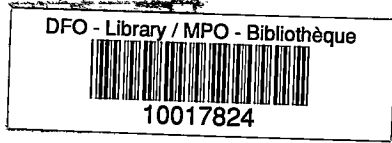




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Life History Data of the Alewife and Blueback Herring of the Saint John River New Brunswick, 1975

by
B.M. Jessop

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LIFE HISTORY DATA ON THE ALEWIFE AND
BLUEBACK HERRING OF THE SAINT JOHN RIVER,
NEW BRUNSWICK, 1975

B.M. JESSOP

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FRESHWATER AND ANADROMOUS DIVISION
RESOURCE BRANCH
FISHERIES AND MARINE SERVICE
DEPARTMENT OF FISHERIES AND THE ENVIRONMENT

HALIFAX, NOVA SCOTIA

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INTRODUCTION

A commercial fishery for gaspereau (the term refers to both the alewife, *Alosa pseudoharengus*, and the blueback herring, *A. aestivalis*) has been conducted for many years in the Saint John River, New Brunswick (Fig. 1). This fishery provided about 3.6 million kg or 66% of the total 1968-72 New Brunswick gaspereau harvest, for a mean annual value of \$298,000.

Little is known of the life history and population dynamics of gaspereau in the Saint John River, and particularly of the effects of the commercial fishery. With this in mind, a study was begun in 1973 with the following objectives: (1) establishing whether alewives and blueback herring are homogeneous populations or form distinct local populations within the river system, (2) evaluating the influence of the commercial fishery and hydroelectric development on the populations, and (3) providing a data base for the establishment and evaluation of management practices.

With modifications, this program was conducted for the three years 1973 through 1975. This report will present the tabulated data from the 1975 survey and will be followed by a final technical report, which will evaluate the data with respect to the program objectives.

METHODS

In 1975, the commercial fishery was sampled weekly during the fishing season at five sites in Fishery Districts 56 and 57: the Oromocto River, Indian and Washademoak lakes and Kennebecasis Bay (Fig. 1). Sites were located at the lower and middle regions of Washademoak Lake. The main stem of the Saint John River, where commercial fishing was not permitted, was sampled at Mactaquac Dam in District 58. At each site, 50 fish were collected in several representative scoopfuls from either the net-brail or barge into which fish were loaded in the commercial fishery, or from the brail-pool of the fishway at Mactaquac Dam.

Fork length, weight, sex, maturity and species were recorded, and a scale sample was obtained from each fish collected. Total length was recorded for a proportion of the fish. All lengths were measured to the nearest millimeter and weights to the nearest gram (by electric balance). Fork lengths were used exclusively in the data analysis. Sex and maturity were established by dissection, using Nikolsky's (1963) maturity classification; while species identification was based on body conformity and peritoneal color (Bigelow and Schroeder 1953).

Whenever possible, scales were taken from the left side of each fish, just above the lateral line and behind the posterior edge of the dorsal fin. Eight to ten scales were placed on

transparent plastic slides (Power 1964), and each sample was independently aged twice without reference to associated length or weight data. If readings differed, a third reading was made and an age assigned on the basis of majority agreement. Very few fish were unageable due either to a lack of scales, scales with regenerate centers or ageing disagreements.

Age was determined for adult fish by counting the number of annuli and spawning marks and adding a year for the scale edge (Cating 1953; March 1969). Fish under age four frequently exhibited plus (+) growth and judgement based upon capture date was used in deciding whether or not to add a year for the scale edge. Scale analysis included counting the number of transverse grooves per annulus in order to establish a criterion for locating annuli that were difficult to interpret (Cating 1953; March 1969).

RUN TIMING

Movement of mature gaspereau into the lower Saint John River, i.e., Kennebecasis and Belleisle bays (Fig. 1), may occur as early as January; but the major upstream spawning migration begins in late April, peaks in late May or early June and is completed by early August. In 1975, the start of commercial fishing varied with location, from late April to early May, depending upon ice conditions and water levels. Commercial fishing ceased in mid- to late June on the Oromocto River, Indian Lake and Kennebecasis Bay. Fishing in Washademoak Lake continued into the first week of July, because the fishermen were late closing and removing their nets following the season's end on 30 June. At Mactaquac Dam, the run began on 20 May, peaked in mid-June and ended on 21 July.

RESULTS

A total of 1,747 fish was collected from all sites between 6 May and 18 July. Sampling was distributed as follows:

Location	Sample	
	Period	Number
Kennebecasis Bay	12 May-16 Jun	300
Washademoak Lake	(lower) 22 May	50
	(middle) 8 May-2 Jul	399
Indian Lake	7 May-12 Jun	298
Oromocto River	6 May-18 Jun	250
Mactaquac Dam	23 May-18 Jul	450
Total		1,747

Conversions between fork and total lengths can be made for alewives and blueback herring respectively, by using the following G.M. regressions: (a) $Y=0.88193X + 0.00537$ and (b) $Y=0.88570X + 1.44126$, where Y =fork length and X =total length (Figs. 2 and 3).

The data have been tabulated, in various combinations, according to species, location, sex, length, weight, age, maturity and spawning history (Tables 1-23 and Figs. 4-7). Between tables, totals may not always agree due to incomplete data, i.e., unageable scales.

DISCUSSION

No analysis has been presented of the data contained in this report; that will be the purpose of a technical report. Rather, this report presents the available data in a wider variety of formats than might be used in a technical report.

TABLE 1. Mean fork lengths (mm), by sample date and location, for gaspereau¹ from the Saint John River, 1975.

Date	Kennebecasis Bay			Washademoak Lake ²			Indian Lake			Oromocto River			Mactaquac Dam		
	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD
May 4-10	0	—	—	50	257.6	13.55	48	261.0	15.28	50	266.5	14.35	0	—	—
May 11-17	50	255.1	17.05	50	256.6	14.54	50	262.3	16.55	50	264.5	13.84	0	—	—
May 18-24	50	257.6	24.10	50	251.6	18.48	50	256.5	12.00	50	269.2	14.37	50	279.3	9.89
May 25-31	50	243.0	14.12	49	247.9	20.84	50	249.7	18.11	50	256.8	15.06	50	268.7	16.10
Jun 1-7	50	240.2	16.00	50	208.9	25.08	50	240.9	20.99	0	—	—	50	255.0	16.75
Jun 8-14	50	228.7	20.10	50	219.1	22.97	50	249.5	12.80	50	242.3	29.12	50	259.4	21.15
Jun 15-21	50	225.2	14.64	50	222.0	21.24	0	—	—	0	—	—	50	257.1	17.63
Jun 22-28	0	—	—	50	214.2	19.43	0	—	—	0	—	—	50	241.5	19.14
Jun 29-Jul 5	0	—	—	50	220.6	22.84	0	—	—	0	—	—	50	233.0	18.68
Jul 6-12	0	—	—	0	—	—	0	—	—	0	—	—	50	229.3	19.87
Jul 13-19	0	—	—	0	—	—	0	—	—	0	—	—	50	229.4	18.08
Totals	300	241.6	21.58	449	233.1	27.40	298	253.3	17.75	250	259.8	20.62	450	250.3	24.44

¹Gaspereau includes both alewives and blueback herring.

²Middle and lower sampling sites included.

TABLE 2. Mean fork lengths (mm), by sample date and location, for alewives from the Saint John River, 1975.

Date	Kennebecasis Bay			Washademoak Lake ¹			Indian Lake			Oromocto River			Mactaquac Dam		
	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD
May 4-10	0	—	—	50	257.6	13.55	48	261.0	15.28	50	266.5	14.35	0	—	—
May 11-17	50	255.1	17.05	50	256.6	14.54	50	262.3	16.55	50	264.5	13.84	0	—	—
May 18-24	34	262.0	23.67	46	253.3	18.21	49	256.9	11.71	50	269.2	14.37	50	279.3	9.89
May 25-31	0	—	—	32	257.9	18.38	42	253.5	17.00	49	257.4	14.58	49	269.6	14.91
Jun 1-7	0	—	—	31	206.2	29.39	40	244.9	20.48	41	247.9	28.44	48	255.0	17.09
Jun 8-14	0	—	—	32	218.9	26.64	43	251.2	12.10	0	—	—	48	260.4	20.95
Jun 15-21	0	—	—	18	226.6	32.03	0	—	—	0	—	—	50	257.1	17.63
Jun 22-28	0	—	—	11	215.2	28.40	0	—	—	0	—	—	39	245.1	17.41
Jun 29-Jul 5	0	—	—	24	228.6	23.28	0	—	—	0	—	—	6	240.7	13.47
Jul 6-12	0	—	—	0	—	—	0	—	—	0	—	—	2	240.0	26.87
Jul 13-19	0	—	—	0	—	—	0	—	—	0	—	—	0	—	—
Totals	84	257.9	20.15	294	241.3	28.67	272	255.4	16.60	240	261.6	18.88	292	261.1	19.83

¹Middle and lower sampling sites included.

TABLE 3. Length-frequency distributions of mature alewives, by sex and location, Saint John River, 1975.

Fork length (mm)	Kennebecasis Bay				Washademoak Lake				Indian Lake				Oromocto River				Mactaquac Dam				Summary			
	Male		Female		Male ¹		Female ²		Male ³		Female		Male ⁴		Female		Male ⁵		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
190-199	0	—	0	—	11	7.0	4	3.2	0	—	0	—	1	0.8	0	—	0	—	0	—	12	1.8	4	0.8
200-209	0	—	0	—	11	7.0	5	4.0	0	—	0	—	2	1.5	0	—	0	—	1	0.8	13	2.0	6	1.2
210-219	0	—	0	—	8	5.1	2	1.6	0	—	0	—	2	1.5	2	1.9	2	1.2	0	—	12	1.8	4	0.8
220-229	0	—	0	—	13	8.2	2	1.6	2	1.3	2	1.7	1	0.8	0	—	8	4.9	1	0.8	24	3.6	5	1.0
230-239	9	16.4	2	6.9	35	22.2	6	4.8	31	20.0	8	6.8	10	7.5	1	0.9	22	13.6	8	6.2	107	16.2	25	5.0
240-249	13	23.6	9	31.0	33	20.9	16	12.8	40	25.8	21	18.0	18	13.5	8	7.6	32	19.8	11	8.5	136	20.6	65	12.9
250-259	13	23.6	6	20.7	22	13.9	31	24.8	33	21.3	30	25.6	27	20.3	13	12.3	14	8.6	20	15.4	109	16.5	100	19.9
260-269	11	20.0	1	3.5	12	7.6	24	19.2	18	11.6	25	21.4	41	30.8	28	26.4	38	23.5	16	12.3	120	18.2	94	18.7
270-279	5	9.1	2	6.9	11	7.0	11	8.8	25	16.1	14	12.0	21	15.8	28	26.4	33	20.4	30	23.1	95	14.4	85	16.9
280-289	2	3.6	3	10.3	1	0.6	16	12.8	3	1.9	12	10.3	8	6.0	21	19.8	10	6.2	29	22.3	24	3.6	81	16.1
290-299	1	1.8	3	10.3	0	—	3	2.4	2	1.3	3	2.6	1	0.8	5	4.7	2	1.2	13	10.0	6	0.9	27	5.4
300-309	1	1.8	1	3.5	0	—	1	0.8	0	—	2	1.7	0	—	0	—	0	—	1	0.8	1	0.2	5	1.0
310-319	0	—	2	6.9	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0	—	2	0.4
Totals	55		29		157		121		154		117		132		106		161		130		659		503	

¹One fish was recorded in the 160-169 mm interval.

²Four fish were recorded in the 170-179 mm interval.

³One fish was recorded in the 180-189 mm interval.

⁴One fish was recorded in the 170-179 mm interval.

⁵One fish was recorded in the 160-619 mm interval.

TABLE 4. Length-frequency distributions of immature alewives, by location, Saint John River, 1975.

Fork length (mm)	Kennebecasis Bay		Washademoak Lake		Indian Lake		Oromocto River		Mactaquac Dam		Summary	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
140-149	0	—	1	9.1	0	—	0	—	0	—	1	8.3
150-159	0	—	1	9.1	0	—	0	—	0	—	1	8.3
160-169	0	—	3	27.3	0	—	1	100.0	0	—	4	33.3
170-179	0	—	3	27.3	0	—	0	—	0	—	3	25.0
180-189	0	—	0	—	0	—	0	—	0	—	0	—
190-199	0	—	3	27.3	0	—	0	—	0	—	3	25.0
Totals	0		11		0		1		0		12	

TABLE 5. Observed length-frequency of alewives, by age-groups, sexes and locations combined, Saint John River, 1975.

Fork length (mm)	Age - group								Total
	2	3	4	5	6	7	8	9	
140-149	1								1
150-159	1								1
160-169	4								4
170-179	3	4							7
180-189	1	0							1
190-199		17	1						18
200-209		14	3	1	1				19
210-219		7	7	2	0				16
220-229		1	23	3	1				28
230-239			107	22	0				129
240-249			125	67	5	1			198
250-259			51	125	31	1			208
260-269			9	96	99	6	1		211
270-279			1	54	91	26	3		175
280-289				22	48	26	5		101
290-299				3	10	17	1		31
300-309					1	2	2	1	6
310-319								2	2
Total	10	43	327	395	287	79	12	3	1,156
Percent	0.9	3.7	28.3	34.2	24.8	6.8	1.0	0.3	

TABLE 6-1. Mean fork lengths (mm) of alewives, by sex and age, Kennebecasis Bay, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Length		SD	No. of fish	Length		SD
		Mean	Range			Mean	Range	
4	19	241.8	231-252	6.53	11	243.2	235-253	5.67
5	17	252.3	230-294	13.39	5	249.4	242-265	9.76
6	13	268.8	254-281	7.36	7	278.9	252-303	19.30
7	3	273.7	268-285	9.83	3	289.0	284-297	7.00
8	2	280.5	260-301	28.99	0	—	—	—
9	0	—	—	—	2	318.0	—	—

TABLE 6-2. Mean fork lengths (mm) of alewives, by sex and age, Washademoak Lake, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Length		SD	No. of fish	Length		SD
		Mean	Range			Mean	Range	
2	1	165.0	—	—	0	—	—	—
3	22	201.6	194-214	6.34	12	191.6	170-213	15.41
4	61	233.1	198-258	12.28	29	238.6	202-254	13.59
5	51	249.4	207-275	12.33	44	260.0	242-285	10.37
6	17	264.1	242-281	10.41	30	270.4	246-289	10.62
7	3	261.0	248-272	12.12	7	284.1	267-290	8.32
8	0	—	—	—	2	291.5	281-302	14.85

TABLE 6-3. Mean fork lengths (mm) of alewives, by sex and age, Indian Lake, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Length		SD	No. of fish	Length		SD
		Mean	Range			Mean	Range	
2	1	183.0	—	—	0	—	—	—
3	0	—	—	—	0	—	—	—
4	69	241.6	229-271	8.45	37	247.8	223-268	10.15
5	45	255.2	222-282	13.12	52	259.8	235-290	13.24
6	34	266.9	248-294	9.65	22	274.2	256-293	11.18
7	3	279.3	272-294	12.71	5	284.6	273-304	12.61
8	1	271.0	—	—	0	—	—	—
9	0	—	—	—	1	302.0	—	—

TABLE 6-4. Mean fork lengths (mm) of alewives, by sex and age, Oromocto River, 1975.

Age	No. of fish	M a l e			SD	No. of fish	F e m a l e		
		Length		SD			Length		SD
		Mean	Range				Mean	Range	
2	1	176.0	—	—	0	—	—	—	
3	6	209.0	199-226	9.76	0	—	—	—	
4	25	242.0	232-260	6.59	9	245.7	215-260	13.51	
5	59	260.4	236-283	10.12	53	264.7	210-287	13.60	
6	36	269.2	252-282	7.35	40	276.1	256-299	10.06	
7	4	280.3	275-290	7.09	3	290.3	283-296	6.67	

TABLE 6-5. Mean fork lengths (mm) of alewives, by sex and age, Mactaquac Dam, 1975.

Age	No. of fish	M a l e			SD	No. of fish	F e m a l e		
		Length		SD			Length		SD
		Mean	Range				Mean	Range	
4	47	237.3	214-247	7.62	20	243.1	225-255	8.70	
5	33	251.8	215-283	14.72	36	262.1	231-295	14.56	
6	55	264.6	168-286	16.40	34	272.2	200-297	17.04	
7	18	275.2	252-295	9.12	30	283.8	260-301	8.14	
8	4	279.5	270-288	7.77	3	288.7	282-296	7.04	

TABLE 7. Summary of mean fork lengths (mm) of alewives, by sex, age and location, Saint John River, 1975.

Age	<u>Kennebecasis Bay</u>		<u>Washademoak Lake</u>		<u>Indian Lake</u>		<u>Oromocto River</u>		<u>Mactaquac Dam</u>	
	Mean length	No. of fish	Mean length	No. of fish	Mean length	No. of fish	Mean length	No. of fish	Mean length	No. of fish
<u>Male</u>										
2	—	0	165.0	1	183.0	1	176.0	1	—	0
3	—	0	201.6	22	—	0	209.0	6	—	0
4	241.8	19	233.1	61	241.6	69	242.0	25	237.3	47
5	252.3	17	249.4	51	255.2	45	260.4	59	251.8	33
6	268.8	13	264.1	17	266.9	34	269.2	36	264.6	55
7	273.7	3	261.0	3	279.3	3	280.3	4	275.2	18
8	280.5	2	—	0	271.0	1	—	0	279.5	4
<u>Female</u>										
3	—	0	191.6	12	—	0	—	0	—	0
4	243.2	11	238.6	29	247.8	37	245.7	9	243.1	20
5	249.4	5	260.0	44	259.8	52	264.7	53	262.1	36
6	278.9	7	270.4	30	274.2	22	276.1	40	272.2	34
7	289.0	3	284.1	7	284.6	5	290.3	3	283.8	30
8	—	0	291.5	2	—	0	—	0	288.7	3
9	318.0	2	—	0	302.0	1	—	0	—	0

TABLE 8-1. Mean weights (g) of alewives, by sex and age, Kennebecasis Bay 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
4	19	202.5	166-312	33.65	11	201.7	160-229	21.77
5	17	211.7	176-263	24.29	5	219.6	195-237	18.70
6	13	257.5	217-308	29.60	7	301.1	196-418	86.72
7	3	269.3	246-312	37.01	3	313.0	204-425	110.53
8	2	283.0	237-329	65.05	0	—	—	—
9	0	—	—	—	2	412.0	405-419	9.90

TABLE 8-2. Mean weights (g) of alewives, by sex and age, Washademoak Lake, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
2	1	60.0	—	—	0	—	—	—
3	22	112.7	84-153	16.04	12	98.3	58-145	28.39
4	61	176.0	80-286	33.69	29	188.2	110-239	34.83
5	51	219.5	129-404	45.62	44	255.5	197-362	39.67
6	17	247.3	178-315	29.13	30	272.6	194-352	44.32
7	3	234.7	169-287	60.12	7	297.9	182-419	77.73
8	0	—	—	—	2	279.0	246-312	46.67

TABLE 8-3. Mean weights (g) of alewives, by sex and age, Indian Lake, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
2	1	88.0	—	—	0	—	—	—
3	0	—	—	—	0	—	—	—
4	69	186.1	144-308	28.48	37	205.9	142-296	33.57
5	45	217.2	158-323	38.49	52	233.3	156-364	45.53
6	34	242.3	195-373	35.66	22	264.7	193-369	50.25
7	3	261.7	227-302	37.82	5	278.8	244-321	32.62
8	1	313.0	—	—	0	—	—	—
9	0	—	—	—	1	326.0	—	—

TABLE 8-4. Mean weights (g) of alewives, by sex and age, Oromocto River, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
2	1	70.0	—	—	0	—	—	—
3	6	116.0	96-139	16.57	0	—	—	—
4	25	190.2	153-239	21.43	9	221.0	188-263	24.35
5	59	229.1	157-307	33.14	53	253.3	117-341	50.15
6	36	256.1	201-315	29.73	40	285.3	203-405	41.54
7	4	282.0	243-315	32.69	3	274.3	246-309	31.98

TABLE 8-5. Mean weights (g) of alewives, by sex and age, Mactaquac Dam, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
4	47	177.5	114-296	27.29	20	198.7	146-290	32.33
5	33	211.2	116-283	35.04	36	264.3	192-370	44.82
6	55	255.2	143-313	30.92	34	300.5	206-409	50.68
7	18	284.6	185-346	35.89	30	337.7	259-409	39.69
8	4	284.0	248-305	26.85	3	361.3	340-393	27.97

TABLE 9. Summary of mean weights (g) of alewives, by sex, age and location, Saint John River, 1975.

Age	<u>Kennebecasis Bay</u>		<u>Washademoak Lake</u>		<u>Indian Lake</u>		<u>Oromocto River</u>		<u>Mactaquac Dam</u>	
	Mean weight	No. of fish	Mean weight	No. of fish	Mean weight	No. of fish	Mean weight	No. of fish	Mean weight	No. of fish
<u>Male</u>										
2	—	0	60.0	1	88.0	1	70.0	1	—	0
3	—	0	112.7	22	—	0	116.0	6	—	0
4	202.5	19	176.0	61	186.1	69	190.2	25	177.5	47
5	211.7	17	219.5	51	217.2	45	229.1	59	211.2	33
6	257.5	13	247.3	17	242.3	34	256.1	36	255.2	55
7	269.3	3	234.7	3	261.7	3	282.0	4	284.6	18
8	283.0	2	—	0	313.0	1	—	0	284.0	4
<u>Female</u>										
3	—	0	98.3	12	—	0	—	0	—	0
4	201.7	11	188.2	29	205.9	37	221.0	9	198.7	20
5	219.6	5	255.5	44	233.3	52	253.3	53	264.3	36
6	301.1	7	272.6	30	264.7	22	285.3	40	300.5	34
7	313.0	3	297.9	7	278.8	5	274.3	3	337.7	30
8	—	0	279.0	2	—	0	—	0	361.3	3
9	412.0	2	—	0	326.0	1	—	0	—	0

TABLE 10. Spawning history of alewives, by sex and location, Saint John River, 1975.

No. previous spawnings	<u>Kennebecasis Bay</u>			<u>Washademoak Lake</u>			<u>Indian Lake</u>			<u>Oromocto River</u>			<u>Mactaquac Dam</u>		
	No.	%	Mean age	No.	%	Mean age	No.	%	Mean age	No.	%	Mean age	No.	%	Mean age
<u>Male</u>															
0	22	40.7	4.3	72	45.9	3.8	73	47.7	4.2	39	29.8	4.2	42	26.8	4.3
1	20	37.0	5.2	74	47.1	4.8	58	37.9	5.1	63	48.1	5.1	47	29.9	4.9
2	8	14.8	6.0	8	5.1	5.8	18	11.8	6.0	22	16.8	5.8	46	29.3	6.1
3	4	7.4	7.5	3	1.9	6.7	4	2.6	6.8	7	5.3	6.4	20	12.7	6.9
4	0	—	—	0	—	—	0	—	—	0	—	—	2	1.3	7.5
5	0	—	—	0	—	—	0	—	—	0	—	—	0	—	—
Totals	54			157			153			131			157		
% repeat spawners		59.3			54.1			52.3			70.2			73.3	
<u>Female</u>															
0	9	31.0	4.0	59	46.1	4.1	38	32.5	4.5	31	29.2	4.8	28	22.8	4.5
1	10	35.7	5.2	45	35.2	5.2	60	51.3	4.9	55	51.9	5.4	36	29.3	5.1
2	6	21.4	6.2	18	14.1	6.1	16	13.7	6.0	16	15.1	5.9	33	26.8	6.3
3	1	3.6	7.0	5	3.9	7.0	2	1.7	7.0	4	3.8	6.5	24	19.5	7.0
4	1	3.6	9.0	1	0.8	8.0	0	—	—	0	—	—	2	1.6	7.5
5	1	3.6	9.0	0	—	—	1	0.9	9.0	0	—	—	0	—	—
Totals	28			128			117			106			123		
% repeat spawners		67.9			53.9			67.5			70.8			77.2	
<u>Sexes combined</u>															
% repeat spawners		62.2			54.0			58.9			70.5			75.0	

TABLE 11-1. Mean fork length (mm) and weight (g) of alewives, by sex and age, in relation to spawning history, Kennebecasis Bay, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
4	0	17	31.5	241.7	6.68	201.7	35.59
4	1	2	3.7	243.0	7.07	209.0	4.24
5	0	4	7.4	248.8	6.29	212.3	24.05
5	1	12	22.2	252.7	15.39	208.8	24.42
5	2	1	1.9	262.0	—	244.0	—
6	0	1	1.9	261.0	—	245.0	—
6	1	6	11.1	272.2	3.54	264.0	28.30
6	2	6	11.1	266.7	9.27	253.0	34.58
7	2	1	1.9	268.0	—	250.0	—
7	3	2	3.7	276.5	12.02	279.0	46.67
8	3	2	3.7	280.5	29.00	283.0	65.05
<u>Female</u>							
4	0	9	32.1	243.4	6.23	204.6	20.27
4	1	2	7.1	242.0	2.83	189.0	32.53
5	1	5	17.9	249.4	9.76	219.6	18.70
6	1	2	7.1	298.0	7.07	414.5	4.95
6	2	5	17.9	271.2	17.02	255.8	47.74
7	1	1	3.6	284.0	—	204.0	—
7	2	1	3.6	286.0	—	310.0	—
7	3	1	3.6	297.0	—	425.0	—
9	4	1	3.6	318.0	—	405.0	—
9	5	1	3.6	318.0	—	419.0	—

TABLE 11-2. Mean fork length (mm) and weight (g) of alewives, by sex and age, in relation to spawning history, Washademoak Lake, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
2	0	3	1.9	154.7	8.96	47.7	10.79
3	0	22	14.0	201.6	6.34	112.7	16.04
4	0	34	21.7	234.6	10.34	180.4	33.48
4	1	27	17.2	231.2	14.35	170.5	33.77
5	0	12	7.6	255.8	11.61	225.1	43.22
5	1	36	22.9	246.6	11.65	215.4	47.77
5	2	3	1.9	257.0	14.53	246.0	16.70
6	0	1	0.6	270.0	—	268.0	—
6	1	11	7.0	263.9	10.23	250.5	27.92
6	2	4	2.6	268.5	5.26	250.8	11.53
6	3	1	0.6	242.0	—	178.0	—
7	2	1	0.6	263.0	—	248.0	—
7	3	2	1.3	260.0	16.97	228.0	83.44
<u>Female</u>							
2	0	3	2.3	172.0	2.65	65.3	5.77
3	0	13	10.2	191.5	14.76	97.4	27.39
4	0	21	16.4	236.3	13.80	187.0	37.64
4	1	8	6.3	244.6	11.72	191.4	28.10
5	0	20	15.6	259.0	8.37	254.8	38.68
5	1	23	18.0	261.2	12.01	255.7	42.20
5	2	1	0.8	252.0	—	263.0	—
6	0	2	1.6	258.5	3.54	213.5	27.58
6	1	13	10.2	270.7	13.05	270.2	52.51
6	2	14	10.9	270.6	6.69	279.4	30.68
6	3	1	0.8	289.0	—	329.0	—
7	1	1	0.8	287.0	—	347.0	—
7	2	3	2.3	285.0	4.58	256.0	80.07
7	3	3	2.3	282.3	13.28	323.3	83.10
8	3	1	0.8	281.0	—	246.0	—
8	4	1	0.8	302.0	—	312.0	—

TABLE 11-3. Mean fork length (mm) and weight (g) of alewives, by sex and age, in relation to spawning history, Indian Lake, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
2	0	1	0.7	183.0	—	88.0	—
4	0	57	37.3	241.4	8.44	185.6	29.08
4	1	12	7.8	242.7	8.77	188.3	26.47
5	0	12	7.8	258.3	10.98	231.2	41.59
5	1	31	20.3	253.7	14.00	211.2	37.63
5	2	2	1.3	260.5	10.61	227.0	4.24
6	0	3	2.0	265.0	13.23	234.3	37.53
6	1	15	9.8	270.7	9.28	250.9	42.46
6	2	14	9.2	264.4	9.02	235.9	28.84
6	3	2	1.3	260.0	7.07	234.5	33.23
7	2	2	1.3	283.0	15.56	241.5	20.51
7	3	1	0.7	272.0	—	302.0	—
8	3	1	0.7	271.0	—	313.0	—
<u>Female</u>							
4	0	22	18.8	249.3	10.00	211.4	33.44
4	1	15	12.8	245.6	10.31	197.8	33.20
5	0	14	12.0	260.1	11.85	234.7	43.68
5	1	35	29.9	258.6	13.11	228.8	44.31
5	2	3	2.6	272.0	19.47	278.3	60.47
6	0	2	1.7	272.0	14.14	236.0	26.87
6	1	10	8.6	274.8	11.96	271.2	50.06
6	2	10	8.6	274.0	11.17	264.0	55.44
7	2	3	2.6	276.3	3.51	262.3	28.36
7	3	2	1.7	297.0	9.90	303.5	24.75
9	5	1	0.9	302.0	—	326.0	—

TABLE 11-4. Mean fork length (mm) and weight of alewives, by sex and age, in relation to spawning history, Oromocto River, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
2	0	1	0.8	176.0	—	70.0	—
3	0	6	4.6	209.0	9.76	116.0	16.57
4	0	16	12.2	241.1	6.35	192.0	21.69
4	1	9	6.9	243.7	7.05	187.1	21.87
5	0	15	11.5	263.3	9.36	241.3	24.68
5	1	39	29.8	259.9	10.35	226.5	36.37
5	2	5	3.8	256.0	9.97	213.0	16.66
6	0	1	0.8	264.0	—	267.0	—
6	1	15	11.5	269.7	6.44	250.7	28.68
6	2	16	12.2	269.1	7.49	258.1	29.22
6	3	4	3.1	269.0	12.03	265.8	43.28
7	2	1	0.8	290.0	—	243.0	—
7	3	3	2.3	277.0	3.46	295.0	24.27
<u>Female</u>							
2	0	1	0.9	165.0	—	55.0	—
4	0	7	6.6	246.9	15.14	226.9	23.63
4	1	2	1.9	241.5	6.36	200.5	17.68
5	0	20	18.9	262.9	8.61	249.2	47.19
5	1	32	30.2	265.9	16.16	257.3	52.55
5	2	1	0.9	263.0	—	208.0	—
6	0	3	2.8	284.0	3.61	317.3	14.98
6	1	20	18.9	272.1	9.90	275.6	40.25
6	2	15	14.2	280.3	9.43	297.7	40.24
6	3	2	1.9	272.5	2.12	240.5	45.96
7	1	1	0.9	283.0	—	268.0	—
7	3	2	1.9	294.0	2.83	277.5	44.55

TABLE 11-5. Mean fork length (mm) and weight (g) of alewives, by sex and age, in relation to spawning history, Mactaquac Dam, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
4	0	30	19.1	238.6	6.97	181.6	30.66
4	1	17	10.8	234.9	8.35	170.3	18.72
5	0	11	7.0	252.0	13.46	210.7	19.52
5	1	20	12.7	253.8	13.86	217.0	36.67
5	2	2	1.3	230.5	21.92	156.5	57.28
6	0	1	0.6	262.0	—	252.0	—
6	1	10	6.3	270.9	7.50	257.2	25.89
6	2	39	24.8	263.8	17.70	255.9	27.61
6	3	5	3.2	258.8	19.40	246.0	63.47
7	2	5	3.2	280.8	9.04	302.6	36.20
7	3	12	7.6	272.5	8.66	277.1	36.12
7	4	1	0.6	279.0	—	284.0	—
8	3	3	1.9	282.7	5.51	296.0	14.73
8	4	1	0.6	270.0	—	248.0	—
<u>Female</u>							
4	0	13	10.6	244.2	7.59	203.6	31.43
4	1	7	5.7	241.1	10.84	189.4	34.36
5	0	15	12.2	256.8	12.17	255.8	44.68
5	1	20	16.3	265.6	15.57	269.5	46.00
5	2	1	0.8	270.0	—	287.0	—
6	1	9	7.3	273.0	10.46	291.6	51.09
6	2	22	17.9	271.4	19.90	304.6	52.82
6	3	3	2.4	275.3	13.01	297.7	45.74
7	2	10	8.1	287.2	8.22	347.0	37.15
7	3	19	15.5	281.6	7.70	332.2	41.95
7	4	1	0.8	290.0	—	350.0	—
8	3	2	1.6	285.0	4.24	345.5	7.78
8	4	1	0.8	296.0	—	393.0	—

TABLE 12. Age at first spawning (maturity) for alewives, by sex and location, Saint John River, 1975.

Age at first spawning	Kennebecasis Bay				Washademoak Lake				Indian Lake				Oromocto River				Mactaguac Dam				Summary			
	Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
2	0	—	0	—	1	0.7	0	—	1	0.7	0	—	1	0.8	0	—	0	—	0	—	3	0.5	0	—
3	5	9.3	5	17.9	56	36.1	27	21.8	23	15.0	23	19.7	30	22.9	8	7.6	28	17.8	14	11.4	142	21.9	77	15.5
4	35	64.8	19	67.9	73	47.1	59	47.6	97	63.4	65	55.6	69	52.7	54	51.4	100	63.7	74	60.2	374	57.5	271	54.5
5	13	24.1	3	10.7	24	15.5	35	28.2	29	19.0	27	23.1	30	22.9	39	37.1	28	17.8	35	28.5	124	19.1	139	28.0
6	1	1.9	1	3.6	1	0.7	3	2.4	3	2.0	2	1.7	1	0.8	4	3.8	1	0.6	0	—	7	1.1	10	2.0
Totals	54		28		155		124		153		117		131		105		157		123		650		497	
Mean age	4.19		4.00		3.79		4.11		4.07		4.07		4.00		4.37		4.01		4.17		3.98		4.16	
SD	0.62		0.67		0.73		0.77		0.67		0.70		0.72		0.68		0.62		0.61		0.62		0.67	
Between sexes significance (p<0.05)	n.s. ¹				**				n.s.				**				n.s.				**			

¹n.s. is non-significant.

TABLE 13. Mean fork lengths (mm), by sample date and location, for blueback herring from the Saint John River, 1975.

Date	Kennebecasis Bay			Washademoak Lake ¹			Indian Lake			Oromocto River			Mactaquac Dam		
	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD	n	Mean length	SD
May 18-24	16	248.3	23.01	4	232.5	8.66	1	235.0	—	0	—	—	0	—	—
May 25-31	50	243.0	14.12	17	228.9	8.07	8	229.8	7.83	1	227.0	—	1	224.0	—
Jun 1-7	50	240.2	16.00	19	213.3	15.45	10	224.9	14.97	0	—	—	2	255.0	4.24
Jun 8-14	50	228.7	20.10	18	219.6	15.03	7	239.6	13.39	0	—	—	2	234.5	3.54
Jun 15-21	50	225.2	14.64	32	219.4	11.48	0	—	—	9	216.6	15.54	0	—	—
Jun 22-28	0	—	—	39	213.9	16.56	0	—	—	0	—	—	11	228.7	20.34
Jun 29-Jul 5	0	—	—	26	213.3	20.14	0	—	—	0	—	—	44	232.0	19.16
Jul 6-12	0	—	—	0	—	—	0	—	—	0	—	—	48	228.8	19.78
Jul 13-19	0	—	—	0	—	—	0	—	—	0	—	—	50	229.4	18.08
Totals	216	235.3	18.65	155	217.7	15.85	26	230.7	13.32	10	217.6	15.02	158	230.3	18.88

¹Middle and lower sampling sites included.

TABLE 14. Length-frequency distributions of mature blueback herring, by sex and location, Saint John River, 1975¹.

Fork length (mm)	Kennebecasis Bay				Washademoak Lake				Indian Lake				Oromocto River				Mactaquac Dam				Summary			
	Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
170-179	0	-	0	-	1	1.3	0	-	0	-	0	-	0	-	0	-	1	1.2	0	-	2	0.7	0	-
180-189	2	1.6	1	1.1	5	6.6	2	2.5	0	-	0	-	1	16.7	0	-	1	1.2	0	-	9	3.0	3	1.1
190-199	3	2.4	0	-	8	10.5	5	6.3	0	-	0	-	0	-	0	-	9	11.0	1	1.3	20	6.7	6	2.3
200-209	3	2.4	1	1.1	15	19.7	6	7.6	2	20.0	0	-	1	16.7	1	25.0	7	8.5	3	4.0	28	9.3	11	4.2
210-219	14	11.1	8	9.1	18	23.7	16	20.3	0	-	1	6.3	2	33.3	0	-	15	18.3	5	6.6	49	16.3	30	11.4
220-229	33	26.2	10	11.4	19	25.0	27	34.2	1	10.0	6	37.5	2	33.3	2	50.0	13	15.9	13	17.1	68	22.7	58	22.1
230-239	35	27.8	17	19.3	7	9.2	15	19.0	5	50.0	5	31.3	0	-	0	-	23	28.1	16	21.1	70	23.3	53	20.2
240-249	21	16.7	22	25.0	3	4.0	5	6.3	2	20.0	3	18.8	0	-	1	25.0	11	13.4	17	22.4	37	12.3	48	18.3
250-259	10	7.9	14	15.9	0	-	1	1.3	0	-	0	-	0	-	0	-	1	1.2	14	18.4	11	3.7	29	11.0
260-269	3	2.4	6	6.8	0	-	2	2.5	0	-	1	6.3	0	-	0	-	1	1.2	6	7.9	4	1.3	15	5.7
270-279	1	0.8	4	4.6	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	1.3	1	0.3	5	1.9
280-289	1	0.8	5	5.7	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	0.3	5	1.9
Totals	126		88		76		79		10		16		6		4		82		76		300		263	

¹One immature fish in the 160-169 mm interval was taken in Kennebecasis Bay; no other immature fish were taken.

TABLE 15. Observed length-frequency of blueback herring, by age-groups, sexes and locations combined, Saint John River, 1975.

Fork length (mm)	Age - group									Total
	2	3	4	5	6	7	8	9	10	
160-169	1									1
170-179		2								2
180-189		12								12
190-199		18	7	1						26
200-209		7	30	2						39
210-219		3	50	19	6					78
220-229			42	46	24	9	2			123
230-239			18	29	50	20	5			122
240-249			4	12	39	19	5	1		80
250-259				1	15	14	4	3		37
260-269				2	5	5	3	4		19
270-279					1		3	1	1	6
280-289							2	2	2	6
Total	1	42	151	112	140	67	24	11	3	551
Percent	0.2	7.6	27.4	20.3	25.4	12.2	4.4	2.0	0.5	

TABLE 16-1. Mean fork lengths (mm) of blueback herring, by sex and age, Kennebecasis Bay, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Mean Length	Range	SD	No. of fish	Mean Length	Range	SD
3	5	189.2	183-192	3.70	1	188.0	—	—
4	10	213.9	203-234	8.60	7	218.3	215-229	4.89
5	13	224.2	212-243	9.30	20	230.2	204-269	14.68
6	44	229.1	210-250	9.24	30	241.1	222-253	6.45
7	32	237.8	221-269	11.11	13	247.8	234-260	8.01
8	11	241.9	234-260	7.64	9	267.1	249-285	12.93
9	6	261.5	247-285	15.55	5	265.8	256-284	11.06
10	0	—	—	—	3	278.0	270-284	7.21

TABLE 16-2. Mean fork lengths (mm) of blueback herring, by sex and age, Washademoak Lake, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Mean Length	Range	SD	No. of fish	Mean Length	Range	SD
3	13	191.4	173-210	9.83	8	198.1	180-213	12.25
4	39	213.2	197-234	9.01	36	217.8	191-237	11.30
5	16	221.8	197-241	10.86	24	228.8	210-242	8.51
6	6	229.0	220-241	7.62	5	241.4	223-260	15.63
7	2	238.5	235-242	4.95	3	238.3	230-245	7.64
8	0	—	—	—	1	264.0	—	—

TABLE 16-3. Mean fork lengths (mm) of blueback herring, by sex and age, Indian Lake, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Mean Length	Range	SD	No. of fish	Mean Length	Range	SD
4	4	217.0	200-235	18.57	6	226.0	220-240	7.51
5	3	231.7	221-240	9.71	8	232.9	216-245	9.82
6	2	241.0	238-244	4.24	2	250.0	237-263	18.39

TABLE 16-4. Mean fork lengths (mm) of blueback herring, by sex and age, Oromocto River, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Length		SD	No. of fish	Length		SD
		Mean	Range			Mean	Range	
3	1	187.0	—	—	0	—	—	—
4	1	207.0	—	—	2	223.5	206-241	24.75
5	3	220.0	214-227	6.56	2	223.0	221-225	2.83
6	0	—	—	—	0	—	—	—
7	0	—	—	—	0	—	—	—
8	1	229.0	—	—	0	—	—	—

TABLE 16-5. Mean fork lengths (mm) of blueback herring, by sex and age, Mactaquac Dam, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Length		SD	No. of fish	Length		SD
		Mean	Range			Mean	Range	
3	12	194.1	176-206	8.35	2	200.0	197-203	4.24
4	24	217.1	197-240	11.02	21	222.9	201-243	10.58
5	9	219.8	210-230	6.22	14	235.4	213-264	12.26
6	27	236.0	217-263	9.44	24	249.4	237-278	9.61
7	9	238.8	232-246	4.74	8	254.3	235-268	10.40
8	0	—	—	—	2	240.0	223-257	24.04

TABLE 17. Summary of mean fork lengths (mm) of blueback herring, by sex, age and location, Saint John River, 1975.

Age	Kennebecasis Bay		Washademoak Lake		Indian Lake		Oromocto River		Mactaquac Dam	
	Mean length	No. of fish	Mean length	No. of fish	Mean length	No. of fish	Mean length	No. of fish	Mean length	No. of fish
<u>Male</u>										
3	189.2	5	191.4	13	—	0	187.0	1	194.1	12
4	213.9	10	213.2	39	217.0	4	207.0	1	217.1	24
5	224.2	13	221.8	16	231.7	3	220.0	3	219.8	9
6	229.1	44	229.0	6	241.0	2	—	0	236.0	27
7	237.8	32	238.5	2	—	0	—	0	238.8	9
8	241.9	11	—	0	—	0	229.0	1	—	0
9	261.5	6	—	0	—	0	—	0	—	0
<u>Female</u>										
3	188.0	1	191.8	8	—	0	—	0	200.0	2
4	218.3	7	217.8	36	226.0	6	223.5	2	222.9	21
5	230.2	20	228.8	24	232.9	8	223.0	2	235.4	14
6	241.1	30	241.4	5	250.0	2	—	0	249.4	24
7	247.8	13	238.3	3	—	0	—	0	254.3	8
8	267.1	9	264.0	1	—	0	—	0	240.0	2
9	265.8	5	—	0	—	0	—	0	—	0
10	278.0	3	—	0	—	0	—	0	—	0

TABLE 18-1. Mean weights (g) of blueback herring, by sex and age, Kennebecasis Bay, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
3	5	78.4	70-87	7.30	1	76.0	—	—
4	10	116.3	90-162	20.05	7	124.0	109-140	12.57
5	13	144.9	119-188	22.05	20	152.6	114-219	26.66
6	44	151.9	106-218	23.30	30	186.4	120-228	26.67
7	32	174.2	121-244	33.41	13	201.2	157-247	29.19
8	11	201.1	147-273	36.20	9	249.2	185-294	37.56
9	6	252.7	193-349	55.20	5	258.4	221-345	51.19
10	0	—	—	—	3	302.0	243-352	55.06

TABLE 18-2. Mean weights (g) of blueback herring, by sex and age, Washademoak Lake, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
3	13	84.5	65-119	13.85	8	95.0	67-117	13.10
4	39	121.9	87-173	20.85	36	136.5	97-190	8.92
5	16	137.5	94-186	27.73	24	154.8	120-197	10.20
6	6	149.5	134-179	16.78	5	177.4	145-199	20.60
7	2	149.5	146-153	4.95	3	169.3	145-183	24.40
8	0	—	—	—	1	264.0	—	—

TABLE 18-3. Mean weights (g) of blueback herring, by sex and age, Indian Lake, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
4	4	131.0	111-155	20.22	6	163.3	149-207	21.82
5	3	155.3	130-174	22.75	8	172.8	117-226	33.88
6	2	191.5	189-194	3.54	2	194.5	117-212	24.75

TABLE 18-4. Mean weights (g) of blueback herring, by sex and age, Oromocto River, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
3	1	85.0	—	—	0	—	—	—
4	1	94.0	—	—	2	115.0	97-133	25.46
5	3	122.3	91-144	27.79	2	134.0	133-135	1.41
6	0	—	—	—	0	—	—	—
7	0	—	—	—	0	—	—	—
8	1	140.0	—	—	0	—	—	—

TABLE 18-5. Mean weights (g) of blueback herring, by sex and age, Mactaquac Dam, 1975.

Age	M a l e				F e m a l e			
	No. of fish	Weight		SD	No. of fish	Weight		SD
		Mean	Range			Mean	Range	
3	12	92.1	68-184	31.26	2	90.0	86-94	5.66
4	24	121.4	77-216	28.91	21	134.4	90-170	19.97
5	9	124.8	105-140	10.69	14	164.3	126-267	34.13
6	27	159.8	132-229	24.00	24	191.6	139-260	25.17
7	9	162.8	150-182	13.08	8	207.1	152-243	30.27
8	0	—	—	—	2	185.0	141-229	62.23

TABLE 19. Summary of mean weights (g) of blueback herring, by sex, age and location, Saint John River, 1975.

Age	<u>Kennebecasis Bay</u>		<u>Washademoak Lake</u>		<u>Indian Lake</u>		<u>Oromocto River</u>		<u>Mactaquac Dam</u>	
	Mean weight	No. of fish	Mean weight	No. of fish	Mean weight	No. of fish	Mean weight	No. of fish	Mean weight	No. of fish
<u>Male</u>										
3	78.4	5	84.5	13	—	0	85.0	1	92.1	12
4	116.3	10	121.9	39	131.0	4	94.0	1	121.4	24
5	144.9	13	137.5	16	155.3	3	122.3	3	124.8	9
6	151.9	44	149.5	6	191.5	2	—	0	159.8	27
7	174.2	32	149.5	2	—	0	—	0	162.8	9
8	201.1	11	—	0	—	0	140.0	1	—	0
9	252.7	6	—	0	—	0	—	0	—	0
<u>Female</u>										
3	76.0	1	95.0	8	—	0	—	0	90.0	2
4	124.0	7	136.5	36	163.3	6	115.0	2	134.4	21
5	152.6	20	154.8	24	172.8	8	134.0	2	164.3	14
6	186.4	30	177.4	5	194.5	2	—	0	191.6	24
7	201.2	13	169.3	3	—	0	—	0	207.1	8
8	249.2	9	264.0	1	—	0	—	0	185.0	2
9	258.4	5	—	0	—	0	—	0	—	0
10	302.0	3	—	0	—	0	—	0	—	0

TABLE 20. Spawning history of blueback herring, by sex and location, Saint John River, 1975.

No. previous spawnings	Kennebecasis Bay			Washademoak Lake			Indian Lake			Oromocto River			Mactaquac Dam		
	No.	%	Mean age	No.	%	Mean age	No.	%	Mean age	No.	%	Mean age	No.	%	Mean age
<u>Male</u>															
0	10	8.3	3.6	34	44.7	3.7	1	11.1	5.0	2	33.3	4.0	23	28.4	3.5
1	19	15.7	5.0	33	43.4	4.4	6	66.7	4.3	2	33.3	4.5	23	28.4	4.5
2	26	21.5	6.0	6	7.9	5.8	1	11.1	6.0	1	16.7	5.0	12	14.8	5.9
3	44	36.4	6.6	3	3.9	6.7	1	11.1	6.0	0	—	—	18	22.2	6.2
4	13	10.7	7.6	0	—	—	0	—	—	1	16.7	8.0	5	6.2	7.0
5	7	5.8	8.6	0	—	—	0	—	—	0	—	—	0	—	—
6	2	1.7	9.0	0	—	—	0	—	—	0	—	—	0	—	—
Totals	121			76			9			6			81		
% repeat spawners		91.7			55.3			88.9			66.7			71.6	
<u>Female</u>															
0	10	11.4	4.6	26	33.8	3.8	1	6.3	5.0	0	—	—	14	19.7	4.0
1	23	26.1	5.0	41	53.2	4.5	12	75.0	4.6	4	100.0	4.5	22	31.0	4.6
2	20	22.7	6.0	5	6.5	5.8	3	18.7	5.3	0	—	—	14	19.7	5.9
3	18	20.5	6.8	4	5.2	6.8	0	—	—	0	—	—	18	25.4	6.4
4	9	10.2	7.9	1	1.3	8.0	0	—	—	0	—	—	3	4.2	7.3
5	3	3.4	9.0	0	—	—	0	—	—	0	—	—	0	—	—
6	5	5.7	9.6	0	—	—	0	—	—	0	—	—	0	—	—
Totals	88			77			16			4			71		
% repeat spawners		88.6			66.2			93.8			100.0			80.3	
<u>Sexes combined</u>															
% repeat spawners		90.4			60.8			92.0			80.0			75.7	

TABLE 21-1. Mean fork length (mm) and weight (g) of blueback herring, by sex and age, in relation to spawning history, Kennebecasis Bay, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
3	0	5	4.1	189.2	3.70	78.4	7.30
4	0	4	3.3	217.8	11.21	122.8	27.67
4	1	6	5.0	211.3	6.15	112.0	14.44
5	0	1	0.8	243.0	—	179.0	—
5	1	9	7.4	222.8	9.04	144.9	22.55
5	2	3	2.5	222.3	1.15	133.3	10.12
6	1	3	2.5	225.3	5.51	152.7	9.29
6	2	21	17.4	228.4	10.03	148.9	27.24
6	3	20	16.5	230.3	8.96	155.0	20.48
7	1	1	0.8	269.0	—	121.0	—
7	2	2	1.7	235.5	4.95	150.0	1.41
7	3	24	19.8	236.4	10.55	179.4	35.10
7	4	5	4.1	238.8	7.22	169.6	19.54
8	4	8	6.6	244.1	7.85	210.5	34.97
8	5	3	2.5	236.0	2.00	176.0	31.19
9	5	4	3.3	264.3	18.68	262.3	68.28
9	6	2	1.7	256.0	8.49	233.5	12.02
<u>Female</u>							
3	0	1	1.1	188.0	—	76.0	—
4	0	3	3.4	220.7	7.37	127.3	13.58
4	1	4	4.6	216.5	1.29	121.5	13.18
5	0	5	5.7	236.8	13.03	167.0	31.66
5	1	15	17.1	227.9	14.93	147.8	24.06
6	0	1	1.1	240.0	—	172.0	—
6	1	4	4.6	239.8	12.28	187.0	47.40
6	2	20	22.7	241.5	5.75	188.7	23.23
6	3	5	5.7	241.0	5.39	179.6	27.78
7	3	12	13.6	247.6	8.34	201.3	30.48
7	4	1	1.1	250.0	—	199.0	—
8	3	1	1.1	272.0	—	272.0	—
8	4	8	9.1	266.5	13.68	246.4	39.10
9	5	3	3.4	261.3	6.11	242.0	19.67
9	6	2	2.3	272.5	16.26	283.0	87.68
10	6	3	3.4	278.0	7.21	302.0	55.05

TABLE 21-2. Mean fork length (mm) and weight (g) of blueback herring, by sex and age, in relation to spawning history, Washademoak Lake, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
3	0	13	17.1	191.4	9.83	84.5	13.85
4	0	20	26.3	217.6	9.59	129.8	21.84
4	1	19	25.0	208.5	5.50	113.6	16.55
5	0	1	1.3	225.0	—	145.0	—
5	1	14	18.4	222.4	11.14	139.6	27.86
5	2	1	1.3	210.0	—	101.0	—
6	2	5	6.6	226.6	5.41	152.6	16.73
6	3	1	1.3	241.0	—	134.0	—
7	3	2	2.6	238.5	4.95	149.5	4.95
<u>Female</u>							
3	0	8	10.4	198.1	12.25	95.0	18.52
4	0	16	20.8	218.4	10.97	136.9	28.88
4	1	20	26.0	217.3	11.82	136.2	25.70
5	0	2	2.6	228.0	5.66	169.5	38.89
5	1	21	27.3	228.4	8.67	151.4	22.77
5	2	1	1.3	240.0	—	197.0	—
6	2	4	5.2	242.5	17.82	173.3	24.34
6	3	1	1.3	237.0	—	194.0	—
7	3	3	3.9	238.3	7.64	169.3	21.13
8	4	1	1.3	264.0	—	264.0	—

TABLE 21-3. Mean fork length (mm) and weight (g) of blueback herring, by sex and age, in relation to spawning history, Indian Lake, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
4	1	4	44.4	217.0	18.57	131.0	20.22
5	0	1	11.1	221.0	—	130.0	—
5	1	2	22.2	237.0	4.24	168.0	8.49
6	2	1	11.1	244.0	—	189.0	—
6	3	1	11.1	238.0	—	194.0	—
<u>Female</u>							
4	1	6	37.5	226.0	7.51	163.3	21.82
5	0	1	6.3	216.0	—	117.0	—
5	1	5	31.3	234.6	9.24	187.0	30.78
5	2	2	12.5	237.0	—	165.0	1.41
6	1	1	6.3	263.0	—	212.0	—
6	2	1	6.3	237.0	—	177.0	—

TABLE 21-4. Mean fork length (mm) and weight (g) of blueback herring, by sex and age, in relation to spawning history, Oromocto River, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
3	0	1	16.7	187.0	—	85.0	—
4	1	1	16.7	207.0	—	94.0	—
5	0	1	16.7	227.0	—	144.0	—
5	1	1	16.7	214.0	—	91.0	—
5	2	1	16.7	219.0	—	132.0	—
8	4	1	16.7	229.0	—	140.0	—
<u>Female</u>							
4	1	2	50.0	223.5	24.75	115.0	25.46
5	1	2	50.0	223.0	2.83	134.0	1.41

TABLE 21-5. Mean fork length (mm) and weight (g) of blueback herring, by sex and age, in relation to spawning history, Mactaquac Dam, 1975.

Age	No. previous spawnings	No.	%	Mean length	SD	Mean weight	SD
<u>Male</u>							
3	0	12	14.8	194.1	8.35	92.1	31.26
4	0	11	13.6	223.7	9.78	126.2	16.39
4	1	13	16.1	211.5	8.89	117.4	36.60
5	1	8	9.9	219.8	6.65	123.9	11.05
5	2	1	1.2	220.0	—	132.0	—
6	1	2	2.5	241.0	7.07	167.0	7.07
6	2	11	13.6	238.2	12.21	163.9	32.75
6	3	14	17.3	233.5	6.71	155.5	16.75
7	3	4	4.9	241.3	5.25	163.5	16.11
7	4	5	6.2	236.8	3.63	162.2	12.09
<u>Female</u>							
3	0	2	2.8	200.0	4.24	90.0	5.66
4	0	10	14.1	224.1	11.28	134.0	19.29
4	1	11	15.5	221.7	10.31	134.7	21.51
5	0	2	2.8	223.5	4.95	141.5	4.95
5	1	10	14.1	238.1	13.20	171.5	37.96
5	2	2	2.8	234.0	—	151.0	15.56
6	1	1	1.4	238.0	—	158.0	—
6	2	12	16.9	249.8	7.22	187.8	16.17
6	3	11	15.5	250.0	11.90	198.8	31.35
7	3	6	8.5	258.2	7.44	221.2	16.39
7	4	2	2.8	242.5	10.61	165.0	18.38
8	3	1	1.4	257.0	—	229.0	—
8	4	1	1.4	223.0	—	141.0	—

TABLE 22. Age at first spawning (maturity) for blueback herring, by sex and location, Saint John River, 1975.

Age at first spawning	Kennebecasis Bay				Washademoak Lake				Indian Lake				Oromocto River				Mactaquac Dam				Summary			
	Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
3	45	37.2	13	14.8	37	48.7	34	44.2	5	55.6	9	56.3	3	50.0	2	50.0	48	59.3	30	42.3	138	47.1	88	34.4
4	69	57.0	64	72.7	38	50.0	41	53.3	3	33.3	5	31.3	2	33.3	2	50.0	31	38.3	37	52.1	143	48.8	149	58.2
5	6	5.0	10	11.4	1	1.3	2	2.6	1	11.1	2	12.5	1	16.7	0	—	2	2.5	4	5.6	11	3.8	18	7.0
6	1	0.8	1	1.1	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0	—	1	0.3	1	0.4
Totals	121		88		76		77		9		16		6		4		81		71		293		256	
Mean age	3.69		3.99		3.53		3.58		3.56		3.56		3.67		3.50		3.43		3.63		3.57		3.73	
SD	0.60		0.56		0.53		0.55		0.73		0.73		0.82		0.58		0.55		0.59		0.60		0.56	
Between sexes significance (p<0.05)			**				n.s. ¹				n.s.				n.s.				*				**	

¹n.s. is non-significant.

TABLE 23. Summary of age at first spawning (maturity), by sex and species, all sites combined, Saint John River, 1975.

Age at first spawning	Alewives				Blueback herring			
	Males		Females		Males		Females	
	No.	%	No.	%	No.	%	No.	%
2	3	0.46	0	—	0	—	0	—
3	142	21.85	77	15.49	138	47.10	88	34.38
4	374	57.54	271	54.53	143	48.81	149	58.20
5	124	19.08	139	27.97	11	3.75	18	7.03
6	7	1.08	10	2.01	1	0.34	1	0.39
Total	650		497		293		256	
Mean age	3.98		4.16		3.57		3.73	
SD	0.62		0.67		0.60		0.56	

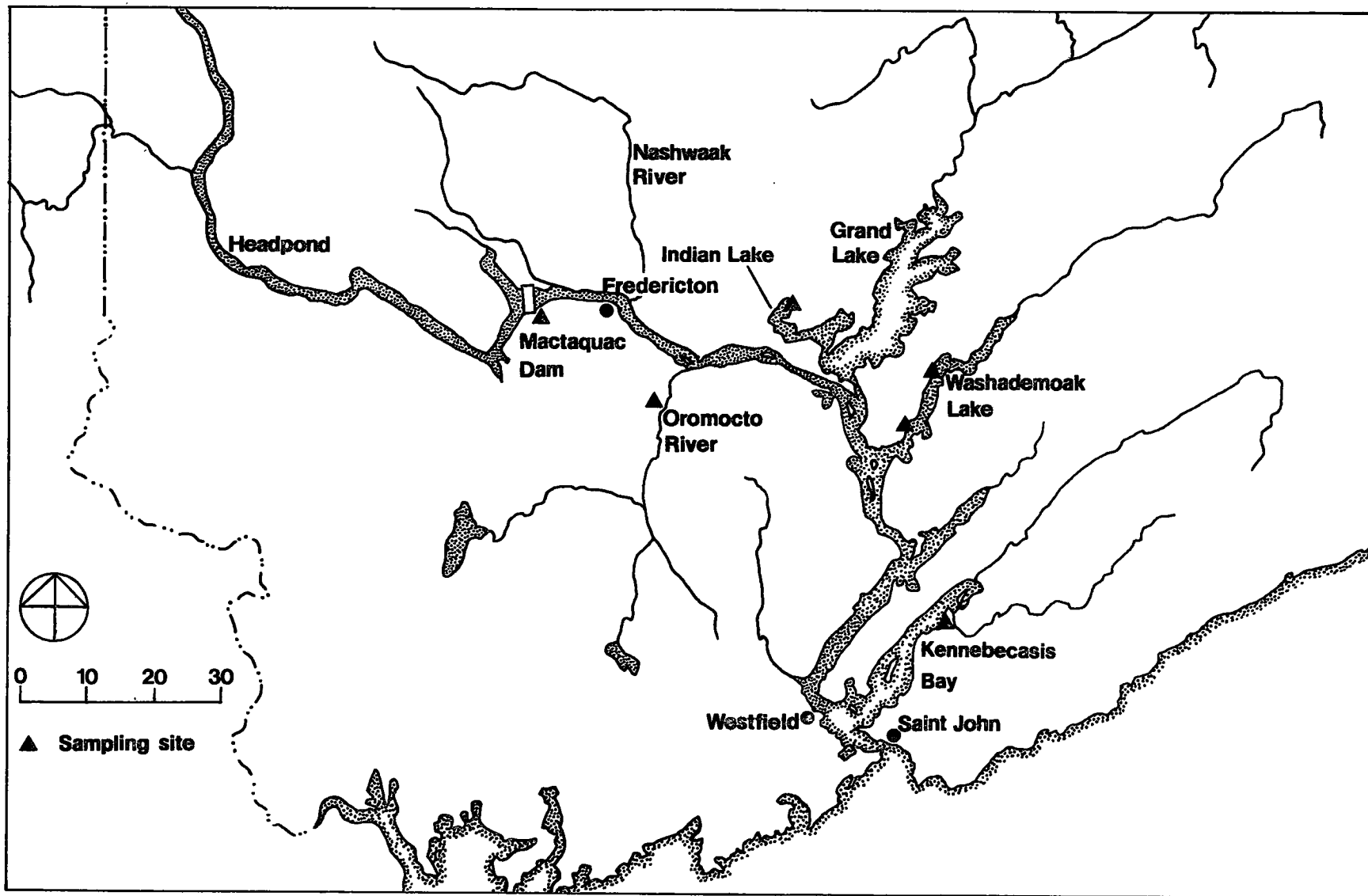


FIG. 1. Sampling sites on the lower Saint John River basin.

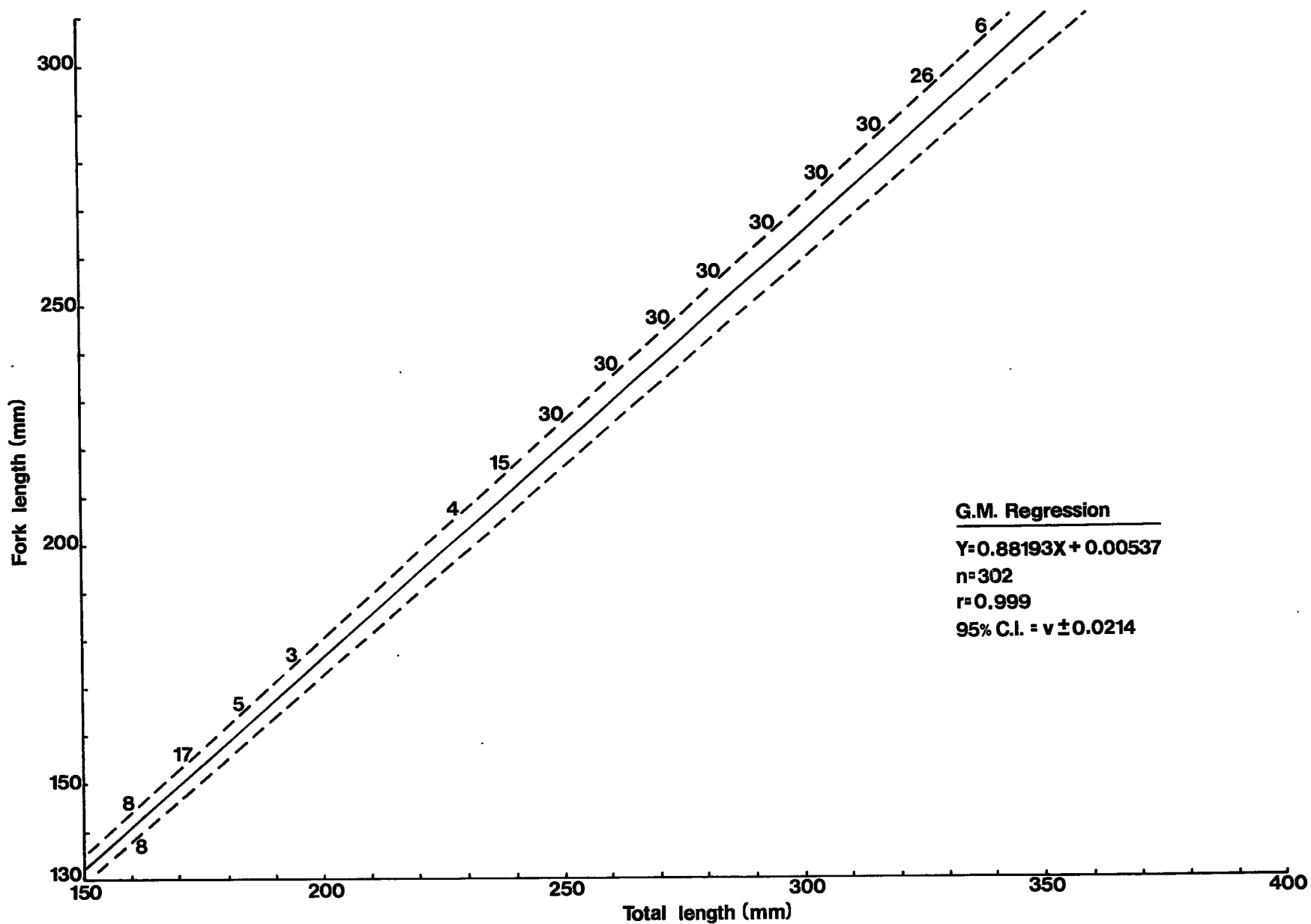


FIG. 2. Geometric mean estimate of the functional regression of alewife fork length and total length. (Numbers accompanying the regression line represent the number of data pairs for each 1.0-cm interval of fork length.)

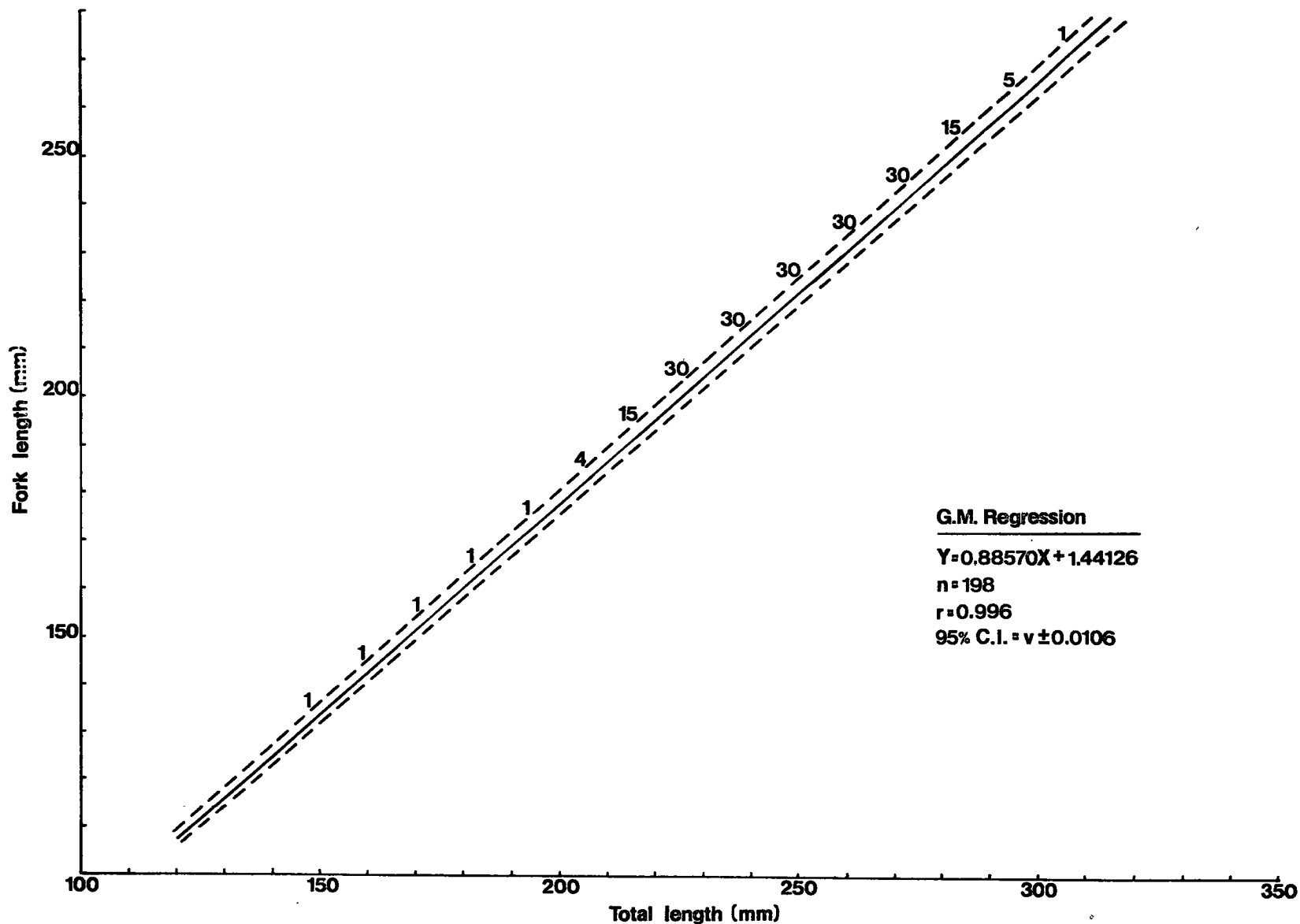


FIG. 3. Geometric mean estimate of the functional regression of blueback herring fork length and total length. (Numbers accompanying the regression line represent the number of data pairs for each 1.0-cm interval of fork length.)

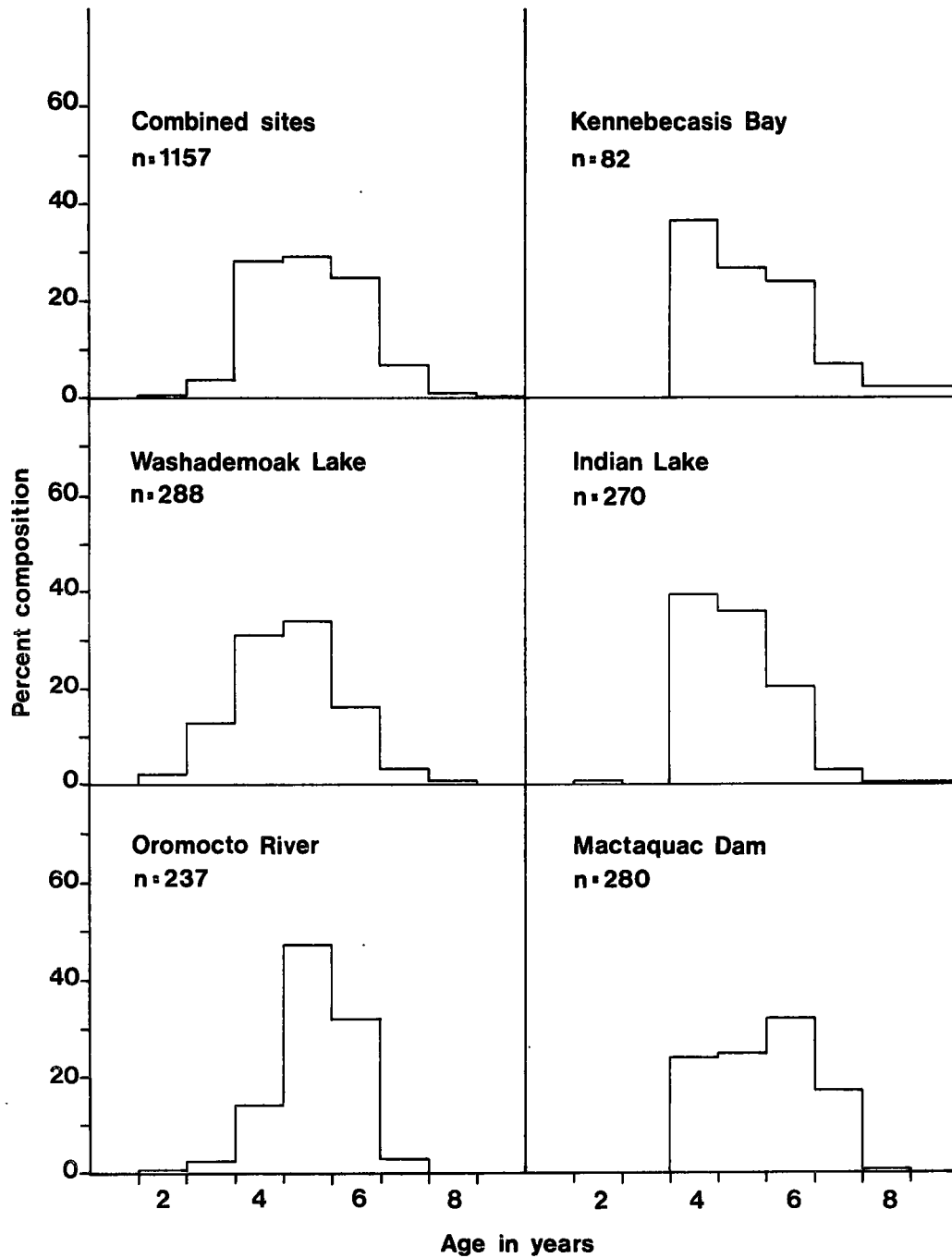


FIG. 4. Age composition of alewives, sexes combined, by location, Saint John River, 1975.

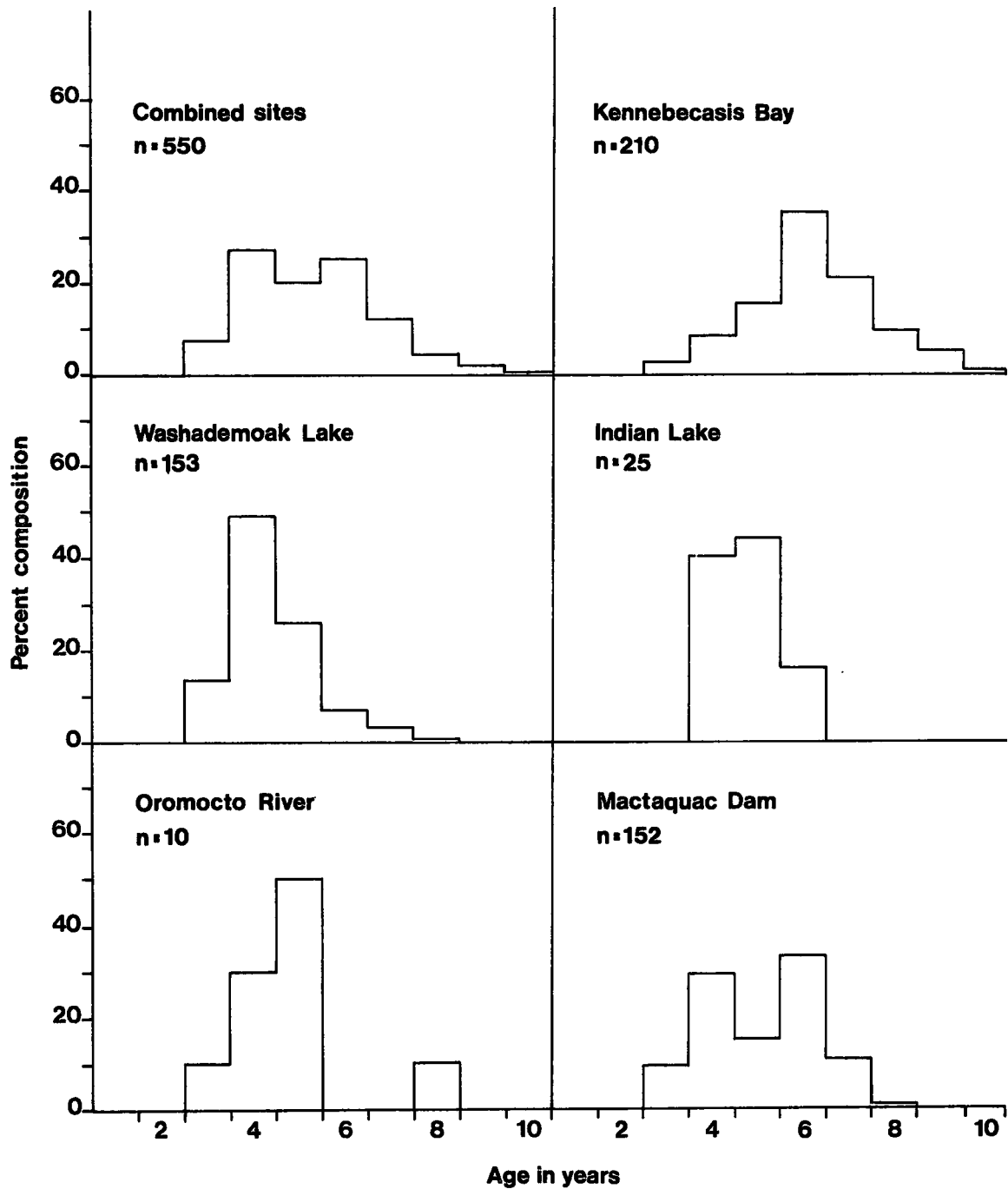


FIG. 5. Age composition of blueback herring, sexes combined, by location, Saint John River, 1975.

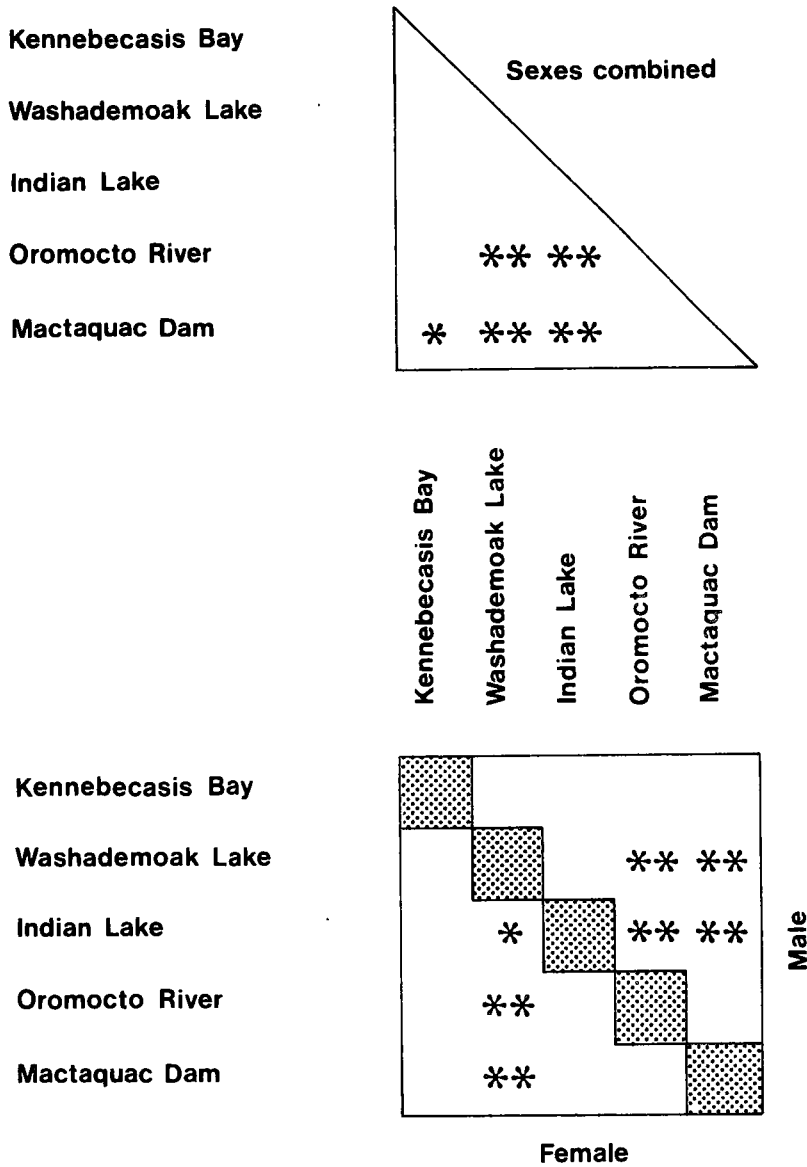


FIG. 6. Significance of differences in proportion of alewife repeat spawners, by sex, sexes combined, and location, Saint John River, 1975.

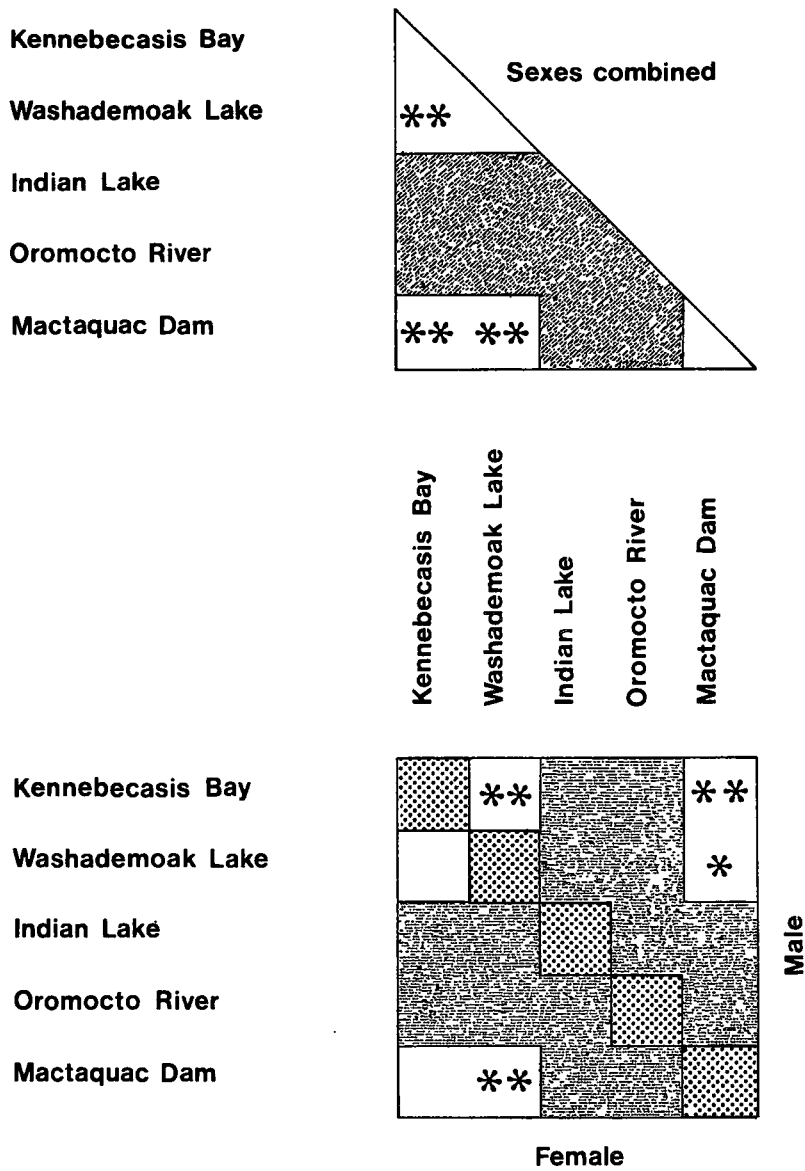


FIG. 7. Significance of differences in proportion of blueback herring repeat spawners, by sex, sexes combined and location, Saint John River, 1975.

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