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Appendix 1

Notes on conducting waterfowl breeding population surveys in the north central states

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Introduction

This manual* will serve as a guide for planning, conducting, and reporting waterfowl breeding population and production surveys on the various kinds of waterfowl habitat used by prairie nesting ducks. Techniques for surveys of pothole habitat differ in some respects from those for lakes and marshes.

Decisions about some problems, such as whether groups of pairs and/or males are "breeding" birds, depends partly upon the observer's objectives and the size of the habitat block surveyed. The rather arbitrary rules outlined here can be modified to meet special conditions.

A standard set of numbered forms is available for field use and reporting (see p. 250 to 254). The item numbers and data categories listed under the section Data Recorded in this manual correspond to items on the forms.

I Sample selection

Considering objectives,

A. Decide on the sampling level to be used:

(1) Complete count of entire habitat unit (marsh, lake, or pothole block).

(2) Partial sampling of unit to provide trend data (an index).

(3) Random sampling, samples drawn from unit; preferably stratified. Confidence limits may be placed on estimates.

If a complete count is made at intervals (say 3 to 5 years), partial sampling may be projected to give a reasonable estimate of the total. Variation in samples will give some idea of the magnitude of error which may be present.

"Expert" advice will be needed to devise a random sampling plan in complex habitat where stratification may be desirable.

B. Select the samples to be counted; they may be individual water bodies, shore line segments and blocks of marsh, or blocks of pothole habitat.

*I have freely used information and techniques and data recording from Fish and Wildlife Service, Canadian Wildlife Service, provincial, and state sources in preparing this manual.

Transects may be used in pothole habitat to estimate the population of a larger habitat unit. Stratified, randomly selected samples are taken to give the degree of accuracy required (preliminary surveys may be needed first to determine variability).

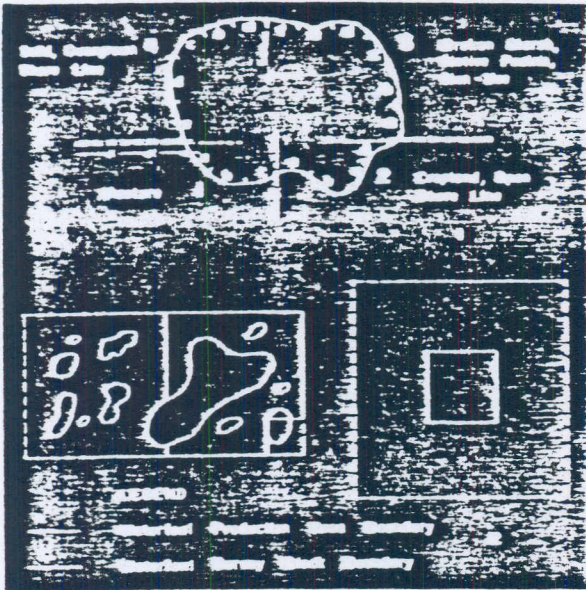
Comparisons between sample units may be desired (1) to compare different existing environments, or (2) to measure results of existing or future management practices.

As far as practical, sample boundaries should be drawn on large water bodies to separate different types of shore line (open, wave-swept; over-grown; attractive broken marsh), different marsh conditions, channels, ditches, etc. Boundaries may also separate different land uses, kinds of nesting cover, or other upland characteristics. Permanent landmarks may be used or artificial markers set out. Since location and shape of shore lines will change with varying water levels, sample boundaries should be drawn so these changes will not lead to future confusion.

For random sampling, shore line segments, sections of marsh, or pothole blocks should be tabulated in units of equal length or size. Shore lines may be tabulated in one-sixteenth mile (330 feet) or one-eighth mile (660 feet) segments; marshes in 40-acre plots (or multiples or fractions of 40 acres). Pothole habitat samples should also lend themselves to easy conversion to a "per-square-mile" analysis.

In many cases, waterfowl production areas should be blocked off to include surrounding pothole habitat on private land. This will permit better evaluation of both productivity and local habitat conditions. These units would have a minimum size of 160 acres; larger blocks will usually be needed for an adequate sample (320, 640 acres).

C. Maps should be prepared showing the sample boundaries and other location data which a new observer would need to duplicate exactly the sample counting. Scales of 4 inches=1 mile are the most practical; aerial photos to this scale.



Examples of sampling units (1) Large marsh or water body; (2) Waterfowl production area.

Note: Samples No. 1 to 4 are tabulated separately. Segments a, b, c, d would not ordinarily be used unless random sampling was considered. In the latter case the marsh water area would be divided into equal-sized units by a numbered grid system.

are available at U.S.D.A. and most Bureau offices. For some purposes, a larger scale may be needed. Habitat and wildlife information can be placed on copies used in the field (transferred to office copies when desired).

Aerial mosaics, upon which sample boundaries and numbers are sketched, provide satisfactory field-sized maps when reduced in size through photography. These are especially useful for units several thousand acres in size.

Items under Pothole transect maps (below) may be worth noting in preparation of maps for large water bodies. See examples of sampling units above and on page 248.

Pothole transect maps

(1) Draw maps, scale 4 inches to 1 mile, from aerial photograph: one-eighth mile on each side of section line road=one-quarter mile total width (they should extend slightly wider than this to show landmarks and water bodies lying outside the transect boundary).

(2) Show all depressions capable of holding water.

(3) Draw lines one-eighth mile from road to show potholes and portions of them within and outside the transect boundary. Portions outside may be shaded.

(4) Number all potholes (see Data recorded,

items (i) and (ii). Number each mile segment, i.e., mile 1, mile 2 . . . mile 8.

(5) During first field inspection mark "X" in or near those potholes not visible from the road.

(6) Show all section lines, trails, and other landmarks.

(7) Show any drainage completed prior to or during survey period.

(8) Show land-use boundaries and enter use symbols during initial survey. Indicate later changes and dates. See Data recorded section for land-use code and symbols, use modified keys.

(9) Water body record:

(a) Colour dry areas red, or if not completely dry, show the location of water boundary in blue as accurately as possible. Water acreage may be obtained from this later in the office.

(b) Emergent marsh vegetation may be shown in green or by cross hatching in large potholes.

(10) Habitat and wildlife information may be placed on field maps if a new map is used each time transect is run.

(11) See Appendix i, p. 249 for mapping details and data tabulation of water bodies on transect or block boundaries.

II Counting methods

Use method necessary to see all birds; goal is a complete count. Methods depend upon water body character; use most rapid and efficient method, but emphasize accuracy. Watch where flushed birds alight to avoid duplication. Indicate if dog was used to increase efficiency.

A. Walk/wade. Usually the most efficient, universal method.

(1) Move downwind with sun at back, if possible.

(2) Zig-zag in heavy cover.

(3) Shout, clap hands, throw stones as aid in heavy cover.

(4) Splashing noise made by wading is very effective.

(5) Walk through all potholes and marshy shore lines where vegetation is apt to conceal birds.

B. Horseback. Probably more efficient than walking if bottoms are not too boggy. Problems of fences and transportation between samples (may need horse trailer).

C. Boats, canoes (with and without motor). Very efficient on open shore lines and with narrow marsh borders where boat can get close to

shore. May also need man on shore if vegetation is tall.

D. Airboats. Efficient, but noisy and windy. Flushes birds at greater distances and may cause problems in recording if birds are numerous.

E. Aircraft. Special techniques required. Same observer and pilot each year, ground/air correlation.

F. Vehicle. Can be used only from elevated shore line and/or where margins are free of vegetation.

G. Marsh vehicle. Probably the most efficient and practical counting method, not yet available on most areas.

III Time of season

Optimum varies between years.

Early nesting species, mallard, pintails, canvasbacks, wood ducks. May 7 to May 17.

Late nesting species, gadwalls, bluewings, redheads, scaup, etc. May 25 to June 7.

Very delayed seasons. May need to delay all counts by a week to 10 days.

Late migrating flocks. When loose flocks of birds occur, or birds which appear to be "unsettled" (these will normally all be paired) it is advisable to make an additional inspection of the localities where these birds were seen to determine whether they remained to nest or moved on elsewhere; e.g. gadwalls, redheads quite frequently.

Non-breeding flocks. Often loose flocks of pairs as with late migrating flocks. Later inspection of localities recommended. Coots may delay nesting beyond the normal dates, responding to new flooding or unknown factors, or may not nest at all. In drought years, it has been impractical to determine what the status of many birds has been.

Frequent count. Where a better estimate of breeding population in a local area is desired, counts may be made at approximately weekly intervals. Often the count for each species becomes rather stable for 2-3 weeks in its early nesting period. This level is assumed to represent the breeding population.

Some workers have used the highest count for each species during its early nesting period. Stewart and Kantrud accept only pairs or males which display behaviour commonly accepted to be characteristic of birds in their home range, e.g., pre-nesting activity, waiting site activity, characteristic calls and flight patterns.

Conclusion. No practical, exact method is available for extensive surveys, since ducks are quite mobile. One of the above will meet the objectives of most survey plans.

IV Time of day

General marsh and pothole habitat. Count throughout the day. If duck pairs are apt to be out of sight in nesting habitat (during laying period), do not count before 9 a.m. Avoid late afternoon on large marshes.

Specific sites and water bodies used as take-off point for nesting. Examples: Artificial potholes, ditches. Count between 6 a.m. and 9 a.m.

Diving ducks in large marshes can usually be counted more readily in afternoons than in mornings (when they remain closer to nesting cover).

V Weather

Wind. Birds move to protected areas, less apt to be on open water of pond. Harder to flush, noise of observer less effective.

Cloud cover reduces visibility.

Rain. Disagreeable, pair counting usually less efficient; avoid counting in rain, if practical.

In general, need avoid only extreme weather conditions.

VI Equipment needs

A. Hip boots a necessity.

B. Tally "whacker" an advantage on marshes and boat runs.

C. Field glasses.

D. Pencils (lead, red, blue, green).

E. Forms, maps, clipboard, field notebook.

F. This Manual, or pocket-sized notes with instructions and codes.

VII Special counting problems

A. Avoid duplication. To avoid duplication when birds fly from one sample to another, or from a group of potholes being counted to a group not yet counted:

(1) Count pothole habitat in belts, keeping track of birds which fly ahead and alight within the uncounted segment (these may depart within a short time, so observer must be alert to this possibility).

(2) Allow several hours to intervene before counting adjoining belts or samples if difficult problems arise. During morning hours pairs and lone males are more apt to return quickly to their usual waiting site and "territory".

(3) Count adjoining problem samples on successive days, the same time each day.

B. Unequal sex ratios. Extra drakes more apt to be found on larger marshes than on pothole habitat. For intensive studies, pre-nesting season sex ratio counts should be made, with corrections applied for the extra drakes.

See VIII D. (p. 247-248) for treatment of male flocks. The method for large marshes will correct for most extra drakes.

C. Safety precautions:

(1) Flashing lights if vehicles parked on shoulder. Avoid road-side parking if possible.

(2) Use extreme care when approaching blind hills with slow-moving vehicle.

(3) Park off the road.

(4) Use life belts in boats.

VIII Data recorded

Suggestions. Do not take more than the day's observations into the field. Files for storage of notes and records in vehicles are satisfactory. Very desirable to summarize data at end of each day. Keep duplicate records of important data at two places. (Wildlife Techniques Manual!).

Note: Item numbers below are used on all data forms.

A. General record data

(1) Numbering. In pothole habitat it is necessary to assign a number to each water body. It may be convenient to set up a numbering system for other wetland blocks: WPA's, easements, or other block of habitat. The water area numbers should be indicated on maps for field use and on permanent maps filed at the office (e.g., in Inventory Plan).

A file of numbers or record sheets in numerical order, giving details of location, may also be useful for reference.

At Lostwood our numbering sequence begins at No. 1 for each section of land (square mile); the section number, township, and range must also be entered for each record sheet used. We use this pattern of number assignment:



(begin No. 1 in NW quarter, continue counter-clockwise through each quarter-section).

Numbers will be in two item classes:

(i) Individual water body. Pool or unit or refuge. Waterfowl production area. Waterfowl production area block. Other water area or management or survey block. Transect and transect segment.

(ii) Samples and sub-samples of units listed under (i) above, i.e.: Unit 8 on Des Lacs Refuge would have several samples and sub-samples with numbers listed under item ii. A WPA block with an assigned number would have several potholes with numbers listed under item ii. Large potholes on a WPA block may also have sub-sample numbers.

In any case where chance for confusion exists always include a descriptive term, e.g., pothole 5, unit 8, WPA 97, Block 6, Transect 2. The name and location, locality data will then complete the identification.

Each district or refuge will establish its own numbering system.

(2) Name. Enter name whenever acceptable local or official name is available, e.g., Chase Lake, Des Lacs Refuge. On most refuges the pools (units) have been assigned numbers, some have names only, some have both. It will save much time if numbers are used for pools, and also tend to help avoid confusion. In the numbering naming system it is well to remember that new faces appear regularly on the refuges and survey jobs and one should take all steps necessary to avoid confusion (and error), even if it means duplication of entries. If unit number was entered under item (1), it should also be entered under (2); e.g., 332 unit, or Pool 7.

(3) Locality, location. In some cases two entries are needed:

Locality: country, state, province, wetland district, county, or smaller division, as needed.

Location: Legal land description (section, part of section (NW quarter NE quarter), township, range), distance and directions from recognized land-marks. Locations by reference to grazing unit or agricultural unit numbers are very poor; these are periodically revised and the files destroyed, leaving no permanent record of what these numbers mean. Odometer mileage often used on road transects.

For transects enter district name and number, as listed below; also enter county and location.

of starting point at east end of transect (use section on north side of first mile segment (SE corner Section—; TWP—; R—).

District Number	District Name
I	Tewaukon
II	Arrowwood
III	Devils Lake
IV	Slade
V	Snake Creek
VI	Crosby
VII	North Central (Upper Souris, Lostwood, Lower Souris, Mountrail, NW Ward, Renville, Bottineau, North McHenry Counties)

(4) Date. Mo.— Day— 19—. Forms are provided with this format if space permits. Always use this sequence and enter abbreviation for month if there is room (even though it lends a continental flavour to reverse the order). Never start records or field notes on any form or slip of paper without first recording the year (and date complete).

Some forms may be used in two ways . . . a) all entries per page made on the same date, or b) entries scattered over several dates. On these there are two spaces for date entries.

(5) *Geological strata (from U.S.G.S. Map 1-331).

Glacial Lake deposits	GL
End or marginal moraine	EM
Ground moraine	GM
Stagnation or collapse moraine	SCM
Outwash, inwash, or terrace	OIT
Ice-contact stratified drift	ISD
Unglaciaded	U

For transects enter major geological type:

C	Coteau (stagnation, collapse and end moraines). High relief.
D	Drift prairies (ground moraine). Low relief.
L	Glacial lake deposits.
OIT	Outwash, inwash, or terrace.
U	Unglaciaded.

(6) Degree Block. Enter latitude and longitude block within which transect or water area is located.

(7) Map reference number. For use by district or refuge maintaining a map file as part of the inventory plan.

*This and some other categories do not appear on forms; they are defined here for future consideration.

(8) Photo reference numbers. File numbers of prints or negatives of the water area or sample.

(9) Standard counting method. Enter one or more of the following methods on data form, with additional details as needed so that (with maps prepared) a new observer can duplicate the survey procedure. Details of method should be included in the refuge or district inventory plan for each sample.

Indicate if dog was used to increase efficiency.

- A. Walk/wade (beat-out).
- B. Horseback.
- C. Boat, canoe (with or without motor to be indicated).
- D. Airboat.
- E. Aircraft.
- F. Vehicle (indicate kind, e.g., passenger or truck).
- G. Observation point (if used, should be located on map).
- H. Marsh vehicle.

(10) Observer(s). Last name(s) and initials.

(11) Number. As used for samples or sub-samples. See item (1).

For transects—each pothole will be numbered consecutively by mile, using mile number of transect segment. Use a separate number series, starting with number 1, for each mile segment. Number from east to west. See Map Section (p. 238-239).

(12) Time. Enter start, end, and total as applicable. Use 24-hour-clock time, e.g., 3:15 p.m.—1515 hours. Enter for each page.

(13) Weather. Enter wind (miles per hour), estimated temperature, and cloud cover symbol. (Example: 8-12; 72°; ○)

Wind, m.p.h.	International description	Specifications
Less than 1	Calm	Calm, smoke rises vertically.
1-3	Light air	Direction of wind shown by smoke drift, but not by wind vanes.
4-7	Light breeze	Wind felt on face; leaves rustle, ordinary vane moved by wind.
8-12	Gentle breeze	Leaves and small twigs in constant motion; wind extends light flag.

13-18	Moderate	Raises dust, loose paper, small branches are moved.
19-24	Fresh	Small trees in leaf begin to sway; crested wavelets form on inland waters.
25-31	Strong	Large branches in motion whistling heard in telegraph wires; umbrellas used with difficulty.
32-38	Near gale	Whole trees in motion; inconvenience felt walking against wind.
39-46	Gale	Breaks twigs off trees; generally impedes progress.

Cloud cover symbols

- clear
- ◐ 1/4 of sky covered
- ◑ 1/2 of sky covered
- ◒ 3/4 of sky covered
- sky completely covered

B. Ecological data—water body description.

(14) Classification (type).

14.1) Wetland type from Classification of the Wetlands of the U.S., Spec. Sci. Rpt. 20., U.S.D.I., Fish and Wildl. Service, 1953.

14.2) Wetland type (Stewart and Kantrud)

See the 1965 Progress Report for description of a proposed revision of pothole type classification. If accepted for general use this will replace the standard type classes.

Standard wetland types

I. Seasonally flooded basins or flats.

III. Shallow fresh marshes, often covered with as much as 6 inches of water. (I believe *Carex* and whitetop sloughs are commonly classed here, in which case they commonly have 18 to 24 inches of water in the spring).

IV. Deep fresh marshes. Soil covered with 0.5 to 3 feet of water during the growing season. Vegetation mainly cattails, phragmites, round-stemmed bulrushes, submerged aquatics.

V. Open fresh water. Water of variable depth. Vegetation mainly at depths less than 6 feet and consisting of submerged aquatics.

X. Saline marshes. Often with as much as 2 feet of water, mostly in shallow lake basins. Vegetation mainly of alkali or hardstem bulrush, often with wigeongrass or sago pondweed in openings.

XI. Open saline water. Water of variable depth. Vegetation mainly at depths less than 6 feet. Sago pondweed, wigeongrass, and muskgrasses.

Wetland type additions suggested by the Central Flyway Waterfowl Council Technical Committee:

XXI. Dugouts.

XXII. Stockponds.

XXIII. Deep lakes and reservoirs.

XXIV. Permanent deep rivers and streams.

XXV. Intermittent streams that normally contain pools of possible significance for waterfowl use.

Note: The above classification would be based upon fairly long-time trends, as far as possible. It is recognized that drought and a superabundance of water can change the character of any water body, as far as depth is concerned. While deep flooding may destroy the previous vegetative types and drought may completely change the plant succession, these changes should be recorded elsewhere. Do not change the wetland type classification, once it is believed to be correctly recorded on a long-time basis. Generally speaking, this has been determined by examination of aerial maps and field checks during the 1947-64 period.

15.1) Basin size. This is the basin acreage to the high water line (below the buckrush zone, usually through the sedge/wet soil plant zone). Will be determined from aerial photos, with ground checks as needed. Use main size class headings below for sizes larger than class 4.4, e.g., 5, 6, 7, 8, etc., except for specific size-class studies (See Table 1).

If automatic data processing will be used, enter acreage (to two decimal places) for both basin size and water surface area.

15.2) Water surface area. Actual acreage of basin covered with water at time of survey. Use size classes from item 15.1. See Maps, p. 238-239. Water area may be coloured blue during field survey. Refer to basin size to aid in estimating.

(16) Water depth. Enter water depth in inches. If water depth is estimated enter an "e" following figure. One or more of several measurements may be made:

16.1) Average.

16.2) Maximum.

16.3) Gauge reading.

Table 1 Round or nearly round water bodies, measured in feet

Code Number	Diameter		Acres		Circumference	
	Range	Midpoint	Range	Midpoint	Range	Midpoint
1.1	0 25	12.5	0.000 0.015	0.003	0 78	39
1.2	26 50	37.5	0.015 0.048	0.025	78 157	118
1.3	51 75	62.5	0.048 0.105	0.070	157 236	196
1.4	76 100	87.5	0.105 0.210	0.138	236 314	274
2.1	101 125	112.5	0.210 0.282	0.228	314 393	353
2.2	126 150	137.5	0.282 0.417	0.341	393 471	432
2.3	151 175	162.5	0.417 0.552	0.476	471 550	511
2.4	176 200	187.5	0.552 0.732	0.634	550 628	589
3.1	201 225	212.5	0.732 0.913	0.814	628 706	668
3.2	226 250	237.5	0.913 1.138	1.017	706 785	746
3.3	251 275	262.5	1.138 1.363	1.242	785 864	825
3.4	276 300	287.5	1.364 1.634	1.490	864 942	903
4.1	301 325	312.5	1.634 1.904	1.761	942 1021	982
4.2	326 350	337.5	1.904 2.220	2.054	1021 1100	1060
4.3	351 375	362.5	2.220 2.536	2.369	1100 1178	1139
4.4	376 400	387.5	2.536 2.896	2.707	1178 1257	1217
5.15	401 450	425	2.896 3.862	3.257	1257 1414	1335
5.35	451 500	475	3.862 4.519	4.068	1414 1571	1492
6.15	501 550	525	4.519 5.465	4.970		1649
6.35	551 600	575	5.465 6.502	5.961		1806
7.15	601 650	625	6.502 7.629	7.043		1964
7.35	651 700	675	7.629 8.846	8.215		2121
8.15	701 750	725	8.846 10.153	9.477		2278

CODE 4.4 (2.896 acres) and less are "Small" potholes.

16.4) Depths indicated by vegetative (aquatic) zone.

16.5) If dry and ecological data have been entered previously this form category has been provided for sample or pothole number.

17.1) Special characters. Enter code number for special characters present.

Code number

- 1 Road borrow pit
- 2 Stock dugout (See type XXI)
- 3 Pond with dam (See type XXII)
- 4 Artificially deepened places in pothole
- 5 Artificial pothole
- 6 Natural island(s)
- 7 Artificial island(s)
- 8 Platforms, nest boxes (specify)
- 9 Rock pile
- 10 Filled with brush, trees, earth
- 11 Drainage construction
- 12 Boating fishing
- 13 Building near (occupied)
- 14 Temporary stream channel (See type XXV)
- 15 Gravel pit
- 16 Hay bales in water area or other artificial loafing sites (specify)
- 17 Floating sedge (+ cattail) mat
- 18 Railroad grade shore line
- 19 . . .

17.2) Kinds of samples.

- 1) Shore line
- 2) Single channel (artificial)
- 3) Double channel (artificial), as road borrow pit
- 4) Natural channel
- 5) Open water
- 6) Marsh
- 7) Mixtures not separated
- 8) Natural potholes
- 9) Artificial potholes, dugouts
- 10) Dam and pond

(18) Shore line description. Applies to large water bodies.

18.1) Shore line length of sample or sub-sample (in feet).

18.15) Shore line conversion factors for narrow water bodies, channels, ditches, and borrow pits. Narrow water bodies and channels have an effective occupancy rate which increases as width increases. At about 250 feet wide, channels have the equivalent of a double shore line (where bluewings are prominent in the species composition).

In measuring "effective" shore line length use these tentative guides:

Channel width (feet)	Correc- tion factor	Channel width (feet)	Double ditches	
			Narrow roads (0-50 ft. wide)	Wide roads (wider than 50 ft.)
Less than 20	0.5	0-19	1.0	1.5
21 to 165	1.0	20-50	1.5	2.0
166 to 247	1.5	51 or greater	2.0	2.0
Greater than 247	2.0			

18.2) Shore line shape. Usually best shown by map; may be expressed as ratio of total shore line length to water body size (see p. 249).

18.3) Shore line contour (slope of bottom):

- 1 Nearly flat
- 2 Gentle slope
- 3 Steep slope

18.4) Shore line character:

- 1 Open, wave-swept shore line
- 2 Solid, overgrown shore line (emergents)
- 3 Broken marsh or zone of open water between shore and emergents
- 4 Combination of 1 + 2
- 5 Combination of 1 + 3
- 6 Combination of 2 + 3

18.5) Shore line soil:

- 1 Bog
- 2 Clay, gumbo
- 3 Gravel
- 4 Mud, muck
- 5 Sand
- 6 Rocky
- 7

18.6) Shore line wooded (a two-number entry):
First number

- 1 Trace, single trees or bushes, small amounts.
- 2 Trace to 0.25 of shore line sample wooded
- 3 0.25 to 0.50
- 4 0.50 to 0.75.
- 5 0.75 to entirely wooded.

Second number. Percentage of overstory. Estimate the percentage of the water which would be screened from view above (as in an aerial photograph) when leaves are out. Code numbers 1 through 10 may be used:

- 1 10% covered
- 2 20% covered . . .
- 10 100% covered

For data processing the estimated percentage will be used.

18.7) Loafing sites for pairs and broods.

- 1 Superior, >48 per mile, ave. 110 feet apart.
- 2 Good, 24-47 per mile, ave. 150 feet apart.
- 3 Average, 18-23 per mile, ave. 260 feet apart.
- 4 Poor, less than 18 per mile, more than 300 feet apart.

18.8) Land use of exact shore line zone (land-water edge). (See item 22).

(19) Emergent vegetation.

19.1) Emergent vegetative pattern for pot-holes. Letter symbols below describe the pattern of marginal (shore line) and central (interior) vegetation. Vegetation matted down might be termed "open". Enter marginal symbol first, followed by that for interior.

Marginal	Interior	Code Number
O = open	O = open	1
O	H = half	2
O	C = closed	3
H = half	O	4
H	H	5
H	C	6
C = closed	O	7
C	H	8
C	C	9

19.2) Marsh character, larger water bodies.

- 1 Open water, no submerged aquatics visible to trace.
- 2 Open water, aquatics trace to 25 per cent.
- 3 Open water, aquatics 26-75 per cent.
- 4 Open water, aquatics 76-100 per cent.
- 5 Broken marsh, emergents trace to 25 per cent of surface.
- 6 Broken marsh, emergents 26-50 per cent.
- 7 Broken marsh, emergents 51-75 per cent.
- 8 Closed marsh, emergents 76-100 per cent.

19.3) Diving duck nesting cover evaluation (redheads or ringnecks).

- 1 No suitable cover.
- 2 Cover suitable in very few restricted sites.
- 3 Barely adequate over small areas.
- 4 Mostly adequate.
- 5 Top quality, good heavy mats of dead and standing vegetation with good interspersions.

19.4) Emergents, kind and per cent. Enter code number(s) to show the vegetative species or group, followed by a percentage estimate of

the total sample water surface covered by emergent vegetation. Species code refers to dominant vegetation.

Species	Code numbers
<i>Carex</i>	1
Whitetop	2
Mixed sedges and grasses	3
Mixed grasses + <i>Polygonum</i>	4
Cattail	5
<i>Eleocharis-Carex</i>	6
Flooded willow and/or aspen	7
<i>Glyceria</i>	8
Hardstem bulrush	9
Prairie bulrush	10
Burreed	11
Phragmites	12
Annual weeds	13
None	14
<i>Eleocharis palustris</i>	15

19.5) Emergents, modification (previous year or prior to survey, if burned)

- 1 Grazing
- 2 Haying or mowing
- 3 Cultivation
- 4 Burning
- 5 Over-ice cutting (specify how)
- 6 Chemicals
- 7 Other

(20) Submerged aquatic vegetation (including algae). Special notes may be recorded on reverse side of forms.

- 1 Filamentous algae abundant
- 2 Suspended algae abundant (especially *Aphanizomenon*)
- 3 Important species present
- 4 Flowering, fruiting

(21) Limnology.

- 1 Physical characteristics (e.g. turbidity)
- 2 Conductivity
- 3 Chemical characteristics
- 4 Aquatic animal life

Note: When water bodies appear to present possible limnological problems or to have value for study purposes, send description and location to Northern Prairie Wildlife Research Center, Jamestown, Attention: Chemist.

C. Ecological data—upland.

(22) Land use. Enter code number of predominant land use surrounding water body. Letter symbols may be used on field maps.

Land use	Code number	(Modified)
Grassland pasture	1	1.1-GI Lightly grazed
Ungrazed grassland	2	1.2-GM Moderately grazed
Wooded pasture	3	1.3-GH Heavily grazed
Ungrazed woodland	4	2 NO Non-use
Hay crops	5	5.1-HW Wild Hay 5.2-HT Tame Hay
Grain crops (small)	6	6 SG Small grain
Stubble	7	7 ST Stubble
Cultivated or plowed	8	8 SF Summer fallow
Corn	9	9 RC Row crop
Other (specify)	10	10 O Other (specify)
Burning (show on map)	11	11 BURN Burned (note when)
Mixed	12	

(23) Nest cover rating, dabblers. For the zone within 100 yards of the pothole give the over-all rating of nest cover abundance and quality (expressed as a density height factor). Consider cover of a quality used by most blue-winged teal for nesting, usually grass or weeds, or mixtures. Enter abundance first, followed by quality, e.g., 4-2. Use two or more entries if "mixed".

23.1) Abundance

Code	Description
1	None to very small amounts.
2	Small amounts to 25 per cent of area in cover.
3	26 to 50 per cent of area in cover.
4	51 to 75 per cent of area in cover.
5	76 to 100 per cent of area in cover.

23.2) Quality

Code	Description
1	Very poor, short, overgrazed; most cropland and hayland. No concealment, except in very scattered clumps. No barrier to animal movement.
2	Density thin and height less than 12 inches. Most of area would offer poor nest concealment and no barrier to animal movement.
3	Moderate density, in clumps or patches. Nests in them would be well hidden, but there will be little barrier to predator animals.
4	Moderate density in fairly solid stands. Nests would be well hidden; would offer a moderate barrier to predator animal movement.
5	Vegetation thick, 12 inches or more tall. Nests would be very well hidden. Vegetation would provide a strong barrier to predator animal travel over most of the area.

(Diving duck nest cover—see item 19.3)

(24) (Not filled)

D. Ecological data—waterfowl breeding population.

All waterfowl are recorded except 1) those flying over the sample or transect and 2) those flying into the sample from outside the sample boundary and landing.

The term "tabulate" is used to designate entries to be classified as breeding birds.

25.1) Species (North Dakota)

AOU number	Map symbol	Species
Common nesting species		
132	Mal.	Mallard
135	Gad.	Gadwall
137	Bal.	(Baldpate) Widgeon
139	GWT	GW teal
140	BWT	BW teal
142	Sho.	Shoveler
143	Pin.	Pintail
146	Red.	Redhead
147	Can.	Canvasback
149	Scp.	Lesser scaup
167	Rud.	Ruddy duck

Rare to uncommon nesting species. Record, but do not tabulate as breeders without evidence of their nesting

133	BLD	Black duck
141	CiT	Cinnamon teal
144	WoD	Wood duck
148	GSc	Greater scaup
151	GEy	Goldeneye
165	SCo	White-winged scoter
150	RNe	Ring-necked duck
131	HoM	Hooded merganser
153	BuH	Bufflehead

25.2) Groups/flocks of ducks. Record all groups and flocks, with size of flock, but tabulate only those indicated below as breeding birds. Pairs—tabulate for all common species, unless in flocks. Gadwalls, etc., still not settled on home ranges appear as loose, scattered flocks—do not tabulate these.

Include diving duck females in small courting parties.

Lone males—tabulate both dabblers and diving ducks.

Lone females—do not tabulate.

Exceptions: (i) diving duck females, if males are not recorded on water bodies nearby (within 0.25 mile). (ii) Special studies, e.g., artificial potholes, where location of female and waiting site may be wanted. Male may be on large marsh. Male groups and groups of males and females. Large study blocks—tabulate as breeders in numbers up to and including five; exclude those over five. Small study areas, e.g., less than 640 acres—do not tabulate male groups of more than two.

Exceptions: (i) baldpates and shovelers; do not tabulate males other than lone males and pairs. (ii) large marshes and lakes where pre-molt gatherings appear. Do not tabulate male groups of more than two. Do not tabulate females and pairs in flocks of males (refer to dabbling ducks).

Diving duck courting parties—tabulate females only.

Dabbling courting (pursuit) flights—males involved (up to 12 at times) may be with females. Care is needed to avoid counting those coming from off the sample or transect. May be necessary to wait until males disperse.

Ducks in field or nesting cover—tabulate, following rules above.

Ducks flying overhead (passing over sample or transect)—do not record or tabulate.

Ducks flying in and landing within sample or transect from outside sample boundary—do not record or tabulate.

Unidentified ducks—enter both as unidentified and also your best guess as to species in body of form. Follow rules above.

25.3) Groups/flocks of coots. Record all groups and flocks, with size of flock, but tabulate only those indicated below as breeding birds: Pairs in nesting habitat—tabulate.

Singles in nesting habitat, mate believed to be hidden in cover—tabulate as a pair.

Flocks (and pairs not associated with nesting habitat)—do not tabulate. Later observation may be needed to determine if they nest.

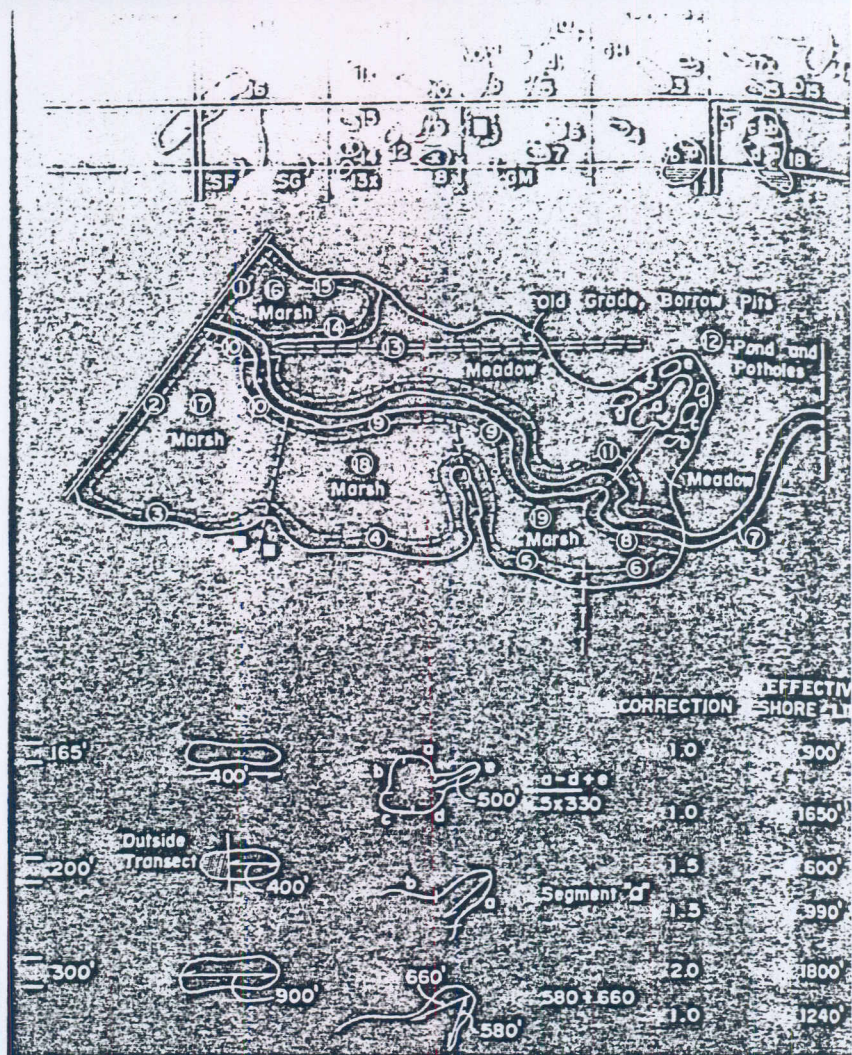
25.4) Canada geese. Tabulate pairs or singles if nest or indicated nest is present. Record all others.

Flocked ducks=Mixed flocks, bottom of Form 4.1.

E. Ecological data—birds.

(26) Other birds. Record other birds of interest, especially if apparently breeding, e.g., rails, upland game, grebes, crows, unusual species.

(27) Nesting records. Fill out nest forms for



all nests of interest, e.g., waterfowl, rails, grebes, short-eared owls, marsh hawks. Determine stage of nesting if time permits and convenient (might use flotation method).

(28) Other wildlife. Record items of interest, especially broods of upland game, predatory animals, big game, etc.

(29) Management recommendations

1. None, marsh and shore line appear satisfactory.
2. Water level should be higher to create an open zone. Estimate how much.
3. Water level should be lower, estimate how much.
4. Vegetation control needed to create loafing sites or feeding zone (or to maintain an open sample for survey purposes, e.g., a brood count).
5. Shore line needs more emergent growth for food and/or cover; needs plantings and/or draw-down.
6. Off-shore marsh vegetation needs control, i.e., it is too dense.
7. Not enough off-shore marsh vegetation; needs drawdown to encourage emergents.
8. Good site for artificial pothole development or shore line improvement by blasting or mechanical means.

- 9 Good site for dam and pond.
- 10 Other (specify).

Appendix i. Method for handling data from water bodies divided by transect or block boundaries.

A. Small water bodies: up to 2,896 acres (through class 4.4).

11) Number	240 (24b)	25a (25b)
14.1) Type	III	III
15.1) Size	2.3	2.3
15.2) Water area	2.1	2.1

All ecological data apply to total pothole. Pair data are recorded for both sub-samples. The sub-sample "b" in parenthesis () pair data are not included in the block total, however. The pair data for the total pothole can be used in additional analysis related to water body size.

B. Large water bodies: 2,896 acres and larger (class 5.1 and up).

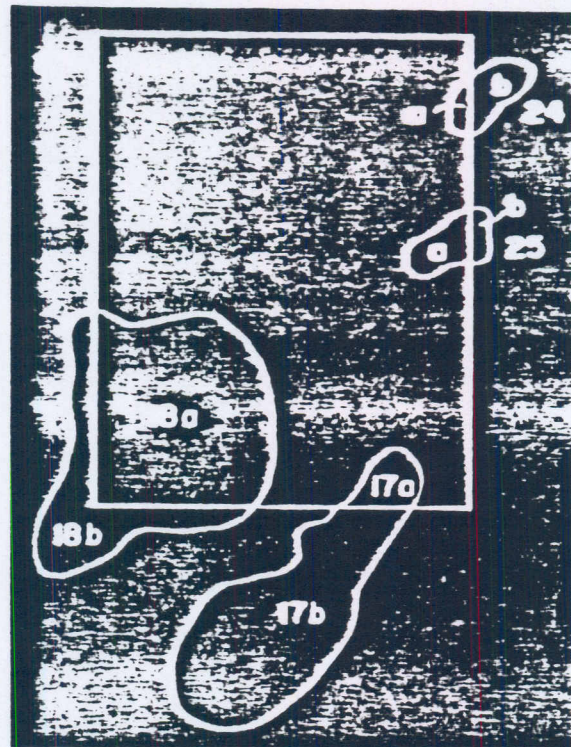
If mostly outside, count only portion inside boundary, e.g., count only 17a. Enter shore line data for 17a on Form 4.1.

If mostly inside, count all, but tabulate sub-samples separately, e.g., count and tabulate 18a and 18b separately. Shore data from both are tabulated, only 18a pair data are included in block total.

For 17a basin size and water area will also be omitted (lines 15.1 and 15.2 of Form 4.1) to avoid chance of recording this as a complete water body. Only shore line data are needed (18.1 to 18.8).

For 17b there will be no entry in Form 4.1.

18a and 18b. There will be a column for each sample. We are primarily interested in the shore line data, but may have use for the other ecological characters (especially for record purposes). Sample 18b may be



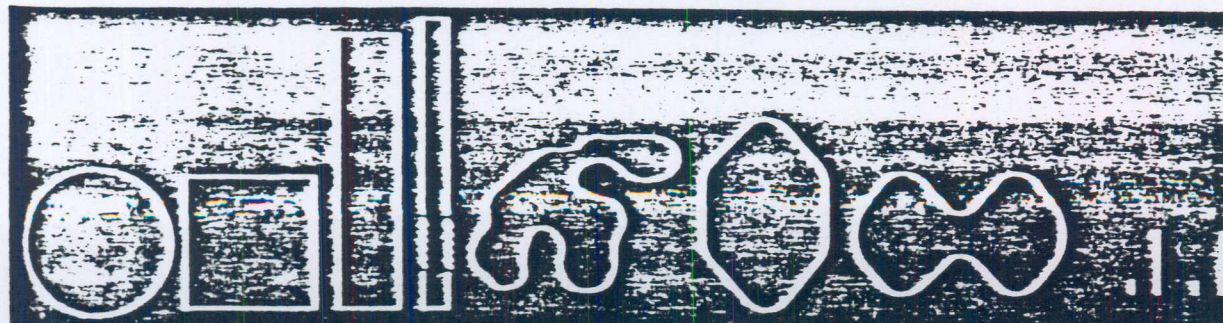
grazed and quite different from 18a (if ungrazed), in which case separate entries would be made in each column. If the other characters are uniform for both samples (e.g., 19.1, emergent pattern) a bracket may be used and entries made as indicated under A (Small water bodies).

Note: Observer has considerable latitude in deciding whether to make a complete count of large water bodies on boundary lines. Generally, unless 75 per cent or 80 per cent of the water body is within the block counted it would be treated as for pothole 17. No data would be collected from the portion outside the block.

Appendix ii. Shore line feet per acre

Code number	Pothole shape	1-acre potholes	10-acre potholes	
1	Round	742	234	
2	Oval	780	260	
3	Square	836	264	
4	Hour glass	930	318	
5	Rectangular	1,072	332	With length = less than 4 times width. In this example, about 4 times.
6	Irregular	1,120	409	
7	Long linear (30 feet or more wide)	2,258	696	With length = 4 or more times width. In this example, 27 times.
8	Long linear (less than 30 feet wide)			No example given.

Pair use expected to fall off as long linear water bodies become more narrow, e.g., especially with narrow ditches. Except for code number 8, shore line per acre increases with increasing code number and regression should occur. No. 8 should possibly be treated separately.



Appendix iii. Waterfowl survey forms

1) No. _____ 3) Locality: _____ Location: _____
 2) Name: _____
 4) Date: _____ 13) Weather: _____ 16.3) Gauge read: _____
 9) Count. Method: _____ 10) Observer: _____

11) Subsample No.
 Date, if not as 4)

Mallard M _____
 F _____
 Pr _____

Gadwall M _____
 F _____
 Pr _____

Baldpate M _____
 F _____
 Pr _____

Pintail M _____
 F _____
 Pr _____

Bluewing M _____
 F _____
 Pr _____

Shoveler M _____
 F _____
 Pr _____

Greenwing M _____
 F _____
 Pr _____

M _____
 F _____
 Pr _____

Total dabblers M _____
 F _____
 Pr _____

Redhead M _____
 F _____
 Pr _____

Canvasback M _____
 F _____
 Pr _____

Ruddy M _____
 F _____
 Pr _____

Scaup M _____
 F _____
 Pr _____

M _____
 F _____
 Pr _____

Total divers M _____
 F _____
 Pr _____

Unid. pairs _____

Total ducks* _____

Coots (birds) _____

*Pairs of ducks; males plus pairs only, indicate if corrected for sex ratios.

POTHOLES

2) Name: _____ 3) Location: _____ 4) Mon: _____ Day _____ Year _____

7) Map No: _____ 8) Photo No: _____ 9) Count Method: _____ 10) Observer(s): _____

12) Time: Start _____, End _____, Total _____ 13) Weather: _____

11) Number								
14.1) Type								
15.1) Basin size								
15.2) Water area								
16.1) Water depth								
16.3) Gauge								
17) Special char								
18.1) Shore length								
18.4) Shore char								
18.5) Shore soil								
18.6) Shore wood								
18.7) Loaf. sites								
18.8) Shore land use								
19.1) Emerg pattern								
19.3) Diving ducks								
19.4) Emerg kind								
19.5) Emerg modif								
22) Land use								
23) Dab. nest cover								
132 Mallard								
135 Gadwall								
137 Widgeon								
139 Greenwing								
140 Bluewing								
142 Shoveler								
143 Pintail								
146 Redhead								
147 Canvasback								
149 Lesser scaup								
167 Ruddy duck								

Total ducks										
Unid. ducks										
Coot pairs										
Flocked coots										
Flock. ducks (mixed)										
Total broods:										
29) Management Recommendations										

Form 4.1

MARSHES

Page _____ of _____

2) Name: _____ 3) Location: _____ 4) Mon. _____ Day _____ Year _____

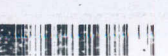
7) Map No: _____ 8) Photo No: _____ 9) Count Method: _____ Observer(s): _____

12) Time: Start _____, End _____, Total _____ 13) Weather: _____

11) Number										
16.3) Gauge										
17.2) Sample kind										
18.1) Shore length										
18.15) Shore conv.										
18.3) Shore contour										
18.4) Shore charac.										
18.5) Shore soil										
18.6) Shore wood										
18.7) Loaf. sites										
18.8) Sh. land use										
19.2) Marsh char.										
19.3) Diving ducks										
19.4) Emerg. kind										
19.5) Emerg. modif.										
22) Land use										
23) Dab. nest cover										
132 Mallard										
135 Gadwall										
137 Widgeon										

Continues same as Form 4.1

Form 4.2



Refuge: _____ Year: _____

Date Sample									Pintail
17.2) Kind									Redhead
18.1) Length									Canvasback
18.4) Char.									Lesser scaup
18.7) Loaf S									Ruddy duck
18.8) Sh. use									
Mallard									
Gadwall									Unid ducks
Widgeon									Coot pairs
Greenwing									29) Mgt. R.
Bluewing									
Shoveler									

Form 1.3

ANNUAL BLOCK BREEDING POPULATION SUMMARY

Year: _____

District or location: _____ State: _____ Observers: _____

Total Pairs in Sample Units (Blocks)

Species	1	2	3	4	5	6	Total
Mallard	_____	_____	_____	_____	_____	_____	_____
Gadwall	_____	_____	_____	_____	_____	_____	_____
Widgeon	_____	_____	_____	_____	_____	_____	_____
Greenwing	_____	_____	_____	_____	_____	_____	_____
Bluewing	_____	_____	_____	_____	_____	_____	_____
Shoveler	_____	_____	_____	_____	_____	_____	_____
Pintail	_____	_____	_____	_____	_____	_____	_____
Dabblers	_____	_____	_____	_____	_____	_____	_____
Redhead	_____	_____	_____	_____	_____	_____	_____
Canvasback	_____	_____	_____	_____	_____	_____	_____
Lesser scaup	_____	_____	_____	_____	_____	_____	_____
Ruddy duck	_____	_____	_____	_____	_____	_____	_____
Divers	_____	_____	_____	_____	_____	_____	_____
Total pairs	_____	_____	_____	_____	_____	_____	_____
Coot pairs	_____	_____	_____	_____	_____	_____	_____

CONDITION OF HABITAT BLOCK—EARLY JUNE

Unit no.	Name	County	Main geol. zone	1	2	3	4	5	6(4/2)	7(5/3)	8
				Total block acres	Water basin acres	Number water bodies	Total water surface	Number of wet water bodies	Per cent of basin acres with water	Per cent of water bodies holding water	Product of 6 X 7
1											
2											
3											
4											
5											
6											
Total											

Prepared by Manager
cc: Area Biologist by June 15
NR Report

Form 4.3

**WATERFOWL BREEDING POPULATION
Sample Unit Summary**

2) Sample Unit Block Name: _____ 3) Location: _____
7) Map Nos.: _____ 8) Photo Nos.: _____ Observers: _____

Maintain a separate form for each WPA breeding population block sampled. Both Manager and Area Biologist will keep a copy. Data obtained from Form 4.3, Annual block breeding population summary.

Species	1st Year	2nd Year	2 year Total	2 year Ave.	3rd Year	3 year Total	3 year Ave.	4th Year	4 year Total	4 year Ave.
Mallard										
Gadwall										
Widgeon										
Greenwing										
Bluewing										
Shoveler										
Pintail										
Dabblers										
Redhead										
Canvasback										
Lesser scaup										
Ruddy duck										
Divers										
Total pairs										
Coot pairs										

Form 4.4