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## Status of the Margaree River gaspereau fishery (1985)

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## ABSTRACT

The gaspereau fishery on the Margaree River, Nova Scotia, harvested 1,223 tonnes in 1985 compared to 883 tonnes in 1984 and 823 tonnes average over 36 years. Much of the improved catch was attributable to the strong 1981 year-class which comprised $80 \%$ of the total. Average fishing mortality over three years of study was estimated at 1.07 compared to $\mathrm{F}_{0.1}$ of 0.42 determined from yield per recruit analysis. Consequently, it is recommended that exploitation be reduced. Fishing at the $F_{0.1}$ level could be expected to harvest only 490 tonnes in 1986. It was estimated that one-, two- and three-day closures would reduce harvest by 9, 19 and 35\%, respectively. A minimum closure of two consecutive days per week appears prudent.

## RE SUNE

Les prises de gaspareau dans la rivière Margaree (Nouvelle-Ecosse) se sont chiffrées à 1223 tonnes en 1985, marquant une hausse par rapport aux prises de 1984 ( 883 tonnes) et à la moyenne de 823 tonnes établie sur 36 ans. Cette augmentation s'explique en grande partie par l'abondance du gaspareau de la classe d'âge 1981, qui représentait $80 \%$ des prises totales. On estime que la moyenne de la mortalité due à la pêche sur trois ans est de 1,07 , comparativement à une valeur $\mathrm{F}_{0,1}$ de 0,42 établie d'après l'analyse du rendement par recrutement. On recommande donc de réduire 1'exploitation. Au taux de pêche $\mathrm{F}_{0,1}$, les prises pourraient ne pas dépasser les 490 tonnes en 1986. On estime que des fermetures de un, deux et trois jours permettraient de réduire les prises de 9,19 et $35 \%$ respectivement. Il apparaît prudent de fermer la pêche pendant au moins deux jours consécutifs par semaine.

## INTRODUCTION

Following the 1983 gaspereau season, a review of the commercial tip-trap fishery on the Southwest Margaree River (Alexander 1984) indicated that this population was being over-exploited. A reduced rate of exploitation was recommended. Consequently, in 1984, fishermen and fisheries managers elected to close the fishery on Saturdays in the lower portion of the river and on Sundays further upstream. An assessment of the 1984 fishery (Alexander and Vromans 1985) concluded that this staggered closure may have resulted in increased escapement relative to 1983 , but fishing mortality remained excessive. Although further reduction in the rate of exploitation was recommended for 1985, no new restrictions were imposed. This paper reviews the characteristics of the 1985 fishery and provides new insight into the potential of the fishery using sequential population analysis.

## METHODS

Samples, ranging from 20 to 40 fish, were collected daily from the commercial tip-trap operated by Martin Cameron in 1985. Determination of species, sex, state of maturity, age, length and weight was similar to that for 1984 (Alexander and Vromans 1985). Biological data were weighted using catch-effort data collected through voluntary logbooks in order to more accurately reflect the characteristics of the catch. These statistics were generated from programs written in-house and run on a Zenith 100 microcomputer. The data base was extended back to 1983 by using biological samples collected at the fish fence and in the commercial fishery (Alexander 1984) in that year in combination with catch-effort information which has recently been obtained for a sample of fishermen.

Age at full recruitment was taken as the age prior to the age when the number of virgin spawners, as determined from scales, was reduced to negligible levels. Total mortality between years was estimated by comparing the catch rate for fully-recruited age groups in one year to the catch rate of those same year-classes in the next year. This total mortality estimate was reduced by an assumed natural mortality rate of 0.2 to approximate between year fishing mortality. Partial recruitment was estimated from the catch matrix and the proportion of virgins at each age by comparing the cumulative catch of virgins from a cohort, adjusted for mortality and escapement, to the initial catch of virgins from the cohort, also adjusted for fishing mortality. For sequential population analysis, mortality of the oldest age groups in all years and for all age groups in the most recent year was taken as the mean annual Paloheimo fishing mortality rate (Ricker 1975) for fully-recruited fish. For age groups not fully recruited, this value was multiplied by the estimated partial recruitment value. Sequential population analysis (SPA) was run using APL programs described by Rivard (1982).

In each instance where catch reductions, as a result of closure, were estimated, it was assumed that all fish caught during the subject interval would have escaped if fishing had not taken place. Similarly, where the
fishing was partially closed, it was assumed that catch would have been equal to the average of that for the first preceeding and succeeding interval if the fishery had been open.

## RESULTS AND DISCUSSION

Gaspereau landings in 1985 increased over that of 1983 and 1984 (Table 1). Unfortunately, the market has been weak and many fish remained unsold in late 1985. Consequently, final harvest figures, recorded at the time of inspection, were not available for this assessment. Harvest was estimated by the area statistical coordinator to be approximately 1,233 tonnes (P. George, pers. comm.). This exceeds the $36-y e a r$ average of 823 tonnes (Table 1).

Logbooks were submitted for only 18 active traps in 1985 compared to 42 in 1984. Harvest by these traps totalled $505,311 \mathrm{~kg}$. A factor of 2.4197 was used to convert logbook data to represent the fishery as a whole. The conversion factor for 1983 was 5.1622 (Table 2) and 1.3722 for 1984 as previously reported (Alexander and Vromans 1985).

The 1985 fishery took place nearly two weeks later than in 1984, commencing May 13 and ending June 21. Within that period, fishing was concentrated into a shorter interval with about $80 \%$ of the effort expended (Table 3) and 90\% of the catch taken (Table 4) between May 20 and June 7. The effects of closure can be seen in the daily effort figures but, in contrast to 1984, reduced catch during closed times was not conspicuous (Fig. 1, Table 4) and catch was actually higher during the partial closure on May 19 than on fully open days immediately before and after. Net reduction in catch as a result of closed times was estimated at $107,589 \mathrm{~kg}$ or 458,563 fish.

Overall catch per unit effort for 1985 was $147.6 \mathrm{~kg} / \mathrm{hr}$. compared to 83.1 for 1984. The logbook effort of 3,423 hours corresponds to an effective effort of 8,283 hours which is lower than in either 1983 or 1984 (Table 2). This may reflect early indications that it would be difficult to sell the catch. The peak single day catch of $274,608 \mathrm{~kg}$ occurred on May 30 (Table 4) and exceeds that for 1984 by a factor of 2 .

The 1985 fish sample of 741 specimens consisted of $87 \%$ alewives (Alosa pseudoharengus) and $13 \%$ blueback herring (Alosa aestivalis). When the sample was weighted by daily catch, however, the total landing was estimated to include 99\% alewife and only $1 \%$ blueback. As in other years, the alewife appeared in the fishery several weeks earlier than blueback with blueback making only a minor contribution late in the harvest (Table 4). Only alewives were considered for the balance of this assessment.

Mean weight of alewife in 1985 was 258 g compared to 277 g and 245 g in 1983
and 1984, respectively.

The age structure of the 1985 sample was $23 \%$ age $3,61 \%$ age 4 and $8 \%$ age 5 with small representation from other ages (Table 5). However, when these samples were weighted by daily catch, the harvest was estimated to contain $12 \%$ age 3, $80 \%$ age 4, 6\% age 5 and negligible proportions at other ages. This difference after weighting is consistent with previous observations and weighting is considered to be essential for more detailed analysis such as sequential population analysis (Alexander and Vromans 1985). Using logbook data recently obtained, the 1983 sample was also weighted and new proportions at each age were estimated (Table 5). A catch-at-age matrix for the three years studied was generated (Table 6). These figures clearly show great strength in the 1981 year-class which made a strong contribution to harvest at age 3 in 1984 and age 4 in 1985.

Mean length at age was determined from the biological samples in each year (Table 7). A weight at age for each year was then determined from log length-log weight regression since this matrix (Table 7) is also required for yield per recruit analysis. The average weight-at-age was determined by weighting the value for each year.

Partial recruitment of alewives was estimated to be 0.0 at age $2,0.4$ at age 3 and 1.0 at age 4 and older. Estimates of cumulative catch per hour for fully-recruited age groups (Table 8) indicated that annual between year mortality was 1.33 in 1983-84 and 0.86 in 1984-85. Average between year fishing mortality was therefore estimated at 0.89 for use in sequential population analysis.

Yield per recruit analysis using the method of Thompson and Bell (Rivard 1982) showed that $F_{0.1}$ was 0.4196 at a yield per recruit of 0.170 kg . Using the Paloheimo fishing mortality rate of 0.89 , weighted fishing mortality estimates from SPA converged within three runs. These mortality rates (Table 9) ranged from 0.890 to 1.349 and greatly exceeded the F 0.1 value. A further reduction in rate of exploitation is therefore recommended.

Population numbers generated by cohort analysis were input into the projection program in order to forecast future catch. In this exercise, number of fish at age 3 is unknown, but the mean value of the three years studied, 5,222,000, was used here. Fishing mortality was input at the F0.1 value of 0.42. These projections (Table 10) indicate that catch in 1986 would drop to 490 tonnes, but then increase in each of the next six years projected, reaching 889 tonnes by 1992. Unfortunately, there is currently no method of predicting the strength of new year-classes although there is promise that environmental variables in Lake Ainslie may be used for this purpose (R. Crawford, pers. comm., Nova Scotia Department of Fisheries). If fishing in 1985 had been at the $\mathrm{F}_{0} \cdot 1$ level, catch would have been 675 tonnes, a reduction of $44 \%$.

It was estimated that the 1985 staggered closure may have reduced harvest by 107.6 tonnes. Examination of the catch on Saturdays, Sundays and Mondays (Table 11) indicated that complete closure on one day per week would
reduce catch by $9 \%$ on average while $18.9 \%$ and $35.2 \%$ would have been the average reduction for two- and three-day closures, respectively. These or alternate measures may be required to achieve $\mathrm{F}_{0 \cdot 1}$.

## CONCLUSION

Weighted fishing mortality for the three years greatly exceeds the calculated $\mathrm{F}_{0.1}$ value. The good catch in 1985 can be largely attributed to the strong 1981 year-class. Although new year-classes of exceptional strength may support better than average fisheries in the future, recruitment at average levels observed necessitates a reduction in exploitation to achieve a more stable fishery. Management action to reduce exploitation should include a full two-day-per-week closure at minimum.

Available data on the Margaree gaspereau fishery are minimal for use in sequential population analysis and data collection should be continued. In order to increase the reliability of catch effort data, it is suggested that completion of logbooks again be made a condition of licence for 1986.

## ACKNOWLEDGEMENT

Martin Cameron and Darlene Cameron again provided the biological specimens critical to the conduct of this assessment. COSEP students Heather Mayhew and Monique Niles processed most of the fish samples with assistance from Bill Gorman and Perry Swan. Provincial student Colleen MacLean under the supervision of Bob Crawford also assisted in processing fish samples. We are grateful to those fishermen who provided voluntary logbook data and look forward to improved reporting in 1986.

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Table 1. Summary of gaspereau (alewife and blueback herring) landings on the Margaree River.

| Year | Catch (tonnes) |
| :---: | :---: |
| 1950 | 713 |
| 1951 | 755 |
| 1952 | 964 |
| 1953 | 638 |
| 1954 | 1,275 |
| 1955 | 1,163 |
| 1956 | 859 |
| 1957 | 58 |
| 1958 | 395 |
| 1959 | 496 |
| 1960 | 531 |
| 1961 | 423 |
| 1962 | 558 |
| 1963 | 551 |
| 1964 | 640 |
| 1965 | 875 |
| 1966 | 320 |
| 1967 | 185 |
| 1968 | 188 |
| 1969 | 251 |
| 1970 | 408 |
| 1971 | 620 |
| 1972 | 965 |
| 1973 | 1,113 |
| 1974 | 1,681 |
| 1975 | 1,238 |
| 1976 | 497 |
| 1977 | 1,202 |
| 1978 | 1,713 |
| 1979 | 1,776 |
| 1980 | 1,069 |
| 1981 | 1,369 |
| 1982 | 1,445 |
| 1983 | 580 |
| 1984 | 883 |
| 1985 | 1,223 |

1985
1,223

Table 2. Logbook catch and effort, total reported catch, estimated total effort and conversion factors used in assessment of the Southwest Margaree gaspereau fishery (1983-85).

|  | Year |  |  |
| :---: | :---: | :---: | :---: |
|  | 1983 | 1984 | 1985 |
| Logbook effort (hrs.) | 2,457 | 7,749 | 3,423 |
| Logbook catch (kg) | 112,319 | 643,770 | 505,311 |
| Total reported catch (kg) | 579,816 | 883,409 | 1,222,698 |
| Expansion factor | 5.1622 | 1.3722 | 2.4197 |
| Expanded effort (hrs.) | 12,684 | 10,634 | 8,283 |

Table 3. Daily catch ( kg ), effort (hours) and catch per unit effort ( $\mathrm{kg} / \mathrm{hr}$ ) in the 1985 Southwest Margaree River gaspereau fishery, District 2, as reported through gaspereau catch and effort logbooks.

|  | Mon | Tue | Wed | Thur | Fri | Sat | Sun | Total |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| May 6-May 12 |  |  |  |  |  |  |  |  |
| Catch (kg) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Effort (hr) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| May 13-May 19 |  |  |  |  |  |  |  |  |
| Catch (kg) | 816 | 1,361 | 1,724 | 2,858 | 3,221 | 0 | 36,832 | 46,811 |
| Effort (hr) | 35 | 37 | 37 | 37 | 31 | 9 | 20 | 206 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 23.33 | 36.78 | 46.59 | 77.23 | 103.89 | 0.00 | 1,841.58 | 227.24 |
| May 20-May 26 |  |  |  |  |  |  |  |  |
| Catch (kg) | 1,413 | 2,359 | 3,806 | 10,954 | 40,211 | 22,702 | 33,384 | 114,829 |
| Effort (hr) | 91 | 129 | 127 | 183 | 201 | 100 | 109 | 940 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 15.53 | 18.28 | 29.97 | 59.86 | 200.05 | 227.02 | 306.28 | 122.16 |
| May 27-June 2 |  |  |  |  |  |  |  |  |
| Catch (kg) | 52,503 | 21,205 | 39,678 | 113,489 | 47,446 | 17,055 | 7,366 | 298,743 |
| Effort (hr) | 214 | 212 | 210 | 224 | 209 | 94 | 85 | 1,248 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 245.34 | 100.03 | 188.94 | 506.65 | 227.01 | 181.44 | 86.66 | 239.38 |
| June 3-June 9 |  |  |  |  |  |  |  |  |
| Catch (kg) | 14,016 | 7,099 | 4,354 | 3,084 | 2,427 | 1,588 | 227 | 32,795 |
| Effort (hr) | 188 | 163 | 135 | 117 | 89 | 55 | 18 | 765 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 74.55 | 43.55 | 32.26 | 26.36 | 27.27 | 28.86 | 12.60 | 42.87 |
| June 10-June 16 |  |  |  |  |  |  |  |  |
| Catch (kg) | 2,472 | 2,563 | 2,631 | 2,858 | 431 | 0 | 635 | 11,589 |
| Effort (hr) | 50 | 59 | 43 | 44 | 14 | 0 | 19 | 229 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 49.44 | 43.44 | 61.18 | 64.95 | 30.78 | 0.00 | 33.42 | 50.61 |
| June 17-June 23 |  |  |  |  |  |  |  |  |
| Catch (kg) | 113 | 159 | 45 | 136 | 91 | 0 | 0 | 544 |
| Effort (hr) | 7 | 6 | 6 | 7 | 7 | 0 | 0 | 35 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 16.20 | 19.84 | 7.56 | 19.44 | 12.96 | 0.00 | 0.00 | 15.55 |
| June 24-June 30 |  |  |  |  |  |  |  |  |
| Catch (kg) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Effort (hr) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TOTALS |  |  |  |  |  |  |  |  |
| Catch (kg) | 71,334 | 34,745 | 52,238 | 133,379 | 93,826 | 41,345 | 78,444 | 505,311 |
| Effort (hr) | 585 | 608 | 558 | 612 | 551 | 258 | 251 | 3,423 |
| CPUE ( $\mathrm{kg} / \mathrm{hr}$ ) | 121.94 | 57.15 | 93.62 | 217.94 | 170.28 | 160.25 | 312.53 | 147.62 |

Table 4. Estimated daily catch of gaspereau in the 1985 S.W. Margaree River gaspereau fishery, District 2.

| Date | Alewife |  | Blueback |  | Catch (kg) |  |  | Number |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Mean <br> wt. <br> (kg) | $\%$ | Mean wt. (kg) | \% |  |  |  |  |  |  |
|  |  |  |  |  | Alewife | Blueback | Combined | Alewife | Blueback | Combined |
| Ma 13 | . 2953 | 100.0 | . 0000 | 0.0 | 1,974 | 0 | 1,974 | 6,686 | 0 | 6,686 |
| Ma 14 | . 3081 | 100.0 | . 0000 | 0.0 | 3,293 | 0 | 3,293 | 10,689 | 0 | 10,689 |
| Ma 15 | . 3188 | 100.0 | . 0000 | 0.0 | 4,171 | 0 | 4,172 | 13,085 | 0 | 13,085 |
| Ma 16 | . 3248 | 100.0 | . 0000 | 0.0 | 6,915 | 0 | 6,915 | 21,291 | 0 | 21,291 |
| Ma 17 | . 3313 | 100.0 | . 0000 | 0.0 | 7,794 | 0 | 7,794 | 23,525 | 0 | 23,525 |
| Ma 18 | . 2950 | 100.0 | . 0000 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ma 19 | . 2877 | 100.0 | . 0000 | 0.0 | 89,122 | 0 | 89,122 | 309,774 | 0 | 309,774 |
| Ma 20 | . 2769 | 100.0 | . 0000 | 0.0 | 3,419 | 0 | 3,419 | 12,347 | 0 | 12,347 |
| Ma 21 | . 2817 | 100.0 | . 0000 | 0.0 | 5,708 | 0 | 5,708 | 20,263 | 0 | 20,263 |
| Ma 22 | . 2576 | 100.0 | . 0000 | 0.0 | 9,209 | 0 | 9,209 | 35,751 | 0 | 35,751 |
| Ma 23 | . 2616 | 100.0 | . 0000 | 0.0 | 26,505 | 0 | 26,505 | 101,320 | 0 | 101,320 |
| Ma 24 | . 2655 | 100.0 | . 0000 | 0.0 | 97,298 | 0 | 97,298 | 366,471 | 0 | 366,471 |
| Ma 25 | . 2670 | 100.0 | . 0000 | 0.0 | 54,932 | 0 | 54,932 | 205,737 | 0 | 205,737 |
| Ma 26 | . 2684 | 100.0 | . 0000 | 0.0 | 80,779 | 0 | 80,779 | 300,965 | 0 | 300,965 |
| Ma 27 | . 2638 | 100.0 | . 0000 | 0.0 | 127,041 | 0 | 127,041 | 481,581 | 0 | 481,581 |
| Ma 28 | . 2660 | 100.0 | . 0000 | 0.0 | 51,310 | 0 | 51,310 | 192,893 | 0 | 192,893 |
| Ma 29 | . 2509 | 100.0 | . 0000 | 0.0 | 96,008 | 0 | 96,008 | 382,656 | 0 | 382,656 |
| Ma 30 | . 2525 | 100.0 | . 0000 | 0.0 | 274,608 | 0 | 274,608 | 1,087,557 | 0 | 1,087,557 |
| Ma 31 | . 2475 | 100.0 | . 0000 | 0.0 | 114,805 | 0 | 114,805 | 463,857 | 0 | 463,857 |
| Jn 1 | . 2400 | 100.0 | . 0000 | 0.0 | 41,268 | 0 | 41,268 | 171,949 | 0 | 171,949 |
| Jn 2 | . 2324 | 100.0 | . 0000 | 0.0 | 17,823 | 0 | 17,823 | 76,693 | 0 | 76,693 |
| Jn 3 | . 2319 | 100.0 | . 0000 | 0.0 | 33,914 | 0 | 33,914 | 146,246 | 0 | 146,246 |
| Jn 4 | . 2243 | 100.0 | . 0000 | 0.0 | 17,177 | 0 | 17,177 | 76,582 | 0 | 76,582 |
| Jn 5 | . 2651 | 97.4 | . 1960 | 2.6 | 10,334 | 201 | 10,535 | 38,982 | 1,026 | 40,008 |
| Jn 6 | . 2369 | 100.0 | . 0000 | 0.0 | 7,462 | 0 | 7,462 | 31,500 | 0 | 31,500 |
| Jn 7 | . 2428 | 100.0 | . 0000 | 0.0 | 5,873 | 0 | 5,873 | 24,187 | 0 | 24,187 |
| Jn 8 | . 2384 | 90.0 | . 2560 | 10.0 | 3,433 | 410 | 3,842 | 14,400 | 1,600 | 16,000 |
| Jn 9 | . 2330 | 80.0 | . 2710 | 20.0 | 425 | 124 | 549 | 1,826 | 457 | 2,283 |
| Jn 10 | . 2380 | 60.0 | . 2474 | 40.0 | 3,533 | 2,448 | 5,981 | 14,845 | 9,896 | 24,741 |
| Jn 11 | . 2429 | 85.0 | . 2433 | 15.0 | 5,270 | 932 | 6,202 | 21,696 | 3,829 | 25,525 |
| Jn 12 | . 2150 | 60.0 | . 2544 | 40.0 | 3,559 | 2,807 | 6,366 | 16,553 | 11,035 | 27,588 |
| Jn 13 | . 2125 | 65.0 | . 2300 | 35.0 | 4,369 | 2,546 | 6,915 | 20,561 | 11,071 | 31,632 |
| Jn 14 | . 2227 | 100.0 | . 0000 | 0.0 | 1,043 | 0 | 1,043 | 4,683 | 0 | 4,683 |
| Jn 15 | . 2157 | 87.5 | . 2412 | 12.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Jn 16 | . 2063 | 75.0 | . 2568 | 25.0 | 1,086 | 451 | 1,537 | 5,264 | 1,755 | 7,018 |
| Jn 17 | . 2050 | 70.0 | . 1997 | 30.0 | 193 | 80 | 273 | 941 | 403 | 1,344 |
| Jn 18 | . 2116 | 80.0 | . 2135 | 20.0 | 307 | 78 | 385 | 1,452 | 363 | 1,815 |
| Jn 19 | . 2070 | 70.0 | . 2372 | 30.0 | 73 | 36 | 109 | 353 | 151 | 504 |
| Jn 20 | . 2196 | 70.0 | . 2465 | 30.0 | 222 | 107 | 329 | 1,011 | 434 | 1,445 |
| Jn 21 | . 1998 | 90.0 | . 2275 | 10.0 | 195 | 25 | 220 | 978 | 109 | 1,087 |
|  | . 2576 |  | . 2432 |  | 1,212,454 | 10,244 | 1,222,698 | 4,707,150 | 42,129 | 4,749,278 |
| $\%$ of | otal |  |  |  | 99.20 | 0.8 |  | 99.10 | 0.9 |  |

Table 5. Approximate percentage of biological samples in each age group from gaspereau (primarily alewives) collected from the Margaree River in 1978, 1979 and 1981-1985. The percentage in each age group in the 1983, 1984 and 1985 fisheries after weighting samples to reflect the harvest are shown for comparison.

| Year | $\begin{aligned} & \text { Sample } \\ & \text { size } \\ & \text { (no.) } \end{aligned}$ | Age |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1978* | 302 | - | 48 | 31 | 13 | 5 | 2 | 1 | 1 |
| 1979* | 2,009 | - | 11 | 57 | 20 | 9 | 3 | 1 | 1 |
| 1981** | 419 | 85 | 8 | 5 | 3 | 1 | - | - | - |
| 1982** | - 537 | 33 | 48 | 7 | 6 | 5 | 1 | - | - |
| 1983 | 314 | 52 | 33 | 12 | 2 | 1 | $<1$ | 1 | - |
| 1983 | Weighted | 24 | 43 | 25 | 4 | 3 | < 1 | < 1 | - |
| 1984 | 1,131 | 53 | 25 | 16 | 3 | 1 | < 1 | < 1 | < 1 |
| 1984 | Weighted | 68 | 22 | 7 | 1 | 1 | < 1 | < 1 | $<1$ |
| 1985 | 741 | 23 | 61 | 8 | 3 | 1 | < 1 | < 1 | - |
| 1985 | Weighted | 12 | 80 | 6 | $<1$ | $<1$ | < 1 | < 1 | - |

[^0]Table 6. Number of fish caught at each age, each year (1983-85) in the Southwest Margaree River gaspereau fishery.

| Age | Year |  |  |
| :---: | :---: | :---: | :---: |
|  | 1983 | 1984 | 1985 |
|  |  | Number |  |
| 2 | --- | --- | 16,280 |
| 3 | 502,731 | 2,450,383 | 564,476 |
| 4 | 898,317 | 787,409 | 3,752,712 |
| 5 | 515,812 | 262,518 | 296,677 |
| 6 | 89,514 | 32,906 | 30,837 |
| 7 | 52,185 | 19,863 | 21,145 |
| 8 | 9,821 | 13,208 | 2,724 |
| 9 | 4,465 | 20,241 | 22,297 |
| 10 | --- | 43 | -- |

Table 7. Mean weight at age matrix determined from length-weight regression equation for alewives in the Southwest Margaree River gaspereau fishery (values in parenthesis are actual sample values).

| Age | Weight (g) |  |  | Mean |
| :---: | :---: | :---: | :---: | :---: |
|  | Year |  |  |  |
|  | 1983 | 1984 | 1985 |  |
| 2 | --- | --- | 161(164) | 161 |
| 3 | 222(220) | 205(210) | 213(210) | 209 |
| 4 | 283 (289) | 289 (288) | 247(251) | 259 |
| 5 | 308 (308) | 356(349) | 310 (321) | 321 |
| 6 | 325(322) | 382(376) | 374(377) | 351 |
| 7 | 356(352) | 428(394) | 408(405) | 398 |
| 8 | 382(375) | 443 (356) | 421 (397) | 421 |
| 9 | 378(356) | 478 (446) | 466(455) | 453 |
| 10 | --- | 500(478) | --- | 500 |
| Mean | (277) | (245) | (258) |  |

Table 8. Estimates of catch per hour at age (based on logbook data) for alewife in the Southwest Margaree River gaspereau fishery (1983-85).

| Age | Catch/hr. |  |  |
| :---: | :---: | :---: | :---: |
|  | 1983 | 1984 | 1985 |
| 2 | --- | --- | --- |
| 3 | 39.64 | 230.43 | 68.15 |
| 4 | 70.82 | 74.05 | 453.06 |
| 5 | 40.67 | 24.69 | 35.82 |
| 6 | 7.06 | 3.09 | 3.72 |
| 7 | 4.11 | 1.87 | 2.55 |
| 8 | 0.77 | 1.24 | 0.33 |
| 9 | 0.35 | 1.90 | 2.69 |
| 10 | --- | 0.01 | --- |
| $Z 4+1983-84=123.78 / 32.80=3.774 \mathrm{Ln}=1.328$ |  |  |  |
| $Z 4+1984-85=106.85 / 45.11=2.369 \mathrm{Ln}=0.86$ |  |  |  |

Table 9. Estimated instantaneous fishing mortality at each age, in each of three years of fishing on the Southwest Margaree River.

| Age | 1983 | 1984 | 1985 |
| :---: | :---: | :---: | :---: |
| 3 | 0.259 | 0.278 | 0.356 |
| 4 | 1.182 | 0.834 | 0.890 |
| 5 | 1.880 | 1.644 | 0.890 |
| 6 | 1.357 | 0.567 | 0.890 |
| 7 | 0.685 | 1.521 | 0.890 |
| 8 | 0.310 | 0.363 | 0.890 |
| 9 | 1.349 | 0.963 | 0.890 |
| $4+$ | 1.349 | 0.963 | 0.890 |

Table 10. Projection of population numbers, population biomass and catch biomass from the Southwest Margaree River gaspereau fishery assuming the available number of fish at age three to be constant at 5,222,000 and fishing at the $F_{0 \cdot 1}$ level of 0.42 .

| Year | 1983 | 1984 | 1985 |
| :---: | :---: | :---: | :---: |
| Population numbers | 4,835,131 | 13,282,644 | 9,424,418 |
| Population biomass (kg) | 777,847 | 2,190,032 | 1,507,141 |
| Catch (kg) | 561,657 | 897,277 | 1,212,454 |
| F or quota | 561,657 | 897,277 | 1,212,454 |
|  | 1986 | 1987 | 1988 |
| Population numbers | 8,771,493 | 10,745,117 | 11,805,818 |
| Population biomass (kg) | 1,716,239 | 2,101,363 | 2,369,740 |
| Catch (kg) | 490,233 | 651,831 | 764,442 |
| F or quota | 0.42 | 0.42 | 0.42 |
|  | 1989 | 1990 | 1991 |
| Population numbers | 12,373,072 | 12,670,030 | 12,748,422 |
| Population biomass (kg) | 2,518,656 | 2,608,916 | 2,630,492 |
| Catch (kg) | 826,928 | 864,800 | 873,854 |
| F or quota | 0.42 | 0.42 | 0.42 |
|  | 1992 |  |  |
| Population numbers | 12,858,844 |  |  |
| Population biomass (kg) | 2,667,777 |  |  |
| Catch (kg) | 889,498 |  |  |
| $F$ or quota | 0.42 |  |  |

Table 11. Estimated potential reduction in catch (in percent of total catch) of alewives due to one-day (Saturday), two-day (Saturday and Sunday) and three-day (Saturday, Sunday and Monday) per week closures of the Southwest Margaree gaspereau fishery.

| Closure period | 1983 | 1984 | 1985 | Years combined |
| :---: | :---: | :---: | :---: | :---: |
| One-day | 5.0 | 13.0 | 8.0 | 9.0 |
| Two-day | 13.0 | 17.0 | 23.0 | 18.9 |
| Three-day | 35.0 | 33.0 | 37.0 | 35.2 |



Fig. 1 NUMBER OF GASPEREAU CAUGHT PER DAY IN THE 1985 MARGAREE RIVER GASPEREAU FISHERY. DAILY CATCHES ON SATURDAYS AND SUNDAYS ARE SHADED FOR CONTRAST.


[^0]:    * Source: O'Neil, J.T. 1980
    ** Source: Crawford, R.H. 1983

