

## 9 DEEP-SEA *SEBASTES MENTELLA* ON THE CONTINENTAL SHELF

Deep-sea *S. mentella* on the continental shelves and slopes around the Faeroe Islands, Iceland, and East Greenland is treated as one stock unit and separated from the stock fished in the Irminger Sea (oceanic *S. mentella*, see Chapter 10). It is believed to have a common area of larval extrusion southwest of Iceland, a drift of the pelagic fry towards the nursery areas on relatively shallow waters off East Greenland, and feeding and copulation areas on the shelves and banks around the Faeroe Islands, Iceland, and East-Greenland. The main fishing grounds are in Icelandic waters.

### 9.1 Landings and Trends in the Fisheries

The total annual landings of deep-sea *S. mentella* from Divisions Va and Vb, and Sub-areas VI and XIV varied between 20 000 and 84 000 t in 1978-1994 (Table 9.1.1 and Figure 9.1.1). Since 1994, landings gradually decreased and in 2001 and 2002 annual landings were 23 000 t, which was the lowest recorded since 1979. Landings in 2003 increased by about 7 000 t from 2002 and was mainly due to increased landings from Va.

In Division Va, annual landings gradually decreased from a record high of 57 000 t in 1994 to 17 000 t and 19 000 t in 2001 and 2002 respectively. However, in 2003 landings increased by amount of 10 000 t and to 28 500 t (Table 9.1.1 and Figure 9.1.1). For the past three years most of the catches were taken by bottom trawlers (the pelagic trawl fishery for the past three years have been negligible) along the shelf west, southwest, and southeast of Iceland (Figure 9.1.2), east of the redfish line (Figure 9.1.3). The catches in the third and fourth quarter of the year decreased considerable in 2001 compared with earlier years and continued to decrease in 2002 (Figure 9.1.4). The reason for this decrease seems to be associated with decreased effort at that time of year. The catch pattern by month changed considerably in 2003. The catches peaked in June, which was unusual compared with other years (Figure 9.1.4). This pattern is probably associated with the pelagic *S. mentella* fishery within the Icelandic EEZ (see Figure 7.5.1). The pelagic *S. mentella* fishery has in recent years moved more northwards and in 2003 it merged with the deep-sea *S. mentella* fishery in the redfish line in June (Figure 7.5.1 and Figure 9.1.3). Length distribution of deep-sea *S. mentella* from the bottom trawl fishery shows an increase in the number of small fish in the catch in recent years (Figure 9.1.5). A peak of about 32 cm in 1994 can be followed by approximately 1 cm annual growth in 1996-2002. The fish caught in 2003 was a little smaller than in 2002 and peaked around 37 cm.

In Division Vb, landings of deep-sea *S. mentella* were 2 100 t in 2003, which is a small decrease compared to 2002 (Table 9.1.1 and Figure 9.1.1). Record high was reported in 1986 as 15 000 t. Length distribution from the landings in 2001-2003 indicates that the fish caught are larger than 40 cm (Figure 9.1.6).

In Subarea VI, the annual landings varied between 200 t and 1 100 t 1978-2000 (Table 9.1.1 and Figure 9.1.1). Landing statistics for 2001 and 2002 showed that the redfish fishery in VI had ceased to a very low level (around 20 t), but increased in 2003 and to around 200 t.

In Subarea XIV, the annual deep-sea *S. mentella* landings has decreased drastically. In 1980-1994, landings varied between 2 000 and 19 000 with the lowest landings in 1989 and the highest in 1994 (Table 9.1.1 and Figure 9.1.1). In the following three years, the annual landings were less than 1 000 t and the redfish was mainly caught as bycatch in the shrimp fishery. In 1998, Germany started a directed fishery for redfish with annual landings around 1 000 t 1998-2001, but landings increased to 1 900 t in 2002. Samples taken from the German fleet indicated that substantial quantities of the redfish caught, especially in 2002, were juveniles, i.e. fish less than 30 cm (Figure 9.1.7). In 2003 there was very little deep-sea *S. mentella* fishery in XIV and only 348 t were landed from that area. The redfish was mainly taken by UK trawlers and there was no redfish fishery by the German fleet. It is not known whether the fishery by the UK trawlers was a direct fishery or whether the redfish was caught as bycatch. No biological samples were taken in Subarea XIV in 2003.

Below the table shows the 2003 biological sampling from the catch and landings of deep-sea *S. mentella* from the continental shelf divided by Division and gear type.

Area	Gear	Landings	Nos. samples	Nos. fish measured
Va	Pelagic trawl	44	0	0
Va	Bottom trawl	28 478	132	23 524
Va	Germany	1 094	2	3 221
Vb	Bottom trawl	2 123	46	4 266
XIVb	Bottom trawl	348	0	0

## 9.2 Trends in CPUE and survey indices

Data used to estimate CPUE for deep-sea *S. mentella* in Division Va 1986-2003 were obtained from log-books of the Icelandic trawl fleet. Only bottom trawl tows taken below 500 m depth were used and where *S. mentella* composed at least 50% of the total catch in each tow. Indices of CPUE were estimated from this data set using a GLM multiplicative model. This model takes into account changes in vessels over time as well as difference in vessel size, area (ICES statistical square), and month and year effects.

From 1986 to 1989 CPUE in Division Va was relatively stable, but gradually decreased from 1989 to a record low in 1994 (Figure 9.2.1). From 1995 to 2000, CPUE slightly increased annually, decreased in 2001 and 2002, and increased again in 2003. The fishing effort at the time when the stock was considered in stable condition, i.e. from 1986-1990, was 15 000-40 000 hours fishing. From 1991 to 1994, the fishing effort increased drastically, but decreased between 10% and 20% each year to 2001. Since 2001 there has been an increase in effort. ICES recommended 25% annual reduction in fishing effort during the same time period. Effort increased by about 12% between 2001 and 2002 and by about 40% between 2002 and 2003.

CPUE indices in Division Vb for deep-sea *S. mentella* and obtained from the Faeroese CUBA trawlers decreased from 500 kg/hour in 1991 to of 300 kg/hour in 1993 and has, since then, been at this level (Figure 9.2.2). Fishing effort during decreased between 2001 and 2002, but was in 2003 little lower than in 2002. The summer survey 1996-2003 in Division Vb shows nearly a continuous decrease in the catch rate or from about 10 kg/hour to about 2 kg/h (except in 1999 when the catches were over 10 kg/h) (Figure 9.2.3).

CPUE data from Division XIV were only available from 1998 when directed fishery for *S. mentella* by Germany started along the continental slope of East Greenland. Fishing effort was similar in the first three years or around 2 200 hours fishing, decreased to 1 000 hours in 2001, and increased again in 2002 to 1 500 hours (Figure 9.2.4). At the same time, CPUE decreased between 1998 and 1999, but has since then increased annually. No CPUE and effort data were available from Subdivision XIV in 2003, as there was no effort exerted by the German fleet and no information were available from the UK fleet.

Surveys conducted on the continental shelf of West and East Greenland and Iceland (from the spring survey conducted at depths of 0-500 m) cover only the distribution of juvenile deep-sea *S. mentella* (recruits). The results indicate that juveniles are most abundant off East Greenland, while negligible part of juveniles are distributed off West Greenland and Iceland (Figure 9.2.5). Figure 9.2.5 shows that the abundance was dominated by a single strong year class recorded for the first time in 1987 at a mean length of 20 cm. Annual growth of this cohort was about 2 cm and fully recruited to the survey gear in 1997 at a length of about 27 cm, when abundance and biomass reached its maximum (total abundance estimated 7 billion individuals and biomass 1.5 million tons). This year class seems to have left the survey area in the following years. The abundance (Figure 9.2.6) and biomass (Figure 9.2.7) records in 2003 are the second highest since 1985, indicating further recruiting year classes.

The state of the stock will be dealt with during the September session in Bergen, Norway (see Section 7.1).

## 9.3 Catch projections

It is possible to estimate catch for deep-sea *S. mentella* that corresponds to different effort. Here, this was done by using the formula:

$$\text{Catch}_{2005} = \text{Average CPUE index}_{2001-2003} * \text{Average Effort}_{2001-2003}$$

where effort for each year is calculated as:  $\text{Effort} = \text{Catch}/\text{CPUE}$ . This formula was applied to catch statistic and CPUE from Va and Vb, giving a catch of 21 508 t in Va and 3 070 t in Vb (Table 9.2.1). This will correspond to a catch of 24578 t for the whole stock (Table 9.2.2). The above calculation was a basis the ACFM advise last year.

## 9.4 Biological reference points

Not relevant here since it will be dealt with during the September session in Bergen, Norway (see Section 7.1).

## 9.5 Management considerations

The landings increased between 2002 and 2003 in Division Va by about 10 000t and was considerable higher than the set quota. There are two likely explanations for this increase. First, the pelagic *S. mentella* fishery has in recent years

been merging with the deep-sea *S. mentella* fishery on the continental shelf (see detailed description in Chapter 10.1.2.4 where the overlap of these two fisheries in 2003 is described). It is, however, uncertain whether these represent the same stock or not and this issue will be discussed within ICES SGSIMUR working group held in Bergen Norway August 31-September 3. Second, the increase in deep-sea *S. mentella* landings could be due to decreased effort towards *S. marinus*. It should be noted that Icelandic authorities give a joint quota for *S. marinus* and *S. mentella* and the increase in deep-sea *S. mentella* landings in 2003 resulted in a decrease in *S. marinus* landings. The working group recommends that the TAC of *S. marinus* **should be given separately**. There is a strong indication that *S. mentella* and *S. marinus* in Va are spatially separated and therefore, separate quotas for these species can be given.

The WG did not conclude about the status of the stock and did not recommend any quota for this stock as it will be assessed within the NWWG in September. The advice will be based of the outcome of the SGSIMUR meeting.

The Working Group recommends, however, a maximum protection of the juveniles in Division XIV and therefore, **no directed** fishery towards deep-sea *S. mentella* in Division XIV should be allowed.

**Table 9.1.1** Nominal landings (tonnes) of deep-sea *S. mentella* on the continental shelf and slopes 1978-2003, divided by ICES Division.

Year	ICES Division					Total
	Va	Vb	VI	XII	XIV	
1978	3 902	7 767	18	0	5 403	17 090
1979	7 694	7 869	819	0	5 131	21 513
1980	10 197	5 119	1 109	0	10 406	26 831
1981	19 689	4 607	1 008	0	19 391	44 695
1982	18 492	7 631	626	0	12 140	38 889
1983	37 115	5 990	396	0	15 207	58 708
1984	24 493	7 704	609	0	9 126	41 932
1985	24 768	10 560	247	0	9 376	44 951
1986	18 898	15 176	242	0	12 138	46 454
1987	19 293	11 395	478	0	6 407	37 573
1988	14 290	10 488	590	0	6 065	31 433
1989	40 269	10 928	424	0	2 284	53 905
1990	28 429	9 330	348	0	6 097	44 204
1991	47 651	12 897	273	0	7 057	67 879
1992	43 414	12 533	134	0	7 022	63 103
1993	51 221	7 801	346	0	14 828	74 196
1994	56 720	6 899	642	0	19 305	83 566
1995	48 708	5 670	536	0	819	55 733
1996	34 741	5 337	1 048	0	730	41 856
1997	37 876	4 558	419	0	199	43 051
1998	33 125	4 089	298	3	1 376	38 890
1999	28 590	5 294	243	0	865	34 992
2000	31 393	4 841	885	0	986	38 105
2001	17 292	4 247	34	0	927	22 500
2002	19 045	2 688	19	0	1 903	23 655
2003 <sup>1)</sup>	28 478	2 123	197	0	348	31 145

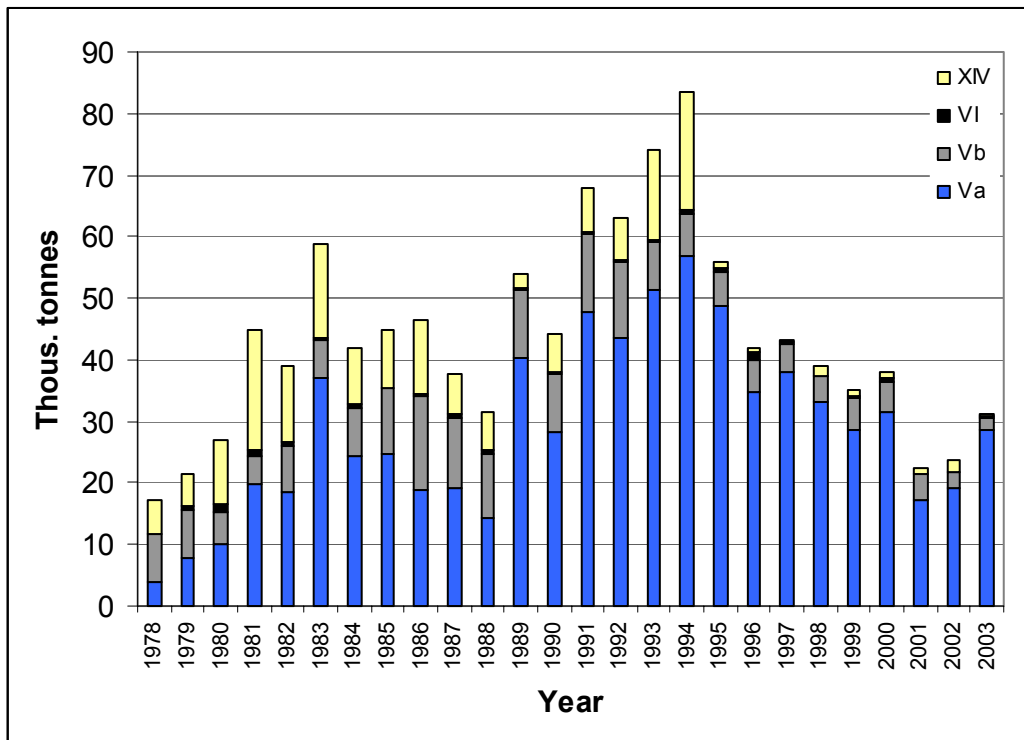
1) Provisional

**Table 9.2.1** Catch projection of deep-sea *S. mentella* for 2005. The table gives the nominal landings (tonnes), CPUE and fishing effort in Va and Vb, the catch projection for the 2005 fishing year in Va and Vb based on mean CPUE and effort of 2001-2003, and total catch in these two areas.

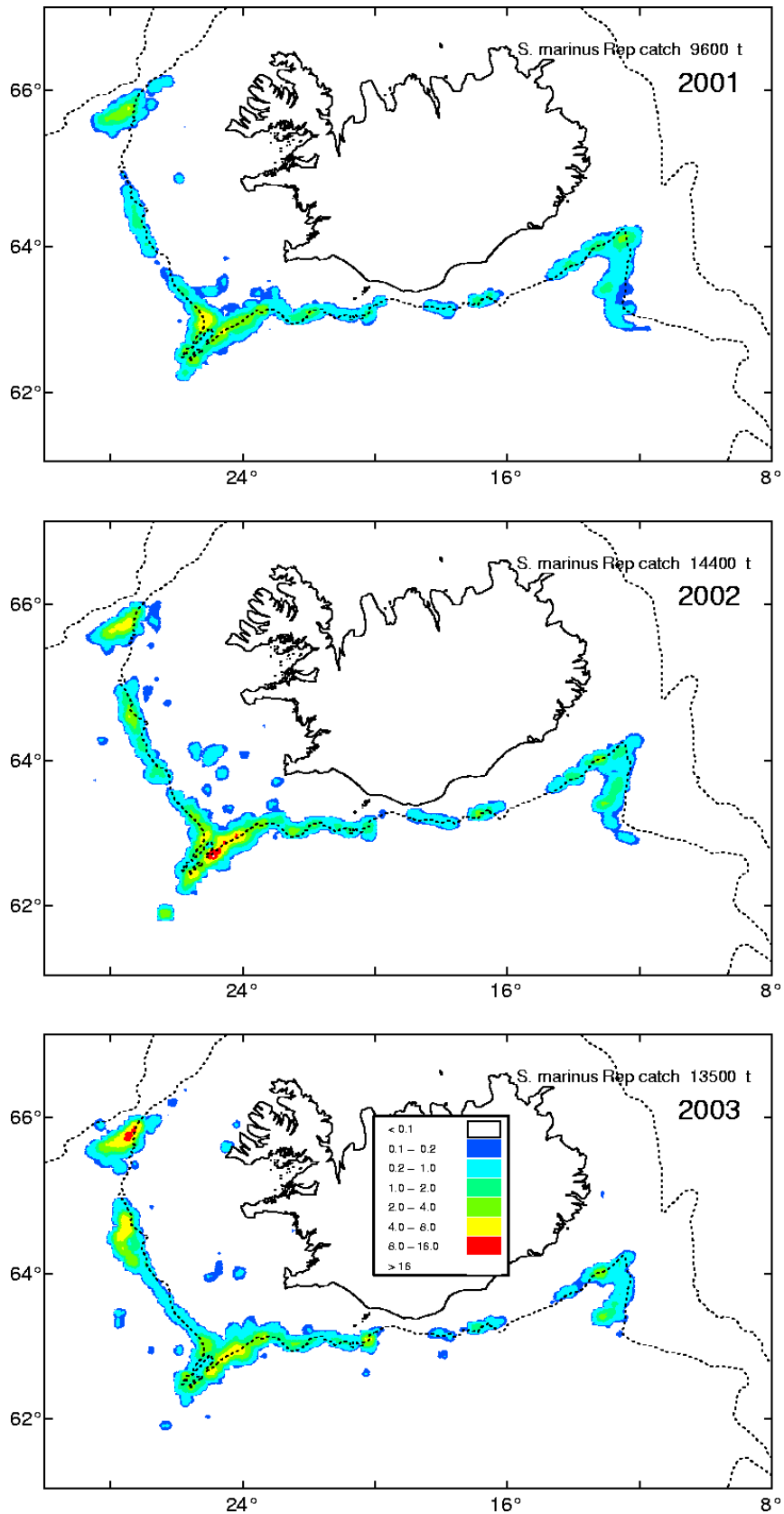
Year	Iceland (Va)			Faeroe Islands (Vb)		
	Landings	CPUE	Effort	Landings	CPUE	Effort
1986	18 898	1 000	19			
1987	19 293	1 096	18			
1988	14 290	988	14			
1989	40 269	949	43			
1990	28 429	907	31			
1991	47 651	924	52	12 897	501	26
1992	43 414	720	60	12 533	384	33
1993	51 221	652	79	7 801	321	24
1994	56 720	581	98	6 899	308	22
1995	48 708	596	82	5 670	311	18
1996	34 741	601	58	5 337	292	18
1997	37 876	631	60	4 558	337	14
1998	33 125	635	52	4 089	295	14
1999	28 590	675	42	5 294	307	17
2000	31 393	715	44	4 841	289	17
2001	17 292	699	25	4 247	308	14
2002	19 045	689	28	2 688	373	7
2003	27 478	729	39	2 123	314	7
<b>Av. 01-03</b>		<b>706</b>	<b>30</b>		<b>332</b>	<b>9</b>

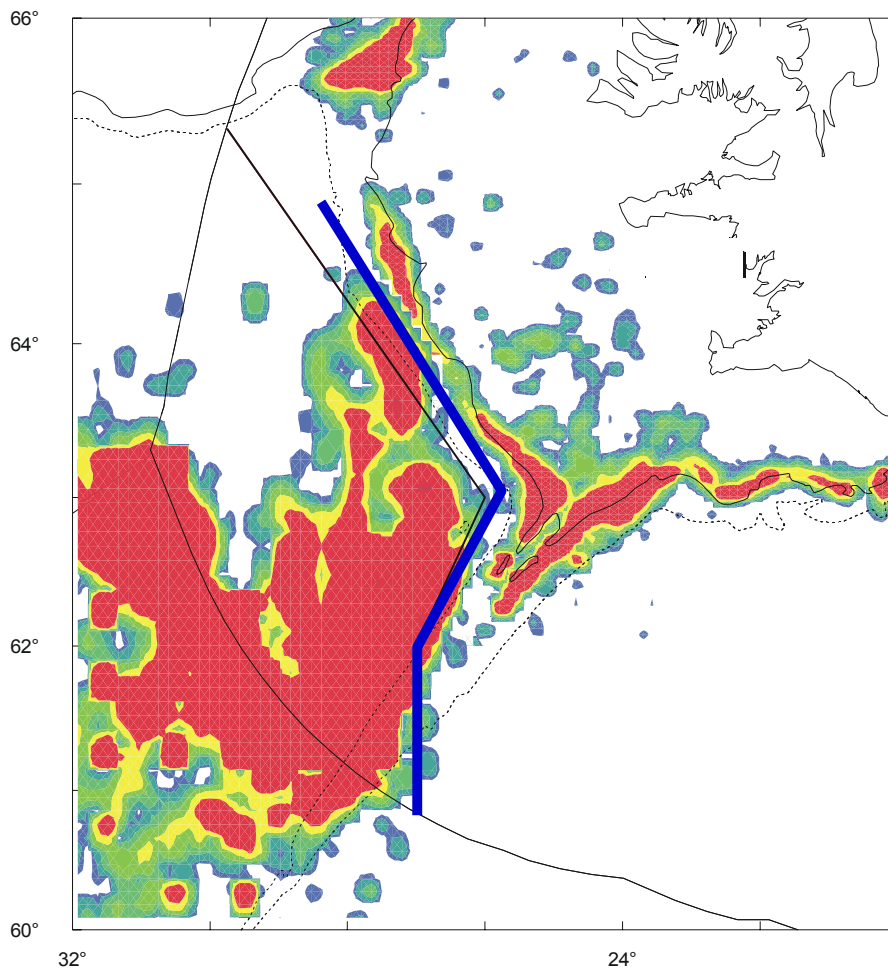
Catch 2005 = Mean CPUE <sub>(2001-2003)</sub> * Mean Effort <sub>(2001-2003)</sub>			
Level	Va	Vb	Total
120%	25 810	3 684	29 494
100%	21 508	3 070	24 578
75%	16 131	2 302	18 433
50%	10 754	1 535	12 289



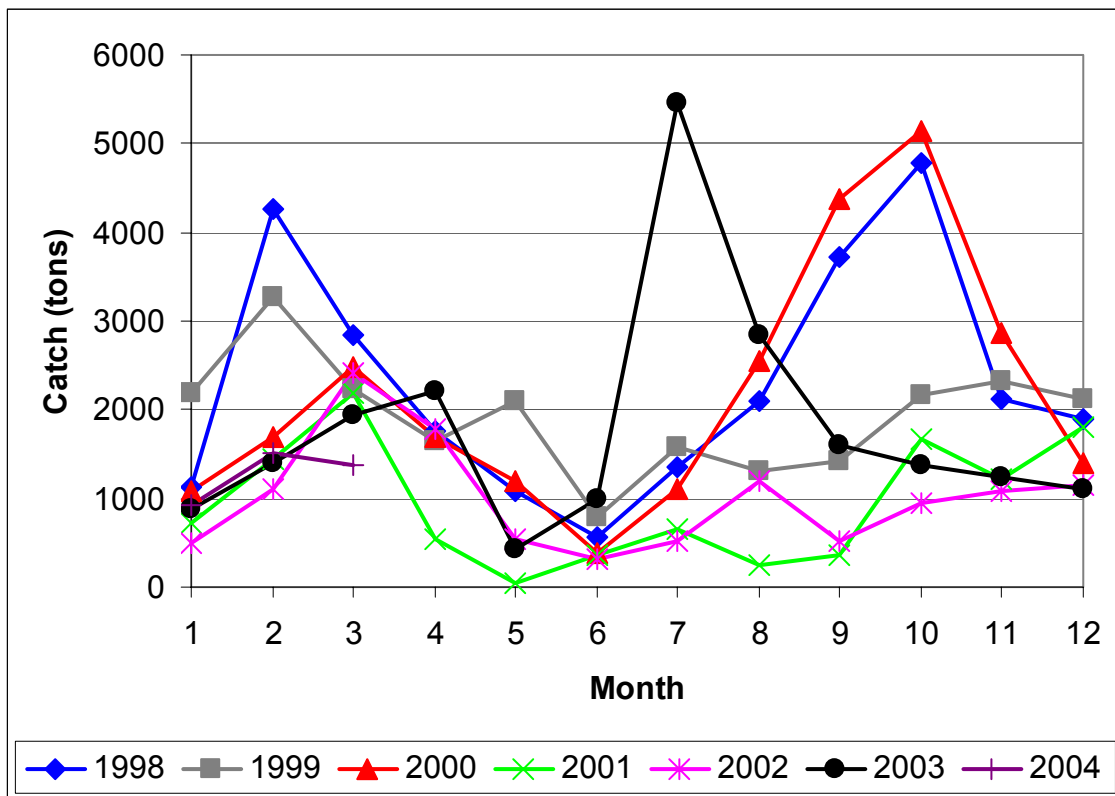
**Figure 9.1.1** Nominal landings of deep-sea *S. mentella* (in tonnes) from ICES Divisions Va, Vb, VI and XIV 1978-2003.



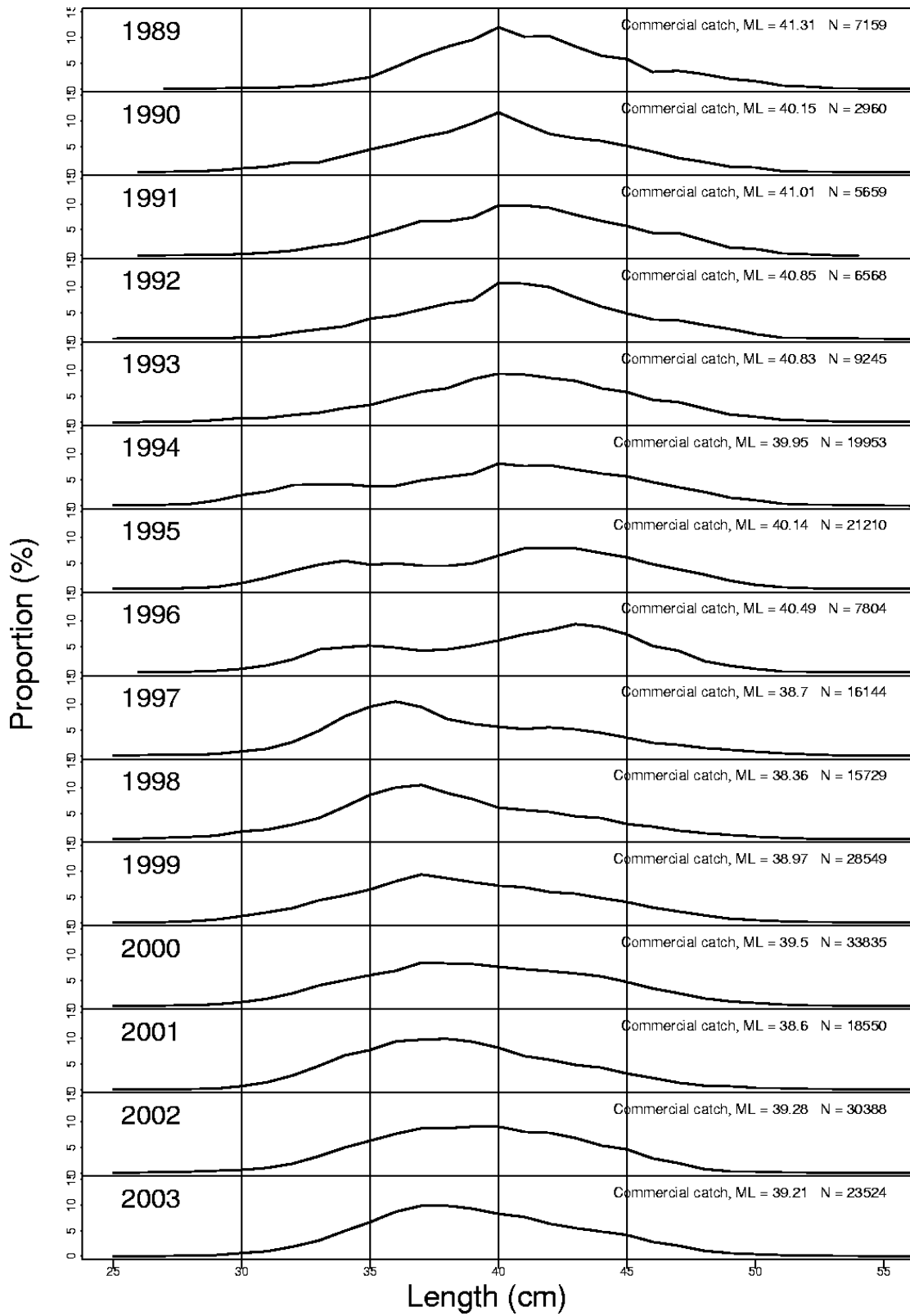
**Figure 9.1.2** Geographical location of the deep-sea *S. mentella* catch in Icelandic waters 2001-2003 as reported in log-books of the Icelandic bottom trawl fleet.



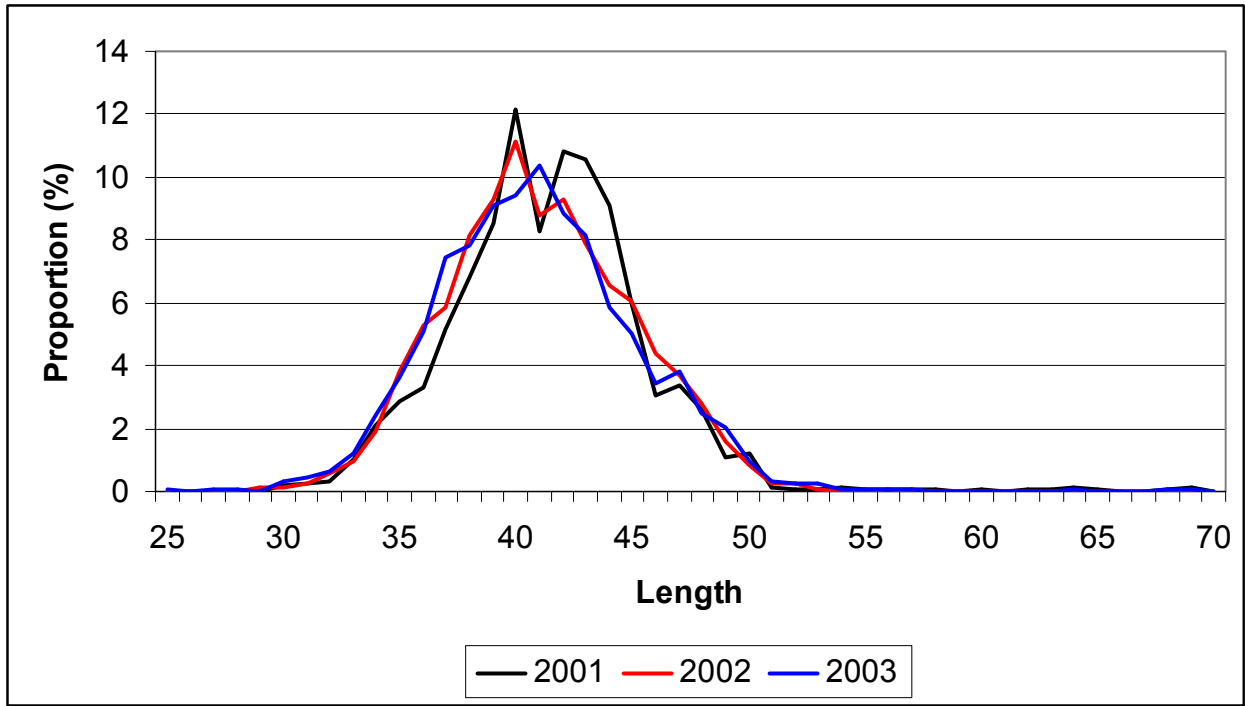
**Figure 9.1.3** Geographical location of *S. mentella* (both pelagic and deep-sea) catch in Icelandic waters 2001-2003 (all years combined) as recorded by log-books. The map also shows the line used by the Icelandic authorities to separate the landing statistics between deep-sea *S. mentella* and pelagic *S. mentella*. The catches west of the “redfish line” is from the pelagic fishery, whereas the catch north and east of the line is of “shelf type”. The blue line is the one implemented in 2003, whereas the black one is the old one.



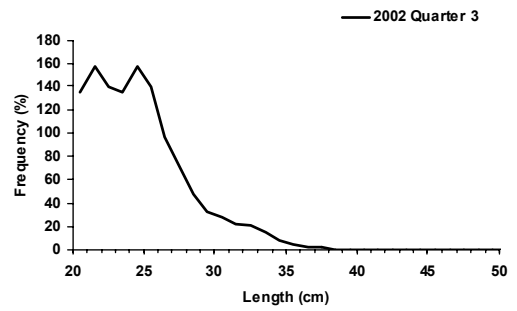
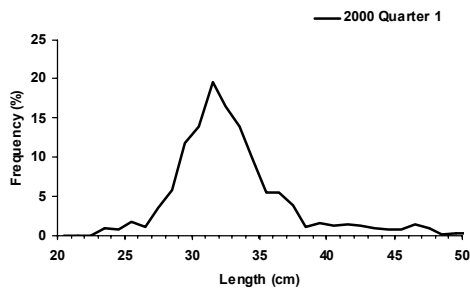
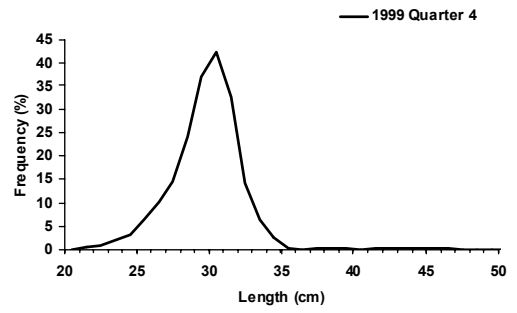
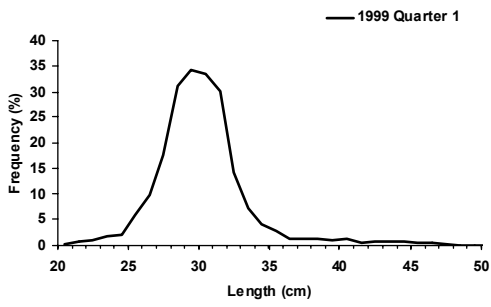
**Figure 9.1.4** Nominal landings of deep-sea *S. mentella* (in tonnes) in Icelandic waters (ICES Division Va) of the Icelandic bottom trawl fleet 1998-2004, divided by month.



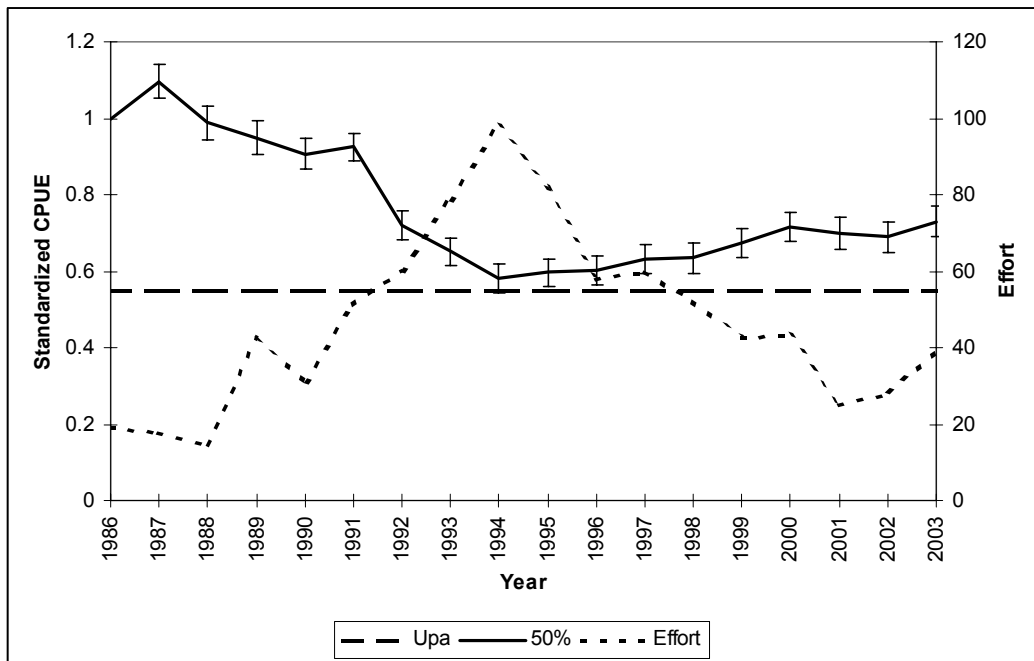
**Figure 9.1.5** Length distributions of deep-sea *S. mentella* from the Icelandic bottom trawl catch and landings in Division Va 1989-2003.



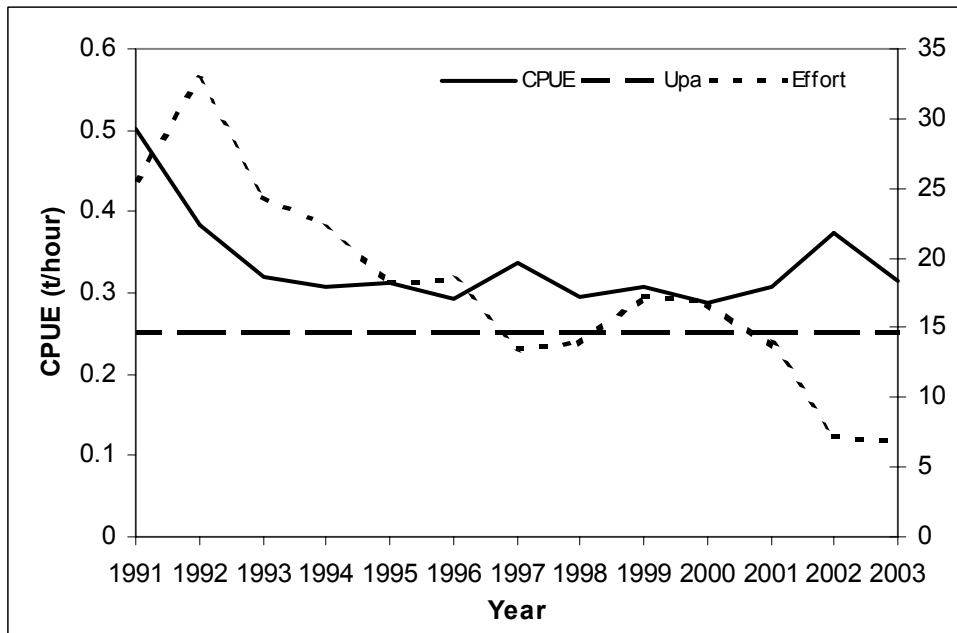
**Figure 9.1.6** Length distribution of deep-sea *S. mentella* from landings of the Faeroese fleet in Division Vb 2001-2003.



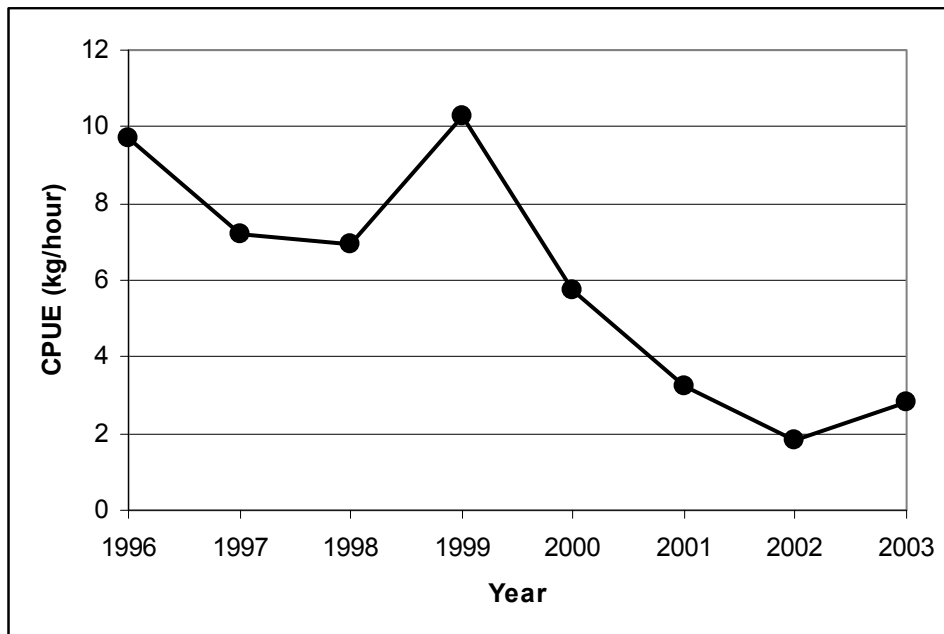
**Figure 9.1.7** Length distribution of deep-sea *S. mentella* of the German commercial landings in Division XIV 1999-2002, divided by quarters of the year.



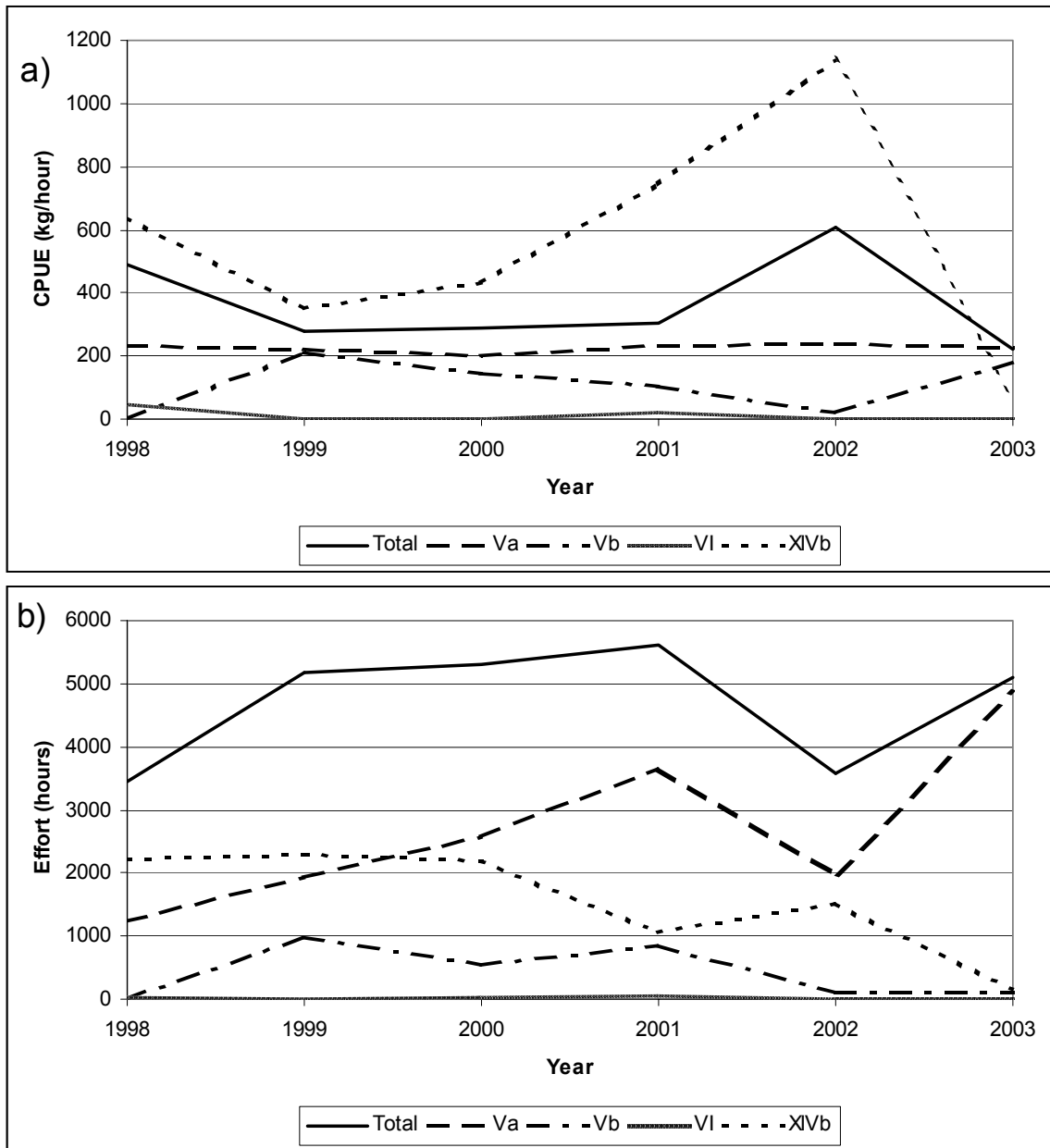
**Figure 9.2.1** CPUE, relative to 1986, of deep-sea *S. mentella* from the Icelandic bottom trawl fishery in Division Va. CPUE based on a GLM model, based on data from log-books and where at least 50% of the total catch in each tow was deep-sea *S. mentella*. Also shown is fishing effort (hours fished in thousands).



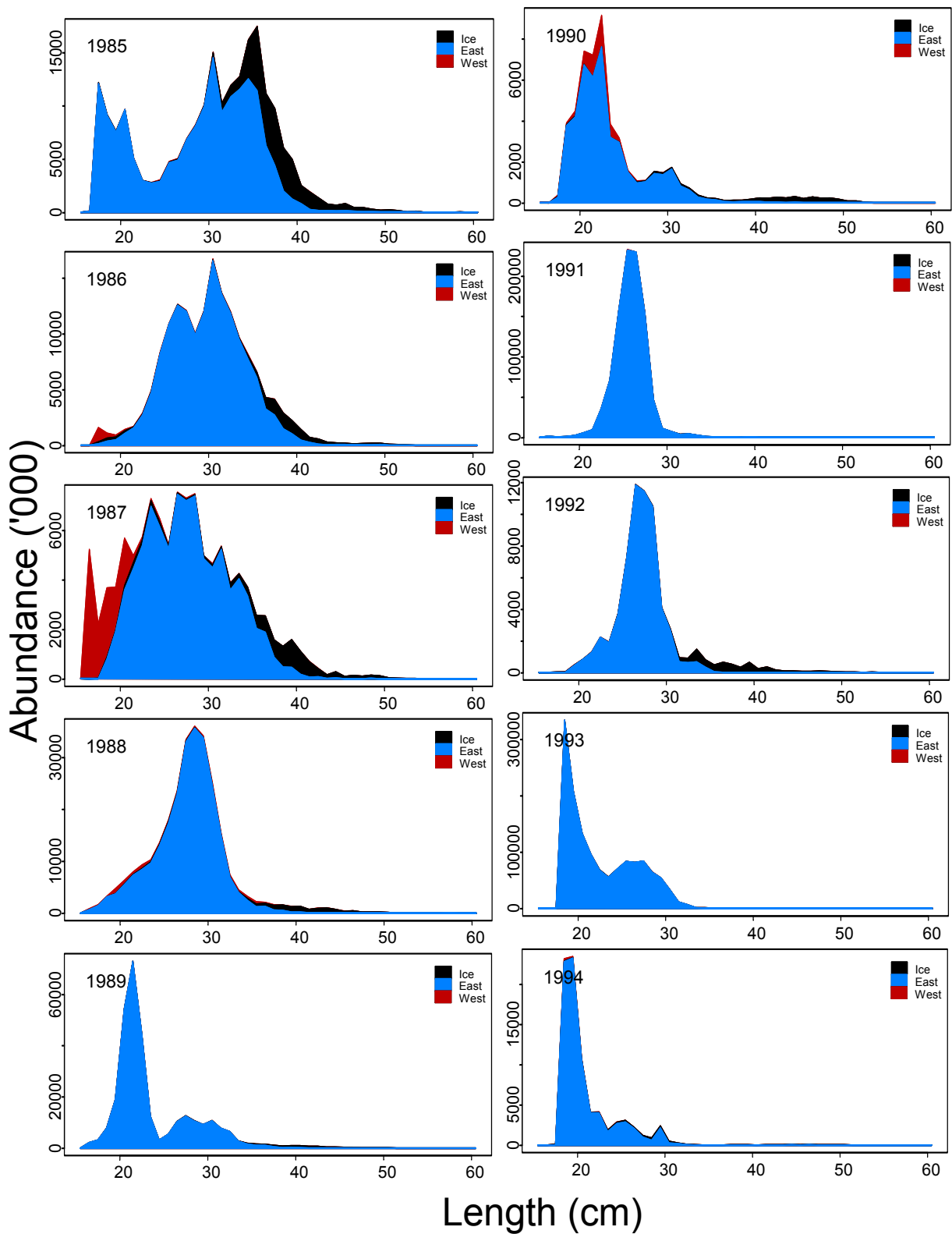
**Figure 9.2.2** Deep-sea *S. mentella*. CPUE (kg/hour) and fishing effort (in thousands) from the Faeroese CUBA fleet 1991-2003 and where 70% of the total catch was deep-sea *S. mentella* .



**Figure 9.2.3** Deep-sea *S. mentella*. CPUE (kg/hour) from the Faeroese summer survey 1996-2003.



**Figure 9.2.4** Deep-sea *S. mentella*. (a) CPUE (kg/hour) and (b) effort (hours fished) of the German commercial fleet 1998-2003, divided by ICES divisions.



**Figure 9.2.5** Deep-sea *S. mentella* (15-35 cm) on the continental shelves off West- and East-Greenland and Iceland. Length composition off Greenland and Iceland is derived from the German and Icelandic groundfish surveys 1985-2003. Note different scale on y-axis.

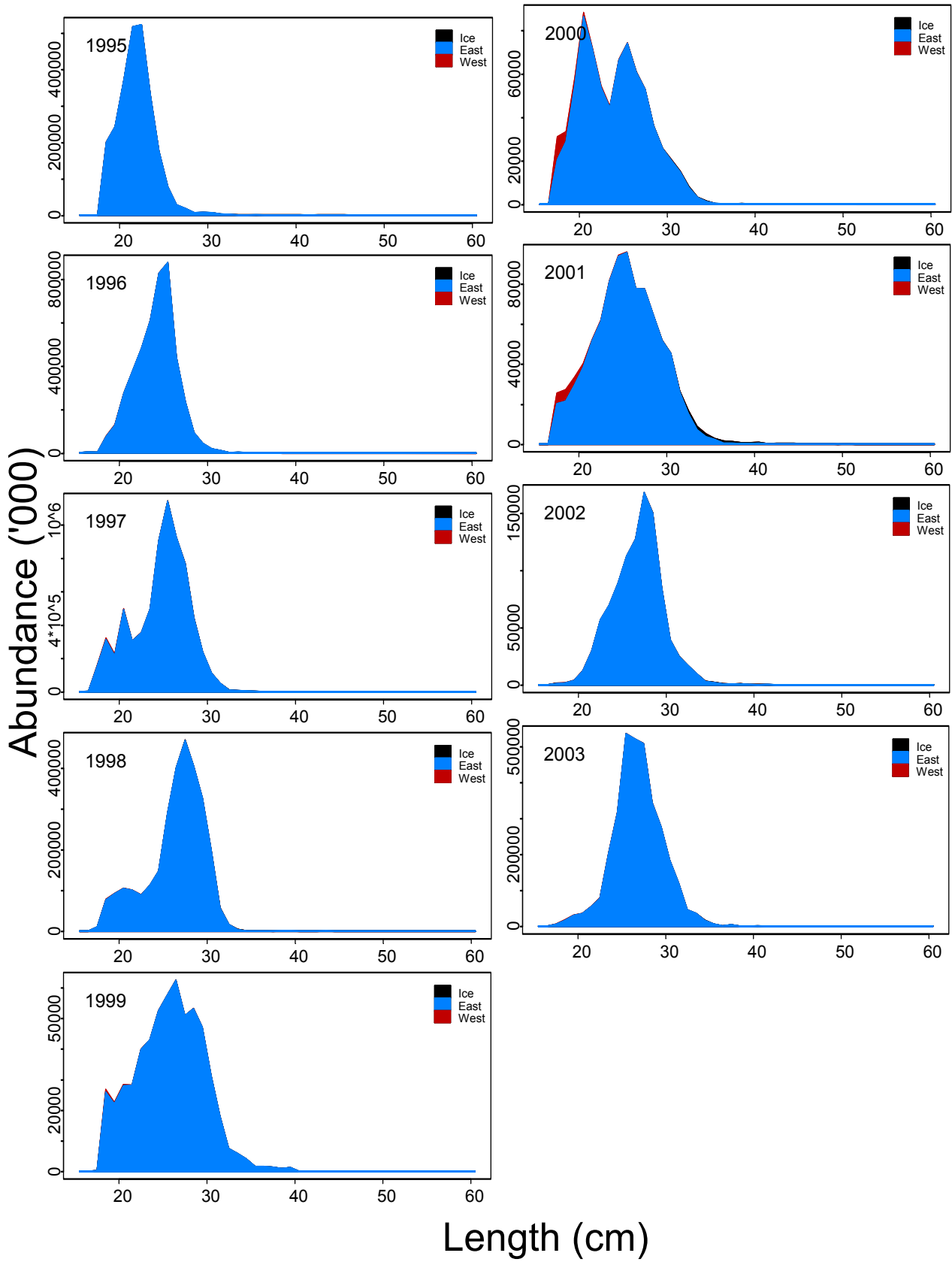
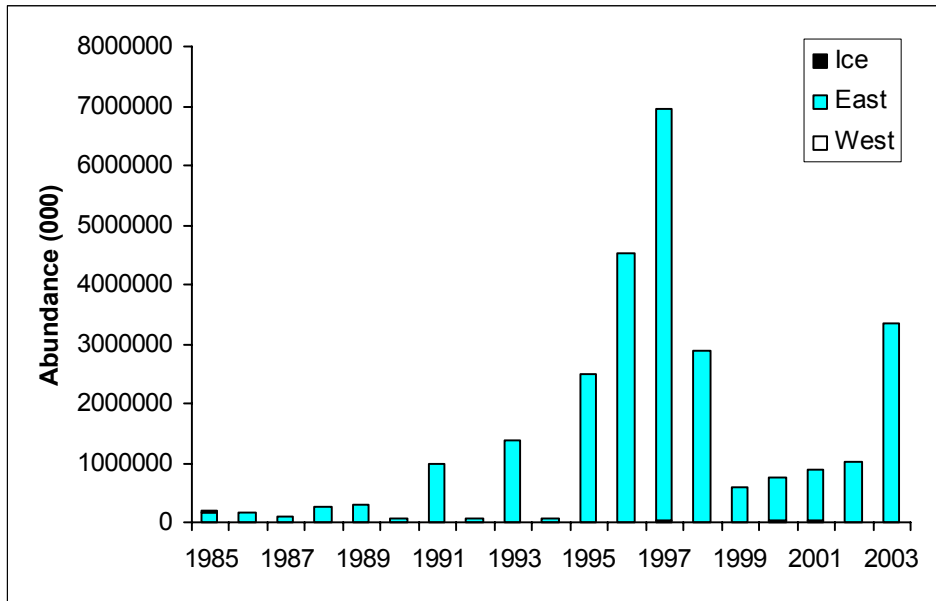
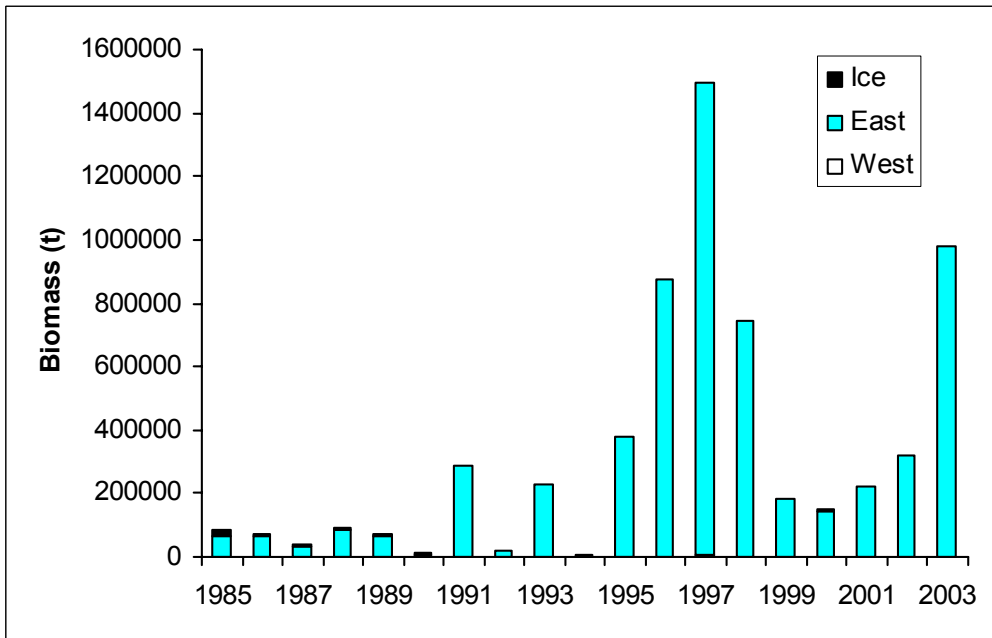


Figure 9.2.5 Continued.



**Figure 9.2.6** Deep-sea *S. mentella* ( $\geq 17$  cm) on the continental shelf. Survey abundance indices for East and West Greenland and Iceland derived from the German and Icelandic groundfish surveys, 1985–2003.



**Figure 9.2.7** Deep-sea *S. mentella* ( $\geq 17$  cm) on the continental shelf. Survey biomass indices for East and West Greenland and Iceland derived from the German and Icelandic groundfish surveys, 1985–2003.