

would lead one to suspect, are most closely related to *mariposae* and appear to be a northward extension of this race as well as a connecting link between it and *brevicauda*. The winter-taken *megarhynchus* overlap extensively with *fulva* and their average is intermediate between those of *mariposae* and *fulva*. Further study of the graphs shows that there is a nicely graded blending among the various races of Fox Sparrows, with the least, however, between *brevicauda*, on the one hand, and *fulva* and *megarhynchus* on the other. These facts, coupled with the evidence from the Onion Mountain series, do not agree with Swarth's statement (p. 162) that "*megarhynchus* is most nearly like *brevicauda*."

This disagreement becomes increasingly marked as one considers the geographic correlations of the average bill measurements. On a map (fig. 28), the Onion Mountain group is seen to form part of a chain of groups with increasing bill size, running from the vicinity of Johnsville, Plumas County, north to Onion Mountain and from there south to the vicinity of Yolla Bolly Mountain, Trinity County. *Megarhynchus*, contrary to what had been expected, does not fit into this chain at any point where breeding birds have not been collected, at least as far as can be told from the measurements.

To my knowledge no specimens of *Passerella* have been taken on the western slopes of the southern Cascades in Oregon. As this is the most favorably situated area of large enough size to support a race of Fox Sparrow, it is possible that here may lie the unknown breeding grounds of *megarhynchus*. This falls in with the evidence obtained from measurements, but of course the area needs to be explored in order to obtain necessary factual material.

Another possibility is that the race *megarhynchus* does not exist as such in nature, but instead has been "synthesized" from certain similar variants of other races. Such a mishap is possible, but insufficient work has been done to allow further discussion of it.

To conclude, *megarhynchus* is not the breeding Fox Sparrow of the southwestern mountains of Oregon as was formerly supposed. Instead, this area is occupied by a connectant population of *mariposae* that intergrades between *mariposae* of the Siskiyou area and *brevicauda*. This means that the breeding ground of *megarhynchus* is as yet undiscovered and may lie, if the race exists as a natural population, on the western slopes of the southern Cascades in Oregon.

San Francisco, California, January 21, 1938.

ENVIRONMENTAL FACTORS AFFECTING WATERFOWL IN THE SUISUN AREA, CALIFORNIA

By JAMES MOFFITT

Upon reading Stoner's record of ducks shot in the years 1882 to 1907 on a gun club near Cygnus, Solano County, California (Condor, vol. 39, 1937, pp. 242-248), some recollections based upon twenty-five years' experience with the ducks of the Suisun marsh area came to mind which I believe should be taken into consideration in analyses of this sort. Nothing that I state here is intended as criticism of Stoner's interesting paper, the thoughts being presented as suggestions to be borne in mind when evaluating data of this kind.

Environmental conditions for ducks have changed greatly in this region since the first shooting club was organized in 1879. No doubt many alterations traceable directly and indirectly to civilized man affected the Ibis Club grounds, of which Stoner writes,

in the period in which bag records were kept. Some of these changes unquestionably resulted in fluctuations in relative abundance of different species by making the habitats for the individual kinds increasingly or decreasingly attractive. Furthermore, before the first club was established, conditions on this marsh may have been changed by man, by silting of the bay and ponds and perhaps by increased salinity of the water due to early hydraulic mining operations. Originally the Lesser Snow Geese (*Chen hyperborea hyperborea*) made the ponds on this marsh by tearing up clumps of three-square (*Scirpus americanus*) to secure its bulbs for food, just as McIlhenny (Auk, vol. 49, 1932, p. 287) has so graphically shown the Blue Geese (*Chen caerulescens*) of Louisiana do. Then, the Whistling Swans (*Cygnus columbianus*), working in the areas opened by the geese, deepened the ponds to three feet or more by tilting up like surface-feeding ducks and reaching down with their long necks. Plant growth, of which sago pondweed (*Potamogeton pectinatus*) is by far the most important one locally, becomes established when ponds with proper conditions of salinity and requisite depth (18 inches or more) are created. Sago pondweed, an excellent food plant, attracts surface-feeding ducks, notably Pintail (*Dafila acuta*), until the ponds are deepened so that the growth is no longer within reach of the surface-feeders. The ponds then become attractive to diving ducks, of which the Canvasback (*Nyroca valisineria*) is the only common one in this region. Canvasbacks in their feeding operations, may further deepen the ponds. The carp, an introduced fish in California, fortunately is not common in the Suisun marsh area but is abundant in other duck habitats in California. They also deepen ponds and are tremendously destructive to food plants.

In the Suisun region, Mallards (*Anas platyrhynchos*) are common along some sloughs and the bay shore where there are thick growths of hard-stem bulrush or common tule (*Scirpus acutus*). They are only to be found in numbers on the marsh in ponds bordered by this growth or by cattail (*Typha latifolia*). This duck is especially fond of tideland tule thickets where openings permit it to alight and to feed on the fallen seeds of the plant. Green-winged Teal (*Anas carolinense*) to some extent share this feeding habit with Mallards. In my experience on the marsh, I have seen a good mallard pond ruined for this species through destruction of the tules by overgrazing of cattle, and in other instances hogs have caused similar damage. At the same time, these domestic animals have made certain areas more attractive to some birds, such as Wilson Snipe (*Capella delicata*). Winter tule burning, widely and long practiced by gun clubs on this marsh, keeps down thick growths bordering shooting ponds where many crippled birds would be lost. Although it is of benefit in this way, it destroys much duck food, cover, and shelter. The last is an important item at times of high wind, when ducks are seen to congregate in numbers to the leeward of tule thickets, levees and other sources of protection.

Originally, of course, water flowed freely over the Suisun marsh at periods of high tide. This condition must have resulted in there being proportionately many more Mallards present in early days. Sometimes today, and probably originally too, in times of high tides accompanied by heavy rains and river flood waters most of the marsh is covered, in places to considerable depths. At such times it is either unattractive to most kinds of ducks, or other areas, newly flooded by the same rains, are so much more attractive that few birds are then found on the marsh.

In the first years of shooting clubs, as shown by McAllister's map of the Ibis Club grounds in 1888 (*op. cit.*, p. 245), the ponds were not diked off and protected by flood gates, but the tides were permitted to flow freely in and out of them. Early in local gun

club history, low levees were erected by Chinese hand labor with flood gates to control the depth of water on the properties. As high tides often overflowed these low dikes and inundated the grounds, with the coming of dredge equipment higher levees were built to permit man to regulate the depth of water in the ponds. This technique is so important in creating optimum conditions for ducks that it is usually supervised by one man in each club. Thus have developed some of the best practical "duck ecologists," men who know to an inch the depth of water on their grounds most attractive to a certain kind of duck and from whom many professional "game managers" could gain a wealth of information.

Since Pintail are the most numerous, and to gunners the most desirable, species in the vicinity, it is for them that conditions are usually made attractive. Canvasbacks are also much sought, but only clubs having deep ponds or sloughs can hope for numbers; I know of no instance where deep ponds have been locally man-created for this bird. It seems almost certain that the Ibis Club grounds were altered by the construction of dikes and that control of water during the period of record resulted in a much reduced kill of Mallards. This fact plus the difference in habitats noted by Stoner and the different periods of years covered by the reports, seem to explain the large variation in numbers of Mallards killed on the Ibis and on the adjoining Tule-Belle clubs (*op. cit.*, p. 246).

The "overflow," while not affecting conditions on the Ibis Club grounds in the period of records because the first one was not created in the Suisun marsh until about 1912, is an innovation which so drastically affected the old-time, natural deep ponds that it should be mentioned here. In the natural ponds, in which water is in so far as possible kept under 18 inches in depth for surface-feeding ducks, the principal natural duck food is sago pondweed. In ponds well seeded by this plant which are not completely dried out in summer and which are flooded in late summer with water that is not too saline, such rank growths of this weed develop by early October as to render difficult rowing a boat or wading through them. It is in these favorite ponds that the early arriving surface-feeders, chiefly Pintails, congregate to feed. Within a few weeks, or usually by mid-November, most ponds are entirely stripped of this growth down to the extent of surface-feeding ducks' reach. After that, the birds are forced to feed at the edges of the ponds where they seek less easily obtainable sustenance, or they go elsewhere to feed. For this reason, the wise shooting ground manager will keep the water as shallow as practicable in the ponds in the early season and after the exhaustion of the "nut-grass" (local name for sago pondweed) will from week to week increase the depth of the water so as to open up succeeding areas of marginal feeding grounds. Prior to its prohibition, bait was also used to keep the birds on the ponds after depletion of the "nut-grass."

As stated, the "overflow" was conceived about 1912 and so successful were the first ones in providing enlarged feeding grounds, more desirable habitats for certain surface-feeders and therefore better gunning, that in ensuing years, through the 1920's, more and more clubs were forced by the competition of others to construct them. Briefly, an "overflow" is a flat piece of marsh land diked off and flooded to a uniform depth. Practically, in the Suisun area, lands largely devoid of "pickle-weed" (glasswort, *Salicornia*) were chosen if available because this plant provides little duck food and crowds out more valuable plants. If "pickle-weed" was present, its eradication was attempted by plowing or by submergence. After enclosing the area of the "overflow" with dikes and after eradication of "pickle-weed," only sub-soil moisture was provided in summer, with shallow flooding, again carefully regulated, in the hunting season.

Many natural food plants sprang upon lands so treated among which of greatest importance is a small composite with yellow flower and succulent leaves which is avidly eaten by surface-feeders. Thus, relatively large areas of ecologically attractive land were created for the birds, which drew a far greater population of Pintails to the locality in the peak years in the late 1920's than existed on the marsh at any previous time in the course of my observations since 1913. As intimated, the relatively more attractive "overflows" tended to draw the birds away from the old, deeper ponds with the result that very poor shooting was had on many of them after "overflows" became numerous.

While attractive to Widgeon (Baldpate, *Mareca americana*) and teal, as well as to Sprig, the "overflows" are not particularly sought by Shovellers (*Spatula clypeata*). This species seems to be most numerous on the Suisun marsh in periods of high water when most of it is flooded. They apparently are attracted chiefly by the abundance of floating insect food thus made available. Teal alone seem attracted by flooded "pickle-weed" and perhaps chiefly by the insect food thus afforded. Possibly the reason that this species alone among the surface-feeders is commonly found in this environment lies in its small size which permits greater mobility among the rank growths that this plant characteristically forms. The largest aggregation of Green-winged Teal that I have ever seen, about 6000 individuals, came to a field of "pickle-weed" south of Suisun shortly after it was flooded by a levee break, where they remained for three weeks. Smaller concentrations frequently have been observed locally in similar situations. Mallards are not at all attracted by "overflows."

Canvasbacks are the only diving ducks which are common on Suisun Bay and marsh. On the marsh they are restricted to sloughs and ponds over two feet in depth, and they prefer deeper ones. Upon arrival in October and November, they first visit marsh waters of requisite depth affording sago pondweed, being especially fond of its tubers. When this food is exhausted and unless held on the club grounds by bait (usually wheat which is greatly preferred to rice or barley, or sometimes chopped potatoes which they avidly seek), the Canvasbacks resort to the bay, feeding largely on small clams and other animal food. Since the birds roost on the bay from the time of their arrival, including the period when they feed in the marshes, it appears that pondweed and grain are foods favored over animal matter. It was an easy matter for clubs with proper water conditions and good growths of pondweed to "hold" Canvasbacks on their properties with bait long after the birds had cleaned out the natural food supply. After baiting was abolished, so far as the clubs were concerned, Canvasback shooting ceased for the season with the exhaustion of natural food. But this did not mean that many "Cans" were not shot after they left the marsh, for when feeding in the bay they were prey for the sculler and bay-shore decoy gunner. It did, however, result in much poorer tasting birds being shot, for when the Canvasbacks fed on vegetable matter in the marshes their flesh was delicious and free from fishy taint, but soon after they commenced feeding in the bay they became so strong in flavor as to be relatively undesirable for food.

It proved difficult for some clubs with proper water conditions to establish Canvasback shooting by heavy baiting alone, though the species was locally abundant. While sago pondweed has a moderately high tolerance for salinity, it dies out when a certain concentration is reached. Thus a levee break permitting an influx of strongly salt water to a slough where good Canvasback shooting obtained for years, killed this plant growth off with the result that these birds for a long period ceased to visit the grounds, although bait was exposed for them. When the pondweed began to re-establish itself, a few Canvasbacks appeared and more the next year, with increasing numbers coming in successive

seasons until a fine flight was regained after the natural food became plentiful. Since bait was placed in all years, the results indicate that abundance of pondweed was the important factor, and that it required years of experience to draw more and more ducks to the ponds, possibly old ones returning with their young or bringing other birds with them season after season. Thus, numbers of waterfowl cannot always be quickly attracted to an area simply by the placement of food, but it may take years to build up a large population.

Another instance of destruction of Canvasback feeding grounds occurred about 1928 on Suisun Creek adjoining what is now the Suisun State Game Refuge. At that time this property was used as a gun club, but the marginal tidewaters of the creek were (and are) according to law "open" shooting territory. A small tule island here provided cover for the hunter without trespassing on the club lands, and the intervening bed of the creek held some food, probably animal, that for several years had attracted numbers of Canvasbacks. Some of my friends and I, and other "unattached" gunners here secured a number of large bags of these birds. Either annoyed by our success or by the reports of our guns, the adjacent property owner had the tule island removed and the bottom surrounding it dredged out, ruining the duck food supply. The birds ceased at once to visit the locality and have not since been observed there by me, indicating that the food is not yet re-established. Up to about fifteen years ago, the tidal sloughs of Suisun marsh provided feeding places, and in times of heavy winds the banks afforded protection for numbers of ducks of different kinds, including besides Canvasbacks and a few Lesser Scaups most of the local surface-feeders, notably Mallards and Teal. There, especially in stormy weather, the non-affiliated gunner could at times enjoy good sport. Much increased travel by man, especially by bass fishermen in outboard motorboats, has since so disturbed the birds that few now resort to the sloughs.

Salinity, shown to be an important factor as regards sago pondweed, likewise has a strong effect upon other plant and animal life. The increased salinity of the waters of Suisun Bay and its tidelands, which came with greater use of water from its tributary rivers for irrigation, became acute in the drought years of the early 1930's. Salinity was knowingly avoided by all informed duck club managers by storing fresh water for summer use from the June freshets and as sparingly as possible adding to it the salty water of autumn until the rains brought relief. Of late years mosquito control work on the Suisun marsh has presented a serious obstacle to this plan and is resulting in the destruction of many duck food plants. The technique of this work involves ditching to tap all pools and low-lying land and keeping water circulating during the summer, or else draining the ground dry. The former treatment results in circulating through the land in summer, strongly brackish water which is often far above the limits of tolerance for salt of many desirable plant species. Mosquito control, coincident with the abolition of baiting, has made it doubly difficult for property owners to keep their grounds attractive to ducks. Thus, it will have an adverse effect upon land values and taxes levied in the district, because experience has shown the land to be unsuited to profitable agriculture and worth little for purposes other than hunting.

If mosquito control work had not so destroyed the inherent abilities of the land to produce duck foods, a land owner conceivably might develop by clever management a natural food supply sufficient to continue to attract enough birds to provide good sport after the prohibition of baiting. Under conditions existing on the Suisun marsh in the late 1920's, enough natural food was produced to hold the then larger population of birds there without baiting until well into November. It argues that the same amount of food now would keep the smaller quantity of ducks for a longer time. It has always

been the experience on this marsh that if food exists, the birds remain in numbers until heavy rains flood areas elsewhere, thus providing new and better feeding grounds. Normally such conditions do not occur until mid-December or later, but this year (1937) much of California's lowland was overflowed before the shooting season opened on November 27. Thus, for all of California a wider distribution and lesser concentration of ducks is to be expected as the season advances. This is an excellent argument for a late open season on waterfowl in California which would avoid concentrated gunning and would distribute the birds more evenly over the state. One fair objection to this proposal, however, comes from sportsmen in northeastern California (Tule Lake, Modoc and Lassen counties) and east of the Sierra, where a late opening date might find the ponds frozen and the waterfowl absent. This objection could be overcome by declaring a different open period for the area, similar to that for contiguous Oregon and Nevada where this year's open season is the month of November; but the plan has the fault that many hunters from the southwestern area would travel to the region to take advantage of the earlier season, resulting in a concentration of gunners with probable overshooting.

Another matter of importance to be considered in the interpretation of bag records over a period of years is the preference of gunners for certain species. Generally the larger birds, Mallard, Pintail and Canvasback, are shot in preference to others, although some hunters especially like to bag teal. When there was no bag limit, prior to 1901 in California, gunners were not so selective of their game as later and tended to shoot almost any duck that flew by. This, I think, explains to a large degree, the high percentages of Widgeon and of Ruddy Ducks (*Oxyura jamaicensis rubida*) in the record of the Ibis Club, for the latter species and Buffleheads (*Bucephala albeola*) have not to my knowledge been purposely bagged other than rarely in this locality in the course of the past 25 years. Thus, their present complete protection under federal statute means nothing locally. No doubt a greater degree of selection of game prevailed at the Ibis Club during the period when the duck limit was 50 per day, 1901-1906, but the quantity was still high enough not to induce such selection as developed later. In 1907 the limit was reduced to 35 ducks per day and two years later, to 25, where it remained until federal regulation cut it to 15 a day in 1931, 12 in 1933 and 10 in 1936, with complete protection afforded to several locally unimportant species in 1931 and to Canvasbacks in 1936. Weekly state bag limits of twice the daily limit resulted in no conservation of ducks on the Suisun marsh where clubs long ago voluntarily agreed to shoot only two days a week (Wednesdays and Sundays) as a means for providing better sport. During the time that the daily limit was 25 ducks, hunters tried to take straight "limits" of one species, preferably Canvasbacks or Pintails, with the result that proportionately fewer birds of other kinds were killed, and this practice became more general with further limit reductions. In the past 25 years, relative numbers of Widgeon, Green-winged Teal and Shovellers have decreased markedly in California as compared with Sprig. Too much stress, I think, has been laid on reduction of breeding grounds as a cause and not enough to the fact that these kinds have been shot off in greater proportion than the Pintail. Even though the latter is more desirable, the former kinds are much less wary and decoy more readily than do Sprig.

As further evidence for the operation of the factors which have been discussed, percentages of species bagged by a shooting club on the Suisun marsh with grounds similar to those of the Ibis and Tule-Belle clubs combined (natural ponds, and shallow and deep sloughs) are provided for the period 1919-1926, inclusive, as follows:

Mallard	.5
Pintail (Sprig)	49.7
Widgeon (Baldpate)	22.3

Teal	16.3
Shoveller (Spoonbill)	7.5
Canvasback	3.6
Gadwall	} .1
Lesser Scaup	
Ring-neck	

These records should be compared with Stoner's (*op. cit.*, p. 246), especially with his percentages of combined kills of both clubs. Outstanding is the great increase of Pintails. This species in my table about equals all other kinds combined. The low percentage of Canvasbacks is explained by the fact that the period of record covers one of the poor years for this duck on this club due to temporary depletion of natural food. The grounds are not suited to Mallards.

The combined records agree in indicating that the Sprig is the commonest duck, followed by Widgeon, Teal, Canvasback, Shoveller, and Mallard, a conclusion which checks with my observational evidence over the 25-year period. These are the only ducks that can be termed "common" on the Suisun Marshes and Bay. Ruddy Ducks and Lesser Scaups (*Nyroca affinis*) are still to be classed as fairly common on deep water, the latter on the Bay only. The Ibis Club records of "Black-jack" unquestionably include perhaps as many Ring-necked Ducks (*Nyroca collaris*) as "Bluebills," for the colloquial name "Black-jack" is used by some gunners for both kinds and others are unable to distinguish them. My experience has shown the Ring-neck to occur on the marsh nearly as frequently as does the Lesser Scaup. Buffleheads are rather uncommon on the marsh while Gadwalls (*Chaulelasmus streperus*), and Redheads (*Nyroca americana*) appear now to be even less numerous than formerly. No doubt a few Gadwalls are scored as Mallards and some Redheads as Canvasbacks in the club records, but my observations indicate that both are relatively rare visitors locally. Golden-eyes (*Bucephala clangula americana*) are only fairly common on the bay and infrequent visits on the part of this species to the marsh are apparently confined to young of the year and to females.

Among the mergansers, all of which are grouped by gunners as "fish ducks" and are seldom shot and if so never saved for food, my experience indicates that the Red-breasted (*Mergus serrator*) is almost entirely restricted to the bay, where it is not numerous. The American Merganser (*Mergus merganser americanus*) is, conversely, to be seen chiefly on the marsh where it has been noted but sparingly by me in mid-winter only, especially in cold winters. The Hooded Merganser (*Lophodytes cucullatus*), likewise restricted to marsh waters, is rare and I have but one local record, a female in my collection shot near Teal Station, December 19, 1915. Wood Ducks (*Aix sponsa*), indicated by Stoner's records (*op. cit.*, p. 246) to have been not rare on the Ibis Club in early days, are now seldom seen on the marsh. Not more than four instances of this duck's occurrence have been reported to me in the past 25 years (one killed near Suisun, October 9, 1927; others reported since then). In view of this species' successful "comeback" in the Sacramento Valley where it is at present abundant, it is strange that more Wood Ducks are not now seen on the Suisun marsh. Occurrences of other kinds of ducks in this area are to be regarded as accidental. I have one record each for Fulvous Tree Duck (*Dendrocygna bicolor*) and Old Squaw (*Clangula hyemalis*), the latter recorded by J. W. Mailliard (Condor, vol. 18, 1916, p. 85). Scoters of at least two kinds and Greater Scaup (*Nyroca marila*) surely occur on Suisun Bay at times, but I have no definite records.

Among the geese, the Lesser Snow has been much the most numerous kind throughout the period of my observations. Several thousands of these birds winter regularly in the area and so far as I know have roosted at night exclusively on Joice Island, both before and after establishment of the state game refuge there. I have a number of times noted flights of this species back and forth across the mountains north of Suisun, assuming them to represent travels to or from the Sacramento Valley. Occasionally many more than the normal number of these birds may be present for several days. While this condition has been observed principally during periods of flood, or of freezing weather, in the Sacramento Valley, the largest local concentration of Snow Geese coming under my observation occurred in mid-November. At least 20,000 white geese spent November 17, 1929, on Suisun Bay where pursuit by gunners often drove them to flight and provided excellent opportunities to estimate their numbers which I conservatively placed at this figure. The outgoing tide drifted the two-mile-long "raft" of birds down opposite Martinez by late afternoon when all arose, most of them to alight on mud banks exposed on the northeast side of the bay; but several large flocks flew over Pierce Station and Cordelia, to disappear in the northerly direction of Williams or Arbuckle in the Sacramento Valley. Partly on account of their habits, but mainly because gunners do not relish their flesh, white geese have formed a relatively small part of hunters' bags in proportion to their relative abundance in the region. Stoner's surmise (*op. cit.*, p. 247) that the local birds are referable to *hyperborea*, the lesser form, is assuredly correct, for the larger race, *atlantica*, is almost unknown west of Atlantic coastal waters.

Next to Snow Geese in point of abundance come the White-fronted (*Anser albifrons albifrons*). Because of their tender flesh, they have even supplanted Canada Geese in the hunters' favor. I have recorded the presence of the Tule Goose (*Anser albifrons gambelli*) on this marsh (Condor, vol. 28, 1926, p. 241), and more recently have found this large form to be fairly numerous locally in some years in midwinter. Five were shot (3 preserved) from flocks totalling 150 or more, 1 mile east of Pierce Station, December 28, 1932, whence others were reported about the same date in the preceding and following years. One of the birds secured was heavily coated with crude oil. Numbers of Tule Geese were observed adjoining the north boundary of the state game refuge, 4 miles south of Suisun, on January 14 and 17, 1931.

Of the Canada Geese, *Branta canadensis canadensis* is the only race which now regularly visits the Suisun marsh, where it is a late winter visitant in small numbers. Probably not more than 700 Honkers, all told, are to be found on the marsh in recent years of average visitation. Because of their wariness, relatively few of these birds are shot. Heermann (Pac. Railroad Rept., vol. 10, part 6, no. 2, 1859, p. 67), as noted by Stoner has presented under the title "Hutchins' Goose," a graphic description of enormous numbers of geese which visited the area in early days, and his remarks upon feeding habits may correctly be applied to those of the much smaller numbers of Snow and White-fronted geese wintering there today. Heermann's account indicates that the Lesser Canada Goose (*Branta canadensis leucopareia*), which name has since replaced Hutchins Goose (*Branta canadensis hutchinsi*) for the middle sized "Canada" goose abundant in California in winter, was formerly numerous on the marsh. This bird is so scarce now locally as to be of only casual occurrence, although it is still abundant in the interior valleys of California. In the period 1919 to 1925, when I frequently hunted for ducks on a club 4 miles south of Suisun, only one Lesser Canada Goose was bagged (November 2, 1919) and a small flock was noted on Suisun Bay, seven days later.

The Cackling Goose (*Branta canadensis minima*) apparently was never a regular visitant to Suisun marsh; report of but one bird being shot has reached me in the past 14 years. It seems that this form has always preferred to winter farther inland in California, and it and the Lesser Canada are still rather numerous late seasonal visitors to Maine Prairie (see Stoner, *loc. cit.*, p. 247) and to the neighborhood of Rio Vista, Solano County, where ecological conditions are those of the interior valleys rather than of the Suisun marsh. These appear to be about the westernmost localities in the San Francisco Bay region regularly visited by these kinds. Other geese, including the Ross (*Chen rossii*) are of but casual occurrence on the Suisun marsh.

Whistling Swans are now quite common winter visitants to the area. Certain ponds, like the Pringle Pond 1½ miles southwest of Suisun, are favorites for the species and have been considerably deepened by their feeding operations.

The most important innovation affecting ducks instituted by man on the Suisun marsh in the past 25 years was the establishment in 1932 of a state waterfowl refuge of 1711 acres on the middle section of Joice Island. This refuge has annually saved more ducks in the shooting season than all other conservation measures combined. Because the large number of ducks still wintering on the Suisun marsh quickly depletes the natural food supply of the refuge, they continue to feed mainly on other grounds which are principally owned by shooting clubs. Before the refuge was established, on calm shooting days the surface-feeding ducks sought refuge from the guns by rafting on Suisun Bay, where they were considerably persecuted by scullers and other kinds of hunters. In windy weather the bay became unattractive to surface-feeding ducks when the waves forced them to fly to marsh ponds. It was in such weather that marsh gunners made their biggest kills. Now that the refuge is available and apparently large enough to accommodate most of the local duck population, the birds seek safety on it, especially in stormy weather. The ducks continue to feed on the club properties on non-shooting days, but soon after the Wednesday and Sunday morning bombardments commence, most of them quickly learn to fly directly to the refuge where they spend the rest of the day, and so well do they recognize its safety that they cannot be frightened from it by an airplane or other means.

The federal prohibition of recent years of shooting ducks before 7:00 a.m. appears to me to be too drastic and unpopular a measure to continue for long. In this latitude it results in not being legally permissible to shoot until long after daylight. It has saved some ducks on the Suisun marsh, as elsewhere, but there seems to be a limit to the degree that it is wise to invoke unpopular laws because of the danger of breaking down respect for other more important measures. Personally I believe that return to the half-hour-before-sunrise regulation that was in vogue for years, would be wise and would work for better reception of more important modern duck legislation on the part of gunners. Since shooting on the Suisun marsh for years has ceased almost universally by one or two o'clock in the afternoon, the present 4:00 p.m. daily cessation law means nothing locally.

California Academy of Sciences, San Francisco, December 15, 1937.