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Witch Flounder in the Northern
Gulf of St. Lawrence
(NAFO Divisions 4RS)

by

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ABSTRACT

Landings have averaged 2000-3500 t over the past 11 years with the major effort coming from the Newfoundland otter trawlers in the southwest portion of Esquiman Channel in the wintertime and to a lesser extent the Danish Seiners on the south side of St. Georges' Bay in the summertime. The age groups comprising this fishery have been reduced from 6-26 years old in 1976 to 6-15 years old in 1980 with this reduction in the number of age groups compensated by increased growth and recruitment. Despite the large reduction of the older age groups, over the past few years, biomass estimates and the number of age classes comprising the fishery appear to be stabilizing. This apparent stability has been generated by average annual removals through fishing of about 3500 t.

RESUME

Au cours des 11 dernières années, les débarquements annuels moyens de plie grise ont été de 2 000-3 500 t. Ils provenaient surtout de l'effort de chalutiers terre-neuviens pêchant dans la partie sud-ouest du chenal d'Esquiman en hiver et, à un degré moindre, de bateaux pêchant à la senne danoise dans le secteur méridional de la baie Saint-Georges en été. Les groupes d'âge capturés ont rajeuni, passant de 6-26 ans en 1976 à 6-15 ans en 1980. Cette réduction du nombre de classes d'âge a été compensée par une croissance et un recrutement accrus. En dépit de la forte diminution des groupes âgés ces dernières années les estimations de biomasse et le nombre de classes d'âge alimentant cette pêche semble se stabiliser. Des prélèvements annuels par pêche d'environ 3 500 t ont engendré cette apparente stabilité.

THE FISHERY

The fishery for witch flounder in the northern Gulf of St. Lawrence has essentially been a Newfoundland based fishery since it began. This species generally forms a prespawning concentration in wintertime in the southern part of the Esquiman Channel just southwest of the mouth of St. George's Bay. It is near this same time and area when the cod are concentrated and consequently the same time and area that the main witch fishery is prosecuted. In the summertime the fish disperse and the only area of concentration appears to be on the southern portion of St. Georges' Bay where it is fished to a smaller extent by Danish Seiners.

Landings over the past 11 years have been between 900-5300 t annually but averaged about 2800 t (Table 1). The total catch in 1980 was 2678 t (Table 1) of which 1366 t was taken by Newfoundland based trawlers, 771 t primarily by Danish Seiners and 541 t by Maritime based trawlers. Preliminary statistics for 1981 indicate that a total of 282 t of witch have been taken in Divisions 4RS by Newfoundland and Maritime based trawlers combined up to April 7. Any trawler fishery for witch in this area would now be essentially completed. If the Danish Seiners maintain their catch of 700-1000 t for 1981, then the total witch landings for 1981 from Divisions 4RS is not likely to exceed 1200-1500 t regardless of what the quota might be.

The obvious reason for the reduction in the trawler landings for 1981 is the reduction in effort resulting from the exclusion of large trawlers from the northern Gulf cod fishery. This would suggest that there may never have been a strictly directed trawler fishery for witch in this area but simply a very large by-catch of witch in the cod fishery where both species happened to be concentrated at the same time.

The first pre-emptive quota was placed on the stock in 1977 at a level of 3500 t, however, assessments later showed the presence of large numbers of old, slow growing fish, many of which were landed in "jellied" condition contributing to a poor quality product. The TAC was raised to 5000 t in 1979 with the expectation of reducing the numbers of old fish which would, in turn, stimulate the growth rate and improve the quality of fish landed. A review of this management strategy was presented at last year's meeting in Bowering and Brodie 1980.

AGE COMPOSITION OF THE DIVISIONS 4RS WITCH STOCK

From 1976 to 1980, commercial age and length samples have been secured from the Newfoundland otter trawl fishery, however, the 1980 sampling included only one small sample. Danish seine samples have never been taken, therefore, catch at age for these samples was adjusted to total catch by all gears.

As indicated by Bowering (1979) and Bowering and Brodie (1980) a marked decrease in the numbers of old fish has taken place. This decrease in older age groups is again evident in the 1980 sample, although small (Table 2; Fig. 1). The age composition has gone from 6-26-yr-old in 1976 to 6-15-yr-old in 1980. The numbers of younger fish are presently in higher proportions than previously; probably a combination of discarding of smaller fish in earlier years as well as an increase in growth rate over the past 5 years (Bowering and Brodie, 1980).

During 1978-81 inclusive, stratified-random biomass surveys have been conducted in the Gulf of St. Lawrence. Age composition for the 1978-80 surveys inclusive is presented in Fig. 2, however, the 1981 data are not available at this time. It is evident from these research vessel data (Fig. 2) that there has been a considerable reduction in the older age groups of the stock that is very similar to that shown by the commercial data. This decrease in the numbers of age groups has been generated by an average catch of about 3500 t annually over the past few years. With the trend in frequency distribution continuously moving to the left (Fig. 1) it is still difficult to be certain of where it would stabilize if fishing pressure was maintained at the levels of the past few years, however, if predictions hold for future effort into this fishery it would probably not move further left and may, in fact, shift to the right again.

CPUE AND MORTALITY

Catch and effort statistics were available for the Newfoundland trawler fishery where the fishery may not necessarily have been directed towards witch but where witch was the main species in the catch. The percentages of the annual catch for 1976-80 from which the CPUE were derived were 35%, 13%, 35%, 28% and 12% respectively. Bowering and Brodie (1980) indicated that there was a fluctuation in CPUE with no apparent trend from 1976-79, however, with the addition of the 1980 data there has been a decreasing trend in the CPUE over the past 3 years from 0.46 t/hr in 1978 to 0.13 t/hr in 1980. This reduction is also evident in the percentage reported as main species over the past 3 years, suggesting that it is now essentially a by-catch fishery with the exception of the Danish seine portion of the fishery.

Bowering and Brodie (1980) made several attempts to derive recent estimates of fishing mortality, however, it was virtually impossible considering the nature of the data. With the shifting of the age frequency distribution and the rather questionable estimates of CPUE it is impossible to calculate F 's by the Paloheimo method. To obtain an estimate of long-term fishing mortality from these commercial data is also not possible with any degree of reliability because of the obvious shifting in the recruitment pattern over the past several years. However, considering the state of the present stock compared to that of 1976 there is obviously extremely high mortality in the fully recruited age groups.

An estimate of the exploitation pattern derived by Bowering and Brodie (1980) indicated that fish in this stock would not become fully recruited until age 13. This being the case, the 1980 catch data shows less than 1% of the total catch is now comprised of fish fully recruited to the fishery.

ESTIMATES OF BIOMASS FROM SURVEYS

During January-February of 1978, 1979, 1980 and 1981, stratified-random biomass surveys have been conducted in the northern Gulf of St. Lawrence according to the stratification scheme presented in Fig. 3.

The population weights and numbers by stratum are presented in Table 3 for Division 4R, Table 4 for Division 4S and the totals for both divisions in Table 5.

As evidenced by the commercial fishery, the main concentrations are located in the area of the Esquiman Channel southwest of St. George's Bay during wintertime. Considering Division 4R, the estimates of biomass (Table 3) have been relatively consistent for the past 4 years with the exception of the low value for 1980. This can be explained when we look at Division 4S. For Division 4S the 1979 survey is very incomplete and, therefore, is of no use. The estimates for 1978 and 1981, however, are about the same. The very high estimate in 1980 is probably overestimated by more than 50% for the following reason. In Fig. 3, the sets of very high abundance in Stratum 803 are very close to the border of Stratum 802 and biomass should probably be adjusted to about half of the stratum (803, incidentally, is the largest stratum in the Gulf area) considering the small catches to the west side of the stratum. These large catches west of the borderline of Divisions 4R and 4S would explain the low estimate in Division 4R in 1980. If this adjustment were made for Stratum 803, Division 4S, then estimates of biomass for 1978, 1980 and 1981 would be about the same.

The initial management strategy designed for this stock over the past few years appears to have worked to a large degree, however, not at a level of 5000 t but more like 3500 t annually. While age groups comprising the stock have been reduced dramatically over the past few years, the biomass appears to have remained relatively stable. On the basis of this, it would seem reasonable to suggest that the annual landings should not exceed 3500 t. In any case, with the exclusion of the large trawlers from the cod fishery in the Gulf of St. Lawrence, the landings of witch are not likely to be in excess of 1500 t in the near future, at least for 1981.

REFERENCES

- Bowering, W. R. 1979. Current status of the witch fishery in the Gulf of St. Lawrence (ICNAF Divisions 4RS). CAFSAC Res. Doc. 79/8, 17 p.
- Bowering, W. R., and W. Brodie. 1980. An evaluation of recent management strategy for witch in the Gulf of St. Lawrence (NAFO Divisions 4RS). CAFSAC Res. Doc. 80/49, 20 p.

Table 1. Witch landings Divisions 4RS (t).

Year	4R	4S	Total
1970	3147	251	3398
1971	1996	132	2128
1972	550	402	952
1973	751	136	887
1974	2208	312	2520
1975	1664	281	1945
1976	3623	1718	5341
1977	1968	631	2599
1978	3429	866	4295
1979	3087	701	3788a
1980	2169	509	2678

a - Provisional catch statistics,
NAFO Sept. 1980.

Table 2. Numbers caught at age from witch 4RS commercial fishery based on revised catch statistics (nos. in '000's)

Age	1976	c/1000 hr	1977	c/1000 hr	1978	c/1000 hr
6	1	0.09	2	0.15	50	5.27
7	1	0.09	36	2.78	168	17.78
8	61	8.52	113	8.74	515	54.52
9	103	9.31	315	24.36	623	65.98
10	221	19.99	524	40.53	1196	126.70
11	537	48.56	788	60.94	1213	128.54
12	556	77.41	834	64.50	1372	145.40
13	1055	95.41	844	65.27	1272	134.73
14	936	84.64	796	61.56	986	104.44
15	588	53.17	351	27.15	496	52.55
16	475	42.96	199	15.39	270	28.58
17	207	18.72	100	7.73	152	16.07
18	153	13.84	52	4.02	58	6.19
19	55	4.97	15	1.16	9	0.92
20	41	3.71	21	1.62	9	0.92
21	47	4.25	8	0.62		
Total Catch	5341 tons		2599 tons		4295 tons	
Total Effort	11058 hrs.		12930 hrs.		9440 hrs.	
CPUE	0.483 tons/hr		0.201 tons/hr		0.455 tons/hr	
Age	1979	c/1000 hr	1980	c/1000 hr		
6	15	4.42	89	4.39		
7	274	79.75	257	12.67		
8	468	136.12	609	30.02		
9	564	163.99	656	32.33		
10	1144	332.79	1119	55.17		
11	1765	513.10	1328	65.46		
12	1990	578.76	982	48.40		
13	1394	405.49	158	7.79		
14	274	79.75	47	2.32		
15	144	41.96	21	1.04		
16	32	9.29				
Total Catch	3788 tons		2678 tons			
Total Effort	11044 hrs		20288 hrs.			
CPUE	0.343 tons/hr.		0.132 tons/hr.			

Table 3. Biomass estimates of witch in Divisions 4R from research vessel surveys (G. Atlantica).

Stratum	<u>Population weights (tons)</u>			
	1978	1979	<u>Year</u> 1980	1981
801	881	36	179	286
802	1158	2325	1235	2448
809	1861	2884	491	2454
810	332	137	212	66
811	141	100	56	33
812	905	554	161	153
813	485	69	91	209
820	74	317	26	0
821	0	16	45	251
822	0	156	42	6
824	0	0	0	4
Total	5837	6594	2538	5910

Stratum	<u>Population numbers ('000's)</u>			
	1978	1979	<u>Year</u> 1980	1981
801	1958	97	545	731
802	1897	5241	2426	4358
809	3882	5507	1411	4570
810	502	212	385	104
811	178	231	82	33
812	2116	1383	441	320
813	1906	238	368	736
820	74	386	37	0
821	0	39	84	460
822	0	301	142	28
824	0	0	0	9
Total	12513	13635	5921	11348

Table 4. Biomass estimates of witch in Division 4S from research vessel surveys (G. Atlantica).

Stratum	<u>Population weights (tons)</u>			
	1978	1979	<u>Year</u> 1980	1981
803	3732	-	17458	6603
804	569	-	177	73
805	-	-	652	288
806	99	-	99	47
807	67	52	22	39
808	1673	53	1306	629
814	37	-	40	2
815	540	96	125	51
816	135	110	77	127
817	-	-	38	4
818	21	-	16	19
819	0	32	3	8
Total	6873	343	20013	7890

Stratum	<u>Population numbers ('000's)</u>			
	1978	1979	<u>Year</u> 1980	1981
803	7227	-	27592	10956
804	981	-	490	163
805	-	-	2396	899
806	186	-	171	128
807	190	156	86	52
808	3490	1545	4110	1311
814	113	-	105	11
815	1511	362	900	249
816	815	624	440	541
817	-	-	279	40
818	95	-	63	47
819	0	47	11	16
Total	14608	2734	36643	14413

Table 5. Population numbers and biomass estimates of witch in Divisions 4RS.

Division	Year			
	1978	1979	1980	1981
Weights (tons)				
4R	5837	6594	2538	5910
4S	6873	343	20013	7890
Total	12710	6937	22551	13800
Numbers ('000's)				
4R	12513	13635	5921	11348
4S	14608	2734	36643	14413
Total	27121	16369	42564	25761

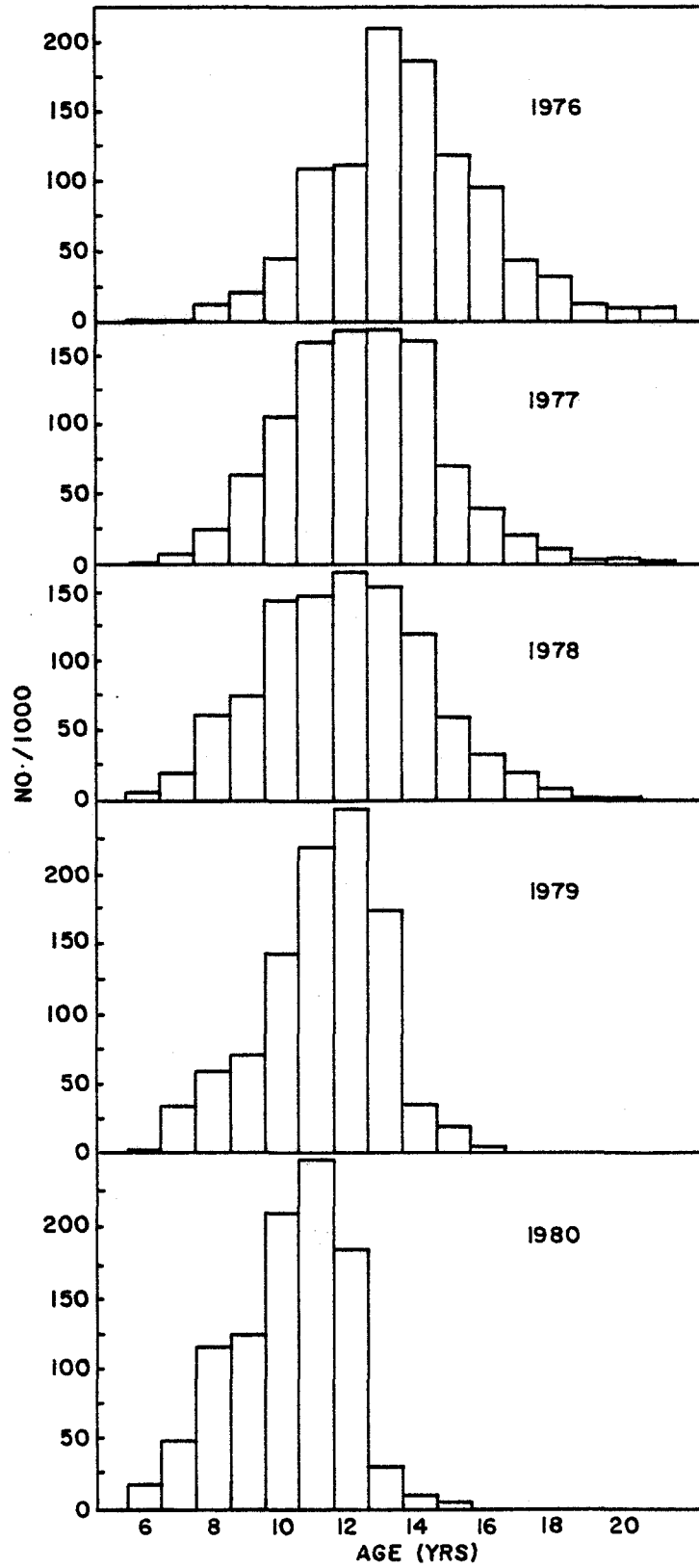


Figure 1. Frequency distribution of commercial witch in Division 4RS.

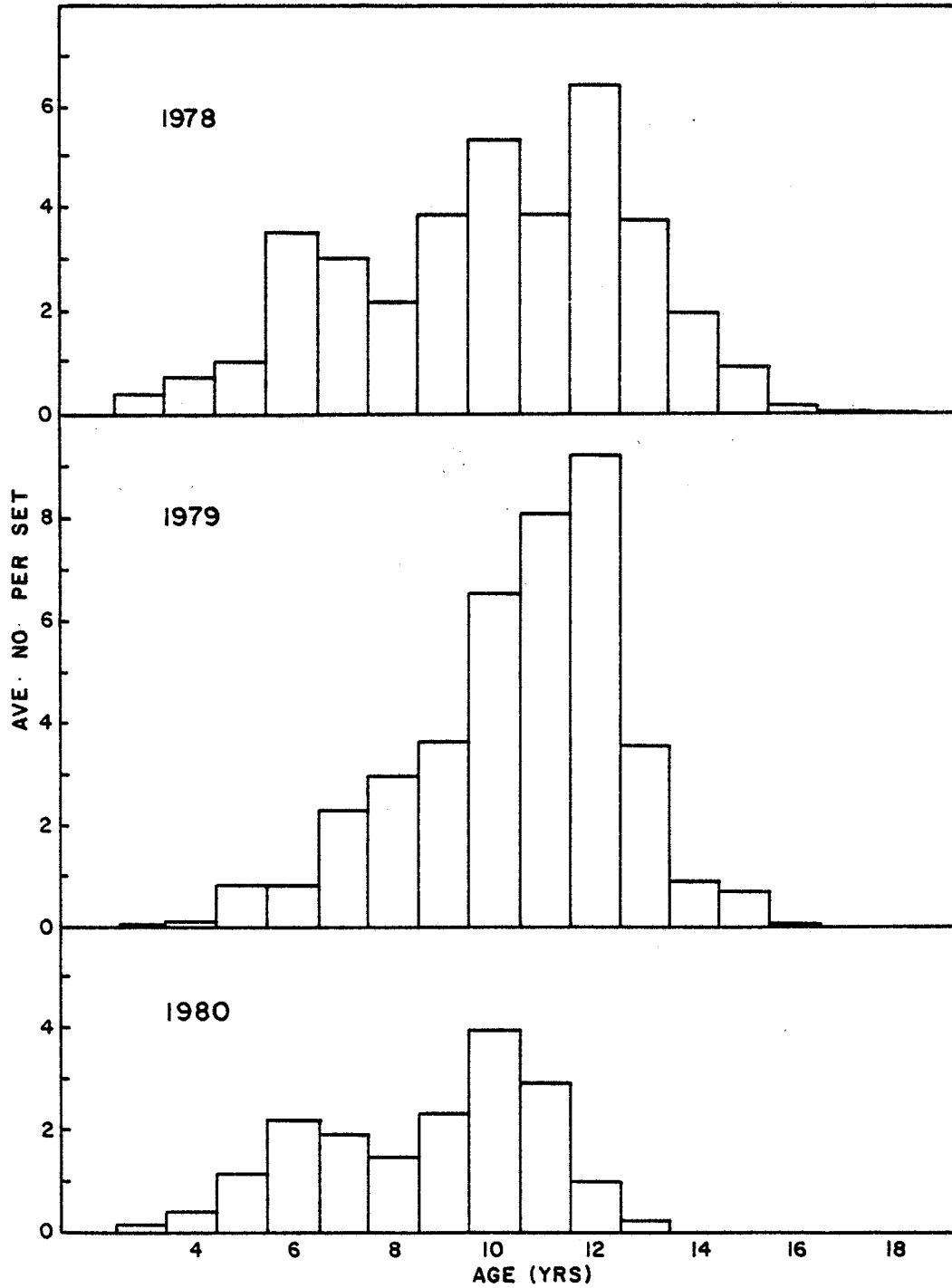


Figure 2. Average number of witch per set by age from Gadus Atlantica research surveys in Divisions 4RS.

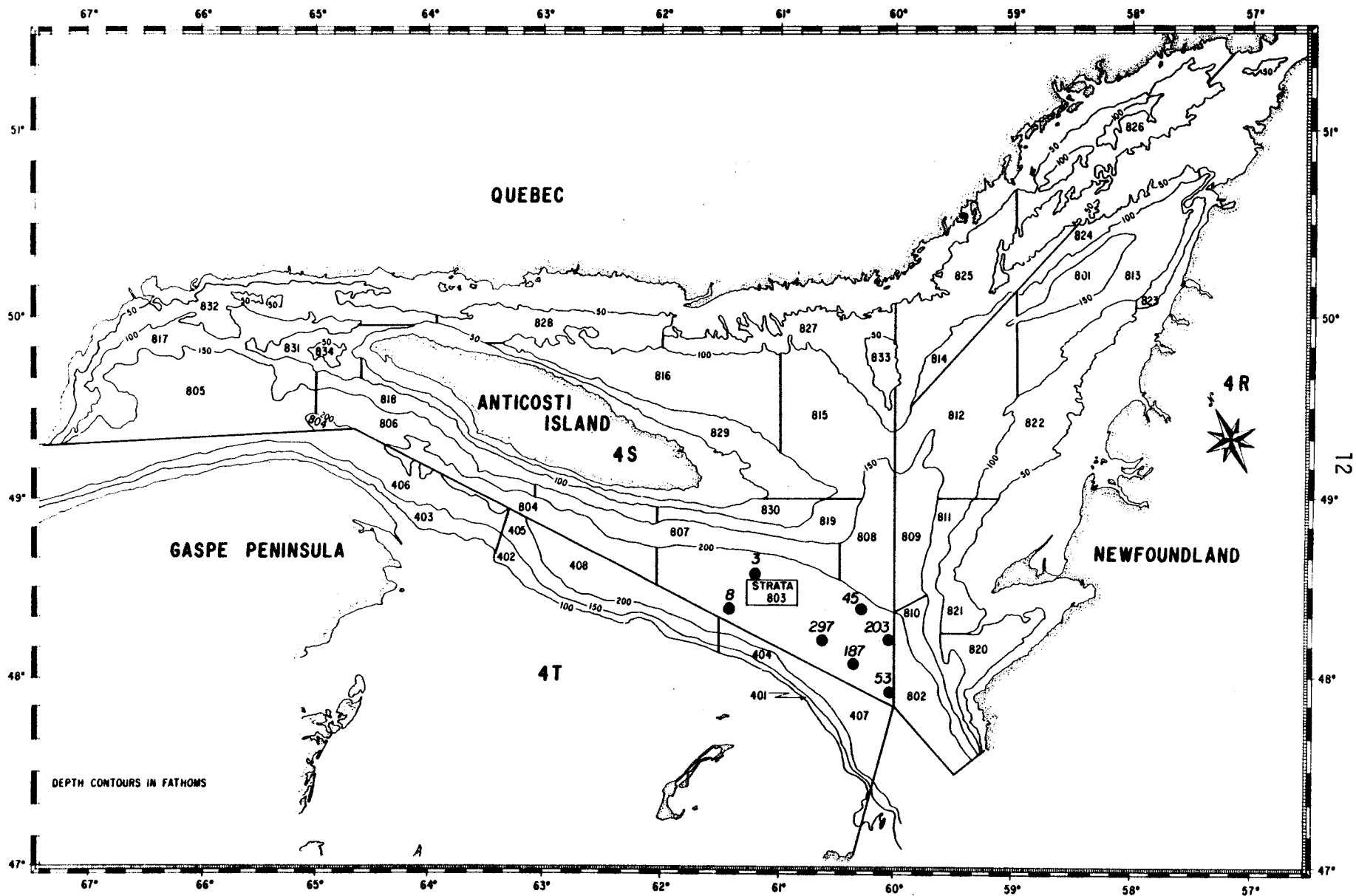


Figure 3. Stratification scheme for the Northern Gulf of St. Lawrence with results of 1980 survey for Stratum 803.