

Re: Bird Control Inv.

INSTITUTE FOR FISHERIES RESEARCH
UNIVERSITY MUSEUMS
RECEIVED UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN

MAY 12 1931

April 24, 1931

FISH DIVISION Report No. 58

SECOND REPORT ON THE RELATION OF GULLS AND TERNS TO COMMERCIAL
FISHERIES IN SAGINAW BAY, MICHIGAN

I. INTRODUCTION

Commercial fishermen of Saginaw Bay, Michigan, have believed that the common, black and Caspian terns and Bonaparte's gull, which they indiscriminately call "minnie gulls" cause great damage to the fish supply of the bay. The investigations herein reported were made to obtain the facts in the case. The investigations were made and this report prepared by Canuto G. Manuel. This, the second report on the subject, will be followed next year by the final and more extensive report. All estimates and conclusions herein presented are subject to amendment as new evidence is obtained.

Approximately 150 days were spent in the field in this study, in two long periods from late spring to late summer of the years 1929 and 1930, and in shorter trips early in the spring and early in the fall. The Bonaparte's gull and the Caspian tern are transients and for this reason they could be studied only during their northern migration in the spring and their southern migration in late summer (Caspian tern) or fall (Bonaparte's gull). The herring gull was not studied, because it is essentially a scavenger.

The birds were collected and observed at 13 different places in Saginaw Bay, at intervals from the time they arrive until they leave. The materials studied represent both sexes and different ages. The detailed studies of the common tern which form the main part of this report was made at Sand Point and at Lone Tree Island. These two places had the largest colony of common terns in Saginaw Bay in the years 1929 and 1930

respectively. Observations on the common tern cover breeding behaviour, feeding behaviour at different periods of the season, and at different times of the day and general movements.

Experiments were made to discern whether or not the birds will devour fish dumped in certain places of their feeding grounds and in their breeding places, and to ascertain the number of fish and insects that a single young bird will devour when food is freely offered. Other experiments were performed to determine the time required for a number of fish to be digested, and to find out at what depth of water the bird will dive for fish. The nests and the nestlings were closely observed, using a blind.

In order to establish the relation of the food of the bird to the fish and insect fauna of the region, collections of fish and insects were made. Collections of fish at different places and at intervals of about 15 days were made throughout the season the birds occurred. Much of the fishing was done so as to obtain relative and absolute estimates of the abundance of different fish species on the feeding grounds of the birds.

By shooting birds carrying fish in their bills, a few other facts were established.

The stomach examinations were made in the Division of Fishes, Museum of Zoology of the University of Michigan.

For convenience, the food recovered was summarized as insects, and as commercial and non-commercial fish. No other items were present in any considerable quantity.

Thirteen species of insects, three of commercial fish and 10 of non-commercial fish were recovered. May-flies (*Hexagenia*) for the insect, perch fingerlings for the commercial fish and lake-shiners (*Notropis atherinoides*) for the non-commercial fish figured most prominently in the diet of the birds studied.

II. CASPIAN TERN

Judging from the result of the stomach examination, it appears that this bird might be considered detrimental to the fisheries. Eleven perch 30 to 174 mm. long were recovered from 14 stomachs. Two stomachs contained one lake herring each. One was 180 mm. long, and the other was estimated from the size of the scales and from its age to be about 250 mm. long.

The following mitigating considerations, are, however, to be noted:

1. At the time these birds were shot, there were seen floating along the shores nearby, perch of about the same size as those recovered from their stomachs. It may be that the fish were picked from among the dead perch. Throughout the seasons, the birds had not been observed to dive deep enough to get fish other than those on the surface, and the large perch do not frequently swim near the surface.

2. It is very probable that the lake herring were picked up near the fish house either in Bayport or in Caseville, where, about May 1, when the Caspian terns were sampled, the fishermen allowed a few fish to slip away in handling. Gulls (herring and ring-billed) flocked around these places, obviously feeding on the dead fish, and some Caspian terns may well have been included among the gulls.

3. Even if the Caspian terns did capture their fish alive, there would be no occasion for an attempt to control this species. In the first place it is difficult to shoot. In the second place it is so rare in the bay that the total fish destruction by the species must be of insignificant effect on the fisheries. Its rareness is attested by the fact that only 14 were killed during two years strenuous effort to obtain a larger number for stomach analysis. In the third place, the large Caspian tern, one of the handsomest of our birds, is much enjoyed not only by the bird lovers and students, but by the general public as well.

To conclude: the evidence does not indicate the desirability of attempting to control the numbers of Caspian terns on Saginaw Bay.

III. BONAPARTE'S GULL

The result of the studies on Bonaparte's gull shows that while this bird feeds on both fishes and insects, it sometimes is entirely piscivorous and at other times (rarely) entirely insectivorous. In view of this situation, also true of the other species to be discussed subsequently, the percentages of the different types of food as they occur in the stomachs were computed both on volumetric and numerical bases. During the last two field seasons, a total of 193 stomachs were obtained and examined. The following results were obtained. By volume, the commercial fish (perch fingerlings only) constituted 3%, non-commercial fish 96% and insects only 1% of the food. By number of individuals, the commercial fish represented eight-tenths of one per cent, the non-commercial fish 96% and insects 3% of the food items.

From these figures, it is evident that this bird is largely a fish eater. Its chief food in Saginaw Bay proves to be the lake shiner, Notropis atherinoides. It should be noted that 86 per cent of these birds collected were obtained during their fall migration, when they are most abundant on Saginaw Bay, and when the yearling lake shiners were extremely abundant along the shore.

The belief of the fishermen that the fish eaten by this species of gull are fingerlings of the lake herring, Leucichthys artedi, was perhaps primarily responsible for their contention that the "minnie gulls" are doing a great harm to their industry. During the investigation, that erroneous impression of the fishermen was largely removed by demonstrating to them that the fish eaten were shiners. When the water receded in the fall, it was a very common sight to see great numbers of young lake shiners trapped in small pools all around the shore. It is about this time that the Bonaparte's gull were observed to alight and feed in the water 10 centimeters or less deep, in places where they are little disturbed. They were surely feeding on the shiners which were thus trapped, and which likely would perish anyway.

The shiners eaten constitute no doubt only a very small part of the immense population in the bay, and many of these shiners would perish if the birds would not get them first. The small numbers of perch fingerlings eaten by the few hundred Bonaparte's gulls during the short time they are on the bay must be an insignificant proportion

of the more than 200,000,000 estimated to be present in the bay.

To conclude: the evidence does not indicate that the destruction of the Bonaparte's gull would cause any material increase in the fishery yield of the bay.

IV. BLACK TERN

An examination of 79 stomachs of the black tern, tends to show that this bird eats more insects than fish. Like the common tern, which will be described later, the black tern feeds on all stages of the large burrowing may-fly Hexagenia (the "fish-fly" of the bay). This insect, which is excessively abundant in Saginaw Bay, forms more than 80 per cent of this bird's food. To a lesser extent, dragon flies (both naiads and adults), caddis flies, moths, ant-lions and carabid and chrysomelid beetles serve as food of this bird. These species of insects were recovered 38 times from the stomachs of the birds. In the identifiable and counted material, a total of 974 insects were gathered.

It is interesting to note that the black tern feeds on fish during the latter part of the season and then generally mixes any fish taken with insect food. From observations on the movements of insects and fish, it was thought safe to assume that conditions being equal the black tern prefers an insect food.

Fourteen perch only were recovered, and from only 7 of the 79 stomachs. In one of these stomachs, 7 perch were obtained. The largest of these was 26 mm. long.

Of the non-commercial species, 7 common lake shiners (Notropis atherinoides) were found in 4 stomachs; 3 golden shiners (Notemigonus crysoleucas) in 2 stomachs and one spot-tail shiner (Notropis hudsonius).

Expressed by volume, the contents of 79 stomachs of the black tern comprise only 11% commercial fish (perch fingerlings), 18% non-commercial fish (shiners) and 71% insect food. By number of individuals eaten, the commercial fish make up 1%, the non-commercial fish 1% and the insects 98%.

The destruction of perch fingerlings by the black tern may be very roughly computed. From the analyses made, the average number of perch per stomach at any one time is .13. If we assume as for the common tern that the number in the stomach at one time is one-eighth of the number eaten in a day, then the average take of

perch fingerlings by black tern figures 1.4. Estimating the average black tern population of the bay as 1000 over a 120 day period, the total perch fingerling destruction would be 168,000. This is only seven-hundredths of one per cent of what we consider a very low estimate (229,000,000) of the total perch fingerling production of the bay.

It is the opinion of the Institute for Fisheries Research that a one-tenth of one per cent change in fingerling perch population will probably have no significant effect on the total poundage of perch produced in the bay. Therefore no material benefit would be expected to ensue if the black terns were destroyed.

V. COMMON TERN

Of the species of birds under consideration, the common tern is the most abundant in Saginaw Bay. These terns arrive a few at a time from about the first week of May. They reach their greatest abundance over the period from the early part of June until about the second week in July. Then the adults gradually leave, but are replaced by the young which are then capable of independent living. In order of abundance, their colonies located were those of Lone Tree Island, Big Charity Island, Sand Point, Little Charity Island and Defoe Island, including Pitcher's reef. A few were also noted congregating close to the shore at Pinconning, Omer, Point Lookout and Tawas City, but no evidence of colony formation was seen there.

The birds were observed to hover and swoop down on places where freshly killed minnows were dumped into the water in their feeding ground. On the other hand, freshly killed minnows dumped onto the ground in the breeding areas were not disturbed.

An artificially fed young common tern ate ~~ate~~ as many as 65 small fish daily, but a single minnow would serve to keep the bird alive. On one day, 125 mayflies were given and perhaps more would have been eaten.

By feeding several terns and then killing them after a timed interval, it was

estimated that a fish (or a number of fish) lodged in the gizzard is digested in about one hour and forty-five minutes.

In view of the failure so far to obtain any substantial results from the experiment made to determine the depth to which a bird may dive for its fish, actual observation was resorted to. It now appears certain that the terns do not dive deeply enough to entirely submerge their bodies under the surface of the water. This is confirmed by the findings of the stomach examination. In general, the fishes recovered were surface feeding species. A very striking indication that they do not go deep enough to catch bottom feeders was obtained at Lone Tree Island. There, the bottom-loving straw-colored Notropis deliciosus stramineus and mimic shiners (Notropis deliciosus stramineus and N. v. volucellus) were very plentiful, and yet almost none of these species were found in the stomachs of the birds. The semi-pelagic lake shiner Notropis atherinoides was, however, eaten freely.

The female is partly fed by her mate during the nesting season. Feeding of the young, which is done largely by the male, starts when they are two, or sometimes three days old. These actual observations, made by using a blind, were further corroborated by the fact that all birds shot carrying fish in their bills were males.

Of the 389 stomachs examined, 14 per cent were empty. Nearly all of the stomachs with food were divided into:

1. Stomachs with insects only.
2. " " insects and fish combined.
3. " " fish only.

The last item, stomachs with fish only, includes stomachs with non-commercial fish, stomachs with commercial fishes and stomachs with both non-commercial and commercial fishes. To get a readily comparable estimate of the relative frequency in which the commercial fishes, non-commercial fishes and insects were eaten, each

species of fish and insect found in each stomach was considered as a unit of frequency, without reference to other food items present in the same stomach. The sum of the frequencies for each of the three types of food was divided by the total number of stomachs studied. The results obtained are as follows: commercial fish, 18%; non-commercial fish, 48% and insect 29%.

The per cent of the birds feeding on each of the three different types of food was estimated by counting the stomachs containing each type and dividing the sum by the total number of stomachs examined. The result shows that 17 per cent of the birds feed on commercial fishes, 43 per cent on non-commercial fishes and 30 per cent on insects.

Volumetrically, the sampled food of the common tern comprised 30% commercial fish (95.4% perch fingerlings and 4.6% yellow pike fingerlings by volume), 54% non-commercial fish and 16% insects. Numerically, however, the commercial fish make up only 14%, the non-commercial fish 27% and the insects 59% of the total number of individual animals eaten. From these figures, it may be seen that the commercial and the non-commercial fishes recovered are of about the same average size, while the insects are very much smaller.

In order to roughly estimate the bird's relation to the commercial fisheries of Saginaw Bay, the following estimates and computations were made:

<u>Average number of individuals of each food</u>	
<u>type present in [∞]stomach at one time</u>	
Perch fingerlings.....	0.4
Yellow pike fingerlings.....	0.02
Non-commercial fish.....	1.12
Insects.....	2.50

These figures were obtained by dividing the total number of individuals of each food type recovered by the total number of stomachs obtained.

Average number of individuals of each food

type eaten by one bird in a day

Perch fingerlings.....	3.2
Yellow pike fingerlings.....	0.16
Non-commercial fish.....	8.96
Insects.....	20.00

These figures are obtained on the assumption that the tern eats about 8 times as much each day as it shows in its stomach at one time. This assumption is based on the observations that these birds digest food (fish) in about 1.75 hours, and that they feed 14 hours a day. It is true that the birds often take food before the last lot is digested, but it is with about equal frequency that the birds are found without any food. These two compensating factors are guessed to about balance one another.

Total number of individuals of each

food item eaten by all the terns

in Saginaw Bay in one year

Perch fingerlings.....	1,380,000
Yellow pickerel fingerlings.....	64,000
Non-commercial fishes.....	3,580,000
Insects.....	8,000,000

These figures were those of the preceding table multiplied by 400,000, since it was estimated that an average of 2500 birds was present over a period of 160 days (400,000 bird-days).

Total number of perch fingerlings and of

non-commercial fish present in Saginaw Bay

Perch fingerlings.....	229,000,000
Non-commercial fishes.....	about 300,000,000

These figures were obtained from the numerous quantitative seine hauls made around the bay through the season. The shore line out to 20 meters was repeatedly

seined with a 75 foot seine with central bunt of 1/4 inch mesh. The shore line of Saginaw Bay (from Point aux Borques to Tawas Point) including that of islands, sand spits, river mouths for a short distance, etc., was measured from the chart as 440,000 meters; the area out to 20 meters is therefore about 8,800,000 sq. meters. The average number of fish landed by square meter was: perch, mostly fingerlings, 0.5; non-commercial fishes, mostly shiners, 1.77. These figures in our computation were doubled, on the warranted assumption that at least half of the fish in the areas covered by the seine escaped through, around, over or under it. Probably the true number is much higher, for most of the shoreward fish in summer are small enough to pass through the seine unless caught sidewise. Each of these average figures was multiplied by 8,800,000, the total sq. meters of water which was sampled. In deeper water, to 1.5 meters, a 125 foot seine with a bag of 1/4" mesh was used for a few days. Most of these hauls were made far from shore, so that the net had to be set and pulled into the anchored boat - a crude procedure which it is estimated allowed at the very least 4 fishes to escape for each one captured. The number of fish of each group caught per square meter seined over was therefore multiplied by 4 and by 550,000,000, the measured number of square meters in Saginaw Bay more than 20 meters from shore and less than 2 fathoms deep. No doubt many fish, especially perch, go into deeper water, farther from shore, and indeed some of the terns were seen feeding there. This fact also indicates that our estimate of population may be too low. The estimated number of fish obtained by each of the two types of seining are added together, to give the figures presented in the last table.

Another reason for thinking that our estimate of fish population in Saginaw Bay is too low is that the seining was done mostly on sandy shores, where the density of fish population was observably less than on the marshy shores, where the dense growth of rushes prevented shore seining. Probably the reason why very few yellow pickerel

fingerlings were obtained is that they were hiding in the shelter of dense weeds. Too few yellow pickerel were seined to make an estimate of their total number possible.

The estimate of 229,000,000 perch fingerlings for all of Saginaw Bay seems low, when we consider that about 9,000,000 perch fingerlings were seined in Boardman River in the fall of 1930. It also seems very low when we compare this number with the number of legal-sized perch (9 inches or longer) caught in Saginaw Bay in 1929.

Total number of adult perch and yellow pickerel
caught in Saginaw Bay in 1929

Perch.....	1,020,000
Yellow pickerel.....	265,000

These figures were obtained by dividing the recorded catch of 443,283 pounds of perch, and of 660,192 pounds of yellow pickerel by the average weight of the fish caught, as determined by the Bureau of Fisheries in Saginaw Bay (200 grams for perch, from 79 samples weighed in 1928 and 1929), and 2.5 pounds for yellow pickerel, from 89 fish weighed in 1929.

We should expect that not more than one-fifth of the total adult population is caught in one year, and that not less than 100 fingerlings exist for each adult. This would give us a rough estimate for Saginaw Bay of 500,000,000 perch fingerlings which is probably more nearly correct than 229,000,000, and of 130,000,000 yellow pickerel fingerlings.

In comparison, the estimated destruction of 1,380,000 perch fingerlings and of 64,000 yellow pickerel fingerlings seems rather low.

We regard it as safe to say, that the common terns of Saginaw Bay destroy not more than one-half of one per cent of the total perch fingerling population; very roughly only one two-hundredths of one per cent of the yellow pickerel fingerlings, and virtually no lake-herring, whitefish or other species which these birds were

suspected of eating. The destruction of such a small percentage of yellow pickerel as indicated can not be expected to have any measurable effect on the adult population. The effect on the perch catch of a destruction of one-half of one per cent of the fingerlings (if that many really are destroyed) is not an easy matter to estimate. Of this we may be fairly sure on general biological ground, that this destruction does not necessarily mean a decrease of one-half of one per cent in the poundage of perch to be caught, because the great majority of fingerlings meet with some sort of natural disaster, because the natural destruction mounts rapidly with increased density of population, and because partial destruction of a fish population usually allows the remaining part to grow faster, sometimes enough faster to compensate for the initial loss.

The competition that the birds offer the commercial fish will be dealt with more fully in the final report. Those who live about Saginaw Bay will agree that the 10,000,000 odd may-flies ("fish flies") eaten by the common terns each year is but an infinitesimal part of the annual crop of these insects. And almost as surely the 3,200,000 non-commercial fishes eaten by the common terns each year is but a fraction of the total population of forage fish in the bay (our estimate of about 300,000,000 is very probably low, for the same reasons, that we suspect our perch estimate similarly derived to be too low).

The relative destructiveness of the predaceous fishes of Saginaw as compared with that of the birds will receive attention in the final report. The lawyer especially appears to be vastly more destructive than all of the birds combined.

GENERAL SUMMARY AND CONCLUSIONS

The gulls and terns on Saginaw Bay are not doing enough harm to the commercial fisheries to cause any alarm.

They do not feed on lake-herring as has been claimed. The fish most heavily fed on

is the abundant lake shiner, Notropis atherinoides, which has been mistaken for the fingerling stage of the lake herring.

The Caspian tern is too rare to warrant any effort at its control.

The Bonaparte's gull is present in numbers only during migration and then feeds chiefly on the lake shiner, doing no appreciable harm.

The black tern is chiefly an insect-feeder, but takes some perch fingerlings. It is thought that the number eaten has no marked effect on the commercial yield of perch.

The common tern is an insignificant competitor of the food fishes, and eats a virtually negligible per cent of the yellow pickerel fingerlings of the bay. It does destroy many, perhaps somewhat more than a million perch fingerlings each year, but this is estimated to be a destruction of not more than one-half of one per cent of the total perch fingerling population of the bay. Such a destruction presumably causes considerably less than one-half of one per cent decrease in perch catch in the bay.

Any very notable increase in the population of common terns in the bay might intensify the perch destruction enough to warrant a consideration of a partial control of the numbers of common terns, but no control measures under present conditions may be expected to yield any measurable advantage to the commercial fisheries of the bay. It should be remembered that only the perch is significantly involved, and that catch of this species constitutes only a small part of the total fish production of the bay.

As will be brought out in the final report, there is at present a very high natural mortality of eggs and young on the very limited breeding colonies of the common tern in Saginaw Bay. This natural check on tern increase in our opinion is a sufficient control for the present.

Finally, it should be pointed out that these graceful birds have a distinct scenic value, and are of great interest to the bird-lover and to the professional zoologist.