

An Ecological Study of a Mixed Area
on the East Shore of Douglas Lake

by

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A report on an original field study
conducted for Zoology 119 (Advanced
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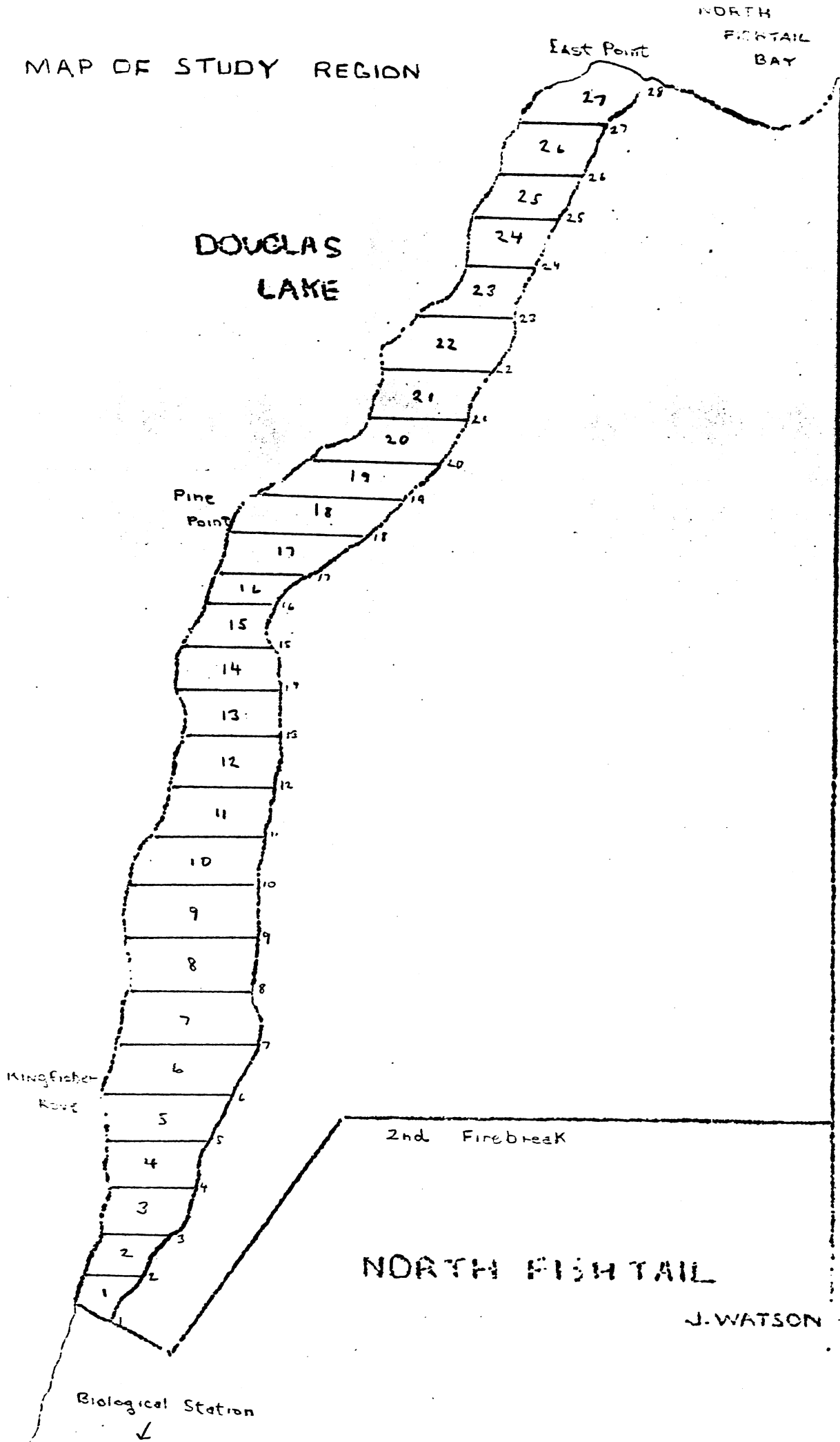
An Ecological Study of a Mixed Area on the East Shore of Douglas Lake

During the summer of 1946, a study was made of the breeding birds of an area located on the east shore of Douglas Lake. The study whose manner was to be ecological, had a three-fold purpose: (1) To determine the breeding bird population, (2) to attempt to correlate this population with the main factors limiting bird distribution and (3) if the above correlation is successful, attempt to analyze the trends in bird succession which occur in the region. The area chosen for the problem was especially appropriate to the purposes since it contained a varied vegetation consisting of five different associates and ecotones.

The study area was located on the east shore of Douglas Lake in Munro Township of Cheboygan County, Michigan. Its shape was linear and its boundaries were Douglas Lake on the west and north, a trail running from the Biological Station to East Point on the east, and a firebreak on the south. The size of the area, determined by means of a planimeter on an aerial map, was 35 acres. The time of the study extended from the 27th of June, when the first preliminary trip was made, to the area, to the 1st of August, when the last visit occurred. A total of 68 hours observation was made; the majority of it occurring in the first three weeks of the study.

The method of the study was that of a plot census of the region. This was done by dividing the area into 27 quadrats. This was done by marking out the east boundary into 50-meter sections and running imaginary lines west to the lake. The quadrats which resulted were not equal in size, ranging from .6 acre to 1.7 acres in size, but they achieved their primary purpose of allowing the position of each bird to be rather carefully plotted. The plotting of the location of the birds

MAP OF STUDY REGION



J. WATSON

was done on a map of the study area. This map was copied from an aerial map of the region and then enlarged until a scale of 1 cm. to 50 m. resulted. A large number of these maps were made by means of a duplicating machine allowing for a new map to be taken into the field each trip.

Since a correlation was to be attempted with the vegetative characteristics of the region, some method had to be used to obtain an idea of the vegetation. The time available for this work was limited so any method which involved actual counting of even a small percentage of the dominant plants was excluded from the beginning. The method which was finally used had as its primary basis the vegetative characteristics which could be seen on an aerial photograph of the region. Immediately discernible from this map were the areas which were open and those which were forested. Regions where edge was present could also be easily located.

Within a forested region however, the process for distinguishing different associations or associates was difficult and in some cases impossible. The pines located on the lake edge could be differentiated from the aspens by means of their darker appearance. The method in the end however, was to visit the area with the aerial photograph and attempt to correlate the photograph with the vegetative characteristics. In this way it was possible to see whether a lighter area meant a less dense region of the same associates or whether it indicated a new associate. When the main vegetative regions had been determined qualitatively a day was spent in the field attempting to obtain some quantitative information. This was done by strip counts in the various associates. The strips were 50 m. long and 2 m. wide and were chosen in a purely random fashion. Every plant above one meter high was counted in seven of these strips, together with information concerning the height and diameter.

The main difficulty in analysing this data resulted from the fact that only a fraction of 1% of the area could be counted. This made it impossible in some cases to tell whether the results were significant or merely a random deviation.

The author is indebted to Dr. S. Charles Kendeigh, under whose direction both the field work and analysis of results was done, for his many helpful criticisms and suggestions as to how the study should progress. To Dr. Theodora Nelson and Miss Peggy Muirhead thanks are due for their advice, given during the course of the summer. Acknowledgements are also due to Prof. Ramsdell for his loan of an aerial map, and to Dr. Paul S. Welch for information on how to use a planimeter. Much of the mapping and tree counting was done with the assistance of Byron Harrell, to whom thanks must also be given.

Ecological Environment

Cheboygan County is in the northern tip of the Lower Peninsula of Michigan. The county, which as a whole, is a plain, is situated in the eastern lake section of the great Central Lowland, a plains area which owes its general details of relief to glacial action. Geologically speaking, the area is comparatively young. The land originally was covered by a dense forest except for a few bogs and swamps which supported a marsh grass, hedge or shrub type of vegetation. The original forest has been so completely logged that only a few areas of virgin forest remain. The larger portion of the cut-over land has been burned over once or twice since the original lumbering. On the more recently burned areas, aspen, red maple, and pin cherry are the most abundant species in the secondary growth. The area under study is no exception,

the last fire in the northern portion of the region occurring in 1901, while the southern portion was burned as recently as 1921.

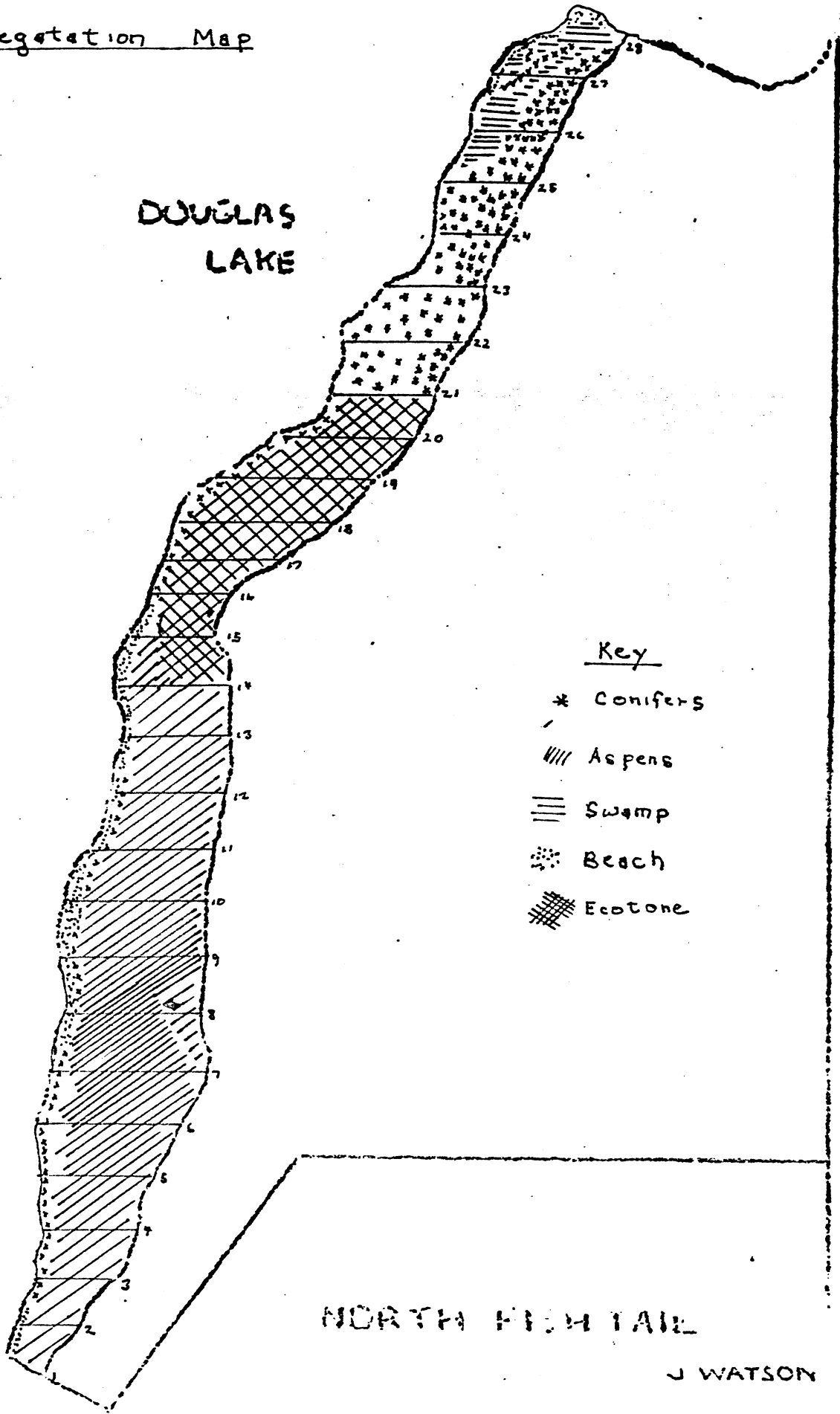
Actual statistics better

The climate of the region, while generally considered temperate, is characterized by long cold winters, short cool summers, mild autumns, and late cold springs. The prevailing winds are westerlies, evaporation is low, while the precipitation averages 28 inches with the least amount occurring in the cooler months. Snowfall is heavy throughout the winter, forming a complete blanket over the region. A short growing season is present, averaging from the first of June to the 15th of September.

Within the study area, five different plant associations^{as} may be located. While their importance within the area varies considerably, they may be easily distinguished from each other. They are (1) a beach association, (2) a Swamp or Beach Pool associates, (3) a Cedar Bog associates, (4) a Red Maple, Aspen, White Pine Ecotone area, and (5) the Aspen associates. Since the area occupied by each of these communities was different, their relative importance in determining the bird population of the entire area varied greatly. The most important association in the area was the Aspen association which occupied over one-half of the total area. Following in importance was the Cedar Bog which included around one-fifth of the region. The Red Maple, Aspen, and White Pine ecotone was of about the same size though its boundaries are not as easily discernible. The remaining two associations did not together total one sixth of the population and so were present in areas too small for accurate analysis or discussion.

In the next few pages, each one of these associates or ecotones will be treated separately to an extent demanded by its effect on the bird

Vegetation Map



DOUGLAS
LAKE

Key

- * Conifers
- //// Aspens
- === Swamp
- ⋯ Beach
- ⊞ Ecotone

NORTH FISH TAIL

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DATE OF CENSUS TRIP	JULY 2	JULY 4	JULY 5	JULY 9	JULY 16	JULY 18	JULY 23	JULY 25	PRE CENSOS
TIME	6.15 11.20	5.15 11.10	5.20 10.30	5.15 10.15	3.30 9.30	3.30 7.30	4.55 6.00	3.50 7.10	
TEMPERATURE									
WEATHER RATING	CLEAR	PARTLY CLOUDY	CLEAR	CLEAR	CLEAR	CLOUDY	FOG	PARTLY CLOUDY	
SPECIES									
LOON									1
GREAT BLUE HERON	2	1			1				
AMERICAN MERGANZER									
SHARP-SHINNED HAWK	1								
BALD EAGLE									1
RUFFED GROUSE	1			1					
KILLDEER			1						
SPOTTED SANDPIPER	3	3	3	2	1	1	0	1	
HERRING GULL									
RING BILLED GULL									
CASPIAN TERN									2
YELLOW BILLED COCKOO			1	1	1				
WHIP-POOR-WILL					1			1	
BELTED KINGFISHER	1	1	1	1	1	1	1	1	
FLICKER	1	2	2	1	2	1	0	2	
HAIRY WOODPECKER	1	0	1	0	1	1	0	1	
DOWNY WOODPECKER	0	0	0	0	1	1	0	0	
CRESTED FLYCATCHER	1	2	2	2	2	2			
WOOD PEWEE	3	2	2	3	3	1	2	2	
ROUGH WINGED SWALLOW	1			1					
PURPLE MARTIN				1		1			
BLUE JAY	2	2	10	2	15	2	1	4	
CROW	4	1	1	4	4				
BLACK CAPPED CHICKADEE	3	2	4	4	3	3	1	3	
WINTER WREN					1			1	
BROWN THRASHER		1	1			1			
WOOD THRUSH			1	1					
CEDAR WAXWING	2	4	1	4	3	2	2	2	
RED EYED VIREO	3	6	4	5	4	3	4	3	
BLACK AND WHITE WARBLER	2	2	2	1	1	2	1	1	
NASHVILLE WARBLER		1		1					

STRIP SPECIES	ASPEN (1)		ASPEN (2)		ASPEN (3)		ASPEN (4)		ECOTONE (1)		ECOTONE (2)		CEDAR (1)		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
POPULUS GRANDIDENTATA	24	75	30	75	10	52	7	26	2	5	2	14			78	39
ACER RUBRUM			4	10	1	5	2	7	25	69	1	7	9	32	42	21
BETULA ALBA	4	12	1	2			11	42			2	14	1	4	19	9
POPULUS TREMVLOIDES									2	5	9	65	2	7	13	7
TSUJA OCCIDENTALIS													13	46	13	7
PINUS STOBUS							6	23	6	16					12	6
FAGUS GRANDIFOLIA	2	6	4	10	3	16	1	4							10	5
PRUNUS PENNSYVANICA					5	24									5	3
QUERCUS BOREALIS	2	6	1	2											3	2
PINUS RESINOSA									2	5					2	1
ULMUS AMERICANA													2	7	2	1
ABIES BALSAMEA													1	4	1	.5
LARIX LARICINA									1	3					1	.5
TOTAL	32		40		19		27		37		14		28		200	100

life as a whole. The analysis of each association will be of a nature so that the factors which are important in limiting bird distribution will be emphasized.

The Aspen Associes

This associes which is located in the southern half of the study area, has as its life form trees averaging 35 feet high. The dominant tree within this associes is the Large-^tToothed Aspen (Populus grandidentata) which may comprise over 75% of the tree population. Among the less important trees found in this community are the White Birch (Betula alba var. papyrifera), the Beech (Fagus grandefolia), the Red Oak (Quercus borealis), the White Pine (Pinus strobus), the Red Pine (Pinus resinosa), and the Pin Cherry (Prunus pennsylvanica). The shrub layer was not important but where present included such shrubs as the June Berry (Amelanchier canadensis), Maple-Leaf Viburnum (Viburnum acerifolium), and the Smooth Sumac (Rhus glabra^{bra}). The herbacious layer consisted in most places of only one plant, the Bracken Fern (Pteris aquilina), which late in the growing season my reach a height of 3-4 feet. When the soil was slightly richer, the Bush Honeysuckle (Diervilla lonicella) also became a sub-dominant plant in the association. Other herbacious plants which were found in scattered areas include Wintergreen (Gaultheria procumbens), False Solomons Seal (Smiliana racemosa), various grasses (Poa sp.), False Lily of the Valley (Maianthemum canadense), and the Blackberry (Rubus pennsylvanica).

The composition of this associes does not remain constant through the study area, but shows a gradual tendency to become more varied in the northern portion. Correlated with this change, is an increase in

the density of trees causing a closing of the crowns, an increase in the percentage of coniferous trees, a larger number of herbaceous species, and an increase in the average age and size of the trees.

This community is not the climatic climax for the region but is the common secondary associates which follows lumbering or fires. Work by plant ecologists (Gates 1929) have shown that this associates is but a temporary stage in the soil ^{sere} following fire and lumbering and which depending upon soil conditions will either lead to coniferous or deciduous hardwood climaxes. The average life time for this association is 40-50 years. Judging from the number and size of the seedlings, this associates will give way to a coniferous forest of Red and White Pines, within a period of 25 years.

The important features of this community which limit bird distribution are (1) the life form is trees, (2) the trees are primarily deciduous, (3) a shrub layer of thick undergrowth is not present, (4) the canopy is for the most part closed, and (5) the growth of Bracken does provide protection for feeding and nesting.

The Red Maple-Aspen-Pine Ecotone.

This ecotone which is located in the center of the study area has as its life form trees which average 30 to 40 feet high, depending on their location. No tree can be said to be clearly dominant within this ecotone as the species composition changes with position. Trees which may be dominant in certain locations include the Red Maple (Acer rubrum), the large-toothed Aspen (Populus grandidentata), and the White Pine (Pinus strobus). Species whose numbers were less numerous include the Red Pine (Pinus resinosa), the Trembling Aspen (Populus tremuloides), the White Birch (Betula alba var. papyrifera), and the Larch (Larix

lariceria).

A shrub layer was present in most areas, the location usually being a function of the nearness to edge. Several shrubs were quite common, among them being the Christmas Berry (Ilex verticillat^aer), and the Mountain Maple (Acer spicatum). At the herbaceous level were found a large number of plants including Wild Sarsaparilla (Aralia nudicaulis), the Bracken Fern (Pteris aquilina), the Blackberry (Rubus allenenhensis), the Blueberry (Vaccinium pennsylvanicum), Wintergreen (Gaultheria procumbens), and the False Lily of the Valley (Maianthemum canadense).

The plants in this area form an ecotone between two seral stages in the succession following lumbering and subsequent burning of the region. These seral stages are the Aspen associates and the cedar sub climax. The possible direction of this sere may be seen from an analysis of the factors controlling plant distribution. Two factors important in the case of this association are (1) the poor fertility of the soil, and (2) the high level of the water table which permits the location of a swamp adjacent to this association. However, these factors may have quite individual variations which probably account for the uneven distribution of trees. Work in plant ecology has shown the probable result of these factors will be a sub climax of coniferous trees either *Pinus* or *Thuja* depending on the condition of the water table and of the soil.

Since the dominance of one or two species is not present as an indication of associates difference, the conditions which separate this community from either the Aspen associates or the Cedar Bog associates should be presented. The most important consideration is that this area is relatively open as compared with typical areas of either the Aspen or

Conifer forests. Therefore, we may expect that edge effect will be important in this ecotone. The situation cannot be simply analyzed, since a simple gradation does not exist between the two (seres).[?] Very small areas representative of those types may be found in a very heterogeneous manner. This ecotone can be summarized by stating that it represents an ecotone between a number of ^{communities} biomes, characterized chiefly not by the vegetative dominants but by the complexity of the vegetation both vertically and horizontally.

The main factors limiting bird distribution which have a vegetative basis are (1) the life form is trees, (2) the vegetation contains both coniferous and deciduous trees but with the deciduous in the majority, (3) the density of the vegetation while exhibiting great variability is not great, the open canopy in many places being a result, (4) open areas containing shrubs are present, (5) the amount of edge is large, the density of the trees in some cases being small enough so that large areas should be considered edge, (6) the acreage of any of the given type of trees is quite small.

The Cedar Bog Associates.

This association, which has as its life form trees, is located in the northern portion of the study area. While areas adjacent to the study area present fairly continuous patches of this associates, within the study area this association is represented only by small groups of conifers separated by large amounts of edge. This will be an important factor to consider in the determination of the types of niches which this community has to offer. The following discussion of the vegetation will be concerned only with the conditions found in the small groups of conifers and will completely ignore for the present a discussion of the

edge.

The dominant tree in this association is the White Cedar (Thuja occidentalis), which in most places in the community comprises over 50% of the trees. The next commonest tree in this association is the Red Maple (Acer rubrum), which, where one of the strip counts was made, comprised 30% of the trees. However, this high percentage was probably due to the nearness of the edge for the percentage of trees of this species decreased as one goes into the more dense portions of this association. Among the less important trees in this association are the Balsam Fir (Abies balsamea), the Trembling Aspen (Populus tremuloides), the American Elm (Ulmus americana), the White Birch (Betula alba var. papyrifera), and the Black Ash (Fraxinus nigra).

A shrub layer is present in some portions, more often occurring in the wetter portions or near the edge. The commonest shrubs are the Christmas Berry (Ilex verticillata), and the Alder (Alnus incana). The herbaceous layer is well developed especially in the more open areas with the dominant plant being the Wild Sarsaparilla (Aralia nudicaulis), Bracken (Pteris aquilina) is present in some numbers, but only near the edge and in the drier portions.

The composition of the forest does not remain the same through all parts but exhibits considerable variability. These changes can usually be correlated with the nearness to edge, the disturbance by man, the level of the water table, and the age of the trees. Among the more important trends are (1) an increase in the percentage of coniferous trees as the distance from edge increases, (2) an increase in the density of the forest as the trees become older, (3) a decrease in the shrub and herbaceous layers when the trees become older or when the number of coniferous trees increases.

This community is not the climatic climax for the area, but is a secondary associates following the action of fire and lumbering. The important factors determining the direction of the secondary succession are (1) the level of the water table and (2) the soil fertility which is probably due to the action of the first factor over a long period of time. The denser portions of the region are probably representative of the sub climax for such a physiographic region. The successional trend is probably toward a replacement of the deciduous trees present by coniferous trees. The possibility of the climatic climax (Beech-Maple) ever occurring is very remote, this sub climax being a very permanent one.

The important vegetative characteristics which limit the distribution of birds in this area are (1) the life form is trees, (2) while both deciduous and coniferous trees are present, the coniferous are the most important (3) a well developed undergrowth is present in some spots, (4) the canopy is relatively closed, and (5) the amount of edge is great.

Bird Communities Found Within the Study Area

General Discussion.

A bird community has been characterized by Pettingill (1945) as "an association of birds on a unit of area on which a complex association of birds, other animals, and plants exists in a state of dynamic equilibrium". This area is distinguished by the physical and biotic environment found upon it and by their interrelationships.

The type of plant community is usually the deciding factor in the distribution of bird communities. These bird communities in most cases are named after the plant communities since the latter are more easily

recognizable. However, in many cases where plant ecologists have described several different plant communities, the ornithologist is able to work as if only one association existed. This is because plant ecologists will separate plants of the same life form while for the purpose of the ornithologist, these differences, except for the distinction between coniferous and deciduous, are not important in bird distribution.

On the basis of the plant associations, five different bird communities may be found in the area. They are the Aspen Community, the Cedar Bog Community, the Red Maple-Aspen-White Pine Community, the Beach Pond Community, and the Beach Community. Of these, only the first three may be considered important since the acreage belonging to either the Beach Pool or Beach Communities is too small for even qualitative analysis. They will be discarded therefore in the discussion of the bird communities. The Aspen Community was the largest as far as acreage was concerned, but contained the smallest number of breeding birds per unit area. The community which contained the largest number of breeding birds per unit area was the Red Maple-Aspen-White Pine Community, which was the second largest as regards area. While the conifer area contained the smallest number of pairs it was also the smallest in area, so that the resultant density was almost as high as that of the preceding association.

Since none of the associations can be considered homogenous as regards vegetation it is not surprising that the type of species found in these communities does not always agree with the results obtained by observers working in more homogenous areas. That differences in the niches located in the various communities exist is shown by the fact that over $\frac{1}{2}$ of the species found in the study area nested in only one community. While the distribution in all cases cannot be correlated

easily with the vegetative sub-strata, for the majority of these species a correlation can be demonstrated.

However, the hypothesis that the distribution of birds over an area is a direct function of the main vegetative types runs into difficulty when the distribution of birds within one community is examined. There instead of finding a homogenous pattern, we find that the number of birds whose territory is found in a given quadrat varies greatly. Even when the figures had been corrected for differences in size of the quadrats, the results ranged from 1 to 7 pairs per quadrat in the case of the Aspen Community, from 4 to 14 pairs in the case of the Red Maple-Aspen-White Pine Community, and from 4 to 12 pairs in the case of the Cedar Bog Community.

It might be thought that these differences could be accounted for by differences in the density, size, and type of the vegetation found within a particular association. To a certain extent this is true as is shown by the increasing number of birds found in the Aspens as one goes into older and denser portions. This is not the complete picture, for areas of exactly the same cover type were found to have different densities. An answer to this problem has been sought by a number of workers in the field. One hypothesis advanced as a possible solution is that the number of birds within a given association is a function of the amount of edge present. Quantitative work to test this hypothesis was done by Beecher (1942) who found a positive correlation between amount of edge and the nesting bird population.

Edge has been defined as the amount of border around any plant community in a given complex of communities. It could be considered as the ecotone or zone of tension between various communities. The effect of edge on bird populations can be tested in two ways from this

study. The first method is to compare the various associations as to their amount of edge and to see how this affects the bird population. However, this method has many falacies among them being that it is impossible to differentiate in many cases as to whether the different density is due to vegetative characteristics or to the amount of edge. The second method is to take an area of somewhat similar plant composition and to see how the population varies with edge. Before an analysis of this type is done, it would be well to consider the nature of the ecotone separating the aspens from the cedar bog. This association was characterized earlier as being distinguished not by the type of dominant plants, but by the general complexity of the vegetation, both qualitatively and quantitatively. Open areas exist throughout this association and small patches of coniferous and deciduous trees grow adjacent to each other. Therefore it might be possible to consider this entire area edge, that is, a zone of tension between various associations.

Since the areas studied were quite small, accurate quantitative work on the effect of edge was impossible in this case. However, the following qualitative results were obtained some of which indicate fairly important trends. They are (1) that the association with the largest amount of edge contained the largest number of birds, while the association with the second largest amount of edge had the second highest density, and (2) that the distribution of birds in a given association followed very closely the amount of edge present. This is shown in the Aspen association where the highest population was found adjacent to a cut over portion containing only Bracken (Pteris aquilina). Evidence also indicating this tendency is supplied also by the ecotone area itself where the greatest number of pairs was found where not only deciduous and coniferous grew adjacent to each other but because of

where the high water table, a cattail swamp intruded into the area. The results of this study could then be said to be in agreement with the concept of edge as a factor controlling population density.

The manner in which edge operates is not completely known but it probably operates in that edge is an expression of the vegetative complexity of the area. One way it does this is by adding a pronounced shrub layer to the community. This is a result of the more open canopy permitting a greater amount of light to reach the lower levels of the forest. With the addition of the pronounced shrub layer such birds as the Brown Thrasher and Indigo Bunting are apt to come in. Also, birds which require closed areas from nesting, but open areas for feeding, would also have a tendency to invade such areas.

An attempt was made to see if the distribution of birds within the study area fitted into any of the known Frequency Laws. A law of frequency which applies to certain type of biological populations is Raunkairers Law of Frequence. This law as translated by Kenoyer (1927) states that "the percentage of frequence of a given species is the percentage ratio which the plots on which the species occurs bears to the whole number of plots taken". Raunkaier also pointed out that the species of least frequence are by far the most numerous with the number steadily declining as higher frequencies are encountered until the percentage reaches 80% when the number increases slightly. Gleason (1929) in an analysis of these laws states that they merely express the fact that in any association there are more species with few individuals than with many, that the law is most apparent when quadrats are chosen of the most serviceable size to show frequency and that it is obscured or lost if the quadrats are either too large or too small.

It was found that analysis of this sort does not work satisfactorily for such a small area. The number of quadrats were both too small and too few. When the number of plots on which a species nested was divided by the total number of plots all that was obtained was the abundance of the species. This is because the quadrats were so small that only one bird was found on a quadrat. The other danger lies in making the quadrats so large that the frequency of all the species becomes 100%. The optimum size for a quadrat to be used in ornithological work has yet to be determined, but it would appear from this study to be many times the size of the quadrats used in this study (average size was 1 acre).

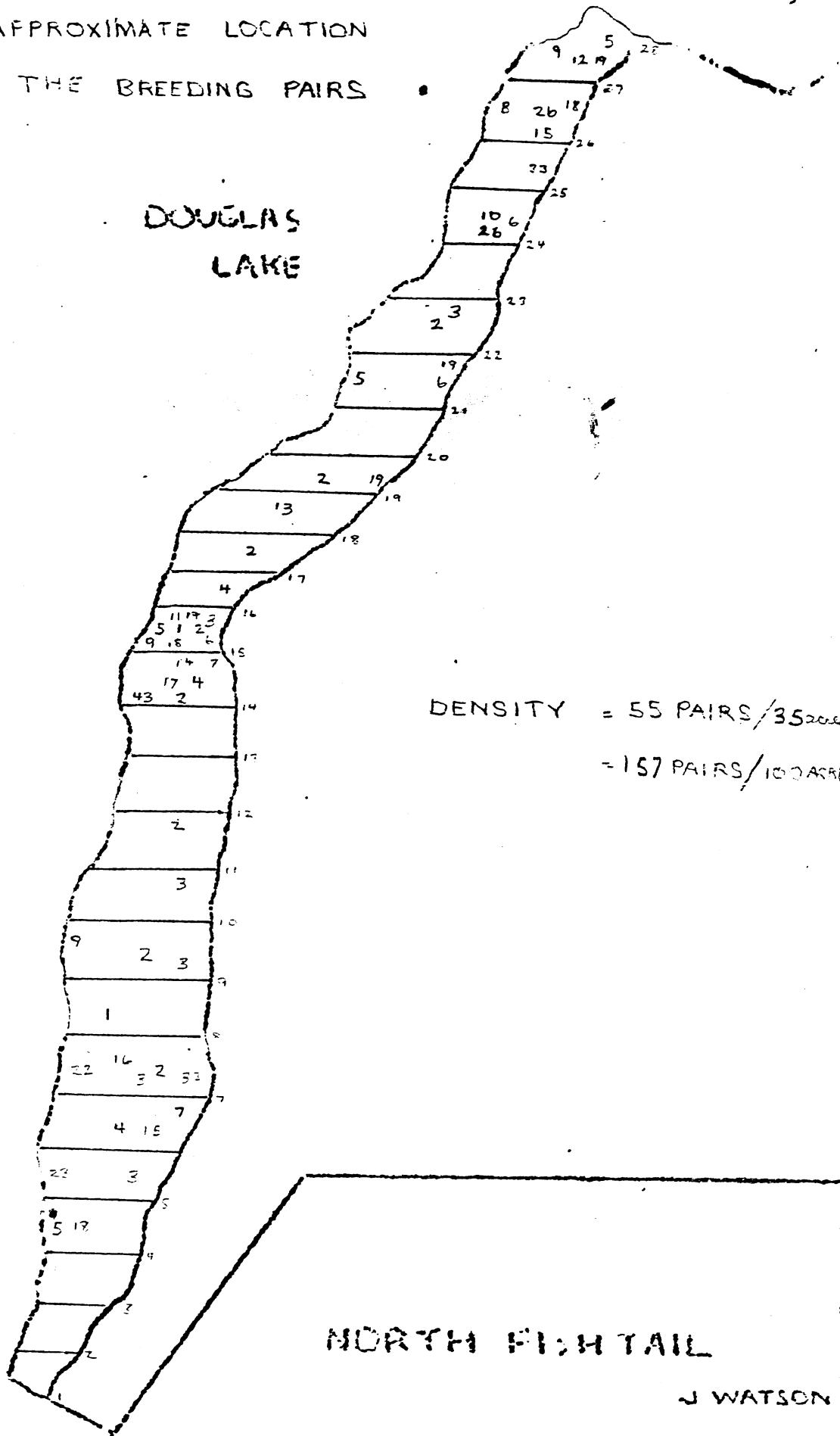
What this law expresses is merely that dominance exists in a bione. That is, that there are several plants which are quite common, hardly any with intermediate populations and a great number of them quite scarce. In a general sense, this is true of this area, the ^{mu-}dominant birds being the Red-eyed Vireo and Ovenbird. Only a few birds were found which were close to those in density, while a great number were present in one or two pairs.

Bird Communities

Aspen Community.

This bird community which was located in the Aspen Area, contained 17 pairs of birds representing 13 different species. The predominant birds in the area were the Red-eyed Vireo and the Ovenbird which comprised 23% and 18% of the total population respectively. Other birds found in this community included the Wood Pewee, the Redstart, the Crested Flycatcher, the Ruffed Grouse, the Flicker, the Whippoorwill, the Robin, the Cowbird, the Song Sparrow, the Cedar Waxwing, and the

APPROXIMATE LOCATION
OF THE BREEDING PAIRS



DENSITY = 55 PAIRS / 35 acres
= 157 PAIRS / 100 ACRES

- 1) Peewee
- 2) Ovenbird
- 3) Red Eye
- 4) Redstart
- 5) Song Sparrow
- 6) Bl. and Wh
- 7) Creeper
- 8) Kingfisher
- 9) Spotted
- 10) Quail
- 11) Hairy Wood
- 12) Red Wing
- 13) Tanager
- 14) Chipping
- 15) Quail
- 16) Flicker
- 17) Indigo Bunting
- 18) Waxwing
- 19) Chickadee
- 20) Cowbird
- 21) Crow
- 22) Pine Warbler
- 23) Rough Wing
- 24) Great Blue
- 25) Kingbird
- 26) Nuthatch
- 27) Blue Jay
- 28) Sharp-shin
- 29) Bl. Th. Blue
- 30) Starling
- 31) Purple Finch
- 32) White-throat
- 33) Robin
- 34) Wood Thrush
- 35) Goldfinch
- 36) Killdeer
- 37) Cuckoo
- 38) White-th. Sparrow
- 39) Purple Martin
- 40) Morning Dove
- 41) Bl. Th. Green
- 42) Baltimore Oriole
- 43) Whippoorwill
- 44) Ovary

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BIRD COMMUNITIES FOUND WITHIN THE STUDY AREA

*Top high area to ...
+ birds extended ...
outside measured area*

ASPEN COMMUNITY

S	SPECIES	DENSITY				STATUS			
1.	Red-eyed Vireo	4	pair	equal	22	pair/100	acres	forest	interior
2.	Ovenbird	3	pair	"	17	"	"	"	"
3.	Ruffed Grouse	1	"	"	6	"	"	"	"
4.	Whip-poor-will	1	pair	"	6	"	"	"	edge
5.	Flicker	1	pair	"	6	"	"	"	"
6.	Crested Flycatcher	1	"	"	6	"	"	"	interior
7.	Wood Pewee	1	pair	"	6	"	"	"	"
8.	Robin	1	pair	"	6	"	"	"	edge
9.	Cedar Waxwing	1	"	"	6	"	"	"	"
10.	Pine Warbler	1	"	"	6	"	"	"	interior
11.	Redstart	1	pair	"	6	"	"	"	"
12.	Song Sparrow	1	pair	"	6	"	"	"	edge
13.	Cowbird	*							
		17 pair equal				94 pair/100 acres			

CEDAR COMMUNITY

	SPECIES	DENSITY				STATUS			
1.	Chickadee	2	pair	equal	33	pair/100	acres	forest	interior
2.	Black and Wh. Warbler	2	"	"	33	"	"	"	"
3.	Ruffed Grouse	1	"	"	16	"	"	"	"
4.	Robin	1	"	"	16	"	"	"	edge
5.	Cedar Waxwing	1	"	"	16	"	"	"	"
6.	Red-eyed Vireo	1	"	"	16	"	"	"	"
7.	Black Thr. Bl. Warbler	1	"	"	16	"	"	"	interior
8.	Myrtle Warbler	1	"	"	16	"	"	"	"
9.	Ovenbird	1	"	"	16	"	"	"	edge
10.	Rose-breasted Grosbeak	1	"	"	16	"	"	"	interior
11.	Song Sparrow	1	"	"	16	"	"	"	edge
		13 pair equal				216 pair/100 acres			

ECOTONE COMMUNITY

	SPECIES	DENSITY				STATUS			
1.	Ovenbird	4	pair	equal	50	pair/100	acres	forest	interior
2.	Redstart	2	"	"	25	"	"	"	edge
3.	Chickadee	2	"	"	25	"	"	"	"
4.	Hairy Woodpecker	1	"	"	12	"	"	"	interior
5.	Wood Pewee	1	"	"	12	"	"	"	"
6.	Crested Flycatcher	1	"	"	22	"	"	"	edge
7.	Cedar Waxwing	1	"	"	12	"	"	"	"
8.	Red-eyed Vireo	1	"	"	12	"	"	"	interior
9.	Black and Wh. Warbler	1	"	"	22	"	"	"	edge
10.	Scarlet Tanager	1	"	"	12	"	"	"	"
11.	Indigo Bunting	1	"	"	12	"	"	"	"
12.	Chipping Sparrow	1	"	"	12	"	"	"	"
13.	Song Sparrow	1	"	"	12	"	"	"	"
14.	Cowbird	*							
		18 pair equal				224 pair/100 acres			

Pine Warbler. Only one bird pair of each of the species was found.

The area of this community was 18 acres, giving a density of 94 pairs/100 acres. This density is relatively small when compared to the other two communities which both had densities of over 200 pairs/100 acres. The distribution of birds was not uniform with very little bird life in the southern portion of the area. The density has probably some correlation with the density of the forest. An indication of this is provided by area located south of the study region. All of this region is quite similar to quadrats 1 to 4 which are very sparse in their vegetative covering. The trees are quite young, spaced relatively far apart permitting a fairly open canopy. In spite of the large amount of light reaching the forest floor the shrub layer was relatively undeveloped. While quantitative work was not done, a number of walks through the region revealed a very small number of birds. This data is confirmed by the work of Blaine (1939) whose data showed a very small bird population in the area.

The mechanism by which the density of the trees affects the bird distribution has not yet been determined. The denser areas by these definitions provide a greater amount of vegetation, but in a purely qualitative way it would seem that the relatively green ^{green} Aspen would provide the necessary niche requirements. An example of the preference for shaded areas is shown by the distribution of the three predominant birds of the deciduous forest, the Redstart, the Ovenbird, and the Red-eyed Vireo. In a climax forest, the density of these species is about equal. As the environmental factors become less like the climax condition, the density of these birds rapidly changes, but the differential is quite different. The Redstart population is the first to decrease

in numbers and practically disappears when a pure Aspen area is reached. The Red-eyed Vireo will remain in Aspen areas at only a little less than maximum density but disappears when the canopy becomes open. The Ovenbird was found in all parts of the study area; its only requirements seeming to be the presence of some ^{deciduous} trees and undergrowth.

Quantitative statements regarding the other birds found in the area cannot be made, due to the small number of birds involved. It can be said within the community, the Red-eyed Vireo, Ovenbird, Wood Pewee, Ruffed Grouse, Redstart, and Crested Flycatcher showed a preference for forest interior, while the Flicker, Robin, Whippoorwill, Song Sparrow, and Cedar Waxwing were more often located near edges. The Cowbird should be considered a visitant while the presence of the Pine Warbler was due to a strip of Pines found along the lake from which this species never moved.

This bird community can be summarized by stating that the birds are qualitatively like those of the deciduous biome climax, but due to the lack of complexity of the vegetation, had a very small breeding bird population.

The Red Maple-Aspen-White Pine Community.

This bird community which was located in the Red Maple-Aspen-White Pine area contained 18 pairs in 8 acres giving a breeding bird density of 224 bird pairs/100 acres. Thirteen species were found breeding in the area of which the predominant bird was the Ovenbird, which comprised 22% of the population. The Chickadee and the Redstart were the next commonest species, two pair of each being found in this community. The remaining birds all represented by only one pair, were the Red-eyed

Vireo, the Indigo Bunting, the Scarlet Tanager, the Black and White Warbler, the Crested Flycatcher, the Cedar Waxwing, the Hairy Woodpecker, the Song Sparrow, the Chipping Sparrow, and the Wood Pewee. The Nashville Warbler and the Brown Thrasher were seen in the area but frequency of occurrence suggests that they were not breeding. Cowbirds were seen flying over the area, but were not included in the population figures.

Of the breeding species, only 4 seemed to show a preference for the denser, more shaded portion of the area, they were the Ovenbird, the Red-eyed Vireo, the Wood Pewee, and the Hairy Woodpecker. The remaining birds were seen more often in the trees bordering on the edge or in the more dense undergrowth. While coniferous trees are present in some numbers in this plant association, they do not seem to have affected the bird population. Not one species which is limited to the coniferous biome was found in this area. The birds were either of the deciduous forest biome, or birds of shrub, low trees, and forest edge areas. The acreage was too small to see what effect this ecotone area had upon the quantitative nature of the population. The qualitative effect would be to limit birds which require dense shade.

The Cedar Community.

This bird association located in the northern portion of the study area contained 13 pairs of 11 different species in an area of 6 acres, giving the density of breeding birds as 216 pairs/100 acres. The boundaries of the bird communities were determined by the existence of coniferous trees in dominant numbers. Due to the small number of pairs, predominance could not be determined but the Black and White

Warbler and the Chickadee both were present as two pairs while only one pair of each of the other species was found. The species which were present as one pair included the Myrtle Warbler, the Robin, the Black-throated Blue Warbler, the Rose-breasted Grosbeak, the Cedar Waxwing, the Ruffed Grouse, the Red-eyed Vireo, and the Song Sparrow. The Wood Thrush, Winter Wren, and Nashville Warbler were seen in this community but data from location of their singing posts, and from the frequency of occurrence, indicates that they bred outside of the study area, but within the same type of bird community.

Several facts are quite apparent from an analysis of the bird population. One of these is that birds characteristic of both the deciduous forest biome and the coniferous forest biome are found in the area. This can be explained by the occurrence of both types of vegetation in large percentages. The second fact is that birds which require edge as a niche requirement, comprise over 30% of the population. Those birds were the Robin, the Cedar Waxwing, the Nashville Warbler, the Song Sparrow, and the (Black-throated Blue Warbler. ?)

The high density found in this small area can probably be laid to the combination of these two factors; relatively great complexity of vegetation and the large amount of edge. This bird community can be summarized by stating that the population is not characteristic exclusively of either type of forest biome, but represents a combination of the two.

Analysis of Population Data by the Method of Palmgreen.

The Finnish ornithologist Palmgreen was the first to suggest that a definite relationship existed between the number of pairs found on

one trip to an area to the total breeding population. His results indicated that on one trip to an area about 50% of the population could be determined. Furthermore, he found that the total population was usually determined after 5 trips to the area with the number of pairs located as a result of each successive trip increasing in an exponential manner, with the slope reaching zero after the fifth day. The value of this form of analysis is that if this data holds over a large area, an idea of the breeding population could be known after only 1 or 2 trips to the area.

In this county Kendeigh has analyzed his data on breeding bird censuses in this way and found his results in general agreement with Palmgreen. The data from this study were put to the test of this analysis (Table) and it was seen that a little over one half of the population was determined after one trip. The breeding population was completely determined after 5 days, indicating agreement with Palmgreen. However, it is felt by this author that this method of determining bird population is not accurate enough for a study of this sort. Its chief value if general concurrence of results is found, will lie in estimating the populations of large areas where even errors of 10-20% will not be considered too large.

Analysis of Early Morning Song.

On five mornings in July, visits were made to the area to obtain data on the morning song of the birds of the area. Information as to when the birds first began to sing, and for how long the ^{period} of song would be, was to be recorded. The purpose of obtaining this information was to see if any correlations existed between the amount and time of singing and the territories of the various species. The results

MORNING SONG DATA

SPECIES	RANK					TIME OF START					
	July	11	16	18	19	25	11	16	18	19	25
Whip-poor-will	1	2	1	1	1		3.37	3.51	3.45	4.07	4.00
Ovenbird	2	6	2	2	7		3.47	4.30	4.06	4.21	4.51
Scarlet Tanager	3	3	4	5	2		4.03	4.06	4.18	4.50	4.15
Wood Pewee	4	1	6	6	4		4.14	3.25	4.24	5.30	4.26
Red-eyed Vireo	5	5	8	7	6		4.28	4.29	4.44	5.30	4.44
Pine Warbler	6						4.31				
Chickadee	7	9	9				4.33	4.38	4.45		
Redstart	8	10	13				4.38	4.41	4.51		
Black and White	9	8	11		8		4.42	4.34	4.46		5.00
Robin	10	4	5	4	5		4.42	4.17	4.22	4.44	4.35
Wood Thrush	11	11	3		3		4.50	4.46	4.15		4.25
Winter Wren		13	10					5.04	4.45		
Cedar Waxwing		12	12					4.55	4.51		
Song Sparrow	12	7	7		9		4.50	4.31	4.32		5.10
Indigo Bunting				3						4.28	

Weather best for each type?

Time of sunrise?

obtained are summarized in Table . Aside from the general tendency noted for the birds to sing at a later time and for shorter periods each day, the results are too incomplete to be significant. The decrease in singing while accompanying the decrease in sunlight does not appear to be primarily related to it since the rates of decrease are not at all similar.

Annotated List of the Birds Found in the Study Area

Breeding Birds

Ruffed Grouse, Bonasa umbellus. Two families were found of this bird, one family was found feeding in the Aspen associates, while the second group was located among the cedars. The nest of the group located in the cedar associates was found on June 21. It contained 8 eggs which hatched one week later. The young remained in the area until the 1st of August when they were last recorded. Since the birds often wandered out of the study area, no attempt was made to determine size of territories.

Spotted Sandpiper, Actitis macularia. This sandpiper was found breeding along the beach. At the beginning of the study, three pairs were present of which one soon disappeared. One nest was located at Pine Point, while the other was situated on East Point. Only the latter nest produced young, of which 3 out of 4 survived until the family group left the area. This species was recorded exclusively from the beach association. Nelson (1929) found no evidence of the existence of territories in this species.

Whip-poor-will, Antrostomus vociferus. One bird was heard singing from the Aspen association on a number of times. The location of the

singing post remained quite constant, never moving out of one quadrat. Otherwise, no information as to the size or occurrence of territories was obtained. Though the bird continued singing throughout the entire length of the study, both the duration and frequency of the song decreased. This bird was as a rule the first bird to sing in the morning, with the time when the song began to sing became later, as the summer progressed.

Belted Kingfisher, Megaceryle alayon. One pair of this species was found in the beach association. The nest was probably located in a hole in Kingfisher Cove. No evidence of territory was observed, the species being merely confined to areas near water.

Flicker, Colaptes auratus. This species was seen in all parts of the study area, but from the frequency of occurrence, it was decided that only one pair bred in the study area. This pair was located in the Aspens where on July 4 two adults with one juvenile just able to fly were seen. Since the young usually hatch around the 15th of June in this area, the random scattering of the birds in most cases was to be expected. No data could be obtained on the size of territories due to the above mentioned factor.

Hairy Woodpecker, Dryobates villosus. The exact density of this bird could not be determined exactly. This is in part due to the fact that the young should have been able to fly by the time this problem started. While the records were generally randomly distributed, the presence of the bird more often in the ecotone area suggests that this was possibly the nest site. However, the frequency of occurrence of this species is great enough to make it quite probable that at least one pair nested in the study area. Information as to the size of

territories was not obtained.

Crested Flycatcher, Myiarchus crinitus. Two pairs of this species were found within the study area. One pair occurred in the Aspens, while the other nested in the ecotone. The territories were large, and in both cases extended out of the study area. They appeared to persist until the end of the study, though nesting data would indicate that the young should be able to leave the nest by the 15th of July.

Eastern Wood Pewee, Myiochanes virens. This species was found nesting in both the Aspen and the ecotone areas. The territories, whose average size appeared to be about 6 acres, persisted as long as the study progressed. Two pairs bred in the study area, while another pair occasionally came into the area from the south.

Rough-winged Swallow, Stelgidopteryx ruficollis. One pair nested in the banks at Kingfisher Cove. This species nests very early, which probably accounts for the early disappearance of this species from the area. The last date when it was recorded was July 9. No evidence for the existence of territories was found.

Black-capped Chickadee, Penthestes atricapillus. While this species was seen in every association, the frequency of occurrence indicates four family groups, two occurring in both the ecotone and the cedar regions. This species wanders greatly, especially after the young have left the nest which in this area should be by the 1st week in June. Data from this study would seem to indicate that the wandering is usually confined to areas of 3 or 4 acres.

Robin, Turdus migratorius. This bird was seen in various localities of the study area. Determination of territories was not possible since the birds wandered out of the study area many times. However,

it appears probably^e that one pair nested in the Aspens while the other pair was found most often in the ecotone area. The situation was complicated by the early nesting of this species, though one male continued to have a morning song until the end of the study. The forest interiors were avoided, this species preferring edge.

Cedar Waxwing, Bombycilla cedorum. Up to the present, the existence of territories for this species has not been demonstrated. However, the distribution of this species was not random, but the spots where this species was seen being grouped into three rather localized regions. These regions were located in each of one of the three associations. It was assumed therefore, that there were three breeding pairs in the region, though it is possible that at least one of the areas was but a feeding station. Some waxwings were seen coming in from outside the area, the purpose being to feed on June Berries (Amelanchier canadensis), but those were not plotted.

Red-eyed Vireo, Vireo olivaceus. This species was the second commonest bird in the study area, 6 pairs being plotted. When the distribution was analyzed as to associations, it was found that 4 pair nested in the Aspens, with a pair each in the other areas. The distribution was very regular for this species, allowing territories to be determined easily. The average size of a territory was one acre, with the sizes ranging from $\frac{1}{2}$ to $1\frac{1}{2}$ acres. The number of available deciduous trees was small and rather closely grouped in the conifer association. Here the territory size was relatively very small, being less than $\frac{1}{2}$ acre. The territories in 4 out of 6 cases held until the study terminated. This species appeared to be disturbed by the Blue Jays, who often were seen in the vicinity of the nest. Judging from

the alarm notes given by the Vireo, the Jays were attacking the young birds.

Black and White Warbler, Mniotilta varia. Three pairs were located of this species, two in the cedar association, and one in the ecotone area. Again due to the small areas used, figures for density are not significant, but this species appeared to be one of the most common birds in the cedar bog. The territories of each of these pairs extended out of the region studied, but from the data present, it would appear that this bird has a relatively large territory, 3 or 4 acres being the probably size. This species was not observed fighting among themselves, but one instance of this species chasing a Nashville Warbler out of its territory was observed. This may be due to the fact that these species occupy relatively similar niches. It was observed mostly in shrubs or small trees in the ecotone area, but where it was located in the cedars, it was usually seen feeding among the higher branches. The territories of this species appeared to hold throughout the time of the study.

Black-throated Blue Warbler, Dendroica corulescens. One pair of this species was found in the Cedar Association. Its territory extended out of the study area, so determination of the size of the territory was not attempted. This bird was seen only until the 9th of July. Judging from the other breeding records, this is a little early for disintegration of territory, so it is possible that the nest was for some reason destroyed.

Pine Warbler, Dendroica pinus. One pair was found in the study area. While the general location was in the Aspen association, the distribution was completely determined by the presence of rather tall

pinus found only along the lake. Since the species only went about 8 meters at a maximum from the edge of the lake, the size of territory was quite small. The male bird did wander some 300 meters along the shore. The male was last seen on the 18th of July. The breakdown of the territory probably occurred when the young left the nest, which in the case of a pair outside the study area, occurred on July 12.

Myrtle Warbler, Dendroica coronata. This species was found only in the conifer association, where one pair was found. The territory was relatively large, occupying about 4 acres. It was present at the beginning of the study and lasted through the 3rd week in July. The density in the conifers area was found to be 16 pair/100 acres.

Ovenbird, Seiurus aurocapillus. This species was the commonest bird in the study area, with a density of 23 pairs/100 acres. While the distribution was generally over the whole area, this bird was commonest in the ecotone region, where a density of 50 pairs/100 acres was recorded. The lowest density was in the conifers with 16 pairs/100 acres, but it is doubtful whether these figures are significant. Territories of this species were well marked, being already present when the study began. They continued to exist until the last week in July, when the singing males were not heard in several cases. The singing of the male continued in one case until at least one week after the young had left the nest. This species was found in all three associations, indicating the adaptability of this species to various environments, the main requirement being broad leaf trees. This latter is probably the reason for the relatively high density of this species. The sizes of the territories ranged from 1 to 2 acres.

Redstart, Setophaga ruticilla. Three pairs of this species were

found, two in the ecotone region, and one in the Aspens, giving a density of 9 pairs/100 acres. This species was not limited to either the forest interiors or edge, being in either place at various times. The territories of this species ranged from $1\frac{1}{2}$ to 3 acres, and were present at the beginning of the study. However, the territories of this species broke up early, with all three pairs leaving the area by the beginning of the 3rd week of July.

- Red-winged Blackbird, Agelanis phoeniceus. Three individuals of this species, two female and one male, were seen a number of times in the beach pond association. However, the dates when they were seen were all in late June or early July. The last recorded date for this species was July 9, when one bird was seen. It is doubtful whether this species nested in this association since no trace of a nest or young was found. The regularity of their occurrence suggests, however, that they probably were going to nest in the region, but for some reason, abandoned the effort.

Cowbird, Molothrus ater. This species, a well known social parasite, of course had no nest in the area. However, since it lays its eggs in nests of species found in the area, it was included in the list of breeding birds. No figures for density can be given, and since the territories do not exist for this species, data cannot be given on them. This species was seen or heard quite regularly until the 3rd week in July, when it disappeared from the area. The absence probably correlated with the end of egg laying by most of the birds found within the study area.

Scarlet Tanager, Peranga erythromelus. Two pairs of this species frequented the study area, but only one was believed to be nesting.

This pair occurred in the ecotone region, but wandered a great deal. The territory of this pair was found to be large, probably over 5 acres, but the exact size could not be determined. The territory as known from the presence of a singing male, persisted throughout the entire length of the observation.

Indigo Bunting, Parserina cyanea. One pair was present in the ecotone, but since it occasionally wandered out of the study area some distance, the size of the territory, although known to be large, could not be determined. A figure of the population would be misleading for the same reason. The territory persisted throughout the length of the study. This bird was confined at all times to forest edge areas, and probably nested in undergrowth bordering the swampy area.

Rose-breasted Grosbeak, Hedymelas ludovicianus. One pair was present in the conifer association, but due to the relatively large territory which went beyond the study area, a density figure would be misleading. The existence of territories was shown by the fighting of this pair's male with a male from the conifer area east of the study area. No figure for territory size could be determined with any accuracy. This species was only found in the conifer area, but this is probably due to a factor other than the type of leaf since as a rule this is a bird of the deciduous woods. The territory broke up relatively early for this species, this bird not being observed after the 2nd week in July. This is in general agreement with other records from the Station vicinity which indicate a very early nesting for this species, the young leaving the nest by the 28th of June.

Chipping Sparrow, Spizella passerina. One pair of this sparrow was located in the ecotone region. It left the area soon after the

James D. Watson
1946

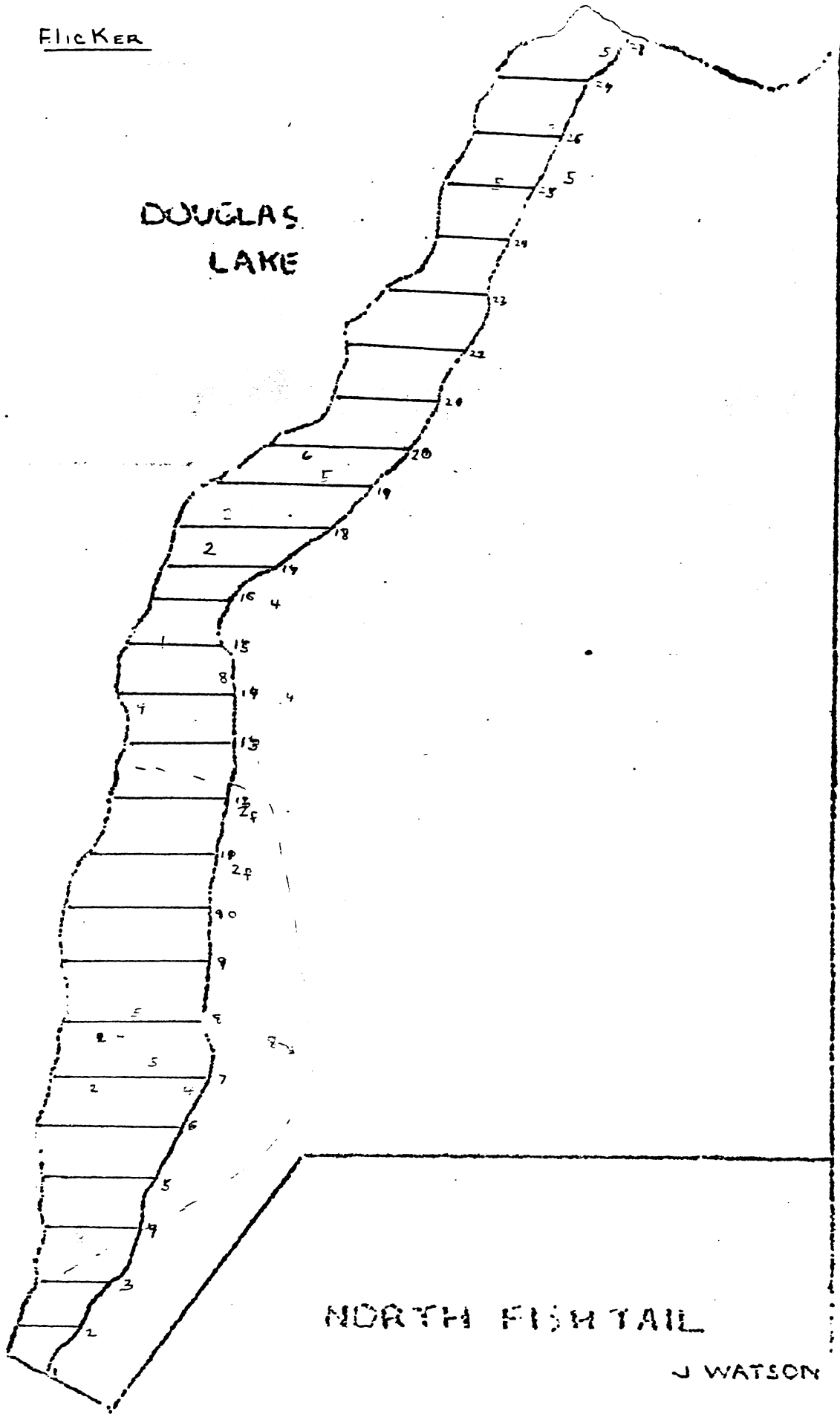
TERRITORIES OF SOME OF THE BREEDING BIRDS
OF THE REGION

DATE ON WHICH THE BIRD WAS SEEN
IS INDICATED BY A NUMBER

- 1. = JULY 2
- 2. = JULY 4
- 3. = JULY 5
- 4. = JULY 9
- 5. = JULY 16
- 6. = JULY 18
- 7. = JULY 23
- 8. = JULY 25

Flicker

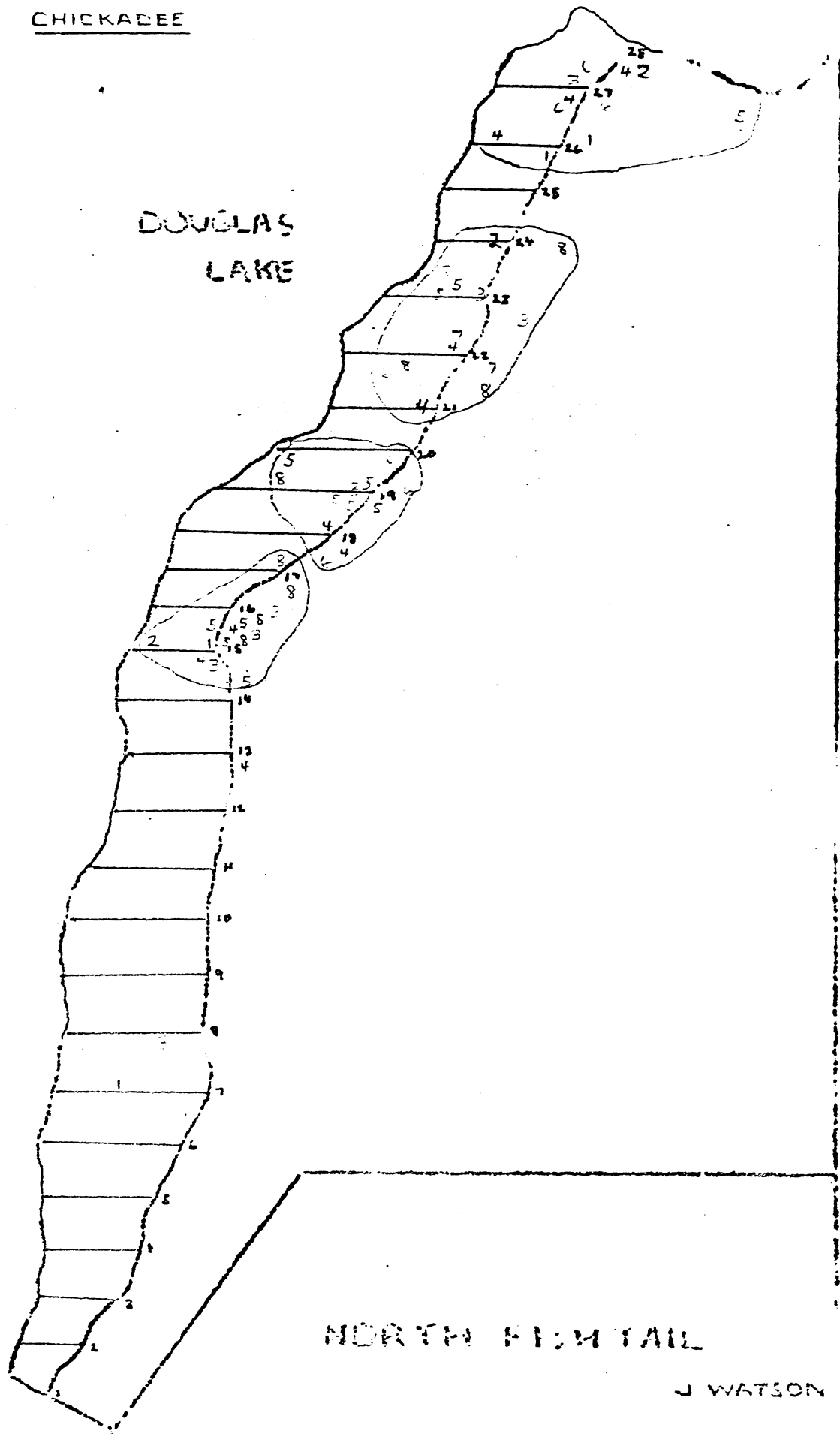
DOUGLAS
LAKE



NORTH FISH TAIL

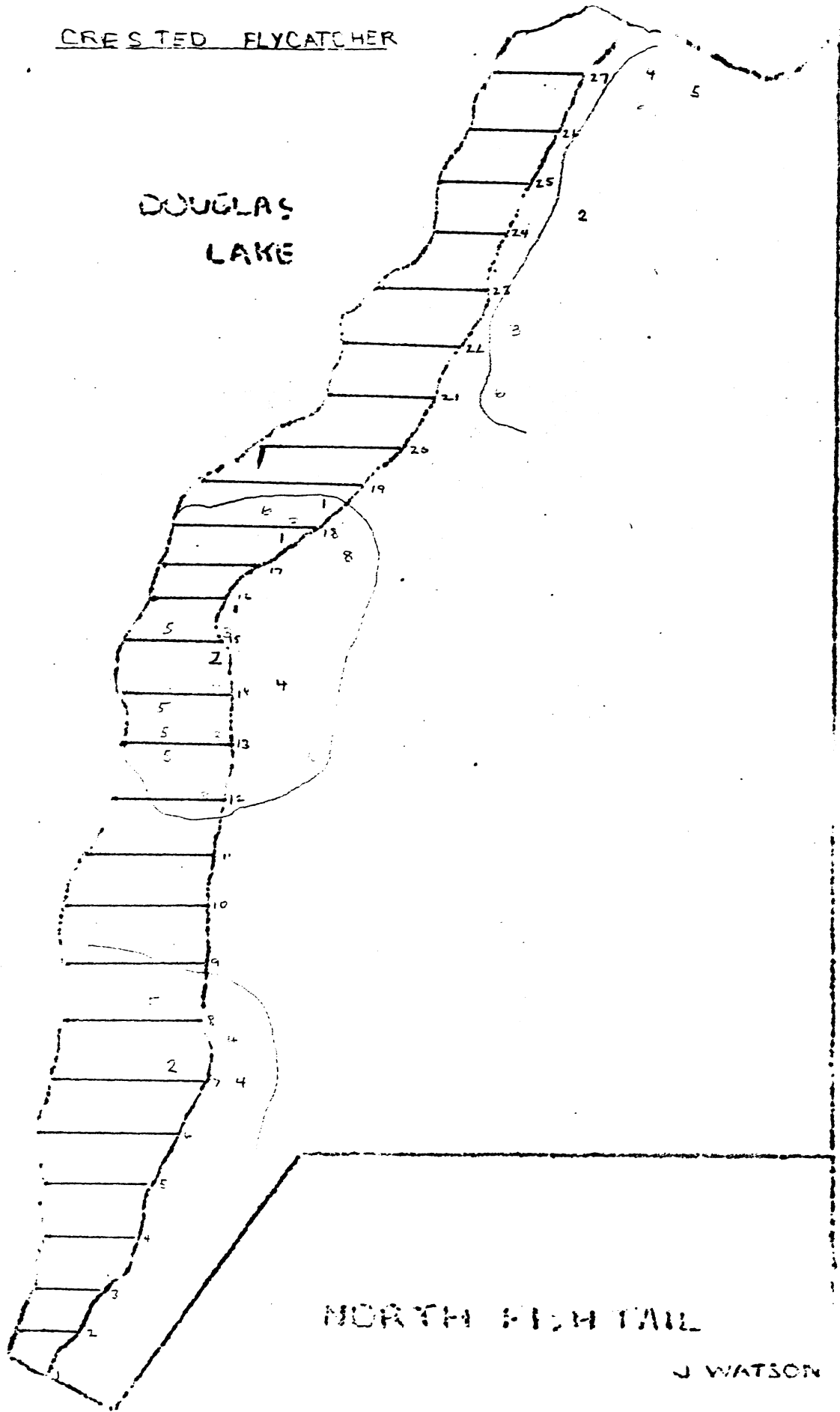
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CHICKADEE



CRESTED FLYCATCHER

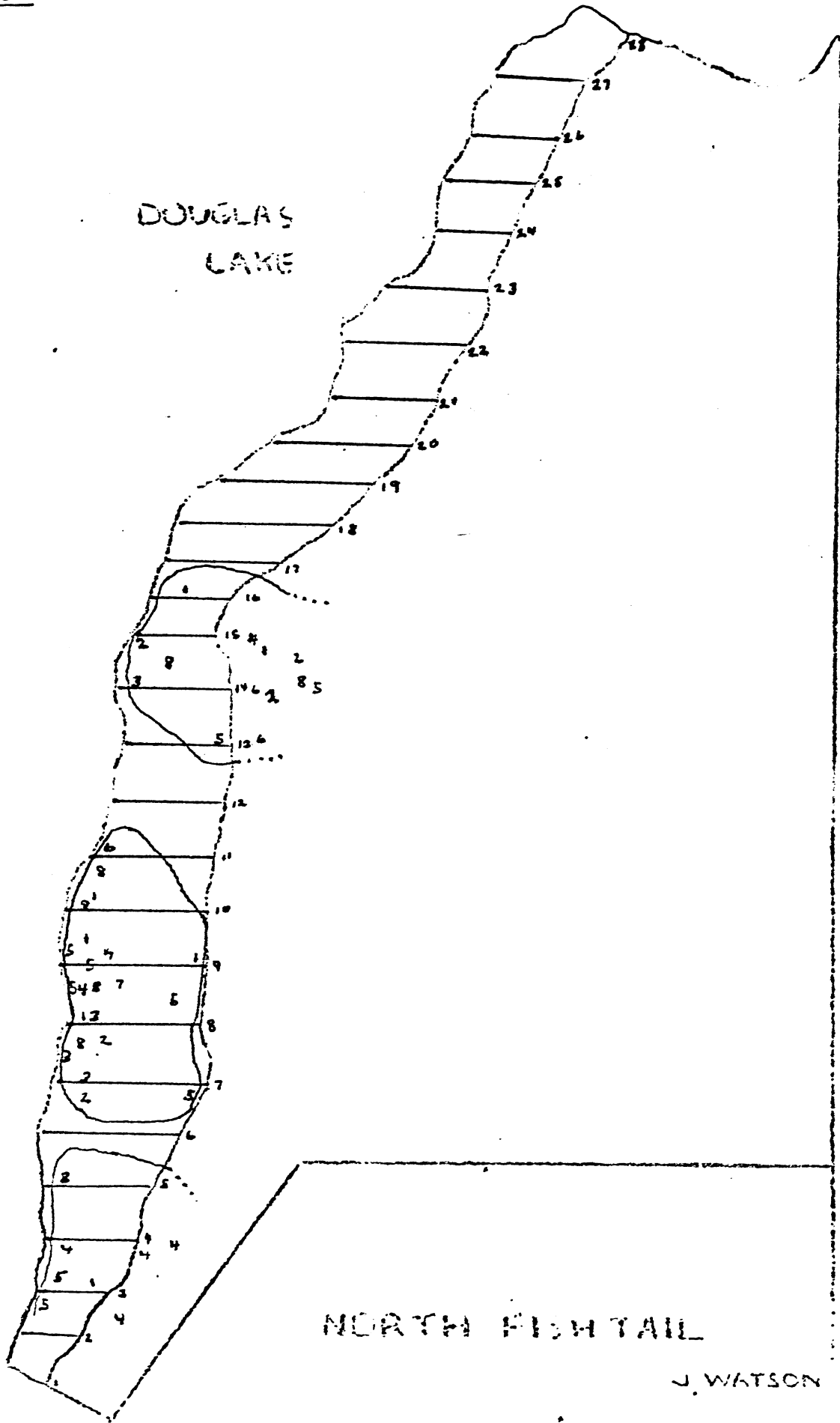
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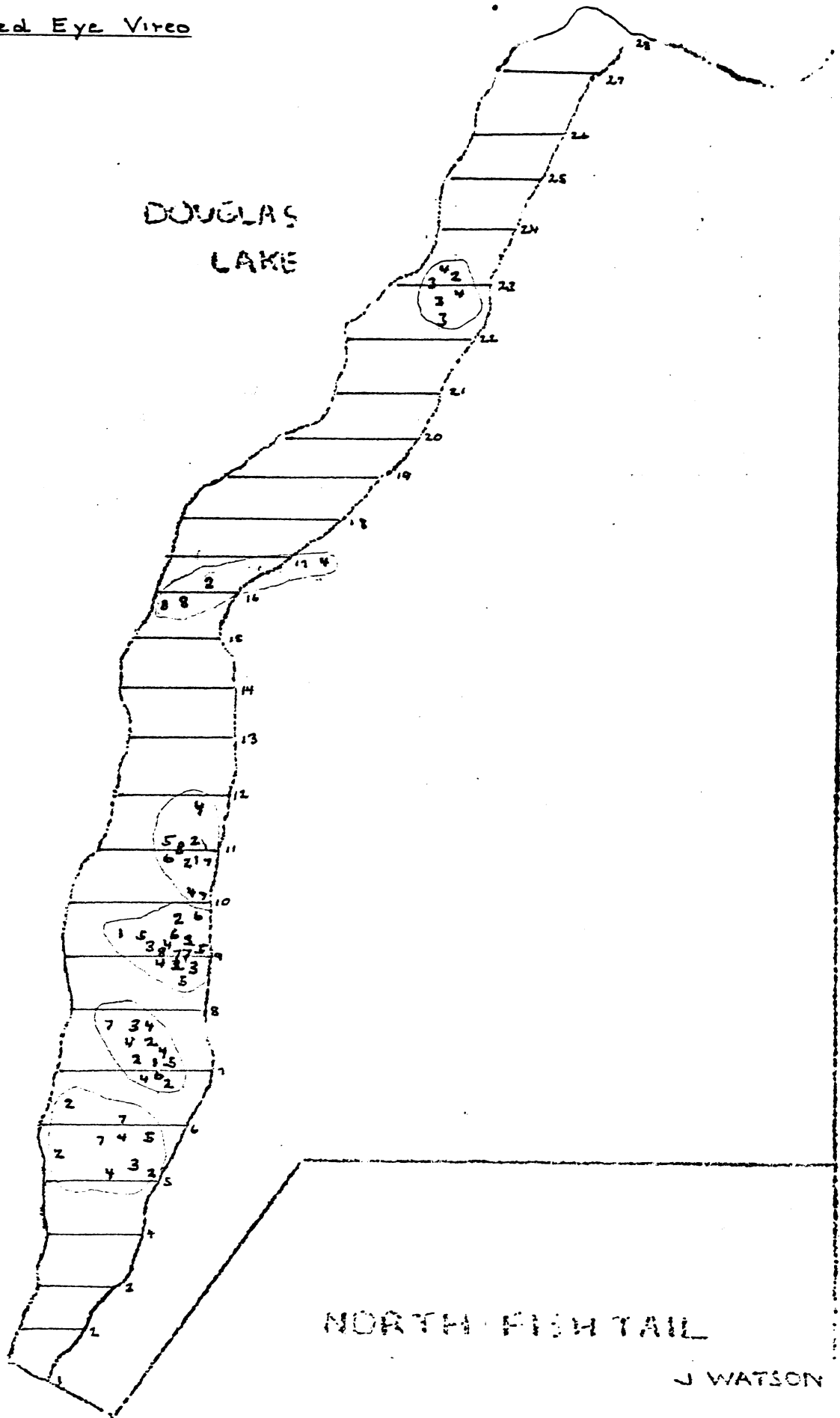
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Pewee



Red Eye Vireo



MYRTE WARBLES —

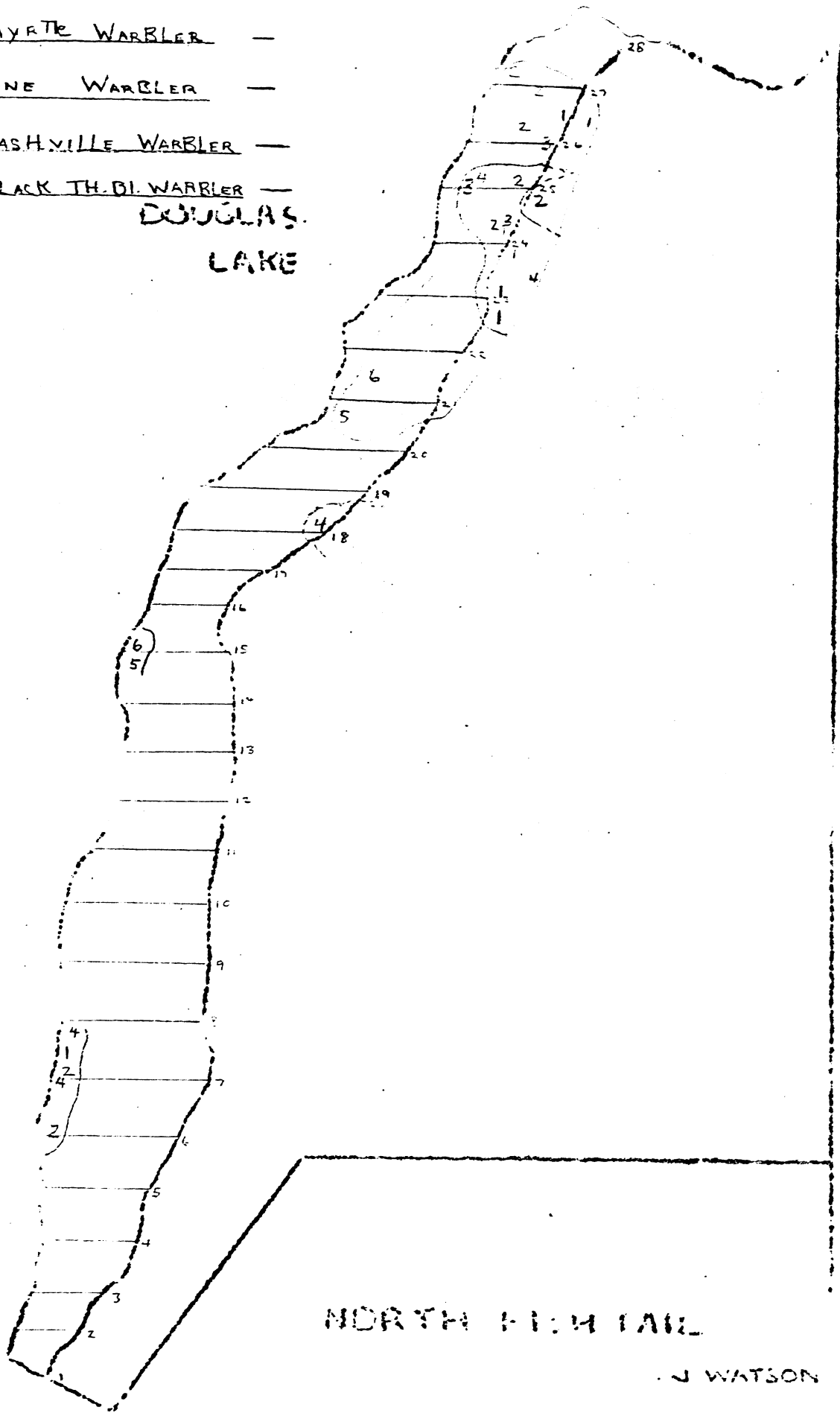
PINE WARBLES —

NASHVILLE WARBLERS —

BLACK TH. BL. WARBLERS —

DOUGLAS

LAKE

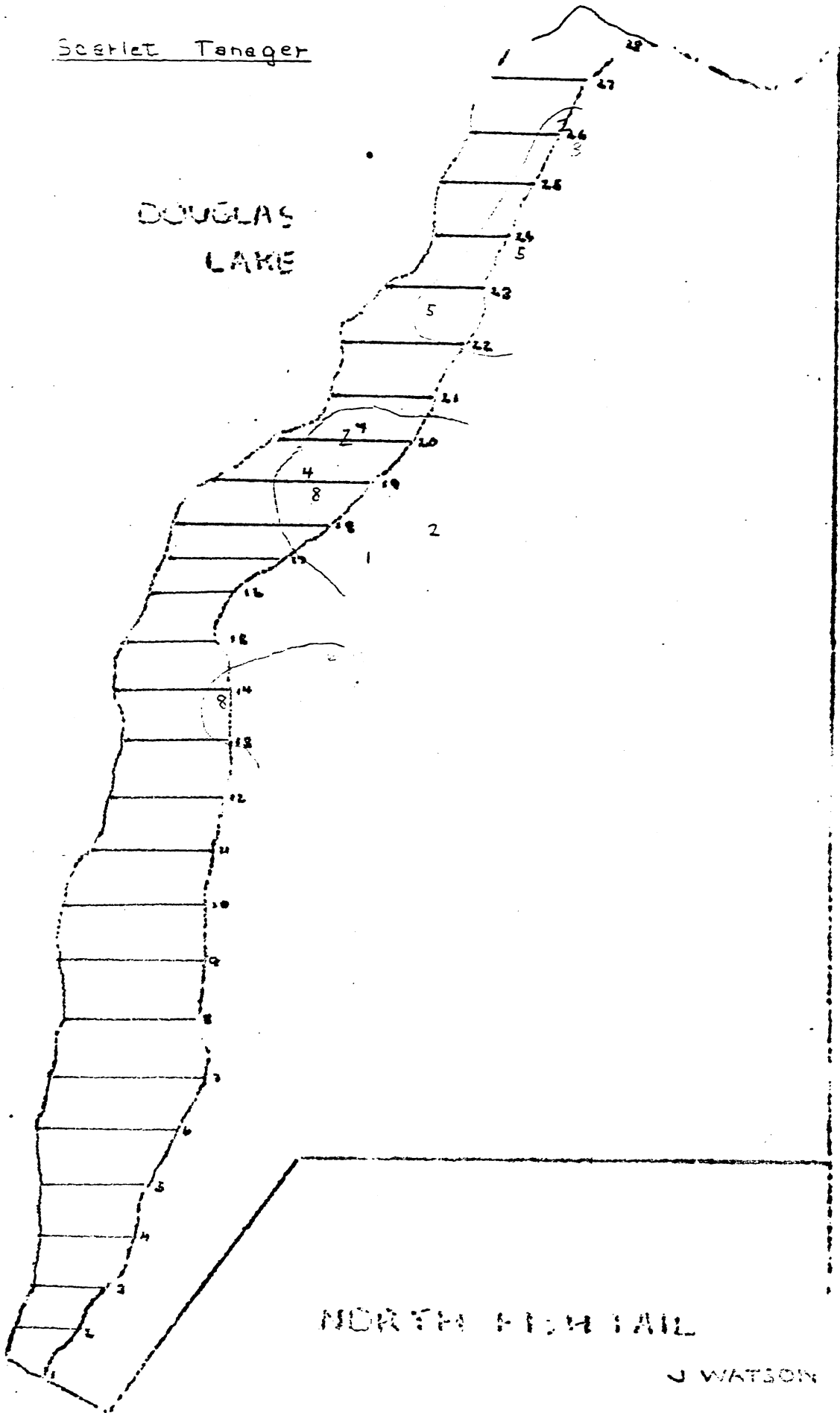


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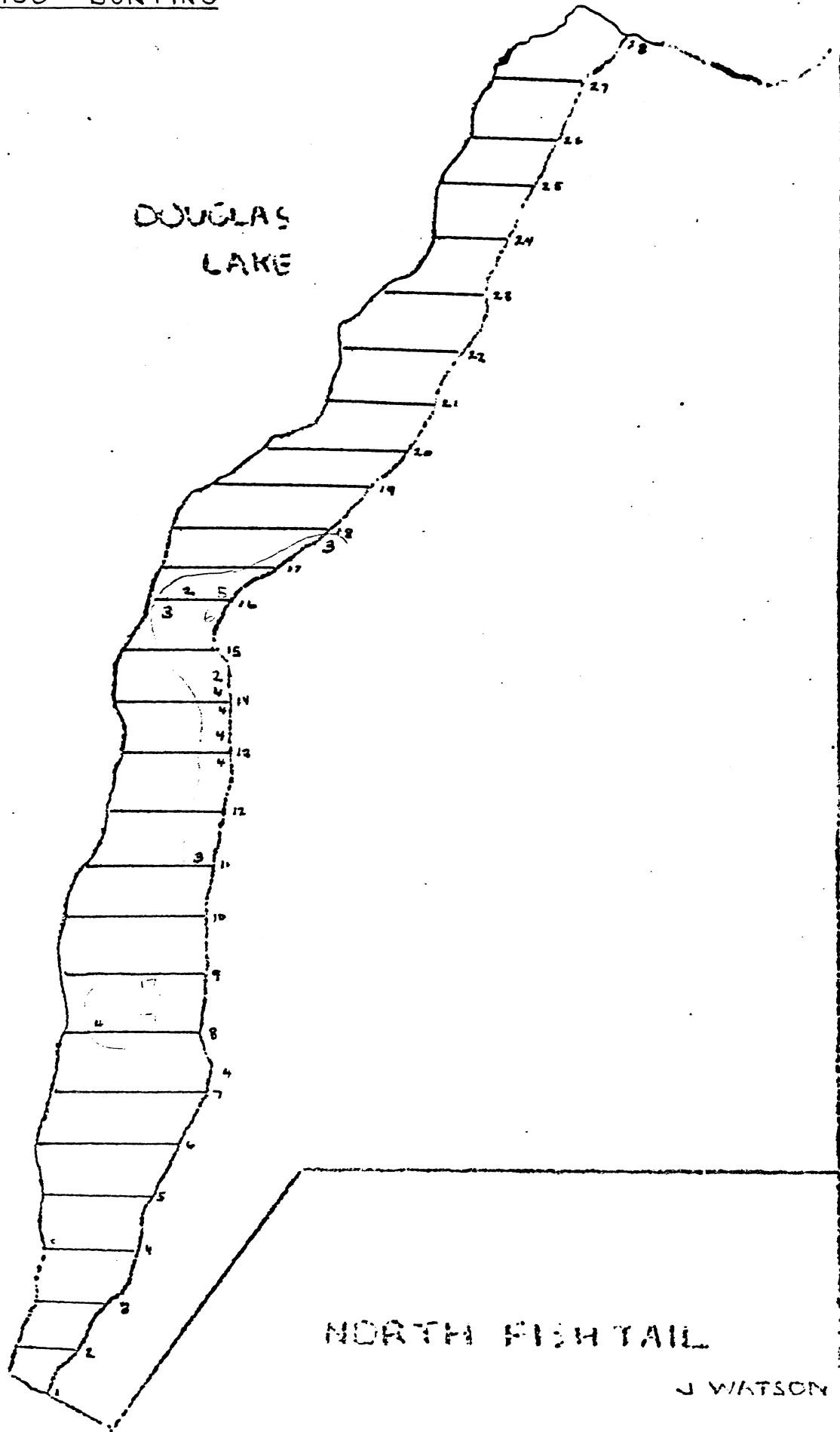
J. WATSON

Scarlet Tanager

DOUGLAS
LAKE



INDIGO BUNTING

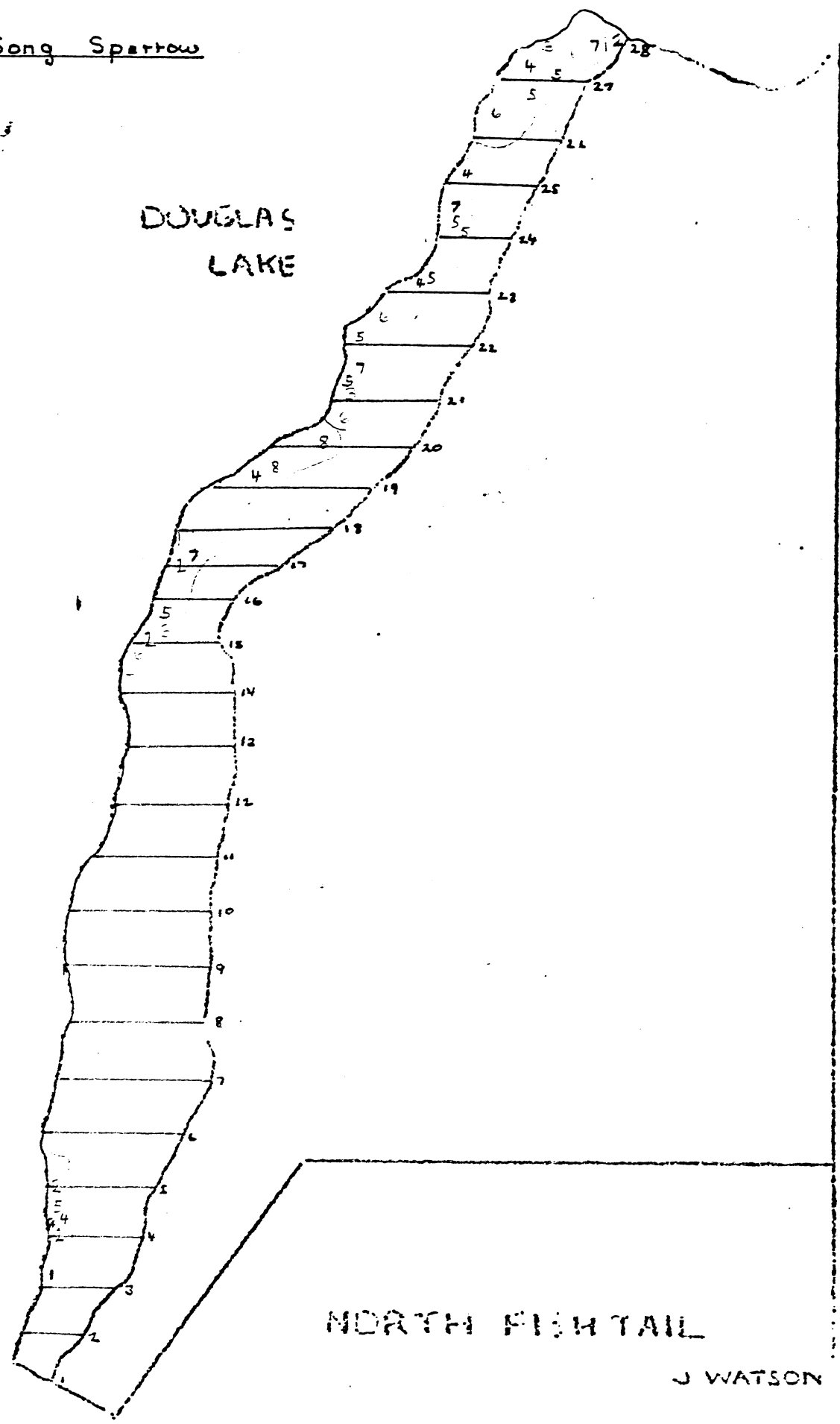


DOUGLAS
LAKE

NORTH FISH TAIL

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Song Sparrow



DOUGLAS
LAKE

NORTH FISH TAIL

J. WATSON

study commenced, so adequate data on territory was not obtained. The early departure is easily possible since this species is an early nester in the region. The density figure obtained was 12 pairs/100 acres of the ecotone region.

Song Sparrow, Malospiza melodia. This species accounted for 4 pairs of the breeding pairs of the study area. While they were distributed in each of the main associations, their territories were always situated on the strip of edge bordering the lake. It can be considered as a bird of the edge therefore. Its density for the whole area was 11 pairs/100 acres, but this is misleading due to the edge effect. A better way of expressing its distribution might be to say that there were four pairs per $\frac{3}{4}$ mile of shore line. Territorial size ranged from 1 to 3 acres. This species is an early nester, most of the nests producing young by the middle of the study.

Birds Recorded from Area, but Non-Breeding in Study Area.

Lesser Loon, Gavia immer. This bird was seen feeding a few feet off shore adjacent to the Cedar Association on June 23.

Great Blue Heron, Ardea herodias. A frequent visitant to area, being seen on three separate mornings. It was always seen in the beach association either nesting or feeding.

American Merganser, Mergus merganser. A female with 8 young was seen feeding a few feet off shore on the 4th of July.

Sharp-shinned Hawk, Accipiter velox. An adult was seen once on July 2 in the conifer association. At that time it was being chased by Blue Jays.

Bald Eagle, Haliaeetus bucocephalus. A bird of the second year was seen by T. Nelson at Pine Point on June 28.

Killdeer, Ceryle alcyon. One adult was seen at East Point feeding on the beach on July 5.

Herring Gull, Larus argentatus. This bird was seen flying over the area on practically every visit.

Ring-billed Gull, Larus kumlieni. This gull together with the preceding species was always seen flying over the lake.

Caspian Tern, Hydroprogne caspia. On two occasions during the study, this tern was seen flying along the beach.

Yellow-billed Cuckoo, Coccyzus americanus. This bird was heard or seen on four different occasions on or near the study area. It was probably nesting in the swampy area to the east of the ecotone region.

Nighthawk, Chordeiles minor. This bird could be seen flying over the area just before sunrise in numbers of one or two. Its nest site was unknown.

Downy Woodpecker, Dryobates pubescens. It was seen twice, once in the Aspens, while the second time it was in the ecotone region. The dates on which it was seen were both late in the study, and considering the early nesting of this species, these records should be laid to post breeding individuals.

Purple Martin, Progne subis. Recorded on two days as flying over the region. The birds were probably from the nesting boxes in the Biological Station Campus.

Blue Jay, Cyanocitta cristata. This bird was seen on every visit in numbers from 1 to 15. They were found in no one area, and no evidence of territories or nests was found. Nesting was probably about finished at the time when the problem was begun. Since no accurate

method of determining density was known, it was decided to leave the species off the breeding bird record.

Crow, Corvus brachyrhynchus. This species was heard or seen on every trip to the area, but in no definite locality. No nests were found or young heard, so the bird was presumed nesting in another region. The greatest number seen on one day was four, with one being the median.

Winter Wren, Nannus hienalis. One pair of this species was breeding in the cedars just adjacent to the study area on the east. The size of the territory was large and on two occasions this species wandered into the study area. It was heard singing on every visit to the area, indicating that the territory persisted throughout July.

Brown Thrasher, Taxostoma rubum. The edge area to the east of ecotone region had on Thrasher pair. It wandered into the ecotone region on three occasions, the last being on the 18th of July. Singing of this species ended in the second week of July, which is probable, considering the early nesting of this species, permitting the young to leave the nest in many cases in late June.

Wood Thrush, Hylocichla mustalina. A pair nested in the cedar association, though in a spot outside of the study area. On both the 5th and the 9th of July it was heard singing within the study area. Rather incomplete data suggests that this species has a relatively large territory which persists throughout July.

Nashville Warbler, Vermivora ruficapilla. While recorded on two occasions in the study area, these records are probably due to two separate pairs found on the other side of the path. One of these pairs nested in one of the edge surrounding the swamp, while the other nested in the cedar association.

Baltimore Oriole, Icterus galbula. A male of this species was seen on July 16 in the cedar area. Since this is an early nester, it might possibly be post breeding male yet to undergo molt.

Analysis of Data.

It might be wise to review the data presented to see if any general conclusions might be reached concerning the bird distribution within the study area, so that possible successional trends could be predicted. The starting point in an analysis of this sort is that within certain wide limits, the bird life in the area is determined by the vegetative characteristics. This is easier to visualize qualitatively especially when the concept of niche requirements is applied. That is, certain birds require a definite type of vegetation for such requirements as nest site, nest material, and feeding. The manner in which niche requirements affect this bird life qualitatively, has been discussed in a previous paper, Watson 1946, and so will not be treated in this report.

Preliminary data from this study also suggests that the vegetative characteristics determine the quantitative structure of a population. While this appears to be a reasonable hypothesis and is assumed by many people, the exact manner in which this factor operates is very difficult to determine. Several examples of this problem were found in this study. The most obvious case is the ecotone area where despite the presence of a large number of coniferous trees, no birds typical of a coniferous area were found. It was not until the conifer association was reached until such birds as the Winter Wren, and the Myrtle Warbler were seen. The difference between the two areas was

partly one of the density of the trees but the manner in which this might operate is unknown. Food would not seem to be an important factor, nest site would be available, as would nest material. The last two factors would not be as abundant, but would be present in sufficient numbers.

The density in the Aspen area also appeared to be controlled by the density of the vegetation. It would appear that a certain density was required before a species such as the Red-eyed Vireo could invade the area. What this threshold limit is, has not been determined for any species, and would probably vary from area to area. However, a series of studies like this on a much larger scale might provide the necessary data for a correlation on a quantitative basis.

The bird population in an area is of course affected by such factors as nesting success and predation. This factor would tend to fluctuate the population from year to year, and in some cases, might determine the importance of a species in one area. There is no way to foretell the direction of the factor, and so when attempting to predict a possible trend in population, these factors must be assumed to have no effect. When this is done, the problem becomes one of analyzing the vegetative characteristics for their successional trends. The trend in the case of this area will be toward associates with coniferous trees dominant. Where Aspens are present, Red Pine will probably be dominant, while the northern portion will become a more typical Cedar associates. The ecotone area will become dry coniferous, but due to the high water, will contain a great deal of edge for a long time. The Aspen area, while going toward a coniferous forest, will at first become a denser Aspen associates.

The effect of these vegetative trends as a whole will be to increase the number of birds requiring coniferous trees. As a rule, the number of edge birds will decrease, while the number of birds requiring forest interior will increase. Some edge birds will always be present due to the large amount of edge bordering Douglas Lake, and the edge present as a result of the swamp to the east. Therefore, we can expect birds like the Myrtle Warbler, Winter Wren, Wood Thrush, and Pine Warbler to increase and might expect birds such as the Blackburnian Warbler, Black-throated Green Warbler, and Parula Warbler to invade the area. The number of Ovenbirds probably will remain constant, as this species can tolerate a large percentage of coniferous trees. The Red-eyed Vireo will disappear as a dominant, but its decrease will not be as rapid as that of the Redstart. Chickadees will continue to find the necessary habitat, and should remain one of the commoner species. The fate of the edge birds cannot be predicted individually, but their percent of the population should decrease greatly.

Summary.

1. A study was made of a mixed area of the shore of Douglas Lake during the summer of 1946. The purpose of this study was threefold, (1) to determine the breeding bird population, (2) correlate it with the vegetative characteristics, and (3) to determine possible successional trends in the bird population.

2. Three main plant communities were found in the area, the Aspen Associates, the Cedar Associates, and the Red Maple-Aspen, White Pine Ecotone. They were analyzed as to their effect on bird population.

3. The bird communities found in the various plant communities

were analyzed both collectively and individually. The vegetative substrata was found to be the main factor limiting distribution. However, the effect of edge should be taken into consideration.

4. The density of birds for the whole area was 157 pairs/100 acres and when broken up into the various communities, was 94 pairs/100 acres for the Aspen, 216 pairs/100 acres for the Cedar associates, and 224 pairs/100 acres for the ecotone region.

5. An annotated list of the birds seen in the region was presented.

6. Maps showing the territories of some of the breeding pairs were included in the report.

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