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

1991-2002

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Abstract

The reported effort in 2002 is the lowest observed in the last eight years and amounted to 12 700 hours only. As observed in previous years, the majority of the 2002 effort was applied during the second and third quarters. During the second quarter in 2002, the hauls were almost exclusively distributed in NEAFC Regulatory Area of ICES Division XIV between the Greenland and Icelandic EEZs. In 2002, there was significant fishing effort exerted in the NAFO Sub-area 1F mainly within the NAFO Regulatory Area. The decrease of annual landings discontinued in 2002 with a catch figure of 10 700 tons in 2001. In 2002, 18 % or 2 300 tons of the total landings 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 2000-2002, the CPUE remained at that low level. 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 1996-2002 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 are evaluated since 1991. Due to changes in the structure of the official database, the analysis of the commercial data covered the most recent period 1995-2002 only. In 1995-2002, 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 (ICES C.M., 2002).

Material and Methods

For the period 1995-2002, data on commercial landings, effort (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 1991-2002. 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. Discards were reported to be negligible.

Results and Discussion

Table 1 lists a quarterly breakdown effort in fishing hours of the German fleet directed at oceanic redfish in 1995-2002. 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 by 15 % to 15 800 hours and increased again in 1999 by 12 % to 17 700 hours. Since 2000, the effort decreased to about 13,000 hours annually. The reported effort in 2002 is the lowest observed in the last eight years and amounted to 12 700 hours only (32 % decrease from maximum in 1997).

As observed in previous years, the great majority of the 2002 effort was applied during the second and third quarters. There was almost no effort in the first quarter and only 1 % of the total trawling hours were conducted during the fourth quarter in 2002. The geographic effort distributions by quarter in 1995-2001 and 2002 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 1995-2002, 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 1995-2002 were characterised by a more widespread effort distribution in southern and western directions occupying mainly the Greenland EEZ in ICES Division XII. 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 and 2002 (Fig. 1c-d and 2c).

Quarterly disaggregated landing figures for 1995-2001 are listed in Tables 1-4 and illustrated in Figure 4. Annual landings 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 landing figure of 12 500 tons in 2000 and amounted only to 10 700 tons in 2001, the lowest record since 1995. The landing in 2002 increased by 24 % and amounted to 13 200 tons. According to the seasonal effort distribution, 73-99 % of the landings were taken during the second and third quarters in 1995-2002. In 2000 and 2002, 36 % or 4 500 tons and 18% or 2 300 tons of the total landings were taken in the NAFO Div. 1 F, respectively.

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 2000-2002, the CPUE was calculated to remain at that low level and amount to 1 050, 910 and 1 140 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 18 hours in 2002 (Fig. 7). There was recently no clear trend in the CPUE series as derived from the observer programme which covers only about 5 % of the effort (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 1996-2002 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. Females tend to dominate the shares between sexes 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 1995-2002 were dominated by males (54-69 %). The same information can be drawn from Figures 11-14, which show the size and sexual composition of the landings by year and quarter. The third and fourth quarters show almost identical single-modal size distributions with smaller and dominating males until 1998 and after 1999. 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 1996-2002 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 of females. 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

Anon. 1993. Report of the Study Group on Redfish Stocks. Copenhagen, 12-14 May 1993. ICES C.M. G: 6, 1-12 ICES 2002: Report of the North-Western Working Group. *ICES C.M.* 2002/ACFM: 20, 1-411 pp.

Sigurðsson, Þ. and P. Reynisson 1998. Distribution of pelagic redfish (*Sebastes mentella* Travin), at depths below 500 m, in the Irminger Sea and adjacent waters in May, 1998. ICES CM 0:75, 1-17

Stransky, C. 2000: Migration of juvenile deep-sea redfish (*Sebastes mentella* Travin) from the East Greenland shelf into the central Irminger Sea. ICES C.M. 2000/N:28 (Theme Session on Spatial and Temporal Patterns in Recruitment Processes), 10 pp.

Table 1 Landings, effort (hours), unstandardized mean CPUE and accompanied standard deviations by year and quarter of the German fleet, 1995-2002.

Year	Quarter	Catch (t)	Effort (h)	CPUE (kg/h)	Std.Dev. (kg/h)
1995	1	1072	817	1392	1006
1995	2	10333	5782	2552	2615
1995	3	4981	4637	2292	5328
1995	4	2513	3011	855	547
1995		18900	14247	2055	3506
1996	1	533	1444	434	566
1996	2	9604	8591	1253	1055
1996	3	9051	5971	1969	2891
1996	4	2111	2449	1006	741
1996	•	21299	18455	1452	2032
1000		21200	10100	1102	LUCE
1997	1	91	116	825	603
1997	2	6153	7286	877	585
1997	3	9853	7921	1468	1220
1997	4	4344	3254	1626	1672
1997		20446	18578	1310	1216
1998	1	4	209	19	15
1998	2	5889	6510	938	733
1998	3	9578	6769	1629	1550
1998	4	2575	2352	1251	1127
1998		18046	15839	1301	1285
		10010		1001	1200
1999	1	0	0		
1999	2	8472	8051	1072	611
1999	3	6823	7830	924	709
1999	4	1192	1817	673	376
1999		16487	17698	968	651
2000	1	0	0		
2000	2	6728	6984	987	607
2000	3	5284	5224	1150	792
2000	4	486	579	871	356
2000		12498	12787	1050	688
2001	1	0	0		
2001	2	5155	6944	786	492
2001	3	5121	5594	1045	912
2001	4	391	488	924	694
2001	•	10667	13026	912	735
				0.12	
2002	1	0	17	0	0
2002	2	7240	6746	1188	904
2002	3	5867	5794	1086	799
2002	4	83	127	682	168
2002		13191	12684	1136	857

Table 2 Landings, effort (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, 1995-2002.

Year	Quarter	Catch	Effort	CPUE	Std.Dev.	Catch	Effort	CPUE	Std.Dev.
		(†)	(h)	(ka/h)	(ka/h)	(†)	(h)	(ka/h)	(ka/h)
		NRA	NRA	NRA	NRA	FEZ	EE7	EF7	EF7
1005	1		0		IN VI				
1995	1	7100	0	0740	0000	0	0	1005	000
1995	2	/182	3769	2/13	2690	278	218	1205	608
1995	3	387	357	1109	723	1825	1516	4551	8411
1995	4	0	0			133	0		
1995		7569	4126	2592	2628	2103	1734	4142	7959
1996	1	0	14	0	0	0	0		
1996	2	0	33	0	0	0	0		
1996	3	0	0			4419	2348	2227	2468
1996	4	0	0			0	0		
1996		0	47	0	0	4419	2348	2227	2468
		Ŭ		Ū.	Ŭ		2010		2.00
1997	1	0	0			0	0		
1007	2	0	5	0	0	0	0		
1007	2	0	5	0	0	4924	2100	1040	1465
1997	3	17	0	005	200	4024	3100	1042	1400
1997	4	47	69	625	288	3995	2873	1692	1712
1997		47	74	417	3//	8819	5973	1772	1587
1998	1	0	0			0	0		
1998	2	0	37	0	0	0	0		
1998	3	0	0			7371	4469	1886	1717
1998	4	0	0			2375	2061	1323	1169
1998		0	37	0	0	9746	6529	1726	1600
1999	1	0	0			0	0		
1999	2	468	485	953	635	113	109	1051	273
1999	3	196	234	784	407	6235	7108	920	674
1999	4	284	470	625	402	909	1346	692	367
1000		0/8	1180	796	527	7257	8563	880	641
		340	1103	730	527	1251	0000	003	041
2000	1	0	0			0	0		
2000	1	0	0	0.5		0	0		0.40
2000	2	0	2	0.5		42	90	441	242
2000	3	401	370	1169	553	682	964	758	314
2000	4	0	0			3	5	619	
2000		401	372	1116	595	727	1059	724	318
2001	1	0	0			0	0		
2001	2	0	13	0	0	0	3	123	
2001	3	223	322	696	305	3272	3495	1052	757
2001	4	59	87	744	432	323	395	949	750
2001		282	421	657	360	3594	3893	1038	756
2002	1	0	0			0	0		
2002	2	0	0		I	0	0		
2002	2	27	26	10/11	228	2001	2637	1101	010
2002	3	21	127	690	200	2301	2007	1131	340
2002	4	03	121	002	100	2004	0	1101	040
2002		110	0153	/ 54	226	2901	2037	1191	940

Table 3 Landings, effort (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, 1995-2002.

Year	Quarter	Catch	Effort	CPUE	Std.Dev.	Catch	Effort	CPUE	Std.Dev.
		(t)	(h)	(kg/h)	(kg/h)	(t)	(h)	(kg/h)	(kg/h)
4005		1070			1000			EEZ	
1995	1	1073	817	1392	1006	0	0		
1995	2	2873	1795	23/7	2544		1000	000	500
1995	3	1832	1705	1210	1542	936	1060	893	538
1995	4	2513	3011	855	547	0	0		
1995		8291	7328	1407	1687	936	1060	893	538
1996	1	533	1430	444	558	0	0		
1996	2	9604	8558	1268	1052	0	0		
1996	3	435	421	1221	1201	4196	3202	1830	3277
1996	4	2103	2447	988	707	8	2	3988	
1996		12675	12857	1114	983	4204	3204	1838	3274
1997	1	91	116	825	603	0	0		
1997	2	6153	7265	886	581	0	16	0	0
1997	3	1752	1754	1140	912	3283	3068	1189	865
1997	4	0	0		-	302	313	1151	1220
1997		7996	9135	935	667	3585	3397	1176	905
			0.00						
1998	1	0	0			4	209	19	15
1998	2	5889	6469	949	730	0	4	0	
1998	3	1089	1371	833	526	1119	929	1217	898
1998	4	0	0			199	291	707	349
1998		6978	7840	929	705	1322	1432	929	873
1999	1	0	0			0	0		
1999	2	7891	7443	1084	611	l õ	15	6	
1999	3	21	72	1467	2479	216	185	1239	1114
1999	4		0			0	0		
1999		7912	7515	1087	643	216	200	1167	1120
2000	1	0	0			0	0		
2000	2	6692	0	1002	604	2	24	100	101
2000	2	200	346	631	207		24	120	101
2000	3	209	340	031	207		0		
2000	4	6903	7014	0.07	507		24	100	101
2000		0093	7214	907	597	3	24	120	101
2001	1	0	0			0	0		
2001	2	5154	6928	792	490	0	0		
2001	3	133	202	727	588	677	886	820	428
2001	4	0	0			9	7	1367	
2001		5287	7130	790	493	686	893	829	430
2002	1	0	17	0	0	0	0		
2002	1	4512	11	080	555	2727	10/6	1634	1257
2002	2	4010	4000	900	200	2121	1940	6004	1207
2002	3	550	001	020	340		110	020	100
2002	4	5063	U 5400	050	FFF	2705	2056	1500	1017
2002		2003	2490	909	202	2195	2000	1209	1247

Table 4 Landings, effort (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, 1999-2002.

Year	Quarter	Catch	Effort	CPUE	Std.Dev.	Catch	Effort	CPUE	Std.Dev.
		(t)	(h)	(kg/h)	(kg/h)	(t)	(h)	(kg/h)	(kg/h)
		NRA	NRA	NRA	NRA	EEZ	EEZ	EEZ	EEZ
1999	1	0	0			0	0		
1999	2	0	0			0	0		
1999	3	0	0			154	231	663	226
1999	4	0	0			0	0		
1999		0	0			154	231	663	226
2000	1	0	0			0	0		
2000	2	0	0			0	0		
2000	3	2558	2219	1231	571	1434	1325	1360	1156
2000	4	438	506	909	374	46	69	716	214
2000		2995	2725	1171	554	1480	1393	1324	1134
2001	1	0	0			0	0		
2001	2	0	0			0	Ő		
2001	3	26	36	752	147	791	654	1540	1744
2001	4	0	0			0	0		
2001		26	36	752	147	791	654	1540	1744
2002	1	0	0			0	0		
2002	2	0	0			0	0		
2002	3	2167	2122	1088	678	155	218	864	977
2002	4	0	0			0	0		
2002		2167	2122	1088	678	155	218	864	977

Table 5 Mean depth, mean towing duration, mean CPUE and accompanied standard deviations by year and quarter as derived from an observer programme, 1991-2002.

Year	Quarter	Hauls	Depth	Std.Dev.	Towing	Std.Dev.	CPUE	Std.Dev.
			(m)	(m)	dur.(h)	(h)	(kg/h)	(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
2002	1	1	650		17.00		294	
2002	2	21	734	39	18.51	4.69	641	327
2002	3	11	340	17	19.11	5.00	871	345

Table 6 Mean length by sex and total and sex ratio by year and quarter as derived from an observer programme, 1991-2002.

Year	Quarter	Hauls	Length	Length of	Length of	Proportion	Proportion
			(cm)	Males (cm)	Females (cm)	Males	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
2002	1	1	39.53	39.43	39.56	0.22	0.78
2002	2	21	40.16	39.86	40.32	0.36	0.64
2002	3	11	35.04	34.86	35.25	0.57	0.43



•. NAFO NEAFC

Fig. 1a German fleet's effort distribution, 1st quarters 1995-2001.



NAFO NEAFC . Fig. 1b German fleet's effort distribution, 2nd quarters 1995-2001.



Fig. 1c German fleet's effort distribution, 3rd quarters 1995-2001.



quarters 1995-2001.



NAFO NEAFC Fig. 2a German fleet's effort distribution, 1st quarter 2002.



Fig. 2b German fleet's effort distribution, 2nd quarter 2002.





Fig. 2d German fleet's effort distribution, 4th quarter 2002.



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), 1995-2002, respective values are listed in Tables 2, 3 and 4.



Fig. 4 German landings 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), 1995-2002, 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), 1995-2002, 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 towing 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 landings by year, quarter and sex, 1991, 1993 and 1994.



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



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



Fig. 14 Length Composition of commercial landings by year, quarter and sex, 2001-2002.