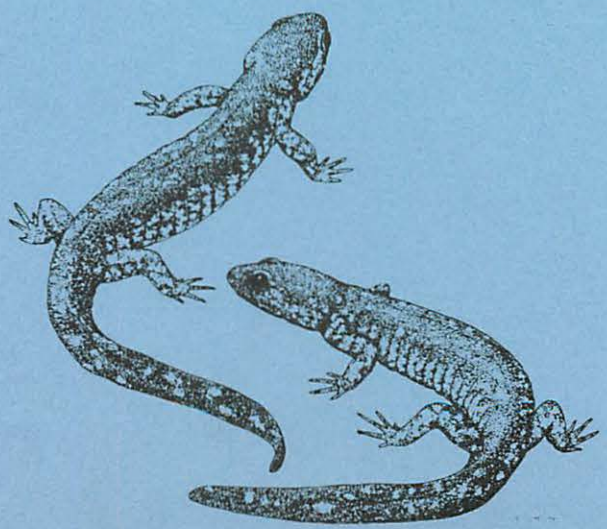
Curatorial Report Number 22

Nova Scotia Museum
1747 Summer St.
Halifax, Nova Scotia, Canada

Distribution, natural history and morphology of the blue-spotted salamanders, *Ambystoma laterale* and *A. tremblayi* in Nova Scotia

By John Gilhen
Curatorial Assistant
June 1974



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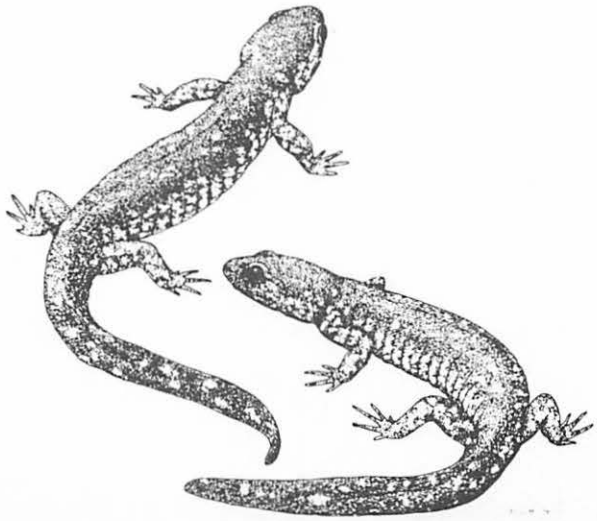


NOVA SCOTIA MUSEUM

Curatorial Reports

The *Curatorial Reports* of the Nova Scotia Museum contain information on the collections and the preliminary results of research projects carried out under the program of the museum. The reports may be cited in publications but their manuscript status should be clearly indicated.

INTRODUCTION

Four species of blue-spotted salamanders (known as the *Ambystoma jeffersonianum* complex) have been recognized in Eastern North America. Two species are diploid (2n=28): the Jefferson's salamander, *A. jeffersonianum,* and the blue-spotted salamander, *A. laterale*. Two species are triploid (3n=42): the silvery salamander, *A. platineum* and Tremblay's salamander, *A. tremblayi*. The diploid species are bisexual while the triploid species consist almost entirely of females (Uzzell, 1964).

Uzzell points out that the ranges of the two diploid species overlap in New York and New England. The Jefferson's salamander is a more southern form and is distinguished from the blue-spotted salamander of the north in having a broader snout, longer legs, greater body size, lighter colour and in being less heavily spotted. In a wide zone where the ranges of the two bisexual species meet, there are triploid females that are intermediate between the two kinds of diploid females in snout width, body size and colour. These triploids have larger cells and nuclei and produce fewer eggs in relation to body size than do the diploid females.

Uzzell suggested that the triploid populations arose by hybridization of *A. laterale* and *A. jeffersonianum,* and stated that variation within the triploid females parallels that between the two diploid species. The silvery salamander is found associated with the Jefferson's salamander, and Tremblay's salamander is found associated with the blue-spotted salamander. Triploid females complete with diploid females for spermatophores and their progeny are almost always females. In populations where diploid and triploid species are found, the sex ratios are often highly unbalanced and it can be assumed that preferential selection against triploid females by diploid males probably offsets this imbalance.

Unfortunately during Uzzell's study of the complex, living specimens from Nova Scotia were not available. Prior to his study *A. jeffersonianum* was the only species recognized in Nova Scotia and six preserved specimens labeled as such existed in museum collections, four in the Nova Scotia Museum, Halifax, and two in the National Museum of Natural Sciences, Ottawa. Based on Uzzell's study, an examination of these and 246 additional specimens show that *A. laterale* and *A. tremblayi* are the only members of the *Ambystoma jeffersonianum* complex found in Nova Scotia. The purpose of the present study, 1968-1973, was to obtain a better knowledge of the distribution, abundance, natural history and morphology of the blue-spotted salamanders in Nova Scotia.

BACKGROUND TO PRESENT STUDY

The first documented account of a blue-spotted salamander in Nova Scotia appears in the 1935 accession book of Harry Piers, former curator of the Provincial Museum. Under accession number 8071 (now 935-Z-1, see Appendix 1) Piers gives a detailed description, including colour notes, number of costal grooves, vomerine teeth, body shape, 18 measurements and three line drawings of a large adult male (134 mm total length prior to preservation), collected on the bottom of a pool of water, about six or eight inches deep, between Truro and Harmony, Colchester County, on 5 May 1935.

An historical review of this species in Nova Scotia accompanies the detailed account made by Piers. He begins with this statement:

> *This specimen verifies the occurrence of this species in Nova Scotia. I felt sure it must be the species which I had noted before, but till now was unable to compare.*
>
> *Dr. A. H. MacKay in an article in Proc. N. S. Inst. Sci. Vol. 9 (1896), p. xliii, lists a blackish species of salamander thus:"? (Blackish sp.)," which no doubt is this species.*
>
> *On 22 July 1897, Harold W. Tremaine took a salamander in water not more than six inches deep on a red-clay bottom, near the western shore of "Fenerty's Lake" (=First Lake of Geol. Survey Map), Sackville, 3 m. northwest of Bedford, Halifax County. He gave it to me in the same summer, but I have since mislaid it. As well as I can remember it was about 4 inches long and of a grey colour (perhaps mostly on under parts) with whitish or greyish white spots, and possibly marbled with these colours beneath. I am now confident it was* A. jeffersonianum.
>
> *On 28 May, 1917, Arthur Lauf while in Internment Camp at Amherst Foundry, Amherst, Cumberland County, N. S., got his first 4 of this species while digging a trench, in sand, at the Camp at the Foundry. One was about 3 1/2 inches long, and three of them about 2 3/4 inches. Afterward in the season of 1917 and 1918, he got about 20 more, measuring from 4 to 6 inches in length. Tail compressed. Colour, pitchy black; some of them with very small spots (like "pin-pricks") of blue. He considered them the next commonest species there, next to* A. punctatum (=A. maculatum).

Two additional specimens, accession number 8102 and 8169 (now 935-Z-2 and 935-Z-3; see Appendix 1) were examined and given almost the same extended treatment by Piers. The first specimen (8102) is an adult male, 118 mm in total length prior to preserving, found under a pile of wood near Camden, Colchester County, on 2 June 1935. The second specimen (8169) is also an adult male, 103.5 mm in total length prior to preserving, found in a damp place near Harmony, Colchester County, on 27 June 1935.

A fourth specimen recorded by Piers (accession number 8259) was collected at Harmony Road, about 1 mile SE of the limits of the town of Truro, Colchester County, on 4 Sept. 1935. This specimen was kept alive until it escaped on 27 September 1935. Although a detailed description was not possible, Piers noted it agreed with the three previous records in general colour, etc., but this specimen "appeared fairly large."

Bleakney (1951) in his account of *A. jeffersonianum,* recorded one juvenile specimen, 84.1 mm in total length (prior to preserving), collected under a piece of wood at James River, Antigonish County on 22 July 1950 by Ann Watts, plus a verbal report from the Windsor area Hants County. He stated, "The new record from Antigonish County extends its known range considerably and would indicate that perhaps the Jefferson's salamander is not as rare as it is commonly believed to be." Bleakney mentioned in his discussion (p.76): "If a survey was conducted in early spring when the spotted and Jefferson's salamander may be caught at their breeding ponds, a more precise idea of their numbers would be possible."

During the week of April 9, 1951 Bleakney and J. Lynton Martin, of the Nova Scotia Museum of Science, made herpetological collections in the counties of Queens and Annapolis. Bleakney (1951) supplemented his account with the following statements: "Observations made on several spring breeding ponds showed that the Jefferson's salamander is common in the Kempt area, Queens County. Before this it had been considered 'rare'... There is now the possibility that similar surveys made in other sections of the province will show it to be equally as common as the spotted salamander."

Bleakney (1952) confirmed the inclusion of Hants County in the species' distribution when seven larvae were collected at St. Croix in 1951 (three on 10 July and four on 25 July). Two of the larvae transformed after a short time in captivity and are presently preserved in the Herpetological Collections of the National Museum of Natural Sciences.

Bleakney (1958) repeated the records for mainland Nova Scotia and stated that the absence of *A. jeffersonianum* on Cape Breton Island may be a false impression because of the lack of collecting in early spring.

Cook and Rick (1963) were first to report a blue-spotted salamander for Cape Breton Island. On 31 May 1962 one adult female, 64 mm snout to mid-vent (prior to preserving), was collected in one of the archaeological excavations at Fortress Louisburg, Cape Breton County. Cook identified this specimen as the blue-spotted salamander, *A. laterale*. Cook and Rick were not aware of an unpublished record of an adult female collected at Baddeck, Victoria County, in June 1960 by Keilor Bentley. Bentley has since donated his preserved specimen, which measured 47 mm (snout to anterior edge of vent) and contained 154 enlarged ovarian eggs, to the National Museum of Natural Sciences, Ottawa.

In August 1963, Irving Deale donated a live juvenile specimen to the Nova Scotia Museum of Science, Spring Garden Road. It was found under a wood pile at Middle Musquodoboit, Halifax County. This specimen measured 72 mm in total length prior to being used for exhibit purposes. A plastic replica has been retained in the Nova Scotia Museum Herpetological Collection.

METHODS

Collections of adult blue-spotted salamanders were made during the spring breeding season in or near roadside ponds. Advanced larvae were collected in July and August. They were kept alive in gallon jars set up as semi-aquatic terraria in the lab, and were fed on whiteworms of the species commonly fed to tropical fish. Temperature ranged from 21 to 23 ^{o}C over each 24-hour period.

Juveniles and adults were measured in millimeters prior to preserving: body length = snout to posterior angle of vent; tail length = posterior angle of vent to tip of tail (only specimens with complete tails which showed no visible sign of regeneration were measured for tail length); internarial distance = shortest distance between the nares.

Blood samples were obtained by making a small cut in the web of the hind foot of live adult specimens. A small sample drop of blood was transferred with a micropipette to a drop of Amphibian Ringer solution on a microscope slide. The sample was covered with a number one cover glass and a suitable field photographed using a Pentax camera fitted to a Nikon stereo microscope. An eyepiece micrometer scale was also photographed so that the areas of the erythrocytes could be measured directly from the photographic prints. The photographic prints obtained show the erythrocytes magnified 1,250 times. The areas of ten erythrocytes from each sample were determined using millimeter-scale graph paper and corrected to true value using the micrometer scale.

COLLECTIONS

1968: 32 larvae

In April of 1968 roadside cattail ponds in the Kempt area, Queens County, the Truro area, Colchester County and Annapolis, Annapolis County were checked for adult blue-spotted salamanders. Only adult (yellow-) spotted salamanders, *A. maculatum*, were observed in these ponds.

In June, July and August 1968, 153 advanced salamander larvae were collected in Halifax, Hants, Cumberland and Inverness Counties (Table 1) and kept alive until the end of August when most of the larvae transformed. Of the 153 larvae 32 were blue-spotted salamanders, from five localities (stations 3,5,6,8 and 9) in Cumberland County, and 121 were (yellow-) spotted salamanders.

Harry Piers (1935) reported on collections from Amherst, Cumberland County by Harold W. Tremaine. Although no specimens are available the records from Mattatall Lake, Mahoney Corner and Thomson Station areas confirm the inclusion of Cumberland County in the distribution of blue-spotted salamanders in Nova Scotia.

1969: 38 adults (21 males, 17 females)

In April of 1969, 37 adults (21 males, 16 females) were collected at night in breeding ponds at five localities in Hants County and three localities in Cumberland

County (see Appendix 1). Collections from Cumberland County were made at stations 6, 8 and 9 of the 1968 larvae survey (Thomson Station area) while collections from Enfield-Elmsdale area, Hants County, are new localities. One adult female collected near a well in the Little Harbour area, Pictou County was donated to the Nova Scotia Museum by Andrew MacDonald. This is the first record for Pictou County.

1970: 26 adults (16 males, 10 females) and 1 juvenile male

Collections of adults were made at night during the spring breeding season in Hants, Cumberland and Colchester Counties (see Appendix 1). North River and Cloverdale, Colchester County and Wentworth Centre, Cumberland County represent three new localities. Bernard LeBlanc collected a juvenile male under a piece of plywood at Pomquet, Antigonish County on 7 September. Pomquet is a new locality for Antigonish County.

1971: 54 adults (39 males, 15 females)

Collections were made at night during the spring breeding season in Hants, Cumberland and Colchester Counties. Three Mile Plain represents a new locality for Hants County.

1972: 8 adults (one male, 7 females)

Collections were made at night during the spring breeding season in Hants and Cumberland Counties.

1973: 114 adults (74 males, 40 females) and two juveniles (one male, one female)

Collections were made at night during the spring breeding season in Cumberland, Colchester, Pictou and Antigonish Counties. Lower Wentworth and Wallace Station, Cumberland County; Mattatall Lake area, Beacon Hill, Four Mile Brook and East New Annon, Colchester County; Pinetree Brook and Alma, Pictou County and Beaver Meadow, Bayfield, Purl Brook, Ashdale, North Lochaber and Antigonish, Antigonish County all represent new localities. On 25 April one adult was found dead on the highway at Two Mile Lake, Guysborough County. This is the first report from Guysborough County.

Table 1. Collections of salamander larvae in 1968

Station Number	General Locality	Date	Number of specimens *A. maculatum*	Number of specimens *A. laterale* and/or *A. tremblayi*
1	North Beaverbank, Halifax County	26 June	1	
2	East Uniacke, Hants County	29 June	1	
3	Mahoney Corner, Cumberland County	2 July	9	2
4	Thomson Station, Cumberland County	2 July	5	
5	Thomson Station Cumberland County	8 July		11
6	Thomson Station, Cumberland County	8 July		14
7	Thomson Station, Cumberland County	8 July	7	
8	Thomson Station, Cumberland County	8 July	11	3
9	Mattatall Lake, Cumberland County	8 July		2
10	Miller Lake, Halifax County	8 July	1	
11	Grand Lake, Halifax County	12 July	3	
12	Meaghers Grant, Halifax County	12 July	7	
13	Uniacke Lake, Halifax County	23 July	1	
14	Lower Sackville, Halifax County	27 July	5	
15	Miller Lake, Halifax County	27 July	19	

Table 1. (continued)

Station Number	Locality	Date	Number of specimens A. *maculatum*	Number of specimens *A. laterale* and/or *A. tremblayi*
16	Glendale, Inverness County	5 August	6	
17	Horton Lake, Inverness County	5 August	20	
18	Grand Anse River, Inverness County	6 August	11	
19	Grand Anse River, Inverness County	6 August	14	
		Totals:	121	32

Exact localities are given on catalogue cards in Nova Scotia Museum.

DISTRIBUTION

During this present study blue-spotted salamanders were found in areas underlain by the Pictou, Cumberland and Riversdale Groups of the Pennsylvanian Period and the Canso, Windsor and Horton Groups of the Mississippian Period. These formations include beds of red sandstone, conglomerate and shale. The salamanders were absent from the granite, slate and quartzite coastal areas of mainland Nova Scotia as well as from Economy Mountain and the Cape Breton Highlands. The restricted distribution may be partly due to the acid soils in the hard-rock coastal areas. One published record from Louisburg, Cape Breton Island, is within the Fourchu Group of the Cambrian Period which also includes beds of sandstone, conglomerate and shale. Two reports (First Lake, Halifax County by Piers, and Kempt, Queens County by Bleakney) (see Figure 1) are unusual in that they are in the drumlin-covered slate, schist and minor quartzite formation of the Meguma Group (Lower Ordovician Period).

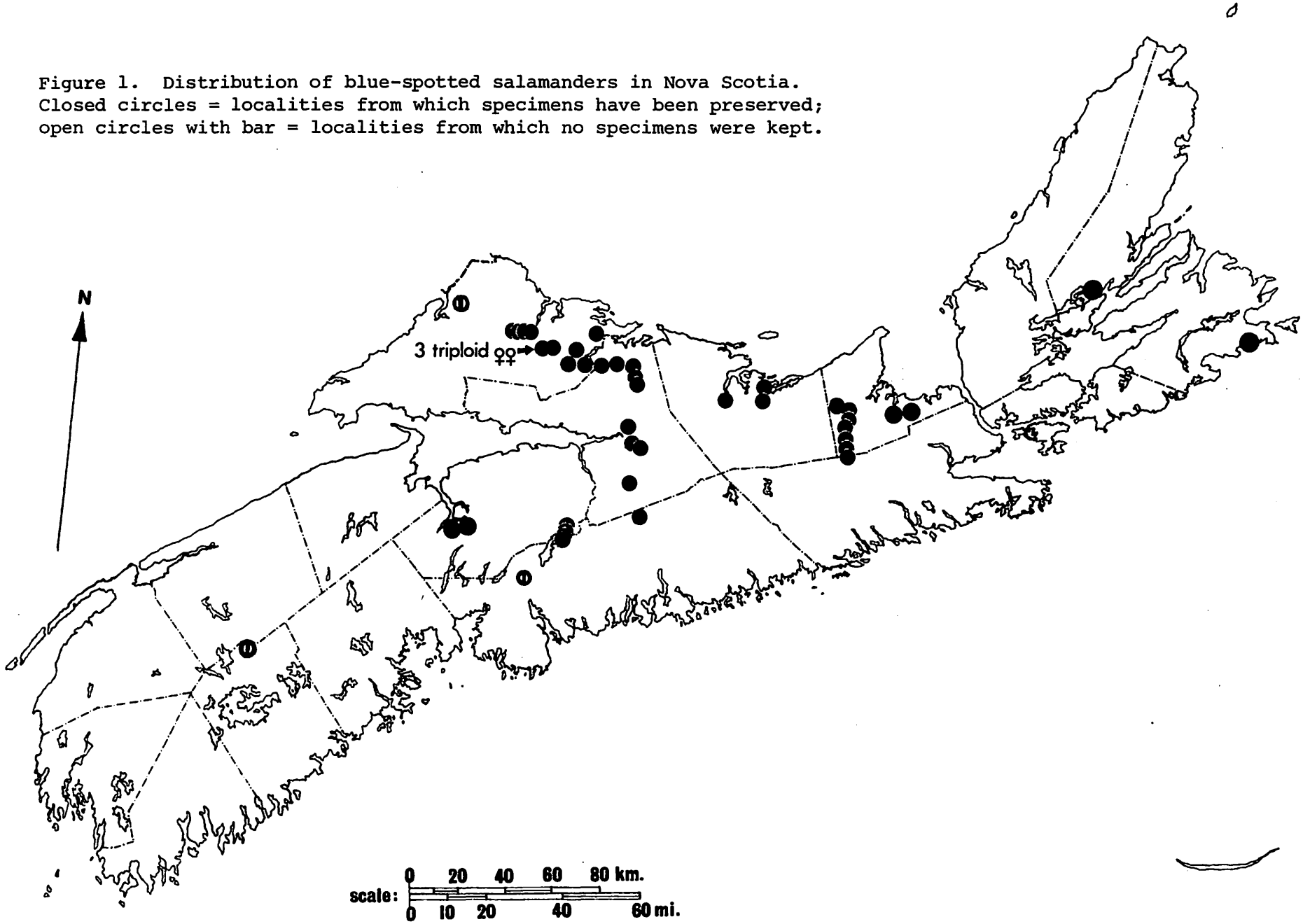
HABITAT AND ASSOCIATED AMPHIBIAN FAUNA

Most blue-spotted salamanders were collected during the spring breeding season. They were usually found in or near shallow sparsely-vegetated, red-mud bottomed roadside ponds adjacent to coniferous, deciduous and mixed forest (Figures 2,3,4 and 5). They usually occured with the (yellow)-spotted salamander, *A, maculatum*, in equal or greater numbers in larger ponds, and were occasionally alone in smaller ponds. The northern spring peeper, *Hyla crucifer crucifer*, and the wood frog, *Rana sylvatica*, also used the breeding ponds and a loud mixed chorus was heard during the breeding season. The leopard frog, *R. pipiens*, was also frequently seen but was usually silent or was less vocal than *H. c. crucifer* and *R. sylvatica*. In larger ponds the red-spotted newt, *Notophthalmus viridescens viridescens*, was frequently encountered. The green frog, *Rana clamitans melanota*, and juvenile bullfrog, *Rana catesbeiana*, were seen on two occasions and one adult male American toad, *Bufo americanus americanus*, on one occasion near Thomson Station, Cumberland County, late in April.

MIGRATION

The first migration of blue-spotted salamanders from their woodland places of hibernation to breeding ponds begins in early April, depending on climatic conditions. On rainy nights throughout April and up to the middle of May these salamanders can be observed migrating across highways, moving to and from roadside ponds. Adults are rarely seen on the highways after the middle of May. Recently transformed blue-spotted salamanders were observed migrating across highways on rainy nights in late July, August and early September

Figure 1. Distribution of blue-spotted salamanders in Nova Scotia. Closed circles = localities from which specimens have been preserved; open circles with bar = localities from which no specimens were kept.



F. SCOTT '70

Figure 2. Roadside pond at Enfield, Hants County, Nova Scotia.

Figure 3. Roadside pond at Elmsdale, Hants County, Nova Scotia.

Figure 4. Roadside pond at Mattatall Lake, Cumberland County, Nova Scotia.

Figure 5. Roadside pond at Thomson Station, Cumberland County, Nova Scotia.

EGG LAYING HABITS

Eggs were usually laid at the base of aquatic vegetation, stones and rocks as well as on the mud bottom. They were most frequently laid individually; however, small clumps of from two to four eggs were not uncommon. On 28 April 1971, 2 1/2 miles north west of Oxford, Cumberland County, 38 pairs of blue-spotted salamanders were observed. The base of a rock about six inches in diameter was completely encircled with eggs. In two places one inch apart there were clumps of eggs, one of three and another of four. The remaining eggs were laid individually. Also, in the same pond, there were individual eggs at the base of one aquatic plant which also supported a complement of (yellow-) spotted salamander (*A. maculatum*) eggs (Figure 6).

COLOUR AND PATTERN

Blue-spotted salamanders from Nova Scotia vary in ground colour from bluish-black to almost black on the dorsal surface, becoming paler on the ventral surface in some individuals. The lighter ventral colour was more noticeable on large specimens. The spotting which occurred mostly on the sides of the chin, trunk, tail and limbs varied from light blue to almost white. Spots were irregular in shape and each spot on the sides of the trunk consisted of a group of small irregularly-shaped spots or fleck-marks. Spots were so frequent and prominent on the trunk sides of some individuals that the salamanders appeared to have lateral stripes. On others the spots varied from large and frequent to small and infrequent. Most specimens also had spots on the belly and chin. Spots on the chin were usually paler than those on the belly. Some specimens, particularly juveniles, had small spots on the dorsal surface.

The dark ground colour and frquent spotting of Nova Scotia blue-spotted salamanders is more typical of *A. laterale* and *A. tremblayi* than of *A. jeffersonianum* and *A. platineum*.

IDENTIFICATION OF A. LATERALE *AND* A. TREMBLAYI *BY ERYTHROCYTE AREA*

Uzzell (1964) points out that the triploid species *A. tremblayi* has a larger mean cell size than *A. laterale*. Blood samples were successfully taken from 22 specimens. The average erythrocyte area of one female (specimen number 969-z-51-1(7)1) from Thomson Station, Cumberland County was approximately .5 times larger than the other 21 specimens. (Table 2, Figure 7 and 8). The body length of this large (85 mm) spent female also exceeds the range of 51 to 72 mm given by Uzzell (1967b) for the blue-spotted salamander, *A. laterale*, by 13 mm, but is well within the range of 56 to 94 mm given by Uzzell (1967) for the triploid species, *A. tremblayi*. On the basis of its sex, erythrocyte area and body length this female can be assigned to Tremblay's salamander, *A. tremblayi* and is first reported from Nova Scotia. The body length of all 10 males and the remaining 11 females are within the range for *A. laterale*.

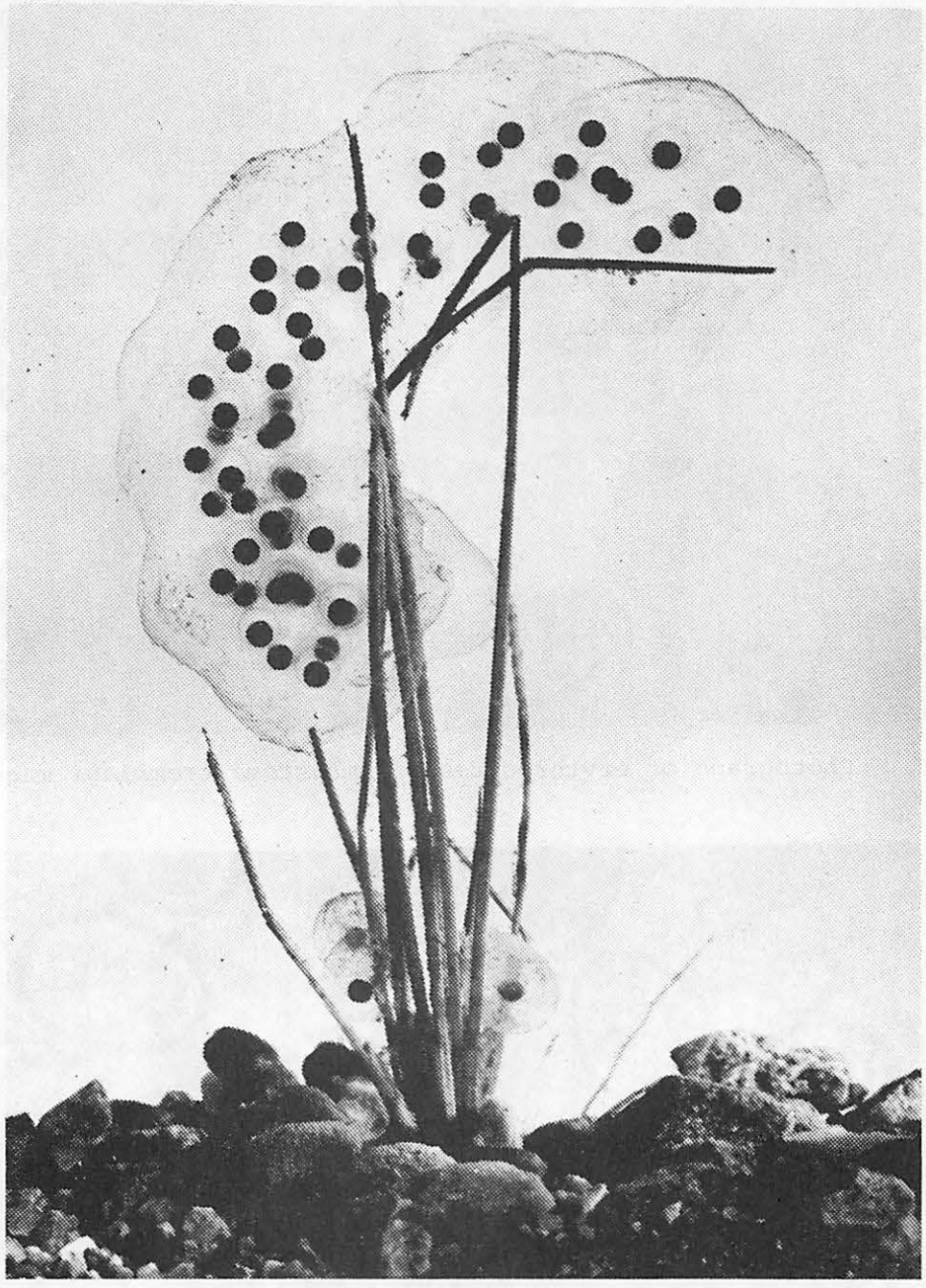


Figure 6. Photograph of *Ambystoma* eggs. Large mass is that of *A. maculatum;* three individual eggs at base of plant are those of *A. laterale*.

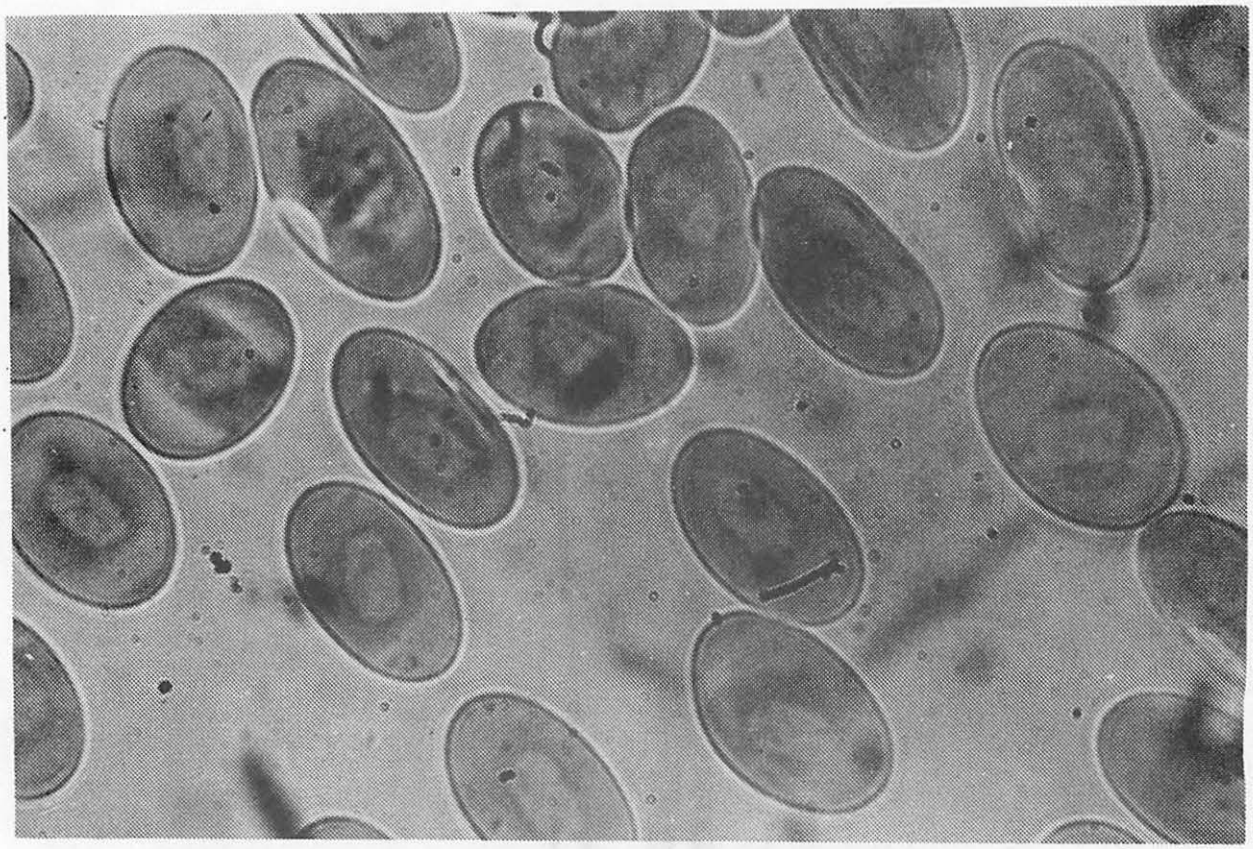


Figure 7. Photograph of erythrocytes of *Ambystoma tremblayi* magnified 1,250 times.

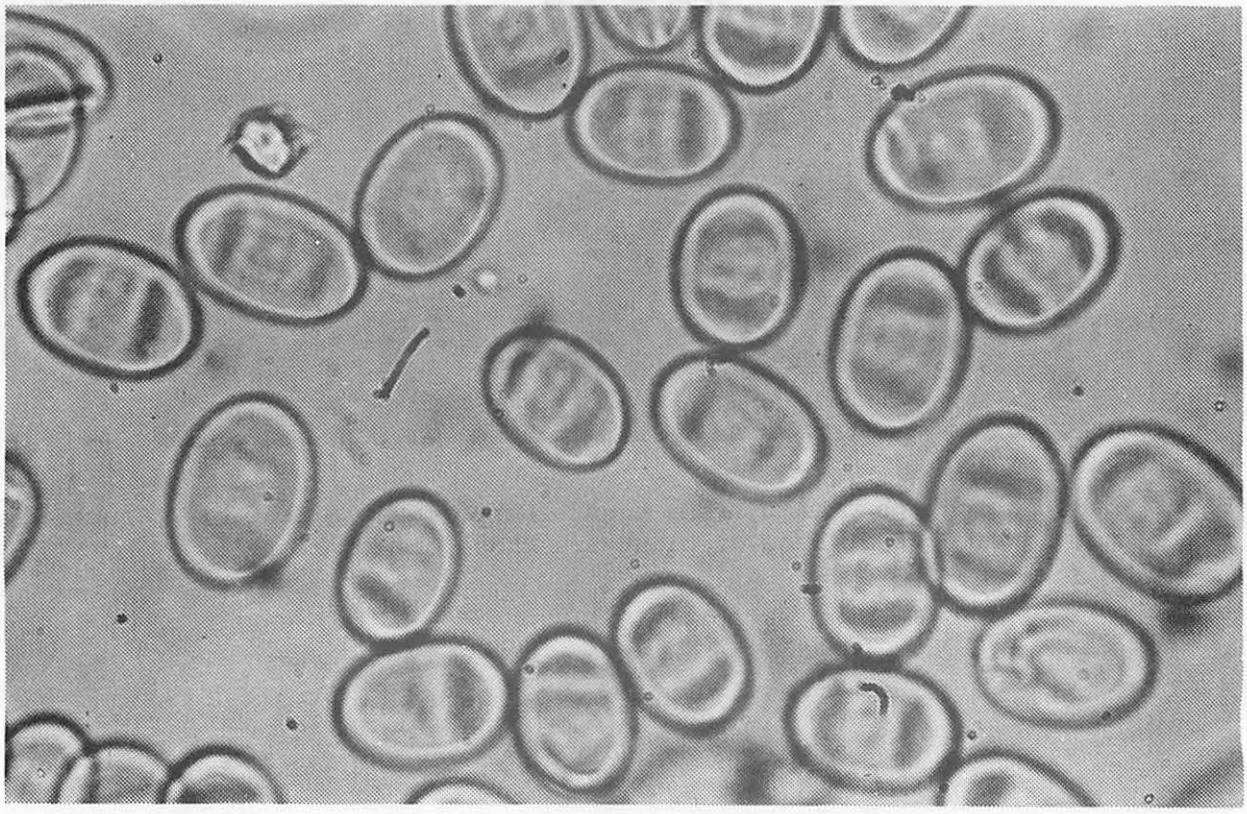


Figure 8. Photograph of erythrocytes of *Ambystoma laterale* magnified 1,250 times.

Table 2. Range and mean erythrocyte area in square microns for samples of 10 erythrocytes each from 21 individual blue-spotted salamanders collected in Nova Scotia in 1969

Specimens No.	*Ambystoma laterale* range	(mean)	*Ambystoma tremblayi* range	(mean)
969-z-42-1(3)1	8.96 - 12.13	(10.31)		
969-z-42-1(3)2	8.58 - 12.19	(10.80)		
969-z-42-1(3)3	8.38 - 12.74	(10.61)		
969-z-43-1(1)1	8.99 - 12.06	(10.33)		
969-z-44-1(1)1	8.38 - 11.58	(10.38)		
969-z-45-1(5)1	8.74 - 11.84	(10.21)		
969-z-45-1(5)2	8.54 - 13.47	(10.05)		
969-z-45-1(5)3	9.50 - 12.29	(11.00)		
969-z-45-1(5)4	9.25 - 11.36	(10.44)		
969-z-45-1(5)5	8.67 - 11.87	(10.40)		
969-z-46-1(1)1	8.74 - 12.83	(10.41)		
969-z-47-1(1)1	8.54 - 12.03	(10.28)		
969-z-51-1(7)1			13.06 - 18.14	(15.47)
969-z-51-1(7)2	8.64 - 12.06	(10.39)		
969-z-51-1(7)3	9.06 - 12.13	(10.54)		
969-z-51-1(7)4	9.95 - 12.26	(10.79)		
969-z-51-1(7)5	8.48 - 12.10	(10.14)		
969-z-51-1(7)6	8.96 - 11.90	(10.30)		
969-z-51-1(7)7	8.42 - 12.13	(10.86)		
969-z-52-1(2)1	7.30 - 11.81	(10.10)		
969-z-52-1(2)2	7.94 - 11.52	(9.88)		
969-z-53-1(1)1	9.28 - 13.06	(10.65)		

SIZE RANGE

Body length in 151 adult males ranged from 45 to 70 mm (mean 58.14 mm). As indicated in Table 3 all Nova Scotia males are within the range of *A. laterale*, with the mean body length being shorter than the minimum body length of 62 mm for *A. jeffersonianum*.

Females therefore must be either *A. laterale* or *A. tremblayi*. In 89 adult females the body length ranged from 51 to 85 mm. With the exception of three females (specimen nos. 969-Z-51-1(7)1, 85 mm; 971-Z-67-1(1)1, 75 mm and 972-Z-49-2(7)4, 73 mm), all Nova Scotian females are within the range of *A. laterale*. The three largest females, all taken from the same pond in the three years 1969, 1971 and 1972 are within the range for *A. tremblayi*.

Tail length in 122 adult males ranged from 33 to 65 mm (mean 51.12 mm). In 73 adult female *A. laterale* the range was 41 to 72 mm (mean 49.19 mm) and two adult *A. tremblayi* measured 63 and 69 mm (mean 66 mm).

Total length in 122 adult males ranged from 78 to 134 mm (mean 108.41 mm). In adult female *A. laterale* this measurement ranged from 95 to 131 mm (mean 110.36 mm) and two *A. tremblayi* measured 138 and 154 mm (mean 146 mm).

The total length range of male and female *A. laterale* from Nova Scotia slightly exceeds the ranges given by Uzzell (1967b). The mean total length of females exceeds the minimum total length of 110 mm for *A. jeffersonianum* by .5 mm. These measurements indicate that *A. laterale* has a longer tail in the north-eastern extremity of its range. Cook (1967) found that Prince Edward Island specimens differ from *A. laterale* of Indiana in having a longer tail.

INTERNARIAL DISTANCE

As indicated in Table 3, Nova Scotia blue-spotted salamanders have the shorter internarial distance typical of *A. laterale* and *A. tremblayi*. *A. laterale* from Nova Scotia ranged from 2.4 to 3.6 mm; *A. tremblayi* from 3.3 to 4.3 mm. Uzzell (1967) gives ranges of 2.7 to 3.9 mm for *A. laterale;* 3.3 to 4.7 mm for *A. tremblayi*, 5.0 to 6.3 mm for *A. jeffersonianum* and 4.6 to 6.0 mm for *A. platineum*.

NUMBER OF COSTAL GROOVES

Costal grooves were counted on the right side and included one over the front and hind limbs, a method suggested by Highton (1957) for *Ambystoma*. Of the 243 specimens, 141 (or 58%) had 15 grooves; 96 (39.5%) 14 and 6 (2.5%) 13.

Table 3. Measurements in millimeters of blue-spotted salamanders in north America.

(Uzzell, 1964 and 1967)

Species		Body Length	Tail Length	Total Length	Tail Total	Internarial Distance
A. jeffersonianum	males	62-95		110-186	.62-1.15(.891)	5.0-6.2
	females	76-101		129-196	.69-1.03(.874)	5.2-6.3
A. laterale	males	42-70		71-129	.60-.91(.777)	2.7-3.5
	females	51-72		84-129	.60-.84(.708)	2.8-3.9
A. platineum	one male	83		148		5.6
	female	73-109		129-199		4.6-6.0
A. tremblayi	females	56-94		93-160		3.3-4.7

Nova Scotia

Species		Body Length	Tail Length	Total Length	Tail Length	Internarial Distance
A. laterale	males	45-70	33-65	78-134	.64-1.02(.875)	2.4-3.3
	females	51-72	41-59	95-131	.69-.96(.803)	2.6-3.6
A. tremblayi	females	73-85	63-69	138-154	.81-.84(.825)	3.3-4.3

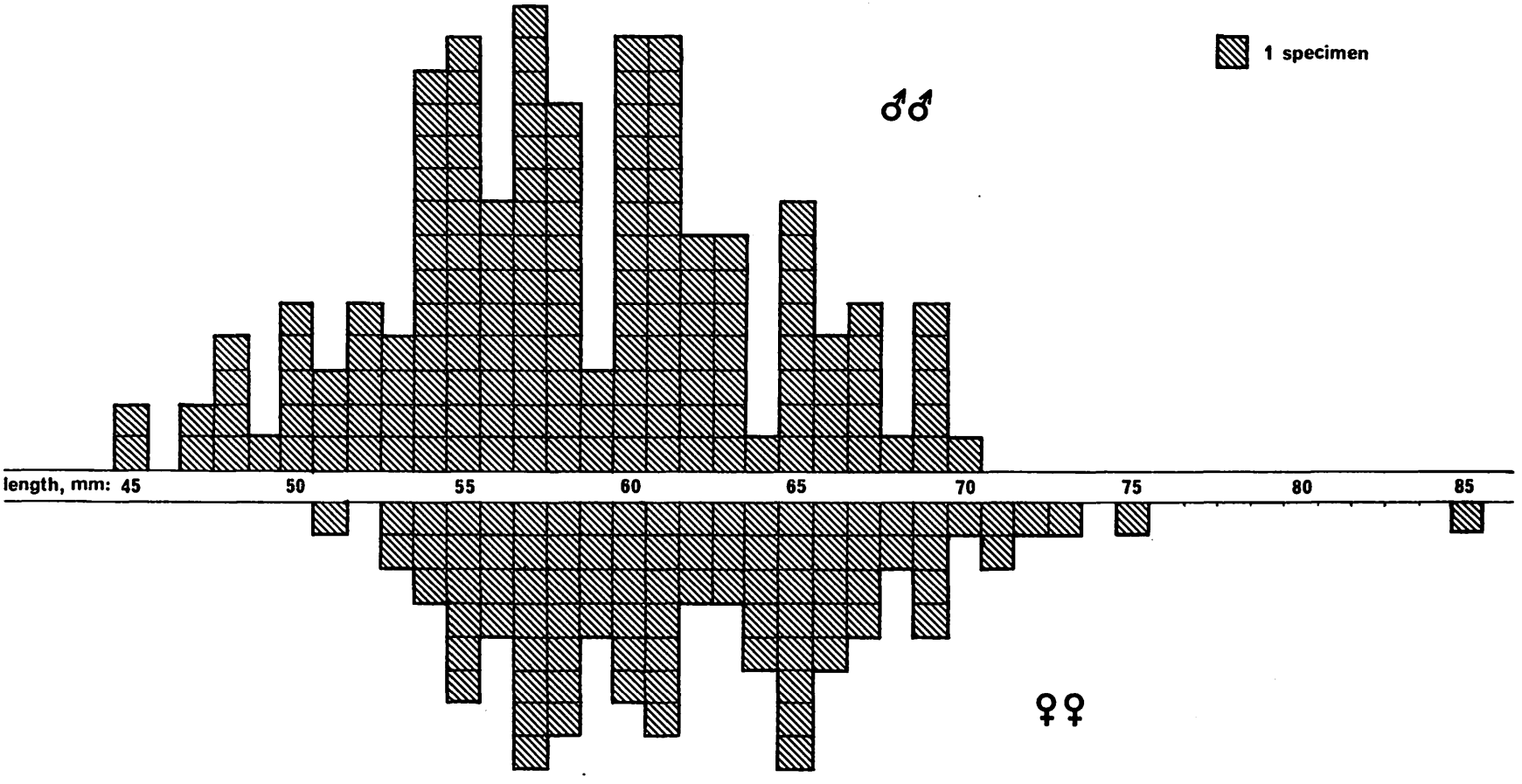


Figure 9. Histogram of body length in 240 adult blue-spotted salamanders from Nova Scotia

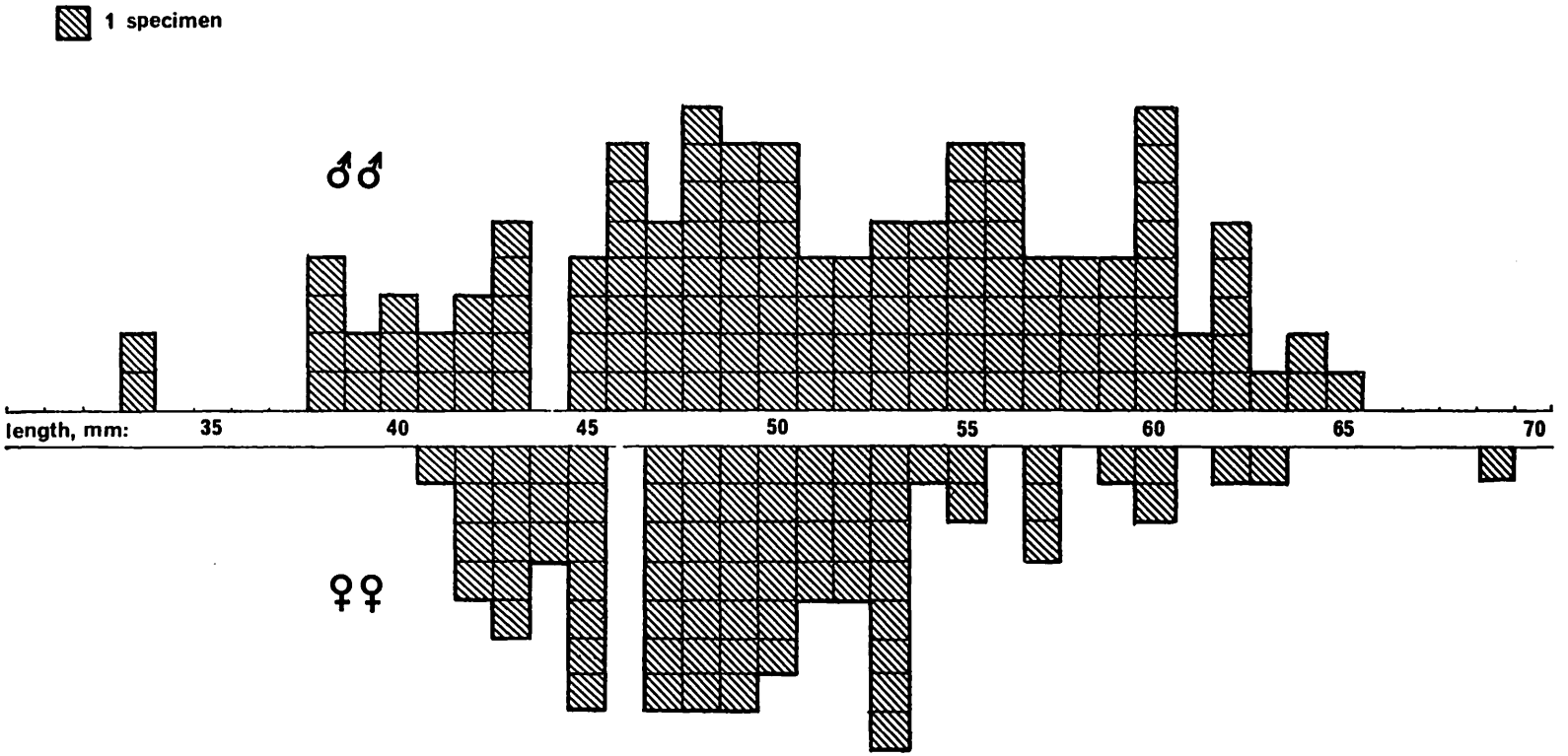


Figure 10. Histogram of tail length in 198 adult blue-spotted salamanders from Nova Scotia.

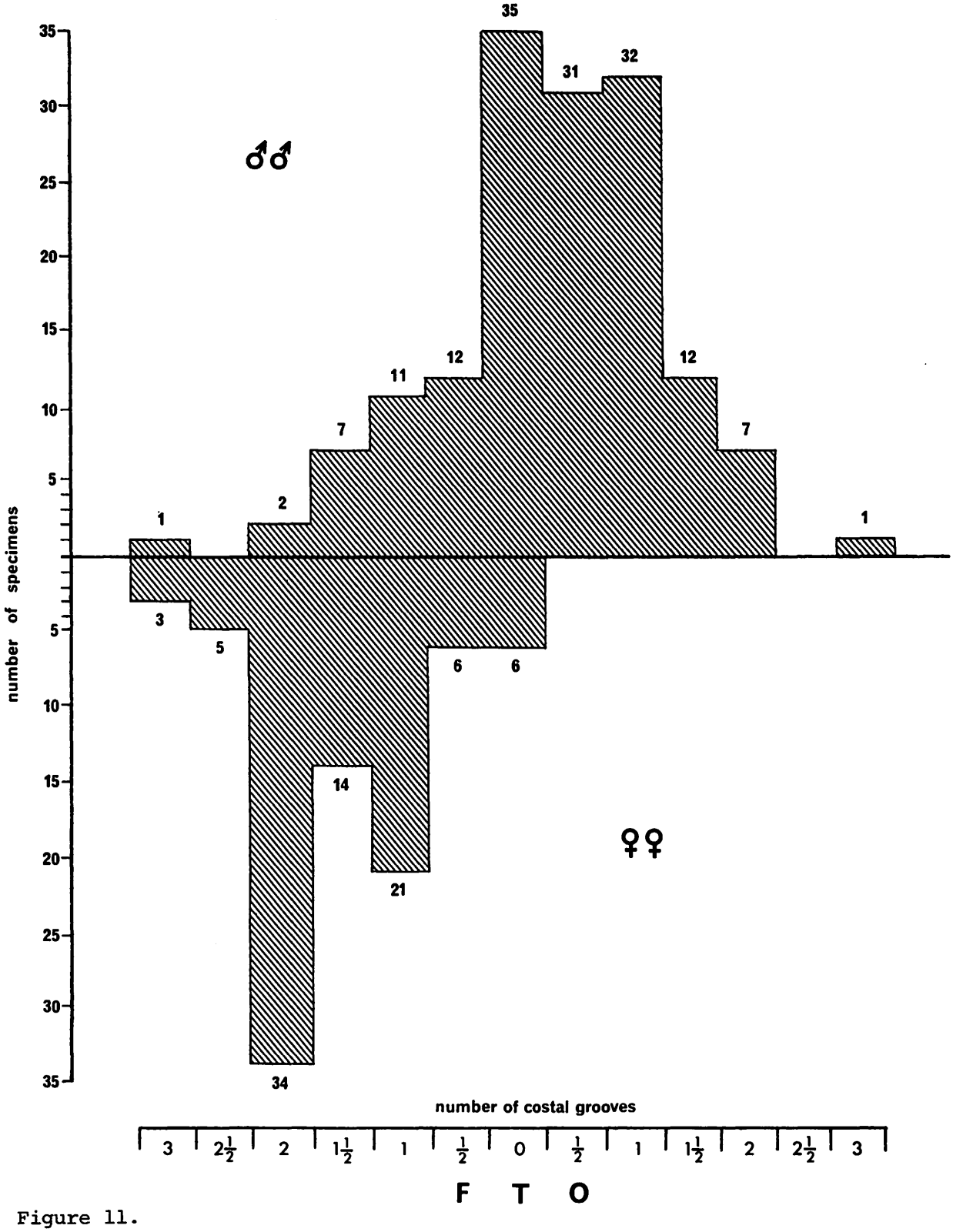


Figure 11.

Histogram showing relationship between costal grooves and appressed limbs. O= toes overlap; T= toes touch; F= toes fail to touch. (Based on 240 adult blue-spotted salamanders from Nova Scotia.)

APPRESSED LIMBS

The right front and hind legs were pressed toward each other along the right side in 151 adult males. The toes touched or overlapped in 118 specimens (78.15%) and failed to touch in 33 specimens (21.85%). The toes did not fail to touch or overlap by more than three folds. In 89 adult females the toes in all specimens failed to touch by up to three folds. (Figure 11).

Uzzell (1967a, 1967b) states that the appressed limbs of small mature males overlap by as many as two costal folds and fail to touch by as many as two folds in large males of *A. laterale*. In *A. jeffersonianum* the appressed limbs overlap by one costal fold in large mature males and by as many as five costal folds in small mature males.

Most Nova Scotia specimens have the shorter legs typical of *A. laterale* and *A. tremblayi*.

NUMBER OF ENLARGED OVARIAN EGGS

Since females usually lay their eggs singly, those females taken in ponds may have shed some of their eggs prior to being captured. Therefore, 39 females (37 *A. laterale* and two *A. tremblayi)* captured before they entered ponds probably had a complete complement of eggs and the egg counts are of value. The range for 37 *A. laterale* was 123 to 538. The count of 538 for one female exceeds by 49 the maximum of 489 given by Uzzell (1967b). The range for two *A. tremblayi* was 212 to 293. The count of 293 for one female exceeds by six the maximum of 287 given by Uzzell (1967d).

EGG NUMBER IN RELATION TO BODY LENGTH

Uzzell (1964) states that triploid females have fewer enlarged ovarian eggs at any body size than the diploid females with which they are found. Figure 12 shows the relationship between egg number and body length. Two females identified as *A. tremblayi* on the basis of body length appear distinct, supporting the view of Uzzell that this species produces fewer eggs than *A. laterale* of the same body length.

STOMACH CONTENTS

Of the 243 stomachs dissected, 47 contained identifiable material (Figure 13). The most common food item was terrestrial slugs. In 18 stomachs 24 slugs (20 *Deroceras* sp., 4 *Arion* sp.) were found. The most interesting items found were aquatic insects, larvae and nymphs, which indicates underwater feeding. The stomach of one female (specimen no. 973-Z-155-1(12)3) contained one slug and one earthworm while the abdomen was swollen with 399 enlarged ovarian eggs. Bishop (1941) listed earthworms, insects and their larvae, millipedes and spiders as the food of adult *A. jeffersonianum* in New York.

Table 4. Numbers of enlarged ovarian eggs in female blue-spotted salamanders in North America.

species	(Uzzell 1967)
A. jeffersonianum	147 - 288
A. laterale	82 - 489
A. platineum	66 - 208
A. tremblayi	61 - 287
Nova Scotia	
A. laterale	123 - 538
A. tremblayi	212 - 293

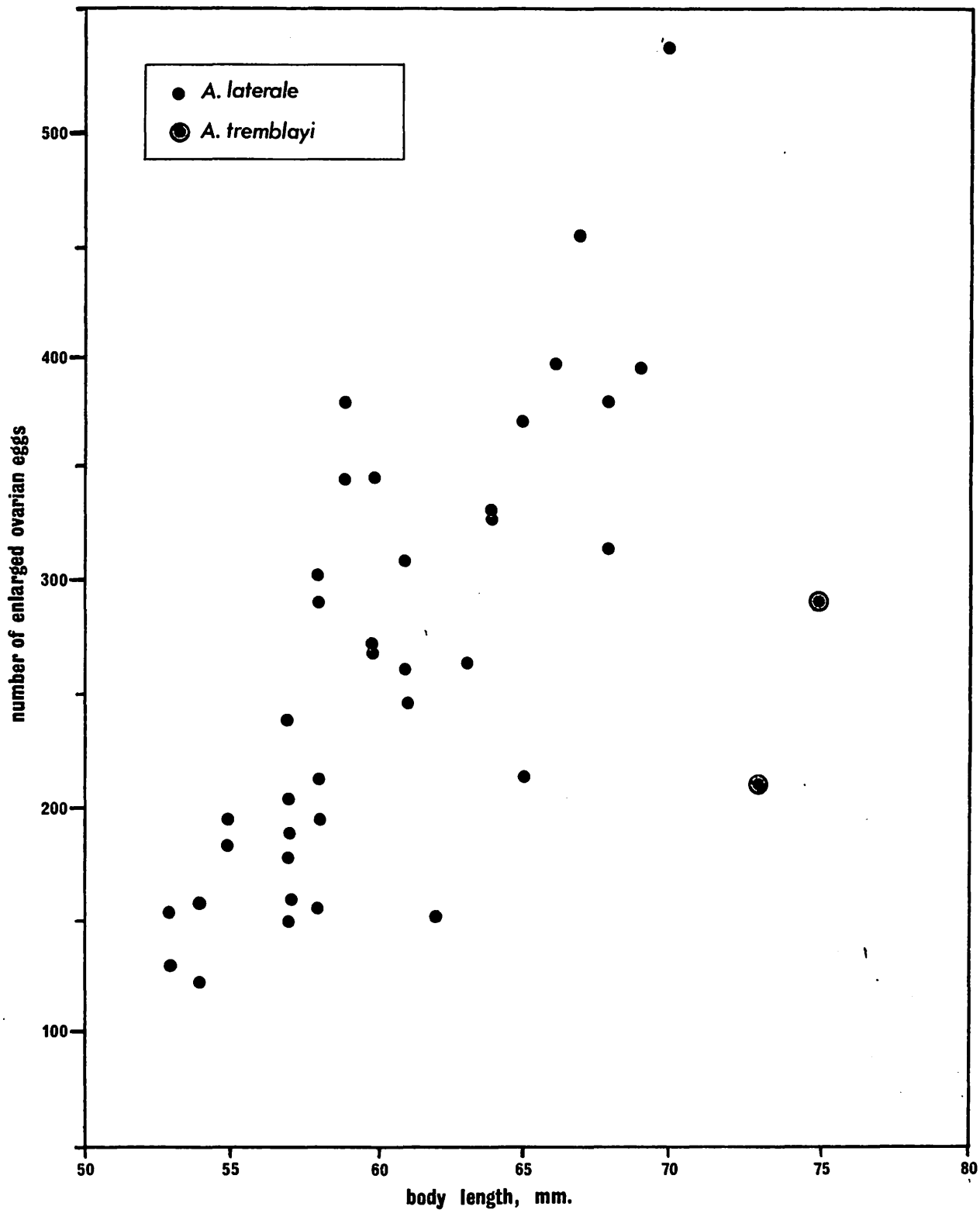


Figure 12. Egg number in relation to body length in 39 adult female blue-spotted salamanders from Nova Scotia.

Table 5. Analysis of stomach contents of 47 blue-spotted salamanders collected in Nova Scotia between 1969 and 1973. Numbers are given where indentifiable food items could be counted. Pieces of unidentifiable material are indicated with an x.

Specimen number

Stomach contents	969-Z-49-1(6)3	969-Z-49-1(6)5	969-Z-50-1(8)3	969-Z-50-1(8)4	969-Z-50-1(8)6	969-Z-50-1(8)7	969-Z-51-1(7)6	969-Z-52-1(2)1	969-Z-52-1(2)2	970-Z-100-1(2)1	970-Z-104-1(5)1	970-Z-104-1(5)3	971-Z-62-1(5)1	972-Z-49-2(7)2	973-Z-145-1(5)5	973-Z-147-1(21)6
spiders (Araneae)		1								1				1		
centipedes (Chilopoda)												1				
springtails (Collembola)																
mayfly nymph (Ephemeroptera)																
dragonfly nymph (Odonata)																
nabid bug (Hemiptera)																
water beetle larvae (Dytiscidae)		1												1		
water scavenger beetle (*Hydroporus* sp.)	1														1	
caddisfly larvae (Trichoptera)																
moth larvae (Lepidoptera)													1			
midge larvae (Diptera: Chironomidae)			1	18	2	14		3	12							
earthworm (*Eisenia* sp.)																
land snails (Pulmonata: *Zonitoides* sp.)													2			
slugs (Pulmonata: *Arion* sp.)							3									
slugs (Pulmonata: *Deroceras* sp.)											2					
slugs (unidentified pieces)													x			
grasses (Gramineae)																
sedge fruit (*Carex* sp.)																
rush capsule (*Juncus* sp.)							1									
spruce needle (*Picea* sp.)													1			
balsam fir needle (*Abies balsamea)*																3
tamarack seed (*Larix laricina)*																
unidentified vegetable matter																

Stomach contents	973-Z-147-1(21)10	973-Z-147-1(21)12	973-Z-147-1(21)17	973-Z-148-1(15)3	973-Z-148-1(15)7	973-Z-148-1(15)9	973-Z-148-1(15)10	973-Z-148-1(15)15	973-Z-149-1(6)5	973-Z-152-1(2)1	973-Z-155-1(12)1	973-Z-155-1(12)3	973-Z-155-1(12)4	973-Z-155-1(12)7	973-Z-155-1(12)8	973-Z-155-1(12)9
spiders (Araneae)																
centipedes (Chilopoda)																
springtails (Collembola)																
mayfly nymph (Ephemeroptera)										1						
dragonfly nymph (Odonata)										1						
nabid bug (Hemiptera)					1											
water beetle larvae (Dytiscidae)							1	1								
water scavenger beetle (*Hydroporus* sp.)																
caddisfly larvae (Trichoptera)										2						
moth larvae (Lepidoptera)	1			1												
midge larvae (Diptera: Chironomidae)																
earthworm (*Eisenia* sp.)											1	1			1	
land snails (Pulmonata: *Zonitoides* sp.)			1													
slugs (Pulmonata: *Arion* sp.)																
slugs (Pulmonata: *Deroceras* sp.)						1						1	3	1		1
slugs (unidentified pieces)																
grasses (Gramineae)									1							
sedge fruit (*Carex* sp.)	1															
rush capsule (*Juncus* sp.)																
spruce needle (*Picea* sp.)		1														
balsam fir needle (*Abies balsamea)*																
tamarack seed (*Larix laricina)*																
unidentified vegetable matter																

Stomach contents	973-Z-156-2(2)1	973-Z-161-1(11)1	973-Z-161-1(11)2	973-Z-161-1(11)6	973-Z-162-1(3)2	973-Z-162-1(3)3	973-Z-163-1(12)4	973-Z-163-1(12)6	973-Z-163-1(12)9	973-Z-163-1(12)11	973-Z-164-1(6)2	973-Z-164-1(6)4	973-Z-165-1(2)1	973-Z-169-1(2)1	973-Z-171-1(2)2
spiders (Araneae)															
centipedes (Chilopoda)															
springtails (Collembola)	1														
mayfly nymph (Ephemeroptera)															
dragonfly nymph (Odonata)															
nabid bug (Hemiptera)															
water beetle larvae (Dytiscidae)															
water scavenger beetle (*Hydroporus* sp.)															
caddisfly larvae (Trichoptera)															
moth larvae (Lepidoptera)															
midge larvae (Diptera: Chironomidae)															
earthworm (*Eisenia* sp.)		1	1							1					
land snails (Pulmonata: *Zonitoides* sp.)															1
slugs (Pulmonata: *Arion* sp.)						1									
slugs (Pulmonata: *Deroceras* sp.)				2		1	1	2		1	2				2
slugs (unidentified pieces)	x				x										
grasses (Gramineae)															
sedge fruit (*Carex* sp.)															
rush capsule (*Juncus* sp.)															
spruce needle (*Picea* sp.)			1												
balsam fir needle (*Abies balsamea)*															
tamarack seed (*Larix laricina)*															
unidentified vegetable matter									x			x	x		

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_____ 1967c. *Ambystoma platineum*, p.49 in catalogue of American amphibians and reptiles. American Society of Ichthyologists and Herpetologists.

_____ 1967d. *Ambystoma tremblayi*, p.50 in catalogue of American amphibians and reptiles. American Society of Ichthyologists and Herpetologists.

APPENDIX 1. A list of extant collections of blue-spotted salamanders from Nova Scotia. Specimens marked with an asterisk are in the National Museum of Natural Sciences collection in Ottawa. All others are in the Nova Scotia Museum.

Catalogue No.	Locality	Date	No. of Specimens
935-Z-1-1(1)	Harmony, Col. Co. (Harmony Road, about 2 miles southeast of railway station in Truro)	5 May 1935	1 (male)
935-Z-2-1(1)	Camden, Col. Co. (About 5 miles southeast of railway station in Truro)	2 June 1935	1 (male)
935-Z-3-1(1)	Harmony, Col. Co. (About 3 miles southeast of railway station in Truro)	27 June 1935	1 (male)
950-Z-2-1(1)	James River, Antigonish Co.	22 July 1950	1 (female)
2189 *	St. Croix, Hants Co.	10-25 July 1951	1 (immature, collected as larva)
2209 *	St. Croix, Hants Co.	10-25 July 1951	1 (female, collected as larva)
7600 *	Baddeck, Victoria Co.	June 1960	1 (female)
6855 *	Louisburg, Cape Breton Co.	31 May 1962	1 (female)
963-Z-12-1(1)	Middle Musquodoboit, Halifax Co.	August 1963	1 (plastic replica used for exhibit purposes)
968-Z-68-1(4)	Thomson Station, Cumb. Co. (At Trans-Canada Highway)	8 July 1968	4 (larvae)
969-Z-42-1(3)	Enfield, Hants Co. (At Route 102, 1 1/4 miles north of Enfield overpass)	11 April 1969	3 (males)
969-Z-43-1(1)	Enfield, Hants Co. (At Route 102, 2 miles north of Enfield overpass)	11 April 1969	1 (male)

Catalogue No.	Locality	Date	No. of Specimens
969-Z-44-1(1)	Enfield, Hants Co. (At Route 102, 2 1/2 miles north of Enfield overpoass)	11 April 1969	1 (female)
969-Z-45-1(4)	Elmsdale, Hants Co. (At Route 102)	11 April 1969	4 (two males, two females)
969-Z-46-1(1)	Elmsdale, Hants Co. (At Route 102, 3 miles north of Elmsdale exit)	11 April 1969	1 (male)
969-Z-47-1(1)	Enfield, Hants Co. (At Route 102, 1 1/4 miles north of Enfield overpass)	12 April 1969	1 (male)
969-Z-48-1(2)	Enfield, Hants Co. (At Route 102, 2 miles north of Enfield overpass)	27 April 1969	2 (males)
969-Z-49-1(6)	Enfield, Hants Co. (At Route 102, 2 1/2 miles north of Enfield overpass)	17 April 1969	6 (males)
969-Z-50-1(8)	Thomson Station, Cumb. Co. (At Trans - Canada Highway, 1 1/3 miles east of Thomson Station overpass)	19 April 1969	8 (three males, five females)
969-Z-51-1(7)	Thomson Station, Cumb. Co. (At Trans - Canada Highway)	19 April 1969	7 (one male, six females)
969-Z-52-1(2)	Thomson Station, Cumb. Co. (At Trans - Canada Highway, 1 1/3 miles east of Thomson Station overpass)	20 April 1969	2 (one male, one female)
969-Z-53-1(1)	Oxford, Cumb. Co. (At Trans - Canada Highway, 2 1/2 miles northwest of Oxford exit)	20 April 1969	1 (female)
969-Z-54-1(1)	Little Harbour, Pictou Co.	April 1969	1 (female)
970-Z-100-1(2)	Elmsdale, Hants Co. (At Route 102)	18 April 1970	2 (males)
970-Z-101-1(5)	Cloverdale, Col. Co.	21 April 1970	5 (four males , one female)
970-Z-102-1(7)	Oxford, Cumb. Co. (Trans - Canada Highway, 2 1/2 miles north of Oxford exit)	25 April 1970	7 (four males, three females)

Catalogue No.	Locality	Date	No. of Specimens
970-Z-104-1(5)	Mahoney Corner, Cumb. Co. (Trans-Canada Highway)	25 April 1970	5 (two males, three females)
970-Z-105-2(1)	Wentworth Centre, Cumb. Co. (Trans - Canada Highway)	25 April 1970	1 (female)
970-Z-106-1(1)	Enfield, Hants Co. (At Route 102, 2 miles north of Enfield overpass)	15 April 1970	1 (male)
970-Z-107-1(4)	Cloverdale, Col. Co.	22 April 1970	4 (three males, one female)
970-Z-108-1(1)	North River, Col. Co. (At Trans - Canada Highway)	29 April 1970	1 (female)
970-Z-181-1(1)	Pomquet, Antigonish Co.	7 September 1970	1 (male)
971-Z-53-1(6)	Three Mile Plains, Hants Co. (At Route 101)	22 April 1971	6 (males)
971-Z-54-1(4)	Three Mile Plains, Hants Co. (At Route 101)	23 April 1971	4 (males)
971-Z-56-1(6)	Thomson Station, Cumb. Co. (At Trans - Canada Highway)	23 April 1971	6 (two males, four females)
971-Z-57-1(7)	Thomson Station, Cumb. Co. (At Trans - Canada Highway, 1 1/3 miles east of Thomson Station)	23 April 1971	7 (six males, one female)
971-Z-58-1(17)	Oxford, Cumb. Co. (Trans-Canada Highway. About 2 1/2 miles northwest of Oxford exit)	23 April 1971	17 (14 males, three females)
971-Z-61-1(4)	Oxford, Cumb. Co. (About 2 miles northwest of Trans - Canada Highway)	28 April 1971	4 (one male, three females)
971-Z-62-1(5)	Oxford, Cumb. Co. (Trans-Canada Highway. About 2 1/4 miles northwest of Oxford exit)	28 April 1971	5 (four males, one female)
971-Z-64-1(3)	Oxford, Cumb. Co. (Trans-Canada Highway. About 2 5/8 miles northwest of Oxford exit)	28 April 1971	3 (one male, two females)

Catalogue No.	Locality	Date	No. of Specimens
971-Z-67-1(1)	Thomson Station, Cumb. Co. (At Trans-Canada Highway)	1 May 1971	1 (female)
971-Z-72-1(1)	Cloverdale, Col. Co.	11 April 1971	1 (male)
972-Z-49-2(7)	Thomson Station, Cumb. Co. (At Trans-Canada Highway)	16 May 1972	7 (females)
972-Z-50-1(1)	Enfield, Hants Co. (At Route 102, 2 1/2 miles north of Enfield overpass)	17 May 1972	1 (male)
973-Z-145-1(5)	Thomson Station, Cumb. Co. (At Trans-Canada Highway)	22 April 1973	5 (males)
973-Z-147-1(21)	Wentworth Centre, Cumb. Co. (At Trans-Canada Highway)	22 April 1973	21 (19 males, two females)
973-Z-148-1(15)	Mattatall Lake, Cumb. Co. (near Lake)	22 April 1973	15 (14 males, one female)
973-Z-149-1(6)	Mattatall Lake, Col. Co. (community)	22 April 1973	6 (three males, three females)
973-Z-150-1(3)	Mattatall Lake, Col. Co. (2 miles east of community)	22 April 1973	3 (males)
973-Z-151-1(2)	Beacon Hill, Col. Co.	23 April 1973	2 (one male, one female)
973-Z-152-1(2)	Four Mile Brook, Col. Co.	23 April 1973	2 (one male, one female)
973-Z-153-1(2)	East New Annan, Col. Co.	23 April 1973	2 (males)
973-Z-155-1(12)	Pomquet, Ant. Co.	23 April 1973	12 (five males, seven females)
973-Z-156-2(2)	Beaver Meadow, Ant. Co.	23 April 1973	2 (males)
973-Z-157-1(1)	Pinetree Brook, Pict. Co.	23 April 1973	1 (male)
973-Z-158-1(1)	Alma, Pict. Co. (At Route 6)	23 April 1973	1 (male)
973-Z-159-1(1)	North River, Col. Co. (At Trans-Canada Highway)	23 April 1973	1 (female)

Catalogue No.	Locality	Date	No. of Specimens
973-Z-161-1(11)	Bayfield Road, Ant. Co.	24 April 1973	11 (three males, eight females)
973-Z-162-1(3)	Purlbrook, Ant. Co. (At Route 7)	24 April 1973	3 (two males, one female)
973-Z-163-1(12)	Ashdale, Ant. Co. (At Route 7)	24 April 1973	12 (five males, seven females)
973-Z-164-1(6)	North Lochaber, Ant. Co. (At Route 7)	25 April 1973	6 (one male, five females)
973-Z-165-1(2)	Lochaber, Ant. Co. (At Route 7)	25 April 1973	2 (one male, one female)
973-Z-169-1(2)	Lower Wentworth, Cumb. Co.	27 April 1973	2 (one male, one female)
973-Z-171-1(2)	Wallace Station, Cumb. Co.	27 April 1973	2 (males)
973-Z-174-1(2)	Antigonish, Ant. Co. (At Trans Canada Highway)	27 April 1973	2 (males)
973-Z-180-1(2)	Purlbrook, Ant. Co. (At Route 7)	1 May 1973	2 (one male, one female)
973-Z-181-1(1)	Ashdale, Ant. Co. (At Route 7)	1 May 1973	1 (female)

Appendix 2. Length measurements, in millimeters, for three juvenile (two males, one female) and 240 adult (151 males, 89 females) blue-spotted salamanders collected in Nova Scotia between 1969 and 1973. Specimens are separated according to sex and those of the same body length are grouped together beginning with the smallest and ending with the largest.

Males					Females				
Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.	Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.
					40	30.5	70.5	.76	.43
43	33	76	.77	.43					
43	37	80	.86	.46					
45	33	78	.73	.42					
45	41	86	.91	.48					
47	-	-	-	-					
47	42	89	.89	.47					
48	38	86	.79	.44					
48	38	86	.79	.44					
48	38	86	.79	.44					
48	40	88	.83	.46					
49	46	95	.94	.48					
50	-	-	-	-					
50	-	-	-	-					
50	43	93	,86	.46					
50	43	93	.86	.46					
50	43	93	.86	.46					
51	-	-	-	-	51	49	100	.96	.49
51	-	-	-	-					
51	46	97	.90	.47					
52	33	85	.64	.39					
52	40	92	.77	.44					
52	42	94	.81	.45					
52	43	95	.83	.45					

Appendix 2. (continued)

Males					Females				
Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.	Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.
52	47	99	.90	.47					
52.5	-	-	-	-					
53	38	91	.72	.42	53	-	-	-	-
53	47	100	.87	.47	53	42	95	.79	.44
53	48	101	.91	.47					
54	-	-	-	-	54	-	-	-	-
54	-	-	-	-	54	42	96	.78	.44
54	-	-	-	-	54	50	104	.93	.48
54	39	93	.72	.42					
54	40	94	.74	.43					
54	42	96	.78	.44					
54	45	99	.83	.46					
54	46	100	.85	.46					
54	47	101	.87	.47					
54	48	102	.89	.47					
54	48	102	.89	.47					
54	54	108	1.00	.50					
55	-	-	-	-	55	42	97	.76	.43
55	46	101	.84	.46	55	43	98	.78	.44
55	46	101	.84	.46	55	43	98	.78	.44
55	46	101	.84	.46	55	44	99	.80	.44
55	46	101	.84	.46	55	45	100	.82	.45
55	49	104	.89	.47	55	45	100	.82	.45
55	49	104	.89	.47					
55	50	105	.91	.48					
55	50	105	.91	.48					
55	51	106	.93	.48					
55	54	109	.98	.50					
55	56	111	1.02	.50					

Appendix 2. (continued)

Males					Females				
Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.	Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.
56	-	-	-	-	56	41	97	.73	.42
56	-	-	-	-	56	42	98	.75	.43
56	-	-	-	-	56	45	101	.80	.45
56	-	-	-	-	56	47	103	.84	.46
56	49	105	.88	.47					
56	51	107	.91	.48					
56	51	107	.91	.48					
56	55	111	.98	.50					
56.5	47.5	104	.84	.46	56.5	45	101.5	.80	.44
57	-	-	-	-	57	-	-	-	-
57	-	-	-	-	57	-	-	-	-
57	-	-	-	-	57	43	100	.75	.43
57	47	104	.83	.45	57	45	102	.79	.44
57	48	105	.84	.46	57	47	104	.83	.45
57	49	106	.86	.46	57	47	104	.83	.45
57	50	107	.88	.47	57	49	106	.86	.46
57	50	107	.88	.47					
57	53	110	.93	.48					
57	53	110	.93	.48					
57	54	111	.95	.49					
57	55.5	112.5	.97	.49					
57	57	114	1.00	.50					
57.5	47.5	105	.83	.45					
57.5	48	105.5	.84	.46					
57.5	52	109.5	.90	.48					
58	39	97	.67	.40	58	44	102	.76	.43
58	41	99	.71	.41	58	45	103	.78	.44
58	43	101	.74	.43	58	48	106	.83	.45
58	45	103	.78	.44	58	48	106	.83	.45
58	49	107	.85	.46	58	50	108	.86	.46

Appendix 2. (continued)

Males					Females				
Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.	Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.
58	51.5	109.5	.89	.47	58	53	111	.91	.48
58	52	110	.90	.47	58	53.5	111.5	.92	.48
58	53	111	.91	.48					
					58.5	47	105.5	.80	.45
59	-	-	-	-	59	-	-	-	-
59	45	104	.76	.43	59	50	109	.85	.46
59	55	114	.93	.48	59	52	111	.88	.47
					59.5	49	108.5	.82	.45
					59.5	51	110.5	.86	.46
60	-	-	-	-	60	43	103	.72	.42
60	46	106	.77	.43	60	48	108	.80	.44
60	48	108	.80	.44	60	48	108	.80	.44
60	49	109	.82	.45	60	51	111	.85	.46
60	49	109	.82	.45					
60	50	110	.83	.46					
60	52	112	.87	.46					
60	54	114	.90	.47					
60	55	115	.92	.48					
60	56	116	.93	.48					
60	57	117	.95	.49					
60	58	118	.97	.49					
60	59	119	.98	.50					
					60.5	48	108.5	.79	.44
61	-	-	-	-	61	-	-	-	-
61	-	-	-	-	61	44	105	.72	.42
61	-	-	-	-	61	45	106	.74	.43
61	-	-	-	-	61	49	110	.80	.45
61	45	106	.74	.43	61	52	113	.85	.46
61	50	111	.81	.45	61	53	114	.87	.47
61	53	114	.87	.47					

Appendix 2. (continued)

Males					Females				
Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.	Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.
61	55	116	.90	.47					
61	56	117	.92	.48					
61	58	119	.95	.49					
61	59	120	.97	.49					
61	59.5	120.5	.98	.49					
61	60	121	.98	.50					
62	-	-	-	-	62	43	105	.69	.41
62	54	116	.87	.47	62	51	113	.82	.45
62	55	117	.89	.47	62	51	113	.82	.45
62	56	118	.90	.48					
62	58	120	.94	.48					
62	59	121	.95	.49					
62	62	124	1.00	.50					
62.5	54.5	117	.87	.47					
63	-	-	-	-	63	-	-	-	-
63	59	122	.94	.48	63	-	-	-	-
63	60	123	.95	.49	63	47	110	.75	.43
63	60	123	.95	.49					
63	60	123	.95	.49					
63	60	123	.95	.49					
63.5	60	123.5	.95	.49	63.5	49	112.5	.77	.44
					64	-	-	-	-
					64	47	111	.73	.42
					64	48	112	.75	.43
					64	53	117	.83	.45
65	-	-	-	-	65	-	-	-	-
65	56	121	.86	.46	65	-	-	-	-

Appendix 2. (continued)

Males					Females				
Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.	Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.
65	58	123	.89	.47	65	47	112	.72	.42
65	60	125	.92	.48	65	50	115	.77	.44
65	61	126	.94	.48	65	52	117	.80	.44
65	62	127	.95	.49	65	53	118	.82	.45
65	62	127	.95	.49	65	53	118	.82	.45
65	62	127	.95	.49	65	57	122	.88	.47
					65.5	62	127.5	.95	.49
66	-	-	-	-	66	48	114	.74	.42
66	55	121	.83	.46	66	50	116	.76	.43
66	64	130	.97	.49	66	57	123	.86	.46
66	65	131	.99	.50	66	60	126	.91	.48
66.5	56.5	123	.85	.46	66.5	57	123.5	.86	.46
67	-	-	-	-	67	50	117	.75	.43
67	-	-	-	-	67	53	120	.79	.44
67	53	120	.79	.44	67	55	122	.82	.45
67	63	130	.94	.49					
					67.5	-	-	-	-
68	61	129	.90	.47	68	53	123	.81	.45
69	50	119	.73	.42	69	49	118	.71	.42
69	51	120	.74	.43	69	52	121	.75	.43
69	56	125	.81	.45	69	53	122	.77	.43
69	57	126	.83	.45	69	60	129	.87	.47
69	62	131	.90	.47					
70	64	134	.91	.48	70	-	-	-	-
					71	49	120	.69	.41
					71	55	126	.78	.44

Appendix 2. (continued)

Males					Females				
Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.	Body Length	Tail Length	Total Length	Tail L. / Body L.	Tail L. / Total L.
					72	59	131	.82	.45
					73	-	-	-	-
					75	63	138	.84	.46
					85	69	154	.81	.45