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Analysis of Waterfowl Harvest in British Columbia

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Analysis of the waterfowl
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ANALYSIS OF THE WATERFOWL HARVEST RETURNS
IN BRITISH COLUMBIA

by

Fred Simpson

September, 1969

Original project for Dr. J.F. Bendell, Zoology 421, University of British Columbia. Data revised and rewritten for the Canadian Wildlife Service, Vancouver Office.

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Abstract

The 1968 waterfowl kill survey in British Columbia showed a decline in the return of wings by hunters when compared to 1967 results. There was no change in the occurrence by species in the hunters' bag, while the productivity rate showed a decline in 1968. The decline in wing returns by the hunter can be attributed to the decline in waterfowl productivity.

Introduction

Studies on various aspects of waterfowl populations are of vital importance to all game departments. Those studies can range from pair counts in the early spring to the hunter kill surveys in the fall and play an important role in setting up a comprehensive program for proper management of waterfowl.

This report is based on the returns of the National Waterfowl Kill Survey in British Columbia, which is conducted during the fall hunting season. This survey has been conducted on a national scale for the last two years by the Canadian Wildlife Service. Previous surveys (1966) have been conducted by the regional offices of the Canadian Wildlife Service with the co-operation of the Fish and Wildlife Department of British Columbia. Sampled hunters, who are randomly selected from previous years sales record of Canada Migratory Bird Hunting Permits, are requested to send one wing from each duck killed in a post-paid pre-addressed envelope to the regional Canadian Wildlife office. The wings are recorded as to species, age, sex and location at time of kill. The tabulated information can be analysed for population trends and indication of the activities of the hunter in relation to the waterfowl. In total, a management program can be designed when this information is supported by other survey results.

The information in this report is based on hunting over a two-year period, 1967 and 1968. Comparisons are made in regard to species composition, sex and age ratios on a province-wide basis and federal management areas within the Province. I have attempted a simple statistical analysis of the data in order to give a more meaningful picture of the available information.

Procedure

A 10% random sample of the total hunters in British Columbia was selected from previous years sales records of the Canada Migratory Bird Hunting Permits. Those selected were sent post-paid pre-addressed envelopes of their wing samples. No national survey was attempted in the 1966 season because there was no sales record for the previous year. However, a sample was obtained on a provincial wide basis by the British Columbia office of the Canadian Wildlife Service; the hunters sent in one wing from each duck killed and completed the necessary information on the envelopes.

The wings were processed as to species, age, sex and location of kill. This information was tabulated and compared in respect to species composition, age, sex ratios on a province-wide basis and also, on the six Federal management area breakdown for the Province.

Results and Discussion

The general trend, as noted in Figure 1, shows a decline in sample returns. This is particularly noted in the 1967 and 1968 season. Hunter sample size (10%) for each of these years remained consistent. In 1966, a hunter sample was larger (20-30%), thus resulting in a much higher return. However, despite that bias, the declining trend seems valid.

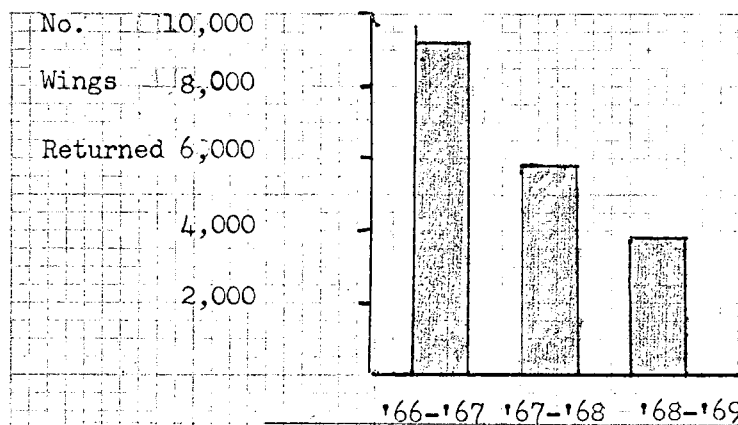


FIGURE 1

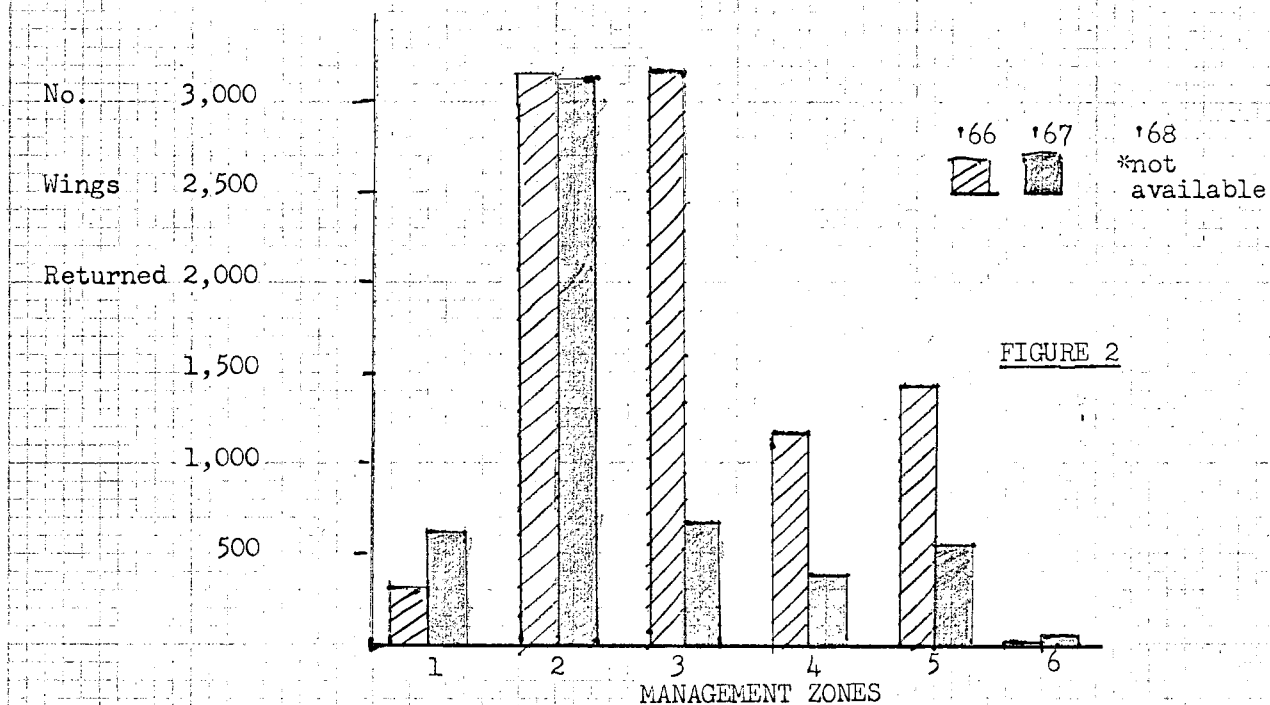


FIGURE 2

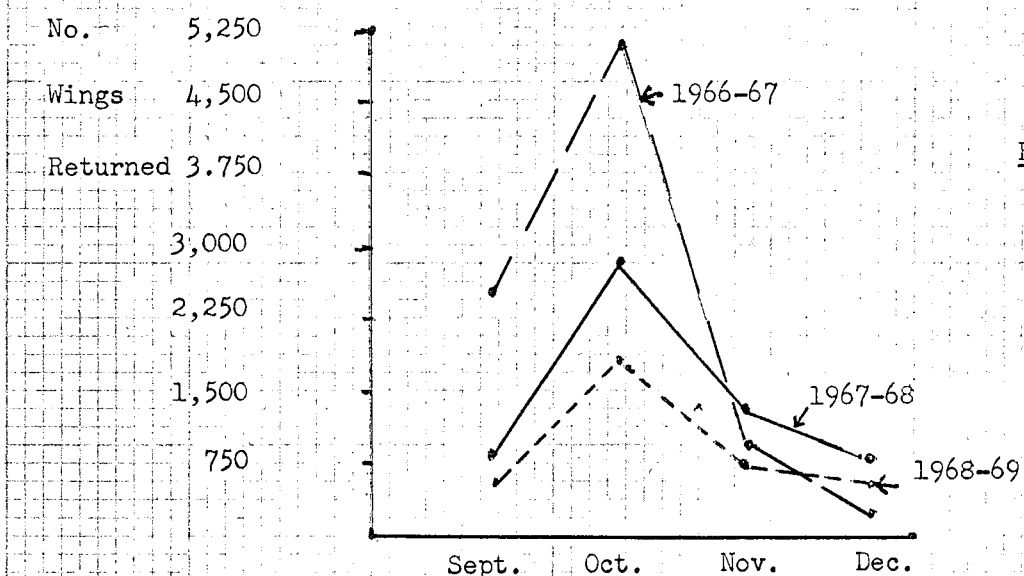


FIGURE 3

Federal management area breakdown of species also shows a general decline for a two year period, (Figure 2 *1968-1969 data not available), except for Zone 1 and 2. Two assumptions can be made from these results at the present leve, ⁽¹⁾ all species have declined sharply or ⁽²⁾ the rate of returns by the hunters have declined for this period. These assumptions appear to be validated by the decline in wing returns at the present time for 1968-1969 season. Management Zones 2 and 3 appear at the present time more favourable in terms of hunter success, possibly due to more permits sold for these districts. The period of most hunter activity is October, as indicated by Figure 3. This can be expected particularly if one correlates management zone results with hunting time schedules for each zone.

Factor analysis of the species composition data for the last two years, (1967-1968, 1968 - 1969), indicated the following results (Table V(b)). There is a significant difference between each species for both years of comparison. One would expect this situation. There is no significant difference between the two years for each species involved in the comparison (11 species). This is shown in analysis of percentage composition as well as actual wing return counts for each species for this period. Similar analysis of data for the three year period indicates no change in the comparison of percentage species composition. The use of actual numbers of wings shows significance for both species and years comparisons. However, this could be attributed to the method of sample collection in the 1966-1967 season, Table V(b).

The data also indicates that mallard, widgeon, green-winged teal and pintail are highly significantly different from each other and from the remaining species (Figure 4) for all years of comparison. The remaining species show

little, if any, significant difference among themselves in comparison.

T-test @ .05 level - 5.85%.

** highly significant

* indicates significance

Figure 4

Mallard	- 117.99**	Shoveller	- 7.25*	Woodduck	- 1.71
Widgeon	- 53.10**	B.W. Teal	- 5.89*	Red Head	- 1.59
G.W. Teal	- 40.51**	C. Golden Eye	- 5.18	Canvas Back	- 1.26
Pintail	- 35.96**	B. Golden Eye	- 4.52	Greater Scaup	- 1.20
Bufflehead	- 9.17*	Ring-Neck	- 3.18	Gadwall	- .81
L. Scaup	- 8.50*				

An index of the duck population can be determined by the use of immature-adult ratios. These ratios may indicate productivity of the population or mortality of the young provided the adult mortality is constant. Analysis of variance of this ratio for the last two years indicate no significant difference between the (11) species compared. However, there is a significance between these years for each species compared. This would indicate that the productivity decline (Table Va2) is valid from the 1967-1968 to 1968-1969 season.

Analysis of the age ratio of the 4 major species for the same two-year period also indicates that the productivity decline is significant for each species. As a point of interest, similar analysis for the three-year period was done. No significant difference was found between species and the years during this period for both the 11 species and four major species comparison. No explanation can be given for this fact, other than method of collection for 1966-1967 season.

Hunting for waterfowl in British Columbia has shown only a slight increase as noted by the number of potential hunters during the survey period. One would assume that the hunting pressure on waterfowl has remained fairly constant during the past two years.

Potential Hunters 1966	-	32,244
1967	-	33,195
1968	-	33,301

Since the data for the two seasons is considered statistically sound, the overall picture of results would indicate a decline in productivity for the 1968 season. The correlation of the no changes in species percentage composition for the two year with the decline in productivity would indicate the returns percentage for each species hunted remains fairly constant regardless of the population trend.

Conclusion

The general indication of the National Waterfowl Kill Survey shows that the rate of returns by the hunter has declined over the last two years. Analysis of the available data indicates the species composition has shown no significant changes in the percentage of kill returns for each species hunted in British Columbia. However, evaluation of the age ratio index shows a significant decline in productivity for the four major species (mallard, widgeon, green-winged teal and pintail) hunted as well as the remaining species. This factor would explain the reduction in actual number of returns by the hunter during 1968-1969 survey period.

The hunting pressure for each species remains fairly constant as noted by the insignificant changes in species composition percentage of wing returns.

Hunting pressure can be maintained at the present level provided the results from 1969 spring survey show an increase in waterfowl production.

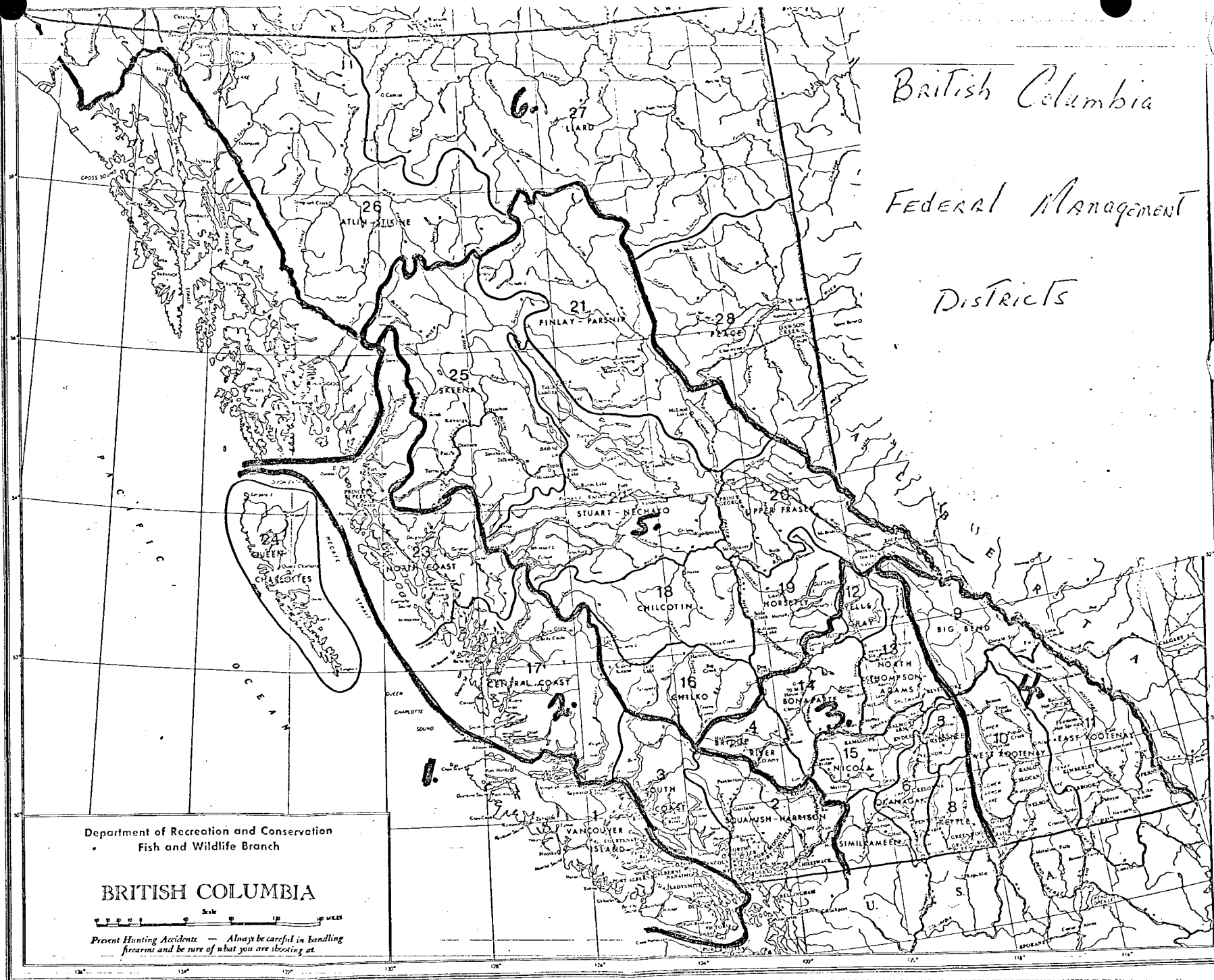
This survey should be maintained at the present level of administration in order to assure consistency in the collection of data. It provides a valid assessment of trends in waterfowl population which is required for proper management of these populations. However, management programs should not be based totally on the findings of this survey and other surveys must be included concurrently. More publicity is needed to show hunters the value of this survey.

Acknowledgments

I express sincere appreciation to Canadian Wildlife Service who made available previous years' data, special thanks to W.A. Morris, Wildlife Biologist, Canadian Wildlife Service, and M.D. Noble, Technician II, Canadian Wildlife Service, for their suggestions on analysis of the data. Thanks to D. Lauriente, Statistician, University of British Columbia Biology Department, for her computer analysis of the data and the co-operation of hunters who made this survey possible.

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SPECIES	ZONE 1		ZONE 2		ZONE 3		ZONE 4	
	66-67 Sample %	67-68 Sample %	66-67 Sample %	67-68 Sample %	66-67 Sample %	67-68 Sample %	66-67 Sample %	67-68 Sample %
Mallard	33 - 10.12	302 - 48.32	1249 - 39.92	1184 - 38.02	1118 - 34.96	396 - 59.10	522 - 43.76	189 - 48.09
Hadwin	- - -	2 - .32	4 - .13	15 - .48	8 - .25	- - -	5 - .42	- - -
Pintail	41 - 13.31	42 - 6.72	663 - 21.19	468 - 15.03	225 - 7.04	25 - 3.73	101 - 8.47	18 - 4.58
G.W. Teal	54 - 17.53	123 - 19.68	507 - 16.20	629 - 20.20	265 - 8.29	31 - 4.63	59 - 4.95	23 - 5.85
B.W. Teal	1 - .32	1 - .16	8 - .26	3 - .09	119 - 3.72	12 - 1.79	21 - 1.76	4 - 1.02
Widgeon	53 - 17.21	94 - 15.04	551 - 17.61	639 - 20.52	343 - 10.73	70 - 10.15	326 - 27.33	115 - 29.27
Shoveller	9 - 2.92	14 - 2.24	52 - 1.66	54 - 1.73	119 - 3.72	14 - 1.14	11 - .92	4 - 1.02
Wood duck	- - -	- - -	8 - .26	30 - .96	1 - .03	3 - .45	18 - 1.51	18 - 4.58
Red Head	- - -	- - -	6 - .19	2 - .06	67 - 2.00	2 - .30	27 - 2.26	1 - .25
Ring Neck	- - -	4 - .64	18 - .56	6 - .19	90 - 2.81	5 - .75	17 - 1.42	1 - .25
Canvas Back	- - -	- - -	19 - .61	11 - .35	19 - .59	2 - .30	5 - .42	3 - .76
Water Scaup	14 - 4.55	14 - 2.24	15 - .48	12 - .39	- - -	4 - .60	2 - .17	1 - .25
Lesser Scaup	11 - 3.57	3 - .48	8 - .26	13 - .42	176 - 5.50	29 - 4.32	18 - 1.51	2 - .51
C. Golden Eye	9 - 2.92	2 - .32	4 - .13	9 - .29	261 - 8.16	5 - .75	32 - 2.85	2 - .51
B. Golden Eye	1 - .32	2 - .32	- - -	4 - .13	10 - .31	49 - 7.31	3 - .25	4 - 1.02
Bufflehead	34 - 11.04	7 - 1.12	6 - .19	18 - .57	331 - 10.35	27 - 4.03	18 - 1.51	5 - 1.27
Others +	48 - 15.58	15 - 2.40	11 - .35	17 - .53	46 - 1.44	2 - .30	6 - .50	3 - .76
Total	308	625	3129	3114	3198	670	1193	393

WATER FOWL

SPECIES COMPOSITION -

* occurrence

+ Ruddy duck, Mergansers, scoters, oldsquaw

Table I

Species	Zone 5		Zone 6		Zone 7 ²		Provincial Composition		
	66-67 sample %	67-68 sample %	66-67 sample %	67-68 sample %	66-67 sample %	67-68 sample %	66-67	67-68	68-69
Mallard	548 - 37.11	268 - 48.11	- -	49 - 61.25	- -	187 - 44.42	3470 - 37.04	2575 - 44.13	1423 - 36.12
Endwall	3 - .21	- -	- -	1 - 1.25	- -	- -	20 - .22	18 - .31	11 - .28
Pintail	65 - 4.52	33 - 5.92	- -	17 - 21.25	- -	66 - 15.68	1085 - 11.88	669 - 11.46	496 - 12.62
G.W. Teal	168 - 7.51	40 - 7.18	- -	- -	- -	46 - 10.93	994 - 10.72	892 - 15.28	570 - 14.51
B.W. Teal	97 - 6.75	27 - 4.85	- -	- -	- -	2 - .48	246 - 2.67	44 - .83	94 - 2.39
Widgeon	142 - 9.87	72 - 12.93	- -	5 - 6.25	- -	63 - 14.96	1415 - 15.35	1058 - 18.13	771 - 18.62
Shoveler	38 - 2.64	9 - 1.62	- -	- -	- -	10 - 2.38	229 - 2.48	99 - 1.69	121 - 3.08
Woodduck	- -	4 - .72	- -	- -	- -	6 - 1.43	27 - .29	61 - 1.04	15 - .38
Red Head	19 - 1.32	4 - .72	- -	- -	- -	1 - .24	119 - 1.29	10 - .17	5 - .13
Ring Neck	48 - 3.35	14 - 2.51	- -	- -	- -	2 - .48	193 - 1.88	32 - .54	30 - .76
Canada Bick	15 - 1.04	5 - .90	- -	1 - 1.25	- -	- -	58 - .63	22 - .38	10 - .25
Greater Scaup	- -	- -	- -	- -	- -	3 - .71	31 - .34	34 - .58	11 - .28
Lesser Scaup	86 - 5.98	14 - 2.51	- -	4 - 5.00	- -	3 - .71	299 - 3.24	68 - 1.16	164 - 4.19
C. Golden Eye	85 - 5.91	2 - .36	- -	- -	- -	- -	393 - 4.26	20 - .34	23 - .58
B. Golden Eye	81 - 5.63	31 - 5.57	- -	1 - 1.25	- -	11 - 2.61	95 - 1.03	102 - 1.79	67 - 1.70
Bufflehead	91 - 6.33	29 - 5.21	- -	- -	- -	12 - 2.85	480 - 5.21	98 - 1.67	90 - 2.29
Others ⁺	12 - .83	5 - .90	- -	2 - 2.50	- -	9 - 2.15	75 - .81	27 - .46	27 - .69
Total	1438	557	-	80	-	421	9219 ✓	5834	3928

Waterfowl

SPECIES Composition

* OCCURRENCE = %

+ Ruddy duck, Mergansers, Scoters, old squaw

1 - excludes Scoters, old squaw

2 - general - no location determined by hunters

TABLE I

SPECIES	ZONE 1				ZONE 2				ZONE 3				ZONE 4			
	66-67		67-68		66-67		67-68		66-67		67-68		66-67		67-68	
	SAMPLE	I/A	SAMPLE	I/A	SAMPLE	I/A	SAMPLE	I/A	SAMPLE	I/A	SAMPLE	I/A	SAMPLE	I/A	SAMPLE	I/A
Mallard	27 - 5.80		281 - 3.30		1218 - 3.56		1045 - 3.50		1102 - 9.30		374 - 3.70		477 - 3.87		176 - 1.7	
Gadwall	- -		1 - -		4 - -		15 - 2.8		8 - 7.00		- -		5 - 1.5		- -	
Pintail	41 - 4.10		40 - 4.0		654 - 2.82		429 - 4.0		220 - 6.58		23 - 6.76		101 - 2.88		18 - 1.6	
G.W. Teal	54 - 4.4		106 - 6.1		491 - 2.43		549 - 7.2		231 - 3.2		24 - 7.0		45 - .46		21 - 9.5	
B.W. Teal	1 - -		1 - -		8 - 1.67		3 - -		119 - 1.25		9 - -		21 - 1.3		3 - -	
Widgeon	53 - 3.40		92 - 4.40		549 - 2.87		626 - 4.90		342 - 7.14		70 - 1.8		322 - 2.42		113 - 3.9	
Shoveller	9 - 8.		13 - 5.5		51 - 4.67		50 - 4.60		118 - 2.56		7 - 2.50		11 - -		4 - -	
Wood duck	- -		- -		7 - 2.5		24 - 11		- -		3 - 2.0		18 - .64		18 - -	
Red Head	- -		- -		6 - -		2 - -		67 - 4.58		2 - -		27 - .93		- -	
Ring Neck	- -		4 - 1.0		18 - 5		5 - 4.0		83 - 3.61		5 - -		16 - 2.2		- -	
Canvas Back	- -		- -		19 - 5.33		11 - 4.5		18 - 3.50		2 - 1.0		5 - -		3 - 2.0	
Greater Scaup	14 - 3.66		14 - 2.5		15 - .25		12 - 3.0		- -		4 - -		2 - -		1 - -	
Lesser Scaup	11 - 4.5		3 - -		8 - -		13 - 5.5		176 - 7.38		27 - 4.4		18 - 5.0		- -	
C. Golden Eye	9 - 3.5		2 - 1.0		4 - 3		9 - .8		252 - 6.2		5 - .7		33 - 4.33		2 - -	
B. Golden Eye	1 - -		1 - -		- -		4 - -		10 - 1.43		48 - 15.0		3 - .5		4 - 3.0	
Buffle head	34 - 3.86		7 - 2.5		6 - 1.0		17 - 7.5		229 - 3.89		26 - 3.3		14 - 1.33		5 - -	

WATER FOWL - AGE RATIO (KNOWN AGES)

TABLE II

SPECIES	ZONE 5		ZONE 6		ZONE 7 ²		Provincial - Ratio		
	66-67	67-68	66-67	67-68	66-67	67-68	66-67	67-68	68-69
	SAMPLE - $\frac{F/A}{}$	SAMPLE - $\frac{F/A}{}$	SAMPLE $\frac{F/A}{}$	SAMPLE - $\frac{F/A}{}$	SAMPLE $\frac{F/A}{}$	SAMPLE $\frac{F/A}{}$	SAMPLE $\frac{F/A}{}$	SAMPLE $\frac{F/A}{}$	SAMPLE - $\frac{F/A}{}$
Mallard	505 - 3.46	248 - 7.0	- -	47 - 3.7	- -	163 - 4.1	3329 - 5.01	2381 - 3.50	1312 - 2.35
Godwail	- -	- -	- -	- -	- -	- -	20 - 5.66	17 - 2.4	11 - -
Pintail	65 - 5.5	32 - 4.3	- -	17 - 16.0	- -	58 - 3.8	1081 - 3.43	617 - 4.10	478 - 3.47
C.W. TEAL	96 - 6.38	37 - 5.2	- -	- -	- -	36 - 8.0	902 - 2.85	773 - 7.10	530 - 6.46
B.W. TEAL	96 - 2.43	25 - 7.3	- -	- -	- -	2 - -	245 - 163	43 - 13.38	91 - 6.00
Widgeon	142 - 6.47	72 - 10.3	- -	5 - 1	- -	63 - 4.7	1408 - 3.56	1041 - 4.50	749 - 2.86
Shoveller	37 - 6.4	8 - 3.0	- -	- -	- -	10 - 4.2	226 - 4.51	92 - 4.40	114 - 4.70
Wood duck	- -	4 - -	- -	- -	- -	6 - 2.0	26 - 1.00	55 - 10.10	15 - -
Red Head	19 - -	3 - -	- -	- -	- -	1 - -	119 - 3.25	8 - -	5 - -
Ring Neck	45 - 4.63	14 - 6.0	- -	- -	- -	2 - -	162 - 3.76	30 - 5.00	29 - 1.90
CANVAS BACK	15 - 4.0	5 - .7	- -	- -	- -	- -	57 - 4.70	22 - 2.10	10 - -
GREATER SCAUP	- -	- -	- -	- -	- -	3 - -	31 - 1.06	34 - 3.30	- -
LESSER SCAUP	83 - 4.92	13 - 4.3	- -	3 - 2.0	- -	3 - 2.0	296 - 3.17	63 - 4.20	151 - 1.56
C. GOLDEN EYE	82 - 12.67	2 - -	- -	- -	- -	- -	380 - 6.92	20 - 1.20	23 - 1.56
B. GOLDEN EYE	81 - 5.75	31 - 6.8	- -	1 - -	- -	- -	95 - 3.31	10 - 11.55	63 - 2.94
Buffle head	89 - 8.89	28 - 2.1	- -	- -	- -	12 - 2.0	471 - 6.03	95 - 3.15	88 - 2.38
			- -	- -	- -	- -			

TOTAL 8848 5390 3669

WATERFOWL - AGE RATIO (KNOWN AGES)

* general - no location determined by hunters.
TABLE II

SPECIES	1966-67		1967-1968		1968-69
	SAMPLE AM/AF	SAMPLE EM/EF	SAMPLE AM/AF	SAMPLE EM/EF	SAMPLE AM/AF
Mallard	553-1.19	2776-1.03	509-1.44	1792-.98	390-1.19
Cardinal	3-.5	17-1.13	5-.67	12-1.40	-
Pintail	244-.42	837-1.23	122-.85	495-1.12	107-1.18
G.W. Teal	234-.8	668-.79	97-.56	663-.86	71-.54
B.W. Teal	93-.69	152-1	3-0	40-2.08	-
Widgeon	309-1.14	1099-.93	190-1.71	851-1.08	194-2.13
Shoveler	41-.52	185-.95	17-.42	75-1.78	20-.18
Wood duck	13-.63	13-.63	5-.67	50-1	-
Red Head	28-.87	91-1.07	0--	8-1.67	-
Ring Neck	34-1.13	128-.71	5-1.5	25-1.27	-
Canvas Back	10-1	47-2.13	7-2.5	14-1	-
Greater Scaup	15-.67	16-3.0	8-.33	26-1.16	-
Lesser Scaup	178-.82	225-.91	12-1.0	50-1.38	59-3.54
C. Golden Eye	48-.23	332-1.35	9-1.25	11-2.67	-
B. Golden Eye	22-.38	73-.87	8-0	27-1.29	-
Buffle head	17-.76	404-1.09	23-.92	71-.97	-

WATER FOWL SEX RATIO (KNOWN SEXES)

TABLE III

SPECIES	SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	66-67	67-68*	68-69	66-67	67-68*	68-69	66-67	67-68*	68-69	66-67	67-68*	68-69
Mallard	846		233	1902		614	484	-	371	117		219
Widgeon	297		81	786		332	172		121	128		173
H. W Teal	203		64	697		308	60		92	18		22
B. W Teal	142		72	102		31	12		5	-		
Shoveller	77		24	136		77	14		17	2		6
P. Teal	161		50	743		325	149		139	26		71
Red Head	42		7	71		2	6		1			
Ring Neck	66		13	105		13	2		2			
Canvas B	20		-	29		10	5		-			
L Scaup	132		14	139		19	15		5	9		4
C. Molder Eye	233		6	142		70	12		4	1		3
B. Molder Eye	84		24	8		26	2		8	0		3
Bufflehead	191		20	250		41	13		17	18		16
	2494	910	598	5110	2722	1808	936	1349	782	316	824	459

Monthly Wing Returns.

Table IV.

* 1967-68 - Species Total Not Available.

Table V a

(1)

SPECIES	% WATERFOWL SPECIES COMPOSITION			
	1966-67	1967-68	1968-69	TOTAL
Mallard	37.64	44.13	36.22	117.99
Gadwall	.22	.31	.28	.81
Widgeon	15.35	18.13	19.62	53.10
C.W. Teal	10.72	15.28	14.51	40.51
B.W. Teal	2.67	.83	2.39	5.89
Shoveller	2.48	1.69	3.08	7.25
Pintail	11.88	11.46	12.62	35.96
Wood duck	.29	1.64	.38	1.71
Red Head	1.29	.17	.13	1.59
Ring Neck	1.88	.54	.76	3.18
Cinnamon Back	.63	.38	.25	1.26
Greater Scaup	.34	.58	.28	1.20
Lesser Scaup	3.24	1.16	4.17	8.50
C. Golden Eye	4.26	.34	.58	5.18
B. Golden Eye	1.03	1.79	1.70	4.52
Buffbreed	5.21	1.67	2.29	9.17
-Total	99.13	99.50	99.26	297.89.

WATERFOWL SPECIES COMPOSITION

* DATA FROM TABLE I

T DATA FROM TABLE II

(2)

SPECIES	T IMMATURE/ADULT. RATIO			
	1966-67	1967-68	1968-69	TOTAL
Mallard	5.01	3.50	2.35	10.86
Gadwall	5.66	2.40	-	8.06
Widgeon	3.56	4.50	2.86	10.92
C.W. Teal	2.85	7.00	6.46	16.31
B.W. Teal	1.63	13.30	6.00	20.93
Shoveller	4.51	4.40	4.70	13.61
Pintail	3.43	4.10	3.47	11.00
Wood duck	1.00	10.00	-	11.00
Red Head	3.25	-	-	3.25
Ring Neck	3.76	5.00	1.90	10.66
Cinnamon Back	4.70	2.10	-	6.80
Greater Scaup	1.66	3.30	-	4.96
Lesser Scaup	3.17	4.20	1.56	8.93
C. Golden Eye	6.92	1.20	1.56	9.68
B. Golden Eye	3.31	11.50	2.94	17.75
Buffbreed	6.03	3.10	2.38	11.51
Total	59.85	79.60	36.18	175.63.

IMMATURE/ADULT. RATIO.

PERCENTAGE SPECIES COMPOSITION - 2 YEARS - 16 SPECIES
A 2 FACTOR ANALYSIS WITH NUMBER OF LEVELS 16 2 0 0

	Sum Sq	DF	MSQ	F	P	F.05	F.01
SPECIES	0.3460E 04	15	0.2307E 03	40.83	0.0000	4.54**	8.68*
YEARS	0.1428E 01	1	0.1428E 01	0.25	1.0000		
ERROR	0.8473E 02	15	0.5649E 01				
TOTAL	0.3546E 04	31					

SPECIES COMPOSITION - Actual Numbers - 2 YEARS 16 SPECIES
A 2 FACTOR ANALYSIS WITH NUMBER OF LEVELS 16 2 0 0

	Sum Sq	DF	MSQ	F	P	F.05	F.01
SPECIES	0.8567E 07	15	0.5711E 06	12.86	0.0000	4.54	8.68
YEARS	0.1135E 06	1	0.1135E 06	2.55	0.1273		
ERROR	0.6659E 06	15	0.4439E 05				
TOTAL	0.9347E 07	31					

1967-'68 AND 1968-'69 SEASON.

ANALYSIS OF VARIANCE - SPECIES COMPOSITION

TABLE II b

PERCENTAGE SPECIES COMPOSITION 3 YEARS 16 SPECIES
A 2 FACTOR ANALYSIS WITH NUMBER OF LEVELS 16 3 0 0

	Sum Sq	DF	MSQ	F	P	F.05	F.01
SPECIES	0.4781E 04	15	0.3187E 03	7.47	0.0000	3.68	6.36
YEARS	0.2013E 01	2	0.1006E 01	0.22	1.0000		
ERROR	0.1338E 03	30	0.4460E 01				
TOTAL	0.4917E 04	47					

SPECIES COMPOSITION Actual Counts - 3 YEARS 16 SPECIES
A 2 FACTOR ANALYSIS WITH NUMBER OF LEVELS 16 3 0 0

	Sum Sq	DF	MSQ	F	P	F.05	F.01
SPECIES	0.1888E 08	15	0.1259E 07	18.72	0.0000	3.68	6.36
YEARS	0.9803E 06	2	0.4901E 06	6.61	0.0042		
ERROR	0.1996E 07	30	0.6654E 05				
TOTAL	0.2176E 08	47					

1966-'67, 1967-'68, AND 1968-'69 SEASON.

IMMATURE TO ADULT RATIO - 2 YEARS - 11 SPECIES
A 2 FACTOR ANALYSIS WITH NUMBER OF LEVELS 11 2 0 0

	SUM SQ	D.F.	MNSQ	F	P	F.05	F.01
SPECIES	0.1181E 03	10	0.1181E 02	2.65	0.0695	4.96	10.04
YEARS	0.2983E 02	1	0.2983E 02	6.71	0.0260		
ERROR	0.4445E 02	10	0.4445E 01				
TOTAL	0.1924E 03	21					

IMMATURE TO ADULT RATIO - 2 YEARS 4 SPECIES
A 2 FACTOR ANALYSIS WITH NUMBER LEVELS 4 2 0 0

	SUM SQ	D.F.	MNSQ	F	P	F.05	F.01
SPECIES	0.1688E 02	3	0.5629E 01	43.28	0.0096	10.13	34.12
YEARS	0.1960E 01	1	0.1960E 01	15.07	0.0330		
ERROR	0.3900E 00	3	0.1300E 00				
TOTAL	0.1923E 02	7					

1967-68 AND 1968-69

ANALYSIS OF AGE RATIO TABLE IIc

IMMATURE TO ADULT RATIO - 3 YEARS - 11 SPECIES
A 2 FACTOR ANALYSIS WITH NUMBER LEVELS 11 3 0 0

	SUM SQ	D.F.	MNSQ	F	P	F.05	F.01
SPECIES	0.4830E 02	10	0.4830E 01	0.70	1.0000	4.10	7.56
YEARS	0.3123E 02	2	0.1561E 02	2.28	0.1264		
ERROR	0.1369E 03	20	0.6847E 01				
TOTAL	0.2164E 03	32					

IMMATURE TO ADULT RATIO 3 YEARS - 4 SPECIES
A 2 FACTOR ANALYSIS WITH NUMBER OF LEVELS - 4 3 0 0

	SUM SQ	D.F.	MNSQ	F	P	F.05	F.01
SPECIES	0.7248E 01	3	0.2416E 01	1.15	0.4018	9.55	30.81
YEARS	0.2819E 01	2	0.1409E 01	0.67	1.0000		
ERROR	0.1255E 02	6	0.2093E 01				
TOTAL	0.2263E 02	11					

1966-67, 1967-68, AND 1968-69