

21 Shallow Pelagic *Sebastes mentella*

21.1 Stock description and management unit

This section addresses the fishery for shallow pelagic *S. mentella* in the Irminger Sea and adjacent areas (parts of Division 5a, subareas 12 and 14; eastern parts of NAFO divisions 1F, 2H and 2J) at depths shallower than 500 m. No information was available on number of vessels participating in the fishery in 2017.

21.2 Summary of the development of the fishery

The historic development of the fishery can be found in the Stock Annex. The clear changes in the spatial pattern of the fishery can be seen in Figure 21.2.1, based on logbook data from the Faroe Islands, Greenland, Iceland and Norway. A summary of the catches by ICES Divisions/NAFO regulatory area as estimated by the Working Group is given in Table 21.2.1 and Figure 21.2.2. The estimated catch for 2017 is 101 t compared to 1967 t caught in 2016 (Tables 21.2.1 and 21.2.2).

There are no new CPUE data for 2017. The standardized CPUE index trend for the period 1994–2006 is shown in Figure 21.2.3. This standardized CPUE series includes data from Faroe Islands, Iceland, Germany, Greenland, and Norway, and it is estimated with a GLM model including the factors year, ship, month and towing time. The model residuals are in Figure 21.2.4.

21.3 Biological information

There are no new data. The length distributions for the period 1989–2006 of biological stocks based on Icelandic data are shown in Figure 21.3.1. The length of the largest proportion of caught fish oscillates around 35 cm for the whole period.

21.4 Discards

Redfish form aggregations composed of individuals with a narrow size range, which results in very clean catches. Thus, discards are negligible according to available data from various institutes.

21.5 Illegal Unregulated and Unreported Fishing (IUU)

The Group had again difficulties in obtaining catch estimates from several fleets. Furthermore, there are problems with misreported catches from some nations. The Group requests NEAFC and NAFO to provide ICES in time with all the necessary information.

21.6 Surveys

The last international trawl-acoustic survey for the shallow pelagic stock was carried out in June/July 2018 and it is described in detail in ICES WGRS Report 2018 (ICES, 2018). Only one vessel from Russia participated in the survey. Iceland informed WGIDEEPS in November 2017 that it would not participate, and Germany had to withdraw its participation in June 2018 because of a broken vessel. For this reason, only Subarea A was surveyed which is not enough area

coverage to obtain total biomass estimates for the shallow pelagic stock (Figures 21.6.5 and 21.6.6). Therefore, no total biomass estimates are available for the shallow pelagic stock since 2013 (Table 21.6.1). Results from the survey in 2018, although limited, are discussed in sections 21.6.1 and 21.6.2.

21.6.1 Survey acoustic data

Since 1994, the results of the acoustic survey show a drastic decreasing trend from 2.2 million t to 600 000 t in 1999 and have fluctuated between 700 000 t – 90 000 t in 2001–2013 (Table 21.6.1). The 2003 estimate, however, was considered to be inconsistent with the time series due to a shift in the timing of the survey.

The most recent trawl-acoustic survey on pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters that covers the whole distribution of the stock was carried out by Iceland, Germany and Russia in June/July 2013. Approximately 341 000 NM² were covered. Figures 20.6.1 and 20.6.2 show the biomass estimates for depth shallower than the DSL (Depth Scattering Layer). A total biomass of 91 000 t was estimated acoustically in the layer shallower than the DSL (Table 21.6.1 and Figure 21.6.4). The results showed a substantial biomass decline in subarea B compared to 2011 but in other areas the biomass was similar as in 2011 (Table 21.6.2 and Figure 21.6.5 for area definition). No biomass estimates of redfish were derived in 2015 at depths shallower than the deep scattering layer (DSL) by hydroacoustic measurements.

The survey in 2018 (ICES, 2018) only covered Subarea A (Figures 21.6.5 and 21.6.6), and only 103 000 NM² was covered compared to 341 000 NM² in 2013 (Table 21.6.1). An estimate of 82 000 t was estimated acoustically in the layer shallower than the DSL which is the highest value observed since 2007 (Table 21.6.2). Biological samples from the acoustic estimate above the DSL a mean length of 33 cm in Subarea A which is 2.9 cm smaller fish than caught in 2013.

21.6.2 Survey trawl estimates

In addition to the acoustic measurements, redfish biomass was estimated by correlating catches and acoustic values at depths shallower than 500 m at 200 000 t, a 45% decrease respect the estimation of 360 000 t for 2011 (Table 21.6.1 and Figure 21.6.4). Figure 21.6.3 shows the distribution of the redfish catches within the DSL and shallower than 500 m. It should be noted that the estimate for 2013 was recalculated due to technical error made in 2013 (ICES 2014).

The trawl biomass estimates in Subarea A in 2018 was 171 000 t which is the highest value observed in this subarea since the beginning of the time series in 2001 (Table 21.6.3).

The obtained correlation was used to convert the trawl data at greater depths to acoustic values and from there to abundance. For that purpose, standardized trawl hauls were carried out at depth 350–500 m, evenly distributed over the survey area (Figure 21.6.3). For the time being, the correlation between the catch and acoustic values is based on few data points only and it is highly variable. It is also assumed that the catchability of the trawl is the same, regardless of the trawling depth, thus the abundance estimate obtained is questionable and must only be considered as a rough attempt to measure the abundance within the DSL. Evaluation on the consistency of the method has to wait until more data points are available.

Biological samples from the trawls within the DSL and shallower than 500 m showed a mean length of 33.2 cm, which is 2.5 cm smaller fish than caught in 2015. Figure 21.6.3 shows the spatial distribution of samples used in the survey and Figure 21.6.7 shows the corresponding length distribution.

The 2018 survey, therefore indicates a marked decrease in the average total length in Shallow Pelagic *S. mentella* in the area observed. Despite no indication of young juvenile redfish on the Greenlandic or Icelandic shelf in the last 5–10 years (ICES, 2018) this may give an indication of recruitment of juvenile fish into the adult population of Shallow Pelagic *S. mentella* in the Irminger Sea.

21.7 Methods

The assessment of pelagic redfish in the Irminger Sea and adjacent waters is based on survey indices, catches, CPUE and biological data. See Stock Annex and Section 21.6 for details.

21.8 Reference points

For pelagic redfish in the Irminger Sea and adjacent waters, no analytical assessment is carried out due to data uncertainties and the lack of reliable age data. Thus, no reference points can be derived.

21.9 State of the stock

21.9.1 Short term forecast

For pelagic redfish in the Irminger Sea and adjacent waters, no analytical assessment is carried out due to data uncertainties and the lack of reliable age data. Thus, no short-term forecasts can be derived.

21.9.2 Uncertainties in assessment and forecast

21.9.2.1 Data considerations

Preliminary official landings data were provided by the ICES Secretariat, NEAFC and NAFO, and various national data were reported to the Group. The Group, however, repeatedly faces problems to obtain reliable catch data due to unreported catches of pelagic redfish and lack of catch data disaggregated by depth from some countries. There are indications that reported effort (and consequently landings) could represent only around 80% of the real effort in certain years (see Chapter 20.3.3 in the 2008 NWWG report, ICES, 2008). No new data in IUU have been available since 2008.

As in previous years, detailed descriptions on the horizontal, vertical and seasonal distribution of the fisheries were given.

The need and importance of having catch and biological data disaggregated by depth from all nations taking part in the fishery cannot be stressed strongly enough, and the Group urges all nations involved on supplying better data. With this need in mind, ICES sent a data call to all EU countries participating in the redfish fishery, encouraging stockholders to deliver detailed catch data before the WG would meet, but the response was very limited.

21.9.2.2 Assessment quality

The results of the international trawl-acoustic survey are given in section 21.6. Given the high variability in the correlation between trawl and acoustic estimates as well as the assumptions that need to be made about constant catchability across depth and areas, the uncertainty of these estimates is very high.

The survey carried out in 2015 and 2018 only covered part of the geographical distribution of the shallow pelagic stock and hence, no total biomass estimates are available since 2013.

The reduction in biomass observed in the surveys within the hydroacoustic layer (about 2 million t in the last decade) cannot be explained by the reported removal by the fisheries (about 500,000 t in the entire depth range in 1995–2013) alone. A decreasing trend in the relative biomass indices in the acoustic layer, however, is visible since 1991.

It is not known to what extent CPUE reflects changes in the stock status of pelagic *S. mentella*, since the fishery focuses on aggregations. Therefore, stable or increasing CPUE series might not indicate or reflect actual trends in stock size, although decreasing CPUE indices are likely to reflect a decreasing stock. The new data available to the NWWG were insufficient to estimate the CPUE for 2013.

NEAFC set for 2015–2018 a 0 TAC for Shallow Pelagic *S. mentella*. However, the Russian Federation decided on a unilateral annual quota of 27 300 t in 2015 and 2016 and 24 900 in 2017 and 2019. This quota was taken from both Shallow and Deep pelagic stocks, since the Russian Federation does not agree on the division of the *S. mentella* management units and stock structure.

21.9.3 Comparison with previous assessment and forecast

The data available for evaluating the stock status are similar to last year.

21.9.4 Management considerations

The Group needs more and better data and requests that NEAFC and NAFO provide ICES with all information leading to more reliable catch statistics.

The main feature of the fishery since 1998 is a clear distinction between two widely separated fishing grounds with pelagic redfish fished at different seasons and different depths. Since 2000, the southwestern fishing grounds extended also into the NAFO Convention Area. Biological data, however, suggest that the aggregations in the NAFO Convention Area do not constitute a separate stock. The NAFO Scientific Council agreed with this conclusion (NAFO, 2005). The Group concludes that at this time there are not enough scientific bases available to propose an appropriate split of the total TAC among the two fisheries/areas.

21.9.5 Ecosystem considerations

The fisheries on pelagic redfish in the Irminger Sea and adjacent waters are generally regarded as having negligible impact on the habitat and other fish or invertebrate species due to very low bycatch and discard rates, characteristic of fisheries using pelagic gear.

21.9.6 Changes in the environment

The hydrography in the June/July 2013 survey show that temperature in the survey area is above average but it was lower than in 2011 in most of the surveyed area, except for the Irminger Current (ICES, 2013).

The increase of water temperature in the Irminger Sea may have an effect on spatial and vertical distribution of *S. mentella* in the feeding area (Pedchenko, 2005). The abundance and distribution of *S. mentella* in relation to oceanographic conditions were analysed in a special multistage workshop (WKREDOCE1-3). Based on 20 years of survey data, the results reveal the average relation

of redfish to their physical habitat in shallow and intermediate waters: The most preferred latitude, longitude, depth, salinity and temperature for *S. mentella* are approximately 58°N, 40°W, 300 m, 34.89 and 4.4°C, respectively. The spatial distribution of *S. mentella* in the Irminger Sea mainly in waters <500 m (and thus mainly relating to the “shallow” stock) appears strongly influenced by the Irminger Current Water (ICW) temperature changes, linked to the Subpolar Gyre (SPG) circulation and the North Atlantic Oscillation (NAO). The fish avoid waters mainly associated with the ICW (>4.5°C and >34.94) in the north-eastern Irminger Sea, which may cause displacing towards the southwest, where fresher and colder water occurs (ICES, 2012b).

Results based on international redfish survey data suggest that the interannual distribution of fish above 500 m will shift in a southwest/northeast direction depending on integrated oceanographic conditions (ICES, 2012b).

21.10 References

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Table 21.2.1 Shallow Pelagic *S. mentella* (stock unit <500 m). Catches (in tonnes) by area as used by the Working Group.

| Year | Va | XII | XIV | NAFO 1F | NAFO 2J | NAFO 2H | Total |
|------|-------|--------|--------|---------|---------|---------|---------|
| 1982 | 0 | 39 783 | 20 798 | 0 | 0 | 0 | 60 581 |
| 1983 | 0 | 60 079 | 155 | 0 | 0 | 0 | 60 234 |
| 1984 | 0 | 60 643 | 4189 | 0 | 0 | 0 | 64 832 |
| 1985 | 0 | 17 300 | 54 371 | 0 | 0 | 0 | 71 671 |
| 1986 | 0 | 24 131 | 80 976 | 0 | 0 | 0 | 105 107 |
| 1987 | 0 | 2 948 | 88 221 | 0 | 0 | 0 | 91 169 |
| 1988 | 0 | 9 772 | 81 647 | 0 | 0 | 0 | 91 419 |
| 1989 | 0 | 17 233 | 21 551 | 0 | 0 | 0 | 38 784 |
| 1990 | 0 | 7 039 | 24 477 | 385 | 0 | 0 | 31 901 |
| 1991 | 0 | 9 684 | 17 037 | 458 | 0 | 0 | 27 179 |
| 1992 | 106 | 22 969 | 39 488 | 0 | 0 | 0 | 62 564 |
| 1993 | 0 | 66 461 | 34 310 | 0 | 0 | 0 | 100 771 |
| 1994 | 665 | 77 211 | 18 992 | 0 | 0 | 0 | 96 869 |
| 1995 | 77 | 78 898 | 21 160 | 0 | 0 | 0 | 100 136 |
| 1996 | 16 | 22 544 | 19 210 | 0 | 0 | 0 | 41 770 |
| 1997 | 321 | 18 211 | 9 213 | 0 | 0 | 0 | 27 746 |
| 1998 | 284 | 22 002 | 1 864 | 0 | 0 | 0 | 24 150 |
| 1999 | 165 | 23 713 | 1 101 | 534 | 0 | 0 | 25 512 |
| 2000 | 3 375 | 17 491 | 1 298 | 11 052 | 0 | 0 | 33 216 |
| 2001 | 228 | 32 164 | 2 383 | 5 290 | 1 751 | 8 | 41 825 |
| 2002 | 10 | 24 025 | 336 | 15 702 | 3 143 | 0 | 43 216 |
| 2003 | 49 | 24 211 | 132 | 26 594 | 5 377 | 325 | 56 688 |
| 2004 | 10 | 7 669 | 1 158 | 20 336 | 4 778 | 0 | 33 951 |
| 2005 | 0 | 6 784 | 281 | 16 260 | 4 899 | 5 | 28 229 |
| 2006 | 0 | 2 094 | 94 | 12 692 | 593 | 260 | 15 734 |
| 2007 | 71 | 378 | 98 | 2 843 | 2 561 | 175 | 6 126 |
| 2008 | 32 | 25 | 422 | 1 580 | 0 | 0 | 2 059 |
| 2009 | 0 | 210 | 2 170 | 0 | 0 | 0 | 2 380 |
| 2010 | 15 | 686 | 423 | 1 074 | 0 | 0 | 2 198 |

| Year | Va | XII | XIV | NAFO 1F | NAFO 2J | NAFO 2H | Total |
|------|-----|-------|-----|---------|---------|---------|-------|
| 2011 | 0 | 0 | 234 | 0 | 0 | 0 | 234 |
| 2012 | 28 | 0 | 0 | 3 113 | 32 | 0 | 3 173 |
| 2013 | 32 | 13 | 40 | 1 443 | 1 | 0 | 1 529 |
| 2014 | 153 | 5 068 | 489 | 713 | 0 | 0 | 6 423 |
| 2015 | 161 | 2 281 | 0 | 3 119 | 34 | 0 | 5 595 |
| 2016 | 235 | 1 671 | 0 | 61 | 0 | 0 | 1 967 |
| 2017 | 81 | 10 | 10 | 0 | 0 | 0 | 101 |
| 2018 | 0 | 2 203 | 0 | 2 396 | 0 | 0 | 4 599 |

1982–1991 All pelagic catches assumed to be of the shallow pelagic stock

1992–1996 Guesstimates based on different sources (see text)

1997–2018 Catches from calculations based on jointed catch database and total landings

Table 21.2.2 Shallow pelagic *S. mentella* catches (in tonnes) in ICES Div. 5a, subareas 12, 14 and NAFO Div. 1F, 2H and 2J by countries used by the Working Group. * Prior to 1991, the figures for Russia included Estonian, Latvian and Lithuanian catches.

| Year | Bulgaria | Canada | Estonia | Faroes | France | Germany | Green-land | Iceland | Japan | Latvia | Lithuania | Nether-lands | Norway | Poland | Portugal | Russia* | Spain | UK | Ukraine | Total |
|------|----------|--------|---------|--------|--------|---------|------------|---------|-------|--------|-----------|--------------|--------|--------|----------|---------|-------|-----|---------|---------|
| 1982 | | | | | | | | | | | | | | 581 | | 60 000 | | | | 60 581 |
| 1983 | | | | | | 155 | | | | | | | | | | 60 079 | | | | 60 234 |
| 1984 | 2 961 | | | | | 989 | | | | | | | | 239 | | 60 643 | | | | 64 832 |
| 1985 | 5 825 | | | | | 5 438 | | | | | | | | 135 | | 60 273 | | | | 71 671 |
| 1986 | 11 385 | | | 5 | | 8 574 | | | | | | | | 149 | | 84 994 | | | | 105 107 |
| 1987 | 12 270 | | | 382 | | 7 023 | | | | | | | | 25 | | 71 469 | | | | 91 169 |
| 1988 | 8 455 | | | 1 090 | | 16 848 | | | | | | | | | | 65 026 | | | | 91 419 |
| 1989 | 4 546 | | | 226 | | 6 797 | 567 | 3 816 | | | | | | 112 | | 22 720 | | | | 38 784 |
| 1990 | 2 690 | | | | | 7 957 | | 4 537 | | | | | 7 085 | | | 9 632 | | | | 31 901 |
| 1991 | | | 2 195 | 115 | | 201 | | 8 724 | | | | | 6 197 | | | 9 747 | | | | 27 179 |
| 1992 | 628 | | 1 810 | 3 765 | 2 | 6 447 | 9 | 12 080 | | 780 | 6 656 | | 14 654 | | | 15 733 | | | | 62 564 |
| 1993 | 3 216 | | 6 365 | 6 812 | | 16 677 | 710 | 10 167 | | 6 803 | 7 899 | | 14 112 | | | 25 229 | | | 2 782 | 100 771 |
| 1994 | 3 600 | | 17 875 | 2 896 | 606 | 15 133 | | 5 897 | | 13 205 | 7 404 | | 6 834 | 1510 | | 16 349 | | | 5 561 | 96 869 |
| 1995 | 2 660 | 421 | 11 798 | 3 667 | 158 | 10 714 | 277 | 8 733 | 841 | 3 502 | 16 025 | 9 | 4 288 | 2170 | | 28 314 | 4 327 | | 2 230 | 100 136 |
| 1996 | 1 846 | 343 | 3 741 | 2 523 | | 5 696 | 1866 | 5 760 | 219 | 572 | 5 618 | | 1 681 | | 476 | 9 348 | 1 671 | 137 | 273 | 41 770 |
| 1997 | | 102 | 3 405 | 3 510 | | 9 276 | | 4 446 | 28 | | | | 330 | 776 | 367 | 3 693 | 1 812 | | | 27 746 |

| Year | Bulgaria | Canada | Estonia | Faroes | France | Germany | Green-land | Iceland | Japan | Latvia | Lithuania | Nether-lands | Norway | Poland | Portugal | Russia* | Spain | UK | Ukraine | Total |
|------|----------|--------|---------|--------|--------|---------|------------|---------|-------|--------|-----------|--------------|--------|--------|----------|---------|-------|-----|---------|--------|
| 1998 | | | 3 892 | 2 990 | | 9 679 | 1161 | 1 983 | 30 | | 1 734 | | 701 | 12 | 60 | 89 | 1 819 | | | 24 150 |
| 1999 | | | 2 055 | 1 190 | | 8 271 | 998 | 3 662 | | | | | 2 098 | 6 | 62 | 6 538 | 447 | 183 | | 25 512 |
| 2000 | | | 4 218 | 486 | | 5 672 | 956 | 3 766 | | | 430 | | 2 124 | | 37 | 14 373 | 1 154 | | | 33 216 |
| 2001 | | | 9 | 4 364 | | 4 755 | 1083 | 14 745 | | | 8 269 | | 947 | | 256 | 5 964 | 1 433 | | | 41 825 |
| 2002 | | | | 719 | | 5 354 | 657 | 5 229 | | 1 841 | 12 052 | | 1 094 | 428 | 878 | 13 958 | 1 005 | | | 43 216 |
| 2003 | | | | 1 955 | | 3 579 | 1047 | 4 274 | | 1 269 | 21 629 | | 3 214 | 917 | 1926 | 15 418 | 1 461 | | | 56 688 |
| 2004 | | | | 777 | | 1 126 | 750 | 5 728 | | 1 114 | 3 698 | | 2 721 | 1018 | 2133 | 13 208 | 1 679 | | | 33 951 |
| 2005 | | | | 210 | | 1 152 | | 3 086 | | 919 | 1 169 | | 624 | 1170 | 2780 | 15 562 | 1 557 | | | 28 229 |
| 2006 | | | | 334 | | 994 | | 1 293 | | 1 803 | 466 | | 280 | 663 | 1372 | 4 953 | 3 576 | | | 15 734 |
| 2007 | | | 209 | 98 | | 0 | | 71 | | 186 | 467 | | | 189 | 529 | 4 037 | 339 | | | 6 126 |
| 2008 | | | | 319 | | | | 63 | | | 8 | | | | | 1 597 | 73 | | | 2 059 |
| 2009 | | | | 93 | | | | 5 | | 59 | 138 | | | | | 649 | 1 438 | | | 2 380 |
| 2010 | | | | 653 | | | | 22 | | | 551 | | 12 | | 377 | 567 | 16 | | | 2 198 |
| 2011 | | | | 162 | | | | 72 | | | | | | | | | | | | 234 |
| 2012 | | | | | | | | 28 | | | | | | | | 3 145 | | | | 3 173 |
| 2013 | | | | | | | | 72 | | | | | | | | 1 457 | | | | 1 529 |
| 2014 | | | | | | | | 355 | | | 287 | | | | | 5 781 | | | | 6 423 |

| Year | Bulgaria | Canada | Estonia | Faroes | France | Germany | Green-land | Iceland | Japan | Latvia | Lithuania | Nether-lands | Norway | Poland | Portugal | Russia* | Spain | UK | Ukraine | Total |
|------|----------|--------|---------|--------|--------|---------|------------|---------|-------|--------|-----------|--------------|--------|--------|----------|---------|-------|----|---------|-------|
| 2015 | | | | | | | | 161 | | | | | | | | 5 434 | | | | 5 595 |
| 2016 | | | | | | | | 235 | | | | | | | | 1 732 | | | | 1 967 |
| 2017 | | | | | | | | 91 | | | | | | | | 10 | | | | 101 |
| 2018 | | | | | | | | | | | | | | | | 4 599 | | | | 4 599 |

Table 21.6.1 Shallow Pelagic *S. mentella*. Results for the acoustic survey indices 1991–2018 from shallower than the scattering layer, trawl estimates within the deep scattering layer and shallower than 500 m, and area coverage of the survey in the Irminger Sea and adjacent waters. No estimates are available for 2015 and only Subarea A (Figure 21.6.5) was surveyed in 2018.

| Year | Area covered (1,000 NM ²) | Acoustic estimates (1,000 t) | Trawl estimates (1,000 t) |
|---------|---------------------------------------|------------------------------|---------------------------|
| 1991 | 105 | 2,235 | |
| 1992 | 190 | 2,165 | |
| 1993 | 121 | 2,556 | |
| 1994 | 190 | 2,190 | |
| 1995 | 168 | 2,481 | |
| 1996 | 253 | 1,576 | |
| 1997 | 158 | 1,225 | |
| 1999 | 296 | 614 | |
| 2001 | 420 | 716 | 565 |
| 2003* | 405 | 89* | 92* |
| 2005 | 386 | 552 | 392 |
| 2007 | 349 | 372 | 283 |
| 2009 | 360 | 108 | 331 |
| 2011 | 343 | 123 | 361 |
| 2013 | 340 | 91 | 200 |
| 2015** | - | - | 69** |
| 2018*** | 103*** | 82**** | 171*** |

* The 2003 biomass estimate is considered as inconsistent as the survey was carried out about one month earlier than usual, and a marked seasonal effect was observed.

** The 2015 biomass estimate is considered partial as only Subareas A and B were surveyed (Figure 21.6.5).

*** The 2018 biomass estimate is considered partial as only Subareas A was surveyed (Figure 21.6.5).

Table 21.6.2. Results (acoustic biomass in '000 t) for the international surveys conducted since 1994, for redfish shallower than the DSL for each subarea (see Figure 21.6.5 for area definition) and the total biomass. No total biomass estimate was available in 2015 (no data) and in 2018 only Subarea A was surveyed.

| Year | Subarea | | | | | | Total |
|-------|---------|-------|----|-----|-----|----|-------|
| | A | B | C | D | E | F | |
| 1994 | 673 | 1,228 | - | 63 | 226 | | 2,190 |
| 1996 | 639 | 749 | - | 33 | 155 | | 1,576 |
| 1999 | 72 | 317 | 16 | 42 | 167 | | 614 |
| 2001 | 88 | 220 | 30 | 267 | 103 | 7 | 716 |
| 2003* | 32 | 46 | 1 | 2 | 10 | 0 | 89 |
| 2005 | 121 | 123 | 0 | 87 | 204 | 17 | 552 |
| 2007 | 80 | 95 | 0 | 53 | 142 | 3 | 372 |
| 2009 | 39 | 48 | 4 | 1 | 15 | 1 | 108 |
| 2011 | 5 | 74 | 0 | 3 | 40 | 1 | 123 |
| 2013 | 9 | 33 | 2 | 5 | 42 | 0 | 91 |
| 2015 | - | - | - | - | - | - | - |
| 2018 | 82 | - | - | - | - | - | - |

* The 2003 biomass estimate is considered as inconsistent as the survey was carried out about one month earlier than usual, and a marked seasonal effect was observed.

Table 21.6.3. Biomass estimates (trawl biomass in '000 t) within the DSL layer and shallower than 500 m by Subarea (see Figure 26.6.5 for area definition) from the international redfish surveys in the Irminger Sea and adjacent waters. No biomass estimates are available for 2005 and 2007.

| Subarea | | | | | | | |
|---------|-----|-----|----|-----|-----|---|-------|
| Year | A | B | C | D | E | F | Total |
| 2001 | 23 | 40 | 45 | 399 | 54 | 5 | 565 |
| 2003* | 25 | 46 | 3 | 4 | 14 | 0 | 92 |
| 2005 | 55 | 66 | 1 | 45 | 114 | 2 | 283 |
| 2007 | 69 | 117 | 1 | 27 | 110 | 8 | 332 |
| 2009 | 136 | 68 | 0 | 25 | 48 | 0 | 278 |
| 2011 | 69 | 185 | 1 | 30 | 76 | 0 | 309 |
| 2013 | 71 | 94 | 0 | 9 | 26 | 1 | 201 |
| 2015** | 31 | 38 | - | - | - | - | 69 |
| 2018*** | 171 | - | - | - | - | - | 171 |

* The 2003 biomass estimate is considered as inconsistent as the survey was carried out about one month earlier than usual, and a marked seasonal effect was observed.

** The 2015 biomass estimate is considered partial as only Subareas A and B were surveyed (Figure 21.6.5).

*** The 2018 biomass estimate is considered partial as only Subareas A was surveyed (Figure 21.6.5).

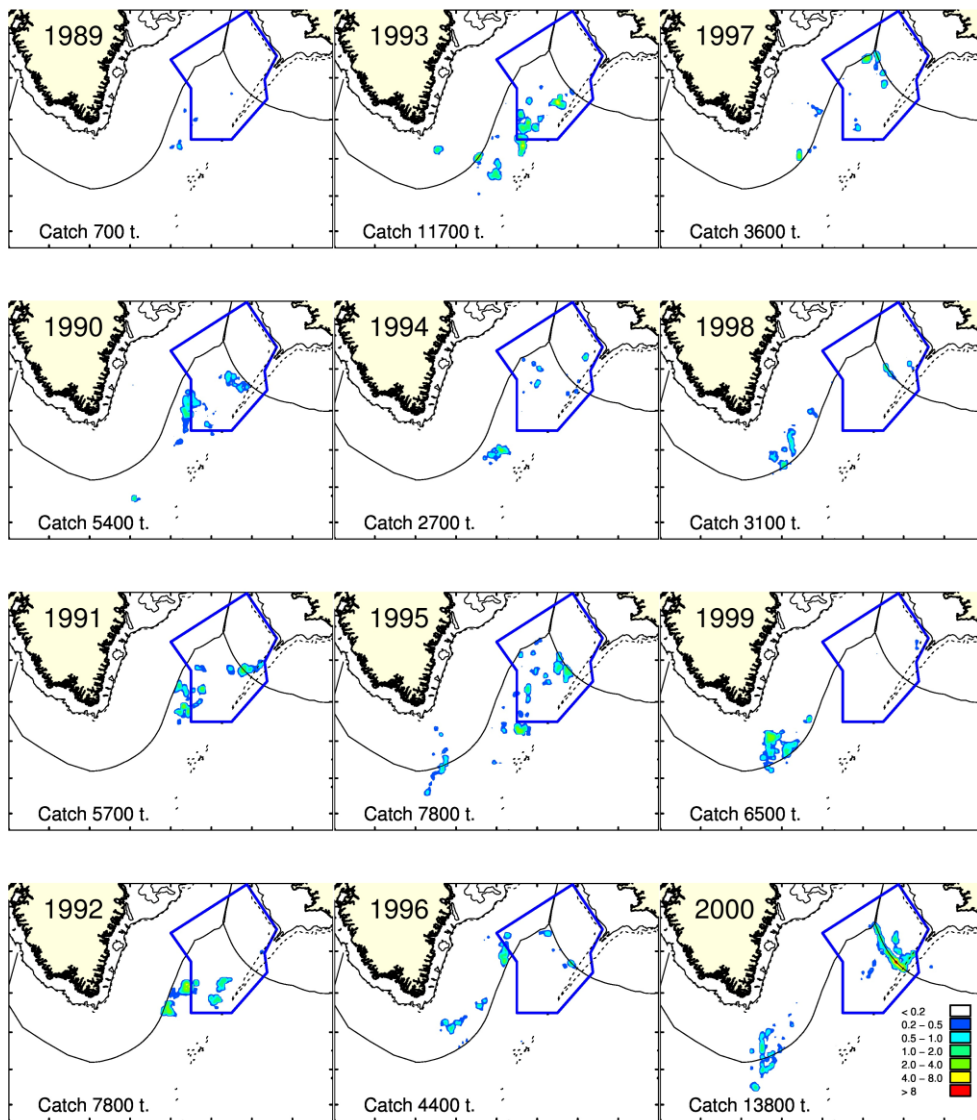


Figure 21.2.1 Fishing areas and total catch of pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters 1989–2012. Data are from the Faroe Islands (1995–2012), Iceland (1989–2012) and Norway (1992–2003). The catches in the legend are given as tonnes per square nautical mile. The blue box represents the management unit for the northern fishing area.

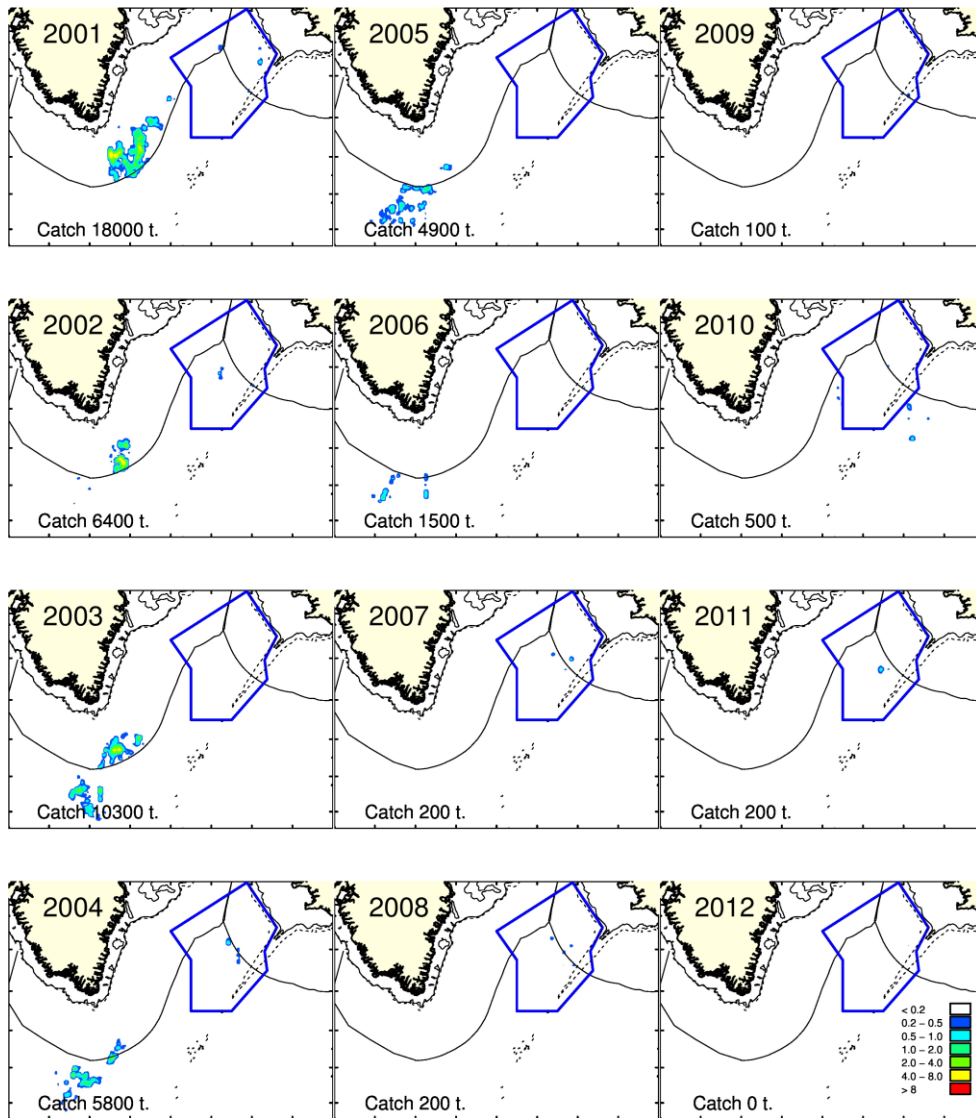


Figure 21.2.1 (Cont.) Fishing areas and total catch of pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters 1989–2012. Data are from the Faroe Islands (1995–2012), Iceland (1989–2012) and Norway (1992–2003). The catches in the legend are given as tonnes per square nautical mile. The blue box represents the management unit for the northern fishing area.

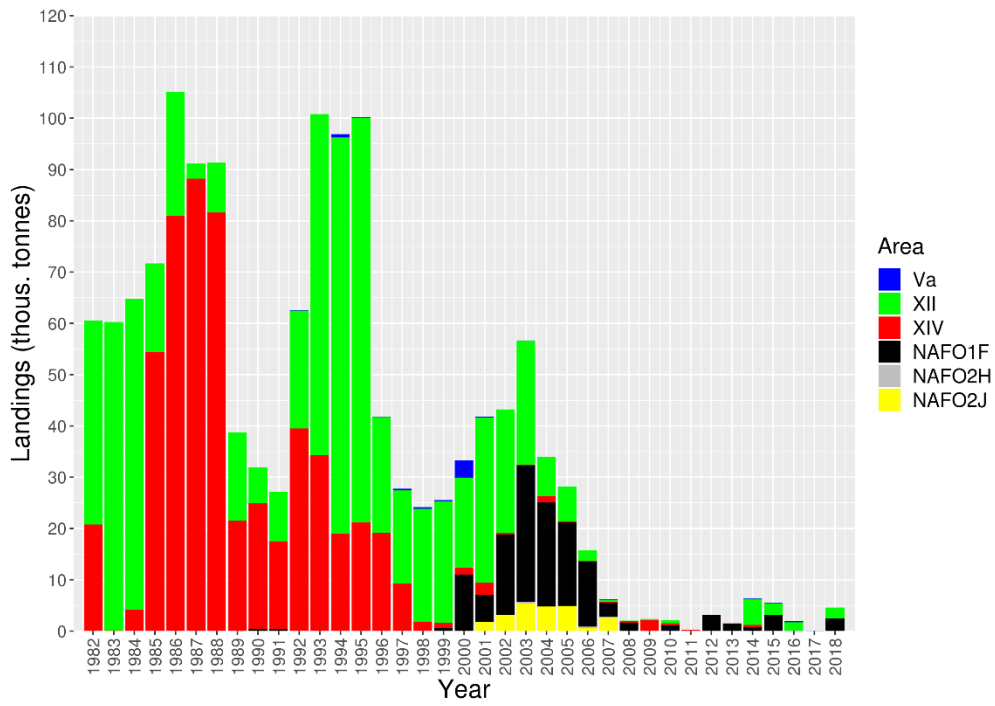


Figure 21.2.2 Landings of shallow pelagic *S. mentella* (Working Group estimates, see Table 21.2.1).

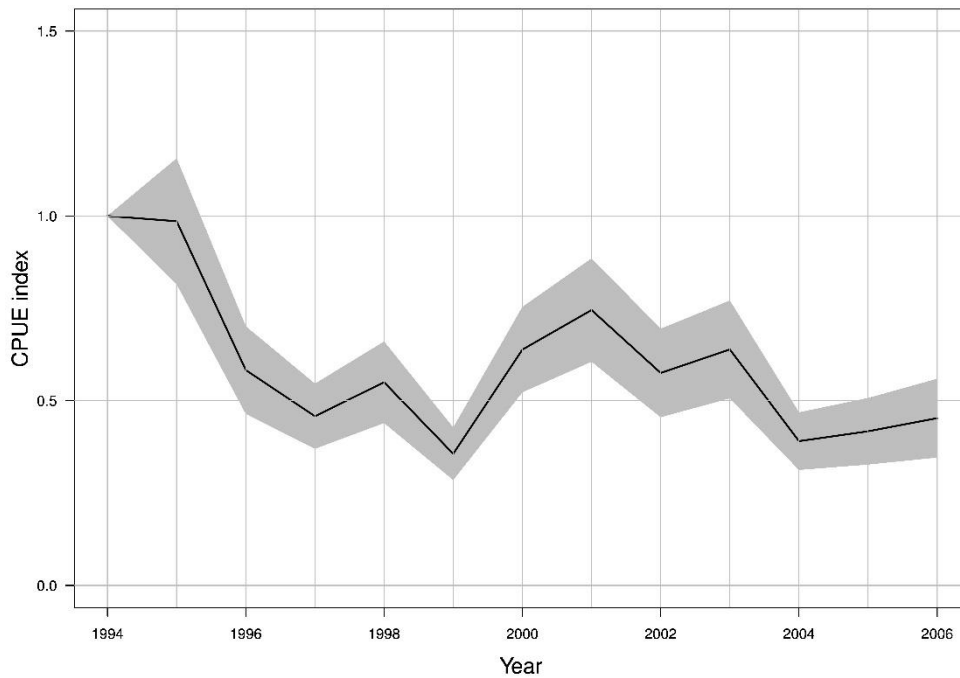


Figure 21.2.3 Trends in standardized CPUE of the shallow pelagic *S. mentella* fishery in the Irminger Sea and adjacent waters, based on log-book data from Faroes, Iceland, Norway, and Greenland.

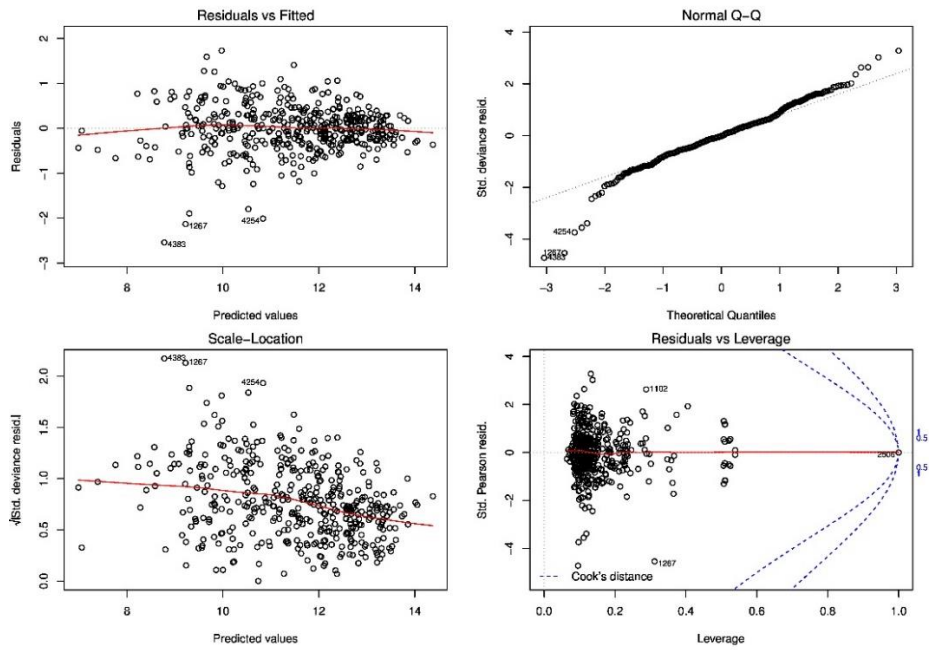


Figure 21.2.4 Residuals from the GLM model used to standardize CPUE, based on log-book data from Faroe Islands, Iceland, Greenland and Norway.

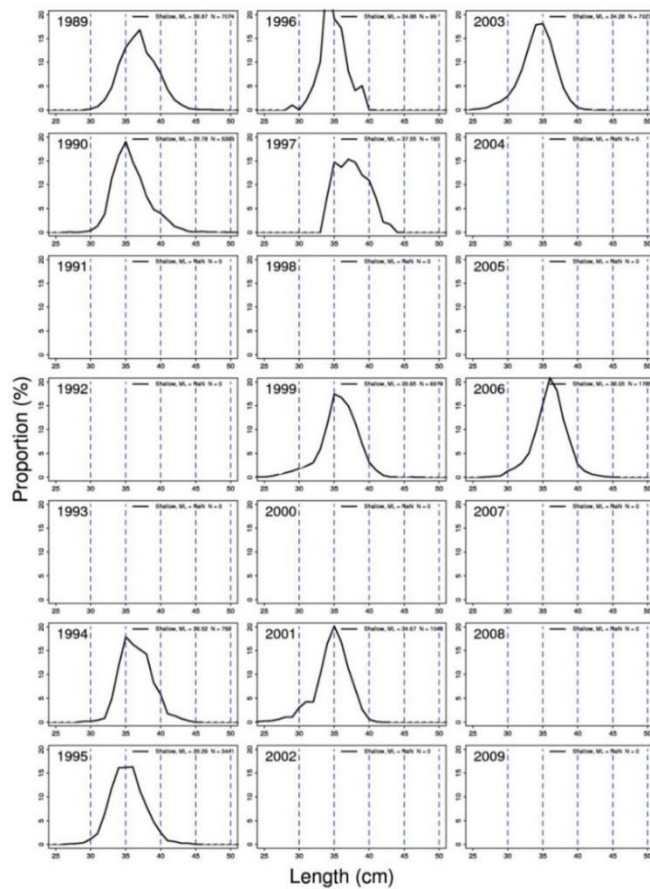


Figure 21.3.1 Length distribution from Icelandic landings of shallow pelagic *S. mentella*.

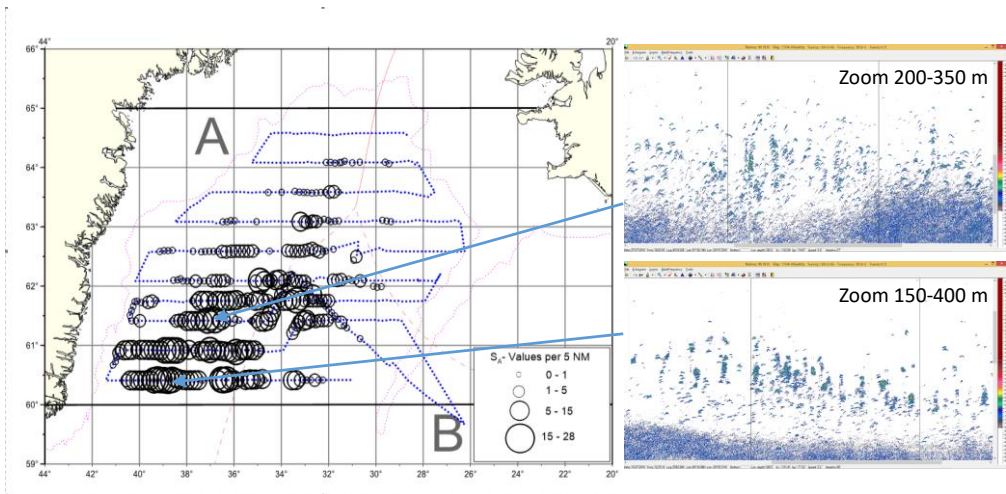
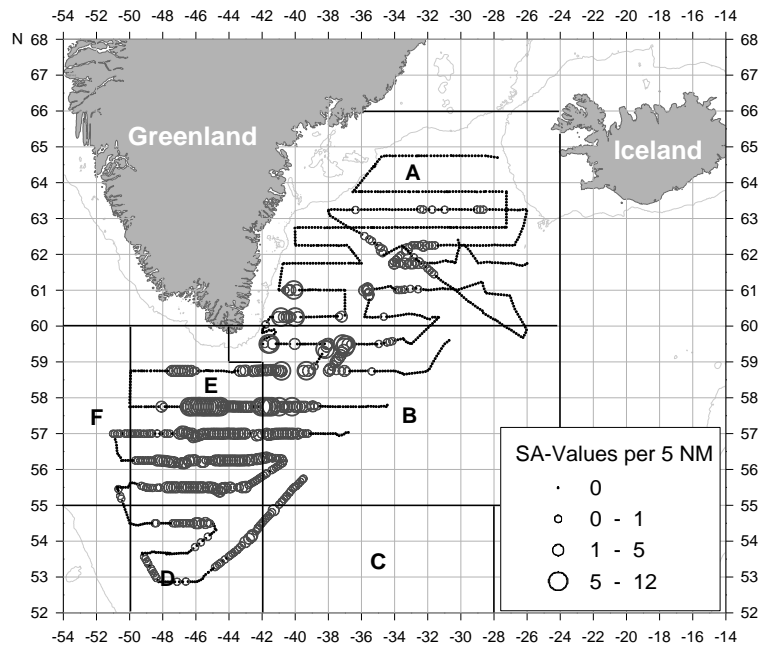


Figure 21.6.1 Pelagic *S. mentella*. Acoustic estimates (average s_A values by 5 NM sailed) shallower than the deep-scattering layer (DSL) from the joint trawl-acoustic survey in June/July 2013 (upper) and 2018 (lower).

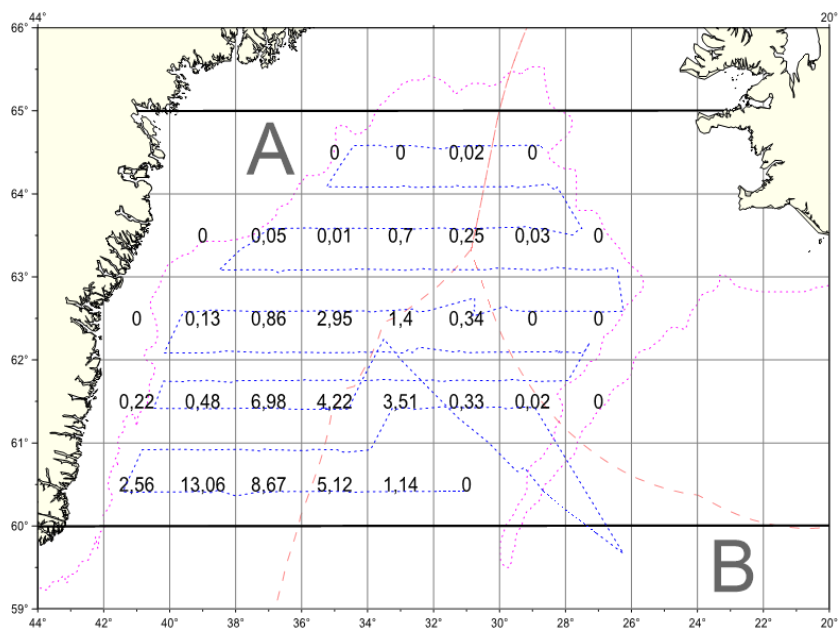
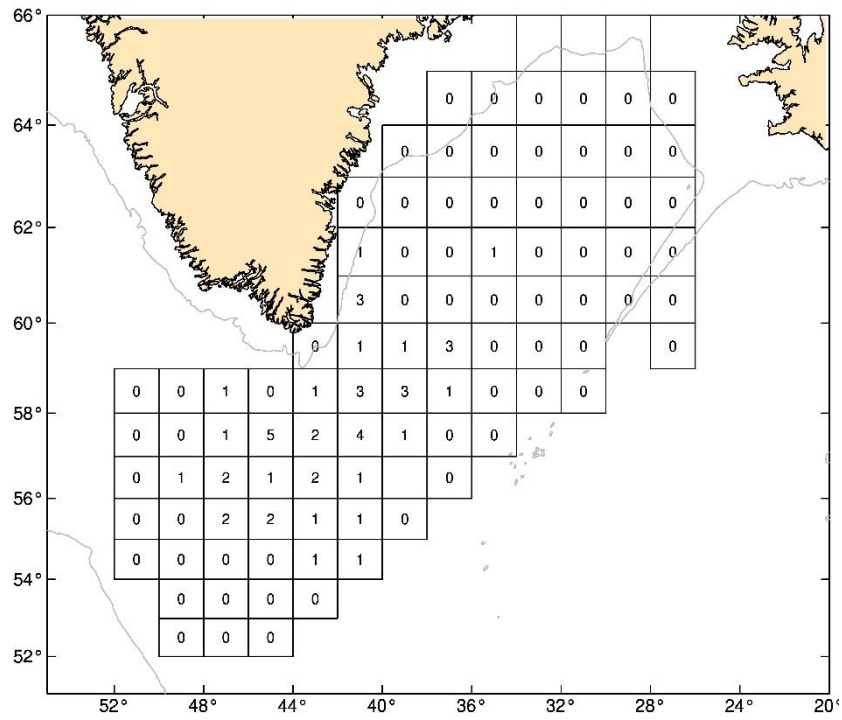


Figure 21.6.2. Redfish acoustic estimates shallower than the DSL (ca. 0–350 m) during the joint international redfish survey in 2013 (upper) and 2018 (lower). The figure shows average s_A values within statistical rectangles.

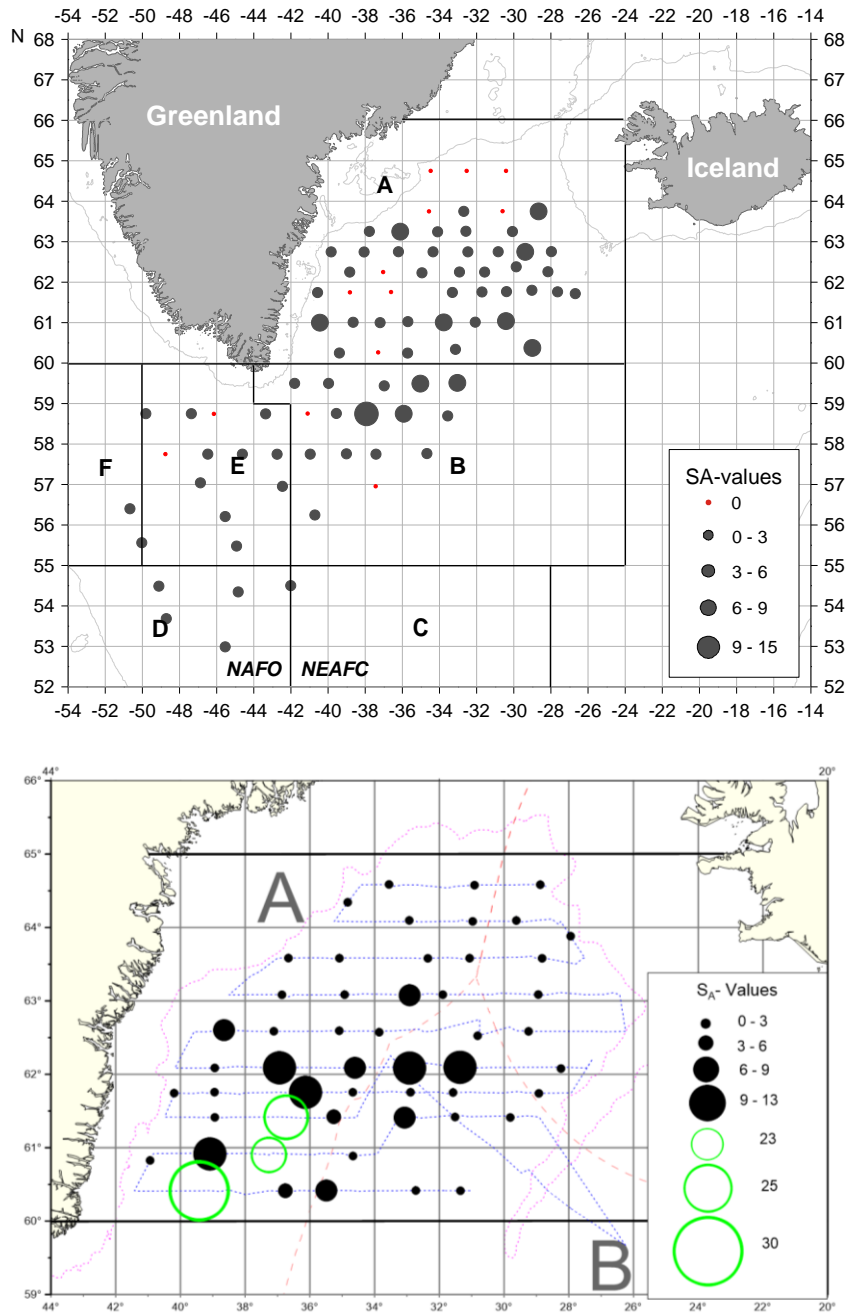


Figure 21.6.3 Redfish trawl estimates within the DSL shallower than 500 m during the joint international redfish survey in 2013 (upper) and 2018 (lower) . s_A values calculated by the trawl method (Section 21.6.2).

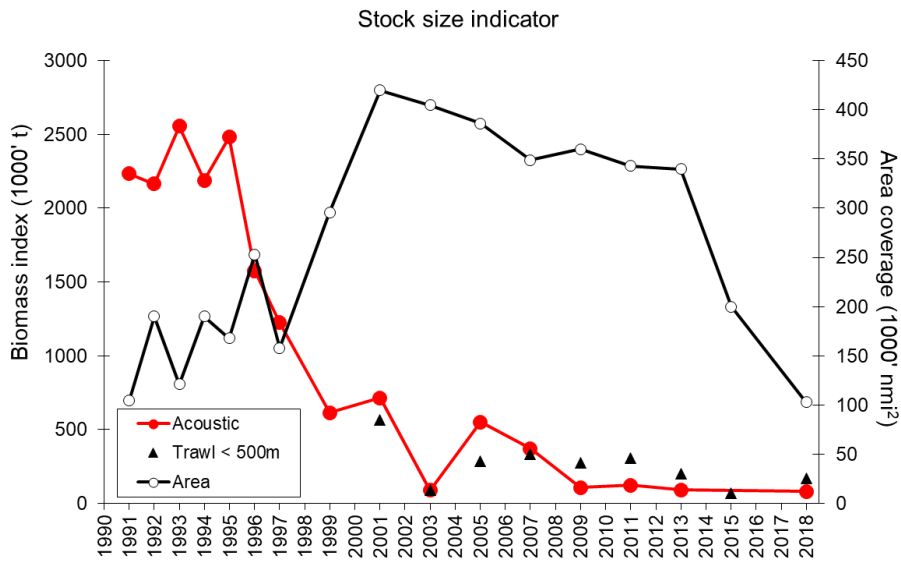


Figure 21.6.4. Overview of acoustic survey indices (thousand tonnes) from above the scattering layer (red filled circle), trawl estimates within the scattering layer and shallower than 500 m (black triangle), and aerial coverage (nmi²) of the survey (black open circle) in the Irminger Sea and adjacent waters.

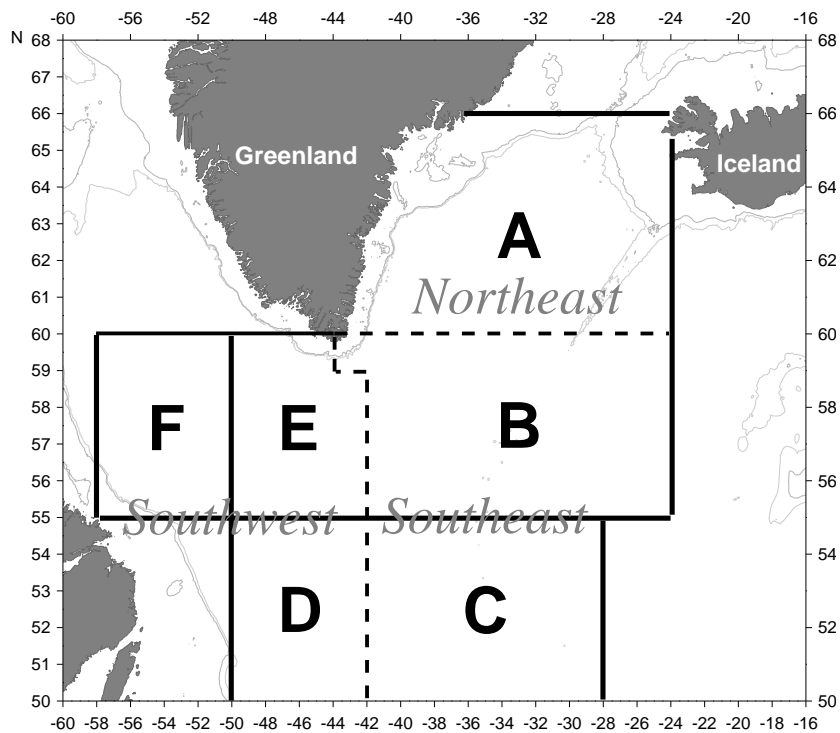


Figure 21.6.5 Subareas A–F used on international surveys for redfish in the Irminger Sea and adjacent waters, and divisions for biological data (Northeast, Southwest and Southeast; boundaries marked by broken lines).

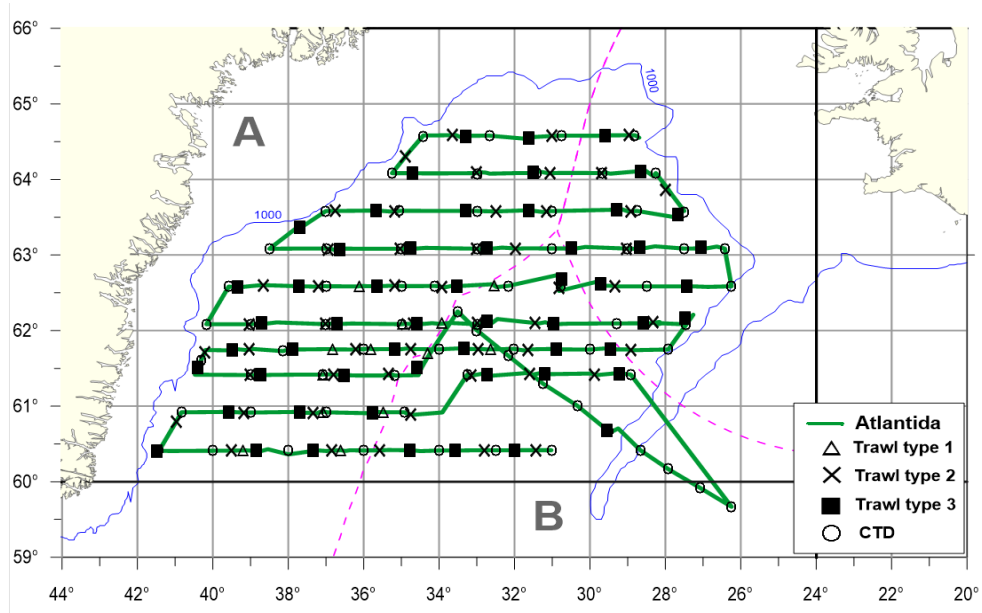


Figure 21.6.6. Cruise tracks and stations taken in the joint international redfish survey in June/July 2018.

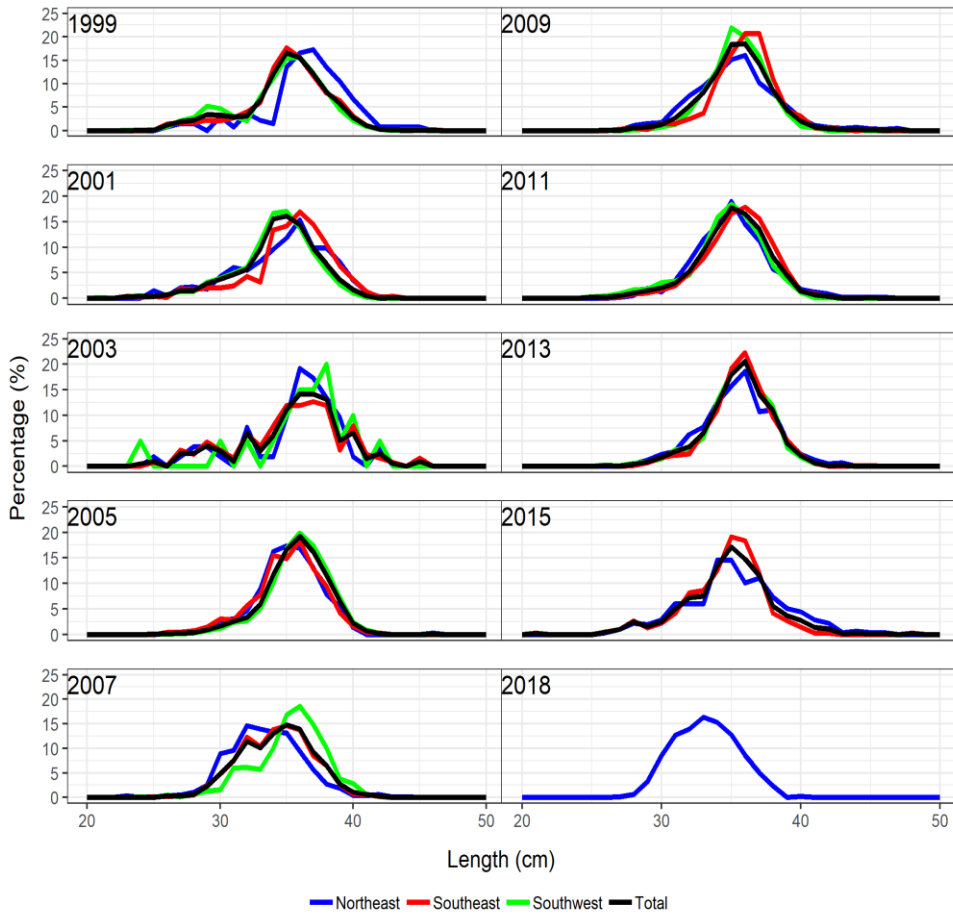


Figure 21.6.7. Length distribution of redfish in the trawls, by geographical areas and total, from fish caught shallower than 500 m 1999–2018.