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Abundance, Biomass and Population Structure for American Plaice from the Surveys Conducted
by Spain in the NAFO Regulatory Area of Divisions 3NO, 1995-2001

by

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Abstract

Since 1995, a stratified random spring bottom trawl survey in the NAFO Regulatory Area of Div. 3NO was conducted by Spain. The depth strata surveyed was extended to 1464 m. The main propose of the surveys was obtain abundance and biomass indices for the commercial species in the area. Following the recommendations of the 2000 Scientific Council Meeting, the entire series of abundance and biomass for American plaice are presented for the period 1995-2001. The indices calculated from the survey series shows a general increasing in the American plaice abundance and biomass in this period, and an important recruitment in the area in last years; this data suggest a recuperation of the stock.

Material and Methods

Survey design and gear used

The surveys on NAFO Regulatory Area of Div. 3NO was initiated by Spain in 1995. The surveys were carried out in spring (May), on board the Spanish vessel *C/V Playa de Menduiña* (338 GT and 800 HP) using bottom trawl net type *Pedreira*. The main specifications and geometry of this gear, as the rigging profile and the net plan, and a sheet with the resume of the main technical data of the survey are described in previous paper (Durán Muñoz *et. al.*, 2001). In the Table 1 are presented the number of valid tows, the depth strata covered and the dates of the survey series. In the period 1998-2001, the surveyed depth strata were the same (extended to 1464 m), more deeper than in the previous surveys, as show in the cited Table. The survey area was stratified following the standard stratification schemes (Bishop, 1994). Sets were allocated to strata proportionally to their size, with a minimum of two planned hauls per stratum and the trawl positions were chosen at random (Doubleday, 1981). Biomass and abundance indices were calculated by the swept area method (Cochram, 1997), assuming catchability factor of 1. The catch from each haul was sorted by species and weighed. Samples of American plaice were measured at random to the total length at cm below. Length distribution estimated from catches is presented for the period 1995-2001.

Stratified mean catches of American plaice

The mean catch is calculated by stratum by the following formula:

$$\bar{Y}_i = \sum_{j=1}^T \frac{y_j}{T}, \quad i=1, \dots, h$$

where: y_j is the catch by haul in the stratum
 T is the number of hauls in the stratum
 h is the total number of strata

and the stratified mean catch by stratum is obtained as follow:

$$Y_i = \bar{Y}_i n_i, i=1,\dots,h$$

where: n_i is the area of the stratum $i, i=1,\dots,h$

Then the total stratified mean catch by year is calculated according to the formula:

$$\bar{Y} = \sum_{i=1}^h \frac{Y_i}{N}$$

where: $N = \sum_{i=1}^h n_i$ is the total area by year

Results

Catches of American plaice

The American plaice mean catches by stratum are presented in Table 2, included swept area, number of hauls and SD. The stratified mean catches of American plaice are presented in Table 3. Data from year 1995 are added, although in that year a few sets were made, so it is not representative. The American plaice indices show an increasing year by year, specially since 1998 (Fig. 1), although in 2001 it decreased in relation to 2000, but is higher than in 1999. The decreasing in 1997 value should be related to changes in the American plaice distribution.

Abundance and Biomass of American plaice

Following the recommendations of the 2000 Scientific Council Meeting, the entire time series (1995-2001) of abundance and biomass estimates of American plaice are presented (updated) in Table 4 and Table 5, respectively. The abundance Table show an increasing in the survey estimates through the studied period (Fig. 2), and quit the same occurs to biomass (Fig. 3), although in 2001 there was a decreasing with regard to 2000, as in mean catches. It shows that although the number of individual has increased, its weight has fell.

Presence of juveniles of American plaice

The length distribution of American plaice for the period 1995-2001 is shown in Table 6 and Table 7, and in figure 4 and Fig. 5 we can see its evolution along the years. The presence of juveniles (length ≤ 22 cm.) is increasing in the last years. The evolution of males and females is almost the same in the period 1999-2001 (Fig. 5). The high presence of juvenile individuals indicates the recruitment of a new class-year with a size higher than last years average. The increase of this new class-year may contribute to the recovery of the stock. It would be necessary other studies to determinate the size and the quantitative importance of this year-class.

Therefore, it suggests a recuperation of the American plaice. Against what NAFO reports said, our data of length of 2001 indicates a high number of recruits, even highest than the number of adults.

The data analysed from American plaice suggested the beginning of the rebuilding of this resource in the surveyed area.

References

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TABLE 1. Spanish spring bottom trawl surveys on NAFO Div. 3NO: 1995-2001.

Year	Vessel	Valid tows	Depth strata covered (m)	Dates
1995	C/V Playa de Menguíña	77	>56-731	May 18-May 29
1996	C/V Playa de Menguíña	112	>56-1098	May 07-May 24
1997	C/V Playa de Menguíña	128	>56-1280	April 26-May 18
1998	C/V Playa de Menguíña	124	>56-1463	May 06-May 26
1999	C/V Playa de Menguíña	114	>56-1464	May 07-May 26
2000	C/V Playa de Menguíña	118	>56-1465	May 07-May 28
2001	C/V Playa de Menguíña	130	>56-1466	May 03-May 24

TABLE 2. Swept area, number of hauls and American plaice mean catch (kg.) and SD (*) by stratum. Spanish Spring Surveys on NAFO Div. 3NO: 1995-2001. Swept area in square miles. n.s. means stratum not surveyed.

Stratum	1995					1996				1997					1998			
	Swept area	Tow number	A. Plaice Mean catch	A. Plaice	SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice	SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice SD
353	0.0353	3	228.43	134.801	0.0371	3	695.00	101.180	0.0480	4	154.27	80.671	0.0465	4	861.75	333.925		
354	0.0353	3	400.93	213.469	0.0319	3	417.02	133.936	0.0233	2	109.85	59.326	0.0356	3	1226.90	470.858		
355	n.s.	n.s.	n.s.	n.s.	0.0221	2	177.50	79.903	0.0233	2	45.10	14.849	0.0221	2	433.10	427.517		
356	n.s.	n.s.	n.s.	n.s.	0.0203	2	24.90	2.121	0.0225	2	26.20	13.294	0.0221	2	45.75	17.183		
357	0.0109	1	28.35	-	0.0218	2	20.63	20.683	0.0443	4	5.97	3.379	0.0240	2	7.50	1.556		
358	0.0319	3	72.05	42.721	0.0319	3	23.45	14.726	0.0563	5	14.29	14.199	0.0236	3	21.64	4.069		
359	0.0345	3	184.03	202.625	0.0548	5	144.86	71.296	0.0690	6	96.87	50.727	0.0698	6	638.70	642.382		
360	0.3563	31	113.41	91.025	0.3761	31	231.59	139.386	0.3754	32	84.09	57.373	0.2561	25	345.82	208.587		
374	0.0225	2	10.58	9.581	0.0233	2	37.30	5.374	0.0353	3	27.00	10.195	0.0353	3	12.87	2.914		
375	0.0225	2	6.85	4.101	0.0229	2	81.30	83.439	0.0116	1	5.94	-	0.0345	3	19.07	11.418		
376	0.1729	15	17.91	5.542	0.1650	14	97.33	78.161	0.1583	14	40.31	28.112	0.0930	10	266.69	235.685		
377	0.0221	2	25.55	13.294	0.0229	2	75.80	27.294	0.0116	1	67.40	-	0.0229	2	151.75	191.979		
378	0.0435	4	35.86	2.182	0.0330	3	31.50	9.824	0.0210	2	6.00	5.091	0.0120	2	16.80	7.071		
379	0.0221	2	42.13	40.906	0.0113	1	22.10	-	0.0206	2	5.72	5.042	0.0356	3	8.53	5.800		
380	n.s.	n.s.	n.s.	n.s.	0.0221	2	22.05	7.707	0.0210	2	4.52	0.255	0.0113	2	5.45	3.041		
381	n.s.	n.s.	n.s.	n.s.	0.0229	2	21.20	10.324	0.0221	2	4.98	2.878	0.0229	2	27.05	35.143		
382	n.s.	n.s.	n.s.	n.s.	0.0338	3	28.63	20.270	0.0461	4	1.90	1.092	0.0229	3	14.00	9.702		
721	n.s.	n.s.	n.s.	n.s.	0.0214	2	47.52	24.720	0.0221	2	43.10	39.315	0.0203	2	24.70	20.789		
722	n.s.	n.s.	n.s.	n.s.	0.0206	2	23.40	26.446	0.0214	2	150.05	211.778	0.0101	2	6.40	7.637		
723	n.s.	n.s.	n.s.	n.s.	0.0109	1	8.90	-	0.0210	2	28.28	17.572	0.0233	2	32.30	27.719		
724	0.0105	1	33.70	-	0.0203	2	30.30	15.698	0.0225	2	42.89	54.751	0.0206	2	34.85	8.132		
725	0.0334	3	44.25	66.484	0.0225	2	2.65	1.768	0.0206	2	4.23	2.835	0.0086	1	2.00	-		
726	0.0214	2	8.43	8.238	0.0218	2	7.55	1.626	n.s.	n.s.	n.s.	n.s.	0.0094	2	9.50	8.768		
727	n.s.	n.s.	n.s.	n.s.	0.0210	2	19.38	10.783	0.0094	1	30.14	-	0.0233	2	29.00	12.162		
728	n.s.	n.s.	n.s.	n.s.	0.0218	2	163.80	167.867	0.0214	2	103.20	77.075	0.0206	2	50.10	14.849		
752	n.s.	n.s.	n.s.	n.s.	0.0109	1	93.30	-	0.0218	2	362.45	411.890	0.0229	2	160.65	22.840		
753	n.s.	n.s.	n.s.	n.s.	0.0199	2	701.10	739.917	0.0214	2	182.60	133.926	0.0218	2	472.70	42.709		
754	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0330	3	17.68	20.735	0.0210	2	8.60	12.162		
755	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0206	2	1.25	1.768		
756	n.s.	n.s.	n.s.	n.s.	0.0210	2	70.80	1.697	0.0109	1	243.40	-	0.0225	2	642.45	830.355		
757	n.s.	n.s.	n.s.	n.s.	0.0188	2	272.60	381.413	0.0304	3	2013.45	2422.909	0.0206	2	264.50	324.562		
758	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0214	2	1.94	1.438	0.0105	2	12.95	18.314		
759	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0214	2	0.00	0.000		
760	n.s.	n.s.	n.s.	n.s.	0.0210	2	49.15	7.425	0.0105	1	55.20	-	0.0214	2	25.85	17.748		
761	n.s.	n.s.	n.s.	n.s.	0.0199	2	0.00	0.000	0.0315	3	3.89	6.284	0.0206	2	11.15	5.162		
762	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0308	3	0.00	0.000	0.0094	2	0.00	0.000		
763	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0218	2	0.25	0.354		
764	n.s.	n.s.	n.s.	n.s.	0.0210	2	1.45	0.778	0.0206	2	0.54	0.764	0.0218	2	0.80	1.131		
765	n.s.	n.s.	n.s.	n.s.	0.0199	2	0.00	0.000	0.0206	2	0.00	0.000	0.0098	2	0.00	0.000		
766	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0308	3	0.00	0.000	0.0191	2	0.00	0.000		
767	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.0109	2	0.00	0.000		

$$(*)S.D. = \frac{\sum (x_i - \bar{x})^2}{n-1}$$

TABLE 2 (cont.). Swept area, number of hauls and American plaice mean catch (kg.) and SD (formula in previous sheet) by stratum. Spanish Spring Surveys on NAFO Div. 3NO: 1995-2001. Swept area in square miles. n.s. means stratum not surveyed.

Stratum	1999					2000					2001				
	Swept area	Tow number	A. Plaice Mean catch	A. Plaice	SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice	SD	Swept area	Tow number	A. Plaice Mean catch	A. Plaice	SD
353	0.0360	3	1250.95	121.001		0.0356	3	1370.12	677.434		0.0341	3	1635.00	653.562	
354	0.0218	2	592.15	321.663		0.0356	3	474.17	272.659		0.0338	3	701.53	483.302	
355	0.0229	2	195.60	96.874		0.0233	2	193.00	4.950		0.0199	2	532.00	117.663	
356	0.0229	2	101.20	76.792		0.0225	2	90.42	78.369		0.0244	2	95.60	82.731	
357	0.0236	2	9.85	6.152		0.0124	1	1.78	-		0.0233	2	66.35	84.075	
358	0.0349	3	29.12	48.392		0.0341	3	960.47	1407.386		0.0349	3	51.53	40.965	
359	0.0364	3	1559.40	272.198		0.0469	4	2121.83	447.704		0.0825	7	1008.56	904.048	
360	0.2325	19	848.30	294.671		0.2396	20	1044.45	865.893		0.2381	20	1064.49	707.622	
374	0.0244	2	141.50	4.808		0.0240	2	18.00	1.414		0.0240	2	66.64	2.107	
375	0.0236	2	135.75	49.992		0.0244	2	96.85	29.911		0.0240	2	32.91	11.066	
376	0.1219	10	385.60	201.803		0.1200	10	807.18	576.609		0.1193	10	254.68	149.513	
377	0.0240	2	277.10	377.312		0.0229	2	86.91	93.472		0.0229	2	58.85	40.941	
378	0.0229	2	22.95	13.506		0.0233	2	63.50	72.832		0.0233	2	72.85	97.086	
379	0.0236	2	2.50	0.990		0.0225	2	7.40	3.684		0.0214	2	3.15	3.323	
380	0.0236	2	7.15	0.212		0.0236	2	5.61	1.294		0.0206	2	9.55	2.051	
381	0.0229	2	1.90	0.742		0.0236	2	6.52	4.080		0.0236	2	7.55	0.495	
382	0.0484	4	7.23	1.962		0.0499	4	6.16	1.806		0.0469	4	9.73	2.989	
721	0.0244	2	64.50	33.375		0.0236	2	13.56	15.196		0.0248	2	59.80	1.838	
722	0.0229	2	7.80	2.263		0.0218	2	3.90	5.515		0.0263	2	31.40	2.970	
723	0.0229	2	109.50	96.308		0.0248	2	34.30	23.617		0.0229	2	35.25	32.880	
724	0.0225	2	31.80	33.658		0.0233	2	39.60	5.798		0.0233	2	83.30	105.359	
725	0.0229	2	7.97	0.233		0.0210	2	27.80	28.001		0.0221	2	7.85	3.041	
726	0.0225	2	128.50	151.321		0.0221	2	26.50	13.435		0.0236	2	12.40	10.748	
727	0.0236	2	24.30	24.607		0.0210	2	14.75	6.718		0.0225	2	27.20	16.971	
728	0.0233	2	122.00	71.701		0.0210	2	73.41	0.573		0.0229	2	18.80	3.677	
752	0.0233	2	114.75	35.143		0.0206	2	412.10	82.590		0.0210	2	50.79	25.477	
753	0.0229	2	47.40	15.981		0.0218	2	546.60	697.773		0.0214	2	192.80	219.910	
754	0.0206	2	0.00	0.000		0.0195	2	0.00	0.000		0.0195	2	4.05	5.728	
755	0.0311	3	0.17	0.289		0.0431	4	0.00	0.000		0.0416	4	0.00	0.000	
756	0.0225	2	399.90	142.977		0.0203	2	101.90	38.042		0.0233	2	65.80	14.142	
757	0.0233	2	54.90	12.162		0.0214	2	16.48	21.956		0.0233	2	338.26	476.929	
758	0.0214	2	1.00	1.407		0.0210	2	4.25	5.303		0.0218	2	0.50	0.707	
759	0.0218	2	1.10	1.556		0.0210	2	6.40	9.051		0.0221	2	0.85	1.202	
760	0.0225	2	65.30	90.934		0.0210	2	140.20	187.808		0.0240	2	32.70	33.093	
761	0.0210	2	0.00	0.000		0.0221	2	0.60	0.849		0.0225	2	0.40	0.566	
762	0.0210	2	59.45	84.075		0.0203	2	0.00	0.000		0.0225	2	0.00	0.000	
763	0.0311	3	0.00	0.000		0.0416	4	0.98	1.950		0.0330	3	0.00	0.000	
764	0.0225	2	0.00	0.000		0.0218	2	0.00	0.000		0.0225	2	0.53	0.184	
765	0.0221	2	0.00	0.000		0.0203	2	0.00	0.000		0.0218	2	0.00	0.000	
766	0.0218	2	0.00	0.000		0.0214	2	0.00	0.000		0.0203	2	1.40	1.980	
767	0.0214	2	0.00	0.000		0.0210	2	0.36	0.502		0.0218	2	0.00	0.000	

TABLE 3. American plaice stratified mean catches by stratum and year. n.s. means stratum not surveyed.

Strata	Survey						
	1995	1996	1997	1998	1999	2000	2001
353	61448.57	186955.00	41499.30	231810.75	336506.45	368562.28	439815.00
354	98629.60	1.70	27023.10	301817.40	145668.90	116645.82	172577.20
355	n.s.	2.40	3337.40	32049.40	14474.40	14282.00	39368.00
356	n.s.	0.53	1231.40	2150.25	4756.40	4249.51	4493.20
357	4649.40	3382.50	979.45	1230.00	1615.40	291.92	10881.40
358	16211.25	5276.25	3215.70	4868.25	6552.75	216105.00	11595.00
359	77478.03	60986.06	40780.87	268892.70	656507.40	893288.33	424602.56
360	315623.62	644506.89	234021.60	962405.93	2360818.90	2906690.44	2962467.32
374	2263.05	7982.20	5778.00	2753.47	30281.00	3852.00	14260.96
375	1856.35	22032.30	1609.74	5167.07	36788.25	26246.35	8917.26
376	23887.49	129836.31	53770.68	355764.46	514389.07	1076778.12	339743.12
377	2555.00	7580.00	6740.00	15175.00	27710.00	8690.50	5885.00
378	4984.89	4378.50	834.00	2335.20	3190.05	8826.50	10126.15
379	4465.25	2342.60	605.79	904.53	265.00	783.87	333.90
380	n.s.	2116.80	433.92	523.20	686.40	538.08	916.80
381	n.s.	3052.80	716.40	3895.20	272.88	938.16	1087.20
382	n.s.	9821.23	651.70	4802.00	2478.18	2113.74	3335.68
721	n.s.	3088.80	2801.50	1605.50	4192.50	881.08	3887.00
722	n.s.	1965.60	12604.20	537.60	655.20	327.60	2637.60
723	n.s.	1379.50	4382.63	5006.50	16972.50	5316.50	5463.75
724	4178.80	3757.20	5317.74	4321.40	3943.20	4910.40	10329.20
725	0.42	278.25	443.63	210.00	836.33	2919.00	824.25
726	606.60	543.60	n.s	684.00	9252.00	1908.00	892.80
727	n.s.	1860.00	2893.44	2784.00	2332.80	1416.00	2611.20
728	n.s.	327.60	8049.60	3907.80	9516.00	5725.59	1466.40
752	n.s.	12222.30	47480.95	21045.15	15032.25	53985.10	6652.84
753	n.s.	96751.80	25198.80	65232.60	6541.20	75430.80	26634.00
754	n.s.	n.s.	3181.80	1548.00	0.00	0.00	729.00
755	n.s.	n.s.	n.s	481.25	64.17	0.00	0.00
756	n.s.	7150.80	24583.40	64887.45	40389.90	10291.90	6645.80
757	n.s.	27805.20	205371.90	26979.00	5599.80	1680.45	34502.52
758	n.s.	n.s.	192.36	1282.05	98.51	420.75	49.50
759	n.s.	n.s.	n.s	0.00	139.70	812.80	107.95
760	n.s.	7569.10	8500.80	3980.90	10056.20	21590.80	5035.80
761	n.s.	0.00	665.19	1906.65	0.00	102.60	68.40
762	n.s.	n.s.	0.00	0.00	12603.40	0.00	0.00
763	n.s.	n.s.	n.s	65.25	0.00	254.48	0.00
764	n.s.	145.00	53.75	80.00	0.00	0.00	53.00
765	n.s.	0.00	0.00	0.00	0.00	0.00	0.00
766	n.s.	n.s.	0.00	0.00	0.00	0.00	201.60
767	n.s.	n.s.	n.s	0.00	0.00	56.09	0.00
(\bar{Y})	94.15	143.01	82.98	232.36	413.96	564.39	440.33

TABLE 4. Survey estimates (by the swept area method) of American plaice abundance (,000) by stratum on NAFO Div. 3NO. n.s. means stratum not surveyed.

Strata	Survey						
	1995	1996	1997	1998	1999	2000	2001
353	19049	57734	9909	45219	67332	114514	152956
354	31583	35491	8378	60908	34706	20765	37753
355	n.s.	4003	904	6257	1484	2687	9209
356	n.s.	459	384	457	850	624	812
357	1523	875	248	226	199	66	8980
358	5640	2104	1098	1429	939	26317	2768
359	43984	22674	11800	54100	119923	162321	125557
360	134416	179032	59743	207258	382612	601212	1020482
374	808	2705	1815	547	5309	704	4057
375	554	3505	326	941	5830	3497	1445
376	7947	26694	11723	66322	72665	147335	52526
377	1193	3006	2661	2541	7795	1632	3056
378	2518	1898	266	985	638	1370	3013
379	1554	1119	200	255	49	137	84
380	n.s.	1002	239	350	130	118	279
381	n.s.	1998	397	1624	120	439	384
382	n.s.	5356	321	2414	982	619	907
721	n.s.	1012	771	328	779	143	1046
722	n.s.	592	6897	267	81	42	531
723	n.s.	499	1351	884	2932	745	1267
724	1098	1078	1391	932	607	608	1761
725	1207	103	173	47	188	680	218
726	135	149	n.s.	377	1813	417	162
727	n.s.	896	1485	718	532	329	550
728	n.s.	5461	3575	1448	2210	1281	273
752	n.s.	3239	14454	5861	4034	12635	1473
753	n.s.	26344	6186	16478	1345	15708	5018
754	n.s.	n.s.	628	351	0	0	120
755	n.s.	n.s.	n.s.	148	0	0	0
756	n.s.	1904	6358	13012	8138	2155	1080
757	n.s.	8238	53379	6544	1134	229	5468
758	n.s.	n.s.	32	443	23	61	14
759	n.s.	n.s.	n.s.	0	29	163	11
760	n.s.	2853	1674	635	1570	2885	642
761	n.s.	0	119	373	0	0	15
762	n.s.	n.s.	0	0	1916	0	0
763	n.s.	n.s.	n.s.	13	0	31	0
764	n.s.	0	15	18	0	0	22
765	n.s.	0	0	0	0	0	0
766	n.s.	n.s.	0	0	0	0	36
767	n.s.	n.s.	n.s.	0	0	8	0
TOTAL	253.21	402.02	208.90	500.71	728.89	1122.48	1443.98

TABLE 5. Survey estimates (by the swept area method) of American plaice biomass (t.) by stratum on NAFO Div. 3NO.
n.s. means stratum not surveyed.

Strata	Survey						
	1995	1996	1997	1998	1999	2000	2001
353	5230	15107	3458	19941	28042	31037	38665
354	8394	9655	2325	25416	13395	9823	15340
355	n.s.	1187	287	2897	1266	1229	3962
356	n.s.	116	109	194	416	378	369
357	428	311	89	103	137	24	936
358	1526	497	286	618	564	18998	997
359	6737	5570	3546	23131	54145	76227	36027
360	27465	53120	19950	93939	192927	242603	248816
374	201	687	492	234	2485	321	1188
375	165	1926	138	449	3114	2154	743
376	2073	11016	4757	38254	42206	89732	28490
377	231	663	580	1327	2309	760	515
378	458	398	79	389	279	759	871
379	404	208	59	76	22	70	31
380	n.s.	191	41	93	58	46	89
381	n.s.	267	65	341	24	79	92
382	n.s.	873	57	630	205	170	285
721	n.s.	289	253	159	344	75	314
722	n.s.	191	1179	106	57	30	201
723	n.s.	127	417	431	1484	430	478
724	398	371	473	419	351	422	889
725	418	25	43	24	73	278	75
726	57	50	n.s.	146	822	172	76
727	n.s.	177	309	239	197	135	232
728	n.s.	1175	753	379	819	545	128
752	n.s.	1124	4366	1840	1293	5235	634
753	n.s.	9736	2358	5998	572	6936	2492
754	n.s.	n.s.	289	147	0	0	75
755	n.s.	n.s.	n.s.	47	6	0	0
756	n.s.	681	2261	5768	3590	1016	572
757	n.s.	2966	20284	2616	482	157	2968
758	n.s.	n.s.	18	244	9	40	5
759	n.s.	n.s.	n.s.	0	13	77	10
760	n.s.	721	810	372	894	2056	420
761	n.s.	0	63	185	0	9	6
762	n.s.	n.s.	0	0	1200	0	0
763	n.s.	n.s.	n.s.	6	0	24	0
764	n.s.	14	5	7	0	0	5
765	n.s.	0	0	0	0	0	0
766	n.s.	n.s.	0	0	0	0	20
767	n.s.	n.s.	n.s.	0	0	5	0
TOTAL	54.18	119.44	70.20	227.17	353.80	492.05	387.01

TABLE 6. American plaice length distribution in NAFO 3NO 1995-2001 in frequency in %. Indet. means indeterminates.

Length (cm.)	1995			1996			1997			1998		
	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.057	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.327	0.233	0.641	0.000	0.000	0.095	0.054	0.052	0.000	0.032	0.016	0.000
16	0.519	2.758	0.126	0.338	1.494	0.172	0.131	0.130	0.000	1.105	0.257	0.000
18	3.148	5.371	0.000	1.947	4.031	0.242	1.759	2.569	0.000	0.016	0.432	0.000
20	17.732	16.454	0.000	4.678	12.076	0.019	4.687	4.511	0.076	0.460	0.941	0.000
22	65.937	54.017	0.000	9.250	15.276	0.591	11.638	8.161	0.000	2.192	1.180	0.000
24	105.205	84.664	0.000	26.030	19.881	0.000	20.936	14.825	0.000	8.159	7.272	0.000
26	91.656	75.419	0.000	69.268	37.885	0.571	29.546	27.023	0.000	20.695	19.052	0.000
28	61.966	67.162	0.000	94.158	80.012	0.000	61.984	36.037	0.000	33.127	26.354	0.000
30	34.992	54.757	0.000	64.828	93.258	0.000	107.571	40.957	0.000	53.484	35.444	0.000
32	22.446	51.733	0.000	38.092	87.597	0.000	71.124	61.794	0.000	63.067	46.526	0.000
34	14.231	43.543	0.000	23.611	73.810	0.095	60.989	71.031	0.000	50.672	78.545	0.000
36	9.029	29.084	0.000	16.677	66.431	0.000	41.345	72.619	0.000	31.869	106.773	0.000
38	5.571	20.620	0.000	7.390	48.008	0.000	16.546	70.970	0.000	16.543	116.496	0.000
40	3.360	15.291	0.000	3.598	30.346	0.000	10.732	52.417	0.000	7.826	89.580	0.000
42	1.953	12.340	0.000	2.161	20.727	0.000	3.059	36.147	0.000	2.682	67.161	0.000
44	0.948	7.841	0.000	1.237	14.479	0.000	2.464	23.476	0.000	1.295	45.563	0.000
46	0.662	5.630	0.000	0.456	8.332	0.000	1.738	9.435	0.000	0.787	26.917	0.000
48	0.031	3.672	0.000	0.249	5.544	0.000	0.179	8.971	0.000	0.358	17.631	0.000
50	0.063	3.492	0.000	0.064	4.770	0.000	0.051	7.378	0.000	0.016	8.171	0.000
52	0.000	1.594	0.000	0.000	2.920	0.000	0.000	1.576	0.000	0.000	3.929	0.000
54	0.000	0.967	0.000	0.000	2.567	0.000	0.000	1.161	0.000	0.000	1.825	0.000
56	0.000	0.872	0.000	0.000	1.542	0.000	0.000	0.674	0.000	0.255	1.588	0.000
58	0.000	0.320	0.000	0.000	0.732	0.000	0.000	0.343	0.000	0.000	1.178	0.000
60	0.000	0.492	0.000	0.000	0.605	0.000	0.000	0.357	0.000	0.000	1.417	0.000
62	0.000	0.565	0.000	0.000	0.407	0.000	0.000	0.181	0.000	0.000	0.322	0.000
64	0.000	0.031	0.000	0.000	0.770	0.000	0.000	0.229	0.000	0.000	0.367	0.000
66	0.000	0.340	0.000	0.000	0.397	0.000	0.000	0.259	0.000	0.000	0.237	0.000
68	0.000	0.000	0.000	0.000	0.172	0.000	0.000	0.109	0.000	0.000	0.187	0.000
70	0.000	0.000	0.000	0.000	0.075	0.000	0.000	0.000	0.000	0.000	0.000	0.000
72	0.000	0.069	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
76	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
78	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	439.777	559.389	0.833	364.033	634.182	1.785	446.533	553.391	0.076	294.640	705.360	0.000
N° Ind.:	6652	6614	9	6569	10111	21	8297	5729	3	4640	7390	0
N° samples:		77			100			116			108	
Range:		12-71			14-71			14-68			13-68	
Total catch:		6966			16678			13388			27453	
Sampled catch:		3037.033			4846.300			4471.710			5200.395	
Total hauls:		84			120			139			136	

TABLE 6 (cont.). American plaice length distribution in NAFO 3NO 1995-2001 in frequency in %. Indet. means indeterminates.

Length (cm.)	1999			2000			2001		
	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
10	0.000	0.266	0.266	0.000	0.000	0.000	0.013	0.052	0.000
12	0.000	1.063	0.356	0.406	0.971	0.026	0.152	0.104	0.000
14	0.000	0.306	0.144	8.335	10.004	0.009	3.311	2.898	0.000
16	0.972	2.227	0.000	43.051	50.519	0.000	4.790	5.898	0.000
18	1.432	3.703	0.000	48.333	70.905	0.009	35.289	24.228	0.000
20	0.479	0.077	0.000	13.825	25.959	0.000	107.969	98.879	0.000
22	1.335	2.254	0.000	3.894	4.693	0.000	104.995	106.383	0.000
24	3.845	1.967	0.000	3.820	2.667	0.000	35.687	54.017	0.000
26	17.692	4.381	0.000	4.724	4.140	0.000	7.448	13.252	0.000
28	47.893	20.538	0.000	9.365	2.236	0.000	8.682	5.650	0.000
30	79.172	38.293	0.000	29.101	7.314	0.000	13.282	5.880	0.000
32	97.359	44.277	0.000	57.163	15.420	0.000	32.584	5.712	0.000
34	72.024	41.532	0.000	52.298	35.973	0.000	39.103	9.467	0.000
36	44.902	53.297	0.000	34.498	43.415	0.000	27.592	18.899	0.000
38	22.950	83.459	0.000	18.274	51.448	0.000	14.016	28.521	0.000
40	10.651	81.267	0.000	9.037	69.679	0.000	5.614	32.884	0.000
42	3.906	78.759	0.000	3.203	74.358	0.000	2.138	36.352	0.000
44	1.411	52.704	0.000	1.394	65.399	0.000	0.230	32.671	0.000
46	0.777	30.815	0.000	0.916	45.201	0.000	0.346	30.047	0.000
48	0.000	19.095	0.000	0.759	27.135	0.000	0.000	15.894	0.000
50	0.064	14.109	0.000	0.135	16.392	0.000	0.243	10.785	0.000
52	0.000	6.487	0.000	0.255	13.382	0.000	0.000	7.400	0.000
54	0.000	4.556	0.000	0.000	6.719	0.000	0.000	5.601	0.000
56	0.000	3.308	0.000	0.000	4.996	0.000	0.043	2.476	0.000
58	0.000	1.400	0.000	0.000	2.591	0.000	0.000	1.171	0.000
60	0.000	0.929	0.000	0.000	2.027	0.000	0.000	0.683	0.000
62	0.000	0.606	0.000	0.000	2.010	0.000	0.000	0.425	0.000
64	0.000	0.501	0.000	0.000	0.932	0.000	0.000	0.052	0.000
66	0.000	0.147	0.000	0.000	0.576	0.000	0.000	0.149	0.000
68	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.000
70	0.000	0.000	0.000	0.000	0.085	0.000	0.000	0.000	0.000
72	0.000	0.000	0.000	0.000	0.027	0.000	0.000	0.000	0.000
74	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
76	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
78	0.000	0.051	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	406.861	592.374	0.765	342.784	657.172	0.044	443.527	556.473	0.000
N° Ind.:	4541	7742	4	3732	7721	5	5730	9505	0
N° samples:		93			96			103	
Range:		10-77			11-72			10-67	
Total catch:		33977			49954			41919	
Sampled catch:		5974.244			5457.327			5593.540	
Total hauls:		117			123			124	

TABLE 7. American plaice length distribution in estimated numbers on NAFO 3NO for the period 1999-2001. Indet. means indeterminates.

Length (cm.)	1999			2000			2001		
	Males	Females	Indet.	Males	Females	Indet.	Males	Females	Indet.
10	0	19	19	46	111	3	2	8	0
12	0	76	25	46	111	3	23	16	0
14	0	22	10	950	1140	1	503	440	0
16	69	159	0	4907	5758	0	727	896	0
18	102	263	0	5509	8082	1	5359	3679	0
20	34	5	0	1576	2959	0	16398	15017	0
22	95	160	0	444	535	0	15946	16157	0
24	274	140	0	436	304	0	5420	8203	0
26	1258	312	0	538	472	0	1131	2013	0
28	3403	1459	0	1068	255	0	1318	858	0
30	5627	2721	0	3317	834	0	2018	893	0
32	6919	3147	0	6515	1757	0	4949	867	0
34	5119	2952	0	5961	4100	0	5938	1438	0
36	3191	3788	0	3932	4949	0	4190	2870	0
38	1631	5932	0	2083	5864	0	2129	4332	0
40	757	5776	0	1030	7942	0	852	4994	0
42	277	5597	0	365	8476	0	325	5521	0
44	100	3746	0	159	7454	0	35	4961	0
46	55	2190	0	104	5152	0	53	4564	0
48	0	1357	0	86	3093	0	0	2414	0
50	5	1003	0	15	1869	0	37	1638	0
52	0	461	0	29	1525	0	0	1124	0
54	0	323	0	0	766	0	0	850	0
56	0	235	0	0	570	0	7	376	0
58	0	99	0	0	295	0	0	178	0
60	0	66	0	0	231	0	0	104	0
62	0	43	0	0	229	0	0	65	0
64	0	35	0	0	106	0	0	8	0
66	0	10	0	0	66	0	0	22	0
68	0	0	0	0	0	0	0	11	0
70	0	0	0	0	10	0	0	0	0
72	0	0	0	0	3	0	0	0	0
74	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0
78	0	4	0	0	0	0	0	0	0
Total	28916	42100	54	39116	75018	8	67360	84517	0
N° Ind.:	4541	7742	4	3732	7721	5	5730	9505	0
N° samples:		93			96			103	
Range:		10-77			11-72			10-67	
Total catch:		33977			49954			41919	
Sampled catch:		5974.244			5457.327			5593.540	
Total hauls:		117			123			124	

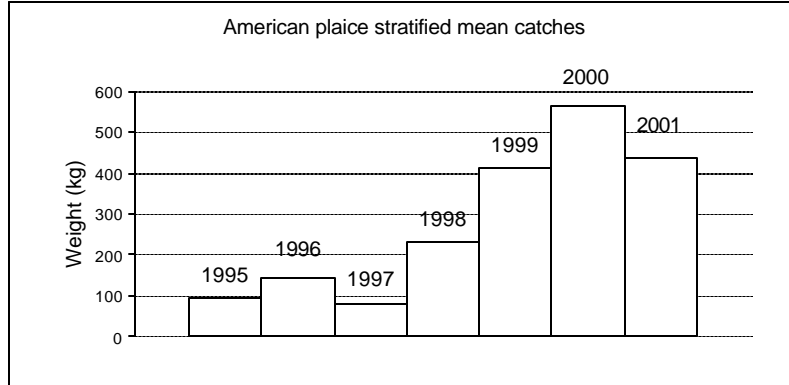


Fig. 1. American plaice stratified mean catches by year. Spanish Spring Surveys on NAFO Div. 3NO: 1995-2001.

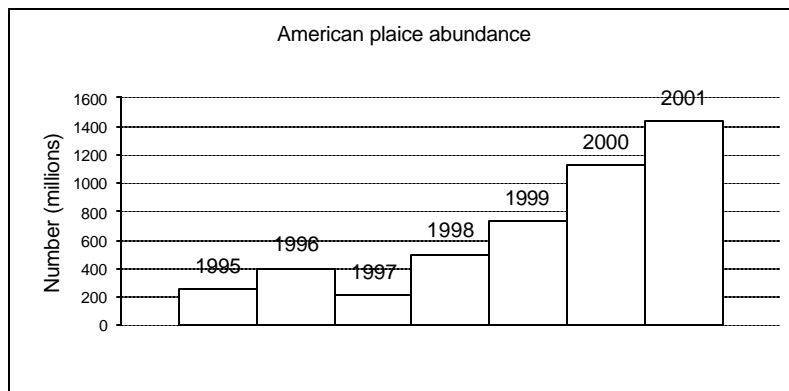


Fig. 2. American plaice abundance by year. Spanish Spring Surveys on NAFO Div. 3NO: 1995-2001.

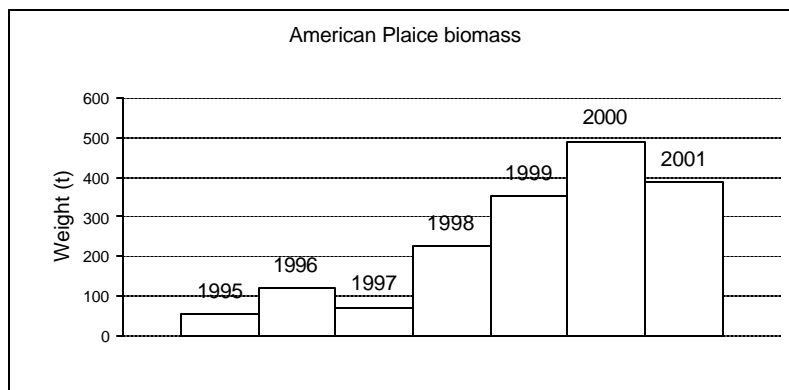


Fig. 3. American plaice biomass by year. Spanish Spring Surveys on NAFO Div. 3NO: 1995-2001.

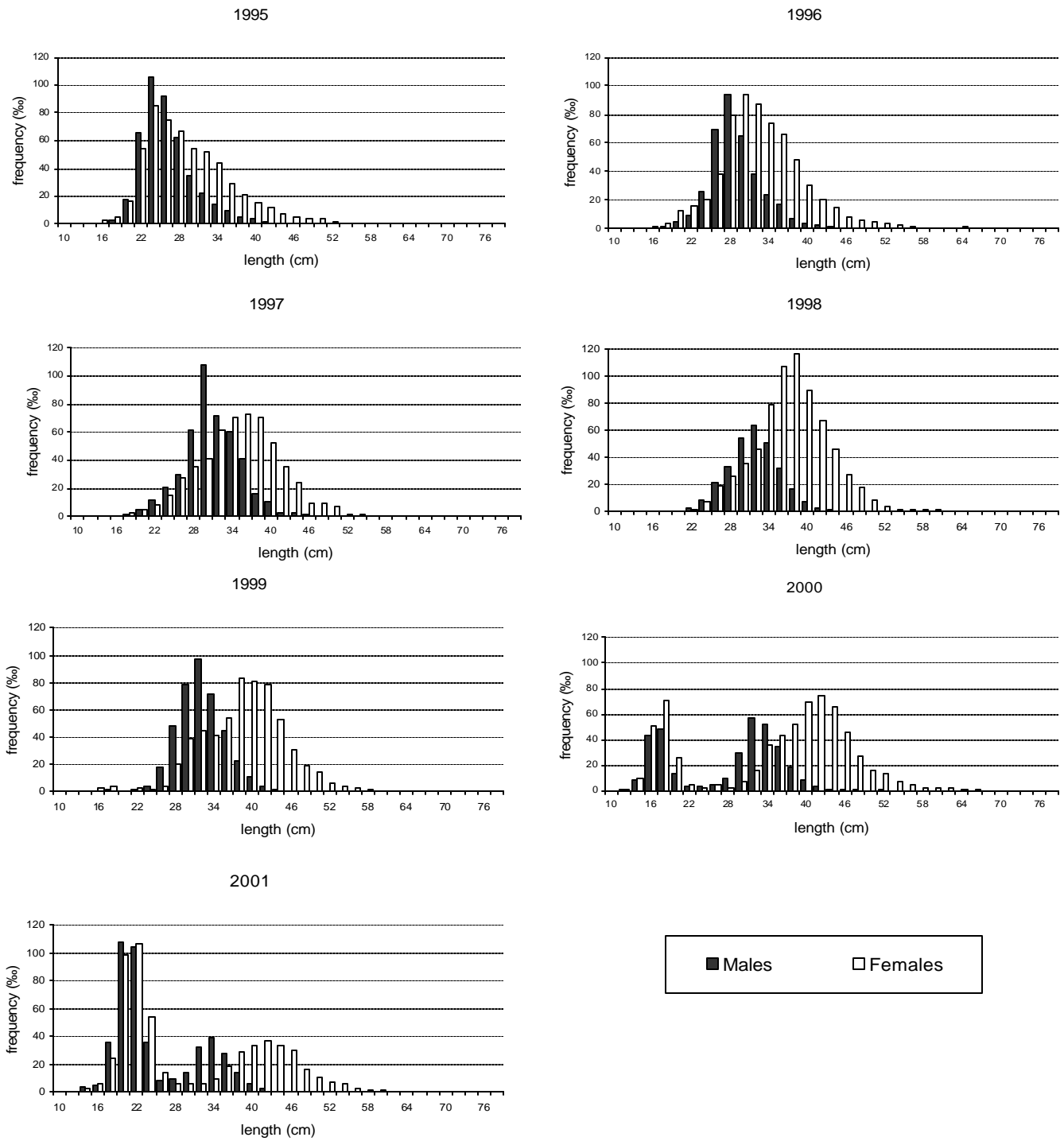


Fig. 4. American plaice length distribution (cm.) on NAFO 3NO: 1995-2001. Frequency in %.

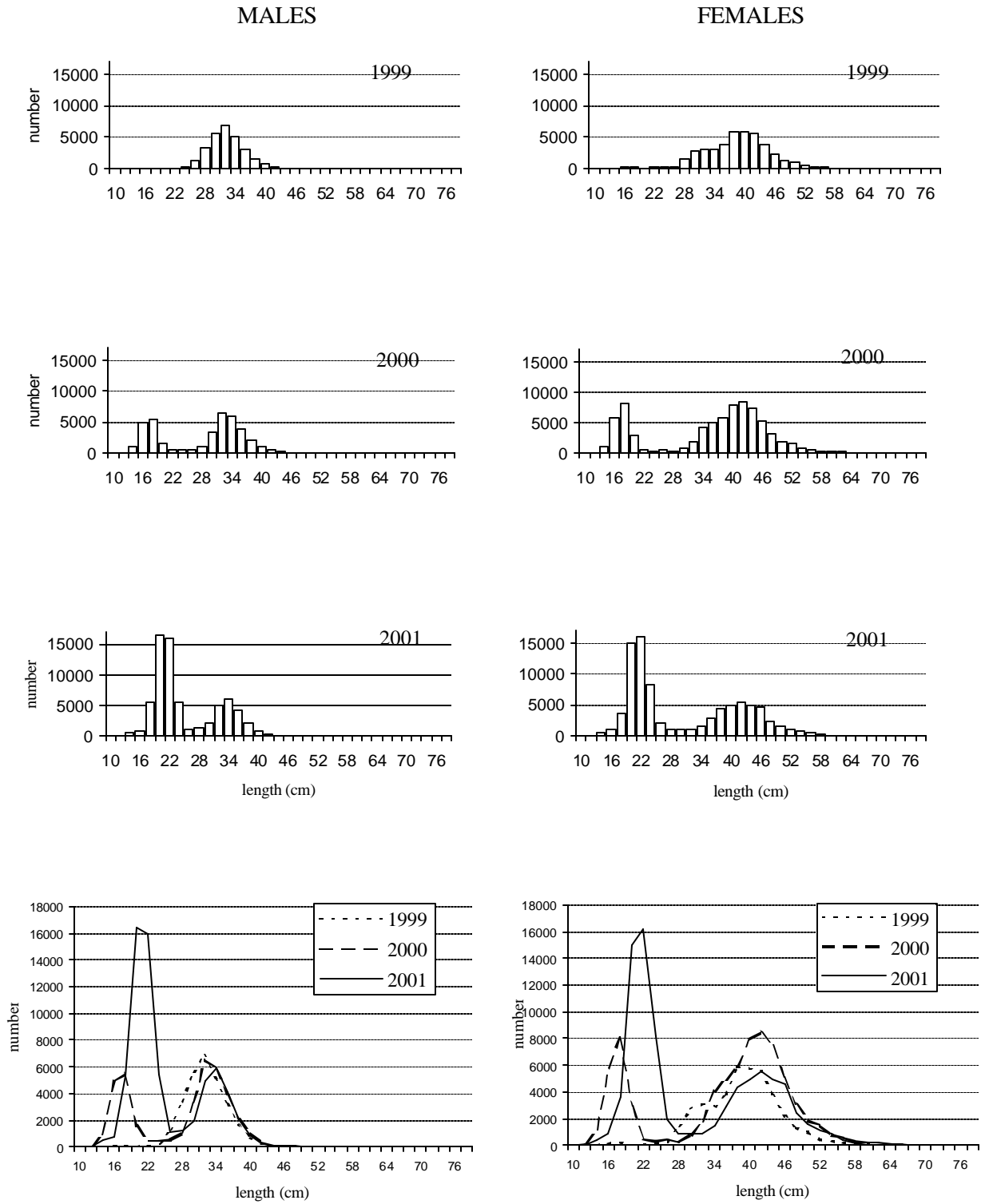


Fig. 5. American plaice length distribution in estimated numbers on NAFO 3NO for the period 1999-2001.