

One other observation may have a bearing on the general problem. For 5 years or so we have had a small shallow, artificial fresh-water pond, which was made the edge of the marsh by damming a swamp. This is frequented by wild ducks. Sometimes for 2 or 3 weeks in late summer most of it is mud with water only in the deeper parts, and in somewhat isolated pools. Least terns and other birds at such times take out a large part of the grown fish population, concentrated within the reach. Offhand it might now seem to be a danger spot. However, at this time I have found fish fry, a very great abundance of more or less predaceous water bugs, and wrigglers in any of its water. May we deduce as a general rule that it is not temporarily isolated pools (which will contain a concentration of corrective agents) that make a condition favorable for mosquitoes? If this is the case should not the objective be to ditch a marsh so that as its water rises all parts of it will be available to the residual fish-life of its deeper parts, rather than so as to drain off its waters?

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These observations are too cursory and too little critical to prove one or another hypothesis. They may serve to emphasize the conviction that successful control of mosquitoes, or any other animal, should rest on an understanding of the existing balance of life, and where possible, work with not against it.

Observations on Some Relations of Mosquito Control
Ditching - To Marsh Birds

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The various different problems that come under long term conservation are not as successful as they might

A different kind of conservationist goes enthusiastically to work, either not realizing or disregarding the fact that what he does or wants to do is detrimental to another kind of conservation. Conservationists need to get together, iron out their differences and take a wide view of the whole problem. Thus, I being interested in all kinds of wild-life conservation, and knowing that that is best brought about by saving natural areas in an unchanged condition, would like best to see salt marshes left just as nature first made them. But I must understand that you, who are working on mosquito control, are therefore engaged in the very important conservation of human health, and I must temper my desires accordingly.

But physical health is not the only basis of human happiness. A large and rapidly increasing number of people in this country are finding their happiness and interest in life greatly increased because there are so many birds to know and enjoy. It would be sad if, in some days, when even more people have found this interest in life, we no longer had Clapper Rails or Seaside Sparrows for them to know, because the salt marshes were all destroyed in the cause of mosquito control. So we, who have a special interest in the life of salt marshes, simply ask that you, who are working on the problem of mosquito control, find a way to accomplish your purpose that will keep the marsh as nearly natural as possible.

There are a good many species of birds that may be found at different times in salt marshes. Most of them, however, are species that may be found in other places as well; water birds that occur about fresh water as well as salt; shore birds that feed both in salt marsh and on mud flats along the beach; predatory birds that prey upon meadow mice that are often particularly abundant in salt marshes, and birds of grassy fields that are equally at home in salt meadows or

grass lands inland. These species are not entirely dependent on salt marsh. But the species that are found in salt marshes, and both breed and feed there are the ones most important to consider. Destruction of the marsh or any great change in it will cause them to find it and disappear from that vicinity. What actually happens to the particular birds that breed in such an area when that area is destroyed, we do not know. We merely know that they do not breed in any other areas, and there is a limit to the number that can breed in a given area of salt marsh, so that the total number in existence is determined by the total area of salt marsh.

The species of birds that I am familiar with in Connecticut that breed only in salt marshes are Clapper Rail, (Rallus longirostris), Seaside Sparrow (Ammodramus maritima) and Sharp-tailed Sparrow (A. caudacuta). These birds are strictly dependent on salt marshes and evidently cannot live elsewhere. There seems to be no reason, from the physical standpoint, why a Clapper Rail should not be able to live and nest in a fresh water marsh, as its relative, the King Rail, does. In the same way the Seaside and Sharp-tailed Sparrows would seem perfectly able to live and nest in any grassy meadow. But instinct is a strong factor in wild creatures and the instinct to seek a salt marsh in which to live and breed, and a salt marsh only, is strong in all these birds. Salt marshes in Connecticut have been steadily decreasing in area. Many of them have been filled in and developed for shore real estate. Others have been turned into parking places at shore resorts. When these areas are so changed, the salt marsh birds do not adjust themselves to life in some other kind of area, nor do they increase in the salt marsh areas that are left. They decrease in numbers, and it is logical to assume that if or when salt marshes are entirely gone, they will come extinct.

I believe that the chief object of mosquito control

in ordinary salt marshes, is the abolishment of stagnant water and the maintenance of ditches in which water flows and ebbs with the tides. It is my opinion that such ditching in the marshes does not have a detrimental effect on the three species of birds I have been discussing. So long as that is all that is done to the marsh, these birds remain in normal abundance. In recent years it would seem that the Clapper Gull has increased at least in Connecticut. So far as I know, pools of stagnant water are not necessary factors to any form of bird life.

A good many shore birds feed in salt marshes during their migrations to and from their northern breeding grounds. Some of these birds; particularly the Yellowlegs (Totanus melanoleucus and T. flavipes) feed only in shallow water and are attracted by pools. I believe it has been suggested that mosquito ditching has eliminated many of these pools and thus been detrimental. I have not myself noted any decrease in Yellowlegs in the marshes; in fact, they seem to be increasing in number each year. But they are not confined to salt marshes as feeding places, but are common along the beach at low tide, and often about the mouths of streams. They also occur inland in suitable fresh water areas. Another group of shore birds, the Ruddy Turnstone, Black-bellied Plover, Knot and Dowitcher often feed together in salt marshes, making a picturesque group of exceedingly attractive birds. They do not feed, in my experience, to any great extent about pools, but here and there over the surface of the marsh, seeming to find their food in and about the salt marsh grasses. I do not know definitely, but I believe the food they eat is largely a small salt marsh snail of the genus Hydrobia that is exceedingly abundant in the marshes. This snail is often so common that there seem to be more for every square inch of marsh. I know from stomach examination that Black Ducks (Anas platyrhynchos) eat it, and I have also found it in the

stomachs of Starlings (*Sturnus vulgaris*) shot in a marsh, and I believe that many of the salt marsh birds depend largely on it for food. When fire burns over salt marsh, these snails are destroyed in great quantities, and the area becomes practically birdless for some time thereafter. We had a case some years ago in a field, Connecticut, where men engaged in mosquito control burned the salt marshes because they claimed that the dead grasses of the former year got into the ditches and stopped the flow of water. However, I am informed that this is not the practice of mosquito control workers today, and I sincerely hope that it will never be found to be necessary.

Ditches in the salt marsh are often helpful to the bird observer. Clapper Rails are difficult birds to observe, because they keep hidden in the taller grasses of wetter parts of the marsh and rarely fly. I have found, however, that they often run along the bottom of a mosquito ditch. By looking up and down the long, straight ditch with binoculars, I often find and observe them. I remember one case where a bird was in a ditch that ran toward the beach and finally terminated at the edge of the sand dunes. I followed the bird by walking along the side of the ditch, getting nearer and nearer to it. When it came to the end, it emerged into plain sight, and, as I still approached it, finally decided to fly across the marsh and drop into another ditch. This was the first time I had seen this species in flight.

Similarly the Sharp-tailed Sparrow keeps out of sight in the grass, and though it flies more readily than a rail, its beautiful markings of gray, olive, orange-buff and black are difficult to observe. I usually get my best views of this bird on the edges of a mosquito ditch. The Seaside Sparrow may also be seen well here, but it is always more easily seen than the Sharp-tailed, for it likes to mount up into a marsh elder bush (*Iva*) to sing. It sings much more commonly

the Sharp-tailed Sparrow, and I believe that the case of marsh elder bushes, due to mosquito ditching, makes a more favorable environment for this bird.

In the past few years I have observed the effect of a different kind of ditching for mosquito control. In this case the marsh, though not far back of the beach, was several feet higher in elevation than the high tide level. It had been ditched in the ordinary manner for a good many years, but this was apparently unsatisfactory, so, through the W.P.A. a much wider and deeper main ditch was dug, down to the level of high tide, and the water led by conduit under the road to the beach to the sound. The result, so far as wild life was concerned, was a complete change in both plant and animal life. The original salt marsh grasses and plants, such as Spartina patens, Distichlis spicata, Juncus gerardi, and others, disappeared and the chief vegetation that took their place was a heavy growth of Switchgrass (Tripsacum dactyloides). The salt marsh birds disappeared, and at present the only breeding bird appears to be the Cowbird (Sturnella magna). Other birds occur in the marsh in summer and in winter, and in the past two years there have been, in August, in fall migration, a large number of Short billed Marsh Wrens (Cistothorus stellaris). In 1941 I saw in the switchgrass more birds of this species than I had seen before in forty years of bird observations.

It is possible that birds can be helpful in the control of mosquitoes. Most of the birds that eat flying insects are known to include mosquitoes in their diet. Of these the swallows might be attracted to the vicinity of salt marshes. Swallows are fond of flying over open meadows in pursuit of insects. Where there are available nesting sites, they will remain through the summer, and since they nest more or less in colonies and are not territorial in feeding habits, their numbers could be increased. I believe that erection

of structures on salt marshes that would fill the place that barns now do, would attract the Barn Swallow (Hirundo erythrogaster) in sufficient quantities to make a difference in the numbers of mosquitoes. The Purple Martin (Progne subis) is a beautiful bird, with a melodious voice and an appetite for mosquitoes. Before the introduction of the English Sparrow it was common in the northern states. When the Sparrow arrived in this country, it became rare. It became still rarer with the advent of the Starling. It seems to me that martin boxes erected in the middle of a salt marsh would be unlikely to be troubled by sparrows. By such a means we might help in mosquito control, and also aid in increasing a beautiful and valuable bird.

Mr. H. H. Stage, Bureau of Entomology and
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presented a talk on the subject "The Relationship of Mosquito Control to the War Effort".

U. S. ARMY

Mr. Stage reported that mosquito control work had begun by the Army in the fall of 1940, after Colonel Hardenbergh and several of his associates had made an extended preliminary survey of the mosquito control needs at 151 stations and reservations in the Fourth and Eighth Corps Areas. The work strongly emphasized the control of malaria carrying species of mosquitoes. It was generally organized on the basis of spraying units consisting of 3 men with a supervisor, and brushing and ditching crews composed of 15 men and a supervisor. The effectiveness of the work is illustrated by comparing statistics of 1917 when the malaria case rate in the army was 7.5 per 1000 with 1941 when the rate was 1.8 per 1000. The spraying was begun in April,