

Sprat (*Sprattus sprattus*) in subdivisions 22–32 (Baltic Sea)

ICES stock advice

ICES advises that when the EU multiannual plan (MAP) is applied, catches in 2018 that correspond to the F ranges in the plan are between 219 152 tonnes and 301 722 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (291 715 tonnes) can only be taken under conditions specified in the MAP.

ICES advises that a spatial management plan is considered for the fisheries that catch sprat.

Stock development over time

The spawning-stock biomass (SSB) is well above $MSY B_{trigger}$. The recent increase in SSB is attributable to the strong year class of 2014. The 2015 and 2016 year classes are estimated slightly below average. Fishing mortality (F) has declined in recent years and is now below F_{MSY} .

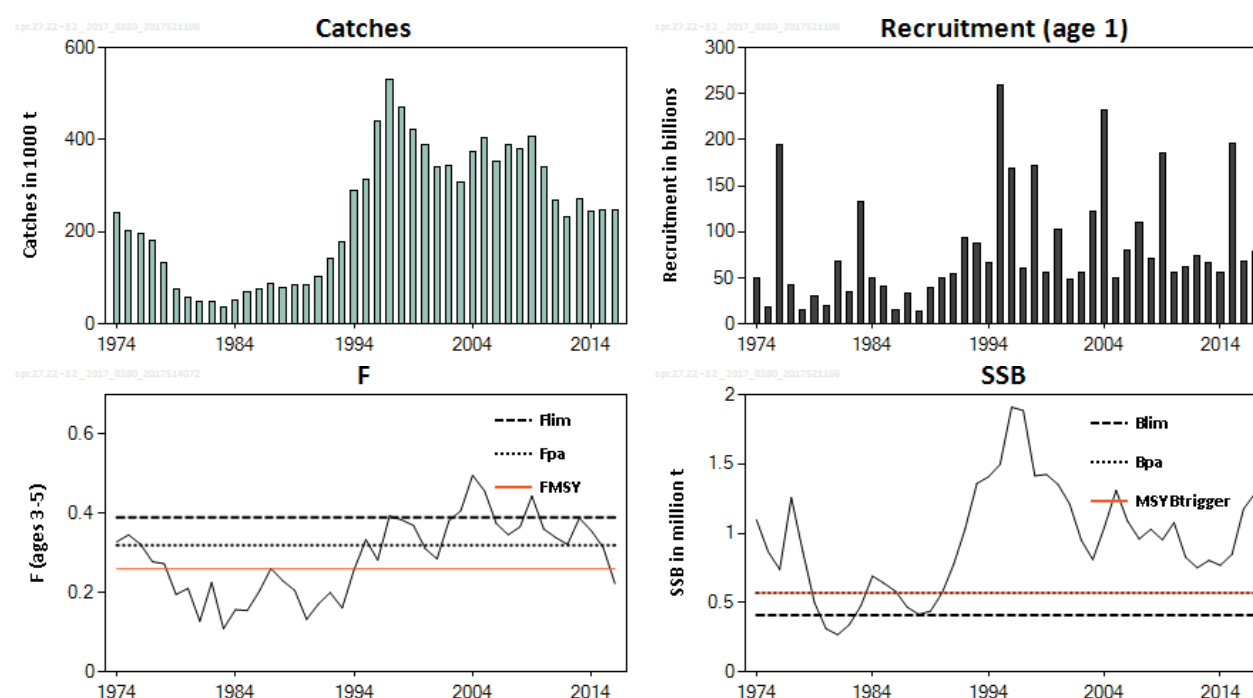


Figure 1 Sprat in subdivisions 22–32. Summary of the stock assessment. SSB at spawning time in 2017 is predicted.

Stock and exploitation status

Table 1 Sprat in subdivisions 22–32. State of the stock and fishery relative to reference points.

| | | Fishing pressure | | | Stock size | | |
|---------------------------|----------------------|------------------|------|-------------------------|-----------------------|------|------------------------------|
| | | 2014 | 2015 | 2016 | 2015 | 2016 | 2017 |
| Maximum sustainable yield | F_{MSY} | ✗ | ✗ | ✓ Below | MSY | ✓ | ✓ Above trigger |
| Precautionary approach | F_{pa} , F_{lim} | ○ | ✓ | ✓ Harvested sustainably | B_{pa} , B_{lim} | ✓ | ✓ Full reproductive capacity |
| Management plan | F_{ranges} | ✗ | ✗ | ✓ Within range | MSY , $B_{trigger}$ | ✓ | ✓ Above trigger |

Catch options

Table 2 Sprat in subdivisions 22–32. The basis for the catch options.

| Variable | Value | Source | Notes |
|--------------------------|----------|-------------|---|
| F ages 3–5 (2017) | 0.26 | ICES (2017) | Catch constraint* |
| SSB (2017) | 1289000 | ICES (2017) | Catch constraint (in tonnes) |
| R _{age1} (2017) | 79182000 | ICES (2017) | RCT 3 estimate (in thousands) |
| R _{age1} (2018) | 88708000 | ICES (2017) | Geometric mean 1991–2016 (in thousands) |
| R _{age1} (2019) | 88708000 | ICES (2017) | Geometric mean 1991–2016 (in thousands) |
| Total catch (2017) | 303593 | ICES (2017) | Catch constraint* (in tonnes) |

* Catch constraint of 303 593 t in 2017 (EU quota of 260 993 t and Russian quota of 42 600 t).

Table 3 Sprat in subdivisions 22–32. Annual catch options. All weights are in tonnes.

| Basis | Total catch (2018) | F _{total} (2018) | SSB (2018) | SSB (2019) | % SSB change * | % TAC change ** |
|--|--------------------|---------------------------|------------|------------|----------------|-----------------|
| ICES advice basis | | | | | | |
| EU MAP [^] : F _{MSY} | 291715 | 0.26 | 1225338 | 1220893 | –0.4 | –4.0 |
| F = MAP F _{MSY lower} | 219152 | 0.19 | 1255583 | 1308530 | 4.2 | –27.9 |
| F = MAP F _{MSY upper} | 301722 | 0.27 | 1221156 | 1208985 | –1.0 | –0.7 |
| Other options | | | | | | |
| MSY approach = F _{MSY} | 291715 | 0.26 | 1225338 | 1220893 | –0.4 | –4.0 |
| F = 0 | 0 | 0.00 | 1341000 | 1587000 | 18.3 | –100.0 |
| F _{pa} | 350992 | 0.32 | 1200243 | 1150369 | –4.2 | 15.5 |
| F _{lim} | 415620 | 0.39 | 1171008 | 1075110 | –8.2 | 36.7 |
| SSB (2019) = B _{lim} | 1093000 | 1.51 | 800000 | 410000 | –48.8 | 259.5 |
| SSB (2019) = B _{pa} | 906242 | 1.09 | 919677 | 570016 | –38.0 | 198.1 |
| SSB (2019) = MSY B _{trigger} | 906242 | 1.09 | 919677 | 570016 | –38.0 | 198.1 |
| F = F ₂₀₁₇ | 295000 | 0.26 | 1224000 | 1217000 | –0.6 | –3.0 |
| F = MAP F _{MSY lower} | 219152 | 0.19 | 1255583 | 1308530 | 4.2 | –27.9 |
| F = MAP F _{MSY lower} + 0.01 | 229758 | 0.2 | 1251417 | 1295652 | 3.5 | –24.4 |
| F = MAP F _{MSY lower} + 0.02 | 240364 | 0.21 | 1247250 | 1282773 | 2.8 | –20.9 |
| F = MAP F _{MSY lower} + 0.03 | 250650 | 0.22 | 1242711 | 1270205 | 2.2 | –17.5 |
| F = MAP F _{MSY lower} + 0.04 | 260916 | 0.23 | 1238148 | 1257658 | 1.6 | –14.2 |
| F = MAP F _{MSY lower} + 0.05 | 271183 | 0.24 | 1233703 | 1245228 | 0.9 | –10.8 |
| F = MAP F _{MSY lower} + 0.06 | 281449 | 0.25 | 1229521 | 1233061 | 0.3 | –7.4 |
| F = MAP F _{MSY lower} + 0.07 | 291715 | 0.26 | 1225338 | 1220894 | –0.4 | –4.0 |
| F = MAP F _{MSY upper} | 301722 | 0.27 | 1221156 | 1208985 | –1.0 | –0.7 |

* SSB 2019 relative to SSB 2018.

** Catches in 2018 relative to sum of autonomous quotas in 2017 (303 593 t; EU quota of 260 993 t and Russian quota of 42 600 t).

[^] MAP multiannual plan (EU, 2016).

Basis of the advice

Table 4 Sprat in subdivisions 22–32. The basis of the advice.

| | |
|-----------------|---|
| Advice basis | EU Baltic multiannual plan. |
| Management plan | The EU multiannual plan (MAP) in place for stocks in the Baltic Sea includes sprat (EU, 2016). The advice is based on the provisions of the plan and is considered precautionary. |

Quality of the assessment

The historical variations in the assessment are to some extent related to the revisions of predation mortalities from cod, used as input in the assessment model.

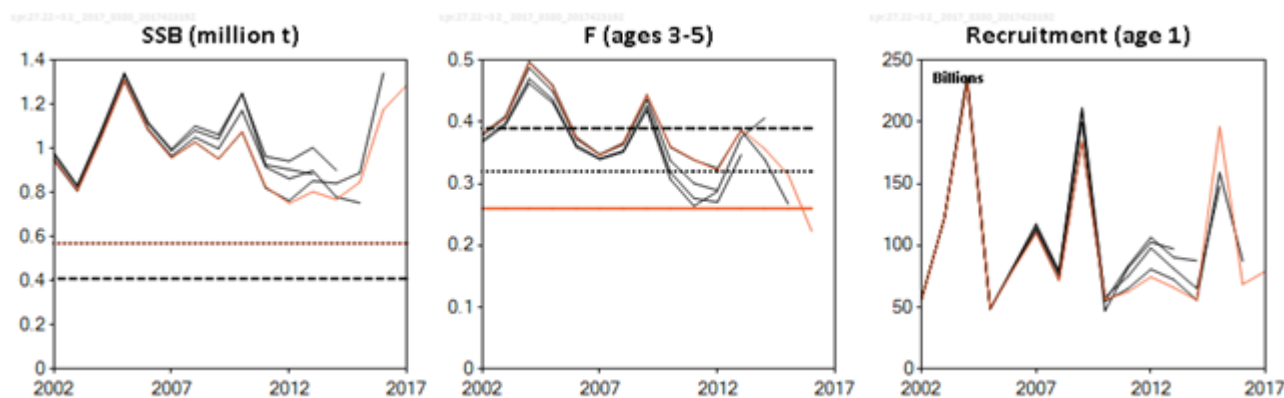


Figure 2 Sprat in subdivisions 22–32. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The F_{MSY} ranges in the EU Baltic Sea Multiannual Plan (MAP) are consistent with the ranges provided by ICES (2015); these were evaluated to result in no more than 5% reduction in long-term yield compared with MSY. The ICES advice according to the MAP is based on the provisions of the plan and is considered precautionary. The ICES advice rule is used, i.e. F is adjusted by the factor $SSB/MSY B_{trigger}$ when SSB is below $MSY B_{trigger}$. For this stock, the SSB in 2018 is above $MSY B_{trigger}$. In this situation, catch options applicable under the MAP correspond to fishing mortalities between F_{lower} and F_{upper} . However, according to the MAP, catches corresponding to F higher than F_{MSY} (i.e. Column B of Annex I in the MAP) can only be taken under conditions specified in the MAP.

ICES recommends that a spatial management plan is developed for the fisheries that catch sprat, with the aim to improve cod condition. The abundance of cod in subdivisions 25–26 is high compared to other areas in the Baltic and the cod condition is considered to be limited by food availability. Sprat and herring are important food items for cod (especially sprat), but the present high biomass of the two prey stocks is mainly distributed outside the distribution area for cod (Figure 3). Any fishery on the two prey species in the main cod distribution area (subdivisions 25–26) will potentially decrease the local sprat density, which may lead to increased food deprivation for cod (Casini *et al.*, 2016). The relative catch proportion of sprat in the main cod distribution area has since 2010 increased from 37% of the total catch to 47% in 2012–2016. Any increase in fishing pressure on sprat in the main cod distribution area may deteriorate the feeding condition for cod as prey availability decreases. Restrictions on sprat catches taken in the main cod area should be established.

Redistribution of the fishery to the northern areas (subdivisions 27–32) may also reduce the density-dependent effect, i.e. increase growth for the clupeids in the area.

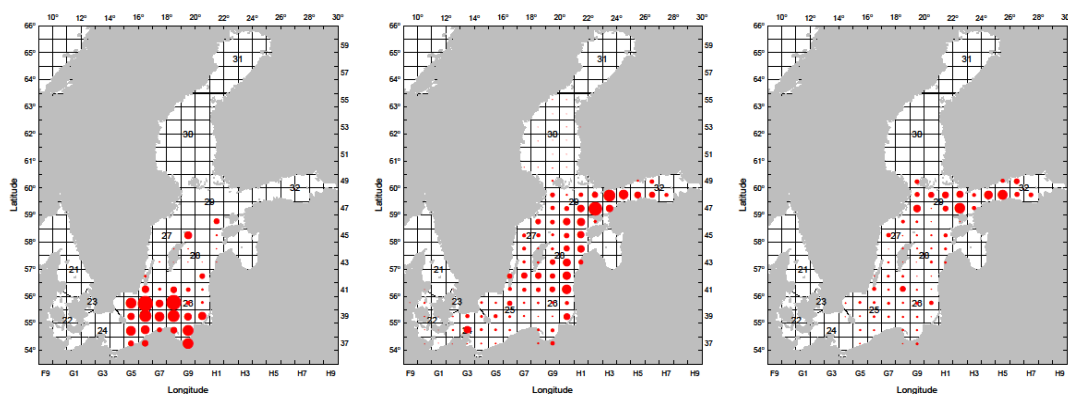


Figure 3 Sprat in subdivisions 22–32. Distribution of eastern Baltic Sea cod from the bottom trawl survey (BITS, in number h^{-1}) in the 4th quarter 2016 (left panel); Baltic sprat from the acoustic survey (BIAS, in millions) in the 4th quarter 2016 (middle panel); and herring in subdivisions 25–29 and 32, excluding the Gulf of Riga, from the BIAS survey (BIAS, in millions) in the 4th quarter 2016 (right panel). The cod panel includes fish ≥ 30 cm, while the herring and sprat panels include ages between 0 and 8. Note that the figures are based on number of individuals and not on biomass.

Reference points

Table 5 Sprat in subdivisions 22–32. Reference points, values, and their technical basis.

| Framework | Reference point | Value | Technical basis | Source |
|------------------------|------------------------------|-----------|--|--|
| MSY approach | MSY $B_{trigger}$ | 570 000 t | Assumed at B_{pa} . | ICES (2015) |
| | F_{MSY} | 0.26 | Stochastic simulations with segmented regression and Ricker stock–recruitment curves from the 1992–2013 time-series. | ICES (2015) |
| Precautionary approach | B_{lim} | 410 000 t | Stock–recruitment relationship (biomass which produces half of the maximal recruitment in a Beverton–Holt model). | ICES (2013) |
| | B_{pa} | 570 000 t | $B_{lim} \times 1.4$. | ICES (2013) |
| | F_{lim} | 0.39 | Consistent with B_{lim} . | ICES (2013) |
| | F_{pa} | 0.32 | Consistent with B_{pa} . | ICES (2013) |
| Management plan | MAP MSY $B_{trigger}$ | 570 000 t | MSY $B_{trigger}$ | Annex II column A in EU (2016) |
| | MAP B_{lim} | 410 000 t | B_{lim} | Annex II column B in EU (2016) |
| | MAP F_{MSY} | 0.26 | F_{MSY} | Annex I columns A and B in EU (2016) |
| | MAP target range F_{lower} | 0.19–0.26 | Consistent with the ranges provided by ICES (2015), resulting in no more than 5% reduction in long-term yield compared with MSY. | ICES (2015), and Annex I column A in EU (2016) |
| | MAP target range F_{upper} | 0.26–0.27 | Consistent with the ranges provided by ICES (2015), resulting in no more than 5% reduction in long-term yield compared with MSY. | ICES (2015), and Annex I column B in EU (2016) |

Basis of the assessment

Table 6 Sprat in subdivisions 22–32. Basis of assessment and advice.

| | |
|--------------------------|--|
| ICES stock data category | 1 (ICES, 2016). |
| Assessment type | Age-based analytical assessment, XSA (ICES, 2017) that uses catches in the model and in the forecast. |
| Input data | Commercial catches (international landings, ages and length frequencies from catch sampling); two acoustic surveys (BASS; BIAS); natural mortalities from the multispecies model (SMS) and regression of M against eastern Baltic cod SSB. |
| Discards and bycatch | Not included, considered negligible. |
| Indicators | None. |
| Other information | This stock was last benchmarked in 2013 (WKBALT; ICES, 2013). |
| Working group | Baltic Fisheries Assessment Working Group (WGBFAS) |

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 7 Sprat in subdivisions 22–32. ICES advice, the agreed TAC, and ICES estimates of catch. All weights are in tonnes.

| Year | ICES advice | Predicted catch corresponding to advice | Agreed TAC | ICES catch |
|------|--|--|------------|------------|
| 1987 | Catch could be increased in subdivisions 22, 24 and 25 <i>Status quo</i> F for subdivisions 27, and 29-32 | | 117200 | 88200 |
| 1988 | Catch could be increased in subdivisions 22–25 | - | 117200 | 80300 |
| 1989 | Catch could be increased for subdivisions 26 and 28 <i>Status quo</i> F for subdivisions 27 and 29-32 | 72000 | 142000 | 85800 |
| 1990 | | 72000 | 150000 | 85600 |
| 1991 | TAC | 150000 | 163000 | 103200 |
| 1992 | <i>Status quo</i> F | 143000 | 290000 | 142100 |
| 1993 | Increase in yield by increasing F | - | 415000 | 178100 |
| 1994 | Increase in yield by increasing F | - | 700000 | 288800 |
| 1995 | TAC | 205000 | 500000 | 312600 |
| 1996 | Little gain in long-term yield at higher F | 279000 | 550000 | 441000 |
| 1997 | No advice | - | 550000 | 529400 |
| 1998 | <i>Status quo</i> F | 343000 | 550000 | 470800 |
| 1999 | Proposed F_{pa} | 304000 | 467005 | 422600 |
| 2000 | Proposed F_{pa} | 192000 | 400000 | 389100 |
| 2001 | Proposed F_{pa} | 314000 | 355000 | 342200 |
| 2002 | Proposed F_{pa} | 369000 | 380000 | 343200 |
| 2003 | Below proposed F_{pa} (TAC should be set on central Baltic herring considerations) | 300000 | 310000 | 308300 |
| 2004 | Below proposed F_{pa} (TAC should be set on central Baltic herring considerations) | 474000 | 420000 | 373700 |
| 2005 | TAC should be set on central Baltic herring considerations | < 614000 | 550000 | 405200 |
| 2006 | Agreed management plan | 439000 | 468000 | 352100 |
| 2007 | < F_{pa} | < 477000 | 454000* | 388900 |
| 2008 | < F_{pa} | < 432000 | 454000* | 380500 |
| 2009 | < F_{pa} | < 291000 | 399000* | 407100 |
| 2010 | < F_{pa} | < 306000 | 380000* | 341500 |
| 2011 | < F_{pa} | < 242000 | 322700** | 267900 |
| 2012 | MSY transition scheme | < 242000 | 255100** | 235000 |
| 2013 | $F < F_{MSY}$ | < 278000 | 278000** | 272400 |
| 2014 | MSY approach | < 247000 | 267900** | 243800 |
| 2015 | MSY approach | < 222000 | 240200** | 247200 |
| 2016 | MSY approach ($F = 0.26$) | ≤ 205000 | 243000** | 246500 |
| 2017 | MSY approach ($F = 0.26$) | ≤ 314000 | 303593** | |
| 2018 | MAP target F ranges: F_{lower} to F_{upper} ($F = 0.19–0.27$), but F higher than $F_{MSY} = 0.26$ only under conditions specified in MAP | 219152–301722, but catch higher than 291715 only under conditions specified in MAP | | |

* EU autonomous quota, not including Russian catches.

** TAC is calculated as EU + Russian autonomous quotas.

History of the catch and landings

Table 8 Sprat in subdivisions 22–32. Catch distribution by fleet in 2016 as estimated by ICES.

| Catch (2016) | Landings | Discards |
|----------------|--|--|
| 246 500 tonnes | Most of the catch is taken by pelagic trawlers | Discarding is considered to be negligible. |
| | 246 500 tonnes | |

Table 9 Sprat in subdivisions 22–32. History of ICES catches presented by area for each country participating in the fishery. All weights are in tonnes.

| Year | Denmark | Finland | German Dem. Rep. | Germany Fed. Rep. | Poland | Sweden | USSR | Total | | |
|------|---------|---------|------------------|-------------------|--------|-----------|--------|--------|--------|--------|
| 1977 | 7200 | 6700 | 17200 | 800 | 38800 | 400 | 109700 | 180800 | | |
| 1978 | 10800 | 6100 | 13700 | 800 | 24700 | 800 | 75500 | 132400 | | |
| 1979 | 5500 | 7100 | 4000 | 700 | 12400 | 2200 | 45100 | 77100 | | |
| 1980 | 4700 | 6200 | 100 | 500 | 12700 | 2800 | 31400 | 58100 | | |
| 1981 | 8400 | 6000 | 100 | 600 | 8900 | 1600 | 23900 | 49300 | | |
| 1982 | 6700 | 4500 | 1000 | 600 | 14200 | 2800 | 18900 | 48700 | | |
| 1983 | 6200 | 3400 | 2700 | 600 | 7100 | 3600 | 13700 | 37300 | | |
| 1984 | 3200 | 2400 | 2800 | 700 | 9300 | 8400 | 25900 | 52500 | | |
| 1985 | 4100 | 3000 | 2000 | 900 | 18500 | 7100 | 34000 | 69500 | | |
| 1986 | 6000 | 3200 | 2500 | 500 | 23700 | 3500 | 36500 | 75800 | | |
| 1987 | 2600 | 2800 | 1300 | 1100 | 32000 | 3500 | 44900 | 88200 | | |
| 1988 | 2000 | 3000 | 1200 | 300 | 22200 | 7300 | 44200 | 80300 | | |
| 1989 | 5200 | 2800 | 1200 | 600 | 18600 | 3500 | 54000 | 85800 | | |
| 1990 | 800 | 2700 | 500 | 800 | 13300 | 7500 | 60000 | 85600 | | |
| 1991 | 10000 | 1600 | | 700 | 22500 | 8700 | 59700* | 103200 | | |
| Year | Denmark | Estonia | Finland | Germany | Latvia | Lithuania | Poland | Russia | Sweden | Total |
| 1992 | 24300 | 4100 | 1800 | 600 | 17400 | 3300 | 28300 | 8100 | 54200 | 142100 |
| 1993 | 18400 | 5800 | 1700 | 600 | 12600 | 3300 | 31800 | 11200 | 92700 | 178100 |
| 1994 | 60600 | 9600 | 1900 | 300 | 20100 | 2300 | 41200 | 17600 | 135200 | 288800 |
| 1995 | 64100 | 13100 | 5200 | 200 | 24400 | 2900 | 44200 | 14800 | 143700 | 312600 |
| 1996 | 109100 | 21100 | 17400 | 200 | 34200 | 10200 | 72400 | 18200 | 158200 | 441000 |
| 1997 | 137400 | 38900 | 24400 | 400 | 49300 | 4800 | 99900 | 22400 | 151900 | 529400 |
| 1998 | 91800 | 32300 | 25700 | 4600 | 44900 | 4500 | 55100 | 20900 | 191100 | 470800 |
| 1999 | 90200 | 33200 | 18900 | 200 | 42800 | 2300 | 66300 | 31500 | 137300 | 422600 |
| 2000 | 51500 | 39400 | 20200 | 0 | 46200 | 1700 | 79200 | 30400 | 120600 | 389100 |
| 2001 | 39700 | 37500 | 15400 | 800 | 42800 | 3000 | 85800 | 32000 | 85400 | 342200 |
| 2002 | 42000 | 41300 | 17200 | 1000 | 47500 | 2800 | 81200 | 32900 | 77300 | 343200 |
| 2003 | 32000 | 29200 | 9000 | 18000 | 41700 | 2200 | 84100 | 28700 | 63400 | 308300 |
| 2004 | 44300 | 30200 | 16600 | 28500 | 52400 | 1600 | 96700 | 25100 | 78300 | 373700 |
| 2005 | 46500 | 49800 | 17900 | 29000 | 64700 | 8600 | 71400 | 29700 | 87800 | 405200 |
| 2006 | 42100 | 46800 | 19000 | 30800 | 54600 | 7500 | 54300 | 28200 | 68700 | 352100 |
| 2007 | 37600 | 51000 | 24600 | 30800 | 60500 | 20300 | 58700 | 24800 | 80700 | 388900 |
| 2008 | 45900 | 48600 | 24300 | 30400 | 57200 | 18700 | 53300 | 21000 | 81100 | 380500 |
| 2009 | 59700 | 47300 | 23100 | 26300 | 49500 | 18800 | 81900 | 25200 | 75300 | 407100 |
| 2010 | 43600 | 47900 | 24400 | 17800 | 45900 | 9200 | 56700 | 25600 | 70400 | 341500 |
| 2011 | 31400 | 35000 | 15800 | 11400 | 33400 | 9900 | 55300 | 19500 | 56200 | 267900 |
| 2012 | 11400 | 27700 | 9000 | 11300 | 30700 | 11300 | 62100 | 25000 | 46500 | 235000 |
| 2013 | 25600 | 29800 | 11100 | 10300 | 33300 | 10400 | 79700 | 22600 | 49700 | 272400 |
| 2014 | 26600 | 28500 | 11700 | 10200 | 30800 | 9600 | 56900 | 23400 | 46000 | 243800 |
| 2015 | 22500 | 24000 | 12000 | 10300 | 30500 | 11000 | 62200 | 30700 | 44100 | 247200 |
| 2016 | 19100 | 23700 | 16900 | 10900 | 28100 | 11600 | 59300 | 34600 | 42400 | 246500 |

* Sum of landings by Estonia, Latvia, Lithuania, and Russia.

Summary of the assessment

Table 10 Sprat in subdivisions 22–32. Assessment summary. Weights are in tonnes.

| Year | Recruitment (age 1) thousands | SSB* | Catches | F (ages 3–5) |
|------|-------------------------------------|------------|---------|-----------------|
| 1974 | 50439000 | 1097000 | 242000 | 0.329 |
| 1975 | 18933000 | 867000 | 201000 | 0.346 |
| 1976 | 194491000 | 738000 | 195000 | 0.322 |
| 1977 | 42726000 | 1257000 | 180800 | 0.278 |
| 1978 | 15221000 | 866000 | 132400 | 0.273 |
| 1979 | 30534000 | 498000 | 77100 | 0.196 |
| 1980 | 20034000 | 311000 | 58100 | 0.211 |
| 1981 | 67761000 | 268000 | 49300 | 0.128 |
| 1982 | 35164000 | 340000 | 48700 | 0.226 |
| 1983 | 133282000 | 478000 | 37300 | 0.109 |
| 1984 | 50388000 | 691000 | 52500 | 0.157 |
| 1985 | 40541000 | 639000 | 69500 | 0.155 |
| 1986 | 15178000 | 581000 | 75800 | 0.203 |
| 1987 | 33942000 | 466000 | 88200 | 0.261 |
| 1988 | 13469000 | 415000 | 80300 | 0.23 |
| 1989 | 40010000 | 438000 | 85800 | 0.206 |
| 1990 | 49578000 | 570000 | 85600 | 0.133 |
| 1991 | 54515000 | 776000 | 103200 | 0.171 |
| 1992 | 93807000 | 1034000 | 142100 | 0.2 |
| 1993 | 87489000 | 1359000 | 178100 | 0.162 |
| 1994 | 66666000 | 1407000 | 288800 | 0.258 |
| 1995 | 259113000 | 1496000 | 312600 | 0.334 |
| 1996 | 169590000 | 1910000 | 441000 | 0.282 |
| 1997 | 59730000 | 1885000 | 529400 | 0.394 |
| 1998 | 171199000 | 1414000 | 470800 | 0.384 |
| 1999 | 56587000 | 1424000 | 422600 | 0.37 |
| 2000 | 102305000 | 1352000 | 389100 | 0.312 |
| 2001 | 49022000 | 1210000 | 342200 | 0.285 |
| 2002 | 55337000 | 950000 | 343200 | 0.381 |
| 2003 | 122138000 | 810000 | 308300 | 0.407 |
| 2004 | 231693000 | 1045000 | 373700 | 0.496 |
| 2005 | 49142000 | 1310000 | 405200 | 0.457 |
| 2006 | 80627000 | 1086000 | 352100 | 0.374 |
| 2007 | 110130000 | 959000 | 388900 | 0.346 |
| 2008 | 71665000 | 1029000 | 380500 | 0.366 |
| 2009 | 184869000 | 953000 | 407100 | 0.444 |
| 2010 | 56163000 | 1077000 | 341500 | 0.361 |
| 2011 | 62368000 | 827000 | 267900 | 0.339 |
| 2012 | 74515000 | 751000 | 235000 | 0.322 |
| 2013 | 65855000 | 804000 | 272400 | 0.388 |
| 2014 | 55731000 | 769000 | 243800 | 0.357 |
| 2015 | 196213000 | 848000 | 247200 | 0.315 |
| 2016 | 68547000 | 1176000 | 246500 | 0.223 |
| 2017 | 79182000** | 1289000*** | | |

* At spawning time.

** Output from survey data (RCT3 analysis).

*** Predicted.

Sources and references

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