

THE CALIFORNIA CLAPPER RAIL  
ITS NESTING HABITS, ENEMIES AND HABITAT  
By DUDLEY SARGENT DE GROOT

(Contribution from the Department of Zoology, Stanford University)

THE AUTHOR since his arrival in the San Francisco Bay Region eleven years ago has been a continuous and interested observer of the California Clapper Rail (*Rallus obsoletus*). Rather extensive field work during eight of those eleven years, singly and in coöperation with other ornithologists, has given him a fairly large store of information with which to form the background for the present paper.

To Harry Carriger, who was instrumental in giving me a proper introduction to many California birds, I owe thanks for my first rail trip in 1915. Since then we have made many trips together into rail country, each one of which has contributed material used in this study. To Professor John O. Snyder, of the new Stanford Museum of Natural History, friendly adviser of my college days, I owe thanks for encouragement in carrying out the field work on this project. But to my good friend Chase Littlejohn, that vigorous, enthusiastic, keen-eyed observer and naturalist, I owe endless thanks. Without Mr. Littlejohn's extensive field notes and minus his constant help and advice this paper would indeed have been a difficult task. Despite his seventy-three years of age he is today as active in the field as many collectors fifty years his junior, as is witnessed by the fact that during the spring of 1926 we took together no less than twenty field trips, covering in all over twenty-five hundred miles of territory!

In addition to the fact that there seems to be little unanimity of opinion among various ornithologists who from time to time have contributed articles upon the breeding habits of our California Clapper Rail, there are several important matters which I believe to have been either mis-stated or overlooked. I refer particularly to the number of eggs constituting a set; the usual or, one might say, invariable nesting site; the nesting material used; the average date upon which complete sets of eggs are most commonly found; early nesting records; late nesting records; the rearing of two broods per season by many pairs of rails; differences between first and second nests, with reasons therefor; reasons for the decrease in numbers of rail; and reasons for the continual decrease in rail habitat. Feeling that published records do not satisfactorily cover these matters, and in view of the fact that it is unquestionably only a matter of a very few years until this species will be nearly extinct in its native habitat, I offer these data for what they may be worth.

As a basis for the statements which follow I submit the field records of Mr. Chase Littlejohn, accumulated during the past fifty-five years, and my own personal records of the past eleven years. Mr. H. W. Carriger's records have also been used in some instances, these dating back over a period of twenty-five years.

NUMBER OF EGGS PER SET

Of a total of seventy-four nests with sets observed and recorded, the distribution in eggs per set is as follows: 3-5, 6-6, 20-7, 19-8, 19-9, 3-10, 2-11, 1-14, 1-21. The sets of five were, in each instance, complete, as were also the sets of six. The unusual set of fourteen is in the collection of Mr. Littlejohn. The uniformity of the eggs of this set leaves no question but that it was actually laid by one bird. One of the sets of eleven is in Mr. Littlejohn's collection, while the other is in the author's collection. These, too, are very uniform sets. The set of 21 was collected by Mr. Littlejohn in 1912. It

was unquestionably laid by two birds, for eleven of the eggs were distinctly different in size, shape and markings from the remaining ten. In addition, the "set" of eleven was ready to hatch, while the "set" of ten was practically fresh. This is the only record of double nesting of which I have knowledge.

On the basis of these figures there seems to be no question but what a set of seven is just as common and fully as complete as a set of nine, and yet invariably authors in the past have proclaimed "full sets" to contain "eight or nine eggs". A more correct statement would be, "seven, eight or nine eggs constitute the usual set."

#### NEST LOCATION

A survey of field notes, and of the data of sets collected, discloses the fact that in only three instances were nests placed more than fifteen feet from small or large "gutters". A "gutter", I might explain, is a small ditch, tributary or finger of a larger slough or creek. There are literally thousands of these gutters in any given piece of San Francisco Bay marshland, as anyone who has ever tried collecting there well knows. The whole life of the rail centers about these gutters; here it is they get most of their food, do most of their travelling, first teach their young to swim and hunt for food and, sad to say, here it is that many rail meet their doom.

Along the banks of these gutters grows what might well be termed the "rail bush", scientifically known as *Grindelia cuneifolia*. Reaching an average height of two and one half feet, these bright, green-leaved bushes are conspicuous as the tallest plants on the marsh, excluding tules. There is no simpler method of finding the Clapper Rail's nest than to locate a gutter whose banks are lined with these small bushes, and then proceed to switch each bush, in turn, with a small stick. If a person be in rail country and it is nesting season it will not be long until a rail will flush from her nest, giving even the most experienced oölogist a thrill.

The nest is generally placed at the base of a clump of grindelia bushes, where it is afforded considerable protection from discovery. The nest itself has been well described in several publications, and the only addition or correction which I might make is that in a majority of cases dried tule stalks or stems form the basis of the nest, rather than pickleweed, which is, however, invariably one of the constituents.

Of late years, and largely I think for protective reasons, especially protection from winged enemies, many Clapper Rail have adopted the heaviest and thickest clumps of pickleweed (*Salicornia ambigua*) they can find, for nesting sites. Thirty years ago seldom was a nest found in such a location; ten years ago it was the exception rather than the rule. During the past three years almost fifty percent of the nests found have been located in these dense clumps of pickleweed. There is no question but that this change is giving nesting birds greater protection from avian enemies as well as from prowling animals, including humans.

To find a nest in one of the new locations takes exceptionally keen eyesight and far greater knowledge of where to look than under the old conditions. The birds leave almost invariably by runways through the dense salicornia; they seldom flush as of old. And because they generally have two entrances, or rather an entrance and an exit, to their new domiciles they generally sneak off before you reach the nest proper. This means that a careful and continuously diligent search must be made to locate the well-hidden nest. Often the salicornia at the nesting site is two feet in depth, two feet of an extremely dense matting which often completely obscures the nest and eggs.

But although the rail have thus taken a beneficial step forward, toward self-preservation, they have overlooked one serious point, and that is that they still invariably nest within fifteen feet of the marsh gutters. In conclusion of this point, therefore, I should say that California Clapper Rail invariably nest along the banks of marsh gutters; that

in about fifty percent of the cases the nests are placed at the bases of the small grindelia bushes; that in about forty-five percent of the cases, and this figure is constantly on the increase, they nest beneath dense mats of pickleweed, and in the remaining five percent of cases in such unusual places as inside old barrels or old oil cans, under piles of drift, and under boards along the larger creeks.

#### NESTING MATERIALS

Of the many descriptions of nests and nesting material of the California Clapper Rail which I have read, few agree altogether with my records, which comprise observations on no less than three hundred and thirty-five nests. Nests, in the first place, must be divided into two classes: (1) those constructed early in the year for the first sitting; (2) those constructed late in the year, apparently for a second sitting.

The foundation or basis of the nest, in either case, is of broken bits of dried tule stems ranging from two to eight inches in length. Over this, for the early season nest, is placed a matting or layer of salicornia twigs which generally raises the structure from one to three or four inches above the usually damp marsh ground. The second, or late season nests are much more compactly and securely built and often measure four inches in depth and eighteen inches in diameter. These are generally constructed almost entirely of tules, either dried or living, and they are often attached to living tules, much in the manner of a coot's nest. They are often found floating about in the tule patches during the flood tides of late June and early July. It might be remarked here that these flood tides would float away any eggs laid in the early season nests.

#### EARLY AND LATE NESTING RECORDS

It has been the general tendency for authors upon the subject simply to remark that the breeding season extends from the "middle of April until the middle of May", or "fresh eggs may be found from the first of April until the first of May." As a matter of fact my records show complete sets to have been found as early as March 22, 1906 (Chase Littlejohn, Redwood City), and as late as July 13, 1926 (Chase Littlejohn and the author), and July 18, 1905 (Chase Littlejohn). On August 13, 1899, Mr. Littlejohn caught a young Clapper Rail which could not have been more than ten days old, indicating that eggs may be found as late as August 1.

Of the seventy-two nesting records previously referred to, twelve were recorded prior to April 10, fifteen after April 25, and forty-six between April 10 and 25. It is clearly evident from these records that the height of the breeding season is reached between April 10 and 25. Young birds have been noted by the author as early as April 15, while Mr. Littlejohn records the taking of a set of nine eggs on April 5, 1914, "almost ready to hatch."

By May 15 it is almost impossible to find a rail's nest containing eggs, although families of young birds are everywhere in evidence. On May 10, 1896, Mr. Littlejohn, by diligent search found a nest containing six eggs. On May 12, 1926, the author, in company with Will Unglish of Gilroy and D. Bernard Bull of San Jose, spent an entire day on the marsh near San Carlos, the net results of which were, as far as rail were concerned, 1-9 and 4-8, all evidently on the point of hatching. Many families of rail were seen, however, in all stages of growth, from those just hatched to others able to fly. In addition, Bull and Unglish found no less than twenty nests apiece, many with egg shells still evident, while the author located no less than fifty-two such nests. These facts, together with other similar data for other years, prove conclusively, I believe, that the first nesting of *Rallus obsoletus* is over by May 15.

To Mr. Littlejohn must go all of the credit for the statement which follows, namely, that our California Clapper Rail, or at least a good many pairs, raise two broods

per season. Under date of July 12, 1901, Mr. Littlejohn records the following: "Today I took a walk about the marsh near the Bay shore and was surprised to find the rail nesting again, but from previous observation I am convinced that they do this each year. After rearing the first brood, hatched in April or May, they nest again, building most of their nests this time in the new growth of tules and making a floating nest out of the old growth which has fallen down and become loosened from the roots. Although there must have been at least a foot of water under the nests at full tide, a few hours before, the eggs and upper material of the nest were perfectly dry. The birds were sitting and were flushed from the nests."

The fact that our records show no nests with eggs between May 15 and June 15, though search for them has been made on many occasions, together with the fact that we have many records of fresh sets after June 15 and from then on until July 18, seems proof positive that *Rallus obsoletus* in many instances does raise two broods per season. That all individuals do not raise second broods seems self-evident because second sets are not as easily found, nor as common, as first sets. Probably less than fifty percent of our California Clapper Rail raise second broods, but the fact that some second broods are raised is, I believe, beyond question.

In conclusion of this point I might summarize as follows: The earliest nesting date for *Rallus obsoletus* of which I have record, is March 22 (1906, Mr. Littlejohn); the latest, July 18 (1905, Mr. Littlejohn). There are two breeding periods the first of which reaches its height between April 10 and 25, during which all or a large majority of the birds breed; while the second reaches its height between June 25 and July 15. It seems probable, with the evidence now at hand, that approximately fifty percent of our rail raise second broods. Nests for the first brood are rather flimsy affairs and are generally placed on the dry ground beneath small bushes or in heavy clumps of pickleweed; nests for the second laying are well made structures of dried tule stems, generally placed in patches of living tules, where they are attached in such a manner that the high summer tides allow them to float, thus safe-guarding the eggs.

#### ENEMIES OF THE RAIL

Nowhere have I been able to find any comprehensive discussion of the causes for the depletion of our California Clapper Rail. In the old literature, particularly in the *Nidologist*, early volumes of the *Condor*, and other bird magazines, are to be found many articles roundly criticizing the "game hog, the city dude with his pump gun, dog and boat, etc." There is no question but what we owe a good deal of the depletion of rail to these so-called "sportsmen." Thanks to local and federal legislation further depredations from this source have been practically abolished, until today there is no open season on rail, nor has there been for several years past.

As far back as 1894, R. H. Beck told Cooper Club members that "they [*Rallus obsoletus*] are rapidly becoming scarce" (*Nidologist*, vol. I, 1894, p. 122). D. A. Cohen, speaking of the species in 1899, said, "it would be a wise move for the Supervisors of Alameda County to declare a closed season, or two successive closed seasons, on rail. This is the only means of preventing this fine bird, now almost absent from our marshes, from becoming annihilated" (*Bull. Cooper Orn. Club*, vol. I, 1899, p. 31). H. R. Taylor in 1894 mentions the fact that "the California Clapper Rail are becoming rapidly thinned in numbers. The pot-hunter and his dog and gun have done the work" (*Nidologist*, vol. I, 1894, p. 153).

Many references may be found which call attention to the numbers of these birds which were formerly slaughtered by the market hunter. M. S. Ray is quoted as follows: "As late as 1889 I remember sportsmen returning with as many as 200 Clapper Rails" (*Grinnell, Bryant, and Storer, Game Birds of California*, 1918, p. 288). H.

C. Bryant said in 1915 that the California Clapper Rail were "so reduced in numbers four or five years ago, that the species would doubtless have become absolutely extinct within a few years" had it not been for the passage of the Federal Migratory Bird Law (California Fish and Game, vol. I, 1915, p. 192).

And yet in spite of legislative protection there is no close follower of the "rail situation", if it may be so termed, who is not decidedly alarmed about the future of this pathetically helpless species. Ornithologists were alarmed about the depletion in the numbers of rail twenty and thirty years ago due to lack of protection by law. Ten years ago they were still alarmed, although optimistic because of recently enacted Federal and State legislation. Since that time (1915) there have been many new and alarming developments. It is to these that I shall now turn my attention.

Whereas legislative protection, as Bryant has said, was the saving of our rail ten or fifteen years ago, today it appears to me that only legislative action of a far more drastic nature can possibly save the species from extinction. Let me explain that statement and give reasons for my belief.

Originally our rail were resident quite generally over the entire marshes of San Francisco Bay. With the coming of civilization, and more particularly with the coming of the modern pump-gun, thousands upon thousands of rail were shot annually by sportsmen and market hunters resident in the Bay district. About the cities, particularly about San Francisco, Oakland, and Alameda, they began gradually to disappear until, by 1915, Bay Farm Island was the only point in this territory where rail could still be found.

Since the enactment of the Federal Migratory Bird Law in 1913 I should enumerate rail enemies, in order of their importance, as follows: 1. Industry and the encroachments of civilization upon the few remaining haunts of our rail. 2. Individuals, particularly boys and young men, who persist in shooting rail in spite of our protective game laws. 3. The Norway rat, which infests almost all of the remaining marsh land, particularly those areas which have been dyked. 4. A small species of mussel which was introduced from the east into the Bay region at Redwood City some twenty years ago, and which has since spread to almost all of the gutters in the Palo Alto, Redwood, San Carlos and Belmont marsh areas. 5. A certain few "egg hogs" who year after year invade the marsh, taking every set of rail eggs they find. 6. Migratory Prairie Falcons, Ferruginous Rough-legs, Duck Hawks, and Cooper Hawks, and occasionally a resident Red-tailed Hawk or Golden Eagle. A brief discussion of each of the above points will, I believe, suffice in support of my statements.

#### I. INDUSTRY AND THE ENCROACHMENT OF CIVILIZATION

That civilization in general, and industry in particular, constitutes our rail's greatest enemy there can be little question. Twenty-five years ago the birds were fairly common in the northern half of the Bay region. Today reclamation of much of that land for agricultural purposes, and the ever increasing development of industrial plants of one sort or another, has completely wiped them out of existence in that territory. Not even a single specimen has been recorded from there in recent years! In 1915 in a two-hour field trip on Bay Farm Island, Alameda, I had little difficulty in locating a dozen rail nests. Today Bay Farm Island throbs with human life and industry, and the unfortunate rail has been forced to retreat on one more front.

At Hayward, where Cohen once found them abundant, and even on down to Newark, where ten years ago they were quite common, today hardly a rail can be found. Salt works by the score, magnesia plants, the Dumbarton railroad and automobile bridges, and other industrial enterprises of a similar nature have completely wiped out their breeding and feeding grounds.

At Alviso several industrial plants are endangering haunts which have always been famous for the abundance of Clapper Rail. Here, in addition, many private and a few commercial duck clubs, where I am sorry to say all of the members are not above "potting" a rail now and then for a "mulligan", constitute an additional hazard which is further depleting the ranks of this rapidly vanishing species.

From Alviso on around the lower end of the Bay, and on the Peninsula side up to Palo Alto, only two serious rail hazards present themselves. The first is the reclamation of marsh land for agricultural purposes, and the second is the establishment of several duck preserves. Here again, breeding and feeding grounds are being depleted, and it is to be feared that during the duck season a very considerable number of rail meet their fate in some "unexplainable manner"!

At Palo Alto the Dumbarton railroad and vehicle bridges have destroyed the security of one of the rail's strongest stamping grounds. Several duck clubs have also helped to break up heretofore inviolate breeding grounds in this district. Between Palo Alto and Redwood City one large real estate venture threatens to break into another heretofore prosperous rail territory. At Redwood City proper the Pacific Portland Cement Company's plant has destroyed one huge area formerly occupied by rail, and it threatens to break into another. Across Redwood Creek from the cement plant, to the north, there remains one large tract of land which has always been "safe ground" for rail because it has been isolated from the mainland on all sides; it is virtually an island. This tract, which comprises some 4000 to 6000 acres, has during the past few years been an increasingly important breeding ground because of its singular isolation. It is inaccessible to humans except by boat, it has not been dyked, no duck clubs have invaded any part of it, and so far no industrial plants have been established within its confines.

To the north of the large creek (Smith's) which flows out towards the bay from San Carlos lies a large reclaimed area which is now being used for agricultural purposes. From Belmont north to Beresford the bay shore has been dyked and is being used for salt ponds and a duck preserve. At Beresford the aviation field takes up a considerable area, just north of which there are more salt ponds. The Leslie Salt Works cover the bay shore area immediately adjoining South San Mateo and Leslie, while at North San Mateo various human enterprises have destroyed once famous rail country. Among these may be named an amusement park, city dump, residential property, etc.

From Burlingame north to Broadway civilization is too evident for the security of rail, and I have not seen or heard of a bird thereabouts for several years. Between Broadway and South San Francisco is another piece of once famous rail ground now totally, or nearly, devoid of this bird. Much of this land has been reclaimed and now supports large dairy herds, while a portion of it is only now being broken up by the new Bay Shore Highway. Way up into Baden, where rail nested commonly fifteen years ago, civilization has almost completely wiped out any evidence that the bay once covered that area. Beyond South San Francisco and on up to San Francisco every vestige of marshland is rapidly being eradicated by factories, shops, railroad yards, etc., until today it would be a novelty indeed to see one of our picturesque little rail anywhere in the district.

Such is the status of the rail ground about San Francisco Bay today, the only ground in the world where California Clapper Rail have ever been abundant. For fifty years the web of civilization has been ever tightening, ever forcing the species into a smaller and more narrowly confined area until it is now, without doubt, only a matter of a few more years until *Rallus obsoletus* will be wiped out of existence in its native haunts.

I do not know of a single species of bird which has taken such a strong hold upon me as has this pathetic marsh dweller. Anyone who knows the Clapper Rail, his harmless habits, his clownish and helpless flight, his friendliness and apparent curiosity as he stands out in the middle of a mud flat or upon some piece of floating debris, the most conspicuous object in sight, cannot help but love him.

To summarize: During the early days of the settlement and civilization of the Bay region the rail's worst enemy was the man with the gun and dog. Man-made protection, in the form of game laws, finally came to his aid and since 1913 protection from hunters has been fairly complete. Since civilization began in the Bay region a far more sinister and relentless foe has been at work gradually annihilating the rail by taking away, bit by bit, his feeding and breeding grounds. Never yet have sportsmen or nature lovers found a way of stopping the onrush of this most ominous foe of wild life, human industry. With all Americans business is business and seldom if ever does sentiment stand in the way of business progress.

The San Francisco Bay region is destined within the next few decades, without doubt, to become one of the great industrial centers of the Pacific Coast, if not of the world. This means that the great marsh areas are to be completely wiped out of existence, as such, within the next few years. The result is obvious, for industry means all of the thousand and one human "improvements" which will contaminate or eliminate the rail's natural habitat, his breeding and feeding grounds.

#### II. INFLUENCE OF DUCK PRESERVES AND SCARCITY OF DUCKS

About the Bay region, particularly about the marshes adjacent to Alviso, Mountain View, Palo Alto, Redwood City and San Carlos, are to be found many private duck clubs or preserves. About these clubs during the duck season a good many hunters congregate for semi- or tri-weekly shoots. When duck shooting is poor, as it has been invariably for the past few years, many of these hunters do not hesitate to "practice" on other targets. A few hunters go out and bag protected game birds without discrimination, these commonly including curlew, plover, snipe of various species, and rail. Other hunters either through ignorance, inexperience, or whatever you wish to call it, shoot the first thing that comes along that looks even remotely like a duck; very often rail fall in this class. Other hunters about these preserves often shoot Black-crowned Night Herons, Great Blue Herons, Red-tailed, Sparrow and Marsh Hawks, and even occasionally a White-tailed Kite, on the grounds that such birds are "destructive", or "no good", or "just naturally nuisances"!

Second only to these adult law breakers who are contributing to the destruction of many beneficial birds, including the California Clapper Rail, comes "the boy with a gun and a lust to kill something, anything". About the smaller peninsula towns there are many of these boys, ranging from twelve to twenty-one years of age, who spend most of their spare time during the duck season on the marsh, and woe to the luckless rail that dares show himself. Boys are boys, and rarely do you find one nowadays, when wild life is so scarce, who can resist the temptation to shoot the first bird that jumps. Many rail, just how many it is hard to say, are killed at the hands of these youngsters.

For the benefit of all of our protected birds, but more particularly for the benefit of the Clapper Rail, the White-tailed Kite, the Sparrow Hawk and the Marsh Hawk, it seems to me that the Fish and Game Commission of the State, the Audubon Society, the Cooper Club, and other interested organizations can and should immediately enter into an extensive educational campaign. The printing in colors of life-sized pictures of such birds, giving a detailed description of them and their value to society, such pictures to be placed in all duck preserve club-houses, sporting goods stores, public schools,

etc., would be a preliminary step which, I am sure, would bring results of far-reaching importance.

In addition the Fish and Game Commission might well extend their excellent "Dollar a Year Game Warden" plan so that every section of the state, no matter how small, would be looked after. Certainly, about the Bay region there is a crying need for more wardens who will give special attention to the protection of our rail. By educating the ignorant and disciplining the law-breakers there can be little question but that the Clapper Rail, along with other protected species, would benefit materially.

### III. THE NORWAY RAT

For various reasons, for example the establishment of salt ponds, the placing of power lines, and the reclamation of land for agriculture and for industrial projects, many areas about the San Francisco Bay shore have been dyked. No sooner is a dyke constructed than Norway rats appear in great numbers. Large gray fellows they are, on a dark night appearing to be as large as small cotton-tail rabbits. Their home is on the dykes, generally in an old shack, a pile of drift material, or some similar rendezvous. The Clapper Rail has no more deadly enemy than this sinister fellow. No rail dares nest on a marsh area which has been dyked, for as surely as she does this vicious enemy will track her down and destroy the eggs. Many nests have I found bearing mute evidence of the fact that some luckless rail had gambled her skill at nest-hiding against the cunning of the Norway rat, only to have her home destroyed.

Ridding the marsh of these rats seems a hopeless job, to say nothing of being an expensive one. The rail's only alternative is to move to new undyked areas. But with more dykes being erected constantly, the available undyked land becomes smaller and smaller in area. Once again the relentless surge of civilization plays a leading part in annihilating our Clapper Rail.

### IV. THE INVISIBLE FOE

Some thirty years ago a small black mussel was introduced from the east into the marsh near Redwood City. It spread like a weed and it was only a few years until every creek and gutter on the west side of the Bay was inhabited. This apparently harmless little mussel has been another of the rail's most relentless enemies, and the number of rail deaths attributable to its activities is incredible.

A peculiar and characteristic thing about this mussel is that when it dies the two halves of its shell are so tightly locked together that they cannot be pried apart without injuring or breaking the shell. And therein lies the story of the death of many a rail. Countless millions of these small mussels cover the edges and sometimes the entire bottoms of the gutters and creeks of the west Bay marshes. Up under the banks, where the rail so commonly feed and hide when the tide is out, these death traps are found in greatest numbers. With the incoming and outgoing tides, at just the time when the rail are feeding, these mussels open their shells in search of food. Along comes a rail gingerly pecking into the soft mud in search of crabs, worms, or other small marsh life. Inadvertently he rams his beak into the open mussel and in an instant the trap is sprung and the rail is helplessly and hopelessly trapped. If it happens to be an adult bird the mussel is generally pulled loose from its surroundings by the frantic efforts of the bird to release himself from his unexpected assailant. But, alas! shaking and scraping and pulling are all in vain; for no self-respecting mussel, once closed on an enemy, will ever release his death grip. Unable to prod for food, often unable even to open his beak, and frightened into madness by the relentlessness of his foe the poor rail eventually comes to a pitiful end, death by starvation. Mr. Littlejohn had for years a mounted adult rail which he collected on the marsh in the last stages of such a



struggle. Several other specimens have been reported in the same condition and no one knows or can even estimate the number which go to their death in this manner.

A second and perhaps a more common method by which these mussels destroy rail is by trapping their toes. While in search of food it is almost impossible for the birds to avoid stepping onto or into these partially or often fully hidden traps. The instant they do so the trap closes and then the battle for life begins. In the case of an adult rail the mussels are generally pulled loose and often dragged around the marsh for days, or even weeks. Eventually the rail may die, or, as is more generally the case, that part of the toe which is encased in the mussel's shell breaks or tears loose from the rest of the foot.

Many dead and live rail have been examined by Mr. Littlejohn in the past twenty years, and a good number by the author, and in almost every instance one or more toes have been found missing. It is our belief that at least seventy-five percent, and perhaps more, of the adult rail of the Redwood marsh area are minus toes from this cause. While the adult birds are generally able to pull the mussels loose from their attachments there are, no doubt, some cases where the bivalves prove too strong for the rail. In such cases it is simply a matter of hours until the next incoming tide drowns the hapless individual so caught. But while the adult rail generally escapes with merely the loss of a toe or two, young birds must meet death frequently by both methods, particularly by the latter.

Upon hatching a brood of young the parents at once lead them to some small gutter where they teach them to look for food. It is these small gutters, particularly, which are filled with mussels, so filled in fact that it is practically impossible to find space along their sides which is not literally covered. The hazard to young rail therefore is obvious; it is greater, I should say, than any other single hazard which these silky little black balls of down have to face in their early days of life.

Here again it is difficult, in fact it is merely guesswork, to estimate the number of young which are killed annually by these deadly enemies. Two facts give me some basis for stating that probably one or two chicks in every brood, if not more, meet an untimely end in this manner. First, whereas generally every egg of the usual rail set of seven, eight or nine, is fertile and hatches, seldom do you observe half or three-quarter grown broods of young rail containing more than five or six individuals. I attribute this loss or decrease to the work of the mussels. Second, this year Mr. Littlejohn and I were fortunate enough actually to obtain proof of this contention when, on July 13 at Redwood City, Mr. Littlejohn heard an adult bird clucking to a brood of young in a small gutter. He called me to the spot and after diligent searching we discovered the cause of the parent bird's extreme solicitude. One of her young, probably four days old, was held tightly in the grip of a mussel which had closed on its center toe. The tide was coming in rapidly and in a very few minutes, had we not discovered him, the poor little tyke would have been drowned. He was exhausted from his frantic efforts to free himself from his merciless captor and his frail little toe was just hanging by a thread, enough of a thread, however, to hold him fast. We tried to pry the shell open but without avail. As a last resort we cut the tiny ligament which held the little fellow captive, and put him back on the ground where he lost no time disappearing in the direction in which his mother had last been seen.

#### V. EGG-COLLECTORS

Lattin and Short's egg price list of 1905 listed California Clapper Rail eggs at fifty cents each. The American Oologists Exchange Price List of 1922 lists the same egg at one dollar. At either period it is clearly evident that California Clapper Rail eggs were not classed as rarities; nor are they today. Yet when the extremely limited range of the species is taken into consideration, is this not rather an interesting situation?

Throughout all of the literature which I have scanned, and as a result of personal correspondence and personal field work, I find but two localities in the world where *Rallus obsoletus* have been known to breed. Marsh land about San Francisco Bay, as already described, is the normal and by far the most common breeding ground, while the Elkhorn Slough district south of Watsonville, California, is the second recorded breeding area. Additional records of stray birds observed along the ocean marshes of Marin County may be found, with perhaps a casual bird being noted as far north as Grays Harbor, Washington.

But there remain, as indicated, but two places in the world where these birds have ever been found actually breeding. Ninety-nine and ninety-nine one-hundredths percent of the sets of California Clapper Rail eggs in collections today have been taken on San Francisco Bay, or in its environs. Furthermore, it would be safe to say that a majority of these sets have been collected by fewer than twenty-five well-known collectors, perhaps a dozen of whom have made it their business to supply the market.

In order to do this it is obvious that many of these collectors have made it their business to go out onto the marsh and take every rail set they could find. Locating a nest is an easy task, as previously pointed out, and ten years ago twenty-five to thirty nests in a day's hunt was considered to be just an ordinary occurrence. I have it upon the authority of Mr. Littlejohn that certain egg collectors loaded up in this manner, not once, but several times during a season. Although those days and those particular collectors are now gone, even today there are a few collectors who make it their business to go to the marsh, once or twice every season, taking every set of rail's eggs they find, totally regardless of the increasing scarcity of the birds.

In view of the above facts, all of which point to the early extinction of the species unless some drastic protective measures are taken, would it not be wise for the California Fish and Game Commission to place the California Clapper Rail upon its list of fully protected birds? Certainly sets of rail eggs and prepared skins are common enough and of small enough value so that all active egg and bird collectors would respect any such protective legislation.

#### VI. RAIL AS FOOD FOR RAPTORES

Without question Chase Littlejohn has made a more careful and thorough study of the relationship between the California Clapper Rail and the resident and migratory raptores of the south Bay region than any other ornithologist in history, and his field notes offer a rich storehouse of material upon which to draw. Turning first to the migratory raptores we find the names of Ferruginous Rough-leg, Duck Hawk and Prairie Falcon conspicuous as rail enemies. In former years, particularly during the fall and winter months, these birds all contributed toward the destruction of the rail. Of late years, although seen occasionally on the marsh, we believe this source of danger to be almost negligible. This is due, in large part no doubt, to the woeful decrease in the number of ducks which annually winter in the Bay marshes, and which these raptores follow.

In former years, when rail were plentiful, it was not at all uncommon to see one of the above mentioned hawks swoop down into a small gutter, soon to reappear with an unfortunate rail clutched in its talons. But it was at high tide, particularly, that the rail were at the mercy of these enemies. With their native hiding places, the gutters, filled with water, many of them foolishly strutted forth to points of vantage on the high ground, seemingly totally oblivious to all danger. Here, perched upon an old log or piece of drift they fell easy prey to the alert eye, bullet-like dive, and slashing talons of marauding Duck Hawks. Oftentimes, aware of the enemy, a luckless rail would des-

perately take to wing in an attempt to gain some thick clump of salicornia in which to hide; but rarely if ever with his slow, pathetically helpless flight was he able to evade the bullet-like speed and accuracy of his enemy's charge.

The Cooper Hawk has always been, and still is, a frequent visitor of the marsh land about San Francisco Bay. I have never seen this species actually catch or kill a rail, although many times I have seen a rail make the same desperate effort to hide from this species as it would from the hawks mentioned above. The evidence would point, therefore, to the fact that this species too may occasionally kill rail.'

Turning next to resident species: in early days when squirrels, rabbits and other small mammals were abundant in the foothills, it is safe to say that rail were almost never molested by resident raptors. But with the ever-increasing tide of civilization, there has been a steady decrease in their native food supply. Squirrels have been poisoned and shot by farmers, farm bureaus and many other agencies, until today it takes a careful search to find any sizeable colony of them near the Bay. Rabbits, including cotton-tails, brush rabbits and even jack rabbits, are almost a novelty nowadays in San Mateo and Santa Clara counties, thanks to the annual bombardment by hunters of the Bay region. Other less common, but none the less important species of small mammals are correspondingly depleted in numbers until today our few remaining Red-tail Hawks, Golden Eagles and Horned Owls have a hard time indeed, getting a square meal. With their native food supply so sadly depleted these resident birds have been forced to look elsewhere for food. What more natural source could they have found than the rail of the marsh?

For the past ten years it has been no uncommon sight to see as many as half a dozen eagles and red-tails circling above a certain piece of marsh land at one time. We have never caught an eagle actually in possession of a rail, but we have, times without number, seen red-tails in possession of rail. Mr. Littlejohn during the past fifteen years has personally killed over twenty Red-tail Hawks, each one of which had some portion of a freshly killed rail in its talons. A majority of these birds were shot while feeding on their kill, perched in a giant walnut tree which stands at the edge of the marsh in Mr. Littlejohn's back yard. During the last five years, however, red-tails have become so scarce in San Mateo and Santa Clara counties that this source of danger to the rail is practically eliminated.

Our big Horned Owl we have occasionally seen on the marsh on moonlight nights, silently gliding about the rail habitat in a rather suspicious manner. And although we have never found rail feathers about the owl's nest, nor have we ever actually caught an owl with a rail in his possession, indications point to an occasional rail death from this source. Certainly the rail set up a terrific racket when, on a moonlight night, one of these huge sinister shadows glides low over their territory.

For a period of years, beginning, so far as we know, about 1900 and lasting until about 1912, and perhaps even today in some other marsh locality, a pair of Duck Hawks nested on the bay shore of the marsh, near Redwood City. Mr. Littlejohn first discovered this pair nesting in an old barrel, above high tide, on a shell bank. For several years he annually collected a beautiful set of eggs from this pair of birds. Their food, and the food for their young, undoubtedly consisted largely of rail which at the rate of a bare minimum of two a day would amount to the appalling total of some seven hundred per year. Fortunately for the rail of the vicinity I believe that this pair of Duck Hawks was killed by hunters several years ago, as the birds have not been noted in their o'd haunts for some time past.

#### POSSIBILITY OF DOMESTICATION OR OF INTRODUCTION INTO NEW LOCALITIES

An interesting and unusual occurrence was brought to my attention in the early part of May, 1926, at Menlo Park, California. Out in the chicken yard of a certain

family was a bantam hen proudly strutting about the enclosure, the unique "mother" of seven little fuzzy black rail. Upon questioning the owner I learned that the eggs had been found in their nest on the marsh, brought into town, immediately placed under this bantam hen and in due course of time had hatched out just as perfectly as though they had never been disturbed. The young rail were as healthy and seemingly as contented as any youngsters I had ever observed on the marsh, picking and pecking here and there just as placidly as any young chicks in the yard. Their adopted mother took exceptionally good care of them, fighting for their rights just as fervently as though they were her own.

For two weeks they got along splendidly, and then one day, suddenly and apparently without cause, several bantam roosters turned on them and, despite the gallant defense of the mother hen, killed them all. Human help arrived too late to save any of the helpless little waifs and thus unfortunately ended one of the most unusual wild game raising efforts, I believe, ever attempted.

This experiment proves rather conclusively that under proper auspices, at very little expense or trouble and with practically no equipment, these rail might very easily be "hand-raised" and domesticated. If this could be done, and places made for them at the State Game Farm and in various public parks, duck preserves, etc., a happy and inexpensive solution of the rail problem would be found. Introduction into other parts of the state might feasibly be carried out and if the rail seemed to thrive in these new locations perhaps their extinction might be averted. I, for one, would be glad to donate my services to the Game Commission in the furtherance of any such project.

#### ADDENDUM

Since completing this paper some new material has come to my attention which warrants an additional word or two concerning the rail habitat. In my discussion of present nesting grounds I stated that a certain large tract of land north of Redwood City and south of Belmont, a large part of which actually lies between Redwood and Smith creeks, was without doubt the most prolific rail breeding ground on the Bay yet untouched by civilization. I spoke too soon, however, for only recently I have received no less than three separate advertising circulars telling of one of the latest and greatest developments ever planned for the Bay region, namely the establishment of Port San Francisco on the very tract of land which I mentioned above.

This immense project is being pushed by the San Francisco Bay Terminals Company, a corporation of San Francisco business men. As their pamphlets state: "The property embraced within the project is 4156.5 acres located on the San Francisco Bay Shore", between Belmont and San Carlos. Ground for unit number one, which is located just south and east of Belmont, was broken on October 10, 1926, so that in all probability many rail in the spring of 1927 will be forced to vacate nesting sites which have been used by them for generations upon generations. The ultimate establishment of units 2 and 3 to the south of number 1 will, in all probability, eat into the very heart of that great Redwood-San Carlos breeding ground which, as I stated, has heretofore been rail ground inviolate.

With the ultimate establishment of Port San Francisco, with its factories, docks, warehouses, railroad trunk lines, highways, etc., will come the end of the California Clapper Rail in a part of their native habitat which today stands forth as their most conspicuous and important breeding and feeding ground. With the ruination of this tract, except for small isolated, rat infested areas here and there, particularly in the neighborhood of Alviso, so far as I can see we will have to write "finis" to the history of the California Clapper Rail. I can only hope that ways and means of saving it from actual extinction, by introduction into suitable districts elsewhere, will be carried out.

*Santa Barbara State College, Santa Barbara, California, April 8, 1927.*