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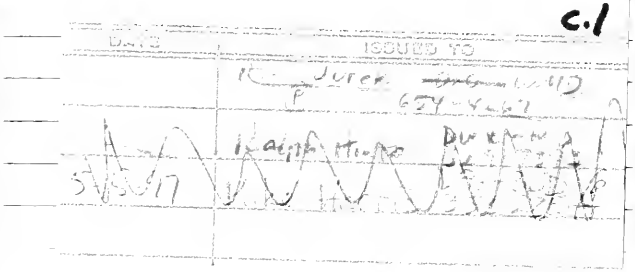

CALIFORNIA FISH AND GAME

CONSERVATION OF WILD LIFE THROUGH EDUCATION

VOLUME 18 SACRAMENTO JANUARY 1932 No. 1

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SOUTHERN CALIFORNIA DOVE SHOOTING

By Ernest McGaffey

THE MOURNING DOVE, or as it is sometimes called, the turtle-dove or Carolina dove, has been for some time on the list of game birds in California, and a number of the Southern States of the United States. From time to time efforts have been made to take it from this list, but without avail so far as the Golden State is concerned. Such efforts are not alone confined to the dove, for in Ohio there is no

open season on the bob-white quail, that splendid little game bird having been designated as a songster. However, the mourning dove is likely to remain on the game list here in California, not only by reason of the fact that he is not, as yet, a rare species, but because of the variety of pleasure which the sport affords, and the further fact that the dove, when properly cooked is an extremely delicious morsel. Doves are very prolific although the female only lays two eggs, but they nest and bring out their young during a number of months in the year.

Their nests are sometimes on the ground and sometimes in bushes or trees. They roost sometimes on the ground, and sometimes in the trees at night, and are found more or less numerous in all of the counties of southern California, according to the favorable or unfavorable conditions of the season.

In southern California the open season for the birds is confined to the month of September in the counties of Ventura, Santa Barbara, Kern, Tulare and San Luis Obispo; in all other counties the season runs from September 1st to October 31st, inclusive Doves are not only found in the cultivated portions of the country, but also on the desert areas, where excellent shooting is often had where the birds are seeking their food among the greasewood and sagebrush of such localities, in the bare spots between the clumps of such growth.

There are three separate and distinct general methods of bringing them to bag. One is by jumping them from the stubbles, sunflower patches, or desert growth, and shooting them on the rise. When this angle of the sport is followed, especially in stubbles, dove-weed, kaffir cornfields where the corn has been cut away, or the sunflower growth, the shooting is not unlike jacksnipe shooting. Singles and pairs are the rule, and as with the jacksnipe, a winged bird will make its presence known when the shooter nears it, and will not attempt to hide, like the quail or other upland birds.

Another method of enjoying the sport is for the hunter to station himself at the edge of a water hole or small pond, and wait for the doves to come in for their morning or evening drink. While a number of these ponds do not afford any concealment, a very crude and yet effective "blind" can be made by taking a hatchet along, cutting off a good-sized branch of a tree, and sticking it in the ground close to the pond. Two branches make a better "blind" than one, as the shooter will then be hidden from view on both sides.

Doves come into such places, especially where the water holes are few and far between, in very large numbers. The shooter can either rise and fire as the doves swerve away from the water, or he can wait until they light and then rise and take them as they are speeding away.

It is simply the most murderous and unsportsmanlike pot-hunting to shoot them on the ground.

Still a third method of dove shooting is practiced which is the best sport of all. This is by the hunter locating himself at a point one or two hundred yards from a water hole, and shooting at the doves as they come into the water. This is practically the same method as pass-shooting on ducks, and will test the skill of the best shot if he expects to get his limit. The limit on doves in California is now fifteen per day or thirty in a week.

When doves are coming into the water, they fly with a rapidity of flight which necessitates a considerable lead on the birds. Incoming

doves are extremely difficult for some shooters, and I have known men who made up for their poor marksmanship at incomers by wheeling the instant the bird was coming in and about fifty yards away and catching him just as he passed overhead.

This trick can be somewhat easily mastered by some shooters while others appear to miss the knack of wheeling at the exact moment so as to present a shot at the fast disappearing bird when he is within good shooting distance.

On a windy day, if the doves are coming in shooters will have their hands full in getting their birds.

Another form of dove shooting which presents great difficulties is when the birds are scattered among a low growth of oaks, and are flushed from the trees by the hunter. In such cases they drop quickly from the branches, twisting, darting, and swerving away with something akin to the zigzag flying of the jacksnipe. Often there is only the chance of a snapshot between tree trunks, and quite often a mere glimpse of the dove as it flies outward through the branches of the trees. No one but a man who is accustomed to snap shooting will ever be able to solve the intricate movements of the birds under such circumstances.

In Imperial County thousands of doves are killed in the kaffir corn fields and other fields. In San Diego County they are found in the pastures, fields, and stubbles, as well as along the creeks and farm lands. In Orange and Los Angeles counties they are found in the growth along the creeks, in the canyons, and along the foothills, and in the oak growth and stubbles on the different ranches. In Ventura, Santa Barbara, and San Luis Obispo counties they are found practically in the same localities and in the stubbles of Kern County and Tulare County as well as in numerous other localities in these counties many birds are brought to bag during the season.

In Inyo and in Mono and San Bernardino counties, which with San Diego give dove shooting during the months of September and October, many hunters are found during the season, and when the flight is good the sport is excellent. Fine dove shooting is often had in Riverside County, and this includes the desert portions. Desert shooting in San Diego County and Los Angeles County, Imperial County and San Bernardino County is sometimes very good and at other times rather questionable.

Imperial County doubtless gives the best dove shooting of any of the 13 southern counties, at least this is so in my own personal experience.

As to the kind of gun to be used in dove shooting that will depend entirely upon the fancy of the hunter. In these latter days of wing shooting, the small bore shotgun of 20-gauge, and occasionally even 28-gauge, is used, while 16-gauges are the favorites of many shooters. I still stick to my old 12-gauge hammer gun, cylinder bored in the right barrel, and the left-hand barrel full choked. With a gun choked for duck shooting, if this is done with both the barrels, you may smash your bird if you have to shoot him at close range.

Shots at doves vary all the way from 15 to 60 yards. If a pair jump at say 25 or 30 yards, you are equipped, in my judgment to get both of them, if a good wing-shot, using the cylinder barrel, of course, for the first shot, and the full choke for the second.

Number eight shot is my preference, although many shooters use number seven and one-half. In the early part of the season, I have known some hunters to use number nines.

It is a good precaution to clean birds as quickly as this can be done, and by wiping them dry and wrapping them in a clean cloth they will be kept in much better condition, especially if the day is warm.

What the State needs badly in regard to protection of these birds is an additional number of game wardens. These men could patrol the country and see that no doves were killed out of season by rabbit shooters, or by unscrupulous hunters when the closed season is on. Doves are subject to the depredations of the Cooper hawks and sharp-shinned hawks, as well as some members of the four-footed vermin families, and bounties on these game destroyers would be a good investment for the State.

Doves come in for water at the water holes both in the morning and in the evening, especially in the evening, and sometimes these vantage points are literally thronged, particularly on the first two or three days of the season.

With the advent of the automobile, the continued extension of modern paved highways, and the advance in numbers of the army of hunters, the mourning dove will be exterminated if care is not taken to give him a chance for his life. It is a curious phenomena of nature that in the city of Los Angeles numbers of these birds appear to have taken up their permanent residence. They nest in the tall tops of the native palm, and in other trees, and will be found here year in and year out in the same areas. Whether or not they read the daily papers and look over the publications of the Fish and Game Commission is beyond my knowledge; but for the past six years I have noted, from my office windows, the presence of a number of mourning doves, who not only roost in the trees about an old residence adjacent to the building of the Automobile Club of Southern California, where my office is located, but who have regularly come back, every day, to the place where that residence once stood, and forage and feed on the bare ground where the house was once located, and light in the trees which were left after the building had been removed.

The low and melodious notes of the mourning dove are among the sweetest sounds in the gamut of bird calls. A young dove, properly broiled, is one of the sweetest tidbits imaginable on a well-ordered dinner table.

CONDITIONS AND CONTROL OF BOTULISM (DUCK DISEASE) IN WATERFOWL

By Dr. M. Hobmaier

Contribution from the State Fish and Game Laboratory [illegible] Hooper Foundation for Medical Research, San Francisco, California

Introduction

A DEFINITE decrease of waterfowl can be noticed throughout the state. The irrigation of land for agricultural purposes in connection with seven dry years has brought about enormous destruction of breeding and feeding grounds for waterfowl. On the other hand the so called duck disease or western duck sickness has decimated the remainders. The exact number of the losses due to this disease, however, is unknown, but an approximate estimate would be about thirty millions of birds.

The conservation of wild life requires the study of these two very important problems. The subject of this paper includes only the different questions about duck disease. It may be regarded as a continuation of an earlier publication by the same writer, entitled, "Duck Disease Caused by the Poison of the *Bacillus botulinus*," CALIFORNIA FISH AND GAME, vol. 16, no. 1, pp. 285-286, 1930.

History

The time and place of the first appearance of the duck disease in the west remains unknown. In California the sickness has been observed since about 1890. After 1909 it became stronger and stronger. The enormous stock of waterfowl existed at that time and the tremendous losses due to that malady is indicated, if we read, in that 50,000 to 100,000 sick and dead waterfowl have been found on one lake during a few days, (3). The duck disease at this time spread over the different states in the west. Therefore the other name, Western Duck sickness, can be understood. Foci of the disease at this time were at Bear River, Weber River, Jordan River, Utah; Southern Joaquin Valley, Soleta Lake, Goose Lake, Buena Vista Lake, Tulare Lake, Salton Sea, and others in California.

It may be recalled that the duck disease in the beginning was observed at the mouths of different rivers, on borders of shallow lakes, and on marshes, and more recently also on the artificial ponds of some gun clubs.

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* EDITOR'S NOTE: Due to the widespread interest in duck sickness the Division of Fish and Game is taking this opportunity to present the results of the study of this malady by its pathologist, Dr. M. Hobmaier.

At the same time, attention is called to similar studies that have been prosecuted by the U. S. Bureau of Biological Survey and particular reference is made to the papers on the subject by E. R. Kalmbach: Western duck sickness produced experimentally. *Science*, New Series, Vol. 72, No. 1878, pp. 658-660, December 26, 1930; Progress in western duck sickness studies. *Science*, New Series, Vol. 75, No. 1932, pp. 57-58, January 8, 1932.

Since large areas of forest land have been cut down and on the other hand the natural water supply of lakes and streams have been used to a larger extent for agricultural purposes in irrigation work, many of the rivers, lakes, and marshes dried up entirely in the following years. However, before becoming dry, they showed vast areas of mudflats and sloughs, with rotten stagnant water. These conditions

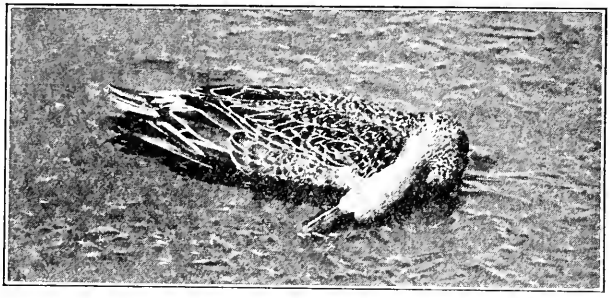

FIG. 1. A duck recently killed by duck disease. Note perfect condition of the plumage, indicating its death without a struggle. Tule Lake, Siskiyou County, Calif. October 12, 1928. Photo by E. S. Cheney.

have been found most favorable for the appearance of the duck disease during the hot season of the year.

In 1931 only two principal foci of the disease could be observed; it was prevalent on some gun clubs around Colusa and on some of those around the Salton Sea.

James Moffitt of the Division of Fish and Game has collected valuable information from a number of gun clubs in the Sacramento Valley. According to these reports the disease was confined in 1931 to the west side district between Colusa, Williams, and Maxwell during the month of September. The disease disappeared about the first of October with the decrease of the temperature in this region.

Around Salton Sea, especially along the south shore, the disease occurred throughout the month of October in accordance with the higher temperature prevailing in this region.

Symptoms and Post-mortems

The first sign of the disease in ducks is a weakness of the body. Instead of flying, the diseased birds try to swim away. In this relation the observations of Chas. C. Sperry are interesting. He writes: (1) "In rare cases a bird can thus be pursued for many rods while it flops over the surface of the water or dives and dodges about among the thin reeds when, having apparently worked up a surplus nervous energy, it at last actually gets in the air and once on the wing flies steadily until lost in the distance."

Later the wing muscles and muscles of the legs become more and more paralyzed. The sick birds remain at the same place even when disturbed. The muscles of the neck may not yet be affected. The sensorium of the birds is still normal. A paralysis of the nictitating membrane is apparent in many species. The discharges of the intestine

are more frequent in the earlier stages of the disease [illegible] is to be noted.

At the end of the disease, the head drops on the back or is stretched out on the earth. The bird, seemingly dead, remains in this position for hours until death arrives. Most birds die without a struggle and they are often found as if over one night. The feathers of the birds are ruffled. The eyes are often [illegible] eyelids being stuck together by a mucous discharge.

The outstanding symptom of the disease is the complete loss of power to fly and to walk, often combined with a paralysis of the vibrating membrane, producing an absolutely helpless condition of the diseased birds.

Post mortems are characterized by the absence of gross pathological lesions. Ordinarily the birds are in normal flesh. The intestinal tract below the caeca is distended and filled with urine. This enlargement of the lower intestine is a remarkable change in sections [illegible] corresponds with the paralysis of the urine bladder often found in diseases in animals.

FIG. 2. Internal organs of a duck that died from [illegible] at the Hollywood Gun Club, Kern [illegible]. Note the enlargement of the lower intestine [illegible] of arrows, a typical symptom of this malady. Photo by E. S. Cheney.

If other changes are present they may be produced due to another disease. Cases can be observed in which the specimen is suffering from duck disease and from another disease at the same time. One of these ordinarily seen secondary diseases is the presence of a destructed wall of the stomach in ducks, produced by the presence of round worms.

It is well known and most noteworthy that sick birds taken from the ponds and placed in pens recover to a large extent.

Diseased birds have no voice and after having recovered, the voice remains raw for a long time, as is ordinarily observed in food poisoning in man.

Theories

Duck disease has been studied by various observers. A valuable work has been done by these investigators. Among these the names of Charles C. Sperry (1), Frank Clark (2), Alexander Wetmore (3), Donald D. McLean (4), E. R. Kalmbach (5), and others, must be mentioned with admiration. The facts drawn to light by these investigators are exceedingly important.

The same can not be said about the theories concerning the etiology of the disease. It would be wasted time to repeat the different theories about the origin of this sickness. Only one theory may briefly be mentioned as being the most popular one and especially since it has received scientific consideration.

This theory suggests that the duck disease is caused by an alkali poisoning. In this relation the conclusions of Chas. C. Sperry (1) are much to the point: "Alkali may be a factor in the duck sickness of Oregon but it certainly can not be considered as the only one and it more than likely is not the chief cause of this malady . . . Experiments disclosed the fallacies in a number of more or less popular theories and substantiated the more advanced belief that the trouble was due to the toxic action of a chemical or a vegetable poison. It appears that this poison accumulates in the liver for in one experiment the sickness was produced by feeding affected liver to a healthy bird . . ."

Paul A. Shaw (6) 1930, a defender of the alkali poisoning theory states in his paper: "Several normal birds were given suspected water to drink for a period of ten days. For one series the water was concentrated to one-fourth the original volume for the experiment. All these birds remained healthy and the blood tests at the end of the period did not show the changes characteristic of the diseased birds . . ." He was not able to reproduce either the clinical or the pathological picture of the disease in his experiments with water of the suspected area.

The Cause

The writer spent October 10 and 11, 1930, at Klamath Falls, Oregon, where he consulted with E. R. Kalmbach, of the Biological Survey, who was studying duck disease at that point. Mr. Kalmbach advised that he had succeeded in reproducing the duck disease in healthy birds by feeding them the livers of ducks that had died from this disease. These organs were kept in incubators at about 85° F. for some time and were then administered by feeding. The writer collected material at Colusa and at Klamath Falls which he brought back to the laboratory with the aim to ascertain the reason of the toxic effect of liver in the experiments of Mr. Sperry and Mr. Kalmbach. According to my previous hypothesis that the disease closely resembled botulism in birds, the writer used anaeorbic media for the isolation of the suspected causative organism.

On October 24, 1930, the writer announced that the disease is caused by the toxin of the *Bacillus botulinus*, probably type *C*. This statement was made after having isolated this microbe in toxic cultures

obtained from internal organs of a diseased and two dead ducks, victims of the disease. Report to President I. Zellerbach. Further explanations have been given in two papers of the same year. 7, 8.

In an appendix to the interesting paper of Kalmbach 5, Giltner and Gough came to the same conclusion.

In 1931 the writer isolated the causative organism from twenty-two wild ducks out of twenty-four specimens. The two remaining ducks showed neither the causative organism nor other pathological changes. By feeding these cultures to normal birds the identical picture of the disease could be produced.

The writer could further demonstrate the toxin of *Bacillus botulinus* type *C* in the blood stream of diseased birds, as later described.

These findings prove that the duck disease is a true food poisoning caused by the poison of the *Bacillus botulinus C*, in a similar way as food poisoning in man is caused by the poison of the *Bacillus botulinus* types *A* or *B*. It may be mentioned that cases of food poisoning with this *botulinus* type *C* in man have, as yet, not been observed. Thousands of diseased ducks have been eaten by man without any detrimental effect.

On the other hand the duck disease is closely related to the so-called limberneck of chickens. It may be mentioned that there is a difference in the susceptibility of different species of birds for the poison or toxin. Tame ducks are much less susceptible than wild ducks. About ten times more poison is required to kill a tame duck than, for instance, a teal, and about twice as much to kill a chicken as a tame duck. This indicates by no means that this type of botulism is exclusively related to wild birds and may be practically harmless to tame birds. Cases on Salton Sea where wild ducks and tame ducks got the disease on the same pond are of interest to note.

It may be mentioned that in experimental work food poisoning in wild birds can be produced not only with the toxin of *Bacillus botulinus* type *C*, but also with the poison of types *A* and *B*. 7. The fact, that food poisoning due to the poison of types *A* and *B* has been observed, as yet, exclusively in barnyard fowl and not in wildfowl under ordinary conditions, indicates that the bionomics of both are different in some way from those of type *C*, since K. F. Meyer (10) regards *Bacillus botulinus* types *A* and *B* practically ubiquitous in California.

Development and Duration

Most of the dead ducks are found in good condition. Ordinarily emaciation is not present. This indicates that the duration of the disease is short. In cases of emaciation the post-mortems often reveal the presence of other diseases. Observations in the field show that normally the sickness lasts from one to three days. The shortest time in experimental work required to kill a wild duck by food poisoning was four hours, the regular time is one to three days. The disease can last one week and longer. In this case an emaciation is developed. The end of the disease is either death or recovery. Sometimes recovery occurs in a few hours, sometimes after one to two weeks. The voice of recovered ducks remains raw for a long time.

We do not know how many birds recover under natural conditions, but it is well known that diseased birds placed in pens recover to a

large extent. In experimental work the same condition can be reproduced with small doses of the toxin. This reveals the important fact that the birds in the field ordinarily consume small doses of toxin. Large doses of the toxin may kill every bird, when there is no recovery. The experiments show further the possibility to produce the sickness by feeding the birds repeatedly with very small doses of the poison, a single dose of which would be not sufficient to produce the disease.

During the disease the birds do not eat or drink. As recovery commences they begin to drink, later on to feed and finally to clean the feathers, then they try to stand up and to fly.

Every excitement of the diseased birds is followed by an exaggeration of the disease. We suggest that sick birds forced to fly may die in a short time due to paralysis of the respiratory muscles or due to heart failure.

The length of the time between the consumption of the toxic food and the outbreak of the disease is different. In experimental work the first symptoms of a bird having received a large dose of toxin could be seen in two hours. Smaller doses produced the first symptoms in eight to twelve hours. A minor dose of the toxin produced the first symptoms after one to two days. Under natural conditions the incubation is reported as being eight to twelve hours.

The course of the disease is different. Only a few birds are sick ordinarily on the first days of an outbreak. After three to five days the highest number of sick birds can be found. Then follows a decline of the disease of varying degree.

Even when hundreds of birds are sick the disease can disappear entirely in a few days if the temperature lowers. This fact has often been observed in the fall. During the hot months of the year the disease is ordinarily not only stronger but also of longer duration. An outbreak during the winter time is unknown.

A decrease of the temperature of the water therefore must be considered as an essential factor in the disappearance and in the control of the disease. On the other hand an increase of the temperature in itself is not sufficient to produce the disease as generally known.

The disease can be observed not only in one bird at different times in the same year, but also it can occur repeatedly on the same ground. The development of a so-called immunity has as yet not been ascertained.

Affected Birds

About fifty species of birds have been found affected with the disease. Most of them are waterfowl and many of them shore birds. It is of interest that Wetmore (3) found many species of birds habitually or accidentally feeding or drinking in the shallow portions of the bays liable to contract the disease.

The same investigator declares the domestic chicken highly susceptible to contract the disease. He seems to be sure that muskrats, frogs, large beetles (*Ditiscus* sp., *Cybister* sp.) have been found apparently dead or helpless due to the malady.

Most of the susceptible birds eat combined food, plants and insects too. Investigations of the food conducted by Sperry (1), Wetmore (3), McLean (4), the writer, and others, showed no indications of any poisonous plants or insects. One of the generally considered seed-

eating birds, which often can be [illegible] However, this bird may [illegible] hawk, by eating dynamited [illegible] accordance with observations [illegible] made the important discovery [illegible] writer [illegible] fed to a normal bird [illegible]

Most of the [illegible] Few of them may be [illegible] blackbirds or crows [illegible]

The symptoms [illegible] described except for [illegible]

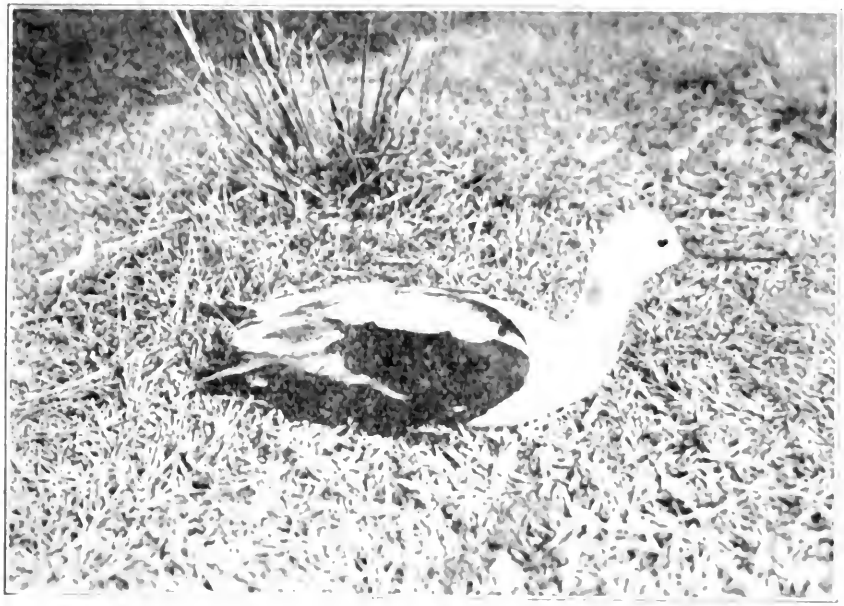

Fig. [illegible] [illegible] Hawk [illegible]

larly be seen paralyzed in all species. Mules and [illegible] equally.

Botulinus and Food Poisoning

In 1895 Van Ermengen [illegible] discovered the [illegible] organism [illegible] food poisoning in man and has given publicity to the most important findings on this subject. The diligent work of other investigators later on has amplified our knowledge of these matters. [10].

The *Bacillus botulinus* occurs in different types. These types are differentiated only by minor qualities. That is shown by the name type instead of species. All these types are considered as microbes of the soil, unable to complete their life-cycles under natural conditions in any animal. They are dangerous for beings due to their production of poisonous substances or toxins, which even when ingested with food are able to penetrate the blood stream and to produce an intoxication which

is in many cases fatal. *Botulinus* types *A* and *B* are closely related to food poisoning in man. The toxin type *C* is known to be deterimental especially to birds and horses, a variant of this type in Australia, to sheep. Intoxications of birds due to the toxin of types *A* and *B* have been repeatedly observed, but as yet no intoxication of man from the toxin of type *C*.

The microbe occurs in two forms. A vegetative form in the shape of rods can be observed and a permanent form, comparable to the seeds of plants, the spores. The toxin production probably takes place by the transformation of the rods into spores. The spores are highly resistant against destruction and they are absolutely necessary for the maintenance of the type. They show no vital reactions until favorable conditions awake them to new life. These conditions are especially the absence of oxygen, a temperature between 72° and 100° F, and a favorable medium for growth consisting of plant, or meat, products. These conditions sometimes are fulfilled by improperly prepared foodstuffs of man, oftener by foodstuffs of birds and mammals, therefore, food poisoning in man is rare, meanwhile botulism in birds and mammals is more common.

The clinical symptoms in man following the consumption of poisoned food are quite similar to those observed in intoxicated animals and in cases of duck disease.

Food Poisoning in Barnyard Fowl

The State Botulinus Commission of California (11) reported food poisoning or botulism in chickens, turkeys, and ducks in 1922. One hundred six outbreaks covering the time between 1903 and 1922 have been reported. The commission feels that only the major outbreaks were available. According to this report many thousands of domestic birds have been lost due to this disease.

The foodstuffs primarily responsible for these intoxications were spoiled string beans, bean hay, corn, asparagus, spinach, potatoes, bread, apricots, tomatoes, salmon, fried chicken and sour milk. Most of these foodstuffs were home prepared and a part of them were at the same time the cause of food poisoning in man.

The picture of the disease was the following: "The birds are inactive and dull, refuse to eat, remain quiet in one place with feathers ruffled. As a rule the movements of the nictitating membrane are sluggish and sometimes there is a marked constipation, but the general picture of extreme weakness governs all the symptoms, the wings droop and the beak or side of the head rests upon the floor of the cage or the barnyard . . . The clinical manifestations are exceedingly characteristic and easily diagnosed." (Dickson). Apparently these symptons are quite similar to those of the duck disease.

In 106 records of outbreaks eighteen times the *Bacillus botulinus* type *A* was found, four times the *Bacillus botulinus* type *B*, and once probably the *Bacillus botulinus* type *B*. In ninety-three outbreaks the type remained unknown. No case of intoxication with the poison of *Bacillus botulinus* type *C* could be revealed. This type was discovered in 1922 by Ida Bengtson of Washington (12), as the cause of many cases of botulism in birds. The type frequently could be found in the soil of barnyards and horse stables, where food poisoning had occurred.

According to Robinson [13] the *Botulinus* type *C* is very common in South Africa. It could be isolated from the body of wild ducks having died after a heavy rainfall in a pond of the zoological garden in Pretoria. The same type of *Bacillus botulinus* has been recorded by Robinson in turkeys, in wild rats, in horses and in mules causing sickness or death. Horses are highly susceptible to this type *C* in South Africa and the same is recorded by Bengtson for the east of the United States.

In California the type *C* was isolated for the first time from wild ducks (Hobmaier) and in 1931 in two cases from wild rats (Hobmaier). Further an outbreak of limberneck in turkeys in which forty three died out of forty seven during three days was caused by this type (Hobmaier).

Since a part of the cases registered by the State Botulinus Commission are closely connected with the region of the duck disease such as Colusa or Klamath Falls, and having found this microbe in the outbreak in tame birds, it is not unlikely that this microbe type *C* occurs in California too as a cause of food poisoning in animals and tame birds; but most remarkable are the losses of wildfowl due to the toxin of this microbe.

Bionomics of the Bacillus Botulinus Type C

The *Bacillus botulinus* type *C* occurs in two variants alpha and beta (Coleman Hooper Foundation) has determined, that the type *C* concerned with the duck disease is the variant *C* alpha (not yet published).

The causative organism of the disease therefore must be considered as the ordinary American type *C* strain of *Bacillus botulinus* of Bengtson and Graham, causing limberneck in fowl and botulism in horses.

A series of experiments has been conducted to establish the properties of this type under natural conditions. Media have been chosen available for the microorganism on the ponds and around them.

Earth or mud, water, and the organic matter desired to be tested, has been mixed until forming a paste. This mixture has been sterilized in small bottles. After an inoculation with spores of the *Bacillus botulinus* type *C* an incubation followed at 25° to 37° C. for a period of three to ten days.

The same experiment was repeated drowning the substances in pure water.

The results obtained were the following: Cultures containing barley were more toxic than those with rice. Cultures with carcasses of different animals, beetles, grasshoppers, fly larva, molluses, fishes, produced toxin cultures. Cultures, however, containing substances of animals, etc., produced more powerful toxins than those prepared with seeds.

It is of interest to note, that grasshoppers for instance, remained poisonous to ducks, even when washed for twenty-four hours in fresh water, before feeding.

In a second series of experiments mud was taken from duck ponds around Colusa and around Salton Sea. An addition of water was made until a paste was formed. The medium was inoculated, after sterilization, with spores of *Bacillus botulinus* type *C*. After an

incubation of from three to five days the cultures were tested on wild ducks. Death could be produced in one to three days by feeding the paste as well as by feeding the water of the paste, but only in six cases out of fourteen different samples, meanwhile eight produced no disease.

The Diagnosis of the Duck Disease

The diagnosis of the duck sickness can be based on the epidemiology, the clinical picture, the isolation of the causative organism, and the demonstration of the toxin.

1. *Epidemiology and Clinical Picture.* Appearance, course, and disappearance of the disease are highly characteristic as previously shown. Together with the clinical picture there is no other sickness, which could be confused with that disease especially as far as wildfowl is concerned. Methylalcohol poisoning, encephalitis lethargica, and cerebrospinal meningitis, three diseases in man similar to botulism, are unknown in waterfowl.

2. *The Isolation of the Causative Organism.* During the last year the causative organism of the duck disease has been isolated from the liver of twenty-two cases of the disease out of twenty-four cases in the laboratory of the Fish and Game Commission. All these specimens were in good condition. Eight of them were killed. Forty-seven investigations on birds not having suffered from the sickness failed to show this organism. These findings justify the conclusion that the isolation of *Bacillus botulinus* type *C* from the liver of diseased or freshly dead birds is of diagnostical value in the case of botulism in fowl.

3. *The Demonstration of the Toxin.* For this demonstration are required 0.4 to 1.0 cc. blood of a diseased duck at the height of the sickness, for an injection into a white mouse. Eight experiments conducted in this line gave positive results in all cases. Five of the inoculated mice died, three recovered, all showing typical symptoms of botulism. In accordance with the method indicated by Weinberg (14) the type of the botulinus could be determined at the same time.

Bacillus Botulinus C in the Field

Investigations were performed in the laboratory consisting of examinations of soil and mud samples from different shooting clubs around Colusa and the Salton Sea during 1931. Duck disease occurred in both regions in this year.

Seventy-six mud samples were secured from the levees of fifteen duck ponds and especially from sloughs, and wet and dry mud from near their borders. Only places suspected of the presence of the bacillus were chosen. The number of samples taken from every pond were two to six. In eight cases the foam on the surface of the water was tested. Twenty-eight samples out of seventy-six showed the presence of the toxic *botulinus* strain type *C*. Two samples out of eight of a greyish foam on the surface of the water were found to contain the causative organism.

The ponds around Colusa received water from rice fields and the Sacramento River (drain 2047). Four samples were taken from an evaporating ditch and four from a ditch nearby that had dried up entirely. In three samples of the former and in two of the latter the

Bacillus botulinus type *C* could be isolated. The source of the pollution remained unknown. The possibilities were pollution from dead fowl from rice fields or from outlet water of the surrounding ponds.

Fifteen samples were secured from an area of rice fields near these duck ponds. The fields were drained. A pond had remained in the middle of the fields. Many waterfowl could be seen there, but no sick or dead birds. Little pools with decaying fish of different sizes were abundant in these fields. Two out of the fifteen samples performed toxic cultures of *Bacillus botulinus* type *C*, using enrichment media. Further investigations in this line are required to ascertain if these fields are of direct or only indirect importance in the outbreaks of the disease.

Three samples out of three taken from mud of the saltworks on the north shore district of the Salton Sea gave negative results. This statement is of importance in so far as the saltworks is generally considered as the chief cause of the disease in this region.

Sixteen samples taken from the mud of the temporarily overflowed shore line of the South Salton Sea showed the presence of the *Bacillus* in seven cases.

In a series of experiments twenty mud samples collected from ponds near Colusa and Salton Sea were investigated for the presence of the toxin. Without any preparation only three samples produced symptoms of botulism by feeding the mud to wild ducks. After an incubation for seven days at about 30° C. six more samples were found to be toxic.

Botulism in a normal duck could also be produced by feeding barley collected from an enclosure on a duck pond on the Angelus Club, Salton Sea. In this enclosure the call-ducks had previously died from duck disease. They had been fed with barley thrown in a heap in the water and on the water itself.

On the Coachella Club near Salton Sea, decaying ducks were found on the borders of a pond. Myriads of fly larva were found on the carcasses, and many of them had also drowned in the water. Feeding a small quantity of these drowned fly-larva to a healthy duck produced the typical duck disease.

The water of five different ponds was tested without positive results. These few experiments, however, do not prove that the water is harmless in outbreaks of the disease. Small accumulations of water may be of importance, like the water contained on certain places in the mud.

The experiments show that the presence of the *Bacillus botulinus* type *C* as well as the toxin on various substances in the duck ponds and on other feeding places of the waterfowl can be demonstrated. It is noteworthy that the media giving positive results were mostly rich in organic matter.

Sources of Pollution With Bacillus Botulinus Type C

1. The most important sources of pollution are the carcasses of waterfowl having died from duck disease. The easiest way to isolate these microorganisms, as shown by Robinson (13), is if the specimen is allowed to decay for a month or longer. In the same way the carcasses

of rodents (wild rats) and other animals (for instance horses) having died from botulism (*C*) may produce a pollution.

2. The droppings of sick waterfowl and mammals suffering from botulism, living near the water.

3. Botulism in barnyard fowl. The pollution may be affected by throwing the carcasses in rivers or lakes or if drainage water can reach the places where these carcasses are decaying. An aggregation of the spores at the mouths of rivers or in marshes and lakes may be understood in this way. The theory the duck disease primarily originated from these sources is most convincing. The same pollution, however, is brought about in the same way due to carcasses of other animals having died from botulism type *C* and handled as above mentioned.

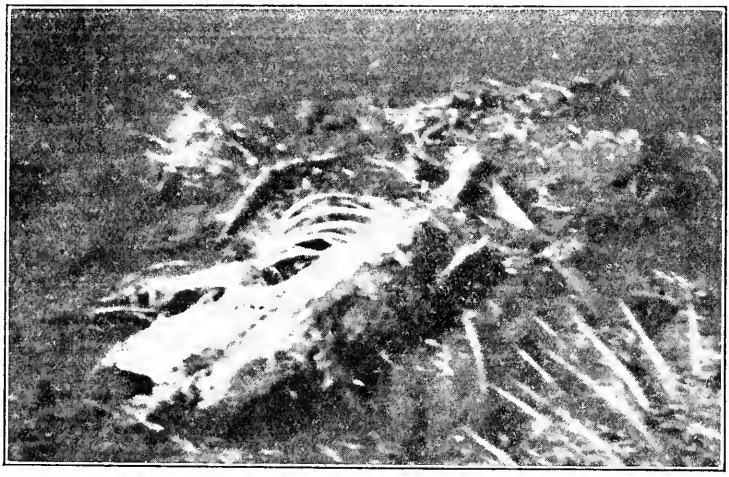

FIG. 4. Decomposing carcass of a duck that died of duck disease. Tule Lake, Siskiyou County, California, October 12, 1928. It is in this manner that the author suggests a spread of the organism causing the disease, resulting in probable recurrence of the sickness in a following season on the same ground. Photo by E. S. Cheney.

4. A similar undesired effect may be expected, if manure of diseased animals has been used for fertilization of fields flooded in fall and used as duck ponds.

In earlier times the running water of heavy run-offs seems to have cleaned the rivers and lakes bringing the spores of Botulinus down to the sea. More recently slow and smaller water run-off has changed the situation. Floating matters now silt up to a large extent the borders of our lakes.

Conditions on Duck Ponds

Duck ponds on which the duck disease is prevalent are characterized by unsanitary conditions.

To attract waterfowl the gun clubs provide water and feed, even on places on which there is naturally no water and no food. Gun clubs with artificial ponds can be seen during the shooting season.

Most of these ponds are dry during a part of the year. They are flooded in the hottest time of the year. The water used is of different

quality. Drainage water is often used for that purpose and must be considered as polluted.

In order to provide food for the ducks some [illegible] have flooded harvested grain lands. Certainly many foodstuffs are contained in a pond formed by drowning the fauna and flora of a grain field. Unfortunately in doing so the clearing process of the water is delayed or entirely suspended. Under the influence of the hot temperatures an undesired fermentation takes place. Due to the shortage of water usually no water change is provided. Decaying organic matter develops to an unusual degree cellulose bacteria followed by vampire gas producing especially Methan and SH2 indicating that the anaerobic bacteria instead of the aerobe bacteria are prevalent in these ponds. The mud smells bad and a greyish foam partially covers the water surface. If there are spores of the *Bacillus botulinus* type C in the water or mud an outbreak of the disease can be expected during the hot days since the fermentation itself raises the temperature of the water.

Similar conditions are produced if the land is flooded without building levees around ponds. Mudflats and sloughs are formed at the borders. The stagnant water is of a dark color and its temperature sometimes raises to 75° to 80° F. A continual decrease of the water due to evaporation can be observed followed by the formation of more mudflats and sloughs.

It must be considered furthermore as detrimental if the same pond is flooded year after year, during the late summer or early fall without cleaning the ground. Too much organic matter is deposited on the bottoms of these ponds due to the used water, the droppings of the waterfowl, and the decaying of plants and animals.

The presence of sick and dead waterfowl on these ponds, suffering or having died from botulism is a potential source of the same disease during the following year. On October 30, 1930, a dead wild duck having died from duck disease was buried behind the laboratory. Soil samples taken from this place on September 15, 1931, showed the presence of *Bacillus botulinus* type C.

Other Foci of the Disease

It is known that in earlier times the heaviest losses occurred at the mouths of different rivers, on marshes, and on the borders of shallow lakes. Most of these places dried up entirely. The appearance, however, of the sickness on one of these places, is of great importance due to the fact that larger flocks of waterfowl concentrate in such situations and the losses resulting are more numerous than on other places.

The appearance of duck disease in 1931 was reported from Salton Sea only from the south shore district. This part of Salton Sea is very flat. Sloughs and mudflats extend approximately 100 yards in the direction of the lake and form its border. Many carcasses of dead wild birds could be found along the shoreline. If the wind blows from north the drying mudflats are overflowed, forming ponds. If the wind changes in the contrary direction the lakeshore consists of wet and drying mudflats. The mud is a loamy earth and contains ill smelling matter. It is of interest to note that in this region of the shore large quantities of water from irrigation ditches and from two rivers flows

into the lake. This water forms a red zone about 200 yards wide along the shoreline. The water of the lake itself is of a blue color. It indicates that the water from the rivers and the ditches is not completely mixed with the water of the Salton Sea, but that the former is spread along the shore. The dirt from the ground seems to have been brought to the shore partially by the water of the New River and by drainage water. Some may have been developed there itself due to the fact that alfalfa fields existed there two years ago to be since drowned out. It will be remembered that on this shoreline in seven out of sixteen samples of soil the *Bacillus botulinus* type *C* was isolated.

On the east side of the Salton Sea around Bombay Beach, there is no water from irrigation or from a river at all. There about 5000

FIG. 5. Ducks that had been picked up in helpless condition due to duck disease often recovered fully within three to five days after being put in pens and provided with clean water. Hollywood Gun Club, October 26, 1928. Photo by E. S. Cheney.

ducks were aggregated at the time of my visit. The shore does not indicate the same unsanitary conditions as described for the south end of the Salton Sea. On a route of about half a mile along the east shore the carcasses of only six wild birds could be found. No sick birds were present. No *Bacillus botulinus* type *C* could be isolated from soil samples taken there.

This short description of the conditions on Bombay Beach and on the south of the Salton Sea serves to bring vividly to mind, that not the water of the Salton Sea itself, but the unsanitary conditions of certain spots on the shore must be blamed for the outbreak of duck disease in this region.

Suggestions for the Control of Duck Disease

The disease was observed at two principal places on the south shore of the Salton Sea and on the ponds of various gun clubs. It is necessary to provide sanitary conditions at these places.

If the gun clubs had sufficient water to flood their ponds there would probably be no trouble of duck disease on these ponds. The question is, therefore, how is it possible to produce sanitary conditions in this case, on the duck ponds without getting a larger water supply. For this purpose I would propose the following measures to be taken by the gun clubs.

1. *Preparation before flooding:* To first submerge land to be used for duck ponds is thought to be impractical as it is the practice to plow or disc fields of barley or other grain under prior to flooding. This practice may not be detrimental to wild life, if the flooding takes place during the month of October, when the weather is not as hot as earlier.

It is necessary to use well leveled ponds. Sloughs, mudflats and shallow places should not be formed in these ponds as the temperature can be kept down easier, the clearing process of the water accomplished in shorter time and therefore the conditions kept less favorable for the growth of botulinus, if such do not exist. The shortage of the water supply makes it necessary to accommodate the size and number of the ponds to the available water supply.

Prior to flooding the bottom of the ponds they should be cleared of excess vegetable material.

Regarding the shape of the ponds, round ones or ponds with round corners are preferable, since more complete water circulation is obtained in such than in ones with square corners.

The feeding places should be clean and covered with dry sand. The food may be mixed with gravel. It is preferable to feed on the dry margins of ponds, to throwing the grain in the water.

The inlets and outlets of the ponds should be carefully prepared to provide a change of water if it is desired.

2. *Flooding of the ponds:* The flooding of the ponds should be done as quickly as possible. In doing so the temperature of the water is kept down.

Artesian water as used on the north of the Salton Sea requires no special treatment. No drainage water at all should be used, if it is possible. If drainage water can not be avoided in flooding ponds this water may be cleaned by the addition of chlorine.

3. *Handling after flooding:* A pond prepared as indicated requires little further care. The first requirement is to keep the water at the same level during the season. If water and levees are clean the temperature of the pond should be watched. The thermometer should not exceed 72° F. at any place in the pond. If the temperature on any place in the pond reaches this height, it is necessary to open the gates and produce in this way a permanent movement of the water. It might be mentioned that especial care should be given to the feeding places. Carcasses of any kind on the ponds and around them should be removed immediately.

4. *Handling in case of duck disease:* In case of duck disease the sick birds should be collected and enclosed in pens with fresh water, the dead ones should be carefully collected and burned. An inspection of the sanitary conditions should be made. The Fish and Game Commission will always be very glad to help clear up cases when informed.

It will be repeated, that all these measures are only proposed for imperiled gun clubs. On other places steps like those proposed are not required.

South Shore of Salton Sea

The waterfowl on the Salton Sea and on the gun clubs around the sea are continually imperiled due to the unsanitary conditions on this shoreline. To make sanitary conditions there is an important problem of conservation of wild life. There is no doubt that the pollution of the shore line is caused mostly by polluted water running into the lake. This water seems to be polluted by two sources. One source is the water of the ditches. Another important source is the pollution brought about by garbage and industry and from farmers. From the standpoint of conservation of wild life it is necessary to show these people the importance of keeping the rivers clean at the present time. Without this cooperation of industry and farmers on the borders of the rivers and shores a satisfactory sanitation of the shore line can hardly be performed.

The sanitation work requires, furthermore, the deepening of the mouths of the rivers running into the Salton Sea. It is necessary to destroy the sloughs and the mudflats on the south shore line by moving their borders forward about 100 to 200 yards in this region.

Conclusion

The so called duck disease or western duck sickness is an intoxication of waterfowl due to the poison of *Bacillus botulinus* type *C*. It is a real food poisoning like botulism in man. The water on places on which the disease is prevalent is polluted with spores of this microbe. During the hot months of the year these spores grow and produce toxins, if, at the same time the water is rotten and hot.

Keeping the water clean and its temperature low are means of preventing the duck disease. The installation of sanitary conditions in affected areas will reduce the losses. It may not be possible to destroy all the sources of the disease at once, but only relatively little effort, as shown, is required to diminish the losses, and in doing so to establish a valuable conservation of wild life.

Donald D. McLean and James Moffitt of the Fish and Game Commission were of the greatest assistance in this study giving every possible information, both traveling to different places around Colusa, and Mr. Moffitt besides helping me in the formulation of this paper. J. Hecker, Game Warden in Coachella, assisted me in my visit to the Salton Sea. It is a pleasure to acknowledge their kindness.

Literature Cited

1. Sperry, Charles C. Report on the Duck Sickness in Southern Oregon and Northern California, Summer 1927. (Manuscript.)

2. Clarke, Frank C
3. Wetmore, A
4. McLean, Donald D
5. Kalmbach, E R
6. Shaw, Paul V
7. Hohmuier, M
8. Hohmuier, M
9. Van Emmenes, F
10. Meyer, K F
11. Geiger, J., Dickson, F G and Meyer, K F
12. Bengtson, Ida A
13. Robinson, E M
14. Weinberg, M., and Ginsburg, B

UNUSUALLY GOOD FISHING IN AND OFF MONTEREY BAY*

By J. B. Phillips, California State Fisheries Laboratory

ABNORMALLY high temperatures of the water along the California coast, probably due to warm ocean currents, are most likely responsible for the unusual runs of fishes, especially the semitropical forms, that have occurred in and off Monterey Bay during 1931.

The early fall season of 1931 furnished what is probably the best mackerel fishing that dock fishermen have ever experienced at Mon-

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terey. The fish referred to is the Pacific mackerel (*Pneumatophorus japonicus diego*), commonly, although not correctly, called striped, zebra, or common mackerel. Oldtimers, who have spent their entire lives at Monterey, have pronounced this season's "run" as exceptional.

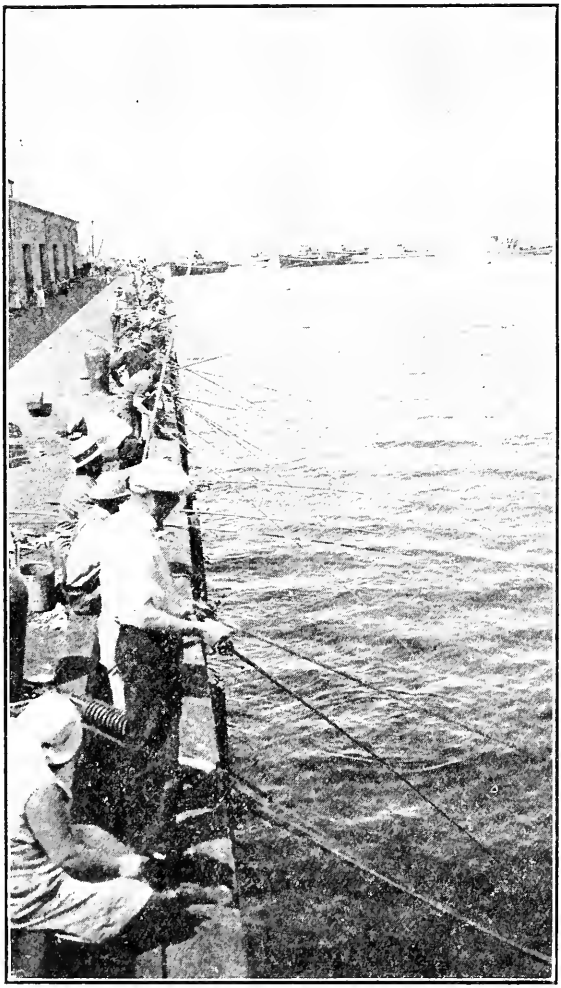

FIG. 6. A portion of a Monday crowd on one side of the Municipal Pier at Monterey while the Pacific mackerel "run" was close to shore. Ordinarily the mackerel schools fluctuate beyond the fishing boat moorings in the distance, but during a six-week period in August and September of 1931, wharf fishermen experienced the best fishing that they had ever had at Monterey. Photo by J. B. Phillips, September 21, 1931.

Never have they seen such a prolonged run so close to shore. During the last three weeks of August and the first three weeks of September, great numbers of fishermen lined the Municipal Pier and at times the Fisherman's Wharf. On week ends, choice standing and sitting room

was at a premium. Strong graceful [illegible] weighing one-half to three pounds, broke many a window on the Municipal Pier when over-anxious fishermen swung their catch out of the water. Many fishermen stopped fishing when they filled a sack, but others were more enthusiastic. Fish were freely given to onlookers and [illegible] when the fishermen returned home. Many caught more [illegible] sport of catching, than they themselves could use. On some days [illegible] a conservative estimate of the amount taken by fishermen on the pier alone sometimes would amount to 15 or 20 tons. The amount taken by the sportsmen is an estimate often out altogether. The California Division of Fish and Game has no record at present of the [illegible] showing species, weights and prices paid [illegible] sportsmen as it has of the commercial deliveries.

Several normally southern California fishes are appearing in abundance in Monterey Bay and just outside. Many tons of barracuda (*Sphyraena argentea*) have been taken during the period of August and September. Barracuda have not appeared in any great numbers in Monterey Bay for several years. Catch figures show this season's landings from Monterey Bay to exceed by many tons that of any other season represented. The catches of barracuda have been accompanied by record catches of bonito (*Sarda chiliensis*). Many of the bonito specimens range between 7 and 10 pounds in weight. This fish is sometimes misnamed skipjack in the Monterey region. The most easily recognized, distinguishing mark of these two tunas are that the bonito (*Sarda chiliensis*) has narrow black bars extending more or less obliquely across the back above the lateral line, while the skipjack (*Katsuwonus pelamis*) has dark horizontal stripes on the lower half of the sides. Albacore (*Germo alalunga*), the prime member of the tuna group, made its appearance off the coast just south of Monterey Bay during the second week of September. This is the second consecutive season for a number of years that the "chicken of the sea" has appeared in any numbers in this region. The most easily recognized characteristic of the albacore is the long, aberlike pectoral fin which reaches well beyond the front of the anal fin. All the tunas, bonito, skipjack, yellowfin, bluefin, and albacore, as well as the other members of the mackerel family, have several finlets following the last dorsal fin and the anal fin.

On September 15, 1931, there were landed at Monterey 1800 pounds of saury, also called skipper or bluefish, *Cololabis brevirostris* (perhaps not separable from the Japanese species, *Cololabis saira*). This is a slender, mackerel like fish more closely related to the flying fishes and normally found in the open seas. The saury is a small fish not exceeding 18 inches in length, with the dorsal and anal fins inserted about two-thirds the distance from the head to the tail, followed by several finlets. Small, bright blue blotches appear haphazardly along the sides. When a school of saury is pursued by tuna, the fish crowd forward and in their anxiety to escape, the hindermost ones leap forward from the water, skipping and soaring for probably a hundred feet.

Sardines (*Sardina caerulea*), on the other hand, have been scarce in this bay during August and September, when the sardine plants are in operation. This season, during the two-month period mentioned, approximately 30 per cent of the catches of sardines were made in the bay, the balance coming from north of the bay. During this same period for the two previous seasons, approximately 90 per cent of the catches were made in Monterey Bay.

A misleading report is that yellowtail are being landed at Monterey. The reference is to the yellow-tailed rockfish of the species *Sebastodes flavidus* and not to the true yellowtail (*Seriola dorsalis*), whose range is normally from Point Conception south.

During the last week of March and the first week of April, 1931, several California sheepshead (*Pimelometopon pulcher*) were taken from Monterey Bay. The normal range of this species is from Point Conception south.

Usual landings of commercially important fishes from Monterey Bay include members of the rockfish group; flatfish group; perch group; smelt group; herring; anchovy; Pacific cultus or cultus cod; kingfish, with which are mixed a small percentage of queenfish; sablefish; horse mackerel; white sea bass; and salmon. The season on some of these species, such as salmon, white sea bass, or horse mackerel, is short, due either to legislative restrictions or the migratory nature of the fish. Squid (a mollusc related to the octopus) landings are also large enough to be of importance. Abalones are taken by diving in District 18, which extends from the mouth of the Carmel River to the Santa Barbara-Ventura County line. Small amounts of octopi, or devilfish (mollusks) and prawns (crustaceans) are taken just south of Monterey Bay.

THE CALIFORNIA QUAIL SANCTUARY AND GAME REFUGE CAMPAIGN

By Walter R. Welch

When old Dame Nature created the Valley and Mountain Quail of California she made a beautiful as well as a brave and game little bird, to which the sportsman who enjoys a day afield with gun and dog, the farmer, rancher, orchardist, and vineyardist is most deeply indebted.

Not very many years ago the valleys, hills, desert areas, and mountain slopes throughout this great State were alive—so to speak—with these beautiful native game birds, but today, sad to relate, there remains but a pitiful remnant of that once bountiful supply.

During the past thirty odd years laws have been enacted, theories advanced, and efforts made to protect and to bring back the supply of quail, but without any very noticeable or beneficial results.

It had become quite apparent that if our native quail were to be saved from total extermination, it would be necessary to ask the State

Legislature to enact a law that would afford quail the protection of an absolute closed season for a period of from five to ten years in order to save them from the "one bird list" for perpetual protection, unless some statewide system could be put in operation whereby the supply of quail could be maintained at not increased without the necessity of taking such drastic action.

With this view in mind and realizing that future quail hunting and shooting in this State will necessarily be confined to a great extent to private property, and that no system or effort to maintain or reestablish the supply of quail in or will result successfully without it meets with the support and cooperation of the farmers, ranchers, orchardists and vineyardists throughout the State, the Fish and Game Commission, in 1930, put in operation, through the medium of the Volunteer Deputies of the Division of Fish and Game, a statewide movement to encourage farmers and other owners of land to voluntarily set aside part of their land as inviolate quail sanctuaries and game refuges, and to close to hunting and shooting the areas thus set aside for a period of three years.

While the lands that are thus set aside are private property over which the Fish and Game Commission has no direct supervision or control, and are not State game refuges, this movement on the part of the Commission has been met with the spontaneous and enthusiastic support and cooperation of farmers, landowners and sportsmen. The result is that although the campaign has been in operation only a little over one year, upwards of twelve hundred inviolate quail sanctuaries and game refuges have been voluntarily established on private property where quail and other game may now propagate undisturbed and unmolested in open breeding grounds, from the nucleus of wild birds in the fields.

This movement, as it is at present being conducted by the Fish and Game Commission in its efforts to solve the quail problem in California, has met with support and cooperation. It is proving to be successful and beneficial, and interest in it has not abated or lessened and bids fair to continue, as is evidenced by correspondence and photographs received from farmers and landowners who have set aside part of their land as quail sanctuaries and game refuges, editorials, cartoons, and articles published in newspapers, and reports from Volunteer Deputies who have assisted the farmers and landowners in establishing quail sanctuaries and game refuges and in posting the areas closed to hunting and shooting.

In this connection it may be briefly stated that thirty odd farmers and ranchers in the Sierra National Forest and vicinity, during the past year, have set aside part of their land as inviolate quail sanctuaries and game refuges. This was done in response to a letter addressed to them by Forest Supervisor M. A. Benedict of North Fork, California. These farmers without exception state as a result of establishing sanctuaries there has been a noticeable and decided increase in the supply of quail and other game on their land this season. They are heartily in favor of reposting and continuing the sanctuaries.

A landowner near Los Altos, Santa Clara County, states that there are more quail on his land this year than there have been at any time during the past twelve years. The owner of a forty-acre

vineyard near Escalon, San Joaquin County, reports over one hundred and fifty quail on his land this year where less than a dozen birds were to be seen two years ago.

A farmer in Ventura County states that he can now see fifteen or twenty grey squirrels around his home where none were to be seen two years ago. The wives of farmers in Santa Cruz and other counties report that from thirty to fifty quail now come to the house and feed with the chickens every day.

Many farmers have reported that the supply of quail and other game on their land has increased very noticeably since the establishment of a sanctuary and that they now frequently see deer in their orchards, vineyards, or fields.

In many instances the wives of farmers and landowners have manifested a deep interest in, and have contributed to the success of the quail sanctuary campaign by supplying the birds on the sanctuary established on their property with water and feed, and in assisting in affording them protection.

All of these facts indicate that the farmers and landowners of California are now beginning to realize that while the title to all wild game is in the State, a good supply of it, if maintained on their land, is a valuable asset to them. They realize also that it would be properly protected and conserved and that the campaign for the establishment of inviolate quail sanctuaries and game refuges on the lands of the farmers, as it is being conducted by the Fish and Game Commission of California at this time, is one of the most constructive cooperative movements to reestablish the supply of native game birds, such as quail, that has ever been attempted in this or in any other state, and that it is proving to be an unqualified success.

As it is a practical impossibility for the State to maintain public shooting grounds, all well informed sportsmen of the present generation are aware of the fact and now fully realize that the day of free hunting and shooting of quail and other small upland game in California has passed and that we must now depend upon the farmer and landowner for our future hunting grounds.

While, as heretofore stated, the title and ownership to all wild game, so far as it is capable of ownership, is in the State and while as a matter of fact the owner of land has no title or ownership to any of the wild game thereon, and can not hunt, pursue, take, kill or have in his possession any wild game found on his land, except at such time and in such manner and quantity as is provided by state law, Section 627 of the Penal Code of this State provides that it shall be unlawful for any person to hunt, pursue, take, kill or destroy any animal or bird on any land that is private property without first having secured the written permission of the owner of the land.

Therefore, at this day and date, when the russet days draw on, and we long to go afield with gun and dog for a quail or other upland game shoot, as a license to hunt, granted by the State, gives its holder no right to hunt upon private property without the consent of the landowner, we are reminded, as suggested in Frost's painting, "The Conciliator," to have the foresight to provide ourselves with the necessary flask, the presentation of which so frequently causes the

stern features of the born [illegible] into a welcoming smile [illegible] grounds.

In any event the [illegible] sion to hunt on the land [illegible] expresses his gratitude [illegible]

FIG. 7. Before [illegible] was not a difficult [illegible] above picture, taken [illegible] birds at mee[illegible] are, left to right, [illegible] English setter. How [illegible] depleted quail population [illegible] 1931.

senting the farmer's wife with [illegible] some fruit, thus making his [illegible] and desired.

I was born and raised in [illegible] the vanishing of this State's [illegible] including our native quail. [illegible] been in the game fields of the State in the discharge of the duties of

a game warden, working and many times fighting to protect and succor our wild life. During all of these years I have tried, and seen tried, many different plans and campaigns for the propagation and protection of wild life, only to see them result in a battle between the "Army of Destruction" and the "Army of Defense," and prove to be a failure in their intended purpose.

Much has been said, and still is being said, by sincere wild life conservationists relative to the necessity of a campaign of education in regard to the value of wild life as a lure for healthful outdoor recreation and pleasure and the need of its protection and conservation. Such a campaign has been and is now being conducted by the Division of Fish and Game, and has proven to be of great value. But, as the time has now long gone by for the use of soft-voiced, soft-handed methods for wild life protection, and the time has arrived when we must resort to drastic and strong armed practice, if we would save the supply of our wild life from being reduced to the verge of total extermination, in no account should the value of education as a practical factor in wild life preservation be stressed beyond its real potential value.

However, while it is far from me to discourage any move that offers even a fighting chance to save our wild life from extermination, whether that move be one of education or otherwise, I would at this time post one note of warning. Until such time as it has been fully and definitely determined whether the present quail sanctuary and game refuge campaign as it is being conducted by the Fish and Game Commission of this State has proven to be either a success or a failure do not be sidetracked or deceived by any theories that may be advanced or advocated by "Lotus Eaters," who dream that the depleted game fields of California will again become restocked with quail that have been raised in captivity on State game farms, and that we will again be able to enjoy free hunting and shooting on the lands of the farms and landowners, or on public shooting grounds maintained by the State.

Nevertheless, too much can not be said in favor of the State game farms that the Fish and Game Commission of California have established at Yountville and Chino, nor too much credit be given to August Bade, superintendent of the farms, for the splendid and capable manner in which he has conducted them, which has resulted in there having been liberated into the game fields of the State within the past few years, many thousands of pheasants and other desirable game birds.

While our State Game Farms are necessary and will be beneficial to the efforts being made to establish and maintain a supply of quail and other upland game birds within the State to a sufficient degree to afford good hunting and shooting to reasonable and appreciative sportsmen, it can not be accomplished upon the basis of providing the sportsmen with future free hunting and shooting on private property, or on public shooting grounds maintained by the State—not by a long shot. Make no mistake about that. Also make no mistake that the success of the effort to reestablish the supply of quail and other upland game within the State, depends upon the attitude of the sportsmen toward the quail sanctuary and game refuge campaigns.

If the sportsman who enjoys hearing the valley quail's call of "Here we are," "Here we are," "Here we are," and is thrilled at

seeing a covey of these beautiful little [illegible] will actively and harmoniously [illegible] and owners in the quail sanctuary [illegible] fident that within three years [illegible] been sufficiently reestablished to not [illegible] but also a place to hunt and shoot [illegible] and landowner, but also [illegible] tained in the twenty million [illegible] within the State, and upon which [illegible] allowed to hunt.

STUDIES ON THALLIUM POISONING IN GAME BIRDS

THE USE of thallium [illegible] control work has raised [illegible] sportsmen, and others [illegible] That serious losses have occurred [illegible] tic animals is realized by [illegible] with the work, and has recently [illegible] tion of the public through the [illegible] (1), and Dr. Hall [illegible] with the pharmacology of thallium [illegible] also been published recently [illegible] A fourth publication by [illegible] cites and discusses a number of [illegible] following oral administration [illegible] (loss of hair). These papers [illegible] in the thallium problem.

A series of studies has now [illegible] Laboratory at the Hooper Foundation [illegible] University of California [illegible] birds and analyses to determine [illegible] ing to humans through consumption [illegible] detail of this work is also to be published [illegible] We feel, however, that an article giving [illegible] thallium, together with a summary [illegible] interest to many readers of California [illegible] other publications are noted briefly.

History, Occurrence, Properties and Uses of Thallium

The metal thallium was discovered by Crookes, in 1861, while investigating, by means of the spectroscope, certain residues from a sulphuric acid plant in England. The characteristic green coloration produced by the thallium flame is responsible for its name which is derived from the Latin *thallus*, meaning a young shoot or green twig.

In many physical and chemical properties thallium is similar to lead. It is a heavy metal (density 11.8), soft, bluish white, and forms a series of crystalline salts when treated with different acids, the common ones such as the nitrate, acetate, and sulphate being white and water soluble. The iodide is an insoluble yellow compound, which characteristic forms the basis for one method of detection and estimation.

Small quantities of thallium occur in pyrites ore from many parts of the world; higher concentrations of thallium are found in combination with other elements in certain ores from Sweden and Macedonia. While the distribution of thallium is rather wide the total amount available is quite small and the cost is correspondingly high. As a rodent poison the sulphate of thallium is ordinarily used; in medicine the acetate is used to cause loss of hair during the treatment of ringworm of the scalp in children. It is also used in certain optical glass requiring a high refractive index, and is of value elsewhere due to its photo-chemical and electrical properties.

Toxic Action of Thallium

Soon after the discovery of thallium it was found to have toxic properties. Lamy, while working on this element in France about 1863, developed general lassitude and weakness of the lower limbs. Suspecting that thallium was the cause, he conducted a series of animal feeding experiments that definitely indicated its lethal power. Many investigations relating to the action of thallium were conducted during the following years. In 1909 an excellent article was published by Swain and Bateman of Stanford University, in which the lethal dose and toxic symptoms were determined for several species of laboratory animals. As previously stated the most recent and complete contribution of a technical character is that by Dr. Munch, consulting pharmacologist for the U. S. Biological Survey.

Thallium is a cumulative poison, several small doses being as effective as one larger dose unless the interval between doses has been several weeks. The poison is eliminated very slowly and has been detected in practically every body tissue. The poison may be absorbed following application to the skin and produce toxic symptoms in this manner as well as when administered by mouth. The action is slow but definite: paralysis, respiratory distress, lack of appetite, and diarrhea usually develop in three or four days. It requires a dose several times the lethal dose to produce symptoms in one day, and with just a sufficient dose to kill the symptoms will not be delayed greatly although the subject may remain in a paralyzed condition for a longer time before death in this case. The immediate cause of death is respiratory paralysis. Autopsies do not reveal a sufficiently characteristic condition to warrant diagnosis by this means.

The lethal dose is reported as approximately 25 milligrams per kilogram of body weight or 1 unit weight of poison to 40,000 unit weights per subject. In some instances a much smaller dose has proved fatal. For a human adult, irrespective of weight, it is considered

unsafe to ingest more than 300 [illegible] grains, the weight of the ordinary [illegible] salts have a high specific [illegible] the size of such a tablet would be [illegible] years of age 5 to 8 milligrams of [illegible] weight has been extensively used [illegible] worm of the scalp. This treatment [illegible] weeks, followed by a heavier [illegible] treatment have usually been [illegible] cies in computing the dosage [illegible] icity, its salts give no warning [illegible] stomach pump or a vomitive [illegible] no known antidote.

Introduction as a Rodent Poison

Thallium was first introduced [illegible] poison by a German company about [illegible] U. S. Government men for [illegible] toot for its use in California. Since [illegible] been rapidly introduced and [illegible] counties, principally those south of [illegible] the Sierra. The tenth annual report [illegible] Agriculture states that 3,000,000 pounds [illegible] were used in California during [illegible] on a concentration of 0.5 per cent [illegible] lethal dose of 25 mg. kg. This is [illegible] living matter.

Poisoning of Geese at Lake Tulare Near Merced

Early in December 1930 [illegible] dying geese were to be found at Lake [illegible] pany with Deputy R. C. [illegible] area on December 10th. We [illegible] dying geese along one mile [illegible] to the laboratory for investigation. [illegible] indicates that the total fatality was [illegible] tion from another source indicated [illegible] phosphorus grain spread during [illegible]

Preliminary qualitative tests [illegible] intestinal contents on a platinum [illegible] observing through a spectroscope [illegible] of thallium on 32 of the specimens. [illegible] Hohmaier showed pathological [illegible] observed in birds experimentally poisoned [illegible] statements to the effect that thallium [illegible] fied by observing the green color [illegible] the flesh or stomach contents in a gas flame. In my own work I do not believe that such an identification could be made as the yellow flame that is produced by sodium salts contained in the organic matter will obscure the green produced by a small quantity of thallium. For

positive identification a portion of the flesh such as the gizzard, thigh or breast should be destroyed by acids and the thallium separated by chemical reagents. A confirming test in the flame or spectroscope can then be made on the purified salt.

Analytical and Experimental Work

The question has been raised many times regarding the possibility of secondary poisoning to humans following the ingestion of thallium poisoned flesh from game birds. The flesh on hand from thallium poisoned geese offered excellent material for a partial answer to this question.

Twenty samples from the breast, thigh, and skin of 17 of the geese were analyzed quantitatively for thallium. The amounts found ranged from 4 to 57 milligrams per kilogram of flesh with an average of 29 mg/kg; the figures indicating that higher concentrations were probably deposited in the thigh than the breast. On the basis of the average value, and considering 320 milligrams (5 mg/kg for 150 pound person) as the highest dose that could be safely ingested by a human adult, it would require 11 kilograms or 24 pounds of poisoned flesh to supply this amount. The probability of killing birds, following ingestion of thallium grain and previous to development of toxic symptoms that would cause suspicion, and of eating such flesh in the quantity above indicated would appear very remote. The experimental work discussed later also bears out this point. However, to establish more definitely the quantities of residual thallium remaining in the tissues of birds poisoned in the field, it is planned to analyze those specimens available during the next few months.

In any event, the following precautions by sportsmen should eliminate any danger:

1. Do not shoot or keep any bird that appears sluggish or partially paralyzed.
2. Refrain from shooting on or near an area that you know has been recently treated with thallium. An inquiry or two in the neighborhood should establish this fact.
3. In case you do eat material of which you are suspicious, refrain from eating the gizzard or drumstick which will contain the higher concentrations if any thallium is present.

Experimental data on the toxicity of thallium in quail, ducks, and geese has been obtained by feeding both poisoned grain and pure thallium sulphate. While tests have not been made on a sufficient number of birds to determine the absolute lethal dose, the following values are believed to be approximately correct.

Bird	*Lethal dose of metallic thallium milligrams per kg.*
Quail	12
Geese	15
Ducks	30

Believing that these figures will be of more value when expressed in terms of poisoned grain and birds of definite weight, the following table has been computed.

Species	[illegible]	[illegible]	[illegible]
Quail	[illegible]	[illegible]	[illegible]
Quail	[illegible]	[illegible]	[illegible]
Ducks	[illegible]	[illegible]	[illegible]
Ducks	[illegible]	[illegible]	[illegible]
Ducks	[illegible]	[illegible]	[illegible]
Geese	[illegible]	[illegible]	[illegible]
Geese	[illegible]	[illegible]	[illegible]
Geese	[illegible]	[illegible]	[illegible]
Geese	[illegible]	[illegible]	[illegible]

* The [illegible] formula contains [illegible] 0.8 per cent metallic thallium.

** These values [illegible]

In general terms we may state [illegible] cent of the body weight in poisoned grain [illegible] and for ducks 0.4 per cent of the body [illegible] be a lethal dose. Munch in his work [illegible] cent of the body weight of food [illegible] On this basis it is easily seen that [illegible] lethal dose might be greatly exceeded [illegible]

With just the lethal dose a goose died [illegible] dosage to 2 or 3 times the lethal dose [illegible] Quail apparently were not as resistant [illegible] to 2 days, in the smallest dosage given [illegible] Ducks are more resistant than geese and [illegible] following the minimum lethal dose [illegible] days. Tests conducted on ducks and [illegible] rapidly and in smaller amount when [illegible] than when given in solution by means of a pipette.

The quantity of thallium absorbed by the [illegible] on ducks and geese. In both species it was [illegible] absorbs an amount parallel with its proport[illegible] ratio decreasing, however, with excessive dos[illegible] death. A bird dying in 15 days still retained [illegible] thallium in the breast. The thigh and gizzard [illegible] considerably higher concentrations than the breast [illegible] contained less. The following table [illegible] point of probable secondary poisoning. The dosage [illegible] in terms of kernels of grain rather than the [illegible] which was given. The birds were mallard ducks weighing approximately 2.2 pounds each.

Dosage Kernels of grain	[illegible]	[illegible]	[illegible]
110	15	0.0015	16
100	23	0.0036	20
220	2	0.0075	9
267	1	0.0029	10
360	1	0.0080	8
675	1	0.0049	14

From this table it will be seen that the greatest danger is from birds dying in 1 to 2 days; this fact, however, is offset by the unlikelihood of securing such birds before suspicious symptoms have developed. Where the symptoms have been delayed by a smaller dosage the

amounts of flesh required for secondary poisoning have been increased far beyond the probability of consumption by one individual.

Summary

Game birds, such as quail, geese, and ducks, are killed by the oral administration of 12 to 30 milligrams of thallium per kilogram of body weight. The poison is largely retained and distributed throughout the body, being deposited and concentrated somewhat in the thigh and gizzard.

Secondary poisoning to humans would occur only after the ingestion of relatively large amounts of poisoned flesh and the probability of such poisoning is slight.

Poisoned grain as prepared by the Biological Survey is of sufficient strength to carry a lethal dose in less than a single feeding.

A summary has been given of the history, uses, toxic action, and introduction of thallium as a rodent poison.

Literature Cited

1. Linsdale, Jean M.: Facts Concerning the Use of Thallium in California. The Condor, Vol. XXXIII; pp. 92–106, May, 1931.
2. Hall, E. Raymond: The Poisoner Again. Outdoor Life, April and May, 1931.
3. Munch, James C.: The Pharmacology of Thallium and Its Use in Rodent Control. Technical Bulletin No. 238. United States Department of Agriculture, April, 1931.
4. Lynch and Scovell: The Toxicology of Thallium. The Lancet, Vol. 219, pp. 1340–1344, 1930.

AN OUTLINE OF THE HABITS OF THE STRIPED SKUNK AND LITTLE SPOTTED SKUNK WITH SOME DIRECTIONS FOR TRAPPING

By E. L. Sumner, Jr.

1. Relationship of Skunks

SKUNKS belong to that great group of weasels and weasel-like animals, the family Mustelidae, although one might not suspect such a relationship at first glance. As a matter of fact, skunks have long ago departed from the main line of evolution followed by their more lithe and energetic relatives and have struck out upon a separate path of their own. Probably the most important single factor which has determined the direction in which they have evolved has been the enormous development of the anal scent glands for defense purposes. These glands are present in all the members of the weasel group but are nowhere else so prominently developed as in the skunks. With the acquisition of such a potent armament, the skunks have not found it necessary to preserve the agility or the quickness of reaction which is so characteristic of the majority of the weasel family. So, too, with this slowing up of life's activities and general dulling of the senses we find a corresponding restriction of the diet to small and easily captured creatures such as mice and insects, which is humbler food than that of most of the weasels.

2. Kinds of Skunks and Distribution

The skunk group is divided into two genera, each of which contains two species, two of which are represented in California. Of the two species in this state, one comprises the common large or striped skunks, *Mephitis mephitis*, while the other embraces the little spotted skunks, *Spilogale gracilis*, or "civet cats," as they are often called by trappers.

The common striped skunks range over most of the North American continent south of Northern Canada, the Hudson Bay country and northern British Columbia and Alberta to the Gulf of Mexico wherever suitable conditions are found. Open country, interspersed with dense cover, especially if it be moist, or where streams or bodies of water are preferred to dense forests, are their favorite places. The requirements of these animals are elastic, however, and the striped skunk will always remain among the commonest of our wild mammals.

The little spotted skunks are more restricted in distribution, extending farther down through Central America than the striped skunks, but being restricted to a correspondingly shorter range northward. Although they are found in suitable localities throughout California, they do not occur in the humid coastal plain of southern British Columbia on the Pacific Coast, southern Manitoba and central Wyoming and southern Idaho in the interior, and west of the Alleghenies and Georgia on the Atlantic Coast. Within their range, however, the little spotted skunks show a preference for the same general conditions of climate and topography about as great as that of their larger relatives for rocky ledges high upon the slopes of mountains, brushy canyons, or hot desert plains seem to be especially attractive to them.

3. General Habits of the Striped Skunk

A number of observers have followed the tracks left in the snow by foraging skunks from the time the animals left their dens in the early evening until their return once more at dawn. They all agree that the home range of each individual is very small. Rarely do tracks lead from the den farther than 500 feet, although the total distance covered by a single animal in a night may range between four and eight miles.

There has been some controversy from time to time as to whether or not striped skunks can climb trees, and the question about the ability of the little spotted skunk in this respect. As with most questions regarding the behavior of animals, it is not possible to make an absolutely hard and fast statement to which there will be no exceptions. As a rule, striped skunks do not climb trees, or indeed any other upright objects, but this rule like most others is not inviolate and we do have a few records of the climbing of trees by these animals. Seton, in his "Lives of Game Animals" (1926, New York, Vol. II) records that one particular skunk which he raised on his fur farm developed a habit of climbing straight to the top of a ten-foot perpendicular fence by hooking its long claws into the wire mesh, but this sort of behavior was in his experience the rare exception.

Although skunks are not usually considered aquatic, there are numerous instances of their entering water, not only when hard pressed, but even voluntarily upon occasion. Preble relates the fol-

lowing instance which illustrates the habit of voluntarily taking to water in the Canada skunk. "While paddling up the channel between Windy and Pine lakes on September 12, we saw a skunk swimming across the stream a hundred yards in front of our canoe. On seeing us he redoubled his exertions but we overtook and shot him just as he reached the shore." (1902, North American Fauna No. 22, U. S. Biological Survey.) They are said also to be fond of bathing at the edges of shallow ponds and streams (Lantz, 1914, Farmers Bulletin 587, U. S. Department of Agriculture).

Although skunks are usually silent animals, they may on occasion utter a low "churring" or scolding note especially if disturbed without being greatly excited, according to Seton (*op. cit,* p. 334). When two males fight, they utter low snarling sounds, and if one of the contestants is overpowered it gives vent to loud long drawn squeals of fear. A characteristic "warning" gesture, used by a skunk at bay either when confronted by some other animal, such as a dog or another skunk, or by man, is a rapid stamping or scratching motion of the front feet, the tail being raised straight up meanwhile with every hair erect. Apparently this behavior is for the purpose of intimidation.

Although capable of digging dens for themselves, skunks prefer to enlarge the burrows of ground squirrels and woodchucks, or to appropriate hollow logs, recesses beneath tree roots, or cavities in rock piles. Haystacks, covered drains and other retreats afforded by human occupation are also made use of upon occasion. When skunks dig their own burrows they seldom go below the ordinary frost line and are usually content with a rather short tunnel ending in a rounded chamber containing the nest. This nest is a bed of leaves or dry grasses and is raised somewhat above the level of the tunnel for drainage. In desert regions, a favorite den site is beneath a clump of prickly pear cactuses or yucca plants.

In northern latitudes the animals remain indoors during the period of severest cold, although they do not seem actually to hibernate in the sense of becoming completely dormant. If dug out at such times they are found to be quite lively and indeed they are in the habit of coming out and wandering about whenever there is a temporary period of mild weather. Usually a considerable number of individuals is present in the den during the winter months, and while in some cases there may be family groups they are not always so, for usually the members of a family separate in the fall. Some winter dens may contain as many as a dozen individuals all of which appear to be adults, while in other cases certain dens may harbor groups in which young only two-thirds grown predominate.

The striped skunk mates during February and March, and the young, which number from four to ten, are born in April or May, the period of gestation being 62 to 63 days. Newborn skunks are blind and nearly hairless at birth and no larger than a full grown mouse. Their eyes do not open until about the fourth week. By the sixth week they begin to creep to the entrance of the burrow at the approach of dusk and move about uncertainly with their tails held straight up in characteristic adult skunk fashion.

By the seventh week they commence to follow their mother about on her excursions, often in a long single file over logs and stones or

across roadways. In summer the family [illegible] ing before sunset and may remain abroad all [illegible]

4. Food of Striped Skunks and Their [illegible]

Skunks are omnivorous, but [illegible] nearly all of which are noxious to [illegible] insects constitute a surprisingly [illegible] mice, gophers and similar [illegible] this time. Other food items [illegible] skunks are lizards, turtles [illegible] manders, fish, crustaceans, earthworms [illegible] and various small berries as well as [illegible] that the common garden toads [illegible] beneficial by reason of their destruction [illegible] always refused by skunks with [illegible] because the skin of toads is provided with [illegible] is distasteful both to birds and [illegible]

Among the insects even wasps [illegible] and it sometimes happens that [illegible] the attacks made by the skunk upon [illegible] be entirely avoided, however, [illegible] the lower, horizontal limbs of trees.

The economic status of the striped skunk [illegible] again and again during the last [illegible] of agriculture, both state and federal. [illegible] In every case, judgment passed [illegible] and yet even today popular prejudice [illegible] strong in many localities. Doubtless [illegible] effect produced by their odorous [illegible] of fact, hardly any animal can be [illegible] the standpoint of the farmer. The following [illegible] Bulletin No. 587 of the U. S. Department of Agriculture [illegible] as typical of the conclusions reached by [illegible]

"The belief that skunks feed [illegible] is so general that statements to the contrary [illegible] While the animals occasionally eat wild birds [illegible] furnished by stomach examinations [illegible] skunks and proves that, on the whole, [illegible] observers since the days of Audubon [illegible] usefulness of these animals, but popular [illegible] come.

"A skunk making its home under sheds or [illegible] about them at night in search of food. [illegible] That it should occasionally learn to take chickens and eggs is not surprising, but this happens far less frequently than might be expected. It is a habit learned by a very few individuals and not a characteristic of skunks as a family. * * * Of course the individual skunk that learns to kill and eat chickens should be destroyed."

Persons interested in the preservation and propagation of game birds are particularly hostile to the skunk, believing that it destroys pheasants, quail and other ground nesting birds and their eggs. As a matter of fact, evidence supporting this view is very meager, while

upon the other hand, the great mass of information gained from stomach contents (see appended bibliography) points in exactly the opposite direction. Indeed, there are many records of quail which successfully hatched out their broods within a few rods of a skunk den. "The truth is that at the season when the native game birds are nesting, skunks have abundant insect food, and by the time this food fails the birds are strong of wing and seldom fall a prey to this mammal." (Farmers Bull. No. 587, p. 11.) Before attaching importance, then, to the loss through these animals of an occasional bird we ought, not only in fairness but from self interest, to consider the great good which they accomplish by their constant destruction of harmful insects and rodents.

5. General Habits of the Little Spotted Skunk

In so far as they are known, the habits of the little spotted skunk are similar to those of its larger striped relative. However, it must be admitted that our knowledge of this animal is less extensive than our knowledge of the common skunk, perhaps because the former seldom goes abroad in the daytime and because it partakes more closely of the original weasel characteristics in being swifter, more restless and more secretive in its habits than the larger animal. In proof of its agility, it may be mentioned that when pursued by dogs, it will take refuge in trees with almost the nimbleness of a squirrel.

Like the striped skunk, it prefers to make use of natural cavities in rocks, the inner recesses of cactuses and other thorny vegetation or the burrows of other animals rather than to dig its own den. Dr. E. W. Nelson, formerly chief of the U. S. Bureau of Biological Survey, states that "On the plains of Arizona they have been known to live inside the mummified carcass of a cow, the sun-dried hide of which made an impregnable cover" (1918, Nat. Geographic Mag., p. 475).

The young are two to six in number. Little spotted skunks are as playful as they are active and graceful, in marked contrast to the heavy bodied striped skunk. Dr. Nelson, in the article already quoted, gives us two delightful and highly amusing pictures of the antics of these little animals as he lay and watched them on moonlight nights. Lack of space prevents quoting his anecdote of the bear hunt during which one of these little skunks came galloping up to within a few inches of his face and surveyed him with curiosity. The other incident is related more briefly, however, and may be given here.

"Once at the mouth of a canyon at the southern end of the San Joaquin Valley, California, I camped several days at a deserted ranch. At night I spread my blankets on the bare floor of the house, from which the doors were gone. Under it led several burrows of some animal which I at first supposed to be a ground squirrel. Each night while there I was awakened by the sound of little footfalls padding rapidly about over the floor on which I was sleeping, and in the dim light from the moon could see two or three little spotted skunks pursuing one another around me like playful kittens. At the slightest movement on my part they dashed out the door and into their dens under the house. As there was no food of any kind in this room, it was evident that the little fellows were there for a frolic on the smooth board floor."

I recall an amusing experience at the [illegible] Dr. F. B. Sumner, at Scripps Institution. La [illegible] house is situated on a high seaward facing hill [illegible] of its original wildness. For years [illegible] for various families of these playful [illegible] venience to persons above. It happened [illegible] evenings now and then when we [illegible] takable odor, whereupon [illegible] chasing the skunk kittens [illegible] more than compensated [illegible] after supper with the Professor [illegible] one of the bright, inquisitive [illegible] behind old boxes right by [illegible] which we would throw to [illegible] the stairs of the back porch [illegible] prints as they scampered about [illegible] sion to which I refer, my aunt [illegible] crowd with the usual bustle [illegible] kitchen, and in the hurry [illegible] left open. What was my aunt's [illegible] to the kitchen, to behold [illegible] sink and the stove with every appearance [illegible] In justice to the skunk it should be [illegible] allowed itself to be shooed out [illegible] quarters in the basement.

One of the most characteristic [illegible] skunk is the "hand stand" reaction. [illegible] human acrobatic feat of the same [illegible] walking and the body and [illegible] case of the skunks, this position [illegible] the animal stands still, or for [illegible] which ease balance seems to be [illegible] use the "hand stand" reaction [illegible] to say. That the reaction is [illegible] young skunks exhibit it, and [illegible] startled is a matter of observation. It [illegible] when a skunk is closely pressed [illegible] scent it abandons this posture [illegible] feet on the ground and both [illegible] simultaneously.

Alex Walker, who has [illegible] observed the "hand stand" reaction [illegible] part simply an indication of [illegible] when given in a spirit of hostility [illegible] stamping reaction with the forepaws [illegible] to that of the striped skunks when [illegible]

6. Food of Little Spotted Skunks and Their Economic Importance

Like its striped relative, the little spotted skunk is omnivorous but from the farmer's point of view it is even less to be censured in regard to its food habits. Mice and insects form its principal food although other items such as lizards, salamanders, gophers, small ground

squirrels, mushrooms, cactus fruit and persimmons have been found in the stomachs of some individuals. An instance of its value in destroying house rats is quoted from D. E. Lantz in Bulletin No. 129 of the Kansas State Agricultural College (1905, p. 389).

"At one time, my family occupied for two years a house with large cellar openings on the outside. * * * The cellars, and in fact the entire house, were overrun with rats and mice. A couple of months after we had first occupied the house, I noticed that a little striped skunk was present in the cellar. We could often hear the fights between it and rats and I was careful not to disturb it when I went to the cellar for coal. I often saw it in the cellar, and it did not seem to fear my presence there. In a very few weeks, we could hear no more fights with the rats, and all the rats and mice were either killed or driven from the place."

7. The Scent Glands of Skunks

The scent glands of skunks consist of two oval sacs located just beneath the skin below the base of the tail—one on each side. They are provided each with a duct which leads into the rectum, opening near the anus. When the animal is on the defensive it raises its tail high up out of the way and by contracting the muscles surrounding the glands, ejects the fluid through the ducts in two fine jets of spray which unite to form a single stream. The ordinary distance to which the fluid is thrown is from six to ten feet but large and vigorous animals have been known to eject it to a distance of twenty feet. A skunk can aim its stream of musk with considerable accuracy. If the object is on the right side of the animal, the hind part of the body is directed as much toward the object as possible and the musk shot in greater quantity from the left gland than from the right. Similarly, when the object is on the left side the greater quantity of musk will come from the right gland. A skunk can cover any object within its range without altering the position of the forepart of the body which is often held facing the observer, so that the animal is bent in a U-shape. The popular idea that the skunk discharges a stream of musk upon its tail and then flirts it at the offending object is quite unfounded. That a skunk can not discharge its musk if it is held in such a way that its hind feet are off the ground is another popular notion equally false. W. Kenneth Cuyler, who has hunted skunks for many years, states that if jarred or in way startled when held up by the tail they will invariably discharge their scent. On one occasion, when holding a skunk up in this manner, he received the full discharge in his eyes (*Journal of Mammalogy,* 1924, p. 185).

The liquid emitted by skunks causes nausea in many persons, but not in all, and I suspect that as in sea sickness the cause is often psychological. If it strikes the eye, its acrid properties make it very painful so that a copious flow of tears is produced, but the idea that blindness results is erroneous. Cuyler (*op. cit.*) and many others have testified that their eyesight was quite unimpaired although they had had their eyes filled with the fluid many times. The experience of dogs, some individuals of which get their eyes filled several times every year, is a further proof of the harmlessness of musk in this respect. Bathing

the eye with water, or with boracic acid [illegible] is recommended as a relief for the inflammation.

Washing in chloride of lime or gasoline will remove the odor from one's hands but the former is not recommended for clothes because of its effect on colored fabrics. Clothes may be deodorized by washing them in gasoline, ammonia or benzine and then hanging them in a sunny, windy place; they may also be buried in the ground for a few days or immersed in [illegible] water.

Skunks make interesting and attractive pets if taken when young and from the first in captivity. Old skunks which have been taken from the wild, and skunks which have been [illegible] are likely to use their scent glands on their keepers and other animals, but skunks which have been properly reared and handled practically never give offense in this way and may be kept in well settled neighborhoods without [illegible]. The removal of scent glands is very simple to accomplish [illegible] who wish to take this added precaution are referred to page [illegible] of G. Ashbrook's book entitled "[illegible]" published by [illegible] New York for simple directions for the care and breeding of [illegible] this work.

8. Natural Enemies of Skunks

Although seemingly fearless of [illegible] possessed of a weapon whose [illegible] witnessed too often to be doubted, [illegible] natural enemies. Mountain lions have not infrequently been captured whose fur reeked with the smell of skunk and whose stomachs bore confirmatory evidence of the nature of their last meal. Wolves, coyotes, foxes, and badgers also kill skunks at times, [illegible] prey the horned owl is a most determined foe. Many a hunter can recall picking up one of these birds and detecting the smell of skunk, but upon further investigation [illegible] with the black and white furred prey. Human eyes actually to witness such an encounter between skunk and owl, but there is one such case recorded by [illegible] it is so vividly described as to merit [illegible]:

"One morning, late in the autumn, I was driving through the woods when I heard a disturbance in the dry leaves a little distance from the road. I stopped my horse, and as I looked in the direction of the sound, saw something struggling on the ground. As I drew near I saw clearly the cause of the disturbance. A few feet in front of me was a large horned owl in a sort of [illegible]. His back and head were against an old log. His feet were thrust forward and firmly grasped a full grown skunk. One foot had hold of the skunk's neck and the other clutched it tightly by the middle of the back. The animal seemed to be nearly dead, but still had strength enough to leap occasionally into the air, in its endeavors to shake off its captor. During the struggle, the owl's eyes would fairly blaze, and he would snap his beak with a noise like the clapping of your hands. • • •

"The skunk could no more free itself from the owl's claws than it could have done from the jaws of a steel trap. Its struggles grew

less and less frequent and at the end of about fifteen minutes they ceased altogether. Then the owl loosed one foot, settled himself in a more comfortable-looking position, and appeared ready to enjoy the spoils of his battle." (*Bird-Lore,* 1913, p. 369.)

9. Directions for Trapping Skunks

That the striped skunk is California's most valuable fur-bearing animal is demonstrated by the figures for the total value of the fur sales for the State. A greater return is received for the skunk than for any other species of fur bearer.

Skunks because of their unsuspicious nature are easily trapped and no special precautions are necessary. Traps should be set in such places as the paths they travel to obtain water, or near the openings to their dens. Occupied dens will be clear of cobwebs and have a slight odor of skunk, with often a few skunk hairs about the entrance. Among the signs revealing their presence, in addition to tracks along the muddy banks of streams and ponds or in dusty paths, are the numerous shallow pits one or two inches deep made by the animals in fields and pastures where they have dug for white grubs.

If the traps are set at the entrances to dens they may be left unbaited; if set along paths they are best baited with a chicken head, a piece of tainted meat, or best of all, a bit of skunk fur or meat. If the den is inhabited by more than one animal, time may be saved by setting several traps in the vicinity. It is a matter of common experience among trappers that skunks are strongly attracted to any place where one of their number has previously been killed and that a trap site for these animals becomes better in proportion to the number of skunks which have been caught there. A No. 1 trap is the best size for skunks, although a No. 2 can be used. Traps should be set lightly and a little trash, such as leaves or grass, scattered over them in such a way as to leave the place looking natural. The bait may be placed in a V-shaped opening between two rocks, or between two traps, with sticks or stones on each side to guide the animal over the traps in its effort to get the bait. Another good set is made by suspending the bait by a wire or string just out of reach of the skunk and directly above one or two traps so that the animal will step into them while trying to reach the bait.

Skunks when trapped do not often discharge their scent so as to defile their fur but are likely to do so when being killed unless care is exercised. If the trapper will move slowly, and stand still for a moment whenever the skunk shows by its actions that it is about to emit its scent, he can get near enough to strike the animal a sharp blow across the back. This paralyzes the hind quarters and prevents any discharge. Box traps are particularly recommended for use in cellars and other places where it is essential that the skunk be removed without any liberation of scent. (For details of construction see a leaflet entitled, "Trapping on the Farm," 1919, obtainable from the Bureau of Biological Survey, Washington, D. C.).

Bibliography of References to the Food Habits of Skunks

Ashbrook, F.
1928. Fur farming for pro[illegible] M[illegible] N[illegible]
Cuyler, W. K.
1924 Observations on the habits [illegible]
Dice, Lee.
1926 Skunk eats litter [illegible]
Dixon, J.
1925. Food predilections [illegible] 6, pp. 31, 46
Hamilton, W. J., Jr.
1929 The winter food [illegible]
Howell, A. H.
1906 Review of the skunk [illegible]
Lantz, D. E.
1905. Kansas mammals [illegible] College Bull. 129, [illegible]
1914 Economic value of N[illegible] Bull. 587, p. 9
Nelson, E. W.
1918 Wild animals of N[illegible]
Seton, E. T.
1926 Lives of game [illegible]
Shaw, W. T.
1928 The spring and [illegible] State Mus. Handbook 4, p. 90
Swenson, S. B.
1929 Bete pranto of M[illegible]

GIANT KELP UTILIZED AT MONTEREY*

By J. B. [illegible]

SEAWEEDS are among the most valuable of plant resources of the Japanese Empire. The Japanese have apparently utilized these plants to their fullest extent in the preparation of food products in the form of jellies, soups, salads and seasonings, in the manufacture of clarifying agents for beverages, as a sizing for textiles, as fertilizer, as a cultural medium for bacteriological work, and as iodine.

The seaweeds of California are utilized in the production of chemicals, fertilizer, food for human consumption (mainly Chinese and Japanese), and as a stock feed.

A giant kelp business of minor importance is in the second year of operation at Monterey. The kelp harvested is entirely of the species *Nereocystis luetkeana*, and is sometimes called giant bladder weed, bull kelp, seal head kelp, or onion kelp. It grows in beds along the rocky coastal zone from Point Sur northward, [illegible] abundance in Puget Sound where it sometimes attains a length of [illegible] feet.** This kelp is not to be confused with another form, *Macrocystis pyrifera*, that is harvested mechanically on a large scale in southern California waters. In the region from Point Conception to San Diego the cutting is done by harvesters similar to grain reapers which cut the kelp two to four

* Submitted for publication [illegible] October, 1[illegible]
** Swan, James G. On the economic value of the giant kelp and other seaweeds of the northwest. U. S. Fish Comm. Bull. for 1[illegible] Vol. [illegible] p. 375-376. 1884.

feet below the surface. As the boat pushes forward, the cut kelp falls on a slanting conveyor and is carried onto the deck. The species of kelp taken at Monterey cannot be handled in this manner but is cut by hand.

The Division of Fish and Game of California has control of the kelp beds, and stringent laws are in effect to govern the cutting of this marine growth. To protect against depletion the beds are numbered

FIG. 8. Launch docking at Monterey with 6 to 7 tons of giant bladder kelp, gathered off Carmel Highlands. Photo by J. B. Philips, August 17, 1931.

and a system of opening and closing, together with cutting regulations, has been worked out in order to give the kelp time to grow again during the closed season.

Nereocystis lutkeana grows from a holdfast on rocks, the smooth stalks growing commonly up to 100 feet in length and terminating in an enlarged portion or air bulb, from the crown of which about 50 streamers, 30 to 40 feet long, float at the surface of the water. The long stalks, which are as much as 3 inches thick just below the air bulb, may

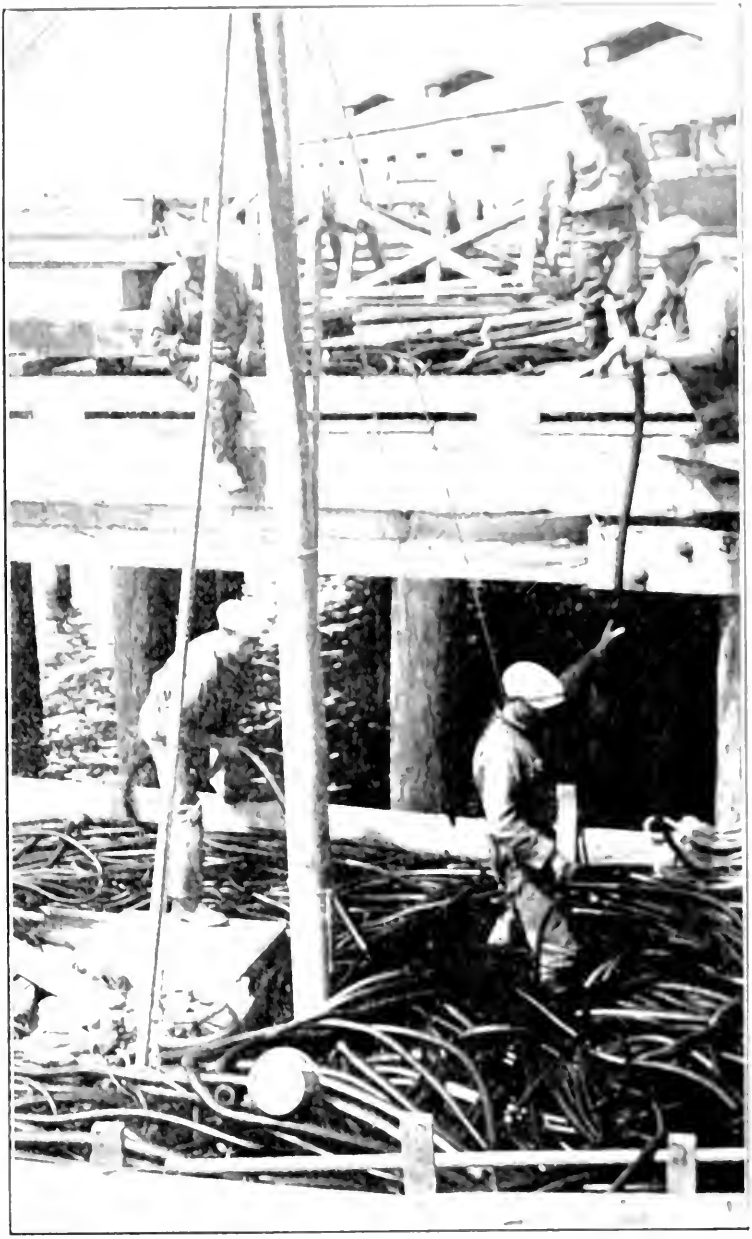

FIG 9. Unloading [illegible] are passed up to the [illegible] streamers growing [illegible] gathered, as can be noted by [illegible] Photo by J. B. Phillips, August [illegible]

taper to about one-quarter of an inch in diameter at the holdfast portion.

Last season (1930) about 200 tons of kelp were harvested at Monterey during September and October. This year it is expected that about 450 tons will be harvested; operations commenced during the middle of August and will continue until the late fall storms, probably in late October or November. The harvesting is being done by two crews, and occasionally, a third, using gas-powered fishing boats of 30 to 40 feet in length, with 3 to 5 men comprising a crew. Gathering operations are carried on between Point Pinos and Point Sur, directly south of Monterey Bay. This year (1931), $10 a ton is paid for the cut kelp, delivered on dock. By dint of hard work a capacity load of 6 to 7 tons can be gathered in about 5 hours. The kelp is obtained by tying the boat to a bunch and then cutting the kelp within reach. Stalks are cut to a depth of 15 feet below the surface by means of a 10- to 15-foot pole, having an 8- to 12-inch blade attached at one end. The cutters claim that the stalks are more closely bunched 12 to 15 feet below the surface of the water, and so several can be cut at a time. The cut stalks are hauled into the boat with the aid of a hook on a pole. Only the large beds are chosen, as the working operations, in order to be profitable, can not be interrupted by much moving about. The crop is unloaded at the Monterey Municipal Pier onto trucks, and carried to the grinding plant in Oak Grove, Monterey.

The kelp is ground and packed in barrels for shipment to a chemical firm in New York. The grinding is accomplished by running the stalks through a power-driven machine resembling an oversized meat grinder. The machine grinds about one ton an hour, one to three stalks being fed at a time. Excess moisture is pressed from the ground kelp with the aid of a screw press and a slotted barrel. Kelp when ground resembles small amber colored chips of wood. This product is then packed for shipment in barrels, each of which weighs from 450 to 500 pounds. The reduction in weight of the kelp after grinding is about three-fourths of the original.

The final product, as extracted by the New York firm, is a dark vaseline-like substance that lathers freely in water. This product is used extensively as a binding agent in the process of dyeing artificial silk. The substance is dissolved in water and the artificial silk threads dipped in the suds formed, preparatory to dyeing.

The late fall storms that usually occur during the latter part of October or in November put a stop to the harvesting operations by tearing up the beds and washing them ashore. Last season kelp that had been gathered from the beaches was used when cutting operations necessarily ceased. Formerly, operations of the kelp firm now in Monterey, had been centered on Puget Sound, Washington, but the unreliable weather conditions during the short period available for harvesting curtailed steady production. A. K. Anderson is manager for this company and C. M. Simpson is foreman in charge of grinding and shipping operations.

FIFTY YEARS AGO ON THE SUISUN MARSH

IN THE YEAR 1878 [illegible] owning 5000 acres on the Suisun marsh [illegible] that time that area had been shot over for market [illegible] years. The two most famous market [illegible] Jim Payne and Seth Beckwith, partners for many [illegible] Chamberlain property was subdivided in 1878 and divided [illegible] were rented to form several clubs.

At Teal Station, the Teal Club was formed [illegible] Francis Smith, prominent lawyer of that day. California Street was [illegible] W. W. Traylor, after whom the Traylor Pond was named. Mr. [illegible] the stock broker, W. B. Bradford, who owned Grizzly Island [illegible] opposite Antioch for several years. Will Hopper's [illegible] The area leased by the Teal Club was between 700 and 800 acres and included the 200 acres directly east of the main [illegible] known as the Six Reach Pond.

The writer took a 10 years' lease for 640 acres [illegible] Horan Slough. He formed a club there known as the String of Pearls and included such well known sportsmen as Fred S. Butler, Matt Fuller, Charlie Randall, Ben Stuckney and Lea Weinmann in the membership.

What is now the Tule Belle Preserve at Cygnus Station was then shot over for a number of years by Charlie Joslyn, Fred Van Sicklen, Herman Oelrichs and others. Prior to that time [illegible] about 1000 acres was owned by old man Freckbrion, and [illegible] several hundred acres were owned by Emily O'Brien, [illegible] raised honkers for the market. During a hunting season [illegible] was alive with mallard, teal and jacksnipe.

What is now and has been for the past 14 years the Ibis Club, was then known as the Hardland ponds. Their membership included 10 or 12 of the most prominent sportsmen in the State including Harry Babcock, M. Hall McAllister, Johnnie Orr, Billie Corbett and others.

The Pringle Pond near Suisun had long been shot over by anybody and everybody of that locality and all seemed to [illegible] Cruickshanks.

San Francisco, April 11, 1931.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California Division of Fish and Game.

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All material for publication should be sent to Leo K. Wilson, 510 Russ Building, San Francisco, California.

Vol. 18 JANUARY, 1932 No. 1

An investment in game production will pay big dividends in health, recreation and food. Why not buy a few shares?

REORGANIZED FISH AND GAME COMMISSION

On January 8, 1932, J. Dale Gentry, Earl B. Gilmore and I. Zellerbach met in the San Francisco offices of the Division of Fish and Game for the organization meeting of the Fish and Game Commission which had been appointed the week previous by the Honorable James Rolph, Jr., Governor of the State of California. At the meeting, J. Dale Gentry, rancher and sportsman of San Bernardino, was elected to the important position of president of the reorganized commission. This act terminated the long and successful career of I. Zellerbach as president. He was originally appointed a commissioner during the tenure of Governor Friend W. Richardson, in May, 1925.

Never have the sportsmen of California been so fortunately represented as under the direction of these three outstanding leaders. President Gentry has been associated with the Commission in the past as a member of the Game Refuge Committee and is thoroughly familiar with the needs of the sportsmen and of the activities of the Division of Fish and Game.

The past fine record of Commissioner Zellerbach calls for no comment. Commissioner Gilmore has long been interested in the fish and game activities in the State and from this group may be expected some outstanding accomplishments in future years.

THE RETIRING COMMISSIONER, C. R. BELL

During the tenure of office of C. R. Bell as a fish and game commissioner, much progress has been made by that group. Always an interested conservationist Mr. Bell cooperated fully at all times with the sportsmen and with his fellow commissioners and much of the progress of the last year may be directly attributed to his unfailing interest in fish and game problems.

GRAHAME B. RIDLEY, NEW ASSISTANT EXECUTIVE OFFICER

In the selection of Grahame B. Ridley as assistant to the executive officer in September, 1931, the sportsmen of California have found

a friend at court whose knowledge [illegible] hearted desire to cooperate with [illegible] made him an outstanding fish and game [illegible] hunter and fisherman and as the past [illegible] sportsmen's groups in the State [illegible] needs of hunters and fishermen [illegible]

PERSONNEL CHANGE

Rated as one of the most [illegible] W. H. Shebley is now fish [illegible]

First meeting [illegible] of Fish and Game [illegible] to right: J. Dale Gentry [illegible] Photo submitted through [illegible]

He was formerly in charge of the Bureau [illegible] freed from the burdensome administrative details [illegible] a trying position in order that his great [illegible] available without interruption. He has served this State for more than 47 years.

For some time the Fish and Game Commission has been endeavoring to work out some arrangement to lighten the heavy and constantly growing burdens attached to game fish propagation and distribution and thus allow Shebley to regain his health.

Under the present plan Dr. J. O. Snyder of Stanford University has been named as active administrative head of the Bureau of Fish

Culture and he and Shebley will cooperate in their efforts to carry on the excellent work in this State. Such a plan has been approved and Shebley's priceless knowledge of fish culture will be available without seriously retarding his physical welfare.

Shebley has spent his entire life in fish cultural work in this State. Historical records show that his father, J. V. Shebley, established the first mountain hatchery for trout propagation in Nevada County in the early eighties.

It was Shebley's good fortune to study under the late J. G. Woodbury, originator of fish cultural work in California. Shebley showed such an aptitude for the work that he was placed in charge of this Nevada County Hatchery in 1885; in 1887 he was placed in charge of the Hat Creek Hatchery and in 1893 he became superintendent of the Mount Shasta Hatchery. He has led this work up to the present date.

To Shebley goes the credit of developing the entire fish culture system in California. Through years of patient study and labor he advanced the plan from one to 29 excellent hatcheries. When one considers the tremendous encroachment of civilization over this state during the past 50 years, the work of the Bureau of Fish Culture in perpetuating the natural acquatic life and reintroducing species into "dead" lakes and streams is second to none throughout the world.

Dr. Snyder has worked with the division for many years on scientific fishery investigations. In assuming the administrative responsibility of the Bureau of Fish Culture he announced that he would not only endeavor to maintain the excellent record as established by his predecessor, but would utilize every available means in order to cope with California's fast growing angling population.

DUCK CLUBS COOPERATE

Appreciation should be expressed to those duck clubs and those members of duck clubs who this year cooperated with the State and Federal governments in making the 1931 waterfowl season a breathing spell for the migrating flocks of birds that wintered within the borders of our State. Almost without exception, duck shooting properties were flooded and feeding operations were carried on as in past seasons in spite of the fact that this necessitated a considerable expense to the members with a greatly diminished return due to the one-month shooting season. This is just one more indication that the duck club in California has been a vital factor in the perpetuation of migratory waterfowl in this State.

CHANGE IN HANDLING OF STATE BIRD-BANDING PERMITS

The Division of Fish and Game and the Western Bird-banding Association wish to announce certain changes in the methods of issuing and renewing scientific bird-banding permits.

First it shall be noted that the Association's headquarters have been transferred to the Museum of Vertebrate Zoology, University of California, Berkeley, whence all future correspondence relative to banding should be addressed. Here the Association will function under the direct supervision of T. T McCabe, president, Elinor B. McCabe, secretary, and E. L. Sumner, business manager. The desire to centralize the office where the officers were located was the reason for this recent

change. The Division and the Western Bird Banding Association wish to acknowledge their thanks and appreciation [illegible] operation and work devoted to this cause by Dr. J. M. B. Robertson, Buena Park, California, and Mr. [illegible], Los Angeles, California, who formerly handled the permit [illegible] Association.

Commencing January 1, 1932 new permits [illegible] the Western Bird banding Association. [illegible] on a card 2½ x 4 inches in size [illegible] size. This, it is felt certain, will be found more convenient to carry on the person than the old letter sized permit. [illegible] expire at no definite date, but are valid [illegible] Their validity, however, will depend upon [illegible] the conditions of the permit, which are printed [illegible] the card. Of great importance in this regard is the [illegible] reports of banding operations at required intervals [illegible] so will result in automatic cancellation of permits.

All applications for new bird banding permits shall be made on the newly prepared form and submitted to the Association's official quarters in Berkeley. Here the Association will approve or disapprove the application. If approved, the permit will be mailed direct to the applicant after duplicate record cards have been [illegible]. One of these record cards will be retained for the Association's files, the other will be mailed to the Division of Fish and Game at Sacramento where the application will either receive final approval or, if disapproved, the permit will be canceled. Permits are signed by the Chief, Bureau of Education and Research and are countersigned by an officer of the Western Bird-banding Association.

It is felt by all concerned that the system outlined above is a great improvement over the old method of handling these permits, yet it reduces clerical work to a minimum.

Finally all sportsmen, hunters, or other persons securing or finding banded birds, are urgently requested to cooperate in this important work to the extent of mailing the bands in question to the Western Bird banding Association, Berkeley, California, or the U. S. Biological Survey, Washington, D. C.

DEER DAMAGE RELIEF

The following information is given [illegible] questions regarding the administration of the law authorizing the Fish and Game Commission to issue permits to kill deer causing damage to crops.

The Commission is interested in the relationship between posted areas and deer damage, but it is obvious that many posted areas are wholly unfit for hunting purposes, so posting is not a bar to the issuance of a permit. In fact, section 602 of the Penal Code probably allows all hunting on fenced or cultivated property without written permission of the owner.

A hunting license is required, but permits and special deer tags, with postage paid, are issued without cost to the applicant.

The disposition of carcasses is determined in each individual case, it being the intent of the Commission that, in general, the meat will be used in charitable institutions or by welfare organizations to feed the

poor. In no case, however, will the permittee be required to deliver the carcass beyond the limits of his property unless he is willing to do so.

A number of agriculturists have demanded the use of the deer meat for their own consumption, but the Commission feels that the primary purpose of the legislation is to reduce the amount of crop damage being done by deer, and has adopted regulations to accomplish this purpose. It is certain that the sportsmen of the State will question the sincerity of the agriculturists if they insist upon using the venison on their own tables.

In the case of State aid in the building of deer proof fences, specifications for the fence are included in the act, and the Commission has no authority to change these specifications.

DAVID STARR JORDAN

In the death of David Starr Jordan the world has undoubtedly lost a very great man. Here in California where we have been in such close contact with him, the loss will be felt all the more keenly.

Doctor Jordan was very much interested in our fish and game problems. His advice and council was extremely valuable in this work and he was very generous in assisting the Division. He also was a contributor to our publications.

In recognition of this friendly association, a card has been received at the San Francisco office, addressed to the Employees of the Division of Fish and Game, and reads as follows:

> To the multitude of friends of David Starr Jordan who recently have expressed enduring devotion to his memory and profound sympathy for his wife and family in their bereavement they wish to express their most heartfelt thanks.

As all living things must do, he performed his station in life and then retired to the humble grave. In the years to come, new facts will be brought to light and many changes will take place in the advancement of wild life science, but it is an assured fact that his contributions will form a permanent step in this important work.

IN MEMORIAM ALEXANDER EUGENE CULVER

Alexander Eugene Culver was born in LaSalle, Illinois, on October 25, 1859. He moved to Ohio with his parents in 1861 and resided there until after the close of the Civil War. Then he moved to Missouri where he attended country school until about 15 years of age, at which time he entered high school in Trenton, Missouri, and graduated from there in two years. He taught school two terms, and then entered the normal school at Kirksville, Missouri, and graduated from there.

In 1883, he went to Kingman, Kansas, and entered the employ of a large dry goods firm as bookkeeper.

He came to California, landing in Los Angeles in 1884. Later he came to San Francisco and went from there to Sitka, Alaska, as bookkeeper for a large mining company. He returned to San Francisco and took a position as bookkeeper for the Red Cross Lumber Company.

Later he went to Dunsmuir and [illegible] he took a position as manager for [illegible]

A. E. Culver entered the employ of the State in 1913 [illegible] surveyor for the Fish and Game Commission, in the Bureau of Fish Culture, where he made [illegible] ress with the work. He was an ardent sportsman and lover of life. He was well posted on habits of the salmon and trout. He made many experiments [illegible] years that he was engaged [illegible] surveyor for the Commission.

Mr. Culver was a loyal [illegible] a dependable man and true [illegible] servant of the State. In his passing, the State has lost an efficient employee who had the good will of all his coworkers. He will be missed by all his associates. He was always good natured no matter how many trials he was subjected to. Even during the years of his illness, he never complained.

He died September 28, 1931, and is survived by his wife and their five children. W. H. Sanborn, November 20, 1931.

A. A. A. STARTS DRIVE TO SAVE ALL WILD LIFE

The American Automobile Association [illegible] lists for wild life conservation. [illegible] Bureau of Biological Survey, Charles P. [illegible] association, recently opened an educational [illegible] life restoration by turning the Washington [illegible] into an exhibition of live game birds.

In a statement to the American Forest Association Mr. [illegible] he believed every motorist should realize the need for intelligent conservation.

"The American people have been brought in closer contact with the out-of-doors in the last decade of automobile development than at any time in the past 50 years," he declared. "This contact has been greatly beneficial to the motorist, but also it often proves harmful to nature and her works.

"It is clear that if depletion of wild life and forests continues as it has in the past ten years there will soon be little left of our great

natural resources. To get to the heart of nature most men use the automobile. If the A. A. A. can convince them of the necessity of conservation, the battle will be nearly won.

"There are too many men whose pleasure and health depend on hunting and fishing to consider the legal prohibition of such sports.

"If we can influence the millions who annually 'ride into the country' after every recreation, from picnics to big game—if we can show them the necessity for a new and more rational attitude toward plants, birds and animals—if we can impress on them that they also will suffer if present methods continue, then the A. A. A. will have done the Nation a lasting service in conservation."

A CORRECTION

In the April, 1931, issue of CALIFORNIA FISH AND GAME there appeared a short story, on page 198, entitled "Moose-Elk in Montana." The story told of the killing of an animal that apparently was a cross between a moose and an elk.

Due to the source of the information it was not deemed necessary to check this report directly with the fish and game authorities of Montana. This was a mistake.

Here are excerpts from a letter that was received from J. W. Carney, assistant game warden in Montana:

"While reading your April issue of the CALIFORNIA FISH AND GAME, on page 198 I noticed the article Moose-Elk in Montana, and was very much interested, as I happened to be one of the men who arrested this man for killing the moose, which was supposed to be part elk.

"The man who did the shooting claimed to be an old hunter and a good sportsman, from Butte, Montana, and the story published in your magazine is the one he told when he returned to Butte, to alibi himself. He no doubt sent this story out to the different sporting magazines. * * *

"I am writing you to give you the facts in this case, as the moose-elk as called in the article was one of the truest types of moose that one would wish to see."

It is hoped that this will right the wrong and clear the mystery and we are greatly in debt to Mr. Carney for being so generous in volunteering such excellent information.

STATE HAS MANY REFUGES

In the news comes the story that a speaker in southern California said "that the State should set aside refuges for the game of the State, not one or two, but fifteen or twenty." Data at hand reveals that we already have more than 40 refuges established by the State, and to proceed still farther there are at least 12 national parks and monuments where protection is afforded the wild living things. And not only that but money is constantly set aside by the State for the purchase and development of refuge lands.

GAME FISH

NEW EGG COLLECTING STATIONS

Two new field stations for the [illegible] established in the Mount Whitney district [illegible] of being very successful. The [illegible] October and closed the middle of November [illegible]

One trap on Rush Creek [illegible] million Loch Leven eggs. [illegible] puted.

The collection of Loch Leven [illegible] effort on the part of the division [illegible] this species in this wonderful [illegible]

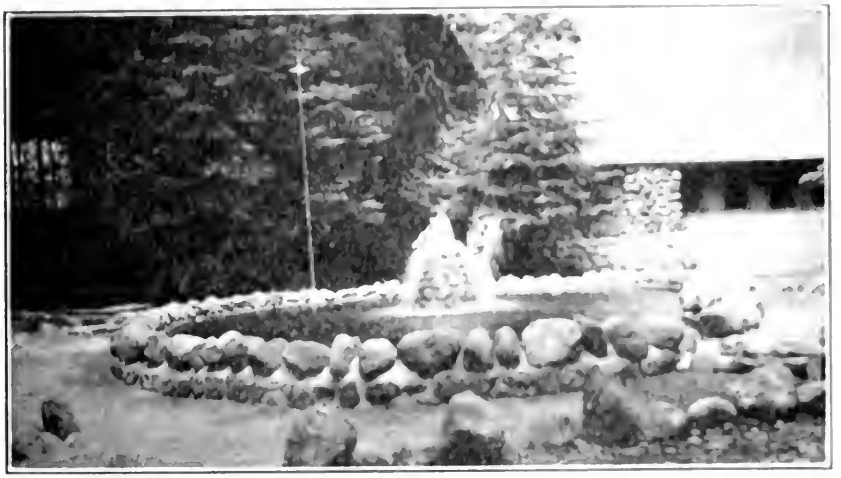

Fig. 10. Outdoor [illegible] toss shiny pennies to the [illegible] work of cleaning the [illegible] 1929.

that Loch Leven eggs have been collected at [illegible] latter months of the year.

The other new station has been established on Little Walker Lake. Eastern brook trout eggs are collected here. The eggs collected have added considerably to the available supply [illegible] district.

The Gull Lake station, which has been operating for several years, has proven to be very successful. The take of eastern brook trout eggs totaled well over the million mark.

TROUT CREATE "STRIKING" FUND

Although great countries are constantly tussling with the silver-gold standard problems, trout at the Yosemite Hatchery of the division have stolen the march and readily agree on copper.

Of course there may be a number of sly angles to this copper standard business and perhaps a line of discussion would not be amiss.

It seems that there is a beautiful outdoor aquarium at the above named hatchery. It also seems that interested spectators are in the habit of tossing pebbles into the water in order to see the fine big trout rise and strike.

Now then, Peter Topp, the fellow who cares for these trout, soon discovered that the cleaning up problem had assumed the proportions of a major activity. Shoveling piles and piles of pebbles from the aquarium during the sombre moments after the crowds had disappeared sort of appealed to his inventive sense of mind.

One day he dropped a shiny copper penny into the pool. The trout nearly butted each other out of the tank to get at the lure. After a quick nibble the successful trout merely dropped the copper to the bottom.

And this is how the pebble tossing ended. As soon as a crowd of potential pebble throwers would assemble, Topp would edge up to the tank and casually toss a penny to the fishes—the effect was almost magnetic on fish and spectator alike. Pebblers retired in dismay.

Soon a regular shower of pennies slithered through the water. The bottom of the aquarium assumed a beautiful coppery lustre.

Thus the die was cast. The cleaning process is not nearly so laborious, according to reports, and the State hatchery is gathering quite a "striking" fund.

Will some one kindly step forward with a few dimes or quarters?

"FLYING FISH"

Airplanes are obtaining excellent results in fish planting operations, according to word received from Warden C. J. Walters of Independence. In a recent report to E. L. Macaulay, chief of patrol, Walters said:

"We have been busy planting fish night and day, by airplane and every way possible, in order to get them out before the cold weather sets in.

"Hope to be all through this month. On August 28th, 1931, we took 10,000 steelhead trout by airplane from Lone Pine to Monache Meadows—it took the plane 14 minutes to make this trip. Two trips were made in all."

Under ordinary conditions this trip would require about 26 miles of automobile travel and 12 miles by pack train—a real hard trip for one day over a high mountain pass, not only for the men but for the fish also.

TROUT LIVE LONGER IN REARING PONDS

Trout live longer when held in rearing ponds and spawned by artificial hand methods than when allowed the natural freedom of the streams, according to W. H. Shebley.

Several reasons could be advanced for such a conclusion, he said, but the main cause can be attributed to "better care." In the rearing pond the fish is protected from natural enemies, is fed regularly with the proper foods, is spawned at the proper time and leads a more peaceful life in general.

In the streams the trout [illegible] dependent, to a great extent, on the [illegible] that, Shebley said, but the trout [illegible] of an army of natural enemies [illegible]

At the Mount Shasta Trout H[illegible] kind in the country. There are [illegible] 864 hatching troughs and [illegible] from studies of the fish [illegible] also been made at this station.

STRIPED BASS IN NEWPORT BAY

A striped bass plant [illegible]

A consignment [illegible] during October, 1931, and [illegible] surroundings in the [illegible]

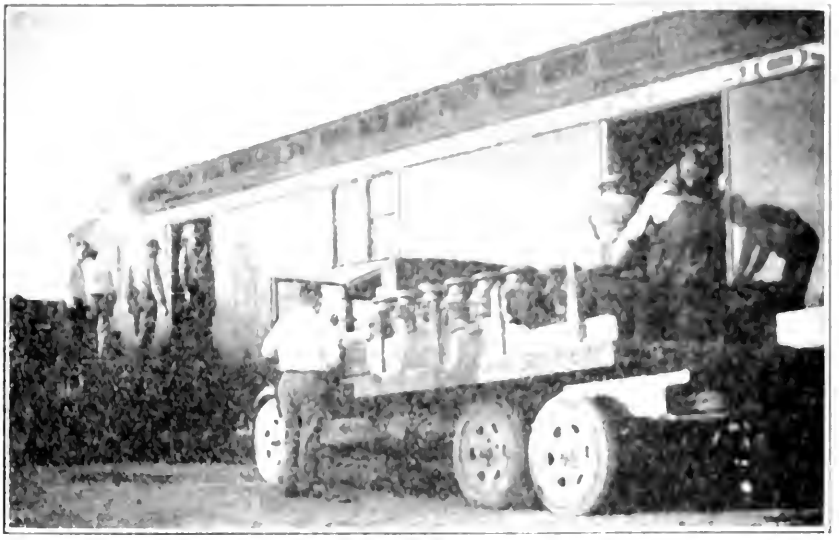

Fig. 11. [illegible] Tracy to southern [illegible] Sea and Newport Bay. [illegible] Photo submitted by R[illegible]

considered a very excellent [illegible] original, and only, plants in the [illegible] of less than 500 young striped bass. [illegible] there is now a plentiful supply.

Workers who secured the bass [illegible] to eight inches in length and were in excellent condition. George Neale in charge of the Bureau of Fish Rescue and Restoration, said that they were seined in the brackish waters that penetrate the sloughs of the San Joaquin Valley near the city of Tracy.

Sportsmen in this southern section of the State have been discussing the possibility of introducing the favorite "striper" into some likely waters, and due to this keen interest the division sent expert's to make a survey of the situation.

Whether the striped bass will adopt the new waters and become an abundant game fish of southern California is a question that is beyond the power of man to decide, the executive officer said. One of the big problems that the fish will have to overcome will be to locate a suitable spawning area and, generally, upon the success of this quest hinges the life of the project.

ATLANTIC SALMON IN NORTHERN CALIFORNIA

Atlantic salmon, a great and prolific food fish native to the northeastern coast of this continent, have again been introduced in substantial numbers along the rivers in the northern section of California.

Records show that this plant consisted of about 40,000 fish and occurred during the month of October, 1931. They were reared in the Mount Shasta and Burney Creek hatcheries and then transported by train and truck to branches of the Smith River. As the division's distribution railroad car is equipped with air hoses and all modern facilities to give the fish plenty of oxygen, the loss en route was negligible.

In addition to this plant, Shebley announced that there were also planted approximately 15,000 of these fine fish in Beaver Creek, a tributary of the Klamath River. These were planted under the supervision of E. V. Cassell, superintendent of the Mount Shasta Hatchery.

The Smith River planting was done under the supervision of J. C. Lewis, superintendent of Fort Seward Hatchery. He reported that the young salmon averaged better than three inches in length and were in excellent condition.

A part of the eggs for the plant was received by the division from the Department of Fisheries of the Dominion of Canada through a friendly exchange for other varieties; a part was also received through the United States Bureau of Fisheries.

The Atlantic salmon is an excellent variety of food fish that seems to prefer the cold waters of the northeastern coast of North America. Its life habits appear to be somewhat similar to those of our own steelhead trout; that is, these salmon do not die after spawning but return from the ocean to the parent stream from year to year until the life cycle is completed. Salmon familiar to us on this coast die after the first spawning.

The Atlantic salmon also grows to a very profitable size for a food fish. In the native waters fish weighing from 40 to 50 pounds are not uncommon. Like our steelhead trout the young fish run to sea as soon as they are strong enough to assume the rigors of life development and it is in these secret waters that they find the nourishment that produces size and weight.

If these fish will adapt themselves to the water conditions of the northern part of our coast they will prove to be an invaluable asset, but, like other types of introduced wild life, it will require several years at least before an accurate determination can be made.

DON'T IMPORT OR TRANSPLANT FISH

It is absolutely against the law to import or transplant fish in the State of California without the authority of the division.

Occasionally reports come to the division that persons or organizations are contemplating such planting activities. Little thought seems to be given to the damage that might accrue from such plantings according to fish culturists.

In regard to the subject, John L. Farley, executive officer of the division, said: "Our native fish and game must be protected against undesirable species from other states and countries. Carp were enthusiastically introduced into California in the belief that great benefits to the State would follow. The destruction they have wrought and the nuisance they have created are familiar to all, yet these fish are still being carelessly added to new waters in the State.

"California laws are strict and definite. No fish, eggs or aquatic plants or seeds may be legally brought into the State for the purpose of propagation without proper notice to the Department of Fish and Game, followed by an inspection of the proposed introduction. The division may destroy diseased shipments and authorize the prevention or destruction of deleterious fish, eggs, aquatic plants or seeds."

All sportsmen and public spirited organizations should co-operate in the eradication of such nuisances. With full co-operation it is possible to keep such dangerous practices and waters at a minimum.

ANCIENT FISH HOOKS

Copper fish hooks used by fishermen of the Kuskokwim Eskimo's thousands of years ago are in the possession of the Field Museum and are said to be not very different from modern hooks, according to a July 1931, issue of *Science News Letter*.

RETURNED FISH SURVIVE

Do infantile fish, jerked above water for their first goggle-eyed view of the world from the end of an angler's line, die of the shock after being returned to the water? This query, which has bothered fishermen ever since many states placed a size limit on game species, has been answered by 600 little fish at the Harrietta Hatchery, Michigan, according to the American Game Association. These piscatorial experimenters bit an assortment of hooks, and suffered them in the cause of science and all but a small percentage of them were living to tell of "their operation" two months later. All save two or three per cent of the young fish caught with flies survived, while a tenth of those caught with barbed hooks, the most difficult to remove, paid with their lives. The fish division of the Michigan Conservation Department believes its investigations have proved that the percentage of young fish surviving an encounter with the hook testifies sportsmanly observance of the law. It has urged anglers to remove hooks carefully, wetting the hands before touching the fish.

WORM FARM

Demands of present day anglers for more hours along the stream and less time in preparation for the trip have created a new and somewhat wriggling industry near Los Angeles. Fishing-worm farms are said to be doing a squirming business.

Angleworms are raised in special earth beds, fed scientifically, harvested by tender hands, placed in comfortable containers and shipped hither and yon.

And just as this unique business gets under way comes the report that Lieutenant Governor Earl Cooley of Colorado has invented a rubber fishing worm. It wriggles and twists, too, reports say. It is not only designed to fool the fish but relieves the anxiety of those who suffer qualms cognizant to the mistreatment of angleworms.

SNAGGED STREAMS MAKE BETTER FISHING

Streams can be made more attractive to game fish by building snags out of logs, brush and rocks. By changing or slowing up the current water pockets are formed, it is easier for fish foods to collect or become attached to the obstructions and areas of shade and rest are established, according to the American Game Protective Association.

Restocking experiments carried on in Michigan waters by the late Dr. Jan Metzelaar and his successor, Dr. Carl Hubbs, State fish research specialist, have proved the value of the so-called resnagging system of restoring fish to small flowing bodies of water.

When nature is left to follow her own method of taking away and rebuilding the earth's surface, obstructions are formed. These natural barriers have been removed in many streams throughout the country as a result of driving logs, a desire on the part of landowners to change water courses for landscaping purposes or to make possible the navigation of small craft.

Dr. Metzelaar's survey shows that fishermen using streams where resnagging experiments have taken place generally approve the work.

To snag a stream does not mean to dam it up altogether, but to slow up the water course at convenient points. People owning stream or river frontage can build satisfactory obstructions with material at hand.

COMMERCIAL FISHERY NOTES

DECISION ON STRIPED BASS CASE

Early in September, Frank Vitalie, a commercial fisherman of Collinsville, was taken into custody by wardens on the patrol boat *Quinnat,* and charged with taking striped bass other than with hook and line and taking more than five bass in one calendar day. A writ of habeas corpus was granted by Judge Hugh Preston of the Appellate Court, Third District, at Sacramento. This case, which was designed to test the constitutionality of the new bass law, came up for argument on October 5 and attracted a great deal of interest on the part of sportsmen and commercial fishermen. On October 19, the court upheld the constitutionality of the law, dismissed the writ and remanded the defendant to the custody of the sheriff of Solano County. As this decision is important as well as interesting, we give the main part of the decision:

"It is argued that [illegible] lawfully engaged in fishing for shad or [illegible] If this be true there appears [illegible] nets more frequently to prevent [illegible] the water.

Neither is the act [illegible] shad by means of a net during [illegible] bass is prohibited, for the [illegible] from his net. The fact that [illegible] net when he is lawfully [illegible] unconstitutional. It [illegible] bass, the result might render [illegible] future to restrict the [illegible] as to uphold the law it [illegible] families of fish. There [illegible] and place of spawning, or that [illegible] of fish have been transplanted [illegible] Legislature has wisely refrained [illegible] nation. In the absence of evidence [illegible] in the rules for regulation, it [illegible] reason.

628a of the Penal Code [illegible] graph two prohibits the catching [illegible] of a hook and line, while the [illegible] sale of such bass in a [illegible] are 'accidentally taken' while [illegible] code was enacted at the [illegible] appears to be an exception [illegible] graph. It does not appear [illegible] fishing for bass.

The question as to whether [illegible] good faith, and was respondent's [illegible] defense. Mere matters of defense [illegible] will not avail to discharge a petitioner [illegible] the merits to the trial court. [illegible]

The writ is discharged and [illegible]

We concur:
J. PLUMMER,
P. J. PRESTON."

LOS ANGELES ENLARGES ITS FISH HARBOR

Los Angeles is spending [illegible] improving its fish harbor at [illegible] Harbor, where the tuna and sardine [illegible] too small to accommodate [illegible] seine boats and the large tuna clippers [illegible] dations. The enlarged harbor will [illegible] ing boats. It will give over [illegible] for fishing boats. The plans provide for [illegible] $4,000,000 for jetties and breakwaters [illegible] Los Angeles Fish Harbor one of the best in the world.

INTRODUCTION OF MEXICAN FISHES INTO SOUTHERN CALIFORNIA WATERS

During the summer of 1931, the California live-bait boats fishing for tuna off Mexico returned to San Pedro with bait, taken in those southern waters, still alive in their tanks. These fish were released in

Los Angeles Harbor or in the region adjacent to it. Should any of these fishes succeed in establishing themselves, new species may be added to our California fishery. In the month of September occasional specimens of anchoveta appeared in the fresh fish markets of San Pedro, taken incidentally in the round haul nets supplying these markets.

The following species have been identified from collections secured from these live-bait tanks when the tuna boats returned to San Pedro:

Anchoveta *Cetengraulis mysticetus.*
Thread herring *Opisthonema libertate.*
Runner *Oligoplites saurus.*
Big-eyed bass *Xenestius californiensis.*
Conodon serrifer.
Micropogon ectenes.

—F. N. Clark, California State Fisheries Laboratory, Terminal Island, October, 1931.

MACKEREL CANNING

Although it has fallen from the heights it attained in 1928 and 1929, the mackerel canning industry is still one of the most important fisheries of southern California.

Four Los Angeles Harbor canneries packed mackerel during the summer and fall of 1931. Two of these had to pack steadily to keep up with the numerous orders that came in. The others packed intermittently in advance of orders.

The market for canned mackerel was much better than in 1930 but prices remained low ($2.25 to $2.50 a case, according to reports) due to the competition of the large pink salmon packs of recent years. Both export and domestic markets have picked up markedly. The Philippine Islands, which were the best market in 1929–1930 and the poorest in 1930–1931, began to take considerable quantities in July. Fairly large orders have been received from Greece, Italy and the Southern States of this country recently.

A recent development in the mackerel industry is the manufacture of canned dog and cat food from mackerel. One cannery has this animal food in production and reports increasing sales. A carefully planned newspaper and radio advertising campaign, something new in the California fishing industry, is probably responsible for the success of the venture as much as the undoubted quality of the product.

The amounts of mackerel delivered to Los Angeles County canneries, by months, for the summer and fall seasons of 1930 and 1931, are shown in the following table:

	1930 *Pounds*	*1931* *Pounds*
June	920,000	1,180,000
July	790,000	800,000
August	120,000	1,610,000
September	220,000	930,000
October	4,090,000	1,850,000
Totals	6,140,000	6,370,000

The availability of the mackerel to the fisherman varied considerably during the period under consideration (June-October, 1931). During several periods of about a week each the fish were so numerous

that the fishermen had little difficulty [illegible] San Pedro. At other times the [illegible] always successful in their quest. [illegible] has remained constant at $10 per ton [illegible] California State Fisheries Laboratory [illegible]

OYSTER GROWING IN CALIFORNIA

Early in 1931 a cooperative [illegible] of Fish and Game and the [illegible] whereby the bureau was to [illegible] expert, the direct object being to [illegible] The Division of Fish and Game [illegible] which arrangement is in line [illegible] the states in the latest and best [illegible] they may be able to carry on [illegible] selves.

Although some preliminary [illegible] ments have been started in the State [illegible] working independently and in cooperation [illegible] Bureau of Commercial Fisheries [illegible] start until October 1, 1931. At that time [illegible] of the United States Bureau of Fisheries [illegible] oyster work in Washington and Oregon [illegible] ing a thorough oyster survey of [illegible] research worker of the Division of Fish and Game [illegible] biological training, was assigned [illegible]

The first work will be a survey of the [illegible] the State. The survey started [illegible] that conditions are not right for the [illegible] oysters but are very favorable for the [illegible] oyster of the Pacific Coast. There [illegible] and about the mouths of some of the [illegible] their growth is remarkably fast. [illegible] land, in Humboldt Bay, which are [illegible] oysters.

For many years we have been [illegible] possibilities in this State for the development [illegible] siderable proportions. The efforts to [illegible] during past years have been devoted almost [illegible] our own Atlantic coast, but our water [illegible] good results with Atlantic oysters, and very little effort is now being expended on them. Some slight effort [illegible] native oyster, found from Mexico to Alaska, the same species which has made famous the city of Olympia, Washington, where the cultivation of the native oyster has grown into an industry of large proportions, mainly for the reason that the industry was [illegible] biologists to direct their work. By intelligent methods they have accomplished wonders.

A number of years ago, the division engaged Dr. Harold Heath to investigate the possibilities of developing the native oyster industry on Tomales Bay. Doctor Heath reported that he believed the industry could be profitably developed but that it would require that a biologist

be constantly on the ground to devote full time to the work. The United States Bureau of Fisheries was then appealed to, but at that time the bureau was not able to supply the demand for an oyster expert for the Atlantic oyster industry, an industry much more valuable than that on the Pacific coast. Since that time, however, the bureau has developed a corps of oyster men whose researches have developed improved cultural methods that have given new impetus to the industry. Our recently renewed appeal for aid in developing the California oyster industry resulted more favorably, as already stated.

Although only very limited surveys and experiments have as yet been carried out in California, it is confidently believed that in a number of localities both the native oyster and Japanese oyster can be satisfactorily cultivated and the area of suitable oyster ground is sufficient for the development of a very large and profitable industry.—N. B. Scofield.

SOFT SHELL CLAM BEDS IN THE VICINITY OF SAN FRANCISCO BAY

The soft shell clam (*Mya arenaria*) is not a native of the west coast but was accidentally introduced with the first shipments of eastern oysters brought to San Francisco Bay in 1879. Since that time the clam has spread along the California coast to the north until it is found at present from San Francisco Bay to the Oregon line in every suitable place. Its natural habitat is a firm mud bottom with a fair amount of current. Although so widespread in distribution it is nowhere very common unless given protection. The stingrays and flounders eat vast quantities of the clams. The stingrays will dig and eat the whole clam. The flounders bite off the siphons. If only the tip of the siphons are lost the clam can replace it, but if several inches is nipped off the clam dies. A good sample of what protection can do for the soft shell is illustrated by the bed of John Connell at Bayshore. Connell fenced off the cove at Bayshore in 1925, intending to plant the enclosed area with soft shell clams. About the time he finished fencing he took a job in another city which kept him away for two years. At the end of that time he returned and, as his fence was still intact, looked the cove over with a view of carrying out his original intention of planting clams. However, he never planted any. The protected area inside his fence was thickly set with clams and he has dug clams from it on a commercial scale until this year (1931).

It has been demonstrated by this and other similar instances that any favorable mud flat in any of the larger California bays will produce clams in quantity wherever they are protected from the stingrays and flounders. A great number of clams are dug annually by amateur and professional diggers on public unfenced beds, but the proportionate number found on such beds is very small compared to the number inside a protecting fence.

There are only a few enclosed beds in the vicinity of San Francisco at present. Several beds have been destroyed or abandoned during the last two or three years due to expiring leases and pollution.

South San Francisco Bay

South City (near Fuller Paint Works) [illegible] acres. The bed was staked in 1890 and [illegible] by a family named Maitzer. It is in fine shape at [illegible].

Western Pipe and Steel Plant. This bed was [illegible] John Connell and was worked for [illegible]. It was destroyed in 1920 by the shipyard which [illegible].

Bayview. A staked bed of 40 acres laid out in 1890 [illegible]. It was worked until 1930, when it was abandoned due to [illegible] wastes which are dumped into the bay. The [illegible] steadily increasing as more and more factories locate on that part of the bay.

Bayshore. This bed was staked in 1925 by Connell. It was an enclosed bay of about 10 acres. It was destroyed in 1931. Connell's lease ran out and the city took over the cove and is now filling it up with refuse from the incinerator.

San Leandro Bay. This bed is not fenced. It is quite large. A good many clams are dug for the market from this bed by Chinese.

North San Francisco Bay

All the beds from Sixteenth Street, Oakland, to Cosy Cove with the exception of Quong Sang's bed at Albany are merely open flats where any one can dig clams.

Albany. This bed is enclosed by a very modern square meshed wire fence on redwood posts. The fence encloses about 100 acres and there is a small house where a couple of Chinese live who act as keepers and diggers.

Martinez and Napa River. I have not seen these beds. They are reported to be good. Digging on them started this year. The reports I have received all claim that clam beds so far up the river are due to the lack of fresh water and the consequent upriver push of salt water.

Tiburon. There are three small beds here, all staked and owned by John Connell, who owned the beds about South City. The beds will cover about 8 acres of bottom.

Tomales Bay

There is only one staked bed in Tomales. It is the largest fenced bed in the vicinity. The area enclosed is about 300 acres. It belongs to the Pacific Oyster Co. and was originally intended for oysters. It is at present under lease to the Hop Lung Clam Co. Although there are soft shell clams all over Tomales Bay, they can only be found in paying quantities inside this fence.

Bodega Bay

The whole bottom of Bodega Bay is good clam ground and six or seven species are taken in commercial quantities, including the soft shell. A great many of the clams of all species are used by the local fishermen for bait. None of the bottom is fenced.

ENUMERATION OF CLAM BEDS

Location	*Acres*	*Started*	*Destroyed*	*Owner*
South City----------fenced	25	1890	----	Maitzner
South City----------fenced	25	1890	1920	Connell
Bayview ----------fenced	50	1890	1930	Connell
Bayshore ----------fenced	10	1925	1931	Connell
San Leandro Bay---------unfenced	100	----	----	Public
Sixteenth Street, Oakland_unfenced	150	----	----	Public
Brooks Island----------unfenced	50	----	----	Public
Sobrante ----------unfenced	100	----	----	Public
Wine Haven----------unfenced	100	----	----	Public
Cosy Cove----------unfenced	40	----	----	Public
Albany ----------fenced	100	1928	----	Quong Sang
Tiburon ----------fenced	3	1930	----	Connell
Tiburon ----------fenced	2	1930	----	Connell
Strawberry Point----------fenced	3	1930	----	Connell
Tomales Bay----------fenced	300	1910	----	Pacific Coast Oyster Co.

—Paul Bonnot, November 15, 1931.

NEW FISH BULLETINS IN DEMAND BY PUBLIC

The four fish bulletins recently issued by the Bureau of Commercial Fisheries have been so well received by the public that scores of readers have felt urged to write us praising certain features that were considered especially noteworthy.

The "Handbook of Common Commercial and Game Fishes of California," by Lionel A. Walford (Fish Bulletin No. 28) has been more appreciated than any other publication because its photographs and brief descriptions serve to identify easily the species and settle questions as to the use of common names. Hundreds of sportsmen, marine research institutions, housewives, business firms, scientists, commercial fishermen, libraries, elementary and secondary schools, universities, and plain stay-at-home citizens from all parts of California, as well as from other states, are writing in for this handbook, the schools and universities often requesting several copies for use in zoology classes. Some 4500 copies have been distributed already, and the indications are that the flood of requests will continue for many months. Fortunately, we have a large supply to meet this demand.

Another bulletin in great demand and one that has also brought letters of praise, is No. 29, "The Striped Bass of California," by E. C. Scofield. This is of special interest to the army of anglers and surf fishermen of central and northern California, and requests for copies of this booklet are still arriving with every mail. The clear, direct style of writing and the interesting material included have made this bulletin more acceptable to the ordinary reader than is usual in a report covering rather technical subjects.

Bulletin No. 30, "The Commercial Fish Catch of California for the Year 1929," appeals to the reader as a citizen rather than as an angler. This is the third and best of a series of bulletins picturing the importance and diversity of the fish catch in this State. The text makes for more entertaining reading than you are led to suspect from the title, and several of the articles have received warm praise from leading citizens throughout the State. Some of the most flattering letters have come from the eastern states and from officials and tradesmen in Europe.

"Studies of the Length Frequencies of the California Sardine" (Fish Bulletin No. 31, containing two articles on this subject by Frances N. Clark and H. C. Godsil), is a title that warns the reader that the

subject matter is technical, but the language used is such that it deals with big words and the style is simple and clear. While the subject has not the wide appeal of the previous [illegible] it is in demand by those interested in the [illegible].

These bulletins are published for free [illegible] State and copies may be had by writing to [illegible] Fisheries Laboratory, Terminal Island. Any effort [illegible] deputies toward giving these publications [illegible] will be appreciated.

SALMON PROTECTIVE MEASURES UPHELD

Protective measures legislated by the State [illegible] have been upheld by Superior Judge Warren V. Tryon in the Humboldt County court. The case revolves around restrictions which prevent the transportation of salmon through closed districts [illegible] and has been of special interest to both commercial fishermen and conservationists.

In the districts involved, Nos. 6, 7, 8 and 9, the commercial fishing season on salmon closed September 15th. Fishermen [illegible] a desire to fish beyond the three mile limit, on the high seas, but restrictions prevented them from possession of salmon within the State limits in that territory. They sought an injunction to prevent the Division of Fish and Game from enforcing the State law. Judge Tryon ruled that the order restraining the State from enforcing the law be dissolved.

The reason for such a restriction is not to permit hardship on the fishing industry but to hold the commercial catch, as nearly as possible, to a point where a supply is insured for seasons to come. The districts are opened along the coast when the salmon, through years of study, are known to be running in the larger sizes.

In ruling against the possession of salmon during the closed season the State is not only endeavoring to protect the fish within the three mile limit but also on the high seas. These are the fish that run and spawn in our rivers, according to commercial fishery authorities.

CATCHING SEA LIONS ON THE LOWER CALIFORNIA COAST

During the early part of August, 1941, the San Diego Zoological Society sent an expedition into Lower California for the purpose of collecting sea birds and sea lions for their zoo. I was privileged to be on this expedition and at Asuncion Island Dr. Harry Wegeforth, President of the San Diego Zoological Society, and I caught the five California sea lions (*Zalophus californianus*) we brought back with us. The methods and equipment used for this work are simple. We used a three meshed trammel net of the same type used for fish, only it was of larger mesh and heavier twine than is ordinarily used in fish nets. The net is 50 feet long and 25 feet deep. The cork line is well bouyed and the lead line has only comparatively few leads and is therefore light. The center webbing is of 9 inch mesh and the two outside pieces are of 25-inch mesh.

Our mode of procedure was to lay out the net along the kelp just outside the breaker line and close to a beach where the sea lions were hauled out. A good many of the animals would leave the beach while

we were laying out the net and, as they are very curious, swim around and around the boat. We tied one end of the net to the kelp and kept the rope at the other end in the boat. When a sea lion hit the net it acted in the same manner as a gilled fish, floundering and kicking and becoming more and more entangled. It never seemed to occur to them that they might endeavor to back out. When we had four or five young sea lions, preferably yearlings entangled, we signalled for the motor tender which towed the whole thing to the ship. By towing slowly none of the animals was drowned as they could raise their heads at intervals and breathe. When we arrived alongside, a large wire crate was lowered on a boat davit and the tangled net and its catch were carefully floated in and the door dropped. The crate was lifted to the upper deck and the animals released by cutting a few meshes of the net and gradually working them out under the door. We made only two hauls, after which the net had too many holes in it to be effective. In each haul we caught a big adult cow which we did not want. Both of them managed to free themselves before we got alongside. We successfully crated six sea lions but at Guadalupe Island a couple of hours of unusually bright sunshine killed one of them before we realized that anything was amiss. We turned the salt water hose on the remaining five. They seemed to thoroughly enjoy the bath. Their crates were then covered with canvas. They were landed in San Diego in good shape and taken to their new home in the San Diego Zoo.—Paul Bonnot.

NEW FISH BULLETIN

"The California Halibut and an Analysis of the Boat Catches" is the title of a bulletin published by the Bureau of Commercial Fisheries of the division. Authorship is credited to G. H. Clark.

This report is presented to aid directly the administration of the division in their conservation program. The bulletin gives an account of the California halibut fishery and a detailed analysis of the catch in the Los Angeles harbor district by means of the catch per unit of effort expended.

The paper is so arranged that the general and fundamental aspects of the fishery and the results of a catch analysis are briefly given in the first part. For those who may be interested in the detail of the fishery some of its life history and methods of boat catch analysis employed, the balance of the paper will be of importance.

This bulletin, No. 32, will be mailed free of charge to any person writing to the California State Fisheries Laboratory, Terminal Island, California.

HARBOR IMPROVED FOR FORT BRAGG FISHING FLEET

End of construction is in sight on a jetty being built by the Federal government at the mouth of the Noyo River, Fort Bragg, to provide shelter for fishing craft. Several hundred salmon trollers operate out of Fort Bragg during the fishing season and the breakwater will also give protection to the larger trawl boats from San Francisco.

In the past, fishing boats have been able to cross the bar at the mouth of the Noyo only at high tide. When the work is completed

there will be a channel, 100 feet wide and 10 feet deep from the mouth up the river 1300 feet.

A total of $170,000 is being spent on the work, $[illegible],000 of which is for the dredging of the channel. *Pacific Fisherman*, September 1931 p. 29.

OYSTER VERY POPULAR

The oyster is found in every seacoast State in the country, and a commercial fishery for it is conducted in all these states except Maine and New Hampshire. According to recent figures the production of oyster meats in 1929 was 155,824,000 pounds, valued at $16,824,000 to the commercial oystermen. A considerable proportion of this is taken from privately owned oyster beds upon which the oysters are farmed, that is, the oysters are planted and harvested in a manner comparable to the planting and harvesting of crops on land. *Fishery Service and Trade*.

UPLAND GAME BIRDS

STUDY LIFE HABITS OF QUAIL

California valley quail are certainly getting a very fair opportunity to demonstrate their abilities as field managers under present-day conditions.

In making advanced studies on the life habits of this excellent upland game bird the division has established two tracts of land in San Diego County where conditions affecting the valley quail will be observed by research workers for the next few years.

One tract of land remains practically undisturbed, according to the plan, and the birds are allowed to proceed under natural conditions. Outside of the elimination of hunting, very little effort will be made to promote the welfare of the quail in this section except the addition of better water and food conditions.

On the other tract of land everything is being done to protect and assist the birds in the affairs of life. Known predators are studied and eliminated, if deleterious, and watering facilities are undergoing development.

A comparison of results from the two tracts will produce valuable information. The studies will include, among many other factors, the relationship between hawks, coyotes, skunks and other alleged predators and quail; relationship between rodents and upland game birds, especially the effect of the small mammals on seed bearing food supplies and the seasonal habits of the birds under various natural conditions.

This important experimental work in the field is conducted under the supervision of Dr. Paul Radir, from the bureau of refuges. He is assisted by Alan McKean.

Radir is making surveys of the land and is constantly checking the bird and animal population. Observation stations are located at every point of vantage. The investigation will take at least four or five years before real definite conclusions can be determined.

Officials of the division said that the exceedingly important work was launched to learn if proper game management could be developed in the field without depending entirely on the planting stock produced at the State game farms near Yountville in the north, and Chino in the south.

QUAIL BRING NEW INTEREST TO HOSPITAL PATIENTS

California valley quail are playing an imortant role toward the convalescence of patients at the Veterans Hospital, near Livermore, and the Frank R. Howard Memorial Hospital, at Willits.

In communications with these two institutions, some very interesting facts have been brought to light.

A letter from Guy M. Johnson from the Veterans Hospital reads in part as follows:

"There are many natural attractions on this reservation for quail and song birds. Sloping hills, a creek, acres of green lawn, trees, shrubs, thickets and high native grass.

Every effort is made to encourage and attract the quail. They are fed twice daily, and if the feeding is delayed, they scold until fed. They have multiplied each year, but only by constant work on the part of everyone have we been able to maintain them. No firearms are allowed on the hospital reservation so the toll is not taken by man, but by house cats. We are constantly waging war on these pests. After the cats have had a taste of quail meat, they turn into real hunters. We have made traps out of orange boxes, baited them, and they are proving to be successful. Everything is being done to keep the cats down, for it is the only way we can hope to maintain our present flock, and hope for an increase. When people think their own cats wouldn't kill, they are mistaken, for I have trapped several of these pets right by the roosting place. Eight cats in one night is our record. Cats are, as I said, being warred against constantly, but they keep coming in. None of them frequent the buildings, but are to be found out where there are birds.

A word or two for the deer. They frequent the vineyard, browse around, knowing they are safe.

Wild life is an attraction to everyone hospitalized. We study their habits and encourage their presence. The officers in charge of the hospital are doing everything in favor of our feathered friends."

W. F. Whitney, U. S. Commissioner and Justice of the Peace, has been very kind in sending the following information from Willits:

"In the winter of 1927, construction on the $70,000 Frank R. Howard Memorial Hospital, a gift to the city of Willits by Charles S. Howard, of San Francisco, California, was started.

During the months of construction from November, 1927, to May, 1928, a small flock of quail consisting of about twenty-five, was noticed from time to time by those in charge. It is claimed by old residents that this same flock of quail had made their home on the hospital location for over ten years, but had never increased in size.

As soon as the hospital was opened, Dr. Raymond Babcock, in charge, asked that the city authorities help in protecting the small flock, which they agreed to do. Also the nurses were ordered to place feed for the quail every day on the lawn south of the hospital. Under protection and with the feeding of the quail during the winter of 1928 and 1929, a flock of over thirty quail could be counted on the hospital lawn nearly every day. In the winter of 1929–1930, the flock had increased until it was nothing to count from 100 to 130 every day on the hospital land, and in the winter of 1930–1931, the flock had increased and at one time 225 quail were counted eating on the lawn south of the hospital.

As the quail at this time have not started to bunch it is impossible to get a real count but Dr. Babcock, and the nurses in charge estimate that the flock has now increased well over the 300 mark as the number of small quail seen is larger this year than in the past years.

The Howard Hospital is located in the [illegible] a wooded hill consisting of about thirty acres. The [illegible] are only seen during the early morning and late evening [illegible] feeding on the hospital lawn and drinking from the [illegible] has been made to tame the birds in any respect. [illegible] to the birds being fully protected from hunting and [illegible] with the proper feeding."

CALIFORNIA QUAIL IN MONTANA

It is interesting to read a story on Montana Wild Life, October, 1931, which says that "California quail, [illegible] of the field, have been successfully reared [illegible] as well as natural surroundings at the State game farm at Bozeman, conducted by Superintendent J. F. Hoffman. Some day the fiery flier will at no late date become a fixture of Montana fields."

Reading further in the story it says: "Ten pairs were released about one mile from the game farm [illegible] of Warm Springs Creek. The liberated birds have multiplied in much the same manner as described by Ellis Parker in 'Pigs in Peas.'"

It has long been a practice in our own State, California, to raise valley quail for stocking purposes. The report from Montana should set aside any doubt as to the practical value of such a practice, even though quail are one of the most difficult species to propagate in captivity. Our decidedly modern methods of artificial propagation by electrical equipment has eliminated many of the hazards formerly encountered when domestic hens were used for brooding purposes.

CATALINA CATS AND QUAIL

In a report received from Herbert M. [illegible], volunteer deputy, it is revealed that there are quite a number of quail on Catalina Island, but the birds do not seem to increase from year to year in large numbers.

"This is due to the fact, I believe, that there are so many stray and homeless cats which roam the island in search of food," he said.

"Since January 1, 1931, more than 100 cats have been trapped. Fish scrap is used for bait. The number of cats shot and killed is not known."

He also reported that many cattle, goats and horses roam over the island and probably destroy many of the quail nests. The report also stated that dove are not plentiful on the island, due in part, to the same reasons that affect the quail supply.

INCREASE GAME BIRDS IN SOUTH

Plans for the increase of upland game birds in the southern part of California were discussed at a meeting held at Upland between members of the Izaak Walton League and officials of the Division of Fish and Game.

Very much interest was taken in affairs by the southern sportsmen and the problem of propagating greater batches of California valley quail at the State game farm at Chino for stocking purposes was considered in detail.

It was brought out at the meeting that many localities are making complaints which state that quail are causing a considerable amount of damage to certain agricultural crops. State game officials feel that trapping and transplanting of quail and general game management in the field should be practiced before the commission resorts to game farms as a major source of supply. These birds respond readily to protection and feeding. Field methods should be supplemented by work at the game farm.

It was also revealed that large areas controlled by water companies have been closed to public shooting for years and that through special lease it will be possible to open a part of these lands to sportsmen. Other parts of the area will be established as quail sanctuaries and will yield birds for the trap-plant methods.

Members of the league expressed satisfaction with the plans as outlined at the meeting and it was believed that some very constructive work was accomplished. Among those present from the Division of Fish and Game were John L. Farley, executive officer; Grahame B. Ridley, assistant executive officer; W. H. Shebley, fish cultural adviser of the Bureau of Fish Culture, and August Bade, superintendent of State Game Farms.

DOVES AND PHEASANTS ON REFUGE

Other game birds besides waterfowl are nesting on the Grey Lodge migratory waterfowl refuge, according to Asa McLellan, superintendent in charge of development work. The refuge was recently purchased by the division and is destined to be a fine resting ground for migratory waterfowl in proper season.

Chief among the nesting birds noted so far are pheasants and dove. Both of these fine game birds like plenty of water, McLellan said, and they find conditions ideal here for propagation.

"There is a wealth of tall marsh grasses and tule clumps on the refuge," the superintendent said, "and I have not had the time to ascertain the approximate population of these birds, but I know that they are here, and doing well."

He also stated that the land was quite free from predators and that it should not be a difficult matter to keep this problem under control. Former owners of the property conducted a very successful war against waterfowl and game-bird menaces and this asset will give the division a long head-start in development work.

DOVES SHOW INCREASE

From all information that can be gathered the past season has been one of the best dove years sportsmen have experienced in a long time. An official report from Jack Boaz, of the Bureau of Education and Research of the Division, revealed that: "Many limits of doves were checked by the wardens throughout the districts of southern California. The great abundance of this bird was noticed in the Imperial Valley country. From all reports and appearances, this species of upland game bird is on the increase."

DON'T SHOOT HOMING PIGEONS

A letter was received by the Department [illegible] May [illegible] University Avenue, Berkeley, which [illegible] are being shot and mutilated during [illegible]

The note said that "during the 1930 [illegible] some valuable birds that came home [illegible] miles, with their wings and breasts pierced with [illegible] birds are valued at more than $100 [illegible] their worth as messengers in times of war [illegible] immeasurable.

Doves can be easily distinguished from [illegible] appearance. They have longer tails than pigeons [illegible] have sharper features and, in most cases, a more [illegible] The flight of both birds is swift.

HUNGARIAN PARTRIDGES IN FRESNO COUNTY

Hungarian partridges appear to be [illegible] County, according to a letter received by the Department [illegible] Pierson, rancher.

This species of upland game bird was released on the Pierson Ranch during the past year by August Bade, Superintendent of State Game Farms at both Yountville and Chico. The rancher reported that he counted between 50 and 75 birds in one canyon where there was a spring and some green feed.

Pierson also said that: "At other points on the ranch [illegible] through the valley I have seen other small coveys of Hungarian partridges and I feel satisfied that there has been a [illegible] increase of these birds during the season."

The Hungarian partridge, known in Europe as the "gray" partridge is considered by many sportsmen as the best game bird of all, Bade said. In the State of Washington a check showed that they multiplied just twice as fast as pheasants or quail. Their broods [illegible] according to that check, averaged sixteen, while quail and pheasants could do no better than eight. These figures are for matured [illegible] and not the number hatched, the superintendent said.

In discussing the habits of these game birds Bade said: "The average nest of the Hungarian partridge will contain [illegible] eggs and the larger percentage of matured birds [illegible] hatching is due mostly to better care on the part of the parents. Very few birds show so much practical knowledge of how a family should be reared. Both parents have an equal share in the family [illegible] and guidance continues until the family breaks up during the following spring for the mating season. At no time in the history of the family do they come together in flocks but remain as separate family units.

"This practice leads to a wider distribution of the birds over any given areas, as one family will battle another for the territory they have selected as their own. When this trait is understood it is easy to see why, with their prolific production, they will populate a given area sooner than any other game bird."

Bade also said that these birds will not flush from cover when some one of its enemies of the air try to get them excited and on the wing. A hawk will do little with birds that refuse to flush, he said, and this factor alone probably will be a great factor in aiding this bird in its bid for existence.

CITIZENS PROTECT WILD TURKEYS

Wild turkeys liberated in Humboldt County by the Division are receiving full support and protection by citizens in that locality. This has been demonstrated in a case decided by Judge E. G. Kay of Blocksburg.

The guilty party, Felix P. Senestraro of Loleta, received a sentence of $250 fine or 125 days in jail for having wild turkeys in his possession. Arrest of the law violator was made on the Fort Seward Range by Wardens Captain J. D. Dondero of Lakeport, E. J. Johnson of Garberville and Scott Feland of Fortuna.

Information that the birds were being taken by a clever law violator was received in the bureau of patrol through the cooperation of citizens. The three wardens from outlying districts gathered together and made the drive.

The confiscated meat was distributed among needy families in the district.

WATERFOWL

CONSERVATION OF OUR WATERFOWL

By the President of the United States of America

A PROCLAMATION

The long-continued and severe drought of the past two years has inflicted not only economic hardships by seriously curtailing crop and stock production, but also has resulted in an emergency condition as regards the present and future safety and abundance of the waterfowl of the continent. In large areas of the United States and Canada, through lack of the water on breeding grounds essential to rearing the young birds, the drought has entailed widespread destruction among the former hordes of the wild fowl that migrate to our several states.

This devastation has constituted so great a menace to our wild-life resources and to their future enjoyment by our people as to impel the Secretary of Agriculture to adopt a regulation compatible with the Migratory Bird Treaty Act (40 Stat. 755), whereby during the coming fall there will be an open hunting season on these birds of only one month.

Now, therefore, I, Herbert Hoover, President of the United States of America, do hereby urge that all persons take cognizance of this emergency, and I call upon all game and conservation officials, State and local, all members of game-protective organizations, landowners, sportsmen, and public-spirited citizens generally to lend their cooperation to effect full observance of this regulation, to the end that adequate

numbers of waterfowl may return to their breeding [illegible] and that there may be no repetition of the calamity [illegible] that has already overtaken some species of our [illegible]

In witness whereof, I have hereunto [illegible] seal of the United States to be affixed.

Done at the City of Washington this [illegible] year of our Lord nineteen hundred and [illegible] dence of the United States of America [illegible]

By the President:

WILLIAM R. CASTLE,

Acting Secretary of State.

August 26, 1931.

CLOSE BIRD REFUGES TO HUNTING

The Secretary of Agriculture has [illegible] permitted hunting on Federal bird reservations [illegible] Big Lake, Arkansas; Tule Lake, California; [illegible] Pipe and Pablo, Montana; Rio Grande, New Mexico; [illegible] Oregon. This action was taken, officials of the Bureau [illegible] Department of Agriculture, explained, because of the [illegible] gency confronting wild ducks and geese.

Of the eighty one reservations established [illegible] placed under the administration of the Bureau [illegible] are the only ones on parts of which hunting [illegible] new series of refuges being established under the [illegible] servation act of 1929 will be inviolate sanctuaries, [illegible] will not be permitted after they are under [illegible] logical Survey.

The secretary's order, it was pointed out, [illegible] dential proclamation of August 25th shortening [illegible] geese, brant and coot, to thirty days and [illegible] conservation of waterfowl. These emergency [illegible] was explained, have been necessitated by severe [illegible] plains states and westward to the Cascade Mountains [illegible] provinces of Canada, the principal wildfowl [illegible] continent. The drying up of sloughs and marshes [illegible] prevented the birds from rearing normal numbers [illegible] result the annual flight of ducks and geese [illegible] the smallest on record.

WATERFOWL SHOOTING REGULATIONS

Following are the migratory waterfowl shooting regulations as observed in California during the season of 1931:

California's hunting season on ducks, geese, brant and coots or mudhens opens at noon November 16 and closes at sunset on December 15.

Bag and possession limits are as follows:

Ducks (except wood duck), 15 per day in the aggregate of all kinds; 30 in possession.

Geese, including brant (except Ross and cackling geese), 4 per day in the aggregate of all kinds; 8 in possession.

Coots or mudhens, 25 per day.

There is no open season on the wood duck or Ross and cackling geese.

It is unlawful to shoot migratory game between sunset and one-half hour before sunrise.

Throughout the State hunters may shoot on any day of the week, except that shooting days on commercial clubs are restricted to Sundays, Wednesdays, Saturdays and all legal holidays. The season begins at 12 o'clock noon on the opening day and the last day of the season is a legal shooting day throughout the State.

Blinds on commercial clubs must be situated at reasonable distances from each other, but in no event are they to be less than 80 yards apart, and at no time shall more than two hunters occupy any one blind.

Commercial gun clubs are strictly prohibited from guaranteeing bag limits.

It is unlawful to shoot game from a power boat, sailboat, automobile or airplane; or to hunt waterfowl from a scull boat in districts 8 and 9, except on Wednesdays and Sundays, or at any time in District 12, or in the Napa River south of Edgerly Island, or to use a shotgun larger than ten gauge, or to possess an extension automatic or a cane gun.

STATE WARDENS ASSIST FEDERAL SERVICE

Waterfowl regulations as prescribed by the United States Department of Agriculture were strictly enforced during the past season by State game wardens. Such action was almost imperative since more than 120 of our deputy fish and game commissioners were drafted into the Federal service during the drought emergency period; they supplemented the force organized and working under the leadership of George Tonkin, Federal game protector for California. It was purely a cooperative action between government and State, with all interests centered on the protection of the depleted waterfowl supply.

$25,000,000 FIVE-YEAR WATERFOWL PROGRAM PROPOSED BY THE AMERICAN GAME ASSOCIATION

The American Game Association was born of the original struggle to protect migratory birds. For twenty years it has studied the situation and has recommended constructive programs. Only part of these have been put into action. The present waterfowl crisis demands heroic and immediate measures.

Restrictions upon shooting will always be necessary, but *instead of more restrictions we must have more production.* Until nationwide and international producing machinery is put to work in a big way, we will never save the ducks.

The remedy for the present calamity divides itself into five major phases:

1. Restore and set aside ample breeding, feeding and resting grounds, scattered at strategic points throughout the entire range of our migrants.

2. Adequate enforcement of the regulations to stop poachers, duck bootleggers and game hogs.

3. Greater protection of the breeding ground against natural enemies.

4. More waterfowl breeding by states, clubs and individuals to increase the supply.

5. Negotiate a migratory bird treaty with Mexico.

PRESENT PROGRAM GROSSLY INADEQUATE

The present $8,000,000 ten year Norbeck Andresen program authorized by Congress in 1929 is grossly inadequate and progress will be entirely too slow. The staff of Federal game protectors is too small to render effective service, and the states are not yet doing their full share to help.

It is obvious that Congress is not likely to appropriate more money than already authorized under the Norbeck Andresen refuge program. Many feel that under present conditions Congress may be induced to appropriate the full amount authorized, and that it will be difficult to obtain enough money to increase the force of Federal game protectors to an adequate staff.

SALES TAX ON AMMUNITION DOUBTFUL

In 1925 an effort to finance a big national waterfowl program through a sales tax on arms and ammunition was bitterly opposed. Recent suggestions of a cent a shell on ammunition have met with the same determined opposition. Even though it might be an equitable method of collecting the necessary funds, the past attitude of Congress in the matter of sales taxes holds little or no hope for funds from that source.

Contributions from organizations, individuals and clubs have been suggested to supplement State and Federal appropriations, but past experience indicates that this method of financing is far too slow to get quick results.

In view of the foregoing, the American Game Association at a meeting of its board of directors on September 16, 1931, decided to recommend the following program:

1. Federal Breeding Grounds and Administration:

To get quick action under the machinery established by the Norbeck-Andresen Act of 1929, and to supplement that program in several important directions, Congress will be urged to enact legislation as follows:

(a) Bond Issue: Provide a special fund of $25,000,000 through the issuance of special bonds at the rate of $5,000,000 annually for five years to purchase, lease and maintain migratory bird breeding grounds.

(b) Federal License: Retire these bonds from funds collected through a $1 Federal license to hunt migratory game birds, and continue the work thereafter from said revenue. Licenses to be available at postoffices to attach to State licenses. Exempt landowners on lands whereon they reside. It is believed the income from such a license will be $2,500,000 to $3,000,000 annually.

(c) Contributions: Make provision for the acceptance of contributions to this migratory bird conservation fund from organized groups, public-spirited individuals, and others to expedite the program.

(d) Division of Funds: Use not less than 70 per cent of the income to this fund to purchase, lease and administer breeding grounds and refuges, the balance for enforcing the migratory bird regulations.

(e) Cooperation with Canada: Provide that any part of this fund may be expended in the establishment of migratory bird breeding grounds in cooperation with Canada under a workable plan to be evolved by the officials in charge, or by an International Migratory Bird Commission established for that purpose.

(f) Cooperation with States: Provide for State and Federal cooperation under this program of establishing breeding grounds and refuges on a fifty-fifty basis of participation in cost, such jointly purchased areas to be turned over to the states for administration under the Federal regulations. *This will double the amount available* and will be especially helpful in the creation and administration of many small areas of 1000 acres up.

2. State and Local Action:

Urge the states to expand their refuge systems to benefit migratory birds. Utah, Minnesota, Wisconsin and Michigan and several other states have already shown the way in the matter of waterfowl breeding grounds. All other states should follow their fine example.

Encourage local associations, communities, clubs and individuals to restore and administer breeding grounds and refuges wherever possible.

3. Natural Enemies:

Control the natural enemies of our nesting birds on the northern breeding grounds. Crows, certain gulls, coyotes and other predators are said to be destroying terrific numbers of eggs and helpless young waterfowl, shorebirds, and song and insectivorous birds annually.

Fence off portions of good breeding sloughs and marshes to prevent undue disturbance and destruction of nests by live stock.

4. Waterfowl Breeding:

Help develop an acceptable plan to encourage individuals and clubs to raise wild ducks both for shooting and for stocking purposes, and urge its general adoption. Numerous clubs are producing as many ducks as they take annually; some of them considerably more.

5. International Surveys:

If further surveys are needed, they should be initiated at once; but the waterfowl needs of both the United States and Canada are quite well known by the officials in charge. They can very quickly assemble any additional data and agree upon an interlocking program of action.

6. Treaty with Mexico:

A compact similar to the treaty between the United States and Canada should be consummated without delay between the United States and Mexico.

This program is somewhat similar to the one the association and its coworkers recommended ten years ago, which resulted in the adoption of the Norbeck-Andresen program in 1929—but this plan is much more comprehensive and will produce results far more quickly.

Had the original plan been adopted more than $[illegible] worth of reestablished breeding marshes would now be producing [illegible] of thistles.

To buy up marginal and unwisely drained land [illegible] them with water will take millions of acres out of competition with productive farm lands, thereby helping the farmers of America and assuring a future supply of migratory birds.

Now is the time to act while both land and money are cheap. All conservation and sportsmen's clubs and associations, conservation officials, and others are urged to join with the American Game Association in the promotion of this emergency program. (American Game Association, Investment Building, Washington, D. C. September 1, 1931.

MOUNTED POLICE PROTECT MIGRATORY GAME BIRDS

Thousands of migratory game birds that visit a group of small islands in the St. Lawrence River just east of the Island of Orleans are to receive special protection by a patrol of two Quebec mounted police, according to a report received through official channels by Paul G. Redington, chief of the Bureau of Biological Survey of the United States Department of Agriculture, from the American consul at Quebec, Canada.

The object of this patrol, according to the local division of the Provincial Association for the Protection of Fish and Game, is to protect the birds that rest on the islands during their spring trip north from molestation by resident hunters. The only known flock of greater snow geese comes regularly up the St. Lawrence each spring after wintering in Virginia and North Carolina. These birds rest several days on these islands before continuing north for the summer. Other game birds appearing there at this season are Canada geese, brant, black ducks, pintails, mallards, and teals. These same birds return in the autumn with their young en route southward.

It was reported that a similar police patrol for 23 days of April last year stopped much of the illegal hunting of these birds. "Occasionally," it was stated, "hunters dressed in white clothes were making use of motor launches painted white so that their approach would not be readily discerned by flocks on the river surface, the stream being usually partly filled with ice and snow at this time of year."

In commenting on this effective cooperation to conserve the wild birds of the continent, Mr. Redington, who heads the branch of the United States Government charged with carrying out in this country the provisions of the Migratory Bird Treaty, said that patrols similar in purpose are being maintained by the Biological Survey by means of game protectors stationed in various parts of the country. "It is only by such cooperative measures on the part of the two countries," he said, "that we can hope to fulfill our obligations under the treaty and save our wild fowl for future generations. Both Canada and the United States are also creating and maintaining nationwide systems of refuges that furnish sanctuary for many species of our migratory birds."—U. S. Department of Agriculture, Office of Information.

MAN-MADE DROUGHT

A resumption of wet years will not materially check the downward trend of this continent's wild fowl supply, now at its most alarming level in history, H. L. Betten, member of California's advisory committee on waterfowl sanctuaries and nationally recognized authority on wild life conditions, declares in a statement made public by the American Game Association.

"In the great prairie regions of America and particularly in the wheat belt of Canada unwise and unrelenting reclamation and drainage projects have been extended so rapidly that a perpetual man-made drought now exists on the most important breeding grounds," he claims.

Lines of transportation flung across Canada and the northern tier of states have sprayed millions of settlers over the land, paving the way for drainage of tremendous areas of lakes, sloughs and marshes which served as natural reservoirs for water as well as waterfowl and shorebird nesting grounds.

"Under the direction of private interests and a governmental bureau obsessed with a mania for reclamation," he charges, "hundreds of worthless projects have been foisted on the country, bringing ruin to thousands of settlers.

"Congress might well direct an investigation in such channels to determine responsibility for these unwarranted if not criminal developments and to check further useless desecration of invaluable water sources and of wild life resources.

"The crux of this restoration problem lies within Canada and can be reached only through cooperation with Canadian sportsmen," he believes.

DUCK MARSH POSTED IN MICHIGAN

Conservation officers in California who post their territory with signs warning hunters and anglers that a game warden may be watching them at any time have nothing on special conservation officers in Ottawa County, local hunters report.

Before the opening of the duck season last fall signs were erected all around Bruces Bayou reading as follows: "Hunters beware. This entire marsh is being patrolled by conservation officers. Don't start shooting until a half hour before sunrise and don't shoot after sunset. Giving the ducks time to feed and rest is good conservation. Remember guns and boats can be confiscated if you are arrested."

The signs were printed in striking black letters on red cardboard and were put up in conspicuous locations.

Inquiry among hunters on the bayou indicated that the results obtained from this posting were well worth while.

MAMMALS

THE TULE ELK

The tule elk proposition has been before the public many times and numerous facts have been discussed in regard to their protection and what they will do in the future. I am sending you a few facts I have gathered from observing them.

I have heard from the old time settlers in the Buttonwillow district that several thousand elk roamed there at one time. However there are only about 170 there now.

During the latter part of 1927 I made several counts of these elk having the help of two or three men at different times, and found that there were only seventy two at this time. Now, four years later we have about 170 of these animals, which means better than 100 per cent increase. I believe they will increase faster in an enclosure if it is suitable for them.

The tule elk range in wide areas, traveling four to six miles to water. At one time this spring during the green grass period one herd of about twenty eight was known to go for twenty five days without water. They may be able to go a longer period without drinking but I have not any record of such an event.

Another unusual trait attributed to the tule elk, is that while they are an excellent jumper for height, an ordinary wire fence with the bottom wire about six inches from the ground will hold them out of a field of good feed. If the bottom wire is twelve to eighteen inches above the ground they will crawl under the fence. It is quite a sight to see a big bull with a large spread of antlers going under a low wire fence.

If you are crowding a herd and they are running, they will run through a wire fence and break it down instead of jumping over it, which they could do very easily. When a small herd was run into the pen in the Buttonwillow district one cow elk jumped and cleared the fence which is built on a steep bank. The jump would be equal to eight feet, sheer height. This is the only instance I ever witnessed where an elk jumped a fence.

During the breeding season these elk do not mate, but run much the same as our California deer.

The bulls are severe fighters and usually one bull elk is boss of the herd. Once I found a dead bull elk with his horns broken badly and the ground torn up for two or three hundred feet around. This indicated that he had been fighting and was evidently killed by another bull.

When a herd of elk are traveling the bulls always take to the rear as though to watch behind and to hurry the cows along. Whenever they are being chased there is always a cow leader.

There are always a few bulls with a herd of cows, even though it is not in breeding season, but there is also a herd of bulls running alone.

These elk are about the fastest animal I have ever seen. They can outrun a fast horse easily. They do not jump like a deer when in full

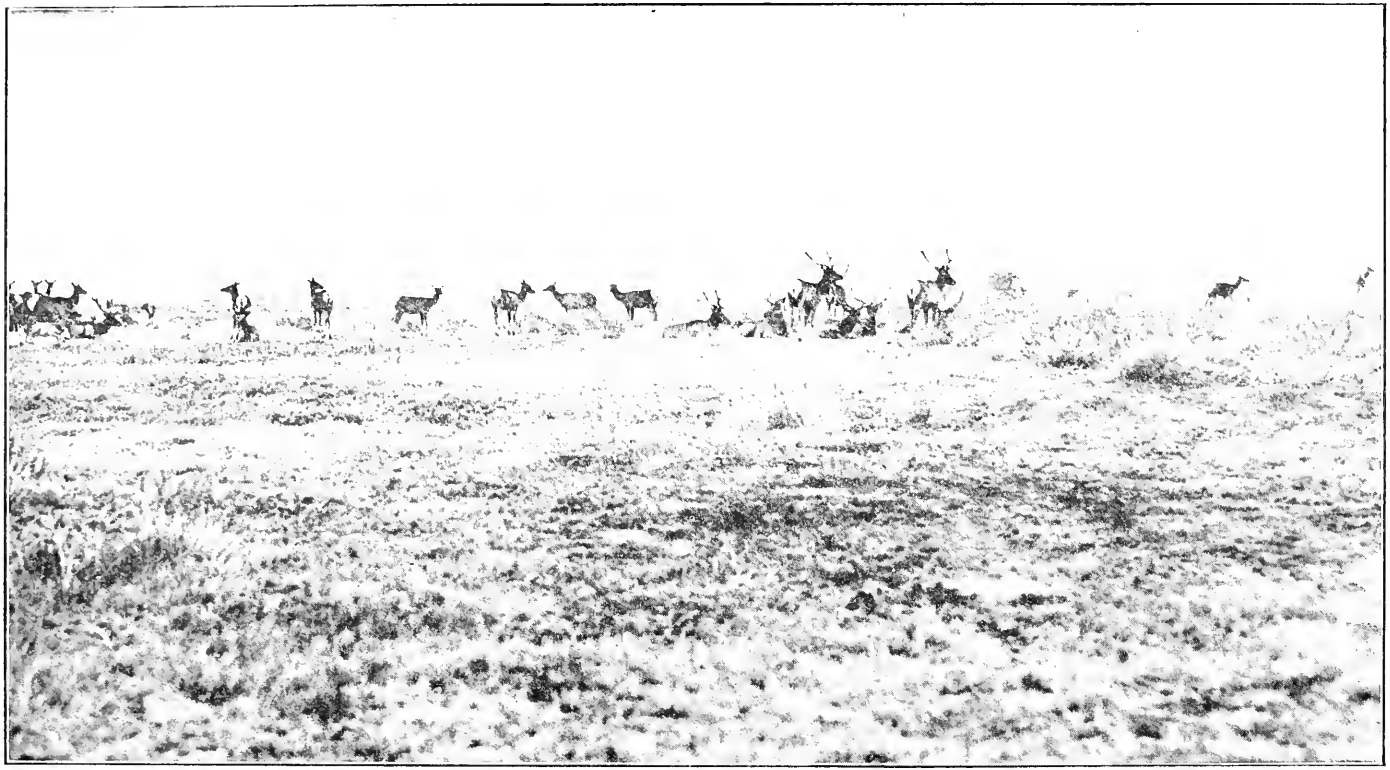

FIG. 12. Tule elk in the Buttonwillow district are part of the remnants of the once great herds of these mammals that roamed California's valley lands. Civilization has encroached on their natural habitat until it is now necessary to form refuges in order to prevent extermination of the species. Photo submitted by Bakersfield Chamber of Commerce, June 15, 1931.

flight, but run like a horse. They feed at night [illegible] to our discomfort and very much to the Button[illegible]

Elk can be tamed very easily in confinement, [illegible] to man, and do not seem to become pugnacious [illegible]

The elk are a light brown in summer and a dark [illegible] The bulls will weigh about 500 pounds and the cows [illegible] The bulls shed their horns every year. A. R. Aug[illegible]

DOES HAVE ANTLERS

Two does who had the misfortune to grow antlers [illegible] among the missing from the Devil's Garden District of the Mod[illegible] National Forest. These were killed by Ed de Putron of Lakeport and Calvin Simms of Cedarville, during the 1931 season. Both [illegible]

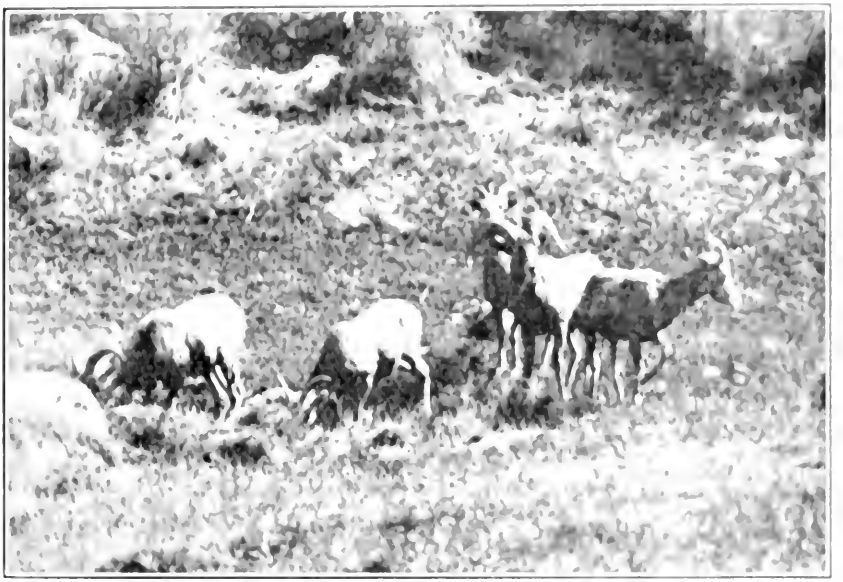

Fig. 13. Desert mountain [illegible] mals are extremely wary and [illegible] study. Photo by E. S. Cheney, Oct[illegible]

ried fine antlers, being 26 and 28 inches in spread, respectively. While all the bucks had rubbed and polished their antlers at the time these were killed, both does were in the velvet, which was, however, thoroughly dry, indicating perhaps that does when bearing antlers do not rub them.

Other male characteristics were evident on one animal and both were evidently without fawns. F. P. Cronemiller, Forest Supervisor, November 13, 1931.

INVESTIGATE SHEEP DEATH

During the past fall a report was received that desert mountain sheep were dying from thirst at Hidden Spring in southern California. The report said that: "Hidden Spring, a strange, bubbling pool in a

canyon several miles east of Mecca which for many years has been an oasis for wild animals of the region, was reported as having dried to a mere cupful of water. Near the lessened water supply, which rises mysteriously from the desert sands with four or five gaunt palm trees standing guard over it, were found carcasses of two yearling sheep. The animals had died of thirst."

An investigation was made by Deputy R. J. Little, of Banning, and he reported as follows: "Have checked up on this report and find that it is true, but can't say that the two sheep died from lack of water. There are other water holes within ten miles of Hidden Spring and mountain sheep will go far for water. I think that the two animals died from other causes.

"The water holes on the desert side of San Bernardino are lower this year than ever before to my knowledge. I found two dry springs last week; heretofore there would be between 400 and 500 quail at these locations but now there is no sign of any birds. Almost all of the prospectors on the desert keep the water holes open for the quail and animals."

Reports from Inyo County indicate that desert mountain sheep are increasing in numbers. E. H. Ober, authority on mountain sheep, told D. D. McLean, field naturalist, that quite a number of big-horn sheep have been observed watering at Deep Spring Valley in Inyo County. Ober is the author of an excellent article on "The Mountain Sheep of California," which appeared in the January, 1931, issue of CALIFORNIA FISH AND GAME.

EXCELLENT DEER SEASON

Deer taken during the past hunting season totalled 25,805, according to figures tabulated by the Bureau of Refuges of the Division. This shows an increase of 1673 more than were taken during the season of 1930.

Counties in which more than 1000 deer were killed include Mendocino, 1706; Siskiyou, 1516; Modoc, 1486, and Humboldt, 1069.

Out of the entire 58 counties in this State only two were registered where no deer were taken—San Francisco and Imperial counties. Sutter County holds the low record of but one deer bagged. Sacramento runs a close second with a grand total of four bucks on record. The remainder of the counties range from 10 deer on up to well above the thousand mark.

Such a successful season reflects not only the practical results of sensible legislation and effective enforcement, but also indicates that sportsmen are giving their full support to the protection of these big game mammals throughout the year.

DEER IN CAVE

It is easy to imagine bears, pumas, or skunks in caves even though we may never have seen one there, but a deer in a cave seems quite out of place. I was therefore somewhat surprised as I walked along the bridle path below the old village, to see an adult doe bedded down in a large cave. A large rock which had fallen down over two smaller rocks formed a cave about eight feet wide and ten feet deep. The opening was considerably smaller than the space within and the deer

was lying with her head about six feet from the entrance. She was again seen in the same cave twice the following week showing that this was her regular retreat when not foraging.—A. E. Borell, ranger naturalist, Yosemite Nature Notes, October, 1931.

SHOTGUNS WOUND DEER

Shotgun hunters have wounded many deer in the northern part of the State. The carcasses of the animals have been found by sportsmen and indications show that in many cases the animals perished after much suffering.

While laws seem not to have been necessary to prevent this type of deer hunting, every effort is being made to discourage the practice. Sportsmen will undoubtedly cooperate in eliminating the use of this type of gun from the big game field and this will not only prevent much suffering among the animals but will also help prevent great losses in the deer population.

BRUIN AND THE FLUME

Where is the classification line between accident and habit, and how can it be applied to the bear family?

This question has come down from the mountains of Amador County and the Division of Fish and Game is hunting for the answer.

And the reason for all this serious study is none other than Mr. Bruin—a 400-pound bear. He has been splashing around, accidently or otherwise, in a new hydroelectric development flume along the Mokelumne River, if all reports are true.

The first time this great mammal was discovered in the flume a cry of "Accident!" arose among big-hearted workmen, so Bruin was rescued and deposited on dry land in a rather undignified manner. A lasso around his neck, coupled with a wire looped to one hind leg, accomplished the delicate task. Due to the nature of the subject at hand, no one had the time nor inclination to make a count of the man power applied.

Several days later when Mr. Bruin was again sighted in the sparkling waters a cry of protest arose from the "rescue" crew. "It must be a habit," they declared, and decision was made to let the furry clown do a little rescuing on his own account.

The bear evidently succeeded in locating a runway escape from the concrete water channel for he was later observed swaggering boldly up a mountain side. It is easy to identify Mr. Bruin because he still carries a wire dangling from one hind leg. Notoriety of some sort awaits the person who attempts to remove this decoration.

His presence in the flume has been observed several times since. Taking all conditions, including icy water, into consideration, the problem is a puzzle. Whether he is entering the channel through accident or by habit is a question that, so far, defies solution.

Members of the Division of Fish and Game account for one certain fact, however, Bruin is a real tough customer.

BEAR MEAT SHOULD BE COOKED

All persons who obtain bear meat should cook the food thoroughly before using.

Several cases of trichinosis are generally reported to the Division every year following the opening of the bear hunting season and these could be eliminated in a very simple manner. The danger lurks in eating jerked bear meat or otherwise utilizing the food in the raw state.

In commenting on the subject of trichinosis, Dr. M. Hobmaier, pathologist for the division, said that bears are often infected with a parasitic hair-like worm known as trichina. The larva of this parasite enters the blood stream through the intestine. From the blood stream the trichina work into the muscles of the animal. Many conditions regulate the effect of the parasite on the health of the animal.

"It is possible for a bear to live many years with this parasite in the muscles," Dr. Hobmaier said, "and this is true with other infected animals. The parasite will live in the animal after death for several weeks so that if another carnivore should feed on the carcass the disease will be transmitted in this way."

The severity of the infection depends on the amount of infected meat that is consumed by the subject, according to Dr. Hobmaier, but the discomforting effects, even in case of recovery, are liable to pursue the members of the human species for many years. The disease often creates a condition similar to rheumatism.

By cooking thoroughly the parasite is killed and the meat is as harmless as any other useful foods. This method of insurance against infection is by far the most satisfactory.

And, in conclusion, don't feed the raw bear meat to your dog, or any other animal, because if the meat happens to be infected the disease will be transmitted to the innocent party.

Nevertheless if you would be sure that your bear meat is free from trichinosis, send a raw piece of the diaphragm muscle to Dr. Hobmaier of the State Fish and Game Laboratory, Hooper Foundation, Second and Parnassus avenues, San Francisco, for microscopical test.

ALASKAN BEARS PROTECTED

The monarchs of North American wild life and largest carnivorous animals in the world are losing some of the illusions of dangerous ferocity built up around them by sportsmen—but gaining a new grip on existence, says a bulletin of the American Game Association in announcing recent measures to save from extinction the giant Alaskan brown bears.

One of the outstanding moves has been the extension of the formerly inland Katmai National Monument to the coast line of Shelikof Strait. It was found that the brown bears—often weighing more than 1200 pounds—like nothing better than to amble with their families down to seashore resorts for the summer, where they have been an easy prey to an increasing number of sportsmen.

Other recent regulations, announced by the U. S. Bureau of Biological Survey, increase from five to seven the number of Alaskan areas in which brown and grizzly bears are protected by a hunting season limited to the period from September 1st to June 20th.

Lately conservationists have urged protection of the Kodiak bear, famous cousin of the brown variety, through creation of a preserve on

Kodiak Island, lying directly across Shelikof Strait from the Katmai National Monument reservation.

It is now held that the reported ferocity of the big brown bears is mostly fable, and that in the main they are peaceful, even timid beings unless cornered or in a fury of pain.

Revised game regulations have been recommended. Various officials of the Biological Survey state that the period of depletion in the territory and the great popularity of Alaska as a hunting ground for American sportsmen. The fine specimens of rare and high priced trophies, have been freed with extermination.

DON COYOTE STEPS FAST

How fast can a coyote run? According to a report by Joseph Joffe, assistant superintendent of Yellowstone National Park, one has been timed at 35 miles per hour. The superintendent was traveling in his automobile over the snow-covered roads when Mr. Don Coyote appeared in the roadway. Instead of hightailing for the woods the animal struck off down the road. Joffe speeded up to see how fast the coyote could hold his own at a very lively clip. After a time the coyote dodged to one side of the road and was lost in the gathering dusk.

MISCELLANEOUS

GLENN-COLUSA APPEAL

Defendants in the Glenn-Colusa Irrigation District case have appealed to the Supreme Court from a recent decision of the Superior Court, according to John Spencer, in charge of the Bureau of Hydraulics. Ralph Scott, assistant attorney for the division, said that it would probably be several months before the higher court made a decision.

This case has been of keen interest to those connected with the conservation of fish life and irrigation projects. As smaller water diverters in various sections of the State are required to use screens to protect fish life, the division insisted that the large projects should be required to do likewise. The Glenn-Colusa Irrigation District maintained that the fish that went through their pumps were mostly rough species of no value, that the percentage of loss going through was small, that screens would greatly interfere with the operation of the pumps, and various other reasons.

Judge H. S. Gans, presiding over the Superior Court at Willows, upheld the attitude of the division when he decided the case during the early summer.

REPORT BIRD BANDS TO U. S.

Sportsmen hunting wild fowl and other game birds are urged by the Division of Fish and Game and the American Game Protective Association to keep a close watch for bands on bagged birds and report those found to the United States Bureau of Biological Survey, Washington, D. C.

Bird-banding cooperators of the bureau, in advancing its studies of North American waterfowl, have banded game birds at more than fifty stations in the United States and Canada, from the Arctic regions south to Louisiana and Georgia and from Maine to California, officials of the bureau announced.

The Biological Survey desires a report on every banded bird that is recovered, and requests the cooperation of sportsmen. The report should state the number printed on the band (including any series designation, such as A, B, or C) and the date and locality where the bird was obtained. In return, the Biological Survey will tell the person rendering the report where and when the bird was banded, and send interesting information on the application of the banding method to bird study.

Bird banding, as conducted by the Biological Survey and its 1700 cooperators, furnishes a means of obtaining information regarding conservation measures. The banding records of the bureau have furnished much information on hunting and conservation problems, such as showing the regions that are visited by particular concentrations of birds. The solution of these problems means much to the perpetuation of the sport of wild-fowling, and sportsmen are accordingly urged to examine the ducks and other wild fowl in their bags and report banded birds to the Biological Survey.

FIRST EGGS OF HARRIS'S SPARROW ARE DISCOVERED

A gap in the bird study of North America lasting for almost a century has been bridged with what is believed to be the first authentic discovery of eggs of the Harris sparrow. Credit for this find goes to the naturalist, George Miksch Sutton, and his associate, John Bonner Semple. Both have recently returned from an expedition to Churchill, Canada, on Hudson Bay, the nesting region of the bird.

Harris's sparrow, a shy individual with a black hood and white underparts was one of the few American birds left whose eggs had not been found. Sets of doubtful identification, however, have been preserved and descriptions generally held erroneous, also given.

In reporting his discovery to *Science Service,* Mr. Sutton said:

"The eggs are not 'creamy-white' (as a previous description states), but are very pale greenish-blue, spotted, blotched and scrawled more or less all over with brown, lilac, gray and rusty."

It was not until the nineteenth century that the breeding range of the Harris sparrow was known. Half the year the bird haunts the Missouri River basin and migrates northward to breed with the approach of spring. The bird was unknown to ornithologists until 1834 when it was discovered near Independence, Missouri, by Thomas Nuttall.—*Science News Letter,* August 22, 1931.

DIVISION ACTIVITIES

BUREAU OF FISH CULTURE

Fish plants made during the past three months bring the season's total up to nearly forty million. These plants were made in streams and lakes where water conditions gave assurance of holding fish refreshed by the winter rains. With the heavy fall of snow that occurred in the mountains during the early winter fish culturists of the bureau have expressed the belief that water shortage will not be as acute this coming season as it was in the past and that the fish life will benefit accordingly.

Salmon eggs totaling 13,613,000 were taken at stations along the Klamath River and were delivered to Fall Creek and Mount Shasta hatcheries. This is the greatest salmon egg take in the past five years and the young fish will be ready for planting in the early spring.

Sand and gravel filters have been installed at various hatcheries and other improvements are being made that will add to the efficiency of the entire trout propagation system.

The fall take of eggs, from the fall spawning species, was completed and preparations are under way for the spring spawning activities.

BUREAU OF FINANCE AND ACCOUNTS

Hunting licenses, which heretofore have been on a calendar basis are for an eighteen months' period, being effective from January 1, 1932, to June 30, 1933. Thereafter, they will be on a fiscal year basis. The denominations for each class of hunting licenses for this particular eighteen months' period are one and one-half times the regular fee, as follows:

Class	*Regular fee*	*Increased fee*
Citizen	$2.00	$3.00
Citizen, junior	1.00	1.50
Nonresident	10.00	15.00
Alien	25.00	37.00
Declarant alien	10.00	15.00

Commencing with the 1933-34 series of hunting licenses, the denominations will revert back to the regular fee.

While the demoralizing effects of the drought and general business depression somewhat curtailed the activities of sportsmen, certain branches of field sport, particularly deer hunting, not only held up well but showed a substantial increase in revenue over previous seasons. It is believed that with the promise of better watering conditions during the coming seasons, outdoor sports will call many persons into the field.

BUREAU OF GAME REFUGES

Predatory animal control work on and adjacent to refuges is being developed under a very careful plan, and in all cases a record is being kept of stomach contents of animals killed, so that their food habits may be determined. Mountain lion hunters were very active during the past three months and during the month of November alone took more than 23 of the large predators; this brought the 11 months kill up to 258 lions, ending in November.

The Gray Lodge waterfowl refuge, near Gridley, more than lived up to expectations and proved to be a wonderful resting grounds for the migratory birds. There was ample water on the refuge and yet enough high ground exists to raise feed for the ducks that remain through the dry part of the season.

The new refuge on Joice Island, in the Suisun Marsh, was made available and is an excellent location for conservation purposes. This refuge is subject to complete control of water conditions.

The past deer hunting season was one of the most successful in the history of the State. Records show that nearly 26,000 bucks were taken and the loss to the deer population was not perceptible.

BUREAU OF PATROL

In order to enforce Federal regulations limiting the duck hunting season to one month, all State wardens were appointed Federal Game Protectors by the U. S. Bureau of Biological Survey. Comfortable living quarters were maintained in both the Sacramento and San Joaquin Valley duck areas, giving our field men a chance to change into warm clothing promptly after their work for the day or night patrol was completed. It is gratifying to note that practically all hunters complied with the regulations limiting the open season to one month. Very few arrests have been made for shooting before the official opening date.

Our bay and river patrol reports that striped bass violations are now largely confined to the use of set lines, some of them being over 1000 feet in length, with many hundreds of hooks attached. Due to the unusually heavy snow fall in December, many of our wardens have been busily engaged feeding deer and quail, particularly in Modoc, Siskiyou, Shasta and El Dorado counties.

BUREAU OF FISH RESCUE AND RECLAMATION

The season of 1931 was one of the most arid in the history of the State. Many of the lakes, streams, and a number of artificial reservoirs, all containing valuable food and game fishes, became dry for the first time in history. Added to this condition was the excessive heat, causing rapid evaporation which necessitated the hurried removal of live fish and placing them in living waters.

With the valuable assistance and fine cooperation of wardens, sportsmen, and various individuals and organizations, the bureau was enabled to rescue 7,855,865 fishes during the summer and fall season

of 1931. Included in the reseued fishes were 1,824,146 large mouthed black bass; 1,319,100 bluegill sunfish; 1,091,916 green sunfish, 662,063 catfish; 324,450 calico bass; 32,000 salmon fry, 23,650 striped bass and other varieties, namely, Sacramento perch, steelhead trout, small yellow perch and adult salmon.

The reseued fish were given wide distribution to various sportsmen organizations for stocking purposes. The larger fish of the spawning age will furnish a permanent supply of naturally hatched fish for the future.

It is not uncommon to rescue from fifty to one hundred fish and young fish hatched but a few days and remove them from the isolated shallow waters to their permanent homes in which there is an abundance of plant or aquatic growth. This growth furnishes both food and shelter for them where they may develop until they are able to protect themselves against predatory fishes.

BUREAU OF EDUCATION AND RESEARCH

Excellent work is being done in the State through the lecture program of this bureau. Members of the bureau have appeared in almost every section of California during the past few months and have addressed and shown motion pictures to sportsmen's organizations, clubs, fraternities, schools and other agencies of public interest.

Six instructive motion picture reels were completed during the past three months and are now in circulation. Following a special request from the east coast, three reels were arranged and shipped to the American Game Conference which was held in New York City during the first part of December last year; these reels were arranged to cover a wide range of subjects and met with instant favor.

Field research men have continued with quail investigation work and some very valuable information is being assembled.

An exceedingly important paper on duck disease has been prepared by Dr. M. Hohmaier and appears elsewhere in this issue.

Work on various bird studies and deer damage is progressing under detailed plans and publication of results of some of these investigations will be made in the future.

During the past three months approximately 1500 newspaper clippings were returned from stories sent to the press from the bureau; these clippings represented about 300 newspapers.

The library is being used constantly, not only by our own office and field force, but also by those requiring definite information on some particular activity.

BUREAU OF HYDRAULICS

The improvement work on the Folsom fishway at the Folsom Dam on the American River has been completed and has the appearance of a very good job and should be of great aid to the movement of anadromous fishes.

Benbow Power Company has completed the first portion of its dam on the south branch of the Eel River at Benbow but failed to

install a permanent fishway as ordered by the Commission. Arrangements were made for a temporary and immediate construction of a fishway to take care of this season's run of salmon and steelhead and with some interruptions these fish have successfully passed the dam with the exception of the first run of King salmon.

The Commission, through superior court action, has attempted to have the owners of the Cosumnes Dam on the Cosumnes River install a fishway. A court order was obtained for the installation of an efficient fishway but the construction as carried on by the owners can not in any wise be considered a fishway and hence the Commission has been forced to cite the owners for contempt of the superior court orders. This matter is still pending.

The Department of Public Works Division of Highways of the State has completed a fishway on a culvert installed by the Department on Rattlesnake Creek in Mendocino County.

Some falls which have been obstructing the run of fish in Hull Creek in Mendocino County, except in very high waters, have been blown out and reports state that fish will now have no difficulty in ascending this stream.

The Pacific Gas and Electric Co. is continuing the work of deer protection on its Salt Springs project in Amador County.

The Associated Oil Co. at Avon has built new and additional sumps and improved reclamation equipment very materially so that no oil pollution will occur at this point.

Some of the Southern California beach cities being interested in the preservation of the beaches called for a mass meeting which was held at Long Beach with the result that a committee of thirty was appointed to study the matter of beach protection and prevention of pollution. The Commission's representative stated at the meeting that the main sources of oil pollution occurring along the Southern California beaches originate outside of the State's jurisdiction as practically no oil pollution now occurs which originates within the State which would effect these beaches.

BUREAU OF GAME FARMS

Activities at the two State game farms, one near Yountville in northern California and the other near Chino in the southern part of the State, during late fall were centered on "brushing in" the game bird pens and making other preparations for the winter months. As much land as possible was placed under cultivation for the purpose of raising greens and other feed for the stock birds.

Substantial plantings of pheasants, quail, turkeys and Hungarian partridges were made in various parts of the State where it is believed that the birds will have a reasonable chance to become established.

As increased demands are constantly being made by sportsmen's organizations for pheasant eggs every effort will be made to increase our output for the coming season. Ample stock have been held over to produce eggs and very encouraging results are predicted.

Due to our modern methods of propagation through the use of electric incubators and brooders, our two game farms have been particularly free from diseases that attack our upland game birds. The excellent conditions of our game farms attracted many favorable comment from hundreds of visitors both from this and foreign countries.

Arrangements are also being made at both game farms to increase the output of valley quail so that there will be more birds to plant in depleted areas.

BUREAU OF COMMERCIAL FISHERIES

The State Department of Public Health's quarantine on mussels and clams, which ran to September 30, was extended to October 15 for the coast between the Golden Gate and the Russian River. Tests by the Department of Public Health showed that mussels and clams around Bodega Bay still carried a record of the toxin to endanger the life of those who eat them. The quarantine against mussels or clams in the region from the Golden Gate to San Luis Obispo County was lifted on October 1st, as it was found that north of the Golden Gate these mollusks were less toxic than at that time of year.

Merrill W. Brown, who has been working on the salmon investigation, suffered a painful accident on the night of October 2. While inspecting the fishway at the Fifth dam on the Stanislaus River, he fell over an embankment, breaking one ankle, spraining the other and partly crushing a vertebra. He was taken to a Modesto hospital and will apparently be laid up some weeks.

Striped bass continue to be plentiful in the San Francisco Bay and river districts, and the price paid fishermen declined in October from 12½ cents to 10 cents a pound. These bass are being caught by commercial hook and line fishermen, as it is unlawful to take them in nets except while fishing for shad between March 15th and May 1st, inclusive. The Bureau of Commercial Fisheries is very anxious to get an accurate record of all bass caught commercially and would like to have the wardens see that all bass bought from anglers are properly recorded on the triplicate receipts furnished by the division. There is still much confusion on the part of commercial fishermen and dealers as to the provisions of the new law and it is believed that these receipts are not being made out in many cases, under the belief that it is unlawful to buy bass which are caught in districts which were formerly closed and in cases where the fisherman has more than five bass in possession.

Hugh R. Israel has been engaged by this bureau to undertake an investigation of the life history of the California shrimps. This work will be carried out under the supervision of Dr. Frank Weymouth, of Stanford University, who is also in charge of the Louisiana shrimp investigations for the U. S. Bureau of Fisheries.

In compliance with a resolution passed by the Assembly at the last session of the Legislature, a committee composed of Assemblyman Hubert

B. Scudder, Jerrold L. Seawell and Henry McGuinness was appointed and instructed to make a study of the fish and game in California with a view to its protection and conservation. This committee, accompanied by Major Farley, visited the Klamath River early in September to investigate commercial and sport fishing conditions at the mouth of the river. On September 9th this committee was joined at Monterey by N. B. Scofield, where it put in three days studying the sardine fishing and canning methods at that place. An all-night trip was made on one of the large purse seine boats and the committee was able to get at first hand the method of catching sardines with these large nets. Near the end of the month this committee visited southern California, where they took in the State Fisheries Laboratory and the fish packing plants at Terminal Island. From this place they were driven to San Diego, where they made a study of the fish canneries and the large tuna boats which catch their tuna from as far away as the Galapagos Islands.

Lionel A. Walford, of the staff of the State Fisheries Laboratory and the author of the Handbook of Common Commercial and Game Fishes of California, resigned at the end of September to enter Harvard University, where he will study for a doctor's degree. The Handbook is having a widespread popularity, being in great demand by schools, libraries, sportsmen and those interested in the fisheries industry, and Mr. Walford's resignation is a distinct loss to this bureau.

VOLUNTEER DEPUTIES

That farmers and land owners are taking interest and actively cooperating in the state-wide campaign being conducted by the Fish and Game Commission through the medium of the volunteer deputies for the development of the supply of native quail in open breeding grounds, is evidenced by the fact that Mr. Anthony Crafton, a farmer who resides near Concord, Contra Costa County, has established upwards of 75 quail sanctuaries on the lands of farmers in the San Ramon Valley.

Volunteer Deputy Captain John E. Warman, of Stockton, reports that upwards of 150 quail sanctuaries have been established in the San Joaquin County district.

In order to know whether or not the quail sanctuary campaign has been a success or a failure in its intended purpose, a questionnaire has been sent to each of the 1300 farmers and landowners who have set aside land as an inviolate quail sanctuary and game refuge. Without exception, those who have filled out and returned the questionnaire state that there has been a decided increase in the supply of quail on their land during the past season, and that the establishment of the sanctuary on their land has proven beneficial.

Volunteer Deputy Edward C. Gordon of Los Angeles has contributed a .38 caliber Smith & Wesson revolver as one of the prizes to be awarded to the volunteer deputy who sends to the office of the division the greatest number of predatory bird and mammal stomachs in the aggregate of all kinds, during the sharp-shinned, Cooper hawk, and bob-cat prize contest, which closes March 1, 1932.

The activities of the volunteer deputies in predatory bird and animal control on quail sanctuaries has resulted in the destruction of about 6000 of the various species of birds and mammals that are alleged to be the enemies of quail.

LIFE HISTORY NOTES

BASS TRAVELS THIRTY MILES WITH LINE

On the morning of November 1 a Chinese lad F. Thom of Georgia Street, was trolling near the Sears Point Bridge at Vallejo using a record Pflueger No. 5 spoon and with a section of pork rind attached. He hooked a fish which he judged to weigh about 12 pounds.

After playing his catch for about 5 minutes the line parted and Thom lost about 20 feet of line along with spoon and hook. I should mention here that Thom had scratched his name and address on the spoon.

No more was thought of the incident until the following Saturday when a Japanese by the name of Kirmauri, of Post Street in San Francisco, called on Thom and asked him if he had hooked a fish and lost a spoon.

When told that he had, Kirmauri asked Thom to come to his car if he wished to see the fish that took his line and spoon. The striped bass with the spoon and line still dangling from his mouth, weighed 48 pounds.

Kirmauri said that it had been caught that morning in Suisun Slough, a distance estimated at about 30 miles from where the fish was hooked by Thom. The fish was finally taken on sardine bait.—S. A. Magistrini, 221 Georgia Street, Vallejo, California, November 17, 1931.

MOUNTAIN PLOVER AND KILLDEER IN LARGE FLOCKS

Between Gilroy and Hollister to the east of the Bolsa road are broad fields which are pretty thoroughly grazed by cattle.

On November 10, 1931, while scouting about in search of shore bird data I chanced to come upon a large flock of killdeer feeding in one of these dry fields. There were several hundred individuals in this flock. While watching these birds through the glasses I noted that scattered here and there among them were a goodly number of mountain plovers. Since that time I have been through more of this section and find that there are more of both species scattered here and there over the whole section.

This, I believe, is a recent western record for the mountain plover which normally winters in the San Joaquin Valley on the east side of Mount Hamilton range. There are other records from the Santa Clara Valley but none of recent date.

It is also interesting to note that the killdeer were in very large flocks and not in small scattered companies.—D. D. McLean, 510 Russ Building, San Francisco, November 17, 1931.

QUAIL NEST ON FRONT PORCH

Soon after moving to our home in the Sequoyah Hills, Alameda County, we noticed that quail in the vicinity were becoming very tame. H. L. Dewing, who lives with his daughter, Mrs. H. A. Post, cultivated the friendship of these beautiful birds by scattering feed for them. The quail became so tame that they would not fly very readily although we approached quite closely. We have counted more than 80 of these fine birds on our lawn at one time.

When nesting season arrived in the early summer, one pair of birds selected a hidden corner in a window flower box on our front porch. Although the nest was but a few feet from the front door the birds were not the least disturbed as we passed back and forth.

FIG. 14. It is not difficult to cultivate a friendship with California valley quail. H. A. Post, of Sequoyah Hills, Oakland, observed a pair that nested and hatched a covey in a window flower box on the front porch of his home. Photo submitted by H. A. Post, August, 1931.

After the young birds hatched we observed the mother bird coax them from the nest. It was only about two hours from the time we discovered the first bird until the entire young covey, consisting of eleven birds, was ready to follow their mother.

She flew down onto the porch floor and began calling to the tiny "chicks." Soon one little bird jumped down to her and she continued fluttering around the window flower box until they all joined the party. After the last bird had responded to her calls she took them to one corner of the porch and hovered them for about twenty minutes. Her next move was to lead them to the steps and down onto the ground into some shrubs near the house where they hid for several hours.

It is very interesting to watch the matured birds feed when other birds are around. The quail do not seem to molest the sparrows but I have seen them dart at blue jays and chase them away.—H. A. Post, Sequoyah Hills, Oakland, California, August, 1931.

PRAIRIE FALCONS

A female prairie falcon, a supposedly notorious game bird killer which I collected near the Los Banos waterfowl refuge, was found to be stuffed with seventeen Jerusalem crickets. However, a male, probably the mate of the above, was as equally stuffed with the flesh and feathers of a female sprig. This is peculiar in that the female prairie falcon is much larger and more powerful than the male and should attack larger prey.—D. D. McLean, 510 Russ Building, San Francisco, California, November 12, 1931.

EFFECT OF EMASCULIZATION

A few days before the close of the deer season, October 15, 1931, while patrolling west of the Milk Ranch, near Highlands Lakes, I made the following observation which may be of interest to sportsmen. Shortly after I arrived at a hunter's camp, one of the men came in with the antlers of a fine four point buck, along with the hinder quarters. One glance at the antlers indicated that they had come off at the thimble where they normally drop when shed.

The hunter told the story. As this particular buck came in he fired and hit the deer through the neck, dropping him immediately. Upon walking up to the body, he was much surprised to find both antlers lying on the ground, one on either side of the dead animal. Upon dressing out the carcass, he found that it had previously been wounded through the testicles, the bullet ranging on through the flank. On examining the hindquarters, I found that the wound was more or less infected, although the injury seemed to have occurred some 10 or 15 days before the death of the animal, and it is possible that the deer would have recovered from the wound.—J. W. Thornburg, Markleeville, October 17, 1931.

EAGLE ATTACKS WORKMEN

July 24th at 9 a.m., two men, Tom Allen and Edward Westphal, were working on the concrete flume at Salt Springs Trigger Creek flume of the Mokelumne River project, near the Bear River road crossing, and they reported that a large eagle suddenly flew at them with its talons extended in attack. They drove it away twice, and the third time it flew at them, they hit it on the head with a shovel. They took it to camp and turned it over to James Smith, U. S. Fire Warden. He in turn presented it to Henry Warrington, of Sutter Creek.

Warrington identified the bird as a golden eagle (*Aquila chrysaetos*). It weighed approximately twelve pounds, with a wingspread of six feet.—Information furnished by Pacific Gas and Electric Company, September, 1931.

WHITE COYOTE

A white coyote was killed during October in Monterey County. This coyote, probably about nine months old, has been running on the A. L. Eade place in the Sweetwater district. This property is situated about five miles east of King City. The animal was the only white one in a litter and had furnished a bewildering target for many an unsuccessful hunter. No one seemed to be able to get the proper range on

the animal and it remained for the automobile to accomplish the deed. On the night of October 18, Eade was on his way home from town when his automobile struck the white coyote and killed it. Because of its unusual appearance it has been prepared for museum purposes.—Orben Philbrick, King City, California, October 22, 1931.

FOOD HABITS OF THE PACIFIC HARBOR SEAL

(*Phoca richardii*)

In the *Journal of Mammalogy* for August, 1931, Theo. H. Scheffer and Charles C. Sperry of the United States Biological Survey have an article dealing with the examinations of the stomachs of harbor seals taken about Puget Sound and Willapa Bay, Washington.

Dr. Scheffer has championed the seals and sea lions for many years and has been able to demonstrate his beliefs about them by many stomach examinations. He says in this article, "The seal's habit of feeding commonly in the tidal reaches about the mouth of a stream tends to reduce in numbers and frighten away predators upon young salmon fry that are swarming about before dispersal in the salt water. Any fish culturist will agree that the enormously preponderant losses in fish propagation occur in the egg stage or when the young fry are learning to dodge the foes that are besetting them on every side. From the evidence of other studies in the struggle for existence among animals it is not at all unreasonable to assume that the seal will save alive many more salmon by preying upon the enemies of the young fish than it will have opportunity to catch when of edible size. To strengthen this assumption with factual data will require, in turn, a study of the food habits of the creatures preyed upon by the seals in their activities about the influx of spawning streams. Certain it is that balanced relations were sustained between salmon and seals in the days when both were very much more abundant than they are now."

After giving a detailed account of the stomach contents of 100 harbor seals a summary is given as follows: "Fish comprised 93.58 per cent of the food. The chief species were tom-cod, flounders, Pacific herring, hake, sculpins, cod, blue-cod, pollack, and shiners. Salmon were found in only two stomachs. Squids were eaten in winter and octopuses in summer, the two comprising 5.82 per cent of the food."

Whenever a scientific study has been made of the food habits of the seals and sea lions, the investigator has in all cases found that the food of these animals consisted of species which were of minor importance as food for humans, or of species which prey on food fish and whose destruction is a direct benefit to the fisheries. Still, there are organizations and individuals who brush aside this evidence and demand the slaughter of the seals and sea lions.—Paul Bonnot.

A NOTE ON THE FISHING OF THE CALIFORNIA SEA LION

On August 8, 1931, at Cerros Island, Lower California, I was afforded an opportunity of observing fishing methods as carried on by a California sea lion (*Zalophus californianus*). The animal was a large cow of that species. We had hung a flood light over the side of the

ship under which had collected a large number of flying fish, a few cormorants and a vast number of little yellow nereis worms all moving about in the patch of light. The sea water here is very deep and unusually clear and objects can be distinctly seen to a depth of 40 or 50 feet.

The sea lion was rather timid at first, playing around at the edge of the lighted area but gradually became bolder as nothing happened, and extended her operations to include the area under the flood light. She would dive out in the shadow and come toward the boat swimming on her back at a depth of about 30 feet. When she arrived directly under the milling school of fish she would suddenly bend upward and shoot up at the fish at an almost unbelievable speed and seldom failed to make a capture. She ate six large flying fish to my certain knowledge. A good many of the fish had been badly hurt by flying blindly against the side of the ship. When the sea lion accidentally caught one of these she would hold it in her mouth a few seconds and if it showed little or no signs of life it was promptly discarded with a jerk of the head.—Paul Bonnot.

MONTEREY SPANISH MACKEREL LANDED IN MONTEREY

Two specimens of the Monterey Spanish mackerel (*Scomberomorus concolor*) were landed in Monterey by fishermen on March 30, 1931. This is the first record of this species having been taken in this region for over forty years. From 1870 to 1880, this fish, although scarce, was taken in commercial quantities. It was considered a great delicacy and commanded fabulously high prices in the San Francisco markets. During the eighties, it disappeared entirely from the catches of Monterey fishermen and has not been seen again until this year.—J. B. Phillips, October, 1931.

WOLF-FISH TAKEN AT MONTEREY

During the year elapsing since the last report (CALIFORNIA FISH AND GAME, Vol. 17, No. 1, p. 85, 1931) on wolf-fish (*Anarrhichthys ocellatus*) at Monterey, no less than three of these voracious fishes have been taken at Monterey: one in March, one in April, and one in September of 1931. All were caught in the surf in an exhausted condition, the natural habitat of this fish being at considerable depths in the ocean.—J. B. Phillips, October, 1931.

RIBBON-FISH TAKEN AT MONTEREY

Probably one of the rarest fishes taken off the coast of California was brought in from Monterey Bay on October 7, 1931. The remarkable specimen belongs to the family known as ribbon fishes or "king of the herrings," and is called "king of the salmon" (*Trachipterus rex-salmonorum*). Only a few specimens of this apparently deep-water fish have been recorded off our coast, as it is evidently taken only through some accidental cause. The present specimen was fourteen inches long, but adult specimens may be as long as seven feet.* The body is compressed to exceptional thinness, and is covered with a naked skin shining

* Kincaid, Trevor. An annotated list of Puget Sound fishes. Washington Dept. Fisheries, Olympia, p. 17, 1919.

like burnished silver. The dorsal fin extends far forward and runs for almost the entire length of the body. At its anterior end there is a raised finlet consisting of a few greatly lengthened rays. The tail fin, instead of spreading out fan-like in the usual manner, is greatly elongated and directed diagonally upwards. The under part of the body along the margin is thickly set with prickles, as well as the base of each dorsal ray. The caudal and ventral fins are bright red in life, while the other fins are colorless. The anal fin is absent in this species.

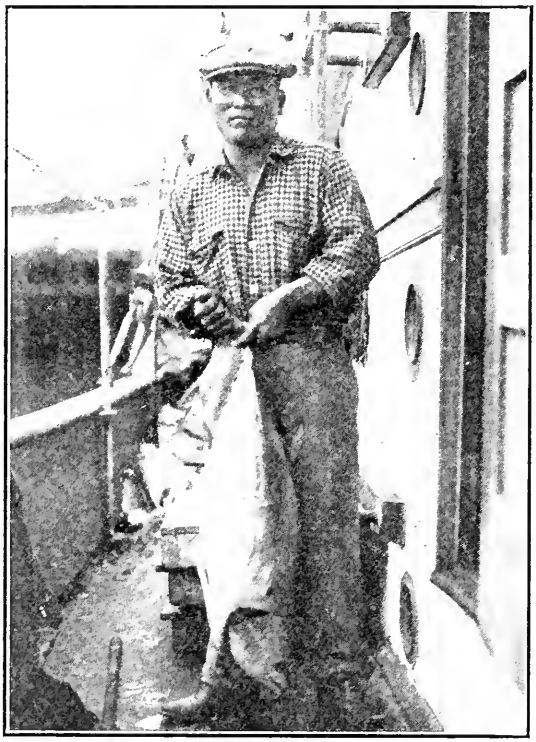

FIG. 15. Captain Ishikawa and his record breaking skipjack. Photo by R. S. Crocker, October 14, 1931.

Characteristic markings of this fish are a black splotch as large or larger than the eye, about two diameters of the eye above and backwards from the eye, and also three large dark blotches along the sides. The anterior portion of the head is also darkened.

R. F. Classic, in charge of the Division of Fish and Game office at Monterey, was responsible for recognizing the specimen as a rarity and making arrangements with M. Lewis, at whose market it was on display, to have the specimen identified.—J. B. Phillips, October, 1931.

RECORD SKIPJACK LANDED AT SAN PEDRO

The largest skipjack (*Katsuwonus pelamis*) on record for the eastern coast of the Pacific Ocean was brought into Los Angeles Harbor on October 14, 1931, by the tuna boat *White Rose*. The fish was 36

inches long, had a girth of 27 inches, and weighed 38½ pounds on tested scales when landed. On October 4, the day it was caught, it weighed a little over 40 pounds but it lost some of its weight during the ten days before it reached San Pedro. The average weight of skipjack is under 15 pounds, so the size of this specimen is really remarkable. During the 1931 season, in fact, fishermen had difficulty in getting any number of skipjack above the minimum legal weight of five pounds.

The skipper of the *White Rose*, Captain Ishikawa, caught this exceptional skipjack on the Ranger Bank off Lower California about 400 miles south of San Pedro.

Some few years ago, the Coast Fishing Company received a shipment of frozen skipjack from Hawaii that contained a number of 40 pound fish, according to Mr. Takahashi, the foreman, but such large fish have not hitherto been reported from this coast.—R. S. Croker, California State Fisheries Laboratory, Terminal Island, October, 1931.

REPORTS

SEIZURES OF FISH AND GAME

July, August, September, 1931

Fish—	
Abalones	58
Barracuda, pounds	660
Bass:	
Black	93
Rock, pounds	160
Striped, pounds	608
Bluegills	43
Clams	1,468
Catfish	19
Crabs	58
Lobsters, pounds	262
Perch	12
Mussels	200
Skipjack, pounds	6,800
Smelt, pounds	75
Salmon, pounds	13,830
Trout	242
Tuna, (Yellowfin) pounds	19,239
Traps, lobster	50
Miscellaneous fish, pounds	113
Game—	
Deer	69
Deer meat, pounds	702
Doves	218
Ducks	37
Quail	42
Rabbits	19
Shorebirds	2
Squirrels	7
Nongame birds	2
Pheasant	3

FISH CASES

July, August, September, 1931

	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act; violations of	55	$1,081 00	59
Abalones; small; over limit	20	395 00	
Barracuda; small	1	10 00	
Bass—			
Black; selling of; over limit	11	690 00	30
Striped; small	36	984 00	
Catfish; closed season	1		10
Clams; overlimit; small	42	745 00	10
Commercial Fishing License Act; violations of	7	75 00	
Crabs; closed season	1	25 00	
Dynamiting fish	3	200 00	
Illegal fishing apparatus	9	30 00	
Fishing near mouth of stream	6	100 00	
Lobsters; closed season	6	330 00	30
Nets, seines; illegal use of	30	925 00	650
Night fishing	2	50 00	
Salmon; closed season	6	95 00	
Trout; over limit	18	347 00	
Totals	255	$6,082 00	789

GAME CASES

July, August, September 1911

Hunting License Act, violations of			1	
Deer; closed season, killing fawn				
Ducks, closed season				
Doves; closed season, over limit				
Grouse; closed season				
Night shooting				
Non-game birds, killing of				
Nets, (bird), illegal				
Pheasants, killing of				
Pigeons, closed season				
Quail, closed season				
Rabbits, closed season				
Shorebirds, closed season				
Squirrels, tree, closed season				
Shooting from automobile				
Shooting in game refuge				
Trapping License Act, violations				
Trespassing on enclosed ground				
Totals				

DEER KILLED IN CALIFORNIA

	2-points					3-points					4-points and over					Totals				
	1927	1928	1929	1930	1931	1927	1928	1929	1930	1931	1927	1928	1929	1930	1931	1927	1928	1929	1930	1931
Alameda	171	198	205	161	192	42	54	64	74	48	7	11	6	17	8	220	263	275	252	248
Alpine	14	20	24	54	44	21	23	32	27	38	32	23	33	43	47	67	66	89	124	129
Amador	19	28	32	40	39	18	31	27	26	32	22	19	28	35	33	59	78	87	101	104
Butte	74	80	82	113	152	68	71	70	100	172	86	61	82	101	170	228	212	234	314	494
Calaveras	50	77	61	118	81	47	65	58	86	84	52	49	56	79	62	149	191	175	283	227
Colusa	161	162	184	220	189	76	84	85	95	85	26	26	28	28	30	263	272	297	343	304
Contra Costa	4	5	11	5	7	1	1	2	1	4			1			5	6	14	6	11
Del Norte	16	18	27	8	11	12	10	13	19	12	14	20	15	13	15	42	48	55	40	38
El Dorado	183	176	215	262	260	173	183	202	227	209	179	189	180	196	230	535	548	597	685	699
Fresno	215	292	283	325	358	170	230	232	285	288	207	241	249	283	306	592	763	764	893	952
Glenn	284	280	306	301	229	242	198	210	224	148	97	114	70	76	53	623	592	586	601	430
Humboldt	389	336	284	393	525	258	290	249	319	351	174	151	156	205	193	821	777	689	917	1,069
Imperial	1	2	2					1				2	1	1		1	4	4	1	
Inyo	74	89	96	88	87	48	76	81	76	64	51	74	76	87	60	173	239	253	251	211
Kern	83	129	135	130	160	72	82	103	101	121	63	84	59	93	73	218	295	297	324	354
Kings		1	2	9	2	3		1	1	4		2		2	4	3	3	3	12	10
Lake	599	695	583	585	501	229	267	194	227	172	73	76	64	73	53	901	1,038	841	885	726
Lassen	20	26	35	35	26	86	146	166	186	215	190	221	310	364	366	296	393	511	585	607
Los Angeles	279	256	470	437	678	92	70	150	144	180	54	43	71	56	91	425	369	691	637	949
Madera	96	126	122	148	186	77	84	91	124	133	87	90	100	107	123	260	300	313	379	442
Marin	297	362	337	347	385	58	68	48	46	54	12	14	9	10	10	367	444	394	403	449
Mariposa	32	50	53	80	87	31	47	52	72	57	32	37	39	83	46	95	134	144	235	190
Mendocino	853	791	728	822	1,014	426	477	422	456	496	196	200	205	205	196	1,475	1,468	1,355	1,483	1,706
Mereed	41	45	29	45	42	21	16	15	17	15	5	7	4	6	3	67	68	48	68	60
Modoc						138	269	300	375	571	372	460	535	754	915	510	729	835	1,129	1,486
Mono	14	12	32	19	35	7	11	20	25	30	15	32	24	29	45	36	55	76	73	110
Monterey	541	536	502	577	635	161	217	173	211	187	55	77	59	76	78	757	830	734	864	900
Napa	242	327	332	337	333	155	179	149	142	114	45	63	42	57	41	442	569	523	536	488
Nevada	38	51	62	93	84	48	44	47	69	68	39	45	60	74	77	125	140	169	236	229
Orange	24	36	50	49	73	17	22	22	27	24	15	11	9	14	17	56	69	81	90	114
Placer	121	125	112	126	139	105	126	124	109	118	115	95	99	105	104	341	346	335	340	361
Plumas	177	177	233	279	337	169	192	194	196	280	205	217	268	289	351	551	586	695	764	968
Riverside	170	120	216	337	357	82	76	93	163	189	71	53	95	129	117	323	249	404	629	663
Sacramento		1			3				1			1		1	1		2		2	4
San Benito	150	210	180	197	205	54	90	67	89	54	13	20	22	27	16	217	320	269	313	275

San Bernardino	32	57	66	80	111	21	34	29	50	63	21	31	25	58	63	74	122	120	188	237
San Diego	95	120	114	141	175	38	76	66	65	98	36	36	53	44	61	169	232	233	250	334
San Francisco														3	2	21	14	22	22	24
San Joaquin	13	10	18	12	17	8	4	4	7	5										
San Luis Obispo	251	290	255	353	347	103	112	140	126	147	40	48	60	59	58	394	450	455	568	552
San Mateo	61	83	78	81	88	13	4	22	14	10	3	2	2	5	5	77	89	102	100	103
Santa Barbara	424	526	445	471	506	154	204	164	204	189	91	121	108	102	99	669	851	717	777	755
Santa Clara	243	371	403	461	515	119	134	131	138	136	35	31	43	51	46	397	536	577	620	697
Santa Cruz	69	81	84	101	107	6	7	16	12	15	3	4	2	2	5	78	92	102	115	127
Shasta	171	175	190	203	222	240	230	267	237	281	201	198	245	215	270	612	603	702	655	773
Sierra	27	26	44	42	65	27	30	42	38	47	47	46	46	57	78	101	102	132	137	190
Siskiyou	424	450	218	270	297	491	522	366	478	517	750	682	627	624	702	1,665	1,654	1,211	1,372	1,516
Solano	22	30	31	41	34	16	15	20	13	9	7	7	3	4	2	45	52	54	58	45
Sonoma	519	506	469	532	587	188	194	216	263	251	44	53	47	70	65	751	753	732	865	903
Stanislaus	53	69	77	66	61	26	28	33	36	28	12	14	9	9	5	91	115	114	111	94
Sutter		2	1			1	1	1	1	1	1					1	3	2	1	1
Tehama	286	280	284	343	263	288	329	262	247	271	225	237	212	255	181	799	846	756	845	715
Trinity	299	295	234	249	309	339	310	277	321	311	263	195	240	140	221	921	830	751	760	841
Tulare	341	484	361	418	400	300	250	257	319	254	203	205	189	225	236	744	939	807	965	930
Tuolumne	64	74	70	100	116	72	88	74	95	120	77	51	68	55	93	213	213	213	280	329
Ventura	164	226	233	208	256	74	99	75	74	99	36	37	38	26	35	274	362	346	308	390
Yolo	55	97	100	130	121	39	46	49	61	57	21	26	22	23	13	115	169	176	214	191
Yuba	24	22	23	43	34	19	21	14	33	28	10	9	14	17	29	53	52	55	93	91
Totals	9,069	10,113	9,823	11,085	12,087	5,688	6,537	6,282	7,172	7,545	4,750	4,865	5,117	5,815	6,173	17,567	21,515	21,222	24,132	25,835

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to November 30, 1931, of the Eighty-third Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau Administration:					
Executive	$3,400 00				$3,400 00
Clerical and office	9,125 81	$413 86	$138 25	$150 23	9,828 15
Printing		5,539 95			5,539 95
Automobiles		126 43	153 96		280 39
Traveling			1,157 50		1,157 50
Postage			1,967 53		1,967 53
Telephone and telegraph			2,000 14		2,000 14
Freight, cartage and express			1,397 82		1,397 82
Rent			6,394 39		6,394 39
Accident and death claims			1,538 68		1,538 68
Accounting pro rata	1,125 00				1,125 00
Legal	2,750 00		137 23	75 55	2,962 80
Premiums on bonds			12 50		12 50
Publicity			68 86		68 86
Total bureau administration	$16,400 81	$6,080 24	$14,966 88	$225 78	$37,673 71
Bureau education and research:					
Chief and assistants	$2,500 00				$2,500 00
Clerical and office	934 95	$94 34	$107 38		1,136 67
Traveling			2,808 02		2,808 02
Telephone and telegraph			11 43		11 43
Freight, cartage and express			79		79
Photographer	600 00		76 75	$620 35	1,297 10
Librarian	850 00	12 78	32 17	69 63	964 58
Research	4,375 00	118 58		28 00	4,521 58
Blue printing			12 66		12 66
Publicity			353 94		353 94
Exhibits			8 25		8 25
Lecturer	1,575 00				1,575 00
Total bureau education and research	$10,834 95	$225 70	$3,411 39	$717 98	$15,190 02
Bureau patrol and law enforcement:					
Chief and assistants	$4,595 00				$4,595 00
Clerical and office	1,605 32	$19 63	$8 68	$11 47	1,645 10
Automobiles		3,827 85	1,752 36	613 76	6,193 97
Traveling			48,733 90		48,733 90
Postage			142 19		142 19
Telephone and telegraph			668 98		668 98
Freight, cartage and express			16 96		16 96
Rent			215 45		215 45
Heat, light and power			6 82		6 82
Captains and deputies	87,916 33	768 63	214 62	142 90	89,042 48
Launches		606 04	468 61		1,074 65
Fish planting	2,377 72	539 81	205 00		3,122 53
Volunteer deputies	360 00				360 00
Premiums on bonds			539 47		53 9 47
Temporary help	24 00				24 00
Cooks	525 00				525 00
Total bureau patrol and law enforcemeut	$97,403 37	$5,761 96	$52,973 04	$768 13	$156,906 50
Bureau commercial fisheries:					
Chief and assistants	$6,645 00			$41 00	$6,686 00
Clerical and office	4,300 00	$174 56	$66 67	3 00	4,544 23
Automobiles		335 93	133 05		468 98
Traveling			9,464 01		9,464 01
Postage			2 52		2 52
Telephone and telegraph			285 92		285 92
Freight, cartage and express			320 95		320 95
Rent			535 00		535 00
Heat, light and power			112 61		112 61
Research	3,961 00	13 16		53 54	4,027 70
Captains and deputies	7,075 00	128 18	22 22	10 00	7,235 40
Launches	5,270 00	1,715 95	269 01	167 50	7,422 46
Laboratory	13,600 00	314 91	567 26	108 12	14,590 29
Blue printing			2 52		2 52
Statistics		255 60	689 35	42 15	987 10
Fish cannery research			3,750 00		3,750 00
Fish cannery inspectors—seasonal	5,682 90				5,682 90
Total bureau commercial fisheries	$46,533 90	$2,938 29	$16,221 09	$425 31	$66,118 59

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to November 30, 1931, of the Eighty-third Fiscal Year

Function	Salaries and wages	Materials and [illegible]	[illegible]	[illegible]	[illegible]
Bureau fish culture					
Chief and assistants	$ [illegible]				[illegible]
Clerical and office	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Automobiles		[illegible]	[illegible]		[illegible]
Traveling			[illegible]		[illegible]
Postage			[illegible]		[illegible]
Telephone and telegraph			[illegible]		[illegible]
Freight, cartage and express			[illegible]		[illegible]
Rent			[illegible]		[illegible]
Heat, light and power			[illegible]		[illegible]
Hatcheries	[illegible]	[illegible]	[illegible]		[illegible]
Special field investigations	[illegible]	[illegible]			[illegible]
Fish cars	[illegible]	[illegible]	[illegible]		
Blue printing			[illegible]		[illegible]
Cooperative research	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fish hatchery assistant (seasonal)	[illegible]				[illegible]
Total bureau fish culture	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]
Bureau hydraulics					
Chief and assistants	$ [illegible]		$[illegible]		$ [illegible]
Clerical and office		$[illegible]	[illegible]		[illegible]
Automobiles		[illegible]	[illegible]		[illegible]
Traveling			[illegible]		
Postage			[illegible]		[illegible]
Telephone and telegraph			[illegible]		[illegible]
Cooperative research	[illegible]				[illegible]
Total bureau hydraulics	$[illegible]	$[illegible]	$[illegible]		$[illegible]
Bureau game propagation					
Superintendents	$[illegible]				[illegible]
Clerical and office	[illegible]				[illegible]
Automobiles		$[illegible]	[illegible]		[illegible]
Traveling			[illegible]		[illegible]
Postage			[illegible]		[illegible]
Telephone and telegraph			[illegible]		[illegible]
Freight, cartage and express			[illegible]		[illegible]
Heat, light and power			[illegible]		[illegible]
Maintenance		[illegible]	[illegible]	[illegible]	[illegible]
Assistants	[illegible]		[illegible]		[illegible]
Total bureau game propagation	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]
Bureau fish rescue					
Chief and assistants	$[illegible]		$[illegible]		$ [illegible]
Traveling			[illegible]		[illegible]
Rent			[illegible]		[illegible]
Total bureau fish rescue	$[illegible]		$[illegible]		$[illegible]
Bureau game refuge					
Chief and assistants	$[illegible]				$ [illegible]
Clerical and office	[illegible]	[illegible]			[illegible]
Automobiles		[illegible]	[illegible]		[illegible]
Traveling			[illegible]		[illegible]
Postage			[illegible]		[illegible]
Telephone and telegraph			[illegible]		[illegible]
Freight, cartage and express			[illegible]		[illegible]
Lion hunters and trappers	[illegible]				[illegible]
Refuge posting	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Predatory animal control			[illegible]		[illegible]
Temporary help	[illegible]				[illegible]
Refuge maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total bureau game refuge	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to November 30, 1931, of the Eighty-third Fiscal Year—Continued

Function	Property and equipment	Total
Construction, improvements and equipment:		
Improvements at Lake Almanor Hatchery	$1,312 97	
Telephone and power line from Chester to Lake Almanor Fish Hatchery	2,400 00	
Filter at Big Creek Hatchery	114 07	
Permanent repairs on Brookdale Hatchery	761 30	
Construction of dams on Cherry Creek	1,000 00	
Completion of egg collecting racks at Chester	486 82	
Construction of rearing ponds and a temporary house for an attendant, Hat Creek, Inyo County	1,068 21	
Tank and egg collecting station at Huntington Lake	1,509 92	
Filter at Kaweah Hatchery	47 84	
Repairs and improvements at Mt. Shasta Hatchery	854 98	
Permanent improvements on Snow Creek Hatchery	1,233 12	
Total construction, improvements and equipment		$10,789 23
License commissions		$21,013 98
Purchase of game refuges		55,000 00
State Fair and other exhibits		4,801 06
Prior year expense—82d fiscal year only		14,930 87
Grand total proprietary group		$539,553 65

STATEMENT OF INCOME

For the Period July 1, 1931, to November 30, 1931, of the Eighty-third Fiscal Year

License sales	Total	
Departmental income		
Angling licenses, 1931	[illegible]	
Commercial hunting club licenses, 1931-32	[illegible]	
Commercial hunting club operators' licenses, 1931-32	[illegible]	
Deer tags, 1931	[illegible]	
Fish breeders' licenses, 1931	[illegible]	
Fish importers' licenses, 1931	[illegible]	
Game breeders' licenses, 1931	[illegible]	
Hunting licenses, 1931	[illegible]	
Kelp licenses, 1931	[illegible]	
Market Fishermen's licenses, 1931-32	[illegible]	
Trapping licenses, 1931-32	[illegible]	
Wholesale fish packers' and shell fish dealers' licenses, 1931-32	[illegible]	
Total license sales		[illegible]
Other income		
Contributions from importers	[illegible]	
Court fines	[illegible]	
Fish packers' tax	[illegible]	
Fish tag sales	[illegible]	
Game tag sales	[illegible]	
Interest on bank balances	[illegible]	
Kelp tax	[illegible]	
Miscellaneous sales	[illegible]	
Total other income		[illegible]
Total departmental income		[illegible]
Income for the State University Fund		
Kelp tax	[illegible]	[illegible]

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JULY, AUGUST AND SEPTEMBER, 1931

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

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore							7		19,162
Anchovies							75,937		31,441
Barracuda							6,766	36,802	93,669
Bonito								1,914	8,602
Carp				98	644	341			
Catfish				148	27,575	24,853			
Cultus Cod	452,943	17,236					63,899	4,948	13,421
Dolphin									
Flounders	61,155	520					9,598	60	4
Grayfish	810						3,807		637
Halibut	411,398	7,261	123				644	1,307	2,863
Hardhead					100				
Herring									15,986
Kingfish							1,206	806	16,284
Mackerel							633	8,695	318,432
Mackerel—Horse									105,711
Mackerel—Spanish									
Mullet									
Perch	648		7,136				19,384	33	5,679
Pike					49				
Pompano								27	31
Rock Bass									
Rockfish	156,161	437					98,926	108,442	367,549
Sablefish	198,148	1,384					1,485	59,644	4,201
Salmon	2,225,683	626,285		87,962	131,397	265,774	409,838	59,748	1,968
Sandabs	105,262	520					2,969		1,953
Sardines							7,863,185	586	33,624,249
Sculpin							165	20	
Sea Bass—Black									
Sea Bass—White			8,464				6,725	27,635	6,301
Shad				562	20,222	2,182			
Shad—Buck						29			
Shad—Roe						12			

Sheepshead										
Skates	13,409						6,334			1,981
Skipjack										
Smelt	12,121	291	15,542				29,140	47,085		98,047
Sole	2,193,634	1,930					43,561	111		6,008
Splittail					4					
Striped Bass			222	200	7,435	35,095	7,845			
Suckers										
Swordfish										
Tomcod	492						68			
Tuna—Bluefin										
Tuna—Yellowfin										
Turbot			220				74			
Whitebait	16,048	5,074	5,315				1,488			35
Whitefish										
Yellowtail										
Miscellaneous	7,297						55	32		1,300
Total fish	5,855,209	626,518	5,310,[illegible]	[illegible]	57,[illegible]	28,[illegible]	[illegible]	357,965		34,745,514
Crustaceans:										
Crabs	27,528						81,267			
Shrimps			27,000				2,400			626
Mollusks:										
Abalones										1,183,640
Clams—Cockle	6	68	17,418							
Clams—Mixed	1,400	40						22		51
Clams—Pismo								111		
Clams—Softshell		25	1,000			4,200	4,800			17,000
Cuttlefish	80						720			
Oysters—Eastern			20,000				4,320			
Oysters—Native	29,597		2,000				1,200			3,472
Squid										
Totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]

All amounts shown in [illegible] are [illegible]

[1] 1,147 dozen

[2] 1,344 dozen

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JULY, AUGUST AND SEPTEMBER, 1931—Continued

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

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	From south of the International Boundary brought into San Pedro	From south of the International Boundary brought into San Diego	Total from south of the International Boundary brought into California
Albacore		4,508	21		23,698			
Anchovies		10,918		240	118,536			
Barracuda	2,070	459,609	7,757	513,349	1,120,022	141,208	74,054	215,262
Bonito	113,984	1,894,029	4,466	186,437	2,209,432			
Carp		27,028	12		28,123			
Catfish					52,576			
Cultus Cod	39	413			552,897			
Dolphin		151	347		498			
Flounders	43	422			71,802			
Grayfish	55	59,309	23,412	71,105	159,135			
Halibut	103,823	86,041	2,002	3,632	619,094	1,060	14,216	15,276
Hardhead					100			
Herring					15,986			
Kingfish		44,621	13	118	63,048			
Mackerel	700	3,704,951	15,667	45,581	4,094,659			
Mackerel—Horse		159,703			265,414			
Mackerel—Spanish						3,768		3,768
Mullet		1,089	1,637	2,525	5,251			
Perch	681	29,203		22	62,786			
Pike					49			
Pompano		1,443		27	1,528			
Rock Bass	547	100,793	16,208	60,807	178,355	655	697	1,352
Rockfish	22,521	309,226	6,712	140,355	1,210,329			
Sablefish		5,661			270,523			
Salmon					3,808,655			
Sandabs		2,682			113,386			
Sardines		23,850	275	79,602	41,591,747			
Sculpin		21,270	38	2,079	23,572			
Sea Bass—Black	2,081	23,633	3,809	12,453	41,976	19,197	44,238	63,435
Sea Bass—White	25,151	292,101	859	164,081	531,317	127,526	152,331	279,857
Shad					22,966			
Shad—Buck					29			
Shad—Roe					12			

Sheepshead	15	33,995	155	993	35,158			
Skates		8,025			29,752			
Skipjack	20	7,644,997	54,812	4,336,628	12,036,657	699,965	836,370	1,536,335
Smelt	12,091	44,519	7,732	55	265,106			
Sole	85,786	25,532	28	34	2,356,628			
Splittail					4			
Striped Bass					52,363			
Suckers					3			
Swordfish		121,792	488	52,355	294,630	265		265
Tomcod					557			
Tuna—Bluefin		1,038,393		704	1,191,441	291,814	571	292,385
Tuna—Yellowfin		656,324	73	44,772	736,267	1,243,058	444,787	17,692,487
Turbot					4			
Whitebait					4			
Whitefish		9,927		45	9,972			
Yellowtail	1,412	335,104	9,570	4,[illegible]	7[illegible]	926	[illegible]	[illegible]
Miscellaneous	1,311	26,[illegible]		4,[illegible]	4,463		[illegible]	[illegible]
Total fish	372,320	17,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Crustaceans:								
Crabs								
Shrimps					4			
Molluska:								
Abalones	48,078							
Clams—Cockle		7,731						
Clams—Mussel		5,044						
Clams—Pismo	30,362				4			
Clams—Softshell					4			
Cuttlefish		53						
Oysters—Eastern					4			
Oysters—Native		7						
Squid								
Totals	451,760	17,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[1] 4,491 dozen.

ABSTRACT
CALIFORNIA SPORTING FISH AND GAME LAWS
VALID UNTIL 90 DAYS AFTER CLOSE OF 1933 LEGISLATURE

1931 OPEN AND CLOSED SEASONS 1932

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES

GAME	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
DEER	1½										15			No Does, Fawns or Spike Bucks No Forked Horned Deer in Dist. 1¾ No sale of Venison or Deer Skins Two Bucks per Season except in 1¾ where limit is one See Notes 6-9-10-12
	2-2½-3									14				
	1-1¾-4-4½-4¾-23-24-26									16	15			
Rabbits—Cottontail and Brush	ALL EXCEPT 4¾											15	15	15 per day. 30 per week. No limit in District 4 No protection in 4¾
Bear, Fur Animals	ALL											15		See Note 7
Ducks, Geese, Jack Snipe, Mud Hens	ALL — FEDERAL LAW										OPEN NOON OCT. 1			15 Ducks, 30 in Possession; 4 Geese, 8 in Possession; 20 Snipe, 25 Mud Hens, No Ross Snow or Cackling Geese
	ALL — STATE LAW	15												25 Ducks, 25 Snipe, 25 Mud Hens. 50 Per Week Goose Limit See Note 4. See Notes 9-10-11-12-13
Quail—Valley, Desert and Mountain	ALL EXCEPT 1½											15	15	Valley and Desert 15 per day. 30 per week Mountain 10 per day. 20 per week
	1½													
Dove	ALL EXCEPT 4-4½-4¾													Federal Season Opens Noon September 1 — 15 per day 30 per week
	4-4½-4¾													

There is no open season on Elk, Antelope, Mountain Sheep, Sea Otter, Tree Squirrel, Sierra Hare, Rail, Wood Duck, Pigeon, Swan, Shore Birds (except Jack Snipe), Grouse, Sage Hen, Imported Quail, Wild Pheasant, Partridge, or Wild Turkey.

FISH	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
Steelhead and all Trout (except Golden), Whitefish Unlawful to take trout in waters closed by Governor's proclamation	1-1½-1¾-2-3-4-4½-4¾-15 Klamath River, Lake Almanor													Bag limit for taking and possession, 25 trout or 10 pounds and one trout. — No Sale No Spearing For other restrictions See Notes 12-15-16-20 21-22-28-29 31-33 On this Card
	2½		28			30								
	23-24-25					30								
	Truckee River					15								
	See Note 22													
	1½ Winter Klamath River													5 Trout regardless of weight
	Russian, Navarro, Napa and Eel (Dist 2) Tidewater Dists. 2-3-15													3 Trout regardless of weight
Golden Trout	ALL													20 per day. None under 5 inches Not more than 10 lbs. and one
BLACK BASS	ALL EXCEPT 4¾													15 per day In Open Season 4 Miles of Clear Lake — No Black Bass under 9 ins. Clear Lake 10 per day — No sale Hook and line only
	CLEAR LAKE IN LAKE CO.													
Sunfish	ALL													25 per day
Sacramento Perch and Crappie	ALL EXCEPT CLEAR LAKE													25 per day — Hook and line only No sale
	CLEAR LAKE													10 per day
Striped Bass	1-3-12A													None under 12 inches, 5 per day. None to be taken from Salton Sea. See Note 19
Crabs	ALL EXCEPT 1½-6-7-8-9							30					15	Season Districts 1½-6-7-8-9 August 31, December 14 See Note 24, None under 7 inches. No Female
Abalones	ALL	14		16										Only for food. Must be brought in shore alive in shell Angling License Required. See Note 27
Pismo Clams	17													None under 5 inches. No shipment. 15 per day Angling License Required District 18a Closed
Spiny Lobster	ALL											15		No Sale of Meat. None under 10½ or over 16 inches See Note 24
GRUNION	ALL													

Salmon and Shad May Be Taken as Noted in Paragraphs 19-23. No open season on Sturgeon (possession prohibited).

NOTES

IT IS ALWAYS UNLAWFUL

1. To hunt, kill, possess wild birds or mammals, to possess firearms, except under written permit from the Commission, within districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q 1r, 1s, 1t, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 4a, 4b, 4c, 4d, 4e, 4f, 4g, or General Grant Refuge, or the Mt. Tamalpais Game Refuge, including Richardson Bay, or San Francisco Refuge, or Silver Lake Refuge (water fowl may be killed in 4a and 4e), or to hunt quail in the Bolinas Quail Refuge, or to hunt or discharge firearms in Huntington Lake Refuge or San Leandro Bay Refuge.

2. To hunt birds or mammals excepting predators without a hunting license.

3. To possess any bird net or to net, trap or to hold protected game or birds of any kind, their nests or eggs except under written permit from the Commission.

4. To take or possess more than 8 geese per day or 50 per week; or more than 8 honkers or sea brant per day or 24 per week.

5. To take or kill non-game birds, except blue jay, butcher bird, English sparrow, sharp-shinned, Cooper or duck hawk, great horned owl, linnet, white pelican, shag, and in districts 1, 2, 3, 4 and 4½, blackbirds.

6. To hunt deer without a deer tag license. To fail to attach to the horns of deer immediately on killing, properly filled out license tag or at the same time to send duplicate tag to the Division. To carry a deer into a closed district without having license tag countersigned, or to have untagged deer in possession. To fail to retain in possession during open season and for ten days after the skin and portion of head bearing horns of deer killed and to produce upon demand. To use more than one dog to the hunter in hunting deer or to allow dogs to run deer in closed season, or to possess doe or fawn skins, or deer skins not bearing evidence of sex.

7. To trap for profit bear, ring-tailed cat, coon, pine marten, skunk, fisher, wolverine, mink, river otter, fox, beaver or muskrat, or to kill these animals during the closed season, except when destroying property. To interfere with the traps of licensed trappers. To use saw tooth or spike jawed traps for taking fur bearers.

8. To use any animal other than a dog to stalk wild birds.

9. To shoot game from a power boat, sailboat, auto, airplane; or to hunt waterfowl from a scull boat in districts 8, 9, except on Wednesdays and Sundays, or at any time in district 12 or Napa River south of Edgerly Island, or to use a

shotgun larger than ten gauge, or [illegible] automatic or a tone gun.

10 To shoot resident game [illegible] and 1 hour before sunrise [illegible] and ½ hour before sunset [illegible] game

11 To hunt waterfowl in [illegible] 22, other than on Wednesdays, Saturdays, holidays, opening and [illegible] between 9 a.m. and sunset [illegible] of auto, airplane, or power boat [illegible]

12 To hold game [illegible] season, vehicle to days

13 To sell wild game [illegible]

14 To make a false [illegible] fail to show licence upon [illegible]

15 To take game or fish [illegible] season is not open in [illegible] Trout legally taken may be [illegible] into a closed district [illegible] duplicate setting forth [illegible] licence and name and [illegible] must be attached [illegible] the officer to [illegible] closed district where [illegible] affect that trout were [illegible] by agent to whom [illegible]

16 To ship or [illegible] dried fish [illegible] than [illegible] packages or [illegible] signed and [illegible] state

17 To operate a [illegible]

18 To give [illegible] 24, 25, 26 [illegible]

19 To buy, sell or [illegible] length, or to [illegible] base during [illegible] line [illegible] and July 31, or [illegible]

20 To take [illegible] hand or with [illegible] than 3 lbs. ea.

21 To have in [illegible] landing gaffs [illegible] unlawful to spear [illegible]

22 To take trout [illegible] of any stream [illegible] of any stream flowing [illegible] within two miles from [illegible] to August 1

23 To take [illegible] a gigantic [illegible] Klamath River [illegible] Chinook less than 2 [illegible] of club anglers and [illegible] dition that the [illegible]

LICENSES MUST BE SHOWN UPON DEMAND

[illegible]

LICENSE PROVISIONS

HUNTING

[illegible]

Resident under 21	$1.00
Resident citizens	2.00
Non-resident citizens	10.00
Duplicate license	10.00
Alien	25.00
Other Aliens	25.00

[illegible]

ANGLING

[illegible]

Resident [illegible]	$1.00
Non-resident citizens	5.00
Aliens	5.00

Duplicate [illegible] requested

TRAPPING

[illegible]

Citizens	$1.00
Aliens	2.00

Duplicate [illegible] requested

DEER TAG

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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ARTIFICIAL METHODS OF PROPAGATING GAME BIRDS

By AUGUST BADE, Superintendent of State Game Farms

THE MORE WE DELVE into this interesting subject of artificial incubation and brooding and become familiar with its possibilities, the more we are convinced that the system has come to stay and game birds of the future will be produced via the incubator and brooder. Quite naturally there are a few minor details to be worked

out, but practical breeders of the present day are well agreed on fundamentals. The adjustments that will be needed will be more in the nature of changes to suit local conditions.

Brooding practices will hold quite true in all localities but the incubator presents troublesome details that will test the patience and ingenuity of the operator. We should not be discouraged for history tells us that the orientals are past masters with artificial incubation although their equipment is very primitive.

One traveler relates this interesting story. While visiting in the Hawaiian Islands he witnessed three Chinamen taking off a hatch of 14,000 ducks. For incubators they used holes dug in the bank of a rice paddy and common manure furnished the heat. Each hole or incubator contained about 100 eggs and about 90 per cent of the eggs produced ducklings. Surely if a Chinaman can secure such good results with primitive equipment we ought to be able to do equally as well with the fine equipment at our disposal at the present time.

Modern engineers have given us positive heating elements in gas, oil, and electricity, as well as ventilating systems that change the air in a machine as often as desired. In addition to heating and ventilating systems, our modern machines are equipped with moisture devices that will meet the incubating requirements of any kind of egg under any climatic conditions.

Experience has shown that chicks properly hatched are easy to brood, so the time to start getting results from your brooder is in the incubator. The best of brooding equipment, the choicest feeds, and the best of care will not make good poults from poorly hatched chicks. It is not enough to get the chicks out of the shell, but rather the important thing is the way they get out. Many chicks develop within a day or two of the hatching time and then die. Some even pip the shell and can't get out. These facts are indicative of poor incubation.

Generally speaking heat, moisture, and ventilation are the chief factors in incubation. Or putting it in another way, and possibly the correct way, it is the proper combination of these three factors that produces fine healthy chicks. Modern engineers have given us positive and dependable heating units in electricity, gas, and oil, so that we know we can maintain an even temperature in any kind of an incubator. At the same time ventilating systems have been tried and proven so it is possible to change the air in a room or incubator as often as desired. A power driven fan is usually employed for this purpose. Incubators using this system of ventilation are called forced draft machines. The Buckeye, Jamesway, Lincoln, Robbins, and Petersime are representative types.

Then there is another kind of incubator in which air circulation depends entirely upon the principle that warm air, being lighter, will be replaced by cold air, and in that way the machine is ventilated. This type of machine is called a flat top. The Charters (now Wood Bros.), the Petaluma, Prairie Queen, and J. W. Miller machines are typical types of the flat tops.

Probably the greatest factor in good incubation is a well ventilated and arranged incubator room. The best of machines placed in poorly ventilated rooms will give mediocre results. A basement, an outbuilding, or unoccupied room is often pressed into service as an incubator

room with poor results. Many times the particular type of machine used is blamed for the results when it is a matter of fact the fault lies entirely with room conditions.

Since the incubator must breathe or take up the air in the room it is easily seen that if the room is not supplied with fresh air the incubator will suffer. We are all familiar with the results of having slept in a poorly ventilated room. After an egg begins to incubate and the germ develops it throws off carbon dioxide just as we do in breathing. If the room does not afford clean fresh air in sufficient quantities to produce and sustain life the eggs will not hatch and at what few do hatch are liable to be short lived.

The first requisite then in any program of artificial incubation is a well ventilated room. In addition to being well ventilated all draughts should be avoided and the air admitted so it will be gradually warmed as it enters the room. If this is done it will be much easier to keep the room at an even temperature, which is a second requisite for the proper operation of an incubator. If the room temperature shows too much of a variation it will be hard to keep the machine at the proper temperature. So far as possible the room temperature should be kept at about 75 and then it will be found much easier to control moisture conditions in the incubator.

Most of the late model machines have ample moisture facilities so with the aid of the hygrometer it may be known exactly what moisture content is present in the machine at all times. The hygrometer is just as much a part of the equipment of a good incubator as the thermometer is in reading the temperature of the machine.

If a forced draft machine is being used it should be set for a temperature reading of 99, and the machine be run for a day at least to be sure it is holding this temperature. For the first week the hygrometer should read 70 and this reading may be increased two points each week.

After the first hatch is off it is possible to check more closely on the moisture content according to how the eggs hatch. A good way to judge the moisture is by the development of the air cell in the egg. This can be done very well by setting a hen at the same time the incubator is started and compare the eggs as the process of incubation proceeds.

The hen should be set on the ground with just enough of nest litter to protect the eggs from coming in contact with the soil. If conditions are right the air cell at hatching time will occupy about two-fifths of the length of the egg. The development of the air cell should be gradual and if the air cell in the incubator eggs is not developing as fast as the eggs under the hen then cut down on the moisture in the machine. The common egg tester may be used in examining the air cell. If this instrument is not available a common flashlight and cardboard with a small hole in it may be used.

At the end of eight days it is well to test all eggs so the infertile ones may be discarded. Under the light of the egg tester the infertile eggs will show white and the fertile ones will show blood veins and the form of the chick. As the incubating period advances fertile eggs will become darker and the only light spot on the egg will be the air cell at the large end of the egg.

If a forced draft machine is used it is not necessary to air the eggs as is the common custom. There may be some justification for this procedure with the flat top, although it is a debatable question among hatcherymen. But the turning of eggs at regular intervals is very important. They should be turned at least twice daily and four times during the twenty-four hours if it can be done. If eggs are not turned, crippled chicks will be the direct result.

When the flat top type of incubator is used the temperature reading is different. Experiments with this type of machine show that the best results are had when the temperature is held between 101 and 103. In taking this temperature reading care should be taken to always have the bulb of the thermometer in the same relative position, which should be the center of the egg. It must be remembered that the heat in a flat top machine drops rapidly as the bottom of the incubating chamber is approached. This test taken with a thermometer will convince anyone of the necessity for always taking the temperature at a given point.

The following table of temperatures and relative humidity will aid the operation of flat top machines in hatching game bird eggs:

Time	*Temperature*	*Relative humidity*
First eight days	101 to 101½ F.	45
Second eight days	101 to 101½ F.	45
Last eight days	101½ to 103 F.	45 to 55

DRY DOWN OR EVAPORATION DURING INCUBATION

As the period of incubation advances eggs become lighter in weight and experiments have shown that the best results are had when this evaporation takes place according to the following table:

The first eight days will show a loss of 4 per cent in actual weight.

The next eight days will show a total loss of 9 per cent in actual weight.

The last eight days will show a total loss of 13 per cent in actual weight.

If one cares to check this closely the tray can be weighed when empty, and then weighed when full of eggs, and the difference in weight at the end of each period noted.

Present day incubators are made as near fool proof as possible with automatic controls and thermostats, but there is always a place for the personal element and the ingenious operator will always get added returns for his care and painstaking attention to details.

Seldom are two places found identical in climatic conditions so it is useless to lay down hard and fast rules and say that they will at all times give good results. The safer way is to master the fundamentals of artificial incubation, study local factors, and adjust your machine to meet the requirements. A record of outside temperatures night and day, average room temperature, and a complete record of the machine, will generally help the operator to solve local problems. And if these records are not kept accurately they will be of little value. If there is a local hatcheryman in the locality who is successful, he should be consulted as he may be familiar with local conditions and in a position to give real help.

THE ARTIFICIAL BROODER

Brooders, like incubators, are of many [illegible] good, and others not so efficient. Here again [illegible] electricity for developing the necessary heat. [illegible] tricity is in general use and widely distributed [illegible] larly with this type of brooder. Electric brooders [illegible] two types, the hot air and the radiant type. We [illegible] details on the merits of the two only to remark [illegible] past few years the radiant type has [illegible] possibly operated with less attention to details.

If the brooder room is well ventilated [illegible] is of no concern, except as it applies to [illegible] type of brooder is used. If the hot air brooder [illegible] be given to its ventilation in order to [illegible]

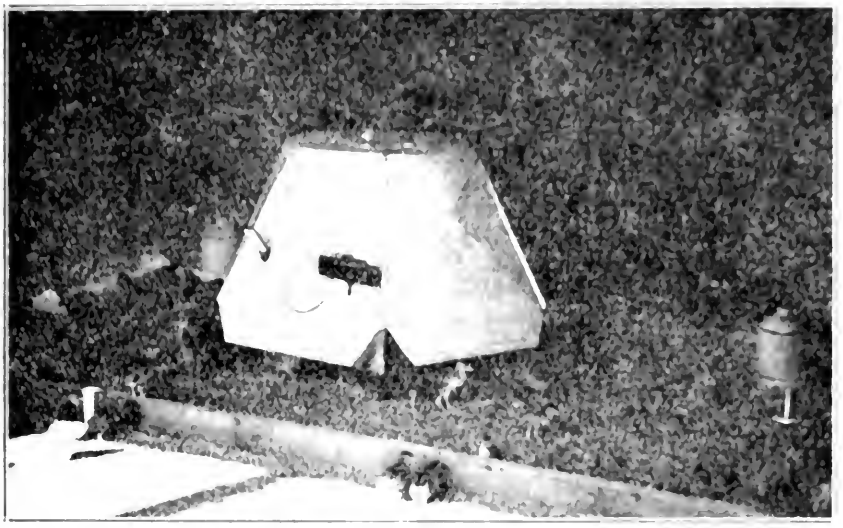

Fig. 16. RADIANT TYPE ELECTRIC BROODER. [illegible] volts, 500 watts, will take care of [illegible] period of 35 days. This is [illegible] with a 6 x 12 foot run.

In the study of artificial incubation we were [illegible] with but three factors, heat, ventilation, and moisture. In brooding we are only interested in heat and ventilation. As was pointed out under incubation the first step in successful brooding is a well hatched chick. The next consideration is the kind of equipment, and the third is a balanced feed ration.

The particular type of brooder is not so essential but it must have positiveness so it will maintain the proper heat at all times and under all circumstances, with ventilating facilities, either in the brooder, or through the room ventilation, so that a uniform temperature may be had at all times of the day and night. Of all the brooding ills chilling is positively the worst as it leads to many other incurable

troubles. In the selection of the brooder it should be made certain that it is equipped with a thermostat and ample heating units so it will be able to keep the temperature at an even level, day and night.

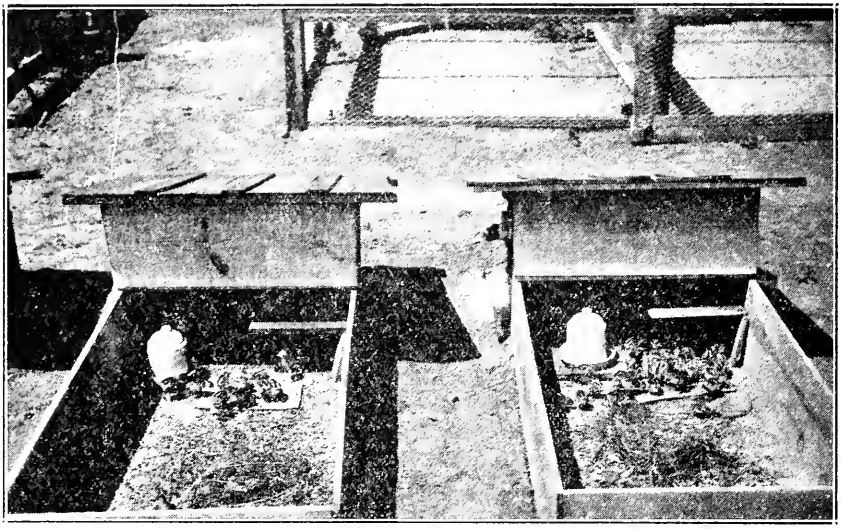

Fig. 17. SMALL INDIVIDUAL BROODERS.—For the person who desires to raise but a few broods of birds this equipment is ideal. The hover will fit into the average field coop and the heating elements develop about 150 watts.

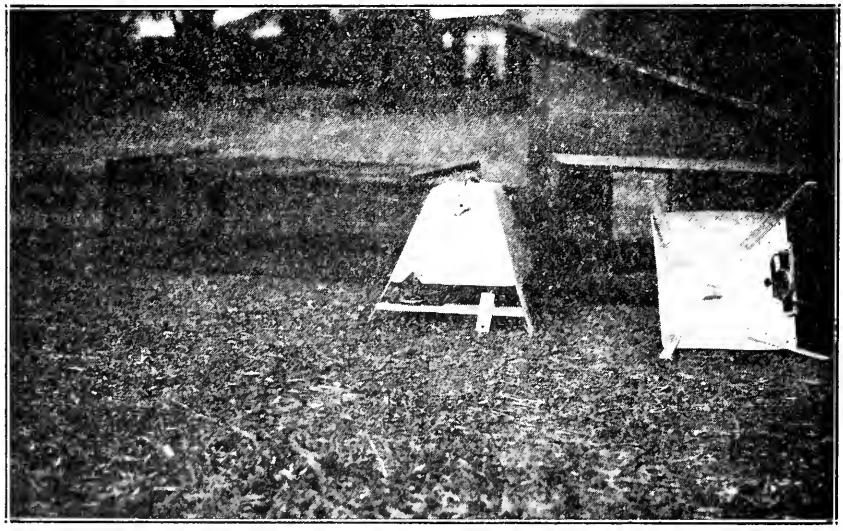

Fig. 18. CONSTRUCTION OF SMALL BROODER.—These small brooders are made either square or round. The square type here shown is 14 inches across the base and 6 inches at top. Height of side is 10 inches and length of legs 4 inches.

There are many types of thermostats in use and like incubators and brooders they vary in dependability. The cheap type of thermostat very often proves costly in the end. Care should be taken to get the

best when buying a thermostat and [illegible] before chicks are put in the brooder.

BROODING TEMPERATURE

The nursery chamber of the [illegible] used, will be about 98 degrees, soft [illegible] very close to this temperature in order that [illegible] change to cause chilling. In too humid [illegible] bator care should be taken to avoid chilling. [illegible] from the incubator till they are dry and [illegible] nursery tray of the incubator for [illegible] better results will be had than if they are [illegible]

If there are enough chicks for two brooders [illegible] them as they are taken out of the incubator, placing [illegible] ones together and the slower moving chicks [illegible] At the end of three or four days there may be little [illegible] but the first few days in the brooder may [illegible] where strong and weak birds are placed together.

SIZE OF BROODERS AND BROODER HOUSE

Game birds can not be crowded in a brooder to the extent that domestic poultry can, and one fact to be remembered at all times is to give them ample space. Experience has proven that pheasants and birds of that type require at least 1.6 square feet of floor space per bird in order to get the best results. If large numbers of them are being brooded, a room 8 x 12 feet with a screened in run 6 x 12 feet will take care of 100 birds. For a room of this size the 250 watt radiant type of brooder with 500 watts of heating units is used.

The brooder stove is placed in the center of the back 8 x 6 feet of the room and the birds are confined around the hover for the first few days by the use of a circle that can easily be made with strong building paper 18 inches high. The circle should be started about eight inches from the edge of the hover and gradually widened as the birds develop until about the end of the fifth day it will be out at least two feet from the edge of the hover and then it may be removed entirely, giving the birds the use of the entire room. If the weather is very warm they may be permitted the use of the screened in run for several hours after they are six or seven days old.

The back portion of the brooder room floor, the space 6 x 8 feet where the brooder stove sets, is covered with an inch of coarse river sand. The other half of the brooder room floor may be covered with rice hulls to the depth of an inch. This affords fine floor litter as well as providing small grit for the birds. The floor of the run in front of the brooder is covered with loam mixed with fine sand to the depth of two inches. This screened in run not only affords extra exercise space but a fine dusting place and brings the birds in contact with the direct rays of the sun. The front of the brooder house is covered with one inch mesh poultry netting in addition to having a muslin curtain that is used at night and on cold days to keep the room warm. On warm days this curtain is removed, allowing extra ventilation as well as direct sunlight to enter the room.

For convenience in keeping the room as well as the run in a sanitary condition the floor of both is made of concrete about four inches thick. The brooding period lasts about thirty days after which the birds are ready for the open rearing pens with no heat but that furnished by their well feathered bodies. The litter of the brooder room floor as well as the loam on the floor of the run is removed, disinfectant applied, and a new coating of sand, rice hulls, and loam put on, before another lot of birds are placed in the brooder house. If this procedure is followed little trouble will be experienced with any of the many ills coming from unsanitary conditions. So much then for the large brooder house and its equipment.

Many people want to raise but a few birds so we have devised a small brooder stove and equipment that will meet their needs in a very satisfactory way. This brooder stove is equipped with a small

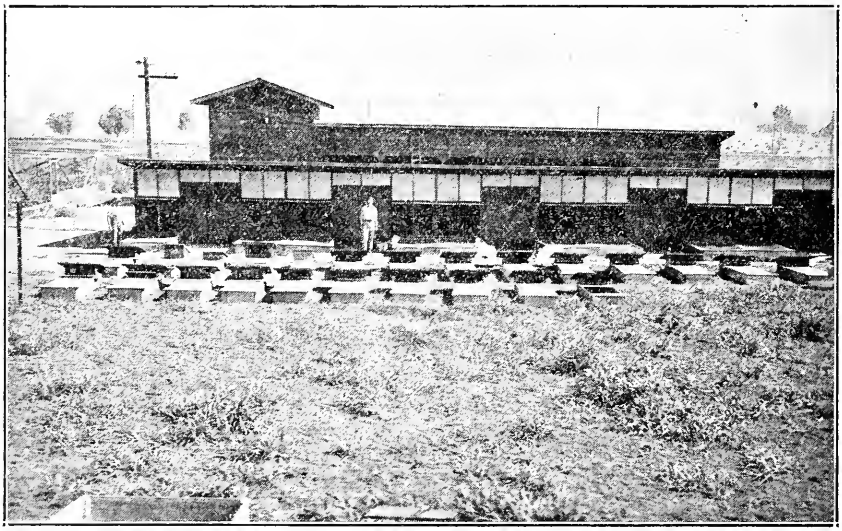

Fig. 19. SMALL BROODERS HANDLING QUAIL.—This picture was made May 22, 1931, at the Los Serranos farm. Six hundred Valley quail are being brooded in this battery of small brooders.

heating unit of about 150 watts and will take care of from 16 to 20 pheasants or partridges. These hovers are built to fit into the ordinary field coop that was formerly used when the domestic hen was the source of brooding heat. These hovers may be either square or round in construction, and are supported by four inch legs. Experiments have proven that chicks placed in this type of brooder and treated in every way as though a hen were their foster mother respond normally and naturally to this metal hen.

However, the metal hen has this advantage. She does not step on any of the young birds and is always hot and ready to brood them when they become chilly. Anyone who has attempted the raising of pheasants or quail with domestic hens will appreciate this feature of the metal hen. This is not the only advantage this type of hen has over the Buff Orpington or Rhode Island. The metal hen carries no

disease or external parasite [illegible]
and sanitary in every way.
If the artificial heat [illegible]
and it has many more [illegible]

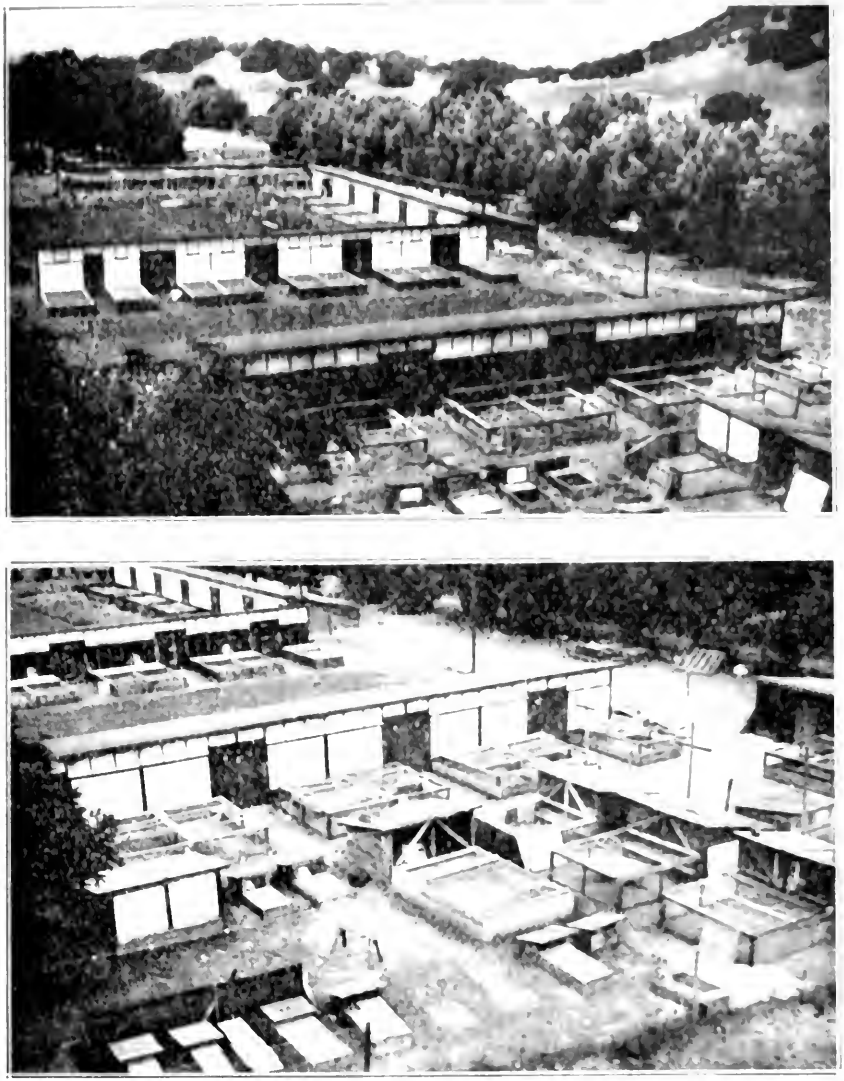

Fig. 20. BROODER HOUSES OF VARIOUS TYPES [illegible]
brooder houses in use at [illegible] place and others laid back to give more [illegible]

the disease hazard would justify its use. It [illegible] that this is an electric age. The average boy or girl knows more or less about electrical appliances and is familiar with the savings in labor and actual results accomplished. It is only natural then that

this type of equipment should appeal to them because it embodies the every day practices of household duties and much of the common work of the farm.

But when it comes to domesticated hens and their handling, there is an inclination to not be interested, and as a matter of actual fact how many of our younger generation understand the hen and can get along with her? Not many, I assure you, judging from experiences on our game farms. But it is different with electrical equipment. Our boys put in long hours working with the incubators and brooders and at no time do the hours seem to hang heavy. The work is interesting at all times and the results are far better than they were a few years ago when the old domestic hen held forth.

There is another advantage seldom thought of and that is a matter of actual room required, and the general working conditions. The

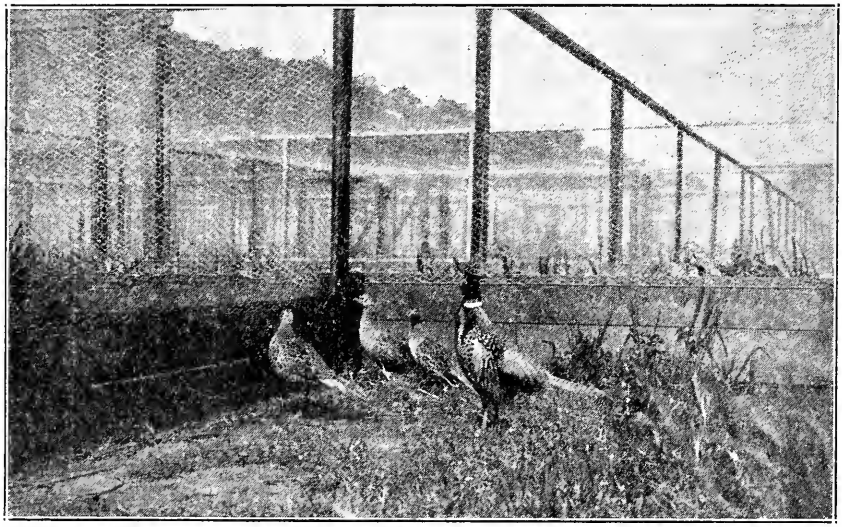

Fig. 21. The Ring Neck pheasant in breeding pen.

average back yard can be utilized for the rearing of many birds up until the time they are ready for liberation, which is about ten weeks, and the space so used, and the equipment, is easily cleaned, disinfected, and made ready for another lot of birds.

FEEDS AND FEEDING METHODS

According to experiments at both of our farms during the past three years we have secured the best results from a combination of the wet and dry systems of feeding. A dry mash that is made up of the following ingredients is kept before the young birds at all times.

DRY MASH FORMULA

25 lbs. ground yellow corn
25 lbs. ground barley
25 lbs. ground wheat
15 lbs. best fish meal
5 lbs. dried buttermilk
5 lbs bone meal
2 lbs. ground limestone

For the first two weeks' feeding the dry mash is ground in the ordinary way, but after that a coarser grind is used as there is less waste in the feeding process.

THE WET MASH

The wet mash is made with various combinations according to the operator and his past experience. The following is very good for the most general use is as follows:

Pheasant meal number 12	25
Hard boiled egg finely grated	10
Cottage cheese or Milko	10
Crissel or fish meal	10
Finely chopped green clover, [illegible]	35

For the first day or two it is well to feed first the grated egg with the cottage cheese or Milko, and a little of the finely cut greens. After this the regular ration may be used for the next two weeks when the amount of eggs is decreased and its place taken with more greens. By the end of the third week leave the egg out entirely and at this time change the number 12 meal for the number 5 which is the next larger size.

HOW TO PREPARE PHEASANT MEAL

Pheasant meal is a very dry, well cooked product that requires moistening before it is ready for use in feeding. Never try to feed it dry. If this feed is not properly moistened there will be a great deal of waste in its use as the birds do not eat the dry hard particles. If prepared in the following way it is not an expensive feed to use. For every four parts of dry meal add three parts of hot milk or water and stir well until every particle comes in contact with the liquid. As soon as it is well mixed it should be allowed to stand for five minutes, and then mix it again. Go through this procedure three or four times. As the meal is worked with the hands the swelling of the particles will be noticed and the object is to get the meal fully expanded before it begins to cool.

After it is fully expanded let it set for an hour or so until it is perfectly cool before using it in the feed. It is well to mix the morning feed the night before and each following feed at least two hours before it is needed. By this is meant the preparation of the meal. The other ingredients such as cheese, crissel, greens, etc., are mixed with the meal just prior to feeding time. If a cool place is available in which to keep the meal the entire day's supply of moistened meal may be prepared at one time. If left in a warm place it will sour quickly. Avoid any kind of sour feed.

Wet mash feed is best served on boards about a foot wide. The ordinary redwood lumber a half inch thick and ten or twelve inches wide when cut into two foot lengths makes excellent feed boards. As soon as the birds are through eating, the feed boards should be leaned up against the run or side of the brooder. These boards should be kept clean at all costs. The dry mash is best fed from small metal feeders. These can be had in all desired lengths. Fill the dry mash trays about two-thirds full and less waste will be evidenced, and a saving will be effected in the amount of mash consumed. If these metal

feeders are placed on 1 x 8 boards it will be found easier to keep them clean.

Use the wet mash feed four times a day, a small amount at a time, just what the birds will clean up in about ten minutes, and at the end of two weeks cut the feed to three times daily. Continue this program until the birds are eight weeks old when two feeds a day are sufficient.

IMPORTANCE OF CLEAN WATER

The inverted crock or watering jar will give good service as these may be had in convenient sizes. Always wash them daily and know they are clean. When very young birds are first watered, do not give them cold water, but temper it to the temperature of the room. After they are older they will readily take cold water with no injurious results. Many diseases begin in and around the watering devices.

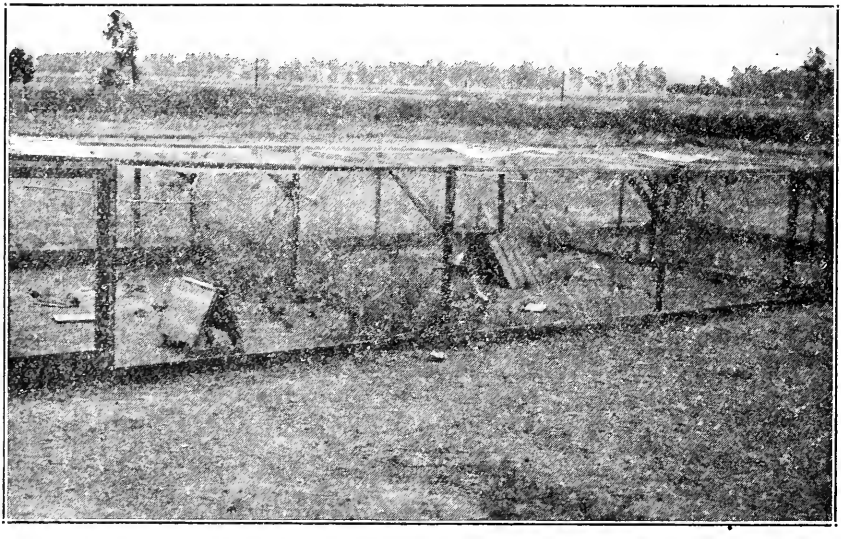

Fig. 22. Valley quail breeding pens where flock breeding is carried on with good fertility and egg production.

Always treat the watering of birds as though it were for human consumption and no trouble will be experienced from this source.

REGULAR FEEDING TIMES

Game birds are naturally regular in their feeding habits and if a regular schedule is carried out with them they will respond much better. They are early risers and the morning feed should be made about 6 o'clock, the second at 10, the third at 2, and the last feed at 5.30 or 6 in the evening. The first feed to be eliminated is the 2 o'clock feed. The next the 10 o'clock, and then the birds are eating at the same times as they do in their natural wild state. All game birds are morning and evening feeders. During the remainder of the day they are quietly resting in the cover of their habitat. Here is the clue to successful handling of birds in confinement. Always sow some kind

of cover crop in the rearing pens [illegible] protection the same as they would [illegible] should be provided with [illegible] or breeding pens.

Fig. 23. The building and [illegible]

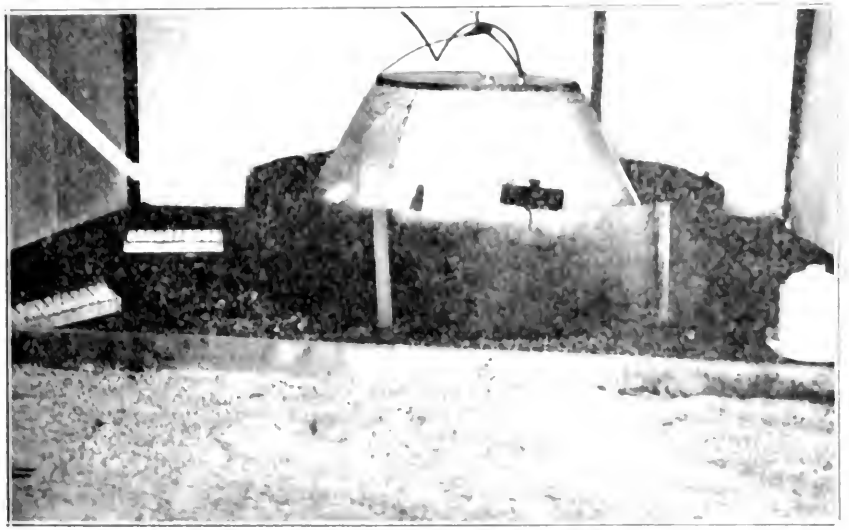

Fig. 24. For the first few days young birds are [illegible] of an 18-inch circle set to start with at [illegible] hover. Day by day this circle is enlarged and [illegible] entirely.

KINDS OF COVER CROP

Buckwheat has proven one of the best cover crops for the rearing of young birds. It affords cover protection as well as excellent green

food. For breeding pens, transplanted kale plants, about 24 plants to a 24-foot square pen, with oats and vetch drilled in rows 8 inches apart. Seed the oats and vetch together. In order to have breeding pens ready for the season it is necessary to start preparing them in the fall so they will be suitable for the birds about the first of March.

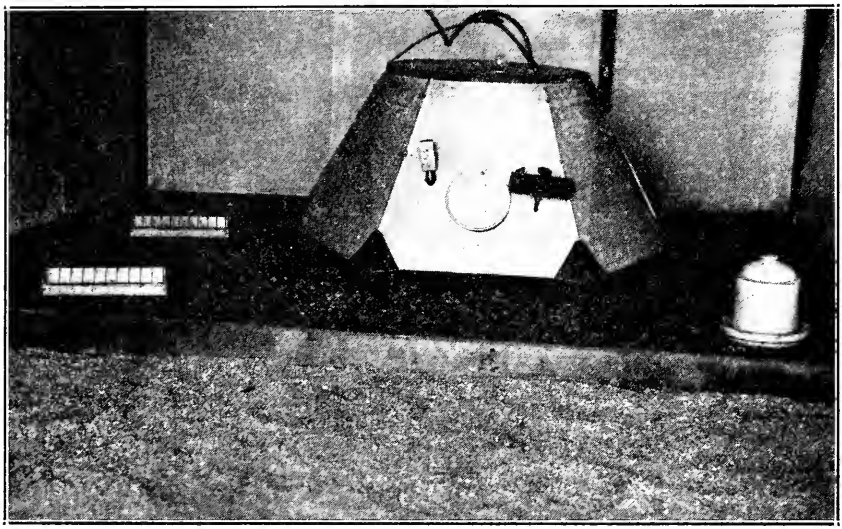

Fig. 25. Dry mash feeding trays and watering jars are placed near the hover until the birds are well acquainted with this equipment. This picture shows the division of the brooder room floor, the back part being covered with sand and the front half with rice hulls.

RATIONS FOR BREEDING STOCK

A good scratch feed and a wet and dry laying mash will prove beneficial for all kinds of game birds during the egg producing season. Use covered feeding troughs or hoppers for the dry mash and metal plates of some kind for the wet mash. The scratch feed may be fed on the ground. Pheasant meal number 5, prepared as before mentioned, 10 per cent crissel, and 25 per cent rolled oats, will give a good laying ration. The following formula affords a good dry laying mash, and should be ground coarse. Ground yellow corn 30 per cent, ground wheat 30 per cent, ground barley 15 per cent, fish meal (good grade) 12.5 per cent, dried buttermilk 5 per cent, alfalfa blossom meal 4 per cent, ground oyster shell 2.5 per cent, and ground limestone 1 per cent.

Ring Neck and Mongolian pheasants breed well in the ratio of five hens to each male with at least 64 square feet of pen room per bird. Valley quail do well when mated in the ratio of 7 males to 10 hens. Most of the partridges are strictly monogamous and seem to do better in pairs. Silver, Golden, and Amherst pheasants do better in trios. The Reeves breed well with three hens for each male with plenty of pen room.

It is not advisable to set different species of eggs under the same hen due to the different incubating dates. The following table gives the incubating period for many of the common breeds of birds usually kept in confinement either for pleasure or profit

Ring Neck pheasant 23 to 24 days
Mongolian pheasant 24 to 25 days
Quail (Valley and Mountain) 22 to 23 day
Partridges 22 to 23 days
Silver pheasant 26 days
Amherst and Golden pheasant 22 to 23 day
Reeves pheasant 23 to 24 days
Turkeys 28 to 30 days
Guinea fowl 28 to 30 days
Ducks 28, excepting Muscovy 33 to 35 days
Geese 30 to 33 days.
Pigeons 17 days from time second egg is laid
Domestic chickens 19 to 20 days for light breeds to 21 for heavy types.

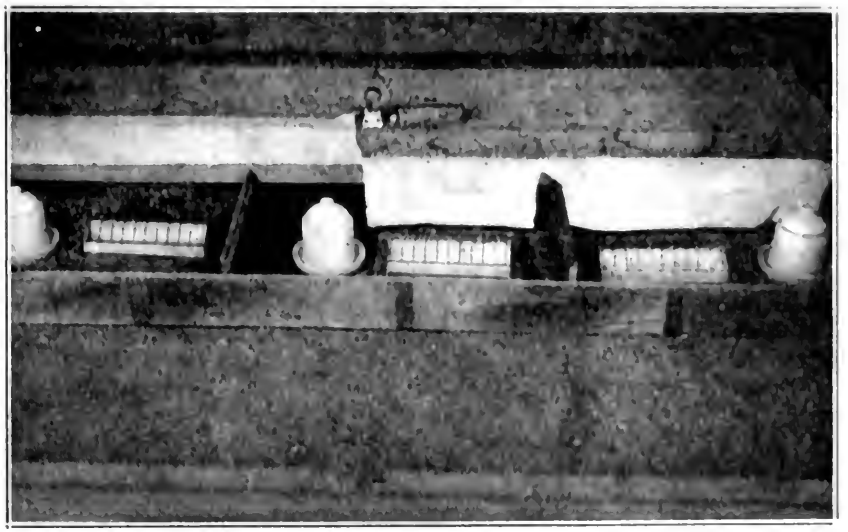

Fig. 26. Special quail brooder. This brooder seven feet [illegible] wide [illegible] divided by two partitions into three compartments, covers the back part of the room. The heating elements are nichrome wire. This heating element is similar to that used in small incubators. The brooder will accommodate 75 birds [illegible] to each compartment. At the end of ten days the two partitions are removed and the birds treated as one flock. These brooder houses are eight feet [illegible] with an 8 x 12-foot run.

In such a short bulletin it is not possible to go into all the details so we have tried to call attention to the more important facts as they have impressed us in our years of experience breeding and rearing game birds. It is the hope of the author that some good may be done and the work of the amateur breeder made easier.

FIFTY-FIVE YEARS AGO ON THE McCLOUD RIVER

By Edward N. Moor

FIFTY-FIVE YEARS AGO I received the answer to a long desired wish, to fish the McCloud River in northern California. I have a record of this trip in an old sketch book, with dates on the sketches that pin my memory down to June, 1876. At that time, even when all the streams within easy reach of San Francisco presented good sport for the lover of angling, the McCloud was looked upon as being the one place of all others to visit.

I recall in those days the possibilities within easy reach of this city, and the man who now passes these places in his automobile, unquestionably doubts that such could have been the case, even in horse-and-buggy days. A small rivulet that passed right through the present town of Burlingame was "fishable" in April, when the season opened, and enough could be caught for a fair mess; San Mateo Creek from San Andreas Valley right through the town and to tide water, was good; San Francisquito, and all the small streams below that to the south, would surprise one, for they were overlooked most of the time. In Napa County every rivulet that debouched into Napa Creek on both sides of the valley was well filled with trout; in fact, a trip to any of these places brought satisfactory results; a bit further away in Sonoma County, both forks of Austin Creek, Ward and Kidd creeks; the Upper Gualala; all almost untouched by outside visitors, and even the residents, farmers and stockmen, seldom indulged in the sport. It was the exception when one met another fisherman on these streams, and there were no beaten paths or footprints on the creek bed, gravel, or sands that told of a procession of fishermen being ahead of you.

There was no limit, and I do not remember a single instance wherein waste or wanton catches were made. There were always plenty left for the next fellow.

Even all these possibilities of April first paled when the McCloud came into one's thoughts, for that place was the ultimate.

The train trip to Redding, an all-day ride, and the stage from Redding north about 9 p.m., an all-night ride, brought one to Sisson's the next morning about breakfast time. It was a rough, rapid ride, thoroughbrace stages carried the mail, and they were hard riders, and all bumps worked vertically—on the passengers, and plenty. Sisson's was the starting place for the sportsmen, and they came from far and near at times to that place, seeking a good game country. Mr. Sisson kept a hostelry wherein everything could be had to go north, south, east or west. He knew the country and had about him men fully capable, and good companions as well, to give the visitor every answer to his desire to angle or hunt.

My companion, Jim ———, and self joined forces at Sisson's with two San Francisco business men off on a trip, and we four, with Jerome Fay, the guide, outfitted for a visit to the McCloud. Jerome was one of the best men I ever went out with and he had many tales

of experiences in that country. One that evidenced his standing was of a night passed on the summit of Mount Shasta with that wonderful lover of nature, John Muir, caught in a storm and with the lava trail they did not dare descend the mountain and passed the night enjoying the comfortable warmth of a hot spring below the summit. Mr. Muir in his interest in all about him could not be hurried to [illegible] until too late to do so with safety.

The ride to the McCloud took one through fine timber country and the road was practically a rough trail throughout. The first view of the stream came from the edge of the lava cap above it's course and a steep grade leading down to the river at the Horse Shoe Bend. A large pool, with white water at its upper end and the same below it was a sight thoroughly satisfying, for in it salmon and trout could be seen in quantity. A foot log crossed the rapids above a large yellow pine tree hole; and the face of the stream just about reached the upper side.

Into camp, on a strip of land in the bight below the pool we settled down and got into shape to stay indefinitely until we had enough. I owned an English green heart salmon fly rod, and as soon as possible rigged up and sought the center of the foot log at the head of the pool. It was bait fishing, with spawn, for it was accepted that when the salmon came up to spawn that was the only method to follow. I dropped my tackle downstream from the log, and almost before I had settled myself into a receptive position I had a strike and the trouble started. The manner in which that fish rammed about the pool showed that he possessed strength and determination as well. I handled him all right, and as might be imagined, full of excitement and as busy as could be, when right in the middle of the fracas one of the pair we joined with walked out on the log, rod in hand, and tried to get me to pass him my rod; he couldn't keep his hands off. Finally got him subdued. I mean the man, and about that time the salmon came upstream, passed under the foot log, and I was handling the rod on the lower side, with the fish, I should say, thirty yards upstream above me, managed to keep from snagging the log, and the next move was a downstream rush the length of the pool, into the rapid outlet of same. I gradually put on brakes, and when the line was about gone we parted company abruptly. And the other fellow said "I told you so"! I have found we all have — that things will crop out of humanity, when fishing and camping, in pursuit of happiness, that cause wonderment as to just how they ever entered the other fellow.

That was the last one I lost. A weak line, from salt water, was the cause, and soon corrected.

That day was enough of the salmon. Some were fresh run and in fighting shape, but many were battered and bruised from their long fight upstream. Lighter tackle and the rainbow trout kept me busy and interested from then on. Some distance below camp a small stream came into the McCloud from the west. There was an eddy caused by an out-reaching point and accessible, with good landing surroundings. I took from that spot and a reach just below, seven fish that scaled twenty-one pounds weight one afternoon—rainbow, with the exception of one Dolly Varden, six and one-quarter pounds. It was by long patient work that I finally succeeded in getting that

large fellow to hook. He had an abiding place between parallel reefs of rock with the stream bed, in about six feet of water; my first cast close to him brought him forth to within about a foot of the hook, and then a retreat into his runway where he could be plainly seen stemming the current, which was rapid, but not surface-broken. I do not remember how many times he came so far and no farther. Jim and I determined to get him if it took all day. My companion derived as much pleasure from carrying the landing net as from fishing, and he rested and took it easy, enjoying everything in his preferred way. After a number of pipe smokes, much trying, and patient waiting after these rushes that stopped short of the goal, I swatted the hook down good and hard right over him and the offense was too much for him, and a rush came that finished in firmly hooking him, carefully I worked that fellow up to the net, and it was done. That one fish was worth the trip, and he was the only Dolly Varden taken by any of us.

From the coolness of the water came what were really acrobatic trout, for not only once into the air would they go, but time after time, and no give-up until they had actually exhausted themselves with efforts to get free.

There was no one on the stream outside of our party, and no indications of others having been ahead of us. It was as virgin to the fisherman as if it had been one hundred instead of fifty-five years ago. Now I understand that all that ground is owned by individuals and covered by expensive and elaborate summer homes, and I believe a trip there would produce heartache when comparisons were made and companions thought of, in those unspoiled days of 1876.

The fish not eaten on that trip were packed in snow from Shasta's slopes and were brought to San Francisco in perfect shape, despite the length of the journey. There was absolutely no waste of a fish at any time. One hundred and forty pounds of trout were in that ice box.

We disbanded at Sisson's that year and I went back of Eddy Mountain to the west of Shasta with Jerome, after deer. As it was on the McCloud, so it was with the deer on that trip, which ended as far as sport went at Castle Lake, on the way back.

A year later, 1877, Jim and I picked two friends and we went again. We unpacked at the Horseshoe Bend in a driving rainstorm and everything was soaked before we could get under cover. Disconcerting to our two new recruits, whose camping trips had never bumped into anything like it.

After some satisfactory days there a tramp upstream with the rifle brought us to the falls and we determined to investigate the lay of the land above them. They were of such character to preclude salmon getting over them, and if fishing could be good, should be above the falls.

Looking at the map, I believe our camp to have been about where the present town of McCloud now is.

We picked our way through the timber and struck the upper river at the lower end of a long meadow above the upper falls of the river, and made camp in a grove of tamarack pines close to the stream. That

was a stream fairly alive with fish, and the fly would no sooner land than be taken. I caught within calling distance of camp before supper fifty-six fish, and if one desired, a cast of three flies for I tried it would sometimes fill before you got all in. They were different in build from the rainbow, slimmer and not as large in size, just about right to make it interesting with a light outfit.

Upstream not far above camp were three distinct colonies of beaver; dams, indications of their diligent workings, all about, and it was with great interest that some time was passed in watching them. I shot one, and got him after going in up to my shoulders and stubbing my toes against his body, for I had clipped the crown of his head off as it just cleared water, swimming upstream. He sank in easy water and air bubbles showed his location. We roasted his tail and that as far as we got. The pelt I cured and brought home, and as well the skull with its wonderfully efficient chisels in the lower jaw.

At the head of the stream, with their dairy house built over the output of a big spring, and a barrel churn operated by a paddle wheel therein, was a camp of butter makers. They carried their operations on there where the feed was good until the advent of winter. Put up the butter in firkins and hauled it out at the end of the season.

Sisson told me afterward that he did not know of a soul that had fished that upper stretch of the river, and there was no indication of camping anywhere to be seen. One man in an hour could take more fish than we could eat in a day. Too far away to get out to anyone, and the only way was to do something else or stop fishing. We sent the team back to Sisson's and got some of those butter firkins from a barrel factory there, a supply of salt, and the large fish were split down the back and put up exactly as New England mackerel are and each of us had plenty to take home. They were fine eating.

That was fifty-four years ago, and if anyone ever camped in an ideal spot that upper river certainly was the place. Arriving at Sisson's on the way back, the balance of the party went home. I joined a party of four and we went to Yreka, and from there north across the Klamath at Whittles Ferry, and from there into lower Oregon, and northerly to a spot called Buck Lake which could not have been very far from Ashland, Oregon; from there back, northeast of Shasta, touching the lava beds, and back to Sisson's over an old emigrant road to the north of Shasta. On this trip after passing the Klamath no one was met until we got back to that river. Through the country to Sisson's I do not believe we met half a dozen men.

We encountered a very large band of antelope north of Shasta, at least three hundred in the band. Did not hunt them. On these journeys enough venison was had to meet camp needs, no more. It would have been possible west of Sisson's in the Eddy Mountain country to kill a dozen deer a day and not half try, and the same in southern Oregon.

I hope this will convey some adequate idea as to northern California at that time.

I am the only one remaining of all those men, and fifty-five years bring changes in country, and as well to those living in it, that certainly mark time.

DAMAGE BY DEER TO CROPS IN CALIFORNIA

By Gordon H. True, Jr.

THE EXISTENCE of competition between wild deer and cultivated crops in California has long been recognized, but only in recent years has the problem begun to assume economic proportions. In many places, today, we hear demands for relief from those of California's agricultural frontiersmen who, on their far-flung battle line, are waging war against the depredations of the last and most

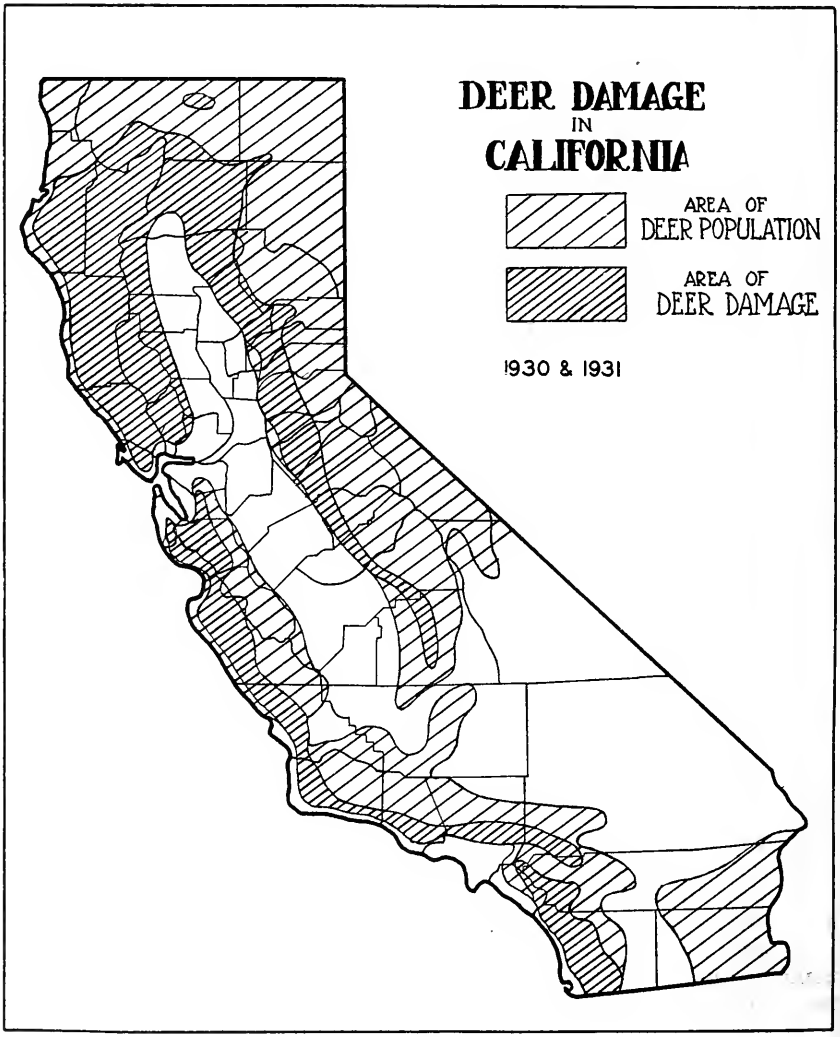

Fig. 27.

successful of our big game [illegible] deer. Since it became obvious that [illegible] follow the road taken by the [illegible] to most of us we have bent every [illegible] They have responded nobly. In [illegible] and sporting value we have been [illegible] with another group in the human [illegible]

That we might better understand [illegible] so arrive at its solution with [illegible] tion was made by the Game Department [illegible] California State Chamber of Commerce [illegible] were obtained through the [illegible]

Fig. 28. West portion of vineyard [illegible] or killed by deer. Vineyard [illegible] County, California. Photo by T. I. Storer.

and game, forest and agricultural officials [illegible] in the files of the Division of Fish and Game and the State Chamber of Commerce. In all, two hundred and ninety-two such reports were available from fifty-one counties. The aim of this paper is to present a picture of the deer damage situation, using as material's the mass of information obtained through the medium of this survey.*

Deer damage occurs in forty-three out of our fifty-eight counties. Those counties which have little or no difficulty are Del Norte, Lassen and Plumas to the north; Sutter, in the Sacramento Valley; San

* Special analysis of the deer damage reports was made by Dr. T. I. Storer and G. H. True, Jr.

Joaquin, Stanislaus, Merced, Kings and Kern, in the San Joaquin Valley; San Francisco and Contra Costa, in the San Francisco Bay region; Mono, Inyo and Alpine, in the southern Sierras; and, in the extreme southeastern corner, Imperial County. These counties are situated for the most part in the high mountains where there is little agriculture, exclusive of grazing, or in our great central valley, where

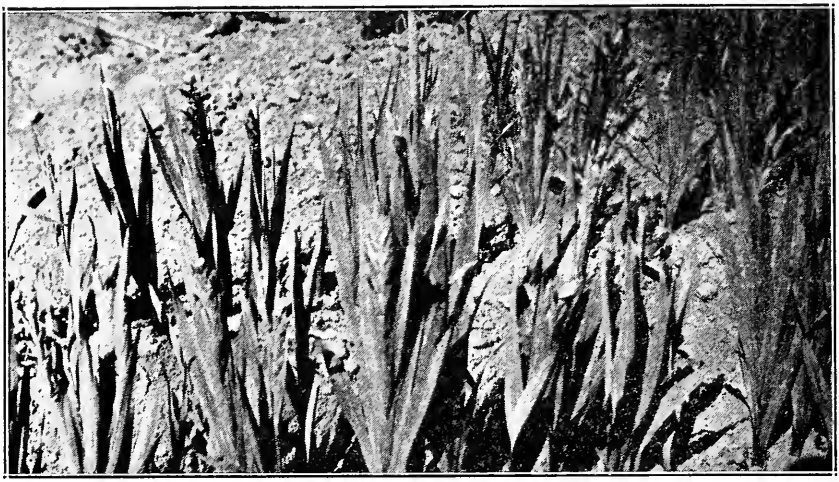

Fig. 29. View of gladioli which have been damaged by deer, the ends of flower stalks which have been eaten appearing as white spots. Nursery of E. D. Rodgers, Swanton, Santa Cruz County. Photo by Donald McLean, 1929.

there is no deer population. Those counties in which damage occurs include within their borders, in most cases, portions of the Coast Ranges or the Sierran foothills. Damage is often found to be localized in certain mountain valleys or in the immediate neighborhood of State and national forests and parks where deer are protected. Game Refuge 1A, in the northern part of Siskiyou County, is an example of this latter condition.

The majority of reports indicate that deer damage is seasonal in occurrence. Although in some places damage occurs throughout the year, in by far the greater number of cases the period of destruction is limited to the actual growing season of the crops affected, with special emphasis on the late summer and early autumn months. On the coast, where the deer population of a given area is relatively constant throughout the year, there is little variation in the amount of damage throughout the period during which it may occur. This is also true of the lower Sierran foothills. At middle elevations in the Sierra Nevada and in the northeastern part of the State there is a noticeable increase in damage over the normal amount during the period of migration of the deer to and from their summer and winter ranges. This has been noticed particularly in El Dorado County, where the deer damage problem has been given especial attention. Regardless of the fact that the greatest amount of damage has been reported as occurring during the latter part of the growing season, the author has observed that, at least in the coastal region, the most serious damage occurs during the early part of the summer when plants are sending

out the first tender shoots. At this time a few deer may do more damage than a larger number later in the season. It is reasonable to assume, however, that a greater number of deer [illegible] expense during that period when natural forage [illegible] cultivated crops kept green by irrigation in [illegible] to the wild forage.

Opinion seems to be that deer damage [illegible] in California. A few persons report that [illegible] or that there is a decrease in the amount of damage [illegible]

Fig. 30. Individual vine showing [illegible] some damage to berries. Vineyard of [illegible] northwest of Yountville, Napa County, [illegible] T. I. Storer, October 11, 1930.

activities of the deer seem to have actually come to a standstill or to be decreasing in only one area, Tuolumne County. This may be accounted for by the fact that the deer population of that region has not yet recovered from the reduction which occurred during the epidemic of foot and mouth disease in 1924–25, when over 22,000 deer were slaughtered in successfully preventing the further spread of that

malady. A majority of the reports from over the State indicate that the present wave of deer damage complaints is founded upon an actual increase in deer, rather than being a hysterical response to the increased attention that the problem has received.

Reports concerning the period of time over which deer damage has occurred are exceedingly variable. Several state that deer have been damaging crops ever since the beginning of agriculture. Others indicate a ten to twenty year period. In most instances damage is reported as more serious during the past one to five years.

Innumerable factors have been mentioned as the causes of deer damage. Among them are shortage of natural feed, scarcity of water on the deer range, increase in deer population, desire for succulent feed, concentration around salt-licks, planting of crops in the midst of deer inhabited areas, and a lessened wariness on the part of the deer. Several correspondents have suggested that, while the present situation is due primarily to an increase in the deer population, particularly

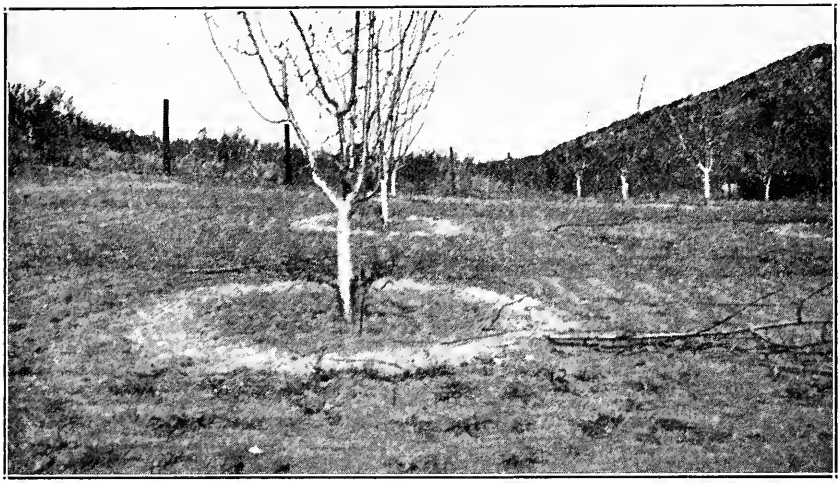

Fig. 31. View of orchard showing malformation of trees due to continued eating back. The branches in the foreground have been broken off by deer. El Dorado County. Photo by R. C. Berriman, February 27, 1931.

does, we must consider as an indirect cause that factor which has aided to such an extent in bringing about this increase; namely, predatory animal control. Campaigns directed toward the extermination of predatory species, principally mountain lions and coyotes, have relieved the deer population of considerable pressure. This has resulted in an almost startling increase in the deer population of some areas. We have only to look back at the Kaibab situation in order to realize that such an assertion may not be entirely without foundation. However, the deer damage problem can not be attributed to any one factor. Granting that our deer population has increased, that increase, plus any one or any combination of other factors, would be enough to bring about a situation such as we are facing today.

Despite the fact that an opportunity was afforded correspondents to express an opinion regarding possible competition between live stock and deer on the wild range, this was mentioned as a factor in only

a few cases—ten, to be exact—enough to show that there is at least a potential problem presented by such competition.

An attempt to arrive at an estimate of financial loss to the state as a whole, as a result of deer feeding upon cultivated crops, would be an almost impossible task if one were dependent solely upon the figures contained in the deer damage reports. One individual may estimate the loss to his county at ten thousand dollars, another individual from the same county may arrive at a much lower estimate or indicate the financial loss as negligible. There are cases in which the reported loss reported by an individual farmer far exceeds the estimated loss reported by some other correspondent for the entire county. We may assume, however, that the estimate submitted by an individual as to his own loss is more nearly correct. Out of the tangled mass of figures at our disposal the accompanying table has been assembled. It can, however, only a very rough and incomplete picture.

TABLE I

Estimates of financial loss due to deer damage to various individuals and counties in California

Estimated Financial Loss per Individual

County	*Maximum*	*Maximum*	*Minimum*	*Loss Reported by Individual Farmer*	*Loss Reported by Individual Farmer*
Lake	$10,000	$2,000	$ 25	$ 50	
Los Angeles	150,000	2,000	25	5	
Monterey	20,000	2,000	10	100	
Riverside	100,000	5,000	25	5	
Siskiyou	100,000	1,000	60	1,000	
Trinity	6,000	1,000	200	1,000	
El Dorado	1,500	500	150	2,000	

Total for seven counties

Average loss per individual in seven counties $20

Estimated Financial Loss per County

County	*Maximum*	*Maximum*	*County*	*Minimum*	*Maximum*
El Dorado	$500	$2,000	San Bernardino	$5	$
Fresno	250	1,000	San Diego	2	
Lake	200	2,000	San Luis Obispo	2	
Los Angeles	500	1,000	Santa Clara	2	
Mendocino	200	500	Santa Cruz	2	
Monterey	2,000		Siskiyou	2	
Napa	1,000	10,000	Sonoma	2	
Nevada	500		Trinity	2	
Orange	500	1,000	Tulare	2	
Riverside	2,000	5,000	Tuolumne	2	

Totals for twenty counties $ $

Average minimum loss per county $1,37+
Average maximum loss per county $4,541

In 1930 a survey was made of damage by deer to orchards of El Dorado County, by Mr. Ivan W. Lilley, farm adviser, who has kindly supplied the following data. Due to his careful and painstaking work we are able to present a very complete statement of the financial loss to El Dorado County farmers as a result of deer damage. From about 300 questionnaires sent out, reports were received from ninety-eight farmers. Of these, eighty-nine reported damage to field crops, to young trees set back one to three years, and young trees killed which had to be replaced. The number of trees set back one year was 11,646, two years 9212, three years 8366; the number of one year trees replaced 11,812, of two year trees replaced 3625, of three year trees replaced 1931. The value of trees lost totaled $27,584 (using cost records com-

piled by the University of California of $0.90, $1.40, and $1.90 for one, two and three year old trees, respectively). The damage to field crops, owner's estimates, totaled $9,915. The total damage reported for eighty-nine farms was $66,667.84, or an average of $740 per farm. The annual damage totaled $16,728.27, or an average of $185 per farm. The annual damage on farms varied from $1.50 to $855, and the total damage to individual farms from $5 to $872.

Concluding this general discussion of the deer damage situation, it will be well to consider more in detail the crops which are damaged and the nature of the damage to each type of crop. Deer, in those sections of California where they are in the habit of invading cultivated areas, enjoy a large and varied diet. During the study carried on by the Game Depredations Study Committee, those complaining of deer damage were asked to name the specific crops affected. The resultant list of crops (see Table 2), compiled from reports received by the committee and supplemented with observations by the author during his study of the problem in his official capacity as a member of the Division of Fish and Game, is appalling in its variety. If one were to call the roll of agricultural crops grown in California, there would be only a few among those present which could not be also found on the bill of fare of the deer.

For the sake of convenience the crops subject to depredations by deer will be considered under subheadings, as follows: orchard crops, truck crops, forage crops, cereal crops, and miscellaneous.

TABLE 2

Crops damaged by deer in California. Statistics compiled from questionnaires sent out by the Special Game Depredations Study Committee of the State Chamber of Commerce. Many correspondents reported damage to several crops; this explains the seeming discrepancy between the total number of reports received and the number of reports of damage for the several crops

Crops	*Number of reports*
ORCHARD:	
Apple	83
Pear	48
Prune	36
Peach	33
Citrus	25
Apricot	20
Avocado	14
Cherry	5
Persimmon	1
Plum	1
Olive	1
Almond	1
Walnut	1
Chestnut	1
Fruit trees (misc.)	26
Total	296
TRUCK:	
Potatoes	9
Beans	7
Corn	6
Strawberry	6
Cabbage	4
Lettuce	4
Carrots	3
Tomatoes	3
Peas	3
Beets	2
Melons	2
Cauliflower	1
Celery	1
TRUCK—Continued	
Squash	1
Artichokes	1
Truck gardens (misc.)	91
Total	144
FORAGE:	
Alfalfa	78
Range	10
Clover	5
Hay (?)	4
Vetch	1
Timothy	1
Sudan	1
Total	100
VINEYARDS:	
Various varieties	94
CEREAL:	
Barley	3
Oats	3
Wheat	1
Grain	15
Total	22
MISCELLANEOUS:	
Flower gardens	18
Seed gardens	15
Bulbs	10
Acorns	2
Forest plantations	1

Heading the list by a large majority we find the orchard crops. There are 296 reports of damage to fruit trees of which 270 refer to specific varieties. The remainder are simply designated as "fruit trees" or "orchard". To some, the wide variation in the numbers of reports of injury to separate varieties might indicate that the deer are selective, preferring one variety of fruit tree to another. Granting that differences in palatability are undoubtedly a factor, there is little question that this variation is primarily due to crop distribution. In other words, the varieties of fruit trees which suffer the most damage are those which are grown extensively within the range of the deer. Apples, for instance, are found throughout the foothill and mountain regions of California and are grown on a commercial scale at higher altitudes than any other orchard crop. Is it not probable, then, that apple trees would be more subject to damage than other varieties of trees not so well adapted to mountain conditions? El Dorado, Lake and Mendocino counties are the finest pear producing sections of the State; and, they are among the first in amount of deer damage.

The greatest amount of damage to fruit trees occurs during the first one to three years after planting, since, during this period, the deer are able to reach the tender terminal shoots. If these shoots are destroyed during the early years, the tree suffers a serious set back. Often, if these shoots are eaten early in the season, they will grow out again during the same year. If they are again destroyed death of the tree is a common result. Even if a tree does survive several attacks it becomes so stunted and malformed that it never becomes an economic member of the orchard. That more trees are destroyed during their first year than in their second, and more in their second year than in their third, is borne out by the statistics obtained from the deer damage survey of El Dorado County, previously mentioned. It was found that, over the period of time during which the farmers of that county had been troubled by deer, it had been necessary to replace 11,812 one year old trees, 3625 two year old trees and only 1931 three year old trees. The degree of susceptibility of a tree to deer damage decreases markedly with increase in age and consequent increase in height. In comparison to the amount of injury done to young trees, the amount done to mature trees is slight. In Santa Cruz County, the author has visited a number of orchards, planted before deer had become troublesome, in which it is impossible, due to the increase in the deer population, to rear young trees at the present time. The mature trees, however, show little evidence of damage. Damage to mature trees is limited, for the most part, to the "pruning" of the lower branches.

There is, as a general rule, little damage to the fruit itself, which is usually safely out of reach. Prune growers in Napa, Sonoma, and Santa Cruz counties, however, state that they suffer considerable losses due to the deer eating the prunes that have fallen to the ground. The truth of this statement is supported by the observations of the author, who has not only seen deer picking up prunes, but has seen the ground literally covered with the stones of the fruit that had been eaten previously. Some growers find that they can reduce their losses to a considerable extent by picking up all the prunes from the ground at the end of each day. Thus, the prunes that have fallen between morn-

ing and evening are saved and only those which may fall during the night are likely to be eaten by the deer.

The list of truck crops includes all of the common vegetables with the exception of spinach, turnips, radishes, cucumbers, egg plant, and peppers. In referring to the table, however, it will be noted that ninety-one of one hundred forty-four reports merely state that "truck crops" have been damaged and name no specific varieties. It might be possible that some of the common vegetables not included in the list would be found susceptible to damage if more specific reports had been made. In view of that fact, it would not be fair to state that deer will not eat those varieties. In reporting damage to truck crops correspondents did not differentiate between damage to the average farmer's kitchen garden, containing small amounts of a variety of vegetables, and the commercial truck farm of large acreage, devoted to the cultivation of, at most, only a few varieties. We know, however, that a number of the truck crops upon which deer have been known to feed are grown commercially within the deer range, principally in the coastal region south of San Francisco Bay; among them, beans, peas, lettuce, cabbage, cauliflower, and artichokes. In the northern part of the State, particularly in Shasta County, strawberry plants are grown commercially. Deer seriously damage some of these strawberry plantations not only by actually eating the plants, but by walking between the rows and thereby breaking the innumerable runners sent out by the "mother" plants. This latter procedure greatly reduces the yield of young plants with a consequent reduction in revenue. If one doubts the ability of the deer to subsist on a wide variety of forage, one has only to review the truck crop situation to have the omniherbivorous nature of the deer most emphatically emphasized.

The forage, or hay, crops, by virtue of including alfalfa within their ranks, are found to occupy third place on our list. Seventy-eight of the one hundred reports of damage to these crops refer to alfalfa. Where this crop is grown within the deer range, and much of it is, an immense amount of damage is done. One Lake County farmer writes, "I have two fenced alfalfa fields of approximately the same acreage. One has not been pastured this season (1930) and the other has supported a band of sheep throughout the summer. Deer have kept the unpastured field eaten down shorter than the field in which sheep have been kept. With the aid of a flash-light, I have counted as many as sixty-eight deer in the field at night." This is but one example of the injury that deer may cause the farmer who depends on alfalfa for all or part of his livelihood. There are numerous cases in which the farmer has been able to cut only one crop of alfalfa hay, the first, the deer keeping the green alfalfa cropped short during the remainder of the season. Losses of from three to thirty tons annually have been attributed to deer. That deer will travel long distances to feed on green alfalfa is shown by the authentic case of a buck, killed in Lake County at a distance of twelve miles from the nearest cultivated land. His paunch was found to be full of alfalfa. It is interesting to note, among the reports of damage to forage crops, ten instances of competition between deer and live stock on wild range. I. B. Barrass, Covelo, estimates that, during the 1930 season, deer destroyed one-third of his winter feed. While such reports are few in number, we have enough

information to show that the existence of such conditions can be overlooked.

Since, on our list of crops the various categories have been arranged according to the actual number of reports received, vineyards must necessarily take fourth place. Damage to vineyards is much more serious than this position would indicate. In the opinion of the author, damage to vineyards is second only to that suffered by [illegible]. The individual vines composing a vineyard, like the trees of an orchard, are nonproductive during the first few years of their existence; in other words, until they become mature. After maturity, the vine may be depended on to produce an annual crop. If a vine is killed or destroyed during the course of any one growing season, the grower loses not only the crop for that season but for future ones as well. If the same or a series of injuries should result in the death of the vine it must be replaced. The new vine must be cultivated "for nothing" until it comes into bearing. It is easy to see that the farmer who must continually replace vines that have been destroyed will not reap large profits, since he will always be cultivating and caring for a number of vines that are not producing. The loss to the vineyards is therefore greater than the loss to the truck or grain farmer who plants his crops annually, or to the maker of hay who grows the type of crop that can withstand periodic cutting back.

The greatest amount of injury to vineyards occurs when the first leaves are making their appearance in the spring. If the vines are defoliated during this period, the greater portion of the flower clusters—the embryo crop—are destroyed. In spite of the best cultural methods vines so injured will produce at best only a light second crop of grapes. Again comparing the vineyard with the orchard, it is found that defoliation of the vines causes them to suffer a severe set back. Successive attacks result in death. Vines which have successfully passed through the early growing stage and have developed a wealth of foliage seem to lose much of their tempting qualities in so far as deer are concerned. However, where these animals are numerous and hungry, vines may be defoliated during the late summer and early fall months, even until the autumn-hued leaves fall to the ground. Not contenting themselves with the foliage alone, deer frequently vary their diet with the bunches of grapes. They strip the fruit from the stems, and, judging from the skins and seeds to be observed on the ground in the neighborhood of the vines, suck out the juices, discarding the above-mentioned parts. Often, rather than destroying a whole bunch, they will merely take a bite or two. It is needless to say, however, that even a slightly injured bunch of grapes has been rendered unmarketable. Although the author has noted no instance in which any one variety has remained immune to deer-invasion, it is evident that deer show a marked preference for some varieties. In Napa County, for instance, deer seem to prefer Petite Sirah, a wine grape; Muscats and other varieties of table grapes. Considerably less damage is done to some of the other wine grapes, such as Zinfandel and Burgundy.

Damage to cereal crops, or grain, is not very extensive, most of the reports of damage to this type of crop having originated in Trinity County. As a whole, very little grain is grown in deer inhabited areas, and while here and there a small grain field in a mountainous

area may be damaged, the total loss over the State can not be very large. Deer injure grain principally by nipping off the heads when in a green condition and by trampling down the stalks.

Injury to flower gardens, standing first under the subheading "Miscellaneous Crops," is, from the observations of the author, a more serious problem locally than the number of reports would indicate. Deer damage questionnaires that were filled out and returned referred to farming communities alone and did not include suburban areas, such as may be found in the vicinity of the Mount Tamalpais Game Refuge and in San Mateo County. The author has spent considerable time in the neighborhood of Ross, San Anselmo, and Fairfax, all towns bordering the Mount Tamalpais Refuge in Marin County; and if, from those towns alone, all reports of damage had been available, they would have amounted to many times the number actually received. The amount of damage done to gardens in this area is quite extensive, the semidomesticated deer entering them in broad daylight to feed on the choicest blooms. Damage to flower gardens, regardless of financial loss, is extremely annoying to the owners, many of whom have built homes in suburban areas that they might make a pastime of floriculture. The fact that most of the eighteen reports which have been listed originated in rural districts indicates, however, that such damage is not entirely limited to localities beyond the metropolitan areas. In these last it is merely aggravated. Deer will eat at least part of most of the common annuals, perennials and shrubs, showing a decided preference for roses.

Fifteen reports were received of injury to seed gardens. In no case, however, did the complainant specify the varieties of seed. The damage, here, is undoubtedly of the same type as might be found in any truck or flower garden and needs no further discussion.

A few bulb growers, particularly in Santa Cruz County, have suffered losses. Deer seem to be rather partial to gladioli and it is from those who grow these plants that the greatest number of complaints has been received. Deer usually begin working on a gladioli patch just before the first blooms appear, walking down the rows and removing the buds as they go. This destruction of the buds not only prevents the grower from marketing flowers but interferes with the "rogueing" that is necessary to keep varieties pure. Deer have also been known to eat freesias and narcissus. They do not seem to care for calla lillies, which are grown extensively in Santa Cruz County. Fortunately, the number of bulb growers who are carrying on their activities in close proximity to deer country is small, and, therefore, though the losses to individuals have been rather large in certain instances, the industry as a whole has not suffered to any extent.

Reports of damage to acorns came as something of a surprise, since they are not ordinarily considered in the category of agricultural crops. One of the complainants, a resident of San Luis Obispo County, made the statement that in the past he had been able to fatten 100 head of hogs annually on acorns on a certain area. In recent years, however, the deer had become so numerous there and had shown such a liking for acorns that he had been forced to abandon that profitable practice.

The Los Angeles County Forestry Department reports deer damage to a large percentage of their reforestation projects, the damage being localized in small plantations. The damage consists of nipping off the

tips of young trees, both conifers and hardwoods [illegible] Aleppo Pine, Incense Cedar, Big Tree, Black Locust, [illegible] and Carob. They also damage trees by trampling and rolling [illegible] making runs and beds throughout the plantations. Practically all [illegible] plantations are within a game refuge. On one plantation in sample areas [illegible] staked Aleppo Pine and Carob, all of the trees were eaten, [illegible] 90 per cent of the trees died as a result of deer injury.

The subject of control of deer damage will not be discussed here. Of the three principal methods of control, fencing, the killing of deer doing damage, and the use of repellents, the former has been made the subject of a previous paper.* The killing of [illegible] made possible by recent legislation but, as yet, there are no records on hand upon which a discussion of the effects of that procedure can be based. A discussion of the use of repellents is of sufficient importance to warrant separate consideration and will, therefore, be made the subject of another paper.

OYSTER PESTS IN CALIFORNIA†

[illegible]

CALIFORNIA has a native species of oyster, *Ostrea lurida*, which has great commercial possibilities but which has never been utilized to any great extent. From the beginning of the industry exotic species have been brought into the State with varying degrees of success. The growers have been encouraged to bring in the foreign oysters and their investments have been protected by legislation. There has, however, been no provision made for the inspection of incoming shipments and as a result some of the California bays have become heavily infested with the Eastern drill, *Urosalpinx cinerea*, Say, and the slipper shell, *Crepidula fornicata*, Linnaeus. The drill is always destructive but the slipper shell on its native heath, in the presence of its natural checks, is not harmful. When transplanted the slipper shell may become a serious pest in the new environment. The native oyster industry in particular has suffered from its introduction and it is important that due consideration be given this species in the administration of the oyster resources of California.

The American slipper shell or "quarter deck" is normally scattered along the New England coast and southward to the Gulf. They usually inhabit tide pools and shallow water, clinging to rocks, shells and other solid objects. They appear most frequently in clusters of six to ten individuals attached one upon another to a single object. The life history and embryology of this form have been of interest to scientists for some time, and the facts concerning its growth and development of the species have been well worked out. Only in recent years has it become of economic importance as a pest on the oyster beds.

* Storer, T. I., and True, G. H., Jr., Deer Proof Fences in California, California Fish and Game, Sacramento, Vol. 17, No. 3, pp. 264-269.

† Printed with permission of the U. S. Bureau of Fisheries.

Recently the American slipper shell was introduced in the oyster producing waters of Great Britain through transplanting of American seed oysters. They have reproduced rapidly and have become a great menace to the oyster industry. In the lower end of Puget Sound where the native is produced in large quantities the slipper shell has become established. On the natural beds where the land has not been graded and diked the slipper shell does not grow in large numbers; on the artificial beds they are a serious problem.

The artificial beds are made up of a series of terraces each level of which is surrounded by a low dike which keeps two to fifteen inches of water over the bed at low water. The bottom is solid and covered with shell and oysters, making an ideal breeding place for the slipper shell. The damage by the pests is from three causes: (1) culling is made slow and difficult, (2) the pests occupy a large proportion of the room in the dikes designed for the oysters, and (3) from the condition of the oyster from infested areas it appears that the food of the oyster is taken by the slipper shell.

In the harvesting of some beds over half of the labor involved is in the handling of pests. More equipment is necessary to maintain production and the cost per bushel for harvesting is increased. If left on the beds the slipper shell would fill the dikes to the water level in a short time and prevent the growth of oysters therein. Removal of the pests from the beds is also necessary to prevent depletion of the food supply of the oysters.

It is possible that some means of biological control will eventually be worked out but at present removal by hand is the only relief. It is important, whenever possible, to prevent the introduction of pests of all kinds and avoid the serious loss which follows. At the present time we have no diked areas in California, but it is proposed to cultivate the native oyster in Humboldt Bay by this method. This place offers an ideal set of conditions for the industry and is entirely free from natural and imported pests. The introduction of detrimental species should be carefully avoided if the beds are to be made to produce to capacity.

Since the seed imported from Japan has been subjected to inspection the quality has greatly improved. At present practically nothing accompanies the oyster that is large enough to be visible. As an added precaution it would be well worth while to isolate imported seed as far as possible, and grow one species in each bay. In the case of Humboldt Bay it is strongly recommended that no opportunity be given to pests to establish themselves there. No foreign seed should be planted at any time regardless of its condition or the inspection it has been through.

CIRCLE GILL NETTING FOR SMELT

By [illegible]

[illegible]

A LARGE PORTION of the smelt catch of the M[illegible] fresh fish markets is brought in by op[illegible] the balance is delivered by operators of [illegible] (a purse net). Circle gill netting is carried [illegible] the smelt are in shallow waters. When [illegible] during the winter months, netting operat[illegible] haul and on occasions with ring nets. Smelt are [illegible] at Monterey throughout the greater part of the year, although peak periods of landings come in during the summer months.

The term "smelt" is a rather universal one [illegible] applied to the members of two families of fishes, the Osmeridae or true smelts, and the Atherinidae or silversides. The most outstanding distinguishing characteristic of the two groups is the presence of an adipose fin in the Osmeridae and the absence of such in the Atherinidae. At Monterey the smelt catch is composed mainly of two members of the Atherinidae group: the jack smelt (*Atherinopsis californiensis*) and the bay smelt or panzarotti (*Atherinops affinis*). The grunion (*Leuresthes tenuis*), third California member of this group, is not present. The balance of the smelt catch is composed of whitebait (*Allosmerus elongatus*), and surf smelt (*Hypomesus pretiosus*), members of the Osmeridae or true smelt group. From observations made during 1931 it is safe to say that throughout the year 90 per cent of the smelt taken at Monterey are jack smelt.

The bay smelt may be differentiated from the jack smelt by its slightly deeper body; its larger scales; the upper jaw projecting slightly over the lower jaw, whereas in the jack smelt both jaws are even; the back portion of lighter color than that of the jack smelt; the teeth being forked at the base, those of the jack smelt simple.

Circle gill netting for smelt in Monterey Bay is divided into two phases: the large jack smelt phase and the bay smelt phase. Circle gill netting for jack smelt may be termed a spring and summer fishery. It commences about April and usually runs into September or October. During this period the large jack smelt are in shallow water. With the movement of the jack smelt into deeper water in the winter months, this type of fishing ceases. Catches are then made with round haul and in a few cases with ring nets. Gill netting of smelt, when possible, is preferred to capturing by round haul or ring nets. The wild nature of the smelt when frightened makes the latter nets hard to handle while being pulled in. With a gill net the proper sized fish are helplessly gilled, and the net easily hauled in from one end.

Circle gill netting for bay smelt may be termed a winter fishery. Operations commence with the first appearance of the bay smelt during

[illegible]

* Contribution No. 120 from the California State Fisheries Laboratory, January, 1932.

the latter part of October or the early part of November, and may run into January or February. However, the heaviest catches are made during the first month or so of the "run." The catches then diminish and may be intermittent during the balance of the winter.

The basic principle of circle gill netting for smelt is to surround a school of desirable smelt with a net of webbing of uniform mesh. Then,

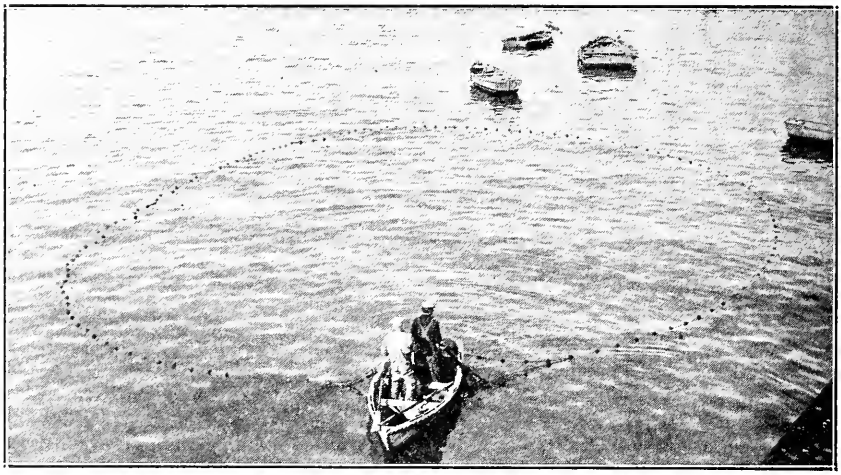

Fig. 32. A gill net laid out in a circle for smelt fishing. Photo by J. B. Phillips, November, 1931.

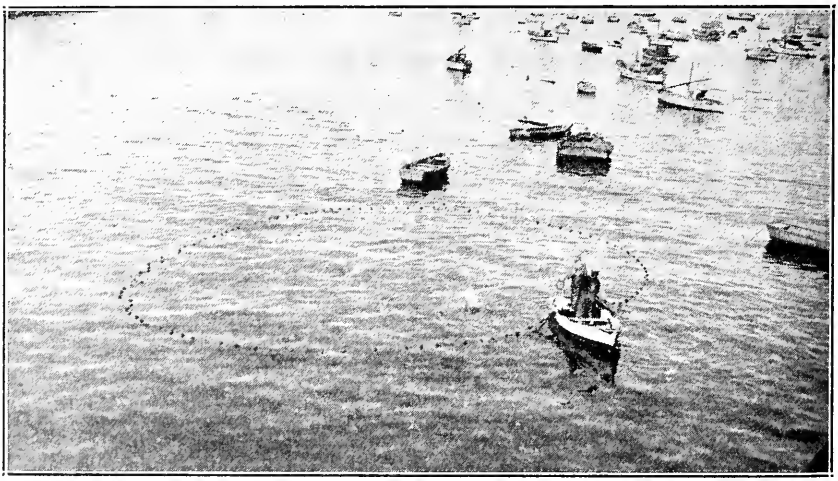

Fig. 33. Process of frightening smelt into gilling themselves while circle of netting is being decreased in size. The common method of "scaring" is as shown in Figure 34. Photo by J. B. Phillips, November, 1931.

as the smelt hover inside the circle with apparent uncertainty, they are frightened into gilling themselves by use of a "scare." The set is made in shallow water so that the lower edge of the net approaches bottom, thus preventing escape in that direction.

In general, a gill net is a rectangular strip of webbing hung flat between a cork line at the upper edge and a lead line at the lower edge. The mesh of this webbing is ordinarily all of one size but sometimes the net is lengthened by tacking on another section of webbing the mesh of which may not be of the same size as the mesh of the previous section. The Division of Fish and Game regulates the minimum size of mesh to be used in certain districts and for certain fishes, so as to insure the escape of the smaller fish.

A gill net functions as follows. Fish that are smaller than the meshes of the net go through. Fish of a certain size range are not so fortunate. In attempting to escape through the mesh of the net the tapering head of the fish allows it to make forward progress until the bulkier portion just back of the gill covers causes it to wedge in the mesh. Finding that it can make no further forward progress, the fish attempts to back out. This is prevented by the twine of the mesh sliding under the gill flaps, with somewhat the same effect as an attempt to pull an umbrella through a chicken wire fence, handle first.

Inasmuch as there are some variations in the actual fishing performances in capturing jack smelt and bay smelt, these two phases of smelt fishing will be treated separately.

GILL NETTING FOR JACK SMELT

Gill nets used for jack smelt vary from 500 to 800 feet in length and are 25 to 35 feet in depth. The size of mesh varies from 1¾ to 2 inches, stretched mesh. Mesh in this size-range gills jack smelt of mainly 8 to 12 inches in length. The largest jack smelt of about 16 inches length, will weigh three-quarters of a pound each. However, there is more of a market demand for the medium sized smelt of about eight inches length and running about nine to the pound. So the tendency is to add mesh of the smaller size, when making additions or replacements to a gill net. Jack smelt may be taken anywhere along Monterey Bay. Sometimes the Monterey gill netters may journey to the flats off Capitola for their catches. When the jack smelt move into deeper water, with the fall and winter months, this type of fishing ceases.

Two men and a skiff ordinarily compose a circle gill net crew. The net is piled on the stern of the skiff. When traveling any distance a motor-powered launch is used for transportation, the actual fishing being accomplished with the aid of the skiff. During the 1931 season, one crew was able to supply most of the market demand. Some seasons several crews operate. Most of the netting is done at night, while the moon is absent. The smelt are at this time located by the characteristic luminescence that they produce in the water. Tides are taken into consideration as fishermen find that smelt move in with the tide. Occasionally catches are made during daylight, but this method is only about a third as successful as the night fishing. When a desirable school of smelt is located one man commences to pay out the net over the stern of the skiff while the other man rows in a circle. When the circle is completed there is an overlapping of ends so as not to leave any opening. Where the ends overlap the cork lines are fastened together. The net now hangs in the water in the form of a cylinder; the buoyant property of the corks along the upper line keeps that edge

of the net at the surface of the water, while the weight of the leads along the lower edge of the net stretches the rest of the net downwards in the water. The smelt, in the meantime, hover rather uncertainly inside the circle. They are frightened into hurriedly gilling themselves (if of proper size) by the splashing of a brick or rock in the water or by the

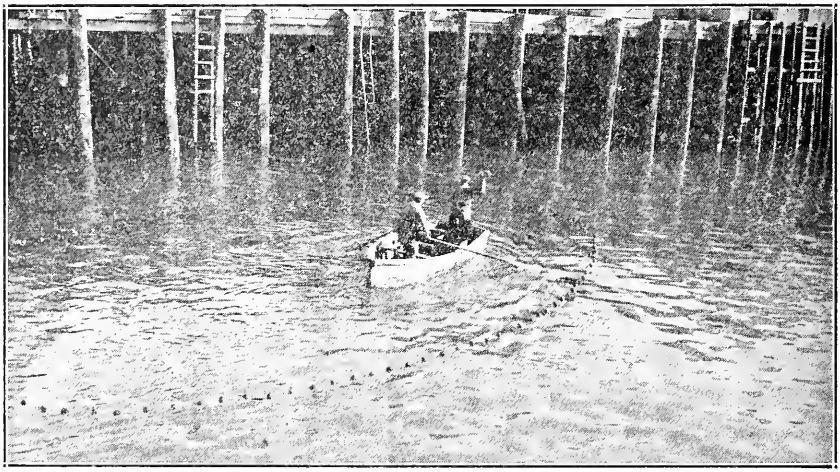

Fig. 34. The more common manner of scaring smelt into hurriedly gilling themselves. One man propels the skiff inside the circular wall of netting, while the other man repeatedly throws a brick or rock into the water. The "scare" is tied to one end of a rope so that it can be retrieved. Photo by J. B. Phillips, November, 1931.

Fig. 35. Extricating bay smelt from a gill net that has been circled around a school of smelt. Photo by J. B. Phillips, November, 1931.

flashing of a light at or under the surface of the water. The "scaring" is done by one man while the other rows around inside the circle. The brick or rock scare is tied to one end of a small rope so that it can be retrieved and used repeatedly. Sometimes, when the smelt are close to the beach, the circle is left open in the direction of the beach. The

skiff, during the "searing" proce[illegible] This method is most effective if the [illegible] with the net. After the smelt have [illegible] selves, the net is pulled into the [illegible] being extricated as it is brought in.

GILL NETTING FOR BAY SMELT

Gill nets used for bay smelt vary [illegible] and 15 to 25 feet in depth. The size of the [illegible] 1¼ inches, stretched. This [illegible] 6-inch size, which run about 18 to the [illegible] years the catches of bay smelt for the M[illegible] made almost entirely in District 10. [illegible] California. District 10 is defined as [illegible] lands to high water mark of that portion of M[illegible] of a line drawn from the ex[illegible]

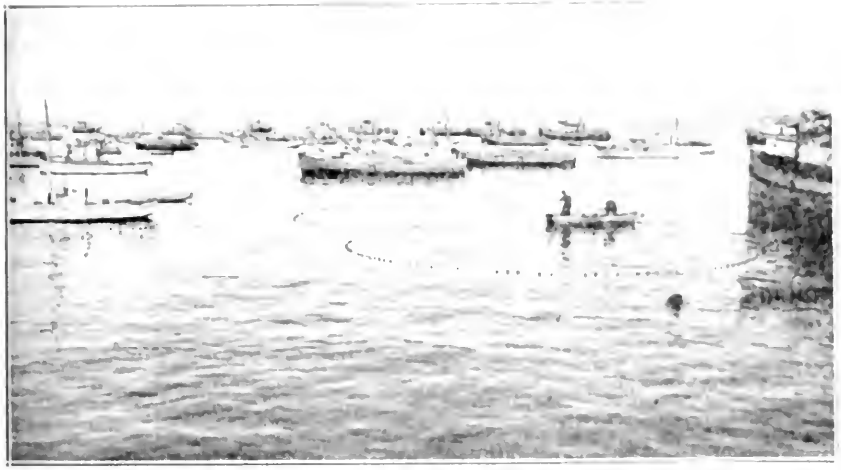

Fig. 36. A long gill net being divided into [illegible] The two smaller circles are then [illegible] November, 1931.

straight line easterly to the eastern shore of M[illegible] north of the town of Seaside known as the 1st [illegible] survey monument." The most successful [illegible] Monterey sardine canneries and the fresh fish market's [illegible]

All of the bay smelt netting is done in the daytime. Two men in a skiff compose a gill net crew. The net is piled [illegible] and eireling operations are the same as those explained for the jack smelt. In practically all cases, the smelt are completely encircled with the net and the ends fastened where they overlap. The fish are frightened into gilling themselves by the use of a brick or rock "scare." One man rows the skiff around inside the circle, while the other man repeatedly throws the weight into the water.

Sometimes a long net is divided into two smaller circles after the initial large circle has been made, so as to facilitate "searing" operations.

A rare variation of the above netting performance is for one man to start drawing in the net from one end as soon as the circle has been completed, the other end being anchored to the skiff. As the net is being pulled in by one man, the other stands in the stern of the skiff and throws the "scare" into the water so as to prevent the smelt from

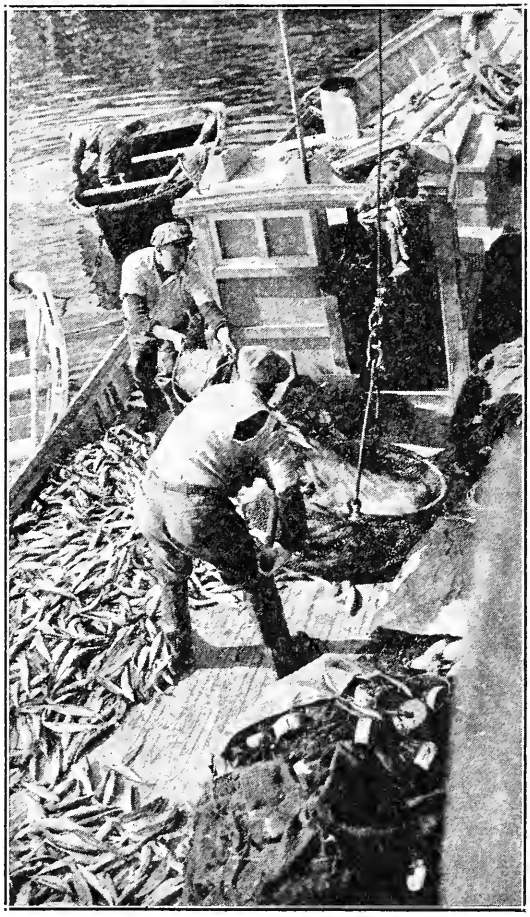

Fig. 37. Unloading a catch of jack smelt at Monterey. The launch is used mainly for transportation to and from the fishing grounds. The actual fishing is accomplished with the aid of one, and sometimes two, skiffs. Photo by J. B. Phillips, August, 1931.

passing under the boat and to frighten them back into gilling themselves as the circle diminishes in size.

A few days after the evident appearance of the bay smelt off Monterey, the catch by gill nets is about 90 per cent bay smelt and the balance mainly jack smelt. After the first month or so, the percentage of bay smelt in the catches decreases until their disappearance from the commercial catch about January or February.

About the time of the appearance of the bay smelt in the commercial catch, large catches of small jack smelt, called "fryers," make their appearance. These are smelt that range in size from two to four inches in length, and are caught with small mesh drift nets in shallow water. Whereas the catches of bay smelt during the first month or so of their appearance in the commercial catch are small, catches of "fryers" are continuous throughout the season (depending upon weather conditions). Examination of catches of "fryers" during the 1931 season showed them to be composed of smelt in the main. No bay smelt were found mixed in the catches. Often times, however, there are found up to 20 per cent of sardines and occasionally smaller amounts of whitebait and jack smelt.

OTHER DRIFT GILL NETTING IN MONTEREY BAY

As has been mentioned, the bay smelt phase seems to be confined entirely to District 16. A legislative enactment allows a drift gill net as the only type of net* that can be used for fishing in this district except that a round haul net or a purse net may be used for the purpose of catching squid, anchovy and sardines.

A set gill net is differentiated from a drift gill net as follows: "A set gill net is one that is made fast in any way and shall not be allowed to drift with the tide or current, or a net so placed as to catch or entangle fish within a bight, bay, or estuary against the shore upon the receding tide."

Drift gill nets, of about 1 inch mesh, are also used in the vicinity of various perches off the shallow rocky portions of the beach in District 16. Two men in a skiff operate the net. Instead of circling, the net is more often placed across an indentation in the shore or a small cove. Catching of the fish in this case is accomplished by frightening the fish seaward from the shore.

Gill nets are also used in Monterey Bay for the capturing of king fish, herring, white sea bass and halibut, but these nets are not considered in the nature of set gill nets.

REFERENCES

Bonnot, Paul.

1930. The California whitebait fishery. Cal. Fish and Game, vol. 16, no. 2, pp. 130-136.

Clark, Frances N.

1928. The smelts of the San Pedro wholesale fish market. Cal. Fish and Game, vol. 14, no. 1, pp. 16-21.

1929. The life-history of the California jack smelt, Atherinopsis californiensis. Cal. Div. Fish Game, Fish Bull., no. 16, 22 p., 12 figs.

Walford, Lionel A.

1931. Handbook of common commercial and game fishes of California. Cal. Div. Fish Game, Fish Bull., no. 28, pp. 65-69.

* Fyke nets, shrimp nets, or crab nets are not considered as set nets.

REPELLENTS AND DEER DAMAGE CONTROL

By Gordon H. True, Jr.

COMPETITION between wild deer and cultivated crops in California has, during the past decade, been steadily increasing until it has come to constitute a problem of considerable economic importance. The necessity of some action whereby the situation may be relieved has been recognized by the Division of Fish and Game and, as a result, considerable effort has been expended toward that end. One line of endeavor is represented by the investigation that has been carried on by the author in determining the role that repellents may play in deer damage control. It is the purpose of this paper to present the results of that investigation.

The author wishes to express his thanks to those who have aided him in this work. A number of farmers have gladly given assistance and various members of the patrol force of the Division of Fish and Game have devoted part of their time to this work. The author is indebted to Mr. E. M. Mills, U. S. Bureau of Biological Survey, for valuable suggestions.* Material obtained through the medium of questionnaires sent out by the Game Depredations Committee of the State Chamber of Commerce was also of aid.

At the outset of the investigation, all available data concerning repellents that had been used, not only in California, but in other sections of the country as well, were gathered together with the idea of subjecting to rigid tests those repellents which appeared to be of value. It is needless to say that these were found to be in the minority. The value of this preliminary survey lay in the fact that it brought to light the nature of the many difficulties to be encountered in attempting to control the depredations of deer by this means. Through it, also, the possibility was recognized that, guided by the experiences of others, a really practical, effective repellent might be found.

Actual field tests of various repellents have been carried on throughout the State during the past two years. Although these tests have not been entirely restricted to any one part of California, the greater portion of the experimental work has been carried on in Santa Cruz County and in the more mountainous parts of Napa, Sonoma and Marin counties. In selecting a location for a test it has been the practice to choose a farm on which only one type of crop is being grown and, if possible, one that is immediately adjacent to others on which the same crop is being grown under similar conditions. Thus, in the first place, the confusion that might arise from dealing with a variety of crops is eliminated and further, the neighboring acreages serve as controls. It is of the utmost importance that the owner or tenant of the land on which a test is to be made be in sympathy with the investigator and willing to assist in the work. The observations of the farmer must of necessity be depended upon to a certain degree and his aid is often required in the application of repellents.

* Mills, E. M., The Fruit Grower and Deer Damage, The Rural New Yorker, Vol. 89, No. 5108, pp. 658–659, May 17, 1930.

Let us define a repellent in this case as any substance or combination of substances which, due to its odor, taste or texture, or other qualities will serve to protect agricultural crops from the depredations of wild deer. Repellents may be divided into two classes, chemical repellents, which act through the effect they may produce on the senses of smell or taste, and devices which intensify the natural wariness. The first class includes those substances which may be in the form of sprays or dusts, applied directly to the foliage or may be effective through merely being placed in the proximity of the kind of plant life to be protected. The second class comprises scarecrows, noise makers and other contrivances which are calculated to frighten deer which approach them. It is not sufficient that a repellent be effective. In addition it must be reasonable in price, easily and quickly put into operation and must retain its repellent properties over a reasonable long period of time. The two classes of repellents will be discussed separately.

CHEMICAL REPELLANTS

The first group of chemical substances to be discussed are animal by-products of the meat packing industry, namely blood, ground blood meal, ground meat scrap, digester tankage and ground bone meal.

Blood has been employed successfully as a spray for the protection of young cherry trees in the H. Gansberger and neighboring orchards situated in Palomares Canyon, between Dublin and Hayward, Alameda County. Fresh warm blood was obtained from a neighboring slaughter house, placed in containers and stirred until cool. After the stirring process all coagulated material was removed and the containers were placed in the sun until their contents had become more or less decomposed. An equal volume of water was then added and the evil smelling mixture was sprayed on the foliage of the young cherry trees by means of an ordinary knapsack sprayer. If the application was repeated at intervals of from one to two weeks, this method resulted in almost 100 per cent control. Rags dipped in blood and hung about the orchard or vineyard have been made use of in some sections with varying degrees of success. Vineyardists in the vicinity of Geyserville, Sonoma County, painted the grape stakes with blood but found that the 'treatment' must be renewed too frequently to be practical. In no case has the blood treatment been as effective as when used as a spray, according to the method outlined above. The use of blood as a 'repellent' is, unfortunately, limited by the supply. There are few cases where that material may be obtained in amounts large enough to control deer damage over an area of any size.

Blood meal, ground meat scrap and digester tankage are all employed in a similar manner and, if frequently applied, will afford a considerable degree of protection, i. e., from 50 to 100 per cent. These substances may be used in the dry condition or mixed with water. In the first case the material is merely sprinkled on the foliage. The wet mixture is best applied by throwing it on the foliage with a whitewash brush or whisk broom. Since it is necessary to repeat the application of the above substances at intervals of a few days, they are not practical for use on large acreages. If used in an ornamental garden they have the disadvantage of being unsightly. Mr. J. A. Winkleman, Placerville, reports that blood meal, mixed with water and allowed to putrefy,

has given good results in some places in El Dorado County. Meat scrap has been effective in the protection of young apple trees on the ranch of Mr. F. C. Clarke, Laytonville, Mendocino County. The best type of meat scrap is that which possesses a putrid odor and may usually be obtained from the small-town butcher. It is much more satisfactory than the ordinary commercial grades which often lack that necessary quality.

Bone meal was recommended to the author as an excellent repellent but has proved to be almost without value, both in the dry condition and mixed with water. It is almost without odor and, the particles being extremely fine, is readily blown away.

Current prices for the above materials per cwt. are: ground blood meal $2.75, ground meat scrap (commercial) $2, digester tankage $1.50, and ground bone meal $1.50. No prices are quoted for whole blood.

D4

In July, 1930, Bulletin Number 1, of the New Hampshire Department of Fisheries and Game, was received by the author. The bulletin was in the nature of a progress report dealing with D4, a proprietary spray for deer damage control that had been used in New Hampshire with considerable success. A supply of D4 was obtained for trial under California conditions. D4 is applied as a water solution, one part of the former being mixed with sixteen parts of the latter. Nothing has been divulged concerning its composition. It is distributed by the Merrimac Farmers' Exchange, Concord, New Hampshire. The retail price is $2.50 per gallon f.o.b. Concord.

Experimental work with D4 was begun on January 29, 1931, at Ross, Marin County, California. On that date two adjacent rose gardens on Southwood Avenue were sprayed with the repellent. On February 5th two gardens directly across the street were similarly treated. The spraying was done with a 2½ gallon pressure sprayer of the type commonly used in the control of insect pests. Inspections at intervals of one week were made throughout the course of the experiment, which was terminated on April 18, 1931. At the time of the first application of D4 the leaf buds were just opening and the work was continued until the roses were in full bloom. At each inspection the gardens were carefully examined for evidence of damage and for the tracks of deer. Only twice were tracks observed and only once, on April 10th, were there any signs of damage. On that day it was observed that two shoots had been taken from one rose bush. The gardens were sprayed four times during the experiment. It was deemed necessary to repeat the applications because of the rapid growth of the plants with continual production of new foliage. There were also several showers of rain which, it was feared, might have washed the repellent from the plants.

The results of this experiment would seem to indicate that D4 had successfully protected the rose gardens from deer damage, since, during the corresponding period in 1930 the rose bushes had been completely defoliated. Also, during the course of the experiment, rose gardens in the immediate vicinity of those treated had suffered considerable injury. On the other hand, the almost complete absence of deer tracks in the gardens indicates that D4 did not receive a thorough trial, for it is inconceivable that a repellent of that nature would keep

deer entirely out of the areas over which it had been applied. The time of year must also be taken into consideration. During the early spring months there is an abundance of wild forage in the vicinity of Ross and, consequently, deer are not driven to cultivated crops as they are later in the summer when the wild forage has become dry.

On May 5, 1931, a prune orchard belonging to Mr. W. R. Tr[illegible] Bonny Doon District, Santa Cruz County, was sprayed with D4. The ten acre orchard is bounded by a road on one side, by alfalfa fields, yard and pasture land on another, and by wild land on the other two. Deer had been doing more or less damage to the prune trees for a period of ten years. During the past few years it had been necessary to replant an average of one hundred trees per year. In the western half of the orchard, a block of 176 trees of all ages was sprayed, while the remaining 128 trees were scattered about the remainder of the orchard. Twenty one trees had already been damaged and these were marked with tags. Nine gallons of spray were used. The application took one hour and a half.

Inspection of the orchard on May 10th revealed no significant damage to untagged trees. On May 27th, it was found that a number of trees had been injured. The latter inspection was made just following a rain of two days duration. The orchard was literally full of deer tracks. Whether the injury had been done before or after the rain could not be determined. The trees were resprayed on May 27th, the trees damaged since May 5th being tagged. On June 12th the orchard was visited for the fourth time and it was noted that nearly all of the small trees had been nibbled, and lower branches of the larger trees in the west end of the orchard had been partially defoliated. There had been rain on the 5th of June. The orchard was sprayed again on that day. After June 12th the damage became continuous and by the end of the month all of the smaller trees had been almost completely denuded of leaves. No further applications of D4 were made.

During the early part of November, 1930 a supply of D4 was sent to R. A. Browne, Castella, Shasta County, in order that it might be given a trial with reference to the protection of a strawberry plantation that had been damaged extensively by deer. The spray was first applied on November 20, 1930, and was apparently effective for a period of one month. At the end of the month winter snows set in and made further applications not only impossible but unnecessary. Sixteen gallons of the spray were required to cover slightly less than one-half acre of strawberry plants. Mr. Browne reported that during the month following the application of the spray deer had entered the plot but had done no feeding. The only damage consisted in the breaking of the runners from some of the plants by deer walking between the rows. During the summer of 1931 the strawberry plants were sprayed again and within two weeks several deer consumed the entire crop.

G. Mancardi, Laurel, Santa Cruz County, used D4 on young prune trees and reported serious injury by deer after a period of three to four days. E. D. Rodgers, Swanton, Santa Cruz County, found that deer regarded gladiolus buds as palatable at from four to six days after treatment with the spray.

From the experimental data concerning D4, we may draw the conclusion that that material is not an effective repellent under California conditions. Although it is reasonably effective during the winter and early spring months when green wild forage is available or when untreated crops are in the immediate vicinity of crops that have been sprayed, it has little repellent effect during the dry summer months when deer are forced to resort to cultivated crops for succulent food.

WHALE OIL SOAP—LIQUOR CRESOLIS COMPOUND

A spray composed of liquid whale oil soap and liquor cresolis compound (surgical) has been used with good results for the protection of vineyards. Early in the course of this investigation, the author observed that whale oil soap had, for a short period, a decided repellent effect. After some experimenting it was found that this repellent effect was increased and lasted for a longer period of time upon the addition of a small amount of liquor cresolis compound (surgical). The proportions used were five gallons of liquid whale oil soap and two quarts of liquor cresolis compound to one hundred gallons of water. On the basis of ten gallons of water, two quarts of the whale oil soap and fourteen tablespoonfuls of liquor cresolis compound should be used.

On June 1, 1930, the vineyards of Mr. G. Gaudino and F. Caldera, Atlas, Napa County, were sprayed with this material. The vineyards, comprising some twenty-five acres in all, are isolated and completely surrounded by wild land except where they adjoin each other. Both had been damaged considerably by deer. The spray program involved the spraying of a strip six vines wide around the vineyards with the exception of one block of 650 newly grafted vines in the Gaudino vineyard. In the case of the latter all the vines were sprayed. A fifty gallon barrel mounted on a horse drawn sled and supplied with a hand pump was used to apply the spray. Although the vines had been injured to quite an extent during the early part of the season, the deer left the vineyards strictly alone until the 21st day of June when a few vines in an isolated corner of the Gaudino vineyard were damaged. The vineyards were sprayed again on June 26th. This second application was effective until the second day of August. At this time it was deemed inadvisable to continue with the spraying since further use of a liquid spray might have resulted in injury to the grapes, which were rapidly maturing. The owners of the vineyards were satisfied with the use of the spray. During the months of June and July the vines had become full grown and consequently less palatable to the deer. After the cessation of spraying the only damage done was the nibbling of the ends of some runners and a few bunches of grapes.

During the month of October, 1930, a visit was paid to the vineyard of Mr. W. R. Depew, Bonny Doon District, Santa Cruz County. It was found that the vineyard had been almost completely defoliated by deer. The vineyard had been similarly damaged in 1929 and to a less extent in 1928, the first year that the condition had become noticeable. It was estimated that deer had destroyed eighty-five per cent of the 1930 crop. The four acre vineyard is bounded on two sides by apple orchard and on the other two by wild land.

In the spring of 1931, just prior to the grape season, the owner of the vineyard was supplied with a quantity of [illegible] liquor cresolis compound and was instructed to [illegible] at the first sign of deer damage. The first spray [illegible] afternoon of the 25th and the morning of the 26th. Sixty gallons of spray were used. There was no [illegible] 24th when a few vines were slightly injured. [illegible] vineyard was sprayed for the second time. [illegible] required for the second spraying was more [illegible] larger amount of foliage to be covered. A [illegible] repellent from the foliage and thereby [illegible] cation on May 7th. Sixty gallons were [illegible] spray applications during the remainder of the season. [illegible] was hesitant with regard to the use of a liquid [illegible] the bunches of grapes were maturing. [illegible] from March 26 to June 1, 1931 [illegible] injured and these not seriously. Free deer [illegible] the vineyard at any time. The vines [illegible] showed no signs of injury that might have been [illegible] spray. Since further use of a liquid repellent was [illegible] method was resorted to that successfully protected [illegible] the remainder of the season. The nature of that method will be discussed under another heading. The cost of materials for the protection of the vineyard for the period mentioned was $2.31 for [illegible] materials. Three days labor by two men was required for the [illegible] applications. The spray was applied by means of a 1000 gallon orchard spray machine.

The whale oil soap liquor cresolis spray was used to [illegible] to protect gladioli at the nursery of E. D. Rodgers, Santa [illegible] Cruz County, and was effective for periods varying from [illegible] two weeks. The author attempted to prevent deer [illegible] yard of G. Luchesi, Yountville, Napa County, with [illegible] The results of that experiment were disastrous. One [illegible] spray a fifteen acre vineyard with a two and a half [illegible] keep ahead of the deer and the weather.

Since, in the case of vineyards, the critical period is during the early part of the growing season, the whale oil soap liquor cresolis compound spray may be recommended for use at that time. It has been found that if a vineyard is afforded protection during this critical period the damage later in the season will be slight in most instances. Deer do not find old foliage nearly so palatable as the tender shoots of the first spring growth. This spray should not be used on trees as it will burn the foliage. If used in the recommended proportions, however, there will be absolutely no burning of grape vines.

Liquid whale oil soap may be obtained from any spray dealer and liquor cresolis compound (surgical) from any druggist. Michel and Pelton, Emeryville, California, quote the following prices for the above materials: whale oil soap (liquid), fifty five gallon drums, $0.55 gal.; five gallon cans, $3.50; one gallon cans, $1; liquor cresolis compound (surgical), thirty gallon drums $1.50 gal.; five gallon cans, $1.65 gal.; one gallon cans, $1.80. Five gallon cans containing whale

oil soap and liquor cresolis compound already mixed may be obtained from the same concern $4.25 per can.

NAPHTHALENE FLAKES

Naphthalene flakes have proved to be an effective repellent for the protection of young orchard trees. The naphthalene method has been employed in various orchards throughout the 1930 and 1931 seasons and has resulted in from ninety-five to one hundred per cent control. In preparing naphthalene flakes for use, two tablespoonfuls are placed in a piece of white muslin about eight inches square. The corners of the cloth are then tied together to form a small bag. One of these bags is hung in each tree to be protected about three feet from the ground. In the humid coastal region one treatment lasts for approximately two months. Where atmospheric moisture is low the treatment must be renewed as often as once a month. Successive treatments must overlap, that is, a fresh supply of the repellent must be put on before the material used for the preceding treatment has completely evaporated. In the case of trees over two or three years old it is wise to increase the number of bags to two or three per tree, depending on their size.

Naphthalene flakes were used in the protection of young prune trees in the orchard of Mr. J. Haub, Geyserville, Sonoma County, during the summer of 1931. Prior to treatment with naphthalene a number of the trees in this orchard had been injured to quite an extent. Naphthalene bags were put out and a smooth circle was raked around the base of each treated tree. Although deer tracks were frequently observed on the raked areas, no further damage was done throughout the remainder of the season. Control, in this instance, was 100 per cent. In November, 1930, the Thornhill Broome Estate, Oxnard, Ventura County, found itself faced with a serious deer damage problem. Deer were rapidly making away with a newly planted orange grove. Naphthalene flakes were recommended and, at once, 1700 trees were treated. The naphthalene was placed in small sugar sacks obtained from a nearby refinery and was in the form of moth balls rather than flakes but, in principle, the method was correct. On February 30, 1931, Game Warden R. E. Bedwell, Ventura, reported that deer damage control in the Broome orange grove had been 100 per cent.

On May 4, 1931, young apple trees in the orchards of Mr. Harry Baker, Mr. William Ryder, and Mr Glenn Spencer, Aptos, Santa Cruz County, were treated with naphthalene flakes. The Ryder orchard, the most open to attack, suffered only a slight amount of damage throughout the rest of the summer, about five per cent. In the Baker orchard injury to treated trees was negligible. A number of trees in this orchard were left untreated and these were destroyed. The Spencer orchard remained undamaged until the latter part of June when the owner neglected to renew the supply of naphthalene which, by that time, had evaporated. A large proportion of the young trees were then destroyed. The Ryder and Baker orchards were treated three times, at intervals of approximately two months, during the season. It is significant that in the three Santa Cruz County orchards considered here, the rearing of young trees had been regarded as impossible due to the certainty of their destruction by deer. Mr. Ryder lost almost

his entire plantings for at least three years before naphthalene was used. With the advent of the naphthalene treatment the owners of the orchards were able to bring young trees [illegible] successfully.

Naphthalene flakes may be obtained in fifty pound sacks at [illegible] per pound. In smaller amounts the price will run from [illegible] per pound. Even at the latter price however, the treatment is remarkably inexpensive. Using one bag to each tree one pound will treat ten trees.

ASAFOETIDA

Gum asafoetida may be employed in the same manner as that recommended for naphthalene flakes, a piece of the gum about the size of a golf ball being placed in each bag. Although asafoetida has not been as effective as naphthalene, it has the advantage of lasting for a longer time. The material is effective as long as it remains in a "green" condition but when it becomes hard the odor is lost and it must be renewed. In Santa Cruz County one application proved to be sufficient for an entire summer. In [illegible] County the asafoetida became hard and worthless in about three months. Gum asafoetida costs $0.25 per pound in fifty pound lots. One pound will treat twelve trees.

CREOSOTE

Creosote and creosote dips have been widely used for the purpose of deer damage prevention but in most cases the method has met with little success. The usual procedure has been to saturate strips of cloth with the liquid and hang them at various points in the vineyard, orchard or garden. Since the strips of cloth are exposed to the sun and wind, the creosote rapidly evaporates and the repellent effect is lost within a few days.

Game Warden J. D. Dondero, Lakeport, Lake County, evolved a method whereby creosote becomes more effective, particularly in the case of orchards. Heavy woolen material (old blankets, overcoats, etc.) is cut into pieces ten to twelve inches square. Each piece is then rolled into a tight ball and secured with a piece of hay wire. The balls are then soaked in creosote or sheep dip until they become thoroughly saturated. One is then hung on each tree in such a manner that none of the liquid will come in contract with the tree and injure it through burning. The balls of cloth must be redipped at intervals of from two to three weeks. The fact that the pieces of cloth are rolled into balls cuts down evaporation and is the basis for the success of the Dondero method. The method has been responsible for almost one hundred per cent control in several Lake and Napa County orchards. It is primarily designed for orchard protection, being much less effective in the case of vineyards and gardens.

Agricultural Commissioner J. A. Winkleman, Placerville, El Dorado County, has outlined a method of using creosote that has been employed successfully by some of the orchardists in El Dorado County. In principle, it is identical with the Dondero method. Small pieces of wood about the size of playing cards are dipped in creosote and suspended in young trees by means of wire. The chips are redipped about twice a month.

Creosote costs 50 cents per gallon in 50-gallon drums.

SLUTMAN'S FORMULA

It will be remembered that, in connection with the use of whale oil soap and liquor cresolis compound in protecting the W. R. Depew vineyard, Santa Cruz County, another repellent was used after further use of the liquid spray was considered unsafe. The repellent that was used is the invention of Mr. William Slutman, La Canada, Los Angeles County, and was used by him in the successful prevention of deer damage to his vineyard during the 1931 season. Mr. Slutman allowed the author to use the dust under the condition that the formula be not divulged. Consequently nothing can be said here concerning the nature and composition of the repellent. Mr. Slutman has been busy perfecting his concoction and expects to place it on the market, where it will be available to those who wish to make use of it for deer damage control.

SCARING DEVICES

Scaring devices of many kinds have been widely used in an effort to prevent deer damage. Such devices, while serving as deterrents for a short time, have been ineffective as long-time control measures. Deer invariably become accustomed to them. Probably the most striking instance of this is the automatic flash gun.

The automatic flash gun is a contrivance especially designed to frighten wild animals and birds. The machine is operated by carbide gas and is so arranged that the gas explodes at intervals of from two to ten minutes. The explosion may be compared with the report of a .30 caliber rifle. In addition to the periodic explosions, the pilot burner throws a beam of light. The machine is hung from a tripod and, at the point of attachment, is fitted with a swivel. As the gun swings about in the wind the beam of light is thrown in all directions. An automatic flash gun was put into operation at the nursery of Mr. E. D. Rodgers, Santa Cruz County. The deer were naturally considerably frightened at first but after the machine had been in use for about a week they could be seen feeding in its light, merely raising their heads in mild annoyance at the sound of each explosion.

Scarecrows resembling humans have been used extensively with little or no effect. Strips of white cloth or pieces of bright tin strung on lines are seldom of value for more than a few days, a week at the most. The discharge of firearms may frighten deer at first but, like the automatic flash gun, effects no permanent cure. One farmer hung kerosene lanterns at various points in his vineyard. When questioned as to the success of the method he remarked that the deer seemed to appreciate his efforts in their behalf. He had merely provided them with light by which to feed. Lake County farmers who tried the same method in alfalfa fields came to the same conclusion.

Many have tried the effect of bird shot upon hungry deer but find that, though the deer leave their nocturnal repast at the time of the bombardment, they usually return to the feast within an hour or two. The control accomplished by this method has not been sufficient to warrant the expenditure of ammunition and the loss of sleep that it necessitates.

Dogs have been used with varying degrees of success depending on the type of dog that the landowner happens to have in his possession. Hounds have been generally unsuccessful since they take one deer out

across the country leaving the rest to contribute with the work of protection. The mongrel shepherd, barking at anything [illegible] will keep deer away until he gets tired of the game. [illegible] type of dog has been remarkably effective. [illegible] to the author's attention was one that contained [illegible] around his owner's vineyard during the day time. It [illegible] rabbits and squirrels and kept up a continual chase [illegible] that no deer bedded down in the neighborhood [illegible] consequently there were fewer to enter at night. [illegible] ascribed his lack of deer damage entirely to the dog. It [illegible] had been damaged extensively. Few are the instances [illegible] which dogs have consistently afforded protection [illegible] of time. In most cases, though at first greatly [illegible] deer become accustomed to one another and [illegible] lie down together.

CONCLUSION

The effectiveness of any repellent has been found to depend on a number of conditions. Such factors as temperature, humidity, number of deer in the neighborhood, and the relative attractiveness of wild land all have their effect. The economic importance of deer in any one place will often be the deciding factor in determining whether or not a repellent will give satisfactory results and what it will cost. A method that has been highly successful under one set of conditions may prove entirely worthless under another.

In conclusion it may be stated, that while the ideal repellent has not been found, there are materials that will greatly reduce the amount of deer damage. Whether or not any of the repellents here mentioned will be used is, of course, up to the individual farmer. In those cases where the amount of deer damage is small, the expense connected with the use of repellents, though not great, will probably not be justified. In cases where deer are causing real losses, however, the saving accomplished through the use of repellents will more than compensate the cost of control.

COOKING AND CLEANING LOSSES IN CANNING TUNA

By D. H. Fry, Jr.

THIS WORK was carried out to learn how much weight tunas lose at different stages in the canning process. The amount lost in cleaning is of interest to statistical workers who frequently have to convert cleaned weight into round weight; while law enforcement officers have to be sure that the cleaned fish in canneries were not under the legal weight limit when round. Besides this, cannery officials like to know when the loss at any one step in the canning process becomes excessive.

[1]Contribution No. 121 from the California State Fisheries Laboratory, January, 1932.

When tunas are taken to a cannery, they are first weighed then given to cleaners, who remove the entrails. The next process is to steam-cook the fish for a length of time, which varies with species, size, fatness, etc., then they are allowed to cool, and sometimes to stand an extra day. After this the head, skin, dark meat, fins, and bones are removed, leaving nothing except white meat which is then sliced and placed in cans with a little oil and salt.

The first load examined consisted of iced yellowfin tuna from Mexico. Sixty of these fish, ranging in weight from six to twenty pounds, were taken from the cannery floor a few at a time, weighed, placed on a cleaning table and reweighed after they had been given the preliminary cleaning by regular cannery workers in the routine manner.[2]

The fish examined were then placed on trays and steam-cooked in the standard way. The rack containing the trays was marked and each tray numbered to make it easy to keep track of the fish and to reweigh each one after cooking. To get the weight accurately it was frequently necessary to make use of the theorum, "the whole is equal to the sum of all of its parts." In other words, the fish were much inclined to lose outlying portions of their anatomies as they were removed from the trays. The length of time the yellowfin were cooked was not ascertained, but was the same for all—a condition which would not be likely to occur ordinarily as larger fish are usually cooked longer.

One hundred and three skipjack were treated similarly. These fish were also from Mexico and had been on ice for ten days. Cooking in this case was for three hours at 220 degrees Fahrenheit. The rack was weighed ten hours after cooking and again twenty-four hours after that to ascertain the loss on standing. After the second weighing of the rack the individual fish were weighed and returned to the rack. They were then taken to the cleaning room and given to two regular employees of the cannery who removed skin, dark meat, bones, and in fact everything but the white meat which goes into the can. The white meat of each fish was weighed separately.

In examining the figures it should be borne in mind that they are the result of only one run of fish of each kind, that differences in the technique of the cleaners, length of cooking time, temperature used, fatness of the fish, and so forth, will each undoubtedly make some slight difference. Just how much could not be determined without an exhaustive series of tests. The figures therefore do not claim to be more than an approximation.

Yellowfin	*Per cent of round weight lost*	*Per cent of round weight remaining*
Yellowfin tuna (6 to 20-pound fish):		
Preliminary cleaning	7.5	92.5
Preliminary cleaning plus cooking after about 10 hours standing	36.0	64.0
Skipjack (3½ to 10½-pound fish):		
Preliminary cleaning	7.0	93.0
Preliminary cleaning plus cooking after about 10 hours standing	34.0	66.0
Preliminary cleaning plus cooking loss after about 34 hours standing	35.0	65.0
Total loss after final cleaning had removed everything but white meat	69.0	31.0

[2] To carry out this preliminary cleaning the worker makes a small, lengthwise slit in the body cavity, then while reaching in and grasping the viscera with one hand, cuts them loose from the head with the other; a heave then slides the fish on its way and removes the viscera. The process takes less than five seconds. The fish are then rinsed and placed in the cooking racks.

This table gives the total loss up to and including each step mentioned. Percentage of round weight lost *at* each step can be figured by subtracting the loss up to and including the *preceding* step from that including the stage in question, for example the [illegible] standing is 35 per cent less 34 per cent leaves a [illegible] per cent round weight.

PRELIMINARY CLEANING LOSS

Preliminary cleaning loss appears to be about the same [illegible] sizes of fish of the same species [illegible] percentage of its weight as a large one.

PRELIMINARY COOKING AND CLEANING LOSS

Given the same amount of cooking, a small fish loses a [illegible] greater percentage of its weight than a large one. This is easily explained by the fact that the steam does not have to penetrate as far in a small fish and consequently cooks it more thoroughly in a given length of time. The skipjack sample under discussion would indicate that four pound fish lose on the average about 1 or 1½ per cent more than eight pound fish [illegible] 1-1½ per cent of round weight.

LOSS ON STANDING

A load of skipjack which, when round, had weighed 622 pounds lost about seven pounds after standing an extra 24 hours, [illegible] about 1 per cent (the large platform scale used for this weighing would not check themselves within a pound).

TOTAL LOSS INCLUDING FINAL CLEANING

Here again the percentage loss is greater for small fish. In this case the difference seems to be about the same as that caused by the cooking (1-1½ per cent). Probably about half of this is due to cooking and half to the loss of small bits of white meat which the workers consider big enough to be worth saving from large fish, but not from small. Roughly half of the cooked fish is left after the final cleaning. Any loss which will amount to say 1½ per cent of the round weight in the cooked fish will be reduced to about one-half of that after the final cleaning, since one-half of the shrunken material is discarded and does not enter into the final weighing. There is a possibility that the waste parts of the fish, such as the head, dark meat, fins, etc., may lose nearly all that they are going to in the first part of the cooking, and that from then on the largest part of the loss is sustained by the white meat. This of course would invalidate the statement made above.

As mentioned at the beginning of the article the final cleaning was done by two workers. They happened to be quite different in technique and in the amount of white meat they retained. One worker in scraping off skin, dark meat, clotted blood, etc., retained white meat to the extent of 32 per cent of the round weight of the fish. This operator used long strokes of the knife and rarely went over the same ground more than once. The other worker was inclined to be more fussy and scraped with short strokes, quite frequently over the same ground. She retained white meat to the extent of only 28 per cent of the original weight. The difference would amount to about 80 pounds of

canned tuna per ton of fish. The worker who used long strokes, in addition to retaining a higher percentage of white meat, was able to clean about sixty fish while the other was doing twenty-six.

If the differences in the method of cleaning consistently produce this result, it would certainly be worth the while of the canners to teach the workers to use the more efficient method. We have no way of knowing if this would prove to be the case. Only two workers were tested and the differences in skill of these two might mean far more than the differences in method.

I wish to thank Richard S. Croker of the California State Fisheries Laboratory for his assistance, and the officials and employees of the local (Los Angeles harbor district) tuna canneries for their cooperation in this work.

A SIMPLE METHOD OF AGE DETERMINATION OF STRIPED BASS

By Eugene C. Scofield

HOW OLD was that striped bass which you caught several years ago? Find the record, get its length, then refer to figure 1. This chart offers a simple method by which you can obtain the age of any female striped bass between the lengths of 1 and 48 inches.

Comparatively recent research on the life history of the bass (E. C. Scofield, Cal. Div. Fish and Game, Fish Bull. No. 29, 1931) has enabled the author to establish very definitely the age, rate of growth and the weight-length of this species. However, due to the lack of sufficient data there has been some uncertainty as to the accuracy of material exceeding 30 inches in length. Through the courtesy of various sportsmen of California there have now been gathered data from about 200 female bass, all of record size, or exceeding 30 inches in length. These data have made possible the completion of the age-length, and length-weight curves as presented in figure 38.

The chart not only shows the age of a female striped bass of a given length, but it also presents a few other facts of general interest. Observe the age-length curve, perhaps more commonly called the growth curve. It will be seen that a striper grows much faster in its earlier life than later when it is eight or nine years old. For example, it grows 6 inches during its second year, while during its eleventh year it grows but 2 inches. In its twentieth year it only grows 1 inch.

Now turn to the length-weight curve. The order is here reversed and we find that as a bass grows it takes on more and more weight in relation to its increase in length. Until a bass reaches a length of 12 inches it is less than one pound in weight. When it is 36 inches long it weighs about 19 pounds. However, when it is 51 inches it is 53 pounds in weight.

Referring back to the age-length curve once more, we can observe that when a bass has reached the ripe old age of twenty years she is still growing considerably since there is no indication of a tapering off

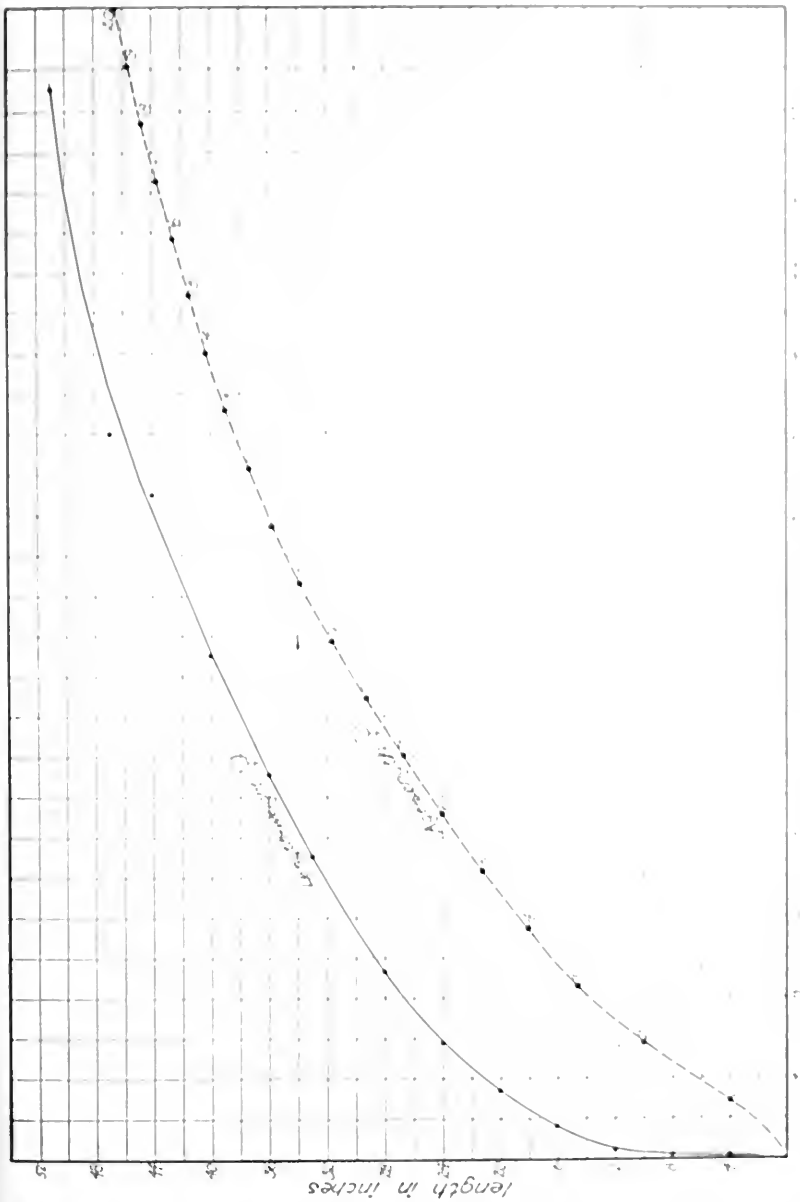

Fig. 38. In the above chart the age-length curve represents the annual increase in length of female striped bass between one and twenty years of age. The length-weight curve represents the proportionate increase in weight with the increase in length of females. To determine the age of your female bass locate its total length in inches on the vertical scale to the left. From this point trace across horizontally until the line intersects the age-length curve. The age of your bass will then be the number directly above on the curve. If only the weight is known then locate the weight of your bass on the horizontal scale at the bottom. Trace up vertically until the line intersects the length-weight curve. Then trace to the right, horizontally, until the line intersects the age-length curve. Read the number directly above on the curve. This will be the age of your fish.

in the curve. It is evident, therefore, that there are a few bass lingering in deep holes which have an excellent record of 25 to 30 years behind them. From a reliable source has come the statement that the record striper from the east coast was well over 100 pounds in weight which would undoubtedly class it as 30 to 35 years or more.

HOW TO AGE YOUR BASS BY THE CHART

In order to age your striped bass by using the chart, all you need know is either the length or weight of the fish. The length is preferred since it is more constant. Assume that your fish is 36 inches long. Locate 36 inches on the vertical scale to the left, then trace across horizontally until the line intersects the age-length curve. Since it intersects at a trifle above 11, the fish is in its twelfth year.

Now assume that the length of this fish was unknown, but its weight was 19 pounds. Locate 19 pounds on the horizontal scale at the bottom, then trace up vertically until the line intersects the length-weight curve. From the point of intersection trace vertically to the right until the line intersects the age-length curve. The result is 11 plus, or the fish is in its twelfth year.

One can expect to use this scale with a fair amount of accuracy. Among bass over 36 inches in length there is a great deal of variation in age-lengths. Below 36 inches the age variations in respect to length are greatly minimized. Because of this condition it can be said that the chart can be used very accurately in age determinations of fish less than 36 inches in length, but, one can expect a certain amount of error in aging bass more than 36 inches. For accurate age determination of very large bass it is requested that the scales, along with the length, weight, sex, date and locality, be sent to the author in care of the Division of Fish and Game, Bureau of Commercial Fisheries, San Francisco.

THE PRESENT STATUS OF THE PISMO CLAM

Tivela stultorum[1]

By Frances N. Clark

ORIGINAL DISTRIBUTION AND ABUNDANCE

WHEN the first settlers came to California, they found on all the exposed sandy beaches of southern California a great abundance of exceptionally thick shelled clams, which in these later years are known to everyone as Pismo clams. These clams have been taken as far northward as Half Moon Bay, just south of San Francisco, and are reported from this point southward along the coast of southern California and Lower California to Socorro Island. Their exceptionally thick shell fits them for a life in the sand constantly exposed to the heavy beat of the surf and it is only on such open beaches that the Pismo clam thrives.

[1] Contribution No. 115 from the California State Fisheries Laboratory, December, 1931.

1

2

Fig. 39. Pismo clam, *Tivela stultorum*. 1. Exterior view showing three dark rings indicating that the clam was in its fourth year when taken. 2. Interior view. (*From* Calif. Fish and Game Comm., Fish Bull., no. 4, pl. 6.)

Stories of the abundance of these clams in the early days tax the credulity of the present generation of clammers frequenting these same beaches. At low tide the beaches were reported as "paved" with clams and in various localities, notably Pismo and Long Beach, the farmers are reputed to have plowed the clams out and used them as hog and chicken feed and for fertilizer. This tremendous abundance persisted in some measure at least on Pismo Beach as late as 1919 as is attested by figure 40. In this view of a portion of Pismo Beach at low tide in the fall of 1919, every mound and pit represents a clam. In addition

Fig. 40. Pismo Beach at low tide in 1919. Each mound and pit represents a Pismo clam. (*From* Calif. Fish and Game Comm., Fish Bull., no. 7, fig. 15.)

other clams which do not show in the picture were present deeper in the sand.

HISTORY OF LEGISLATION

Before 1919, Pismo clams had become scarce on the more southerly beaches, notably Long Beach, and in Monterey Bay to the north. Because of this growing scarcity the first legislation to protect these clams was enacted by California in 1911, when a limit of 200 clams per digger per day and a minimum size limit of 13 inches around the outer edge of the shell was defined. This law remained in operation until 1915, when the bag limit was reduced to 50 clams and the size limit to 12 inches around the outer edge. In the succeeding three

sessions of the Legislature, the laws relating to Pismo clams were changed in each biennium and each new act became more stringent. In 1917 the size limit was changed to 4½ inches greatest breadth, the bag limit remained at 50 clams but a closed season was created from May 1 to August 31, applicable to District 17. In 1919 the size limit was left at 4½ inches and the closed season in District 17 Monterey Bay remained unchanged but the daily bag limit was reduced to 36 clams. In the next legislative year, 1921, the size limit and closed season again remained unchanged but once more the bag limit was reduced, this time to 15 clams per day.

After 1921 the Pismo clam laws were not changed until 1927 when the minimum size limit was increased to 5 inches, the closed season the bag limit remained at 15 clams and the closed season remained effective. In addition shipment of clams was prohibited and it became unlawful to retain clams in possession if removed from the beach. The last regulation was passed to simplify the enforcement of the size and bag limits. In 1929 all the restrictions of 1927 were made effective and in addition a closed area was created known as District 18A comprising the southern portion of Pismo Beach. In this area no clams may be dug during any season of the year. In 1931 the laws were again made more stringent by applying the general sport angling license law to Pismo clams. All amateur diggers must first secure an angling license costing $2 per year for residents of California, $3 for people from other states, and $5 for aliens. For the past several years commercial clam diggers have operated under the commercial fishing license laws. The size limit of 5 inches, the bag limit of 15 clams, the closed season for District 17, and the closed area for District 18A remained unchanged in 1931.

SCIENTIFIC INVESTIGATIONS

During the years when all these laws were passed for the protection of the Pismo clam, the Division of Fish and Game of California has made a scientific study of these clams. The work was originated by Weymouth in 1919 and in 1923 he published the first detailed account of the life history and abundance of this species. Following Weymouth's work further studies of life history and abundance were made by Herrington and published in 1930.

By means of the dark rings on the shell (see figure 1) it is possible to determine the age of individual clams and the results of Weymouth's and Herrington's work indicate that Pismo clams are mature and spawn for the first time at the beginning of their third or fourth year. The present legal size limit of 5 inches is reached between 6 and 10 years with an average of 8 years. The former limit of 4½ inches was attained between 5 and 8 years and the average sized clams were of legal dimension at 6 or 7 years. This means that under protective measures which have been in force since 1917 clams could have spawned from 3 to 4 times before they might be taken from the beach legally. The effectiveness of this size limit is discussed later in this report.

In addition to life history studies, Weymouth inaugurated in 1919 a statistical study of the clam population on Pismo Beach. Each fall since that date a census has been made of the clams to be found in this region. The method consists of digging a trench of standard width

and depth across the intertidal zone and recording the number, age and size of all clams found in this trench. This gives an accurate record of the number of clams of each year class to be found in any season on the beach and makes possible a comparison of these numbers from year to year. The increasing scarcity of the clams as revealed by these censuses has brought about the more and more stringent protective measures which were passed between 1919 and 1931.

STUDIES OF ABUNDANCE

One of the most striking revelations of this statistical study of the Pismo clam has been the great variation in the yearly set of young clams, the result of each season's spawning. In some falls the clams of the year have been exceedingly numerous and in other years so scarce as to indicate that the season's spawning was practically a failure. The largest set that has been recorded occurred in 1919; the four succeeding years were characterized by few young clams; and in the fifth year, 1924, a good set of clams was found. The clams of the 1924 year class were only one-fifth as abundant as those for 1919, but about three times more numerous than the total for the four previous years. After 1924 again four seasons elapsed when each year's set of young clams was very few but in 1929 the set was once more very good. In 1929 the clams of the year were somewhat more plentiful than in 1924 but only one-fourth as abundant as in 1919. The following year, 1930, produced another good set equal to 1924 and again in 1931 young clams resulting from that season's spawning were very numerous. The 1931 set exceeded the 1924, 1929 and 1930 year classes and was almost one-half as great as the 1919 year class.

Weymouth and Herrington, through studies of the cross-section material and through data from the commercial catch, suggested that successful spawnings for the Pismo clam may occur in intervals of 5 to 7 years. The finding of good sets in 1929, 1930 and 1931 furnished further indications of this same time interval between good sets. The set of 1929 occurred five years after the 1924 successful spawning and the set of 1931 seven years later. One difference in these later sets remains, however. The 1919 and 1924 year classes were immediately preceded and followed by poor sets while from 1929 to 1931 three successful years occurred in succession.

Since the 1919 and the 1924 year classes were each followed by poor spawning years, the Pismo clam fishery until 1929 was largely maintained by these two age groups. For this reason the history of these two groups graphically describes the history of the entire population on this beach. Herrington traced the abundance of the 1919 group and found that until these clams reached legal size, the decrease in numbers was not excessive, but after 1924 when about half of this age group was of legal size these clams began to disappear rapidly. By 1926 there were no clams of this year class left on the beach. Thus within three years after the exceptionally abundant year class of 1919 had reached legal size it had been entirely removed from the intertidal zone of Pismo Beach—a very striking commentary on the intensity of clamming in this region.

The history of the 1924 year class is even more tragic. This group of clams was never as abundant as was the 1919 group which may

account in part for its more rapid disappearance. The [illegible] from 1924 to 1925, however, was no greater [illegible] corresponding year of life for the 1923 [illegible] about 30 per cent probably results [illegible] about by environmental conditions. [illegible] the clams of the 1924 year class reached [illegible] group had been so greatly reduced as to be [illegible] clams of corresponding age were [illegible] of the 1924 clams reached legal [illegible] appeared from the intertidal zone. [illegible] taken from the beach within three years after it reached [illegible] the 1924 year class did not survive [illegible] Because we have no records of exceptionally [illegible] conditions during the years that the 1924 [illegible]

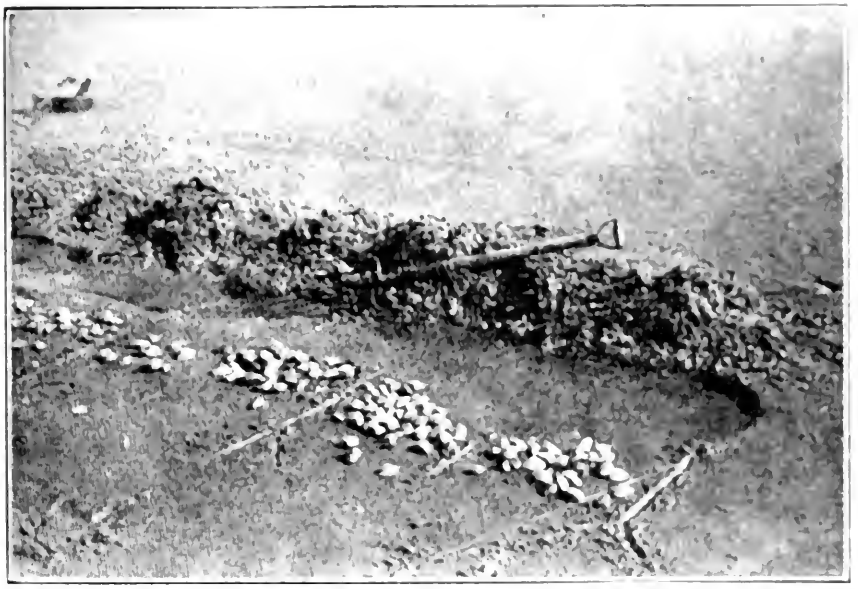

Fig. 41. The results of a cross [illegible] been dug and the clams [illegible] meter are shown. (From Cal. Fish and Game [illegible]

maturity, we must conclude that the rapid decrease [illegible] class resulted from their being taken by the clammers before they had attained a legal size limit.

The fact that clams are now being removed from Pismo Beach before they are of legal size testifies to the great paucity of clams in this area. Were large clams to be found in the intertidal zone, clammers would not be tempted to encroach more and more on the undersized clams. A comparison of figures 41 and 42 further illustrates the tremendous change in abundance which has been brought about in the past ten years. Figure 41 shows the results of a cross section census made about 1919 to 1920 when clams were fairly abundant. The trench was marked off in meter segments and the clams found in four meters and part from a fifth are shown in the picture. The trench was 16

centimeters in width. Figure 42 is the picture of a census made in 1929. Three meters of the trench have just been dug, the sand has been carefully forced through a screen, and everyone is intently watching for the 3, 4 or possibly 10 clams which may be found in the three meters of trench.

Each year the results of the fall census are more discouraging than the last. In 1931 clams comprising year classes older than 1929, the

Fig. 42. Results of a cross section dug on Pismo Beach in 1929. Three meters of trench have been dug, the sand forced through a screen, and everyone is watching carefully for the three, four or possibly ten clams which may be found in the screen. Photo by R. S. Croker.

first good set since 1924, were almost 50 per cent less numerous than for corresponding year classes in 1930. The total number of clams on the beach increased between 1930 and 1931, but this increase was brought about by the exceptionally good sets of 1929, 1930 and 1931. If these three year classes had a fair chance of survival the future prospects for the Pismo clam might be less dismal but the history of these groups bids fair to be even more tragic than that of the 1924 group.

In figure 43 are shown mortality curves for all year classes since 1918. In order to simplify the presentation, these year classes have been combined into two five-year groups, 1919 to 1923, 1924 to 1928, and contrasted with the 1929–1930 combination. Each of the five-year combinations represents the survival curve of an abundant group and of four sparsely represented groups. The clams found in each fall's set and representing 0 age were considered 100 per cent, and the number of clams in each succeeding year of life were expressed in percentage of the numbers in the 0 group.

For the first five-year combination, 1919–1923, the percentage decrease was not great until after the third year. Between the third and fourth year the curve drops rapidly and this decline continues until the sixth year when there were practically no clams of these year classes left on the beach. Throughout most of their life, the clams of these year classes were protected by a legal size limit of $4\frac{3}{4}$ inches. Thus the clams of each age class reached the legal size between 5 and 8 years.

The rapid decrease in numbers between [illegible] suggests that clammers were continually taking [illegible] size and that any one age group was [illegible] it had attained an authorized size limit. [illegible] of undersized clams, the rapid drop [illegible] the third and fourth year would not [illegible] seventh year. Since the 1919–1923 [illegible] years, we feel justified in concluding [illegible] of clams just smaller than the [illegible] inroads on the population and [illegible] No natural catastrophe could [illegible] the third and fourth year. [illegible] unusually poor environmental [illegible] year, these same conditions would [illegible] year classes between the first and [illegible] years, respectively. At the same [illegible] would have been affected to [illegible] sixth years. Thus in a curve [illegible] ties for each year class would [illegible] trated between the third and fourth year.

The survival curve for the [illegible] an even greater mortality rate than [illegible] The decrease in clams between the 0 and 1 [illegible] than in 1919–1923, but between the first and [illegible] third years the clams disappeared rapidly. The [illegible] to the sixth year was somewhat slower, but [illegible] interval practically no clams of the 1921–1928 [illegible] the intertidal zone of Pismo Beach after their [illegible] this second group of five age classes, the [illegible] so reduced after the fifth year that these [illegible]

FIG. 43. Mortality curves for all year classes [illegible] The curves represent two five-year age [illegible] considered 100 per cent and each succeeding age [illegible] of the 0 group.

negligible role in maintaining the clams on the beach. The clams of the 1924–1928 year classes throughout most of their life were protected by a legal size limit of 5 inches instead of 4½ inches, and yet they were removed from the beach at an earlier age. It is evident that as clams become scarcer the temptation to take undersized clams becomes proportionately greater and each year clammers are removing smaller and smaller clams from the beach.

Because of the pathetic scarcity of clams comprised in the year classes from 1919 to 1928, the survival of the good sets of 1929, 1930 and 1931 is exceedingly important. Nothing can be said as yet for the 1931 year class, but the history for the first two years of 1929 clams and one year for 1930 is shown in figure 43. Between 0 and 1 ages these clams decreased over 50 per cent and the decline from the first to the second year was almost as rapid. Since in former years the normal decrease from 0 to 1 was only about 30 per cent, and since the 1929 and 1930 year classes both experienced a decline of over 50 per cent, the conclusion seems inevitable that the rapid disappearance of the 1929 and 1930 year classes is brought about by man's depredations. The clammers are now taking their toll from clams of all sizes even the smallest not yet two years old.

Since clams spawn for the first time at the beginning of their third or fourth year, probably not more than 50 per cent of the clams of the 1919–1923 year classes spawned more than once before being taken by the clammers. For the clams of the 1924–1928 age groups probably not more than 20 per cent were allowed one spawning before being removed from the beach. If the heavy drain on the 1929 and 1930 year classes continues less than 10 per cent of these groups will be permitted to produce even one lot of spawn.

REASONS FOR THE FAILURE OF PROTECTIVE MEASURES

It is evident from the data presented in figure 43, that the increasing stringency of the laws has not served to protect the clams on Pismo Beach. The reasons for this failure require careful analysis. Two explanations can be offered, either the protective measures enacted have not been adequate to check the depletion of these clams or the laws have not been properly enforced.

We have no measure of the adequacy of the laws, but we do know that it has been impossible to enforce the protective measures. Let it be clearly understood at the outset, however, that this failure to enforce the laws protecting the Pismo clam has not been due to negligence on the part of the enforcement personnel of the Division of Fish and Game. For several years one deputy has devoted his entire time to the Pismo clam work and in addition he has received the aid of other deputies carrying on game protective work in the region. Furthermore, on holidays during the summer one or two additional deputies have been assigned to the Pismo clam patrol. The failure of enforcement has resulted, therefore, not from inefficiency on the part of the Division of Fish and Game but from lack of cooperation of the general public. Part of this lack of cooperation has been due to ignorance. Individuals coming to Pismo Beach from inland regions do not realize the seriousness of the Pismo clam situation and feel that the few undersized clams which they take will have no appreciable effect on the population as a whole. They quite forget the thousands of people who are acting under the same impulse and the resultant tremendous toll taken from the clam population each summer.

On the other hand the residents of San Luis Obispo County should be especially active in their cooperation. The Pismo clam is an invaluable asset to this county because of the tourist diggers which it attracts to the beaches and because of the increase in restaurant trade. At

present Pismo clams may not be legally shipp[illegible] and due to the scarcity of these clams on other b[illegible] of this county are practically the only ones in [illegible] may serve Pismo clams legally. For these r[illegible] importance for San Luis Obispo County to mai[illegible] Pismo clams.

There is much that private citizens can do to a[illegible] Each resident should feel it his personal respon[illegible] strangers are informed of the laws protecting the cl[illegible] importance, although less tangible, is the creation [illegible] attitude favoring law enforcement. In pa[illegible] handicaps to the enforcement of the Pismo clam l[illegible] reluctance of the judges to make convictions wh[illegible] laws were brought up for trial. Time after time the [illegible] missed the cases or suspended sentence. The only [illegible] method is that the violator goes out and sa[illegible] ditions the hands of the deputies have [illegible] able to do little to decrease the numbers of consist[illegible]

In times past, especially when the 1924 year c[illegible] on the beach, the most important factor in the depl[illegible] was the tourist digger. Herrington calculated that on a [illegible] as many as 3000 amateur clammers have at times sought [illegible] the intertidal zone of Pismo Beach. The resultant [illegible] thus removed from the beaches throughout the summer [illegible] beyond conception, but is clearly proven by the abject [illegible] appearance of the 1924 year class before it had reached l[illegible] by the even more rapid mortality rate of the 1929 and 1930 [illegible]

As long as a fair number of adult clams remained [illegible] beyond the reach of amateur diggers there was [illegible] cient spawn would be produced to repopulate the b[illegible] population is being drawn upon continually by the c[illegible] and because the later year classes are being taken [illegible] adulthood, it is inevitable that the supply of clams [illegible] must decrease. The evidence of this decrease is found [illegible] commercial diggers are yielding more and more to the [illegible] take undersized clams and to poach in the closed area w[illegible] is illegal. The supply of adult clams is now so low [illegible] danger of reducing the spawners to the point where [illegible] can not be supplied. Thus the number of adult [illegible] commercial diggers is of much greater importance [illegible] were a few years ago.

POSSIBILITIES FOR THE FUTURE

With this dark picture of the present status of the Pismo clam confronting us: What of the future? If the clams are not to be reduced to a state similar to Long Beach where the occasional specimen found is a rare curiosity, it is imperative that some way be found to protect the 1929, 1930 and 1931 sets until they reach legal size. Our present laws without adequate enforcement will not do this, and if the present laws could be enforced, the clams are now so seriously depleted that they might not furnish sufficient protection to build up the stock. More laws will probably have to be passed. The mildest of these will

be the clarification of the measures relating to the closed area and nonshipment of clams. The law should be amended to prohibit the possession of clams or the possession of any digging apparatus in the closed area and to prohibit the sale of clams outside of the San Luis Obispo and Monterey regions. This would somewhat simplify the enforcement problem. Further protection would be afforded if the sale of clams was prohibited in the entire State. A more drastic measure, but probably the only one which could now augment the numbers of clams, would be the complete closure of the entire beach for an indefinite number of years. Under such a measure permission to reopen the beach should not be granted until the annual census made by the Division of Fish and Game indicated that the population had increased sufficiently to justify such a procedure, and this justification should be decided by disinterested experts in population studies.

But these added restrictions will be of little value unless the laws can be enforced, and the ability to enforce these laws depends chiefly on the residents of San Luis Obispo County. Within the past few months citizens of Pismo and neighboring towns have taken the preliminary steps to aid in the protection of the clams by creating an atmosphere favoring such protection. If this constructive work can be continued the outlook is much more promising. In fact enforcement officials can do nothing further without such support and the future of the Pismo clam is dependent on the actions of local residents. But may the warning be sounded that the efforts expended by the people of this region to protect their clams must be a united one and must be maintained over a long period of years.

REFERENCES

California Fish and Game

1922. Cold weather kills Pismo clams. Cal. Fish and Game, vol. 8, no. 2, pp. 124–125.

Clark, Frances N.

1928. Pismo clam census. Cal. Fish and Game, vol. 14, no. 1, p. 86.
1929. Pismo clam census. Cal. Fish and Game, vol. 15, no. 1, pp. 72–73.
1930. Pismo clam census. Cal. Fish and Game, vol. 16, no. 1, pp. 75–76.
1930. Large Pismo clams. Cal. Fish and Game, vol. 16, no. 2, pp. 189–190.
1931. Increasing scarcity of clams on Pismo Beach. Cal. Fish and Game, vol. 17, no. 1, p. 84.

Herrington, William C.

1925. The Pismo clam crop. Cal. Fish and Game, vol. 11, no. 3, pp. 103–109.
1926. Depletion of the Pismo clam in California. Cal. Fish and Game, vol. 12, no. 3, pp. 117–124.
1930. The Pismo clam. Further studies of its life history and depletion. Cal. Div. Fish and Game, Fish Bull., no. 18, pp. 1–69.

Weymouth, Frank W.

1919. A case of destruction of Pismo clams by oil. Cal. Fish and Game, vol. 5, no. 4, pp. 174–175.
1920. The edible clams, mussels and scallops of California. Cal. Fish and Game Comm., Fish Bull., no. 4, pp. 29–34.
1921. The abundance of young Pismo clams. Cal. Fish and Game, vol. 7, no. 2, pp. 103–106.
1923. The life-history and growth of the Pismo clam (*Tivela stultorum* Mawe). Cal. Fish and Game Comm., Fish Bull., no. 7, 120 p.

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Vol. 18 APRIL, 1

MEETING OF THE FISH AND GAME COMMISSION

At the meeting of the Fish and Game Commission held in San Francisco, presided over by President J. Dale Gentry, at which Commissioners Henshaw and I. Zellerbach were present, held at San Francisco, March 25, 1932, the following resolution was adopted relative to rodent control in California:

Resolved, That the Fish and Game Commission of the State of California commends the U. S. Biological Survey and the State Department of Agriculture for their past and endorses their continued supervision and operation of predatory animal and rodent control work, but urges these departments to redouble their efforts to prevent unauthorized and careless use of poisons;

Resolved, That the Fish and Game Commission recommends that the use of poison be avoided when other effective methods are available, and urges the continuance of studies for the development of control methods which will not be a hazard to humans and to desirable wildlife.

Because of the lack of a settled policy and the general misunderstanding that has surrounded rodent control work in California, this resolution came at a very happy time. It is to be hoped that as a result of this action that future cooperation between the Bureau of Biological Survey, the State Department of Agriculture and the Division of Fish and Game will proceed in a regular and orderly fashion.

SUGGESTED SEASON ON WATERFOWL

In order that the sportsmen of California may have a correct understanding with regard to the open season on waterfowl during the season of 1932, the Fish and Game Commissioners at their regular meeting held early in March made certain definite recommendations to the Honorable Arthur M. Hyde, Secretary of Agriculture, with regard to the waterfowl situation in California. The contents of the letter forwarded to Mr. Hyde are herewith set forth in full.

"As the result of a careful study of waterfowl conditions in California, the Fish and Game Commission of this State recommends to you the changing of the Migratory Waterfowl regulations to provide for California an open season during the entire months of November and December, 1932.

"It is further recommended that the bag limit for ducks, except wood ducks, be fixed at fifteen and that the bag limit for all geese, including the brant, be fixed at four.

"It is further recommended, and strongly urged, that the possession limits be the same as the bag limits in this State. In California it is entirely practical to make daily shipments of legal game, and it is impossible to enforce a daily bag limit when a larger possession limit is legal.

"It is further recommended that the present distinction between species which gives complete protection to Ross and cackling geese be removed, as the protection is unnecessary in this State, and the enforcement is wholly impractical.

"It is further recommended that due cognizance be taken of the special conditions which maintain in this State, and that the regualtions affecting this zone be established in accordance with the requirements of the zone, irrespective of unrelated conditions which may exist in the East and Middle West.

"The Fish and Game Commission of California further recommends to you the selection of an alternate member for each principal selected for membership in your recently reorganized Advisory Committee. The selection of such an alternate would insure a proper representation of all sections of the country, even though pressure of personal business might prevent the attendance of the principal.

"Assuring you of the wish of the Fish and Game Commission of this State to assist you in the preservation of our migratory waterfowl, I am, (Signed) John L. Farley, Executive Officer."

The recommendations contained in the letter from John L. Farley, executive officer of the Division of Fish and Game, to the Secretary of Agriculture, contain in so far as possible all of those opinions which would appear most equitable to the majority of the sportsmen of the State. It is extremely difficult to please all shooters, but from the commendation that has been given the commissioners as a result of their resolution, it would seem that the recommendations contained in the above letter are as near perfect as it is possible to produce.

H. L. BETTEN RESIGNS

H. L. Betten of Alameda, member of the State Game Refuge and Shooting Grounds Advisory Committee of the Bureau of Fish and Game, tendered his resignation as a member of the Advisory Committee to the State Fish and Game Commission at its meeting held on March 2, in San Francisco.

The resignation was accepted. A delegation of the Associated Sportsmen were present and asked that they be given an opportunity of making suggestions as to a successor for Mr. Betten. The request was granted and the Sportsmen Association will present a list of names of those they believe suited for the position.

OPIE L. WARNER, NEW PUBLICIST

Opie L. Warner, San Francisco newspaperman, has been appointed publicist for the Division of Fish and Game, taking over the duties of the office March 1.

Warner succeeds Earl Soto, who for the past two years has occupied the position, and who placed his resignation before the State Fish and Game Commissioners in February.

For more than 20 years Warner [illegible] of the *San Francisco Call* and *Los Angeles* [illegible] latter paper some five years. Prior [illegible] engaged in newspaper work in San Bernardino [illegible] general editorial work, he owned and [illegible] and daily paper.

The new publicist is an ardent outdoor [illegible] in hunting and fishing and with his experience [illegible] with his newspaper experience will be [illegible] the Division of Fish and Game in a manner that will bring [illegible] number of hunters and fishermen interested [illegible] done to stock the streams and highways [illegible]

A CORRECTION

In the interest of scientific accuracy, I wish to [illegible] which appeared in an article written by me [illegible] FORNIA FISH AND GAME, entitled "Some Notes [illegible] mals of the Los Banos Duck Refuge, With Special Reference to Predatory Species." On page 270 [illegible] in the killdeer of the usual marital duties of the sexes I quoted an article by Dr. Gayle Pickwell, who has made a special study of this species. In quoting this article I attributed to it more than it actually states, thereby creating the impression that it asserted that the female is more aggressive than the male and that she more often visits the nest. In reality, the evidence presented by Dr. Pickwell indicates only that the male is more solicitous than the female in the process of incubation, as Dr. Pickwell has been good enough to point out to me. My own observations on the greater activity of the female in driving away intruding killdeers may be regarded as new, but leave the question as to which sex construes the nest remains open to further investigation. E. L. Sumner, Jr.

REVISED MAILING LIST

With the October, 1931, number of CALIFORNIA FISH AND GAME, an effort was made to weed out those individuals who were receiving the quarterly and yet who had no interest in its contents. For that purpose, a slip was attached to the front cover asking those interested in continuing their subscriptions to forward the same to the San Francisco office.

As a result of this action, the present mailing list is found to contain approximately 7000 names; slightly less than 2000 were removed from the mailing list. In some instances this has been due to faulty mailing addresses and not to a lack of interest in the quarterly.

In order that no interested readers may be overlooked, it is requested that those desiring to be placed upon the mailing list indicate their desire by a letter in writing to the editor.

COMMERCIAL FISHERY NOTES

Alaska has developed a food fish reduction situation similar to that which has been bothering us in California for a number of years.

About the only difference between the two is that in California it is the sardine, while in Alaska it is the herring which causes the difficulty.

In Alaska the herring packers are permitted to use in reduction plants the herring which are not suitable for salting, but the way this works out in practice is that the reduction of herring into oil and meal is the main business and the salting a side issue. A great industry, with millions invested, has been built up and now the investigations of the U. S. Bureau of Fisheries show that the herring supply in southern Alaska is being depleted by overfishing.* The people of Alaska who would conserve their fisheries are asking each session of Congress to pass a law to prohibit the reduction of food fish in Alaska. At each session of Congress the bill fails of passage, the arguments against it being: It would destroy an industry which represents millions of invested capital and employs many men in the capacity of fishermen and reduction plant operators. It is also contended that there is little demand in late years for herring as food, and to close the reduction plants would not increase the output of herring for food. How remarkably like our California sardine situation is this herring controversy in Alaska!

If the reduction industry of Alaska runs true to form it will object to and defeat legislation which would reduce the intensity of fishing, designed to prevent the exhaustion of the herring supply.

We, in California, have been asked: "Why do you care about what happens to the fish after they are caught? Just limit the catch and let the plants do what they please with the fish." This is good advice, provided the fisheries regulatory body has the power to regulate the fishing; but if it is left to Congress or legislatures to pass the fishing regulations, no reduction industry, with millions invested and looking for quick profits, is likely to be put out of business or seriously curtailed to conserve the natural resource represented in the herring or sardine supply.—N. B. S.

According to the annual report of the Biological Board of Canada, an investigation of the pilchard, or sardine, and the herring is being carried on jointly by the Biological Board and the Provincial Fisheries Department in British Columbia. The pilchard investigation was started about three years ago. Samples of the catch have been collected and analyzed as to length, weights and sex, with the object of detecting the signs of depletion. A study is being made of the specific characters of the pilchard, the object being, it is stated, to determine the migrations of the schools and determine the relationship between the British Columbia pilchard and California sardine. Studies are also being made to determine age from the otoliths, as the scales are not satisfactory. They are also collecting material for the study of the pilchard's food throughout the year. Their program, it can be seen, follows very closely the sardine program which is being carried out by the California Division of Fish and Game.

The herring of British Columbia is being investigated along the same lines. In addition, an attempt will be made to each year inspect

* Fluctuation in the supply of herring (*Clupea pallasii*) in southeastern Alaska. By George A. Rounsefell, U. S. Bur. of Fish. Bull. No. 2, 1931, 41 pp., 26 figs., 14 tables.

the spawning areas and collect data on which to base predictions of the future supply of herring. N. B. S.

Under the new striped bass law it is legal for commercial fishermen to market the striped bass which are accidentally caught in the nets while they are fishing for shad between March 1 and May 1. There were not many shad running prior to March 1 and there was very little, if any, profit in fishing shad alone, but when the 1st arrived on which bass could be legally taken in the shad nets fishing at once became profitable. Large numbers of bass were sent to the markets and soon there was an oversupply and the price to fishermen declined until, in less than two weeks, the price had reached four cents a pound, the lowest price ever paid for bass in the history of the fishery. As a matter of fact, the fishermen could not get even four cents as the dealers refused to take any more.

This glut of the market adds more complications to an already difficult situation. Striped bass are continuing to increase in abundance and the river is alive with them at this time, March 20. The net fishermen are prohibited from taking them until March 1, when the market is soon glutted and there is no outlet for the bass accidentally caught during the shad fishing operations. Most of the bass are dead when they are taken from the gill net, and it seems there is nothing the fishermen can do but throw them back, even if they are dead. To thus waste fish is a technical violation of the law, as there is a statute which prohibits the waste of fish. The new law, which permits commercial hook and line fishing in all parts of the State where striped bass are found, apparently permits a larger commercial catch than the old law. N. B. S.

DIVISION ACTIVITIES

BUREAU OF FINANCE

This department has taken over the handling of fish packers' tax and fines, thereby entailing extra work. It has been found necessary to install a new system of accounts, and one was provided whereby much time was saved and duplication avoided.

All delinquent fish packers' taxes have been satisfactorily settled, with the exception of one packer.

Owing to there being a lull, as usually follows the end of the year and the beginning of another, license income has fallen off. However, with the approach of the fishing season there is expected a big rush for the necessary permits.

The Los Angeles office has caught up with all the work. County clerks are responding in a splendid manner with their license returns, displaying an excellent spirit of cooperation. Such difficulties that have arisen has been made so by the slowness of subagents.

BUREAU OF GAME REFUGES

Water condition on all refuges are reported as being good, a contrast with previous quarterly reports. The many rainy days has caused delays on development work planned at many of the refuges.

With water increasing at the refuges, many ducks and geese are observed frequenting the refuge areas.

The purchase of 1100 acres adjoining the Imperial Valley Refuge was announced by the Commission at the March meeting in Los Angeles. This, it is believed, will cause a lessening of complaint by farmers of that section about ducks damaging their crops.

Mountain lions killed during the months of December, January and February totaled 108. The total slain during 1931 was 293, one less than the preceding year. February marked the largest kill of lions reported for a single month since 1912. The number of big cats taken out of circulation by the state lion hunters being 55, six more than any month since 1912.

Good progress is reported in the San Diego Quail Experimental area. This district is being freed of predatory animals under direction of an experienced trapper.

The refuge crew is completing its work in the southern end of the State and preparing for a trip northward.

BUREAU OF FISH CULTURE

The heavy storms of the present winter, ending the protracted spell of drought, brought joy to those who have seen the streams of this State dwindle to nothing. With the heaviest rain and snowfall in years a plentiful supply of water for the lakes and streams is assured for the present year.

However, the rain and snow, though badly needed and greatly appreciated, also brought its share of hard work to the hatcheries. Precautions to protect the plants from the sudden rise of streams, demanded long hours of hard work of the hatchery forces. Snow had to be cleared in those high up in the mountains, roads had to be opened, and in some instances distribution of eggs was made difficult by the bad conditions of the roads.

The members of the various staffs met the situation and with the exception of the Snow Creek Hatchery, which reports the loss of some 25,000 rainbow trout, but small damage was done.

All the hatcheries were busy preparing for the eggs distribution from the main hatcheries. Quotas were received in fine shape, and the hatching of the eggs exceptionally good, in spite of the unusual weather conditions.

The planting and distribution of trout for the season of 1931 was completed in the latter part of December, and over 33,000,000 of this species of fish were shipped or planted during the year.

The heaviest planting of Chinook salmon made in ten years was finished during February when over seven million were freed in the Klamath River, and nearly four million in the Sacramento River. All these salmon were hatched at the Mount Shasta Hatchery.

The first experiment in gathering salmon eggs from the Klamath River, taking them to the Mount Shasta plant and planting the hatch in the Klamath was pronounced a great success.

BUREAU OF GAME FARMS

With the ending of the heavy rainy season and the approach of spring the outlook is better than for several seasons for propagation work on both game farms.

With the coming of March egg gathering was instituted and preparations completed for hatching eggs of the pheasants, quail, grouse and turkeys. The brooders are ready and everything is in shape to fill the orders for both eggs and young bird.

This year in addition to furnishing eggs and [illegible] birds, arrangements have been made to send out 30 day old chicks to responsible people, who will see to their care and feeding until they are of an age proper for liberation. The 30 day old chicks will have passed the danger stage and will thrive in properly constructed quarters and with the proper care.

Inspection trip over the State, taking our Superintendent as far south as Imperial Valley, disclosed the fact that game birds released in the past are thriving, and he was more than pleased with the survey.

Bakersfield and Fresno sportsmen are completing their plans for 48 standard pens to accommodate 2000 pheasants, which they will maintain under our supervision.

All our breeding stock is in splendid condition and a banner year is indicated.

BUREAU OF HYDRAULICS

This Bureau was busy with cleaning up oil from ocean waters, occasioned by the breaking of pipe lines at various points along the coast. One of the most serious was in San Pedro harbor when a line break dumped some 350 barrels of oil into the bay waters. However efficient equipment soon cleared the bay.

At Rodeo the Standard Oil line broke and released about 500 barrels into the bay, but by damming the small creek into which the oil had gone, little, if any, got out into the open waters of the bay.

The Benbow Power Company has apparently been able to install a proper fish ladder at their power dam, as the steel head are getting up stream in a satisfactory manner.

The Folsom fishway has been completed, meeting a long required need.

The disposal systems of southern California oil companies withstood the rigorous storms of the season in excellent manner.

Inspection was made of the Pacific Gas and Electric work in Amador County, also the Cosumnes dam and fishway.

This Bureau is cooperating with the State Highway Commission in installing bridges over creeks along the new Coast Line Highway between Monterey and San Luis Obispo.

BUREAU OF FISH RESCUE AND RECLAMATION

The radical change of water conditions between the winter of 1931 and this year caused the work of this Bureau during March and February to be somewhat different. Last season, with low water, it was necessary to remove and transplant over seventy thousand fish; this year the total amounted to only 1589.

Flooding of the State streams during the heavy storms of the winter entailed much work, to see fish were not left in areas that would be left high and dry when the streams subsided to a normal level.

The year ending December 31, this Bureau accounted for the rescue of 7,038,972, while deputy wardens rescued 816,893 fish.

From a survey over the State it is evident but comparatively few fish have been lost during the year. Fish rescued were placed in permanent water, close to the point of rescue.

BUREAU OF PATROL

The heavy snowfall in the high Sierra during the storms that featured the past winter presented a problem to the patrol that called for prompt action and understanding. With the mountains covered by high drifts, deer and quail were facing starvation, their feed being cut off entirely in many localities. Our wardens, with the splendid cooperation of sportsmen and landowners, met the situation and relieved the dangers by carrying feed to birds and animals. As a consequence the latest survey show the deer to be in good condition, and reports indicate that but few were lost.

The bulk of the work was in Modoc, El Dorado, Tuolumne, Lassen, Plumas and Siskiyou counties.

The arrests for the past three months show a falling off and a consequent reduction of fines.

Arrests for December, January and February totaled 467, as against 588 a year ago. Fines were $10,070, a decrease of $7,828 from last year.

Since July 1, 1931, to February 29, there has been 1441 arrests, and fines collected amounted to $38,215, which is over $20,000 less than a like period to February 28, 1931. This condition is due to the fact that there has been less hunting and fishing than in former years, due to economic conditions.

The wardens also assisted in fish rescue work where the swollen streams were spreading fish over areas that would be dry soon after the heavy rains had ceased.

The Reo truck and crew were sent from Owens Valley to assist in the salmon planting from the Mount Shasta Hatchery.

BUREAU OF COMMERCIAL FISHERIES

With the closing of the sardine season, February 15, came the end of one of the poorest seasons of several years. At Monterey the delivery of sardines was over 44,000 less than the previous season. Poor prices for canned sardines, meal, and oil—lowest for years—is responsible for the lessened delivery. There were plenty of sardines but no market, and it is estimated the Monterey carry-over will amount to 200,000 cases.

Monterey fishermen were granted permission to bring in 3000 tons as an emergency measure by the Division of Fish and Game. They asked for a permit for 5000 tons, their petition being backed by the mayors and chambers of commerce of Monterey and Pacific Grove, who pointed out that it was a splendid economic move, furnishing work for many men who otherwise would be out of employment, and with boats to maintain. However, owing to inclement weather the fishermen only brought in 510 tons.

Serious trouble was threatened between [illegible] at San Pedro, and at Monterey with the sardine [illegible] But it appears that permanent breaks have been [illegible]

Heavy seas during the recent storms [illegible] and fishermen around Monterey Bay [illegible]

The *Albacore* has been busy patrolling [illegible] Reyes, keeping fishermen beyond the three-mile [illegible] that the floating reduction plant shipkept [illegible] check has been kept by this department on [illegible] reduction plant, and while figures [illegible] this season, on account of low prices it does [illegible] such ships could be maintained at [illegible] menace in reducing the supply of sardines along the [illegible]

The *Bluefin* made inspection trips [illegible] fish smugglers along the lower coast from San [illegible] Islands. Off Anacapa Island the *Bluefin* rescued [illegible] *Clarice*, which was in distress.

The *Bluefin*, during the early part of the year, was [illegible] some extent, and radio equipped. This [illegible] left for a cruise to Magdalena Bay and along the coast of Lower California. Many hauls were made for sardine eggs and larvae [illegible] for young sardines in sheltered waters. A study of [illegible] be available in a short time on the results of the cruise.

E. C. Scofield was transferred from the Hopkins Marine [illegible] to the laboratory, where for some time he will [illegible] sardine spawning and development.

This bureau is working in harmony with Scripps [illegible] oceanographic work, and interesting developments [illegible] the end of the survey.

Much interest has been displayed in our Fish Bulletin [illegible] have 2000 names for copies from those interested in the Bulletin generally and 3000 applications from those who are interested in some or few of the subjects covered.

Paul Bonnot, of this department, with the State Board of Health and U. S. representatives, has completed a preliminary survey of oyster lands along the California coast, and working out plans to insure sanitary handling of oysters and preventing the marketing of oysters from contaminated beds.

Merrill Brown, Junior Fisheries Researcher, made a study to plan for installation at Mount Shasta Hatchery of wire screens and traps to count salmon going to sea. The proper racks have been constructed and ready when the young salmon start to migrate.

In northern waters there have been but few violations of the fish laws and, as down in southern waters, those who broke the laws were quickly arrested and punished.

VOLUNTEER DEPUTIES

Much valuable work was done by the voluntary deputies during the heavy snow storms which cut off the feed for thousands of quail. Plenty of proper feed was taken to points where the quail were virtually on the point of starvation. In some instances the feed had to be taken by men on snow shoes.

The volunteer deputies are devoting much time to the supervision of quail sanctuaries. The results derived from these sanctuaries can be surmised by the reports received on 300 questionnaires sent to those landowners who have set aside a part of their land for the propagation of quail. All replies but very few indicate a goodly increase of birds.

The vounteer deputies, who now number 400 in the State, have in addition to looking after quail sanctuaries and relief work for quail during the year, rendered valuable service to the deputy wardens.

The annual report shows they have checked 49,364 licenses; hunting, fishing and deer tags; assisted and made 413 arrests, from which fines amounting to $10,378 were collected, and have killed, by trapping and shooting, 7068 predatory birds and animals.

The predatory bird and mammal prize contest closed March 1st, and the response to the contest was most pleasing. Prize winners were announced in the April Service Bulletin.

BUREAU OF EDUCATION AND RESEARCH

James Moffitt during February took the second annual census of black sea brant in California. He made a personal count of the birds at Tomales, Humboldt and Morro bays. Through the kind cooperation of the Museum of Vertebrate Zoology and the members of the San Diego Museum of Natural History, counts were also taken at Bodega, Drakes and San Diego bays. A detailed report of this census will appear in a future issue of this magazine.

E. L. Sumner, Jr., is working on the area in San Mateo County where experiments are being conducted on quail environment and habits. Pens have been constructed and the enclosures planted to food suitable for the birds. The quail are under constant observation and from what is learned of food conditions, life history, natural enemies and habits, it is hoped that valuable information of a practical nature will be secured to the end that the division will be in a position to put the theory in practice on other areas to benefit quail conditions and ultimately replenish their abundance.

Extensive lecture programs have been carried on in the schools of various counties. It is hoped that through this concentrated effort it will induce the County Boards of Education to introduce nature study in the curriculum.

REPORTS

STATEMENT OF INCOME

For the Period July 1, 1931, to December 31, 1931, of the Eighty-third Fiscal Year

License sales	Items	
Departmental income:		
Angling licenses, 1931	$ [illegible]	
Angling licenses, 1932	[illegible]	
Commercial hunting club licenses, 1931-32	[illegible]	
Commercial hunting club operators' licenses, 1931-32	[illegible]	
Deer tags, 1931	[illegible]	
Fish breeders' licenses, 1931	[illegible]	
Fish importers' licenses, 1931	[illegible]	
Game breeders' licenses, 1931	[illegible]	
Game breeders' licenses, 1932	[illegible]	
Hunting licenses, 1931	[illegible]	
Hunting licenses, 1932	[illegible]	
Kelp licenses, 1931	[illegible]	
Market fishermen's licenses, 1931-32	[illegible]	
Trapping licenses, 1931-32	[illegible]	
Wholesale fish packers' and shell fish dealers licenses, 1931-32	[illegible]	
Total license sales		$[illegible]
Other income:		
Contributions from importers	$[illegible]	
Court fines	[illegible]	
Fish packers' tax	[illegible]	
Fish tag sales	[illegible]	
Game tag sales	[illegible]	
Interest on bank balances	[illegible]	
Kelp tax	[illegible]	
Miscellaneous sales	[illegible]	
Total other income		$[illegible]
Total departmental income		$[illegible]
Income for the State University Fund		
Kelp tax		$[illegible]

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to December 31, 1931, of the Eighty-third Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau administration:					
Executive	$4,200 00				$4,200 00
Clerical and office	10,985 81	$648 67	$155 58	$171 26	11,961 32
Printing		6,979 05			6,979 05
Automobiles		126 43	171 11		297 54
Traveling			1,696 97		1,696 97
Postage			3,025 73		3,025 73
Telephone and telegraph			2,375 28		2,375 28
Freight, cartage and express			1,592 15		1,592 15
Rent			7,654 31		7,654 31
Accident and death claims			1,737 68		1,737 68
Accounting pro rata	2,250 00				2,250 00
Legal	3,300 00		386 65	75 55	3,762 20
Publicity			68 86		68 86
Total bureau administration	$20,735 81	$7,754 15	$18,864 32	$246 81	$47,601 09
Bureau education and research:					
Chief and assistants	$3,000 00				$3,000 00
Clerical and office	1,219 95	$109 97	$107 38		1,437 30
Traveling			3,088 55		3,088 55
Telephone and telegraph			13 03		13 03
Freight, cartage and express			79		79
Photographer	720 00		77 54	$846 00	1,643 54
Librarian	1,020 00	12 78	50 24	84 10	1,167 12
Research	5,250 00	133 88		28 00	5,411 88
Blue printing			12 66		12 66
Publicity			398 43		398 43
Exhibits			8 25		8 25
Lecturer	1,890 00				1,890 00
Total bureau education and research	$13,099 95	$256 63	$3,756 87	$958 10	$18,071 55
Bureau patrol and law enforcement:					
Chief and assistants	$5,520 00				$5,520 00
Clerical and office	1,620 32	$34 91	$8 68	$11 47	1,675 38
Automobiles		3,928 42	2,072 41	613 76	6,614 59
Traveling			65,557 36		65,557 36
Postage			224 35		224 35
Telephone and telegraph			943 88		943 88
Freight, cartage and express			24 59		24 59
Rent			248 15		248 15
Heat, light and power			6 82		6 82
Captains and deputies	104,554 31	769 09	272 46	286 65	105,882 51
Launches		638 04	572 29		1,210 33
Fish planting	3,767 72	539 81	205 00		4,512 53
Volunteer deputies	360 00				360 00
Premiums on bonds			561 97		561 97
Temporary help	24 00				24 00
Cooks	975 00				975 00
Total bureau patrol and law enforcement	$116,821 35	$5,910 27	$70,697 96	$911 88	$194,341 46
Bureau commercial fisheries:					
Chief and assistants	$7,980 00			$41 00	$8,021 00
Clerical and office	5,310 00	$206 75	$77 67	3 00	5,597 42
Automobiles		351 97	151 99		503 96
Traveling			11,151 91		11,151 91
Postage			3 52		3 52
Telephone and telegraph			320 44		320 44
Freight, cartage and express			384 21		384 21
Rent			616 42		616 42
Heat, light and power			140 72		140 72
Research	4,543 09	13 16		53 54	4,609 79
Captains and deputies	8,450 00	128 18	36 57	10 00	8,624 75
Launches	6,305 00	1,864 94	1,361 75	184 20	9,715 89
Laboratory	16,065 00	388 50	697 46	150 86	17,301 82
Blue printing			2 52		2 52
Hydro-biological survey—Monterey Bay			750 00		750 00
Statistics		271 10	758 35	42 15	1,071 00
Fish cannery research			7,500 00		7,500 00
Fish cannery inspectors—seasonal	8,611 61				8,611 61
Total bureau commercial fisheries	$57,264 70	$3,224 60	$23,953 53	$484 75	$84,927 58

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to December 31, 1931, of the Eighty-third Fiscal Year

Function	Salaries and wages	Materials and supplies	Equipment	Land	Structures	Total
Bureau fish culture						
Chief and assistants	$4,120.00					$4,120.00
Clerical and office	2,059.62	$1,[illegible]	[illegible]	[illegible]		[illegible]
Automobiles		2,[illegible]	[illegible]			[illegible]
Traveling			[illegible]			[illegible]
Postage			[illegible]			
Telephone and telegraph			[illegible]			
Freight, cartage and express			[illegible]			[illegible]
Rent			[illegible]			[illegible]
Heat, light and power			[illegible]			[illegible]
Hatcheries	[illegible]	20,052.10	[illegible]	[illegible]	[illegible]	[illegible]
Special field investigations	[illegible]	1,[illegible]	[illegible]			[illegible]
Fish cars	1,[illegible]	[illegible]	[illegible]			[illegible]
Blue printing			[illegible]			[illegible]
Cooperative research	[illegible]	[illegible]		[illegible]		[illegible]
Fish hatchery assistant—season	14,[illegible]					[illegible]
Total bureau fish culture	$84,[illegible]	$42,[illegible]	$[illegible]	$[illegible]	$[illegible]	
Bureau hydraulics						
Chief and assistants	$4,170.00		[illegible]			[illegible]
Clerical and office		$[illegible]	[illegible]			[illegible]
Automobiles		2,[illegible]	[illegible]			[illegible]
Traveling			[illegible]			[illegible]
Postage						
Telephone and telegraph			[illegible]			[illegible]
Cooperative research	1,500.00					[illegible]
Total bureau hydraulics	$5,670.00	$[illegible]	$[illegible]			$[illegible]
Bureau game propagation						
Superintendents	$1,650.00					[illegible]
Clerical and office	40.00					[illegible]
Automobiles		$255.67	$[illegible]			[illegible]
Traveling			[illegible]			[illegible]
Postage			[illegible]			[illegible]
Telephone and telegraph			[illegible]			[illegible]
Freight, cartage and express			[illegible]			[illegible]
Heat, light and power			[illegible]			[illegible]
Maintenance		[illegible]	[illegible]	$[illegible]		[illegible]
Assistants	7,[illegible]					[illegible]
Total bureau game propagation	$8,[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	
Bureau fish rescue:						
Chief and assistants	$2,560.00		$[illegible]			$[illegible]
Traveling			[illegible]			[illegible]
Rent			[illegible]			[illegible]
Total bureau fish rescue	$2,560.00		$[illegible]			$[illegible]
Bureau game refuge:						
Chief and assistants	$4,240.08					$4,240.08
Clerical and office	960.00	$22.76				[illegible]
Automobiles		447.96	$[illegible]			[illegible]
Traveling			[illegible]			[illegible]
Postage			[illegible]			[illegible]
Telephone and telegraph			[illegible]			[illegible]
Freight, cartage and express			[illegible]			[illegible]
Lion hunters and trappers	4,019.50					[illegible]
Refuge posting		118.66	[illegible]	$[illegible]		[illegible]
Predatory animal control			[illegible]			[illegible]
Temporary help	6,094.11					[illegible]
Refuge maintenance	2,730.00	[illegible]	[illegible]	[illegible]		[illegible]
Total bureau game refuge	$18,053.59	$3,402.40	$[illegible]	$[illegible]		$[illegible]
License commissions						$25,[illegible]

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to December 31, 1931, of the Eighty-third Fiscal Year—Continued

Function	Total
Construction, improvements and equipment:	
Permanent repairs on Brookdale Hatchery	$761 30
Improvements at Lake Almanor Hatchery	1,380 68
Telephone and power line from Chester to Lake Almanor Fish Hatchery	2,400 00
Filter at Big Creek Hatchery	141 85
Construction of dams on Cherry Creek	1,000 00
Completion of egg collecting racks at Chester	497 38
Construction of rearing ponds and a temporary house for an attendant, Hat Creek, Inyo County	1,238 58
Tank and egg collecting station at Huntington Lake	1,920 17
Improvements, and equipment for filter at Kaweah Hatchery	316 98
Repairs and improvements at Mt. Shasta Hatchery	875 37
Permanent improvements on Snow Creek Hatchery	1,233 12
Total construction, improvements and equipment	$11,765 43
Purchase of game refuges	127,650 00
State Fair and other exhibits	4,801 06
Prior year expense—eighty-second fiscal year only	14,998 86
Grand total proprietary group	$717,525 17

SEIZURES OF FISH AND GAME

October, November, December, 1931

Fish:	
Abalones	1,036
Abalones, pounds	270
Bass, striped	60
Bass, striped, pounds	400
Clams	1,857
Crabs	17
Cockles	312
Lobsters	575
Lobsters, pounds	3,048
Mussels, pounds	150
Salmon, pounds	895
Spotfin, croaker, pounds	56
Skipjack, pounds	215
Trout, steelhead	17
Spear fish	4
Net	1
Miscellaneous fish	9
Game:	
Deer	209
Deer meat, pounds	1,358
Deer hides	3
Doves, pigeons	42
Ducks, geese, mudhens	646
Non-game birds	119
Rabbits	7
Shorebirds	44
Swans	6
Skins (animals)	37
Traps (animal)	18
Turkeys, wild	5
Wood ducks	10
Bird nets	4

FISH CASES

October, November, December 1931

	Number arrests	Fines collected	Jail sentences imposed
Angling License Act, violations of	[illegible]	[illegible]	[illegible]
Abalones, undersized, overlimit	[illegible]	[illegible]	[illegible]
Bass			
Black; closed season	[illegible]		
Striped; small	[illegible]	[illegible]	
Clams; overlimit, undersized	[illegible]	[illegible]	[illegible]
Cockles; small	[illegible]		
Crabs, closed season, female crabs	[illegible]	[illegible]	[illegible]
Commercial fishing license act, violations of	[illegible]	[illegible]	
Destroying fish	[illegible]	[illegible]	[illegible]
Fishing too near dam	[illegible]	[illegible]	[illegible]
Illegal fishing apparatus	[illegible]	[illegible]	
Lobsters, small	[illegible]	[illegible]	
Mussels; overlimit	[illegible]	[illegible]	
Miscellaneous fish	[illegible]	[illegible]	
Night fishing	[illegible]	[illegible]	
Nets, seines, illegal	[illegible]	[illegible]	[illegible]
Pollution of streams	[illegible]	[illegible]	
Salmon; overlimit	[illegible]	[illegible]	[illegible]
Trout, closed season	[illegible]	[illegible]	
Totals	[illegible]	[illegible]	[illegible]

GAME CASES

October, November, December, 1931

	Number arrests	Fines collected	Jail sentences imposed
Commercial Gun Club License Act	[illegible]	[illegible]	
Deer; closed season; killing fawns, does, spike bucks	[illegible]	[illegible]	[illegible]
Deer tags; failure to attach tags, hunting without tags	[illegible]	[illegible]	[illegible]
Doves; closed season; overlimit	[illegible]	[illegible]	
Ducks, geese, mudhens; overlimit	[illegible]	[illegible]	
Hunting License Act; violations of	[illegible]	[illegible]	[illegible]
Hunting in refuge	[illegible]	[illegible]	
Nets (bird); illegal	[illegible]	[illegible]	
Night hunting	[illegible]	[illegible]	[illegible]
Non-game birds; killing of	[illegible]	[illegible]	
Pigeons; closed season	[illegible]	[illegible]	
Pheasant; closed season	[illegible]	[illegible]	[illegible]
Quail; closed season	[illegible]	[illegible]	[illegible]
Rabbits; closed season	[illegible]	[illegible]	
Shorebirds; closed season	[illegible]	[illegible]	[illegible]
Squirrel (gray); closed season	[illegible]	[illegible]	
Swan; closed season	[illegible]	[illegible]	
Shooting from motor boat, auto	[illegible]	[illegible]	
Trespassing	[illegible]	[illegible]	
Turkeys (wild); killing of	[illegible]	[illegible]	[illegible]
Trapping License Act; violation of	[illegible]	[illegible]	[illegible]
Woodducks; killing of	[illegible]	[illegible]	[illegible]
Totals	467	$13,001.00	1,589

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1931

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

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore									10,918
Anchovies							22,385		35,310
Barracuda							1,504	271	11,072
Bonito									720
Carp					1,508	24			
Catfish				1,156	87,458	37,362			
Cultus Cod	100,004	5,752					83,708	2,935	47,655
Flounders	37,804	6,240			6		19,322	405	
Grayfish	19,145						49,459	2,137	355
Hake	420						6,806		
Halibut	69,682						3,192	609	2,102
Hardhead					9,599				
Herring	173		146,142				54,440		
Kingfish							126	1,829	50,809
Mackerel							1,536	2,254	116,014
Mackerel—Horse									130,187
Mackerel—Spanish									
Mullet									
Perch	13,177		9,348				8,920	162	5,523
Pike					287	18			
Pompano								10	287
Rock Bass									
Rockfish	91,869	5,917					120,960	141,453	332,599
Sablefish	257,621	1,042					6,961	111,783	7,912
Salmon	26,330			725	276	222			
Sandabs	44,067	4,810					22,222	249	230
Sardines							30,735,768	500	62,759,216
Sculpin							20	175	
Sea Bass—Black									25
Sea Bass—White			1,353				4,574	207	5,021
Sheepshead									
Skates	16,002						26,736	1,825	1,262
Skipjack									

Smelt	62,621	967	8,884				10,885	28,977	78,160
Sole	1,195,490	43,738					743,570	23,021	4,076
Splittail					749	2,150			
Striped Bass			407	18,533	18,312	132,146	516		
Sting Ray							150		
Suckers					87				
Swordfish									
Tomcod	1,940						406		
Tuna—Bluefin									
Tuna—Yellowfin									
Turbot			150				[illegible]		
Whitebait		170	150				[illegible]		[illegible]
Whitefish									
Yellowtail									
Miscellaneous	15,850	150					[illegible]	4	[illegible]
Total fish	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Crustaceans:									
Crabs	[illegible]	[illegible]					[illegible]	[illegible]	
Ecrevisse									
Shrimps			[illegible]			[illegible]	[illegible]		[illegible]
Spiny Lobsters									
Molluska:									
Abalones									[illegible]
Clams—Cockle	[illegible]	[illegible]	[illegible]						
Clams—Mixed	[illegible]	43							
Clams—Pismo									[illegible]
Clams—Softshell	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		
Cuttlefish									
Mussels	400		[illegible]						
Oysters—Eastern							[illegible]		
Oysters—Native	[illegible]		[illegible]				[illegible]		[illegible]
Squid									
Miscellaneous:									
Terrapins		[illegible]							
Totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]

All amounts shown in pounds except [illegible]

[1] 186.6 12 dozen
[2] 13.7 12 dozen
[3] 23,109.5 12 dozen
[4] 102 dozen

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1931—Continued

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

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into California via San Pedro	Fish from south of the International Boundary brought into California via San Diego	Total fish from south of the International Boundary brought into California
Albacore		2,706			13,624			
Anchovies		888	270		58,853			
Barracuda	69	357,166	401	53,315	423,798	129,584	39,224	168,808
Bonito		647,941	913	8,536	658,110	59,470		59,470
Carp		1,260			2,792			
Catfish					125,976			
Cultus Cod		24			240,078			
Flounders	14	214	9		64,014			
Grayfish	1,037	37,882	25,094	24,211	159,320	25	3,345	3,370
Hake					7,226			
Halibut	77,986	66,336	4,623	5,757	230,287	547	1,336	1,883
Hardhead					9,599			
Herring				15,320	216,075			
Kingfish		52,578	308	84	105,734			
Mackerel	1,035	5,479,921	40,689	39,852	5,681,301			
Mackerel—Horse		115,269	160		245,616			
Mackerel—Spanish						1,880	585	2,465
Mullet			2,794	3,261	6,055	370	342	712
Perch	174	11,555	73		48,932			
Pike					305			
Pompano		551			848		455	455
Rock Bass	1,800	38,506	7,746	29,339	77,391	4,398	1,054	5,452
Rockfish	10,732	465,410	4,462	130,213	1,303,615	455	1,109	1,564
Sablefish		7,471			392,790			
Salmon					27,553			
Sandabs		1,598	45		73,221			
Sardines	710,960	36,201,889		3,029	130,411,362			
Sculpin	10	12,208	1,526	3,807	17,746			
Sea Bass—Black	210	27,253	6,853	22,075	56,416	40,107	18,165	58,272
Sea Bass—White	689	262,096	256	7,086	281,282	4,389	3,235	7,624
Sheepshead	9,870	39,170	687	13,025	62,752			
Skates		6,299	420		52,544			
Skipjack		17,294		1,965	19,259	1,101,273	931,123	2,032,396

Smelt	5,080	70,521	41,465	3,397	310,957	88	9	97
Sole	53,371	17,311	20	261	2,080,558			
Splittail					2,599			
Striped Bass					169,917			
Sting Ray		287			437			
Suckers					87			
Swordfish		85,756	438	31,488	117,682			
Tomcod					2,346			
Tuna—Bluefin		6,593			6,593			
Tuna—Yellowfin		18,427		1,460	19,917	2,251,239	3,098,049	5,349,288
Turbot					1,119			
Whitebait					3,441			
Whitefish		24,218	6	15,470	39,694	4,597	520	5,117
Yellowtail	300	148,110	2,496	72,173	223,088	126,069	77,749	203,749
Miscellaneous	45	153,022	42	2,130	174,165	33,693	103,811	137,504
Total fish	[1]73,382	44,377,730	141,799	467,290	144,227,674	3,749,115	4,280,111	8,040,226
Crustaceans:								
Crabs		450			561,926			
Ecrevisse								
Shrimps					278,592			
Spiny Lobsters	35,038	138,868	10,355	103,510	286,571	2,756	345,343	348,099
Molluska:								
Abalones	23,856				665,406			
Clams—Cockle		10,286			39,685			
Clams—Mixed		672			13,469			
Clams—Pismo	16,163				25,415			
Clams—Softshell					39,550			
Cuttlefish		98	39		1,815			
Mussels					400			
Oysters—Eastern					97,867			
Oysters—Native					54,273			
Squid	70				187,772			
Miscellaneous								
Terrapins					48			
Totals	[2]48,546	[3]44,528,704	152,149	[4]587,800	[5]147,477,810	[6]3,754,627	[7]4,627,454	[8]8,382,325

[1] 2,112 dozen
[2] 23,413.7 12 dozen

ABSTRACT
CALIFORNIA SPORTING FISH AND GAME LAWS
VALID UNTIL 90 DAYS AFTER CLOSE OF 1933 LEGISLATURE

1931 OPEN AND CLOSED SEASONS 1932

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES

GAME	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
DEER	1¾										15			No Does, Fawns or Spike Bucks No Forked Horned Deer in Dist. 1¾ No sale of Venison or Deer Skins Two Bucks per Season except in 1¾ where limit is one See Notes 6-9-10-12
	2-2½-3									16				
	1-1½-4-4½-4½-23-24-25									16	15			
Rabbits—Cottontail and Brush	ALL EXCEPT 4-4¾											15	15	15 per day. 30 per week. No limit in District 4 No protection in 4¾
Bear, Fur Animals	ALL											15		See Note 7 Predatory animals unprotected in districts 2-2½-3-4-4½
Ducks, Geese, Jack Snipe, Mud Hens	ALL — FEDERAL LAW										OPENS NOON OCT. 1			15 Ducks, 30 in Possession; 4 Geese, 8 in Possession; 20 Snipe, 25 Mud Hens, No Ross Snow or Cackling Geese
	ALL — STATE LAW 15													25 Ducks, 25 Snipe, 25 Mud Hens. 50 Per Week Goose Limit See Note 4. See Notes 9-10-11-12-13
Quail—Valley, Desert and Mountain	ALL EXCEPT 1½											15	15	Valley and Desert 15 per day. 30 per week Mountain 10 per day. 20 per week
	1½													
Dove	ALL EXCEPT 4-4½-4¾													Federal Season Opens Noon September 1 — 15 per day 30 per week
	4-4½-4¾													

There is no open season on Elk, Antelope, Mountain Sheep, Sea Otter, Tree Squirrel, Sierra Hare, Rail, Wood Duck, Pigeon, Swan, Shore Birds (except Jack Snipe), Grouse, Sage Hen, Imported Quail, Wild Pheasant, Partridge, or Wild Turkey.

FISH	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
Steelhead and all Trout (except Golden), Whitefish Unlawful to take trout in waters closed by Governor's proclamation	1-1½-1¾-2-2¾-3-4-4¼-4½-15 Klamath River, Lake Almanor													Bag limit for taking and possession, 25 trout or 10 pounds and one trout. — No Sale No Spearing For other restrictions See Notes 12-15-16-20 21-22-28-29 31-33 On this Card
	2½			28		30								
	23-24-25					30								
	Truckee River					15								
	See Note 22													
	1½ Winter Klamath River													5 Trout regardless of weight
	Russian, Navarro, Napa and Eel Dist. 2 Tidewater Dists. 2-3-15													3 Trout regardless of weight
Golden Trout	ALL													20 per day. None under 5 inches Not more than 10 lbs. and one
BLACK BASS	ALL EXCEPT 4¾													15 per day — No Black Bass under 9 ins. No sale Hook and line only
	CLEAR LAKE IN LAKE CO.													Clear Lake 10 per day
Sunfish	ALL													25 per day
Sacramento Perch and Crappie	ALL EXCEPT CLEAR LAKE													25 per day — Hook and line only No sale
	CLEAR LAKE													10 per day
Striped Bass	1-3-12A													None under 12 inches, 5 per day. None to be taken from Salton Sea. See Note 19
Crabs	ALL EXCEPT 1½-6-7-8-9													Season Districts 1½-6-7-8-9 August 31, December 14 See Note 24, None under 7 inches. No Female
Abalones	ALL													Only for food. Must be brought to shore alive in shell Angling License Required. See Note 27
Pismo Clams	17													None under 5 inches. No shipment. 15 per day Angling License Required District 18a Closed
Spiny Lobster	ALL													No Sale of Meat. None under 10½ or over 16 inches See Note 24
GRUNION	ALL													

Salmon and Shad May Be Taken as Noted in Paragraphs 19-23. No open season on Sturgeon (possession prohibited).

NOTES

IT IS ALWAYS UNLAWFUL

1. To hunt, kill, possess wild birds or mammals, to possess firearms, except under written permit from the Commission, within districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q 1r, 1s, 1t, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 4a, 4b, 4c, 4d, 4e, 4f, 4g, or General Grant Refuge, or the Mt. Tamalpais Game Refuge, including Richardson Bay, or San Francisco Refuge, or Silver Lake Refuge (water fowl may be killed in 4a and 4e), or to hunt quail in the Bolinas Quail Refuge, or to hunt or discharge firearms in Huntington Lake Refuge or San Leandro Bay Refuge.

2. To hunt birds or mammals excepting predators without a hunting license.

3. To possess any bird net or to net, trap or to hold protected game or birds of any kind, their nests or eggs except under written permit from the Commission.

4. To take or possess more than 8 geese per day or 50 per week; or more than 8 honkers or sea brant per day or 24 per week.

5. To take or kill non-game birds, except blue jay, butcher bird, English sparrow, sharp-shinned, Cooper or duck hawk, great horned owl, linnet, white pelican, shag, and in districts 1, 2, 3, 4 and 4½, blackbirds.

6. To hunt deer without a deer tag license. To fail to attach to the horns of deer immediately on killing, properly filled out license tag or at the same time to send duplicate tag to the Division. To carry a deer into a closed district without having license tag countersigned, or to have untagged deer in possession. To fail to retain in possession during open season and for ten days after the skin and portion of head bearing horns of deer killed and to produce upon demand. To use more than one dog to the hunter in hunting deer or to allow dogs to run deer in closed season, or to possess doe or fawn skins, or deer skins not bearing evidence of sex.

7. To trap for profit bear, ring-tailed cat, coon, pine marten, skunk, fisher, wolverine, mink, river otter, fox, beaver or muskrat, or to kill these animals during the closed season, except when destroying property. To interfere with the traps of licensed trappers. To use saw tooth or spike jawed traps for taking fur bearers.

8. To use any animal other than a dog to stalk wild birds.

9. To shoot game from a power boat, sailboat, auto, airplane; or to hunt waterfowl from a scull boat in districts 8, 9, except on Wednesdays and Sundays, or at any time in district 12 or Napa River south of Edgerly Island, or to use a

shotgun larger than ten gauge, or to possess an [illegible] automatic or a [illegible] gun.

10. To shoot resident game [illegible] and ½ hour before [illegible] and ½ hour before [illegible] game.

11. To hunt water[illegible] 22, other than on W[illegible] holidays, opening and [illegible] between [illegible] a.m. and [illegible] of auto, airplane [illegible]

12. To hunt game or fish [illegible] season, [illegible] days.

13. To sell wild game [illegible]

14. To make a false statement [illegible] fail to show license [illegible]

15. To take game or fish [illegible] season [illegible] Trout legally taken [illegible] into a closed district [illegible] duplicate setting [illegible] license and name [illegible] must be [illegible] the officer [illegible] closed district [illegible] effect that [illegible] by agent [illegible]

16. [illegible] dried fish [illegible] packages [illegible] signee and [illegible] state.

17. To operate a [illegible]

18. To [illegible] 21, 3, 4, [illegible] 23, 24 and [illegible]

19. To [illegible] length [illegible] bass during [illegible] line [illegible] and July 31, or September [illegible]

20. To take [illegible] hand [illegible] than 3 hooks.

21. To have in possession any [illegible] landing [illegible] within [illegible] feet of [illegible] unlawful to spear same.

22. To take [illegible] in any lake within [illegible] feet [illegible] of any stream [illegible] of any stream [illegible] within two miles from [illegible] to August 1.

23. To take salmon on spawning [illegible] a spawning [illegible] Klamath River [illegible] than [illegible] less than [illegible] or [illegible] under [illegible] dition that the [illegible] can [illegible] be taken [illegible]

FISH & GAME DISTRICTS of CALIFORNIA
1931 — 1932

LICENSES MUST BE SHOWN UPON DEMAND

Districts [illegible] Game Refuges. Hunting prohibited. Angling [illegible]

[illegible] Commercial Fishing Districts. Hunting and angling in accordance with [illegible] district [illegible]

[illegible] Fish Commission [illegible] fishing prohibited.

District [illegible] Mendocino County [illegible] except [illegible] and [illegible]

District 22. The watershed of Lake Tahoe and Truckee River [illegible] and Little Truckee above confluence [illegible] watershed of American River and [illegible] Creek above [illegible]

District [illegible] waters [illegible] watershed of [illegible] highway bridge, waters of North Fork American River between [illegible] Bar Bridge and mouth of [illegible] Creek, the waters of the Carson, West Carson and [illegible] Rose Meadow [illegible] and all [illegible] streams.

LICENSE PROVISIONS

HUNTING

License year [illegible] July 1 to June 30

Residents under 18	$1.00
Resident citizens	2.00
Non-resident citizens	10.00
Declarant Aliens	10.00
Other Aliens	25.00

The amount of change in hunting license year [illegible] June 30 [illegible] months [illegible] same as above schedule.

ANGLING

License year January 1 to December 31

Resident citizens	$1.00
Non-resident citizens	3.00
Aliens	3.00
Under 18 no license required	

TRAPPING

License year July 1 to June 30

Citizens	$1.00
Aliens	2.00
Under 18 no license required	

DEER TAG

License year January 1 to December 31

Everyone (2 tags)	$1.00

COMMERCIAL HUNTING CLUBS

License year July 1 to June 30

Citizens	$25.00
Aliens	100.00
Operators, citizens	5.00
Operators, aliens	25.00

For Laws in Full See Penal Code.

For Commercial Fish Laws See Commercial Abstract.

For Information Regarding Fish or Game Write to the Division of Fish and Game.

CALIFORNIA FISH AND GAME

CONSERVATION OF WILD LIFE THROUGH ...

VOLUME 18 SACRAMENTO, JULY 1932 NO. ...

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DISEASES OF WILD ANIMALS TRANSMISSIBLE TO MAN

By K. F. MEYER, University of Cal...

THE KNOWLEDGE that diseased wild animals play an important rôle in the realm of public health is not generally recognized. It is believed that wild animals possess a high standard of health which is continuously maintained by the action of natural selection. While it is true that animals are normally much more healthy than human

beings, and that the weaklings are weeded out by the natural enemies of the species or the severity of the environmental factors, they are not free from epidemic disease. In fact inquiries instituted by various agencies have shown that there exist a number of unstudied epidemic diseases in wild species with which man and his domestic animals are daily in contact directly and indirectly. It is not unlikely that a study of these epidemics offers a possibility of tracing some of the epidemic maladies of man to reservoirs in the wild species. That the animal kingdom may be a source of discomfort, distress, sickness and death has only been appreciated in recent epochs. In the past, empirical experience guided man in avoiding the harmful and destructive effect of animals. Today scientific knowledge is required in order to break the chain of transmission from animals to man. Preventive measures can only be instituted provided detailed information concerning the cause and the course of the epidemic in the animals is known. There is some evidence that by continuous observation one may forecast with some degree of accuracy the outbreaks of wild animal plagues. This is a great advantage since it is very seldom possible to predict a strictly human epidemic. Furthermore, medical science has benefited tremendously by studying epidemics in animals. Attention is here directed to the fundamental contributions made by *Topley, Webster,* and others (See *Science,* 1932, Vol. 75, p. 445), who have diligently analyzed the progress of an infectious disease in experimentally created mouse villages.

As already intimated, little is as yet known concerning the epidemics, except in the cases of tularemia, plague, rocky mountain spotted fever, etc. A brief review of the essential facts may be of general interest.

Tularemia, also known as rabbit fever or deer fly fever, is probably not a "new disease," but it has without a doubt existed unrecognized for a long period of time. California has played a conspicuous part in this disease, for not only was the causative organism, the Bacterium tularense, discovered in 1911 by McCoy and Chapin in Tulare County, from which it takes its name, but the first known human case occurred in National City, San Diego County, as long ago as 1904. Only quite recently was this fact established. Dr. T. F. Johnson, for many years health officer of National City, stated in a letter to Dr. Edward Francis, of the United States Public Health Service, that his son contracted tularemia as a boy, 15 years of age, when hunting and dressing rabbits in May, 1904. The blood serum still agglutinated Bact. tularense when tested in June, 1928, or 24 years after his illness. Between 1904 and 1925 only three laboratory infections at San Francisco and Los Angeles, and two cases due to handling jack rabbits in the vicinity of Sacramento, were reported. Early in June of 1928, the game deputies in the Alturas region and near the Nevada border reported an enormous mortality among the jack rabbits. Unfortunately suitable specimens for examination were not secured. But the simultaneous appearance in August of six cases of tularemia in laborers stationed in the Alturas district and subsequently treated in the Southern Pacific Hospital at San Francisco, left no doubt that the rabbit disease was tularemia. As an aftermath of this intensive distribution of the rabbit infection which was ushered in by an extensive mortality among the rabbits in Oregon and Idaho, as early as 1926, the incidence of human tularemia was 16 cases in 1928

and 15 in 1929. Of the 58 proved infections [illegible] handling rabbits, 15 followed the bite of [illegible]. While the wild rabbit and hare contribute [illegible] infection for other animals and man [illegible] and transmitters such as woodchucks [illegible] sheep, and perhaps quail and a few weeks [illegible] indicate the ever widening spread of the [illegible] animal and insect life. This situation is almost [illegible] perpetuation of the disease among lower animals [illegible] the possibilities for the development of the rate [illegible] Annually, 500 cases with a mortality of close to [illegible] the tribute which the people of the United States [illegible] infested woodtick and its temporary host the [illegible]

In Idaho and Montana tularemia is transmitted to [illegible] causing heavy losses amounting to over 5 per cent [illegible]

Those who rarely if ever come in contact with [illegible] plague can not appreciate the feeling of uneasiness [illegible] in a territory where this disease exists in the rodents. [illegible] the great pandemic which originated in the city of [illegible] kong, the American continent was invaded by plague [illegible] seen in San Francisco's famous Chinatown, it extended [illegible] but finally vanished only to reappear in 1907. It is not [illegible] chronic plague persisted in the rats and after the [illegible] migration set in which scattered the diseased rodents. [illegible] not unlikely that the rats became infected from the [illegible] It is now known that in 1900 epidemics of plague existed [illegible] squirrel population of the San Francisco East Bay counties. [illegible] tions have repeatedly shown that ground squirrels [illegible] same burrows and that exchange of ecto parasites [illegible] common. The general belief that plague was originally [illegible] California coast by rats on ships which docked in the San [illegible] and that these rodents escaped to the mainland and [illegible] plague virus to the ground squirrels, is not all probable [illegible] Gradually plague as an epidemic disease of rodents has [illegible] until every county bordering the Pacific, from the San [illegible] Los Angeles County, has yielded in the course of years [illegible] variable percentage of infected ground squirrels. At [illegible] intervals extensive epidemics of plague reduce the squirrel [illegible] population of certain areas. Observations in California [illegible] human cases of plague, whether bubonic or pneumonic in character are invariably preceded by such epidemics among the rodents.

The danger from infected squirrels is twofold: they convey their disease accidentally to man (1) by contact, usually while being skinned or dressed, and (2) through ecto parasites. The first is preventable by educating the hunters to beware of sick squirrels. The procedures to reduce the chances from the second source can not be outlined until the factors which are operative are better understood. The California ground squirrel is infested by two species of fleas which can carry the plague bacillus. Whether or not in rural districts where no infected rats are found plague is transmitted to them solely through the instrumentality of these fleas, remains to be determined. The rôle of passive wild animal carriers of fleas from the ground squirrel nests or burrows

to the human habitations must be studied. Moreover, until one has investigated the factors which lead to the periodic plague epidemics among the rodents, which are probably much more effective than all eradicative measures, the problem of plague in California remains an important field for research.

Quite recently attention has been called to a new human disease, relapsing fever, in which rodents are apparently involved. Since 1921 sporadic cases of relapsing fever or Spirochaetosis have been diagnosed in people who had camped in widely separated areas of the Eastern California mountain ranges at an altitude of above 5000 feet. Nothing definite is known concerning the mode of transmission. By analogy with similar relapsing fever infections in Texas a tick is suspected as the vector of the parasite. However, in view of the brilliant studies of the Tunisian workers, Nicolle and Anderson, who had shown that the spiral parasites commenced as parasites of small mammals and that burrowing rodents serve as reservoirs of the disease, an inquiry in this particular direction was instituted. Preliminary blood examinations of a number of animals in 1931 incriminated the squirrels as possible carriers of the spirochaetes. Early in 1932, Miss D. Becks of the State Department of Public Health obtained conclusive proof that quite a percentage of chipmunks examined in the mountain regions of Southern California are heavily infected with the parasite of relapsing fever long before ticks have made their appearance. Obviously these rodents serve as potential reservoirs which bring the infection and the transmitting insect close to the human habitations. Again an endless chain of questions must be answered by further investigations.

Rocky Mountain spotted fever is dreaded in the sections in which it is endemic. The mental worry prevents many people from enjoying the opportunities for outdoor life and far outweighs the economic loss due to the actual occurrence of human infections. The prevalence of the malady among those concerned with range management frequently presents a real problem for wool growers. Rocky Mountain spotted fever is primarily an infection of rodents and certain small carnivores, while human infection is accidental. The two-host ticks (wood tick) which are concerned in the transmission of the parasite—a rickettsia—among the ground squirrels, chipmunks, rabbits, or prairie dogs, have complicated life cycles; the successive stages of the insect feed on separate hosts over a period of two years. The control of the disease by means of tick eradication has been found impractical. However, the painstaking studies of Spencer and Parker of the United States Public Health Service climaxed in the preparation of a prophylactic vaccine which has yielded very promising results. More than 4000 persons have been inoculated. The results suggest that the vaccine confers full protection against the milder types of the disease, and ensures the recovery of those who are attacked by the virulent type which occurs in the notorious Bitter Root Valley of Montana.

Since 1926 evidence has been furnished by Maxcy and others that endemic typhus fever observed in the eastern and southern United States must be associated with a reservoir in rodents. The origin of some of the cases was traced to food establishments and places receiving visits of rats and mice. Through the studies of Dyer, Rumreich and Badger (1931) and others it is now proven that the rat is a reservoir for the infection in man. Bloodsucking arthropods were suspected as

the transmitting agents. To be sure it was denied [illegible] that the causative organism of typhus fever very closely [illegible] of Rocky Mountain spotted fever is capable of maintaining [illegible] bedbugs and fleas. Dore and Shelmire have [illegible] mites which feed on the brown rat may [illegible] To date this mite is known to occur at different [illegible] and Gulf coasts, particularly Texas. It is [illegible] these vectors and consequently a wider distribution [illegible] quences belongs in the realm of possibilities. [illegible] lationship of Rocky Mountain spotted fever to endemic [illegible] attracted considerable attention since the former has appeared recognized in Virginia.

Trichinosis has been unduly prevalent in California [illegible] In the course of a study to determine the sources of the infection of hogs with this round worm, two state [illegible] the trichinous meat of bears shot on the open range in [illegible] has caused a severe and fatal human disease. These [illegible] emphasize anew the importance of trichinosis as a [illegible] continues to offer many involved problems.

As an endemic disease of dogs rabies assumes from time to time epidemic proportions. If by chance the coyotes become infected a very embarrassing situation both to the inhabitants and to [illegible] may develop. Several years ago rabid coyotes endangered [illegible] school children in Shasta County and caused great losses among herds of sheep. A vigorous campaign finally eradicated the [illegible] but there is no assurance that in the course of a spread of [illegible] similar catastrophe may not repeat itself. It is generally [illegible] that skunks may propagate rabies among their own kind. [illegible] skunks have been known to attack persons also. The relative [illegible] tunity or lack of the tendency to bite when rabid is probably the [illegible] reason human rabies due to skunks is very rare.

Many more examples or a more detailed account of the diseases already mentioned could be given, but these were merely [illegible] trate the ever increasing complexity of the factors which endanger the health and welfare of the inhabitants in this State and elsewhere. Medical visitors are quite generally impressed by the many new problems which are sometimes thrust upon the public health worker in a western State. There is no need for anxiety as long as everybody continues to contribute his share to the investigations and the control of the maladies.

A SURVEY OF THE DESTRUCTIVENESS OF SARDINE NETS USED IN THE MONTEREY REGION[1]

By J. B. PHILLIPS, California State Fisheries Laboratory

TWO CLASSES of circle nets have been responsible for the building up of the California sardine industry—the lampara and the purse nets. There is only the one type of lampara net, called the Italian round haul; of the purse nets there are two types, called the purse seine and the very recent ring net. The lampara net, having no purse rings, must depend upon the speed with which the wings can be pulled in and the fish safely impounded in the deep central bag. The impounding of fish with the purse net depends upon the quick closing of the bottom of the net by means of the purse rings. The lampara net can only be successfully used on a lampara type boat, while the purse seine can only be successfully used on a purse seine type boat. The ring net can be adapted for use on either type of boat.

As the lampara net has not been a factor in the commercial sardine fishery in the Monterey region for the past two seasons and inasmuch as the operations of the lampara net were presented at an earlier date,[2] the present survey is confined more or less to the two types of purse nets and accompanying gear.

CONTROVERSY NOT A NEW ONE

A historical review of the sardine fishery at Monterey reveals that the competition between the lampara net and the purse seine is not new. With the start of sardine canning in 1903, purse seines were used until 1906.[3] In 1905 the lampara net was introduced on the Pacific coast at Monterey, displacing the purse seine, one or two of which continued in use until about 1915. No purse seines were then in operation until 1926. From 1926 until 1929 two purse seine boats using purse seines competed against an overwhelming number of lampara gear. The 1929–1930 season brought an influx of a large number of purse seine boats. In the face of this competition the lampara crews by the end of 1929 discarded the lampara net in favor of the fast working, effective ring net.

W. L. Scofield reported in 1926[4] that there were several reasons why the purse seines of the early days failed to yield a steady supply of fish. Among the reasons were—unfamiliarity with the habits and movements of the fish, crude methods of operating gear, and improper gear with which to operate the net.

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[1] Contribution No. 124 from the California State Fisheries Laboratory, March, 1932.

[2] Scofield, N. B. The lampara net. Calif. Fish and Game, vol. 10, no. 2, p. 66–70, 1924.

[3] Gill nets were used for the taking of sardines for bait.

[4] Scofield, W. L. Purse seines for California sardines. Calif. Fish and Game, vol. 12, no. 1, pp. 16–19, 1926.

It is interesting to note that the recent introduction of the purse seine boat and improved fishing gear to the sardine fishery at Monterey is meeting with the same opposition that the lampara net encountered when it was introduced. Although the lampara [illegible] to stave off the new gear by discarding the [illegible] ring net, they are still at a disadvantage in [illegible] of boat and its economy of operation.

It is appropriate at this time to [illegible] on the lampara net published in 1921.

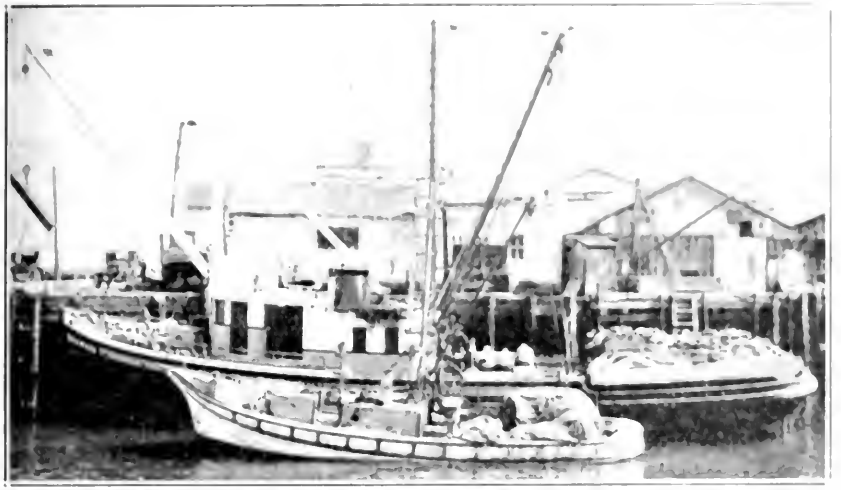

Fig. 44. A purse seine boat with a lampara [illegible] the larger types of purse seine boats. While the lampara [illegible] The purse seine boat is complete in itself while the [illegible] as represented in Fig. 45. Photo by J. B. Phillips, [illegible]

Now that the use of the lampara net is firmly established in California [illegible] considered to be a good and legitimate net by nearly all fishermen, [illegible] to go back to the time when these nets were introduced into the sardine [illegible] Monterey and to see the bitter opposition which was raised against [illegible] that time. The introduction of this net has helped probably more than any other contributing factor in the development of California's great sardine industry. It is hard now for fishermen at Monterey to realize that a large number of men bitterly opposed its use ten or twelve years ago. The introduction of any new form of fishing gear which profoundly affects a fishery is usually met with opposition from fishermen who can not successfully compete with their old style gear and their opposition is always on the ground that the new gear is highly destructive and will ruin the fishery.

In 1913 a bill was introduced in our State Legislature which provided for the use or the possession of a lampara net in Monterey Bay, and this bill had a good chance of passing. It is as much the duty of the Fish and Game Commission to prevent ill-advised legislation whenever possible as it is its duty to advocate restrictive measures wherever any fishery is in danger of exhaustion. Therefore the Commission, desiring more information in regard to the use of this new net for the bill was to come up before the Assembly Fish and Game Committee within a few days, asked the writer to proceed to Monterey and report on conditions as he found them.

For similar reasons the present investigation of the destructiveness of sardine gear was inaugurated.

[8] Scofield, N. B., loc. cit., p. 66.

ASSIGNMENT OF PROBLEM

The present writer has been stationed at Monterey for the past three seasons checking on the commercial catch. Frequent trips on sardine boats are required as part of the duties. In view of recent improvements in fishing gear and the objections raised, an intensive survey was carried on during the past sardine season in regard to the wastage of the nets. The aid of the Division of Fish and Game patrol boat, *Albacore,* was enlisted on some occasions.

Although it may seem in this report that many phases of the sardine fishery are treated in detail, it is felt that an understanding of the many principles involved are necessary for a better understanding of the problem. The results of the survey are summarized at the end of the article.

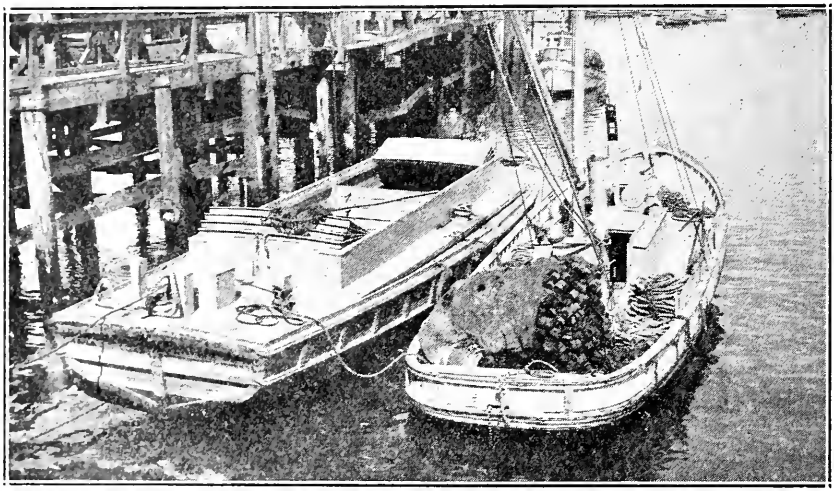

Fig. 45. A lampara lighter with the launch alongside. The lighter carries the catch and is towed to and from the fishing grounds. These two boats are about 45 feet long and the lighter will hold about 50 tons of sardines. Photo by J. B. Phillips, September, 1930.

NETTING OPERATIONS WITH A PURSE NET

Before going into the question of any wastefulness of the nets, it may be an aid in analyzing the problem to give a brief outline of the netting operations, schooling habits of the sardine and the available fishing time.

Inasmuch as, during the past two seasons, the bulk of the lampara boat ring net crews have changed the landing bag from the middle of the net to one end, the netting operations of the two types of purse nets (purse seines and ring nets) used in the Monterey region are very much alike.

After a purse net has been circled around a school of sardines the net hangs in the water like a curtain. The next step is to purse the bottom of the net. This is done by reeling in both ends of the purse rope which passes through the rings attached along the bottom of the net. In the meantime a waterproof electric light is let down about

15–20 fathoms and flashed intermittently on and off. This procedure frightens the fish up and away from the opening of the net, thereby preventing the possibility of being closed. After the bottom of the net is gotten aboard and the sardines are on board, the operating lights may be turned on. When the sardines inclined to "sound," the turning on of the lights keeps the fish beneath the surface while the net is being taken aboard. With say fifty tons of fish in the net, it unfortunately happens that there were only a few fish in the net as the deck hands found on the backs of the sardines as they were picking them out of the net one or two below the surface.

The heaviest webbing of the net is at the end and it is bunched into this section of the net called the landin' bag. This bunching is accomplished by pulling in the other end of the net, thereby herding the catch toward the landin' bag. As the fish become more and more bunched, an occasional leaping up of fish will be observed. After enough length of the net has been pulled in so that the fish are well bunched, the catch is concentrated preparatory to dipping the net. This is accomplished by pulling in the webbing to form a relatively shallow bag. To prevent as much as possible the escape of the fish over the cork line at this time, the large skiff is stationed on the opposite side of the net and a section of the cork line pulled down.

SCHOOLING HABITS OF THE SARDINE

Reference has been made to a Monterey Bay period of sardines which may be termed a transitional period. In the fall months before this period, the size of the sardines in the population is fairly constant in the winter months after this period and until the end of the season, the size of the fish increases because the population is made up of older year classes. The fishermen say that the fall population of fish is found in shallow schools and the winter population to form much deeper schools. There is not only a seasonal variation in the depth of the schools in one region, but the shape or general outline of the schools appears to occasionally vary. This is also claimed to be true between regions. For example, the outline of the schools in the Monterey region tends toward compactness, while in the San Pedro region the tendency is toward a long wave-like formation. Obviously where a sardine school is in it's most compact form, not so much webbing will be required. Invariably the San Pedro crews have shortened their nets 20–50 fathoms for fishing in the Monterey region.

Although the bulk of the sardines is located by the luminescence the fish create in the water, this is not always the case. Sometimes luminescence is absent or only slightly present due to murky water. In this case sardines are sometimes located by the splashing they cause when feeding at the surface. The luminescence is only visible during the dark of the moon and the degree of visibility depends upon the clearness of the water. When hauls are made during moonlight, at sunset or at daybreak the fish are usually located by their splashing. In such cases the sets are usually blind. Even during the dark of the moon, the sardine schools may remain at the surface for only a short period and then "sound." Then again, the schools may be moving

*This is partly substantiated at Monterey by the writer's observations.

rapidly in various directions. During the latter part of the season just closed, storms interfered a great deal with the scouting and following up of schools.

AVAILABLE FISHING TIME

Sardine fishing is divided into lunar periods, that is, from one full moon to the next. The average lunar period consists of about twenty-nine days. Fishing is carried on almost entirely at night and the bulk of the night fishing is done during the dark of the moon, so that the luminescence will be readily visible. As has been pointed out, due to murky water, hauls are occasionally made during moonlight, at sunset or at daybreak, when fish are jumping.

At full moon time there are usually a few days when fishing activities cease. Within a day or two after full moon time the available fishing time gradually increases nightly until it is dark all night at new moon. The number of idle days at full moon time varies with the season of the year.

SCARCITY OF FISH IN MONTEREY BAY

The complaint that since the ingress of the purse seine boats there has been a scarcity of sardines in Monterey Bay is not sound. In 1930, Lindner[7] made an analysis of fishing localities for the California sardine from November, 1919, to March, 1929. The results of his analysis showed the following: To meet the increased demand for sardines the fishing area has been expanding to the north each year. A period of scarcity in Monterey Bay sardine fishing appears every year throughout the late fall and winter months. This period has been increasing in duration since the 1921–1922 season. The facts pointed out by Lindner coupled with the placing by Legislature of a restricted season for the first time with the 1929–1930 season were undoubtedly the major factors responsible for the ingress of the purse seine boats and gear during the 1929–1930 season. The purse seine has proven itself by its ability to scout greater distances for fish during periods of scarcity.

COMPLAINTS AGAINST THE PURSE NET AND PURSE SEINE BOAT

It is claimed that there is a relative scarcity of sardines in Monterey Bay and the purse seine gear is blamed for this.

It is claimed that the purse seine gear destroys many tons of sardines by impounding more than can be utilized. When an excess of fish is set free after brailing out the boat limit, the balance of the fish die because of suffocation and loss of scales.

Of course there are other lesser complaints, but these are in the nature of grievances.

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[7] Lindner, Milton J. Fishing localities at Monterey from November, 1919, to March, 1929, for the California sardine (*Sardina caerulea*). Calif. Div. Fish Game, Fish Bull., no. 25, p. 8–27, 1930.

PURSE SEINE MEN DEFEND THEIR GEAR

Summarily, the purse seine men defend their gear [illegible] Although there are times that it is hard to judge the [illegible] is being circled, normally when luminescence is present [illegible] fish can be estimated fairly well by the size of the [illegible] Schools vary a great deal in size and when a part [illegible] is located only a portion of it is circled, [illegible] They admit that it is laborious to handle a part [illegible] like to make their limit in one set if possible. [illegible] seine might be considered advantageous inasmuch [illegible] many small schools that the lampara crews could [illegible] nets.

The purse seine crews wish that a distinction be made between the purse seine type of boat and the lampara type of boat. They claim that the purse seine type of boat, because of its large carrying [illegible] and accomodation facilities, is able to make extended searches [illegible] such times as there is a scarcity of fish in local waters or when the sardines in local waters might contain "green feed" are naturally small or are mixed with other varieties of fish. They would also like to have it known that the purse seine boat has the facilities for taking good care of the catch in instances where an over limit is unavoidably impounded.

WASTEFULNESS OF THE PURSE NET

The wastefulness of the purse seine and ring net is considered in two phases: first, the possibility of avoiding the capturing of an over limit; and second, the facilities for taking care of an unavoidable over limit haul.

LAYING OUT AND HAULING NET

It has been claimed that the purse seine and ring net continually capture more fish than they require and that when this surplus is released it is doomed. In this case it is the type of boat and not the type of net that is one of the major factors. In the first place, the voluntary shortening of nets by the San Pedro purse seine crews in the Monterey region indicates that a great excess of fish in the net is undesirable. Toll is taken in damaged nets.[8] Nevertheless, there is no doubt that the purse type of net has the capacity of impounding more fish than is sometimes needed. This is more apt to be true when low limits are levied by the canneries. However, at such a time any net may have the capacity of taking over the limit. In cases where large luminescent areas indicate the presence of sardines, only a portion need be circled at such times. But when fish are located by their splashing it is hard to estimate the amount present. In the latter cases the set is blind and no approximation of the amount of the fish in the net can be had until the net is being pulled in. After the fish have been well bunched a crew can tell very closely the tonnage in the net by pushing a pole down and considering the surface area.

In instances when the crew is certain while pulling in the net that they have an excess of fish, they may divide the net into two portions before the fish are too well-bunched. The dividing of the net is accom-

[8] In addition to overloading, nets are often damaged when sharks or sea lions are impounded with the catch.

plished by starting with the lead line and pulling in the meshes of the net until the cork line is reached. The fish in the one portion of the net are allowed to remain in slack water while the other portion is further bunched or concentrated preparatory to unloading the net. If enough fish are obtained from the one portion, the fish in the other portion can be freed unharmed. Because dividing the net involves quite a bit of added labor it is doubtful that this is done very often.

It has been suggested that where the bag is at one end, as in the case of the purse seine and most of the present day ring nets, that the one end of the bag nearest the boat can be let down and the excess of fish allowed to escape. Although this is possible, it is more apt to lead to total escapement. The strong schooling habits of the sardine would undoubtedly exert a great pressure on the opening and even prevent its being closed until the bulk of the fish escapes.

Where several crews are fishing in the same vicinity, as is nearly always the case, one crew if it has a surplus will donate to another less

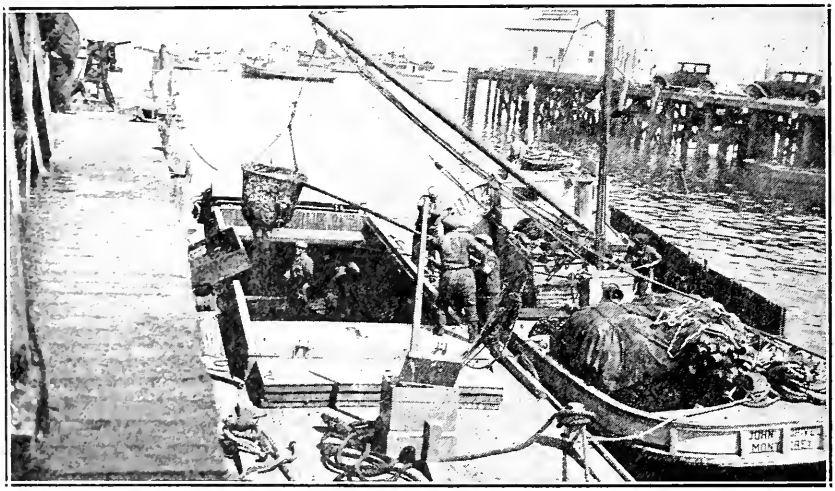

Fig. 46. A lampara sardine crew unloading at a cannery with a shallow dip net. This same dip net is used in unloading the catch from the net. Photo By J. B. Phillips, September, 1931.

fortunate crew. Crews are attracted to the vicinity where another crew is making a haul or is unloading, as the chances are good that there are other schools nearby. With low limits, sometimes two crews agree to alternate, with one crew going out for two limits.

UNLOADING OF CATCH

It is the degree of concentration of catch preparatory to unloading and the time thus held that are most important in cases of over-limit catches. It is just as necessary for a fish to have oxygen as it is for other animals. However, a fish is so constructed that it can only extract oxygen from water. In their efforts to resist suffocation, when the catch is greatly concentrated, the fish attempt desperately to free themselves. In this manner the sardine may lose scales. The sardine can lose some scales without ill effects, as all loose scaled fishes have power of regenera-

tion of scales. Nevertheless, the loss of a great n[illegible] would no doubt have dire effects through [illegible]

Observations made of the unloading op[illegible] of boat and the purse seine type of boat show th[illegible] be in a better position to take care of the [illegible] mast, the long boom and the added pow[illegible] the use of a dip net having a very long h[illegible] These dip nets have an iron ring from 4 5 feet in [illegible] is suspended a bag of netting, 18 21 feet long. A long [illegible] usually the length of the bag, is attached to the ring [illegible] of dip net can be guided. The net is lowered or [illegible] a rope, attached to the ring, which runs up through a [illegible] of the boom. The end of the bag is closed and [illegible] runs up through another block at the end of the boom. [illegible] emptied by placing the ring perpendicular to the edge [illegible] by hoisting up on the end of the bag.

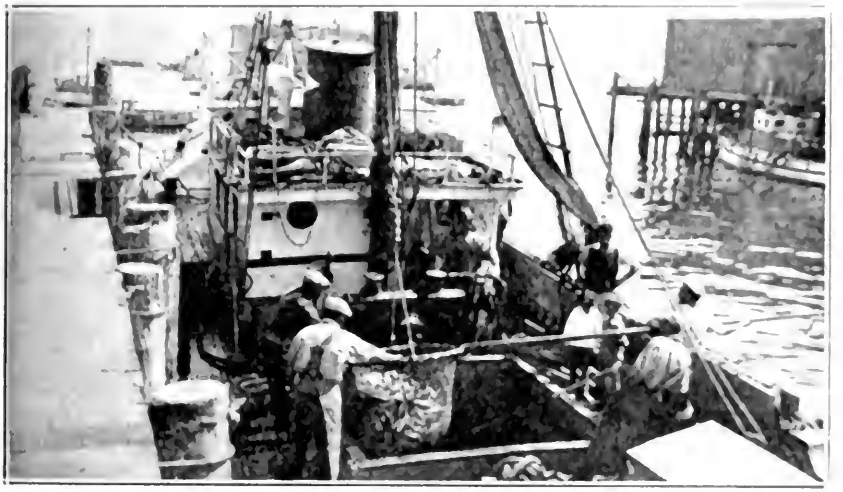

Fig. 47. A purse seine crew unloading at a cannery w[illegible] This dip net is only used for unloading at the cannery. A [illegible] of a long bag dip net, which is used in unloading the [illegible] be seen hanging above the right hand edge of the h[illegible] figure 48. Photo by J. B. Phillips, August, 1930.

Unloading operations of the lampara type of boat are [illegible] by means of a shallower dip net. Nearly all of the dip nets used by this type of boat have a ring or mouth from 3 3½ feet in diameter. The bag of webbing attached to the ring is about 4 feet deep. A fairly long handle is attached to the ring so that the net can be guided. The contents are emptied through the bottom of the dip net. This is accomplished by releasing the tension on a chain that runs through small rings along the bottom edge of the webbing. The net is lowered or raised by means of a rope running through a block at the end of a short boom. Previous to the wholesale adoption of ring nets by the lampara crews, the catch used to be unloaded by the use of 3 or 4 small hand dip nets with 3 men to a dip net. The unloading time was slow—probably with 4 of the

man-powered dip nets working at top speed, as much may have been accomplished as one of the present day shallow dip nets.

Obviously, in the case of the shallow dip net, the catch must always be concentrated to a great degree in order to unload the net efficiently. In the case of the long bag dip net the amount of concentration varies with the different boats. Sometimes, as with a weak purse net,

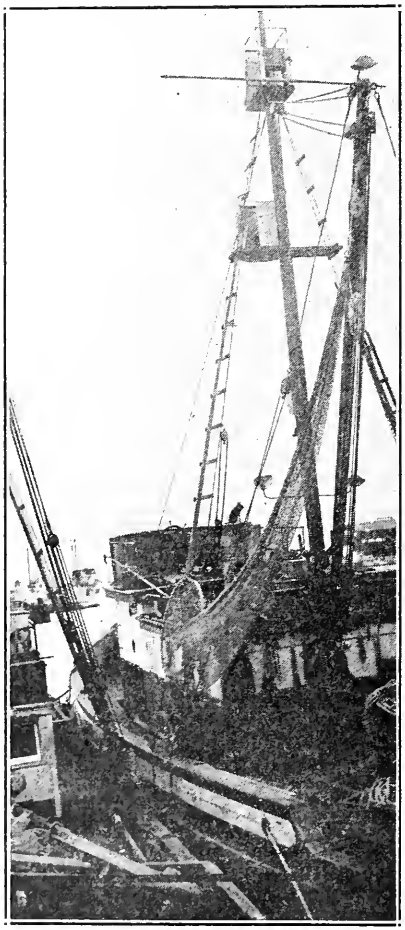

Fig. 48. A long bag dip net which is part of the equipment of sardine purse seine boats. The long handle, attached to the iron ring, is here shown slashed to the ladder. This dip net has a 4-foot mouth and a 20-foot bag. Photo by J. B. Phillips, February, 1932.

the fish are hardly more than bunched. Sometimes the degree of concentration approaches that of the small boats. In any case, when the catch is concentrated to such a degree that in their struggles the fish continually break water and produce an audible hissing noise, any surplus that is freed would undoubtedly be doomed if held very long.

In timing the unloading operations of the [illegible] the long bag dip net and the shallow dip net the [illegible] boats using the long bag dip net can [illegible] hour at 1500 3500 pounds per dip from [illegible] shallow dip net, 25 35 tons an hour at 100 [illegible] normal rate of unloading. Under very favorable [illegible] bag dip net can unload 100 tons per hour at [illegible] for the shallow dip net. There is more of a [illegible] bag dip net because of the variation in [illegible] concentration of catch. The shallow dip nets are [illegible] ized as to size, and concentration of catch [illegible] effectiveness.

When Bonnot * made his survey during the 1928 1929 [illegible] two purse seine boats then at Monterey were [illegible] net. With the start of the 1929 1930 season and the [illegible] seine boats, the long bag or stocking dip net was introduced [illegible] of dip net is now part of the equipment of all the purse [illegible] well as shallow dip nets which are used for [illegible] the boat at the cannery. The lampara boats use the [illegible] net for unloading the catch from the net and for [illegible] from their lighters at the cannery.

Lampara and purse net crews alike admit that [illegible] sardines tend to "sound," that is, head downward [illegible] condition are practically dead weight in contrast to the [illegible] of live and active fish. It is harder work, with more danger of [illegible] net, to haul in just a few tons of dead or weakened sardines [illegible] in many tons of live and active sardines. Probably the best [illegible] for the use of the long bag dip net is that the mouth of the net [illegible] down far enough to scoop up the dead or weakened fish [illegible] of the net.

FISH AND GAME ORDER NO. 12

During previous seasons there have been many tons [illegible] wasted in the course of a season because of the dumping [illegible] catches after the crews had unloaded at the canneries. Even though limits might have been pronounced by the canneries or [illegible] might have brought in over limit catches in the anchor [illegible] crews had missed or had torn their nets. Before the start of the 1931 1932 season the Division of Fish and Game issued Order No. 12 consisting of two regulations. Regulation 1 prohibited the dumping of fish and required a bona fide order for the amount of fish delivered to the plant. Regulation 2 required that not more fish be taken into the net than the crew actually had an order for, and that any surplus of fish be relased in a healthy condition before brailing operations commenced.

One would gather from hearing the one side of the controversy that the purse seine boats captured a great deal more fish than they actually needed every time they set out. During the 1931 1932 season, just closed, either Order No. 12 had the desired effect or the over-catching properties of the purse seine have been over-rated. In going through

* Bonnot, Paul. Report on the relative merits and demerits of purse seines vs lampara nets in the taking of sardines. Calif. Fish and Game, vol. 16, no. 2, p. 125–130, 1930.

the regular season sample records, purse seine boats are represented as making 129 catches. Forty-eight of the catches, or 37 per cent, fell at least 5 tons under the limit; 44 catches, or 34 per cent, at least 10 tons under the limit; 37 catches, or 29 per cent, at least 20 tons under the limit. There are no records of the boats that missed entirely. In cases where no limit was levied by the cannery, just the hold capacity of that particular boat was taken as the limit. It is evident that in 35–40 per cent of the cases throughout the season, the purse seine boats made hauls that resulted in 5–10 tons under the limit loads. When fish are loaded into the hold of a boat, the tonnage can be told quite accurately. If the fish are available, in cases of limits, the load is apt to be a ton or so over the limit, or in cases of no limits, the hold may be filled with possibly a deck-load in addition.

SUMMARY AND RECOMMENDATIONS

Any efficient fishing gear has capabilities of catching more fish than the fishermen can dispose of, especially at such times that limits are in effect. In the case of sardine nets, it is not the gear that is responsible but the handlers of the gear. However, no type of fishing gear should be encouraged unless it is shown that the gear, properly handled, does not continually destroy a large surplus of fish.

A survey of the netting operations of purse seines and ring nets in the sardine fishery in the Monterey region may be summarized as follows:

1. A period of scarcity of sardines in Monterey Bay was present and growing in length of duration at a time when the purse net was not in use at Monterey.

2. The voluntary shortening of purse seines by southern California sardine crews fishing in the Monterey region tends to show that an excess of fish in the net is undesirable. When luminescence is absent, the haul is more or less blind, and an excess is impounded, a purse seine can be divided or the surplus allowed to escape over the cork line.

3. In the case of the purse seine boats, the use of the long bag dip net reduces materially the time that fish are held in a bunched state and allows the weakened or dead fish to be scooped first from the bottom of the net. For the proper manipulation of this dip net, the catch should not be bunched too tightly.

4. That purse seine boats are not continually making over-limit catches is shown in an analysis of sample records. Based on the 1931–1932 season records, hauls made by the purse seine fleet resulted in under-limit catches in 35–40 per cent of the cases. No record is available of the times that the boats missed entirely.

5. Continued enforcement of Order No. 12, issued by the Division of Fish and Game prior to the 1931–1932 season, is all that is recommended at this time.

RELATIVE DESTRUCTIVENESS OF SARDINE CIRCLE NETS IN SOUTHERN CALIFORNIA

By [illegible]

THE QUESTION has come up recently [illegible] tiveness to sardines of the three types of [illegible] southern California waters [illegible] purse seine. The purpose of this report is to [illegible] tions made by the members of the California State [illegible] tory staff and their researches into the subject of the [illegible] use of these various nets. It has been contended [illegible] here presented that if the fisher men operating any [illegible] nets use a fair amount of gal en [illegible] any appreciable amount of fish life other than that [illegible] food to the markets and canneries.

OPERATION OF NETS

The three types of circles nets used in fishing sardines [illegible] California are operated in about the same manner. The net is [illegible] laid out in a circle around a school of fish; then the net is [illegible] so that the fish are captured and held in a bag. The fish are [illegible] further concentrated in a smaller space and dipped into the boat by means of a large dip net. The construction of these nets is [illegible] so that the method of impounding the fish is not the same for each type of gear. As far as the sighting of schools of fish, estimating the number of tons in them, and the actual setting of the net are concerned the crews using any one of the three types of net follow similar methods. Experienced fishermen are remarkable in their ability to estimate the tonnage of a school of fish. If the school, according to their estimate, contains the desired amount of fish, they will encircle the school (depending on the type and size of their fishing gear) [illegible] the school is too large they may "split" the mass and encircle [illegible] a third of it. "Splitting" can be done if the fish are not [illegible] or active.

After circling, the fish are impounded, in the case of the [illegible] by hauling in the wings and lead line in order to confine the fish in the "bunt" or bag; with the ring net, by simultaneously pursing the net and pulling in the wings, and with the purse seine by completely pursing the net and then hauling aboard the rings and the lead line, together with part of the net.

After the fish are impounded, the captain may decide that there is a surplus, in which case the cork line on that portion of the net farthest from the boat is submerged until a sufficient number of fish escape. The cork line is then allowed to come to the surface and the remainder of the captured fish is contined prior to being dipped into the boat.

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[1] Contribution No. 122 from the California State Fisheries Laboratory, January, 1932.

In the event that the sardines are "wild" and it is impossible to estimate accurately the tonnage in a school, the fishermen using a purse seine may set the net and impound the whole mass. Then, in order not to destroy the fish or to confine all of them too closely, the impounded fish are divided into two groups by pulling along a row of knots in the net. One group is then confined more closely and dipped into the boat. In case the first group does not contain the required amount, some fish may be taken out of the other section. However, if the first group fills the need, the second group is liberated by sinking the cork line, in which case no fish are destroyed.

DIPPING OR BRAILING

Dipping or brailing the sardines from the water to the boat is done in the same way regardless of the type of net used to capture the fish. A large dip net with a long handle is operated usually from the skiff, which is stationed on the opposite side of the net from the boat. The net is dipped down into the water where the fish are confined, pushed by means of the handle, and dragged along by the rope attached to it from the boom. Then the net is lifted clear by the boom rope with the aid of a power winch. The dip net is pushed to a position over the hatch, and the purse line which closes the bottom of the net is released to allow the sardines to drop into the hold. If a small (shallow) dip net is used, from 500 to 700 pounds of sardines can be transported to the hold of the boat at each dip. Using this type of dip net, the fish can be removed from the impounded area at an average of one ton every three minutes, or about 2 hours for a 40-ton catch. However, if the larger dip net is used (this type was employed almost exclusively for sardines in southern California during the 1931–1932 season) the fish can be unloaded from the net at the rate of about a ton a minute or even faster, so that a 40-ton catch can be unloaded in about 30 to 40 minutes. These large dip nets are from 20 to 25 feet long and scoop up from 1500 to 2500 pounds at a time. Such dip nets are operated from the boat; they have no opening in the bottom but are inverted into the hold. Some of the sardines near the bottom of the confined area in the water are bound to be smothered, but this is only a very small percentage. Such fish are still good and of course are loaded on the boat with the rest of the catch. No large numbers of fish are impounded in the net above the amount wanted by the fishermen. As stated before, experienced fishermen seldom catch much above the required limit; perhaps there may be a difference of one or two tons above or below the set amount, but this is not enough to be of any consequence. In our opinion, very few sardines are destroyed in the operations of the three types of circle nets if the fishermen use reasonably good judgment.

BOAT LOADS

After the sardines are loaded on the boat, the net is piled aboard and the boat goes back to port to deliver the catch. If the fish are delivered the same day (24-hour period) as caught, they are almost always in a good condition. Very few fish are crushed during the dipping process from net to boat or from being stored in the hold. It

has been noticed repeatedly that mackerel [illegible] close to port by a circle net are still alive when delivered to the cannery, that is the ones on top of the boat load, and those are [illegible] last from the net, which indicates that the [illegible] not smother or crush the ones on the bottom. [illegible] mackerel have been known to be so lively after [illegible] off the cutting tables in the canneries. "Soft" fish are [illegible] not because of being crushed in the net but because [illegible] in the hold for two days or more or were transported [illegible] causing the fish to become soft and unfit for canning. This [illegible] usually occurs when inclement weather hinders [illegible] ing to port immediately after the catches are made.

DIFFERENCE IN OPERATING METHODS

The lampara net is no longer a factor in [illegible] in southern California. Some of the smaller market [illegible] for various other species of fish but no great [illegible] this gear. Lamparas are employed a great deal more [illegible] small sardines, the same method being used as [illegible] sizes of sardines, except that the fish caught [illegible] tanks to be used later as live bait. Naturally, [illegible] destroyed because it is to the fisherman's advantage [illegible] However, the operation of the lampara net is the same as [illegible] for market species.

Ring nets and purse seines, and not lampara nets, are [illegible] mercial fishing for sardines and mackerel. The [illegible] have been described above.

The main difference in the use of the ring net and the purse seine is the fact that the ring net is easier to handle. A crew [illegible] ring net can circle a small school of fish, whereas, in the case of a purse seine crew a small school would not be considered because of the greater amount of labor involved in operating a purse seine. It is [illegible] that the purse seine is capable of impounding and holding a larger amount of fish than either the ring net or the lampara [illegible] If proper care and judgment are exercised, purse seines [illegible] more destructive of fish than the lampara or ring net. The whole question of destructiveness of fish in circle nets rests with the individual who directs the fishing operations. Even though a ring net or lampara impounds a smaller number of fish each set, such gear must make more sets in order to equal the tonnage secured by a purse seine boat. For instance, if the cannery limit is 10 tons, a purse seine crew may impound 50 tons in the net and release 10 tons; a ring net or lampara crew may make 2 sets, the first impounding 20 tons and the next attempt 10 tons, in which case they would have to be content with 30 tons or make an additional set that may result in 20 more tons. The ring net or lampara crew then would have to release the surplus of 10 tons, as in the case of the purse seine, and keep the rest, or they can dip out half the fish in the net and then dump the remainder out of the net, although the fish may have been damaged. It is not the net which destroys fish but destruction is due to the lack of good judgment and care on the

part of the individual fishermen, regardless of the type of gear used. Criticism of the purse seine has been based on the fact that it can impound large amounts of fish. Suppose a purse seine does capture 200 tons but can use only 40 tons—the crew does not keep the 200 tons in confinement until 40 tons are dipped into the boat, as this great weight of 200 tons might tear the net if retained very long. A ring net or lampara is subject to this same danger if too large a school is impounded.

SUMMARY

All circle nets (lampara, ring and purse seine) are operated similarly. Catches made by such gear are brailed in the same manner. These nets can be operated in such a way that excess impounded fish can be released from the net without being damaged. The purse seine is capable of impounding a larger amount of fish than the ring net or lampara at one time, but the ring net and lampara have to be set more often in order to obtain the same tonnage as the purse seine.

If fishermen are careful, no appreciable amount of fish need be destroyed by any of the three types of circle nets.

REFERENCES

Fry, D. H., Jr.

1930. The ring net, half ring net, or purse lampara in the fisheries of California. Calif. Div. Fish Game, Fish Bull., no. 27, 65 p.

Phillips, J. B.

1930. Success of the purse seine boat in the sardine fishery at Monterey, California (1929–1930 fishing season). Calif. Div. Fish Game, Fish Bull., no. 25, 44 p.

Scofield, W. L.

1929. Sardine fishing methods at Monterey, California. Calif. Div. Fish Game, Fish Bull., no. 19, 61 p.

PARASITISM OF THE CALIFORNIA VALLEY QUAIL BY HAEMOPROTEUS LOPHORTYX, A PROTOZOAN BLOOD PARASITE

E. I. [illegible]
[illegible]

THE CALIFORNIA VALLEY QUAIL [illegible] Shaw, has long been [illegible] State's most prized game bird. [illegible] naturalists, it is similarly a favorite [illegible] with the development of the country, [illegible] tribution and relative numbers of [illegible] welfare of the birds and in others [illegible]

One of the activities of the [illegible] quail has been a series of studies into the [illegible] disease as being factors of importance [illegible] tribution and numbers of the birds.

In the following pages will be [illegible] observational and experimental work [illegible] valley quail which was discovered near Yosemite [illegible] The quail on which the original discovery was [illegible] state game farm, and the thought that [illegible] was that possibly the parasite had been brought [illegible] introduced game birds that were being propagated [illegible]

In order to test this hypothesis, [illegible] the game farm as well as wild birds [illegible] but none of them revealed the presence [illegible] found in the quail.

The survey was then extended [illegible] farm and several additional records obtained [illegible] parasite in quail. From these records it was [illegible] has no relationship to introduced game birds [illegible] dence was accumulating that the parasite was [illegible] importance and might be the cause of serious [illegible] among quail.

From available literature, it was [illegible] observation was protozoan, belonging to the genus *Haemoproteus* or *Proteosoma*, sporozoans which are known [illegible] in birds known as bird malaria. The important [illegible] between the two genera is that *Proteosoma* can be transmitted by direct blood inoculation, whereas *Haemoproteus* [illegible] mental work that was done, therefore, was a series of blood inoculation experiments. Blood from parasitized quail was inoculated into susceptible young quail as well as into young pheasants and chicks. All such attempts at transmission were futile fixing the identity of the parasite as *Haemoproteus*.

A complete check of the literature on the *Haemoproteidae* of birds indicated that this particular species was new to science. It has therefore been described as such under the name of *Haemoproteus lophortyx*.[1]

As soon as the investigations were well under way, the work resolved itself into a series of studies along the following lines:

1. Host and geographic distribution of the parasite.
2. Collecting ectoparasitic louse flies of quail.
3. Experimental transmission of the parasite.
4. Life history of the parasite.
5. Pathology, disease symptoms in infected birds.
6. Some problems of infection and immunity.
7. The possible influence of certain ecological factors.

The various studies were carried on concurrently, each week's observations usually contributing towards progress along several of the above lines. For clearness in presenting the results of the above studies, they will be grouped under the headings outlined above.

HOST AND GEOGRAPHIC DISTRIBUTION

The records of parasitism of birds by various species of Haemoproteus are largely from the old world, although Opie (1898) [2] gives a list of several North American birds taken largely in the vicinity of Baltimore, Maryland, which were parasitized with blood parasites of the genus Haemoproteus. He did not include any quail, partridges or other gallinaceous birds in the list and did not assign specific or varietal names to any of the different kinds of Haemoproteus which he found.

A typical example of one of the more comprehensive European lists of host birds is that of Galli-Valerio (1902).[3] He examined 101 birds belonging to 29 genera and 36 species in the Alpine regions of central Europe. Among them he found Haemoproteus in 16 genera and 18 species. In the present studies, an attempt was made to examine as many species as possible which were to be found in the same environment as the valley quail. Twenty-eight genera and 36 species in all were examined. Ten of these species, however, were wild ducks and geese and should really not be included in the list for comparison. In all, a total of 170 individual birds were examined. Of this entire lot of birds other than quail, only one species, *Aphelocoma californica,* yielded any Haemoproteus. Three individuals, only, were parasitized. They were all from one lot and were shot near Orinda, California, September 30, 1928. Parasitism in these blue jays was very light and the species of Haemoproteus was not determined. Fourteen other blue jays taken at various places and at various times were not parasitized. Whether the parasites in the blue jays may have been *Haemoproteus lophortyx* is not known because of the inability of the writer to identify them from the scanty material.

Contrasted with these negative records previously enumerated is the widespread distribution of *Haemoproteus lophortyx* in quail of the genus *Lophortyx* taken in California. Collecting extended over the period of time from December, 1927, to July, 1929. Wherever possible, the blood sample was taken from the wing vein of the living quail in order to avoid needless sacrifice of the birds.

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[1] O'Roke, Earl C. The morphology of *Haemoproteus lophortyx* sp. nov. Science, Vol. 70, No. 1818, p. 432.

[2] Opie, E. L. On the Haemocytozoa of birds. Journ. Exp. Med., 3, 79–101, pl. 9.

[3] Galli-Valerio, B. Untersuchungen uber die Hamosporidien der Alpenvogel. Centralbl. Bakt., 1, Abt., 31, 162–165.

EXPLANATION OF PLATES

PLATE 1

Fig. 1. Salivary glands of *Lynchia hirsuta*. Iron-haematoxylin stain, photomicrograph, × 280.

Fig. 2. Sporozoites in salivary glands of *Lynchia hirsuta*. Iron-haematoxylin stain, photomicrograph, × 80.

Fig. 3. Oöcysts on wall of mid-gut of *Lynchia hirsuta*. Sketch from living material. × about 350.

Fig. 4. Section of spleen of infected quail showing pigment deposits. Unstained, cleared material, photomicrograph, × 200.

Fig. 5. Section of testis of infected quail showing pigment deposits. Iron-haematoxylin stain, photomicrograph, × 200.

Fig. 6. Smear preparation of lung of infected quail showing pigment deposits. Unstained, cleared material, photomicrograph, × 80.

Fig. 7. Sausage-shaped schizont from spleen of infected quail. Iron-haematoxylin stain. × 1266.

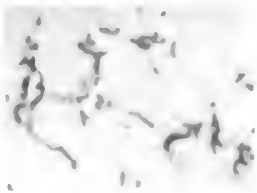
Fig. 8. Male gametocyte, just preceding liberation of male gametes. Dark field illumination. × about 2500.

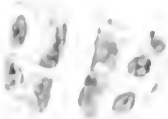
Fig. 9. Living microgamete. Dark field illumination. × about 5000.

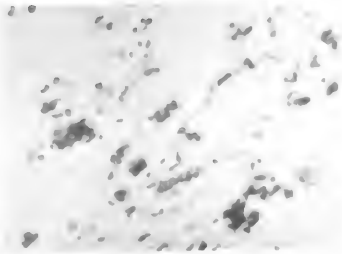
Fig. 10. Merozoites in epithelial cell from liver. Giemsa's stain. × 1866.

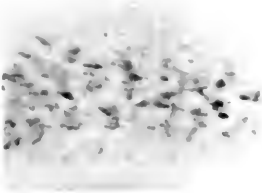
Fig. 11. Sporozoites of *Haemoproteus lophortyx*. Iron-haematoxylin stain. 3500.

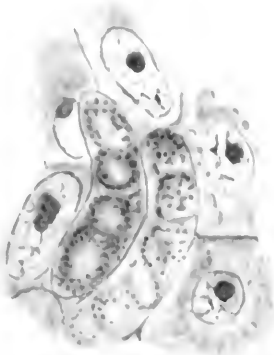
Fig. 12. Sporozoites of *H. columbae*. Redrawn after Adie (1921). × 3500.











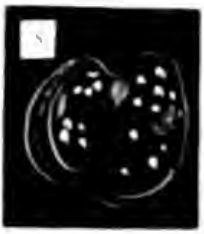


PLATE I

PLATE 2

All figures drawn with camera lucida. × 2533. Methyl alcohol fixation, Giemsa's stain.

Figs. 13–16. Developing gametocytes.

Fig. 17. Mature male gametocyte in blood cell.

Fig. 18. Mature male gametocyte out of blood cell and rounded up preparatory to gametogenesis.

Figs. 19–23. Successive divisions of the nucleus of the gametocyte resulting in the formation of the nuclei of the microgametes.

Fig. 24. Male gametes in various stages of development. One mature male gamete visible.

Fig. 25. Residual mass of male gametocyte after the liberation of the microgametes.

Fig. 26. Free microgametes.

Fig. 27. Female gametocyte in blood cell.

Fig. 28. Female gametocyte outside of blood cell and rounded up preparatory to gametogenesis.

Fig. 29. Macrogamete and polar cell.

Fig. 30. Zygote with fertilization membrane. Thickness of membrane exaggerated.

Fig. 31. Elongating oökinete.

Fig. 32. Motile oökinete.

PLATE 2

The source of supply was the State game farm at Yountville, numerous private aviaries, birds trapped and sent in by deputies or shot by the writer. For the purpose of the investigation it was necessary to shoot several quail during the closed season. The usual practice was to take samples here and there from numerous coveys. When we were operating in settled communities we always made it a point to explain to the ranchmen what we were doing and why we were doing it and

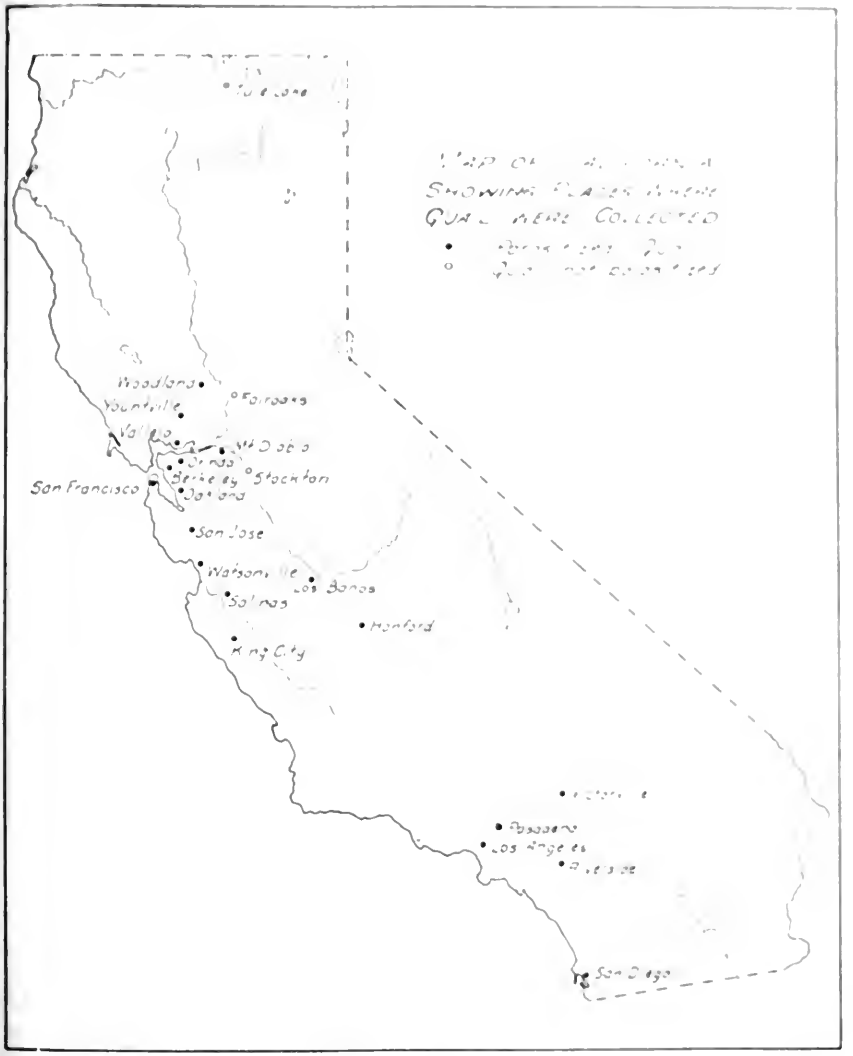


FIG. 19

to ask permission to take the necessary samples for study. Altogether 312 quail were examined. These included all of the species and subspecies of the genus *Lophortyx* which are to be found in California, including Santa Catalina Island. Of all of the quail examined, 45 per cent were parasitized. Parasitism in different lots varies from

0 to 100 per cent. No species or subspecies of the genus *Lophortyx* was found to be free from the parasites. The highest per cent of infection, 100 per cent, was found in Gambel Quail at a private aviary. The accompanying map shows the locations where collections were made.

It will be observed that only a few places did not yield parasitized birds, and it is quite probable that more extensive collections made there would have shown that these localities are not exceptions to the general rule.

COLLECTING ECTOPARASITIC LOUSE FLIES OF QUAIL

Since the Sergent's work (1907)[1] in northern Africa had proved experimentally that *Haemoproteus columbae* Celli and Sanfelice is transmitted by the bite of the louse fly *Lynchia maura*, it seemed probable that some species of louse fly would be found to be responsible for transmitting this newly discovered parasite of the valley quail in California. Accordingly, a survey was made of entomological collections in California which might include such flies. From this study it was ascertained that two species of such flies had been reported from quail in the state. They were namely, *Lynchia hirsuta* Ferris and *Stilbometopa impressa* Bigot.

The former species had only recently been described by Ferris (1927)[2], and was represented by only three specimens in the collections of Professor G. F. Ferris, of Stanford University. The latter was represented by two specimens in the University of California collection. With this information as a starting point, field search was instituted. Guided by the knowledge that the louse fly of the pigeon deposits its pupae about cracks and crevices and around nests in pigeon lofts, examination was made of the quail pens at the State Game Farm in the hopes of finding the flies or their pupae. Repeated examinations made during May and June proved to be fruitless. The next step was to drive the quail into cloth-screened pens at the game farm in the hope of finding the flies on the birds. This likewise yielded negative results. Operations were then extended to the field. Penned quail were taken out into natural environments of the wild quail, left for a few hours and then placed in cloth bags to be examined for any flies that may have alighted on them. Wild quail were trapped and similarly examined, but with entirely negative results. In the meantime, examinations of the roosting places and haunts of wild quail were continued but no hypoboscid flies were found.

Following upon the failure to obtain flies or their pupae by any of these methods, it became necessary to shoot quail and place them immediately in gauze bags. These bags were made up into conical shape, about a foot long. Field practice indicated that unless a quail could be shot in an open clearing and placed in the gauze bag within a few seconds after it was killed, any flies present among the feathers of the quail would make their escape. After a quail had been placed in a bag, the bottom of the bag was closed with a rubber band. It was

[1] Sergent, Ed and Et. Etudes sur les hematozoaires d' oiseaux; Ann. Ist. Past., 21, 251–280, pls. 6–7, 5 figs. in text.

[2] Ferris, G. F. Some American hippoboscidae (diptera pupipera) Canadian Entomologist 59, 246–251, 4 figs. in text.

then held suspended by the apex and any flies that were present invariably crawled up into the tapering part of the [illegible] to be the instinct of the fly to leave its host immediately after the death of the latter. After the flies had crawled up [illegible] transferred to 22mm shell vials which were [illegible] bag and moved upwards until the flies had [illegible]

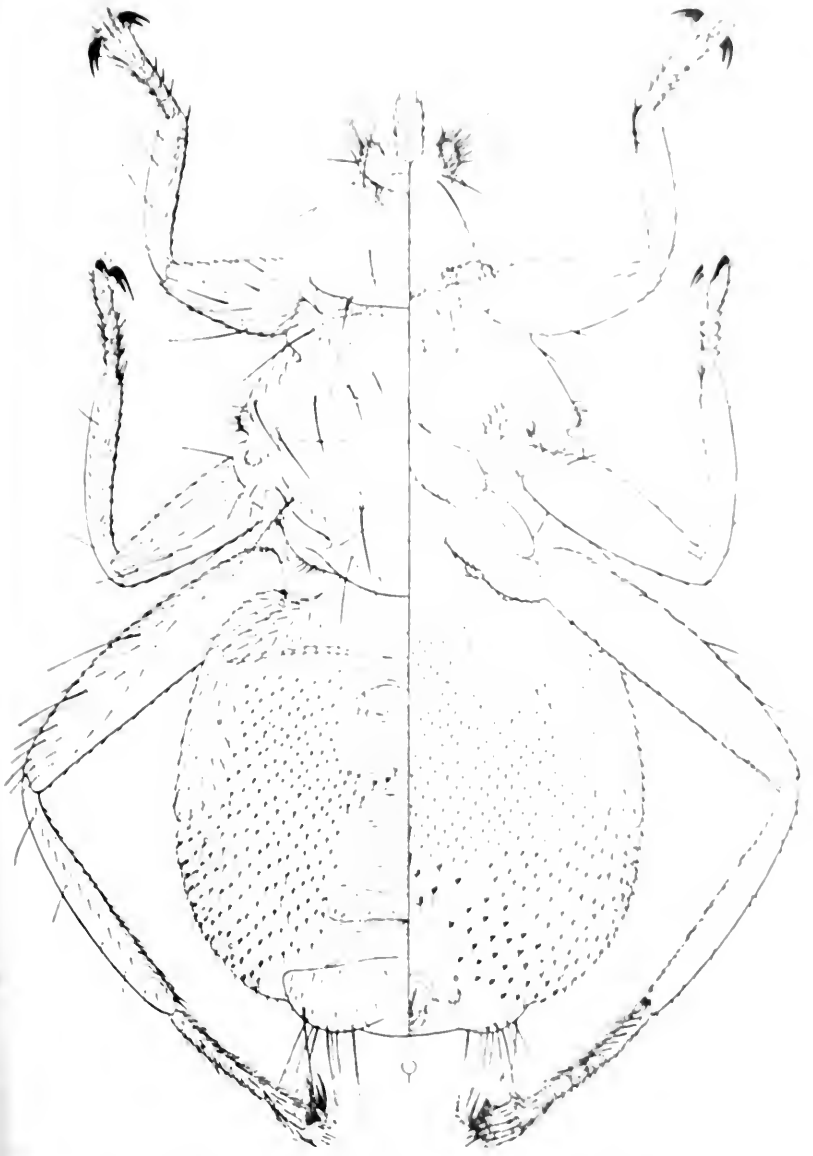


FIG. 50. *Lynchia hirsuta* Ferris. Female, wings removed. After Ferris. About 25 X.

fly taken by this method was captured on July 7, 1928, at the Whitman Ranch, near Mount Diablo. By November this method had yielded 32 flies. The greatest number taken on any one quail was four. Many had none at all and several only one or two. The only species taken throughout the investigations was *Lynchia hirsuta* Ferris.

Collections of flies were made from several places in the vicinity of Mount Diablo and at a few localities in the Berkeley Hills between Berkeley and Orinda. When a fly was transferred to a vial, it was customary to put the vial in one's shirt pocket in order to keep it alive and warm until such time as it could be used in transmission experiments.

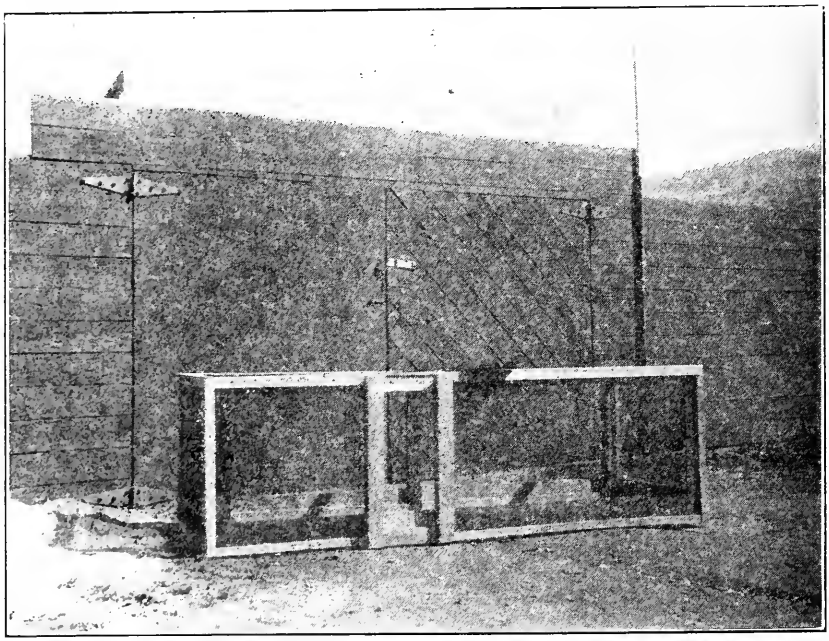


FIG. 51. Screen cage used at Yountville Game Farm in a series of transmission experiments with quail.

During the course of collecting flies, a few facts were gathered which may be of assistance at some time in the future to anyone working out the life history of the fly, which is unknown. No flies were ever found apart from their hosts. A pair of flies were observed in copula October 5. Three different flies were observed to oviposit a pupa immediately after being taken from quail and placed in vials. These ovipositions took place July 7, August 2, and October 5. All of the pupae were placed in a constant temperature box maintained at 35.5 degrees Centigrade. The one obtained August 2 gave rise to a fly in thirty-one days. The other two failed to hatch. The longest time that a fly lived in captivity was five days. They must live considerably longer than this as will be apparent when consideration is given to the development of *Haemoproteus lophortyx* in this fly.

They are, however, delicate and their [illegible] relative to the welfare of their host from which they [illegible] from which they obtain warmth. As will be seen in the accompanying figure, their pincher like feet enable them to [illegible] the feathers of their hosts and their flat bodies enable them to [illegible] the feathers easily.

EXPERIMENTAL TRANSMISSION [illegible]

Through the cooperation of [illegible] State Game Farm, at Yountville, 26 young quail were placed with their brooder hens in screened cages immediately after hatching, on May 25, 1928. At the beginning of the experiments one cage contained twelve little quail and the other fourteen. The [illegible] by A. W. Elder and E. D. Platt at the game farm [illegible] insect free during the time that the quail were being kept for use in the experiments. Some of the quail were removed from time to time and transferred to smaller cages for [illegible] last of the quail were not removed from the screened pens until December 7.

A long series of transmission experiments was [illegible] carried out. These began by merely placing an infected and uninfected quail from the screen cage in a small laboratory screened cage about 6x12x12 inches together with flies taken from quail shot in the field. Scarcity of flies necessitated improving this procedure and eventually the fly biting method adopted was to place the fly in a small biting cup about 22mm. in diameter and made from bobbinet and gummed paper tape which was sealed into position directly against the skin of the bird.

The usual practice was to confine the fly over night on the belly of a quail. When it became apparent that the scarcity of flies might prevent a thorough test by this method of the hypothesis that *Lynchia hirsuta* Ferris was a transmitting host of the parasite, still more accurate experiments were planned. When flies were taken on parasitized quail, they were subjected to microscopic analysis to determine whether the infective stage (sporozoite stage) of the parasite was present in the insect. Three such infected flies were found. One of these taken on October 5, 1928, was heavily infected, its salivary glands being gorged with the sporozoites of *Haemoproteus* [illegible]. The salivary glands of this fly when chopped up in [illegible] of normal saline solution and injected intravenously into the wing vein of a quail produced a positive case of transmission of the parasite, the infection developing in about thirty days. The control quail that were kept in the original screened cages at the game farm remained free from infection with the parasite.

LIFE HISTORY OF THE PARASITE

Haemoproteus lophortyx is a sporozoan having a complicated life cycle similar to that of the causal organisms of human malaria which is transmitted by the bites of mosquitoes. There are two distinct phases in its life cycle, the sexual and the asexual phase. Transmission is biological, the parasite going through the sexual part of its cycle in the body of the fly. A convenient though perhaps not logical starting

point for discussing the life cycle is the gametocyte stage in the red blood cells of the quail. When freshly drawn blood is placed between a slide and a cover slip and examined under the microscope, it will be noticed that the mature male and female gametocytes are at rest in the red blood cells. Within a few minutes after the drop of blood is drawn the male gametocytes escape from the blood cells and round up preparatory to gamete formation. By a process of successive nuclear divisions, the nucleus of the gametocyte forms the nuclei of from four to six male gametes. In addition, to the nucleus, the male gamete is provided with a small amount of cytoplasm. By rupture of the membrane of the gametocyte these gametes are liberated. They are extremely active vermicular organisms.

In the meantime, a single large macrogamete or female gamete is being formed from each female gametocyte through the throwing off of a polar cell. This process is a little slower than that of gamete formation in the male gametocytes. After the gametes are formed, fertilization takes place by the complete entrance of the male gamete into the substance of the female gamete. The process requires but fifteen seconds. As a result of this process a zygote is formed. About twenty minutes later this zygote begins to elongate into a motile oökinete. When this process occurs normally in the stomach of the louse fly *Lynchia hirsuta* Ferris, the oökinete soon burrows through the wall of the stomach and comes to rest on its outer surface, where it develops into an öocyst.

Within the öocyst, repeated nuclear divisions give rise to from 500 to 5000 sporozoites. The mature öocyst then ruptures liberating the minute sporozoites into the haemacoele of the insect. These sporozoites then enter the walls of the salivary glands and come to rest in the central cavities of the tutular glands. When a fly thus infected bites a quail some of these sporozoites are discharged and enter the blood stream of the quail. From here they enter endothelial cells of the blood capillaries of such organs as the lungs, liver and spleen. Through repeated divisions numerous merozoites are produced. These in turn produce more generations of merozoites in the tissues of the organs mentioned above. Finally some of these merozoites give rise to gametocytes which enter red blood cells and grow to maturity. When such mature males and female gametocytes are present in the blood, the bird becomes infective to another bird.

PATHOLOGY, DISEASE SYMPTOMS IN INFECTED BIRDS

Numerous investigators have studied the pathological conditions which are revealed by autopsies performed on infected birds. Few, however, have paid any attention to the appearance and behavior of infected birds and to the possibility that disease produced by Haemoproteus may be serious and even fatal. During the progress of this work special attention has been paid to this phase of the studies. As mentioned early in this article over 300 quail have been actually handled. Hundreds of others have been observed in the field. As a result of the observations on living quail, and of autopsies performed on birds used in the investigations, four types or stages of Haemoproteus disease may be recognized. These are:

The following diagram illustrates the [illegible] in the sexual cycle.

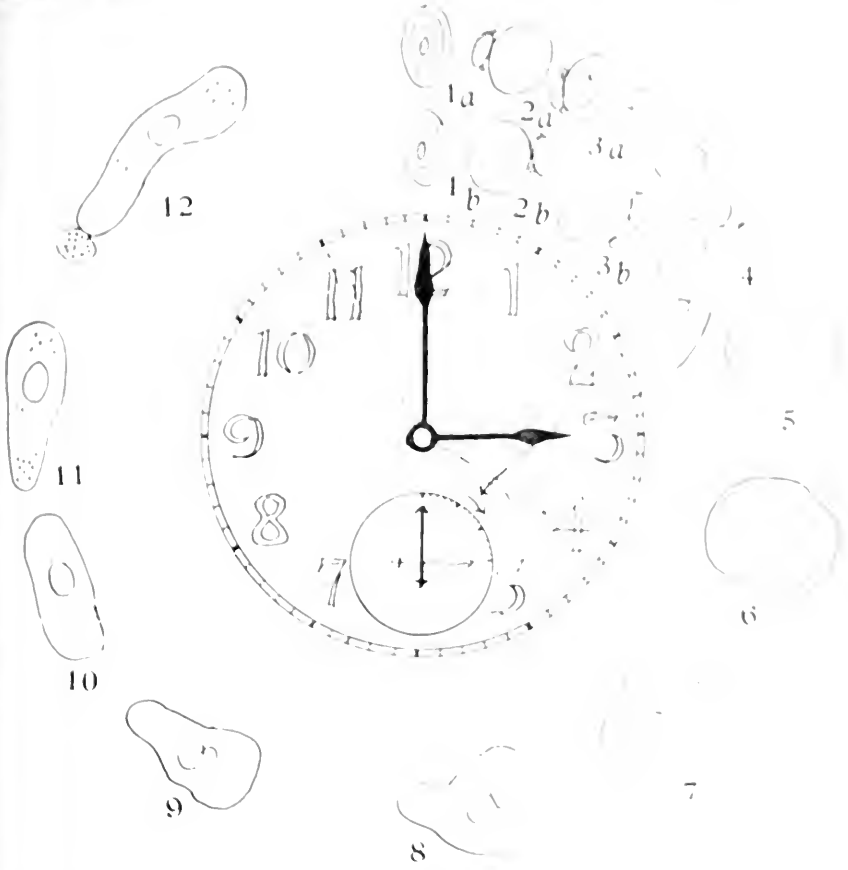


FIG. 52. Diagram showing the time [illegible] in the [illegible] fertilization and ookinete formation on the microscope [illegible] 1a, male gametocyte in blood cell; 1b, female gametocyte; 2b, gametocytes out of blood cell and rounded up; [illegible] gametes formed and liberated; 3b, gametocyte [illegible] fertilization; 5, fertilization membrane formed; [illegible] elongating ookinete; 11 12, motile ookinete.

1. Mild, chronic. This is by far the most common, [illegible] exhibiting no outward symptoms of disease and the presence of gametocytes in the blood being the only indication that the bird is parasitized. This type of infection is extremely persistent, extending throughout the year. Birds thus infected are undoubtedly carriers although they may manifest no disease symptoms themselves.

2. Mild, acute. This type apparently results from an initial infection the magnitude of which is sufficient to cause the bird some discomfort. It is restless and "off feed" for from two to four days, whereupon the infection is either thrown off or settles down to the chronic type.

3. Moderate, chronic. This type is commonly observed under field conditions. The bird is thin and anemic and more or less weakened. Such an underlying condition might well account for losses of birds in the field due to secondary causes, such as exposure or exhaustion following the nesting season.

4. Heavy, acute. This type occurs in late spring or early summer, whether as the result of new infective fly bites or the lapse of an old infection is not known. The percentage of red blood cells containing gametocytes that have reached the pigment-producing stage may be as high as 10 per cent and even more. The bird loses flesh rapidly, is unable to fly, refuses food, becomes droopy and may die. Only four fatal cases have actually been seen by the writer, and they are believed to be rare. It must be remembered, however, that under natural field conditions, the struggle for existence might eliminate birds before they

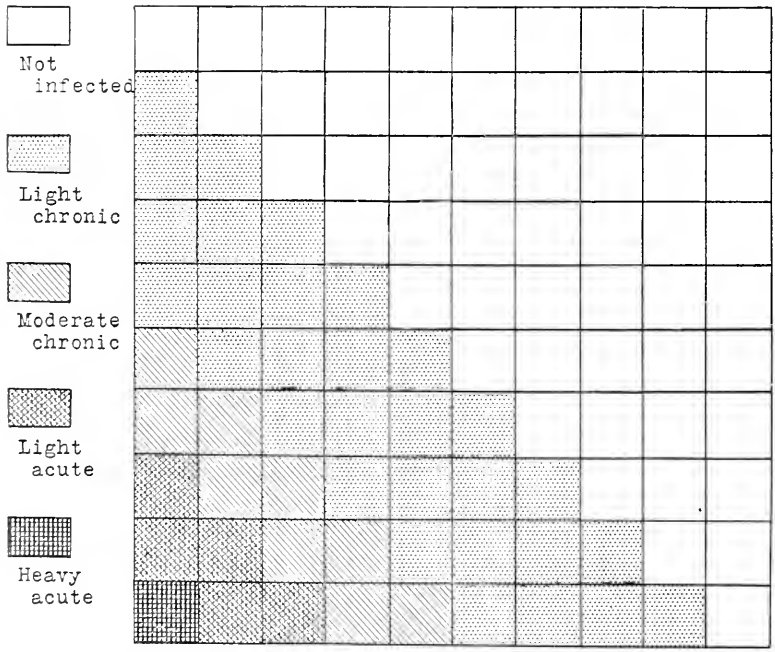


FIG. 53. Graph showing the relative percentages of quail harboring the various classes of infections observed. Chart represents 100 birds, sample population.

reach such a stage of helplessness. Several cases have been reported from widely separated localities of quail that were unable to fly and which could be caught with the hands. Four such cases, personally investigated by the writer, showed the birds to be heavily infected with *Haemoproteus lophortyx*. Two of these cases ended fatally and post-mortem examinations disclosed no lesions other than those due to the Haemoproteus infection. No acute fatal cases have ever been observed in young birds less than six weeks old, but it is conceivable that such cases do occur. If, for instance, the brooding birds should be heavily infected and if they should harbor a large number of flies which transmit the parasites, conditions for infecting the young would be ideal.

But anyone familiar with the habits of young quail knows that the chances of finding them where they may have died in their natural surroundings are almost negligible. The fact that young quail raised at game farms and private aviaries are not found to be [illegible] probably due to the circumstances under which they are hatched and raised apart from their parents, thus not being [illegible] any flies which might be living on the adult birds.

As to diagnosis of the disease and post [illegible] ence in the red blood cells of halter shaped gametocytes [illegible] black pigment deposits is characteristic. The [illegible] parasitized may run from a fraction of one per cent to [illegible] per cent. An almost constant lesion is an enlarged blackened spleen contrasted with the much smaller pink spleen of the normal quail. Similar black pigment deposits may also be found in the lungs and liver. Destruction of the red blood cells by the parasite brings about an anemic condition of the bird. Hypertrophy and [illegible] the blood cells due to the presence of the parasites [illegible] about congestion in the smaller capillaries of the lungs.

In a case of a successful experimental transmission where a portion of a lung of an infected quail was transplanted to the body [illegible] of a susceptible quail, the artificially infected bird was [illegible] just before the developing gametocytes became visible [illegible] This period of depression of the bird was marked by severe [illegible] which threatened to end fatally before the bird rallied and recovered. It is conceivable that such a heavy, acute infection could be produced in a natural way by insect transmission and terminate fatally without any gametocytes being discernible in the red blood cells.

From reference to the life cycle of the parasite discussed on previous pages, it is apparent that there is considerable destruction of lung and liver tissue with the multiplication of the [illegible] stages of the parasite in the endothelial and epithelial cells of these organs. This, together with any toxic effects that may be produced because of the presence of the parasites, may account for the severity of an initial infection of great intensity.

SOME PROBLEMS OF INFECTION AND IMMUNITY

As previously noted, page 230, infections may vary from extremely light to fatally acute. These variations are probably due to several causes, such as the number of parasitized flies, variations in the virulence of the parasites, and state of natural resistance of the host.

Transmission would seem to be facilitated by the observed fact that gametocytes may be found in the blood of the quail throughout the year, and that flies have been reported from nearly all months of the year. The gregarious habits of quail would also contribute to the ease of transmission. Tending to limit the extent of the infection among quail could be the small number of flies observed, the low percentage of infections among them and the lightness of such infections. It is also possible that the flies are limited to certain portions of the quail range, a subject upon which more data are needed.

POSSIBLE INFLUENCE OF CERTAIN ECOLOGICAL FACTORS

For the most part the experimental work involved in this paper has been done under controlled conditions where the various factors were known and could be evaluated. In a state of nature, it is not always possible to arrive at such precise values. For instance, one hears reports that quail in certain partly protected areas do not increase, and in fact become reduced in numbers. It would be of interest to make most searching investigations into the actual field situation which gives rise to the reports. Does full protection at first result in overcrowding and may such a condition be followed by flare-ups of parasitism and disease which defeat the purpose of protection? What is the situation with regard to parasitism of quail by *Haemoproteus lophortyx* in this respect? We have data showing that in some cases in private aviaries the quail were 100 per cent infected. The highest percentage of infected birds found in any one lot in a state of nature was about 65 per cent. Does the presence of heavily infected, weakened birds react unfavorably upon the rest of the covey? Would such birds under normal conditions be eliminated by predatory animals and certain species of raptorial birds? These are practical questions which can not be answered except by the most painstaking comparative study of field areas over a relatively long period of time.

SUMMARY AND CONCLUSIONS

In the foregoing pages an account has been given of the incidence and pathogenicity of *Haemoproteus lophortyx*, a new species of blood parasite of the California valley quail, Gamble quail and Catalina Island quail. It is widespread in the state, having been found in numerous localities. Fortunately, by far the greater number of cases seem to be light, benign infections, showing that at least partial immunity is well established. Fatal cases do occur, however, and it is possible that *Haemoproteus lophortyx* may be the indirect cause of losses commonly attributed to other causes. The parasite is transmitted from quail to quail by the ectoparasitic louse fly *Lynchia hirsuta* Ferris.

Plates I and II in this paper are identical with those appearing in a more technical account [1] published by the University of California. This publication contains a complete bibliography.

ACKNOWLEDGMENTS

Grateful acknowledgment is made to the many captains and deputies whose assistance in the field was invaluable. Special credit is due to Professor C. A. Kofoid of the University of California under whose supervision the experimental and laboratory work was done.

To Mr. Eugene D. Bennet, Dr. H. C. Bryant, Mr. R. E. Ludlum, Mr. D. D. McLean, Dr. H. Van Roekel, Dr. K. F. Meyer, Professor G. F. Ferris, Professor W. B. Herms and Professor E. C. Van Dyke the writer is indebted for cordial cooperation and assistance.

The painstaking care given the experimental birds at the State Game Farm at Yountville by Superintendent August Bade and his capable assistants as well as many other courtesies extended by Mr. Bade have been greatly appreciated.

[1] O'Roke, Earl C. The morphology, transmission and life history of *Haemoproteus lophortyx* O'Roke, a blood parasite of the California valley quail. Univ. of Calif. Pub. In Zool., Vol. 36, No. 1, 1930.

FISHWAYS IN CALIFORNIA

By [illegible]

IT HAS BEEN SAID that [illegible]
ment. Conservation [illegible]
that idea as it is applied [illegible]
the perpetuation of the wild life [illegible]
ment. Civilization is constantly [illegible]
occupied by fish and game in [illegible]
to expect that we may again [illegible]
when great herds of deer were [illegible]
their flight obscured the sun," [illegible]
streams that persons walked from [illegible]
These stories of abundance may [illegible]
ence as compared to present [illegible]
skeptical. The many established [illegible]
are not so generally known. [illegible]
zance of these factors and makes [illegible]
tions so that appropriate measures [illegible]
or postpone the ill effects that [illegible]
destruction of the species.

Probably the first adverse [illegible]
was the advent of the gold miner in 1849, [illegible]
polluting the streams, making [illegible]
structing dams for the diversion of water [illegible]
enable migrating fish to pass the [illegible]
This continued without restriction for [illegible]

In 1870, twenty years after the [illegible]
a Board of Fish Commissioners was [illegible]
restoration and preservation of fish life. [illegible]
appropriated to carry on this work. [illegible]
appointed by the Governor and [illegible]
pay. No changes have occurred [illegible]

The records of the early [illegible]
interesting reading. Many problems [illegible]
but probably the most difficult was the [illegible]
public, as few realized or would admit the [illegible]
changes. Increased responsibilities were given the Commission by the passage of game laws in 1878 and later the [illegible] Fish and Game Commission. Too much credit cannot be given those early and conscientious conservationists who [illegible] brought about the passage of the basic fish and game laws.

No doubt the early Commissions thought the problems presenting themselves difficult of solution but time has not lessened but rather increased these difficulties. Many more factors enter into the problems and must now be considered if any degree of balance is to be maintained between wild life and the advancing activities of the people.

In 1872 the first fish ladder or fishway law was enacted by the Legislature as it was recognized that the continued construction of

dams by the gold miner would in time destroy the runs of fish up the streams unless suitable means were provided for the passage of fish. Amendments to the law have been made at different times as necessity demanded.

The law now in effect (section 637, Penal Code of State of California) briefly states that the Fish and Game Commission may order installed on any dam or artificial obstruction, a fishway for the passage of fish over or around the dam or obstruction, when in its opinion one is required; such construction being at the expense of the owners. Accompanying the order the Commission must provide a plan of the proposed fishway setting forth location, form and capacity. Legal processes are established for the protection of the owners as well as the State. If there is noncompliance with the order the Commission may carry the matter to the courts for determination. In lieu of fishway installation the Commission may require the construction of a fish hatchery or have fry planted.

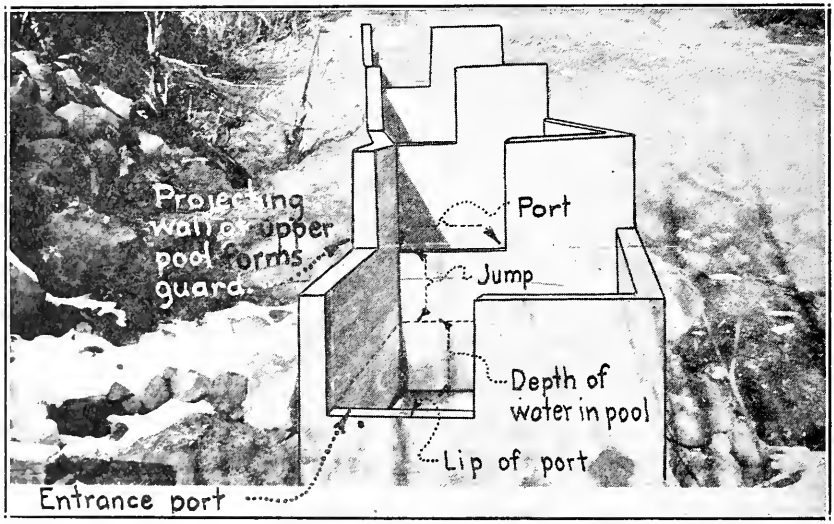


Fig. 54. Portion of concrete fishway without flow of water showing typical construction and nomenclature. Downstream face of dam at left, stream immediately in front of fishway and not shown in photo December, 1928.

In carrying out the obligations imposed on the Commission by the above law a survey of each dam is made and consideration given to the many factors entering into the design of an efficient and adequate fishway. Its location is important. The entrance to the fishway is a major factor in determining the location though the exit into the reservoir together with the general layout receive study. In general it may be said that the entrance should be at a point in or in the immediate vicinity of the line of travel used by the fish and should be as close to the base of the dam as possible and yet avoid the overpour of water over the dam. At some dams freshets or flood waters may cover the lowest pools at times but the entrance to some pool above may be readily found. It appears that the instincts of different species of fish vary, some being very "set" in their ways. Where more than

one species inhabit a stream the entrance [illegible] determined by the less flexible species of [illegible] though, where one fishway for a dam [illegible] operation by the owner, interest [illegible] the dam, accessibility and possibility [illegible] the other items given thought. [illegible] of the physical conditions, finally [illegible] is made to produce a plan that will require [illegible] and attention by the owner and [illegible] for the passage of fish.

While studying the entrance and location of [illegible] been in the mental background an outline of [illegible] required. The material to be used [illegible] specified in the order thought in and [illegible] gestions are made which may be adopted or not [illegible]

The pool type of fishway, which has been [illegible] most efficient for trout and anadromous [illegible] boxes or pools, each higher than the preceding one by a [illegible] amount, the pools joined together and [illegible] of water at least equal to the difference in elevation [illegible] (height of jump). At the junction of the pools there [illegible] tion (ports) through which the water flows and [illegible] water height is increased by the depth of the water flowing [illegible] the ports. As the fish in their jumping efforts may [illegible] tion the sides of the boxes or pools are continued [illegible] four feet. The outside wall adjacent to the port is [illegible] same elevation for a distance of about four feet to the next lower pool forming an additional guard and reducing the possibility of fish [illegible] ing out of the fishway. The width of the port opening is about one-half the width of the pool and the port lip should not be thicker than six inches unless it is properly beveled. In line with the foregoing for migrating fish of moderate size the minimum size of pools should be at least 6′ x 8′ by 6′ high and at least having 2½′ to 3′ of storage water. For large salmon and or where the runs may occur in a short space of time an area of 250 square feet is not excessive for each pool.

The difference in elevation between pools or jumps is determined after considering the varieties of fish that are in the stream or that may be planted, distance and obstacles overcome prior to arrival at fishway—that is, the estimated ability or vitality of migrating fish, fishway, water conditions, and the practicability and reasonableness of construction of the fishway. In some fishways it is necessary to interpose between the regular pools larger ones for loafing or resting areas as an aid to the ascending fish.

In the operation of dams changes in water level in the reservoir occur in many instances, these being from seasonal to daily fluctuations. This necessitates a slightly different treatment of the upper pools in order that a regulated flow of water may be passing through the fishway as required.

In a few instances the topography and formation below the dam is such that with very little work the natural ground may be used for the fishway. Where such construction is possible the results are generally very satisfactory.

The photo showing typical construction of fishway has the openings or ports on one side. This is the general practice followed, though changes are made as necessity demands. Construction of some years ago alternated the ports from one side to the other of the fishway. This method created currents contrary to the line of travel by the fish and also lessened the area of quiet water used for resting while preparing for the next jump.

It is apparent that each dam is a problem by itself and before any order and plan for a fishway may be prepared a survey must be made so that the many and varied factors shall be given proper consideration and also comply with the spirit and letter of the law by specifying location, form and capacity of the proposed fishway.

Some streams have one "run" or migration of fish each year while other streams may have two. Where streams have different varieties of fish the "runs" of these varieties may or may not coincide.

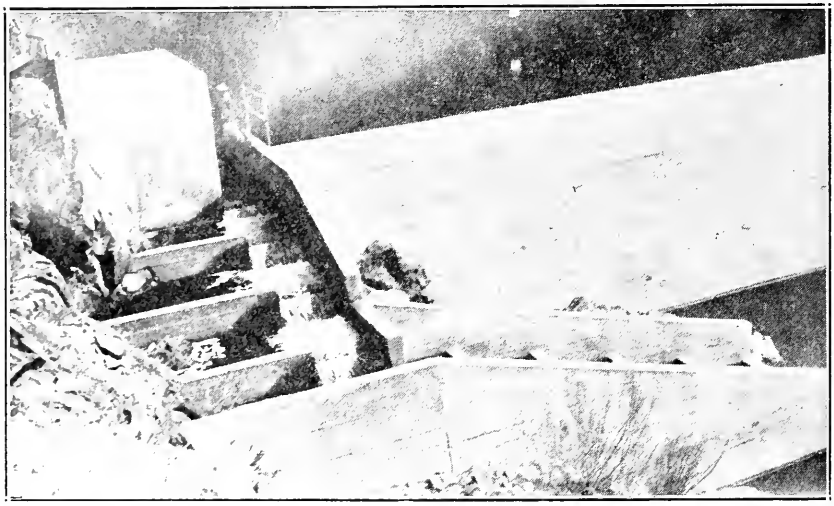


Fig. 55. Fishway of concrete construction. Natural rock bank forms bottom and portion of one side. A float at upper port regulates amount of water through fishway.

Some fish are in advance of the main run and others may be termed stragglers, so that there may be some merging of the runs. At times there may be such numbers that there is some concentration or "piling" up of fish at a dam as all can not use the fishway immediately but this occurs only for a limited time. Sometimes the concentration is due to lack of desire to proceed but when the "urge" to move comes the fishway is used and in a short space of time no fish will be visible. When fish are loafing near a dam or in a fishway criticism as to its efficiency generally results as people expect to see a steady procession of fish through the fishway and no false leaps. If the conditions are favorable when anadromous fish enter the mouth of a stream the movement upstream is generally a leisurely one but when the fish are held back by low water and other factors rapid movement may occur when the adverse factors are removed.

While there is a wealth of interesting information [illegible] the practical application with the view of increasing [illegible] to the numbers is not easily determined. [illegible] besides the need of fishways at dams [illegible] sidered in this article. Similar to other [illegible] materially changed from the [illegible] evolved the efficient pool type for the [illegible] This type has been in use for many [illegible] fully designed the construction [illegible] plans has necessitated reconstruction of [illegible] in a loss to the owner and also loss of [illegible] pleted. When operating conditions [illegible] ing when the fishway was originally designed [illegible] may be required to meet the new conditions.

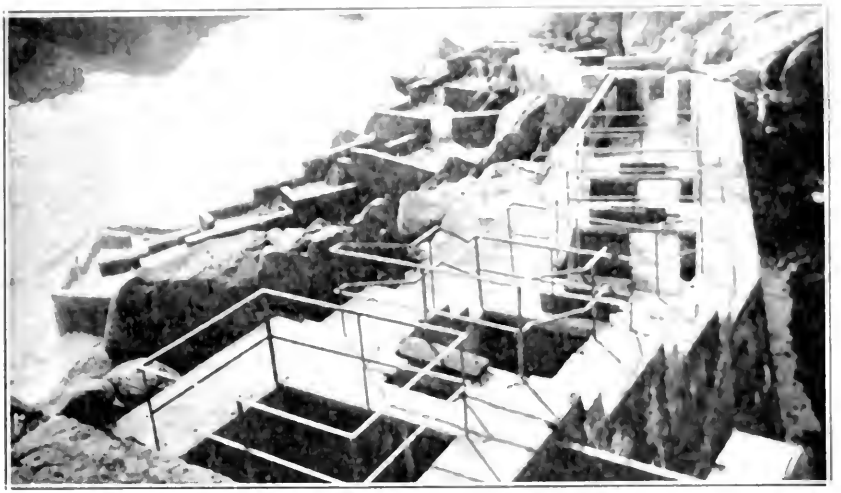


Fig. 56. Fishway over Eastman dam [illegible] elevation, 15 feet. Lowest four pools [illegible] adjustable ports at upper [illegible]

There are instances where fishway installation on dams [illegible] delayed or have been inefficient resulting in decreased fish life in that stream. Only by keeping the streams free from obstructions or by the installation of appropriate fishways at dams may fish life be maintained on a normal basis. This is especially true of anadromous fishes. If prevented from ascending to their natural spawning grounds for a few years the run up that stream will be entirely eliminated and only by laborious and expensive planting of fish fry and proper treatment of obstructions and dams can the run again be built up.

In considering designs of fishways the known instincts of the fish should be utilized. They may be induced, but attempts at compulsion result in failure. Mechanical lifting devices have been tried in lieu of fishway construction and also a combination of both. As far as known these can not be classed as entirely successful. An illustration of the latter type of construction may be seen in the Baker River, at Concrete, Washington. A dam about 200 feet high was constructed

there several years ago and equipped with a fishway consisting of pools and a mechanical hoist. Prior to construction Baker River was well known as a salmon stream. The first reports made shortly after construction indicated the successful passing of anadromous fish over this dam. Later reports would indicate that the salmon run up that river is becoming less and if continued Baker River as a salmon stream will cease.

The prosperity of California, in the main, is dependent upon the most efficient utilization of the State's water resources and probably the most ardent conservationists or "dyed in the wool" sportsman would not expect that this development should cease because of possible conflict with fish life. The thought prevails that with orderly and regulated development the benefits of both may be had and enjoyed by the people of the State if due consideration is given the problem and approached on a friendly and cooperative basis. It should be borne in mind that this development creates a problem which heretofore has not been present and the burden of its solution may not honestly be passed entirely to conservation agencies.

The problem becomes more acute as the tendency appears to be toward higher dams and nearer to the floor of the valleys and unless intelligent and well directed experimental work is carried on with the views of successfully passing anadromous fish over these barriers to the spawning grounds beyond the State will lose the valuable commercial and sporting varieties of fish which up to this time have been enjoyed.

BARGE FISHING, A SOUTHERN CALIFORNIA SPORT

By Donald H. Fry, Jr.

IF YOU LIVE within fifty miles of the coast in southern California you are likely to answer your doorbell almost any summer evening to find a neighbor standing on the porch with his hands full of fish. "Can you use any fish?" asks the neighbor. "We went out on a barge today and caught more than we can use." It is only etiquette to accept as many as you can cram in your ice box, particularly if you have been guilty of dumping your own surplus in the same way.

Fishing barges are scattered along the coast from Santa Barbara to San Diego, but are thickest in Santa Monica Bay. They are anchored from a hundred yards to several miles off shore. Some of them are what the term "barge" indicates—low, flat-bottomed, square-ended structures of the type used for hauling gravel. The others are old schooners stripped of practically everything, to make room for as many fishermen as can fit elbow to elbow along the rail. In late years the schooner type has become the more common, probably because it is more seaworthy and can accommodate more people. From the fisherman's point of view the flat barge has one great advantage, as anyone who has tried to lift heavy fish up the high sides of the schooner can testify. It also has one disadvantage—for those who get seasick easily.

The schooners are unbelievably steady. In the course of over twenty trips to them I have never seen a single passenger [illegible]. The trip from shore may make a person groggy, but [illegible] all right again after a short time on the barge.

The best times of year for barge [illegible] autumn. Fishing in the late spring [illegible] relied upon. Winter and early spring [illegible]

Rates for a day's fishing range [illegible] a half. The charge covers the use of [illegible] prefixed by the word "telegraph" [illegible] of line attached to it. Hand lines and [illegible] in the price. Live bait is generally available [illegible] sometimes costs a cent each to twenty [illegible] ally comes as high as five cents each.

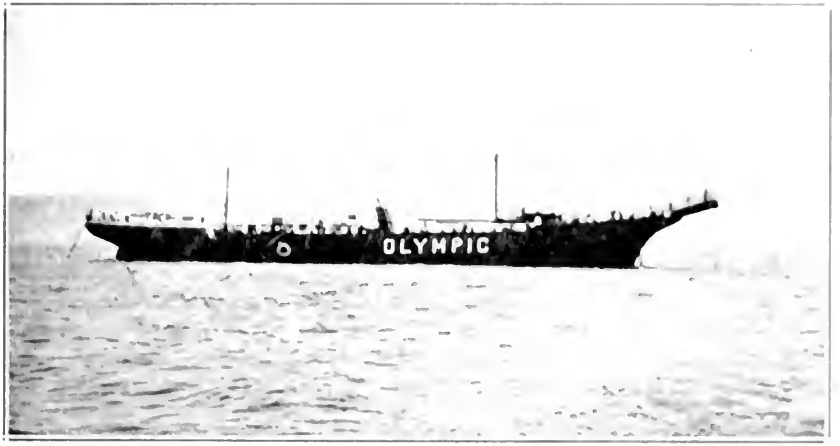


Fig. 37. [illegible]

Most live bait is supplied by fishermen who take their catch in the morning with a small round haul net, and deliver it to floating receivers hung alongside the barge. A second method is to take the bait with a large hoop net hung over the side of the barge itself. This system produces a scanty supply of inferior quality. At Catalina the bait is taken with hoop-nets, usually baited, but the fishermen go after it instead of waiting for it to come to them. The supply is kept in receivers.

The barges are reached by "speed" boats which take off from a nearby pier. At Redondo there is a barge which has for a landing a motor-driven, floating platform, with a passenger deck elevated several feet above it on stilts. A long gangplank stretches to the shore, the passengers embark, and the whole contraption crawls grumbling through the surf, dragging its gangplank behind it. A speed-boat meets it beyond the breakers and carries the passengers the rest of the way.

When a fisherman arrives at a barge, along with a load of his fellows, the first thing he does is to make a rush for the best looking place and establish himself. Then he gets some bait, a pole (unless he gathered one up in the course of his rush), and starts fishing. If he uses cut bait his first catch will probably be a mackerel. If he strikes

soon enough the mackerel will come sailing through the air and land with a thud on the deck; but if he hesitates and the mackerel gets its head down there will be a fight out of all proportion to the size of the fish. The mackerel must be taken off the hook with an air of disdain. The fact that he is able to outfight many justly famous game fishes must not be allowed to count in his favor. He is just too darned common. To be sure, on barges located in kelp or near rocks, where the mackerel is comparatively scarce, it is sometimes in great demand—as jewfish bait. Mackerel is supposed to be poor eating, but the trouble is that most people do not know how to prepare it. The next time that you have a mackerel, try boiling it fifteen minutes in a saturated salt solution, split it, break away the dark meat, bones and skin, and serve the white meat with a good cream sauce. If more people did this they would probably put their mackerel into their gunny-sacks with more respect.

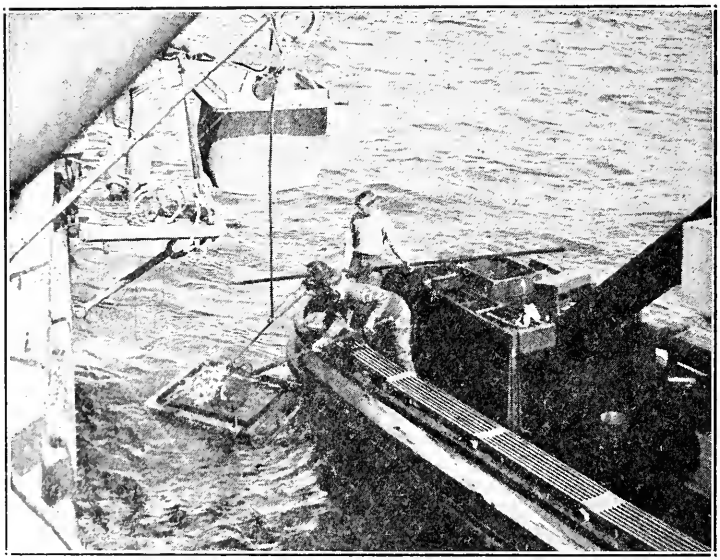


Fig. 58. Loading live bait into a floating receiver alongside a barge. Note the empty receiver hanging in midair. The searchlight is for night fishing.

If the fisherman uses live bait he may hook a mackerel, bonito, or barracuda. Bonito, the smallest of the tunas, is very like a mackerel on a somewhat larger scale, but is much more highly regarded. A barracuda can generally give a good account of itself during the few seconds allowed it on barge tackle, but if he has a chance to fight he soon proves that he has not the almost unlimited endurance of the bonito or mackerel.

If the fisherman lets a hand-line down to the bottom he is likely to get a halibut, rock cod, sanddab, flounder, or kingfish. The last three are not caught when you are fishing in deep water—they are merely discovered waving feebly on the end of the line. The sanddab and flounder are highly regarded as food; but as the epicurean qualities of

the kingfish are commonly considered [illegible] it is angrily unhooked and thrown back into the water. [illegible] has been ruptured in the trip up from the [illegible] floats helplessly with the current until [illegible] to pieces by seagulls.

The bow, and to a lesser extent the stern [illegible] occupied by the fishermen who "fly fish" [illegible] for bonito, always keeping a weather eye out [illegible] school of yellowtail shows up most of the [illegible]

Fig. 59. Swinging a mackerel [illegible]

for the largest live bait (up to ten or twelve inches) that the fishermen can lay their hands on. They cast out large live sardines and reel them in slowly, hoping to get a strike, while others are still trying desperately to get suitable bait. Yellowtail bait is not often found in the floating receivers of a barge, so the fishermen catch their own (usually by snagging. When a yellowtail is hooked he must not be allowed to run far. Along the middle of the barge, lines are often only three feet apart,

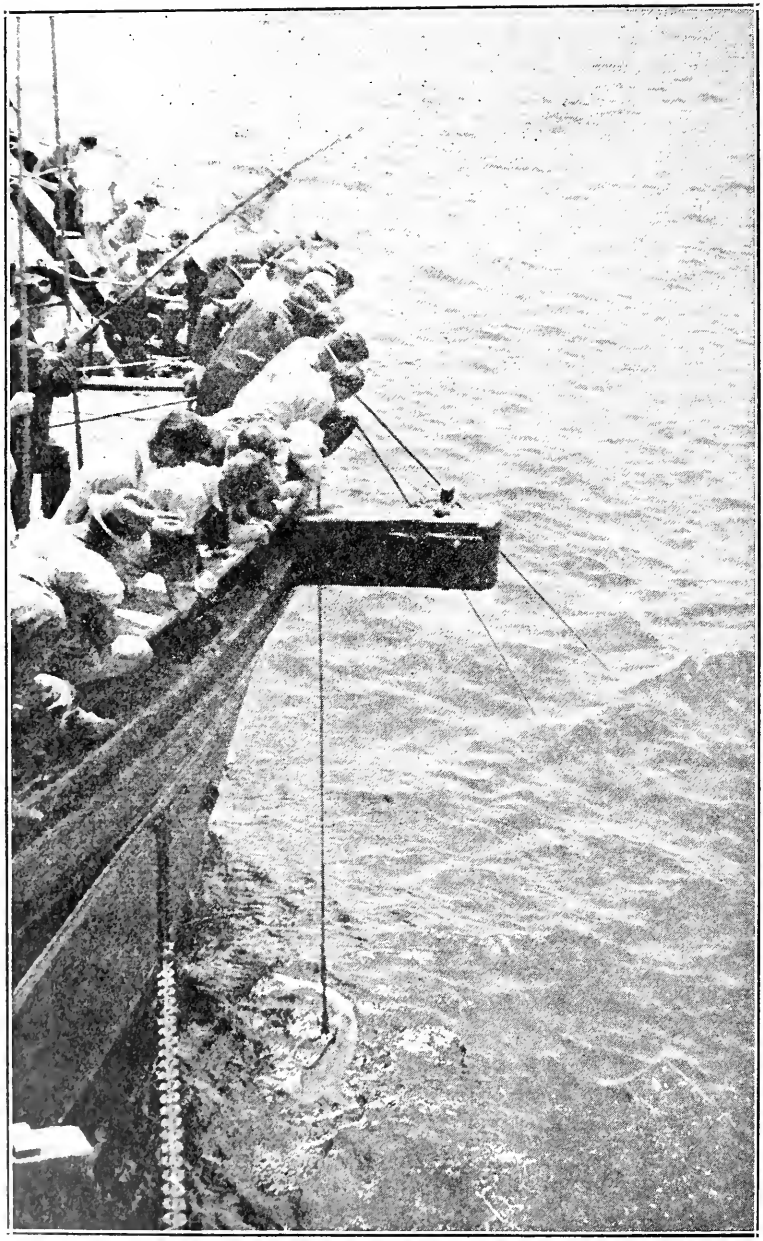


Fig. 60. Gaffing a shark that tried to get away with a jewfish bait.

and if the yellowtail starts doing a [illegible] to create a superlative mess. Light [illegible] if a yellowtail or even a big bonito [illegible] can not be promptly dissuaded [illegible] surf rod.

There are a few of the men at the bow [illegible] sea bass or jewfish. They often engage [illegible] while they wait for a bite. The jewfish [illegible] after yellowtail, does not use live bait. He [illegible] a huge hook and lets it down to the bottom. The [illegible] crate about picking up a bait and when he does [illegible] be given plenty of time to get it far enough [illegible] strike will set the hook instead of merely pulling [illegible] hook the jewfish, the fisherman is in for plenty of [illegible] monster cuts the entertainment short by [illegible] around the anchor chain or by galloping [illegible]

Around the barges located in kelp beds or close to [illegible] are less common but there are many additional species [illegible] the open sea. Rock bass, sheepshead and white sea bass are [illegible] them. These are all good fish, both to catch and to eat. The white sea bass is a special prize.

On the barges, as everywhere else on earth, justice is [illegible] lacking. I was once fishing on a barge when a lot of experienced fishermen were offering all the specially caught live bait they could put hands on to a yellowtail that showed not the least interest. A raw [illegible] middle-westerner, obviously on his first barge trip, walked up [illegible] with a piece of cut bait on his hook and dropped it in. After a short while he gave a mighty heave and the yellowtail lay flopping on the deck beside him. While everybody looked on, green with envy, he eyed the fish thoughtfully and then asked, "What's that?"

If you decide to go out on a barge don't beg us by engaging the photographer to take the picture of you and your jewfish in the time-honored pose. You probably won't catch a yellowtail, either, and you may even be passed up entirely. But take along a good big gunny sack anyhow, because the chances are that evening will find you (or your wife) ringing your neighbor's doorbells and asking, with your best smile, "Can you use any fish?"

DEER MEAT INVESTIGATION

By H. W. Estill, Department of Bacteriology, University of California Medical School, San Francisco

THE PROBLEM of the differentiation of deer from various other meats, for example, goat and beef, is a very real and pressing problem with which the Division of Fish and Game has been confronted for some time. So far as the writer is aware, no entirely satisfactory test has been evolved.

Although some work on the precipitin test has been done in this laboratory in connection with the problem, practically the entire time has been given to a study of the anaphylaxis reaction and in particular the sensitized guinea-pig uterine strip method of Dale.

In the cases where it can be used, no method known to immunology can compare with Dale's technique for the differentiation of closely related proteins, which, of course, is the problem involved. The outstanding merit and value of this method is the exactness and finality with which specific desensitization to various heterologous antigens can be determined. At the same time the Dale reaction is by no means devoid of traps and pitfalls, which is especially true of a problem like this one where meat extracts must be used, for example, a change in pH and toxic effects are items in point.

The blood-serums of the various species involved were first used as possible sensitizing agents and control substances because of the relative ease with which they are obtained and their stability over considerable periods of time. The serums were also used to become familiar with the technique involved before any work was done on the meat extracts. Although it can not be definitely stated, it seems reasonably certain that the blood serums of the deer, goat, beef and sheep can be differentiated from each other. Also it has been quite definitely established that these serums can not be used as sensitizing substances for testing meat extracts.

It was further shown that meat juices (kept constantly in a freezing mixture) of the deer, goat and beef were unsatisfactory as sensitizing and control substances.

Dried raw muscle preparations of the several species are now being tested in the hope that they may be satisfactory standards of reference and will yield proteins which are sufficiently soluble so they can be used as antigens. These preparations consist of the finely pulverized muscle (as free from gross fat as possible) dried first in a current of warm air, then over calcium chloride and finally over phosphorus pentoxide. A 0.9% sodium chloride extract of these preparations is being tested at present and gives evidence that it may be satisfactory.

Although the work on the saline extracts of the raw dried muscle preparations is incomplete, the data furnished by gross shock in the guinea-pig and by the virgin guinea-pig sensitized uterine strip method of Dale suggest that

(1) these freshly prepared extracts contain enough soluble, unaltered and specific protein to act as a sensitizing medium.

(2) desensitization can readily be accomplished with heterologous antigens and yet leave sufficient anaphylactic antibody so there is a sharp and definite reaction to the homologous antigen.

(3) many control guinea-pigs (which received none of the extracts) have shown practically no reaction, in marked contrast to the extract—treated animals.

Work is in progress with regard to such items as appropriate sensitizing and assaulting doses, possible pH changes, and the presence of toxic or histamine-like substances to determine whether this method will be satisfactory.

THE CRUISE OF THE "MAYFLOWER"

By Conrad P. Maxwell, Director

DOCKING at her home port, San Diego, the tuna clipper *Mayflower* completed [illegible]. This is said to be the longest [illegible] history in the commercial fish[illegible] namesake made American history at Plymouth Rock.

The *Mayflower*, large [illegible] partners, Dave and George [illegible] and Sabina Enos. Originally it was [illegible] scouting trips for schools of albacore. [illegible] Union Diesel engine and has a fish [illegible] gives her a cruising radius of about [illegible]

[illegible]

Manuel O. Medina conceived the trip [illegible] though he did not make the voyage. The [illegible], Joaquin O. Medina, captained the crew of fourteen [illegible] navigator on the famous trip. Though they hoped to [illegible] albacore for delivery to the Point Loma plant of the K. Hayden Company, they were unable to sight any of these fish during their cruise.

The *Mayflower* left San Diego March 16th for the vicinity of Magdalena Bay in search of bait. Twenty two tons of bait, "anchovetas," similar to and about the size of large "quarter oil" sardines, were caught. These small fish are found only at Cape San Lucas or Magdalena Bay, or adjacent waters. They are more desirable for bait than sardines because of their resistance to changes in water temperatures. After getting used to the bait tanks they survive warm water

currents 60 to 100 miles wide, running as high as 87° Fahrenheit—a temperature that would kill sardines.

On April 6th, after experiencing considerable difficulty in securing the desired bait, the vessel left Magdalena Bay on the longest leg of her voyage—Christmas Island. She arrived at this point April 19th, having logged the 3000 miles at an average of 10 knots per hour. From Christmas Island the clipper went to Palmyra, Fanning and New York or Washington Islands and took a few yellowfin tuna at all of these islands, about 45 tons in all. No skipjack were caught.

At Christmas Island they began to be uneasy about their fuel supply and dared not do too much prospecting. Three weeks had been consumed in securing bait, and the auxiliary engines had to be kept running to keep the ice plant in operation, as well as to keep the water in the bait tanks circulating. It is believed, had it not been for this contingency, a much larger catch would have been made.

Being the largest fishing vessel ever to visit the islands, the *Mayflower* created considerable interest when she docked at Honolulu. That she came from so far a point as San Diego added to her fame, and Captain Medina and his crew were most hospitably entertained during their seven days' stay. Two days were devoted to unloading the cargo of 45 tons of tuna, which was delivered to the Hawaiian Tuna Packers, Ltd., of Honolulu, at $90 per ton. This is a higher price than is being paid by local canners. As there is no bait around Honolulu, Captain Medina had no trouble in getting $2,000 for that remaining in his tanks. The canners buying this bait sold it to their local fishermen. These fishermen use diesel-operated "sampans"—flat-bottomed boats not unlike those used on the coasts of China and Japan. The Hawaiian boats have bait wells, and the rocking motion of the craft furnishees the necessary circulation of water to keep the bait alive in the tank.

The cruise of the *Mayflower* into Hawaiian waters may revolutionize the tuna industry. Having pioneered the way to unknown fishing banks, the vessel got in touch with a market hitherto unused by California tuna fishermen. When it is considered that the distance from San Diego to Honolulu is 100 miles shorter than to the present southern tuna fishing banks or the Galapagos Islands, and the market somewhat higher, it is not unlikely that a number of our local boats may follow the example of the *Mayflower*.

The main drawback to such a voyage will not be the lack of cruising radius, but rather of bait storage capacity, and the problem of keeping the bait alive and in good condition. Fishermen never know what bait will do in the tank, but after they get used to the tank and feed on the raw fish, which has been ground in a meat grinder, no further trouble is had in keeping them in good condition. They swim in a circle in the tank, their course always to the left. This peculiarity of turning to the left has caused fishermen to term them "left handers." I think this custom of swimming to the left may be due to the fact that the water enters the tank on the port side, in the majority of cases, and the bait swim against the current created by the incoming water.

As the main object of the *Mayflower* is to catch albacore, it is not unlikely our California canners may get to pack this most popular

fish in large quantities, as they did years ago. The owners of the vessel have found they may cruise thousands of miles for this desirable member of the mackerel family, and, if not enough can be found, they may fill up their space with yellowfin and skipjack. The fish thus discovered will find a ready market in Honolulu and [illegible] always be desirable to California packers.

So much faith have the owners, captain and crew [illegible] that they are now off on a second cruise to Hawaiian waters. On their second voyage they obtained bait more readily and expect to reach Honolulu with a good cargo of tuna and, with warmer weather, hope to strike albacore for the California market. They are better equipped for more extensive prospecting than they were on their first trip.

The result of their first trip was noted by the industry with special interest, who are maintaining a still deeper interest in the second cruise of the *Mayflower*, which has, I think, the good will and best wishes of the industry for this progressive venture into [illegible] waters.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California Division of Fish and Game.

All material for publication should be sent to Leo K. Wilson, Division of Fish and Game, 450 McAllister Street, San Francisco, California.

Vol. 18 JULY, 1932 No. 3

NATURE'S CARE OF HER OWN

Nature takes loving care of all her own
With marvelous cunning and with watchful eye,
So that her countless brood may multiply,
Nor leave their mother desolate and lone.
To the wild fruits by care of man unknown,
That ripe where winter at his stormiest blows,
She gives more seeds and better than to those
In cultured garden delicately grown.
And so in him that on the rugged breast
Of mountain finds his joy and his repose,
Who makes the pine his fellow, and with zest
Treads the great glaciers and their kindred snows,
A strength is planted, that in direst test
Dares all the devils of danger to oppose.

EDWARD ROBESON TAYLOR.

IMPORTANT NOTICE

Beginning with the current issue for July, 1932, CALIFORNIA FISH AND GAME, the quarterly publication of the Division of Fish and Game of the Department of Natural Resources, will be distributed on a subscription basis for $1 per year.

This is not an attempt to enter the commercial printing field, but the move is made only because of an overwhelming number of requests from sportsmen and others to be placed on the mailing list.

A free list will be maintained for the benefit of schools, educational institutions and libraries. The magazine will be available for exchange for publications of a similar nature. For accepted contributions, one year's subscription will be furnished free. As the official organ of the Division of Fish and Game, this magazine will be sent free of charge to all officers of the Division and to the heads of other State departments. All others interested will need to pay the subscription fee.

Those who wish to subscribe should fill in the enclosed attached subscription blank and return to this office not later than September 30, 1932, with subscription fee of $1. Stamps will not be accepted.

Subscriptions will begin with the current July number. This will be the last number distributed unless subscription blanks are returned. Stamps will not be accepted to cover subscription fee.

CHANGE OF ADDRESS

On May 13, 1932, the San Francisco office of the Division of Fish and Game was removed from 400 Russ Building to new quarters in the State Annex Building at [illegible]. After this time forward that address will be [illegible] the Division of Fish and Game in San Francisco.

The Los Angeles office, as of [illegible] May, 1932, moves from the Associated Realty Building to Room 401 of the California State Building.

These changes of locale are made by the administration to group all State [illegible] buildings.

NEW PATROL ADMINISTRATION

With the start of the [illegible] fiscal year, the commercial fisheries patrol, since its inception a separate unit, has been merged with the patrol work in the State, has been merged with the [illegible] Division of Patrol. This transfer was made [illegible] certain economies in personnel by [illegible] patrol activities. E. L. Macaulay will [illegible] commercial fisheries patrol as well as the work presided in the past.

N. B. Scofield will carry on as chief of the Bureau of Commercial Fisheries. Scofield's work, as in the past, will be [illegible] with scientific investigation and the [illegible] this field.

The commercial fishery patrol, which [illegible] under Chief Macaulay and will be [illegible] financial reports of the Division since it is [illegible] ing taxes, will cooperate with the [illegible] has in the past in the securing of scientific [illegible] ducting of investigational work.

IN MEMORIAM

GEORGE ALBERT COLEMAN
(1866–1932)

George Albert Coleman died suddenly of a heart attack at Balboa, California, April 28, 1932, while conducting research work for the California Fish and Game Commission. He was accompanied by his wife at the time and had only gone to southern California a few days before to continue investigations at the Salton Sea, where he has been working for some years on the possibilities of establishing the striped bass in that large inland sea. The major part of his life has been spent in the study of entomology and fresh water biology in California. He was reserved,

[1] American Men of Science, ed. 3, p. 137; ed. 4, p. 193, 1927. Berkeley Gazette, p. 20, April 29, 1932.

of a very generous and kindly disposition, and overcame many serious difficulties by patient and conscientious hard work and continuous endeavor. He was born at London, Nebraska, September 24, 1866; at the time of his death he was biologist of the California State Fish and Game Commission and engaged in a biological and ecological survey of lakes and streams in California. This entailed studying the life histories and making collections of aquatic insects, protozoans, rotifers, cladocercas, copeds, ostracods, higher crustaceans, water mites and plant life, as well as the parasites of fishes; also a study of physiological environment in the fish hatcheries and in the streams with a view to bettering cultural practices and food conditions for game fishes.

He served ten years in the U. S. Biological Survey, prior to his graduation from Stanford University with the degree of A.B. in 1903. The degree of A.M. was received from the same institution in 1905, and B.E. and a life diploma from the Nebraska State Normal School, Peru, Nebraska, in 1906. From 1903–1906, also, he was forester and entomologist of the Pacific Improvement Company in California; from 1906–1908, forest supervisor in the U. S. Forest Service; from 1908–1909, biologist, California State Fish and Game Commission; from 1909–1911, horticulturist and entomologist, from 1911–1913, curator of museum and apiculturist, University of California; from 1914–1920, instructor in entomology and apiculture, University of California; from 1914–1920, instructor in entimology and apiculture, University of California; after which he again accepted a position with the State Fish and Game Commission.

Coleman was specially interested in the systematic study of scale insects, Coccidae, and published a number of important papers on the same while at Stanford and the University of California, and did a great amount of work on a monograph of the Coccidae of the world, which he was unable to finish. He also wrote on apiculture. His private exhibit of apicultural methods and way of studying the honeybee in the schoolroom, accompanied by daily demonstrations with living bees, and weekly lectures delivered to the public at the Panama-Pacific Exposition in San Francisco in 1915–1916, won for him a gold medal and highest praises from the Exposition officials. He also directed and made five reels of motion pictures illustrating the life of the honeybee and beekeeping, one of which is in the Edison Series No. 11. The results of his ecological work have appeared in the Monthly Bulletin of the California State Fish and Game Commission. Among his more important papers may be mentioned the following:

The redwood mealybug (*Dactypolius sequoiae* n. sp.), Calif. Acad. Sci., Proc. (3), Zool., vol. 2, pp. 409–418, pl. xxvii (1901).

Coccidae of the Coniferae, with the descriptions of ten new species from California, Jour. N. Y. Entom. Soc., vol. 11, pp. 61–85, pls. v-vii (1903); suppl. no. 1, vol. 16, pp. 197–198, pls. iv-v (1908).

Beekeeping for the fruit grower and small rancher, or amateur, Calif. Agr. Expt. Sta., Circ. 185, 11 pp., 8 figs. (1917).

He made a collection of birds and mammals in Nebraska, which was exhibited at the New Orleans Exposition in 1884–1885, and also a collection of insects which were given to the University of Nebraska. His large and valuable collection of the Coccidae of the world is the property of Stanford University, to whom he also bequeathed his private library.

Some of the California Coccidae named by [illegible]
Redwood mealybug, *Pseudococcus sequoiae* [illegible]
California nutmeg mealybug, *Puto cupressi* [illegible]
Xylococcus macrocarpae Coleman
Leucaspis kelloggi Coleman
Physokermes taxifoliae Coleman
Douglas fir scale, *Aspidiotus chihoria* [illegible]
Redwood scale, *Aonidia shastae* Coleman
Coleman's mealybug, *Pseudococcus colemani* [illegible] for him.

Since 1911 he has made his home in Berkeley, [illegible] time of his death being 2649 Russell Street. He is survived by his widow, Mrs. Florence C. Coleman, and an only daughter, Mrs. Harold V. Heffner, and a grandson, Harold Coleman Heffner, of Chico, California. He was a member of the American Association for the Advancement of Science, the Entomological Society of America, Public Health Association, American Eugenics Society, the California Academy of Sciences, the San Francisco Aquarium Society, the Stanford Alumni Association, and the Thousand Oaks Lodge, No. 478, F. and A. M.

E. O. Essig, University of California

LIFE HISTORY NOTES

A MENDED NEEDLE FISH

A fisherman came to the State Fisheries Laboratory on Terminal Island the other day with a specimen and a puzzled expression. He said that he had been fishing in these waters many years but had never seen the like of the creature he had with him. He wondered if we could identify it.

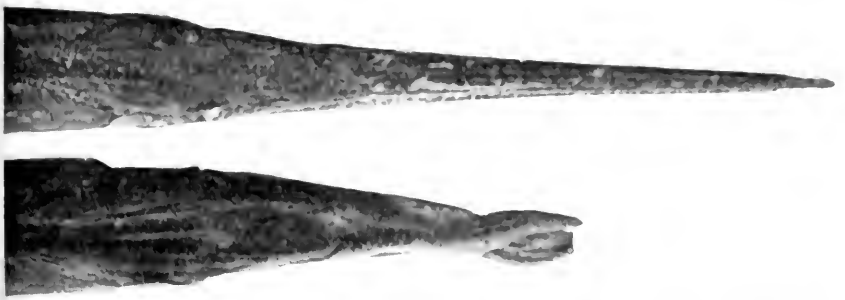


Fig. 62. A needlefish with deformed jaws and a new [illegible]

We had never seen anything like it, either, but the identification was nevertheless not very hard. The object of concern was a needlefish that had met with a bad accident; the end of its long pointed bill was missing. Perhaps it had been bitten off in a fight or perhaps it had been rammed against something. At any rate, it was broken clear off, and what was left was so damaged that the two jaws had set in the peculiar curve shown in the accompanying photograph. The flesh had

healed entirely, and the fish seemed to have been in otherwise good health when it was caught. Unfortunately, when we took the specimen to the window to get a better look at it, the fisherman walked out unnoticed, so we did not learn where or how it was taken.—D. H. Fry, Jr., January 26, 1932.

TWO ECTOPARASITES OF THE CALIFORNIA VALLEY QUAIL

During the latter part of November, 1931, two species of ectoparasites taken from the California valley quail were sent in for identification by Deputy Roswell C. Welch of Kernville. Deputy Welch had discovered the parasites on dead birds while checking quail hunters.

The parasites were identified as a quail louse-fly, *Stilbometopa impressa,* and the common fowl tick, *Argas persicus.*

The louse-fly is a member of the family Hippoboscidae of the order Diptera, or two-winged flies. To this family belong also the common sheep "tick" and deer louse-fly, well known to all who have had anything to do with their hosts. The louse-fly may be winged or the wings may be lacking as in the case of the sheep tick. All the Hippoboscidae are blood suckers and are parasitic on birds and mammals. They do not lay eggs, the larvae being nourished within the body of the female by special glands. When they become ready to pupate they are extruded and the dark brown pupal case forms almost at once. The pupae remain attached to the hairs or feathers on the body of the host. At the end of the pupal period the adult louse-fly emerges and begins feeding at once. In the case of the wingless forms the entire life history is passed on the body of the host. Little is known of the biology of the louse-fly and the winged forms are rare in entomological collections.

It is improbable that the quail louse-fly due to its blood sucking habit alone is responsible for any serious amount of injury to our quail population. It may, however, be an important factor in the spread of disease. *Lynchia hirsutus,* another louse-fly from the valley quail, has been implicated in the transmission of *Haemoproteus lophortyx,* a blood parasite of that bird.

With regard to the other parasite, *Argas persicus,* this is not the first time that it has been reported from quail in California. It has also been reported from the western mourning dove. The instances in which this tick has been taken from wild species of birds are relatively rare, since it is commonly a parasite of poultry and is in its element in the henhouse. It is not likely that it will ever become a serious pest of quail.—Gordon H. True, Jr.

THE PRONGHORN ANTELOPE

The game warden of the county of Los Angeles has land under his protection where roam some of the last of the once numerous pronghorn antelope. The pronghorn antelope range in scattered remnants throughout California, Arizona, New Mexico, Texas, Nevada, Utah, Colorado, Idaho, Montana, North and South Dakota and Nebraska. In Los Angeles County the last few members of one of the most graceful of animal groups are living in the valley to which they have given their name—Antelope Valley.

In the present herd there were counted on March 13th of this year (1932) seven individuals: one large buck, five does and one individual

smaller than the rest that looks like a yearling doe. These comprise the last of a herd that numbered, according to old residents of the region, as high as five to six hundred animals. [illegible] region. As with other natural resources, [illegible] the preservation of these animals. The large Texas Ranch [illegible] they range for the most part on low hills and [illegible] plies them with a moderate amount of protection.

Their great weakness which has accounted [illegible] is their curiosity. When startled they will run [illegible] hundred yards and then turn and face the pursuer. [illegible] attracted by waving a flag or by the old Indian method of [illegible] back and waving the legs. By such methods [illegible] within gunshot.

The pronghorn antelope is the only living species of [illegible] fossil remains show it to be one of the oldest of American [illegible] When the last pronghorn is gone, there will be no [illegible] on the earth.—HARVEY T. ANDERSON, JR., Deputy Assistant [illegible] Game Warden, County of Los Angeles.

ON THE DESERT

While walking along a desert trail near Stone [illegible] County, one of the desert killers was seen in action. A king [illegible] observed just after he had seized a water snake by winding [illegible] of his body around that of the water snake. These coils were about three-fourths of the way back from the water snake's head and consisted of a half-hitch and two direct coils.

The king had apparently just captured his prey [illegible] ately proceeding to reduce its resistance sufficiently [illegible] utilize it for food. The king snake was about twenty-two [illegible] and the water snake two or three inches shorter.

The king wore down his antagonist by winding its [illegible] and around the body in ever tightening coils. Each coil was drawn up and tightened separately and, except for the three original coils, were about one inch apart. When the series of coils neared the water snake's head the king seized its neck in his jaws. This hold was continued until the water snake's muscles commenced to relax when he released his hold and tried to seize its head in his mouth. Just at this moment the water snake opened its mouth and king seized the lower jaw only. The water snake closed down on the king's upper jaw and they remained locked in this position for several minutes.

Eventually the water snake's jaws relaxed and the king viciously tore loose his hold and reaching his head around in front of the other's head seized the snout of the water snake in his capacious jaws.

Immediately the king commenced a swallowing process by extending its jaws and neck muscles and gradually pulling the head and body of the water snake into its mouth. He apparently took advantage of each spasmodic muscular movement of his victim, releasing the coils which he had wound around the other's body as the swallowing performance continued. When the three original coils were reached these were loosed quickly and the remaining portion of the water snake's body and tail rapidly disappeared down the king's throat.

During the swallowing process several attempts were made to distract the king's attention by grasping the water snake by the tail and holding them up off the ground, but the king paid no attention and continued cruelly in subduing the other.

After the king had finished swallowing the water snake he was ready for battle and viciously resented any interference with his journey into some leaves at the base of a cactus bush. After waiting several minutes the leaves under which he had crawled were carefully raised and the king was lying comfortably coiled but with head up and tongue darting showing resentment of any interference and a fear that his hard earned repast might yet be taken from him.

This circumstance was witnessed by D. A. Clanton and A. E. Burghduff, October 25, 1931.

COMMERCIAL FISHERY NOTES

An illustration of the value of investigations in connection with fisheries conservation was given by N. B. Scofield in a talk on size limits, before the recent San Francisco conference of deputies.

As a result of an investigation of the commercial crab carried on a little over 20 years ago by Frank W. Weymouth, of Stanford University, when the San Francisco crab fishery was declining and fishermen believed the minimum size limit of six inches was too high, it was shown that the size limit was too low, as it did not protect the male crabs until after they had a chance to breed. With the evidence obtained it was easy to convince the Legislature that the minimum size should be raised to seven inches.

A few years later, when the first crop of crabs under the protection of this new law reached the seven-inch size, the production of the fishery suddenly doubled, and since then has increased until the fishery produces annually 75,000 dozen more crabs than it did before the law was changed. This increase in production is worth $185,000 annually to the fishermen—or more than the average annual budget of the Bureau of Commercial Fisheries.—N. B. S.

FISHING CONDITIONS, MONTEREY COUNTY

Along the rocky coast line between Monterey and the Big Sur more sports fishermen are engaged in salt water fishing this season than in any previous year. Rockcod, bluefish and sculpins are the gamest of the fish caught along this coast line and considerable fishing tackle is being sold by local hardware dealers. The bait used is sardines and abalone trimmings, and good catches are made during the incoming tides.

The local office of the Division receives many calls and letters regarding salt water fishing in Monterey Bay, and over the week-end and holidays two or three hundred anglers are in boats salt water fishing.—Ralph F. Classic, Monterey, California.

The California State Board of Public Health on May [illegible] new shellfish regulations as follows:

PERMANENT QUARANTINE ON CLAMS [illegible]

By reason of sewage pollution of San Francisco Bay [illegible] quential danger of typhoid fever and gastro-enteritis [illegible] quarantine is hereby established prohibiting the taking [illegible] for sale of all clams, including soft shell clams, [illegible] cisco Bay and tributary sloughs in the counties of San Francisco, San Mateo, Santa Clara, Contra Costa, Solano [illegible] Marin, except at the following places in Marin County:

(a) For one mile each side of Calstoga Point.

(b) The south shore of Tiburon Peninsula from Richardson Bay [illegible] one mile north of Belvedere.

(c) Between McNear Point and Gallinas Creek to [illegible] McNear Point.

SEASONAL QUARANTINE ON RAZOR CLAMS AND MUSSELS [illegible] COUNTY TO THE KLAMATH RIVER IN DEL NORTE CO.

By reason of the toxicity of razor clams and mussels [illegible] quarantine each year is established, prohibiting the taking or offering for sale of razor clams and mussels from the coastal area of California extending from Monterey County to the Klamath River in Del Norte County, with the exception of the Bay of San Francisco. The duration of the quarantine is to be determined upon the laboratory tests for toxicity. For the year 1932, the quarantine was lifted made effective May 28th to continue through September 30th.

A seasonal quarantine is hereby authorized prohibiting the taking, sale or offering for sale of quahaug clams (cockles, Washington clams, horseneck clams and soft shell or mud clams as soon as toxicity has been demonstrated. The quarantine, hereby authorized, applies to the coastal area of California from Monterey County to the Klamath River in Del Norte County. In order to execute this order all persons engaging the above clams is hereby required to submit samples of each variety—such samples to be taken at weekly intervals each year during the months of May, June, July, August and September.

Dr. Frank W. Weymouth, in charge of the shrimp investigation for the U. S. Bureau of Fisheries, was a visitor at the California State Fisheries Laboratory on May 2d, at which time he discussed fisheries conservation work with W. L. Scofield and other members of the staff as well as relating the progress that has been made in the work on shrimps. Dr. Weymouth was on his way from Stanford University to New Orleans to resume active supervision. For the past few months, Dr. Weymouth has been at Stanford University, during which time Milton J. Lindner, former staff member of the laboratory, has been directing the scientific program.

This investigation, commenced in 1930 by the U. S. Bureau of Fisheries, in which three gulf States—Louisiana, Texas and Georgia—are cooperating, will take several years to complete, according to Dr. Weymouth. The shrimp industry is an important one in the

United States, ranking fifth in value and sixth in volume in comparison with other fisheries, but until the formation of the present extensive program no adequate study has ever been made of the shrimps.

On May 5 and 7, 1932, Dr. Cecil von Bonde, Director of the Fisheries and Marine Biological Survey for the Union of South Africa, was at the California State Fisheries Laboratory to consult with W. L. Scofield, and gave interesting accounts to the members of the laboratory of the fisheries resources in South Africa and what is being done in investigating the potential fishing areas and in carrying out marine research for the further development of the fisheries. Dr. von Bonde is on an extensive tour of the United States and Europe to study methods of fisheries investigations used by various countries. He has already been in the eastern part of the United States, and while in Washington, D. C., conferred with Henry O'Malley, U. S. Commissioner of Fisheries, Elmer Higgins and other members of the U. S. Bureau of Fisheries staff. While in southern California he also visited the Scripps Institution of Oceanography at La Jolla. On May 8th Dr. von Bonde left for the State of Washington, and later intends to go to Europe for a stay of a few months before returning to South Africa.

BIG-EYED BASS AND STRIPED BASS

In the October, 1931, issue of the California Fish and Game appeared a note that striped bass were taken by sport fishermen at San Clemente. Howard R. Hill, of the Los Angeles Museum, has since written to say that the fish, on further study, proved instead to be the young of the big-eyed bass (*Xenistius californiensis*). That people may not confuse these two fishes, the following brief description is given of the big-eyed bass.

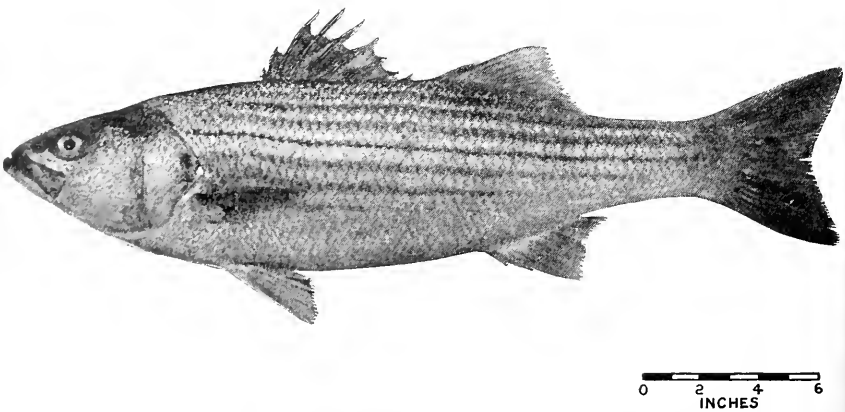


Fig. 63. Striped Bass (*Roccus lineatus.*) The eye of the striped bass is proportionately much smaller than that of the big-eyed bass, being much less than one-third the length of the head, and the pectoral fin does not reach beyond the tips of the ventrals.

Relationship: The only fish of the snapper family [illegible] which occurs in California. The family [illegible] inhabiting warm seas throughout the world. Many species [illegible] them of increasing commercial importance [illegible]

Distinguishing characteristics: There are [illegible] (that is, in the center of the roof of the mouth) [illegible] the maxillary bone is covered by the [illegible] large, being a little less than one-third of the [illegible] pectoral fins extend farther back than the [illegible]

Color: Metallic blush above, silvery [illegible] and sides with six or seven horizontal, orange [illegible] a length of about a foot.

Distribution: San Pedro southward [illegible] to Guaymas, Mexico, not common north [illegible] A. Walford, California State Fisheries Laboratory [illegible]

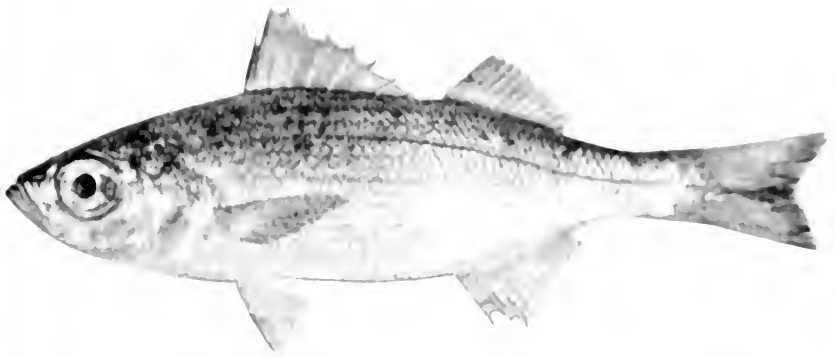


Fig. 61. [illegible]

DIVISION ACTIVITIES

BUREAU OF FINANCE

Though April started out with very bright prospects for a prosperous business in angling licenses, the unfavorable climatic conditions caused a dropping off during May and the income from this source was not up to former years. However, with the assurances there are plenty of fish in the lakes and streams, and with more favorable weather, a brisk business was experienced during June.

The unsettled economic conditions are being felt on the income of the Division of Fish and Game. Judges are disposed to be more lenient in assessing fines on game law violators, and giving as well, time to pay such fines as are levied. This increases the work of this bureau.

Licenses issued to credit dealers are being kept at as small a number as possible, owing to requests from the bonding companies covering these licenses.

Fish packers' tax and fines have fallen off, although all packers are paying promptly with but one exception.

The bureau has also taken over the larger field of direct distribution of licenses, formerly handled by county clerks.

An order has been placed for 320,000 metal deer tags, and 160,000 cardboard tags for distribution when the deer season opens.

BUREAU OF GAME REFUGES

Early indications that the present year, on account of the abundance of rain, would prove a successful one on the migratory waterfowl refuges have proven true. Ducks nested well on the Gray Lodge Refuge near Gridley, nests being found on almost every section of the place.

The San Joaquin area reports all the more common species of ducks were found taking advantage of the excellent water conditions, the best for ten years.

On the Suisun refuge the number of sprig nesting there was surprising as were they on Gray Lodge and at Los Banos.

Reports show a good crop of ducks will be hatched on Buena Vista Lake and in the Kings River area.

By raising the water level at the Imperial Refuge thirty inches, thus stopping spreading of tule growth, a larger surface will be afforded migratory birds for a loafing place.

One of the most devastating predators the Los Banos Refuge had to contend with was the house cat gone wild. These animals were destroying the nests of the waterfowl, but with the killing of 51 this hazard is believed to have been eliminated.

Los Banos reports great numbers of geese—Hutchins and cackling. Although there have been some egg lays the females don't seem to be interested in raising families.

At Gray Lodge a good crop of mallards have materialized from the domesticated birds and wild domesticated mallards have laid well at Los Banos, but their eggs do not seem to be so fertile.

Quail results throughout the State are good and many refuges are being posted, especially in southern California and that area south of San Francisco.

The eight predatory animal trappers have made it tough for coyotes and bobcats. The report for the year so far on waterfowl refuges shows 130 coyotes and 108 bobcats killed.

Lion hunters for the year to June 1 have turned in 159 scalps, 14 more than at this time in 1931. May was a big month—13 females and 12 males being killed, 4 over last year. April was a dull month for lion hunters. They only bagged 13, but for March they turned in 39 scalps, 20 of which were from females. The kill in March, 1931, was 29.

To date this year, 345 game breeders have taken out licenses.

The fur animal raisers have filed their annual report and show a great falling off, as the prices have been less than half of last year and still less than prices for pelts in 1930.

The State Department of Public Works has let the contract for fencing the Kern County Elk Refuge. The rate was $700 per mile for the metal posts and wire necessary for the seven-foot fence. The Anchor Post Fence Company was the successful bidder.

BUREAU OF HYDRAULICS

This bureau has devoted consid[illegible] pollution many streams noted for gam[illegible] Tuolumne rivers have cooperated to keep [illegible] followed suggestions from the head of this bureau.

John Spencer, chief of the bureau [illegible] California Sewage Workers Association held in [illegible] also took part in the deliberations of the State [illegible] which resulted in the Benbow Company agreeing [illegible] ladder in their power dam.

A survey was made of the proposed site for a [illegible] on Bull Creek to be operated by a Mr. Reed [illegible] survey have been forwarded to the Bureau of [illegible]

The Sierra Power Company has installed a part[illegible] the Truckee River at Floriston.

Appearances in courts totaled over 125, [illegible] sketches prepared for the department amounted to [illegible] months just passed.

BUREAU OF GAME FARMS

March found the game farms all set for the [illegible] season. Pens had been cleaned, plowed, sowed and [illegible] habitable for the selected brood stocks that were to be [illegible]

The demand for game bird eggs was heavier [illegible] season, and the allotment of 30,000 ring necked pheasants was spoken for long before the height of the egg laying.

The quail egg crop was splendid, showing an increase over past years. As this species of bird is to be distributed north [illegible] fornia, the eggs gathered at the Yountville Game Farm were sent to the Los Serranos Game Farm, at Chino.

Interest in raising pheasants, turkeys and quail has shown a marked increase.

In Petaluma, the hatching plant handling pheasant eggs turned out a high percentage of chicks and these birds when at the proper age are to be distributed in Marin and Sonoma counties.

In the San Joaquin Valley section, great success has attended the efforts of sportsmen's organizations in raising pheasants and they have been properly distributed.

The new Jamesway incubating plant has proven its worth and added to the convenience and production facilities of the Yountville farm.

Superintendent August Bade is lending every assistance to James Moffitt and A. W. Elder in inspecting and selecting sites for quail sanctuaries offered by public-spirited landowners. To date six sanctuaries, four in the south and two in the north, are expected to be posted and under proper supervision of the Fish and Game Commission by the end of June. Others will follow.

The Game Farm, at Yountville, has afforded work to several local families, thus contributing its part toward lessening the depression.

BUREAU OF COMMERCIAL FISHERIES

The closing of the sardine season in southern and northern California waters in March was followed by the opening of the salmon and tuna season in April.

In southern California, the five sardine plants reported an increase of 4000 tons over the 1931 season. Most of the cannery inspectors have been laid off. In Monterey some canners are experimenting with a new pack, using agar-agar jelly which dispels the fishy odors and keeps the sardines more solidly packed.

Low prices of salmon have kept many fishing boats from going to sea. In Eureka, but a small portion of the 125 trollers have gone for fish, and those that did brought in small catches as compared to former seasons. Salmon running from 10 to 12 inches were brought in by half the salmon fishing fleet that sail out from Noyo. The boats report as high as 400 pounds of salmon per vessel.

In the Shasta area, reports were received that many spawning beds were destroyed by overcrowding. A survey was made to determine how large the loss is.

The migration of salmon fingerlings, which ended May 15, was heavy this year.

Sacramento and San Joaquin rivers report a good run of shad, but prices dropped considerably. There was a good eastern market that made conditions desirable.

San Pedro and San Diego canneries started operating in April with the opening of the tuna season. Nine of the 11 major tuna canneries have formed a cooperative association, known as the Tuna Canners Institute. The purpose is to prevent overproduction and endeavor to promote the widest market for this commodity. Sardine canners are planning a similar organization.

There was some trouble about prices between the tuna fishermen and canners at the beginning of the season, with the result there was a one-third dropping off of the tonnage delivered during the opening month. However, as the trouble has been settled, it is expected this decrease will more than be made up.

From January to June 1, 3,500,000 pounds of mackerel were delivered to the canneries.

The Bayside Fish Flour Company, of Monterey, made formal application for a permit to manufacture 20,000 tons of fish flour. They intend to erect a new plant in Richmond.

Low prices for the fresh fish caused dealers to give away tons of yellowtail brought from Mexican waters to San Pedro. This bureau gave a half-ton of confiscated tuna to the Whittier State School.

Harvey McMillin and Paul Bonnot have made an extensive survey of oyster lands along the California coast. All lands available for oyster culture have been filed on.

McMillin went to Eureka April 7 to remain until July 1. In Humboldt Bay it has been found native oysters thrive and mature in much less time than in more northern waters. McMillin and Bonnot supervised the installation of the first dikes on the California coast for the protection of oysters from climatic changes and to keep sufficient water over the oyster beds during low tide. This dike was built in North Humboldt Bay. Experiments were also carried on in Newport and

Morro bays and Mugu lagoon in oyster planting. The planting of 470 boxes of Japanese oyster "seed" in Elkhorn slough was the accomplishment of these experts. It has been proved that the Japanese oysters in Elkhorn mature in less than half the time they require in their native waters, and that they are richer in protein than any other oysters found in any place in the world.

Cooperating with Dr. J. O. Snyder, of the Bureau of Fisheries, this bureau is working out a record form by which it is hoped data may be kept of fish caught by sportsmen from ocean piers, party charter party and fishing barges. From results obtained so far in the experiment, it has been found that sports fishermen in the Los Angeles area caught as many fish as the commercial fresh fishermen.

Small catches marked the opening of the salmon trolling season April 1.

Squid catches in the Monterey district fell off one half over former years. All dried on the beach for Chinese trade; none were prepared for Italian trade.

The patrol boat *Bluefin*, after being put in repair, made a survey trip to determine the definite maximum sardine spawning area. This was found to be from the Mexican border to Point Conception and extending 100 miles out to sea.

During April, the patrol boat *Albacore* weekly aided the hydrobiological survey in its work along the northern coast, and patrolled as far north as Point Reyes. The crew also put the small boat *Shearwater* in condition.

BUREAU OF FISH CULTURE

Severe weather in the early part of the second quarter of 1932 with high water running in many streams, delayed fish egg taking somewhat, but by the end of the season, around May 31, the work had been well done. The "take" of eggs this year was very satisfactory, many species of trout showing a marked increase, others holding their own. However, the eggs of the rainbow this year fell a couple of million less than the average. This loss is made up, however, by the increase of other varieties, and will not lessen the supply available for the anglers.

After much planning, the new experimental hatching and rearing ponds for black bass at Friant, Fresno County, has been completed by the Department of Public Works and turned over to the Division of Fish and Game. Already, a small supply of small mouth black bass has been transferred to the ponds from Stockton as brood stock, and several thousand golden shiners to furnish food for the bass received from San Diego.

Minor defects are being remedied and the experiment is being given every encouragement. Merrill W. Brown has been placed in charge with Carlton Rogers, as assistant.

During April, a shipment of 28,000 Atlantic salmon eggs were received at the Mt. Shasta Hatchery from the Canadian Department of Marine Fisheries.

There was great activity in all the hatcheries during the past three-months period, seeing the trout eggs were given the proper attention.

The hatch was above normal, assuring a good supply of sport fish for the streams and lakes of this State for future seasons.

Plans were started in June for the annual planting in trout waters, and the anglers are assured of some 35,000,000 of these game fish for the streams and lakes, while the salmon plant will increase the fish planting to some 40,000,000 for 1932.

BUREAU OF FISH RESCUE AND RECLAMATION

March was a light month for this bureau, but its personnel was busy in May, rescuing and moving nearly 2,000,000 large-mouth black bass. This action was made necessary on account of the cannabalistic tendency of this species of game fish—the parent fish eating the young, sometimes when they are 30 days of age.

The young fish rescued were taken to permanent waters, away from their native haunts, where conditions would be ideal for their maturity.

Sports fishermen are continually increasing their demands for black bass, to the exclusion of other species of spiny-rayed game fish.

The total of fish rescued for May was 1,842,861. For April, the total was 390,430. The receding waters of many streams made it necessary for this bureau to take prompt action to save these thousands of fish for the anglers.

In line with the policy of the Division of Fish and Game, many nongame fish were caught, destroyed or given away.

BUREAU OF PATROL

A change in the attitude of magistrates toward violators of the fish and game laws has been very noticeable during the second quarter of this year. While justices of the peace are convinced the laws should be enforced and arrests made, they seem inclined toward leniency when it comes to fining those arrested. They seem to feel that during the depression it would be well to go a little easy on those who have not violated the game laws too glaringly. In one month, out of 206 arrests, 57 defendants found guilty were given suspended sentences.

With the opening of the trout season May 1, the usual number of anglers were found without a fishing license. Forty-five of these were arrested by deputies. Sixteen arrests grew out of the fact of fishermen being unable to read, or at least they did not pay any attention to the signs posted, declaring certain streams and lakes closed to fishing.

Arrests and money collected as fines fell considerably below the total for March, April and May. For the period from January 1 to May 31, 1931, $73,000 in fines were collected; for a like period this year, only $46,070.

Deer meat possessors to the number of 34 were arrested, and fined or jailed for having venison in their possession out of season.

The bureau heads are busy trading in automobiles owned by the State and used by the patrol since 1930. In purchasing new autos, small type cars with closed cabs and pick-up bodies are being favored.

VOLUNTEER DEPUTIES

Volunteer deputies have taken great interest in the work of establishing quail sanctuaries throughout the State [illegible] in posting some 15,000 acres of land set aside for the propagation of this noted game bird. The sanctuaries that make up this acreage are located in San Diego, San Mateo, Tulare and San Joaquin counties.

Reports from the volunteers indicated that during the [illegible] season the quail paired off splendidly, nested well and [illegible] a good hatch.

Captain John Warman of the San Joaquin area reported that there were 250 pairs of quail on one ranch set aside [illegible].

Following the policy of the Fish and Game Commission to keep the list of volunteer deputies to as small a number as possible, Captain Walter Welch has been busy weeding out those who [illegible] great interest in fish and game conservation and in the enforcement of the laws of the division. The reduction of the ranks has been accomplished in a manner that has aroused no ill feeling among those sponsoring the deputies dropped.

The volunteer deputies did much work prior to the opening of the trout season, preventing fishing before May 1. Many angling licenses were checked and a number of arrests were credited to men of this bureau.

Predatory birds and animals in large numbers fell before the guns of the volunteer deputies during the past three months.

BUREAU OF EDUCATION AND RESEARCH

Some of the outstanding work of the Bureau of Education and Research was confined to the wild life displays and the visual education exhibits. E. S. Cheney erected an exhibit booth at the Butte Council of the Boy Scouts of America exhibit which was held at Marysville the latter part of April. In addition to this, exhibit assistance was rendered by this bureau in the installation of an exhibit in the windows of the Pacific States Savings and Loan Association. This exhibit is a traveling one and will be shown in the principal cities in northern California.

The rapid growth of the mailing list of CALIFORNIA FISH AND GAME necessitated a change in the method of distribution from the complimentary system to that of a subscription basis. Details of this project were worked out by the Department of Finance and the system became functional with the current issue.

An elaborate investigation of the effect of rodent control on quail populations was conducted by Ira Gabrielson, of the U. S. Bureau of Biological Survey, W. C. Jacobsen, of the State Department of Agriculture, and Leo K. Wilson, of this bureau. This work was done in Monterey and Kings counties.

Gordon H. True, Jr., completed the work undertaken by James Moffitt on the effect of predatory animals upon the nesting waterfowl population in northeastern California. This work will be the basis of a report to be published in the near future by James Moffitt.

REPORTS

SEIZURES OF FISH AND GAME

January, February, March, 1932

Fish:	
Abalones	1,062
Bass, striped, pounds	1,150
Bass, striped (fish)	195
Crappie, perch, sunfish	41
Crabs	316
Clams	1,537
Lobsters	224
Lobsters, pounds	1,289
Nets, illegal	1
Miscellaneous fish	306
Mussels, pounds	496
Steelhead	536
Spears, illegal	5
Salmon, pounds	134
Trout	56
Traps, fish	32
Game:	
Deer	14
Deer meat, pounds	721
Deer hides	23
Doves	5
Ducks, geese and mudhens	728
Elk meat, pounds	55
Non-game birds	171
Pigeons	33
Pheasants	10
Quail	20
Rabbits	19
Shorebirds	32
Wood ducks	1
Skins, fur bearing animals	7
Trap, bird	1

FISH CASES

January, February, March, 1932

	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act; violations of	44	$578 00	64
Abalones; closed season; small	46	580 00	60
Bass—			
Striped, small; netting of	12	350 00	----------
Black, small	1	100 00	----------
Clams; small, overlimit	53	740 00	185
Crabs; small; female	12	770 00	5
Commercial Fishing License Act; violations of	31	320 00	25
Illegal fishing apparatus	10	240 00	130
Fishing in refuge	2	----------	----------
Lobsters; small	15	205 00	53
Mussels; overlimit	28	----------	336
Nets; seines; illegal	33	1,017 00	358
Perch, crappie, sunfish; closed season	12	243 00	36
Pollution	1	----------	----------
Salmon in closed district	1	50 00	----------
Spears, illegal	4	40 00	----------
Trout; steelhead	16	435 00	25
Traps, fish	2	----------	----------
Yellowfin; selling of	1	10 00	----------
Taking marine life from Hopkins Marine Life Refuge	3	5 00	----------
Totals	327	$5,683 00	1,277

GAME CASES

January, February, March, 1932

	Number arrests	Fines [illegible]	Average [illegible] Fine
Deer; closed season	[illegible]	[illegible]	[illegible]
Ducks, geese, mudhens, closed season	[illegible]	[illegible]	[illegible]
Doves; closed season	[illegible]	[illegible]	[illegible]
Hunting License Act, violations of	[illegible]	[illegible]	[illegible]
Hunting on refuge	[illegible]	[illegible]	[illegible]
Non-game birds, killing of	[illegible]	[illegible]	[illegible]
Night hunting	[illegible]	[illegible]	[illegible]
Pigeons; closed season	[illegible]	[illegible]	[illegible]
Pheasants; closed season	[illegible]	[illegible]	[illegible]
Quail; closed season	[illegible]	[illegible]	[illegible]
Rabbits; closed season	[illegible]	[illegible]	[illegible]
Squirrel; closed season	[illegible]	[illegible]	[illegible]
Shipping wild game by parcel post	[illegible]	[illegible]	[illegible]
Traps (furd), illegal use	[illegible]	[illegible]	[illegible]
Trespassing	[illegible]	[illegible]	[illegible]
Trapping License Act	[illegible]	[illegible]	[illegible]
Totals	[illegible]	[illegible]	[illegible]

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to March 31, 1932, of the Eighty-third Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau administration:					
Executive	$6,600 00				$6,600 00
Clerical and office	16,603 23	$862 97	$320 92	$171 26	17,958 38
Printing		17,426 25			17,426 25
Automobiles		225 79	213 54		439 33
Traveling			2,595 90		2,595 90
Postage			4,026 78		4,026 78
Telephone and telegraph			3,370 38		3,370 38
Freight, cartage, and express			2,057 93		2,057 93
Rent			11,435 95		11,435 95
Accident and death claims			2,885 32		2,885 32
Accounting pro rata	3,375 00				3,375 00
Legal	4,950 00		718 37	182 46	5,850 83
Premiums on bonds			87 50		87 50
Publicity			68 86		68 86
Total bureau administration	$31,528 23	$18,515 01	$27,781 45	$353 72	$78,178 41
Bureau education and research:					
Chief and assistants	$4,612 94				$4,612 94
Clerical and office	1,962 05	$163 71	$230 80	$26 70	2,383 26
Traveling			4,724 74		4,724 74
Telephone and telegraph			16 78		16 78
Freight, cartage and express			4 10		4 10
Photographer	1,080 00		141 04	1,190 32	2,411 36
Librarian	1,530 00	23 08	113 10	101 13	1,767 31
Research	8,144 68	310 08		28 00	8,482 76
Blue printing			12 66		12 66
Publicity			518 32		518 32
Exhibits			8 25		8 25
Lecturer	2,835 00				2,835 00
Temporary help	18 63				18 63
Total bureau education and research	$20,183 30	$496 87	$5,769 79	$1,346 15	$27,796 11
Bureau patrol and law enforcement:					
Chief and assistants	$8,295 00				$8,295 00
Clerical and office	2,415 32	$70 32	$17 91	$11 47	2,515 02
Automobiles		6,550 20	3,134 29	1,286 14	10,970 63
Traveling			95,120 66		95,120 66
Postage			331 07		331 07
Telephone and telegraph			1,517 93		1,517 93
Freight, cartage and express			45 95		45 95
Rent			461 85		461 85
Heat, light and power			21 27		21 27
Captains and deputies	156,492 99	1,634 38	405 13	291 65	158,824 15
Launches		2,138 07	850 39	46 33	3,034 79
Fish planting	4,922 72	539 81	226 00		5,688 53
Volunteer deputies	440 00				440 00
Premiums on bonds			2,215 48		2,215 48
Temporary help	30 00				30 00
Cooks	1,536 29				1,536 29
Total bureau patrol and law enforcement	$174,132 32	$10,932 78	$104,347 93	$1,635 59	$291,048 62
Bureau commercial fisheries:					
Chief and assistants	$12,075 00			$41 00	$12,116 00
Clerical and office	7,964 72	$230 92	$97 42	8 60	8,301 66
Automobiles		566 46	242 12		808 58
Traveling			16,242 84		16,242 84
Postage			3 52		3 52
Telephone and telegraph			495 47		495 47
Freight, cartage and express			476 50		476 50
Rent			890 68		890 68
Heat, light and power			310 50		310 50
Research	6,863 09	78 61		80 90	7,022 60
Captains and deputies	12,590 00	141 05	36 57	10 00	12,777 62
Launches	9,410 00	3,679 41	1,965 52	228 35	15,283 28
Laboratory	23,435 19	541 91	1,159 90	593 65	25,730 65
Blue Printing			5 94		5 94
Hydro-biological survey—Monterey Bay			750 00		750 00
Statistics		696 19	1,355 67	48 15	2,100 01
Fish cannery research			11,250 00		11,250 00
Fish cannery inspectors—seasonal	15,040 55				15,040 55
Total bureau commercial fisheries	$87,378 55	$5,934 55	$35,282 65	$1,010 65	$129,606 40

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to March 31, 1932, of the Eighty-third Fiscal Year (estimated)

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau fish culture					
Chief and assistants	$6,510 00				$6,510 00
Clerical and office	3,000 67	$182 32	$ [illegible]	$45 [illegible]	[illegible]
Automobiles		3,701 38	[illegible]	[illegible]	[illegible]
Traveling			[illegible]		[illegible]
Postage			[illegible]		[illegible]
Telephone and telegraph			812 48		812 48
Freight, cartage and express			434 58		434 58
Rent			1,225 84		1,225 84
Heat, light and power			878 78		878 78
Hatcheries	$84,418 58	38,196 66	1,020 61	[illegible]	[illegible]
Special field investigations	2,788 66	171 83	20 16	7 65	[illegible]
Fish cars	2,633 00	212 46	881 83	2 95	[illegible]
Blue printing			34 65		34 65
Cooperative research	1,068 50	43 75	542 24	184 85	[illegible]
Fish hatchery assistant—seasonal	17,818 02				[illegible]
Total bureau fish culture	$123,788 43	$42,512 80	$15,700 16	[illegible]	[illegible]
Bureau hydraulics:					
Chief and assistants	$6,255 00		$25 66		$6,280 66
Clerical and office		$21 89	40 [illegible]		[illegible]
Automobiles		322 80	216 5		539 [illegible]
Traveling			1,079 25		1,079 25
Postage			1 00		1 00
Telephone and telegraph			6 20		6 [illegible]
Cooperative research	2,250 00				2,250 [illegible]
Total bureau hydraulics	$8,505 00	$344 69	$1,377 81		[illegible]
Bureau game propagation:					
Superintendents	$2,475 00				$2,475 00
Clerical and office	40 00				40 00
Automobiles		$ 51 04	$117		[illegible]
Traveling			1,512 [illegible]		1,512 [illegible]
Postage			5 00		5 00
Telephone and telegraph			[illegible]		[illegible]
Freight, cartage and express			[illegible]		[illegible]
Heat, light and power			576 72		576 72
Maintenance		7,356 01	7[illegible]	[illegible]	[illegible]
Assistants	10,149 15				[illegible]
Total bureau game propagation	$12,664 15	$7,707 65	$[illegible]	[illegible]	[illegible]
Bureau fish rescue:					
Chief and assistants	$3,790 00		$[illegible]	[illegible]	[illegible]
Traveling			[illegible]		[illegible]
Rent			[illegible]		[illegible]
Total bureau fish rescue	$3,790 00		$[illegible]	[illegible]	[illegible]
Bureau game refuge:					
Chief and assistants	$6,374 97				[illegible]
Clerical and office	1,440 00	$31 29			[illegible]
Automobiles		694 85	[illegible]		[illegible]
Traveling			[illegible]		[illegible]
Postage			[illegible]		[illegible]
Telephone and telegraph			17 75		17 75
Freight, cartage and express			50		50
Lion hunters and trappers	5,658 88				5,658 88
Refuge posting		122 91	[illegible]	[illegible]	[illegible]
Predatory animal control			5,[illegible]		5,[illegible]
Temporary help	10,528 85				10,528 85
Refuge maintenance	4,125 00	3,397 92	[illegible]	54 00	[illegible]
Total bureau game refuge	$28,127 70	$4,246 97	$11,[illegible]	$[illegible]	[illegible]

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to March 31, 1932, of the Eighty-third Fiscal Year—Continued

Function	Total
Construction, improvements and equipment:	
Telephone and power line from Chester to Lake Almanor Fish Hatchery	$2,400 00
Improvements at Lake Almanor Hatchery	1,391 55
Filter at Big Creek Hatchery	141 85
Permanent repairs on Brookdale Hatchery	761 30
Construction of dams on Cherry Creek	1,000 00
Completion of egg collecting racks at Chester	601 16
Construction of rearing ponds and a temporary house for an attendant, Hat Creek, Inyo County	1,245 18
Tank and egg collecting station at Huntington Lake	1,924 69
Filter at Kaweah Hatchery	466 15
Repairs and improvements at Mt. Shasta Hatchery	1,333 44
Permanent improvements on Snow Creek Hatchery	1,233 12
Total construction, improvements and equipment	$12,498 24
License commissions	$39,503 45
Purchase of game refuges	127,650 00
State Fair and other exhibits	5,183 81
Prior year expense—eighty-second fiscal year only	14,998 86
Grand total proprietary group	$999,726 27

STATEMENT OF INCOME

For the Period July 1, 1931, to June 30, 1932, of the Eighty-third Fiscal Year

License sales	Detail	Total
Departmental income:		
Angling licenses, 1931	$620 201 [illegible]	
Angling licenses, 1932	2,502 [illegible]	
Commercial hunting club licenses, 1931-32	1,375 [illegible]	
Commercial hunting club operator's licenses, 1931-32	345 [illegible]	
Deer tags, 1931	124,645 [illegible]	
Fish breeders' licenses, 1931	85 [illegible]	
Fish breeders' licenses, 1932	100 [illegible]	
Fish importers' licenses, 1931	15 [illegible]	
Fish importers' licenses, 1932	85 [illegible]	
Game breeders' licenses, 1931	130 [illegible]	
Game breeders' licenses, 1932	702 50	
Hunting licenses, 1931	367 471 [illegible]	
Hunting licenses, 1932	1,203 [illegible]	
Kelp licenses, 1931	10 [illegible]	
Market Fishermen's licenses, 1931-32	29,140 [illegible]	
Market Fishermen's licenses, 1932-33	270 [illegible]	
Trapping licenses, 1931-32	2,792 [illegible]	
Wholesale fish packers' and shell fish dealers' licenses, 1931-32	1,240 [illegible]	
Total license sales		$991,838 90
Other income:		
Contributions from importers	30 [illegible]	
Court fines	46,654 [illegible]	
Fish packers' tax	67,739 27	
Fish tag sales	2,376 [illegible]	
Game tag sales	135 30	
Interest on bank balances	4,991 43	
Kelp tax	68 85	
Lease of kelp beds (kelco)	972 [illegible]	
Miscellaneous sales	888 25	
Total other income		123,469 26
Total departmental income		$1,115,428 16
Income for the State University Fund:		
Kelp tax	$35 01	$35 01

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1932

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

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Anchovy							500	2,800	34,475
Barracuda								9	
Bonito									10
Cabrilla									
Carp		14,265	153	474	2,903	1,677			
Catfish				705	47,161	16,815			
Cultus	46,859	3,990					142,448	5,657	25,285
Flounder	13,502	3,285	22				285,833	10,345	76
Flying fish									
Hake							10,033		
Halfmoon									
Halibut—California							61	11,621	12,456
Halibut—Northern	11,304	450					11,649		
Hardhead		129,420			1,712	20			
Herring	5,271	700	207,450			64,130	238,975	58	17,423
Kelp Bass									
Kingfish							290	17,119	53,252
Mackerel—Horse									19,389
Mackerel—Pacific									21,027
Mackerel—Spanish									
Mullet									
Perch	13,447		16,332				6,301	1,730	38,224
Pike				66	694	601			
Pompano								26	135
Ray									
Rock Bass									
Rockfish	25,492	9,968					286,367	236,157	352,616
Sablefish	25,701	500					28,509	82,836	2,595
Salmon				7,061	20,156	17,960	60		
Sand Dab	15,978	8,840					188,893		830
Sardine							3,925,720	20,404	41,055,390
Sculpin		46					538	530	88

Sea Bass—Black								10	25
Sea Bass—White									746
Shad				22,365	7,397	100,349	817	29	
Shark		1,000					177,179	5.03	703
Sheepshead									
Skate	450	875					151,447	1,250	5,723
Skipjack									
Smelt	23,357	1,446	7,235			6,000	57,960	1,350	27,261
Smelt—Jack	667							194	
Sole	195,108	70,000					1,676,273	1,884	11,380
Splittail		8,725			4,927	566			
Striped Bass			42	22,735	25,533	148,341	87		
Sucker		7,525			164				
Swordfish—Broadbill									
Tom Cod		61				5	1,582		
Tuna—Yellowfin									
Turbot		125	66				4,015	33	
Whitebait	26,175		157				3,451	638	3,520
Whitefish									
Yellowtail									
Miscellaneous	3,012	950				7	11,911	191	534
Total fish	406,329	271,179	251,457	53,406	111,633	355,517	7,215,356	349,871	43,683,143
Crustaceans:									
Crab	38,738	1,332					876,503	2,044	66
Shrimp			5,675			33,367	166,921		385
Spiny Lobsters									
Mollusks:									
Abalone									71,810
Clam—Hardshell	300	324	48,299						
Clam—Mixed	1,057	799	218						34
Clam—Pismo								21	1,610
Clam—Softshell		177	27,405			2,446	34,711		
Octopus		70					280	10	1,307
Oyster—Eastern			29,250				68,400		
Oyster—Native	1,200		4,279				21,000		
Squid									41,184
Totals	447,124	273,857	361,583	53,406	111,633	391,330	8,338,444	352,000	43,799,639

All amounts shown in pounds except [illegible]

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1932—Continued

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

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into California via San Pedro	Fish from south of the International Boundary brought into California via San Diego	Total fish from south of the International Boundary brought into California.
Anchovy		4,196			41,971			
Barracuda	594	159,684	180	50,398	210,865	91,993	12,484	104,477
Bonito		28,723	451	2,137	31,321	143		143
Cabrilla						8,442	73,410	81,852
Carp					19,472			
Catfish					64,681			
Cultus		458	315	12	225,024			
Flounder	196	190	72		313,521			
Flying fish		55			55			
Hake					10,033			
Halfmoon		6,040			6,040			
Halibut—California	88,877	180,864	29,683	32,531	356,093	12	4,668	4,680
Halibut—Northern					23,403			
Hardhead					131,152			
Herring	103			2,077	536,187			
Kelp Bass		997			997			
Kingfish	105	88,436	967	1,129	161,298			
Mackerel—Horse		98,501			117,890			
Mackerel—Pacific	398	2,719,499	33,108	38,535	2,812,567			
Mackerel—Spanish						1,900	4,700	6,600
Mullet			833	3,313	4,146		2,755	2,755
Perch	1,035	11,041	154		88,264			
Pike					1,361			
Pompano		584	41		786			
Ray		255	302		557			
Rock Bass	2,114	14,670	6,158	40,944	63,886	672	804	1,476
Rockfish	18,552	711,973	13,785	242,131	1,897,041		2,518	2,518
Sablefish		14,789	2,010		156,940			
Salmon					45,237			
Sand Dab		1,795	37		216,373			
Sardine		48,334,770		2,860	93,339,144			
Sculpin	100	7,443	2,347	6,884	17,976			
Sea Bass—Black	762	25,802	4,025	108,290	138,904	42,947	46,788	89,735

Sea Bass—White	9,555	112,426	1,473	3,556	127,766	91	145	236
Shad					130,657			
Shark	6,477	70,175	14,029	21,282	299,845			
Sheepshead	7,995	18,557	316	3,221	30,092		205	205
Skate		4,950	925	257	165,877			
Skipjack							297,728	297,728
Smelt	3,229	76,611	30	9,329	214,729			
Smelt—Jack	9,569	2,223			12,683			
Sole	41,612	14,668	1,231	1,198	2,022,369			
Splittail					14,251			
Striped Bass					145,448			
Sucker					7,693			
Swordfish—Broadbill		103			103			
Tom Cod					1,695			
Tuna—Yellowfin						417,483	1,121,566	1,539,049
Turbot					8,457			
Whitebait					33,752			
Whitefish	999	21,085	5	36,925	57,974	516	3,575	4,485
Yellowtail	165	174,487	91	12,140	186,792	17,475	39,043	56,517
Miscellaneous		6,412			22,759		9,117	9,370
Total fish	1,[illegible]	32,611,002	117,[illegible]81	611,112	14,599,787	6,2[illegible]77	1,[illegible]791	2,221,868
Crustaceans:								
Crab					218,783			
Shrimp					271,477			
Spiny Lobster	11,065	50,052	1,[illegible]77	22,745	95,[illegible]80	15,224	51,[illegible]22	514,737
Molluska:								
Abalone	3,142				14,[illegible]22			
Clam—Hardshell		11,647			6,[illegible]42			
Clam—Mixed	28	887			12,[illegible]27			
Clam—Pismo	12,527				21,[illegible]28			
Clam—Softshell					51,[illegible]20			
Octopus		25	10		1,[illegible]70			
Oyster—Eastern					46,[illegible]36			
Oyster—Native					20,740			
Squid		141,240			187,477			
Totals	2[illegible],[illegible]28	32,115,016	12[illegible],961	644,857	15,[illegible],[illegible]21	[illegible],[illegible]71	[illegible],[illegible]4	2,[illegible]30,933

All amounts shown in pounds unless otherwise specified. [illegible] pack as [illegible] were omitted.

95686 9-32 9500

ABSTRACT

CALIFORNIA SPORTING FISH AND GAME LAWS

VALID UNTIL 90 DAYS AFTER CLOSE OF 1933 LEGISLATURE

1931 OPEN AND CLOSED SEASONS 1932

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES

GAME	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
DEER	1½										15			No Does, Fawns or Spike Bucks No Forked Horned Deer in Dist. 1¾ No sale of Venison or Deer Skins Two Bucks per Season except in 1¾ where limit is one See Notes 6-9-10-12
	2-2½-3									14				
	1-1¾-4-4¼-4½-23 24-25									16	15			
Rabbits—Cottontail and Brush	ALL EXCEPT 4¾											15	15	15 per day. 30 per week. No limit in District 4 No protection in 4¾
Bear, Fur Animals	ALL											15		See Note 7 Predatory animals unprotected in districts 2-2½-3-4-4¾
Ducks, Geese, Jack Snipe, Mud Hens	ALL — FEDERAL LAW										OPENS NOON OCT. 1			15 Ducks, 30 in Possession; 4 Geese, 8 in Possession; 20 Snipe, 25 Mud Hens, No Ross Snow or Cackling Geese
	ALL — STATE LAW	15												25 Ducks, 25 Snipe, 25 Mud Hens. 50 Per Week Goose Limit See Note 4. See Notes 9-10-11-12-13
Quail—Valley, Desert and Mountain	ALL EXCEPT 1½											15	15	Valley and Desert 15 per day. 30 per week Mountain 10 per day. 20 per week
	1½													
Dove	ALL EXCEPT 4-4½-4¾													Federal Season Opens Noon September 1 — 15 per day 30 per week
	4-4½-4¾													

There is no open season on Elk, Antelope, Mountain Sheep, Sea Otter, Tree Squirrel, Sierra Hare, Rail, Wood Duck, Pigeon, Swan, Shore Birds (except Jack Snipe), Grouse, Sage Hen, Imported Quail, Wild Pheasant, Partridge, or Wild Turkey.

FISH	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
Steelhead and all Trout (except Golden), Whitefish Unlawful to take trout in waters closed by Governor's proclamation	1-1½-1¾-2-3-4-4¼-4¾-15 Klamath River, Lake Almanor													Bag limit for taking and possession, 25 trout or 10 pounds and one trout. — No Sale No Spearing For other restrictions See Notes 12-15-16-20 21-22-28-29 31-33 On this Card
	2½		28			30								
	23-24-25					30								
	Truckee River					15								
	See Note 22													
	1½ Winter Klamath River													S Trout regardless of weight
	Russian, Navarro, Napa and Ist Dist 2) TidewaterDists 2-3-15													3 Trout regardless of weight
Golden Trout	ALL													20 per day. None under 5 inches Not more than 10 lbs. and one
BLACK BASS	ALL EXCEPT 4¾													15 per day In Closed Season in 4¾ — No Black Bass under 9 ins.
	CLEAR LAKE IN LAKE CO.													Clear Lake 10 per day — No sale
Sunfish	ALL													25 per day — Hook and line only
Sacramento Perch and Crappie	ALL EXCEPT CLEAR LAKE													25 per day — Hook and line only
	CLEAR LAKE													10 per day — No sale
Striped Bass	1-3-12A													None under 12 inches, 5 per day. None to be taken from Salton Sea. See Note 19
Crabs	ALL EXCEPT 1½-6-7-8-9							30					15	Season Districts 1½-6-7-8-9 August 31, December 14 See Note 24. None under 7 inches. No Female
Abalones	ALL	14		16										Only for food. Must be brought to shore alive in shell Angling License Required. See Note 27
Pismo Clams	17													None under 5 inches. No shipment. 15 per day Angling License Required — District 18a Closed
Spiny Lobster	ALL											15		No Sale of Meat. None under 10½ or over 16 inches See Note 24
GRUNION	ALL													

Salmon and Shad May Be Taken as Noted in Paragraphs 19-23. No open season on Sturgeon (possession prohibited).

NOTES

IT IS ALWAYS UNLAWFUL

1. To hunt, kill, possess wild birds or mammals, to possess firearms, except under written permit from the Commission, within districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q 1r, 1s, 1t, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 4a, 4b, 4c, 4d, 4e, 4f, 4g, or General Grant Refuge, or the Mt. Tomalpais Game Refuge, including Richardson Bay, or San Francisco Refuge, or Silver Lake Refuge (water fowl may be killed in 4a and 4e), or to hunt quail in the Bolinas Quail Refuge, or to hunt or discharge firearms in Huntington Lake Refuge or San Leandro Bay Refuge.

2. To hunt birds or mammals excepting predators without a hunting license.

3. To possess any bird net or to net, trap or to hold protected game or birds of any kind, their nests or eggs except under written permit from the Commission.

4. To take or possess more than 8 geese per day or 50 per week; or more than 8 honkers or sea brant per day or 24 per week.

5. To take or kill non-game birds, except blue jay, butcher bird, English sparrow, sharp-shinned, Cooper or duck hawk, great horned owl, linnet, white pelican, shag, and in districts 1, 2, 3, 4 and 4¾, blackbirds,

6. To hunt deer without a deer tag license. To fail to attach to the horns of deer immediately on killing, properly filled out license tag or at the same time to send duplicate tag to the Division. To carry a deer into a closed district without having license tag countersigned, or to have untagged deer in possession. To fail to retain in possession during open season and for ten days after the skin and portion of head bearing horns of deer killed and to produce upon demand. To use more than one dog to the hunter in hunting deer or to allow dogs to run deer in closed season, or to possess doe or fawn skins, or deer skins not bearing evidence of sex.

7. To trap for profit bear, ring-tailed cat, coon, pine marten, skunk, fisher, wolverine, mink, river otter, fox, beaver or muskrat, or to kill these animals during the closed season, except when destroying property. To interfere with the traps of licensed trappers. To use saw tooth or spike jawed traps for taking fur bearers.

8. To use any animal other than a dog to stalk wild birds.

9. To shoot game from a power boat, sailboat, auto, airplane; or to hunt waterfowl from a scull boat in districts 8, 9, except on Wednesdays and Sundays, or at any time in district 12 or Napa River south of Edgerly Island, or to use a

shotgun larger than ten gauge, or to possess an extension automatic or a rifle gun.

10. To shoot resident game between ½ hour after sunset and ½ hour before sunrise. To use a gun, rifle or firearm between ½ hour after sunset and ½ hour before sunrise. To use a spotlight in hunting game.

11. To hunt waterfowl in districts 1, 1½, 2, 3, 4, 4½ or 22 other than on Wednesdays, Saturdays, Sundays, legal holidays, opening and closing days of the season, or between 4 p.m. and sunset. To drive game for the purpose of hunting, by means of auto, airplane or power boat or motor vehicle.

12. To hunt game or fish longer than 3 days after close of season, seasons 15 days.

13. To sell wild game or any part thereof.

14. To make a false statement in applying for [illegible] fail to show license upon demand.

15. To take game or fish from waters [illegible] season is not open in that district. [illegible] Trout legally taken may be [illegible] into a vessel [illegible] duplicate setting forth [illegible] license and name and address [illegible] must be attached to the [illegible] the officer before whom [illegible] exact date when [illegible] effect that the [illegible] by agent to whom [illegible]

16. To export [illegible] dried fish other than [illegible] packages or with [illegible] agree and convey [illegible] state.

17. To operate a commercial fishing boat without [illegible]

18. To fish in [illegible] 21, 23, 24, and 25, [illegible]

19. To buy, sell or [illegible] length [illegible] base during [illegible] line. To possess [illegible] and July 31, or Register [illegible]

20. To take trout [illegible] hand or with [illegible] than 3 hooks.

21. To have in possession any fish except [illegible] lawful gill net [illegible] unlawful to spear same.

22. To take trout in any lake within [illegible] of any stream flowing [illegible] of any stream flowing [illegible] within two miles from [illegible] to Aug. 31.

23. To take [illegible] a spawntaking station [illegible] Klamath River [illegible] China less than 2" [illegible] or club antlers [illegible] dition that the [illegible]

LICENSES MUST BE SHOWN UPON DEMAND

District 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1J, 1K, 1L, 1M, 1N, 1P, 2, 2A, 3, 3A, 3B, 3C, 3D, 3E, 3F, 3G, 3H, 4, 4A, 4B, 4C, 4D, 4E, 19A, 20A, 22 and 23: Hunting and Game Refuges. Hunting prohibited. Angling: Restrictions on the taking of bass, catfish and striped bass.

District 1, 1½, 2, 2½, 3, 3½, 4, 4½, 19, 19A, 20, 20A, 21, 22, 23, 24, 25: Commercial Fishing Districts. Hunting and angling: Open season dates with reference to bass, catfish and other fish.

District 1A: Fish [illegible]

District 1: [illegible] boundaries in Mendocino County, beginning on the Pacific Ocean [illegible] and 18 W. [illegible] and township 22 N., R. 18, 17 and 16 W.

District 19: The entire [illegible] Lake, Pit River, Eel River and Lower Salmon Rivers and Beaver Creek above the Forks.

District 21: [illegible] watershed of Colusa County, [illegible] Bridge to High Bridge at South Fork, Eel River, between Chic Bar Bridge and mouth of Butter Creek, the waters of the Cache, Wilt, Grass and [illegible] Creeks, Twin Lakes, Rice Fork, Blue Meadow, Wood, Water, Horse, Scott, Bartlett Lakes and all tributary streams.

LICENSE PROVISIONS

HUNTING

License year [illegible] to June 30

Residents under 18	$ .00
Resident citizens	2.00
Non-resident citizens	15.00
Declarant Aliens	10.00
Other Aliens	25.00

No licenses [illegible] issued to hunting [illegible] year [illegible] from January 1, [illegible] June 30, [illegible] 1931, and for [illegible] license shown [illegible]

ANGLING

License year January 1 to December 31

Resident citizens	$1.00
Non-resident citizens	1.00
Aliens	3.00

Under 18 no license required

TRAPPING

License year July 1 to June 30

Citizens	$1.00
Aliens	2.00

Under 18 no license required

DEER TAG

License year January 1 to December 31

Everyone 12 up	$1.00

COMMERCIAL HUNTING CLUBS

License year July 1 to June 30

Citizens	$25.00
Aliens	100.00
Operators, citizens	5.00
Operators, aliens	25.00

For Laws to Fall See Penal Code.

For Commercial Fish Laws See Commercial Abstract.

For Information Regarding Fish or Game Write to the Division of Fish and Game

CALIFORNIA FISH AND GAME

CONSERVATION OF WILD LIFE THROUGH EDUCATION

VOLUME 18 SACRAMENTO, OCTOBER, 1932 NO. 4

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CONSERVATION AS FORMERLY PRACTICED BY THE INDIANS IN THE KLAMATH RIVER REGION

By RUTH KELLETT ROBERTS

THE INDIANS subsisted on the resources which nature provided. Where natural resources were bountiful, the population was most numerous. Streams and areas that abounded in food supplies became, naturally, the permanent abodes of the Indian.

The lower Klamath River region supplied all the necessities of food, shelter, clothing, and materials for utensils, which their

mode of life required. Through its entire length the Klamath River drainage area was supplied with foods in great abundance and variety. The waters of the river teemed with fish and the neighboring forests abounded in deer and other game. A rich supply of acorns was furnished by the oaks; and grass seeds, pine nuts, and berries were easily obtained. The Indian name for the river itself is said to have meant "abundance," and it naturally followed that this locality supported many thriving Indian settlements. The density of the pre-white population of this region was noted and commented upon in the early investigations of Stephen Powers,[1] and in the later studies of A. L. Kroeber.[2]

During the acorn gathering season, the population migrated to areas where the oak trees were most numerous and frequently established camps there. Similar excursions were made for the purpose of gathering grass seeds, pine nuts, sea weed, berries, and other necessities.

Fig. 65. Trolling at the mouth of the Klamath River.

Regard for property rights among them was very much higher than it is among some of our more civilized people. They were not obliged, upon their return to their established homes, to make an inventory of the depredations committed upon their property during their absence.

An exchange of products among the Klamath River Indians amounted to a commerce which provided all groups with such supplies as they were in need of. Sea weed and other ocean foods were exchanged by the Indians living near the mouth of the river for such necessities as were more plentiful along the upper stretches of the stream.

The Indians, of necessity, avoided diminution of any natural resources upon which their life depended. Public opinion and community law disapproved of any waste. Trees were felled only for

[1] "Tribes of California," Cont. N. Am. Ethnology, vol. III, Washington, 1877, Stephen Powers.

[2] Bureau of American Ethnology, Bulletin 78, Handbook of The Indians of California, A. L. Kroeber.

Fig. 66. Looking up the Klamath River from [illegible]

construction of canoes and houses, and dry brush [illegible] for firewood. Seasonal burning over of certain areas was [illegible] their mode of farming, as it served to produce grass [illegible] and hazel twigs and grass for basket weaving. The [illegible] two years. It also protected their game by destroying the [illegible] brush shelters of predatory animals. Systematic burning [illegible] to rid the immediate neighborhood of rattlesnakes [illegible] bear, and to check the increase of insect life.

To destroy wild life for any other reason than [illegible] of food would have been as ridiculous a procedure to the Indian [illegible] we entered our own gardens or went among our own herds and [illegible] for the sheer enjoyment of our prowess as destroyers.

This "happy hunting ground" of the Indian showed no depletion of its remarkable resources of fish and game until after the [illegible] the whites.

In contrast to the white man's idea of sportsmanship, the Indian killed only what he needed for food, and he wasted no [illegible]

Fig. 67. Eel traps used on the Klamath River.

the game taken by him. Even the entrails of animals were dried for winter food for the dogs. Any one who caught more fish or killed more game than he and his family could use shared it with others who were less fortunate. To the Indian, hunting was not a sport; it was a means of obtaining his food supply, and the killing of wild life was limited to his necessity for sustenance. To destroy this supply meant nothing short of self-destruction.

The white pioneers of this region killed off great herds of elk and deer for their hides and left the carcasses to be devoured by the buzzards. The modern "sportsman" catches steelhead and salmon for the "sport," and in many cases takes a quantity far greater than he has any use for and leaves them on the shore to rot. Prowess as a killer of wild life is still mistaken by many as an indication of superior sportsmanship. This notion is very largely an inheritance from early days in the West, when wild life was plentiful and when boastful satisfaction was proportionate to the killer's skill in destroying it.

A Yurok legend tells that woman held the hidden knowledge of the source of food supply and guarded this secret jealously. In this respect Indian tradition agrees closely with the belief that prevailed generally among other races at the dawn of history.

The origin of the most important food supplies, such as salmon and acorns, is accounted for by legend. According to the Indians, the Klamath River at one time emptied at the site of the old Indian village of "Omen," at the mouth of Wilson Creek, four or five miles north of the present outlet, but no fish entered there and the Indians were hungry. The Creator, seeing their plight, shifted the river mouth to it's present location, and brought "Oregos" (a tall rock shaped like a woman) from "Omen" to "Rekwoi," the Yurok village at the present mouth, and placed this rock for "luck," and as guardian of the river. Still there were no fish; and so "Oregos," at the suggestion of an Indian boy who had been prompted in a dream, went across the ocean by canoe to another land, and brought back a charmed fishing rock. This was divided by "Oregos" into two sister rocks, with identical names. One was placed at the base of "Oregos" on the north side of the river, and the other near the foot of the hills on the opposite side of the stream, marking the limits within which the river at various times shifts it's outlet. After the placing of these rocks, fish came into the stream, and the annual runs have continued ever since.

The food supply was regarded as the gift of the Creator, and the taking of fish was a solemn and prayerful undertaking, governed by very strict formulae. The first salmon to enter the Klamath in the spring was permitted, with elaborate ceremony, to pass up the river, as the Indians believed this fish acted as a leader for the run to follow. It was thought that this salmon in its ascent to the spawning grounds left scales on the rocks to indicate the route which the salmon entering later should follow, so that the Indians up river would be assured of a food supply. Other leaders, and then the whole run of salmon, followed, leaving their scales; and by the time they reached the spawning grounds they were battered and exhausted.

One of the earliest, if not the earliest, observations to be made of the condition of the salmon in the spawning stream, is that recorded

in the diary of the overland party of the Wilkes Exploring Expedition, early in October, 1841. According to this record the explorers purchased two salmon which the Indians had taken from the Smith River. Their description of the fish is "The salmon were of a yellow color, and not at all delicate to the taste. Their tails were worn off and the fish otherwise bruised and injured."

References are made in Indian lore to [illegible] limited run of fish. One tale, antedating the coming of the white man, tells of a war between the Tolowa Indians of Smith River and the Karok Indians of the Klamath brought on as a result of the fact that the fish, in this particular year, had entered the Klamath before the Smith River. The Tolowas blamed the Karoks for the shortage. About 1200 warriors from Smith River crossed over the trail that later became known as the Kelsey trail and descended upon the village at what is now Happy Camp burned the lodges, killed as many of the inhabitants as they could, took the Karok food supplies and women and started down the river. News of this attack reached the people down stream, who closed in upon the marauders at the village of Ishipishi Falls, and killed all but three of them.

Another legend tells of a great famine that spread among the Indians along the entire lower stretches of the Klamath River when no fish or eels came in. Other food sources had also failed. Even the mussels were blasted, and there were no acorns. In the beginning two sisters who resided at the Yurok village of "Rekwoi" had secret knowledge with which they had prevented the entrance of the fish. The Karoks and Hoopas descended upon the village before the inhabitants were awake, and set fire to the houses. Many Yuroks both men and women, were killed, and a great war involving the whole region from Smith River to Orleans and Hoopa resulted.

The food supply sources were not in all cases common property. Many of the acorn producing groves and grass seed and brodiaea patches were owned by individuals and by family groups. Since salmon was an important part of the food supply of the Indians on the river individual and family ownership of fishing places developed and was scrupulously respected. A single fishing place was sometimes held in joint ownership by several individuals or families. The women and girls did not fish, but assumed responsibility for smoking and drying the catch. Persons who did not own a fishing place or who were not allowed dipping privileges by the owners of such places were given fish in payment for assistance rendered to those who had such rights.

Ownership of these fishing places could be transferred by will for care in old age or during illness, and could be sold. Ownership was sometimes staked in gambling and lost, and was sometimes given in advance payment to an Indian doctor. Good doctors became very rich both in possession of fishing places and in Indian money and furs. Among some Indian groups there was a law against a doctor exacting a mortgage on a fishing place, or acquiring a fishing place in advance payment for "doctoring."

Besides the individual ownership of fishing places, there were community projects, such as at the mouth of the Salmon, in the pools below Ishipishi Falls, and the fish weirs at "Lo-olego" (an Indian village just above Weitchpec, now extinct) and at Kepel. Jedediah S. Smith's

party of American trappers recorded the presence of a "fishing establishment" in the vicinity of Weitchpec, in May 1828, which was probably the one at "Lo-olego."[1]

Frequent mention is made throughout Smith's diary of the volume of water observed in all of the streams of this area, which would indicate that in 1828 a very much larger flow existed than at present.

A fish weir was put in at Kepel in September, and was allowed to remain until carried away by high water, about a month later. The weir consisted of a series of traps extending across the river with a space at either end, near the banks, wide enough to allow canoes to pass. This space also permitted the passage of fish. Many fish jumped over the weir, which projected about three feet above the surface of the river, and made their way up stream.

The several important families who sponsored the construction of the weir had prior dipping rights. They took what fish they wished each morning, and were followed by those who possessed no fishing places or privileges.[2]

At the height of the run, when there was danger of the dam being broken by the crowding of fish against it, the traps were opened after the day's fishing, and the fish allowed to pass through until the next morning. Indians in great numbers from a considerable distance up and down the river gathered here for the annual fishing event and for the merrymaking that accompanied it.

At the mouth of the Salmon, and in the pools below Ishipishi Falls, quantities of salmon were taken in dip nets. In the fall, Indians came here from great distances to fish. It has been reported that the salmon were so numerous that thirty or forty were taken at one time in a net, and that several men were required to drag the catch to shore.

Another instance of the recognition of established community rights with respect to a food source is mentioned by Kroeber.[3] This was in the case of whales that were occasionally washed up along the Humboldt and Del Norte coast. The tribal boundaries determined the group ownership of the whale carcass. Each man took a cut a half fathom wide, and the rich man, a full fathom.

In describing methods of fishing, Kroeber states:[4]

"The dip net, or lifting net, as it may be called to distinguish it from a smaller instrument on an oval frame occasionally used by the Karok and other tribes to scoop boiling riffles and rapids (Pl. 6), was let down from a scaffolding built out over the water, almost invariably at some eddy or backwater. Here the fisherman sat on a block or little stool, holding the bone button of the string which closed the entrance to the pyramidal net stretched out in the current. This net was hung from the bottom of a long A-shaped frame with a bottom crossbar. The whole was hauled out as soon as a pull on the cord had inclosed a salmon, which was then struck on the head with a club. A single night's vigil sometimes produced a hundred salmon, it is stated—a winter's supply, as the Yurok say. At other times a man will sit for half a day without a stir. The old men are much inclined to this pursuit, which would be trying to our restless patience, but gives them

[1] Dale, The Ashley-Smith Explorations.
[2] Originally the weir was equipped with eight traps, but with the decrease of Indian population the number of traps diminished to four.
[3] Kroeber, *op. cit.*, p. 14.
[4] Kroeber, *op. cit.*, p. 85–86.

opportunity for undisturbed meditation or dreaming or mental distress along with a sense of profitable occupation. [illegible]

"Lampreys, customarily known as eels [illegible] Yurok for their rich greasiness, also ascend the river in great [illegible] sturgeon are not rare. Both species are taken [illegible] though of course with a net of different mesh. In [illegible] pots were also set. Trout in the affluent creeks are [illegible] considered by a people frequently netting 20 pound [illegible]

"Both salmon and lampreys were split for drying [illegible] a wooden-handled knife (Pl. 16, of 'whale colored' flint [illegible] called it; the latter with a bone awl. A steel knife probably [illegible] a different and perhaps a more precise handling, so that [illegible] years ago the old women clung to the aboriginal tools. [illegible] fish was somewhat smoked and put away in old baskets [illegible] slabs. The pulverized form convenient for packing [illegible] Columbia, was probably more prevalent among interior and [illegible] tribes like the Shasta. Surf fish were often only sun-dried [illegible] kept hung from poles in rows. They make a palatable [illegible] dition. Dried salmon is very hard and nearly [illegible] but [illegible] satisfying and, of course, highly nourishing.

"A long net was sometimes set for sturgeon. One that was measured had a 6-inch mesh, a width of 3 feet, and a length of [illegible] use was doubled to half the length and double the width.

"A measured salmon seine had a scant 3-inch mesh, a width of [illegible] feet, and a length of over 60 feet.

"Nets were made of a splendid two-ply cordage rolled with [illegible] from fibers of the Iris macrosiphon leaf. The gathering [illegible] and extraction of two fine silky fibers from each by means [illegible] artificial thumb-nail of mussel shell was the work of women. [illegible] string was usually twisted and the nets always knotted by [illegible] mesh spacer and netting shuttles were of elk antler, net [illegible] grooved, pierced, or naturally perforated stones. [illegible]

"The salmon harpoon, which could be more frequently used in the aboriginal period than now when mining renders the river [illegible] had a slender shaft, sometimes more than 20 feet long. To [illegible] attached two slightly diverging fore shafts, one a few inches [illegible] on which were set the loose barbs of pitched and wrapped [illegible] horn. The lines were short and fastened to the main shaft, a pay line being unnecessary for prey of the size of a salmon. In fact, an untoggled barbed spear would have sufficed but for the opportunity it's resistance offers a heavy fish to tear itself free. This harpoon was made with no essential variation in practically all fishable parts of Calif[illegible] and it is the only harpoon known, except for a heavier implement driven by the Yurok and Chumash into sea lions."

In small streams fish dams were made of green poles with a fill of brush and rocks, but always with one end of the barrier free from the shore, which permitted the passage of fish.

Trout were caught in a V-shaped set basket which looked like a dip net. Set baskets were also used for trapping eels. These were set in the river and emptied at intervals.

The Indian fished practically throughout the entire year. No limit to the catch was imposed other than that determined by the needs of

the person or family fishing. Fishing rights were determined by ownership (or lack of ownership) of a fishing place, possession of extended fishing privileges, or accessibility to a common fishing place.

Salmon were permitted to pass up the river for a half moon before any were caught. Most of the spring salmon were allowed to pass, except what was wanted for immediate use. This run was so rich in oil that the fish did not keep when smoked. The summer and fall salmon were preferred for drying. This may have been because they contained less oil and particularly for the reason that by taking the later run the winter food supply need not be carried through the warm summer.

Open deer season was fixed at a time in the fall when wild celery seeds were ripe. Deer and elk were trapped in pits or snares, or were taken with the aid of dogs. If bucks could be found, does were not killed. Each family killed as many as it could use. All surplus meat was jerked for winter use. Quail and grouse were not taken during the nesting period unless a family was starving. There were no restrictions upon the taking of eels.

It was an established belief among the Indians of the lower Klamath River region that any person who violated accepted fish and game regulations would "loose his luck" as a hunter or fisherman, or would not live to hunt or fish another season. This belief had a very restraining effect. The conservation of fish and game on the Klamath River, as elsewhere, is very largely a struggle to restrain the white man in his delight in killing.

THE LIFE-HISTORY AND THE CONTROL OF THE CROPWORM, CAPILLARIA CONTORTA, IN QUAIL

By Adele Hobmaier

TWO IMPORTANT species of cropworm in quail belonging to the genus Capillaria are known, namely *Capillaria contorta* and *C. annulata*. In the eighteen cases of the past year in which the presence of cropworm has been observed in the State Fish and Game Laboratory, *Capillaria contorta* exclusively could be collected. Only in one case a ring-neck pheasant (*Phaseanus colchicus torquatus*) was the host, meanwhile quail were found to be infested in the remaining seventeen cases. Fifteen of these parasitized quail were raised by breeders, and two wild living ones. This observation may justify the statement, that *C. contorta* is the ordinary cropworm of quail in California and that the importance of this parasite is more significant in game farms than in free living quails.

The life-history and the control of *Capillaria annulata* is closely related to that of *C. contorta*. Having ascertained, however, *C. annulata* as yet in no case, the description is confined here to that of *Capillaria contorta*.

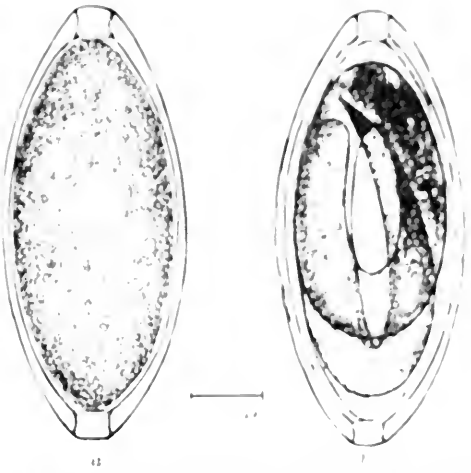


Fig. 68. Eggs of [illegible] a [illegible] b [illegible]

Its control is of importance. Besides [illegible] birds may become weakened and even death may occur. [illegible] the possibility of spreading the infestation to [illegible] from this parasitic disease. Thousands of quail are raised every year throughout California to be liberated later. It is important [illegible] birds are free from any bacterial or parasitic disease.

Reference is made to the valuable work done by other investigators especially by Cram, who has contributed much towards our knowledge on this subject. It may be recalled that Dr. Henry Van Rossem previously has published two pictures of the parasite in the [illegible] Fish and Game, Vol. 15, No. 1, showing the adult roundworms and a part of an egg bearing female.

LIFE HISTORY

The life cycle of parasites is different in some way by every genus. The prevention of infestations and even often their control depends on the knowledge of their life history. There are two principal forms of development of parasites: A direct one completed without using an intermediate host and an indirect one, which requires the presence of an intermediate host.

The cropworm of quail belongs to the group of parasites without intermediate host. Every adult female cropworm living in the mucous membrane of the crop produces thousands of eggs. These eggs pass out together with the droppings, the eggs, however, if swallowed by other birds are as yet unable to produce an infestation because of the immature stage of the eggs. They are as yet not embryonated (Fig. 68a). Even under suitable conditions about five weeks are required to produce an embryo (Fig. 68b). Those eggs containing an active embryo are infestive. Oxygen, a certain amount of moisture, and a temperature not far below 60° F. are necessary for this development. The absence of one or more of these conditions produces a retardation in the development and finally death of the eggs. Even when kept in

cultures the time required for the embryonisation was different. Meanwhile the first eggs reached the infestive stage in 4 weeks, the greater part ripened after about 5 to 6 weeks. Others showed advanced segmentation 9 to 10 weeks later, and a certain amount of eggs had died under the same conditions. Complete dryness lasting longer than three days was able in my experimental work to kill the eggs in development as well as the eggs with a developed embryo. The observations of E. Cram, however, show that cultures with embryonated eggs remained infective for about 11 months if alternately dry and wet.

That behavior is able to throw some light on the epidemiology of the disease. Wild living birds are less infested because the eggs are spread over a larger area, meanwhile the possibility to become infested is a very great one in the small pens of home raised birds. This development shows on the other hand, that the infestation is dependent to a large extent from climatic and hygienic conditions of the pens. That will be remembered hereafter discussing the control of the disease.

The infestation of the quail is accomplished in a simple manner. The embryonated eggs are swallowed with the food. The microscopical eggs from the size of about 60 μ in length are lemon shaped and closed on both ends by a mucous plug. (Fig. 68.) These plugs become dissolved in the crop and the larvae leave the eggs and penetrate the mucous membrane of the crop.

About 5 weeks later adult females and males can be found and ovoposition takes place. The adult worms are embedded in the mucous membrane. Both are threadlike worms. The full grown female is about 6 cm ($2\frac{1}{2}$ inches) long, the male about 3, 6 cm ($1\frac{1}{2}$ inches). Both show a white color. The ovoposition, however, has been observed by females already 3, 5 cm long. The adult worms disappear in the course of at least one year after infestation.

OTHER HOSTS

From the standpoint of the control it is noteworthy, that the parasite is not exclusively found in quails but also in different other birds. It is noted by different species of pheasants (*Phasianus colchicus, Ph.*

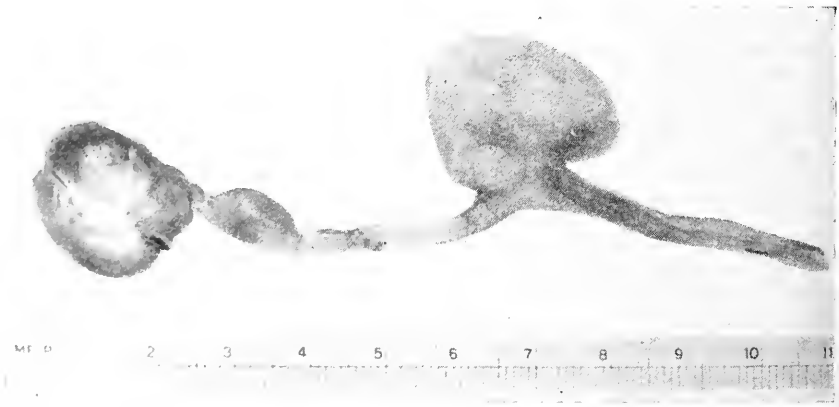


Fig. 69. Esophagus, crop and gizzard of a heavily infested California valley quail.

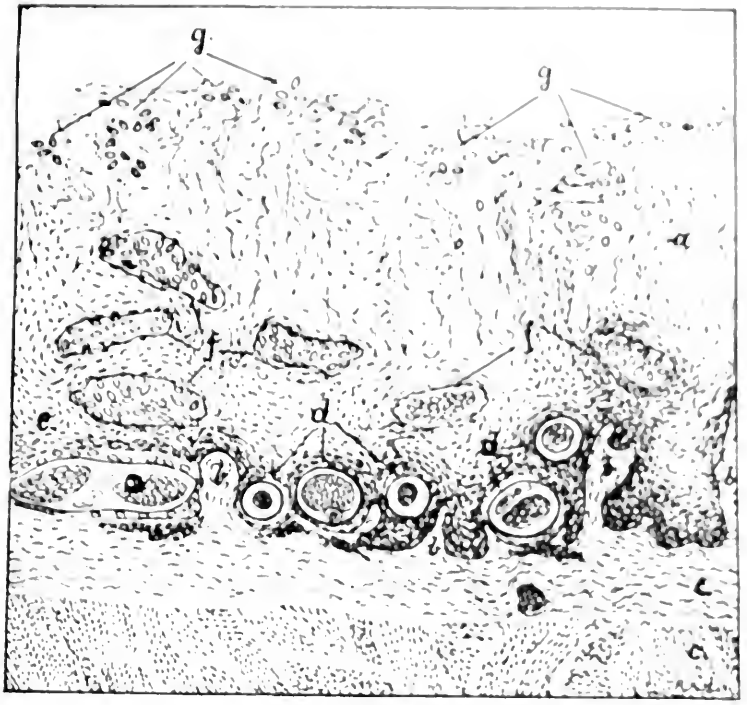


Fig. 7e. *a* Epithel of the surface of the crop in the region of destruction and emaciation. *b* Papillae of the mucous membrane. *c* Muscular tissue of the crop. *d* Sections through the parasites in tunnels near the surface of the crop. *e* Uterus filled with eggs. *f* Sections through the parasites. Accumulations of eggs in tunnels of the crop tissue. *g* Parasites on the surface of the mucous membrane.

colchicus torquatus, by domesticated and by wild ducks and [illegible] ferent other wild birds which are of less importance.

Chickens could be infested in the Fish and Game Laboratory by feeding with embryonated eggs of *Capillaria contorta* collected from the California valley quail, meanwhile earlier investigators were not able to produce an infestation of these birds using a strain collected from a ring-necked pheasant.

No differences could be observed in the development of Capillaria in quail and in chicken. Eggs of the parasite appear in the droppings about six weeks after infestation like in quail. One month later the birds have been killed without showing symptoms of disease. Post mortem examinations revealed an inflammation of the mucous membrane of the crop and the presence of dozens of roundworms. Only about the twentieth part, however, of the parasites fed previously to the chickens had developed into adults.

Apparently this is the first record of an experimental infestation of chickens due to a strain obtained from quail. Infestations of chickens under natural conditions, however, are reported. In the Fish and Game Laboratory the parasite has been found besides in the California valley quail and in the bobwhite quail in a ring neck pheasant.

in accord with observations of other investigators. Working on duck disease (Botulism) a large number of different species of wild ducks carefully has been investigated, but no crop worms of the species *Capillaria contorta* could be as yet detected. The parasite, however, has repeatedly been observed in pintail (*Dafila acuta*) by other investigators.

PATHOLOGICAL CHANGES

Slight infestations with the roundworm ordinarily remain undisclosed during the life of the bird. A microscopical investigation of the droppings would be required to detect the eggs of the parasites. Even a detailed post-mortem examination would show no peculiar microscopical changes besides a slight inflammation of the wall of the crop and the presence of the roundworms. These unrevealed carriers, however, later on may be detrimental to the entire flock spreading the disease under more suitable conditions.

Heavy infestations are followed by general and local disturbances of the bird. Emaciation and weakness ordinarily are well marked. The crop shows particular changes. (Fig 69.) Its wall appears to be enlarged, thick, stiff, and reddish. The crop mostly bears no food. Its content consists of a copious creamy white-yellow fluid. A microscopical investigation reveals that it consists of desquamated epithels. mucous, and a large quantity of eggs. The subjacent epithel layers of the mucous membrane are soft, cheese like, and thickly folded. The spying glass reveals the presence of a great number of roundworms lying in snake-like curvings under the epithels, especially near the borderline of the muscular tissue in the papillarzone. The wall of the epithelium appears about twice to three times thicker as ordinarily, meanwhile the muscular tissue of the crop is not evidently damaged. Similar changes may be present in severe cases in the mucous membrane of the undilated esophagus, especially near the crop. Microscopical slides are required to reveal the finer changes of the diseased tissue. The wall of the crop as a part of the esophagus consists of two plates of tissues of a mucous membrane inside and of a muscular tissue outside, both are fixed together by connective tissue. The mucous membrane is steadily peeled off on the surface to be renewed by the germinative cells of the papillae. The upper layers of epithels are mortified and hardened by a natural horning process.

The histological slide above (Fig. 70) presents the picture of a heavily infested crop. Different sections of roundworms may be seen (d, e). All are situated near the papillae in the strata of the germinative cells. They have formed tunnels in this region of the mucous membrane. Some of these tunnels partially are filled with eggs (e). The large amount of eggs produced by a single female worm may be seen on the section of the uteri of worm (e). The layers of the mortified epithels are enlarged, and partially liquified (a). Accumulation of eggs are visible on different places of the mucous membrane (f). Eggs are scattered on the surface and near the surface of the mucous membrane (g). The irregular shape of the surface and the destruction of these cell-layers is of interest. Besides the fluid exudate only a few round cells are to be seen in the papillae and near the tunnels. The muscular tissue (c) of the crop shows no changes.

With this picture at hand the life [illegible] body of the host can easily be interpreted [illegible] on the germinative cells of the mucous membrane. We do not know if they feed on these cells or if they [illegible] believe the latter. In undermining the [illegible] and in doing so they cause a destruction [illegible] of the mucous membrane. This process [illegible] horning process of the mottled epithelium [illegible] of tissue lymph into the epithel. Both [illegible] of the mucous membrane marked by [illegible]

The oviposition takes place inside the [illegible] continually are brought nearer to the surface [illegible] by its natural growing process. [illegible] the surface (fig.). Now they have the possibility [illegible] droppings. In this way the life cycle of the parasite [illegible] may originate again.

SIGNIFICANCE

Slight infestations with the cropworm [illegible] toms of disease in quail as pointed out [illegible] narily remain undetected. The danger of a [illegible] worm disease, however, is to be feared, especially [illegible] season of the year.

Heavy infestations may produce weakness [illegible] and even death. Most of the investigators believe [illegible] of the cropworm may be an indirect one, preparing the [illegible] entrance of different germs. Other theories advanced [illegible] death of the birds assume an obstruction of the [illegible] inertia of the wall of the crop, and an asphyxia [illegible] on the pneumogastric nerve.

After my investigations, I believe the death of [illegible] caused by a disturbance of the digestion followed by [illegible] tion. Post mortem examinations reveal in these cases [illegible] digestive tube and an extreme loss of body weight besides [illegible] above described in the wall of the crop. If on the other hand, [illegible] birds are found dead being in good flesh, the death is caused [illegible] another unknown disease. The presence of cropworms may [illegible] siderable or having favored the entrance of deadly germs.

CONCLUSION.

The principal facts in the life history [illegible] the following:

1. The infestation of quail with the parasite lasts about [illegible] if death does not occur.

2. During this time thousands of eggs are deposited with the droppings, contaminating the soil.

3. Under suitable conditions the eggs become infective about 3 weeks after their deposition.

4. Lack of oxygen, freezing temperature, and dryness may delay the development of the eggs and finally destroy them.

5. An infested pen remains infective practically throughout the year.

6. Slightly infested birds show no symptoms of disease. They are carriers and therefore responsible for new outbreaks. Heavily infested birds succumb to the infestation.

CONTROL

From the development of the parasite we have learned that there are stages of the roundworm inside the body of the host and that others exist outside the host. Therefore two possibilities exist to control the parasite; namely to destroy the eggs outside the body, or to kill off the mature forms of the worms inside the host.

If we intend to kill the adult worms the use of certain drugs is required. Carbon tetrachloride has been recommended. It is the best of the parasiticid drugs, but unfortunately highly dangerous by improper administration. It would be preferable to use a milder drug, for instance a solution of 2 per cent carbolic acid or a solution of 1 per cent copper sulfate (bluestone), added to the drinking water or to the mash.

The second way and a more preferable procedure to control the disease would be to interrupt the development of the eggs outside the body. Remember that the ripening process of the eggs requires about 5 weeks. The use of any disinfectants is not required if we remove the eggs prior to that time. The worms have no possibility to become developed, if the pens are properly handled according to hygienic requirements. That includes to remove one to two inches of the dirt surface of the pens every second week and to replace fresh sand. This time would be sufficient to prevent the cropworm development. To perform that procedure without molesting the birds and in order to do it with accuracy the use of a double set of pens is commendable. Avoid wet places in the pens. Wet places are favoring the outbreak of different diseases. Use a wire-mesh square about 1 yard large and about two or three inches high to put the water container at top. Quails may be kept strictly separated from any other birds, especially from chickens and turkeys.

Take the opportunity to send birds at the beginning of a disease to the laboratory for investigation and do not delay until the disease has spread over the entire flock.

THE STRIPED BASS SUPPLY, PAST AND PRESENT

[illegible]

IN LINE with the policies of the Division of [illegible] ascertain the condition of our fisheries [illegible] striped bass catch in the San Francisco Bay and [illegible] regions has been analyzed for the years 1928–August 14, 1931, inclusive.[2] This continued the work of Craig.[4]

The results of this study are of importance to [illegible] men, commercial fishermen, dealers and laymen of the State.

Craig (1930) demonstrated that the total catch [illegible] did not give a correct index of the availability [illegible] fishermen. For this reason in the present as well as in Craig's [illegible] individual boat catches were used to determine the yield per unit expended.

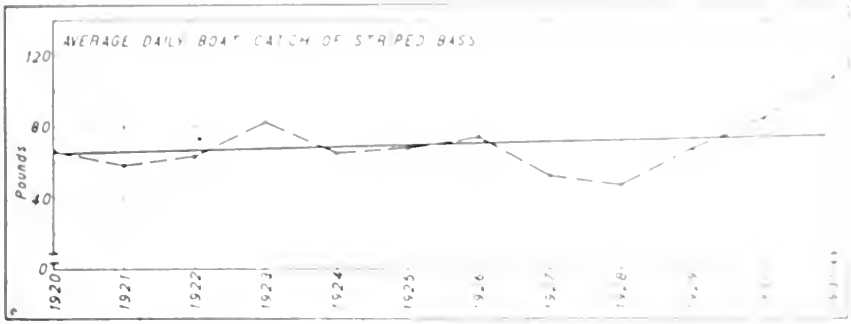


Fig. 71. Average daily boat catch of striped [illegible] 1920–August 14, 1931.

The source of material used [illegible] the boat catches [illegible] netters and the methods of analysis were the same as employed by Craig (1930).

The result of these methods is the catch per fishing unit and [illegible] expended—it is a trustworthy measure of the availability of striped bass to the fishermen.

Figure 71 shows that the striped bass boat catch was fairly constant from 1920 to 1927, inclusive. In 1928 the catch dropped slightly only, to recover in 1929 and 1930 and to reach a new high point in 1931.

[1] Contribution No. 126 from the California State Fisheries Laboratory. August 1932.

[2] This article is a brief summary of the detailed report on the [illegible] analysis of striped bass catches from 1928–August 14, 1931, which is now awaiting publication.

[3] The analysis was carried on with data from the commercial [illegible] August 14, 1931, only, because on that date it became unlawful to take striped bass by means of nets at any time except when taken accidentally in seal nets in District 12B between March 15–April 30, inclusive. It is not illegal however to take bass for the market by hook and line.

[4] Craig, J. A. An analysis of the catch statistics of striped bass (*Roccus lineatus*) fishery of California. Calif. Div. Fish and Game, Fish Bull., no. 24, 1930.

Without doubt the striped bass were extremely plentiful in 1929–1931. Aside from the biometric study here presented, the fishermen (both sportsmen and commercial) can testify that striped bass were abundant and that catches were larger and easier to make in these years. The commercial dealers found fish so plentiful that it was necessary to place limits on the boats for the first time in the history of this fishery. These limits were set in the fall of 1929 and during parts of the seasons of 1930 and 1931, in order not to flood the over-supplied markets and to prevent any further decreasing of the abnormally low striped bass prices.

The fact that commercial fishing methods and gear have not changed to any extent in the last few years and that the unit of effort has remained constant, indicates that the increased boat catch was due to an increased abundance of bass. The numbers of bass taken by anglers [1] undoubtedly have increased each year, for this sport has become very popular with anglers, drawing more and more sportsmen to striped bass fishing. In spite of this increased drain on the striped bass population, this species increased in 1931 to a point higher than in any previous year analyzed in our study. (See Fig. 71.)

It is difficult to point to any one factor or factors and say this or that is responsible for the increase of the striped bass abundance. Very likely, however, the early legal protection given this species as well as the later additional wise conservation restrictions of fishing areas and sizes of fish are responsible for a great part of the gain in the population. This protection, of course, was both direct, through the limitation of the total catch, and indirect, through the protection of sizes of fish and restriction of waters, so that successful spawnings of striped bass occurred year after year. The last striped bass law passed in 1931 is not considered a conservation measure, as it throws open all previously closed fishing areas to commercial and sport hook and line fishing and gives no protection to large spawning bass.

From the results of this study and of this investigation, it appears, if conditions remain the same, that there are enough striped bass for everyone. However, intelligent conservation of this species should be continued. The restrictive measures previous to 1931 did not seriously hamper the fishermen, both commercial and sport, and assured a steady yield to all concerned without depleting the breeding stock.

SECOND ANNUAL BLACK BRANT CENSUS IN CALIFORNIA

By James Moffitt

THE RESULT of the first annual census of the black brant (*Branta bernicla nigricans*), undertaken by the California State Division of Fish and Game and voluntary cooperators February 6 to 12, 1931, was announced by the writer in California Fish and Game, Vol.

[1] For catch analysis in future years, it would be very advantageous to have a record of the catches made by anglers together with the effort expended. At the present time we have no record of the number of striped bass anglers or statistics of their catch.

17, No. 4, pp. 396-401. In this paper I pointed out the fact that on account of the concentration of this bird on a few large coastal bays supporting growths of eel grass (*Zostera marina*) it is possible to secure rather accurate censuses of its number within the State. This condition is practically unique in brant and waterfowl distribution in the rest of the species in this group being so widely distributed over the State as to render any effort at census taking inaccurate and inaccurate. Because our winter population of brant can be counted so easily and at a nominal expenditure of time it is highly desirable to take annual inventories of this important game bird. Thus, if similar records are obtained at the same time and places and preferably by the same observers we soon have a very good indication of the status of the bird. The value of these records will increase in value as the length of the year's count is obtained, which fact is itself a reason for continuing this work regularly each season.

In 1931, the period February 10 to 15 was selected for the census taking as we considered the maximum number of brant would then be present on our waters. It now appears that this was somewhat early for this condition to exist particularly as the winter was as was our last one, for the birds seemed to be rather late in reaching our waters in 1932 and maximum concentration probably did not occur before March 1 this year. However, the value of the data obtained was taken on these dates outweighed this consideration and we planned to take our 1932 counts on the same days.

More time for organization of the work in 1932 resulted in counts being made at all important points this year. Counts were also made in 1932 on Bodega and Drakes bays, which had to be omitted in 1931 because cooperators could not be organized to take the counts. The counts in 1932 show the importance of including these waters. This was possible through the kind cooperation of Mr. T. T. McCabe, Dr. J. Linsdale of the Museum of Vertebrate Zoology, Berkeley, who volunteered their services to take censuses on the respective bays. Dr. Joseph Grinnell, Director of the Museum, to permit Dr. Linsdale to do this work. Acknowledgment of similar nature is also due Mr. L. M. Huey and Dr. Clinton G. Abbott of the San Diego Natural History Museum for observations made at San Diego Mission bays, and to Mr. C. L. Clay, and Captain of Patrol W. [illegible] Harp of the Division for assistance rendered at Humboldt Bay.

The results of the various counts in 1932 [illegible] son, the figures for 1931 are also provided where censuses were made in that year.

Locality	*Date*	*Observers*	[illegible]	[illegible]
Humboldt Bay	Feb. 12, 1932	C. L. Clay Wm. Harp James Moffitt	[illegible]	[illegible]
Bodega Bay	Feb. 11, 1932	Joseph Linsdale	[illegible]	None
Tomales Bay	Feb. 11, 1932	James Moffitt	[illegible]	[illegible]
Drakes Bay	Feb. 11, 1932	T. T. McCabe	[illegible]	None
Morro Bay	Feb. 10, 1932	James Moffitt	[illegible]	[illegible]
Mission Bay	Feb. 12, 1932	L. M. Huey	None	[illegible]
San Diego Bay	Feb. 12, 1932	L. M. Huey	None	None

The count secured on Humboldt Bay this year is thought to be at least 85 per cent accurate which fact is most gratifying after the great

discrepancy that existed between two observers' figures in 1931. At that time, C. I. Clay attempted to count the tremendous concentration of birds on South Humboldt Bay from the shore, which is quite impractical, and there is little wonder that the figures he gave evidently highly exaggerated the number of birds then present. When viewed from a distance, a strip of birds three or four miles long and one or two hundred yards wide, as the brant are wont to consort on Humboldt Bay, gives the observer the impression of "millions" of individuals. Indeed, some residents of Fields Landing, hunters at that, seriously assured us on the day we took the census this year, that there were "millions" of brant present. However, a very careful count failed to record more than 24,415 birds. This shows the difference between estimating and counting.

Messrs. Clay, Harp and I left Fields Landing in an outboard motor boat at ten o'clock in the morning, February 12, 1932. The tide was low (1.5 ft.) at 10.08 a.m. and all the brant in the vicinity were apparently feeding in the bay at this time. A brisk northwest wind made the ocean outside quite rough, which fact furthered our supposition that most, if not all, the brant were in the bay. Most of the birds were strung out along the shore in an almost unbroken line from a point a little south of the entrance to the southern end of the bay at Table Bluff, thence eastward to Hookton Slough and north halfway to Fields Landing. (See Fig. 72.) This condition made for rather accurate counting, for with Captain Harp running the boat and Clay and I counting independently, we circled the bay in this direction, counting only those birds that flew back of us or to the center of the bay, which all had done by the time the circle was completed on our return to Fields Landing. At the conclusion of the count, 2.00 p.m., a check-up between Clay's and my figures revealed almost identical results. We then drove to North Humboldt Bay by automobile and scanned its waters for brant with glasses from the road. No brant

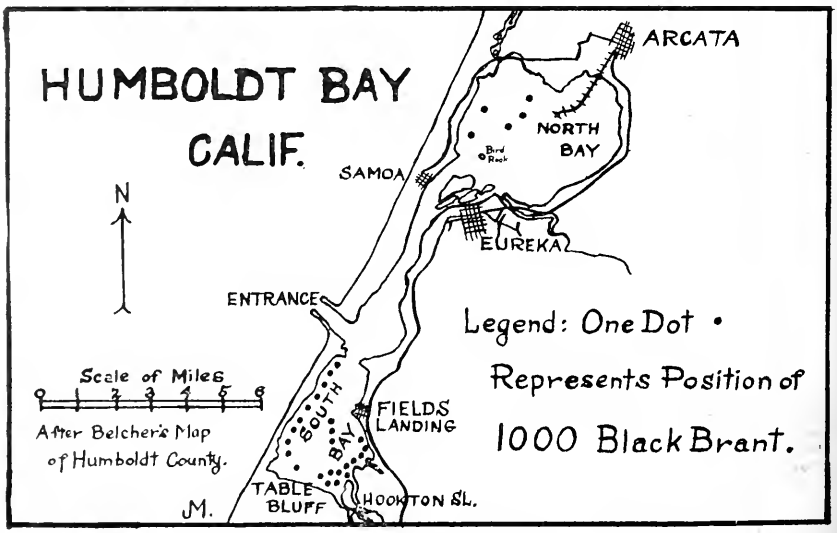


Fig. 72. Map of Humboldt Bay, California, showing position of black brant on its waters, February 12, 1932.

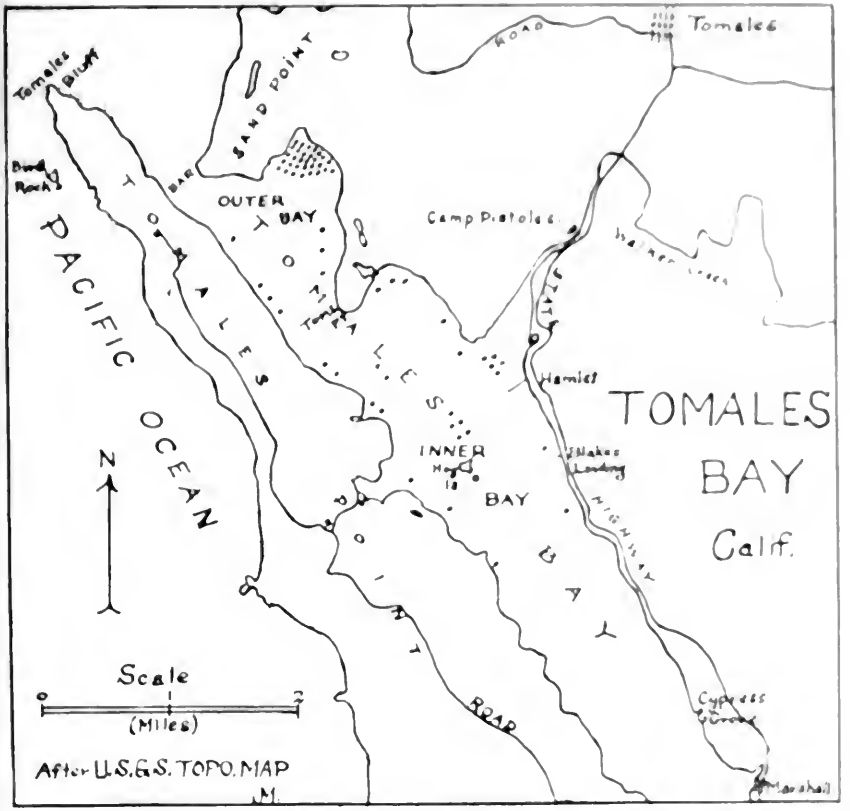


Fig. 73. Tomales Bay, Marin County, Calif. [illegible] brant at mid-day February 1, [illegible] brant.

was seen between Eureka and Arcata where the water was [illegible] from the then strong northwest wind. A considerable number of brant was seen between Arcata and Samoa, mainly lying far off shore where they were difficult to count exactly. We estimated their number to the best of our ability after watching them through glasses at 15000 birds was the unanimous conclusion we arrived at. It is regrettable that time did not permit our also counting the brant on North Humboldt Bay from a motor boat. This census was made between 3:00 and 4.30 p.m. High water (4.3 ft.) was at 3.58 p.m. and as is their custom the birds had fed on the incoming tide and were resting and loafing when we took the census, which accounted for their scattered position far from shore.

I made inquiry among hunters and others while in Eureka February 12 as to the relative abundance of brant on Humboldt Bay this year against a year ago. Numerous hunters, Captain Harp and other members of the Division's patrol force were in agreement that more birds were present in 1931, but all thought that their numbers then were not more than 25 per cent greater than at the same season this year.

Dr. Linsdale took the census on Bodega Bay, February 11, 1932. He counted from the shore with the aid of a telescope between 11 a.m. and 2 p.m. and at the conclusion of his work felt quite certain that he had secured an accurate record of the number of brant on the bay, 3200 birds.

I took the census on Tomales Bay from an outboard motor boat the same day, commencing at noon and finishing at 3.15 p.m. The day was cloudless and calm until one o'clock, up to which time a very accurate count was obtained. A stiff north wind sprang up about that hour which rendered counting more difficult thereafter. The tide was low (1.7 ft.) at 8.41 a.m. and high (4.0 ft) at 2.51 p.m. The accompanying sketch map (Fig. 73) shows the distribution of the birds on the bay that day. I believe most, if not all, the brant in the vicinity were in the bay as I saw no flocks flying back and forth to the ocean across the bar. It is singular that although Tomales Bay extends southeastward about 7 miles from Marshall, I have never in some 40 to 50 trips to the bay seen a brant south of a point a half-mile north of this town. At first, I attributed this condition to the fact that their main food, eel grass, did not grow south of this point; but I now understand that it does, so I am at a loss to explain this matter.

Mr. T. T. McCabe counted the brant on Drakes Bay, February 11, 1932, working from the shore with glasses. He comments on his work as follows: "I caught the six o'clock ferry and in the course of a long day covered all of the west and practically all the east side including

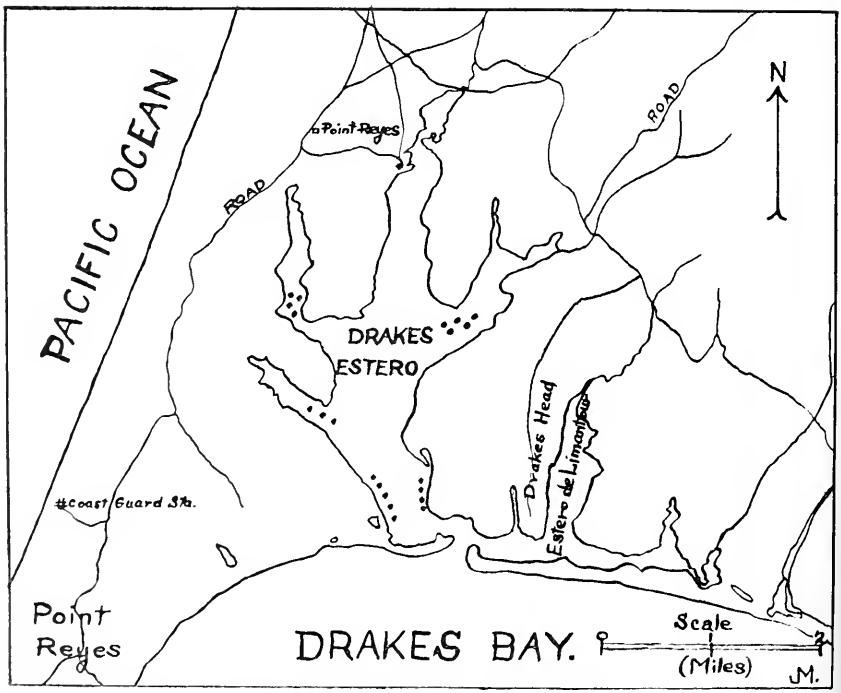


Fig. 74. Drakes Bay, Marin County, California (after U. S. G. S. Topo. Map), showing position of black brant, February 11, 1932. Each dot represents 100 birds.

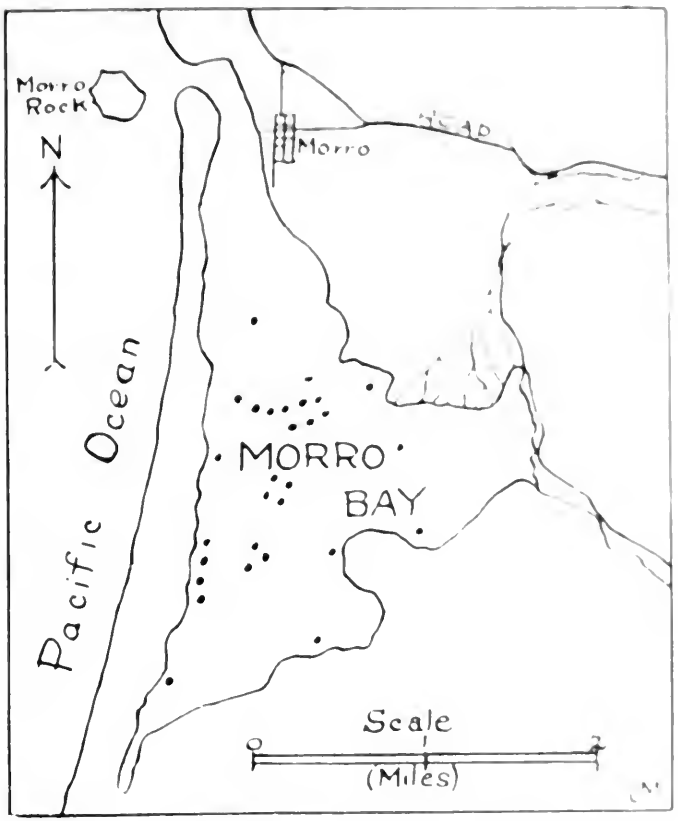


Fig. 74. Morro Bay. Scale [illegible] Chart [illegible] U. S. C. & G. S. [illegible] March [illegible] water [illegible] at [illegible] each.

all of the various arms, all of which I was at [illegible] I did not quite perfectly cover the upper end of the Estuero [illegible] tour. I counted 2108 brant. Almost all of these were [illegible] bird. I enclose a tracing from the topographical [illegible] the flocks were (see Fig. 74), though towards [illegible] was some shifting back and forth."

I made the count on Morro Bay, February 10, 1932, [illegible] at 9 a.m. and finishing at noon. Apparently all the [illegible] ing in the bay as no flock was seen interchanging to [illegible] and the ocean. The tide was low (1.6 ft.) at 6:44 a.m. and high (4.6 ft.) at 1:21 p.m. The day was partly cloudy with a moderate west wind which blew with increasing intensity up to noon. The accompanying map (Fig. 75) shows that most of the birds were found in the center of the bay. This was contrary to the condition that existed in 1931 when the brant were concentrated in the lower, or southeast end of the bay. A very satisfactory count was secured, mainly because there were no fishermen or other boats out to interfere with my work and disturb the birds.

Mr. L. M. Huey kindly searched Mission and San Diego bays for brant on February 12, 1931. He wrote the next day as follows: "I spent yesterday afternoon scouring San Diego and Mission bays for brant, but was unsuccessful in seeing a single individual. I selected the most promising time for this search, which was the lowest possible tide with afternoon light enabling me to use glasses and scrutinize most of the large flocks of water birds that had sought the mud flats as their feeding grounds. I called up Mr. Glidden and he reported seeing six brant about a week or ten days ago at the south end of the bay, and I believe Mr. Gander saw a half dozen brant near Coronado during our Christmas bird census." Apparently brant are becoming scarcer annually on Mission and San Diego bays. Evidently too much human activity, especially boating and shooting has all but succeeded in driving this bird away from what was once one of its favorite wintering grounds.

The black brant census work has already provided highly interesting indications in regard to the migration of these birds to and from our waters. It now appears that this goose's migratory flight along the Pacific Coast is quite unique in that the majority of the birds apparently fly far south into Lower California waters in November, where they remain until late December to gradually work northward into our bays and probably those of Oregon and Washington during late December, January and early February. Thus we have a continual southward flight of brant along our coastline during November and early December with little or no halting of the birds in our waters. Our real winter and spring visitant brant do not ordinarily appear until December and are not abundant on our bays until mid-January or later. Evidence, as later provided in this paper, points to the fact that these birds come to us from the south, rather than from the north as one would naturally believe. Our brant population reaches its maximum in February, when it remains about constant until early April when the true northward migratory flight to the breeding grounds commences. This continues in full swing throughout this month and by May, most of the birds have left us. A few belated migrants linger on our waters into May, some, mainly immature birds, not leaving before the latter half of that month. That all Lower California wintering brant do not leave its coast in mid-winter is attested by the fact that some flocks of these birds are noted flying northward along our southern coastline at the time of the main migratory flight in April.

Evidence in support of this theory is as follows, no contrary evidence has yet reached my attention. Mr. Silva, professional brant hunter of Morro Bay, a man thoroughly familiar with the habits of this bird, told me that as usual there had been a continual southward movement of these birds past that point for thiry days commencing November 10, 1931. None of these birds stopped over at Morro Bay longer than to rest there a few hours. Silva said that the first birds to stop in the bay appeared about December 15 and that these and those arriving later *came from the south,* as, he stated, they always do at this season.

I visited Tomales Bay November 11, 1931, where I noted but two flocks of respectively 33 and 26 brant on that date. Mr. Henry J. Jensen, of Hamlet, told me that he saw the first brant of the season

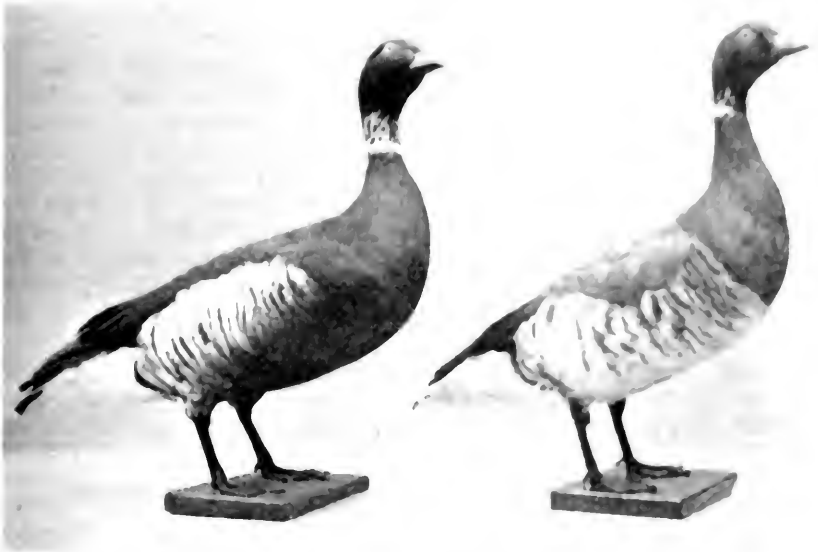


Fig. 7a. Mounted specimens [illegible] the rock brant (C. [illegible])

there on November 8, a flock [illegible] Tomales Bay December 15, 1931, when [illegible] bay and adjacent ocean. These birds were [illegible] possibly belated southbound migrants or [illegible] northbound birds from Lower California, for [illegible] themselves to the bay and flew about the [illegible] in a nervous manner. Brant, when settled on [illegible] larly timed flights between the ocean and their [illegible] inner bay near Hamlet, which are dependent [illegible] this time, Jensen advised that southbound [illegible] per flock had straggled past the bay from [illegible] that at no time prior to December 15 was any [illegible] birds present on the bay. Brant were later [illegible] common on Tomales Bay last winter and there were [illegible] present on my next visit to the region, January [illegible] previously stated, maximum winter numbers [illegible] census-taking time February 11, for on a later visit [illegible] March 16, more birds were noted than in February.

If weather is any factor in governing the [illegible] to our waters and if the birds reach us from [illegible] with most migrants breeding to the north of us, [illegible] the brant to have arrived earlier than usual last winter, [illegible] unusually early and heavy one. That the contrary was [illegible] favor of the supposition that our wintering brant [illegible] south and that the severe weather possibly delayed their movement northward. In furtherance of this theory, it may be pointed out that brant became common on Tomales Bay early in the fall of 1930 and 3087 were counted there on December 16, 1928, both of which were

light, late winters. (See CALIFORNIA FISH AND GAME, Vol. 17, No. 4, p. 398.)

Mr. T. T. McCabe writes as follows regarding an incident witnessed by him at Drake's Bay, February 11, 1932, which is in further support of this supposition: "I ate my lunch on the beach under the cliffs a little east of the sandpit and while I was there, a flock of 18 brant swung up the shore toward Point Reyes, and followed the shore until they got opposite the life saving station, where evidently they could see across to the outside. Here they abruptly changed their course and swung across the neck. In other words, this small flock seemed to be traveling northward along the coast. They did not come out of Drake's Bay."

I was at Humboldt Bay January 20 and 21, 1932, when brant were just commencing to reach that place in numbers. I estimated that not more than 3000 of these birds were then present on South Bay and residents said they had arrived within the preceding three or four days. This makes the date of their first arrival there about January 16, or ten days later than when 1500 birds were seen by me on Tomales Bay some 170 miles to the *southward*. If the birds come to our waters from the north, we should expect them to reach Humboldt Bay before Tomales Bay, that the contrary is the case suggests that they fly northward from the south of us. January 18 was a stormy day with a strong south wind at Humboldt Bay. January 20, fishermen who had been outside Humboldt Bar or entrance on January 19 stated that "flocks of one or two hundred brant were continually arriving from the *south*" throughout that day.

In order to confirm these indications regarding the black brant's migration, information relative to the manner of the birds occurrence

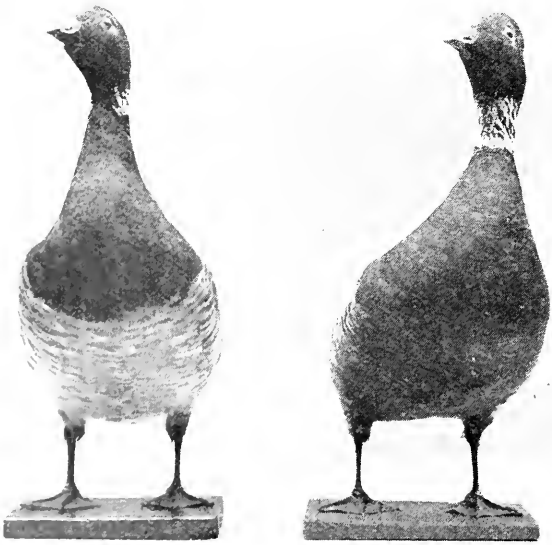


Fig. 77. The same birds shown in Fig. 76. Eastern brant (left) shows the lighter undersurface and narrow collar. Photo by James Moffitt.

to the north and south of its temperate [illegible] in regard to the status of brant in Lower California [illegible] few data are available. The only information [illegible] kindly provided by Mr. L. M. Huey and [illegible] theory. I quote from his letter as follows: [illegible] making a non-stop migration to Lower California [illegible] quite feasible, as this seems to check with [illegible] been able to get from my fishermen friends [illegible] on the west coast of Lower California. [illegible] gate in vast numbers there during December, January and February, but toward the end of February [illegible] was the condition I found when in San Ignacio Lagoon during April 1927. At that time [illegible] seen, which according to Captain Scott [illegible] to those he had seen during January [illegible]

In response to my inquiry relative to the [illegible] of black brant in the Puget Sound region, Mr. J. V. Mackie, Federal Migratory Bird Officer for the Western Province, kindly wrote as follows, February 24, 1932: "Data [illegible] of arrival and departure, but I can say with certainty that [illegible] do remain in the Gulf of Georgia in considerable numbers during December and January. All reports of hunters indicate that [illegible] occurs in February and that the first southern flight [illegible] I expect to secure more data relative to this bird's [illegible] to the north of California, particularly in Oregon and Washington this winter, which information I will publish later."

Another factor, aside from weather conditions, [illegible] to me as perhaps influencing the Pacific Coast black brant [illegible] flight, namely that of food supply. It may be that the food [illegible] birds in Lower California becomes depleted in mid-winter [illegible] some of them back north to more plentiful feeding grounds [illegible] the true migratory flight commences. It also seems more than a mere coincidence that black brant appear on Tomales Bay, Bodega, Morro, Humboldt bays, I am told, coincident with the first spawning of the Pacific herring (*Clupea pallasi*). This fish deposits its eggs on eel grass and other marine vegetation. The first spawning runs of herring come into Tomales Bay ordinarily between November 15 and 21 and at first spawn on isolated patches of eel grass above low water. Later in the season, when the herring run is at its height, they spawn on practically all of this grass in the northern third of the bay. The brant arrive on Tomales Bay shortly after the herring begin spawning and their partiality in feeding on the isolated patches of grass that have been spawned on by this fish is shown by their concentration at these points along with gulls, loons, scoters and other fish and spawn eating birds. In fact it is through the presence of these birds that the fishermen locate the schools of spawning herring.

The photographs accompanying this paper are published to indicate the differences in plumage between the black brant (*Branta bernicla nigricans*) of the Pacific coasts of America and Asia from the eastern or light-bellied brant (*Branta bernicla hrota*) of our Atlantic seaboard. The black brant breeds on the Arctic coasts and islands of Siberia from the Taimyr Peninsula eastward across northern America to Coronation

Gulf and on the islands east to about longtitude 100° W. It winters south on the western shores of the Pacific to Japan and northern China and on the east from Vancouver Island south to Magdalena Bay, Lower California. The eastern brant breeds in the Arctic regions of eastern North America and in the Canadian Arctic Archipelago, from about 100° W. Long. eastward and south to latitude 74° N., on both western and eastern coasts of Greenland south to 70° N. Lat., and on the Spitzbergen Archipelago. It winters chiefly on the Atlantic coast of the United States from New Jersey to North Carolina, casually south to Florida, and also on the coasts of northwestern Europe. The European brant, the third member of this species, breeds in northern Europe and Asia from Novaya Zemlya to the Taimyr Peninsula, in Franz Josef Land and on Kolguev Island. It winters on the coasts of northwestern Europe.

Occasionally, but very rarely, eastern brant are reported from the Pacific Coast and black brant from the Atlantic Coast. These occurrences are regarded as casual stray birds. Thus there is one known record of the light-bellied or eastern brant's occurrence in California, an adult male taken near Bird Island, Arcata Bay, Humboldt County, January 30, 1914 (H. C. Bryant, *Condor,* xvi, 1914, p. 183). Doubtless other eastern brant have been killed in California and their capture either not reported or recognized. Sportsmen securing specimens of this rare bird in California are urged to report the fact or preferably to send the specimens to the California Museum of Vertebrate Zoology, or to this Division. The eastern brant apparently occurs more often on the Pacific Coast in the Puget Sound region. Major Allan Brooks has recorded it from Comox, Vancouver Island, several times and states that "about 8 per cent of the brant in Comox Bay are the eastern species." Conversely the black brant has occasionally been reported from the Atlantic Coast, thrice in New York state, twice each in Massachusetts and New Jersey. While the black brant's migration route is along our coastline, it is not infrequently recorded from the Sacramento and San Joaquin valleys and has also been taken as far inland as Pyramid Lake, Nevada, and even on the Bear River marshes of Utah.

For a long time, the black brant was considered to be a species separate from the eastern and European birds. In fact, many authorities and even the latest (fourth) edition of the *American Ornithologists Union Check-List of North American Birds* (1931, p. 38) consider it a full species, which means that it has not been found to interbreed or "intergrade" with either the eastern or European birds. While the nesting grounds of the black and light-bellied brant apparently meet in northern America between 100 and 110 degrees West Longitude, I know of no single specimen ever having been procured in America showing indications of interbreeding. The breeding range, however, of the black brant meets that of the European brant in the region of the Taimyr Peninsula in northern Siberia, where some authorities believe that intergradation between the two birds may exist. Hence, J. L. Peters in his *Check-List of Birds of the World,* Vol. 1, 1931, p. 149, follows the opinion of Schioler (*Danmarks Fugle,* Vol. 1, 1925, pp. 497–523) and of others in considering both the black and light-bellied

brant as simply subspecies of the [illegible] of nomenclature that I prefer to follow.

The black and light bellied brant [illegible] specimens I have indicate that the [illegible] larger. Plumage patterns are identical [illegible] belly (see Fig. 78) and the back [illegible] are very much lighter than in the black brant [illegible] the collar partially encircling the [illegible]

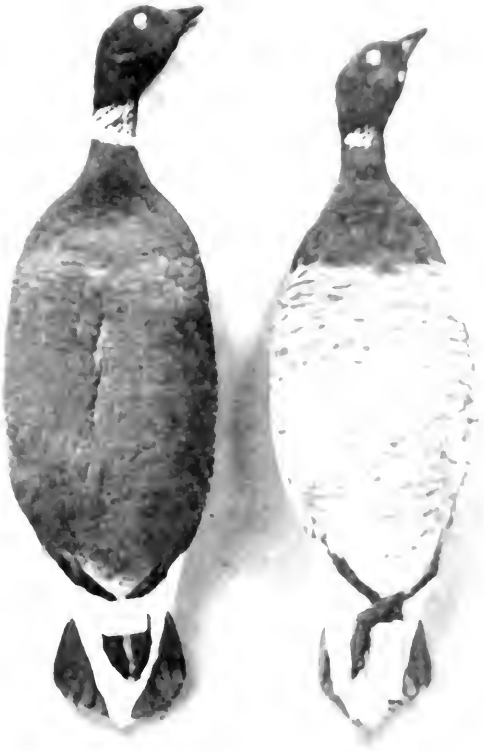


Fig. 78. Study skins of [illegible] and eastern brant [illegible]
Photo by James [illegible]

developed in the Pacific form. These are about [illegible] tinguishing the two forms, which are said to be [illegible] voice, flight, etc.

It is a pleasure to state that the report of the [illegible] Brant Census brought many letters and expressions of [illegible] from California sportsmen. It is hoped that the second report will be [illegible] similarly received that this work may be continued as an annual event.

Thanks are again due to the voluntary cooperators. It would [illegible]

be gratifying if interested parties to the north and south of California could arrange to take similar census at places of brant concentration along the whole Pacific coast from British Columbia to Lower California; in which way a complete census of the number of these birds wintering in America might be obtained. Persons so interested are invited to correspond with the writer in this regard with the promise of his complete cooperation.

ATAVISM IN A CALIFORNIA HALIBUT

By J. B. Phillips, California State Fisheries Laboratory

ATAVISM is a biological term meaning the recurrence in a descendant of characters of a grandparent or more remote ancestor, in other words, reversion to a more primitive type.

A flatfish that had developed pigmentation on most of its lower side as well as on the upper side was an object of interest at one of the Monterey fresh fish markets on March 25, 1932. This flatfish or flounder, 27 inches long and $8\frac{1}{2}$ pounds in weight, was a specimen of the California halibut (*Paralichthys californicus*). The specimen was normal in every respect except for the atavistic pigmentation. Ordinarily the California halibut, as well as all members of the flounder family, develop coloring only on the top side, and the lower or blind side remains white or colorless. In the present specimen not only did the top side have the characteristic greenish brown coloring but the lower or blind side, except for the head region, was also colored a dark brown, the same shade as on the upper side but lacking the greenish tinge.

The flounder family of fishes, including the flounder, halibut, sole, turbot, and plaice, is an interesting group of fishes with us today, which demonstrates the working of evolution. Throughout the centuries, the flounders apparently have evolved from an ordinary symmetrically built pelagic form to the present unsymmetrical bottom form. The flounders still retain their ancestral characteristics in their early development. The eggs of the flounders are pelagic and free-floating in the water. When the larvae hatch from the eggs and for a short period thereafter, the young are normal and symmetrical as are other true fishes. The young after a short period, however, settle down on the bottom, developing the characteristics by which they are easily identified. The cranium and bones of the head become twisted, one eye migrating over to the other side so that both eyes are on the same side of the head. In the meantime, the body becomes flattened dorsoventrally. The flounder's normal position in the water is with its blind side to the bottom, which permits the fish to lie flat on the bottom or to cover itself partially with sand. When it is lying on the bottom, the protective coloration of the exposed side makes the fish invisible to its enemies. The flounder swims by undulations of its body and fins, with its blind side down.

The bottom habit of the flounder has resulted in a lack of pigmentation development on the lower or blind side of the body so that it

is white or colorless on this side. The upper side [illegible] a strongly developed coloring. That this pigmentation is due to the effects of light has been shown by various experiments. Perhaps one of the earliest and most effective experiments was [illegible] J. T. Cunningham,* who worked with plaice. The [illegible]

Fig. 79. [illegible] demonstrating that [illegible] most of the lower [illegible] top [illegible] March, 1912.

aquarium and all light shut out except that which was reflected from a mirror on the bottom of the tank. He chose young plaice that had developed to the point where they had just lost their symmetry and had settled to the bottom. The results of his experiments showed that in the earlier stages of its development the plaice persisted in its acquired tendencies of no pigmentation development on the lower or blind side

* Cunningham, J. T. An experiment concerning the absence of color from the lower sides of flat-fishes. Zool. Anz., Vol. 14, p. 27-32, 1891.

However after about two weeks, pigmentation began developing on the bottom side. The coloration first started along the margins of the sides and worked inwards, finally covering the entire side.

It might be surmised that the present specimen lived over a shallow bottom that had a composition which reflected light such as in Cunningham's experiment. However, this is highly improbable in that more specimens with the same characteristic would have been taken from that same area. The most feasible explanation is that the halibut had for some reason lost its sense of equilibrium. When away from the bottom, it was just as apt to turn bottom side up as top side up. That fishes and other marine animals can lose their sense of equilibrium has been demonstrated by experimenting with the inner ear cavity.

Other instances of atavism around us today are the occasional presence of three toes on a horse's leg and the extension of the spinal column to form a tail in some humans.

SPORTING TACKLE FOR SPORTIVE STEELHEADS

By Tod Powell

(With three photographs by the author) *

ALONG THIS Pacific coast of our Golden State is the habitat, natural environment and home of the fightin'est freshwater fish that ever flang his lip over a hook. You of the anglers' clan know "whatof" I speak—the steelhead of our coastal streams—the he-battling fish that lures Waltonians from the world around.

Big Sur, Carmel, Soquel, San Lorenzo—at seasons you'll find the finned scrappers in these streams. Pescadero and San Gregorio—you'll find the husky steelhead there, too, when the bars are open in the latter part of winter. And then there's the Papermill Creek of Marvelous Marin and the White House Pool near Point Reyes, and a jump farther north to the Russian River with its Duncan's Mills, Bohemian and other pools.

The Gualala, Garcia, Navarro, Albion, Big, Noyo, Mattole and many another stream up coast are splendid steelhead waters. But all of them are comparatively minor to the Eel in the heart of the Redwood Empire, and the mighty Klamath, the great daddy of all California fishing streams, the one by all the rights of the gods and the laws of man that should forevermore be kept entirely free for the perpetuation of the grand and glorious salmon and the tackle-smashing steelhead. This river is the one last stream of consequence in all the thousand-mile coastline of California which could be set aside for salmon and steelhead to insure their kind against extinction.

Tackle! Steelhead tackle! That's my subject, but I wandered afield, or rather upstream as it were, with my enthusiasm locating pools and riffles for you.

* These photographs released for use or reproduction only as illustrations for Tod Powell's article, "Sporting Tackle for Sportive Steelheads" in California Fish and Game, Volume 18, number 4, October, 1932.

Inasmuch as fly fishing [illegible] to take steelhead who never [illegible] that type of tackle will be [illegible]

Fly rods for steelhead [illegible] bone, plus enough power to [illegible] of a long heavy line. [illegible] will give a rod great [illegible]

Fig. 80. Whipping the mighty [illegible] head that lures Waller [illegible]

nearly so violent to the rod as it is [illegible] pick up your cast from heavy water. [illegible] mended for steelhead fishing. They will [illegible] punishment from this type of fishing will [illegible] that isn't fair to a fine fly rod.

A sturdy 9-foot rod of from 5½ to 6½ ounces may be used successfully, but unless you are some inches above six feet in height you'll

better use either a 9½- or 10-foot rod. This additional six or twelve inches is to offset some of your depth wading waist deep in the stream, as it will require all of the reach it is possible to command to clear the long forward cast and then pick up the retrieve against water friction. A 9½-foot rod should weigh at least 6 ounces preferably a half to three-quarter ounces more, and a 10-foot one should weigh from 6¾ to 7½ ounces. Once, on the Rogue, I used a 10-foot rod weighing only 5¾ ounces. It was a grand rod, but most assuredly it was an exceptional one—one in thousands.

The long 7-ounce—or more—rod would readily become a very tiresome piece of equipment in case one wielded it all day long on an ordinary trout stream, but for the period the best steelhead fly fishing is really on—an hour and a half or more before sunset—it isn't such a task to work the big stick, especially if you have some activity on the water-terminal of your line. My old pet heavy bamboo became very light one evening when I fed a whole pear-picking crew along the river by taking on a fly, five snorting good steelhead, total weight 39 pounds.

The best rods for steelhead fly fishing are specially hand-made by skilled artisans, but any fly rod, regardless of price, which has the power and specifications mentioned above will give you what you want—the capacity to cast properly a fairly long line and to stand up under heavy work. As this sort of fishing is done *with the rod,* your selection should be centered on this part of your equipment—not, however, neglecting the other items used.

For steelhead a single-action fly-reel is best. In trout fishing your reel is more or less just a house for your line, but in steelhead fishing you want a better reel and a larger reel. It should, by all means, have an adjustable tension, because when one of these fellows takes your fly and starts away with it, he goes places at express speed and a reel which has no braking action, click tension or adjustable tension of some kind is quite likely to race on and on with the burst of speed, thus causing your line to backlash and creating a snarl that means the end of that particular catch right then.

The reel should have capacity for a full 30-yard fly-casting line, with about 250 feet of backing. Steelhead often make an initial run of more than 75 yards and if you haven't the line there to take care of it—good-bye fish! The best of the reels have been made in England, but of late years American tackle-makers, appreciating the demand for a high-class product, have turned out reels that will do the work quite as acceptably.

As for a line, the best is a fairly heavy double-tapered product of at least 30-yard length and of soft smooth finish. The newly developed triple-tapered line has added advantages, especially on lighter weight rods. The reel and line should balance your rod, and achieving this balance by fitting a line to the already selected rod and reel is a job for an expert. Here is one place where you should deal with a salesman you can trust, at least until you have acquired knowledge through your own experience.

Spliced to this tapered line should be your backing, and this can be either light-weight braided silk or cuttyhunk. Be sure the splice is small, smooth and even, that it may run readily through the guides of your rod. The best of the tapered lines, like the reels, originated in

England but very good ones are to be [illegible] carefully dressed and vacuum filled [illegible]

Of course steelhead can be caught [illegible] some people have taken them on [illegible] line makes for a clearer cast and [illegible] the line out far better.

Fig. 5. [illegible]

Leaders for the steelhead fly game preferably run [illegible] in length and may be either level or tapered. I prefer the tapered, but in any event should be of absolutely first quality. Steelhead leaders should be without loops, as in this sort of fishing the use of [illegible] is decidedly sound ethics.

Flies for steelhead are generally large, number four or number six, are tied wet mode and fished wet. Sometimes a number eight is

used, depending on whether the water is clear or not. The hooks should be sturdy ones, never the delicate Sneek bend or such models. Most of the successful flies are gaudy contraptions that look like nothing a fish ever ate or saw before, though of recent years the more modest bucktails and streamers have been used to advantage.

A great many of these flies show red but there is no more exact rule for selecting this color than for any other department of angling, unless some steelhead, sometime, may advise that the red in fly-tie gives semblance to his favorite tid-bit, the roe. It is a good idea to buy your flies from a dealer who lives near the water you intend to fish and knows something of the local idiosyncracies of the fish and stream.

Some flies have been developed especially for steelhead and, consequently, have been named for California anglers whose catches of this heroic battler have won them fame. Among them are the Carson, Soule and Sam Wells. The Railbird, Kate, Red Ibis, Royal Coachman, the old reliable Parmachene Belle and the March Brown are other flies frequently used with success. Most of these are additionally millinered with a couple of feathers from the neck of India's sacred bird, the Jungle Cock.

Steelhead flies ordinarily are not snelled and should properly be tied by the angler to the leader of his choice.

A net or gaff is very nearly useless and not quite the sporting thing anyway in fly fishing for steelhead. The best way to land this fish is to wear him down by skillful angling and then beach him. And a creel or basket for he-sized steelhead is out of the question.

Fly-fishing, desirable as it seems to many, is not, however, the only means of taking steelhead. There are a percentage of fishermen who prefer to use spinners or bait. In spinner fishing a heavy fly-rod can be used but it is not advisable, as the strain takes the action out of it and deprives it of the very thing for which it was made and purchased—the finely actioned ability to make a long and accurate cast.

For this sort of fishing, especially when done from the shore, the lure-casting rod used for bass and other spiny-rayed fish is both preferable and superior, and split bamboo is superior to steel. Many anglers use a 5- to 6-foot rod; the foreign type of spinning rod, a few feet longer, makes a sportier outfit and gives more flexible action.

In this type of fishing the reel is of greater importance than in fly fishing. Consequently you will wish to give more attention to the reel used for this sort of work than to the rod. One of quality with a low, wide spool and quadruple action should be selected. Ones made in America lead the world.

For a line, silk, the ordinary bait-casting line, but not too heavy gauge. A line with a breaking strain of 12 to 15 pounds makes casting easier and since you're not out to land your fish with an anchor chain and windlass, why not use the sportier tackle anyway?

And don't forget that a hundred yards of line will seldom, if ever, be too much.

You will need about a 6-foot leader for this sort of work—and, of course, it should be proportioned in strength to the line you are using.

Spinners numbers 3 or 4 are most used. Some anglers use brass, some copper, some copper and nickel and some use all three, or rather four in the additional case of the nickel and copper reversed.

And many spinners used are made up with [illegible]
shank. The matter is one of individual [illegible]
The copper nickel spinner is often [illegible]
water shows murkiness.

It is a well known fact that [illegible]
stream and are voracious eaters of [illegible]
which can be obtained ready prepared [illegible]
So also is the roe from freshly [illegible]
steelhead.

In the winter runs, the steelhead [illegible]
opinion that a steelhead rarely [illegible]
is instead attracted or annoyed by [illegible]
as the flash of a spinner will cause it [illegible]
winter, with more or less [illegible]

Fig. 82. In mid-winter [illegible]
"strawberry" [illegible]

the rule, it seems a spinner or salmon egg [illegible]
salmon eggs, tied up in cheesecloth, making [illegible]
as a "strawberry" is the best lure. It can be [illegible]
red fabric to contain the eggs and red thread [illegible]

Many anglers who go after steelhead in the [illegible]
making use of a method developed, I believe, in California [illegible]
"strip casting." This method has the advantages [illegible]
convenience. For it the angler provides himself with [illegible]
basket from his office desk, a folding canvas washbasin or [illegible]
tray-like container which he attaches to the front of his belt. He uses
a sporty 9- or 10-foot rod, a free running reel and a good [illegible] braided
silk line. Sometimes the line is waterproofed, as the fishing is usually
in brackish water, the reaches of tidewater. Sometimes, too, the line
is made up of 40 or 50 yards of synthetic Japanese gut leader backed

with the same amount of silk or cuttyhunk. This gut becomes very flexible and free-running when wet. A light bell sinker is used on the line.

With this outfit the fisherman simply strips the line from his rod after every cast and arranges it in coils in his basket or tray before him. Then when he casts again it picks up very rapidly and, because of its extreme flexibility, the accuracy of his cast is limited only by his own skill.

Waders and felt-soled shoes are the accepted garb of the steelhead fisherman. Hip boots are, almost without exception, useless in the heavier steelhead rivers. In case you are fishing heavy waters and are ill at ease regarding the safety of waders, you can step out in wool sox, wool underwear, wool trousers and either felt-soled shoes or brogues with hobs. However, this takes a pretty hardy constitution, for steelhead waters in the fall and winter are cold and most of us cannot stand the chill which they set up.

With equipment such as I have outlined above a man may enjoy steelhead fishing for what it is—a fair battle between a smart, gamy fish and a man who has deliberately reduced the odds given him by his intelligence and physical strength to a point where he is somewhere near fish-size. I have seen many men on the rivers after steelhead with deep-sea rods and lines and everything else in proportion.

Personally, I see no more real sport in this than in shooting tame quail on the ground. If you eliminate the difficulties of a sport you've eliminated its charm. Sporting tackle for sporting fish, say I—and leave the other stuff to the meat-hunters.

THE WHITE SEA-BASS AND RELATED SPECIES THAT ARE SOLD IN CALIFORNIA FISH MARKETS [1]

By R. S. Croker

FOR SEVERAL YEARS California fresh fish markets have been selling several closely related species of fish under the names "white sea-bass" and "corbina." Prior to about 1927, however, the only species sold under the former name was the true white sea-bass (*Cynoscion nobilis*), and no fish called corbina was offered for sale. At present, California fishermen operating off the Pacific coast of Lower California catch several species quite similar to the white sea-bass and dealers sell them under the names "white sea-bass," "sea-trout" and "corbina." In addition Mexican fishermen, operating in the Gulf of California, ship two other similar species to California dealers under the names of "corbina" and "white sea-bass" or "totuava." All six species are so much alike that a casual observer would not distinguish them.

[1] Contribution No. 127, from the California State Fisheries Laboratory, August, 1932.

The real white sea bass is protected from [illegible] by a closed season and a minimum size limit,[2] but the related species are not. This article has been prepared to enable fishermen, dealers and [illegible] ment officers to distinguish the various species of [illegible] tentional violations and unnecessary arrests. [illegible] to untangle the existing confusion of common [illegible] and retail dealers will be able to sell each species by [illegible] and so the consumer will know just what species [illegible]

The California corbina (*Menticirrhus undulatus*) [illegible] law.[2] A description of this species is included [illegible] point out the differences between it and the other corbinas [illegible] no legal protection.

The following key includes all the species of the genus *Cynoscion* (the white sea bass, gulf corbina and their allies) [illegible] occur in the waters of California, Lower California, Sonora and Sinaloa. If it is not certain that any fish in question is [illegible] genus, the use of the key in the "Handbook of Common [illegible] Game Fishes of California" is recommended. [illegible] down to section 95, page 22 of the Handbook [illegible] *Cynoscion*. As the key in the Handbook includes [illegible] only, the following key has been prepared to take the [illegible] 95. Figure 83 illustrates the anatomical terms employed [illegible] key.

[2] Consult current fish and game laws for details.

[3] Walford, Lionel A. Handbook of common [illegible] fornia. Calif. Div. Fish and Game, Fish Bul. No. [illegible]

A KEY TO THE IDENTIFICATION OF THE SPECIES OF CYNOSCION THAT OCCUR ON THE PACIFIC COAST OF MEXICO

1. IF: The anal and second dorsal fins are densely covered with small scales, the fish is a Gulf Corbina (*Cynoscion othonopterus*). See page 321.

BUT IF: There are no scales on the anal and second dorsal fins, see section 2. (*Note:* The low sheath of scales at the base of the fins is not to be confused with the scaly covering that extends over nearly the entire fin of the Gulf Corbina.)

* * * *

2. IF: The back is covered with dark horizontal streaks and there is a light stripe along the lateral line, the fish is a Striped Corbina (*Cynoscion reticulatus*). See page 322.

BUT IF: There are no horizontal streaks or stripes on the body, see section 3.

* * * *

3. IF: The lining of the mouth is bright orange yellow and the tail fin is yellow, the fish is an Orange-Mouthed Corbina (*Cynoscion xanthulus*). See page 323.

BUT IF: The lining of the mouth is white or pale yellow and the tail fin is dusky, see section 4.

* * * *

4. IF: The anal fin has 2 spines and but 7 soft rays, the fish is a Totuava (*Cynoscion macdonaldi*). See page 324.

BUT IF: The anal fin has 2 spines and 9 or 10 soft rays, see section 5. (*Note:* The anal spines of all species of *Cynoscion* are often imbedded in skin and consequently hard to see but it is the number of soft rays that is important here.)

* * * *

5. IF: The inner surface of the pectoral fin is black and the pectoral fin reaches to or beyond the tip of the ventral fin when both fins are flat against body, the fish is a White Sea-Bass (*Cynoscion nobilis*). See page 325.

BUT IF: The pectoral fin does not nearly reach to the tip of the ventral when both fins are flat against body, the fish is a Short-Fin Sea-Bass (*Cynoscion parvipinnis*). See page 326.

NOTE.—The California Corbina (*Menticirrhus undulatus*) differs from the Gulf, Striped and Orange-Mouthed Corbinas in the possession of a barbel on the lower jaw and in the possession of a snout that projects beyond the lower jaw. It differs from other related forms in its slim body and in having but one anal spine. See page 327.

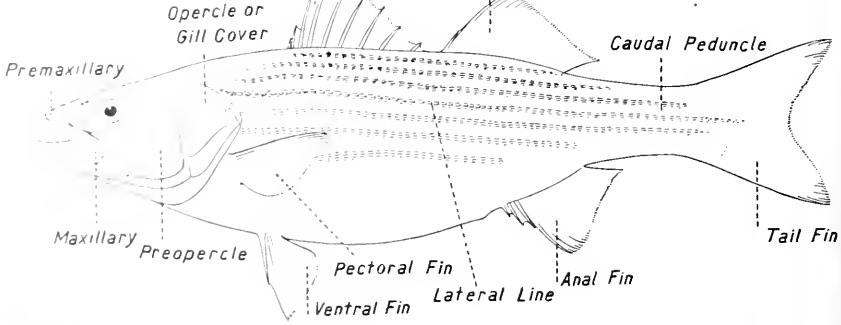


Fig. 4. Illustrating anatomical terms used in key. (Drawing from Starks, 1921.)

Fig. 81. Photo by [illegible]

GULF CORBINA

Cynoscion othonopterus

Distinguishing Characters: All fins except [illegible] fine scales; 23 or more rays in second dorsal fin [illegible] reaching to tip of ventral fin; 1 or 2 long canine teeth [illegible] ones on each side of them. *Color:* Steel blue above, [illegible] below; fine dark points everywhere; lower fins yellow; [illegible] fins dusky.

Distribution: Gulf of California.

Fishing Season: Autumn, winter and spring.

Importance: Commercially the most important [illegible] to California markets exceeded 115,000 pounds. Shipped [illegible] Gulf ports to San Pedro and Los Angeles.

Fishing Gear: Hand lines, set lines.

Unauthorized Names: Mexican [illegible]

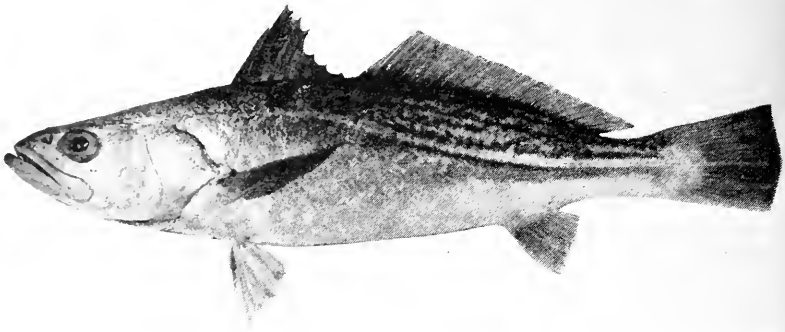


Fig. 85. Photo by D. H. Fry, Jr.

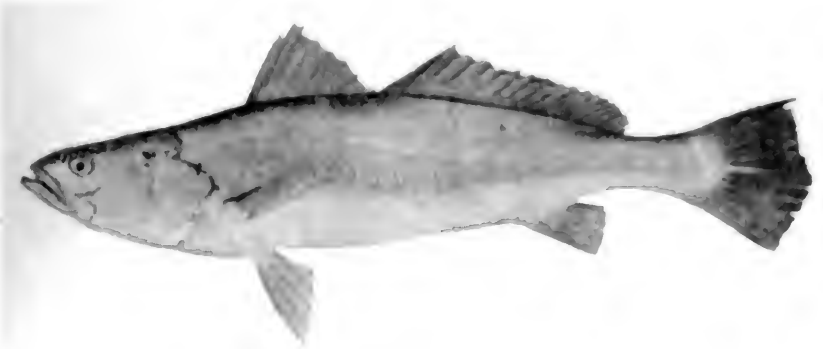
STRIPED CORBINA

Cynoscion reticulatus

Distinguishing Characters: All fins without scales; pectoral fin inserted directly above ventral fin insertion and its tip reaching beyond tip of ventral fin; back covered with dark brown streaks; lateral line in a light stripe bordered above and below by darker ones. *Color:* Back and sides marked as described above; belly silvery; lower part of sides, head and tail with many small dark points; tail fin yellow; inside of mouth orange.

Distribution: Lower California south to Panama.

Importance: Not brought to California in commercial quantities.



ORANGE MOUTHED CORBINA

Cynoscion xanthulus

Distinguishing Characters: Soft [illegible] fin just or not quite reaching to tip of ventral [illegible] tail fin yellow. *Color.* Bluish above and on [illegible] with many small dark points. Lining of [illegible] spring.

Distribution: Pacific coast of Mexico.

Fishing Season: Brought to California [illegible] spring.

Importance: Of minor commercial [illegible].

Fishing Gear: Hand lines, set lines.

Unauthorized Name: Sometimes misspelled [illegible].

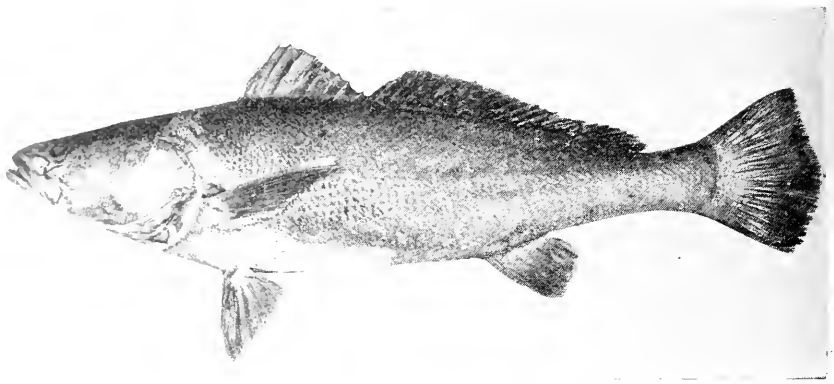


Fig. 87. Photo by Hawthorne Studios, Los Angeles.

TOTUAVA

Cynoscion macdonaldi

Distinguishing Characters: Fins without scales; no horizontal stripes on body; anal fin with 7 soft rays; lining of mouth pale yellow; tail fin dusky. *Color:* Metallic, bluish gray above, becoming dusky silvery on sides and belly; tail fin dark, other fins pale. Young with coarse black specks along lower part of the head and sides; back with many irregular spots which disappear with age. *Size:* The females attain to a weight of over 200 pounds; the males are said to be much smaller, seldom exceeding 75 pounds.

Distribution: Gulf of California and mouth of Colorado River.

Fishing Season: Fall, winter and spring.

Importance: One of the most important species handled by California fresh fish markets; 1931 deliveries in California were over 1,300,000 pounds. Shipped overland by truck from fishing towns on Gulf to San Pedro and Los Angeles. Also shipped by truck and rail to Arizona cities. A soup stock, which is popular with Chinese, is made from the air bladders of the large females. Sportsmen hold this fish in high esteem.

Fishing Gear: Hand lines, set lines, spears.

Unauthorized Names: Mexican sea-bass, white sea-bass. The Mexican fishermen call the males "machorro" and the females "totuava."

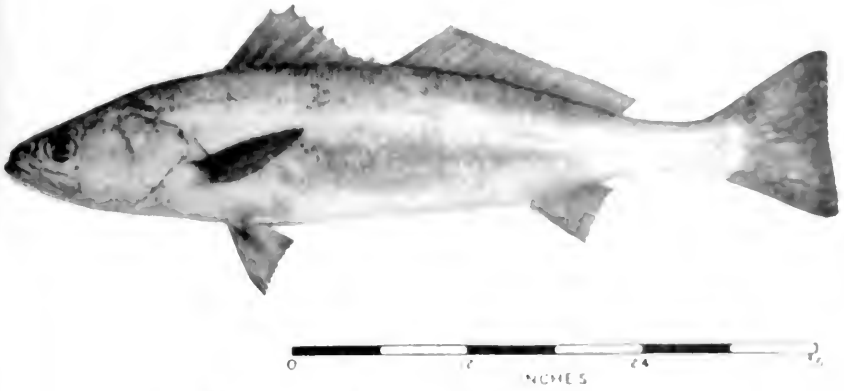


Fig. [illegible] [illegible]

WHITE SEA BASS

Cynoscion nobilis

Distinguishing Characters: Soft fins without [illegible] body, anal fin with 2 soft rays, pectoral fin [illegible] ventral fin when both fins are flat against body [illegible] white; dark brown or black spot at base of pectoral fin [illegible] face of fin. *Color:* Bluish gray above, frosted silver. [illegible] points on body; dark spot at base of pectoral fin, all fins [illegible] have 3 to 7 vertical cross bands on body and an entirely [illegible]

Distribution: Puget Sound to Gulf of California [illegible] Francisco.

Fishing Season: Legal open season is from July 1 to April [illegible] writing (1932). Maximum landings are during [illegible]

Importance: One of the most important [illegible] markets of California. The total catch for 1931 was [illegible] 340,000 pounds came from the west coast of Lower California [illegible] are made at San Pedro and San Diego. Highly [illegible]

Fishing Gear: Commercial: round haul net, [illegible] hook and line; sport: hook and line.

Unauthorized Name: The young are sometimes [illegible] fishermen mistakingly thinking they are of a different [illegible]

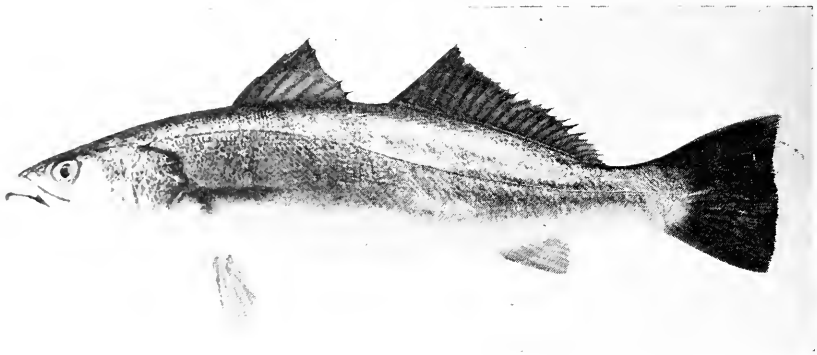


Fig. 89. Photo by Hawthorne Studios, Los Angeles.

SHORT-FIN SEA-BASS

Cynoscion parvipinnis

Distinguishing Characters: Soft fins scaleless; no horizontal stripes; anal fin with 9 or 10 soft rays; pectoral fin short, not nearly reaching to tip of ventral fin when both fins are flat against body; a pair of long canine teeth in the middle of upper jaw; tail fin dusky; lining of mouth pale. *Color:* Metallic, bluish above, lighter on sides and belly; sides and back with numerous small dark points; lower fins white, others dusky.

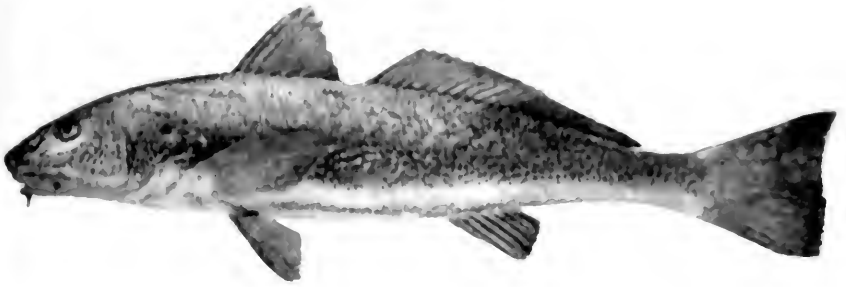
Distribution: Pacific coast of Lower California, and Gulf of California; occasionally strays as far north as San Pedro, California.

Fishing Season: Brought to California ports during fall, winter and spring.

Importance: Of minor commercial importance at present writing (1932). Forms a small proportion of the white sea-bass catch.

Fishing Gear: Caught in Mexican waters by California boats using hand lines and gill nets.

Unauthorized Names: Incorrectly called sea-trout, bluefish.



CALIFORNIA CORBINA

Menticirrhus undulatus

Distinguishing Characters: Barbel on lower jaw [illegible] jaw, single spine on anal fin, long slender body. Color [illegible] blue on the back shading into gray on the side and becoming [illegible] vague, dark, wavy lines made by dark points in the center of [illegible] upward and backward on the back, the back sometimes has [illegible] small black dots are on the lower part of the sides.

Distribution: Point Conception southward into the Gulf of [illegible] Occasionally found as far north as San Francisco. Usually [illegible] shore in the surf of sandy beaches.

Fishing Season: Caught by sportsmen throughout the year.

Importance: At present writing (1932), it is contrary to the law [illegible] this species with nets or to sell or buy it in California. Highly [illegible] sportsmen.

Fishing Gear: Caught with hook and line from piers or [illegible] sandy beaches.

Unauthorized Names: California whiting, corvina [illegible]

IMPROVEMENTS IN SARDINE FISHING GEAR IN THE MONTEREY REGION (1930–1932) [1]

By J. B. Phillips

(With three photographs by the author)

PREVIOUS to the 1929–1930 sardine season, the lampara net furnished almost the entire supply of sardines to Monterey sardine plants. During the 1930–1931 and 1931–1932 seasons, the entire cannery supply of sardines at Monterey has been caught by crews using purse nets. The purse nets are of two types: the purse seine and the ring net. The purse seine has evolved through years of use while the ring net is a comparatively recent gear.

The modern ring net came into being at Monterey during the 1929–1930 sardine season. The influx of a large number of purse seine boats during the aforementioned season caused the lampara crews to abandon the entirely hand-operated lampara net in favor of the more competitive semipowered operated ring net.[2] The ring net gained early popularity. Because of its light construction it can be adapted for use on either the lampara or the purse seine type boats. On the other hand, the purse seine can be successfully used only on a purse seine type boat, while the lampara net can be successfully operated only on a lampara type boat. The purse seine may readily be differentiated from the ring net by the fact that the heavier webbing of the purse seine permits it to be tarred (webbing is tarred but once before using), while the lighter webbing of the ring net is tanned. (Tanning is accomplished by placing the net in a hot tan bark solution, preferably once every two weeks during continuous fishing.)

During the 1929–1930 sardine season about 90 per cent of the ring net crews had the landing bag in the middle of the net. The landing bag is that portion of the net of heavier webbing into which the catch is bunched preparatory to brailing. The rest of the ring net crews had the landing bag at one end as with a purse seine. Having the landing bag in the middle of the net requires more men as the net must be pulled from both ends at the same time. Also the net must be repiled after each haul, but when the bag is at one end the net is piled in position for the next lay-out while the net is being hauled in. During the 1930–1931 season the crews with ring nets having the landing bag in the middle, commenced changing the bag to one end, so that by the end of the 1931–1932 season only about 10 per cent of the crews were fishing with ring nets having the bag in the middle. The original placing of the landing bag in the middle of the net was most likely a carryover of the lampara net which had been in use at Monterey for so many years.

[1] Contribution No. 123 from the California State Fisheries Laboratory, April, 1932.

[2] Phillips, J. B. Success of the purse seine boat in the sardine fishery at Monterey (1929–1930 fishing season). Calif. Div. Fish and Game, Fish Bull., No. 23, 1930.

Fry, Donald H., Jr. The ring net, half ring net, or purse lampara in the fisheries of California. Calif. Div. Fish and Game, Fish Bull., No. 27, 1930.

Fig. 91. A Monterey [illegible] crew [illegible] practice with [illegible] lighter [illegible] August, 1929.

Former lampara crews now [illegible] laying out of their nets by attaching one end [illegible] instead of the lighter. The buoy is usually a [illegible] weighted so that a protected small light [illegible] bulb is lighted by a dry cell inside the barrel. [illegible] outfit consisted of a launch and a lighter which was towed [illegible] launch for transporting the catch. The net was piled [illegible] the launch. When the ring net was first used [illegible] of the crews employed the following procedure when [illegible] sardines: When a school of sardines was sighted the [illegible] drawn up to the launch and one end of the net fastened [illegible] The lighter would then be cast free and the circle of net [illegible] the fish. When the circle was completed and the [illegible] the lighter, the first end of the net was taken on board [illegible] the net hauled aboard. This procedure was undoubtedly [illegible] lampara net days. The universal method now [illegible] net and also the lighter rope tied to the buoy. The [illegible] the buoy and the lighter is then given a turn or two around the [illegible] post of the launch. When fish are sighted the [illegible] the buoy cast overboard. The resistance for pulling [illegible] launch is still furnished by the lighter, but when the circle is completed only the buoy is picked up. The lighter is not pulled up [illegible] until the catch has been bunched preparatory to brailing. On the other hand, the purse seine boats are not handicapped by having to tow a lighter inasmuch as the catch is loaded into a [illegible] board. A large skiff is taken along, to which one end of the net is made fast. When fish are sighted the skiff is cast loose with sometimes one or two men in the long oars to furnish added resistance, if necessary, to start the net into the water.

A lighted buoy is sometimes used by purse seine boats to mark a small school of fish, while cruising around in the same vicinity in search of a more desirable school.

Another improvement of the lampara boat crews now using ring nets is the use of an electric light for a "scare" while the net is being closed. This consists of an incandescent bulb in a water-tight socket, attached to a waterproof cord. The light is dropped far enough in the water so that the fish are frightened backward and upward from the opening of the net, as the net is being pursed. This method of frightening was introduced by the San Pedro purse seine boats during the 1929–1930 sardine season. Fry (1930) reports that the use of the electric light scare originated in southern California waters during the 1928–1929 sardine season.

The larger purse seine boats on which ring nets have been used are being changed back to purse seines again. At Monterey, the ring net was first tried on the purse seine boat during the 1929–1930 season when four crews, or about 15 per cent of the purse seine boats, used the net. In all cases the turntable was removed and the net piled directly on deck. During the 1930–1931 season about 15 crews, or about 50 per cent of the purse seine boats, used the ring net. However, as the season progressed these crews found that the ring net was not as well adapted to the large boats as might be. Toward the latter part of the aforementioned season, some of the boats commenced replacing their turntables and either used ring nets on the turntables until the nets were badly worn, or directly replaced the ring net with a purse seine. During the 1931–1932 season, about 9 crews, or about 25 per cent of the purse seine boats, were using ring nets. Some of the Monterey owned purse seine boats that used a ring net previously and changed to a purse seine during the 1931–1932 season are: *Pal*, *Francis*, *Ranger*, *St. Joseph*, *Dante Alighieri*, *Serra*, and *Johnny Boy*.

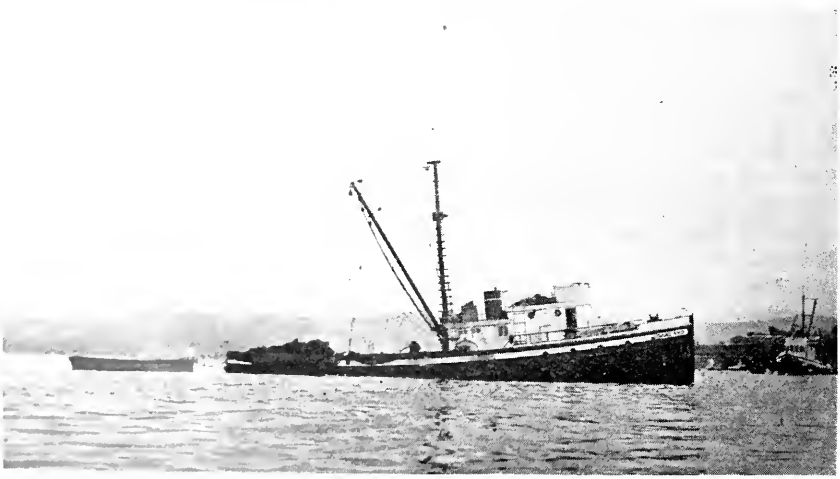


Fig. 92. A sardine purse seine boat of the larger type waiting to unload its fare at a Monterey cannery. Note the long movable boom which is hinged to the mast at the lower end. The hoisting ropes run through the blocks at the top of the boom. This boat is about 80 feet long. February, 1932.

A number of purse seine crews have come to [illegible] waters to fish in the Monterey region. These [illegible] the nets used in the southern waters are [illegible] in the northern waters, and have invariably [illegible] fathoms. This has been due to the method [illegible] sardines in the Monterey region. Practically [illegible] seine boats in the Monterey region (1931-1932) range between 160-200 fathoms in length.

All of the purse seine type boats in the Monterey region are [illegible] using the long bag dip net for unloading of the catch from the net into the hold. These dip nets consist of an iron ring 4 to 5 feet in diameter from which is suspended a bag of webbing 18 to 24 feet long. This bag is closed at the end, terminating in a rope which runs through a block at the end of the movable boom overhead. A long wooden handle, usually the length of the webbing, is fastened to the iron hoop so that the mouth of the dip net can be guided. The dip net can be raised or lowered by means of a rope attached to the hoop in a three-point suspension and running through a block at the end of the movable boom overhead. The contents are emptied by placing the hoop perpendicular to the opening of the hold and then raising the closed end of the net by reeling in on the rope attached to it, also running through an overhead block. The rope is reeled in by taking a turn or two on a small revolving drum. The advantage of the long bag dip net is the speed with which the bunched catch can be unloaded from the net. From 1500-3500 pounds at a dip, or at the rate of 60-80 tons per hour, can readily be loaded. Also the long bag dip net can be pushed deep enough so that the dead or weakened fish can be scooped up from the bottom of the net first.

A centrifugal suction pump for unloading of the catch from the net into the hold of the boat was given preliminary trials on the purse seine boat *Pal* during the latter part of the 1931-1932 season. The principle is the same as that involved in the suction pumping of the fish from the fishing boats to the canneries. However, the pump has not yet been perfected for use on boats, and its high cost at this time makes it prohibitive.

CALIFORNIA FISH AND GAME

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Vol. 18 OCTOBER, 1932 No. 4

THE OUT-OF-DOORS

"A call from the open spaces, a call from the forests dim;
A call from the rushing rapids, from the partridge on the limb;
A call from the endless marshes and the driving flocks of ducks;
A call from the great white waters or a challenge from antlered bucks.

Sometime, somehow, it comes to us that vague, unreasoning want—
The ghost of the long ago returns our lives to haunt;
A voice of the time in the long ago when man hunted flesh for his life,
And fought and killed and ate and slept and lived in the forest's strife.

Those times are gone, and now we sit—bloated with other's kill—
But the call of God's own earth comes strong and we heed it as God's will.
We go to the open spaces, we go to the forests dim;
We go to the great white waters, we camp on the blue lake's rim.

We go to the endless marshes, we hunt the flocking ducks;
We fight with the rushing rapids, we answer the antlered bucks;
We go back to the ways of our fathers, we do as they did then;
We live the life God meant us to, we live the life of men."

—ERIC JORDAN.

IS CALIFORNIA'S GAME A REVENUE PRODUCING RESOURCE?

Beginning several days before the opening of the 1931 deer season and continuing for the full thirty-day period, the Sierra National Forest maintained 24-hour registration stations on all roads entering the forest. Under the Hazardous Fire Area law all hunters were requested to register both in and out of the forest, thereby making it possible to obtain practically a perfect record of the deer killed.

In all, 6145 hunters were registered, an average of 207 per day for the season and 1920 automobiles were used on the trip, each averaging 300 miles, or a total of 576,000 miles. Estimating that these cars would obtain 12 miles per gallon of gasoline, and an oil change each 1000 miles, 48,000 gallons of gasoline and 3000 quarts of oil were consumed—equal to 975 drums of gas and oil.

The total number of hunters, running 3.2 men per car, traveled 1,844,000 man miles by auto and 100,000 man miles on foot.

Estimating that each man shot 12 times on the trip, either at game or in testing his rifle, a total of 73,740 cartridges were used—equalling 2687 boxes or slightly over two tons of ammunition.

The records indicate that each man spent an average of [illegible] his hunting trip—a total of 39,942 man days [illegible]

A total of 1400 deer were registered on [illegible] —a much higher average than had been [illegible] exceedingly dry weather and resultant [illegible] In 165 cases, hunters were able to secure [illegible] The total number of deer was estimated at 100 [illegible] 70 tons or 2 carloads of dressed venison [illegible] plete records, and to common belief [illegible] better than forked horns. The actual record [illegible]

2 points 574 3 points 393 4 points [illegible]
6 points 11 7 points 6 8 points [illegible]

In addition to the $18,150 which we [illegible] licenses and tags, it is estimated that each [illegible] for the necessities of the trip. This indicates [illegible] 000 for 140,000 pounds of meat, or $1 per pound [illegible] which brings us to the conclusion that the [illegible] crop has a potential value of $100 per head. We [illegible] that there is an annual kill of at least 20,000 [illegible] national forests, we have an expenditure of some [illegible] that would not be spent if our deer crop failed [illegible] or destruction of their feed and habitat by [illegible] whole thing is that the money is spent in [illegible] practically every enterprise including gas stations, [illegible] and shoe merchants, grocery stores, druggists, garages [illegible] dealers, tobacconists, sporting goods houses, [illegible] and packers, hatters, clothing stores, etc., etc. There [illegible] business for all—whether big game hunter, justice of [illegible] —to assume a direct interest in game conservation and [illegible] always bearing in mind that breeding stock and [illegible] equal value with the legal buck.—Roy H. Brood, Sierra Nat[illegible]

A CORRECTION

Attention wishes to be called to an error which appeared [illegible] July, 1932 (Vol. 18, No. 3), issue of CALIFORNIA FISH AND GAME.

On page 275, Statement of Income reads "For the Period [illegible] 1931, to June 30, 1932, of the Eighty third Fiscal Year" [illegible] read "For the Period July 1, 1931, to March 31, 1932 [illegible] third Fiscal Year."

THE HUNTER'S DAILY DOZEN DON'TS

1. DON'T point your gun, or let it point itself, at anyone, any time, anywhere. Remember, it is always the empty gun that kills.

2. DON'T keep your gun loaded except when actually hunting. In camp and when others are around keep the bolt open.

3. DON'T shoot at any game until you are *sure* and *know* that your partner is not in the line of fire.

4. DON'T ever handle your gun by the muzzle. It is bad enough to have a fool at the other end.

5. DON'T fail to unload your gun when climbing fences or where there is dangerous footing.

6. DON'T go buck hunting without wearing a red hat. It might save you, for it is unlawful to shoot woodpeckers.

7. DON'T fire a gun unless you are *positive* that the gun barrel is clear of all obstructions.

8. DON'T go hunting without first having bought a hunting license. The game warden never sleeps, would pinch his own mother, and is a darn fine fellow—if you are.

9. DON'T lean on the muzzle of a gun or rest it on your foot. You won't look so nice mutilated.

10. DON'T neglect to clean and oil your gun as soon as possible after firing. A gun's efficiency is 99 per cent in the rifling. Once rusted the gun is ruined.

11. DON'T shoot harmless creatures just to see them die, or game that you can not use or pack to camp. It is always unlawful. The greatest charm of the forest is its wild life. Be decent. Treat all forest animals and game as though they were your own private property.

12. DON'T trust a "safety." It isn't always safe. A gun in your hands is a death sentence if your vigilance slackens for a moment. Be careful and in addition to that *be careful!*

HUNTING ACCIDENTS, 1931

Number of persons killed	60
Number of persons wounded, not killed	119
Number of self-inflicted accidents—	
Fatal	34
Nonfatal	64
Number of accidents inflicted by others —	
Fatal	15
Nonfatal	49
Number of accidents, unknown how inflicted—	
Fatal	11
Nonfatal	6
Occurred while hunting large game (deer, bear, etc.)—	
Fatal	23
Nonfatal	36
Occurred while hunting small game (rabbits, duck, quail, etc.)—	
Fatal	16
Nonfatal	55
Occurred while hunting unknown game—	
Fatal	21
Nonfatal	28

Fig. 94. [illegible]

FISHERMEN REPAIR THEIR OWN BOATS

Commercial fishermen are also hard [illegible] period of business dullness. An example of this [illegible] accompanying photograph of a few net boats drawn [illegible] at Monterey for hull scraping. Periodic scraping and [illegible] are necessary because of the accumulation of [illegible] this case the fishermen have taken advantage of the [illegible] during calm weather to beach their craft. They can [illegible] boats during low tide or for about five or six hours after [illegible] tide comes in, when the boats can be floated off the beach. [illegible] times the commercial fisherman considers his time [illegible] will make use of the boat yard ways at about $5 [illegible]. The sardine or net boats can not be beached in this manner [illegible] weight.—J. B. Phillips.

LIFE HISTORY NOTES

DEER FEED AND ITS RELATION TO HUNTING

The last few weeks of the deer season have brought to light an interesting coincidence in regard to the failure or success of the hunter in getting his limit.

Deer, like all animals, wild or domestic, have well known preferences for certain herbaceous and browse plants at definite seasons of the year; and food, or the lack of it, is one of the chief factors responsible for their movements. Water, while equally necessary, may not always be of such importance, deer being able to travel a considerable distance for it.

Information gathered from various sources shows that two zones within the Kings River Canyon district on the Sequoia National Forest, differing widely in elevation, have given the best results.

In the Goat Mountain-Wildman country at an elevation of 8000–8500 feet, several parties report good hunting, and in most cases have an average of success of about 60 per cent. Hunters scouring the White Deer-Sampson country, of 2500–3500 feet, appear to have been equally successful. Those who covered the more open flats or plateaus in the yellow pine-fir type around the 5000–7000 foot elevation, have not averaged better than 10 to 15 per cent.

These reports concur with the estimates of forage conditions for both deer and domestic stock using the range. The "successful areas" offer a good assortment of forage during September and early October, and would indicate that deer, instead of being "where you find 'em," are where the feed is.

I have seen numbers of hunters in the vicinity of Big Meadows and Redwood Canyon, carefully working their way through types of country that even a self-respecting goat would hesitate to live in. It would seem strange that a deer would choose a densely timbered area to hide in, with little chance of cover or feed, when there are acres and acres of likely bed-grounds with plenty of food and from which a good view could be obtained, close by.

Distribution of animal life, wild or domestic, is primarily dependent on food. Acres of chinquapin (*Castanopsis sempervirens*) or manzanita, may provide cover but you will find the deer on the edge of these types and not in the middle. Variation of palatable forage plays an important part in the deer's bill of fare, and they are more likely to be found where there is an intermingling of vegetative types, and consequently a larger variety of forage, than in large areas of similar type and character.

The two "successful" areas seem to fill these requirements. Both offer a good assortment of feed, and water is not scarce. The feed-types in the high country while comparatively small, are interspersed with those containing little feed but ample cover. Those of the lower country, while larger and containing a high percentage of dried forage and browse (especially oak), are in many places overlapping.

Fig. 9. [illegible]

The deer from the [illegible] fat, and the hide quite blue, [illegible] shape, but not completely shed [illegible] Examiner, Sequoia National [illegible]

CRABS

On Thursday, June 23, 1932, [illegible] crab carapaces and legs on the Wadell Beach [illegible] of Santa Cruz County. This consisted [illegible] legs, in the main, although at one [illegible] siderable numbers of carcasses with [illegible] parts being missing. From the specimens

Fig. 26. Deposit of crabs [illegible]

bution of these parts it is inferred that the main deposit was made probably one or two days before the date of observation. Two typical ten-foot cross-sections of the beach were measured off and the carapaces counted. In one there was 103 and in the other 125; if we say that the average was 10 to the foot this would give over 50,000 to the mile and the deposit extended for at least two miles by actual observation. They were all about the same size, from six to seven inches across the carapace. Specimens were sent to Professor Harold Heath at the Hopkins Marine Station at Pacific Grove and were commented on by him as follows:

"The crabs have just arrived, and all prove to be *Cancer magister*, the edible crab of the markets. Also, all prove to be molted shells, so that it would appear that, possibly coming into shallow water from deeper levels, they molted and their cast off shells washed in. MacGinitie here is especially interested in the enormous numbers you report, and to all of us it is a revelation—no one has suspected that this species exists in such abundance, and I am surprised that commercial companies have not exploited the region before this. The crabs are of market size and with conservation measures the fishing for these animals may mean much to the people of the State."

On July 2d there was another tide which brought in about as many more.

The illustrations show about the average of the two miles.—Theodore J. Hoover.

PHEASANTS LAY EGGS IN CLOSE CONFINEMENT

In an experiment employing twelve female Chinese ring-neck pheasants (one to two years old) retained in very close confinement, it was observed that some birds would lay. The birds were placed in individual cages (28″ x 24″ x 24″ in size) on March 22, 1932. They were fed scratch grain (cracked corn and wheat), chicken laying mash,

Fig. 97. Deposit of tides. Photo by Theodore Hoover.

grit, and water. Cod liver oil was given we[illegible]. After April 7 all birds were handled at least [illegible] handled more often.

The first egg was laid on April 18 and [illegible] were in production. The remaining three did [illegible] during a period of approximately four months. [illegible] period they were necropsied. In two the ovaries [illegible] the third the abdominal cavity was impacted [illegible] material. The largest number of eggs laid by [illegible] This number of eggs was laid between April 20 and [illegible] of 171 eggs were laid during a period of [illegible] by nine pheasants. At the end of this period five [illegible] all but three had active ovaries. It was observed that [illegible] had developed the habit of egg eating; therefore it [illegible] some eggs were destroyed, without being recorded. [illegible] small sized egg (1½ cm. in diameter, which contained [illegible] yolk (approximately 3 mm. in diameter).

These observations may be of interest to [illegible] breeders, since it has been reported that pheasants will [illegible] under conditions so remote from nature. H. Van Roekel, Department of Veterinary Science, Massachusetts Agricultural Experiment Station.

THE WHITE PELICAN

Of all the predatory birds and animals that prey upon fish life, the white pelican is the worst of all. Mr. Pelican is strictly aquatic. He feeds entirely in fresh water, he likes his fish fresh, and he likes them alive. He is the most efficient fisherman extant, one pelican can and does eat more fish per day than would supply a large family, he is not particular as to size, he can swallow a five-pound fish as easily as a five-inch one.

His pouch and maw will hold several pounds of fish which he will carry to the nesting grounds to his one, two or three babies and regurgitate the contents of his maw into theirs.

One of the most disgusting and foul smelling sights to be seen is a visit to the rookery or nesting grounds of these birds.

They select the so-called nest in the open barren ground, preferably in holes in the bedrock, there is no semblance of a nest, just a hole with one or two sticks to keep the eggs from rolling out of the cavity.

As soon as the sun appears, they leave the nest and let the sun do the rest, after hatching occurs and during the first few days the youngsters make a marvelous growth and keep their parents busy supplying them with partly digested and disgusting fish food.

On Lone Tree Island, five miles above the city of Sacramento and before reclamation, but now known as the Natomas Farms Company, with its wonderful orchards, the writer has seen many thousands of these birds, the pictures show but one of the groups in a small area, but there were twelve miles of them, when he took the pictures.

Since the reclamation of these wonderful farming lands, made so by overflows from both the Sacramento and Feather rivers, and the wild water fowl which wintered there, these birds have sought other places in which to nest, their natural home and habitat is Pyramid Lake in the State of Nevada.

Unlike the sea pelican, their brown relative, they do not dive from the air to take their food on the water. A long line of from thirty to fifty of these white birds will maneuver high above the water taking their bearings like a company of soldiers, then dropping down suddenly well out from shore, will line up in a new moon curve and each bird thrashing his wings on the surface thus driving the fish to the shore where the feast begins.

They live upon live fish, frogs and other aquatic beings. When the pelicans beat the fish rescue crew to a pond where thousands of fish,

Fig. 99. Pelican nesting grounds.

Fig. [illegible]

and mostly game fish too, were yesterday, well at [illegible] clean it out as clean as we can with nets.

The Bureau of Fish Rescue endeavor to locate [illegible] they are working and head them off before they get [illegible] work. We kill a great many of them, but it [illegible] them to some other feeding grounds, they are just now [illegible] ing from the nesting grounds and raising havoc wit[illegible] although they are not in the least particular as to species [illegible] are just a delicacy to them.

An examination of the pouch and stomach [illegible] idea of the number of fish consumed by them, and wh[illegible] 50 per cent of the amount required to feed their young at nest [illegible]

An examination of three of seventeen kil[illegible] coming from feeding showed:

Number 1. Three hardheads and nine carp of abo[illegible]

Number 2. Five black bass of 1½ pounds each [illegible] carp 8 inches each;

Number 3. Fourteen small black bass, 4 inches each [illegible] forked catfish, 2 inches, five large pollywogs, two small [illegible] two small blue gill sunfish.

July 26, 1932, nine pelicans were killed, one of which [illegible] field nearby regurgitated fifty three fish of different species, [illegible] bass and crappie, as seen in the picture. All the pelicans were killed on the Cosumnes River overflow and from whence we receive about 90 per cent of our fish.—George Neale, Sacramento, California.

DIVISION ACTIVITIES

BUREAU OF COMMERCIAL FISHERIES

Sardine canners on the California coast, some 23 in number, appeared before the Division of Fish and Game Commissioners in July and asked that they be allowed to reduce more sardines to edible oil and meals than heretofore. As an emergency measure the Commission granted the canners permits, that aggregate some 130,000 tons for the season.

There was much wrangling among canners and fishermen as to prices to be paid the latter, but there seems to be every promise that this feature will be adjusted on a basis of about $4.75 per ton.

A few canneries opened before September, but the most of them waited until later as up to September 1st there is a deficiency of oil in this species of fish.

While only two reduction ships are known to be preparing to go beyond the legal limit to gather sardines for reduction purposes it is rumored a third will be in the field. The *Lansing,* to be operated by a company made up of fishermen is about ready to put to sea from San Pedro, and take up a position off the Monterey coast.

The District Court of Appeal denied the plea of the Bayside Fish Flour Company to force the Division of Fish and Game to give them an unlimited permit.

Salmon trolling season closed on June 30 in the Monterey area after a poor season of three months. Fish were scarce and prices low. In the San Francisco district the season was extended one month, from August 15 to September 15 at the request of Governor James Rolph, Jr. Some salmon fishermen endeavored to retail their catches at the San Francisco wharves but the idea was unsuccessful. Prices dropped to as low as 4 cents per pound for cleaned and headed fish.

North of San Francisco to the Klamath the salmon catches were better. The cannery at Requa opened and after canning 1000 tons turned to selling their supply to fresh fish markets.

Anglers had plenty of good salmon and steelhead fishing at the mouth of the Klamath. At one time 180 boats and 50 men were seen fishing on the lagoon or from the shores.

Three canneries on the river were operated under the name of "Sportsmen" plants.

At San Diego and San Pedro the tuna turn in has been splendid, prices holding up fairly well.

A San Diego superior court judge decided the fishermen last season did not break their agreement on prices with the canneries and ordered those canneries that held out a third of the money due during the last half of the 1931 season to pay the money to the fishermen. One cannery is said to have held out $90,000 pending the outcome of the suit.

Some apprehension was caused by the receipt of shipments of canned tuna from Japan. This tuna was offered for sale here for less than the expense of canning in California. However, despite the

excellency of the Japanese tuna [illegible] menace to local tuna canneries.

The shad season now closed [illegible]

Rock cod and mackerel were [illegible] owing to low price daily limit [illegible]

In southern California [illegible] were turned over to public and [illegible] received from these thanking the [illegible] donations.

Two companies has [illegible] to a new low level the [illegible] endeavor as in many others.

BUREAU OF HYDRAULICS

After months of [illegible] the case of the Benbow Improvement [illegible] action on the construction of a proper [illegible] Eel River. When a representative of [illegible] justice of the peace court he promised [illegible] ladder completed for the run of steelhead.

Some major oil companies in the San [illegible] considerable loss and were put to considerable [illegible] of oil, following breakage in their pipe [illegible] the work of cleaning up the water and [illegible] in a manner that soon reestablished [illegible]

Oil companies along the Santa Barbara [illegible] to satisfactorily control the oil wastes in the [illegible] waters are free from pollution.

A survey and an inspection of water rights [illegible] Forest Home Hatchery properties recently [illegible] of Fish and Game.

BUREAU OF GAME REFUGES

The Buttonwillow Elk refuge in Kern [illegible] The cost of the fencing was $200 per mile less [illegible] the herd enclosed on the Miller Lux ranch has been [illegible] range and work is starting on rounding up some [illegible] large. Quail and cottontail rabbits have found [illegible] to go, and it appears this area will be an excellent [illegible] birds and animals to increase under absolute protection.

Mountain lion hunters have showed great activity [illegible] 240 scalps have been turned in, 66 above the [illegible] months of the past 20 years.

Wild ducks have nested more numerously [illegible] than for many years past, and never in the history of the [illegible] refuge has there been seen so many young ducks as this year.

Frank Booth of San Francisco donated to the Department of Fish and Game 260 domesticated wild gray mallards and 100 black mallards. These birds were raised on Winters Island, but the salt water was not conducive to their well being, and in the fresh waters of Gray Lodge, Los Banos and Gridley refuges it is expected they will show improvement.

These birds will be allowed to hatch their young under natural conditions, in large enclosures. The young will be banded as they are liberated.

The falling off of the number of deer killed in districts 2, 2½ and 3 checks with the decrease in the sales of hunting licenses. Deer were numerous throughout the three districts, and hunters had no difficulty in getting their bucks, and many got limits in short time.

BUREAU OF GAME FARMS

The hatching season has ended on the game farms, and the work of distributing young and strong young birds has commenced. Pheasant, valley quail, wild turkeys and guina fowl are being placed in various sections of the State. Especially in northern California have wild turkeys been doing well, and more are being sent to selected regions.

Various cities throughout California have given wonderful cooperation in rearing pheasants, and especially has success crowned the efforts of sportsmen of Oroville, Etna, Redding, Chico, Fall River Mills, Lookout, Alturas and Bakersfield.

At Bakersfield the pens erected by fish and game associations and the county, were filled three times with young pheasants from Yountville which were held until 12 weeks old and then released in the county.

On one new quail refuge in southern California 200 quail have been released. These were properly banded so a check can be kept of the range of the birds. Hunters killing any quail with a fish and game band on its leg should send the band to the nearest branch of the Division of Fish and Game. Over 7000 acres of land has now been set aside for quail refuges in the south.

Attractive game bird exhibits were sent from the Yountville farm for fairs at Sebastapol, Stockton and Sacramento. The Chino Farm prepared a live bird exhibit for the Pomona Fair.

BUREAU OF FINANCE

With the fiscal year report completed, this department was kept very busy getting out the licenses and deer tags for the opening of the deer seasons, the first of which started August 1. It was noted there was a falling off in the sales of hunting licenses and deer tags for this year's deer season. The new metal tags seem to have been favorably accepted throughout the State by the hunters.

The 84th annual fiscal report shows a falling off in fines, and a decline in fish packers tax. Court fines have been collected quite promptly, and at the end of the year there was only $8,000 outstanding. An effort, by this bureau in collecting the fines held by magistrates, has resulted in over $2,000 being brought in during the past few months.

In the coastal area, first opened to deer hunting, the three offices of this bureau were kept busy issuing licenses and a brisk business was expected when the Sierra and southern California districts were thrown open on September 16.

A survey of the business done since July 1 in license sales indicate there will be quite a decrease in sales of all licenses this year.

BUREAU OF FISH CULTURE

The Division of Fish and Game took over the [illegible] of Henry Robbins, which the latter has operated [illegible] San Bernardino County during the past 16 years. [illegible] equipped and with a supply of some 2,000,000 [illegible] fingerlings to 12 inches is situated at an elevation [illegible] and splendidly fitted out for hatching and rearing [illegible]

Dr. S. H. Davis and Dr. Paul R. Needham [illegible] Fisheries made an inspection of the plant for the [illegible] mission and pronounced the fish in excellent [illegible]

To relieve the crowded rearing ponds the [illegible] largest plant of matured trout that has ever been [illegible] Some 300,000 fish ranging from 6 to 12 inches [illegible] streams and lakes of San Bernardino, Ventura, Los [illegible] side counties. Anglers turned out in unprecedented [illegible] these fish and any who had a pole and a license [illegible] getting limits. In some instances grownups have [illegible] to aid in augmenting the supply for the creel.

Checks were made of the number placed in each [illegible] checks will be kept to see how many of the fish were [illegible] those not caught come through the winter. In addition [illegible] are being made to observe if the trout will spawn [illegible] after being raised in a hatchery.

The experiment in graylings has proved a success. A [illegible] of Grayling Lake, in the Yosemite area was made and [illegible] fish released two years ago have grown to from 12 [illegible] presence of many young graylings in the stream below [illegible] the graylings are increasing in their new environment.

The Friant plant for small mouth black bass is getting [illegible] hot summer of the Fresno region in good order. The [illegible] the water has been held low enough so the loss has been [illegible]

There is plenty of food fish for the bass and [illegible] rearing ponds will produce many of this variety of [illegible] season, and which will be planted in nontrout waters.

During the past three months the planting of trout [illegible] State has gone on under the direction of this bureau [illegible] wardens and angler associations. Through the close co-operation existing between these and the railroad companies the [illegible] during transportation has been negligible.

From present indications the plant of trout and salmon [illegible] will reach the great total of over 56,000,000, of which some [illegible] are salmon.

BUREAU OF EDUCATION AND RESEARCH

The exhibit at the California State Fair, at Sacramento, [illegible] from September 3 to 10 was one of the outstanding groups at that exposition. In the County Building, an elaborate diorama was set up showing the fish and game resources of California from the deserts of the south to the redwood belt in the north. In the very center of this scene was a replica of Strawberry Creek on the American River Canyon, the waterfall pouring over into the hole in which there were many of our native fishes. In addition to this exhibit, the aquaria on

the outside of the exhibit contained representatives of all of the spiny-rayed fish to be found in California waters. This work was sponsored by the Bureau of Fish Rescue and Reclamation and attracted considerable attention.

In the Western States Building, an exposition of deer heads was sponsored. Prizes were offered by interested sportsmen and conservationists and the showing was a remarkable one. This was the first year that such a plan had been put in operation and it is expected that in future years this deer head competition will be one of the important works at the Fair.

A handbill covering the new waterfowl regulations as fixed by the U. S. Department of Agriculture was prepared and released for distribution.

Dr. M. Hobmaier worked out the control method of scabies infestation of tree squirrels in Marin County and has continued his investigation of duck sickness. A rather serious outbreak of lead poisoning among the ducks of the Suisun Marsh occupied much of his attention. Considerable time was spent securing material from that area, and it was found that what was first thought to be a recurrence of botulism was only lead poisoning due to the fact that the birds had picked up shot from the bottom of the ponds. These ponds have been shot over since the early 70s and there is a considerable quantity of shot on the bottom of the ponds.

BUREAU OF FISH RESCUE AND RECLAMATION

The recession of waters in the mountain streams during the summer months has called for much activity on the part of the bureau in rescuing fish left in pools formed by high waters earlier in the season.

In sloughs much work was done as the water levels lowered.

During July 625,462 fish were rescued, over 300,000 of these being catfish, and over 150,000 green sunfish.

August the catch was 322,581, with 265,054 catfish, 35,151 green sunfish and 11,294 striped bass.

BUREAU OF PATROL

During the past quarter the patrol and the cannery inspection activities, formerly conducted by the Bureau of Commercial Fisheries, were merged. Seventeen employees were affected, and this number added to the personnel of the Bureau of Patrol.

During July, 3,575,565 pounds of tuna were brought into San Pedro, being inspected by the men under this bureau. Some five tons of undersized tuna were confiscated and donated to the Los Angeles County hospital.

As a result of the close harmony existing between the deputies and the new men added from the cannery activities force, the patrol of the clam grounds about Pismo Beach are said to be the most effective for many years past.

The opening of the deer season caused added activities among the wardens, but for the most part the large army of hunters observed the law. The new metal tags seemed to give but little trouble, and deer were plentiful. Less than 30 arrests were made for violating game laws as affecting deer hunting.

Extra wardens were sent to Mono and Alpine counties to clean up on reports of illegal trout fishing.

Many arrests were made around Pt. Conception for taking undersized striped bass.

Spotlight hunters in the San Francisco Game Refuge in the Spring Valley watershed received considerable attention. Eight arrests were made of hunters seeking deer within the refuge. Some sheep grazing under permit in that area were reported as being killed.

State owned automobiles that have seen [illegible] 35,000 or more miles behind them are being traded in for new ones. The new ones are of the closed cab type with pick-up body.

The *Albacore* has been doing patrol work [illegible] Obispo. Arrests were made by the crew of the [illegible] illegal drag nets. The *Albacore* was later sent to Monterey, a survey being made for tuna, and assisted in securing valuable data relative to this commercial fish in that area.

The *Bluefin* has had wireless installed and [illegible] high seas in any direction.

VOLUNTEER DEPUTIES

Volunteer deputies, during the first six months of the year, issued 955 hunting licenses, 11,434 angling licenses and arrested [illegible] in arresting 85 violators of fish and game laws in which [illegible] amount of $2,305 were imposed.

In addition to assisting in establishing small game [illegible] killed the following number of predators on small game [illegible] house cats, gone wild, 256; skunks, 351; coon, 13; [illegible] such animals, 29, and carnivorous birds, 826.

The force of volunteer deputies has been reduced from [illegible]

Reports from volunteer deputies indicate quail have increased materially during the past year, due in a measure to the [illegible] hundreds of acres set aside as a refuge for these birds.

REPORTS

STATEMENT OF INCOME JULY 1, 1931, TO JUNE 30, 1932

83d Fiscal Year

	Division of Fish and Game	County clerks	Total
Hunting, 1929		$523 68	$523 68
Hunting, 1931	$237,509 00	161,865 90	399,374 90
Hunting, 1932	3,826 50	1,251 00	5,077 50
Angling, 1928		2,104 32	2,104 32
Angling, 1929		2,383 80	2,383 80
Angling, 1931	264,861 00	155,418 00	420,279 00
Angling, 1932	63,545 00	43,423 00	106,968 00
Deer tags, 1931	69,360 00	59,645 00	129,005 00
Deer tag, 1932	1 00		1 00
Market, 1931-32	29,290 00		29,290 00
Market, 1932-33	25,950 00		25,950 00
Trapping, 1931-32	2,858 00		2,858 00
Game breeders, 1931	130 00		130 00
Game breeders, 1932	877 50		877 50
Fish breeders, 1931	85 00		85 00
Fish breeders, 1932	445 00		445 00
Fish importers, 1931	15 00		15 00
Fish importers, 1932	95 00		95 00
Wholesale fish packers, etc., 1931-32	1,285 00		1,285 00
Commercial hunting club, 1931-32	1,375 00		1,375 00
Commercial hunting club operators, 1931-32	345 00		345 00
Kelp, 1931	10 00		10 00
Total license sales	$701,863 00	$426,614 70	$1,128,477 70
		Judges	
Kelp tax	$90 22		$90 22
Fish tag sales	3,023 10		3,023 10
Fish packers' tax	84,446 17		84,446 17
Interest	5,437 94		5,437 94
Game tag sales	145 98		145 98
Importers' contributions	45 00		45 00
Miscellaneous sales	728 10		728 10
Court fines	54,498 19		54,498 19
Lease kelp beds	1,256 40		1,256 40
Total other income	$149,671 10		$149,671 10
Total income	$851,534 10	$426,614 70	$1,278,148 80

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to June 30, 1932, of the Eighty-third Fiscal Year

Function	Salaries and wages	Materials and supplies	Equipment	Special	Total
Administration					
Executive	$				$
Clerical and office					
Printing					
Automobiles					
Traveling					
Postage					
Telephone and telegraph					
Freight, cartage and express					
Rent					
Accident and death claims					
Accounting pro rata					
Legal					
Premiums on bonds					
Publicity					
Total administration	$	$	$	$	$
Education and research					
Chief and assistants	$				$
Clerical and office					
Automobiles					
Traveling					
Telephone and telegraph					
Freight, cartage and express					
Photographer					
Librarian					
Research					
Blue printing					
Publicity					
Exhibits					
Lecturer					
Temporary help					
Total education and research	$	$	$	$	$
Patrol and law enforcement					
Chief and assistants	$				$
Clerical and office		$	$	$	
Automobiles					
Traveling					
Postage					
Telephone and telegraph					
Freight, cartage and express					
Rent					
Heat, light and power					
Captains and deputies					
Launches					
Fish planting					
Volunteer deputies					
Premiums on bonds					
Temporary help					
Cooks					
Total patrol and law enforcement	$229,447 48	$	$	$	$
Commercial fisheries:					
Chief and assistants	$			$	$
Clerical and office		$	$		
Automobiles					
Traveling					
Postage					
Telephone and telegraph					
Freight, cartage and express					
Rent					
Heat, light and power					
Research	$ 113 47				$
Captains and deputies					
Launches					
Laboratory					
Blue printing					
Fish tags					
Hydro-biological survey Monterey Bay					
Statistics					
Fish cannery research					
Fish cannery inspectors seasonal					
Total commercial fisheries	$109,482 32	$	$	$	$

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to June 30, 1932, of the Eighty-third Fiscal Year—Continued

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Fish culture:					
Chief and assistants	$9,700 00			$42 80	$9,742 80
Clerical and office	4,119 67	$192 68	$35 20	93 35	4,440 90
Automobiles		5,951 01	2,684 17	3,862 06	12,497 24
Traveling			12,147 26		12,147 26
Postage			110 57		110 57
Telephone and telegraph			1,204 00		1,204 00
Freight, cartage and express			1,279 19		1,279 19
Rent			1,549 84		1,549 84
Heat, light and power			1,388 81		1,388 81
Hatcheries	113,347 16	67,947 38	1,862 05	2,607 31	185,763 90
Special field investigations	9,735 66	178 88	20 19	7 25	9,941 98
Fish cars	3,540 00	427 60	2,559 74	19 61	6,546 95
Blue printing		9 24	40 91		50 15
Cooperative research	1,856 45	85 43	909 18	310 25	3,161 31
Fish hatchery assistant—seasonal	29,490 46				29,490 46
Total fish culture	$171,789 40	$74,792 22	$25,791 11	$6,942 63	$279,315 36
Hydraulics:					
Chief and assistants	$8,340 00		$50 66	$41 00	$8,431 66
Clerical and office		$23 82	47 54		71 36
Automobiles		449 04	271 27		720 31
Traveling			2,261 26		2,261 26
Postage			1 00		1 00
Telephone and telegraph			8 25		8 25
Cooperative research	3,000 00				3,000 00
Total hydraulics	$11,340 00	$472 86	$2,639 98	$41 00	$14,493 84
Game propagation:					
Superintendents	$3,300 00				$3,300 00
Clerical and office	90 00				90 00
Automobiles		$473 60	$136 05	$537 72	1,147 37
Traveling			2,379 99		2,379 99
Postage			19 60		19 60
Telephone and telegraph			268 98		268 98
Freight, cartage and express			63 68		63 68
Heat, light and power			1,030 02		1,030 02
Maintenance		10,560 08	1,233 26	4,209 56	16,002 90
Assistants	14,297 57				14,297 57
Total game propagation	$17,687 57	$11,033 68	$5,131 58	$4,747 28	$38,600 11
Fish rescue:					
Chief and assistants	$5,034 00	$14 94	$198 62	$68 00	$5,315 56
Traveling			2,188 47		2,188 47
Rent			210 00		210 00
Total fish rescue	$5,034 00	$14 94	$2,597 09	$68 00	$7,714 03
Game refuge:					
Chief and assistants	$8,645 00				$8,645 00
Clerical and office	1,920 00	$32 89	$4 00		1,956 89
Automobiles		1,038 18	299 29		1,337 47
Traveling			4,654 78		4,654 78
Postage			1 97		1 97
Telephone and telegraph			21 35		21 35
Freight, cartage and express			50		50
Lion hunters and trappers	7,466 59				7,466 59
Refuge posting		122 91	252 60	$863 04	1,238 55
Predatory animal control			7,970 00		7,970 00
Temporary help	16,497 29				16,497 29
Refuge maintenance	5,306 00	4,441 98	4,816 77	6,429 60	21,493 75
Pump and pump shelter				3,916 13	3,916 13
Total game refuge	$40,334 88	$5,635 96	$18,021 26	$11,208 17	$75,200 27
Additions and betterments—construction Russian River jetties (Payable from Support—83d F. Y. Chap. 183-31)					$48 02
Additions and betterments—opening Salinas River channel (Payable from Support—83d F. Y. Chap. 183-31)					42 50

STATEMENT OF EXPENDITURES

For the Period July 1, 1931, to June 30, 1932, of the Eighty-third Fiscal Year

Function	Property and Equipment	Maintenance and Operation	Total
Construction, improvements and equipment			
Telephone and power line from Chester to Lake Almanor Fish Hatchery			
Improvements at Lake Almanor Hatchery			
Bass ponds			
Filter at Big Creek Hatchery			
Permanent repairs on Brookdale Hatchery			
Construction of dams on Cherry Creek			
Completion of egg collecting racks at Chester			
Construction of rearing ponds and a temporary house for [illegible] County			
Tank and egg collecting station at Huntington Lake			
Filter at Kaweah Hatchery			
Klamathon Station—Station House and Dry Room Project			
Klamathon Station—Warehouse Project			
Repairs and improvements at Mount Shasta Hatchery			
Maintenance and improvements—Navarro River jetty			
Opening Salinas River channel			
Permanent improvements on Snow Creek Hatchery			
Total construction, improvements and equipment			
Expenditures to pay claim of Electro Metals Company			
Expenditures to pay claim of John H. Holland, R. J. Hu[illegible] Mercantile Co			
License commissions			
Protecting construction of Russian River jetties (payable from Ch[illegible])			
Purchase of game refuges			
State Fair and other exhibits			
Prior year expense—32d fiscal year			
Grand total proprietary group			

NOTE—$9,376.91 was transferred from Fish and Game Preservation Fund

SEIZURES OF FISH AND GAME

April, May, June, 1932

Fish:	
Abalones	1,184
Bass—	
Black	15
Striped, pounds	488
White sea, pounds	516
Barracuda, pounds	4,073
Crappie and perch	268
Crabs	232
Clams	1,167
Catfish, pounds	162
Cockles, pounds	500
Halibut, pounds	24
Lobsters, pounds	210
Miscellaneous fish, pounds	105
Mussels, pounds	200
Steelhead, pounds	260
Shad, pounds	170
Trout, pounds	409
Tuna—	
Bluefin, pounds	56,093
Yellowfin, pounds	1,337
Traps, lobster	12
Game:	
Deer	4
Deer meat, pounds	369
Doves	20
Ducks, geese	17
Grouse	1
Pheasants	4
Quail	2
Rabbits	5
Squirrels	10
Shorebird	1
Sagehens	4

FISH CASES

April, May, June, 1932

	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act; violations of	88	$1,248 00	79
Abalones; overlimit; small	82	1,320 00	30
Barracuda; small	2	25 00	2½
Bass—			
Black; closed season; small	5	80 00	
Striped; small	19	350 00	
White sea	1	25 00	
Clams; overlimit; small; closed district	49	535 00	245
Cockles; small	7	25 00	30
Crappie; perch; sunfish; closed season	9	100 00	4
Catfish; selling small	4	20 00	
Crabs; small	17	215 00	100
Commercial Fishing License Act; violations of	43	190 00	22½
Lobsters; closed season	1	000 00	
Mussels; overlimit	7	35 00	6
Nets; seines; illegal use of	8	258 00	242
Spear; too near stream	5	27 50	
Shad; closed season	1	000 00	
Trout; closed season	52	596 00	86
Tuna; selling overweight of	3	25 00	
Traps; lobster	4	60 00	
Fishing with several lines; fishing near dam	6	40 00	
Taking marine life within the Hopkins Marine Life Refuge	1	5 00	
Totals	414	$5,179 50	847

GAME CASES

April, May, June, 1912

Deer, closed season	3
Ducks, geese, closed [illegible]	
Doves, closed season	
Grouse, closed season	
Hunting License Act, violation	
Hunting in refuge	
Non-game birds, killing	1
Pigeons, closed season	
Pheasants, closed season	
Pollution of streams	
Quail, closed season	
Rabbits, closed season	
Sagehen, closed season	
Spotlight hunting	
Squirrel, tree, killing	
Trapping, [illegible]	
Total	

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY AND JUNE, 1932

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

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Anchovy							63,175		68,095
Barracuda									
Bonito									
Cabrilla									
Carp		16,965		31	355	2,479			
Catfish				84	22,274	7,791			
Cultus	153,444	8,803					38,259	22,161	12,440
Flounder	90,820	910	11				3,895	11,388	53
Flying fish									
Hake	2,505	250					760	3,208	
Halfmoon									
Halibut—California								3,569	5,973
Halibut—Northern	263,332	3,391	164				853	2,236	
Hardhead		274,965			38				
Herring	3,011								300
Kelp Bass									
Kingfish	695						160	15,076	20,713
Mackerel—Horse									35,277
Mackerel—Pacific							560	2,884	184,206
Mullet									
Perch	2,109	9	1,781				975	2,566	7,306
Pike					256	167			
Pompano								23	33
Ray									
Rock Bass									
Rockfish	173,275	6,401					105,588	268,905	288,057
Sablefish	225,724	318					9,753	41,676	7,491
Salmon	748,462	174,510	90	38,258	168,985	195,731	210	42,151	38,733
Sand Dab	124,438	1,820					790	24,063	6,759
Sardine							743,375	7,655	290,612
Sculpin							1,398	216	
Sea Bass—Black									
Sea Bass—White								58	1,094

Shad				57,917	39,765	661,941	52,701		
Shark	1,375						1,480	1,040	
Sheepshead									
Skate	13,750						1,625	8,030	2,888
Skipjack									
Smelt	4,980	666	13,622			2,397	72,317	21,481	18,419
Smelt—Jack	575						80		
Sole	2,275,444	6,110					23,353	187,739	21,689
Splittail		5,500			63	509			
Striped Bass				9,381	26,842	117,645	1,972		
Sucker		4,950							
Swordfish—Broadbill									
Swordfish—Marlin									
Tom Cod	140						20		
Tuna—Bluefin									
Tuna—Yellowfin									
Turbot			1,034						
Whitebait	35,774	8,805	2,084				4,774	193	7,373
Whitefish									
Yellowtail									
Miscellaneous	34,857	2,000			178	159	971	494	25
Total fish	4,134,719	510,571	18,786	1,067,721	261,780	1,142,119	1,157,471	666,882	1,017,636
Crustaceans									
Crab	1,750	1,815					42,128	624	662
Shrimp			1,457			24,854	775		2
Spiny Lobster									
Molluska									
Abalone		20							1,275
Clam—Hard-shell		57	40						
Clam—Mussel	10	251							
Clam—Pismo									
Clam—Soft-shell		141	178				6		94
Mussel	15								
Octopus		41							
Oyster—Eastern			15						
Oyster—Native			1				1		
Squid									
Totals									

All values in above

CALIFORNIA FISH AND GAME

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY AND JUNE, 1932 Continued

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

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into San Pedro	Fish from south of the International Boundary brought into San Diego	Total fish from south of the International Boundary brought into California
Anchovy		21,589			152,859			
Barracuda	3,666	988,781	31,611	210,808	1,234,866	52,736	8,266	61,002
Bonito	61	157,408	1,499	311,291	470,259		1,210	1,210
Cabrilla				786	786	36,558	52,078	88,636
Carp		10,550			30,380			
Catfish					30,149			
Cultus	23	80	56		235,266			
Flounder	15	479	23		107,594			
Flying fish		27,484			27,484			
Hake					6,723			
Halfmoon		3,041	17	417	3,475			
Halibut—California	75,218	85,011	13,117	18,019	200,907			
Halibut—Northern					269,976			
Hardhead					275,003			
Herring					3,311			
Kelp Bass	1,120	795			1,915			
Kingfish	70	69,049	224	452	106,439			
Mackerel—Horse	69	85,486			120,832			
Mackerel—Pacific	1,255	2,941,202	15,317	59,684	3,205,108			
Mullet		1,398		5,274	6,672			
Perch	199	21,753	37		36,735			
Pike					423			
Pompano		3,140	9		3,205	3,728		3,728
Ray		490	340	60	890			
Rock Bass	560	53,042	2,255	56,090	111,947	587		587
Rockfish	20,273	434,633	19,226	160,498	1,476,856		4,567	4,567
Sablefish	88	23,262	362		308,674			
Salmon		16			1,407,146			
Sand Dab		1,512	20		159,402			
Sardine		32,151	140	524,466	1,598,399			
Sculpin	20	22,059	301	1,923	25,917			
Sea Bass—Black	836	3,660	3,428	24,822	32,746	22,774	16,296	39,070
Sea Bass—White	9,800	45,818	973	12,419	70,162		55	55

Shad					1,042,354			
Shark	4,640	88,360	87,835	29,343	214,073			
Sheepshead	1,465	6,738	22	116	8,371	41		41
Skate		6,222	247	62	32,924			
Skipjack						1,430,869	3,583,070	5,013,939
Smelt	10,055	56,600	225	7,184	207,955			
Smelt—Jack	807	1,865			3,270			
Sole	39,365	10,148	311	77	2,964,236			
Splittail					1,572			
Striped Bass					15,716			
Sucker					4,469			
Swordfish—Broadbill		54,215	1,254	1,343	56,812	277	1,548	2,625
Swordfish—Marlin		475		147	622		285	285
Tom Cod					20			
Tuna—Bluefin		21,292		1,784	23,078	2,292		206,284
Tuna—Yellowfin				5	5	7,852,421	6,364,529	14,216,960
Turbot					1,214			
Whitebait					76,442			
Whitefish		11,054		1,605	24,772	482	1,243	1,682
Yellowtail		2,670	5,185	1,125	6,980	1,424,256	54,218	17,424
Miscellaneous	1,162	10,191	1,126	1,256	53,717	1,447	1,310	4,857
Total fish								
Crustaceans								
Crab					1,214			
Shrimp					27,000			
Spiny Lobster								
Mollusks								
Abalone	225,745							
Clam—Hard-shell		5,125			6,125			
Clam—Mussel		1,584			1,584			
Clam—Pismo	28,013				28,013			
Clam—Soft-shell					1,000			
Mussel					500			
Octopus								
Oyster—Eastern					4,000			
Oyster—Native					4,000			
Squid					1,000			
Totals								

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97833 3-33 3M

ABSTRACT
CALIFORNIA SPORTING FISH AND GAME LAWS
VALID UNTIL 90 DAYS AFTER CLOSE OF 1933 LEGISLATURE

1931 OPEN AND CLOSED SEASONS 1932

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES

GAME	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
DEER	1½										15			No Does, Fawns or Spike Bucks No Forked Horned Deer in Dist. 1¾ No sale of Venison or Deer Skins Two Bucks per Season except in 1¾ where limit is one See Notes 6-9-10-12
	2-2½-3									14				
	1-1¾-4-4½-4¾-23-24-26										16 15			
Rabbits—Cottontail and Brush	ALL EXCEPT 4¾											15	15	15 per day. 30 per week. No limit in District 4 No protection in 4¾
Bear, Fur Animals	ALL											15		See Note 7 Predatory animals unprotected in districts 2-2½-3-4-4¾
Ducks, Geese, Jack Snipe, Mud Hens	ALL FEDERAL LAW										OPENS NOON OCT. 1			15 Ducks, 10 in Possession; 4 Geese, 8 in Possession; 20 Snipe, 25 Mud Hens, No Ross Snow or Cackling Geese
	ALL STATE LAW	15												25 Ducks, 25 Snipe, 25 Mud Hens, 50 Per Week Goose Limit See Note 4. See Notes 9-10-11-12-13
Quail—Valley, Desert and Mountain	ALL EXCEPT 1½											15	15	Valley and Desert 15 per day. 30 per week Mountain 10 per day. 20 per week
	1½													
Dove	ALL EXCEPT 4-4½-4¾													Federal Season Opens Noon September 1 — 15 per day 30 per week
	4-4½-4¾													

There is no open season on Elk, Antelope, Mountain Sheep, Sea Otter, Tree Squirrel, Sierra Hare, Rail, Wood Duck, Pigeon, Swan, Shore Birds (except Jack Snipe), Grouse, Sage Hen, Imported Quail, Wild Pheasant, Partridge, or Wild Turkey.

FISH	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
Steelhead and all Trout (except Golden), Whitefish Unlawful to take trout in waters closed by Governor's proclamation	1-1½-1¾-2-3-4-4½-4¾-15 Klamath River, Lake Almanor													No Sale No Spearing For other restrictions See Notes 12-15-16-20 21-22-28-29 31-33 On this Card
	2½		28			30								Bag limit for taking and possession, 25 trout or 10 pounds and one trout.
	23-24-25					30								
	Truckee River					15								
	See Note 22													
	1½ Winter Klamath River													5 Trout regardless of weight
	Russian, Navarro, Napa and Eel Dist 2) Tidewater Dists. 2-3-15													3 Trout regardless of weight
Golden Trout	ALL													20 per day. None under 5 inches Not more than 10 lbs. and one
BLACK BASS	ALL EXCEPT 4¾													15 per day Be Closed Season in 4¾ — No Black Bass under 9 ins.
	CLEAR LAKE IN LAKE CO.													Clear Lake 10 per day No sale Hook and line only
Sunfish	ALL													25 per day
Sacramento Perch and Crappie	ALL EXCEPT CLEAR LAKE													25 per day — Hook and line only
	CLEAR LAKE													10 per day — No sale
Striped Bass	1-3-12A													None under 12 inches, 5 per day. None to be taken from Salton Sea. See Note 19
Crabs	ALL EXCEPT 1½-6-7-8-9													Season Districts 1½-6-7-8-9 August 31, December 14 See Note 24, None under 7 inches. No Female
Abalones	ALL	14			16									Only for food. Must be brought to shore alive in shell Angling License Required. See Note 27
Pismo Clams	17													None under 5 inches. No shipment. 15 per day Angling License Required District 18a Closed
Spiny Lobster	ALL											15		No Sale of Meat. None under 10½ or over 16 inches See Note 24
GRUNION	ALL													

Salmon and Shad May Be Taken as Noted in Paragraphs 19-23. No open season on Sturgeon (possession prohibited).

NOTES

IT IS ALWAYS UNLAWFUL

1. To hunt, kill, possess wild birds or mammals, to possess firearms, except under written permit from the Commission, within districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q 1r, 1s, 1t, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 4a, 4b, 4c, 4d, 4e, 4f, 4g, or General Grant Refuge, or the Mt. Tamalpais Game Refuge, including Richardson Bay, or San Francisco Refuge, or Silver Lake Refuge (water fowl may be killed in 4a and 4e), or to hunt quail in the Bolinas Quail Refuge, or to hunt or discharge firearms in Huntington Lake Refuge or San Leandro Bay Refuge.

2. To hunt birds or mammals excepting predators without a hunting license.

3. To possess any bird net or to net, trap or to hold protected game or birds of any kind, their nests or eggs except under written permit from the Commission.

4. To take or possess more than 8 geese per day or 50 per week; or more than 8 honkers or sea brant per day or 24 per week.

5. To take or kill non-game birds, except blue jay, butcher bird, English sparrow, sharp-shinned, Cooper or duck hawk, great horned owl, linnet, white pelican, shag, and in districts 1, 2, 3, 4 and 4f, blackbirds.

6. To hunt deer without a deer tag license. To fail to attach to the horns of deer immediately on killing, properly filled out license tag or at the same time to send duplicate tag to the Division. To carry a deer into a closed district without having license tag countersigned, or to have untagged deer in possession. To fail to retain in possession during open season and for ten days after the skin and portion of head bearing horns of deer killed and to produce upon demand. To use more than one dog to the hunter in hunting deer or to allow dogs to run deer in closed season, or to possess doe or fawn skins, or deer skins not bearing evidence of sex.

7. To trap for profit bear, ring-tailed cat, coon, pine marten, skunk, fisher, wolverine, mink, river otter, fox, beaver or muskrat, or to kill these animals during the closed season, except when destroying property. To interfere with the traps of licensed trappers. To use saw tooth or spike jawed traps for taking fur bearers.

8. To use any animal other than a dog to stalk wild birds.

9. To shoot game from a power boat, sailboat, auto, airplane; or to hunt waterfowl from a scull boat in districts 8, 9, except on Wednesdays and Sundays, or at any time in district 12 or Napa River south of Edgerly Island, or to use a

shotgun larger than ten gauge, or to possess an automatic or a ...

10. To shoot [illegible] between ½ hour after sunset and ½ hour before sunrise. To use a spotlight ... game.

11. To hunt waterfowl in [illegible] 22, other than ... holidays, opening and closing days ... between 9 a.m. and 4 p.m. ... of auto, airplane ... power boat.

12. To kill game or fish ... season, ... days.

13. To sell wild game or ...

14. To make a false statement ... fail to show ... tag.

15. To take game or fish ... season is not open. ... Trout legally taken ... into a closed ... duplicate or tag ... license and name ... must be attached ... the officer ... to whom ... check at stations ... affect ... by agents ...

16. ... dried fish ... packages ... shipped ... segment ... state.

17. ... operate a ...

18. ... [illegible] 21, 22 and 23.

19. ... length ... bass during ... line ... and July 1 ...

20. ... hard ... than 3 hooks.

21. ... landing ... unlawful ...

22. ... of any ... of any stream ... within two miles ... to August 1.

23. ... a spawning ... known as ... chinook salmon ... or fail to ... ditch that ...

LICENSES MUST BE SHOWN UPON DEMAND

[illegible]

LICENSE PROVISIONS

HUNTING

[illegible]

Residents under 18	$ .50
Resident citizens	2.50
Non-resident citizens	5.00
Duplicate, all states	25.00
Other than above	25.00

[illegible]

ANGLING

[illegible]

Resident citizens	$ .50
Non-resident citizens	1.00
Aliens	1.00

Under 18 no license required.

TRAPPING

[illegible]

Citizens	$ .50
Aliens	1.00

Under 18 no license required.

FUR FARM

[illegible]

Everyone (2 tags) $ 1.00

COMMERCIAL HUNTING CLUBS

[illegible]

Citizens	$25.00
Aliens	100.00
Operators, citizens	5.00
Operators, aliens	25.00

FISH & GAME DISTRICTS of CALIFORNIA

1931 — 1932

For Laws to Fall See Penal Code

For Commercial Fish Laws See Commercial Abstract

For Information Regarding Fish or Game Write to the Division of Fish and Game

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 18 San Francisco, January, 1932 Number 1

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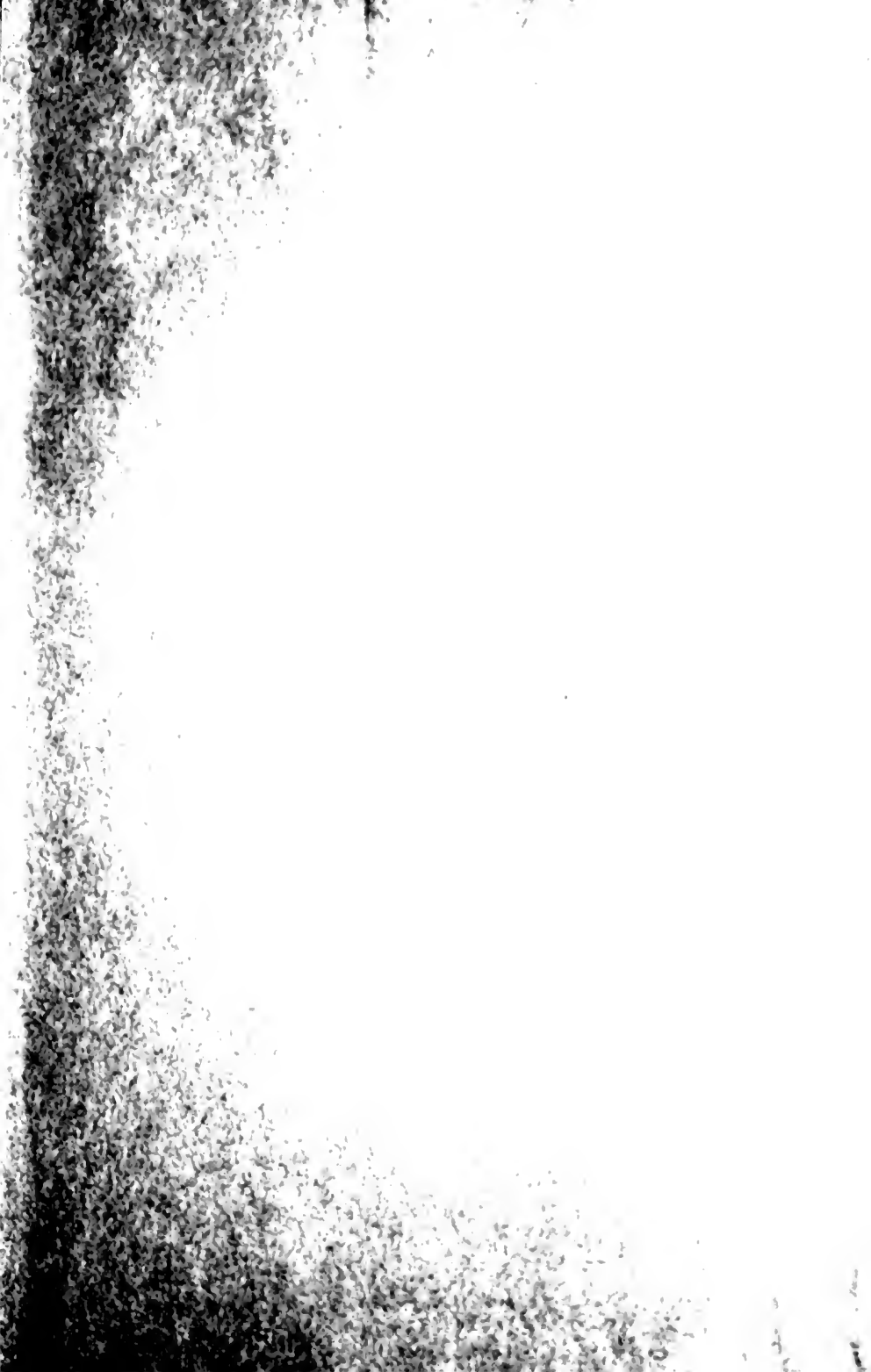

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