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**Is the index from the NEFSC spring research vessels bottom trawl surveys
representative of the abundance of the so called "Northern contingent"
of Atlantic mackerel (*Scomber scombrus* L.)?**

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- MacKay, K.T. 1979. Synopsis of biological data of the northern population Atlantic mackerel (*Scomber scombrus*). Fish. Mar. Serv. Tech. Rep. 885: vi + 26 pp.
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Table 1. Set characteristics of the NEFSC spring research vessels bottom trawl surveys conducted from 1968 to 2008.

YEAR	Nb. STRATA	Nb. AREA	STATION TOTAL			STATION EAST OF 70° W		MACKEREL (nb/set)		
			Nb.	Nb. With Mackerel	% With Mackerel	With Mackerel	% With Mackerel	Min.:	Mean	Max.:
1968	41	23	180	38	21.1	5	2.8	0	53.8	3 538
1969	41	23	184	16	8.7	2	1.1	0	0.9	107
1970	41	23	193	58	30.1	12	6.2	0	11.9	448
1971	41	22	191	44	23.0	1	0.5	0	11.2	736
1972	41	23	194	51	26.3	15	7.7	0	8.2	331
1973	41	25	216	67	31.0	13	6.0	0	79.9	15 619
1974	41	23	159	58	36.5	29	18.2	0	6.3	253
1975	37	19	163	32	19.6	11	6.7	0	7.4	738
1976	41	22	191	39	20.4	11	5.8	0	7.9	494
1977	41	23	191	36	18.8	3	1.6	0	1.3	80
1978	41	23	194	28	14.4	0	0.0	0	3.8	256
1979	41	23	251	25	10.0	7	2.8	0	0.4	15
1980	41	24	231	31	13.4	5	2.2	0	2.0	220
1981	40	23	169	43	25.4	10	5.9	0	15.8	1 120
1982	41	23	180	30	16.7	1	0.6	0	5.1	420
1983	41	20	175	27	15.4	16	9.1	0	0.7	23
1984	41	23	178	20	11.2	0	0.0	0	11.2	603
1985	41	25	172	39	22.7	11	6.4	0	9.2	595
1986	41	21	178	33	18.5	8	4.5	0	3.5	379
1987	41	23	179	48	26.8	2	1.1	0	26.8	1 470
1988	40	22	160	33	20.6	0	0.0	0	14.0	579
1989	41	25	155	31	20.0	2	1.3	0	9.3	316
1990	40	23	157	30	19.1	0	0.0	0	8.6	632
1991	41	23	160	46	28.8	15	9.4	0	15.3	910
1992	39	23	156	44	28.2	7	4.5	0	18.3	692
1993	39	23	157	42	26.8	11	7.0	0	21.6	974
1994	40	21	158	42	26.6	11	7.0	0	32.4	1 064
1995	41	22	156	59	37.8	18	11.5	0	19.7	859
1996	41	23	167	55	32.9	22	13.2	0	37.4	2 222
1997	39	24	158	48	30.4	20	12.7	0	20.3	1 168
1998	40	23	163	64	39.3	26	16.0	0	19.8	681
1999	41	24	160	68	42.5	25	15.6	0	45.8	1 521
2000	41	24	160	61	38.1	32	20.0	0	70.4	2 067
2001	41	22	160	75	46.9	40	25.0	0	114.8	5 792
2002	41	24	159	53	33.3	22	13.8	0	28.7	1 232
2003	41	23	151	54	35.8	11	7.3	0	41.6	1 103
2004	41	22	160	47	29.4	7	4.4	0	80.5	2 536
2005	41	23	159	31	19.5	0	0.0	0	27.5	1 944
2006	40	22	161	49	30.4	8	5.0	0	52.8	2 590
2007	41	23	186	61	32.8	20	10.8	0	26.6	2 511
2008	41	21	167	46	27.5	13	7.8	0	57.9	3 946

Table 1. (Continued).

YEAR	DEPTH (m)			BOTTOM TEMP. (°C)		
	Min.:	Mean	Max.:	Min.:	Mean	Max.:
1968	20.0	106.0	329.5	0.0	5.4	11.4
1969	21.5	102.4	379.5	0.0	5.7	13.3
1970	28.5	104.8	333.5	0.0	6.6	15.8
1971	19.0	100.2	329.0	0.0	5.7	14.3
1972	26.0	106.0	370.5	0.0	7.5	16.1
1973	0.0	84.9	494.0	0.0	6.4	15.5
1974	26.0	106.3	417.0	0.0	7.8	15.3
1975	0.0	99.4	329.0	0.0	6.5	12.5
1976	18.0	97.8	470.0	0.0	7.9	14.8
1977	19.0	98.5	410.0	0.0	6.6	11.3
1978	23.0	96.0	348.0	2.3	5.8	13.1
1979	19.0	89.3	281.0	0.0	6.5	12.0
1980	22.0	89.6	424.0	3.3	7.1	13.0
1981	25.0	93.9	359.0	0.0	7.0	14.5
1982	24.0	103.5	393.0	0.0	4.2	12.3
1983	24.5	103.1	334.0	0.0	6.9	16.7
1984	22.0	100.7	455.5	0.0	7.1	16.2
1985	19.5	98.8	430.5	0.0	2.9	12.9
1986	19.5	105.1	382.5	0.0	3.6	18.2
1987	24.0	103.1	358.5	0.0	4.1	12.2
1988	27.0	86.8	374.0	0.0	4.2	11.8
1989	19.0	88.7	342.0	0.0	2.9	13.5
1990	18.5	86.9	399.5	0.0	3.6	12.6
1991	26.0	92.7	343.0	0.0	7.3	17.8
1992	12.5	84.0	312.5	0.0	6.6	13.9
1993	18.0	84.2	344.5	2.5	5.9	14.8
1994	23.0	87.1	304.0	0.0	6.9	13.4
1995	24.0	88.9	323.0	0.0	7.8	14.0
1996	16.5	88.8	327.5	0.0	6.6	14.2
1997	20.5	85.6	284.5	3.7	7.5	13.4
1998	22.5	86.6	313.0	0.0	6.4	14.4
1999	24.5	86.8	309.0	0.0	7.8	16.2
2000	19.0	82.8	267.5	0.0	8.0	13.3
2001	23.0	92.0	358.0	3.8	7.1	14.4
2002	16.0	90.2	378.0	5.1	8.6	14.5
2003	21.0	87.2	323.0	0.0	5.6	11.6
2004	16.0	89.4	375.0	0.0	5.3	11.9
2005	22.0	87.6	355.0	0.0	6.2	13.0
2006	18.0	88.5	354.0	4.2	7.7	14.0
2007	22.0	99.0	366.0	3.2	6.9	11.8
2008	23.0	85.1	293.0	0.0	7.3	13.0

Table 2. Standardized stratified mean catch per set in numbers and weight (kg) for Atlantic mackerel in the NEFSC spring research vessels bottom trawl surveys conducted from 1968 to 2008.

SPRING SURVEY BACKTRANSFORMED		
GEOMETRIC MEAN		
YEAR	No/Set	Wt/Set
1968	17.921	1.831
1969	0.190	0.033
1970	2.908	0.972
1971	3.154	1.023
1972	2.566	0.657
1973	3.490	0.885
1974	3.444	0.866
1975	1.200	0.232
1976	1.353	0.345
1977	0.535	0.209
1978	1.068	0.482
1979	0.405	0.231
1980	0.797	0.368
1981	4.606	1.978
1982	1.112	0.396
1983	0.611	0.121
1984	2.819	0.971
1985	3.036	1.005
1986	1.334	0.484
1987	14.006	3.676
1988	7.095	2.469
1989	4.321	0.713
1990	4.104	0.883
1991	6.577	1.477
1992	12.719	2.267
1993	9.767	2.674
1994	15.604	3.045
1995	15.668	2.865
1996	15.555	2.669
1997	6.679	1.248
1998	13.389	1.736
1999	24.723	3.723
2000	30.193	3.446
2001	59.106	6.022
2002	11.387	2.615
2003	44.151	5.177
2004	32.741	3.063
2005	7.761	1.611
2006	38.982	4.917
2007	15.602	2.606
2008	9.166	1.893

Table 3. Parameters of the isotropic variograms calculated from the number of Atlantic mackerel per set for the NEFSC spring research vessels bottom trawl surveys conducted from 1968 to 2008.

YEAR	MODEL*	Nugget	Sill	Range	R ²	RSS**
1968	Spherical	10	5775	36	0.955	1.771E+05
1969	<i>Spatial structure of the data doesn't allow the construction of a variogram</i>					
1970	Spherical	1	3058	33	0.938	9.922E+04
1971	Spherical	1	355	38	0.925	1.693E+03
1972	Exponential	334	1620	29	0.819	9.561E+04
1973	Spherical	0	133	45	0.935	9.290E+02
1974	Spherical	0	126	92	0.956	4.470E+02
1975	Spherical	1	8	137	0.979	8.440E-01
1976	Spherical	10	34	138	0.999	1.740E-01
1977	Spherical	3	8	100	0.911	1.740E+00
1978	<i>Spatial structure of the data doesn't allow the construction of a variogram</i>					
1979	Spherical	1	3	368	0.932	1.520E-01
1980	<i>Spatial structure of the data doesn't allow the construction of a variogram</i>					
1981	<i>Spatial structure of the data doesn't allow the construction of a variogram</i>					
1982	Spherical	349	1614	65	0.931	2.733E+04
1983	Spherical	4	9	84	0.893	1.700E+00
1984	Spherical	11	43	82	0.887	5.330E+01
1985	Spherical	1	623	41	0.860	2.045E+04
1986	Spherical	8	25	70	0.949	6.840E+00
1987	Spherical	1	2596	52	0.964	4.463E+04
1988	Spherical	580	4075	50	0.895	3.702E+05
1989	Spherical	365	1221	37	0.971	5.140E+03
1990	Spherical	0	102	34	0.974	1.330E+02
1991	Spherical	12	208	109	0.925	2.092E+03
1992	Spherical	10	5551	80	0.861	1.808E+06
1993	Spherical	1	1144	50	0.874	9.475E+04
1994	Spherical	1	1738	27	0.866	4.344E+04
1995	Spherical	10	6825	53	0.913	4.455E+06
1996	Spherical	100	35960	58	0.901	8.393E+07
1997	Exponential	1183	2367	102	0.848	5.648E+04
1998	Exponential	620	7243	6	0.973	5.275E+04
1999	Spherical	10	8624	63	0.951	1.677E+06
2000	Spherical	10	5724	80	0.948	4.021E+05
2001	Spherical	10	13920	38	0.983	7.083E+05
2002	Spherical	720	8021	53	0.914	1.567E+06
2003	Spherical	10	20810	51	0.911	2.426E+07
2004	Spherical	10	12940	54	0.955	3.074E+06
2005	Spherical	1	590	42	0.838	1.817E+04
2006	Spherical	1	2702	38	0.762	7.541E+05
2007	Exponential	100	54010	34	0.942	6.035E+07
2008	Spherical	84	186	171	0.900	8.410E+02

* Spherical
$$\gamma(h) = \begin{cases} 1.5 \frac{h}{A_0} - 0.5 \left(\frac{h}{A_0} \right)^3 & \text{if } h \leq A_0, \text{ and } 1 \text{ otherwise} \end{cases}$$

Exponential
$$\gamma(h) = 1 - \exp\left(-\frac{3h}{A_0}\right)$$

** Residual sum of squares

Table 4. Mean number per set of Atlantic mackerel calculated by kriging for the NEFSC spring research vessels bottom trawl surveys conducted from 1968 to 2008.

YEAR	MEAN NUMBER PER SET		
	TOTAL	East of 70° W	West of 70° W
1968	56.988	14.730	82.920
1969	n/a	n/a	n/a
1970	13.688	1.190	21.357
1971	12.514	0.047	20.164
1972	7.987	4.280	10.262
1973	5.161	6.375	4.416
1974	7.197	4.400	8.914
1975	5.471	11.598	1.710
1976	7.312	8.534	6.562
1977	0.858	0.067	1.343
1978	n/a	n/a	n/a
1979	0.535	0.314	0.670
1980	n/a	n/a	n/a
1981	n/a	n/a	n/a
1982	4.910	0.028	7.906
1983	0.952	0.903	0.982
1984	12.311	0.001	19.866
1985	8.728	9.027	8.545
1986	4.272	0.464	6.609
1987	30.670	0.093	49.435
1988	16.106	0.790	25.505
1989	11.276	1.097	17.522
1990	11.005	0.003	17.756
1991	30.573	0.734	48.885
1992	32.594	0.776	52.120
1993	24.288	8.853	33.761
1994	35.930	2.833	56.241
1995	30.208	8.660	43.431
1996	40.075	6.875	60.449
1997	19.909	22.473	18.335
1998	24.570	11.798	32.407
1999	41.283	73.022	21.805
2000	59.865	120.431	22.697
2001	117.453	217.983	55.761
2002	34.711	7.480	51.422
2003	56.231	3.283	88.724
2004	74.516	0.769	119.773
2005	38.659	0.000	62.382
2006	68.686	0.176	110.729
2007	30.228	49.055	18.674
2008	22.716	2.743	34.973

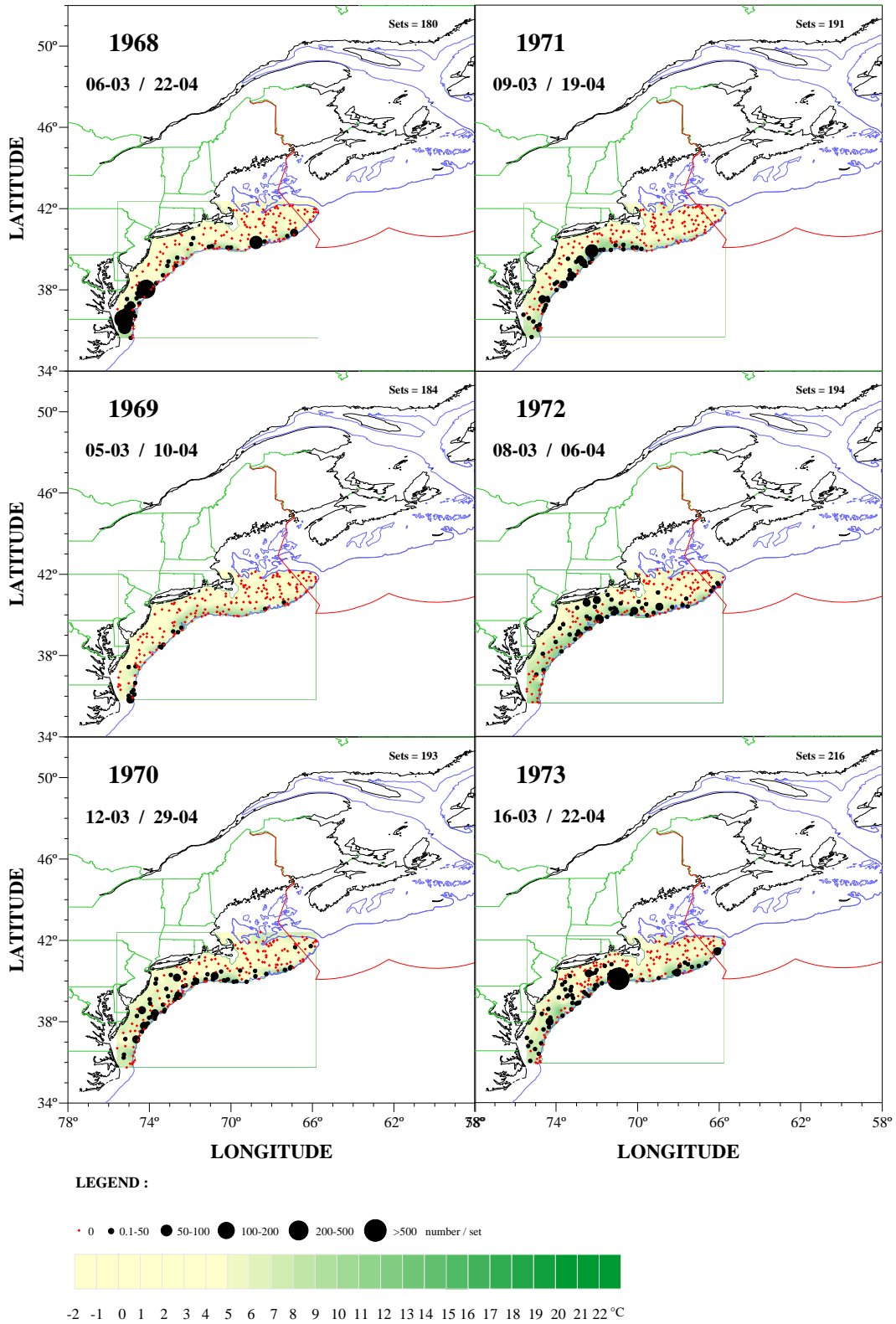


Figure 1. Spatial distribution of Atlantic mackerel (nb/set) and bottom temperature (°C) for the NEFSC spring research vessels bottom trawl surveys conducted from 1968 to 2008.

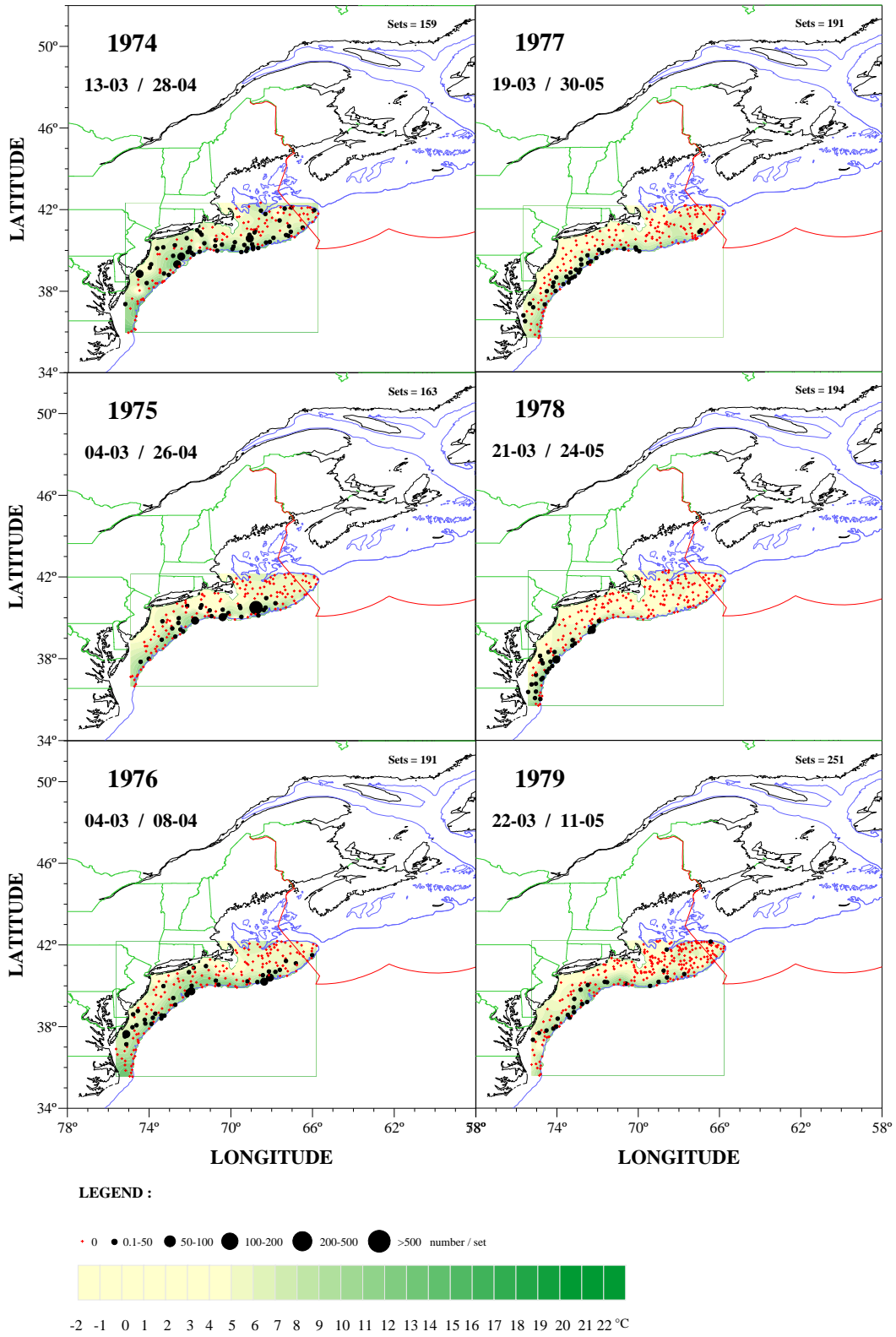


Figure 1. (Continued).

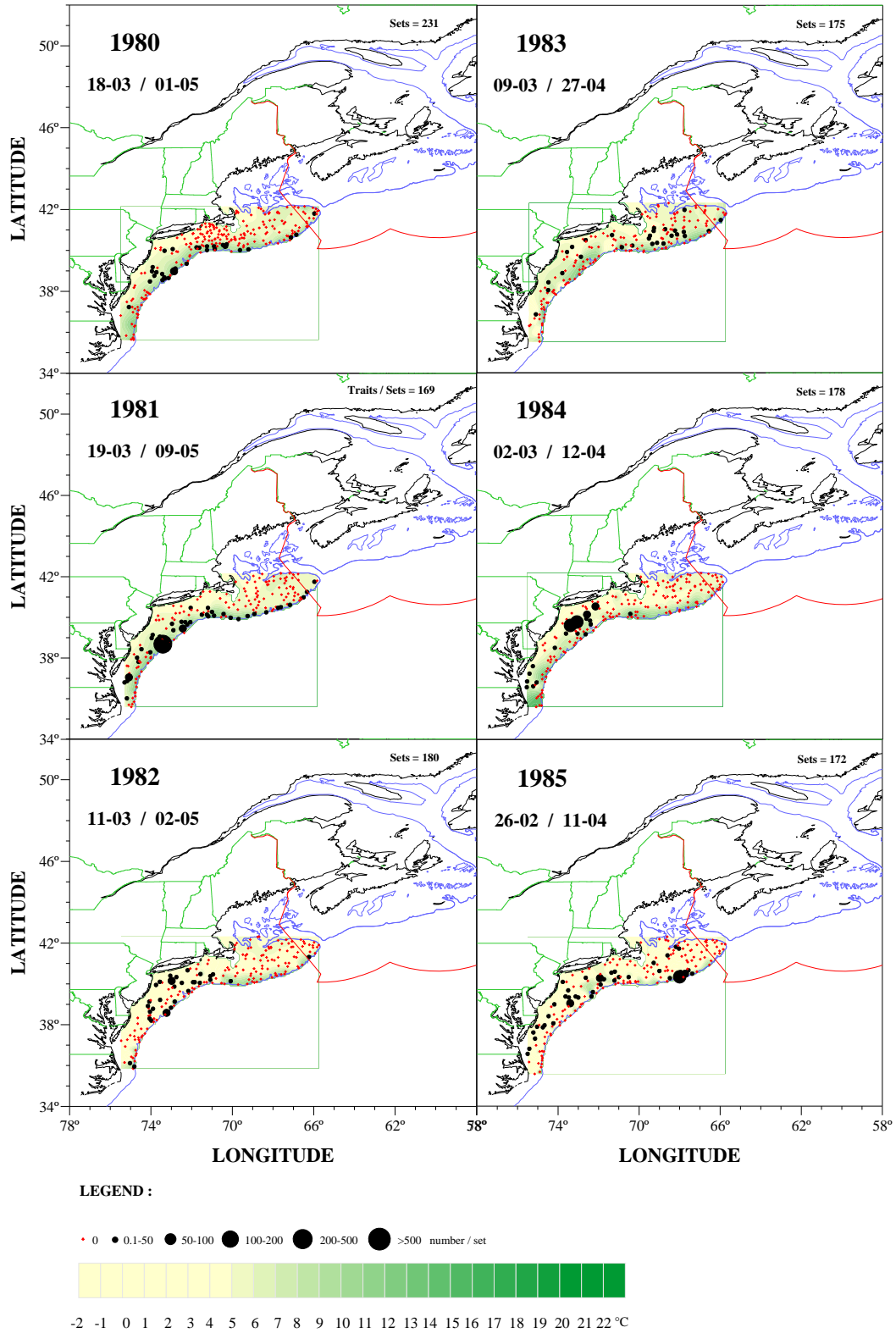


Figure 1. (Continued).

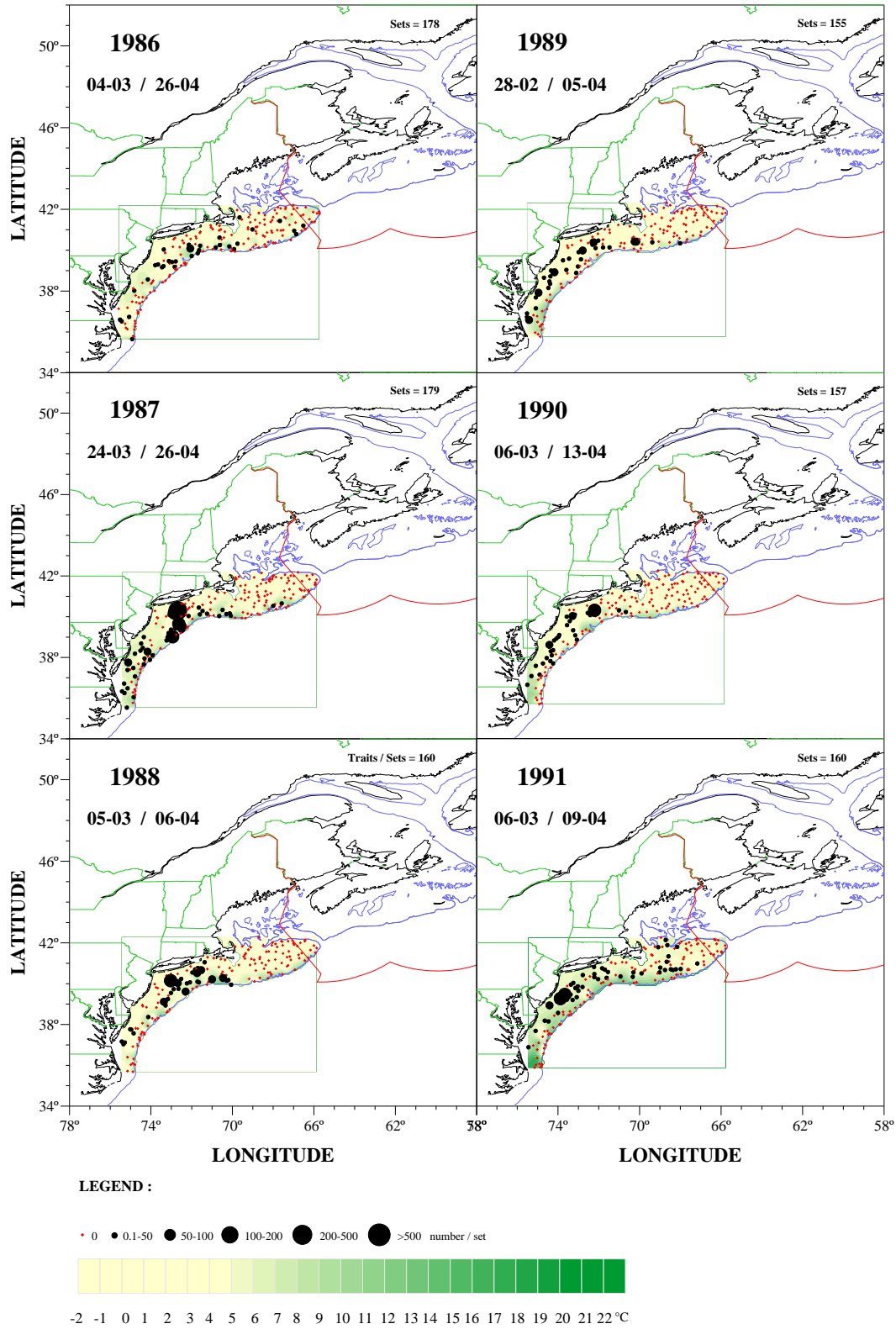


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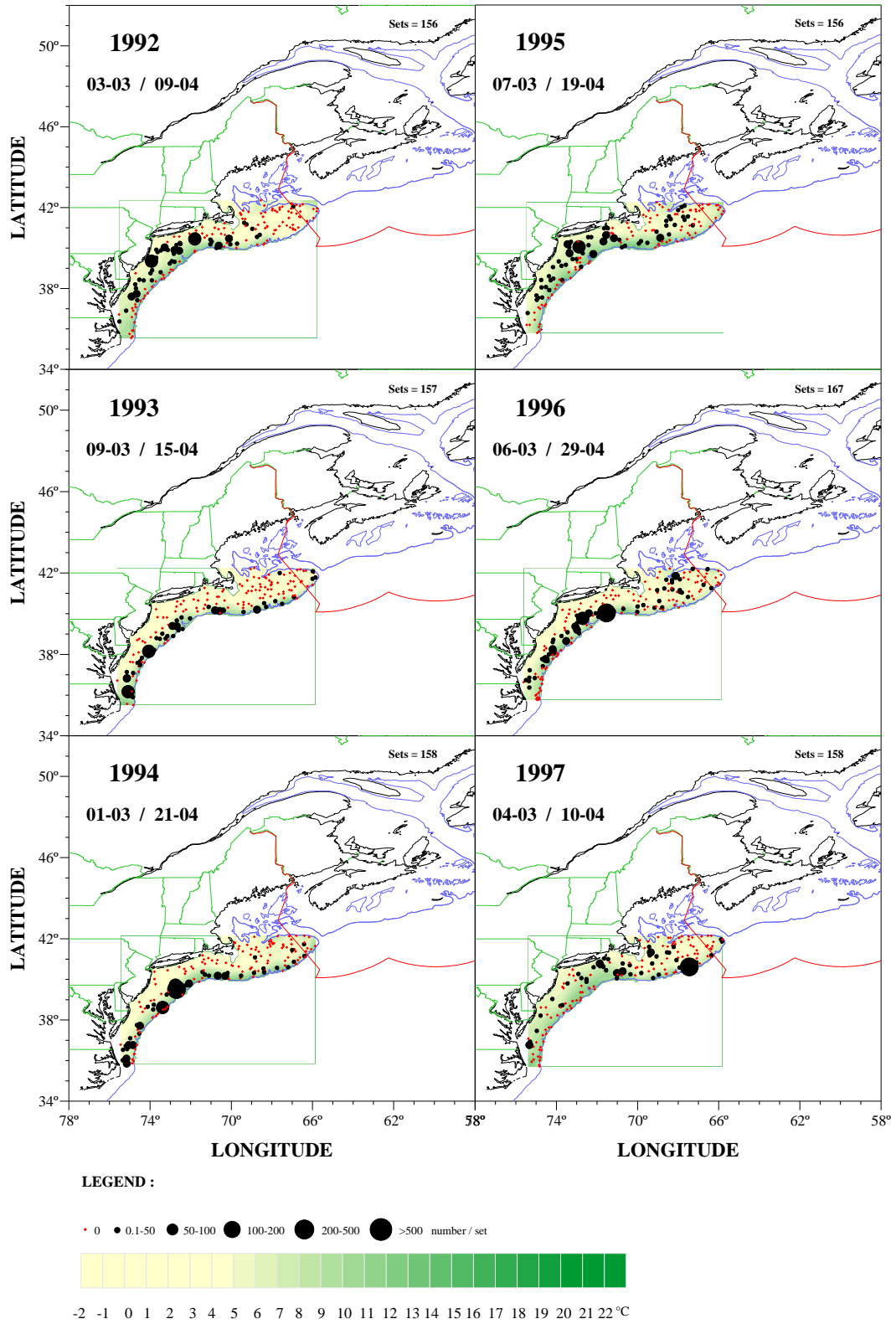


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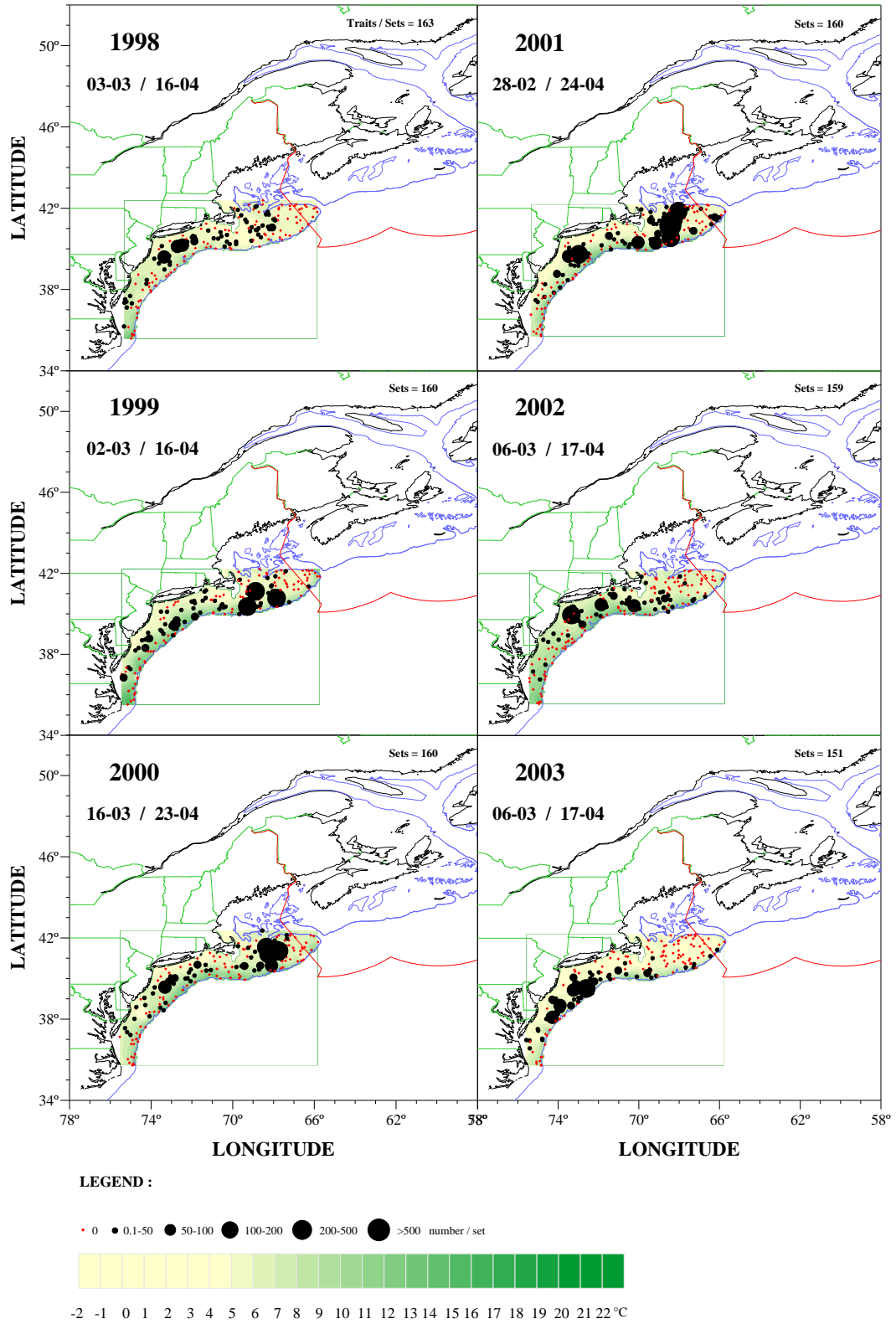


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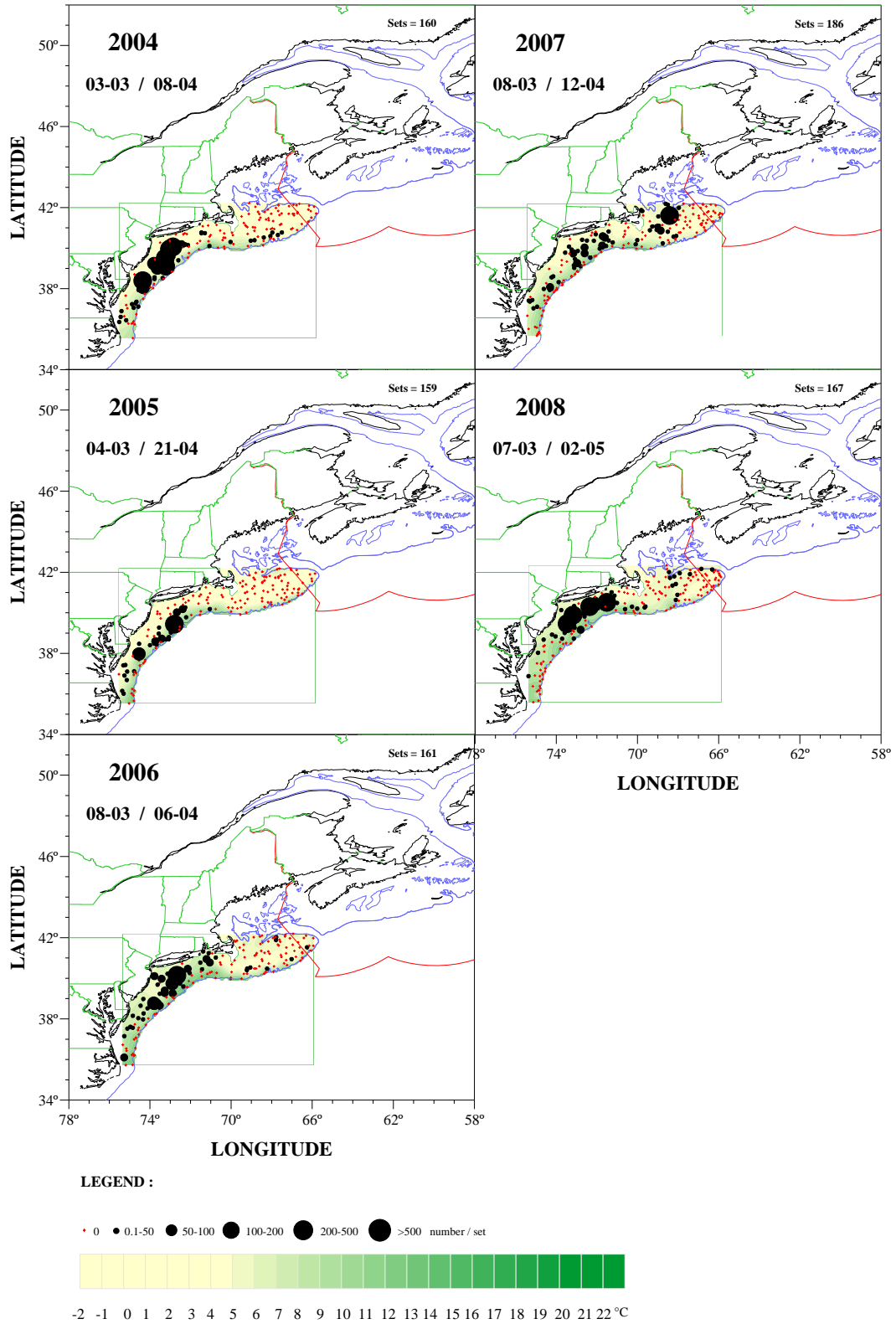


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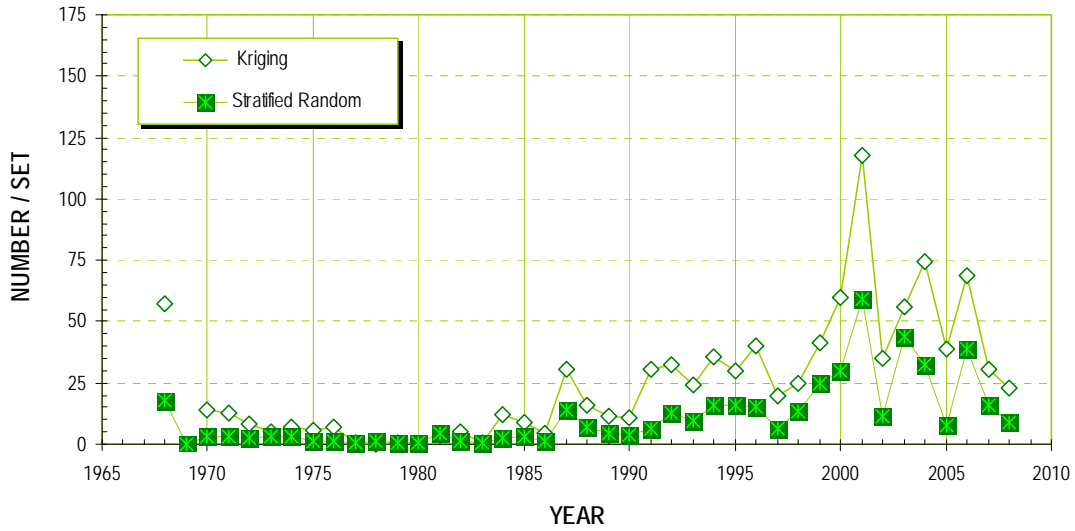


Figure 2. Mean number of Atlantic mackerel per set calculated by kriging and from a stratified random design survey for the NEFSC spring research vessels bottom trawl surveys conducted from 1968 to 2008.

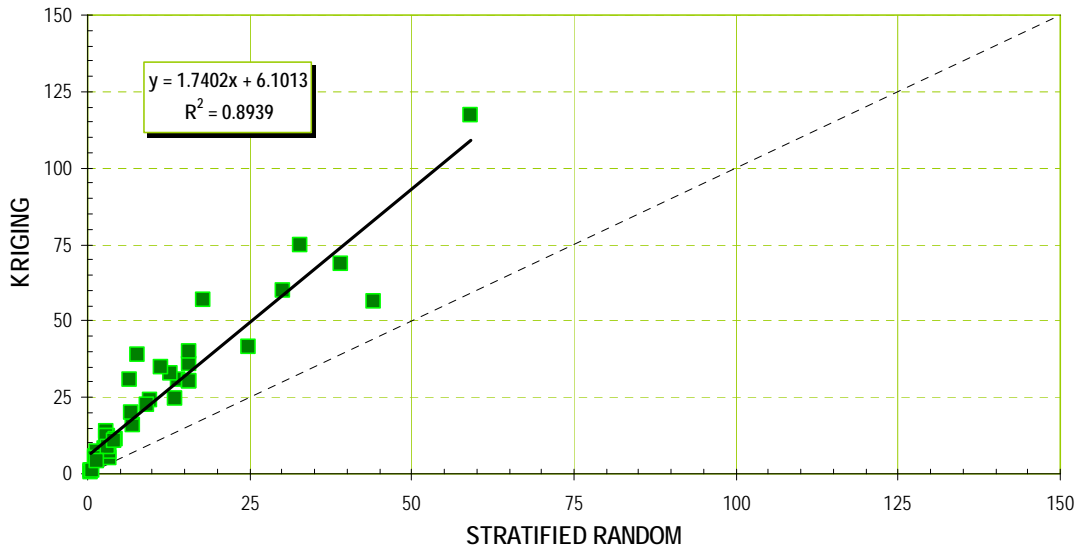


Figure 3. Relationship between the mean numbers of Atlantic mackerel per set calculated by kriging and from a stratified random design survey for the NEFSC spring research vessels bottom trawl surveys conducted from 1968 to 2008.

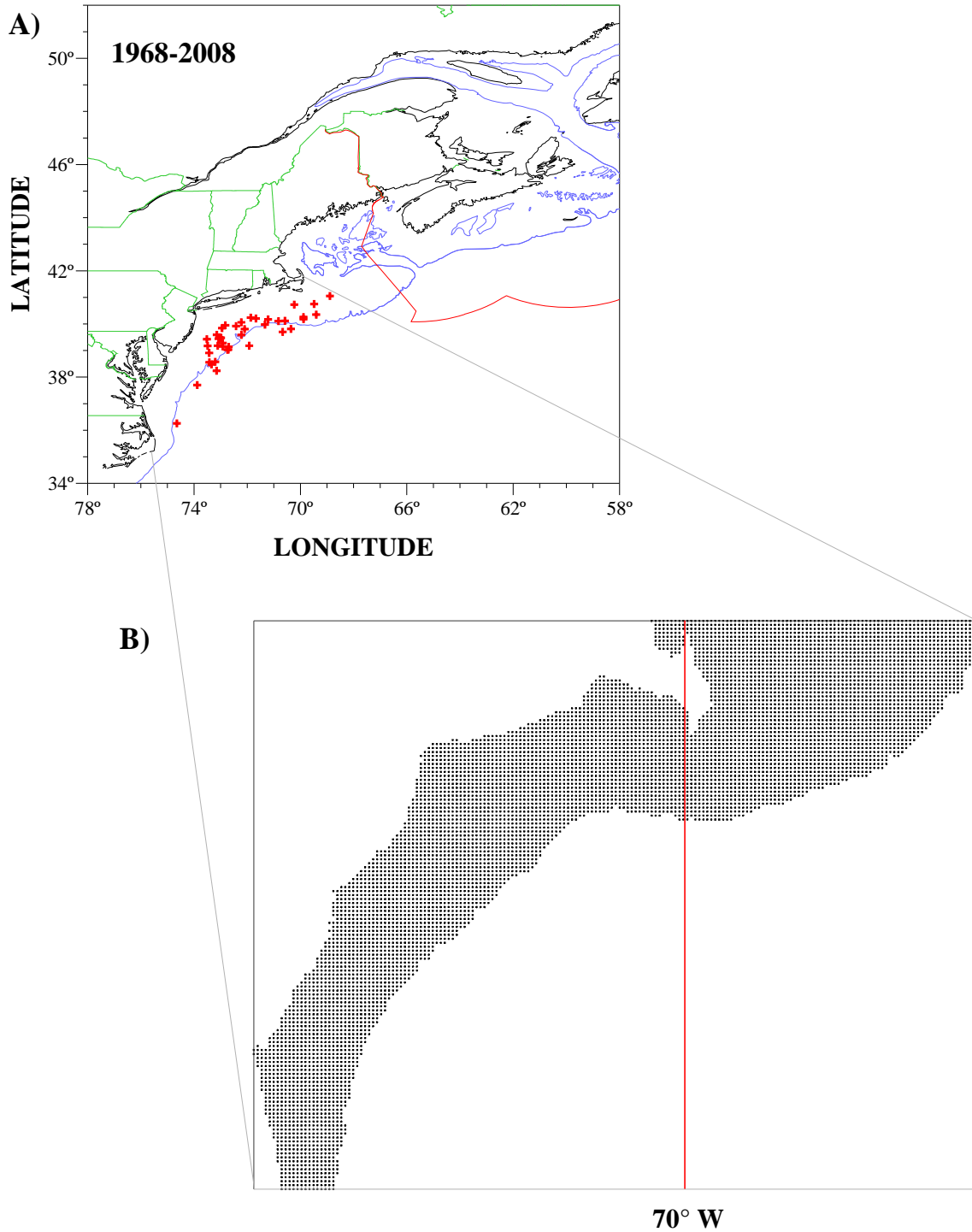


Figure 4. Mean longitude and latitude of Atlantic mackerel catches for each NEFSC spring research vessels bottom trawl survey conducted between 1968 and 2008 (A) and locations of 7247 points used for kriging number per set of Atlantic mackerel (the points are 5 km apart) (B).

Figure 5. Mean number of Atlantic mackerel per set calculated by kriging for the areas located to the west and east of 70° of longitude W.

