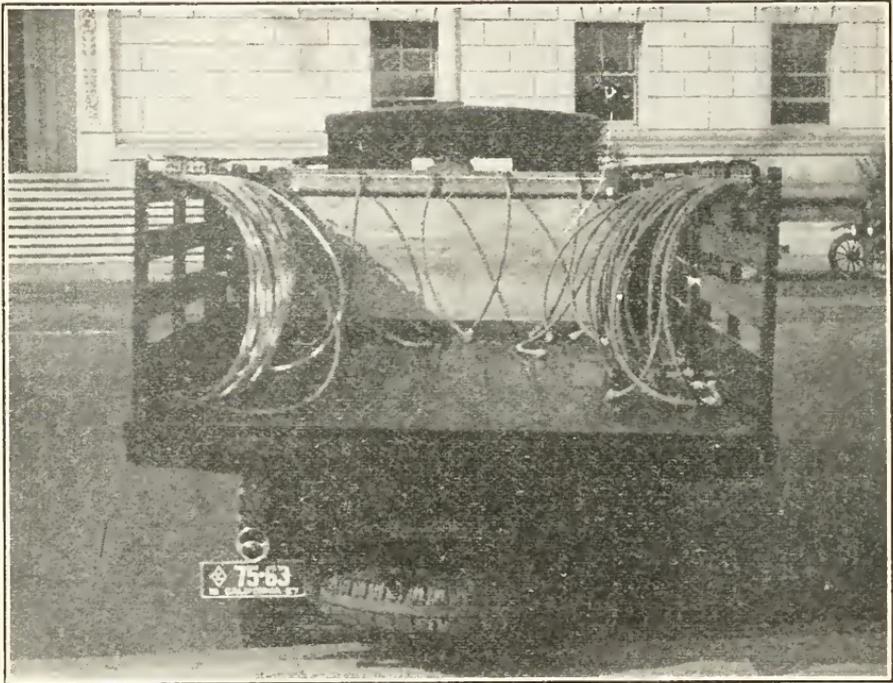


FIG. 24. New fish distribution truck showing aerating apparatus. Photograph by H. C. Bryant.

charged. The law provides for a license fee of \$25 to citizens and \$100 to persons not citizens of the United States. Each commercial hunting club operator must pay a \$5 license fee if he be a citizen and a \$25 license fee if he be an alien. Up to December 1, forty-three commercial duck clubs had been granted permission to operate and fifty-six operators were licensed to work on these preserves. The men who pay their fee and hunt on these commercial gun club grounds have found that they are better protected and the Division of Fish and Game is now

week; Sunday, Wednesday and Saturday. Additional operating days, the opening and closing of the season and all legal holidays.

REGULATION No. II.

A blind must be within shooting distance of water. Blinds must be a reasonable distance apart, to depend upon local conditions.

REGULATION No. III.

Each shooter must be given a satisfactory blind. No shooters to be allowed to hunt at large when blinds are full.

REGULATION No. IV.

Operators must cooperate with the Fish

and Game Commission in law enforcement.

REGULATION No. V.

Where clubs adjoin, no blinds to be located within 70 yards of adjoining boundary, except under mutual agreement.

REGULATION No. VI.

The continual shooting of birds out of range will be regarded as a nuisance and the club may at its discretion refund the money paid for shooting privilege and bar shooter from further hunting.

REGULATION No. VII.

Under no consideration is a club to guarantee limit.

The foregoing order is hereby approved and ordered filed as "General Order No. 9, Division of Fish and Game, of the Department of Natural Resources of the State of California."

Dated: This thirtieth day of September, 1927.

I. ZELLERBACH,
REGINALD FERNALD,
GEO. B. CLARKSON,

Fish and Game Commission.

Many requests have come from commercial duck club operators and hunters, who can only seek birds on these club preserves, that they be permitted to shoot every day during the week. After a thorough investigation of all angles in connection with the problem it was deemed to the best advantage of the hunters, the clubs and the ducks that the regulations as laid down by the Commission be enforced and that hunting be permitted only three days a week.

PATROL CONFERENCE.

Many important matters were discussed at a special conference of the patrol officers, held in San Francisco, October 10th and 11th. Captain K. P. Allred, acting chief of patrol, discussed general policies. As a better means of handling the large field force it was decided that each deputy will report directly to his captain and the captain directly to the chief of patrol. Thus there will be corrected the general tendency for men to go over the heads of their captains to the higher officers of patrol. Under this plan it is expected that the men will be able to work to the very best of their ability and accomplish splendid results.

KMN GOES ON THE AIR.

In order to increase the efficiency of the patrol service, the Division of Fish and Game at San Francisco has installed a 500-watt transmitting set, and with receiving sets a detail can be in almost constant touch with the head office. The station, known as KMN, is capable of sending messages to the remotest points in California both day and night. It has

an advantage over telephone systems in that it affords almost instantaneous service and there is no danger of the message being broken or "tipped off" as has been frequently the case with telephone calls. It will prove a valuable feature in regions where deputies are far from a telephone.

At duck headquarters for northern California, near Maxwell, a 100-watt transmitter has been set up. Here operators are constantly on duty and in ready contact with the central office. The ten men in the field at Maxwell are thus consistently informed in regard to developments and information received at the San Francisco office. In turn, the central office is advised of the needs of the men patrolling the duck fields, when a large haul is suspected and when relief deputies are wanted to check nightshooting. So excellent has been the patrol so far that no instance of a "drag" is known to have been made.

Another station has been installed at San Pedro and at the conclusion of the duck season it is the intention to remove the set at Maxwell to Sacramento. This will enable the three central offices to be in constant communication.

Another ambition is to equip the patrol with small portable sets and to instruct and train the deputies as to their operation. It is estimated that but three weeks, at most, will be necessary to teach a man how to take a message. Every deputy will have his own code letter. Messages will be sent from the central office at agreed periods known only to the field forces.

There is no doubt that the efficiency of the patrol will be greatly increased by means of the use of this modern invention. It is believed that this is the first instance in history that a patrol force has been directed by wireless.

KILL OF DEER, SEASON 1927.

A tabulation of the kill of deer in California has been made possible by the enactment of the Deer Hunting License Tag Act. This law provides that every person who hunts deer in this state must first procure license tags in addition to a regular hunting license. For a fee of one dollar, the hunter is furnished with two deer tags in duplicate; the original tag to be attached to a deer when killed and the duplicate mailed to the Division of Fish and Game.

The purposes of the new law are: (a) to make possible better enforcement of the laws for the protection of deer; (b) to secure accurate information on the number of deer killed; (c) and to provide additional revenue for field patrol.

The following report shows the number of deer killed during the 1927 open season. However, only a part of the data secured from duplicate deer tags is indicated; a full report will be published at an early date.

Game is importing from Czecho-Slovakia five hundred pairs of Hungarian partridges. A friend of conservation work who has been importing birds for his own use helped in making the arrangements. On arrival, these birds will be

DEER KILL^{ED} BY COUNTIES, SEASON 1927.

County	Points								Total
	2	3	4	5	6	7	8	9	
Alameda.....	171	42	7						220
Alpine.....	14	21	27	2	3				67
Amador.....	19	18	17	4	1				59
Butte.....	74	68	69	13	3	1			228
Calaveras.....	50	47	42	5	2	3			149
Cohusa.....	161	76	25	1					263
Contra Costa.....	4	1							5
Del Norte.....	16	12	10	4					42
El Dorado.....	183	173	138	32	7	1		1	535
Fresno.....	215	170	159	33	12	2		1	592
Glenn.....	284	242	88	6	3				623
Humboldt.....	389	258	155	15	3	1			821
Imperial.....	1								1
Inyo.....	74	48	35	11	3	1		1	173
Kern.....	83	72	52	8	3				218
Kings.....		3							3
Lake.....	599	229	65	6	1	1			901
Lassen.....	20	86	129	37	14	3	4	3	296
Los Angeles.....	279	92	45	8	1				425
Madera.....	96	77	64	14	6	1	2		260
Marin.....	297	58	10	2					367
Mariposa.....	32	31	24	4	2	1	1		95
Mendocino.....	853	426	180	11	5				1,475
Merced.....	41	21	4	1					67
Modoc.....		138	262	69	24	10	3	4	510
Mono.....	14	7	10	5					36
Monterey.....	541	161	41	11	1	2			757
Napa.....	242	155	41	3	1				442
Nevada.....	38	48	36	3					125
Orange.....	24	17	12	2	1				56
Placer.....	121	105	95	14	4	2			341
Plumas.....	177	169	167	25	8	2	3		551
Riverside.....	170	82	51	19	1				323
Sacramento.....									
San Benito.....	150	54	10	2	1				217
San Bernardino.....	32	21	14	6	1				74
San Diego.....	95	38	33	3					169
San Francisco.....									
San Joaquin.....	13	7	1						21
San Luis Obispo.....	251	103	29	8	2			1	394
San Mateo.....	61	13	3						77
Santa Barbara.....	424	154	74	16	1				669
Santa Clara.....	243	119	31	4					397
Santa Cruz.....	69	6	3						78
Shasta.....	171	240	164	25	4	1	4	3	612
Sierra.....	27	27	44	2	1				101
Siskiyou.....	424	491	578	120	28	10	4	10	1,665
Solano.....	22	16	7						45
Sonoma.....	519	188	37	7					751
Stanislaus.....	53	26	8	3		1			91
Sutter.....			1						1
Tehama.....	286	288	192	29	2	2			799
Trinity.....	299	339	238	35	4	4	2		921
Tulare.....	341	200	177	24	1		1		744
Tuolumne.....	64	72	52	20	1	3		1	213
Ventura.....	164	74	27	7	2				274
Yolo.....	55	39	18	3					115
Yuba.....	24	19	6	4					53
Totals.....	9,069	5,687	3,807	686	157	52	24	25	19,507

HUNGARIAN PARTRIDGES
PURCHASED.

In the hope of furnishing still another desirable game bird for the sportsmen of California, the Division of Fish and

Game is importing from Czecho-Slovakia five hundred pairs of Hungarian partridges. A friend of conservation work who has been importing birds for his own use helped in making the arrangements. On arrival, these birds will be

placed at the Yountville Game Farm to form the basis of a brood stock. In British Columbia and the state of Washington, the Hungarian partridge has become well established and is fast becoming

ing a favorite game bird over a large area. Thus far, difficulty has been experienced in attempting to rear these birds under artificial conditions. However, the state of Oregon now has a brood stock that gives hope of better results in the future.

ASSOCIATED SPORTSMEN'S CONVENTION.

It is gratifying to all conservationists to find that at last the numerous fish and game protective associations of the state are united and pulling together to bring about better conservation of natural resources. The Associated Sportsmen of California held their third annual convention in San Francisco on November 3d and 4th. Representatives of the affiliated organizations were present and

TROUT DISTRIBUTION FOR 1928 PLANNED.

The present policy of establishing local hatcheries to care for nearby territory is proving a success. Time and energy are saved as well as losses in the shipment of fingerling trout. Well equipped auto trucks deliver the fish to the streams in splendid condition because of a short haul. The system can be made yet more effective by making all allotments of trout to the various streams in the fall in order that eyed eggs may be sent to the various hatcheries in proper quantities to care for each local district. Accordingly this is being done through a series of meetings with various captains of patrol. The needs of various districts are being ascertained and the allotments made. This



FIG. 25. Fish Car No. 01 arrives in Marin County with shipment of trout designed for Marin County streams. September 18, 1927. Photograph by Walter Sellmer.

there was much discussion on numerous and various subjects. As in past years, emphasis was placed upon the need for the destruction of predatory animals and the suggestion was made that the Division of Fish and Game put more lion hunters in the field charged with the additional duty of killing other predatory animals. A report on the reflooding of Lower Klamath Lake by a representative of the Bureau of the U. S. Biological Survey was not heartening. The concluding session of the convention was devoted to a display of motion pictures and to addresses by President Zellerbach of the Division of Fish and Game, B. D. Marx Greene, retiring executive officer, and Eugene D. Bennett, his successor.

having been done it will be an easy matter to allocate the proper number of eyed eggs to each hatchery and thus eliminate the long hauls which cause losses in trout shipments.

OUTBREAK OF DUCK DISEASE.

During the last days of October ducks died in large numbers at Buena Vista Lake, Kern County. It was estimated that at least two thousand birds lost their lives. In order of abundance the sick birds found were as follows: pintail, shoveller and greenwinged teal. Some mud hens were also affected. An investigation made by the Bureau of Research showed the symptoms to be similar to past outbreaks but when chemical analy-

sis was made of the water from Buena Vista Lake it was found to be in relatively fresh condition, the concentration of salts being very low.

In the study of sick ducks at Tule Lake, Modoc County, last year it was evident that temperature was a contributing factor in the occurrence of the disease. The appearance of the disease at Buena Vista Lake was preceded by hot weather. In the case of Buena Vista Lake there was a large percentage of decaying organic matter. Since laboratory experiments have demonstrated that gases such as those found where the disease occurs may be fatal to ducks, experiments designed to settle the question whether gas poisoning is concerned are being made.

A determination of the exact cause of this malady which has periodically swept this and other states is a necessity if waterfowl are to be conserved. The Division of Fish and Game is making a determined effort to solve this fundamental conservation question. It is indeed fortunate that Dr. K. F. Meyer, director of the Hooper Foundation for Medical Research of the University of California, has been secured to supervise this and other studies of disease by means of carefully planned experiments. It is expected that the mystery will be solved as soon as sufficient material is made available for study.

POT-HUNTING AND SHOOTING ETHICS.

In a certain place in Madera County where the land rises on end to meet the sky, two mountain masses come together forming a natural trap and affording but one outlet up a draw. Deer in considerable number frequent the region and it would be difficult to find in California a combination of circumstances more favorable for their slaughter on an incredible scale.

The tendency of man to devise means of killing game by wholesale methods is as old as the human race. In the day of the club and stone axe, man was ambitious to lay traps and to discover ways of gaining advantages over game that permitted of their easy and wholesale destruction. Such methods can be forgiven, considering the poorness of man's early weapons and the struggle he had to make to survive against the savagery of the world.

But a different principle governs the use of such methods today. The coming of the high-powered firearm has brought with it certain ethics in regard to its

right use. It is unsportsmanlike to shoot quail on the ground. It is taking an unfair advantage of ducks to shoot them on the water. It is equally beyond the pale of decent sportsmanship to "pot" a deer.

Unfortunately, an instance of deer "potting" on an extensive scale must be recorded for the opening day of the deer season. Some thirty men, employing a pack outfit of over forty horses, effected a "drive" on the deer in the region vaguely alluded to and enacted a day of slaughter seldom equalled in the present. The country was systematically combed. Those bucks attempting to escape up the draw met a shower of lead. Sentiment, not for a moment, swayed the bloody business and little thought was bestowed on the fact that others were being robbed of a sport, on the pursuit of which many writers have delighted to linger.

It is known that the law was not violated in any particular. The limit rule was observed and females and "spiked" bucks were not molested or harmed. The slaughtered were piled on a truck along with two black bear and the hunters merrily went their way leaving the country "shot out."

It is known, further, that some one thousand hunters were admitted to the region subsequently by the Forest Service, and that these, without hardly an exception, profited little by their long days of toil in quest of the very few bucks remaining. During the whole season the region gave a most pitiful reward to those who had enjoyed the sport of deer hunting in it in former years. Assuredly, such methods of killing game in California are to be uniformly condemned for their selfishness, their unfairness to the game pursued and their woeful want of sportsmanship.

WHAT IS A "FORKED-HORN"?

Is it legal to kill a deer with a fork on one side and a spike on the other? This is assuredly a very reasonable question and one which arises so obviously from a reading of the present law defining a "forked-horn" that there is good reason to answer the question here.

The present law reads, "any male deer with antlers of two branches on both sides shall be considered a 'forked-horn'" (Sec. 626e). The ambiguity springs from the fact that the law does not specify that a legal deer must have branched horns or antlers on *either* side. Hence, it is very likely that a judge considering the purpose and intent of the law would be most apt to recognize that any deer

without branched antlers on both sides would be an illegal deer.

NEW PLAN FOR DUCK CONSERVATION.

The failure of the Game Refuge-Public Shooting Bill at past sessions of congress has led to the formation of new plans that immediate results may be obtained. In the deficiency bill which awaits the present session of congress is a clause that provides, under the Phipps Bill, for an appropriation of \$350,000 to be used in the building of a dike across the mouth of the Bear River in Utah, as a means

Commissioner D. L. Madsen of Utah was appointed a committee of one to consult with the western states regarding any such proposals that may be submitted. By this action it is hoped that an adequate program may be initiated.

The Division of Fish and Game has adopted the resolution passed and is watching for additional opportunities to be of service in improving the situation. California has made a fine start by setting aside one-third of the hunting license fees to be used exclusively for the purchase and rental of refuges.



FIG. 26. Taking motion pictures of Hungarian partridges at State Game Farm. A blind was necessary to secure natural pictures of these wary birds. July, 1927. Photograph by Sidney Snow.

of holding fresh water on an area of about 200 square miles. The lake and marsh thus created probably will prevent the recurrence of the duck disease which has killed so many ducks in the past and will at the same time provide excellent nesting and feeding grounds.

At the meeting of the Western Association of Fish and Game Commissioners at Seattle a resolution was passed requesting the Secretary of Agriculture to submit proposals for creating and financing the necessary wild fowl refuges to care for the present critical situation.

The estimated kill of ducks in California is set at one million. Those in a position to know claim that the annual toll of the duck malady on Bear River marshes is a million ducks per year. Enactment of the Phipps Bill (included in the deficiency bill) will save ducks to the number of the estimated annual kill in California. Banded birds give evidence that 25 per cent of ducks that traverse Utah find their way to California during their migration. The reason why Californians should support this measure is evident.

AN ELK REFUGE NEEDED.

The elk, the largest game mammal of the west, was once very abundant in California. A census of the total number of wild elk left in the state would probably show less than five hundred animals. The last stand of the smaller valley elk is being made in Kern County where several hundred animals range back into the hills and then forage on the ranges near Butte-willow.

Complaints as to the depredations of these animals have been frequent. For many years it has been clear that unless land could be purchased and an elk refuge established in this vicinity the state will soon have to add this famous game animal to its list of exterminated species. Several attempts have been made to stir

and December 1st, twenty thousand acres were disposed of in this region by the Miller and Lux Co. Marsh land in this area is selling at \$25 an acre and upland, from \$45 to \$75 an acre. The refuge should, of course, contain both lowland and upland.

Both federal and state officials are united in the belief that an elk refuge in the San Joaquin Valley is an important and immediate need. The matter of finance is the only factor which is preventing the solution of this problem. Somehow or other adequate means must be found for taking care of these wild elk in the San Joaquin Valley.

The Izaak Walton League recently raised \$36,500 by popular subscription, bought 1760 acres of land and presented

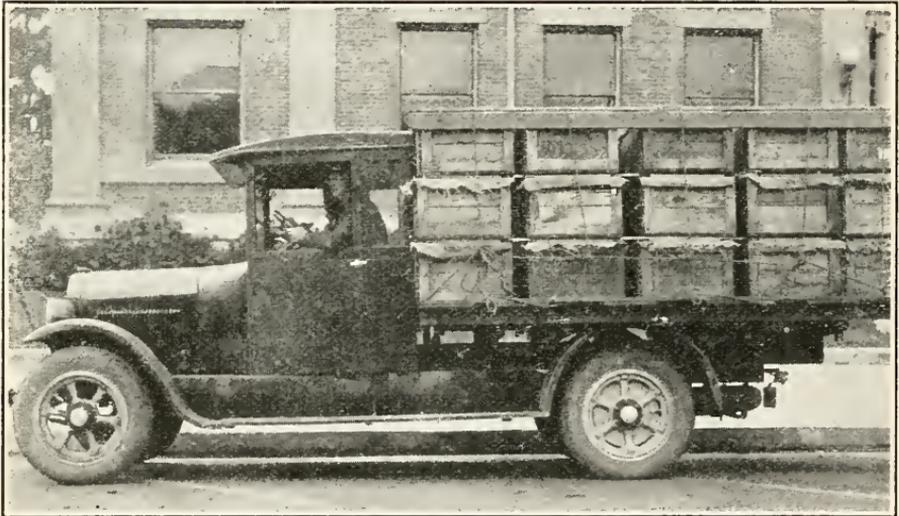


Fig. 27. Truck load of pheasants at Salinas on their way to the fields where they were planted. August 9, 1927. Photograph by Sidney Snow.

interest among the Order of Elks, but thus far no move has been made actually to furnish a satisfactory home for this final herd of elk. The U. S. Biological Survey has long advocated a refuge and recently Mr. E. A. Goldman, in charge of the federal reservations, made a survey of the situation. He reports that a refuge should comprise at least four sections of land. This is hardly possible in Kern County because most of the marsh grounds are now under private ownership. Near Los Banos, Merced County, where there is considerable marsh land of the type formerly frequented by the valley elk, there is still an opportunity to secure suitable land. However, a purchase must be made quickly for between August 1st

it to the government to be added to the winter elk refuge in Jackson Hole, Wyoming. As a consequence, Yellowstone elk will find better winter pasturage and starvation in hard winters will be avoided. The critical situation in Wyoming has been improved. Who is going to improve the situation in California?

VOLUNTEER WARDENS.

The work of game wardens in investigating violations of fish and game laws is purely and simply detective work. It is work of criminal investigation, and as such it requires a fair knowledge of all the laws and of criminal procedure in the courts.

Without this knowledge a game warden is constantly groping in the dark and he never knows whether his actions will be approved or condemned when his cases are brought into court, where they must inevitably land. This point can not be too strongly emphasized. No matter how clever and energetic a warden may be in other ways, if he is ignorant of the intent and purpose of the law and criminal procedure, he will fail in the course of time. If he works in disregard of the laws, his activity is certain to get him into trouble. Therefore, he must be familiar with the law and the rules of criminal procedure in the court.

No special set of rules can be laid down for the reason that no set of rules will

of the state. The duties of sheriffs, constables and police officers usually end when they have apprehended a violator of the law, but that of a game warden has really just commenced after the arrest has been made. Then begins the trying stage. The warden now drops his role of "Policeman of the Woods" and assumes the role of prosecuting attorney. He has deprived a person of his liberty; now let him prove in a court of law that the said person has committed a crime—or by what right did he cause such person's arrest?

Herein will be shown the warden's fitness or unfitness. Whether the warden has used good judgment, is honest and has the requisite knowledge of what con-

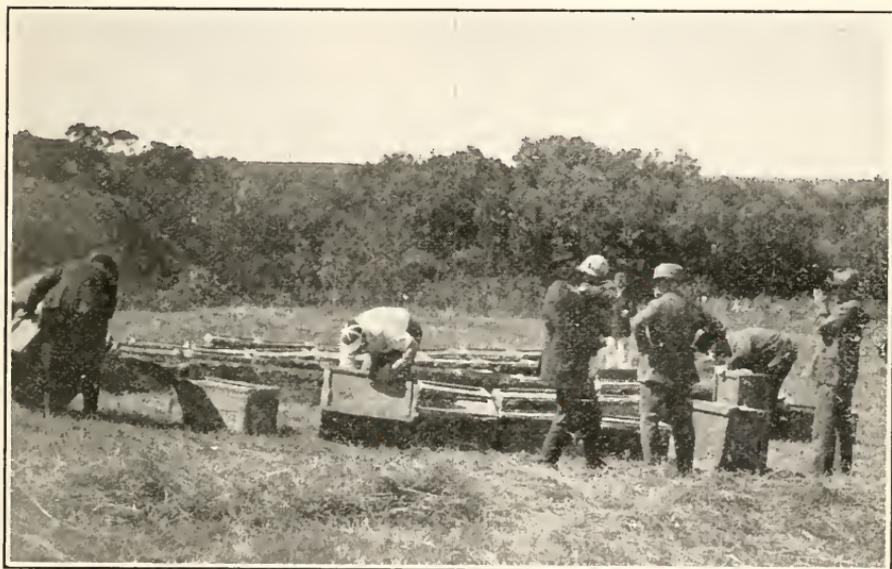


FIG. 28. Arranging liberation of pheasants in the Salinas Valley. August 9, 1927. Photograph by Sidney Snow.

apply to all cases. Each case demands its own particular treatment and attention. However, it must follow that a game warden should possess some slight ability, either natural or acquired, as a detective. Each and every case demands the application of *common sense rules*, persistent effort, patience and careful attention in every detail, with the view always in mind that the enforcement of the fish and game laws must be clean, fair and just in all ways, and at all times, in order that the wardens may command the confidence, respect and support of the people.

In most instances the work and duties of game wardens are peculiar as compared with other law enforcement officials

stitutes legal evidence in a court of law, is now put to test. The warden may be honest and have acted in good faith, but, if he is ignorant of his full duty, in the eyes of the law, or has used poor judgment, he will be criticized and condemned. It behooves wardens to go slow at first and to feel their way, but there is no reason for an intelligent warden to hesitate if he is perfectly familiar with the laws for the protection of fish and game, and carefully and conscientiously performs his duties.

A game warden may feel perfectly certain within his own mind that a party is guilty of violating the fish and game laws, but that should have no bearing on the matter. The question is: Can the

warden prove the fact by competent legal evidence? Mere rumors, conjectures, prejudice and popular opinion should not interfere with the warden's judgment. Facts are what he is after and such facts as are relevant material and will support the warden's charge against the person arrested.

The quicker the warden learns his duty the better will he be able to do his work. As a rule, the real duty of game wardens is to educate the people as to the value and necessity of fish and game laws and to prevent violations of the laws, as much as it is to arrest those who violate the laws.

All volunteer deputies are advised to keep their own counsel relative to reported violations of the fish or game laws and not to openly discuss such matters.

When a volunteer deputy is confronted with any subject or matter relative to the protection of fish or game, the fish and game laws, or the enforcement of the laws, that he does not understand thoroughly, he should take up such matters with the commission and be guided by their advice.

While the Division of Fish and Game does not expect the volunteer deputies to be able to make frequent arrests for violations of the fish and game laws, it does want to know what each deputy has accomplished. Therefore, it is necessary and very important that all volunteer deputies comply with the instructions issued to them and render, either to their captain or to the field assistant, a monthly report of their activities. These reports should be made upon monthly report blanks which will be supplied.

With *activity* and *efficiency* the watchwords, and *cooperation* and *coordination* between the regular patrol and the volunteer deputies the key note all along the line, let us, one and all, put our shoulder to the wheel and make the volunteer deputy forces a body of men meriting and commanding the confidence, respect and support of the people in the efforts made to protect and conserve the state's supply of fish, game and wild life.—(Instructions issued to Volunteer Wardens by Walter R. Welch, Field Assistant.)

EDUCATION IN CALIFORNIA

The Fish and Game Commissioners began educational work in the schools in 1911 and 1912 when Miss Gretchen Libby traveled the state speaking to groups of children. The state is still reaping some of the benefits of Miss Libby's work.

Beginning on August 1, 1914, the work was reestablished on a more permanent basis and since that time bulletins for teachers and lectures at schools have been part of a well planned educational program. Few other states have had so uninterrupted a program as has California. Now work of this kind is recognized as fundamental by most states. The state of Pennsylvania launched a similar program a number of years ago and a questionnaire recently received gives an opportunity to summarize the present status of the educational work in California. The questions are those put by the Board of Game Commissioners of Pennsylvania; the answers those made by the director of the Bureau of Education of the Division of Fish and Game.

QUESTIONNAIRE.

Issued by the Board of Game Commissioners, Harrisburg, Pennsylvania.

Approximately how much money is available yearly for educational work?
\$23,317.

Do you present lectures throughout the state to sportsmen's organizations, schools, etc., and if so, how long has this method of education been carried on?

Yes, about sixteen years.

How many lecturers are carried on your staff?

Heretofore, but one. Beginning this month (September) two will be detailed for work in schools. Two part-time lecturers are employed for summer resort work.

Are the lectures illustrated with lantern slides and motion pictures?

Yes.

How long have you used motion pictures of wild life with your lectures? How long since your first motion pictures were made?

Thirteen years.

Do you photograph your own motion pictures?

Only a small part of them.

How many lectures illustrated with slides and motion pictures are presented in your state in a single year?

About 150 in past years.

Do you have live exhibits of birds and mammals? Are they located permanently in a museum or zoo, or are they sent throughout the state to county fairs, etc?

A few located at the game farm which are used at exhibits occasionally.

Do you have exhibition cases containing mounted birds and animals which you use in lecture work?

Not as yet, but plan to have. We have study skins of birds and mammals for loan to teachers.

Do you keep a photographic file of pictures of wild life, or other pictures of interest representative of your department?

Yes, we have both.

Do you have a collection of scientific skins of birds?

Yes.

Do your publications include an annual or biennial report or quarterly magazine, etc?

Both.

Do you publish bulletins or pamphlets dealing with the life history of the birds and mammals representative of your state, and if so may we have a list of same?

Yes. A series of Fish, Game, Teachers and miscellaneous bulletins.

Do you maintain a separate bureau in your Game Department for purely educational work? If so, when was this bureau inaugurated?

Yes. 1914.

How was the work carried on prior to the inauguration of an educational bureau?

School lecturer, 1910-1912. Bureau of Education established in 1914. (See report of the Bureau of Education in last Biennial Report.)

EXPRESS SHIPMENTS OF DUCKS INSPECTED.

Before the sale of ducks was stopped it was difficult to keep track of the various shipments arriving in the large cities. At present it is proving dangerous for anyone to ship more than a limit of ducks by express. (Parcel post shipments are prohibited by law.) A deputy detailed to investigate all shipments of game arriving in San Francisco has apprehended a number of violators who ship more than a legal limit to their homes.

TAHQUITZ GAME REFUGE.

After many years of endeavor a sizable area has been set aside in the San Jacinto Mountains which is known as the Tahquitz Game Refuge. Here a large number of southern mule deer will find satisfactory protection. This new refuge is well situated; on the north and east it is practically inaccessible to man, with no roads or trails. On the south and west only three trails lead into the refuge. The only person living within its boundary is the lookout of the United States Forest Service, located on Tahquitz peak. This lookout is cooperating heartily with the Division of Fish and Game and is in a position to hear practically any shots fired within the refuge. An abundance of water, fine feed and cover help to make conditions ideal. Deputy Robert J. Little on a recent visit to this region reported seeing seventy deer and many tree squirrels and mountain quail.

OPENING OF DUCK SEASON ENCOURAGING.

Pessimism has reigned in California for several years regarding the status of ducks. Sportsmen have continually complained of few birds. The fall season of

1927 opened on October 1 and reports from the duck country have justified the hope that the present season will be a nearly normal one. Early rains furnished considerable overflow land and ducks appeared in numbers. A splendid flight was reported from the Imperial Valley and limit bags were the rule in the San Joaquin Valley.

FISH PLANTING.

Old timers love to tell of conditions a decade or so ago when it was the usual thing to catch hundreds of pounds of trout in a single day. But trails were few in those days and very difficult to travel. Bridges were wanting, all modern conveniences were absent and a trip into the high country often involved much of hardship and danger. Now with new trails built and old trails improved, so many resorts furnishing pack outfits at reasonable rates and means of rapid locomotion ever at hand, more fishermen are present along the mountain streams than during whole summers in the early days.

All this increased activity of anglers augurs an enormous drain on the streams and means that fish planting must be on a scale of equal magnitude. Indeed few anglers realize the enormity of the task that has devolved on the division to keep the streams replenished with gamey fish. Over 19,184,000 fish were planted from the hatcheries this year. Truly this is an achievement. Nor should it be forgotten that literally thousands of black bass, crappie, perch and catfish were rescued from overflow waters and pools fast going dry and placed in live water.

SAGE HEN GIVEN PROTECTION.

Game Refuge 1-Q, located in Lassen County and created by the state legislature last year, is a boon to the future of the sage hen. It accorded them adequate protection this year and it is reported that there are now some five thousand birds at Painter Flat. These are increasing and will stock the adjacent area.

It is reassuring to know, further, that stockmen are materially aiding in the good the refuge is accomplishing by keeping their gates locked so that hunters find the refuge difficult of access and do not get into the refuge innocently at night. They are further contributing to the welfare of the sage hen by warning hunters of the prohibited area. As an instance of this, one occurrence is of worth to note here. The refuge is approached from the Nevada side by way of Upper Smoky Creek. Riders from the Secret Valley Ranch were stationed on

the road on the opening day to inform the Nevada cars that they could not hunt in the refuge. At least twenty-five cars with their respective occupants would have taken toll of the sage hen had it not been for this splendid cooperation.

A FAMOUS ANIMAL BLIND.

Bull hunting, a spectacular method of slaughter, is now a thing of the past. One is no longer able to go out into the back country and watch a market hunter "walk his shot." Furthermore, there are few recorded accounts of the animals and methods used in this sort of hunting. As a consequence it seems worth while herewith to give a photograph of "Old Tom," most famous of the hunting steers.

license law went into effect, two new speed boats manned by trained deputies will protect ducks in two of the great hunting spots of California.

A Johnson aquaplane, equipped with a high speed outboard motor capable of 18 miles an hour, has been placed on Morro Bay, while another boat identical in construction will be used by the fish and game patrol on the famed Salton Sea in Imperial Valley.

Morro Bay in San Luis Obispo County and the Salton Sea, unique inland ocean in the Imperial Valley, are famous for ducks. In years past violators of the game laws have frequented these places and made great hauls by motor boat due

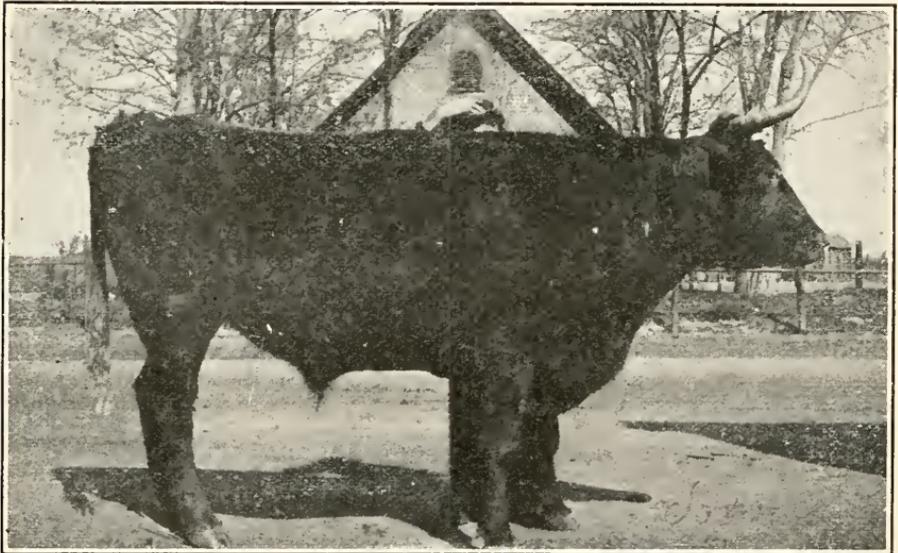


FIG. 29. "Old Tom" a famous hunting steer of the olden days when "bull hunting" was legal. This animal weighed 1850 pounds and made an excellent blind because of its size.

"Old Tom," because of his training, his size, and build, made a most satisfactory blind. When he was sold to his owner, P. A. Blackburn, of San Bernardino, in 1914 he weighed 1850 pounds and stood 5' 8" high. During the days of market hunting "Old Tom" was utilized in practically every inland county of the state. This assistant of the market hunter, although concerned in extensive slaughter, deserves none of the blame to be heaped upon those who take more than their fair share of the state's game supply.

TWO SPEED BOATS ADDED TO PATROL.

Carrying out the program of progressive efficiency promised when the new

to the fact that the areas were not properly patrolled. But now that the deficiencies of patrolling these watery areas are removed by the addition of this equipment to the Patrol Department's resources, and with men on duty day and night, adequate law enforcement is made sure.

RESOLUTIONS OF WESTERN ASSOCIATION.

The Western Association of State Game Commissioners held its seventh annual meeting at Seattle, Washington, on September 8 and 9, 1927. Many important questions relative to fish and game conservation in the western states were discussed. The general attitude of the meeting toward a number of problems is

indicated by the following resolutions which were passed:

I.

Whereas, this association and conservation in general has lost a valuable and esteemed friend in the passing of the late C. A. Jakeway, who was a charter member of the organization; therefore, be it

Resolved, that we do hereby express to the family of Mr. Jakeway, our sincere sympathy, and assure them that his name and good work will long be remembered by his associates in conservation; therefore, be it further

Resolved, that this resolution be spread upon our minutes and a copy sent to the family of the deceased, and to each member of this organization.

II.

Whereas, the water area suitable to waterfowl has been greatly decreased through reclamation, drainage, and evaporation; and

Whereas, there is great need for the establishment and maintenance of refuges for the perpetuation of migratory waterfowl in the United States; therefore, be it

Resolved, that the Western Association of State Game Commissioners favors enactment of legislation for the establishment and maintenance of said migratory bird refuges.

III.

Whereas, the long continued mortality among migratory birds in the Bear River marshes is seriously affecting the abundance of these birds in Western America; and

Whereas, the restoration of these marshes would effect the saving of many thousands of migratory birds annually; and

Whereas, said restoration is both feasible and practical; therefore, be it

Resolved, that the Western Association of State Game Commissioners commends and urges the immediate passage of the Phipps measure, which has for its purpose the appropriation of \$350,000 to be expended by the federal government in the restoration of these marshes.

IV.

Whereas, the reclamation of Lower Klamath Lake has destroyed a great habitat of migratory waterfowl; and

Whereas, the reflooding of Lower Klamath Lake is both desirable and urgent; therefore, be it

Resolved, that the Western Association of State Game Commissioners hereby favors the introduction into congress of the United States of a bill proposing the appropriation of — dollars, for the purpose of reflooding Lower Klamath Lake. Be it further

Resolved, that the president of the association is hereby directed to appoint a committee of two to prepare or have prepared the draft of a suitable bill and submit the same to the states comprising the membership of this organization for their approval. Be it further

Resolved, that the committee of two is hereby authorized to confer with and solicit support from all other conservation organizations in America in carrying out the purpose of this resolution and to pledge the support of the Western Association in securing the passage of such legislation as may be determined upon.

V.

Whereas, the Western Association of State Game Commissioners has by resolution favored the creation of migratory bird refuges; and,

Whereas, the need of this action is urgent; therefore, be it

Resolved, that the president of this association be directed to request the United States Secretary of Agriculture to prepare proposals for financing and creating such refuges and submit the same to a committee of one, which the president of this association is hereby directed to appoint. Be it further

Resolved, that this association favors plans for financing said projects in the following respective order:

1. Federal appropriation.
2. Federal appropriation supplemented by state appropriation.
3. Federal hunting licenses.

Be it further

Resolved, that the respective states comprising the membership of this association be requested to furnish to the committee of one an estimate of their requirements for refuges and the approximate cost thereof. Be it further

Resolved, that the committee of one is hereby instructed to confer with the states comprising the membership of this association for the purpose of determining upon the projects proposed. Be it further

Resolved, that the committee of one is hereby authorized to confer with and solicit support from all other conservation organizations in America in carrying out the purpose of this resolution and to pledge the support of the Western Association in securing the passage of such legislation.

VI.

Whereas, the American Fisheries Society and the International Association of Fish, Game and Conservation Commissioners have elected to hold the 1928 convention in the city of Seattle; therefore, be it

Resolved, that we believe that the best interests of conservation would be served by a joint session of these organizations and the Western Association of State Game Commissioners, and we therefore respectfully tender the full cooperation of the membership of this organization to participate in the program and activities of their convention in such manner as they may determine, and we pledge our hearty support in making the joint convention a success. Be it further

Resolved, that we authorize our incoming president to invite the conservation agencies of our friends across the border to participate in the deliberations of this convention in such manner as may best suit their convenience.

VII.

Whereas, the Honorable Roland H. Hartley, governor of the state of Washington, and the Honorable Bertha K. Landes, mayor of the city of Seattle, have evidenced their keen interest in conservation by giving hearty support to the success of our convention; and

Whereas, the very able committee on arrangements has contributed so largely to our comfort and convenience; and

Whereas, the Chamber of Commerce and the press of the city have accorded us such excellent publicity and support; and

Whereas, the management of the Olym-

pic Hotel has furnished every facility required for our meeting; therefore, be it *Resolved*, that we extend to these persons our sincere thanks and appreciation.

VIII.

Whereas, S. F. Rathbun, our worthy president, has transacted the business of this association in a proper and most efficient manner, and has unselfishly given unstintedly of his time and effort thereto; therefore, be it

Resolved, that we do now extend to President Rathbun our thanks and appreciation for his efforts during the past year which have resulted in a better understanding of our mutual problems, and especially do we commend President Rathbun for his preparation for this meeting which has made the seventh annual convention the most successful in the history of our organization.

GOVERNMENT TO TAKE WATER-FOWL CENSUS.

There has been much discussion whether the general complaint relative to the scarcity of ducks can be supported on the basis of actual census figures. There are too many loose statements concerning the comparative abundance of various game species. In order to bring together some real data relative to the abundance of waterfowl, the United States Biological Survey is asking the cooperation of sportsmen and bird students throughout the United States in the taking of a census. Instructions are given to each observer to select the best area in his vicinity. This is to be covered in a single day on the same day of the month for each month of the year. It is hoped thereby to obtain some accurate information on this much mooted question. From these data it is hoped to bring to light some of the causes of local fluctuations and facts relative to migration.

HABITS OF THE CALIFORNIA CLAPPER RAIL.

One of the important notable contributions to the life history and habits of a game bird are to be found in the November-December number of the *Condor*, under the title "The California Clapper Rail, its Nesting Habits, Enemies and Habitat," by Dudley Sargent DeGroot. The author gathers together much valuable data relative to the number of eggs, nest location, nesting material and time of nesting. The latter part of the paper discusses the causes for the disappearance of the clapper rail. The following are listed: enemies, encroachment of civilization, Norway rat, mussels and predatory animals. After suggesting the possibility of domesticating and distributing clapper rail to other marshes, the attention is called to the recent reclamation project which will

destroy more than four thousand acres of the best rail marshes located on the San Francisco bay shore, between Belmont and San Carlos.

MAINTENANCE OF WILD LIFE ON RESERVATIONS.

With the settlement of the country, involving the removal of forests, the drainage of marshes and water areas for cultivation, the building of towns, and the construction of roads, together with excessive killing by hunters and inroads by predatory animals, the game and other useful wild life early disappeared from many sections. Public opinion is now, however, becoming aroused to an appreciation of the economic, recreational, and educational values of the presence in reasonable numbers of many forms of wild life. This has given a real impetus to conservation, and experience in wild-life administration has demonstrated the practicability not only of saving the remnants of our animals and birds but through restocking measures to restore them to territory long depleted. A commendable zeal to conserve game and other forms of wild life has in a few places even resulted in a surplus. Game-administration programs should, therefore, provide for the maintenance of a suitable number of breeding individuals and the utilization, ordinarily through hunting, of any surplus that may accrue.

The reservations under the jurisdiction of the Biological Survey include four fenced areas primarily used for buffalo, mountain sheep, antelope, and other big game; a winter elk refuge in Wyoming; the Upper Mississippi River Wild Life and Fish Refuge; the Curry Game, Bird and Fish Refuge, Alaska; the Alaska Railroad Muskrat and Beaver Refuge, Alaska; and sixty-eight other areas in the United States, Porto Rico, Hawaii and Alaska that are primarily bird refuges. Some of these widely scattered bird refuges are notable island colonies, containing interesting species not found elsewhere, and the need of extending them special protection to prevent extermination is vital.—Ann. Rpt., Chief, Bureau of Biological Survey, 1927, pp. 14-15.

PHEASANTS AND CATS.

The ringneck pheasants are increasing as well as can be expected when one takes into consideration what this wonderful game bird has to go through even to exist. I am daily in pheasant country and have had the opportunity to watch and to study this bird. The delta land, where the pheasant thrives best, consists

of the best land that California has and is therefore all under cultivation, with the exception of a few islands. It is noticeable that the birds are a little more plentiful on these uncultivated islands.

Thousands of nests are destroyed annually by mowing machines, rakes, cultivators and different implements used to till the soil and harvest the crops, for a large percentage of these birds like to nest in the growing alfalfa, corn and barley fields, although there are many levees and sloughs where they do nest. Then there is the common house cat that is one of the greatest destroyers of young pheasants and quail. It is not so strange when you view the cat situation as it is that which proves to be such a menace to these birds. It should be taken seriously. The cat has gradually been planted on our islands, much as the Commission has planted pheasants and other game birds.

First there are the farmers and people living in towns who haven't, as they say, the heart to drown small kittens, and finding them a nuisance, take them in the car and drop them along the road in some out of the way place. Furthermore, there is the delta tenant who moves out of a camp and leaves the cats to shift for themselves. I have often seen these cats along the road in the evening. I had a house cat at my home that killed two quail, less than a half a mile apart: one was found partially eaten beside her nest of sixteen eggs, and the other within a few feet of her nest of twenty-one eggs. I saw this and know that this one cat destroyed two coverts of quail inside of two days. Later I came upon another cat eating a young pheasant about the size of a quail. These cats were killed, and I have declared war on all the cats that I find in the field, and up to date have killed quite a few.

The planting of cats in this innocent way has given this animal such a start that it will take more than one game farm to produce enough birds to feed these cats. Many of the delta farmers are foreigners, who have made it a practice to hunt and trap these birds, but they are taking notice of our good judges who can say \$100 or \$500 just as easily as the judge, a few years back, said \$25.—D. E. Roberts.

A COSTLY LESSON.

One Lassen County man who shot a doe and entertained secret ambitions to "out smart" the law, completed arrangements with Judge Taylor of Taylorville early in November to pay his \$400 fine

in monthly installments. Deputy Walter I. Long of Westwood took the case nearly two weeks after the act had been committed. He learned that two fawns had starved to death as the result of the slaughter of their mother. The tragedy persisted in his mind with a strange fascination and he determined to make the best of the scanty information that had come to his ears.

Finally, through two farmers who were sufficiently incensed over the distress of the fawns to be willing to tell all they knew of the matter, he succeeded in gathering in the remaining facts necessary to his case. At first, the doe slayer denied the charge, but when faced with the evidence that the deputy had gathered so carefully, he plead guilty.

There are times and occasions when severe fines, though they impose a very serious burden on the offender, are necessary because of the reprehensible nature of the offense. The exposure of the two fawns to the many perils of the wilderness by the removal of their mother; even their lingering death by starvation, might be viewed with some indifference, if the doe had been killed by a man whose family were on the verge of perishing for want of food. But in this case the killing was wholly wanton and Judge Taylor probably was of the opinion that the offender's lack of sportsmanship and failure to keep the law could best be corrected by a severe fine. Inasmuch as the doe slayer could not pay the entire fine, he was ordered by the court to pay \$50 a month over a period of eight months.

THE FOOD OF FISHES.

The source of subsistence of fishes inhabiting the vast expanses of the sea has excited man's keenest interest. This springs partly from a desire to know what is hidden beneath the waves of the ocean. While it is possible to see fish sporting about beneath the surface, rarely is the secret of their livelihood revealed. To discover this, scientists have tediously examined samples of sea water with high-powered microscopes, strained the water through fine cloth or filter paper and availed of all manner of methods to satisfy their curiosity as to the kinds of living things which serve as food for marine fishes.

Dr. W. E. Allen in the *California Monthly* (Vol. xxi, No. 2) gives an account of the study now being made at the Scripps Institution of Oceanography of the plankton, a general name applied to floating animals and plants resident in

the sea that fall victims to fish. In describing the host of creatures composing the plankton group, Dr. Allen writes:

"Obviously, a term as sweeping as this includes a wide variety of organisms some of which live suspended in sea water throughout their existence while others live as plankton through only a brief period of their lives. For example, very young barnacles, mussels, and starfishes may be found in the plankton inshore, at times, but they live on, or are even fixed to, solid objects over a much longer period after they have reached the adult form.

"Some species of animals and plants are free-floating or free-swimming throughout indefinite numbers of successive generations. They constitute the permanent plankton. Others, including fish eggs and very small fish fry, belong to the plankton for only a few days or weeks. They constitute the temporary plankton, or rather the temporary components of the plankton. Some organisms, such as jellyfishes, belong to the plankton only during a sexual generation, the preceding and following generations being fixed to solid objects in much the same way as sea weeds. In general, they constitute only a small part of the temporary plankton, although in certain localities they may swarm in such numbers as to be almost all of it for a few days.

"Plankton consisting of individuals large enough to be seen readily with the unaided eye is called 'macroplankton.' That which requires the use of a microscope for effective study is called 'microplankton.' That which can be studied only with very high powers of the microscope is called 'nanoplankton.' The bacteria are included in it. Animal plankton is called 'zooplankton' and plant plankton is called 'phytoplankton.'

"None of the animal components of the plankton can manufacture foods from raw materials of air and water (including dissolved and suspended salts and gases). They must feed upon other animals or upon plants or their products. Some plankton animals are able to feed on sea weeds or fragments of sea weed, but most of them are finally dependent upon the plants of the plankton.

"Of these plants, diatoms are most widely distributed and, apparently, most important by reason of their power to manufacture living substance from raw materials, and by reason of their usefulness as forage for animals. Diatoms are microscopic plants which usually give no evidence of their existence to our unaided eyes. But there are times when they swarm by countless billions over hundreds of square miles of sea and to some scores of yards beneath its surface.

"In general, it may be said that the plankton in all seas tends to reach greatest abundance in the spring of the year. This is particularly true of plants, although it has not yet been shown to be a fully dependable rule. Many links in different food chains have been traced, for example, the use of diatoms for food by copepods (tiny shrimp-like animals in the plankton mentioned above), of diatoms and copepods by fishes, of smaller fishes by larger fishes, and so on.

"In southern California it has been found that great variations in production of diatoms may occur in successive years and in different localities. In favorable localities and under favoring conditions

diatoms may be found in numbers of several million cells to the liter (about a quart). Plankton organisms tend to occur in swarms just as strongly as fishes tend to occur in schools. The sea sometimes shows reddish, brownish, or yellowish hues for many miles because of the abundance of certain plankton organisms which have found living conditions exceptionally good. Coastal waters, upwelling waters, and Arctic seas in the summer season have been found to show high productivity as compared with other waters. There is increasing evidence that conditions of drainage from land into the sea may have great influence on the productivity of neighboring oceanic territory. For example, at the Scripps Institution of Oceanography it is considered probable that reduced and severely controlled drainage in southern California in the last several years is partly responsible for the lower production of plankton and of commercial fishes.

"Not only are components of the plankton most favorable amongst marine organisms for studies of fundamental conditions of origin and maintenance of life in the seas of today, but they are also highly important in furnishing clues to conditions of life in the past. For example, both living and fossil diatoms and foraminifera are being extensively studied for information concerning the conditions in the sea under which certain marine deposits were formed. They are also used by stratigraphic geologists as an aid in the location of petroleum deposits. Since it appears that these minute organisms contain material which may be the mother substance of petroleum, they are also being studied in connection with the investigation of the origin of possible source beds of petroleum."

COURT DECISION DIVIDES JURISDICTION OVER KAIBAB DEER.

In connection with the plan to reduce the number of deer on the Kaibab game preserve in northwestern Arizona, a conflict arose between the United States Forest Service and the state of Arizona as to the issuing of hunting licenses. When the Forest Service proposed issuing special licenses to hunters to kill a certain number of deer, the state authorities objected, claiming the deer of the Kaibab were under state jurisdiction. When the matter was carried to the United States District Court of Arizona the court granted a perpetual injunction against the state officials from enforcing the game laws of Arizona against "officers, agents, servants or employees of the United States on account of anything done by them in carrying out the regulations or orders of the Secretary of Agriculture relative to reducing the number of deer in the forest or game preserve." On the other hand, the decision provided that "this decree shall not be construed to permit the licensing of hunters to kill deer."

LION HUNTER BRUCE BREAKS RECORD.

That State Lion Hunter Jay Bruce has been especially active the past year is demonstrated by the thirty-nine lions killed up to December 1st, and with a chance of adding several more during the month of December. His total kill to date has been 324. Mr. Bruce accounts for the bettering of his average of thirty being due to the assistance in camp furnished by a friend. With someone who could drive the machine and meet Bruce at some other point, much time has been saved.

MOSQUITO FISH A SUCCESS.

One of the latest fishes to be successfully introduced into California waters is not a food or game fish, but a small top minnow known as the mosquito fish, introduced to help in the control of malaria. Heretofore, the cure of malaria has depended primarily on the skill of a physician in poisoning the malarial parasite which works in the blood corpuscles, with the least damage to the human body. The salts of quinine secured from a Peruvian tree has been most successfully used. A recent paper entitled, "The Mosquito Fish (*Gambusia*) and its Relations to Malaria," by David Starr Jordan (Smithsonian Report, 1926, pages 361-368, 4 pls.) points out that attention is now being given to prevention rather than cure. Anything which helps to destroy the carrier of the disease, which has been proved to be certain mosquitoes, is real prevention. The small top minnows from the coast streams of eastern Mexico eat the eggs of the "wrigglers" of disease carrying mosquitoes. Immediate success was obtained in acclimatizing this fish in California and worthwhile results are claimed by those interested. The success here has caused the introduction of the same fish in Hawaii, Formosa, Philippine Islands and more recently in Spain, Italy and Albania.

SEASHORE ANIMALS OF THE PACIFIC COAST.*

These days there are increasing numbers of people who find recreation along the seacoast. Not only are the sandy beaches chosen, but the rocky cliffs and tide pools are explored. Many there are also who inspect the wonders of the deep through glass-bottomed boats. To all

such comes the constant question, "What is that beautiful sea animal, what are its near relatives and what its habits?" Though the shell collector has had the handbook of Josiah Keep, "West Coast Shells," those interested in other animal life could find no book to which to turn to find dependable information. There has been a real need felt by western naturalists, teachers, leaders of scouts and visitors at the beaches for a readable, fully illustrated account of the common seashore animals of the west coast. This need has now been filled through the publication of a sizeable book entitled, "Seashore Animals of the Pacific Coast," by Myrtle Elizabeth Johnson and Harry James Snook. The authors discovered the need and made their plans while doing graduate work in the Zoology Department of the University of California. Through the years, though busy teaching in two widely separated parts of the state, these two authors through summer studies at various biological stations and independent work have brought to completion this splendid volume. Eleven colored plates give evidence of the beautiful colors which nature has evolved in living organisms that find their home about the reefs, rocky beaches and sandy patches of shore. Seven hundred additional illustrations help the reader to visualize each form of animal life.

Every rocky point that juts into the surf is a natural museum. Crevices in the rocks and the mat of seaweed afford shelter for numerous forms, while the hard rocks give places of attachment for those animals that lead a sedentary life. Nearby the outgoing tide leaves pools in rocky basins which form traps for shrimps, fish and other purely aquatic forms. With this newly published book in hand, one may segregate the various forms according to their relationships and find the correct names for them and learn of their distribution and interesting habits. Though great care has been taken to make the book scientifically accurate, it is designed for use by all those interested in sea life whether they have a zoological vocabulary or not.

Anyone interested in fish and game and its conservation will find of value the paragraphs relating to such game species as the edible crab, the spiny lobster and the various edible clams. A cursory review will bring to light such interesting facts as the following: The red abalone produces annually from one to two million eggs. Yet in spite of this the number of abalones have so decreased in recent years

* Johnson, Myrtle Elizabeth, and Snook, Harry James, 1927. Seashore animals of the Pacific coast. (The Macmillan Company, New York), xiv, 659 pp., 11 col. pls., 700 figs. in text.

that special legislation has been necessary in the effort to conserve them. The spiny lobster produces a quarter million eggs and the young have a curious larval existence. The flattened condition of the body has given them the name of phyllosome (leaf body). Artificial propagation has as yet been unsuccessful. One kind of starfish is so common a food of other animals that seldom is an individual found with all of its rays. Thirteen species of shore sponges are commonly found on the California coast. They seldom resemble the sponge of commerce, which is only the skeleton of this animal. The "rubberneck" clam or gaper is a conspicuous inhabitant of the mud flats of Tomales Bay. Though it lives two to four feet below the surface, long siphons connect the animal with the water above in order that it may obtain food and air. It sometimes shoots jets of water a foot or more above the surface of the mud whenever an intruder invades the flats.

The life along the shore constitutes a natural resource. The more the citizens of the state know about the individual inhabitants, the better use can be made of this resource and better attention can be given to its preservation. This new book is a worthy contribution to science and to conservation.—H. C. Bryant.

STATE BIRD TO BE SELECTED.

The California Audubon Society is sponsoring a move to secure a poll of the state as to a choice of a state bird. Children in the schools will enjoy making recommendations as will many bird lovers. In making choice, some decision must be made as to whether the requirement is for a bird well known to all or whether one of the more unusual and distinctive birds of the state may well be a candidate. The great California condor, the largest of land birds in North America, is restricted to this state and might well be chosen because of its size and its historical background. The valley quail is, of course, a contestant for honors and probably would be the choice of most sportsmen. Although less well known the wren-tit, a typical bird of the chaparral and to be heard in every patch of brush in the foothills, is a distinctive species found in the southwestern United States and the only bird in a family. No close relatives of this bird are known. Likewise, the yellow-billed magpie, found only in the state of California, receives consideration from the standpoint of beauty and uniqueness. If any reader is interested in this contest, he should send his

choice to the California Audubon Society, Los Angeles.

GAME RESTORATION PROGRAM INAUGURATED.

After hearing so much of such phrases as game depletion, game decimation and game disappearance, the term game restoration is refreshing. The *National Sportsmen's Magazine* has taken up this slogan and is doing its utmost to stir interest in putting back into game covers what is taken out by hunters. Emphasis is placed on game propagation as one method of bringing about better hunting conditions. The day has passed where a sportsman can consider his responsibility ended after he has paid the state license fee. His two-dollar payment certainly would not replace one deer nor the twenty-five ducks which he shoots. Hunting and fishing is worth more to a sportsman than he is paying for it, but he must assume responsibility in a restoration program.

REFLOODING OF LOWER KLAMATH LAKE HELD IMPRACTICABLE.

It has long been the hope of conservationists that some arrangement might be made by which a program could be undertaken for reflooding Lower Klamath Lake, which was at one time a splendid waterfowl breeding and feeding ground, lying partly in southern Oregon and partly in northern California. By reason of the use of the water of Klamath River in recent years for irrigation of agricultural lands and also for power, water has been lacking to keep the marshes of Lower Klamath Lake habitable for waterfowl.

A study was made this year by L. T. Jessup, an irrigation engineer assigned by the Bureau of Public Roads to the Biological Survey of the United States Department of Agriculture, to determine the practicability of a reflooding program. At a conference held in Klamath Falls, Oregon, on September 27 and 28, by Paul G. Redington, chief of the Biological Survey, with representatives of the California and Oregon game commissions, the report of the engineer was rendered. The many obstacles that preclude further consideration of the project were there brought out.

In the first place, the full supply of water from the Klamath River is needed for existing and projected irrigation plans and for power use. In the second place, legislation of the states of Oregon and California, which ceded the lands involved to the federal government for use as a reclamation project, stipulated that the

water should be used for irrigation purposes. In the third place, even if water were available, it is held that the reflooding of Lower Klamath Lake would be detrimental to agriculture in the immediate region, and the cost of necessary project works, such as dikes and pumping plants, and the purchase of privately owned lands, would run into a very large figure.

At the conference held in Klamath Falls it was decided to drop consideration of the reflooding program in the Lower Klamath region and to concentrate the efforts of sportsmen and others interested throughout the country on the restoration work to be done on the Bear River marshes, at the northern end of Great Salt Lake, in Utah. Here it is possible by diking to establish large areas of fresh water, which when completed will not only furnish breeding and feeding grounds for a very large number of waterfowl but will operate to decrease the mortality that has been so serious among the birds for many years.

The chief of the Biological Survey, in commenting on this general situation, stated that the news of the abandonment of the Lower Klamath Lake project would be disappointing to many sportsmen and conservationists of the country who had banked on the reestablishment of an important waterfowl concentration area there. Continuing, Mr. Redington said, "I am very sorry to be the harbinger of this bad news, since I am well aware of the great interest displayed by thousands of sportsmen and bird lovers in the project, but the obstacles to reflooding Lower Klamath Lake appear to be of an insuperable nature. Copies of the engineer's report on the project are to be given to many of the organizations that have been behind this project, and it is my opinion that after reading the report their judgment as to the unfeasibility of the project will coincide with the judgment of the Oregon and California fish and game commissions and with that of the Biological Survey.

"We are daily expecting the report of our engineer who has been working for the past few months on a plan to construct additional dikes on the Bear River marshes in Utah. We know that this sort of restoration work is entirely possible since the State Fish and Game Commissioner of Utah, Mr. Madsen, and certain duck clubs owning land on the Bear River marshes have already by diking established such areas.

The state of Utah has, by legislation, consented to the establishment of a federal project, which, when completed, will comprehend more than 100 square miles of fresh-water marshland territory for

wild fowl, and it is our hope that this project may be consummated in the near future. Valuable not alone as a breeding ground but for feeding and resting, it is as important a concentration area as any that can be found throughout the United States, and it is imperative that action be had to remedy the conditions that for the past decade or so have caused such a heavy mortality of the ducks and other waterfowl in the lines of the great western migration."

Mr. Redington further stated that the engineering examinations of the Bear River marshes in Utah and the Lower Klamath and Malheur lakes in California and Oregon would not have been possible but for the generosity of western sportsmen, who raised a fund of more than \$6,000, which permitted the Biological Survey to obtain the services of competent engineers.

DISTEMPER ON FOX FARMS TO RECEIVE CAREFUL STUDY.

The University of Minnesota Medical School is engaging in cooperative studies with the Federal Bureau of Biological Survey of the cause and treatment of fox distemper, according to an announcement of the United States Department of Agriculture. Cooperators of the University are aiding the movement financially, and assistance by the Biological Survey also has been made possible by a slight increase in the federal appropriations made for the purpose by the last congress.

Fur farmers throughout the country and in Canada are bending every effort to prevent contagious diseases of their foxes, and the cooperation of research workers of the university and the Biological Survey will be welcomed by all fur producers. Studies of outbreaks of disease have been made by research workers of the two organizations, and as rapidly as possible the results will be made available to fox farmers.

Dr. J. E. Shillinger of the Biological Survey, formerly of the Bureau of Animal Industry, is in charge of the federal work, and Dr. Robert G. Green of the Department of Bacteriology and Immunology of the Medical School, represents the University of Minnesota.

So far as the resources of the Biological Survey permit, representatives of that bureau will cooperate with fox farmers in efforts to maintain the health of their stock. Outbreaks of disease on fox farms, if reported to Paul G. Redington, chief, Bureau of Biological Survey, Washington, D. C., will receive as careful attention as the funds for the purpose warrant. Material for laboratory study will be thus obtained, and research work will

be conducted to determine, when possible, the cause of the disease and remedial measures.

BEAVER FARMING IN CUT-OVER LANDS PROMISES PROFIT AND INTERESTING WORK.

In a report on the possibility of raising beavers profitably, the Biological Survey of the United States Department of Agriculture says that there are many localities where these fur bearers could be re-introduced without harm and where, through storing water in the reservoirs along mountain streams, they would do much good by helping prevent floods and extensive erosion, by increasing the stream flow in dry weather, and by improving the fishing resources of streams and lakes. In such places they would not only enrich forests and parks with a unique and intensely interesting form of wild life, but also would add much to the decreasing supply of valuable fur.

Beavers, the Survey has found, can be kept readily in a fully controlled if not a fully domesticated state. Because the animals are comparatively clumsy and slow walkers, they rarely go more than twenty or thirty rods from their home stream. To confine them to a narrow strip along a certain stream, therefore, it is only necessary to fence across the stream a short distance above and below their colony, running the fences at right angles to the stream about thirty rods on each side.

The best location for beaver farms is believed to be in the tier of states along the Canadian border. A rough guide to desirable range for beavers is the presence of the aspen or poplar tree. These trees are their favorite food and are of little value commercially. Much of the best beaver country is in localities where, after the original timber has been lumbered off and the ground burned over, thickets of aspen and pin cherry have sprung up as second growth. Such land is generally considered almost worthless, but it might support a large beaver population and could be successfully handled either on a large or a small scale. A small fur farm, where detailed attention can be given to the animals, is likely to prove more successful at first, and can be extended when management practices are fully mastered.

Anyone interested in the possibilities of beaver farming may obtain a booklet giving much additional information by writing to the United States Department of Agriculture at Washington, D. C., asking for Technical Bulletin No. 21-T,

BIOLOGICAL SURVEY SEEKS COOPERATION OF HUNTING CLUBS.

An effort is being made to enlist the cooperation of wild-fowl hunting clubs throughout the United States and Canada in reporting to the Biological Survey of the United States Department of Agriculture their bags of wild ducks and other migratory game birds taken during the 1927-28 open season. This information is desired as a basis, in part, for determining whether migratory game birds generally are increasing or decreasing. It will be of value in formulating regulations for their protection.

Paul G. Redington, chief of the Biological Survey, states that "this cooperation from the sportsmen and sportsmen's clubs of this country and Canada will be of great benefit not only to the birds but to the sport as well." Clubs and individuals interested are requested to communicate with the Biological Survey, Washington, D. C.; instructions and forms will be furnished. The work will be started early in October.

WATERFOWL SHOOTING PERMITTED ON PARTS OF UPPER MISSISSIPPI.

Under a recent order of the Secretary of Agriculture, waterfowl shooting is permitted during the present hunting season on parts of the Upper Mississippi River Wild Life and Fish Refuge, in accordance with the provisions of the Migratory Bird Treaty Act and the regulations thereunder, with state laws, and with regulations governing the use of the refuge.

The order permits hunting over navigable waters and meandered lakes only. Thus it has the effect of preventing shooting on marshlands and ponds, and on these areas waterfowl will have sanctuary. This reservation was authorized by congress chiefly to provide a refuge for wild life, but at the same time to afford a place that the public might enjoy for hunting and other recreational purposes, so far as consistent with the main objects for which the reservation was made. Hunting on private lands within the limits of the refuge is not affected by the order. It relates to waterfowl shooting only and does not permit the taking of other wild life on the reservation.

FORESTS PLAY IMPORTANT ROLE IN REGULATION OF STREAMFLOW.

That the forest plays an important part in the regulation of streamflow has been brought out by scientific investigation over a great many years and in many parts of the world, according to Raphael

Zon, director of the Lake States Forest Experiment Station of the Forest Service, United States Department of Agriculture.

The forests are not only an important factor in regulating streamflow, but also aid in modifying climate and the character of the soil, tending toward the improvement of the water storage capacity of any watershed. These conclusions of Doctor Zon's regarding the relationship of forests and floods are of particular interest just now when ways and means of preventing floods and regulating flood waters are being given such wide consideration. In his booklet entitled "Forests and Water in the Light of Scientific Investigation," just republished by the United States Department of Agriculture, he points out that although floods which are produced by exceptional rainfall can not be prevented by forests, yet, without the mitigating influence of the forests, floods are more severe and destructive.

"A national policy," he says, "which, though considering the direct value of forests as a source of timber, fails to take full account also of their influence upon erosion, the flow of streams, and climate, may easily endanger the well-being of the whole people."

The tendency of the forest is to equalize the flow throughout the year of all streams having their origin in tree-covered mountain regions. This is explained in an interesting discussion of the combined effects of the forests upon air and soil temperature, relative humidity, effective precipitation, evaporation, wind, physical character of the soil, and run-off of water, which, in turn, control streamflow. A comparison of many streams having forested and nonforested watersheds supports the conclusions reached by the study of contributing factors.

The booklet shows the effect of forest cover to be most beneficial on steep slopes, at the higher elevations and on nonporous soils. The forest breaks the force of storms, absorbs some of the water, permits still more water to seep down into the soil where it is gradually released to feed the springs and larger streams. The maintenance of a forest cover is shown to be the cheapest and best way of preventing erosion by its tendency to bind the soil in place.

A limited number of free copies of "Forests and Water" are available upon application to the Office of Information,

Department of Agriculture, Washington, D. C.

GAME ANIMALS KILLED IN FOREST EVEN BY SLOW GROUND FIRES.

Like the exile who brought about his undoing by yielding to the desire to return once more to his old home, the instinct of wild game to drift back to their range following a forest fire often leads to their destruction, according to evidence gathered by foresters of the United States Department of Agriculture.

While a forest fire, unless it is "crowning," or traveling in the tree tops, ordinarily does not travel fast enough to overtake the fleeing game birds and animals, the homing instinct is said to bring them back to their haunts frequently before a fire has subsided.

Commenting on the destruction of wild life by forest fires, J. W. Humphrey of the Forest Service, describes some of his observations during the Lost Johnny Creek fire in the Flathead National Forest in Montana last summer. This fire occurred in a mixed stand of spruce, fir, larch and white pine.

"The fire while at its height," Mr. Humphrey says, "did not travel faster than two miles an hour. This being the case, it would seem unlikely that deer or game birds would be overtaken by the flames. Pine squirrels and other animals, however, were all destroyed in the path of the fire. Along the edge of the fire, where we were trenching, we saw a number of pine squirrels that apparently had their feet so badly burned they could not climb trees.

"I found two whitetail deer on the creek below the fire fighters' camp that were burned to a crisp. Two others—one a large buck and the other a yearling—died near the Riverside pasture gate. Another old buck, with the hair over his hind quarters badly singed, and his feet so badly burned that he could hardly walk, was seen by the entire crew a number of times between Riverside and Murray Creek. I also saw a fawn in the vicinity of Spring Meadows that had evidently lost its mother. The feet of this fawn had been badly burned. However, it appeared as if it would recover. We found a great many grouse that had died from the effects of the fire.

"This fire did not travel fast enough to overtake either the game or the birds. It is my opinion that both, after the fire had quieted down, drifted back to their old range through the smoldering ashes. After getting in where the ashes were extremely hot, and burning their feet, they had become bewildered, and probably had run on until so badly burned that, even though they got out of the fire, they later died. Both deer and grouse appeared very reluctant to move away from their home range and returned before the ground had had time to cool. Nearly every day we would see deer wandering through the burn, especially on the meadows, even though the forage was practically all destroyed."

STUDY MADE OF MAGPIE IN RELATION TO AGRICULTURE.

The common magpie, a characteristic bird of the plains and mountains of the west, exerts an economic influence similar to that of the crow of the east. A study of its food habits, the results of which have just been published by the United States Department of Agriculture in Technical Bulletin 24-T, "The Magpie in Relation to Agriculture," by E. R. Kalmbach, biologist of the Biological Survey, indicates that as an insect eater the magpie surpasses the crow and all other members of the Corvine family, which includes jays, crows and magpies. Destructive weevils, caterpillars and grasshoppers characterize its insect food, which forms nearly 36 per cent of the bird's annual diet. The magpie also eats a limited number of small rodents, and as a carrion feeder it does additional good.

On the other hand, the magpie has some outstanding faults. It is guilty of the destruction of poultry and beneficial wild birds and their eggs and at times becomes a pest on the cattle ranch by its attacks on sick, injured or weak live stock. There are times when these birds become so bold or gather in such great numbers that a reduction in their numbers is warranted. Poisoning during the winter has been found to be an economical, effective and safe method of accomplishing this. Extirpation of the bird, however, is not called for, and before local campaigns of control are inaugurated careful consideration should be given to their necessity and scope.

Copies of the new bulletin may be had upon request addressed to the United States Department of Agriculture, Washington, D. C.

ANNUAL FUR LAW SUMMARY ISSUED.

To encourage effective action on the

part of those concerned in maintaining the supply of fur animals, including trappers, fur tradesmen, administrative officials, legislative committees and conservation societies, the Biological Survey issues a summary of the fur laws for each season. The thirteenth annual summary, entitled "Fur Laws for the Season 1927-28," and known as Farmers' Bulletin No. 1552-F, has just been published by the United States Department of Agriculture.

The authors of the bulletin state that the fur resources of the country are steadily diminishing and that the factors responsible for this are out-of-season trapping, overtrapping, a general tendency in many sections to class fur bearers as vermin to be killed on sight, a great reduction of fur-producing areas, unwise drainage of swamps and marshes, and needless destruction of forests and cover. The raw-fur catch during 1925-26 was approximately 20 per cent less than in the previous year, and the decrease for 1926-27 was even greater. The primary responsibility for making and enforcing laws to protect fur animals rests with the individual states, and the states are more and more appreciating this fact, as well as the fact that if they do not make and enforce appropriate fur-conservation laws, the public and private benefits from the fur resources will diminish to the vanishing point in the not distant future.

The new bulletin gives a complete summary in synopsis form of all the laws of the various states relating to fur animals effective for the present trapping season, also those of Canada, Newfoundland and Mexico. Regulations affecting interstate shipment of pelts are explained, and the fur legislation enacted during the year is reviewed, with all important changes noted. Copies of the bulletin may be obtained from the United States Department of Agriculture, Washington, D. C.

COMMISSION ACTIVITIES.

A number of important administrative changes have been made by the new Board of Commissioners since their appointment on September 2. They are as follows:

J. S. Hunter from chief of patrol to assistant to the executive officer. New duties will include game census and technical advice.

Mrs. Pearl Ford from assistant to the executive officer to secretary to the Board of Fish and Game Commissioners.

K. P. Allred from captain, San Luis Obispo district, to acting chief of patrol.

J. D. Dondero from deputy to captain in charge of the district to include Lake, Napa and Mendocino counties.

La Rue Chappell from deputy to captain in charge of portion of southern California territory.

W. B. Sellmer, captain Marin County, additional charge of launch patrol.

New badges have been issued to the

volunteer deputies to replace the many different styles and patterns. The new badge is a bronze shield and somewhat resembles that of the federal game warden. It assures uniformity and an equal dignity throughout the volunteer forces. The assortment of glittering oddities that formerly posed as badges has been called in and those privately owned will no longer be honored as marks of authority.

The comments on stream and field and game conditions made in the reports of the volunteer deputies are proving of interest and value to the division. They indicate not alone the coordinative work of the volunteer force with the regular patrol, but also indicate a more favorable attitude of the public toward the value of wild life and the need of its proper protection.

Up to November 1, sixty-seven organizations that have for their object the conservation of fish and game had recommended and sponsored the appointment of 269 volunteer deputies. These appointments have been made by the division.

Replies have come in from practically every employee of the division, giving the data requested on the personnel questionnaire sent out in July. A vast amount of useful information can be found in these papers disclosing ambitions and capabilities, as well as desires to become more proficient in each respective field of endeavor. It is planned to have these data serve not only as a personnel record but as a means of adapting those better fitted to perform other lines of work, and as a means of making adequate advancements.

The survey crew posting the boundaries of California's thirty-four game refuges was recently loaned a one-ton truck used at the Yosemite Hatchery. This additional equipment will serve to carry the crew from one refuge to another and will expedite the work.

Game refuges 1-H, Plumas County, 1-I, Placer County, 1-O, El Dorado County, 3-F, Contra Costa County, 3-G, San Mateo and Santa Clara counties, have been surveyed and posted. The crew is now chaining and posting refuges 3-A, Santa Cruz County, and 3-E, Santa Clara County.

Department of Patrol.

Much of the routine of the patrol office has been reorganized and adjusted.

Captains in all districts have been placed in complete authority and are now held accountable for conditions obtaining there. Except in cases of unavoidable emergency, deputies are instructed to act through their captains.

On October 11, a conference of the captains of patrol was held in San Francisco. Both land and water forces convened for the purpose of arriving at a common understanding of certain problems which were discussed in open meeting. The success of the conference has merited the suggestion that similar gatherings be held every three months.

The most clever schemes of men oftentimes are of no avail. This proved the case of two dove hunters in the Monterey district who, on killing over the limit of doves, thought themselves achieving the pinnacle of adroitness by concealing 26 doves in their bed-roll. Deputy Richard Young became suspicious of their character, however, and succeeded in taking them before Judge F. J. Voll of Hollister, who imposed a fine on each of \$75.

Due to the skill of deputies C. J. Walters and E. S. Hurlbut a catch of 190 trout was discovered in a snowbank near Lake Ellery in Mono County. An arrest of a near-by camper followed and Judge A. E. Rule of Mono Lake fined the "trout hog" \$100.

Even the ranks of the game wardens in California have been invaded by the fair sex. The division recently appointed Mrs. Walter B. Sellmer a volunteer deputy and her first case involved the arrest of an individual shooting from a motor driven conveyance.

A record plant of 100 cans of trout fry was made by Captain J. E. Newsome's division on October 28. Just two hours and five minutes were allotted to the men to plant 20 miles of the Merced River from the terminus of the railroad at El Portal to the upper end of Yosemite Valley. Three trucks met the fish car at El Portal at 11.45 a.m. and returned the empty cans before the departure of the train at 1.50 p.m. One truck planted the stream as far as the power house, a second, the river above the Pohono bridge and a third from the Sentinel bridge up stream. The water was at a satisfactory temperature, there was little loss in fish and those planted were in fine condition.

An enviable record of arrests and con-

victions dealing with deer cases was attained by deputies Walter Emerick and R. E. Bedwell. They secured eleven convictions during the opening of the deer season in district 3. The fines imposed on the defendants convicted totaled nearly \$1,000. Later in the season, Deputy Emerick made a case involving the killing of a fawn, which resulted in a \$200 fine.

"This should serve notice on all violators of the fish and game laws, that those who come before me will be severely dealt with in the future. The wild life of California is one of the state's greatest assets and I am heartily in sympathy with the rigid enforcement of the laws existing for its protection." With this declaration, Police Judge Daniel O'Brien of San Francisco sentenced John J. Ryan to serve thirty days in jail for having more than 100 wild ducks in his possession during the closed season when he was arrested on August 25. It is claimed that Ryan has been a violator for twenty years.

Profits on the sale of 102 pounds of striped bass were trimmed down as a result of the assessing of a fine against A. Romeo, fish dealer, by Judge Lyle T. Jacks, in a San Francisco police court.

The fish had been delivered to a prominent San Francisco hotel and were about to be served when Deputy Earl Caldwell seized them. Two employes of the hotel declared Romeo had been ordered to bring sea bass, but brought striped bass instead. The offender admitted in court that he had been arrested four times for illegal handling of striped bass. He was warmly scored for his disregard of the law and sentenced to pay a fine of \$250.

The bass were turned over to the Shriners Hospital. Here they were served to the youngsters who were patients in the hospital.

On January 7, 1925, Deputy Walter Sellmer seized a truck loaded with 180 dozen crabs at Sausalito as the driver was about to cross on the ferry to San Francisco. Suit was brought in the name of the Commission for illegal transportation and the crabs were retained on the ground that they had been brought from Humboldt County.

The decision of Superior Judge Edward Butler of Marin County rendered on October 20, 1927, is worthy of more than the brief notice space permits here, for he impressed on the offender that dealers in products of the sea must comply with the laws and rules laid down for the

purpose of conserving and protecting the inhabitants of the deep.

A fine of \$1,000 was meted out with an alternative of one year in jail in the case of Chester Chambers of Colusa on November 13, by Judge John M. Golden of San Francisco. The offender was apprehended with 100 ducks in his possession and charged with two infractions of the law: the possession of ducks during the closed season and possession of more than the limit. The maximum fine was imposed on each count.

It has been suspected that market hunters have been killing ducks by the hundreds and bootlegging them in the larger cities. Judge Golden is deserving of the praise of all those who appreciate the value of checking the ravages of the market hunter. It is only through the coordination of the courts with the work of the wardens that illegal hunting can be pared down.

In commenting on the case, District Attorney Matthew T. Brady said: "With hunters and anglers increasing every year and our fish and game diminishing, we must do everything in our power to protect the remaining supply if the coming generations are to have fish in our streams and game in our fields."

Peter Balestreri, well known San Francisco fisherman and consistent violator, was found guilty of illegally having striped bass in his possession early in November by Judge Lyle T. Jacks and sentenced to pay a fine of \$250 and spend five days in the county jail. It was Balestreri's third offense in one year.

The violator was apprehended by Deputies C. L. Bundock and Earl Caldwell on the morning of October 20 after he had been pursued for many blocks in the early morning. In attempting to elude capture the fisherman tossed out of his speeding machine the two sacks of striped bass and finally in desperation abandoned his car, with the motor running, in the middle of the vacant street. He was positively identified, however, by both deputies before the gloom of the morning concealed him.

Lest the educational campaign directed against the practice of "piecing out the bag limit" has failed to remedy conditions, deputies of the Division of Fish and Game have concentrated their attention on gun clubs. It will take gun clubs in California a long time to live down their reputation of being hoggish in the matter of exceeding the bag limit. Certainly if action does not come within the

organization, the Division of Fish and Game will see to it that the law is enforced. Gun clubs have no special privileges and if they do not enjoy having deputies search members as they leave the club, reform is necessary.

The deputies patrolling the duck haunts in northern California have established a camp near Maxwell. A building of a rice grower has been fitted to serve as a dormitory and assurance thus made that deputies exposed to a night of mud and rain while watching for the flash of a pot hunter's automatic will have a warm shelter and a dry bed. Further consideration for their health and comfort has been manifested in the employing of a cook, who, it is said, serves excellent meals.

The reports from the Los Banos and San Joaquin delta districts are very encouraging and market hunters are well aware that deputies are in the vicinity. So far little trouble has been experienced with violations on the part of free lances. About the only irritation with the commercial clubs has been the tendency of the duck clubs to oversell their blinds, and in nearly all cases of the sale of ducks, the sale has been made in the duck fields to hunters who failed to bag a limit of ducks and desired not to lose favor among those to whom they had boasted at home.

It was estimated that there were 3000 duck hunters in Imperial Valley on the opening day of the duck season. Every hotel from Westmoreland to Mexicali was full and hundreds of hunters were camped along the roadside.

At the first break of day it sounded like Chinese New Year. After one hour of shooting the ducks were up in the air so high they looked like small black-birds and were all headed for Mexico, never to return.

Deputy E. D. Ricketts writes: "Deputies W. S. Talbott, R. J. Little and myself estimated that there were 250 limits of ducks killed on the opening day. These included sprig, cinnamon teal, green-wing teal and Fulvous tree-duck, a Mexican duck that very seldom goes north of the Salton Sea. There were very few geese.

"The duck area of the Salton Sea ranges from 150 feet to 250 feet below sea level and in this area there are some forty-odd commercial duck clubs and private clubs that have most all the land along the sea from Mullet Island to Mecca, in Riverside County. The charge to hunt on the commercial clubs is from one to

five dollars per day. It devolves upon the hunter to try and get a duck if he can. When a duck comes along everyone starts to shoot and if a duck is killed everyone runs for it, then the fight starts to see who gets it.

"There are also thousands of shore birds in the rice fields and along the sea. Several hundred curlew and a few jack-snipe were seen in the rice and barley fields.

"Six cases were made the first two days of the open season for shooting shore birds and four duck cases were made the night before the opening for shooting ducks in closed season.

"The ducks feed mostly at night in the Imperial Valley and return to the Salton Sea at daylight, to rest. The Salton Sea is quite a large body of water some 40 miles long and from five to seventeen miles wide. There are two rivers running into the sea, the New River and the Alamo. Most of the ducks loaf at the mouth of these streams where fresh water comes in, as the water in the Salton Sea is very salty, and these points are where the most of the motor boat shooting has been going on.

"The division had no motor boat patrol on the Salton Sea until this year and all the deputies could do was to stand on the shore and look on, but with the patrol boat, *Ibis*, which is being launched at Mecca, the deputies will be able to put a stop to the motor boat shooting on the sea."

Over nineteen millions of trout fry were planted under the supervision of the deputies this season. The reports are uniform in their showing that the fish were planted with entire success. In all cases of apparent inefficiency, further investigations disclosed that the negligence was unavoidable. In a few instances deputies were ill or called away unexpectedly to take care of unforeseen cases that required their immediate attention. On the whole the loss of fish was slight.

The planting went forward very rapidly during August and September and then slackened considerably as the hatcheries were emptied. By the middle of October there were but three carloads to be sent out from the Mount Shasta Hatchery and nine from the Mount Whitney Hatchery. These late shipments were to regions in the coast range where there was little danger of the planting crews being caught by snow. The last fry shipped from the Whitney Hatchery were large, and, though more cans were required to transport them, their good size

and fitness assured better chances of survival.

A study is being made by supervising captain O. P. Brownlow involving plans for the coming year and the mapping out of a definite program.

The success of the new planting truck suggests a way out of many difficulties so common in the past. If trucks could be extensively used throughout the state to convey the fry to the streams, a decided improvement would result over the present system. Captains of districts could go to the hatchery foreman and learn when their allotment would be made and then make plans accordingly so as to serve better the interests of their respective districts. This plan would avoid last minute notices and work under conditions hastily planned and often very arduous because of lack of adequate preparation.

If three pack trains of eight mules each could be placed in the fields with three men working on each train and each train working out from bases at concentrated points, distribution could be made in the less accessible areas and in places not reached by trucks. The pack trains could also transport fish caught by hook and line to barren waters in the vicinity. It is suggested that the first distributing bases for pack outfits be so located as to cover eastern Fresno and Madera counties, Mono County and El Dorado and Placer counties.

A new location was selected for the holding pond near Cloverdale on the Russian River to afford a better test of its feasibility. The pond selected last year to try out the benefits and detriments of holding ponds in general proved unsatisfactory. The present location is shaded and the water diverted from the river constantly cooled by seepage.

Squaw fish and hardheads are abundant in the Russian River, as well as black bass. These fishes have a great preference for trout fry and are very destructive. It is hoped to hold the trout placed in the pond near Cloverdale until they reach a size capable of holding their own against these natural enemies.

Captain J. D. Dondero has performed some very creditable work rescuing stranded fish in tributary streams of the Eel River. He estimates that he has placed some 80,000 fish in good water.

Rescue work involving the saving of many thousands of bass, crappie, perch and catfish has also been in progress in the San Joaquin Valley south of Newman under the direction of Captain J. E.

Newsome, and in Tulare County supervised by Captain E. W. Smalley.

Captain Walter Sellmer on November 15 seized 12,000 feet of illegal nets being used by fishermen in District 2 in the mud flats between Mare Island and Sonoma Creek. These nets, nearly two miles in length, were being used in an unlawful way to block off an area in territory closed to fishing.

On November 3, George Baird forwarded by parcel post an apparently innocent looking package marked "bulbs and plants" from Shasta County to a party in Ross, Marin County. The Horticultural Commissioner at Ross opened the package with an eye to discover any possible introduction of plant diseases. To his amazement there were five mountain quail. They were turned over to Captain Sellmer who is now prosecuting the case for concealed shipment of quail shot out of season.

Department of Fish Culture.

The 2,350,000 quinnat salmon held in ponds at the Mount Shasta Hatchery were liberated into the Sacramento River around November 15.

Distribution of trout throughout the state was made by both cars No. 01 and No. 02 until September 14, when car No. 01 was transferred to the Mount Whitney Hatchery. The last trip of the distribution car was made from the Mount Whitney Hatchery on November 9, over 2,000,000 trout being distributed from this hatchery for the season. Up to November 1, a total of 10,636,500 trout had been distributed from the Mount Shasta Hatchery.

Spawning has been late this year and but 317,000 Loch Leven, 90,000 eastern brook and 114,000 brown trout eggs have been secured. Six hundred ninety thousand quinnat salmon eggs have reached the Mount Shasta Hatchery from the Klamathon station. The trout in the ponds are looking well and it is believed that a yield equal to that of previous years will be forthcoming from the pond fish.

The repair work of the auxiliary stations of Camp Creek, Bogus Creek, Beaver Creek, Shackelford Creek and Hornbrook Creek has been completed. These stations are now ready for the operations of the egg collecting crews.

From the Gull Lake egg collecting sta-

tion 900,000 eastern brook trout eggs were received at the Mount Whitney Hatchery on November 19. This station was forced to close and the crews to abandon their work due to the cold and storms. The snow was so deep the crew had difficulty in making their way out. The excessive fishing in June and Gull lakes will soon materially reduce the number of eggs that can be collected unless conditions take a turn for the better.

The Domingo Springs and Clear Creek hatcheries have been closed and repairs

to Blackwood Creek where it will be set up. The Taylor Creek racks have been reinforced and the seining quarters shingled.

Four large retaining tanks have been constructed at the Yosemite Hatchery. These are to be used for the purpose of holding trout fry until they reach a certain size, which, it is believed, will insure a greater percentage of survival. They will also increase the capacity of the hatchery and enable certain hatcheries to serve full time. The Department of



FIG. 30. A catch of golden trout from Rock Creek near Lone Pine, California. Through fish distribution, streams containing golden trout are now accessible to all. Photograph by Burton Frasher.

made. The Warner Creek trap is ready for installation as well as the Butt Creek trap. If snow does not fall too deep, it is planned to build more troughs and tanks to increase the capacity of these hatcheries.

The superintendent's and employees' cottages at the Tahoe Hatchery have been completed and furnished and are now occupied. Repairs are being made on the hatchery building. The Ward Creek trap has been dismantled and transported

Architecture is constructing a superintendent's cottage and another for his assistants.

Plans have been perfected for the establishment of an aquarium in a room adjoining the Yosemite Hatchery. The aquarium tanks will be in readiness by the coming tourist season. The hatchery is so admirably serving in an educational way that this additional feature will materially aid in conveying to those who visit the hatchery a more delightful impression of fish cultural work.

The Prairie Creek egg collecting station is about complete. This station, it is hoped, will furnish at least half the supply needed for the Fort Seward Hatchery. It was established after considerable investigation. The racks were located so as to take advantage of the run of both salmon and steelhead up Lost Man Creek and Prairie Creek.

Another experimental station will be located on Mill Creek, one of the main tributaries of the Smith River in Del Norte County. A tent hatchery will be set up and a trap installed, the station being ready for operation by the beginning of the steelhead run.

Still a third station has been selected on Mormon Creek four and one-half miles from Sonora. A tent hatchery will be in place containing thirty troughs. If the site proves suitable for hatchery purposes a permanent hatchery will be built to supply the fish for Tuolumne County, and, possibly, Calaveras County.

The Kern River station, a fourth experimental station, will be in readiness before the end of the year. Living quarters for the attendants have been built and the troughs are on their way to be installed in the tent hatchery.

Thirty-five years ago an agreement was entered into between the states of Nevada and California for joint operations on Marlette Lake. This practice had to be discontinued some years due to the shortage of fish. Happily, there were enough fish in the lake to justify a division of the eggs this season. Marlette Lake is situated at an altitude of 8000 feet and supplies from a million to a million and a half eastern brook trout eggs when weather conditions are favorable. The early fall of the year just past was unfortunate in this regard and the Nevada Commission is not expecting to harvest the usual amount of eggs.

The foreman and his assistants are rushing construction and preparation of the troughs in order to get the new Burney Creek Hatchery in shape for the coming season's work. Eggs will be shipped from the Mount Shasta Hatchery as soon as possible and it is planned to have the hatchery raise enough fry to plant all of eastern Shasta and Modoc counties.

Traps will be installed in the spring in the creeks tributary to Lake Britton. It will require several years, however, to establish a good run of trout in the lake. The presence of large numbers of bass

in Lake Britton will probably prevent this.

A hatchery on Cold Creek in Mendocino County, is being constructed. This new hatchery will be located about eight miles from Ukiah and will replace the old hatchery at Ukiah which has been able to supply but one-quarter of the number of fry needed for the district. The Ukiah Hatchery, however, will not be abandoned until it is certain that the Cold Creek Hatchery will be completed in time to take advantage of the steelhead run.

An epidemic among chinook salmon broke out during the month of September. The biologist of the department, George A. Coleman, made a technical examination of conditions prevailing on the Klamath River at the time when the epidemic was at its height. These epidemics, while known to have occurred in the past, have not been made the object of any special study. Hence, this investigation was of particular value and interest.

Mr. Coleman also made investigations of the Yosemite Hatchery, Lake Eleanor, and of Prairie Creek. The latter two investigations were made for the purpose of determining the feasibility of establishing egg taking and egg eyeing stations.

Department of Commercial Fisheries.

Mr. H. B. Nidever, an employee of the Division of Fish and Game since June, 1908, has been put in complete control of the Commercial Fisheries Patrol of both northern and southern California. Centering responsibility should aid greatly in law enforcement. Mr. Nidever will stimulate better enforcement of the law protecting Pismo clams as well as enforcing laws relative to fish reduction. It is expected also that the complaint that the laws were better enforced in the southern part of the state than elsewhere will be obviated.

Three ships of the Scandinavian whaling fleet operated for some time during the fall in the vicinity of San Clemente Island. These ships were tied up by the United States marshal during October on account of debts owed a local ship chandler and because of noncompliance with the custom laws.

Captain Peterson, a local fisherman at San Pedro, has conceived the idea of

bringing Pismo clams from Turtle Bay, Mexico, to San Pedro in several ton lots and planting them on the nearby beach and selling them to the local markets as the trade demands. In starting this new industry, Captain Peterson has promised to comply with all laws which apply both here and in Mexico. Having obtained a supply at Turtle Bay, the success of the new venture is awaited with interest.

Mr. L. H. Kelly of the Hawaiian Division of Fish and Game has been visiting California with the purpose of securing various birds and fish for introduction into the Islands. Mr. Kelly plans to take several hundred Pismo clams and abalones to Hawaii and attempt their introduction. There have been several former attempts of this kind but they have met with failure because of the difficulty of shipment. Mr. Kelly has devised some specially designed crates which he believes will transport these shellfish satisfactorily.

During the barracuda season a research assistant of the State Fisheries Laboratory centered his attention on field work. Data as to the size measurements of the catch and observations of the spawning were gathered. Some very young fish were fortunately obtained during September. The question of age determination through the microscopic examination of scales is to be undertaken this spring.

This past fall a purse seine boat from San Pedro demonstrated that purse seines can catch sardines in steady quantity in Monterey Bay. However, since the lampara fishermen were delivering all the sardines the canneries could handle, both canners and fishermen wished to cancel the contract with the purse seiner. This was finally accomplished by joining the forces of both canners and fishermen.

The patrol boat *Albacore* has been overhauled and repaired and during November and December worked over the northern end of the district. Mr. Paul Bonnot continued his work of gathering knowledge as to the extent of damage caused by sea lions and additional data as to their life history and habits.

Bureau of Education.

In that the Division of Fish and Game is made responsible for the protection of song birds, it is only reasonable that depredations by such birds be investigated and help given the farmer. For

several years complaint has been growing relative to the destruction of grapes by birds in the Porterville district of Tulare County. During the early part of November, Mr. Donald McLean was detailed to find out how much damage was being done and which birds were responsible. He found that certain owners were hiring men to patrol the vineyards and shoot every small bird seen. Reason for such a procedure was shown in that late ripening grapes are packed in sawdust, and if one or two grapes are broken the whole keg is likely to spoil. Each bunch of grapes has to be trimmed of the bird-picked fruit. Some of the birds killed in vineyards were sent to the San Francisco office and a study made of the stomach contents. Some were found to be grape eaters, others were apparently innocent species bent upon the destruction of insects rather than the destruction of fruit. Like studies were made of the damage done by quail in vineyards in San Benito County.

Investigations of this sort will do much to gain the confidence of the public and at the same time will place bird protection on a sounder basis.

During November the exhibit, "A Forest Tragedy," was installed at two different expositions held in the Civic Auditorium, San Francisco. Thousands viewed the exhibit and commented upon the lesson it teaches. Literature on a nearby table was furnished those interested.

The complete collection of birds' skins and birds' eggs has been rearranged and catalogued. In addition, a fine set of new specimens has been added to the collection of bird skins. Celluloid containers are being manufactured and it will soon be possible to make loans of bird skins to teachers and to various organizations. Such containers are necessary in order to prevent deterioration of the specimens.

Special attention is now being given the lecture program in the rural schools as well as the city schools. The boy with a .22 rifle who shoots everything that flies is a well-known problem in every rural school. If these school lecturers can help develop the boys in our country districts into good sportsmen and conservationists and can at the same time develop respect for the game warden of the district, splendid fundamental work for conservation can be accomplished.

Bureau of Hydraulics.

The cooperation of oil companies in cleaning up their properties and in nipping the pollution problem in the bud, so to speak, is being secured through an earnest effort on the part of the bureau. The bad effects of pollution and its cure by effective methods is finally being heeded. There is no doubt that some of the latest examples of this cooperation will greatly increase the efficiency of the present program of protection for fish and plant life.

sump and the measures taken to prevent pollution.

A suit against sixty-seven oil operators in the Huntington Beach field was filed early in October in the superior court of Los Angeles County. This suit was in the form of an injunction sought to prevent the present polluting of the Pacific Ocean with petroleum now permitted to flow into lines of drainage by the respective defendants.

The suit comes as the result of an exhaustive investigation pursued by the bureau after an inspection of the field

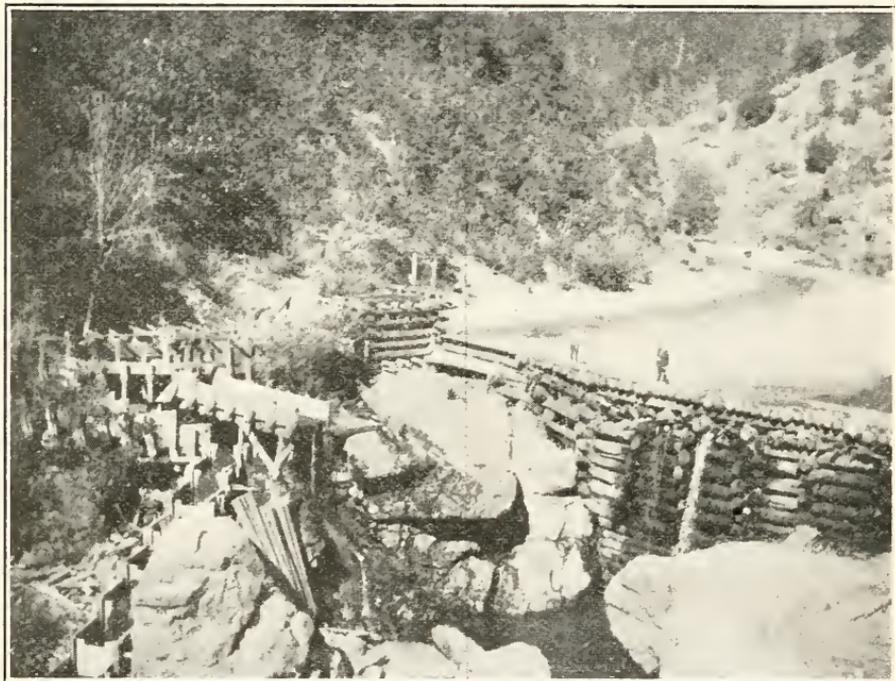


FIG. 31. McGillavray Dam on Canyon Creek, Trinity County, showing the new fish ladder recently completed. October, 1927. Photograph by G. O. Laws.

An inspection of the Shell Oil Refinery at Martinez occasioned praise for the excellent work done by the company and in particular by G. H. Van Senden, manager of the refinery, for the fine results obtained in dredging the sumps, making a general cleanup and providing against possible leakage of oil in the future. At least \$20,000 was spent in carrying out the cleanup program and in precluding the possibility of further pollution.

Much satisfaction also resulted from the way in which the Oil Operators, Inc., at Long Beach, are maintaining their

early this summer. The inspection was extended to the premises of every offending operator of oil wells in the field and conditions were summed up to be very bad. Samples of oil were taken at the time of the survey and photographs of the drainage and the polluted area were made with a view to their use in a court action.

The suit will enjoin the offending companies from operating until such time as the areas in question are cleaned up and assurances made that the pollution will not occur again. The larger oil companies have always shown a willingness

to cooperate in the attempt of the Bureau to prevent and halt pollution, but the smaller independent operators have, so far, failed to see the light. It is hoped that the filing of a suit on a wholesale scale will stop these smaller companies from operating unless the pollution is stopped and that the steps taken will have the same effect that similar action had on a large number of companies in the Long Beach field last year.

A last minute report shows that the majority of the defendants named in this action are taking steps to clean up the polluted areas.

The Cain Irrigation Company in Mono County will install a fish ladder on Grant Lake and four fish screens on Rush Creek as the result of a court hearing held at Bridgeport in September. Efforts to effect an installation without the necessity of legal action were of no avail.

A fish ladder on Ralston Dam at French Meadows, Placer County, was inspected and found satisfactory. This ladder was installed last year in accordance with an agreement.

The Mendocino Lumber Company completed a fish ladder at Hellgate Dam on the South Fork of Big River in Mendocino County.

An agreement was reached with the Marin Sanitary District to install a fish ladder at a place where a sewer pipe crossed San Anselmo Creek in Marin County.

The Clover Valley Lumber Company in Loyalton, Sierra County, has cleaned its mill pond of bark, sawdust and other settled matter deleterious to fish life.

The State Board of Health after a hearing in Sacramento gave permission to the Sacramento Development Company to pass the effluent from a fifty-ton sulphide pulp mill and a 3300-pound rayon plant into the Sacramento River at Freeport. The attitude of the division in the matter was presented to the board at the time of the hearing. It is believed that the permit issued will safeguard plant and fish life inasmuch as it might be affected by the effluent.

The owners of the S. S. *Edna Christensen*, Sudden and Christensen, were brought into court and fined \$300. They

were found guilty of pumping oil in bilge water into the estuary at Oakland.

The Pan American Petroleum Company has been making experiments to ascertain the best way to prevent pollution. They are constructing cooling towers at the very considerable cost of \$125,000 at their Watson refinery that will cool and save about 80 per cent of the water, according to tests made.

The Union Oil Company at Oleum is engaged in enclosing and filling in an area along its shore line to mitigate the unsightliness of the many scattered oil drums and to prevent oil seepage into the San Francisco Bay waters. The bulwark is of planked piling and rock fill and will cost, together with dredging the old sumps, some \$85,000.

For twenty years the salmon and steelhead have been barred from Greenwood Creek, a fine spawning stream that empties into the Pacific near Elk in Mendocino County, but this year, due to the cooperation of the Goodyear Redwood Company with the Division of Fish and Game, the stream has been opened.

During this long span of years the stream had been blocked by a dam maintained by the lumber company to operate a pond for floating logs for milling purposes. After a series of conferences a fish ladder was devised for one end of the dam. While these negotiations were under way many difficulties cropped out and at one time it was thought that it would be necessary to tunnel through the rocky hill at the side of the dam for over one hundred feet, at an almost prohibitive cost. A ladder, however, was designed that solved the problem and the lumber company went to work on the job as soon as the plans were completed by the bureau.

Reports declare that fish are making use of the ladder and are having no difficulty in going through the jumps. The ladder is unique and the splendid cooperation of the lumber company with the Division shows that there are still commercial concerns that want to conserve fish.

Bureau of Game Farms.

During September 1709 ringneck pheasants were liberated. By far the larger number of these went to Santa Barbara and Imperial counties. The fol-

lowing month, 895 birds were planted: at Red Bluff, 100 birds; Pleasanton, 100; Orland, 125; Bakersfield, 150; Tulare, 150; Temecula, 120; and Crows Landing, 150. These birds made a wonderful showing. They were full grown and their color and beauty impressed spectators as they took to the air from the open coops.

The selection of the new farm in the southern part of the state has occasioned much investigation, for many factors enter therein. Water is one of the prime requisites governing the choice of location. Avoidance of fog is another as well

every day of the year and noted the whole cycle in the activities of the ringneck are now in a position to give valuable data. What is equally reassuring is the increased interest shown in the welfare of the introduced species in all these areas.

All the plantings of last year have been carefully checked and it has been found that the pheasant is doing as well in California as in Washington, Oregon and British Columbia. The state has much territory well adapted to upland game birds, furnishing cover and suitable food the year around. The greatest area suit-



FIG. 22. Superintendent Bade of Yountville Game Farm discovers stolen pheasant nest. July 17, 1927. Photograph by Sidney Snow.

as avoidance of heat from April to July.

Further construction work at the Game Farm has involved the erection of new breeding pens. These, due to their secluded location and quiet, will insure a higher quality of eggs. Care has been expended to place the birds as near to natural conditions as permissible.

All of the areas stocked last year have now been replanted. Useful and valuable information has been secured from farmers and those who have been in close touch with the progress made by the birds. Farmers who have been on the ground

able is in the great interior valley of California. Both the San Joaquin and Sacramento valleys are large enough to readily absorb the output of a single game farm.

With the recent rains the work of renovating and cleaning up the pens was commenced. All of the pens along the main alley way have been plowed and seeded. The domestic poultry house has been rearranged and a new cooking house built to accommodate two forty-five gallon caldrons.

Bureau of Research.

A number of major problems of game diseases have been carried to the point where the full time services of a qualified pathologist are necessary. Hence, a full time pathologist has been secured. The bureau will continue to have the cooperation and aid of the Hooper Foundation.

The tabulation and filing of over 19,000 deer tags in addition to license stubs and compilation of trapping data and case records has occasioned routine work for the department of very considerable magnitude.

The Director of the Bureau attended the Seventh Annual Convention of the Western Association of State Game Commissioners held in Seattle on September 8 and 9. The outstanding feature of this convention was the desire of the representatives to bring about a solution of the migratory waterfowl situation in the west.

As an aftermath of this meeting in Seattle, the division was cordially invited to be represented at a conference held at Klamath Falls. Here a progress report was heard on the feasibility of reflooding Lower Klamath Lake. The report presented the present obstacles in the way of establishing a suitable and adequate refuge for migratory birds and summed up a survey recently made by government engineers under the auspices of the United States Biological Survey.

R. J. Irvine made a series of tests in the use of thallium as a rodent poison. The experiments were made possible by the United States Biological Survey, whose agents operated recently on the property of the Moraga Land Company in Contra Costa County.

Thallium salts will color the flame of

an alcohol lamp green. It was at first believed that this was a certain and convenient means of detecting the presence of the poison. After many tests, it was decided that the spectroscope, after all, was the most reliable and sure means of discovering whether the poison was present in either animal or bird.

The experiment was made to determine the effect of the poison on rodents at a time of year when food is scarce and to gain some notion of the amount of poisoned grains likely to be uneaten by rodents, and left to be picked up by birds.

The formula for the poison is twenty ounces of thallium sulphate to 125 pounds of potted barley. The thallium was mixed with starch and enough glycerine added to make a paste. This was placed in a copper drum and rotated until the barley was well coated with the poison. The poisoned grains were then placed in a leather bag, for wherever the poison comes into contact with the hair, it is said to cause it to fall out. The grain was scattered from a horse, the operator using a metal spoon.

The experiment showed that four men could poison 1000 acres in three days at a cost of around \$218.

There have been few serious recurrences of the duck disease epidemic. A slight outbreak flared up in the Tule Lake country, but an investigation proved not as alarming as at first reported. Another case of duck sickness was reported in Contra Costa County but this too was found to be not extensive. Further research on dead birds disclosed lead-poisoning and it is believed that death was occasioned by this cause rather than from sickness. Sixteen number six, chilled shot were fed to a well duck and eight to another duck. Both ducks died, revealing pathological conditions similar to the dead birds from the Contra Costa locality.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

SARDINE SCARCITY AT MONTEREY.

Beginning with the second week in October, eight weeks have passed during which practically no sardines have been caught at Monterey. During September, the catch was exceptionally heavy and the ten canneries at that place were running at capacity. This long absence of sardines is unprecedented and is causing a

great financial loss to the canners, the several thousand persons employed in the industry, and, in turn, to the whole Monterey community. The question arises in the minds of sardine canners and fishermen: Is this scarcity caused by overfishing, and has the supply been seriously depleted by present intensive fishing methods?

To detect depletion of our commercial fisheries is an important part of the work of the Department of Commercial Fisheries, and for seven years now, extensive data of the sardine catch at Monterey have been gathered and analyzed by members of the State Fisheries Laboratory staff.

There is no good evidence, as yet, that the fishing operations at Monterey are drawing too heavily on the sardine supply for safety of the future, or that any fluctuations in abundance are due to other than natural causes. It must be admitted, however, that a series of records extending over a period of seven years is hardly sufficient to show whether or not the fishing is too heavy, and we should be very cautious about any undue exploitation of the supply until the investigations have been carried to the point where we can be certain of detecting depletion before it has advanced beyond the danger point.

While there is no evidence that the fishing operations at Monterey are causing any noticeable diminution of the total sardine population from which the fishery draws its supply, there is evidence that the operations temporarily exhaust the local sardine population to such an extent that fishing operations cease until fresh sardine schools are brought into the bay by storms. The supply of sardines in Monterey Bay is soon exhausted by the tremendous daily catch of a thousand tons. There is a slowing down of the fishing, and finally it ceases and the industry is idle until a fresh sardine supply arrives.

Under these conditions, to take more sardines than can be put in cans, and run the surplus in the reduction plants, lengthens the time when there is an absence of local sardines and the canneries and the thousands of employees are idle. There is good reason to believe that if, during the time of sardine abundance in Monterey Bay during the first of the season, no sardines had been used in the reduction plants, the canneries could have continued to operate for a longer time. In the meantime, there are no sardines for the Monterey canneries and gloom hangs over the historic place—and those who seldom pray are now praying for a storm or a good stiff north wind to bring the sardines in.

Another thing has been noticed and spoken of by the canners, and that is that the period elapsing between the times of plentiful sardine supply is becoming increasingly longer; and it has been noticed that not always does a storm or

a favorable north wind bring the expected supply of sardines into the bay.

In the light of these facts, we should be careful with the supply when the getting is easy.—N. B. Scofield.

BOOTLEG BARRACUDA.

The barracuda is one of the most important fish in the southern district on account of its abundance, its good eating and shipping qualities. The catch of barracuda in the state, taking an average of fish received for the past seven years, amounts to 7,000,000 pounds annually, including about 2,500,000 pounds received from Mexican waters. Practically all of the barracuda is taken in southern waters. However, some years there is a fair catch in Monterey Bay.

During the flush of the season in May, June and July, the Department of Commercial Fisheries is actively engaged in overseeing the barracuda catch. This is necessary on account of the weight limit of three pounds imposed by law and the restricted methods of taking the fish. The numerous docks and landing places around San Pedro, Wilmington and Long Beach add another serious difficulty to the situation and it has been necessary to maintain a night and day patrol in order to stop the "bootleg" barracuda business.

The regularly established wholesale markets have, in most cases, realized that the game of violating the law in the aggregate does not pay. Accordingly, most of them have become fairly good conservators. All the wholesalers of the San Pedro district recently made what might be termed a "gentlemen's agreement" not to handle any unlawful barracuda. It was agreed that in any case where one found the other, or anyone else, handling small or purse-seined fish, they were to report the violation and assist so far as possible in prosecuting the offender.

Since the law prohibiting the use of purse seines and lampara nets for taking barracuda went into effect in 1925, the fish have been taken with gill nets and hook and line. The purse-seiner or lampara net fishermen still persist in making hauls and either transfer their load to a gill or hook-and-line boat at sea or try to smuggle it into the harbor and land it on some waiting truck or wagon at night.

An amendment to the net law which became effective July 29 again allows the use of purse seines and lampara nets for taking barracuda. It is still unlawful to use these nets during two and one-half months from May 15 to July 31. It is hoped this law will overcome the over-

catch condition which always accompanied spring fishing. The marketman's, as well as the fisherman's, business will be relieved of the oversupply, with the resultant low price which was formerly the case, when both the marketman and fisherman lost money.—H. B. Nidever.

DRAG-NET FISHING HAS DEPLETED HALIBUT SUPPLY.

A southern California paper quotes the skipper of a local fishing fleet to the effect that the high price of 18 cents per pound for halibut is chiefly caused by the depredations on halibut and nets by seals. This is in line with the tendency of commercial fishermen to explain the scarcity of fish by attributing the cause to anything rather than to overfishing. The high price of fish is caused by a scarcity of the fish, and the scarcity of southern California halibut is due to destructive methods of fishing in the past and to a condition of depletion at the present time. There is considerable doubt as to whether seals do any appreciable damage to halibut, but there is no doubt that the past destructive fishing of drag boats is the principal cause of the scarcity. Drag-net fishing has been prohibited south of Santa Barbara County for four years, and it remains to be seen if this great protection will cause halibut of that region to increase in numbers.

It should be remembered that not many years ago, before our fisheries began to be developed, there were many more seals than at the present time and the halibut were also very abundant. The seals and sea lions have been reduced almost to the point of extermination, and coincident with this halibut have become so scarce that they bring 18 cents a pound. The cause is clearly one of overfishing. The explanations of fishermen and fish dealers (and fish canners, for that matter) for the scarcity of fish, whether it be salmon, sturgeon, tuna or halibut, are often weird and fantastic, and anything but the real reason—overfishing.

SOUTH AFRICA WANTS HERRING.

The Englishmen in South Africa have decided to improve on nature and establish the herring, a fish of the northern hemisphere, in the seas of the Union of South Africa. One often hears the expression "you can't improve on nature," but the fact is we are improving on nature all the time. All of the fruits, vegetables and field crops we grow in California have been improved by man from their original forms found in nature.

The shad, striped bass and soft-shelled clam were not by nature placed in California, but they have been established here by man. Captain Lambson, the modest but efficient superintendent of our Mount Shasta Hatchery, many years ago took king salmon eggs from California to New Zealand. There they were hatched and liberated in the streams, and now salmon are abundant in New Zealand streams where, apparently, the Lord never intended them to be. That is one of the things the genial captain will have to answer for.

If salmon can be taken from the northern hemisphere and established in the southern half of the world, why not herring? Herring spawn along the shore, where their eggs adhere firmly to the rocks and seaweed. These eggs would hatch in ordinary water temperature before they could be gotten to South Africa, but the hatching can be delayed by keeping them at a low temperature, just above freezing. The eggs must have oxygen, for they breathe as does every other living organism. The best way to ship the eggs will be to keep them in an ice chest where they are kept moist with salt water, and at the same time exposed to the air. Salmon and trout eggs are shipped that way, except that they are moistened with fresh water and the temperature need not be kept so low, as their period of incubation is much longer than that of herring eggs. The problem is entirely feasible, and South African herring may some time be as famous as Norway or Alaska herring, but that will not be during our lifetime.

It is also proposed to transplant the halibut from the north Atlantic to the seas of South Africa. This will be a more difficult task than transplanting the herring. The halibut inhabits deep water in the north Atlantic and the north Pacific. The fish are of such large size that it will be the young that will have to be used in the experiment. The young or developing eggs will be extremely hard to get, and if they are successfully gotten to South Africa and they make themselves at home, it will be a great many years before they can multiply to such an extent that they can be found or noticed, for a halibut does not mature and spawn until it is past twelve years of age. The success of the experiment would not be apparent until after several generations have been produced.—N. B. Scofield.

LOUISIANA SHRIMP INDUSTRY.

In the year 1921, 34,992,443 pounds of shrimps were caught in the state waters

of Louisiana—an increase of 50 per cent over the catch determined by the United States Bureau of Fisheries for the year 1916. The catch of 1921 had a value, to those engaged in the industry, of about three million dollars.

The principal cause of this great increase in the shrimp industry was the introduction of the otter shrimp trawl in 1917. In that year four of the trawls operated, and by 1921 the number had increased to 983. Beach seines, the only apparatus formerly used, decreased in number 50 per cent between 1916 and 1921. The seines could be operated only along shores, while the trawls could be operated in both shallow and deep water. Thus new fishing grounds were opened and it was found possible to avoid certain shallow waters at the times when young shrimps would be caught. There was a tendency among some of the fishermen, however, to catch young shrimps which were too small to market except they be dried, and to take them to the drying platforms. In spite of this abuse, the trawl is an improvement over the shrimp seine, from the standpoint of conservation, and in time, the catching of young shrimps can be prevented.

The history of the Louisiana shrimp industry is that of nearly all the larger fisheries. Great advances are caused by the introduction of improved and more efficient fishing apparatus. It appears, from the report of the Louisiana Department of Conservation, that the otter shrimp trawl is less destructive to young shrimps and to young fish than the shrimp seines.

The products of the commercial fisheries of Louisiana amount to about one-third that of the fisheries of California. The revenue which Louisiana derives from her fisheries in the way of licenses, fisheries tax and oyster ground rentals amounted to \$98,185.09 for the year ending December 31, 1923—a sum greater than that received by California from her much more extensive and more valuable fisheries.—N. B. Scofield.

PISMO CLAM CENSUS.

Members of the staff of the California State Fisheries Laboratory made the fifth annual census of Pismo clams at Pismo Beach on November 8-10, 1927. The purpose of this census, as in previous years, was to obtain data for an estimate of the total number of clams on the beach. Three trenches, located approximately a mile apart, were dug across the intertidal zone and a count made of all

clams found. The results of this year's census indicated even fewer clams on the beach than did last year's findings. No clams of legal size were obtained. The largest clam was less than four and one-half inches in diameter and only 15 per cent of the total exceeded three inches. The 1927 set of clams was apparently not as successful as the 1926 set, although it exceeded some of the poor sets of previous years. The very serious depletion of the clams on Pismo Beach was again demonstrated by this year's census, and unless the protective measures now in force are loyally supported by public sentiment, Pismo clams, if not entirely eliminated from our California beaches, will soon be practically unobtainable to both the amateur and the commercial digger.—Frances N. Clark, California State Fisheries Laboratory. November, 1927.

EUROPEAN BIOLOGICAL STATIONS.

While motoring through England this summer I had the good fortune to visit two places of interest to people in fisheries work—the Plymouth Marine Biological Station and the Ministry of Agriculture and Fisheries in London. The Plymouth Marine Biological Station was on our "itinerary" through this town of such great significance to Americans. We knew we had arrived on a special holiday, as evidenced by all the populace being in costume and grotesquely masked, and the streets being gaily decorated. After threading our way through the holiday traffic, we found our way up to the top of Citadel Hill. This is a part of the Hoe, the steep hill that lies between the town and the sea. The holiday crowd seemed to consider the Aquarium a place worthy of their attention, for many were paying the "tuppence" entrance fee to see the fish. After asking to see Dr. Allen, we were courteously presented to the genial director of the Biological Station. From his evident pleasure in showing us the whole institution he was certainly the true host.

I am afraid my memory of exact details may be faulty, but I believe there were individual laboratories for about forty research workers. A large aquarium room was equipped with all sorts of clever mechanical devices for duplicating ocean conditions. A separate building served as a class room for the special use of undergraduate classes that come occasionally from the different universities. The library, containing about ten thousand volumes, is rich in all the literature on fish and fisheries, besides having a good reference section in general biology.

In the aquarium Dr. Allen took pride in showing us the many kinds of fish, but especially the little species in the small tanks ingeniously lighted from above. They, with their dainty shapes and colors, were fully as interesting as the great undulating eels, darting bass, decorous cod, and gracefully soaring plaice. But best of all, our genial host took us out on the Hoe to "see" Sir Francis Drake's little fleet of vessels in the inner harbor; and the Green, a little distance away, where the admiral was playing at bowls when the Armada was first sighted. It was one of the thrills of a very interesting summer to stand there and look out across the sparkling bay to see in imagination the Spanish galleons sailing by, and Sir Francis himself, pausing in his game to gaze at the spectacle, for as we remember, he is said to have finished his game before putting out in pursuit.

In London I had the opportunity of visiting the Ministry of Agriculture and Fisheries. The room in which I waited to see Dr. E. R. Russell had little in it to suggest any connection with the sea except a model of a boat hauling a special sort of drag net. I was shown up three flights of very steep and winding stairs to the office of Dr. E. R. Russell, who received me in the gracefully courteous English way, and expressed his regret that the building was rather out of date, and had no elevator—to be exact it was three hundred years old—but that if people had the perseverance to search him out in his eyrie they deserved special consideration.

I must confess I was too poorly informed about the things I might have asked to talk intelligently. But now when I see the "Journal du Conseil Permanent International pour l'Exploration de la Mer," edited by E. R. Russell, it recalls a very interesting half hour in a building older than our own nation and a pleasant acquaintance with one of England's best known scientists.—Genevieve Corwin, Librarian, California State Fisheries Laboratory, October, 1927.

ABALONE SAFE FROM EXTERMINATION.

The laws protecting the abalone from commercial extermination are ideal, and it is not likely that the commercial abalone fishermen will exterminate or seriously deplete the abalone supply. The red abalone, which is the only one used commercially, is protected from amateurs by a seven-inch minimum limit. Red abalones which have reached this seven-inch limit have spawned at least three

times. At the request of commercial abalone fishermen, the minimum commercial size limit was fixed by the legislature at eight inches, and a red abalone has spawned at least six times before it reaches this eight-inch limit. Therefore, no commercial abalones are taken until they have spawned at least six times.

The red abalone is abundant in water deeper than the diver is able to go and to operate profitably. There is also an area in shallow water where the diver can not go on account of moving water which is outside the low tide line. Abalones in this area are not disturbed by the diver. The abalones, therefore, are protected so that they have ample opportunity to seed the rocks in the neighborhood where they spawn. If the commercial divers take all of the abalones which are eight inches or larger, they can not seriously deplete the supply because the law does not permit them to take them any smaller than that, and as has been shown, none of the abalones can be taken commercially until after they have spawned six times and there are many abalones which can not be taken by divers which spawn more than six times. The seven-inch abalone produces more than a million eggs. These eggs are fertilized in the open water and become a free swimming organism for several days before they settle down and attach themselves to the rocks; so that no matter whether the spawning abalones are in deep or shallow water, the young find their way to all places along the shore.

There is evidence that the young abalones, during the first two or three years of their lives, are more numerous in the deeper water and that these abalones move inshore later, in search of places where they may attach themselves to the rocks. This movement, however, takes place several years before they are of the size that may be taken commercially. Abalones, after they get to be five or six inches long, seldom permanently leave their places of attachment.

There has been a great deal of hysteria on the subject of abalone conservation. There is absolutely no reason why any region should object to taking abalones commercially. Not to take abalones for commercial purposes is wasting a valuable food supply without gaining anything.—N. B. Scofield.

TO SAVE THE FISHERIES OF THE GREAT LAKES.

For a number of years the yield of the Great Lakes fisheries has been declining, and just recently the lake herring fishery

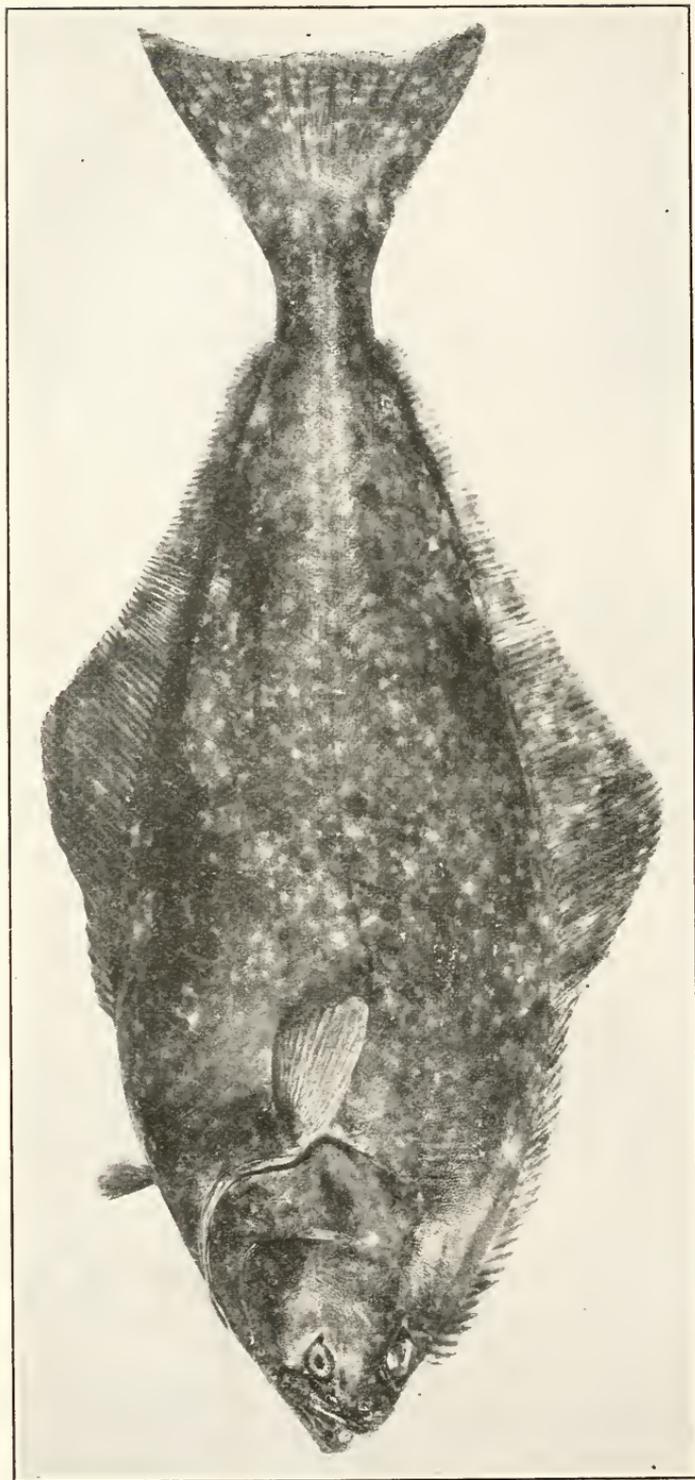


FIG. 33. A fourteen pound northern halibut, *Hippoglossus hippoglossus*, taken southeast of Santa Rosa Island in 100 fathoms of water November 18, 1927, by the crew of a boat owned by K. Kuramoto.

has failed entirely. There is but little doubt that this has been caused by inadequate fishing regulations and wasteful fishing methods, although many of the fishermen blame the trouble on pollution of the water from cities and factories which turn their sewage and factory waste into the lakes. Besides Canada, there are eight states bordering on the lakes, and there has been poor cooperation between them in the way of regulations or investigations.

Realizing that coordinated action was necessary if the important fisheries of those waters were to be saved from destruction, Governor Green of Michigan called a conference of the interested fisheries officials. Besides the representatives of the eight states bordering on the lakes, there were present representatives of the Department of Marine and Fisheries of Canada and the Bureau of Fisheries of the United States. United States Commissioner of Fisheries Henry O'Malley was chosen chairman.

The convention approved a list of regulations which are to become effective when the states and Canada adopt them. These regulations would restrict the types of nets and fishing gear which can be used, prevent pollution of the waters, save the spawn of fish, taken by commercial fishermen, for the fish hatcheries, and have each state or government concerned adopt a system of gathering fisheries statistics similar to that used by California. To facilitate the adoption of

recommended regulations, it was urged that all the state fisheries commissions be given power by their legislatures to make and enforce fishing regulations.

This getting together of these eight states, Canada and the U. S. Bureau of Fisheries for the conservation of the Great Lakes fisheries is apparently an attempt to get the coordinated action of a group of states and another government, without resorting to the usual expedient of an international treaty where the states would lose jurisdiction over their own fisheries and that jurisdiction would be assumed by the central government.

Secretary of Commerce Herbert Hoover, under whose department comes the care of fisheries, through the Bureau of Fisheries, is on record as opposing the tendency of the states to turn over the regulation of the fisheries, electric power, etc., to the government. He states that this tendency is likely to make the central government top-heavy; leads to bureaucracy and tends to destroy local initiative. He has recommended that where a group of states have a common interest in fisheries, they form a coalition, with the sanction of congress, to handle their fisheries as a unit. This organization of the Great Lakes states is a move in this direction and it strikes us as a good move and one which may well be epoch-making. It also pleased us immensely to have this progressive group hold up our fisheries statistical program as an example to be followed.—N. B. Scofield.

LIFE HISTORY NOTES.

NORTHERN HALIBUT IN SOUTHERN CALIFORNIA.

On November 18, 1927, the fishing boat *Angel*, owned by K. Kuramoto and operating from San Pedro, brought into port a fourteen-pound northern halibut (*Hippoglossus hippoglossus*), which is pictured in the accompanying illustration. The specimen was caught on the southeast side of Santa Rosa Island in 100 fathoms.

So far as we have been able to find from the literature, the incident is remarkable in that it is the first time a northern halibut has ever been recorded in these waters. Jordan and Evermann (1898) give the Farallons as the southern limit of this species, and Starks (CALIFORNIA FISH AND GAME, 1918) gives Monterey Bay as the southernmost boundary. According to Mr. Mitchel Planchard of the Gilbert Van Camp market where the fish was delivered, this is the fourth northern halibut brought into

Van Camp's in the last two years.—L. A. Walford, California State Fisheries Laboratory, Terminal, California.

GRUNION AT LA JOLLA.

The two remarkable photographs here reproduced were sent to the Division of Fish and Game by Mr. Willis E. Zader of La Jolla. These were taken at La Jolla in April, 1927, and show grunion spawning in great numbers on the beach.

Grunion, as far as known, are the only fish that come out of the water and lay their eggs on what might be termed dry land, the sand of the beaches. This occurs during the favorable tides in the spring months of each year. On certain beaches, especially at Long Beach, vast crowds of people gather when the grunion are running and take these fish in great numbers. As a result, the grunion in waters adjacent to Los Angeles have become seriously depleted.

Mr. Zader writes that he has been observing the grunion at La Jolla for fifteen years, and as yet, can see little diminution in numbers, but feels that, unless protective measures are passed, these fish may be endangered. The illustrations show a much heavier run of fish than occurs at the present time on the beaches of Los Angeles County, although in past years the runs were as heavy as in the San Diego region.

A closed season is now in force which prohibits the taking of grunion during the months of April, May and June. It is hoped, as a result, that the grunion runs on the beaches in the Los Angeles region will increase and that the runs at La Jolla will continue in their present magnitude.—Frances N. Clark, California

where attempts will be made to develop a pure white strain.

Mr. Williams of Coalinga reports that one bird nearly white in color appeared in a litter of eight birds of normal parentage. This bird, now two years of age, had two litters of his own this year: one of nine and another of three. The birds of both litters have white feathers on breast, wings and backs, but are not as white as the father bird. The original parents had a litter of eleven birds that are all partly white. These birds have been feeding regularly near the home of Mr. Williams, but by the middle of November moved into the higher hills.—H. C. Bryant, Berkeley, California, November 23, 1927.



FIG. 34. Grunion spawning on the beach at La Jolla, California, April, 1927. Photograph by Willis E. Zader. Taken at 12.30 a.m.

Fisheries Laboratory, Terminal, California, October, 1927.

ALBINO QUAIL.

Albinism is likely to be found almost anywhere in animal life. Sometimes an albinistic variety can be developed by selective breeding. A pure white Java sparrow is imported in numbers; a faded-out variety of the shell parakeet is a common cage bird. Only one attempt so far as we know has been made to secure a pure white strain of the valley quail. Mr. H. R. Noack of Oakland for several years attempted to breed a pure white bird but without success.

This past fall a number of albinistic valley quail have been reported near Coalinga. Two albinistic forms were captured and sent to the state game farm

HUMPBACK SALMON TAKEN OFF SANTA MONICA.

The round haul boat *Victor Emanuel* on September 12, 1927, caught an apparently erratically wandering specimen of humpback salmon (*Oncorhynchus gorbuscha*) off Santa Monica, California. The specimen, a male, measures twenty-four and one-quarter inches long and weighs five pounds.

This part of California, we believe, is farther south than the humpback salmon has ever been recorded, the range as noted by Jordan and Evermann (1896), by Meek (1916) and by Messrs. Goode and Gill (1903), being the Pacific coast and rivers of North America and Asia from Oregon northward. Mr. N. B. Scofield in CALIFORNIA FISH AND GAME, January, 1916, records several specimens taken

from the San Lorenzo River, Santa Cruz County. These fish are occasionally taken in the Sacramento River where they are known as "lost salmon."—L. A. Walford, California State Fisheries Laboratory, Terminal, California, September 20, 1927.

WHITE-TAILED KITES NEAR HOLLISTER.

On November 27th, while watching a number of hawks along the dirt road between Gilroy and Hollister, I noticed perched on a fence post only fifty feet or so away a pearly gray and white hawk with black shoulders. Of course there is only one such colored hawk in California, the white-tailed kite. It sat there for some time, then sailed lightly away, only

The flight of this bird is very light and buoyant, but at times quite rapid. When compared with the similarly-sized prairie falcon, the flight of the kite is found to be indirect and carried at many changes of grade (slope of flight), at varying levels from the ground, while that of the falcon is direct, rapid, stiff-winged and carried at a steady level above the ground. The falcon is pale clay-brown above, white beneath with dark streaks and spots.

The adult male marsh hawk might be mistaken for the kite, or vice versa, but one good look at the white rump patch and bluish-gray tail with six to eight darker bands of the marsh hawk will distinguish it from the pure white tail of the kite.



FIG. 35. Grunion spawning on the beach at La Jolla, California, April, 1927. Photograph by Willis E. Zader. Taken at 1 a.m.

to stop and hover sparrow-hawk-like for a moment or so. For several minutes more I watched this bird, when suddenly from space another bird appeared and the two wheeled and turned back and forth over a small corner of one of the large fields.

My neck began to get tired following their flight, so I glanced across to the other side of the road and there were two more of the birds beating over a weed patch near an old well.

These birds were very busy hunting, but only once did I see them actually catch anything, apparently a frog or a small toad. On a number of occasions they were seen to drop to the ground only to resume flight almost instantly with nothing showing in their claws or bill.

Their flight is often quite similar, both beating back and forth over fields and marshy ground. The kite hovers more often than the marsh hawk.

The kite is so reduced in numbers that the birds can not be taken even as scientific specimens by collectors. It is to be hoped that the species is on its way back to somewhere near its former numbers.—D. D. McLean, Berkeley, California.

ACORNS AS A DUCK FOOD.

While skinning three confiscated wood ducks, *Aix sponsa*, from Maxwell, California, I discovered in the gullets several acorns of the valley oak, *Quercus lobata*. In one of the male birds I found three acorns in the gullet. The stomach had been removed. In the second male bird

there were five acorns in the gullet. The stomach had also been removed. The female bird had two acorns in its gullet. These acorns average an inch and three-quarters in length and nearly three-quarters of an inch in diameter. The largest was an inch and seven-eighths long and seven-eighths of an inch through. Imagine how the bird must have to stretch its throat and the gigantic gape it must open in order to swallow the nuts.—D. D. McLean, Berkeley, California.

BIRDS AND GRAPES.

During the last two months many complaints have come in from various sources against several species of birds. These complaints are all similar in that the birds are accused of eating grapes.

On the whole most of the birds accused are those unprotected by the state law, namely, the linnnet or house finch and the English sparrow. The California or valley quail, golden-crowned and gambel white-crowned sparrows are accused of damage and also blacklisted by some men.

Several places were visited during October and a careful survey made of each situation. Two places near Morgan Hill were visited where linnets were doing 90 per cent of the damage, with California quail and golden-crowned sparrows doing the remainder.

Mr. Reeves, at Paicines, was practically cleaned out by California quail. He had trained his vines rather low and consequently the quail, which is a ground feeder, had nearly annihilated his crop. He would not shoot them because he felt he was breaking the law. Just across the road from his place, on another man's land, is a large thicket of brush which is a veritable harbor for quail and brush rabbits. Mr. Reeves made an offer to the other gentleman to clear out the thicket for the wood, but was refused. Consequently he has suffered. In the trip through the vineyard with him on October 20, the work of linnets, golden-crowned sparrows and quail was very apparent. Brush rabbits and cottontail rabbits had done considerable damage to the young shoots and also had apparently done some damage to the grapes themselves.

On November 3 and 4, I was on the east side of the San Joaquin Valley, near Porterville, Lindsay and Exeter. The damage done by linnets and English sparrows there has been prodigious.

Mr. Baier has a number of plots aggre-

gating several thousand acres in that vicinity. On one of the smaller places, comprising about eighty acres, he estimated his loss last year conservatively at \$30,000, while the three largest places showed an aggregate loss of between \$75,000 and \$80,000.

Red Emperor grapes are valued at about \$2,500 per car. When one figures that before the birds became a pest, Mr. Baier hired twenty pickers and they turned out five carloads a day, while last year and this year he hired sixty pickers and they scarcely averaged two cars per day the loss is apparent. Pickers are paid approximately 40 cents an hour.

A bunch of grapes unpecked by birds will only take from two to four seconds to pick and place in the lug box, while the pecked bunches take on an average of from fourteen to sixteen seconds, the slowest recorded sixty-three seconds. Two-thirds of the pickers' time is easily spent in clipping pecked grapes from the bunches and inspecting the bunches in search for them. The bunches must also be inspected in the packing house, wasting another seven or eight seconds.

Mr. Baier spent \$5,000 for ammunition at the beginning of the 1927 season.

Approximately seventy stomachs of birds were examined for grape pulp, seeds and juice. The following species were represented: linnnet, gambel white-crowned sparrow, golden-crowned sparrow, audubon warbler, willow goldfinch, chipping sparrow, English sparrow, western Savannah sparrow, lark sparrow, red-shafted flicker, valley quail and western mockingbird. From this examination only two species were found to be a really serious menace, the linnnet and English sparrow. Three others were found to be consistent eaters of grapes, the gambel white-crowned sparrow, golden-crowned sparrow and red-shafted flicker. But since they are not present in hordes, their damage is but slight.

The remainder of the list were present in the vineyards, but were only eating weed seeds, grass seeds and insects.

From this evidence it can be seen that here is an important economic problem. In cooperation with Mr. Baier I am now trying to find a solution by which the destruction can be curbed without menacing all the birds present, since most of the species are a benefit to the vineyard and only five species mentioned are really a menace.—D. D. McLean, Berkeley, California, Nov. 30, 1927.

CONSERVATION IN OTHER STATES.

MAINE OPENS SEASON ON MOOSE.

Although Minnesota has permanently closed the season on moose and although the animal is practically extinct over most of its range, the state of Maine is trying the experiment of a fall open season of six days in eight of the counties of the state. This is the first time in many years that any moose hunting has been available to sportsmen of the United States proper, and it may be that this is the last moose hunting that will be available for many years to come, dependent, of course, on the results of this experiment.

KANSAS AFTER WILDFOWL REFUGE.

The Cheyenne bottoms and depression of approximately one hundred square miles and lying in the heart of the state of Kansas, having been flooded by heavy rains, has drawn attention to this area as a possible wildfowl refuge. Reports are to the effect that this inundated area has attracted more ducks than had been known in the vicinity for more than twenty years. Many sportsmen are saying that even though the cost of the land would be a million dollars, the Cheyenne bottoms are worth it. Here is another interest where the state finds the project too great to accomplish by itself. Federal authorities have, therefore, been urged to consider ways and means of giving the middle west a fine refuge for waterfowl.

MISSOURI INCREASES WARDEN FORCE.

Missouri Game and Fish Department has announced an extended protective program. The warden force, which had but twenty-five men, has been nearly doubled. The state has been divided into three divisions, each in charge of a field warden, and each field warden directs the work of twelve regular wardens. The whole force is under the direction of a chief of wardens. Thus has attention been given to the necessity for thorough supervision and the patrol of a definite territory. The announcement states that though the chief object of the reorganization is a stricter enforcement of the game and fish laws, it is intended that at least one-half of the time of the wardens will be directed to educational work. It is recognized that an awakened public consciousness is the greatest asset that the cause of conservation can have.

NEW MEXICO UNDERTAKES FISHING WATER SURVEY.

An investigation was recently launched in New Mexico for the purpose of securing information on the following points:

- (1) The location and magnitude of each water supporting or possibly capable of supporting fish.
- (2) Their capacity for supporting fish life.
- (3) The kind of fishes best adapted to them.
- (4) Their accessibility to man.

With this information at hand, the kinds of fish that will best thrive in various waters can be determined. A summary of the total mileage of fish supporting streams is 2037, that of lakes, 63,913.

Two pertinent paragraphs in the report are worth quoting:

"To the average man, if a stream fails to provide good fishing the remedy is to stock it. If the fishing still remains poor—stock it more heavily. It is amazing the number of people who are firm in the conviction that the only thing that prevents a water from delivering up to the eager angler an unlimited number of fish is an insufficient amount of stocking. The same man who would recognize an evidence of stark lunacy in an attempt to raise a thousand head of steers on a quarter-section of range, will generally quite cheerfully dump a thousand fingerlings into a section of stream having the same relative amount of food, with a child-like faith that by some miraculous process they will somehow be transmuted into legal size fish by next spring.

"The factors which enter into the capacity of a water to support fish, and the determination of the most suitable species, are many and diverse, and all must be reckoned with if a reasonably accurate estimate is to be made. And when it is realized that many of these factors are still far from being perfectly understood, it will be appreciated how difficult it is to say with any degree of certainty 'this number of this species of fish must be planted in this mile of water per year to obtain best results.' However, the knowledge we have is far better than pure guesswork, and will go a long way toward securing a more equitable distribution of the product of our hatcheries."

NEW BIRD REFUGE IN FLORIDA.

By recent executive order, the President has transferred from the War Department to the Department of Agriculture as a refuge for birds a portion of the Fort Matanzas Military Reservation in the state of Florida. The area consists of a group of marsh islands lying in the Matanzas River about 15 miles south of St. Augustine, Florida, and serves as a nesting place for wild fowl, chiefly terns. Shearwaters nest in the vicinity and possibly occupy some portions of the reserved area. The administration of the new refuge is placed under the Bureau of Biological Survey.

NEW ZEALAND USES EDUCATIONAL METHOD.

As indicative of the strong belief in educational work as a means of furthering conservation, reference can be made to New Zealand. A recent report states that several hundred projecting machines and several million feet of film have been accumulated. The proper apparatus is loaned to various schools on the theory that "one good picture in fifteen minutes makes a more lasting impression than several books with several weeks utilized in learning their contents."

MOUNTAIN SHEEP SUCCESSFULLY INTRODUCED IN MONTANA.

In 1922 the Bureau of Biological Survey liberated twelve mountain sheep on the National Bison Range in Montana. A reduction of the predatory animals was then obtained. The sheep have now increased to sixty-nine. Thus has been demonstrated the fact that it is possible to successfully introduce this wariest of game animals in suitable areas. Success attained here suggests the possibility of reestablishing the big horn in the higher mountains of California.

SPECIAL LICENSE NEEDED TO KILL BEAR IN NEW MEXICO.

New Mexico has changed the status of the black bear from an unprotected predatory animal to that of a big game mammal with special protection afforded it. The open season is placed from October 10 to October 31 and the bag limit is one per season. A hunter must have a big game license costing residents \$3 and non-residents \$25.25 before he can kill a bear. Many states need to follow New Mexico's example.

AUXILIARY GAME REFUGES FOR MISSOURI.

Missouri following the passing of the Auxiliary Game Refuge Bill by the legislature, and following the example of Pennsylvania, is soliciting the cooperation of its sportsmen in the establishment of auxiliary game refuges in every district in the state. These auxiliary refuges differ from regular game refuges in that the latter are on state-owned lands and the former are on lands of others and leased for periods of not less than ten years. Blanks giving printed requirements and conditions under which these refuges may be established are made available through the State Department, but no application will be considered if the private lands covered are not connected with public hunting grounds, it being the intent of the state to have the sites amply large for public hunting in addition to the refuge proper. —Missouri Game and Fish News, July, 1927.

Pennsylvania has a system of auxiliary refuges based on a written agreement with the owner of the property. In the fall of 1926 there were sixty-five of them located in forty-three different counties totaling about 90,000 acres. These auxiliary refuges differ from the large permanent refuges only in size and in that there is no resident refuge keeper. They are under the supervision of a district game protector.

LOST FISH RECEIPT BOOKS.

During the year 1926 three of our fish receipt books were lost on a barge operating at Point Reyes, and when the barge was again placed in service in 1927 these books were recovered.

These books show that 106,065 pounds of salmon, 6336 pounds of crabs (264 dozen), 97 pounds of rock cod, 95 pounds of halibut and 693 pounds of codfish were received on this barge in 1926, but this amount of fish does not appear on our report of the catch for San Francisco for 1926, as the records were made up and published before these books were found.

Dealers should use every precaution to see that fish receipt books which they have are turned in, so we may have a complete record of the catch. Receipt books are seldom lost, but in this case a considerable commercial catch of fish does not appear in our records.

REPORT ON SARDINE CANNERIES 1926-27.

The first canning operations in Monterey for 1927 started in August, and all canneries except one ceased operation in March. Canning operations were started in the San Pedro district in November and continued into May. In San Diego, packing was carried on throughout the year, but on a small scale, and less than fifteen thousand cases of all size cans were packed.

The following table shows the production at Monterey and San Pedro districts. One plant was operated in northern California outside of Monterey and the output is included in the Monterey figures.

CANNERY, FISH FLOUR, MEAL AND OIL PRODUCTION.

Season June 1, 1926, to May 31, 1927.

District	Tons fish received	Tons fish used for canning	Tons fish used for meal and flour
Monterey.....	79,343	60,941	18,318
San Pedro.....	64,216	52,324	11,892
Totals.....	143,559	113,265	30,210
Deduct fish used for other purposes.....	3,165		
Fish used by canning plants.....	140,394		

District	Tons offal	Cases 1-lb. ovals packed	Cases other size cans packed	Other size cans equivalent to cases 1-lb. ovals	Cases per ton	Tons flour
Monterey.....	20,306	1,202,516	39,134	21,673	16.1	184
San Pedro.....	17,441	986,858	52,561	63,264	16.3	
Totals.....	37,747	2,189,374	91,695	84,937		
Add other sizes.....		84,937				
Equal to cases 1-lb. ovals.....		2,274,311				

District	Meal, tons	Ratio per ton meal	Oil, gallons	Gallons oil per ton of offal and fish	Tons fish used for other purposes
Monterey.....	6,675	5.6	1,562,351	40.4	3,165
San Pedro.....	5,962	4.9	682,796	23.3	
Totals.....	12,637		2,245,147		3,165

TABLE OF CASE PRODUCTION, RATIO OF MEAL AND OIL PRODUCTION.

Name of plant	Location	Kind of plant	Number of cases 1-lb. oval cans per ton	Ratio per ton of meal	Gallons of oil per ton of offal and fish
Bayside Fish Flour Company	Monterey	Fish flour		6.4	44.8
F. E. Booth Company	Monterey ¹	Cannery	16.9	5.3	42.4
California Packing Corporation	Monterey	Cannery	15.8	5	43.6
Carmel Canning Company	Monterey	Cannery	16.9	5.9	40.5
E. B. Gross Canning Company	Monterey	Cannery	15.1	5	43.6
K. Hovden Company	Monterey	Cannery	16.8	6.2	47
Monterey Canning Company	Monterey	Cannery	14.7	6.4	29.2
San Carlos Canning Company	Monterey	Cannery	15	4.8	40.7
San Xavier Packing Company	Monterey	Cannery	15.3	6	35
Sea Pride Canning Company	Monterey	Cannery	15	6.4	30
Coast Fishing Company	Wilmington	Cannery	17.2	4.7	18.1
Franco-Italian Packing Company	East San Pedro	Cannery	14.1	5.5	30.4
French Sardine Company	East San Pedro	Cannery	18.1	5	24
General Fisheries	San Pedro	Cannery	6.4	4.8	33.3
Italian Food Products Company	Long Beach	Cannery	16.3	7.8	23.5
Los Angeles Sea Food Company	East San Pedro	Cannery	14.3	4.8	23.4
Kittle-Joerissen Canning Company	East San Pedro	Cannery	16.4	4.2	17
Southern California Fish Corporation	East San Pedro	Cannery	17.5	4.7	20.6
Seacoast Packing Company	East San Pedro	Cannery	17.3	5.5	16.5
Stafford Packing Company	Wilmington	Cannery	13.8	3.7	28.7
Toyo Fisheries	Wilmington	Cannery	16.6	4.7	19
Van Camp Sea Food Corporation	East San Pedro	Cannery	16.4	5	25.5

¹Includes operation of Pittsburg plant.

The percentages shown for various plants are based on sworn reports furnished by each plant, and same method used for all plants to arrive at above ratios.

The following table shows case pack, meal and oil production for calendar years 1916 to 1926.

1-Lb. Ovals.

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	97,100	2,512	7,133	106,745
1917	331,065	43,221	34,380	408,666
1918	593,315	136,632	17,790	747,737
1919	798,566	113,909	33,594	946,069
1920	687,777	213,714	50,302	951,793
1921	287,954	77,048	1,189	366,191
1922	353,188	340,860	3,595	697,643
1923	580,464	488,885	19,215	1,088,564
1924	631,286	693,133	12,135	1,336,554
1925	737,743	920,191	29,846	1,687,780
1926	1,158,133	861,088	63,410	2,082,631

Fish Meal, Tons.

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	249	261	25	535
1917	875	2,606		3,481
1918	2,874	4,737	1,123	8,734
1919	3,812	5,667	1,674	11,153
1920	3,969	3,328	1,559	8,856
1921	2,115	3,566	636	6,317
1922	2,695	5,373	959	9,027
1923	3,806	4,216	1,216	9,238
1924	6,601	7,726	1,001	15,328
1925	7,105	13,023	2,808	22,936
1926	7,307	7,066	1,394	15,767

Includes all meal produced.

Fish Oil, Gallons.

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	25,563		500	26,063
1917	92,393	83,900		176,293
1918	261,466	67,858	17,400	346,724
1919	341,173	146,298	26,791	514,262
1920	419,474	152,937	39,174	611,585
1921	226,826	93,305	16,607	336,738
1922	295,858	244,310	6,882	547,050
1923	576,553	346,883	28,452	951,888
1924	1,240,296	1,059,001	51,425	2,350,722
1925	1,246,561	1,715,633	187,847	3,150,041
1926	1,418,512	651,006	54,410	2,123,928

Includes all fish oil produced.

For quick reference and comparison of activities in the Monterey and San Pedro districts, a chart is given below showing receipts of sardines, number of cases packed on basis of 1-lb. oval cans, number of tons of meal and gallons of oil produced.

SARDINE RECEIPTS	DISTRICTS	40 M.	80 M.			
	MONTEREY	[Bar chart showing Monterey receipts]				79343 TONS
	SAN PEDRO	[Bar chart showing San Pedro receipts]				64216 TONS
CASES PACKED BASIS ONE POUND OVALS		400 M.	800 M.	1200 M.		
	MONTEREY	[Bar chart showing Monterey cases]				1224189 CASES
	SAN PEDRO	[Bar chart showing San Pedro cases]				1050122 CASES
MEAL PRODUCTION		4 M.	8 M.			
	MONTEREY	[Bar chart showing Monterey meal production]				6675 TONS
	SAN PEDRO	[Bar chart showing San Pedro meal production]				5962 TONS
OIL PRODUCTION		400 M.	800 M.	1200 M.		
	MONTEREY	[Bar chart showing Monterey oil production]				1562351 GALS
	SAN PEDRO	[Bar chart showing San Pedro oil production]				682796 GALS

Fig. 36. Receipts of sardines in various districts of California, season 1927.

REPORTS.

GAME CASES.

July, August, September, 1927.

Violation	Number arrests	Fines imposed	Jail sentences (days)
Hunting License Act.....	104	\$2,375	140
Deer Tag License Act.....	42	1,550	100
Deer: closed season or district.....	22	1,625	290
Deer: does, fawns, spiked bucks, forked horn bucks in District 1 $\frac{3}{4}$	51	4,075	270
Deer: over limit.....	6	-----	-----
Deer: failure to produce horns or hide.....	11	400	-----
Deer: running with dogs, closed season.....	2	25	-----
Ducks: closed season.....	17	500	30
Doves: closed season.....	36	1,010	-----
Doves: over limit.....	11	400	-----
Sage hens: over limit.....	3	100	-----
Pheasants: closed season.....	1	100	-----
Quail: closed season.....	39	1,625	-----
Pigeons: closed season.....	3	25	50
Non-game birds.....	12	290	-----
Rabbits: cottontail-brush: closed season.....	60	1,295	140
Squirrels, tree: closed season.....	1	25	-----
Shooting game from automobile.....	5	100	-----
Trespass.....	1	25	-----
Night hunting.....	12	475	-----
Game refuges: hunting, possession of firearms.....	15	175	150
Totals.....	454	\$16,165	1,170

FISH CASES.

July, August, September, 1927.

Violation	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act.....	31	\$660	38
Commercial Fishing License Act.....	36	505	-----
Trout: over limit.....	16	-----	-----
Trout: taken other than with hook and line.....	3	25	15
Striped bass: undersized and over limit.....	27	960	-----
Striped bass: sale of, in closed season.....	1	20	-----
Crabs: undersized.....	1	-----	-----
Crabs: closed season.....	2	20	-----
Clams: undersized and over limit.....	27	790	25
Abalones: undersized and over limit.....	17	495	-----
Abalones: drying, illegal.....	1	-----	-----
Lobsters: closed season.....	1	25	-----
Barracuda: undersized.....	5	225	-----
Black bass: undersized.....	14	330	-----
Illegal fishing: withing 300 feet of inlet to lake; 250 feet fishway; 150 feet lower side dam.....	8	150	-----
Illegal possession of fish spear.....	2	70	-----
Nets: illegal possession or use.....	12	1,000	-----
Pollution.....	6	1,000	-----
Totals.....	210	\$6,820	78

SEIZURES OF FISH AND GAME.

July, August, September, 1927.

Salmon, pounds.....	7,000
Spot fin croaker, pounds.....	620
Barracuda, pounds.....	5,000
Striped bass, pounds.....	503
Sunfish.....	26
Black bass.....	166
Trout.....	477
Perch.....	15
Crabs.....	48
Clams.....	755
Abalone.....	18
Lobsters, pounds.....	50
Quail.....	105
Pheasant.....	3
Dove.....	395
Sage hen.....	27
Ducks.....	114
Band-tailed pigeons.....	7
Nongame birds.....	37
Deer meat, pounds.....	3,401
Deer hides and horns.....	5
Illegal nets and traps.....	5

STATEMENT OF INCOME.

For the Period July 1, 1927, to September 30, 1927, of the Seventy-ninth Fiscal Year.

	Detail	Total
License sales:		
Angling licenses—1927.....	\$61,978 00	
Hunting licenses—1926-27.....	11,014 70	
Hunting licenses—1927-28.....	43,295 00	
Market fishermen's licenses—1927-28.....	19,400 00	
Wholesale fish packers and shell fish dealers'—1926-27.....	30 00	
Wholesale fish packers and shell fish dealers'—1927-28.....	920 00	
Game breeders' licenses—1927.....	40 00	
Fish breeders' licenses—1927.....	15 00	
Trapping licenses—1927-28.....	380 00	
Commercial hunting club licenses—1927-28.....	275 00	
Commercial hunting club operators' licenses—1927-28.....	75 00	
Deer tag licenses—1927.....	23,332 00	
Total license sales.....		\$160,754 70
Other income:		
Game tag sales.....	\$7 50	
Court fines.....	12,121 32	
Fish packers' tax.....	8,485 73	
Kelp tax.....	6 26	
Fish tag sales.....	1,368 61	
Interest on bank deposits.....	642 50	
Total other income.....		22,631 92
Total income.....		\$183,386 62

STATEMENT OF EXPENDITURES.

For the Period July 1, 1927, to September 30, 1927, of the Seventy-ninth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....	\$5 50	\$3,765 00	\$259 68	\$1 75	\$4,031 93
Clerical and office.....	391 72	5,145 00	772 85	447 54	6,757 11
Rent.....			2,724 38		2,724 38
Automobiles.....	62 47		42 10	6 95	111 52
Telephone and telegraph.....			1,006 68		1,006 68
Postage.....			1,230 90		1,230 90
Freight, cartage and express.....			837 97		837 97
Printing.....	5,894 35				5,894 35
Accident and death claims.....			393 75		393 75
Commissioners.....			34 45		34 45
Total administration.....	\$6,354 04	\$8,910 00	\$7,302 76	\$456 24	\$23,023 04
Education:					
Director.....	\$114 52	\$2,691 93	\$344 73	\$1,248 23	\$4,399 41
Publicity:					
Director.....		\$825 00	\$299 23		\$1,124 23
State fair.....	\$237 28	597 50	624 93	\$18 45	1,478 16
Total publicity.....	\$237 28	\$1,422 50	\$924 16	\$18 45	\$2,602 39
Conservation and protection:					
Chief and assistants.....		\$3,054 99	\$301 96		\$3,356 95
Clerical and office.....	\$39 35	992 07	8 80	\$180 34	1,220 56
Rent.....			98 46		98 46
Automobiles.....	323 76		97 80	2,736 90	3,158 46
Captains and deputies.....	25 50	43,321 07	38,984 39	379 06	82,710 02
Patrol launches.....	359 20	525 00	44 65		928 85
Lion hunting.....		450 00	285 78		735 78
Lion bounties.....			1,020 00		1,020 00
Fish planting.....	102 17	1,346 00	781 82	136 49	2,366 48
Refuge posting.....	98 18	575 48	200 82	432 27	1,306 75
Total conservation and protection.....	\$948 16	\$50,264 61	\$41,824 48	\$3,865 06	\$96,902 31
Commercial fisheries:					
Chief and assistant.....	\$14 26	\$2,634 99	\$675 57	\$12 73	\$3,337 55
Deputies.....	7 07	5,338 07	1,217 79		6,562 93
Patrol launches.....	534 97	1,170 00	132 80	72 91	1,910 68
Statistical.....	4 55	1,395 00	68 45		1,468 00
Laboratory.....	181 86	8,360 48	1,097 12	266 46	9,905 92
Salmon tagging.....			214 50		214 50
Botulism.....			3,750 00		3,750 00
Automobiles.....	152 59		57 25		209 84
Total commercial fisheries.....	\$895 30	\$18,898 54	\$7,213 48	\$352 10	\$27,359 42
Fish culture:					
Chief and assistant.....		\$999 99	\$16 25	\$10 00	\$1,026 24
Clerical and office.....	\$34 36	1,015 50	6 80		1,056 66
Rent.....			84 00		84 00
Automobiles.....	937 03		683 38	4,638 72	6,259 13
Hatcheries.....	21,445 83	30,708 28	4,727 64	4,189 87	61,071 62
Hatchery additions and betterments.....				1,663 83	1,663 83
Special field investigation.....		2,635 00	505 80		3,140 80
Total fish culture.....	\$22,417 22	\$35,358 77	\$6,023 87	\$10,502 42	\$74,302 28
Hydraulics:					
Chief and assistant.....	\$3 52	\$1,305 00	\$833 99		\$2,142 51
Game propagation:					
Game farm.....	\$1,639 55	\$2,220 00	\$571 37	\$71 05	\$4,501 97
License commissions.....			\$11,922 50		\$11,922 50
Research:					
Director.....	\$13 33	\$1,644 00	\$182 50		\$1,839 83
Total expenditures.....	\$32,622 92	\$122,715 35	\$77,143 84	\$16,513 55	\$248,995 66

CORRECTION.

In the January, February and March report of the catch of fish in California, published in the July, 1927, Vol. 13, No. 3, issue of CALIFORNIA FISH AND GAME, pages 229 and 230, the following corrections should be made:

Alameda-Contra Costa counties should read:

Perch	644
Salmon	6,559
Shad	894
Shad—Buck	97,138
Shad—Roe	84,802
Striped bass	110,525
Total fish	317,595
Total	326,840

San Francisco-San Mateo counties should read:

Cultus cod	76,889
Rockfish	265,399
Sablefish	80,993
Salmon	572
Total fish	4,559,011
Crabs	1,026,888
Total	5,891,022

Footnote No. 4, showing number of dozens of crabs should read 42,787 dozen.

To correct the total catch for the state, the following amounts should be added to the totals for California, pages 231 and 232:

Cultus cod	873
Perch	11
Rockfish	1,721
Sablefish	126
Salmon	643
Shad	69
Shad—Buck	2,310
Shad—Roe	2,107
Striped bass	2,544
Crabs	14,040

Footnote No. 1, page 232, should read 47,245 dozen.

These corrections were made on account of delayed reports having reached this office after the original report was made up for publication.

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JULY, AUGUST AND SEPTEMBER, 1927.
Compiled by Division of Fish and Game, Department 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.....
Albacore.....							153,080	218	2,390
Anchovies.....									2,594
Barracuda.....								1,731	
Bonito.....				523	1,425	6,912			
Carp.....				4,546	36,746	28,881			
Catfish.....		5,060					100,682	19,281	8,577
Clarus Cod.....		34,093					55,525	74,740	900
Floundere.....		4,210					8,455	6,625	
Grayfish.....							27,866	8,602	
Hake.....							3,648	3,371	4,783
Halibut.....	249,013	37,029					24,686	24,686	424
Kingfish.....							26,066	1,049	332,303
Mackerel.....									7,640
Mackerel—Horse.....									
Mullet.....			1,940						
Perch.....	3,648			6	30	23	21,708	7,774	8,683
Pike.....									
Pompano.....									
Rock Bass.....		4,435					185,109	155,789	168,149
Rockfish.....	27,637	12,638					175,069	55,833	1,458
Sablefish.....	86,159	1,271,027					1,342,826	97,517	37,705
Salmon.....	694,951	390		168,806	191,938	272,634	149,280	104,132	710
Sardinas.....							6,361,490	565	85,833,447
Sardines.....	108							507	
Sculpin.....									
Sea Bass—Black.....									
Sea Bass—White.....									
Shad.....				311	249	10,080	4,615	36,243	6,266
Shad—Buck.....					44	1,263			
Shad—Rose.....					12				
Sheepshead.....									
Skates.....									
Skupjack.....									
Snelt.....	5,388	100	3,729			58	10,746	55,935	55,952

Sole.....	4,045	4,680					1,851,303	701,891	69,976
Saltilail.....						58			
Striped Bass.....			2,724	15,735	13,036	131,655	839		
Swordfish.....							315		
Tomcod.....									
Tuna—Bluefin.....									
Tuna—Yellowfin.....									
Turbot.....			1,374						
Whitebait.....	17,232					15	4,113		79
Whitesh.....									
Yellowtail.....	1,353			155				198	1,857
Miscellaneous.....						48	8,627		
Total fish.....	1,098,451	1,373,662	23,224	138,082	244,380	451,627	10,513,006	1,349,030	86,566,396
Crustaceans:									
Crabs.....	120,880							57,056	
Shrimps.....			365,864						
Mollusks:									
Abalones.....	86,000								827,425
Clams—Cockle.....		673	867						
Clams—Mixed.....	1,202	292	4,609						
Clams—Pismo.....									
Clams—Softshell.....			12,960			13,475	11,300	58	11,940
Cuttlefish.....							623		360
Mussels.....									
Oysters—Eastern.....			12,485				431,681	14,700	37,883
Squid.....									
Totals.....	1,206,533	1,374,627	420,009	188,082	244,380	465,102	10,740,493	1,370,844	87,444,004

All amounts shown in pounds. Albacore and skipjack cleaned.

¹ 870 dozen.

² 56,750 shell oysters.

³ 153 dozen.

⁴ 143,550 shell oysters.

⁵ 294 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JULY, AUGUST AND SEPTEMBER, 1927—Continued.
Compiled by Division of Fish and Game, Department of Commercial Fisheries.

Species of fish	San Luis Obispo, Santa Barbara, Ventura-----	Los Angeles-----	Orange-----	San Diego, Imperial-----	Total-----	Mexican, brought into California via San Pedro...	Mexican, brought into California via San Diego...	Total Mexican brought into California-----
Albacore-----		3,188,672	8,849	709,162	3,897,683		100,922	123,969
Anchovies-----		650			156,338			
Barracuda-----	13,698	1,285,218	2,030	286,612	1,590,152		56,097	56,097
Bonito-----	309	483,801	867	315,135	801,843		1,043	1,043
Carp-----					8,860			
Catfish-----	171				75,233			
Cultus Cod-----					171,661			
Flounders-----	3,134		20		136,599			
Grayfish-----	22,118			167	37,365			
Hake-----					36,497			
Halibut-----	96,070	44,207	51	12,205	447,377	108,262	108,262	108,262
Kingfish-----		25,752		2,745	79,663			
Mackerel-----	5,972	490,077	7,585	66,656	903,642			
Mackerel—Horse-----		111,584			119,224			
Mullet-----		5,018	413	3,900	9,331			
Perch-----	406	20,174	823	1,908	66,364			
Pike-----					59			
Pompano-----		283		451	734			
Rock Bass-----	2,301	92,109	20,851	65,588	180,749		358	358
Rockfish-----	29,825	102,355	3,589	129,109	865,997			
Sablefish-----	40				311,197			
Salmon-----	21				4,077,425			
Sandbars-----		3,113			257,625			
Sardines-----	672	532,231		270,072	93,088,645			
Sculpin-----	35	13,784	130	14,326	28,782			
Sea Bass—Black-----	865	6,381	3,513	74,087	89,446		44,186	44,186
Sea Bass—White-----	21,875	210,774	1,231	68,251	363,012	342,090	342,090	344,680
Shad-----					10,640			
Shad—Buck-----					1,307			
Shad—Roe-----	110	7,144	58	4,013	12			
Sheepshead-----		2,950			11,325			
Skate-----		4,069,213	1,929	999,255	41,783		8,541,729	17,064,816
Skipjack-----			32,552		5,071,395		8,523,087	
Smelt-----	12,046	86,648			266,680			

Sole.....	86,411	6,793	8	2,725,107		
Solifitail.....				58		
Striped Bass.....				162,909		
Swordfish.....		5,851		103,275		
Toncod.....				97,424		
Tuna—Bluefin.....		2,818,124	765	318,089		79
Tuna—Yellowfin.....		137,821	45	42,563		3,094,434
Turbot.....				1,374		
Whitebait.....				21,439		
Whitesh.....	75	6,626		30,995		
Yellowtail.....	20	187,317	411	740,660		414,598
Miscellaneous.....	283	33,315	204		9,087	
Total fish.....	271,105	14,021,237	85,924	4,240,999	12,153,623	24,910,434
Crustaceans:						
Crabs.....				631,608		
Shrimps.....				545,500		
Mollusks:						
Abalones.....	4,088			917,513		
Clams—Cockle.....				1,540		
Clams—Mixed.....				6,103		
Clams—Pismo.....	20,171			20,171		
Clams—Softshell.....				37,744		
Cuttlefish.....	96			12,717		
Mussels.....				360		
Oysters—Eastern.....				744,066		
Squid.....				302		
Totals.....	295,460	14,021,237	85,924	4,241,301	12,153,623	24,910,434

9 1,317 dozen.
7 200,300 shell oysters.

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION."

Volume 14

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Number 2

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FACTS YOU SHOULD KNOW ABOUT ANIMAL DISEASES— AN ELEMENTARY TALK*

By K. F. MEYER, Director George Williams Hooper Foundation for Medical Research,
University of California Medical School, San Francisco.

My talk has been announced as facts regarding animal diseases. Before I set forth in simple language some of the facts, let me consider what is meant by disease. Briefly stated disease is a departure from health or in other words, changes in the normal structure and function of the organs. The human or animal body can not adjust

* This and the next five papers were addresses given before the Third Annual Convention of Employees of the Division of Fish and Game held February 28-March 1, 1928, in San Francisco.

itself to factors which lead to the departure or to the variations in environment in which it must live. Whether these factors are climatic, electrical or mechanical in nature, or whether the changes are due to the invasion of certain types of microorganisms, or parasites or chemical disturbances, makes quite a difference in the picture of the disease. When the body adjusts itself to the various factors, no disease will result. For example, if a person is not affected by sudden changes in temperatures, infections of the lungs like pneumonia may never develop. If one adapts oneself to the typhoid bacillus, one does not contract typhoid fever. In the latter instance the adjustment is spoken of as immunity or resistance against the typhoid germ.

It is very interesting that in the past acute diseases have shortened the life span of men as well as animals. In the Stone Age the span was probably not more than 30 years. Preventive-measures, the application of hygiene, etc., have increased it to about 56 years. Yet in certain countries in which infectious diseases are still prevalent the life span of man is still around 30. In this connection it is worth while to remember that aside from the prolongation of life—modern science has given us a much more useful and livable life. Just think for a moment, a man without teeth, or a man without eyesight in the Stone Age—meant death—his defects were absolutely fatal to his existence. Why? He could neither chew the available food nor could he evade the dangers to which he was exposed. Today, many of us with artificial teeth and with eyeglasses do not consider these manifestations of disease as a handicap although the loss of sight is certainly lethal for game animals.

That animals are subject to disease just as frequently as man, is a well established fact. In old documents dealing with hunting one finds various descriptions of destructive diseases of game, but since man was primarily interested in reducing his own mortality the interest in the maladies of animals has lagged considerably. Only when animals become domesticated it appeared important to control the disease to which they were heir. Today a great deal is known regarding the diseases of the domestic and the captive wild mammals and birds in zoological gardens (see Herbert Fox, *Disease in captive wild mammals and birds*; Lippincott 1923) and those animals which may be the reservoirs or the carriers of certain germs transmissible to man. I once spent a period of three years in Africa and studied some of the reservoirs of the sleeping sickness parasites. I became interested in the sickness of animals, not merely in order to protect man but in order to solve some of the fundamental aspects of disease processes. I wanted to know if wild animals died as a result of acute infectious diseases similar to those seen in man, or if they are subject to chronic disorder such as degenerations, fibrosis or hardening of the kidney, the blood vessels, etc. To my amazement I was forced to realize that chronic degenerative processes exist through the entire animal kingdom.

Our knowledge regarding the diseases which affect the game animals—mammals and birds—of this state is still meager and the study is very much in its infancy. We are organizing a group of investigators who will serve as a fact-finding institution. Only when we have facts can we hope to develop preventive and corrective measures. Any-

body who analyzes logically the findings which have been made will immediately appreciate that it is exceedingly difficult to do anything in a curative way. In fact it is well known that the medical treatment of a malady, even in man, is limited. We prevent today, we do not cure. Man recovers from disease without and in spite of the bottles of drugs or patent medicines which have been consumed or used. Unfortunately the layman continues to adhere to the belief that sickness must be cured by medicines. The suppression of disease among wild mammals and birds can rarely be accomplished by drugs. Preventive and not curative measures must be chosen.

If we analyze a disease what do we have to look for? There are first, the causes of disease. Second, lesions, or tissue changes which we may see with the naked eye or the microscope or by chemical means and third, disturbed functions which produce the so-called symptoms. For example, an attack of pneumonia instigates certain symptoms which enable the physician to recognize the nature of the disease. He records fever, a rapid pulse, difficult and superficial breathing, peculiar sounds in the chest, general restlessness, etc. The same applies to animals—their diseases produce disturbed functions and symptoms. It is always of greatest importance to record carefully any symptoms which may be noted since they may aid in the recognition of the malady. In poisoning cases there are definite disturbances. And again in a lingering disease, the wasting away, the restlessness or the dullness toward the outside are significant manifestations. Most of you living out of doors and endowed with a very keen sense of observation can help us a great deal by recording faithfully the symptoms of the diseased game. Let me illustrate this point, there has always been a debated question whether deer may die when they harbor bot fly in their nasal passages. The question: Do the fly larvæ obstruct the air passages leading to the lungs, and is death due to suffocation, or may some of the bots be aspirated into the lung tissue producing pneumonia, and consequently do the animals die from secondary infections asquired by the aspiration of the bots, was solved by a careful study of the symptoms and the lesions. One observer noted that the ground surrounding the dead deer was disarranged and had every earmark that the animal had struggled in an attempt to breathe. The post-mortem proved the diagnosis suffocation—the upper air passages were completely blocked by the fly larvæ but the lungs were free from lesions. In another case, similar to the one Mr. Ludlum brought to my laboratory, the bot fly had been caught in a branch of one of the air passages of the lung. It had obstructed a portion of the lung, but since it also brought bacteria from the nasal passages it caused aseptic pneumonia, and the deer had died from general blood poisoning. In this case the animal was ill for several days, but died without a struggle.

If in any way possible, the disturbed functions should be observed. Naturally, in many cases we can not apply modern methods of examination. We can not go around and use a thermometer; we can not thump the chest to see if the animal has pneumonia. But you should keep in mind that symptoms may furnish excellent leads in a study of the causes of sickness.

Now comes the next important step in the study of disease—the anatomical lesions and tissue changes. In order to establish the

lesions one must perform a post-mortem examination or autopsy. Such examinations should be made as soon as possible after death. Particularly in wild animals it is always essential that only fresh carcasses be examined, since the invasion of microorganisms from the intestinal tract lead rapidly to decomposition of the tissues and to changes in color, consistencies, etc., of the organs. A decomposed cadaver or tissues are utterly useless for any serious investigation of any sort. You can save yourselves the trouble of a post-mortem and the expense of shipping such tissues to the laboratory. If you can not perform a complete post-mortem immediately after death, remove at least the intestines from the body and separate them from the spleen, liver, etc.

A post-mortem examination should be done by somebody who knows what is normal and who can recognize what is abnormal, preferably an animal pathologist. In order to perform a perfect post-mortem a great deal of experience is required, which can be acquired only by the opening up of every dead animal. One should do that on every occasion. I do not claim to have a thorough knowledge of the anatomical makeup of every bird or every wild mammal, consequently I always ask the people who submit animals or organs for a post-mortem examination, that they give me an opportunity to see a healthy animal of the same species. Thus I familiarize myself with the shape, sizes, etc., of the organs and my mind is then prepared to detect abnormalities.

I have many times been amused when performing post-mortems before inexperienced persons. For example, I opened up the mouth of a deer and somebody standing around said, "now look here, this animal has no incisors in the upper jaw." To them a perfectly normal condition was already a definite lesion. I once saw a group of students searching a whole morning for the gall-bladder in a deer. Furthermore, there are certain conditions in the lungs of animals—the amount of fibrous tissue which is between the air sacs—which are of greatest significance in judging the permanent damages produced by pneumonia. These examples probably suffice to emphasize that the game warden and hunter should examine healthy animals before they attempt a diagnosis of the lesions in a diseased animal.

Now what should you do when you perform a post-mortem? I will give you some of the essential steps since in many instances we shall have to depend upon your work and observations. You are going to send us the organs of the animals in order that we may determine the cause of death. Therefore, every observation you make is of greatest importance. You open up the abdomen; you note first the arrangement of the organs; the location of the stomach, the intestines, etc. There may be various disarrangements in the position to the cavity or in the organs to themselves. If you can not describe what you see, make a sketch. In case you have an idea regarding the cause of the disarrangement write it down in simple language. Then take out the organs, the spleen first, then the liver, look at it; is the size normal or is the organ enlarged? What is the color; dark or light brownish, rich in blood? Is the surface smooth or rough? What is the consistency; hard, soft or friable? Then make an incision and note if the blood oozes from the vessels, if it contains gas bubbles, is it partially clotted, etc.? All these things have a definite meaning. Then you prepare the organs for shipment to the laboratory. Do not send

pieces but send the whole organ. The best thing is to wrap each organ separately in a clean cloth. Don't wash the tissue in water, more bacteria which favor decomposition and putrefaction are added. If you have bichloride tablets soak the cloth in a 1:1000 solution. Place the wrapped organs in a box with sawdust, or excelsior, or straw, or any absorbent material and ship to the laboratory by express. Small organs may be packed in glass jars and shipped on ice. During the summer months ice should be used freely.

In the course of a post-mortem examination one should always follow a certain procedure in taking out the organs. One should never open the intestines before one has removed the other organs of the body. The best thing is to take out the spleen first; then the kidneys; lungs and heart, possibly hanging together; liver and then the intestines. Never forget to examine the bones of the limbs, chest and the muscles, the skin and the natural openings. Under certain special conditions it may be advisable to send the head so that the brain, the eyes, etc., can be examined.

In reporting your findings, you should be strictly objective; never let yourself be guided by impressions. The best procedure is merely to describe what you see. For example, if you note a tumor or swelling, just state that it was the size of an apple located in the center lobe of the liver or the left lung, that it was hard, uneven and whitish, rather gritty when being cut, etc.

The recording of the gross lesions is a very important part of a post-mortem since it serves as a guide for subsequent investigations.

When we have determined the lesions, we naturally want to know the causes of the abnormal structure and function.

The causes of disease are numerous.

There are first the group of (1) *mechanical forces*, factors causing injuries—for example, shot wounds, fractures, hemorrhage, etc., due to accidents. The lesions induced by mechanical forces are of greatest importance in finding the cause of death since not infrequently an injury sustained many weeks or months before may be followed by complications due to bacteria, etc. Then we have secondly the lesions due to (2) *electrical forces*. Injuries due to lightning strokes are the same in man and animals—sometimes internal, sometimes external. Birds succumb frequently to the effect of power currents with an electromotive force of 500–800 volts. Then there are the (3) *thermic changes* such as heat and cold, which affect wild animals rarely since their organism can readily adjust itself. (4) *Injurious chemical substances or poisons* are fast becoming very important causes of death among game animals. This group produces not infrequently few and indefinite changes and is rarely recognized without finer laboratory studies. The effects of some poisons are known, but in the group of plant poisons there still exist many mysteries. To illustrate this statement I will briefly describe a South African disease called lame sickness or lamziekte. In the course of this disease, ostriches, cattle, etc., develop a general weakness, a paralysis of the limbs; they are unable to get up or to raise their heads. This disease was a mystery until it was found that the soil on the Lamziekte ranches was poor in phosphorus and that on account of the deficiency the animals developed a desire to eat bones and carrion—in fact anything which contained phosphorus

and lime. They developed into bone-eaters and had a disease known as osteophagia. Studies were then made on the carrion bones and to the amazement of the investigators it was found that they contained a bacterial poison similar to that of botulism found occasionally in home-canned food. The decomposition of dead animals and the formation of carrion led to the generation of the poison. As soon as enough bone meal was placed on the Lamziecte ranches the animals had no desire to eat carrion and the disease was stopped automatically. It is not unlikely that similar types of poisonings may occur in game animals. We do not know the cause of the duck disease in California. The leg and wing weakness is probably not a true paralysis since birds transferred to fresh water make not infrequently an uneventful recovery. Aside from bacterial toxins, plant poisons, venoms and other organic and inorganic substances may act as chemical causes of diseases.

In a discussion dealing with the causes of disease among domesticated animals a large part is taken up by the (5) *infections* caused by plant parasites, such as bacteria and fungi. The number of diseases due to bacterial infections of game is very small, this must in all probability be ascribed to the mode of living. When many animals of certain species live together the chances for localization and multiplication of disease producing germs are favored and infectious diseases due to bacteria may make their appearance in epidemic form. Isolated cases of disease due to molds—particularly skin or lung infection—are sometimes found in game animals. The lesions are rarely extensive. Parasitism due to (6) *animal parasites* play a very important role as causes of disease. Insects and worms of various sorts are rarely missed on game animals. They produce general disturbances, but only massive invasion may lead to fatal processes. Not infrequently the consequences of parasites are overestimated. The study of the life cycles of the parasites is very important. We are always interested to know their portal of entry into the body—if the skin, the lung or the digestive tract. Are there any intermediary hosts? Where do game animals contract the parasites? Have certain worms a specific ability to localize in certain tissues and why? All these questions can only be answered by tests conducted in the laboratory.

Not infrequently the cause or causes of a disease are not readily apparent. For example, the duck disease of California requires extensive chemical tests before we can prove the so-called alkali poisoning theory. If we solve this problem in the next five years we will congratulate ourselves.

When we have considered the causes of the various infectious diseases, we are naturally interested in the behavior of some of the causes on a large group or congregation of animals. Thus far we have merely considered the individual. If one person contracts pneumonia, the health officer is rarely interested, but when hundreds of people exhibit the same malady, as they did for example in 1918, then we are entitled to become alarmed since we are confronted with the epidemic form of influenza.

What is an epidemic disease? It merely means that a large number of persons or animals in a community or reservation are affected by the same cause in a short time. What happens when an epidemic sweeps through an animal population? Certain interesting things

have been noted. I can best illustrate the facts by reciting a set of experiments which we conducted several years ago. We placed about 150 healthy white mice in a large cage. They were fed a balanced diet; they had plenty of ultra-violet rays and the cages were regularly cleaned. Then we placed in the cage a mouse which was infected and discharged mouse typhoid bacilli in the feces. We watched the cycle of events. After an elapse of a week a few mice appeared ill, the coats were rough and the eyes closed by crusts. Two or three days later the sick animals died and within the next four weeks a total of 120 of the 150 mice had succumbed to a mouse typhoid epidemic. The population was nearly wiped out, but what happened to the survivors? We studied them and found that 16 harbored the mouse typhoid bacilli in the intestinal canal, spleen and liver. They were so-called disease carriers and potentially capable of spreading the infection. If we had taken one of those carriers and put it in a cage with healthy mice, the carrier would have started an epidemic of the same character. In another experiment we placed a number of carriers in separate cages and added every ten days ten healthy mice. They contracted the disease, some died and some survived, but the mouse typhoid epidemic could be kept going as long as new mice were added.

In the first experiment 14 mice which survived failed to show mouse typhoid bacteria in their organs. To all intents and purposes they were immune. They either had contracted the disease, recovered and eliminated the causative microbe from their system, or they were hereditarily immune and could never contract the disease. The latter observation is very interesting since one can experimentally prove that the mating of resistant mice may give rise to a generation of highly resistant rodents in which the mortality from mouse typhoid is relatively low. If the survivors are mated again, the resistance is again slightly increased and so on. In this manner a mouse population highly immune to disease can be raised. It is not unlikely that similar factors may operate in the spread of an epidemic among game animals. Then again the present resistance to certain bacterial infections may be due to the transmitted immunity which the great-grandfathers acquired in the course of an epidemic. For the present we lack, however, the necessary proof. It is, however, important to keep in mind that an epidemic disease with a high mortality always produces carriers and reservoirs of the disease and no assurance can be given that quite unexpectedly a flare up may occur when susceptible animals come in contact with these carriers.

These conditions have been noted in epidemics among human beings and domesticated animals. Every 25 years epidemic influenza reappears. Certain definite biological laws govern the course and trend of the epidemic disease. In order to control them we must know the mode of transmission, etc. Promises are made that a given disease may be controlled although the cause of the disease is unknown. Expensive procedures are outlined only to be discredited six months later by the negative results they produced. For example, it is practically impossible to eradicate Rocky Mountain spotted fever, since the tick infested areas can not be freed from the insect. The same applies to ground squirrel plague and to the jackrabbit disease, tularemia. The only thing we can hope is to keep the infections at a low level and

thus reduce the chances of contact infection among a scattered rodent population. Even when every precaution is taken, recurrences do take place. Why? The answer remains one of the many unsolved problems.

That brings me to the last point. The examination of diseased animals is always connected with a certain amount of danger. In this state we have at least two diseases of wild animals transmissible to man. The jackrabbit disease—tularemia—and plague in ground squirrels. When you open up a jackrabbit and you note white spots on the liver and pus under the skin, bury the carcass and wash your hands most carefully with antiseptic solutions. In fact, it is a wise policy to wear rubber gloves when you examine suspected rabbits.

Tularemia is an unpleasant disease. To date there have been 430 cases with 18 deaths in the United States. Relatively few human cases have been noted in California, but the disease is common in Nevada, and is known in Utah as "deer fly fever." The causative microbe was first seen in ground squirrels caught by the United States Public Health Service in Tulare County. That is the reason why the germ responsible for the disease is called *Bact. tularense* and the malady tularemia. It is noteworthy that everybody who worked with this microbe in the laboratory became infected; in all, 20 cases of tularemia have occurred among laboratory workers. In the Lister Institute in London they desired a culture of the bacterium, which was sent to them by the Hygienic Laboratory, United States Public Health Service. They experienced difficulties in growing the microbe in culture and therefore undertook some experiments on guinea pigs. In a few weeks three workers of the laboratory had contracted the disease. In the light of these observations the need of some care is obviously indicated.

As far as plague is concerned the following should always be kept in mind. Ground squirrels with abscesses under the skin, or spots on the spleen, may be infected with the plague bacillus, which is transmissible to man. The experiences in Oakland in 1919 leave no doubt that a very dangerous form of plague infection, namely, the pneumonic or "black death" type, may result from such sources. In case a person develops boils after he has skinned rodents, he should always consult a physician without delay.

In closing, let me assure you of my cooperation. I am at the service of the state. You furnish the material and the problems. Even a small specimen well preserved will be of great value leading to the recognition of the causes responsible for certain diseases among animals. Always remember we can only conserve animal life when we know more about disease and the causes of death.

OUR POLICIES

By EUGENE D. BENNETT, Executive Officer.

I want to talk to you for about twenty minutes, to tell you of some of the things I have in mind. As to the plans before us; there is nothing revolutionary, nothing strange or unusual. There will be no upturning nor any grand upheaval. The principal thing I can do as I see it in my capacity as executive officer is to carry out the work as it has been organized and outlined, constantly striving to improve

wherever improvement may be made and to correct mistakes where they occur.

Many of my friends think this position as executive officer is a sinecure. Now I have been with this work for three months and feel that it is one of the biggest jobs I can conceive of today, and as time-consuming as any position I have had. The only compensation is that the nature of the work is pleasant. One is building here a good constructive future dealing with live things and live issues, and associating with a splendid group of men and women.

My part is to act as executive and to assist department heads in accomplishing the program and general plan of action the commissioners have given us. I am impressed with the tremendous responsibility I have upon my shoulders. Furthermore, I realize, being new to the work, that much of it is technical in its nature. I feel in this sense I am ill prepared to act as an executive for this great undertaking. There is compensation, however, in the fact that the men who have been selected to carry on their part have been at it for a long period of time and have dedicated their lives to the service.

Public service is a hard task. It is a hard task in any office if done right. In this task we have to work just as hard as in any other service of the state government. When you enter the state service and take the oath of office, it means you place yourself in a different position than you ever had before. You do not possess the right to do or think just as you would like to do or think on all occasions. A man in the field has certain duties to perform and has those duties to uphold. If necessary, he must even take action against his friends. The only way I see, men, is do your duty, assume the responsibility willingly, enter the field of your endeavor, entirely divorcing the selfish instinct. This is the only way of satisfactorily carrying on this work.

I know it is difficult to go out into the field at night and more comfortable to stay at home. However, you are a public servant. You are following a service to your community and state. I hope you will find me square and honest and I hope at all times you will never find a grain of prejudice in my make up. I can not make promises, because I believe it unfair. All I hope to do is do my level best, give the best of what is in me in every possible way, carry out the fine work as outlined, directing the great enterprise we have before us, and adjust the little difficulties which arise among us, keeping them within the organization and later solve them in a fair and just manner. Perhaps criticism may be directed to you and a reprimand from headquarters sent out, but if such happens it will be entirely official. I shall not let any personal feeling enter on my part or let any influence affect me whatever. All I want and ask is that you give your best, honest industry, in attempting to do your duty as laid out for you to do and I am sure you will get the great satisfaction that comes from conscientious work well performed.

It is a year-round proposition and you will always find that we people in San Francisco are thinking of you out in the field; we are thinking of your problems; we are thinking of your particular work which you have before you. Just remember we are here to serve you and help you carry out your work, and you are not given your commission merely to serve us.

I trust this convention will be successful and you will go away having gained something by it. That is the only reason we have you here today. Feel at all times, whenever we in San Francisco can be of real help to you, that you can come to us with any just cause of complaint, your troubles and problems. Do not try to influence any of us with unfair tactics or procedure, but keep up the *esprit de corps* this Commission should have. If you do not do your duty properly, you can not fit into this fine organization. You should have courage and individual sense of pride in your work; if not, enter your resignation, or, if you stay, enter into the fine spirit of it, *the spirit to serve and the will to do*.

POSTING OF GAME REFUGES

By J. S. HUNTER, Assistant Executive Officer.

In 1902, a constitutional amendment was adopted, giving the legislature the right to divide the state into fish and game districts and to adopt appropriate legislation for the protection of fish and game within those districts. It was not until 1913 that this amendment was made use of by the legislature. At this time the state was divided into game districts in which there were different laws for the taking of various species.

In 1915, the district act was amended so as to provide for the creation of smaller districts. Section 626s of the Penal Code set these districts aside as game refuges in which all hunting and even the possession of game was prohibited. The Commission at that time did not have the funds to properly take care of the refuges through the employment of resident deputies whose duty it would be to see that the various provisions of section 626s were not violated.

It was not until the adoption of the increased license bill that we were assured that refuges could be properly patrolled. Last year an item was included in our budget providing for the posting of refuges. This meant that a crew of men could be appointed whose duty it would be to survey the boundaries of the refuges and to post signs warning the general public that hunting in that particular area was prohibited.

We were unfortunate in the first crew that we selected, but at the present time the crew is working excellently and has already surveyed refuges in the Sierras and in the coast from Marin County down south to Los Angeles County. I will read from the log of the man in charge of the refuge crew. This will give you an idea of something of the work that the boys are doing.

“February 10. Went to Solvang. Met Deputy Lyons, who put me in touch with rangers who all agree that the only practical method or procedure was to get a pack outfit and that would take about eight days to make the trip. Lightened up the truck as much as possible and then drove to the ranger station, seventeen miles above Los Olivos, seven miles of which is very steep and very rough road. Thirty-five per cent over grades. All of seven miles in low gear and in some places were just able to make it. Met packer and Mr. Tunnel and made arrangements to wait one day for him to get stock and have them shod.

"February 11. Went out with ranger to get a general idea of the country in the forenoon, and in the afternoon arranged for a pack of food, etc.

"February 12. You will note that the crew is working Sunday as well as every other day. Rode fifteen miles over steep trails to Manzana Creek, the south line of the refuge; then about five miles in an easterly direction up the Manzana, posting as we went along. Made camp at 4 p.m. at point near where the trail leaves Manzana. Saw seven deer along trail outside of refuge and a few mountain quail.

"February 13. The packer and Gurley and Young started across the refuge on trail to Hurricane Deck and the lower end of the South Fork of the Sisquoc River, while I took the canyon of the Manzana on foot and followed it and posted to the summit of Pine Mountain, six miles. No trail, rough going and very steep, encountered snow about two miles from summit, which was really more of a help than hindrance, as it was hard enough to hold and helped smooth over the rough spots. From the summit of Pine Mountain down the South Fork of the Sisquoc I posted about six miles, which took from 1.30 p.m. to 7.20 p.m. No trail and very steep going from one large boulder to another through about four miles of snow from eight inches to three feet deep and eight to ten feet in the drifts. I would not advise anyone to take this trip alone again owing to the danger element. I took several bad falls in trying to make time in the snow. Saw six deer, mostly on the snow line. This hike is from an elevation of about 3000 to 7000 feet. Saw several mountain lion tracks (Jay Bruce, please note) and one bear track on the top of the mountain. The boys saw, on their trip across the refuge, 150 deer and seven flocks of quail of from twenty to twenty-five in a flock, all at about an elevation of 3000 feet. They arrived at camp on the fork of Sisquoc, about one-half mile above the main river, at about 2.30 p.m."

These field notes will show you the character of information we are getting from the refuge crew. They are instructed to keep their eyes open and give us full and reliable notes regarding the abundance of game in all of the sections in which they work. They are also securing information relative to changes that should be made in the boundaries of the refuges. In other words, we are getting somewhere with our game refuge system and I would ask that whenever the crew works in the vicinity where any of you are located, you would help them to the fullest extent just as deputies Lyons and Emerick already have.

VOLUNTEER DEPUTIES

By WALTER R. WELCH, Captain of Patrol in charge of Volunteer Deputies.

Among the many duties that are assigned to the Fish and Game Commissioners is that of strictly enforcing the laws for the protection and conservation of fish and game that have been enacted by the state legislature. For that purpose the Commissioners are empowered by the provisions of section 642 of the Political Code of California to appoint, with or without pay, such deputies as they may need to discharge their duties in the enforcement of the fish and game laws in a proper manner.

Realizing that the regular salaried deputy forces of the Commission are not sufficient in number to properly patrol the game fields and streams for the strict enforcement of the fish and game laws throughout the state, the Commissioners have availed themselves of the law, and have appointed a number of men to act as volunteer deputies of the Division of Fish and Game.

As a former experience of the Fish and Game Commission with volunteer deputies in this state, as well as that of similar commissions in many other states, has proven that unless controlled by rules and system the majority of men appointed as volunteer deputies are a liability rather than an asset to the state in fish and game law enforcement, the Fish and Game Commissioners of this state have established a system for the appointment and supervision of the activities of all volunteer deputies of the Division of Fish and Game.

Under the system and rules adopted by the Commission for the control of volunteer deputies, the appointment of each volunteer deputy must be sponsored by a bona fide fish and game protective association or club.

The application and recommendation for appointment of each volunteer deputy must be endorsed by the captain of patrol of the district where the applicant resides, and be approved by the captain of patrol in charge of volunteer deputies.

Each volunteer deputy must be bonded to the state in the sum of \$2,500 for the faithful performance of his duties, and is required to report monthly to the captain of patrol in charge of volunteer deputies, giving a full account of all of his activities during the month, such as number of hunting and fishing licenses checked, miles of game fields and streams patrolled, arrests made, fines imposed, etc.

California is the first state to undertake a system and rules for the control and supervision of the activities of men appointed as volunteer deputies for the enforcement of the fish and game laws.

Although the work has been pioneering in nature and at this time has not been completed, the result has far exceeded the hope of the Commissioners. At this time there are about 650 volunteer deputies within the state. About 375 of these deputies are federal forest rangers, and their appointment as volunteer deputies of the Division of Fish and Game is sponsored by the U. S. Forest Service. The appointment of the balance of the volunteer deputies is sponsored by various fish and game protective associations or clubs throughout the state.

At this time the volunteer deputies in twenty-one counties of the state have been organized and instructed in the discharge of their duties, and are now working under captains in cooperation and coordination with the regular patrol, with very beneficial results in law enforcement, and fish and game protection, as is evidenced by the fact that many arrests for fish and game law violations have been made by volunteer deputies, in which cases fines of from \$25 to \$250 have been imposed.

As cooperation is the keynote to the successful operation of any business, and as the enforcement of the fish and game laws, and the protection of fish, game and wild life is a business, and a big business, of interest and value to all of the people of the state, the cooperation of

the people with the regular patrol and the volunteer patrol is very necessary, and will result beneficially to the efforts being made by the Fish and Game Commission to restock the depleted game fields and public waters, and to protect and conserve the supply of fish, game and wild life.

A CONTINENT-WIDE WATERFOWL CENSUS

By HARRY C. OBERHOLSER, Biologist, U. S. Bureau of Biological Survey.

It gives me a great deal of pleasure to stand before you today, and to look into the faces of the wardens of the great State of California, because you and I are working for the same cause. We are trying to do what the country would have us do, not only in this state but in all other states—to preserve what we have left of the out-of-doors, and also to keep for ourselves and for posterity the great sport and recreation of hunting. It goes without saying that without any birds to hunt, without any other animals to hunt, there can be no hunting. Hunting and fishing are a little different from the pursuit of many other things in life. The real joy of hunting is the pursuit rather than the getting. You have seen a man sit on a log for a whole day and not catch a thing, go home and tell his friends what a wonderful time he had fishing. Much the same may be said with regard to hunting.

A few words might be said regarding what the Biological Survey is trying to do. The federal government and the state governments have distinct niches in conservation work. The federal government does not wish to take any of the glory of the states, rather is attempting to add to it; and the work of the federal government, including the Biological Survey, the Forest Service, and Bureau of Fisheries, is to help the states to coordinate their different activities with each other state, and to those things that require work in all the states for their best accomplishment.

Cooperation is particularly important in connection with the migratory horde of waterfowl that goes from state to state, from country to country, as a matter of fact from Canada to Mexico, for each one of our states must know what is going on in other states, and must cooperate with other states in order best to do its own work. It is to forward this cooperation that the Bureau of Biological Survey is working. We have felt for some time that there is a great lack of knowledge regarding waterfowl, particularly concerning their numbers, movements, and distribution.

Your state commission is making an intensive study of the duck sickness, and the Biological Survey is working along the same lines, but much remains to be accomplished. Another of the most important problems is what should further be done for the conservation of our waterfowl. There are several things that we need to find out before we can attack this problem with any degree of intelligence, or with any hope of success. We must know where the birds are, in what numbers, when they occur, and whether they are increasing or decreasing. As a matter of fact, we know but little. We have tried a number of means to obtain such information, but have found them unsatisfactory.

We have now decided to attempt what has never been attempted before—a comprehensive continent-wide census of the waterfowl, once a month. That may seem like a hopeless task, but it is not as hopeless as it looks, and it promises very important results.

The method of procedure is to gather information regarding areas in which waterfowl are found, and to get persons who know the ducks and geese to take the census regularly. Our purpose now considers only ducks, geese, swans, and mud-hens. Each individual who is willing to cooperate is asked to select a certain area, as much as he can cover in one day. He is to make a careful count where numbers are small enough, or an estimate if the number is too large to count, of each kind of waterfowl on that area, on a certain designated day each month, so that there may be no duplications. Waterfowl travel fast, so we must count them all on the same day. In this way, we shall have a census, or a stock report you might call it, each month, of the waterfowl of the North American continent. We have been organizing and conducting this work since August. Game wardens, game commissions, sportsmen's organizations, individual sportsmen, and others interested are being asked to help.

We started in August with 500 observers throughout the North American continent, today we have 2700. With even that number we can not adequately cover many of the large areas like California. We need your support and help in your great state. Our purpose is to enlist your support and interest; and our hope is that you will become interested in the waterfowl census, and come to see it as not only something the federal government is doing, but something that in your own state is needed to forward the very work in which you are interested. It is our purpose to make all the information available. Not only the information gathered in your state, but in all states will be available for your commission and for you. If the Biological Survey can help you in any way to increase the waterfowl and preserve the sport of hunting, that is our desire and we ask your help to that end.

CALIFORNIA TROUT

By J. O. SNYDER, Stanford University.

Under the authority of the Fish and Game Commission, I have been for some time engaged in an investigation of the salmon of the state, and during this time considerable data have accumulated which relate to other species of fish, particularly the trout. I have examined some thousands of them, large and small. There are notes of a descriptive character, scales, anatomical structures and preserved specimens laid away against the time when they may be used to advantage. Certain conclusions relating to growth, distribution and relationships, which will no doubt be of value in propagation and conservation, are foreshadowed by these data, and of some of these I wish to speak.

In an oral discussion of this sort I may fail to always distinguish between fact and fancy, but I shall try to use the words theory, guess or presume, where they are most needed.

We have at hand a theory of geographic distribution and relationships of the trout of the state which I think is of value, perhaps even in artificial propagation. We have in the state the finest trout in the world. Some of them are the most beautiful in color, and they possess the finest qualities as game fish. They exhibit great variation in anatomical characteristics and they are adapted to extremes of climatic conditions. We have alpine forms in the region of the high Sierra, subalpine species adapted to the streams draining the higher slopes of the mountains, and transition forms near the sea level.

Among the alpine forms is the royal silver trout of Lake Tahoe and the Tahoe cutthroat (*Salmo henshawi*). The former is a deep lake form whose habits are unknown, while the latter is adapted to more general fluvial and lacustrine conditions. Related to the Tahoe cutthroat is the Columbia River cutthroat (*S. clarki*), which reaches the northern coastal region of the state, entering the streams as a steelhead, as far south as Redwood Creek and perhaps Eel River.

It was presumed by its describer that the royal silver trout (*S. regalis*) is related to the rainbow trouts which inhabit most of the larger streams of the state. They, the rainbows, are on the whole larger scaled forms than the cutthroats. The coastal rainbows are all geographic variants related to *Salmo irideus* which inhabits the streams to points far below Monterey Bay. These fishes migrate from the sea to the streams as steelheads, for spawning purposes. Their progeny live for a time in the fresh water as stream trout, after which they enter the sea, where they rapidly attain large size. We now have facts enough relating to these trout to speak with perfect assurance as to the relationships of the steelheads and rainbows, and the steelheads and cutthroats. The steelheads are stream trout which have gone down to the sea and profited largely therein, to return again after a period of one or more years. We have then cutthroat steelheads and rainbow steelheads. We have steelheads and stream trout, and conservation of the one depends absolutely upon conservation of the other. We burn the candle at both ends when we overfish both the steelheads and stream trout. We are awakening to the fact that we can not both destroy the steelheads and maintain the rainbows. Trout go to sea at ages varying

from one to three or possibly more years. They return from the sea after a year or more of life therein, spawn in the stream, and, if possible, migrate again to the sea. They spawn several times, returning to the sea after each nuptial migration. The extent of their life under the most favorable conditions is not known, but they live for a considerable number of years. They are occasionally taken at sea by salmon fishermen. To the southward the rainbow trout is represented by landlocked forms, the San Gorgonio trout of the San Bernardino region, and the Nelson trout of the San Pedro Martir of Lower California. The latter no doubt reached this far southern point in a past period when colder conditions prevailed, and trout extended over a larger area.

It appears probable that we have, as intimated before, two series of rainbow trouts, the coastal forms and another series which we may term subalpine. The latter are either landlocked or do not enter the sea for some other reason. Among these are our most brilliantly colored forms, the golden trouts, the Kern River and Shasta trouts and the Eagle Lake trout. Under favorable conditions these fishes attain a large size, and no better trout is known. Their age, rate of growth, and many other phases of life history are matters for investigation.

I believe that an understanding and a consideration of the natural geographic distribution of our trout, together with some more definite knowledge of the life history of the various species will be of great value in artificial propagation, and the proper distribution of fry in the streams.

I want to repeat that we have in this state the finest and most beautiful trout in the world—already naturally adapted to the greatest extremes of climate, river, lake and sea conditions. I want to express the opinion, in closing, that we have already made a great mistake in introducing inferior species to cope with our native forms, and any proposition to introduce others, such as the Atlantic salmon, for example, is a tacit admission of our inability to cope with the problem of conservation of our own superior species.

QUAIL SHOOTING IN CALIFORNIA TODAY AND FIFTY YEARS AGO

By WALTER R. WELCH.

Time: December 1, 1927. *Place:* An old abandoned logging road along the banks of the Gualala River, Mendocino County, California. Two San Francisco sportsmen about to return home after a day's quail shooting. *Equipment:* An auto, and two 16-gauge automatic shotguns.

"Well, Tom, this is the best quail shoot we have ever had. I have nine birds and you have eleven. If we had had a good dog to retrieve all the birds we killed we would have bagged the limit, for I killed at least a dozen birds I could not find."

Let us turn the pages of time back to September, 1872. *Place:* A brush covered pasture near San Gregorio, San Mateo County, California. Two middle-aged men and a boy out for a day's quail shooting. *Equipment:* A saddle horse, three double-barreled muzzle-loading 12-gauge shotguns, and three well-trained bird dogs.

"Jim, how many birds have you and Walt?"

"We got 72. How many have you, Alex?"

"I got 47. With what we killed yesterday that makes about 20 dozen—enough for a shipment. Let's quit."

Alex and James Butchart, who have long ago crossed the Great Divide, were the men mentioned, and the writer was the boy. Well do I remember that day, my first as a "market hunter."

What a difference in the supply of quail in 1872 from that of 1927. The "Butchart boys" began the hunting of quail for the San Francisco markets in Marin County during the Sixties, and about 1870 moved to San Mateo County, locating at San Gregorio.

The Butcharts were brothers, and were real sportsmen of the old Scotch school. While they marketed the game they killed, they did all their shooting on the wing, over well-trained bird dogs. They would spend more time to retrieve a wounded or dead bird than would be required to flush and kill a half dozen birds. Both were splendid wing shots, frequently bagging as many as 60 quail each in a day's shoot. I have seen Jim Butchart kill 27 quail straight, singles and doubles, without losing a bird, the birds being flushed from brush cover.

The "Bissell boys," Englishmen, and twin brothers, were also early-day market hunters for quail in San Mateo County. They did their hunting on the coast side of the county, and also in the vicinity of Woodside, west of Redwood City. The Bissell boys were also good wing shots and did their shooting over dogs.

During the eighties and nineties, Enos Ralston and Thomas Johnson did a great deal of market hunting for quail on the coast side of San Mateo County. These men were also splendid wing shots and did their shooting over dogs.

While those mentioned were the recognized market hunters for quail in San Mateo County during the early days, there were many others who shot and trapped quail for market in that section of the state. Some of those who trapped quail maintained a string, often consisting of as many as fifty traps.

The figure four set was the trap commonly used for trapping quail, much of the trapping being done by boys, and the wives of farmers and ranchers. During the sixties and seventies, and even as late as the early eighties, traps set for quail could be seen all over San Mateo County. All that was required to construct a trap capable of catching quail was a strong, sharp pocket knife with which to cut hazel or other material about one-inch in diameter by four feet in length, which would be placed one upon another in pyramid form, the pieces being made shorter as the trap was built up. When the trap was completed it would be held together by a "binder" across the top, which was fastened by a piece of string to the bottom slat of the trap, thus binding the trap firmly together; the trap being baited with wheat or other grain or seed that might be obtained.

During the sixties, seventies and eighties, Dr. R. O. Tripp, who conducted a general merchandise store at Woodside, San Mateo County, and who made regular weekly trips by team and train between Woodside and San Francisco, handled nearly all of the quail killed by market hunters in that section of the country. Dr. Tripp paid the hunters cash for their quail and resold the birds to the retail game dealers in San Francisco.

The market hunters on the coast side of San Mateo County shipped their quail by Wells, Fargo & Co.'s Express and stage, to game dealers in San Francisco.

The Butchart boys, the Bissell boys, Ralston and Johnson, although referred to and recognized as market hunters, did their hunting more for the sport of shooting than for the money made from the sale of quail.

These hunters used muzzle-loading, 12-gauge shotguns in shooting quail, as did also the majority of quail hunters until about 1885. In 1885, Ralston and Johnson, recognizing the advantage of breech-loading guns over muzzle-loaders, each purchased 14-gauge breech-loading Parker shotguns and 150 brass shells, bought their ammunition in bulk and loaded their own shells.

I have been informed by Mr. Ralston that in quail shooting he loaded his shells with $2\frac{1}{2}$ drams of powder and $\frac{3}{4}$ of an ounce of shot, and that during the quail shooting season of 1885 he used 310 pounds of number 10 shot and 77 pounds of powder, which indicates that he shot upwards of 6000 times at quail during the open season of 1885. Mr. Ralston also informs me that his best one-day bag of quail was 10 dozen and one bird; that his best double-barrel pot shot was 47 quail, and that his best single-barrel pot shot was 30 quail, and that Mr. Johnson and he would average 6 dozen quail per day in good weather.

William Packard, who had the misfortune to lose his left arm in one early-day sawmill of San Mateo County, was also one of the market hunters for quail in that county during the seventies and eighties. Although having the use of but one arm with which to handle his gun and game, Packard was a successful quail hunter and a splendid wing shot. His best two-barrel bag was 18 quail and his best day's bag was 72 quail.

While many pot shots of from 11 to 30 quail were made during the early days of quail shooting in San Mateo County, some of the record two-barrel pot shots were George Carter, 48; Joseph Frisco, 33; F. Moulton, 32; Alphus Davis, 52; John D. Feliz, 43; Mrs. Frank Bill (*nee* Beckie Palmer) 24, and 46 by the writer.

As the means of transportation developed, the market hunting and trapping of quail spread down the peninsular into Monterey and other southern counties, where, during the late eighties and until about 1901, in the section of country west of Bradley and King City, and in the vicinity of Jolon, Pleyto, Poso, San Ardo, Paso Robles and Santa Margarita, thousands of quail were slaughtered each year by market hunters. In these sections of the state great numbers of quail were destroyed by nets used to trap quail at springs and water holes. The trappers would use a piece of 1-inch mesh net about 15 by 50 feet. The back part of the net was usually buried in dirt, the ends and sides of the net were fastened to willow poles, and a stick about 2 feet in length, to which was fastened about 200 feet of strong string, was used to hold up and trip the trap. A pan filled with water was placed under the net and the trap baited with wheat, chaff or other grain or seed.

As water was scarce in the section of country mentioned, quail in bands consisting of thousands of birds would congregate about the springs and water holes in the vicinity of which the traps were set. When a sufficient number of quail had entered the net, the trapper

who was watching the trap would pull the stick from under the net, and thus cause the net to drop on the birds.

In this manner at times quail to the number of several hundred would be caught by one fall of the net or trap. The trapper would then proceed to kill the birds by using a willow stick with which to hit the birds on the head as they stuck out through the meshes of the net. After the birds had been killed and removed from the net, the net would be reset and baited.

The trapper would then proceed to draw the quail and tie them in bunches of six birds each. The bunches of birds would be hung up in a tree at a distance of about 30 yards, and a shot from a shotgun fired at them, in order to remove evidence that the birds had been trapped.

As a rule the trappers would fill the springs and water holes with brush and so block it that quail would not be able to secure a drink.

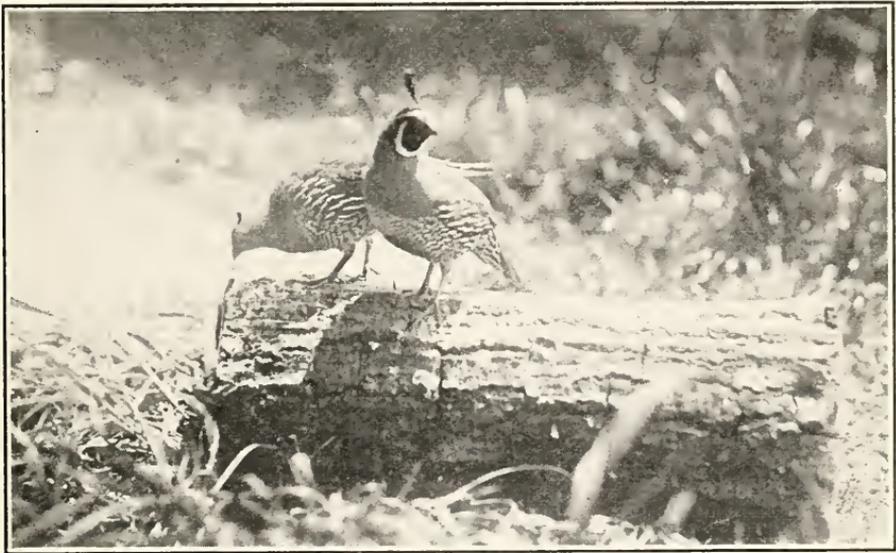


FIG. 37. The California valley quail, the finest of California's upland game birds. Photograph by H. C. Bryant, Hayward Game Farm.

The net would then be set, baited and so left for a day in order that the quail would become accustomed to it and enter it; then the trap would be sprung—usually twice in one day—which would result in about cleaning up the flock of quail that frequented that particular locality, which might consist of several hundred birds. The trapper would then move to another location. In this way he would be able to trap and ship several hundred quail twice per week.

As a rule the quail trappers above described worked in pairs, and their outfit usually consisted of a pack horse or mule, a roll of blankets, coffee pot, frying pan, a short-handled shovel, an ax, a shotgun, a piece of 1-inch mesh 15 by 50 feet, a quantity of wheat or other grain for bait, and a large, shallow pan to be filled with water and placed under the net or trap.

The Lambert boys, also brothers, were early-day market hunters in Alameda County and the San Joaquin Valley, as was also Jack Ellis.

During 1891, 1892 and 1893, Jack Ellis did a great deal of market hunting and quail trapping in the San Joaquin Valley, and states that each quail trapper in that section would operate a string of about 100 traps. Pack mules and horses were used to transport supplies and to deliver the birds to shipping points. Mr. Ellis states that sometimes there would be as many as 20 trappers in the vicinity of "Lone Tree Canyon," in the San Joaquin Valley, and that the average catch of quail was about 100 dozen quail per week per man.

The price paid for quail ranged from \$0.50 to \$1.75 per dozen, depending upon the condition of the birds. In 1885, I saw many quail exposed and offered for sale at grocery stores and butcher shops on Third street, San Francisco, for 50 cents per dozen.

The quail trappers in the San Joaquin Valley, and also in the Monterey County section of the state, seldom did any wing shooting at quail. When quail were shot at in these sections, the shooting was done by "ground sluicing" the birds at springs and water holes, when from 40 to 60 quail would be killed at one shot.

It was not until 1895 that a decrease in the supply of quail became noticeable, and it became apparent that something must be done, and done quickly, to protect quail or the supply would be totally destroyed. Therefore, the Fish and Game Commission, in order to be supplied with data to support the passage of needed legislation, detailed a man to ascertain the number of quail sold in the Los Angeles and San Francisco markets in 1895-1896. The figures secured show that during the open quail-shooting season for 1895-1896, 177,366 quail were sold in the open markets of Los Angeles and San Francisco alone. Of this great number of birds Monterey County furnished 39,831, San Luis Obispo, 25,526; San Bernardino, 12,663; and Los Angeles 11,026. From various other counties in the state were shipped to and sold in the two cities, quail ranging in number from 89 to 9800. These figures do not include quail shipped to and sold in the various other cities and towns within the state, nor quail killed and consumed by the hunters, their families and their friends. The 177,366 quail sold for a total of \$15,160.08, or at an average of less than 10 cents apiece.

These figures certainly furnish the present generation and those who are inclined to lay the cause for the present scarcity of quail at the door of predatory birds and animals, with food for thought.

It is quite safe to say that during the eighties and nineties not thousands, but millions of quail were shot, trapped and sold in California, and that had it not been for the enactment of a law in 1901, which fixed a bag limit and prohibited the sale of quail, the supply of quail in this state would have been totally exterminated. The law enacted in 1901 fixed the bag limit at 25 per day and prohibited the sale of quail.

Subsequent to the passage of this law the market hunters resorted to bootleg methods in shipping quail. During the years 1901 to 1909, in order to be able to secure a sufficient number of quail to warrant shipment in a trunk checked as baggage, hunters to the number of eight or ten in the Monterey section of the state would combine in a quail hunt, pool their bag of quail, and in that manner be able to escape game wardens in the field, and transport large numbers of quail to the large cities. Quail were shipped to San Francisco and other large cities in egg cases, butter boxes, rolls of

blankets, green cow hides, suit cases; in boxed demijohns as wine, in coal oil cans as honey, in kegs as butter and salt fish, and in trunks checked or expressed as baggage. Here they sold at from \$2.50 to \$6 per dozen. In this way, for a number of years despite the activity of game wardens, thousands of quail found their way to the markets of the large cities and were sold in restaurants and hotels, with the result that by 1925 only a pitiful remnant remained of this state's once bountiful supply.

I distinctly recall an afternoon's quail shoot I had in San Mateo County in the fall of 1880, in company with Fred S. Johnson of San Francisco, whose son, Frederick M. Johnson, now resides at San Mateo. On that afternoon Fred and I bagged 98 quail, all killed on the wing, over dogs, in one gulch and from one bevy of birds we had flushed and "stuck" in a ravine bordered by a grain field. We shot 12-gauge muzzle-loading shotguns, loaded with $2\frac{1}{2}$ drams of black powder and $\frac{3}{4}$ of an ounce of No. 9 shot. I can not recall that on that shoot either of us lost a wounded or dead bird.

In those days a majority of hunters used 12-gauge muzzle-loading shotguns, the usual charge for quail shooting being as given above, during the fall months, with a change to 1 ounce of No. 8 shot during the winter months. As these hunters universally used dogs in hunting quail, very few wounded or dead birds were lost.

It is not predatory birds and animals, or inbreeding, that is responsible for the decrease in the supply of quail in California. The scarcity of quail in this state at this time is due to the usurpation of their food and cover, and to man, who has thoughtlessly and indiscriminately killed and destroyed quail at all seasons of the year in violation of law.

There is no game bird that will respond more quickly to protection than California valley quail, the "Plumed Knight of the Chaparral." To restore the millions of acres of quail habitat that still exist in this state with California's gamest bird, the valley quail, all that is required and is necessary in conjunction with the present law, which prohibits the sale of quail, provides for a daily and weekly bag limit, and protects quail for eleven months of the year, is to *strictly enforce the law*, develop springs and other means to provide the birds with water and feed, and *have set aside numerous small quail sanctuaries and refuges* in all sections of the state.

That small quail sanctuaries or refuges can be made the means of restocking and maintaining the supply of quail in the shot-out quail areas of this state, has been thoroughly demonstrated by Messrs. Edgar A. and John Shaw, of Pescadero, San Mateo County. By maintaining a quail refuge of about 60 acres of land on their 610-acre ranch located near Pescadero, the Shaws during the past 27 years have been able to keep a good supply of quail on their property, and at the same time enjoy quail shooting each year. It is needless to say that the Shaws do no shooting on their 60-acre refuge at any time.

In every county inhabited by valley quail there should be a number of quail sanctuaries or refuges in which shooting of all kinds is *absolutely prohibited* at all times of the year. From these refuges the surrounding country for several miles will become stocked with quail each year, provided that proper water and feed is developed, and the law enforced.

If every county fish and game association or club will interest its members along these lines, and interview farmers and land owners with the view of having them set aside small parts of their holdings as quail sanctuaries and refuges, assist in the development of water and feed for the birds, and *actively support* the efforts being made for the strict enforcement of the laws, within three years, and without the additional expense of importing quail for restocking purposes, every acre of suitable quail cover and habitat in this state can be satisfactorily restocked through natural channels from the nucleus of wild quail already in the fields.

THE RELATION OF PARASITISM TO WILD LIFE CONSERVATION *

By E. C. O'ROCK, Parasitologist, Bureau of Research.

While food and water, shelter or cover, and protection from enemies are the factors ordinarily considered in planning for the conservation of wild life, the important but little understood questions of parasitism are beginning to command the attention of conservationists as well as biologists.

A parasite is an animal that lives in or on, and at the expense of another living animal, which is called the host. The term "animal" in the sense that the zoologist uses the word, may mean anything from a one-celled organism to a whale.

Parasites and parasitic diseases of domestic animals have long taken heavy toll from flocks and herds. Wild animals and birds are equally subject to the attacks of parasites, yet parasitism in these forms is rarely brought to the attention of the public.

Science does not know how parasitism originated. In many cases we are helpless to remove parasites from an animal when once they have become established in it. When the life cycle of any parasite is known, however, its control becomes a problem of preventive medicine, in some cases simple and practical, in others exceedingly difficult.

The number of protozoan parasites is legion. Round worms, flukes or trematodes, and tapeworms are also extremely numerous and important.

When we speak of a rabbit's having "blisters" or "boils," we mean that it harbors in its flesh the encysted larval forms of tapeworms. These boils develop in a rabbit only after it has taken in with its food the eggs (embryos) of a tapeworm of the proper species. The source of these tapeworm eggs is the feces of a dog or other carnivore that harbored tapeworms in its intestines. The dog in turn got its tapeworms by eating the flesh of a rabbit that had boils. These various situations with respect to the tapeworm, we call its life cycle.

One of the serious parasites of the range sheep in parts of the Rocky Mountain regions is the fringed tapeworm of the bile ducts. This same form or one that is very much like it may parasitize deer. Its life cycle is unknown.

* A study of the parasites of game is now being undertaken by the Division of Fish and Game and articles on this subject will appear in later issues of this publication.

Fishes, amphibians, reptiles, birds, and mammals are all subject to being parasitised by a variety of forms of flukes and tapeworms.

One characteristic of the flukes is that nearly all of them live at some stage of their existence in the body of a snail or other mollusk, where they undergo part of their development. The fluke parasites of water-fowl are therefore intimately associated with the kinds of snails that live in the marshes where they feed.

Of particular interest is the fact that an introduced animal for instance may bring in parasites that might prove to be fatal to a native species. Similarly, a native species might transmit its parasites to an introduced form with fatal results.

Parasites may exist in animals for generation after generation with seemingly little effect, then suddenly they may flare up in enormous numbers, and be so virulent as to practically annihilate their hosts.

At times in some of the lakes in the northern lake states, the flesh of the bullheads is simply plastered with the yellow cysts of parasitic trematode worms. The combination of factors which brings about this condition is unknown, but whatever its explanation, the wormy fish have a serious effect upon commercial fishing activities in the infested areas.

Within the field of parasitism are many practical problems of present day biology that challenge the attention of all who would practice "Conservation of wild life through education."

VARIOUS CONDITIONS REGULATING BIRD POPULATION AND MIGRATION

By D. D. McLEAN.

In certain bird-infested localities, where the responsibility for much damage to fruit and other crops has been placed against birds, it has been a leading question among farmers and orchardists as to just what attracts them to the area besides the food. The question becomes puzzling when other localities with the same fruits and crops are unharmed by them.

Several factors seem to govern the movements and feeding habits of the various species of birds, both those which are destructive and those which are likewise known as beneficial.

In order to help distinguish between the various types of country, both faunally and geographically, the terrain has been divided by zoologists and botanists into so-called life zones. We find that these zones include the following: Tropical, Lower Sonoran, Upper Sonoran, Transition, Canadian, Hudsonian and Alpine-Arctic. The following are a few points to be used in determining these zones. The Tropical is characterized by a warm, moist climate; heavy plant growth, often known as jungle. The Lower Sonoran is characterized by deserts, thorny trees and shrubs, cactus, hot winds and dry atmosphere. Quite often there is a lack of trees and shrubs of any kind; the Upper Sonoran is the foothill zone with many deciduous trees and shrubs. There is little barren ground in this zone as a rule. The Transition is that type of country where one finds both deciduous and coniferous trees present in nearly equal numbers. The northwestern redwood

belt is generally considered Transition, but there is a close relationship between it and the Tropical and Canadian life zones. In the Canadian zone, one will find the heavy stands of timber, mainly of coniferous varieties, with only a few of the hardier species of deciduous trees present. The Hudsonian zone includes forests, often dwarfed, barren ridges, granite domes and peaks, wet meadows and glacial lakes. The Alpine-Arctic begins at the upper edge of the Hudsonian, or timber line, and continues on up to the tops of the highest peaks and into the polar regions.

This classification will be found usable whether one is climbing from low country up to the mountains or traveling north into the Arctic regions.

In certain sections of the state we find sheltered areas where the winds are broken by foothills, groves of trees or other natural barriers. Flocks or groups of birds will seek these sheltered covers and there spend the winter. From these protected places the birds scatter out over the adjacent fields and orchards to feed, returning to rest. Wherever orchards, vineyards and other crops are located in or near these foothill coves the damage done by birds is often considerable. Those products which are grown out into the larger valleys are often unharmed, because there is a lack of necessary cover for protection.

The sheltered Upper Sonoran section of the eastern San Joaquin Valley, in which is located Visalia, Lindsay, Exeter, Strathmore, Lemon Cove, Porterville, Terra Bella and Tulare, is overrun in winter with various birds such as the linnet, golden-crowned and gambel sparrows. This area is comprised of open land with but little prevailing wind and many foothill canyons which are sheltered from storms and the temperature is seldom low. There is a quantity of natural food in the form of turkey mullein, water grass and wild portulaca. Formerly, there was probably an abundance of food out in the open country where the deciduous fruit section is today. This, however, is now lacking, due to cultivation; hence, since the birds by instinct come back to this section each winter, they have by necessity turned to the next best food, which has been chosen as the buds of several deciduous fruit trees.

On the western side of the San Joaquin Valley from Coalinga north there is a belt of country where the winds are strong and water is scarce. Very few birds are present in this district, although weeds are fairly plentiful and there are areas of low brush which would make fairly good cover. It seems that the scarcity of water and the strong winds tend to keep the birds from spending their winter months there.

Deciduous orchards and vineyards which are in close proximity to citrus groves are particularly in danger because of the protection afforded the birds from the elements and enemies by the dense foliage.

Telephone, electric, telegraph and fence wires are attractive perches that are taken advantage of by many species. These wires should always be taken into consideration before such drastic measures as poisoning and shooting are undertaken. Large trees offer excellent lookout stations for wary species. Such birds usually perch and scan the nearby territory before dropping down to feed. Clumps and tangles of willows, berry vines, rosebushes, hedges, arbors, tangled masses of wire, weed patches and similar situations are all harbors for many species of brush and ground inhabiting birds.

It will be found, after the breeding season, that many species of birds begin to congregate into flocks, while others go individually into suitable places to spend the colder months of fall or winter. Resident species remain here all winter while certain migrant species stay until they depart for the south later in the fall.

In migration, various geographical conditions enter into the routing of flight lanes to and from their northern breeding grounds. Deserts, mountain ranges, north and south valleys, forested areas, lakes, streams, headlands, bays, straits, oceans and mountain passes all seem to regulate the flight. Of course there are always some exceptions. Some of these conditions attract some species, while others deflect their flight to one side or the other. Some birds take one route northward in the spring and return south in the fall by an entirely different one. In some instances these routes are a thousand miles or more apart.

Some migrating birds do not seem to be inconvenienced in the least by natural barriers. This appears to be true of cranes, pelicans, geese, hawks, swifts and other species with exceptional powers of flight. Cranes, geese and pelicans soar to great heights, then take the familiar V-shaped formation and pass over mountains, deserts, lakes and canyons, pausing now and then to once more gain altitude by soaring.

When we speak of migration, we do not necessarily mean the bird flies in a direct north and south route, for that has been proved false. Ducks have been banded one winter in the central United States and have presumably gone north for the summer and the following winter were taken in California. Other species have a migration movement known as altitudinal; that is, they move up the mountain slopes in summer and down in winter. The mountain quail is an excellent example of this type of migration.

During the nesting season most birds pick out their particular niche and are only found there. There are occasional exceptions to the rule, but on the whole, for example, if the bird prefers riparian willow thickets, that will be where one will find the greater majority of that species.

The Ross snow goose is a good example of a species which winters in one small area. Practically all of the Ross snow geese winter in the interior valleys of California and formerly in Los Angeles County. The breeding range of the species is unknown but is presumably north of the mouth of the Mackenzie River in the Arctic regions.

Some birds are very locally distributed, even in the breeding season, that is, in one locality the species will be numerous, while in nearby territory of the same general character it will be practically absent. There is presumably some reason, not always evident to man, but of importance to the bird that causes it to be either present in numbers or absent. Still other species have become localized by the inroads of their enemies, such as man. In this group, the California condor, yellow-billed magpie and white-tailed kite are good examples. Some, which were formerly only distributed locally, have now become generally numerous due to the spread of cultivation and reclamation. Competition with man's interests become so keen in other instances that a bird is finally wiped from the face of the earth, becoming extinct. Examples of this are the great auk, passenger pigeon, Labrador duck and Eskimo curlew. Others apparently due to follow the above are:

trumpeter swan, whooping crane, white-tailed kite, California condor, heath hen and clapper rail.

If a bird's natural breeding ground is destroyed, it will, as a rule, disappear from that area. As the destruction continues and finally becomes complete over its whole breeding range the bird will eventually disappear as a member of the fauna. So far none of our American birds have met this fate but the heath hen, prairie chicken, swallow-tailed kite, clapper rail, whooping crane and trumpeter swan are doomed.

Water governs the bird population in many cases. This is especially true in the smaller species found in the more arid sections. They do not generally fly a great distance in order to secure water, consequently when available water is covered over or piped, they must seek new fields.

Prevailing winds are shunned by many species that congregate in sheltered mouths of foothill canyons. A noticeable exception to this is the horned lark. This bird seems to prefer the cold, bleak, wind-swept plains, feeding on open ground where even the grass and weeds are stunted.

It is interesting to note the attitude of various migratory birds toward storms and clouds. Over certain parts of the Sierra Nevada mountains, sandhill and little brown cranes pass regularly to and from their northern breeding grounds. Oftentimes in their spring migration they have been observed to come up from the San Joaquin Valley and take a diagonal course across the mountains only to encounter a storm or cloud bank in their ascent up the western slope. Their first endeavor is to fly over it by soaring to great heights. This failing, they will try to fly through it, but seldom do. After much wheeling and calling they generally coast back down the slope to the valley again. Geese, however, will usually fly through a storm or over it with little unnecessary demonstration. Fog, however, will befuddle a flock of geese as well as cranes and often break it up entirely, many becoming lost.

I have seen an entire flock of geese return toward the lowlands when a golden eagle made a swoop into the group. Cranes, however, show little concern other than the increased volume of calling, over an eagle's onslaught, even though the bird may have gone through the entire flock and scattered it temporarily. They soon come together again and continue on their way. This is an excellent example of the difference in temperament between two migratory species that follow similar routes in migration.

Many species of birds abound in forested areas, never wandering out into the open country, while others may be found present in both types of country. Even then there is generally a preference. Hawks usually nest in forested country but do a considerable part of their hunting in the open.

One can see the way varying natural and unnatural conditions regulate the movements and numbers of birds in various sections, not to mention food as an attraction. At no time can one be certain that a bird is going to be common one year, in a certain locality, simply because it was common the year previous. Any one, or a combination of the many factors, may change their range, while nearby they may be numerous.

The numbers of ducks and geese are governed on their winter range by food and water conditions and the amount of shooting done, to a noticeable extent. Heavy shooting causes the birds to rise and if the shooting is continued, they will gradually shun the area entirely, often apparently leaving for distant parts. Even when there is plenty of food, the birds will take their departure as soon as the season opens.

A good example of what a little protection will do was noted in the fall of 1927 at Los Banos. A few hundred acres of Miller and Lux holdings were under observation.

No hunting was done except on Sunday morning. The birds, both ducks and geese, were quick to take advantage of this and congregated there by the thousands. It seemed like half of the birds in the San Joaquin Valley were located on that small tract. This shows what could be done in the line of conserving a breeding stock of the various species.

The summer visitants do not seem to be affected by varying conditions as much as migrants and winter visitants. Resident birds are quick to take advantage of any opportunity offered them in obtaining food, and protection from enemies and severe weather.

High winds are almost sure to cause a movement among birds, especially the ducks, geese, cranes and shorebirds. Most of their movements are performed at night so we know little of what actually takes place. We do know that an influx of winter birds can take place in a few hours.

There are three general migration routes for ducks and geese into California from their northern breeding grounds. One from the north along the coast usually off shore, one down the great valleys from Oregon and one from the Nevada sinks across the Sierra Nevada mountains into the San Joaquin Valley.

Through reclamation, so much of the original ground used by birds at various seasons has been changed that the formerly common species are no longer present. Is it any wonder that they change their flight lanes and are seldom seen again?

It is high time something should be done in an effort to prepare a winter range for such birds as ducks, geese and shorebirds in California. One should be in the Sacramento Valley and one in the southern San Joaquin. This would be preferable in order to take care of the birds coming in on the two distinct migration routes to the great valleys. These are the birds that reclamation is ousting from the state. On such a range, food should be plentiful at all seasons. None except the trained naturalist or wardens should be allowed on the premises and absolutely no hunting, farming, building or reclamation. There should be a generous planting of food plants. There should be open water, marsh, dry ground, mud holes and sloughs.

We are certainly devoid of such refuges in the state but not due to the scarcity of suitable space, but to poor foresight on the part of those who should be most interested in the conservation of our natural resources.

In writing this article, I have endeavored to show the numerous factors concerned in the distribution and migration of birds. Also the necessity of careful study, by experienced men, of the life zones, food conditions, sheltered areas, prevailing winds, natural barriers,

flight lanes, temperature, water conditions, storm areas, fog belts, forests, plains, reclamation, shooting, predatory animals and like conditions before refuges are established or similar projects undertaken. The same study is necessary in order to properly control the damage done to agricultural interests by birds. Until such studies are performed it is folly to blindly place a refuge or undertake the control of injurious birds.

REPORT OF THE COMMITTEE ON SPECIES DESTRUCTIVE TO GAME

(Adopted at the Fourteenth National Game Conference.)

The Committee is faced with a problem that for a long period has been perplexing to sportsmen and, at times, has received the most radical and unwarranted treatment. In the absence of basic knowledge, prejudice has had full sway and has led unthinking people to commit deeds harmful, and when carried to extreme, disastrous to game conservation. In taking up this problem, the committee has done so with an open mind and with the determination to treat each species under suspicion justly and equitably, as human beings are treated in courts of justice in accordance with law.

ALL ANIMALS PREDATORY

It is doubtful whether there are many forms of vertebrate life that will not devour or destroy the eggs of birds if they have the opportunity. It is only through eternal vigilance on the part of parent birds, and their ability to place their nests where they are hard to find, that many young are brought to maturity. If it is true, as we believe it is, that all animals are more or less predaceous, it then would seem to be our duty to check one against another and for the good of the whole to encourage those that do the least harm.

MARSH HAWK EATS FEW QUAIL

In carrying on quail investigations in Georgia, Mr. Stoddard found that the marsh hawk, in more than a thousand meals, ate four quails only, but fully a thousand cotton rats, which rodent in turn was found to have taken 7 per cent of all quail eggs destroyed. To destroy this hawk indiscriminately, except locally where a few individuals are doing harm, is one of the most deplorable methods taken in an attempt to conserve game.

OWE MUCH TO ORNITHOLOGISTS

Since we owe to ornithologists the greater part of our knowledge relative to the food and breeding habits of birds, facts touching on their migration and distribution, and the control of diseases and parasites affecting them, it is difficult for your Committee to understand why some game commissions and sportsmen are prejudiced against ornithologists. If for any reason ornithologists should stop collecting and studying birds, sportsmen would be one of the greatest losers. What possible harm can be done in following this research work, when esti-

mates show that ornithologists kill annually not over 20,000 specimens out of approximately 1000 species and subspecies, while sportsmen in one-fourth of that time kill 20,000,000 birds included in not more than 100 species? Some ornithologists and sportsmen may kill excessively, but why condemn the whole?

AS TO THE KINGFISHER

There are some who consider the kingfisher a direct menace to trout culture. If individuals congregate about trout hatchery ponds and commit depredations they can be easily controlled. In some states even where the kingfisher has always been rare, it is almost impossible for well-equipped fish commissions to keep the streams supplied with fish to satisfy the ardent fishermen. Since kingfishers are no more abundant now than they were when the streams teemed with trout, it would be well for us to be fair with ourselves and to acknowledge this truth.

While many fishermen are complaining of mergansers as fish eaters, what should be said of a large black bass, which we recently have learned fed on young ducklings.

SPARE THE SEA LION

Alleging that the sea lion destroys salmon, commercial fishermen want to exterminate this marine mammal, when in truth it feeds principally on squids and fish of little commercial value. Almost criminal destruction of salmon by commercial canneries must be defended, and the scarcity of the fish explained by accusing the sea lion, which apparently has no sponsor in court.

The thoughtless or selfish gunner who has no consideration for breeding stock will exterminate a covey of quail and then try to make himself believe that the mouse-eating hawk sitting in the top of a dead tree in an adjoining field, is the real culprit.

SONG BIRDS EAT FRUIT AND GRAIN

The food of many of our favorite song birds includes at least 10 per cent that is of value to man, such as fruit, grain and garden produce, and many of our game birds are even worse offenders.

In approaching our problem, therefore, it would seem just and equitable for us to give little thought to those species that do not destroy more than a potential 10 per cent, except under strictly local conditions.

QUESTION IS REGIONAL ONE

Species must also be considered regionally. For example, the grape growers of California recognize that the quail is one of the most destructive species, and some would like to have these birds exterminated in their vineyards. New Hampshire paid \$14,000 to those who have suffered from grouse depredations in their orchards. The great horned owl is destructive to game and poultry in the east, but in the far western states is most beneficial as a destroyer of such pests as jackrabbits, cottontails and pocket gophers.

RODENTS VERY DESTRUCTIVE

Economic biologists have learned that rodents often are naturally, or seasonally, very destructive to game and poultry. The common wharf rat is one of the best examples of a carnivorous animal. In localities where the rat's natural enemies have been killed or driven away, game birds have little chance to save their eggs or young. The alien house cat, through the mistaken kindness of those who dislike to kill kittens, has taken possession of many wild areas and in the more settled localities probably does more damage to wild game and song birds than all their other natural enemies combined.

SOME HAWKS ALTOGETHER BAD

Although the Cooper and sharp-shinned hawks have a tendency to keep the fruit and grain-eating birds from becoming too numerous, when given the opportunity they destroy game birds and poultry, and consequently must be controlled.

The goshawk, a bird that periodically enters the United States when food is scarce in Canada, is one of the most notorious species destructive to game and has little to be said in its favor.

SNOWY OWL NOT CONDEMNED

Late migrations of the snowy owl brought hundreds of individuals from the north last winter, and, from examination of stomachs, these birds were found to have fed largely on the house rats. The ducks that it was supposed to have fed on had been disabled or killed by the oil menace, which is so destructive to all forms of ocean life and which is one of the serious problems to be considered by sportsmen if waterfowl and shellfish are to be preserved.

OTHER HAWKS AND OWLS

Taking the country as a whole, the duck hawk and the prairie falcon are the only other bird-eating hawks to be considered. They, however, are nowhere abundant and do not confine themselves strictly to waterfowl and upland game birds. The food of the larger, slow-flying hawks and owls, including the red-shouldered, broad-winged, rough-legged, swainson and red-tailed hawks, and the barred, long-eared, short-eared and barn owls, consists mainly of rodents and insects, which in their turn are injurious to agricultural products and game.

VALUE OF FUR BEARERS

In our effort to control we must remember that many of the predatory animals that are valuable fur bearers are rigidly protected by closed seasons in some states, and that the sale of their skins makes up a considerable part of the \$65,000,000 annually paid for native raw furs. The bear is a game animal and should be killed out of season only when destructive to live stock. The same may be said of fur bearers that support a valuable industry and at times are feeding upon rodents destructive to game.

GROUND SQUIRRELS AND COTTON RATS

A member of the Committee has been informed by the late Mr. Samuel Evans, of the Evans Game Farm in Illinois, that ground squirrels destroy more young pheasants there up to the time they are a week old than do weasels, minks and all other predaceous species. As above stated, Mr. Stoddard found that the cotton rat took 15 per cent of all the quail eggs that were destroyed by natural enemies.

The Chairman of this Committee has seen probably fifty weasels carrying mice or young squirrels, and in no instance a game bird. The marten, when at all abundant, keeps under control the red squirrel, a great destroyer of eggs and young birds.

A LOCAL QUESTION

In recommending control of those animals that are truly game destroyers, locality must first be considered. In and about game refuges or fish hatcheries, those that are naturally or by education or environment destructive to game should be carefully considered and dealt with as occasion demands. It is felt that the fur trapper can be trusted to keep the general mass of predatory fur animals under control, so that game breeders have to cope only with individuals that from time to time become troublesome.

The matter of control of enemies of game must be looked at from every angle by game breeders and sportsmen, since other important agencies enter into the problem.

MAKE HASTE SLOWLY

We must go slowly in an attempt to kill those animals of service to agriculture or valuable as fur bearers and never destroy other than the individual attacking game. In this way we secure the culprit, save the lives of those valuable to agriculture and as fur bearers, and thus hold the respect and cooperative spirit of the farmers and those interested in fur-bearing animals.

IMPRACTICAL TO LIST SPECIES

Conditions and circumstances vary so widely that your Committee finds it impossible and also undesirable to present a list of species which should be classed as destructive or to recommend definite measures of destruction. It firmly believes, however, in two fundamental principles which should govern our actions in the control of species which either generally or locally may be destructive:

First—We are opposed to bounties.

Second—We believe in local control under proper legal supervision.

(Signed)

A. K. FISHER, Chairman,

A. G. MACVICAR,

JOHN C. PHILLIPS,

ALDEN H. HADLEY,

FRANK M. CHAPMAN,

FREDERIC C. WALCOTT,

—*American Game*, January, 1928.

CALIFORNIA FISH AND GAME

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May 14, 1928.

HIGH LIGHTS OF THE CONVENTION

Deputies from all parts of the state assembled in San Francisco, February 28, 29 and March 1 for the third annual convention of employees of the Division of Fish and Game. The purpose of the convention was to secure better cooperation within the Division and to give the deputies a better understanding of the different fields of work and to enable the men to meet and to exchange ideas.

The convention was formally opened on the afternoon of Tuesday, February 28 by a welcoming address given by President I. Zellerbach. He reviewed the accomplishments of the Division stressing increased license, plenary powers, holding tanks, new hatcheries, fish distribution, radio, new moving pictures, research on disease, and screens and ladders. This was followed by a few words from Commissioner George Clarkson. Mr. Earl Kauffman, representing the sportsmen of the state, requested in their behalf, the cooperation of deputy and sportsman. Mr. B. D. Marx Greene, former executive officer, then spoke to the deputies asking them to give to Mr. Bennett, the new executive, the same willing help that he received while in office.

Mr. E. D. Bennett, executive officer, then gave a very straightforward declaration of the policy of the Division. His pleasing discussion and his feeling toward his new position won for him the confidence of all.

Mr. F. H. Vore, director of the bureau of Public Relations, explained how a deputy could use newspaper publicity to good advantage.

The convention was very fortunate in having present Dr. H. C. Oberholser, chief biologist of the U. S. Bureau of Biological Survey, who explained the

work of the survey in taking bird censuses, a nation-wide project. Mr. Oberholser's address is being reviewed at greater length in this issue.

The question of the advisability of the deputies wearing uniforms was discussed. It is now the consensus of opinion that all deputies should wear uniforms, particularly when appearing in court, and it will soon be obligatory that they do so. The color decided upon is a forest green.

Mr. Walter Welch, captain in charge of volunteer wardens, spoke briefly on the work of those under his direction and requested that cooperation be given this group of men by the deputies.

Mr. Horace M. Albright, superintendent of Yellowstone National Park and assistant director of the National Park Service, gave an address, illustrated with lantern slides and motion pictures on, "Game Conditions in Yellowstone National Park."

A highly entertaining feature scheduled for late in the afternoon was the exhibition of disarming, given by the San Francisco police athletic team. This was preceded by a very interesting talk given by Captain Duncan Matheson, of the San Francisco Police Department.

The annual banquet was held the evening of the 28th at the St. Francis Hotel. The Division was honored by having present Governor C. C. Young. The Governor voiced his appreciation of the excellent work being done for conservation by the Division and assured all those present that he was heart and soul for the program as outlined by the Division. The rousing talk by the Governor made the men feel that they were fellow workers in the business enterprises of the state.

Mr. A. R. Heron, head of the Department of Finance, was also a guest. He assured the Division employees of the support of his department in their efforts to preserve the state's natural resources. Motion pictures taken by Jay Bruce, state lion hunter, and other educational films terminated the evening's entertainment.

The program was opened the following day, February 29, by a talk on the subject of trout given by J. O. Snyder of Stanford University. This address is also reproduced in this number.

Dr. H. C. Bryant, director of the Bureau of Education reviewed briefly the more interesting books, which are available in the library of the Division.

A clear explanation of the intent and uses of the radio together with a demonstration of the instruments was made by H. J. Breuer.

The work of surveying and posting refuges, made possible by the increased license fee and deer tag license money, was explained by J. S. Hunter, assistant executive officer. Mr. Hunter's address is found elsewhere in this magazine together with the very interesting and informative talk of Dr. K. F. Meyer on "Facts You Should Know About Animal Diseases."

The captains were then given an opportunity to meet and to discuss with their deputies the work being carried on in their respective counties.

On the afternoon of the 29th, an innovation was introduced into the convention in the form of a "short course of instruction." Thirteen able and competent instructors gave half-hour lectures on interesting, pertinent subjects of value to the deputy in his work. The deputy was granted the privilege of attending the lecture in which he was most interested. The lecture on "First Aid" given by Dr. M. J. Seid was required of all.

The following morning the men assembled at the Presidio for a pistol shoot. A perpetual trophy, a silver cup, presented by President Zellerbach, was the reward offered. Deputy Taylor London, of Requa, one of the newest and youngest employees, carried off all honors in this event with a score of 96 out of a possible 100.

The program for the closing afternoon began with a talk on "Evidence in Game Cases—Relation to the Court" given by Eugene D. Bennett.

Joseph Dixon, economic mammalogist of the Museum of Vertebrate Zoology, University of California, spoke on a much discussed subject, "The Conservation of Predatory Animals." In this talk, Mr. Dixon paid a very fine tribute to the work of Jay Bruce, state lion hunter.

This address was followed by the answering of questions which had been placed in a "Question Box." The majority of the questions were on the interpretation of the fish and game laws. After discussion the meeting adjourned and the convention closed.

The Division of Fish and Game wishes to take this opportunity to thank the Extension Division of the University of California for the use of the University Extension Building, in which all meetings were held; also to extend its thanks to Dr. Oberholser, Mr. Albright, Captain Duncan Matheson, the San Francisco police athletic team, Dr. M. J. Seid and Mr. Dixon for their presence and assistance in making the third annual convention of this Division a success.

The following resolution was adopted:

Whereas, E. W. Hunt has been with the Fish and Game Commission, under the able leadership of our old war horse W. H. Shebley, in the Fish Culture Department, for the past forty years, without practically losing a day; and

Whereas, We all fully appreciate the invaluable services rendered by him for and on behalf of the Fish and Game Commission; and

Whereas, He is now and has been seriously ill and unable to attend to his duties in the care of the little fishes as field superintendent; now, therefore, be it

Resolved, That we here in this convention assembled all extend to him our profoundest sympathy with the strongest hope for his speedy recovery; as well as an early return to his work among us; and be it further

Resolved, That this resolution be spread upon the minutes of this convention, and that a copy thereof be sent to E. W. Hunt.

From his associates, deputies and assistants of the Fish and Game Commission at their Third Annual Convention at the University Extension Building, San Francisco, California, March 1, 1928.

GAME FARM WILL EXPERIMENT WITH NEW BIRDS

A state game farm should not only rear and plant pheasants within the state but it should determine experimentally what other game birds are suitable for introduction into those parts of California where native game has disappeared. Within the past few months, the State Game Farm at Yountville has received a shipment of three different kinds of tinamous from South America and a shipment of bamboo partridges from the Orient. The tinamou is the most notable upland game bird of South America and undoubtedly it is of high value for food, but whether the species is attractive as a mark for the gunner and whether it can be successfully acclimated in the cultivated sections of the state is yet to be determined. The test now being made is to discover whether or not these foreign game birds can be successfully reared in numbers on a game farm.

REFLOODING OF KLAMATH LAKE CONSIDERED IMPRACTICABLE

Apparently protests regarding the drainage of lower Klamath Lake came too late to be effective. Ten years after the lake was drained, sufficient interest in a reflooding program led to the raising of a sum of money for a survey of the situation. After a thorough study by a competent engineer, the difficulties in the way of reflooding appear insurmountable. More than 80 per cent of the water of the Klamath River has been appropriated, leaving insufficient for the reflooding of the lake. The Bureau of Biological Survey has announced the abandonment of the reflooding project. At the same time

this government bureau states that a federal refuge will continue to be maintained at lower Klamath Lake, where there will always be found some areas of water.

With the abandonment of the Klamath Lake project, attention has been centered on restoration work on the Bear River marshes, where the state of Utah has already diked and made into a public shooting grounds some 30,000 acres of marshland. There is additional area which can be suitably reclaimed to furnish a refuge for ducks. The state of Utah by legislation consented to the establishment of a federal project which will cover more than 100 square miles of fresh water marshland. A bill now before Congress is to provide funds for this development. This area is both valuable as a breeding ground and as important concentration area for ducks during their migration. The project also will help to alleviate serious inroads due to "duck disease."

GAME WARDENS' DUTIES MULTIFARIOUS

In times past, the average picture which came to the mind at the mention of "game warden" was some political favorite who spent his time talking in the corner grocery or in a near-by saloon. Nowadays a California game warden is a respected man of the community, always on hand to run down a violator and equipped with underground channels of securing suitable information. But this is not all. He is expected to be a naturalist and public speaker and able to handle an educational campaign. To many, efficiency as a police officer and as a lawyer and prosecutor come more easily than the role as scientist and educator.

The standard has continually been raised; unfortunately, not so the salaries.

JOHNSON BILL WOULD PROVIDE WILDFOWL REFUGES

At the request of sportsmen, Senator Johnson has introduced into congress, Senate Bill No. 2718. This bill shows the genuine effort being put forth to secure adequate feeding and resting grounds for waterfowl in California. It authorizes the Secretary of Agriculture to acquire by purchase, gift or lease such areas of land, or land and water not used for agricultural purposes, as may be determined suitable for use as a migratory bird refuge. A sum of \$1,000,000, or so much thereof as may be necessary, is asked to carry out the provisions of the act.

KLAMATH RIVER SALMON EPIDEMIC

Great numbers of king salmon died on the Klamath River during the month of

November, 1927. In every respect, conditions were like those during the epidemic of 1922. The mature fish were attacked, particularly the females, whereas the younger fish appeared to be resistant. Dr. George A. Coleman, biologist, after an investigation, called attention to the following facts:

1. The dead fish were in especially fine physical condition. However, the gills were found covered with a heavy coating of blue-green algae and diatoms. This apparently prevented free circulation.

2. The water was found heavily charged with gases. An odor accompanied the vegetable matter in the water.

3. Analysis showed an unbalanced condition in the water: a total lack of zooplankton and a superabundance of blue-green algae which indicate a condition of stagnation and decay of vegetable matter.

4. The presence of deleterious gases in the water and the superabundance of algae and diatoms sufficient to produce asphyxiation is the probable explanation of the epidemic.

CROWDING AND THE BIRTHRATE

That there is a possibility of basing the toll taken by the hunter on known facts regarding birth rate and death rate is attested by recent findings of biologists. In a recent number of *The Quarterly Review of Biology*, Dr. Raymond Pearl discusses growth of populations. He points out that experimental study is bringing to light broad facts regarding general biology of population growth. Organisms of the most diverse kinds ranging from bacteria and yeast to man are found to follow in their growth a particular type of mathematical curve. The two more interesting laws supported by investigations are:

1. Death rate slowly increases with density of population until a certain point is reached and then increases rapidly.

2. On the other hand, birth rate increases markedly at first with increased population but later is but slightly affected.

With these laws before us, light can be shed on results to be expected when in planting trout we crowd the population into narrow limits. Under such circumstances, provided a certain density of population is reached, the death rate increases enormously.

Another point of view: When we continually take a certain toll of quail on an area, we automatically increase the birth rate. In other words, nature has so arranged matters that greater toll of adult individuals means increased birth rate. Experiment has shown that such an in-

crease need not await several years time, but appears rather quickly.

Admittedly such a discussion is rather technical, but the greatest advances in the future are going to be along lines which have taken into consideration basic biologic laws.

THE ANNUAL KILL OF DUCKS

The sportsmen's column in a metropolitan newspaper has recently published the number of ducks killed by various sportsmen during the open season. It is suggested that 400 birds during the season is a high average for a member of a gun club. Since we have yet to have a means of taking the census of the annual kill of ducks, every opportunity of securing a basis for such a computation is utilized. If we knew what the average kill of the

museum not only provides proper labels but furnishes a lecturer whose duty it is to take groups of school children through the museum. The more worthwhile exhibits are thus pointed out and properly described. Yet another departure is to be found in the field trips which are offered by certain museums. The San Diego Museum of Natural History reports that during 1927 thirty-two trips were taken to various localities, sixteen being made on foot, fourteen in chartered buses and two in chartered boats. The object of these field excursions was to furnish opportunity for a first-hand study of natural history. That this type of educational work is appreciated is evident from the splendid attendance—2810, an average of nearly 100 per trip. Educational work of this kind is fast building

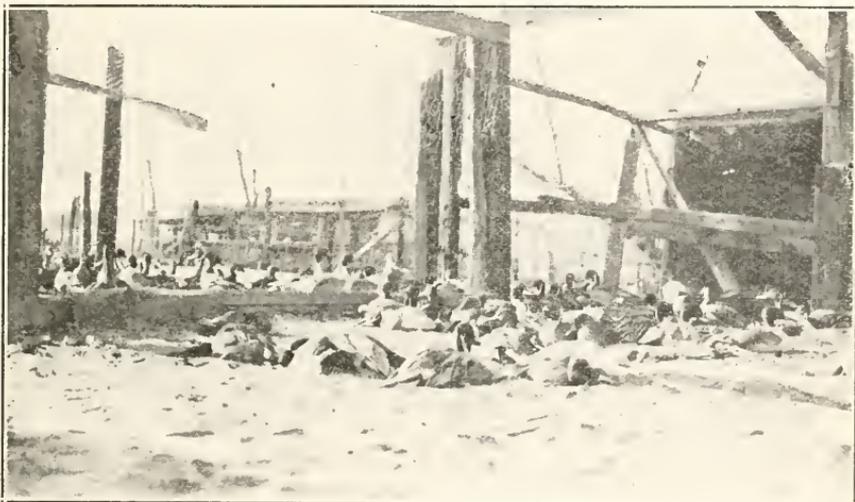


FIG. 38. Patients at the receiving pens, "duck hospital," near Buena Vista Lake, February 11, 1928. Photograph by Roy Ludlum.

gun club man is and the total number of members in the state, there would be a means of estimating the numbers of ducks killed on the grounds. Then if a similar computation could be made for the kill of the independent hunter, some basis of computation would be at hand. As it is the old guess of 1,000,000 ducks per year must hold. Meantime, it is worth while looking forward to the day when a census similar to that provided by the new deer law will be available.

MUSEUMS HELP IN NATURE EDUCATION

Originally museums were static institutions. Exhibits covered with dust awaited visitors and few labels there were to help in understanding the displays. A modern

up an appreciation of natural resources which will mean much in future conservation work.

BIRD BANDING ON LAKE MERRITT

The U. S. Biological Survey, through the agency of E. W. Ehmann, A. D. Trempe and H. P. Gray, trapped and banded between 1100 and 1200 ducks on Lake Merritt, Oakland, California. This is the largest number ever banded at one time. Birds banded at Lake Merritt have been taken later in Alaska in the north, and San Diego in the south.

SALVAGING DUCKS ON BUENA VISTA LAKE

After being dry for several years, some 23,000 acres were overflowed in Buena

Vista Lake during the spring of 1927. This was the only large body of open water in the southern part of the San Joaquin Valley and apparently offered ideal conditions for waterfowl. Conservative estimates indicate that some 80,000 ducks were killed during the open season. A census taken about a week after the season closed indicated that, at that time, approximately 125,000 ducks were on the lake.

However, although conditions appeared to be ideal for ducks, "duck sickness" made its appearance early last fall. The cause of the disease has not been discovered. Investigations have shown that it is not the so-called "alkali poisoning." So far no communicable organism has been found to be the causative factor.

Through the courtesy of the Western Water Company, pens and other facilities were furnished on the property of this company near the lake. Sportsmen from local organizations at Bakersfield and Taft cooperated with our deputies, and some 700 ducks that were unable to fly, including sick and crippled birds, were collected. Many of the birds so collected were in a critical condition. When first placed in the pens, some would lie prostrate for several hours. Some of these died, but most of them began to drink and eat within twenty-four to forty-eight hours. After the birds began to drink and eat, recovery was usually rapid and it became necessary to separate the birds and segregate them in pens containing others in the varying stages of recovery to prevent

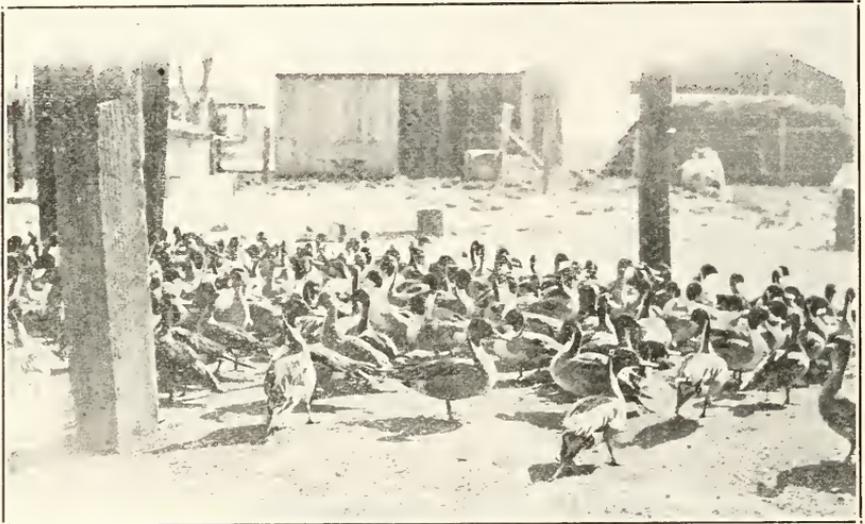


FIG. 39. Evidence that treatment was effective. Recovered patients at the "duck hospital" near Buena Vista Lake, February 11, 1928. Photograph by Roy Ludlum.

The Division of Fish and Game, in cooperation with the Hooper Foundation for Medical Research, is now making preparations for a thorough study of the disease and it is believed that considerable progress will be made during the coming year.

In the case of Buena Vista Lake, as in certain other instances, it was found that a large percentage of sick birds would recover when removed from the affected area and placed on different water and feed. As a considerable number of sick and crippled ducks were on the lake after the close of the season, this Division undertook to establish a "duck hospital" and salvage as many as possible.

the stronger birds from injuring the weaker ones. As soon as the birds were sufficiently recovered, they were banded and liberated. During the latter part of February about 500 were released. The ducks remaining in the pens will be liberated as soon as they recover.

The program at Buena Vista Lake has already effected the recovery of at least 500 ducks and will add this much to the numbers that will make the flight to the northern breeding grounds. In addition, it has made possible the banding of a large number of birds, the returns from which will add materially to our information on migrations and lines of flight.

Work at Buena Vista Lake will be continued. The sportsmen of the state can be assured that the Division of Fish and Game will continue its investigations to

A REMARKABLE DISPLAY OF WILDFOWL

In many ways California is particularly suited for experiments in breeding vari-

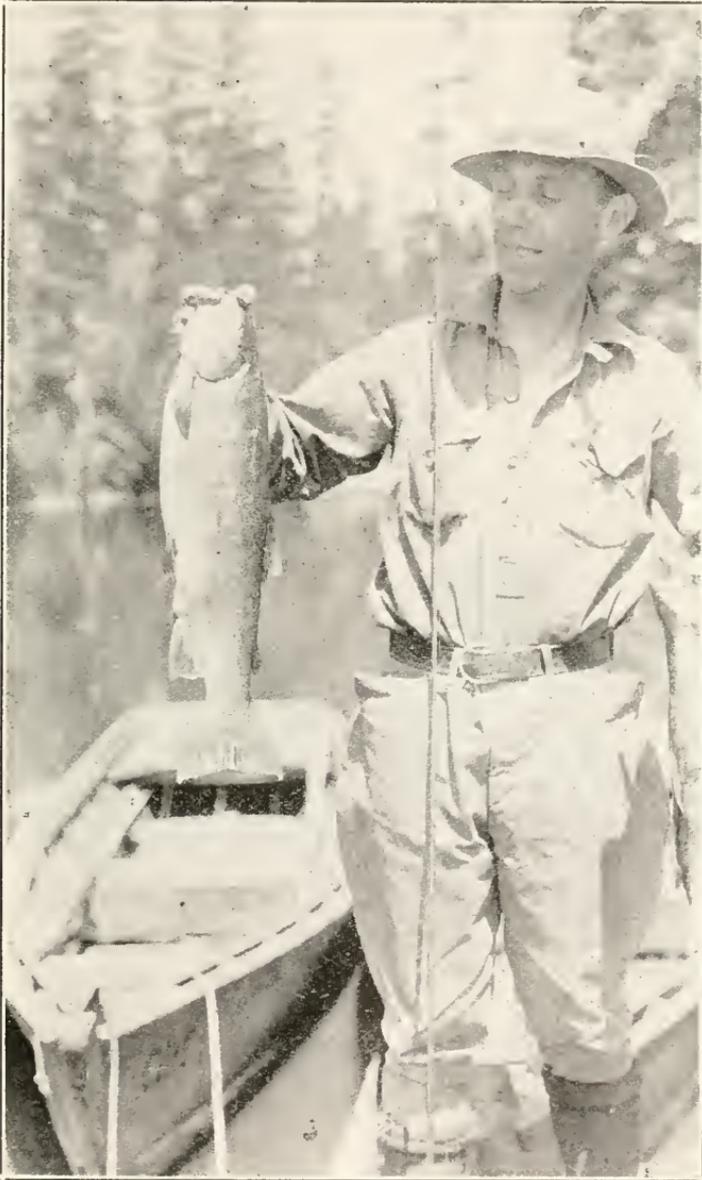


FIG. 40. A Lake Almanor rainbow trout, a limit in weight.
Photograph by Perc Meakin, August, 1927.

the end that all possible information regarding the disease of ducks will be secured and that the mortality will be reduced to the minimum.

ous kinds of birds. Persons who follow aviculture as a hobby can doubtless furnish a very large list of birds which have never been successfully bred elsewhere.

Two in California have recently turned their attention to worthwhile experimental work along the lines of game breeding. Mr. F. E. Booth, a well known business man of San Francisco, has established a large game farm near Woodland, in the Sacramento Valley, and is specializ-

this collection is not the finest to be found anywhere in the world, it certainly takes second place! Among rarities are the Paradise shelldrake, the Abyssinian yellow-bill, Baer's pochard and the Magellau and Egyptian goose.

Excellent conditions for breeding having



FIG. 41. Working the lily pads for black bass, using a fly rod. Near Modesto. Photograph by Perc Meakin.



FIG. 42. Landing a black bass near Modesto. Photograph by Perc Meakin.

ing on various kinds of upland game birds. Mr. J. V. DeLaveaga, also of San Francisco, has interested himself in the propagation of wildfowl, not for profit but for his own pleasure. On his estate in San Mateo he now has fifty-eight different varieties of ducks and more than twenty different varieties of geese. If

been furnished, Mr. DeLaveaga can boast of splendid success. Even some of the rarities noted above have successfully reared their young. Although the rearing of wildfowl is largely a hobby with Mr. DeLaveaga, yet in reality he is contributing a great deal to science. His name appears often in that monumental work,

"The Natural History of Ducks," by John Phillips. Should someone with means undertake the breeding of song birds on the same scale as that undertaken a number of years ago by Judge H. W. Henshaw, three fields of endeavor, rather than two, might thus be covered.

ACCOMPLISHMENT OF A PRIVATE GAME FARM

About five years ago, Mr. A. P. Hoffschneider of Soulsbyville, California, became interested in the rearing of pheasants. He secured a breeding stock and about four years ago began liberating the surplus in the vicinity of his ranch.

Gambel quail have been found as easy to rear as the valley quail. Mountain quail, thus far found very difficult of handling, have also produced young successfully.

DESERT MOUNTAIN SHEEP

Life on desert ranges is not easy. Scant food supply makes desert animals sturdy of limb; lack of suitable hiding places increases danger from predatory species and this increased danger must be cared for by keen eyesight and sense of smell. While taking motion pictures of mountain sheep in Inyo County, Mr. E. S. Cheney had under observation eleven ewes. By October 1, each of these had



FIG. 43. The mining dredger is a menace to fish. The picture shows how completely the Trinity River was blocked by dredging operations in 1926. It is evident that no migratory fish could successfully pass such an obstruction during low water. Photograph by G. O. Laws.

The birds have become established and there are many reports of successful nesting. Meantime, he has continued to rear large numbers of pheasants and during the past season liberated 168 more.

On this same game farm some 800 quail have been reared in the past four years. Mr. Hoffschneider attributes his success to the food furnished: weed seeds, eggs and lettuce. In one instance this past season, a bantam reared twenty-five out of thirty quail. Even bobwhite quail have been successfully reared and at least twenty-five pairs have been liberated.

lost their lamb, although previous to this time, several had been followed by their young. The mountain sheep of desert ranges have not increased greatly since total protection was given them. It is difficult to determine the factors concerned which prevent increase. In the Rocky Mountain region many mountain sheep have died from "lungworm," a common ailment of domestic sheep. The main point is that after long years of protection, mountain sheep are not sufficiently abundant to warrant an open season.

JAPANESE SPORTSMEN ORGANIZE PROTECTIVE ASSOCIATION

The Japanese, more than immigrants from other foreign countries, after settling in California, quickly become interested in fish and game resources. A few years ago, a number of law violations were traced to the Japanese, but in more recent years most Japanese have carefully adhered to the game laws.

At Watsonville recently, the Pajaro Valley Fish and Game Protective Association was host to the Japanese sportsmen of the Pajaro Valley. This was the initial step in the formation of a Japanese fish and game protective association. More than forty Japanese sportsmen

has been no evidence of a lessened supply of deer.

Pennsylvania has attempted to put through a bill which would allow the killing of does. However, this met with a great deal of opposition and it failed of passage. Forced to take action of some kind to reduce the number of does, the Pennsylvania Commission proposed to send expert marksmen into the deer country and permit them to kill an unlimited number of does. As in the case of does illegally killed, the carcasses were to be turned over to hospitals. This also met with opposition on the basis that sportsmen who purchased hunting licenses should be allowed to kill the does if it



FIG. 44. A California deputy on patrol. Deputy William Armstrong of Vallejo, although an old-time law enforcement officer, keeps abreast with the times.

attended the meeting. Such an organized group is in a position to do much in the line of education and in the protection of game birds and fish.

THE BUCK LAW

New York has been stirred regarding the numerous reports that does are so numerous as to endanger the deer population of that state. Other states have listened to those who claim that there is danger in killing bucks only. Accurate information, however, has not yet been gathered. Until then it seems best to thoroughly test out the buck law before advocating a change. Certainly the buck law has been responsible for less hunting accidents and here in California there

was intended to have a wholesale slaughter.

The buck law in California has many staunch defenders.

ACCOMPLISHMENTS OF A WOMAN GAME WARDEN

California's only woman game warden, Mrs. Walter B. Sellmer of Fairfax, Marin County, has arrested thirteen people for the violation of the fish and game laws since she pinned a special deputy badge on her blouse, November 22. In each case a fine has been secured and this attractive protector of the state's wild life can point with pride to a goodly sum for fines ranging from \$15 to \$50.

It may well be said that the ink had hardly dried on Mrs. Sellmer's commission before she arrested a San Franciscan at Stinson Beach for shooting game from a moving automobile. Only a few days after this, her activities brought to the bar of justice another bay city law breaker with a bag of illegally taken song birds. Close on the heels of this case followed another, involving two men who had caught undersized crabs and netted undersized striped bass.

Nor has Mrs. Sellmer been negligent in her attention to less spectacular viola-

two deer slayers who so strongly felt the urge to take life that they shot a doe in the Marin woods. Fearful of exposure, the killers cached their illegal game in a tree and wandered on in the manner of those recreation bent, awaiting the cover of darkness. Their capture came about only after a long vigil and real commendable courage and distinguished service on the part of Mrs. Sellmer.

STILL GAME TO EAT

Judging by the last report of the New York Conservation Commission, the taste for game is being at least partially supplied by importation. During 1927, importation agents handled and tagged in the port of New York, 133,909 pieces of domestic and imported game. Game tags to the number of 25,200 were sold to private game preserves of the state. The game tagged consisted of deer, elk, partridge, pheasant, quail, mallards and ducks, together with certain game species from South America.

WILD QUESTIONS

(Questions on the wild)

1. What rodent in California rears the smallest number of young?
2. What California fish is considered the largest member of the minnow family?
3. What large game mammal most successfully withstands open desert conditions?
4. Which of the following are typical diving ducks: canvasback, baldpate, pintail, ruddy duck, mallard, lesser scaup, surf scoter, redhead, shoveller, cinnamon teal?
5. Where may one find muskrats in California?
6. Are wood rats good to eat?
7. What kind of goose has been found nesting at Lake Tahoe and other mountain lakes?
8. Where may California's largest kind of deer be found?
9. What is the proper common name of "black-spotted trout"?
10. Did the buffalo ever range into California?

BOUNTY PAID ON MUSKRATS TO SAVE IRRIGATION DITCHES

The Imperial Valley Irrigation District in Imperial County, which controls and maintains 2400 miles of highline canals distributing water used for irrigation purposes in Imperial Valley, reports that over \$10,000 has been paid in bounties for muskrats taken during the twelve-



FIG. 45. Mrs. Walter B. Sellmer, California's first woman game warden. Mrs. Sellmer, as a volunteer warden, has made a number of important arrests.

tions. Through her untiring efforts a trapper, plying his trade without a license, and five hunters, hunting without licenses, have felt the stern arm of the law. Two of these men were found within the Tamalpais Game Refuge openly violating the law of the sanctuary. Another proved to be a mere youth who is now serving a six months' probation.

Mrs. Sellmer's most recent case was made in conjunction with Captain Sellmer and resulted in the apprehension of

month period ending March 1, 1928. Owing to damage to levees and loss of water resulting from the habits of these rodents, constant warfare is being waged by trappers employed by this irrigation district, which offers 25 cents per tail taken from each muskrat killed.

VIEWPOINT CHANGES ON ROUTE TAKEN BY DUCKS

In some manner or other most of us have believed that ducks fly north and south on their migrations. Ever since banding was instituted, it has been known that ducks and geese from central Canada sometimes winter in the great valleys of California. Numerous ducks banded on the Bear River marshes in Utah have been taken in California. Now comes additional dependable evidence of this kind. Technical Bulletin No. 32, U. S. Department of Agriculture, is devoted to "Returns from Banded Birds, 1923-1926."

A glance over the returns of various ducks again shows a criss-cross rather than a direct north and south flight. At least six pintail ducks banded in the middle west in Illinois, Iowa, Kansas and Missouri have been taken in California. Four green-winged teal ducks banded on Avery Island, Louisiana, in 1922 and 1923 were taken as follows: Alvarado, Butte Creek, Dos Palos, Yolo County, all stations in California. These birds may well have returned to breeding grounds in the north and taken a westward flight the following year. In three of the four instances, however, they were taken the following winter in California, and the exception two years later.

Two shoveller ducks banded at Klamath Falls, Oregon, were retaken in the Sacramento Valley; in one instance, three months later, and in the other, one year later.

Nineteen mallard ducks banded at Irvington, California, were retaken at the same location a year or two later. One only, of twenty-nine banded, made a long distance flight. This one was taken over a year later at Walla Walla, Washington.

A pintail duck banded at Irvington, January 27, 1926, was taken May 9, 1926, at Rampart, Alaska. Other birds banded at the same location were taken scatteringly over the southern half of the state.

Several pintail ducks banded on Lake Merritt, Oakland, were recovered in the Sacramento Valley the following winter. One was taken east of the Sierra in Honey Lake Valley, and one at Ocean Park, Washington.

SCHOOLS TAKE INTEREST IN CONSERVATION

A few months ago a leaflet was prepared giving salient facts regarding the

administration of fish and game resources in California. Given out at the State Fair, it proved effective in stirring interest in the reader. After a lecture at Fortuna High School some of these leaflets were left with the principal. An interesting test was arranged by the principal covering the facts in the leaflet and those furnished by the lecturer of the Division of Fish and Game. Believing that readers might be interested in both the leaflet and the list of questions, they are both appended.

DEPARTMENT OF NATURAL RESOURCES

Division of Fish and Game

Pointed Paragraphs on Fish and Game Administration

In the reorganization of the State government, the Fish and Game Commission now becomes a Division of the Department of Natural Resources, which Department also has jurisdiction over three other divisions—Forests, Parks, and Mining. The Division of Fish and Game is administered by a Fish and Game Commission of three non-salaried members appointed by the Governor. The Fish and Game Commission appoints an executive officer who handles all of the activities of the Division of Fish and Game under the direction of the Commission.

All of the work of the Division in administering and protecting wild life resources of the State is supported solely by hunting and angling licenses, fines imposed by the courts for violations of the fish and game laws, and the licenses and privilege taxes paid by commercial fishermen and fish cannery.

The Division of Fish and Game now owns and operates 18 hatcheries and 20 egg-collecting stations. It has under construction at the present time four new hatcheries. The hatchery at Mt. Shasta is the largest in the world. It has 56 ponds and 5 hatchery buildings and is equipped to handle over 20,000,000 trout and salmon. The egg supply of trout is taken partially from brood fish reared and held at the Mt. Shasta Hatchery and partially from artificial traps set in streams and lakes in which mature wild fish are taken and spawned.

The Division of Fish and Game has a patrol force of 125 regular deputies and about 400 special deputies, in addition to the Commercial Fisheries patrol. These deputies work under the direction of Captains. The Captains report to Assistant Patrol Chiefs—one each in the northern and southern districts of the State. The Assistant Patrol Chiefs report to a Chief of Patrol.

The Division has launches and speed boats for patrol on the waters of the bays and rivers of the State and is increasing their numbers as funds permit.

This year, for the first time, the Division is doing its own planting of young fish under the direction of a Supervising Captain. The fish are now consigned from the hatcheries to the Captains of Patrol throughout the State who meet the shipments and see that they are properly planted. The lakes and streams to be planted were determined in advance

by the patrol force, acting in conjunction with the Department of Fishculture.

By next fish planting season the Division hopes that it will be able to eliminate to a very great degree the movement of small fish by fish cars and plant directly from adjacent hatcheries by truck.

Serious effort is being made to survey both from physical and biological standpoints all lakes and streams of the State with a view of determining what waters, barren at present, will sustain fish life. If the biological survey shows these waters to be devoid of food for fish, the food will be furnished and in a few years many extra lakes and waters will be added to our angling area. It is estimated that there are 2000 barren lakes in California at present.

The Commercial Fisheries Department of the Division has charge of all affairs relating to commercial fishing operations in the state. The magnitude of its work can be judged from the fact that San Pedro is now the largest fishing port in the United States and Monterey the third largest. This Department has two patrol boats—one at San Pedro and one in Monterey Bay. It has a force of deputies patrolling the coast and cannery inspectors checking canning operations. In addition, this Department maintains at San Pedro a laboratory for research where it is doing constructive work of the most advanced kind to make determinations as to the supply of fish and to aid in framing legislation to prevent depletion.

The Division has recently inaugurated a Bureau of Research which handles all problems of bird and animal diseases and statistics. The statistical operation of the new deer tag law comes under this Bureau and for the first time California, at the close of this present season, will have available full statistics as to the total number of deer killed, their classification and abundance. Scientists are being added to the Bureau as fast as possible. We now hope to be able to cope successfully with any form of disease which breaks out among our wild life.

The Bureau of Education has been greatly augmented by added lecturers, moving pictures and other methods of disseminating information on our wild life. It is planned to carry this message to the schools and to adults under the maxim that "an ounce of prevention is worth a pound of cure." In this connection it might be well to emphasize the thought that the Division of Fish and Game frowns upon any technical cases made for violation of the law, but believes in educating the public so they will not violate the law. This theory, first put in practice about a year and a half ago, has proven that the people of the State as a whole are certainly back of the new thought.

The Bureau of Hydraulics handles the question of the installation of fish ladders over dams to aid migratory fish in going up-stream for spawning purposes and the installation of screens in irrigation ditches and canals to prevent our game fish from being stranded. This Bureau also has charge of pollution matters. Strenuous efforts are now being made along all three of these lines for the Division realizes fully that it is a waste of money to propagate our fish and plant

them unless proper safeguards are maintained to rear them to maturity.

The Division maintains at Yountville, in Napa County, one of the largest single game farms in the world, the construction of which was completed in the summer of 1926. There are eight acres under wire, covering 580 pens. There the Division raises pheasants, quail and partridges and is experimenting with other wild game birds. Last year over 3,000 pheasants were distributed throughout the state and this year approximately 9,000 will be liberated. The first brood stock of Hungarian partridges has been reared. The Division has inaugurated a system of planting game birds unique in the United States in that the liberating is done by our own men by the use of our own trucks, and only on areas set aside as sanctuaries on which all hunting is prohibited until such time as the Legislature shall declare an open season. Plants are made in numbers of not less than 100 birds and the areas contain not less than 10,000 acres. A second game farm is now proposed for Southern California and will be built as soon as a site is selected and in time for next year's operations. Next year should see the liberation of approximately 24,000 pheasants.

Following are a few statistics relating to fish and game in California:

In 1926, there were 256,629 angling licenses sold.

In 1926, there were 252,017 hunting licenses sold.

California has 27 state game refuges containing about 2,000,000 acres of land. Another million acres are contained in National Parks, Monuments and Federal Bird Reserves. Hunting is prohibited on all game refuges. A crew of engineers has just commenced to survey and post all of these refuges.

In the last biennial period, 1924-26, there were planted in our streams from our hatcheries 59,000,000 trout and 14,000,000 salmon.

It is estimated that there are 26,000 miles of fishing streams in California and 10,000 lakes, with an area of over 800,000 acres.

The new hunting license act provides that one-third of all revenue from hunting licenses must be spent in the acquisition of land for game refuges and public shooting grounds. This will give us a chance to obtain refuges for migratory waterfowl to offset the drastic loss of loafing grounds caused by reclamation projects and the drying up of former flooded areas.

It is estimated that there are at present 150,000 square miles on which hunting is permitted.

Test Given to Fortuna Union High School Students

Test on Visual Instruction and Division of Fish and Game Circular.

If the statement is true place a (+) sign after it. If it is wrong place a (-) sign after it.

1. The members of the Fish and Game Commission are elected by the people of the state at a regular election. ()

2. The legislature makes an annual appropriation to support the activities of the Fish and Game Commission. ()

3. The Mt. Shasta Hatchery which is owned and operated by the Division of

Fish and Game is the largest hatchery in the world. ()

4. Some of the egg supply comes from fish reared for this purpose by the hatchery experts at the hatchery. ()

5. The Division of Fish and Game is attempting to have a survey made from physical and biological standpoints to determine what bodies of water contain fish food at the present time. ()

6. A Bureau of Research which handles all problems of bird and animal diseases and statistics has its headquarters at San Pedro where the Department has established a laboratory for this work. ()

7. The Division of Fish and Game believes in educating the public so that they will not violate the law. ()

8. The Fish and Game Commission is a Division of the Department of Natural Resources. ()

9. The Bureau of Education also handles the question of the installation of fish ladders over dams to aid migratory fish in going upstream for spawning purposes. ()

10. A second game farm has been built and is now operating in Southern California. ()

Underscore the correct answer.

1. The Fish and Game Commission of California is composed of 2, 3, 5, 7 members.

2. The Division of Fish and Game now owns and operates 12, 14, 16, 18 hatcheries.

3. The Division of Fish and Game operates 10, 15, 20, 25 egg-collecting stations.

4. In 1926 there were more (angling) (hunting) licenses sold in California.

5. California has 9, 18, 27, 36 state game refuges.

6. In the last biennial period, 1924-26 there were planted in out streams from our hatcheries (14 million) (59 million) trout and (14 million) (59 million) salmon.

7. The new hunting license act provides that $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{2}$ of all revenue from hunting licenses must be spent in the acquisition of land for game refuges and public shooting grounds.

8. Through scientific management by experts at Napa the production of game birds is 2, 3, 4, 5 times greater than it would be if these birds were left to nature.

9. It has been estimated that there are (10,000) (26,000) miles of fishing streams in California and (10,000) (26,000) lakes.

10. The construction of the game farm in Napa County which is one of the largest single game farms in the world and contains eight acres under wire, covering 580 pens was completed in 1916, 1921, 1926.

DANGERS ATTENDANT UPON INTRODUCTIONS OF FOREIGN BIRDS

Success in the acclimatization of various game birds is leading to numerous attempts at supplying a substitute for native species. The average sportsman becomes enthusiastic at the mere mention of bringing in some famous game bird of Europe or Asia. Seldom does he stop to listen to the warning issued by biologists that introductions are always dangerous; first, because of resultant competition

with native species; and second, because of the danger of introducing disease. Though in California a policy has been decided upon, yet it is fair that the opposite point of view be recognized. Even if committed to introduction of worth-while species, assembling of all facts bearing on this mooted question is desirable.

A recent article by P. A. Taverner which appeared in *The Canadian Field Naturalist*, October, 1927, discusses the first of these dangers as applied to the competition between the Hungarian partridge and the sharp-tailed grouse. In several of the provinces of Canada, the Hungarian partridge has become well established; whereas, the sharp-tailed grouse seems to disappear in these areas. Mr. Taverner ends his discussion with the following paragraphs:

"Of course all this discussion is now purely academic. The Hungarian Partridge is with us, probably to stay, and it will spread just as far as ecological conditions are favorable, whether we like it or not. If it has introduced disease into native stock, that mischief is done, and is ineradicable now and even the total extermination of the original host would do no good now or at any succeeding date. However, the subject is of great interest and should be closely watched as a guide to policies of the future if for no other reason.

"The disturbing thought is, that no experience of this sort in the now is of much help in the future. Warnings of evil become buried in past literature and unknown to succeeding advisors who have most weight in such matters. In spite of all the disastrous results of introductions in the past, the English Sparrow and the two Starlings in this country, the rabbit in Australia, the Mynah in Hawaii and the dozens of other cases that could be cited, attempts at acclimatization and introduction go merrily on by local organizations who know not the dangers and pitfalls that the past has demonstrated. It is well that control of such work be considerably strengthened. There are undoubtedly forms of life to be found elsewhere in the world that would be valuable acquisitions to this country, but the danger of their introduction is great and should not be entered upon without careful consideration as to whether the probable advantage is worth the risk."

In the same number of *The Canadian Field Naturalist*, is an article by L. B. Potter on "The Partridge Versus the Sharptail," in which he cites at least four observers who report conflict between these two species in which the Hungarian partridge was always a winner. He sums up his evidence by saying:

"As a game bird no doubt the Hungarian Partridge is all that its advocates claim it to be. But there is a large, and I believe increasing number of farmers, the writer included, who regard the prairie chicken with special affection, to be encouraged to come around the farm buildings, especially in winter when so few of our birds are with us."

FUR RESEARCH AT UNIVERSITY OF MINNESOTA

With Minnesota one of the leaders in the fur industry, the University of Minnesota has established a research station to further the project in the state.

The station, established at the university by the Bureau of Biological Survey of the United States, will study the diseases of fur-bearing animals, principally those in captivity on fur farms.

Dr. Winford P. Larson, head of the department of bacteriology, says the university was chosen as a site for the station because of the success of independent investigation on animal distempers that had been made by scientists in the medical school.

In establishing the station at the university, the federal government has provided an annual budget of \$7,500 for five years.—*The Fur Journal*, January, 1928.

COYOTE NOT STRICTLY CARNIVOROUS

The examination of the stomach contents of carnivorous animals often dispels existing conceptions as to their food habits, as well as proving beyond doubt that a certain animal does certain things that popular opinion does not credit him with doing. The coyote is an outstanding example of this fact. Classed as carnivorous, and generally presumed by the majority of people who are interested in the animal to be all that the name carnivore stands for, it is far from being strictly a flesh eater. As a matter of fact, during the proper season in certain localities, coyotes may abstain from seeking a diet of flesh and subsist, if not entirely, at least nearly so, upon grapes, melons, figs, prunes, dates and manzanita berries. The fact of the matter is that a coyote may, and often does, constitute as great an economic menace to the vineyardist, melon and prune raiser as he does to the sheep and poultry man, because of his fondness for this sort of food. There is abundant and unquestionable proof that such is the case, in the form of records of the stomach contents of every coyote that is captured by the predatory animal control forces of the federal and State Department of Agriculture. These records show that at certain times of the year the animal

in question feeds entirely upon grapes in one locality, melons in another, figs in another and prunes in another. In the Imperial and Coachella valleys, for example, there are instances where ripe dates form the chief article of diet, and frequently somewhat elaborate precautions have to be taken to prevent serious losses from this source. Manzanita berries are sometimes the principal article of food of this animal in localities where the shrub abounds.

Coyotes have been captured which were consuming entire grape crops, and the same holds true with prunes; entire crops have been destroyed in some small orchards. The same also is true with melons, of which they appear to be very fond. Figs also appeal strongly to coyotes, and are eaten with avidity. Oftentimes one or more fig trees are found on abandoned land holdings in the mountains or foothills, and in all cases, if there are coyotes in the locality, evidence will show that they have been feeding upon the fruit as fast as it falls from the trees. A place of this kind is one of the best locations for trap settings or poison work. In addition to feeding upon fresh prunes and figs, coyotes will at times readily take the dried product, though not in as large quantities as the fresh. As additional proof that coyotes were the offenders in many depredations on vineyards, orchards and melon patches, when the coyotes were eliminated losses ceased entirely.

After all, the coyote is not so much different from a dog in his food habits. After he has been in touch with man and his customs for some time, he adapts himself readily to the prevailing conditions, especially relating to food.

To anyone familiar with the coyote, there is nothing strange or unusual in the fact that fruits and many other things which have not been mentioned are included in his menu.—Charles G. Poole, in *Monthly Bulletin*, Department of Agriculture, January, 1928.

CALIFORNIA'S KILL OF FUR-BEARERS

Fur trapping, one of the oldest industries in the United States, is holding its own in California. This statement is substantiated by the statistics just compiled by the Division of Fish and Game, which show that a total of 278,202 skins netted the commercial trappers licensed by the Division \$743,211.52 during the three-year period that ended February 28, 1927 (see table, p. 180).

The figures compiled by the research department of the Division are estimates based on reports of the licensed trappers and do not include animals trapped by

minors under 18 years of age, who are not required to secure a license, or those taken in predatory animal control.

Raccoon skins brought the most money, 39,891 of these pelts bringing the trappers \$182,324.45. Skunk finished in second place, 86,273 skins netting \$123,244.96. Third comes the much maligned coyote, with 26,183 hides furnishing a revenue of \$118,762.41. Mink ranks fourth, the 11,337 skins being sold by the trappers for \$67,487.10, while 26,677 gray fox pelts brough \$50,608.34.

The most valuable fur trapped was that of the fisher, the skins of this animal averaging \$34.75 each for the period, and the 130 that were caught brought the lucky trappers \$4,612.34. Next to the fisher the red fox brought the largest price per skin, averaging \$18.31, a total of \$1,598.87 for the 86 that were trapped. The take of muskrat quadrupled and the value nearly doubled.

After the season on beaver had been closed for several years, it was opened in 1925 and 4019 skins brought the trappers \$49,698.95. It is interesting to note that serious inroads were made on the beaver during this period, as the next season's report shows only 692 were trapped and the skins brought \$9,530.26. The average price of beaver pelts increased from \$12.36 in 1925 to \$12.90 in 1927.

During the three-year period three wolverines were taken and the skins sold for \$30. None of these animals have been trapped since 1925, according to the reports filed with the Division of Fish and Game.

Twenty-one species are shown in the reports used in compiling the statistics. In addition to those mentioned, the following are included: 18,535 wildcats, 12,495 civet cats, 22,588 muskrats, 8479 ringtail cats, 3578 kit fox, 2050 marten, 1695 badgers, 2033 opossums, 912 weasels, 810 bears, 441 river otter, and 130 mountain lions.

The lion pelts averaged \$15.80 each, the total bringing in \$3,418.80.

During the 1924-25 period 2984 licenses were issued and 77,787 skins brought the trappers \$181,215.13. In the 1925-26 period, the licenses increased to 3530 and 88,185 skins sold for \$257,711.42.

Another increase was noted in the 1926-27 period when the licenses increased to 3790 and 112,230 skins were taken, bringing the trappers \$304,284.97.

COUNTY WARDENS HELP ENFORCE GAME LAWS

Los Angeles County forestry officers, who were recently appointed special deputy wardens, were very active recently

along the south coast. They arrested for the state, nine people for having undersized abalones, four for over-the-limit abalones, two for undersized lobsters, and one for shooting ducks at sunrise. An average fine of \$25 each was paid. These cases were mostly tried before Justice of the Peace Billings at Sherman.

Three Japanese were convicted for destruction of evidence and fined \$500 each at Sherman Court. These men saw the officers coming and threw the abalones in the ocean. Upon their promise of good behavior and evidence submitted to the court of their past record, the fines were all suspended except \$25. A rather lengthy article appeared in the Japanese newspapers relative to this case and it is hoped some good was accomplished, as the Japanese for some time have made every effort to dispose of evidence by throwing it into the ocean and have made it very hard for law enforcement officers to apprehend them. If this practice continues, the Japanese will enrich the State Fish and Game coffers to the extent of many dollars, as these officers are very familiar with the law and will make it interesting for anyone who endeavors to destroy any evidence.

THE LECTURE PROGRAM

An educational program inaugurated to stir interest in conservation should make contact with various groups of people. Although emphasis in the past has been placed upon work in the public schools, yet adults have not been overlooked. Through the months, as a result of demand, emphasis has been swung from srvice clubs to lodges and from lodges to fish and game protective associations. During the months of December, January and February, nineteen lectures have been given before fish and game protective associations. The demand from this source shows that, as never before, these organizations are supporting conservation work and are lending definite aid to the conservation program.

MAJOR CONSERVATION PROJECTS

A number of major conservation projects were stressed at the fourteenth annual National Game Conference, held in New York City, December 5 and 6, 1927. These projects are as follows:

1. Federal legislation. Support of the pending Migratory Bird Conservation bill, known in the seventieth congress as the Anthony-Norbeck bill, H. R. 5467 and S. 1271, and of the McNary-Woodruff forestry bill was urged. Both these measures have been pending in several sessions of Congress, but final action on them has never been obtained.

2. Bear River marshes. Passage of the appropriation bill pending in Congress, providing for reclamation of areas in Utah, in which heavy losses of waterfowl have occurred, was urged.

3. Cheyenne bottoms. Permanent maintenance of this important waterfowl resort in Kansas was advocated.

4. International boundary waters. The Conference declared for the protection of the international watershed between Minnesota and Ontario for perpetual recreational use and protested its exploitation for commercial purposes in such a way as to injure its wilderness value.

5. Cooperation of sportsmen and landowners. The Conference declared that the basis of good will between sportsmen and landowners must be a recognition of the farmer's rights and drastic suppression of the lawless, marauding element which has become so obnoxious. On the other hand, the farmer should recognize a distinct advantage to him in the cooperation of the decent, respectable sportsmen whose license fees pay for patrol and protection of both game and insectivorous birds, and who assist the farmers in preventing depredations of the lawless.

6. Chesapeake-Albemarle Canal. The Conference declared in favor of reconstruction of locks in this canal to prevent destruction of feeding areas of vast numbers of waterfowl by salt water.

7. Coyotes in Alaska. Encouragement was offered the government of Alaska in its efforts to control the invasion of the game fields of that territory by the western coyote.

8. Pollution of waters. Action by the federal and state governments to eliminate and prevent everywhere pollution of lakes and streams, which constitutes a growing menace to fish life, waterfowl and public health, was strongly urged.

9. Importation of game birds. More favorable conditions for importation and transportation of game birds for stocking purposes, by removal of import duties and reduction of transportation rates, was approved by the Conference.

10. Species destructive to game. A study of the vermin question has disclosed the fact that local conditions must be intensively studied and that abundance of game often depends more on keeping destructive species under control than on any other one factor.

11. Scientific research. Investigations, such as the Grouse Inquiry and the Cooperative Quail Investigation, were approved and declared to be the proper basis for conservation methods.

12. Cooperative Game Breeding and Fish Culture. This subject was stressed at the Conference and advocated as a

necessary complement to the work of the states and the federal government, in which sportsmen's clubs may help augment the game and fish supply.—*Field and Stream*, February, 1928.

WHAT IS A FORKED HORN?

The article under the above caption in the last number of CALIFORNIA FISH AND GAME called attention to the ambiguity of the law in that spike bucks are defined, and forked horns are defined by using the term "on both sides." Unfortunately, it did not make clear that the discussion had to do with the situation in Modoc and Lassen counties.

THE WEALTH OF THE SEA

Several years ago there was reviewed in these columns a book designed to meet the needs of the fishing industry, entitled, "Marine Products of Commerce," by Donald K. Tressler of the Mellon Institute of Industrial Research (CALIFORNIA FISH AND GAME, Vol. 11, pp. 87-89). Dr. Tressler has now issued a more popular volume under the title "The Wealth of the Sea." In this volume the author has attempted to furnish both information and entertainment in the hope that the book will be of interest not only to those who are primarily interested in marine products, but also to the general reader and to students of commercial geography, biology, geology, chemistry, oceanography and navigation. Descriptions of technical processes are simple and brief. The scientific names and technical terms have been largely omitted.

The first chapter deals with the area and depth of the ocean, temperature, salinity, pressure, movements and life of the sea. One learns that the extent of the sea is 139,000,000 square miles; that the average salt content of a gallon of sea water is about a quarter of a pound, and that surface fishes down to seventy-five fathoms are colorless. From 150 to 250 fathoms, they are silvery or gray in color, and at depths where little light penetrates they are black or at least dark colored.

The next chapter cleverly shows how the sea and its products enter into our daily life. It is surprising to learn how many household articles have been finished with fish oils. "When we rise in the morning we may use a soap made from fish or whale oil for our bath. The razor we shave with was tempered in fish oil. The cold cream or other toilet preparation used after we shave contains glycerin which may have been obtained from menhaden or some other fish. We put on shoes which were finished with menhaden oil.

"We go to our door, painted perhaps with a salmon-oil paint, and get a newspaper printed with ink made from fish oil and lampblack. If we eat herring or mackerel for our breakfast, we obtain much nutriment from the fat and vitamins of the herring or mackerel oil.

"We may ride to work in an automobile painted with a baking japan containing fish oil, and sit on imitation leather seats prepared by the use of menhaden or other fish oil. Even if the car has real leather upholstery, fish and fish-liver oil were used in the final tanning and finishing processes.

"We enter our office building painted perhaps with menhaden oil paint, containing driers made from fish oils. The linoleum on the floor may have been made with fish oil. The greases used in the lubrication of the elevator machinery probably contain fish oil.

"If it is raining when we come from work in the evening, we put on a raincoat which may have been made from cloth covered with many coats of a fish oil varnish.

"Our feet may get wet on the way home. To prevent catching cold we take a tonic. One of the best we may choose is cod-liver oil, which contains the fat-soluble vitamins needed to build up vitality and resistance to disease.

"Perhaps we shall have candles on our dinner table; if so, it is likely that they were made from stearin obtained from fish or whale oil. Our furniture may be finished with a menhaden oil varnish. And the oilcloth which covers the kitchen table was probably made by painting cloth with special menhaden oil paints.

"When we prepare for bed we put on slippers made soft and comfortable by treatment with fish and fish-liver oils, and as we switch off the electric light we may touch an imitation rubber knob of fish oil composition."

Other chapters deal with the manufacture of salt from sea water, iodine and other chemicals from seaweed. A chapter each is devoted to pearls and imitation pearls and to precious corals; a discussion of fishes and their preservation and of America's fisheries follow; and chapters on various mollusks, crustaceans, whales, fur seals and sponges conclude the volume.

Dr. Tressler has furnished a 340-page illustrated volume which gives a comprehensive and fascinating story of the nature, uses and economic importance of the various products which come from the sea. The information is authentic and the story of whale hunts, pearl diving and deep sea fishing makes the book attractive to everyone.—H. C. Bryant.

CALIFORNIA HUMMINGBIRDS

A most enlightening and interesting article bearing on the hummingbirds of California, which are among the smallest in size of one of our large American bird families, is that by Mr. Robert S. Woods, appearing in a late issue of the *Auk* (Vol. XLIV, No. 3). Mr. Wood prefaces his very full report with the statement that, although the hummingbirds "include some 500 species, but nineteen have been found within the United States, and of these only one occurs east of Texas and the Rocky Mountains. Of the nineteen, two species, both of which are taken in California, are thought to have been mere adventitious hybrids, while nine are restricted to within 100 miles of the Mexican border in Arizona, New Mexico and Texas * * * of the remaining eight, which may be considered more definitely a part of our fauna, six species are of common occurrence over large portions of California, while the seventh has also been found within the borders of the state."

The fact is brought out that, although green is the prevailing color on the throats or other luminous parts of the plumage of the Mexican, Central American and West Indian species, this color is not found on the throat of any of the eight hummingbirds whose range is largely within the United States. The gorget is red in four of these; in two it is reddish or rose pink and in the remaining two, violet, and note is made of the fact that in the 140 species listed in Mr. Ridgeway's "Birds of North and Middle America," the red color appears in only five or six species, and does not appear in any of the thirty species living in or near the Panama Canal Zone. The impression is thus obtained that northern latitudes are in some way conducive to the development of the red areas in the plumage of this bird family and "this impression is strengthened when we consider that the Rufous and the Ruby-throated hummingbirds, which reach the highest latitudes in summer, and likewise Anna's and Allen's hummingbirds, which winter farthest north, all have red gorgets, while the Rufous hummingbird, the hardiest pioneer of all, is unique in the reddish color of its back as well. Despite the predominance of yellow flowers, pure yellow is entirely lacking in the plumage of North American hummingbirds."

The brilliancy and variation of the coloring in the two California species of the genus *Calypte*, Costa and Anna hummingbirds, overshadows the scarcity in numbers of this family in California, compared with the many in South and Central American countries. The changing hues.

affected and reflected by varying conditions of light; the brilliant rose-pink gorget, enhanced by a border of rich gold of the Anna; the wide variation in the coloring of the Costa; the burnished gold of the rufous and the reddish-purple of the callope, coupled with the interest which attaches to this particular bird from its being the smallest of our birds, make one who possesses an appreciation for color, ever sensible to the wonders of this species.

Several pages are devoted to description of the flight of the different species; the elaborate nuptial flight of the Anna, that of the Allen; the shuttling of the black-chinned, which follows the path of a narrow figure 8 lying on one side; the hovering of Anna's "motionless in the air with body nearly horizontal, suddenly rise rapidly and vertically, as if by a reversal of the force of gravity, is to obtain some idea of the bird's remarkable mystery of the air."

The occurrence of the species in California is given and Mr. Wood's particular observations of the birds in San Gabriel Valley are cited.

Intimate and full life history details are given, with more especial note to the "family life" of the Costa, which Mr. Wood simply disposes of by saying that "he has none," because his experience has shown that the male Costa has never shown enough interest in family affairs to indicate his relationship with any particular brood, "his mate, however, making up his deficiencies and finding no difficulty in managing the household without his aid."

Much study has been given to the location and construction of the nest of these birds; their eggs and behavior of the various individuals while brooding.

The mentality of the hummingbird, a much mooted question, is discussed at length, Mr. Wood quoting largely from Mr. W. W. Hudson in his comparison of the bird with insects and dragon flies, all of which Mr. Wood has not found to be convincing, and, although he, too, has not been able to detect any indication of the hummingbird possessing any reasoning power—"an accomplishment which, after all, is rarely enough displayed even by the human race—and that it may be lacking in some of those finer emotions which make many of the birds seem so akin to mankind, nevertheless its actions and attitude, its alert interest in its surroundings, its apparent love of sport and its ability to recognize those who befriend it, certainly furnish competent evidence of an acutely conscious intelligence."

The article is amply illustrated with excellent photographs.—B. W. Kibbe.

CANADA LEADS IN BUFFALO CONSERVATION

The preservation of the American buffalo has been undertaken naturally by the two governments and peoples most interested, that is, the United States and Canada, but the latter from the beginning of the work has been in the lead. Of the 16,000 buffalo now existing, there are 12,000 in Canada and some 4000 in the United States.

In all the history of animal life, there has been none as extraordinary as that of the American bison and its near extinction in a short period of years. It numbered nearly fifty million head, which far exceeded that of any known species of large quadruped. Its range was practically from the Atlantic to the Pacific and north to the barren grounds of the Arctic and south to the twenty-fifth degree of north latitude, being nearly to the Tropic of Cancer.

The animal authority, Dr. Edward W. Nelson of the United States Biological Survey, in his book "Wild Animals of North America" (p. 461), writes:

"When the American continent was first discovered (1492), their numbers were from thirty to sixty million. In 1870 there were still about five and one-half million; these were practically all exterminated by 1890, there remaining in all about 800 buffalo in private hands."

Some have questioned how could anyone know that the above figures of millions were anywhere near correct. In the book "Reminiscences of a Sportsman," by J. Parker Whitney (p. 162), he writes as follows:

"A competent authority has estimated that between the years of 1868 and 1880, two and one-half million dollars were paid out in the three states mentioned (Kansas, Nebraska and Missouri) for Buffalo Bones gathered on the prairies at \$8 per ton, and if the estimate of 100 buffalo to one ton of bones has been correctly calculated, it will be observed that the bones of over thirty millions of buffalo would be required to furnish the amount purchased." If three states furnished thirty million head, then another twenty million for all remaining territory is conservative. The estimate of twenty pounds of bones to each animal, being ten for the skull and ten for the rest of the animal, is also reasonable.

The range of the buffalo to the south being nearly to the tropics, is proved by a book, "Sport with the Rod and Gun," published by The Century Company in New York, 1883, in which is an article by General Lew Wallace, author of "Ben Hur," who took part in a hunt. He reported a herd of several hundred ani-

mals and they bagged seven buffalo in one morning's hunt. It was in the year 1867 just after the Civil War, and he was making a horseback journey across Mexico from Monterey, the hunt being near the town of Hornos, State of Coahuila, about 500 miles southeast of El Paso, Texas, the latitude being about twenty-five degrees north, about ninety miles from the Tropic of Cancer.

To tell now what Canada has done for this great animal. In 1907 the Canadian government bought the Michael Pablo herd in Montana and moved the 709 buffalo to their new park at Wainwright, Alberta, by railroad. This took three years and it was not until 1910 that the last were transferred.

In sixteen years these 700 head increased to 12,000, of which some 2000 annually have been disposed of commercially in order to offset the increase. Wainwright Park can not reasonably support a larger number than 5000 animals.

During the last three years the Canadian government has moved about 2000 animals some 700 miles to their new Wood Buffalo Park, which is on the Slave River, being a tract of some 100 miles square which has been occupied by the original herd of about 1500 of the "Wood buffalo." The transfer was started in 1925. Movement during June to August amounted to seven loads and it took about one week of rail and steamer on the Peace River to make the transit. About 2000 were transferred each year in 1925 and 1926. The experiment was most successful.

The history of the original herd of Peace River Wood buffalo is most interesting, as this is the only remaining wild herd; except a small remnant in the Yellowstone National Park, Wyoming. The first authentic report was about forty years ago by the Canadian explorer, Warburton Pike, who saw the herd on his trip after musk-ox in 1890. Various reports are as follows:

	Estimate
1890 Warburton Pike.....	100
1894 Casper Whitney.....	150
1907 Ernest Seton Thompson---	625
1920 C. Gordon Hewitt.....	2,000
1922 Fullerton Waldo.....	2,500
1924 Royal Geographical Society	2,000
1926 American Bison Society---	1,500

The above, of course, are only the estimates of casual visitors based on the reports of the guardians or custodians of the herd. A few years will probably show a herd of 10,000 buffalo in Wood Buffalo Park, on Slave River, Canada, which will become a valuable basis of supply for meat, hides and other products.

In the United States the American

Bison Society was organized in 1906 and has done splendid work, though on a smaller scale. The first annual report of buffalo was compiled by Dr. W. T. Hornaday in 1903. The totals of all the pure-bred American bison in the world are as follows:

1903—1,753 buffalo in the United States and Canada.

1921—9,311 buffalo in the United States and Canada.

1923—12,521 buffalo in the United States and Canada.

1927—16,417 buffalo in the United States and Canada.

There are seven of the small eastern states which have no herds of buffalo on exhibition, but otherwise this animal is well distributed throughout the United States.—M. Hall McAllister, San Francisco, California.

THE IRISH ELK

Through the generosity of Mr. William M. Fitzhugh, a trustee of the academy, the Museum of the California Academy of Sciences, in Golden Gate Park, has acquired a head of the gigantic extinct Fallow deer (*Cervus giganteus*), commonly known as "Irish elk." This prehistoric animal was one of the largest of the deer, standing six feet or more in height at the shoulder, and second in size only to the moose, among present-day species. In spread of antlers it even exceeded the moose, some skulls having been found with antlers that were twelve feet across; six feet is an exceptionally wide spread for a moose.

The Irish elk lived ages ago in western Europe, in England and in Ireland. Most of the specimens in museums were found in peat bogs in Ireland, where the carcasses happened to sink and the skeletons thus became more or less perfectly preserved.

The academy specimen from Ireland is a fine example of the species in excellent condition and with antlers that spread more than eight feet across. It is now on exhibition on the wall of the Mammal Hall in the Museum.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA, A PROCLAMATION

For several years a special week has been set apart for public discussion of our forests and of what must be done to safeguard and restore them. Among the agencies making for progress in this direction, American Forest Week has proved its usefulness and I am glad to proclaim it again and to announce that Canada is

again concurrently observing a similar week.

The rehabilitation of our forests demands first of all that the forest fire evil be suppressed. Many of the forested States, with the cooperation of timber land owners, have undertaken organized protection against forest fires; and in recent years, under the Clarke-McNary law, the Federal Government has given its support to the movement. This great cooperative enterprise must be extended and strengthened until every forested county in the United States is safeguarded against forest fires.

But we are still far from the goal of complete protection. Every year, on the average, 80,000 fires scourge our woodlands, steadily undermining their vitality. For this bad situation, the blame falls equally on us all. Public agencies rarely provide adequate protection against fire, the timber land owner is too often indifferent to his property, the forest worker is too often neglectful of the future forest, the average citizen is too often careless with fire in the woods. We must all gain such respect for the forest that its destruction through indifference or carelessness shall be unthinkable.

We can not permanently abuse our forests with impunity. The soil is the ultimate source of all our wealth and of life itself. One-fourth of our American soil is best suited for forests. Much of this land is already idle. More of it is being made idle by destructive logging and fire. Yet we can not safely permit our forest land to lie fallow and useless any more than we can permit our farms and factories to lie idle.

To make our vast empire of forest land fully productive of continuous crops of timber will have momentous consequences in our national life. It will give agriculture the advantage of a new and valuable crop. It will afford permanent employment to millions of men in the forest industries. It will provide raw materials for many industries. It will furnish traffic for our railroads. It will maintain foreign and domestic commerce. It will restore our forests as conservers of soil and water, and as givers of health and pleasure to our people.

We already have made a beginning in forest renewal; but the task is stupendous and we should permit no satisfaction over what has been done to blind us to the magnitude of what remains to be done.

NOW, THEREFORE, I, Calvin Coolidge, President of the United States of America, do hereby designate and set aside as American Forest Week the week beginning April 22 and ending April 28, in

this year of 1928. I recommend to the Governors of the various States that they also designate this week for special observance by all our people; and that, where practicable and not in conflict with law or custom, Arbor Day be observed during the course of the same week. I urge that during that week all citizens and appropriate organizations—including public officials, legislators, business organizations, educators, editors, clergymen, landowners and others—give thought to the preservation and wise use of our forests, to the end that energetic forest policies will be adopted in all communities.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the United States to be affixed.

DONE at the City of Washington this twenty-fourth day of February, in the year of our Lord, one thousand nine hundred and twenty-eight, and of the Independence of the United States of America the one hundred and fifty-second.

By the President:

CALVIN COOLIDGE.

FRANK B. KELLOGG,

Secretary of State.

PUBLIC WARNED TO GUARD AGAINST TULAREMIA

Tularemia, a serious and often fatal disease, known also as "rabbit fever" or "deer-fly fever," has spread so widely that Paul G. Redington, Chief of the Biological Survey of the United States Department of Agriculture, has issued a warning to all field men of the department to be on guard against it. The department is making public this warning for the benefit of sportsmen, lumbermen, cattle and sheep tenders, farmers and others of the general public who may come in contact with the disease. Mr. Redington's warning has been endorsed by the United States Public Health Service.

"Tularemia," Mr. Redington explains, "is a plague-like disease of rodents transmissible to man. Of 500 human cases reported in the United States, 20 have terminated in death."

Cases of tularemia have been discovered in all states except Washington, Wisconsin, New York, Delaware and the New England States. It has been established definitely that the disease is caused by an organism, *Bacterium tulareense*. In nature the disease affects jack rabbits, snowshoe rabbits and cottontail rabbits. This provides a reservoir for infection of both wild animals and human beings. No cases have yet been recognized in commercial rabbitries, and care should be exercised to avoid the introduction of

tularemia into such places. There is no danger of contracting the disease from eating rabbit meat if it is thoroughly cooked, even though the animal may have been infected.

In the western states the disease is carried from animal to animal and from animal to man by the bites of infected deer flies and ticks. Ticks also act as carriers in the southern states. Men also become infected by handling rabbit carcasses, as in dressing them for the table or cutting them up to use as food for animals or bait in fishing or trapping. In the east, such direct contact is the common means of infection.

For protection against tularemia the best known precaution is the use of rubber gloves when handling or dressing rabbits, or when skinning other animals that may be infected with the disease. In the open it is wise to exercise care in avoiding the bites of deer flies, ticks or other possible carriers. Wearing rubber gloves is not an absolute protection, for skilled laboratory workers who are scrupulously careful because they are aware of the dangers, often contract infection. Rubber gloves should be worn in handling fresh skins. Dried skins are not likely to carry infection. One attack of tularemia confers immunity to man, hence those who have recovered from the disease should be employed, wherever possible, in occupations where there is risk of infection. No protective vaccine has been developed as yet.

In addition to the wild rabbits most affected by tularemia, and man who may contract the disease, scientists have discovered cases of tularemia in California ground squirrels, Columbia ground squirrels, Utah ground squirrels, desert ground squirrels, pine squirrels, yellow-bellied chipmunks, pocket gophers, woodchucks, opossums, cats, porcupines, house mice, deer mice, meadow mice, wood rats and coyotes, and susceptibility is being investigated in other animals. All possible carriers of the disease should be handled with care.

Mr. Redington also warns of the danger of liberating wild rabbits trapped in one locality for the restocking of hunting areas. When restocking seems desirable, a quarantine should be maintained and no rabbits should be liberated for about ten days, to give the disease time to develop in the imported rabbits, which it will do usually in five or six days if they are infected. Otherwise the diseased rabbits are likely to cause a rabbit epizootic, reduce the game available for hunting, and create a center of infection from which human beings may contract the disease.

In man tularemia is likely to manifest itself first by pain, tenderness and a swelling of the lymph glands draining the region where the infection occurs, as those of the elbow or armpit when infection has occurred on the finger. These symptoms are likely to develop within two to five days after infection. An inflamed and painful ulcer may soon appear where the insect bite occurred, although in some cases this does not happen. The development of the disease is likely to be accompanied by sudden onsets of headache, aching pains, chills, prostration, general weakness and fever.

DENMEAD AND GOLDMAN DISCUSS PROBLEMS OF GAME PRESERVATION

The comparative merits of restocking hunting areas with imported game and the protection of game already in the area, were discussed by Talbott Denmead, Deputy Chief United States Game Warden, at the Fourteenth National Game Conference held in New York early in December, and E. A. Goldman, also of the Biological Survey of the United States Department of Agriculture, explained to the conference members some of the factors leading to the numerical fluctuations of game.

Mr. Denmead particularly emphasized that his remarks should not be taken as a criticism of state conservation commissioners and others who have been active in importing game for restocking purposes, but rather to emphasize the need of keeping account of the results of importations to decide whether the practice pays. As a result of his experience, he was inclined to the opinion that further protection of existing game should be paramount and importation secondary. He noted that game brought from a distance is liable to injury in transit, is more susceptible to disease, or because of conditions of transit and unfamiliarity with the country may die or be killed after liberation. Even if animals stand shipment in good condition, "there still remains the doubt whether they will become acclimatized and adapt themselves to weather and food conditions; and there is still further danger that they may be entirely wiped out by reason of their unfamiliarity with the country and lack of knowledge of their enemies known as vermin."

The warden recounted several unsuccessful importations, and stressed the additional danger of introduction of fatal disease by imported birds and animals. He quoted with approval M. D. Hart's statement of conditions in Virginia: "We have the ruffed grouse, the wild turkey

and the quail—three of the finest game birds on earth. It will pay us to take care of them and not import foreign birds."

Protection instead of importation "may make the State game officer's account look like too much overhead if more money is expended on game wardens and the destruction of vermin and less on birds and animals for liberation, but results are what count in the long run and are what the hunters are looking for and expect. Large numbers of animals and birds imported and released may look good in annual reports, but the question to be answered by every State game authority is, does it pay?"

Instead, Mr. Denmead recommended a more thorough and intelligent control of vermin and the establishment of permanent game sanctuaries, with restocking of depleted covers with imported game only when and where it can be done successfully.

Mr. Golden, in charge of the Division of Game and Bird Reservations of the Biological Survey, in discussing fluctuation in the numbers of birds and animals as one of the most pressing problems of wild-life administration, said that some of the factors were easily understood and could be controlled, but that other factors that may depend on the weather and those that are involved in biological relationships are often baffling in their complexity.

He mentioned various studies of numbers of game and thought it doubtful that a stabilized balance under natural conditions was ever attained for a long period. Records of abundance in furs delivered to the Hudson's Bay Company for a hundred years show cycles of abundance and scarcity.

Whatever other effects there may be on the numbers of game, the presence of man has disturbed the former balance, and as an offset "suitable areas must be set aside or created for the benefit of game, in which all breeding stocks are preserved, if game is to be maintained on anything like a satisfactory scale, and a surplus provided for sportsmen."

The speaker gave consideration to damage done by predatory animals and vermin, the extent of which is not generally realized, and also discussed some of the reasons for the wide fluctuations in the numbers of such well-known herds as the Yellowstone elk and the Kaibab deer, and for the increase of mountain sheep on the National Bison Range, in Montana.

"Sufficient food and water and adequate protection from enemies are essential," Mr. Goldman remarked, "if game is to thrive and be maintained on a satisfactory

scale, but freedom from parasites and diseases, especially those that become periodically epizootic, and, in waterfowl, freedom from maladies believed to be due to mineral poisons, is of vital importance. Parasitism may account for the comparative rarity of some animals, including various members of the weasel family that, especially in the warmer regions, apparently are able to obtain abundant food, and, so far as known, have few natural enemies. Epizootics evidently provide the final check to overabundance in all wild life, and correspond to epidemics in man."

TERN BANDED IN LABRADOR FOUND DEAD IN FRANCE

Another trans-Atlantic flight—and probably a "nonstop" one—has come to light. A communication received by the Biological Survey of the United States Department of Agriculture from Prof. Robert Poncey of Geneva, Switzerland, incloses a clipping from *Le Chasseur Français* to the effect that M. Robert Pradier, of Port-Dauphine, La Rochelle, France, found, on October 1, 1927, on the Greve de Marsilly, near La Rochelle, "a kind of black-headed gull, known in the region as 'hirondelle de mer,' or sea swallow," and carrying on its right foot an aluminum ring with the inscription, "Notify Biol. Surv.," and the number 548656. M. Pradier would be glad to learn, the account said, the habitat and name of this bird, as well as the date on which it was banded.

The Biological Survey, which supervises the bird-banding work in the United States and Canada, finds in its records that band No. 548656 was that of an Arctic tern (*Sterna paradisaea*) banded when it was between 1 and 5 days old at the Red Islands, Turnevick, Labrador, on July 22, 1927, by Oliver L. Austin, of Tuckahoe, N. Y., who at the time was on an expedition to Baffin Island in connection with which he was banding birds on their northern breeding grounds for the Biological Survey. The straight distance from Labrador to the coast of France is about 4200 miles, a remarkable travel record for so young a bird.

This is the second transoceanic bird return in the records of the survey, the first being that of a common tern (*Sterna hirundo*) banded as a nestling on the coast of Maine in 1913, and recovered four years later in the delta of the Niger River, on the west coast of Africa. Several other remarkable distances have been traveled by birds recovered from South America. The Biological Survey has about 1000 volunteer cooperators scattered throughout the United States and Canada

who are helping in the bird-banding work, by means of which valuable data are being collected for the solution of problems regarding the migratory and other habits of wild birds.

NEW LEAFLET TELLS HOW TO RAISE MINKS IN CAPTIVITY

Comparatively few persons are raising minks in captivity, even though the fur has sold for high prices during the past ten years, according to Frank G. Ashbrook, biologist of the Biological Survey, in a leaflet on "Mink Raising," just issued by the United States Department of Agriculture. A keen interest has been manifested in mink farming, he says, since the beginning of the present century, but it has been spasmodic rather than sustained. Mink farming is not altogether in the experimental stage, however, for minks have been raised successfully in captivity, and the quality of fur produced on farms is in no way inferior to that trapped in the wild.

Minks are very prolific, and when fed and handled properly they breed and produce young regularly, their litters numbering usually six, seven or eight. Young minks born in captivity are much superior for breeding stock, and consequently the prices asked for ranch-raised minks are often higher than prospective mink farmers care to pay. Those who have made money in mink raising thus far have sold the animals chiefly for breeding purposes. Further experiments will be required before it can be determined whether raising these animals in captivity as fur producers can be made profitable.

The new leaflet No. S-L describes minks and their habits and gives information on selecting a ranch site, making pens and dens, breeding, mating, feeding, and killing and pelting. Copies may be had free upon request addressed to the United States Department of Agriculture, Washington, D. C.

BIRD-CENSUS TAKERS WANTED

Bird students are invited this year, as in the past, to assist the Biological Survey of the United States Department of Agriculture in taking censuses of breeding birds on tracts convenient to their homes. Such a census of birds means an exact and complete enumeration, by species, of the birds that actually nest within the boundaries of a selected area. It does not

include birds that merely visit the tract, birds that nest near but outside the boundaries, and migrants. It will be seen that a thorough familiarity with the birds of the region is needed to take a successful census. Bird censuses become particularly valuable when the volunteer enumerator counts the birds making their homes in the area for five or more years in succession. In the latitude of Washington, D. C., and St. Louis, Mo., the count should be made about June 1, and correspondingly earlier or later south or north of this line.

A suggestion as to the most effective way to take the census is that a count be made of the singing birds very early in the morning, with a recount on one or more mornings in the course of the next few days. Bird-census reports are desired on many types of land, such as farm lands, woodlands and forests, near irrigation projects, in marshlands, and on the shores of rivers, lakes and the sea, and in special areas such as city parks, cemeteries, bird sanctuaries and other spots having a dense population of birds.

Anyone interested in the taking of a bird census may write to the Biological Survey, United States Department of Agriculture, Washington, D. C., for directions, census blanks, and a return envelope that requires no postage for mailing the reports.

ANSWERS

(Questions on page 147)

1. The porcupine.
2. Squawfish or "Sacramento pike."
3. Prong-horned antelope.
4. Canvasback, ruddy duck, lesser scaup, surf scoter, redhead.
5. Eastern Modoc County and Eagle Lake, Lassen County; Imperial County; Buena Vista Lake, Kern County (probably introduced).
6. Yes. In Mexico they are sold for food.
7. Canada goose or "honker."
8. Modoc County.
9. Cutthroat trout.
10. Yes. Eastern Modoc and Lassen counties.

COMMISSION ACTIVITIES

Department of Patrol

The old adage of a man profiting by another's loss was well exhibited in San Francisco on Saturday, January 21, when a systematic raid on the ice boxes of clubs and markets resulted in a collection of 250 ducks and 50 geese. In order to enforce the closed season and prevent the nonsale of wild game, it is imperative that a time limit must be set within which birds taken in open season must be consumed. In the case of ducks and geese, five days are imposed by law as the limit of grace.

Search of the numerous storehouses of ducks and geese throughout the city, five days after the close of the season, disclosed many limits, all properly tagged, some bearing the names of well-known sportsmen whose good sportsmanship has never been questioned. As soon, however, as the respective owners found that they had forgotten to remove their game from storage before the deadline, they all, with one accord, manifested a spirit of charitable sportsmanship when they learned that the birds were turned over to the San Francisco Relief Home. At their expense the patients enjoyed a real feast, for wild game is seldom on the menu.

The revival of the old sport of trapping game birds is being met with determined resistance whenever practiced in the state. Hulbert Toole, a resident of Santa Paula, Ventura County, persisted in trapping quail, carefully cared for by interested residents, until their dwindling numbers caused suspicion that they were being trapped. A plan of capture was devised by Deputy Walter Emerick, assisted by volunteer deputies Walter Claberg and Lawrence Gardner, which lead to the arrest of the offender. Judge Hawthorne's court at Fillmore imposed a severe fine of \$150, with the view of discouraging such operations in the future.

The efforts of Deputy J. W. Thornburg to check the trapping of quail in Riverside County resulted in the discovery of an extensive system of traps. These were made of one-inch mesh chicken wire attached to old iron tires of a spring wagon, once a familiar vehicle. The approaches were covered with dirt and leaves and corn was used as bait. In one trap, Deputy Thornburg found twenty-

five birds making a fruitless effort to escape.

The diligence and vigilance exercised in minimizing this illegal method of taking game is worthy of the highest praise.

Two Los Banos citizens, one a hotel proprietor, the other a special deputy sheriff and former employee of Miller and Lux, were arrested early in January as a result of the persistent efforts of the Division to prevent the selling of wild game. Jack Twigly and Curry Anderson were apprehended, following information that they were selling ducks, and the raid systematically made on their establishments revealed a large number of birds in their possession. Previous to this raid, an investigator of the Division had purchased ducks from both of the offenders.

Judge D. E. Hales, of Gustine, imposed a fine of \$100 on each offender. It is hoped that such sure and swift justice will deter others from engaging in this pernicious practice.

The versatility of deputies was again shown in the recent installation of a "duck hospital" on Buena Vista Lake. Captain M. S. Clark, together with deputies L. Arnold, A. R. Ainsworth and Ray Ellis, in three days caught some 200 ducks suffering from disease. The sick ducks were then placed in an enclosure, where good care, abundance of fresh water and a changed diet resulted in the recovery of about 90 per cent of those affected.

All of the surviving birds were banded with Biological Survey markers and liberated. Thus, not only were a large number of birds saved by reason of the energy and promptness of the field forces, but another splendid opportunity was afforded to advance the knowledge of bird migration.

"The ways of man are wonderful and sometimes past finding out." This was admirably illustrated in a letter received recently by J. S. Hunter. The letter stated that the writer had violated the game laws of California over a considerable period of time and now wished to make amends. He was advised of the minimum fine for hunting without a license. In paying this "conscience money" the reformed violator expressed the wish that it be donated to a specific charitable organization, "as they are the

people that told me how to be saved and keep saved."

Efforts to preserve Pismo clams from reaching depletion have met with such success that the outlook for the future of this important bivalve fishery is encouraging. Not many years ago, commercial diggers used horses and plows on Pismo Beach, and great waste attended this method. Signs of depletion soon became evident. Even at the time when the present law stopped the shipment of clams from Pismo and Morro beaches, 274,317 pounds were exported annually.

Much special attention has been given to the enforcement of the present law. Warnings were issued concerning the procedure that would be followed in case of violation. As a result of this, a much better feeling among the local residents has been brought about. Judges, too, have manifested a better spirit and shown greater willingness to cooperate. There yet remains considerable indifference on the part of small colonies of clam diggers on Pismo and Morro beaches, who persist in digging over the limit.

The apprehension of these violators has been vigorously carried on by Special Commercial Fisheries Deputy Ross W. Markley and Deputy H. E. Black. As these deputies are known to the clam diggers, their endeavors are rewarded only after long hours of watchful waiting and persistent efforts to outwit the diggers. For instance, Deputy Black apprehended Pete Lee, whose left foot had only four toes, by tracking his footprints to a cache where he had buried several overlimits of clams. Again, after patient watching with glasses from a vantage point, Deputy Black witnessed C. E. McDonald take two limits of clams and then conceal them in the false bottom of an automobile. The arrest of another clam digger at Morro Bay by Deputy Markley came about only because Markley was mistaken for a tourist by the lookout of the colony, "One-eye Ellis."

Efforts to restore the depleted covers of San Diego County are encouraging. Some 400 valley quail were trapped at the Point Loma Homestead by A. W. Elder of the Game Farm, assisted by deputies Webb Toms and E. H. Glidden. The San Diego Zoological Society and the San Diego Fish and Game Protective Association aided materially in making this work successful.

Volunteer Deputy Otto Broeker caught a member of the Alameda Duck Club in

the duck fields with sixty-seven ducks. After hiring an attorney and using all the influence that could be brought to bear to be absolved from his act, and failing to secure the sympathy of the Division, the violator plead guilty and was fined \$250 by Judge Colthurst of Vallejo.

Snow and ice in the northern regions of the state have caused many hardships in law enforcement. Deputy Brice Ham-mack of Fort Jones, for example, was under the necessity of making a trip by way of Oregon to catch G. B. Crabtree, who had on hand a considerable store of deer meat.

Deputy Walter I. Long of Westwood made four deer cases in the vicinity of Loyaltan and Calpine. Later, in cooperation with Deputy Barnes, he arrested two Indians for the killing of a forked-horn. The carcass was skilfully hidden and the Indians made the two wardens pay a heavy price in the expenditure of physical energy to effect their capture.

A splendid fine of \$150 was secured by Deputy A. D. Miner of Quincy for deer meat which was held in possession out of season. Judge Taylor of Taylorville imposed the fine.

Judge Rohrback assessed a fine of \$100 for a similar offense. The arrest was made by Deputy F. H. Post of Salinas.

Deputy V. E. Von Arx, Sebastopol, caught a man in the act of using a salmon as a target for pistol practice. This cost the violator \$100.

Deputies C. M. Bouton and C. F. England, operating with the launch *Quinnat*, caught a violator using small mesh net, and secured a fine of \$100.

KMN, the Division's radio, contributed materially to the arrest of a commercial duck club operator shortly after the close of the duck season. Rumors, crystallizing into reliable reports, reached the ears of Captain S. J. Carpenter, at Maxwell, that Vencel Novotny was operating the Hefelsteine and Gordon Duck Club, near Williams, in open violation of the game laws. Such turned out to be the case, for Novotny was caught with more than the legal limit of geese in his possession. Hailed into the court of Judge George B. Reckers, at Williams, he was fined \$50 and his permit and license canceled.

Unfortunately, this fine failed to heighten the offender's respect for the law.

office that Novotny was trying to secure another license and attempting to have a Radiograms informed the San Francisco friend secure a permit. Search of the records revealed the application and its issuance was held up. Meanwhile, operators of the Division, suspicious of Novotny's character, applied to him for a "shoot." Their desire to have a duck hunt out of season met with ready encouragement and they were told to call the next day. They did so, and a fee was accepted. All this time, radio messages filling the air between Maxwell and the central office, were quietly, yet quickly and surely, exposing all of Novotny's pretty schemes. On January 11, he found himself again facing Judge Reckers, charged with operating without a permit.

In addition of a fine of \$200, Judge Reckers imposed the injunction that should Novotny violate the law within the next six months, he would find himself serving a 200-day jail sentence.

The launch patrol, which is made up of five men, have to their credit seventy-five cases covering the period of October 17, 1927, to March 1, 1928, which netted \$2,350 in fines. Six cases are still pending. Twenty-four nets were seized with a total footage of 21,952. The longest net, of 10,000 feet, was taken by deputies William Armstrong and C. F. England.

Deputies S. H. Lyons and Frank E. Dunne, Santa Barbara County, on reliable information furnished early in September that H. W. Waldbillig had killed a deer before the season, secured a conviction and a fine of \$100.

On December 8, 1927, volunteer deputies Louis Cardinalli and R. M. Grose were tempted to try a "special dinner" at the Commission Cafe in San Francisco when told by the waiter that the special feature of the meal comprised "wild sprig duck." Later, on December 17, the operators of the cafe found themselves before Judge J. M. Golden, who imposed a fine of \$200.

Allotment blanks listing numbers of fish desired and kinds preferred for planting the net work of streams and lake bodies of California have been filled out by captains and unattached deputies and returned to Captain O. P. Brownlow. Care has been exercised in most cases in the composition of these allotments to avoid exaggerated needs. There are about fifty counties having streams and lakes in

which fish are planted and consideration must be had for a fair and equal distribution. The supply of fish forthcoming from the hatcheries is not sufficiently abundant to allow overstocking.

Department of Fish Culture

The number of trout eggs taken during the fall spawn totals well over eleven millions. By species these eggs taken at egg collecting stations from wild trout in racks or traps, and at hatcheries from brood fish are as follows: Eastern brook, 3,375,500; brown trout, 2,434,000; and Loch Leven, 5,558,000. These figures also include eggs recently purchased in the east.

The spawning season at the Mount Shasta Hatchery is over and the spawning crew, so active in sorting the trout to size and sex, in cleaning the ponds and transferring the trout to various pools, are turning to other duties. Some of the eggs of the first spawners have been hatched and so far the loss during the hatching period has been below normal. It is believed that this is due to the excellent condition of the trout at the time they were spawned.

During December, 1,945,000 Loch Leven, 595,000 German brown and 304,000 eastern brook trout eggs were taken, while a total of 128,000 eggs were secured during the month of January. In addition to these eggs, 750,000 eastern brook eggs have been secured from Cresco, Pennsylvania, and 50,000 of the same variety from Massachusetts. These several lots of eggs are being distributed to the various hatcheries throughout the state.

The 3,251,000 Quinnet salmon eggs at the Fall Creek Hatchery are in excellent condition. Already the first lot of eggs taken are hatched and the balance are developing.

During the winter the Klamath River stations were placed in readiness for the spring run of trout. At some stations new concrete piers, racks, holding tanks and traps have been constructed, and at all stations equipment has been repaired. The run was late this year, since the seasonal rainfall and snowfall, with the exception of San Diego County, was below normal.

Some 950,000 eastern brook trout eggs taken at Gull Lake during the fall spawn-

ing are in the process of hatching at the Mount Whitney Hatchery. During January, 100,000 of these eggs were shipped to the Mount Shasta Hatchery and 200,000 to the Burney Creek Hatchery in Shasta County.

A storm the latter part of November caused the water in Prairie Creek to rise to such a height as to wash out the racks. As a result of this new racks have been built fourteen feet long and placed in the main channel and the old racks placed in the newly created stream channel; hence the station is now in condition to cope with heavy floods.

The first steelhead and cutthroat trout taken at the Prairie Creek Station proved to be too green for spawning and the crew was forced to prepare a place to hold them. By placing a set of low racks below those in the new channel a suitable pond was made which will serve a similar purpose in the future.

Thirty more troughs have been added to the original eight at this station. Several million steelhead trout eggs can be eyed now and sufficient number of eggs hatched to meet local demands if Prairie Creek enjoys this year the good runs that have attended it in the past.

The channel from the spring to the hatchery at Bear Lake has been cleaned out and the sides of the stream walled up with rock to prevent the water washing the banks. This will insure a cleaner water supply for the hatchery and be a great aid when the hatchery season is at its height. The winter has been mild at Bear Lake, but the permanent traps are in place in the event a good fall of snow makes assurance of an increased water supply.

The Loch Leven trout in holding tanks at the Yosemite Hatchery have had a difficult time clinging to life during the winter on account of the considerable amount of ice formed in the tanks. An investigation by the biologist of the department showed the water was so cold that the fish were not eating as they should and sour stomachs caused them to develop internal bacterial infection.

Hatchery operations at this hatchery have started for the season with a shipment of 100,000 Loch Leven and 100,000 eastern brook eggs from the Mount Shasta Hatchery.

The experimental hatchery at Mormon Creek has been completed and an experienced fishculturalist, F. A. Hamor,

placed in charge. It was necessary to fence the premises to keep stock from interfering with the hatchery water supply and to build ditches and levees to turn away the surplus water and keep the ponds uncontaminated. Attention to other details has rendered the site habitable and convenient for the season's operations.

In December Loch Leven eggs were shipped from the Mount Shasta Hatchery to the number of 300,000. In January, 50,000 more Loch Leven eggs were placed in the hatchery troughs and 100,000 brown trout eggs.

It is planned to open the Tallac Hatchery earlier than usual this season in order to receive a larger shipment of rainbow trout eggs so that the resulting fry can be removed to the fly-casting club nurseries on the Truckee River.

The Lake Tahoe Hatchery has 200,000 Loch Leven and 380,000 eastern brook eggs in the process of hatching. Of the eastern brook eggs 80,000 were supplied from a take at Marlette Lake, Nevada.

The Department of Architecture is rushing the work on the new Kaweah Hatchery building, with the object in view of having the hatchery in shape to receive the eggs from spring spawners. For preparedness sake, in case the new building is not completed, the old troughs are being placed under a temporary shed.

It is planned to stock the streams and lakes in Sequoia National Park and the surrounding high Sierra as well as the streams in the Tule River drainage basin from this hatchery.

Two hundred thousand eastern brook eggs were placed in the troughs at the Kern River Hatchery on January 17. These eggs were received from the Paradise Brook Trout Company at Cresco, Pennsylvania.

The Loch Leven eggs from the Mount Shasta Hatchery are hatching slowly, due to the extreme coldness of the water.

The water in Lake Pillsbury is very low and a storm of thirty-six hours duration is necessary to cause the water to flow over the spillway of the Snow Mountain Water and Power Company. Repairs, however, have been made at the Snow Mountain Egg Collecting Station and everything is in readiness for the steelhead run. If a rainstorm does not raise the waters of the lake, little hope is entertained that the power company can be

induced to allow sufficient water to escape to bring the fish up to the egg-collecting station.

Bureau of Education

The Bureau of Education has received a legacy of historical value. An exhibition case from California's first museum of natural history—Woodward's Gardens, San Francisco—has been donated by the Golden Gate Park Museum, together with a fine series of mounted specimens of birds and mammals. Some of the specimens were promptly used at the Cloverdale Citrus Show where an exhibit was installed. Mounted specimens, as well as study skins, are now available for school use as a result of this donation.

Reports of damage to deciduous fruit trees as a result of bird-cutting activities of linnets and other birds have been investigated and means are being devised to solve this economic problem. In eastern Tulare County the damage is real and the rancher needs some means of protecting his crop against depredations by birds.

The lecture program has increased to such an extent that the attendance record for the past few months shows an average of about 10,000 persons per month.

Bureau of Research

Reports of duck sickness on Buena Vista Lake led to an investigation. Chemical analyses were made of the water, birds were examined for blood and other parasites and an earnest endeavor made to locate the cause. Efforts made to salvage sick ducks were successful, nearly a thousand birds having been liberated after recovery.

Numerous miscellaneous autopsies have been performed, including a study of three quail apparently poisoned in Berkeley and two quail from Catalina Island which disclosed no reason for their death.

Parasitologist O'Roke has been gathering data on normal conditions in ducks and quail. A series of blood slides has been prepared and a number of internal parasites isolated. A study of the literature relating to animal disease is being made.

Bureau of Game Farms

The first pheasant egg was laid on the morning of February 24. This event was heralded as a token of spring's arrival.

The winter season has been devoted largely to preparations for the approaching hatching period at the Game Farm. New breeding pens have been erected, a few decidedly larger than any heretofore used. The ground in the pens has been seeded to suitable cover crops which are now well up and in flourishing condition. The work of picking the breeding stock has been completed, and, by a process of eliminating the less fit, some 800 Chinese ring-necked pheasants have been selected. One hundred and fifty more bantams and their crosses have been hatched in order to increase the stock of this class of birds and to facilitate propagation of greater numbers of pheasants.

Among the latest additions to the Game Farm are nine wild turkeys—seven hens and two toms. These noble birds have been brought from Arizona and are a loan of Mr. George O'Connor. Half of each year's increase is to remain the property of the state and it is anticipated that this arrangement will at least furnish the basis for operations to stock suitable covers with this famous American game bird.

For the purpose of introducing new blood and virility into the brood stock, an exchange of twenty-four male ring-necked pheasants has been effected with another game farm.

Three male versicolor pheasants have also been secured for the purpose of obtaining a cross between this variety of pheasant and the ringneck. Many game breeders consider this cross advantageous, claiming that the new strain produces birds more alert and swift of wing. It is expected to secure about 600 eggs from the three breeding pens in which the three versicolor males will be placed.

Negotiations have been under way with the end in view of making a further exchange of birds wanted by the San Diego Zoological Society for other game birds desired for propagation studies at the Game Farm.

The equipment specially designed to properly handle and propagate the new lot of Hungarian partridges has been productive of good results. Construction work on the pens was rushed during the winter and results so far indicate that

this effort was well spent. The pens are equipped with trap doors operated in such a manner that the attendant can segregate a pair of birds that have left the flock and

Already on February 17, a pair showing every evidence to begin the season's work was placed in one of the new breeding pens.

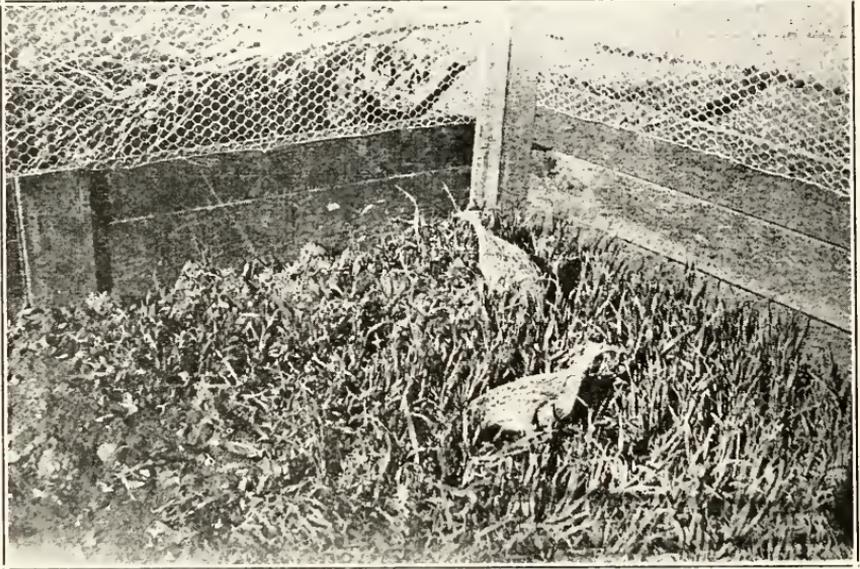


FIG. 46. Tinamous, new birds from South America which will form the basis of breeding experiments at the Yountville Game Farm. February, 1928.

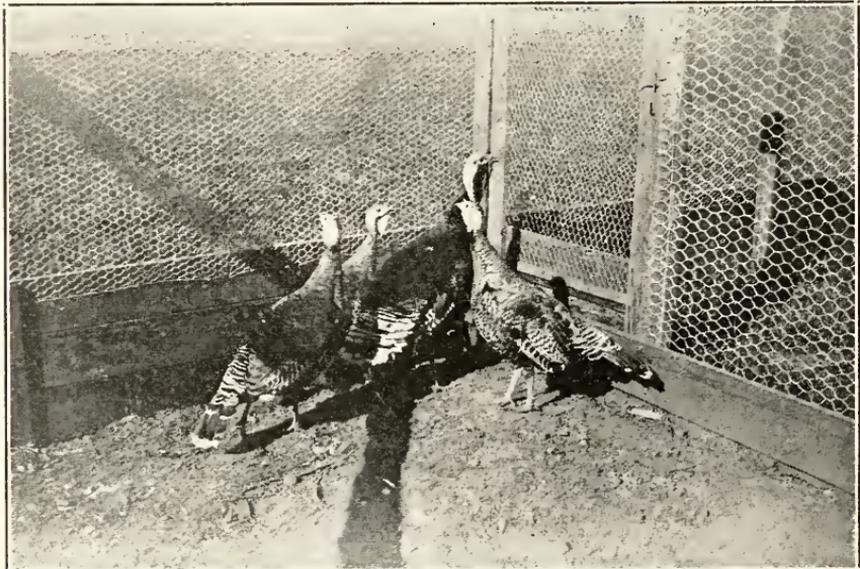


FIG. 47. Arizona wild turkeys, new arrivals at the Yountville Game Farm. February, 1928.

mated. This arrangement is necessary since the Hungarian partridge persists in selecting its own mate and because it is impossible to mate the bird artificially.

The 1928 season commenced with the following birds on hand: 1391 ring-necked pheasants, 29 silver pheasants, 33 golden pheasants, 10 Reeves and 2 Lady Amherst

pheasants; 3 versicolor pheasants; 125 Hungarian partridges; 10 tinamous; 49 Chinese bamboo quail; 121 California valley and 4 mountain quail; 1 grouse; 20 mallard ducks; 12 peafowl; and 9 wild turkeys.

Bureau of Public Relations

The Bureau of Public Relations during the past months has been engaged in the preparing of timely publicity stories, establishing of contacts with newspaper publishers and organizations, and on a few occasions addressing meetings of service and other clubs.

The function of this bureau is to promote better relations for our Division through the media explained above. Through a large acquaintanceship with newspaper publishers, editors and reporters, and with the knowledge that our message is of vital importance, it has been possible to secure valuable publicity for the various activities of the division not only in the smaller papers, but in the metropolitan areas: San Francisco, Oakland, Los Angeles, San Diego, Fresno, Sacramento, San Jose and Santa Barbara.

At times it is necessary to develop news stories which are of only immediate interest. When this condition arises, the stories are released through the three press associations which have headquarters in San Francisco: the Associated Press, United Press and International News Service.

The Service Bulletin, personnel organ of the division, is one of the products of this bureau. This monthly bulletin is prepared from reports of field men and bureau heads, and contains valuable information of importance to those who receive it.

The success of the work of the department depends upon the cooperation of the various bureaus where information is sought and the men in the field who can aid by making full and complete reports of unusual or sensational incidents that may occur, either when some violator is arrested, prosecuted and fined or when an extraordinary situation arises.

Bureau of Hydraulics

Suits against ten more of the Huntington Beach operators have been dismissed, as a survey of their properties showed determined efforts on their part to check pollution. These companies have further made assurance that they will continue to safeguard against the evil.

Legal action has been started against six companies operating in the Long Beach field, where conditions have become so bad as to warrant this step. Many of the Long Beach companies are members of the Oil Operators, Inc., and are, accordingly, in a position to run their waste oil into a pipe connecting with the sump put in a year ago. The six companies served with summons, however, have permitted the oil to escape into natural drainage, where, in the course of time, it finds its way to the beach and ocean.

Allowing waste oil to escape into the Ventura River was a costly negligence on the part of two companies operating in that field, where fines of \$200 apiece were imposed. Noting oil on the river, Deputy Walter Emerick traced the source of the pollution to the McKeon Drilling Corporation and the Bolsa Chica Oil Company. Judge Henderson of Ventura imposed a fine of \$200 for each offense, but suspended half of the penalty, warning the latter company that a recurrence of the offense would necessitate paying the full fine.

The Associated Oil Company, operating a refinery at Avon, has joined the ranks of those who have stopped oil pollution, or are approaching it.

An inspection of the southern California oil fields reveals that a new oil field is being opened on the seashore at Rincon. No evidence of pollution has come to light so far.

It is a pleasure to know that the California Petroleum Company has put its properties in such shape as to minimize pollution in the Huntington Beach and Long Beach oil fields. The Standard Oil Company has completed a waste water line to the ocean, thus entirely eliminating pollution from this source.

United States Army engineers have repaired and altered the fish ladder at the Daguerre Cut Dam on the Yuba River, twelve miles northeast of Marysville.

A fish screen of parallel bars has been installed by the Hallwood Irrigation Company and the Cordura Irrigation District on this jointly owned ditch which diverts water from the Yuba River at Daguerre Cut Dam.

The Mendocino Lumber Company has completed the construction of a fish ladder on the North Fork of Big River, Mendocino County. This will open the upper regions to the spawning salmon and steelhead.

The Cascade Land Company has completed a fish ladder on San Anselmo Creek, Marin County.

The Eastbrook Dam on the Trinity River, in Trinity County, now no longer offers obstruction to migrating fish, as some portions have been removed.

The Union Oil Company at San Luis Obispo has continued the removal of oil from the creek and beach caused by a fire in the early part of 1926. All traces can not be removed and it is expected that signs of oil will appear for some time to come. Nevertheless, the work done will greatly lessen the deleterious effects on fish and plant life which the oil would have caused had it remained.

Fish ladders have been constructed, replaced or repaired on the Gardella Dam, Trinity County; Madonna Dam, San Luis Obispo County, and the Black Dam, Santa Clara County.

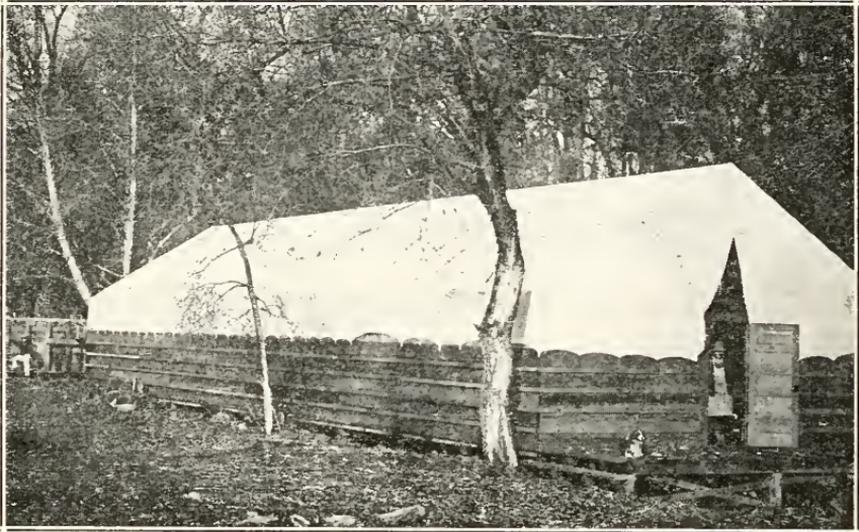


FIG. 48. Mormon Creek experimental hatchery, near Sonoma, Tuloumne County. One of the newest hatcheries. Photograph by Fred Leighton, February, 1928.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor.

UNTANGLING THE NAMES OF FISHES

When is a herring not a herring? The answer to this one is simple; when it is a queenfish. The reason for this flat joke is that along the southern California coast a small member of the croaker family, the queenfish, is caught and much of the time called (especially by sport fishermen) a "herring." Since this fish does not in any way resemble a herring, which is a member of the same family as the sardine, this misnaming makes a confusion of terms.

Unfortunately, we have many such common name tangles among our salt

water fishes in this state. Most of these have come about by people labeling a fish with a name that belongs to some other species with which they are familiar and imagine it resembles. Also, fishermen and dealers sometimes like to call local fish by the names of fish which have excellent reputations for food qualities elsewhere, thus making it easier to sell the species in question on the reputation of another. Then some of our fish are wrongly labeled for no good reason at all.

One of the worst of these confusions is the "bluefish" caught chiefly around Monterey. This is a species of rock fish and, probably because it has a blue tint

in its coloration, is called "bluefish." The distressing part of this is that on the Atlantic coast there is a true bluefish, a fish justly famous for its gastronomic and sporting qualities. These fish do not resemble each other any more than do booby owls and mallards, and the eastern bluefish certainly would not feel flattered by having its name tacked onto our rock fish. Just to make matters a little worse, there is a croaker which is occasionally taken in southern California, which is also called "California bluefish."

Another perplexity is the young white sea bass, which is called "sea trout." It is not a relative of a trout and, besides, there is no sense in having a fish start out a trout and end up a bass. Incidentally, the white sea bass is not a bass, but a croaker. A member of the Hexagramidae family, common around San Francisco, is also called "sea trout." The only resemblance it bears to a trout is that it has spots—but so has a setter pup.

Besides these cases, we have the southern halibut, which is a flounder; several so-called soles, all of which are flounders; a rock fish called a "salmon grouper" and several more tangles of names. Therefore, it is wise to look with skepticism upon any individual who catches a fish out of the Pacific Ocean and says, "I know what it is. I used to catch the same fish out of a creek back in Nebraska." However, by means of the knowledge of local names that the Department of Commercial Fisheries has collected, the catches of the various species are correctly tabulated and published. Also, it is hoped that the bulletin which the laboratory plans to publish within the next year, showing photographs and accepted common names of all our commercial fishes, will help to standardize the correct names.—J. A. Craig, State Fisheries Laboratory.

FISH CANNERS ORGANIZE

The resignation of B. D. Marx Greene as attorney for the Commercial Fisheries Department became effective March 1, 1928. Mr. Greene has held this position since resigning as executive officer. In addition to resuming his private practice, Mr. Greene will act as attorney for the Monterey Sardine Canners Association and other cannery in southern California. These concerns have retained him in a movement which it is hoped will lead to an organization of the entire industry upon a more profitable basis. His investigation will have as its objective the working out of a system which will mean an export corporation under the Webb Law and, among other things, a closer cooperation with the Fish and Game Commission along law enforcement, legislative and constructive lines.

Mr. I. Zellerbach, president of the Fish and Game Commission, commented on Mr. Greene's resignation as follows: "Mr. Greene has served the Commission faithfully and efficiently for four years. During two of these years he held three combined positions—executive officer, attorney for the Commission and attorney for the Commercial Fisheries. It pleases me greatly to learn that he has accepted a retainer to make this extensive survey for what promises to be a real organization of fish cannery."

"Had such an organization been formed years ago in this great industry, many bitter legal battles would have been avoided. I understand this will mean a much closer cooperation with the Fish and Game Commission, and this attitude on the part of the cannery is one which I have urged ever since becoming a member of the Fish and Game Commission. It appears that a new day has dawned for the packers and the Commission."

LIFE HISTORY NOTES

A PLEA FOR THE WHITE-TAILED KITE

One of our most beautiful birds that is nearing extinction in California is the white-tailed kite, *Elanus leucurus*. This bird is most apt to be met with flying over swamps or marshy river bottoms, and can be recognized by its white tail, black shoulders, and its silvery wings and light underparts. It is the size of a small gull and has the habit of slowly flying back and forth over damp ground, hovering at times almost stationary with beating wings just before dropping upon its prey. Small rodents, such as mice and shrews, with insects, compose the greater part of

its food. Thus it is of economic value to the farmer besides adding a touch of wonderful beauty to the landscape.

To anyone who has seen this bird in flight, especially when it is going through these falling and hovering antics, which it accomplishes with utmost grace, there is a charm supreme.

The kite's note is a soft whistle with an occasional low cackle and is heard most often when one is near its nest. It is also at this season that the bird gives its best demonstration of turning, tumbling and diving through the air, an exhibition of rare charm and beauty that will never be forgotten by one who has witnessed it.

One must not forget that the kite is a rare bird in California and that it is protected at all times by our laws; even scientific collectors are forbidden to harm the bird or molest its nest.

Those hunters who frequent marshes, swamps or river bottoms should be very careful not to shoot this small gull-like hawk. It is not a destroyer of game birds and harms not your sport in the least. Leave them alone, as there are all too few left and they must not go the way of our passenger pigeons and buffalo.

Let these harmless creatures remain so that their beauty can add its charm to our already beautiful California landscape.—Wright M. Pierce, Claremont, California, January 6, 1928.

back. It is entirely white below except for brownish flecking on the throat and breast. In spring and summer the entire underparts are solid black, with a white border over the forehead and down the sides of the neck. Since we see this bird mostly in fall and winter, we are not familiar with the black-bellied plumage. Some birds are in the process of changing to summer plumage before they leave this latitude in the spring.

The spotted sandpiper also changes to a considerable extent in spring and fall. If one goes to the Sierra Nevada Mountains in summer they will see this bird in its breeding plumage with its white belly and throat, spotted with large, round, black spots and grayish, black flecked



FIG. 49. White-tailed kite from a mounted specimen. Courtesy of San Diego Society of Natural History.

MISLEADING NAMES IN VARIOUS COMMON BIRDS

Quite often there are questions forthcoming by people in the field with regard to birds with descriptive names that do not match their actual plumage coloration, as we see it.

Some of these are as follows:

Red-tailed hawk.

Black-bellied plover.

Spotted sandpiper.

Red-backed sandpiper.

Red phalarope.

The red-tailed hawk does not acquire its russet tail until it is several years old. The tail previous to that time is barred with gray and black.

The black-bellied plover is a bird which changes its plumage in the fall to a modest dark gray flecked with white on the

back. In the winter this bird is white beneath and grayish above, with a few fine brownish lines on the back feathers.

The red-backed sandpiper is another bird which has entirely different plumages for summer and winter. In spring and summer the top of the head and the back are a bright chestnut brown with black streaks on the back. The throat and breast are white, streaked with dusky and a black patch on the belly. The rest of the underparts are white. In the fall and winter, the upper parts are ash gray, underparts mostly white with brownish band across the breast. We see but very few birds in the spring and summer plumage.

The red phalarope in spring and summer has the top of its head black, with the sides of the head white. The upper-

parts are buffy brown streaked with black. Underparts are entirely deep chestnut. The bill is yellow with a dusky tip; feet yellowish. In winter the forehead is white, back bluish gray with but few acquire their adult plumage until after several years in the immature plumages and intermediate stages have been gone through.—D. D. McLean, 711 Postal Telegraph Bldg., San Francisco.



FIG. 50. White-tailed kite in flight. Copyrighted photograph by Wright M. Pierce.

streaks. The underparts are pure white. The bill is black with yellowish base. Feet bluish gray.

This will, I hope, help to clear up some of the identification troubles of some of the deputies and people working in the field. Shorebirds are hard enough to identify without their going through a complete change of plumage in spring and fall. Many hawks and gulls do not

THE PIGEON HAWK'S BILL OF FARE

Although the northern pigeon hawk (*Falco columbarius*) is never common in California, it might be well to note some of its food habits during its stay with us during the winter months. Most of my experience with this species has been in the lower edge of the yellow pine belt (Transition life zone) of the Sierra Nevada Mountains.

During the winter months, the pigeon hawk is rather locally distributed.

Of the nine specimens I have taken, eight have come from the same locality in Mariposa County. The ninth was taken between Hollister and Gilroy, in San Benito County.

Its favorite prey seems to be shorebirds, robins, pipits and Savannah sparrows, while that of the sparrow hawk is almost entirely insects.

A female bird, taken in Mariposa County, had eaten a junco and a pipit with the remains of two other pipits in



FIG. 51. White-tailed kite hovering in air. Copyrighted photograph by Wright M. Pierce.

In flight, this species shows the same dash and spirit as does the duck hawk, but is so small that it is not capable of coping with such large prey. The bird is only slightly larger than the sparrow hawk.

The food of this species is a noticeable contrast to that of the sparrow hawk.

the stomach which were nearly digested. An immature male from near the same place had eaten a robin and could scarcely fly, due to the added weight. Still another immature bird had parts of a robin and had a meadowlark in its stomach. The meadowlark was nearly digested. An adult male was eating a

robin when shot and another had just killed a red-shafted flicker. Another adult male had a California jay in its possession, while another had eaten a robin. A young male bird that seemed droopy had eaten a junco, a pipit and an unidentified bird, presumably an Audubon warbler. The one collected near Gilroy had eaten four Savannah sparrows.

All of their food seems to be plucked to a considerable extent, but none of the flesh is discarded unless possibly some of the entrails. Wings, feet and bills were found in the stomachs.

Birds are generally knocked down in a cloud of feathers, then picked up and carried away to be eaten in some secluded spot.—D. D. McLean, 711 Postal Telegraph Bldg., San Francisco.

brant, *Branta nigricans*. At times several hundred birds were present.

The brant has not been present on the bay for a number of years, due, probably to the fact, that the increased habitation and consequent building on Mission Beach strand, separating the bay from the ocean, has frightened the bird. It is hoped it will become accustomed to the improvements and continue to make this bay its habitat during the winter months, as in former years.

The brant has been observed also in large numbers on San Quentin and Magdalena bays to the southward.—Ad B. Pearson, San Diego, California.

A NOTE ON THE FOOD OF THE LONG-BILLED CURLEW

On examining the stomach and gullet

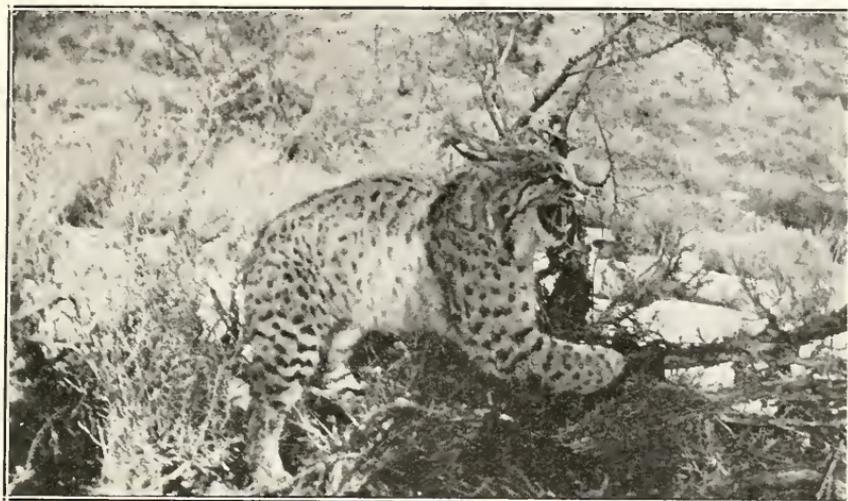


FIG. 52. Large wildcat taken near Verdi, Nevada, by S. M. Wiley. Weight nearly 60 pounds.

UNUSUALLY LARGE WILD CAT CAPTURED

In September, 1927, I trapped a very large wildcat near Verdi, on the California-Nevada line. It weighed nearly sixty pounds and the skin stretched on a board measured five feet. It was the finest pelt I ever saw. The accompanying photograph gives a good idea of its large size and perfect spotting.—S. M. Wiley, Verdi, Nevada.

BLACK SEA BRANT ON MISSION BAY

In addition to pintail and widgeon ducks being more abundant this year than for several years past on Mission Bay, four miles north of San Diego Bay, we have seen several flocks of black sea

of a long-billed curlew, sent in for preparation into a study specimen. I discovered seven large sand fleas (*Orchestoidea californiana?*). Several of them were in the gullet and the remainder were in the stomach in varying stages of decomposition, due to the process of digestion in the curlew. No other species was found in the digestive tract.

The bird was taken on Morro Beach, San Luis Obispo County, California, January 20, 1928.—D. D. McLean, 711 Postal Telegraph Bldg., San Francisco.

NOTES ON A CAPTIVE TURKEY VULTURE

On January 10, 1928, a turkey vulture (*Cathartes aura septentrionalis*) was brought to me. It had been shot through the right wing, but the bones were not

broken, and it seemed to be otherwise uninjured, except for the loss of the right foot, an injury of long standing, since the stump of the tarsus was healed and enlarged on the end from being used in place of the missing foot. It appeared to be an immature bird from the absence of red skin about the head. I put it in the stable for the night and the next day made a pen of chicken netting in a corner of the upper floor of the barn, where it would get the sun in the afternoon. I got some beef liver for it, but it paid no attention to this food, which remained in the pen and dried up, and was not eaten at all.

The bird had nothing to eat until

canvas to watch developments. The vulture stood in the far corner of the pen for several minutes without moving, then started preening its feathers and shaking itself and eyeing the gopher. At 2.56 it came over to the gopher, nibbled at it, picked it up by a leg and dropped it several times, then left it and spent several minutes trying to get out of the pen. At 3 it was back in the corner preening its back and breast feathers. Standing on the one foot, only using the stump when moving about, at 3.03, ran a primary covert through the beak, twice, turned head on side and looked up at the roof several times, as if expecting others of its kind to come to the feast, and at

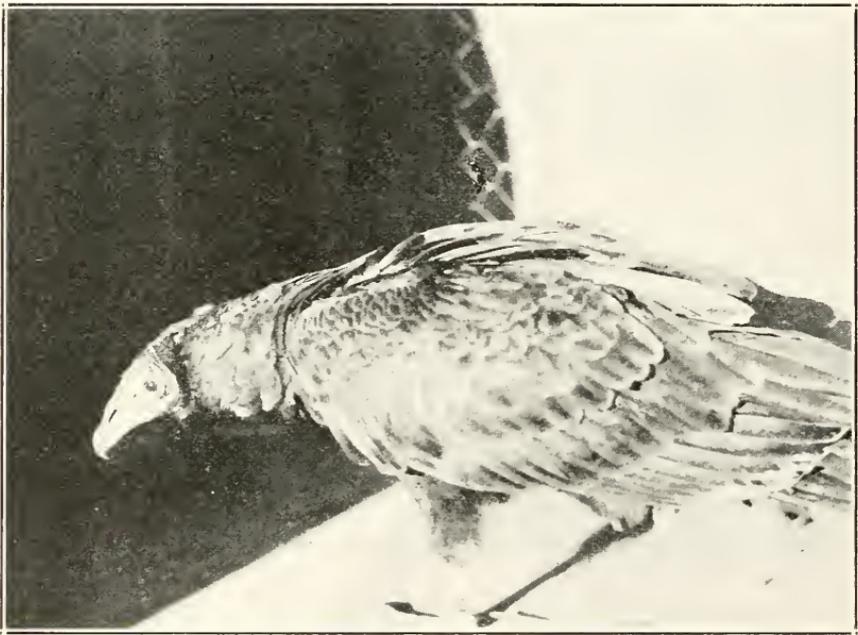


FIG. 53. Captive one-legged turkey vulture. Photograph by J. A. Calder.

January 13, when a mouse and a pocket gopher were given it, and the mouse was gone about an hour later and the gopher was eaten the next day. From then until February 2, the bird ate one pocket gopher a day. On January 18, I put band No. 421544 on the bird and turned it loose, but it could not fly, so I put it back in the pen. On January 21, Mr. James A. Calder took some pictures of it, and it was still unable to fly.

Being anxious to see how a vulture with only one foot could hold a gopher to tear it, I put up a blind of canvas about eight feet from the center of the pen, and on January 24, at 2.47 p.m., I put a gopher, that had been dead twenty-four hours, in the pen, and retired behind the

3.05 yawned. At 3.10 stood with feathers fluffed out, occasionally preening feathers of lower back or breast, seemed suspicious of movements of the canvas caused by the wind. It stood almost motionless until 3.16 when I left the blind. I was nearby until 3.43, when I left the barn and did not return until 5.05; by that time the gopher was gone except for the head and the stomach.

On January 25, at 2.50 p.m., I put a gopher in the pen and went into the blind. The vulture moved to the sunny side of the pen, stood on its one foot with the stump drawn up close to its body, peering around suspiciously, preening, and once rubbing its head on its back. At 2.57 it approached the gopher.

picked it up by a leg and dropped it, several times, and nibbled at it, and then, trying several times to hold it with the stump, hopped about until the claw of the long middle toe of the left foot held the gopher down, and then tore it open, starting just back of the ribs, on the side. The intestines and all the other organs were eaten, except the stomach, which was pulled out and dropped to one side. Still holding the carcass with the middle toe, pieces were torn off and swallowed, bones and all; then the hind quarters were torn from the rest of the body, and both hind legs, the tail and part of the spine were swallowed in one chunk with much gulping and straining. A large piece of skin from the back was discarded, and, then, trying to hold it down with the stump, but being unsuccessful and resorting to the middle toe again, the fore part of the body was torn off and swallowed in small bits until at 3.10 only the skull and the skin on top of it remained. Then the bird turned its attention to the discarded piece of skin and ate most of it; then the stomach was torn apart and eaten, only part of the contents, a mass of green vegetable matter being discarded. At 3.19 the vulture retired to the corner of the pen, the meal finished.

This was a small gopher, and with some larger ones more skin and some bones besides the skull were left; in several cases the front legs were pulled back through the skin and the bones picked clean, and in some cases the skull was skinned out and picked clean, the lower jaw being torn loose from the skull. With one extra large gopher several inches of the spine was left attached to the skull. Pellets were ejected which were composed almost entirely of fur, only small fragments of bone were found in some of them. A can of water was kept in the pen, but I saw no evidence that the bird drank any of it.

On January 31, the vulture was out of the pen and roosting on a timber over the open barn door, and was put back in the pen, and on February 2, when I got back from work, it was gone and has not been seen since. It shed many white, downy feathers, and several flight feathers while in captivity. When our dog came near the pen, it usually made a loud hissing sound,

if I was not in sight, but was silent when I was nearby. It did not require its food to be ripe, as it sometimes ate gophers before the blood heat was out of them.—John McB. Robertson, Buena Park, California.

MUSKRATS AND BEAVER IN IMPERIAL COUNTY

A recent investigation of the activities of trappers in the southeastern portion of Imperial County disclosed a considerable number of operators. In the main, the catches comprise muskrat, fox, skunk and coyote. Of these the muskrat appears to be preferred. One trapper told us he had caught 130 muskrats in nine days along the banks of the Imperial Valley levee. As the muskrats were much easier to skin and handle than any other fur animal, their popularity with the trappers is obvious. This trapper stated he could skin ten "rats" to one coyote.

The majority of the muskrats are caught in the tules bordering the canals of the Imperial Valley proper. A number are also trapped around the potholes near the Colorado River. These potholes are formed by the receding waters of the river and are sometimes miniature lakes, being a mile in length and one-half mile in width. The water in these lakelets offers a decided contrast to the muddy appearance of the turbulent river and is quite clear and placid. Willows and cottonwoods grow in abundance about their margins and offer attractive food for colonies of beaver. Most of them exhibit "beaver sign" by the numbers of trees felled into the water. Beaver "slides"—avenues in and out the lakelets—are other evidence of their presence. As a rule, the trappers set their traps in these places.

Happily, beaver appear to be on the increase. This is no doubt due to the closed season and the resulting protection afforded. The Arizona season, too, has been closed for a number of years, but at the time it was open it was common practice for Arizona trappers to cross the river at night and return before morning with a few California beaver. The state of Arizona employs two wardens to patrol the Arizona side of the Colorado and protect these beaver.—E. H. Glidden, San Diego, January, 1927.

CONSERVATION IN OTHER STATES

NEW YORK INTRODUCES VARYING HARES

Like many an eastern state, New York has been lamenting the disappearance of rabbits. As a consequence, the Department of Conservation recently purchased 700 pairs from Maine. These were all wild hares trapped in their native haunts. After holding the shipment so that the animals might be examined for traces of disease, they were liberated in suitable covers, particularly in the Adirondacks in brush marshes and ravines. There is a chance to reestablish this game mammal. Some seven counties were thus stocked.

NEW YORK PLANS SERIES OF REFUGES

Recently the state of New York provided for funds to be used in the acquiring of more agriculture areas for establishing fish and game refuges. It has been found that one-half the moneys received from the sale of licenses would amount to about \$350,000 per year. The Department of Conservation is now starting out on a program to furnish a fish and game refuge in every county of the state that is suitable for one. The plan includes the placing of these refuges in such situations that every hunting ground in the state will be benefited by the overflow from the refuges. The first refuge of more than 3800 acres has been purchased. Other proposals are being considered.

NEW YORK SUCCEEDS IN STOCKING AREA WITH MALLARDS

Several years ago the New York Game Farm at Sherburne secured a setting of mallard eggs. From year to year, the breeding stock has been increased and at the same time the surplus have been liberated. Now for miles surrounding the game farm, mallard ducks are permanent residents. For thirty to forty miles both up and down the river which borders the game farm may be found mallard ducks which are the direct descendants of those propagated on the game farm.

NOVA SCOTIA CREATES SANCTUARY

A splendid stretch of 200 square miles of virgin territory, including numerous lakes and streams, has been set aside as a game sanctuary in Nova Scotia. There are natural boundaries which are well defined. The sanctuary is particularly adapted to the conservation of game as it forms a natural breeding ground already inhabited by a large number of game animals. It will be easy to admin-

ister as it is far removed from settlements and from territory ordinarily used by the hunter and trapper.

YELLOWSTONE ELK THRIVE IN CANADA

According to an article by Hoyes Lloyd appearing in the *Canadian Field Naturalist* (September, 1927), the Canadian National Parks branch has stocked various areas in Canada with Yellowstone elk which were furnished by the United States Department of Agriculture. In exchange Canada furnished mountain goat and sheep. One of the first introductions was that of sixty-three elk, yearlings and two-year-olds, which were shipped to Banff on February 20, 1917. Later in December, 1919, another shipment of 194 was made. The animals have increased and have spread widely over the entire park.

A shipment of nearly 100 elk was sent to Jasper National Park in British Columbia on March 13, 1920. This herd has increased rapidly and a census in 1926 showed about 1200 head in the park. They are now found in practically every valley.

Active interest in saving the buffalo brought worthwhile results and it appears that the North American elk can be handled as successfully.

There yet remains the successful solution of California's elk problem. Cut down to some 400 head of wild animals at the lower end of the San Joaquin Valley, there is needed at least two well fenced areas where these remaining animals can find a suitable food supply and where they can be kept for enjoyment of future generations. Depredations in cultivated fields continue to warn conservationists of the need for early action in this regard.

REARING vs. PURCHASING GAME

Mr. H. J. Burlington, president of the New Jersey Board of Game and Fish Commissioners, concerning the wisdom of operating state-owned game farms as against purchasing game in the open market, stated that the cost of rearing ring-neck pheasants in his state has been brought down to \$2.28 per bird, and they hope to do considerably better. Last year they reared 8000 ringnecks and purchased 10,000 birds in the open market. They also distributed about 40,000 eggs to interested sportsmen and farmers for hatching purposes. New Jersey has found it unwise to release ringnecks before they are fourteen weeks old.

REPORTS

STATEMENT OF EXPENDITURES

For the Period October 1, 1927, to December 31, 1927, of the Seventy-ninth Fiscal Year

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....	\$1 92	\$4,215 00	\$458 25	\$8 75	\$4,683 92
Clerical and office.....	169 64	4,039 75	466 00	18 15	4,693 54
Rent.....			2,960 81		2,960 81
Automobiles.....	94 12		167 72	13 80	275 64
Telephone and telegraph.....			1,443 34		1,443 34
Postage.....			765 78		765 78
Freight, cartage and express.....			452 86		452 86
Printing.....	4,155 80				4,155 80
Accident and death claims.....			280 06		280 06
Commissioners.....			345 11		345 11
Total administration.....	\$4,421 48	\$8,254 75	\$7,339 93	\$40 70	\$20,056 86
Education:					
Director and assistants.....	\$97 55	\$3,660 17	\$906 34	\$3,013 35	\$7,677 41
Publicity:					
Director.....		\$825 00	\$244 57		\$1,069 57
State Fair.....			50 00		50 00
Total publicity.....		\$825 00	\$294 57		\$1,119 57
Conservation and protection:					
Chief and assistants.....		\$3,580 03	\$803 87	\$87 00	\$4,470 90
Clerical and office.....	\$17 89	818 67	1 00		837 56
Rent.....			116 46		116 46
Automobiles.....	619 77		193 25	44 40	857 42
Captains and deputies.....	105 83	49,567 27	37,992 95	3,255 52	90,921 57
Patrol launches.....	400 09	520 00	165 25	602 25	1,687 59
Lion hunting.....		450 00	187 32		637 32
Lion bounties.....			1,670 00		1,670 00
Fish planting.....		665 00	194 94	121 91	981 85
Refuge posting.....	75 02	495 81	154 67	20 65	746 15
Total conservation and protection.....	\$1,218 60	\$56,096 78	\$41,479 71	\$4,131 73	\$102,926 82
Commercial fisheries:					
Chief and assistants.....	\$69 40	\$2,410 03	\$603 53	\$127 95	\$3,210 91
Deputies.....	11 61	7,743 02	2,203 50	43 09	10,001 22
Patrol launches.....	465 47	1,188 17	773 96	2 76	2,430 36
Statistical.....	1 25	1,395 00	99 44	150 00	1,645 69
Laboratory.....	339 97	7,847 58	1,681 77	923 15	10,792 47
Salmon tagging.....			22 50		22 50
Botulism.....			3,750 00		3,750 00
Automobiles.....	217 21		62 55		279 76
Total commercial fisheries.....	\$1,104 91	\$20,583 80	\$9,197 25	\$1,246 95	\$32,132 91
Fish culture:					
Chief and assistants.....		\$1,000 03	\$19 35		\$1,019 38
Clerical and office.....	\$44 24	941 33	6 30		991 87
Rent.....			108 00		108 00
Automobiles.....	1,253 07		270 29	\$98 92	1,622 28
Hatcheries.....	6,436 11	29,735 69	4,165 36	6,423 75	46,760 91
Hatcheries, additions and betterments.....				16,612 51	16,612 51
Special field investigation.....	6 85	2,775 00	529 97		3,311 82
Total fish culture.....	\$7,740 27	\$34,452 05	\$5,099 27	\$23,135 18	\$70,426 77
Hydraulics:					
Chief and assistants.....	\$11 82	\$1,305 00	\$304 20		\$1,621 02
Cooperative research work.....	99 79	491 67	32 50		623 96
Total hydraulics.....	\$111 61	\$1,796 67	\$336 70		\$2,244 98
Game propagation:					
Automobiles.....			\$6 50		\$6 50
Game farm—Yountville.....	\$1,397 09	\$2,010 00	1,199 02	\$997 28	5,603 39
Total game propagation.....	\$1,397 09	\$2,010 00	\$1,205 52	\$997 28	\$5,609 89
Research:					
Chief and assistants.....	\$2 77	\$2,362 50	\$830 40		\$3,195 67
License commissions.....			\$13,619 85		\$13,619 85
Total Division of Fish and Game.....	\$16,094 28	\$130,041 72	\$80,309 54	\$32,565 19	\$259,010 73

STATEMENT OF INCOME

For the Period October 1, 1927, to December 31, 1927, of the Seventy-ninth Fiscal Year

	Detail	Total
License sales:		
Angling, 1927	\$39,156 10	
Angling, 1928	69 00	
Hunting, 1927-1928	99,081 40	
Hunting, 1928	16 00	
Market fishermen's licenses, 1927-1928	5,820 00	
Wholesale fish packers' and shell fish dealers' licenses—1927-1928	215 00	
Game breeders' licenses, 1927	52 50	
Fish breeders' licenses, 1927	5 00	
Trapping licenses, 1927-1928	3,413 00	
Commercial hunting club licenses, 1927-1928	1,185 00	
Commercial hunting club operators' licenses, 1927-1928	350 00	
Deer tag licenses, 1927	73,302 50	
Kelp licenses	10 00	
Total license sales		\$222,675 50
Other income:		
Game tag sales	\$11 43	
Court fines	20,794 08	
Fish packers' tax	24,706 85	
Kelp tax	1 31	
Fish tag sales	1,037 04	
Miscellaneous sales	20 00	
Interest on bank deposits	738 87	
Total other income		47,309 58
Total income		\$269,985 08

SEIZURES OF FISH AND GAME

October, November, December, 1927

Salmon, pounds	128
Barracuda, pounds	9,935
Striped bass, pounds	372
Spot-fin croaker	20
Black bass	15
Trout	348
White fish	2
Crappie	39
Perch	1
Catfish, pounds	90
Crawfish	140
Crabs	301
Clams	1,700
Abalone	145
Lobster, pounds	522
Quail	295
Pheasant	11
Doves	21
Geese	118
Ducks	225
Mudhens	1
Shore birds	49
Non-game birds	57
Deer meat, pounds	1,418
Deer hides and horns	3
Rabbits, cottontail, brush and Sierra hare	59
Hides of fur bearing mammals	22
Illegal nets and traps	4

GAME CASES

October, November, December, 1927

Violation	Number arrests	Fines imposed	Jail sentences (days)
Hunting License Act.....	104	\$2,240	62
Deer Tag License Act.....	8	250	---
Commercial Gun Club License Act.....	1	---	30
Deer: closed season or district.....	24	1,425	---
Deer: does, fawns, spiked bucks, or forked horn in District 1¼.....	11	675	150
Deer: running with dogs, closed season.....	1	25	---
Deer: illegal sale of meat.....	1	25	---
Ducks: closed season.....	11	150	115
Ducks: over limit.....	10	525	---
Swan: closed season.....	4	100	---
Geese: over limit.....	8	200	---
Shore birds: closed season.....	30	785	5
Doves: closed season.....	10	350	---
Quail: closed season.....	34	1,250	150
Quail: over limit.....	3	150	---
Pheasants: closed season.....	7	450	---
Non-game birds.....	32	740	---
Rabbits: cottontail and brush, closed season.....	31	760	---
Squirrels, tree: closed season.....	2	50	---
Shooting game from automobile, power boat, etc.....	9	205	---
Game refuges: hunting or possession of firearms in.....	12	275	50
Night hunting.....	55	1,440	90
Trespass.....	4	200	---
Illegal trapping of birds.....	1	---	---
Illegal shipping of game.....	3	75	---
Illegal sale of game.....	4	325	---
Fur trapping regulations.....	11	240	10
Totals.....	431	\$12,910	662

FISH CASES

October, November, December, 1927

Violation	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act.....	23	\$570	---
Commercial Fishing License Act.....	9	80	---
Trout: over limit.....	7	100	---
Trout: closed season.....	3	100	---
Striped bass: undersize or over limit.....	23	905	5
Striped bass: sale of, in closed season.....	2	225	---
Salmon: over limit.....	4	100	---
Salmon: closed season or district.....	2	100	---
Salmon: illegal sale of.....	1	100	---
Salmon: illegal taking of on spawning beds.....	2	50	---
Black bass: illegal sale of.....	1	25	---
Crappie: over limit.....	2	50	180
Barracuda: undersize.....	3	100	---
Crawfish: undersize.....	2	100	50
Crabs: undersize and females.....	6	135	---
Crabs: closed season.....	1	20	---
Clams: undersize and over limit.....	43	1,775	60
Abalones: undersize and over limit.....	37	1,085	5
Lobsters: under or oversize.....	11	275	10
Illegal fishing: within 300 feet of inlet to lake; 250 feet fishway; 150 feet lower side of dam.....	1	25	---
Illegal fishing: more than one rod or line in trout fishing.....	1	50	---
Nets: illegal possession or use.....	19	625	---
Illegal possession of fish spear.....	20	600	65
Illegal night fishing.....	4	75	---
Illegal shipping of fish.....	1	25	---
Pollution.....	3	700	---
Totals.....	231	\$7,995	375

SUMMARY OF ANNUAL KILL OF FUR BEARING MAMMALS IN CALIFORNIA—SEASONS 1924-1927

Species	Estimated number				Average price				Estimated value			
	1924-1925	1925-1926	1926-1927		1924-1925	1925-1926	1926-1927		1924-1925	1925-1926	1926-1927	
Skunk.....	29,092	28,107	39,074		\$1.265	\$1.406	\$1.203		\$36,721.65	\$39,517.29	\$47,006.02	
Raccoon.....	11,006	13,358	15,527		3.28	4.392	5.639		36,099.88	58,667.82	87,556.75	
Gray fox.....	8,301	8,878	8,498		1.852	1.928	2.132		15,373.45	17,117.15	18,117.74	
Coyote.....	8,043	8,509	9,631		4.412	4.048	5.07		35,485.72	34,447.52	48,829.17	
Wild cat.....	5,443	6,087	7,015		2.24	2.047	2.242		12,460.52	12,460.52	15,727.63	
Civet cat.....	3,364	4,292	4,869		.476	.688	.655		1,601.26	2,918.37	3,174.38	
Beaver.....		4,019	692			12.366	12.365			49,698.95	9,590.26	
Muskrat.....	3,120	6,207	13,261		.463	.633	.818		1,444.56	3,929.03	10,847.50	
Mink.....	3,066	3,394	4,867		4.635	5.548	7.057		14,310.91	18,829.77	34,346.42	
Ringtail cat.....	2,304	2,698	3,477		2.018	2.414	2.633		4,649.47	6,512.34	9,154.94	
Kit fox.....	1,261	272	2,145		1.949	2.035	2.166		2,457.69	553.52	4,646.07	
Marten.....	1,086	472	479		10.677	11.108	10.485		11,599.70	5,244.97	5,022.32	
Badger.....	457	496	742		1.578	1.723	1.709		720.15	854.61	1,268.08	
Opossum.....	356	613	1,064		.634	1.038	.80		225.70	642.29	851.20	
Weasel.....	338	227	347		.792	.742	.765		267.70	168.43	265.46	
Bear.....	227	292	291		8.50	6.92	8.49		1,929.50	2,018.76	2,470.59	
River otter.....	142	141	158		12.26	13.446	14.456		1,740.92	2,051.01	2,284.05	
Fisher.....	68	30	32		36.784	25.124	42.357		2,501.31	755.61	1,355.42	
Mountain lion.....	65	75	68		15.80	14.071	19.654		1,027.00	1,035.33	1,336.47	
Red fox.....	45	18	23		18.583	14.859	21.50		836.24	268.13	494.50	
Wolverine.....	3				10.00				30.00			
Totals.....	77,787	88,185	112,230						\$181,215.13	\$257,711.42	\$304,284.97	

The above is based on reports furnished by licensed trappers, and is an estimate of the total catch made by licensed commercial trappers. No attempt has been made to include an estimate of the animals trapped by minors under the age of 18 years, or those taken for private use, or those killed in predatory animal control campaigns.

	1924-1925	1925-1926	1926-1927
Number of trapping licenses issued.....	2,984	3,530	3,790
Number of trappers reporting.....	1,933	2,338	2,619
Per cent reporting.....	64.8	66.5	69.1

DEER KILLED IN 1927, BY COUNTIES

County	Deer killed	Land area, square miles
Siskiyou.....	1,665	6,256
Mendocino.....	1,475	3,539
Trinity.....	921	3,096
Lake.....	901	1,238
Humboldt.....	821	3,575
Tehama.....	799	2,925
Monterey.....	757	3,330
Sonoma.....	751	1,582
Tulare.....	744	4,856
Santa Barbara.....	669	2,740
Glenn.....	623	1,337
Shasta.....	612	3,858
Fresno.....	592	5,950
Plumas.....	551	2,593
El Dorado.....	535	1,737
Modoc.....	510	3,823
Napa.....	442	783
Los Angeles.....	425	4,115
Santa Clara.....	397	1,328
San Luis Obispo.....	394	3,334
Marin.....	367	529
Placer.....	341	1,411
Riverside.....	323	7,223
Lassen.....	296	4,531
Ventura.....	274	1,878
Colusa.....	263	1,140
Madera.....	260	2,112
Butte.....	228	1,698
Alameda.....	220	732
Kern.....	218	8,003
San Benito.....	217	1,392
Tuolumne.....	213	2,190
Inyo.....	173	9,991
San Diego.....	169	4,221
Calaveras.....	149	1,027
Nevada.....	125	974
Yolo.....	115	1,014
Sierra.....	101	923
Mariposa.....	95	1,463
Stanislaus.....	91	1,450
Santa Cruz.....	78	435
San Mateo.....	77	447
San Bernardino.....	74	20,175
Alpine.....	67	776
Merced.....	67	1,995
Amador.....	59	601
Orange.....	56	795
Yuba.....	53	632
Solano.....	45	822
Del Norte.....	42	1,024
Mono.....	36	3,030
San Joaquin.....	21	1,448
Contra Costa.....	5	714
Kings.....	3	1,159
Imperial.....	1	4,089
Sutter.....	1	608
Sacramento.....		983
San Francisco.....		42
Totals.....	19,507	155,672

To better compare the 1927 kill of deer in the several counties, the following chart shows the average number killed per 100 square miles of area:

County	Average per 100 square miles of area	Deer killed	Land area, square miles
Lake.....	75	901	1,238
Marin.....	69	367	529
Napa.....	57	442	783
Glenn.....	48	623	1,337
Sonoma.....	47	751	1,582
Mendocino.....	42	1,475	3,539
El Dorado.....	31	535	1,737
Santa Clara.....	31	397	1,328
Alameda.....	30	220	732
Trinity.....	30	921	3,096
Tehama.....	28	799	2,925
Siskiyou.....	27	1,665	6,256
Santa Barbara.....	25	669	2,740
Placer.....	24	341	1,411
Colusa.....	23	263	1,140
Monterey.....	23	757	3,350
Humboldt.....	23	821	3,575
Plumas.....	21	551	2,593
Santa Cruz.....	18	78	435
San Mateo.....	17	77	447
Butte.....	17	228	1,698
Shasta.....	16	612	3,858
San Benito.....	16	217	1,392
Tulare.....	15	744	4,856
Ventura.....	15	274	1,878
Calaveras.....	15	149	1,027
Modoc.....	13	510	3,823
Nevada.....	13	125	974
San Luis Obispo.....	12	394	3,334
Yolo.....	11	115	1,014
Sierra.....	11	101	923
Madera.....	10	260	2,112
Los Angeles.....	10	425	4,115
Fresno.....	10	592	5,950
Tuolumne.....	10	213	2,190
Amador.....	10	59	601
Alpine.....	9	67	776
Yuba.....	8	53	632
Orange.....	7	56	795
Lassen.....	7	296	4,531
Mariposa.....	7	95	1,463
Stanislaus.....	6	91	1,450
Solano.....	6	45	822
Riverside.....	5	323	7,223
San Diego.....	4	169	4,221
Del Norte.....	4	42	1,024
Merced.....	3	67	1,995
Kern.....	3	218	8,003
Inyo.....	2	173	9,991
San Joaquin.....	1	21	1,448
Mono.....	1	36	3,030
Contra Costa.....	1	5	714
San Bernardino.....	-----	74	20,175
Kings.....	-----	3	1,159
Sutter.....	-----	1	608
Imperial.....	-----	1	4,089
Sacramento.....	-----	-----	983
San Francisco.....	-----	-----	42
		19,507	155,672

HUNTERS KILLING TWO DEER.

County of residence of hunter—	
Alameda.....	112
Alpine.....	7
Amador.....	50
Butte.....	8
Calaveras.....	45
Colusa.....	28
Contra Costa.....	6
Del Norte.....	29
El Dorado.....	66
Fresno.....	34
Glenn.....	96
Humboldt.....	23
Imperial.....	40
Inyo.....	7
Kern.....	33
Kings.....	8
Lake.....	166
Lassen.....	13
Los Angeles.....	43
Madera.....	2
Marin.....	89
Mariposa.....	9
Mendocino.....	4
Merced.....	72
Modoc.....	34
Mono.....	4
Monterey.....	13
Napa.....	25
Nevada.....	44
Orange.....	23
Placer.....	18
Plumas.....	21
Riverside.....	100
Sacramento.....	42
San Benito.....	78
San Bernardino.....	15
San Diego.....	83
San Francisco.....	67
San Joaquin.....	20
San Luis Obispo.....	57
San Mateo.....	4
Santa Barbara.....	142
Santa Clara.....	25
Santa Cruz.....	93
Shasta.....	28
Sierra.....	16
Siskiyou.....	45
Solano.....	31
Sonoma.....	65
Stanislaus.....	17
Sutter.....	28
Tehama.....	29
Trinity.....	8
Tulare.....	1
Tuolumne.....	1
Ventura.....	3
Yolo.....	
Yuba.....	
Arizona, State of.....	1
Nevada, State of.....	1
Oregon, State of.....	3
Total.....	2,223

STATISTICS ON DEER KILL, SEASON 1927

COUNTY OF RESIDENCE OF HUNTER →

COUNTY WHERE DEER WAS KILLED. ↓

	ALAMEDA	ALPINE	AMADOR	BUTTE	GALAVERNAS	COLUSA	CONTRA COSTA	DEL NORTE	EL DORADO	FRESNO	GLENN	HUMBOLDT	IMPERIAL	INYO	KERN	KINGS	LAKE	LASSSEN	LOS ANGELES	MADERA	MARIN	MARIPOSA	MENDOCINO	MERCED	MODOC	MONO	MONTEREY	NAPA	
ALAMEDA	167					12													2										
ALPINE	10	1	1	12																									
AMADOR	5		21	4				1																				1	
BUTTE	5		166	1	4					2							1		5										
CALAVERNAS	3		11	60	4									1			1		2					1					
COLUSA	3			6	141	7					8							1	3		1	1						1	
CONTRA COSTA						4																							
DEL NORTE								38				1							2										
EL DORADO	21	2	31	3	1	6		228							2	2		18					1			5	3		
FRESNO	3								377					11	15	20		71	6	1				4			4		
GLENN	31			47	78	3			1	196					2			9	1	5		6	1				4		
HUMBOLDT	38					2	15		3	2	501			1	3		2	26	1	16		32	1			1	6		
IMPERIAL																			1										
INYO														105	7				50										
KERN														3	134				66									1	
KINGS																	3												
LAKE	23			4	57	21			2	3	1			3	3	297		12		7		29	1			3	58		
LASSSEN	8			24	4	8			5	3							3	101	15	1		3	3				2		
LOS ANGELES																			402										
MADERA										81								17	99		8	8					1		
MARIN	15					8														209									
MARIPOSA	4				2					2					1	1		6	16		32		21						
MENDOCINO	167			3	13	40			2	20	12			4	9	9		32	1	46		494	5			2	18		
MERCED	1							1				1							1				42			2			
MODOC	18			20	14	7		1	8	9	9	1		2	12	18	7	25	1	4		5	5	103		4	10		
MONO												1	10					7					1			11			
MONTEREY	12					4			9						1	1		31		2		1					436	1	
NAPA	18				3	6			2								7		1	3		1					226		
NEVADA	6					1		1							1			9		1		1					1	1	
ORANGE																			3										
PLACER	21				3	13		16				1						2		4							2	18	
PLUMAS	28				77	5	5		6	9							1	36	42	1	4	2	3				6		
RIVERSIDE										1			6	1	1				20										
SACRAMENTO																													
SAN BENITO	4							11										2		6	1		2				16		
SAN BERNARDINO																				18									
SAN DIEGO																				22									
SAN FRANCISCO																													
SAN JOAQUIN	2				1																								
SAN LUIS OBISPO									3		1	25	2						21									11	
SAN MATEO																					1								
SANTA BARBARA	1								5						68			57		1	1						1		
SANTA CLARA	26				1		7											4						7			3		
SANTA CRUZ																												1	
SHASTA	32			7	6	8			3	3	5			4	3	6	3	24	1	4		3	3	2			1	5	
SIERRA	8			3		1			1									1		1									
SISKIYOU	53			24	16	23			5	22	10	1		11	6	10	6	77		1	1	8	4	17			1	13	
SOLANO	7				2																							2	
SONOMA	43				1	17						2							12	2	15		7				15		
STANISLAUS	3					9														1			10				1		
SUTTER																													
TEHAMA	28			77	19	12			13	52					2	5	5	5	65	1			3				3	11	
TRINITY	62			9	1	7	4		2	2	161	1		4	4	2		52		13		53					7		
TULARE	2									21				14	10	16			93	1				2					
TUOLUMNE	8			1	22	3		1										2				2	1		2				
VENTURA																													
YOLO	4				2	3																						2	
YUBA	2				7		1																						
TOTALS	967	3	65	474	111	366	256	42	260	552	391	702	14	145	244	9	366	258	61	33	341	43	652	128	91	13	502	210	

NEVADA	ORANGE	PLACER	PLUMAS	RIVERSIDE	SACRAMENTO	SAN BENITO	SAN BERNARDINO	SAN DIEGO	SAN FRANCISCO	SAN JOAQUIN	SAN LUIS OBISPO	SAN MATEO	SANTA BARBARA	SANTA CLARA	SANTA CRUZ	SARASTA	SIERRA	SISKIYOU	SOLANO	SONOMA	STANISLAUS	SUTTER	TEHAMA	TRINITY	TULARE	TULUMNE	VENTURA	YOLO	YUBA	ADJ. RESIDENT	TOTALS		
								6	2			4		24	2						1									220			
		1						4	22													11				1			2	67			
					14			1	9					1							1						1			59			
		4			2			1	4	1					2	1				1	5		12	2			5	4	228				
		1			3				6	37				4	1						1	5				1	6		1	149			
		2			10				7	8		4									1	1					37	6		263			
									1																					5			
		1																												42			
	1	2	39			111	1	2	4	20		2		6	2						3	6	4	3			2	3	2	535			
		6					1	1	3	1	1				2											58	7			592			
		3	7				42		2	12	17	2	9	4	5	2	5				13	17	2	29	17					623			
		2			4	4	1	2	9	63	3	1	9		10		2				2	6	16	15	4	8	4	2	3	1	821		
										1																				1			
		3					2	1			2																2			173			
		5			2		5																			1	1			218			
																														3			
	1	3		1	38		1	4	58	13		11	1	15	2					39	62	5	10	1	1	2	36	3	921				
	2	5	5		8	1		1	9	7	1		1	6	6	5			4	3	6	10	8	9	2		4	5	2	296			
		6					2																				9			425			
	1						10	2	3	2		3	1	2	8							6				3				260			
									74			6	1	1							4	47								367			
									2	3	2											2				1				95			
																															1475		
							1		1						9											2	1		5		67		
	6	6			22	1	3	17	12	11	4		4	7	7	8			16	6	33	9	5	8	14	7	4	4	13	510			
							2	1	2																					36			
		9		1	1	7	1	2	26	1	87	8	7	27	69					4							8	1		757			
		2		1	15			1	26	4		5		4						67	11	3	1				34		442				
	63	13			9			1	4						3													2	8	1	125		
		52																									1				56		
			124			50			27	14		1	10	4	1					5	8	3	3					10	1	341			
	1	5	20	132	3	28	1	1	15	9	2	2		11		1	8			5	7	1	30	12	2		20	8	1	551			
		24		158			30	11																							323		
							132	2	5	2	2		2	12	11											4				217			
		12			4		40																								74		
		12			2		3	129						1																	169		
										17																					21		
							2		2	268	2	46	1	1							2					4	1			394			
								8		51		7	9							1											77		
							2	4		37	139		8													2	33				669		
								17	1	20	285	11									1										597		
								6		7	8	53																			78		
								10	1	1	13	10	1	1	8	4	348														612		
									8		1	1																			101		
									1																							1665	
									6	45	11	1	7	3	29	2	45				999	12	12	7	12	20	5	8	3	11	4	30	1665
									1						2						14		1					14	1		425		
									1	10	4	4	7	2	9						3	480	1								751		
									1	8			3	1																		91	
																																1	
																																798	
																																921	
																																744	
																																213	
																																274	
																																115	
																																53	
83	754	249	150	193	507	174	136	205	938	320	427	187	530	561	232	472	35	1063	260	981	229	185	342	209	446	118	228	537	122	56	1950		

DEER KILLED IN OTHER DISTRICTS SEPTEMBER 16 - OCTOBER 15.

	SEPT 17	18	19	20	21	22	23	24	25	26	27	28	29	30	WRI.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTALS	
ALPINE	17	10	5	9	4	4	4	1	1	1	1	1	1	1	1	1	1	3	1	1	2	1	1	1	1	1	1	1	1	1	67
AMADOR	7	10	11	5	5	2	3	4	16	2	6	1	1	1	1	2	1	1	2	1	2	1	1	1	1	1	1	1	1	1	39
BUTTE	29	10	25	8	5	7	4	4	16	2	6	1	1	1	1	2	8	12	2	8	4	4	15	5	3	7	5	11	17	228	
CALAVERAS	32	12	25	6	1	3	1	3	9	6	2	1	1	1	1	4	10	2	2	3	2	2	6	2	2	5	2	6	8	149	
ELDORADO	10	44	56	10	14	15	9	9	11	31	6	5	4	9	7	11	22	1	9	4	7	10	14	21	10	13	11	19	26	18	535
FRESNO	96	47	34	27	26	17	19	15	16	14	18	5	11	8	11	13	11	7	4	10	13	10	10	19	11	7	10	14	14	9	526
IMPERIAL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
INYO	22	31	11	10	8	7	4	3	1	3	1	4	2	3	2	2	10	3	2	3	4	2	5	4	3	4	2	4	5	12	173
KERN	40	18	10	9	9	2	2	1	7	3	5	4	4	3	3	5	4	1	3	12	3	3	9	3	1	2	4	10	4	186	
KINGS	55	16	42	12	14	7	6	7	9	6	9	3	5	5	5	12	4	5	5	5	4	3	5	11	6	7	11	7	8	246	
KOS ANGELES	78	32	43	5	3	7	3	4	9	29	7	10	6	7	10	8	29	3	5	11	7	6	10	31	4	12	8	13	13	12	425
MADERA	59	29	19	8	4	5	4	9	5	8	3	4	1	2	3	5	3	6	5	4	4	10	16	4	3	8	9	9	8	260	
MARIPOSA	15	8	10	2	1	2	3	3	1	3	1	2	2	1	1	3	1	2	3	1	2	2	7	1	1	8	1	4	8	95	
MERCED	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	
MODOC	84	61	44	18	25	26	11	12	15	14	5	9	11	13	11	3	12	4	5	13	9	14	19	9	12	8	13	17	8	510	
MONO	5	4	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	36	
NEVADA	10	5	9	4	3	5	3	2	1	8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10	
ORANGE	8	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	125	
PLACER	80	40	29	16	5	9	6	5	10	18	3	4	5	5	2	5	14	5	6	8	5	6	5	13	3	4	3	8	10	9	341
PLUMAS	82	50	39	24	26	25	11	18	15	25	4	9	16	4	10	12	14	7	8	14	11	9	21	28	14	6	12	14	15	8	351
RIVERSIDE	145	27	15	19	4	4	3	6	8	7	3	1	5	4	4	7	10	2	2	5	5	4	11	11	5	4	6	15	13	8	313
SACRAMENTO	17	4	7	2	3	1	2	1	1	2	1	1	1	1	1	2	6	2	1	1	1	2	1	2	1	2	3	4	3	74	
SAN BERNARDINO	26	7	7	1	7	1	4	3	5	8	5	4	2	2	5	3	11	2	4	3	2	4	8	16	3	3	7	6	6	4	169
SAN JOAQUIN																															
SHASTA	80	38	27	45	21	19	18	13	20	23	17	11	7	11	12	13	23	10	14	9	14	13	21	32	10	18	21	20	36	26	612
SIERRA	7	9	17	1	3	4	1	2	3	1	1	2	1	1	1	3	2	1	1	1	4	5	11	3	1	1	3	3	6	101	
STANISLAUS	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	
SUTTER																															
TEHAMA	85	46	49	31	24	16	20	19	17	7	13	10	15	8	16	25	13	13	25	26	16	24	46	29	32	35	29	52	40	799	
TRINITY	94	41	64	58	32	32	19	21	22	32	27	24	26	23	24	24	22	20	24	21	22	18	34	35	34	26	14	42	30	921	
TULARE	171	98	57	35	27	35	29	27	16	15	14	20	5	6	3	7	16	10	9	8	13	8	19	22	14	10	4	9	16	23	744
TUOLUMNE	31	21	12	7	4	5	3	1	2	1	2	1	3	2	1	3	5	1	5	2	1	12	5	3	2	8	9	2	13		
YUBA	4	2	3	1	3	1	2	3	1	2	3	1	2	1	1	6	1	2	2	1	1	1	1	1	1	1	1	1	1	5	
TOTALS.	1455	722	663	339	289	258	194	198	198	327	141	154	137	135	135	160	311	116	139	156	181	146	294	403	189	175	215	235	340	284	8642

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1927

Compiled by Division of Fish and Game, Department 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.....
Albacore.....							15,725		1,051
Anchovies.....									3,830
Barracuda.....									16
Bonito.....				735	6,878	2,383			40
Carp.....		21,466		1,957	63,846	52,908			
Catfish.....		1,820					84,173	7,828	66,781
Cultus Cod	1,251					36	5		
Eels.....	595	26,360					131,529	4,764	475
Flounders.....							70,575		3,775
Grayfish.....					21,092		3,427		
Trout.....	104,173	4,030					2,258	786	1,794
Halibut.....							87,520		
Hardhead.....			251,460				7,225	170	9,285
Herring.....	1,067						138	484	359,306
Kingfish.....									37,669
Mackerel.....									
Mackerel—Horse.....									
Mullet.....									
Perch.....	1,778		11,022	54		845	6,674	500	1,924
Pike.....									
Pompano.....									
Rock Bass.....									
Roekfish.....	25,173	8,970	162				230,107	88,039	447,045
Sablefish.....	197,367						64,976	6,018	32
Salmon.....	150,514			1,323	582	1,356	193,248	3,828	2,429
Sandlabe.....		11,440					11,490,318		28,839,489
Sardines.....								68	60
Seubon.....									
Sea Bass—Black.....			1,668				3,789	1,113	483
Sea Bass—White.....				25					
Shad.....					773	1,491			
Shad—Buck.....					100				
Sheepshead.....								500	1,479
Skates.....								53	
Skipjack.....								12,889	2,765
Smelt.....	8,360		8,345				2,330		
Sole.....		76,740					2,457,823	32,043	40,927

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION."

Volume 14

SACRAMENTO, JULY, 1928

Number 3

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PARASITES AND PARASITIC DISEASE IN THE CALIFORNIA VALLEY QUAIL*

By E. C. O'ROKE

From time to time reports are current that valley quail are not now as numerous in some sections as they have been in comparatively recent years. Whether these reports are true and to what factors the changing conditions may be attributed is beyond the scope of this article.

* The above article is a progress report of the investigation of parasites of valley quail which is being conducted in connection with a survey of diseases of game in California.

The study of game diseases has been made possible largely through the cooperation of the University of California. Dr. K. F. Meyer, Director of Hooper Foundation for Medical Research has accepted an appointment as Consulting Pathologist of this division, and has undertaken the supervision of our pathological investigations to

The Division of Fish and Game is, however, genuinely interested in getting at the facts. Accordingly, with the opening of the quail season in 1927 some preliminary investigations were started in order to discover whether parasitism might be a factor in reducing the number of quail.

Working under plans outlined by the Bureau of Research, the writer was detailed to carry on these investigations. The method used was to go into the field with scientific equipment, make examinations of recently killed birds and collect such material as would be useful for later laboratory studies.

The birds in general seemed to be free from external parasites. No coccidia or other dangerous protozoan parasites were found in the visceral organs. Small caecal worms such as are commonly found in gallinaceous birds were absent. This was also true of the larger round worms belonging to the family Ascaridae. In only one lot of quail taken in Stanislaus County were tapeworms present. The infestation was only nominal. It thus appeared that from the standpoint of parasites of the digestive tract, quail taken at this time of year were in a healthy condition.

Part of the routine examination was to make blood slides in the field. These were then stained and studied. Two cases of parasitism by microfilaria in the blood were found in quail taken in Napa County.

Early in the course of the investigations, the discovery of deposits of pigment in the red blood cells indicated that blood parasites of some kind were present. This condition was first observed in wild quail shot near the game farm at Yountville. The natural inference from this situation was that perhaps birds other than quail at the game farm would be found to be so parasitized.

In the course of following up this lead, representative numbers of domestic chickens, pheasants and quail were examined at the game farm. Blood samples were taken from the wing veins of the birds and prepared immediately in the field. This led to the positive identification of a protozoan parasite of the genus *Haemoproteus* in the red blood corpuscles of the valley quail. Studies were then extended beyond the open season to include several species of native wild birds as well as quail in localities far removed from the game farm. In all cases the results were the same; namely, the parasite was found only in the valley quail. Only a limited territory has been studied thus far, parasitized quail having been found in Napa, Contra Costa, Santa Clara and Stanislaus counties.

While there seems to be little in the literature concerning the serious effects of parasitism by *Haemoproteus* in birds, its similarity in appearance and behavior to the organism that causes malaria suggested that the investigations should be continued to determine whether or not this parasite is harmful to its host.

which he has devoted much of his time without compensation. The parasitological studies outlined by Mr. O'Roke are conducted in the laboratory of the Zoology Department of the University of California under the direction of Professor C. A. Kofoid.

The sportsmen of the state, as well as the Division of Fish and Game are to be congratulated for the splendid cooperation of the University of California in the study of game diseases. The knowledge of diseases of birds and mammals is now meager, especially with reference to the relation of such diseases to the abundance of game. The survey of game diseases is a progressive step that will produce much valuable scientific information in the interest of game conservation.—EDITOR.



FIG. 54. Quail No. 46 in late stage of disease produced by *Haemoproteus* parasites. This bird died six hours after the above photograph was taken. Photographed June 9, 1928, by Joseph Dixon.



FIG. 55. Quail No. 32, slightly parasitized but apparently in good condition. Photograph June 9, 1928 by Joseph Dixon.

Accordingly, penned birds from the game farm and wild ones trapped near there were taken to the University of California at Berkeley where they could be kept under daily observation at the Department of Zoology.

By means of a blood counting apparatus it has been possible to make exact counts of the percentage of parasitized blood cells. This has been found to run from less than one per cent to over seven per cent in samples of blood taken from the wing veins. The birds that are most heavily parasitized are found to be anemic compared to normal

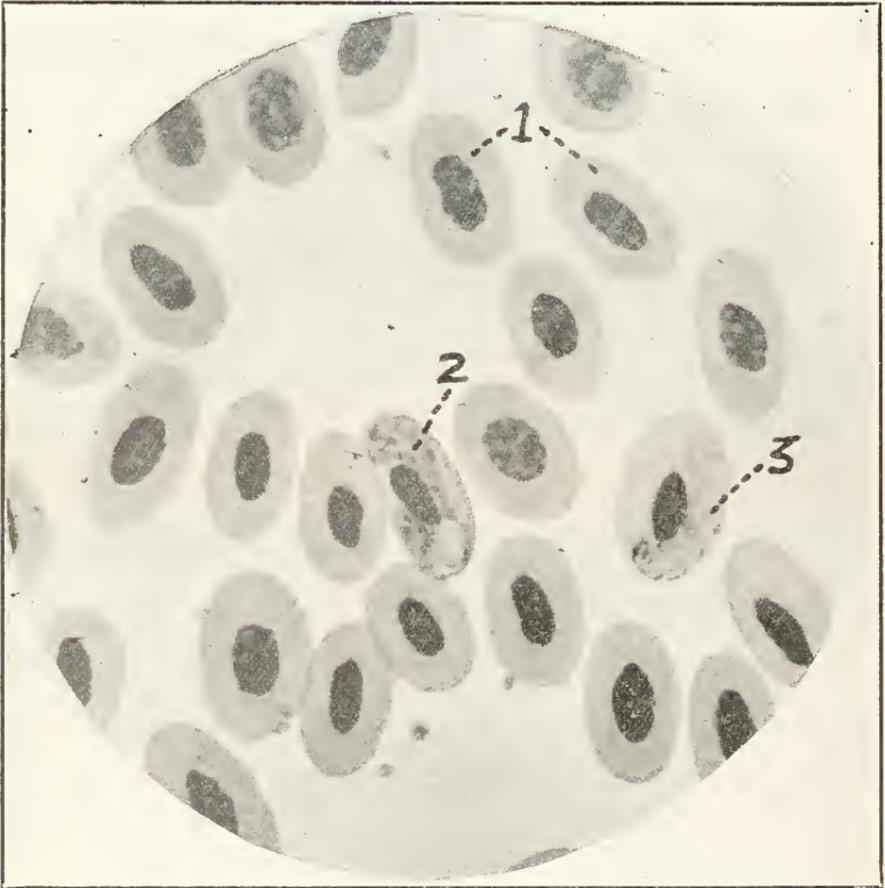


FIG. 56. Blood taken from Quail No. 29. 1, normal red blood cells; 2, *Haemoproteus* parasite, male gametocyte in red cell; 3, *Haemoproteus* parasite, female gametocyte in red cell. Giemsa stain, preparation and photo-micrograph by K. F. Meyer, June 23, 1928.

birds. It is to be noted also that they seem to be weaker and not as active as normal birds.

Our investigations are as yet too limited to enable us to predict the probable incidence of infection that prevails among the wild quail throughout the state. It probably varies with the time of year and is affected by various modifying factors. Five out of six quail obtained at the game farm April 3 were infected. Since these birds were caught in hand nets and since the weaker birds would naturally be less able

to resist capture, it is possible that the indicated incidence of infection may be altogether too high.

Of the quail kept in an outdoor pen under healthful conditions at the university three out of ten have died. Post-mortem examinations have disclosed no striking lesions other than those occasioned by the parasites that could have accounted for the death of the birds. These lesions are an enlarged black spleen, pigmented liver, and a pronounced anemia. One of the cases, that of a specimen (No. 46) taken in Santa Clara County, is of especial interest. On June 8, 1928, in the San

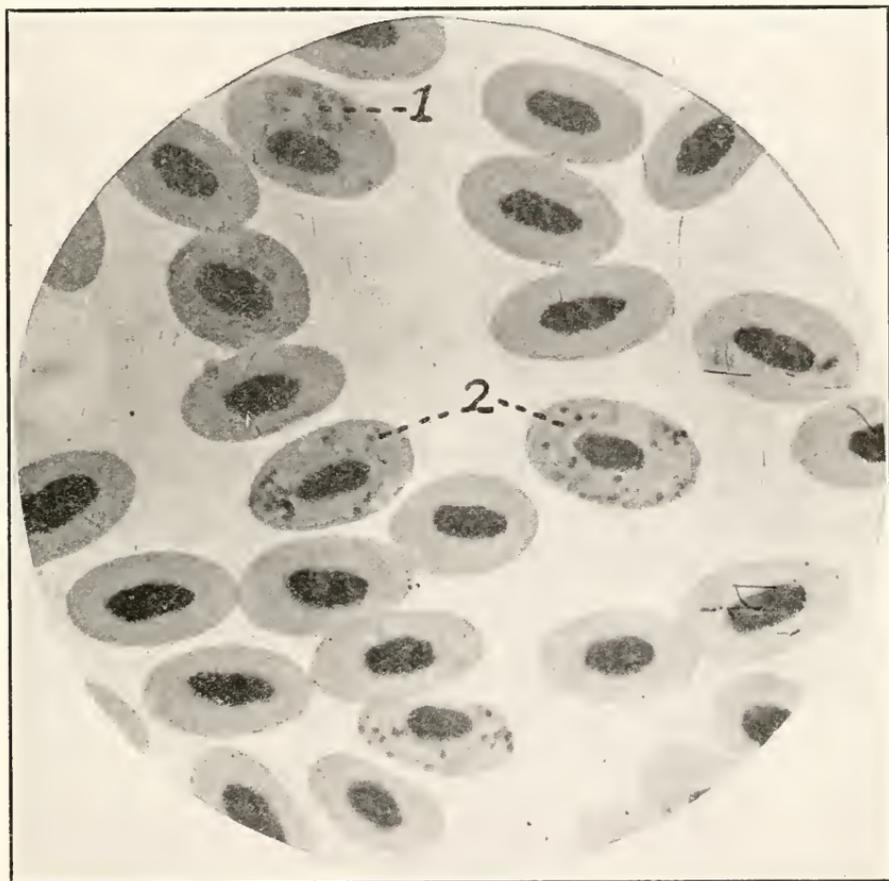


FIG. 57. Blood from Quail No. 39. 1, young gametocyte with small amount of pigment; 2, mature gametocytes, pigment granules large and numerous. Giemsa stain, preparation and photo-micrograph by K. F. Meyer, June 23, 1928.

Felipe Valley, an adult male was found that could fly but little and was unable to keep up with the covey. It soon crawled under some bushes where it was easily captured with the hands. This bird was in poor condition and its crop was empty. Upon being taken to the laboratory, it was found to be heavily parasitized. It gradually became weaker and died the following day. Failure to find evidences of accident or of disease other than that caused by the parasites leads us to believe that we have discovered a fatal case of natural infection with *Haemoproteus* in the valley quail.

In Europe and Africa where *Haemoproteus columbae* of the domestic pigeon has been studied, it has been found that the parasite is transmitted by a biting bird-fly belonging to the family *Hippoboscidae*. This is the same family to which the sheep tick belongs, but unlike the sheep tick the bird-flies have functional wings.

The writer has examined the collections of *Hippoboscid* flies of Professor G. F. Ferris of Stanford University who reports that two species of these flies have been found on the valley quail in California. It is not unlikely therefore that one or both of these flies will be found to transmit this quail parasite in California. While many species of *Haemoproteus* have been reported from large numbers of species of birds in the old world and in South America, the finding of the parasite in the California valley quail is a new record.

The investigations will be continued to determine the incidence of *Haemoproteus* parasitism in the quail of California. Much work will need to be done in order to learn the seasonal and geographic distribution of the parasite and to determine the seriousness of injuries caused by it. Experimental and observational work is now under way with a view to solving the problem of its transmission.

SARDINE SEASONS AT MONTEREY AND LOS ANGELES HARBOR*

By W. L. SCOFIELD

Within the last year the question has arisen as to just what months constitute the bulk of the sardine canning season at the two chief fishing ports, Monterey and Los Angeles harbor (including San Pedro, Wilmington and Long Beach). These two ports, separated by less than five hundred miles, have decidedly different sardine canning seasons, and the purpose of this article is to show wherein they differ by giving the relative amounts of sardine landings for each month of the year for each port.

There is great fluctuation from year to year in the amount of fish received at each canning center. Of recent years the pack has been several times greater than the pack in 1921 or 1922, for instance. The seasons showing the largest amounts of fish received might have undue weight in a plain average intended to show merely the relative importance of each month. To avoid this difficulty and to bring the two ports to an equal basis, we may treat each calendar year as one hundred per cent and figure each month as a percentage of the year. This enables us to see the true relative importance of each month as compared with the other eleven months of the year, and allows us to contrast months at the two fishing ports.

Since there is such variation from year to year, it gives a more reliable result if we use a ten-year period. In the accompanying graph and table the yearly sardine catch at each port was taken as one hundred per cent, and the catch of each month was figured as a percentage of the annual. The ten-year period, 1918 to 1927, inclusive, was used and the ten results for each month were averaged.† These catch

* Contribution No. 71 from the California State Fisheries Laboratory, May 10, 1928.

† For the benefit of the reader of sensitive mathematical conscience, we should explain that the doubtful method of averaging percentages is in this case justified since it expresses exactly the point desired.

figures are those compiled by the Commercial Fisheries Department since 1916, to show the monthly landings of each species of fish in each district of the state. (For an analysis of the sardine seasons published in 1926, see Fish Bulletin No. 11, "The California Sardine," especially pages 24 and 28.)

It will be seen (Fig. 58) that the average season at Monterey is from June through March of the following calendar year with April and May the off months. At Los Angeles harbor the average season is from October through June with July, August and September as the

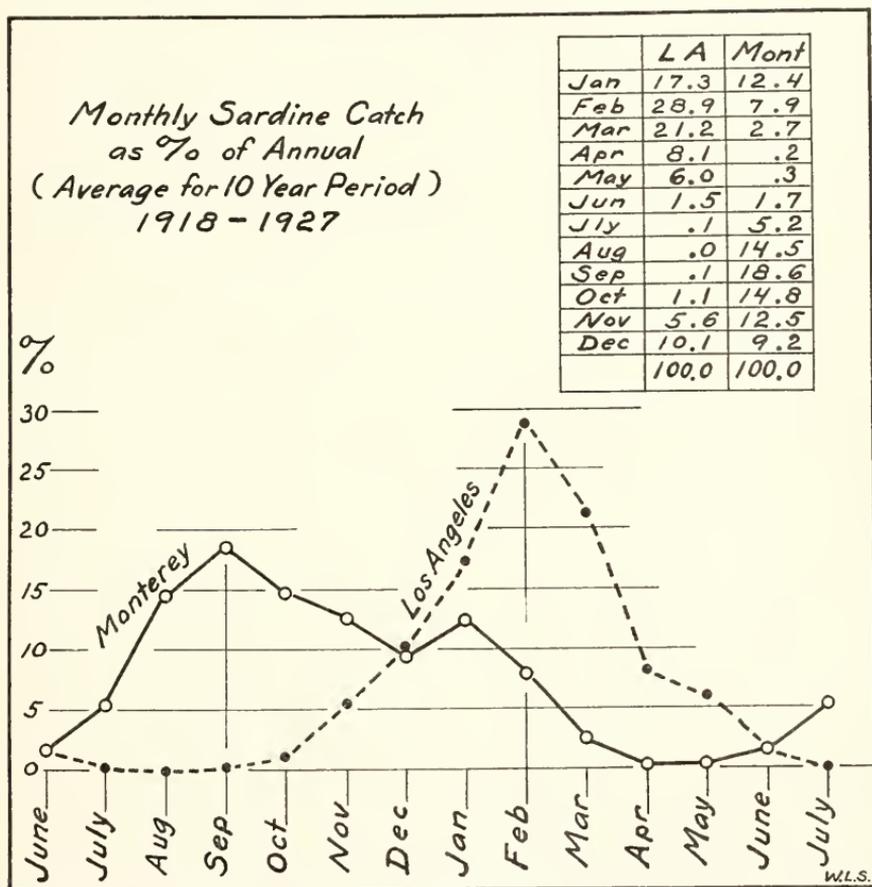


FIG. 58. Monthly sardine catches expressed as a percentage of the annual catch at each port. Percentages averaged for the ten-year period, 1918-1927.

off months. It is also evident that the Los Angeles season is more concentrated about February as the peak, while the Monterey season is distributed between six big months with September as the peak. It is characteristic of the Monterey season that January is greater than December.

The May pack of sardines at Los Angeles harbor for 1927 was considered exceptional, but in past years May was an important month in tonnage received. In 1917 and 1919, May was the biggest month of the year, and in 1918 it was second only to April. During the twelve-

year period, 1916 to 1927, the May catch has averaged considerably greater than October and not far behind April and November.

It will be seen from the graph and table that an arbitrary seven months' period at each fishing port would include nine-tenths of the catch. At Monterey, the seven months of August to February, inclusive, will account for ninety per cent of the annual catch. At Los Angeles the seven months' period, October to April, includes ninety-two per cent of the yearly total.

As an illustration of the fact that the total annual catch of sardines

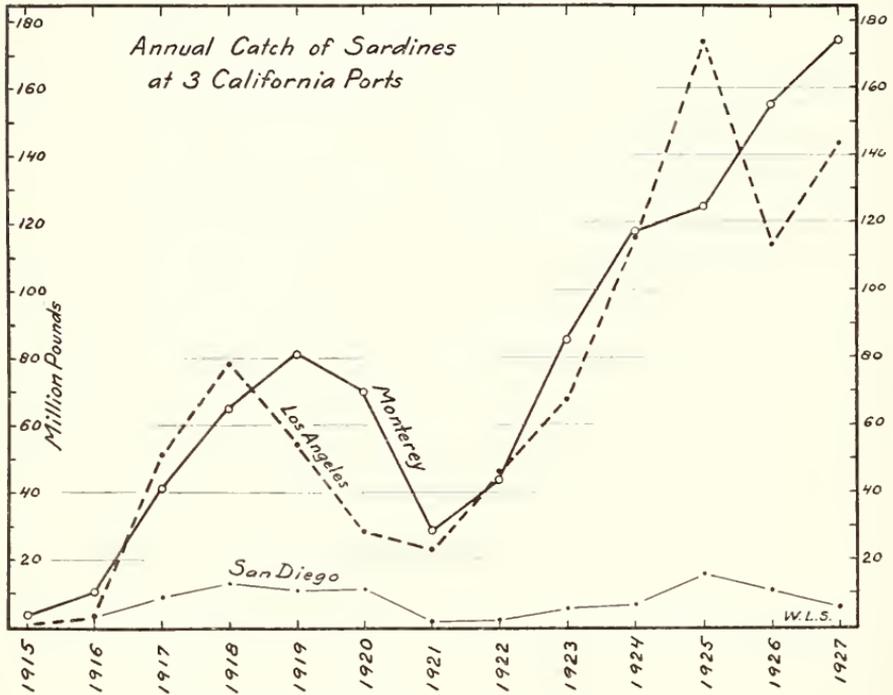


FIG. 59. Annual sardine catch at Monterey, Los Angeles Harbor and San Diego for the thirteen-year period, 1915-1927.

fluctuates greatly from year to year, a graph has been prepared showing the yearly catches by districts (Fig. 59). The relative importance of the two fishing ports may be readily traced for past years. The graph as a whole pictures the beginning of the sardine canning industry, its development during the world war with the post war slump in 1921 and 1922, followed by a remarkably quick recovery. The catch for each of the last four years has greatly exceeded the peak of the war time catches of 1918 and 1919. The trend of these catch curves is so obviously affected by economic conditions in the industry that it is hoped no one will be guilty of assuming that these curves picture the abundance of sardines in the ocean. Any banker can tell us why the pack was low in 1921.

MUSSEL POISONING IN CALIFORNIA*

By K. F. MEYER

During the month of July, 1927, 102 people were seriously poisoned and 6 died following the consumption of the large mussel *Mytilus californianus* Conrad, which had been freshly gathered at 14 different beds on the open shore line of the Pacific coast in the vicinity of San Francisco (see text, figure 1). Although the origin of the poison is not definitely established since the investigations are still in progress it is known that (1) the toxic properties of the mollusks are due to a poison, probably a quaternary amine, which is heat stable in acid solutions and which causes motor nerve paralyses. The concentration of the poison as determined by laboratory test may vary in different mussels and different beds (see text figure 1); (2) the poison is not formed by bacteria nor due to copper salts from the rocks nor due to the little crab, *Pinnotheres pisum* which lives in the mantle cavity nor is it induced by parasites such as sponges and starfish. (3) The poisonous mussels were neither located in stagnant and polluted basins nor exposed to the sun for a long period at low tide, but they were subjected to the ebb and flow of the tides; the poison is therefore not due to asphyxiation or post-mortem changes. (4) It is probably the result of a metabolism disease influenced by the food and spawning condition of the shellfish. (5) Poisonous mussels can not be distinguished from sound mollusks neither by appearance nor behavior on cooking; occasionally a pungent odor may be noted; the "liver" is always large and dark. (6) The shellfish may become poisonous within a few days and may remain so for several weeks. No assurance can be given that the mussels may not acquire the poisonous properties overnight. (7) During the winter months December-March the poison disappeared only to reappear late in March; however, the amount of poison which may be present early in spring is not sufficiently concentrated to cause symptoms on ingestion in an empty stomach. (8) Since it is impossible to examine all the mussel beds along the California shore line it is impossible to establish by laboratory test the absence of poisonous mussels in certain beds and during certain months of the year. From the experiences thus far collected it is quite apparent that the use of mussels on the California coast during the summer months is always connected with some danger. Near Santa Cruz poisoning cases have occurred in two successive years. No assurance can be given that this condition may not repeat itself. People who notice a tingling or numbness around the lips and prickly feeling in the finger tips and toes 30 minutes or longer after they have eaten mussels should empty the stomach by an emetic, purge the intestinal tube by brisk laxatives and call for a physician immediately. All, even mild cases of mussel poisoning should be promptly reported to the State Department of Health (San Francisco, Park 8700).

* Contribution from the George Williams Hooper Foundation for Medical Research, University of California Medical School, San Francisco.

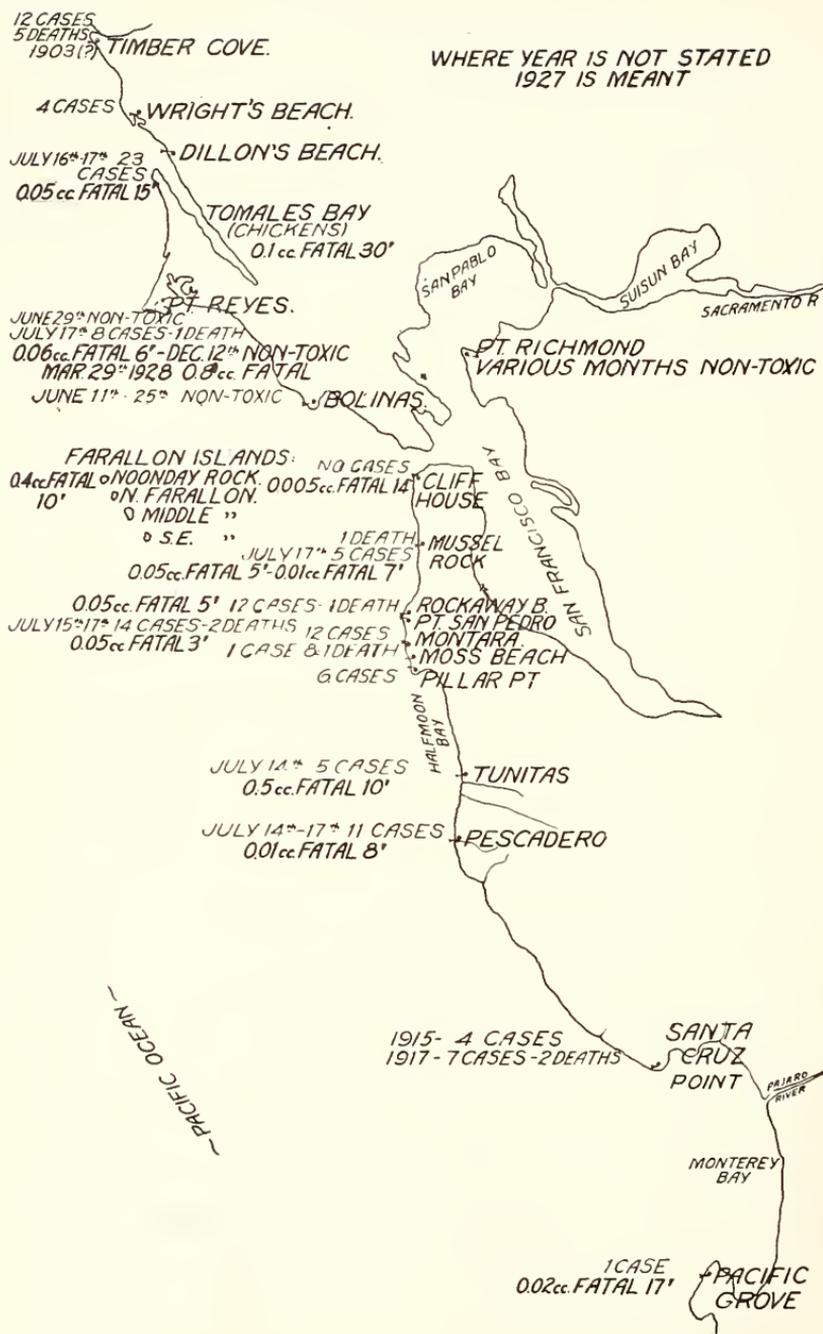


FIG. 60. Sketch map showing outbreaks of mussel poisoning in California

OYSTERS IN CALIFORNIA

By N. B. SCOFIELD

The native oyster of California is quite small, compared with the oyster of the eastern United States, and has never been important commercially. This native species is found on our Pacific coast from Mexico to Alaska and is fairly abundant in protected waters where there are rocky reefs suitable for them to attach themselves. In the Puget Sound region this native oyster is "farmed" along scientific lines and is the basis of a profitable industry. In California, however, this oyster has not been "farmed" and only half-hearted efforts have been made to increase the yield by putting out collectors to which the young oysters can attach themselves. The demand for oysters has grown so that this small native oyster, which is used in cocktails and dressing for meats, is more valuable than it was and it is to be expected it will receive the attention it deserves and be made the source of a profitable industry in this state also.

Oysters native to the eastern United States were first introduced into California in the early seventies, when plants were made in numerous places in San Francisco Bay. Since that time other plants have been made in Humboldt, Tomales and San Diego bays and in Elkhorn Slough. Only in San Francisco and Tomales bays have the planting operations paid. Seed oysters, or "spat," about one year of age were brought to the coast by the carload and laid out on prepared beds. These seed oysters grew with fair rapidity and reached marketable size in from two to four years, according to the size demanded by the markets. The United States Commissioner of Fisheries reported, in his 1900 report, that the value of mature oysters sold at that time was considerably over \$500,000 a year and that the quantity and value were on the increase. By 1910 the value of the oysters sold was nearly \$1,000,000 a year. One company, the largest, was doing a yearly business of \$800,000.

It was the belief of the oyster companies that the water of the California bays was too cold to permit the eastern oyster to propagate. Experts from the Bureau of Fisheries, however, found that there was some natural propagation in favored localities, especially in South San Francisco Bay. The young oyster larvae would drift to the eastward with the surface current caused by the prevailing winds, and settle down and attach themselves to the native oyster shells found on reefs along the east side of San Francisco Bay. Nothing much has ever been done in California in the way of putting out "collectors" to which the young oysters could attach themselves, the oyster companies being content to spread the spat on beds prepared with old shell, and to protect these from sting-rays with stake fences. This method worked all right until a little over ten years ago, when it was found that the young oysters did not grow as they formerly did, and that they became thin and watery, and many of them died. It then became the practice to ship from the eastern coast oysters which were ready for the market. These were then placed on the beds simply to hold them a few weeks and take them up as the trade demanded. The oyster business of San Francisco Bay has dwindled from one of the major fishing industries of the state to almost nothing.

No accurate records have been kept of temperatures, salinities or amount of food carried by the water on which oysters feed, to enable us to say just what caused this failure of the oysters. It is believed, however, that the reclamation of tide lands around the bay, which prevented the ebb and flow of the tide on the flats, has diminished the oyster food in the bay. The heavy drain on the water resources of the bay region for purposes of irrigation has largely prevented the flow of fresh water into South San Francisco Bay. It is believed that all of these conditions together have caused the failure of the oysters in South San Francisco Bay.

Soon after oysters were first planted in San Francisco Bay, it was found they did not do well in the upper bay for the reason that during the winter months the upper bay at times becomes entirely fresh water. In the summer months there are times when the bay is almost pure sea water. The eastern oyster will not stand these great fluctuations in salinity.

It is possible that, with the application of scientific methods, oysters may be propagated and made to pay where the right water conditions can be obtained. It will be hard, however, to find localities of this sort. The eastern oyster has also been tried in Puget Sound but it has been found that there, as in California, the temperature of the water is too cold to permit spawning. The eggs and larvae of the eastern oyster can live only within a narrow range of temperature, and the temperature in the sound is seldom, if ever, suitable. A species of Japanese oyster, which breeds at a lower temperature, we understand, has been successfully introduced into Puget Sound. Such an oyster might very well be established in favorable places in this state.

The best accounts of the early oyster industry in California can be found in the Reports of the U. S. Commissioner of Fisheries for 1889-91, 1893 and 1900, which can be obtained at public libraries.

THE CALIFORNIA BADGER*

By WALTER FRY

The California badger (*Taxida tarus neglecta*) is a vanishing species. The animals are yielding rapidly before cultivation, settlement and wanton killing so that in much of the territory formerly occupied, they are seen no more. Man is practically the only enemy of the badger and unfortunately kills this useful animal at every opportunity and almost always without any good reason. Some fifty years ago they were fairly abundant throughout their range, but the ever-increasing occupation by man of their territory and his hostile attitude has reduced them from year to year, and, if continued unchecked, must lead to the extermination of an animal at once picturesque and useful.

Family and Distribution—The badger belongs to the weasel family and is the third largest of that family in North America; only being exceeded in size by the wolverine and the otter. The badger's former home was in the Great Plains of North America, the Rocky Mountains and westward to the Pacific coast, from the southern tablelands and Puebla Mexico on the south, to Peace River in Canada on the north.

* Originally issued as Bulletin No 22, Sequoia National Park Natural History Series.

The animals have been much depleted or exterminated over most of their eastern range, but in the west they are still holding forth. In California the animals inhabit sparingly the more favored spots from sea level to elevations of 10,500 feet. They seem more abundant in the High Sierra where they live in the more open country and meadowlands. They have been driven to high altitudes by persecution and remain there because of the wildness of the country. Generally speaking, badgers are plains animals and do not favor heavy forest belts.

Description—The badger is an animal of strange form and habits. It is short and flat bodied, very low in stature with a broad flat-shaped head which joins directly onto the body with no defined neck. The jaws are strong and pointed and set with heavy teeth. The legs are short and heavy with unusually large feet armored with long, heavy claws. The nose is well pointed; tail short and drooping; eyes small, dark, glittering; ears small, rounded, set well down upon the sides of the head back of and slightly below the level of the eyes. The body length is about 24 inches, height about 12 inches, weight about 17 pounds. The fur is unique and beautiful, being mixed with black, white, yellow and gray. The body is a grizzled gray slightly tinged with yellowish brown with a narrow white stripe extending from the nose over top of head to shoulders. Sides of head white with black spot on each cheek. Upper part of the head each side of the white stripes, nose and feet black.

The animals have a surly, sullen and savage disposition towards other than their own kin. I do not mean from this that the badgers go about molesting or attacking other animals, for this they never do. But they do not respond to kind treatment and seldom become good pets. They always avoid trouble like all the weasel family, but when once attacked, they fight viciously and effectively. When attacked, they neither quail nor hesitate, but throw every ounce of energy into the battle; while agile as cats, they hang on in bulldog fashion. What the badger wants is to be let strictly alone so as to obey his natural impulse in his search for food. Every muscle of the badger shows tremendous strength. This, together with the dark glittering eyes gives the animal an expression of both intelligence and power. In my opinion for fighting qualities, measured by size, the badger is only outclassed by the wolverine. The dog that inadvertently attacks a badger is sure to be severely cut and slashed by the animal's sharp teeth before he can escape. Badgers are shy, sensitive and capricious animals.

Habits—Badgers are not prolific breeders. The young range from one to four in number and it is doubtful if more than a single litter is produced each year. The little badgers are born in underground burrows and in beds without nest linings. When first born they are shaped like adults, but are much lighter and of undefined color. Their eyes are closed, no teeth are visible, soles of feet are black and toes have tiny white claws. They grow rapidly and usually make a first appearance above ground at the age of about three weeks. When less than half grown the mother weans her young, but continues to catch food for them until they are almost two-thirds grown; then she leaves them to shift for themselves.

The breeding season of the badger is irregular owing to varying altitudes and climatic conditions. For instance, in the San Joaquin

Valley at elevation of 500 feet, young are born in February and March, while at Twin Lakes in Sequoia National Park at elevation of 10,500 feet, young are born in April and May. These same conditions regulate to an extent the time and duration of the badgers' hibernating period.

I have been fortunate in several personal experiences with badgers. One evening, on June 22, 1912, I came upon a mother badger and her two young in Willow Meadow, Sequoia National Park, elevation 7500 feet, where they lived in seclusion and thrived on small rodents which the mother caught in the meadow. The young were about the size of a full grown Fisher ground squirrel and to all appearances about three weeks old. When first I saw them, they were off a few feet from their burrow, the mother lying on the ground with her young rolling over in play in front of her. They did not see me, so I crawled up on their leeward side behind some willow bushes that shielded me, and was within about thirty feet of them. In a few moments, the two young badgers returned to their home underground and the mother strolled from my sight across the meadow for her evening hunt. I decided that the entertainment was all over and was moving on, when to my surprise and gratification, both the baby badgers toddled from the burrow and resumed their play. I watched their frolic for a few moments, then ran quickly to the burrow, jumped on it with both feet and sat down flat over the entrance before the young badgers realized what was happening.

Never have I seen young wild animals more mystified than were these baby badgers by my presence. Instead of dashing away in any direction that was open, as do most young wild animals under similar circumstances, they first fell flat upon the ground for a few seconds, then came direct to me, calmly looking at me, wonderingly and inquiringly, but with practically no signs of fear; then straightway, true to their kind, they began to dig under me in an effort to regain entrance to their subterranean home.

I took the little fellows in my hands and tossed them out into the grass a few feet from me, but on each occasion they would manifest an impracticable obstinacy and quickly return, uttering soft wheezy grunting sounds and making frantic efforts to reenter their burrow. They were not strong enough to do me any damage, but they gave a marvelous display, showing excellent skill with their claws in both scratching and digging. In every attitude demonstrated, an animal of persistent thought and determined effort.

Having amused myself with the animals for some little time, the young badgers were permitted to return to their burrow and I took my departure. When away a distance of some hundred yards, I saw the mother badger coming in from her evening hunt with some kind of rodent in her mouth. She soon passed from my sight into her terrestrial home to rejoin her much disturbed, but anxiously awaiting, offspring.

Badgers have but few social ties aside from those of the mother and her young during the mating period. I have never yet observed any instance of the male badgers helping to care for the young or taking any interest whatsoever in household affairs. However, in a few instances, I have seen both a male and female living in the same burrow.

Badgers feed on ground rodents of every description and on a great variety of insects. They are not gifted with either speed or stealth to

aid them in obtaining food supply and are forced to dig and capture practically all their prey underground. Their principal diet is gophers, ground squirrels, rats and mice. They are skillful in locating the burrows of their quarry and the inhabitants soon fall victim, owing to their rapid digging. Indeed, they are so destructive to rodents that prey on vegetation that their services are more beneficial to agriculture than those of any other of our North American mammals.

Badgers are largely nocturnal in habit and hunt chiefly at night, but when forced by hunger they will hunt by day. They wander far and wide in search of food at night, but usually return to their burrows by sunrise. They move around little, except in search of food. When it becomes scarce they shift to a new territory where food is more plentiful. They establish themselves in their new home by digging a new burrow in which to live and to be sheltered from enemies.

Of all our North American mammals, badgers hold the record for rapid digging. On September 2, 1912, while at Mitchell Meadow, Sequoia National Park, elevation 8500 feet, we came suddenly upon a large badger some 100 yards from his den. We shut off his return to his burrow and chased him for a few moments on horseback. No sooner did we stop our chase than the badger dug into the ground and made the most rapid progress in digging of any animal I have ever seen. Although the ground was hard and somewhat crusted with sod, the badger dug himself completely from our sight and plugged the hole behind him with dirt in less than one and one-half minutes. In excavating, his whole being was brought into action; he used all four of his feet as well as his mouth with great skill.

Should the Badger Be Protected or Exterminated?—The worst enemy the badger has is man. I have never found evidence that badgers have lost their lives through any other enemy except large domestic dogs. Large birds of prey and carnivorous wild animals seem to leave the badgers strictly alone. I do not know whether this is due to the savage fighting qualities of the badger, or whether the flesh of the badger is distasteful as food, or both; but believe it is due to the former cause, for the badger's thick fur and tough skin are hard to penetrate and when the animals once engage in combat they will fight to the death.

To me, the California badger is one of our most interesting and beneficial animals. It should be given protection. At present, the only shelter the animals have is within our National Parks. Here there is perhaps sufficient seed stock left to insure perpetuation of the species within a given area for sometime to come. But when the animals pass beyond the boundaries of the parks, they soon fall victim to hunters and trappers. Furthermore, the animals have never been proven guilty of destructiveness. The worst harm which they have ever been accused of doing to man is that the burrows they dig, on occasions, have caused horses to stumble and fall with their riders. But as compensation for this, the badger hunts and kills rodents that are harmful to crops and other growing vegetation, 365 days each year of his life.

The wanton destruction of this picturesque and beneficial species of California mammal life is unwarranted and unjustifiable. It should be stopped. Let us have it said that California is the one safe spot in this vast republic that may be called the badger's last home. A spot where the animals are given the right to live out their lives according

to their destiny in peace; a right of a harmless and useful animal that man is in duty bound morally to respect.

No moral law is ever violated with impunity. Man is paying for his brutality to the badger in the plagues of rodents which God created the badger especially to prevent. Give the badger a chance and he'll clean up the ground squirrels, gophers and other rodents which destroy California's crops.

FISH SCREENS IN CALIFORNIA IRRIGATION DITCHES*

By JOHN SPENCER

The work of fish screen installation in the State of California is carried out under provisions of the Penal Code, which in general state that when, in the judgment and opinion of the Fish and Game Commission, a fish screen is required to be installed in a ditch, tailrace, tunnel,

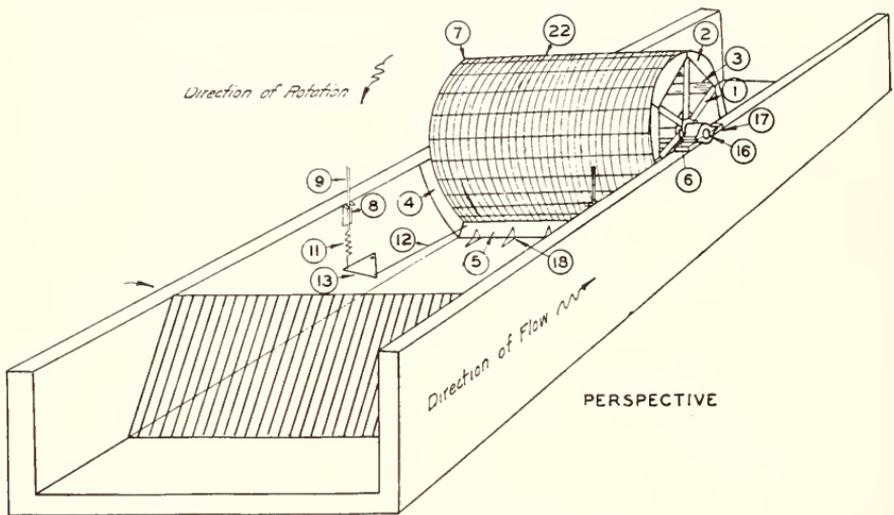


FIG. 61. Diagram of the California rotary fish screen. In front is a parallel "grizzly" or rack to protect both screen and ditch, constructed on either timber or steel and placed near head of it. No. 5 indicates draper board on strap hinges (18), and No. 9 to B shows parts of adjustable spring device to regulate the draper.

etc., the Commission may order one in, specifying location, type, size and in fact, all the details which are necessary for its construction.

The party ordered to install a screen may request a hearing on the necessity of its installation within ten days from the date of service, and failing to do so the order is fully effective. If a hearing is requested, the Commission will then issue its findings after said hearing. If the screen is not installed as requested by the Commission, the matter may be carried to the courts. If a screen is installed in accordance with the requirements of the Commission and maintained, then costs arising from changes in design by the Commission must be borne by the Commission. All costs are borne by the owner of the water, except any change of design as above noted. The law was enacted in 1895 and last amended in 1927.

* Spencer, John. 1928. Fish Screens in California Irrigation Ditches. *Pacific Fisherman*, April, 1928, p. 16, 2 figs.

Two general types of screen installation are used in California, namely, the rotary self-propelled type and the stationary parallel bar type. The rotary type consists of a steel shaft to which there is attached a circular frame which supports mesh of $\frac{1}{2}$ by six inches, with boards or paddles set on the inside which furnish the motive power for its rotation. This screen is set in a box of supports for the entire width to be screened and is a little over twice the height of the water in diameter. To pass the trash that may come down, or to remove the moss, it is set up from 4 to 8 inches from the bottom of the ditch and this space is protected by a board set on hinges, fastened to the bottom of the ditch and connected by rods to a spring, so that when the pressure of the trash becomes more than the tension of the spring, the board or draper will drop down sufficiently to pass this trash and then come back into place. On the top of this draper, or board, is a section of canvas or rubber belting which lightly touches the wheel as it rotates and thus leaves and moss are removed from the rotating screen.

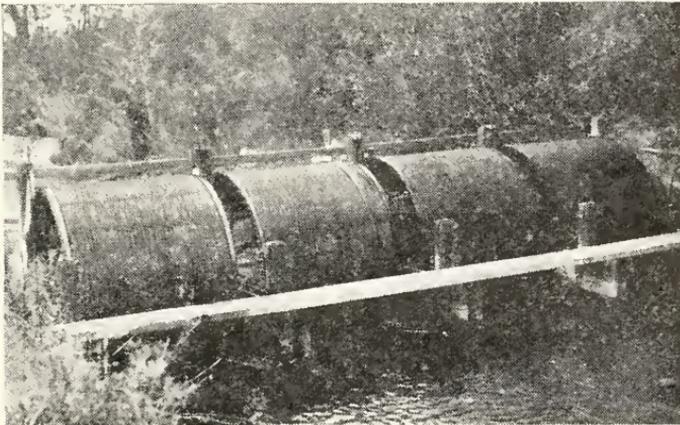


FIG. 62. Battery of four rotary screens operating in a 20-foot ditch diverting water from the Arroyo Seco River, Monterey County. Photograph by John Spencer, March 22, 1928.

This general type is used because it is not patented, and while there may be patented screens that are equal to and perhaps better, yet it would not be policy to order in a patented screen unless the diverter of water so desired it.

The stationary parallel bar screens are built in sections and placed at an angle to the direction of the flow—the greater the angle the better—and trash is thus carried on up to the upper portion of the bars and thus more easily removed than if the parallel bars were set at right angles to the flow of water. Speaking roughly, these stationary parallel bar screens are a refinement of what is commonly known as a grizzly, or rack. There are variations of this type of screen in that some are made to rotate, and some have attached a self-cleaning device, the power being furnished either by the water itself or by a motor. For these bars the spacing is seldom less than $\frac{1}{2}$ inch, and when placed properly in the stream offer no appreciable interference with the flow of water.

The stationary type of screen is in general considerably cheaper to install, in proportion to the area to be screened, than the rotary type,

and is more commonly used for the larger ditches, while the rotary screen is considered more suitable for small ditches.

It is felt in California that the matter of screening is one that should be taken up between the various commissions and the diverters of water in a way that would consider the interests of both; and when this is done, it has been found that the rights of the diverter are not infringed upon nor is he unduly burdened, and the best type of installation will thus be decided upon.



CALIFORNIA FISH AND GAME

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September 15, 1928

Unstocked or depleted waters indicate a wasted resource and are a direct challenge to our ability to develop the uses of our mountains and streams.

A LOOK TO THE FUTURE

For many years past, it has been difficult to find a basis for optimism regarding the future of game in the United States. Depletion has been noted everywhere. We look for instances where actual increase has been noted and discover that these are few and far between. The average person interested would probably cite Vermont and her increase in deer and Pennsylvania with her improved conditions. There should be other states where improvement is noticeable; certainly considerable sums of money are spent annually. There are those with a vision and able to properly plan restoration programs. Why then are outstanding results so far between? Doubtless, a partial answer to this question is to be found in the fact that states have been floundering around attempting to find suitable methods of solving the many problems presented. Each state has suddenly found itself confronted with depletion and has then begun at too late a date to remedy conditions. As a consequence, considerable time has been needed. Now that certain states have demonstrated what can be done, other states will model their programs after successful states and will help to bring about the improved conditions sought. After many years of test, certain general policies have been determined upon here in California and a worthwhile program inaugurated. Given time, results are sure to appear.

SOUND VALUE

Extravagance in government has, from the beginning of time, been the popular

cry and complaint of the public who pay the bills. Certain it is that in many instances such complaints were well founded and history reveals that many thrones have tottered and empires have fallen through the revolution of a long suffering people, righteously indignant at their yoke and burden of taxation.

Modern theory of government and up-to-date business methods applied thereto have greatly lessened this evil, and yet complaints may still be heard and there is still probably here and there some room for improvement.

Whatever may be its other failings, no good reason exists why the Division of Fish and Game should be found extravagant or wasteful on any occasion. The conservation, protection and upbuilding of our resources of fish and game is a vast business enterprise of the people of California and must be carried out by efficient business methods, the cornerstone of which is economy of operation.

The same principle that governs private business must govern this Division. It must be adhered to by the department head when arranging his budget, organizing the work of his department, purchasing supplies and selecting its personnel. It must govern as well each individual of the field force in the performance of his duty. Each day's work in patrol or otherwise should be planned to save all unnecessary expense and lost motion. To successfully and most efficiently conserve the state's wild life, we must conserve the funds with which we have to work by practicing at all times true economy, not the "penny wise pound foolish" variety, but that which will return to the state sound value for every dollar expended.—Eugene D. Bennett.

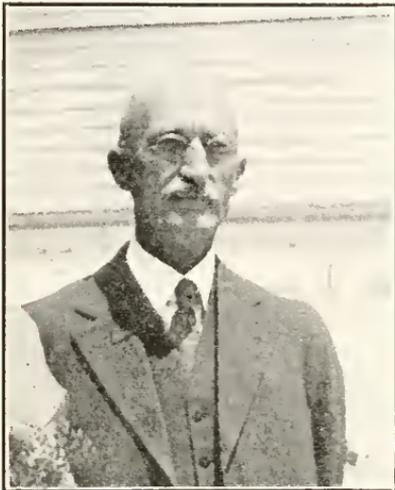
IN MEMORIAM

DAVID E. ROBERTS

My intimate acquaintance, both social and official with Dr. D. E. Roberts who passed away April 13, 1928, enable me to know and analyze "Doc," perhaps more intimately than any other person. To know a man's true worth in the standard in which we should estimate him, one must enter into business relations aside from just that of friendship which is easily made.

Deputy "Doc" Roberts had a host of friends among the sportsmen of the Mother Lode, San Joaquin and Sacramento counties, and wherever he was known and wherever he enforced the laws relating to the protection of our wild life.

Beside his code of game laws which he practiced and which it was his duty to enforce, "Doc" had a code of his own which was of greater value than all the statutes relating to game protection. Game law violators, and there were many in the days when he became an officer, respected him because he was the highest type of a sportsman. "Doc's" code called for and gave a square deal. He educated instead of persecuted. He exacted truth-



David E. Roberts

ful promises from violators because he knew only truth himself. He detested dishonesty because honesty was a part of his code. Hypocrisy, deceit and ingratitude were contrary to his code of ethics.

David E. Roberts was a native of Calaveras County. In his early years he practiced dentistry. He was a member of the Board of Supervisors of Calaveras County for some years. His great love for "the open" called him away from his profession. He was appointed a State Deputy of the Fish and Game Commission October 1, 1911. Even then many of the old timers were as a law unto themselves, respecting game laws with a less degree than any other of the statutes. "Doc" gave them what any old timer expected and exacted, a square deal. In a short time old Calaveras County was one of, if not the best game law abiding counties in the state. He was attached to the Sacramento Division Office under Commissioner Newbert with Geo. Neale in charge of the Northern Division. At the time of his death he was captain in charge of the Sacramento District. "Doc"

was a type of man and officer that should be copied by all law enforcement officers.

Geo. Neale,
Former Executive Officer of the
Fish and Game Commission.

FRANK MACHADO

It is with extreme sadness and regret that we announce the death of volunteer deputy, Frank Machado, by accidental drowning, on June 10th. Deputy Machado was in his motor boat on Pinto Lake, near Watsonville, when, in attempting to fix his stalled motor he lost his balance and fell overboard. It was a very windy day, the lake was rough, and before those who witnessed the accident were able to reach and render assistance to Machado, he was drowned.

Frank Machado was a popular young man, a lover of the wild life and the great outdoors, and was an efficient, hard-working deputy.

He is survived by a wife and son, daughter, mother, brother and sister, all of whom reside at Watsonville.

The funeral, which was largely attended by relatives and friends, was held at Watsonville June 14.—Walter R. Welch.

MORE KNOWLEDGE NEEDED

Trout have been propagated and planted in streams for more than fifty years. Some improvements have been made in fish cultural operations, but many fundamental facts relative to necessary food, care and disease need to be made available to fish culturists. There has been little change in the actual methods of planting and only recently have some of the faults of present methods been exposed, as a result of controlled experiments.

Canada has been most forehanded in pointing out certain dangers. Mr. A. P. Knight has shown that from 73 to 96½ per cent of the fry dumped into the streams, lose their lives because of enemies; that native fry are better able to care for themselves than hatchery fry; that predatory fish increase as a result of the additional food fish by fish planting. Mr. Knight's last report on his experiments was published in *Rod and Gun in Canada* (volume 29, pages 783-787, 819-820). Certainly the evidence presented should force the conclusion that there is still much to be learned regarding inter-relations of organisms in a stream, and at the same time, is a reminder that there has been considerable waste in the past

because of a lack of this pertinent knowledge.

This report also suggests to the reader that other controlled experiments determining whether it is a wise procedure to take fish from a stream less than six inches in length and whether artificial food supply could be furnished which would support greater numbers of fish would contribute greatly to future projects.

ADVISORY COMMITTEE APPOINTED

At the last session of the legislature the hunting and angling license law was amended to provide "that the fish and game commissioners are hereby authorized and directed to expend, for a period of five years, beginning with January 1, 1928, not less than one-third of all moneys collected annually from the sales of hunting licenses in the purchase, lease or rental, and the development, improvement, maintenance and administration of land, or land and water, or land and water rights, therefore suitable for game refuges or public shooting grounds, or both, within the State of California." It further provides for the appointment of a game refuge and public shooting grounds advisory committee to consist of seven members. Early in the year, this advisory committee was appointed and approved by the governor. It is composed of Jacob Baum, Los Angeles; H. L. Betten, Alameda; J. Dale Gentry, Santa Barbara; Manly Harris, Dr. K. E. Meyer, Nathan Moran, and Dr. Barton W. Evermann of San Francisco.

On April 8 the committee met and organized, electing Nathan Moran as chairman. This committee has undertaken the work before it with enthusiasm and progress reports may be expected from time to time. Each seems to realize the great need for something constructive along the lines of game refuges, particularly of wild fowl refuges, and consequently worthwhile results will be forthcoming. A report as to the original breeding grounds of migratory game birds, their former and present status together with the means to be taken to restore former breeding and feeding grounds was discussed at the second meeting of the committee.

SENATE PASSES FEDERAL GAME REFUGE BILL

For seven years there has been reported in these columns the ups and downs of a proposed law to create federal game refuges and public shooting grounds, and at the same time, to establish a

federal license. Each year the bill has been proposed, there have been stormy sessions of debate, ending with defeat for the proponents of the measure.

Opponents of the measures of past years have held out for an elimination of the federal license, for recognition of state rights, for direct appropriation, and for an elimination of the objectionable feature concerned with the trial before a United States Commissioner.

The Norbeck Migration Bird Bill of the present session of congress was introduced in practically the same form as those of past years. After being debated at great length, it was amended until it hardly bears the semblance of former measures. In this amended form it passed the senate on April 18, 1928. The new bill does not contain the objectionable features. This bill makes actual sanctuaries of all of the game refuges, rented or purchased; provides adequate warden protection, and authorizes appropriations not to exceed \$1,000,000 a year. Another interesting feature is the following:

"That when any state shall by suitable legislation make provision adequately to enforce the provisions of this act and all regulations promulgated thereunder, the Secretary of Agriculture may so certify, and then and thereafter said state may take over the enforcement of said act and the regulations made in aid of said act. The said state may and shall, so long as it shall enforce the said act and regulations made in pursuance thereof, be reimbursed from said funds for the costs of said enforcements to that extent said services would have cost had the service been performed by the federal government."

It was impossible to get this bill to a vote before congress adjourned. It will come up again at the next session and in the meanwhile sportsmen and other conservationists can make their wishes known to their representatives.

PACK TRAIN TO TRANSPORT GOLDEN TROUT

There has been little distribution of golden trout in the southern Sierra during the past ten years. Beginning July 1, 1928, five head of stock equipped with pack cans and three animals to carry provisions were placed in charge of Deputy F. A. Bullard. Special trips will be made to waters stocked in 1914, and from there adult fish will be transported to barren streams and lakes in adjacent territory. Later in the summer, when golden trout fingerlings become

available at the Mount Shasta Hatchery, these will be carried by pack train and planted in isolated localities.

It is becoming more and more evident that out of the way places are becoming populous centers of vacation travel and that the streams adjacent will soon be overfished. A wider distribution and the full utilization of all waters is the one preventive of present day problems. With others, we are willing to admit that unstocked or depleted waters indicate a wasted resource and are a direct challenge to our ability to develop the uses of our mountains and streams.

A FULL PROGRAM FOR SUMMER RESORTS

An intensive program of education was planned for summer resorts and camps this summer. The nature guide work at Yosemite again was a cooperative program between the Division of Fish and Game and the National Park Service. The Yosemite School of Field Natural History opened its doors for the fourth season on June 25 to give training in conservation to teachers and nature guides. The Division of Fish and Game was represented by two nature guides in California State Redwood Park who conducted field trips and gave evening lectures. This ambitious program of education for summer vacationists is based on the fact that people are most susceptible to conservation ideas when face to face with nature. The need for conservation is more apparent when a person is out-of-doors than when he is within four walls.

MORE STATE PARKS MEAN MORE GAME REFUGES

Every reader of this magazine should be interested in the state park program. At the last session of the legislature, a Division of State Parks, under the Department of Natural Resources, was created, and a bill passed providing for a referendum at the November election to provide a six-million-dollar bond issue, which, matched dollar for dollar by outside funds, will make possible the purchase of some of the more important areas needed for a unified park system. As has been evidenced in the State Redwood Park in Santa Cruz County, a state park can become a worthwhile game refuge. Visitors have long been pleased with the tameness of deer and their abundance. The Mount Tamalpais region, which is already a game refuge, will undoubtedly be one of the first areas added to the state park system. Additional areas useful as recreation grounds

will be a direct contribution to the game refuge system. Many states plan their refuge system on the basis of large areas for every county and smaller areas for every township. An additional number of state parks will furnish some of these needed smaller refuges.

CONSERVATION LESSONS AS AIDS TO CLASSROOM INSTRUCTION

The special attention given in the lecture program of the Division's Bureau of Education to elementary grades in city schools has supplied the teacher in many cases with seasonable material for class room exercises. The conservation lessons taught with the aid of specimens have, in a number of instances, been a source of inspiration for compositions. The following from a low fifth grade in an Oakland school reveals that the pupils absorbed the lessons and reproduced a surprising amount of the material presented.

"In Italy and Spain the people had big nets. With these nets the people caught all the song birds that were going where it was warmer. When the birds rested in the hedges the people put the net right into the hedges and the birds got caught and the people ate them.

"Birds are very helpful, they eat the insects and grass seeds. When the people catch the birds and eat them the insects come and eat their crops. This makes their country poor.

"The people chop down all the timber and when it rains the water runs down the hills and washes all the soil until it comes to clay. Their crops can not grow because the clay is not fertile.

"When there are forest fires and it burns all the trees and brush, the animals will not come again because there is no food for them. And when it rains the water washes all the ashes and burnt things down into the little brooks and the fish die. Another way when there is a fire, the water in the brook will get warm from the heat and the fish die.

"When the salmon goes to spawn it goes to fresh water. After it spawns it starts to go back to salt water, but before it reaches its home, it dies.

"All trout belong to the salmon family. Fish do not have lungs. When you see them it looks like they are yawning; every time they do it, water goes in their mouths. They breathe the oxygen and the water goes out through their gills.

"The trout is a silvery fish and his tail is different than that of the salmon. The salmon's tail is skinny; the trout is wide. The men in the cannery can tell easily, because when they pick up the salmon it is easy; when they pick up the trout it slips out of their hands.

"The Roosevelt golds are only found by the high mountain, Mt. Whitney. The men from the fish hatchery go up there and get the fish eggs and bring them back and hatch them. They then put them into something like a milk can, and take a lot of burros and put them back. They stop every few hours by a stream and put the cans in the streams to keep the cans cool. When they camp over night they leave the cans in the water all night.

"There is a hatchery not far from Mount Whitney.

"The trout love fresh, bubbling water. But they can not stand salt water. The salmon lives in salt water and spawns in fresh water.

"The trout loves shady brooks.

"In a fish hatchery, they have troughs. They keep the fish eggs in troughs. When the eggs hatch, the little fish come up to the trough for something to eat. The men feed them for a few months.

"The trout and salmon have black spots.

"The rainbow trout is very pretty. It has a pink stripe going through the lower part of its body.

"A pack of Roosevelt trout went up a stream. The stream had some lava in it. The water was a different color. That is why they are this color. They

"She said some countries were poor,
Such as Italy and Spain,
For after birds were in their reach
They never flew again.

"She told us that we oughtn't
To cut our forests down;
They do it to make cities
But what's the use of another town?

"Some people are careless
When they go into the wood,
And forget to put their campfires out,
As we know they should.

"The heat of the forest fires
Kills the fishes in the streams
And burns down all the timber,
Spilling pretty scenes.



FIG. 64. State lion hunter Jay Bruce with a take of five lions.

are a little green at the top and yellow. They have black marks in the middle like finger prints. The tail has black spots.

"There is another kind of fish which is called steelhead. When it spawns it goes upstream and when it goes back it does not die like salmon. It goes back and forth to the ocean.

"Spawning means when a fish goes to spawn it goes upstream where there is sand. It flips its tail back and forth, making a small hole in the sand, in which it lays its eggs. A fish lays from 300 to 1200 eggs."—Emile Petersen.

"Mrs. Brownlow came to our class
To talk about the song bird.
She told us many, many things
We never heard before.

"Mrs. Brownlow was very nice;
She told us many things
How to put the campfires out
And about the bird that sings."

—Julia Towar

"When the trout comes up the mountain stream, it finds a place to spawn. After he finds a place to spawn he makes a little hole with his tail, there he lays his eggs. Sometimes he lays three and four hundred eggs at a time.

"After he goes back to his home in the mountain stream, men come and take the eggs to the fish hatcheries. There the eggs are put in ice cold water.

"When the fish come out of the egg, the egg stays on the fish's body, and that is what he feeds on until the egg is all eaten off, then he is old enough to eat other food.

"The men who feed the fish chop up liver very fine. They put it in a dipper and put in the water and it makes the water look like milk. The fish feed off this until they are big enough to live in the mountain stream once more.

"The men take pack mules or horses or burros and put the fish in cans, that look like milk cans, and take them up to the highest mountain streams where the water is always rushing and foaming down the mountains.

"It takes them four or five days to go up, and about three to come down. They stop every hour and put the cans in the water, because the water in the cans gets warm and the fish do not like it. At night they leave the cans overnight, they put a screen on the can so the fish would not get out, then they let them out the

It requires no stretch of the imagination to picture what the game sanctuary or refuge means to birds or animals. For a number of years, our National Parks have been concrete examples of this system of protection and natural propagation.

Many states have adopted this plan and in nearly every case the results have more than justified the outlay of time and money. If the output of our game farms could be liberated in well protected game sanctuaries under the supervision of a competent attendant, it would be but a few years until the adjoining terri-

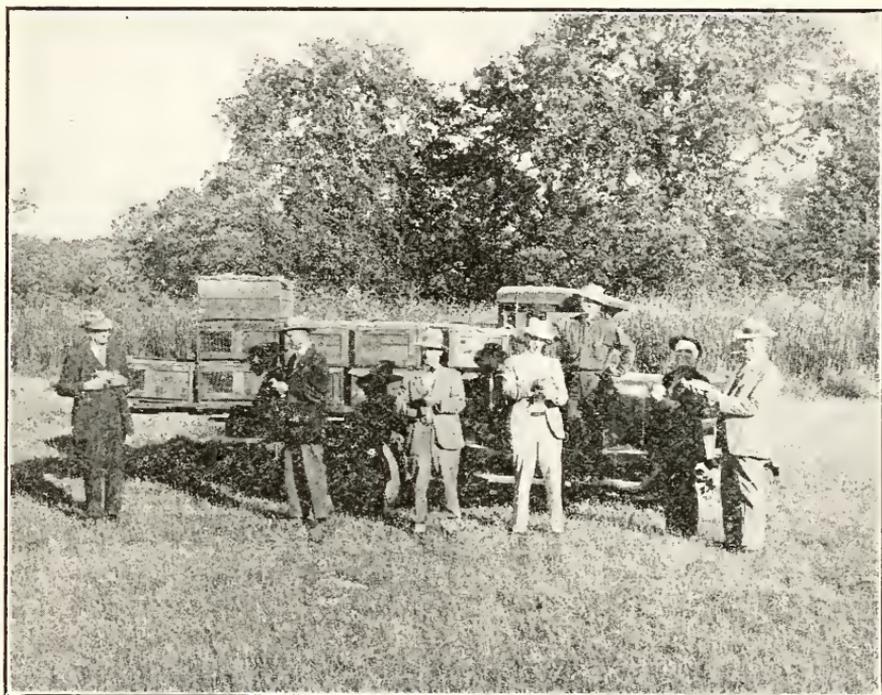


FIG. 65. An ideal spot for pheasants. Liberation of 100 birds, Bryden Ranch, Marysville, California.

place they want to let them out."—Raymond Greenman.

HOW BIRDS RESPOND TO PROTECTION

Birds as well as animals seem to know where they are protected and show their appreciation by making themselves at home. The dove shown in this picture is one of a half dozen that found their way into the pheasant pens on the State Game Farm and have taken the liberty of remaining and going about their business in a normal and natural way by nesting and otherwise conducting themselves as doves are wont to do.

tory would be well stocked with game birds and the sportsmen would then be getting real interest on his investment.—August Bade, Yountville, California.

ANOTHER BLUE JAY HUNT

A news item carries the information that in a certain county at least one thousand "of these pirate birds were destroyed as a result of an annual hunt." The item is dated April 25, 1928, and goes on to state "scores of hunters took part in the yearly event and scatter guns operated all day." To many it will seem a worthwhile accomplishment to destroy

a thousand blue jays; some will say that at least an equal number of quail were thus saved. We wonder how many will think of the other side of the question. If scores took part and scatter guns operated all day during the early nesting season of quail, we wonder how many deserted nests of quail remained behind. With such a picture before us, we can not help but wonder whether a blue jay hunt staged in the spring during the nesting season of quail accomplishes as much as is claimed for it. Those who have observed how easy a quail will desert a nest when disturbed will be the ones who will line up against shoots of this kind.

WARNING



HUNTERS AND FISHERMEN

Volunteer Deputies of the Division of Fish and Game are patrolling and strictly enforcing the Fish and Game laws in this district.

CALIFORNIA FISH AND GAME COMMISSION

FIG. 66. Sample poster issued by volunteer deputies.

LOOKING BACKWARD

Sometimes a review of the past stirs one to heightened endeavors, for to use an old phrase, "the success of the past is the hope of the future." A glance backward at the record in game conservation in this state shows the following:

1852. First closed season (12 counties), antelope and elk.

1854. Closed season on antelope and elk throughout the state.

1869. Lake Merritt established as game refuge.

1880. Trapping of quail, partridge or grouse prohibited.

1889. Board of fish commissioners authorized to import game birds for introduction.

1893. Hunting with gun larger than ten gauge prohibited.

1895. Possession or sale of game during closed season prohibited.

1897. Robin removed from list of game birds.

1901. Night shooting prohibited. First daily bag limits established.

1905. Sale of doves and all shore birds prohibited.

1907. System of annual hunting license inaugurated.

1909. Game refuges established. Use of animal blinds prohibited.

1913. Sale of game with exception of ducks and geese prohibited. Afterwards repealed by referendum.

1915. Wholly closed season on rail, wood duck, band-tailed pigeon, cranes, and shore birds.

1919. System of game refuges greatly extended.

1927. Definite program of game refuges assured through allocation of license fees.

These are accomplishments of the past. Accomplishments of the future should include further extension of the refuge system.

DEPUTIES FACE NEW PROBLEM

Imagine the difficulty of a game warden these days! Instead of looking after the violators residing in his own county, he must watch for the influx outside his district. A game warden in southern California, who has patrolled his district for sixteen years, states that ninety-five per cent of those who hunt in his county come from without the county. Nor do they travel with a team of horses. This makes a new situation and a growing one which will take new methods to properly control.

WILD FOWL REFUGE FUNCTIONING

The only wild fowl refuge established in recent years in this state is Richardson's Bay, in Marin County. That this refuge is attractive to birds is proved by a recent census made by Dr. Harry Oberholser of the Bureau of Biological Survey and Captain Walter Sellmer, on March 2, 1928. On that date, it was estimated that 3500 ducks were congregated on this bay.

STREAMS CLOSED TO ANGLING

Under the law providing for the closing of trout streams passed by the last legislature, a number of the heavily fished streams were closed to all angling when the trout season opened on May 1. They were closed by executive order of Governor C. C. Young, and Fred G. Stevenot, Director of Natural Resources.

Two classes of streams and tributaries were closed: first, those closed arbitrarily because of the necessity of protecting the streams for egg-taking purposes by the Division of Fish and Game; and second, streams recommended either by sports-

the streams, additional deputies will be placed on patrol duty, and the closed area will be closely guarded.

The notice below is the official closing order and the original notices signed by Governor Young and Director Stevenot.

Following the official notice will be found a list, by counties, of all streams and other fishing water closed under this order:

"For the purpose of further protecting trout with which the Fish and Game Commission has stocked the various waters of this state, of insuring their larger growth and better means of propagation as well as providing an adequate supply of trout eggs for the various fish hatcheries of

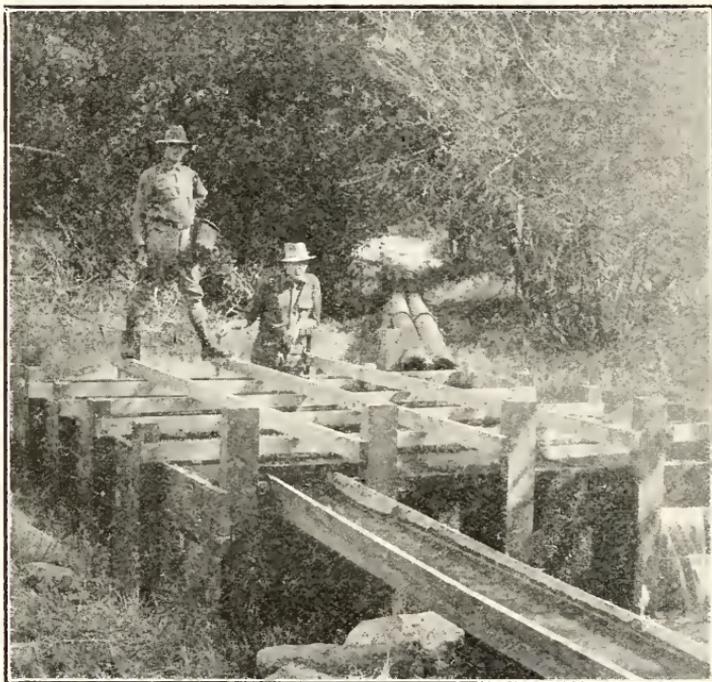


FIG. 67. Settling tank at Kings River Experimental Hatchery.
Photograph by E. G. Grimes, June, 1928.

men's organizations or by petitions filed with the Fish and Game Division by interested groups of citizens.

By closing of these heavily fished streams and lakes it is hoped that fish in the tributaries will attain larger size before going into the main rivers, and that spawning grounds will be protected and the egg take thereby greatly increased.

Signs were placed at conspicuous places where camp sites are located, where roads and trails cross the streams and all points where they can be easily seen by the fishermen. In addition to the posting of

this state to the end of improving fishing conditions generally throughout the state;

"Now therefore, upon the recommendation of the Fish and Game Commission of the State of California and pursuant to and by virtue of the authority vested in me by the provisions of Chapter 751, 1927, Statutes of California, it is ordered that the following waters within the County of-----, State of California be and the same are hereby closed to trout fishing or the taking, killing or having of any trout therein or therefrom from and after the date hereof and during all times and seasons until such time as new legislation is enacted by the state legislature or by further or other order of the Director of Natural Resources.

"It is further ordered that in addition to the publication of this order as pro-

vided for by Sec. 4 of the aforesaid statute, a copy hereof be posted at the courthouse of said county at the place where notices are posted pursuant to the provisions of Sec. 1373 of the California Code of Civil Procedure, or some other conspicuous place."

1. STREAMS CLOSED TO FISHING TO PROTECT THE SPAWN-TAKING AREAS.

Humboldt County: Prairie Creek, and all tributaries, to its junction with Redwood Creek.

Inyo County: Middle Cottonwood Lake and connecting streams.

Lassen County: Snag Lake and tributaries.

Mono County: Reverse Creek from June Lake to the point where it enters Rush Creek.

Shasta County: Grassy Lake and stream connecting with Snag Lake.

Orange County: Holy Jim Creek.
Nevada County: Alder Creek and Sage Hen Creek.

Los Angeles County: Bear Canyon Creek and Devil's Canyon Creek.

Lake County: Willow, Rice, Deer, Trout, Soda and Salmon creeks, tributary to South Eel River and Rice Fork to Eel River.

Fresno County: All tributary streams flowing into Shaver Lake. All tributaries to Dinkey Creek, including West fork of Dinkey Creek, Rock, Bear, Laurel, Deer, Bear Meadow and Ross creeks, and other unnamed creeks.

El Dorado County: Rainbow Lake, Grouse, Le Conte, Waca, Pyramid, Gefe, Toem and Jabu lakes.

Tributaries to Lake Tahoe in El Dorado County are McKinney Creek, General, Meeks, Lonely Gulch, Rubicon, Eagle, Cascade, Taylor creeks, Upper Truckee,

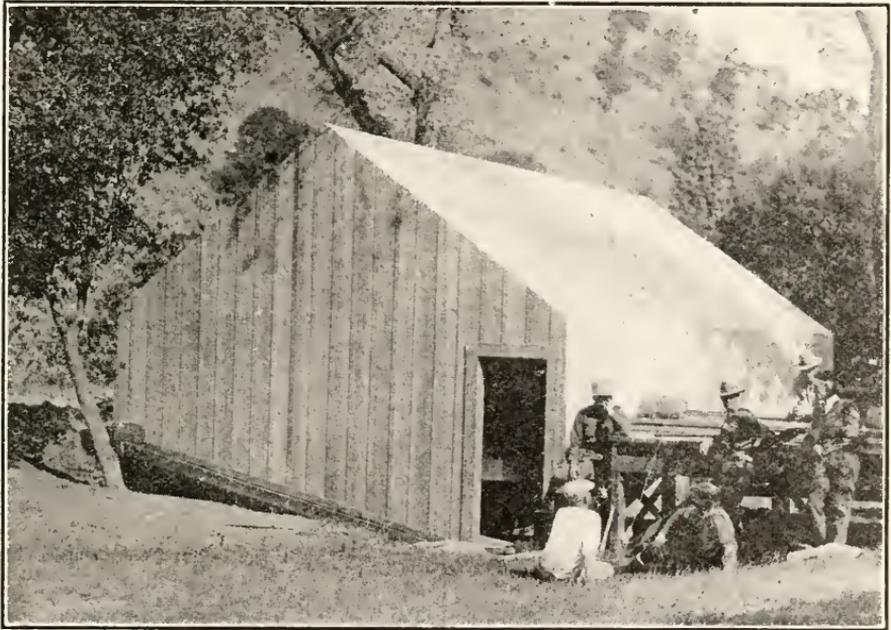


FIG. 68. Kings River Experimental Hatchery. Photograph by E. G. Grimes, June, 1928.

2. STREAMS CLOSED ON RECOMMENDATION OF SPORTSMEN'S ORGANIZATIONS AND INTERESTED CITIZENS.

Tulare County: McIntyre, Boulder, Bear, Coy, Lost Meadow creeks, North Fork of Middle Fork of Tule River above Redwood Crossing, Alder Creek, Deer Creek above its junction with Tyler Creek.

Sonoma County: Santa Rosa, Mark West and Salmon creeks.

Siskiyou County: Soda Creek.

Shasta County: Hazel Creek and Shotgun Creek.

Plumas County: Thompson, Tollgate, Black Hawk, Clear and Rock creeks, all tributary to Spanish Creek. Also, Red Clover Creek, tributary to Indian Creek.

Placer County: Martis Creek and tributaries to Lake Tahoe, including Griff's Creek, Slim Jim, Burton, Ward, Blackwood, Madden and McKinney creeks.

Trout Creek, Cold Creek and all tributaries of the above named creeks.

Plumas County: Butt Creek.
Tulare County: Big Kern Lake, Tobias and Brush creeks.

Santa Cruz County: All streams after August 1, each year to May 1 of the year following.

STATE PARKS AND GAME PROPAGATION

Our forefathers, in landing and settling these United States, found the Indians to be true sportsmen as they positively would only kill what game they needed for food. I am very sorry indeed, our people, who love the chase and great outdoors, have not followed the example

set by the North American Indians, who were, and what few remain today are the most sincere conservationists of this great continent.

The forests of any state are one of their most valuable assets. Without forests the human race would suffer a great loss and without forests our wild life would be destroyed almost entirely. The stately trees with the accumulated undergrowth and the mossy floors furnish very excellent protection and food to a certain extent for wild life of practically all species. Therefore it is very essential that in the establishment of state parks, the commissions, departments, or under whosever's supervision this comes, should by all means establish game refuges thereon. On said areas there positively should not be any hunting of game or insectivorous birds at any season of the year. Of course, vermin should be controlled rather than eliminated, as it is very essential in the propagation of game of any species that vermin should be controlled in a manner whereby any species of vermin should not become plentiful enough to be detrimental to the game on the area in question.

The establishment of game refuges on these areas is very essential for the assurance of the continuation of wild life on this continent, whereby future generations will have some of the enjoyment of their forefathers from the great outdoor life, and especially the chase.—E. Lee Le Compte, State Game Warden of Maryland.

BOY SCOUTS AND CONSERVATION

Considerable newspaper publicity was recently given to the successful efforts of Boy Scouts of Great Falls, Montana, on behalf of thousands of game and song birds. A copper mining company nightly turned flashlights on its smokestacks, which caused a heavy toll of death among migratory birds who, blinded by the lights, collided with the stacks. The Scouts were successful in having the lights turned off during the flight season.

This was a fine good turn to wild life, and it is gratifying to realize that it is only one among thousands of such good turns that Scout troops are systematically practicing. In the Report of the National Court of Honor, the records of the three awards of the Honor Badge of the Wild Life Protection Fund are published. This fine type of service is particularly Scout-like and should be encouraged. Here are other good turns to wild life reported to the National Office:

Connellsville, Pa., Troop 6. Fed wild game.

Springville, N. Y., Troop 24. Conservation wild life, building bird houses, etc.

Rutland, Vt., Troop 1. Regular bird feeding.

Windsor, N. Y., Troop 1. Land posting campaign for wild life.

Lancaster, Mass., Troop 1. Maintained bird feeding stations.

Oak Park, Ill., Troop 32. Troop had a bird observation contest in the spring.

Hamburg, N. Y., Troop 6. Conducted bird house contest.

Lowe^{ll}, Mass., Troop 33. Fed birds and placed bird feeding stations in wood during winter.

Woonsocket, R. I., Troop 1. Entire troop turned out to feed birds in woods last winter.

Toluca, Ill., Troop 1. Taught other boys to stop killing birds.—Boy Scouts of America, Report of Chief Executive for 1927.

ASSOCIATION STATES AIMS

The aims of the American Wild Fowlers concisely given are as follows:

1. To interest all persons or groups of persons in the intelligent preservation and increase of migratory wild fowl in order that legitimate sport and a supply of game food may be permanently insured.

2. To assist the Biological Survey in those of its policies approved by the Executive Committee of the American Wild Fowlers, and resist legislative efforts designed to impede or cancel the functional authority of the Biological Survey to administer the migratory bird life of the nation.

3. To cooperate with all state game departments, state sportsmen's associations and organized wild fowl interests in legislation consistent with policies of the American Wild Fowlers.

4. To demonstrate to the public that the active efforts and interest of sportsmen in the principal element of insurance to the future safety of wild fowl.

5. To study and assist in more intelligently demonstrating conditions looking toward an increase in wild fowl life and to remedy conditions adversely affecting them.

6. To urge upon congress legislation necessary in behalf of wild life habitats which can, by national and state supervision, be relieved of conditions adversely affecting their wild fowl, by restoring or creating drainage areas suitable to attract, harbor and feed an increased supply of wild fowl.—Nash Buckingham, Executive Secretary.

DESTRUCTION OF DUCKS' NESTS BY IRRIGATION WATER

Reports have come in from reliable sources that there is about seventy-five per cent loss of ducks and geese on the

marshes of Honey Lake and in Honey Lake Valley due to the flooding of the lands for irrigation at the time the ducks and geese start setting. This increased water floods the nests, preventing the eggs from hatching.

The count of ducks and geese for May 12 in this district showed 2426 birds. The seventy-five per cent loss of half this number multiplied by eight will show a loss of 7203 birds. This is based on the average of eight eggs to the nest. This loss is appalling and it is a question whether or not is occurring all over northern California where ducks and geese are nesting in irrigated districts.

Motion pictures were obtained of this destruction and it is hoped that by showing these pictures at the farm centers along with a lecture, it will be possible to induce the farmers to turn on the irrigation water early enough so as to catch the birds building their nests and make them move to higher grounds.

This loss must be curbed and in so doing the cooperation of the farmer is essential.—C. O. Fisher, Susanville.

PROTECTING ORCHARDS FROM DEER

Soaking strips of woolen cloth in sheep dip and hanging these strips by means of wire in trees has been found a successful means of keeping deer away from orchards. One strip of cloth saturated in sheep dip to each tree is sufficient. The cloth should be so placed that it does not come in contact with the bark of the tree. At the end of six weeks it is necessary to resoak the cloths, but this is a simple matter.

This method is not only cheaper than spraying, but more effective. In spraying, evaporation takes place. Consequently, the trees must be sprayed frequently.—J. D. Dondero, Lakeport.

CAUSE OF RUFFED GROUSE EPIDEMICS STILL UNKNOWN

Attempts to rear ruffed grouse in captivity on a practical scale have met with uniform failure according to a report made by Dr. A. A. Allen who has conducted the investigation for the American Game Protective Association in cooperation with three eminent eastern parasitologists. Eight different methods, each given a fair trial, have been disappointing. Now no hope of success is entertained by the investigators until further understanding is gained of the diseases or other causes for the disappearance of grouse periodically from their native covers.

It was believed in 1924 that periodic epidemics were due to the stomach worm, *Dispharynx*, a parasite which proved especially deadly to pen reared birds. However, cooperative experiments and investigations showed that this parasite could not be the sole cause as the organism was not found out of New York and the New England states.

Over 1500 specimens have so far been examined and some twenty different parasites identified. Yet to use the words of Dr. Allen, "The work has been discouraging, I am frank to admit; we have worked for a good many years and have not gotten very far, except that I think now we do know about what the normal condition of the grouse is, and if we should get into an epidemic year we might be able to determine the organism. Whether or not we would be able to do anything about it is open to conjecture. We can make no promises; all we can promise is that nothing can be done until we know something about it."

A SOLUTION SUGGESTED

The opening of the trout season in Los Angeles County saw thousands of men and women in the far reaches of our mountain streams. Many limits were taken. Very few trout were over six or seven inches. The water in the San Gabriel and its tributaries, which are the only important streams in Los Angeles County, is very low at this time of the year.

I have spent many days along these streams since the trout season opened and I do not hesitate to say that it would be a fine thing to close part of these streams for at least two years. I have noted the small fish. Men and women may be seen in the streams using very small bait and very small hooks, jerking out the little two- and three-inch trout. By closing a part of these streams for a couple of years, we would again have some real trout, if we could give our fish time to grow to a fair size. I feel sure that the limit could be reduced to fifteen instead of twenty-five. As a matter of fact, I have checked several catches since the opening day and in some instances, the limit was found and not one fish over six inches long. It would be more sport and assuredly more merit to catch fifteen trout twelve to fourteen inches long than to catch twenty-five trout, six inches long.—R. E. Jeffries, Monrovia, California.

WHAT DEER EAT

A recent article by Joseph Dixon has contributed many valuable facts as a direct result of careful observation of the

food habits of deer in Yosemite Valley.* Material was gathered in preparation for a more extended investigation of the subject and the study of competition between deer, cattle and sheep on the grazing lands of the national forests in California.

The Forest Service estimated 227,145 deer, 414,199 sheep and goats, and 168,455 cattle and horses grazed in the national forests of California in 1925. The Forest Service estimates 605,964 deer in the national forests of twenty-six states, one-third of which are found in California.

Full knowledge of the grazing requirements of deer as well as domesticated

during June, 1926. This was supplemented by the author during the 1927 summer season in the same locality. Yosemite was selected because the natural conditions presented there remain unchanged by domestic stock. Deer there have become reconciled to human beings, making the study much easier and closer observation could be carried on. The camera could be used as a means of recording the food plants.

The paraphernalia used was a notebook, pencil, binoculars, watch and camera. Herbarium specimens were taken from the identical plants upon which the deer grazed and browsed. Another meth-

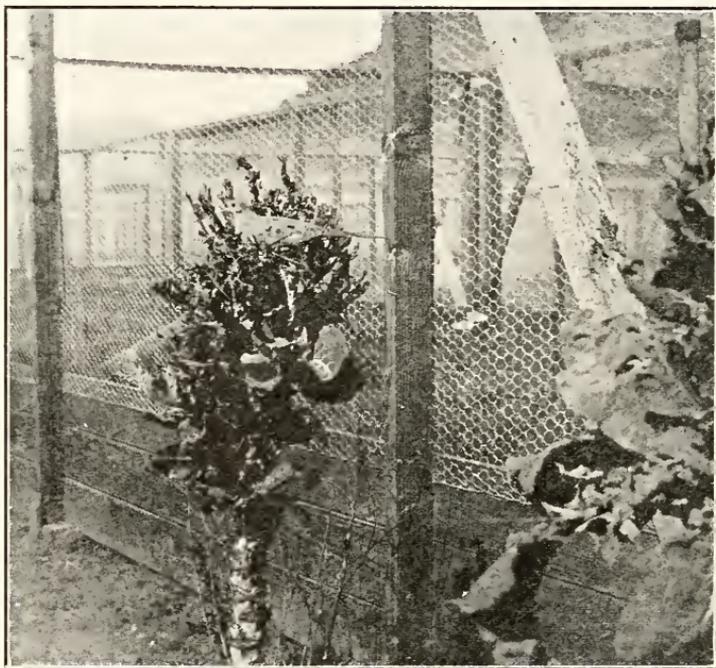


FIG. 69. Western mourning dove responding to protection by nesting in a pen at Yountville Game Farm. Photograph by Milton Clarke, April 20, 1928.

live stock must be had before the proper administration of grazing lands can be carried on economically. California can profit by the serious situation that has developed in the Kaibab National Forest in Arizona, where grazing complications are already in evidence.

Professor A. W. Sampson of the Division of Forestry at the University of California carried on investigations as to just what deer eat under natural conditions

od was used by the author to express the food preferences of deer. The number of deer that browsed upon each species of plant and the time spent in browsing was noted. By multiplying the number of deer selecting any species of plant by the minutes spent browsing on that plant, the result is designated as "deer minutes." Such observations made daily for a period of two weeks, after being computed, actually made it possible to say what deer ate in that locality at that time of year.

* Dixon, Joseph. 1928. What deer eat. American Forests and Forest Life, vol. 34, no. 411, pp. 143-145, illus.

Many obstacles were encountered in identifying plants, due to shyness on the part of some deer, and the difficulty in determining positively the species of fine grass being selected from a clump of herbage. The 17-inch F.5.4 Ross telecentric lens and a reflecting camera helped much in identification. Deer feed principally in early morning or after sundown, hence it was necessary to use an open lens and fast plates to secure good photographs.

The food varies much with the season. Many observations will therefore be necessary in several regions before a definite complete report could be made. Deer fed on fifty different plants in Yosemite during the summer. At that season, browsing on deer brush (*Ceanothus integerrimus*) was only noted once. During winter this is known to be one of the favorite foods.

Deer were not observed to touch azalea or larkspur, which is said to be poisonous to cattle and sheep. Cow parsnip and other poisonous plants were not even touched. Green manzanita (*Arctostaphylos patula*) which is generally supposed to be off the deer menu was eagerly sought by an undernourished buck. California laurel, a tree in the same category, was also eaten.

Mr. Dixon believes deer are apt to browse a little on almost any kind of plant, and refuses to say that they never eat this or that plant.

Sixty per cent of plants eaten by deer are taken by sheep and over fifty per cent are grazed by cattle. Competition is, therefore, certain.

Plans are being made to build up a reference collection of plants eaten by deer with photographs of the actual feeding process.

Plants in the order of their importance as deer food are as follows: yard fescue (*Polygonum aviculare*); meadow fescue (*Festuca elatior*); Spanish clover (*Lotus americana*); western chokecherry (*Prunus demissa*); California black oak (*Quercus kelloggii*); velvet grass (*Holcus lanatus*); curly dock (*Rumex crispus*); horseweed (*Erigon canadensis*); green manzanita (*Arctostaphylos patula*); deer brush (*Ceanothus integerrimus*); sneezeweed (*Helenium bigelovii*); California dogwood (*Cornus californica*). Careful records were made of the number of deer feeding upon each of these twelve species of plants, the duration or extent of browsing set down in minutes. Hence, the "deer minutes" were easily computed showing which plants were most preferred at that time of year.—D. D. McLean, Berkeley, California.

A PLEA FOR SHOREBIRDS

All interested in migratory wildfowl will find satisfaction in reading an interesting bulletin published last fall by the United States Department of Agriculture.* The bulletin gives an account of the present status in South America of the snipes, sandpipers, and plovers that migrate in winter from North America to points south of the equator. Dr. Alexander Wetmore, now assistant secretary of the Smithsonian Institution, is the author. The report covers results of a series of investigations in Argentine, Uruguay, Paraguay, Patagonia and Chile. The pampas and coast of South America furnish wintering grounds for no fewer than twenty-four species of migrant shorebirds, which are either resident or migratory in the United States.

In the bulletin one may read regarding the finding in their winter haunts of such birds as the sanderling, greater and lesser yellowlegs, spotted sandpiper, Hudsonian curlew, and the golden and pileolated plover. Just as settlement has brought about unfavorable conditions in America, so in like manner changing conditions are to be noted in the Argentine and neighboring countries. In addition it was found that all kinds of birds are hunted extensively. Nongame, as well as game birds, are hunted. Ducks and tinamous are offered for sale in the markets of Buenos Aires and are included on the menus in the principal restaurants. Legislation for the protection of birds in the republics of southern South America is in somewhat the same stages as it was in the United States thirty years ago. A few laws have been recently passed but the public in general has not yet been educated to their observance.

The bulletin points out in conclusion that some of the species of shorebirds are now practically gone and the outlook for certain others is gloomy at best. More laws and better enforced ones in the countries to the south will aid greatly in assuring a future supply of valuable game birds, now so nearly gone that they are given total protection in the United States.

GAME LAW ENFORCEMENT

A search of court records nowadays indicates that the public believes in game laws and believes in their enforcement. An editorial in the *New Mexico Conservationist* (March, 1928) vividly calls attention to the fact that game resources

* Wetmore, Alexander. 1927. Our migrant shorebirds in southern South America. U. S. D. A. Tech. Bull. 26, 24 pp. 6 figs.

constitute a publicly owned asset just as state lands, public buildings and highways are:

"Try fencing and plowing up the section of highway running through your land, or tearing down the neighborhood schoolhouse for firewood and see what an outraged public sentiment will do to you. Go into the city zoo and shoot down a deer and you will not be charged with illegal deer killing unless the maximum fine for that offense happens to be higher than the penalty for any other possible charge that could be brought.

"The public is beginning to realize that between killing a deer in the zoo and killing one illegally in the woods the difference, if any, is one merely of degree. Both belong to the public and are for the enjoyment of the whole people. The public has decreed that each of its members may use the wild life resource in a certain prescribed manner, which prescription is designed to admit of maximum use and avoid destruction. To deviate from this manner results in an injury to the balance of the public, and, luckily for posterity, the public will no longer stand for it.

You may give your children an education in the schoolhouse; you may dance in it or hold a box supper there, but you may not take the window sash from it to use in your home. It's against the law, and it's a good law.

"It is also against the law to take more than our share of the game, but we are just now beginning to admit that it, too, is a good law."

SPORTSMEN VERSUS LANDOWNER

The need of taking steps to bring about a better understanding between the landowner and the sportsman was emphasized in a report made during the annual conference of the American Game Protective Association held in New York in December, 1927. The report urges sportsmen to make an ally of the former, points out the similarity of their interests and draws a distinction between the true sportsman and the "mere shooter" who is a constant source of annoyance to the farmer and who persistently transgresses the landowner's rights.

The following excerpts are taken from the spring issue, 1928, of the *Maryland Conservationist* in which the report of the Committee on Relations of Sportsmen and Landowners appears:

"The true sportsman will be and is anxious to help the landowner restrain the irresponsible, to assist in patrolling his premises and furnishing him protection. He will join with the owner in the expense of planting food for game and hedge rows along the fences, and in the control of vermin which is destructive to game and domestic poultry. In other words the landowner and the sportsman can legitimately and profitably cooperate to the fullest extent, to the end that both will receive many benefits. The owner will be relieved from vandalism, and be protected from marauders. The game, which is an asset to his property, will be conserved and increased, insectiv-

orous birds, which are essential to crops, will be preserved, and the sportsman, in return, will occasionally have the privilege of enjoying a day in the field.

"All who go afield must recognize the fact that good sport can not be had for nothing, and like the automobile or other desirable means of pleasure and recreation, it has to be paid for. It is a form of recreation which can no longer be obtained free. Recklessness in destroying wild life without any care for the future should be universally and most severely condemned, and all sportsmen should recognize the fact that effective methods of maintaining the supply, such as are employed in agriculture and stock-raising, must be applied. The following is a quotation from a letter from Mr. L. J. Taber, president, National Grange, dated November 3:

"For years we have enjoyed the lavish bounty of nature without making any return; every individual sportsman must now realize his individual obligation to replace what he takes in his sport.

"Therefore, the necessary steps to develop good will between the landowner and the sportsmen are, first a recognition of the farmers' rights. Courtesy and common sense are essential. Local sportsmen's associations should prove their belief in fair play by helping to prosecute game law violators and trespassers who injure farm property. Local sportsmen's associations should have standing committees to cooperate with the Grange, the Farm Bureau Federation and other farmers' organizations for the promotion of better understanding. Farmers should be invited to affiliate with all sportsmen's associations and to participate in all their social events in order that leaders of thought and sentiment of both may become better acquainted and thereby be better able to meet on a basis of mutual friendship and understanding. State-wide sportsmen's organizations should work with state and county farm organizations, so that the farmer will come to realize that the sportsman is ready to meet him more than half way in adjusting all difficulties and misunderstandings."

A NATURE ALMANAC*

One of the reasons why nature education has not been more widely utilized in the schools is because of a lack of suitable outlines and programs. Furthermore, it is seldom possible to find summarized information regarding advances in nature education. Both types of information brought up to date are to be found within the covers of a new volume entitled, "The Nature Almanac, a Handbook of Nature Education," edited by Arthur Newton Pack and E. Laurence Palmer. This book was written keeping in mind the general aims of a nature course and the need for a course which does not require a special time allotment on the daily program.

* Pack, Arthur Newton, and Palmer, E. Laurence. 1927. The nature almanac and handbook of nature education. (American Nature Association, Washington, D. C.) viii, 312 pp., illus.

An introductory chapter by Mr. Pack, president of the American Nature Association, points out some of the aims of nature education. After a nature calendar, which suggests objects worth seeing at the various times of the year, there follows short reports on various nature activities in the United States. It is quite evident that California does not stress nature education as do many eastern states. Various societies and character building organizations report on their contributions to the subject. Four pages are devoted to the science museums of the United States. The subject of nature guiding and of nature education in summer camps is also discussed. After a review of work accomplished in the various states, a school nature outline gives many helpful suggestions to teachers. In each case references to *Nature Magazine* are indicated. Suggestions are grouped for the first two grades, third and fourth grades, and fifth and sixth grades, each with enlarged scope. The book ends with an up-to-date bibliography grouped under the headings of: texts, bird study, earth and weather study, fungi, ferns and other flowering plants, flowering herbs, insects and their kin, mammals, reptiles, stars, trees and forestry. There are but four illustrations contained in the book all in the forms of cartoons.

Here, then, is a compendium of information of just the kind which the average nature study teacher needs to have in order to keep abreast of the times, know what other people are doing, and have at hand the materials suitable for use in furthering nature education.—II. C. Bryant.

GAMEKEEPERS' SCHOOL ESTABLISHED

A gamekeepers' school for the purpose of training men who can take charge of game bird raising and game restoration work for state commissions, agricultural colleges, private estates, and sportsmen's organizations is being established in an appropriate location of 1400 acres near Clinton, New Jersey, by the Game Conservation Society of New York City. It is believed that the time has come when the country needs men who are specially trained along this line. It is now impossible to fill the demands for gamekeepers from clubs and private estates and trained men are often imported from Europe to take charge of such work. The school is being established in the east where there is greater need for game restoration than in any other part of the country. It is directed by men who have demon-

strated their ability to build up preserves and put them on a profitable basis.

The school is open to men over eighteen years of age who desire theoretical and practical education in the production of game.

The full course of the school, according to present plans, is two years. This period, however, will undoubtedly be considerably modified and eventually become dependent upon the ground work that each individual has had before entering the school.

There is no charge for tuition, books or practical equipment, but the individual is expected to pay his board, lodging and laundry, which, it is stated, can be had on the preserve at an expense not to exceed \$40 a year.

Sixteen states are represented in the first class which began April 15. A number are college graduates and have an excellent foundation on which to build. An appreciation of the economic value of game has spread to colleges. Several states are seriously considering making it a part of their regular agricultural course.

Quoting from June, 1928, *Forest and Stream*: "The course in practical game breeding covers the quail and its propagation both by hand rearing and semi-wild rearing; practical experience in the handling and breeding of stock, the preparation of grounds, the control of natural enemies, food problems and the adaptation of the successful English Easton System to American conditions.

"There will be a similar course devoted to the wild turkey, the Hungarian partridge, the pheasant and the more important varieties of waterfowl—ducks, geese, swans, etc.

"The student at this school will receive careful instruction in natural history, a comprehensive training and experience in the practical side of game breeding—covering the construction of pens, box traps, nest boxes, and other implements used in the production of game. In addition, they will be thoroughly trained in the art of trapping and the general control of vermin, the handling and training of dogs and the use of sporting weapons."

NESTING HABITS OF BAND-TAILED PIGEON*

An interesting account of the personal observations of the nesting habits of the band-tailed pigeon is given by Mr. Albert

* Stillman, Albert E. 1928. Nesting of the Band-tailed Pigeon. *American Forests and Forest Life*, vol. 34, no. 413, May, 1928. pp. 267-268, 300, illus.

E. Stillman in the May, 1928, issue of *American Forests and Forest Life*. According to the author, while the pigeon breeds in small numbers in southern California, not much has been written on its nesting habits. Location of the nests is difficult and observation even more so, as the birds are careful not to betray their location. The male does not perch too near it, and the female does not flush from it unless danger threatens.

Mr. Stillman's observations were made while residing several summers in a cabin on the top of Bushnell Mountain, in the coast range, near Mesa Grande, California. The cabin was surrounded with white oaks in which were many western gnatcatchers and California woodpeckers, together with band-tailed pigeons, "that roosted in the lonely oaks, even homing high on the mountains."

It is interesting to note Mr. Stillman's account of his first seeing the female pigeon early in July with nest building material fly into a manzanita bush across the canyon, followed shortly by the male, and the difficulty that Mr. Stillman had in locating the nest, together with the unique experience that eventually led to its discovery: "We explored the woods for more than two weeks before it was discovered by mere chance. We were collecting pine cones in a tree about twenty feet high. It happened that my belt caught on a dead limb, and as I gave the limb a shake, a band-tailed pigeon left her nest on the horizontal branch of a black oak, several feet away, and alighted in the top of a nearby pine tree. A moment later we were looking at our first band-tailed pigeon nest. We never would have seen it had the bird kept her place. The nest was no more than fifteen feet from the ground and about twenty-five feet from the trail."

The nest is described as being rather bulky, a mere pile of about one hundred and fifty oak and squaw-bush twigs, ranging from a sixteenth to a quarter of an inch in diameter.

Much time was spent in trying to obtain the birds' confidence, in which Mr. Stillman was finally successful, enabling him to approach as close as two feet and to make some of his notes from a camp stool within three feet, and eventually, within one week, the author sat at the foot of the tree and watched the mother bird's operations.

"In September the baby pigeon was in the nest; its dark skin covered with soft, cottony yellow down, gave it the appearance of a gosling. As I watched, the mother bird flew to a pine tree on the

other side of the trail. Then, with a loud clapping of wings, she darted to a branch beside her nest. Frequently I saw her stretch herself out so as to obtain a better view of the nestling. Presently she entered the nest and gave the food to her young."

Not wishing to disturb the pigeons, the next visit to the nest was made after four days, shortly after sunup, and the pigeon was found beside her nest directly overhead. "The baby bird was strong and active. An adventuresome little fellow he was, wriggling to the nest-edge to be fed. Later, undisturbed by our presence, he huddled down among the small twigs, closed his eyes, and dropped off to sleep."

"When the baby pigeon was small, the mother stayed near the nest, often sheltering it with her wings during the midday heat; but when it was about ten days old she remained away from the nest for hours at a time. The male was observed about the nest only twice."

When the young bird was two weeks old the nest was visited by the author and Mr. Clinton G. Abbott of the Natural History Museum of San Diego, who after making friends with the nestling succeeded in photographing same.

"The following day the old pigeon left the oak tree in the early morning and returned at twilight. Next day she left at daybreak and returned at sundown. For more than a week after that she was not observed at the nest except in the late afternoon * * *. Early in October the young bird left the nest. With folded wings it sat on a small branch of the oak, where it remained until late in the afternoon. That night it roosted on the high limb of a nearby pine tree. The following day it left the neighborhood and I did not see it again."

A short time later Mr. Stillman discovered another band-tailed pigeon sitting on her nest about ten feet above the ground in a live oak tree near a country road. This nest was remarkably well constructed of oak twigs and had a thick lining of pine needles and contained one egg.

Mr. Stillman was unable to make continuous observations of this nest for more than one week, but from data gathered from another source, it is reported that a severe thunder storm swept across the mountain and on the day after the storm the mother bird was seen brooding but that she left the nest and did not return to it. It is understood that it is not the ordinary habit of the bird to brood so late in the season, and "that the date of

my finding, October twelfth, established a new late nesting record of forty-eight days for the band-tailed pigeon in California."—Bessie W. Kibbe.

CARP CATCH INCREASED BY NOVEL METHOD

The German carp has gained a bad reputation and is suspected as a destroyer of the spawn of game fishes. For this reason any method devised which will greatly deplete the numbers of these "rough" fish at once wins the approbation of those who would conserve the more desired species. The Minnesota Fish Commission permits seining in carp infested lakes during the winter months and carefully supervises the operations to prevent game fish from being removed. The carp taken are shipped to the larger eastern cities where they are in considerable demand during Jewish holidays.

In an article in the *Fishing Gazette* (vol. 45, no. 5, p. 18), George Roger Chute tells of the innovation in the method of seining which resulted in such a phenomenal catch during the past winter.

"The belief has always been prevalent that in winter the carp gather in the deepest parts of the lakes, and can there be seined. But this year it has been learned that a high percentage of the fish of the lake actually are to be found close under the ice, at the very edges of the water. Whether the fish are feeding there or are seeking air is a matter of conjecture, but the seiners have found that by the old process of passing their nets, a great proportion of the fish escaped by never being within it.

"Cultivating an ice field may seem a strange farming operation, but in Minnesota it has been found productive of a bounteous crop of carp. The fisherman there mounts to the driver's seat of a big disc harrow, whips up his horses shod with ice calks, and proceeds around the perimeter of the water-body to be seined. The cutting discs of the steel harrow chisel and grind against the ice, grooving the surface, gouging out irregularities, and creating withal a rattle and chop which must be most confounding and frightful to the fish just beneath. At all events, we are assured by the seiners that the stampede of the strayed fish is as precipitous as their terror is complete, and that by the time the howling harrow has made the rounds of the lake shore once or twice, every carp capable of locomotion has fled to the central depths of the pond, there to huddle with his fellows, seeking gregarious protection, and wittingly laying himself directly in the path of the seine's deep bunt as the gear is circled about.

"The discovery of this novel method of fish-driving has resulted in great gratification to everyone connected with the business. It has literally netted a greatly increased catch with a correspondingly enlarged return to the seiner and to the state; it has caused a far more efficient and thorough ridding of the lakes of undesired species."

WOOD DUCKS INCREASING

Since the wood duck has been accorded complete protection, it has been slowly but steadily increasing and a few definite notes may be of interest. In talking with Dr. Robert Cushman Murphy at the meet- of the American Ornithologists' Union he said that wood ducks were the most abundant ducks in California, where he had just been on a duck hunt. That is, of course, far away from Ontario, but on a visit to Point Pelee on December 21, I was told by a resident who is a conscientious conservationist, that, on the opening day of shooting, these ducks were the most abundant of all and that very many of them were killed. Unfortunately the perpetrators escaped in every instance, and my informant belonged to one of the few parties that refused to kill them. On my return home (London, Ontario) I found awaiting me a memorandum regarding a wood duck, and on December 25th I saw the bird itself, which had doubtless been wounded during the shooting season and had lived on my own lake until it froze over. It was flushed by a man on the 22d and scuttled over the ice towards the open water, but was brought in by a dog, uninjured. But it is doubtful that it will recover and probably will never be able to fly. These ducks were regularly seen at my place from August onward.—W. E. Saunders in *The Canadian Field Naturalist* (vol. 52), February, 1928.

REFUGES MOST IMPORTANT IN SAVING WILD LIFE

Establishment of sanctuaries for birds will do more for their welfare than any other one thing, Paul G. Redington, chief of the Bureau of Biological Survey, United States Department of Agriculture, told the members of the Izaak Walton League, a national organization of persons interested in hunting and fishing, at their annual convention in Omaha, April 20. "While restrictions are necessary," he said, "I feel that I am safe in saying that they take second place to a carefully worked out system of refuges, and I am glad to say that progress has been made in this respect within the last year."

"Unanimity of the League and other sportsmen in favor of the flooding of the Bear River marshes of Utah has brought results in the current session of congress," Mr. Redington said, and legislation to make the Cheyenne Bottoms in Kansas a permanent refuge for waterfowl is now pending. Also before congress is legislation to hasten completion of the purchase of land within the Upper Missis-

issippi River Wild Life and Fish Refuge, which Mr. Redington said, "was conceived and made possible by the influence of the Izaak Walton League of America." Another measure for which the League has worked is the McNary-Sweeney Bill for a study of relationships between the forests and wild life. The Budget Bureau approved it as did the senate committee. "We are all hopeful," he added, "that the bill may be put on the statute books at this session of congress."

In particular Mr. Redington thanked the league and other sportsmen for the aid they gave the Biological Survey in one of the central states where violations of the Migratory Bird Treaty Act were numerous and where attempts had been made to do away with the game warden and to demolish his power boat. The League sent letters to all chapters in the state urging support of the authorities, and a notable improvement followed.

Mr. Redington's address reviewed many of the activities of the Bureau of Biological Survey for the past year and needs and plans for the future. "The federal government alone can not be depended upon to solve the many problems of wild life administration." Facts and cooperative effort are needed, to provide a basis for a long-time program of conservation, including studies of food habits of migratory birds of which only a few have been completed, and which will be a guide to formulation of a refuge program. Other activities have been surveys of areas available for refuges; studies of propagation of game birds; plans for studies of the feeding habits of animals along lines similar to those undertaken in connection with the Jackson Hole elk; the organization of the waterfowl census, which is now under way and enjoying the cooperation of sportsmen throughout the country; and the bird banding work, in which more than 1200 sportsmen and bird students are aiding the bureau. In this connection Mr. Redington mentioned that ducks banded on the celebrated Cheyenne Bottoms of Kansas were retaken in 16 states, three provinces of Canada, in Alaska and in Mexico.

Mr. Redington also made a plea for sympathetic support of the new Alaska Game Commission. "Seldom has such an opportunity been given to those interested in the perpetuation of our big game animals to unite their efforts in the establishment of a well-balanced and effective game administration program as can be done in Alaska."

IMPORTED WILD BIRDS NOT EASILY ESTABLISHED HERE

Importations of foreign birds for the stocking of game coverts, or in the hope of adding to the variety of bird music in the woods, or for warfare on insect pests, have led to strange and unexpected results. Probably few persons anticipated that the English sparrow would thrive and multiply and spread itself over the whole continent as it has since the first scattering importations were made on the Atlantic coast in the early 1850's. On the other hand, bird lovers, sportsmen, and state game authorities have spent thousands of dollars in efforts to acclimatize and establish desirable varieties of game birds. Reckoned by number a large proportion of the attempts have failed. Sometimes the birds have simply disappeared and were never seen again, leaving the importers wondering whether they may have migrated or fallen prey to disease or animals in the new environment. At times sportsmen have grown crops on game preserves with the expectation of allowing the birds to harvest the crops and enjoy a favorable chance for colonization. In other instances, birds have seemed to settle down and nest and reproduce satisfactorily for a year or more, only to vanish a few years later, apparently gaining stamina and reproductive power for a few years only to lose it later. The English sparrow increased in numbers and in range for perhaps 30 to 40 years when it reached a peak of abundance and was considered a serious pest. In recent years, these birds have declined greatly in numbers both in cities and in rural districts, and nature seems to be setting a balance in regard to them.

The foregoing is representative of the general discussion of the subject that Dr. John C. Phillips offers in a 64-page pamphlet, "Wild birds Introduced or Transplanted in North America," just published by the United States Department of Agriculture as Technical Bulletin 61-T. Dr. Phillips has cooperated with the Bureau of Biological Survey, and has collected a great quantity of records and reports that he summarizes briefly for each species and variety for which he has been able to gather facts. He prefaces his report with the statement that "the early history of the introduction of foreign birds into this country is mostly clothed in darkness. The records of many attempts, if such there were, have long since been buried in back numbers of

local newspapers, and if any experiment was successful it was soon forgotten." For the most part he has depended on the files of sportsmen's magazines, the records of the Biological Survey, and supplementary correspondence with many bird lovers and biologists in various regions where birds have been liberated. Since 1900 the records of the Biological Survey are a complete guide to importations. Many birds imported as cage birds have been freed or have escaped and some have established themselves in favored localities.

One principal use of this bulletin, the author believes, will be to record and bring to the attention of those who attempt to acclimatize birds a record of the failures with the same or similar birds, and so prevent waste of money in ill-considered introductions.

Doctor Phillips devotes several pages to the various kinds of quail, including the bobwhite, and tells how these have been moved about from one section to another, sometimes successfully but often unsuccessfully. Massachusetts sportsmen began comparatively early to import quail, first from the Ohio Valley, later from Kansas and the Indian Territory, and still later from Mexico. When Mexican birds were first imported the prices ran as low as \$1.50 a dozen. Later the Ohio Valley and even Oklahoma and Texas, which were at one time dependable sources of supply, also found their game so depleted that they in turn bought to restock. From 1910 to 1925, the author reports, more than 233,000 Mexican bobwhites are recorded as having entered the United States, and the price has steadily risen to \$24 to \$36 a dozen.

In the new bulletin the author gives facts concerning importations and acclimatization experiments with more than 100 species and varieties of wild birds. Technical Bulletin 61-T may be obtained free upon application to the United States Department of Agriculture, Washington, D. C.

UPPER KLAMATH WILD LIFE REFUGE ESTABLISHED

By recent executive order, President Coolidge has set aside for use as a refuge and breeding ground for birds and wild animals an area in southern Oregon embracing certain unappropriated public lands near the upper end of Upper Klamath Lake. The new reservation will be known as the Upper Klamath Wild Life Refuge and will be administered by the

Bureau of Biological Survey of the United States Department of Agriculture.

All the lands involved have been withdrawn for reclamation purposes in connection with the Klamath irrigation project in Oregon and California and, as with other reclamation projects set aside as wild life refuges, are primarily under the jurisdiction of the Bureau of Reclamation of the Department of the Interior. The reservation of these lands as a bird refuge therefore is subject to use by the Bureau of Reclamation for irrigation and other purposes.

About 5200 acres are included in the refuge, which extends as a rather long, narrow strip between the Crater National Forest, embracing the high mountain range bordering this part of the Klamath River Valley on the west, and Upper Klamath Lake. The refuge area consists mainly of marshland containing a dense growth of tules, sedges, and other aquatic vegetation and affording abundant cover for the nesting wild fowl of the region. The marshes and the more open water areas also included will provide important feeding and resting grounds for migratory waterfowl, especially wild ducks and geese.

The establishment of the refuge will be of great importance to the waterfowl of the region, in view of the fact that there has been such extensive drainage of marsh areas in that general section in connection with the reclamation of lands for agricultural purposes. The reservation will be of great interest to conservationists generally as well as to sportsmen who are familiar with the drainage operations that have led to the practical elimination of Lower Klamath Lake, embracing about 80,000 acres and formerly one of the most important breeding grounds for resident waterfowl and feeding and resting grounds for migratory waterfowl in western North America. The creation of the refuge at Upper Klamath Lake will in a way serve to offset the disappointment that many felt because of the impracticability of reflooding Lower Klamath to save it as a wild fowl haven.

The development of wild life refuges in this general section will provide for the needs of the birds on an important migration route near the Pacific coast. The new refuge will also extend needed protection to fur-bearing animals. It is unlawful, within the reservation, wilfully to set on fire any timber, underbrush, or grass, or after building a fire to leave it without totally extinguishing it, or to hunt, trap,

capture, or wilfully disturb any wild animal or bird or the eggs of any wild bird, except under such rules and regulations as may be prescribed by the Secretary of Agriculture.

MIGRATORY BIRD TREATY ACT REGULATIONS AMENDED

Amendments to the Migratory Bird Treaty Act Regulations, changing the classification of gallinules, the open seasons in a number of states, and the sinkbox regulation, have been adopted by Secretary of Agriculture Jardine and approved by the President. Gallinules are no longer classified under the open season for wild ducks and geese, being now included in the open season for rails. In Illinois the season on waterfowl will open next fall on September 16 and close December 31, this being in lieu of the former period from October 1 to January 15. In Massachusetts the season on rails and gallinules (except coot) is changed from the period September 1 to November 30 to the period September 16 to December 15.

In South Carolina, Georgia, Florida, Alabama, and Mississippi the open season on mourning doves has been changed from the period October 16 to January 31 to two periods covering the month of September and from November 20 to January 31.

The provision prohibiting the use of sinkboxes in strictly inland waters in the hunting of migratory waterfowl was not changed, but the restriction having application to the distance between sinkboxes, and between sinkboxes and shore lines or islands, has been eliminated. Under the regulations of last season it was required that sinkboxes (batteries) used in the taking of waterfowl in coastal sounds and bays and other coastal waters be placed not less than 700 yards from the shore line of the mainland at ordinary high tide and not less than 700 yards from any island at ordinary high tide and not less than 700 yards from any other sinkbox.

FOREST SERVICE PLANS NOVEL CAMPAIGN

"What Price Fire," a thrilling motion picture showing how Dan Crockett, a miner and packer won an uphill fight against the red enemy of the forest, will be the main attraction of a fire prevention campaign to be put on by the U. S. Forest Service in northern California this summer. The picture was taken in the Mt. Shasta, Klamath River and Marble

Mountain regions of Siskiyou County, with local settlers as the leading actors, and contains many beautiful shots of noted scenic attractions, game animals and birds, and high mountain country.

The educational fire prevention campaign will start at Redding May 22 and will cover 115 cities and towns within and adjacent to the Shasta, Klamath, Trinity and California National Forests, and along the Redwood highway from Crescent City to the San Francisco Bay region. A show will be given each night, except Sunday, in different towns and will be free to all. In addition to the three-reel story, "What Price Fire," there will be a movie entitled "She's Wild" with bronco-busting, steer roping and tying, and other exhibitions of cowboy prowess at a frontier day celebration, and a brief talk illustrated with beautifully colored lantern slides, showing the loss by fire of valuable timber, recreation, and fish and game resources.

To carry on this campaign in northern California, the Forest Service has equipped a truck with an electric generator, motion picture projectors, stereoptican lantern, screen, and other necessary paraphernalia for putting on a complete movie show not only in large towns but even in out-of-the-way settlements. Asher Ireland, an officer with 18 years of experience in the forest service, will direct the campaign.

BEAR RIVER MARSHES, UTAH, SAVED FOR MIGRATORY BIRDS

Carrying authorization for an appropriation of \$350,000, the Bear River Migratory Bird Refuge Bill, which has been pending in congress for the past two sessions, has been approved by President Coolidge. This important conservation legislation authorizes the Secretary of Agriculture to construct at Bear River Bay and vicinity, Utah, such dikes, ditches, spillways, buildings, and improvements as may be necessary for establishment of a suitable refuge and feeding and breeding ground for migratory wild fowl and to acquire, by purchase, gift, or lease, water rights and privately owned lands necessary for the purpose.

The Bear River Marshes, on Bear River Bay, comprise the greatest wild-fowl area of its kind in the Rocky Mountain region and form the gathering place for millions of wild ducks and geese during their north and south migrations. The new law seeks to improve conditions at Bear River Bay so as to prevent a recurrence of the enormous losses of mi-

gratory wild fowl that have resulted from the concentrated alkaline waters there. It is estimated that in the past few years not less than 7,000,000 ducks alone have perished, owing to scanty rainfall and the diversion of water for irrigation purposes from Bear River and other streams tributary to the marshes in that district. The shallow waters in many parts of these marshes during summer and fall of each year becoming concentrated solutions of alkali.

The building of dikes and other improvements to store waste fresh waters, now flowing into Salt Lake, for the purpose of reflooding the Bear River Marshes will eliminate the death areas and afford a breeding ground for great numbers of the birds. Instead of a death trap the area will become a supply point for the surrounding region, producing vastly increased numbers of wild fowl.

During the summer of 1927, with the cooperation of the Associated Sportsmen and the United Duck Hunters of California, an engineer of the Bureau of Public Roads made a careful study for the Bureau of Biological Survey of conditions at Bear River Bay. His report showed that the project is entirely feasible and indicated that an appropriation of \$350,000 would cover the cost of the development of a refuge in the region, which will include the marshes of the delta proper and provide for impounding fresh water over the broad marginal flats. The act stipulates that not more than \$50,000 shall be expended for the purchase of land, and that not less than 60 per cent of the area acquired shall be maintained as an inviolate sanctuary for migratory birds.

The Bear River project is primarily the heart of the wild-fowl conservation problem of the 11 states west of the Rocky Mountains, and it has been conclusively shown by the bird-banding operations of the Biological Survey conducted in the region that these marshes form a distributing center supplying migratory wild fowl to all the surrounding states. It is predicted that the food value of the birds that can be saved in a single season, not to mention recreational and esthetic values, will be far in excess of the cost of the proposed improvements. Sportsmen and conservationists throughout the country will welcome the measure as a most far-reaching step in the wild-life conservation program. The acquisition of lands for the refuge and its administration when established will be by the Bureau of Biological Survey of the United States Department of Agriculture.

UTAH MAN WILL HEAD BEAR RIVER BIRD REFUGE PROJECT

David H. Madsen, State Fish and Game Commissioner of Utah, has been appointed superintendent of the new migratory bird refuge authorized to be established at Bear River Bay, Utah, under the Bear River Migratory Bird Refuge Bill recently approved by President Coolidge. Mr. Madsen is president of the Western Association of Game Commissioners and has been prominently identified with the conservation of wild life for a number of years. Fully familiar with wildfowl conditions in his state, he has been one of the strongest advocates for the reflooding of the Bear River Marshes and the creation of a refuge there as a means of preventing the annual mortality of birds in the region. Mr. Madsen will take up his new duties on July 2.

The construction work necessary for the reflooding of Bear River Marshes, as provided by the act, will be performed under the direction of L. M. Winsor, Bureau of Public Roads engineer stationed at Logan, Utah. He has been engaged for a number of years on irrigation projects in the west and through his long experience in the Division of Agricultural Engineering of the Bureau of Public Roads of the United States Department of Agriculture is well fitted for the work. Mr. Winsor during the summer of 1927 made a careful study for the Bureau of Biological Survey of conditions at Bear River Bay.

The second deficiency bill, which became a law during the closing hours of the 70th Congress, carried an item of \$200,000 for the construction of such dikes, spillways, buildings, and improvements as may be necessary for the establishment of a refuge for migratory wildfowl in this region so well fitted as feeding and breeding grounds, and to acquire the land and water rights needed for the purpose. This is part of the \$350,000 appropriation authorized in the Bear River Migratory Bird Refuge Act. Plans for the preliminary work of the acquisition of lands and for engineering operations are being developed by the Bureau of Biological Survey which will administer the refuge when it is established.

The Bear River Marshes, on Bear River Bay, comprise the greatest wildfowl area of the kind in the Rocky Mountain region and form the gathering place for millions of wild ducks and geese during their north and south migrations. The new law seeks to improve conditions at Bear River Bay so as to

prevent a recurrence of the enormous losses of migratory wild fowl, especially ducks, that have resulted from the concentrated alkaline waters there. The building of dikes and other improvements to store fresh water now flowing into Salt Lake, in order to reflood the Bear River Marshes, will not only eliminate the death areas, but will also afford a feeding and breeding ground for great numbers of the birds. Instead of a death trap, the area will become a supply point for the surrounding states, producing vastly increased numbers of wild fowl.

FOX DISTEMPER BEING INVESTIGATED

Frequent requests from fox breeders for assistance in controlling infectious diseases in their animals have prompted the Bureau of Biological Survey of the United States Department of Agriculture to investigate conditions on a number of fox farms. Between the years 1921 and 1926 Dr. Karl B. Hanson and Dr. H. L. Van Volkenberg, of the Division of Fur Resources of the Biological Survey, visited as many infected premises as possible, studying conditions for periods ranging from a day to a week at each. Special note was made regarding the history of the various outbreaks, the rate of mortality, and the class of animals affected, their symptoms and the organs involved.

The source of the disease was directly traceable in the greater proportion of the outbreaks to animals brought from other farms or from fox shows. Whenever a bacteriological laboratory was near at hand, advantage would be taken of the opportunity to send fresh carcasses there for examination. Lack of facilities or funds prevented other studies of the bacteriology or the microscopic injuries caused in these infections.

It was soon found that a very thorough and comprehensive investigation would have to be made of so-called distemper, or of the various diseases known by that name. It was deemed important that the bacteriology and microscopic pathology of the animals affected first be given particular attention with a view to determining the causes of the trouble and working out more accurate methods of diagnosis.

Dr. R. G. Green, of the Medical School of the University of Minnesota, who, with a group of associates had investigated outbreaks on large farms near Minneapolis, visited F. G. Ashbrook, of the Bureau of Biological Survey, in December, 1926, and discussed the work

done at the University of Minnesota. Fresh material in abundance had been available for his use, and each outbreak was kept under close observation throughout its entire course.

A program of cooperative research on diseases of carnivorous animals was entered into between the Biological Survey and the University of Minnesota on October 1, 1927. The work has been carried out under the combined direction of Dr. J. E. Shillinger of the Bureau of Biological Survey, and Dr. R. G. Green of the University of Minnesota. The cooperative undertaking had the benefit of almost three years' earlier work by Doctor Green and his associates. Dr. Earle T. Dewey and Dr. Newell R. Ziegler, who have been associated with Doctor Green since the time he began his fox-disease investigation, have continued as part of the staff of nine workers under the cooperative program.

When the university group started its investigations its activities were directed to the study of a bacterial infection that was present on a number of fox ranches in Minnesota. This disease, known as fox paratyphoid, disappeared in Minnesota and was followed by another, discovered by Doctor Green, and here tentatively called epizootic fox encephalitis, to which investigations are now being directed. An epizootic, it will be understood, is in animals the same as an epidemic in man.

On a number of fox ranches in the northwest an infection known as fox paratyphoid occurred during the fall of 1924 and the winter and spring of 1925. It appeared to be a disease of young foxes rather than adults. On affected ranches the young would die in large numbers, while only an occasional breeding animal would succumb. The mortality in its typical course ran as high as 60 per cent of all the younger animals on a ranch. Bacterial vaccine tended to control the disease on these ranches, and the fox paratyphoid has not been encountered by the University of Minnesota group since the summer of 1925. The very fact that it has disappeared from view is strong evidence that the disease studied was a primary infection, and if so, that it can be expected to reappear in epizootic form sometime in the future.

Following their work on the paratyphoid infection, the university group began investigations of a second disease of foxes that previously was not described or was known under the name "distemper," and now is tentatively being called epizootic fox encephalitis. The

solution of the various problems, especially the development of a preventive vaccine, will undoubtedly require the major efforts of the group for several years to come.

This disease was first encountered in the fall of 1925. It was recognized first in groups of animals that had been immunized with the paratyphoid vaccine. The evidence that foxes so vaccinated were resistant to an infection by the same organism indicated that a new disease was being dealt with in vaccinated animals. Accordingly, transmission experiments were carried on with foxes that had been so vaccinated.

Epizootic fox encephalitis has been present on numerous ranches throughout the United States during the past three years. Outbreaks developed following fox shows at Portland, Me., and Buffalo, N. Y., in 1925, and have been present on many ranches under observation continuously since that time. It appears to be a disease of adult foxes as well as pups, and in outbreaks studied, deaths in adults have been as numerous as among the young. Even on a carefully supervised ranch the majority of animals are found dead even though only a few hours before they were apparently well. Sick foxes when found may show convulsions, extreme weakness, paralysis, or sleepiness. All the various symptoms appear-

ing in ranch animals have been reproduced in animals artificially infected from a single sick fox, showing that all these manifestations are part of the same disease.

The animals dying from experimental infection appear the same in all ways as do the animals dying on a ranch. On a ranch the mortality from this disease does not often exceed fifteen per cent, but a number of epizootics have been observed where it was as high as 40 per cent. Positive diagnosis of this disease has been difficult, and one of the problems confronting the investigators is to find a technique making the diagnosis less difficult.

Considerable experimental work has been necessary to an understanding of epizootic fox encephalitis. Close to 400 animals have been used in transmission experiments, and approximately 1400 sick animals have been carefully studied. Thus far it appears that two diseases of foxes have been encountered, and the group of investigators is not sure but that a third may be discovered as the work goes on. The development of a vaccine for epizootic fox encephalitis is the immediate aim, and it is hoped that a research undertaken by the University of Minnesota and the Bureau of Biological Survey will have the cooperation and support of fox ranchers.

DIVISION ACTIVITIES

Appropriate and distinctive metal buttons and insignia have been secured and will be supplied the field force. These will complete the olive drab uniforms which have been prescribed for the field force of the Division. In adopting a uniform for its fish and game patrol force, California has followed the precedent established by other leading game conservation states, which have found that placing the patrol force in uniform has not only elevated the standing of the force, but has also tended to increase its efficiency. Under regulations, the uniform will be worn at all times except on special missions and investigations requiring concealed identity.

Negotiations leading up to the acquisition of a game farm site for southern California have been completed and plans are under way for the construction of the necessary plant, buildings and equipment, which will permit this farm to be in operation during the coming season.

The Division will conduct a large ex-

hibit at the Pacific Southwest Exposition in Long Beach, July 27 to September 3, depicting the various phases of wild life conservation now being carried out.

As a forward step toward conserving the supply and preventing the waste of sardines, the Board of Fish and Game Commissioners has issued its order establishing August 6 as the opening date of the 1928 season when sardines may be canned. This order was made by reason of the fact that sardines taken prior to this date have so little oil content as to render them unsatisfactory and uneconomical for canning purposes. The order establishing a closed period for the taking of sardines for canning purposes establishes a precedent, but has met with the unanimous approval of the sardine canners of the state, in a resolution adopted by their association. The action taken here, in all probability, will be followed by legislation establishing an open and closed season for the taking of sardines for the whole state.

The game refuge survey crew under the leadership of A. H. McClellan recently finished the survey of Refuge 4C, located on the line between Riverside and Orange counties. Work on 4C was slow due to the fact that the refuge is described by section and township lines. Brush was so thick that it was difficult to locate monuments. Quail were found to be very abundant in part of the refuge. Deer were found also, but they are not as abundant as in some of the other refuges.

The boundaries of Refuge 4E, the most southern refuge located on the summit of Cuyamaca Mountain in eastern San Diego County were run in May. Posting the boundaries of refuges 4D and 4G was followed by the posting of the northern line of the two big southern California refuges, 4A and 4B.

It is probable that the southern line will not be run until next winter as the summer months can be used to better advantage in the northern section where snow conditions make it impossible to work during the winter.

The 1928 fish planting season opened with a plant made the first two days in April in Captain J. E. Newsome's territory. The fish in the new Mormon Creek Hatchery near Sonora made such a remarkable growth that it was necessary to plant some 100,000 Loch Leven to make room for incoming spawn.

Car No. 01 has made four trips from the Mount Shasta Hatchery laden with fish to be planted in various sections of the state. Captains of patrol made preparations for the reception of fingerlings before the car arrived. Reports show the fish were planted with a negligible loss.

Supervising Captain Brownlow prepared a letter of instructions again this year, which was sent to the field force. Emphasis in these instructions was placed on care and distribution in order to give the tiny finny favorites every advantage possible for survival. Attention has also been paid to trout planting equipment and improvements which it is anticipated will produce good results.

Indications are that low water will be prevalent this year and a warning has been issued to deputies not to plant trout in streams which are certain to go dry. The importance of rescuing stranded fish has also been stressed.

State lion hunter Jay Bruce has bagged ten more lions since the first of the year, bringing his enviable record to a total now of 338 during his activities as a lion hunter.

Efforts to lessen the depredations of lions in San Luis Obispo County did not meet with the success expected. Lion signs were present in Lopez Canyon and Posso, but the weather was so warm that the dogs were unable to work well. After several attempts to induce them to hold to the trail of the lion, it was decided to await a more seasonable time when weather conditions are more favorable.

Little work was accomplished in game refuge 1K, and in the region of the north fork of the Kings River. High water and rushing mountain torrents seriously hampered progress. No lion signs were noticed on Patterson Mountain.

VOLUNTEER DEPUTIES

The appointment and organization by the Fish and Game Commissioners of fishermen, hunters and out-door lovers who are willing to contribute their services as deputies of the Division of Fish and Game to the restoration of sports afield and astream with gun and rod in California, without commercial, political or personal ties, or hope of reward, is undoubtedly the most comprehensive move and program ever undertaken for the protection and conservation of wild life in the United States.

This movement represents a patriotic and unselfish endeavor to save for our children and for future generations that priceless heritage of nature, the fish, game and wild life of the state, in order that they may enjoy the health, recreation and happiness that only the great out-o'-doors can give them.

The volunteer deputies of the division have been drafted from and represent the highest ranks of citizenship within the state, many of them being nationally known, which insures the integrity and high standing of the organization.

Less than two years have passed since the Fish and Game Commission of California established a system for the appointment and supervision of men willing to serve without compensation as deputies of the division for the protection and conservation of wild life, and the enforcement of the laws enacted for that purpose. Yet the services that have been rendered by these deputies have been exceedingly satisfactory and have resulted in awakening thousands of sportsmen and lovers of the great out-o'-doors to a realization of the perils that are threatening the supply of fish and game of the state. They have further materially aided in bringing about the necessity of cooperative action on the part of the sportsmen and the

people in general in the work being carried on for the protection and conservation of wild life, and the enforcement of the fish and game laws, as well as the efforts being made for the restocking of the game fields and public waters.

The Fish and Game Commission has appointed a total of 752 volunteer deputies of the Division of Fish and Game. 347 of these deputies being federal forest rangers and forest fire guardians located in the various national forest reservations within the state. These appointments have been recommended and are sponsored by the United States Forest Service.

Four hundred and five of these deputies are men who have been drafted from the ranks of sportsmen within the state, their appointment being recommended and sponsored by bona fide fish and game protective associations and clubs.

All volunteer deputies of the Division of Fish and Game, except those who are employed by the federal government, are required to be and are bonded to the state in the sum of \$2,500, for the faithful performance of their duties.

The activities of the volunteer deputies of the Division of Fish and Game, except those who are in the employ of the federal government, are, under the system and rules that have been established by the Fish and Game Commission for their control, under the direction and supervision of the captain of patrol in charge of volunteer deputies, and are required to report monthly and to render an account of all of their activities, such as the number of hunting and fishing licenses checked, the number of miles of fields and streams patrolled, the number of arrests made for violations of the fish and game laws, the amount of fines imposed, fish and game conditions observed while afield, etc.

That the cause of fish, game and wild life protection and conservation within the state has been benefited through the activities of the volunteer deputies of the Division of Fish and Game, is indicated from a brief and incomplete summary of the monthly reports rendered by these deputies, which show that during the past two years they have checked a total of 19,102 hunting and fishing licenses, that they have patrolled 314,575 miles of fields, streams, bay shore and coast line, that they have made 428 arrests and assists in arrests for violations of the fish and game laws, for which \$12,168 in fines were imposed.

The action of the men who have, without compensation or hope of reward of any kind, volunteered their services as

deputies of the division, and entered the fields for the protection and conservation of fish, game and wild life and the strict enforcement of the laws that have been enacted for that purpose, is certainly worthy of the highest commendation, and surely deserves the hearty and united support and cooperation of all sportsmen and law-abiding citizens within the state.—Walter R. Welch.

Department of Patrol.

May was a banner month for the patrol department. Deputies by their energy and efficiency greatly increased the number of arrests and fines made. By way of comparison, during the month of May, 1927, 103 arrests were made and \$3,555 collected in fines; while during the month of May, 1928, 252 arrests and \$8,245 collected in fines imposed for violations. It is necessary, however, in all fairness to point out that there is an increase in the patrol force of about one-fifth.

It is now further known that conservation is fast becoming more popular with the people even in the most remote corners of the state. This is reassuring and indicates that much prevention of law violation is being accomplished by the patrol force through their activities in enlightening the people in their districts and impressing them with the need for the protection of fish and game.

Changes in the personnel of the patrol force are as follows:

Lewis T. Ward was appointed captain of the Sacramento district with headquarters at Sacramento to succeed Captain D. E. Roberts, deceased.

Deputy C. L. Bundock, who has been working in the San Francisco office for two and one-half years, was transferred to San Benito County with headquarters at Hollister.

Deputy C. F. Barnes was transferred to Quincy to take the post of Deputy Miner, who has resigned to go into business for himself. Volunteer Deputy E. L. Mercer was appointed regular deputy for the Portola station.

Deputy J. F. French was transferred from Fall River Mills to Redding to assume charge of the district of Deputy Frank A. Greene, resigned. Andrew H. Millett appointed deputy to fill the vacancy left by Deputy French at Fall River Mills.

Deputy F. J. McDermott transferred from the San Francisco office to Santa Cruz County with headquarters at Santa

Cruz. Deputy E. D. Moody, for many years operating in Santa Cruz County, transferred to the San Francisco office.

Volunteer Deputy J. C. Schneider appointed a regular deputy with headquarters at King City to succeed Deputy Frank A. Burke resigned.

Deputy G. L. Hoke appointed deputy at Requa to fill the position left vacant by the resignation of Taylor London.

A list of the deputies is appended on the back cover of each issue of this magazine for the purpose of informing the general public of the locations of deputies.

and the destruction was the only logical disposition that could be made of them. Most of the cork and lead that could be salvaged was stripped from the netting before it was placed in a huge pile and soaked with kerosene prior to burning.

As much publicity to this act was given as possible. Official movie cameras clicked during the burning and numerous photographers secured shots from every angle. It is hoped this wholesale burning of illegal fishing gear will have a salutary effect upon fishermen who have gained the idea that they can violate the law with impunity.



FIG. 70. Nine miles of illegal nets confiscated by deputies in warehouse, Vallejo, California, awaiting destruction. Photograph by Henderson Studio, April 28, 1928.

It is hoped that those interested in the perpetuation and conservation of fish and game, who witness law violations or have knowledge of such on information or belief, will immediately notify the deputy in whose district the violation occurs. Deputies can also be consulted for information regarding fishing and hunting conditions.

On April 30, nine miles of illegal fish nets valued at nearly \$20,000, were officially destroyed by the Division at Vallejo. The nets could not be used legally

Ben Cowden of Grass Valley is languishing in the Nevada County jail as a result of fishing before the opening of the trout season. He was apprehended on Squirrel Creek by deputies A. W. Sears and A. H. Willard. When brought into the court of Judge H. B. Dow, at Nevada City, he was fined \$100 or an alternative of 100 days in jail.

Another offender, J. Ballou, is serving 150 days in jail in default of an assessment of \$400 levied by Judge W. E.

Everson, of Elk Grove, for trapping and having in his possession four Chinese ring-necked pheasants. Deputies Bert Laws, William Hoppe and Paul Bonnot are to be credited with the making of the arrest.

Captain Jack O'Connell, assisted by deputies William Hoppe and Bert Laws, caught a native of Portugal, J. George, after he had killed a Chinese ring-necked pheasant on Tyler Island. The offender paid a record price for the slaughtered bird, for he was fined \$300 by Judge Everson.

If pheasants are to be successfully introduced into California they must be

alibis and change of venue failed to save Samuel Thompson and Cash Caley of San Bernardino and Jack Murphy of Los Angeles from a conviction for possession of deer meat in Game Refuge 4-A. Deputy C. J. Malone and Deputy Sheriff Brown arrested the trio in the game refuge after finding two sacks containing the hind quarters of two deer in Thompson's woodshed. The men had concealed their weapons in an automobile by covering them with canvas. As there was a foot of snow on the ground at the time, their explanation that the guns were covered to be protected from the dust, was not accepted by the deputies.



FIG. 71. Confiscated illegal nets valued at \$20,000 being burned at Vallejo, April 30, 1928. Photograph by H. C. Bryant.

protected until such time as the state decides to open the season on them.

Deputy R. L. Sinkey of Woodland arrested R. A. Fanan for killing a pheasant. A fine of \$100 was imposed by Judge R. W. Harrison of Woodland.

Possession of deer meat out of season cost H. E. Ford \$125 in the court of Judge Chester Moore of San Jose. This case was made by Deputy I. L. Koppel assisted by volunteer deputy V. W. Hensil.

Pleas of not guilty, carefully prepared

When haled into the court of Judge C. A. Johnson of Rialto, the defense claimed that two strangers had called the day before and left the sacks containing the deer meat. This shallow alibi failed to impress the court and a fine was imposed on each violator of \$500 together with a 100-day jail sentence. \$200 of each fine was suspended and the jail sentences for one year pending good behavior of the defendants.

Two residents of Humboldt County paid a price of \$5 a pound for eighty pounds of deer meat that patients in the county hospital enjoyed. Deputies Wil-

liam Kaliher and McPherson Lough arrested Harold Pavey of Rio Dell and F. G. Coffton of Arcata at Rainbow Bridge and brought them before Judge Frank E. Niskey, at Eureka. The apprehension of these illegal killers came as the result of information that they had been operating in the Monument Country, Humboldt County, where deer concentrate during the winter months. Rumors have it that these hunters had been killing yearlings, taking the back straps and hams and disposing of their illegal take on the open market. The penalty imposed by Judge Niskey was, therefore, none too severe.

Acting on reliable rumors that operators of the Triumph Mine on the South Fork of the Feather River were serving deer meat to their employees, deputies A. J. Stanley and George Thompson succeeded, on the morning of April 24, in walking into the boarding house at the mine and finding a last year's fawn being prepared for the table.

Robert Osborne pleaded guilty to the charge of killing the deer and as a consequence served thirty days in the county jail at Oroville and paid a fine of \$150. Judge H. S. Hills of Oroville, in imposing the heavy fine and jail sentence, expressed the hope that his action would discourage further practices of this sort.

H. R. Harrison maintaining a mink farm at Mill Creek Homesite has discovered to his sorrow that the overhead in operating a fur farm can not be reduced by feeding illegal deer meat to fur bearers. Found with twenty pounds of deer meat in his possession by deputies Harry Brittan and A. J. Stanley, Harrison was fined by Judge S. R. Dales of Los Molinos \$500 and sentenced to serve 125 days in jail.

Four San Franciscans were caught by Deputy F. J. McDermott on June 10, at Boulder Creek, with several packages of deer meat in their possession. Taken before Judge Younger at Santa Cruz, B. O. Alfred admitted killing the deer and was fined \$250 and given a six months' suspended jail sentence. The other three offenders were each fined \$100.

Two Sausalito "sooners" are now serving 150 days in the Marin County jail for invading the Mt. Tamalpais Game Refuge and killing a deer with a spotlight at night. The pair was apprehended by Captain Walter Sellmer and volunteer deputy Mrs. Sellmer almost before the

echo of the rifle shot that brought down their deer had died away.

Judge H. De La Montanya at San Rafael, in addition to the jail sentence of 120 days for Walter S. Stittmatter and 150 days for George Nolan, imposed a fine of \$200 on each deer slayer.

Mrs. Sellmer, single-handed, arrested five Japanese at Tomales Bay on charges of possession of undersized abalones. At first, the aliens refused to submit to arrest, but on seeing the earnestness of the woman warden changed their minds. They were arraigned before Judge Herman Rudolph at Novato and paid their fines.

Mrs. Sellmer made eight more abalone cases during the latter part of June. Patrolling the north shore of Marin County, she found Dr. F. B. Jones of Vallejo with undersized abalone in his possession. Dr. Jones, who is six feet four inches tall and weighs more than 200 pounds, demanded that his feminine accuser, who is but five feet four inches, cite him for trial in Petaluma. Mrs. Sellmer promptly informed him that she was doing the demanding in the case. A bystander mentioned that Dr. Jones was a physician of repute and someone retorted that he was arrested by the best looking game warden in the state.

Attempting to curb a bad practice, Judge Henry King of Castroville, levied a fine of \$50 on S. Gnisa of Chularin, for the possession of two doe fawns. Extensive publicity has been issued to prevent the kidnapping of fawns and it is now the determination of the Division to arrest those who insist on picking up fawns that are apparently abandoned by their mothers. Seldom is it possible for fawns taken out of the wild to be reared successfully under domestic conditions. Deputies Fred Post and Ralph Newsome apprehended Gnisa.

Deputy L. Arnold arrested three young men in April for killing a doe. Judge Fred Snyder, Jr., of Tehachapi, Kern County, fined them \$100 each.

Deputy C. E. Holladay of Morgan Hill apprehended A. Balanesi for killing a deer and Judge Chester Moore of San Jose imposed a fine of \$250.

A \$250 fine for having deer meat in possession was levied by Judge Louis J. Morris of Santa Maria, Santa Barbara County, on C. Schmidt. Arrest made by Deputy S. H. Lyons.

Possession of deer meat cost C. M. Wayne \$250. The fine was levied by Judge J. R. Anderson of Maricopa, Kern

County, and the case was made by Deputy L. R. Ainsworth.

Deputy A. D. Miner of Quincy arrested Harris Self for having deer meat in his possession after the close of the season. A fine of \$150 was imposed by Judge Clarence Taylor of Greenville, Plumas County.

Judge E. S. Robertson of Fortuna imposed a fine of \$100 on R. H. Elliott for having deer meat in his possession. The violator was brought before Judge Robertson by Deputy William Kaliher.

Two hours after information reached the San Francisco office that Tony Vargas at Half Moon Bay had killed a deer, Deputy Curtis Bundock, assisted by volunteer deputy Allan Curry, succeeded in arresting the violator at Half Moon Bay. He was fined \$100 by Judge E. McAuliff at Redwood City.

A fine of \$75 was imposed in Judge William Jones' court in Garberville, Humboldt County, on Alvin Pollock, caught on the Metole River by Deputy McPherson Lough, with deer meat in his possession. While this fine, although not so severe, is exceptional, convictions have been rare in this section of Humboldt County.

That it costs money to attempt to set nets for taking fish in the San Joaquin River is now well impressed upon Steve Belleci and Mike Orlando, Pittsburg fishermen. Apprehended by deputies Charles Bouton, Charles England and L. G. Van Vorhis, the two fishermen were brought into Judge Matthew Ward's court at Antioch, Contra Costa County, and paid a fine of \$100 each.

Possession of small mesh nets cost A. Ginis of Sherman Island \$270 as a result of his arrest by Deputy William Hoppe. The court of W. E. Everson, at Elk Grove, levied the fine.

Deputies William Armstrong and Charles England from a concealed vantage point watched Ben Newman of Santa Rosa and his agents for seventeen hours before they saw them kill five geese out of season. Judge L. A. Maynard of Napa fined Newman \$150.

Deputies Ray Ellis and Roy Taylor found Sam Gould with game fish during the closed season. Judge Horace N. Caldwell of Fowler, Fresno County, assessed a fine of \$100.

Two cases involving over the limit of game fish were made by deputies F. A.

and R. J. Bullard. Curiously enough both cases involved the arrest of four men. Judge E. C. Archer of Cutler, Tulare County, imposed a fine of \$100 for one offense and Judge Albert E. Holderman, Reedley, Fresno County, \$300 on the other.

Deputy Jack Burke secured a fine of \$300 from Judge E. I. McAuliff's court in Redwood City when he arrested A. Printon for having trout in his possession out of season.

Judge J. D. Blackwell of Newman, Stanislaus County, extracted \$125 from L. Hewson, brought before him by deputies C. L. Gourley and George Magladry for using set lines.

Below normal precipitation has resulted in rapid decrease of stream flow and brought about good fishing early in the season. Conversely a dry summer with its attendant increased fire hazard and dry stream beds will result in additional work on the part of the patrol force in rescuing stranded fish.

Soon after the water stops flowing, pools where the young trout concentrate will be found all along stream courses. Their congestion will serve as a magnet and attract a large number of snakes, birds and predatory creatures. A few large trout in the pools will aid further in the destruction of the small fry.

In saving great numbers of young trout from perishing during such times of stress, deputies frequently devote much of their zeal, their energy and their experience. In not a few cases, many of these stranded pools are filled with large boulders; some have willows and brush making the use of a dragnet well-nigh impossible. Then, too, the transportation of the fish to live water involves much hardship and patience.

Deputy J. D. Dondero of Lakeport writes as follows:

"I find that it takes three persons to do rescue work adequately. First, I locate the pools, then I get in and remove all brush and stones, making as smooth a bottom as possible. The next day when the water is running clear, with the aid of three others, I start the net at one end of the pool and work it very slowly, keeping the leadline on the bottom. I have gathered as many as fifty pounds of three-inch trout in one hauling by this method. These are poured from the net into the cans, previously filled with good, clear water, without being touched by the hands of the

rescuers. Since the temperature in the pond has become fairly warm, I find the fish much easier to handle in transportation.

"I prefer to have boys sixteen years of age than men, as such chaps seem to enjoy the work, looking upon it as a kind of adventure. In most cases, it is necessary to work early and late to get the best results and boys of this age are willing to lose sight of the passage of time.

"Last year on the lower reaches of Soda Creek, I rescued approximately 80,000 trout."

Deputy E. H. Glidden of San Diego recently performed some good work in checking the spread of carp in San Diego County. Eleven carp from nine to fourteen inches in length were taken from an old cistern where they had apparently prospered. From reliable sources, it is positively believed that this is the first instance of the appearance of live carp in the county, although it is claimed by some that carp inhabit Santa Margarita Lake. It is not known how or when these carp were introduced. However, Deputy Glidden took pains to remove all possibility of these reputed undesirable fish perpetuating their kind in any of the other lakes or streams of the county.

Department of Fish Culture

In March, 2,493,000 rainbow trout eggs were received at the Mount Shasta Hatchery from the Klamath River Auxiliary stations. 20,000 eggs were spawned from the rainbow trout in the brook ponds at the hatchery. 207,000 eyed eggs were shipped to other hatcheries for further development.

In April, further allotments totalling 980,000 rainbow trout eggs were shipped to Mount Shasta from the Klamath stations. Shipments of 1,950,000 eyed eggs during this month left a balance of 1,593,000 eggs.

In May, some 300,000 black-spotted trout eggs were received from the Mount Whitney Hatchery and an additional 963,000 rainbow trout eggs from Shackelford and Beaver creeks.

Distribution of fingerlings was well in progress by May. Car No. 01 distributed 710,000 Loch Leven and 350,000 German brown trout to several localities in the state for planting by deputies. Approximately 8,376,000 trout of different varieties remained to be distributed in June from the Mount Shasta Hatchery.

Six hundred thousand salmon fry were liberated from the Fall Creek Hatchery in March, and an additional 400,000 were turned out when high water flowed over the top of the pond in which they were being cultured. The growth of these salmon fry was so splendid that during May, 1,250,000 more were liberated. Another million in fine condition are to be planted later.

Due to the very cold water, the rainbow trout egg take at the Fall Creek Station has not equalled that of average years. Nevertheless, a sufficient number of eggs have been procured to stock the streams in the Fall Creek section.

All egg collecting stations on the Klamath River were closed by the middle of May. Shackelford proved the banner station this season and remained in operation almost as long as Beaver Creek, where a large take was also made.

Hornbrook station had a very poor season and as there was little prospect of another run of trout the racks and equipment were stored earlier than usual.

Much trouble was experienced in March at these stations due to the high water. Camp Creek overflowed the racks, and driftwood damaged the trap, but not seriously. Heavy rains caused much driftwood to come down Bogus Creek, which clogged the head of the fishway. Few fish came up the creek during the bad weather, but began to run in fair numbers as soon as the water lowered.

The total number of fish of all varieties in the Mount Whitney Hatchery in May amounted to 2,755,000.

A crew of men was dispatched the latter part of May to the Cottonwood Lakes to procure golden trout eggs. Some 1500 golden trout have so far been trapped and spawning will commence the first week of June. This will be the earliest period golden trout have been found ripe. The unusual condition of the fish is no doubt due to the mild and open winter.

The closed season on June Lake has aided the egg take materially. During the first twelve days in May, 1,155,000 steelhead eggs were obtained. Steelhead were caught in the seine every day, while last year, after the season opened, only a few fish repaid the effort expended.

Fern Creek Hatchery was opened on March 12, and the crew set about to trap fish. Some 450,000 black-spotted trout eggs were collected, and before the

end of the following month 1,320,000 black-spotted trout eggs had been forwarded to the Mount Whitney Hatchery. It was all the crew could do to spawn and care for the 2,451,000 trout eggs that remained on hand during April.

The Rush Creek trap from which most of the black-spotted eggs were collected has given very satisfactory results this season. Even during May the take in this species amounted to 505,000 eggs.

A new experiment station established on Walker River will test out the water this year and determine if conditions will warrant the location of a permanent hatchery there for Mono County.

At Fort Seward Hatchery 958,000 steelhead trout and 168,000 rainbow trout eggs have hatched and are advancing nicely.

The egg-collecting season came to a close on Prairie Creek in April. In March the new tent hatchery neared completion sufficiently to receive a portion of the eggs and by May it had some 567,000 steelhead trout fry developing in its new troughs.

At the Cold Creek Hatchery 1,200,000 steelhead fry are being developed into fingerlings for distribution in Lake, Mendocino, Napa and Sonoma counties.

Repairs were being rushed in April to take advantage of another good run of fish at the Snow Mountain Egg Collecting Station. Unfortunately, the power company opened a number of gates in the Gravelly Valley Dam, bringing the water level in Lake Pillsbury below the crest of the dam. This act occasioned stoppage of the flow of water and many fish laden with spawn coming up to the Snow Mountain Station were forced to turn back down the river. Their spawn was irrecoverably lost. Later, a like manipulation by the power company followed, and it was decided to abandon the station. The total take amounted to 2,100,000 eggs.

Over 2,000,000 rainbow, Loch Leven and eastern brook trout are developing at Clear Creek, and 585,000 rainbow trout at Domingo Springs Hatchery.

Every effort was made to obtain more rainbow eggs in Clear Creek, Domingo Springs and other adjacent stations. At Manzanita Lake, a trap was placed in the creek leading into the lake. Another was placed in the creek entering Butte Lake. Work at Clear Creek was inter-

rupted by washouts and inclement weather during the spring and only 900,000 eggs were collected.

The 1,225,000 eggs at the Yosemite Hatchery have hatched and all are in excellent condition with the exception of the oldest Loch Leven which have been the most affected by an epidemic of azalea poisoning. Medical baths and other remedies checked the epidemic and prevented any great loss.

Work on the aquarium is nearing completion. The four ample tanks will serve a real educational capacity when mature fish are swimming about in them.

The condition of the Loch Leven trout in the holding tanks improved materially as soon as the temperature of the water became warmer. The fish fed better and plans are under way for their liberation.

The Wawona Hatchery has been considerably renovated and there are now on hand 141,300 rainbow trout, 92,500 steelhead trout, and 147,800 black-spotted trout.

Water conditions in the vicinity of Bear Lake have made for difficulties in spawning this season. Two streams where traps have been used with success in the past dried up in April. With Metcalf and Grout creeks dry only North Creek was left.

Two-thirds of the eggs taken at the Bear Lake Station have come from Kidd Bay. The bay has had less than a foot of water in it, but fish somehow are attracted there and form in schools at the upper end. Large numbers have been captured with a small piece of seine.

In May, however, the water supply at Bear Lake failed and it was necessary to rush to completion the two new experimental stations in southern California to take care of the rainbow trout eggs taken from Bear Lake.

The San Gabriel Station, on the north fork of the San Gabriel River northeast of Azusa, was completed in time to receive 500,000 of the Bear Lake rainbow trout eggs.

Forsee Creek Station near Seven Oaks in San Bernardino County was ready to receive eggs early in June.

Construction of holding tanks to be located at Coldbrook Camp on the San Gabriel River and Forsee Creek commenced in June. It is hoped that these holding tanks will lessen difficulties and relieve the unfortunate conditions at Bear Lake, as well as produce a larger fish for planting.

It will be necessary to make early distribution of the 1,125,000 fry in the Feather River Hatchery. The water in Tamarack Creek is falling rapidly.

Loch Leven and eastern brook trout in the Kern River Hatchery are evidencing signs of disease. The Loch Leven have responded to treatment; the eastern brook have so far shown little signs of improvement. The cause may be due to the large amount of water mould and algae in the water. The biologist of the department is making a careful study to determine whether the water is suitable for the establishment of a permanent hatchery.

Rainbow trout eggs numbering about 100,000, and a like number of steelhead eggs have hatched.

The 922,000 fry at Big Creek Hatchery are reported to be in first class condition. 576,600 steelhead eggs were shipped from the hatchery in April and 996,000 eggs collected. In May, 263,000 steelhead eggs were taken. Some were sent to Sonora.

Plans are being made to operate the Brookdale Hatchery as an experimental place where pathogenic conditions of both fish and eggs can be studied. The hatchery is also to serve its former function in hatching and distributing a supply of fish for local streams.

Six new tanks, four feet wide, sixteen feet long and thirty-two inches deep, have been built at the Mormon Creek Hatchery to care for the 795,000 fish that are developing rapidly and range in size from four inches down to almost the sac stage. The new tanks are sheltered in a large shed strongly built and capable of withstanding the snows of winter.

An investigation shows that the fish planted last year in the waters of this vicinity are lively and vigorous. Conditions in the stream at present are ideal for planting and some of the trout now being developed will soon be liberated.

The new Kaweah Hatchery is nearing completion and will be occupied shortly. Meanwhile, the old tent has been doing its best to serve the purpose of a hatchery. The steelhead and rainbow eggs are hatched and the resulting fish have been feeding since the early part of May.

It has been necessary to build eight new troughs to hold the 100,000 black-spotted trout eggs now being developed in the Kings River Hatchery. There are

also 100,000 rainbow trout eggs developing at this station.

The water supply at the Lake Tahoe Hatchery is becoming serious. The snow is about gone and the streams are low. It will be necessary to transfer some of the 1,390,000 fry now on hand if water conditions become more alarming.

An early distribution will also be made from the Mt. Tallac Hatchery to relieve the congestion caused by low water. The hatchery has been filled to capacity since May.

A biological study has been made of the condition of steelhead eggs collected at Scott Creek, Santa Cruz County. Examination of the eggs just previous to hatching showed abnormal oil globules in the yolk which brought about changes resulting in the death of the embryo and the entire egg being covered with a heavy fungus growth.

The condition of the water supply at the Yosemite Hatchery was also investigated, as well as that at the Kern Hatchery. The water coming into the Kern Hatchery was found to contain great quantities of blue-green algae, causing a heavy growth on the sides of the tank within twenty-four hours after they had been thoroughly cleaned. The fry were found to be suffering from a heavy infestation of the gills by peculiar desmid (*Auhistrodesmus*) which is tinier than the point of the finest cambric needle. This penetrates the gills causing an irritation followed by bacterial infection which is very rapid in its growth due to the weakened condition of the fish, and soon causes death by suffocation.

Department of Commercial Fisheries

The patrol boat *Albacore* was sent to Ventura on March 14th to search for bodies washed out to sea by the St. Francis dam disaster. The crew found the waters of that section of the coast very muddy, and encountered drift-wood, shrubs and trees, lemons and oranges floating around within one to three miles offshore, but found no bodies. The search was continued until the 22d, when the *Albacore* returned to Terminal Island.

Later in the following month, the *Albacore* left for Eureka where the coast was patrolled against violators having salmon in possession in a closed district.

During July, the boat was used in assisting Dr. Henry B. Bigelow of Har-

vard University, who is carrying on investigations of the currents, temperature and salinity of the water and the distribution of plankton in Monterey Bay. The information obtained in this work will be of use to the division as it may lead to an explanation of the abundance of the sardine.

Deputy Ross W. Markley at Pismo Beach has been energetic in suppressing violations of the law respecting Pismo clams. A recent arrest of Frank Bisell for having over the limit of these famous clams was made on March 21, and Judge William Mallagh of San Luis Obispo, gave the offender thirty days in jail.

The month of May was a busy one for the patrol force at all points. L. G. Van Vorhis of Pittsburg checked boats for registration and fishermen for licenses at Pittsburg during the height of the shad run.

Ralph Classic and N. M. Matthews were busy with the salmon fleet and trawlers on Monterey Bay.

Deputy Markley, at Pismo, had a very active month with vacationists and professional clam diggers and abalone hunters along the San Luis Obispo coast.

In the San Pedro district, C. H. Groat, Tate Miller and N. C. Kunkel were busy night and day thwarting attempts of barracuda bootleggers after the closing of the purse seine and lampara season.

At San Diego, Captain Coburn Maddox was kept occupied checking boats for registration and fishing licenses, as well as checking allotments of fish coming into California from Mexico.

The chief field work of the laboratory has involved the sampling of the commercial catch of sardines at the three fishing centers. The abalone catch is also being sampled and the barracuda catch observed. Minor observations are made on the catch of various species of fresh-water fishes in the fish markets. Occasionally, members of the staff do seining to collect material for research purposes.

Mr. Paul Bonnot is continuing his work on the sea lions. With the use of the patrol boat *Albacore* he will make a survey and census of the sea lions along the coast from Oregon to Mexico. The purpose of the census is to keep an accurate record of the number of sea lions and to have available complete data on the rate of increase of the herds. Many people advocate indiscriminate slaughter of the sea lions, but this is

not the policy of the Fish and Game Commission. If the herds are increasing too rapidly and are becoming a menace to the fish in some localities and it becomes necessary to reduce the herds, it should be done in a humane and scientific manner under the supervision and control of the Fish and Game Commission.

The following circular was sent to all dealers in Oregon and California, under date of May 31, on the subject of "Fish Tags":

"The Division of Fish and Game will discontinue use of the hexagonal-shaped fish tags for tagging Chinook salmon which may be held or sold during the closed season, or shipped in during the closed season, and steelhead which may be shipped in from Oregon and Washington at any time. This form of tag will be used only for tagging domesticated trout at trout farms situated in California, or domesticated trout which may be shipped into California from other states.

"All dealers who are holding any of the hexagonal-shaped tags should return them to the Division of Fish and Game, San Francisco, on or before July 1st, unless they are holding them for use in tagging domesticated trout to be shipped into California.

"For use in tagging salmon and steelhead, a new oval-headed, spear-shaped tag will be put into use on July 1, and complete instructions for handling same will be furnished with the tags."

Bureau of Education

An invitation was extended to the bureau to furnish a series of broadcasting over the Pacific coast network in connection with a half-hour program conducted as the "Phileo Campfire." The first two Thursday nights in May were utilized by Dr. H. C. Bryant in a discussion of candidates for the state bird. Subsequent subjects dealt with the sea otter, celebrated fur-bearer of the state, and other suitable campfire topics.

The first of a series of portable exhibits has been completed. It shows mountain sheep in their desert home. The coloring and installation was done by Mr. E. S. Cheney. A fine ram stands in the foreground and a small band are seen in the distance about a waterhole. Still another sheep animated by an electric motor, is seen to leap down a steep cliff. This exhibit was initially displayed in the Ferry Building, San Francisco.

Two new reels of motion pictures are being assembled. One will show various activities of the Division of Fish and Game: law enforcement, fish propagation, game bird propagation, education; the other will be a conservation picture emphasizing depletion and the real need for conserving a breeding stock sufficient to furnish good sport.

The new feature reels showing fish propagation and fish distribution are meeting with popular favor and are in almost constant use.

Those seeking knowledge on fish and game and natural history subjects will find they can make good use of the excellent library, under the supervision of Mrs. Bessie W. Kibbe, a trained natural history librarian, maintained at San Francisco, at the headquarters of the Division.

Together some 475 volumes and 6000 pamphlets are now available. Special attention is given to the official publications of the fish and game departments of other states. The laws of all the states and territories, as well as those of Canadian provinces are on file. These are often consulted. Books on birds, fish, mammals, crustaceans, oceanography, nature study, reptiles, insects, zoology and biology and five natural history sets make up the scientific section, while authentic works on fur farming, game bird farming, fishing and other fish and game subjects are included in the extensive reference list.

Numerous letters requesting information are daily received, bearing on fish ponds, identification of fishes, seasons, how to grow them and their acclimatization and diseases; identification of birds, their economic value, their migrations, songs, houses, eggs and life history; game bird farming; fur farming and alligator farming; hunting, deer, mountain lions, squirrels and trapping of muskrats and other animals.

Books are loaned only to employees of the division, but the library is open to the public and their visits are solicited for reference work.

Additional investigations of the reputed damage committed by small birds to rice and fruit buds has been carried on in the Oroville section. A study was also made in the Richvale district in Butte County on the damage done by tri-colored black-birds to recently sowed rice.

Several studies on the effects of thallium poisoning have been made. A serious condition developed near Stockton where

thallium poisoning was spread and a number of vertebrate animals destroyed. The effect of thallium poisoning on quail on the western slope of Mount Diablo was also looked into.

The demand for lectures illustrated by motion pictures has increased to a point where careful planning is necessary. Sections of the state are now intensively covered after a lecture itinerary has been previously arranged. Care is taken to give all sections of the state equal attention. This program further emphasizes the serious attempt to make fish and game laws more popular in places where law enforcement is difficult.

Efforts to introduce a program of nature study and conservation in the public schools have met with a success almost beyond expectation. Mrs. O. P. Brownlow, to whom no small measure of credit is due for this work, has by her zeal, aroused a deep interest in the San Francisco and Oakland public schools in the study of living things.

Bureau of Research

Stockmen and others have complained that predatory animal control carried on by agencies in areas surrounding game refuges has been hampered because the predatory species migrate into the refuges where they are harbored in safety until the fury of the campaign of extermination subsides.

Two predatory animal trappers were employed in April to work in game refuges and ascertain the validity of these complaints. A thorough examination of the Mount Diablo Refuge (3-F), was made, but not sufficient signs of predatory animals were discovered to justify any considerable amount of work. Hence, the trapper was transferred to the Mount Hamilton Refuge (3-E), where he has, in cooperation with the other trapper, made a careful study of conditions. Only five coyotes, and a like number of wildcats, were trapped in April. On the whole, the survey has shown that great numbers of predatory animals were not present in the refuge.

This work is being conducted in cooperation with the State Department of Agriculture and the United States Biological Survey.

To forestall a recurrence of mussel poisoning which caused much consternation last year, considerable research has

been conducted by Dr. K. F. Meyer of the Hooper Foundation for Medical Research. Mussels are now being tested for toxicity and the Bureau is assisting in procuring samples of mussels for Dr. Meyer's researches. Dr. Meyer will issue statements through the newspapers if the toxicity reaches a degree where poisoning would result from the use of mussels.

The parasitologist of the Bureau is conducting an investigation on quail diseases and is making a careful study of blood parasites affecting quail. Possibility of insect transmission of parasites of game birds is being experimented with also. No blood parasites originating from this source have yet been discovered in any wild bird other than quail.

Some duck sickness is still present at Buena Vista Lake. Much material has been collected and prepared for study. An extensive examination into the possible sources of the duck sickness to the end of correcting the Buena Vista Lake situation has been set on foot.

Most of the ducks treated at the "duck hospital" have recovered, been banded and liberated.

Bureau of Public Relations

Routine work of the bureau during the past quarterly period included the preparation of sixty-four stories for publication in more than 400 newspapers on the Division publicity list.

In addition to this, a special story has been prepared weekly for the National Automobile Club bulletin which reaches over 800 newspapers. These stories do not in any way conflict with the regular news releases.

A trip during the month of April covered the southern part of the San Joaquin Valley. Talks were made at Bakersfield and Hanford and calls made on organizations and newspaper publishers at the places mentioned as well as at Visalia, Tulare, Fresno, Madera and Los Banos.

Numerous good cases made by field deputies have furnished copy for several news stories that have been given general publication, while two general stories sent out, one on the opening of the trout season and another on the closing of streams in different parts of the state, were published in practically all of the papers on the list.

A special feature story on the "Planting of Golden Trout in Barren Waters of California" has been prepared and is being made ready for publication.

Records show that interest in fish and game matters is growing, as more and more newspapers are not only using the division publicity releases, but are developing special stories of their own.

Bureau of Hydraulics

Many fish ladders neglected and needing repairs are now working and fish are passing up them to spawn. Reports recently made by deputies supplied information concerning the ill state of these ladders, and steps were quickly taken by the bureau to cause their repair.

A few dams no longer serving a useful function were also reported on and arrangements are being made to have them blown out.

The reports show that screens were inspected and were in condition for use when water will be diverted this season.

A fish ladder has been completed by the Donner Lake Company at the outlet of Donner Lake, Nevada County, in compliance with plans furnished.

Reports show that fish are ascending San Anselmo Creek, Marin County, and that some are seen at places where, during the past seven or eight years, none have been noticed. This satisfaction comes as the result of the installation of a fish ladder by the Emporium Country Club and Cascade Estates Company.

On an inspection of the Fort Bragg vicinity, Mendocino County, it was found that three recently constructed fish ladders were being used by salmon and steelhead.

Other inspections made include the fish screen operated by the Anderson-Cottonwood District, Shasta County; the screen of the Hallwood Irrigation District, Yuba County; and a number located in Tehama County. The Elk Lumber Company's fish ladder on the Elk River, Humboldt County, was examined and that of the Yuba River near Marysville, Yuba County, recently damaged by flood. Arrangements were entered into for the construction of fish ladders on the Enos Dam and the Gibson Dam, Trinity County.

The Union Oil Company has cleaned San Luis Obispo Creek and removed all evidences of pollution. An oil tank fire

caused large amounts of oil to flow into the creek and the company made a considerable outlay in cleaning up the damage done.

The company is satisfactorily keeping the beach clean at Avila, San Luis Obispo County, and employing men from time to time to scrape up and burn deposits of oil swept out to sea and returned to shore by the tides.

The Rincon oil field north of Ventura has been maintained in a most creditable manner. Inspection of the operations there disclosed no cases of pollution. Drilling crews have been warned by the operators that permitting oil to escape is a serious offense, subject to severe censure and even discharge.

The Signal Hill oil field at Long Beach was inspected. A material improvement in the condition of the field has resulted from certain changes recently made in what is known as the "frog pond." A new channel to take care of storm waters was cut so as to leave the old channel useful as a pond to receive oil and mud.

The Shell Oil Company has just finished the installation of a system of sumps at Bicknell in the Orcutt oil field. It is anticipated that the system will handle 2000 barrels of waste oil daily, returning the water to the natural drainage clear and free from oil.

The Rice Ranch Oil Company have recently installed a system of tanks and sumps at the scene of their operation near Orcutt. This has also been done to prevent pollution.

Probably one of the most impressive manifestations that powerful companies have given lately of their desire to put an end to pollution and remedy unfortunate situations where they have occurred, is the large sums of money being expended.

The Oil Operators, Inc., operating Signal Hill, Long Beach, for instance, have spent over \$215,000. Cleaning the oil from the flood control channel cost them about \$1,500. A sump of about 225,000-barrel capacity represented another goodly outlay and work is now going forward on the construction of further sumps to provide amply for future demands exerted on the field.

The Texas Company of California may be cited as another example. The corporation plans to install an oil separating system at Watts, Los Angeles County, which will cost from \$60,000 to \$80,000.

The same company will have another separator in operation in the San Pedro field, and intends to expend around \$70,000.

The Associated Oil Company has joined the ranks of those who are taking definite steps to prevent pollution. They have fitted the *S. S. Whittier* with a reclaiming device. This has proved so satisfactory that by a recent order all vessels owned and operated by the Associated Oil are to be similarly equipped.

Blow lines have been installed by the Richfield Oil Company as the result of an inspection of a wharf jointly owned by the Richfield, General Petroleum and California Petroleum oil companies at Parr Terminal, Oakland. Further work will be carried on by the other two companies.

The gas plant at Vallejo, Napa County, operated by the Pacific Gas and Electric Company, has discharged waste products for many years on the bay flats. The situation has been further aggravated by deposits of refuse from oil tanks. An investigation proved the need of a clean-up campaign. This is now in progress and measures have been taken for permanent relief.

The Pacific American Petroleum Company has filled in a sump and corrected other sources and means of pollution. The sump in question was located in the natural drainage and greatly aided in aggravating the pollution problem of the Huntington Beach field.

The Orange County Refining Company at Newport, Orange County, has mopped up escaped oil resulting from a fire. Some of this oil reached the bay, and this, too, has been removed.

Court action against the Pacific Coast Oil Company and four individuals operating at Huntington Beach, Los Angeles County, has been dismissed since unfavorable conditions complained of have been rectified.

Under the stress of storms, sumps have been in the past accustomed to breaking and letting the oil they contained pollute the area round about. Peculiarly enough, sumps located in other than the Huntington Beach field have not acquired this habit. The obvious conclusion is that the operators in the Huntington Oil district have been availing of storms as an excuse to empty their sumps.

Persistent patrolling during recent storms by Deputy E. A. Chan thwarted this pernicious practice.

A common illustration that pollution may cause trouble in the future is offered when oil saturated ground oozes during warm weather. A rarer instance of this resulted in May when the Wilshire Oil Company, at Huntington Beach, liberated quantities of hot water into a ditch. The hot water coming into contact with the oil soaked ground soon acquired a film of oil colors and these found their way into the natural drainage.

It is still necessary to resort to legal action.

\$450 of the fine, however, but with the injunction that the balance automatically become payable upon proof of any future pollution.

Pollution of the Ventura River by allowing waste oil to flow into that stream cost the General Petroleum Corporation, operating in the Ventura field, a fine of \$200 in the court of Judge Edward Henderson at Ventura.

This company was hailed into court less than a year ago and a fine of \$500 was suspended. However, in the present case, the judge insisted that the fine be paid. Deputy R. E. Bedwell made the arrest.

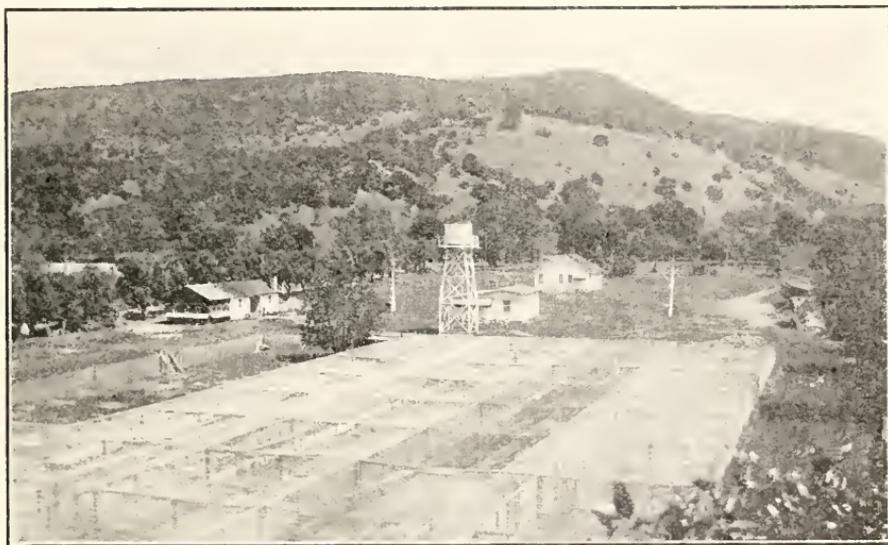


FIG. 72. Original breeding pens built in 1926 for Chinese ring-necked pheasants transformed into quail section at Yountville Game Farm. Here quail experiments are being carried on. Photograph by Milton Clarke, April 20, 1928.

On March 24, Deputy E. A. Chan filed a criminal action against P. C. Hofmann, superintendent of the Pan Pacific Refinery, for discharging oil into Long Beach harbor. Following the trial of April 26, Judge Charles D. Wallace fined the violator \$500 or an alternative of 250 days in jail. Four hundred and seventy-five dollars of the fine was suspended for two years in the event the refinery committed no further violations.

The superintendent of Featherstone and Preston, Inc., was charged on April 23, for liberating an oil filled sump into the natural drainage. On plea of guilty, he was fined \$500 in the municipal court at Long Beach with an alternative of 100 days in jail. Judge Wallace suspended

Bureau of Game Farms

The first of June found the Chinese ring-necked pheasants well advanced in egg output for the season. Exactly 6776 eggs were on hand in various stages, from those but recently collected and waiting to be set, to eggs just about to hatch. During the month 4203 chicks hatched.

During May a total of 3342 Chinese ring-necked pheasant eggs were hatched. Some of these chicks came from 5392 eggs set in April under domestic hens and in incubators. The pheasant hens commenced to lay in earnest in April and two weeks afterwards the attendants on

the farm were playing the "shell" game with thorough familiarity.

The wild turkeys from Arizona were the first to reproduce and more than a hundred eggs were laid by the hens in March. The first twenty-two eggs set yielded twenty chicks on the last day of March. One egg was broken in incubation, the other proved infertile.

The hens continued laying in April and May. A total of 186 young turkeys are now in the rearing pens and 116 eggs are incubating. Thus, a problem is presented of finding room as soon as the birds attain the age when they should be ranged. A field for this purpose is now being arranged.

The first crested tinamou, a game bird of South America, hatched on April 26. The tinamou is a stranger to California and there was no certainty that the brood stock on the farm would reproduce. Both male and female are exactly alike. Hence, this occurrence was a pleasant surprise.

Before the end of the month following, five additional olive green eggs were laid. The eggs were fertile but from some unknown cause the young all died in the shell three or four days prior to the hatching time and only one bird hatched.

The second and smaller variety of tinamou laid two eggs during the first week of May. These are a beet red color and elicit comment from visitors as they seem especially prepared Easter eggs.

By the end of May the third variety of tinamou had reproduced, bringing the total number of eggs incubating to 13. The last five hatched are being anxiously cared for and fed grasshoppers and other prized insects.

Forty Hungarian partridges were released in a sanctuary established in Squaw Valley near Fresno on March 26. These birds represented the remainder of the flock and seemed averse to mate while in the pens. It was deemed best to liberate them while it was yet possible for them to mate.

During the week of May 13, the first Hungarian partridge egg was picked up

in one of the breeding pens. The birds then started to lay in a limited way. Before the end of the month fifteen eggs had been laid. These are now being incubated.

Latest reports from Squaw Valley are that the Hungarian partridges have remained within a mile of the place of liberation. No loss so far has been discovered and it is expected that the birds will multiply.

The large white swan presented to the Game Farm last year after the Sportsmen's Show in San Francisco, decided that the climate was not to his liking, possibly because he was all alone, and left for the northland. The swan was kept with some geese and mallards at the Napa State Farm, a half mile from the Game Farm where the use of an open pond of water is available.

An added attraction for visitors is a pair of native grey tree squirrels. The attendants caught this pair near the farm. They had been watching the nest and waiting until the young squirrels were big enough to be right for pets.

A very fine cage has been constructed around one of the olive trees and in a month or so the little animals will be real pets. They now sit up in regular squirrel pose, taking a piece of nut between their paws and eating it with relish.

An incubator room was added in April to the side of the building where food for the birds on the farm is prepared. The three additional electric incubating machines will give the room an incubating capacity of 2500 eggs. The room was built with special regard to coolness and ventilation.

Faithful to a promise made last winter, 360 Chinese ring-necked pheasant eggs were shipped to the Territory of Hawaii during the last week of April.

An even trade of Chinese ring-necked pheasant eggs for Hungarian partridge eggs has been arranged with Ralph Baird of Brooks, Alberta, Canada. Early in May 100 ring-necked eggs were shipped.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor

RECORD CATCH RECORDED

Owing to the great mass of figures that must be gathered to compile the annual catch of fish in California waters, the report for 1927 has just been completed and will be published soon, together with a report of the fish pack for the year, and a report of the sardine canning industry for the season of 1927-28.

Not only leading the United States but establishing a record for California, the fishermen of this state turned in a banner catch during the year of 1927, when a total of 424,367,182 pounds was produced, having an estimated value of almost \$30,000,000. Sardines, as usual, lead with a poundage of 342,275,289, while sole was second with 10,298,268 pounds. The smallest item in the report was five pounds of eels taken in the San Francisco-San Mateo district.

Other species reported were: salmon 6,511,929 pounds; rockfish 6,369,323 pounds; skipjack 5,803,649 pounds; bluefin tuna 4,898,386 pounds; mackerel 4,728,903 pounds; albacore 4,455,372 pounds; barracuda 4,355,583 pounds; buck shad 1,986,295 pounds; roe shad 1,980,546 pounds; yellowtail 1,435,456 pounds; halibut 1,387,178 pounds and herring 1,168,321 pounds.

In the shellfish group, crabs totaled 123,346 dozen; spiny lobsters 508,123 pounds; abalones 2,816,530 pounds; shrimps 1,697,365 pounds; cockle clams 5,914 pounds; mixed clams 59,076 pounds; Pismo clams 133,000 pounds; soft-shell clams 151,383 pounds and squid 6,014,113 pounds.

Monterey County led the state in fish production with a total of 185,775,478 pounds; Los Angeles was second with 169,995,637 pounds; San Francisco-San Mateo third with 37,616,402 pounds; San Diego-Imperial fourth with 13,362,571 pounds. Other districts rank in the following order: Alameda-Contra Costa 3,973,963 pounds; Del Norte-Humboldt 3,367,575 pounds; Santa Cruz 2,768,088 pounds; Mendocino-Sonoma-Lake 2,033,440 pounds; Marin 1,727,254 pounds; Sacramento-San Joaquin 1,007,631 pounds; San Luis Obispo-Santa Barbara-Ventura 1,007,482 pounds; Solano-Yolo 987,141 pounds; Orange 744,520 pounds.

In addition to the California catch, records of fishermen and packers showed that 62,132,490 pounds of fish were brought in from Mexican and extra-terri-

torial waters off the coast of Mexico during the year by California fishermen. The largest item in this list was 28,003,362 pounds of skipjack. Barracuda totaling 1,844,156 pounds and white sea bass totaling 1,466,848 pounds came in from waters south of the California-Mexico boundary.

GRUNION AND SMELT

Many fishermen who are interested in catching surf smelt along northern California beaches have been confused by the law which was passed at the last session of the legislature, protecting the grunion in southern California during the spawning season, from April 1 to June 30. Although the fish are similar in appearance, the grunion is not a smelt, while the northern California fish is a true smelt. Smelt are peculiar to the beaches of northern California, but the grunion is found only south of Point Conception. The spawning habits of the two fish are entirely different, the smelt spawning outside the beach line where gravel is found, while the female grunion deposits her eggs several inches below the surface of the sand and far above the level of the average tide.

ALBACORE

Two shipments of imported albacore were recently received at Wilmington. One consignment of a little more than a ton arriving on June 2, was sent from Honolulu, and the second lot, which came on June 4 from Japan, amounted to twenty-six tons. Reports show that several shipments of this species have been sent from Japan to the Los Angeles harbor during the last year. The albacore in these two shipments were much larger than those that are caught off the shores of California. Forty-seven pounds was the average weight of the fifty albacore making up the consignment from Honolulu. The largest local albacore that the writer saw during the regular sampling season of 1927 were in a catch of twenty-nine that was delivered at Long Beach; these averaged forty-one pounds. The fact that the Hawaiian albacore were devoid of heads when weighed and that the local specimens were not, makes the difference more pronounced. Another item of interest is that roe was found in a number of the females in the Hawaiian consignment. —L. E. Herz.

WHY CALIFORNIA SARDINES ARE CAUGHT AT NIGHT RATHER THAN BY DAY

In California, sardine fishing, the most important in the state, is carried on at night for two good reasons.

First, the schools of sardines are more easily located at night on account of the phosphorescent light or glow in the water. This light is caused by microscopic organisms which are to be found in myriads in the sea water. These organisms when disturbed have the power to give out light of the same nature as glow worms or fire-flies. Fish swimming about in the water at night cause these organisms to glow, and when the fish are in compact schools the light thus caused can be seen for a considerable distance by the lookout in the fishing boat, if the night is dark.

Second, most of our sardines are caught with a lampara net which is specially designed to take advantage of this phenomenon of "phosphorescence." When a school of sardines is located, the net is laid out around it and the two ends then hauled into the boat, the circle becoming narrower until finally the sardines are confined in the "bunt" or pocket of the net, when they may be transferred to the boat with small dip nets. If all of the meshes of the net were so small that a sardine could not get through, it would be difficult to pull because of the resistance of the water. The ends or wings of the lampara nets have meshes as large as 20 inches, which the sardines could easily pass through if it were not for the fact that the phosphorescent fire caused by the net passing through the water frightens the fish away from it and into the center of the circle, until the small-meshed center or "bunt" is around and under them. Such a net can be operated faster and with fewer men than a net of similar dimensions with all small mesh. To be effective, however, the sardine net must be used at night.—N. B. Scofield.

MACKEREL CANNING

In past years small quantities of mackerel have been salted and smoked in California, and there is a steady demand for moderate amounts in the fresh fish markets of the state. There have also been several trials at canning mackerel, but there has never been the wholesale utilization of this resource such as we find in the sardine and tunas. During this last

spring several canneries packed mackerel as a small side line. One plant at San Diego cut the fish into three or four pieces and packed it in one pound salmon cans. One or two canneries in the Los Angeles Harbor region packed mackerel during the early spring months, and three canneries at Monterey canned small amounts of mackerel. Most of this canned product is in round cans, usually the one pound tall, but a little has been packed in six ounce tall cans.—W. L. Scofield.

FISHING OFF SOUTHERN BEACHES GROWING IN POPULARITY

From a small beginning in 1921, there has developed a large industry which caters to the angler fishing for sport in ocean waters along the southern California coast. At the present time, there are at least fifteen barges resorted to by anglers who enjoy ocean fishing lying off Santa Monica, Ocean Park, Del Rey, Hermosa and Redondo beaches, also Long Beach and Newport. Seaworthy launches ply back and forth between the principal piers furnishing transportation to and from the barges. Fishing tackle and bait are furnished from \$1.50 to \$2 per day and a conservative estimate of the number of fishermen is placed at 200 during Saturdays, Sundays and holidays for each barge. On week ends there are as many as fifty fishermen.

Aside from the barges, there are twenty to thirty pleasure fishing boats large enough to accommodate some sixty-five persons each. Trolling is largely practiced by these pleasure fishing parties and it is believed that at least fifty persons engage in this pastime during holidays and about twenty-five at other times. The variety of fish caught consists mostly of mackerel, halibut, rock bass, barracuda and an occasional jewfish or black sea bass.

The piers also have their full quota of fishermen. An average of at least 200 each daily, while on Saturday and Sunday as many as eight or nine hundred, are to be seen along the ends and sides, busily engaged in trying to keep their lines free from those of their neighbors. Mackerel and halibut are mostly caught, but not the amount that is taken offshore.

Besides the deep sea fishermen, a great many find pleasure in fishing for corbina in the surf. Santa Monica Canyon, north of the Nalibu, is one of the favored beaches for this sport.—R. J. Sadler, Venice.

LIFE HISTORY NOTES

HUMBOLDT COUNTY ELK

The surviving bands of Roosevelt elk, happily, are doing well in the great redwoods of northwestern Humboldt County. Indeed, it is very reassuring to know that these noble animals have not only maintained themselves in the southern limits of their present range, but are reported to have "made a very apparent increase in the last few years."

John W. Davison of Orick states that they now range in small bands as far south as Little River and as far north and east in Humboldt County as the

in a narrow strip of land three miles wide and ten long, lying west of Prairie Creek. This area, he claims, will sustain at most but two hundred elk. It is now overstocked and during winter the elk are so hard-pressed for food that they become an annoyance to farmers. In fact, not a small number have acquired the habit during the summer time of coming into hay fields at night and committing depredations.

SCREECH OWL VS. FLICKER

Four holes were drilled by flickers through the boards of a redwood tank



FIG. 73. Young elk in hay field near ranch of John W. Davison, Orick, Humboldt County, California. Photograph by J. W. Davison, summer, 1927.

Klamath River. "Elk sign" is not so scarce as it was ten years ago and almost every herd observed contains young elk. He estimates that there are between 350 and 500 in the county. An accurate count is impossible, for the larger herds remain in the denser forests where the undergrowth is tremendous and are very seldom seen. Smaller and more venturesome bands frequent the open country. Hence, an observer who only obtained glimpses of these small herds would be inclined to underestimate the number of elk in the country.

Deputy Earl P. Barnes is of the opinion that the greater majority of elk range

house belonging to Mr. E. L. Bickford of Napa, California, in an effort to make nesting sites. Boxes were placed back of these holes and the birds ceased boring and began nesting. They used the holes for a number of years.

Two or three years ago a screech owl was found in one of the boxes with what was left of one of the flickers; namely, his wing feathers. Feathers of other song birds were also found in the box. The screech owls were taken as pets and in due time other flickers took up their abode in the boxes.

In the spring of 1928 the flickers again disappeared and on investigation one of

the holes was found to contain a screech owl's nest with the young just hatched.

It seems that the flickers and screech owls both favor this nesting site, but are unable to get along congenially even when using separate nest holes.—D. D. McLean, Berkeley, California.

WHITE-WINGED DOVE IN THE IMPERIAL VALLEY

The white-winged dove from Mexico commenced its flight up the Colorado River as the nesting time for the species drew near. Usually the birds start to nest the latter part of April, while stragglers and late comers prolong the nesting period sometimes for several months. They build their nests of small twigs in the willows and mesquite trees. In these they lay two white eggs. Some large mesquite trees have as many as twelve or more nests ranging from four to sixteen feet from the ground.

Their nesting habits somewhat resemble those of the band-tailed pigeon, in that they nest in colonies and go in large bands to feed. Their feed consists of various kinds of berries, grain and small seeds. After the nesting season is over, late in the fall, they return with their young to their wintering quarters in Mexico.

The white-winged dove is a little larger than the mourning dove, and while in flight shows a white crescent on each wing and a white border at the end of the tail. Further, the tail is much shorter than that of the mourning dove. The former bird has a very dark bill and reddish feet.

A story was told me by an old Mexican that there were countless thousands of these birds in Sonora, Mexico, and that they call them Sonora pigeon. He said these birds winter there and start to come north the latter part of March, flying north until they reach the Gulf of California and thence to the Colorado River and on up the river, coming into California near Yuma, Arizona. The white-winged dove rarely goes north of Needles, San Bernardino County, nor does the bird range very far west of the Colorado River. Sometimes a few drift into Imperial Valley.—E. D. Ricketts, Brawley, California.

CANADA GEESE NEST ON HONEY LAKE

I went down into Honey Lake Valley, Lassen County, on March 22, and after tramping around in the marsh for three or four hours found two nests of the Canada goose. One nest had five eggs in it and the other six. Both birds were setting and most likely had been for two or three

weeks. We also found a nest that had not been completed. This shows that the local birds and the ones that come in from below do not nest at the same time here. We raised some mallards and they are evidently nesting too. The Canada goose usually nests in the heavy tules where there is running water near at hand. The nest is generally about two feet off the ground and sometimes in very plain sight. It is not unusual for Canada geese to nest on top of hay stacks and several nests have been located at Lake Almanor on the top of broken-off snags of large trees sometimes forty feet above the water. I have often wondered how the old bird got the young ones to water after they reached the age to leave the nests thus located.

On the 19th of April, 1927, I found the nest of a Canada goose in the tule section of Honey Lake. The young birds were hardly dry when I found them. This was evidently not an early hatching for there were young goslings about on the marsh at that time large enough to run around.—C. O. Fisher, Susanville, California.

A TICK-INFESTED DEER

The mule deer of the Sierras are prey to many insect pests, not least among them being the western dog tick. In fact, this species could be more appropriately named deer tick. Whether or not these pests cause much physical suffering and actually inflict considerable injury, is at present an open question.

In January of the present year a young buck was found dead near the foot of the Coulterville road. The body was literally infested with ticks, hundreds of them along the neck and the insides of the flanks. There were solid rows of the gorged females and the body swarmed with the younger undeveloped individuals.

There was no evidence that this spike horn had met death by accident, nor did it appear to have been affected by any disease. Except for a slight deficiency in weight, the body appeared to be that of a reasonably healthy animal—that is, exclusive of the ticks.

The western dog tick is the commonest variety on the Pacific coast. Dogs, sheep, cattle, horses, deer and ground squirrels are subject to infestation, and man is frequently enough the unwilling host. But deer are the greatest sufferers, ticks abounding, as they do, on ceanothus and others of their chaparral food plants. The female ticks are reddish brown with white markings. Their oval bodies average around 10-12 millimeters in length when gorged.

Though the buck looked as though it might actually have died of ticks, the theory is hardly tenable, according to most biologists. Nevertheless, it is true that unhealthy individuals being unable to rid themselves of these tenacious ecto-

A STRIPER STRANGLES

On April 8, 1928, near the mouth of the Tuolumne River on the San Joaquin, a large dead fish was reported which turned out to be a giant striped bass, weighing approximately forty-four

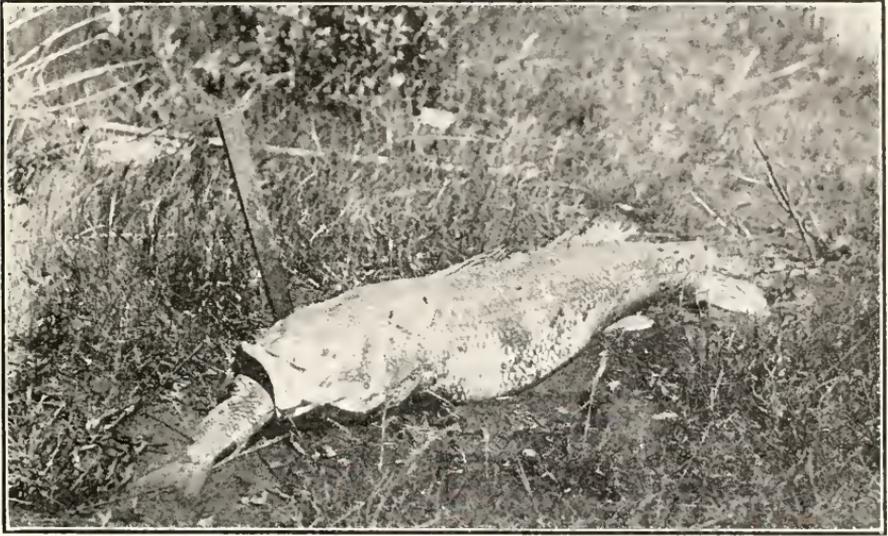


FIG. 74. Striped bass strangled by thirteen-inch carp. Found near mouth of Tuolumne River, April 8, 1928. Photograph by Perc C. Meakin.



FIG. 75. New bay and river patrol boat *Rainbow*. Photograph by John O'Connell.

parasites, are heavily parasitized and may thus suffer an accentuation of their already weakened condition.—George M. Wright, *Yosemite Nature Notes*, Vol. 7, No. 5, p. 38.

pounds, and forty-seven inches in length. The fish had been dead about three days when discovered.

This striper had captured a thirteen-inch carp and had endeavored to swallow

it. Apparently the carp became lodged in the throat of the bass. The bass, being unable to swallow or toss up the carp, had strangled and was cast upon the bank by high water. Such occurrences as this are of particular interest in that they give some knowledge of the

capacity of a bass's throat, and throw light on its voracious habits.

Incidentally, carp are preferred by striped bass, and fishermen claim that when carp can be procured they are the principal food.—P. C. Meakin, Modesto, California.

CONSERVATION IN OTHER STATES

FLORIDA ENACTS ADVANCED LAW

Florida has adopted a system of accurately recording the bags of the hunter and the trapper's take in order to effect a more advanced type of fish and game administration. Good business practice dictates that a record be kept of amounts used of every kind of commodity in order to avoid waste and the folly of over-drawing and thus exhausting the supply.

The following is an extract from an article entitled, "Florida Requires Game Reports" in *Field and Stream*, June, 1928, under the heading of the Bulletin of the American Game Protective Association.

"An improved state-wide game and fish law was passed by the last legislature. One of the provisions of the new law requires hunters and trappers to report what they have taken under their licenses within ten days after the close of the season under penalty of being denied a license for the next season.

"This requirement is found in the laws of very few states, but some others have a voluntary system of reports. It should be mandatory in every state in order that reliable statistics of the kill of game from year to year might be collected. There can be no better index of the tendency toward increase or depletion than is furnished by such reports, and they supply a sound basis on which to base restrictive or other regulations. Minnesota was the first state to enact a law making such reports mandatory."

NEW BRUNSWICK GAINS IMPORTANT ADDITION TO REFUGE SYSTEM

The establishment of the Lapreau Game Refuge in the wilds of New Brunswick adds one of the best areas for big game in the province to the system. The refuge comprises nearly ninety-five square miles and brings the total territory set aside for game refuges to almost five hundred square miles. The new refuge is the result of a determined policy on the part of the present administration to enlarge the sanctuary area of New Brunswick.

RECENT LEGISLATION IN KENTUCKY

Several new laws were enacted by the Kentucky legislature at its last session. These afford additional protection to game and fish and enlarge on the powers of the Kentucky Commission to more adequately administer refuges. Increased funds also will aid in a greater output from hatcheries.

A few of the new enactments are:

Doves may be shot only from noon until six o'clock each day during open season.

Bass and crappie may not be sold.

Deer and pheasants may not be killed until 1932.

NEW YORK PROVIDING FOOD FOR GAME

Food for game animals and birds will be an important consideration in the reforestation program of the New York Development Association. A liberal number of berry-bearing trees and shrubs will be planted to each acre. Hardwood trees, such as beech and maple, will also be set out and care will be taken to afford both a winter and summer food supply.

The Association contemplates planting some billion trees during the next fifteen years on waste lands in the state and its program provides for the planting of one hundred million trees each year thereafter until all the idle lands are productive.

To further encourage the planting of food producing plants in areas not included within the reforestation project, the Association is distributing suitable trees and shrubs without cost to sportsmen's associations and interested individuals.

MISSOURI IMPORTS QUAIL

The state of Missouri just purchased 3000 quail for liberation this past spring. The birds were released in state-owned and auxiliary game refuges. In making a report on this contribution to the game resources of the state, it is pointed out that the \$2.50 hunting and fishing license falls short \$1.52 of paying for a single pair of the imported quail.

IDAHO TO INTRODUCE EGGS OF FRESHWATER SMELT

An interesting experiment is to be carried out by the Bureau of Fisheries, Idaho State Fish Commissioner and Forest Service in shipping the eggs of the freshwater smelt from eastern Maine for planting in Idaho waters.

This little fish, ordinarily growing to about six inches long, is remarkably prolific and runs in large schools in the deep waters of lakes. In early spring they ascend inlets to spawn, the spawn being very minute and sticking to rocks, sticks, etc. The eggs develop rapidly and hatch in from two weeks to a month, the minute young migrating immediately to deep water.

Owing to the rapid development of the eggs, it is difficult to ship them successfully such long distances. The eggs are to be surrounded by a layer of ice and packed in an insulated box to be sent by express. If this method is not successful, a small shipment by air mail will be attempted.

The object in introducing the smelt is to furnish an abundant and suitable forage fish for trout and salmon to eat. They live principally on minute forms of life which ordinarily occur in abundance in deep water lakes and turn this into a readily available trout food. In one instance, a lake in which trout were not thriving, owing to a lack of large forms of food, although the minute forms were abundant, was stocked with the smelt in the spring and that fall yearling steelhead trout and landlocked salmon from 6-9 inches long were planted. By the following summer, 8-9 months later and over winter, the trout and salmon reached two pounds in weight. The next summer steelhead trout were taken weighing 4½ lbs., the food being almost entirely the little smelt.

The smelt is the natural food of the landlocked salmon which has never been successfully established in its absence and although encouraging results have come from the introduction of this salmon in the Redfish Lake section in Idaho, the planting of the smelt will make favorable results much more certain. The abundance of trout food which the smelt will supply should improve conditions for other trout as well and it is quite probable that the little redfish occurring there will grow considerably larger in size than at present.

PATHFINDER BIRD REFUGE REESTABLISHED IN WYOMING

By recent executive order, President Coolidge has reestablished for the protec-

tion of native birds the Pathfinder Bird Refuge, embracing 22,700 acres on the North Platte River in central Wyoming. The area is set aside for the use of the Department of Agriculture as one of the numerous refuges administered by the Bureau of Biological Survey.

All the lands involved have been withdrawn for reclamation purposes in connection with the North Platte Project, Wyoming, and are primarily under the jurisdiction of the Department of the Interior. The area includes mainly a reservoir constructed for the use of the Reclamation Service in the irrigation of lands. The establishment of this refuge furnishes nesting grounds as well as important feeding and resting places for the large numbers of migratory waterfowl, especially ducks, in a region where open water areas providing a haven for birds are scarce.

It is unlawful, within the refuge, to hunt, trap, capture, wilfully disturb, or kill any wild animal, or bird of any kind whatever, or take or destroy the eggs of any wild bird, except under such rules and regulations as may be prescribed by the Secretary of Agriculture.

UPPER MISSISSIPPI REFUGE ENLARGED

A joint resolution recently approved by President Coolidge authorizes the Secretary of Agriculture to accept from James B. Munn, of New York City, on behalf of the United States, a gift of certain lands in Clayton County, Iowa, to become a part of the Upper Mississippi River Wild Life and Fish Refuge. These lands, embracing a total area of 488 acres estimated to be worth thirty or forty thousand dollars, were generously donated to the government by Mr. Munn through his interest in the objects of the refuge.

Situated near McGregor, Iowa, the lands are more or less overgrown with original timber and are especially attractive for upland migratory birds. One parcel includes an excellent lookout point, known as Pikes Peak, that will be of great value in connection with fire protection, administrative uses, and other purposes on the refuge. Although adjacent to the lowlands embraced in the refuge much of the area is not subject to overflow, as it extends up into the hills bordering the river bottoms, and the inclusion of this high land will have the desirable result of lending variety to the refuge and attracting and protecting additional species of wild life.

The Upper Mississippi River Wild Life and Fish Refuge includes lands along

both sides of the river between Rock Island, Ill., and Wabasha, Minn., and the acquisition of further lands to be included is being carried forward as rapidly as possible by the Bureau of Biological Survey of the Department of Agriculture.

NEW ANTELOPE PRESERVE FOR NEVADA

The National Association of Audubon Societies has acquired the Last Chance Ranch in northern Nevada, which it will maintain as an antelope sanctuary.

Some time ago at a national conference called in Washington to consider means of saving these beautiful and hard-pressed animals in the semi-desert regions of the west, the National Association of Audubon Societies was appointed to take the lead in securing by congressional action the establishment of an antelope and sage hen reservation in southeastern Oregon. Political interference at the behest of the nomadic sheep herding interests caused the project to fail. Since that time the State of Oregon has declared the killing of antelope in this region to be illegal, but as no wardens are available to enforce the regulation, conditions so far as the antelope are concerned remain virtually unchanged. Reports are current that wandering sheep herders and other travelers of the deserts continue to wipe out the small bands of antelope that still remain. Across the line in Nevada an exactly analogous situation exists, but it is here that a real reservation has at last been created.

While Dr. T. Gilbert Pearson, president of the Audubon Association was engaged in field work in the west last summer he learned from E. R. Sans of Reno of the peculiar conditions that surround this Last Chance Ranch in northern Nevada.

This range of 380 acres contains open water, and water in this desert means many things, one of which is that from great distances antelopes come in spring to drop their fawns on the slopes surrounding the water hole. It is this ranch

the Association has acquired.—*Outdoor Life-Recreation*, Vol. 61, No. 4.

NORTH CAROLINA UNDERTAKES A GAME BAG CENSUS

The Director of the Department of Conservation and Development of North Carolina sent out 125,000 return card blanks during the month of March. Hunters are asked to fill in the blanks with the number of each species of game taken and to return the card. The census will provide the state with the first definite and comprehensive idea of the value and extent of game animals and birds taken during any one open season. With this as a basis, some estimate can be made of the game population of the state.

GEORGIA CREATES REFUGES

A decreasing game supply has forced Georgia to begin the establishment of a series of game refuges and public shooting grounds in various parts of the state. One such forest and game preserve has been created and others are to follow in the central and southern part of the state, and on the coast.

Mexican quail are also being introduced. In 1926, 6000 quail were imported, and in 1927, 5000.

HUNGARIAN PARTRIDGES IN PENNSYLVANIA

During the past three years, the Game Commission of Pennsylvania has undertaken the acclimatization of the Hungarian partridge. In 1925, 3962 Hungarian partridges were imported from Czecho-Slovakia. They arrived in good condition and were immediately released. In 1926, 1643 were similarly imported and released. It may be that the releasing of these birds in sizable coveys rather than in small lots has contributed to the success obtained. In nearly all of the places where these partridges were released, there has been evidence of normal increase. In only one instance did the birds entirely disappear. In one county where 216 were released, it is estimated that there are now 1200 birds.

REPORTS

GAME CASES

January, February, March, 1928

Violation	Number arrests	Fines imposed	Jail sentences (days)
Hunting license Act.....	17	\$460	-----
Deer Tag License Act.....	1	50	-----
Deer: buy or sell; run with dogs; taking and possession, closed season; failure to retain horns and hide; over bag limit.....	22	2,375	-----
Deer: taking and possession, does, fawns, spiked bucks, forked horns in Dist. 13½	13	1,310	-----
Rabbits: cottontail, brush; taking and possession, closed season.....	28	685	30
Ducks: buy or sell; taking and possession; closed season; over bag limit.....	21	686	90
Geese: taking and possession, closed season; over bag limit.....	6	175	30
Mudhens: taking and possession, closed season.....	7	175	60
Swans: taking and possession (no open season).....	1	25	-----
Shorebirds: taking and possession (no open season).....	6	150	-----
Quail: taking and possession, closed season; over bag limit.....	13	450	83
Pheasants: taking and possession (no open season).....	4	500	-----
Non-game birds: taking and possession.....	6	140	-----
Commercial Gun Club License Act.....	1	200	-----
Fur Trapping Regulations.....	3	85	-----
Shooting wild game from power boat.....	2	10	-----
Game refugees: hunting and possession of firearms.....	2	50	-----
Night hunting.....	11	310	-----
Bird nets: illegal possession of.....	2	50	-----
Totals.....	166	\$8,885	293

FISH CASES

January, February, March, 1928

Violation	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act.....	38	\$1,010	360
Commercial Fishing License Act.....	19	210	-----
Trout: taking and possession, closed season.....	19	370	60
Black bass: taking and possession, closed season.....	7	225	60
Sunfish, perch, crappie: taking and possession, closed season.....	12	310	30
Night fishing, illegal.....	2	25	-----
Striped bass: undersized and overlimit.....	7	450	-----
Salmon: illegal taking and possession.....	1	100	-----
Catfish: sale of undersized.....	6	210	-----
Barracuda: undersized.....	1	50	-----
Spot-fin croaker: sale of.....	1	50	-----
Crabs, undersized.....	13	275	30
Clams: undersized and overlimit.....	57	1,349	130
Ablones: taking and possession, closed season; removal of shells from below high tide mark; undersized and overlimit.....	53	1,390	-----
Lobsters: taking and possession, closed season; undersized.....	9	265	-----
Illegal fishing: fish reservation.....	2	75	-----
Nets, traps, lines, spears: illegal possession or use.....	18	1,430	-----
Water pollution.....	5	1,300	-----
Totals.....	270	\$9,094	670

SEIZURES OF FISH AND GAME

January, February, March, 1928

Deer meat, pounds	449
Rabbits, cottontail, brush	27
Ducks	494
Geese	29
Mudhens	5
Swans	1
Shorebirds	5
Divers	1
Quail	16
Pheasants	4
Non-game birds	27
Trout	77
Black bass	11
Sunfish, perch, crappie	85
Striped bass, pounds	47
Catfish, pounds	712
Barracuda, pounds	4,755
Calico bass	1
Crabs	52
Clams	1,365
Abalones	527
Abalone meat, pounds	39
Lobsters, pounds	178
Nets, fish spears	4
Bird nets	1

STATEMENT OF INCOME

For the Period January 1, 1928, to March 31, 1928, of the Seventy-ninth Fiscal Year

	Detail	Total
License sales:		
Angling licenses, 1927	\$23,531 00	
Angling licenses, 1928	4,601 00	
Hunting licenses, 1927-1928	110,649 00	
Hunting licenses, 1928	334 00	
Market fishermen's licenses, 1927-1928	3,630 00	
Market fishermen's licenses, 1928-1929	230 00	
Wholesale fish packers' and shell fish dealers' licenses, 1927-1928	45 00	
Game breeders' licenses, 1928	460 00	
Fish breeders' licenses, 1928	175 00	
Trapping licenses, 1927-1928	1,244 00	
Deer tag licenses, 1927	14,125 00	
Total license sales		\$159,024 00
Other income:		
Game tag sales	\$7 92	
Fish tag sales	1,621 93	
Court fines	15,237 35	
Fish packers' tax	23,311 54	
Kelp tax	3 75	
Miscellaneous sales	125 00	
Interest on bank deposits	405 07	
Total other income		40,712 56
Total income		\$199,736 56

STATEMENT OF EXPENDITURES

For the Period January 1, 1923, to March 31, 1923, of the Seventy-ninth Fiscal Year

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....		\$4,181 94	\$265 58	\$1,022 89	\$5,470 41
Clerical and office.....	\$213 15	4,399 77	612 43	78 88	5,304 23
Rent.....			2,582 58		2,582 58
Automobiles.....	114 30		120 45		234 75
Telephone and telegraph.....			987 60		987 60
Postage.....			1,023 40		1,023 40
Freight, cartage and express.....			294 16		294 16
Printing.....	3,161 54				3,161 54
Accident and death claims.....			166 35		166 35
Commissioners.....			528 39		528 39
Total administration.....	\$3,488 99	\$8,581 71	\$6,580 94	\$1,101 77	\$19,753 41
Education:					
Director and assistants.....	\$222 07	\$3,175 00	\$563 03	\$1,201 09	\$5,161 19
Publicity:					
Director.....		\$825 00	\$220 47		\$1,045 47
Conservation and protection:					
Chief and assistants.....		\$3,129 99	\$591 56	\$4 25	\$3,725 80
Clerical and office.....	\$50 91	695 00			745 91
Rent.....			98 46		98 46
Automobiles.....	392 90		88 21		481 11
Captains and deputies.....	71 85	51,370 02	39,281 53	27 10	90,750 50
Patrol launches.....	278 93	525 00	212 69	2,923 32	3,939 94
Lion hunting.....		750 00	270 57		1,020 57
Lion bounties.....			2,990 00		2,990 00
Fish planting.....		630 00	87 75		717 75
Refuge posting.....	706 54	605 00	518 98		1,830 52
Total conservation and protection.....	\$1,501 13	\$57,705 01	\$44,139 75	\$2,954 67	\$106,300 56
Commercial fisheries:					
Chief and assistants.....	\$75 25	\$2,743 33	\$609 39		\$3,427 97
Deputies.....	97 48	8,976 21	2,733 06		11,806 75
Patrol launches.....	553 72	1,220 00	94 17	48 65	1,916 54
Statistical.....	244 23	1,415 00	46 67		1,705 90
Laboratory.....	420 59	7,533 39	1,185 35	380 70	9,520 03
Botulism.....			3,750 00		3,750 00
Automobiles.....	126 64		79 56		206 20
Total commercial fisheries.....	\$1,517 91	\$21,887 93	\$8,498 20	\$429 35	\$32,333 39
Fish culture:					
Chief and assistants.....		\$1,033 33	\$25 50	\$10 20	\$1,069 03
Clerical and office.....	\$57 82	905 00	12 80		975 62
Rent.....			255 00		255 00
Automobiles.....	810 12		168 70	4 20	983 02
Hatcheries.....	7,052 21	26,245 88	3,198 04	3,040 94	39,537 07
Hatcheries, additions and betterments.....				17,362 09	17,362 09
Special field investigation.....		2,509 06	527 43		3,036 49
Total fish culture.....	\$7,920 15	\$30,693 27	\$4,187 47	\$20,417 43	\$63,218 32
Hydraulics:					
Chief and assistants.....	\$6 30	\$1,375 00	\$511 31	\$45 29	\$1,937 90
Cooperative research work.....	13 21	750 00	20 60		783 81
Total hydraulics.....	\$19 51	\$2,125 00	\$531 91	\$45 29	\$2,721 71
Game propagation:					
Game farm, Yountville.....	\$1,112 28	\$1,958 00	\$352 63	\$962 46	\$4,385 37
Automobiles.....	165 29				165 29
Total game propagation.....	\$1,277 57	\$1,958 00	\$352 63	\$962 46	\$4,550 66
Research:					
Chief and assistants.....	\$27 91	\$2,217 26	\$260 89		\$2,506 06
License commissions.....			\$10,325 55		\$10,325 55
Total Division of Fish and Game.....	\$15,975 24	\$129,168 18	\$75,660 84	\$27,112 06	\$247,916 32

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1928
Compiled by Division of Fish and Game, Department 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
Albacore									
Anchovies									7
Barracuda									110
Bonito									
Carp		54,583		4,191	22,317	10,250	116		
Crab		6,700		1,765	34,349	28,780			
Cutrus Cod	258						151,686	2,065	21,985
Eels							5		
Flounders	11,281	10,790		25			77,450	1,681	170
Grayfish							104,025	125	650
Halibut	63,853						3,159	412	3,624
Hardhead					22,247				
Herring	61,442		390,550			20,325	502,620	3,059	21,581
Kingfish							625	18	362,435
Mackerel									400
Mackerel—Horse									
Mullet	14,138	3,151	30,180				1,289	625	1,586
Perch				37	1,853	645			
Pike									
Pompano									
Rock Bass							255,204	52,014	529,350
Rockfish	21,133	10,100					148,275	4,124	724
Sablefish	88,424						31		
Salmon				1,029	7,669	4,799	223,201	378	7,542
Sardines		13,080					5,341,094	200	80,498,675
Sandbars									10
Sardines									
Sculpin								57	
Sea Bass—Black									
Sea Bass—White				54	56	513	130		
Shad				8,411	4,090	26,583			
Shad—Buck				6,700	3,498	22,626			
Shad—Roe									
Sheepshead		1,040					77,929	1,500	13,115
Skates									
Skipjack									
Smelt	25,613	91	4,262				21,959	4,954	1,429
Sole		98,790					2,603,381	10,699	83,431

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1928

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

Species of fish	Total					Total	Fish from south of the International Boundary line brought into California via San Diego	Fish from south of the International Boundary line brought into California via San Pedro	Total fish from south of the International Boundary line brought into California
	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial					
Albacore		348				348			
Anchovies		1,345				1,345			
Barracuda		46,501	114	15,955		62,577	90,973	619,458	
Bonito	8	14,613	43	20,244		35,018	15,326	38,008	
Carp						36,883			
Catfish						119,477			
Cutthroat Cod	50	400	20			189,224			
Eels						101,417			
Flourders		20		3,208		125,354			
Grayfish		17,229	117	3,208		45,354			
Halibut	68,024	200,302	82,450	81,388		453,212	55	78,867	78,922
Hardhead						22,247			
Herring	490			6,938		952,465			
Kingfish		131,640	172	220		157,327			
Mackerel	4,735	1,386,764	226,851	323,303		2,303,106	200	200	
Mackerel—Horse		86,772	170			86,342			
Mullet				2,558		2,558	28,900	35,359	
Parrish	393	13,197		231		64,790	312	1,190	
Pike						2,235			
Pompano		52				52	14,498	15,784	
Rock Bass	3,583	30,193	24,488	8,052		66,316	14,273	14,273	
Rockfish	43,362	530,026	32,440	443,004		1,916,663			
Sablefish	90	4,263				245,900			
Salmon						14,428			
Sandbars		4,459				248,610			
Sardines		88,110,999		5,680,879		179,637,847			
Sculpin	25	4,534	332	11,381		16,282			
Sea Bass—Black		2,546	6,530	61,387		70,463	2,151	24,260	26,411
Sea Bass—White	731	7,136	3,240	10,849		22,013	12,748	33,277	46,025
Shad						753			
Shad—Buck						39,084			
Shad—Roe						32,824			
Sheepshead	18	142,052	1,528	11,293		154,891			
Skates		10,137	236	1,400		105,357			
Skinjack						270,369	433,839	704,208	
Smelt	21,584	132,664	458	13,387		226,375	75	75	
Sole	30,204	8,826	1,688	6,885		2,843,904			



FIG. 76. Map showing pheasant plantings in California for 1926 and 1927. Map by courtesy of Rand McNally.

1926 Plantings—▲—Letters			1927 Plantings—●—Numbers			1927 Plantings—●—Numbers		
Plant	No. of birds	Nearest Locality	Plant	No. of birds	Nearest Locality	Plant	No. of birds	Nearest Locality
A	169	Dunsmuir	1	126	Dunsmuir	22	150	Merced
B	229	Redding	2	462	Redding	23	557	Sanger
C	174	Napa	3	100	Red Bluff	24	130	Coalinga
D	42	Birds Ldg.	4	240	Chico	25	190	Hanford
E	208	Stockton	5	150	Marysville	26	140	Hanford
F	278	Modesto	6	150	Roseville	27	150	Tulare
G	189	Salinas	7	125	Orland	28	225	Salinas
H	192	Soledad	8	140	Willows	29	126	Gonzales
I	300	Fresno	9	427	Napa Valley	30	318	Soledad
J	175	Hanford	10	240	Woodland	31	80	Atascadero
K	250	Bakersfield	11	393	Birds Ldg.	32	120	Buellton
L	252	Solvang	12	110	Healdsburg	33	120	Santa Maria
M	252	Chino	13	184	Point Reyes	34	80	Santa Barbara
N	495	Colton	14	126	Lodi	35	150	Bakersfield
O	105	Temecula	15	150	Crows Ldg.	36	140	Bakersfield
P	110	El Centro	16	100	Pleasanton	37	366	Chino
			17	80	Centerville	38	246	Colton
			18	221	Modesto	39	120	Temecula
			19	150	Stockton	40	240	El Centro
			20	72	Oakdale	41	240	Ontario
			21	72	Sonora			

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 14

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THE STRIPED BASS SUPPLY OF CALIFORNIA ¹

By J. A. CRAIG

(With three graphs.)

The striped bass, *Roccus lineatus*, first appeared in California in 1879, when 132 of these fish were collected in the Navesink River, New Jersey, and shipped to this state. About twenty-five of the fish died and those that survived the transcontinental journey were planted in the Straits of Carquinez at Martinez. Three years later a plant of about three hundred fish was made in Suisun Bay at Army Point.

Evidently the new habitat in which these fish found themselves proved to be extremely suitable to their welfare. This is indicated by the fact that as early as 1889, or only ten years after the first plant, a

¹Contribution No. 73 from the California State Fisheries Laboratory, September 10, 1928.

commercial catch of 16,296 pounds was reported by the United States Bureau of Fisheries. In 1892 the yearly catch was given by the same agency as 56,209 pounds.

A rough idea of the rapidity with which the striped bass multiplied, during the years immediately following their introduction, can be obtained from these figures of total catch. The fish constituting the catch of 1892 were estimated to average² about ten pounds in weight. Therefore, in 1892 there were about fifty-six hundred fish taken in the commercial catch. This number of fish represents only part of the annual increase of the population since the striped bass undoubtedly have become more abundant since that time.

When we consider the fact that the entire population originated from a group of less than five hundred individuals, planted ten and

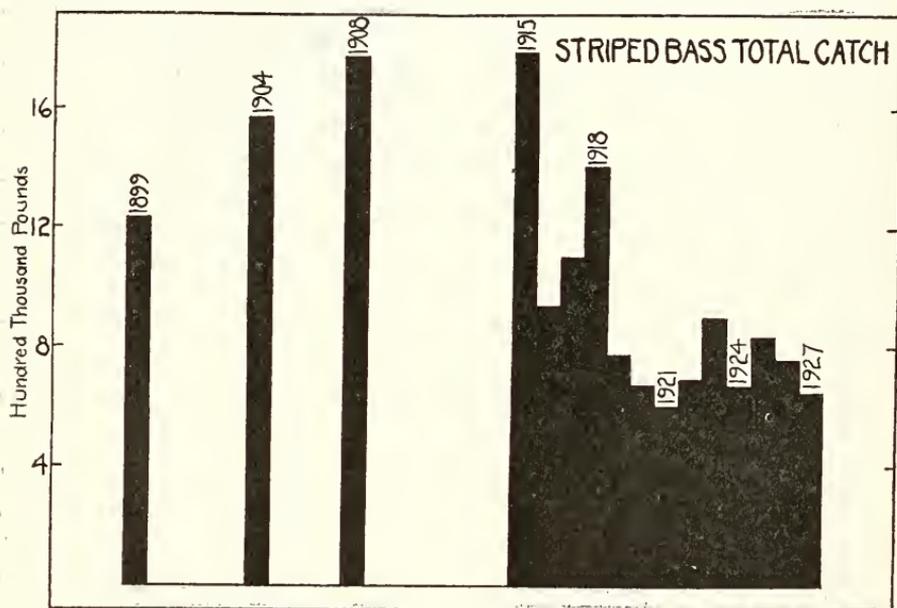


FIG. 77. Yearly total commercial catch of striped bass in California. The figures for 1899, 1904 and 1908 were compiled by the United States Bureau of Fisheries. From 1915 to 1927, inclusive, the data were compiled by the Division of Fish and Game of the Department of Natural Resources of California.

twelve years before, it is evident that the striped bass must have been placed in extremely suitable surroundings, containing an abundant food supply, ample spawning beds, favorable temperature and hydrographic conditions and very few natural enemies.

The introduction of striped bass into California probably has been rivaled only in success by the bringing of the shad into the same waters and the planting of rainbow and other trout in New Zealand.

As shown in figure 77, the total yearly catch of striped bass reached the sum of 1,234,320 pounds in 1899. The catch then rose to 1,570,404 in 1904, and 1,776,000 in 1908. The next yearly catch total available was 1915, which was 1,784,448. In 1916 there was a pronounced drop in total catch to 941,849 pounds. The catch of 1917 was of about the

² Report of the United States Commissioner of Fish and Fisheries, for the year 1893.

same magnitude, and 1918 showed a decided gain, totaling 1,407,841 pounds. From 1919 to 1927, inclusive, the yearly catch fluctuates without a great deal of variation around a mean of about 725,000 pounds.

From an inspection of figure 77, one might be apt to conclude that the striped bass have decreased in abundance since 1915, because the total catch falls off to such a great extent. However, total yearly catch figures are very seldom an accurate criterion of the abundance of a species of fish.

This is necessarily so, when we consider the fact that the abundance of a fish is only one of the many factors which determines the magnitude of the yearly catch. Increased fishing effort, that is, more men, boats and gear entering a fishery, may cause the yearly catch to become greater while the abundance of fish really is growing steadily less. Economic conditions, such as falling off in demand for a particular fish, sometimes bring about a drop in price, which leads the fishermen to turn to another fishery, with the result that less effort is expended and the total catch declines, while the abundance of the species remains unchanged. Poor weather conditions may cause a light catch while the supply of fish remains constant, or a strike of the fishermen may halt all fishing operations for a time, with a small yearly catch resulting. Also restrictive legislation, such as closed seasons, prohibition of effective gear or closing of productive fishing areas, may cause a decline of total yearly catch, while the abundance of the species is constant or even increasing.

The next step then is to see what factors other than the abundance of striped bass may have influenced the catch figures shown in figure 77. Changes in fishing effort, that is, fluctuations in amount of men and gear employed in the fishery, are often one of the major causes of variations in total catch. From data collected by the United States Bureau of Fisheries, Mr. C. B. Tendick, Pacific Coast representative of the Bureau of Fisheries, estimates that in 1915 there were approximately two hundred and sixty-five gasoline engine powered boats and four hundred and eighteen sail and row boats employed in the striped bass fishery in California, and in 1926 about two hundred and seventy-six gasoline boats and only four sail and row boats.

This shows an increase of only about eleven power boats and the almost complete loss of the fleet of over four hundred sail and row boats. While these figures are merely estimates there is no doubt but that there are fewer men and boats employed in the striped bass fishery now than in 1915. This is certainly one of the contributing causes to the decline in total catch since 1915.

Doubtless there are several reasons for the loss in number of men and sail boats from the striped bass fishery. The majority of the sail boats were remodeled and fitted with gasoline engines. Then during 1915 and the years immediately following, there was an extensive development of the fisheries of Monterey, chiefly salmon trolling and sardine fishing. This induced a large number of the fishermen to leave the bass, salmon and shad fisheries of San Francisco Bay and its tributaries, which is the only commercial fishing area for striped bass in the state, and move to Monterey. Also there was a great deal of restrictive legislation passed concerning striped bass fishing following

1915, and a number of the fishermen probably abandoned their occupation and turned to more lucrative pursuits.

Unquestionably the chief cause of the drop in total catch from 1915 to 1919 was restrictive legislation. The first legislative measure protecting striped bass went into effect as early as 1893, when San Francisco County passed an ordinance prohibiting the sale of striped bass under eight pounds in weight. In 1895 a three-pound size limit was made state wide by the State Legislature, and it was also made unlawful to take striped bass commercially between sunrise on Saturday and sunset of the following Sunday. Since that time at almost every legislative session there has been some added protection given the striped bass in the form of additional closed seasons, regulation of gear or withdrawal of fishing areas from commercial fishing.

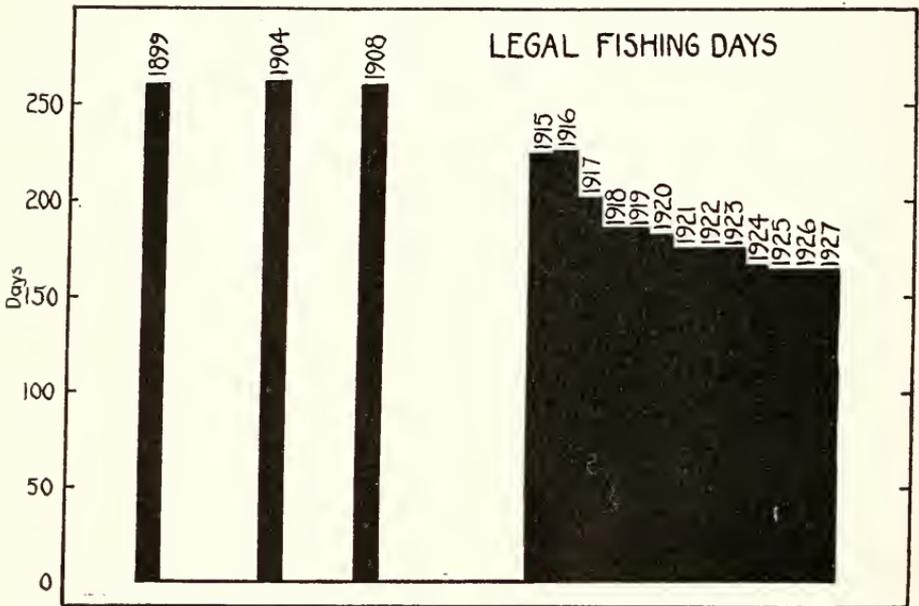


FIG. 78. Number of days in each year upon which commercial fishing for striped bass could be carried on legally in California.

Some idea of the extent to which added closed seasons have lessened the number of legal fishing days can be gained from figure 78. In 1899, 1904 and 1908, the only closed days were the Saturdays and Sundays, which left about two hundred and sixty-one days available to the fishermen. Then more closed seasons were added until in 1927 there were only one hundred and sixty-four days during the year in which commercial fishing could be legally done. Therefore, in 1927 the number of legal fishing days was only 63 per cent of the days available to the fishermen in 1908.

This would tend to cut down the yearly catch, since a man can not be expected to catch as many fish in one hundred and sixty-four days as he formerly did in two hundred and sixty-one days. Also a large part of the closed days were taken from a portion of the year, May 16 to July 31, inclusive, when the bass are abundant on the fishing grounds and fishing conditions are usually good. Therefore, the effect of the

closed season on the yearly catch would tend to be even more than the indicated loss of about one-third of the yearly fishing time.

Another series of legislative changes which have had a large influence on the yearly catches, are the measures prohibiting commercial fishing in many of the best fishing grounds. In 1911 it was declared unlawful to fish commercially in Cache Slough, Napa or Mokelumne rivers. In 1915 all commercial fishing was restricted to San Francisco Bay and the main channels of the Sacramento and San Joaquin rivers. This made it unlawful for the commercial fishermen to utilize many square miles of the most productive fishing areas, and probably had more to do with the drop in yearly catches than any other single piece of legislation.

Then in later years District 2 was closed to commercial fishing. In 1927 commercial fishing was prohibited in the greater portion of San Pablo Bay. This legislation removed another choice area from the commercial fishing grounds.

Besides the two major restrictions, of closed seasons and curtailment of fishing area, other less important protective measures, such as a closed season for commercial fishing for bass over ten pounds in weight between April 1 and May 31, and regulation of gear which may be used, have been passed by the state legislature, since the year when extremely high total catches were made.

Since the protective measures passed alone seem to be a sufficient reason for the lessened yearly catch of the last ten years, the trend of the total catches, when other factors affecting it are considered, certainly does not seem to indicate that the striped bass have been depleted. Instead it appears that the yearly take has been curtailed by a series of wise protective measures and the withdrawal of part of the men and boats working in the fishery. To pass legislation which has the effect of diminishing the yearly take of fish and then become alarmed because the catch falls off is no more sensible than for a man to become worried over his financial condition because he has deposited his money in a bank and so has not spent as much as usual.

As stated before, yearly total catch figures are at best a poor measure of the abundance of a species of fish. In order to obtain a definite idea of the abundance of a certain fish, more detailed and complete data than yearly total catches are needed. Also, the data must be handled in such a way that the effects of factors influencing the fishery other than the abundance of the fish, such as changes in fishing effort, gear, and number of available fishing days, are nullified as much as is possible.

Fortunately we have such detailed data in the pink ticket receipts collected by the Division of Fish and Game. These are the triplicate copies of the receipts which all fish buyers are required to make out when buying fish from a fisherman. The original is given to the fisherman who caught the fish, and the duplicate copy is kept by the buyer. The receipt shows the name of the man who caught the fish, species of fish caught, number of pounds in the catch, price paid for the fish, date of sale, and the name and custom house number of the boat. In this way the Division of Fish and Game is able to obtain a detailed record of every catch of fish sold in the state. In cases where the boats usually

go out and return on the same day, as in the striped bass fishery, this amounts to a detailed record of each boat's daily catches.

When these records of daily catches are handled in such a way that the catch of a constant unit of effort and gear during comparable periods of time is obtained, the result can be said to indicate the abundance of the species of fish, or at least the availability of the fish to the fishermen, as accurately as it is possible for any catch data to accomplish. In the process known as a boat catch analysis we have such a means of determining the yield of a constant unit of fishing gear and effort over comparable periods of time.

Figure 79 shows graphically the result of a simple boat catch analysis of the striped bass fishery of San Francisco Bay and its tributaries. The first step in obtaining these results was to go through the individual boat records and select twenty boats which had fished for striped bass continuously through all of the years during which the ticket system has been in operation, 1920 to 1927, inclusive. The boats so selected have been under the same owner and have used practically the same sort of gear during this eight-year period. This selection of data eliminates fluctuations due to increases or decreases in number of men or boats and changes of gear in the fishery, and provides a constant unit of gear and personnel with which to work.

The next step is to get the data in such a form that the result will show the catch of a constant unit of time. It can be easily seen that if the total catch of these boats for a year or month or week were used, the results from year to year or month to month would not be comparable because some years or months might contain many more days, when fishing was actually carried on, than others. The average catch per day during each year is the unit of time shown in the curve in figure 79. In computing this average, only those days upon which catches were reported were used, since we have no means of knowing when fishermen went out and failed to catch fish. However, it is safe to say that the great majority of times when no catches are reported, represent days on which the fishermen did not go out, because of engine trouble, mending nets, vacations, additional closed seasons and various other causes. The number of times when they fished and caught absolutely nothing are very few and would average about the same for each year over a long period of time, so they are of relatively little importance.

Some boats habitually bring in much larger catches than others, either because they have larger nets or more men in the crew, are larger boats or are operated by more skilful fishermen. If the boats making the larger catches did not make as many catches as usual in some year, the combined average daily boat catch of that year would be lowered artificially, while if some of the smaller boats made less than the usual number of catches, the average would be raised because the normal amount of small catches would not be present. Also small fluctuations in small catches should be as indicative of the abundance of the fish as larger fluctuations in larger catches. Therefore, the catches of all of the boats were weighted in such a way that all boats had equal weight in determining the final result.

The method of accomplishing this was as follows: First, the average catch per day of each boat during the eight-year period, 1920 to 1927,

inclusive, was computed by adding up the daily catches of each boat made during that period and dividing the sum of the catches by the number of catches included in the total. The boat then having the largest average daily catch during the eight-year period was given a weight of one. The daily averages of each of the other boats were then divided into the average of the boat with the largest catch in order to find out how much greater the average catch of the boat given the weight of one was than the averages of each of the others. The results of these divisions were then used as factors by which the catches of all of the boats could be raised to an equal footing with each other, and with the boat having the largest catches.

For example: Suppose boat A has the largest average daily catch of 200 pounds. Then boat B has an average daily catch of 100 pounds during the eight-year period. The factor for boat A is 1, since it has the highest average catch. For boat B the factor is $200 \div 100$ or 2. By multiplying all of the catches of boat B by 2 they can be raised to an

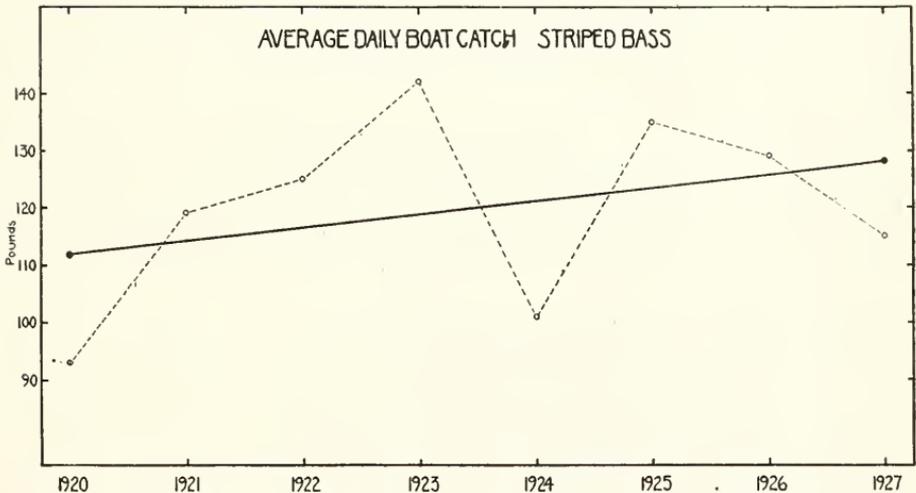


FIG. 79. Average daily catch per boat of striped bass in San Francisco Bay and its tributaries.

equal magnitude with the catches of boat A and fall about the same mean as those of boat A, and both boats will have an equal weight in determining the final combined average of all of the boats.

This process of course is repeated with the data of each of the remaining boats.

When the catches of all of the boats had been weighted so that all boats have equal importance in determining the final average, the next step was to compute the average daily catch of all of the boats for each year. This was done by adding up the weighted daily catches of all of the boats in one year and dividing the sum so obtained by the number of catches included in the total. This was repeated with the data for each year.

The dotted line in figure 79 shows the result of this boat catch analysis. In 1920 the average daily catch per boat was only 93 pounds. This increased to 142 pounds in 1923 and then it dropped to 101 pounds in 1924. The year 1925 showed a marked increase to 135 pounds, and

1926 and 1927 were somewhat lower with 129 and 115 pounds, respectively.

The solid line in the same figure indicates the straight line that best fits the points determined by the dotted line. M the slope of the line was computed from the formula $M = \frac{\sum xy}{\sum x^2}$, x being the deviations of the years from their midpoint in half years and y being the deviations of the yearly average daily catches from the mean of the eight values given for these averages. The trend of the solid line in figure 79 is more significant in giving a general picture of the abundance of striped bass than the dotted line showing the exact status of the average daily boat catch for each year since it summarizes the trend of these separate points. Also some of the yearly results are influenced by factors other than the availability of the fish to the fishermen. As an example of this, during 1924 there was very little rain and a resulting condition of low, clear water which was not favorable to large catches of striped bass. Also in 1927 very large catches of shad were made which caused the fishermen to concentrate on shad fishing and to go to places where large shad catches could be made, even though the bass catches resulting were smaller than usual.

The catch return per constant unit of effort and gear has had an upward trend during the eight-year period, 1920 to 1927, inclusive. From this we can safely assume that the abundance of striped bass, or at least the availability of the bass to the fishermen has increased during that time, since the same gear used by the same men for the same length of time has brought catches whose trend in size is greater as the years progress.

To briefly summarize the statements made in the previous pages: The striped bass when introduced in 1879 and 1882 found a habitat extremely suitable to their welfare and increased rapidly, until in 1899 they were supplying a total annual catch of over 1,200,000 pounds. This period of large yearly catches continued until 1915, after which, with the exception of 1918, the catches were much lower. This drop in total catch upon careful analysis appears to be due to withdrawal of men and boats from the fishery and restrictive legislation. During the years from 1920 to 1927, inclusive, the catch per unit of gear and effort for a constant unit of time has become greater, which strongly indicates an increased abundance or availability of bass to the fishermen.

Certainly there appears no reason to fear that the fishery is being depleted. Rather it seems that through wise protective measures the total catch is being held to a level low enough so that the supply of bass is at least holding its own and probably slightly increasing, which it might be expected to do, unless too great a strain is placed on it, until the species becomes numerous enough to fill its new habitat and completely utilize the food, spawning grounds and environment available to it.

GRUNION ON CABRILLO BEACH ¹

By FRANCES N. CLARK.

Although much has been written ² of the habits of the grunion, that unique fish found spawning on the sandy beaches of Southern California, this year has added a new item to our knowledge of the adaptability of this unusual fish.

The grunion deposits its eggs in the sand at the upper edge of the zone reached by the highest tides and appears on the southern California beaches in two-week intervals from March to August of each year. The spring tides, which accompany the full and dark of the moon, are the time tables by which the grunion runs can be predicted. For about an hour after the turn of the tide on the three or four nights following the full and dark of the moon, these little fish are to be found washed up on the beach, the female digging tail first into the sand and depositing her eggs, which the male fertilizes as he lies arched around her. Succeeding tides bury the eggs more deeply in the sand where they lie until dug out two weeks later by the next series of high tides. At this time the eggs hatch and the tiny fish are washed back to the sea.

Many have speculated on the question: Do grunion hatched on a particular beach return to the same beach to spawn when they have reached maturity? It has been definitely demonstrated that Pacific salmon ³ spawn not only in the same stream, but in the same tributary of the stream in which they hatch. Eels ⁴ migrate thousands of miles to deposit their eggs in the same region of the ocean where they began life as tiny larvae. If two species of fishes have such strong homing instincts, may this not hold true for other species also? An answer to the question as to whether or not the grunion are home beach spawners has been furnished, in part at least, by observations made in the spring and summer of 1928.

During the spring and summer of 1927, a new beach was constructed at the base of the breakwater protecting Los Angeles Harbor. This beach, known as Cabrillo Beach, was filled in by pumping sand from the channel of the harbor, and laying it down at the foot of the bluff both on the harbor and ocean sides of the breakwater. The beach on the harbor side is well protected with almost no surf. On the ocean side, the surf is heavy and the slope of the sand where the waves break relatively steep—a condition which would seem scarcely favorable for spawning grunion, as the water washes back too quickly for the fish to readily maintain their position preparatory to the spawning process.

Although the beach appeared unsuitable and the possibility that grunion would so quickly populate a new beach seemed remote, the writer made observations on the favorable series of tides during the

¹ Contribution No. 72 from the California State Fisheries Laboratory, August, 1928.

² Thompson, Will F., assisted by J. B. Thompson. The spawning of the grunion. Calif. Fish and Game Comm. Fish Bull. No. 3. 1919.

Clark, Frances N. The life history of *Leuresthes tenuis*, an Atherine fish with tide controlled spawning habits. Calif. Fish and Game Comm. Fish Bull. No. 10. 1925.

Clark, Frances N. The conservation of the grunion. Calif. Fish and Game, Vol. 12, pp. 161-166. 1926.

³ Gilbert, Charles H. Contributions to the life-history of the sockeye salmon. (No. 5) British Columbia Comm. Fish. Report, 1918, pp. 26-52.

⁴ Schmidt, J. The breeding places of the eel. Phil. Trans. Roy. Soc. London, 211-B, pp. 179-208. 1922.

spawning season of 1928. Until the night of June 5, many fruitless visits had been made to Cabrillo Beach, but on that night grunion were seen for the first time, and that these fish are not strictly home beach spawners was thus demonstrated. This first run of grunion was remarkably large, the fish appearing by the thousands. The run began about fifteen minutes after the turn of the tide and lasted about an hour.



FIG. 80. Cabrillo Beach at San Pedro, California. An artificial beach appropriated by the grunion as a spawning ground. August, 1928.

Fish were observed on the ocean side of the breakwater only and none were found on the protected inner beach. On the following night, a second good run was seen although only about half as great as on the previous night. Two weeks later, on June 20, another run occurred which was small in size and lasted about a half hour. Since the peak of the spawning season had been passed, a smaller run was to be expected at this time. Again, on July 4, a small school of grunion was found spawning on this new beach.

These four observations, on three successive series of favorable tides, demonstrate quite conclusively that individuals of this group of fishes do not necessarily return to spawn on the same beach on which they were hatched, but can adapt themselves to a new beach at least a limited distance from well established spawning grounds. For several years spawning grunion have been seen on Brighton Beach and on Long Beach, approximately five and ten miles from Cabrillo Beach. But whether a new beach at a considerable distance from any spawning grounds would be appropriated immediately by grunion remains in doubt.

In addition to the interesting ecological aspects of the occupation of Cabrillo Beach by the grunion during the first spawning season following the construction of the beach, and the consequent demonstration that grunion do not always return to spawn on the beach on which they were hatched, it is encouraging to learn that these fish are still present in sufficient numbers in the region of Los Angeles Harbor to furnish the exceptionally large run witnessed on June 5. The depletion of the grunion has reached the point where the complete extermination of the fish has been feared. But with the aid of the closed season, which is now effective between April 1 and June 30, it is hoped in a few years time that the spawning runs may be built up to something of their former magnitude.

THE TOTUÁVA FISHERY OF THE CALIFORNIA GULF

Trans-Desert Trucking of Mexican-Caught Fish ¹

By GEO. ROGER CHUTE

(With eight photographs by the author.)

The story of the strange commencement and meteoric rise of the Totuáva ² industry constitutes, no doubt, one of the most picturesque and interesting episodes in the history of fishing. Originating in an inhospitable and remote region, surrounded by the most discouraging natural obstacles, the traffic in this splendid food fish has leaped from inconsequential proportions into sudden gigantic maturity and arrogated to itself a position of conspicuous prominence in the fresh fish trade of southern California. So swift has been this happening that although thousands already have seen the product and come to appreciate its qualities under the name of "Mexican Bass," "White Sea Bass," or any other of several inexact designations, few persons have an understanding, as yet, of the remarkable circumstances surrounding the marketing of the great Totuáva.

State Laboratory Takes Early Interest. In the beginning days of the business, when it first was rumored that men with automobile trucks were bringing loads of big bass from out of the sweltering desolation of the Imperial valley deserts, an investigator was sent

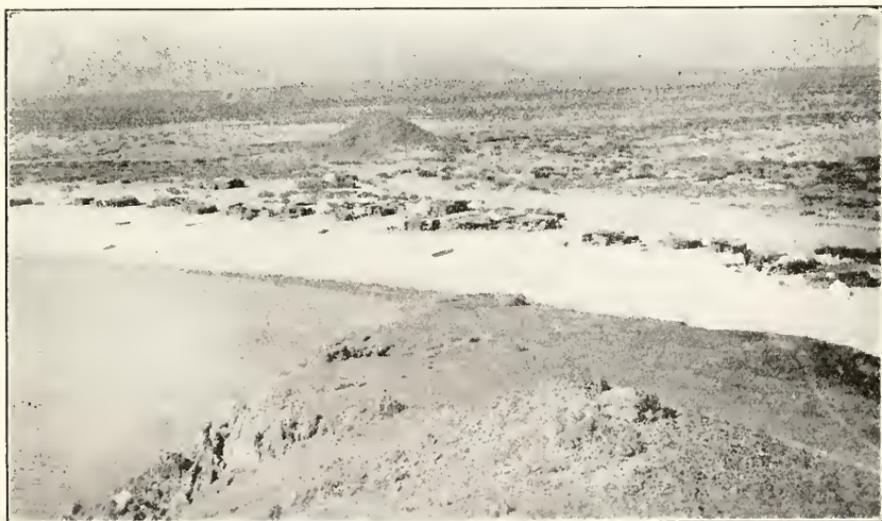


FIG. 81. A bird's-eye view of San Felipe, taken one morning when the beach was deserted, the canoe fleet being at sea, fishing. Waiting trucks at the right edge of the picture. March 11, 1927.

from the State Fisheries Laboratory at Terminal Island, California, to view the fishery. Floods in the deserts and impassable roads defeated that original purpose, but successive later attempts resulted in a

¹ Contribution No. 74 from the California State Fisheries Laboratory, August, 1928.

² The accent written above the word "Totuáva" (Tō-tō-áh'-väh) does not occur in the Spanish spelling, but it is here applied to facilitate correct pronunciation of a foreign word, new to our language.

continuous observance being made, and a record of progress has been kept, year by year.

Mexicans Commenced the Industry. A long time ago the fishing for Totuáva had its beginning at Guaymas, that once great seaport of the Pacific which lies part way up the mainland shore of the "Mar de Cortez," as the Mexicans seem to prefer to call the Gulf of Cali-

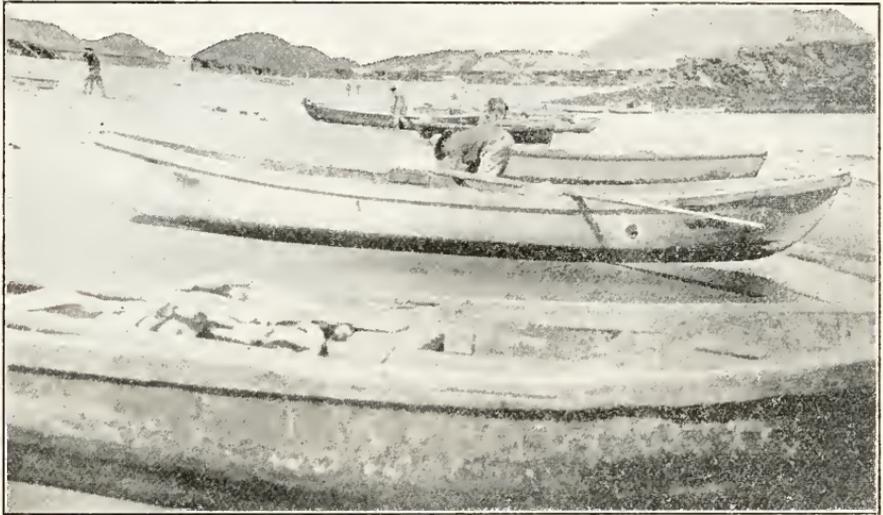


FIG. 82. Dug-out canoes of the Totuáva fishermen. These boats are brought from Jalisco, and are valued highly, since they last for more than a lifetime. Very few plank boats are used. March 12, 1927.

fornia. At Guaymas the fishing began, the Totuáva being held in high esteem, by the town folk of that time. But it happened that some Chinese of the place discovered that the sound or swim-bladder of the fish was of unusual character, and not dissimilar to that of fishes in the Orient which, when properly dressed and dried, sold for astonishing prices. So the experiment was tried, and the Chinese in China took so well to the new product that a regular sound-drying business arose. Many Mexicans were induced, by the high price offered for sounds or "buche," to go to sea in dug-out canoes in quest of the fish, and it is told by residents of the ancient town that eventually so many of the Totuáva were caught that to capture more became exceedingly difficult.

Search for Undepleted Waters. By the time this seeming condition of depletion is said to have become acute a number of white men had been attracted to the fishery by the unusual profits it offered, among these being a half dozen former German seamen—adventurous and capable men who had originally come into the country to seek for gold. These sea-bred prospectors found opportunity present for winning their gold from their accustomed ocean, they engaged in the fishing in serious fashion, and when the local scarcity reduced their revenue, went sailing away into virgin waters to discover this buche-yielding fish where it might be plentiful.

Expansion of the Fishery. And they did find it. Far to the northward, on the opposite side of the gulf, and perhaps only fifty miles

from the mouth of the Rio Colorado, rich fishing grounds were discovered. At the foot of a high rock headland, in the curve of a little bay, they built shelters of desert brush, found fresh water by making a well and commenced work. Of course the fish themselves were thrown away—only the swim-bladders or sounds were saved, these being cleaned with exact care and dried in the intense heat of the desert sun. Yes, desert sun, for the little camp lay on the edge of the Baja California waste lands, broad and hot. It was a hundred miles to running water; a hundred miles to the nearest town.

Formation of Fishing Settlements. But the fishing was rich, and the venture highly productive. The Germans sailed back to Guaymas with canoes loaded with bales of "buche," and the spectacle of their splendid success so emboldened the natives that each year thereafter increasing numbers of them followed the pioneers across the gulf to the camp called San Felipe. The first season men only went, but on the second wives and children were brought, and in this way the town sprang up, growing from an original five white men to as many hundreds of Indians and Mexicans.

Waste and Destruction. It is now impossible to calculate what tons of fish these people caught and wasted. But that the slaughter was appalling can not be doubted, for great consignments of baled "buche" were sent to China from Guaymas, all of it originating at San Felipe. It is true that occasionally a few fish were steaked, and the flesh sun-



FIG. 83. Dressing Totuáva on the beach. Only the truck drivers (fish buyers) wear shoes. During the height of the winter fishing many tons are landed every afternoon. The fish sold for five cents each four years ago, but now sometimes are in demand at as much as four cents a pound.

dried for carrying home to the mainland, but this utilization was insignificant compared with the tons and tons that were cast back into the sea.

First Sale of Fish Flesh. News of the presence of the fishing camp to the southward on the gulf finally reached the border town of Calexico, and there the waste of fish was told. Two American truck-

men, haulers of melons, cotton and hay, loaded their machines with barreled water and gasoline and with an abandon that was both heroic and pathetic went down over the roadless deserts, floundered through the mud plains of the Colorado, crossed the salt flats where there is no water in ninety miles, climbed the hills, negotiated a passage through the sand dunes and finally actually arrived at San Felipe. The Mexicans were astounded.



FIG. 84. Severing the spine at the base of the head. The fish in this picture were caught by three men in three hours, quarter of a mile from shore. Practically all of the fish in this picture were males, and yielded no "buche."

Twenty Pounds for One Cent. For ten centavos each (five American cents) as many hundred-pound Totuáva were bought as the trucks could carry out, and thus, in the winter of 1924-25, the fish truck traffic began. It was a fearful undertaking—and not without much real danger—to reach the seashore camp, but the fish were abominably cheap and the Mexicans glad to sell. The Americans realized large profits.

Further Expansion. San Felipe is now a purely Mexican town, the German founders having left. These voyaged across the gulf, as they had done before, and settled a second camp called Santa Clara. The natives have followed them there, also, and now the town produces more fish than ever has San Felipe.

Some Startling Statistics. The records of the United States Customs at the entry port of Calexico show that a sportsman brought the first Totuáva across the border there in 1923. "75 pounds sea bass—2 fish" reads the meticulous record, and that ended the business for the

year. But the ensuing winter, when the American truckers broke the road, the importations rose to 170,000 pounds. The next season, when twenty Mexican imitators followed the lead of the American pioneers, the quantity handled practically quadrupled. Since that time each annual increment has almost doubled the tonnage of the year before, and at present the combined product of the camps totals nearly two million pounds.

An Unconserved Resource. But the waste of fish goes on. Buche-making continues to be the main support of the fishery, for a big

sound is worth five dollars, whereas the fish itself brings only two dollars, even at present enhanced prices. Marketing the flesh of the fish is but a by-product of the buche business and serves only to enlarge the revenue of an already lucrative enterprise. So the buche-



FIG. 85. It is the fisherman's obligation, after selling his Totuáva, to deliver them to the truck. The fish are strung on the looms of long ash sweeps, for convenience in carrying. March 13, 1927.



FIG. 86. Loading the fish trucks at San Felipe. As much as 28,000 pounds of fish have been hauled out of camp in a single night. It is rarely that any ice can be brought so far, so the outward drive is a hard one, no stops being made except for a lunch until the border is reached. March 11, 1927.

making continues, wasting the resource from which it comes. During summer, when American markets are stocked with home-caught fish, the Totuáva trucks do not run. The canoes then wander away, following to Totuáva schools in their migration down the gulf. In remote

rendezvous the canoemen make their camp, buche drying racks are built and the destructive work goes on, the fish being wantonly wasted. But in the autumn the flotilla straggles home again, trailing the traveling schools northward, the arrival being timed to be coincident with the resumption of the truck trade.



FIG. 87. Fish truck caravan on the great "salitre," the wide salt desert of the middle road. Here it is 90 miles between supplies of water. High tides from the gulf occasionally flood this plain, converting it into a sea of bitter mud. March 10, 1927.

A Dug-Out Canoe Fishery. It is an odd association, this combination of rude and primitive Mexican fishery with the highly developed, specialized scheme of transportation which has been invented by the American haulers to get the fish to market. At the camps one sees the Indians and Mexicans launching their canoes at early dawn. Two or three to the dug-out, they paddle away to the grounds to handline over the side for man-sized fish. At noon they come sailing home on the inshore breeze, the catch is thrown out and dressed on the sand where the canoes are beached, and after the buches have been removed and carefully laid aside for later attention, the carcasses are sold to truckmen present at the time. Most of the haulers within the bounds of Mexico are now natives. These load the fish into small machines and commence a precipitous race for the boundary, driving against time, for the deserts are hot, the road is long, and there is no ice. Usually they succeed, but there have been many failures.

Refrigerated Transportation. At the border the American haulers are waiting. With giant trucks, carrying heat-proof refrigerator bodies, they receive the little loads of a half dozen Mexican vehicles before finally obtaining the five to six tons needed to cargo one of their own. The fish are first washed, then packed into the trucks in ice, and when evening comes the big mobile refrigerators commence the long run for San Pedro, the market. It is 237 miles from Calexico. From Yuma it is 317. Miles of hot desert must be traversed and the road leads from the shores of the Salton Sea—five hundred feet below sea level—to across the four thousand-foot mountain pass at Banning. But in

ten to fifteen hours the thing is done, for trucks leaving the border in the evening arrive at the markets at daylight the next morning!

A Record Achievement. Probably no other food fishery has sent its product to market by so striking a method. It is believed that the four-hundred-mile Gulf-to-San Pedro route is the longest motorized fish transit known and it is doubted whether there exists anywhere an express service so saving of time while crossing broad reaches of hot sand-lands to deliver a perishable sea food product in such perfect condition. Truck transit is notoriously costly and only a valuable commodity can afford its use, but the Totuáva is a superior food and a delicacy of increasing esteem and price.

Totuáva Catch of the Gulf of California by Seasons, July First of One Year to July First of the Next *

1923-24	-----	None
1924-25	-----	171,000 pounds
1925-26	-----	664,000 pounds
1926-27	-----	1,039,000 pounds
1927-28 (to April 25)	-----	1,838,000 pounds

* Statistical data from the records of The California State Fisheries Laboratory, Terminal Island, California.



FIG. 88. Mazes of rutted roadways cover the muddy flood plains of the Rio Colorado for many miles. During the river's freshets, or following winter rains, these oozy trails can not be crossed for weeks at a time. Bogging down with heavy loads is a frequent happening here. March 10, 1927.

A NOTE ON THE SQUAWFISH AND ONE OF ITS RELATIVES

By W. I. FOLLETT

(With four photographs by the author.)

There has been some discussion in recent numbers of CALIFORNIA FISH AND GAME regarding the trout-eating propensities of the squawfish or Sacramento pike (*Ptychocheilus grandis*, Girard) of the Sacramento-San Joaquin system and certain coastal streams. Those who are interested in passing judgment on this question from their personal



FIG. 89. A typical growth of the sedge (*Carex nudata*) which is eaten by *Mylopharodon*. Near Virgilia, Plumas County, California, on east branch of north fork of Feather River. June 17, 1928.

observations should bear in mind the fact that the squawfish is not the only large Cyprinoid to be found in California trout streams.

Consider for example the East Branch of the North Fork of the Feather River at a distance of ten or twelve miles east of Belden. This stretch of the river formerly contained rainbow trout in fair numbers. That they are now almost entirely gone is attributable to various man-made causes, but the fact that they were formerly abundant will permit us to consider this a "trout stream."

In this portion of the river is to be found not only the squawfish above mentioned, which there attains a length of three feet, but also an outwardly similar species of a related genus whose food habits are substantially different. This is *Mylopharodon conocephalus* (Baird & Girard), sometimes known as the "hardhead," which in the same locality reaches a length of upwards of 18 inches—next to *Ptychocheilus*, the largest member of the minnow family (*Cyprinidae*). It might be noted in passing that the squawfish here under discussion is not the largest species of the family. That honor must go to another species of

the same genus—the so-called “white salmon” of the Colorado River basin (*Ptychocheilus lucius*, Girard), said by Jordan and Evermann to reach a length of five feet and a weight of 80 pounds. Our squawfish, however, attains proportions second only to those of this giant of the Colorado.

As may be observed from the accompanying photographs, *Ptychocheilus* and *Mylopharodon* might easily be confused by the superficial observer. The number of dorsal and anal rays, as well as the scale counts, are so nearly alike that individual variation renders this method of distinguishing the two quite unsatisfactory in the absence of a series of specimens. In general the coloration of *Ptychocheilus* tends more toward silvery upon the sides, where *Mylopharodon* is of a dusky hue, and the lower fins of the former take on an orange tinge during the breeding season, while those of the latter are dark-colored at all times. But coloration is an exceedingly variable quantity, greatly affected by such factors as light and shade, and the degree of clearness of the water. Again, generally speaking, *Ptychocheilus* has a large mouth, *Mylopharodon* a considerably smaller one. This is perhaps the most satisfactory means of hasty identification, but here we run afoul of the fact that the relative size of various parts of the anatomy of these fishes varies a great deal with the age of the individual. One of the most satisfactory methods of distinguishing the two is by an examination of the lower pharyngeal teeth. The pharyngeal bones are situ-

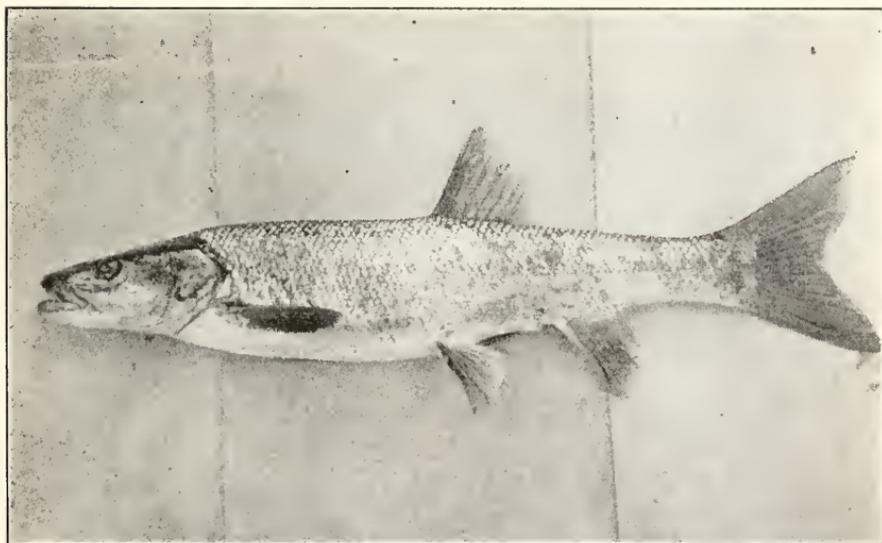


FIG. 90. Squawfish or Sacramento pike (*Ptychocheilus grandis*). Length (total) 15 $\frac{5}{8}$ inches. East branch of north fork of Feather River, near Virgilia, Plumas County, California. June 10, 1928.

ated behind the gills, corresponding in position to a fifth gill-arch. They may be easily removed while “cleaning” the fish. In *Ptychocheilus*, the teeth borne on these bones are slender and slightly recurved, without any trace of a grinding surface. They may be termed raptorial—adapted to seizing upon the prey which the fish has taken into its mouth. Teeth of this sort are typical of the subfamily *Leuciscinae*,

to which *Ptychocheilus* belongs. *Mylopharodon*, on the other hand, has given its name to a distinct subfamily, the *Mylopharodontinae*, both words being derived from a shortened form of the Greek *Mylopharyn-*

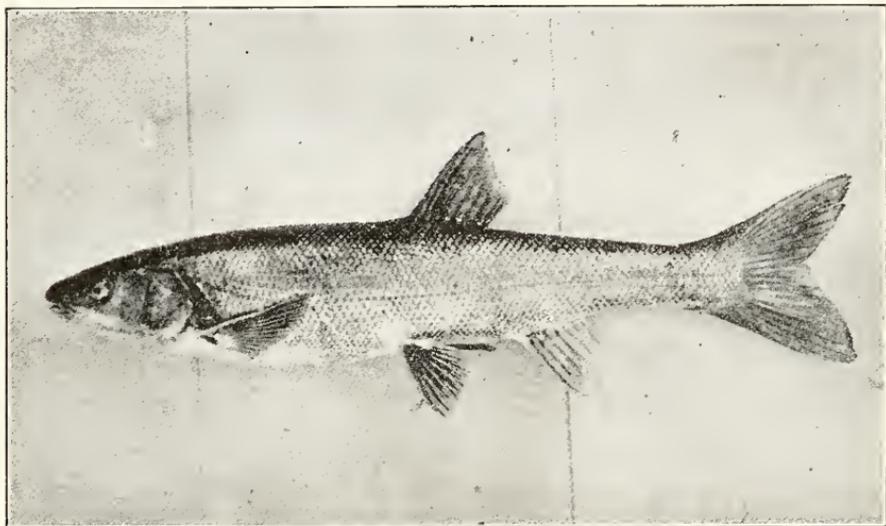


FIG. 91. Hardhead (*Mylopharodon conocephalus*). Length (total) 15 inches. East branch of north fork of Feather River, near Virgilia, Plumas County, California. June 16, 1928.

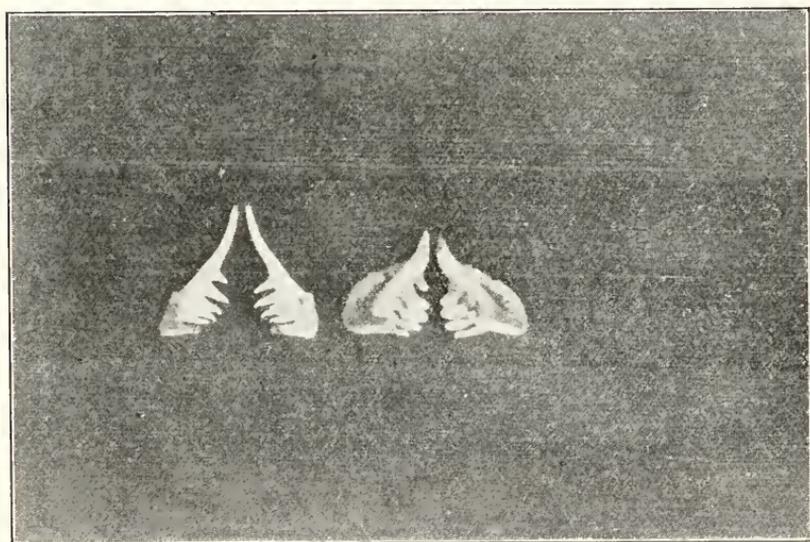


FIG. 92. Lower pharyngeal teeth of *Ptychocheilus* (left), and *Mylopharodon* (right).

godon, which may be translated "grinder-pharynx-tooth." How accurately this word describes the fish in question will be appreciated when one observes the enlarged molar pharyngeal teeth with flat grinding surfaces.

It has been the writer's observation that *Ptychocheilus* is an exceedingly voracious fish, a true carnivorous type. It will without hesitation seize a fish of its own kind which shows the slightest signs of being disabled, even though its prey be so nearly its own size that it is unable to swallow the victim. A good-sized piece of fresh fish "skittered" across the surface of the water, or a small live frog hooked so that it can swim, will prove an excellent bait for the squawfish.

Mylopharodon, however, is at least partly herbivorous. The writer has examined stomachs of this species which contained nothing but a mass of sedge or "tuft grass" (*Carex nudata*), the leaves of which frequently trail in the water and are readily accessible from beneath the surface. Although this fish will also take a grasshopper in lively fashion, it is not a voracious type like its relative, and will probably be found to do little harm to trout unless it be by destroying their spawn.

Whether or not *Ptychocheilus* actually devours live and uninjured young trout the writer can not say from his own observations, but there is no reason at all to doubt that it would seize a crippled trout. And on the other hand, it is an interesting fact that a piece of squawfish will often prove successful as a bait for rainbow trout at times when most other lures are of no avail.

THE BONEFISH—OVERLOOKED BY CALIFORNIA SPORTSMEN

By W. I. FOLLETT

(With one photograph by the author.)

In volume 4 of CALIFORNIA FISH AND GAME, at pages 59-60, Professor Starks describes the Bonefish (*Albula vulpes* [Linnaeus]), variously known as ladyfish, macabí, sanducha, and bananafish.

The name first given is that by which it is known to the majority of fishermen on the Florida coast, where, in relatively recent years, it has attracted an extraordinary amount of interest, and is considered one of the most desirable of game fish—in fact great numbers of anglers are said to make annual pilgrimages to Florida in quest of this fish alone.

The high esteem with which sportsmen regard the bonefish is shown by the fact that Zane Grey, in his book entitled "Tales of Fishes," describes it as "the gamest fish that swims," while Wendell Endicott, in his "Adventures with Rod and Harpoon Along the Florida Keys," considers the taking of a bonefish to be "the champagne of fishing."

It is remarkable, therefore, that it has not attracted more attention on the Pacific Coast, for it is quite generally known to occur in San Diego Bay, and the writer has on more than one occasion taken it from the south side of Terminal Island in Los Angeles harbor, while fishing for croakers and surf-fish.

In the latter locality the most successful bait for this fish, as for most others, proved to be the segmented sea-worms (*Nereidae*), known to fishermen as "pile worms" because of their being found among the

mussels and barnacles of wharf piles. In Florida, however, the hermit-crab is said to be the bait regarded with greatest favor.

As a food-fish, *Albula* has the disadvantage of being exceedingly bony, as indeed, are most of its kindred, but the flesh, like that of the shad, has an excellent flavor, and one who has the patience and skill to cope with the bones will find it much to his liking.

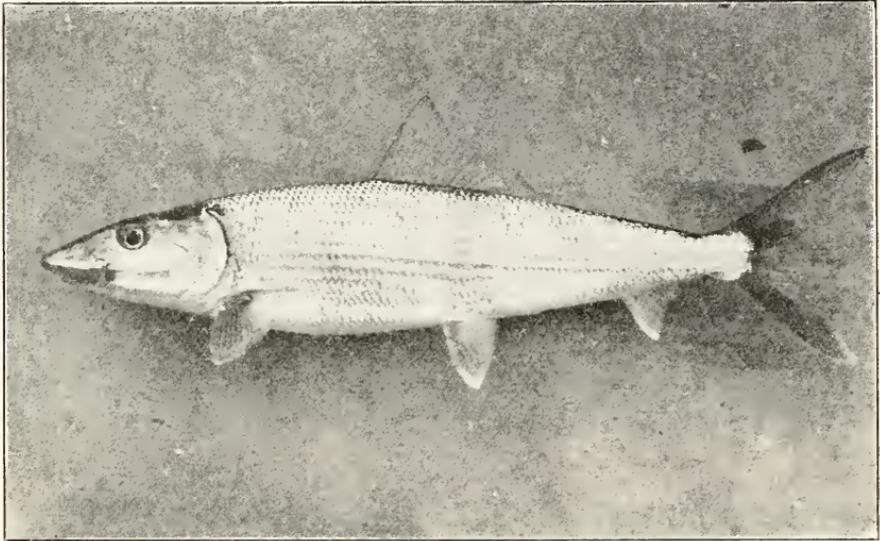


FIG. 93. Bonefish *Albula vulpes* (Linnaeus). Family *Albulidae*. Length (total) 15 inches. Terminal Island, Los Angeles Harbor, California. October 28, 1926.

INTESTINAL PARASITES OF WILD DUCKS AND GEESE*

By E. C. O'ROKE, Parasitologist

(Diseases of fish and game in California. Paper 2.)

While many different kinds of intestinal parasites have been reported from wild ducks and geese, our knowledge concerning the majority of them is meager and based upon random observations rather than upon concerted effort. This is not unusual. It merely represents a stage of progress comparable to that of our knowledge of the parasites of domestic poultry until in recent years.

By comparison, we are safe in saying that parasitism in wild birds just as in domesticated birds deals with matters involving many factors and relationships.

Fox† in discussing parasitism among wild geese and ducks at the

* This is the second article from the Bureau of Research on parasites of game birds. The first concerned parasites of the valley quail, and was published in the July number of this publication. We are grateful to the University of California for continued use of the laboratory facilities of the Zoology Department and to Professor C. A. Kofoid, chairman of this department, for helpful advice and for allowing the use of his personal library. Credit is due Mr. O. L. Williams of this department for finding and identifying the gizzard worms mentioned in this report.

The work on parasites is a part of a survey of game diseases which has been undertaken by the Division of Fish and Game. The study of game diseases has been made possible largely through the cooperation of the University of California. Dr. K. F. Meyer, Director of Hooper Foundation for Medical Research, has accepted an appointment as Consulting Pathologist and is supervising our pathological investigations.

† Fox, Herbert, 1923. Disease in captive wild mammals and birds (J. B. Lippincott Co., Philadelphia, Pa.), 665 pages, 87 figs. in text, pls. included.

Philadelphia Zoological Gardens gives figures showing that of the birds that died in a given period of time at the gardens, 15 per cent of the geese and 4 per cent of the ducks were parasitized with various kinds of flukes and tapeworms.

This situation suggests further analysis. Are wild birds in zoological gardens more prone to harbor parasites than they are in their native wild state?

What kinds of parasites are present in wild ducks and geese? What about their relative numbers? What about their host and geographic distribution? How do they directly or indirectly affect the welfare of the birds?

Obviously questions of this kind can not be answered by drawing conclusions from conditions that prevail in domesticated birds or in wild birds in captivity, owing to differences in environment and feeding conditions, and the survey method is suggested as being the most logical procedure to follow.

For many years, serious losses among wild ducks have attracted the attention of those interested in their preservation. Since the nature of the malady or maladies has remained obscure, it was thought that a survey of parasites, in addition to being desirable in itself, might be of value at least indirectly or as a matter of elimination, in investigations of duck sickness that are now being carried on by this Division.

Accordingly with the opening of the duck season in 1927 a survey of parasites was begun. Sufficient progress has now been made that a report can be issued at this time. As will be seen by the accompanying map, an attempt has been made to extend the survey to areas where duck sickness has been reported as well as to places apparently free from the malady.

METHOD OF INQUIRY

With the helpful cooperation of various gun clubs, employees of the Division of Fish and Game have been able to be present on shooting days, and have thus had access to more material than they could have obtained working independently.

As the birds were brought in and the entrails removed, casual examination was made immediately for any obvious or unusual conditions occasioned by parasitism. Samples of all parasites found were then collected, preserved, and taken to the laboratory for later study.

The following table shows the results of the survey to date. Due to the unsettled condition of the literature on the Trematode and Cestode worms, no attempt has been made to classify some of the specimens into divisions lower than the genus to which the specimen belongs.

Owing to lack of space in the table, the authorities' names are not included with the genera and species. In accordance with correct usage, however, the list is included and is as follows:

Ascaridia lineata (Schneider, 1866).

Hymenolepis lanceolata (Bloch, 1782) Weinland, 1858.

Hymenolepis anatina (Krabbe, 1869) Cohn, 1901.

Zygocotyle ceratosa Stunkard.

Genus *Diorchis* Clere, 1903.

Genus *Amidostomum* Raillet and Henry, 1909.

Genus *Notocotylus* Diesing, 1839.

CANADA GOOSE

Branta canadensis canadensis (Linnaeus)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	12/4/27	Live Oak	O	-----	-----	-----
2	12/4/27	Live Oak	O	-----	-----	-----
3	12/4/27	Live Oak	O	-----	-----	-----
4	12/4/27	Live Oak	O	-----	-----	-----
5	12/4/27	Live Oak	O	-----	-----	-----
6	1/3/28	Jacksnipe	Thread worm <i>Amidostomum</i> sp?	Gizzard	3	-----

LESSER SNOW GOOSE

Chen hyperboreus hyperboreus (Pallus)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	Tapeworm <i>Hymenolepis taenicolata</i>	Small intestine	1	-----
2	11/19/27	Los Banos	O	-----	-----	-----
3	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard	3	-----

HUTCHIN'S GOOSE

Branta canadensis hutchinsi (Linnaeus)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	Tapeworm <i>Hymenolepis taenicolata</i>	Small intestine	2	-----
2	11/19/27	Los Banos	O	-----	-----	-----
3	11/19/27	Los Banos	O	-----	-----	-----
4	11/19/27	Los Banos	O	-----	-----	-----
5	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard	3	-----
6	11/19/27	Los Banos	O	-----	-----	-----

ROSS SNOW GOOSE

Chen rossii (Cassin)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	Fluke <i>Notocotylus</i> sp?	At the junction of caeca	7	-----
2	11/19/27	Los Banos	O	-----	-----	-----
3	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard	2	-----
4	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard	7	-----
5	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard	3	-----

PINTAIL OR SPRIG
Dafla acuta teitzithoa (Vieillot)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	Tapeworm <i>Diorchis</i> sp?	Small intestine	5	
2	11/19/27	Los Banos	0			
3	11/19/27	Los Banos	0			
4	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard	2	
5	11/19/27	Los Banos	Tapeworm <i>Hymenolepis anatina</i>	Small intestine,	1	
6	11/19/27	Los Banos	Nematode cyst	Outer wall of gizzard.		Unidentified.
7	11/19/27	Los Banos	0			
8	11/19/27	Los Banos	0			
9	11/19/27	Los Banos	Tapeworm <i>Hymenolepis anatina</i>	Small intestine	Many	Immature.
10	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard	2	
11	11/19/27	Los Banos	Tapeworm <i>Hymenolepis anatina</i>	Small intestine	Many	Immature, intestine inflamed.
12	11/19/27	Los Banos	0			
13	11/19/27	Los Banos	0			
14	11/19/27	Los Banos	0			
15	11/19/27	Los Banos	0			
16	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?			Individual records of these small nematode worms from gizzards not kept, but the numbers ran from 2 to 5 in each individual, numbers 16, 17, 21, 25, 26, 27, 30, 31, 32.
17	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?			
18	11/19/27	Los Banos	0			
19	11/19/27	Los Banos	0			
20	11/19/27	Los Banos	0			
21	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard		
22	11/19/27	Los Banos	0			
23	11/19/27	Los Banos	0			
24	11/19/27	Los Banos	0			
25	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard		
26	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard		
27	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard		
28	11/19/27	Los Banos	0			
29	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard		
30	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard		
31	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard		
32	11/19/27	Los Banos	Thread worm <i>Amidostomum</i> sp?	Gizzard		
33	11/19/27	Los Banos	0			
34	12/ 4/27	Live Oak	0			
35	12/ 4/27	Live Oak	0			
36	12/ 4/27	Live Oak	0			
37	12/ 4/27	Live Oak	0			
38	12/ 4/27	Live Oak	0			
39	12/ 4/27	Live Oak	Tapeworms <i>Hymenolepis anatina</i>	Small intestine	3	
40	12/ 4/27	Live Oak	Tapeworms <i>Hymenolepis anatina</i>	Small intestine	2	
41	12/ 4/27	Live Oak	Caecum worms <i>Ascaridia</i> sp?	Caecum	7	
42	12/ 4/27	Live Oak	Tapeworms <i>Hymenolepis anatina</i>	Small intestine	2	
43	12/ 4/27	Live Oak	0			
44	12/ 4/27	Live Oak	0			
45	12/ 4/27	Live Oak	Tapeworms <i>Hymenolepis anatina</i>	Small intestine	3	
			Caecum worms <i>Ascaridia</i> sp?	Caecum	1	

The gizzards of Nos. 34-37, inclusive, not examined.

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
46	12/ 4/27	Live Oak	Tapeworms	Small intestine	4	
47	12/ 4/27	Live Oak	<i>Hymenolepis axatina</i>			
48	1/ 4/28	Jacksnipe	0			Hard tumor on mesentery probably caused by parasitic nematode.
49	1/ 4/28	Jacksnipe	0			
50	1/ 4/28	Jacksnipe	0			
51	1/ 4/28	Jacksnipe	0			
52	1/ 4/28	Jacksnipe	Fluke <i>Zygocotyle ceratosa</i>	Small intestine	1	
53	1/ 4/28	Jacksnipe	Thread worm <i>Amidostomum</i> sp?	Gizzard	?	Lining of intestine a mass of scar tissue.
54	1/ 4/28	Jacksnipe	0			It is interesting to note that this lot of sprig, Nos. 48-53, taken on the salt marshes, are not as heavily parasitized as other lots taken on fresh water in the inland valleys.
55	1/ 4/28	Jacksnipe	0			
56	1/ 4/28	Jacksnipe	0			
57	1/ 4/28	Jacksnipe	0			
58	1/ 4/28	Jacksnipe	0			
59	1/ 4/28	Jacksnipe	0			
60	1/ 4/28	Jacksnipe	0			
61	1/ 4/28	Jacksnipe	0			
62	1/ 4/28	Jacksnipe	0			
63	2/11/28	Bakersfield	0			
64	2/11/28	Bakersfield	Ameba	Caecum	Many	Protozoan parasite.
65	2/11/28	Bakersfield	Ameba	Caecum	Many	Species unidentified.
66	2/11/28	Bakersfield	0			No worm parasites found in this lot.
67	2/11/28	Bakersfield	0			
68	2/11/28	Bakersfield	0			

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	0			
2	12/ 4/27	Live Oak	0			This lot of widgeons, numbering in all 15 from three different localities, showed no parasitism of any kind.
3	12/ 4/27	Live Oak	0			
4	12/ 4/27	Live Oak	0			
5	12/ 4/27	Live Oak	0			
6	12/ 4/27	Live Oak	0			
7	1/ 3/28	Jacksnipe	0			
3-15	1/ 3/28	Jacksnipe	0			

AMERICAN WIDGEON
Mareca americana (Gmelin)

GREEN-WINGED TEAL,
Nettion carolinense (Gmelin)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1-7	11/19/27	Los Banos	0			
8	11/19/27	Los Banos	0	Gizzard	1	In all 23 teal from three localities were examined with only one record of parasitism.
9-14	11/19/27	Los Banos	0			
15-18	12/ 4/27	Live Oak	0			
19-23	1/ 3/28	Jacksnipe	0			

MALLARD

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	1/ 3/28	Jacksnipe	0	-----	---	-----

Anas platyrhynchos (Linnaeus)

CANVASEACK

No. of Bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	1/ 3/28	Jacksnipe	0	-----	---	-----
2	1/15/28	Vallejo	Tapeworms <i>Hymenolepis</i> sp?	Small intestine	3	-----
3	1/15/28	Vallejo	Tapeworms <i>Hymenolepis</i> sp?	Small intestine	12	-----

Maria valisineria (Wilson)

SHOVELLER OR SPOONBILL

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	0	-----	---	-----
2	12/ 4/27	Live Oak	0	-----	---	-----
3	12/ 4/27	Live Oak	0	-----	---	-----
4	1/ 3/28	Jacksnipe	0	-----	---	-----

Spatula clypeata (Linnaeus)

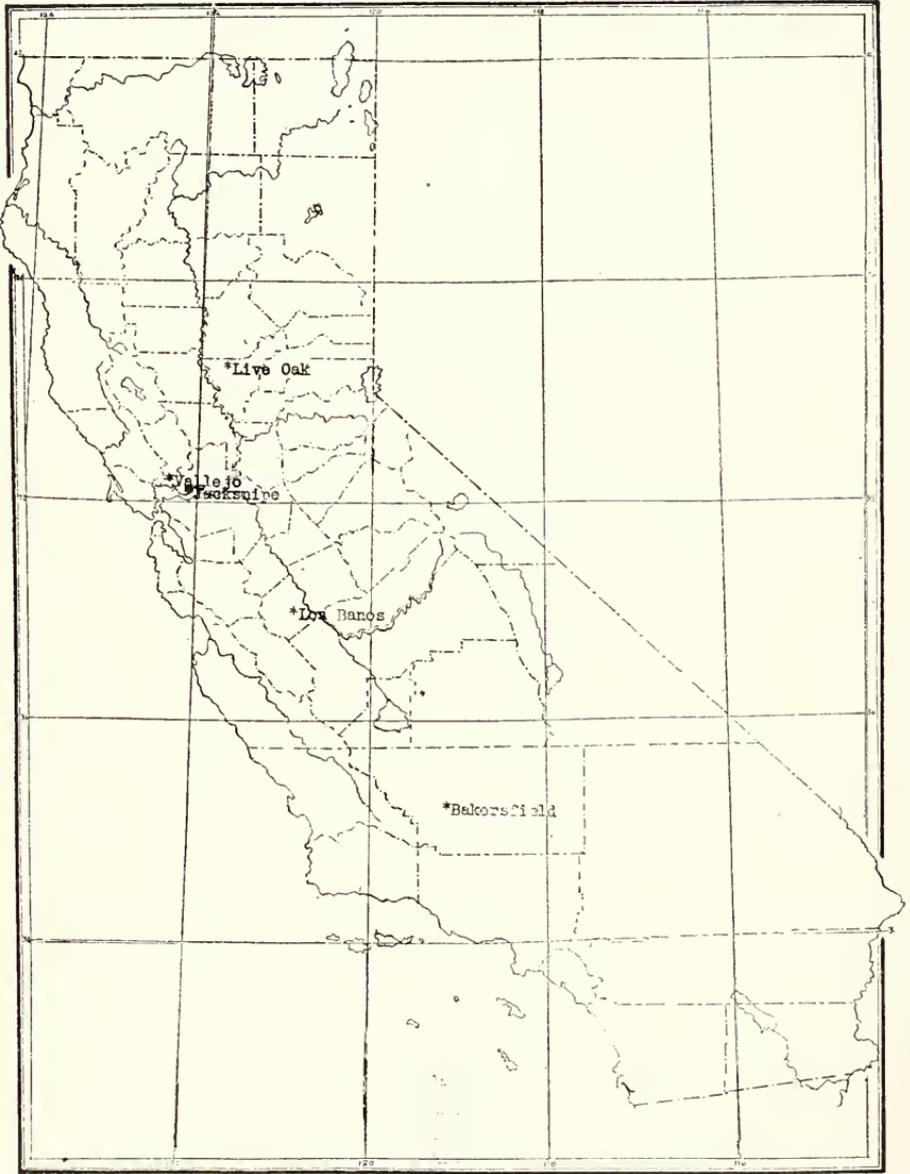


FIG. 94. Outline map of California showing locations where collections of parasites of ducks and geese have been made.

While the preceding table shows the numbers of different species of birds examined and the conditions of parasitism with regard to each, it does not take into consideration several interesting comparisons which are apparent when the subject matter contained in the table is rearranged.

Disregarding kinds of parasites and arranging a table to show the number of birds of each species that were examined and the percentage parasitized, the tabulation is as follows:

<i>Species of bird</i>	<i>Number examined</i>	<i>Number parasitized</i>	<i>Per cent parasitized</i>
Mallard -----	1	0	.0
Spoonbill -----	4	0	.0
Widgeon -----	15	0	.0
Green-winged teal -----	23	1	4.3
Canada goose -----	6	1	16.6
Hutchin's goose -----	6	2	33.3
Pintail -----	68	42	62.0
Lesser snow goose -----	3	2	66.6
Ross snow goose -----	5	4	80.0
Totals -----	131	52	39.4

A further analysis of this table shows that with the single exception of the Canada goose, all of the geese are in the group that shows a high percentage of parasitism. If these figures represent an average sample of the conditions of parasitism obtaining among our common waterfowl, it would seem that the pintails and the geese are more susceptible to parasites than the others are. This condition might have its explanation in relative immunity or in differences in feeding habits.

As to correlations existing between the conditions of parasitism found and the localities studied, the collections from Vallejo and Bakersfield were so small as to be of doubtful value for comparison with those from other localities. Fortunately, Live Oak, Los Banos and Jacksnipe afford interesting data for comparing conditions in the Sacramento and San Joaquin valleys and in a typical salt-water marsh area. The figures are as follows:

<i>Locality</i>	<i>No. of birds examined</i>	<i>Number parasitized</i>	<i>Per cent parasitized</i>
Jacksnipe -----	26	3	11.5
Live Oak -----	29	8	27.6
Los Banos -----	63	26	41.2

It would seem from this table that parasitism is more common in birds that frequent inland bodies of fresh water than it is in those that live habitually on the salt marshes. Also it appears that birds are more heavily parasitized in the San Joaquin Valley than they are in the Sacramento Valley. The various matters of migrations, feeding habits, summer conditions, etc., are so complicated that it is indivisible to draw too many conclusions from one season's work with a limited number of birds.

Referring back to the original table, it will be noticed that by far the most common parasite found was the small thread worm *Amidostomum* sp? This form is almost microscopic in size, about the diameter of ordinary sewing thread, and lives embedded in the inner surface of the gizzard just at the edges of the grinding pads. They averaged

from one to five per parasitized bird, and the records show that this form was found in twenty-three different birds belonging to six different species.

The tapeworm *Hymenolepis anatina* was next in abundance, being found eight times, but only in pintail ducks. Four specimens were the most found in any one bird with the exception of two cases where the tapeworms were immature, and so small that an accurate count was not made.

Another tapeworm *Hymenolepis lanceolata* was found but twice in two different species of geese. The round worm *Ascaridia* sp? was likewise found but twice in only one species of bird.

All other records are based upon finding the parasite only once and in one host only.

From the foregoing tables and discussion it will be seen that intestinal parasites are present in nearly all species of our ducks and geese commonly taken during the hunting season. The fact that no parasites were found in the small numbers of mallards, spoonbills and widgeons examined does not necessarily mean that these birds are not parasitized. Another season might show a higher percentage of these birds in the bag and parasites in proportion to their number. No cases were found where mature parasitic worms were really abundant. With two or three exceptions the parasitized birds seemed to be in as good condition as the unparasitized ones.

The above studies being made in late fall and winter with mature birds give, of course, no picture of the situation that may prevail among the young birds in early summer where parasitism may be of considerable importance. In this connection it may be said that the life cycles of parasites and the susceptibility of various hosts to infection by such parasites are the factors to be considered. The life cycles of only a few of the worm parasites of birds are known, and all of these involve complex factors of food relationships of the birds and the things upon which they feed.

From the standpoint of intestinal parasites, the survey thus far has disclosed no apparent relationships existing between duck sickness and the presence of parasites.

As has been mentioned previously protozoans, particularly amebae have been found in the digestive tracts of two sick ducks from Buena Vista Lake that were being kept under observation. This is of interest and suggests the desirability of making more extensive collections of these organisms than was done in last season's work. To do this will involve the use of special equipment in the field for making up the material on microscope slides and preserving it immediately after the birds are killed.

Those who observed the collecting of parasites in the field last year will recall that it is a comparatively simple matter. The following diagram will give an idea as to the relationships of the parts of the digestive tract and the places where parasitic worms may be found.

The intestinal tract is removed from the bird and placed in a pan of water. It is then slit open with small scissors and examined in the water. Using a pipette or medicine dropper to squirt little jets of water into the opened intestine serves to free the parasites from the surrounding material. When a parasite is found, it is washed free,

lifted out by means of a camel's hair brush and placed in the preserving fluid. Round worms and flukes can be handled with a small pair of forceps, but tapeworms are usually broken by this method of handling. The greatest danger of destroying tapeworms as specimens in the process of collecting them is to break off the scolices (heads) which are attached to the intestinal wall. It is important that these heads be intact for they are invaluable for identification.

For collecting the small gizzard worms, a sharp-pointed pair of forceps should be used.

Four per cent formaldehyde makes a good fixing and preserving fluid. An important thing to remember is that a generous amount of

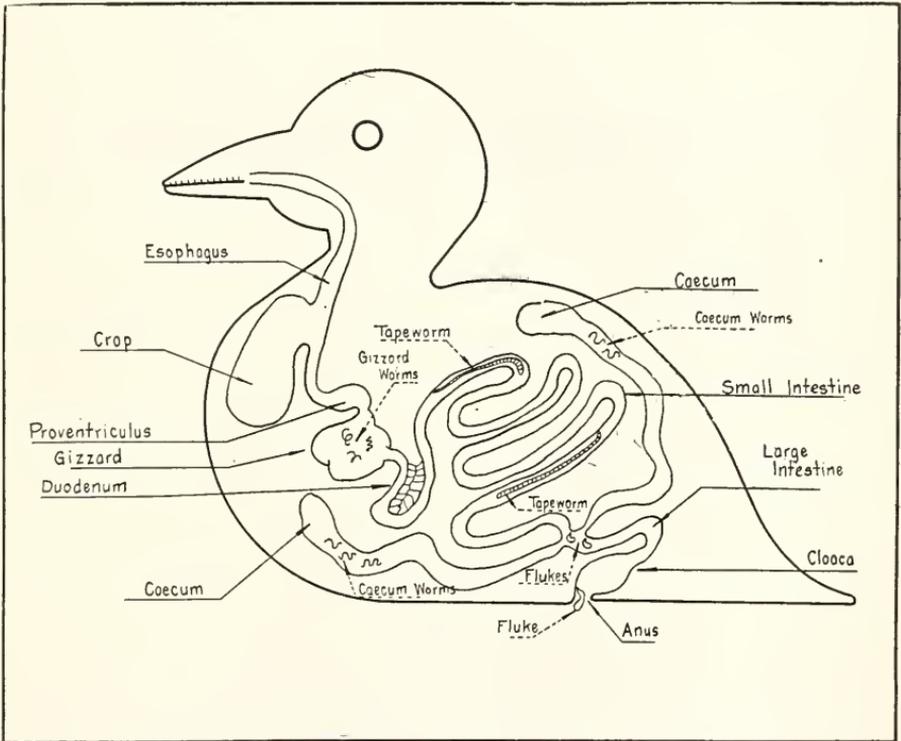


FIG. 95. Diagram of intestinal tract of duck showing places where parasites may be found.

the preserving liquid should be used. About ten times as much liquid as the bulk of the specimens is the correct amount to use. Most important of all is exact labeling, stating the host bird, the locality, date, the place in the host where the parasite is found, and the collector's name.

Interest taken by sportsmen and others in the parasite survey of game birds will be appreciated by the Division and we will also be glad to obtain any specimens that may be sent in.

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FIG. 96. Rescuing fish from overflow area. August, 1928.
Photograph by George Neale.

FISH RESCUE AND RECLAMATION

By GEORGE NEALE

(With three photographs by the author.)

While the Division of Fish and Game has previously been engaged in fish rescue work principally of black bass, its purpose was, primarily, to fill requisitions for the stocking of barren waters or for replenishing those waters which were over fished more than from a conservation viewpoint. No funds had been available or organization created to carry on the work.

The work of rescue and distribution was carried on for a number of years out of Sacramento by the late deputy Manuel Cross and the writer. The conditions were ideal for natural propagation in both Yolo and Sacramento counties. There were more black bass, possibly, in those two counties than in all the state. A total of 507 shipments of large mouth bass were made during the years 1904 to 1912 to counties as far south as San Diego and north to Siskiyou. Up to this date the other spiny-rayed tribe, crappie and sun fishes, were not in sufficient numbers to justify their removal to other waters for stocking purposes. Since then these spiny-rayed fishes were introduced into the Sacramento and San Joaquin valleys and thrived so remarkably well, because of the natural propagating conditions existing, that the angling fraternity has learned the economic and great outdoor value

of them. Consequently, the demand has grown and increased very materially. It is not generally known that these spinous fishes can not be egged or spawn stripped for artificial propagation as are the salmon family. Nature furnishes these fish with outdoor hatcheries and the fish take advantage of flood conditions to make it possible for the parent fish to select their own spawning areas to reproduce themselves. But unfortunately, these spawning areas are not controlled by human agencies as are our hatcheries for trout or salmon. Later these overflow areas become dry through evaporation. Both young and adult fish consequently become a prey to both predatory birds and animals and thus become total loss.

From my experience in fish rescue work of over twenty years I have estimated that the *loss of spinous fishes*, striped bass, black bass, all of the crappies and sunfishes, including catfish, and all of great economic value, exceeds the output of three of our largest artificial propagating plants. Since a license is now required to angle for them and since none are artificially propagated it is logical that we should take advantage of what nature offers. This is the purpose of the "Bureau of Fish Rescue and Reclamation" work by the Division of Fish and Game of the Department of Natural Resources. I have advocated this work for many years. Many of the eastern and middle western states are engaged in this work, also the U. S. Bureau of Fisheries, and have been for many years.

California received her first shipment of spiny-rayed fishes for stocking our waters upon requisition by our fish cultural department,

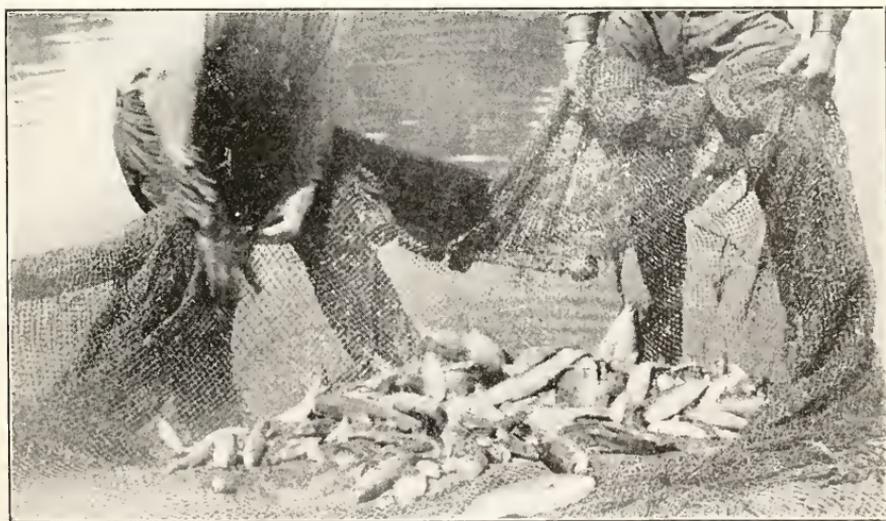


FIG. 97. A catch of fish ready to be transported to more favorable conditions. August, 1928. Photograph by George Neale.

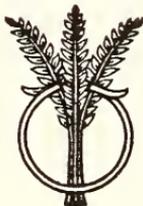
from the U. S. Bureau of Fisheries. They have thrived in the great valleys.

During the month of August, 258,200 of these valuable fishes were saved to the anglers of the state. These have been transplanted into living waters. Several shipments have been made to southern California. The Division's fish car has distributed ten eans of crappie and

sunfish to waters above the Santa Anita dam, Los Angeles County; twenty-four cans of crappie, sunfish and catfish to Henshaw Lake, San Diego County; thirty-four cans bluegill and crappie to Diez Lake, Inyo County; thirty cans mixed fish to Big Bear Lake, San Bernardino County, and six cans of catfish to Foss Lake, San Diego County. All the above were from the overflow of the Cosumnes, Mokelumne and American river watersheds. The torrid weather during the time the work was going on made it impossible to hold the smaller fish any length of time except the catfish, or for any great distance, consequently the larger fish were shipped and the small fry returned to the nearest living waters.

Captain E. W. Smalley of Hanford has been very active in fish rescue work in his district. He reports having saved up to August 31st, 158,200 fishes, 110,200 of which were catfish, 15,000 of which were planted in Kings River, 4000 in Cross Creek, Tulare County, and 40,000 in Kaweah River, McKays Point. The other species, black bass, crappie and sunfish, were returned to the main rivers.

In the saving of the game and food fishes I would eliminate all the useless nonfood fishes that are of no commercial or food value, of which there are several. I would also condemn the rapidly growing practice of the promiscuous use of minnow seines now used for gathering bait in fresh waters. This practice is harmful for the reason that the seining destroys the spawn of the game fishes. It also kills many young game fishes caught in the seine, many of which are returned to the water dead or left to perish on the shore. Unfortunately, many species of the finny tribe have been introduced into waters contrary to existing law and with no authority. If I am permitted it will be the policy of this bureau to stock barren waters with the species of fish most adaptable to existing conditions.



CALIFORNIA FISH AND GAME

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December 10, 1928

Most of us, as we grow older, grow to care relatively less for the sport itself than for the splendid freedom and abounding health of outdoor life in the woods, on the plains, and among the great mountains.—Theodore Roosevelt.

HEAD OFFICE MOVED

On the last two days of August, the head office of the Division of Fish and Game at San Francisco was moved from the Postal Telegraph Building to the fifth floor of the Russ Building, San Francisco's new skyscraper. The new accommodations, which occupy the Bush street wing, are furnished in dark mahogany. One enters a lobby with an information desk opposite. Then follow on the left of the hallway, the license bureau, department of patrol, bureau of research, bureau of public relations, department of commercial fisheries; to the right of the hall is found the library, bureau of education, bureau of hydraulics and department of fish culture. Most of the departments are in one large room separated by railings. A suitable telephone system connects all departments. Although missing the privacy given by separate rooms, the new accommodations give a businesslike appearance. A laboratory and a dark room are additional facilities. Most of the storage room is in the basement.

The Russ Building is thirty stories high and although but eighty per cent occupied at present, accommodates 4000 people, a city in itself. It has been advertised for some time as the "business center of San Francisco."

GAME RESTORATION

Someone has coined a worthwhile phrase. The term "game restoration" aptly describes recent attempts to restore game conditions. In some instances, a

stocking program backed by modern game farms is bringing back game in the cultivated areas. The phrase is also apt when describing what Utah has done in improving conditions for wildfowl. Valueless land was purchased, dikes were built and the land flooded with water to a depth of a foot. Proper conditions being furnished, wildfowl find here a suitable feeding and breeding ground. This is game restoration. There should be more of it!

OBLIGATIONS

Many people seem to have the idea that having paid their hunting and angling license fee they can put the burden of conservation and protection on the state department. These same persons, although paying little attention to season and limit laws, curse the Division of Fish and Game for allowing certain species to disappear. The state department in charge often attempts to shoulder the greater responsibility which comes with larger numbers of hunters and changing conditions which limit the food supply of game. In recent months, there has been a *concerted effort* made to stir sportsmen themselves to responsibility. Their obligation is not ended with the payment of dues in a game protective association, or the payment of a license fee. A real game restoration program is dependent upon the concerted effort of the whole body of sportsmen backed by public sentiment. A fish and game commission can only accomplish a share of the work to be done. Such an organization usually lives up to its responsibility as best it can, but some of the burden must be shouldered by those who hunt and fish.

MORE STATE PARKS NEEDED

Even though California possesses a full share of national forests and national parks, yet she is convinced that sufficient recreation grounds have not yet been set aside. Much state-owned land, which should have been saved, has become private property and necessity now forces the state to buy suitable recreation areas. Here is a state with a population of 5,000,000 which owns but five state parks. A state parks program has been formulated and voters of the state are asked to provide a bond issue of \$6,000,000 in order to insure the recreational feature for her citizens. This sum is to be matched by an equal sum in private donations.

Buildings are built and rebuilt and so are roads, but when natural scenery and wild life resources are destroyed by conversion of lands to other uses, they are

gone forever and impossible to replace. This is a sound argument for immediate action. The needs of the future must be anticipated.

California is not the only state that has waked up to recreational needs. The state of Connecticut is buying and leasing her streams for the use of the public for fishing and recreation. New York has authorized bond issues aggregating \$25,000,000 for forests and public parks. Pennsylvania has expended over \$4,000,000 to buy forest lands, and this fall will vote upon a \$25,000,000 bond issue with which to purchase 3,500,000 acres. The voters of Illinois will decide upon a \$20,000,000 bond issue to be redeemed from the fish and game fund with which

game bird propagation and the effect of forest fires on fish and game.

An accurate portrayal of the brood pond system at the Mount Shasta Hatchery was conveyed by a large cement pond containing brood trout of the German brown variety lazily swimming about. Other ponds painted in the canvas backgrounds with hatchery buildings beyond and snow mantled Mount Shasta dominating the whole made a satisfying picture of the state's largest hatchery. Artificial rock work, mossed and refreshed by ferns, and the music of falling water, added a note of beauty to the scene.

Along the side wall of this set was a hatchery trough with hundreds of tiny black-spotted trout, while a hatchery bas-

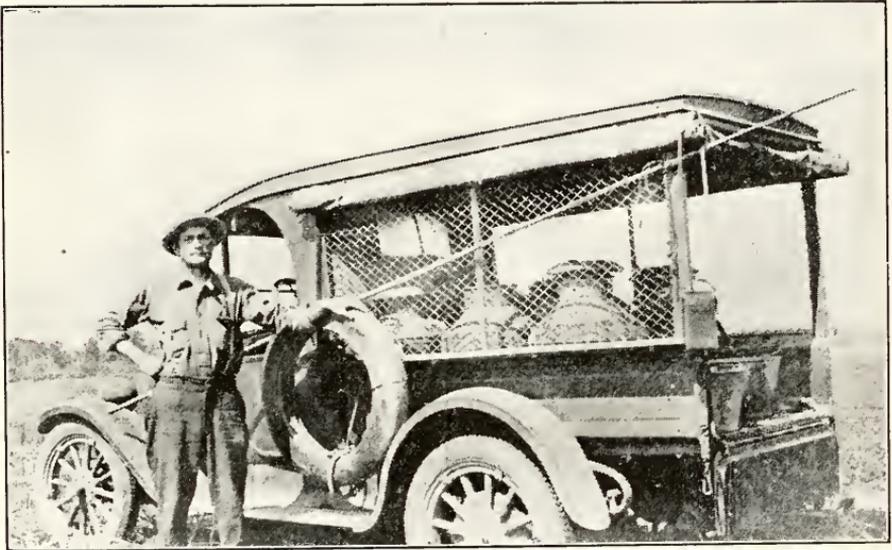


FIG. 98. Truck with rescued fish ready for transportation to live waters. August, 1928. Photograph by George Neale.

to purchase lands and waters for fish and game refuges and for recreational uses. The necessity for such progress is evident and affirmative action is to be expected. Recreation areas are necessary and now is the time to act!

DIVISION'S WORK SUBJECT OF VISUAL STUDY

During the forty-day display of the Pacific Southwest Exposition, Long Beach, thousands of visitors learned of the work of the division in the protection and production of fish and game resources. Three harmonized, realistic groups, occupying almost one entire side of the California Building, with appropriate natural and artistic settings and panoramic backgrounds, exhibited fish cultural operations,

ket containing eggs completed the steps in the fish cultural cycle.

Colored plates and maps with the necessary explanatory legends on the wall above the hatchery trough gave the spectator a knowledge of the scope of the division's fish cultural activities.

Visitors attracted by the colorful plumage of the golden pheasants, Chinese ring-necked pheasants, valley quail and Hungarian partridges in the game bird group, looked into a series of pens projected into the painted background and enjoyed the illusion of gazing into a game farm out of doors. Particular care was given to reproduce faithfully a section of the proposed southern California game farm near Chino, San Bernardino County.

In the central group, a striking effect was achieved by contrasting the "before and after" effect of fire. The intimate relation of a living forest and the pursuit of life by wild creatures was impressed in a way few could escape. The live animals used combined to represent in a composite way as many important species of value and interest to the sportsman as could be associated together without too great a variance from actual fact. A pair of mallard ducks with their brood of young rafted on the small pond in the foreground; a covey of quail, bobbing in and out brush and about the trees hunting for food, and a young black-tailed deer, oblivious to the attention of exposition throngs, lent a naturalness to the set and conveyed that intimate charm of wild life close at hand.

Desolation and charred trees in the burned forest area expressed unequivocally the evil that forest fires do. A deer skeleton took the place of the living animal in the live forest section. But the ducks and quail were gone. In their stead were two black vultures.

In an educational way, the exhibit accomplished much. Young and old were able to understand it and learned something of the work of the division. Many carried away with them the conviction of the need for protection and the necessity for preservation of fish and game.

The exhibit was a cooperative affair with the United States Forest Service and with the division. As a whole, it revealed a mastering idea. This achievement in symmetry and arrangement was due to the efforts of Paul J. Fair, of the Forest Service. The paintings used in the background of the three groups were done by the noted landscape artist, Frank J. Mackenzie. Rodney S. Ellsworth had charge of the exhibit for the division.

IN MEMORIAM

EUGENE WILLIAM HUNT

Death claimed one of the Division's oldest employees in time of service on September 18, 1928. Eugene William Hunt (67) field superintendent of hatcheries since 1912, began his services with the then Fish Commission as secretary to J. V. Shebley, hatchery superintendent, on August 7, 1887. He therefore rounded out forty-one years of service. "Gene" Hunt was born of a pioneer Sacramento family sixty-seven years ago. As a young man, he worked in the tax collector's and assessor's office in San Francisco. In 1901 he married Eleanor Nelson of a

pioneer Marin County family in San Francisco. After becoming associated with hatchery work, he played an important part in developing the famous Battle Creek Hatchery for salmon in Tehama County. He assisted in building many of the present hatcheries. Many will remember him as superintendent of hatchery operations at Lake Tahoe. As field superintendent he has helped correlate hatchery work and improve conditions at the various hatcheries.



EUGENE W. HUNT.

E. W. Hunt was dependable, loyal to his duties and to his host of friends. His genial disposition, his many kind and charitable acts and his faculty to meet the public and his untiring devotion to his duties won him the respect and esteem of his superiors through over forty years of public life. He was a true sportsman and believed in the conservation of wild life in the fullest sense of conservation.

Eugene Hunt was a Knight Templar and a Master Mason. The funeral service was conducted by the Masonic order at his request.

Of immediate relatives, he leaves a brother, W. B. Hunt of Mt. Shasta; a sister, Mrs. Elizabeth Healy, and a nephew, Captain Jack Neely of San Francisco, to mourn his loss. The Hatchery Department especially, the whole working force, and thousands of friends will long remember the good works of the deceased.—W. H. SHEBLEY.

GEORGE THOMPSON

While on patrol duty, endeavoring to apprehend violators, Deputy George Thompson of Gridley, California, was shot and killed by Charles Hogaboom, an alleged demented rancher of Pennington, Sutter County, on September 7, 1928. George Thompson was one of the most faithful, industrious men on the force. He knew ducks and their habits for he was, as a young man, a market hunter. Yet experience had shown him the dangers of wholesale destruction and he made a better warden for his early experiences in hunting. His knowledge of wildfowl furnished him with the ability to imitate their calls. He was considered one of the most expert men in the state in calling ducks and geese. He fearlessly enforced the game laws and won the confidence of his district.

George Thompson was a native son, born in Sutter County in 1880. He became a deputy fish and game commissioner in 1921 and by diligence established an enviable record. It was never too early or too late for him to be in the field. Many a night was spent in the tules attempting to catch "ground sluicers." For many years he engaged in farming. He is survived by a wife and four children, two boys and two girls. Though but small consolation for the loss of husband and father, they are privileged to remember that he was killed while doing his duty. Deepest sympathy goes to the bereaved ones from his fellow workers.—H. C. B.

GAME COMMISSIONERS MEET AT SEATTLE

A joint meeting of the American Fisheries Society, the Western Association of State Game Commissioners and the International Association of Game, Fish and Conservation Commissioners was held at the Olympic Hotel in Seattle, Washington from August 27th to 31st. This was the 8th annual meeting of the Western Association of Game Commissioners, the 22d annual meeting of the International Association, and the 58th annual meeting of the American Fisheries Society. The first two days were devoted to the joint program of the first two organizations, while the remaining three days were devoted to the program of the American Fisheries Society.

This was a meeting of conservation officials, experts and enthusiasts from the United States and Canada. Many addresses and papers were given and much discussion engaged in on all phases of fish and game conservation. Each of the

three organizations gets out a printed report of the meetings and all of the papers and the discussions will be available for any who are interested. One of the greatest benefits to be derived from a meeting of this kind is actually to meet and to exchange ideas with those who stand out as leaders in the conservation movement in North America.

There were in attendance from the California Division of Fish and Game, President I. Zellerbach who delivered an address based on his experience as president of the California Fish and Game Commission; Mr. Eugene D. Bennett, executive officer, who, when the roll of the states and provinces was called, answered with a short talk on the organization and work of the California Division of Fish and Game; Mr. E. C. Scofield, who gave a paper on the striped bass investigations in California; and J. S. Hunter, Roy Ludlum and N. B. Scofield, who helped enliven the discussion and served on various committees.

The next meeting of the Western Association of State Game Commissioners is to be held in San Francisco at a date to be decided upon later. President Zellerbach received the honor of being elected the next president. The other two organizations will hold a joint meeting at Minneapolis next year during the week commencing September 9th.

Addresses especially worthy of note given at the Seattle meeting were: "Bear River Marsh as a National Project," by David H. Madsen, Superintendent Bear River Marsh Migratory Bird Reserve, Utah; "Measures for Better Protection of Wild Life," by Colonel Paul G. Redington, Chief, U. S. Bureau of Biological Survey; "Alaska Salmon—an Achievement in Conservation," by Henry O'Malley, U. S. Commissioner of Fisheries; "A Canadian-American Salmon Reclamation Project," by John Pease Babcock, Chairman, International Fisheries Commission, British Columbia; "Work of the International Fisheries Commission," by Will F. Thompson, Director, Scientific Investigations; "Development of the Oyster Industry of the Pacific," by Professor Trevor Kincaid, University of Washington; "Effect of Paper Mill Waste on Young Salmon—Means of Prevention by Disposal," by H. W. Nightingale, Sanitary Engineer, Washington State Department of Health; "Harbor Seals of Northwest Coast Country," by T. H. Scheffer, Washington, U. S. Bureau of Biological Survey. There was a symposium on fish propagation which included research on fish foods, conducted by John W. Titcomb,

Superintendent of Fish Culture for Connecticut. There was a group of papers on "Problems Relating to Reclamation and Power Projects." There were other valuable papers too numerous to mention here. One evening was given over to an illustrated lecture on "Bird Life," by Dr. T. Gilbert Pearson, President, National Association of Audubon Societies. The Thursday session of the American Fisheries Society was held in the open air at the beautiful grounds of the state's Green River Hatchery to which those in attendance were taken in motor cars. A picnic lunch was served on the grounds. On Wednesday evening was the International Wild Life Dinner, in the Venetian Gardens of the Olympic Hotel.

All who are interested in conservation should secure printed copies of the transactions of the three organizations. Most of the papers will appear in the Transactions of the American Fisheries Society. The Transactions have been issued for a period of 58 years and contain most valuable contributions on fish culture, fisheries science and conservation of the game and commercial fisheries. The report of this organization has grown until it contains over 300 pages and no better investment can be made by anyone interested than to take out a membership in the society which costs \$3 and secure the publications as they are issued.

HUNTER VS. FARMER.

The hunter continues to accuse the farmer of selfishness when he is ordered off the owner's land. The farmer complains bitterly that the hunter has no respect for other people's property. The situation appears to be growing more acute. One of the Portland papers has carried a series of articles under the heading, "A Farm Woman Speaks." The articles point out that in self defense "no hunting" signs were put up, but did little good. It is also pointed out that often tame quail which are feeding in the farmer's yard are shot by the careless hunter. The question is even broached. "Why is there no farm representation on a game commission when the farmer has such a personal interest in game?"

One wonders how the average farmer can be induced to protect and increase the game on his land if he does not receive fair treatment from the hunter who claims a right to take the game which law says belongs to the commonwealth and not to the owner of the land. In spite of pleas continually made to the sportsmen, conditions show but little improvement. However, here in California, there is an earnest endeavor being made to hold

the respect and support of the man who really helps raise the game shot by the hunter. When a new fish and game protective association is formed, the assembled members are always asked to pass the following resolution. If sportsmen would indeed follow these injunctions the problem could be solved.

WHEREAS, It is generally concluded that great and irreparable injury and damage is done to the property of farmers and land owners by irresponsible hunters and fishermen; and

WHEREAS, It is the object and aim of this association to create a better understanding of the rights of the farmer and land owner and more appreciation for the privileges granted the sportsmen by the farmer and land owner, be it

Resolved, by the members of ----- Fish and Game Protective Association, that they will not hunt, shoot or fish on any enclosed or cultivated lands that are private property without first having secured permission so to do from the owner or tenant of the lands; and be it further

Resolved, That upon requesting permission or having been granted such permission the members of this association will voluntarily exhibit to the owner or tenant of the lands their membership card in this association together with their hunting or fishing license.

A CHANGED VIEWPOINT NEEDED

The pioneer hunted game purely as a meat supply. Later there were days when markets were stocked with every sort of game. In order to save wild life resources, it became necessary to stop the sale, and add numerous restrictions on the taking. At present, a changed viewpoint is necessary. Everyone must admit that the greatest usefulness of game is not to be found in its meat value; but in its recreational value. Furthermore, it is coming to be recognized that the mere presence of wild birds and animals is an asset. If, with changed conditions, we place a different valuation on game, there must be modification of its care. Every citizen of the state has a right to assume ownership. Each has a right to have a hand in game administration. Wild life resources must be administered in a progressive manner coincident with changing conditions. Fifty years ago, game was considered useful only to those who killed it for food, today game in some places has a usefulness to those who would go out and see it alive in the open. Proper utilization will come only when study has revised the importance of each contributing factor.

CONSERVATION TRAINING CAMP FOR BOY SCOUTS OPENED IN YOSEMITE

State conservation leaders have for some time sought effective means of better utilizing the boy scout organization in the conservation program. This past

summer, the Bureau of Education of the Division of Fish and Game decided upon a plan involving a summer camp where an intensive course on conservation methods would be given to advanced scouts, especially selected by each council in the state. Yosemite was chosen as the location because of the availability of the nature guide staff to help in instruction. A cooperative arrangement was worked out with the executive committee of Region XII of the Boy Scouts of America whereby the Division of Fish and Game and the Yosemite Nature Guide Service were to furnish instruction and the Boy Scouts to furnish camp direction. The camp opened on August 5 with twenty-nine enrolled. The objectives to be attained were outlined and there followed studies of fish, game and fur-bearing mammals, waterfowl and shorebirds, forestry, and then conservation methods. Field trips were taken daily, including the Yosemite Hatchery, elk paddock, Yosemite Museum and a day and a half trip taking in Glacier Point and the Pohono trail. One evening Governor C. C. Young appeared and gave the boys a straight-from-the-shoulder conservation talk. This experience will long be remembered by the boys. When the camp closed on August 15 all the boys enthusiastically maintained that they had never learned so much before.

DEPUTY KILLED BY VIOLATOR

"Shot and killed while in performance of duty." Not only do we read this in connection with police officers, but also in connection with game wardens. A game warden deals with malcontents and often risks his life in performing his duty. The latest to fall victim to the rage of a man caught in a violation of the game laws was George Thompson, a faithful deputy of the Division of Fish and Game. Thompson, on September 7, started from his Gridley home early to check up on dove hunters who were reported as violating the game laws. Near Pennington, Sutter County, Thompson stopped Charles Hogaboom and asked him for his license. The violator leveled his shotgun at Thompson and shot him three times in the head. The dead warden was found later in the morning and the murderer was captured after a severe battle. Hogaboom, said to be demented, confessed. This tragedy adds a fourth regular warden to the list of those murdered since 1913. In addition, two regular deputies were injured. Two special deputies have been killed and two others injured in similar encounters.

The list of murdered and injured wardens is as follows:

Deputy George J. Rodolph, Merced County, November, 1914.

Deputy Richard Squires, San Joaquin County, December, 1916.

Deputy Ray Heacock, San Joaquin County, December, 1916.

Deputy George Thompson, Sutter County, September, 1928.

Deputy Frank Cady (injured), Lassen County, April, 1926.

Deputy Jack O'Connell, (injured), San Joaquin County, June, 1927.

Special Deputy Bert Blanchard, Contra Costa County, February, 1913.

Special Deputy Ernest Raynaud, Marin County, April, 1913.

Special Deputy John Nelligen (injured), Lassen County, April, 1913.

Special Deputy John W. Galloway (injured), Santa Cruz County, March, 1913.

It is a satisfaction to note that most of the murderers were apprehended and are serving life sentences.

STATE LION HUNTER SERIOUSLY INJURED

Jay Bruce, who since January 1, 1919, has been state lion hunter, met serious injury on June 27, 1928, resulting in the loss of the sight of one eye. The accident occurred while in performance of duty. While hot on the trail of a mountain lion in Rubicon Canyon, El Dorado County, Bruce stepped on a crooked stick which, flying upward, struck him with great force in the left eye, cutting and penetrating the eyeball. Although stunned and suffering from an excruciatingly painful wound, Bruce made his way to the place where the lion was treed. Unable to see well enough to shoot, he encouraged his son, Jay, Jr., to kill the lion. The boy failed to place a death shot and the lion got away but was treed again and shot by Bruce, whose vision had now sufficiently cleared, 400 yards farther on. The lion was skinned by young Bruce at the direction of his father, and the skin packed out to the machine. Unassisted, Bruce clambered 2500 feet up the walls of the canyon to a cabin, where he administered first aid treatment to himself.

Upon arrival in San Francisco the injured man was given medical attention at the St. Francis Hospital. Although Bruce is out and around again, his left eye records little more than light.

Unless given a helper, Bruce will necessarily have to give up lion hunting. This means that the successful control of mountain lions in California will be hard hit. Only one other man in the state has even begun to approach Bruce in ability at getting mountain lions.

NEW BUREAU ESTABLISHED

For many years there has been desultory rescue of catfish, striped bass and black bass from overflowed areas. When trout were found dying in a drained reservoir or drying-up stream, the nearest deputy usually went to the rescue. The work, though important, was sporadic and did not come within the scope of any particular department. Feeling the need for definite attention to the work of saving and transplanting fish, the Commission has established a Bureau of Fish Rescue and Reclamation with headquarters at Sacramento, and has placed in charge an experienced man. George Neale, with twenty-three years of service in fish and game conservation work in this state, will head this bureau. What this step will mean to the conservation of fish is evidenced by the August report of the bureau, which shows a total of 258,200 fish rescued and distributed to suitable locations.

THE BUILDING OF DAMS

Oregon is wrestling with the same problem which confronted California when a high dam was proposed for the Klamath River. The McKenzie River is one of Oregon's best fishing streams. Sportsmen claim that it will become another Clackamas if the dam is built. The Clackamas has deteriorated as a fly casting stream since dams were built. The power company concerned, of course, is making wonderful promises of the latest type of fish ladder. In the real fight now raging in Oregon, there is to be found at least one consolation: The fish and game commission is now considered as an interested body with some say as to power developments which may injure fish resources. Their stamp of approval is asked. Not many years ago, a state conservation board was ignored in such matters. This much is progress toward proper solution of a vexing problem.

NATIONAL WATERFOWL REFUGE LAW

The essential principles of such a bill are: the securing of ample refuge areas at the earliest possible date; certain and adequate revenue for purchasing maintenance; provision for administration which will insure efficiency free from politics, favoritism and abuses. The impossibility of reconciling all groups to unanimous support of such a bill is evident. However, it should be possible to work out a plan of reconciliation, adjustment and compromise so that there will not be involved a serious reversal of principle in case the essential results are attained.

Conservationists and sportsmen should show a spirit of cooperation so that this law may be enacted.

A NEW GAME FARM

After a careful survey, a site has finally been selected for the proposed southern California game farm. The Los Serranos Country Club has agreed to donate twenty-nine acres near Chino, San Bernardino County, and negotiations are well under way to acquire this property. The site is well drained. A good water supply is available. Plans call for 364 pens in a vermin-proof enclosure. There is hope that construction will be of steel rather than of wood. In addition a large open rearing field planted to alfalfa will be provided.

FOLSOM FISHWAY REPAIRED

During the high water season of this year, parts of the fish ladder at the dam at Folsom became so filled with boulders that much criticism was forthcoming from neighboring county sportsmen. Deputy G. I. Fleckenstein helped in solving this vexing problem. Captain Iarkin, working in cooperation with the state and Pacific Gas and Electric Company, who jointly own, control and maintain this dam, undertook to put the same in good condition. Twenty-three convicts were placed upon the work for about three to four weeks removing the enormous boulders. Photographs submitted at the time the work was being done show the men at work and many dead eels floating on the water at the foot of the dam.

STATE FAIR EXHIBIT, 1928

The permanent panorama exhibit at the State Fair, at Sacramento, in September, was remodeled to depict a winter scene in the Lake Tahoe region. The exhibit was under the direction of W. H. Shebley. The lighting effects were beautiful and the ponds full of trout furnished realism. An added feature was the exhibit portraying the activities of the Bureau of Fish Rescue and Reclamation. The fishes exhibited in the aquaria were those rescued from overflow areas. As in past years, the division's exhibit stirred the admiration of practically every visitor to the fair grounds.

LUMBER COMPANIES PROTECT MULE DEER

Despite the fact that deer season in the mule deer country was scheduled to open on September 16, hunters were unable to hunt deer in Shasta, Siskiyou and part of Modoc counties until October 1. This was

brought about by the posting against hunters by the McCloud Lumber Company and the Weed Lumber Company, whose timber holdings cover practically all of the mule deer country. The motive in back of this action is understood to be protection against fire. It has a direct bearing, however, on the conservation of mule deer because it materially hampered the activities of the army of eager hunters accustomed to invade this territory at the opening of the season.

MUSKRATS IN KERN COUNTY

Muskrats have been reported in Kern County, inhabiting the region along some of the canals. They have proved a menace to the crops in that they cause wash-outs as a result of their burrowing habits.

The Division of Fish and Game is cooperating with the State Department of Agriculture by issuing no permits allowing the introduction of muskrats for use in fur farming in the areas west of the Sierra Nevada and Sierra Madre ranges of mountains. Muskrats are native east of these ranges.

THE BEAR RIVER PROJECT

The Bear River Refuge Bill was passed by Congress and received the approval of the president on April 23. The bill carries an appropriation of \$350,000 for use in establishing waterfowl refuges in the Bear River marshes of Utah. Not over \$50,000 of the appropriation may be used for buying land, most of the land needed being already government land. The balance of the fund will be used largely for constructing dikes to raise the level of the fresh water in the marshes so as to prevent the loss of birds from alkali poisoning.

The bill as passed permits the use of not to exceed 40 per cent of the area included in such refuge for public hunting grounds, the remaining 60 per cent to be maintained as sanctuary.

Senators Phipps of Colorado and King of Utah introduced almost identical bills on this subject. The King bill was passed by the senate. The Colton bill was passed by the house with amendments not contained in the King bill, which were accepted by the senate and the Colton bill became the law.

Hon. David H. Madsen, for years the State Fish and Game Commissioner of Utah, and one of the outstanding conservation officials in America, severed his official connection with the state of Utah on July 1, and accepted the position of superintendent of the new Bear River Bay Migratory Bird Refuge now being

created by the Biological Survey under the provisions of the recently signed King Colton bill.

The construction work necessary for the reflooding of the Bear River marshes will be performed under the direction of L. M. Winsor, Bureau of Public Roads engineer stationed at Logan, Utah, who has been engaged for a number of years on irrigation projects in the west and is well fitted for the work. Mr. Winsor during the summer of 1927 made the preliminary surveys at Bear River Bay for the Biological Survey.

This important project therefore will go forward under the direction of two experienced Utah men—Mr. Madsen, fully familiar with wildfowl conditions and with wild life administration, and Mr. Winsor, familiar with construction of levees and enjoining details. Mr. Madsen has been one of the strongest advocates for the reflooding of the Bear River marshes and the creation of a refuge there as a means of preventing the appalling annual mortality of birds in that region. He planned and executed Utah's famous public shooting grounds of 30,000 acres.

It is expected that the building of dikes to store fresh water now flowing into Salt Lake will not only eliminate the death areas which killed millions of birds in the past, but will afford a feeding and breeding ground for great numbers of waterfowl. Instead of a death trap for ducks, the area should become a supply point for western North America. California is sure to profit by this development, for many ducks banded in the Bear River marshes have been taken in the great valleys of California, indicating a direct line of flight.

GAME ADMINISTRATION

The Board of Game Commissioners of the Commonwealth of Pennsylvania has issued, as Bulletin No. 10, a statement by Commissioner Francis H. Coffin outlining the history and accomplishments in game administration in Pennsylvania. In the bulletin the following significant statement is made:

"The average citizen who considers the work of game administration at all is apt to think that the most serious thing the board has to deal with is the illegal hunter or law violator. The game warden, or as we term our field man, the 'game protector,' was formerly considered as an obnoxious and pestiferous individual, who went snooping around the woods making trouble for the hunter who accidentally or thoughtlessly exceeded his bag limit, or who in some other relatively harmless way infringed the stringent laws

of the Commonwealth. This point of view happily no longer prevails among our Pennsylvania hunters, who have learned to know their game protectors as fellow sportsmen, and as men working at all times to protect and foster the best interests of sport for the average citizen. The truth is that while the police activities of the game protective force are very important, this phase of their work is only a small part of it."

THE RESTORATION OF MARSHES

In urging the necessity for restoration of marsh areas in California for use of wild waterfowl J. P. Cuenin writes the following impressive statement in the San Francisco *Examiner*:

"We have reached the stage now where we must do more than merely talk about providing breeding, feeding and resting grounds for our ducks and geese—we

WINTER FEEDING

The Department of Conservation of the state of Michigan will attempt this coming year to encourage the extensive use of feeding stations for both nongame and game birds. The plan is based on the supposition that the increase of quail and certain other species in many parts of Michigan is dependent upon the successful wintering of the birds. Pursuant to the plan, the Department of Conservation has asked for information on what foods are most suitable for winter feeding of game birds, the type of location most appropriate, and the precautions which must be taken to protect the feeding birds from predatory birds and mammals.

MIGRATION OF TROUT STUDIED

It is well known that some species of trout are distinctly migratory and that dams or other obstructions block their



FIG. 99. Pack train with golden trout crossing a summit in Sierra in 1914. For the first time this transplantation work was reinaugurated in 1928. Photograph by A. D. Ferguson.

must act at once. Ducks can't breed in the air, they can't feed on the air and they can't rest in the air, and we have passed the stage where we can count on badly overworked nature to assist the hunters.

"Some duck shooters seem to have the idea that without the restoration of marsh areas the present supply of ducks can be maintained, but this class of hunter has evidently given little thought to the subject. A few figures may enlighten them. Nine years ago there were 174,291 hunting licenses issued in California. At that time there were 697,560 acres of marshland in the concentration points of the ducks in this state. At the present time there are more than 253,000 hunters in California, and the marsh area has been reduced to the insignificant size of 77,000 acres. Here is an increase of more than 78,000 hunters and a decrease in the duck grounds of 620,560 acres."

progress. In other instances it seems possible that certain kinds of trout are largely non-migratory and that man-made barriers do not interfere seriously with the life habits of trout. However, much of the information at hand is largely guesswork, and it is quite necessary that there be an endeavor to determine the ability of trout to pass beyond dams and waterfalls. The Conservation Commission of Michigan has recently tagged 10,000 trout in order that a determination may be made as to the percentage of success attained in passing certain barriers. Work along the same lines should be instituted in California in order that dependable data may be at hand when defense is made of various power projects.

TO STUDY LIFE HISTORY OF PACIFIC EEL

Professor Johann Schmidt of the University of Copenhagen has started a two

years' scientific cruise in the Pacific with the intention of solving the riddle as to the spawning grounds and migration routes of the Pacific eels.

Only recently has the puzzling migration of the Atlantic eel been solved. It was known that young eels were never seen to descend a river and that old eels never went in any other direction. Young ones came up from the sea, the old ones went to sea. Finally, what is supposed to be the eggs and young of eels were found in the north Atlantic, north-east and east of the West Indies. Here the adult eels lay their eggs and then die. The young eels, which are leaf shaped, flat, thin and transparent as glass, feed on the minute water organisms and finally reach the fresh water streams along the Atlantic coast. Professor Schmidt now hopes to find the spawning grounds and work out the life history of the eels of the Pacific Coast.

GIANT TORTOISE BROUGHT TO SAN DIEGO

Last May 180 giant tortoises secured on the Galapagos Islands by the New York Zoological Society were brought to the United States to attempt breeding them at a number of different points. A breeding stock was left at Balboa, Canal Zone; in Arizona, in Texas, in Louisiana and in San Diego, California. All of the tortoises have been numbered, weighed and measured so as to furnish information as to their rate of growth. Since these tortoises have furnished mariners with a food supply through the centuries, it seems reasonable that colonies be developed in various suitable locations. On some of the South Sea islands the British government has successfully established land tortoises which have proved a valuable resource. Were they a faster growing species, they would lend themselves more readily to domestication.

MEXICAN GAME BIRD PROPAGATED

Mr. W. Leland Smith of Fair Oaks, California, has been experimenting with the famous Mexican game bird, the chachalaca. During the past season, a pair of birds owned by Mr. Smith have successfully reared two clutches, and in late August were incubating a third.

FRY AND FINGERLINGS

There has been considerable misunderstanding concerning the size of the various kinds of baby fish that should be called fry and fingerlings. To clarify the terminology the United States Bureau of Fisheries has recently called attention to

the generally accepted meaning, which is as follows:

Fry—Fish up to the time the yolk sac is absorbed and feeding begins.

Advanced Fry—Fish from the end of the fry period until they have reached a length of one inch.

Fingerlings—Fish between the length of one inch and the yearling state. The various sizes are designated as follows: No. 1, a fish one inch in length and up to two inches; No. 2, a fish two inches in length and up to three inches; No. 3, a fish three inches in length and up to four inches, etc.

Yearlings—Fish that are one year old, but less than two years old from the date of hatching. Fish over two years old and less than three years are commonly termed "two-year-olds." While the term "three-year-olds" may be employed, fish of this age are generally called "adults."

TEACHERS' BULLETIN No. 10

Certainly the organization in charge of the protection of wild life should champion the cause of any birds, animals or fish whose value is not properly recognized by the public. Probably no group of valuable birds suffers more criticism than the hawks and owls. Because some have been seen to destroy game, all kinds, good and bad, are killed on sight.

In a new teachers' bulletin, Mr. Donald McLean makes a plea for the protection of owls and gives short descriptions of the different kinds found in the State of California. This short bulletin will be placed in the hands of teachers in order that they may properly instruct students as to the real values pertaining to owls.

SEA LION BULLETIN PREPARED

One may view the sea lion as many fishermen view it, as a predatory species, feeding largely upon food fishes. On the other hand, one may demand protection for this sea mammal because of the interest and pleasure given to visitors to the sea coast and because of its value as a natural resource. Persons with either point of view will profit and doubtless obtain a more correct impression by perusal of a new bulletin now ready for press which gives the results of an investigation into the life history and habits of this mammal.

Mr. Paul Bonnot points out that of the stomachs examined only two contained valuable food fishes. There is no doubt that sea lions do some damage to fishing industries. On the other hand, they doubtless have a real part to play in the balance of life in the sea. These large

animals might very easily be exterminated and a real resource lost. The least wasteful and most humane method of holding these animals in check would be the killing of a certain percentage of the pups. The killing should be done by trained men and a census should be made regularly to determine the actual status of these animals from year to year. The bulletin will be fully illustrated and will bring together much valuable information relative to sea lions on the coast of California.

A GAME SURVEY

On July 1, Aldo Leopold of Madison, Wisconsin, for a number of years an outstanding attache of the staff of the United States Forest Service, was engaged by the Sporting Arms and Ammunition Manufacturers' Institute to make the first American game resources survey. Mr. Leopold has studied game matters for many years, is well known as a writer on conservation subjects, and is one of the best equipped men in America to make such a survey.

"The purpose of the survey," says the institute in its announcement, "is to collect the experience and ideas of sportsmen and other conservation agencies as to the best ways and means for inducing the sustained production of game crops. It will constitute a search for dependable basic facts. By assembling the facts and making them available to the sportsmen, the sponsors of the survey hope to stimulate the formulation of an effective program of game restoration."

DUCK TIME

The leaves on the trees are brown and sere ;

The grass is withered and dead,

And the sky is blue of the deepest hue
In the narrow chinks o'erhead.

So you pause, perhaps, in the city's streets,

As you level your gaze on high,

For you hear a call, through the dim smoke pall

When the ducks go drifting by.

The lure of the wild gets in your blood,
For the tang of the wind is sweet,

And your pulses burn as you long to turn
Where the land and the waters meet ;

Where the winds wail low through the fringing sedge,

And withering cat-tails dry ;

Where the ripples break on a dead calm lake,

When the ducks go drifting by.

Then it's back to the wild, when the sun comes up,

And the twilight dawn fades fast,

When you lie in your blind, for you hope to find

A shot as the birds drift past.

When the pin-tails quack in the feeding grounds,

And the blue bills venture nigh,

Then a roar and flash—and the waters splash

When the ducks go drifting by.

You who are chained to your desks of wood,

In the heart of the busy hum ;

Turn back a space for a breathing place,
When bracing November comes ;

There's a hunter's camp, and a hunter's life,

And many a shot to try,

And tales to tell by the fire, as well.

When the ducks go drifting by.

—*The Illinois Sportsman.*

RESOLUTION DEMANDS STUDY OF WHALE

At the Tenth Annual Convention of the United States Fisheries Association, held in Buffalo, New York, in the early part of August, the following resolution was adopted :

Whereas, At the present time the killing of whales in all seas of the world where they may be taken commercially is proceeding on an unprecedented scale with the result that important commercial species are threatened with economic exhaustion if not actual extermination, and

Whereas, This great natural resource can only be properly studied and husbanded through cooperative arrangements of the nations concerned, and

Whereas, Certain other species of marine mammals such as Steller's sea lion of the North Pacific, the California sea lion ranging from the Farallon Islands southward to Central Mexico ; the Guadalupe fur seal formerly found along the coasts of California and Lower California ; the northern elephant seal of the same region, and the Pacific walrus of the North Pacific are in danger of ruthless destruction and possible extermination, therefore

Be it resolved, That the U. S. Fisheries Association at its tenth annual convention recommends that steps be taken urging the nations to provide for an international commission to make necessary investigations as to the condition and number of these mammals, whether the supply is being endangered and to make recommen-

dations to the governments concerned as to what regulations are necessary to safeguard and perpetuate these forms, to provide for their complete utilization where the fishery is permitted and to outlaw their ruthless slaughter and where inadequate economic returns result, and

Be it further resolved, That a copy of this resolution be spread upon the minutes of this convention and copies sent to the governments concerned.

WATERFOWL CENSUSES OF BIOLOGICAL SURVEY DEVELOPING VALUABLE CONSERVATION DATA

Efforts to ascertain the fluctuations in the abundance of migratory waterfowl in North America, undertaken by the Bureau of Biological Survey, United States Department of Agriculture, one year ago and persistently followed up since then, are meeting with gratifying success. The accomplishments already indicate that the original conception of the project was conservative, not over-enthusiastic, and that information will ultimately be derived from the censuses that will be of inestimable value in the formulation of a sound policy for the conservation of the country's waterfowl resources. The birds under consideration in this far-reaching cooperative undertaking include not only the ducks, geese, and swans, which collectively are termed "waterfowl," but also the American coot, or "mudhen."

It will, of course, be necessary to have the second year's observations as a basis for computations of increase or decrease of species or of waterfowl as a whole, but several very interesting facts have already been brought out by the censuses up to the present time. Owing to the surprising response that has been made to the requests for cooperation, the vast store of information gathered in the first year of the work has been far in excess of any reasonable expectation. The data obtained have been filed and indexed for ready reference.

These results show particularly the winter concentration areas in the United States during the past year and the striking fact is brought out, more clearly than ever before, that the birds that breed in Canada and migrate over the United States withdraw into surprisingly small areas for the winter. These areas lie

chiefly along the Atlantic Coast from Long Island southward; along the Gulf Coast; up the lower Mississippi Valley; along the Pacific Coast; with comparatively few scattered, relatively small areas throughout the middle and western United States. In addition to this, the waterfowl, chiefly ducks, that winter in Mexico are gathered into about six important areas, from which unfortunately very little information was received during the past year, and which must needs be covered adequately in order to supplement the information now available. Among the most important of the other facts brought out by these waterfowl censuses are the movements of the bulk of the waterfowl east and west, as well as north and south, particularly during migration, the location of the bulk of the birds during different months, and monthly fluctuations in these movements.

To show these facts, a series of preliminary maps has been prepared indicating conditions and locations of the bulk of waterfowl on each of the waterfowl census dates in the United States and southern Canada, from which areas the most satisfactory information has hitherto been received. These maps are filed in the Biological Survey offices, as well as the other information gathered through these waterfowl censuses, and will become more serviceable when all necessary data can be more carefully analyzed and examined and any errors eliminated, for in handling a project of such magnitude it is of course necessary and desirable to exercise all possible precaution to see that the deductions from the data considered represent the true conditions.

One of the most encouraging features of the past year's organization and conduct of these waterfowl censuses has been the almost universal interest and cordial offers to cooperate that have been met with everywhere. The purposes of these censuses are apparently appreciated and the method fully approved by those to whom it has been explained, and the future success of the work seems assured. The Biological Survey hopes to enroll additional observers as soon as possible, particularly in Canada and Mexico, to cover all the important concentration areas, so that the facts gathered may approximate as nearly as possible the exact waterfowl conditions over the North American continent.

DIVISION ACTIVITIES

The Division of Fish and Game was very well represented at the recent meeting of the International Association of Fish and Game Commissioners at Seattle. Meeting was held jointly with the Western Association of Fish and Game Commissioners and the American Fisheries Society from August 27 to September 1. Commissioner Zellerbach was elected president of the Western Association for the coming year. The date for the meeting next year has not been selected but the meeting will be held in San Francisco some time in the fall. Both Mr. Zellerbach and Mr. Bennett took an active part in the discussions at the meetings, as did Mr. Scofield of the Commercial Fisheries Department. David H. Madsen, of Utah, was elected president of the International Association. Our California Division of Fish and Game was represented on the executive board by J. S. Hunter. The next meeting of the International Association will be held in Minneapolis, Minnesota, the week of September 9, 1929.

In conjunction with the American Fisheries Society, W. F. Thompson, formerly of the California State Fisheries Laboratory, gave a paper on the work of the International Fisheries Commission between the United States and Canada appointed for the study of the halibut of the North Pacific. A paper was also given by E. C. Scofield on the striped bass investigations which he has been carrying on for the Division. Other especially interesting papers given were: "The Development of the Oyster Industry of the Pacific," by Professor Trevor B. Kincaid, and "The Harbor Seals of Northwest Coastal Country," by Theodore H. Scheffer.

Department of Patrol

A total of \$9,141 was imposed in fines as a result of the 240 arrests made during July. These figures exceed those of any other month this year.

A few of the more interesting cases which were made during the summer are as follows:

One San Francisco citizen started out on his vacation. He neared Modesto at dinner time and being hungry, and seeing a nice flock of quail crossing the road, he proceeded to kill some. Deputy Magladry happened to be in this vicinity and took him into Judge Rice's court, where he was fined \$200.

A man of Dos Palos wished to treat one of his San Francisco friends to a feed of doves and a few nongame birds. He sent nine doves and three or four nongame birds by express to his San Francisco friend. Deputy J. L. Bundock found the package in the express office; seized the birds, and Deputies Blewett and Gourley of the Los Banos district were notified. They located the violator in Dos Palos. He was fined \$275 by Judge Hales.

One of the Japanese citizens near Salinas wanted some deer meat. He went out into a canyon and killed a doe, without even procuring a license. Deputy Fred Post was watching for such people and arrested the man, took him before Judge King, of Salinas, who fined him \$500 for killing a doe, and \$100 for hunting without a license.

Deputies Hoke, of the Patrol Department, and Bonnot, of the Commercial Fisheries, arrested a fisherman in the Klamath River who was operating a set net. Mr. Davis, a new judge in Requa, fined him \$250.

Two young men of Santa Rosa decided they wanted some deer meat. They went into Deputy Harley Grove's territory and killed a doe. Deputy Groves took them before Judge Ellis, at Cloverdale, who fined them \$250.

Four Chinese operating seine and fike nets near Hood in the Hood Canal were apprehended by Deputy Charles Sibeck. Judge W. E. Everson at Elk Grove assessed each offender \$200.

Possession of deer meat on July 30, was a costly thing for A. B. Stocking, of Boulder Creek. Deputies Forrest McDermott and Jules Vissiere, of Santa Cruz and Watsonville, following up a tip that Stocking had deer meat in his possession, made an investigation at the mill of the Santa Cruz Lumber Company. The defendant refused to tell who gave him the meat, but entered a plea of guilty when brought into court. Judge Younger gave him the alternative of paying the fine or spending 250 days in jail, and after lecturing him severely suspended \$50 of the sentence.

In checking the summer monthly reports of the volunteer deputies it was found they had checked 7632 hunting and fishing licenses, patrolled 100,198 miles of streams, game fields and coast lines, made and assisted in making 77 arrests for violations of the fish and game laws in which cases fines in the sum of \$1,880

were imposed. The above mentioned reports do not include fines in the sum of \$950 imposed for arrests made by county fish and game wardens who hold volunteer deputy appointments in the southern part of the state.

Department of Fish Culture

The summer months are busy ones for the Department of Fish Culture. Special care must be taken to guard against disease and losses due to warm water. This makes it necessary to plant surplus fish in the hatcheries to allow room for those to be aged. The preparations must be made also for the hatcheries to be ready to receive the eggs taken from the fall spawning trout.

In the Yosemite National Park Hatchery there are several species of trout in the aquariums which were collected by Mr. Townsley, chief ranger for the National Park service, who was assisted by Governor C. C. Young and employees of the ranger service of Yosemite National Park. An effort is being made to get rainbow trout from Lake Eleanor for the aquariums. Trout from the hatchery have been distributed in streams within the park and waters outside the park boundary.

An aquarium was set up outside the Big Creek Hatchery and the fish were brought down from Prairie Creek for experimental purposes. Brush was cut and a clearing made for a new road on the grounds.

George A. Coleman, biologist for the fish culture department, has been investigating the bluestoning of lakes and reservoirs in San Diego County. Reservoirs often serve as domestic water supply, recreation and fishing grounds. Therefore, bluestoning to kill algae must be supervised to prevent killing of fish. The main sources of sport fishing in the county need safeguarding.

Over 600,000 golden trout eggs were received at the Mt. Whitney Hatchery from Cottonwood Lakes. Of these, 55,000 were shipped to Bozeman, Montana and to the New York Aquarium at the request of Charles H. Townsend, Director. The take of golden trout eggs was above normal this year. The Cottonwood Lakes were planted three years ago, and half of the eggs taken were from fish planted at that time. Twenty-five thousand more

of the eggs were shipped to the Caledonia Hatchery, New York.

A survey was made of the lakes in the high Sierra with the end in view that these lakes might possibly furnish eggs to be hatched at the Mormon Creek Hatchery, near Sonora. However, it is believed that it would be too difficult to reach these lakes early enough to secure spawn.

Fish were planted from the Kaweah Hatchery during the latter part of July. It was necessary to distribute them early as the water during mid-summer becomes full of algae and water moulds which are injurious to the young fish.

For the second time, to the knowledge of the Department of Fish Culture, an epidemic broke out among the fish west of the Rocky Mountains. The disease, resulted in the loss of two-thirds of the fish at the Big Creek Hatchery. The hatchery was quarantined and specialists engaged to study the problem.

Department of Commercial Fisheries

During July, Dr. Henry B. Bigelow carried on intensive oceanographical study in the waters near Monterey. He was assisted by E. C. Scofield, of the Commercial Fisheries Department, and allowed the use of the patrol boat *Albacore*. It is hoped that from this work a better knowledge of ocean conditions will enable us to predict fluctuations in the abundance of sardines at Monterey.

Work is being continued on the salmon investigations. A man was detailed to make a preliminary survey of the salmon spawning grounds. He later spent some time at Monterey taking scale measurements from salmon landed there.

Investigational work is also being continued on the striped bass.

Since the *Albacore* was in use at Monterey, it was necessary to charter another boat, *Salt*, for the purpose of patrolling the closed district around Catalina Island. Many cases were made of purse seiners seeking bluefin tuna. They were compelled to pay several hundred dollars in fines for fishing and having nets in their possession in a closed district.

Thornley and Company, San Diego, interested in the kelp industry, is undergoing a reorganization and expects soon to ask for a lease on kelp beds. There are only two other companies interested in this industry, Philip R. Park, San Pedro and Pacific Marine Products Co., Chula Vista.

Two new fish bulletins are completed and available for distribution. Fish Bulletin No. 12 by Dr. Frances N. Clark points out the significance of the length-

Bureau of Research

A predatory animal trapper was stationed during June in Game Refuge 1-O in El Dorado County. This assignment was made upon receipt of information that there was a large number of coyotes in this district that were destroying game.

The chemical laboratory which was formerly located at the offices of the Division in the Postal Telegraph Building



FIG. 100. Convicts working on fish ladder at Folsom dam. Dead eels in pool beyond. Photograph by G. I. Fleckenstein, July 2, 1928.

weight relationship in sardines. Fish Bulletin No. 13 by C. B. Andrews deals with seasonal trends in average size of sardines at Monterey. Other bulletins are partially completed and will be ready for publication sometime next year.

The State Fisheries Laboratory has assisted Mr. H. L. Kelly, who is connected with the Division of Fish and Game of the Agriculture and Forestry Department, of the Territory of Hawaii, in procuring some clams and abalones for shipment to Honolulu.

was moved to the Hooper Foundation for Medical Research, where added facilities are available.

E. C. O'Roke, the parasitologist employed by the Bureau of Research, is continuing his work on the investigation of blood parasites of quail. His first report appeared in CALIFORNIA FISH AND GAME, Volume 14, Number 3.

Dr. Henry Van Roekel was employed to conduct pathological investigations. He is working at the Hooper Foundation

under the supervision of Dr. K. F. Meyer, director of the foundation. Dr. Van Roekel has undertaken research problems at the Yountville Game Farm.

During the summer, investigations were made at Buena Vista Lake regarding the "duck sickness" which has been previously reported upon in CALIFORNIA FISH AND GAME. The ducks had all migrated and but few mud hens remained. Samples of water and soil were taken. The amount of decaying organic matter found in the water would indicate that another outbreak of "duck sickness" can be expected as soon as the birds begin to arrive in that section unless there is a very material improvement in the situation.

Bureau of Education

The director returned to the office on August 20. He reported some splendid accomplishments. The nature guide service in Yosemite took 2500 more people on field trips during the past summer than in the preceding one. The School of Field Natural History graduated twenty students, who will return to their homes to carry on conservation work. The new Boy Scout Conservation Training Camp, which stimulated interest of the boys in methods of conserving wild life, gave training to twenty-eight eagle scouts. He also reported worthwhile experiences in the various national parks visited while working with an educational committee appointed by the Secretary of the Interior.

The exhibit showing miniature mountain sheep in a natural setting has been started on a year's trip over the state, and will be shown from Lakeport to San Diego. The trip was made possible by an arrangement through the California Development Association whereby each local Chamber of Commerce takes charge of the exhibit and places it in a desirable location.

The first showing was at the San Francisco Y. M. C. A., from which place the exhibit was sent to the Hotel Oakland, at Oakland, for two weeks. Following a schedule carefully worked out by G. N. Holmes, it was shown at Berkeley, San Mateo, Palo Alto and San Jose. During the ensuing weeks it will be displayed at Santa Cruz, Hollister, Salinas, San Luis Obispo, Santa Barbara, Los Angeles (four weeks), Glendale, Pasadena, Long Beach, Santa Ana, San Diego (two weeks), El Centro, Riverside, San Bernardino, Bakersfield, Visalia, Hanford,

Fresno (two weeks), Madera, Merced, Modesto, Stockton, Sacramento (two weeks), Auburn, Marysville, Oroville, Chico, Willows, Red Bluff, Redding, Yreka, Eureka, Ukiah, Lakeport, Santa Rosa, Napa, Vallejo and Martinez.

A second miniature exhibit depicting hatchery operations at the Mount Shasta Hatchery has been completed by E. S. Cheney. Already it has been on display at a number of different places. Built to scale and with motor attachment moving a truck laden with fish cans, this exhibit represents a faithful and realistic portrayal of a familiar scene at the Mount Shasta Hatchery during trout planting time.

The exhibit is fitted with a moving scroll which gives a knowledge of the scope of the division's fish cultural activities.

A series of four field trips and four evening lectures were given the members of the Labor School held at Guerneville, Sonoma County, from August 24th to 27th. About thirty people from various labor organizations were present and attended all field trips and lectures en masse.

The morning field trip on August 24th was organized to study plants and birds, primarily, while the evening lecture, illustrated with motion pictures, dealt principally with nongame birds and their relation to man's interests.

The field trip on the 25th was devoted to a study of mammals and birds. The evening lecture dealt mainly with deer and mammals and was illustrated with motion pictures. Another lecture was given the local Guerneville resort at the request of E. H. Maize, proprietor. About ninety people attended.

The morning field trip of the 26th started out to be a botanical trip, but geology cropped up on the discovery of a quartz vein, and a long geological discussion took place on the spot. So much interest was shown in geology that a blackboard lecture was given that evening before the pictures were shown.

The following morning found the group working on subjects of interest along the stream side.

This new work is most valuable in that it reaches the working class and is carried back by the members of the school to their various organizations throughout the major part of the state.

Conservation and the knowledge of wild life were the keynotes of the work. J. L. Kerchen of the University of Cali-

ifornia Extension Division, director of the school, appreciated the cooperation and has asked for aid for next year.

Bureau of Hydraulics

Numerous inspections of streams were made to determine whether fish screens and fish ladders were necessary. Recommendations were made to some companies that new fish screens and ladders be installed, and in some cases different locations were suggested.

discharge water is now free from visible signs of oil. About \$50,000 was spent on these improvements.

It has been reported that as a result of the oil cleanup in the waters in the vicinity of Ventura, fish have been seen in the Ventura River for the first time in several years. While no accurate figures are available, it is believed that over \$200,000 has been spent in this field to avoid pollution.

Following repeated warnings which ap-



FIG. 101. Site of proposed southern California game farm near Chino. Photograph by Paul J. Fair, July, 1928.

The Pacific Gas and Electric Company at Vallejo has built earthen dikes to keep the asphaltum beds and waste products that have accumulated there for ten years or more from spreading and finding their way into the channel. In addition, they have installed pumps so that the water is recirculated and the opportunity for pollution is lessened.

The Union Oil Company at Oleum has placed its collecting sumps in such a condition that the discharge water passing out into the bay is now free from oil.

The Standard Oil Company at Richmond has improved its sumps so that the

parently had no effect, three oil companies, the Carson Hill Oil Company, Marine Corporation and the Bush-Vorhiss Company, operating in the Signal Hill field, were taken into court and enjoined from the placing of oil in the natural drainage channel, from which it eventually found its way into the storm drains and into the Pacific Ocean.

The three cases came to trial before Judge Morgan Galbreth of the Superior Court of Los Angeles County, and were vigorously prosecuted by the Division. The Marine Corporation put up a stubborn defense in spite of the fact that the other two defendants defaulted. After hearing the evidence and inspecting the

property in question, Judge Galbreth rendered a decision to the effect that the companies must keep the oil out of the natural drainage or be in contempt of court. Deputy Ed Chan of the southern district secured the evidence in the cases.

Bureau of Public Relations

In addition to the regular publicity work of the Bureau of Public Relations, a 2500 word story relating to the planting of golden trout in barren waters of California, illustrated with a number of appropriate photographs, will appear soon in the *Sunset Magazine*. It covers in considerable detail the history of the work done with the golden trout in the state since the first plant in the seventies.

Bureau of Game Farms

On June 27th the first plant of the 1928 crop of birds was made at Redding and Willows. These birds, 682 in number, were transported to their destination by the farm truck with the loss of but one bird. They were six weeks old and were accompanied by the domestic hens that had raised them.

The Bureau of Game Farms has approved the site at the Los Serranos Country Club near Chino, San Bernardino County, as a suitable location for a second game farm that will serve the southern part of the state. The stock for

the new farm will be sent from the Yountville Game Farm. It will not be necessary to buy breeding stock of any kind.

One of the best ways of acquainting the public with the work of the division is by showing them first hand through exhibits what the Division is doing and the way in which it is being done. Opportunity to display game bird production by the Bureau of Game Farms was availed of in three important localities of the state during the recent fair season. At the Kern County fair, Bakersfield, the State Fair, Sacramento, and the Pacific Southwest Exposition, Long Beach, attractive exhibits of pheasants, quail, Hungarian partridges and turkeys conveyed to the sportsmen of the state that thousands of suitable birds were being propagated for liberation in depleted covers.

An employee possessed with the necessary training and knowledge to present intelligently the bureau's work to the people was in attendance during the course of each exhibit.

A number of beautifully plumaged golden, silver and Reeves pheasants are being supplied public parks upon receipt of application. The parks that secure the birds must guarantee that suitable pens will be provided and that attendants be trained to properly care for the birds and see that the right food is given them. The pheasants are to become a permanent educational exhibit and are furnished without charge.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor.

CRAB SEASON CORRECT

There is some dissatisfaction in regard to the present closed season on crabs in Humboldt County and a desire on the part of some to have the season close earlier.

The closed season as now constituted—July 31 to November 14, inclusive—was arrived at after a number of years of trial and investigation, and it is believed to fit the conditions in the region of San Francisco. The season may not exactly fit the conditions at Eureka. There is evidence that the crab's breeding season and moulting time is a little later at Eureka than it is at San Francisco. The breeding season, which is coincident with

the shedding of the shell by the female crabs, commences here at San Francisco at least by the middle of June, a month and a half before the season closes. The question then naturally arises—What is the object of the closed season? The object of the closed season on crabs is not to protect the crabs during the breeding season. *The object is to cover the period during which soft crabs would enter the nets.* The female crabs are protected at all times, as it has been found that they carry eggs, either internally or externally, practically the year round. The males are protected by a 7-inch minimum size limit, which protects them until after they have passed through one or two

breeding seasons. It is evident, therefore, that with the protection given the females, and with the size limit on males, the crab supply of any region can not be seriously depleted if the laws are enforced. But in addition we have the closed season which saves from loss the male crabs which would be discarded after they have been cooked, due to the watery condition of the meat following the shedding of the shell. At the breeding time males and females are paired and there is no inclination on the part of either sex to seek food and thus get caught in the nets. Then the shell is shed and for a considerable time the crab is unable to move about in search of food for the reason its shell is too soft. When the old shell is cast off the new soft shell underneath is capable of stretching and does stretch as the crab expands after being released from the hard shell which had become too small. This expanding of the soft crab is accompanied by the absorption of water by the crab's tissues and it is this absorption of water by the tissues that renders the crab worthless for food. The new shell then hardens and the tissues get rid of much of the water after it has answered its purpose. The crabs then take on a pithy or woody texture which renders them as unpalatable as the excess of water. After the shell is firm enough the crab moves about for food, and after the *tissues* have become firm again the season is supposed to open.

A question which often arises is: Why is our crab not good to eat when its shell is soft the same as the blue crab of the Atlantic coast? The answer is: The eastern blue crab is taken and held in live cars until it sheds its shell, and it is used for food before the tissues have filled themselves with water. Our Pacific coast crab could be eaten in the same way if it could be taken just at the time it sheds its shell.

The evidence that the breeding and shedding season is possibly a little later at Eureka than at San Francisco is: After the season opens at San Francisco on November 15, no "watery" or what is called "pithy" or "woody" crabs are taken. At Eureka the fishermen have told our deputies that November 15 is too early for the season to open, for at that time a good many of the crabs are still soft and the meat not good to eat. At San Francisco a very small number of soft crabs are taken just before the season closes on July 31, while I have never heard that this occurs at Eureka. After the crabs shed their shells these shells are often washed ashore. The cast shells first make their appearance

along the shore in this vicinity as early as the middle of June, and large numbers have been observed by the end of June. The reports available indicate that most of the shells are washed ashore in the vicinity of Crescent City and Little River during September. Therefore if any change is necessary in the season at Eureka, it should be a little later rather than earlier.

But in reality the closed season is to prevent the catching and waste of soft or "watery" crabs. Of course if evidence, which can be easily obtained from crab fishermen at Eureka, shows that soft crabs are taken in numbers in the crab nets before July 31, then the closed season should start earlier. From the evidence already in our possession, the season should not open any earlier.

SEASON ON SALMON AND BASS RESULTED IN POOR CATCH

When the season on salmon and bass closed this fall on the Sacramento and San Joaquin rivers, fishermen reported the poorest season in years. The fisherman's union announced they would ask for a later opening and for further restrictions on the taking of salmon.

LIBRARY OF CALIFORNIA STATE FISHERIES LABORATORY

People interested in fish and fisheries who have not discovered the library of the California State Fisheries Laboratory (situated at East San Pedro) have a most gratifying surprise awaiting them.

Organized in 1919 at the time of the founding of the laboratory, the library has increased rapidly until it now consists of about four thousand volumes and comprises the major portion of the literature dealing with fisheries problems. Here can be found government and other publications on fisheries biology in every language from Finnish to Japanese. Practically all the literature published on the great fisheries of the North Sea is to be found on these shelves. Mediterranean fisheries literature is well represented and English and American publications are nearly complete.

The library covers not only the scientific aspects of the fisheries problems but also includes publications issued by commercial organizations. The important fisheries trade journals of America, England, France and Germany are shelved here. He who wishes to know the market conditions for Norwegian herring or the problems confronting the German carp ponds finds this information awaiting him.

Besides literature immediately connected with fisheries work, this library has extensive series of publications on oceanography, for to understand our fisheries industries and the behavior of fishes, we must try to understand the waters in which these fish live. Also, any biological study of today demands statistical analysis of the data at hand. The library fills this need by furnishing all modern texts on statistical subjects and current and past issues of statistical journals.

In addition to detailed literature on the scientific aspects of fisheries biology, this library contains works on general biology, general zoology, hydrology, meteorology and fisheries technology. Here the inquiring mind may secure information on the life history of the whale, the water temperature of the Pacific, the ocean currents in the North Sea, the air temperature of Los Angeles, or how to tan shark's skin.

As varied as the scope of the literature contained in this library, are the types of people who come to consult its volumes. The major users are the fisheries biologists working at the laboratory, but also fisheries workers from the whole Pacific coast avail themselves of its resources, both by visiting the library in person and by borrowing books through other libraries and directly by mail. The bibliographical resources are such that specialists in other fields of biology come to this library to consult its vast lists of publications.

Also in this library frequently are to be seen members of the fishing industry: A commercial fisherman who has found an unusual fish which he wishes to identify; a fish canner who wants information on some new or old method of preserving fish; a man planning to develop a fishing industry in a foreign port, wanting to learn the types of fishes available; another with a new idea about utilizing a by-product and seeking all previous knowledge available; a lawyer asking about the migrations of whales on which question hangs a lawsuit. People with whom fishing is a hobby find many questions answered in this fisheries library. Foremost among these questions are the names of peculiar fishes, and occasionally information is sought about special gear, how to make plankton nets, and what will be the effect on fish life, of structures built in streams or bays. Also, high school and college students come in their turn to get information on which to base term papers and theses.

In all cases the personnel is most wil-

ling to be of service and prompt attention is given to questions relating to fisheries.

THE EFFECTS OF STREAM POLLUTION ON FISHES AND THEIR FOOD

A paper by Stephen A. Forbes with the above title has just come to our notice and on account of its intrinsic interest is reviewed although it first appeared in 1926.*

Since 1894, the Natural History Survey of Illinois has been studying pollution conditions of the Illinois River and in 1923 started observations on the Illinois portion of the Rock River. The Water Survey of the state of Illinois cooperated by handling the chemical and bacteriological questions.

Sewage pollutions are of two principal kinds, organic, and chemical or mineral. The former is from households, slaughter houses, dairies, tanneries, pulp mills, etc.; and the latter from gas plants, metal industries, chemical industries, oil refineries and salt works. Organic wastes are subject to decomposition and during the process use up oxygen and add carbon dioxide to the water in quantities injurious to the fish. Chemical wastes do not decay and their effect on fish life ranges from harmless to fatal, and is the result of the poisons acting directly on the tissues, especially the gills.

The difference in reaction of fishes to the two kinds of pollution is interesting. The more sensitive (and more desirable as food) avoid water badly polluted with organic waste while the less sensitive, such as carp and buffaloes, seem to be attracted by it. Chemical poisons do not repel fish and in some cases appear to attract them. Occasionally fish are killed outright with chemical poisons but never with organic. In all cases fish living in polluted water absorb unpalatable flavors.

Experiments on the Illinois River in 1915 showed 5180 pounds per acre of small bottom animals such as make up the food of fishes. In 1920 after five years of increased pollution there were only 240 pounds per acre, a reduction of 96 per cent. This river is large and slow moving and shows a strong contrast with the Fox River, which is smaller and shallower and practically normal 2½ miles below the towns that use it for sewage disposal.

* Read to the Annual Convention of the Izaak Walton League of America, in Chicago, April 9, 1926. Reprinted from *Outdoor America*, September, 1926, by Illinois Department of Registration and Education, Natural History Division.

There are three marked phases of river pollution. In the earliest the organic contents are unchanged and are eaten by adult scavenger fishes. No young fishes of any kind are found in this section. As decomposition takes place the clean water animals disappear and are replaced by sewage fungi, sludge worms, midge larvae. It is easily seen that the bottom conditions are worse than those of the water since the water is purified by contact with the air, whereas the stream bed is continually being coated deeper with filth. The gases forming on the bottom cause worm-

shown that it has an abundance of food for a larger stock of fish than it carries. Then one must conclude that food is not a limiting factor and that an added supply does not increase the number of fish.—Genevieve Corwin, September 4, 1928.

REGULATION OF HALIBUT FISHERY PROPOSED

Birger R. Headstrom, of Medford Hillside, Massachusetts, made the following interesting summary of a report submitted by the International Fisheries Commission, in *Science*, August 31, 1928:



FIG. 102. Successful lion hunters with their kill. Charlie Leadshaw and Ross Harry secured these two lions on the north fork of the main Stanislaus River in March, 1928. Photograph by John Balestro.

and-larvae filled cakes of sediment to break away and rise to the surface. Further decomposition brings about the third stage in which nitrites and nitrates are formed and act as fertilizing agents of the stream. A more abundant growth of plants and animals results, than is found normally. An interesting question then arises: does this added enrichment compensate for the loss farther upstream, and make possible a denser fish population? Before this question is answered another must be settled: is food a limiting factor for the number of fish in a stream? Observations on the Illinois River have

“A recent report by the International Fisheries Commission reveals that, should the present rate of halibut fishing be continued for any length of time, the industry will be reduced to insignificance. Accordingly, a movement to save it is well under way, and stringent regulatory measures have been proposed.

“It is pointed out that not only has there been a fall in the abundance of fish, especially on the older banks, which has fallen to 16 per cent of the abundance in 1906, but there has been a decrease in the size of fish, this being regarded as especially serious because of

the very slow growth of halibut. As an adult fish is from twelve to twenty-five years old, the fish to be caught in the next ten years are already hatched and the yearly abundance for that period has been established. If these fish are greatly reduced in numbers and the present *intensity* of the fishery is maintained, according to the Commission, the outlook for a stock of spawning fish sufficient to maintain the supply is rather hopeless. In fact, few mature fish are now found on the older banks.

"Although there is a complete cessation of halibut fishing for three months each year, this measure is not adequate. The Commission recommends as a minimum re-

quirement that the halibut fishing be limited annually to some fixed proportion of the existing stock. In agreement with the best scientific opinion, it concludes that the taking of a fixed proportion of the halibut equal to that at present taken might ultimately stabilize the industry, since there are indications that the fish could survive under such conditions. Another measure proposed is the closing of two 'nursery areas,' one off Massett Graham Island, B. C., the other off Noyes Island in southwestern Alaska. In fact, the ultimate closing of all such areas is recommended. Furthermore, general restrictions are regarded as indispensable."

LIFE HISTORY NOTES

DUCK MIGRATION BEGINS

For several years I have watched the migration of ducks on Mission Bay, San Diego County. As a rule, the southward flight of pintails begins about the middle of July. This year, although I saw fifteen birds on that day, the main flight has been later than usual. These ducks appeared in increasing numbers until about September 1, when the full flight was on. Apparently these birds stop for but a short time and then proceed farther south.

Two black sea brant and three pintail ducks have remained on the waters of Mission Bay throughout the summer.—Ad. B. Pearson, North San Diego, California.

FEMALE PHEASANT ASSUMES MALE PLUMAGE

There is in our collection of mounted birds a beautiful specimen of the ring-necked pheasant (*Phasianus torquatus*), female. This bird was presented to us alive on the third day of January, 1928, by our mutual friend, Mr. Clarence L. Hopkins of this city, who raised it from a chick, and at the time it came into our possession was about eight years old. During its life time it laid about 280

eggs, many of which were hatched under a bantam hen, as she never evidenced any desire to set, although at diverse times she would gather a few eggs together, evidently for the purpose of nesting. In the year 1926 she quit laying, and from that time on commenced to display an abnormal plumage, commencing at first with flecks about the head, then a ring on the neck, feathers on crown, neck, back changing to that of the male, a well developed ring around the neck, tail elongated and barred, rump feathers, breast and belly the same as the male bird. To all appearances one would take it to be an immature male, except that there are no signs of comb, gills nor pouts feathers from the ears. When the bird was killed in the interest of science an examination of the body was made by the writer. It was very fat, particularly on the breast and intestines; the heart, lungs, liver, gizzard and other vitals seemed to be normal. An examination of the genital organs revealed that the ovaries were completely atrophied, not a semblance remaining, and the ovarian duct had dwindled to the size and color of a slate pencil. We are at a loss as to what may have caused this abnormal change in the plumage.—W. F. Peacock, Marysville, California.

CONSERVATION IN OTHER STATES

MAINE CLOSES SEASON ON MOOSE

Last year the state of Maine opened the season on bull moose. This was the first time for many years that this game animal was allowed to become the mark of the gunner. It is believed that the total kill amounted to 100 animals. However, a statement from the Department

of Inland Fisheries and Game is to the effect that moose are not plentiful enough in Maine to warrant another open season for some time to come. This great American game animal is available to the hunter only in the state of Wyoming, the territory of Alaska and the provinces in Canada.

PENNSYLVANIA RELEASES 80,000 RABBITS

The Pennsylvania State Game Commission has announced the release of the largest number of cottontail rabbits ever purchased and released for stocking purposes in any one year, says a bulletin of the American Game Protective Association. A total of 80,564 rabbits were distributed during the latter part of the winter.

All of these animals were procured from dealers in Missouri and Kansas, who guarantee that no stock handled by them is affected by the dreaded and mysterious tularemia or rabbit fever. All animals are in perfect condition when leaving the dealers' hands. Upon their arrival at the various points in Pennsylvania where they are to be released they are promptly cared for by the game protectors, and any sick or imperfect animals are weeded out. They are shipped in new, clean crates and are given the best of attention on their journey.

The game protector often finds it advisable to keep the crated animals for a time until weather conditions are propitious. Sometimes it is necessary to take the animals for some distance. If they are released in the winter months the protector considers it part of his duty to see that food is placed in accessible situations for the animals. These rabbits are released to provide shooting for Pennsylvania sportsmen.

REESTABLISHMENT OF BIRD REFUGE IN WYOMING

There has been an area set aside for the use of the Department of Agriculture embracing 22,700 acres on the North Platte River, central Wyoming, through executive order of President Coolidge. The lands involved have been withdrawn for use for other purposes and are under the jurisdiction of the Department of the Interior. Within the area is constructed a reservoir for the use of the Reclamation Service in the irrigation of lands. The establishment of this refuge furnishes nesting grounds, as well as feeding and resting places, for migratory waterfowl, especially for ducks, in a region where open water areas are extremely scarce. Within the refuge hunting and trapping is forbidden by law, except under such rules and regulations as may be prescribed by the Secretary of Agriculture.

LICENSE BUTTONS FOR MICHIGAN HUNTERS

With the hunting season approaching, seekers of game are looking forward to

donning the new license buttons that the Michigan Department of Conservation is issuing. The buttons, about 480,000 in number, have been shipped out to distribution points, so that all is in readiness for the license rush. Conservation Department officers predict that the button plan will materially cut down the number of hunters who fail to secure licenses. The badge is large enough to be seen at a distance.—*The American Field*, September 15, 1928.

NORTH CAROLINA SECURES DEER

A deal was recently completed by the North Carolina Department of Conservation and Development with former State Senator J. E. Bursleson whereby approximately 400 acres of mountain land became the property of the state of North Carolina. This area contains about 350 deer, which will be kept intact, and the increase will be used for stocking those parts of the state which have become depleted, other state refuges, and some will be transferred to the state game farm of North Carolina. The fawns will be transferred, as it has been found that the older animals are frightened and kill themselves.

MISSISSIPPI REFUGE ENLARGED

A conservation measure recently approved by the President is a joint resolution authorizing the Secretary of Agriculture to accept from James B. Munn of New York City, on behalf of the United States, a gift of certain lands in Clayton County, Iowa, to become a part of the Upper Mississippi River Wild Life and Fish Refuge. These lands, totaling 488 acres in area and estimated to be worth thirty or forty thousand dollars, were donated to the government by Mr. Munn through his interest in the objects of the refuge.—*Science*, August 31, 1928.

STATE SUPPLIES PHEASANT EGGS

Ringneck pheasant eggs for hatching will be supplied free to New Jersey farmers by the State Fish and Game Commission this year as long as the surplus supply of these eggs is available from the game farms at Forked River and Rockport. Application for these eggs, the commission announces, is made to county wardens.

The breeding flocks at the game farms produce quantities of eggs beyond the hatching capacity of the establishments. A few years ago the State Fish and Game Commission inaugurated the practice of sending out settings of these surplus pheasant eggs to farmers interested in

increasing the game supply in their respective communities. This plan has been increasingly successful, and thousands of pheasants reared on home farms now supplement the supply released directly by the state warden.

OUTSTANDING ACCOMPLISHMENTS OF NEW MEXICO CONSERVATION COMMISSION

In the September, 1928, number of the *New Mexico Conservationist* there appears a section entitled "Progress in

offices game birds, birds of prey and small game animals for educational purposes. (5) Publication and wide circulation of the *New Mexico Conservationist*.

"In cooperation with the State Game Protective Association, other undertakings of far-reaching consequence have been carried through, most important of which are publication of the *Birds of New Mexico*; the protection of bears through legislative enactment, and better organization of sportsmen throughout



FIG. 103. Mt. Shasta Hatchery grounds, with Mt. Shasta in background. Photograph by Sidney Snow.

Game Restoration and Conservation," in which the outstanding accomplishments are summarized as follows:

"(1) Completion of the survey of the wild life resources of the state, and publication and wide circulation of the report covering the survey. (2) Approximating the completion of the big game refuge system, and good progress in the establishment of a system of game bird and waterfowl refuges. (3) Increase and dissemination of game through artificial means—introduction and transplantation. (4) Collecting, mounting and exhibiting at the game department

the state and, through education, stronger public support in game conservation."

A WORTHY BILL THAT FAILED

The bill which provided for the establishment of a five-year constructive and development program for the United States Bureau of Fisheries passed both houses of congress, but was subject to a pocket veto by the President which prevented it becoming a law. This bill provided for the consolidation of several separate bills concerned with the establishment of federal fish hatcheries and fishcultural and research stations

throughout the country over a period of five years. However, as the same congress will be in power this winter, it is entirely possible that the bill may be passed and the Bureau of Fisheries given a wider opportunity for service.

ENTOMOLOGIST EMPLOYED BY MISSOURI STATE GAME AND FISH COMMISSION

The Missouri State Game and Fish Commission is making investigations of plant and animal life that may be used for fish food. K. C. Sullivan, assistant professor of entomology at the University of Missouri, in charge of this work, has found that the *Niangua* is one of the best fish streams in the state, and the food it contains upon which trout and bass thrive will serve to guide the Commission in its work of restocking other Missouri streams. The Commission will then be able to place the fish produced in its eight state fish hatcheries in streams best adapted to their growth and development.

NEW TYPE OF FISH FOOD

The increasing cost of liver as a fish food due to the enormous consumption for human use in the cure of anaemia has forced research departments of state fish and game commissions to search for some satisfactory substitute. A small freshwater animal which has more the characteristics of an unlikeable insect, but goes under the name of *Gammarus*, or freshwater shrimp, is expected to solve this problem for the Oregon State Game Commission. Although each specimen is only one-quarter to three-quarters of an inch long in the adult stage, a mouthful of these little animals seems to satisfy the appetite of trout and salmon in this region. Therefore, Matt Ryckman, superintendent of hatcheries for the Oregon Game Commission, has ordered sev-

eral million of these freshwater shrimps shipped to Oregon hatcheries from Utah and Nevada for breeding purposes. As rapidly as this new type of food can be produced in usable amounts, it will be adopted by hatcheries as standard fish food to take the place of ground liver.

OREGON ADOPTS CONTINUING PROGRAM

The state game protective associations and many local associations have given approval to a plan of the State Game Commission of Oregon for a continuous program and policy in fish and game restoration, some of the objectives of which are the following:

Protection of streams against pollution.

Protection of streams against destruction, provision for efficient fish ladders at power and irrigation dams, and screens for irrigation ditches and power canals and outlets.

Scientific study of propagation, distribution and conservation of wild life.

An educational program including a textbook on Oregon wild life and the outdoors for schools; systematic distribution of public information, and the establishment of a department of marine biology and game administration in one of the state institutions of higher education.

It is recognized that research is necessary to obtain the facts needed in the formation of any constructive policy for management of the fish and game resources of the state. The American Game Protective Association continually advocates the establishment of a department in some university in every state for study of the problem of administration of fish and game and other wild life resources.—*American Field*, August 18, 1928.

REPORTS

FISH CASES

April, May, June, 1928

Violation	Number arrests	Fines imposed	Jail sen- tences (days)
Angling License Act	161	\$3,750	40
Commercial Fishing License Act	12	185	---
Trout: closed season; over limit	81	2,965	130
Striped bass: over limit; undersized	49	1,460	115
Black bass: closed season; undersized; over limit	25	550	---
Sunfish, perch, crappie	25	520	---
Catfish: sale of undersized	2	50	---
Salmon: illegal sale	1	---	60
Barracuda: undersized	6	155	---
Clams: undersized; over limit	36	785	190
Abalone: undersized; over limit	92	2,405	20
Crabs: undersized; illegal shipment	8	240	---
Fish spear, illegal possession	5	125	---
Illegal fishing: within 250 feet of fishway	2	55	---
Fishing, closed district	37	1,200	75
Nets, traps, lines: illegal possession or use	17	2,125	---
Explosives: water pollution	8	700	---
Totals	567	\$17,270	630

GAME CASES

April, May, June, 1928

Violation	Number arrests	Fines imposed	Jail sen- tences (days)
Hunting License Act	11	\$275	---
Deer: closed season	43	3,910	150
Deer: does, fawns, spiked bucks	3	100	---
Rabbits: cottontail, brush; closed season	37	715	210
Ducks: closed season	1	25	---
Doves: closed season	4	50	---
Pigeons: closed season	6	200	---
Quail: closed season	8	280	---
Pheasants: closed season	2	375	---
Nongame birds: killing, possession	1	25	---
Shooting from automobile	1	25	---
Fur trapping regulations	3	30	---
Totals	120	\$6,010	360

SEIZURES OF FISH AND GAME

April, May, June, 1928

Deer meat	pounds	764
Deer hides		1
Deer—fawns (alive)		3
Rabbits—cotton, brush		61
Ducks		3
Doves		8
Quail		19
Pheasants		2
Nongame birds		5
Trout		1,019
Black bass		171
Sunfish, perch, crappie		329
Striped bass	pounds	232
Shad		3
Salmon	pounds	64
Catfish	pounds	10
Barracuda	pounds	11,128
Spotfin croaker	pounds	450
Crabs		95
Clams		1,223
Abalones		205
Nets, traps		8

SUMMARY FUR-BEARING MAMMALS

Species—	Estimated No.		Average price		Estimated value	
	1926-27	1927-28	1926-27	1927-28	1926-27	1927-28
Skunk -----	39,074	56,438	\$1.203	\$1.564	\$47,006.02	\$88,269.03
Muskrats -----	13,261	24,736	.818	.709	10,847.50	17,537.82
Raccoon -----	15,527	19,182	5.639	5.474	87,556.75	105,002.27
Gray fox -----	8,498	14,242	2.132	2.504	18,117.74	35,661.97
Coyote -----	9,631	13,941	5.07	6.452	48,829.17	89,947.33
Wild cat -----	7,015	12,250	2.242	2.829	15,727.63	34,655.25
Civet cat -----	4,839	9,425	.656	.636	3,174.38	5,994.30
Mink -----	4,867	5,854	7.057	7.782	34,346.42	45,555.83
Ringtailed cat -----	3,477	4,368	2.633	3.281	9,154.94	14,331.41
Opossum -----	1,064	2,208	.80	.786	851.20	1,735.49
Badger -----	742	1,216	1.709	2.143	1,268.08	2,605.89
Kit fox -----	2,145	844	2.166	2.366	4,646.07	1,996.90
Beaver -----	692	700	12.905	14.097	9,530.26	9,867.90
Weasel -----	347	661	.765	.918	265.46	606.80
Marten -----	479	495	10.485	15.302	5,022.32	7,574.49
Bear -----	291	239	8.49	6.935	2,470.59	1,657.47
River otter -----	158	163	14.456	17.742	2,284.05	2,891.95
Red fox -----	23	123	21.50	6.489	494.50	798.15
Mountain lion -----	68	88	19.654	12.853	1,336.47	1,131.06
Fisher -----	32	29	42.357	39.281	1,355.42	1,139.15
Totals -----	112,230	167,202			\$304,284.97	\$468,960.46

The above is based on reports furnished by licensed trappers, and is an estimate of the total catch made by licensed commercial trappers. No attempt has been made to include an estimate of the animals trapped by minors under the age of 18 years, or those taken for private use, or those killed in predatory animal control campaigns.

	1926-27	1927-28
Number of trapping licenses issued-----	3,790	5,243
Number of trappers reporting-----	2,619	3,402
Per cent reporting-----	69.1	64.9

STATEMENT OF INCOME

For the Period April 1, 1928, to June 30, 1928, of the Seventy-ninth Fiscal Year

License sales:	Detail	Total
Angling, 1927-----	\$15,441 00	
Angling, 1928-----	68,675 00	
Hunting, 1927-28-----	32,278 00	
Hunting, 1928-----	2,381 00	
Market fishermen's, 1927-28-----	1,210 00	
Market fishermen's, 1928-29-----	21,850 00	
Wholesale fish packers' and shell fish dealers', 1927-28-----	95 00	
Wholesale fish packers' and shell fish dealers', 1928-29-----	170 00	
Game breeders, 1928-----	115 00	
Fish breeders, 1928-----	40 00	
Trapping, 1927-28-----	310 00	
Trapping, 1928-29-----	102 00	
Deer tags, 1928-----	3 00	
Kelp-----	20 00	
Total license sales-----		\$142,690 00
Other income:		
Court fines-----	\$23,957 04	
Fish packers' tax-----	36,902 57	
Kelp tax-----	3 44	
Fish tag sales-----	1,519 57	
Game tag sales-----	7 14	
Miscellaneous sales-----	248 00	
Crawfish inspection-----	150 00	
Interest on bank deposits-----	733 15	
Total other income-----		63,520 91
Total income-----		\$206,210 91

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY, AND JUNE, 1928

Compiled by Division of Fish and Game, Department 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.....
Albacore.....							52,785	106	161,305
Anchovies.....								90	
Barraouta.....									
Bonito.....							740		
Carp.....		74,894		7,356	4,239	14,979			
Catfish.....				3,063	60,035	34,499			
Cultus Cod.....	9,491	8,119					122,477	62,339	17,370
Eels.....									
Flourishers.....	539	19,980					62,522	21,538	200
Grayfish.....							19,605	6,530	800
Hake.....							21,735	19,197	80
Halibut.....	112,814	4,464	37				3,301	1,384	2,733
Hardhead.....		11,090			245				300
Herring.....			15				12,310	10,783	17,996
Kingfish.....							4,323	841	292,588
Mackerel.....									1,851
Mackerel—Horse.....									
Mullet.....									
Perch.....	17,879						3,572	3,015	7,567
Pike.....					12	71			2,197
Pompano.....						234		6	
Rock Bass.....									338,564
Rock fish.....	23,242	4,371					278,141	215,037	9,826
Sablefish.....	122,375						13,301	27,302	226,859
Salmon.....	153,581	544,225		10,372	44,576	39,260	247,226	48,524	226,859
Sandbars.....		15,620					168,269	107,646	1,169
Sardines.....	87						252,550	355	189,823
Sculpin.....								359	
Sea Bass—Black.....									
Sea Bass—White.....									
Shad.....				74	188	15	82,740		
Shad—Buck.....				107,642	34,719	582,708			
Shad—Roe.....				210,580	58,419	923,975			
Sheepshead.....									
Stearns.....		130					44,510	21,044	9,134
Stripack.....									8
Smelt.....	31,333		8,981			46	19,652	37,238	21,273

Sole.....	1,493	70,810				45	230	1,588,391	776,297	129,165
Spittail.....						70,363	106,233	9,986		
Striped Bass.....					19,323					
Stingray.....						49				
Suckers.....										
Swordfish.....										
Tomcod.....										125
Tuna—Bluefin.....										
Tuna—Yellowfin.....										
Turbot.....					2,081					
Whitebait.....					28			900		
Whitefish.....	79,567	2,605						8,722		2,506
Yellowtail.....										
Miscellaneous.....	1,489	390			30			5,557	5,080	3,497
Total fish.....	553,890	756,698	24,530	358,452	272,749	1,702,217	3,023,510	1,366,036	1,433,811	
Crustaceans:										
Crabs.....	20,424									41,872
Shrimps.....					508,326					
Mollusks:										
Abalones.....										
Clams—Cockle.....					5,990					792,325
Clams—Mixed.....			32							
Clams—Pismo.....	716	45			20,919					331
Clams—Softshell.....										
Cuttlefish.....			150		16,200		7,291	2,976	360	345
Mussels.....							80			2,004
Oysters—Eastern.....								478,265		400
Oysters—Native.....								10,300		
Squid.....										1,190,227
Miscellaneous:										
Terminans.....										
Turtles.....									168	
Totals.....	575,030	756,925	658,601	358,452	272,917	1,709,588	4,295,217	1,408,261	3,427,030	

All amounts shown in pounds unless otherwise specified. Skipjack and albacore cleaned.

- 1 851 dozen.
 2 375,621 shell oysters.
 3 44,331 dozen.
 4 355,750 shell oysters.
 5 1,745 dozen.
 6 203 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY AND JUNE, 1928—Continued
Compiled by Division of Fish and Game, Department 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 California via San Pedro.....	Fish from south of the International Boundary brought into Calif- ornia via San Diego.....	Total fish from south of the International Boundary brought into California.....
Albacore.....			18	17	35			
Anchovies.....		41,752	2,508	730	259,276		5,807	8,340
Barracuda.....	9,513	2,129,006	34,841	459,914	2,626,274	2,533	12,837	12,837
Bonito.....		92,386	3,114	394,635	490,225			
Carp.....					102,208			
Catfish.....		141			97,397			
Cultus Cod.....		222	19		219,956			
Eels.....		222			222			
Flounders.....		297			105,076			
Grayfish.....		42,560	188	10,251	79,964			
Hake.....	56,825	150,163	15,669	41,846	41,012		62,624	62,624
Halibut.....					11,335			
Hardhead.....					12,625			
Herring.....		73,940	27	635	107,704			
Kingfish.....		1,813,717	469,087	806,517	3,385,179			
Mackerel.....	1,799	46,781			48,632			
Mackerel—Horse.....		133			5,788			
Mullet.....		22,514		5,655	68,630		7,839	7,839
Perch.....					317			
Pike.....				4	2,466			
Pompano.....		259			194,818		10,397	10,397
Rock Bass.....	1,087	78,757	49,396	65,578	1,696,697	100	3,463	3,563
Rockfish.....	25,146	473,774	3,495	331,927	1,174,355			
Sablefish.....		1,551			1,314,523			
Salmon.....		4,409			297,113			
Sardate.....		6,146,522	1,117	1,369,740	7,960,994			
Sardines.....	200	11,245	28	2,593	14,293			
Scupin.....	68	3,277	14,428	22,832	40,537			
Sea Bass—Black.....			1,424	51,211	264,689		2,726	2,726
Sea Bass—White.....	6,495	205,559			83,017		31,521	31,521
Shad.....					725,069			
Shad—Buck.....					1,192,974			
Shad—Hoe.....	975	27,190	309	1,728	79,202			
Sheepshead.....		3,641	153	569	79,181			
Skates.....					8			
Skipjack.....					1,121,607		276,448	276,448
Smelt.....	18,414	94,204	125	2,118	233,384			1,398,055

Sole.....	96,275	1,122	375	113	2,664,041	
Solifital.....					275	
Striped Bass.....					205,905	
Stringray.....				3,296	3,296	
Suckers.....				29,574	49	
Swordfish.....		1,134			30,708	
Tomcod.....					250	
Tuna—Bluefin.....		2,482,851	21	361,281	2,844,153	
Tuna—Yellowfin.....		320			320	
Turbot.....					2,981	
Whitebait.....		12,813		19,039	93,428	259
Whitefish.....		42,951	692	207,548	31,852	82,891
Yellowtail.....		41,641	370		29,635	53,256
Miscellaneous.....	171				88,260	4,517
Total fish.....	217,060	14,046,892	598,094	4,185,351	28,512,320	14,428,832
Crustaceans:						
Crabs.....		7270			91,131,390	
Shrimps.....					624,158	
Mollusks:						
Abalone.....	9,192				801,517	
Clams—Cockle.....					6,022	
Clams—Mixed.....		213			21,893	
Clams—Pismo.....	33,219				33,550	
Clams—Softshell.....					26,617	
Cuttlefish.....					2,736	
Mussels.....		27			540	
Oysters—Eastern.....					9160,901	
Oysters—Native.....					10,300	
Squid.....					1,190,227	
Miscellaneous:						
Terrapins.....					168	
Turtles.....						
Totals.....	259,471	14,047,402	598,094	4,185,351	32,552,339	3,958,172
						5,439
						14,434,271

7 11 dozen.
 8 47,141 dozen.
 9 731,371 shell oysters.

CORRECTION

On account of delayed reports having reached this office after the original report was made up for publication, the following corrections should be made in the January, February and March, 1928, report of the catch of fish in California published in the July, 1928, Vol. 14, No. 3 issue of CALIFORNIA FISH AND GAME, page 261.

Sacramento-San Joaquin counties should read:

Striped bass.....	28,193
Total fish.....	132,214

STATEMENT OF EXPENDITURES

For the Period April 1, 1928, to June 30, 1928, of the Seventy-ninth Fiscal Year

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....	\$90 87	\$4,195 00	\$570 15	\$560 52	\$5,416 54
Clerical and office.....	203 65	5,049 49	880 59	198 34	6,332 07
Rent.....			2,095 59		2,095 59
Automobiles.....	112 27		52 38		164 65
Telephone and telegraph.....			1,811 46		1,811 46
Postage.....			958 52		958 52
Freight, cartage and express.....			713 52		713 52
Printing.....	4,824 10				4,824 10
Accident and death claims.....			471 30		471 30
Commissioners.....			102 75		102 75
Total administration.....	\$5,230 89	\$9,244 49	\$7,656 26	\$758 86	\$22,890 50
Education:					
Director and assistants.....	\$59 42	\$3,775 00	\$845 39	\$1,418 09	\$6,097 90
Publicity:					
Director.....		\$825 00	\$122 06		\$947 06
Conservation and protection:					
Chief and assistants.....		\$3,129 99	\$619 29		\$3,749 28
Clerical and office.....	\$163 12	720 00	60	\$48 03	931 75
Rent.....			116 46		116 46
Automobiles.....	580 43		174 11	7 90	762 44
Captains and deputies.....	55 63	50,239 98	42,518 81	51 19	92,865 61
Patrol launches.....	410 83	525 00	909 77	1,279 45	3,125 05
Lion hunting.....		600 00	226 30		826 30
Lion bounties.....			2,220 00		2,220 00
Fish planting.....	126 40	630 00	327 90	2,725 48	3,809 78
Refuge posting.....	39 75	646 71	306 53		992 99
Total conservation and protection.....	\$1,376 16	\$56,491 68	\$47,419 77	\$4,112 05	\$109,399 66
Commercial fisheries:					
Chief and assistants.....	\$81 22	\$2,160 00	\$679 42	\$142 28	\$3,062 92
Deputies.....	1,025 47	6,163 50	1,823 89	2 90	9,015 76
Patrol launches.....	569 00	1,185 00	253 28	149 70	2,156 98
Statistical.....	157 16	1,465 00	83 73		1,705 89
Laboratory.....	563 82	8,294 33	1,889 04	427 08	11,174 27
Salmon tagging.....			1 00		1 00
Botulism.....			3,750 00		3,750 00
Automobiles.....	187 27		88 16		275 43
Carp eradication.....	19 05				19 05
Total commercial fisheries.....	\$2,602 99	\$19,267 83	\$8,568 52	\$721 96	\$31,161 30
Fish culture:					
Chief and assistants.....		\$1,050 00	\$13 25		\$1,063 25
Clerical and office.....	\$79 10	1,038 29	9 70		1,127 09
Rent.....			61 55		61 55
Automobiles.....	1,404 61		188 86	\$4,523 76	6,117 23
Hatcheries.....	19,253 90	36,509 68	6,566 77	9,809 31	72,139 66
Hatcheries, additions and betterments.....				17,527 33	17,527 33
Special field investigation.....	62 70	2,261 00	1,482 91	71 02	3,877 63
Total fish culture.....	\$20,800 31	\$40,858 97	\$8,323 04	\$31,931 42	\$101,913 74
Hydraulics:					
Chief and assistants.....	\$101 74	\$1,410 00	\$555 98	\$1,650 35	\$3,718 07
Cooperative research work.....		750 00			750 00
Total hydraulics.....	\$101 74	\$2,160 00	\$555 98	\$1,650 35	\$4,468 07
Game propagation:					
Game farm, Yountville.....	\$2,135 66	\$2,390 50	\$541 88	\$1,035 77	\$6,103 81
Automobiles.....	10 60		5 00		15 60
Game farm, Southern California.....				97 02	97 20
Total game propagation.....	\$2,146 26	\$2,390 50	\$546 88	\$1,132 79	\$6,216 43
Research:					
Chief and assistants.....	\$224 00	\$3,062 00	\$493 80	\$106 84	\$3,886 64
License commissions.....					
			\$9,424 45		\$9,424 45
Totals, Division of Fish and Game.....	\$32,541 77	\$138,075 47	\$83,956 15	\$41,832 36	\$296,405 75

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 Walter Welch, Captain, In Charge Volunteer Wardens-----San Francisco

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 F. A. Bullard-----Reedley
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 Ray Ellis-----Fresno
 W. T. Smalley-----Porterville
 C. R. Taylor-----Coalinga
 C. B. Tibbetts-----Kernville

Launch Patrol

W. B. SELLMER, In Charge-----Fairfax
 C. M. Bouton-----Launch "Quinnat," San Rafael
 Wm. Armstrong-----Launch "Hunter," Vallejo

STATE LION HUNTER

Jay C. Bruce-----San Lorenzo

Captains indicated in capitals.

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