No. 49

March 1, 1959

ONTARIO

FISH AND WILDLIFE MANAGEMENT REPORT

PROVINCE OF ONTARIO

DEPARTMENT OF LANDS AND FORESTS

Division of Fish and Wildlife

(THESE REPORTS ARE FOR INTER-DEPARTMENTAL INFORMATION AND NOT FOR PUBLICATION)

Hon. J. W. Spooner
Minister

F. A. MacDougall
Deputy Minister

TABLE OF CONTENTS

No. 49 November, 1959

Page

Luther Marsh Game Bag Census, October 3, 1959. - by R. E. Mason 1

Waterfowl Bag Check, Tweed District, September 19, 1959. - by W. W. Bittle 3

Report on Opening Day of the Duck Hunting Season, 1959 at Holland Marsh. - by R. H. Trotter and A. A. Wainio 8

Sharp-tailed Grouse Report, Fort Frances District, Winter and Spring, 1959. - by J. Farr 13

Considerations Concerning a Wetland Inventory for Southern Ontario. - by J. B. Dawson 16

Address to Ontario Game Breeders Association, July 15, 1959. - by Dr. F. W. Remmler 20

Census for Cottontail Rabbits, Lake Huron District, 1958-59. - by R. E. Mason 25

Cottontail Index - Pelee Island, 1953-59. - by L. J. Stock 28

The Size, Rate of Growth and Longevity of the Black Bear (*Ursus americanus americanus*). - by C. W. Douglas 29

Moose Browse Survey - Gogama District, 1959. - by G. E. Vozeh and A. Zimmerman 39

Page

The 1958/59 Aerial Census of Moose in Ontario. - by R. Boultbee 44

Trap-net Programme on Lake of the Woods. - by C. A. Elsey 52

(THESE REPORTS ARE FOR INTRA-DEPARTMENTAL
INFORMATION AND NOT FOR PUBLICATION)

LUTHER MARSH GAME BAG CENSUS,
OCTOBER 3, 1959

by
R. E. Mason

An estimated 1,970 hunters utilized Luther Marsh opening day. This estimate was based on a count of automobiles which were parked in the immediate vicinity of the marsh between 12.00 noon and 2.00 P.M.. The mean number of hunters per car was obtained from the six checking stations. The figure of 1,970 hunters should be considered minimum as some hunters come to the marsh in time for the evening shoot only.

Six checking stations were operated at access points from 3.30 P.M. until virtually all hunters had left the marsh. 1,564 hunters were checked, having hunted 8,622 hours to bag 1,723 ducks, or one hunter hunted 4.9 hours to bag 1.1 ducks. Based on the total hunter estimate, an estimated 2,170 ducks were shot opening day. This does not include crippling loss which is suspected to be high. (22% on 4,670 ducks in 1958). In addition 294 coots and five Canada geese passed through the checking stations.

Information collected at the checking stations is presented in the following tables:

TABLE ONE - <u>Species Composition, Sex and Age</u>

Species	Ad.	Ad.	Juv.	Juv.	Unknown	Total	%
Mallard	166	144	59	49	60	478	27.8
Black	133	149	48	33	57	420	24.3
B. W. Teal	78	107	49	83	31	348	20.1
G. W. Teal	32	44	14	20	6	116	6.7
Redhead	1	4	4	8	-	17	0.9
Ruddy	8	5	8	11	2	34	1.9
Wood Duck	14	4	2	-	-	20	1.1
Gadwall	1	1	3	-	4	9	0.5
Ringneck	3	5	4	17	4	33	1.8
Bufflehead	1	-	1	1	-	3	0.1
Pintail	6	10	3	13	2	34	1.9
Scaup	1	3	1	8	1	14	0.8
Shoveler	-	1	-	1	1	3	0.1
American Widgeon (Baldpate)	7	8	5	4	4	28	1.6
Merganser	-	-	-	-	15	15	0.8
Unidentified	-	-	-	-	151	151	8.7
						1723	99.1

TABLE TWO - Sex Ratio Observed

Species	♂♂	♀♀	♂♂/100 ♀♀	Chi square at 0.05 Assum. even Ratio
Mallard	225	193	116.5	not sig.
Black	181	182	99.5	not sig.
B. W. Teal	127	190	66.9	sig.
G. W. Teal	46	64	71.9	not sig.

Of the 5 Canada geese shot - 2 were juvenile males
2 were juvenile females
1 was adult female

TABLE THREE - Age Ratio Observed

Species	Adult	Juvenile	Juv./Adult
Mallard	310	108	0.3
Black	282	81	0.4
B. W. Teal	185	132	1.7

Black ducks were shot in about the same proportions as other years (seven year mean). There was a slight increase in the proportion of mallards and blue-winged teal and a decrease in green-winged teal when compared with the seven year average. Comparing only the 1958 and 1959 figures, the proportion in the bag of blacks, mallards and green-winged teal decreased while blue-winged teal increased from 8.5 to 20.1%.

The juvenile per adult ratio for blacks and blue-winged teal was considerably below (fewer juveniles) both the mean ratio and 1958 ratios for those species. Mallards showed a slight increase (more juveniles) in both instances.

Unfortunately, we are not able to say that these age ratios reflect current production. Under the frequently harassed conditions of a checking station, anal examination is not always possible, and it is expected that ducks recorded in the "unknown" column of table one may contain a disproportionately high number of juveniles. Large magnitude changes where the proportion of "unknown" ducks is small may be indicative of current production.

WATERFOWL BAG CHECK - TWEED DISTRICT - SEPTEMBER 19, 1959

by
W. W. Bittle

Location of Checks -

Wolfe Island
Prince Edward County
South Central Townships
North Central Townships
North Eastern Townships
Conroy Marsh

Purpose

The purpose of the bag check was to determine the number of ducks shot per hunter; the effort and the species in the bag. Where possible an age and sex analysis was carried out.

Low waters in the marshes in the Bay of Quinte-Lake Ontario area was the direct result of fewer ducks in what was our most productive marshes in the south. The routine bag check on Prince Edward County was hindered by an enforcement problem on the Big Island Marsh, as well as low water.

The normal bag check point at Hay Bay was cancelled in favour of a more popular place, Camden (Mud) Lake in Camden Township. The check here also included data gathered from points in the surrounding townships.

General Remarks

During the night prior to the opening day, a heavy frost blanketed the district with the exception of the islands in Lake Ontario. Prince Edward County received a light frost in various places.

The temperature ranged from a low of 27° in the north to a high of 59° in the south.

The cold air mass moved in from the west, but by the time the hunters were going into the marshes (approximately 05:00 hours) the wind was nil. By mid-morning the wind came from the southwest at 10-15 m.p.h.

Over the most part of the district the sky was clear with some heavy fog patches hanging over the waters in certain localities.

Shooting started with the first sign of light at approximately 05:50 although at Mud Lake it was reported the shooting commenced at 05:30. The intensity of gun fire increased and was at its heaviest at 06:10 and remained high until 06:30. From this point on firing gradually quieted to spasmodic bursts throughout the morning. Occasional bursts continued until just before dark when once again the shooting became intense although not in comparison with the morning shoot.

During the early morning on Wolfe Island, flocks of teal could be seen almost everywhere. Blacks and mallards were observed in lesser numbers and usually at a greater height. Many hunters passed up good teal shots, waiting for larger ducks.

By 09:00 hours teal were still seen but generally in small flocks and were decoying for hunters located deep in bays.

Hunters complained of the early opening and that it had a tendency to drive ducks to the south. However, the early opening did result in a large kill of teal which normally would not be here in such large numbers had the hunt commenced at a later date under normal weather conditions.

Throughout Sunday, teal were observed in all the bays along Wolfe Island, coming and going at intervals. Few blacks and mallards were observed.

On Conroy Marsh scarcity of ducks (as compared to other years) resulted in a poor shoot. Added to this was the heavy fog that hung over the marsh and the noise of night-long party makers (would-be duck hunters) with their spirits and fires to ward off the cold (and ducks).

SUMMARY

Location	Hunters	Hours	Ducks	Cripples Lost	Dogs Used	Mallard	Black	Green-winged Teal	Blue-winged Teal	Wood Duck	Ring-necked Duck	Scaup	Pintail	American Widgeon (Baldpate)	Ducks Per Hunter	Ducks Per Hunter Hour
Wolfe Island	83	302	312	38	11	23	43	51	188	0	0	0	6	1	3.7	1.0
Prince Edward County	16	68	59	2	1	9	17	2	23	7	0	1	0	0	3.7	.89
Camden Vic.	72	483	181	4	3	27	58	34	47	7	0	5	3	0	2.5	.37
Central	88	328	87	28	27	9	35	8	8	27	0	0	0	0	1.0	.26
North-East	37	143	102	13	5	4	67	7	3	17	1	1	2	0	2.6	.71
Conroy Marsh	27	49	23	5	0	0	2	0	0	4	16	1	0	0	.8	.47
TOTALS	323	1373	764	92	57	72	222	102	269	63	17	8	11	1	2.36	.55

The number of cripples lost (92 birds) represents 12% of the total ducks in the bag.

On Wolfe Island an effort was made to determine an age and sex analysis by examination of the cloaca. In some cases the age determination in females was assisted by the tail feather method.

The following table shows a total of 192 ducks that were thoroughly examined to give an accurate account of an age and sex analysis.

	♂		♀		Unsexed & Unaged
	Adult	Juvenile	Adult	Juvenile	
Blue-winged Teal	9	53	12	48	66
Green-winged Teal	7	10	6	10	18
Black	2	13	2	4	22
Mallard	0	4	3	5	11
Pintail	0	1	0	2	3
American Widgeon (Baldpate)	0	1	0	0	0

Explanation of Duck Check Points

For the purpose of this report an explanation is felt necessary to describe the method used to check hunters during the opening day of the duck season for 1959.

1. Wolfe Island - Officers Saundercook and Bittle. Hunters were checked throughout the day as they came from the marshes to catch the ferry from the island to the mainland. Between ferry runs, hunters were contacted at their various camps throughout the island and some cars were stopped on other roads if it were obvious that the occupants were hunters.

2. Prince Edward County - Officers Winters and Warner. As previously stated the check was hindered by an enforcement problem relating to baiting. This resulted in the seizure of 54 ducks. When time permitted hunters were checked on marshes in Hallowell and Hillier Townships and at Fish Lake.

3. South central townships - Officers Ferguson and Page. The majority of the check was made at Camden (Mud) Lake in Camden Township. Additional hunters were checked in the surrounding townships of Portland, Sheffield and Hinchinbrooke.

4. North central townships - Officers Dornan, Davison and Thibadeau. Townships of Hungerford, Marmora, Madoc, Elzevir, Clarendon and South Canonto. Hunters were checked on the marshes and on the roads from the marshes.

5. North eastern townships - Officers Stewart and Schonauer. The marshes in and around Calabogie Lake in Blithfield Township and Clyde Forks and Lavant Township. Hunters were checked wherever contacted in the marshes or on access roads to the marshes.

6. Conroy Marsh - Officers Fleguel and Hooton. Hunters were contacted on the marsh surrounding the game preserve in Raglan Township.

REPORT ON OPENING DAY OF THE DUCK SEASON AT HOLLAND MARSH, 1959

by
R. H. Trotter and A. A. Wainio

The Holland Marsh extends from Cook's Bay, the south end of Lake Simcoe, along both sides of the Schomberg River to Highway 11. The heaviest concentration of marsh is found at the south of Cook's Bay just at the mouth of the Schomberg River. Since it is a favourite area for migrating ducks, large numbers of hunters converge on the marsh when the hunting season begins.

Several years ago the opening time on the first day was a half hour before sunrise. While this time was in effect much shooting occurred in the dark hours of the early morning long before they were allowed to shoot. Many complaints forced the Department to advance the opening time to 12 noon.

Last year a limited number of Fish and Wildlife staff prevented us from manning all access points to the marsh with the result that many hunters began shooting around 8 a.m.. As a consequence the Department received much unfavourable publicity and criticism.

This year, in order to have a well supervised opening day we planned a complete coverage of the marsh trying to compel the hunters to abide by the noon opening time. The Department recruited some of the Conservation Officers and many of the regular staff from other services - Parks, Timber, (Reforestation) County Forests and the Severn River Management Unit, to make a total of 36 Department Personnel involved. Along with our own men we had the assistance of two R.C.M.P. officers who patrolled Cook's Bay and the Lake. Also, the Provincial Police carried out road patrol around the marsh.

On the afternoon of Friday, October 2, 1959, the day before the opening date all Department men involved gathered at the Riverview Inn just outside Bradford. At this meeting Mr. Leman and Mr. Trotter outlined just how we were going to proceed with the coverage. Earlier it had been found that there were 19 access points into the marsh. At least one man was to be stationed at each point. Most of these points are concession roads leading into the marsh. The marsh was divided into four areas with one Conservation Officer in charge of each area. Under him would be enough men to look after each access point. Each man received a mimeographed sheet (Sheet 1) outlining what they were to tell the hunters. Also, they received a supply of other sheets (Sheet 2) for distribution among the hunters. This second sheet stressed the opening time, closing time and daily bag limit.

The men stayed over night at the Village Inn in Bradford and at the Riverview Inn. After an early breakfast at 4:30 a.m. Saturday morning the men were at their stations by 6:00 a.m..

It turned out to be a good day for duck hunting. There was a light wind and a clear sky in the morning. In the late afternoon it turned cloudy and by evening it rained lightly.

A few hunters arrived at the marsh just before sunrise but the situation was explained to them and they refrained from entering the marsh until late in the morning. Some men hunted ruffed grouse near the marsh and their firing was sometimes mistaken for that of duck hunters. Most of the hunters remained in their cars at the access points until approximately an hour before opening time. At some places the hunters were asked to remain at the checking points until 11 a.m. and they readily agreed.

Several shots were fired immediately south of Gilford between 8 and 9 a.m.. These resulted from ignorance by two hunters concerning the opening time. When warned by other hunters they proceeded voluntarily to one of the stations to explain that they arrived before the officers and had not been cautioned about the noon opening time.

In the northwest corner opposite access point 17 there are a number of small ponds surrounded by tall bulrushes. There were quite a number of hunters congregated in that area and some shooting occurred between 11:30 and 12:00. The cover was so dense that officers patrolling in the area were unable to apprehend the violators. However, the presence of the officers moving about in the trouble area kept the shooting down to a minimum.

Considering the large number of hunters present there were very few violations noted during the day. The seizures and offences are tabulated.

Several shots were fired immediately before 12 noon but most of the shooting started at 12 and immediately after.

The hunters felt very satisfied with the coverage. In the evening they readily allowed us to check their bags and take wing samples for later identification.

Results of Opening Day of Duck Season on Holland Marsh, 1959.

Hunters Checked:* Resident	583
Non-resident	32
Total number of hours hunted	3101.5
Number of dogs used	25
Mallard	49
Black	71
Pintail	15
Green-winged Teal	87
Blue-winged Teal	42
Wood Duck	20
Common (Wilson's) Snipe	24
Coot	43
American Widgeon (Baldpate)	5
Hooded Merganser	6
Ring-necked Duck	1
Canvasback	1
Lesser Scaup	5
Ruddy Duck	1
Goose	1
Unidentified	35
Lost	130
Total number of ducks	406

The total number of hunters checked = 615*

The number of ducks shot = 406

The number of ducks per man = .66

The number of man hours per duck = 7.6

The number of ducks per man hour = .13

---

* It must be emphasized that these figures do not represent the total number that entered the marsh. A few hunters left by private routes along the shores of Cook's Bay and missed being checked.

Tabulation of Violations Against the Migratory Birds Convention Act in Holland Marsh on Opening Day of Duck Season - 1959.

Number of Violations	Percentage of Violations
2 men apprehended for using .22 rifles	1.1%
3 men apprehended for chasing ducks in a boat	
confiscation of 1 pied-billed grebe	
failure of 1 man to produce a licence.	

SHEET NO. 1

WHEN REPLYING KINDLY QUOTE
THIS FILE NUMBER

ONTARIO

DEPARTMENT OF LANDS AND FORESTS

What to Tell the Hunters

(1) Ask each hunter to show you his gun licence. If he has a gun and does not have a licence take the gun and write down his name and address and detain him till the officer in charge arrives.

(2) Tell the hunters that they are not to shoot more than four redhead ducks in one day (new regulation this year).

(3) Explain to them that guns must be kept encased or dismantled till 12 o'clock daylight saving time. Guns wrapped in a coat are considered encased. If the bolt is removed from a gun it is considered dismantled.

(4) Keep a count of all hunters you check going in.

(5) Tell them to be out of the marsh not later than one hour after closing time.

(6) You should explain to the hunters that we will have men checking their bag limits when they come out of the marsh.

(7) Be sure to have your watch synchronized with the other officers before you leave and have the hunters set their watches the same as yours.

(8) Tell them again just as they are leaving for the marsh to keep those guns encased or dismantled till 12 o'clock.

NO SHOOTING BEFORE 12 noon D.S.T.

Advise them that even if they hear shooting they are not to start as we will have officers in the marsh who will be seizing the guns of any "trigger happy" hunter who opens up before 12 o'clock noon D.S.T..

WHEN REPLYING KINDLY QUOTE
THIS FILE NUMBER

ONTARIO

DEPARTMENT OF LANDS AND FORESTS

OPENING DAY - DUCK SEASON - 1959

ATTENTION HUNTERS ATTENTION HUNTERS

OPENING TIME:	12 o'clock noon, Daylight Saving Time - Saturday, October 3, 1959.
CLOSING TIME:	7:28 p.m. Daylight Saving Time - Saturday, October 3, 1959 (one-half hour after sunset).
DAILY BAG LIMIT:	Ducks, exclusive of mergansers, 6 of which not more than one may be a wood duck and not more than 4 may be a canvasback or redhead. Geese - 5 Rails, Coots & Gallinules - 25 Wilson's snipe - 8 Woodcock - 8

OBSERVE ALL REGULATIONS - FOLLOW SAFETY RULES

GOOD LUCK GOOD LUCK

SHARP-TAILED GROUSE REPORT, FORT FRANCES DISTRICT, WINTER AND SPRING, 1959

by
J. A. Farr

During mid-winter and early spring of 1959 some work of an investigational nature was carried out on sharp-tailed grouse in the Fort Frances District.

Starting in late February attempts were made to locate sharptail coveys and observe them under winter conditions. During the period February 9th-March 6th seven field trips were made and a total of 92 birds in eight different coveys was observed. Four coveys were observed on three separate occasions, and two other coveys were observed twice. In all cases the birds' movement appeared confined to an area of approximately one square mile. During the colder days in February (-15° to +10°F) the birds seemed reluctant to feed, spending only an hour or two near midday away from their snow roosts. With bright sun and warmer weather birds were observed sunning themselves in the trees in the afternoon; although budding seemed to be confined mostly to the mornings. The winter was somewhat more severe than average but there was no evidence that it caused unusual mortality. One bird was found dead beneath the snow but there was no obvious cause of death as the bird appeared well fleshed and normal in every respect. No cases of predation were observed although there was evidence in two cases that foxes had flushed coveys from the snow.

Dancing Ground Locations

Dancing was first observed on March 25th, although sporadic dancing had probably been going on for some time previous to this. In all, 14 mornings were devoted to dancing ground locations and observation. Fifteen dancing grounds were actually located and hooting and wooing birds were heard in eleven additional areas although the dancing ground was not actually located. Most of the dancing grounds were located on slightly elevated open areas, but one case of dancing was observed in a large muskeg where plant growth was quite thick and two to three feet in height. It seems doubtful that this was a regular dancing area as subsequent checks failed to show birds using it.

As early as March 27th, birds were observed perched in trees adjacent to open areas where birds were dancing. These may have been females. However, birds actually observed on the dancing grounds as late as April 20th, appeared to be all males as they all danced. By April 27th, some females began to appear on the dancing grounds but it seems doubtful that the peak of the dancing season had been reached by this date. No observations were made after May 1st, but the peak probably occurred during the first week or ten days in May.

All dancing grounds located were recorded on a large map in the Fish and Wildlife office. Those dancing grounds will form a start for future spring census of dancing birds.

Trapping

It was impossible to devote sufficient time to sharptail trapping using cannon projected net traps. There was some difficulty in locating accessible dancing grounds with a large enough clear area (approximately 50 feet diameter) to be used.

Only one set was attempted on a large dancing ground with from 30 to 40 birds active in a very small area. Only four birds were actually trapped. Two had to be destroyed due to injuries sustained in the net. Although three people were at the net almost immediately to remove the birds, they became so tightly enmeshed that all of them were at least slightly injured. A relatively fine net with a two inch mesh was used. A coarser net would probably increase the amount of tangling. Further practice would make the net much more effective in capturing birds, but it seems possible that the percentage of injured birds would be too high to justify cannon net trapping.

A special type of snare designed to attach snugly about a bird's neck and then break free was experimented with. A small numbered tag was attached to the part of the snare which would be carried away by the bird. There was no opportunity to use the snare, but the principle could be quite effective provided the trapper has a detailed knowledge of the birds' daily behaviour. Certainly the technique deserves some experimenting. The dancing ground located in the Mando radio tower enclosure on the edge of Fort Frances would be a suitable place to attempt snare banding. A maze of net surrounding the dancing ground with snares set in the openings might be one possible procedure for snaring the birds.

Summary

During mid winter seven days were devoted to locating and observing sharptail coveys. A total of 92 birds in eight separate coveys with several repeat observations were made.

Fourteen mornings were spent locating and observing birds during the dancing season. Fifteen dancing grounds were actually located and the general areas for eleven more were recorded. By May 1st, the peak of the dancing activity had not been reached; it probably had occurred by May 10th.

Sufficient time for cannon projected net trapping was not available; considerable skill will be needed to make the technique effective and injuries to birds may be unjustifiably high.

A snare banding system was experimented with briefly. This technique deserves further consideration.

Recommendations

1. The dancing season is definitely the most suitable time of the year to carry out routine sharptail census. Unfortunately it occurs when the spring work load is near its heaviest. There are two possible approaches to starting a systematic census; have one conservation officer devote full time to sharptail census and trapping work during the last two weeks of April and the first two weeks of May. If this cannot be arranged two conservation officers should be allotted adequate time to carry out detailed dancing ground censuses in their patrol areas. In either case the census should be set up systematically so that counts on an adequate number of dancing grounds (perhaps 20 to 40 as a start can be repeated from year to year.

2. If time is available cannon net trapping should be attempted. Further experience should increase the effectiveness of this method. Snare banding should also be attempted.

3. So far it has been impossible to comply with the request from Maine's Department of Game and Inland Fisheries for sharptail for introduction purposes there.

If further cannon trapping proves unsuccessful it is recommended that a private party be hired to trap sharptail during the fall season when they are feeding on grain. A possible rate of payment would be five dollars per bird for the first 20 birds and three to four dollars for any additional birds trapped. Shipping arrangements and assistance should be provided by department staff.

APPENDIX - Dancing Ground Counts

Date	Location	Number of Birds
March 27	Mando Radio Tower	13
April 11	Lot 3, Con. II Burriss	11
April 14	Lot 2, Con. IV	13
April 15	Lot 5, Con. III	12
April 15	Mando Tower	11
April 17	Mando Tower	8
April 20	Lot 17, Devlin	10
April 27	Mando Tower	18-20
May 1	Lot 7, Con. VI Carpenter	30-40

CONSIDERATIONS CONCERNING A WETLAND INVENTORY FOR SOUTHERN ONTARIO

by
J. B. Dawson

Wetlands serve many useful functions; they provide habitat for waterfowl, aquatic furbearers and many upland game species. Other important values associated with wetlands include ground-water storage, retention of surface water for farm uses, stabilization of runoff and prevention or reduction of erosion.

Each year in southern Ontario many wetlands are lost through drainage, while others are lost to public recreation through the posting of private property. As the population of Ontario continues to grow, still greater demands will be put on our existing wetlands.

The fact that a wetland inventory of southern Ontario is badly needed will not be laboured here; suffice it to say that governments of several northern states consider wetland inventory and subsequent acquisition and/or management a very important part of their resource management programs. Minnesota, for instance, is acquiring wetlands as quickly as possible to save them from drainage; as of Feb. 1959, this state had 60,900 acres of wetland purchased or optioned for purchase at a cost of $1,891,000.00. Minnesota's ultimate goal is 209,000 acres at an estimated cost of $6,500,000.00. New York State considers land acquisition one of the most important aspects of its game management program. This state is concentrating on wetlands and their associated upland habitat and is paying as high as $125.00 per acre for public hunting grounds in areas of high population. This program costs about $100,000 per year.

If Ontario is to manage its wetlands, an extensive inventory program must first be carried out. Inventory must be conducted over as short a period as possible since much initial information becomes obsolete during extended surveys. In the same light, acquisition and/or other management programs should follow inventory closely.

Some of the more important information available from an inventory might include:

(a) the total acreage of various wetland types and their distribution throughout southern Ontario.

(b) the location of key wetlands which are in danger through posting or drainage and which might be acquired and/or managed.

It has been suggested that there are several government departments which have an interest in wetlands and which might assist on a wetland survey. It is my opinion that a survey would be best conducted by one department; Lands and Forests has, perhaps, the greatest interest in wetland values. This does not preclude assistance from other sources, however.

Several methods of inventory have been used by other government agencies and four techniques were tested by H. G. Merriam in 1956, working under the direction of Dr. A. deVos at Guelph. The results of this study are contained in Ontario Lands and Forest's Fish and Wildlife Management Report #32, Dec. 1, 1956.

The four techniques listed below involved the use of:

(1) Indispensable[x] aerial photos, topographical maps, and field forms for recording information.

(2) Dispensable aerial photos upon which wetlands were outlined and numbered, and field forms.

(3) Indispensable aerial photos, topographical maps and punch cards which were used to record information.

(4) Dispensable aerial photos and punch cards.

The last, number (4), was the most efficient method; preparation of survey material was much reduced and data could be quickly and efficiently analyzed by needle-sorting the punch cards.

The above techniques were tested in Puslinch Township of Wellington County. The cost and labour requirements of technique (4) are not known, but the less efficient technique (1) cost $3.25 per square mile and required 25 man-days to survey one township of 93 sq. miles.

The average township in southern Ontario probably does not have as high a wetland density as Puslinch township and this might reduce the number of man days required to survey a 100 sq. mile township to about 15. Survey efficiency would also increase by using technique number (4). It is doubtful, however, if survey costs per sq. mile would be substantially reduced, since the project would require full time permanent as well as part time supervisory staff during the field season. It is probable that survey costs would run in the neighbourhood of $3.00 per sq. mile.

---

[x] Photos were borrowed and could not be taken into the field.

If the above figure is related to the area south of the Pre-Cambrian shield (about 30,000 sq. miles[*]), then a wetland inventory of this type for southern Ontario would cost about $90,000.

Assuming that 100 sq. miles could be surveyed in 15 days, a survey of the area south of the Pre-Cambrian shield would require 4,500 man-days. If conducted over a three year period, such a survey would probably require the following personnel each year:

1 full-time biologist
1 part-time field party supervisor
15 summer students (100 days each)

It is evident that both costs and labour requirements of such a survey would be high.

The most practical approach at the present time appears to be a survey based on the stereoscopic study of aerial photographs with data recorded on punch cards.

Mr. G. Merriam, now studying at Cornell University, attempted to compare the accuracy and efficiency of stereoscopic interpretation of photographs with information recorded on ground surveys and used material collected during the 1956 ground survey of Wellington County as an illustration. This writer has recently discussed the results of this comparison with Mr. Merriam, and it appears that stereoscopic interpretation of aerial photos holds much promise.

Advantages associated with this method appear to far outweigh disadvantages: the former include:

(1) Practically all wetlands present in an area can be located.

(2) Photographic analysis gives much better perspective; since relief is exaggerated by the stereoscope, data concerning drainage or impoundment possibilities are much more easily obtained than on the ground. Semi-permanent streams also may be located easily.

(3) Large areas may be surveyed with a minimum of time and effort. A surprisingly accurate appraisal of both terrestrial and aquatic vegetation is possible.

(4) The location of possible sites for new impoundments is facilitated. This is an important factor, since otherwise it requires much experience to assess topography as it relates to drainage and area of watershed.

---

[*] Chapman & Putnam - 1951 - The Physiography of Southern Ontario.

Disadvantages of aerial photo interpretation include:

(i) Shadows on photographs occasionally cause wetlands to be missed, although this error is probably lower than would occur on ground surveys.

(ii) There is some difficulty in recognizing certain types of vegetation.

(iii) Although most land uses are easily recognized, it is difficult to evaluate the intensity of livestock grazing from aerial photographs.

Merriam found that aerial photo interpretation could be surprisingly accurate, - more accurate in some instances than ground surveys. This accuracy applied principally to drainage or impoundment possibilities and to the areas of wetlands.

The interpretation of aerial photographs does take some experience but extensive training is not essential. A good knowledge of the plant associations of different wetland types is probably a more important requisite and personnel engaged on an inventory should have a basic knowledge of wetland plant ecology. Initially, photo interpretation could be checked by ground surveys; later, as workers gain experience, only spot-checks of various wetland types would be necessary to ensure accuracy.

Exact costs and labour requirements are not available; it is evident however, that both would be substantially lower than for other known methods of inventory. In my opinion a survey based on photo interpretation certainly appears to be the logical approach at the present time.

ADDRESS TO THE ONTARIO GAME BREEDERS' ASSOCIATION,

JULY 15, 1959

by
Dr. F. W. Remmler
Griffith's Island
North Keppel, Ontario

One of the first things I did, more than eight years ago, when I came to Canada, was to buy the "Hunters Encyclopedia", a book of more than seven pounds and 1152 pages with over one million words, according to the generous advertisement of the publishers. It was only natural that I wanted to inform myself about the American hunting conditions, and this book, if any, I thought would provide me with the necessary information. With mounting surprise I began to study these seven pounds of printed and illustrated paper and found that out of the 1152 pages 1138 contained information on how to successfully hunt various mammals and birds. Their biology was hardly touched upon, yes, and a whole 14 pages were given to Wildlife Management, or actually to what the Government and the various organizations do for the game. Anything the individual hunter could possibly do is being kept a carefully guarded secret. Not one of the more than a million words concerns hunting ethics or morals. In a similar book published in Europe probably half of the contents would concern itself with wildlife management and hunting ethics, and the remaining portion would describe various hunting methods.

After a little consideration I realized why this American hunting book treated the management part in such skimpish manner. Due to the fact that the hunting rights in America do not belong to the landowner or the owner of the hunting rights, as the case is almost everywhere in the old world, the hunter has no particular interest in wildlife management (unless he happens to be a very idealistic person, or an unusually unselfish sample of the human race) for as a rule he would have no opportunity to reap the fruits of his work. Under these conditions it is easily understood that the wildlife management must be done by the government and a number of idealistic groups and organizations, the work of which I have later learned to be very commendable. As an example I will only mention "Ducks Unlimited." The efforts of this organization as regards the promotion of waterfowl can well be compared with the work of the Inter-European Conventions, as a matter of fact, as far as activity and freehanded action goes, overshadows these.

One thing I have yet to understand is why the book completely ignores everything concerning ethics. This, at least in my opinion, is an unforgivable lack which can hardly be defended.

In America, where the hunting can not look back on many feudal traditions, and where every person has the right and opportunity to hunt, and where this opportunity is made great use of, not enough can be done to raise the level of hunting ethics. Every printed page

concerned with hunting, should remind the hunter that he has not only a right to the game, but also a responsibility toward it, a responsibility toward the whole of nature, for that matter.

But what is the situation actually? In all the great many hunting magazines which I get to read yearly, I don't believe I have ever seen articles concerned with hunting ethics, but not so seldom have I read hunting stories which are a direct slap in the face as far as ethics goes. For instance, to glorify a man who regularly hunts eagles from an airplane, just to take one distasteful story out of the pile. Others, as hunting big game with handguns or holding of beagle-trials in the spring, are not hard to find.

I just mentioned the great work done by governments and the various organizations in the field of wildlife management. Built upon biological facts as it is, this work is both sound and effective. But the individual hunter too, is in a position to do much for the improvement of hunting, without having to spend a great deal of money, for instance, through plantation of cover for upland game, or through the establishment of ponds for ducks, but especially by furthering hunting ethics through speech and writing, and not least, by setting a good example. A question which should be of interest to all of us, is the yearly increasing influence of human culture on nature, and consequently of course on hunting in all its forms. That the management of wildlife must keep in step with this development is only too clear. Thus what is good for the Canadian wilderness doesn't necessarily have to be a blessing to an area near a big city, or one undergoing intensive farming, or for instance, an island like Griffith's Island. The more man alters or destroys nature, the more the wild animals become directly or indirectly dependent on his consideration and care. And the forms of hunting change alongside, step by step, to finally become something so artificial as the modern hunting preserves.

From a viewpoint of hunting I would like to divide the grounds into three different classes or stages of development, depending on how far the changing influence of human culture has progressed.

The primary stage is the untouched wilderness, to which, from a hunting viewpoint also such areas should be included, where the human influence has not yet reached a stage where it has robbed the game of any of its necessities for existence. The animals, which live under these conditions need no artificial feeding during normal years. Only during serious starvation years is a feeding justified, but the question is, if this help, which man can give during such unforeseen years, is of much value. In most cases conditions are such that the help will not arrive in time, at least not to the places where it is most needed. Whether the hunting in such areas is done via weeklong packhorse trips, or from a blind a few hundred yards from the house corner is of no importance. In any case the game is wild from all aspects, and is so to speak untouched by man.

To class two I count such grounds where most of the conditions required by the game for its perpetuation are present, but where the winter feed is strongly reduced, or where it is out of reach of the animals for one reason or another. So, for instance, are the red-deer in mountainous south Germany almost entirely cut off from their natural winter feeding grounds in the valleys by the advance of culture and are therefore forced to stay on the slopes the year around. If we were to go by the principle here that all regular winter feeding is detrimental, then Germany's rich deer stand would soon be but a memory. Here regular winter feeding is not only desirable but very much a necessity.

The south German red-deer are not the only game which receive artificial feeding in Central Europe. I think one could without exaggeration say that all game with the exception of wild boar, is being "Gehegt", a word, which strangely enough has no counterpart in the English language, but which means something like "taken care of."

It is not altogether impossible that the day may come in the USA when a regular winter feeding of elk and mule deer will be a necessity, be it then that the winter feeding grounds can be kept accessible to these animals through drastic measures. But compared to central Europe, the USA has two great advantages. First of all there is more room, and secondly, the situation is clear to everyone and the necessary steps can be taken before it is too late.

As far as the white-tailed deer are concerned, I suppose that one has come to the conclusion everywhere in America that a regular winter feeding is ill-advised and should not be encouraged. If the number is kept at a level of the carrying capacity of the area, so that the animals will not destroy their own requirements for existence through overbrowsing, they can easily live on the edge of a large city, which they often do, as a matter of fact. It does not take too much keeness to find out why Griffith's Island has become an area which must be included in class two. A short visit of the woods makes it clear even to the biologically less schooled that the carrying capacity has been long since exceeded and that the deer have completely destroyed the bush to such degree that it would take roughly 30 years to bring it back to a state where it could carry a limited number of animals. They therefore depend entirely on the feed we give them during the winter. I am mentioning the conditions here on the Island mainly because it shows quite clearly that a deer population can exist and be quite satisfied although they are entirely dependent on an artificial feeding during the winter. In the literature we often find negative opinions about the feeding. For instance, there is in the Wisconsin Conservation Department's Technical Wildlife Bulletin number 14 the following passage: "Besides the fact that artificial feeding contributed to the critical status of the range, it sometimes offered little relief from starvation during critical winters. Starvation losses were tragically high in some feeding areas where the greatest efforts, or at least the greatest costs were incurred." And a little further the following sentence: "When starved deer are found in areas

where feeding operations are being conducted, the inevitable question asked why, if pen-controlled feeding experiments prove conclusively that deer can be sustained satisfactorily on artificial feed for normal yarding periods, should there be any starvation losses?"

During the last winter, which may be considered a very difficult one, we lost only seven deer, two of them through accidents. Of the remaining five these were four buck-fawns and one four year old buck. The last mentioned died of digestive troubles, a very unusual happening here on the Island. Samples of the marrow from two of the fawns showed that undernourishment played a part in their death. I found the other two fawns too late to determine the reason for their death. We feed the deer with oats, corn and alfalfa and begin the feeding in the middle of October. It is important to begin early so that the animals will not become starved and gorge themselves on the first feed given. It is equally important to continue the feeding into the spring until the first green grass is available to the animals. Even here I have been able to confirm the long known fact that late spring is the most dangerous time for the animals, and all five animals we lost during the winter died at the end of March and beginning of April. Should someone care to establish a shooting preserve for deer, I can inform him that the cost of feed for the winter is approximately twenty dollars per average deer.

So, as far as the deer go Griffith's Island must be included in class two of the areas I have mentioned. As far as the pheasants are concerned, the Island is a pure shooting preserve and therefore belongs to class three, where man has taken the game completely in his care, so to say from birth to death. The only difference is that we release the pheasants at eight weeks of age, instead of releasing a certain number of birds immediately preceding each shoot, as is usual on commercial shooting preserves.

Sometime ago I read a magazine article about shooting preserves. The author expressed the opinion that in the near future all hunting will be done on preserves. Forgive an old-timer if he hopes this day lies far away in the future. But nevertheless, I welcome these preserves with satisfaction and wish their operators good luck. Because shooting has become the main point for a great number of hunters (or let's say shooters), all conservation minded hunters will be glad to see these gentlemen finding an outlet for their trigger-happiness and so relieve the pressure on really wild birds in the field. And besides, these establishments promise a good income for a great number of people who are interested in raising game birds.

For several years I have made a series of experiments to get rid of the gapeworm plague which causes the loss of a great number of birds. At first I worked alone and since 1955, in co-operation with the Department of Parasitology of the Ontario Veterinary College, Guelph. We have succeeded in manifesting the earthworm as the intermediate host of the gapeworm, which carries the parasite from one

bird to another. After a series of rather frustrating experiments we have finally found a satisfactory chemical against the earthworm and consequently against the gapeworm. These findings are soon to be published by the Ontario Veterinary College and should be of great value to all pheasant breeders whose flocks suffer from this condition.

CENSUS FOR COTTONTAIL RABBITS
LAKE HURON DISTRICT, 1958-59

by
R. E. Mason

Introduction

The cottontail is more heavily hunted than any other game species in this district. During 1958-59 a mail bag survey of hunters in regulated townships indicated that 46.8% of all game species bagged were cottontails. Pheasants comprised 20.6%, hares (European) 16.6%, waterfowl 8.1% and grouse, squirrels and foxes from 2-3% each. (Job Completion Report, Winter XI, 1959.) Despite this fact relatively little has been done in the line of a census of the cottontail.

Part of the difficulty in securing adequate population information has been the apparent lack of a suitable census technique. In Missouri, cottontail census information is secured by road counts during the period July 13-21. An analysis of eleven years' information secured in this manner revealed a direct relationship between the juvenile to adult ratio, plus number of observations per mile and the hunting success during the following open season. (Wright, H. - Journ. Wildlife Man., Vol. 23, No. 1, 1959). The success of the road count technique in Missouri led to the attempt described here to determine the applicability of the technique in this district.

The survey was attempted only on a preliminary basis by the author, and results are not intended to present a district-wide picture of cottontail populations.

Procedure

Secondary gravel surfaced roads were driven by car during the week of July 13 between 5.30 and 6.45 A.M. The survey was run in Wellington and parts of Halton and Waterloo Counties. Cottontails were recorded as juvenile or not fully grown, and adult or fully grown. Speeds driven were between 30-40 miles per hour although other speeds were tried.

Observations were arbitrarily broken into five mile transects to assist in statistical analysis.

Results

For use in the preliminary data, 19 five mile transects were run with a total observation of seven adults and 19 juveniles. Data are presented below:

Cottontails per transect:	1.37
Cottontails per mile:	0.274
Young per adult:	2.72

In addition two adult and one juvenile European hare were also observed.

Discussion

I of Technique

From the results obtained in Missouri weather factors can be expected to adversely affect the technique. Extremely hot and dry weather during the July census period will reduce the number of observations disproportionately, and lack of snowfall during the hunting season will reduce hunter success, also disproportionately. In the eleven years each of these factors was encountered once.

The time of day for this survey was chosen as cottontails are most active at dawn, but some sunlight is required for accurate observation of age classes. Although cottontails were still observed on some roads after 7.00 A.M., rural traffic increased sufficiently from 6.30-7.00 A.M. to adversely affect observations.

No observations were recorded during the week on hard-surfaced roads. This may be due to the increased traffic on these roads which led to the selection of gravel surfaced roads for the survey. No effort was made to choose roads which passed through any predetermined cover types and cottontails were observed in both open and wooded situations. Secondary roads which have the roadside vegetation either mowed or sprayed should be avoided. In the Missouri study, permanently established routes are used.

A speed of 30-40 M.P.H. was determined to be most satisfactory. Speeds below 30 M.P.H. were not satisfactory as the cottontails ran off the road too far ahead of the car to be accurately aged. Speeds over 40 M.P.H. did not allow sufficient time to observe rabbits. The speed driven is also regulated by road conditions and conditions of vegetation along the roadways.

No difficulty was encountered in aging cottontails by their size during this week. Of a total of 27 observationsused in the preliminary data, only one had to be recorded as unknown. It is felt that variation between observers will not affect the data although this factor was not tested. No difficulty was encountered in distinguishing between European hare of any age group and cottontails. Difficulty might be encountered in distinguishing between snowshoe hare juveniles and cottontail juveniles although adults of these two species should be distinguishable.

II of Results

Using $$S = \frac{C}{N}\sqrt{N \times \Sigma FD^2 - (\Sigma FD)^2}$$

the standard deviation of the mean was determined to be 2.56 and standard error 0.59. Fiducial limits of the 80% level of confidence indicate the value of the mean to be 1.37 ± 0.78. Considering the size of the sample, the results are encouraging.

By application of formula, a total of 42.3 plots or 211.5 miles will be required to adequately sample a population of cottontails at the 80% level of confidence. If individual populations of cottontails are not subject to wide variances in small geographical locations, this represents a small expenditure of manpower to obtain a satisfactory estimate of populations as the 95 miles used in this preliminary data was covered in three mornings. The only evidence offered that populations variation is not great in relatively small geographical locations is the small degree of statistical variation encountered in this survey which covered roughly 200 square miles.

Conclusions

From the results given above it would appear that roadside counts conducted, as described, will provide a workable method of censusing cottontails in this district. Information secured would then be related to hunter success as determined from the mail bag survey for prediction of future hunting.

COTTONTAIL INDEX - PELEE ISLAND, 1953-59

by
L. J. Stock

This cottontail count was made incident to the pheasant survey on Pelee Island in July, 1959.

The index shows an increase of 67% over 1958 despite a season which afforded excellent shooting. Residents reported that an unusually high number of rabbits were shot during the winter of 1958-59.

Year	Miles of Transect	Rabbits Counted	Rabbits Per Mile	Difference Percent	Adult Fem.	Juv.	Juv. Per Ad. Fem.
1953	276	155	0.56				
1954	267	120	0.45	-20			
1956	138	28	0.20	-56			
1957	138	60	0.44	+120	3.5	27	7.7
1958	132	185	1.4	+208	11	143	13
1959	138	309	2.24	+67	30.5	210	6.9

Adult sex ratio is assumed to be 1 to 1

Juvenile to adult female ratio is calculated for all rabbits which could be definitely identified as adult or juvenile. The remainder are either adults or sub-adults and probably include some adult females which would lower the figure for juveniles per adult female. However, the majority of the remainder are believed to be young of the year.

THE SIZE, RATE OF GROWTH AND LONGEVITY OF THE BLACK BEAR (*Ursus americanus americanus*)

by
C. W. Douglas

Introduction

Reliable information on the size of black bears for this area or, for that matter most parts of the continent, is either very scanty or totally absent from the literature. Estimated weights are common but of justifiably suspect accuracy.

Matson (in Drahos, 1952) likely with tongue-in-cheek, treats this subject of estimated weights by suggesting that most hunter-guesses should be divided by two, then add or subtract 25 to 50 pounds according to personal judgment. As a case in point, the 245 pound bear which we weighed on September 24, 1957, was reported as a "500 pounder" and so, by coincidence, lends credence to Matson's humorous comment. This, however, hardly recommends the method for general and exclusive use.

Weights of bears, have, of course, always been the subject of controversy and Arthur E. Brown (in Seton, 1929) also saw humour in this when he said - "It is a curious fact in the geographical distribution of animals - for which an explanation might be sought among ethical rather than physical causes - that 1,000 pound bears are not found inhabiting the same range of country as Fairbanks' scales." This was with reference to grizzlies but, in proportion, is equally applicable to black bears.

Although it is general practise to discredit reports of very large black bears, the existence of at least a few very large ones should not be perfunctorily dismissed. The weights of some very large, weighed specimens recorded in the literature from several widely separated points are set down, later in this paper, to illustrate this, and most of us believe we have seen much larger black bears than we have so far been privileged to weigh.

Because information on sizes and weights is so sparse, presentation of our small series, at this time may serve a useful purpose.

In order that other information of related nature may also be available for ready reference a considerable series from black bear literature is also summarized throughout the paper.

Weights and Lengths of Black Bears In the White River District

As black bears, as game animals, are rising in importance in the area we have, since 1957, carried on a limited investigation to gather general information on bears and specimen material with which to explore the possibility of devising an aging technique for the species.

During this work accurate weights of 19 and lengths (nose-tip to tail-tip) of twenty specimens have been secured. Collectors have also reported the sex of each bear and have given their opinion concerning the animals' state of maturity (cub, immature, adult).

One bear was weighed on a platform scale, the remainder with beam balances.

The lengths, in inches, were established after the carcasses had been placed on their backs in as straight and level a position as the terrain would permit.

In this series, male bears weighed as much as 333 lbs. at 65 inches. A still longer bear, 74 inches, was not weighed.

The heaviest female weighed 180 pounds and the longest measured 58 inches.

This information is summarized in Table No. 1 and No. 2.

TABLE NO. 1 - Lengths and Weights Of Male Black Bears - White River District

Probable Age Class	Length	Weight	Weight÷Length	Date	Area	Checked By:
Cub	30"	19½ lb.	0.65	4/6/58	Oba Lake	C. Elliott
Immature	55"	100 lb.	1.8	21/7/58	Franz	J. Tangie
Immature	50"	115 lb.	2.3	18/8/58	Kwinkwaga L.	D. Rice, G. McIntosh
Immature	51"	130 lb.	2.6	4/7/58	Manitouwadge	E. Mitchell
Immature	51"	138½ lb.	2.7	4/7/58	Manitouwadge	E. Mitchell
Adult	57"	210 lb.	3.7	8/7/58	Hammer L.	E. Pozzo, C. Douglas
Adult	51"	225 lb.	4.4	12/6/58	Goudreau	C. Elliott
Adult	63"	240 lb.	3.8	17/9/58	Wabatonguishi L.	A. Swanstrom, P. Daigle
Adult	55"	245 lb.	4.5	24/9/57	O'Brien	C. Douglas, E. Pozzo
Adult	60"	265 lb.	4.4	9/9/58	Hammer L.	E. Pozzo, C. Douglas
Adult	65"	277 lb.	4.3	12/7/58	Franz	E. Melin, J. Tangie
Adult	61"	291 lb.	4.8	8/7/58	Hammer L.	E. Pozzo, C. Douglas
Adult	65"	333 lb.	5.1	9/9/58	Hammer L.	E. Pozzo
Adult	74"	-	-	11/9/58	Manitouwadge	E. Mitchell

TABLE NO. 2 - Lengths and Weights of Female Black Bears - White River District.

Probable Age Class	Length	Weight	Weight÷Length	Date	Area	Checked By:
Cub	31"	20 lb.	0.65	4/6/58	Oba Lake	C. Elliott
Immature	48"	105 lb.	2.2	8/7/58	Hammer L.	E. Pozzo, C. Douglas
Adult (?)	57"	125 lb.	2.2	5/6/58	Oba Lake	C. Elliott
Immature	57"	127 lb.	2.2	17/7/58	Manitouwadge	E. Mitchell
Immature	58"	141 lb.	2.4	5/9/58	Hemlo	E. Mitchell
Adult	54"	180 lb.	3.3	7/7/58	Hammer Lake	E. Pozzo, C. Douglas

The C.P. Express Agent, Mr. E. N. McMenemy of White River, has weighed, for shipping, hog-dressed bears which tipped the scales at over 400 lbs. Gerstell (1939) reports that bears on the average, lose 14.1% of live weight when hog-dressed. On this basis the 400 lb. bear would have had a live weight of about 465 pounds.

We may, then, reasonably assume that at least a few of our bears will eventually be found to rank well up in the North American weight series presented later. That very large bears will be rare is axiomatic since many of the weights shown in this series were so exceptional as to be worthy of much note in their own localities.

Age Classes of Black Bears

In the management of a species, data on age and reproduction are required. Until a generally-accepted aging technique has been developed it would be desirable if we could at least separate adult from sub-adult specimens.

In general, it is not difficult to look at a bear and form the opinion that it is "young" or "old" but when asked to substantiate or account for this opinion, difficulties are likely to arise.

We have done some preliminary work on tooth-sectioning, after the method now in general use for aging seals.

This work shows promise but we have not yet carried it far enough for presentation at this time.

In attempting to discover a growth-factor which could be expressed mathematically and have some co-relation with age, the weight of each bear, in pounds was divided by the length in inches (Tables 1 and 2, Col. 4). This resulted in the discovery of three distinct groups which we will call "cub", "immature", and "adult". These categories agree with the collectors' opinions as to state of maturity with only one exception and in that case the collector expressed doubt as to his categorization.

Table No. 3 summarizes the ranges of these "growth factor" categories and shows the range of dispersion.

TABLE NO. 3 - Growth Factor (Weight ÷ Length) of Black Bears

Observer's Category	M-2S.D.	M-1S.D.	M-1P.E.	Mean (M)	M+1P.E.	M+1S.D.	M+2S.D.
(a) Males							
Immature	1.542	1.946	2.08	2.35	2.62	2.754	3.158
Adult	3.445	3.910	4.065	4.375	4.685	4.840	5.305
(b) Females							
Immature	2.05	2.15	2.18	2.25	2.32	2.35	2.45
Adult	-	-	-	3.3	-	-	-

Standard deviation (S.D.) = $\sqrt{\frac{\Sigma x^2}{n - 1}}$

Probable error of the Mean (P.E.) = 0.6745 S.D.

In summarizing Tables 1 and 2 we note that this factor was, for males:

a) Cub - 0.65
b) Immature - 2.35 (1.8 to 2.7)
c) Adults - 4.375 (3.7 to 5.1)

and for females:

a) Cub - 0.65
b) Immature - 2.25 (2.2-2.4)
c) Adults - 3.3

Our series show <u>an overlap in the lengths</u> of "immature" and "adult" classes for both sexes. There is <u>no overlapping of the calculated growth factor categories</u> for either sex.

This certainly suggests that this method may prove to be of value in separating adult from immature bears.

Our series is, of course, very small and covers only the months of June through September. Hence we have no figures for bears immediately after or just before dormancy. However, the series does cover the period during which most bears are shot by sportsmen or must be killed to protect property.

It may be held that this factor indicates the physical thriftiness of the bears rather than the state-of-maturity. Occasionally, I expect, this would certainly be so, especially with severely undernourished or unusually fat specimens. However, a study of the tables shows that regardless of date-of-kill (and bears are reputed to gain or lose weight according to season) the calculated factor is within the limits shown in Table 3, and agrees with the observer's opinion regarding maturity.

Local Subspecies of Black Bear

Throughout the balance of this paper, frequent reference is made to bears from other provinces or states. In order that I might be assured that all cited references are concerned with our subspecies I have used, as my authority, the range maps shown in Hall and Kelson (1959) wherein is shown the range of our bear, *Ursus americanus americanus*.

Rate of Growth of Black Bears

Gerstell (1939) gives a series of weights and ages of bears from Pennsylvania which are summarized in the following table:

TABLE NO. 4 - Rate of Growth of Pennsylvania Black Bears
(After Gerstell, Penna. Game News 10 (8))

Age (Months)	Mean Weight (Pounds)	Weight Range (Pounds)
10	55	30-80
22	105	80-130
34	155	125-185
46	205	180-240
58	255	215-295
70	305	255-350

This shows an average rate of growth of 50 pounds per year, but with considerable overlap in older classes.

Since bears mature (mate) at about 3½ years, in zoos, we are able to break Gerstell's series into sections for comparison with our series:

a) Cubs - 30-80 lbs. (to 10 mos.)
b) Immatures - 80-185 lbs. (to 34 mos.)
c) Adults - 180- lbs. (over 34 mos.)

Drahos and Black (1956) give the weights of 54 New York bears (aged by tooth size) as follows:

TABLE NO. 5 - Rate of Growth of New York Black Bears
(After Drahos and Black, (N.Y. State Cons. 11 (2))).

	Male		Female	
Age (Years)	Mean Weight	Number	Mean Weight	Number
Cubs	21	2	21	1
1½	98	4	132	2
2½	178	16	129	1
4½	293	15	203	2
4½+	346	7	226	4

Table 5 gives average weights of immature bears up to 178 lbs.

Comparison of the Pennsylvania and New York figures with our series in Tables 1 and 2 shows that our figures are within the ranges shown for cubs, immatures and adults, lending credence to the proposition that our "growth factor" indices are correlated with age.

Perhaps, then, further work will show our "growth factor" categories to be of value in separating mature from immature bears until such time as a generally-accepted aging technique is developed. Even after that the method may be of value as a field or checking station technique if specimen materials found necessary for aging are also required as trophy material by the hunter.

Recorded Weights of Black Bears

During the course of our black bear study many references to the weight-ranges and maximum size of bears, which have been weighed by or are considered authentic by the various authors have been encountered. These are set down in Table No. 6.

TABLE NO. 6 - Published Records of Black Bear Weights

Author	Average Weight	Maximum Weight	Hunter or Authority Quoted
General References			
Zim (1955)	-	300 lbs.	-
Burt (1948)	225-475	475 lbs.	-
Anthony (1928)	200-500	500 lbs.	-
Cahalane (1947)	200-300	500 lbs.	-
Palmer (1954)	-	600 lbs.	-
Burt & Grossenheider (1952)	200-400	-	-
Regional Reference			
Seton (1929)	-	397 (Maine 1893)	Theodore Roosevelt in "Wilderness Hunter" 1893.
Gunderson & Beer (1953)	250-300	410 (Minnesota 1947)	-
Drahos (1952)	-	530+ (New York 1908)	Mike Todd
Drahos (1952)	-	532 (New York 1938)	Jean Mose, Saranac L.
Severinghaus (1957)	-	605 ((New York 1957)	N. Y. State Conservationist, Oct. Nov. 1957.
Drahos (1952)	-	632 (Michigan 1951)	-
Seton (1929)	300-450	633 (Pennsylvania, 1923)	Report of Penna Bd. of Game Comm. 1922-24.
Seton (1929)	-	635 (Anticosti Is. 1921)	N. Y. Zoo. Soc. Bull., Mar., 1922.
Seton (1929)	-	671 (Louisiana 1921)	La. Dept. Cons. Bull. #10, 1921 Kopman
Seton (1929)	-	720 (Oklahoma 1911)	"Outers Book" Sept. 1912, Dr. R. C. Baird
Drahos (1952)	-	802½ (Wisconsin 1885)	-
Seton (1929)	-	900 (est?) (Arizona 1921)	Bur. Biol. Survey - M. E. Musgrave

These figures certainly show that the black bear occasionally reaches a much greater size than is generally realized and, at least as far as maximum size is concerned, are not in accord with the belief that southern bears are larger.

Longevity of Black Bears

Seton (1929) reports on a pair of black bears in Akron Zoo, saying, "Both - now 24 years old, are still in excellent health, although the male does not become as fat as he did in Autumn, and the female has had no cubs for the past three years."

While Palmer (1954) does not give his source, it appears from his text that it may be these same bears to which he refers on page 81 where he says, "Life span perhaps ordinarily does not exceed 12-15 years; a female lived 24 years in captivity but did not breed the last three years of her life."

In reply to my enquiry regarding the age attained by black bears in captivity I received from Mr. A. Widnall, Secretary-Manager of the Fort William Board of Parks Management, the following information dated February 14th, 1958, concerned with a black bear known as "Teddy" which had been kept in the zoo at Chippewa Park:

"While visiting the Winnipeg Zoo in the year 1930 I took a fancy to this bear, and the Winnipeg Parks Board were kind enough to say we could have same. He was then, I understand, ten years old, and we received him in 1930 and he died in 1956, which means he was some 36 years old."

"We had to destroy him in the end, owing to the fact that he went blind and was crippled with rheumatism."

On the basis of these reports we should be justified in expecting bears, in the wild, to live to between 15 and 20 years of age and, if the fates be kind, to a considerably greater age in rare cases.

Summary

1. Bears in the White River area reach, and are believed to exceed 74 inches in total length and 400 pounds in weight.

2. The weight (in pounds) divided by the length (in inches) appears to produce factors by which subadult and adult bears may be separated. We found no overlap here as was the case with series based only on weight or length.

3. A 500 pound black bear may be considered an exceptionally large specimen, anywhere within the range of Ursus americanus americanus, but there are reliable records of much larger specimens.

4. A black bear has been known to live for 36 years in captivity, which should justify a presumption that bears in the wild may occasionally live to more than half that figure.

Bibliography

1. Anthony, Harold E. Field Book of North American Mammals. Putnam's XXXI +674 p. illustr. 1928.

2. Burt, William H. The Mammals of Michigan. Univ. Mich. Press XX +288 p. illustr. 1948.

3. ________ and R. P. Grossenheider. A Field Guide to the Mammals. Houghton Mifflin XXI +200 p. illustr. 1952.

4. Cahalane, Victor H. Mammals of North America. Macmillan 682 p. 1947.

5. Drahos, Nicholas. Notes on Bears. N. Y. State Cons. 7(2):14-18, Illus. Oct.-Nov., 1952.

6. ________ and Hugh Black. A Bear by the Tail. N. Y. State Cons. 11 (2):28-29, illustr. Oct.-Nov., 1956.

7. Ely, Alfred, H. E. Anthony and R. R. M. Carpenter. North American Big Game. Scribner's XXII +533 p. illustr., 1939.

8. Gerstell, Richard. The Growth and Size of Pennsylvania Black Bears. Pa. Game News 10 (8):4-7, Nov., 1939.

9. Gunderson, Harvey L. and James R. Beer. The Mammals of Minnesota. U. of Minn. Press XII +190 p. illustr. 1953.

10. Hall, E. Raymond and Keith R. Kelson. The Mammals of North America. Ronald 2 vol. XXX +546 - 79, VIII - 547 - 1083 - 79 p. illustr. 1959.

11. Palmer, Ralph S. The Mammals Guide/Mammals of North America North of Mexico. Doubleday 1-384 p. illustr. 1954.

12. Seton, Ernest T. Lives of Game Animals. Branford 8 vol. 1929. Repr. 1953.

13. Severinghaus, C. W. The Bears and the Biologists. N. Y. State Cons. 12 (2):26-27 illustr. Oct. Nov., 1957.

14. Widnall, A. Personal Communication. Feb. 14, 1958.

15. Zim, Herbert S. & Donald F. Hoffmeister. Mammals/A Guide to Familiar American Species. Simon and Schuster 160 p. illustr. 1955.

MOOSE BROWSE SURVEY, GOGAMA DISTRICT, 1959

by
G. E. Vozeh and A. Zimmerman

An appraisal of winter browsing by moose was carried out on one square mile of range in Togo Township during the period May 5 to 8, 1959. The plot was located in a 33 square mile aerial moose census plot situated within (near its western edge) a 600 square mile tract burned over in 1941. Some sections of this burn have supported high numbers of moose in recent years, the average count of moose for the census plot obtained in five surveys made in the past four years being 1.25 per square mile. Utilization of the area by moose has been by no means uniform, or constant from one survey to the next. The time of winter a survey was made probably influenced the number of moose seen (e.g. there seems to be a marked migration from the burn to older stands in late February and March), and the relationship of observations to "islands" of unburned forest leaves no doubt as to the importance of cover to moose in winter.

The browse survey plot was placed in the northwest corner of the census plot, partly because it was the most accessible section and partly because on three of the five aerial surveys moose were observed within that one square mile block (20, 7 and 2). Although none were observed there during the 1958-59 survey, old tracks assured us that the site was being frequented and a browse survey there was justified.

The west side of the browse plot was a high ridge bordering a river. The terrain sloped eastward to a black spruce swamp on the east border, so that most of the plot was a form of plateau. Four smaller mature spruce swamps were scattered among the mixed young growth that covered the greater part of the plot.

Method

The survey method developed by Passmore and Hepburn (1955) for deer was used, the only modification being the use of vertical browsing limits of two feet to 10 feet instead of 1.5 feet to six feet. A total of 64 plots 1/330 acre in size were tallied. These were spaced at five chain intervals on four strips 1/4 mile apart.

Extent of Browsing

The data from the tally sheets are summarized in Table I. Table II shows the browse available on plots and the intensity of browsing.

Of 24 tree and shrub species available to moose, 10 had been browsed during the winter just ended. Pin cherry, found on 70% of the plots, was the most widely distributed species. Mountain ash, white birch and alder occurred on half of the plots. Four species, alder, pin cherry, hazel and mountain ash accounted for 67% of the total stems on the plots. Mountain ash and willow proved to be the species preferred by moose; though they accounted for only 15% of the stems available, they supplied 76% of browse units. Willow alone supplied 30% of browse units, while contributing only 2.3% of available stems. None of the other eight species browsed by moose contributed more than 5% of browse units.

Severity of Browsing

The effect of browsing by moose on commercial tree species and shrubs other than mountain ash and willow on this plot has been negligible (see comparison below).

	Living Stems	Killed	Mutilated	Browse Units
Willow & Mountain Ash	261	19	113	6929
Commercial Species	296	nil	14	902
Other Shrubs	1253	5	15	1266

The results of the survey suggest that on this presumably typical section of the large burn of 1941 the relatively high winter moose densities of recent years have had little visible effect upon the trees and shrubs growing there. Willow and mountain ash, clearly the favorite foods of moose using the area, might be depleted if heavy utilization continues, directing attention to the good variety of other species available. Of the coniferous tree species, balsam and black spruce showed a very little browsing and commercial deciduous species were only lightly damaged (less than 10% mutilated or browsed). Extensive shading out of shrubs by the rising forest will not, in much of the area, occur for some time to come, and the sampled area should be able to continue providing winter browse for good numbers of moose for at least the next decade.

Last year, a similar survey was made of another type of good winter moose range in the District, a mature mixed forest. The two plots were similar in that in both cases mountain ash supplied nearly 50% of the browse units; this species is certainly much sought after by moose in the District. Second choices were different, though, for willows, which were so important on the burn were virtually nonexistent in the mature forest, where mountain maple supplied the second

largest number of browse units (just under 30%, the same proportion as second place willows provided on the burn).

Literature cited

Passmore, R. C. and R. L. Hepburn. 1955
A method for appraisal of winter range of deer.
Ont., Dept. of Lands & Forests, Research Report
No. 29, Technical Series, January, 1955. 7 pp.

TABLE I - Summary of Tally Sheets

	Killed Stems	Living Stems	Mutilated Stems	Browse Units	No. Plots on Which Species Occur
Balsam	-	78	-	175	18
Ground Hemlock	-	2	-	-	1
White Pine	-	1	-	-	1
Jack Pine	-	43	-	-	11
White Cedar	-	4	-	-	2
Willows	2	42	21	2710	12
Aspen	-	49	5	395	18
Hazel	-	323	7	402	19
Yellow Birch	-	1	-	-	1
White Birch	-	87	8	332	31
Alder	3	347	-	60	31
Mountain Ash	17	219	92	4219	32
Juneberry	-	56	-	240	15
Raspberry	-	44	-	-	5
Pin Cherry	2	327	7	454	46
Choke Cherry	-	3	-	-	1
Mountain Maple	-	104	-	90	14
Sugar Maple	-	2	-	-	1
Red Maple	-	9	1	-	2
Honeysuckle	-	8	-	-	1
Elder	-	4	-	-	1
Black Spruce	-	28	1	-	17
White Spruce	-	5	-	-	4
Unidentified Shrub	-	24	-	-	2
TOTAL	24	1810	142	9097	286

TABLE II - Compilation Gogama Moose Browse Survey, 1959

Species	Frequency Index	Living Stems Per Acre	Percent Mutilated	Percent Killed	Percent Browsed	Percent of Available Stems	Percent of Browse Units Supplied
Balsam	.281	402	-	-	2.2	4.3	1.9
Ground Hemlock	.015	10	-	-	-	.1	-
White Pine	.015	5	-	-	-	.1	-
Jack Pine	.171	221	-	-	-	2.4	-
White Cedar	.031	20	-	-	-	.2	-
Willows	.187	216	50	4.5	64.5	2.3	29.8
Aspen	.281	252	10.2	-	8.1	2.7	4.3
Hazel	.296	1665	2.1	-	1.2	17.8	4.4
Yellow Birch	.015	5	-	-	-	.1	-
White Birch	.484	448	9.1	-	3.8	4.8	3.6
Alder	.484	1788	-	0.9	0.2	19.2	0.7
Mountain Ash	.500	1129	42	7.2	19.3	12.1	46.4
Juneberry	.234	288	-	-	4.3	3.1	2.6
Raspberry	.078	226	-	-	-	2.4	-
Pin Cherry	.718	1686	2.1	0.6	1.4	18.1	5.0
Choke Cherry	.015	15	-	-	-	.2	-
Mountain Maple	.218	536	-	-	0.9	5.7	1.0
Sugar Maple	.015	10	-	-	-	.1	-
Red Maple	.031	46	11.1	-	-	.5	-
Honeysuckle	.015	41	-	-	-	.4	-
Elder	.015	20	-	-	-	.2	-
Black Spruce	.265	144	3.5	-	-	1.5	-
White Spruce	.062	25	-	-	-	.3	-
Unidentified Shrub	.031	123	-	-	-	1.3	-
TOTAL		9321					
AVERAGE			7.8	1.3			

THE 1958/59 AERIAL CENSUS OF MOOSE IN ONTARIO

by
R. Boultbee

Four moose management regions in the province were censused from aircraft in the winter of 1958 and 1959. Mr. Lumsden circulated a report dated June 10th, 1959 in which he estimated the moose population separately for each management region. The four estimates were then added to obtain an estimate for the whole province.

It was considered that each management region had a discrete moose population and hence had to be treated separately. This enabled an early, and encouraging, report to be made. Nevertheless it is advisable to try to find if the four populations are truly discrete, or on the other hand essentially homogeneous. The populations in the four management regions could be at different levels with no harm to the compilations. It is only necessary that the separate variances be essentially the same. In statistical procedures it is correct to pool the variances of homogeneous populations.

The purpose of this paper is to report on the opportunity of pooling the separate variances of the 1958-59 moose census. The first step was to test the crude variances for homogeneity. When this was done they were found to differ almost at the five percent point of significance. This was far from satisfactory since the variances were really on the verge of being quite different. However it was conceivable that over as big an area as the province of Ontario there might be extraneous influences adding to the variances. The only available data on extraneous influences were the notes recorded for each plot on Date, Time Spent Over Plot, Temperature, Snow Depth, and Wind Strength. The effects of these factors were eliminated by the process known as stratification.

The recorded factors were used singly and in combination to see if a worthwhile reduction could be obtained in the residual variance. The results of these calculations are given in appendix one. It was necessary to omit the Southern Management Region from these calculations because the additional data were not recorded for a number of plots. One item was also omitted for a plot in the Western Management Region but an average value was substituted from plots censused near the same date.

Appendix one shows that a wide range of reductions can be obtained, from the unaltered variance of 154.77, down to 98.83 when the effects of Date, Time Over Plot, and Temperature are eliminated. This is a very interesting reduction of about one third, due to the removal of extraneous and easily measured influences. From a total of 196 plots in the three management regions, 90 were lost in eliminating extraneous variance leaving 106 to account for the residual variance of 98.83. It is possible to get additional interesting reductions by combining the remaining features but the loss in plots is heavy.

The reduced variance of 98.83 is still pooled from the three management regions. The test for homogeneity, given in appendix two, is far below the level of significance. Thus the three management regions are found to have not merely similar variances but essentially one variance.

We have established an important fact. As far as the 1958/59 moose census is concerned, there is a single population across northern Ontario and a single estimate of its numbers may be made. If we wish we may make a separate estimate for each management unit using the pooled variance of 106 plots to find the confidence limits. This is considerable more plots than any one region censused. Also, if in future years we find we can rely on pooling the variances we will be able to save time and money by censusing fewer plots. The test this year for homogeneity was so convincing that we have some optimism for future years.

Appendices three and four show how the reduced variance of 98.83 is used to get a single estimate of population for the three management regions combined, and for each region separately. Each estimate is the best available for its area but the separate estimates do not add to the total for the three regions combined, although the comparison is consistent. The following table summarizes the estimates.

Area Covered By Estimate	Mean Value	80% Confidence Limits	
		Lower	Upper
Central Management Region	17,474	15,402	19,547
Northern Management Region	17,026	14,944	19,108
Western Management Region	40,584	35,352	45,815
Sum of Three Regions	75,084	65,698	84,470
Three Regions Combined	75,509	70,093	80,925

It is interesting to study how the combined factors produce reductions in the variance. Some factors taken singly produce a noticeable reduction. Taken together certain factors produce a reduction roughly equivalent to the sum of their separate reductions. But certain other factors taken together produce an additional mutual reduction, apart from their separate reductions. This additional mutual effect is called interaction. It is given to us free for the taking and is a useful feature. In the case of Date, Time and Temperature combined, interaction is present at the two percent point of significance. The total reduction in variance from 154.77 to 98.83 is significant at better than the one tenth of one percent point, which is a very strong indication that a true influence was at work rather than mere chance.

It is not much work to make a table for two factors, but for three factors the work can be tedious. In the case of Date, Time and Temperature a separate sheet of paper was used for each half month and a two-way table was made on each for Time and Temperature.

The mind has a little trouble in conceiving Time Spent Over Plot as a stratifying factor. It is likely that most time is spent over plots with the most moose. Hence stratifying by Time Over Plot seems at first to be the same as stratifying by moose counts, which would be unforgivable. However any feature which leads to successful stratification must be associated significantly with the population and Time Over Plot appears to fit this description. The reader is invited to do his own thinking.

Finally, for future benefit, the reader is asked to consider what other features besides Date, Time, Temperature, Snow and Wind could be recorded just for the trouble of writing them down. The time of day was probably recorded but was not included in the summaries used by the writer. Mr. Elsey, the District Biologist at Fort Frances, has suggested relative humidity (this might be difficult in winter). Ground cover types in terms of moose habitat seem to remain undefined in air census and may offer a big reduction in variance. Presence or absence of sunshine might be helpful. Wind direction with its different moisture characteristics might be useful.

Mr. Simkin, District Biologist at Sioux Lookout, has expressed concern over the unknown effects of differences between censusing teams. It is known for instance that Districts have different preferences of height for censusing. It would be possible to do some study of these effects if stratifying were done by teams. Consistent records should be kept for each plot showing each member of the team, including the pilot, and his function. The statistical basis of this study would be that each team would do a group of plots which is assumed to be random within itself as well as belonging to a larger group which is also random. It is assumed that each group of plots censused by a single team would have the same variance. This assumption appears reasonable at least for a management unit. Such a study might be revealing.

We do not know what effects unseen moose are having upon the census, either by reason of uncertain estimates, or their effects upon statistical assumptions. One aspect of unseen moose on a plot is that they may cause a zero count for the plot. Some lessening of the effects of unseen moose may be obtained from stratifying by cover type, sunshine, wind or other factors.

Zero counts pose a small but important problem. They give a skew to the population curve and until we know more about unseen moose we will not know to what extent the skewness is characteristic of the population and to what extent it is a distortion of the facts. Skewness introduces an error in that the average is to one side of the peak of the population curve, thus distorting the standard error. This error is made smaller when the variance is divided by the number of plots to find the variance of the mean, and stratifying may remove more of it, but some error will always remain as long as it is present in the standard error.

APPENDIX ONE

The pooled variance for Central, Northern and Western Regions, based on 196 plots, and with no extraneous variation eliminated, is 154.77. The reductions in this variance obtained by stratifying with one or more factors are given below.

Factor(s)	Reduced Variance	Degrees of Freedom	Significance Point In Percent
Date	150.68	189	10.0
Time (over plot)	142.15	189	0.2
Temperature	153.67	189	-
Snow (depth)	154.43	191	-
Wind (strength)	148.02	190	5.0
Region	153.87	193	-
Date, Time	133.17	168	0.2
Date, Temperature	132.61	164	0.2
Date, Snow	137.57	175	0.3
Date, Wind	129.44	169	0.1
Date, Region	142.12	181	1.0
Time, Temperature	146.62	161	20.0
Time, Snow	126.87	172	0.1
Time, Wind	113.83	168	0.1
Time, Region	141.89	178	2.0
Temperature, Snow	138.88	165	2.0
Temperature, Wind	149.23	163	20.0
Temperature, Region	154.44	175	-
Snow, Wind	145.45	171	10.0
Snow, Region	153.87	183	-
Wind, Region	146.86	180	5.0
Date, Time, Temperature	98.83	105	0.1
Date, Time, Wind	120.50	125	0.3
Date, Time, Region	120.55	141	0.1
Date, Temperature, Wind	130.71	115	3.0
Date, Temperature, Region	116.57	131	0.1
Date, Snow, Region	139.86	155	5.0
Date, Wind, Region	121.46	146	0.1
Time, Temperature, Wind	114.25	109	0.1
Time, Temperature, Region	139.22	127	10.0
Time, Snow, Region	125.98	148	0.1
Time, Wind, Region	119.21	142	0.1
Temperature, Snow, Region	144.43	139	20.0
Temperature, Wind, Region	144.37	131	10.0
Snow, Wind, Region	128.18	147	0.3
Date, Time, Temperature, Wind	123.33	62	9.0

A total of sixty-three combinations of factors is available but only thirty-six have been used. Combinations of four or more factors give some variances lower than 98.83 but too many plots are discarded. For instance the last combination in the table gives a variance of 123.33, which is not much reduced from the crude variance, yet it has only sixty-three effective plots (degrees of freedom = 62).

Conversely, it may be asked why the simple combination of Time and Wind with 169 effective plots was rejected. Its variance of 113.83 gives confidence limits almost as small as 98.83. However the residual variance within management regions is not homogeneous for Time and Wind ($p = 0.09$). For Date, Time and Temperature $p = 0.87$.

The preceding calculations form a heavy work load. In the present instance the writer's secretary did most of the tabulating, analyses of variance, and significanct tests, along with the appropriate checks for accuracy. Organizing the work in this way speeds it up greatly.

APPENDIX TWO

When extraneous variation due to Date, Time and Temperature is eliminated it leaves a variance of 87.29 in the Central Management Region, a variance of 73.14 in the Northern Management Region, and a variance of 95.46 in the Western Management Region. It is not difficult to imagine that these are chance variations around a central value, indicating a variance which is essentially the same in each management region. Bartlett's test for homogeneous variance is given below.

Management Region	Sum of Squares	Degrees of Freedom (n-1)	Reciprocal 1/(n-1)	(S^2) Mean Squares	log S^2	(n-1)log S^2
Central	3666.13	42	0.02381	87.29	1.94096	81.52049
Northern	1024.00	14	0.07143	73.14	1.86416	26.09817
Western	1813.75	19	0.05263	95.46	1.97982	37.61660
a = 3	6503.88	75	0.14787			145.23526

Average value of S^2 = 6503.88/75 = 86.72

log of average value of S^2 = 1.93812

(1.93812) (75) = 145.35900

Chi-square = 2.3026 (145.35900 - 145.23526) = 0.285

$$\text{Correction Factor} = 1 + \frac{0.14787 - 0.01333}{3(a-1)} = 1.022$$

(The figure 0.01333 is the reciprocal of 75)

Corrected Chi-square = 0.285/1.022 = 0.279
(degrees of freedom = a-1 = 2)

The corrected value of Chi-square will be exceeded 87 times out of 100 by chance alone. The effects of extraneous variations have been largely removed.

Bartlett's test is explained in Snedecor's "Statistical Methods", fifth edition, page 287.

APPENDIX THREE

Calculation of moose population of Central, Northern and Western management Regions combined.

Average number of moose per plot

$$= \frac{996 + 703 + 804}{85 + 45 + 66}$$

$$= \frac{2503}{196} = 12.77$$

Variance = 98.83, with 105 degrees of freedom

Variance of the mean = 98.83/196 = 0.5042

Standard error of the mean $= \sqrt{0.5042} = 0.7101$

80 percent confidence limits $= 12.77 \pm (0.7101)(1.29)$

$= 12.77 \pm 0.92$

$= 12.77 \pm 7.17\%$

Total number of plots in three management regions
= 5,913 (Mr. Lumsden's report)

Total moose $= (12.77 \pm 0.92)(5{,}913)$

$= 75{,}509 \pm 5{,}416$

= from 70,093 to 80,925

APPENDIX FOUR

To find if the average number of moose per plot in each management region varies significantly from the grand average of 12.77.

Central Management Region

Average moose per plot = 996/85 = 11.72
Variance = 98.83
Variance of the mean = 98.83/85 = 1.1627
Standard error of the mean = $\sqrt{1.1627}$ = 1.08
80 percent confidence limits = 11.72 ± (1.08) (1.29)
= 10.33 to 13.11
The confidence limits include the grand average of 12.77

Northern Management Region

Average moose per plot = 703/45 = 15.62
Variance = 98.83
Variance of the mean = 98.83/45 = 2.1962
Standard error of the mean = $\sqrt{2.1962}$ = 1.48
80 percent confidence limits = 15.62 ± (1.48) (1.29)
= 13.71 to 17.53
The confidence limits are too high to contain the grand average of 12.77.

Western Management Region

Average moose per plot = 804/66 = 12.18
Variance = 98.83
Variance of the mean = 98.83/66 = 1.4974
Standard error of the mean = $\sqrt{1.4974}$ = 1.22
80 percent confidence limits = 12.18 ± (1.22) (1.29)
= 10.61 to 13.75
The confidence limits include the grand average of 12.77.

Conclusions

Central and Western Management Regions moose populations do not vary significantly from the grand average. The moose population of the Northern Management Region is significantly higher. It follows that the population of the Northern Management Region is at a higher level than that of the other two Regions. If 95 percent confidence levels are used the Northern Region will also include the grand average. However odds to 80 to 20 are reasonably good.

The pooled variance of 98.83 is used throughout, with 105 degrees of freedom. Thus the confidence limits of each management region are set on the basis of 106 effective plots.

TRAP-NET PROGRAMME ON LAKE OF THE WOODS

by
C.A. Elsey

Introduction

The Kenora and Fort Frances Districts jointly requested a trap-net project for Lake of the Woods for the summer of 1958. The principal reasons for the project are best tabulated as follows and not necessarily in order of merit.

(a) We require a good management tool that will minimize the problems involved in dealing with commercial fishermen as opposed to sportsmen and tourist outfitters.

(b) If possible, we should try to help the commercial fishermen with his problems.

(c) In hot weather fish deteriorate rapidly in gill nets. A fishing technique that will permit "putting live fish on ice" will bring more money to the commercial fisherman with no greater poundage of fish removed from the lake. A trap net, if successful, is an obvious answer to this problem.

(d) In windy weather, gill nets can not always be lifted. The result is a total loss of fish. Sometimes they are lifted at great risk of upsetting the boat. A trap net would not have to be lifted daily.

(e) A trap net would be more economical than gill nets for a commercial fisherman to operate since he would not have to visit them every day. Time involved is less.

(f) Saugers appear to be taking an important place in the lake ecology. A good control is indicated.

On this basis a project was organized under the supervision of Mr. E. MacGillivray of Head Office to study the use of trap nets in Lake of the Woods.

Methods and Equipment

Four types of traps were used in this experiment to test the effectiveness of each type. It was kept in mind that commercial fishermen are not wealthy people and that equipment must not be too expensive.

There were two sixteen foot downhaul traps. The first was made of 3" stretch mesh and the second of 2½" stretch mesh. Both had a 6" stretch mesh lead. There was one 8' spring trap and one 6' spring trap. The 8' trap was made of 2½" stretch mesh and the 6' trap was made of 2" stretch mesh. The two smaller traps had 2½" mesh leads. The length of the lead varied with the set.

The traps were set to test the more important commercial fishing sites and information gathered from the local fishermen was extensively used in selecting sites.

Commercial fishermen continued to operate their gill nets much as usual. Their returns were made available to us. For obvious reasons returns of individual fishermen cannot be reported. Therefore, their returns are grouped and averaged.

Results

The catch of fish is indicated in Table 1. As the summer progressed, the various traps were moved either once or twice. Trap A-16' downhaul with a 3" mesh was removed on June 4. It was "gilling" so many cisco, saugers.

In setting up an experiment of this sort it is desirable to compare the effectiveness of various types of traps with each other and with the standard type of gear (gill nets) currently in use. This has been attempted but there are so many uncontrollable factors that no sound comparison seems to exist. Therefore, it seems best to try to draw some general conclusions.

The reasons for our inability to effectively compare results are as follows:

(1) Gill nets were lifted daily. Traps varied from one to five days between lifts.

(2) Fish from gill net catches were those taken by commercial fishermen. All fish were disposed of. In the case of trap nets the desirable fish (Yellow Pickerel and Northern Pike) were released and the undesirable were removed from the lake. Fish may have been recaptured several times.

(3) To obtain a fair comparison it would be necessary to have all equipment set at the same place and at the same time. This is obviously impossible.

(4) There is no standard of comparison between gill nets and trap nets. Should one trap with a 600' lead be compared to one gill net 600' long set at the same site? The gill net reports are not set up in such a way that we can make a comparison e.g. if a man set 1800' of net we do not know if he was visiting six locations or one.

(5) Gill nets are easily relocated to follow the movements of fish. The traps used were seldom moved, although the smaller ones could easily be moved.

The catch of fish for the various traps in their different locations is indicated in Table I.

The sixteen foot, three inch mesh downhaul trap was taken out of use on June 14 because it was gilling so many cisco and saugers and small pickerel that it was felt that commercial fisher-

men would not use it. According to our results it was the most effective trap. We cannot be certain that this was due to greater efficiency in a 3" mesh crib or to location of the trap. It was probably a combination of these factors.

In moving the traps from one location to another it is believed that some traps may have gained while others lost thereby tending to neutralize the effects of location. Table III combines the catch of traps eliminating the consideration of location. Each species caught is shown.

Commercial fishermen are interested in some of these only.

Cisco is not a marketable fish except for a few taken by mink ranchers at a very low price. The cisco are a nuisance to commercial fishermen in their nets. To the sportsmen it is a fish that should be removed. The larger traps were more efficient at cisco removal.

Northern Pike is desirable to both sportsmen and commercial fishermen. None of the traps removed many. The difference in catch was more likely due to locations than efficiency.

Yellow Pickerel are the most important commercial and game species in the south end of the lake. The two larger traps were the most effective in taking this species.

Ling is probably a very important competitor with commercial and game species for both food and space. It is not a desirable fish. The large traps were much more effective in ling removal.

Large perch have some commercial value and no sporting value in this area. The difference in various traps is probably more closely related to the locations of the sets than to the trap size. The largest and smallest average daily catch were taken by the two largest traps.

Saugers are a good fish commercially and sportwise. Since the introduction of sportfishing and commercial fishing their numbers have increased in the south end of the lake. It is probable that to some degree they are taking space and food formerly used by the more desirable yellow pickerel. The numbers taken were somewhat disappointing. The variation in numbers taken are likely due to trap size as indicated by the figures.

A comparison of the effectiveness of traps and gill nets must be based on the period from June 1 to July 16 since commercial fishermen were not permitted to operate earlier. The sixteen foot trap with 3" mesh (Trap A) which was removed on June 4 is not considered. Table III is a summary of this and reports on the more important fish only.

The average daily lift per commercial fisherman was 968 yards. It varied from 400 to 1800 yards per day per fisherman. We believe that one fisherman could very easily handle three 8' traps

per day. Thus the work load would be something like one trap to about 400 ± 100 yards of gill net per day under the conditions existing in the south end of Lake of the Woods.

Examining Table III it would appear that 968 yards of gill net compared with to one each of the various traps was:

(a) Gill nets were more effective in impounding cisco, northern pike, suckers and possibly ling.

(b) Traps were more successful in capturing yellow pickerel, sauger and yellow perch.

Conclusions

(a) There were certain instrinsic weaknesses in our programme making it difficult to make the proper comparisons.

  (1) Yellow pickerel and northern pike should not have been returned to the water.

  (2) One days catch of each of the important species should have been weighed each week so that we could compare gill net and trap net catches.

  (3) Traps should have been moved more frequently so that various grounds could have been tested and so that location of sets was balanced between poor and good sets for any one species.

(b) Much more study is needed before we can actually say whether traps should or should not be used in our warm water fisheries. (Plans are now being made to permit a few selected commercial fishermen to experiment with the traps under our supervision).

Suggestions For Continuing This Study

(a) A few commercial fishermen in Lake of the Woods and Rainy Lake should be granted permits under section 99 of the Special Fisheries Regulations.

(b) They should supply information on prepared forms. The information should include numbers of all species captured. Average weight per fish of each species. Date of catch. Depth of water at crib. Map showing location of set.

(c) All fish to be removed from the trap and either destroyed or sold.

(d) The permittee should also set gill nets so that we will have a standard for comparison.

(e) Some of the yellow pickerel were not legal in size. These should be considered separately on reports.

Suggestions For The Crow Lake Programme

(a) It is undesirable to return captured fish to the water. However public relations considerations make it almost impossible to remove live lake trout from the lake. Therefore, all lake trout should be tagged or fin clipped before release so that their re-entry to the trap can be recorded. This is not a fully satisfactory treatment since we cannot tell what effect the returned fish will have on movements of new fish into the trapping area. In other words our statistics will not be dependable.

(b) Gill nets should be set for comparative studies. In setting the nets depths etc. should be considered.

(c) Traps should be moved more frequently than they were on the Lake of the Woods Programme.

(d) Whitefish and lake trout should be tagged in early stages of the programme in a hope that we can learn something of fish numbers and fish movements.

(e) Efforts should be made to obtain information about average weight of fish.

(f) There should be some advance public relations work done amongst tourist outfitters.

25.3.59.

TABLE I - Fish Caught According to Trap Locations

TRAP NO.	SET NO.	NUMBER OF FISH	DATE SET	DATE LIFTED	No. days set	White-fish	Cisco	Northern Pike	Yellow Pickerel	Common Sucker	Bullhead	Ling	Perch	Rock Bass	Crappies	Small M. Bass	R. H. Sucker	Sauger	Quill-back	Buffalo-Fish	Mooneye
A	1	Total Av. Daily	May 9	June 4	26	1 -	2852 109.7	78 3	3244 124.7	118 4.5	2 -	925 35.6	253 9.7	2 -	1 -	1 -	10 -	1326 51	- -	- -	- -
B	2	Total Av. Daily	May 8	June 16	39	2 -	1593 40.9	54 13.9	5966 153	41 1	2 -	806 20.7	84 2.1	2 -	8 -	1 -	9 -	430 11	7 -	3 -	1 -
	3	Total Av. Daily	June 16	July 8	22	0	760 34.5	24 1	944 42.9	18 1	4 -	28 1.3	32 1.5	0 -	4 -	0 -	5 -	416 18.9	0 -	0 -	0 -
	4	Total Av. Daily	July 9	July 16	3	0	482 160.6	6 2	35 11.6	18 6	- -	12 4	2 .6	- -	- -	- -	- -	48 16	- -	- -	- -
C	5	Total Av. Daily	May 8	June 12	35	0	30 .9	153 4.4	2781 79.1	26 .7	27 .8	245 7	250 7.1	8 -	25 .7	17 .5	0 -	228 6.5	- -	- -	- -
	6	Total Av. Daily	June 12	July 7	25	0	12 .5	42 1.7	1186 47.5	9 .4	6 .2	8 .3	202 8	4 .2	21 8.4	6 2	9 .4	182 7.3	- -	- -	- -
	7	Total Av. Daily	July 8	July 15	8	0	94 12	0	69 8.6	21 2.6	0 0	20 2.5	2 .2	0 0	0 0	0 0	0 0	93 11.6	0 0	0 0	0 0
D	8	Total Av. Daily	June 6	July 17	11	0	0	15 1.4	57 3.8	27 32.5	185 16.8	1 -	32 2.9	10 0.9	6 0.5	1 -	35 3.2	132 12	0 0	0 0	0 0
	9	Total Av. Daily	June 17	July 12	25	0	14 5.6	6 .2	911 36.6	82 3.3	2 -	1 -	137 5.5	1 -	11 -	0 -	112 4.5	631 25.2	1 -	0 -	0 -

* A - 16' Downhaul Trap - 3" Mesh
B - 16' Downhaul Trap - 2½" Mesh
C - 8' Spring Trap - 2½" Mesh
D - 6' Spring Trap - 2" Mesh

TABLE II - Fish Caught According to Trap Type

TRAP NO.	NUMBER OF FISH	DATE SET	DATE LIFTED	No. of days	Whitefish	Cisco	Northern Pike	Yellow Pickerel	Common Sucker	Bullhead	Ling	Perch	Rock Bass	Crappie	Small M. Bass	R. H. Sucker	Sauger	Quill-back	Buffalo Fish	Mooneye
A	Total Av.	May 9	June 4	26	1	2852	78	3244	116	2	925	253	2	1	1	10	1326	-	-	-
	Daily				-	109.7	3	124.7	4.5	-	35.6	9.7	-	-	-	-	51	-	-	-
B	Total Av.	May 8	July 16	64	2	2855	80	6945	77	6	846	118	2	12	1	14	894	7	3	1
	Daily				-	44.1	1.25	108.2	1.2	-	13.2	1.8	-	-	-	-	13.9	-	-	-
C	Total Av.	May 8	July 16	68	-	136	195	4036	56	33	273	454	12	46	23	9	501	-	-	-
	Daily				-	2	2.9	59.3	0.8	-	4	6.7	-	-	-	-	7.4	-	-	-
D	Total Av.	June 6	July 12	36	-	14	21	968	109	187	2	169	11	7	1	147	763	1	-	-
	Daily				-	-	-	26.9	3.0	5.2	-	4.7	-	-	-	4.1	21.2	-	-	-

A - 16' Downhaul Trap - 3" Mesh
B - 16' Downhaul Trap - $2\frac{1}{2}$" Mesh
C - 8' Spring Trap - $2\frac{1}{2}$" Mesh
D - 6' Spring Trap - 2" Mesh

TABLE III - Comparison of the Effectiveness of Traps and Gill Nets from June 1 to July 16

GEAR	NO. OF DAYS	CATCH	Cisco	Northern Pike	Yellow Pickerel	Sucker	Ling	Perch	Sauger
Trap B	46	Total No. of Fish	2147	56	2971	54	138	56	711
		Av. No. of Fish per day	46.8	1.2	64.7	1.2	2.8	1.2	15.4
Trap C	46	Total No. of Fish	108	82	1612	44	33	206	313
		Av. No. of Fish per day	2.3	1.8	35	1.0	0.7	4.5	7.0
Trap D	37	Total No. of Fish	14	21	968	256	2	169	763
		Av. No. of Fish per day	0.4	0.6	26.1	6.9	0	4.6	20.3
Gill Nets (Combined effort of 3 fishermen)	123	Total (lbs.)	16615	5192	3645	7301	1285	348	1042
		Av. Daily catch per fisherman 968 yds.	135.0	42.1	29.4	59.3	10.4	2.8	8.5

B - 16' Downhaul Trap - $2\frac{1}{2}$" Mesh
C - 8' Spring Trap - $2\frac{1}{2}$" Mesh
D - 6' Spring Trap - 2 " Mesh