

by A. J. Erskine

**Populations,  
movements  
and seasonal  
distribution  
of mergansers**



**Canadian  
Wildlife  
Service  
Report Series  
Number 17**



Environment Canada  
Wildlife Service

Environnement Canada  
Service de la Faune

**Populations,  
movements  
and seasonal  
distribution of  
mergansers in  
northern Cape  
Breton Island**

by A. J. Erskine

Canadian Wildlife Service  
Report Series-Number 17

Issued under the authority of the  
Honourable Jack Davis, P.C., M.P.  
Minister of the Environment

John S. Tener, Director  
Canadian Wildlife Service

© Crown Copyrights reserved  
Available by mail from  
Information Canada, Ottawa,  
and at the following  
Information Canada bookshops:

Halifax  
1735 Barrington Street

Montreal  
1182 St. Catherine Street West

Ottawa  
171 Slater Street

Toronto  
221 Yonge Street

Winnipeg  
393 Portage Avenue

Vancouver  
657 Granville Street

or through your bookseller  
Price \$1.00 Catalogue No. CW65-8/17  
Price subject to change without notice  
Information Canada, Ottawa, 1972

Design: Gottschalk + Ash Ltd.  
Cover photo by Norman R. Lightfoot



# Contents

7	Acknowledgements
8	Perspective
9	Abstract
9	Résumé
11	Introduction
13	The study area
15	Methods
15	<i>Assessment of merganser populations</i>
17	<i>Banding and associated studies</i>
17	Results
17	<i>Seasonal chronology within study area</i>
20	<i>Movements of mergansers shown by band recoveries</i>
22	<i>Merganser populations in northern Cape Breton Island</i>
22	<i>The Margaree River system</i>
25	<i>Other river systems and Lake Ainslie</i>
26	Discussion
26	<i>Seasonal chronology</i>
28	<i>Movements shown by band recoveries</i>
28	<i>Merganser populations</i>
28	<i>The Margaree River system</i>
30	<i>Other river systems and Lake Ainslie</i>
31	<i>The aftermath of merganser shooting</i>
32	Literature cited
33	Appendices

## List of tables

1. Numbers of recoveries in 1957–69, by areas and months, of Common Mergansers banded on Cape Breton Island, excluding those killed by the shooting crew, 19
2. Numbers of young Common Mergansers banded on Cape Breton Island, 20
3. Recoveries of banded Common Mergansers by the shooting crew, on the Margaree River system, 20
4. Comparison of recovery rates of mergansers with and without nasal discs, on Cape Breton Island and on Miramichi River, New Brunswick, 1950–61, 20
5. Number of mergansers seen by CWS personnel on Margaree River during surveys in spring and summer, 1960–63, with estimates of breeding populations, 22
6. Numbers of broods of mergansers (both species) estimated for Margaree River system, excluding Lake Ainslie and its tributaries, 23
7. Merganser production on various rivers, Cape Breton Island, based upon brood data, 25
8. Estimated hatching dates (approximate) of Common Mergansers, based on museum specimens and published reports, 26
9. Recoveries in 1957–69 of Common Mergansers banded on Cape Breton Island, grouped by banding area and (a) distance of movement, and (b) month of recovery, 29
10. Estimate of mergansers from other Cape Breton rivers lost to Margaree shooting crew in 1962 (a), and 1963 (b), 29

## List of appendices

1. Winter counts of mergansers, 1960–64, Cape Breton Island, based on reports by Department of Fisheries personnel, 33
2. Results of warden surveys for mergansers, Margaree River, 33
3. Records of mergansers seen and/or killed by the shooting crew, Margaree River system, 1962–68, and merganser-days calculated from them (rounded to nearest 5 or 0), 34

## List of figures

1. Young Common Mergansers escape by running on the water, 8
2. Major river systems on Cape Breton Island, Nova Scotia, including areas where merganser studies were carried out in 1957–68, 12
3. The Margaree River system, Inverness County, Nova Scotia, 13
4. The steep, narrow, bouldery section of the upper NE Margaree, 14
5. The more level, wider, gravelly section of the lower Middle River, 15
6. The net used to trap young mergansers, 16
7. Common Merganser young, about 33 and 23 days, 16
8. Hatching dates of merganser broods compared with April temperatures, Cape Breton Island, 1957–68, 18
9. Distribution of recoveries of Common Mergansers banded on Cape Breton Island, 21
10. Merganser-day indices for breeding seasons, 1957–68, Margaree River, 23
11. Indices to merganser numbers in autumn, winter and spring, Margaree area, 1958–68 (on warden areas only), 24
12. Adult mergansers returned to the rivers as soon as open water was available. Mabou River, April 20, 1967 (a late spring!), 27

# Acknowledgements

This work was part of a joint study involving personnel of the Canadian Wildlife Service, the Fisheries Research Board of Canada and the Department of Fisheries<sup>1</sup>. P. F. Elson, of the Atlantic Biological Station, Fisheries Research Board, St. Andrew's, New Brunswick, organized the project from the fishery side; it has been a pleasure to co-operate with him, and much of the merganser information was first collected following his suggestions. The shooting crew whose records provided the details of merganser numbers from 1962 to 1968 was headed in turn by L. MacFarlane, H. Burtchard and E. Geldert; others in the crew at various times were M. Carmichael (of Nova Scotia Department of Lands and Forests), S. LeBlanc, L. Gallant, J. Bennett and L. Ingraham. Their co-operation in making data available and in recovering specimens was much appreciated. Specimens were stored at the Margaree Fish Hatchery of the Department of Fisheries, by courtesy of T. Lydon and R. Peveril. The warden surveys and winter counts of mergansers were made by personnel of the Department of Fisheries, Protection Branch, offices in Margaree Forks, Baddeck and Port Hood, under supervision of R. Watts, R. MacLeod and H. MacMillan, respectively. Wardens taking part in the surveys included J. Moran, the late D. Ross, D. Carroll, T. LeBlanc, D. Tompkins and W. Gillis, of the Margaree office, R. Campbell and D. MacDonald of the Baddeck office, and P. MacDonald and J. Macauley of the Port Hood office. The Margaree wardens also assisted with the merganser banding in 1958-60 and in 1962, while the Baddeck staff participated with enthusiasm in the banding in 1963 and 1965-68. I wish to acknowledge a debt, of companionship as well as co-operation, to all of these people. Their help was much appreciated.

The CWS project was carried out by Brian Carter in 1957-59, and by me since then. The work was under general supervision in turn by D. A. Munro, A. G. Lough-

rey, A. H. Macpherson and H. Boyd. They all provided much helpful discussion, and their suggestions for presentation of the voluminous data helped in the preparation of this paper. Casual assistants (paid by CWS) during merganser banding included J. P. Murphy, W. Abraham, E. Shaw, R. Gibbon, J. I. Murphy, M. Macdonald, J. Lydon, W. Carroll, A. Doucet, R. Chaisson and M. Doucet.

<sup>1</sup> Now part of the Department of the Environment.



The Common Merganser (*Mergus merganser*) is a large and striking duck. Its fish-eating habits have attracted adverse attention from sport fishing interests, while its rank flesh has discouraged most hunters from urging its conservation as a game species. Efforts on behalf of mergansers have been made by people who find them esthetically pleasing, and by those who feel that no human use of one animal justifies destruction of another.

Like other ducks, mergansers are protected in Canada under the Migratory Birds Convention Act, which is administered by CWS. In recent decades, permits to shoot mergansers outside the legal waterfowl hunting seasons have been issued only to organizations carrying out experiments de-

signed to measure the effects of merganser predation on local fish populations; such experiments usually involved measuring the fish population before and after the merganser population was reduced by shooting. Since 1950, CWS has helped to estimate merganser populations in some experiments, particularly that at the Margaree River in eastern Nova Scotia. We have also attempted to ensure that as much biological information as possible is obtained from the merganser sightings and kills resulting from the shooting programs.

Merganser populations apparently failed to recover following the end of a shooting program on the Miramichi River system in New Brunswick, an area which had been heavily treated with DDT (against spruce

budworm) during much of the shooting period. It was important to determine the effect of a shooting program in an area, such as the Margaree, which has never been treated with DDT.

This study confirms previous findings that elimination of a local merganser population by shooting alone is possible, and suggests that such a program has no important influence on merganser populations on nearby river systems from which resettlement might occur after the end of shooting. More important, however, is the demonstration of how small and sedentary these merganser populations are. Such populations can easily be wiped out when shooting of mergansers or distribution of toxic chemicals are permitted over wide areas.



Fishery interests have frequently advocated reduction or elimination of fish-eating birds on salmon waters. This study was carried out in co-operation with a Fisheries Research Board study of population interactions between Atlantic salmon and mergansers on Cape Breton Island, Nova Scotia, from 1957 to 1968.

Mergansers occurred on the study area at all seasons, with largest numbers present during the brood season and migrations. Band recoveries showed that Cape Breton mergansers wintered mainly on the Atlantic coasts of Cape Breton Island and the Nova Scotia mainland. Movements of ducks to southern Nova Scotia and New England occurred in 2 years when severe cold coincided with the southward migration in December.

The breeding population of the Margaree River system was estimated at 15 pairs of Common Mergansers and two pairs of Red-breasted Mergansers in 1957-62. Systematic shooting, by a Fisheries Research Board crew, reduced this to one or two pairs in 1965-68. Numbers present during migration and in winter were also reduced, probably by 75 per cent or more. Shooting on the Margaree system did not, however, affect the breeding populations of other rivers on Cape Breton Island. Recovery of the Margaree population is occurring much more slowly than at first predicted.

Des personnes directement intéressées à la pêche ont souvent prôné la réduction, voire l'élimination, des oiseaux ichtyophages des eaux à saumon. La présente étude a été faite parallèlement à une étude menée par l'Office des recherches sur les pêcheries au sujet de l'influence mutuelle des populations du saumon de l'Atlantique et des bec-scies de l'île du Cap-Breton (Nouvelle-Écosse), de 1957 à 1968.

Les bec-scies étaient présents dans la région étudiée en toutes saisons, avec une population accrue durant la saison de couvain et lors des migrations. Les bagues récupérées révèlent que les bec-scies du Cap-Breton hivernent surtout sur les côtes atlantiques de l'île du Cap-Breton et de la Nouvelle-Écosse. Les canards se sont déplacés vers le sud de la Nouvelle-Écosse et vers la Nouvelle-Angleterre, au cours des deux années où le froid intense a coïncidé avec la migration vers le Sud en décembre.

Entre 1957 et 1962, la population d'oiseaux nicheurs du bassin de la rivière Margaree était estimée à 15 couples de bec-scies communs et à deux couples de bec-scies à poitrine rousse. Un abattage systématique, par une équipe de l'Office des recherches sur les pêcheries, a réduit cette population à un ou deux couples entre 1965 et 1968. Le nombre des oiseaux présents lors de la migration ou durant l'hiver a peut-être baissé de 75 p. 100 et même davantage. Toutefois, l'abattage systématique dans le bassin de la rivière Margaree n'a pas affecté les populations d'oiseaux nicheurs des autres rivières de l'île du Cap-Breton. Le rétablissement de la population de la rivière Margaree s'opère beaucoup plus lentement qu'on ne l'avait prévu.

# Introduction

Several experiments to increase salmon populations by reduction of merganser numbers have been carried out in the Maritimes (White, 1939; Elson, 1962; unpublished data from Fisheries Research Board and Resource Development Service, Department of Fisheries). The early efforts, on Forest Glen Brook in Nova Scotia in 1936–37, and on Pollett River in New Brunswick in 1947–65, demonstrated that populations of salmon in their young stages (fingerlings, parr and smolts) can increase when merganser predation is sufficiently reduced. The later, inconclusive experiments on the Miramichi system in New Brunswick in 1950–61, and the St. Mary's River in Nova Scotia in 1953–67, and the present study, were expected to show that the return of grilse and mature salmon from the sea was also increased by shooting of mergansers. The failure to achieve results from the Miramichi study must be blamed on the use, by another agency, of DDT to combat spruce budworm. The DDT eliminated young salmon, as well as the invertebrates on which they fed, in the very years when the effects of merganser shooting might have become apparent. The effects of the DDT spraying on salmon populations in the Miramichi River have been published, and it is perhaps unrealistic to hope for a published account of the aborted merganser shooting experiment there. The St. Mary's River program received little publicity, and apparently obtained little usable data on either mergansers or salmon. The Margaree program will presumably be written up, from the fisheries viewpoint, when all the fish spawned after merganser numbers had been reduced by shooting have returned to the river (by 1971).

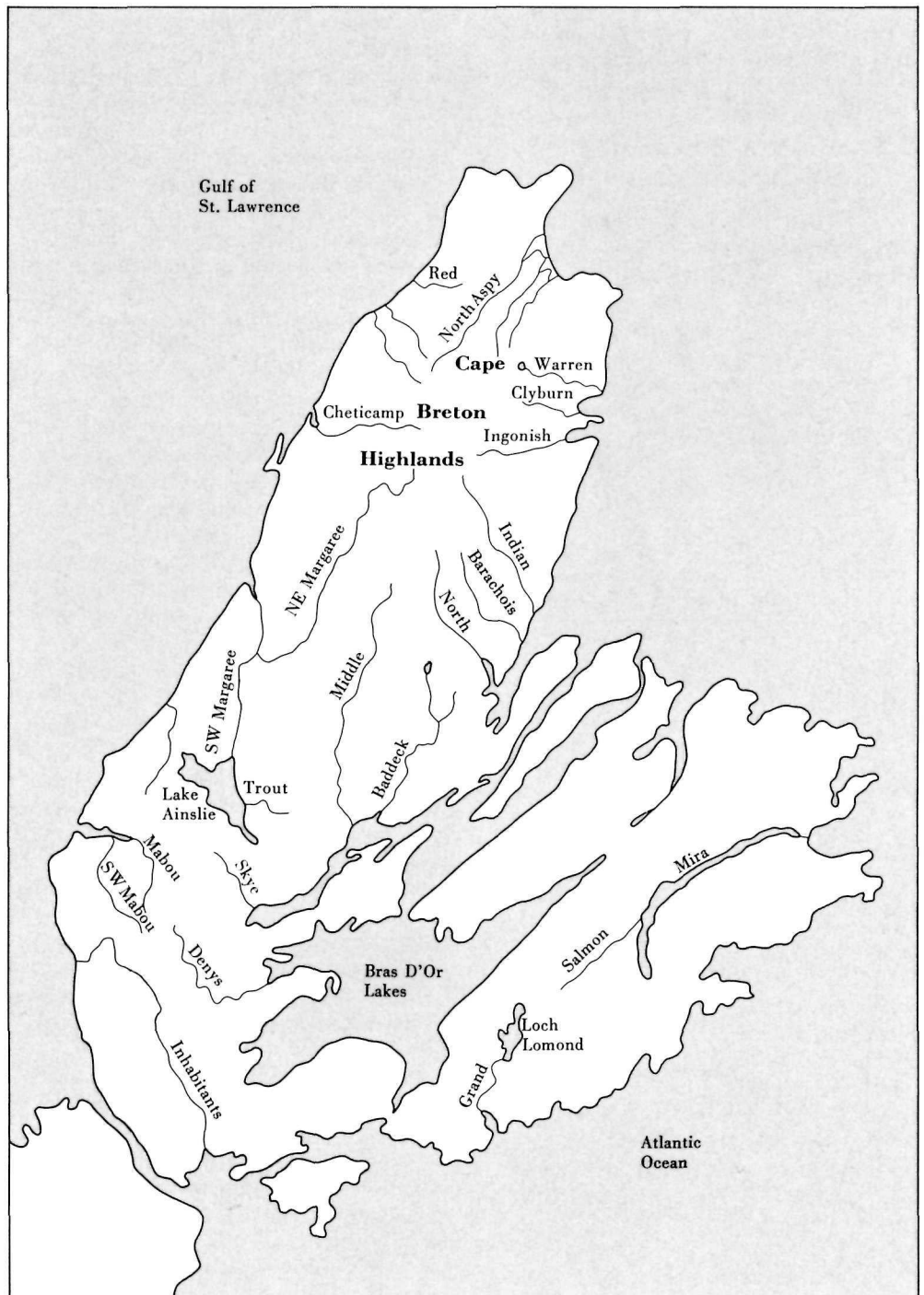
No attempt was made in any of these experiments to assign values to the mergansers eliminated, although the financial returns to be expected from increased salmon catches were often emphasized. Except for gullet contents saved for determination of merganser foods (White, 1957) and a few specimens donated to museums, the birds killed in previous programs were not studied

and the observations of the shooting crews were used only to estimate the reduction in predation on salmon. The total impact of these various shooting programs on merganser populations of eastern North America has never been properly determined.

This paper describes the seasonal fluctuations and movements of merganser (chiefly Common Merganser) populations in northern Cape Breton Island, Nova Scotia; the impact of systematic, year-round shooting on these populations and their movements; and other factors influencing the occurrence of mergansers in this and adjacent areas.

Figure 2. Major river systems on Cape Breton Island, Nova Scotia, including areas where merganser studies were carried out in 1957-68.

Figure 2



# The study area

Figure 3. The Margaree River system, Inverness County, Nova Scotia.

Locations where merganser studies were carried out are shown in Figure 2. The principal study area, and locale of the shooting experiment, was the Margaree River system in Inverness County.

The Margaree River system (Fig. 3) includes four major sections:

1. NE Margaree River. About 40 miles long, averaging 20 yards wide above the end of the road, to which it falls nearly 1300 feet (ft) in 18 miles, and about 30 yards wide below there, with a further drop of about 300 ft; the bottom is of boulders and coarse gravel in the upper reaches, and largely gravel lower down.

2. SW Margaree River. About 14 miles long, averaging 20 yards wide and dropping about 165 ft from the outlet of Lake Ainslie to Margaree Forks; the bottom is largely gravel with some silt in backwaters and slow channels.

3. Main Margaree River. About 8 miles long, averaging 50 yards wide above the tidal limit and at least 100 yards wide in the tidal reaches (the lower 5 miles); the total fall is no more than 25 ft, and the bottom is fine gravel, sand and silt.

4. Lake Ainslie. Headwaters of SW Margaree River, about 12 miles long by up to 4 miles wide; elevation 190 ft; shallow all around the shores, with bottom of mud, sand or gravel.

In addition, each section is fed by a number of streams, among which only Forest Glen Brook (the site of a merganser shooting experiment in 1936-37 [White, 1939]), Ingram (Hatchery) Brook, Lake O'Law Brook and Gallant Brook were large enough to receive appreciable use by mergansers.

We carried out studies similar to those on the Margaree on the Middle River in Victoria County (where no merganser shooting was done except in the regular duck hunting seasons). Like the NE Margaree, this has a steep, narrow, bouldery section of some 8 miles, above the end of the road, and a more level, wider, gravelly section in the lower 15 miles (Fig. 3). The Middle River discharges into the land-locked Bras D'Or Lakes, and consequently has

Figure 3

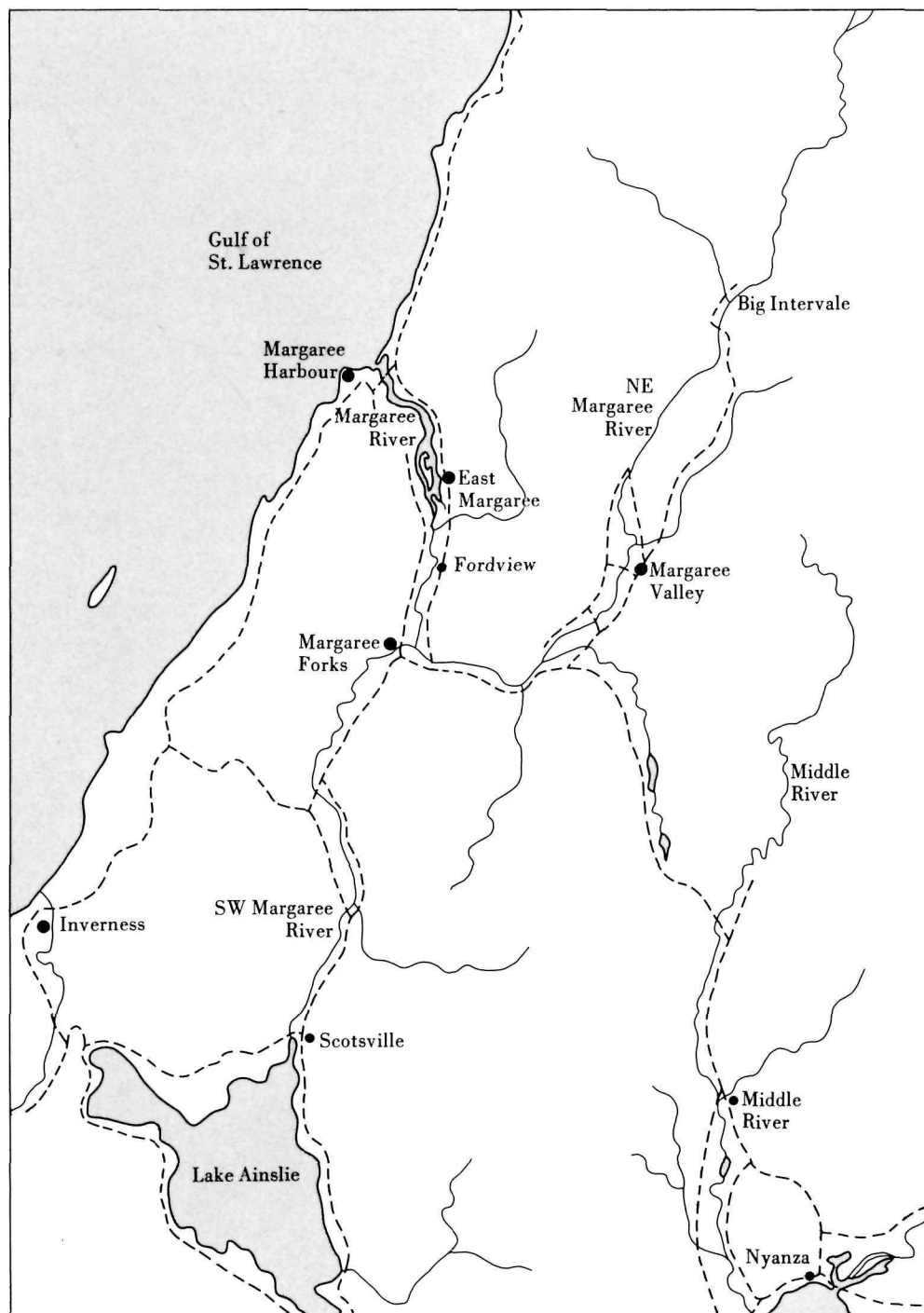




Figure 4. The steep, narrow, bouldery section of the upper NE Margaree.

no tidal section. CWS also studied mergansers at the Baddeck, North and North Aspy Rivers in Victoria County, and the Cheticamp, Mabou, SW Mabou and Inhabitants Rivers in Inverness County. These rivers are all much smaller than the Margaree, both in length and in flow, but all are somewhat similar to one or other section of the Margaree system. All areas lie within 50 air miles of Margaree Forks (Fig. 2).

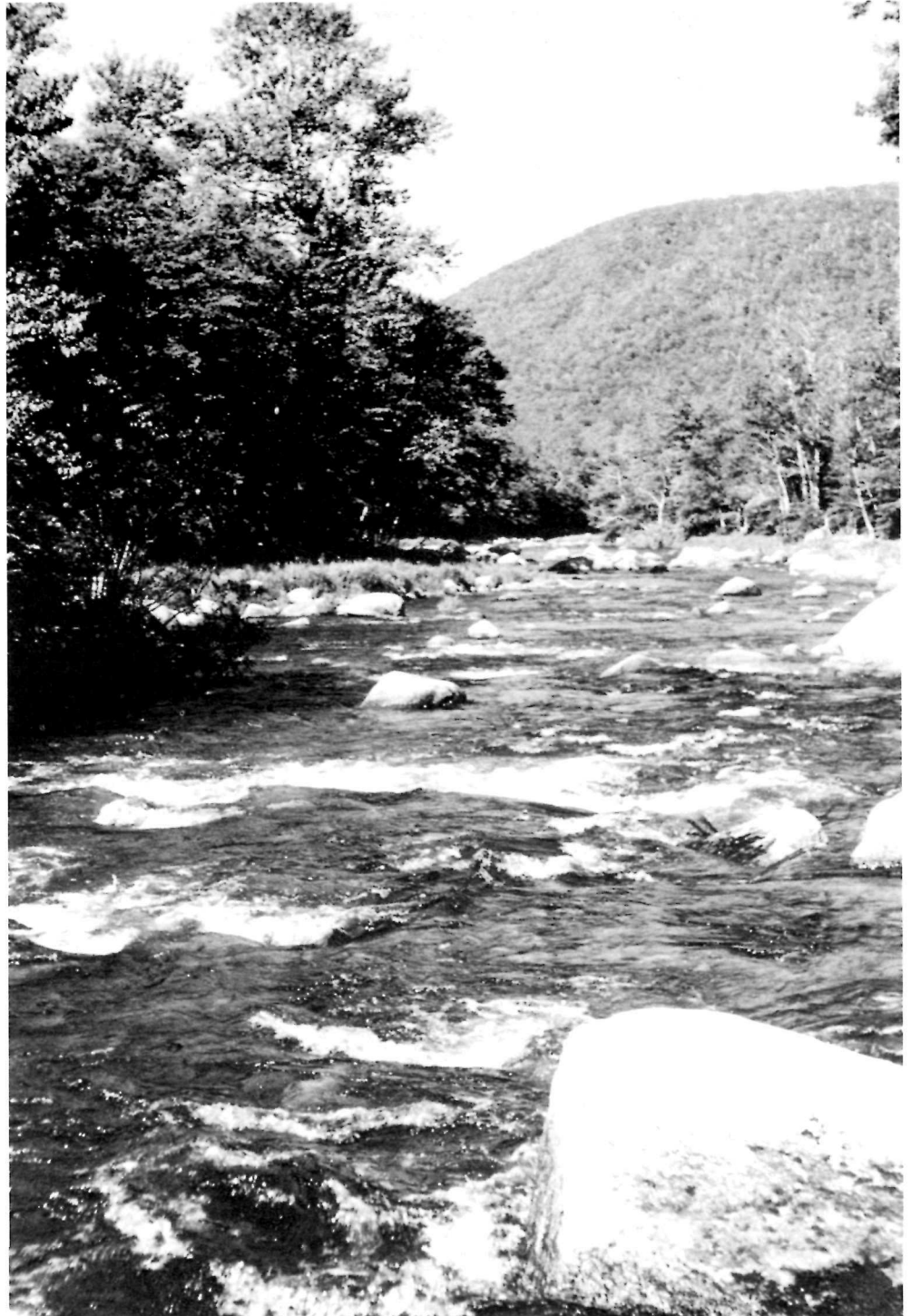


Figure 5. The more level, wider, gravelly section of the lower Middle River.



## Methods

### Assessment of merganser populations

Information on merganser numbers was obtained from several sources. From 1958–1964 wardens of the Department of Fisheries, Protection Branch, surveyed the following areas (see Fig. 3) twice monthly from April through November:

*Main Margaree River* — Fordview to Margaree Harbour;

*NE Margaree River* — Big Intervale bridge to Ingram bridge (at Margaree Valley);

*Middle River* — “Church” bridge (at Middle River) to Nyanza bridge;

*Mabou River* — Mull River bridge to Highway 19 bridge (at Mabou).

Surveys were made on foot, except on the main Margaree River where a car or occasionally in summer a boat was used. These surveys were started in April 1958 and ended in November 1964, except that the Mabou River survey was discontinued after November 1960.

Fisheries officers noted the numbers of mergansers seen on certain open-water areas on the Margaree and Middle Rivers during December through March, when no wardens were on duty. These records were kept from 1960–61 through 1963–64.

The diaries of the shooting crew (directed by the Fisheries Research Board of Canada) provided almost daily records of mergansers sighted and/or killed on various parts of the Margaree system. These records began on August 1, 1962, and ended July 31, 1968. Generally, the crew attempted to cover the main Margaree, the SW Margaree and the NE Margaree below the highest farm at least once each week. The crew visited the area, accessible only by trail, above the highest farm one to three times each summer. They checked the east shore of Lake Ainslie from a car intermittently through the open water season, but did not attempt a systematic survey of the lake. They patrolled on foot, by canoe or from a truck, whichever was most convenient, and snowshoes and a snowmobile were used when necessary in winter. Mergansers seen were stalked and/or ambushed, as described by Elson (1962).

Figure 6. The net used to trap young mergansers.

Figure 7. Common Merganser young, about 33 and 23 days.



CWS personnel visited the area each year. Brian Carter surveyed the Margaree and Middle Rivers in August and November 1957, before the warden surveys were organized. He also searched for nests in May of 1958 and (briefly) 1959. I studied mergansers on the Margaree for extended periods, chiefly in May through August, in 1960–63, and made briefer surveys of other rivers in these years and in 1965–68. I also examined nearly all merganser specimens recovered by the shooting crew, in connection with studies of moult and other annual cycles in the life of mergansers (Erskine, 1971).

### **Banding and associated studies**

CWS crews also banded flightless young mergansers each year from 1957 through 1968, except 1964. This work was organized by Brian Carter in 1957–59, and subsequently by me. We trapped young mergansers by driving broods downstream into a gill net stretched across the river. Starting in 1961, all birds trapped were weighed and measured, and plumage descriptions recorded, so that the broods' ages could be determined more accurately. Results of the growth studies are reported elsewhere (Erskine, 1971). All birds were marked with standard numbered aluminium bands. In 1957 some birds were also marked with a harness bearing a coloured plastic streamer; this technique was unsatisfactory and was discontinued. In 1959 and 1960, young mergansers were marked with coloured plastic discs connected by a silver wire through the external nares (nasal discs), to permit recognition of the birds at a distance.

### **Seasonal chronology within study area**

Adult Common Mergansers usually returned to the study area in March, and males and females were apparently paired on arrival or very soon afterwards. I saw pairs of Common Mergansers at Nyanza on March 10, 1964, and on the NE Margaree on April 7, 1960, the only years when I was in the area this early. Records of the shooting crew suggested that numbers of mergansers on the Margaree increased markedly around March 25, 1963, March 9, 1964, March 18, 1965, February 23, 1966, and March 29, 1968. In 1967, severe ice conditions closed all coastal bays and estuaries, forcing wintering mergansers on to the few open-water areas remaining on the Margaree; it was not possible to determine an arrival date from the 1967 records. The shooting crew recovered few birds during the breakup of ice on the river, so it is not possible to use specimen data to show spring migration dates.

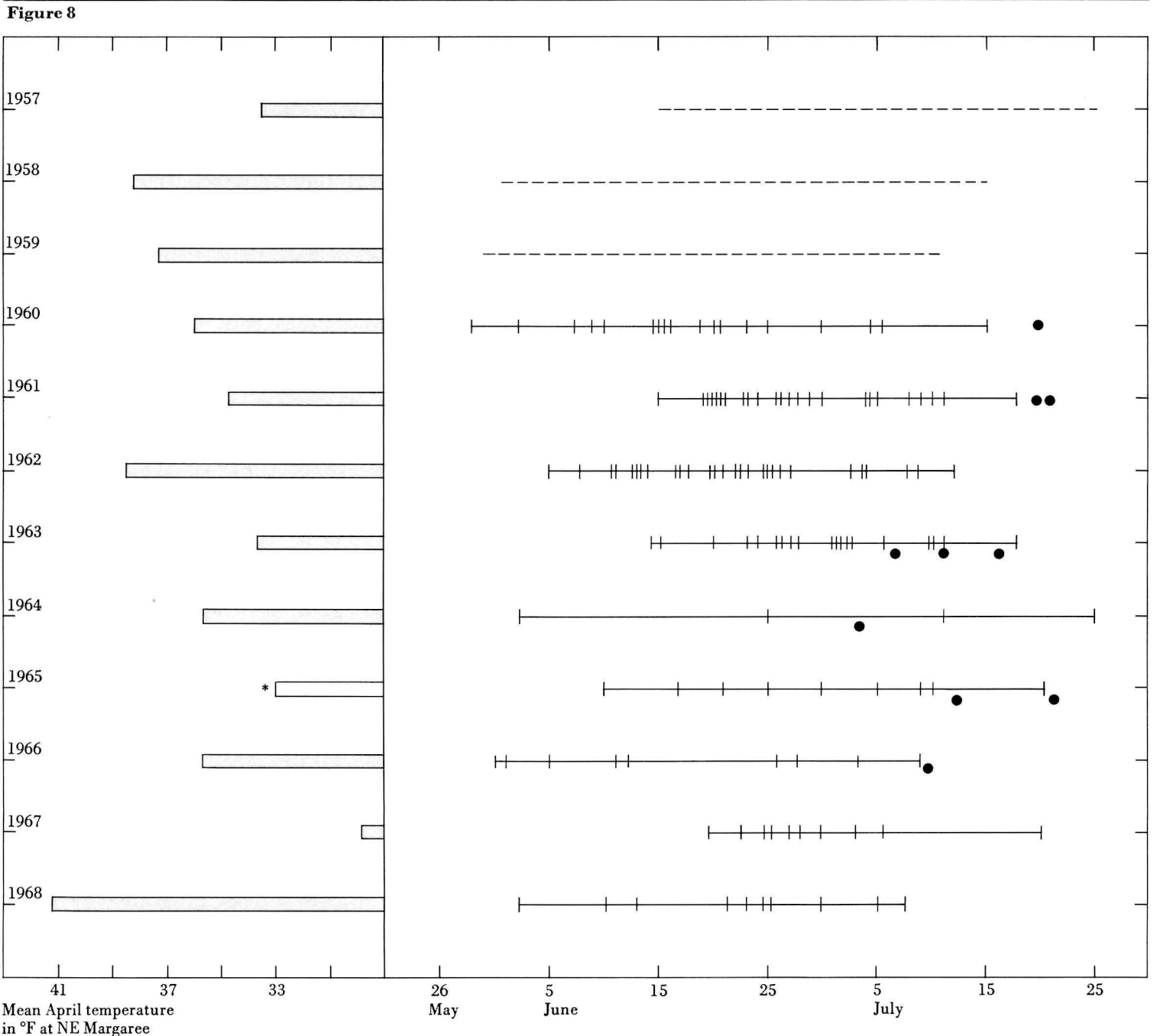
We do not know if the first arrivals include locally breeding individuals. Males were approaching breeding condition (testis length greater than 25 mm) by mid April (23rd in 1963, 14th in 1965, 29th in 1966), and females apparently started laying in late April or early May. Females in laying condition were shot on the Margaree on May 7, 1963, May 13, 1966, and May 8, 1967, but ages of broods seen in the summers indicated that laying often began in April.

Hatching chronology varied between years by as much as 3 weeks. The first broods of Common Mergansers appeared on or before June 1 in 1960 and 1966 whereas in 1967 the first brood apparently hatched around June 20 (Fig. 8). The span of hatching dates was usually about 6 weeks, but tended to be rather less in years when first broods were late in appearing than in early seasons.

Young Common Mergansers in this area are able to fly in 60 to 70 days, and continue to grow for another 2 or 3 weeks (Erskine, 1971). From the hatching dates in



Figure 8. Hatching dates of merganser broods compared with April temperatures, Cape Breton Island, 1957-68.



\* 1965 records lacking; data from four nearby stations suggest a value of about 33°F.

Figure 8 one may calculate that young mergansers began to fly early in August in years when nesting began early, while those that hatched latest did not fly until after mid September. I did no field-work in this area between August 25 and September 20 in any year, so records of mergansers on the verge of flight were chiefly those of the wardens and the shooting crew. The birds that were actually killed and recovered could be checked, but the wardens' reports did not differentiate between Common and Red-breasted (*M. serrator*) Mergansers. I suspect that most records of broods seen during September referred to the latter species, which in this area usually hatched between July 5 and July 20 (Fig. 8).

During September, flocks of Common Merganser young assembled at bays and mouths of rivers. Sometimes the flocks were sizeable: I saw 89 birds together on a shallow bay near Whycocomagh, Inverness County, on September 24, 1960; on October 2–3, 1967, flocks of Common Mergansers were on the mouths of Cheticamp (33 birds), North Aspy (31 birds), and North (31 birds) Rivers and of Indian Brook (39 birds). Flocks of Red-breasted Mergansers on the sea during October reach much greater numbers than these, but that species rarely occurs inland in autumn. From 1962 to 1968, the shooting crew recorded influxes of mergansers beginning as early as September 12, 1964, and as late as October 13, 1967. Such influx dates varied directly with the hatching dates, with the influxes in even years (1962, 1964, 1966, 1968) being consistently earlier than in the odd years, when hatching too was late.

These early wanderings of young mergansers blended imperceptibly into the start of the fall migration. The records of the shooting crew provided the only regular coverage; as the object of the crew was to kill the birds or drive them away, the distinction between the young flocking and the start of migration was not very clear. Recoveries of banded birds (see Table 1) indicated that local mergansers started to move away from Cape Breton Island during

**Table 1**

Numbers of recoveries in 1957–69, by areas and months, of Common Mergansers banded on Cape Breton Island, excluding those killed by the shooting crew.

Area	No. of recoveries in month						Total recoveries	
	Oct.	Nov.	Dec.	Jan.	Feb.†	Mar.†		
Nova Scotia	Inverness	14	4	1	1	1	21	
	Victoria	8	6	3			19*	
	Cape Breton		1	1			4*	
	Richmond	1					1	
	Antigonish	1	1	1			3	
	Cumberland		1				1	
Prince Edward Island	2	3				5		
Newfoundland					1		1	
Nova Scotia (cont.)	Guysborough				2		2	
	Halifax			1	4		5	
	Lunenburg			1	1		2	
	Shelburne			1			1	
	Kings					1	1	
Massachusetts			2	1			3	
Rhode Island			1				1	
New Jersey			1				1	
		26	16	13	9	3	1	71

\*Includes birds recovered in hunting season for which the month is not known.

†Hunting season not open (!).

October. But many local mergansers remained through much of November, and, in some years, into December or even January. The timing of moult in birds shot in late November and December suggested that some, at least, belonged to a different population (Erskine, 1971). The largest flocks of mergansers were reported in early winter. Ralph Watts reported groups of up to 175 on Margaree Harbour through January 7, 1961, and up to 225 mergansers through January 3, 1962, before the start of shooting (Appendix 1). Only small groups were seen there in succeeding winters, 50 on December 13, 1967, being the only estimate over 35 birds. Groups totalling up to 350 mergansers were reported during early December in 1964, 1965 and 1966 on Lake Ainslie; the lake was reported frozen on December 9, December 16 and January 6, in those winters. Failure to note flocks there in other years does not prove that none oc-

curred. Surveys there were sporadic, as the lake is too large to be patrolled adequately and most mergansers on the lake would not be feeding on salmon in any case.

Much of the Margaree system froze over during the winters, but small numbers of mergansers remained wherever open water persisted. Usually there were no more than 10 to 15 birds on the river at a time, but they came and went, depending on the availability of open water on the harbours and estuaries near the tidal limit. Marked influxes during February more likely represented birds forced out by the freezing of water areas on other rivers (as occurred in 1967) than the start of spring migration.

Spring migration usually began in mid March, with the return of adult males, few of which wintered in the area in most years. Records of the shooting crew, which seldom distinguished between the two species, showed migration through April and May

**Table 2**

Numbers of young Common Mergansers banded on Cape Breton Island. 0 indicates that no mergansers were caught. A blank means no banding attempt was made.

River where banded	No. banded in:											
	1957	1958	1959	1960	1961	1962	1963	1965	1966	1967	1968	
Margaree NE branch	42	41	28	49	36	35						
Margaree SW branch		26	5	29	22	12						
Margaree main river	28		6	5	*	3						
Middle	10		11	11	1	8	5	28	24	35	0	
Baddeck					0		16	0	11	0	0	
North					0	0	0	1	0	0	0	
Mabou		4	0	6	0	8	8	0	0	0	7	
SW Mabou					0	11	0	0	0	24	27	
Grand total	80	71	50	100	59	77	29	29	35	59	34	623

\*Ten young Red-breasted Mergansers were banded on the main Margaree in 1961, the only ones caught during this study.

**Table 3**

Recoveries of banded Common Mergansers by the shooting crew, on the Margaree River system.

When shot	When and where banded†	No. of recoveries	
1962: Aug.	1962, Margaree River	30	
	Sept.–Nov.	1959, Margaree River	1
		1961, Margaree River	3
		1962, other Cape Breton rivers	3
1963: May–Aug.	1959, Margaree River	1	
	1960, Margaree River	1	
	1961, Margaree River	2*	
	Oct.–Nov.	1963, other Cape Breton rivers	2
1964: July	1961, Margaree River	1	
	Oct.	1963, other Cape Breton rivers	1
1968: April	1967, other Cape Breton rivers	1	

\*Including one banded as adult female.

†All banding was done in July or August.

**Table 4**

Comparison of recovery rates of mergansers with and without nasal discs, on Cape Breton Island, and on Miramichi River, New Brunswick, 1950–61.

Area	Status of birds	Years of banding	No. banded	No. recoveries*		Recovery rate	
				Direct	Indirect	Direct	Total
New Brunswick	Unmarked	1950–53	141	13	4	9.2	12.1
Cape Breton	Unmarked	1957–61	250	23	12	9.2	14.0
Cape Breton	Nasal discs	1959–60	110	5	2	4.5	6.4

\*Recoveries include only those in hunting season, and none by shooting crews at any time.

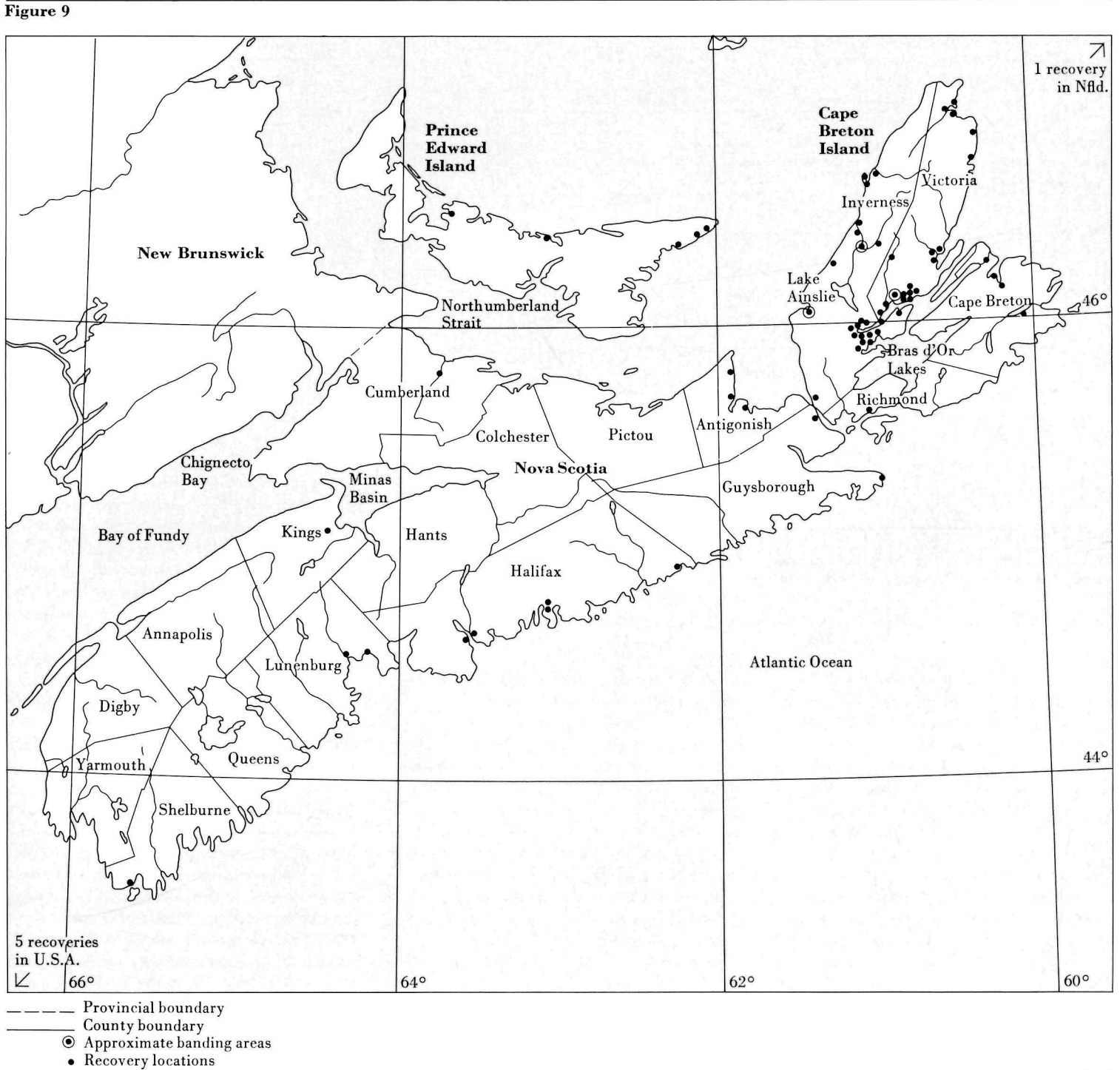
into the first week of June in most years. Many of the May records undoubtedly were of Red-breasted Mergansers, which were rarely shot on the Margaree outside of that month, but my own observations confirmed that flocks of 25 to 35 Common Mergansers were in the area up to the end of May. Examples included 26 at the mouth of Baddeck River on May 22, 1962, and 34 around the delta of Middle River on May 28, 1963. The largest numbers were usually noted in April; shooting crew records on the Margaree included 28 on April 9, 1963, 45 on April 16–17, 1964, 25 on April 29, 1966. My highest counts of Common Mergansers in the area included 97 at Mabou, Whycomagh, River Denys, and Nyanza, on April 23, 1961, and 115 at Nyanza, Little Narrows, Mabou, Margaree Harbour, and intervening points, on April 20, 1967. These peak counts included 47 and 48 per cent, respectively, of adult males, whereas high counts in May often had few drakes; e.g. of 94 mergansers at Nyanza on May 19, 1961, only 11 (12 per cent) were adult males. I had no really large counts of Red-breasted Mergansers on the study area at any time, 32 on May 25, 1960 and 36 on April 20, 1967 were the most I saw in one day.

#### Movements of mergansers shown by band recoveries

From 1957 through 1968, we banded 623 young Common Mergansers on Cape Breton Island (Table 2). The numbers of hunting season recoveries, grouped by areas and months, are shown in Table 1, and the general distribution pattern is shown in Figure 9. Recoveries in the shooting program on the Margaree are not included; details of those are shown in Table 3. We obtained only one recovery, and that in the shooting program, from the five adult female Common Mergansers banded, and none from the 10 young Red-breasted Mergansers (one brood) banded in the same period.

The use of nasal disc colour-markings adversely affected the recovery rate in 1959–60 (Table 4). The recovery rates of the marked birds were less than one-half

Figure 9. Distribution of recoveries of Common Mergansers banded on Cape Breton Island.





**Table 5**  
Number of mergansers seen by CWS personnel on Margaree River during surveys in spring and summer, 1960–63, with estimates of breeding populations. (pr = pair; br = brood)

Year	No. of birds seen on CWS surveys on Margaree River									Estimated breeding population
	May			June			July (broods only)			
	NE branch	SW branch	Main river	NE branch	SW branch	Main river	NE branch	SW branch	Main river	
<b>(a) Common Mergansers</b>										
1960	6 pr 4 ♂	1 ♀	1 pr	7 ♀ 2 br	5 ♀ 3 br	2 ♀ 1 br	7 br	3 br	3 br	15 pr *
1961	6 pr		3 pr	1 pr 5 ♀ 4 br	3 ♀ 3 br		6 br	6 br	0 †	15 pr
1962	6 pr	1 pr	3 pr	1 ♂ 6 ♀ 5 br	2 ♀ 2 br	1 ♀ 1 br †	7 br	3 br	5 br	15 pr
1963	1 pr 5 ♂ 1 ♀	1 ♂	1 pr 3 ♂	2 ♀ 1 br						6+ pr
<b>(b) Red-breasted Mergansers</b>										
1960	3 pr 2 ♂	0	2 pr	1 pr 1 ♀	0	1 pr	0	0	1 br	2 pr
1961	1 pr		2 pr	2 pr	0		0	0	2 br †	2 pr
1962	2 pr	0 †	2 pr	1 pr 2 ♀	0	0 †	0	0	0	1 pr
1963	2 pr	0 †	3 pr	0 †						3 pr

\*Includes two pairs above the end of the road where broods were seen by P. F. Elson on July 28–29, 1960.

†Incomplete survey.

those of unmarked birds from the same area. Mergansers banded (by CWS) in central New Brunswick in 1950–53 during another study of merganser–salmon interrelationships showed recovery rates similar to those of unmarked birds in this study.

A few colour-marked mergansers were seen or recaptured on the same river system up to 3 weeks after they were first marked. The only unequivocal observation of a marked merganser away from the river where it was trapped was of a bird, which appeared to be female, bearing blue discs (i.e. marked on the Margaree) on the estuary of Baddeck River on July 11, 1961. At this date, most adults (2 years old or more) would have been accompanying broods, so this bird was more likely a sub-adult, marked in 1960.

### Merganser populations in northern Cape Breton Island

#### The Margaree River system

No one set of data is complete for the entire period of the study. The breeding population in 1960 to 1962 was estimated from results of my surveys (Table 5). Surveys below East Margaree were cursory in 1960–61, so the estimates for the main Margaree River, particularly for Red-breasted Mergansers, are minimal. The numbers of young mergansers surviving to the time of banding give some idea of relative abundance for 1957 to 1959, compared to 1960 to 1962. The figures for 1957–59 were obtained by a different observer, and are not completely comparable. The data follow:

Year	Young	
	Above East Margaree	On entire system
1957	89	151
1958	86	
1959	74	
1960	120	
1961	111	
1962	74	100

Data from the warden surveys (Appendix 2) and numbers banded (Table 2) suggest that the breeding population changed rather little from 1958 to 1961; the lower numbers seen and banded in 1959 were apparently due to less complete coverage. I have assigned the same numbers of broods to 1957 and 1958 as were found for 1960 and 1961 (Table 6).

Records of the shooting crew indicated the numbers of broods hatched in the years 1963 to 1968 (Table 6). However, all of these broods, except the one in 1968, were shot soon after they appeared on the river.

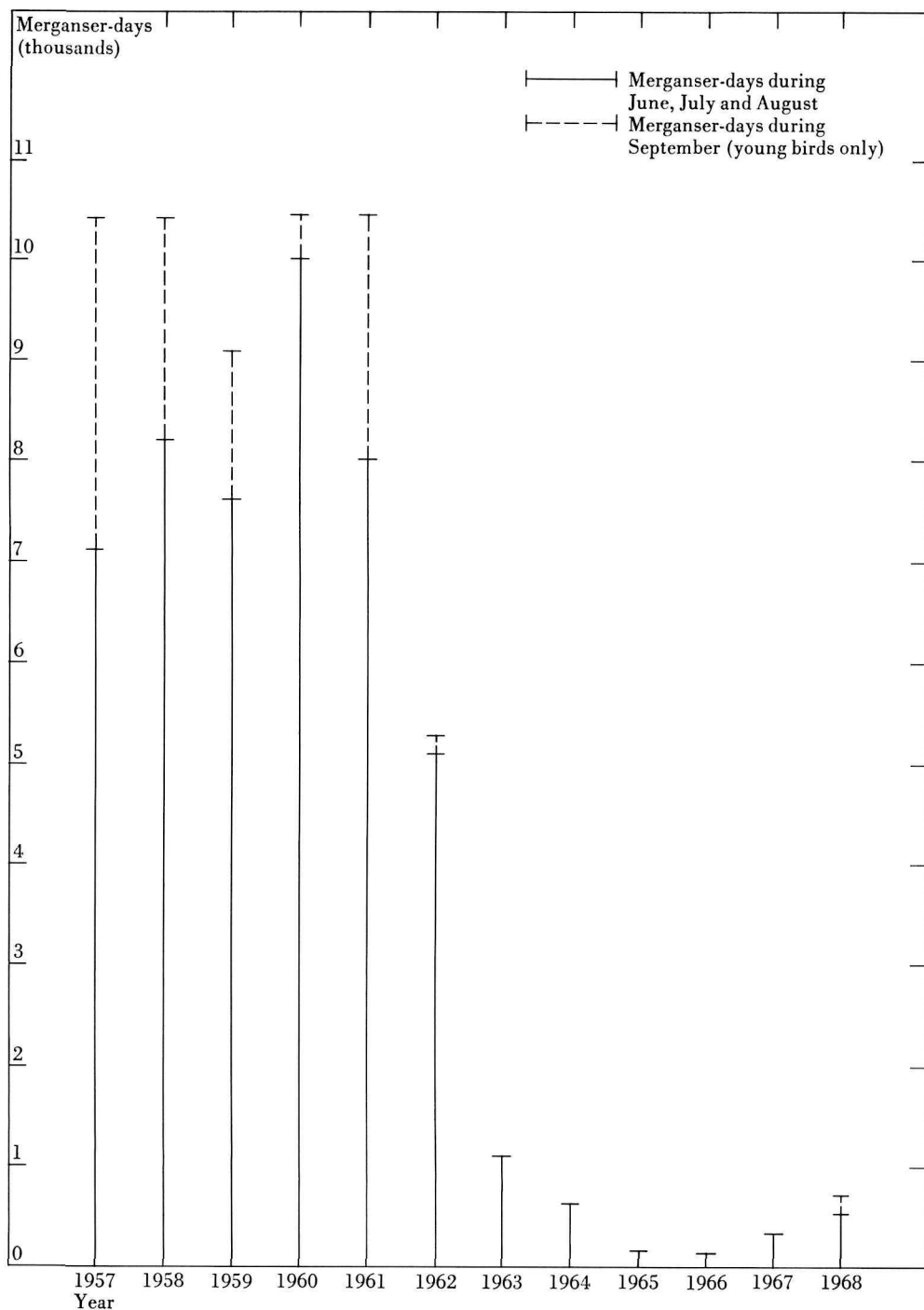
The effect of mergansers fishing on the river can be visualized if the data are expressed in terms of merganser-days (one merganser feeding for 1 day represents 1 merganser-day of use). Certain assumptions have been made in computing merganser-days from field data. A female merganser found with a brood was assumed to have been feeding on the river since the start of incubation (or earlier); since feeding opportunities during incubation are limited, I have assigned 25 merganser-days for the incubation period (about 32 days). The female birds usually remained with their broods until the latter were about 40 days old, unless killed or driven away by shooting, which contributed a further 40 merganser-days. The flightless period of young mergansers is about 70 days (Erskine, 1971), and the birds probably remain on their natal stream until they are fully grown at about 85 days. I have neglected the effect of young mergansers under 1 week old, as they are very small and feed chiefly on insects; the use by a brood was calculated on the basis of seven young on the river for

Figure 10. Merganser-day indices for breeding seasons, 1957-68, Margaree River.

**Table 6**  
Numbers of broods of mergansers (both species) estimated for Margaree River system, excluding Lake Ainslie and its tributaries.

Year	No. of broods	Basis for estimate
1957	17	Observations during banding
1958	17	Observations during banding; warden surveys
1959	15	Observations during banding; warden surveys
1960	17	CWS surveys and banding; warden surveys
1961	17	CWS surveys and banding; warden surveys
1962	16	CWS surveys and banding; shooting crew records
1963	9	Shooting crew records
1964	4	Shooting crew records
1965	1	Shooting crew records
1966	1	Shooting crew records
1967	1	Shooting crew records
1968	1	Shooting crew records
1969	3-4	Warden observations
1970	1	Warden observations
1971	3	Warden observations

**Figure 10**



78 days. The total use by a female and brood before the young can fly is thus about 600 merganser-days ( $[7 \times 78 = 546] + 65$ ).

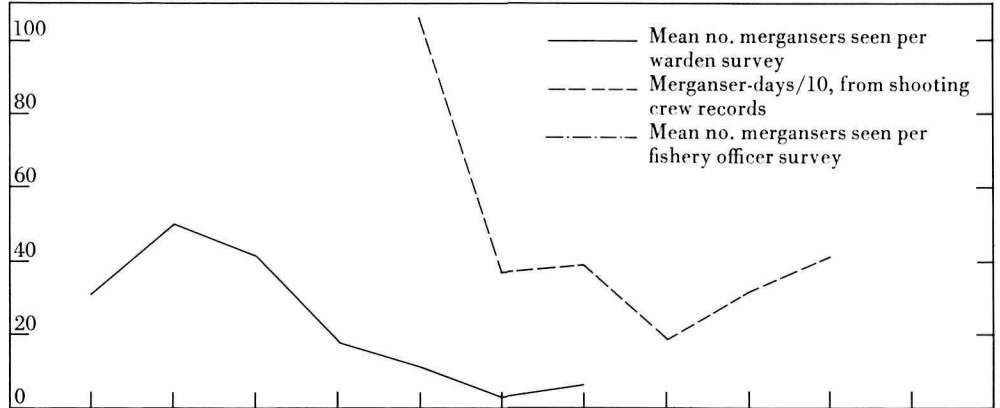
For grown birds, mergansers "... seen on one patrol, but not seen on the patrol before, ... [are assumed to] ... have been on the river for half of the time between the two patrols. If a number of birds are seen but not killed on the first patrol and the same or a greater number are seen on the second patrol, it must be assumed that the first number stayed on the stream all the time between patrols, but that any new birds were only on for half the time" (Elson, 1962; supplement on merganser control, p. 86). Mergansers reported as crippled are assumed to have died soon afterwards. The above assumptions allow for duplication between days, but within a day duplication could only be reduced by personal judgement.

The merganser-day indices for the breeding season (mid June to mid September) are shown in Figure 10, and the monthly

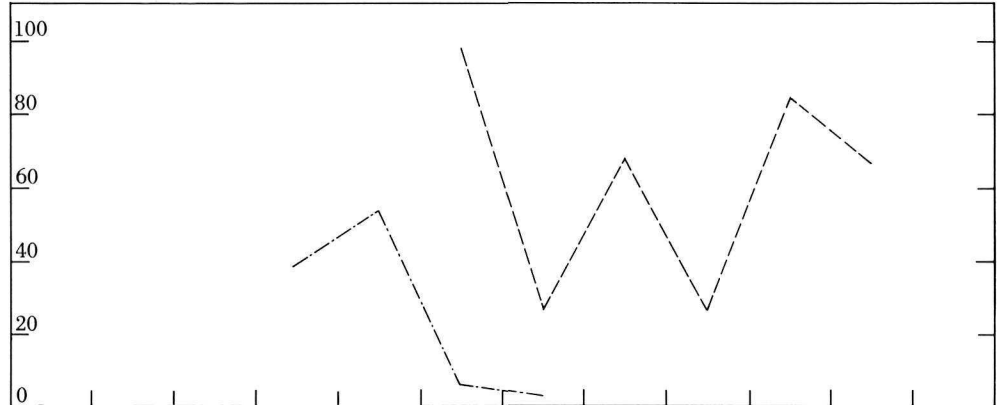
Figure 11. Indices to merganser numbers in autumn, winter and spring, Margaree area, 1958-68 (on warden areas only).

Figure 11

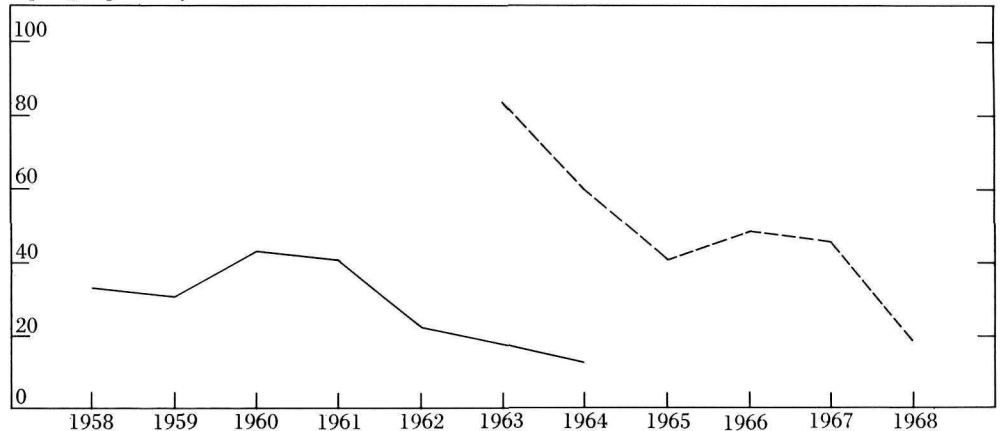
Autumn: mid September–November



Winter: December–March



Spring: April–May



**Table 7**

Merganser production on various rivers, Cape Breton Island, based upon brood data. Data in parentheses based wholly or largely on warden surveys; others from population surveys or banding operations. No data for 1964.

River	No. of broods seen or reported										
	1957	1958	1959	1960	1961	1962	1963	1965	1966	1967	1968
Middle	3	(2+)	2	2	2	3+	2+	5	3	4	3
Baddeck				1+	1+		2	0	1	2+	1+
Mabou		(5+)	(5)	2	0	1	2	0	2	0	2
SW Mabou					4+	4	1	2	1	4	3+
North					2+		(1+)	1	0		2+
North Aspy					1		0				1
Cheticamp					1		0	1			
Inhabitants					2		1				
Lake Ainslie				1+	4+	4+	3+				

estimates for various parts of the Margaree River system are given in Appendix 3. The values for 1957 to 1962 in Figure 10 are certainly too low relative to succeeding years, since no attempt was made to estimate use by non-breeding birds in the earlier years. However, this omission would probably not alter the overall picture very strikingly. Since some broods do not fly until September, merganser-days in that month were calculated separately, using the median hatching dates shown in Figure 8, for 1957 to 1961; in 1962 to 1968 hardly any young survived until September.

For the rest of the year, use indices were derived from the warden and fishery officer (winter) surveys for 1958 to 1964, and from the shooting crew records for the same areas in 1962 to 1968 (Fig. 11).

The records of the warden surveys are given in Appendix 2, and the winter surveys in Appendix 1. The figures are directly comparable; the merganser-day indices were divided by 10, since the shooting crew was usually active about 20 days each month, whereas the warden surveys were made only twice a month.

#### Other river systems and Lake Ainslie

Numbers of merganser broods seen on other rivers in Inverness and Victoria Counties and on Lake Ainslie are given in Table 7

(see Fig. 2 for locations). Two broods on the Mabou River reported by wardens in September 1959 may have been Red-breasted Mergansers, as it is unlikely that immature Common Mergansers would still be recognizable as broods at that season. Single broods of Red-breasted Mergansers were seen on Middle River and at the mouth of the SW Mabou River in 1965. All other broods in Table 7 are believed to have been of Common Mergansers.

Broods of mergansers were also seen or reported on MacIntosh Brook and Judique Intervale Brook on the west shore of Cape Breton Island, on Clyburn Brook and Warren Brook on the east shore, and on River Denys and Skye Brook which discharge into the Bras D'Or Lakes. Broods are not sighted every year on these streams, and it is likely that mergansers are sometimes reared on other streams of similar size, such as Hume Brook, Barachois Brook, Indian Brook, and the Middle Aspy and South Aspy Rivers. Mergansers are regularly seen around the mouths of these streams, although breeding has not been proved.

# Discussion

## Seasonal chronology

The pattern of seasonal activity in Common Mergansers is the same in most areas. The adult birds return to breeding areas as soon as open water is available. This is one of the earlier nesting species wherever it occurs, probably because its large size and its habit of nesting in hollow trees and other well-protected situations make it less vulnerable to adverse weather than are species which nest in the open.

Approximate hatching dates calculated from specimens in museums and from published sources range from early May in extreme southern areas to late July (Table 8). In most areas for which sufficient records are available, the hatching dates show a span of about 6 weeks, similar to that found in our study. This is comparable to hatching spans in species which habitually re-nest following loss of a clutch; however, I doubt that mergansers re-nest. Birds which nest in holes in trees suffer relatively little nest loss (Nice, 1957), and my data for the related Bufflehead (Erskine, 1972) suggested that re-nesting does not occur in that species. An alternative explanation for the long span of hatching dates in Common Mergansers is based upon the shortage of suitable nest sites; Beaupré (*in* Quilliam, 1965) gave evidence that two or more female mergansers sometimes lay simultaneously in one nest, and the number of large broods (with 14 or more young) less than a week out of the nest suggests that composite clutches are quite common. Such clutches are presumably incubated by the female which first completed laying, and the other female(s) must go elsewhere if they are to continue. Locating another nest site probably delays additional laying for several days. These ducks, like other related species (cf. Curth, 1954), probably lay eggs at intervals greater than 1 day, which may well be an advantage when the bird has to seek out a new nest site.

If we assume an incubation period of 32 days and that an average clutch of nine eggs requires 15 days for laying—none of which figures have been conclusively estab-

**Table 8**  
Estimated hatching dates (approximate) of  
Common Mergansers, based on museum specimens  
and published reports.

Area	Latitude (°N)	Hatching dates (no. of records)	Source(s)*
<b>Far west</b>			
Mexico	31	May 21 (1)	Van Rossem, 1929
Arizona	34	May 6 (1)	A.M.N.H.
Nevada	39	June 16 (1)	U.S.N.M.
California	40	May 14 to June 18 (6)	U.S.N.M.; Brooks, 1922
Washington	47	June 15 (1)	U.S.N.M.
British Columbia	50	May 23 to July 23 (8)	N.M.C.; R.O.M.; A.M.N.H.; Munro & Cowan, 1947
Yukon Territory	62	July 5 (1)	N.M.C.; Rand, 1946
Alaska	62	June 16 to July 10 (5)	R.O.M.; U.S.N.M.; A.M.N.H.
<b>Interior west</b>			
Wyoming	44	June 10 and July 31 (2)	U.S.N.M.
Montana	46	June 5 (1)	U.S.N.M.
Alberta	51	June 2 and June 20 (2)	Clark & Cowan, 1945; Macoun & Macoun, 1909
Saskatchewan	54	June 30 and July 5 (2)	R.O.M.; U.S.N.M.
Manitoba	56	July 30 (1)	N.M.C.
Kcewatin	60	(not earlier than) July 20 (1)	Mowat & Lawrie, 1955
<b>Interior east</b>			
Minnesota	48	June 26 and July 6 (2)	A.M.N.H.; Johnson, 1920
Wisconsin	46	June 10 (1)	Schorger, 1925
Michigan	47	May 31 to July 13 (11)	R.O.M.; U.M.M.Z.; Christy, 1925; Manville, 1949
Ontario	46-52	June 3 to July 24 (35)	R.O.M.; N.M.C.; U.M.M.Z.; Hanson <i>et al</i> , 1949
Quebec	49-52	June 15 to July 27 (13)	N.M.C.; Hanson <i>et al</i> , 1949; Manning & Macpherson, 1952
<b>Far east</b>			
North Carolina	36	May 28 (1)	Brimley, 1941
Virginia	38	May 15 to June 30 (3)	Jopson, 1956
Massachusetts	42	before May 30 (1)	Bailey, 1955
Maine	45	ca. June 10 to ca. July 15	Palmer, 1949
New Brunswick	46	June 7 to June 30 (20)	A.M.N.H.; Bent, 1923; White, 1957
Nova Scotia	46	June 3 to July 8 (3)	N.M.C.; U.M.M.Z.; Godfrey, 1958
Newfoundland	48	ca. June 13, 1911 (1)	Arnold, 1912

\*Abbreviations: A.M.N.H.—American Museum of Natural History; N.M.C.—National Museums of Canada; R.O.M.—Royal Ontario Museum; U.M.M.Z.—University of Michigan Museum of Zoology; U.S.N.M.—United States National Museum.

Figure 12. Adult mergansers returned to the rivers as soon as open water was available. Mabou River, April 20, 1967 (a late spring!).





lished for birds in the wild—it is apparent that in early springs such as 1960 and 1966 laying began before mid April, whereas in 1961 and 1967 few, if any, birds were laying until early May. Mean monthly temperatures for April show similar trends (Fig. 8), but the start of laying cannot be determined accurately enough to permit correlation with daily temperatures (cf. Bezzel, 1962).

In areas such as the NE Margaree, where young salmon form the principal food of mergansers, availability of food may limit the length of the brood period. Figures presented by White (1957) and Elson (1962) suggest that mergansers may so deplete local stocks of fish that the birds must leave an area, and my observations confirm that merganser broods gradually descend rivers during the flightless period, congregating on the estuaries about the time they attain flight. The warden surveys suggested that most migrants, before the start of shooting, were found on the tidal reaches of the main Margaree, and few were seen in fall on the NE Margaree or Middle Rivers in 1958–61. If food is less available in the rivers in fall, broods that were still flightless in October would be at a disadvantage compared to those hatched earlier.

All mergansers on my study area were able to fly long before fresh waters began to freeze in late November. With the long flightless period in this species, length of the open water period may restrict the span of hatching dates near the northern limit of its range; for example, in the Chibougamau region of Quebec (lat. 50°) where Hanson *et al.* (1949) saw no young mergansers capable of flight before mid September all young would have to fly by about mid October to survive freeze-up.

The fall migration extends until nearly all fresh waters are frozen, and small numbers of mergansers linger all winter on open stretches. The timing of spring migration is also influenced by availability or extent of open water.

### **Movements shown by band recoveries**

The distribution pattern of band recoveries (Figure 9) is not equally representative for all breeding areas. If the recoveries are grouped by banding area as well as by distance and date of recovery (Table 9), it becomes obvious that the mergansers from the Nyanza area (Middle and Baddeck Rivers) are typically recovered closer to their breeding area and earlier in the season, than are Margaree and Mabou birds. The Nyanza birds spread initially along the northern shores of the Bras D'Or Lakes, which support far more waterfowl hunting than other areas on Cape Breton Island. Possibly, relatively fewer Nyanza birds survive to provide more distant or later recoveries, but the number of recoveries available is too few to adequately test this hypothesis. These groupings also indicate that a far larger proportion of Margaree birds are recovered in distant areas (over 100 miles away) than is the case with other rivers. Since no birds were banded on the Margaree after the start of shooting, and none banded there in 1962 was recovered elsewhere, this was not due to them having been driven away. The more distant recoveries of Margaree-banded birds were concentrated in the winters of 1958–59 (eight recoveries) and 1960–61 (four recoveries). There were periods of severe cold coinciding with both these groups of recoveries: 1958 had the lowest mean December temperature in 25 years, and January 1961 was also very cold. All of the five recoveries in the United States were between December 8, 1958, and January 1, 1959, while the other three distant recoveries in that winter were just before (December 6) and after (January 15 and 16) that period; there were four distant recoveries in Nova Scotia in the period January 14–30, 1961. Undoubtedly these were a result of the cold weather.

Through 1960, only 42 mergansers had been banded outside of the Margaree River system on Cape Breton Island, and 28 of those were marked with nasal discs. It is hardly surprising that we have no record of distant recoveries of birds from these other

areas during the cold winters of 1958–59 and 1960–61. We have no evidence of major movements of mergansers since then, despite comparably severe cold spells in December 1963 and January 1968, although the one recovery from southwestern Newfoundland on February 28, 1968, might come into this category.

The general pattern of the 71 recoveries of Cape Breton birds (Table 1) indicates that few mergansers move more than 50 miles from their natal streams during September and October. In November they range somewhat more widely, but only in the coldest part of the winter are they found outside an area including Cape Breton Island, Antigonish County and eastern Prince Edward Island. Only in very severe winters do some mergansers migrate to southwestern Nova Scotia and New England. This contrasts with behaviour of New Brunswick mergansers, of which recoveries in New England were received nearly every year that banding was done (unpublished data from CWS bandings). The New Brunswick populations inhabit a more continental area, which may freeze up more conclusively than is the case in eastern Nova Scotia.

### **Merganser populations**

#### **The Margaree River system**

The population changes set out in Table 6 and Figure 10 reflect chiefly the effects of the shooting program, which reduced the breeding population from 15–17 pairs in 1957–62 to one or two pairs in 1965–68. At least two other factors may have influenced the 1962 population even before the shooting began on August 1.

As mergansers do not mature until their second winter, the breeding adults of 1961 and 1962 were derived from birds that had hatched in or before 1959 and 1960, respectively. The birds banded in 1959 (39) and 1960 (47) were exposed to the nasal disc colour-marking program. The band recovery rate for the colour-marked birds was only one-half that of other banded mergansers (Table 4), apparently due to increased mortality of young prior to their

**Table 9**  
Recoveries in 1957–69 of Common Mergansers banded on Cape Breton Island, grouped by banding area and (a) distance of movement, and (b) month of recovery.

Banding area (Total no. of recoveries)	No. of recoveries		
	Within 30 miles of banding area	30 to 100 miles from banding area	Over 100 miles
Margaree (40)	12 (30%)	12	16
Mabou* (10)	4 (40%)	6	0
Nyanza† (21)	17 (81%)	2	2

Banding area (Total no. of recoveries)	No. of recoveries				
	Oct.	Nov.	Dec.	Jan.	Other
Margaree (40)	12 (30%)	7	10	8	3
Mabou* (10)	2 (20%)	5	3	0	0
Nyanza† (21)	13 (62%)	4	0	1	3

\*Includes Mabou and SW Mabou Rivers.

†Includes Middle and Baddeck Rivers, and one recovery of a bird banded at North River.

**Table 10**  
Estimate of mergansers from other Cape Breton rivers lost to Margaree shooting crew in 1962 (a), and 1963 (b).

Area	No. mergansers surviving to flight	No. banded mergansers		Estimated total killed by shooting crew
		Surviving to flight	Killed and recovered by shooting crew	
Middle River	35	6	1	6
Mabou River	8	6	1	1
SW Mabou River	20	8	1	3
Total	63	20	3	10
Other rivers	120*			20
Grand total				30

**(b) 1963**

Area	No. mergansers surviving to flight	No. banded mergansers		Estimated total killed by shooting crew
		Surviving to flight	Killed and recovered by shooting crew	
Middle River	16	5	0	1
Baddeck River	16	14	1	1
Mabou River	16	7	1	2
Total	48	26	2	4
Other rivers	160*			14
Grand total				18

\*Estimate

first hunting season. Since rather over one-third of the Margaree mergansers surviving to the time of banding in 1959 and 1960 were colour-marked this could have resulted in a decrease of about one-sixth in the number of new breeders entering the population in 1961 and 1962.

Weather may also have had some influence. Fewer young ducks survive in months in which the mean temperature is well below average and the precipitation well above the average; my observations (Erskine, 1964) showed that this was certainly the case in July 1962, the coldest and wettest July during the entire study period. Similar combinations of low temperature and high precipitation occurred in June and July 1958 and in June 1959; these conditions would have tended to reduce the potential number of new breeders in 1960 and 1961. The warden surveys (Fig. 11) suggested reduced numbers in the fall of 1961 and the spring of 1962. The former decrease was certainly a result of extremely low water levels; the 1962 decrease is not obviously a result of any one factor, but the omission of three out of eight surveys during this period (Appendix 2) undoubtedly makes this figure less reliable than those for 1958–60. Neither the later warden surveys (Appendix 2) nor my own observations (Table 5) indicated any appreciable decrease in the 1962 breeding population compared to preceding years (Table 6).

The numbers of young surviving to banding age showed more variation between years than did the numbers of breeding pairs. The small number banded in 1959 probably resulted from inadequate coverage, but the 1962 result was representative; there simply were not as many young present in late July as there had been in 1960 and 1961. This was probably a consequence of the cold, wet weather in that month. Only 30 of the 50 young mergansers banded on the Margaree in July 1962 were recovered in the shooting program during the following month, and the other 20 were never seen again. In contrast, the 27 young mergansers banded in 1962 on other rivers

yielded six recoveries to hunters, plus three to the Margaree shooting crew, during that hunting season.

Only a portion of the breeding adults were eliminated in the 1962 season. When shooting began on August 1, many of the adult females and all drakes except one crippled bird had left the area. Four of the seven females found with broods in 1962 were killed or crippled. In 1963, all Red-breasted Merganser females found with broods were killed, as were five of the six Common Merganser females with broods. Three of the latter had been banded on the Margaree (Table 3), two being birds that had bred previously. Another banded bird shot while laying in May 1963 had probably also bred in 1962. All females seen with broods in 1964 were shot, and one of the three Common Mergansers was a banded bird that had probably bred first in 1963. Thus, Common Mergansers which had fledged on the Margaree prior to shooting accounted for most of the birds of this species breeding there in 1963 and 1964. The few birds breeding on the Margaree in succeeding years were probably immigrants, and all the females which brought off broods in 1965–67 were shot.

Comparison between results of the warden surveys and those of the shooting crew, for the periods when both were operating, shows parallel trends (Fig. 11) in all cases. The high fall index in 1962 undoubtedly involved many Margaree birds not present when the summer population was largely eliminated in August. The recoveries by the shooting crew (Table 3) in the autumn of 1962 included three females, which might have bred for the first time in 1963, and one adult male. After the summer of 1963, the numbers of birds returning to the Margaree in autumn were lower, and the shooting crew kept migrants from other areas stirred up enough that they seldom lingered there. The large flocks seen on Lake Ainslie in December may have represented birds diverted from the Margaree as the lake, unlike Margaree Harbour, cannot be patrolled adequately. The fall, winter and spring indices

showed no consistent decreases after 1962, although the winter indices fluctuated wildly in response to varying ice conditions.

#### **Other river systems and Lake Ainslie**

Data presented earlier (Table 7, and page 25) suggest that about 25 to 30 broods of Common Mergansers, perhaps 200 birds in all, have been reared annually in Inverness and Victoria Counties, in addition to those reared on the Margaree River. Year to year fluctuations in numbers of broods found are partly related to water levels. Broods descend these small rivers to the estuaries, where they are often less easily found, relatively earlier in years when water levels are low, as in 1961 and 1965.

The warden surveys on Middle River were never very effective in detecting mergansers. The upper part of this area was very difficult to survey thoroughly, as the river was broken up into many small channels. The lower part was much frequented by anglers, particularly after new angling regulations (fly fishing only, and requirement of a salmon licence) were introduced on the Margaree in 1962. Anglers interested chiefly in trout, especially those accustomed to using bait or lures, then shifted in numbers to Middle River, which had always been known as a trout stream.

The warden surveys on the Mabou River were not continued for long enough to provide much useful data. The pattern of use on the two sections (upper river and estuary) was similar to that found on the equivalent sections of the Margaree, except that fewer mergansers frequented the upper part of the Mabou — a much smaller river than the Margaree — in summer. The warden surveys provided the only data on brood production for 1958 and 1959; however, the gaps in August records made the information harder to interpret than that from the Margaree and Middle Rivers.

There were often striking changes in numbers of broods found on a particular river. These may have resulted from local movements, as the combined number of broods on Middle and Baddeck Rivers, and

on Mabou and SW Mabou Rivers, were relatively constant. A brood of half-grown mergansers was seen to travel from the outlet of Baddeck River to the delta of Middle River on July 12, 1962; cases where a brood seen on one river in June could not be found there in July, when several broods or groups of young were at the outlet of the adjacent river, were noted in several years. The outlets of Middle and Baddeck Rivers are little over a mile apart, and those of Mabou and SW Mabou Rivers about 2 miles apart. Broods often move distances much greater than this along a single river.

The numbers of broods observed or reported on the other rivers did not change appreciably throughout the period of the study. The numbers of young banded were somewhat greater in the later years, particularly in 1967, but this was thought to be due more to increased experience in trapping and to good luck than to increased numbers of birds.

Data for Lake Ainslie are incomplete, as surveys there were never made routinely. The shooting crew killed four adults and two young in July and August 1963, and two adults and three young were shot in July to September 1964. Most of the females with the broods were shot, but very few of the young, and it seems unlikely that shooting can have reduced the breeding population of the lake appreciably.

When mergansers banded on other rivers were shot on the Margaree in their first autumn, the proportion recovered there permitted a crude estimate of the impact of the systematic shooting on populations of the other rivers. In 1962, the rate of survival to flying age of banded young mergansers was apparently lower than usual; only 30 of the 50 young birds banded on the Margaree were recovered by the shooting crew, although a few more may have been shot but not recovered. It seems reasonable to assume that on other rivers, too, only about three-quarters of the 27 mergansers banded survived to flight. The estimate of loss to the shooting crew is shown in Table 10. Similarly, in 1963, 29 young mergansers

were banded on the Middle, Baddeck and Mabou Rivers. Perhaps 26 of these mergansers survived to flight (Table 10). No banded mergansers were killed by the shooting crew in autumn in following years.

These estimates tend to confirm that the shooting operation on the Margaree River had no important effects on merganser populations elsewhere on Cape Breton Island.

### **The aftermath of merganser shooting**

The question of what happens after the end of systematic shooting of mergansers in an area has never been fully investigated. Most ducks usually return to (or near to) their natal area to breed (Sowls, 1955), and mergansers are no exception (Table 3). The local breeding stock on the Margaree was virtually eliminated after 1964, and the birds breeding there subsequently were probably immigrants from nearby areas. One brood was hatched each year from 1965 to 1968, and it seems plausible to assume that at least one more pair attempted to settle on the river each year but was eliminated before its young hatched. The brood hatched in 1968 survived the end of shooting in that year, but at most one or two young hatched in 1965–67 survived. The following hypothetical recovery of the Common Merganser population was drawn up prior to the 1969 breeding season; assumptions made were (i) that about half of the young mergansers reared to flight survive to breed 2 years later, (ii) that rather over half of the adults breeding in one year do so in the following year, and (iii) that immigrants (two pairs per year) continue to settle until the population approaches the level existing before shooting began.

1969: the 1968 pair, plus two immigrant pairs – total three pairs;

1970: one pair hatched in 1968, plus two of three 1969 pairs, plus two immigrant pairs – total five pairs;

1971: about four pairs hatched in 1969, plus three of five 1970 pairs, plus two immigrant pairs – total nine pairs;

1972: about eight pairs hatched in 1970,

plus five of nine 1971 pairs, plus two immigrant pairs – total 15 pairs.

In 1972, four years after the end of shooting, the population might have regained its original level. It could easily take longer if the survival assumed above is overly optimistic, or if the immigration rate is lower. The Margaree fisheries wardens reported three (possibly four) broods on the river in 1969, but only one in 1970 and three in 1971. It seems clear that the recovery will be neither as rapid nor as regular as was predicted.

The shooting program on the Pollett River in southeastern New Brunswick (Elson, 1962) extended from 1947 until 1965. The 10-mile-long study area probably supported only two or three broods before the start of shooting, and one or two may have occurred on the upper reaches of the river above the falls. Since this is a small river, and only a part of the much larger Petitcodiac River system, it might be expected to regain its original merganser population more rapidly than would the Margaree. P. F. Elson (pers. comm.) indicated that this area had regained its former numbers by 1969.

Shooting on the Miramichi River system in New Brunswick ended in 1961. This is a much larger river than any of the others where mergansers were shot, so that immigrants from nearby rivers might not colonize all parts of the system promptly. The CWS employees studying effects on birds of spraying against spruce budworm in this area did not detect a single merganser brood in 1964–69, and I saw none during field work there in 1967–69. Reports from fisheries personnel suggested that only two broods were brought off in 1968 on the entire Miramichi system (P. F. Elson, pers. comm.).

# Literature cited

- \***Arnold, E. 1912.** A short summer outing in Newfoundland, 1911. *Auk*, 29:72-79.
- \***Bailey, W. 1955.** Birds in Massachusetts, when and where to find them. The College Press, South Lancaster, Mass. 234 p.
- \***Bent, A. C. 1923.** Life histories of North American wild fowl (Order Anseres), Part 1. U.S. Nat. Mus. Bull., 126: 1-13.
- Bezzel, E. 1962.** Beobachtungen über Legebeginn und Legezeit bei Entenpopulationen. *Anz. Orn. Ges. Bayern*, 6(3):218-233.
- \***Brimley, H. H. 1941.** Unusual North Carolina records. *Auk*, 58:106-108.
- \***Brooks, A. 1922.** On the occurrence of the Bufflehead at Eagle Lake. *Condor*, 24:25-26.
- \***Christy, B. H. 1925.** Summer birds at Huron Mountain, Michigan. *Wilson Bull.*, 37:208-216.
- \***Clarke, C. H. D. and I. McT. Cowan. 1945.** Birds of Banff National Park, Alberta. *Can. Field-Nat.*, 59:83-103.
- Curth, P. 1954.** Der Mittelsäger; Soziologie und Brutbiologie. Die Neue Brehm-Bücherei, H. 126. Ziemsen (Wittenberg-Lutherstad). 102 p.
- Elson, P. F. 1962.** Predator-prey relationships between fish-eating birds and Atlantic salmon. *Fish. Res. Board Can. Bull.*, 133:1-87.
- Erskine, A. J. 1964.** Cape Breton Island waterfowl studies. NE Fish & Wildl. Conf. Hartford, Conn. Unpubl. mimeo. rep., 25 p.
- Erskine, A. J. 1971.** Growth, and annual cycles in weights, plumages, and reproductive organs, of Goosanders in eastern Canada. *Ibis*, 113:42-58.
- Erskine, A. J. 1972.** Buffleheads. CWS Monogr., 4.
- \***Godfrey, W. E. 1958.** Birds of Cape Breton Island, Nova Scotia. *Can. Field-Natur.*, 72:7-27.
- Hanson, H. C., M. Rogers and E. S. Rogers. 1949.** Waterfowl of the forested portions of the Canadian Pre-Cambrian Shield and the Palaeozoic Basin. *Can. Field-Natur.*, 63:183-204.
- \***Johnson, C. E. 1920.** Summer bird records from Lake County, Minnesota. *Auk*, 37:541-551.
- \***Jopson, H. G. M. 1956.** Breeding of the American Merganser in the Shenandoah Valley of Virginia. *Auk*, 72:285.
- \***Macoun, J. and J. M. Macoun. 1909.** Catalogue of Canadian birds. Gov't Printing Bur., Ottawa.
- \***Manning, T. H. and A. H. Macpherson. 1952.** Birds of the east James Bay coast between Long Point and Cape Jones. *Can. Field-Natur.*, 66:1-35.
- \***Manville, R. H. 1949.** Bird notes from northern Michigan. *Wilson Bull.*, 61:106-108.
- \***Mowat, F. M. and A. H. Lawrie. 1955.** Bird observations from southern Keewatin and the interior of northern Manitoba. *Can. Field-Natur.*, 69:93-116.
- \***Munro, J. A. and I. McT. Cowan. 1947.** A review of the bird fauna of British Columbia. B.C. Prov. Mus., Spec. Publ., 2:1-285.
- Nice, M. M. 1957.** Nesting success in altricial birds. *Auk*, 74:305-321.
- \***Palmer, R. S. 1949.** Maine birds. *Bull. Mus. Comp. Zool. Harvard Coll.*, 102:1-656.
- Quilliam, H. R. 1965.** The history of the birds of Kingston, Ontario. Publ. privately. 216 p.
- \***Rand, A. L. 1946.** List of Yukon birds and those of the Canol Road. *Nat. Mus. Can. Bull.*, 105:1-76.
- \***Schorger, A. W. 1925.** Some summer birds of Lake Owen, Bayfield County, Wisconsin. *Auk*, 42: 64-70.
- Sowls, L. K. 1955.** Prairie ducks. The Stackpole Co., Harrisburg, Pa., and Wildl. Manage. Inst., Washington, D.C. 193 p.
- \***Van Rossem, A. J. 1929.** Nesting of the American Merganser in Chihuahua. *Auk*, 46:380.
- White, H. C. 1939.** Bird control to increase the Margaree River salmon. *Fish. Res. Board Can. Bull.*, 58:1-30.
- White, H. C. 1957.** Food and natural history of mergansers on salmon waters in the Maritime Provinces of Canada. *Fish. Res. Board Can. Bull.*, 116:1-63.

\* Cited only in Table 8



# Appendices

## Appendix 1

Winter counts of mergansers, 1960–64, Cape Breton Island, based on reports by Department of Fisheries personnel (not including days on which no birds were seen).

Area	Observer	Season	Dates and no. of birds observed
Margaree Harbour, main Margaree River	R. W. Watts	1960–61	14 Dec. (175); 21 Dec. (75); 3 Jan. (140); 7 Jan. (120); 18 Jan. (43)
		1961–62	3 Jan. (225); 8 Jan. (89)
		1962–63	7 Jan. (15); 21 Feb. (5)
		1963–64	6 Dec. (5)
Brook Pool, NE Margaree River	R. W. Watts	1960–61	27 Dec. (4); 11 Jan. (2); 9 Feb. (2); 21 Feb. (1); 7 Mar. (5); 20 Mar. (5)
		1961–62	7 Mar. (5)
		1962–63	21 Mar. (1)
		1963–64	none seen
Hatchery Brook & Pool, NE Margaree River	A. J. Baxter	1960–61	14 Jan. (1); 21 Jan. (3); 3 Feb. (5); 15 Feb. (5); 7 Mar. (8)
		1961–62	15 Jan. (5); 31 Jan. (5); 5 Feb. (6)
Middle River	R. S. MacLeod	1960–61	21 Dec. (8); 27 Jan. (6); 21 Mar. (16)
		1961–62	none seen
		1962–63	7 Jan. (2); 21 Jan. (3); 21 Mar. (12)
		1963–64	23 Mar. (1)

## Appendix 2

Results of warden surveys for mergansers, Margaree River. Young birds in parentheses.

Survey date	Number of mergansers seen on survey													
	1958		1959		1960		1961		1962		1963		1964	
	Lr.*	Up. †	Lr.	Up.	Lr.	Up.	Lr.	Up.	Lr.	Up.	Lr.	Up.	Lr.	Up.
7 April	20	15	16	6	45	5			19		0			
21 April	18	10	29	11	17	6	10				8		8	
7 May	42	12	23	12	25	11	51	4	8	10	12	3	0	0
21 May	1	16	19	8	61	8	54	1	7	12	36	4	26	1
7 June	32	1	3	13	15(6)	3	5	3	16	3	0	0	0	0
21 June	11	6(10)	0	6(6)	5(7)	1(10)	13(11)	6	15(14)	3	0	0	0	3
7 July	1(18)	15(49)	2(20)	9(8)	6(21)	4(36)	5	10(9)	9(24)	4(25)	0	0	0	0
21 July	4(38)	3(25)	6(27)	0	11(9)	10(3)	8	8(12)	4(14)	1(24)	0	0	0	0
7 Aug.	3(63)	3(31)	8(54)	0	16(73)	1(23)	6(36)	3(37)		1(24)	0	0	0	
21 Aug.	4(44)	14	2(41)	2(17)	0(58)	1(7)	0(34)	0	0(11)	0	0	0	0	0
7 Sept.	18	4	1(27)	0(5)	38	2	15(9)	1	12	0	0	0	0	0
21 Sept.	5	0	34	0	11	0	26	0	24	2	0	0	0	6
7 Oct.	18	6	76	0	29	16	12	0	3	0	0	0	0	16
21 Oct.	0	1	35	0	53	6	0	5	22	0	0	0	0	0
7 Nov.	0	0	34	3	45	8	20	15	0	0	0	0	5	0
21 Nov.	122	2	75	1	28	7	0	1	0	0	10	0	0	2

\*Lr. –Fordview to Margaree Harbour.

†Up. –Big Intervale to Margaree Valley.



### Appendix 3

Records of mergansers seen and/or killed by the shooting crew, Margaree River system, 1962-68, and merganser-days calculated from them (rounded

to nearest 5 or 0). Merganser-days by flightless young are in italics, and those for young less than a week old are also enclosed in parentheses.

Month	Number of mergansers		Merganser-days for area				
	Sighted*	Killed*	Main Margaree River warden area	Main Margaree R. NE branch, and tributaries between warden areas	NE Margaree R. warden area	NE Margaree R. above warden area †	SW Margaree River
<b>1962</b>							
August	no record	7,68	130,495	15,110	20,145	10,30	55,225
September	113	21	195	220	40	20	0(?)
October	105	24	250	155	90	45	170
November	192	30	400	125	85	125	60
December	66	7	150	20	15	0	30
<b>1963</b>							
January	186	32	600	70	50	0	60
February	97	16	50	65	60	0	30
March	38	16	25	45	25	0	55
April	280	33	445	30	55		0
May	209	41	285	140	45	25	10
June	79,15	18,15	145	145,(95),110	30	25	85,(10)
July	33,33	7,31	85,(90),75	40,(40),125	40,10	15,(35),20	0
August	4,18	2,12	10,55	0	0	0	10,50
September	36	14	15	0(?)	70	0	65
October	129	34	95	80	35	0	200
November	77	9	85	80	60	0	0‡
December	9	1	10	0	0	0‡	20
<b>1964</b>							
January	27	5	0§	65	25		10‡
February	14	3	0§	20	30		20
March	87	15	25	130	165	0	25
April	202	11	305	60	75	10	25
May	120	5	185	60	35	0	0(?)
June	33,8	5,6	50	75,(55),100	30	25	15
July	5,15	2,14	30,(50),125	10,65	0	0	25,(20)
August	11,5	3,5	0	10	0‡	40	5,20
September	64	11	75,15	50	50	0	55
October	64	20	5‡	150	70	30	15
November	94	31	75	185	90	10	50
December	86	17	160	155	45	0	0
<b>1965</b>							
				Combined			
January	83	15	20	245		50	0
February	95	28	20	200		5	45
March	74	18	45	270		0	15
April	55	6	130	120		0	5
May	49	7	185	65		20	0
June	3	0	0	20		30	0
July	1,10	1,4	0	0		5,(60),100	0

Month	Number of mergansers		Merganser-days for area				
	Sighted*	Killed*	Main Margaree River, warden area	Main Margaree R. NE branch, and tributaries between warden areas	NE Margaree R. warden area	NE Margaree R. above warden area†	SW Margaree River
				Combined			
August	0	0	0		0	0	0
September	10	5	0		145	0	0
October	13	4	0		80	10	0
November	11	1	0		130	0	0
December	37	7	20		80	0	0
<b>1966</b>							
January	19	3	0§		80	0	0
February	45	16	0§		120	0	35
March	41	8	55		80	0	15
April	34	3	190		70	0	0
May	79	5	145		240	0	25
June	37,8	10,6	0‡		100,(30)	5	0
July	7	5	0‡		10	30	0
August	0	0	0		0	0	0
September	16	6	0		0	0	65
October	75	15	0		150	10	55
November	82	23	150		175	5	
December	146	0	420		0	0	0
<b>1967</b>							
January	30	0	155		10	10	0
February	142	38	0§		230	0	35
March	187	31	0§		280	0	20
April	131	13	135		120	0	0
May	169	23	190		130‡	0	0
June	10	8	0		60	5	0
July	0	0	0		30,(55),145	0	0
August	2,8	2,5	0		10	0	5
September	6	2	20		15	0	0
October	75	26	30		225	0	15
November	78	15	15		410	10	25
December	119	10	225		100	0	0
<b>1968</b>							
January	76	22	0§		180	45	40
February	108	33	0§		160	10	65
March	65	13	155		50	5	40
April	46	6	115		20	0	15
May	22	4	15		45	5	5
June	2	0	25		5	10	
July	1,8	0	30,(55),195		0	0	0
August			30,180				
September	17		165		0		

\*First number is fully grown birds; second number (when present) is flightless young.

‡Patrol regular only on lowest 2 miles, complete patrol once or twice each summer.

‡Patrol inadequate.  
§Frozen.

||No patrol.

# Other publications in the Report Series

*No. 1*

Whooping crane population dynamics on the nesting grounds, Wood Buffalo National Park, Northwest Territories, Canada by N. S. Novakowski  
Cat. No. R65-8/1, Price 50 cents

*No. 2*

Bionomics of the sandhill crane by W. J. Stephen  
Cat. No. R65-8/2, Price 75 cents

*No. 3*

The breeding biology of Ross' goose in the Perry River region, Northwest Territories by John Pemberton Ryder  
Cat. No. R65-8/3, Price 75 cents

*No. 4*

Behaviour and the regulation of numbers in blue grouse by J. F. Bendell and P. W. Elliot  
Cat. No. R65-8/4, Price \$1.00

*No. 5*

Denning habits of the polar bear (*Ursus maritimus* Phipps) by Richard Harington  
Cat. No. R65-8/5, Price 50 cents

*No. 6*

Saskatoon Wetlands Seminar  
Cat. No. R65-8/6, Price \$5.25

*No. 7*

Histoire naturelle du Gode, *Alca torda*, L., dans le golfe Saint-Laurent, province de Québec, Canada, par Jean Bédard  
Cat. No. R65-8/7, Price \$1.25

*No. 8*

The dynamics of Canadian arctic fox populations by A. H. Macpherson  
Cat. No. R65-8/8, Price \$1.00

*No. 9*

Population estimates of barren-ground caribou, March to May, 1967 by Donald C. Thomas  
Cat. No. R65-8/9, Price \$1.00

*No. 10*

The mammals of Jasper National Park, Alberta by J. Dewey Soper  
Cat. No. R65-8/10, Price \$2.50

*No. 11*

A study of sex differential in the survival of wapiti by Donald R. Flook  
Cat. No. R65-8/11, Price \$1.25

*No. 12*

Breeding biology of California and ring-billed gulls: a study of ecological adaptation to the inland habitat by Kees Vermeer  
Cat. No. R65-8/12, Price \$1.25

*No. 13*

Geographical variation in the polar bear, *Ursus maritimus* Phipps by T. H. Manning  
Cat. No. R65-8/13, Price \$1.00

*No. 14*

Studies of bird hazards to aircraft  
Cat. No. R65-8/14, Price \$1.25

*No. 15*

Moose and deer behaviour in snow by J. P. Kelsall and W. H. Prescott  
Cat. No. R65-8/15, Price \$1.00

*No. 16*

Effects of phosphamidon on forest birds in New Brunswick by C. David Fowle  
Cat. No. CW65-8/16, Price \$1.00

