

PIPING PLOVER AND LEAST TERN
POPULATIONS AND HABITAT
IN WESTERN IOWA

Final Report

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9 January 1989

During the 1900s, humans have converted much of the middle Missouri River from a slow-moving, meandering river into a narrow, fast-moving stream. These changes have been dramatically documented in Iowa. From 1890 to 1976, the river length adjacent to Iowa decreased by 32.2 miles (-15%). The sandbar area on the Iowa side of the river declined even more dramatically, going from 17,559 acres in 1890 to only 43 in 1976 (-99.8%). Just since 1947, the sandbar area has declined from 7,991 to 43 acres (-99.5%)(Hallberg et al. 1979). This change has meant that sandbars and their associated open, early seral-stage habitats rarely form on the river. The Piping Plover (Charadrius melodus) and Least Tern (Sterna antillarum), two species that typically nest on these sandbars, are especially affected by these habitat changes. In 1986, the U.S. Fish and Wildlife Service classified the Northern Great Plains population of the Piping Plover as a Threatened species, indicating their concern for its continued survival. In 1986-87, its population numbered an estimated 1,376-1,444 pairs nesting in six states and four Canadian provinces (U. S. Fish and Wildlife Service 1988). Historically, a few Piping Plovers have nested on sandbars along the Missouri River in western Iowa. The inland population of the Least Tern is classified as an Endangered species. In 1987, its population was estimated at 4,515 adults (Sidle et al. 1988). In recent years, both species have nested on fly ash deposited by power plants near the river. Two colonies are located in Iowa: one near Council Bluffs (plovers and terns) and another near Sioux City (plovers, also terns in 1986)(see Tables 1 and 2). These sites have been surveyed periodically in recent years to determine the number of birds using them and their breeding success (e.g., Wilson et al. 1983, Wilson 1984, Williams 1985). The goal of this project was to continue this monitoring in 1988.

Project Objectives

1. Determine the size of the Piping Plover and Least Tern breeding populations in Iowa.
2. Assess the breeding success of Piping Plovers and Least Terns in Iowa.
3. Measure the habitat use of Piping Plovers and Least Terns in Iowa.

METHODS

Population assessment

We concentrated our efforts at the two known nesting sites. The Iowa Power and Light (IPL) site near Council Bluffs was visited on 44 days from 5 May to 8 August. The Iowa Public Service (IPS) site near Sioux City was visited three times-5 May, 2 June, and 27 June. Because of the small number of birds involved, we were able to get virtually complete counts of the number of birds at both areas. In addition, we studied aerial photos of the Missouri River from the Missouri border north to Sioux City and visited all sites that appeared to have potential tern or plover habitat at least once during May or June. Sites that seemed to have good habitat were visited several times. On each visit, we scanned the area with binoculars, walked through areas of good habitat, and listened for the bird's calls. In general, we followed the procedures outlined in U. S. Fish and Wildlife Service (1988).

Breeding success

Once breeding birds had been located, we located active nests by watching the bird's behavior and then plotted the nests on a map of the area. Although the eggs of both species are cryptically colored, we believe that we located virtually all of the active nests. We tried to minimize our disturbance to the birds by watching them from at least 100 meters. We visited nests rarely, kept our time near the nests to a minimum, and visited nests only when temperatures were neither very warm or cool. Usually it was possible to see the eggs or young from a distance when the

adult was off the nest. Thus we usually could determine the clutch size and hatching dates without disturbing the birds. Pairs and their young were watched until the young fledged or the adults left the area.

Habitat use

We assessed habitat use for three different aspects of the bird's life history:

- a. nest site selection
- b. foraging habitat
- c. other use areas-roosting, loafing, etc

Each area being used for the above three activities was assigned to its overall habitat type (e.g., fly-ash deposit, sandbar, natural river shoreline, etc) to try to determine the macro-habitat features important to the birds. Micro-habitat variables at the nest sites were measured at the end of the nesting season. These variables included substrate type, slope, distance to water, distance to nearest vegetation, vegetation type, distance to nearest tern and nearest plover nest, and distance to nearest human use area. Measurements were made with a range finder or tape measure. Variables at roosting/loafing and foraging sites were noted as they were being used by the birds.

Some measurements of the specific way Piping Plovers used their habitat for foraging were made. Individual birds were watched and at each 15-second interval, the bird's location (in water or on land, water depth, substrate type) was recorded to try to determine more specifically the feeding habitat the birds were using.

RESULTS

PIPING PLOVER

Population assessment

Piping Plovers were very secretive, and we seldom saw them away from their nests. We found two plover nests at the IPL ponds. One (nest A) hatched on 9 June, but we saw no further signs of those adults or their young. The other (nest B) was deserted, and that pair was not seen after 6 June. After an interval of 10 days, we saw a pair courting in the area on several occasions from 16-23 June but not later. We saw no indication that this pair initiated a nest. This pair could have been the pair that deserted earlier but we think that it is more likely that it was a third pair. We saw 1-3 plovers on four dates in July; these most likely were migrants. The last bird we saw was on 20 July. Thus our best estimate is that three plover pairs were at the IPL ponds in 1988.

We visited the Iowa Public Service (IPS) ponds near Sioux City three times. We saw three plovers there on 5 May, three pairs and two nests on 2 June, and no sign of any plovers on 27 June.

We saw 1-2 Piping Plovers at Saylorville Lake, Polk County on several dates from 23 April-12 May and one at Riverton Wildlife Area, Fremont County on 24 May. The birds at Saylorville were paired but left the area when recreation use increased in mid May. We saw no sign of nesting at these two sites nor any plovers at any of the other sites along the Missouri River that we visited. Thus we believe that only seven pairs of Piping Plovers were in Iowa this year. Those seven pairs initiated at least four nests.

Breeding success

Piping Plovers normally arrive in Iowa in mid April and depart by early August. In 1988, they were present at the IPL ponds on 23 May when we started field work. Nesting normally begins in mid May. By using the usual 28 day incubation period and back-dating from the hatch date, we estimated that the first nest was initiated

around 6 May, earlier than normal but not unexpected in the mild 1988 spring.

The nest that was initiated about 6 May contained a full clutch of four eggs. The other nest was initiated about 26 May; it had only a single egg on 3 June which seemed to be its full clutch. All four eggs in nest A hatched on 9 June, and nest B was deserted on 6 June. The plover at nest B was repeatedly harassed by a pair of Killdeer (*Charadrius vociferus*) that was building a nest only 30 m away. We believe that this disturbance caused the pair of plovers to desert their nest.

The young at nest A appeared healthy and were active the evening of their hatch. They were attended by one adult. They were gone the next morning, and we never saw those young nor their parents after that. Young plovers normally take 3-4 weeks to fledge, and we should have seen them again at the ponds before they fledged. Thus we believe that these young did not survive but we have no clue as to what happened to them.

Both nests at the Sioux City site contained full clutches of four eggs. One of the nests may have hatched but the other was deserted. We are not aware of any young that fledged at that site in 1988.

Thus, in summary, four known nests contained a total of 13 eggs, at least four of which hatched. To our best knowledge, no young Piping Plovers fledged in Iowa in 1988.

Habitat use-nest sites

Both sites where plovers nested were at fly-ash deposits. All nests that we saw were located on the fly-ash spoil. At the IPL site, there was one nest at each of the two ponds (Fig. 1). Both nests were on open, nearly flat, exposed sites and were placed on the coarse fly ash deposits. The substrate was hard, congealed fly ash with some loose gravel-like material on the surface. Both nests were shallow scrapes in this gravel. The nests were located an average of 101 m from the pond and 62 m from the nearest road. Both nests were in the open with no vegetation growing close to either of them. The nearest vegetation, scattered clumps of *Kochia scoparia*, was an average of 22.3 m away. Nest A was located an average of 94.6 m from the 11 Least Tern nests in the nearby colony. The nearest tern nest was 60 m away, and we saw no evidence of any interactions between the two species. There were no tern nests within several hundred meters of plover nest B. We saw no evidence of any predator trails or dens near either of the nest sites.

Both nests at Sioux City were also on flat open fly ash deposits with virtually no vegetation nearby. Both were about 30-40 m from the edge of the pond. Because the fly ash was extremely soft, we could not approach either nest for detailed measurements. In general, though, the habitat appeared similar to that at the IPL ponds.

Habitat use-foraging and roosting

We seldom saw plovers other than when they were at their nest. Based on 129 minutes of observations of plovers foraging at the IPL ponds, the birds spent 87% of their time on land near the pond's edge and 13% in the shallow water at the edge of the ponds. The birds were at the south pond six times and at the north pond twice. The plovers generally fed close to the water's edge. The data we have on roosting sites is limited to observations on the south pond where one bird often roosted on the open fly ash about 60 m from the water's edge.

Disturbance and predators

Truck activity was the most obvious potential disturbance to the plovers at the IPL ponds. As part of the normal plant maintenance, truckloads of fly ash were periodically dumped along the edge of the north pond. The most frequently-used road to haul this ash passed 14 m from plover nest A. From 23 May to 9 June (period

during which the plover nest contained eggs), we saw 5 trucks (in 64 hours of observation) pass the nest, dump their ash, and return past the nest. These trucks spent a total of 43 minutes ($\bar{x} = 8.6$ min) near the nest. The plover never left the nest during periods of truck activity. We watched the bird on the nest closely but saw no evidence that it was disturbed by the trucks. Plover nest B was not subjected to any human disturbance during our observations.

Another potential problem for the plovers was the large nesting population of Killdeers on the area. Besides Least Terns, Killdeer was the only other bird species that nested on the open fly ash. We found 22 Killdeer nests on the site in 1988. We measured the distance from each plover nest to the nearest four Killdeer nests. These distances averaged 121 m but Killdeer nested as close as 30 m to one plover nest.

Except for the Killdeer described above, we saw no evidence of any other non-human disturbance to the plovers. We saw 12 other bird species that might disturb the plovers either on or flying over the area (Table 3). However, we saw no evidence of them disturbing the plovers in any way. Except for a single visit to each plover nest by us, we are not aware of any other human disturbances to the nests.

LEAST TERN

Population Assessment

We found Least Terns nesting only at the IPL site. Least Terns were first seen there on 23 May when seven adults were present. A total of 11 nests, all on the north pond, were located this year. One nest was deserted early in incubation, and the pair immediately re-nested nearby. At least one more pair was seen courting but we never saw them at a nest. Thus we believe that a minimum of 11 pairs were present at the colony in 1988. By mid July, the number of birds at the colony began to decrease. The last family group (two adults and two young) was still present on 28 July. On 11 August, seven terns (two adults and five young) were present but we believe that these were migrants.

We found Least Terns at four other sites; two in Iowa near Nebraska City, NE on 24 May, one at DeSoto National Wildlife Refuge, Harrison County on 25 May, one at Big Creek Lake, Polk County on 27 May, and one at Forney Lake, Fremont County on 30 June. We visited all of those sites on subsequent dates and did not find terns there. Thus we believe that the 11 pairs of Least Terns at the IPL site were the only nesting Least Terns in Iowa in 1988.

Breeding success

Adult Least Terns were present in the colony by at least 23 May. Courtship was noted on 24 May, and the first nest was initiated on 30 May. The last nest was initiated around 20 June. Ten of the eleven nests were active for at least one week and should have contained full clutches. Seven nests contained full clutches of three eggs and three nests had just two eggs (mean clutch = 2.7). One early nest contained one egg before being deserted four days after initiation. Thus, a total of 28 tern eggs were laid at the IPL ponds in 1988.

Of the eleven tern nests, one was deserted early in incubation because of flooding from heavy rains, three were deserted because of disturbance by trucks, and seven hatched young (64%). These seven successful nests hatched 13 of their 19 eggs (68%). The first egg hatched on 24 June and all had hatched by 29 June. Almost immediately after hatching, all tern chicks left their nests and moved to the edge of the pond east of the colony, making it difficult to determine individual nest success. Of the thirteen chicks, six fledged, one was killed by an American Kestrel, and six met an undetermined fate. Of the latter six, we saw no carcasses and assume that they died from exposure to high temperatures. The week of 18-22

June was extremely hot with air temperatures of 100 or higher every day and probably higher at the ground's surface where the terns nest. Young terns are quite vulnerable to high temperatures at the time of hatching, and we saw several young that died during that time. The last young fledged about 24 July.

Habitat use-nest sites

All of the terns nests we found were located on the fly-ash spoil along the north pond at the IPL site (Fig. 1). Of the 11 tern nests we located, one was in a low depression, three were on flat ground, and seven were on raised mounds or berms. Four were in old tire tracks. The eleven nests were arranged roughly in a line paralleling the edge of the north pond. They were an average of 40.8 m from the edge of the pond (range 13.2-53 m) and 14.5 m (range 8.2-37.7 m) from the nearest Least Tern nest. The eleven tern nests were an average of 94.6 m from plover nest A; the closest nest was 60 m from the plover nest. The only plant that was growing on the fly ash was scattered clumps of *Kochia*. Tern nests were an average of 8.6 m (range 0.06-31 m) from the nearest vegetation. Five of the nests had vegetation within 5 m but we do not believe that the vegetation was significant in the location of the nest. Nests averaged 76.2 m from the nearest road. We found no predator trails or dens at the IPL site.

Habitat use-foraging and roosting

Least Terns were seen leaving the colony 43 times, presumably on feeding flights (Table 4). The terns flying NW were headed to Lake Manawa, an important feeding area. Terns flying east/NE were thought to be feeding on ditches east of Interstate 29. Terns going south were using the south pond while the single tern seen flying west from the pond might have been headed towards the Missouri River.

We saw Least Terns flying into the colony 83 times. All but three of these observations occurred after 23 June, the date that tern eggs began to hatch. As with the outward flights, birds returned most often from the northwest and south (Table 4). Of the 80 observations after 23 June, terns were carrying minnows to the colony 65 times.

Adult Least Terns were watched foraging a total of 54 times. The majority of the adult terns fed on the east end of Lake Manawa and on the south pond. Of 21 minnows caught by adult terns, 10 were 2 cm long and 11 were 3 cm long. All five observations of foraging juvenile Least Terns were at the south pond. Two minnows were caught; one 2 cm long and one 3 cm long.

Least Terns usually roosted and loafed within 10 m of the edge of the north pond. Sites commonly used included the consolidated piles of fly ash that ringed the pond and the slopes of those piles near the edge of the pond.

Disturbances

Least Terns were subject to disturbance from a variety of other birds as well as trucks from the power plant. We saw interactions involving Least Terns and 10 other bird species (Table 3). Most of these were infrequent and probably were not a threat to the terns. Only the interactions with American Kestrels seemed to be serious. We saw kestrels in the colony 44 times (males-4, females-40). We saw a kestrel kill one young tern on 29 June, the only case of predation we noted. On 30 May, we found the partial remains of an adult tern that may have been taken by a kestrel. The terns often mobbed the kestrel if it came close to a tern nest (Table 3). Potentially, both gulls and Great Blue Herons could take tern eggs or young, but we saw no evidence of such losses. The only other predator we saw evidence of was coyotes. We saw their tracks at the ponds several times, but the only scats we found contained mammal hair. Surprisingly, we saw no evidence of raccoons or opossums at the site.

Truck disturbance was a more serious problem. We saw trucks haul fly ash to the edge of the north pond 77 times during 233 hours of observation (one per 3.0 hours). If the truck was close to the colony, the terns left their nests briefly and then returned within a few minutes and continued incubation or care of their young. If the truck was not near the colony, the terns remained on their nest. Although the terns were often disturbed by the trucks, they seemed to adapt to them well and the dumping generally was done away from the nesting area. However, one load of fly ash was dumped with a few meters of two tern nests on 30 June; both nests promptly were deserted.

Other potential Piping Plover and Least Tern nesting sites

We visited about 50 areas along the Missouri River and elsewhere in Iowa to see if they had nesting Piping Plovers and Least Terns in 1988 and to assess their potential for supporting nesting plovers and terns in the future. The following summarizes our findings:

MISSOURI RIVER VALLEY

Riverton Wildlife Area, Fremont County. We saw one Piping Plover here on 24 May but the area dried up in mid June and did not have suitable nesting habitat for either species.

Ponds just east of Nebraska City, NE. Two Least Terns were seen at these ponds on 24 May but there was no suitable habitat for either species to nest.

Gravel pits along Interstate 29 from Missouri border to Sioux City. There are about 20 gravel pits/borrow pits along the interstate highway; none had suitable habitat this year for either the terns or plovers.

Folsom Lake, Mills County. The beach area at this lake is probably not large enough for either species to nest and there is too much human activity for either species.

IPL Ponds, Pottawattamie County. The fly ash deposits along the two main ponds are ideal habitat for both species, and both nested here in 1988.

Lake Manawa, Pottawattamie County. This lake has no suitable habitat for either species to nest on and the heavy human activity would probably lead to the failure of any nesting attempt. However, this lake is an important feeding area for Least Terns. The settling pond area on the south end of the lake is now covered with willows and no open sand habitat is available for nesting.

DeSoto National Wildlife Refuge, Harrison County. Other than the IPL and IPS sites, this area had the best habitat for both species of any site we visited. Brush and trees have been cleared from a fairly extensive area north of the oxbow lake. This area appears to have potential as a nesting site, especially for Piping Plovers. However, the edge of this area that adjoins the lake is covered with cattails, a factor that may inhibit their use by plovers.

California Bend, Harrison County. The oxbow lake here was bounded by cattails and willows with no open sandy areas.

Horseshoe Lake, Harrison County. This is a cattail marsh and has no habitat suitable for terns or plovers.

Tyson Bend, Harrison County. The oxbow was covered with willows and there was no sandy habitat.

Soldiers Bend, Harrison County. This oxbow had no habitat suitable for terns or plovers.

Blencoe Lake, Monona County. This lake was dry in 1988.

Louisville Bend, Monona County. There was no suitable habitat at this site.

Decatur Bend, Monona County. There is a small dune-type area on the Nebraska side of this oxbow lake. The Iowa side of the lake is too heavily vegetated for the terns or plovers

Tieville Lake, Monona County. With the low water of 1988, there was fair habitat for terns and plovers but in most years, with normal water levels, the lake's edges are too heavily vegetated for them.

Blue Lake, Monona County. The edges of this lake are bounded by willows and cattails and there is no suitable tern or plover habitat. The area also receives heavy human use.

Blackbird Bend, Monona County. This area is largely vegetated and didn't have suitable habitat.

Winnebago Bend, Woodbury County. There was some open water but no suitable sandy habitat for the birds.

Snyder Bend, Woodbury County. This area is heavily vegetated with cattails and there is no habitat for plovers and terns.

Omadi Bend, Woodbury County. Although on the west bank of the river, the north end of this area is in Iowa. However, it is covered with willow and cattails and doesn't have good tern and plover habitat on it.

Browns Lake, Woodbury County. This lake is bounded by trees and cattails. The one sandy area is a public beach and receives heavy human use.

New Lake, Woodbury County. This lake has some marsh habitat but no suitable sandy areas for terns or plovers.

IPS Ponds, Woodbury County. These ponds have good areas of fly ash around their borders and have had nesting Piping Plovers annually since 1984.

BIG SIOUX RIVER

Gravel pits near Akron, Plymouth County. These pits receive heavy human use and didn't have terns or plovers on them.

Gravel pits near Hawarden, Sioux County. No plovers or terns were seen here in 1988 but these pits conceivably could support both species

DES MOINES RIVER VALLEY

Saylorville Reservoir, Polk County. The Oak Grove and Sandpiper Beach areas both have suitable habitat for Piping Plovers. The latter site had a pair of Piping Plovers on it in early May but the birds left the area as soon as the heavy recreation season started in mid May.

Gravel pits south of Saylorville Dam, Polk County. These areas have some habitat that might be suitable for terns and plovers.

DISCUSSION

Although Iowa has long had nesting populations of both species, clearly it is on the periphery of their nesting ranges. With the loss of their natural nesting habitat and the decline in their overall population, it is not unexpected that both species would have a precarious status in Iowa. It seems likely that the birds at Sioux City are part of the population that nests along the more natural section of the Missouri River in South Dakota while those at Council Bluffs are part of the Platte River Valley population. Such peripheral populations may well contain younger or less successful birds which may explain why there has been no real growth in the Iowa populations in the past five years.

Although the current management of the IPL site seems ideal for the continued maintenance of suitable nesting habitat for both species, the timing of this activity is critically important to the birds. Fly ash is a by-product of the power plant which continually must be removed and disposed of. The plant currently has two options; it can sell the fly ash or it can deposit it along the pond. Selling is the option of choice but this option depends on demand for fly ash which varies seasonally. Fortunately, there is often high demand during the bird's nesting season, reducing the disturbance by trucks to the site. If the fly ash cannot be sold, it is hauled by truck to the pond and dumped along its edge. Where it is dumped depends somewhat on the weather conditions, especially the wind. If the winds are high, it is usually dumped so the dust from the load will not blow off the site or back onto the truck. When we informed the drivers of where the birds were nesting, we found them very cooperative in staying away from the nesting areas. Neither species seemed to be disturbed by trucks passing near their nests and both species soon acclimated to the truck's presence. However, a single load of fly ash inadvertently dumped in the tern colony late in the nesting season seemed to result in the loss of two tern nests that were close to hatching. Thus, this action can harm the birds. It is also possible that an unknowing driver could drive a truck directly over an active nest itself.

The other maintenance activity, bulldozing the piles of spoil ash, also is a threat to the birds. This activity is done by the plant on a time-available basis. The activity itself is valuable to the birds since it continually clears the site of vegetation and thus leads to better habitat for the birds. Again timing of this activity is critical. In 1988, this work started in July but plant personnel cooperated by working first in areas away from the birds and bulldozing the colony area last. Thus eggs had time to hatch and the young were close to fledging before the colony site itself was bulldozed.

MANAGEMENT RECOMMENDATIONS

Based on our observations of Piping Plovers and Least Terns in 1988, we make the following conclusions and recommendations:

Nesting Habitat

1. We found no suitable habitat for either the Piping Plover or the Least Tern on the Missouri River itself. Currently, numerous revetments, dikes, and other man-made structures have confined the river to a narrow, highly-managed channel. With this management, there is little chance that sandbars or similar habitat will form on this fast-moving river. Unless the management plans for the river change, we see no chance that either plovers or terns will nest on the river itself in Iowa in the foreseeable future.

2. Of all of the isolated oxbow lakes that we visited, only two (DeSoto Bend and Decatur) seem to hold promise of possibly supporting nesting birds. Both have sandy areas and potentially they could support the birds in the future. Of these, DeSoto has the most promise. It has fairly large areas of suitable nesting habitat. The major drawback now seems to be the band of vegetation that separates the sandy areas from standing water. We believe that if the vegetation lying between the sandy areas and the lake were removed, this area would have a much better chance of attracting plovers to it.

3. Several gravel pits near the Des Moines River south of the Saylorville Dam and along the Big Sioux River near Hawarden have potential as plover habitat. We did not see the birds there but they should be watched in the future for signs of use. These are all privately owned now so their future management is subject to the wishes of their owners.

4. A public beach being developed at Saylorville Lake (Sandpiper Beach) was used by a pair of Piping Plovers in 1988, and they might have nested there if there had been less disturbance. Unfortunately, this is a popular recreation area and it will be hard to keep people out of the area the plovers use.

5. The fly-ash ponds at the IPL and IPS sites remain the best nesting habitat for both species in Iowa. Furthermore, the present management whereby fly ash is regularly deposited on the site and the practice of periodically bulldozing all of the vegetation imitates the natural river process of continually creating new open sandbar-type habitat. Thus, under current management, these sites should continue to provide habitat for both species into the foreseeable future. Besides the habitat that is available at these sites, they have the advantage that human access is closely controlled and thus there is little human disturbance on them.

Breeding Biology

1. Both species have had great yearly variation in their breeding success in Iowa (Tables 1 and 2). This past year was a poor year with no known production of Piping Plovers and low production of Least Terns. The small breeding population of both species means that even in good years, the total potential production is not high. Thus, the cumulative effect of a variety of minor types of mortality can result in very poor overall production.

2. Only one nest of Piping Plovers hatched in 1988 and those young were not seen after their first day of life. This is probably the first year since 1984 that no young have fledged at this site. We have no explanation for this but it does point out the precarious nature of their existence at this site.

Feeding Habitat

1. Our limited observations of foraging Piping Plovers indicated that they foraged mainly near their nesting areas at both the IPL and IPS sites. We saw no indication that feeding habitat or food was a limiting factor for the species.

2. Least Terns at the IPL Ponds fed mainly at nearby Lake Manawa as well as at the IPL Ponds. We rarely saw them fly in the direction of the nearby Missouri River and in fact, some small drainage ditches northeast of the IPL Ponds seem to be more important as foraging areas. Obviously some food is available at the IPL Ponds. However, the fact that terns usually fed at the more distant Lake Manawa suggests either that fish at the IPL Ponds are less available or are less preferred than the fish at Lake Manawa. Although Lake Manawa receives much recreational use, the area where the terns usually foraged receives relatively limited human use. The only

food item we saw them carrying was small minnows, the typical food for Least Terns in most areas. We saw no evidence of starvation or malnutrition among the young nor do we believe that the 2.4 km foraging flight to Lake Manawa is excessive for this species. Least Terns in California usually foraged within 3.2 km of their colony but would travel more than 6 km on occasion (Atwood and Minsky 1983).

Predation

1. We saw little evidence of predation during 1988 but any predation can be serious for both species. We found one dead adult Least Tern, and we saw an American Kestrel kill a young Least Tern. We saw kestrels at the IPL site frequently and they potentially are a problem there. There were no nest boxes placed for them along I-29 but they must have nested somewhere else in a natural site.

2. We saw no signs of any mammalian predation at the IPL site. The open habitat they nest on and the nature of the substrate probably discourage most mammals from venturing there. Still, we believe that raccoons or opossums could be a serious problem if either species occupies the area.

Human Disturbance

1. The fact that public access to both sites is closely controlled helps their management greatly. Other than our visits to the site and those of the plant personnel dumping fly ash or bulldozing the area, we saw no evidence of any other humans walking on the IPL site during the 1988 nesting season. Plant security is even stricter at the IPS site so we doubt that casual visits by humans had an effect on the bird's nesting success at either site.

2. To us, the ideal would involve continued cooperation between the Iowa DNR or its representative and IPL. Predictably, Piping Plovers should arrive there in late April or early May while Least Terns should arrive in mid to late May. Piping Plover nests are harder to locate but probably could be found by a good worker in a day or two. Least Tern nests are easy to locate, and the colony could probably be mapped in a half a day or less although late nesters may expand the colony somewhat. Ideally, the nesting site of both species would be marked and truck activity limited from that area during the nesting season, roughly mid May-mid July. If 1988 is typical, truck lanes around or possibly through the nesting areas could be established so that fly ash could be dumped without disturbing the birds. Our experience suggests that plovers will nest successfully if trucks approach no closer than about 15 m to their nests while terns need a buffer zone of about m. Likewise, bulldozing should not occur on the nesting sites during the nesting season although it could occur at other parts of the pond with no effect on the birds.

ACKNOWLEDGMENTS

This study was funded by a Section 6 Grant from the U. S. Fish and Wildlife Service administered through the Iowa Department of Natural Resources. We especially appreciate the support and advice of Daryl Howell of the Iowa DNR. Warren Waldron, Iowa Power, Council Bluffs and Tim Rollinger, Iowa Public Service, Sioux City were both helpful in providing access to the two nesting sites. Others who helped with observations, advice, or in other ways include Eric Anderson, Bruce Dittmer, George Gage, Bob Livermore, Babs Padelford, Jerry Probst, Doug Reeves, Mark Versch, and Barb Wilson. We thank them all.

LITERATURE CITED

- Atwood, J. L., and D. E. Minsky. 1983. Least Tern foraging ecology at three major California breeding colonies. *Western Birds* 14:57-72.
- Hallberg, G. R., J. M. Harbaugh, and P. M. Witinok. 1979. Changes in the channel area of the Missouri River in Iowa, 1879-1976. Iowa Geol. Survey Special Report Series 1, 32 pp.
- Sidle, J. G., J. J. Dinan, M. P. Dryer, J. P. Rumancik, and J. W. Smith. 1988. Distribution of the Least Tern in interior North America. *American Birds* 42:195-201.
- U. S. Fish and Wildlife Service. 1988. Great Lakes and Northern Great Plains Piping Plover recovery plan. U. S. Fish and Wildlife Service, Twin Cities, MN. 160 pp.
- Williams, R. D. 1985. Nesting observations of the Piping Plover near Sioux City. *Nebraska Bird Review* 53:74-76.
- Wilson, B. L. 1984. 1984 search for Piping Plover and Least Tern in Iowa. Report to the Iowa Conservation Commission, Des Moines. 11 pp.
- Wilson, B. L., L. Padelford, and B. Padelford. 1983. Piping Plover nests in Pottawatomie Co. *Iowa Bird Life* 53:69-70.

Figure 1. Map of the study area at the Iowa Power and Light (IPL) plant at Council Bluffs, Iowa. Piping Plover nests A and B are indicated by letters, and the Least Tern nesting area used in 1988 is indicated by cross-hatching.

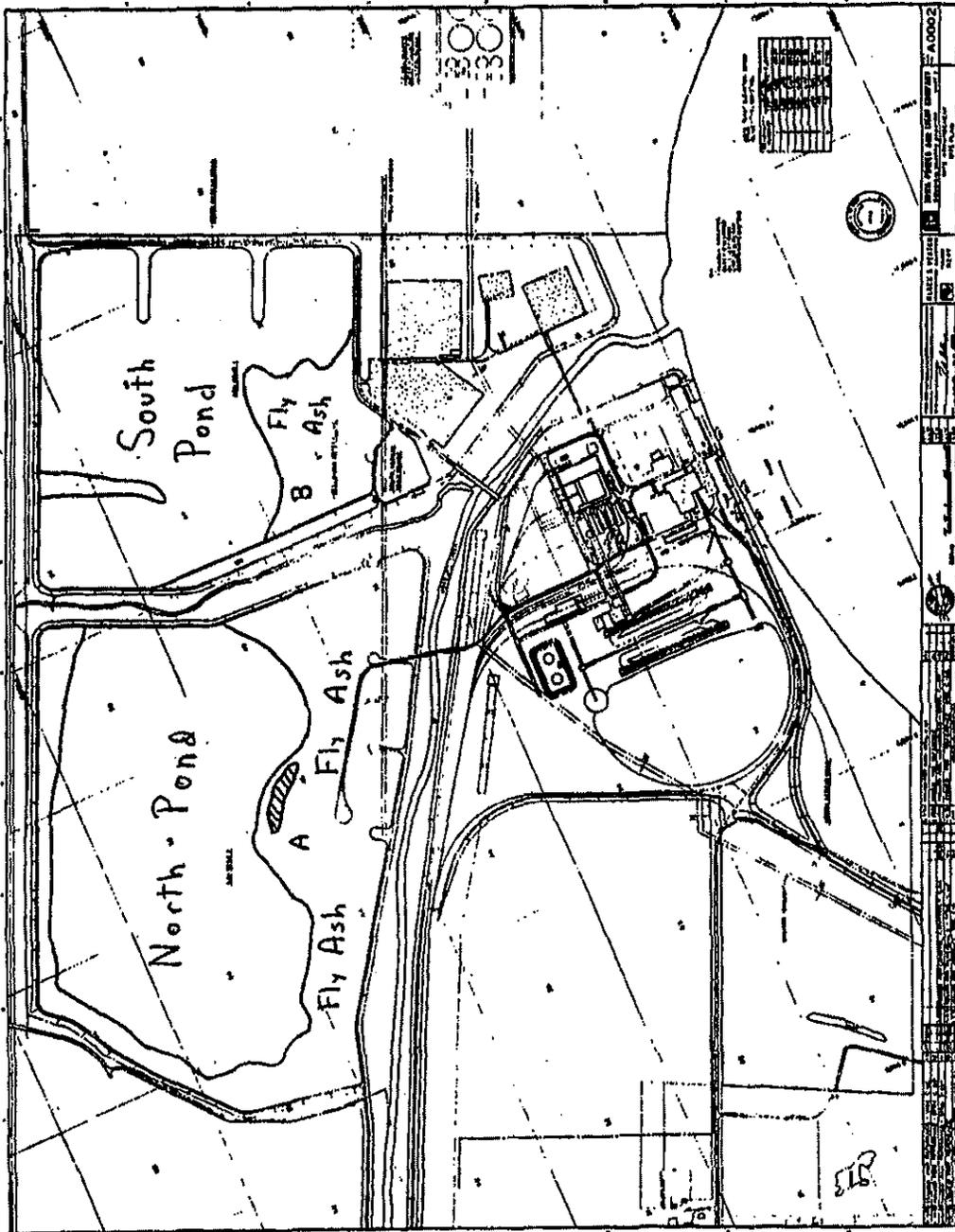


Table 1. Summary of recent Piping Plover nesting records in Iowa.

year	Council Bluffs			Sioux City		
	# pairs	# eggs	# young	# pairs	#eggs	# young
1983	2	7	1+			
1984	4	15	10	3	23	6
1985	6	?	4+	3	?	
1986	8	12+	9	3	?	1
1987	3	?	some	present	?	?
1988	3	5	4	3	8	?

Table 2. Least Tern nesting populations at the IPL Ponds, Council Bluffs from 1984-1988.

Year	# pairs	# nests	# young
1984	9	9	11
1985	9	?	13+
1986	14	14	9+
1987	11+	15	some
1988	11	11	6+
average	10.8	12.2	9.7

A pair was seen at Sioux City in 1986; it is uncertain whether they nested

Table 3. Other bird species that might harm Piping Plovers or Least Terns that were seen at the IPL ponds during the nesting season, 1988. The total number of times each species was seen at the ponds and the number of times that the species was mobbed by Least Terns are presented.

Species	# occurrences	times mobbed by terns
Great Blue Heron (<u>Ardea herodias</u>)	6	5
Turkey Vulture (<u>Cathartes aura</u>)	1	1
Red-tailed Hawk (<u>Buteo jamaicensis</u>)	2	1
American Kestrel (<u>Falco sparverius</u>)	44	24
Ring-necked Pheasant (<u>Phasianus colchicus</u>)	1	1
Killdeer	1	0
Franklin's Gull (<u>Larus pipixcan</u>)	9	9
Ring-billed Gull (<u>Larus delawarensis</u>)	2	2
Herring Gull (<u>Larus argentatus</u>)	1	1
Caspian Tern (<u>Sterna caspia</u>)	1	1
Forster's Tern (<u>Sterna forsteri</u>)	1	1
Loggerhead Shrike (<u>Lanius ludovicianus</u>)	1	0
totals	70	46

Table 4. Directional heading of feeding flights by Least Terns nesting at the IPL ponds in 1988.

Direction	# outgoing flights	# return flights	times adults fed young
northwest	28 (65)	63 (76)	22
north	0	1 (1)	0
northeast	2 (5)	1 (1)	0
east	3 (7)	1 (1)	0
south	9 (21)	16 (19)	4
west	1 (2)	1 (1)	0
totals	43	83	26

percentages are in parentheses

Additional Piping Plover-Least Tern references

Cox, T. A. 1983. Piping Plover nests. Nebr. Bird Review 51:94.

Ducey, J. 1984. Some 1983 summer birds of the Missouri Natural Recreation River, Nebraska. Nebr. Bird Rev. 52:36-40.

Ducey, J. 1984. Least Tern eggs in nests of the Piping Plover. Nebr. Bird Rev. 52:72-73.

Ducey, J. 1988. Nest scrape characteristics of Piping plovers and Least Terns in Nebraska. Nebr. Bird Rev. 56:42-44.

Johnson, C. M., and S. Findley. 1959. Piping Plover nests near Yankton. South Dakota Bird Notes 11:34-35.

Lambeth, D. O., M. A. Bergan, and R. L. Nellerhoe. 1986. Nesting records for Piping Plover in the Red River Valley of North Dakota. Prairie Nat. 18:142.

Molhoff, W. J. 1983. Piping Plovers and Least Terns. Nebr. Bird Rev. 51:94.

North, M.R. 1986. Piping Plover nest success on Mallard Island in North Dakota and implications for water level management. Prairie Nat. 18:117-122.

Williams, R. D. 1985. Nesting observations of the Piping Plover near Sioux City. Nebr. Bird Review 53:74-76.

Wilson, B. L. 1984. 1984 search for Piping Plover and Least Tern in Iowa. Report to the Iowa Conservation Commission, Des Moines. 11 pp.

the authors were listed wrong on this reference, should be:

Wilson, B. L., L. Padelford, and B. Padelford. 1983. Piping plover nests in Pottawatamie Co. Iowa Bird Life 53:69-70. (also note that the county should be spelled Pottawattamie)

WOODWARD H. BROWN
432 TONAWANDA DRIVE
DES MOINES, IOWA 50312

17 May, 1977

Dear Dr. Klass:

Following up on our brief discussion of the Little Tern (Sterna albifrons) here are the dates of my observations at DeSoto Bend:

1968 July 4
1969 June 21
1970 June 5
1971 no trip
1972 May 30
1973 June 6
1974 none seen on June 12

Piping Plover (Charadrius melodus) and their nests were seen on the same dates as the tern observations were made, and were missing on the 1974 trip.

I have not been to DeSoto Bend since 1974.

Sincerely

Woodward H. Brown