MISCELLANEOUS PAPER EL-90-23

(2)

US Army Corps of Engineers

ASSESSMENT OF AVIAN BOTULISM CONTROL PILOT PROJECT AT THE DIKE 14 CONFINED DREDGED MATERIAL DISPOSAL FACILITY, CLEVELAND, OHIO

by

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Original contains color plates: All DTIC reproductions will be in black and white

December 1990
Final Report

ENVIRONMENTAL LABORATORY

Prepared for US Army Engineer District, Buffalo
Buffalo, New York 14207-1399

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Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a REPORT SECURITY CLASSIFICATION Unclassified	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b DECLASSIFICATION / DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S) Miscellaneous Paper EL-90-23	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a NAME OF PERFORMING ORGANIZATION USAEWES Environmental Laboratory 6b OFFICE SYMBOL (If applicable)	7a NAME OF MONITORING ORGANIZATION
6c ADDRESS (City, State, and ZIP Code) 3909 Halls Ferry Road Vicksburg, MS 39180-6199	7b ADDRESS (City, State, and ZIP Code)
8a NAME OF FUNDING / SPONSORING ORGANIZATION USAED, Buffalo 8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c ADDRESS (City, State, and ZIP Code) Buffalo, NY 14207-1399	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO / PROJECT NO / TASK NO / WORK UNIT ACCESSION NO

11 TITLE (Include Security Classification)
Assessment of Avian Botulism Control Pilot Project at the Dike 14 Confined Dredged Material Disposal Facility, Cleveland, Ohio

12 PERSONAL AUTHOR(S)
Simmers, John W.; Apfelbaum, Steven I.; Bryniarski, Len F.

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Final report	FROM _____ TO _____	December 1990	89

16 SUPPLEMENTARY NOTATION
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Avian botulism CDF management

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

The Dike 14 Confined Dredged Material Disposal Facility (CDF) at Cleveland, OH, was the site of an avian botulism outbreak in 1986. At that time the use of noise-making devices was not successful in preventing the use of the CDF by shorebirds, wading birds, and waterfowl susceptible to botulism. The Buffalo District of the US Army Corps of Engineers identified the problem as one requiring a generic solution that could be applied at other operational CDFs. In a pilot project, plant propagules were planted at the CDF prior to the disposal operations so that a vegetative cover would rapidly appear as the CDF dewatered after disposal operations. The vegetation on the dewatering dredged material was expected to make the CDF unattractive to shorebirds, wading birds, and waterfowl. The pilot project was a qualified success in the prevention of a 1987 outbreak of avian botulism. The duration of the disposal operation and the depth of the dredged material placed in the CDF limited the anticipated vegetation establishment. However, the final elevation of the dredged material relative to the level of Lake Erie allowed the site

(Continued)

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT	21 ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	Unclassified
22a NAME OF RESPONSIBLE INDIVIDUAL	22b TELEPHONE (Include Area Code) / 22c OFFICE SYMBOL

19. ABSTRACT (Continued).

to dewater and the vegetation that emerged attracted a terrestrial avifauna. The observed botulism abatement was the result of both additional filling and vegetation establishment. The procedures used to establish vegetation were feasible, compatible with dredging and disposal schedules, and cost-effective. A unique combination of equipment was required, but all of the components were relatively available.

SUMMARY

The Dike 14 Confined Dredged Material Disposal Facility (CDF) at Cleveland, OH, was the site of an avian botulism outbreak in 1986. At that time the use of noisemaking devices was not successful in preventing the use of the CDF by shorebirds, wading birds, and waterfowl susceptible to botulism.

The Buffalo District of the US Army Corps of Engineers identified the problem as one requiring a generic solution that could be applied at other operational CDFs. The following report describes a pilot project in which plant propagules were planted at the CDF prior to the disposal operations so that a vegetative cover would rapidly appear as the CDF dewatered after disposal operations. The presence of the vegetation on the dewatering dredged material was expected to make the CDF unattractive to shorebirds, wading birds, and waterfowl.

The pilot project was a qualified success in the prevention of a 1987 outbreak of avian botulism. The duration of the disposal operation and the depth of the dredged material placed in the CDF limited the anticipated vegetation establishment. The final elevation of the dredged material relative to the level of Lake Erie allowed the site to dewater and the vegetation that emerged attracted a terrestrial avifauna. The observed botulism abatement was the result of both additional filling and vegetation establishment.

The procedures used to establish vegetation were feasible, compatible with dredging and disposal schedules, and cost-effective. A unique combination of equipment was required, but all of the components were readily available.

PREFACE

This work was sponsored by the Buffalo District of the US Army Corps of Engineers (CENCB). The work was conducted by the Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES), Vicksburg, MS. The study was conducted under the direction of Dr. John Harrison, Chief of EL, and under the general supervision of Dr. C. R. Lee, Chief of the Contaminant Mobility and Regulatory Criteria Group, and Mr. Donald L. Robey, Chief of the Ecosystem Research and Simulation Division (ERSD).

The study was conducted by Dr. John W. Simmers of ERSD, Mr. Steven I. Apfelbaum of Applied Ecological Services, Juda, WI, and Mr. Len F. Bryniarski, Planning Division, CENCB. The CENCB Project Manager was Mr. Donald E. Borkowski.

Funding for the study was provided by CENCB. Technical reviewers were Drs. Douglas Gunnison and C. R. Lee, ERSD, and Dr. Gerould Wilhelm, The Morton Arboretum, Chicago, IL.

COL Dwayne G. Lee, CE, was the Commander and Director of WES at the time of the study. COL Larry B Fulton, EN, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.

This report should be cited as follows:

Simmers, John W., Apfelbaum, Steven I., and Bryniarski, Len F. 1990. "Assessment of Avian Botulism Control Pilot Project at the Dike 14 Confined Disposal Facility, Cleveland, Ohio," Miscellaneous Paper EL-90-23, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
acres	4,046.873	square metres
cubic yards	0.7645549	cubic metres
Fahrenheit degrees	5/9	Celsius degrees*
feet	0.3048	metres
horsepower (550 foot-pounds (force) per second)	745.6999	watts
inches	2.54	centimetres
square inches	6.4516	square centimetres

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: C = (5/9) (F - 32).

ASSESSMENT OF AVIAN BOTULISM CONTROL PILOT PROJECT AT THE DIKE 14 CONFINED DREDGED MATERIAL DISPOSAL FACILITY, CLEVELAND, OHIO

PART I: INTRODUCTION

Background

Avian botulism

1. Botulism is a bacterial disease often associated with anaerobic conditions on mud flats. Six strains of the bacterium *Clostridium botulinum* that may cause illness have been identified by Duffus (1980).*

2. Avian botulism is a common disease of waterfowl. The disease, also called limberneck or Western duck sickness, usually occurs in shorebirds or wading birds congregating on emerging mud flats during the late summer. The causative organisms are bacteria of the genus *Clostridium* that multiply and produce a toxin in the bodies of dead invertebrate animals under anoxic conditions. *Clostridium botulinum* type C is the specific strain responsible for limberneck in shallow-water-dwelling, insect-feeding, and omnivorous birds. The bacteria are naturally present in sediments and soils, as spores. Under anaerobic conditions, mesophilic temperatures, and pH levels ranging from 5.7 to 8.0, the spores "germinate" and the bacteria multiply rapidly. It would appear that the appropriate conditions for the multiplication of the bacteria are often present in the hot late summer and early fall months (July-October). During this period, decaying vegetation or vertebrate and/or invertebrate animal carcasses may occur along shorelines and in shallow water providing a source of protein for the bacterial growth. As a carcass decays, the decomposition process uses up available oxygen in the carcass, producing anaerobic conditions. Bacterial spores, possibly ingested when the animal was alive, "germinate" after the animal's death. As the bacteria multiply, they release toxin. As the outbreak progresses, the presence of the carcasses of dead birds may provide additional sources of infection for unaffected birds. Birds may feed directly on invertebrate carcasses that contain the toxin. Alternatively, the birds may feed on live maggots of flesh flies or blowflies that lay eggs on dead vertebrates. These insects apparently accumulate *C. botulinum* toxin in their bodies as they feed on the carcasses. Some infected birds may carry the disease to neighboring wetlands and mud flats. Once a bird is infected, the botulism toxin attacks the parasympathetic nervous system and usually causes death.

3. Botulism bacteria are naturally present in waterways and widely distributed in organic soils. Avian botulism occurs in mud flats and in naturally occurring or manmade wetlands. While little is known about the occurrence or extent of botulism infections in naturally occurring wetlands, the incidence of the disease and the presence of dead and dying birds within confined dredged material disposal facilities (CDFs) are often singled out for attention by resource agencies and the general public. As a result, Corps of

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* Duffus, J. H. 1980. Environmental Toxicology, John Wiley and Sons, New York.

Engineers Districts are often requested to take action after the disease is established. Frequently attempts to reduce the populations of susceptible species with noisemakers or trained raptors are both ineffective and expensive.

CDF management

4. All CDFs progress through the same general stages. At first the dike is placed around an aquatic area. With filling, the enclosed aquatic area is replaced by a wetland and/or mud flat and, finally, an upland as the CDF is filled to capacity. At this point, control of the CDF is returned to the sponsor. Each of these stages requires management procedures appropriate to the habitat and the attracted wildlife. These management procedures are necessary to prevent the movement of contaminants, establishment of undesirable animal species, and wildlife diseases. CDF management must anticipate the possibility that avian botulism may occur at some time during CDF development. Should this event occur, the site must be managed to reduce or eliminate contact by populations of susceptible species.

5. In the US Great Lakes, CDFs contain dredged material contaminated with toxic metals, polychlorinated biphenyls, polyaromatic hydrocarbons, and other substances of industrial origin. Generally CDFs are located in waterways that are contaminated to some extent. There are no data that connect contaminants to avian botulism. The impacts of contaminant mobility and the potential incidence of botulism are apparently independent factors that must be considered in management of CDFs for wildlife usage.

6. The following report is a summary of a 1987 botulism control pilot project conducted at the Dike 14 CDF at Cleveland, OH, for the US Army Corps of Engineers Buffalo District (CENCB). The CDF was the site of an avian botulism outbreak in 1986 (Appendixes A-D). During the pilot project, a vegetative cover was used to eliminate open mud flat areas that attract wading birds. The recommended management procedures contained in this report are intended to be compatible with CENCB maintenance and operations procedures and are generically applicable to other Districts and locations. A botulism control management plan developed for the Saginaw Bay CDF in Saginaw, MI, is included as Appendix E.

Dike 14 CDF

7. The Dike 14 CDF is an endiked disposal facility of approximately 80 acres* projecting into Lake Erie in the Cleveland Harbor (Figure 1). The CDF is divided into east and west portions by the culvert that transfers Doan Brook through the CDF to the lake (Figure 2 and Photo 1). The CDF contains dredged material from the Cuyahoga River and the Cleveland outer harbor. Yearly maintenance dredging operations typically result in the placement of approximately 320,000 yd^3 of dredged material into the site. One third of the material is dredged from the outer harbor and two thirds of the material is dredged from the heavily contaminated Cuyahoga River. The site is currently filled to between 50 and 60 percent of capacity. Doan Brook culvert physically divides the site into two cells and rests on stone rubble requiring the hydrostatic pressure to be balanced on both sides.

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page iv.

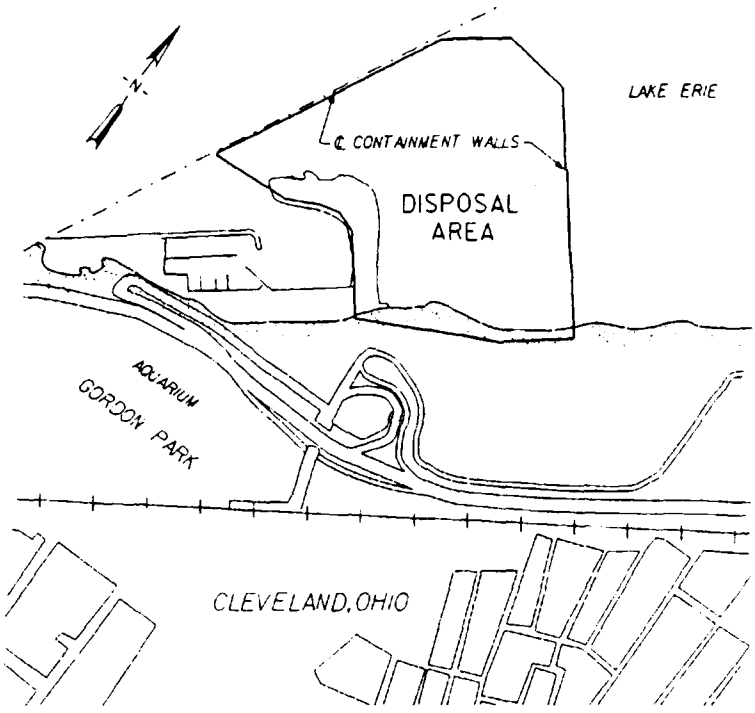

Figure 1. Location of the Dike 14 CDF in the Cleveland, OH, metropolitan area.

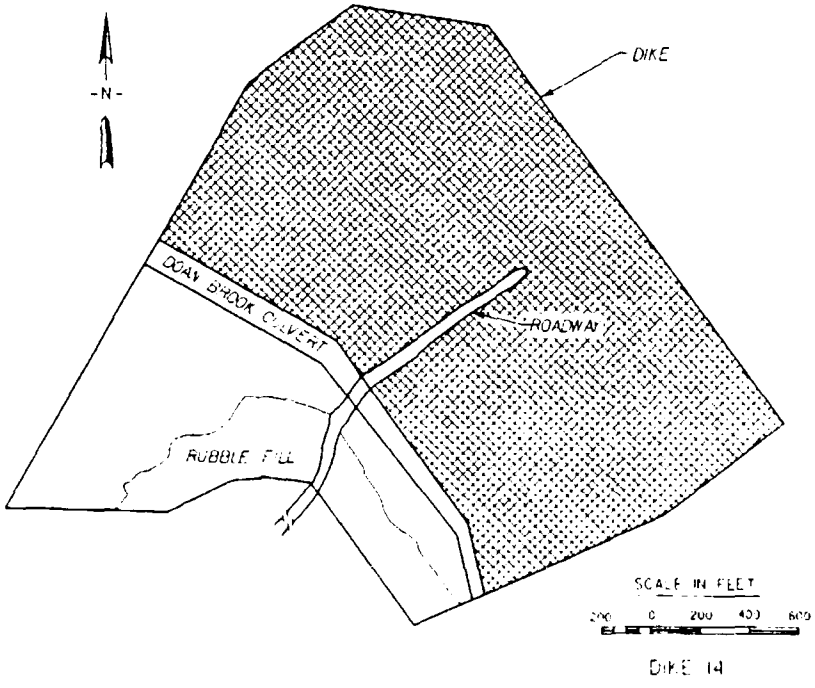

Figure 2. The Dike 14 CDF (the shaded area was the site of the avian botulism abatement pilot project)

Therefore, the differential in the levels of dredged material slurry on either side could not exceed 1 ft until the site had been filled to a depth sufficient to bury the culvert.

8. During 1986, the filling of the site reached the point that there were extensive areas of shallow water in the CDF. As the dredged material dewatered, areas of anaerobic mud flat were exposed, the mud flats attracted large numbers of birds, and an avian botulism

incident occurred. Lists of the species killed in the September 1986 outbreak are included in Table 1 and Appendix A.

Methods of control

9. Hunter et al.* extensively studied botulism in California and summarized techniques that have been used to reduce the severity of outbreaks. These methods are based on improvement of ponds and generally involve the maintenance of controlled water levels to minimize the presence of mud flats. Other approaches have included use of carbide cannons or other noisemakers, falconry, and effigies of predators to keep birds away, and removal of dead and/or infected birds to reduce sources of infection. All methods mentioned, while effective to varying extents, are neither compatible with the logistics of a typical maintenance dredging schedule nor easily converted to a standard operating procedure.

Objectives

10. The objectives of the pilot project were:

a. To demonstrate the use of vegetation to discourage waterfowl and shorebirds from landing on the site, reducing the incidence of avian botulism at CDFs.

b. To demonstrate the feasibility of the above approach as a standard operating procedure.

c. To evaluate the results of the approach when applied to a regularly scheduled dredging and disposal operation.

Approach

11. The techniques that have been suggested and/or applied to reduce the incidence of avian botulism have not been compatible with the operational requirements of a Corps of Engineers District. A District's dredging operations involve one or more contractors, and often several waterways must be dredged. There are also seasonal, construction, and/or environmental restrictions (or constraints) that must be met. Therefore, it is not possible to schedule the placement of dredged material into each CDF at the optimum period for the safety of all waterfowl and shorebird species that are attracted to the site.

12. CDF management usually does not consider the selection or control of colonizing species. As a result, birds are frequently attracted to new habitats provided by CDFs. Birds attracted to early successional habitats may develop dense populations on mud flats. Certain threatened and endangered species attracted to mud flats may also colonize contaminated sites in contaminated waterways. These are also locations where conditions favorable to the spread of naturally occurring diseases may temporarily occur.

13. The management of a CDF must be a continuing process that is based on the anticipation of the sequence of events that occur in the transition of the CDF from an

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* Hunter, B. F., Clark, W. E., Perkins, P. J., and Coleman, P. R. 1970. "Applied Botulism Research Including Management and Recommendations - A Progress Report," Wildlife Management Branch, California Department of Fish and Game, The Resources Agency, Sacramento, CA.

aquatic to a terrestrial ecosystem. The reduction of the incidence of avian botulism is one goal of management; however, the processes managed cannot be separated from the other processes that occur at the CDF. It is critical that any habitat, either naturally occurring or specifically created, must be evaluated by answering the following questions:

a. Which species will be excluded?

b. Which species will be attracted?

c. Will there be significant seasonal differences in species? (i.e., will the mud flat used for nesting by an endangered species in the spring be the site of botulism in late summer?)

d. Are the habitats selected for pathogen abatement consistent with the management of the CDF to reduce contaminant mobility?

e. Will a species be attracted that may be adversely affected by the area surrounding the CDF? (i.e., will species attracted to the CDF dike for nesting be adversely impacted by feeding in a nearby industrial area?)

14. Plant species were established in the areas of the Dike 14 CDF where it was anticipated that shallow water would exist after the 1987 dredging operations. The naturally occurring dewatering during late summer and early fall could contribute to a potential botulism problem. The plants introduced prior to the disposal operations were expected to colonize or emerge through the mud flats as the dredged material dewatered. The vegetated mud flats were expected to be unattractive to the wading birds susceptible to botulism, and to attract a diverse upland avifauna that would neither be susceptible to botulism nor adversely impacted by contaminants due to habitat and feeding preferences. All efforts to modify the postdisposal habitat with vegetation were applied without requiring either costly or time-consuming modifications in the CENCB operations schedule.

PART II: METHODOLOGY

Plant Species

15. A mix of plant species was selected to provide initial and long-term cover on the east side of the culvert (Figure 2). Annual grasses and wetland species were used to create the early successional conditions needed to enable the development of perennial species. These species were planted as seeds, roots, or stem cuttings (Table 2). Common reed (*Phragmites australis*) and sandbar willow (*Salix interior*) were planted as rhizomes and twig cuttings, respectively. All species chosen have either been found within the CDF (Table 3), or are commonly found in disturbed wetlands, and can produce dense vegetative cover.

16. The reed rhizomes were harvested at the Consumers Power Plant, Karns coal-fired electrical generating plant in Bay City, MI. Rhizomes were collected from a graveled road shoulder with a 3-point-hitch spring harrow attached to a 70-hp four-wheel-drive tractor. The tines of the spring harrow cut and lifted the dense rhizome mass from the gravel base. The rhizomes were then cut into 4- to 6-in. lengths, iced, packed in peat moss and stored in Styrofoam chests. The rhizomes were stored at Applied Ecological Services facilities (Juda, WI) at $44 \pm 2^{\circ}$ F for the 2-week period between collection and planting at Dike 14.

17. Willow cuttings were collected near Brodhead, WI, 2 days before planting at Dike 14. The willow was collected as whips 6 ft in length. After collection, half of the willow whips were cut to 1-ft lengths. All cuttings were packed on ice in Styrofoam chests until planting.

Equipment

18. Specialized equipment was assembled for planting seeds, cuttings, and rhizomes at Dike 14. A four-wheel-drive Honda all-terrain vehicle (ATV) fitted with rubber half-tracks (Tracker Industries) was used in planting areas containing standing water and/or unconsolidated dredged material (Photos 2 and 3). Loading rates of the ATV, plant material, and driver were 0.3 to 0.7/sq in. Seeding was accomplished with a 3-bushel cyclone seeder driven by a 5-hp Briggs and Stratton engine carried on the ATV. Rhizomes and 1- and 6-ft willow cuttings were planted by hand from the ATV.

19. A four-wheel-drive Pasquali tractor, with dual wheels, was used in the more consolidated areas to plant reed rhizomes and willow cuttings (Photos 4 and 5). A 3-point-hitch strawberry planter was modified and attached to the tractor as a single row planter. The planter's colter disc opened substrates for insertion of rhizomes and cuttings and packing wheels pressed the substrate around the plant materials. Rhizomes or cuttings could be planted at the rate of up to 3,000/hr.

20. A draw-bar-mounted spring harrow was used to rip the surface 3 to 4 in. of the consolidated substrate at the 1986 botulism problem area, and in the relatively dry south end of the CDF (Photo 6). This tool produced a corrugated seed bed and incorporated the seed into the upper inch of the substrate. A 7.5-ft tined drag was pulled by the ATV in areas too wet to harrow in order to provide microtopographic relief for seed incorporation.

Planting Schedule and Rates

21. Planting was initiated 18 May and completed 21 May 1987. Seeding rates (lb/acre) and the approximate numbers of cuttings and rhizomes are shown in Table 2. The seed mix was homogenized by hand in the hopper of the seeder and then spread at a uniform rate. A 30- to 40-ft seed spread width was typical and provided relatively uniform coverage.

PART III: RESULTS AND DISCUSSION

Planting Strategy Feasibility

22. Three days were required for a crew of five persons to collect and prepare the propagules, and 4 days, 17-21 May 1987, were required for planting by two persons. Five hours were required to till the consolidated portions of the CDF (approximately 20 acres). Seeding required roughly 10-15 min per acre including loading, seed mixing, and spreading. Rhizomes and cuttings were planted at rates of 800 to 3,000 plants per hour depending on the substrate conditions.

23. The dredged material along the northern edge of the dike was neither drivable nor walkable and was covered by 1 to 3 ft of water. The unconsolidated material in this area clogged the ATV track grousers and the vehicle buried itself. Use of a winch and cable to pull the ATV was sufficient to permit planting activities in unconsolidated areas. Prevailing winds and waves were also used to distribute propagules in ponded areas.

Dredging Operations

24. Dredged material disposal operations began 29 May 1987, 8 days after the completion of planting, and continued through 31 July. The dredging contractor, Great Lakes Dredge and Dock, placed 320,000 yd^3 of dredged material in the CDF; 220,000 yd^3 were dredged from the Cuyahoga River and the remaining 100,000 yd^3 were from the Cleveland outer harbor. The unplanted portion of the site (approximately 35 acres west of the Doan Brook culvert) was filled first (Figure 2). Dredged material was then alternately pumped to the east and west halves to maintain equal hydrostatic pressure on the culvert ($\pm$1 ft). Within a month, the dredged material completely overflowed the culvert. By the time the disposal operations were completed, most of the planted area east of the culvert was covered by up to 6 ft of dredged material, or was flooded.

25. By 2 September the CDF had dewatered and the dredged material consolidated. The Doan Brook culvert was covered, there were no shallow areas of standing water to attract wading birds, and there were no indications of avian botulism. Some planted vegetation had emerged through the dredged material.

26. The pilot project was evaluated at the end of the growing season (26 October 1987). During the disposal operations the CDF was filled level with the culvert. The north end of the east half (planted) and the west half (unplanted) of the CDF each received up to 6 ft of dredged material. In the east half of the CDF, depths of dredged material decreased with increased distance from the dredge pipe. The gravel access road in the east half of the CDF supported lush vegetation that apparently acted to filter suspended material so that the south 30 acres of the east half experienced only intermittent flooding.

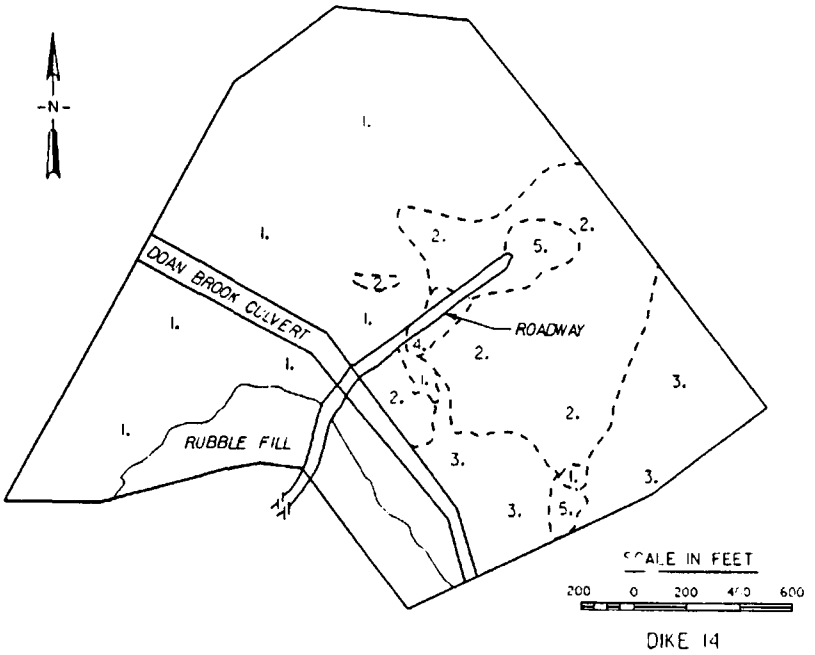
Vegetation

27. Vegetation was not established during the 1987 growing season in areas where deep burial occurred (Photo 7). Only vegetation capable of growing through shallow burial was evident in October (Figure 3 and Photo 8). Smartweed species were able to sprout adventitious roots along the stems and incrementally grew through over 3 ft of

Figure 3. Vegetation at the Dike 14 CDF 26 October 1987

Key:

1. Dry mud flat, unvegetated
2. Dominant plant, smartweed (*Polygonum*)
3. Dominant plant barnyard grass (*Echinochloa*)
4. Dominant plaant giant reed (*Phragmites*)
5. Dominant plants cottonwood (*Populus*) and willow (*Salix*)



dredged material. In areas of shallow dredged material deposits, smartweed and barnyard grass were present in dense stands. Interspersed in these stands were reeds and willow from the spring planting.

28. Seeds of smartweed and barnyard grass littered the substrate throughout the CDF. The seeds in and on the substrate produced by the vegetation planted in 1987 germinated in spring 1988, and by 26 June 1988, 75 percent of the site was vegetated (Photo 9). The reed and willow propagules expected to emerge in 1988 were not evident, and the vegetation was composed mainly of grasses and cattails with isolated stands of reed and willow. Observations made 31 August, after disposal operations were completed, indicated that smartweed was the most prevalent species. Areas of *Phragmites* and willow had expanded, and approximately 75-80 percent of the CDF was vegetated (Photo 10). On 31 August there was no standing water on the site and the only shorebirds or waterfowl present were gulls resting in the dry but unvegetated area left by the most recent (1988) disposal operations.

29. It is interesting to note that, while areas of comparably sized willows and cottonwoods were partially buried by the dredged material, only the willows survived.

Avifauna

30. The combination of increased dredged material elevation relative to the lake level and the dense growths of planted and volunteer grasses and forbs substantially changed the bird habitat. Foraging shorebirds and waterfowl were no longer the most numerous birds at the CDF. Bird watchers at the CDF noticed a shift in the avifauna to species of sparrows, finches, other songbirds, and doves. These bird groups generally feed on seeds or terrestrial insects and therefore do not usually contract avian botulism. Detailed lists

of species have been compiled by the local Cleveland bird watchers. The observations of one volunteer bird bander confirm the magnitude of the change. Jerry Talkington, a volunteer bird bander for the US Fish and Wildlife Service, banded a great many shorebirds and only about 100 sparrows at Dike 14 in 1986. In fall 1987, in 1 day, almost 400 sparrows were banded and by 26 October 1987, Mr. Talkington had banded 17 different sparrow species (Photo 11). William A. and Nancy R. Klamm of Lakewood, OH, have maintained detailed records of the birds observed at Dike 14. Their records for 1986, 1987, and 1988 through September are included as Appendix D. These records document the changes in avifauna visitations that have occurred with the filling of Dike 14 and the related vegetational changes. The Klamm's records confirm the changes in avifauna from various lakeshore-related species to upland birds that have accompanied the filling of the CDF. In particular, long-term records such as these document the presence of stages of finite length or "windows" in the life cycle of a CDF when management of colonizing species may be necessary.

PART IV: CONCLUSIONS AND RECOMMENDATIONS

31. The pilot project was a qualified success in the establishment of vegetation at Dike 14. The duration of the disposal operation and the depth of the dredged material limited the anticipated vegetation establishment. The final elevation of the dredged material relative to the lake level allowed the site to dewater rapidly and the vegetation attracted a different avifauna. The observed botulism abatement was the result of both additional filling and vegetation establishment.

32. The procedures used to establish vegetation were feasible and cost-effective. A unique combination of equipment was required, but all of the components were readily available.

33. Ideally, division of a CDF into two cells would permit the use of one cell for disposal while vegetation developed on the other. This would allow both cells to be vegetated during the critical stage in CDF development when shallow water and mud flats are the only features present. This approach is often not possible due to construction or operational constraints. Therefore, it is critical that the botulism "window" is identified and action is taken before the first outbreak. At Dike 14, an effort to establish emergent vegetation would have been most effective in the spring of 1986.

34. The procedures applied at Dike 14 require fine tuning before they can be considered standard operating procedures. The procedures can be further defined through application at other CDFs where conditions that favor botulism can occur.

35. The pilot project described was a field test of methodology that could contribute toward either preventing or reducing the potential of avian botulism outbreaks at CDFs.

Table 1
Birds Killed in the September 1986 Avian Botulism Outbreak

Number Dead	Common Name	Species
13	Semipalmated plover	*Charadrius semipalmatus*
12	Spotted sanderling	*Calidris* sp.
7	Sanderling	*Calidris alba*
3	Pectoral sandpiper	*Calidris melanotos*
2	Least sandpiper	*Calidris minutilla*
2	Ruddy turnstone	*Arenaria interpres*
2	Mute swan	*Cygnus olor*
1	Stilt sandpiper	*Micropalama himantopus*
1	Lesser yellowlegs	*Tringia flavipes*
1	Knot	*Calidris canutus*
1	Canada goose	*Brantia canadensis*
1?	Mallard	*Anas platyrynchos*
1?	Ring-billed gull	*Larius delawarensis*

NOTE: List compiled from data provided by the Cleveland Museum of Natural History, a more extensive description of the outbreak and list of bird species involved is given in the US Fish and Wildlife Service Columbus Field Office Report included as Appendixes A-D. The total number of dead birds was estimated to be between 687 and 716.

Table 2
Species Selected for the Vegetation of the Dike 14 CDF

Common Name	Species	Planting Rate per Acre for 45-Acre CDF lb/acre
Italian rye grass	*Lolium multiflorum*	11.00
Bentgrass	*Agrostis* sp.	0.90
Bulrush	*Scirpus atrovirens*	0.10
Wool grass	*Scirpus cyperinus*	0.10
Barnyard grass	*Echinochloa crusgalli*	20.00
Smartweed	*Polygonum pennsylvanicum*	5.00
Reed canary grass	*Phalaris arundinaceae*	2.00
Rice cutgrass	*Leersia oryzoides*	0.04
Switchgrass/Cocklebur	*Panicum virgatum Xanthium* sp. mixture	0.40
Common reed	*Phragmites australis*	3,350 rhizomes
Sandbar willow	*Salix interior*	3,350 cuttings

Table 3
Inventory of Plant Species Present on the Dike 14 CDF
Estimates Made February 1987

Common Name	Species	Percent Cover
	Mudflat Area	
Cocklebur	*Xanthium strumarium*	<20 to <5
Shepherd's purse	*Capsella bursa pastoris*	
Barnyard grass	*Echinochloa crusgalli**	
American wormseed	*Chenopodium ambrosioides*	
Beggar's ticks	*Bidens* sp.	
Smartweed	*Polygonum lapathifolium*	
	Coarse-grain-size material	
Sandbar willow	*Salix interior**	50-100
Cottonwood	*Populus deltoides**	
Reed canary grass	*Phalaris arundinacea**	
Common reed	*Phragmites australis**	
Purple Loosestrife	*Lythrium salicaria*	
Rice cutgrass	*Leersia oryzoides**	
Cocklebur	*Xanthium strumarium*	
Love grass	*Eragrostis hypnoides*	
Bog rush	*Juncus* sp.	
Aster	*Aster pilosus*	
	Fine-grain-size material	
Broad-leaved cattail	*Typha latifolia*	100
Narrow-leaved cattail	*Typha anguistifolia*	
Common reed	*Phragmites australis**	
Buttercup	*Ranunculus rhomboideus*	
Bog rush	*Juncus* sp.	
Three-square	*Scirpus americanus*	
Smartweed	*Polygonum lapathifolium*	

* Species selected for site vegetation.

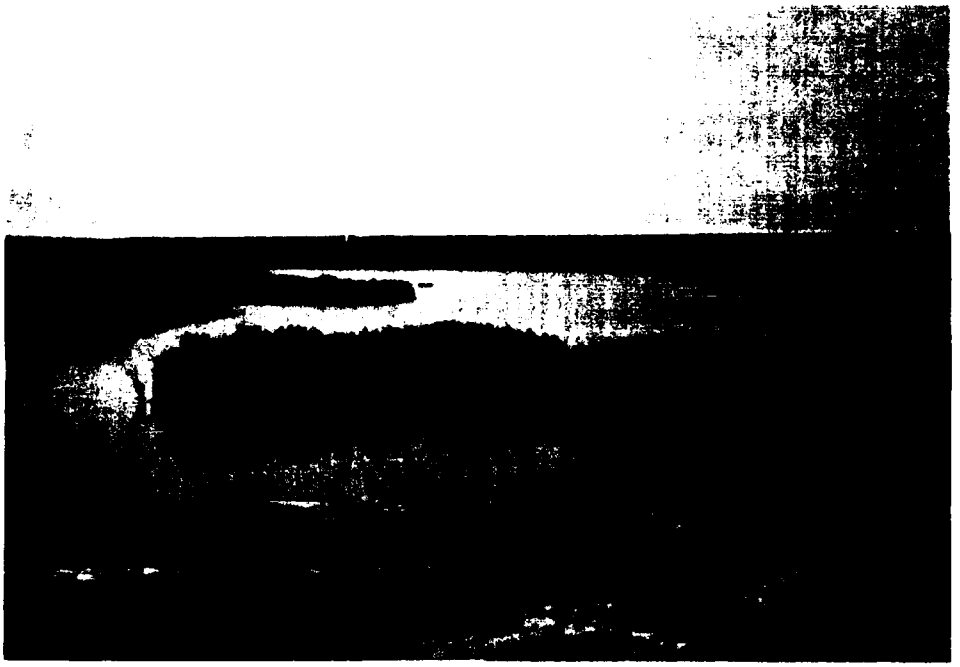


Photo 1. Dike 14 CDF. The concrete structure on the right is the Doan Brook culvert that divides the Dike 14 CDF into east and west portions. The west portion is shown in this photograph. The CDF dike is in the background

Photo 2. The Honda ATV with half tracks as used in the pilot project. The 3-bushel cyclone seeder is mounted on the ATV. This equipment was used in planting unconsolidated mud flats and ponded areas

Photo 3. The Honda ATV operating in water depths of 1-2 ft

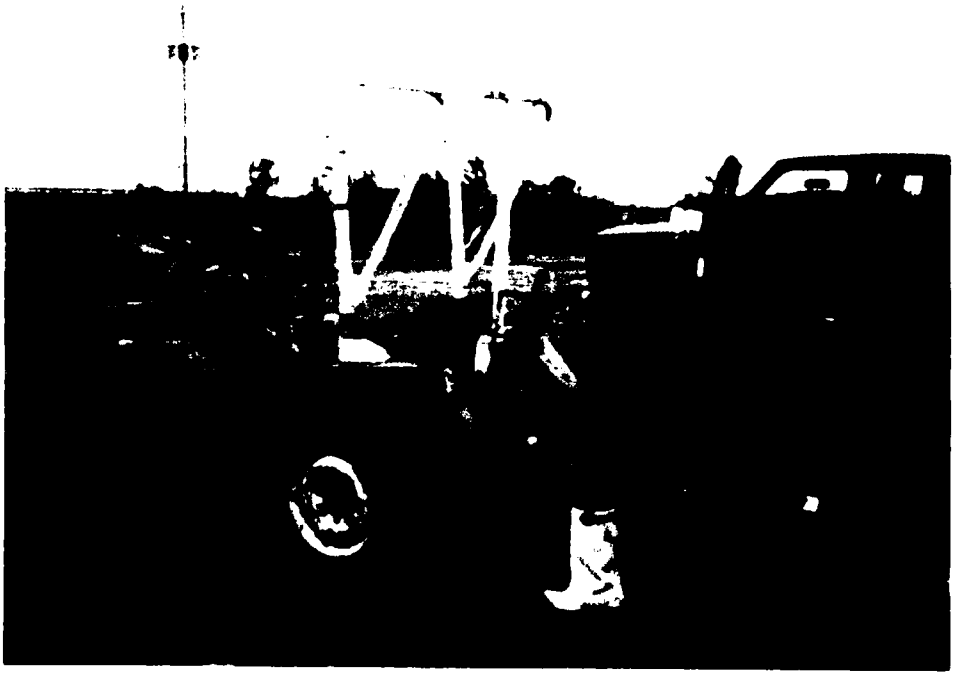


Photo 4. The four-wheel-drive articulated Pasquali tractor with dual wheels as used in the pilot project

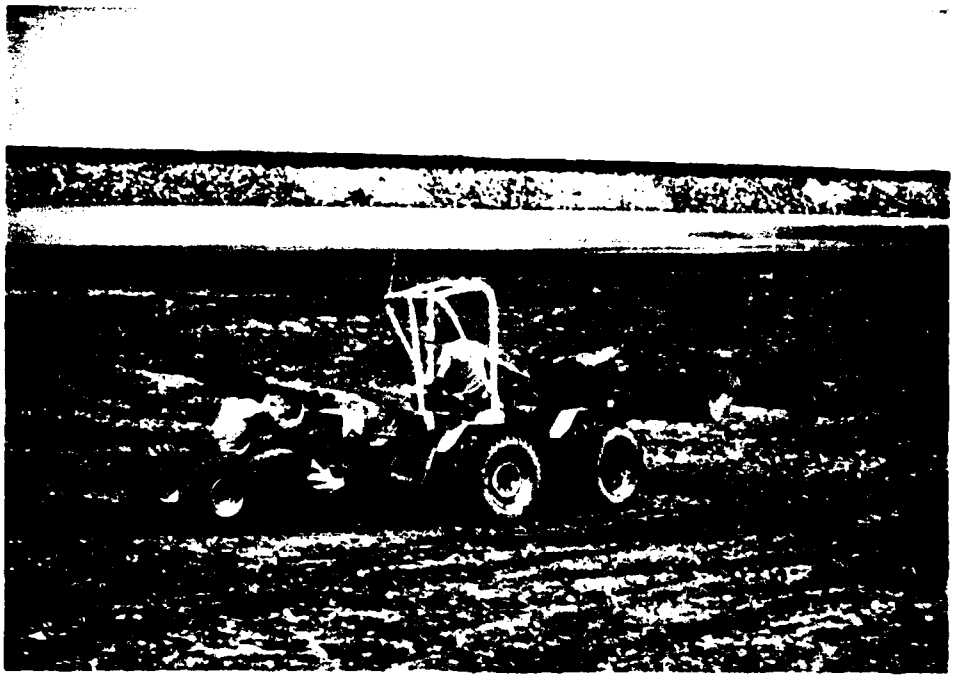


Photo 5. A three-point-hitch modified strawberry planter was used with the Pasquali tractor to plant cuttings and rhizomes in the relatively consolidated portions of the CDF

Photo 6. A 30-hp four-wheel-drive Pasquali tractor was used to pull a modified spring harrow to break up consolidated surface material before planting. This equipment could only be used in the drier areas of the CDF

Photo 7. Planted areas receiving 3-6 ft of dredged material had not become well vegetated by 26 October 1987. There were, however, no areas of standing water and no botulism reported

Photo 8. Planted areas receiving 1 ft of dredged material or less produced relatively lush vegetation in the short time between the completion of the disposal operations and the end of the growing season

Photo 9. Vegetation at Dike 14 during disposal operations (June 1988)

Photo 10. Vegetation at Dike 14 at maximum vegetational growth, September 1988. As in October 1987, there were no areas of standing water and the site was not used by bird species susceptible to avian botulism

Photo 11. Dense grass and forb vegetation substantially changed the bird habitat. Volunteer bird banders captured, marked, and released many seed-eating birds and a few wading birds in 1987. During fall 1987, sparrows representing 17 species were banded

APPENDIX A
US FISH AND WILDLIFE SERVICE REPORT ON THE 1986 AVIAN BOTULISM OUTBREAK AT DIKE 14

An Account of the Botulism Outbreak at the Cleveland, Ohio Confined Disposal Facility in 1986

by William J. Kurey, US Fish and Wildlife Service, February 1987

Closteridium botulinum type C is the bacterium that produces the toxin responsible for mass waterfowl deaths. There are six different strains of this bacterium labeled A through F on the basis of the neurotoxins they produce. The disease known as avian botulism, western duck sickness, or limberneck is caused by the neurotoxin, not by bacterial infection.

Botulism tends to ignite in areas that have not been recently flooded or where water levels fluctuate along a feather edge shore (as in Cleveland CDF). Other conditions conducive to a botulism outbreak include:

a. Warm temperatures - 60^{o} to 90^{o} F (winter botulism outbreaks are thought to be caused by still-active toxin produced under warm conditions earlier).

b. pH of 5.7 to 8.0.

c. Suitable nutrient medium consisting almost entirely of animal matter.

d. Vertebrate as well as invertebrate carcasses.

Flooding of dry land drowns terrestrial invertebrates that then become incubators for the anaerobic botulism bacteria. Botulism can be a problem in water depths up to about 18 in. The decomposition process uses up available oxygen, and bacterial spores ingested during the life of the animal germinate after death. Botulism outbreaks begin when birds feed directly on invertebrate carcasses or live invertebrates containing toxin and are killed, thus providing additional places for C. botulinum to grow. .The outbreak gathers momentum as maggots and other invertebrates concentrate toxin from bird carcasses on which they have been feeding. Ingesting just two to five of these toxin-bearing maggots can kill a duck and more than 5,000 maggots can be produced by a single duck carcass. Once an outbreak occurs it is necessary to remove waterfowl carcasses to break the fly/maggot cycle.

The only positive diagnosis is a laboratory procedure using mice and antitoxin. Signs of botulism intoxication in waterfowl include:

a. Sick birds are of normal weight.

b. Sick birds don't eat.

c. Sick birds have trouble holding their head erect, hence the term limber neck. Leg weakness and wing droop progresses to flaccid paralysis. The nictitating membrane over the eye ceases its rhythmic functioning.

Some sick birds can recover from botulism if given the opportunity. There are three stages of the disease:

Class 1. Birds that can walk but not fly. These birds can recover without special treatment.

Class 2. Birds that suffer a greater degree of paralysis; difficulty walking and usually row their wings. These birds may recover with oral administrations of fresh water.

Class 3. These birds are almost completely immobilized and require intraperitoneal injection of antitoxin to survive.

The Cleveland confined disposal facility (CDF) is a diked enclosure for sediments dredged from the harbor to maintain navigable depths. It is known as Dike 14 to the US Army Corps of Engineers and covers an area of about 88 acres. The northwest lagoon is about 9 acres in size and contains open water over 3 ft deep. Cattail marsh and shallow water areas fringe the south shore of this lagoon. The large east lagoon is about 55 acres in size with several acres of brushy vegetation in the central area: the rest is unvegetated sediment, some hard enough to walk on but mostly mud. Open water, from 10 in. deep along the north dike feathering to 0 in. southward, covered about 10 to 15 acres. The depth and extent of this ponded water varied with the elevation of Lake Erie due to the permeability of the dikes. It was this area that appeared to be the source of the botulism problem, although some carcasses were also found in areas of the west lagoon.

According to Bill McDonald (Buffalo District), prior to the summer of 1986 the east lagoon was full of water. Indeed, aerial photographs of the CDF taken in March or April of 1986 show it was covered with water except for a relatively small area in the center of the east lagoon. He also mentioned that he thought that the amount of sand in the dredged sediments was greater in earlier years.

Botulism does not appear to have been a problem at the Cleveland CDF prior to 1986. However, there have been outbreaks at the Saginaw, MI CDF and the Toledo, OH CDF in previous years.

The US Fish and Wildlife Service (USFWS) involvement in the botulism outbreak began on August 12, 1986, but the problem might have existed for 2 weeks or more before USFWS personnel were informed. The problem was brought to the attention of the USFWS by Mr. Dick Bartz of the Ohio Department of Natural Resources (ODNR) who was advised by an employee that he and local bird watchers had noticed the birds dying in the Cleveland CDF.

On August 14, the USFWS met on site with representatives of the Ohio Division of Wildlife (ODOW), ODNR, and the Army Corps of Engineers. The Corps agreed to collect and dispose of carcasses and to try to scare the birds. The ODOW provided a propane cannon that day; eventually, there were four at our disposal.

On the day of the meeting we counted about 65 carcasses using binoculars and a spotting scope; mostly shorebirds were observed, perhaps 15 percent were ducks and geese. A few shorebirds were alive in varying stages of paralysis and displaying typical signs of botulism intoxication. Sick birds tried to hide under vegetation, and those that could not reach shelter died on the mud flats and were not retrievable. The broad expanse of mud flats was the complicating factor in all of this. There was no way to cross the mud to search for dead birds.

The USFWS returned on August 18 and 19 with two 12-gauge shotguns and cracker-shells for frightening off the birds. The USFWS scared birds and left this equipment with

the Corps for their use. Two cases of crackershells (1,000 rounds) with a replacement value of over $500 were expended over the 46 days they were in use. Eight shorebird carcasses were picked up for submission to the National Wildlife Health Center (NWHC) for necropsy. By September 4, the NWHC had confirmed type C botulism as the cause of death.

The Corps reluctantly agreed to use the propane cannons because of disturbance complaints from a residential area. The propane cannons appeared to be effective in keeping ducks and geese out of the CDF, but shorebirds were unimpressed. Shorebirds were also unimpressed by the use of reflective tape, and even crackershells served to move them only short distances on most occasions. A good deal of the area used by shorebirds (the mud flats) was out of range of the crackershells. The dike walls are hazardous to walk over and could not be used to access remote parts of the CDF.

The USFWS made several more trips to the CDF on August 22, August 29, September 4, and September 10. On August 29, Mr. Bill Kurey of the USFWS Columbus office was interviewed for television about the situation. On a later trip, a fishing rod and reel were employed to retrieve some dead birds that were out of reach (treble hook on the end and several split shot sinkers just in front of it). An attempt was made to use a boat to retrieve carcasses which was effective on the west lagoon but unsuccessful in the east because declining water depth make boat launching impossible. Between August 12 and 29, lake level (and therefore CDF level) decreased 4 in.

Records of CDF water temperature range from 73° to 36° F in the east lagoon during the times measured. Oxygen levels in the west lagoon ranged from 12.2 - 12.8 ppm at the surface to 8.0 - 9.5 ppm at the 3-ft depth on the only day measurements were taken. Good measurements were impossible in the east lagoon because of shallowness and inaccessibility. The east lagoon was well mixed by wind, and high oxygen levels would have been expected. It is suspected that the east lagoon would have very little oxygen in the water after several days of calm weather and high temperatures. However, the oxygen level in standing water may have little significance to the progress of the botulism bacteria. These bacteria thrive primarily in the moist mud zone between the water's edge and the dry soil, an area free of the diluting and head-insulating effects of the water. Reflooding makes this botulism-laden area attractive to waterfowl.

On August 24, contractors were engaged by the Corps to take over the job of scaring birds and searching for carcasses. These efforts continued until October 3. Good records are available of the number of birds collected daily from August 24 to Oct 3 (41 days). Although weather conditions or other factors affected collections on some days, it is felt that the number of carcasses collected was an accurate indication of the relative numbers of birds dying from botulism (especially when taken on a weekly basis). These collections were a relative number because an unknown number of the birds died in the mud and could not be retrieved.

A total of 543 dead birds were collected over a period of 41 days. Counts of the earlier mortality add 143 (Corps count) to 173 (USFWS count) to this number. Therefore, we know that from 687 to 716 birds died; but the real number could be higher by several hundred owing to the difficulty presented by the mud flats in getting an accurate count.

Most of the affected birds (a crude estimate is 90 percent) were shorebirds the size of sandpipers, very small and easily overlooked, and this was another complicating factor.

The following list of some birds in the Cleveland CDF area was made by Ann Bugeda (Lake County Metropolitan Parks) on August 19:

Observed Dead	Observed Alive
Canada goose	Semipalmated sandpiper
Mallard	Semipalmated plover
Ring-billed gull	Ring-billed gull
Semipalmated sandpiper	Lesser yellowlegs
Semipalmated plover	Pectoral sandpiper
	Black-bellied plover
	Bonapartes gull
	Herring gull
	Killdeer
	Mute swan
	Sandpiper sp.
	Great blue heron
	Green heron
	Red-winged blackbird
	Flicker
	Swallow sp.

The two mute swans could not be scared out of the area and eventually died. Some other species were also in the area, including what might have been a falcon (species unknown) which was observed to stoop on a distant group of shorebirds causing them to rise and move out of the area, and the Federally endangered piping plover. The source of the piping plover report also saw marbled godwits, lesser golden plover, and red phalarope in early September. This person was a bird bander who had encountered a total of three piping plover at the CDF in 1986. He saw one in April or May, and two in early August which were sick with botulism. These two birds were banded and nursed back to health by force-feeding flies with tweezers. They were released at Lake Rockwell near Kent, OH, on September 24.

The botulism problem at Cleveland lasted from prior to August 12 to October 3 - about 44 days. About 700 migratory birds, mostly shorebirds, are known to have perished. The Federally endangered species piping plover was among the shorebirds involved, although there was no mortality.

The conditions that led to the 1986 botulism outbreak in Cleveland could exist again in 1987. In order to try to avoid these conditions, the Corps plans to maintain more of a slope on the CDF from the point where sediment filling occurs, and possibly to dredge later in the season to maintain the water level in the CDF. It is expected that up to 300,000 yd^3 of sediment could be added to the CDF in 1987.

Mr. John Simmers of the US Army Engineer Waterways Experiment Station in Vicksburg, MS, has suggested that Phragmites sp. might be planted in the CDF to aid

dewatering and make the area unattractive to shorebirds. The Buffalo District has made no decision on this proposal yet.

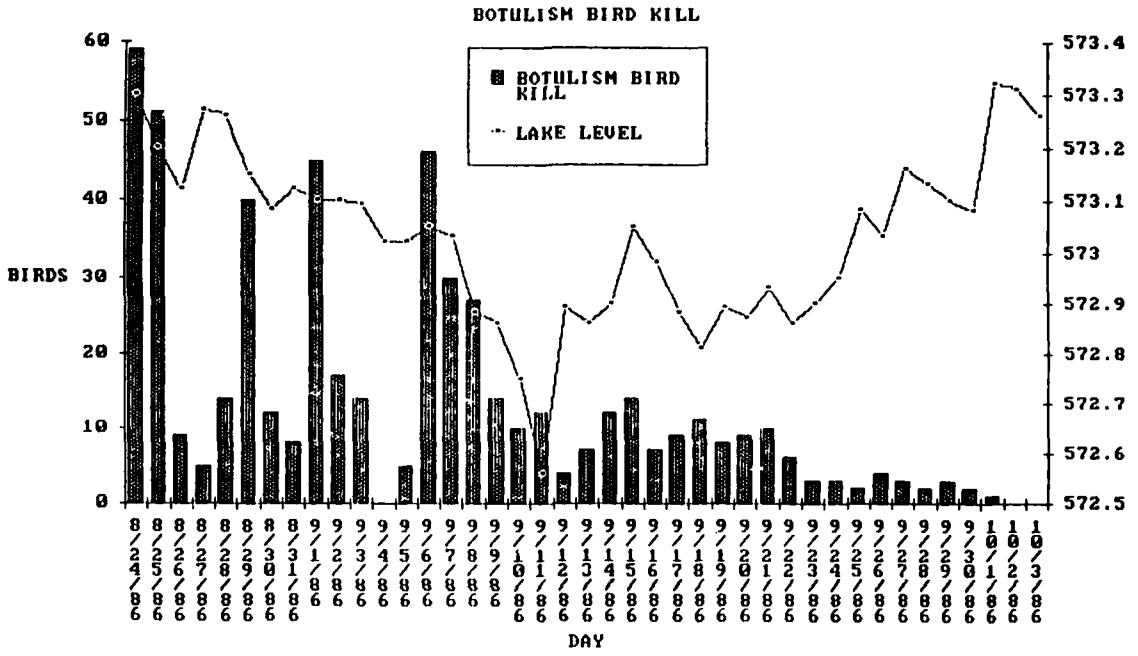


Figure A1. Botulism bird kill

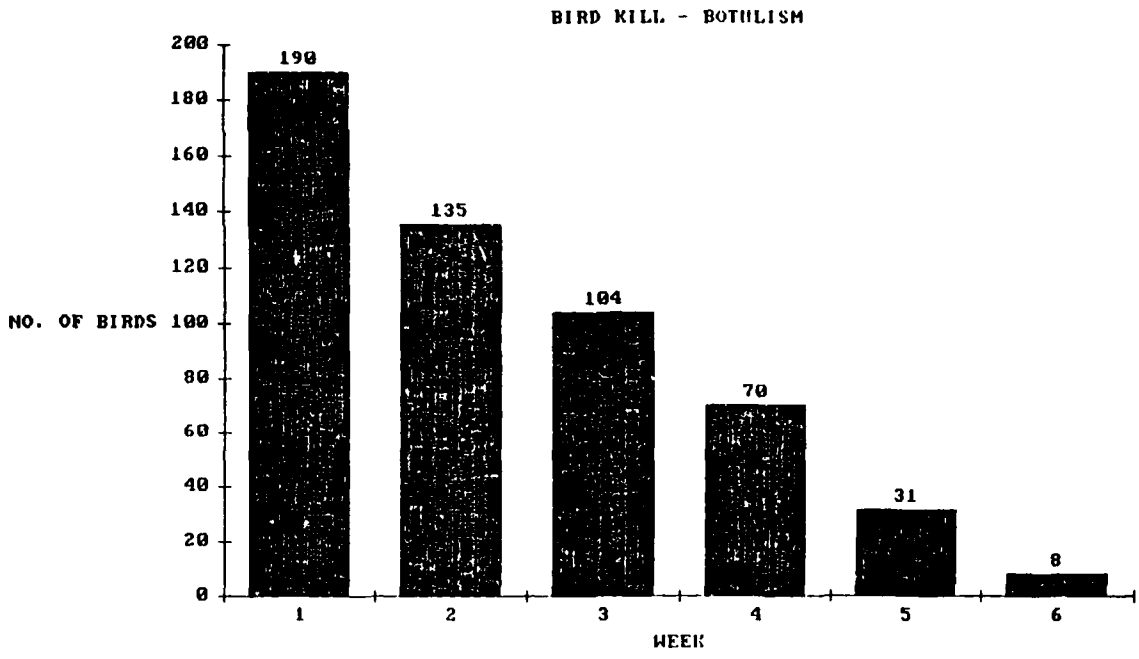


Figure A2. Deaths due to botulism, per week

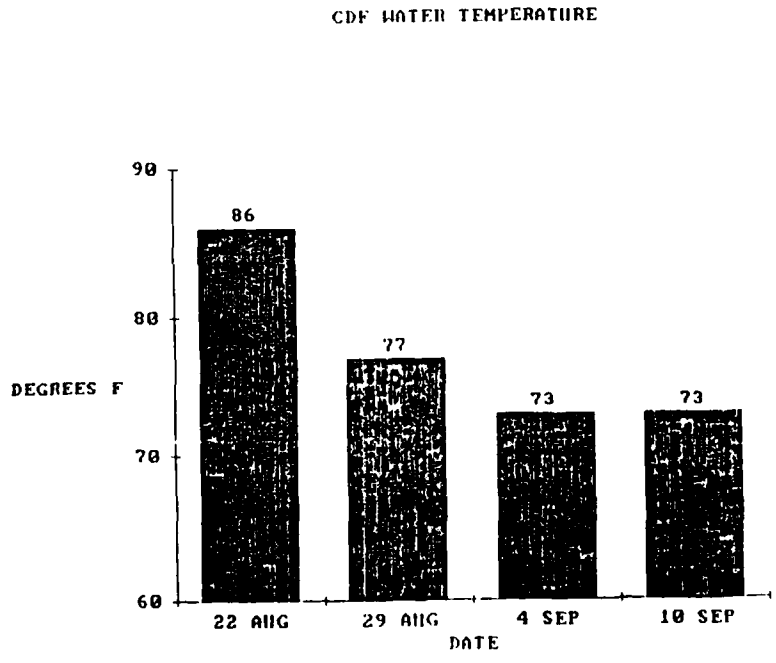


Figure A3. CDF water temperature

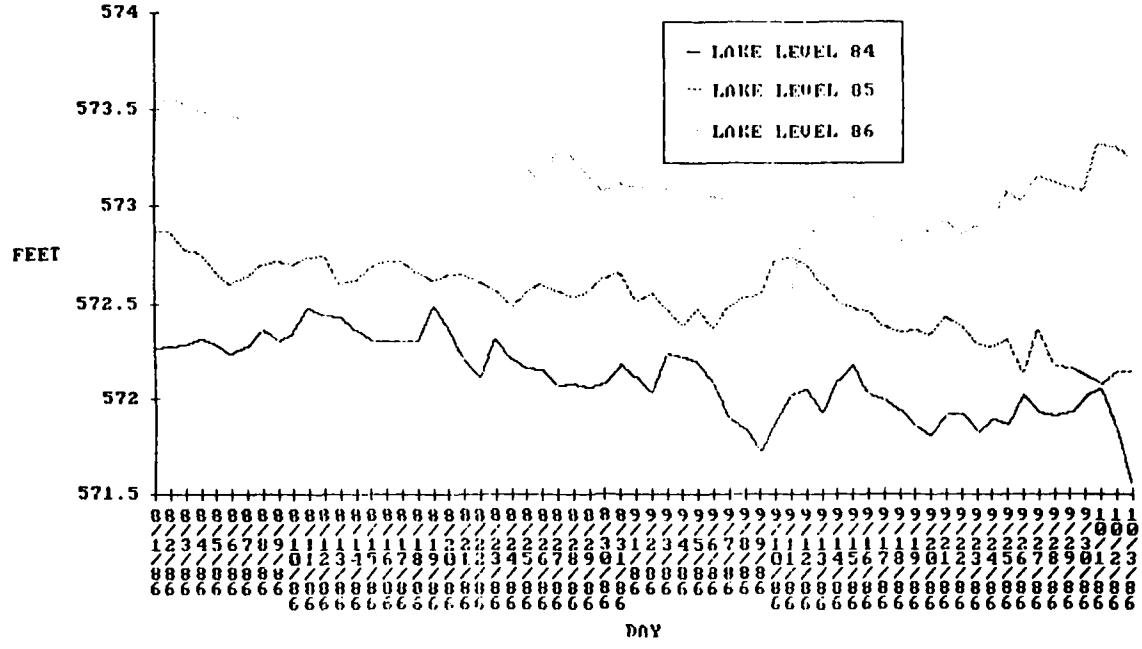


Figure A4. Water level at Dike 14 CDF

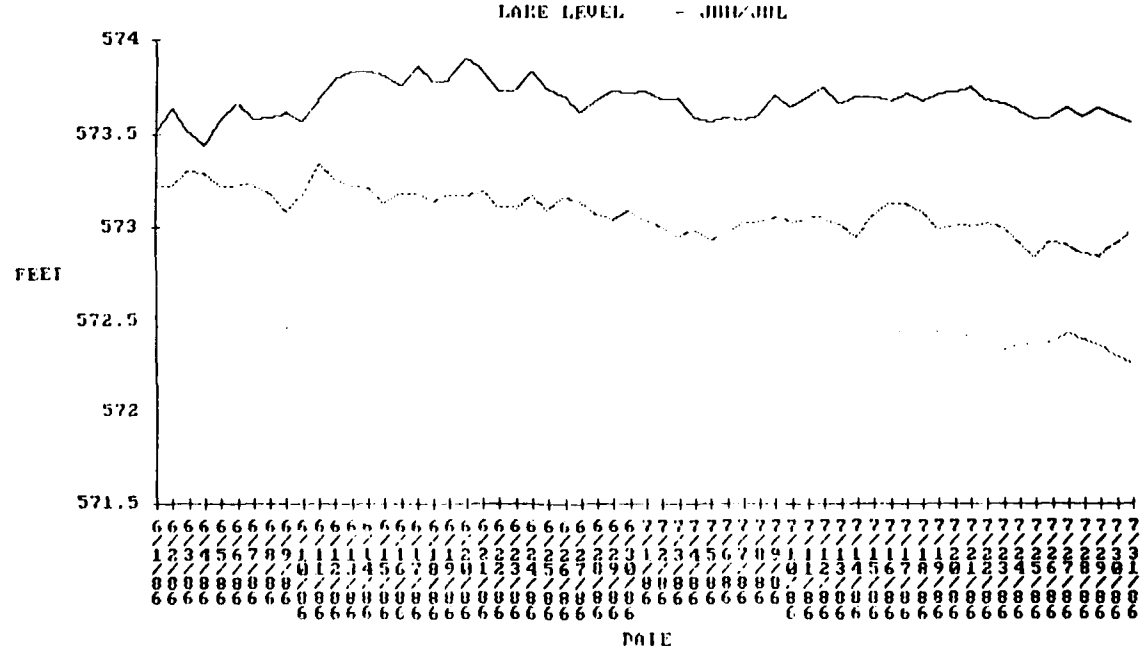


Figure A5. Water level, June and July, 1986

APPENDIX B
DOCUMENTATION OF THE NUMBER OF BIRDS KILLED AT DIKE 14

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO ATTENTION OF

NCBPD-ER

24 NOV 1986

SUBJECT: Cleveland Dike 14 Botulism Problem

Mr. Kent Kroonemeyer
Field Supervisor
U.S. Fish and Wildlife Service
Division of Ecological Services
3990 East Broad Street
Columbus, OH 43212

Dear Mr. Kroonemeyer:

I have enclosed a copy of the day-by-day summary of the number of birds collected by our contractor at the Cleveland, Ohio CDF this past summer as requested. Your continued interest and assistance is greatly appreciated.

My point of contact pertaining to this matter is Mr. William F. MacDonald of my Environmental Resources Branch, who can be contacted by calling commercial number (716)876-5454, extension 2175 or by writing to:

District Commander
U.S. Army Engineer District, Buffalo
1776 Niagara Street
Buffalo, NY 14207-3199
ATTN: Mr. William F. MacDonald

The Buffalo District -- Leadership in Engineering.

Sincerely,

Daniel R. Clark

DANIEL R. CLARK
Colonel, Corps of Engineers
District Commander

Enclosure
as stated

Dead Birds (August 24 - October 3, 1986)

(only pickup burn)

Date	Day	No. of birds	
8/24	Sun	59	
8/25	Mon	51	
8/26	Tue	9	by 9AM
8/27	Wed	5	ducks (2 from park) (1 sent to Vet. by State)
8/28	Thu	14	by 10AM
8/29	Fri	40	birds & 2 ducks
8/30	Sat	12	
8/31	Sun	8	
9/1	Mon	45	
9/2	Tue	17	
9/3	Wed	14	
9/4	Thu	0	
9/5	Fri	5	
9/6	Sat	46	
9/7	Sun	30	
9/8	Mon	27	
9/9	Tue	14	
9/10	Wed	10	
9/11	Thu	12	
9/12	Fri	4	
9/13	Sat	7	
9/14	Sun	12	
9/15	Mon	14	
9/16	Tue	7	
9/17	Wed	9	
9/18	Thu	11	
9/19	Fri	8	
9/20	Sat	9	
9/21	Sun	10	
9/22	Mon	6	
9/23	Tue	3	
9/24	Wed	3	
9/25	Thu	2	
9/26	Fri	4	
9/27	Sat	3	
9/28	Sun	2	
9/29	Mon	3	
9/30	Tue	2	
10/1	Wed	1	
10/2	Thu	0	
10/3	Fri	0	

APPENDIX C
DIAGNOSTIC SERVICES CASE REPORTS, NATIONAL WILDLIFE HEALTH CENTER, US FISH AND WILDLIFE SERVICE

U.S. FISH AND WILDLIFE SERVICE
NATIONAL WILDLIFE HEALTH CENTER
6006 Schroeder Road
Madison, Wisconsin 53711

DIAGNOSTIC SERVICES CASE REPORT

Case # 6546 **Epizoo #** 86-074 **RHT:** PG/JCF

Submitter:
Ken Multerer
Bill Curry
FWS-RCA
3990 E. Broad Street
Columbus, OH 43215

Specimen description/Identification:
Dowitchers/Sandpipers

Date Submitted: 8/19/86

Location: Corps of Engineer confine disposal facility, Cleveland, OH.

General Diagnosis: Type C Botulism

Comments: As you can see from the enclosed necropsy sheets, we were able to demonstrate Type C botulism as the cause of death of the shorebirds (NWHC: 6546-001 thru 008).

Liver samples from birds 001, 002, 005, 006 and 007 were analyzed for lead. Concentration of lead found in the livers of birds 001, 005, and 007 are within normal background range. No lead was detected in livers of birds 002 and 006.

_____ Preliminary Report (__/__/__) date __X__ Final Report (09/04/86) date

__X__ See attached necropsy records for individual specimen observations.
Note: Copies of this report have been sent to:

_____ USFWS Regional Office (RO-)

_____

Pathologist: Lou N. Locke, D.V.M.
P.A. Gullett for LNL

If you have questions regarding this case, contact P. A. Gullette, D.V.M. at 608-271-4640 (FTS 364-5418). Include above Case Number.

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken Multerer
Bill Curry
FWS-RCA
3990 E. Brood Street
Columbus, OH 43216

Case: 6546
Accession: 001
Collected: 8/14/86
Exam Date: (8/20/86)
Pathologist: LNL LNL

Species: Short-bill dowitcher **Specimen:** Carcass
Bandtype: (F) **Ref/Band No:** (Botl) **Euth:** (N) **Weight:(Gm)** (90)

History Summary: The submitter suspects a botulism die-off. Lagoon has shallow water - dredging materials stored in this area. There has been a history of toxic problems. Clinical signs, some green vents and limberneck observed. Mortality location: Corps of Engineer confined disposal facility near Cleveland, Ohio.

External/Internal Observations - Laboratory Results

External: No significant findings (NSF).

Internal/Musculoskeletal system: Pectoral muscles are moderately reduced +2. There is a moderate amount of subcutaneous fat. No fractures found. There were maggots in the oral cavity a around the vent.
Cardiovascular system: A small amount of coronary fat was present. No obvious lesions seen in th heart muscle.
Respiratory system: Marked postmortem changes in the lung. There is some postmortem accumulation of bloody fluid in the ventral portion of the lungs.
Digestive system: Liver - Early postmortem changes, no obvious lesions seen. Gall bladder - normal. There is a small amount of abdominal fat present. Esophagus and proventriculus are grose normal. Gizzard - Gizzard lining is stained dark blackish-blue due to postmortem change. No lead or steel present in the gizzard. Intestinal tract - Postmortem changes.
Urogenital system: Gonads are those of a non-breeding adult male. Kidneys - Early postmortem changes.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- .18 ppm wet wt; .60 ppm dry wt.

Preliminary Diagnosis: Suspect botulism
Sex (M) Age (A)/(___) Body Cond. (G) Postmortem State (F) Giz. Lead (0)/(0)
Samples Saved:
1. Bact: heart-bot
2. Tox: liver-Pb
3.
4.
5.
6.

Final Diagnosis (order of importance)	**topog.**	**morph.**	**Exam type (GO2) etiol.**	**funct.**	**disea**
1. Type C botulism	( )	( )	( )	( )	( )
2.	( )	( )	( )	( )	( )
3.	( )	( )	( )	( )	( )

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken Multerer
Bill Curry
USFWS-RCA
3990 E. Brood Street
Columbus, OH 43216

Case: 6546
Accession: 002
Collected: 8/14/86
Exam Date: (8/20/86)
Pathologist: LNL

Species: Short-bill dowitcher **Specimen:** Carcass
Bandtype: (E) **Ref/Band No:** (Bot2) **Euth:** (N) **Weight:(Gm)** (110)
History Summary: See 001.

External/Internal Observations - Laboratory Results

External: Prominent sternal keel.

Internal/Musculoskeletal system: Pectoral muscles are markedly reduced +3. There is some subcutaneous fat still present. There are no fractures of the wing or leg bones.
Cardiovascular system: Normal - Small amount of coronary fat present.
Respiratory system: Normal
Abdominal cavity: Liver - Grossly normal. Gall bladder is enlarged and filled with greenish bile. Abdominal fat is absent. Esophagus, proventriculus are normal. Gizzard - Gizzard lining is dull tan-brown in color. No ingested lead or steel shot present. Intestinal tract - Grossly normal.
Urogenital system: Gonads are those of a non-breeding adult female. Ovary - Normal. Follicles 1 mm or less in diameter. Kidneys - Grossly normal.
BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).
TOXICOLOGY: Liver Lead- Not Detected.

Preliminary Diagnosis: Suspect botulism
Sex (F) **Age** (A)/( ) **Body Cond.** (P) **Postmortem State** (G) **Giz. Lead** (0)/(0)
Samples Saved:
1. Bact: heart-bot
2. Tox: liver-Pb
3. Hist: kidney (renal coccidia)
4.
5.
6.

Final Diagnosis (order of importance)	Exam type (G03) topog.	morph.	etiol.	funct.	diseas
1. Type C botulism	( )	( )	( )	( )	( )
2.	( )	( )	( )	( )	( )
3.	( )	( )	( )	( )	( )

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken Hulterer
Bill Curry
FWS-RCA
3990 E. Brood Street
Columbus, OH 43216

Case: 6546
Accession: 003
Collected: 8/14/86
Exam Date: (8/20/86)
Pathologist: LNL

Species: Short-bill dowitcher **Specimen:** Carcass
Bandtype: (E) **Ref/Band No:** (Bot7) **Euth:** (N) **Weight:(Gm)** (85)
History Summary: See 001.

External/Internal Observations - Laboratory Results

External: There is a prominent sternal keel. This carcass shows marked postmortem changes and unsuitable for laboratory study.

Internal:

Carcass was discarded

Preliminary Diagnosis: Rotten. Carcass discarded
Sex (_) **Age** (_)/(___) **Body Cond.** (_) **Postmortem State** (F) **Giz. Lead** (__)/(__)
Samples Saved:

1. _____ 4. _____
2. _____ 5. _____
3. _____ 6. _____

Final Diagnosis (order of importance) **Exam type** (GO)

	topog.	morph.	etiol.	funct.	diseas
1. Open. Rotten. Carcass was	( )	( )	( )	( )	( )
2. discarded	( )	( )	( )	( )	( )
3.	( )	( )	( )	( )	( )

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken Multerer
Bill Curry
FWS-RCA
3990 E. Brood Street
Columbus, OH 43216

Case: 6546
Accession: 004
Collected: 8/14/86
Exam Date: (8/20/86)
Pathologist: LNL

Species: Semipalmated sandpiper **Specimen:** Carcass

Bandtype: (E) **Ref/Band No:** (Bot5) **Euth:** (N) **Weight:(Gm)** (30)

History Summary: See 001.

External/Internal Observations - Laboratory Results

External: Sternal keel is somewhat prominent. There is staining of the vents. No fractures o the leg or wing bones seen.

Internal:
Examination shows that postmortem changes in this Sandpiper are too advanced for subsequent laboratory study so this carcass will be discarded.

Preliminary Diagnosis: Rotten

Sex (_) **Age** (_)/(___) **Body Cond.** (_) **Postmortem State** (2) **Giz. Lead** (__)/(__)

Samples Saved:

1. None
2.
3.
4.
5.
6.

Final Diagnosis (order of importance)

		topog.	morph.	etiol.	funct.	disea
1.	Rotten Carcass discarded	( )	( )	( )	( )	(
2.		( )	( )	( )	( )	(
3.		( )	( )	( )	( )	(

Exam type (GO)

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken MKulterer
Bill Curry
FWS-RCA
3990 E. Brood Street
Columbus, OH 43216

Case: 6546
Accession: 005
Collected: 8/14/86
Exam Date: (8/20/86)
Pathologist: LNL

Species: Semipalmated sandpiper **Specimen:** Carcass
Bandtype: (E) **Ref/Band No:** (Bot3) **Euth:** (N) **Weight:(Gm)** ( )
History Summary: See 001.

External/Internal Observations - Laboratory Results

External: No significant findings (NSF)

Internal/Musculoskeletal system: Pectoral muscles are moderately reduced +1. There is a moderate amount of subcutaneous fat and abdominal fat.
Cardiovascular system: Heart - Grossly normal.
Respiratory system: Lungs - Grossly normal.
Digestive system: Liver - Normal. Gall bladder - Normal. Intestinal tract - Grossly normal.
Gizzard - Gizzard lining is normal. No ingested lead or steel shot.
No obvious lesions in the liver, lungs or kidneys.
Urogenital system: Kidneys - Lighter than normal, light purple in color.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- 0.0 ppm wet wt; 0.0 ppm dry wt.

Preliminary Diagnosis: Suspect botulism
Sex (F) **Age** (I)/( ) **Body Cond.** (G) **Postmortem State** (G) **Giz. Lead** (0)/(0)
Samples Saved:
1. Bact: heart-bot
2. Tox: liver-Pb
3.
4.
5.
6.

Final Diagnosis (order of importance)	**topog.**	**morph.**	**Exam type (GO3) etiol.**	**funct.**	**disea**
1. Type C Botulism.	( )	( )	( )	( )	( )
2.	( )	( )	( )	( )	( )
3.	( )	( )	( )	( )	( )

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken Multerer
Bill Curry
FWS-RCA
3990 E. Brood Street
Columbus, OH 43216

Case: 6546
Accession: 006
Collected: 8/14/86
Exam Date: (8/20/86)
Pathologist: LNL

Species: Semipalmated sandpiper **Specimen:** Carcass
Bandtype: (E) **Ref/Band No:** (Bot8) **Euth:** (Y) **Weight:(Gm)** ( )
History Summary: See 001. This bird was found sick and then killed.

External/Internal Observations - Laboratory Results

External: No significant findings (NSF)

Internal/Musculoskeletal system: Pectoral muscles are normal. Excellent deposits of subcutaneous fat, 1 to 2 mm thick. Good deposits of abdominal fat.
Cardiovascular system: Normal - Coronary fat is present on the heart.
Digestive system: Good deposits of abdominal fat. Liver and gall bladder - Normal. Gizzard - Normal. No ingested lead or steel shot.
Respiratory system: Normal.
Urogenital system: Ovary is that of a non-breeding adult female. Follicles are 1 mm or less in diameter. Kidneys are grossly normal.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- Not Detected.

Preliminary Diagnosis: Suspect botulism
Sex (F) **Age** (A)/( ) **Body Cond.** (G) **Postmortem State** (E) **Giz. Lead** (0)/(0)
Samples Saved:

1. Bact: heart-bot
2. Tox: liver-lead
3.
4.
5.
6.

Final Diagnosis (order of importance) **Exam type** (GO)

	topog.	morph.	etiol.	funct.	disea
1. Type C. Botulism	( )	( )	( )	( )	( )
2.	( )	( )	( )	( )	( )
3.	( )	( )	( )	( )	( )

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken Multerer
Bill Curry
FWS-RCA
3990 E. Brood Street
Columbus, OH 43216

Case: 6546
Accession: 007
Collected: 8/14/86
Exam Date: (8/20/86)
Pathologist: LNL

Species: Least sandpiper **Specimen:** Carcass
Bandtype: (E) **Ref/Band No:** (Bot4) **Euth:** (N) **Weight:(Gm)** (45)
History Summary: See 001.

External/Internal Observations - Laboratory Results

External: No significant findings (NSF)

Internal/Musculoskeletal system: There is some subcutaneous fat present. Pectoral muscles are moderately reduced +2.
Cardiovascular system: The heart is grossly normal. There is a small amount of coronary fat present.
Respiratory system: Grossly normal
Digestive system: Grossly normal. Gizzard - Normal. No ingested steel or lead shot present.
Intestinal tract - Grossly normal.
Urogenital system: Grossly normal. Testes and kidneys - normal.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- 0.65 ppm wet wt; 2.25 ppm dry wt.

Preliminary Diagnosis: Suspect botulism
Sex (M) Age (A)/( ) Body Cond. (G) Postmortem State (G) Giz. Lead (0)/(0)
Samples Saved:
1. Heart
2.
3.
4.
5.
6.

Final Diagnosis (order of importance)

		topog.	morph.	Exam type (GO) etiol.	funct.	disea
1.	Type C Botulism	( )	( )	( )	( )	( )
2.		( )	( )	( )	( )	( )
3.		( )	( )	( )	( )	( )

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken Multerer
Bill Curry
FWS-RCA
3990 E. Brood Street
Columbus, OH 43216

Case: 6546
Accession: 008
Collected: 8/14/86
Exam Date: (8/20/86)
Pathologist: LNL

Species: Least sandpiper **Specimen:** Carcass

Bandtype: (E) **Ref/Band No:** (Bot6) **Euth:** (N) **Weight:(Gm)** (40)

History Summary: See 001.

External/Internal Observations - Laboratory Results

External: No significant findings (NSF)

Internal/Musculoskeletal system: Pectoral muscles are slightly reduced. There is a moderate amount of subcutaneous and abdominal fat.
Cardiovascular system: Some coronary fat was present. Heart - Grossly normal.
Respiratory system: Lungs - Grossly normal.
Digestive system: Liver - Grossly normal. Intestinal tract - Normal. Gizzard - Normal. No ingested lead shot.

Preliminary Diagnosis: Suspect botulism

Sex (M) **Age** (A)/( ) **Body Cond.** (G) **Postmortem State** (G) **Giz. Lead** (0)/(0)

Samples Saved:

1. 4.
2. 5.
3. 6.

Final Diagnosis (order of importance)

	topog.	morph.	Exam type (GO) etiol.	funct.	disea
1. Suspect Botulism	( )	( )	( )	( )	( )
2.	( )	( )	( )	( )	( )
3.	( )	( )	( )	( )	( )

APPENDIX D
BIRD SPECIES REPORTED FROM THE DIKE 14 CDF BEFORE AND AFTER THE PILOT PROJECT

Jan., Feb., Mar. 1986

FIELD TRIP RECORD

Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time: No reports for Jan + Feb due to the weather **Localities:**
To:
From:
Total:

• Species observed

Distance: By Car — On Foot
Finish:
Start:
Total:

Day & Date:

WATER BIRDS
- Common Loon
- Horned Grebe
- Pied-billed Grebe
- Double-crested Cormorant

HERONS
- Great Blue Heron
- American Egret Common
- Snowy Egret
- Little Blue Heron
- Green Heron
- Black-crowned Night Heron
- American Bittern
- Least Bittern

SWANS, GEESE, DUCKS
- Whistling Swan
- Canada Goose
- Snow Goose
- Blue Goose
- Mallard
- Black Duck
- Gadwall
- European Widgeon
- ~~Baldpate~~ American Widgeon
- Pintail
- Green-winged Teal
- Blue-winged Teal
- Shoveller
- Wood Duck
- Redhead
- Ring-necked Duck
- Canvas-back
- Greater Scaup Duck
- Lesser Scaup Duck
- American Golden-eye
- Buffle-head
- Old-squaw
- White-winged Scoter
- Ruddy Duck
- Hooded Merganser
- American Merganser
- Red-breasted Merganser

VULTURES, HAWKS, FALCONS
- Turkey Vulture
- Sharp-shinned Hawk
- Cooper's Hawk
- Red-tailed Hawk
- Red-shouldered Hawk
- Broad-winged Hawk
- Rough-legged Hawk
- Bald Eagle (1 sight)
- Marsh Hawk
- Osprey
- Duck Hawk
- Pigeon Hawk
- ~~Sparrow Hawk~~ Kestrel

GALLINACEOUS BIRDS
- Ruffed Grouse
- Hungarian Partridge
- Bob-white
- Ring-necked Pheasant

MARSH BIRDS
- King Rail
- Virginia Rail
- Sora
- Florida Gallinule
- Coot

SHOREBIRDS
- Piping Plover
- Semipalmated Plover
- Killdeer
- Golden Plover
- Black-bellied Plover
- Ruddy Turnstone
- Woodcock
- Wilson's Snipe
- Hudsonian Curlew
- Upland Plover
- Spotted Sandpiper
- Solitary Sandpiper
- Willet
- Greater Yellow-legs
- Lesser Yellow-legs
- Knot
- Pectoral Sandpiper
- White-rumped Sandpiper
- Baird's Sandpiper
- Least Sandpiper
- Red-backed Sandpiper
- Dowitcher
- Stilt Sandpiper
- Semipalmated Sandpiper
- Western Sandpiper
- Buff-breasted Sandpiper
- Sanderling
- Red Phalarope
- Wilson's Phalarope
- Northern Phalarope

GULLS AND TERNS
- Glaucous Gull
- Great Black-backed Gull
- Herring Gull
- Ring-billed Gull
- Franklin's Gull
- Bonaparte's Gull
- Forster's Tern
- Common Tern
- Caspian Tern
- Black Tern

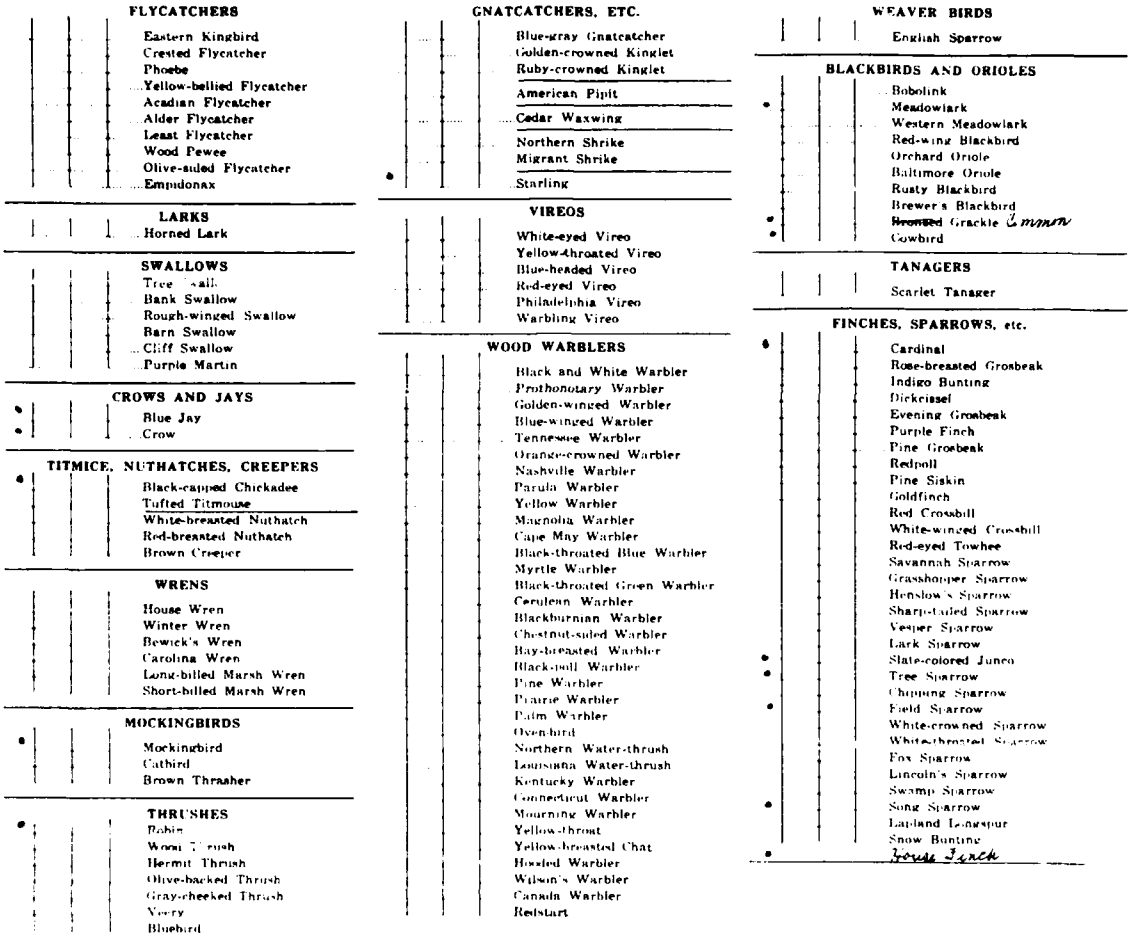
DOVES AND PIGEONS
- Rock Dove
- Mourning Dove

CUCKOOS
- Yellow-billed Cuckoo
- Black-billed Cuckoo

OWLS
- Barn Owl
- Screech Owl
- Great Horned Owl
- Snowy Owl
- Barred Owl
- Long-eared Owl
- Short-eared Owl
- Saw-whet Owl

GOATSUCKERS, ETC.
- Whip-poor-will
- Nighthawk
- Chimney Swift
- Ruby-throated Hummingbird
- Belted Kingfisher

WOODPECKERS
- Flicker
- Red-bellied Woodpecker
- Red-headed Woodpecker
- Yellow-bellied Sapsucker
- Hairy Woodpecker
- Downy Woodpecker



FIELD NOTES

Total Species:

Individuals:

Apr May, June 1986

FIELD TRIP RECORD

Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time: **Localities:**

To:

From:

Total:

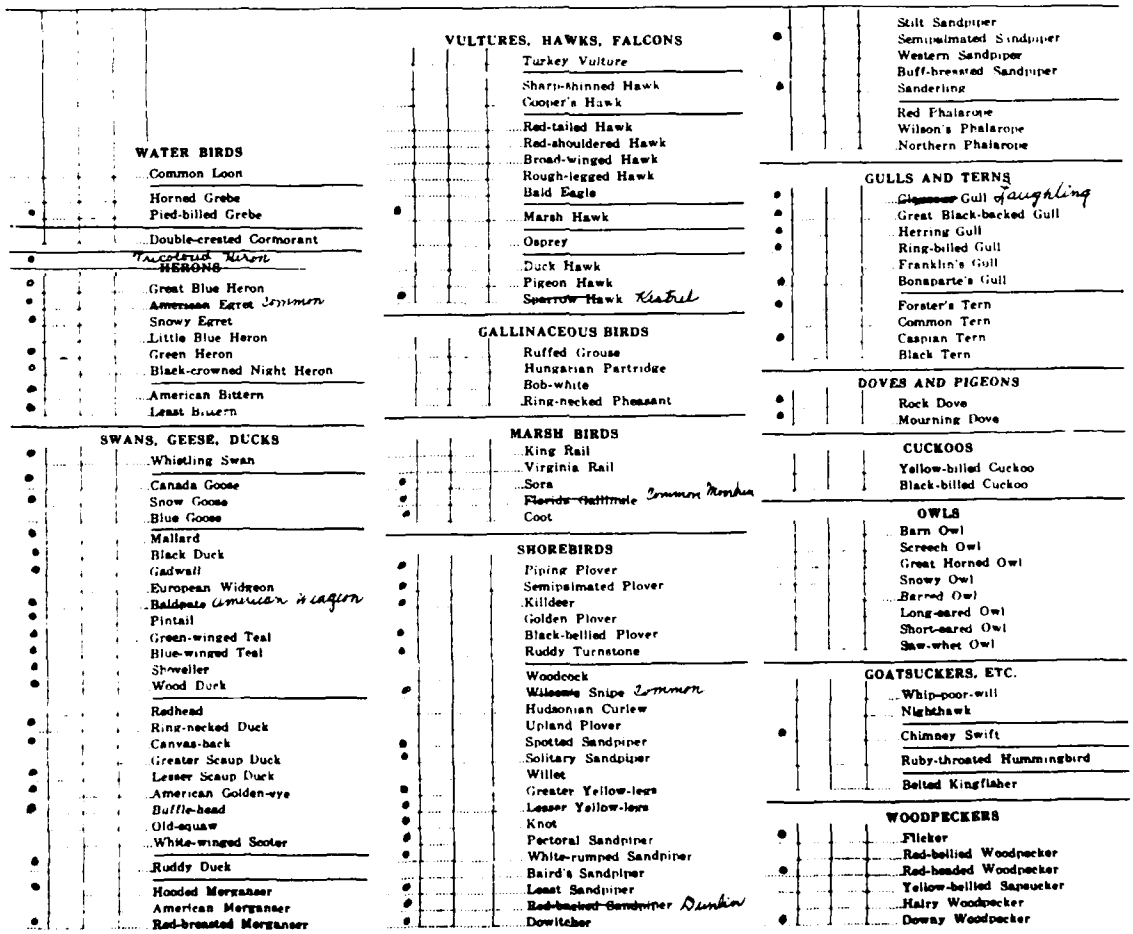
Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:



WATER BIRDS
- Common Loon
- Horned Grebe
- Pied-billed Grebe
- Double-crested Cormorant
- ~~Red-faced~~ Pelagic Cormorant
- ~~Tricolored Heron~~

HERONS
- Great Blue Heron
- ~~American~~ Egret common
- Snowy Egret
- Little Blue Heron
- Green Heron
- Black-crowned Night Heron
- American Bittern
- Least Bittern

SWANS, GEESE, DUCKS
- Whistling Swan
- Canada Goose
- Snow Goose
- Blue Goose
- Mallard
- Black Duck
- Gadwall
- European Widgeon
- Baldpate American widgeon
- Pintail
- Green-winged Teal
- Blue-winged Teal
- Shoveller
- Wood Duck
- Redhead
- Ring-necked Duck
- Canvas-back
- Greater Scaup Duck
- Lesser Scaup Duck
- American Golden-eye
- Buffle-head
- Old-squaw
- White-winged Scoter
- Ruddy Duck
- Hooded Merganser
- American Merganser
- Red-breasted Merganser

VULTURES, HAWKS, FALCONS
- Turkey Vulture
- Sharp-shinned Hawk
- Cooper's Hawk
- Red-tailed Hawk
- Red-shouldered Hawk
- Broad-winged Hawk
- Rough-legged Hawk
- Bald Eagle
- Marsh Hawk
- Osprey
- Duck Hawk
- Pigeon Hawk
- ~~Sparrow~~ Hawk Kestrel

GALLINACEOUS BIRDS
- Ruffed Grouse
- Hungarian Partridge
- Bob-white
- Ring-necked Pheasant

MARSH BIRDS
- King Rail
- Virginia Rail
- Sora
- ~~Florida~~ Gallinule common Moorhen
- Coot

SHOREBIRDS
- Piping Plover
- Semipalmated Plover
- Killdeer
- Golden Plover
- Black-bellied Plover
- Ruddy Turnstone
- Woodcock
- ~~Wilson's~~ Snipe common
- Hudsonian Curlew
- Upland Plover
- Spotted Sandpiper
- Solitary Sandpiper
- Willet
- Greater Yellow-legs
- Lesser Yellow-legs
- Knot
- Pectoral Sandpiper
- White-rumped Sandpiper
- Baird's Sandpiper
- Least Sandpiper
- ~~Red-backed Sandpiper~~ Dunlin
- Dowitcher
- Stilt Sandpiper
- Semipalmated Sandpiper
- Western Sandpiper
- Buff-breasted Sandpiper
- Sanderling
- Red Phalarope
- Wilson's Phalarope
- Northern Phalarope

GULLS AND TERNS
- ~~Glaucous~~ Gull laughing
- Great Black-backed Gull
- Herring Gull
- Ring-billed Gull
- Franklin's Gull
- Bonaparte's Gull
- Forster's Tern
- Common Tern
- Caspian Tern
- Black Tern

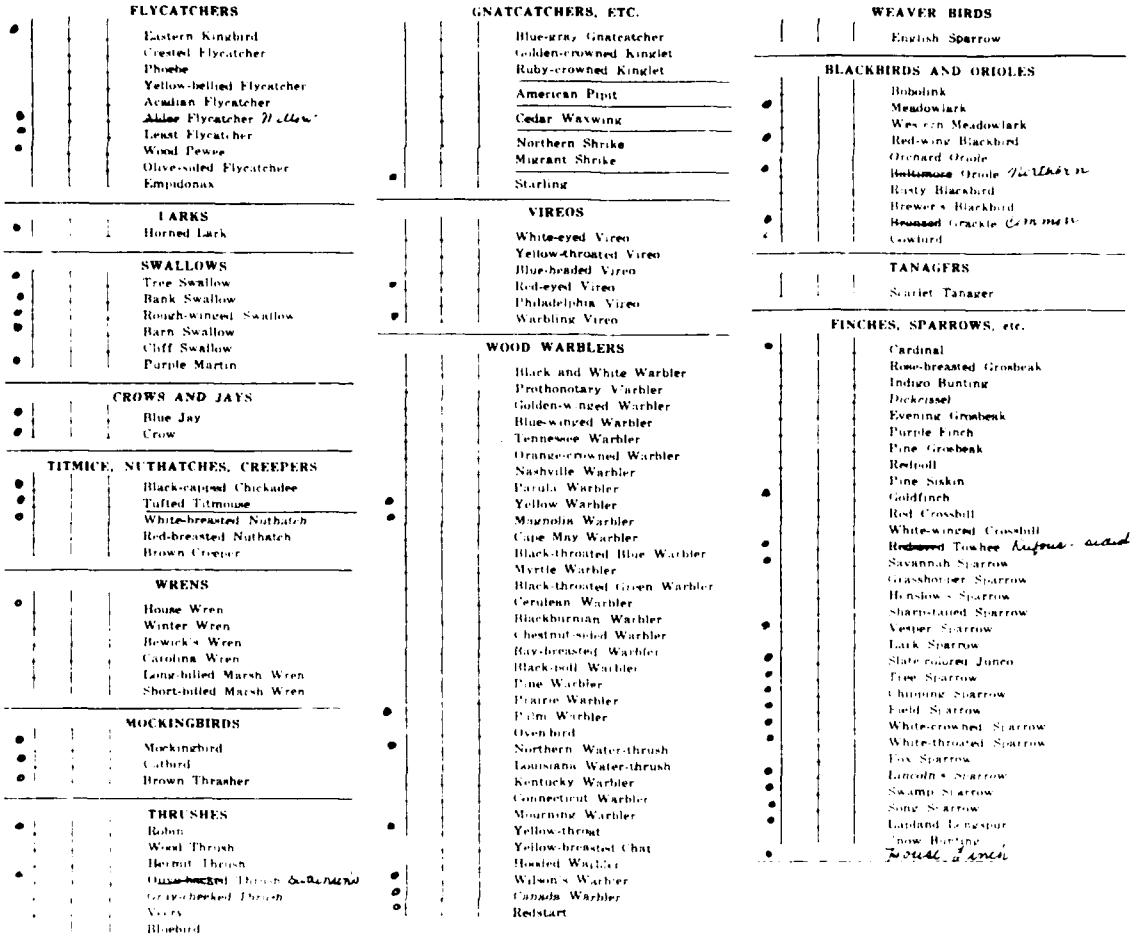
DOVES AND PIGEONS
- Rock Dove
- Mourning Dove

CUCKOOS
- Yellow-billed Cuckoo
- Black-billed Cuckoo

OWLS
- Barn Owl
- Screech Owl
- Great Horned Owl
- Snowy Owl
- Barred Owl
- Long-eared Owl
- Short-eared Owl
- Saw-whet Owl

GOATSUCKERS, ETC.
- Whip-poor-will
- Nighthawk
- Chimney Swift
- Ruby-throated Hummingbird
- Belted Kingfisher

WOODPECKERS
- Flicker
- Red-bellied Woodpecker
- Red-headed Woodpecker
- Yellow-bellied Sapsucker
- Hairy Woodpecker
- Downy Woodpecker



FLYCATCHERS
Eastern Kingbird
Crested Flycatcher
Phoebe
Yellow-bellied Flycatcher
Acadian Flycatcher
~~Alder~~ Flycatcher *Willow*
Least Flycatcher
Wood Pewee
Olive-sided Flycatcher
Empidonax

LARKS
Horned Lark

SWALLOWS
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow
Purple Martin

CROWS AND JAYS
Blue Jay
Crow

TITMICE, NUTHATCHES, CREEPERS
Black-capped Chickadee
Tufted Titmouse
White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper

WRENS
House Wren
Winter Wren
Bewick's Wren
Carolina Wren
Long-billed Marsh Wren
Short-billed Marsh Wren

MOCKINGBIRDS
Mockingbird
Catbird
Brown Thrasher

THRUSHES
Robin
Wood Thrush
Hermit Thrush
~~Olive-backed~~ Thrush *Swainson*
Gray-cheeked Thrush
Veery
Bluebird

GNATCATCHERS, ETC.
Blue-gray Gnatcatcher
Golden-crowned Kinglet
Ruby-crowned Kinglet

American Pipit

Cedar Waxwing

Northern Shrike
Migrant Shrike

Starling

VIREOS
White-eyed Vireo
Yellow-throated Vireo
Blue-headed Vireo
Red-eyed Vireo
Philadelphia Vireo
Warbling Vireo

WOOD WARBLERS
Black and White Warbler
Prothonotary Warbler
Golden-winged Warbler
Blue-winged Warbler
Tennessee Warbler
Orange-crowned Warbler
Nashville Warbler
Parula Warbler
Yellow Warbler
Magnolia Warbler
Cape May Warbler
Black-throated Blue Warbler
Myrtle Warbler
Black-throated Green Warbler
Cerulean Warbler
Blackburnian Warbler
Chestnut-sided Warbler
Bay-breasted Warbler
Black-poll Warbler
Pine Warbler
Prairie Warbler
Palm Warbler
Ovenbird
Northern Water-thrush
Louisiana Water-thrush
Kentucky Warbler
Connecticut Warbler
Mourning Warbler
Yellow-throat
Yellow-breasted Chat
Hooded Warbler
Wilson's Warbler
Canada Warbler
Redstart

WEAVER BIRDS
English Sparrow

BLACKBIRDS AND ORIOLES
Bobolink
Meadowlark
Western Meadowlark
Red-wing Blackbird
Orchard Oriole
~~Baltimore~~ Oriole *Northern*
Rusty Blackbird
Brewer's Blackbird
~~Bronzed~~ Grackle *Common*
Cowbird

TANAGERS
Scarlet Tanager

FINCHES, SPARROWS, etc.
Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Dickcissel
Evening Grosbeak
Purple Finch
Pine Grosbeak
Redpoll
Pine Siskin
Goldfinch
Red Crossbill
White-winged Crossbill
~~Red-eyed~~ Towhee *Rufous - sided*
Savannah Sparrow
Grasshopper Sparrow
Henslow's Sparrow
Sharp-tailed Sparrow
Vesper Sparrow
Lark Sparrow
Slate-colored Junco
Tree Sparrow
Chipping Sparrow
Field Sparrow
White-crowned Sparrow
White-throated Sparrow
Fox Sparrow
Lincoln's Sparrow
Swamp Sparrow
Song Sparrow
Lapland Longspur
Snow Bunting
Prairie Horned Lark

FIELD NOTES

Total Species:

Individuals:

July, Aug, Sept 1986

FIELD TRIP RECORD

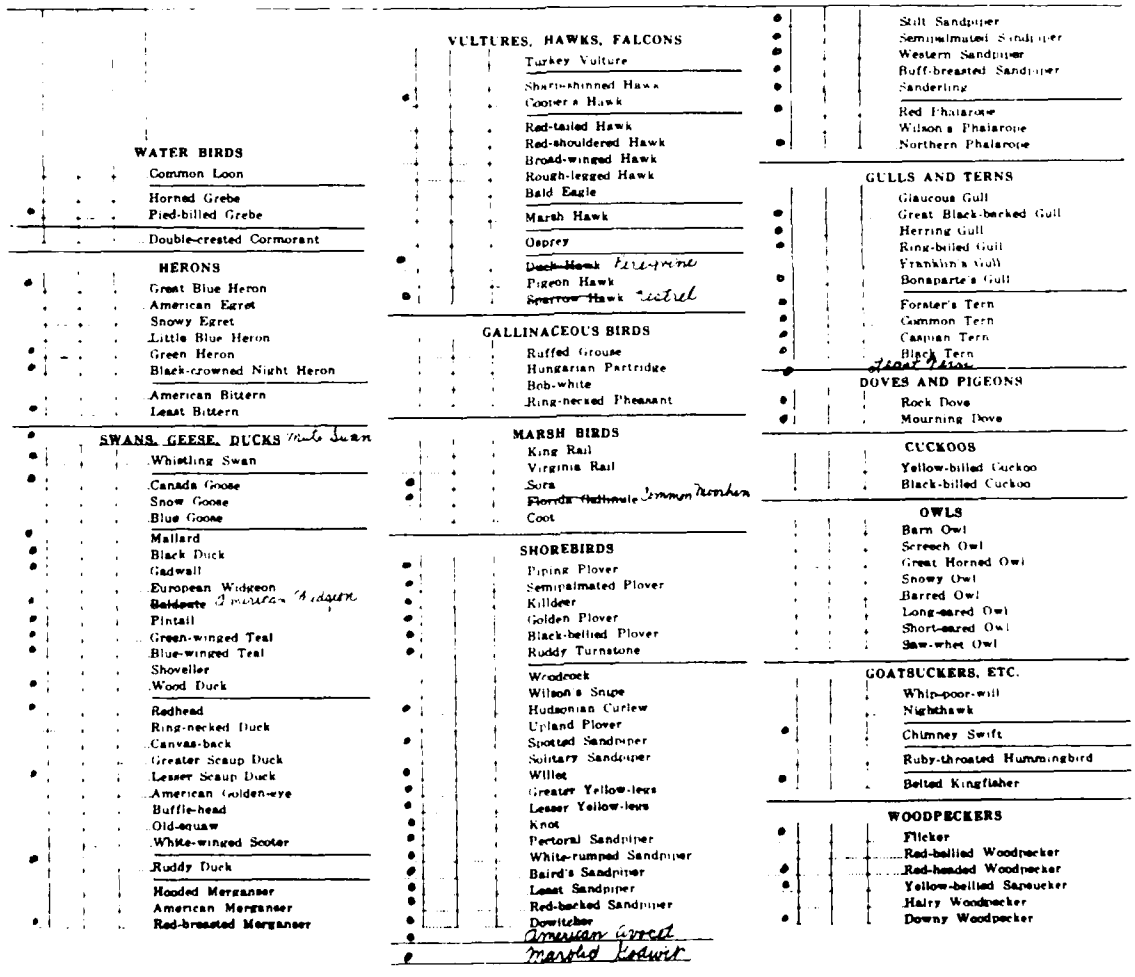
Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time:
To:
From:
Total:

Localities:

Distance: By Car — On Foot
Finish:
Start:
Total:

Day & Date:



WATER BIRDS
Common Loon
Horned Grebe
Pied-billed Grebe
Double-crested Cormorant

HERONS
Great Blue Heron
American Egret
Snowy Egret
Little Blue Heron
Green Heron
Black-crowned Night Heron
American Bittern
Least Bittern

SWANS, GEESE, DUCKS Mute Swan
Whistling Swan
Canada Goose
Snow Goose
Blue Goose
Mallard
Black Duck
Gadwall
European Widgeon
~~Baldpate~~ American Widgeon
Pintail
Green-winged Teal
Blue-winged Teal
Shoveller
Wood Duck
Redhead
Ring-necked Duck
Canvas-back
Greater Scaup Duck
Lesser Scaup Duck
American Golden-eye
Buffle-head
Old-squaw
White-winged Scoter
Ruddy Duck
Hooded Merganser
American Merganser
Red-breasted Merganser

VULTURES, HAWKS, FALCONS
Turkey Vulture
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Rough-legged Hawk
Bald Eagle
Marsh Hawk
Osprey
~~Duck Hawk~~ Peregrine
Pigeon Hawk
~~Sparrow Hawk~~ Kestrel

GALLINACEOUS BIRDS
Ruffed Grouse
Hungarian Partridge
Bob-white
Ring-necked Pheasant

MARSH BIRDS
King Rail
Virginia Rail
Sora
~~Florida Gallinule~~ Common Moorhen
Coot

SHOREBIRDS
Piping Plover
Semipalmated Plover
Killdeer
Golden Plover
Black-bellied Plover
Ruddy Turnstone
Woodcock
Wilson's Snipe
Hudsonian Curlew
Upland Plover
Spotted Sandpiper
Solitary Sandpiper
Willet
Greater Yellow-legs
Lesser Yellow-legs
Knot
Pectoral Sandpiper
White-rumped Sandpiper
Baird's Sandpiper
Least Sandpiper
Red-backed Sandpiper
Dowitcher
American Egret
Marbled Godwit

Stilt Sandpiper
Semipalmated Sandpiper
Western Sandpiper
Buff-breasted Sandpiper
Sanderling
Red Phalarope
Wilson's Phalarope
Northern Phalarope

GULLS AND TERNS
Glaucous Gull
Great Black-backed Gull
Herring Gull
Ring-billed Gull
Franklin's Gull
Bonaparte's Gull
Forster's Tern
Common Tern
Caspian Tern
Black Tern
Least Tern

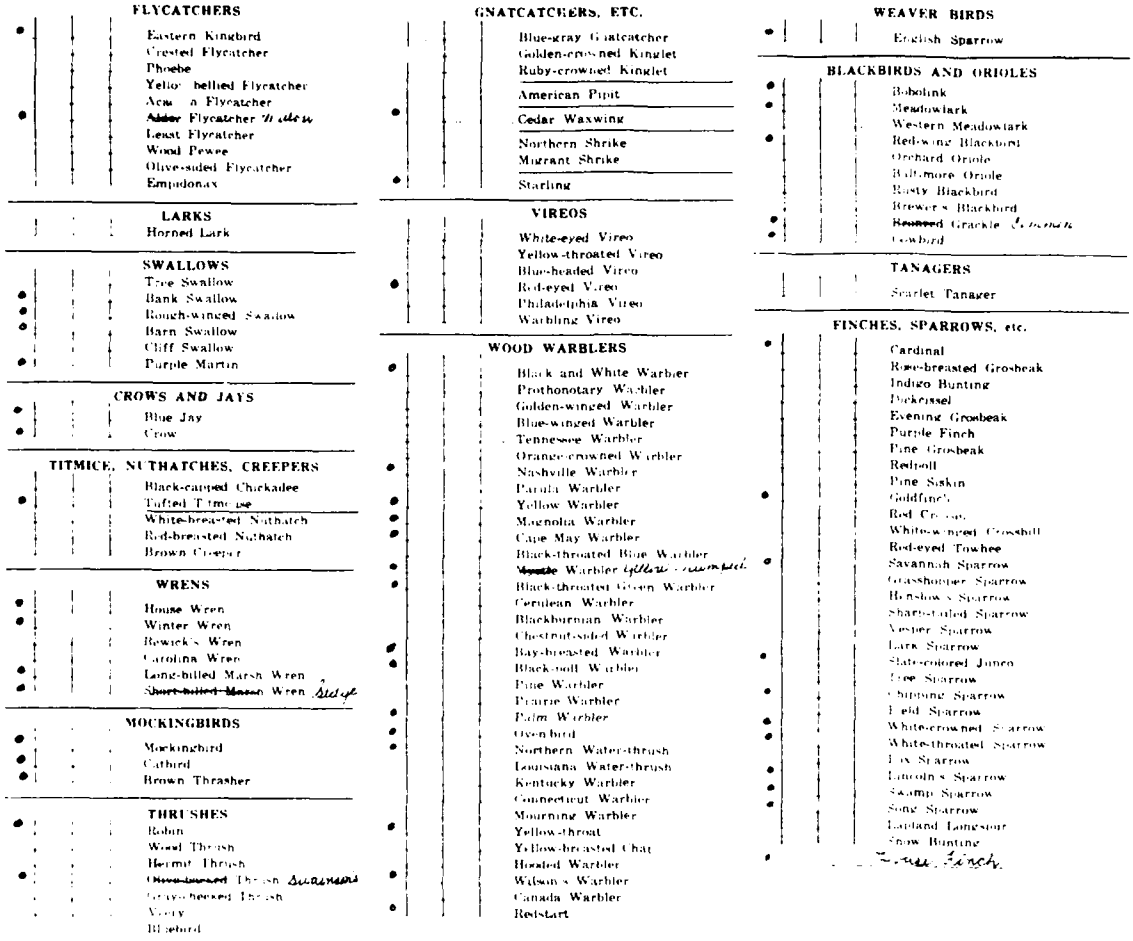
DOVES AND PIGEONS
Rock Dove
Mourning Dove

CUCKOOS
Yellow-billed Cuckoo
Black-billed Cuckoo

OWLS
Barn Owl
Screech Owl
Great Horned Owl
Snowy Owl
Barred Owl
Long-eared Owl
Short-eared Owl
Saw-whet Owl

GOATSUCKERS, ETC.
Whip-poor-will
Nighthawk
Chimney Swift
Ruby-throated Hummingbird
Belted Kingfisher

WOODPECKERS
Flicker
Red-bellied Woodpecker
Red-headed Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker



FLYCATCHERS

- Eastern Kingbird
- Crested Flycatcher
- Phoebe
- Yellow-bellied Flycatcher
- Acadian Flycatcher
- ~~Alder~~ Flycatcher *Willow*
- Least Flycatcher
- Wood Pewee
- Olive-sided Flycatcher
- Empidonax

LARKS

- Horned Lark

SWALLOWS

- Tree Swallow
- Bank Swallow
- Rough-winged Swallow
- Barn Swallow
- Cliff Swallow
- Purple Martin

CROWS AND JAYS

- Blue Jay
- Crow

TITMICE, NUTHATCHES, CREEPERS

- Black-capped Chickadee
- Tufted Titmouse
- White-breasted Nuthatch
- Red-breasted Nuthatch
- Brown Creeper

WRENS

- House Wren
- Winter Wren
- Bewick's Wren
- Carolina Wren
- Long-billed Marsh Wren
- ~~Short-billed Marsh~~ Wren *Sedge*

MOCKINGBIRDS

- Mockingbird
- Catbird
- Brown Thrasher

THRUSHES

- Robin
- Wood Thrush
- Hermit Thrush
- ~~Olive-backed~~ Thrush *Swainson's*
- Gray-cheeked Thrush
- Veery
- Bluebird

GNATCATCHERS, ETC.

- Blue-gray Gnatcatcher
- Golden-crowned Kinglet
- Ruby-crowned Kinglet
- American Pipit
- Cedar Waxwing
- Northern Shrike
- Migrant Shrike
- Starling

VIREOS

- White-eyed Vireo
- Yellow-throated Vireo
- Blue-headed Vireo
- Red-eyed Vireo
- Philadelphia Vireo
- Warbling Vireo

WOOD WARBLERS

- Black and White Warbler
- Prothonotary Warbler
- Golden-winged Warbler
- Blue-winged Warbler
- Tennessee Warbler
- Orange-crowned Warbler
- Nashville Warbler
- Parula Warbler
- Yellow Warbler
- Magnolia Warbler
- Cape May Warbler
- Black-throated Blue Warbler
- ~~Myrtle~~ Warbler *Yellow-rumped*
- Black-throated Green Warbler
- Cerulean Warbler
- Blackburnian Warbler
- Chestnut-sided Warbler
- Bay-breasted Warbler
- Black-poll Warbler
- Pine Warbler
- Prairie Warbler
- Palm Warbler
- Ovenbird
- Northern Water-thrush
- Louisiana Water-thrush
- Kentucky Warbler
- Connecticut Warbler
- Mourning Warbler
- Yellow-throat
- Yellow-breasted Chat
- Hooded Warbler
- Wilson's Warbler
- Canada Warbler
- Redstart

WEAVER BIRDS

- English Sparrow

BLACKBIRDS AND ORIOLES

- Bobolink
- Meadowlark
- Western Meadowlark
- Red-wing Blackbird
- Orchard Oriole
- Baltimore Oriole
- Rusty Blackbird
- Brewer's Blackbird
- ~~Rusty~~ Grackle *Purple*
- Cowbird

TANAGERS

- Scarlet Tanager

FINCHES, SPARROWS, etc.

- Cardinal
- Rose-breasted Grosbeak
- Indigo Bunting
- Dickcissel
- Evening Grosbeak
- Purple Finch
- Pine Grosbeak
- Redpoll
- Pine Siskin
- Goldfinch
- Red Crossbill
- White-winged Crossbill
- Red-eyed Towhee
- Savannah Sparrow
- Grasshopper Sparrow
- Henslow's Sparrow
- Sharp-tailed Sparrow
- Vesper Sparrow
- Lark Sparrow
- Slate-colored Junco
- Tree Sparrow
- Chipping Sparrow
- Field Sparrow
- White-crowned Sparrow
- White-throated Sparrow
- Fox Sparrow
- Lincoln's Sparrow
- Swamp Sparrow
- Song Sparrow
- Lapland Longspur
- Snow Bunting
- ~~Tree~~ Finch

FIELD NOTES

Total Species:

Individuals:

Oct., Nov., Dec 1986

FIELD TRIP RECORD

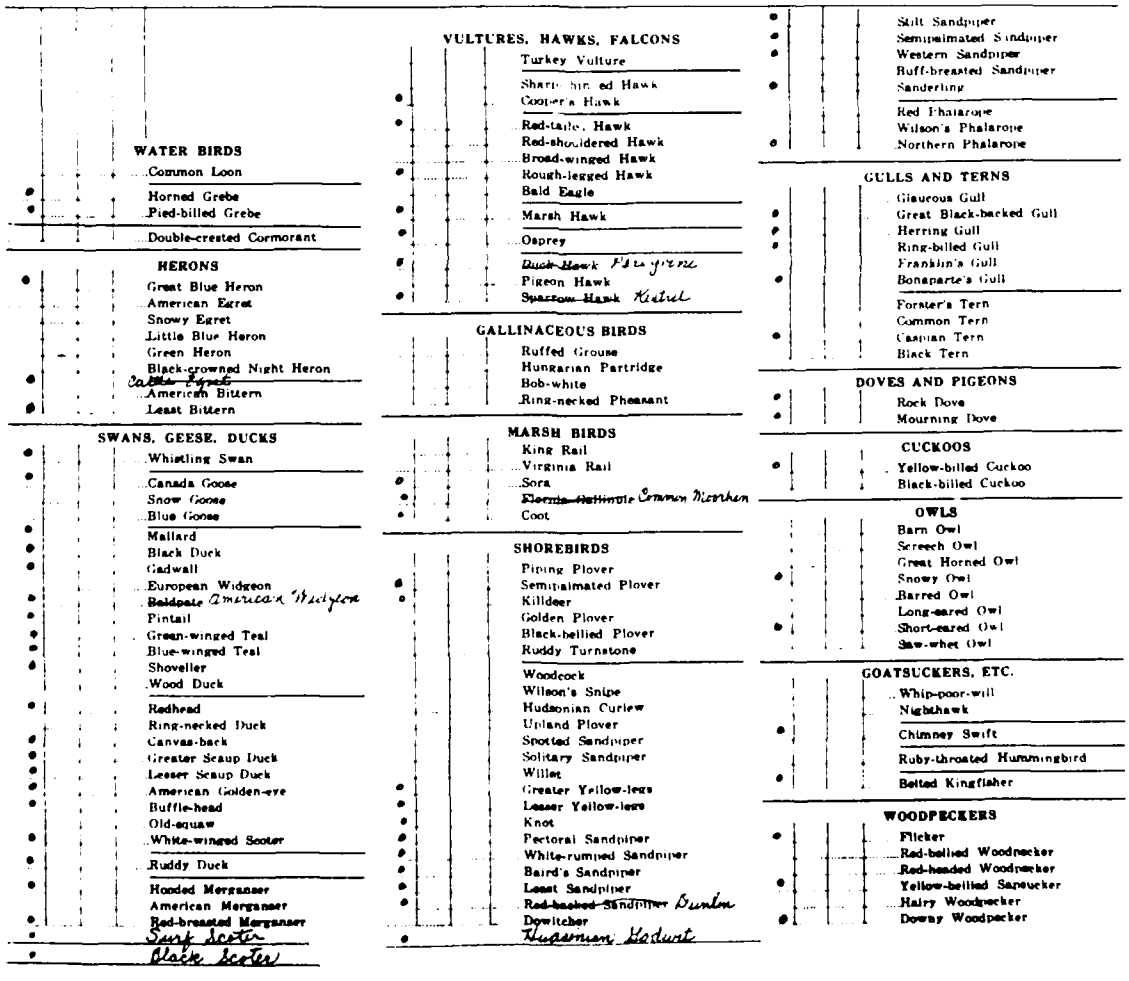
Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

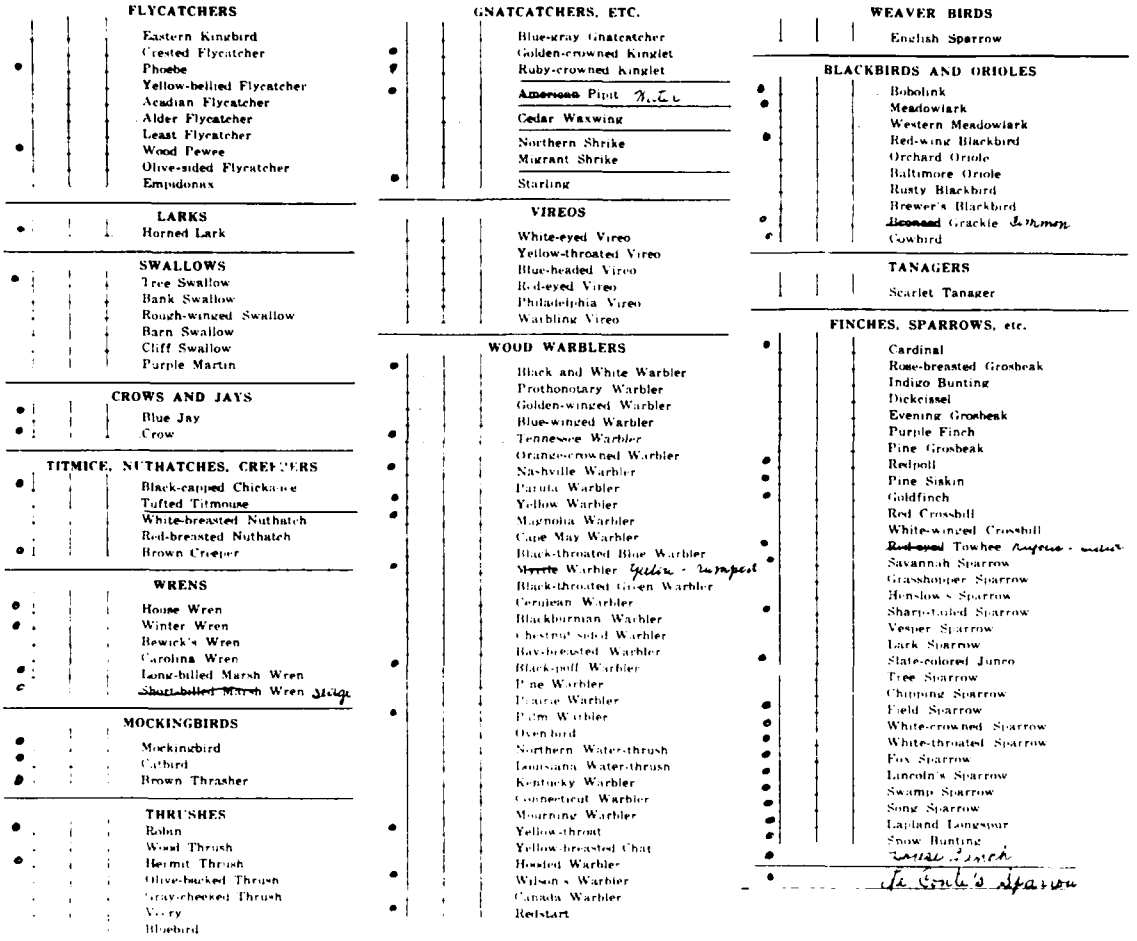
Field Time:
To:
From:
Total:

Localities:

Distance: By Car — On Foot
Finish:
Start:
Total:

Day & Date:





FLYCATCHERS

- Eastern Kingbird
- Crested Flycatcher
- Phoebe
- Yellow-bellied Flycatcher
- Acadian Flycatcher
- Alder Flycatcher
- Least Flycatcher
- Wood Pewee
- Olive-sided Flycatcher
- Empidonax

LARKS

- Horned Lark

SWALLOWS

- Tree Swallow
- Bank Swallow
- Rough-winged Swallow
- Barn Swallow
- Cliff Swallow
- Purple Martin

CROWS AND JAYS

- Blue Jay
- Crow

TITMICE, NUTHATCHES, CREEPERS

- Black-capped Chickadee
- Tufted Titmouse
- White-breasted Nuthatch
- Red-breasted Nuthatch
- Brown Creeper

WRENS

- House Wren
- Winter Wren
- Bewick's Wren
- Carolina Wren
- Long-billed Marsh Wren
- ~~Short-billed Marsh~~ Wren Sedge

MOCKINGBIRDS

- Mockingbird
- Catbird
- Brown Thrasher

THRUSHES

- Robin
- Wood Thrush
- Hermit Thrush
- Olive-backed Thrush
- Gray-cheeked Thrush
- Veery
- Bluebird

GNATCATCHERS, ETC.

- Blue-gray Gnatcatcher
- Golden-crowned Kinglet
- Ruby-crowned Kinglet
- ~~American~~ Pipit Water
- Cedar Waxwing
- Northern Shrike
- Migrant Shrike
- Starling

VIREOS

- White-eyed Vireo
- Yellow-throated Vireo
- Blue-headed Vireo
- Red-eyed Vireo
- Philadelphia Vireo
- Warbling Vireo

WOOD WARBLERS

- Black and White Warbler
- Prothonotary Warbler
- Golden-winged Warbler
- Blue-winged Warbler
- *Tennessee Warbler*
- Orange-crowned Warbler
- Nashville Warbler
- Parula Warbler
- Yellow Warbler
- Magnolia Warbler
- Cape May Warbler
- Black-throated Blue Warbler
- ~~Myrtle~~ Warbler Yellow - rumped
- Black-throated Green Warbler
- Cerulean Warbler
- Blackburnian Warbler
- Chestnut-sided Warbler
- Bay-breasted Warbler
- Black-poll Warbler
- Pine Warbler
- Prairie Warbler
- Palm Warbler
- Ovenbird
- Northern Water-thrush
- Louisiana Water-thrush
- Kentucky Warbler
- Connecticut Warbler
- Mourning Warbler
- Yellow-throat
- Yellow-breasted Chat
- Hooded Warbler
- Wilson's Warbler
- Canada Warbler
- Redstart

WEAVER BIRDS

- English Sparrow

BLACKBIRDS AND ORIOLES

- Bobolink
- Meadowlark
- Western Meadowlark
- Red-wing Blackbird
- Orchard Oriole
- Baltimore Oriole
- Rusty Blackbird
- Brewer's Blackbird
- ~~Bronzed~~ Grackle Common
- Cowbird

TANAGERS

- Scarlet Tanager

FINCHES, SPARROWS, etc.

- Cardinal
- Rose-breasted Grosbeak
- Indigo Bunting
- Dickcissel
- Evening Grosbeak
- Purple Finch
- Pine Grosbeak
- Redpoll
- Pine Siskin
- Goldfinch
- Red Crossbill
- White-winged Crossbill
- ~~Red-eyed~~ Towhee Rufous - sided
- Savannah Sparrow
- Grasshopper Sparrow
- Henslow's Sparrow
- Sharp-tailed Sparrow
- Vesper Sparrow
- Lark Sparrow
- Slate-colored Junco
- Tree Sparrow
- Chipping Sparrow
- Field Sparrow
- White-crowned Sparrow
- White-throated Sparrow
- Fox Sparrow
- Lincoln's Sparrow
- Swamp Sparrow
- Song Sparrow
- Lapland Longspur
- Snow Bunting
- Canada Jay
- Le Conte's Sparrow

FIELD NOTES

Total Species:

Individuals:

Jan, Feb, Mar 1987

FIELD TRIP RECORD

Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time:
To:
From:
Total:

Localities:

Distance: By Car — On Foot
Finish:
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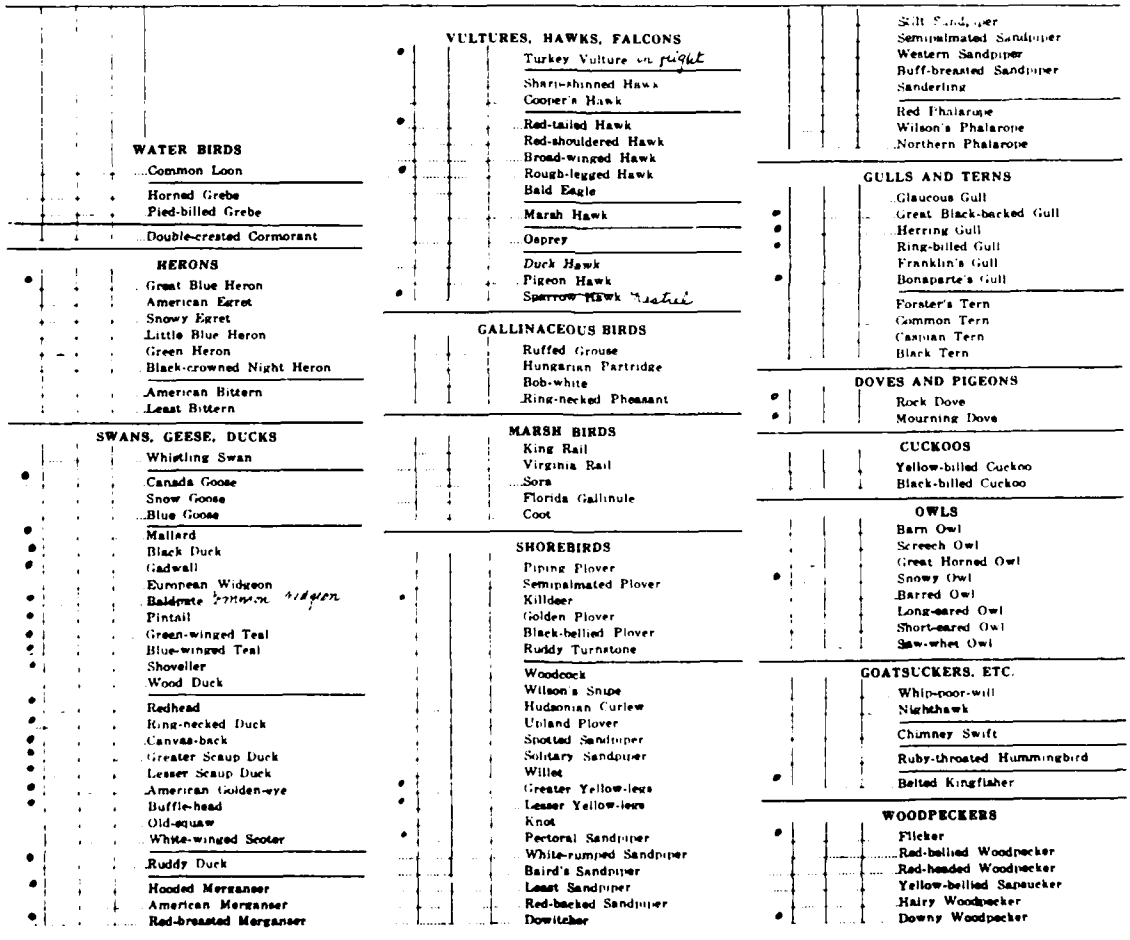
Total:

Day & Date:



WATER BIRDS
Common Loon
Horned Grebe
Pied-billed Grebe
Double-crested Cormorant

HERONS
Great Blue Heron
American Egret
Snowy Egret
Little Blue Heron
Green Heron
Black-crowned Night Heron
American Bittern
Least Bittern

SWANS, GEESE, DUCKS
Whistling Swan
Canada Goose
Snow Goose
Blue Goose
Mallard
Black Duck
Gadwall
European Widgeon
Baldpate (American Widgeon)
Pintail
Green-winged Teal
Blue-winged Teal
Shoveller
Wood Duck
Redhead
Ring-necked Duck
Canvas-back
Greater Scaup Duck
Lesser Scaup Duck
American Golden-eye
Buffle-head
Old-squaw
White-winged Scoter
Ruddy Duck
Hooded Merganser
American Merganser
Red-breasted Merganser

VULTURES, HAWKS, FALCONS
Turkey Vulture on right
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Rough-legged Hawk
Bald Eagle
Marsh Hawk
Osprey
Duck Hawk
Pigeon Hawk
Sparrow Hawk (Kestrel)

GALLINACEOUS BIRDS
Ruffed Grouse
Hungarian Partridge
Bob-white
Ring-necked Pheasant

MARSH BIRDS
King Rail
Virginia Rail
Sora
Florida Gallinule
Coot

SHOREBIRDS
Piping Plover
Semipalmated Plover
Killdeer
Golden Plover
Black-bellied Plover
Ruddy Turnstone
Woodcock
Wilson's Snipe
Hudsonian Curlew
Upland Plover
Spotted Sandpiper
Solitary Sandpiper
Willet
Greater Yellow-legs
Lesser Yellow-legs
Knot
Pectoral Sandpiper
White-rumped Sandpiper
Baird's Sandpiper
Least Sandpiper
Red-backed Sandpiper
Dowitcher
Stilt Sandpiper
Semipalmated Sandpiper
Western Sandpiper
Buff-breasted Sandpiper
Sanderling
Red Phalarope
Wilson's Phalarope
Northern Phalarope

GULLS AND TERNS
Glaucous Gull
Great Black-backed Gull
Herring Gull
Ring-billed Gull
Franklin's Gull
Bonaparte's Gull
Forster's Tern
Common Tern
Caspian Tern
Black Tern

DOVES AND PIGEONS
Rock Dove
Mourning Dove

CUCKOOS
Yellow-billed Cuckoo
Black-billed Cuckoo

OWLS
Barn Owl
Screech Owl
Great Horned Owl
Snowy Owl
Barred Owl
Long-eared Owl
Short-eared Owl
Saw-whet Owl

GOATSUCKERS, ETC.
Whip-poor-will
Nighthawk
Chimney Swift
Ruby-throated Hummingbird
Belted Kingfisher

WOODPECKERS
Flicker
Red-bellied Woodpecker
Red-headed Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker

FLYCATCHERS

- Eastern Kingbird
- Crested Flycatcher
- Phoebe
- Yellow-bellied Flycatcher
- Acadian Flycatcher
- Alder Flycatcher
- Least Flycatcher
- Wood Pewee
- Olive-sided Flycatcher
- Empidonax

LARKS

- Horned Lark

SWALLOWS

- Tree Swallow
- Bank Swallow
- Rough-winged Swallow
- Barn Swallow
- Cliff Swallow
- Purple Martin

CROWS AND JAYS

- Blue Jay
- Crow

TITMICE, NUTHATCHES, CREEPERS

- Black-capped Chickadee
- Tufted Titmouse
- White-breasted Nuthatch
- Red-breasted Nuthatch
- Brown Creeper

WRENS

- House Wren
- Winter Wren
- Bewick's Wren
- Carolina Wren
- Long-billed Marsh Wren
- *Short-billed Marsh Wren*

MOCKINGBIRDS

- Mockingbird
- Catbird
- Brown Thrasher

THRUSHES

- Robin
- Wood Thrush
- Hermit Thrush
- Olive-backed Thrush
- Gray-cheeked Thrush
- Veery
- Bluebird

GNATCATCHERS, ETC.

- Blue-gray Gnatcatcher
- Golden-crowned Kinglet
- Ruby-crowned Kinglet

PIPITS

- American Pipit

WAXWINGS

- Cedar Waxwing

SHRIKES

- Northern Shrike
- Migrant Shrike

STARLINGS

- Starling

VIREOS

- White-eyed Vireo
- Yellow-throated Vireo
- Blue-headed Vireo
- Red-eyed Vireo
- Philadelphia Vireo
- Warbling Vireo

WOOD WARBLERS

- Black and White Warbler
- Prothonotary Warbler
- Golden-winged Warbler
- Blue-winged Warbler
- Tennessee Warbler
- Orange-crowned Warbler
- Nashville Warbler
- Parula Warbler
- Yellow Warbler
- Magnolia Warbler
- Cape May Warbler
- Black-throated Blue Warbler
- Myrtle Warbler
- Black-throated Green Warbler
- Cerulean Warbler
- Blackburnian Warbler
- Chestnut-sided Warbler
- Bay-breasted Warbler
- Black-poll Warbler
- Pine Warbler
- Prairie Warbler
- Palm Warbler
- Ovenbird
- Northern Water-thrush
- Louisiana Water-thrush
- Kentucky Warbler
- Connecticut Warbler
- Mourning Warbler
- Yellow-throat
- Yellow-breasted Chat
- Hooded Warbler
- Wilson's Warbler
- Canada Warbler
- Redstart

WEAVER BIRDS

- English Sparrow

BLACKBIRDS AND ORIOLES

- Bobolink
- Meadowlark
- Western Meadowlark
- Red-wing Blackbird
- Orchard Oriole
- Baltimore Oriole
- Rusty Blackbird
- Brewer's Blackbird
- Bronzed Grackle
- Cowbird

TANAGERS

- Scarlet Tanager

FINCHES, SPARROWS, etc.

- Cardinal
- Rose-breasted Grosbeak
- Indigo Bunting
- Dickcissel
- Evening Grosbeak
- Purple Finch
- Pine Grosbeak
- Redpoll
- Pine Siskin
- Goldfinch
- Red Crossbill
- White-winged Crossbill
- Red-eyed Towhee
- Savannah Sparrow
- Grasshopper Sparrow
- Henslow's Sparrow
- Sharp-tailed Sparrow
- Vesper Sparrow
- Lark Sparrow
- Slate-colored Junco
- Tree Sparrow
- Chipping Sparrow
- Field Sparrow
- White-crowned Sparrow
- White-throated Sparrow
- Fox Sparrow
- Lincoln's Sparrow
- Swamp Sparrow
- Song Sparrow
- Lapland Longspur
- Snow Bunting
- Snow Finch

FIELD NOTES

Total Species:

Individuals:

Apr, May, June 1987

FIELD TRIP RECORD

Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time: **Localities:**
To:
From:
Total:

Distance: By Car — On Foot
Finish:
Start:
Total:

Day & Date:

WATER BIRDS
- Common Loon
- Horned Grebe
- Pied-billed Grebe
- Double-crested Cormorant

HERONS
- Great Blue Heron
- American Egret
- Snowy Egret
- Little Blue Heron
- Green Heron
- Black-crowned Night Heron
- American Bittern
- Least Bittern

SWANS, GEESE, DUCKS
- Whistling Swan
- Canada Goose
- Snow Goose
- Blue Goose
- Mallard
- Black Duck
- Gadwall
- European Widgeon
- ~~Baldpate~~ American Widgeon
- Pintail
- Green-winged Teal
- Blue-winged Teal
- Shoveller
- Wood Duck
- Redhead
- Ring-necked Duck
- Canvas-back
- Greater Scaup Duck
- Lesser Scaup Duck
- American Golden-eye
- Buffle-head
- Old-squaw
- White-winged Scoter
- Ruddy Duck
- Hooded Merganser
- American Merganser
- Red-breasted Merganser

VULTURES, HAWKS, FALCONS
- Turkey Vulture
- Sharp-shinned Hawk
- Cooper's Hawk
- Red-tailed Hawk
- Red-shouldered Hawk
- Broad-winged Hawk
- Rough-legged Hawk
- Bald Eagle
- Marsh Hawk
- Osprey
- Duck Hawk
- Pigeon Hawk
- Sparrow Hawk Kestrel

GALLINACEOUS BIRDS
- Ruffed Grouse
- Hungarian Partridge
- Bob-white
- Ring-necked Pheasant

MARSH BIRDS
- King Rail
- Virginia Rail
- Sora
- ~~Florida Gallinule~~ Common Moorhen
- Coot

SHOREBIRDS
- Piping Plover
- Semipalmated Plover
- Killdeer
- Golden Plover
- Black-bellied Plover
- Ruddy Turnstone
- Woodcock
- ~~Wilson's~~ Snipe Common
- Hudsonian Curlew
- Upland Plover
- Spotted Sandpiper
- Solitary Sandpiper
- Willet
- Greater Yellow-legs
- Lesser Yellow-legs
- Knot
- Pectoral Sandpiper
- White-rumped Sandpiper
- Baird's Sandpiper
- Least Sandpiper
- ~~Red-backed Sandpiper~~ Dunlin
- Dowitcher
- Marbled Godwit
- American Avocet
- Stilt Sandpiper
- Semipalmated Sandpiper
- Western Sandpiper
- Buff-breasted Sandpiper
- Sanderling
- Red Phalarope
- Wilson's Phalarope
- Northern Phalarope

GULLS AND TERNS
- Glaucous Gull
- Great Black-backed Gull
- Herring Gull
- Ring-billed Gull
- *Franklin's Gull*
- Bonaparte's Gull
- ~~Sabine's Gull~~
- Forster's Tern
- Common Tern
- Caspian Tern
- Black Tern

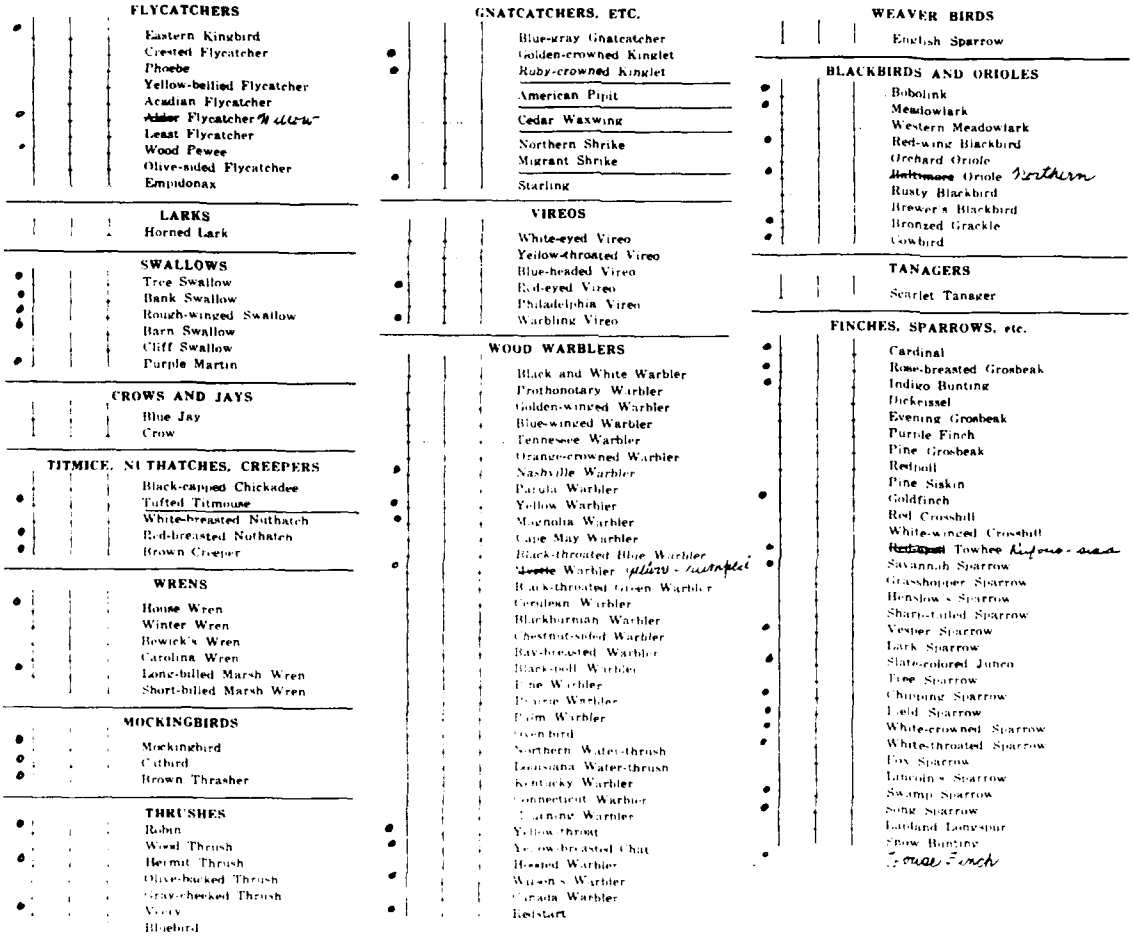
DOVES AND PIGEONS
- Rock Dove
- Mourning Dove

CUCKOOS
- Yellow-billed Cuckoo
- Black-billed Cuckoo

OWLS
- Barn Owl
- Screech Owl
- Great Horned Owl
- Snowy Owl
- Barred Owl
- Long-eared Owl
- Short-eared Owl
- Saw-whet Owl

GOATSUCKERS, ETC.
- Whip-poor-will
- Nighthawk
- Chimney Swift
- Ruby-throated Hummingbird
- Belted Kingfisher

WOODPECKERS
- Flicker
- Red-bellied Woodpecker
- Red-headed Woodpecker
- Yellow-bellied Sapsucker
- Hairy Woodpecker
- Downy Woodpecker



FLYCATCHERS

- Eastern Kingbird
- Crested Flycatcher
- Phoebe
- Yellow-bellied Flycatcher
- Acadian Flycatcher
- ~~Alder~~ Flycatcher Willow
- Least Flycatcher
- Wood Pewee
- Olive-sided Flycatcher
- Empidonax

LARKS

- Horned Lark

SWALLOWS

- Tree Swallow
- Bank Swallow
- Rough-winged Swallow
- Barn Swallow
- Cliff Swallow
- Purple Martin

CROWS AND JAYS

- Blue Jay
- Crow

TITMICE, NUTHATCHES, CREEPERS

- Black-capped Chickadee
- Tufted Titmouse
- White-breasted Nuthatch
- Red-breasted Nuthatch
- Brown Creeper

WRENS

- House Wren
- Winter Wren
- Bewick's Wren
- Carolina Wren
- Long-billed Marsh Wren
- Short-billed Marsh Wren

MOCKINGBIRDS

- Mockingbird
- Catbird
- Brown Thrasher

THRUSHES

- Robin
- Wood Thrush
- Hermit Thrush
- Olive-backed Thrush
- Gray-cheeked Thrush
- Veery
- Bluebird

GNATCATCHERS, ETC.

- Blue-gray Gnatcatcher
- Golden-crowned Kinglet
- Ruby-crowned Kinglet
- American Pipit
- Cedar Waxwing
- Northern Shrike
- Migrant Shrike
- Starling

VIREOS

- White-eyed Vireo
- Yellow-throated Vireo
- Blue-headed Vireo
- Red-eyed Vireo
- Philadelphia Vireo
- Warbling Vireo

WOOD WARBLERS

- Black and White Warbler
- Prothonotary Warbler
- Golden-winged Warbler
- Blue-winged Warbler
- Tennessee Warbler
- Orange-crowned Warbler
- Nashville Warbler
- Parula Warbler
- Yellow Warbler
- Magnolia Warbler
- Cape May Warbler
- Black-throated Blue Warbler
- ~~Irwin~~ Warbler yellow-rumped
- Black-throated Green Warbler
- Cerulean Warbler
- Blackburnian Warbler
- Chestnut-sided Warbler
- Bay-breasted Warbler
- Black-poll Warbler
- Pine Warbler
- Prairie Warbler
- Palm Warbler
- Ovenbird
- Northern Water-thrush
- Louisiana Water-thrush
- Kentucky Warbler
- Connecticut Warbler
- Mourning Warbler
- Yellow-throat
- Yellow-breasted Chat
- Hooded Warbler
- Wilson's Warbler
- Canada Warbler
- Redstart

WEAVER BIRDS

- English Sparrow

BLACKBIRDS AND ORIOLES

- Bobolink
- Meadowlark
- Western Meadowlark
- Red-wing Blackbird
- Orchard Oriole
- ~~Baltimore~~ Oriole Northern
- Rusty Blackbird
- Brewer's Blackbird
- Bronzed Grackle
- Cowbird

TANAGERS

- Scarlet Tanager

FINCHES, SPARROWS, etc.

- Cardinal
- Rose-breasted Grosbeak
- Indigo Bunting
- Dickcissel
- Evening Grosbeak
- Purple Finch
- Pine Grosbeak
- Redpoll
- Pine Siskin
- Goldfinch
- Red Crossbill
- White-winged Crossbill
- ~~Red-eyed~~ Towhee Rufous-sided
- Savannah Sparrow
- Grasshopper Sparrow
- Henslow's Sparrow
- Sharp-tailed Sparrow
- Vesper Sparrow
- Lark Sparrow
- Slate-colored Junco
- Tree Sparrow
- Chipping Sparrow
- Field Sparrow
- White-crowned Sparrow
- White-throated Sparrow
- Fox Sparrow
- Lincoln's Sparrow
- Swamp Sparrow
- Song Sparrow
- Lapland Longspur
- Snow Bunting
- Tree Finch

FIELD NOTES

Total Species:

Individuals:

July, Aug, Sept 1987

FIELD TRIP RECORD

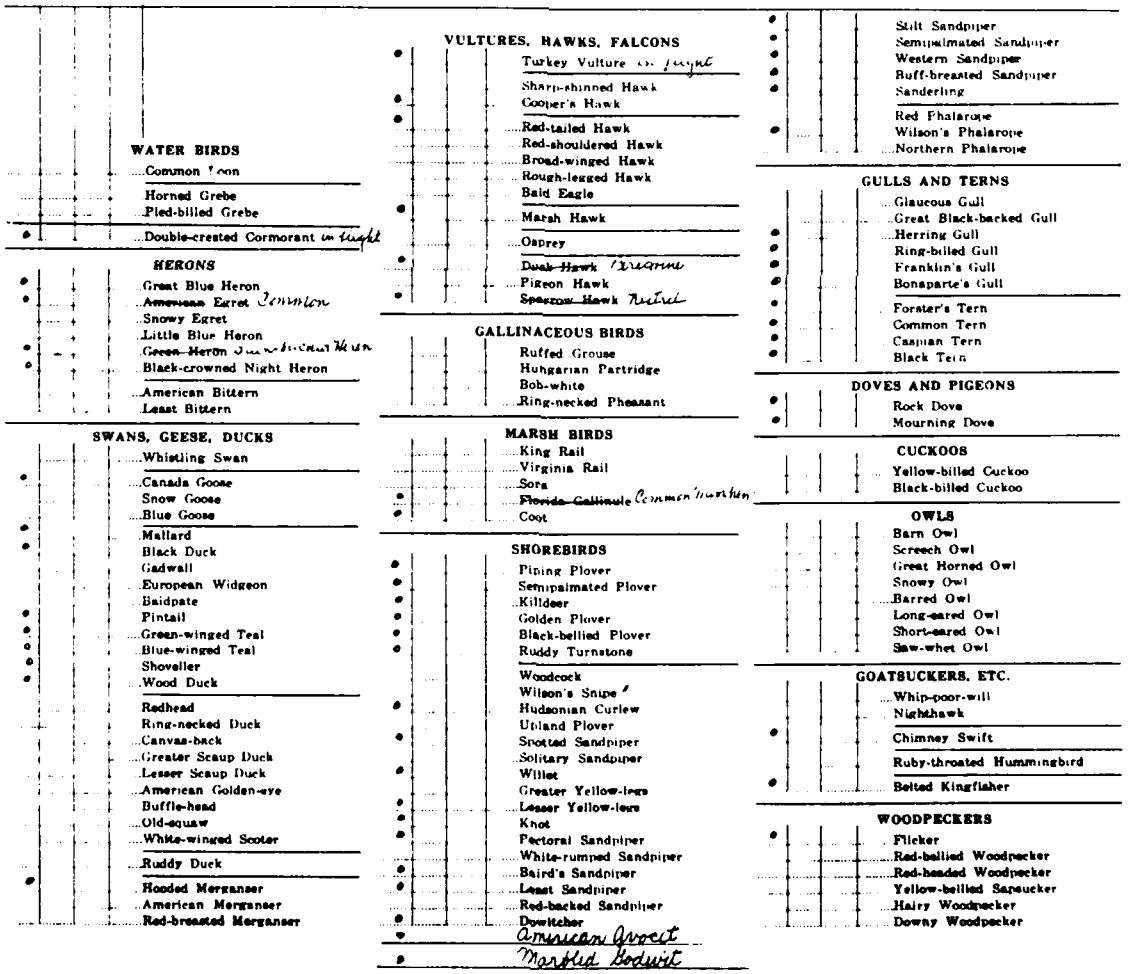
Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

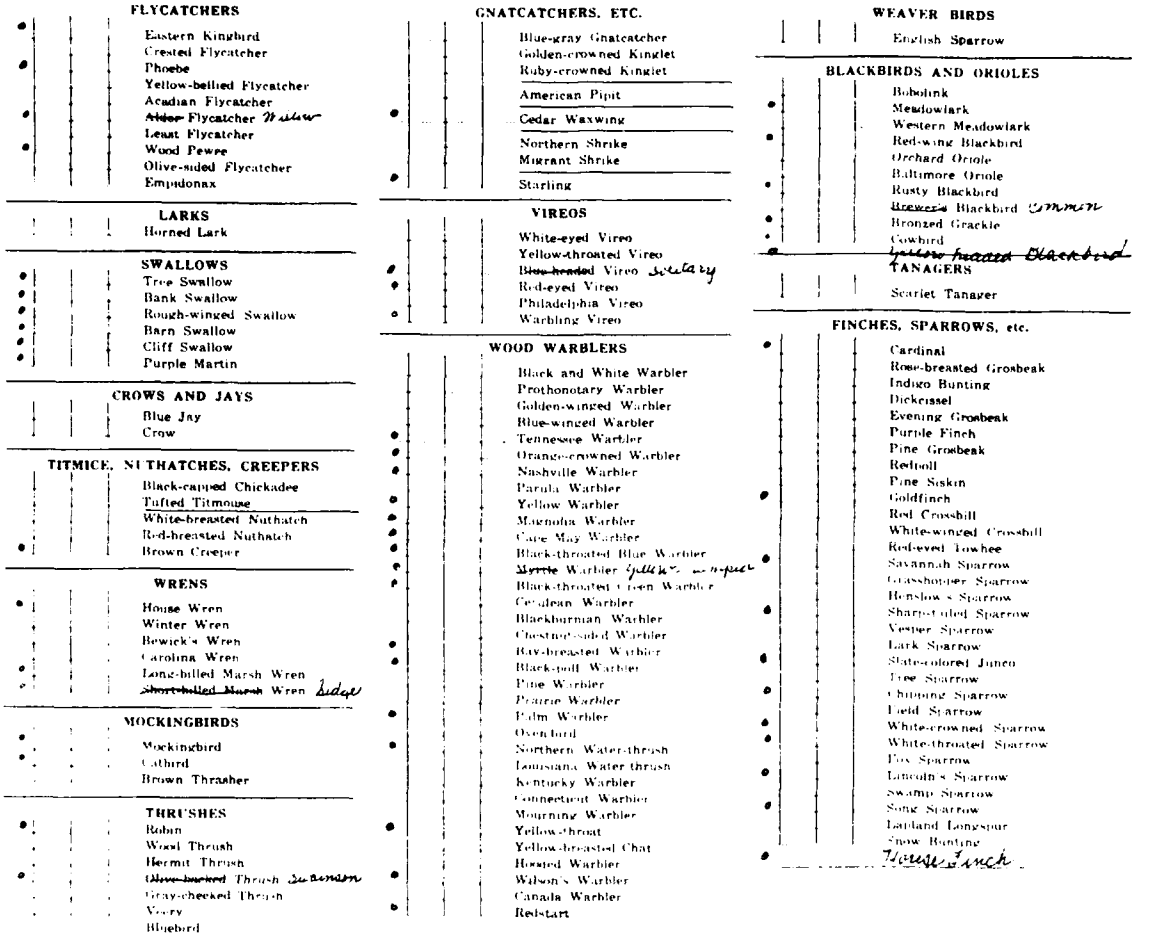
Field Time: To: From: Total:

Localities:

Distance: By Car — On Foot Finish: Start: Total:

Day & Date:





FLYCATCHERS

- Eastern Kingbird
- Crested Flycatcher
- Phoebe
- Yellow-bellied Flycatcher
- Acadian Flycatcher
- ~~Alder~~ Flycatcher Willow
- Least Flycatcher
- Wood Pewee
- Olive-sided Flycatcher
- Empidonax

LARKS

- Horned Lark

SWALLOWS

- Tree Swallow
- Bank Swallow
- Rough-winged Swallow
- Barn Swallow
- Cliff Swallow
- Purple Martin

CROWS AND JAYS

- Blue Jay
- Crow

TITMICE, NUTHATCHES, CREEPERS

- Black-capped Chickadee
- Tufted Titmouse
- White-breasted Nuthatch
- Red-breasted Nuthatch
- Brown Creeper

WRENS

- House Wren
- Winter Wren
- Bewick's Wren
- Carolina Wren
- Long-billed Marsh Wren
- ~~Short-billed Marsh~~ Wren Sedge

MOCKINGBIRDS

- Mockingbird
- Catbird
- Brown Thrasher

THRUSHES

- Robin
- Wood Thrush
- Hermit Thrush
- ~~Olive-backed~~ Thrush Swainson
- Gray-cheeked Thrush
- Veery
- Bluebird

GNATCATCHERS, ETC.

- Blue-gray Gnatcatcher
- Golden-crowned Kinglet
- Ruby-crowned Kinglet
- American Pipit
- Cedar Waxwing
- Northern Shrike
- Migrant Shrike
- Starling

VIREOS

- White-eyed Vireo
- Yellow-throated Vireo
- ~~Blue-headed~~ Vireo Solitary
- Red-eyed Vireo
- Philadelphia Vireo
- Warbling Vireo

WOOD WARBLERS

- Black and White Warbler
- Prothonotary Warbler
- Golden-winged Warbler
- Blue-winged Warbler
- Tennessee Warbler
- Orange-crowned Warbler
- Nashville Warbler
- Parula Warbler
- Yellow Warbler
- Magnolia Warbler
- Cape May Warbler
- Black-throated Blue Warbler
- ~~Myrtle~~ Warbler Yellow-rumped
- Black-throated Green Warbler
- Cerulean Warbler
- Blackburnian Warbler
- Chestnut-sided Warbler
- Bay-breasted Warbler
- Black-poll Warbler
- Pine Warbler
- *Prairie Warbler*
- Palm Warbler
- Ovenbird
- Northern Water-thrush
- Louisiana Water-thrush
- Kentucky Warbler
- Connecticut Warbler
- Mourning Warbler
- Yellow-throat
- Yellow-breasted Chat
- Hooded Warbler
- Wilson's Warbler
- Canada Warbler
- Redstart

WEAVER BIRDS

- English Sparrow

BLACKBIRDS AND ORIOLES

- Bobolink
- Meadowlark
- Western Meadowlark
- Red-wing Blackbird
- *Orchard Oriole*
- Baltimore Oriole
- Rusty Blackbird
- ~~Brewer's~~ Blackbird Common
- Bronzed Grackle
- Cowbird
- ~~Yellow-headed Blackbird~~

TANAGERS

- Scarlet Tanager

FINCHES, SPARROWS, etc.

- Cardinal
- Rose-breasted Grosbeak
- Indigo Bunting
- Dickcissel
- Evening Grosbeak
- Purple Finch
- Pine Grosbeak
- Redpoll
- Pine Siskin
- Goldfinch
- Red Crossbill
- White-winged Crossbill
- Red-eyed Towhee
- Savannah Sparrow
- Grasshopper Sparrow
- Henslow's Sparrow
- Sharp-tailed Sparrow
- Vesper Sparrow
- Lark Sparrow
- Slate-colored Junco
- Tree Sparrow
- Chipping Sparrow
- Field Sparrow
- White-crowned Sparrow
- White-throated Sparrow
- Fox Sparrow
- Lincoln's Sparrow
- Swamp Sparrow
- Song Sparrow
- Lapland Longspur
- Snow Bunting
- Brewer's Finch

FIELD NOTES

Total Species:

Individuals:

Oct, Nov, Dec 1987

FIELD TRIP RECORD

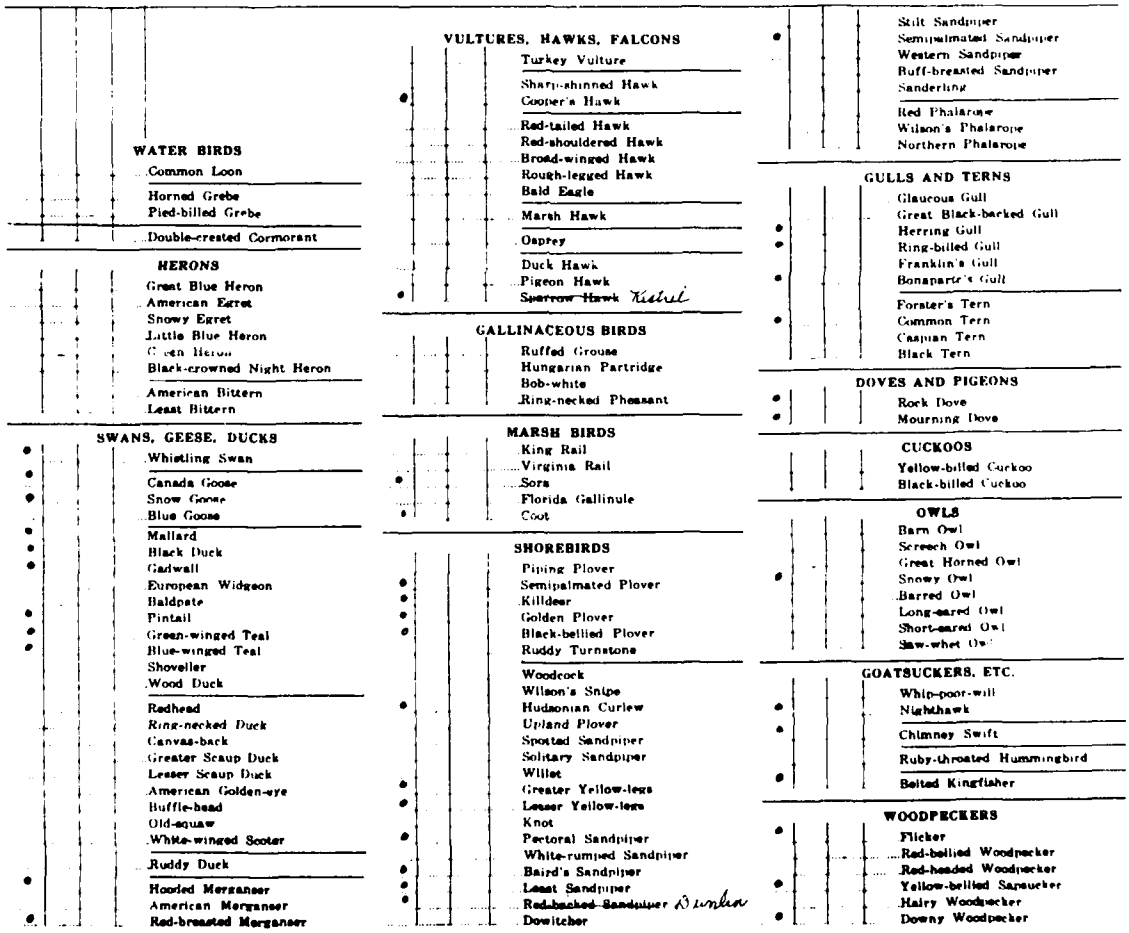
Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

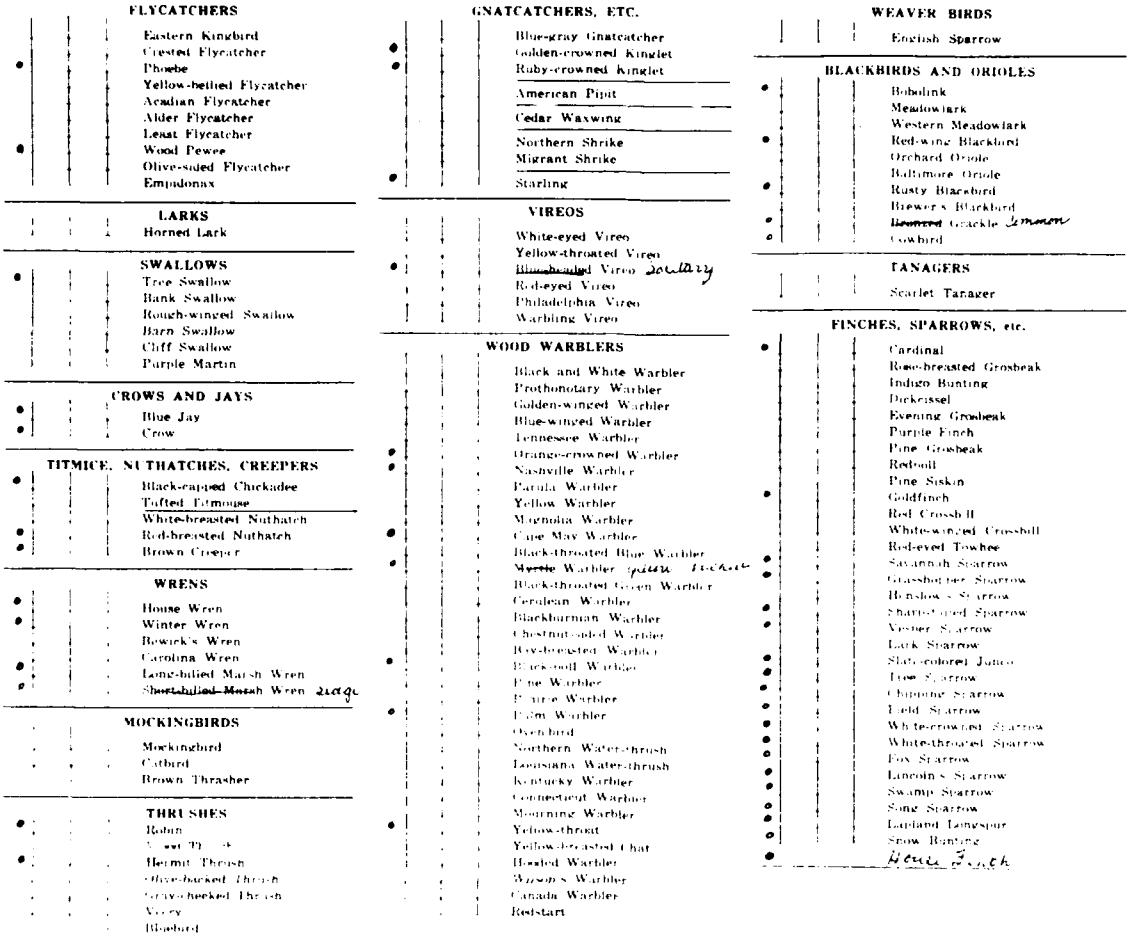
Field Time: To: From: Total:

Localities:

Distance: By Car — On Foot Finish: Start: Total:

Day & Date:





FLYCATCHERS

- Eastern Kingbird
- Crested Flycatcher
- Phoebe
- Yellow-bellied Flycatcher
- Acadian Flycatcher
- Alder Flycatcher
- Least Flycatcher
- Wood Pewee
- Olive-sided Flycatcher
- Empidonax

LARKS

- Horned Lark

SWALLOWS

- Tree Swallow
- Bank Swallow
- Rough-winged Swallow
- Barn Swallow
- Cliff Swallow
- Purple Martin

CROWS AND JAYS

- Blue Jay
- Crow

TITMICE, NUTHATCHES, CREEPERS

- Black-capped Chickadee
- Tufted Titmouse
- White-breasted Nuthatch
- Red-breasted Nuthatch
- Brown Creeper

WRENS

- House Wren
- Winter Wren
- Bewick's Wren
- Carolina Wren
- Long-billed Marsh Wren
- ~~Short-billed Marsh~~ Wren *sedge*

MOCKINGBIRDS

- Mockingbird
- Catbird
- Brown Thrasher

THRUSHES

- Robin
- Wood Thrush
- Hermit Thrush
- Olive-backed Thrush
- Gray-cheeked Thrush
- Veery
- Bluebird

GNATCATCHERS, ETC.

- Blue-gray Gnatcatcher
- Golden-crowned Kinglet
- Ruby-crowned Kinglet

- American Pipit

- Cedar Waxwing

- Northern Shrike
- Migrant Shrike

- Starling

VIREOS

- White-eyed Vireo
- Yellow-throated Vireo
- ~~Blue-headed~~ Vireo *Solitary*
- Red-eyed Vireo
- Philadelphia Vireo
- Warbling Vireo

WOOD WARBLERS

- Black and White Warbler
- Prothonotary Warbler
- Golden-winged Warbler
- Blue-winged Warbler
- Tennessee Warbler
- Orange-crowned Warbler
- Nashville Warbler
- Parula Warbler
- Yellow Warbler
- Magnolia Warbler
- Cape May Warbler
- Black-throated Blue Warbler
- ~~Myrtle~~ Warbler *yellow rumped*
- Black-throated Green Warbler
- Cerulean Warbler
- Blackburnian Warbler
- Chestnut-sided Warbler
- Bay-breasted Warbler
- Blackpoll Warbler
- Pine Warbler
- Prairie Warbler
- Palm Warbler
- Ovenbird
- Northern Waterthrush
- Louisiana Waterthrush
- Kentucky Warbler
- Connecticut Warbler
- Mourning Warbler
- Yellowthroat
- Yellow-breasted Chat
- Hooded Warbler
- Wilson's Warbler
- Canada Warbler
- Redstart

WEAVER BIRDS

- English Sparrow

BLACKBIRDS AND ORIOLES

- Bobolink
- Meadowlark
- Western Meadowlark
- Red-wing Blackbird
- Orchard Oriole
- Baltimore Oriole
- Rusty Blackbird
- Brewer's Blackbird
- ~~Bronzed~~ Grackle *Common*
- Cowbird

TANAGERS

- Scarlet Tanager

FINCHES, SPARROWS, etc.

- Cardinal
- Rose-breasted Grosbeak
- Indigo Bunting
- Dickcissel
- Evening Grosbeak
- Purple Finch
- Pine Grosbeak
- Redpoll
- Pine Siskin
- Goldfinch
- Red Crossbill
- White-winged Crossbill
- Red-eyed Towhee
- Savannah Sparrow
- Grasshopper Sparrow
- Henslow's Sparrow
- Sharp-tailed Sparrow
- Vesper Sparrow
- Lark Sparrow
- Slate-colored Junco
- Tree Sparrow
- Chipping Sparrow
- Field Sparrow
- White-crowned Sparrow
- White-throated Sparrow
- Fox Sparrow
- Lincoln's Sparrow
- Swamp Sparrow
- Song Sparrow
- Lapland Longspur
- Snow Bunting
- House Finch

FIELD NOTES

Total Species:

Individuals:

Jan. Feb, March 1988

FIELD TRIP RECORD

Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time:
To:
From:
Total:

Little activity in Jan. Basin area all snow & ice. Feb: duplicate of Jan. 2 Mockingbirds on the upper field on Feb. 29th. Mar. some days snow covered.

Localities:

Distance: By Car — On Foot
Finish:
Start:
Total:

Day & Date:

WATER BIRDS
- Common Loon
- Horned Grebe
- Pied-billed Grebe
- Double-crested Cormorant

HERONS
- Great Blue Heron
- American Egret
- Snowy Egret
- Little Blue Heron
- Green Heron
- Black-crowned Night Heron
- American Bittern
- Least Bittern

SWANS, GEESE, DUCKS
- Whistling Swan
- Canada Goose
- Snow Goose
- Blue Goose
- Mallard
- Black Duck
- Gadwall
- European Widgeon
- Baldpate American Widgeon
- Pintail
- Green-winged Teal
- Blue-winged Teal
- Shoveller
- Wood Duck
- Redhead
- Ring-necked Duck
- Canvas-back
- Greater Scaup Duck
- Lesser Scaup Duck
- American Golden-eye
- Buffle-head
- Old-squaw
- White-winged Scoter
- Ruddy Duck
- Hooded Merganser
- American Merganser
- Red-breasted Merganser

VULTURES, HAWKS, FALCONS
- Turkey Vulture
- Sharp-shinned Hawk
- Cooper's Hawk
- Red-tailed Hawk
- Red-shouldered Hawk
- Broad-winged Hawk
- Rough-legged Hawk
- Bald Eagle
- Marsh Hawk
- Osprey
- Duck Hawk
- Pigeon Hawk
- ~~Sparrow Hawk~~ Kestrel

GALLINACEOUS BIRDS
- Ruffed Grouse
- Hungarian Partridge
- Bob-white
- Ring-necked Pheasant

MARSH BIRDS
- King Rail
- Virginia Rail
- Sora
- Florida Gallinule
- Coot

SHOREBIRDS
- Piping Plover
- Semipalmated Plover
- Killdeer
- Golden Plover
- Black-bellied Plover
- Ruddy Turnstone
- Woodcock
- ~~Wilson's~~ Snipe
- Hudsonian Curlew
- Upland Plover
- Spotted Sandpiper
- Solitary Sandpiper
- Willet
- Greater Yellow-legs
- Lesser Yellow-legs
- Knot
- Pectoral Sandpiper
- White-rumped Sandpiper
- Baird's Sandpiper
- Least Sandpiper
- Red-backed Sandpiper
- Dowitcher
- Stilt Sandpiper
- Semipalmated Sandpiper
- Western Sandpiper
- Buff-breasted Sandpiper
- Sanderling
- Red Phalarope
- Wilson's Phalarope
- Northern Phalarope

GULLS AND TERNS
- Glaucous Gull
- Great Black-backed Gull
- Herring Gull
- Ring-billed Gull
- Franklin's Gull
- Bonaparte's Gull
- Forster's Tern
- Common Tern
- Caspian Tern
- Black Tern

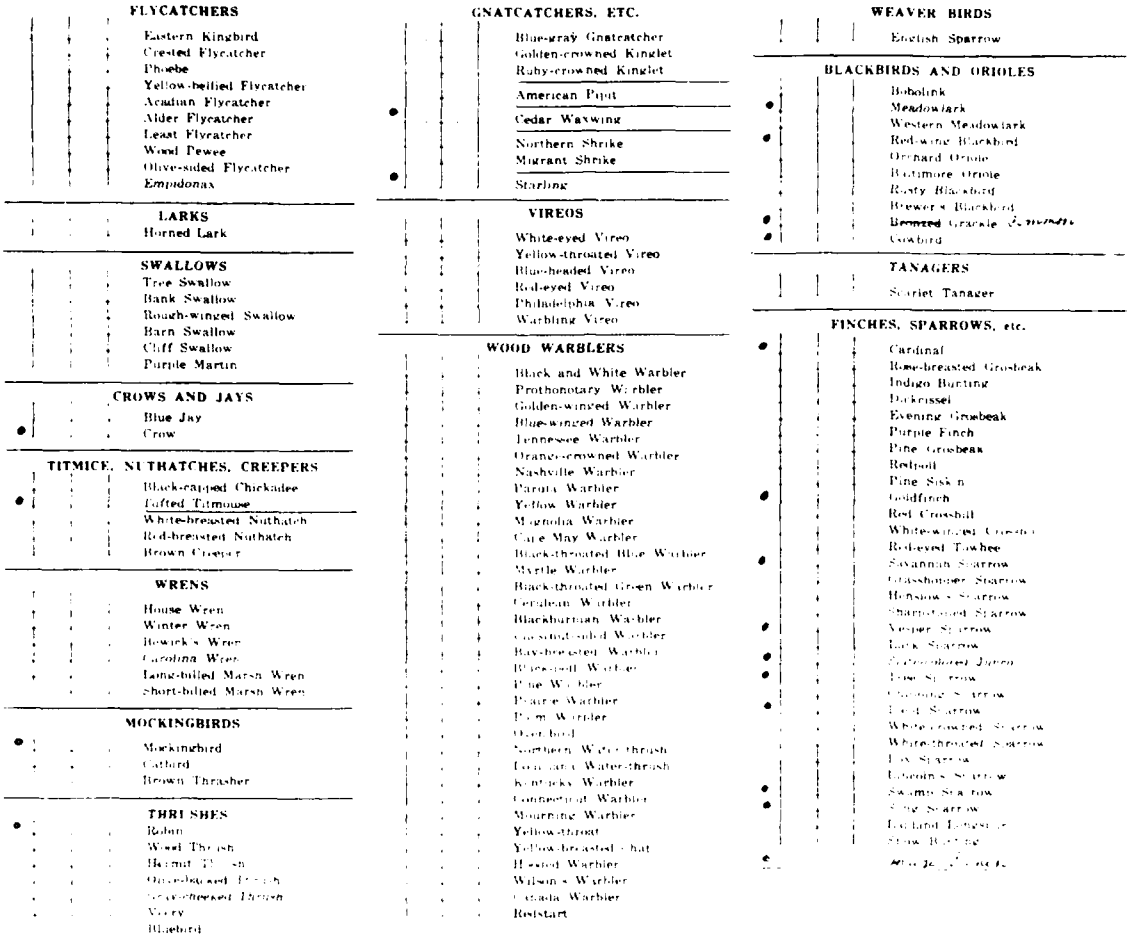
DOVES AND PIGEONS
- Rock Dove
- Mourning Dove

CUCKOOS
- Yellow-billed Cuckoo
- Black-billed Cuckoo

OWLS
- Barn Owl
- Screech Owl
- Great Horned Owl
- Snowy Owl
- Barred Owl
- Long-eared Owl
- Short-eared Owl
- Saw-whet Owl

GOATSUCKERS, ETC.
- Whip-poor-will
- Nighthawk
- Chimney Swift
- Ruby-throated Hummingbird
- Belted Kingfisher

WOODPECKERS
- Flicker
- Red-bellied Woodpecker
- Red-headed Woodpecker
- Yellow-bellied Sapsucker
- Hairy Woodpecker
- Downy Woodpecker



FLYCATCHERS
Eastern Kingbird
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Yellow-bellied Flycatcher
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Wood Pewee
Olive-sided Flycatcher
Empidonax

LARKS
Horned Lark

SWALLOWS
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow
Purple Martin

CROWS AND JAYS
Blue Jay
Crow

TITMICE, NUTHATCHES, CREEPERS
Black-capped Chickadee
Tufted Titmouse
White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper

WRENS
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Winter Wren
Bewick's Wren
Carolina Wren
Long-billed Marsh Wren
Short-billed Marsh Wren

MOCKINGBIRDS
Mockingbird
Catbird
Brown Thrasher

THRUSHES
Robin
Wood Thrush
Hermit Thrush
Olive-backed Thrush
Gray-cheeked Thrush
Veery
Bluebird

GNATCATCHERS, ETC.
Blue-gray Gnatcatcher
Golden-crowned Kinglet
Ruby-crowned Kinglet

American Pipit

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Northern Shrike
Migrant Shrike

Starling

VIREOS
White-eyed Vireo
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Blue-headed Vireo
Red-eyed Vireo
Philadelphia Vireo
Warbling Vireo

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Golden-winged Warbler
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Magnolia Warbler
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Black-throated Blue Warbler
Myrtle Warbler
Black-throated Green Warbler
Cerulean Warbler
Blackburnian Warbler
Chestnut-sided Warbler
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Blackpoll Warbler
Pine Warbler
Prairie Warbler
Palm Warbler
Ovenbird
Northern Waterthrush
Louisiana Waterthrush
Kentucky Warbler
Connecticut Warbler
Mourning Warbler
Yellowthroat
Yellow-breasted Chat
Hooded Warbler
Wilson's Warbler
Canada Warbler
Redstart

WEAVER BIRDS
English Sparrow

BLACKBIRDS AND ORIOLES
Bobolink
Meadowlark
Western Meadowlark
Red-wing Blackbird
Orchard Oriole
Baltimore Oriole
Rusty Blackbird
Brewer's Blackbird
Bronzed Grackle
Cowbird

TANAGERS
Scarlet Tanager

FINCHES, SPARROWS, etc.
Cardinal
Rose-breasted Grosbeak
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Dickcissel
Evening Grosbeak
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Pine Grosbeak
Redpoll
Pine Siskin
Goldfinch
Red Crossbill
White-winged Crossbill
Red-eyed Towhee
Savannah Sparrow
Grasshopper Sparrow
Henslow's Sparrow
Sharp-tailed Sparrow
Vesper Sparrow
Lark Sparrow
Slate-colored Junco
Tree Sparrow
Chipping Sparrow
Field Sparrow
White-crowned Sparrow
White-throated Sparrow
Fox Sparrow
Lincoln's Sparrow
Swamp Sparrow
Song Sparrow
Lapland Longspur
Snow Bunting
Mac[illegible]

FIELD NOTES

Total Species:

Individuals:

Apr. May, June 1988

FIELD TRIP RECORD

Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time:
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Total:

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Day & Date:

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- Common Loon
- Horned Grebe
- Pied-billed Grebe
- Double-crested Cormorant

HERONS
- Great Blue Heron
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- Snowy Egret
- Little Blue Heron
- Green Heron
- Black-crowned Night Heron
- American Bittern
- Least Bittern

SWANS, GEESE, DUCKS
- Whistling Swan
- Canada Goose
- Snow Goose
- Blue Goose
- Mallard
- Black Duck
- Gadwall
- European Widgeon
- ~~Baldpate~~ American Widgeon
- Pintail
- Green-winged Teal
- Blue-winged Teal
- Shoveller
- Wood Duck
- Redhead
- Ring-necked Duck
- Canvas-back
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- Lesser Scaup Duck
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- Buffle-head
- Old-squaw
- White-winged Scoter
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- Osprey
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- Semipalmated Plover
- Killdeer
- Golden Plover
- Black-bellied Plover
- Ruddy Turnstone
- Woodcock
- ~~Wilson's~~ Snipe Common
- Hudsonian Curlew
- Upland Plover
- Spotted Sandpiper
- Solitary Sandpiper
- Willet
- Greater Yellow-legs
- Lesser Yellow-legs
- Knot
- Pectoral Sandpiper
- White-rumped Sandpiper
- Baird's Sandpiper
- Least Sandpiper
- ~~Red-backed Sandpiper~~ Dunlin
- Dowitcher
- Stilt Sandpiper
- Semipalmated Sandpiper
- Western Sandpiper
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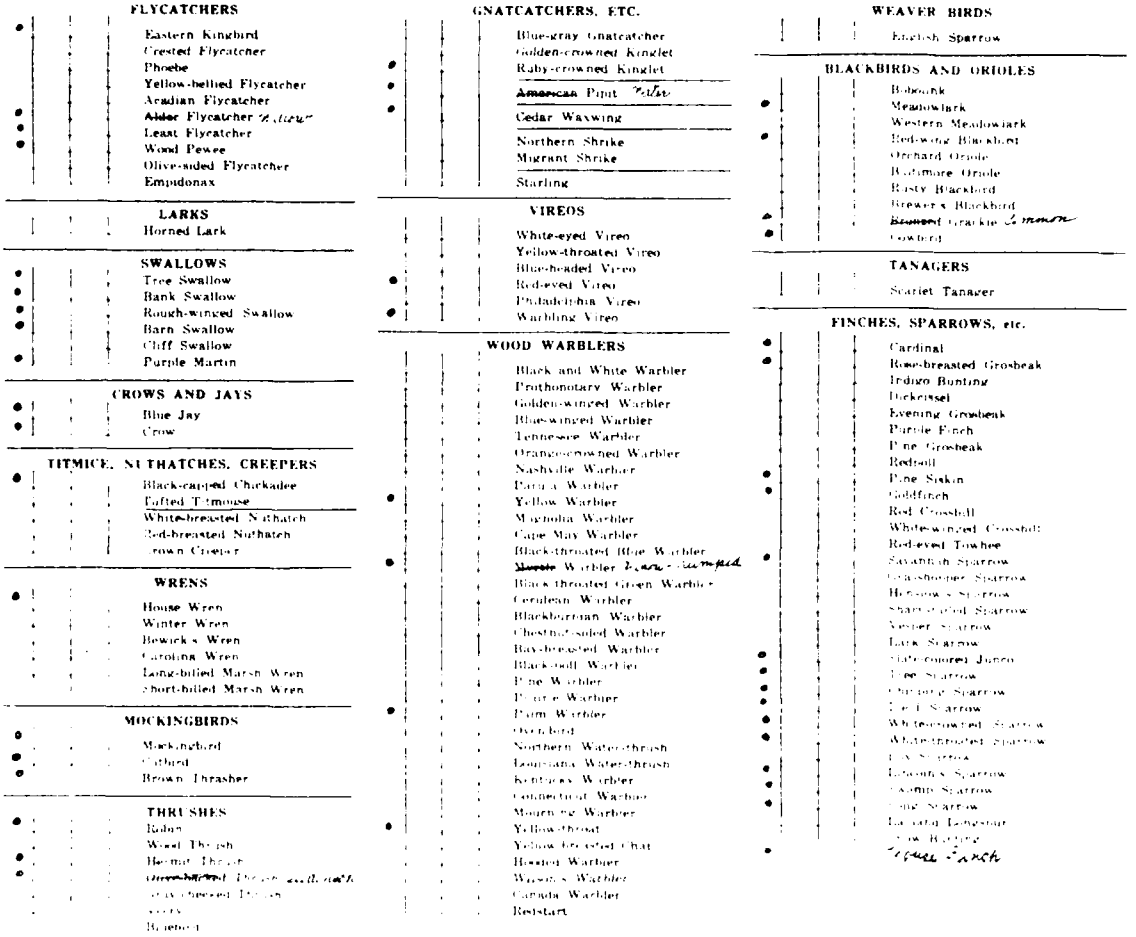
- Great Horned Owl
- Snowy Owl
- Barred Owl
- Long-eared Owl
- Short-eared Owl
- Saw-whet Owl

GOATSUCKERS, ETC.
- Whip-poor-will
- Nighthawk
- Chimney Swift
- Ruby-throated Hummingbird
- Belted Kingfisher

WOODPECKERS
- Flicker
- Red-bellied Woodpecker
- Red-headed Woodpecker
- Yellow-bellied Sapsucker
- Hairy Woodpecker
- Downy Woodpecker



FLYCATCHERS
Eastern Kingbird
Crested Flycatcher
Phoebe
Yellow-bellied Flycatcher
Acadian Flycatcher
~~Alder~~ Flycatcher *Traill's*
Least Flycatcher
Wood Pewee
Olive-sided Flycatcher
Empidonax

LARKS
Horned Lark

SWALLOWS
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow
Purple Martin

CROWS AND JAYS
Blue Jay
Crow

TITMICE, NUTHATCHES, CREEPERS
Black-capped Chickadee
Tufted Titmouse
White-breasted Nuthatch
Red-breasted Nuthatch
[illegible] Creeper

WRENS
House Wren
Winter Wren
Bewick's Wren
Carolina Wren
Long-billed Marsh Wren
Short-billed Marsh Wren

MOCKINGBIRDS
Mockingbird
Catbird
Brown Thrasher

THRUSHES
Robin
Wood Thrush
Hermit Thrush
[illegible]
[illegible]
[illegible]
Bluebird

GNATCATCHERS, ETC.
Blue-gray Gnatcatcher
Golden-crowned Kinglet
Ruby-crowned Kinglet
~~American~~ Pipit *Water*
Cedar Waxwing
Northern Shrike
Migrant Shrike
Starling

VIREOS
White-eyed Vireo
Yellow-throated Vireo
Blue-headed Vireo
Red-eyed Vireo
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WOOD WARBLERS
Black and White Warbler
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Orange-crowned Warbler
Nashville Warbler
Parula Warbler
Yellow Warbler
Magnolia Warbler
Cape May Warbler
Black-throated Blue Warbler
~~Myrtle~~ Warbler *Yellow-rumped*
Black-throated Green Warbler
Cerulean Warbler
Blackburnian Warbler
Chestnut-sided Warbler
Bay-breasted Warbler
Black-poll Warbler
Pine Warbler
Prairie Warbler
Palm Warbler
Ovenbird
Northern Waterthrush
Louisiana Waterthrush
Kentucky Warbler
Connecticut Warbler
Mourning Warbler
Yellowthroat
Yellow-breasted Chat
Hooded Warbler
Wilson's Warbler
Canada Warbler
Redstart

WEAVER BIRDS
English Sparrow

BLACKBIRDS AND ORIOLES
Bobolink
Meadowlark
Western Meadowlark
Red-wing Blackbird
Orchard Oriole
Baltimore Oriole
Rusty Blackbird
Brewer's Blackbird
~~Bronzed~~ Grackle *Common*
Cowbird

TANAGERS
Scarlet Tanager

FINCHES, SPARROWS, etc.
Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Dickcissel
Evening Grosbeak
Purple Finch
Pine Grosbeak
Redpoll
Pine Siskin
Goldfinch
Red Crossbill
White-winged Crossbill
Red-eyed Towhee
Savannah Sparrow
Grasshopper Sparrow
Henslow's Sparrow
Sharp-tailed Sparrow
Vesper Sparrow
Lark Sparrow
Slate-colored Junco
Tree Sparrow
Chipping Sparrow
Clay Sparrow
White-crowned Sparrow
White-throated Sparrow
Fox Sparrow
Lincoln's Sparrow
Swamp Sparrow
Song Sparrow
Lapland Longspur
Snow Bunting
Vigors Finch

FIELD NOTES

Total Species:

Individuals:

July, Aug 1988

FIELD TRIP RECORD

Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time:
To:
From:
Total:

Localities:

Distance: By Car — On Foot
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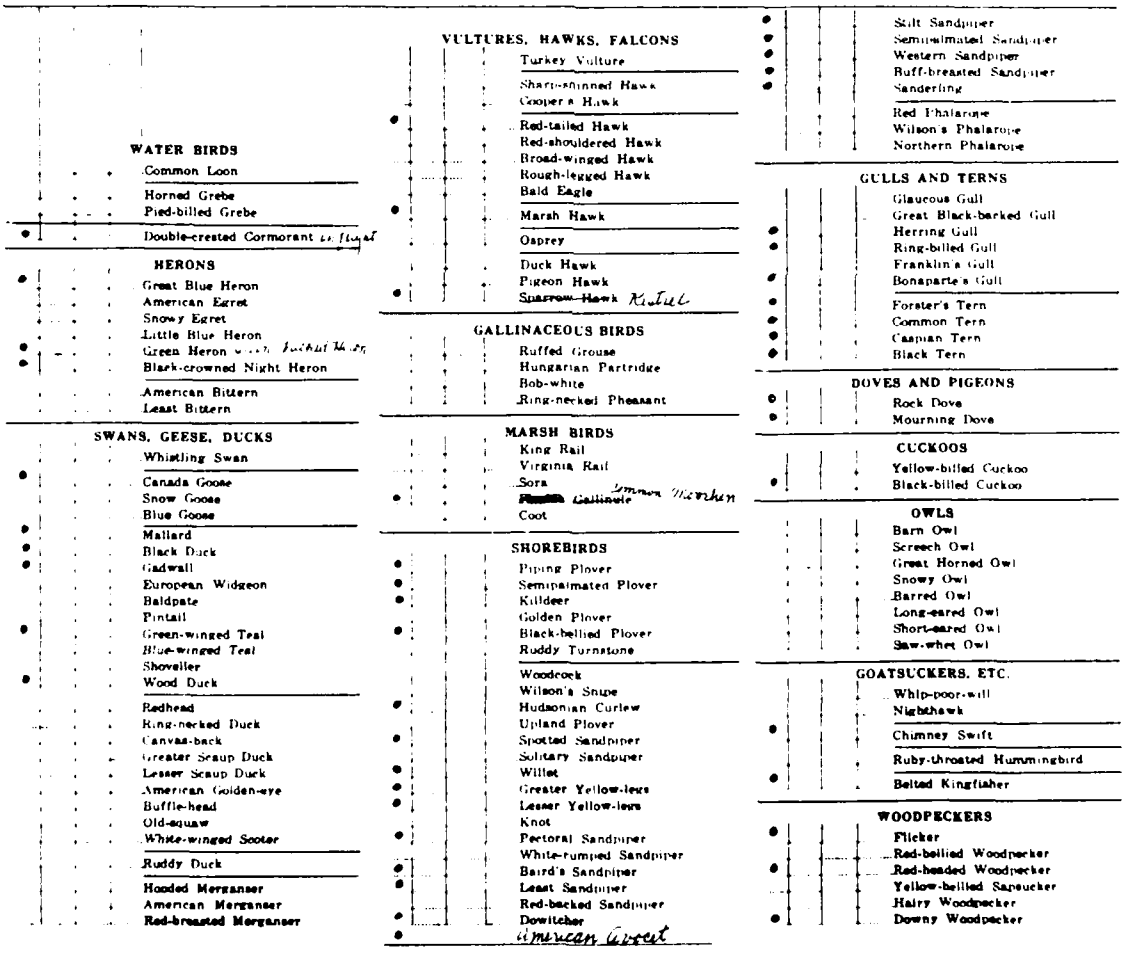

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Canada Goose
Snow Goose
Blue Goose
Mallard
Black Duck
Gadwall
European Widgeon
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Pintail
Green-winged Teal
Blue-winged Teal
Shoveller
Wood Duck
Redhead
Ring-necked Duck
Canvas-back
Greater Scaup Duck
Lesser Scaup Duck
American Golden-eye
Buffle-head
Old-squaw
White-winged Scoter
Ruddy Duck
Hooded Merganser
American Merganser
Red-breasted Merganser
VULTURES, HAWKS, FALCONS
Turkey Vulture
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Rough-legged Hawk
Bald Eagle
Marsh Hawk
Osprey
Duck Hawk
Pigeon Hawk
Sparrow Hawk
GALLINACEOUS BIRDS
Ruffed Grouse
Hungarian Partridge
Bob-white
Ring-necked Pheasant
MARSH BIRDS
King Rail
Virginia Rail
Sora
Coot
SHOREBIRDS
Piping Plover
Semipalmated Plover
Killdeer
Golden Plover
Black-bellied Plover
Ruddy Turnstone
Woodcock
Wilson's Snipe
Hudsonian Curlew
Upland Plover
Spotted Sandpiper
Solitary Sandpiper
Willet
Greater Yellow-legs
Lesser Yellow-legs
Knot
Pectoral Sandpiper
White-rumped Sandpiper
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DOVES AND PIGEONS
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Mourning Dove
CUCKOOS
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Black-billed Cuckoo
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Chimney Swift
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WOODPECKERS
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LARKS

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SWALLOWS

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- Rough-winged Swallow
- Barn Swallow
- Cliff Swallow
- Purple Martin

CROWS AND JAYS

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- Crow

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- Winter Wren
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- Carolina Wren
- Long-billed Marsh Wren
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MOCKINGBIRDS

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- Brown Thrasher

THRUSHES

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- Wood Thrush
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GNATCATCHERS, ETC.

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- Golden-crowned Kinglet
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- Northern Shrike
- Migrant Shrike
- Starling

VIREOS

- White-eyed Vireo
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- Red-eyed Vireo
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WOOD WARBLERS

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- Connecticut Warbler
- Mourning Warbler
- Yellowthroat
- Yellow-breasted Chat
- Hooded Warbler
- Wilson's Warbler
- Canada Warbler
- Redstart

WEAVER BIRDS

- English Sparrow

BLACKBIRDS AND ORIOLES

- Bobolink
- Meadowlark
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- Red-wing Blackbird
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- *Baltimore Oriole*
- Rusty Blackbird
- Brewer's Blackbird
- ~~Bronzed~~ Grackle *Common*
- Cowbird

TANAGERS

- Scarlet Tanager

FINCHES, SPARROWS, etc.

- Cardinal
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- Indigo Bunting
- Dickcissel
- Evening Grosbeak
- Purple Finch
- Pine Grosbeak
- *Redpoll*
- Pine Siskin
- Goldfinch
- Red Crossbill
- White-winged Crossbill
- Red-eyed Towhee
- Savannah Sparrow
- Grasshopper Sparrow
- Henslow's Sparrow
- Sharp-tailed Sparrow
- Vesper Sparrow
- Lark Sparrow
- Slate-colored Junco
- Tree Sparrow
- Chipping Sparrow
- Field Sparrow
- White-crowned Sparrow
- White-throated Sparrow
- Fox Sparrow
- Lincoln's Sparrow
- Swamp Sparrow
- Song Sparrow
- Lapland Longspur
- Snow Bunting
- *House Finch*

FIELD NOTES

Total Species:

Individuals:

Sept 1988

FIELD TRIP RECORD

Weather: **Meteorological Report** **Observers:** William A. Klamm, Nancy R. Klamm

Field Time:
To:
From:
Total:

Since there was appox 1" of rain at the end of Aug. there were casual pools of water, therefore puddle ducks came back. Since the 6th of Sept., there have been no ducks.

Localities:

Distance: By Car — On Foot
Finish:
Start:
Total:

Day & Date:

WATER BIRDS
- Common Loon
- Horned Grebe
- Pied-billed Grebe
- Double-crested Cormorant in flight

HERONS
- Great Blue Heron
- American Egret
- Snowy Egret
- Little Blue Heron
- ~~Green Heron~~ Green-backed Heron
- Black-crowned Night Heron
- American Bittern
- Least Bittern

SWANS, GEESE, DUCKS
- Whistling Swan
- Canada Goose
- Snow Goose
- Blue Goose
- Mallard
- Black Duck
- Gadwall
- European Widgeon
- ~~Baldpate~~ American Widgeon
- Pintail
- Green-winged Teal
- Blue-winged Teal
- Shoveller
- Wood Duck
- Redhead
- Ring-necked Duck
- Canvas-back
- Greater Scaup Duck
- Lesser Scaup Duck
- American Golden-eye
- Buffle-head
- Old-squaw
- White-winged Scoter
- Ruddy Duck
- Hooded Merganser
- American Merganser
- Red-breasted Merganser

VULTURES, HAWKS, FALCONS
- Turkey Vulture
- Sharp-shinned Hawk
- Cooper's Hawk
- Red-tailed Hawk
- Red-shouldered Hawk
- Broad-winged Hawk
- Rough-legged Hawk
- Bald Eagle
- Marsh Hawk
- Osprey
- Duck Hawk
- Pigeon Hawk
- ~~Sparrow Hawk~~ Kestrel

GALLINACEOUS BIRDS
- Ruffed Grouse
- Hungarian Partridge
- Bob-white
- Ring-necked Pheasant

MARSH BIRDS
- King Rail
- Virginia Rail
- Sora
- Florida Gallinule
- Coot

SHOREBIRDS
- Piping Plover
- Semipalmated Plover
- Killdeer
- Golden Plover
- Black-bellied Plover
- Ruddy Turnstone
- Woodcock
- Wilson's Snipe
- Hudsonian Curlew
- Upland Plover
- Spotted Sandpiper
- Solitary Sandpiper
- Willet
- Greater Yellow-legs
- Lesser Yellow-legs
- Knot
- Pectoral Sandpiper
- White-rumped Sandpiper
- Baird's Sandpiper
- Least Sandpiper
- Red-backed Sandpiper
- Dowitcher
- Stilt Sandpiper
- Semipalmated Sandpiper
- Western Sandpiper
- Buff-breasted Sandpiper
- Sanderling
- Red Phalarope
- Wilson's Phalarope
- Northern Phalarope

GULLS AND TERNS
- Glaucous Gull
- Great Black-backed Gull
- Herring Gull
- Ring-billed Gull
- Franklin's Gull
- Bonaparte's Gull
- Forster's Tern
- Common Tern
- Caspian Tern
- Black Tern

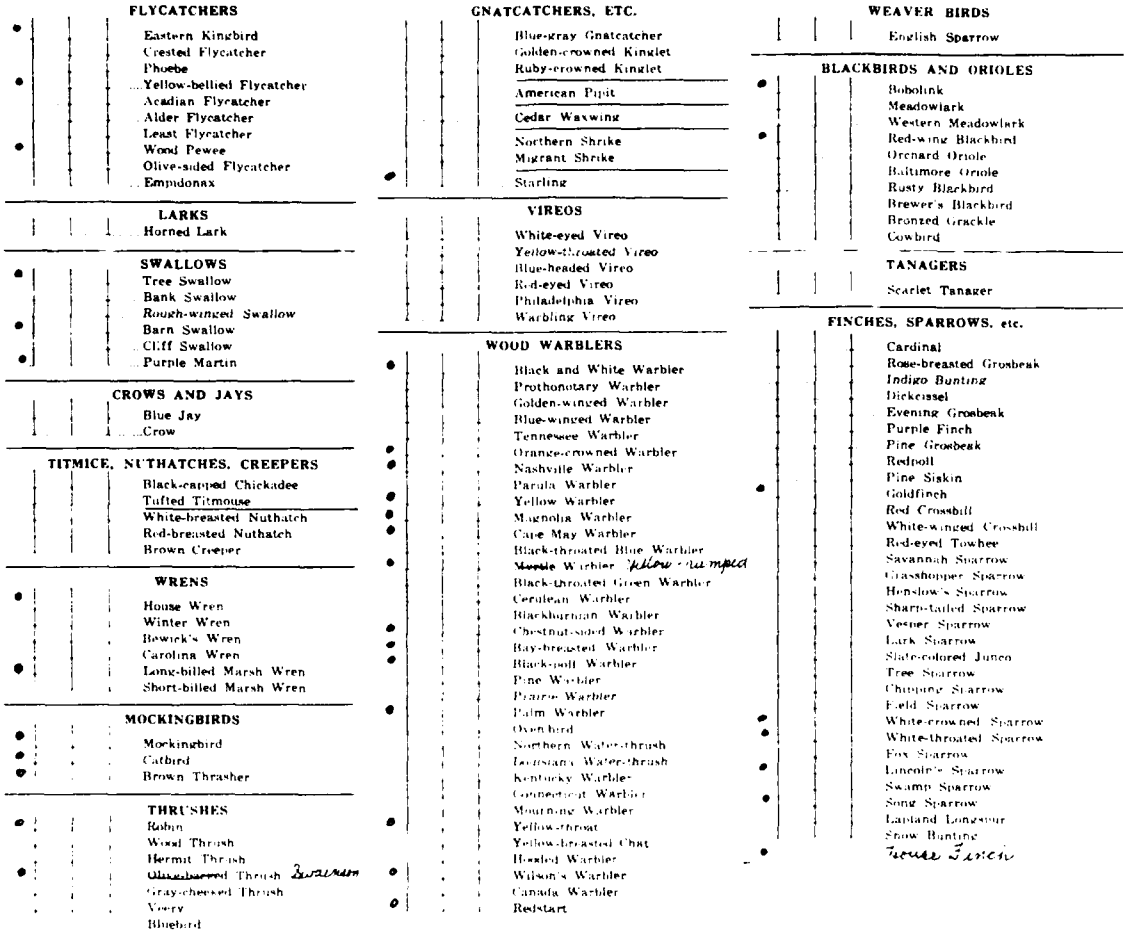
DOVES AND PIGEONS
- Rock Dove
- Mourning Dove

CUCKOOS
- Yellow-billed Cuckoo
- Black-billed Cuckoo

OWLS
- Barn Owl
- Screech Owl
- Great Horned Owl
- Snowy Owl
- Barred Owl
- Long-eared Owl
- Short-eared Owl
- Saw-whet Owl

GOATSUCKERS, ETC.
- Whip-poor-will
- Nighthawk
- Chimney Swift
- Ruby-throated Hummingbird
- Belted Kingfisher

WOODPECKERS
- Flicker
- Red-bellied Woodpecker
- Red-headed Woodpecker
- Yellow-bellied Sapsucker
- Hairy Woodpecker
- Downy Woodpecker



FLYCATCHERS
- Eastern Kingbird
- Crested Flycatcher
- Phoebe
- Yellow-bellied Flycatcher
- Acadian Flycatcher
- Alder Flycatcher
- Least Flycatcher
- Wood Pewee
- Olive-sided Flycatcher
- Empidonax

LARKS
- Horned Lark

SWALLOWS
- Tree Swallow
- Bank Swallow
- *Rough-winged Swallow*
- Barn Swallow
- Cliff Swallow
- Purple Martin

CROWS AND JAYS
- Blue Jay
- Crow

TITMICE, NUTHATCHES, CREEPERS
- Black-capped Chickadee
- Tufted Titmouse
- White-breasted Nuthatch
- Red-breasted Nuthatch
- Brown Creeper

WRENS
- House Wren
- Winter Wren
- Bewick's Wren
- Carolina Wren
- Long-billed Marsh Wren
- Short-billed Marsh Wren

MOCKINGBIRDS
- Mockingbird
- Catbird
- Brown Thrasher

THRUSHES
- Robin
- Wood Thrush
- Hermit Thrush
- ~~Olive-backed~~ Thrush Swainson
- Gray-cheeked Thrush
- Veery
- Bluebird

GNATCATCHERS, ETC.
- Blue-gray Gnatcatcher
- Golden-crowned Kinglet
- Ruby-crowned Kinglet
- American Pipit
- Cedar Waxwing
- Northern Shrike
- Migrant Shrike
- Starling

VIREOS
- White-eyed Vireo
- *Yellow-throated Vireo*
- Blue-headed Vireo
- Red-eyed Vireo
- Philadelphia Vireo
- Warbling Vireo

WOOD WARBLERS
- Black and White Warbler
- Prothonotary Warbler
- Golden-winged Warbler
- Blue-winged Warbler
- Tennessee Warbler
- Orange-crowned Warbler
- Nashville Warbler
- Parula Warbler
- Yellow Warbler
- Magnolia Warbler
- Cape May Warbler
- Black-throated Blue Warbler
- ~~Myrtle~~ Warbler Yellow-rumped
- Black-throated Green Warbler
- Cerulean Warbler
- Blackburnian Warbler
- Chestnut-sided Warbler
- Bay-breasted Warbler
- Black-poll Warbler
- Pine Warbler
- *Prairie Warbler*
- Palm Warbler
- Ovenbird
- Northern Water-thrush
- *Louisiana Water-thrush*
- Kentucky Warbler
- Connecticut Warbler
- Mourning Warbler
- Yellow-throat
- Yellow-breasted Chat
- Hooded Warbler
- Wilson's Warbler
- Canada Warbler
- Redstart

WEAVER BIRDS
- English Sparrow

BLACKBIRDS AND ORIOLES
- Bobolink
- Meadowlark
- Western Meadowlark
- Red-wing Blackbird
- Orchard Oriole
- Baltimore Oriole
- Rusty Blackbird
- Brewer's Blackbird
- Bronzed Grackle
- Cowbird

TANAGERS
- Scarlet Tanager

FINCHES, SPARROWS, etc.
- Cardinal
- Rose-breasted Grosbeak
- *Indigo Bunting*
- Dickcissel
- Evening Grosbeak
- Purple Finch
- *Pine Grosbeak*
- Redpoll
- Pine Siskin
- Goldfinch
- *Red Crossbill*
- White-winged Crossbill
- Red-eyed Towhee
- Savannah Sparrow
- Grasshopper Sparrow
- Henslow's Sparrow
- Sharp-tailed Sparrow
- Vesper Sparrow
- Lark Sparrow
- Slate-colored Junco
- Tree Sparrow
- Chipping Sparrow
- Field Sparrow
- White-crowned Sparrow
- White-throated Sparrow
- Fox Sparrow
- Lincoln's Sparrow
- Swamp Sparrow
- Song Sparrow
- Lapland Longspur
- Snow Bunting
- Tree Swallow

FIELD NOTES

Total Species:

Individuals:

APPENDIX E
SAGINAW, MI, CDF BOTULISM CONTROL MANAGEMENT PLAN
(Includes an excerpt from the 1982 Saginaw CDF Operations Manual referring to botulism control.)

CONFINED DISPOSAL FACILITY
BOTULISM CONTROL MANAGEMENT PLAN
SAGINAW, MICHIGAN
JANUARY, 1982

I. DATA GATHERING PHASE

Saginaw Bay CDF Monitoring Plan

1. Site visits: Once per 2 weeks starting when temperatures reach the mid-60's (around 15 April). Once per week starting mid-June.

2. Monitoring team will consist of at least one person from the Corps and one person from the Michigan Department of Natural Resources (MDNR).

3. Corps will provide boat.

4. Corps will provide instruments to measure temperature and dissolved oxygen (DO).

5. Personnel will walk the perimeter of at least the north dike.

6. Measurements of temperature and DO will be made of any accessible ponded water.

7. Inspectors should indicate on map of CDF (using a new map every week):

   a) Locations of birds:

      1. Numbers & types (species) estimated.

      2. Conditions of birds.

   b) Note on map: mud areas, ponded water, mud crack areas, dry-firm areas.

   c) Note on map: areas with vegetation.

   d) Other general comments should be written at bottom of map or attached, including climate conditions.

8. Inspectors will take 12 photos each trip showing general condition of the facility.

II. REACTION PHASE

Saginaw Bay CDF Immediate Response Plan

1. If the monitoring team reports sick or dead birds or other individuals report sick or dead birds, the Corps and MDNR will react immediately.

2. Initial contacts are Stanley R. Jacek, Corps of Engineers (313-226-6796) and Daniel Morgan, MDNR 8-253-3930 (517-373-3930).

3a. Sick and dead birds collected will be provided to the MDNR field representative, and MDNR laboratories will make the determination of whether or not botulism is present in the affected birds.

3b. Response will include an increase in field visits to two or more times per week to remove dead birds.

4. If botulism is found by the MDNR to be the problem, exploders will be put into operation - up to nine on the north cell dike. (If more exploders are needed, borrow from FWS, and purchase more).

5. Experiments with placement of imitation snow owls on rafts will be accomplished. Owls to be provided by the MDNR Roscommon Office.

6. Additionally, a determination would be made as to whether or not operational changes should be made as a response. These changes could include:

a. Stopping dredging.

b. Pumping more fresh water after each dredge load discharge.

III. LONG-RANGE OPERATIONAL PHASE

Saginaw Bay CDF Operational Plan

This plan is predicated on the knowledge that water management practices within the disposal site are the key to the successful control of the toxin-producing bacteria.

This plan includes the following:

1. Date of Material Placement

a. Place material into the CDF as late in the year as practicable. Cold weather (less than 68^{o} F) inhibits production of the toxin. Not discharging into the CDF will keep sediments dry, thus inhibiting bacterial growth.

b. Fall material placement has an added advantage of holding back the protein substitute (organics in the dredge material which the bacteria need) until after it is too late in the year for the bacteria to grow.

2. Planned Distribution of Dredged Material Within the Dikes

a. Place material directly into the low areas (presently on the east side) during dredging operations. This would allow the mud flats to dry out, and keep a water layer over the most recently placed material.

b. Movement of material after initial dredge placement by use of small hydraulic dredge placed within CDF.

3. Drying of Sediments Within the CDF

a. Evaporative drying will remove water from the upper few inches of dredged material by capillary resupply of the soil, resulting in crust formation. This aids precipitation runoff via desiccation cracks.

b. Good surface drainage, rapidly removing precipitation and preventing ponding of surface water, accelerates evaporative drying. The most efficient method of promoting good surface drainage is by constructing drainage trenches in the disposal area.*

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* EM 1110-2-5007 18 Dec 1978.

c. A dragline could be used to form a perimeter trench, 12 to 15 ft inside the dike, 6 to 8 ft wide, and 12 to 24 in. deep. Operations would normally begin at the weir, digging a sump, extending into the disposal area using maximum boom and bucket reach. Because the material is already piled to the top of the weir, at Saginaw, it would probably be best to allow it to drain to the east side into the existing pool, and pump that pool down to lake level if necessary. The excavated material would be cast on the interior slope of the perimeter dike.

d. Interior drainage via drainage trenches should be initiated when perimeter trenching decreases fluid consistency of dredged material below the thin drying skin to allow trench construction to a significant depth, and support capacity of the soil allows conventional low ground pressure construction equipment to enter the disposal area to construct the trenches.

e. After the above trenching has dried the top dike crust out sufficiently, a conventional dragline may be placed in the CDF on mats and trenching may take place at 4-month intervals.

f. Once a crust of 25 in. is achieved a small dragline may be able to operate with mats.

4. Surface trenching and drying not only decrease the chance for botulism, but help prevent mosquito problems, and firm up the soil for future use of the facility. Drying the sediments also increases CDF capacity. On a large-scale basis, costs of creating disposal volume by progressive surface trenching range from $\$0.10/yd^3$ to $\$0.30/yd^3$ (1977 dollars).*

IV. STUDY PHASE

1. Use of consultants to provide recommendations on dike management to minimize botulism outbreaks.

a. WES - Presently we have contacted the US Army Engineer Waterways Experiment Station (WES) at Vicksburg, MS. A representative from WES is scheduled to make a site visit to Saginaw in April. This site visit will provide the basis for immediate advice and a longer range study of disposal area management to minimize outbreaks of botulism.

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* Technical Report EL-81-11, Dec 1981, pg 137.

EXCERPT FROM:
OPERATION AND MAINTENANCE MANUAL
SAGINAW RIVER CONFINED DISPOSAL FACILITY
LAKE HURON, MICHIGAN
1982

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

* This portion of the original text has been reproduced here as pp E8-E9.

27. BOTULISM CONTROL

a. General - Botulism poisoning occurs as a result of ingestion of toxin produced by the bacterium *Clostridium botulinum.* The conditions for growth are simply: warm temperature, animal protein food supply, and high moisture content or water.

There are now six known types of botulism, each type designated by a letter (A-F) but all are strains of the same bacterium. Type C is responsible for most waterfowl mortalities. Types A, B, E, and F affect humans while D affects cattle. Type E, in addition to causing human disease, also causes losses of some water-associated birds in the Great Lakes area.*

Perched ponds and mud flats with warm stagnant water and dead fish or invertebrates brought up with dredged material facilitate botulism and should be avoided. The most effective method of preventing botulism is to manage the CDF with the objective of drying the dredged sediments, and to maintain close surveillance of the CDF during periods of high potential for botulism.

b. Botulism Surveillance Period - If mud flats are present, botulism can occur when temperatures reach the mid 60s. Therefore, inspections of the CDF should be made periodically between 15 June and 31 October. Between 15 June and 1 August inspections should be made at least once every 2 weeks. During the most critical botulism season, 1 August thru 31 October, inspections should be made at least once per week. Botulism sickness in waterfowl can be identified by the following symptoms which are a result of the extent to which the central nervous system is paralyzed:

(1) The bird is unable to fly but may still be able to swim or walk.

(2) The bird can only sit, or flop on the ground, often not even being able to raise its head. In this case the bird will die from lack of food and water but could survive if given fresh water and protected from direct sunlight and predators.

If dead or sick ducks are found in the facility, the following actions should be taken immediately:

(1) Contact Mr. Don Bilmaier, Chief, Operations and Maintenance Branch, 313-226-6796, who will contact the MDNR field representative.

(2) Bury all carcasses immediately, or place carcasses in plastic bags and remove from the site. (A single decomposing carcass (animal, fish, or bird) can produce enough botulism-infected maggots to kill many waterfowl.)

(3) Sick birds collected shall be given water and provided to the MDNR field representative for determination of whether or not botulism is present in the affected birds.

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* Resources Agency of California. 1971. "Waterfowl Botulism Management," Wildlife Management Leaflet No. 14, Sacramento, CA.

c. If botulism is found to be the problem, the Chief, Operations and Maintenance Branch will direct the appropriate response in accordance with the Detroit District "Botulism Control Management Plan" prepared for the Saginaw CDF.