6 Beaked redfish *(Sebastes mentella)* in Subareas 1 and 2

Following the recommendation from the benchmark assessment for redfish stocks in February 2012 (WKRED, ICES 2012) the analytical assessment is conducted using a statistical catch-at-age model (SCAA, for the period 1992-2016). The additional Schaefer biomass model which was previously used as 'sanity check' for the SCAA output is no longer in use. Advice on beaked redfish in subareas 1 and 2 is provided every third year. A benchmark assessment is scheduled for 2018. The present report therefore updates the advice for 2018 only.

6.1 Status of the Fisheries

6.1.1 Development of the fishery

A description of the historical development of the fishery in Subareas 1 and 2 is found in the stock annex for this stock.

A pelagic fishery for *S. mentella* has developed in the Norwegian Sea outside EEZs since 2004 (Figure 6.1). This fishery, which is further described in the Quality handbook for this stock, is managed by the Northeast Atlantic Fisheries Commission (NEAFC). A new directed demersal and pelagic fishery is permitted in the Norwegian Economic Zone since 2014. The spatial regulation for this new fishery is illustrated in Figure 6.22. In 2016, most of the catches of *S. mentella* from the Russian and Norwegian fisheries were taken in the Norwegian Exclusive Economic Zone or as bycatch in the Fisheries Protection Zone around Svalbard. Catches in international waters were mainly taken by EU nations.

Figure 6.2 show the location of *S. mentella* catches in the Norwegian EEZ in 2016. Sixteen vessels took part in the pelagic Olympic fishery in 2014, compared with 25 in 2013, 32 vessels in 2012, and 58 in 2011. NEAFC could not provide logbook and/or effort information from this fishery in 2015 and 2016, but 4 752 t of *S. mentella* were officially caught (i.e. reported to NEAFC and/or ICES) in this pelagic fishery in 2015 and 7 170 t in 2016. The 44th Session of the Joint Norwegian-Russian Fisheries Commission decided to split the total TAC among countries as follows: Norway: 72 %, Russia: 18 %, Third countries: 10 % (as bycatch in the fishery protection zone at Svalbard (Spitsbergen): 4.1 %, and international waters of the Norwegian Sea (NEAFC-area): 5.9 %).

6.1.2 Bycatch in other fisheries

During 2003-2013, all catches of *S. mentella*, except the pelagic fishery in the Norwegian Sea outside EEZ, were taken as bycatches in other fisheries. Some of the pelagic catches are taken as bycatches in the blue whiting and herring fisheries. From 2014 onwards most of the catch is taken as targeted catch and no longer as bycatch, following the opening of a targeted fishery in the Norwegian EEZ and Svalbard Fisheries Protection Zone.

6.1.3 Landings prior to 2017 (Tables 6.1—6.5, 6.12, 6.13, Figure 6.1)

Nominal catches of *S. mentella* by country for Subareas 1 and 2 combined are presented in Table 6.1, and for both redfish species (i.e. *S. mentella* and *S. norvegicus*) in Table 6.12. The nominal catches by country for Subarea 1 and Divisions 2.a and 2.b are shown in Tables 6.2—6.4, while Table 6.5 shows the catches by country for the pelagic fishery in the Norwegian Sea. The sources of information used are catches reported to ICES, NEAFC, Norwegian authorities (foreign vessels fishing in the Norwegian economic zone) or direct reporting to the AFWG. Where catches are reported as *Sebastes* sp., they are split into *S. norvegicus* and *S. mentella* by AFWG experts based on available information and prior knowledge. All tables have been updated for

the year 2015 and new figures presented for 2016. Total international landings in 1952-2016 are also shown in Figure 6.1.

In 2014, ICES advised that the annual catch in 2015, 2016, and 2017 should be set at no more than 30 000 t.

Because of the novelty of the situation regarding management regulations and fleet dynamics, the total landings of *S. mentella* in Subareas 1 and 2 in 2014, demersal and pelagic catches, amounted to only 18 780 t. The total landings of the demersal and pelagic fishery increased to 25 856 t in 2015 and to 33 979 t in 2016. Of this, 7 170 t were reported from the pelagic fishery in international waters of the Norwegian Sea. The total landings in 2016 are 3 979 t above the TAC advised by ICES. Norway caught the major share of the demersal catches (17 631 t), but Russian demersal catches increased substantially, particularly in ICES Division 2b.

The redfish population in Subarea IV (North Sea) is believed to belong to the Northeast Arctic stock. Since this area is outside the traditional areas handled by this Working Group, the catches are not included in the assessment. The total redfish landings (golden and beaked redfish combined) from Subarea IV have up to 2003 been 1 000—3 000 t per year. Since 2005 the annual landings from this area have varied between 102 and 335 t (Table 6.13).

6.1.4 Expected landings in 2017

ICES has advised on the basis of precautionary considerations that an annual catch in 2015, 2016, and 2017 should be set at no more than 30 000 t, and the 46th Session of the Joint Norwegian-Russian Fisheries Commission decided to follow this advice and set the total TAC in 2017 at 30 000 t.

In 2017 Norwegian fishing vessels can catch and land up to 17 600 t of redfish in the Norwegian economic zone (NEZ) in a limited area north of 65 20′ N (see map in Figure 6.22), in international waters and the fisheries zone around Jan Mayen. Of this quantity 100 t are allocated to cover bycatch in other fisheries and 23 t for research/surveillance and education purposes, while the remaining 17 477 t can be taken in a directed fishery. Only vessels with cod and saithe trawl permits can participate in the directed fishery for redfish. Each vessel which has the right to participate is assigned a vessel quota of 460 t, and a reallocation of vessel quotas will be done after 1 September. This quota must also cover catches of redfish (both species) in other fisheries. It is prohibited to fish for redfish with bottom trawls in the period from 1st March until 10th May. Investigations were conducted in 2015 to see if the protection of females during the main time of larvae release should be improved by extending the period of prohibited fishing until later in May and to see if the area south of Bear Island (marked in Figure 6.22) can be opened for directed fishing, either with or without sorting grid. The brief and preliminary conclusion is that males dominated the catches (about 80%) in the main fishing areas south and southwest of Bear Island during the investigations from late April until the directed fishery started on 10 May, and that the area south of Bear Island should stay closed during January-February due to smaller *S. mentella* inhabiting this area at the beginning of the year.

Since 2015, Russia has had access to the NEZ when fishing their quota share of 5 400 t (18%) and 2 000 t transferred from Norway to Russia of *S. mentella* in the directed fishery. 1 000 t is allocated to bycatch by Russian fishery in addition to the combined Russian-Norwegian quota of 25 000 t, adding up to 26 000 t. It is expected that most of this redfish catch will be *S. mentella*. The remaining 4 000 t are divided between third countries in the NEZ and Svalbard Zone (2 230 t) and the NEAFC areas (1 770 t). It is not unlikely that over 7 000 t will be caught in the NEAFC areas (as in 2016) and therefore that the total catch in 2017 will be above the TAC advised by ICES by about 5 000t.

6.2   Data used in the Assessment

Analytical assessment was conducted for this stock following recommendation from the benchmark assessment working group (WKRED, ICES CM 2012/ACOM:48). Input datasets were updated with the most recently available data. The analytical assessment, based primarily on a statistical catch-at-age model (SCAA) covers the period 1992—2015. The input data consists of the following tables:

Total catch in tonnes (Table 6.1)

Catch in tonnes in the pelagic fishery (Table 6.5)

Total catch numbers-at-age 6—19+ (Table 6.6)

Catch numbers-at-age 11—19+ in the pelagic fishery (Table 6.8)

Weight-at-age 2—19+ in the population (Table 6.7)

Maturity-at-age 2—19+ in the population (Figure 6.5)

Winter survey numbers-at-age 2—15 (Table 6.16b)

Ecosystem survey numbers-at-age 2—15 (Table 6.17)

Russian autumn survey numbers-at-age 2—11 (Table 6.14)

There was no direct observation of catch numbers-at-age for the pelagic fishery operating in 2012 – 2016. Instead, numbers-at-age were estimated based on catch-at-age from previous or following year, and weight at age and fleet selectivities (section 6.2.2 in AFWG report 2013). In 2013, observation from the scientific survey in the Norwegian Sea was used to derive numbers-at-age in the pelagic fishery. Similar observations were made in 2016, but age readings were not available at the time of the working group meeting.

6.2.1   Length– composition from the fishery (Figure 6.3)

Length distributions of the pelagic and demersal catches of *S. mentella* are shown in Figure 6.3. In 2016, data were available from the Russian, Norwegian, Spanish and Portuguese fleets.

6.2.2   Catch–at–age (Tables 6.6 and 6.8, Figure 6.4)

Catch-at-age in the Norwegian fishery were estimated using ECA for 2014. It was not possible to run ECA on the 2015 data and no age readings were available for 2016. For the pelagic and demersal fisheries in 2015 and 2016 proportions-at-age in the catch were derived from proportions at age in earlier years, weight at age and fleet selectivities (section 6.2.2 in AFWG report 2013). Updated age readings and estimations of catch-at-age for 2015 and 2016 are expected from Norway at the next assessment in 2018.

6.2.3   Weight–at–age (Table 6.7, Figures 6.5, 6.6)

In earlier assessment, weight-at-age in the stock was set equal to the weight at age in the catch. This turned out to be problematic because of important fluctuations in reported weight-at-age in the catch that cannot be explained biologically (i.e. these are noisy data). In 2015, it was advised to either use a fixed weight-at-age for the 19+ group, or use a modelled weight-at-age based on catch and survey records (Planque 2015). The second option was chosen. Weight-at-age in the population was modelled for each year using mixed-effect models of a von Bertalanffy growth function (in weight). The model results are illustrated in Figure 6.5. This method resulted in higher weigth-at-age in the +group in recent years (Figure 6.6).

6.2.4 Maturity–at–age (Table 6.19, Figure 6.7)

The proportion maturity-at-age was estimated for individual years using a mixed-effect statistical model (Table 6.19, Figure 6.7). The modelled values of maturity-at-age for individual years are used in the analytical assessment models, except in 2011, 2014 and 2015 when the fixed effects only were considered. There were no age readings available for 2016 and the fixed effect model was therefore used for that year.

6.2.5 Scientific surveys

The results from the following research vessel survey series were evaluated by the Working Group:

6.2.5.1 Surveys in the Barents Sea and Svalbard area (Tables 1.1, 1.3–1.4, 6.14–6.16, Figures 6.8–6.9)

Russian bottom trawl survey in the Svalbard and Barents Sea areas in October-December for 1978–2015 in fishing depths of 100—900 m (Table 6.14, Figure 6.8). *ICES acronym: RU-BTr-Q4*

Russian-Norwegian Barents Sea 'Ecosystem survey' (bottom-trawl survey, August-September) from 1986—2016 in fishing depths of 100—500 m (Figures 6.8—6.9). Data disaggregated by age for the period 1992—2016 (Table 6.15b). *ICES acronym: since 2003 part of Eco-NoRu-Q3 (BTr)*

Winter Barents Seabed-trawl survey (February) from 1986—2014 (joint with Russia since 2000, except 2006 and 2007) in fishing depths of 100—500 m (Figures 6.8—6.9). Data disaggregated by age for the period 1992—2016 (Table 6.16b). *ICES acronym: BS-NoRu-Q1 (BTr)*

The Norwegian survey initially designed for redfish and Greenland halibut is now part of the ecosystem survey and covers the Norwegian Economic Zone (NEZ) and Svalbard incl. north and east of Spitsbergen during August 1996—2012 from less than 100 m to 800 m depth. This survey includes survey no. 2 above, and has been a joint survey with Russia since 2003, and since then called the Ecosystem survey. *ICES acronym: Eco-NoRu-Q3 (Btr)*

6.2.5.2 Additional surveys (Figures 6.11—6.15)

The international 0-group survey in the Svalbard and Barents Sea areas in August-September 1980-2016, now part of the Ecosystem survey (Figure 6.11). *ICES acronym: Eco-NoRu-Q3*

A slope survey "Egga-sør survey" was carried out by IMR from 12th March to 8th April 2016, following similar surveys ran in 2009, 2012 and 2014. The Deep Pelagic Ecosystem Survey (WGIDEEPS, ICES 2016) was conducted in the Open Norwegian Sea from 11th August to 1st September 2016, following similar surveys in 2008, 2009 and 2013. The spatial coverage of the two surveys and the distribution of beaked redfish registered by acoustic are presented in Figures 6.12—6.13). Egga-Sør, Egga-Nor and WGIDEEPS surveys have been repeated several time on a multiannual basis. The length and age distributions of beaked redfish from these surveys show consistent ageing in the population and gradual incoming of new cohorts after the recruitment failure period (Figure 6.14). These surveys are considered as candidates for data input to the analytical assessment of *S. mentella* (see also Planque 2016).

Figure 6.15 shows cod's predation on juvenile (5-14 cm) redfish during 1984—2016. This time-series confirms the presence of redfish juveniles and may be used as an indicator of redfish abundance. A clear difference is seen between the abundance/consumption ratio in the 1980s and at present. A change in survey trawl catchability (smaller meshes) from 1993 onwards (Jakobsen *et al.* 1997) and/or a change in the cod's prey preference may cause this difference. As long as the trawl survey time-series has not been corrected for the change in catchability, the abundance index of juvenile redfish less than 15 cm during the 1980s might have been considerably higher, if this change in catchability had been corrected for. The decrease in the

abundance of young redfish in the surveys during the 1990s is consistent with the decline in the consumption of redfish by cod. It is important that the estimation of the consumption of redfish by cod is being continued.

6.3   Assessment

The group updated the analytical assessment using a statistical catch-at-age (SCAA) model. In earlier years, the SCAA was run in ADMB. In 2016, the model was implemented in TMB (template model builder) and tests based on the 2014 assessment showed that the two implementations gave identical results. The TMB version of the model allows for modelling recruitment as a random walk, using mixed effects. This option gives very similar results to the original approach in which recruitment was estimated independently for each year. Given that there were no available data to inform recruitment (at age 2y) in 2016, the random effect option was used in the current assessment.

6.3.1   Results of the Assessment (Tables 6.20—6.21, Figures 6.16—6.21)

6.3.1.1 Stock trends

The temporal patterns in recruitment-at-age 2 (Figures 6.16, 6.18) confirm the previously reported recruitment failure for the year-classes 1996 to 2003, and indicate a return to high levels of recruitment. The estimates of year-class strength for recent years (after the 2011 year-class) are uncertain due to a lack of age data from the Winter and Summer ecosystem surveys. Modelled spawning-stock biomass (SSB) has steadily increased from 1992 to 2005 (Table 6.21). In recent years, the total-stock biomass (TSB) consists of a larger proportion of mature fish than in the 1990s and is fluctuating around one million tonnes (Table 6.21 and Figures 6.16, 6.18). The decline in SSB in recent years can be attributed to the weak year-classes (1996—2003) entering the mature stock. This trend is expected to reverse in the coming years.

6.3.1.2 Fishing mortality (Figure 6.16, Table 6.21)

The patterns of fleet selectivity at age indicate that most of the fish captured by the demersal fleet are of age 11 years and older, while the pelagic fleet mostly captures fish of age 14 and older (Figure 6.11). This is consistent with the known geographical distribution of different life stages of *S. mentella*. The opening of the demersal fishery in the Norwegian EZ in 2014 has led to a significant increase in the demersal fishing mortality. The steep selectivity patterns combined with the gradual ageing of the adult population of *S. mentella* lead to fishing mortality for ages 12-18 that do not adequately reflect the mortality suffered by the bulk of the adult stock, mostly composed of 19+ individuals. In 2016 F_{12-18} is estimated to 0.030 while F_{19+} is 0.043 (Table 6.21).

6.3.1.3 Survey selectivity patterns (Figure 6.17)

Winter and ecosystem surveys selectivity at age are very similar and show reduced selectivity for age 8 y and older, which is consistent with the known geographical distribution of different life stages of *S. mentella*. Conversely, the Russian survey shows a reduced selectivity for age 7 y and younger. This is believed to result from gear selectivity.

6.3.1.4 Residual patterns (Figure 6.21)

Residual patterns in catch and survey indices are presented in Figure 6.21-e. There is generally no visible trend in the residuals for the Russian groundfish survey neither by age nor by year. Trends in residuals are visible in recent years for winter and ecosystem surveys. The reason for these will need to be investigated further. Alternative methods for the estimation of the survey selectivity patterns will be investigated in the forthcoming benchmark assessment and could potentially resolve the issue.

6.3.1.5 Retrospective patterns (Figure 6.19)

The historical retrospective patterns for the years 2007 to 2016 are presented in Figure 6.19. All model parameters were estimated in each individual run. The most recent model run (last year of data 2016) is consistent with previous runs although indicating higher SSBs in the most recent years of the assessment time-period. This is mainly due to shift from using reported catch weight-at-age to estimated populations weight-at-age, which resulted in higher values for the 19+ group which constitute the bulk of SSB (see section 6.2.3).

6.3.1.6 Projections

Estimated $F_{MSY} = F_{0.1}$ is 0.039 (section 6.5 of AFWG report 2014)

The estimated fishing mortality in 2016 is: $F_{12-18} = 0.030$ ($F_{19+} = 0.043$).

If catch is maintained at the current TAC (30,000 t), this would correspond to $F_{12-18} = 0.027$ ($F_{19+} = 0.039$) and would lead to an increase in SSB of 2.5% by 2019.

If F_{12-18} is maintained as status quo, this would lead to catches of 32,658 t in 2018 and to an increase in SSB of 1.8% by 2019.

Raising F_{12-18} to F_{MSY} ($F_{19+} = 0.057$) in 2018—2020 would lead to catches of 42,358 t during that period and to a reduction in SSB of 0.35% by 2019.

6.3.1.7 Additional considerations

Historical fluctuations in the recruitment-at-age 2 (Figures 6.16 and 6.18) are consistent with the 0-group survey index (Figure 6.11), although the 0-group survey index is not used as an input to the SCAA.

The population age structure derived from the model outputs for the old individuals (beyond 19+, Figure 6.20) is consistent with the age structure reported from the slopes and pelagic surveys (Figure 6.14), although these are not used as input to the model.

Recent recruitment levels estimated with SCAA are highly uncertain since they rely on only few years of observations and since are readings from winter survey were not available for years 2012-2015 and no survey data was available for 2016. The use of the autoregressive model for recruitment (random effects in the SCAA) which was introduced in this assessment allows for a projection of the recruitment in recent years, despite the current lack of age data.

6.3.1.8 Assessment summary (Table 6.21, Figure 6.18)

The history of the stock as described by the SCAA model for the period 1992—2016 is summarized in Table 6.21 and Figure 6.18. The key elements are as follows:

- upward trend in Total-stock biomass from 1992 to 2005 followed by stabilization until 2011 and new upward trend until 2016,
- upward trend in Spawning-stock biomass from 1992 to 2009 followed by stabilization (or slight decline) until 2016,
- recruitment failure for year classes 1996—2003 (2y old fish in 1998—2005),
- good (although uncertain) recruitment for year-classes born after 2005,
- fishing mortality for the 19+ is below natural mortality except in the first years of the assessment period (1992-1994).

6.4 Comments to the assessment

As in previous runs, the trends in numbers and biomass estimated using the SCAA are believed to be robust but the absolute biomass levels are not. These absolute estimates are heavily dependent upon the choice of an appropriate scaling coefficient for the Norwegian-Russian

ecosystem survey. The current scaling coefficient used is 3.5 (as in previous assessments) but likely values spans a range of 3 to 6 potentially leading to **uncertainty in SSB from -25% to +75%.**

Estimated fishing mortalities are lower than the assumed natural mortality of M = 0.05 but these estimates depend upon the true absolute stock level, which remains uncertain. In addition, the cod predation estimates suggest greater mortality rates on young juveniles an issue that requires further investigations.

Currently, the survey series used in the SCAA do not appropriately cover the geographical distribution of the adult population. Priority should be given to including data from the slope and pelagic surveys, that include older age groups, in the analytical assessment in the future (WD 5 in 2015).

The new implementation of the SCAA model in TMB has been tested and gives identical results so the earlier implementation with ADMB.

6.5 Biological reference points

No revision. $F_{0.1}$ = 0.039.

Progress towards the development of other reference points for this stock was described in section (6.6) of the AFWG report in 2014.

6.6 Management advice

Moving to F_{MSY} in 2018 would mean a 25% increase in TAC. This seems dangerous for a long-lived, slow-growth, late-maturing redfish stock. Result from the recent pelagic survey in the Norwegian Sea indicate low abundance and the previous ICES Advisory Drafting Group agreed not to move rapidly to the F_{MSY} based purely on model outputs. We therefore recommend that F should be kept at *status quo* for 2018 (=32.7 kt), which represents a gradual increase towards F_{MSY} compared with previous year's quotas. We recommended that this be a single year advice, to be evaluated at the benchmark assessment scheduled prior to AFWG 2018.

6.7 Implementing the ICES F_{MSY} approach

There is no revision since the 2014 AFWG report.

6.8 Possible future model developments

These were outlined in Chapter 0.16 of the Arctic Fisheries Working Group report in 2016 and proposed for the forthcoming benchmark assessment.

Table 6.1. *Sebastes mentella* in Subareas 1 and 2. Nominal catch (t) by countries in Subarea 1, Divisions 2.a and 2.b combined.

Year		Denmark	Faroe Islands	France	Germany	Greenland	Iceland	Ireland	Latvia	Lithuania	Norway	Poland	Portugal	Russia	Spain	UK (Engl. & Wal.)	UK (Scotl.)²	Total
1993	Canada – 8	4	13	50	35	1	-	-	-	-	5 182	-	963	6 260	5	293	-	12 814
1994		28	4	74	18	1	-	3	-	-	6 511	-	895	5 021	30	124	12	12 721
1995		-	3	16	176	2	-	4	-	-	2 646	-	927	6 346	67	93	4	10 284
1996		-	4	75	119	3	-	2	-	-	6 053	-	467	925	328	76	23	8 075
1997		-	4	37	81	16	-	6	-	-	4 657	1	474	2 972	272	71	7	8 598
1998		-	20	73	100	14	-	9	-	-	9 733	13	125	3 646	177	93	41	14 045
1999		-	73	26	202	50	-	3	-	-	7 884	6	65	2 731	29	112	28	11 209
2000		-	50	12	62	29	48	1	-	-	6 020	2	115	3 519	87	-	130	10 075
2001		Estonia	74	16	198	17	3	4	-	-	13 937	5	179	3 775	90	-	120	18 418
2002		15	75	58	99	18	41	4	-	-	2 152	8	242	3 904	190	-	188	6 993
2003		-	64	22	32	8	5	5	-	-	1 210	7	44	952	47	-	124	2 520
2004	Sweden - 1	-	588	13	10	4	10	3	-	-	1 375	42	235	2 879	257	Netherl.	76	5 493
2005		5	1 147	46	33	39	4	4	-	-	1 760	-	140	5 023	163	7	95	8 465
2006	Canada - 433	396	3 808	215	2 483	63	2 513	4	341	845	4 710	2 496	1 804	11 413	710	-	1 027	33 261
2007		684	2 197	234	520	29	1 587	17	349	785	3 209	1 081	1 483	5 660	2 181	-	202	20 219
2008		-	1 849	187	16	25	9	9	267	117	2 220	8	713	7 117	463	13	83	13 096
2009	EU - 889	-	1 343	15	42	-	33	-	-	-	2 677	338	806	3 843	177	3	80	10 246
2010		-	979	175	21	12	2	-	243	457	2 065	-	293	6 414	1 184	-	79	11 924
2011		-	984	175	835	-	2	-	536	565	2 471	11	613	5 037	1 678	-	55	12 962
2012		-	259	-	517	-	36	-	447	449	2 114	318	1 038	4 101	1 780	-	-	11 059
2013		-	697	-	80	21	1	-	280	262	1 835	84	1 078	3 677	1 459	-	-	9 474
2014		-	743	215	446	15	-	-	215	167	13 503	103	505	1 704	1 162	3	-	18 780
2015		-	657	49	242	48	3	-	537	192	19 720	5	678	1 142	2 529	3	52	25 856
2016¹		-	482	92	434	102	8	-	1 243	1 064	17 631	206	1 066	8 419	3 138	-	94	33 979

¹ Provisional figures.   ² Includes UK (E&W) since 2000.

Table 6.2. *Sebastes mentella* in Subareas 1 and 2. Nominal catch (t) by countries in Subarea 1.

YEAR	FAROE ISLANDS	GERMANY	GREENLAND	ICELAND	NORWAY	POLAND	RUSSIA	UK	TOTAL
1993	2	-	-	-	16	-	588	-	606
1994	2	2	-	-	36	-	308	-	348
1995	2	-	-	-	20	-	203	-	225
1996	-	-	-	-	5	-	101	-	106
1997	-	-	3	-	12	-	174	12	190
1998	20	-	-	-	26	-	378	-	424
1999	69	-	-	-	69	-	489	-	627
2000	-	-	-	482	47	-	406	-	501
2001	-	-	-	32	8	-	296	-	307
2002	-	-	-	-	4	-	587	-	591
2003	-	-	-	-	6	-	292	-	298
2004	-	-	-	-	2	-	355	-	357
2005	-	-	-	-	3	-	327	-	330
2006	2	-	-	-	12	-	460	2	476
2007	-	-	-	8	11	-	210	20	249
2008	-	-	-	-	5	-	155	2	162
2009	-	-	-	8	3	-	80	-	91
2010	-	-	-	-	20	-	10	-	30
2011	-	-	-	-	48	-	13	-	61
2012	-	-	-	-	34	-	17	-	51
2013	-	-	-	-	61	-	27	-	88
2014	-	-	-	-	36	-	63	-	99
2015	-	-	18	-	76	1	125	-	220
2016[1]	-	-	15	-	176	1	229	-	421

[1] **Provisional figures.**

Table 6.3. *Sebastes mentella* in Subareas 1 and 2. Nominal catch (t) by countries in Division 2.a (including landings from the pelagic trawl fishery in the international waters).

Year		Faroe Islands	France	Germany	Greenland	Iceland	Ireland	Lithuania	Latvia	Norway	Portugal	Poland	Russia	Spain	UK	Total
1993		11	15	35	1	-	-	-	-	5 029	648	-	5 328	-	2	11 069
1994		2	33	16	1	-	2	-	-	6 119	687	-	4 692	8	4	11 564
1995		1	16	176	2	-	2	-	-	2 251	715	-	5 916	65	43	9 187
1996		-	75	119	3	-	-	-	-	5 895	429	-	677	5	61	7 264
1997		-	37	77	12	-	2	-	-	4 422	410	-	2 341	9	55	7 365
1998		-	73	58	14	-	6	-	-	9 186	118	-	2 626	55	106	12 242
1999		-	16	160	50	-	3	-	-	7 358	56	-	1 340	14	120	9 117
2000		50	11	35	29	-	-	-	-	5 892	98	-	2 167	18	103	8 403
2001		63	12	161	17	-	4	-	-	13 636	105	-	2 716	18	95	16 827
2002		37	54	59	18	41	4	-	-	1 937	124	-	2 615	8	157	5 054
2003		58	18	17	8	5	5	-	-	1 014	17	-	448	8	102	1 700
2004	Sweden - 1	555	8	4	4	10	3	-	-	987	86	-	2 081	7	18	3 764
2005		1 101	36	17	38	2	4	-	-	1 083	71	-	3 307	20	15	5 694
2006	Estonia - 396 Canada – 433	3 793	199	2 475	52	2 513	3	845	-	4 010	1 731	2 467	10 110	589	958	30 574
2007	Estonia - 684	2 157	226	519	29	1 579	16	785	349	3 043	1 395	1 079	5 061	2 159	120	19 201
2008	Netherland - 13	1 821	179	9	24	9	9	117	267	1 952	666	1	6 442	430	62	12 001
2009	EU – 889	1 316	7	23	-	25	-	-	-	2 208	764	338	3 305	137	62	9 074
2010		961	175	13	12	2	-	457	243	1 705	246	-	5 903	1 183	55	10 955
2011		932	175	697	-	2	-	561	536	1 682	599	-	4 326	1 656	19	11 185
2012		259	-	469	-	32	-	449	447	1 500	1 038	311	3 478	1 770	-	9 753
2013		675	-	24	21	1	-	262	280	921	1 055	68	3 293	1 435	-	8 035
2014	Netherland - 2	728	209	411	15	-	-	167	215	4 367	505	100	1 334	1 159	-	9 212
2015	Netherland - 3	657	49	236	25	3	-	192	537	11 214	678	3	480	2 508	47	16 632
2016[1]		474	65	434	74	8	-	1 064	1 243	9 641	1 052	182	3 949	3102	43	21 331

[1] Provisional figures

Table 6.4. *Sebastes mentella* in Subareas 1 and 2. Nominal catch (t) by countries in Division 2.b.

YEAR		NETHER–LAND	FAROE ISLANDS	FRANCE	GERMANY	GREEN–LAND	IRELAND	NORWAY	POLAND	PORTUGAL	RUSSIA	SPAIN	DENMARK	UK	TOTAL
1993	**Canada** - 8	-	-	35	-	-	-	137	-	315	344	57	4	291	1 191
1994		-	-	41	-	-	1	356	-	208	21	22	28	132	809
1995		-	-	-	-	-	2	375	-	212	227	2	-	54	872
1996		-	4	-	-	-	2	153	-	38	147	323	-	38	705
1997		-	4	-	3	1	4	223	1	64	457	263	-	22	1 042
1998		-	-	-	42	-	3	521	13	7	642	122	-	29	1 379
1999		-	4	10	42	-	-	457	6	9	902	15	-	20	1 465
2000		-	-	1	27	-	1	82	2	17	946	69	-	27	1 172
2001		-	11	4	37	-	-	293	5	74	763	72	Estonia	25	1 284
2002		-	38	4	40	-	-	210	8	118	702	182	15	31	1 348
2003		-	6	4	15	-	-	190	7	27	212	39	-	22	522
2004		-	33	5	6	-	-	386	42	149	443	250	-	58	1 372
2005	**Iceland** - 2	7	46	10	17	1	-	673	-	69	1 389	143	5	80	2 442
2006		-	13	16	8	11	1	688	29	73	843	121	-	67	1 870
2007		-	40	8	1	-	1	155	2	88	389	22	-	62	768
2008		-	28	8	7	1	-	263	6	47	520	33	-	19	932
2009	**Canada** - 3	3	27	8	19	-	-	466	1	42	458	41	-	17	1 082
2010		-	18	-	8	-	-	339	-	47	501	1	-	24	938
2011	**Lithuania** - 4	-	52	-	139	-	-	741	11	14	698	23	-	36	1 717
2012	**Iceland** - 4	-	-	-	48	-	-	581	7	-	606	10	-	-	1 256
2013		-	22	-	56	-	-	854	16	23	357	23	-	-	1 351
2014		1	15	6	34	-	-	9 099	3	-	307	3	-	-	9 468
2015		-	-	-	6	5	-	8 429	1	-	536	21	-	5	9 003
2016[1]		-	7	27	-	14	-	7 814	23	14	4 241	36	-	50	12 226

[1] Provisional figures.

Table 6.5. *Sebastes mentella* in Subareas 1 and 2. Nominal catch (t) by countries of the pelagic fishery in international waters of the Norwegian Sea (see text for further details).

YEAR		ESTONIA	FAROE ISLANDS	FRANCE	GERMANY	ICELAND	LATVIA	LITHUANIA	NORWAY	POLAND	PORTUGAL	RUSSIA	SPAIN	UK	TOTAL
2002		-	-	-	9	-	-	-	-	-	-	-	-	-	9
2003		-	-	-	40	-	-	-	-	-	-	-	-	-	40
2004		-	500	-	2	-	-	-	-	-	-	1 510	-	-	2 012
2005		-	1 083	-	20	-	-	-	-	-	-	3 299	-	-	4 402
2006	**Canada** - 433	396	3 766	192	2 475	2 510	341	845	2 862	2 447	1 697	9 390	575	841	28 770
2007		684	1 968	226	497	1 579	349	785	1 813	1 079	1 377	3 645	2 155	-	16 157
2008		-	1 797	-	-	-	267	117	330	-	641	4 901	390	-	8 443
2009	**EU** - 889	-	1 253	-	-	-	-	-	-	337	701	1 975	135	-	5 290
2010		-	912	-	-	-	243	457	450	-	244	5 103	820	-	8 229
2011		-	740	175	693	-	536	561	342	-	595	3 621	1 648	-	8 911
2012		-	259	-	469	31	447	449	-	311	1 038	2 714	1 768	-	7 486
2013		8	675	-	-	-	280	262	1	68	1 078	2 720	1 435	-	6 527
2014		-	697	-	409	-	215	167	-	100	505	795	1 146	-	4 034
2015		-	606	-	231	-	537	192	-	-	678	-	2 508	-	4 752
2016[1]		-	393	-	272	-	1064	1243	3	-	821	512	2 862	-	7 170

[1] Provisional figures.

Table 6.6. *S. mentella* in Subareas 1 and 2. Catch numbers-at-age 6 to 18 and 19+ (in thousands) and total landings (in tonnes). For the period 2012-2016 age data is missing from the pelagic fishery. For the period 2015-2016, age data is missing from all fisheries. The numbers-at-age have been estimated following the method outlined in section 6.2.2.

YEAR/AGE	6	7	8	9	10	11	12	13	14	15	16	17	18	+GP	TOTAL NO.	TONS LAND.
1992	1873	2498	1898	1622	1780	1531	2108	2288	2258	2506	2137	1512	677	9258	33946	15590
1993	159	159	174	512	2094	3139	2631	2308	2987	1875	1514	1053	527	6022	25154	12814
1994	738	730	722	992	2561	2734	3060	1535	2253	2182	3336	1284	734	3257	26118	12721
1995	662	941	1279	719	740	1230	2013	4297	3300	2162	1454	757	794	2404	22752	10284
1996	223	634	1699	1554	1236	1078	1146	1413	1865	880	621	498	700	2247	15794	8075
1997	125	533	1287	1247	1297	1244	876	1416	1784	1217	537	1177	342	3568	16650	8598
1998	37	882	2904	4236	3995	2741	1877	1373	1277	1595	1117	784	786	6241	29845	14045
1999	9	83	441	1511	2250	3262	1867	1454	1447	1557	1418	1317	658	3919	21193	11209
2000	1	24	390	1235	2460	2149	1816	1205	1001	993	932	505	596	5705	19012	10075
2001	117	372	542	976	925	1712	2651	2660	1911	1773	1220	714	814	16234	32621	18418
2002	2	40	252	572	709	532	1382	1893	1617	855	629	163	237	4082	12965	6993
2003	6	37	103	93	132	220	384	391	434	466	513	199	231	1193	4402	2520
2004	11	24	108	148	427	624	931	580	1385	1047	937	927	549	2055	9753	5493
2005	5	44	128	347	540	567	432	1607	1332	3174	1041	1216	1024	4266	15723	8465
2006	0	10	8	89	153	256	877	1980	2774	4580	5154	4823	4261	35350	60315	33261
2007	0	1	3	22	33	86	235	631	2194	2825	3657	4359	3540	15824	33410	20219
2008	0	0	1	10	44	128	186	492	541	1444	1423	923	1730	16389	23311	13095
2009	0	1	16	22	42	48	1507	520	983	1136	1623	1292	2347	7389	16926	10246
2010	10	4	6	19	34	55	61	237	540	532	848	828	792	14659	18625	11924
2011	4	4	4	25	55	114	234	186	177	482	415	445	394	17315	19854	12962
2012	4	24	29	24	48	95	88	372	226	209	528	537	362	12844	15390	11056
2013	0	14	156	122	531	139	200	138	179	331	315	321	749	11390	14585	9474
2014[1]	14	27	350	220	129	474	226	179	179	181	341	384	266	22670	25640	18780
2015[2]	0	46	90	1077	499	257	847	378	275	261	245	460	524	31551	36510	25836
2016[2]	0	0	129	237	2538	1097	535	1757	620	460	370	355	620	40420	49138	33979

Table 6.7. *S.mentella* in Subareas 1 and 2. Weights at age (kg).

YEAR/AGE	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
1992	0.08	0.11	0.15	0.18	0.22	0.27	0.31	0.35	0.39	0.43	0.47	0.51	0.55	0.72
1993	0.07	0.10	0.13	0.17	0.21	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.54	0.73
1994	0.12	0.17	0.21	0.27	0.32	0.37	0.42	0.47	0.51	0.56	0.60	0.64	0.68	0.83
1995	0.12	0.16	0.21	0.25	0.30	0.35	0.39	0.44	0.48	0.52	0.55	0.59	0.62	0.74
1996	0.12	0.17	0.22	0.27	0.32	0.38	0.43	0.48	0.53	0.58	0.63	0.67	0.71	0.89
1997	0.11	0.16	0.20	0.25	0.30	0.36	0.41	0.46	0.50	0.55	0.59	0.63	0.67	0.84
1998	0.12	0.16	0.21	0.26	0.31	0.36	0.40	0.45	0.49	0.53	0.57	0.61	0.64	0.77
1999	0.14	0.19	0.24	0.29	0.33	0.38	0.43	0.47	0.51	0.54	0.58	0.61	0.63	0.74
2000	0.11	0.15	0.19	0.24	0.29	0.33	0.38	0.43	0.48	0.52	0.56	0.60	0.64	0.80
2001	0.10	0.14	0.18	0.22	0.27	0.31	0.36	0.40	0.44	0.48	0.52	0.56	0.59	0.73
2002	0.10	0.14	0.18	0.22	0.27	0.31	0.36	0.40	0.45	0.49	0.53	0.57	0.60	0.76
2003	0.11	0.15	0.19	0.24	0.28	0.33	0.37	0.42	0.46	0.50	0.54	0.58	0.61	0.75
2004	0.11	0.15	0.20	0.25	0.29	0.34	0.39	0.43	0.48	0.52	0.56	0.60	0.63	0.78
2005	0.11	0.15	0.20	0.25	0.29	0.34	0.38	0.43	0.47	0.51	0.55	0.58	0.61	0.74
2006	0.11	0.15	0.20	0.24	0.29	0.34	0.38	0.43	0.47	0.51	0.54	0.58	0.61	0.74
2007	0.12	0.16	0.20	0.25	0.30	0.34	0.38	0.42	0.46	0.50	0.53	0.56	0.59	0.70
2008	0.11	0.15	0.19	0.24	0.28	0.33	0.37	0.41	0.45	0.49	0.53	0.56	0.59	0.72
2009	0.12	0.16	0.21	0.25	0.30	0.34	0.39	0.43	0.47	0.51	0.55	0.58	0.61	0.73
2010	0.13	0.18	0.23	0.27	0.32	0.36	0.40	0.44	0.48	0.51	0.54	0.57	0.59	0.68
2011	0.14	0.18	0.23	0.28	0.33	0.38	0.42	0.46	0.50	0.54	0.57	0.60	0.63	0.74
2012	0.13	0.17	0.22	0.27	0.32	0.37	0.42	0.46	0.50	0.54	0.58	0.61	0.64	0.76
2013[1]	0.13	0.18	0.22	0.27	0.32	0.36	0.40	0.44	0.47	0.51	0.53	0.56	0.59	0.67
2014	0.12	0.16	0.20	0.25	0.30	0.35	0.40	0.44	0.48	0.53	0.56	0.60	0.63	0.77
2015	0.14	0.19	0.23	0.28	0.33	0.38	0.43	0.47	0.51	0.55	0.58	0.61	0.64	0.74
2016	0.14	0.19	0.23	0.28	0.33	0.38	0.43	0.47	0.51	0.55	0.58	0.61	0.64	0.74

[1] preliminary figures

Table 6.8 Pelagic *Sebastes mentella* in the Norwegian Sea (outside the EEZ). Catch numbers-at-age.

NUMBERS10−3	AGE								
YEAR	11	12	13	14	15	16	17	18	19+
2006	23	93	1083	323	1563	3628	2514	3756	29704
2007	75	440	1331	2909	3347	4138	3692	3437	9114
2008	28	146	115	143	214	594	752	753	13258
2009	9	1314	294	471	889	999	869	1150	2981
2010	0	0	130	336	254	466	467	508	11510
2011	0	223	83	83	168	136	166	136	13182
2012[1]	29	19	294	146	132	217	288	126	8939
2013[2]	123	158	96	169	246	196	238	598	7968
2014[3]	406	103	125	70	113	151	112	130	4398
2015[3]	161	714	170	190	98	145	182	129	4859
2016[3]	570	376	1565	345	352	166	231	277	7101

[1] no age data in 2012, catch numbers-at-age are estimated from proportions at age in 2011 and in 2013.

[2] no age data from the catches in 2013. Age readings from the research survey conducted in September 2013 are used to derive catch numbers-at-age are.

[3] no age data in 2014 – 2016, catch numbers-at-age are estimated from previous year according to protocol described in section 6.2.2.

Table 6.9 Pelagic *Sebastes mentella* in the Norwegian Sea (outside the EEZ). Catch weights at age (kg).

	AGE								
YEAR	11	12	13	14	15	16	17	18	19+
2006	0,44	0,44	0,52	0,44	0,49	0,55	0,53	0,56	0,61
2007	0,39	0,43	0,41	0,48	0,50	0,52	0,55	0,57	0,64
2008	0,36	0,47	0,56	0,50	0,56	0,54	0,56	0,55	0,64
2009	0,38	0,44	0,45	0,48	0,54	0,59	0,64	0,58	0,69
2010[1]	-	-	0,62	0,56	0,54	0,59	0,59	0,56	0,61
2011[1]	-	0,48	0,54	0,54	0,64	0,59	0,54	0,59	0,59
2012	No data	-	-	-	-	-	-	-	-
2013[2]	0,31	-	-	-	0,56	0,62	0,60	0,62	0,68
2014	No data	-	-	-	-	-	-	-	-
2015	No data	-	-	-	-	-	-	-	-
2016	No data	-	-	-	-	-	-	-	-

[1] preliminary figures

[4] As observed in the research survey in the Norwegian Sea in September 2013

Table 6.10. *S. mentella* **in Subareas 1 and 2. Total catch numbers at length, in thousands, for 20112016.**

	LENGTH GROUP																
	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
Year	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52
2011	0	12	0	0	1	8	249	2544	6481	6528	3620	829	95	18	1	0	0
2012	0	0	23	19	26	28	41	287	1898	5030	5385	1911	451	197	43	23	0
2013	0	0	4	32	154	137	90	69	1382	4214	4480	1633	497	197	0	0	0
2014	0	5	0	25	29	235	660	697	3358	7667	8544	3808	787	34	0	0	0
2015	Data not available at the time of the working group																
2016	Data not available at the time of the working group																

Table 6.11. *S. mentella* **in Subareas 1 and 2. Catch numbers at length, in thousands, in the pelagic fishery for 2011-2016.**

	LENGTH GROUP																
	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
Year	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52
2011	0	0	0	0	1	8	244	2562	5887	4425	1537	287	13	0	1	0	0
2012	0	0	0	0	0	0	106	2014	5092	3681	952	48	0	0	0	0	0
2013	0	0	0	0	0	0	75	1352	4791	2967	730	87	6	0	0	0	0
2014	0	0	0	0	0	3	14	349	2408	2454	827	80	6	1	0	0	0
2015	Data not available at the time of the working group																
2016	Data not available at the time of the working group																

Table 6.12 REDFISH in Subareas 1 and 2. Nominal catch (t) by countries in Subarea 1, Divisions 2.a and 2.b combined for both *Sebastes mentella* and *S. norvegicus*.

YEAR	CANADA	DENMARK	FAROE ISLANDS	FRANCE	GERMANY[4]	GREENLAND	ICELAND	IRELAND	NETHERLANDS	NORWAY	POLAND	PORTUGAL	RUSSIA[5]	SPAIN	UK (E&W)	UK (SCOT.)	TOTAL
1984	-	-	-	2 970	7 457	-	-	-	-	18 650	-	1 806	69 689	25	716	-	101 313
1985	-	-	-	3 326	6 566	-	-	-	-	20 456	-	2 056	59 943	38	167	-	92 552
1986	-	-	29	2 719	4 884	-	-	-	-	23 255	-	1 591	20 694	-	129	14	53 315
1987	-	+	450[3]	1 611	5 829	-	-	-	-	18 051	-	1 175	7 215	25	230	9	34 595
1988	-	-	973	3 349	2 355	-	-	-	-	24 662	-	500	9 139	26	468	2	41 494
1989	-	-	338	1 849	4 245	-	-	-	-	25 295	-	340	14 344	5[2]	271	1	46 688
1990	-	37[3]	386	1 821	6 741	-	-	-	-	34 090	-	830	18 918	-	333	-	63 156
1991	-	23	639	791	981	-	-	-	-	49 463	-	166	15 354	1	336	13	67 768
1992	-	9	58	1 301	530	614	-	-	-	23 451	-	977	4 335	16	479	3	31 773
1993	8[3]	4	152	921	685	15	-	-	-	18 319	-	1 040	7 573	65	734	1	29 517
1994	-	28	26	771	1026	6	4	3	-	21 466	-	985	6 220	34	259	13	30 841
1995	-	-	30	748	692	7	1	5	1	16 162	-	936	6 985	67	252	13	25 899
1996	-	-	42[3]	746	618	37	-	2	-	21 675	-	523	1 641	408	305	121	26 118
1997	-	-	7	1 011	538	39[2]	-	11	-	18 839	1	535	4 556	308	235	29	26 109
1998	-	-	98	567	231	47[3]	-	28	-	26 273	13	131	5 278	228	211	94	33 199
1999	-	-	108	61[3]	430	97	14	10	-	24 634	6	68	4 422	36	247	62	30 195
2000	-	-	67[3]	25	222	51	65	1	-	19 052	2	131	4 631	87		203[6]	24 537
2001	-	-	111[3]	46	436	34	3	5	-	23 071	5	186	4 738	91	Est	239[6]	28 965
2002	-	-	135[3]	89	141	49	44	4	-	10 713	8[3]	276	4 736	193[2]	15	234[6]	16 637
2003	Swe	-	173[3]	31	154	44[3]	9	5[3]	89	8 063	7	50	1 431	47[2]	-	258[6]	10 361
2004	1	-	607	17[3]	78	24[3]	40	3	33	7 608[1 2]	42	240	3 601[2]	260[2]	-	146[6]	12 699
2005	Can	Lith	1 194	56	106	75[3]	12[2]	4[3]	55[2]	7 844[1 2]	-	196	5 637	171[3]	5	147[6]	15 501
2006	433	845	3 919	223	2 518	107[3]	2 544[3]	12[3]	21	11 015	2 496[2]	1 873	12 126	719[2]	396	1 066[6]	40 313
2007	Latv	785	2 343	249	587	84[3]	1 647[2]	7[3]	20	8 993[2]	1 081[2]	1 708	6 550	2 186[2]	684	257[6]	27 181
2008	267	117	2 123[3]	250	46	96[3]	36[3]	15[3]	15	7 436[1]	8	785	7 866	467[2]	EU[7]	168[6]	19 694
2009	-	-	1 413	16	100	81	99	-	4	8 128	338	836	4 541	177	889	110	16 732
2010	243[3]	457[3]	1 150	226	52	84[3]	24[3]	-	-	8 059	1[3]	321	6 979	1 187	-	123	18 906
2011	536	565	1 008[2]	228	844	51	24	-	1	7 152	59	638	5 956	1 684[2]	-	68	18 814
2012	447	449	346	182	588	58	59	12	5	6 362	352	1 055	4 782	1 780[2]	-	100	16 577
2013	280	262	780	353	81	66	9	1	-	5 606	103	1 114	4 474	1 459	-	493	15 082
2014	215	167	810	433	451	35	29	-	4	16 556	124	510	2 510	1 162	-	211	23 217
2015	537	192	732	102	266	259	39	-	3	22 208	22	678	1 806	2 530	Denm	108	29 484
2016[1]	1 243	1 064	672	165	497	161	79			22 237	228	1 066	9 283	3 140	7	197	40 039

[1] Provisional figures.

[2] Working Group figure.

[3] As reported to Norwegian authorities or NEAFC.

[4] Includes former GDR prior to 1991.

[5] USSR prior to 1991.

[6] UK(E&W)+UK(Scot.)

[7] EU not split on countries.

Table 6.13. REDFISH in Subarea IV (North Sea). Nominal catch (t) by countries as officially reported to ICES. Not included in the assessment.

YEAR	BELGIUM	DENMARK	FAROE ISLANDS	FRANCE	GERMANY	IRELAND	NETHER–LANDS	NORWAY	SWEDEN	UK (E&W)	UK (SCOT.)	TOTAL
1986	-	24	-	578	183	-	-	1,048	-	35	1	1,869
1987	-	16	3	833	70	-	-	411	-	16	55	1,404
1988	-	32	90	915	188	-	-	696	-	125	9	2,055
1989	1	23	13	554	111	-	-	500[2]	-	134	6	1,342
1990	+	41	25	554	47	-	-	483[2]	-	369	6	1,525
1991	5	29	144	914	213	-	2	415[2]	-	43	38	1,803
1992	4	22	23	1,960	170	-	1	416	-	65	122	2,783
1993	28	14	4	1,211	33	-	1	373	-	138	71	1,873
1994	4	13	1	863	324	-	8	371	-	38	66	1,688
1995	16	12	65	1,120	80	-	16	297	-	46	241	1,893
1996	20	20	1	932	74	-	41	363	-	37	146	1,634
1997	16	23	-	1,049	45	-	53	595	-	21	528	2,330
1998	2	27	12	570	370	4	21	1,113	-	68	681	2,868
1999	3	52	1	-	58	39	16	862	-	67	465	1,563
2000	5	41	-	224	19	28	19	443	-	132	486	1,397
2001	4	96	-	272	13	19	+	421	-	80	458	1,363
2002	2	40	2	98	11	7	+	241	-		524[3]	925
2003	1	71	2	26	2	-	-	474	-	Portugal	463[3]	1,071
2004	+	42	3	26	1	-	-	287	-	-	214[3]	578
2005	2	34	-	10	1	-	-	84	-	-	28[3]	159
2006	1	49	1	12	3	-	-	155	-	33	79[3]	333
2007[1]	+	27	-	8	1	-	-	107	+	-	78[3]	221
2008[1]	+	3	-	8	1	-	-	77	1	-	54[3]	144
2009	-	4	1	38	-	-	-	119	+	-	86[3]	248
2010	-	5	-	3	-	-	-	62	-	-	150[3]	220
2011	-	10	-	90	1	-	-	66	+	-	71[3]	238
2012	-	10	-	19	-	-	-	71	+	-	87[3]	187
2013	-	7	-	40	+	-	-	54	+	-	176[3]	277
2014	-	-	-	32	1	-	-	160	-	-	933	286
2015[1]	-	1	-	14	1	-	-	157	+	-	61	235
2016[1]	-	3	-	10	+	-	-	180	+	-	21	215

[1] Provisional figures.

[2] Working Group figure.

[3] UK(E/W)+UK(Scotl)

+ less than 0.5 ton.

Table 6.14. *Sebastes mentella*. **Average catch (numbers of specimens) per hour trawling of different ages of** *Sebastes mentella* **in the Russian groundfish survey in the Barents Sea and Svalbard areas (1976-1983 published in "Annales Biologiques").**

YEAR CLASS	0	1	2	3	4	5	6	7	8	9	10	11
1974	-	-	4.8	-	4.9	22.8	4.8	4.8	-	-	-	3
1975	-	7.4	-	1.7	6.4	2.4	3.5	5	-	-	4	-
1976	7	-	8.1	1.2	2.5	6.8	4.9	5	1	13	-	-
1977	-	0.2	0.2	0.2	0.9	5.1	3.7	1	19	2	-	-
1978	0.8	0.02	0.9	1	5	3.8	2	20	6	-	-	-
1979	-	1.9	1.4	3.6	2.3	9	11	16	1	-	-	0.1
1980	0.3	0.4	2	2.5	16	6	11	25	2	-	1.5	2
1981	-	2.2	3.9	20	6	12	47	18	6.3	1.6	0.5	1
1982	19.8	13.2	13	15	34	44	39	32.6	4.3	3.1	4.9	+
1983	12.5	3	5	6	31	34	32.3	13.3	4	4.2	0.6	1.1
1984	-	10	2	-	5	18.3	19	2.2	2.4	0.2	1.7	2.4
1985	107	7	-	1	5.2	16.2	1.7	1.7	0.6	2.8	3.8	0.3
1986	2	-	1	1.8	8.4	3.6	2.1	1.2	5.6	8.2	0.9	0.7
1987	-	3	37.9	1.3	8	4.1	2	10.6	9.6	1.4	2	1.3
1988	4	58.1	4.3	13.3	25.8	3.9	8.6	11.2	2.8	4.2	3	4.7
1989	8.7	9	17	23.4	4.6	5.4	4	6.6	6.6	4.1	7.7	5.3
1990	2.5	6.3	6.1	1	4.3	1.7	11.5	6.5	5.5	6.7	7.4	3.6
1991	0.3	1	0.5	1.5	1.2	11.3	3.9	3.3	4.6	5.8	2.7	1.9
1992	0.6	+	0.2	0.1	4.3	1.3	2	2.3	4.9	2.3	1	4.1
1993[1]	-	+	1.5	1.8	1	1.2	3	4.2	2.6	2	3.2	2.1
1994	0.3	3.5	1.7	1.7	0.9	3.6	5.2	4.3	3.1	3.3	1.8	1.2
1995	2.8	1	1.1	0.4	2.2	2.6	3.5	3.4	2.9	1.2	1	8.5
1996[2]	+	0.1	0.1	0.4	0.7	1.1	1	1.4	1	0.8	3.7	0.6
1997	-	-	+	0.4	0.5	0.3	0.9	0.6	1	1.1	0.5	0.4
1998	-	0.1	0.2	0.3	0.2	1.1	0.5	0.7	1	0.4	0.4	0.7
1999	0.1	-	0.1	+	0.1	0.3	0.5	0.8	0.5	0.2	0.4	0.6
2000	-	0.6	0.1	0.5	0.3	0.3	0.6	0.4	0.1	0.1	0.7	0.3
2001	-	0.1	0.4	-	0.1	0.2	0.2	0.3	0.2	0.8	0.1	1
2002[3]	0.1	0.5	0.1	-	-	0.1	0.5	0.4	1.5	0.5	1	1.1
2003	-	-	0.1	-	0.3	1.0	0.5	4.8	2.1	3.7	1.3	1.9
2004	-	0.2	0.3	0.5	1.5	0.9	4.4	3.7	7.5	4.1	3.1	3.3
2005	-	-	1.4	1.9	1.4	2.3	3.9	7.2	6.1	6.8	3.1	
2006[4]	0.1	1.8	1.2	1.1	0.8	2.1	4.1	3.0	6.1	5.9		
2007	2.5	0.4	0.1	1.2	1.7	2.4	3.6	4.3	7.4			
2008	0.1	0.1	1.6	1.8	4.1	2.9	5.8	5.5				
2009	1.6	1.9	1.1	4.4	4.8	2.9	4.8					
2010	7.5	0.7	1.2	1.5	1.9	1.6						
2011	0.1	0.3	0.6	1.6	1.6							
2012	0.2	0.7	0.5	0.3								
2013	0.1	0.1	0.4									
2014	3.6	1.0										
2015	6.6											

[1] - Not complete area coverage of Division 2.b.

[2] - Area surveyed restricted to Subarea 1 and Division 2.a only.

[3] - Area surveyed restricted to Subarea 1 and Division 2.b onl

[4]- Area surveyed restricted to Division 2.a and 2.b only.

Table 6.15a. *Sebastes mentella*[1] in Division 2.b. Abundance indices (on length) from the bottom-trawl survey in the Svalbard area (Division 2.b) in summer/fall 1986-2016 (numbers in millions).

YEAR	LENGTH GROUP (CM)									TOTAL
	5.0–9.9	10.0–14.9	15.0–19.9	20.0–24.9	25.0–29.9	30.0–34.9	35.0–39.9	40.0–44.9	>45.0	
1986[2]	6	101	192	17	10	5	2	4	+	338
1987[2]	20	14	140	19	6	2	1	2	+	208
1988[2]	33	23	82	77	7	3	2	2	+	228
1989	566	225	24	72	17	2	2	8	4	921
1990	184	820	59	65	111	23	15	7	3	1,287
1991	1,533	1,426	563	55	138	38	30	7	1	3,791
1992	149	446	268	43	22	15	4	7	4	958
1993	9	320	272	89	16	13	3	1	+	722
1994	4	284	613	242	10	9	2	2	1	1,165
1995	33	33	417	349	77	18	5	1	+	933
1996	56	69	139	310	97	8	4	1	1	685
1997	3	44	13	65	57	9	5	+	+	195
1998	+	37	35	28	132	73	45	2	+	353
1999	4	3	121	62	259	169	42	1	0	661
2000	+	10	31	59	126	143	21	1	0	391
2001	1	5	3	32	57	228	50	3	0	378
2002	1	4	6	21	62	266	47	4	+	410
2003	1	5	7	11	56	271	50	1	0	403
2004	0	2	7	6	14	78	53	2	0	163
2005	1	1	6	11	19	93	63	1	0	196
2006	82	6	5	7	49	211	101	3	0	463
2007	98	68	1	5	11	95	109	3	0	387
2008	119	45	20	3	9	25	79	4	0	303
2009	8	114	83	14	3	23	191	5	0	440
2010	96	19	46	39	2	20	88	7	0	317
2011	124	91	82	46	11	8	67	5	1	436
2012	27	73	68	78	48	8	91	9	0	401
2013	33	44	131	112	71	19	86	12	0	509
2014[3]	3	12	56	49	39	23	58	17	+	257
2015	74	7	28	144	114	64	69	25	0	525
2016	215	30	41	201	146	150	152	51	+	984

[1] - **Includes some unidentified *Sebastes* specimens, mostly less than 15 cm.**

[2] - **Old trawl equipment (bobbins gear and 80 meter sweep length)**

[3] - **Poor survey coverage in 2014**

Table 6.15b. *Sebastes mentella*[1] **in Division 2.b. Norwegian bottom-trawl survey indices (on age) in the Svalbard area (Division 2.b) in summer/fall 1992-2016 (numbers in millions).**

							AGE									
Year	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1992	283	419	484	131	58	45	14	8	5	2	7	2	1	3	1 462
1993	2	527	117	202	142	8	23	6	13	1	7	1	1	+	1 050
1994	7	280	290	202	235	42	94	1	1	3	4	1	1	+	1 161
1995	4	50	365	237	132	61	19	17	11	+	1	3	0	0	900
1996	23	47	15	37	105	144	84	17	51	32	34	9	6	2	605
1997	8	43	6	6	40	20	30	25	7	3	1	2	2	1	194
1998	+	26	28	14	10	13	69	66	49	15	1	6	15	5	317
1999	3	16	114	27	36	53	117	78	67	41	45	11	19	13	640
2000	4	6	6	14	35	22	31	54	81	60	24	24	10	8	379
2001	2	4	3	1	9	16	22	30	34	57	57	50	54	6	344
2002	3	2	4	2	5	22	34	23	88	36	62	64	15	21	379
2003	0.3	3	4	3	5	4	29	31	50	59	45	70	38	23	365
2004	1	1	3	3	1	4	2	9	9	18	15	17	19	9	113
2005	1	1	2	3	3	6	9	15	14	16	14	21	22	25	152
2006	33	1	3	3	2	9	17	27	24	35	29	45	25	34	287
2007	23	45	0	0	3	2	5	5	8	5	5	9	29	19	158
2008	6	22	22	12	1	2	2	5	4	4	3	5	10	6	102
2009	14	43	55	41	34	19	7	1	2	2	9	10	26	7	270
2010	No age readings														
2011	112	45	57	43	34	35	22	7	2	0	1	0	0	2	360
2012	26	33	38	33	39	49	30	30	14	4	1	1	1	0	298
2013	31	2	29	50	49	65	55	79	21	5	14	11	1	1	509
2014[2]	+	3	2	4	23	29	17	29	15	19	12	13	6	2	290
2015	60	2	12	45	61	45	52	68	37	12	9	6	7	4	547
2016	No age readings available														

[1] - **Includes some unidentified** *Sebastes* **specimens, mostly less than 15 cm.**

[2] - **Poor survey coverage in 2014**

Table 6.16a. *Sebastes mentella*[1]. **Abundance indices (on length) from the bottom-trawl surveys in the Barents Sea in the winter 1986-2017 (numbers in millions). The area coverage was extended from 1993 onwards.**

				LENGTH GROUP (CM)						
YEAR	5.0–9.9	10.0–14.9	15.0–19.9	20.0–24.9	25.0–29.9	30.0–34.9	35.0–39.9	40.0–44.9	>45.0	TOTAL
1986	81	152	205	88	169	130	88	24	13.8	950
1987	72	25	227	56	35	11	5	1	0.1	433
1988	587	25	133	182	40	50	48	4	0.1	1068
1989	623	55	28	177	58	9	8	2	0.3	961
1990	324	305	36	56	80	13	13	2	0.2	828
1991	395	449	86	39	96	35	24	3	0.2	1127
1992	139	367	227	35	55	34	8	2	0.5	867
1993	31	593	320	116	24	25	6	1	+	1117
1994	7	259	289	284	51	70	20	1	0.1	982
1995	264	71	638	506	91	69	31	4	0.5	1674
1996	213	100	191	338	134	42	17	1	0.3	1037
1997[2]	63	121	25	278	274	72	41	5	0.2	879
1998[2]	1	91	63	101	203	41	13	2	0.2	514
1999	2	7	68	37	167	72	21	3	0.1	377
2000	9	13	39	77	142	97	27	7	1.5	412
2001	9	22	7	55	77	73	9	1	0.1	254
2002	16	7	19	42	104	114	23	1	+	326
2003	4	4	10	13	71	200	47	6	0.3	354
2004	2	3	7	19	33	87	32	2	0.1	184
2005	+	6	7	11	28	153	87	4	0.2	297
2006	99	2	10	15	23	103	82	3	0.7	336
2007	446	125	3	6	12	119	120	7	0.2	838
2008	846	354	26	5	12	114	180	5	0.1	1542
2009	94	322	134	5	9	66	160	6	0	797
2010	647	273	213	64	7	73	190	6	0	1474
2011	496	228	211	148	14	46	157	5	0	1304
2012	127	275	84	123	46	14	151	17	0.2	838
2013	248	224	243	158	143	35	192	27	0.3	1271
2014	89	173	249	113	123	51	117	14	0.2	929
2015	175	111	218	303	291	214	172	18	0.1	1501
2016	612	105	146	326	209	159	120	14	0.6	1692
2017	593	210	72	201	289	312	233	11	0.1	1918

[1] - Includes some unidentified *Sebastes* specimens, mostly less than 15 cm.

[2] - Adjusted indices to account for not covering the Russian EEZ in Subarea 1.

Table 6.16b. *Sebastes mentella*[1] **in Subareas 1 and 2. Preliminary Norwegian bottom-trawl indices (on age) from the annual Barents Sea survey in February 1992-2017 (numbers in millions). The area coverage was extended from 1993 onwards.**

	AGE														
Year	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1992	351	252	132	56	14	11	3	9	18	16	12	11	2	5	892
1993	38	473	192	242	62	45	19	22	13	11	10	4	2	3	1,136
1994	7	85	332	189	370	228	73	42	3	30	8	14	25	7	1,413
1995	308	45	146	264	364	211	69	23	7	17	23	9	11	10	1,507
1996	173	119	109	114	128	122	106	64	24	19	12	7	8	4	1,009
1997[2]	43	101	19	54	96	43	44	171	76	74	39	29	10	9	808
1998[2]	1	73	49	27	13	52	107	104	41	18	7	4	3	3	502
1999	1	+	32	43	30	24	30	81	79	28	2	1	6	+	357
2000	9	12	21	17	9	39	77	73	50	41	14	10	7	6	385
2001	1	17	8	1	7	22	39	30	34	23	24	17	9	3	236
2002	18	4	12	7	4	14	49	55	27	19	34	24	28	11	306
2003	0	2	2	4	6	6	14	39	24	34	39	65	46	20	301
2004	0	2	3	1	9	12	15	20	36	8	28	3	25	12	172
2005	0	4	3	3	6	6	11	15	23	14	21	40	35	49	229
2006	4	1	5	5	5	8	15	12	6	15	21	17	32	36	180
2007	428	82	13	1	2	2	5	7	8	8	21	20	31	35	144
2008	648	173	107	11	0	2	5	7	5	10	10	28	27	40	1073
2009	107	112	104	82	63	32	14	9	9	6	16	7	21	11	593
2010	150	239	172	161	103	71	27	13	4	7	13	12	21	33	1027
2011	391	211	106	125	109	67	47	14	5	4	1	3	2	10	1095
2012	No age readings														
2013	No age readings														
2014	No age readings														
2015	No age readings														
2016	No age readings														
2017	No age readings														

[1] **- Includes some unidentified** *Sebastes* **specimens, mostly less than 15 cm.**

[2] **- Adjusted indices to account for not covering the Russian EEZ in Subarea 1**

Table 6.17. Comparison of results on *Sebastes mentella* from the Norwegian Sea pelagic surveys in 2008, 2009, 2013 and 2016.

	2008	2009	2013	2016
mean length (cm) All/M/F[1]	37.0 / 36.4 / 37.5	36.6 / 36.0 / 37.1	37.5 / 37.0 / 38.1	37.7 / 37.0 / 38.3
mean length (cm) S/DSL/D[2]	37.2 / 36.8 / 39.1	37.2 / 36.5 / 38.3	37.1 / 37.4 / 38.9	38.1 / 37.6 / 38.4
mean weight (g) All/M/F	619 / 585 / 648	625 / 609 / 666	659 / 625 / 706	656 / 619 / 694
Mean age (y) All/M/F	25 / 25 / 25	25 / 25 / 24	- / - / -	- / - / -
Sex ratio	45% (M) / 55% (F)	45% (M) / 55% (F)	59% (M) / 41% (F)	50% (M) / 50% (F)
Occurrence	96%	100%	95%	80%
Catch rates	3.80 t/NM²	3.94 t/NM²	3.47 t/NM²	1,01 t/NM²
mean s_A	33 m²/NM²	34 m²/NM²	19 m²/NM²	5.2 m²/NM²
Total Area	53,720 NM²	69,520 NM²	69,520 NM²	67,150 NM²
Abundance (Acoustics)[3]	395,000 t	532,000 t	297,000 t	136,000 t
Abundance (Trawl)[4]	406,000 t	548,000 t	482,000 t	116,000 t

[1] M = males only, F = females only

[2] S = shallower than DSL, DSL = deep scattering layer, D = deeper than DSL

[3] The abundance derived from hydroacoustics is calculated assuming a Length-dependent target strength equation of TS=20log(L)-68.0. In 2016, the TS equation used was TS=20log(L)-69.6, following recommendation from ICES-WKTAR (2010).

[4] Trawls: Gloria 2048 in 2008 and 2009, Gloria 2560 HO helix in 2013 and Gloria 1024 in 2016. Trawl catchability for redfish set to 0.5 for all trawls, based on results from Bethke et al (2010).

Table 6.18. *Sebastes mentella* in Subareas 1 and 2. Abundance indices (on age) from the Ecosystem survey in August-September 1996-2016 covering the Norwegian Economic Zone (NEZ) and Svalbard incl. the area north and east of Spitsbergen (numbers in thousands and total biomass in thousand tonnes) and the continental slope down to 1500 m.

							A	GE										
Year	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	Total N	Total B
1996	146198	112742	22353	53507	165531	181980	108738	43328	65310	40546	38254	19843	29446	10931	17414	1 056 120	171
1997	62682	130816	12492	23452	74342	55880	76607	82503	17640	14274	675	2238	1723	633	8765	564 723	73
1998	313	78767	85715	39849	25805	23413	84825	100332	54287	24329	11334	7457	15250	576	25212	577 464	105
1999	5359	23240	117170	47851	41608	76797	128677	73306	58018	64781	49890	13565	18458	12171	24672	755 562	155
2000	5964	23169	14336	19960	52666	68081	83857	77513	100442	72294	71148	36599	17183	20590	26501	690 304	178
2001	5026	6541	10957	1093	19766	25591	36594	51644	44407	61704	50083	86122	53952	15699	31877	501 057	162
2002	9112	6646	7379	3821	8635	28215	47456	63903	103368	49964	76133	71970	25241	36765	34957	573 565	181
2003	3954	7394	6142	3540	8030	9388	48564	59051	98554	69901	83192	73521	69970	37162	47323	625 687	213
2004	9068	10837	9008	7292	2510	7896	8193	15268	25544	29654	35249	21142	39581	25976	66792	314 010	111
2005	1310	4406	5241	5031	5722	8740	13452	20672	16207	19353	17430	32028	37564	34815	57103	279 072	103
2006	156578	5162	6695	5217	3768	10754	18771	29174	25278	38958	31869	46885	30895	44299	147951	602 255	184
2007	302988	224153	290	7686	11346	2031	7903	10770	12182	6578	6367	9998	41425	22090	211178	876 986	172
2008	86880	183796	121430	21430	4178	3009	3334	6991	5120	4441	3581	6008	10352	10172	99808	570 530	89
2009	98726	133218	196908	118322	131668	37586	18194	3679	8633	3494	9736	14091	25949	8384	251370	1 059 960	200
2010	No age reading																
2011	389536	285787	222753	60809	80266	67419	39695	12409	4144	1175	1174	2246	324	3379	93382	1 264 495	
2012	468 668	201 121	355 968	171 789	111 821	89 591	55 393	36 823	18 795	7 308	7 521	838	4 859	1 770	131 470	1 663 736	
2013	209 352	153 814	160 189	169 748	158 030	137 012	78 817	129 898	52 762	24 338	19 775	23 891	1 405	1 041	129 156	1 449 229	
2014[1]	2 440	23 091	38 542	69 219	49 720	86 768	74 944	69 021	48 043	45 568	42 281	17 440	16 739	3 584	162 911	783 055	
2015	450 847	32 390	53 292	84 098	84 938	101 485	67 651	94 248	69 453	17 908	17 962	8 112	8 073	4 771	141 040	1 1269 508	
2016	No age reading																

[1] - **Poor survey coverage in 2014**

Table 6.19: Proportion of maturity-at-age 5 - 30 in *Sebastes mentella* in Subareas 1 and 2 derived from Norwegian commercial and survey data. The proportions were derived from samples with at least 5 individuals. a50, w1 and w2 are the annual coefficients for modelled maturity ogives using a double half sigmoid of the form 0.5 ((1+tanh(age- a50)/w1)) for age < a50 and 0.5 ((1+tanh(age- a50)/w2)) for age > a50. a50 equals the age at 50% maturity.

YEAR	AGE6	AGE7	AGE8	AGE9	AGE10	AGE11	AGE12	AGE13	AGE14	AGE15	AGE16	AGE17	AGE18	AGE19+
1992	0.00	0.00	0.01	0.02	0.05	0.09	0.18	0.33	0.51	0.57	0.64	0.70	0.75	1.00
1993	0.01	0.02	0.04	0.07	0.15	0.28	0.45	0.55	0.61	0.67	0.73	0.78	0.82	1.00
1994	0.02	0.03	0.07	0.14	0.27	0.44	0.59	0.72	0.81	0.88	0.93	0.96	0.97	1.00
1995	0.03	0.06	0.12	0.23	0.39	0.57	0.71	0.82	0.90	0.94	0.97	0.98	0.99	1.00
1996	0.00	0.01	0.02	0.05	0.09	0.18	0.33	0.51	0.59	0.67	0.74	0.80	0.85	1.00
1997	0.02	0.04	0.08	0.15	0.28	0.46	0.55	0.60	0.66	0.71	0.76	0.80	0.83	1.00
1998	0.02	0.03	0.07	0.14	0.26	0.43	0.56	0.65	0.73	0.80	0.85	0.90	0.93	1.00
1999	0.02	0.05	0.10	0.19	0.33	0.51	0.57	0.64	0.69	0.75	0.79	0.83	0.87	1.00
2000	0.02	0.05	0.10	0.20	0.35	0.52	0.63	0.73	0.81	0.87	0.91	0.94	0.96	1.00
2001	0.01	0.02	0.04	0.09	0.18	0.32	0.50	0.57	0.63	0.69	0.74	0.79	0.83	1.00
2002	0.02	0.05	0.09	0.19	0.33	0.50	0.55	0.59	0.63	0.67	0.70	0.74	0.77	1.00
2003	0.02	0.05	0.11	0.21	0.36	0.52	0.57	0.63	0.68	0.73	0.77	0.81	0.84	1.00
2004	0.03	0.06	0.11	0.22	0.38	0.51	0.55	0.59	0.63	0.66	0.69	0.73	0.76	1.00
2005	0.02	0.04	0.09	0.17	0.31	0.49	0.55	0.61	0.66	0.71	0.75	0.79	0.83	1.00
2006	0.01	0.01	0.03	0.06	0.12	0.23	0.40	0.53	0.59	0.65	0.70	0.75	0.79	1.00
2007	0.02	0.04	0.08	0.16	0.29	0.47	0.64	0.77	0.87	0.93	0.96	0.98	0.99	1.00
2008	0.01	0.03	0.07	0.13	0.25	0.42	0.55	0.65	0.73	0.79	0.85	0.89	0.92	1.00
2009	0.02	0.04	0.08	0.16	0.29	0.47	0.60	0.72	0.81	0.87	0.92	0.95	0.97	1.00
2010	0.02	0.04	0.07	0.15	0.28	0.45	0.55	0.60	0.66	0.71	0.75	0.80	0.83	1.00
2011	0.01	0.03	0.05	0.11	0.21	0.37	0.52	0.59	0.66	0.72	0.77	0.81	0.85	1.00
2012	0.02	0.04	0.09	0.17	0.31	0.49	0.59	0.67	0.75	0.81	0.86	0.90	0.93	1.00
2013	0.00	0.01	0.02	0.03	0.07	0.14	0.27	0.45	0.63	0.79	0.89	0.94	0.97	1.00
2015	0.01	0.03	0.05	0.11	0.21	0.37	0.52	0.59	0.66	0.72	0.77	0.81	0.85	1.00
2016	0.01	0.03	0.05	0.11	0.21	0.37	0.52	0.59	0.66	0.72	0.77	0.81	0.85	1.00

[1] **Model parameter estimates were unrealistic and replaced by average parameter values.**

Table 6.20: *S. mentella* in subareas 1 and 2. Population matrix with numbers-at-age (in thousands) for each year and separable fishing mortality coefficients for the demersal and pelagic fleet, by year (Fy) and age (Sa). Numbers are estimated from the statistical catch-at-age model.

		SA (DEMERSAL)	0.000	0.000	0.000	0.000	0.015	0.035	0.079	0.170	0.327	0.536	0.733
		SA (PELAGIC)	0.000	0.000	0.000	0.000	0.000	0.007	0.013	0.026	0.052	0.101	0.185
Fy (demersal)	Fy (pelagic)	Year\age	2	3	4	5	6	7	8	9	10	11	12
0.094	0	1992	550 651	564 816	481 046	253 362	145 151	91 141	82 132	80 643	96 927	62 472	62 023
0.074	0	1993	335 911	523 907	537 384	457 682	241 057	137 907	86 430	77 564	75 513	89 430	56 521
0.054	0	1994	233 692	319 596	498 462	511 284	435 453	229 094	130 870	81 752	72 876	70 128	81 780
0.043	0	1995	223 980	222 342	304 074	474 252	486 452	413 968	217 556	123 981	77 069	68 119	64 813
0.027	0	1996	196 171	213 101	211 543	289 306	451 219	462 525	393 266	206 279	117 094	72 294	63 322
0.026	0	1997	164 783	186 643	202 751	201 269	275 255	429 133	439 653	373 379	195 378	110 443	67 810
0.037	0	1998	76 235	156 780	177 578	192 904	191 493	261 785	407 924	417 448	353 697	184 332	103 641
0.024	0	1999	61 109	72 532	149 165	168 954	183 535	182 092	248 750	386 981	394 698	332 491	171 952
0.018	0	2000	46 662	58 141	69 009	141 921	160 748	174 559	173 105	236 226	366 711	372 636	312 359
0.031	0	2001	29 154	44 396	55 318	65 658	135 028	152 899	165 976	164 461	224 060	346 831	351 098
0.01	0	2002	30 911	27 738	42 239	52 631	62 469	128 411	145 317	157 531	155 660	211 050	324 605
0.003	0	2003	34 199	29 410	26 391	40 188	50 075	59 426	122 131	138 149	149 625	147 614	199 720
0.006	0	2004	42 323	32 538	27 981	25 109	38 236	47 640	56 533	116 170	131 368	142 209	140 204
0.009	0	2005	79 255	40 267	30 958	26 622	23 890	36 376	45 317	53 761	110 411	124 734	134 851
0.009	0.031	2006	180 624	75 406	38 312	29 454	25 329	22 726	34 598	43 084	51 070	104 731	118 087
0.003	0.022	2007	330 396	171 851	71 744	36 451	28 024	24 096	21 611	32 879	40 892	48 361	98 832
0.004	0.011	2008	329 491	314 349	163 505	68 259	34 681	26 661	22 920	20 551	31 250	38 828	45 846
0.004	0.007	2009	312 609	313 488	299 082	155 564	64 944	32 994	25 362	21 797	19 535	29 680	36 830
0.004	0.01	2010	417 305	297 427	298 263	284 556	148 008	61 786	31 386	24 119	20 720	18 554	28 155
0.003	0.011	2011	484 009	397 037	282 981	283 777	270 736	140 812	58 773	29 849	22 927	19 679	17 599
0.003	0.009	2012	334 959	460 502	377 754	269 237	269 994	257 574	133 949	55 897	28 376	21 779	18 671
0.002	0.01	2013	235 885	318 691	438 136	359 407	256 161	256 868	245 021	127 394	53 139	26 955	20 665
0.005	0.016	2014	137 924	224 428	303 213	416 857	341 951	243 713	244 361	233 057	121 137	50 502	25 595
0.008	0.023	2015	187 689	131 226	213 528	288 486	396 611	325 318	231 810	232 347	221 446	114 960	47 837
0.01	0.033	2016	177 777	178 573	124 852	203 158	274 475	377 300	309 380	220 337	220 612	209 859	108 632

Table 6.20…continues

Fy (demersal)	Fy (pelagic)	SA (DEMERSAL) SA (PELAGIC) Year\age	0.867 0.315 13	0.939 0.483 14	0.974 0.655 15	0.989 0.794 16	0.995 0.886 17	0.998 0.941 18	1.000 1.000 19+
0.094	0	1992	43 244	38 616	32 594	21 090	12 505	8 006	114 782
0.074	0	1993	55 086	37 927	33 639	28 302	18 287	10 836	106 356
0.054	0	1994	50 938	49 155	33 663	29 781	25 028	16 164	103 552
0.043	0	1995	74 780	46 241	44 448	30 383	26 857	22 563	107 899
0.027	0	1996	59 736	68 522	42 239	40 540	27 694	24 474	118 859
0.026	0	1997	59 085	55 541	63 587	39 161	37 572	25 662	132 798
0.037	0	1998	63 312	54 975	51 582	59 003	36 324	34 844	146 937
0.024	0	1999	95 982	58 344	50 527	47 349	54 131	33 316	166 703
0.018	0	2000	160 790	89 467	54 291	46 979	44 008	50 304	185 859
0.031	0	2001	293 252	150 587	83 679	50 748	43 901	41 119	220 644
0.010	0	2002	326 619	271 686	139 203	77 273	46 841	40 513	241 529
0.003	0	2003	306 572	308 058	256 060	131 152	72 792	44 122	265 660
0.006	0	2004	189 575	290 874	292 216	242 865	124 388	69 037	293 794
0.009	0	2005	132 787	179 397	275 133	276 344	229 652	117 616	343 068
0.009	0.031	2006	127 433	125 326	169 203	259 418	260 522	216 491	434 265
0.003	0.022	2007	110 939	119 085	116 430	156 308	238 584	238 897	594 983
0.004	0.011	2008	93 468	104 576	111 813	108 891	145 726	221 965	774 107
0.004	0.007	2009	43 414	88 338	98 623	105 231	102 315	136 779	933 846
0.004	0.010	2010	34 888	41 064	83 433	93 022	99 153	96 340	1 007 344
0.003	0.011	2011	26 664	32 980	38 743	78 572	87 477	93 153	1 035 758
0.003	0.009	2012	16 672	25 212	31 120	36 486	73 878	82 165	1 059 082
0.002	0.010	2013	17 691	15 772	23 811	29 344	34 359	69 515	1 072 817
0.005	0.016	2014	19 599	16 752	14 907	22 464	27 643	32 336	1 073 847
0.008	0.023	2015	24 187	18 469	15 738	13 963	20 993	25 794	1 030 323
0.010	0.033	2016	45 042	22 680	17 241	14 630	12 937	19 408	973 843

Table 6.21. Stock summary for *S. mentella* in subareas 1 and 2 as estimated by the statistical catch-at-age model.

Year	Rec (age 2) in millions	Rec (age 6) in millions	Stock Biomass (tons)	SSB (tons)	F (12–18)	F(19+)
1992	551	145	288685	124220	0.087	0.094
1993	336	241	304632	145116	0.069	0.074
1994	234	435	481345	228190	0.05	0.054
1995	224	486	526851	251943	0.04	0.043
1996	196	451	652211	229135	0.025	0.027
1997	165	275	697966	296910	0.024	0.026
1998	76	191	770636	343876	0.034	0.037
1999	61	184	887812	439069	0.022	0.024
2000	47	161	868440	531670	0.017	0.018
2001	29	135	861483	472034	0.028	0.031
2002	31	62	908738	569041	0.009	0.01
2003	34	50	980190	677674	0.003	0.003
2004	42	38	1051599	722831	0.006	0.006
2005	79	24	1052229	784763	0.009	0.009
2006	181	25	1068341	785615	0.028	0.04
2007	330	28	1026437	939035	0.016	0.025
2008	329	35	1040522	922934	0.01	0.015
2009	313	65	1069911	977252	0.008	0.011
2010	417	148	1036337	881684	0.01	0.014
2011	484	271	1118897	936905	0.01	0.014
2012	335	270	1147477	956327	0.008	0.012
2013	236	256	1078153	819267	0.008	0.012
2014	138	342	1198110	917511	0.015	0.021
2015	188	397	1240661	870576	0.022	0.031
2016	178	274	1262583	856873	0.03	0.043
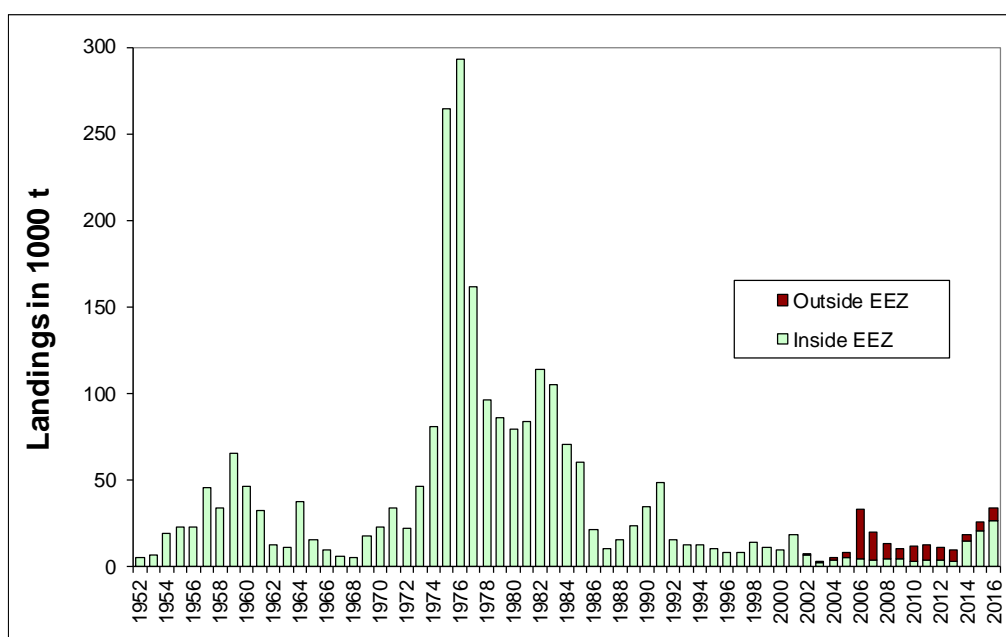
Figure 6.1. *Sebastes mentella* **in Subareas 1 and 2. Total international landings 1952-2016 (thousand tonnes).**
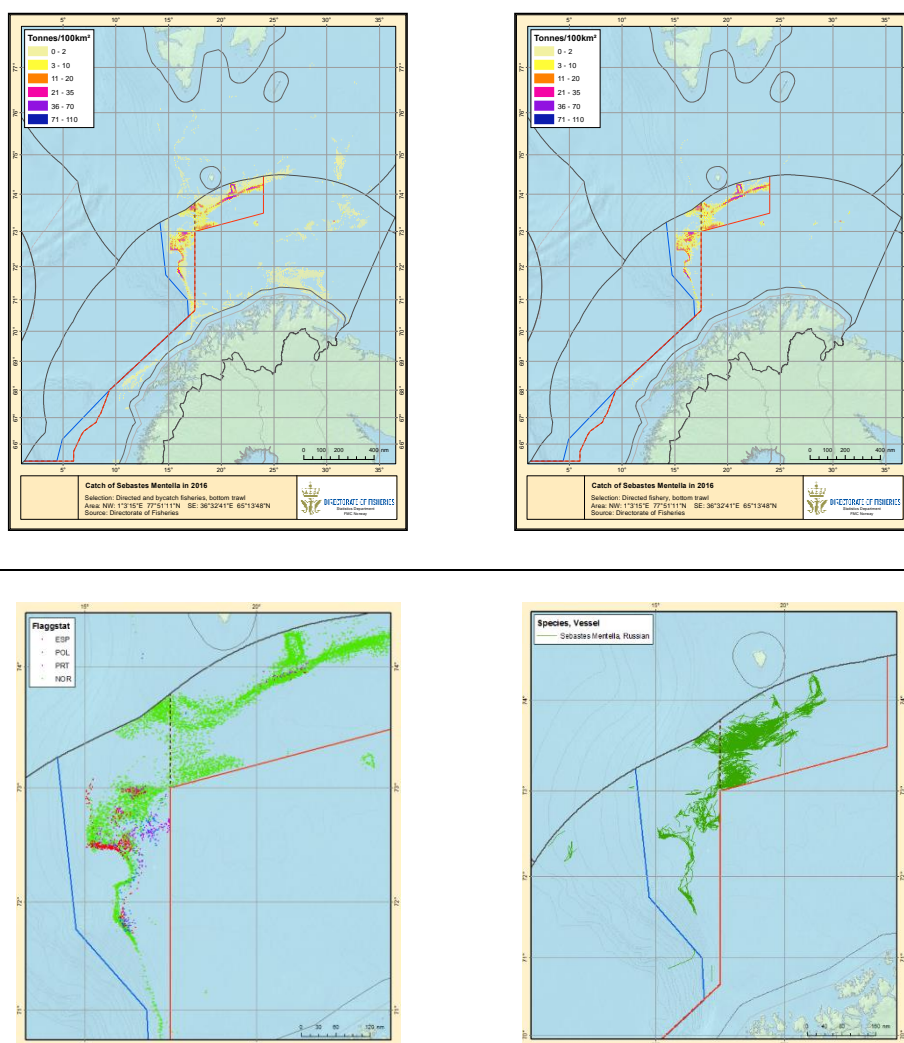
Figure 6.2. *Sebastes mentella* **in Subareas 1 and 2. Geographical location, within the Norwegian Exclusive Economic Zone of directed Catches by Norwegian vessesls (top left), directed and by-catches by Norwegian vessels (top right), catches by Spain, Poland, Portugal and Norway (bottom left) and commercial trawl tracks from Russian vessels (bottom right). Directed fishing with bottom trawl is not permitted to the east of the red line. Directed fishing with pelagic trawl is not permitted to the east of the blue line.**
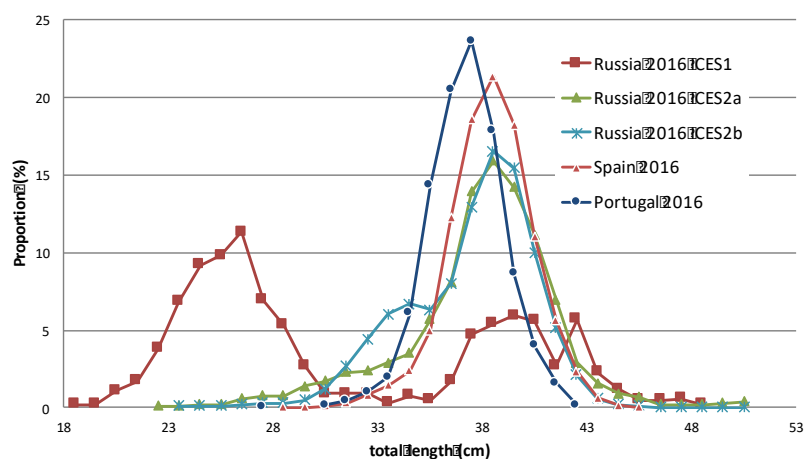
Figure 6.3. *Sebastes mentella* in Subareas 1 and 2. Length-distributions of the commercial pelagic catches by Russia, Spain and Portugal in 2016.
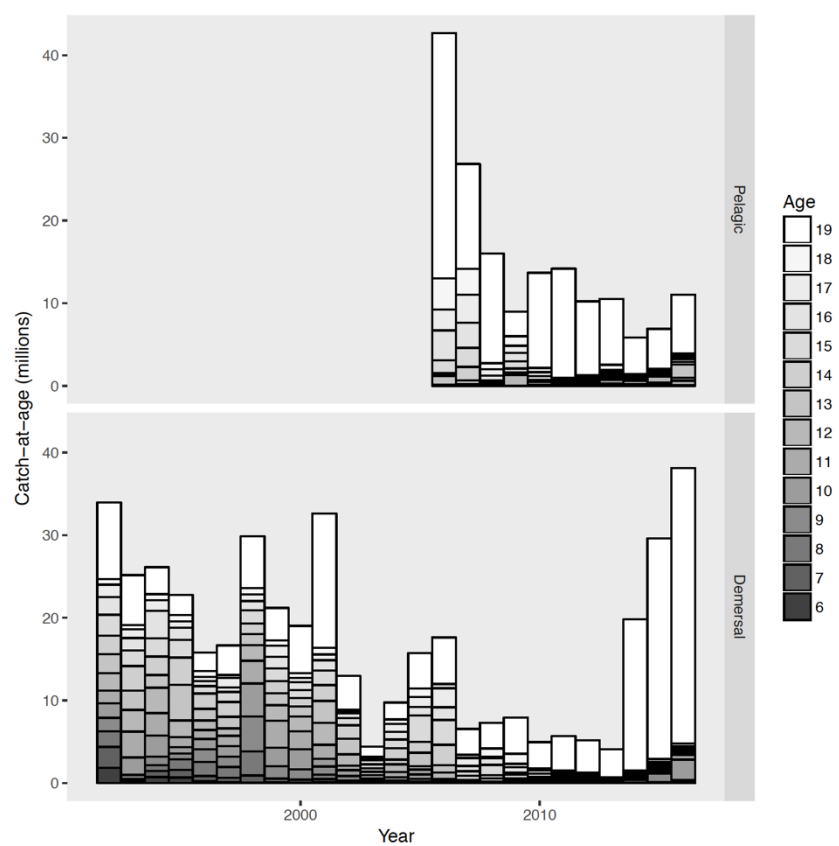
Figure 6.4. *Sebastes mentella* in Subareas 1 and 2. Catch numbers-at-age for the pelagic and demersal fleets 1992-2016.
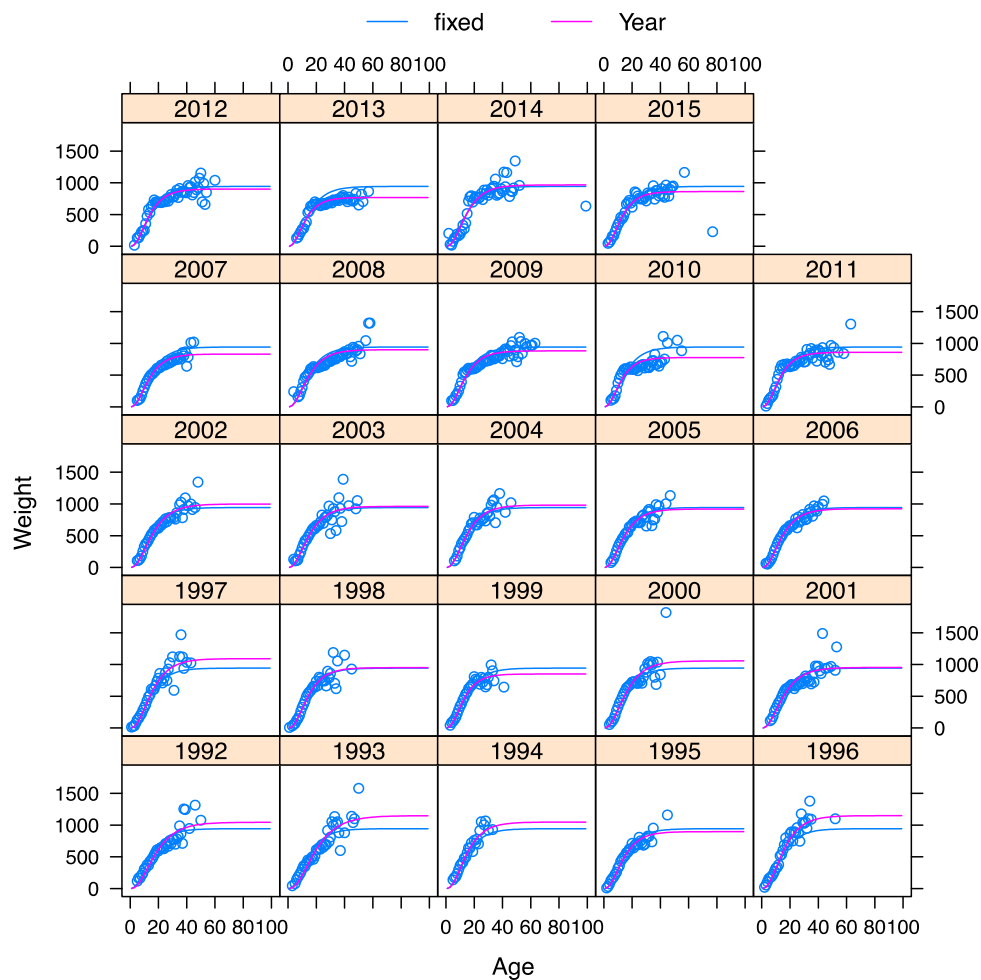
Figure 6.5. Weight-at-age of *S. mentella* **in subareas 1 and 2 derived from Norwegian commercial and survey data (Table DXXX). The weights were derived from samples with at least five individuals. The blue and purple lines show the fitted mixed-effect models. Data for 2016 was not available at the time of the meeting.**
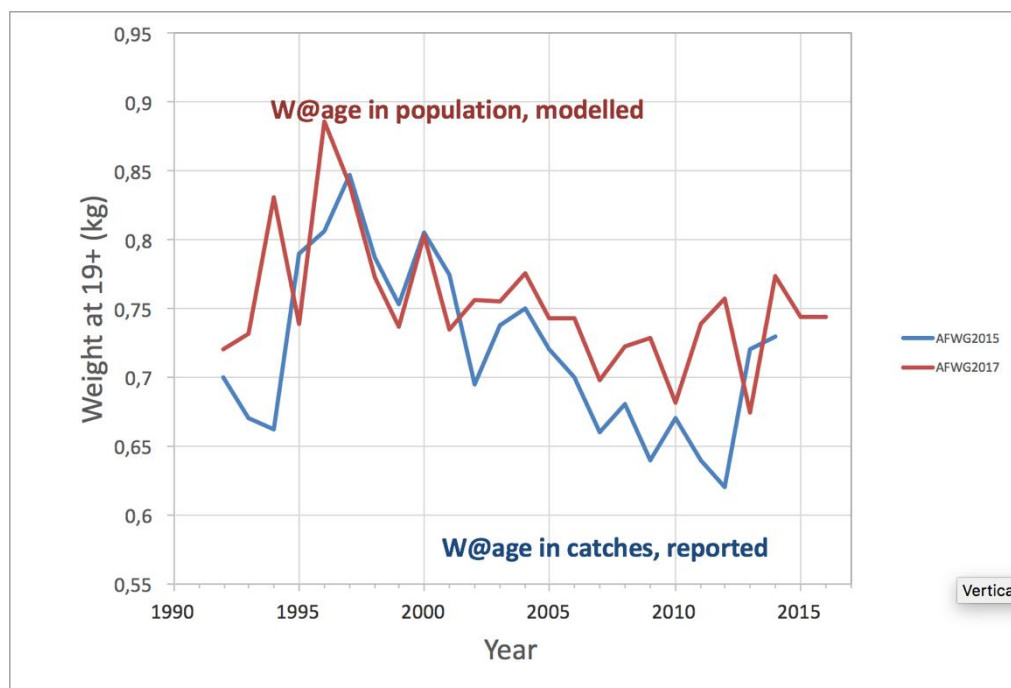
Figure 6.6. *S. mentella* in subareas 1 and 2. Weight-at-age 19+ as reported from catches (blue) or modelled from catches and survey observations (red) using a mixed effect model (Figure 6.X). Data for 2016 was not available at the time of the meeting and modelled weight-at-age for 2015 is used instead.
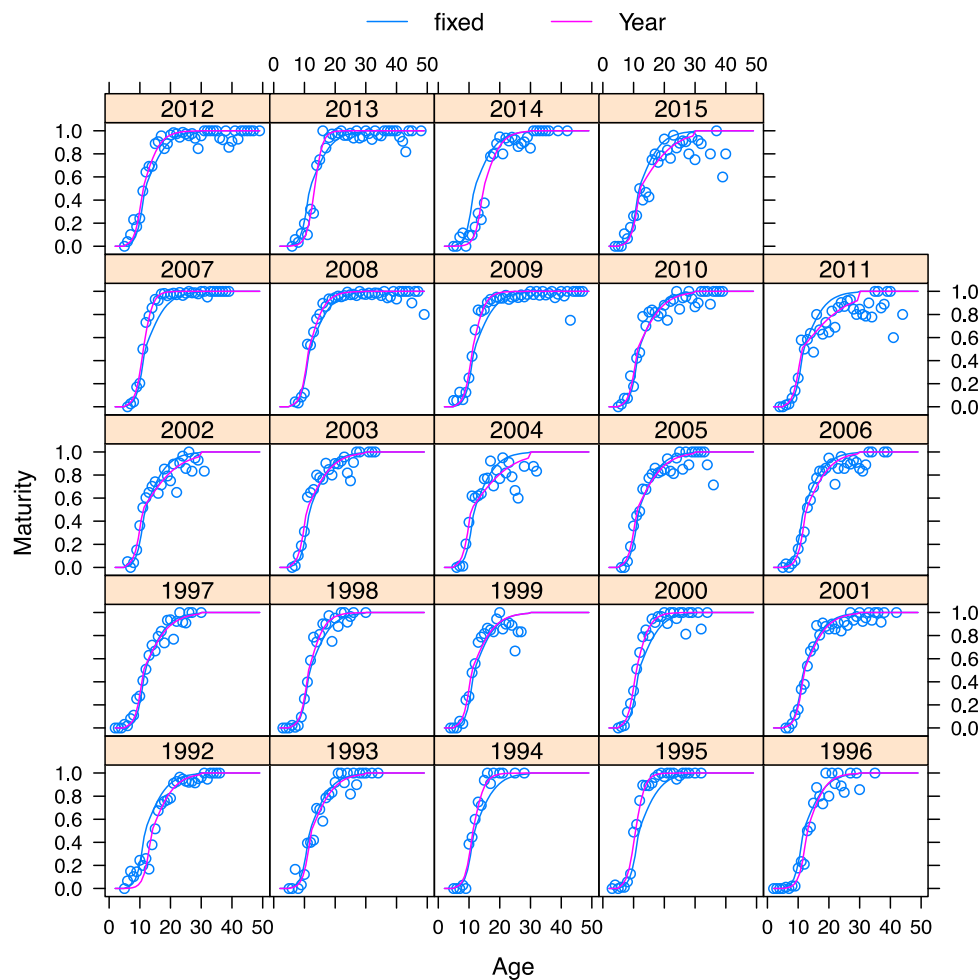
Figure 6.7. Proportion maturity-at-age of *S. mentella* in subareas 1 and 2 derived from Norwegian commercial and survey data (Table D7). The proportions were derived from samples with at least five individuals. The blue and purple lines show the fitted mixed-effect models. For 2011, 2014 and 2015 the common model (fixed effects, blue) was used, for other years the annual models (random effects, purple) were used. Data for 2016 was not available at the time of the meeting and the fixed effect model was used.
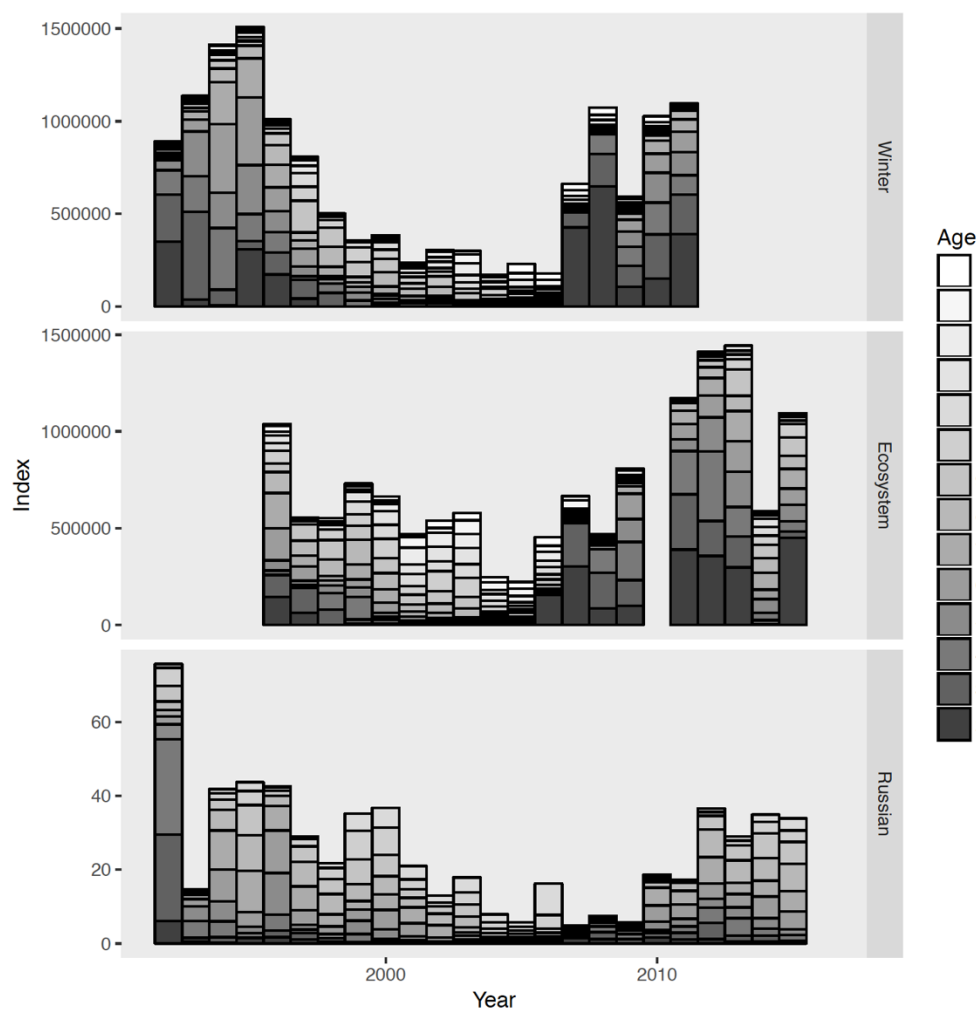
Figure 6.8. *Sebastes mentella* in Subareas 1 and 2. Age disaggregated abundance indices for bottom-trawl surveys 1992-2016 in the Barents Sea in winter (winter survey, top), in summer (Ecosystem survey, middle) and in autumn (Russian groundfish survey, bottom).
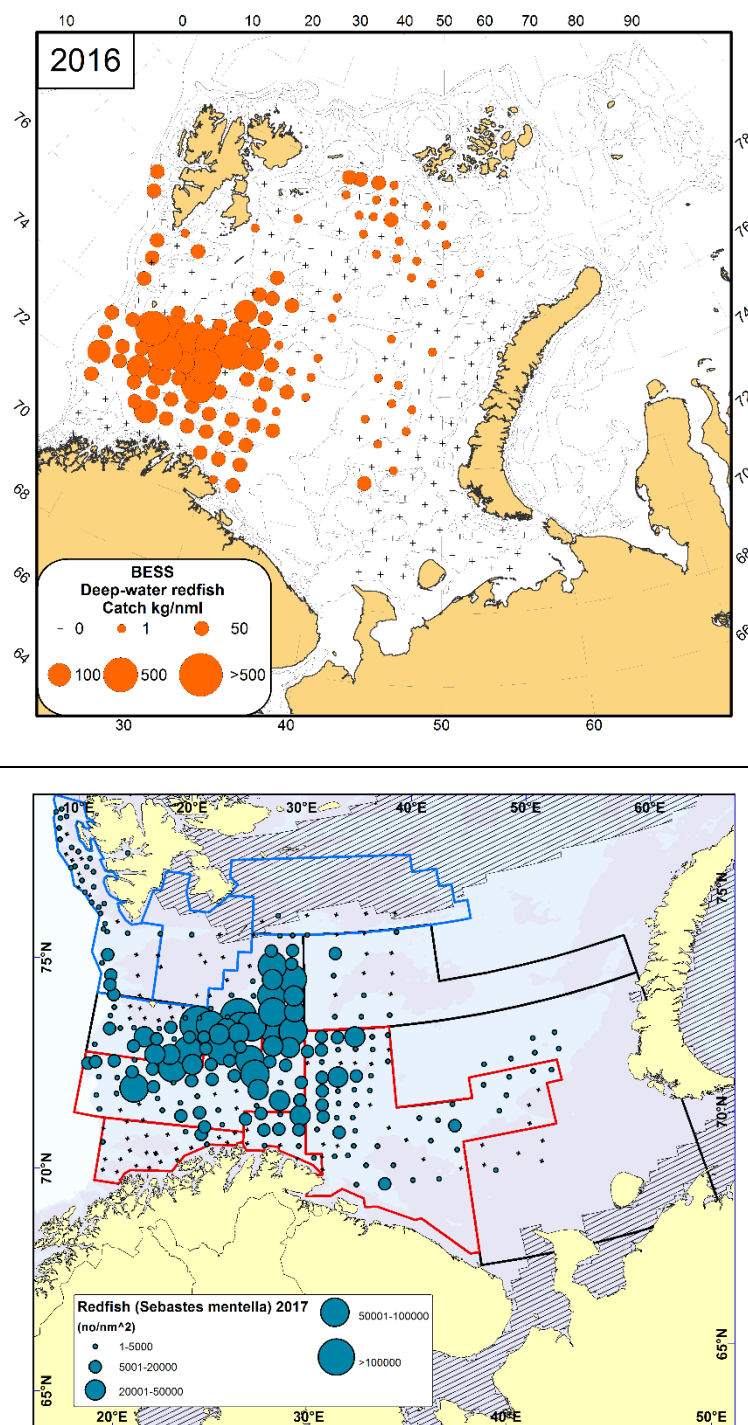
Figure 6.9. *Sebastes mentella* **in Subareas 1 and 2. Abundance indices for individual trawl stations during the ecosystem survey in autumn 2016 (top) and winter survey 2017 (bottom).**
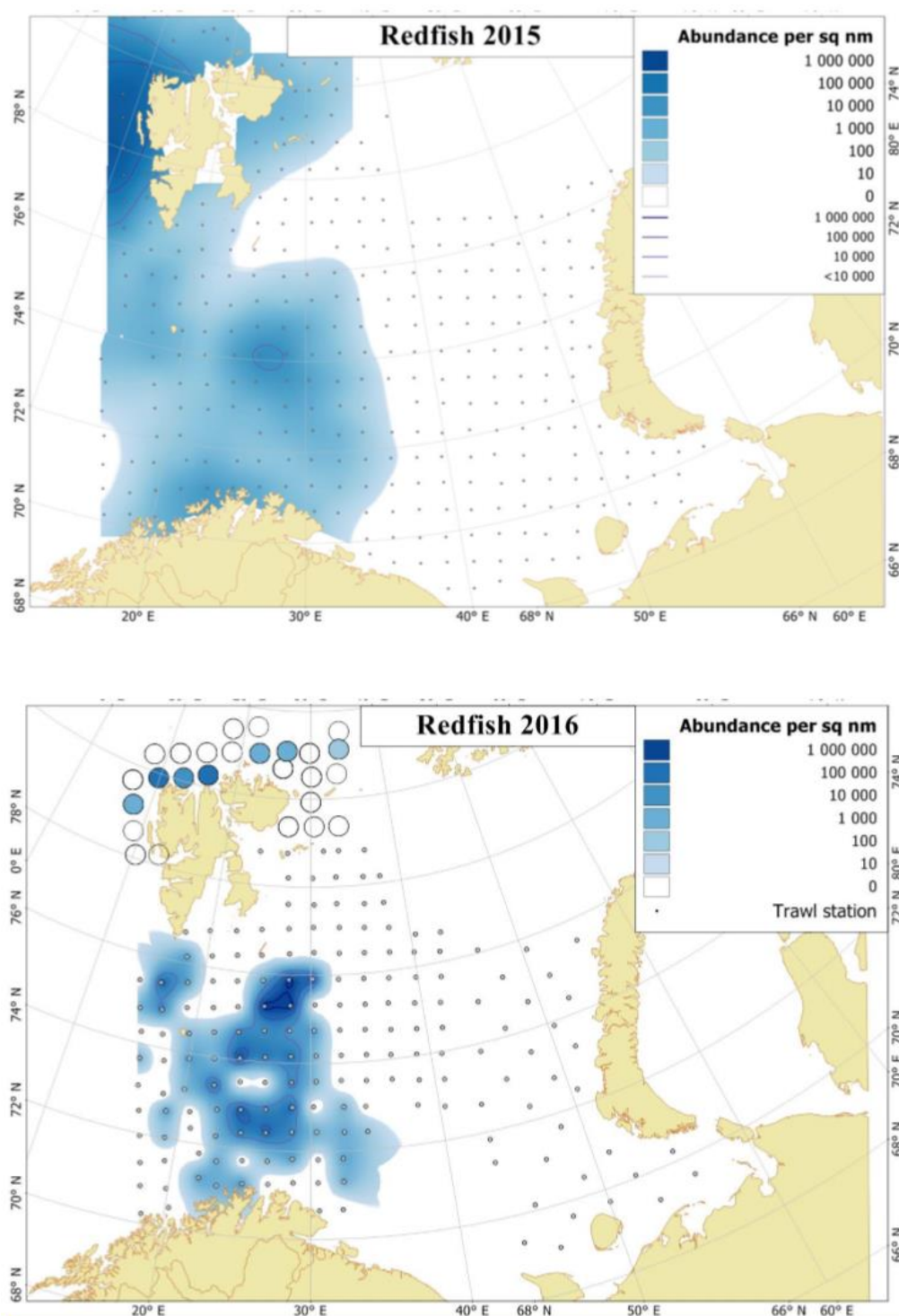
Figure 6.10. Map showing the specific pelagic 0-group trawl stations and the abundance of 0-group *Sebastes mentella* during the joint Norwegian-Russian Ecosystem survey in the Barents Sea and Svalbard in 2015 (upper panel) and 2016 (lower panel).
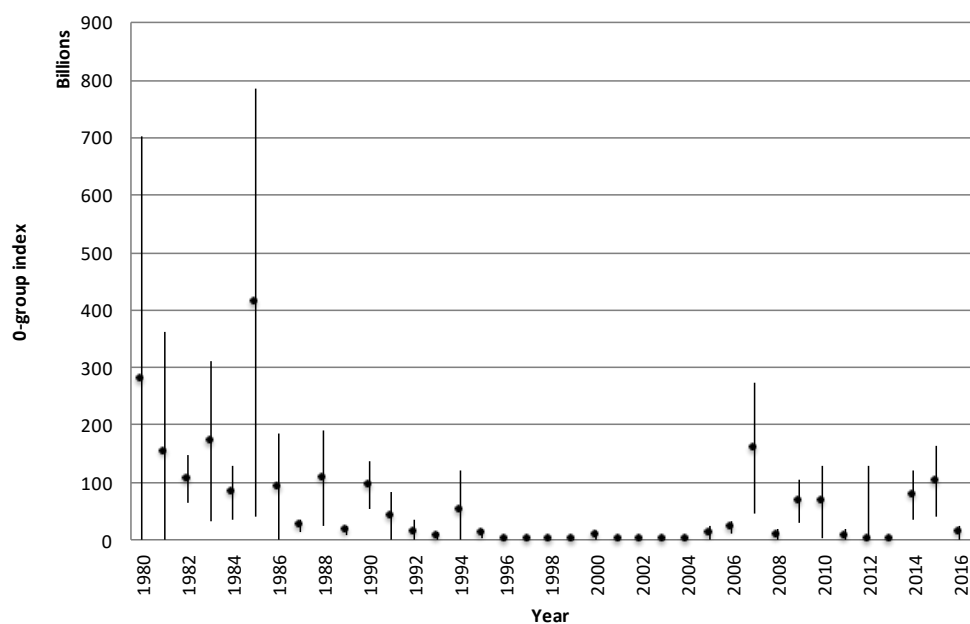
Figure 6.11. *Sebastes mentella* in Subareas 1 and 2. Abundance indices (in millions) with 95% confidence limits of 0-group redfish (believed to be mostly *S. mentella*) in the international 0-group survey in the Barents Sea and Svalbard areas in August-September 1980-2016. Numbers are given in Table 1.1.
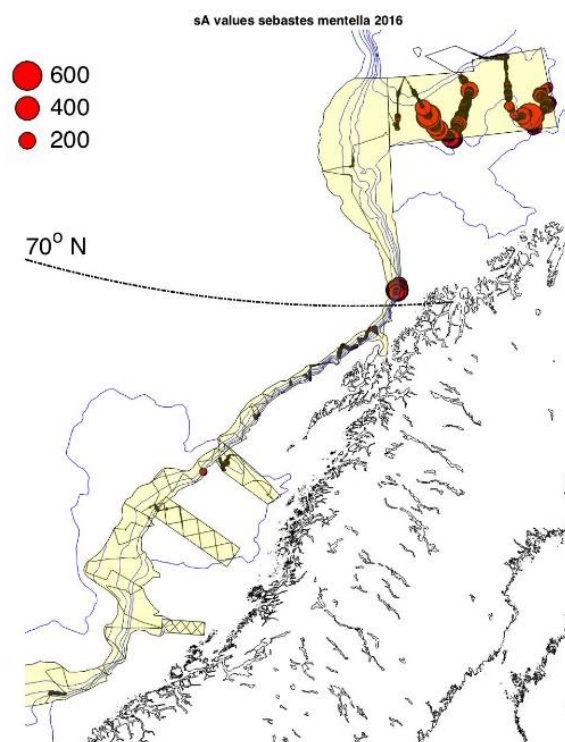
Figure 6.12. *Sebastes mentella* in Subareas 1 and 2. Horizontal distribution of *S.mentella* hydroacoustic backscattering (sₐ) during the Norwegian slope survey in spring 2016. The circles are proportional to the sₐ assigned to redfish along the vessel track.
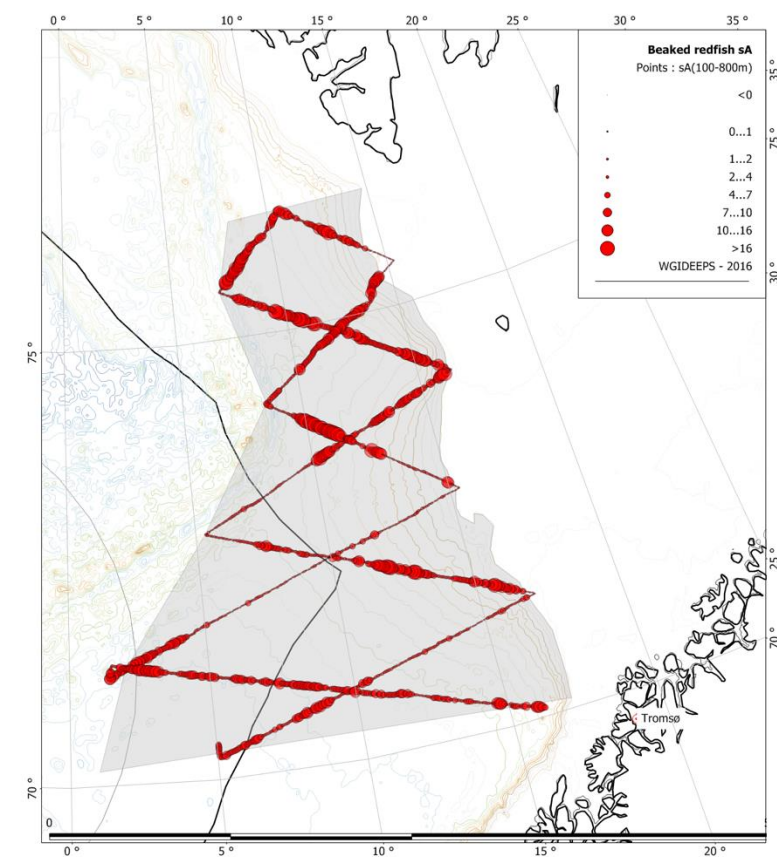
Figure 6.13. *Sebastes mentella* **in Subareas 1 and 2. Horizontal distribution of** *S.mentella* **hydroacoustic backscattering (sA) during the Norwegian Deep Pelagic Ecosystem survey in summer 2016. The circles are proportional to the sA assigned to redfish along the vessel track.**
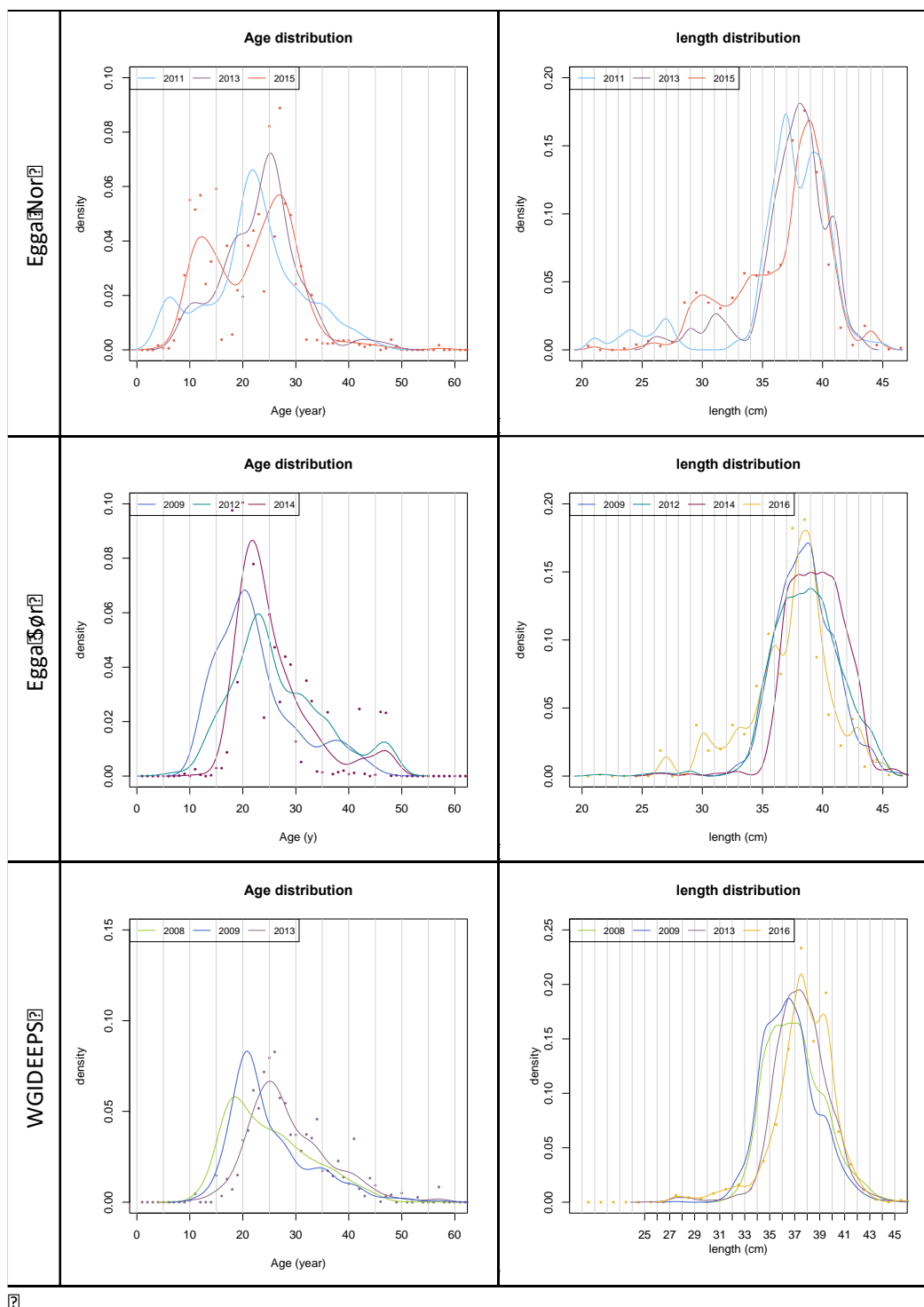
Figure 6.14. *Sebastes mentella* in Subareas 1 and 2. Age (left) and length (right) distribution during the Egga-Nor (top), Egga-Sør (middle) and WGIDEEPS (bottom) surveys between 2008 and 2015. Not all surveys are conducted every year. Most surveys show an increase in age and length of the population over time and the entry of young/small individuals in recent years.
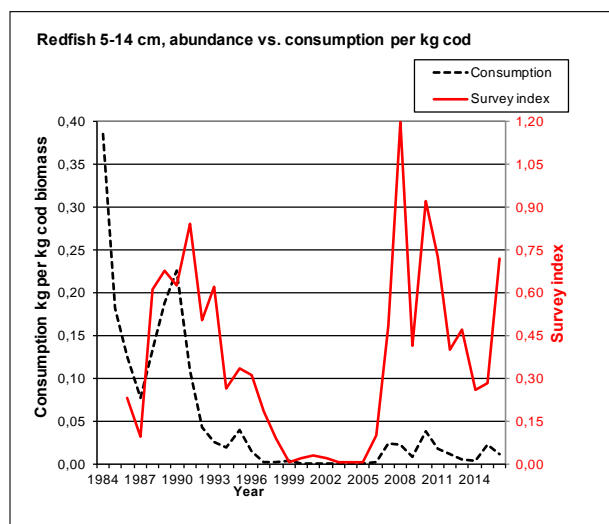
Figure 6.15. Abundance of *S. mentella* (5-14 cm) during the winter survey (February) in the Barents Sea compared with the consumption of redfish (mainly *S. mentella*) by cod (See Chapter 1, Table 1.3).

| Recruitment-at-age 2 | Spawning-stock biomass |

| Fishing mortality – year component | Fishing mortality – age component |
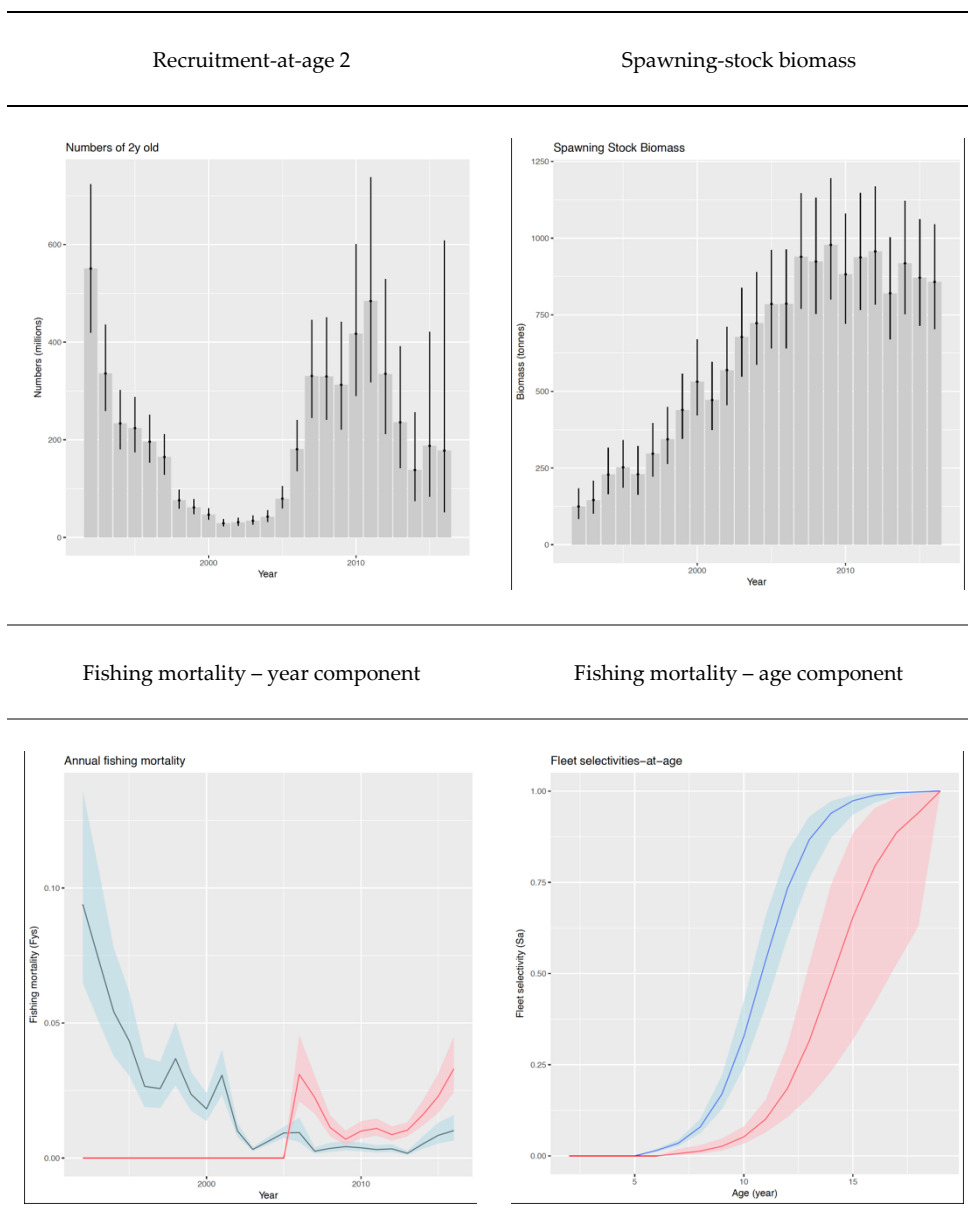
Figure 6.16. *Sebastes mentella* **in Subareas 1 and 2. Results from the statistical catch-at-age assessment run showing the estimated recruitment-at-age 2 and spawning-stock biomass from 1992 to 2016 and annual fishing mortality coefficients by year (Fy) and age (Fa) from the demersal (blue) and pelagic (red) fleets. Error bars (top) and coloured envelopes (bottom) indicate 95% confidence limits.**
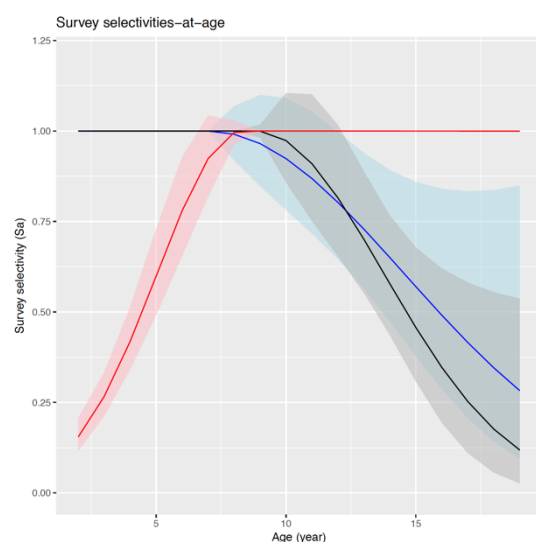
Figure 6.17. *Sebastes mentella* **in Subareas 1 and 2. Results from the statistical catch-at-age assessment run showing the selectivity-at-age of winter (blue), ecosystem (grey) and Russian groundfish (red) surveys.**
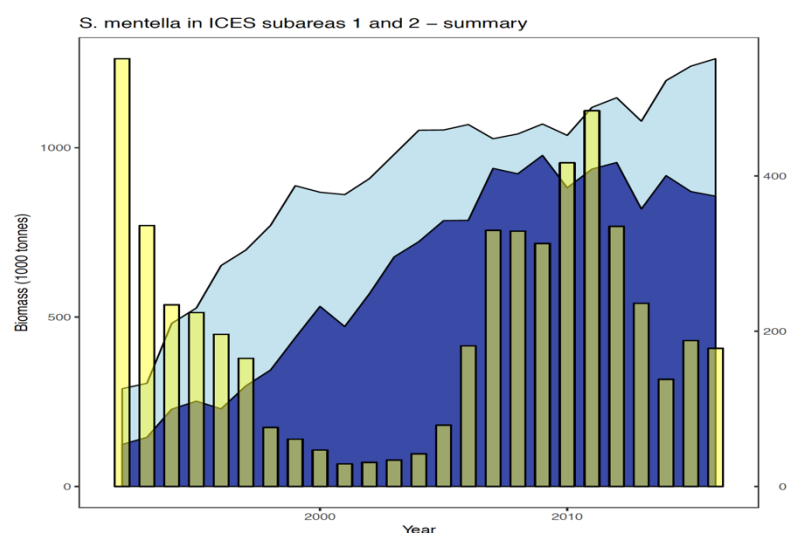
Figure 6.18. *Sebastes mentella* **in Subareas 1 and 2. Results from the statistical catch-at-age model showing the evolution of total biomass (in tonnes, light blue, left axis), spawning-stock biomass (in tonnes, dark blue, left axis) and recruitment-at-age 2 (in numbers, yellow, right axis) for the period 1992-2016, for *S. mentella* in subareas 1 and 2.**
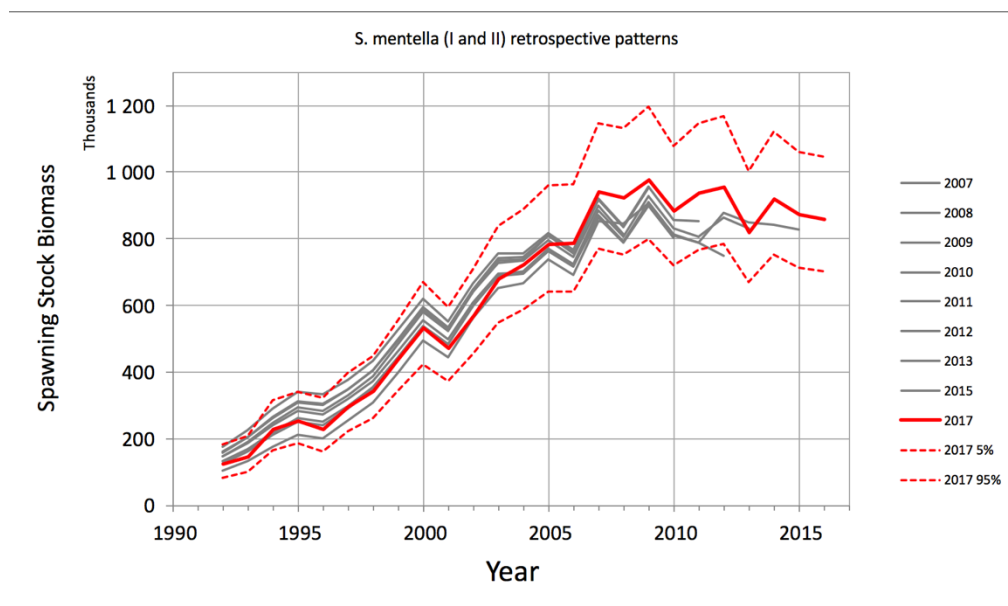
Figure 6.19. Retrospective patterns of the spawning-stock biomass of *S. mentella* estimated by the SCAA model for runs up to years 2007-2016. The higher the SSB estimates in recent years for the 2016 run mainly result from differences in the weight-at-age data for the 19+ group.
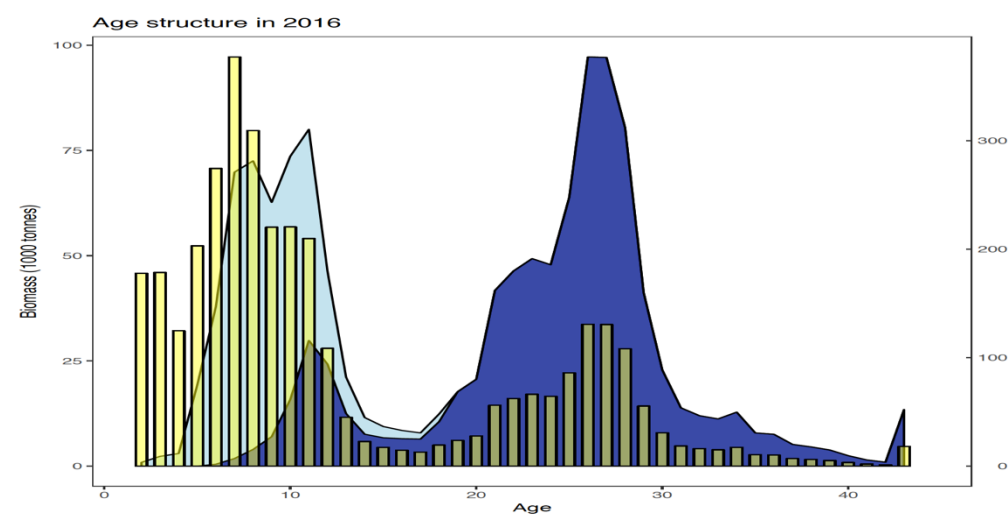
Figure 6.20. *Sebastes mentella* in Subareas 1 and 2. Modelled distribution of numbers (yellow bars), biomass (light blue) and spawning-stock biomass (dark blue) at age 2-43+ in 2016.
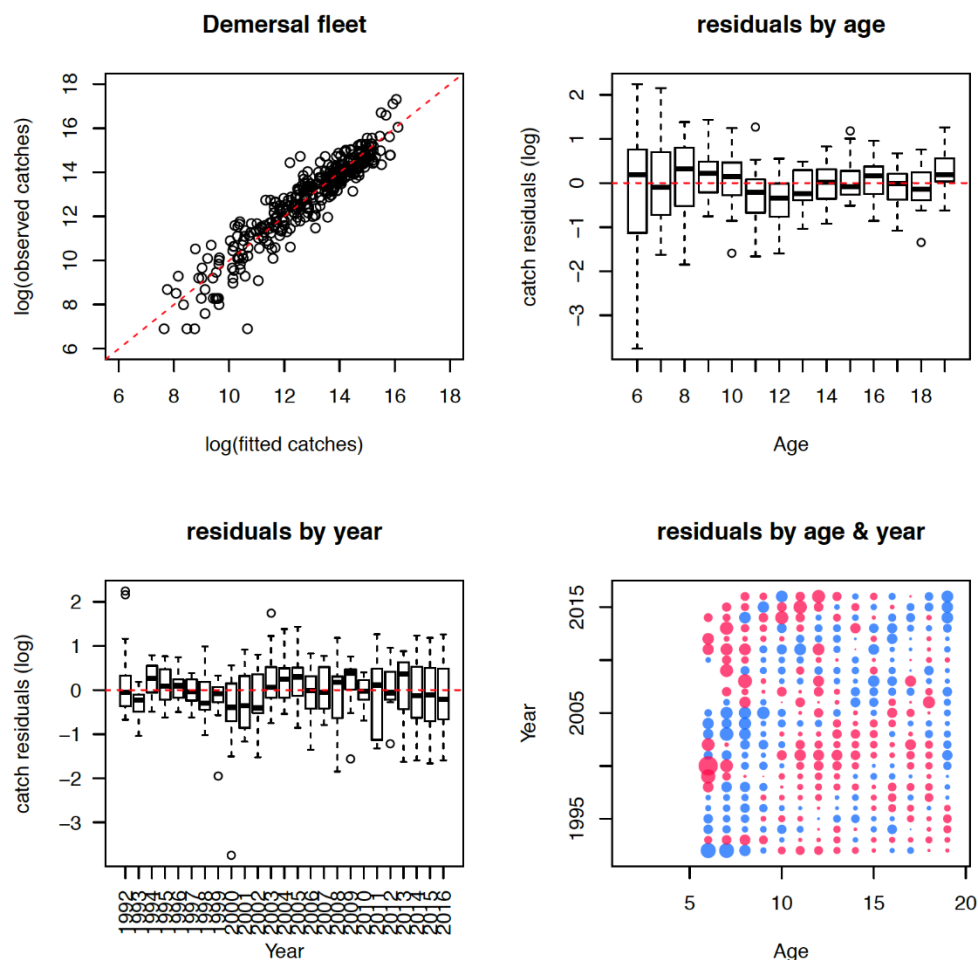
Figure 6.21a. Diagnostic plots for the demersal fleet catch-at-age data. Top-left: scatterplot of observed vs. fitted indices, the dotted red line indicates 1:1 relationship. Top right: boxplot of residuals (observed-fitted) for each age. Bottom left: boxplot of residuals for each year. Bottom right: bubble plot of residuals for each age/year combination, bubble size is proportional to mean residuals, blue are positive and red are negative residuals.
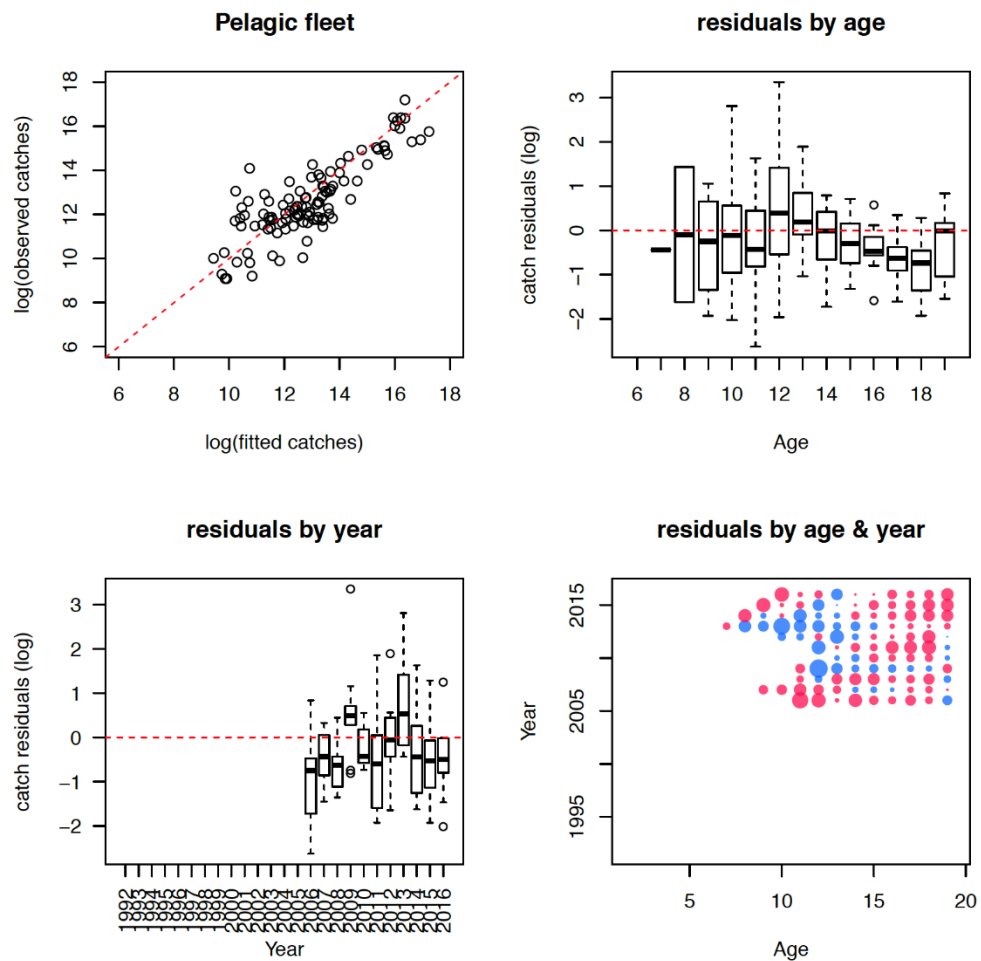
Figure 6.21b. Diagnostic plots for the pelagic fleet catch-at-age data. See legend from Figure 6.21a.
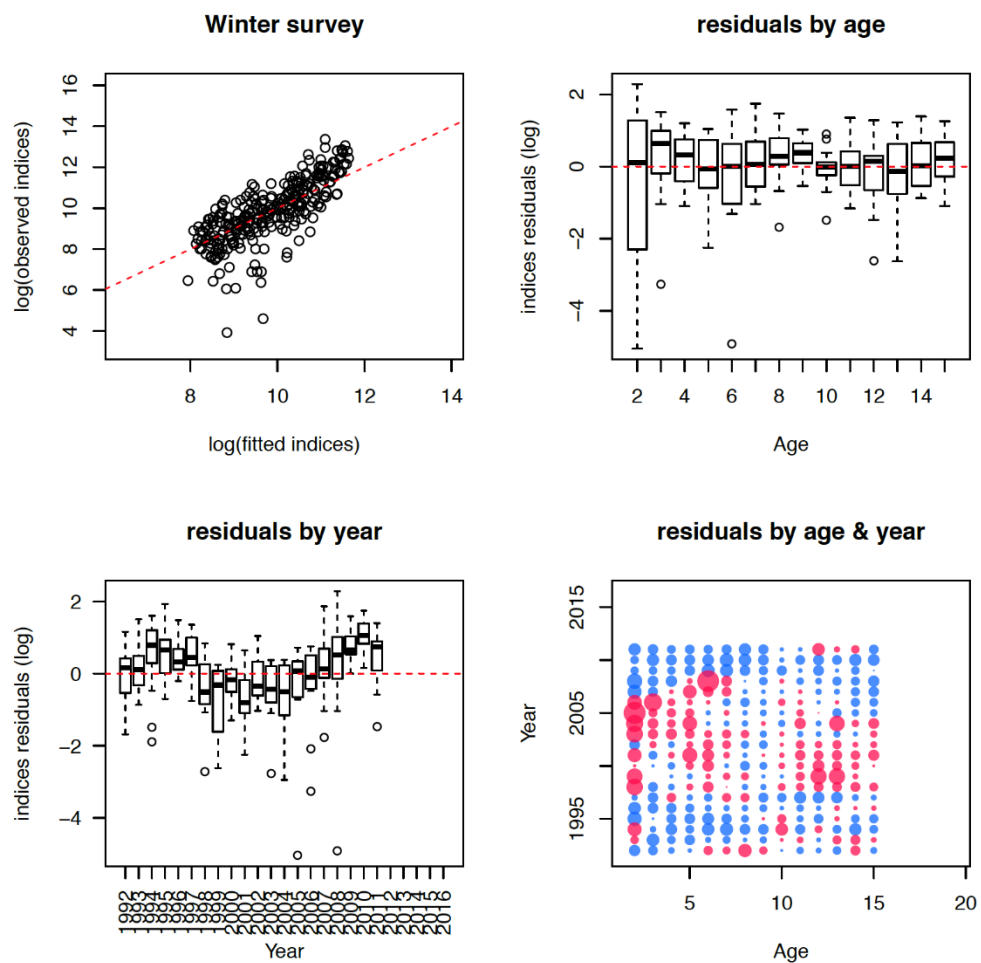
Figure 6.21c. Diagnostic plots for the Winter survey data. See legend from Figure 6.21a
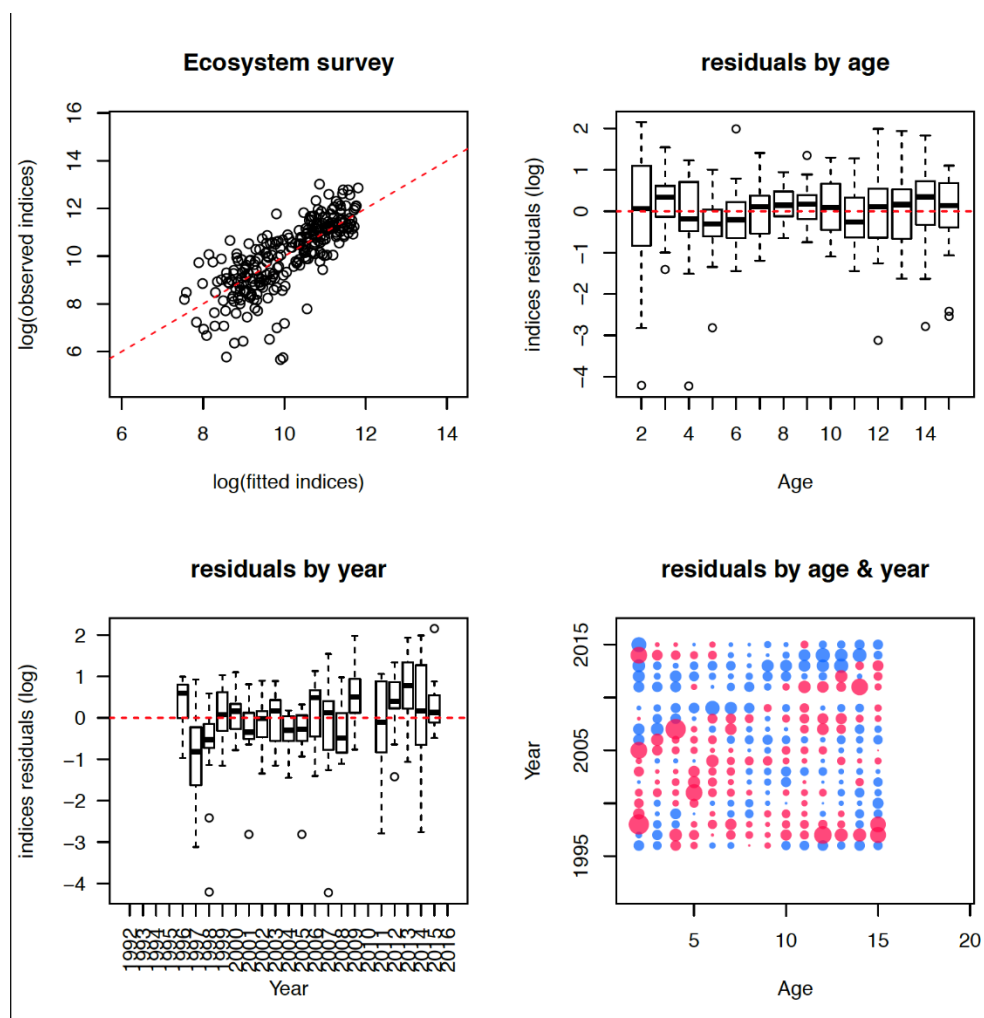
Figure 6.21d. Diagnostic plots for Ecosystem survey data. See legend from Figure 6.21a.
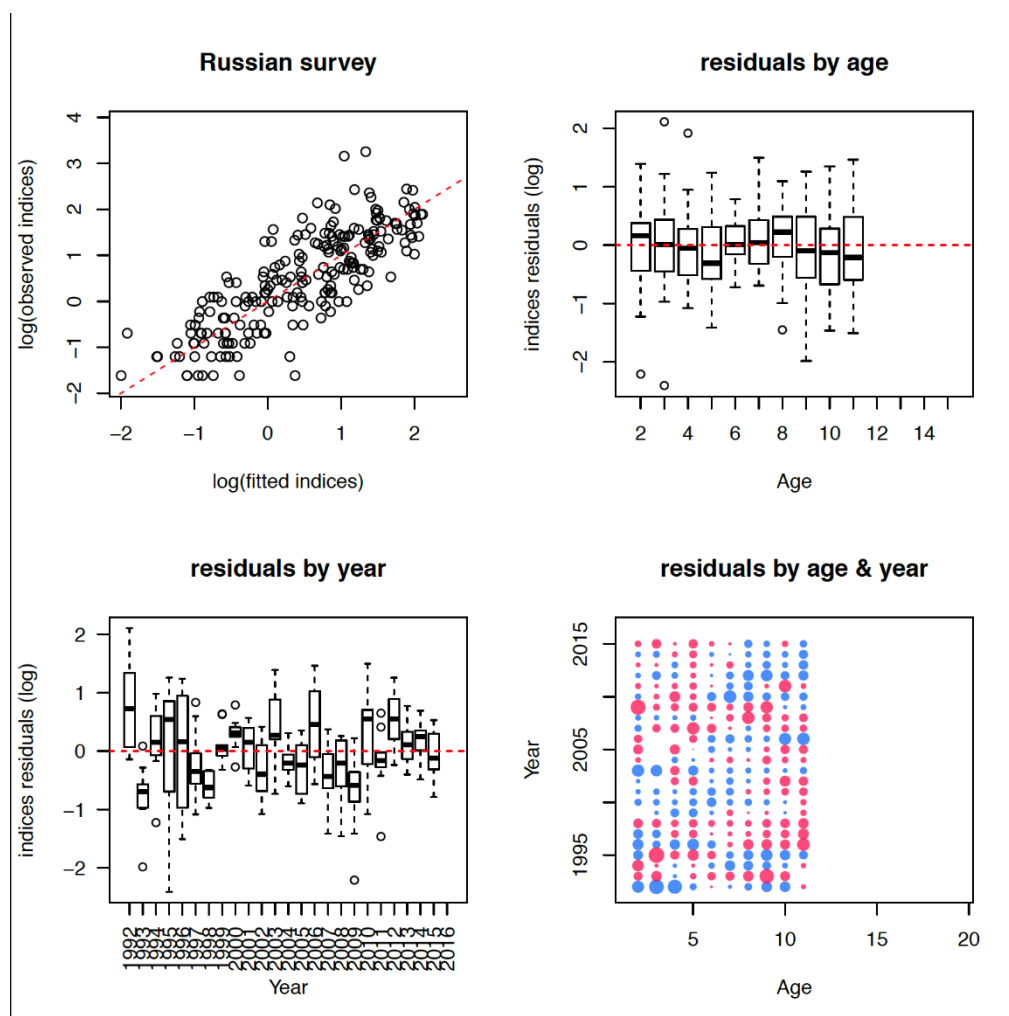
Figure 6.21e. Diagnostic plots for the Russian groundfish survey data. See legend from Figure 6.21a.
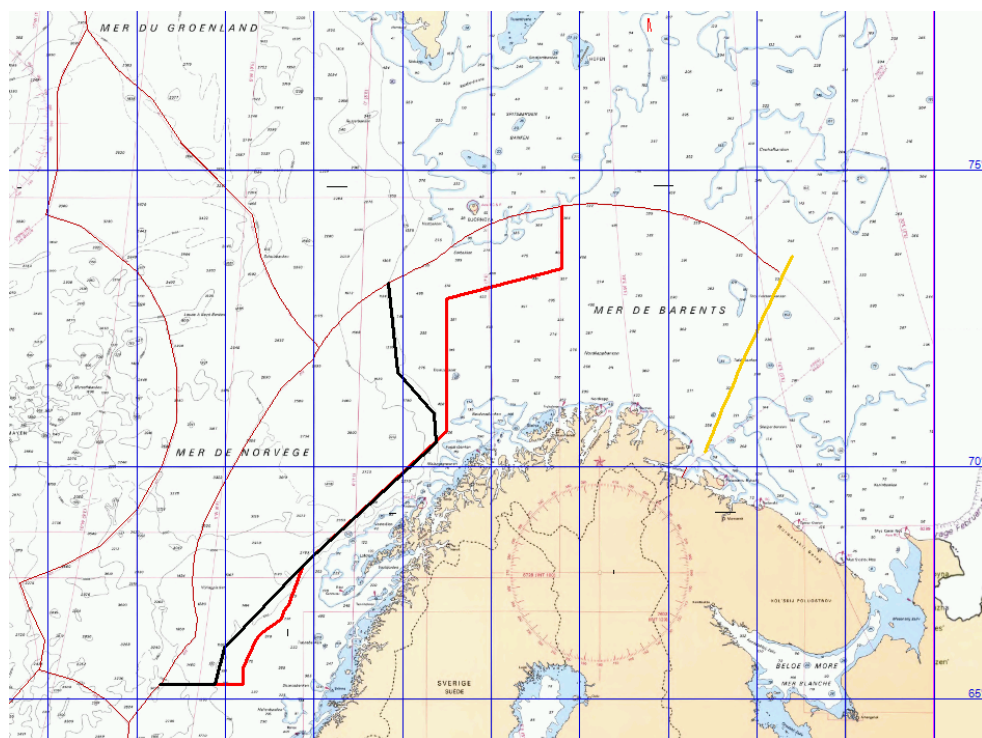
Figure 6.22. Delineation of the geographical limits for directed fishing in the Norwegian Economic Zone in 2014-2015. Directed pelagic trawling is only allowed west of the black line. Directed demersal trawling is only allowed between the black and the red line. The marked area south of Bear Island is currently closed for direct fishing on redfish, but may be reopened later in the year.