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Corrections to the Stratification Scheme in 3Ps

by

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Introduction

The original Stratification scheme in NAFO Division 3P was extended to cover depths beyond 200 fathoms in the early-1970's. The line dividing the Laurentian Channel into NAFO Divisions 4V and 3P extends from a point defined as 47°50'N 60°00'W to a point defined as 39°00'N 50°00'W. The length of this line and the fact that no single chart encompassed the whole area led to the problem. This line was transposed incorrectly to the strata charts used for NAFO Division 3P, by the Newfoundland Region (Fig. 1). This paper outlines changes made to correct this mistake.

Materials and Methods

As a direct result of this mistake incorrect areas were used for abundance and biomass calculations, and the survey overlapped into NAFO Division 4V (Table 1). Checks to see if any other errors had been incorporated in the stratification scheme revealed problems with the 3Ps 3Pn boundary and the 3Pn 4Rs boundary. The problem with these lines stems from how they are defined in the NAFO Convention Annex III. The convention uses headlands for reference points, e.g.,(Burgeo Island for the line dividing 3Ps and 3Pn) and (Cape North and Cape Ray for the 3Pn 4R line). Depending on the source latitude and longitude positions for these points vary.

In the original stratification scheme 3Pn and 3Ps were drawn on separate charts with the line defining the common boundary being different on each chart. This led to a small area actually being excluded from either subdivision. These revisions correct this problem. To facilitate plotting boundaries and creating master copies of strata charts these lines and headland references have been redefined. The positions of headlands as defined in the Newfoundland Pilot and Sailing Directions Nova Scotia (Atlantic Coast) and Bay of Fundy are presented in Table 2.

When boundaries were corrected survey sets were plotted using mapping software (ACON, Black 1993) and reassigned to the appropriate strata or division. Sets falling outside the survey area were re-coded in the archived data using so they would not be used as survey sets. A list of the affected sets for the time series is presented (Table 3).

The next step in this process was to rerun abundance and biomass estimates using the new stratum area file and the correct set file. For this exercise Cod is used as an example and the resulting changes are presented (Fig. 2-3, Table 4-5).

Results and Discussion

Comparisons made, show that except for 1987 and 1991 the corrections made little difference to the indices. The changes in abundance and biomass indices will vary from species to species. The effect is dependent on the reduction of area and the catch or lack of it in sets excluded because the are outside the stratified area. In the example the abundance and biomass decreased on average 3% but in 1987 both were at 12% and in 1991 the change 11.5% for biomass and 6% for abundance.

Acknowledgments

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References

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Anonymous., 1960 Newfoundland Pilot *second edition*, Canadian Hydrographic Service Surveys and Mapping Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

Anonymous., 1990 Sailing Directions Nova Scotia (Atlantic Coast) and Bay of Fundy *First edition* Canadian Hydrographic Service, Department of Fisheries and Oceans, Communications Directorate.

Black, G.A.P. 1993 ACON data visualization software: User manual, version 7.

Table 1. Corrections to Area for strata in Nafo Division 3P

Strata	New Area	Old Area	Area Lost/Gained	% Change	Number of Units
303	554	496	58	12	170
304	147	140	11	5	40
305	722	713	9	1	230
3Pn	1423	1349	78		
306	363	419	-56	-13	110
709	147	158	-11	-8	40
710	156	176	-20	-12	40
711	593	961	-368	-38	170
712	731	973	-242	-25	220
713	851	950	-99	-10	240
714	1074	1195	-121	-10	330
715	128	132	-4	-3	40
776	159	173	-14	-8	40
777	183	208	-25	-12	50
778	166	194	-28	-14	40
3Ps	4551	5539	-988		

Table 2. Latitude and longitude defining Subdivision boundaries

4R - 3Pn dividing line is defined by the following points

1) 47° 30.0' N 59° 34.0' W
2) 47° 37.0' N 59° 20.5' W

3Pn - 3Ps dividing line is defined by the following points

1) 46° 50.7' N 58° 49.0' W
2) 47° 30.7' N 57° 43.2' W

Cape Ray as 47° 37.0' N 59^0 18.0' W

Cape North as 47^0 02.0 N 60^0 25.0' W

Table 3. Sets affected by corrections made to 3P stratification scheme.

OBS	Vessel	Trip	Set	Original set type	Revised set type	Year	Orignal strata	Revised strata	Original NAFO Division	Revised NAFO Division
1	3	221	42	1	1	74	306	303	3P	3Q
2	3	221	43	1	1	74	306	303	3P	3Q
3	3	234	143	1	1	75	306	306	3Q	3P
4	3	234	160	1	7	75	713	*	3P	4U
5	3	261	45	1	1	77	306	303	3P	3Q
6	3	287	50	1	1	79	306	303	3P	3Q
7	3	287	51	1	1	79	306	303	3P	3Q
8	3	316	73	1	1	81	306	303	3P	3Q
9	3	316	82	1	7	81	713	*	3P	4U
10	34	9	126	1	7	83	712	*	3P	4V
11	34	9	127	1	7	83	712	*	3P	4V
12	34	9	128	1	7	83	712	*	3P	4V
13	34	9	130	1	7	83	711	*	3P	4V
14	34	9	135	1	7	83	711	*	3P	4V
15	34	9	136	1	7	83	711	*	3P	4V
16	34	9	137	1	7	83	711	*	3P	4V
17	34	9	138	1	7	83	711	*	3P	4V
18	34	26	31	1	7	84	711	*	3P	4V
19	34	26	35	1	7	84	711	*	3P	4V
20	30	26	84	1	7	85	711	*	3P	4V
21	30	26	85	1	7	85	711	*	3P	4V
22	30	26	92	1	7	85	711	*	3P	4V
23	30	45	54	1	1	86	306	303	3P	3Q
24	30	45	55	1	1	86	306	303	3P	3Q
25	30	45	83	1	7	86	712	*	3P	4U
26	30	45	84	1	7	86	713	*	3P	4U
27	30	45	85	1	7	86	713	*	3P	4U
28	30	45	86	1	7	86	712	*	3P	4V
29	30	45	88	1	7	86	712	*	3P	4V
30	30	45	120	1	7	86	711	*	3P	4V
31	30	45	121	1	7	86	711	*	3P	4V
32	30	55	42	1	1	87	306	303	3P	3Q
33	30	55	43	1	1	87	306	303	3P	3Q
34	30	56	57	1	7	87	712	*	3P	4V
35	30	56	72	1	7	87	711	*	3P	4V
36	30	56	73	1	7	87	711	*	3P	4V
37	30	68	28	1	7	88	711	*	3P	4V
38	30	68	36	1	7	88	711	*	3P	4V
39	30	68	37	1	7	88	711	*	3P	4V
40	30	68	55	1	7	88	712	*	3P	4U
41	30	68	71	1	7	88	714	*	3P	4U
42	30	68	78	1	1	88	714	305	3P	3Q
43	30	81	33	1	7	89	711	*	3P	4V
44	30	81	34	1	7	89	711	*	3P	4V

OBS	Vessel	Trip	Set	Original set type	Revised set type	Year	Orignal strata	Revised strata	Original NAFO Division	Revised NAFO Division
45	30	81	69	1	7	89	711	*	3P	4V
46	30	81	70	1	7	89	711	*	3P	4V
47	30	81	71	1	7	89	712	*	3P	4V
48	30	81	72	1	7	89	712	*	3P	4V
49	30	81	73	1	7	89	712	*	3P	4V
50	30	81	83	1	7	89	713	*	3P	4U
51	30	81	84	1	7	89	713	*	3P	4U
52	30	81	85	1	7	89	713	*	3P	4U
53	30	81	93	1	7	89	714	*	3P	4U
54	30	91	99	1	7	90	713	*	3P	4U
55	30	103	72	1	7	91	711	*	3P	4V
56	30	103	96	1	7	91	711	*	3P	4V
57	30	103	97	1	7	91	712	*	3P	4V
58	30	103	101	1	7	91	712	*	3P	4V
59	30	103	102	1	7	91	712	*	3P	4V
60	30	103	129	1	1	91	306	303	3P	3Q
61	30	118	103	1	1	92	306	303	3P	3Q
62	30	118	124	1	7	92	713	*	3P	4U
63	30	118	139	1	7	92	713	*	3P	4U
64	30	118	140	1	7	92	713	*	3P	4U
65	30	118	145	1	7	92	712	*	3P	4V
66	30	118	146	1	7	92	712	*	3P	4V
67	30	118	154	1	7	92	711	*	3P	4V
68	30	118	157	1	7	92	711	*	3P	4V
69	30	118	158	1	7	92	711	*	3P	4V
70	30	118	160	1	7	92	711	*	3P	4V
71	30	133	143	1	7	93	713	*	3P	4U
72	30	133	144	1	7	93	712	*	3P	4U
73	30	133	145	1	7	93	712	*	3P	4U
74	30	133	161	1	7	93	711	*	3P	4V
75	30	133	163	1	7	93	711	*	3P	4V
76	30	135	43	1	7	93	711	*	3P	4V
77	30	135	45	1	7	93	711	*	3P	4V
78	30	135	46	1	7	93	711	*	3P	4V
79	30	135	48	1	7	93	712	*	3P	4V
80	30	135	141	1	7	93	713	*	3P	4U
81	30	135	142	1	7	93	713	*	3P	4U
82	30	135	145	1	7	93	712	*	3P	4U
83	30	135	146	1	7	93	712	*	3P	4U
84	30	150	58	1	7	94	709	*	3P	4V
85	30	150	59	1	7	94	709	*	3P	4V
86	30	151	8	1	7	94	711	*	3P	4V
87	30	151	10	1	7	94	711	*	3P	4V
88	30	151	38	1	7	94	712	*	3P	4U
89	30	151	49	1	7	94	713	*	3P	4U
90	30	151	52	1	7	94	714	*	3P	4U

OBS	Vessel	Trip	Set	Original set type	Revised set type	Year	Orignal strata	Revised strata	Original NAFO Division	Revised NAFO Division
91	30	166	62	1	7	95	711	*	3P	4U
92	30	166	64	1	7	95	712	*	3P	4U
93	30	166	65	1	7	95	712	*	3P	4U
94	30	167	65	1	7	95	305	*	3Q	4U
95	30	167	66	1	7	95	305	*	3Q	4U

* sets designated as 4V OR 4U have not been reassigned strata.

3P is 3Ps
3Q is 3Pn

4V is 4Vs
4U IS 4Vn

Table 4. Cod abundance estimates (thousands of fish) from research vessel surveys in NAFO Division 3Ps .

Depth range (fathoms)	Strata	Vessel Trips Sets Mean Dat sq. mi.	ATC 197 45 25-Mar 1972	ATC 207 55 18-Mar 1973	ATC 221 79 24-Apr 1974	ATC 234 62 7-Jun 1975	ATC 247 69 15-May 1976	ATC 261 101 20-Apr 1977	ATC 273 44 25-Feb 1978	ATC 287 79 26-Feb 1979	ATC 302 81 27-Mar 1980	ATC 316 69 16-Mar 1981	ATC 330 92 3-Jun 1982	AN 9 164 30-Apr 1983
0-30	314	974	0	27	1170	10	1060	73	0	238	279	307	2237	1859
	320	1320	462	545	335	109	941	247	437	880	528	10354	1362	1589
31-50	308	112	41	34	122	65	34	166	21	74	59	46	235	238
	312	272	337	41	225	221	257	628	378	157	98	92	296	347
	315	827	186	0	62	37	745	1304	179	621	171	0	145	489
	321	1189	223	0	102	16	312	68	179	309	196	402	1227	785
	325	944	77	12	49	0	35	30	567	850	35	213	85	124
	326	166	6	0	3	0	10	1	0	12	6	0	69	62
	783	229	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
51-100	307	395	1621	2645	2622	431	778	1090	1186	2090	949	5505	2372	569
	311	317	2261	822	2861	433	666	125	309	1124	3105	690	1888	1348
	317	193	275	354	761	127	971	199	261	309	1391	623	913	2062
	319	984	1717	872	1182	638	4136	2945	2257	15068	2733	13000	3176	2058
	322	1567	603	221	439	146	2294	326	706	118	2641	471	2632	1882
	323	696	418	110	215	73	78	138	1097	557	261	78	392	383
	324	494	126	42	90	26	37	65	118	93	0	167	352	593
	781	446	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
	782	183	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
101-150	306	363	287	113	136	327	95	51	100	372	177	1907	599	661
	309	296	500	141	111	152	89	63	67	870	289	1811	700	496
	310	170	130	51	64	2038	166	0	183	121	0	651	434	72
	313	165	142	111	89	215	54	26	17	1018	81	266	217	37
	316	189	7	880	76	19	110	14	73	85	35	21	91	128
	318	129	48	10	5	0	0	5	46	528	397	64	97	3
	779	422	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
	780	403	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
151-200	705	195	117	0	55	0	0	48	7	66	432	988	15	5
	706	476	286	0	5	22	144	46	104	202	518	250	9	7
	707	74	19	14	3	0	0	136	35	72	97	46	43	2
	715	128	370	62	41	10	29	19	144	215	240	82	43	102
	716	539	1153	106	40	72	358	20	587	334	223	1123	81	91
201-300	708	126	122	49	91	0	156	10	116	99	3916	159	143	0
	711	593	142	47	101	28	185	73	134	276	401	0	0	11
	712	731	188	64	135	39	245	98	178	6146	110	55	73	0
	713	851	222	75	159	0	289	116	210	430	0	230	0	18
	714	1074	510	192	374	130	655	279	483	961	0	49	0	24
301-400	709	147	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0
401-500	710	156	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
	Total[1]		9633	6413	9629	4656	12722	7106	5546	30645	19270	39214	19649	16047
	Mean wt/tow[1]		16.23	12.59	18.87	13.00	14.34	12.42	8.70	41.44	15.80	33.28	16.23	12.83

Summary (These totals include estimated numbers and weigts for nonsampled strata)

0-30	2294	462	572	1505	119	2001	320	437	1116	807	10661	3599	3448
31-50	3739	870	87	563	339	1393	2197	1324	2023	563	753	2057	2045
51-100	5275	7021	5066	8170	1874	8960	4888	5934	19359	11080	20534	11725	8895
101-150	2137	1114	1306	481	2751	514	159	486	2994	979	4720	2138	1397
151-200	1412	1945	182	144	104	531	269	877	889	1510	2491	191	207
201-300	3375	1184	427	860	197	1530	576	1121	7912	4427	493	216	53
301-400	147	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0
401-500	156	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
Total[2]		12597	7640	11722	5384	14930	8409	10176	34294	19364	39653	19925	16049
Mean wt/tow[2]		10.14	6.15	9.44	4.33	12.02	6.77	8.19	27.61	15.59	31.92	16.04	12.92

Note shaded numbers are estimates for non sampled strata and only 0-300 fathom strata are estimated and used in deriving these estimates.
SNF = strata not fished, with the exception of strata 709 these strata were not added to the survey area untill 1994.

[1] These totals and mean wgts. per tow include all sampled strata.

[2] These totals and mean wgts. per tow include sampled strata and estimated values, where strata were not fished for depths to 300 fathom. Estimates were derived from a multiplicative model using survey data to 1992.

Table 4 continued. Cod abundance estimates (thousands of fish) from research vessel surveys in NAFO Division 3Ps .

Depth range (fathoms)	STRAT	Vessel Trips / Sets / Mean Dat Sq. Mi.	AN 26 / 93 / 13-Apr 1984	WT 26 / 109 / 13-Mar 1985	WT 45 / 136 / 15-Mar 1986	WT 55+56 / 130 / 7-Mar 1987	WT 68 / 146 / 5-Feb 1988	WT 81 / 146 / 9-Feb 1989	WT 91 / 108 / 9-Feb 1990	WT 103 / 158 / 10-Feb 1991	WT 118 / 137 / 14-Feb 1992	WT 135 / 130 / 11-Apr 1993	WT 150-151 / 166 / 15-Apr 1994	WT 166-167 / 161 / 16-Apr 1995
<30	314	974	91	21	0	0	42	8	24	0	0	0	24	0
	320	1320	1870	476	99	129	180	238	0	83	11	0	0	0
31-50	308	112	395	563	0	13	13	4	8	4	8	46	118	21
	312	272	153	1644	31	51	20	7	0	10	0	0	0	7
	315	827	410	177	786	147	103	133	217	35	18	0	0	0
	321	1189	342	77	27	54	162	20	11	57	0	11	0	0
	325	944	71	0	27	47	24	18	35	102	21	0	0	0
	326	166	0	5	0	19	19	0	6	19	0	0	0	6
	783	229	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
51-100	307	395	193	2006	5802	1433	4700	1710	395	79	59	741	4047	123
	311	317	381	3692	127	2427	898	103	119	56	12	48	184	16
	317	193	14	1427	420	420	101	101	7	80	36	36	0	22
	319	984	1637	111	3241	6968	6795	2401	1637	936	214	259	16	83
	322	1567	509	860	1382	1082	206	260	154	210	15	0	18	0
	323	696	901	871	2069	3466	199	112	13	70	9	0	0	0
	324	494	321	10476	178	111	185	0	15	111	15	0	12	9
	781	446	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0	22
	782	183	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	7	0
101-150	306	363	41	232	299	1213	1151	200	1163	64	92	749	429	91
	309	296	56	933	1700	1067	1355	833	733	467	22	700	111	104
	310	170	57	102	179	115	315	351	421	376	19	172	145	70
	313	165	12	111	0	173	43	508	81	211	124	62	19	415
	316	189	78	38	14	38	24	634	5881	85	21	57	57	21
	318	129	0	43	15	392	10	3399	32	813	710	615	0	48077
	779	422	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	8	0
	780	403	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0	0
151-200	705	195	0	285	366	102	271	22	29	7	29	388	224	578
	706	476	0	697	241	5041	411	27	27	27	150	107	116	161
	707	74	0	33	450	450	1364	74	25	447	297	201	11	178
	715	128	24	139	793	356	2080	72	442	6908	673	605	973	168
	716	539	13	170	3004	1119	1432	212	162	113	391	101	227	251
201-300	708	126	0	110	218	6621	9988	28	83	232	662	482	4701	1480
	711	593	0	18	3834	160	211	104	148	5690	148	0	11	11
	712	731	120	320	165	37	274	66	417	560	268	96	174	143
	713	851	142	56	64	639	137	358	9742	2316	630	112	511	431
	714	1074	336	457	409	138	404	1703	9745	11817	6344	585	954	1281
301-400	709	147	SNF	SNF	SNF	SNF	17	6	SNF	11	SNF	306	SNF	39
401-500	710	156	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	9	SNF
		Total[1]	7571	25361	25638	34026	33135	13710	29997	31995	10906	6480	13106	53809
		Mean wt/tow[1]	7.18	22.53	20.95	27.44	26.49	10.96	26.28	25.57	8.99	5.18	9.51	39.55
0-30	2294		1961	497	99	129	222	246	24	83	11	0	24	0
31-50	3739		1371	2466	871	331	341	182	277	227	47	57	118	34
51-100	5275		3956	19443	13219	15907	13084	4687	2340	1542	360	1084	4284	275
101-150	2137		244	1459	2201	2998	2898	5925	8311	2016	988	2355	769	48778
151-200	1412		37	1323	4854	7068	5558	407	685	7502	1540	1402	1551	1336
201-300	3375		598	961	4690	7595	11014	2259	20135	20615	8052	1275	6351	3346
301-400	147		SNF	SNF	SNF	SNF	17	6	SNF	11	SNF	306	SNF	39
401-500	156		SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	9	SNF
		Total[2]	8171	26149	25942	34030	33128	13748	32025	33289	11163	6174	13098	53770
		Mean wt/tow[2]	6.58	21.05	20.88	27.39	26.67	11.07	25.78	25.99	8.99	4.98	9.58	39.85

Note shaded numbers are estimates for non sampled strata and only 0-300 fathom strata are estimated and used in deriving these estimates.
SNF = strata not fished, with the exception of strata 709 these strata were not added to the survey area until 1994.

[1] These totals and mean wgts. per tow include all sampled strata.

[2] These totals and mean wgts. per tow include sampled strata and estimated values, where strata were not fished for depths to 300 fathom. Estimates were derived from a multiplicative model using survey data to 1992.

Table 5. Cod biomass estimates (t) from research vessel surveys in NAFO Division 3Ps.

Depth range (fathoms)	STRAT	Vessel Trips / Sets / Mean Dat Sq. Mi	ATC 197 45 25-Mar 1972	ATC 207 55 18-Mar 1973	ATC 221 79 24-Apr 1974	ATC 234 62 7-Jun 1975	ATC 247 69 15-May 1976	ATC 261 101 20-Apr 1977	ATC 273 44 25-Feb 1978	ATC 287 79 26-Feb 1979	ATC 302 81 27-Mar 1980	ATC 316 69 16-Mar 1981	ATC 330 92 3-Jun 1982	AN 9 164 30-Apr 1983
<30	314	974	0	9	1326	16	2355	249	0	224	432	369	2028	13103
	320	1320	1502	707	828	275	1333	640	1043	1545	2946	23087	1920	5618
31-50	308	112	82	175	278	205	193	311	38	125	240	305	490	766
	312	272	204	19	243	334	456	1047	343	151	107	165	766	524
	315	827	1436	0	591	139	1746	1549	543	1836	235	0	528	2451
	321	1189	1862	0	354	103	1741	270	2035	681	1880	1419	2845	2419
	325	944	121	0	53	0	2	34	180	820	28	1240	95	329
	326	166	8	0	2	0	9	0	0	2	3	0	53	322
	783	229	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
51-100	307	395	2833	5955	3916	883	1126	2095	3219	4105	1763	13723	3028	892
	311	317	3774	573	2430	763	627	410	154	1106	3792	761	1943	3256
	317	193	102	278	589	164	550	491	304	368	536	268	1582	3685
	319	984	4473	643	477	481	3099	2490	2503	10637	1652	15068	3548	3799
	322	1567	683	74	360	96	5178	271	490	14	2599	26	3705	4932
	323	696	715	88	335	107	367	63	1651	631	775	491	1215	858
	324	494	113	5	56	9	8	40	74	29	0	110	430	618
	781	446	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
	782	183	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
101-150	306	363	584	93	290	747	185	130	360	729	396	1976	1049	1083
	309	296	998	437	204	311	178	192	103	1558	863	2983	1178	926
	310	170	150	21	83	2181	154	0	154	119	0	817	608	134
	313	165	202	25	144	242	142	41	50	1036	127	446	283	74
	316	189	6	441	63	19	77	17	80	65	61	25	104	207
	318	129	77	7	4	0	0	6	53	37	829	75	143	11
	779	422	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
	780	403	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
151-200	705	195	146	0	66	0	0	60	1	91	674	1310	22	27
	706	476	369	0	23	39	262	76	173	356	827	304	30	32
	707	74	38	10	4	0	0	181	49	260	151	70	64	5
	715	128	2133	46	148	1	1	31	137	342	484	163	149	328
	716	539	1532	72	147	87	510	92	780	303	248	1608	168	147
210-300	708	126	208	33	115	0	214	12	145	191	4990	204	186	0
	711	593	259	28	137	37	268	103	176	267	687	0	0	9
	712	731	438	56	235	70	452	179	300	6820	212	195	265	0
	713	851	448	54	299	0	462	181	306	461	0	913	0	32
	714	1074	1137	170	624	206	1173	483	789	1170	0	141	0	143
301-400	709	147	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0
401-500	710	156	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
		Total[1]	20823	9242	11028	6313	19365	9542	9696	31101	27430	67805	28070	46729
		Mean wt/tow[1]	35.07	18.14	21.61	17.63	21.82	16.68	15.21	42.05	22.49	57.54	23.18	37.35
Summary (These totals include estimated numbers and weigts for nonsampled strata)														
0-30		2294	1502	716	2152	291	3688	889	1043	1769	3378	23456	3948	18721
31-50		3739	3713	194	1521	781	4147	3211	3139	3615	2493	3129	4777	6811
51-100		5275	12693	7616	8163	2503	10955	5860	8395	16890	11117	30447	15451	18040
101-150		2137	2017	1024	788	3500	736	386	800	3544	2276	6322	3365	2435
151-200		1412	4218	128	388	127	773	440	1140	1352	2384	3455	433	539
201-300		3375	2490	341	1350	313	2569	958	1716	8909	5889	1453	451	184
301-400		147	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0
401-500		156	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
		Total[2]	26635	10020	14366	7515	22871	11744	16235	36082	27540	68267	28426	46734
		Mean wt/tow[2]	21.44	8.07	11.56	6.05	18.41	9.45	13.07	29.05	22.17	54.96	22.88	37.62

Note shaded numbers are estimates for non sampled strata and only 0-300 fathom strata are estimated and used in deriving these estimates.
SNF = strata not fished, with the exception of strata 709 these strata were not added to the survey area until 1994.

[1] These totals and mean wgts. per tow include all sampled strata.

[2] These totals and mean wgts. per tow include sampled strata and estimated values, where strata were not fished for depths to 300 fathom. Estimates were derived from a multiplicative model using survey data to 1992.

Table 5 continued. Cod biomass estimates (t) from research vessel surveys in NAFO Division 3Ps.

Depth range (fathoms)	STRAT	Vessel Trips / Sets / Mean Dat / Sq. Mi.	AN 26 93 13-Apr 1984	WT 26 109 13-Mar 1985	WT 45 136 15-Mar 1986	WT 55+56 130 7-Mar 1987	WT 68 146 5-Feb 1988	WT 81 146 9-Feb 1989	WT 91 108 9-Feb 1990	WT 103 158 10-Feb 1991	WT 118 137 14-Feb 1992	WT 135 130 11-Apr 1993	WT 150-151 166 15-Apr 1994	WT 166-167 161 16-Apr 1995
<30	314	974	567	25	0	0	24	8	139	0	0	0	113	0
	320	1320	5456	5259	284	495	1729	1026	0	121	25	0	0	0
31-50	308	112	681	1024	0	3	4	2	2	1	6	22	42	11
	312	272	674	1016	61	33	3	3	0	4	0	0	0	1
	315	827	1893	329	2762	885	1247	1641	523	367	19	0	0	0
	321	1189	1183	89	335	223	1738	367	2	59	0	19	0	0
	325	944	502	0	35	130	31	7	26	57	13	0	0	0
	326	166	0	7	0	16	28	0	3	16	0	0	0	1
	783	229	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF
51-100	307	395	771	5189	12339	2688	13936	3138	340	20	9	608	3468	51
	311	317	863	4870	399	4331	593	361	18	24	2	21	233	13
	317	193	30	14064	2180	886	109	243	0	552	15	122	0	11
	319	984	3995	1282	10189	7784	12609	10170	1367	650	39	50	4	68
	322	1567	2597	1073	2004	1503	369	52	38	35	6	0	6	0
	323	696	2247	1263	2881	18047	143	281	3	24	22	0	0	0
	324	494	136	10756	230	187	125	0	6	22	7	0	0	2
	781	446	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0	4
	782	183	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0	0
101-150	306	363	204	511	644	1662	3110	232	675	22	65	736	368	62
	309	296	156	1611	3216	2539	2722	1900	1415	299	10	958	171	112
	310	170	134	268	332	198	417	147	194	32	4	127	165	120
	313	165	130	250	0	279	69	570	105	26	13	57	17	656
	316	189	170	85	71	71	25	2847	4707	79	15	67	137	6
	318	129	0	71	85	821	111	13913	27	916	374	680	0	71260
	779	422	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	1	0
	780	403	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	0	0
151-200	705	195	0	542	611	121	501	18	123	1	17	553	321	1089
	706	476	0	2068	447	8319	1134	130	69	100	197	106	118	166
	707	74	0	66	2486	1216	5305	295	26	636	316	345	2	286
	715	128	53	261	1477	785	4437	214	289	7210	820	803	1468	280
	716	539	15	344	3464	1544	2379	384	570	115	189	119	327	423
201-300	708	126	0	194	352	9494	29994	61	78	598	1361	444	3798	3790
	711	593	0	45	5462	294	467	490	187	17671	138	0	8	16
	712	731	411	746	302	128	606	127	562	695	512	102	488	196
	713	851	420	78	298	1199	297	511	17826	2696	950	192	811	938
	714	1074	1070	1057	1627	226	719	3982	17366	15196	9653	854	1179	2163
301-400	709	147	0	0	0	SNF	74	30	SNF	11	SNF	298	SNF	54
401-500	710	156	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	SNF	6	SNF
		Total[1]	22454	52784	53930	66107	85055	43147	45189	48254	14730	7284	13252	81778
		Mean wt/tow[1]	21.31	46.88	44.06	53.3	67.98	34.48	39.58	38.56	12.14	5.82	9.61	60.11
			Summary (These totals include estimated numbers and weigts for nonsampled strata)											
0-30	2294		6023	5284	284	495	1753	1034	139	121	25	0	113	0
31-50	3739		4933	2458	3193	1290	3051	2020	556	504	38	41	42	13
51-100	5275		10639	38497	30222	35426	27884	14245	405	1327	100	801	3711	149
101-150	2137		794	2725	3704	5570	6454	19609	7096	1374	416	2625	859	72216
151-200	1412		68	2954	8485	11985	13756	1041	1051	8062	1539	1926	2236	2244
201-300	3375		0	869	8041	11341	32083	5171	35941	36856	12614	1592	6284	7103
301-400	147		0	0	0	0	74	30	0	11	0	298	0	54
401-500	156		0	0	0	0	0	0	0	0	0	0	6	0
		Total[2]	24355	54440	54617	66113	84999	43220	47136	48635	15064	6986	13246	81724
		Mean wt/tow[2]	19.61	43.82	43.97	53.22	68.42	34.79	37.94	39.15	12.13	5.63	9.69	6.57

Note shaded numbers are estimates for non sampled strata and only 0-300 fathom strata are estimated and used in deriving these estimates.
SNF = strata not fished, with the exception of strata 709 these strata were not added to the survey area untill 1994.

[1] These totals and mean wgts. per tow include all sampled strata.

[2] These totals and mean wgts. per tow include sampled strata and estimated values where strata were not fished for depths to 300 fathom. Estimates were derived from a multiplicative model using survey data to 1992.

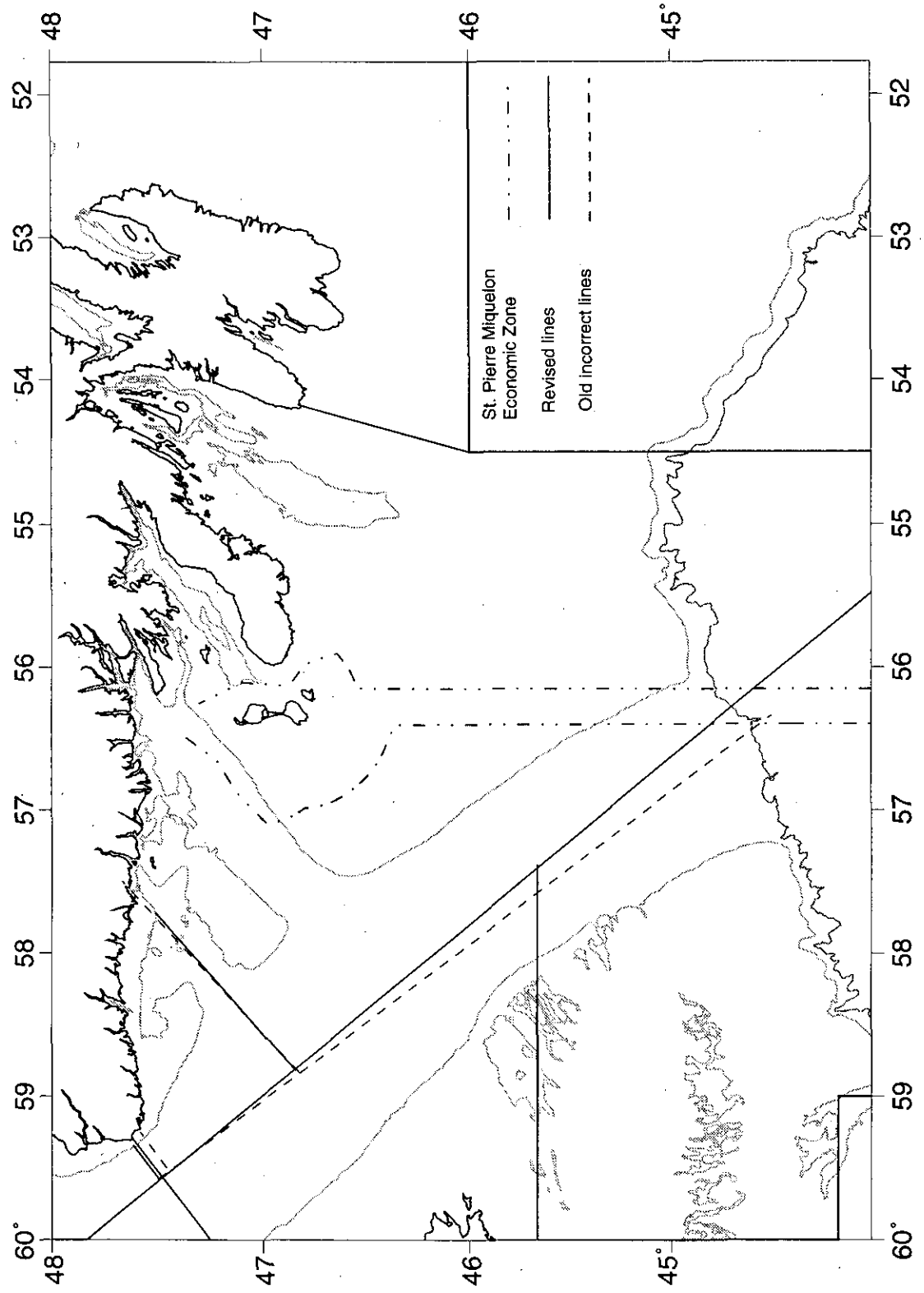

FIGURE 1. Corrections made to 3Ps and 3Pn strata boundries.

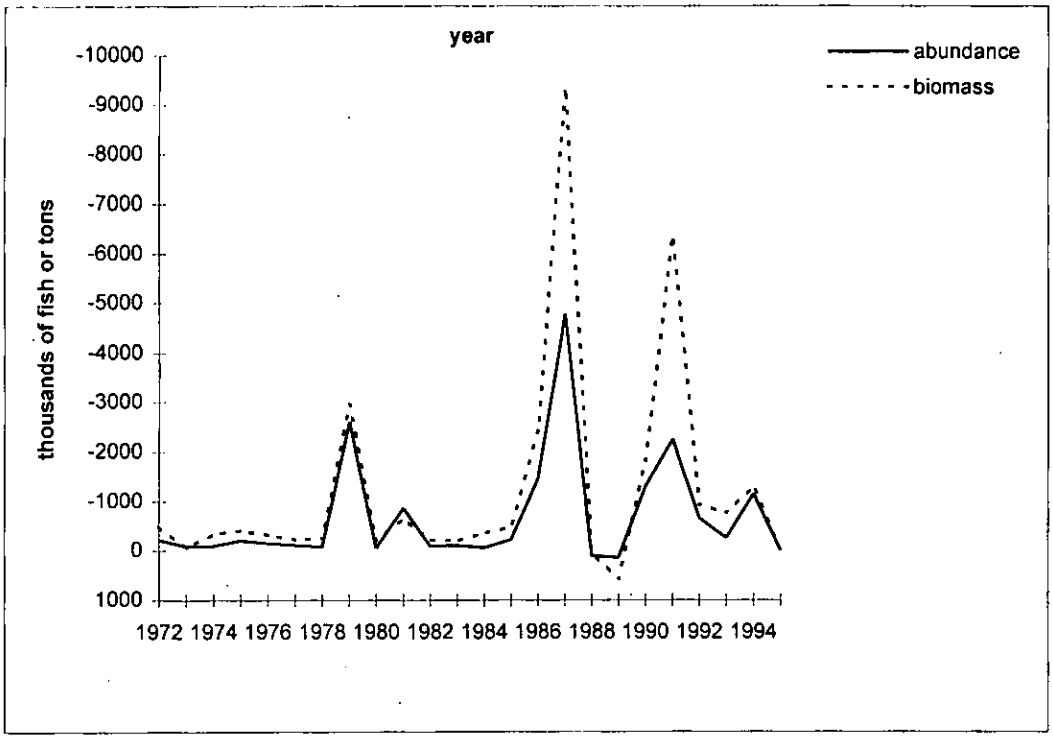

Figure 2. Differences in abundance and biomass as a result of correcting strata boundries.

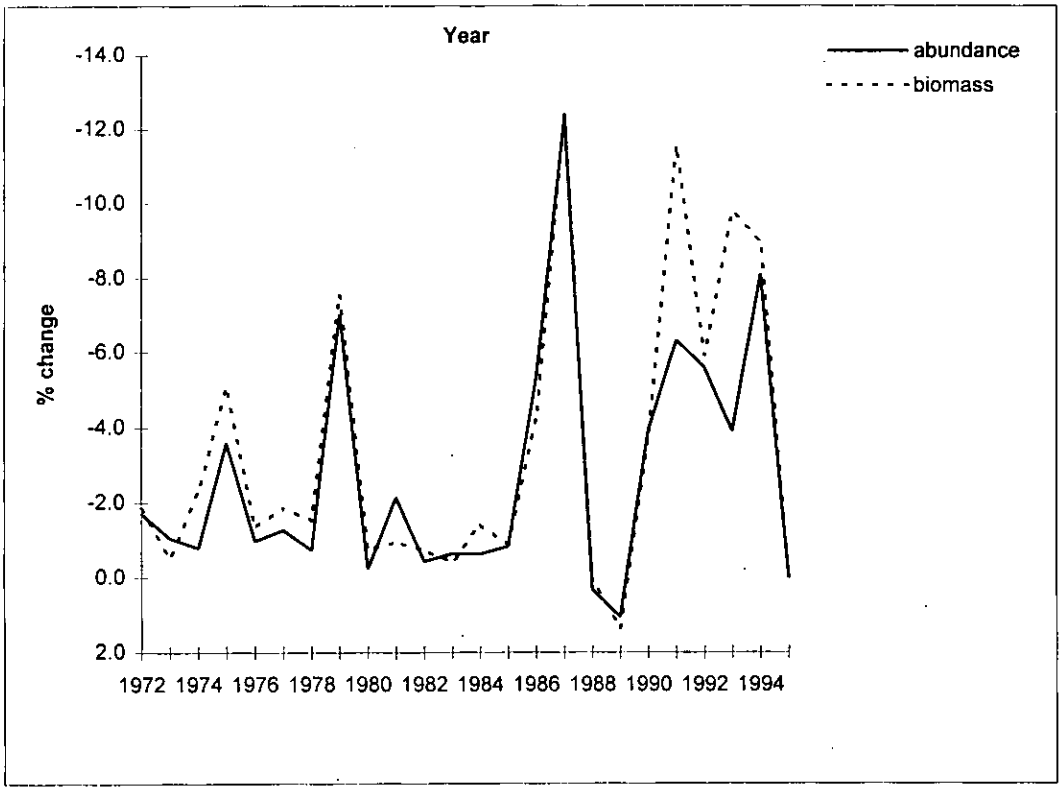

Figure 3. Percent change in abundance and biomass as a result of correcting strata boundries.