

Not to be cited without
permission of the authors.¹

Canadian Atlantic Fisheries
Scientific Advisory Committee

CAFSAC Research Document 84/7

Ne pas citer sans
autorisation des auteurs.¹

Comité scientifique consultatif des
pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 84/7

An Assessment of Atlantic Salmon Stocks in Deadman's Brook
Anchor Brook, Tides Brook and Main River (Sop's Arm), Newfoundland

by

M. F. O'Connell, R. J. Gibson, and E. G. M. Ash
Fisheries Research Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland A1C 5X1

¹This series documents the scientific basis for fisheries management advice in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the Research Documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research Documents are produced in the official language in which they are provided to the Secretariat by the author.

¹Cette série documente les bases scientifiques des conseils de gestion des pêches sur la côte atlantique du Canada. Comme telle, elle couvre les problèmes actuels selon les échéanciers voulus et les Documents de recherche qu'elle contient ne doivent pas être considérés comme des énoncés finals sur les sujets traités mais plutôt comme des rapports d'étape sur des études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée par les auteurs dans le manuscrit envoyé au secrétariat.

Abstract

After several consecutive years of substantially declining angling catches on Deadman's Brook, Anchor Brook, and Tides Brook, the recreational fishery on these systems was closed as a stock restoration measure beginning in 1978. Angling statistics collected during a limited open season (July 9-22) and redd counts in 1983 (year of first major adult returns from the first year of the ban) were compared with data for the pre-closure and closure periods respectively. Both indicators showed that Deadman's Brook and Anchor Brook improved while the reverse was true for Tides Brook. Parr densities (determined in the summer of 1983) for Deadman's Brook and Anchor Brook compared favorably with other insular Newfoundland rivers for the same habitat type; densities on Tides Brook were lower. The reliability of using indices of abundance such as angling statistics, redd counts and parr densities for assessment purposes as alternative to complete smolt and/or adult counts is discussed.

In 1983, a marked decline in recreational catch and catch per unit effort compared with historic levels was noted for Main River (Sop's Arm). An examination of commercial salmon fishery landings in the immediate area revealed evidence to suggest that a large number of salmon destined for that river were taken in cod traps. This situation is examined in relation to environmental conditions prevailing in Main River from mid-June through July.

Résumé

Après plusieurs années consécutives de baisse des prises de la pêche à la ligne dans les ruisseaux Deadman, Anchor et Tides, la pêche récréative dans ces cours d'eau a été interrompue en 1978 par mesure de protection des populations. Des statistiques sur la pêche à la ligne établies au cours d'une saison de pêche limitée (9-22 juillet) et des calculs de population en frayère effectués en 1983 (année des premiers retours importants d'adultes depuis la première année de l'interdiction) ont été comparés à des données relatives aux périodes antérieures et postérieures à la fermeture respectivement. Les deux indicateurs ont permis d'observer une amélioration dans les ruisseaux Deadman et Anchor, alors que l'inverse se produisait dans le cas du ruisseau Tides. Les densités de tacons (déterminées à l'été 1983) dans les ruisseaux Deadman et Anchor se comparaient avantageusement à celles d'autres cours d'eau insulaires de Terre-Neuve pour le même type d'habitat; les densités du ruisseau Tides étaient plus faibles. Nous analysons la fiabilité de l'utilisation, à des fins d'évaluation, d'indices d'abondance comme les statistiques sur la pêche à la ligne, les calculs de population en frayère et les densités de tacons, comme solution de rechange au dénombrement complet des smolts et des adultes.

En 1983, on a observé, dans le cas de la rivière Main (Sop's Arm) une baisse marquée des prises et des prises par unité d'effort récréatives par rapport aux niveaux habituels. Un examen des débarquements commerciaux de saumon dans la région porte à croire qu'un grand nombre de saumons destinés à cette rivière ont été capturés par des pièges à morue. Nous examinons cette situation dans ses rapports avec les conditions environnementales qui règnent dans la rivière Main de la mi-juin à la fin de juillet.

Introduction

As a result of substantially declining recreational catches over several consecutive years on Deadman's Brook, Anchor Brook (Fig. 1) and Tides Brook (Fig. 2) it was decided to close these rivers to angling as a restoration measure for a period of five years beginning in 1978. This paper assesses the effects of these closures by examining changes in certain indicators of escapement levels compared before and after the ban. In 1983, a marked decrease in recreational catch was noted for Main River (Sop's Arm) (Fig. 3) while the level of effort remained unchanged. A possible explanation for this decline is presented. Figure 4 shows the location of all of the above rivers in the context of insular Newfoundland and the appropriate Statistical Area.

Materials and Methods

The 1983 recreational catch and effort data for Deadman's Brook, Anchor Brook, Tides Brook and Main River (Sop's Arm) were added to that previously presented by Moores et al. (1978), Moores and Tucker (1979, 1980), Ash (unpublished) and Moores and Ash (unpublished). Effort in the recreational fishery was presented as rod days (defined as any day or part thereof on which an angler fishes) and represents actual effort reported by DFO personnel. During staff days off, estimates of catch and effort were provided.

Effort for the commercial fishery for communities in the vicinity of Main River (Sop's Arm) in the bottom of White Bay was presented as the number of gear units (one unit constitutes 50 fathoms of gillnet or salmon trap) licenced to prosecute the fishery. Mean weights of fish for each community were determined from commercial purchase slips. Numbers of fish were calculated for each community by dividing total catch weight by the derived mean weight.

Means and standard deviations for ratio variables were calculated according to Cochran (1977) as used previously by O'Connell et al. (1983).

The DeLury removal method (Ricker 1975) was used to estimate parr density for all stations except the one on Deadman's Brook when, due to the fact that greater depth of water relative to the other stations hampered electrofishing efficiency, the Petersen mark-recapture method (Ricker 1975) was adopted. Ages of parr were estimated for each station by means of a length frequency distribution.

Results

Deadman's Brook/Anchor Brook

Angling Statistics. These rivers constitute two outlets or branches from a single system (Fig. 1). Angling occurs mainly between salt water and the lower-most pond on each branch.

Beginning in 1970, recreational catches for each branch showed a marked decline being most pronounced for the period 1974-76 (Tables 1 and 2). In the event that recreational catches were indicative of spawning escapements, both streams were completely closed to angling from 1978 to 1982 as a restoration measure. This was in spite of a marked increase in angling success in 1977 (both catch and catch per unit effort were substantially higher than the 1973-77 mean). However, in view of the relatively poor catches in 1974-76 and the possibility that low spawning escapements in those years would negatively impact on future abundance, the closure was not rescinded. In 1983, an attempt was made to assess the effect of the closure by opening the streams to angling from July 9 to July 22 and comparing catch and effort statistics obtained within that time frame with those available for the same time period for years immediately preceeding the ban. It was hoped that this approach would provide some indication of the degree of success or failure of the closure and at the same time maximize spawning escapement. Given a modal smolt age of 3+ years and the fact that predominantly grilse are produced, most adults returning in 1983 would have been the progeny of the 1978 spawning escapement (the first year of the ban). The results of the limited angling season are presented in Table 3. Excluding 1977, it is evident that Deadman's Brook showed a substantial improvement while Anchor Brook did not (catch responded to effort for the former but not the latter).

Spawning Surveys. Redd counts were conducted in early to mid-November of 1978, 1979, and 1983. The number and distribution of redds for each year are shown in Fig. 1. The total number of redds located in 1978 and 1979 (obviously before the return of progeny from the closure period) was 260 and 143 respectively. This compares with 315 in 1983, the year in which the progeny of 1978 spawners were expected to return. Therefore, using redd counts as a criterion, it would appear that the 1983 escapement improved over levels recorded during the angling closure. It should be noted that the number of redds counted in 1978 and 1979 most likely included fish which otherwise would have been taken in the recreational fishery in addition to the progeny of spawners prior to the ban.

Parr Density. Parr density (Table 4) was determined at one station on each of Deadman's Brook and Anchor Brook during August 25-26, 1983. The locations of these stations are shown in Fig. 1. Density for Deadman's Brook was substantially higher than that of Anchor Brook.

Tides Brook

Angling Statistics. Historical recreational catch and effort data for Tides Brook are presented in Table 5. Angling closure was invoked on this river for the same reasons as given above for Deadman's Brook/Anchor Brook and covered the same time frame. Tides Brook was also opened to angling from July 9 to July 22, 1983. While catch showed an increase during these two weeks over a comparable period prior to the ban (Table 6), effort also increased with little attendant increase in catch per unit effort.

Spawning Surveys. Redd counts (Fig. 2) were conducted in early to mid-November in 1978 and 1983. The total number of redds located in 1983 was 39; this was a marked decline from 1978 when 183 were encountered.

Parr Density. Parr density was determined at two stations (Fig. 2) during August 8-12, 1983. The results are presented in Table 7. Density for Tides Brook was considerably lower than for Deadman's Brook/Anchor Brook.

Main River (Sop's Arm)

Recreational catch on this river declined substantially in 1983 (Table 8) while effort remained much the same as the previous year; catch per unit effort showed a dramatic decline. Effort in 1982 increased markedly over previous years with only a slight decline in catch per unit effort. The commercial fishery in the vicinity of this river was examined for a possible explanation for the poor escapement as indicated by recreational catch. This was prompted by reports of large numbers of salmon being taken in cod traps in the area. An examination of purchase slips from fish plants revealed an overall increase in landings in 1983; this was most pronounced for catches (80% grilse) landed at Purbeck's Cove and Westport (Table 9). By looking at the catches of each individual fisherman in these two communities it was learned that fishermen with cod traps caught more fish than those with salmon nets in both 1982 and 1983. However, as can be seen in Table 10, the difference between the two groups was phenomenally higher in 1983 than in 1982. The cod traps in question (a total of 3) were located across the bottom of White Bay opposite the mouth of Main River (Fig. 3). Salmon nets were spread along both sides of the bay in the vicinity of each community. The cod traps were operated in the same locations in both 1982 and 1983. Why then the dramatic increase in landings in 1983? If one assumes that the majority of salmon caught in the bottom of White Bay originates there, and considers the fact that Main River is by far the largest in the area, it is reasonable to conclude that a substantial portion of the commercial catch could belong to Main River. Comparison of mean weekly water temperatures recorded at Indian River fishway in 1983 with previous years (Table 11) shows that maximum temperatures (and most likely minimum water levels) occurred during the first two weeks of July in 1983 as opposed to the last two weeks and early August in previous years. Because of the close geographic proximity of Indian River to Main River (Fig. 4), the same temperature trends most likely applied to the latter stream for that period. In fact, information obtained from an angler log book survey indicates that low water conditions prevailed for a period of about a week prior to the first week of temperature data presented in Table 11 for 1983 (week ending June 25). Most of the commercial catch referred to above for both 1982 and 1983 was taken between mid-June and mid-July. The great increase in commercial catch in 1983 therefore could be due to the fact that high temperatures and low water levels in Main River caused fish to remain in salt water for a longer than normal period and hence became more susceptible to commercial gear, especially cod traps.

Discussion

Both angling statistics and spawning surveys indicate that Deadman's Brook/Anchor Brook on the whole showed an improvement in 1983 over years preceeding closure of the recreational fishery. The reverse was true for Tides Brook using these two indicators. The total number of redds counted on Tides Brook in 1983 not only showed a considerable decline from 1978 but was even

lower than the number of fish caught during the two week angling period. Field staff who conducted redd counts on this river in 1983 noted that a considerable amount of vehicular traffic (all terrain vehicles and pickup trucks) was occurring up and down the river bed over the major spawning area located on Main Brook tributary (Fig. 2) during the time of the survey. It was suspected that evidence of redds was erased as a result of this practice. Local Resource Management personnel indicated that this traffic occurs throughout the year and has been going on for the past 10 years or more. This combined possibly with a reported high incidence of poaching activity could account in large part for the demise of this salmon stock. During surveys on Deadman's Brook/Anchor Brook in 1983, several beaver dams were located throughout the system. One such dam was located at the mouth of Ten Mile Pond in July which was assessed to be a total obstruction. If it were allowed to remain intact it would have prevented fish from reaching the large spawning area between Ten Mile Pond and Whitney Pond, indicated in Fig. 1. This dam was subsequently opened prior to the spawning season. The prevalence of beaver dams over the years could have in part contributed to the apparent decrease in stock size through limiting access to both spawning and rearing areas.

Unfortunately parr densities were not determined during the period of angling closure (which would have been the progeny of fish spawning prior to the closure) for either Deadman's Brook/Anchor Brook or Tides Brook. Hence, comparisons cannot be made with the pre-closure period. Densities for Deadman's Brook/Anchor Brook compare favourably with those recorded for other insular Newfoundland rivers (R. J. Gibson, unpublished data) for the same habitat type. It is evident from Fig. 1 that there is very little stream habitat available on Deadman's Brook/Anchor Brook and that standing waters constitute the bulk of available rearing area. Parr rearing in standing waters is a common phenomenon in insular Newfoundland (Pepper 1976; Chadwick 1982; O'Connell and Reddin 1983). A fyke trap set overnight in Anchor Pond on July 8, 1983 caught 9 salmon parr, 1 salmon fry, 1 trout, 7 eels, and a number of sticklebacks. If the stream is the preferred habitat type for parr, it is possible that these areas could be occupied to the maximum under both low and high stock size situations. Therefore, in future for systems of this type, before and after population estimates for lakes and ponds might be more meaningful than estimates for stream habitat. Compared with other insular Newfoundland rivers, parr density in Tides Brook was low. Regardless of the level of spawning escapements or egg/juvenile survival (for reasons referred to above), based on habitat type this system appears to be rather unproductive. The lower river consists of deep water with sandy and muddy substrate, the intermediate section is characterized by pebble and cobble, and upstream sections are boulder and bedrock.

The use of recreational catches, redd counts and parr densities as indices of abundance can produce inconclusive results due to the influence of such factors as annual variation in environmental conditions. In the case of recreational catch, its index value was lost for the five years angling was suspended. Even though the cautious approach of opening the season for a brief period might result in a higher spawning escapement, annual variation in the onset and duration of high water temperatures and low water levels in relation to the angling interval in question could result in non-representative data which are not comparable with previous years. When the angling interval is

mid-season, an accumulation of fish from the beginning of the upstream migration, which in previous years would have been subject to exploitation, could artificially increase catch per unit effort in the reduced season. With respect to spawning surveys, the number of redds per female can vary from year to year and there can be variability in the completeness of counts. Ideally, complete smolt and/or adult counts during the closure period and the predicted time of impact of closure would be the most effective means of assessment. It is regrettable that no counts were conducted during the years that the above rivers were closed, hence there is no basis for comparison should such assessments be conducted next year and succeeding years (the first year of expected returns from the closure was 1983 as already mentioned).

There is strong evidence to suggest that the number of salmon taken in cod traps in 1983 in the region of Main River (Sop's Arm) had a severe impact on the level of escapement to that river. The decline in catch on this river was opposite to the situation for most other Newfoundland Region (insular) rivers where catches compared favourably with previous years (O'Connell et al. 1983). Even though it is possible that the earlier occurrence of the period of high water temperatures and low water levels in the river which prevented entry of salmon contributed to the "success" of the commercial fishery this year, the potential exists for this to happen every year. It is interesting to note that very little cod has been landed from these berths traditionally. Nearly all of the cod landed by the fishermen concerned came from gillnets set further out the bay.

References

- Chadwick, E. M. P. 1982. Stock-recruitment relationship for Atlantic salmon (*Salmo salar*) in Newfoundland rivers. Can. J. Fish. Aquat. Sci. 39: 1496-1501.
- Cochran, W. G. 1977. Sampling techniques. John Wiley & Sons, Inc. 428 p.
- Moore, R. B., R. W. Penney, and R. J. Tucker. 1978. Atlantic salmon angled catch and effort data, Newfoundland and Labrador, 1953-77. Fish. Mar. Serv. Data Rep. No. 84, 274 p.
- Moore, R. B., and R. J. Tucker. 1979. Atlantic salmon angled catch and effort data, Newfoundland and Labrador, 1978. Fish. Mar. Serv. Data Rep. 147, 106 p.
1980. Atlantic salmon angled catch and effort data, Newfoundland and Labrador, 1979. Can. Data. Rep. Fish. Aquat. Sci. 212: xiv + 86 p.
- O'Connell, M. F., J. B. Dempson, D. G. Reddin, and E. G. M. Ash. 1983. Status of Atlantic salmon stocks in Newfoundland and Labrador, 1983. CAFSAC Res. Doc. 83/80: 67 p.
- O'Connell, M. F., and D. G. Reddin. 1983. Egg depositions in some Newfoundland Rivers. CAFSAC Res. Doc. 83/15: 9 p.

- Pepper, V. A. 1976. Lacustrine nursery areas for Atlantic salmon in insular Newfoundland. Fish. Mar. Serv. Tech. Rep. 671: 61 p.
- Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can. 191: 382 p.

Table 1. Summary of recreational Atlantic salmon catch and effort data for Deadman's Brook, 1953-83.

RIVER: DEADMANS BROOK (DEADMANS BAY)

CODE: 09089500

YEAR	EFFORT ROD DAYS	GRILSE <2.7KG	SALMON >2.7KG	TOTAL CATCH	CUE	PERCENT GRILSE
1953	477	28	3	31	0.06	.
1954	308	27	2	29	0.09	93
1955	74	31	0	31	0.42	100
1956	606	52	6	58	0.10	84
1957	184	112	4	116	0.63	93
1958	141	112	3	115	0.82	97
1959	311	96	8	104	0.33	93
1960	214	63	15	78	0.36	86
1961	150	58	9	67	0.45	88
1962	391	202	22	224	0.57	72
1963	508	158	23	181	0.36	90
1964	357	124	5	129	0.36	97
1965	409	109	1	110	0.27	99
1966	254	90	0	90	0.35	100
1967	444	121	2	123	0.28	98
1968	457	228	0	228	0.50	100
1969	486	129	1	130	0.27	100
1970	376	68	0	68	0.18	100
1971	363	34	0	34	0.09	100
1972	186	54	1	55	0.30	97
1973	288	116	0	116	0.40	100
1974	632	28	0	28	0.04	100
1975	256	9	0	9	0.04	100
1976	215	10	0	10	0.05	100
1977	467	180	19	199	0.43	34
1978	.	.	.	.	.	.
1979	.	.	.	.	.	.
1980	.	.	.	.	.	.
1981	.	.	.	.	.	.
1982	.	.	.	.	.	.
1983	102	46	0	46	0.45	.

MEANS STANDARD DEVIATIONS N'S:

53-57	329.8	50.0	3.0	53.0	0.16	92
S.D.	215.1	36.1	2.2	37.2	0.07	3
N	5	5	5	5	5	4
58-62	241.4	106.2	11.4	117.6	0.49	89
S.D.	107.7	58.1	7.3	62.5	0.07	4
N	5	5	5	5	5	5
63-67	394.4	120.4	6.2	126.6	0.32	96
S.D.	95.8	24.9	9.6	33.9	0.02	2
N	5	5	5	5	5	5
68-72	373.6	102.6	0.4	103.0	0.28	100
S.D.	117.2	78.6	0.5	78.5	0.08	0
N	5	5	5	5	5	5
73-77	371.6	68.6	3.8	72.4	0.19	92
S.D.	174.5	76.3	8.5	83.4	0.10	9
N	5	5	5	5	5	5
78-82	.	.	.	.	.	.
S.D.	.	.	.	.	.	.
N	.	.	.	.	.	.
69-82	363.2	69.8	2.3	72.1	0.20	97
S.D.	145.3	59.5	6.3	64.2	0.06	3
N	9	9	9	9	9	9

PERCENT GRILSE FIGURES ARE CALCULATED USING LAGGED GRILSE VALUES
 . IN THE ABOVE TABLE INDICATES NO DATA FOR THAT YEAR

Table 2. Summary of recreational Atlantic salmon catch and effort data for Anchor Brook, 1953-83.

RIVER: ANCHOR BROOK

CODE: 09089400

YEAR	EFFORT ROD DAYS	GRILSE <2.7KG	SALMON >2.7KG	TOTAL CATCH	CUE	PERCENT GRILSE
1953	8	1	0	1	0.13	.
1954	34	8	0	8	0.24	100
1955	60	19	0	19	0.32	100
1956	364	16	2	18	0.05	90
1957	66	39	4	43	0.65	80
1958	148	110	19	129	0.87	67
1959	345	65	7	72	0.21	94
1960	341	81	10	91	0.27	87
1961	143	51	2	53	0.37	98
1962	499	183	14	197	0.39	78
1963	620	192	1	193	0.31	99
1964	861	307	9	316	0.37	96
1965	715	108	0	108	0.15	100
1966	621	134	1	135	0.22	99
1967	785	128	2	130	0.17	99
1968	496	130	1	131	0.26	99
1969	704	133	2	135	0.19	98
1970	462	47	0	47	0.10	100
1971	241	31	0	31	0.13	100
1972	290	28	0	28	0.10	100
1973	384	47	0	47	0.12	100
1974	353	13	2	15	0.04	96
1975	252	10	0	10	0.04	100
1976	206	26	0	26	0.13	100
1977	557	234	12	246	0.44	68
1978	.	.	.	.	.	.
1979	.	.	.	.	.	.
1980	.	.	.	.	.	.
1981	.	.	.	.	.	.
1982	.	.	.	.	.	.
1983	238	32	0	32	0.13	.

MEANS STANDARD DEVIATIONS N'S:

53-57	106.4	16.6	1.2	17.8	0.17	88
S.D.	145.8	14.4	1.8	15.9	0.11	4
N	5	5	5	5	5	4
58-62	295.2	98.0	10.4	108.4	0.37	87
S.D.	150.8	52.3	6.5	56.9	0.08	5
N	5	5	5	5	5	5
63-67	720.4	173.8	2.6	176.4	0.24	99
S.D.	104.8	80.8	3.6	84.1	0.05	1
N	5	5	5	5	5	5
68-72	438.6	73.8	0.6	74.4	0.17	99
S.D.	184.0	53.2	0.9	54.0	0.03	0
N	5	5	5	5	5	5
73-77	350.4	66.0	2.8	68.8	0.20	90
S.D.	136.3	95.0	5.2	100.1	0.10	8
N	5	5	5	5	5	5
78-82	.	.	.	.	.	.
S.D.	.	.	.	.	.	.
N	.	.	.	.	.	.
69-82	383.2	63.2	1.8	65.0	0.17	97
S.D.	165.0	73.8	3.9	77.4	0.05	3
N	9	9	9	9	9	9

PERCENT GRILSE FIGURES ARE CALCULATED USING LAGGED GRILSE VALUES
 . IN THE ABOVE TABLE INDICATES NO DATA FOR THAT YEAR

Table 3. Recreational Atlantic salmon catch and effort data for the period July 9-22, 1983 compared with the same time period for 1975-77 for Deadman's Brook/Anchor Brook.

Year	Deadman's Brook			Anchor Brook		
	Total catch	*Effort	CUE	Total catch	*Effort	CUE
1975 (July 21-Aug. 8)	0	0	0.00	0	50	0.12
1976 (July 19-Aug. 1)	1	32	0.03	4	32	0.13
1977 (July 18-31)	62	113	0.55	76	140	0.54
1983 (July 9-22)	46	102	0.45	32	238	0.13

* Rod Days

Table 4. Parr density for a single station on each of Deadman's Brook and Anchor Brook. Also shown is the size of each station and substrate type.

Station location	Station size	Substrate type	No. of Parr/100 m ²					Total
			0+	1+	2+	3+	4+	
¹ Deadman's Brook	444.10 m ² (31.80 x 13.96)	Boulder, rubble	62.6	15.3	4.1	2.5	-	84.5
² Anchor Brook	317.68 m ² (31.80 x 9.99)	Boulder, rubble	23.9	6.3	1.6	2.5	0.3	34.6

¹Petersen Mark-Recapture Method

²DeLury Depletion Method

Table 5. Summary of recreational Atlantic salmon catch and effort data for Tides Brook, 1953-83.

RIVER: TIDES BROOK

CODE: 32064100

YEAR	EFFORT ROD DAYS	GRILSE <2.7KG	SALMON >2.7KG	TOTAL CATCH	CUE	PERCENT GRILSE
1953	165	25	0	25	0.15	.
1954	43	7	1	8	0.19	96
1955	99	5	0	5	0.05	100
1956	152	25	0	25	0.16	100
1957	261	21	2	23	0.09	93
1958	565	183	10	193	0.34	68
1959	228	48	2	50	0.22	99
1960	226	41	2	43	0.19	96
1961	97	12	0	12	0.12	100
1962	278	20	57	77	0.28	17
1963	576	147	2	149	0.26	91
1964	296	202	1	203	0.69	99
1965	675	249	1	250	0.37	100
1966	862	151	2	153	0.18	99
1967	620	81	1	82	0.13	99
1968	458	90	0	90	0.20	100
1969	296	88	3	91	0.31	97
1970	280	78	0	78	0.28	100
1971	322	153	2	155	0.48	97
1972	135	48	1	49	0.36	99
1973	298	100	1	101	0.34	98
1974	392	49	0	49	0.13	100
1975	248	5	0	5	0.02	100
1976	263	7	0	7	0.03	100
1977	513	24	0	24	0.05	100
1978	.	.	.	.	.	.
1979	.	.	.	.	.	.
1980	.	.	.	.	.	.
1981	.	.	.	.	.	.
1982	.	.	.	.	.	.
1983	470	34	18	52	0.11	.

MEANS STANDARD DEVIATIONS N'S:

53-57	144.0	16.6	0.6	17.2	0.12	95
S.D.	81.3	9.8	0.9	9.9	0.02	2
N	5	5	5	5	5	4
58-62	278.8	60.8	14.2	75.0	0.27	81
S.D.	173.4	69.9	24.2	69.9	0.04	17
N	5	5	5	5	5	5
63-67	605.8	166.0	1.4	167.4	0.28	99
S.D.	204.6	63.2	0.5	63.1	0.07	0
N	5	5	5	5	5	5
68-72	298.2	91.4	1.2	92.6	0.31	99
S.D.	115.2	38.3	1.3	38.8	0.06	1
N	5	5	5	5	5	5
73-77	342.8	37.0	0.2	37.2	0.11	100
S.D.	110.4	39.4	0.4	39.8	0.05	0
N	5	5	5	5	5	5
78-82	.	.	.	.	.	.
S.D.	.	.	.	.	.	.
N	.	.	.	.	.	.
69-82	305.2	61.3	0.8	62.1	0.20	99
S.D.	103.6	48.4	1.1	49.1	0.06	0
N	9	9	9	9	9	9

PERCENT GRILSE FIGURES ARE CALCULATED USING LAGGED GRILSE VALUES
 . IN THE ABOVE TABLE INDICATES NO DATA FOR THAT YEAR

Table 6. Recreational Atlantic catch and effort data for the period July 9-22, 1983 compared with the same time period for 1975-77 for Tides Brook.

Year	Total catch	Effort (rod days)	CUE
1975 (July 21-Aug. 3)	2	50	0.04
1976 (July 19-Aug. 1)	1	46	0.02
1977 (July 18-31)	0	103	0.02
1983 (July 9-22)	52	470	0.11

Table 7. Parr density for 2 stations on a tributary of Tides Brook. Also shown is the size of each station and substrate type.

Station location	Station size	Substrate type	No. of Parr/100 m ²				
			0+	1+	2+	3+	Total
Main Brook	306.60 m ² (34.30 x 8.94)	Cobble, gravel, pebble	2.3	1.0	1.6	0.7	5.6
Trib. of Main Brook	301.90 m ² (44.40 x 6.80)	Cobble, gravel, pebble	3.3	0.7	0.3	-	4.3

Table 8. Summary of recreational Atlantic salmon catch and effort data for Main River (Sop's Arm), 1953-83.

RIVER: MAIN RIVER (SOPS ARM)

CODE: 04031100

YEAR	EFFORT ROD DAYS	GRILSE <2.7KG	SALMON >2.7KG	TOTAL CATCH	CUE	PERCENT GRILSE
1953	17	10	1	11	0.65	.
1954	48	25	0	25	0.52	100
1955	.	.	.	.	.	.
1956	18	0	0	0	0.00	0
1957	4	2	0	2	0.50	100
1958	10	3	0	3	0.30	100
1959	40	5	0	5	0.13	100
1960	5	2	0	2	0.40	100
1961	110	24	0	24	0.22	100
1962	112	60	0	60	0.54	100
1963	164	89	0	89	0.54	100
1964	465	284	0	284	0.61	100
1965	666	538	4	542	0.81	99
1966	1350	911	20	931	0.69	96
1967	891	128	1	129	0.14	100
1968	1036	749	26	775	0.75	83
1969	1625	600	44	734	0.45	94
1970	832	472	1	473	0.57	100
1971	713	405	9	414	0.58	98
1972	703	281	0	281	0.40	100
1973	685	409	0	409	0.60	100
1974	797	464	0	464	0.58	100
1975	1231	782	0	782	0.64	100
1976	1082	501	0	501	0.46	100
1977	1041	693	0	693	0.67	100
1978	616	252	0	252	0.41	100
1979	830	983	0	983	1.18	100
1980	916	976	35	1011	1.10	97
1981	1098	1275	2	1277	1.16	100
1982	1848	1620	87	1707	0.92	94
1983	1812	482	1	483	0.27	100

MEANS STANDARD DEVIATIONS N'S:

53-57	21.8	9.3	0.3	9.5	0.44	100
S.D.	18.6	11.4	0.5	11.4	0.13	0
N	4	4	4	4	4	2
58-62	55.4	18.8	0.0	18.8	0.34	100
S.D.	52.5	24.7	0.0	24.7	0.11	0
N	5	5	5	5	5	5
63-67	707.2	390.0	5.0	395.0	0.56	99
S.D.	447.9	340.5	8.5	348.4	0.14	1
N	5	5	5	5	5	5
68-72	981.8	519.4	16.0	535.4	0.55	97
S.D.	383.8	196.2	18.8	212.3	0.06	2
N	5	5	5	5	5	5
73-77	967.2	569.8	0.0	569.8	0.59	100
S.D.	221.8	159.7	0.0	159.7	0.04	0
N	5	5	5	5	5	5
78-82	1061.6	1021.2	24.8	1046.0	0.99	97
S.D.	472.5	504.5	37.8	530.5	0.10	2
N	5	5	5	5	5	5
69-82	1001.2	700.2	12.7	712.9	0.71	98
S.D.	362.0	395.7	25.6	413.1	0.08	1
N	14	14	14	14	14	14

PERCENT GRILSE FIGURES ARE CALCULATED USING LAGGED GRILSE VALUES
 . IN THE ABOVE TABLE INDICATES NO DATA FOR THAT YEAR

Table 9. Commercial landings (approximately 80% grilse) for communities in the vicinity of Main River (Sop's Arm), White Bay.

Community where catch landed	1982		1983		Percent increase in catch (weight)
	Wt. (kg)	No.	Wt. (kg)	No.	
Jackson's Arm	4077	1649	8835	3237	117
Sop's Arm	2284	925	5432	2732	138
Purbeck's Cove	1679	1022	8799	4732	424
Westport	1602	820	6143	2730	283

Table 10. Commercial catch statistics for fishermen with and without cod traps in the vicinity of Main River (Sop's Arm), White Bay. Number of fishermen in parentheses.

Year	Catch (kg)		Average catch per fisherman (kg)		**Effort (No. gear units)		CUE	
	1C.T.	2S.N.	1C.T.	2S.N.	1C.T.	2S.N.	1C.T.	2S.N.
1982	1450	1367	290(5)*	80(17)	3.0	48.8	483.3	28.0
1983	7450	3554	1490(5)*	155(23)	3.0	62.8	2483.3	56.6

¹Fishermen landing salmon who operate cod traps plus salmon nets.

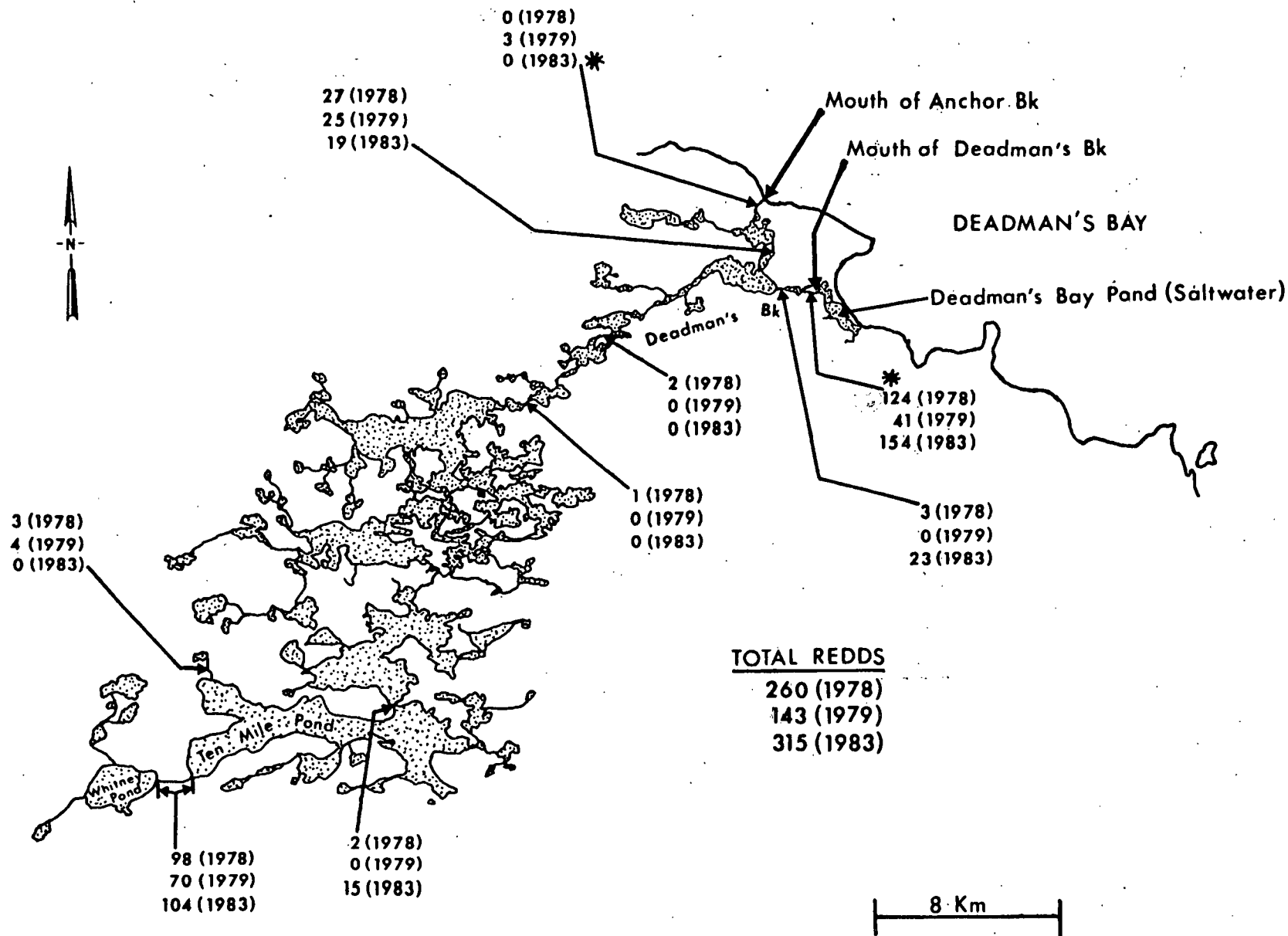
²Fishermen landing salmon from salmon nets who do not operate cod traps.

* 2 crews for a total of 5 fishermen; 3 cod traps operated.

** Gear unit = 50 fathoms for both cod traps and salmon nets.

Table 11. Mean weekly water temperature (°C) in 1983 recorded at the Indian River fishway compared with previous years.

Year	Temperature °C											
1978	- (June 18- 24)	10.0 (June 25- July 1)	12.6 (July 2- 8)	17.1 (July 9- 15)	16.7 (July 16- 22)	15.2 (July 23- 29)	17.7 (July 30- Aug. 5)	16.4 (Aug. 6- 12)	15.8 (Aug. 13- 19)	12.8 (Aug. 20- 26)	8.3 (Aug. 27- Sept. 2)	- (Sept. 3- 9)
1979	- (June 17- 23)	14.1 (June 24- 30)	15.8 (July 1- 7)	17.1 (July 8- 14)	16.0 (July 15- 21)	18.6 (July 22- 28)	18.3 (July 29- Aug. 4)	16.4 (Aug. 5- 11)	13.6 (Aug. 12- 18)	14.4 (Aug. 19- 25)	15.2 (Aug. 26- Sept. 1)	13.6 (Sept. 2- 8)
1980	- (June 15- 21)	16.6 (June 22- 28)	14.4 (June 29- July 5)	14.1 (July 6- 12)	15.7 (July 13- 19)	15.3 (July 20- 26)	16.5 (July 27- Aug. 2)	16.0 (Aug. 3- 9)	15.9 (Aug. 10- 16)	14.9 (Aug. 17- 23)	17.3 (Aug. 24- 30)	15.4 (Aug. 31- Sept. 6)
1981	15.0 (June 14- 20)	14.0 (June 21- 27)	15.6 (June 28- July 4)	16.2 (July 5- 11)	13.9 (July 12- 18)	16.9 (July 19- 25)	18.6 (July 26- Aug. 1)	15.4 (Aug. 2- 8)	18.0 (Aug. 9- 15)	17.5 (Aug. 16- 22)	- (Aug. 23- 29)	- (Aug. 30- Sept. 5)
1982	- (June 13- 19)	- (June 20- 26)	11.5 (June 27- July 3)	13.9 (July 4- 10)	15.3 (July 11- 17)	15.0 (July 18- 24)	14.8 (July 25- 31)	13.8 (Aug. 1- 7)	14.1 (Aug. 8- 14)	15.9 (Aug. 15- 21)	13.1 (Aug. 22- 28)	- (Aug. 29- Sept. 4)
1983	- (June 12- 18)	17.8 (June 19- 25)	18.0 (June 26- July 2)	17.0 (July 3- 9)	18.0 (July 10- 16)	17.6 (July 17- 23)	16.3 (July 24- 30)	17.8 (July 31- Aug. 6)	17.8 (Aug. 7- 13)	- (Aug. 14- 20)	- (Aug. 21- 27)	- (Aug. 28- Sept. 3)
\bar{x} (1978-82)	-	13.7	14.0	15.7	15.5	16.2	17.2	15.6	15.5	15.1	13.5	14.5



* Electrofishing Station

Fig. 1. Map of Deadman's Brook/Anchor Brook showing the location and number of redds for 1978, 1979, and 1983, as well as the location of electrofishing stations.

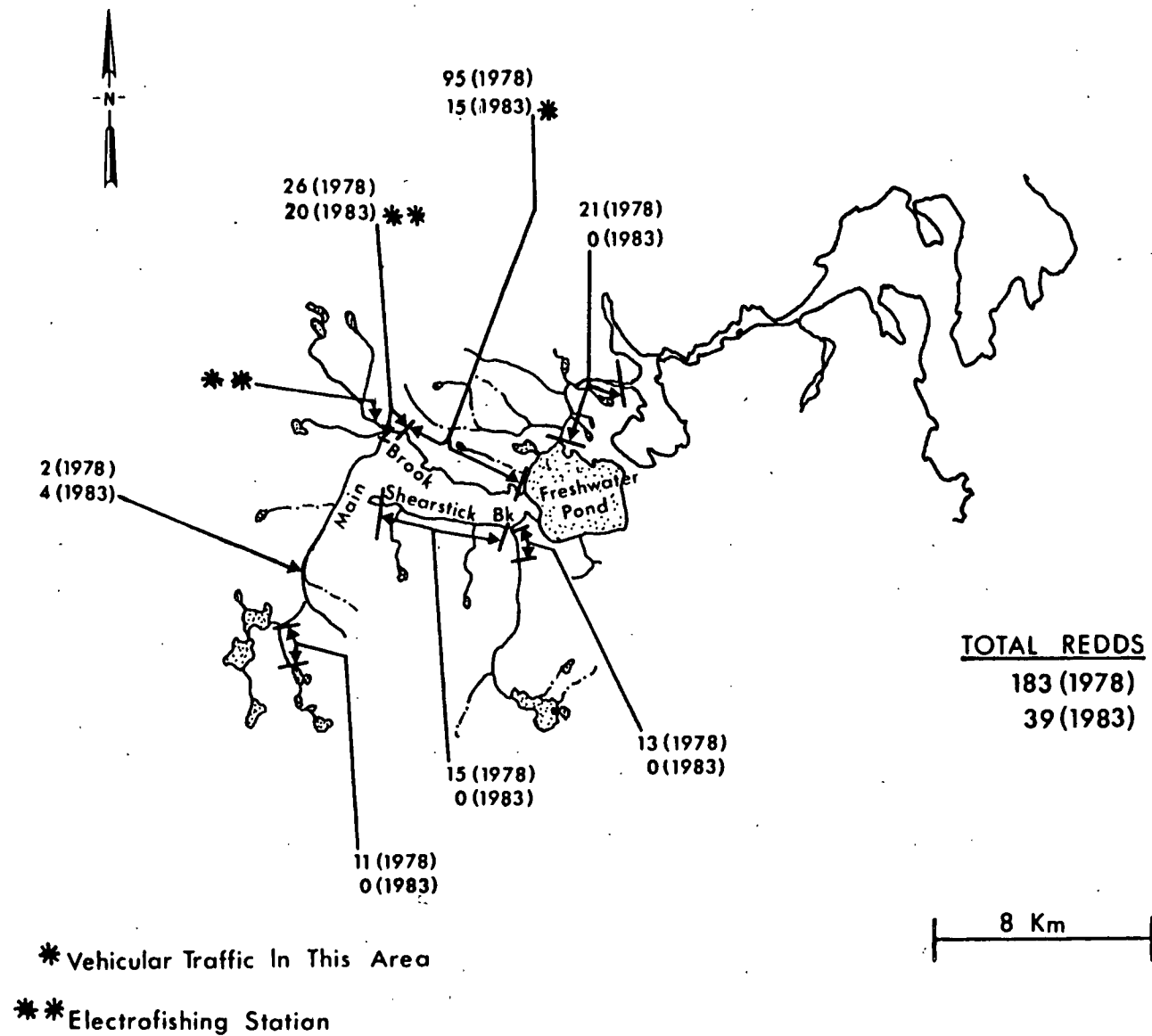


Fig. 2. Map of Tides Brook showing the number and location of redds for 1978 and 1983 as well as the location of electrofishing stations and the area where vehicular traffic occurs.

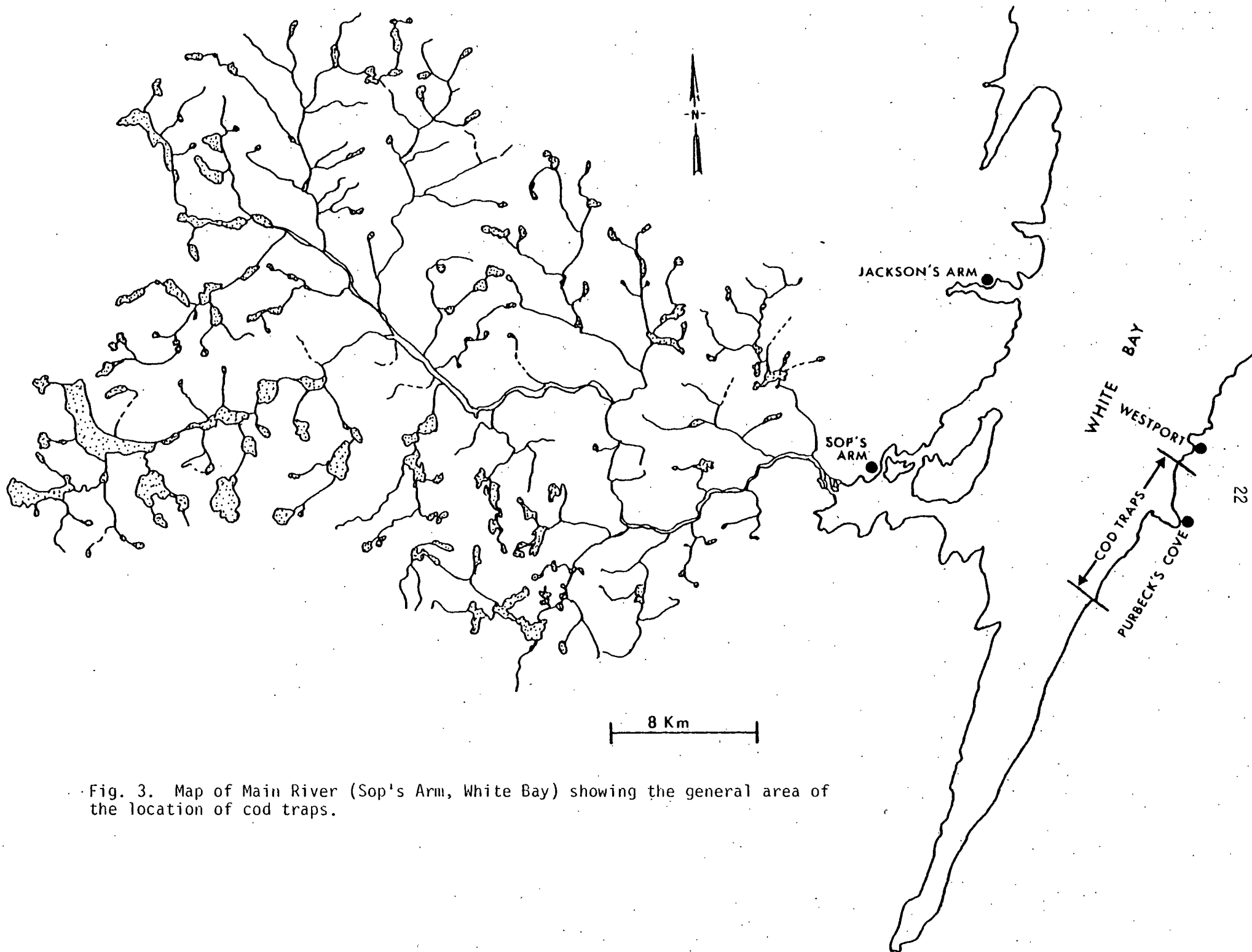


Fig. 3. Map of Main River (Sop's Arm, White Bay) showing the general area of the location of cod traps.

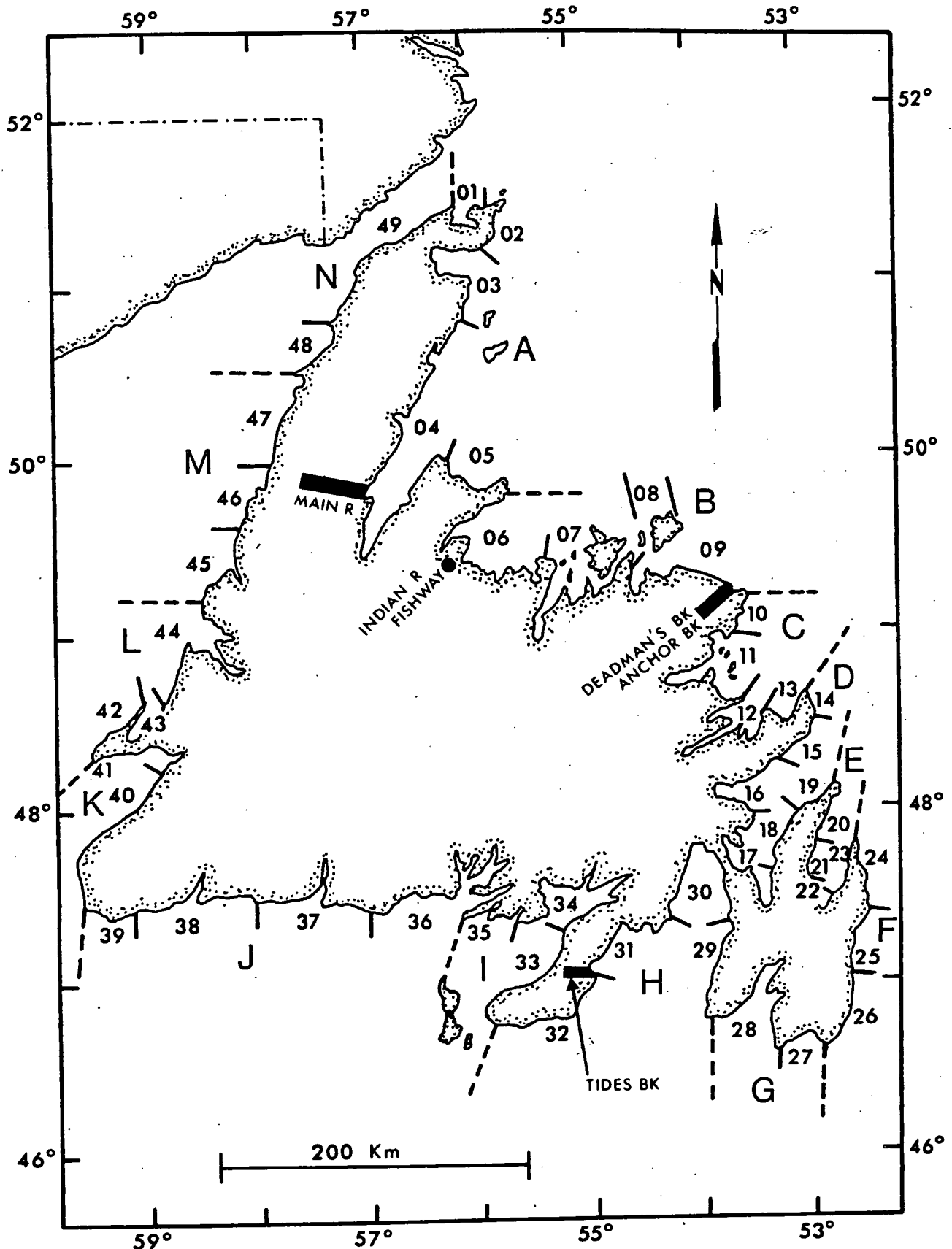


Fig. 4. Map of insular Newfoundland showing the location of Deadman's Brook/Anchor Brook, Tides Brook, and Main River (Sop's Arm).. Also shown are the Statistical Areas and Sections.