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Status of the Miramichi River estuary
gaspereau fishery (1983)

by

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ABSTRACT

Gaspereau landings from the Miramichi River estuary have declined from an historical peak of 11,831 tonnes (1952) to levels as low as 119 tonnes (1964), and between 1960 and 1976 averaged only 481 tonnes. Since 1977, landings have improved, reaching a peak of 3,767 tonnes (1980) but show a consistent decline from that peak to only 1,088 tonnes in 1983. Commercial catch/net/hour information was used in combination with biological data from samples collected from Millbank in 1981, 1982 and 1983 to assess the current status of this stock. Age structure of the catch indicates that the fishery is heavily dependent on fish age 3, 4 and 5 and that the trend is toward greater dependence on fish at younger ages. In 1983, mean weight of both alewives and bluebacks decreased substantially from previous years because of this increased dependence on younger fish. Paloheimo estimates of instantaneous mortality rates indicate a decline from 1.92 in 1981-82 to 0.71 in 1982-83 for alewives and from 1.50 to 1.15 for bluebacks during those intervals, respectively. Rates of fishing exploitation were similar for both species and were estimated to be near 0.56 in 1981, 0.73 in 1982 and 0.64 in 1983. These rates are considered to be excessive for development of a stable fishery.

RESUME

Les débarquements de gaspareau dans l'estuaire de la rivière Miramichi ont diminué à partir d'un sommet de 11 831 tonnes (1952) jusqu'à des niveaux aussi bas que 119 tonnes (1964), et entre 1960 et 1976, ils n'atteignaient en moyenne que 481 tonnes. Depuis 1977, les débarquements ont augmenté, atteignant un sommet de 3 767 tonnes (1980), mais diminuent régulièrement de ce sommet jusqu'à seulement 1 088 tonnes en 1983. On a utilisé les renseignements sur les prises commerciales/filet/heure combinés avec les données biologiques obtenues à partir des échantillons prélevés à Millbank en 1981, 1982 et 1983 afin d'évaluer l'état actuel du stock. La structure d'âge des prises indique que la pêche exploite fortement les poissons d'âge 3, 4 et 5 et tend vers une exploitation accrue des poissons moins âgés. En 1983, le poids moyen des poissons capturés (gaspereau et alose d'été) a diminué de façon substantielle par rapport aux années précédentes, justement à cause de cette exploitation accrue des poissons plus jeunes. Les estimations de Paloheimo pour les taux instantanés de mortalité indiquent une diminution de 1,92 en 1981-1982 à 0.71 en 1982-1983 chez le gaspareau, et de 1,50 à 1,15 chez l'alose d'été pendant cette même période. Les taux d'exploitation étaient semblables pour les deux espèces et on les a estimés à près de 0,56 en 1981, 0,73 en 1982 et 0,64 en 1983. Ces taux sont jugés trop élevés pour le développement d'une pêche stable.

INTRODUCTION

Historical catch data (Table 1) for the gaspereau fishery of the Miramichi estuary show that catches have ranged from a peak of 11,381 tonnes (1952) to a low of 119 tonnes (1964). Between 1960 and 1976 annual landings averaged only 481 tonnes. Landings since 1977 have improved, relative to the previous 17 years, but have remained within the range of 3,767 tonnes (1980) to 1,278 tonnes (1982). This recent improvement in average catch may be partially attributed to abolition of the two-day per week closure in 1979 and to "over-the-side-sales" resulting in improved markets although these sales for all of New Brunswick amounted to only 694 t in 1979 and 398 t in 1980 (Table 1).

An assessment of the status of the fishery was prepared for the Anadromous Catadromous Freshwater Fisheries (ACFF) subcommittee of the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) following the 1982 fishing season (Alexander and Vromans, 1983). That assessment concluded that although there were insufficient data to project a stock decline for 1983, any increase in level of exploitation should be avoided. It was also recommended that stock assessment be continued in 1983 to provide additional information on the status of the fishery. This report summarizes the 1983 gaspereau assessment.

METHODS

Fish for biological sampling were collected from the experimental trap net operated at Millbank by Fisheries and Oceans personnel. In contrast to the 1981 and 1982 procedure of collecting 50 fish twice each week, daily samples in 1983 consisted of: 20 fish when the catch was less than 300, 35 fish when the catch was between 300 and 1000, 50 fish when the catch exceeded 1000. In 1983, samples were frozen for subsequent processing in the lab; this again varied from 1981 and 1982 when all samples were processed fresh. Immediately after thawing, each specimen was measured to the nearest mm fork length and total length and weighed to the nearest gram. Sex and state of maturity were determined by examining gonads and species was identified by examining the colour of the peritoneal lining. The peritoneum in alewives was considered to vary from pink to pearly-grey while it was sooty-black in blueback (Scott and Crossman, 1973). In the few cases where species identification remained uncertain, species was later determined by examination of scales using criteria described by MacLellan et al. (1981). For species confirmation and age determination a sample consisting of 6 - 8 non-regenerated scales was collected from an area below the dorsal fin and extending above and below the lateral line; these were mounted on acetate slides. Regenerated scales could usually be identified by visual inspection. Age of each specimen was subsequently determined in two independent readings by examining scales at a magnification of 25X and applying the criteria established by Cating (1953) and reviewed by Rothschild, (1963). Where there was disagreement between the two age determinations a third reading was made and the age common to two readings was accepted.

Mandatory use of catch effort logbooks was not implemented in 1983. Catch effort data from logbooks voluntarily returned by fishermen in statistical districts 71 and 72 were used for the assessment even though reporting was not complete.

Data on mean fish size, species composition and age structure from samples collected at Millbank were applied to the daily catch records as reported in logbooks for a detailed simulation of the commercial catch. Where rates, such as catch per hour were determined, figures were usually derived directly from logbook reports. Where necessary, components of the total landings in the fishery, such as catch per day, were derived by increasing that component calculated from logbook reports by the ratio of total landings to logbook reported landings. In 1983 this ratio was 1.2816:1.

Paloheimo mortality rates used in this assessment were determined by dividing the catch per unit effort of specified age-classes by the catch per unit effort for those same age-classes in the previous year. The resultant value of x is transformed (Ricker, 1975) to instantaneous mortality rate (\bar{Z}) from the equation:

$$\bar{Z} = -\log_e x$$

Paloheimo mortality rates (\bar{Z}) in combination with fishing efforts (f) were used to determine catchability (q), instantaneous fishing mortality (F), and rate of exploitation (u), using a postulated instantaneous natural mortality rate (M) from the following relationships (Ricker 1975).

$$q = \frac{Z(\bar{Z}-M)}{Z\bar{F}}$$

$$F = qf$$

$$u = 1 - e^{-F}$$

Initial populations (N) and escapement of that population (E) through the fishery could then be derived from the known catch (C) in the fishery using the simple relationships:

$$N = \frac{C}{u}$$

$$E = N - C$$

RESULTS & DISCUSSION

The number of gaspereau traps licenced in Districts 71 and 72 during 1983 remained the same as in 1982. This number is now believed to be 36 and probably has been since 1974 even though the number was previously reported as 34 (Alexander and Vromans, 1983). The fishing season was again seven days per week, May 15 to June 15,

inclusive, although it should be noted that a few nets in the lower portion of district 71 (Napan Bay) (Fig.1) are allowed to fish until June 30.

The 1983 gaspereau landing was recorded as 1,088 tonnes (Table 1; Fig 2.). This represents a decline of 190 tonnes, or 14.9 % from the revised estimated landing of 1,278 tonnes for 1982, and continues the trend toward declining catch since 1980.

As in 1981 and 1982, daily fishing effort in 1983 (Table 2) rose quickly to a peak within one week of the season opening, remaining at or near that level until the season closed on June 15. A small additional effort was imposed until July 1 by the few nets in district 71. Catch per unit effort also followed the same pattern as in previous years with fluctuations following the daily catch trend. Average catch per unit effort in 1983 was 49.3 kg/hr. This value is nearly identical to the 1982 figure of 49.6 kg/hr. which had declined sharply from the 1981 value of 94.8 kg/hr.

Mean weight of alewives decreased from about 382 g near the beginning of harvest (Table 3) to about 139 g in early July. Bluebacks also decreased in size from about 423 g to 175 g. This decrease in mean fish size during the run is a reflection of changes in age structure of the catch with older and, therefore, larger fish contributing earlier. Similar trends in declining mean size were observed in 1981 and 1982 (Table 4). However, the overall mean size of alewives in 1983 was only 269 g compared to 296 and 310 g in 1981 and 1982, respectively. Similarly, mean size of bluebacks in 1983 decreased to 264 g from 333 g in 1981 and 323 g in 1982.

Alewives dominated the daily catch in 1983 until about June 2 when bluebacks began contributing the greatest number (Table 3; Fig. 3.). In contrast to the near normal catch distribution in 1981 and the delayed skew in 1982, the 1983 catch showed at least two distinct peaks in catch corresponding to peak runs of the two species (Fig.3.). It is estimated that the 1983 gaspereau fishery harvested 1,832,700 alewives or 44.9% of the total number, compared to 2,251,400 blueback representing the remaining 55.1% (Table 3). Harvest by weight was 493,800 kg or 45.5% as alewives compared to 594,100 kg or 54.6% as blueback. The contribution of alewives to the total catch has increased from about 23% in 1981 to 39% in 1982 and to about 45% in 1983 (Table 5). Note that estimated number and biomass of gaspereau harvested in 1982 was increased subsequent to the last assessment (Alexander and Vromans, 1983). Corrected harvest estimates for 1982 are attached to this report. (Appendix I).

Examination of the 1983 age structure by species indicates that alewives (Table 6, Fig. 4) contributed to the fishery primarily at age 3 and age 4. Catch of these two year-classes was 87% of the total for the species. The 1978 year-class (age 5) which made a strong contribution to the 1982 fishery provided only about 6% of the

1983 alewife catch. Bluebacks contributed to the fishery primarily at age 4 and 5 (Table 6, Fig. 4). These two year-classes contributed 74% to the blueback fishery. The strong 1975 year-class noted in 1981 and 1982, was still apparent but, as predicted (Alexander and Vromans, 1983), the 7% contribution (age 8) was not large. An examination of contribution to the fishery at each age in 1981, 1982 and 1983 (Table 6) suggests that the fishery is becoming increasingly dependent on younger age-classes of both alewife and blueback herring each year.

Catch per hour has been determined for each age-class of alewife and blueback herring in the 1981, 1982 and 1983 gaspereau fisheries (Table 7). Paloheimo mortality estimates (Table 8) were subsequently determined for various age-groups of fully recruited fish. These estimates suggest that annual mortality rate of alewives age 5 and older was 0.85 in 1981-82 but dropped to 0.51 in 1982-83. It appears that alewives age 6 and over survived slightly better with annual mortality estimated at 0.48 in 1982-83. This could be the result of a number of older alewives passing through the fishing zone prior to commencement of the fishery. Mortality (annual) of bluebacks age 5 and older in 1981-82 was 0.78 and dropped to 0.68 in 1982-83. In contrast to alewives, with a reduced mortality at older age, bluebacks reaching age 6 or over in 1982-83 had a higher annual mortality rate of 0.73 (Table 8). This logically suggests that younger fish arriving near the end of the run were not as heavily exploited due to closure of the fishery on June 15.

No estimate of natural mortality was available for these populations of alewife and blueback herring. A natural instantaneous mortality rate of 0.20 has been assumed for each species at each age since this rate will result in accumulation of fish at older age-classes as observed for unexploited Gulf stocks. Estimates of rate of exploitation (Table 9) suggest that bluebacks are being exploited at slightly higher rates than alewives. For both species, the rate was lowest in 1981, maximum in 1982 and intermediate in 1983. Estimates of catch for fish 5 and older (C_1) suggest a consistent decline from about 3.8 million fish in 1981 to 2.2 million in 1982, and further, to 1.4 million in 1983 (Table 9). The decline was most pronounced for bluebacks but was also apparent in the alewives. In contrast to the catch of older fish, the catch of fish younger than age 5 (C_2) increased from about 0.6 million in 1981 to 1.8 million in 1982 and 2.7 million in 1983. The result is that harvest of all ages of gaspereau ($C_1 + C_2$) remained fairly stable near 4 million fish each year even though biomass landed decreased from 1,410 tonnes to 1,088 tonnes (Table 1) over the same period.

The estimated population of fish available to the fishery at age 5 and older (N_1 ; Table 9) also showed an annual decline from about 6.7 million in 1981 to 3.0 million in 1982 and 2.2 million in 1983. If unharvested fish, or escapement of these older fish (E_1) is assumed to represent the number of spawners, then spawners declined drastically from about 2.9 million in 1981 to 0.8 million in 1982 with a similar level in 1983. The number of alewives and bluebacks required for spawning in the Miramichi River is unknown.

The number of fish available for harvest at ages younger than 5 (N_2 ; Table 9) and the subsequent escapement of these fish (E_2) is somewhat more speculative since in the absence of appropriate data, it must be assumed that exploitation rate is the same as for the older age groups. Nevertheless, it appears that the number of available fish in these age-groups has consistently increased from about one million in 1981 to 2.5 million in 1982 and to 4.2 million in 1983. This increase could be the result of stronger year-classes entering the fishery or it could be the result of increased recruitment to the fishery from the younger age-classes. In the former case we could anticipate an improved catch of fish age 5 in 1984 or 1985; in the latter, we can expect a further decline in the catch of older fish.

The total number of fish available to the fishery ($N_1 + N_2$) has shown only a moderate decline from 7.7 million in 1981 (Table 9) to 5.5 million in 1982 with a slight improvement to 6.4 million in 1983. The number of gaspereau caught at Millbank (Table 10) actually increased somewhat in 1983 possibly reflecting an increase in fish abundance or at least a halt in declining abundance. If escapement of all ages is considered to represent spawners then spawning escapement has shown similar trends, declining from 3.4 million in 1981 to 1.5 million in 1982, increasing to 2.3 million in 1983.

Because of the small escapement of fish age 5 and older in 1983 (0.8 million) (Table 9) contribution to the 1984 fishery from fish age 6 and over can be expected to be equal to or less than in 1983 (0.6 million; Table 10). The fishery must therefore rely heavily on fish age 5 or less. Mean size of fish is therefore likely to be small as it was in 1983. The 1979 year-class of alewives and bluebacks, not fully recruited in 1983, appears to be relatively strong (age 4 in 1983) and may be capable of substantial contribution to the fishery at age 5 in 1984. The 1980 year-class (age 3 in 1983) also appears to be strong and has potential to contribute large numbers to the 1984 fishery. However, true strength of these year-classes is difficult to determine since recruitment to existing fisheries is incomplete and may be subject to annual variation as observed on the Saint John River (Jessop, pers. comm.). Note that in the Miramichi fishery, although there were more 5 year olds in the 1982 catch (Table 11) than there were 4 year olds in the 1981 catch (incomplete recruitment), the 1983 catch of 5 year olds was smaller than the 1982 catch at age 4. This suggests more complete recruitment at age 4 in 1982 compared to 1981. If partial recruitment of the 1979 and 1980 year-classes (age 4 and age 3 in 1983) to the 1983 fishery was high, then this could result in a poor contribution to the 1984 fishery from these year-classes. In this case, total catch in the 1984 fishery will be further reduced from the 1983 level.

CONCLUSION

Few gaspereau age 6 and over will be available for harvest in the 1984 Miramichi fishery. Large numbers of fish in younger age-classes (1979 and 1980) may be adequate to maintain the 1984 harvest near current levels but unknown variations in rate of recruitment provide for great uncertainty. This heavy reliance on only one or two year-classes produces potential for extreme fluctuations in annual catch. Adverse environmental conditions during incubation, inadequate spawning escapement or other single year calamities could result in a virtual collapse of the fishery for one or more future years. Recent preliminary data for a relatively unexploited stock indicate that more than 90% are repeat spawners and that substantial proportions survive to age 10 or greater (Table 12). This accumulation of fish at older ages would provide a buffering effect against year-class failure thus protecting any dependent fishery exploiting the stock at a modest rate.

The present level of fishing effort will continue to exploit the Miramichi gaspereau stock at high rates. This level of fishing effort should not be allowed to increase. There is no evidence that spawning escapement in the range estimated during 1981, 1982, or 1983 (Table 9) will result in increased production of juveniles for future harvest or in accumulation of fish in older year-classes for subsequent harvest. Increased annual landings and improved stability of the fishery in the long-term will likely require a reduction in rate of exploitation. A reduced rate of exploitation is likely to result in reduced harvest for a period of at least four years.

Fishery managers may wish to reduce the rate of exploitation through various options such as a return to the two-day per week closure, shortened fishing season, reductions in effective fishing effort or other possible alternatives.

ACKNOWLEDGEMENT

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Réjean Hébert, statistical officer with the Resource Allocation and Development Branch supplied historical catch and effort information.

Most commercial gaspereau fishermen in statistical districts 71 and 72 are now participating in the voluntary gaspereau logbook program used in stock assessment.

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Table 1. Annual catch statistics and number of fishing licences for the Miramichi River, New Brunswick, gaspereau fishery.

Year	Districts 71 and 72		Districts 70 to 73	
	Catch (mt)	Number of Licences	Catch/licence	Catch (mt)
1950	4952	220	22.51	5311
1951	8014	163	49.17	8163
1952	11381	180	63.23	11608
1953	8026	178	45.09	8095
1954	4649	231	20.13	4859
1955	3413	181	18.86	3648
1956	3009	166	18.13	3327
1957	884	135	6.55	1056
1958	816	120	6.80	871
1959	1596	108	14.78	1716
1960	716	120	5.97	786
1961	161	109	1.48	199
1962	733	67	10.94	875
1963	543	66	8.23	617
1964	119	37	3.22	128
1965	425	36	11.81	501
1966	746	41	18.20	875
1967	532	34	15.65	677
1968	436	27	16.15	567
1969	175	23	7.61	237
1970	874	28	31.21	969
1971	469	37	12.68	555
1972	468	26	18.00	592
1973	967	35	27.63	1012
1974	271	35 ¹	7.74	415
1975	141	34 ¹	4.15	219
1976	406	34 ¹	11.94	483
1977	2240	34 ¹	65.88	2385
1978	1434	34 ¹	42.18	1587
1979	3343 (694) ⁴	34 ¹	98.32	3622
1980	3767 (398) ⁴	34 ¹	110.79	3948
1981	1410	34 ¹	41.47	1503
1982	1278 ²	36	35.50	1362 ³
1983	1088	36	30.22	1254

¹ The number of traps may have been as high as 36 beginning in 1974.

² Revised from previous report of 1072 tonnes.

³ Revised from previous report of 1142 tonnes.

⁴ "Over-the-side-sales" for all gaspereau in New Brunswick.

Table 2 Summary of daily catch (kg) daily effort (hours), and daily catch per unit effort (CPUE; kg/hour), Miramichi River gaspereau fishery (districts 71 and 72 combined), 1983. Values are based on gaspereau catch and effort logbooks returned.

Week	MON.	TUES.	WED.	THURS.	FRI.	SAT.	SUN.
May 16-22							
catch	170	119	1225	1417	907	8290	18325
effort	96	168	192	240	288	288	288
CPUE	1.8	0.7	6.4	5.9	3.2	28.8	63.6
May 23-29							
catch	41560	31094	23712	20400	24256	11703	16908
effort	540	594	576	618	596	564	558
CPUE	77.0	52.4	41.2	33.0	40.7	20.8	30.3
May 30-June 5							
catch	25083	21965	27397	27771	47808	48795	47401
effort	600	600	624	624	642	618	600
CPUE	41.8	36.6	43.9	44.5	74.5	79.0	79.0
June 6-12							
catch	37784	32397	60022	55633	67857	44588	31264
effort	690	642	642	624	624	580	552
CPUE	54.8	50.5	93.5	89.2	108.7	76.9	56.6
June 13-19							
catch	26149	18223	19437	794	822	765	113
effort	624	624	584	120	108	84	48
CPUE	41.9	29.2	33.8	6.6	7.6	9.1	2.4
June 20-26							
catch	1588	227	737	283	794	680	0
effort	72	60	60	60	60	60	24
CPUE	22.0	3.8	12.3	4.7	13.2	11.3	0.0
June 27-July 3							
catch	850	170	397	590	283	113	0
effort	72	60	60	72	48	36	0
CPUE	11.8	2.8	6.6	8.2	5.9	3.1	0.0

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Table 3. Estimated daily catch(kg) and numbers of gaspereau, Districts 71 and 72 combined, 1983 Miramichi River Gaspereau Fishery. (Numbers are based on total landings, Districts 71 and 72 combined.)

Date	ALEWIFE		BLUEBACK		CATCH (kg)			NUMBER		
	Mean Wt.	%	Mean Wt.	%	Alewife	Blueback	Combined	Alewife	Blueback	Combined
Ma 16	.3816	100.0	.4230	0.0	218	0	218	571	0	571
Ma 17	.3786	100.0	.4230	0.0	153	0	153	403	0	403
Ma 18	.3535	100.0	.4230	0.0	1570	0	1570	4441	0	4441
Ma 19	.3283	100.0	.4230	0.0	1816	0	1816	5532	0	5532
Ma 20	.2849	85.0	.4230	15.0	921	241	1162	3233	570	3803
Ma 21	.2863	100.0	.3110	0.0	10624	0	10624	37109	0	37109
Ma 22	.2867	98.0	.3060	2.0	22984	501	23485	80169	1636	81805
Ma 23	.2950	100.0	.3050	0.0	53263	0	53263	180552	0	180552
Ma 24	.2979	100.0	.3050	0.0	39850	0	39850	133769	0	133769
Ma 25	.2889	98.2	.3050	1.8	29806	583	30389	103171	1911	105082
Ma 26	.2732	95.0	.2890	5.0	24766	1379	26144	90650	4771	95421
Ma 27	.2772	51.4	.3554	48.6	14060	17026	31086	50723	47906	98629
Ma 28	.2677	82.9	.3768	17.1	11616	3383	14998	43391	8977	52368
Ma 29	.2826	91.4	.3283	8.6	19541	2128	21669	69147	6482	75629
Ma 30	.2635	70.0	.3881	30.0	19707	12439	32146	74788	32052	106840
Ma 31	.2694	85.7	.3088	14.3	23635	4515	28150	87732	14622	102354
Jn 01	.2786	85.7	.2896	14.3	29927	5185	35112	107419	17903	125322
Jn 02	.2571	45.7	.3428	54.3	13777	21814	35591	53587	63634	117221
Jn 03	.2580	30.6	.3074	69.4	16557	44714	61270	64173	145458	209631
Jn 04	.2859	22.9	.2913	77.1	14089	48447	62535	49278	166312	215590
Jn 05	.2672	49.0	.2530	51.0	30584	30165	60749	114460	119229	233689
Jn 06	.2376	40.0	.2763	60.0	17645	30778	48424	74264	111395	185659
Jn 07	.2463	16.0	.2511	84.0	6536	34984	41520	26537	139322	165859
Jn 08	.2097	26.0	.2570	74.0	17139	59784	76924	81733	232623	314356
Jn 09	.2412	24.0	.2348	76.0	17464	53835	71299	72404	229280	301684
Jn 10	.2805	22.0	.2647	78.0	20011	66953	86965	71342	252941	324283
Jn 11	.2818	10.0	.2354	90.0	6709	50435	57144	23806	214253	238059
Jn 12	.2373	8.0	.2499	92.0	3056	37011	40068	12879	148105	160984
Jn 13	.2451	45.7	.2599	54.3	14834	18679	33512	60521	71869	132390
Jn 14	.2067	30.0	.2456	70.0	6191	17164	23354	29950	69885	99835
Jn 15	.2003	11.1	.2157	80.9	2591	22320	24910	12934	103475	116409
Jn 16	.2400	4.1	.2280	95.9	44	974	1018	182	4272	4454
Jn 17	.2610	2.0	.2330	98.0	23	1030	1053	90	4420	4510
Jn 18	.2085	30.0	.2263	70.0	278	703	980	1331	3106	4437
Jn 19	.2200	17.1	.2349	82.9	24	121	145	107	516	623
Jn 20	.2104	14.3	.2146	85.7	286	1749	2035	1359	8151	9510
Jn 21	.2304	10.2	.2123	89.8	32	259	291	139	1220	1359
Jn 22	.1874	24.0	.1962	76.0	219	726	945	1168	3699	4867
Jn 23	.1903	14.0	.1979	86.0	49	314	363	258	1585	1843
Jn 24	.1524	25.7	.1872	74.3	224	794	1018	1468	4241	5709
Jn 25	.1800	20.0	.1982	80.0	161	710	871	896	3583	4479
Jn 26	.1515	10.5	.1829	89.5	0	0	0	0	0	0
Jn 27	.1604	44.4	.1814	55.6	451	638	1089	2814	3517	6331
Jn 28	.1461	34.2	.1937	65.8	61	157	218	420	808	1228
Jn 29	.1232	25.0	.2019	75.0	86	423	509	698	2094	2792
Jn 30	.2420	15.8	.1915	84.2	145	611	756	599	3192	3791
Jy 01	.1575	10.0	.1818	90.0	32	331	363	202	1820	2022
Jy 02	.1420	31.6	.1797	68.4	39	106	145	273	590	863
Jy 03	.1389	55.6	.1749	44.4	0	0	0	0	0	0
	.2694		.2639		493792	594107	1087899	1832672	2251425	4084097
% of District Total					45.05	54.95		44.87	55.13	

Table 4. Mean weight of alewives and blueback herring in 1981, 1982 and 1983 Miramichi River gaspereau fishery. Mean weights are shown at the beginning of the fishery (May 15), at the end of the fishery (June 30), and for the total run.

Year	Species	Initial Mean wt. (g)	Final Mean wt. (g)	Overall Mean wt. (g)
1981	alewife	373	184	296
1982	alewife	356	165	310
1983	alewife	382	140	269
1981	blueback	427	232	333
1982	blueback	400	226	323
1983	blueback	423	175	264

Table 5. Relative contribution by alewives and blueback herring to the 1981, 1982 and 1983 Miramichi River gaspereau fishery.

Year	Species	Number X 1000	Percentage of Total	Weight kg(X1000)	Percentage of Total
1981	alewife	1,067.7	24.5	316.0	22.4
	blueback	3,289.7	75.5	1,094.3	77.6
1982*	alewife	1,590.1	39.6	493.1	38.6
	blueback	2,425.5	60.4	784.5	61.4
1983	alewife	1,832.7	44.9	493.8	45.5
	blueback	2,251.4	55.1	594.1	54.6

* values corrected

Table 7 Estimates of catch at age and catch per hour at age (number based on logbook returns) for alewife and blueback herring in the 1981, 1982 and 1983 gaspeau fishery in the Miramichi River estuary. Estimates of catch per hour for selected age groups are shown for each species in each year (Effort: 1981 = 13,930 hrs; 1982 = 22,076 hrs; 1983 = 17,204 hrs).

<u>ALEWIFE</u>						
Age	<u>Catch (numbers)</u>			<u>Catch/hour</u>		
	1981	1982	1983	1981	1982	1983
3	34883	468368	485517	2.50	21.22	28.22
4	315444	658806	752628	22.65	29.84	43.75
5	144429	103361	87373	10.37	4.68	5.08
6	289157	78521	41037	20.76	3.56	2.39
7	190106	30498	19978	13.65	1.38	1.16
8	14093	38778	25768	1.01	1.76	1.50
9	11394	828	9149	0.82	0.04	0.53
10			588			0.03
				5-8=	5-9=	6-10=
				45.79	11.41	5.61
					6-9=	7-10=
					6.73	3.23
<u>BLUEBACK HERRING</u>						
Age	<u>Catch (numbers)</u>			<u>Catch/hour</u>		
	1981	1982	1983	1981	1982	1983
3	10471	31920	43275	0.75	1.45	2.51
4	183854	425671	818684	13.20	19.28	47.58
5	440694	626851	488111	31.64	28.40	28.37
6	1719662	253890	193091	123.45	11.50	11.22
7	323360	628741	53421	23.21	28.48	3.10
8	268543	57540	124552	19.28	2.61	7.24
9	128420	74340	11924	9.22	3.37	0.69
10		1050	23334		0.05	1.36
11			227			0.01
				5-9=	5-10=	6-11=
				206.80	74.40	23.61
					6-10=	7-11=
					46.00	12.41

Table 8 Estimates of rates of instantaneous mortality (Z), annual mortality (A), and annual survival (S), determined using Paloheimo's catch effort method, for selected age groupings of alewife and blueback herring harvested in the Miramichi estuary gaspereau fishery.

Species	Age group (year)	CPUE	Z	A	S																																				
Alewife	6-9 (82)	6.73	1.92	0.15	0.85																																				
	5-8 (81)	45.79				Alewife	7-10 (83)	3.23	0.74	0.52	0.48	6-9 (82)	6.73	Alewife	6-10 (83)	5.61	0.71	0.51	0.49	5-9 (82)	11.41	Blueback	6-10 (82)	46.00	1.50	0.78	0.22	5-9 (81)	206.80	Blueback	7-11 (83)	12.41	1.31	0.73	0.27	6-10 (82)	46.00	Blueback	6-11 (83)	23.63	1.15
Alewife	7-10 (83)	3.23	0.74	0.52	0.48																																				
	6-9 (82)	6.73				Alewife	6-10 (83)	5.61	0.71	0.51	0.49	5-9 (82)	11.41	Blueback	6-10 (82)	46.00	1.50	0.78	0.22	5-9 (81)	206.80	Blueback	7-11 (83)	12.41	1.31	0.73	0.27	6-10 (82)	46.00	Blueback	6-11 (83)	23.63	1.15	0.68	0.32	5-10 (82)	74.40				
Alewife	6-10 (83)	5.61	0.71	0.51	0.49																																				
	5-9 (82)	11.41				Blueback	6-10 (82)	46.00	1.50	0.78	0.22	5-9 (81)	206.80	Blueback	7-11 (83)	12.41	1.31	0.73	0.27	6-10 (82)	46.00	Blueback	6-11 (83)	23.63	1.15	0.68	0.32	5-10 (82)	74.40												
Blueback	6-10 (82)	46.00	1.50	0.78	0.22																																				
	5-9 (81)	206.80				Blueback	7-11 (83)	12.41	1.31	0.73	0.27	6-10 (82)	46.00	Blueback	6-11 (83)	23.63	1.15	0.68	0.32	5-10 (82)	74.40																				
Blueback	7-11 (83)	12.41	1.31	0.73	0.27																																				
	6-10 (82)	46.00				Blueback	6-11 (83)	23.63	1.15	0.68	0.32	5-10 (82)	74.40																												
Blueback	6-11 (83)	23.63	1.15	0.68	0.32																																				
	5-10 (82)	74.40																																							

Table 9 . Values for fishing effort (f), mean fishing effort (\bar{f}) and mean total mortality rate (\bar{Z}) for ages 5 and older alewives (a) and blueback herring (b) in the 1981, 1982 and 1983 Miramichi River gaspereau fishery. Using an assumed natural mortality rate of 0.20, catchability (q), fishing mortality (F) and rates of exploitation (u) have been determined. Commercial catch estimates for fish age 5 and older (C_1) were then used to estimate the available fish at that age (N_1) and the theoretical escapement of fish at that age (E_1). Although younger fish are not fully recruited to the fishery, the number of younger fish caught (C_2) has been used to determine the number available to the fishery (N_2) and consequently, a theoretical estimate of escapement for these ages (E_2) has been calculated.

Year	f	\bar{f}	\bar{Z}	q	F	u	C_1	N_1	E_1	C_2	N_2	E_2	C_1+C_2	N_1+N_2	E_1+E_2
Species				($\times 10^{-3}$)			No. $\times 10^3$								
1981 a	13,930			0.0592	0.8252	0.5619	693.5	1,234.1	540.6	374.2	666.0	291.8	1,067.7	1,900.1	832.4
b				0.0598	0.8326	0.5651	3,081.9	5,453.8	2,371.9	207.8	367.7	159.9	3,289.7	5,821.5	2,531.8
a & b							3,775.4	6,687.9	2,912.5	582.0	1,033.7	451.7	4,357.4	7,721.6	3,364.2
a		18,003	1.92												
b			1.50												
1982 a	22,076			0.0592	1.3078	0.7296	291.0	398.8	107.8	1,299.4	1,780.9	481.6	1,590.4	2,179.7	589.4
b				0.0598	1.3195	0.7327	1,897.0	2,589.0	692.0	528.5	721.3	192.8	2,425.5	3,310.3	884.8
a & b							2,188.0	2,987.8	799.8	1,827.9	2,502.2	674.4	4,015.9	5,490.0	1,474.2
a		19,640	0.71												
b			1.15												
1983 a	17,204			0.0592	1.0192	0.6391	242.2	378.9	136.8	1,590.5	2,488.7	898.2	1,832.7	2,867.6	1,035.0
b				0.0598	1.0283	0.6424	1,146.6	1,784.9	638.3	1,104.8	1,719.9	615.1	2,251.4	3,504.8	1,253.4
a & b							1,388.8	2,163.8	775.1	2,695.3	4,208.6	1,513.3	4,084.1	6,372.4	2,288.4

Table 10. Annual catch of gaspereau in the Millbank experimental trap, Miramichi River.

Year	1977	1978	1979	1980	1981	1982	1983
Catch(n)	173,632	126,581	103,946	74,819	43,551	34,164	52,831

Table 11. Number of alewives and blueback herring in each age-class contributing to the 1981, 1982 and 1983 gaspereau fisheries on the Miramichi River.

Year	Species	AGE								
		2	3	4	5	6	7	8	9	older
No x 1000										
1981	Alewife	0	37	337	154	309	203	15	12	0
	Blueback	0	11	196	471	1837	345	287	137	4
	Both	0	48	533	625	2146	548	302	149	4
1982	Alewife	1	540	759	119	90	35	45	1	1
	Blueback	0	37	492	724	293	726	66	86	1
	Both	1	577	1251	843	383	761	111	87	2
1983	Alewife	4	622	965	112	53	26	33	12	7
	Blueback	0	55	1049	626	247	68	160	15	30
	Both	4	677	2014	738	300	94	193	27	37

Table 12. Percentage at each age in samples of gaspereau collected from the relatively unexploited population in West River and from the heavily exploited population in Margaree River, Nova Scotia (1983) and from the Miramichi River, New Brunswick (1983).

Age	N	3	4	5	6	7	8	9	10	11	12
% West River	(251)	1	6	6	20	17	20	11	10	6	2
% Margaree River	(314)	52	33	12	2	1					
% Miramichi River	(1766)	17	49	18	7	2	5	1			

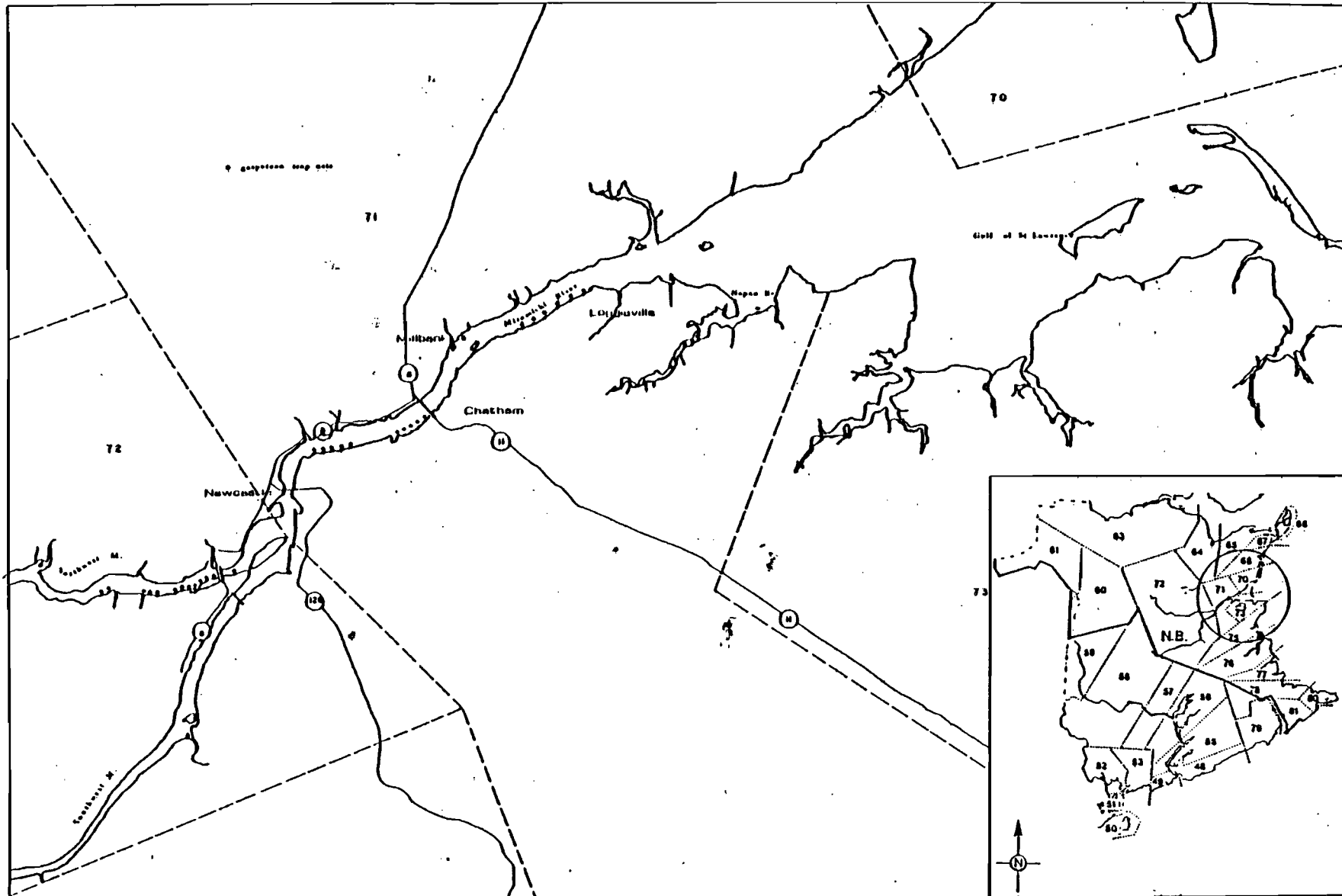


Fig. 1 Map of Miramichi estuary showing boundaries of statistical districts, location of commercial gaspereau traps and location of Millbank trap site.

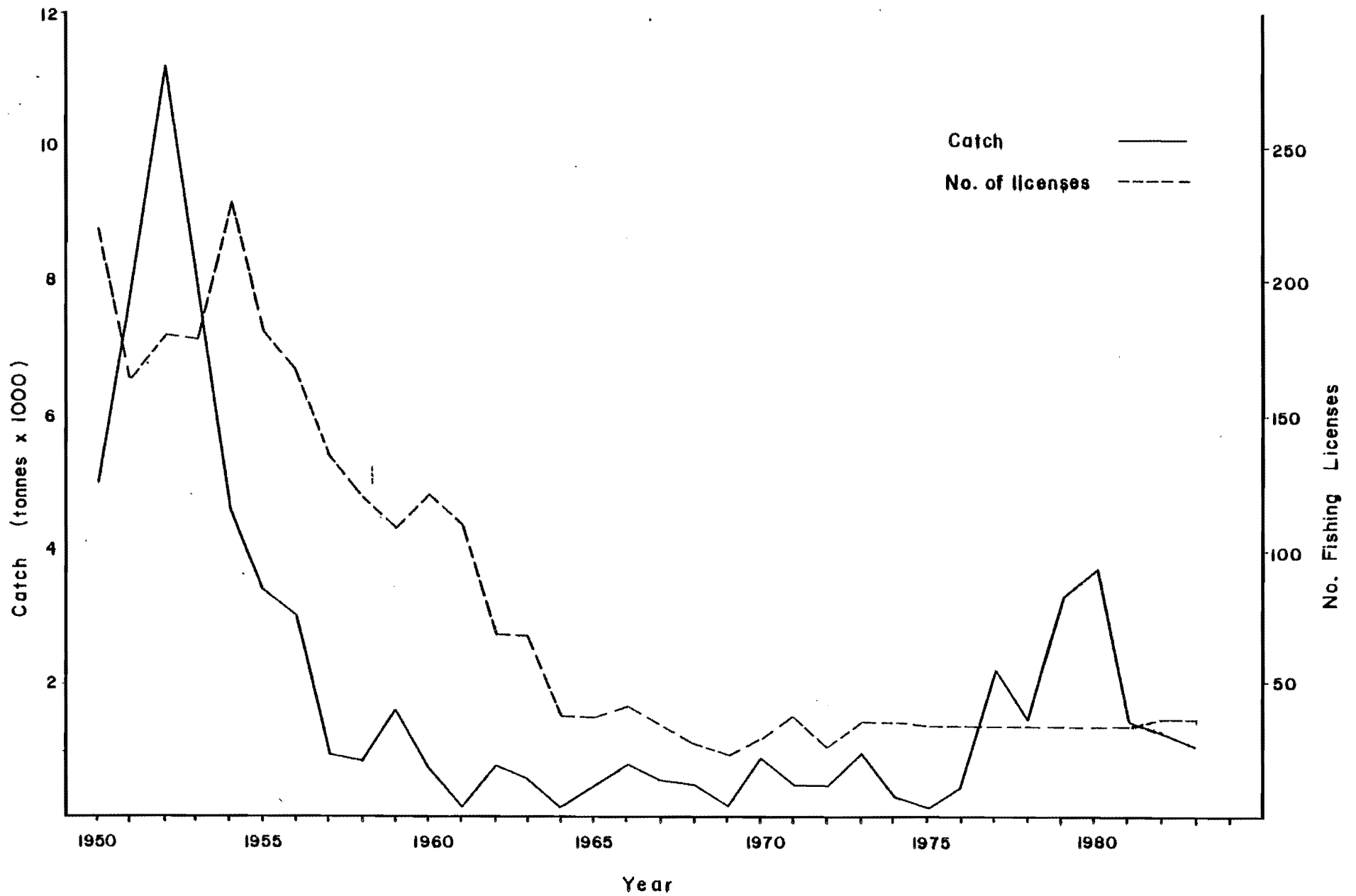


Fig. 2 Number of gaspereau fishing licenses and annual gaspereau catch (mt) in the Miramichi estuary (districts 71 & 72 combined).

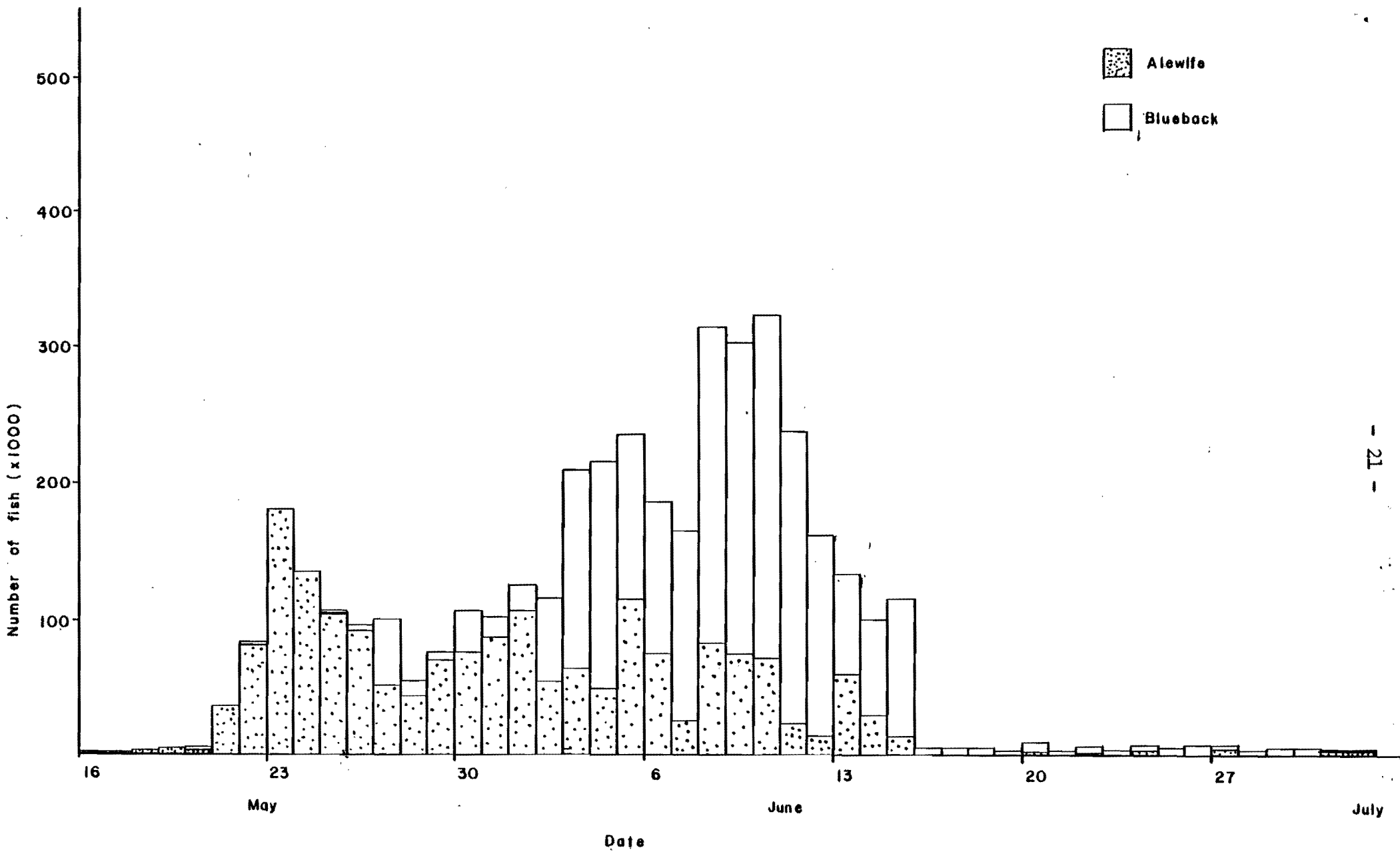


Fig. 3 Estimated number of alewives and blueback herring caught per day in the Miramichi River estuary gaspereau fishery (districts 71 & 72), 1983.

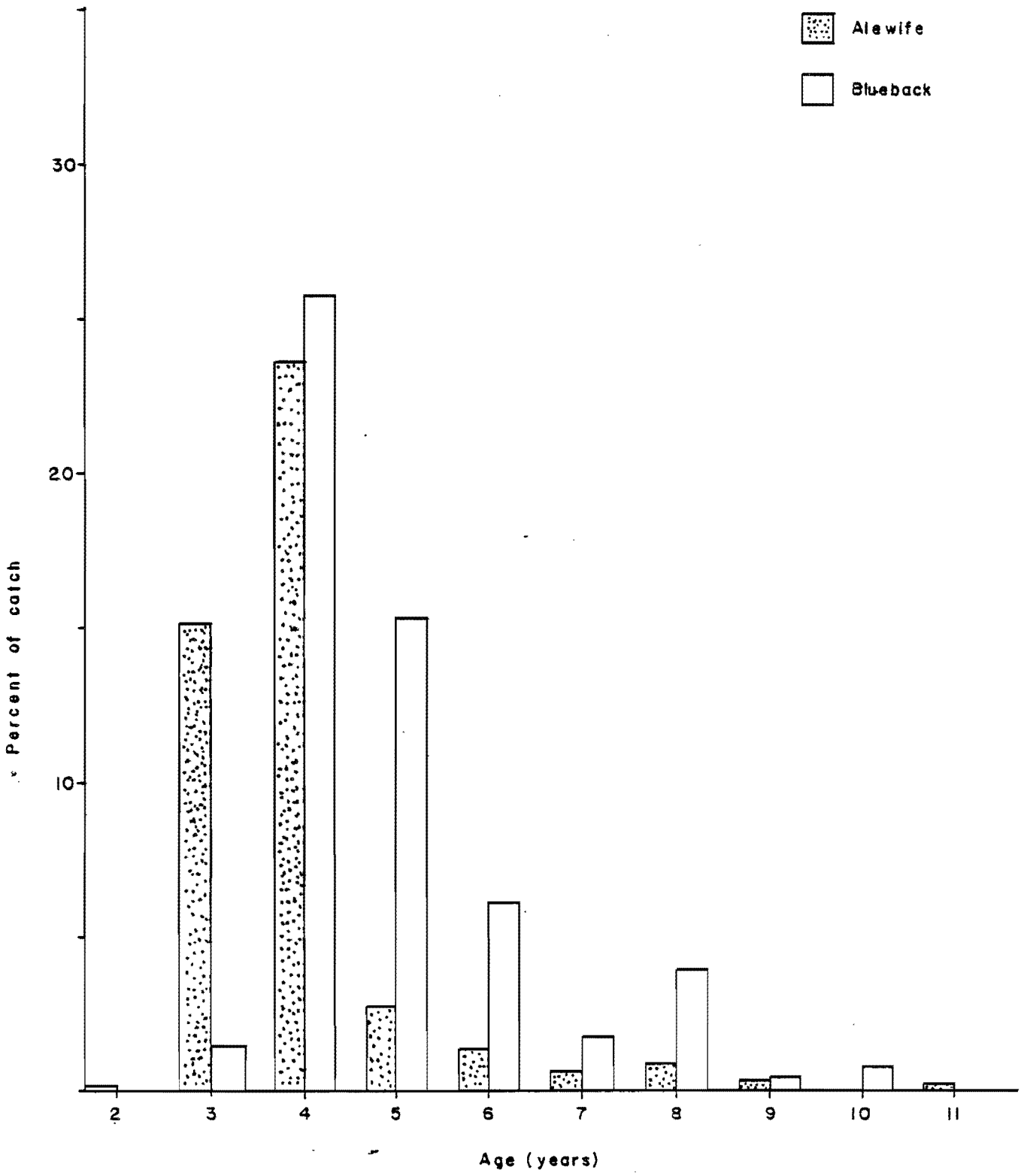


Fig. 4 Catch (percentage of total estimated catch) of alewives and blueback herring, in each age group, in the Miramichi River estuary gaspereau fishery (districts 71 & 72), 1983.

APPENDIX I Estimated commercial catch of alewife and blueback herring in Miramichi River fishery (district 71 and 72) 1982 (revised Jan. 1984).

Date	Total Catch (kg)	Alewife			Blueback		
		No. (x1000)	Wt. (kg)	Mean wt. (g)	No. (X1000)	Wt. (kg)	Mean wt. (g)
May 18	5913	16.6	5913	356	0.0	0	-
19	4848	13.1	4630	353	0.5	218	400
20	4826	12.5	4389	350	1.1	437	400
21	2458	6.4	2168	337	0.7	290	406
22	2841	7.4	2506	337	0.8	335	406
23	328	0.9	289	337	0.1	39	406
24	1018	2.7	867	323	0.4	151	412
25	3698	9.9	3307	335	0.9	391	412
26	5293	14.1	4731	335	1.4	526	412
27	3016	8.1	2817	346	0.5	199	412
28	2055	5.7	1719	301	0.8	336	412
29	3226	7.1	2335	327	2.3	891	391
30	19980	44.2	14460	327	14.1	5520	391
31	113155	198.4	71186	353	113.4	41969	370
June 1	292043	441.7	139590	316	417.7	152453	365
2	250240	378.5	119609	316	357.9	130631	365
3	137497	162.7	45385	279	256.6	92112	359
4	82674	80.1	21477	268	192.4	61196	318
5	60465	58.6	15707	268	140.7	44758	318
6	15460	15.0	4016	268	36.0	11444	318
7	72126	52.8	13579	257	211.4	58547	277
8	37257	17.8	4177	235	116.9	33080	283
9	30224	14.4	3389	235	94.8	26835	283
10	28798	6.5	1522	235	94.7	27276	288
11	29755	4.7	1109	235	107.7	28646	266
12	18440	2.9	687	235	66.7	17752	266
13	15055	2.4	562	235	54.5	14493	266
14	10350	0.9	200	235	41.6	10150	244
15	16869	0.7	163	235	68.5	16706	244
16	1441	0.1	14	235	5.8	1427	244
17	589	0.0	0	-	2.4	589	243
18	1638	0.5	116	235	6.6	1523	232
19	589	0.2	42	235	2.4	548	232
20	983	0.3	69	235	3.9	914	232
21	983	0.6	133	212	3.8	850	221
22	0	0.0	0	-	0.0	0	-
23	983	0.6	126	199	3.9	857	221
24	0	0.0	0	-	0.0	0	-
25	525	1.0	157	165	1.6	367	226
TOTAL	1,277,639	1,590.1	493,146		2,425.5	784,456	
MEAN				310			323
%	100	39.6	38.6		60.4	61.4	