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the Northwest Atlantic Fisheries

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Codification of Survey Stratification Schemes for the Northwest Atlantic

by

Assistant Executive Secretary

Introduction

The Biological Surveys Subcommittee, in its review of the proposed Manual for Groundfish Surveys at the 1978 Annual Meeting, noted the desirability of having a common numbering system for stratification schemes, and recommended *"that member countries submit their stratification numbering schemes to the ICNAF Secretariat with a view to developing a common numbering scheme for consideration at the 1979 Annual Meeting"* (Redbook 1978, pages 40 and 79).

In October 1978, requests for the relevant stratification material, including a set of master stratification charts and a list of strata areas, were forwarded to the following research institutes:

- a) St. John's Biological Station, for Div. 2J and the whole of Subarea 3 (A. T. Pinhorn).
- b) Marine Fish Division, Maritimes Region, for Subarea 4, including the Gulf of St. Lawrence and the Bay of Fundy (R. G. Halliday).
- c) Northeast Fisheries Center, Woods Hole, for Subareas 5 and 6 (R. C. Hennemuth).

Noting that STACRES had not yet adopted stratification schemes for Subareas 0 and 1 and Divisions 2GH, but that enough information may be available for consideration of schemes for these regions at the 1979 Annual Meeting, the St. John's Biological Station (A. T. Pinhorn) and the Greenland Fisheries Research Institute (Sv. Aa. Horsted) were requested to submit information for these areas, if available.

Stratification Schemes

Offshore areas

All relevant information on offshore stratification schemes for the Northwest Atlantic (as reported to the Secretariat) are listed in Table 1 and illustrated in Fig. 1 to 7. Although no master stratification charts were provided, page-size diagrams of the stratification schemes were submitted. However, the Secretariat has received no information on provisional stratification schemes for Subareas 0 and 1 and Div. 2GH.

The list provided by the St. John's Biological Station included a breakdown by ICNAF/NAFO divisions (2J, 3K, 3L, 3M, 3N, 3O, 3P, 4R and 4S) and information on the depth range, the area in square nautical miles, and the number of units for each stratum. Depth ranges are given in meters for strata in Div. 2J and 3K and in fathoms for the remaining divisions (Table 1). However, the numbering of strata on the diagrams for Div. 2J and 3K (Fig. 1 and 2) does not correspond with the numbering for these divisions in Table 1, and some of the strata listed in Table 1 for Div. 3L, 3N and 3O do not appear in the diagram (Fig. 3). The numbering in the diagrams for Div. 3M and 3P (Fig. 4 and 5) appear to be consistent with that of Table 1. No diagram was provided for the strata listed for Div. 4R and 4S.

The list for the remainder of Subarea 4, as provided by the Marine Fish Division, Maritimes Region, had no breakdown by ICNAF/NAFO divisions, but the proximity of strata boundaries between Div. 4T and 4V to the boundary line separating these divisions enabled a tabulation of the stratum information for Div. 4T and 4VWX separately (Table 1 and Fig. 6). The strata areas are given in square nautical miles and the depth ranges (<51, 51-100, >100) in fathoms. The numbers of units composing the individual strata were not provided.

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The list for Subareas 5 and 6 (Table 1), as provided by the Northeast Fisheries Center, Woods Hole, had no breakdown by ICNAF/NAFO divisions or even by subareas (Fig. 7). The strata areas are given in square nautical miles and the depth ranges in fathoms, but the numbers of units composing the individual strata were not provided. The USA list also contained information on strata used for surveys in a part of Div. 4X (see Table 1 and Fig. 7).

Inshore areas

At the 1978 Annual Meeting, STACRES noted that the stratification scheme for Subareas 5 and 6 had been extended to inshore areas for depths less than 15 fathoms, and indicated that the inclusion of material on inshore stratification in the Manual might benefit scientists undertaking such stratification in other areas. Diagrams and information on inshore stratification in Subareas 5 and 6 are given in Tables 8 to 10.

Options for Codification Scheme

Strata by divisions

On the basis of the information available, the number of strata recorded for each division (or group of divisions) is as follows:

Subarea	Division	No. of strata
0	0A, 0B	?
1	1A to 1F	?
2	2GH	?
	2J	36
3	3K	30
	3L	37
	3M	19
	3N	23
	3O	12
	3P	38
4	4R	15
	4S	8
	4T	24
	4VWX	48
5+6	...	51 offshore
5+6	...	90 inshore

Division code as prefix to stratum code

Since the assessments for many of the fish stocks are based on information from single divisions or different combinations of divisions, it would seem appropriate to use the "division code" as a prefix to the "stratum code", thus enabling the retrieval of computerized data by any combination of divisions applicable to the species concerned. Two options are considered:

- It might be appropriate to discard all existing numbering schemes and establish a 4-digit code, using 2 digits for division and 2 digits for the stratum number, the latter starting at "01" for each division. A stratum overlapping two divisions could be included in the division in which most of it lies, but it might be more appropriate to divide such strata and assign the parts to the relevant divisions. Acceptance of such a 4-digit numbering system requires that information be provided on a breakdown by division for the schemes currently used in Div. 4VWX and Subareas 5+6.
- The second option applicable to using division as a prefix code would be to establish a 5-digit code, consisting of 2 digits for division and 3 digits representing the numbering systems currently in general use. This scheme would allow more flexibility regarding strata which overlap division boundaries, in that the 3-digit stratum number could be retained even though the first two digits for division are different. Such a system would simplify the assignment of codes on a divisional basis to strata in Div. 4VWX and Subareas 5+6. It is essential that strata not overlapping divisional boundary lines be different for each division within the subarea. However, casual examination of the strata numbers for Div. 3K, 3L and 3O (Table 1) show duplication of numbering for strata which do not overlap division boundaries, unless, of course, the strata numbers shown in Fig. 2 are the correct ones for Div. 3K.

ubarea code as prefix to stratum code

This numbering system implies the use of a 1-digit code for subarea and a 3-digit code representing the strata numbering schemes currently in use. This system would still require the subarea breakdown of the strata numbers reported for Subareas 5 and 6 combined and the non-duplication of 3-digit numbers for strata within each subarea. However, such a system would be the least efficient of the three methods described, especially from the viewpoint of rapid retrieval of computerized data without supplementary means of identification of the data by ICNAF/NAFO division or stock area for the different species.

Conclusions

A review of existing stratification schemes for the Northwest Atlantic, based on the information supplied by the various research institutes and considered in the light of the utilization of data for assessment purposes (different stocks having different combinations of ICNAF/NAFO divisions with some even overlapping subareas), indicates the need for a numerical code, the first 2 digits of which should designate the ICNAF/NAFO division. The use of such a coding system would also facilitate the exchange of computerized data between research institutes.

The application of a 4-digit code (2 digits for division and 2 digits for stratum number) is the most logical of the systems considered, but this would involve the complete renumbering of the strata in each division (starting with "01"), the avoidance of strata overlapping division and subarea boundaries, and the breakdown by division of the strata listed for Div. 4VWX and Subarea 5+6. Such a proposal would require considerable revision to existing schemes and would have implications on existing time series of computerized data.

The application of a 5-digit code (2 digits for division and 3 digits for stratum area), utilizing existing stratum numbering systems where feasible, would require the least amount of work for revision and could allow for flexibility in the numbering of strata which overlap division boundaries, although it is essential that there be no duplication of stratum numbers within subareas. Such a system could possibly be implemented for Div. 4VWX and Subareas 5+6 by overlaying the ICNAF/NAFO division boundary lines on existing stratification charts for these regions.

Table 1. Existing stratification schemes for the Northwest Atlantic.

ICNAF Div.	Stratum number	Depth range	Area in square nautical miles	No. of units	Stratum number	Depth range	Area in square nautical miles	No. of units
2J	201	101-200 m	1427	480	219	751-1000 m	213	70
	202	201-300	440	150	220	1001-1250	324	110
	203	301-400	480	160	221	1251-1500	286	90
	204	401-500	354	120	222	301-400	441	150
	205	101-200	1823	610	223	401-500	180	60
	206	101-200	2582	860	224	501-750	270	90
	207	101-200	2246	750	225	1001-1250	177	60
	208	301-400	448	150	226	1251-1500	180	60
	209	201-300	1608	540	227	401-500	686	230
	210	201-300	774	260	228	201-300	1428	480
	211	301-400	330	110	229	301-400	567	190
	212	501-750	664	220	230	501-750	237	80
	213	201-300	1725	570	231	751-1000	182	60
	214	201-300	1171	390	232	1001-1250	236	80
	215	201-300	1270	420	233	1251-1500	180	60
	216	301-400	384	130	234	201-300	508	170
	217	401-500	268	90	235	401-500	420	140
	218	501-750	420	140	236	751-1000	122	40

ICNAF Div.	Stratum number	Depth range	Area in square nautical miles	No. of units	Stratum number	Depth range	Area in square nautical miles	No. of units
3K	320	201-300 m	2709	860	335	201-300 m	1274	400
	321	201-300	2859	900	336	201-300	1455	460
	322	401-500	632	200	337	201-300	1132	360
	323	301-400	1027	320	338	301-400	2059	650
	324	201-300	668	210	339	301-400	1463	460
	325	301-400	850	270	340	401-500	198	60
	326	301-400	919	290	341	501-750	584	180
	327	401-500	1194	380	342	751-1000	931	290
	328	301-400	1085	340	343	1001-1250	1266	400
	329	301-400	495	160	344	1251-1500	954	300
	330	301-400	544	170	345	401-500	204	60
	331	401-500	1202	380	346	501-750	333	110
	332	201-300	447	140	347	751-1000	409	130
	333	301-400	2179	690	348	1001-1250	232	70
	334	201-300	1618	510	349	1251-1500	263	80
3L	328	51-100 fath	1519	380	372	31-50 fath	2460	720
	341	51-100	1574	440	384	31-50	1120	320
	342	51-100	585	170	385	51-100	2356	660
	343	51-100	525	150	386	101-150	983	290
	344	101-150	1494	450	387	151-200	718	210
	345	151-200	1432	430	388	151-200	361	100
	346	151-200	865	260	389	101-150	821	230
	347	101-150	983	300	390	51-100	1481	420
	348	51-100	2120	630	391	101-150	282	80
	349	51-100	2114	610	392	151-200	145	40
	350	31-50	2071	610	729	201-300	90	30
	363	31-50	1780	520	730	301-400	93	30
	364	51-100	2817	820	731	201-300	117	30
	365	51-100	1041	310	732	301-400	96	30
	366	101-150	1394	410	733	201-300	312	80
	368	151-200	334	100	734	301-400	160	50
	369	101-150	961	290	735	201-300	160	50
	370	51-100	1320	400	736	301-400	114	30
	371	31-50	1121	320				
3M	1	70-80 fath	342	100	11	141-200 fath	806	240
	2	81-100	838	250	12	201-300	670	200
	3	101-140	628	180	13	201-300	249	70
	4	101-140	348	100	14	201-300	602	170
	5	101-140	703	200	15	201-300	666	200
	6	101-140	496	150	16	301-400	634	190
	7	141-200	822	240	17	301-400	216	60
	8	141-200	646	190	18	301-400	210	70
	9	141-200	314	90	19	301-400	414	120
	10	141-200	951	280				
3N	357	151-200 fath	164	40	379	151-200 fath	106	30
	358	101-150	225	50	380	151-200	116	30
	359	51-100	421	110	381	101-150	182	50
	360	31-50	2992	840	382	51-100	647	180
	361	31-50	1853	480	383	31-50	674	190
	362	31-50	2520	720	723	201-300	155	50
	373	31-50	2520	720	724	301-400	124	40
	374	31-50	931	240	725	201-300	105	30
	375	<30	1593	420	726	301-400	72	20
	376	<30	1499	400	727	201-300	160	50
	377	51-100	100	30	728	301-400	156	40
	378	101-150	139	40				

ICNAF Div.	Stratum number	Depth range	Area in square nautical miles	No. of units	Stratum number	Depth range	Area in square nautical miles	No. of units
30	329	51-100 fath	1721	450	351	31-50 fath	2520	720
	330	31-50	2089	540	352	31-50	2580	720
	331	31-50	456	120	353	31-50	1282	340
	332	51-100	1047	280	354	51-100	474	130
	333	101-150	151	40	355	101-150	103	30
	334	151-200	92	20	356	151-200	61	20
	335	151-200	58	20	717	201-300	93	30
	336	101-150	121	30	718	301-400	111	30
	337	51-100	948	250	719	201-300	76	20
	338	31-50	1898	500	720	301-400	105	30
	339	51-100	585	170	721	201-300	76	20
	340	31-50	1716	490	722	301-400	93	30
3P	301	51-100 fath	77	20	320	0-30 fath	1320	390
	302	51-100	281	80	321	31-50	1189	340
	303	101-150	496	140	322	51-100	1567	450
	304	151-200	141	40	323	51-100	696	200
	305	200+	713	210	324	51-100	494	140
	306	101-150	419	120	325	31-50	944	280
	307	51-100	395	110	326	31-50	166	50
	308	31-50	112	30	705	151-200	195	50
	309	101-150	296	80	706	151-200	476	140
	310	101-150	170	50	707	151-200	93	30
	311	51-100	317	90	708	201-300	117	30
	312	31-50	272	80	709	301-400	96	30
	313	101-150	165	50	710	301-400	36	10
	314	0-30	974	280	711	201-300	961	260
	315	31-50	827	240	712	201-300	973	270
	316	101-150	189	50	713	201-300	950	230
	317	51-100	193	50	714	201-300	1195	340
	318	101-150	123	30	715	151-200	132	40
	319	51-100	984	280	716	151-200	539	150
4R	801	151-200 fath	354	110	820	51-100 fath	396	120
	802	201+	399	120	821	51-100	371	110
	809	151-200	451	140	822	51-100	946	300
	810	151-200	223	70	823	51-100	162	50
	811	101-150	439	130	824	51-100	244	80
	812	101-150	1355	420	825	51-100	1156	360
	813	101-150	1154	360	826	51-100	902	280
	814	101-150	300	90				
4S	803	200+ fath	2034	610	807	151-200 fath	691	210
	804	151-200	726	220	808	151-200	708	210
	805	151-200	1680	520	815	101-150	1285	400
	806	151-200	620	190	816	101-150	1467	450
4T	15	>100 fath	764		27	<51 fath	951	
	16	51-100	1067		28	<51	202	
	17	<51	525		29	<51	1696	
	18	<51	394		31	<51	1419	
	19	<51	443		32	<51	301	
	20	<51	773		33	<51	1188	
	21	<51	329		34	<51	1211	
	22	<51	1244		35	<51	639	
	23	<51	3211		36	<51	958	
	24	<51	1050		37	51-100	495	
	25	>100	630		38	51-100	168	
	26	51-100	388		39	>100	353	

ICNAF Div.	Stratum number	Depth range	Area in square nautical miles	No. of units	Stratum number	Depth range	Area in square nautical miles	No. of units
4VWX	40	>100 fath	924		64	<51 fath	1297	
	41	51-100	1000		65	51-100	2383	
	42	<51	1437		66	>100	226	
	43	<51	1318		70	51-100	920	
	44	51-100	3925		71	>100	1004	
	45	>100	1023		72	51-100	1249	
	46	>100	491		73	<51	265	
	47	<51	1616		74	<51	161	
	48	<51	1449		75	<51	156	
	49	51-100	144		76	51-100	1478	
	50	51-100	383		77	51-100	1232	
	51	>100	147		78	>100	233	
	52	>100	345		80	<51	655	
	53	>100	259		81	51-100	1875	
	54	51-100	499		82	>100	1042	
	55	<51	2122		83	>100	532	
	56	<51	955		84	>100	2264	
	57	51-100	811		85	51-100	1582	
	58	<51	658		90	<51	601	
	59		3148		91	51-100	687	
	60	51-100	1344		92	51-100	1086	
	61	>100	1154		93	<51	533	
	62	51-100	2116		94	<51	417	
	63	<51	302		95	<51	584	
5+6	1	15-30 fath	2516		27	61-100 fath	720	
	2	31-60	2078		28	>100	2249	
	3	61-100	566		29	>100	3245	
	4	>100	188		30	>100	619	
	5	15-30	1475		36	>100	4069	
	6	31-60	2554		37	61-100	2108	
	7	61-100	514		38	61-100	2560	
	8	>100	230		39	31-60	730	
	9	15-30	1522		40	31-60	578	
	10	31-60	2722		61	15-30	1318	
	11	61-100	622		62	31-60	243	
	12	>100	176		63	61-100	86	
	13	31-60	2374		64	>100	60	
	14	61-100	656		65	15-30	2832	
	15	>100	230		66	31-60	555	
	16	31-60	2980		67	61-100	86	
	17	61-100	360		68	>100	52	
	18	>100	172		69	15-30	2433	
	19	15-30	2454		70	31-60	1024	
	20	15-30	1221		71	61-100	281	
	21	31-60	424		72	>100	105	
	22	61-100	454		73	15-30	2145	
	23	31-60	1016		74	31-60	1273	
	24	61-100	2569		75	61-100	139	
	25	15-30	390		76	>100	60	
	26	31-60	1014					
4X(USA)	31	61-100	1875		45	>100	156	
	32	31-60	655		46	31-60	265	
	41	61-100	1478		47	61-100	1232	
	42	31-60	161		48	61-100	1249	
	43	61-100	920		49	>100	233	
	44	31-60	1004					

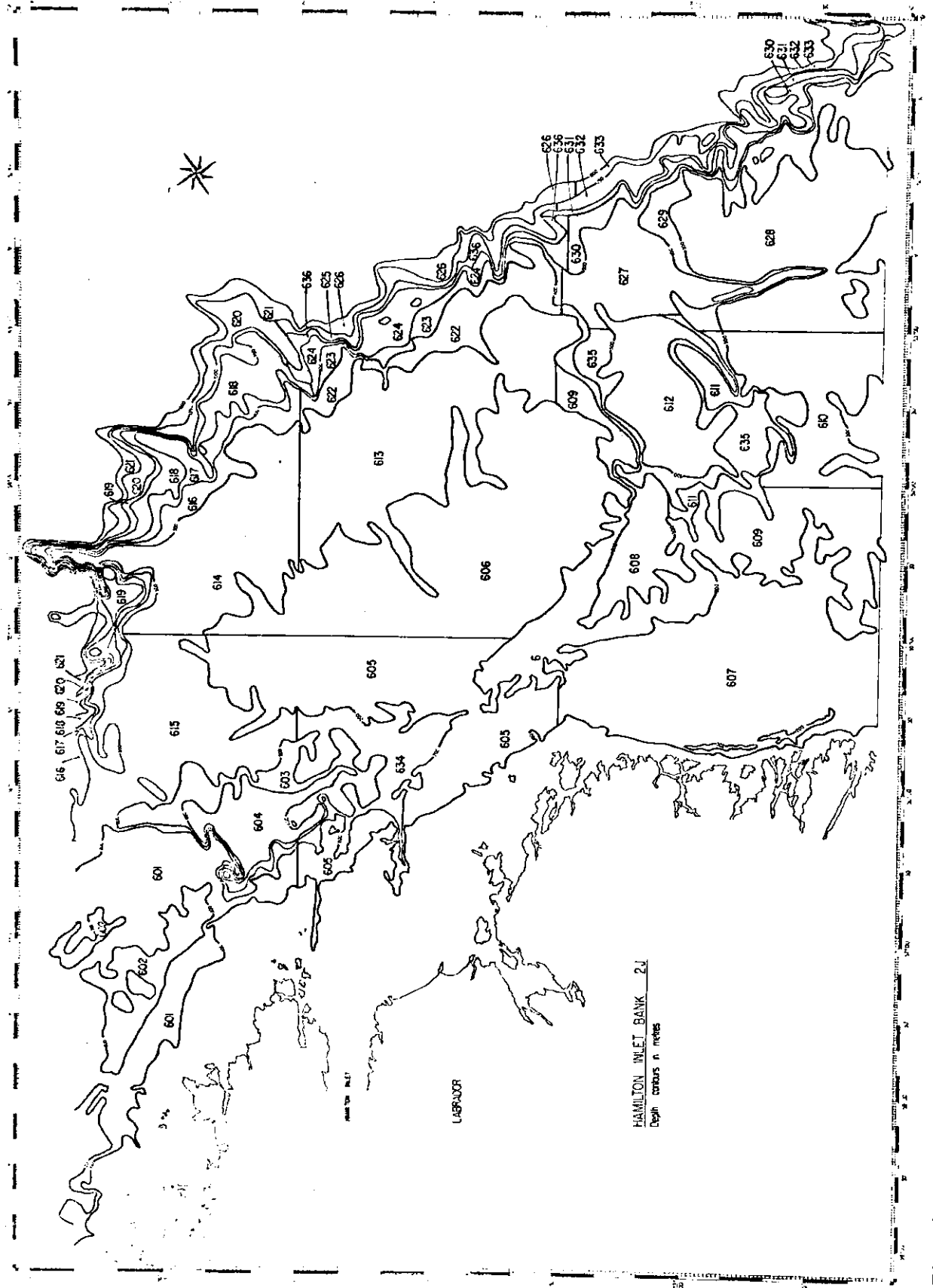


Fig. 1. Diagram of stratification scheme for Div. 2J.

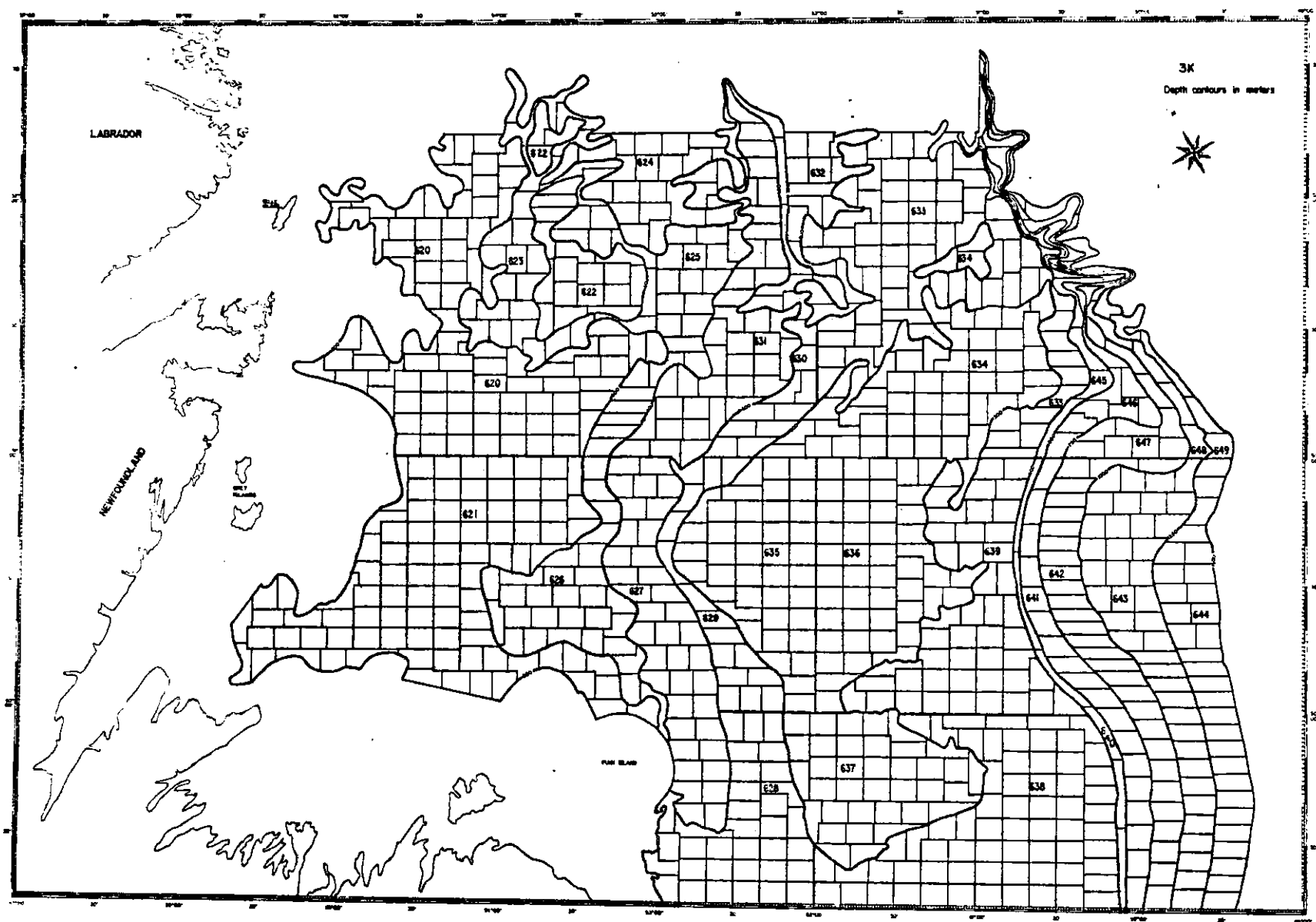


Fig. 2. Diagram of stratification scheme for Div. 3K.

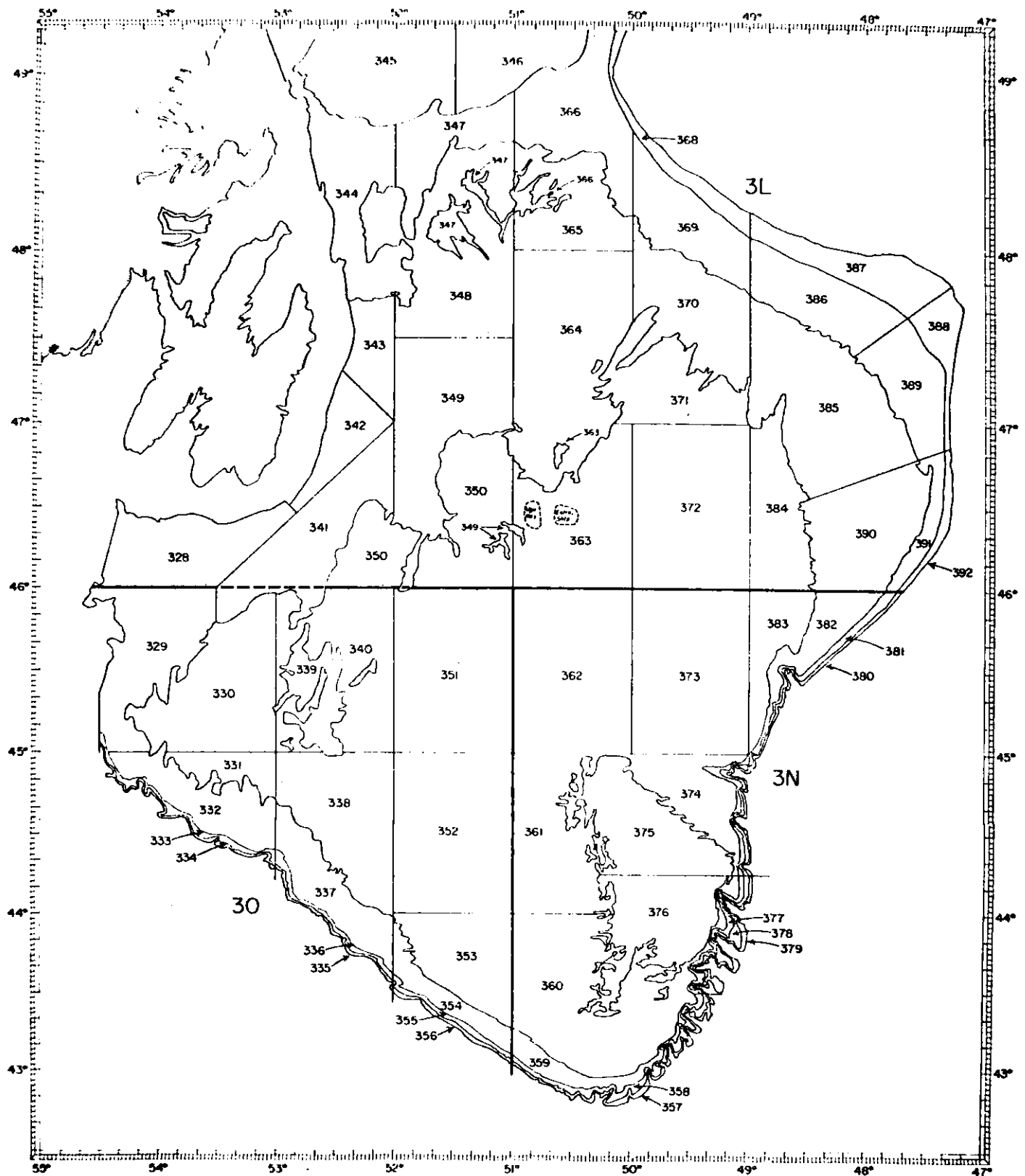


Fig. 3. Diagram of stratification scheme for Div. 3L, 3N and 30.

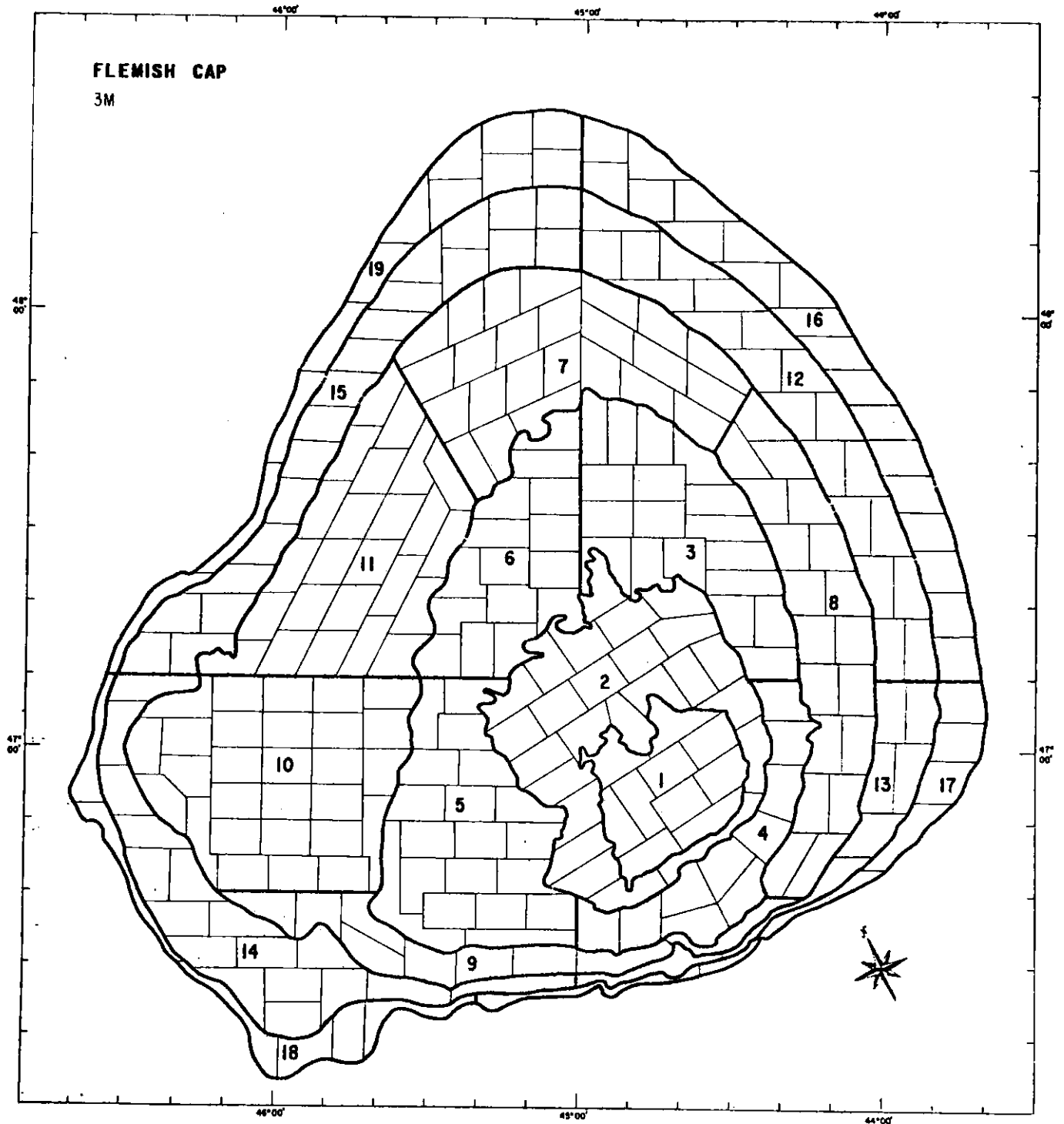


Fig. 4. Diagram of stratification scheme for Div. 3M

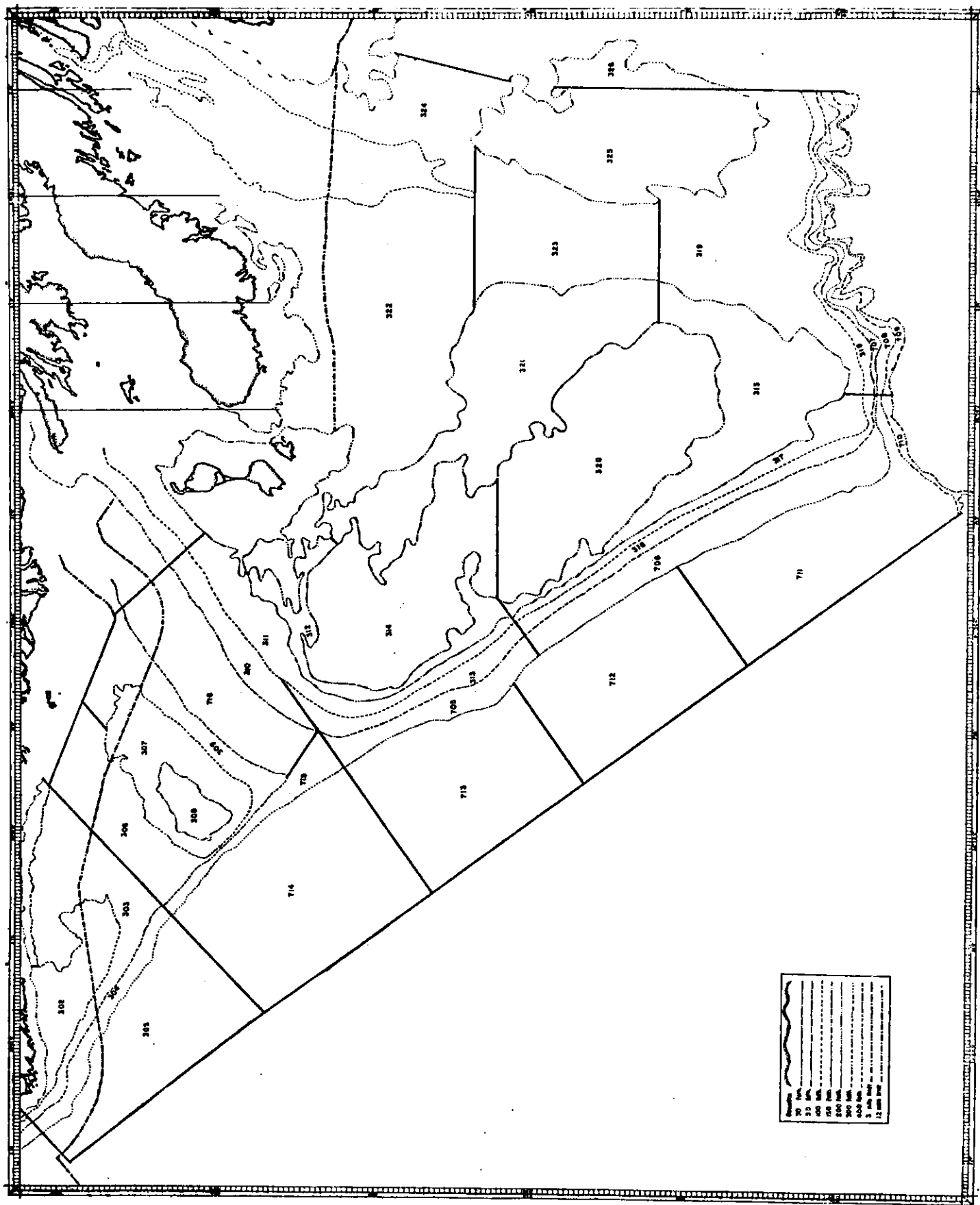


Fig. 5. Diagram of stratification scheme for Div. 3P (Subdiv. 3Pn and 3Ps).

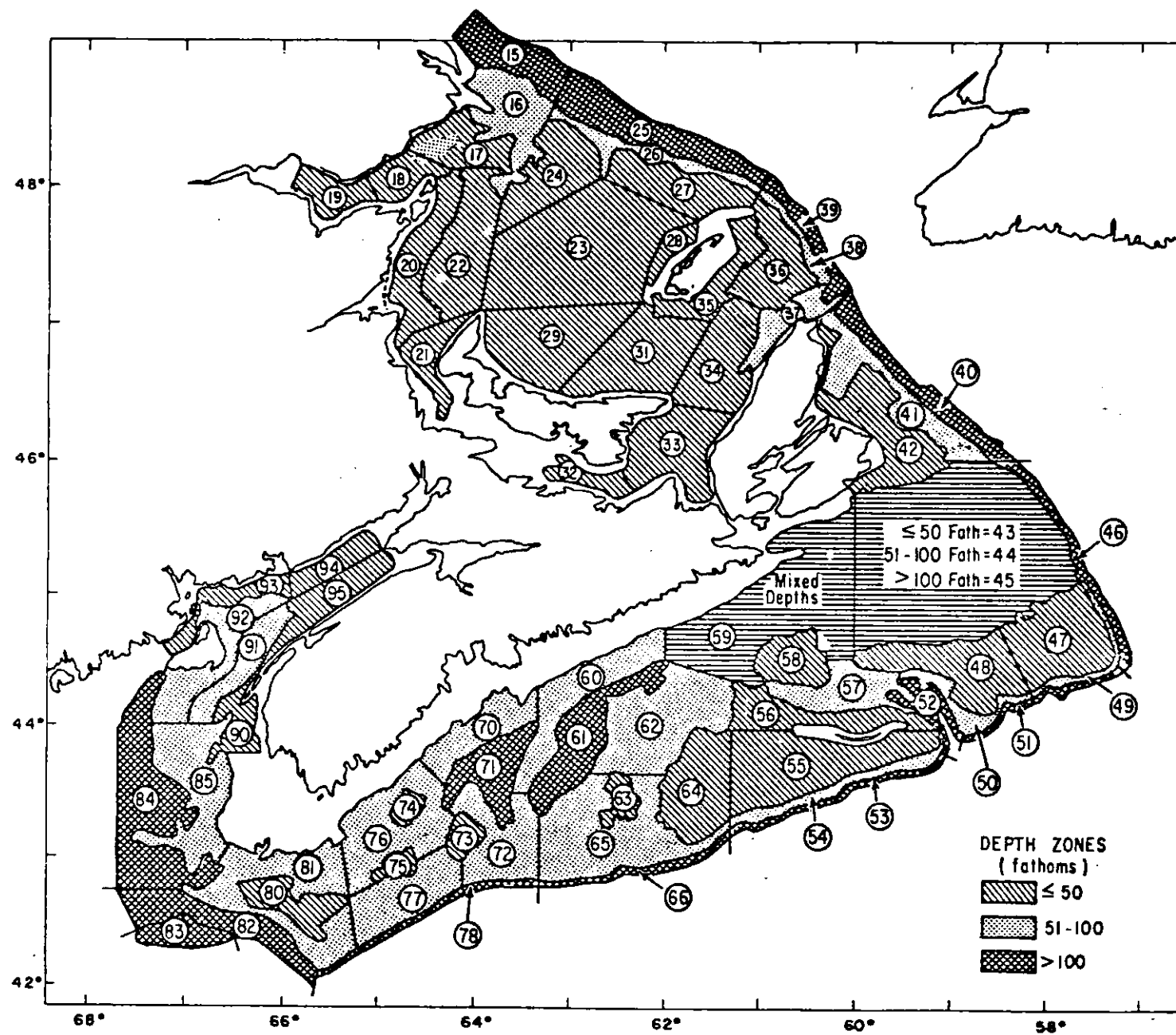


Fig. 6. Diagram of stratification schemes for Div. 4T and Div. 4VWX.

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Survey Unit

STANDARD BOTTOM TRAWL SURVEY

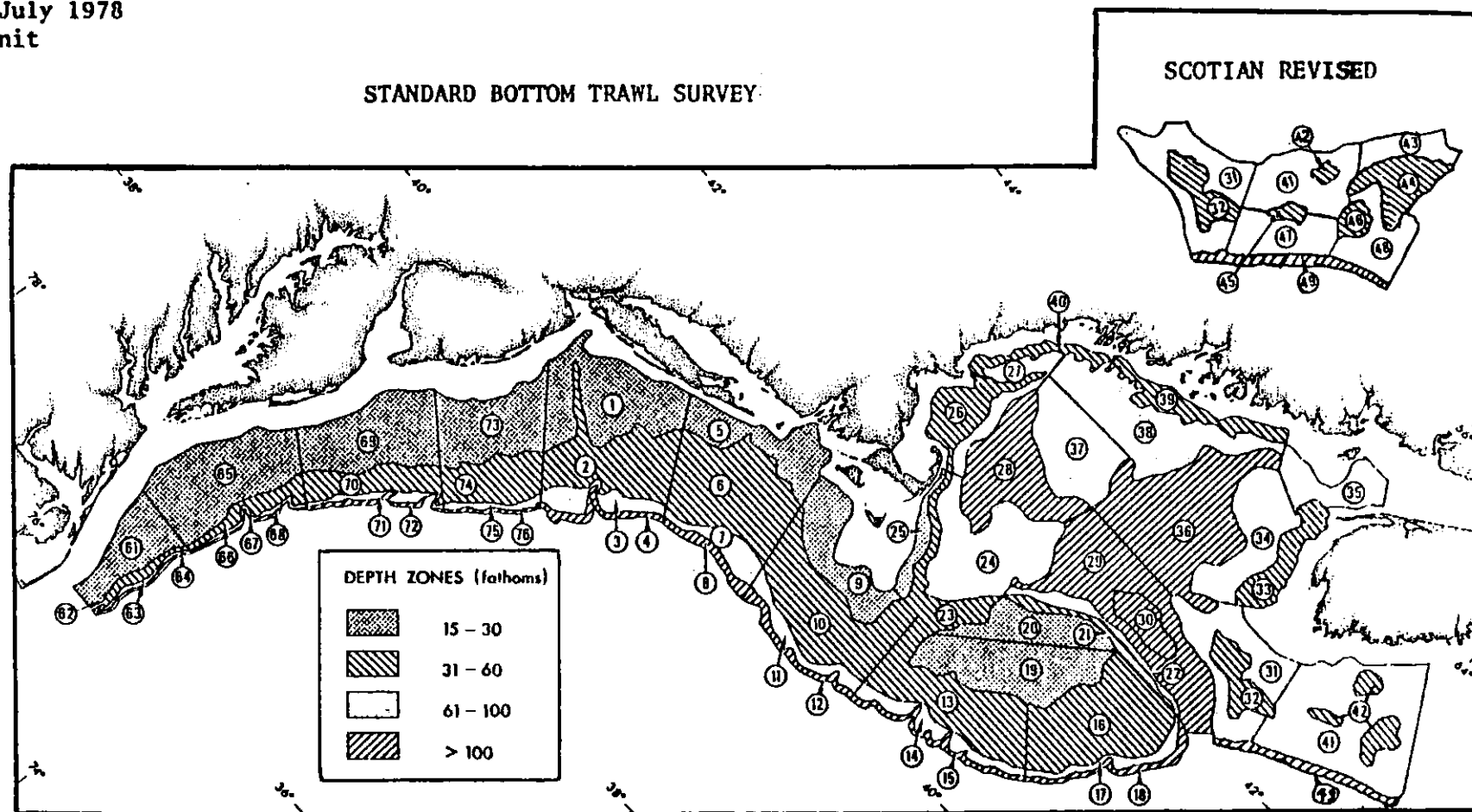
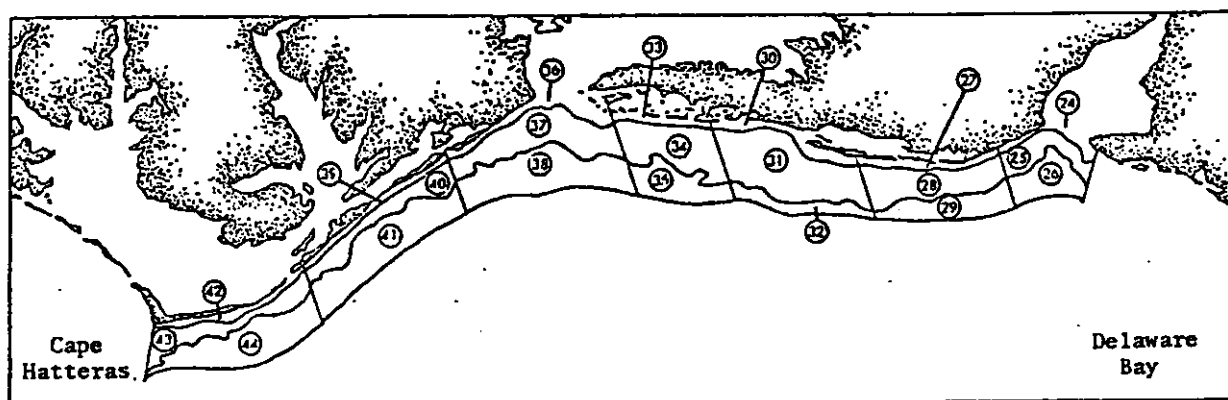
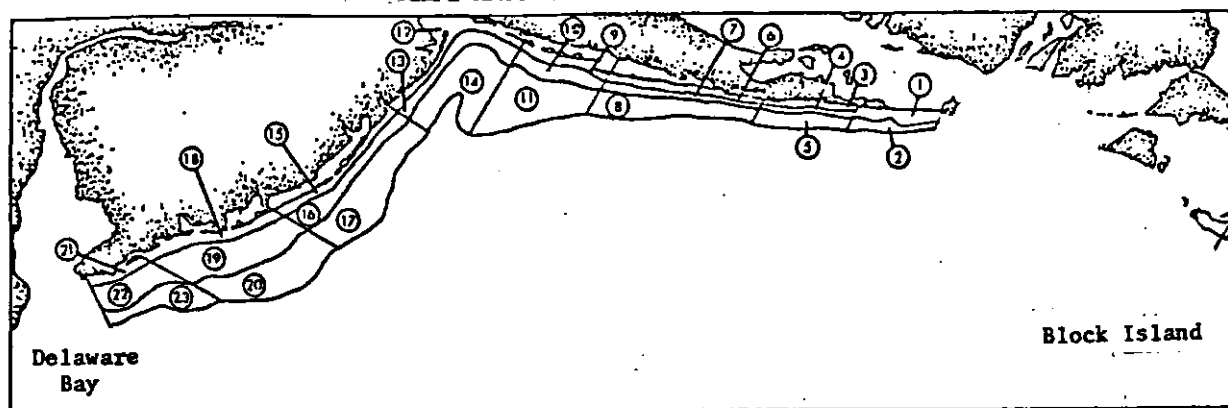


Fig. 7. Diagram of stratification scheme for Subareas 5+6 and part of Div. 4X.

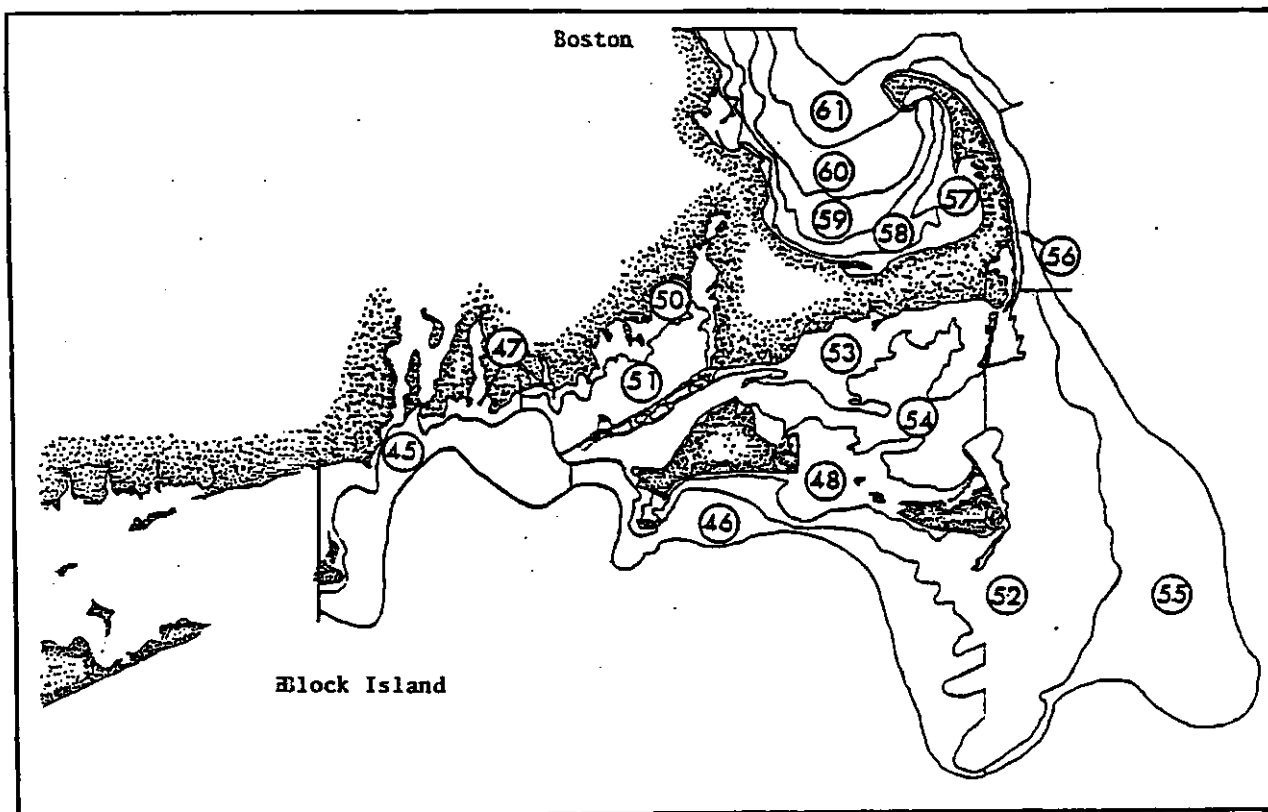
COASTAL STRATA
CAPE HATTERAS TO BLOCK ISLAND



Strata No.	Square Miles	Depth (fms)	Strata No.	Square Miles	Depth (fms)	Strata No.	Square Miles	Depth (fms)
1	44	0-10	16	62	5-10	31	299	5-10
2	62	10-15	17	238	10-15	32	106	10-15
3	13	0-5	18	97	0-5	33	92	0-5
4	26	5-10	19	216	5-10	34	167	5-10
5	62	10-15	20	356	10-15	35	88	10-15
6	26	0-5	21	22	0-5	36	119	0-5
7	35	5-10	22	154	5-10	37	312	5-10
8	150	10-15	23	167	10-15	38	224	10-15
9	40	0-5	24	53	0-5	39	35	0-5
10	48	5-10	25	172	5-10	40	176	5-10
11	242	10-15	26	154	10-15	41	383	10-15
12	44	0-5	27	35	0-5	42	40	0-5
13	88	5-10	28	220	5-10	43	172	5-10
14	110	10-15	29	185	10-15	44	304	10-15
15	22	0-5	30	75	0-5			

Fig. 8. Stratification scheme for inshore waters in Subares 5+6, Cape Hatteras to Block Island.

COASTAL STRATA
BLOCK ISLAND TO BOSTON

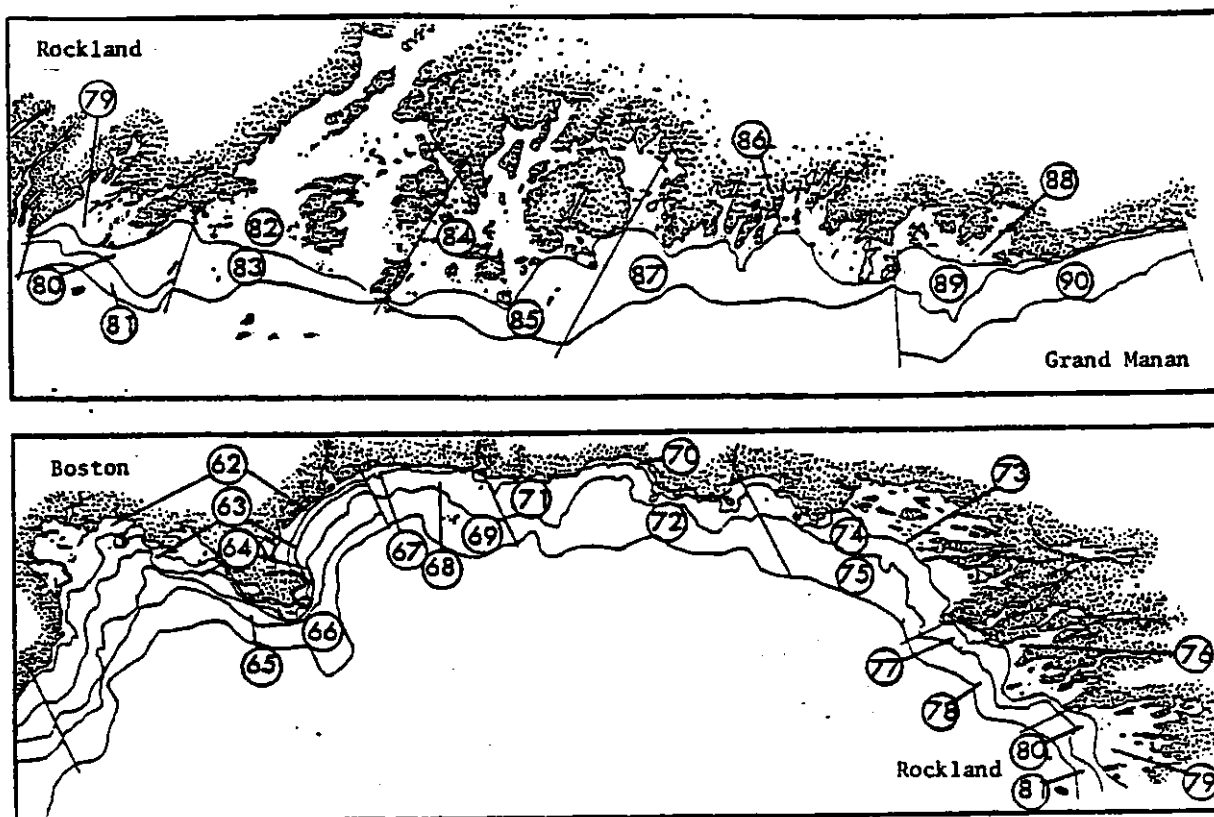


Strata No.	Square Miles	Depth (fms)	Strata No.	Square Miles	Depth (fms)
45	170	10-15	54	277	5-10*
46	273	10-15	55	495	10-15*
47	45	0-10	56	57	5-15*
48	113	0-5	57	34	0-5
50	15	0-5	58	88	5-10
51	117	5-10*	59	93	10-15
52	521	5-10*	60	126	15-23
53	142	0-5	61	133	23-30

* Intermixed depths

Fig. 9. Stratification scheme for inshore waters in Subares 5+6, Block Island to Boston.

COASTAL STRATA
BOSTON TO GRAND MANAN



Strata No.	Square Miles	Depth (fms)	Strata No.	Square Miles	Depth (fms)	Strata No.	Square Miles	Depth (fms)
62	62	0-5	72	129	15-30*	82	209	0-10*
63	78	5-10	73	31	0-5*	83	80	10-30
64	90	10-15	74	68	5-15	84	137	0-10*
65	75	15-23	75	76	15-30	85	106	10-30*
66	151	23-30	76	20	0-10*	86	60	0-10*
67	5	0-5	77	34	10-30*	87	153	10-30*
68	40	5-15*	78	44	10-30*	88	34	0-10*
69	57	15-30*	79	34	0-10	89	59	10-30*
70	10	0-5 *	80	58	10-30*	90	125	30-60*
71	72	5-15*	81	38	10-30*			

*Intermixed depths

Fig. 10. Stratification scheme for inshore waters in Subareas 5+6, Boston to Grand Manan.