

On the German Fishery and Biological Characteristics of
Oceanic Redfish (*Sebastes mentella* Travin)

1991-2001

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Abstract

The reported German fishing effort in 2001 was only slightly higher than the low effort in 2000, the lowest observed in the last seven years, and amounted to 13 000 trawling hours only, a 26 % decrease as compared with 1999. As observed in previous years, the majority of the 2001 effort was applied during the second and third quarters. During the second quarter in 2001, the hauls were almost exclusively distributed in NEAFC Regulatory Area of ICES Division XIV between the Greenland and Icelandic EEZs. In 2001, there was reduced fishing effort exerted in the NAFO Sub-area 1F mainly within the Greenland EEZ during the third quarter as compared with 2000. The decrease of annual catches continued since 1996 with a catch figure of 10 700 tons in 2001. In 2001, 8 % or 800 tons of the total catch were taken in the NAFO Div. 1 F. During 1995-1999, the overall unstandardised CPUE decreased from 2 055 kg/h by 53 % to 970 kg/h. In 2000 and 2001, the CPUE remained at that low level. Catch rates recorded in NAFO Div. 1F are slightly higher than those achieved in the adjacent ICES Div. XII, especially inside the Greenland EEZ. Given the technical, temporal, geographical and depth changes of the fishing activities the relevance of the estimated reduction in CPUE as indicator of stock abundance remained difficult to assess. However, the continued reduction in CPUEs during 1996-1999 should be interpreted as reaction of the stock to removed biomass.

While the females were almost constantly around 2 cm bigger than males, both sexes displayed higher lengths around 39-42 cm during the second quarters when the fleet was fishing at greater depths. The information of bigger fish comprising the catches taken during the second quarters in 1996-2001 is consistent with the recently observed trend to fish in deeper layers during that period.

In the third quarter in 1999, a clear recruitment signal was recorded for the first time with fish around 28 cm in mean length occurring at all depths. Until the third quarter in 2000, those recruits seem to have grown by 2 cm as indicated from the length distribution. The recruits are believed to originate from the East Greenland shelf areas, where a previously abundant recruiting year class declined recently.

Introduction

The present paper provides information on catches, effort distribution and CPUE of the German fleet fishing for pelagic *Sebastes mentella* Travin. Additionally, temporal changes in fish size were evaluated since 1991. Due to changes in the structure of the official database, the analysis of the commercial data covered the most recent period 1995-2001 only. In 1995-2001, catches taken by the German fleets were investigated extensively within the scope of an EU-funded sampling programme. Biological data were collected directly on board of commercial vessels during several cruises covering all fishing seasons. The motivation for conducting detailed observations of the catch structures arose from the necessity to extend the fragmentary knowledge about the ecology and productivity of this redfish population in respect to its recently decreased abundance (Anon., 2001).

Material and Methods

For the period 1995-2001, data on commercial catches, effort (hauls and hours fished) and positions were derived from official logbook statistics. The data were aggregated by quarter, year, ICES and NAFO Divisions as well as the Regulatory Areas of NEAFC and NAFO and the Greenland Exclusive Economic Zone. Unstandardised mean CPUE (kg/h) and accompanied standard deviations were calculated on a haul-by-haul basis. The majority of vessels were equipped with Gloria-type pelagic trawls with a vertical net opening of 120 m and a mesh size of 100-140 mm in the cod end. Towing speed varied between 2.8 and 3.8 knots. The logbook data are not confirmed by scientific or official observers.

Scientists or technicians conducted the biological data collection directly on board of commercial vessels during cruises in 1991-2001. In addition to recordings of dates, position, depth of trawling, towing time, and catch weight, biological data were derived from sub-samples of the catches. The data collection covered the size composition of the catches by sex and sex ratio, maturity and parasitic infestation. Fish size was measured with a precision of cm below. Maturity stages were noted according to the agreed description given by the ICES Study Group on Redfish Stocks (Anon., 1993). Specimens showing any external parasites, their remnants or abnormal pigmentation on their skin were noted as infested. Catch per unit effort (CPUE) was calculated on a haul-by-haul basis. According to the handling of logbook data, the results of the direct observations were derived from quarterly aggregated data sets.

Results and Discussion

Table 1 lists a quarterly breakdown of hauls and effort in fishing hours of the German fleet directed at oceanic redfish in 1995-2001. Compared with 1995, the German effort increased significantly from 14 200 hours trawling by 30 % to 18 500 and 18 600 hours in 1996 and 1997, respectively. In 1998, the total effort decreased again by 15 % to 15 800 hours and increased in 1999 by 12 % to 17 700 hours. The reported effort in 2000 is the lowest observed in the last seven years and amounted to 12 800 hours only (28 % decrease). This lowest effort was only slightly exceeded in 2001 with 13 000 trawling hours (2 % increase).

As observed in previous years, the great majority of the 2001 effort was applied during the second and third quarters. There was no effort in the first quarter and only 4 % of the total trawling hours were conducted during the fourth quarter in 2001. The geographic effort distributions by quarter in 1995-2000 and 2001 are illustrated in Figures 1a-2d, respectively. Tables 2, 3 and 4 list a breakdown of hauls and effort in trawling hours by year, quarter for ICES Divisions XII and XIV and NAFO Division 1F in the NEAFC and NAFO Regulatory Areas as well as the Greenland EEZ. The effort is illustrated as histograms in Figure 3. The geographical distribution indicated that fishing activities are concentrated on fish aggregations instead of a random strategy. During the first and second quarters in 1995-2001, the hauls were almost exclusively distributed in NEAFC Regulatory Area of ICES Division XIV between the Greenland and Icelandic EEZs. The third and fourth quarters in 1995-2001 were characterised by a more widespread effort distribution in southern and western directions occupying mainly the Greenland EEZ in ICES Division XII. For the first time, significant fishing effort was exerted in the NAFO Sub-area 1F both within the Greenland EEZ and the NAFO Regulatory Area during the third and fourth quarters in 2000, but the effort in 2001 was distributed more easterly mainly in ICES Division XII inside the Greenland EEZ (Fig. 2c-d).

Quarterly disaggregated catch figures for 1995-2001 are listed in Tables 1-4 and illustrated in Figure 4. Annual catches increased from 18 900 tons by 13 % to 21 300 tons in 1996 and decreased slightly by 4 % to 20 400 tons

in 1997. A continued decrease by 12 % to 18 000 tons in 1998 and by 9 % to 16 500 tons in 1999 was reported. This decrease continued by 24 % with a catch figure of 12 500 tons in 2000 and amounted only to 10 700 tons in 2001, the lowest catch record since 1995. According to the seasonal effort distribution, 73-96 % of the catches were taken during the second and third quarters in 1995-2001. In 2000, 36 % or 4 500 tons of the total catch were taken in the NAFO Div. 1 F. In 2001, the reported catch taken in NAFO Div. 1F amounted only to 817 tons or 8 % of total catch.

During 1995-1999, the overall unstandardised CPUE decreased from 2 055 kg/h by 53 % to 970 kg/h, respective values being listed in Tables 1-4 and illustrated in Figure 5. In 2000 and 2001, the CPUE was calculated to remain at that low level and amount to 1 050 and 910 kg/h, respectively. In general, the mean CPUE values were accompanied by very high standard deviations indicating high variations in individual catch figures resulting from a patchy fish distribution on a small scale. The quarterly breakdown revealed that the catch rates in ICES Div. XIV in the second quarter remained fairly stable while the reductions mainly occurred in the third and fourth quarter in ICES Div. XII both inside the Greenland EEZ and the international water. Catch rates recorded in NAFO Div. 1F were slightly higher than those achieved in the adjacent ICES Div. XII, especially inside the Greenland EEZ. Given the technical, temporal, geographical and depth changes of the fishing activities the relevance of the estimated reduction in CPUE as indicator of stock abundance remained difficult to assess. However, the continued reduction in CPUEs during 1996-1999 should be interpreted as reaction of the stock to removed biomass.

Since 1991, station and biological data were recorded by scientific observations. Tables 5 and 6 list the sample effort, depth of hauls, towing duration, mean CPUE, mean length by sex, and sex ratio of the catches by year and quarter. Since 1995, the mean depth of catches displayed a significant seasonal pattern. The mean depth of the catches exceeded regularly 500 m during the second quarters. During summer and fall, the fishery targeted the depth layer at 200-350 m (Fig. 6). A decrease in depth variation by season over time is evident.

The commercial fishery displayed a clear trend to increase the trawl duration. The mean trawl duration increased from 7 hours in 1991 to about 15 hours in 1998-2001 (Fig. 7). There was recently no clear trend in the CPUE series as derived from the observer programme (Fig. 8).

The calculated mean length by sex and sampling effort since 1991 is listed in Table 6 and illustrated in Figure 9. The results indicate a dominant seasonal effect. While the females were almost constantly around 2 cm bigger than males, both sexes displayed higher lengths around 39-42 cm during the second quarters when the fleet was fishing at greater depths compared with the smaller fish length around 35 cm at shallow depths. The information of bigger fish comprising the catches taken during the second quarters in 1996-2001 is consistent with the recently observed trend to fish in deeper layers during that period.

The sex ratio by year and quarter is also listed in Table 6 and illustrated in Figure 10. Almost equal shares between sexes were determined during the first and second quarters, which are characterized by deep fishing below 500 m. In contrast, the shallower hauls during the third and fourth quarters in 1995-2001 were dominated by males (54-69 %). The same information can be drawn from Figures 11-13, which show the size and sexual composition of the catches by year and quarter. The third and fourth quarters show almost identical single-modal size distributions with smaller and dominating males until 1998. In the third quarter in 1999, a clear recruitment signal was recorded for the first time with fish around 28 cm in mean length occurring at all depths. Until the third quarter in 2000, those recruits seem to have grown by 2 cm as indicated from the length distribution. The recruits are believed to originate from the East Greenland shelf areas, where a previously abundant recruiting year class declined recently (Stransky, 2000). The fish caught during the second quarters in 1996-2000 at higher depths were bigger and displayed bimodal size compositions like demonstrated by Sigurðsson and Reynisson (1998) for Icelandic catches from the same area, season and depth. In the German catches the two modes were due to the different sizes of both sexes and seem to be generated due to dominating year classes. Preliminary results of morphometric and genetic analyses supporting the hypothesis of two different redfish stocks as suggested by the Icelandic colleagues should therefore carefully checked against sexual dimorphism and year class effects, especially since the observed size differences at different depths confirm the ecological deeper-bigger phenomenon described for numerous fish stocks.

References

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Table 1 Catch, effort (hauls and hours), unstandardized mean CPUE and accompanied standard deviations by year and quarter of the German fleet, 1995-2001.

Year	Quarter	Catch (t)	Hauls	Effort (h)	CPUE (kg/h)	Std.Dev. (kg/h)
1995	1	1072	77	817	1392	1006
1995	2	10333	472	5782	2552	2615
1995	3	4981	349	4637	2292	5328
1995	4	2513	222	3011	855	547
1995		18900	1120	14247	2055	3506
1996	1	533	86	1444	434	566
1996	2	9604	491	8591	1253	1055
1996	3	9051	504	5971	1969	2891
1996	4	2111	168	2449	1006	741
1996		21299	1249	18455	1452	2032
1997	1	91	8	116	825	603
1997	2	6153	378	7286	877	585
1997	3	9853	570	7921	1468	1220
1997	4	4344	245	3254	1626	1672
1997		20446	1201	18578	1310	1216
1998	1	4	15	209	19	15
1998	2	5889	339	6510	938	733
1998	3	9578	453	6769	1629	1550
1998	4	2575	142	2352	1251	1127
1998		18046	949	15839	1301	1285
1999	1	0	0	0		
1999	2	8472	463	8051	1072	611
1999	3	6823	455	7830	924	709
1999	4	1192	95	1817	673	376
1999		16487	1013	17698	968	651
2000	1	0	0	0		
2000	2	6728	523	6984	987	607
2000	3	5284	367	5224	1150	792
2000	4	486	41	579	871	356
2000		12498	931	12787	1050	688
2001	1	0	0	0		
2001	2	5155	390	6944	786	492
2001	3	5121	364	5594	1045	912
2001	4	391	33	488	924	694
2001		10667	787	13026	912	735

Table 2 Catch, effort (hauls and hours), unstandardized mean CPUE and accompanied standard deviations by year, quarter and area of the German fleet for NEAFC Regulatory Area (NRA) and the Greenlandic Exclusive Economic Zone (EEZ) in ICES Div. XII, 1995-2001.

Year	Quarter	Catch (t) NRA	Hauls NRA	Effort (h) NRA	CPUE (kg/h) NRA	Std.Dev. (kg/h) NRA	Catch (t) EEZ	Hauls EEZ	Effort (h) EEZ	CPUE (kg/h) EEZ	Std.Dev. (kg/h) EEZ
1995	1	0	0	0			0	0	0		
1995	2	7182	304	3769	2713	2690	278	17	218	1205	608
1995	3	387	25	357	1109	723	1825	122	1516	4551	8411
1995	4	0	0	0			133	0	0		
1995		7569	329	4126	2592	2628	2103	139	1734	4142	7959
1996	1	0	2	14	0	0	0	0	0		
1996	2	0	6	33	0	0	0	0	0		
1996	3	0	0	0			4419	215	2348	2227	2468
1996	4	0	0	0			0	0	0		
1996		0	8	47	0	0	4419	215	2348	2227	2468
1997	1	0	0	0			0	0	0		
1997	2	0	2	5	0	0	0	0	0		
1997	3	0	0	0			4824	251	3100	1842	1465
1997	4	47	4	69	625	288	3995	219	2873	1692	1712
1997		47	6	74	417	377	8819	470	5973	1772	1587
1998	1	0	0	0			0	0	0		
1998	2	0	3	37	0	0	0	0	0		
1998	3	0	0	0			7371	320	4469	1886	1717
1998	4	0	0	0			2375	127	2061	1323	1169
1998		0	3	37	0	0	9746	447	6529	1726	1600
1999	1	0	0	0			0	0	0		
1999	2	468	32	485	953	635	113	6	109	1051	273
1999	3	196	17	234	784	407	6235	407	7108	920	674
1999	4	284	28	470	625	402	909	67	1346	692	367
1999		948	77	1189	796	527	7257	480	8563	889	641
2000	1	0	0	0			0	0	0		
2000	2	0	1	2	0.5		42	7	90	441	242
2000	3	401	25	370	1169	553	682	61	964	758	314
2000	4	0	0	0			3	1	5	619	
2000		401	26	372	1116	595	727	69	1059	724	318
2001	1	0	0	0			0	0	0		
2001	2	0	2	13	0	0	0	1	3	123	
2001	3	223	20	322	696	305	3272	223	3495	1052	757
2001	4	59	6	87	744	432	323	26	395	949	750
2001		282	28	421	657	360	3594	250	3893	1038	756

Table 3 Catch, effort (hauls and hours), unstandardized mean CPUE and accompanied standard deviations by year, quarter and area of the German fleet for NEAFC Regulatory Area (NRA) and the Greenlandic Exclusive Economic Zone (EEZ) in ICES Div. XIV, 1995-2001.

Year	Quarter	Catch (t) NRA	Hauls NRA	Effort (h) NRA	CPUE (kg/h) NRA	Std.Dev. (kg/h) NRA	Catch (t) EEZ	Hauls EEZ	Effort (h) EEZ	CPUE (kg/h) EEZ	Std.Dev. (kg/h) EEZ
1995	1	1073	77	817	1392	1006	0	0	0		
1995	2	2873	151	1795	2377	2544	0	0	0		
1995	3	1832	116	1705	1210	1542	936	86	1060	893	538
1995	4	2513	222	3011	855	547	0	0	0		
1995		8291	566	7328	1407	1687	936	86	1060	893	538
1996	1	533	84	1430	444	558	0	0	0		
1996	2	9604	485	8558	1268	1052	0	0	0		
1996	3	435	25	421	1221	1201	4196	265	3202	1830	3277
1996	4	2103	169	2447	988	707	8	1	2	3988	
1996		12675	763	12857	1114	983	4204	266	3204	1838	3274
1997	1	91	12	116	825	603	0	0	0		
1997	2	6153	458	7265	886	581	0	2	16	0	0
1997	3	1752	112	1754	1140	912	3283	236	3068	1189	865
1997	4	0	0	0			302	22	313	1151	1220
1997		7996	582	9135	935	667	3585	260	3397	1176	905
1998	1	0	0	0			4	15	209	19	15
1998	2	5889	335	6469	949	730	0	1	4	0	
1998	3	1089	71	1371	833	526	1119	62	929	1217	898
1998	4	0	0	0			199	15	291	707	349
1998		6978	406	7840	929	705	1322	93	1432	929	873
1999	1	0	0	0			0	0	0		
1999	2	7891	424	7443	1084	611	0	1	15	6	
1999	3	21	4	72	1467	2479	216	16	185	1239	1114
1999	4	0	0	0			0	0	0		
1999		7912	428	7515	1087	643	216	17	200	1167	1120
2000	1	0	0	0			0	0	0		
2000	2	6683	512	6868	1003	604	3	3	24	128	181
2000	3	209	19	346	631	207	0	0	0		
2000	4	0	0	0			0	0	0		
2000		6893	531	7214	987	597	3	3	24	128	181
2001	1	0	0	0			0	0	0		
2001	2	5154	387	6928	792	490	0	0	0		
2001	3	133	13	202	727	588	677	59	886	820	428
2001	4	0	0	0			9	1	7	1367	
2001		5287	400	7130	790	493	686	60	893	829	430

Table 4 Catch, effort (hauls and hours), unstandardized mean CPUE and accompanied standard deviations by year, quarter and area of the German fleet for NAFO Regulatory Area (NRA) and the Greenlandic Exclusive Economic Zone (EEZ) in NAFO Sub-area 1F, 1999-2001.

Year	Quarter	Catch (t) NRA	Hauls NRA	Effort (h) NRA	CPUE (kg/h) NRA	Std.Dev. (kg/h) NRA	Catch (t) EEZ	Hauls EEZ	Effort (h) EEZ	CPUE (kg/h) EEZ	Std.Dev. (kg/h) EEZ
1999	1	0	0	0			0	0	0		
1999	2	0	0	0			0	0	0		
1999	3	0	0	0			154	11	231	663	226
1999	4	0	0	0			0	0	0		
1999		0	0	0			154	11	231	663	226
2000	1	0	0	0			0	0	0		
2000	2	0	0	0			0	0	0		
2000	3	2558	158	2219	1231	571	1434	104	1325	1360	1156
2000	4	438	34	506	909	374	46	6	69	716	214
2000		2995	192	2725	1171	554	1480	110	1393	1324	1134
2001	1	0	0	0			0	0	0		
2001	2	0	0	0			0	0	0		
2001	3	26	2	36	752	147	791	47	654	1540	1744
2001	4	0	0	0			0	0	0		
2001		26	2	36	752	147	791	47	654	1540	1744

Table 5 Mean depth, mean towing duration, mean CPUE and accompanied standard deviations by year and quarter as derived from an observer programme, 1991-2001.

Year	Quarter	Hauls	Depth (m)	Std.Dev. (m)	Towing dur.(h)	Std.Dev. (h)	CPUE (kg/h)	Std.Dev. (kg/h)
1991	2	14	395	68	6.64	2.38	2219	1791
1993	3	12	431	144	6.58	3.09	678	687
1994	1	12	504	34	10.12	1.94	1356	502
1995	2	52	501	200	9.32	3.38	1737	863
1995	3	26	287	56	14.83	4.58	1331	688
1995	4	30	260	22	11.75	2.58	1386	805
1996	1	16	458	92	11.62	4.63	1255	2485
1996	2	71	680	100	13.60	5.25	1131	604
1996	3	43	357	193	13.60	3.82	1308	818
1996	4	12	255	13	11.28	1.68	1257	596
1997	2	17	693	107	15.06	5.34	797	384
1997	3	17	245	47	12.99	4.27	2824	1018
1997	4	4	300	0	11.42	6.28	2148	900
1998	2	32	672	39	12.44	5.53	1421	910
1998	3	19	301	19	14.29	3.57	1679	624
1998	4	24	282	20	18.31	6.33	1006	365
1999	2	30	686	63	15.60	4.52	1326	916
1999	3	12	260	16	16.41	5.81	912	329
2000	2	38	700	50	14.94	5.44	933	515
2000	3	19	266	83	16.07	5.21	1411	575
2001	2	50	681	40	17.14	5.73	707	321
2001	3	31	306	33	14.28	4.04	1411	717

Table 6 Mean length by sex and total and sex ratio by year and quarter as derived from an observer programme, 1991-2001.

Year	Quarter	Hauls	Length (cm)	Length of Males (cm)	Length of Females (cm)	Proportion Males	Proportion Females
1991	2	14	34.78	33.92	36.07	0.60	0.40
1993	3	12	35.61	35.16	36.55	0.68	0.32
1994	1	12	36.11				
1995	2	52	36.39	35.66	37.24	0.54	0.46
1995	3	26	35.17	34.76	36.12	0.69	0.31
1995	4	30	35.59	35.07	36.61	0.66	0.34
1996	1	16	36.39	35.70	37.07	0.49	0.51
1996	2	71	40.02	40.19	39.85	0.48	0.52
1996	3	43	37.45	36.68	38.55	0.59	0.41
1996	4	12	36.40	35.84	37.55	0.67	0.33
1997	2	17	39.18	39.19	39.18	0.45	0.55
1997	3	17	35.49	34.95	36.52	0.66	0.34
1998	2	32	41.60	41.08	41.90	0.37	0.63
1998	3	19	34.91	34.59	35.61	0.69	0.31
1998	4	24	34.86	34.43	35.65	0.65	0.35
1999	2	30	40.70	39.95	41.34	0.46	0.54
1999	3	9	34.21	34.68	33.18	0.68	0.32
2000	2	38	40.56	39.98	40.91	0.38	0.62
2000	3	19	35.30	34.91	35.77	0.54	0.46
2001	2	50	39.61	39.54	39.66	0.45	0.55
2001	3	31	35.07	34.90	35.36	0.62	0.38

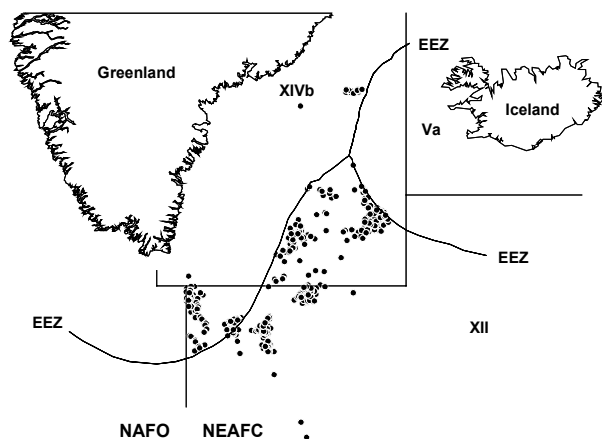


Fig. 1a German fleet's effort distribution, 1st quarters 1995-2000.

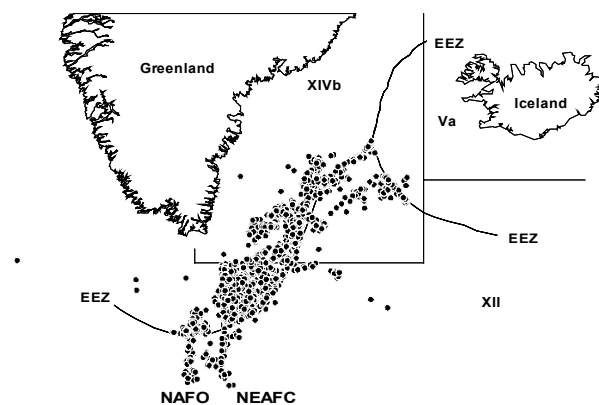


Fig. 1c German fleet's effort distribution, 3rd quarters 1995-2000.

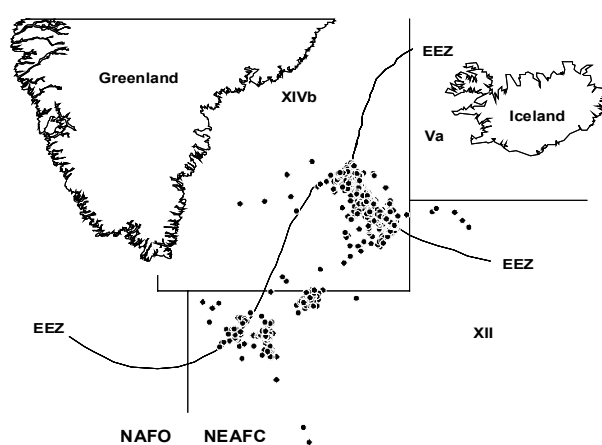


Fig. 1b German fleet's effort distribution, 2nd quarters 1995-2000.

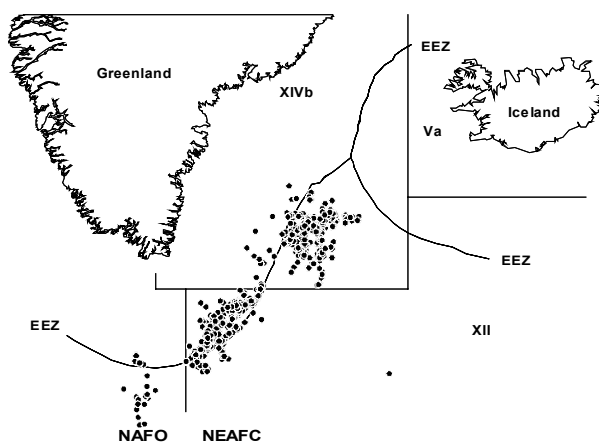


Fig. 1d German fleet's effort distribution, 4th quarters 1995-2000.

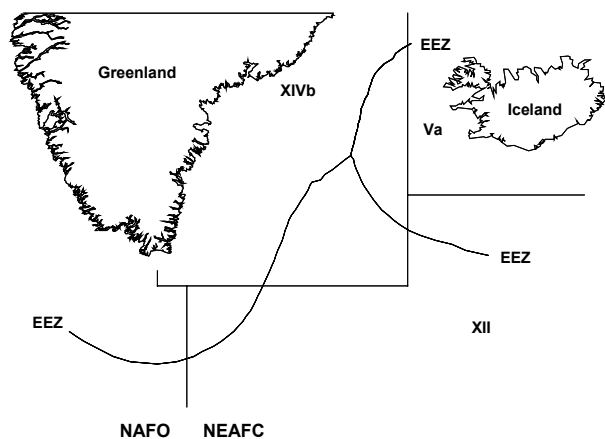


Fig. 2a German fleet's effort distribution, 1st quarter 2001.

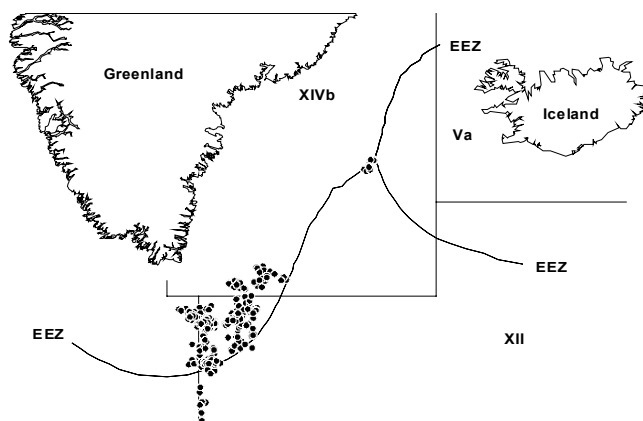


Fig. 2c German fleet's effort distribution, 3rd quarter 2001.

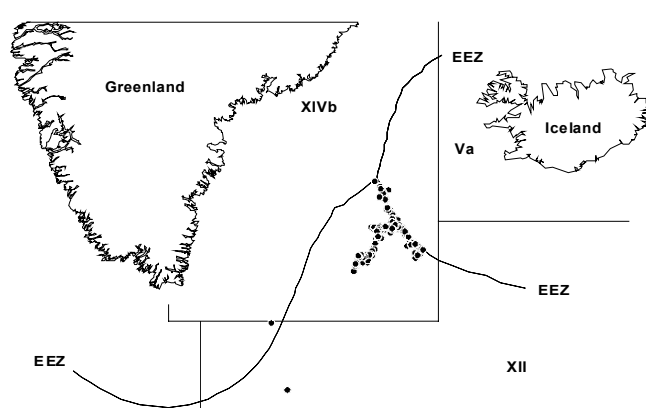


Fig. 2b German fleet's effort distribution, 2nd quarter 2001.

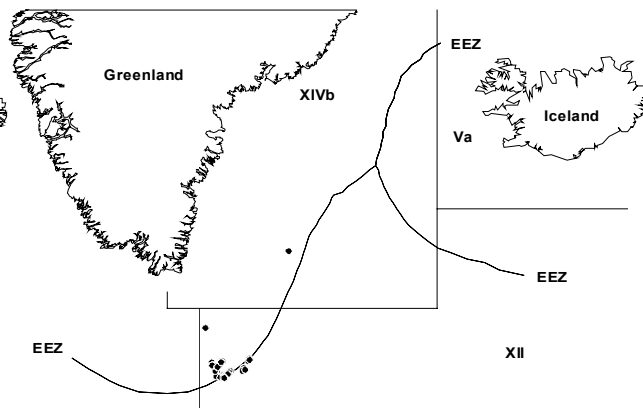


Fig. 2d German fleet's effort distribution, 4th quarter 2001.

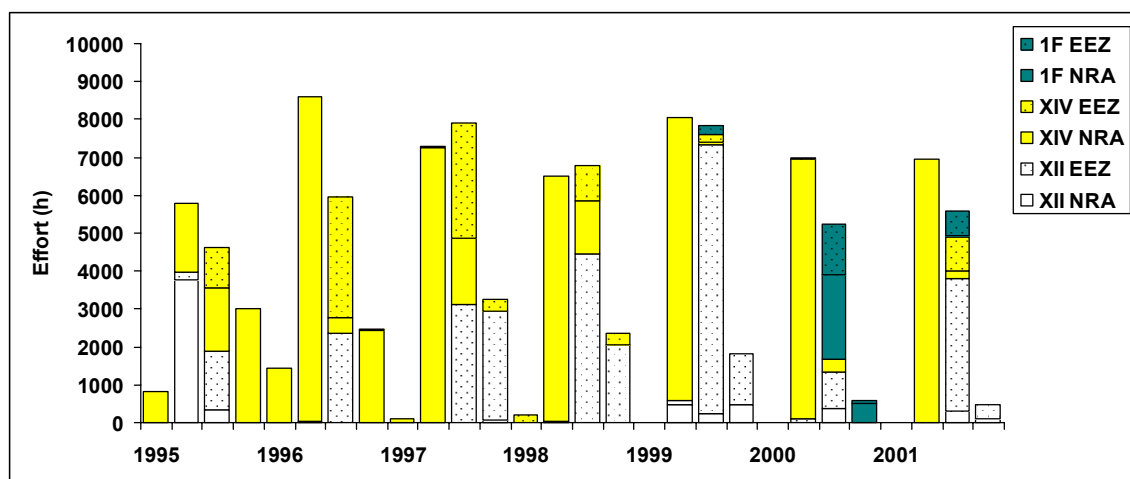


Fig.

3 Effort (hours fished) of the German fleet directed towards oceanic *S. mentella* by year, quarter and area (NEAFC and NAFO NRA and Greenland EEZ in ICES Div. XII and XIV, NAFO Div.1F), 1995-2001, respective values are listed in Tables 2, 3 and 4.

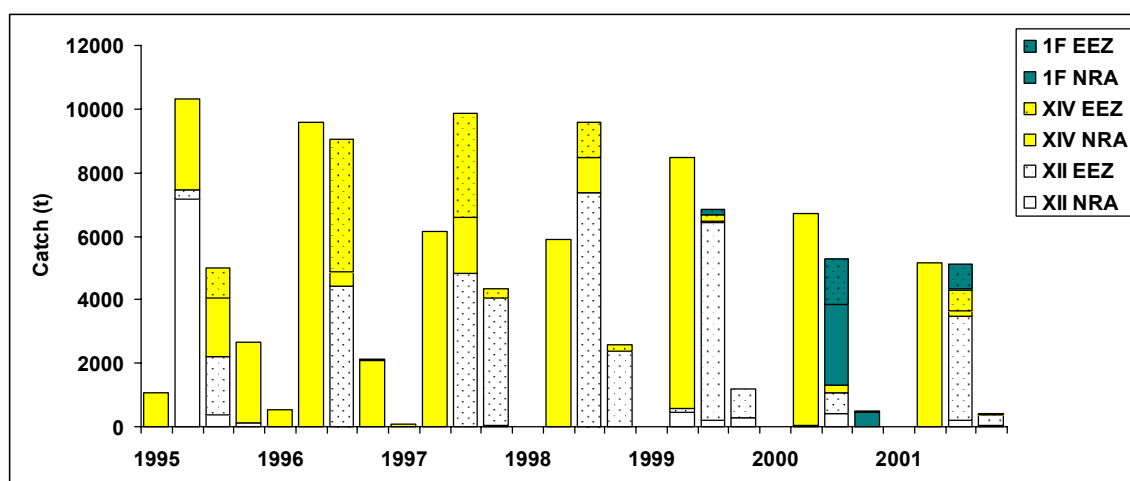


Fig. 4 German catch of oceanic *S. mentella* by year, quarter and area (NEAFC and NAFO NRA and Greenland EEZ in ICES Div. XII and XIV, NAFO Div.1F), 1995-2001, respective values are listed in Tables 2, 3 and 4.

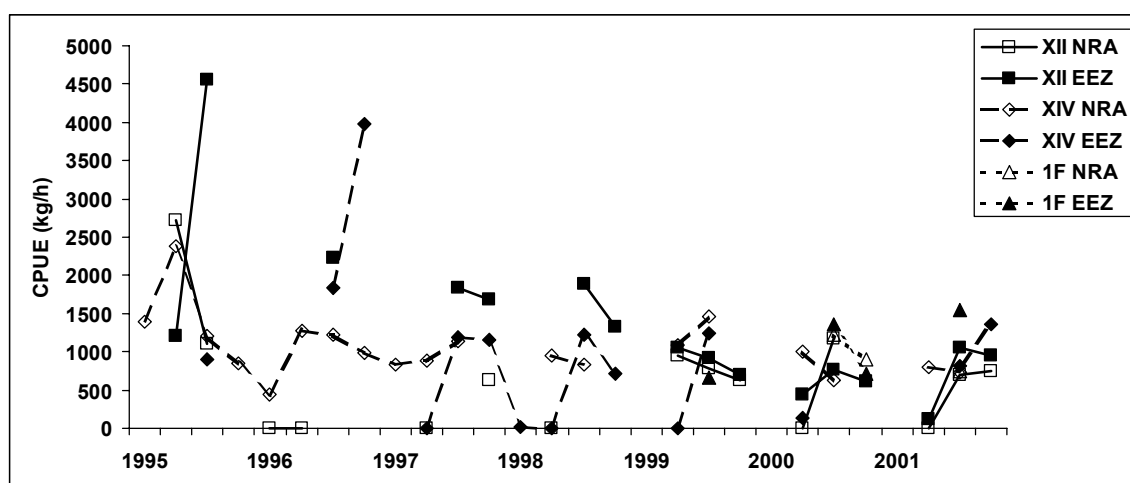


Fig. 5 Unstandardized mean CPUE (kg/h) of the German fleet for oceanic *S. mentella* by year, quarter and area (NEAFC and NAFO NRA and Greenland EEZ in ICES Div. XII and XIV, NAFO Div.1F), 1995-2001, respective values are listed in Tables 2, 3 and 4.

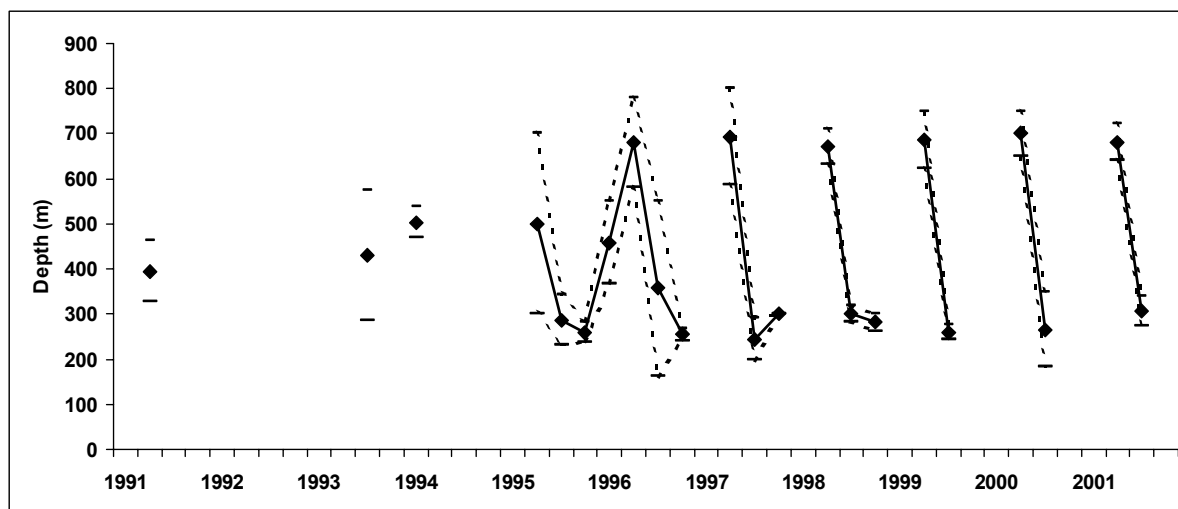


Fig. 6 Mean depth \pm standard deviation by year and quarter of hauls targeted at oceanic *S. mentella*, respective values derived from an observer programme (Table 5).

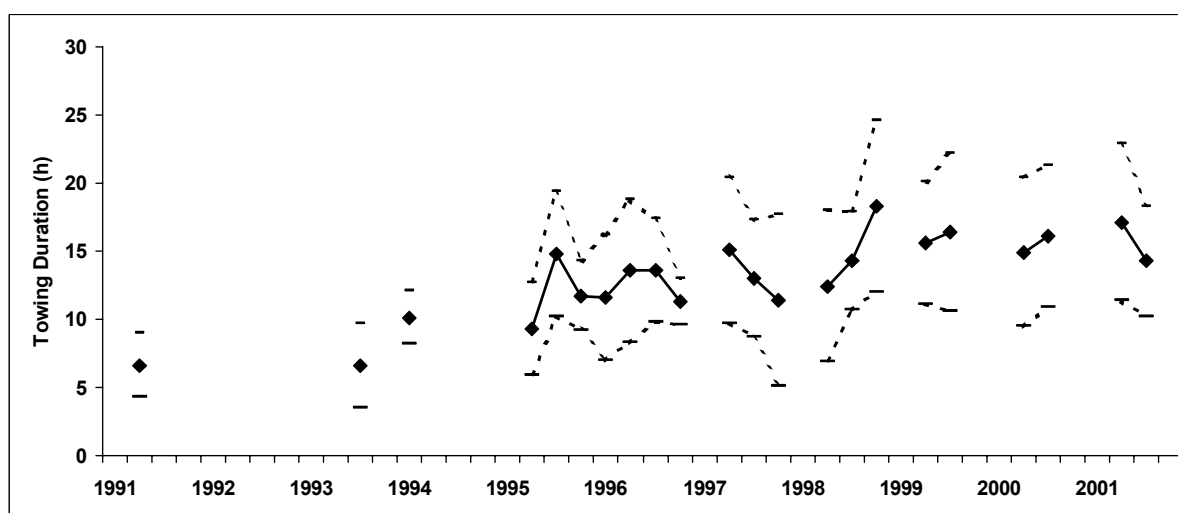


Fig. 7 Mean tows duration (h) \pm standard deviation by year and quarter of hauls targeted at oceanic redfish, respective values derived from an observer programme (Table 5).

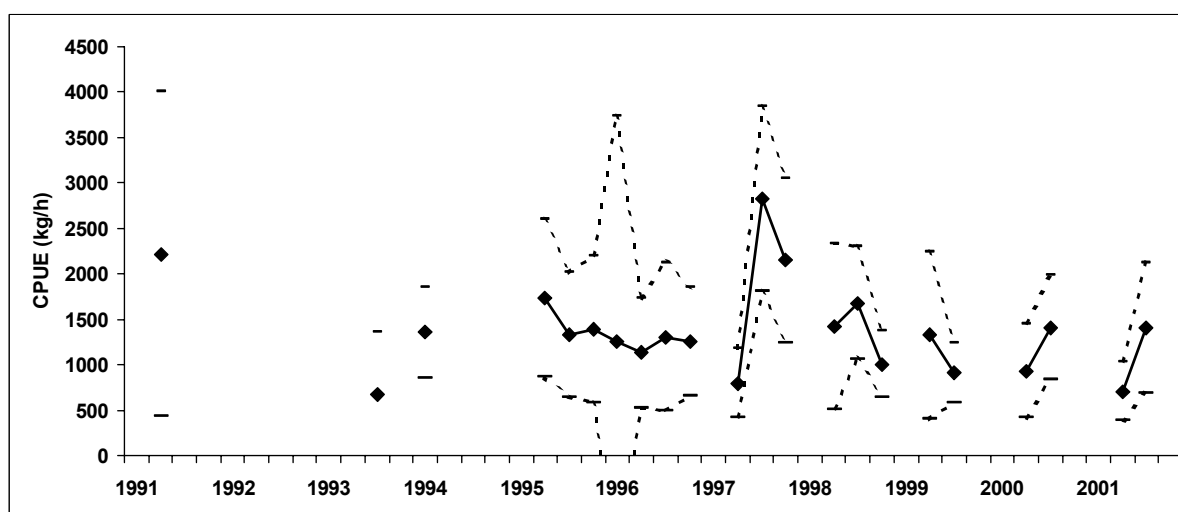


Fig. 8 Mean CPUE (kg/h) \pm standard deviation by year and quarter of hauls targeted at oceanic redfish, respective values derived from an observer programme (Table 5).

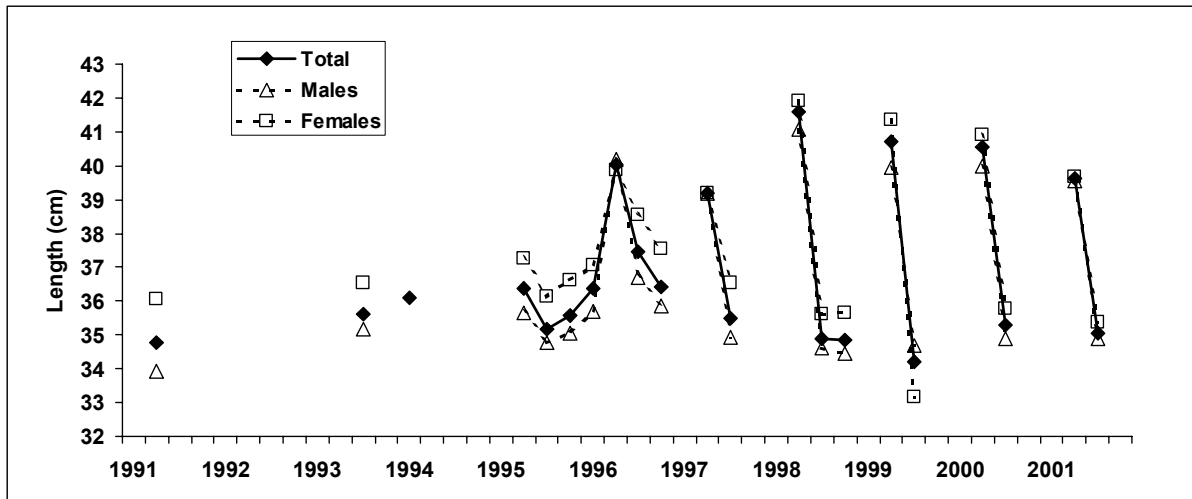


Fig. 9 Mean length (cm) for both sexes and combined to total by year and quarter of hauls targeted at oceanic redfish, respective values derived from an observer programme are listed in Table 6.

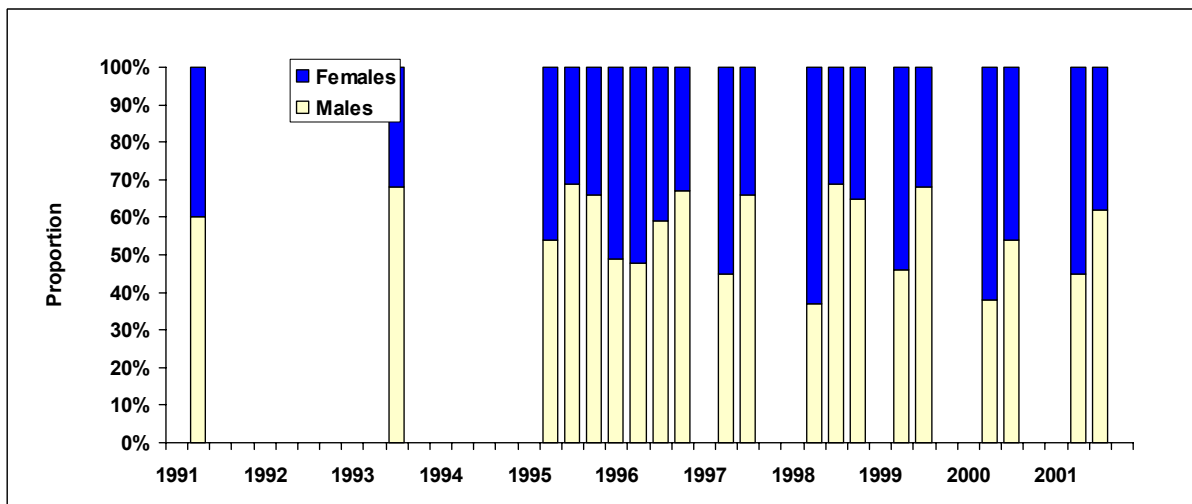


Fig. 10 Proportion males and females by year and quarter of hauls targeted at oceanic redfish, respective values derived from an observer programme are listed in Table 6.

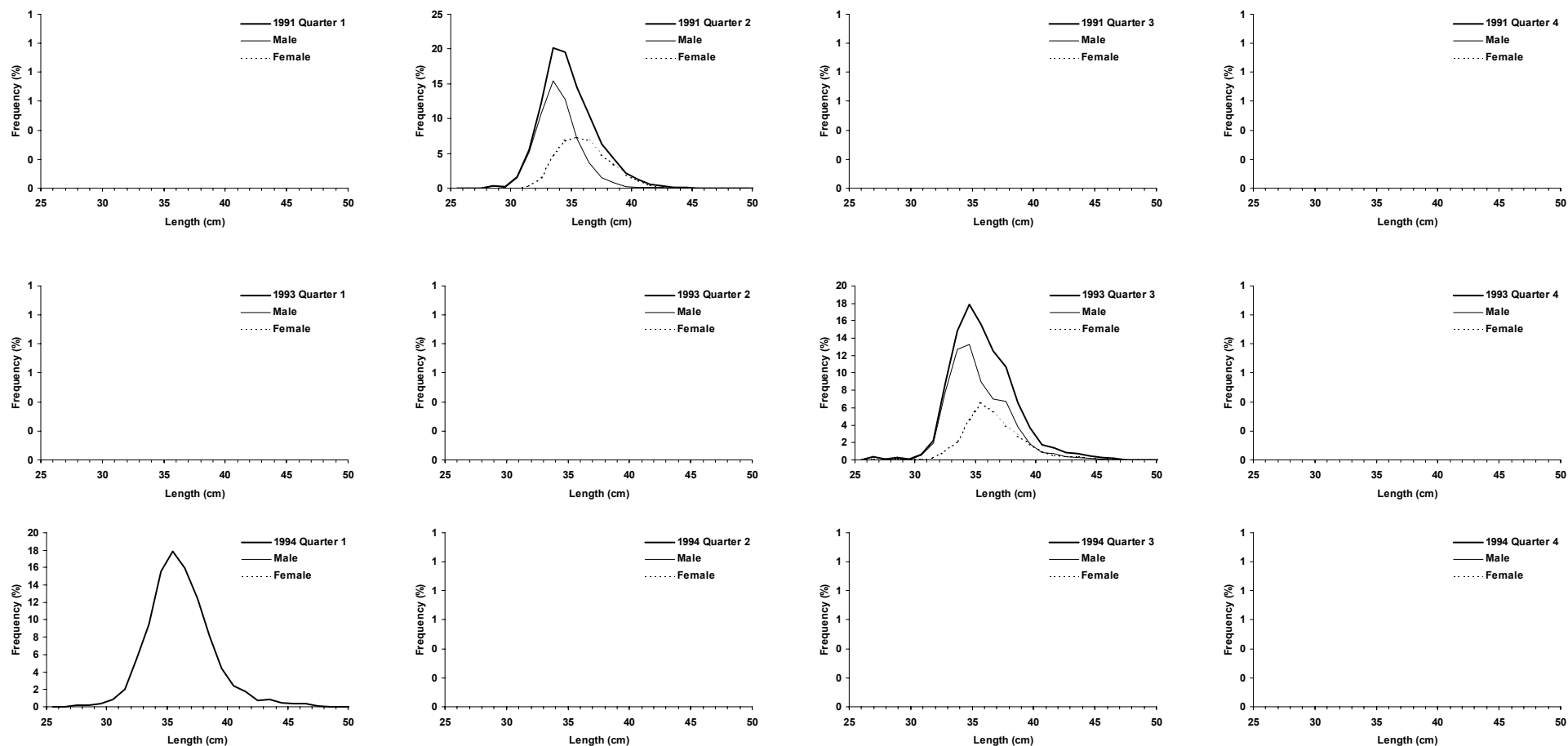


Fig. 11 Length Composition of commercial catches by year, quarter and sex, 1991, 1993 and 1994.

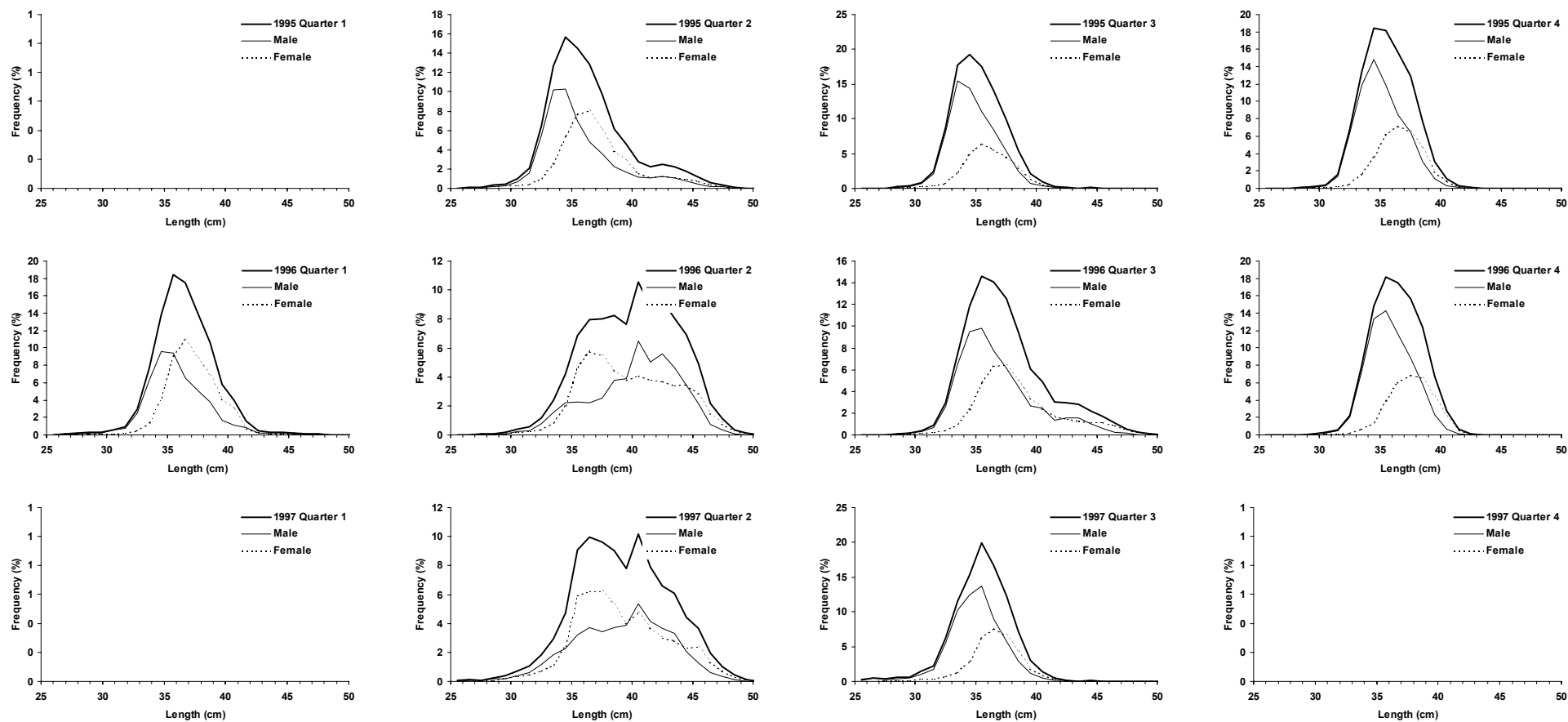


Fig. 12 Length Composition of commercial catches by year, quarter and sex, 1995-97.

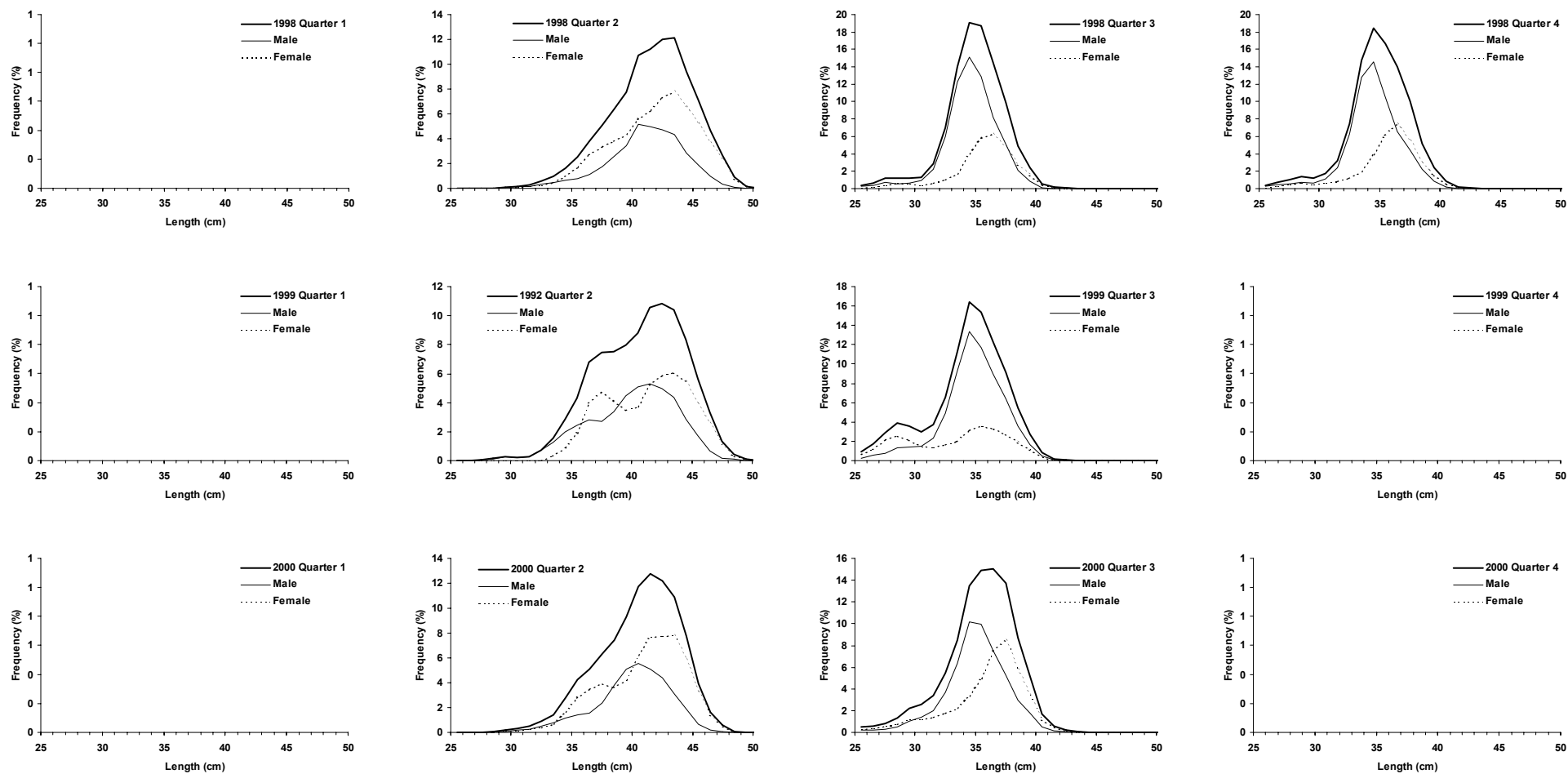


Fig. 13 Length Composition of commercial catches by year, quarter and sex, 1998-2000.

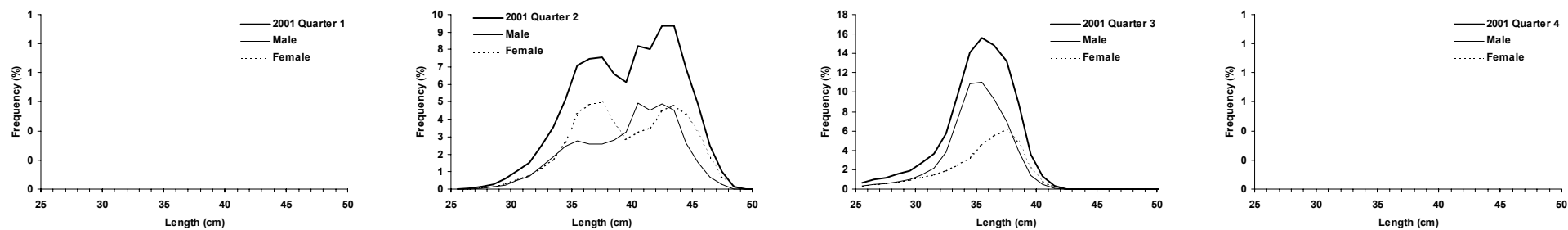


Fig. 14 Length Composition of commercial catches by year, quarter and sex, 2001.