7 Golden redfish (*Sebastes norvegicus*) in Subareas 1 and 2

Multiyear advice

Following a three-year advice cycle, this stock was assessed in 2016 with advice nominally covering 2017-2019. There is no updated assessment in 2017. This report presents new data available and reproduce the latest assessment (2016) for information. It is anticipated that there will be a new assessment and advice after the next benchmark, planned for 2018.

7.1 Status of the Fisheries

7.1.1 Recent regulations of the fishery

A description of the historical development of the fishery and regulations is found in the Stock Annex for this stock. The Stock Annex was last updated in February 2012.

Prior to 1 January 2003 there were no regulations particularly for the *S. norvegicus* fishery, and the regulations aimed at *S. mentella* had only marginal effects on the *S. norvegicus* stock. After this date, all directed trawl fishery for redfish (both *S. norvegicus* and *S. mentella*) outside the permanently closed areas were forbidden in the Norwegian Economic Zone north of 62°N and in the Svalbard area. When fishing for other species it was legal to have up to 15% redfish (both species together) in round weight as bycatch per haul and on board at any time. Until 14 April 2004 there were no regulations of the other gears/fleets fishing for *S. norvegicus*. After this date, a minimum legal catch size of 32 cm has been set for all fisheries, with the allowance to have up to 10% undersized (i.e. less than 32 cm) specimens of *S. norvegicus* (in numbers) per haul. In addition, a time-limited moratorium (up to 8 months) was enforced in the conventional fisheries (gillnet, longline, handline, Danish seine) except for handline vessels less than 11 meters. Since 2015 all directed fisheries with conventional gears have been forbidden (except for the smaller handline vessels), and from 2016 trawling outside 12 nm is allowed to have up to 20% by weight of redfish in each catch and upon landing. When trawling inside 12 nm, it is permitted to have up to 10% bycatch. It is generally prohibited to fish for redfish with conventional gears north of 62° N. The ban does not, however, apply to vessels less than 15 meters fishing with handline during1 June - 31 August. When fishing with conventional gears for other species, it is permitted to have up to 10% by weight of redfish. Vessels less than 21 meters can still have up to 30% by weight of redfish in the period 1 August to 31 December. Bycatch of redfish is calculated in live weight per week.

7.1.2 Landings prior to 2016 (Tables 7.1–7.4, D1 & D2, Figures 7.1–7.2)

Nominal catches of *S. norvegicus* by country for Sub-areas 1 and 2 combined, and for each Sub-area and Division are presented in Tables 7.1—7.4. The total landings for both *S. norvegicus* and *S. mentella* are presented in section 6 (Tables 6.12 and 6.13). 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. Landings of *S. norvegicus* showed a decrease from a level of 23 000—30 000 t in 1984—1990 to a stable level of about 16 000—19 000 t in the years 1991—1999. Since then the landings have decreased further, and the total landings figures for *S. norvegicus* in 2003—2013 have been low but remarkably stable, between 5500—8000 t. In 2014 the landings decreased to 4 436 t, followed by a further decrease in 2015 with landings of 3 633 t, mainly due to stronger regulations. This trend has reversed in 2016 with provisional figures indicating catches of 6 060 t. The time-series of *S. norvegicus* landings is given in Figure 7.1.

The Norwegian landings are presented by gear and month/year in Figures 7.2a,b. Reported landings continued to decrease in 2015 and were then at the lowest level since the World War II. Since 2015 only bycatches of *S. norvegicus* are allowed except for a limited amount caught by vessels less than 15 meters fishing with handline during 1 June31 August.

The reported Russian catches of *S. norvegicus* have been around 600 - 900 t since 2001, while ten other countries together usually report catches of about or less than 300 - 500 t per year (Table 7.1). The bycatch of redfish (*Sebastes* spp.) in the Norwegian Barents Sea shrimp fisheries during 1983 - 2015 were dominated by *S. mentella*, and hence influenced the *S. norvegicus* to a much lesser extent. However, these bycatches probably inflicted an extra mortality on *S. norvegicus* in the coastal areas before the sorting grid was enforced in 1990. From 1 January 2006, the maximum legal bycatch of redfish juveniles in the international shrimp fisheries in the northeast Arctic has been reduced from ten to three redfish per 10 kg shrimp.

Information describing the splitting of the redfish landings by species and area is given in the Stock Annex.

7.1.3 Expected landings in 2017

New regulations have been designed and implemented in the Norwegian coastal fisheries with conventional gears in 2016. No directed fishery is allowed, but the bycatch-regulations are currently rather liberal with vessels less than 21 meters being allowed to have up to 30% by weight of redfish in the period 1 August - 31 December, and calculated in live weight per week. No further reduction in the catches is hence expected. The total landings in 2017 are expected to be about the same as in 2016, i.e. about 6 000 t.

7.2 Data Used in the Assessment (Table 0.1 and Figure E2)

An overview of the sampling levels (by season, area and gear) of the data used in the assessment is presented in Figure E2 for 2013. Although Table 0.1 (see Section 0) shows a reasonably good total sampling level for this stock, the number of different boats sampled and the gear and area coverage should be improved.

7.2.1 Catch at length and age (Table 7.5)

Age composition data for 2015 were only provided by Norway, accounting for 70% of the total landings. Other countries were assumed to have the same relative age distribution and mean weight as Norway. The updated catch in numbers-at-age matrix is shown in Table 7.5. Catch at length data were available from Norway in 2015 (Figure 7.3).

7.2.2 Catch weight at Age (Table 7.6)

Weight-at-age data for ages 7–24+ were available from the Norwegian landings in 2015, and revised for 2014. Variations in the weight-at-age of young individuals (<10 years) must be considered with caution as these numbers are derived from only a small number of aged individuals.

7.2.3 Maturity-at-age (Table E4, Figure 7.7a-b)

A maturity ogive has previously not been available for *S. norvegicus*, and knife-edge maturity-at-age 15 (age 15 as 100% mature) had hence been assumed. Maturity-at-age and length is available from Norwegian surveys and landings, as reported in Table E4 and presented in Figure 7.7a. The maturity ogive modelled by Gadget is presented (Figure 7.7b). This analysis shows that 50% of the fish are mature at age 12.

7.2.4 Survey results (Tables E1a,b-E2a,b-E3, Figures 7.4a,b-7.5a,b)

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

Winter Norwegian Barents Sea (Division 2.a) bottom-trawl survey (BS-NoRu-Q1 (BTr)) from 1986 to 2016 (joint with Russia some of the years since 2000) in fishing depths of 100—500 m. Length compositions for the years 1986—2016 are shown in Table E1a and Figure 7.4a. Age compositions for the years 1992—2015 are shown in Table E1b and Figure 7.4b. This survey covers important nursery areas for the stock.

Norwegian Svalbard (Division 2.b) bottom-trawl survey (August-September) from 19852015 in fishing depths of 100—500 m (depths down to 800 m incl. in the swept-area). Since 2005 this is part of the Ecosystem survey (Eco-NoRu-Q3 (BTr)). Length compositions for the years 1985—2015 and age compositions for the years 1992—2008 and 2012 and 2013 are shown in Table E2a and E2b, respectively. This survey covers the northernmost part of the species' distribution. Insufficient number of age readings in 2009 and 2011, and no age samples collected in 2010 did not allow for updating the age composition in these years.

Data on length and age from both these surveys have been combined and are shown in Figures 7.5a,b.

Age disaggregated catch rates (numbers/nm^2 averaged for all stations within subareas and finally averaged, weighted by subarea, for the total surveyed area) of Sebastes norvegicus from the Norwegian Coastal and Fjord survey in 1995—2010 from Finnmark to Møre (NOcoast-Aco-Q4) (Table E3). The estimated catch rates in 2008 and 2009 were particularly high due to one trawl station with an exceptional high catch. Updating of table E3 is discontinued. The data are no longer used as input to the Gadget analytical assessment as described in the stock annex.

The bottom-trawl surveys covering the Barents Sea and the Svalbard areas show that the abundance indices over the commercial size range (> 25 cm) were relatively stable up to 1998 but declined to lower levels afterwards. Abundance of prerecruits (<25cm) has steadily decreased since 1991 and has dropped to very low levels after 2000 (Figure 7.4a). An increase in the number of prerecruits is visible from 2008 onwards. Although this could originally partly result from taxonomic misidentification, the confirmation of increased numbers for individuals of size 15 cm and greater gives some confidence that at least some of the increasing numbers are *S. norvegicus*.

7.3 Assessment with the GADGET model

7.3.1 Description of the model

Since AFWG2005, the GADGET model has been used for this stock, first with experimental runs, and then as analytical assessments following its adoption by WKRED (2012) benchmark (ICES CM 2012/ACOM:48). The stock has a three-year advice cycle, and advice was updated in 2016. We therefore do not present updated assessment for 2017, however the results and comments from the 2016 are presented here in full, both for reference and in order to ensure that all data and model results are available in a single document as a basis for the planned benchmark in 2018. Note that the natural mortality estimate (M) was changed from 0.1 to 0.05 in 2012, and results are thus not directly comparable with earlier years. The advice given in 2016 nominally applies for 2017-2019. However, it is likely that a new assessment and advice will be presented following a benchmark planned for 2018.

The GADGET model used for the assessment of *S. norvegicus* in areas 1 and 2 is closely related to the GADGET model that currently is used by the ICES North-Western WG on *S. norvegicus* (Björnsson and Sigurdsson 2003). The functioning of a Gadget model, including parameter estimation and data used for tuning, is described in Bogstad *et al.* (2004) and in the stock annex for *S. norvegicus*. In brief, the model is a single species forward simulation age–length structured model, split into mature and immature components. There are two commercial fleets (a gillnet fleet and a combined trawl and other gears fleet), and one survey used in the model. Growth and fishing selectivity are assumed constant over time, and recruitment is estimated on annual basis (no SSB-recruit relationship).

The weighting scheme for combining the different datasets into a single likelihood score is a method where weights are selected so that the catch and survey data have approximately equal contribution to the overall likelihood score in the optimized model, and that each dataset within each group gives approximately equal contributions to each other. This ensures that both noise and bias (actually divergence from the consensus) are taken account of in the weighting of datasets.The parameters in the model are estimated using a combination of Simulated Annealing (wide area search) and Hooke and Jeeves (local search) repeated in sequence until a converged solution is found.

7.3.2 Data used for tuning

- Quarterly catch in tonnes from two commercial fishing fleets, i.e. Norwegian gillnet and 'all others', to 2015.
- Quarterly length distribution of total international commercial landings from two commercial fishing fleets, i.e. Norwegian gillnet and 'all others' to 2015. Due to late data submissions, there is one year time-lag in the inclusion of length distributions from other countries than Norway.

Quarterly age–length keys from the same fishing fleets, up to 2015

Length disaggregated survey indices from the Barents Sea (Division 2.a) bottom-trawl survey (February) from 1990—2015 (Table E1a)

Age–length keys and aggregated survey indices from the same survey up to 2015 (Table E1b)

7.3.3 Assessment results using the Gadget model

The text table below compares the results from this year's Gadget model with previous years for two reference years 1990 and 2003. Note that the natural mortality in the model was changed in 2012, meaning that results from the 2012—2015 assessments are not directly comparable with earlier years.

	Total stock (3+) by 1 January 1990 (tons)	Mean weight in stock 1990 (kg)	SSB (15+) by 1 January 1990 (tons)	Total stock (3+) by 1 January 2003 (tons)	Mean weight in stock 2003 (kg)	SSB (15+) by 1 January 2003[1] (tons)
WG 2006	179 313	0.39	64 019	71 013	0.71	38 927
WG 2007	163 536	0.35	66 712	64 240	0.64	43 096
WG 2008	158 851	0.35	64 838	74 717	0.78	47 693
WG 2009	149 763	0.34	66 153	73 673	0.77	51 683
WG 2010	152 419	0.34	58 774	80 073	0.79	55 995
WG 2011	148 727	0.33	56 271	80 808	0.78	55 810
WG 2 2012	109 021	0.43	48 308	55 229	0.80	40 030
WG 2 2013	111 216	0.37	47 620	50 151	0.79	33 400
WG 2 2014	111 850	0.37	48 861	56 090	0.93	39 050
WG 2 2015	113 840	0.37	49 800	59 510	0.91	41 960

Since WG2007 based on modelled maturation and not 15+, dataseries used for estimation of maturity modified in 2010

The natural mortality in the model was reduced from 0.1 to 0.05 in 2012. This reduced overall numbers and biomass, and increased mean weight. Results are therefore not directly comparable with earlier years.

The general patterns in the stock dynamics of *S. norvegicus* are similar to those modelled for the past several years (Figure 7.10). The overall stock numbers and biomass continue to show a decline, with possible good year classes recruited in recent years. Mature biomass and numbers are in steady decline, while modelled immature numbers and biomass show signs of beginning to improve – although this is not yet reflected in the catch data on the older fish,

As in previous reports it should be noted that it is possible that the improved recruitment signal from the 2003 yearclass may be due to misidentification of small *S. mentella* (which is a larger stock and has had good recent recruitment) as *S. Norvegicus*, and the model has repeatedly revised down the estimate of this recruitment, although not to zero. The largest of these fish are now in the 35-40 cm length category, and have been tracked through multiple survey years. However they are not yet showing up in the catch data, although the model prediction is that they are large enough to begin to enter the fishery. It is therefore still unclear to what extent this recruitment signal is genuine. Assuming the recruitment to be genuine, albeit smaller than originally estimated initially gives the possibility for stabilizing or even starting to recover the stock with improved management. A second, larger, recruitment peak exists from the 2009 yearclass (showing up as age 3 in 2012). This should be considered highly uncertain, as species identification on these smallest fish is difficult. It should therefore be stressed that the exact size of the recruitment events, and the extent to which they will impact on the SSB, remains uncertain.

The most important conclusions to be drawn from the current assessment using the Gadget model are:

The recruitment to the stock has been very poor for a long period, and especially prior to 2005 (Figure 7.9)

There has been somewhat better estimated recruitment in recent years, although still below the long-term average. The exact level is still somewhat uncertain. There may also be a second pulse of good recruitment, however this is still highly uncertain, and will need to be tracked for some years to reduce this uncertainty.

The estimated fishing mortality (F12-19) declined between 1990 and 2005 and steadily increased since 2005, briefly stabilized between 2010 and 2011, and increased again in 2012 and 2013. The current mortality is estimated to 0.27 (Figure 7.8), well above a sustainable level for a redfish species. This estimate is based on the 2003 yearclass being a good one, and the estimate would be higher if this is not the case.

According to the model the total-stock biomass (3+) of *S. norvegicus* has decreased from about 151 000 tonnes in 1992—1993 to around 20 000 tonnes in 2015 (Figure 7.10, Table 7.8). Due to the improved recent recruitment the total biomass is beginning to stabilize, although the SSB is continuing to decline.

The spawning-stock biomass of *S. norvegicus* has decreased from a maximum of about 55 thousand tonnes in 1996 to barely 10 thousand tonnes in 2015 (Figure 7.10, Table 7.8). This reduction is primarily the result of prolonged low recruitment, combined with excessively high fishing pressure. Although this continues to decline, the rate of that decline is starting to slow, based on the estimated strong 2003 year class.

It should be noted that there is a strong retrospective pattern in the assessment model, with mature biomass consistently revised upwards and F downwards between years (figure 7.11). This may relate to the partial coverage of the stock by the survey (and especially the lack of coverage of mature fish in the survey), or due to errors in species identification. The 7 years Mohn's rho index on F is -0.88, indicating a strong tendency to revise downwards. The revision between years does not change the picture of a declining SSB at a low level, and not does it result in the terminal year estimate being higher than the previous terminal year. There is no strong retrospective pattern in the juvenile biomass, suggesting that it may be fisheries data that is driving the pattern in SSB. An experimental retrospective run excluding the survey offers support for this, showing similar trends in mature SSB stock, and similar retrospective patterns. Note that not all years in this experimental run converged, so this does not represent an alternative assessment. This lack of retrospective in the juvenile biomass also indicates that the estimates of a period of poor recruitment are robust to the identified retrospective trend in the SSB. Consequently, we conclude that this is something which should be considered further in the next benchmark. Ideally one would want survey coverage of the mature individuals in order to get level information on this fraction of the stock. However, given the strong downward trend which is not changed by the revisions, the similar pattern seen in the "no survey" model, and the confirmation of these trends from the WKRED production model, the retrospective patterns should not affect the current advice of "zero directed catch, minimize bycatch".

7.4 State of the stock

Survey observations and Gadget assessment update confirm previous diagnostics that this stock is currently in a very poor situation. This is confirmed by the production model run as a check at WKRED, which produced similar trends. Indications are that the SSB is continuing to fall. This has led to an upwards trend resulting in a level of F which may place an increasing burden on an already poorly performing stock. Furthermore, in the absence of a substantial population of fish in the 10—18 age range, the fishery has become increasing concentrated on the oldest (18 years and older) individuals, reducing the reproductive capacity of the stock.

There are indications that new recruits may have entered the population in recent years as noted in previous AFWG reports. The estimated immature biomass is now beginning to increase, and the rate of decline of SSB is reducing. However, the total level of this recruitment is still uncertain, and it will be several years before these will fully recruit to the fishery and the spawning stock. Rebuilding of this stock is therefore dependent on protecting both the existing SSB and any fish recruiting to the SSB. Note that this is a category 2 stock, and thus the exact values of both stock and F are uncertain, although the trends are clearly defined.

Sebastes norvegicus is currently on the Norwegian Redlist as a threatened (EN) species according to the criteria given by the International Union for Conservation of Nature (IUCN).

Red-listing is understood to mean that a species (or stock) is at risk of extinction. ICES convened two workshops in 2009. The first Workshop WKPOOR1 (ICES CM 2009/ACOM:29) addressed methods for evaluating extinction risk, and outlined approaches that could support advice on how to avoid potential extinction. The second Workshop WKPOOR2 (ICES CM 2009/ACOM:49) applied the results of the first workshop to four stocks selected as being of interest to Norway and ICES.

There are three general methods for evaluating extinction risk: (1) screening methods, such as the IUCN redlisting criteria; (2) simple population viability analysis (PVA) based on time-trends; and (3) age structured population viability analysis. None of the methods are considered reliable for accurately estimating the absolute probability of extinction, but they may be useful to evaluate the relative probability of extinction between species or between management options.

Simulations were performed on the Sebastes *norvegicus* stock using the Gadget model at WKRED. An assumption was made that the recruitment observed over the last 10 years would apply in the future, with recruitment independent of the spawning biomass. This indicated that, at stability, the population could sustain an annual catch of around 1,500 tonnes, a finding which was in line with the Schaefer model estimates conducted during WKRED. Separate simulations done by WKPOOR2 indicate that a constant catch above about 6500 tonnes will lead to a progressive reduction of the stock, and a collapse within 10—15 years if recruitment remains low. However, small changes in recruitment and other parameters that enter the assessment will alter these limits. It should be noted that the fish currently in and entering the fishery are from a period of poor recruitment, and that the stock would need to be stabilized before a catch as large as 1500 tonnes could be safely taken.

7.4.1 Biological reference points

The ability to set biological reference points was examined at WKRED (2012). It was not possible to accurately define a SSB-recruitment relationship, or the productivity level of the stock. In addition, there was considerable uncertainty over recent levels of recruitment (due to possible species misidentification and inconsistent signals in the winter survey). As a result, it was not considered possible to set target reference points for this stock at that time. There is now greater confidence in the recruitment event in 2003. One could therefore consider the associated SSB the previous year (2002) as a lower reference point (B_{loss} that led to good recruitment), which would give a value of just over 40,000 tonnes. This year-class is seen in multiple years of the winter survey, and now shows up as a bimodal length distribution, with low values visible in the mid length ranges representing the extended period of poor recruitment prior to 2003. However, the model predicts that this year-class should have begun to enter the fishery, while the available fisheries biological sampling data does not show any upturn in the youngest ages caught. This may be due to poor sampling of the smallest fraction of the catch or a change in selectivity since there were last abundant fish of this size. However, it may also be that the signal in the survey is misidentified *S. mentella*. Consequently, we do not present a calculation for B_{lim}/B_{pa} here. Rather, we recommend that this be considered at the planned 2018 benchmark, by which time the 2003 year-class will have entered the fishery more strongly. The benchmark is also recommended to take a broader look at available survey data, which should also help confirm (or refute) this good year-class. B_{lim} and B_{pa} are thus currently *undefined* for this stock. We note that the SSB is currently at the lowest observed value in the time period of the model, and the stock should thus be considered below any potential reference level. Therefore this lack of a formal B_{lim}/B_{pa} does not affect the perception of the stock as below safe limits, nor impact on the advice or management of the stock in the short term.

A maximum exploitation rate of 5% has been suggested sustainable for long lived species like *Sebastes* spp. when the stocks show no sign of reduced reproductive potential (corresponding to keeping SPR at 60% of the level when no fishing occurs; see chapter 7.8 and Dorn 2002). If we take this to imply a preliminary F_{lim} of 0.05, then this gives a F_{pa} of 0.036 (0.05/1.4). However, this should be considered further at the next benchmark. Based on the selection curves for the fleets, a reasonable approximation of the fishable biomass would be the mature biomass. The modelling at WKRED, using both Gadget and a Schaefer model, suggested around 1500 t as the sustainable yield at average recent recruitment levels, once the stock has recovered from its current low level. At present a recovery strategy is required rather than MSY fishing.

7.4.2 Management advice

AFWG considers that the current catch level is several times higher than can be sustained by the stock, given the ongoing downwards trend in mature biomass. AFWG therefore recommends that current area closures and low bycatch limits should be maintained. No directed fishery should be conducted on this stock at the moment, and the percent legal bycatch should be set as low as possible for other fisheries to continue. There will be no directed fishery for *S. norvegicus* in 2015 except for a small-scale fishery with handline that is expected to catch less than 100 tonnes in 2015. The current bycatch regulations are, however, in general too liberal to further constrain the catch as would be required for the stock to recover.

7.4.3 Implementing the ICES F_{MSY} framework

As a long lived species, *S. norvegicus* has many year classes contributing to the population, and consequently a relatively stable stock level from year-to-year. This makes it relatively simple to manage to some proxy of MSY (e.g. F0.1) provided adequate measures can be implemented to reduce fishing pressure to an appropriate level. It should be noted that the current fishery (F(12-19) = 0.27) is well above the suggested F_{pa} of 5% of the stock (Section 7.6). The main focus should therefore be on reducing total F to no higher than F_{pa}. The current priority is to stabilize the stock and prevent further decline, only then could a recovery strategy and eventually an MSY fishery be implemented. The recent upturn in immature biomass gives some hope that such recovery may be possible, given light fishing pressure.

During the ICES Workshop on Implementing the ICES F_{MSY} framework (WKFRAME, ICES CM2010/ACOM:54), the closely related beaked redfish *Sebastes mentella* stock in Sub-areas 1 and 2 was used as a case study for a data limited situation. The results of this Workshop refer also to Sebastes *norvegicus* in the Barents Sea, where the AFWG is faced with a data limited situation. WKFRAME recommends that the bounds for F_{MSY} proxies should be evaluated in function of the YPR and SPR curves, and that the reproductive capacity of the *S. mentella* (in this case *S. norvegicus*) stock be at least above 30% of the SPR at F=0. The YPR curve left of the plateau can be used as lower bound (F0.1 proxy) and a prescribed per-cent SPR as upper bound. The WKFRAME also illustrates by examples why it is informative and important to carry out sensitivity analyses, particularly assumptions regarding natural mortality, selection pattern, growth (density-dependence) and maturity. The WG did some preliminary analyses of the sensitivity of F0.1 for different natural mortalities. Compared with *S. mentella*, $F_{0.1}$ for *S. norvegicus* is much less sensitive towards changes in natural mortality

During WKRED 2012, the yield-per-recruit (YPR) was calculated by adding recruitment in a single year. Repeat runs were made using a range of values for F, with the results shown in Figure E1. It should be noted that there is no spawning stock–recruitment relationship in the model, rather these calculations assume a constant annual recruitment. Consequently, the model may over-predict yield at higher fishing levels, because these levels will lead to a larger reduction in SSB than in overall stock. The yields presented here should therefore be considered an upper bound (especially at higher fishing levels). The highest yield obtained is at F_{max} = 0.15, but from a rather flat topped curve. $F_{0.1}$ (the point at which the slope is 10% of the slope at the origin, a typical precautionary proxy for F_{MSY}) is around $F_{0.1}$ = 0.08. Other proxy values are certainly possible. Using a constant annual recruitment of 2.6 million individuals with the above fishing mortalities gives the corresponding sustainable yields.

For F_{max} = 0.15 the sustainable yield at (then) current recruitment is 1500 tonnes per year

For $F_{0.1}$ = 0.08 the sustainable yield at (then) current recruitment is 1400 tonnes per year

However, it should be stressed that these are average values for F_{MSY} and yield at the currently estimated recruitment level and for healthy stock. The stock is currently depleted, and recruitment has for a long period prior to the late 2000s been lower than the recent average. Consequently, the stock cannot currently sustain these levels of catches and recover at the same time, and a recovery strategy is required first.

Table 7.1 ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Nominal catch (t) by countries in Sub-area 1 and Divisions 2.a and 2.b combined.**

Year	Faroe Islands	France	Germany[2]	Greenland	Iceland	Ireland	Netherlands	Norway	Portugal	Russia[3]	Spain	UK(Eng. & Wales)	UK (Scot)[4]	Poland	Total
1989	3	796	412	-	-	-	-	20 662	-	1 264	-	97	-	-	23 234
1990	278	1 679	387	1	-	-	-	23 917	-	1 549	-	261	-	-	28 072
1991	152	706	981	-	-	-	-	15 872	-	1.052	-	268	10	-	19 041
1992	35	1 289	530	623	-	-	-	12 700	5	758	2	241	2	-	16 185
1993	139	871	650	14	-	-	-	13 137	77	1 313	8	441	1	-	16 651
1994	22	697	1 008	5	4	-	-	14 955	90	1 199	4	135	1	-	18 120
1995	27	732	517	5	1	1	1	13 516	9	639	-	159	9	-	15 616
1996	38	671	499	34	-	-	-	15 622	55	716	81	229	98	-	18 043
1997	3	974	457	23	-	5	-	14 182	61	1 584	36	164	22	-	17 511
1998	78	494	131	33	-	19	-	16 540	6	1 632	51	118	53	-	19 155
1999	35	35	228	47	14	7	-	16 750	3	1 691	7	135	34	-	18 986
2000	17	13	160	22	16	-	-	13 032	16	1 112	-	-	73	-	14 461
2001	37	30	238	17	-	1	-	9 134	7	963	1		119	-	10 547
2002	60	31	42	31	3	-	-	8 561	34	832	3		46	-	9 643
2003	109	8	122	36	4	-	89	6 853	6	479	-		134	-	7 840
2004	19	4	68	20	30	-	33	6 233	5	722	3		69	-	7 206
2005	47	10	72	36	8	-	48	6 085	56	614	8		52	-	7 037
2006	111	8	35	44	31	3	21	6 305	69	713	9		39	-	7 388
2007	146	15	67	84	68	13	20	5 784	225	890	5		55	-	7 372
2008	274	63	30	71	27	6	2	5 216	72	749	4		85	-	6 599
2009	70	1	58	81	66	-	1	5 451	30	698	-		31	-	6 487
2010	171	51	31	72	22	-	-	5 994	28	565	3		44	1	6 981
2011	24	53	9	51	22	-	1	4 681	25	919	6		13	48	5 852
2012	87	182	71	58	23	12	5	4 247	17	681	-		100	34	5 517

2013	83	353	1	45	8	1	-	3 771	36	797	-		493	19	5 609
2014	67	219	6	20	29	-	1	3 053	5	806	-	**Denmark**	211	21	4 436
2015	76	53	24	211	35	-	-	2 488	-	664	2	1	57	17	3 629
2016[1]	190	72	62	59	71	-	-	4 606	-	864	2	7	104	22	6 060

[1] **Provisional figures.**

[2] **Includes former GDR prior to 1991.**

[3] **USSR prior to 1991.**

[4] **Includes UK (E&W) since 2000.**

Table 7.2 ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Nominal catch (t) by countries in Sub-area 1.**

Year	Faroe Islands	France	Germany[2]	Greenland	Iceland	Norway	Portugal	Russia[3]	Spain	UK(Eng. & Wales)	UK (Scotl)[5]	Total
1989	-	-	-	-	-	1 763	-	110	-	4	-	1 877
1990	5	-	-	-	-	1 263	-	14	-	-	-	1 282
1991	-	-	-	-	-	1 993	-	92	-	-	-	2 085
1992	-	-	-	-	-	2 162	-	174	-	-	-	2 336
1993	24	-	-	-	-	1 178	-	330	-	-	-	1 532
1994	12	-	72	-	4	1 607	-	109	-		-	1 804
1995	19	-	1	-	1	1 947	-	201	-	1	-	2 170
1996	7	-	-	-	-	2 245	-	131	-	3	-	2 386
1997	3	-	-	5	-	2 431	-	160	-	2	-	2 601
1998	78	-	5	-	-	2 109	-	308	-	30	-	2 530
1999	35	-	18	9	14	2 114	-	360	-	11	-	2 561
2000	-	-	1	-	16	1 983	-	146	-		12	2 159
2001	4	-	11	-	-	1 053	-	128	-		16	1 212
2002	15	1	5	-	-	693	-	220	-		9	943
2003	15	-	-	1	-	815	-	140	-		4	975
2004	7	-	-	-	-	1 237	-	213	-		12	1 469
2005	10	1	-	-	-	1 002	-	61	-		4	1 078
2006	46	-	-	-	-	690	-	136	-		-	872
2007	15	-	12	15	-	1 034	-	49	2		20	1 147
2008	45	7	2	-		634	3	49	-		15	755
2009	-	-	3	2	6	701	30	19	-		24	768
2010	58	-	-	-	-	497	-	21	1		6	583
2011	24	-	-	2	1	674	-	7	-		-	708
2012	17	-	3	1	9	546	-	27	-		18	623
2013	28	2	1	-	+	574	-	41	-	**Poland**	4	651
2014	59	10	6	17	4	403	-	26	-	2	17	543
2015	57	4	9	211	13	514	-	51	2	2	10	872
2016[1]	161	7	4	59	51	781	-	136	2	2	60	1 264

[1] Provisional figures.

[2] Includes former GDR prior to 1991.

[3] USSR prior to 1991.

[4] Includes UK (E&W) since 2000.

+ Less than 1 t

Table 7.3 Sebastes norvegicus in Sub-areas 1 and 2. Nominal catch (t) by countries in Division 2.a.

Year	Faroe Islands	France	Germany[2]	Greenland	Iceland	Ireland	Netherland	Norway	Portugal	Russia[3]	Spain	UK(Eng. & Wales)	UK(Scotl)[4]	Poland	Total
1989	3	784	412	-		-	-	18,833	-	912	-	93[2]	-	-	21,037
1990	273	1,684	387	-		-	-	22,444	-	392	-	261	-	-	25,441
1991	152	706	678	-		-	-	13,835	-	534	-	268	10	-	16,183
1992	35	1,294	211	614		-	-	10,536	-	404	-	206	2	-	13,302
1993	115	871	473	14		-	-	11,959	77	940	-	431	1	-	14,881
1994	10	697	654	5		-	-	13,330	90	1,030	-	129	-	-	15,945
1995	8	732	328	5		1	1	11,466	2	405	-	158	9	-	13,115
1996	27	671	448	34		-	-	13,329	51	449	5	223	98	-	15,335
1997	-	974	438	18		5	-	11,708	61	1,199	36	162	22	-	14,623
1998	-	494	116	33		19	-	14,326	6	1,078	51	85	52	-	16,260
1999	-	35	210	38		7	-	14,598	3	976	7	122	34	-	16,030
2000	17	13	159	22		-	-	11,038	16	658	-		61	-	11,984
2001	33	30	227	17		1	-	8,002	6	612	1		103	-	9,031
2002	45	30	37	31	3	-	-	7,761	18	192	2		32	-	8,151
2003	94	9	122	35	4	-	89	5,970	6	264			130	-	6,722
2004	12	4	68	20	30	-	33	4,872	5	396	3		58	-	5,500
2005	37	9	60	36	8	-	48	4,855	56	265	8		48	-	5,430
2006	60	8	35	44	31	3	21	4,404	59	293	9		39	-	5,006
2007	119	15	55	69	68	13	20	4,101	70	599	3		35	-	5,168
2008	229	56	28	71	27	6	2	4,456	68	450	4		70	-	5,467
2009	70	1	55	79	60	-	1	4,543	17	500	-		7	-	5,333
2010	113	51	31	72	22	-	-	5,414	26	287	2		38	1	6,056

2011	-	51	9	49	20	-	1	3,942	-	695	2		13	-	4,782
2012	49	182	33	57	13	2	2	3,599	1	427	-	**Denmark**	33	-	4,398
2013	55	343	-	45	8	-	-	3,076	9	475	-	1	466	-	4,478
2014	8	209	-	3	25	-	1	2,465	2	559	-	-	178	-	3,449
2015	18	49	15	-	22	-	-	1,946	-	439	-	-	47	12	2,549
2016[1]	29	65	58	-	20	-	-	2,280	-	545	-	-	43	8	3,050

[1] Provisional figures.

[2] Includes former GDR prior to 1991.

[3] USSR prior to 1991.

[4] Includes UK (E&W) since 2000

Table 7.4 ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Nominal catch (t) by countries in Division 2.b.**

Year	Faroe Islands	France	Germany[2]	Greenland	Iceland	Ireland	Netherlands	Norway	Portugal	Russia[3]	Spain	UK(Eng. & Wales)	UK(Scotl)[4]	Poland	Total
1989	-	-	-	-				66	-	242	-	-	-	-	308
1990	-	-	-	1				210	-	1157	-	-	-	-	1 368
1991	-	-	303	-				44	-	426	-	-	-	-	773
1992	-	-	319	9				2	5	180	2	35	-	-	552
1993	-	-	177	-				-	-	43	8	10	-	-	238
1994	-	-	282	-				18	-	60	4	6	1	-	371
1995	-	-	187	-				103	7	33	-	-	-	-	330
1996	4	-	51	-				27	5	136	76	3	-	-	302
1997	-	-	20	-				43	-	225	-	-	-	-	288
1998	-	-	10	-				105	-	246	-	3	-	-	364
1999	-	-	-	-				38	-	355	-	2	-	-	395
2000	-	-	-	-				10	-	308	-	-	-	-	318
2001	-	-	-	-				79	1	223	-	-	-	-	303
2002	-	-	-	-				107	16	420	1		5	-	549
2003	-	-	-	-				68	-	75	-		-	-	143
2004	-	-	-	-				124	-	113	-		-	-	237
2005	-	-	13	-				2281	-	288	-		-	-	529
2006	5	-	-	-				1 211	10	284	-		-	-	1 510
2007	12	-	-	-				649	155	242	-		-	-	1 057
2008	-	-	-	-				126	1	250	-		-	-	377
2009	-	-	-	-				207	-	179	-		-	-	386
2010	-	-	-	-				83	22	257	-		-	-	342
2011	-	2	-	-	1	-	-	65	25	217	4		-	48	362
2012	21	-	35	-	1	8	3	102	16	227	-		49	34	496
2013	-	9	-	-	-	1	-	120	27	281	-		23	19	480
2014	-	-	-	-	-	-	-	185	3	221	-	Denmark	16	19	444
2015	-	-	-	-	-	-	-	28	-	175	-	1	-	3	207
2016[1]	-	-	-	-	-	-	-	1 544	-	183	-	7	-	7	1 746

[1] Provisional figures.

[2] Includes former GDR prior to 1991.

[3] USSR prior to 1991.

[4] Includes UK (E&W) since 2000.

Table 7.5. *Sebastes norvegicus* in Sub-areas 1 and 2. Catch numbers-at-age (in thousands).

Year/Age	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	+gp	Total Num.	Tons Land.
1992	5	22	78	114	394	549	783	1718	3102	2495	2104	1837	998	858	688	547	268	3110	19670	16185
1993	0	24	193	359	406	1036	1022	1523	2353	1410	1655	1678	745	716	534	528	576	3482	18240	16651
1994	46	7	292	640	816	1930	2096	2030	1601	2725	2668	1409	617	733	514	256	177	1508	20065	18120
1995	60	85	230	672	908	1610	2038	2295	1783	1406	785	563	670	593	419	368	250	3232	17967	15616
1996	9	119	313	361	879	1234	1638	2134	1675	1614	1390	952	679	439	560	334	490	3135	17955	18043
1997	9	98	156	321	686	1065	1781	2276	2172	1848	1421	851	804	608	511	205	334	2131	17277	17511
1998	28	51	206	470	721	968	1512	1736	1582	1045	1277	970	1018	846	443	764	486	3389	17512	19155
1999	78	593	855	572	1006	1230	1618	1480	1612	1239	1407	1558	1019	394	197	459	174	2131	17622	18986
2000	4	13	70	245	902	958	1782	1409	2121	2203	1715	753	483	458	132	230	224	895	14597	14460
2001	23	23	44	199	347	482	1120	1342	1674	1653	1243	568	119	183	154	112	135	254	9675	10547
2002	14	36	71	143	414	686	1199	1943	1377	1274	1196	388	313	99	104	117	113	253	9740	9643
2003	22	25	30	44	204	359	705	1687	1338	1071	937	481	367	146	84	51	18	69	7637	7841
2004	19	47	46	65	198	277	504	590	677	963	1059	787	436	169	183	108	79	186	6390	7320
2005	40	55	94	80	165	173	393	779	741	916	926	743	376	210	189	129	111	220	6338	7037
2006	45	32	56	70	245	204	201	809	549	779	794	747	496	332	310	188	165	397	6419	7348
2007	15	21	31	68	138	306	448	495	523	637	892	616	510	396	225	322	170	630	6443	7306
2008	1	4	14	12	49	139	265	366	361	443	442	538	547	479	281	223	144	1032	5342	6557
2009	0	0	1	3	9	31	144	245	272	270	416	391	536	431	332	332	266	954	4633	6261
2010	0	0	0	9	8	36	92	336	437	489	420	336	610	537	498	319	317	884	5328	7744
2011	0	0	0	0	2	5	64	305	469	269	317	228	382	295	252	234	257	1010	4089	5852
2012	1	0	3	12	1	3	39	227	285	296	205	174	226	308	268	293	306	1226	3871	5517
2013	0	8	23	34	9	20	51	241	362	429	228	168	151	273	350	236	184	1117	3884	5609
2014	1	2	7	8	8	15	27	50	67	205	198	148	169	186	165	159	215	1228	2858	4436
2015[1]	0	0	6	17	27	44	29	97	113	129	171	148	160	117	99	96	222	1173	2649	3633

[1] Provisional figures.

Table 7.6. *Sebastes norvegicus* in Sub-areas 1 and 2. Catch weights at age (kg).

Year/Age	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	+gp
1992	0.18	0.29	0.48	0.42	0.50	0.59	0.58	0.65	0.65	0.71	0.82	0.84	0.94	1.02	1.03	1.15	1.27	1.27
1993	0.2	0.33	0.36	0.43	0.51	0.51	0.64	0.64	0.76	0.86	0.89	0.98	1	1.03	1.21	1.03	1.2	1.14
1994	0.25	0.37	0.38	0.49	0.51	0.64	0.74	0.76	0.86	0.95	1.03	1.07	1.11	1.16	1.15	1.13	1.02	1.36
1995	0.33	0.43	0.64	0.61	0.59	0.65	0.74	0.79	0.84	0.92	1.12	1.01	1.01	1.21	1.14	1.09	1.3	1.01
1996	0.22	0.49	0.56	0.65	0.71	0.81	0.84	0.88	0.96	1	1.02	1.01	1	1.03	1.04	1.14	1.09	1.16
1997	0.23	0.51	0.53	0.74	0.72	0.78	0.8	0.86	0.91	0.99	1.16	1.18	1.21	1.34	1.28	1.54	1.19	1.29
1998	0.37	0.21	0.47	0.62	0.67	0.77	0.77	0.85	1.05	0.96	1.25	1.28	1.3	1.23	1.87	1.46	1.73	1.29
1999	0.14	0.26	0.44	0.57	0.69	0.78	0.86	1.04	1.07	1.12	1.18	1.71	1.09	1.18	1.04	1.34	1.18	1.34
2000	0.19	0.24	0.32	0.44	0.53	0.64	0.73	0.84	0.96	1.11	1.25	1.32	1.53	1.06	1.29	1.32	1.12	1.2
2001	0.15	0.26	0.45	0.55	0.58	0.67	0.8	0.89	1.01	1.14	1.33	1.43	1.62	1.6	1.47	2	2.7	2.31
2002	0.17	0.25	0.33	0.42	0.54	0.67	0.72	0.84	0.98	1.09	1.2	1.3	1.44	1.78	1.68	1.88	2.12	1.84
2003	0.19	0.22	0.31	0.39	0.49	0.58	0.69	0.84	0.96	1.05	1.29	1.36	1.65	1.74	2.09	1.85	2.3	2.38
2004	0.21	0.26	0.36	0.45	0.51	0.59	0.68	0.8	0.96	1.07	1.22	1.34	1.57	1.67	1.75	2.09	1.9	2.04
2005	0.16	0.21	0.36	0.45	0.52	0.58	0.68	0.82	0.94	1.03	1.16	1.36	1.46	1.51	1.67	1.91	2.23	2.27
2006	0.13	0.15	0.28	0.41	0.51	0.58	0.66	0.74	0.83	1	1.14	1.27	1.39	1.46	1.37	1.47	1.64	2.03
2007	0.15	0.21	0.33	0.39	0.5	0.59	0.65	0.77	0.9	1	1.09	1.27	1.42	1.32	1.53	1.47	1.69	1.81
2008	0.41	0.55	0.55	0.57	0.52	0.58	0.65	0.81	0.9	1.07	1.14	1.36	1.51	1.81	1.99	2.01	2.26	1.93
2009	-	-	0.62	0.55	0.54	0.51	0.77	0.88	0.9	1.06	1.16	1.25	1.36	1.53	1.59	1.66	1.72	1.55
2010	-	-	-	0.33	0.46	0.79	0.71	0.85	0.95	1.11	1.24	1.38	1.45	1.6	1.71	2	1.78	1.86
2011	0.36	-	-	-	0.54	0.52	0.72	0.91	1.08	1.14	1.21	1.45	1.40	1.43	1.53	1.59	1.73	1.85
2012	0.40	0.38	0.51	0.71	0.60	0.88	0.69	0.87	0.95	1.04	1.14	1.19	1.35	1.52	1.38	1.54	1.51	1.79
2013	-	0.35	0.37	0.48	0.47	0.57	0.69	0.88	0.97	1.10	1.19	1.20	1.31	1.38	1.37	1.59	1.81	1.99
2014	0.39	0.36	0.39	0.41	0.56	0.61	0.72	0.87	0.95	1.07	1.14	1.28	1.46	1.35	1.49	1.62	1.67	1.92
2015[1]	-	0.35	0.37	0.51	0.51	0.60	0.66	0.88	0.93	1.03	1.15	1.18	1.23	1.34	1.50	1.49	1.48	1.64

[1] **Provisional figures.**

Table 7.7. *Sebastes norvegicus* in Sub-areas 1 and 2. Fishing mortalities as estimated by Gadget.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
7	0.004	0.003	0.003	0.003	0.003	0.002	0.003	0.002	0.003	0.003	0.002	0.002
8	0.032	0.010	0.008	0.008	0.009	0.007	0.008	0.008	0.009	0.009	0.008	0.005
9	0.067	0.046	0.021	0.021	0.021	0.018	0.020	0.019	0.022	0.023	0.019	0.014
10	0.095	0.080	0.066	0.041	0.043	0.036	0.041	0.040	0.045	0.048	0.039	0.029
11	0.130	0.105	0.098	0.098	0.074	0.062	0.070	0.069	0.078	0.083	0.068	0.052
12	0.172	0.134	0.121	0.130	0.141	0.094	0.107	0.104	0.119	0.127	0.105	0.080
13	0.219	0.167	0.147	0.155	0.175	0.151	0.147	0.144	0.164	0.176	0.145	0.111
14	0.273	0.203	0.175	0.181	0.201	0.178	0.210	0.184	0.210	0.226	0.187	0.142
15	0.332	0.242	0.204	0.207	0.228	0.199	0.236	0.241	0.254	0.275	0.227	0.173
16	0.394	0.283	0.234	0.234	0.254	0.219	0.257	0.263	0.311	0.319	0.264	0.202
17	0.459	0.325	0.264	0.260	0.280	0.239	0.278	0.282	0.332	0.374	0.297	0.227
18	0.492	0.368	0.295	0.286	0.305	0.258	0.298	0.300	0.351	0.393	0.335	0.248
19	0.524	0.389	0.324	0.311	0.329	0.275	0.315	0.316	0.369	0.411	0.347	0.271
20	0.556	0.410	0.339	0.334	0.351	0.292	0.332	0.331	0.384	0.427	0.360	0.279
21	0.587	0.430	0.353	0.346	0.371	0.306	0.347	0.344	0.398	0.442	0.371	0.286
22	0.615	0.450	0.366	0.357	0.381	0.320	0.359	0.356	0.410	0.454	0.381	0.293
23	0.641	0.468	0.379	0.367	0.390	0.326	0.371	0.366	0.420	0.465	0.389	0.299
24	0.664	0.484	0.390	0.376	0.398	0.331	0.376	0.374	0.428	0.473	0.395	0.304
25	0.683	0.498	0.401	0.385	0.406	0.337	0.380	0.378	0.435	0.480	0.400	0.307
26	0.698	0.510	0.410	0.392	0.413	0.341	0.385	0.381	0.438	0.486	0.405	0.310
27	0.710	0.519	0.417	0.399	0.419	0.345	0.388	0.384	0.441	0.488	0.408	0.312
28	0.719	0.526	0.422	0.404	0.424	0.349	0.392	0.387	0.443	0.490	0.409	0.314
29	0.725	0.531	0.427	0.408	0.428	0.352	0.395	0.389	0.446	0.492	0.410	0.315
30	0.733	0.538	0.433	0.414	0.431	0.355	0.398	0.391	0.448	0.494	0.412	0.316
This year												
12 - 19	0.358	0.264	0.221	0.221	0.239	0.202	0.231	0.229	0.264	0.287	0.238	0.182
Previous year												
12 - 19	0.352	0.266	0.222	0.220	0.238	0.201	0.231	0.232	0.271	0.304	0.260	0.202

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001
7	0.002	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.002	0.002	0.003	0.004
8	0.005	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.008	0.007	0.010	0.014
9	0.014	0.011	0.011	0.011	0.013	0.013	0.012	0.013	0.019	0.018	0.024	0.034
10	0.028	0.023	0.022	0.022	0.026	0.027	0.025	0.026	0.039	0.038	0.049	0.069
11	0.050	0.040	0.039	0.039	0.044	0.047	0.044	0.047	0.069	0.067	0.085	0.118
12	0.075	0.062	0.060	0.060	0.067	0.071	0.068	0.072	0.105	0.103	0.130	0.180
13	0.104	0.086	0.083	0.083	0.092	0.098	0.095	0.101	0.146	0.143	0.180	0.249
14	0.133	0.110	0.105	0.105	0.116	0.124	0.122	0.130	0.188	0.185	0.231	0.322
15	0.160	0.133	0.126	0.126	0.139	0.149	0.146	0.158	0.228	0.225	0.281	0.394
16	0.184	0.153	0.145	0.143	0.158	0.170	0.168	0.182	0.263	0.261	0.327	0.461
17	0.205	0.170	0.160	0.158	0.173	0.187	0.186	0.202	0.292	0.291	0.367	0.522
18	0.223	0.185	0.173	0.169	0.185	0.200	0.200	0.217	0.315	0.316	0.399	0.573
19	0.238	0.197	0.183	0.178	0.195	0.210	0.210	0.229	0.332	0.335	0.425	0.615
20	0.253	0.206	0.191	0.185	0.202	0.218	0.217	0.237	0.345	0.349	0.444	0.647
21	0.258	0.214	0.197	0.191	0.207	0.223	0.223	0.243	0.353	0.359	0.457	0.670
22	0.263	0.217	0.202	0.194	0.210	0.227	0.226	0.247	0.359	0.365	0.466	0.685
23	0.267	0.220	0.204	0.198	0.213	0.230	0.229	0.250	0.363	0.369	0.472	0.696
24	0.270	0.222	0.205	0.199	0.215	0.232	0.231	0.252	0.366	0.372	0.476	0.702
25	0.273	0.224	0.207	0.200	0.216	0.233	0.232	0.253	0.367	0.374	0.478	0.706
26	0.275	0.226	0.208	0.201	0.217	0.234	0.233	0.254	0.368	0.375	0.480	0.708
27	0.277	0.227	0.209	0.201	0.217	0.234	0.233	0.254	0.369	0.376	0.480	0.710
28	0.278	0.228	0.210	0.202	0.218	0.235	0.233	0.254	0.370	0.376	0.481	0.711
29	0.279	0.228	0.210	0.202	0.218	0.235	0.234	0.255	0.370	0.377	0.481	0.711
30	0.280	0.229	0.211	0.203	0.219	0.235	0.234	0.255	0.370	0.377	0.482	0.712
This year												
12 - 19	0.165	0.137	0.129	0.128	0.141	0.151	0.149	0.162	0.234	0.232	0.292	0.414
Previous year												
12 - 19	0.186	0.156	0.148	0.146	0.159	0.169	0.165	0.176	0.255	0.253	0.327	

Table 7.8. Sebastes norvegicus in Sub-areas 1 and 2. Stock numbers, biomass, mean weight and maturity ogives as estimated by GADGET.

	Total stock			Mature			Immature			Recruit	Catch
Year	Number	Mean wt	Biomass	Number	Mean wt	Biomass	Number	Mean wt	Biomass	Age 3	(1000t)
	(millions)	(kg)	(1000t)	(millions)	(kg)		(millions)	(kg)	(1000t)	(millions)	
1986	380	0.36	137.80	92	0.76	69.8	287	0.24	68.05	4.43	30
1987	366	0.36	131.00	88	0.73	64.7	278	0.24	66.30	3.14	24
1988	348	0.36	126.07	85	0.70	60.0	262	0.25	66.05	2.30	26
1989	328	0.37	120.66	82	0.67	55.0	246	0.27	65.70	2.16	23
1990	311	0.37	113.84	79	0.63	49.7	232	0.28	64.11	2.33	28
1991	297	0.38	112.17	80	0.62	49.1	218	0.29	63.10	2.13	19
1992	283	0.40	112.51	82	0.62	50.8	202	0.31	61.67	1.74	16
1993	269	0.42	112.38	84	0.64	53.3	186	0.32	59.08	1.65	17
1994	251	0.44	110.34	84	0.66	55.1	167	0.33	55.19	1.24	18
1995	231	0.47	107.51	83	0.68	56.6	148	0.34	50.86	0.93	16
1996	209	0.50	104.14	81	0.71	57.8	128	0.36	46.33	0.58	18
1997	187	0.53	98.67	77	0.74	57.2	110	0.38	41.43	0.59	18
1998	165	0.55	91.29	72	0.76	54.9	93	0.39	36.39	0.39	19
1999	142	0.57	81.55	65	0.78	50.3	77	0.40	31.25	0.34	19
2000	123	0.60	73.46	58	0.80	46.5	64	0.42	26.97	0.26	14
2001	105	0.62	65.53	52	0.82	42.5	53	0.43	23.01	0.22	11
2002	93	0.67	62.55	49	0.86	42.3	44	0.46	20.26	0.13	10
2003	82	0.73	59.52	46	0.91	42.0	36	0.49	17.55	0.08	8
2004	72	0.79	56.36	43	0.97	41.4	29	0.52	14.96	0.09	7
2005	63	0.85	53.51	40	1.03	40.9	23	0.54	12.59	0.06	7
2006	62	0.81	50.21	36	1.09	39.7	26	0.41	10.53	0.77	7
2007	56	0.82	46.12	33	1.14	37.4	24	0.37	8.70	0.31	7
2008	49	0.85	42.01	29	1.20	34.8	20	0.36	7.24	0.09	7
2009	45	0.84	37.89	26	1.24	31.7	19	0.32	6.17	0.26	6
2010	42	0.81	34.17	22	1.28	28.7	19	0.28	5.48	0.32	8

	Total stock			Mature			Immature			Recruit	Catch
Year	Number	Mean wt	Biomass	Number	Mean wt	Biomass	Number	Mean wt	Biomass	Age 3	(1000t)
	(millions)	(kg)	(1000t)	(millions)	(kg)		(millions)	(kg)	(1000t)	(millions)	
2011	50	0.57	28.71	18	1.28	23.5	32	0.17	5.23	1.52	6
2012	75	0.35	26.00	16	1.24	20.0	59	0.10	6.02	3.05	6
2013	69	0.34	23.21	15	1.11	16.3	54	0.13	6.92	0.13	5.6
2014	62	0.33	20.65	14	0.94	12.7	49	0.16	7.98	0.03	4.4
2015	57	0.34	19.34	13	0.78	10.2	44	0.21	9.10	0.03	3.6

Table 7.8. continued

Age	Proportion mature
4	0.037136
5	0.064873
6	0.100898
7	0.147063
8	0.205177
9	0.276624
10	0.361776
11	0.459238
12	0.565117
13	0.672747
14	0.776436
15	0.859185
16	0.921533
17	0.961288
18	0.984072
19	0.994578
20	0.998589
21	0.999702
22	0.999953
23	0.999994
24	0.999999
25-30	1

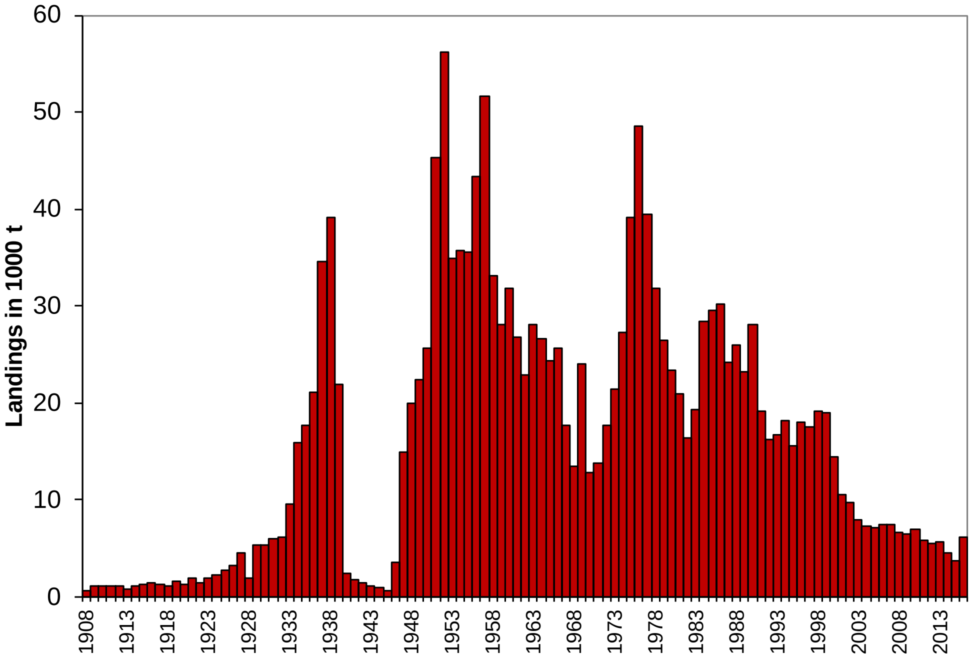


Figure 7.1. ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Total international landings 1908-2016 (in thousand tonnes).**

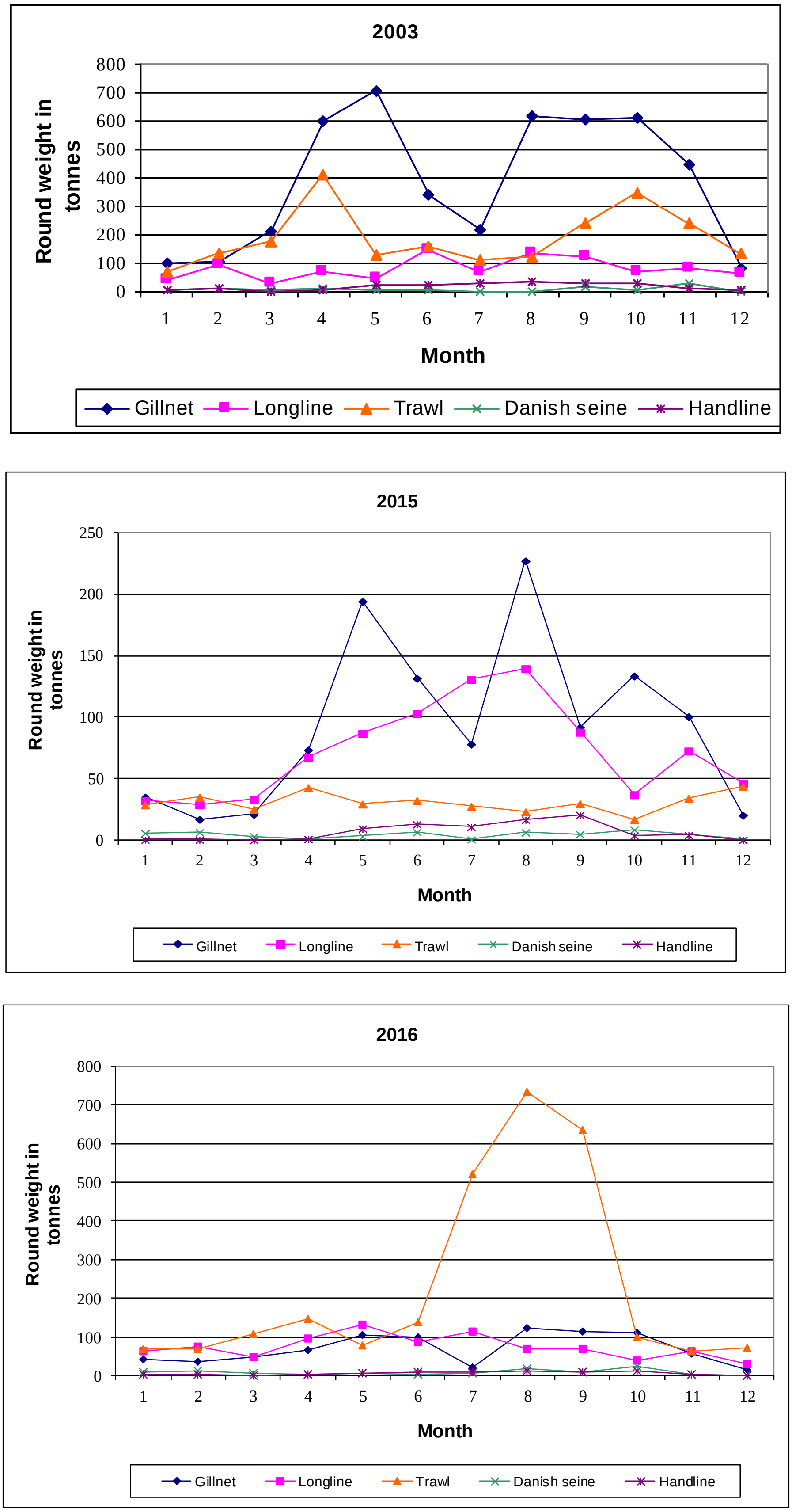


Figure 7.2a. Illustration of the seasonality in the different Norwegian *S. norvegicus* fisheries in 2003, 2015 and 2016, also illustrating how the current regulations are working.

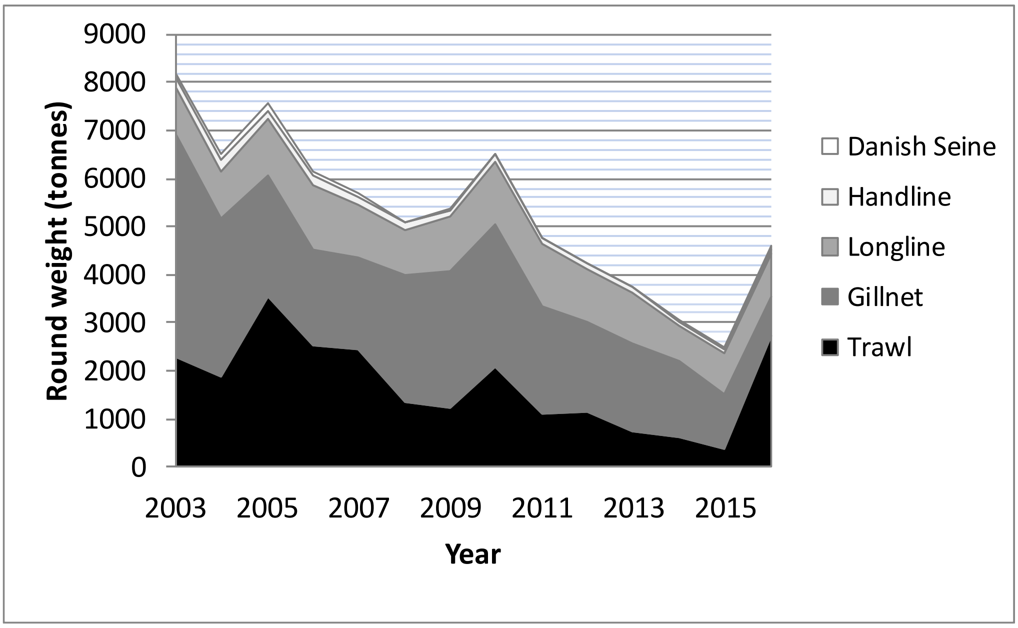


Figure 7.2b. Interannual changes in the Norwegian catches by fleet of *S. norvegicus* fisheries (20032016).

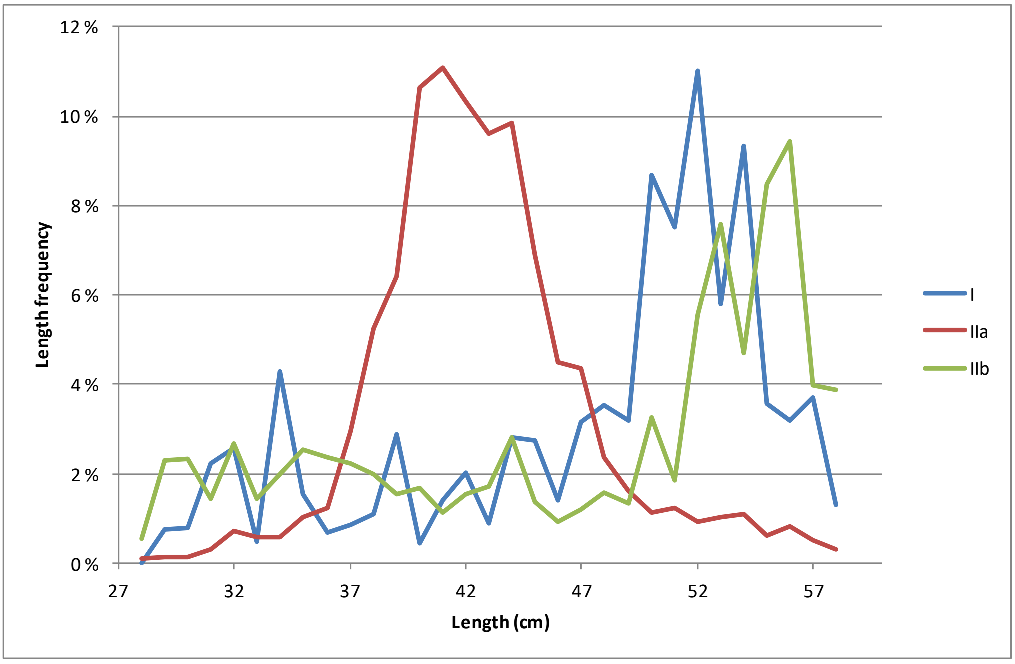
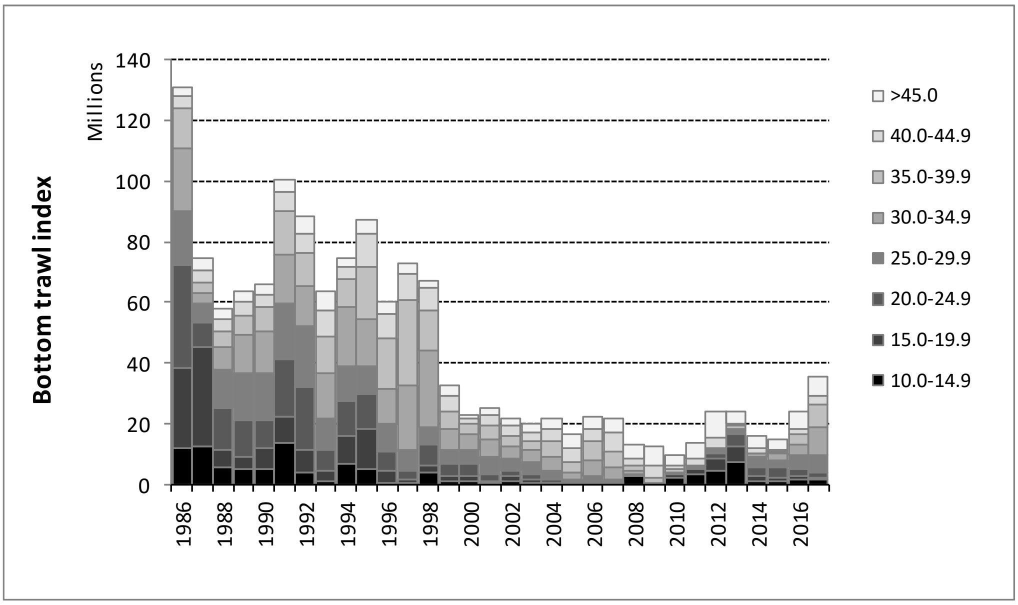


Figure 7.3. *Sebastes norvegicus*. Length frequency of *S. norvegicus* reported from Norwegian catches in subarea 1, 2.a and 2.b in 2015, all gears combined.



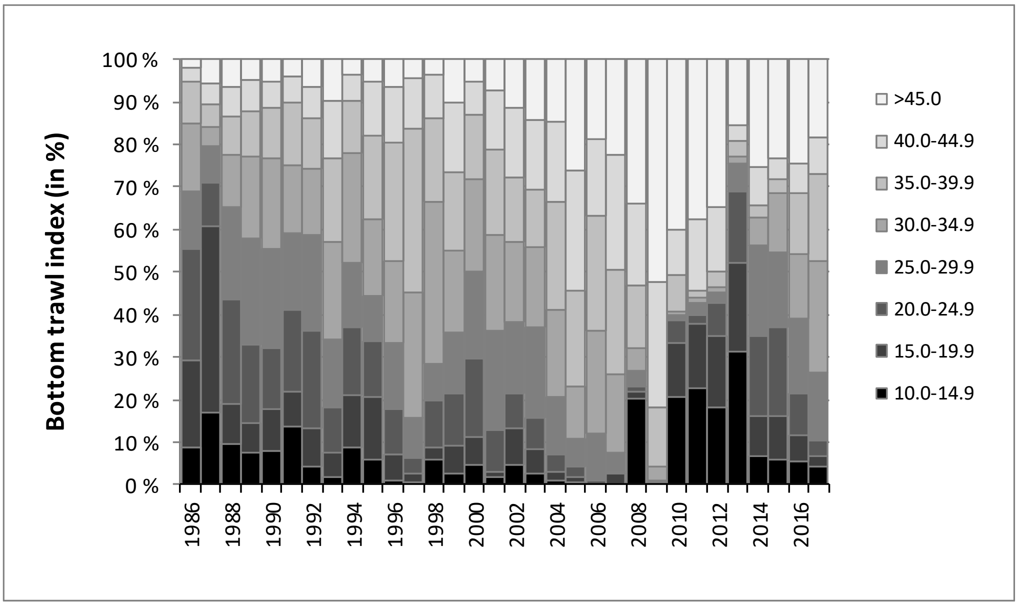


Figure 7.4a. ***Sebastes norvegicus*****. Abundance indices disaggregated by length for the Norwegian bottom-trawl survey in the Barents Sea in winter 1986-2017 (ref. Table E2a). Top: absolute index values, bottom: relative frequencies.**

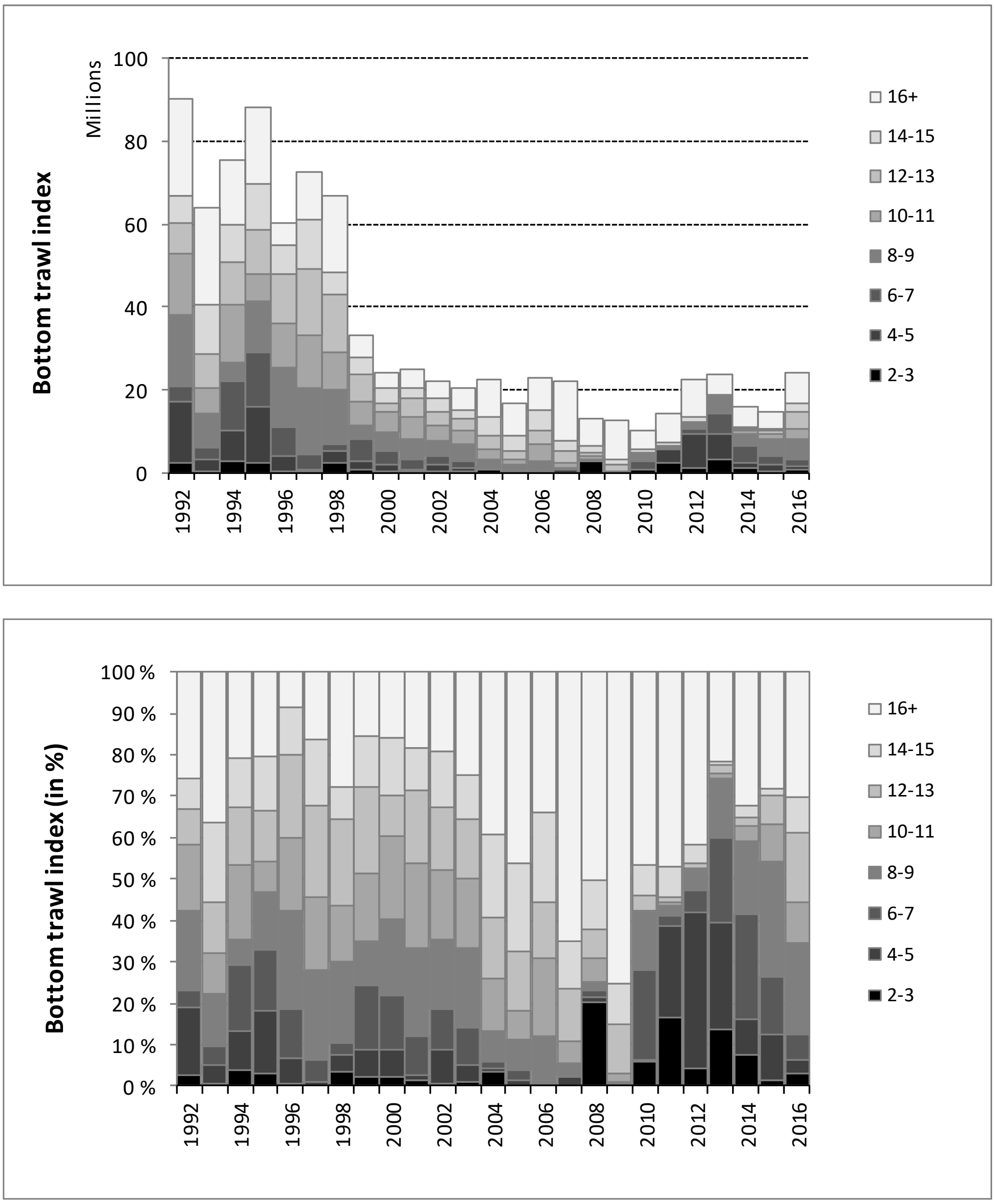


Figure 7.4b. ***Sebastes norvegicus.*** **Abundance indices (by age) from the Norwegian bottom-trawl surveys 1992-2016 in the Barents Sea (ref. Table E2b). Top: absolute index, bottom: relative frequencies. Horizontal line indicates the median age of the surveyed population.**

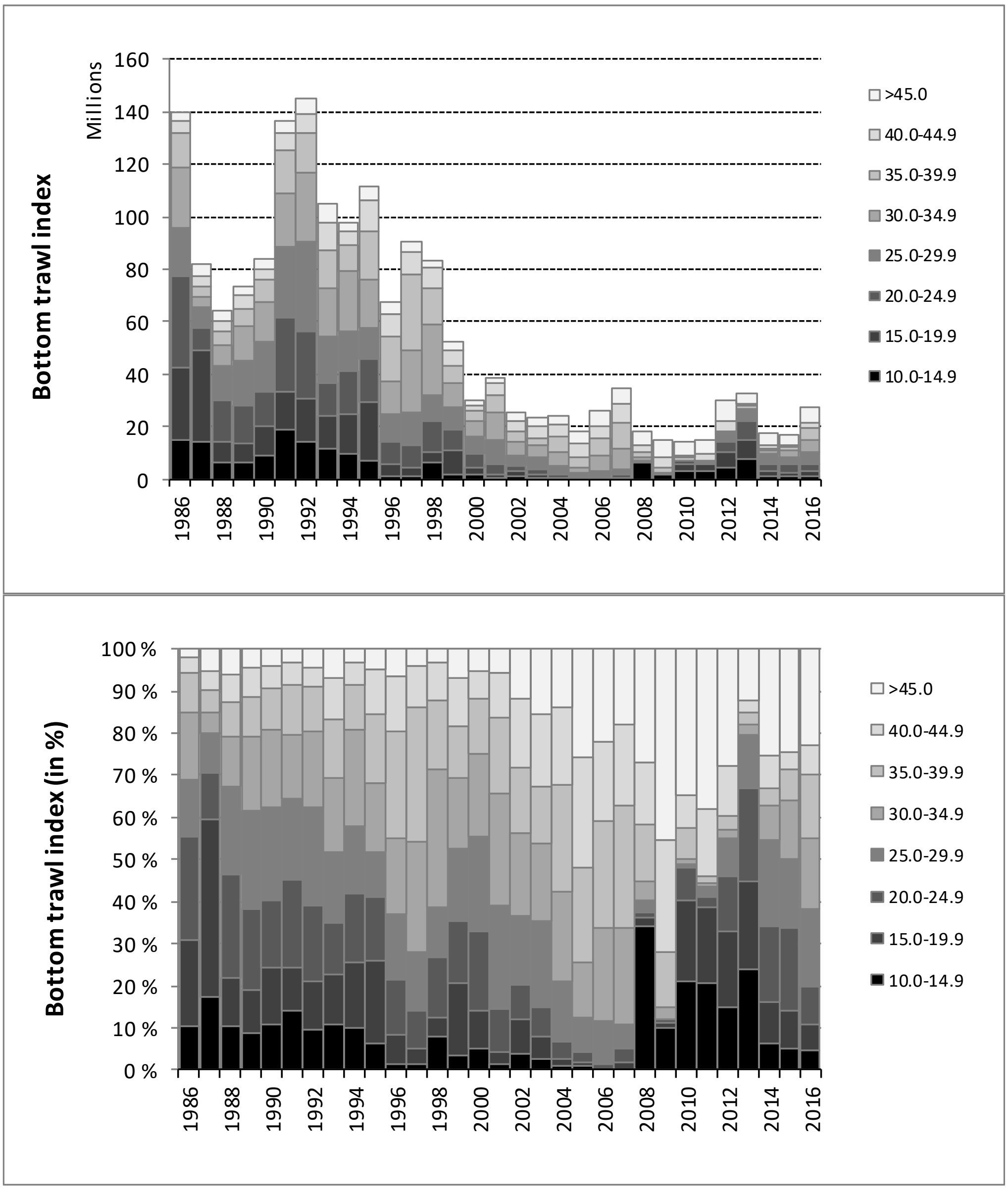


Figure 7.5a. ***Sebastes norvegicus.*** **Abundance indices disaggregated by length when combining the Norwegian bottom-trawl surveys 1986-2016 in the Barents Sea (winter) and at Svalbard (summer/fall). Top: absolute index values. Bottom: relative frequencies. Horizontal line indicates the median length in the surveyed population.**

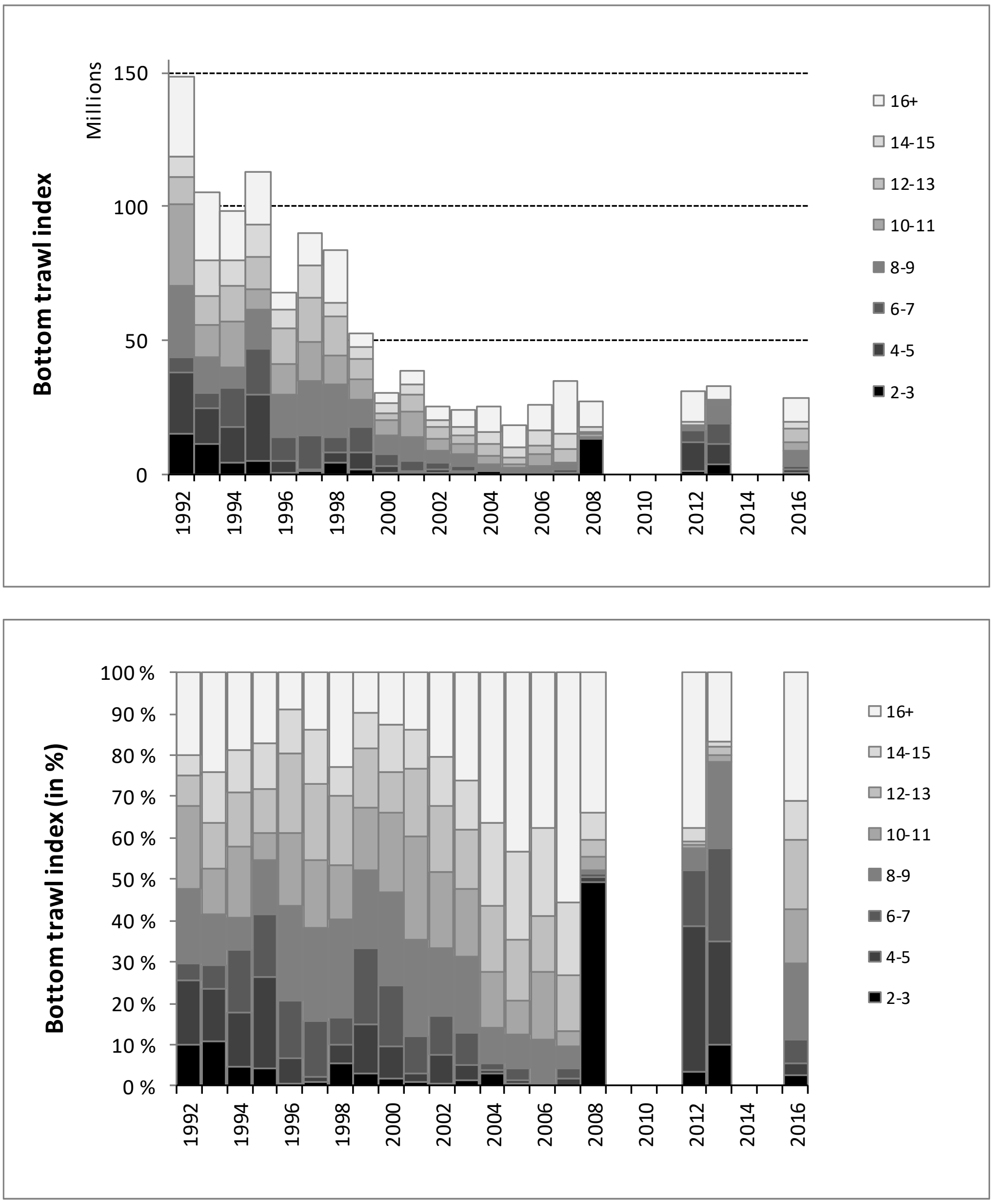


Figure 7.5b. ***Sebastes norvegicus*****. Abundance indices disaggregated by age. Combined Norwegian bottom-trawl surveys 1992-2016 in the Barents Sea (winter) and Svalbard survey (summer/fall). Top: absolute index values, bottom: relative frequencies. Horizontal line indicates median age of the surveyed population. In 2009-2011 and 2014-2015, there was insufficient number of age readings to derive numbers-at-age**

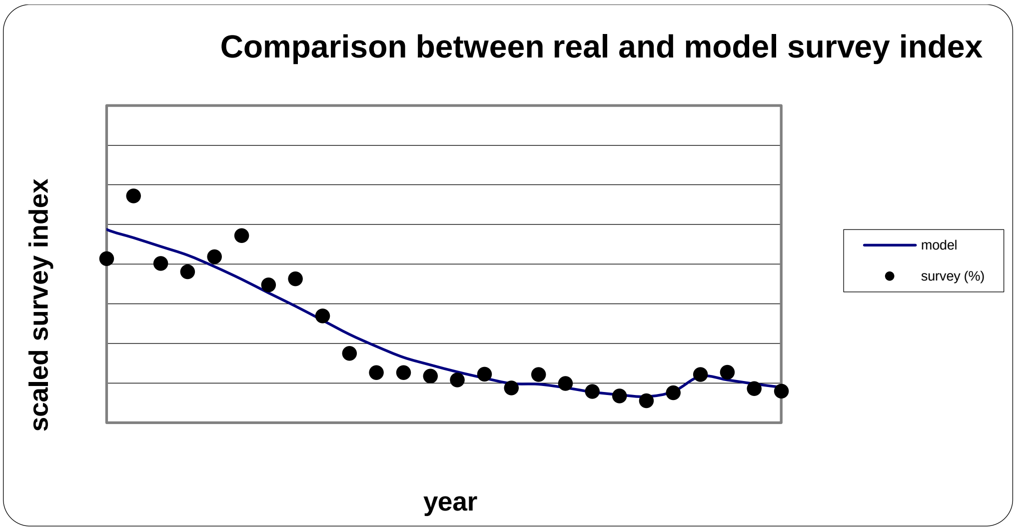


Figure 7.6. ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Results from the Gadget assessment compared to the scientific survey. The Figure shows comparison of observed and modelled survey indices (total number scaled to sum=100 during the time period) – the traditional Barents Sea February survey Dots: survey indices. Plain lines: survey indices estimated by the model.**

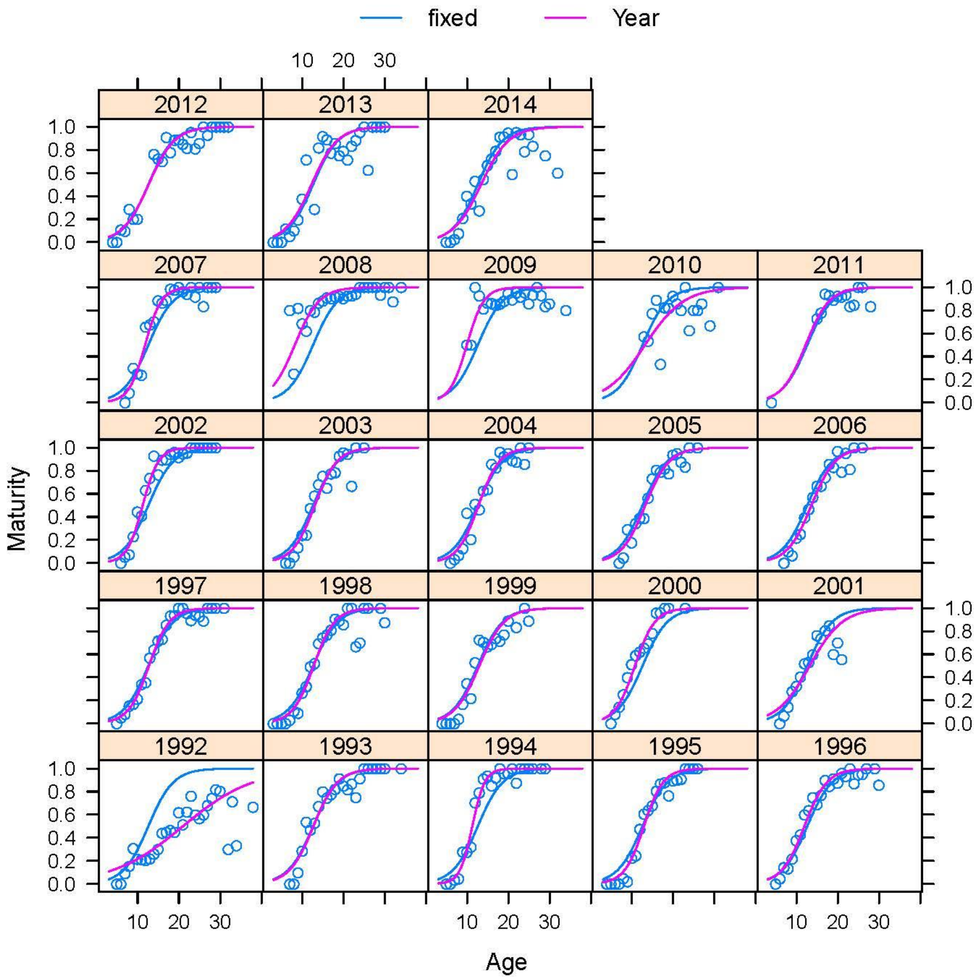


Figure 7.7a. Proportion maturity-at-age of *S. norvegicus* in subareas 1 and 2 derived from Norwegian commercial and survey data (Table E4). The proportions were derived from samples with at least five individuals.

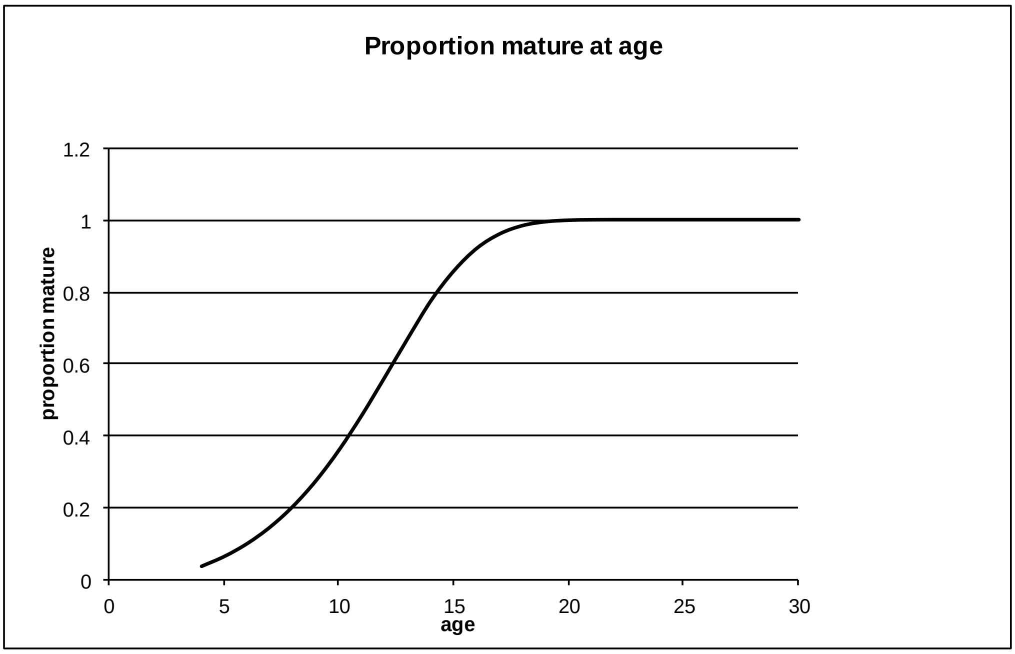


Figure 7.7b. ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Estimates of maturity-at-age by Gadget. Input data have been proportions of** ***S. norvegicus*** **mature both at age and length as collected and classified from Norwegian commercial landings and surveys.**

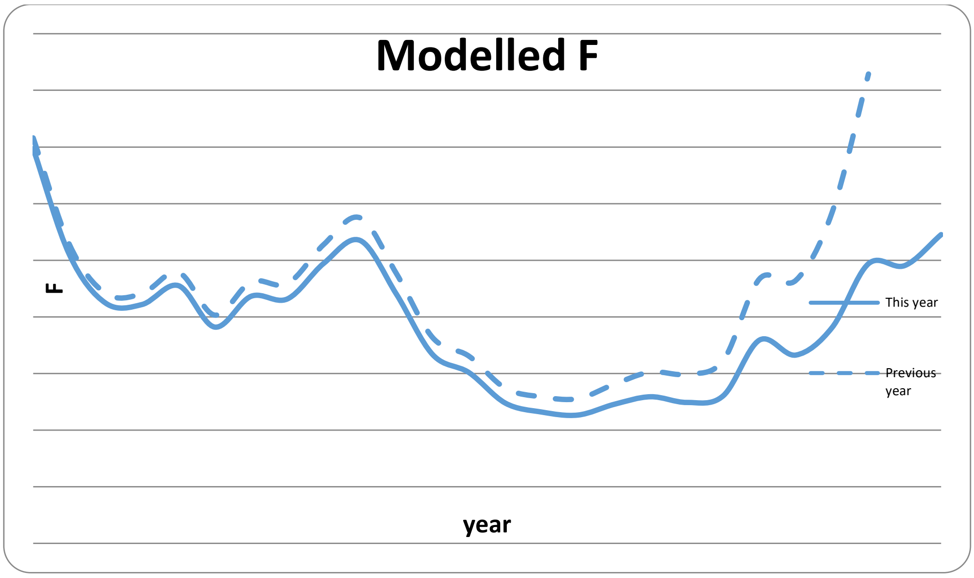


Figure 7.8. ***Sebastes norvegicus*** **in subareas 1 & 2. Unweighted average fishing mortality of ages 1219 as estimated by Gadget in 2016 (solid line) and at the 2014 AFWG.**

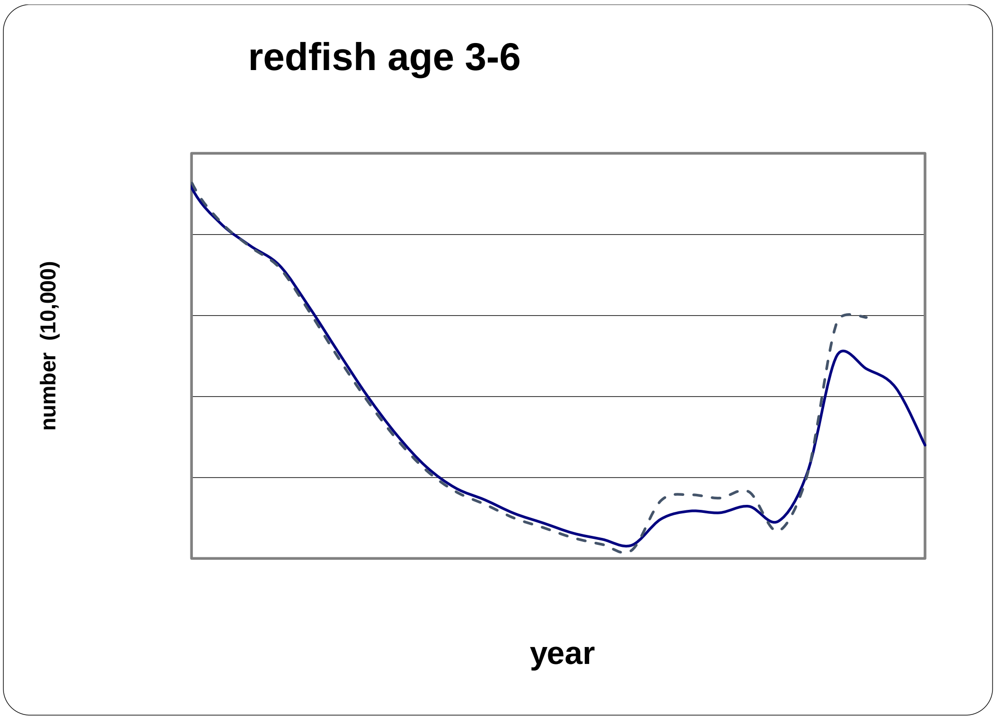


Figure 7.9. ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Estimates of abundance at age 3-6 by Gadget using two surveys as input. Gadget outputs provided in 2014 are shown as dotted line. Current results are shown as plain lines.**

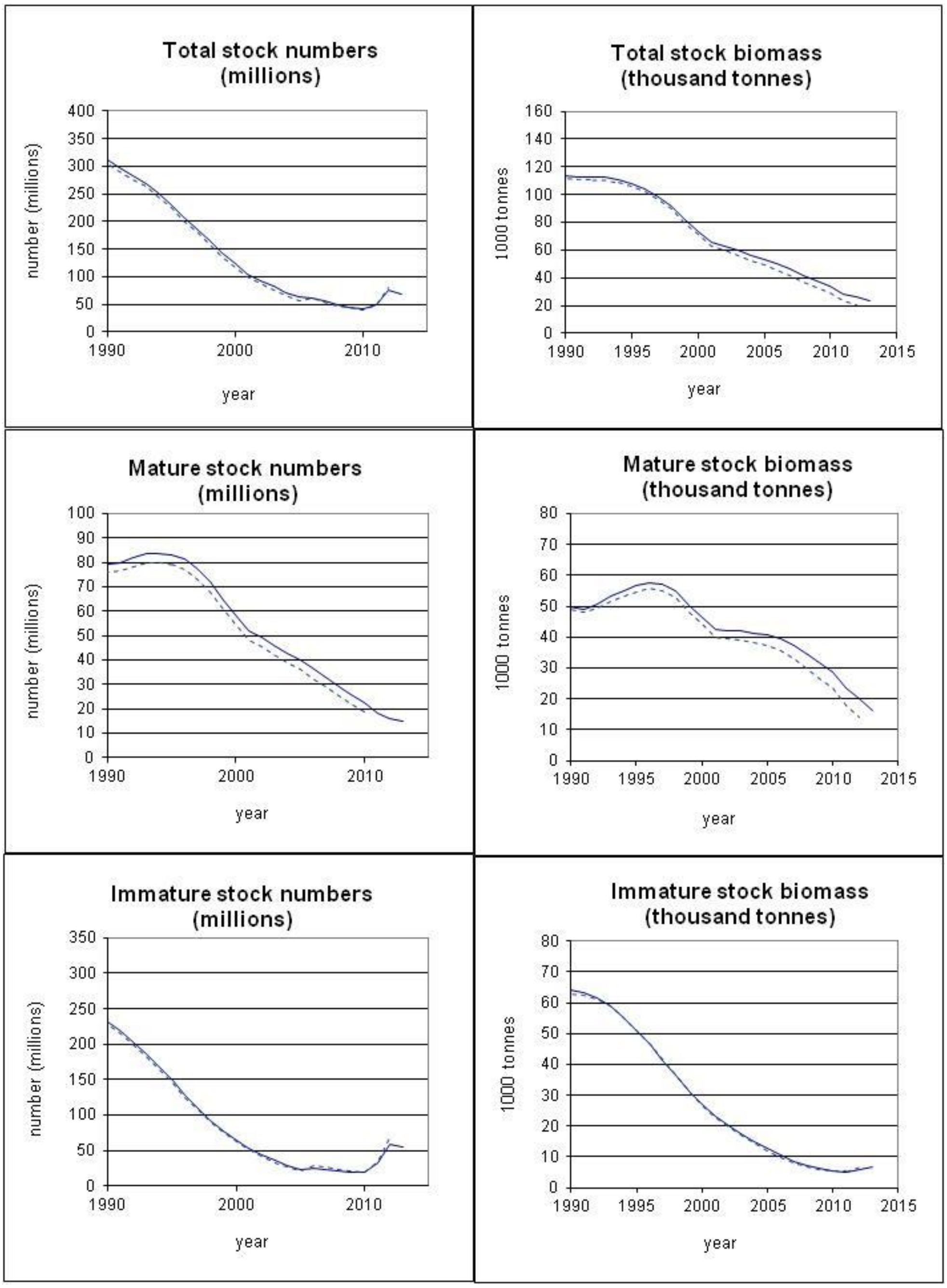


Figure 7.10. ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Stock numbers (in thousands) and biomass (in tonnes) for the total stock (3+) (upper panel), and the fishable and mature stock (middle panel), and the immature stock (lower panel), as estimated by Gadget using two surveys as input. Gadget outputs provided in 2014 are shown as dotted lines. Current results are shown as plain lines.**

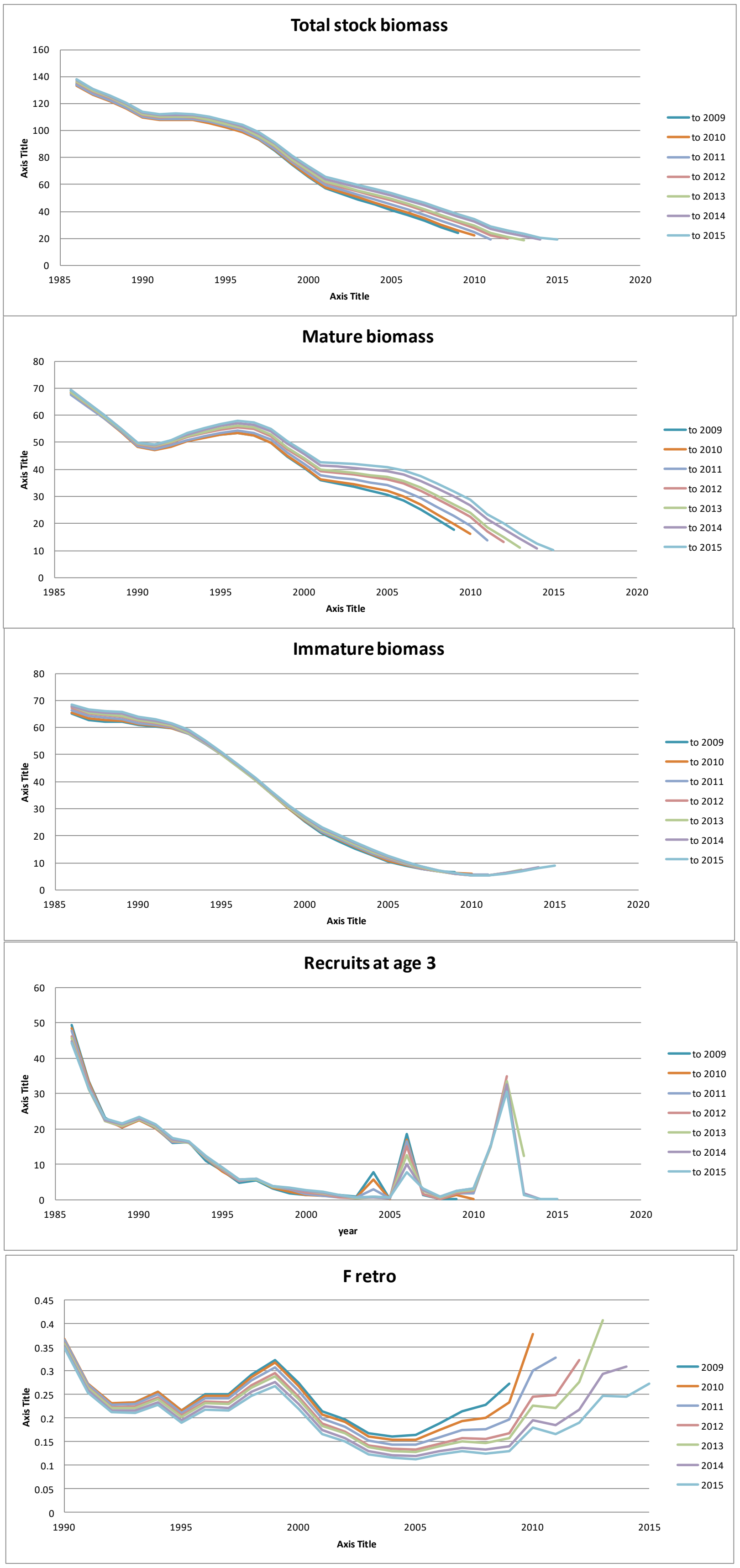


Figure 7.11. 7 year retrospective plots for the *S. norvegicus* Gadget model.

Table E1a. ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Abundance indices - on length - from the bottom-trawl surveys in the Barents Sea (Division 2.a) in the winter 1986-2017 (numbers in millions). The area coverage was extended from 1993.**

				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	3.0	11.7	26.4	34.3	17.7	21.0	12.8	4.4	2.6	133.9
1987	7.7	12.7	32.8	7.7	6.4	3.4	3.8	3.8	4.2	82.5
1988	1.0	5.6	5.5	14.2	12.6	7.3	5.2	4.1	3.7	59.2
1989	48.7	4.9	4.3	11.8	15.9	12.2	6.6	4.8	3.0	112.2
1990	9.2	5.3	6.5	9.4	15.5	14.0	8.0	4.0	3.4	75.3
1991	4.2	13.6	8.4	19.4	18.0	16.1	14.8	6.0	4.0	104.5
1992	1.8	3.9	7.7	20.6	19.7	13.7	10.5	6.6	5.8	90.3
1993	0.1	1.2	3.5	6.9	10.3	14.5	12.5	8.6	6.3	63.9
1994	0.7	6.5	9.3	11.7	11.5	19.4	9.1	4.4	2.8	75.4
1995	0.6	5.0	13.1	11.5	9.1	15.9	17.2	10.9	4.7	88.0
1996	+	0.7	3.5	6.4	9.4	11.7	16.6	7.9	3.9	60.1
1997[1]	-	0.5	1.3	2.7	6.9	21.4	28.2	8.5	3.3	72.7
1998[1]	0.1	3.9	2.0	7.4	5.8	25.3	13.2	7.0	2.3	67.0
1999	0.2	0.9	2.1	4.0	4.6	6.4	6.0	5.3	3.5	33.0
2000	0.5	1.1	1.5	4.2	4.7	5.0	3.5	1.8	1.2	24.0
2001	0.1	0.4	0.4	2.4	5.8	5.6	5.0	3.5	1.8	25.0
2002	0.1	1.0	1.9	1.7	3.7	4.1	3.3	3.6	2.5	22.0
2003	0.0	0.5	1.2	1.5	4.3	3.8	2.7	3.3	2.9	20.2
2004	0.7	0.2	0.4	1.0	2.9	4.4	5.5	4.0	3.2	22.3
2005	+	0.1	0.2	0.4	1.1	2.0	3.7	4.6	4.3	16.4
2006	0.0	0.0	0.0	0.2	2.5	5.4	6.1	4.1	4.2	22.5
2007	0.0	0.1	0.5	0.1	1.0	4.0	5.4	5.9	4.9	21.9
2008	1.8	2.6	0.2	0.2	0.4	0.7	1.9	2.5	4.4	14.8
2009	0.0	0.0	0.1	0.0	0.0	0.4	1.7	3.7	6.6	12.7
2010	0.4	2.0	1.2	0.6	0.1	0.1	0.8	1.1	3.9	10.3
2011	0.3	3.1	2.1	0.3	0.4	0.1	0.3	2.3	5.2	14.1
2012	0.8	4.4	4.0	1.9	0.6	0.3	0.9	3.6	8.3	24.8
2013	0.0	7.4	4.9	4.0	1.6	0.4	0.9	0.8	3.7	23.8
2014	0.1	1.1	1.5	3.0	3.4	1.0	0.5	1.4	4.0	16.0
2015	0.1	0.9	1.5	3.1	2.6	2.0	0.5	0.7	3.4	14.8
2016	0.8	1.3	1.5	2.4	4.2	3.6	3.4	1.7	5.9	24.7
2017	0.4	1.4	1.0	1.4	5.7	9.3	7.3	3.1	6.5	36.1

1 - Adjusted indices to account for not covering the Russian EEZ in Subarea 1

Table E1b. Sebastes norvegicus in Sub-areas 1 and 2. Norwegian bottom-trawl indices - on age - from the annual Barents Sea survey in February 1992–2016 (numbers in thousands). The area coverage was extended from 1993 onwards.

	Age													
Year	3	4	5	6	7	8	9	10	11	12	13	14	15	Total 1–15	16+
1992	2 295	4 261	10 760	2 043	1 474	13 178	4 230	6 302	8 251	3 751	3 865	3 064	3 568	67 042	23 300
1993	468	1 218	1 424	2 020	979	5 048	2 968	4 230	2 142	4 634	3 338	2 951	9 148	40 568	23 300
1994	2 951	4 485	2 573	3 801	8 338	3 254	1 297	7 231	6 443	248	10 192	6 341	2 612	59 766	15 600
1995	2 540	7 450	6 090	7 150	5 820	6 590	5 670	2 000	4 440	6 500	4 320	5 330	6 030	69 930	18 100
1996	310	1 300	2 340	3 520	3 660	8 720	5 650	3 960	6 590	5 730	6 230	4 070	2 950	55 030	5 100
1997	190	80	360	1 320	2 530	5 370	10 570	6 840	5 810	7 390	8 790	9 740	1 980	60 980	11 700
1998	2 380	1 930	850	660	1 140	7 090	6 124	4 962	4 091	5 190	8 790	2 730	2 560	48 487	18 500
1999	737	916	1 246	3 469	1 650	1 826	1 679	3 084	2 371	2 953	3 837	2 132	1 979	27 879	5 100
2000	490	720	900	1 310	1 800	2 440	2 020	2 710	2 090	940	1 440	2 940	430	20 230	3 800
2001	320	170	190	940	1 360	2 220	3 110	2 400	2 690	2 230	2 180	1 200	1 370	20 380	4 600
2002	130	910	902	1 590	544	1 546	2 153	1 822	1 900	2 220	1 073	1 294	1 730	17 814	4 200
2003	220	250	590	1 080	680	1 020	2 910	1 180	2 250	1 370	1 530	840	1 310	15 230	5 000
2004	780	100	100	90	240	540	1 130	1 260	1 590	1 740	1 490	2 570	1 890	13 520	8 800
2005	39	85	107	110	321	524	669	497	697	820	1 517	1 905	1 653	8 944	7 652
2006	0	0	0	24	52	1 011	1 641	1 999	2 246	1 578	1 550	3 487	1 444	15 030	7 666
2007	58	202	248	50	51	185	422	582	592	1 747	1 030	1 127	1 359	7 652	14 248
2008	2 637	0	0	0	203	72	175	272	476	369	553	850	700	6 306	6 543
2009	0	0	0	0	85	0	14	77	192	358	1 146	532	737	3 141	9 539
2010	0	0	16	1 966	267	0	1 450	35	0	117	268	285	494	5 510	4 779
2011	1 832	1 621	1 529	163	148	0	343	0	122	0	204	107	903	7 459	6 624
2012	973	3 187	5 362	923	293	501	556	116	27	212	0	350	758	13 256	9 405
2013	1 432	929	5 194	2 183	2 757	2 346	1 031	250	0	378	117	250	0	18 684	5 112
2014	1 108	215	1 163	1 188	2 923	1 812	992	559	69	0	297	67	402	10 861	5 163
2015	143	526	1 106	954	1 111	1 955	2 126	300	1 043	487	537	143	51	10 554	4 173

Year	Age 3	4	5	6	7	8	9	10	11	12	13	14	15	Total 1–15	16+
2016	247	627	106	1 123	428	1 870	3 365	1 378	948	1 255	2 827	1 536	479	16 682	7 268

16+ group is considered in the calculation since 2005. Values prior to this date were derived by subtracting the sum of abundance in groups 1-15 to the total abundance, available in Table E2a.

Table E2a. ***Sebastes norvegicus*** **in Subarea 1 and 2. Abundance indices - on length - from the bottom-trawl survey in the Svalbard area (Division 2.b) in summer/fall 1985–2016 (numbers in thousands).**

	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
1985[1]	-	1 307	795	1 728	2 273	1 417	311	142	194	8 325
1986[1]	200	2 961	1 768	547	643	1 520	639	467	196	8 941
1987[1]	100	1 343	1 964	1 185	1 367	652	352	29	44	7 060
1988[1]	500	1 001	1 953	1 609	684	358	158	68	95	6 450
1989	200	1 629	2 963	2 374	1 320	846	337	323	104	10 100
1990	1 700	3 886	4 478	4 047	2 972	1 509	365	140	122	19 185
1991	100	5 371	5 821	9 171	8 523	4 499	1 531	982	395	36 420
1992	1 700	10 228	8 858	5 330	13 960	12 720	4 547	494	346	58 172
1993	200	10 160	9 078	5 855	7 071	4 327	2 088	1 552	948	41 284
1994	100	3 340	5 883	4 185	3 922	3 315	1 021	845	423	22 985
1995	470	2 000	9 100	5 070	3 060	2 400	1 040	920	780	24 840
1996	80	130	1 260	2 480	1 030	480	550	990	400	7 400
1997	0	810	1 980	5 470	5 560	2 340	590	190	450	17 430
1998	180	2 698	1 741	4 620	4 053	1 761	535	545	241	16 403
1999	0	794	7 057	3 698	4 563	2 449	467	619	369	20 017
2000	40	360	1 240	1 390	2 010	760	400	160	390	6 750
2001	10	110	790	1 470	3 710	4 600	1 880	680	370	13 660
2002	0	0	64	415	459	880	620	565	519	3 522
2003	90	90	108	83	525	565	447	760	769	3 437
2004	0	0	10	50	650	740	670	430	190	2 740
2005	0	45	0	30	315	384	307	159	274	1 513
2006	0	0	70	64	167	376	473	735	1 514	3 398
2007	0	32	58	1 003	1 049	3 875	4 656	811	1 267	12 751
2008	7 009	3 573	175	21	42	142	475	162	529	12 130
2009	227	1 476	114	114	0	0	185	213	193	2 522
2010	666	917	1 506	522	0	117	172	0	985	4 885
2011	0	0	681	33	0	0	0	131	568	1 413
2012	0	85	1 512	2 138	2 145	327	32	0	133	6 372
2013	48	437	1 971	3 239	2 564	412	152	33	392	9 248
2014	47	0	316	130	223	443	208	0	452	1819
2015	0	0	0	206	193	276	768	0	651	2094
2016	0	0	136	128	916	944	756	234	417	3531

1 - Old trawl equipment (bobbins gear and 80 meter sweep length)

Table E2b. Sebastes *norvegicu*s in Sub-areas 1 and 2. Norwegian bottom-trawl survey indices - on age - in the Svalbard area (Division 2.b) in summer/fall 1992–2016 (numbers in thousands). In 2009–2011 and 2014–2015, there was insufficient number of age readings to derive numbers-at-age.

	Age														
Year	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1992	284	12 378	5 576	2 279	371	2 064	3 687	5 704	9 215	6 413	1 454	1 387	696	22	51 530
1993	32	10 704	5 710	5 142	1 855	1 052	1 314	3 520	2 847	2 757	2 074	1 245	844	119	39 215
1994	429	1 150	3 418	2 393	1 723	1 106	1 714	1 256	1 938	1 596	2 039	484	550	319	20 155
1995	600	1 600	6 400	5 100	1 800	2 200	1 800	700	700	400	700	500	400	500	23 400
1996	40	110	+	560	1 050	940	930	400	1 050	280	320	590	160	70	6 500
1997	320	490	+	480	1 500	6 950	2 720	1 680	800	1 310	550	30	+	120	16 950
1998	210	1 817	881	202	1 555	2 187	4 551	1 913	1 010	797	49	264	73	187	15 696
1999	0	760	2 893	1 339	3 534	1 037	3 905	2 603	762	1 663	481	361	258	152	19 748
2000	40	20	400	350	840	480	730	1 670	620	340	510	100	80	70	6 250
2001	0	40	50	450	330	790	1 760	1 970	3 300	1 200	1 810	150	660	430	12 940
2002	0	0	+	+	65	160	204	326	364	614	442	328	15	0	2 518
2003	30	30	30	+	108	+	219	263	126	259	306	199	248	411	2 229
2004	0	0	0	+	+	20	360	120	430	160	410	360	370	200	2 430
2005	0	45	0	0	0	30	48	228	138	187	194	93	105	109	1 177
2006	0	0	23	23	23	21	22	21	84	0	84	279	194	376	1 148
2007	0	33	19	19	19	764	764	525	0	0	21	1 927	1 927	1 683	7 702
2008	10 583	44	88	44	11	11	0	42	88	13	13	118	63	174	11 292
2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	0	28	121	2 353	1 836	1 183	577	79	30	32	0	0	0	0	6 239
2013	48	44	738	1 298	1 433	1 097	2 746	806	183	91	185	0	0	180	8 849
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	0	0	0	68	68	0	0	0	916	403	442	227	466	145	2 734

Table E3. ***Sebastes norvegicus*** **in Sub-area 1 and 2. Mean catch rates (Num/NM²) of** ***Sebastes norvegicus*** **from Norwegian Coastal Surveys (Division 2.a) in 1995-2010 within 100-350 m depth. Catch rates for the total area.**

Length range (cm)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	# Hauls	Total.Distance (nm)	# Fish Caught	# Fish Sampled	Area (nm^2)
1995	0	41	118	59	54	38	69	214	157	21	2	1	0					
1996	0	34	87	124	151	67	210	415	209	64	0	0	0					
1997	0	4	9	12	64	112	96	178	190	45	2	1	0					
1998	0	0	0	4	12	16	17	110	96	18	3	0	0					
1999	0	0	19	242	160	34	43	151	117	15	4	2	0					
2000	0	0	2	13	7	10	30	160	155	30	4	0	0					
2001	0	0	2	11	14	22	15	83	160	30	2	0	0					
2002	0	0	0	0	2	6	29	259	213	26	4	1	0					
2003	0	0	6	10	43	66	49	219	225	55	6	1	2	123	160	1367	1053	43574
2004	0	1	3	6	21	66	35	351	552	42	3	1	0	104	130	1290	950	43574
2005	0	1	5	5	30	46	48	190	171	37	1	0	0	99	132	833	780	43574
2006	0	0	3	0	2	3	30	145	256	66	9	0	0	112	112	771	680	43574
2007	0	0	0	0	4	7	17	129	177	29	1	0	0	131	140	637	637	43574
2008	0	4	5	1	4	5	17	363	490	99	12	2	0	110	140	1156	850	43574
2009	0	0	8	3	10	19	45	808	945	109	14	1	0	109	127	2945	581	43574
2010	0	40	78	20	9	1	3	67	214	99	7	2	0	117	136	833	690	43574

Table E4. Proportion of maturity-at-age 5 – 30 in *S. norvegicus* in subareas 1 and 2 derived from Norwegian commercial and survey data. The proportions were derived from samples with at least five individuals.

YEAR	AGE5	AGE6	AGE7	AGE8	AGE9	AGE10	AGE11	AGE12	AGE13	AGE14	AGE15	AGE16	AGE17	AGE18
1992	0.00	0.00	0.09	0.15	0.31	0.22	0.21	0.20	0.22	0.26	0.30	0.44	0.45	0.47
1993	-	-	0.00	0.00	0.10	0.29	0.54	0.47	0.53	0.67	0.80	0.75	0.78	0.82
1994	0.00	0.00	0.03	0.05	0.28	0.28	0.32	0.70	0.79	0.91	0.94	0.85	0.92	1.00
1995	0.00	0.00	0.00	0.05	0.02	0.22	0.25	0.48	0.61	0.64	0.68	0.80	0.87	0.88
1996	0.00	0.05	0.14	0.13	0.22	0.38	0.43	0.60	0.64	0.75	0.69	0.77	0.90	0.85
1997	0.00	0.05	0.08	0.15	0.17	0.21	0.34	0.35	0.57	0.64	0.72	0.73	0.85	0.93
1998	0.00	0.00	0.03	0.11	0.09	0.26	0.32	0.49	0.52	0.69	0.74	0.77	0.81	0.91
1999	0.00	0.00	0.00	0.04	0.17	0.35	0.22	0.53	0.73	0.71	0.67	0.69	0.74	0.71
2000	0.00	0.08	0.14	0.25	0.40	0.51	0.59	0.62	0.65	0.69	0.78	0.96	0.96	1.00
2001	-	0.00	0.06	0.14	0.28	0.32	0.40	0.52	0.53	0.60	0.76	0.74	0.81	0.85
2002	-	0.00	0.05	0.07	0.23	0.44	0.41	0.63	0.74	0.93	0.77	0.89	0.90	0.94
2003	-	0.00	0.00	0.05	0.13	0.24	0.24	0.47	0.58	0.68	0.75	0.65	0.77	0.78
2004	-	0.00	0.03	0.07	0.13	0.43	0.21	0.51	0.46	0.63	0.64	0.86	0.82	0.96
2005	-	-	0.00	0.05	0.29	0.18	0.34	0.39	0.39	0.56	0.73	0.81	0.79	0.82
2006	-	-	0.00	0.10	0.06	0.22	0.25	0.39	0.47	0.57	0.67	0.67	0.74	0.86
2007	-	-	0.00	0.08	0.30	0.25	0.24	0.66	0.68	0.70	0.88	0.86	0.89	0.99
2008	-	-	0.80	0.25	0.82	0.68	0.62	0.80	0.79	0.86	0.88	0.91	0.90	0.92
2009	-	-	-	-	-	0.50	0.50	1.00	0.93	0.81	0.86	0.86	0.84	0.86
2010	-	-	-	-	-	-	-	-	0.57	0.53	0.77	0.89	0.33	0.82
2011	-	-	-	-	-	-	-	-	-	-	0.73	0.78	0.94	0.93
2012	0.00	0.11	0.10	0.29	0.20	0.20	-	-	-	0.75	0.72	0.70	0.91	0.78
2013	0.00	0.12	0.05	0.10	0.19	0.38	0.71	-	0.29	0.82	0.92	0.89	0.77	0.86

YEAR	AGE19	AGE20	AGE21	AGE22	AGE23	AGE24	AGE25	AGE26	AGE27	AGE28	AGE29	AGE30
1992	0.45	0.62	0.51	0.63	0.76	0.60	0.57	0.60	0.68	0.74	0.82	0.80
1993	0.91	0.85	0.82	0.87	0.75	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1994	0.96	0.96	1.00	0.88	1.00	1.00	1.00	1.00	-	1.00	1.00	-
1995	0.76	0.89	0.90	0.91	1.00	1.00	1.00	1.00	-	-	-	-
1996	0.91	0.88	0.96	0.93	1.00	0.87	0.95	0.95	1.00	-	1.00	0.86
1997	0.94	1.00	1.00	0.95	0.89	0.94	0.93	0.89	1.00	1.00	1.00	-

1998	0.89	0.86	1.00	1.00	0.67	0.70	1.00	1.00	-	-	1.00	0.88
1999	0.77	0.89	-	0.83	-	1.00	0.89	-	-	-	-	-
2000	1.00	-	-	-	1.00	-	-	-	-	-	-	-
2001	0.60	0.70	0.56	-	-	-	-	-	-	-	-	-
2002	0.96	0.92	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-
2003	0.93	0.96	0.94	0.67	1.00	-	1.00	-	-	-	-	-
2004	0.92	0.95	0.89	0.88	1.00	0.86	1.00	-	-	-	-	-
2005	0.77	0.94	0.95	0.88	0.83	1.00	-	1.00	-	-	-	-
2006	0.83	0.97	0.79	0.95	0.81	1.00	-	1.00	-	-	-	-
2007	0.98	1.00	0.96	0.94	1.00	0.92	1.00	0.83	1.00	1.00	1.00	-
2008	0.92	0.90	0.93	0.93	0.94	1.00	1.00	1.00	1.00	1.00	0.93	1.00
2009	0.88	0.95	0.89	0.95	0.92	0.95	0.86	0.93	1.00	0.93	0.83	0.86
2010	0.82	0.92	0.86	0.80	1.00	0.63	0.80	0.80	0.86	-	0.67	-
2011	0.89	0.92	0.92	0.93	0.83	0.85	1.00	1.00	-	0.83	-	-
2012	0.88	0.89	0.85	0.81	0.95	0.81	0.86	1.00	0.93	1.00	1.00	1.00
2013	0.75	0.79	0.71	0.83	0.88	0.95	1.00	0.63	1.00	1.00	1.00	1.00

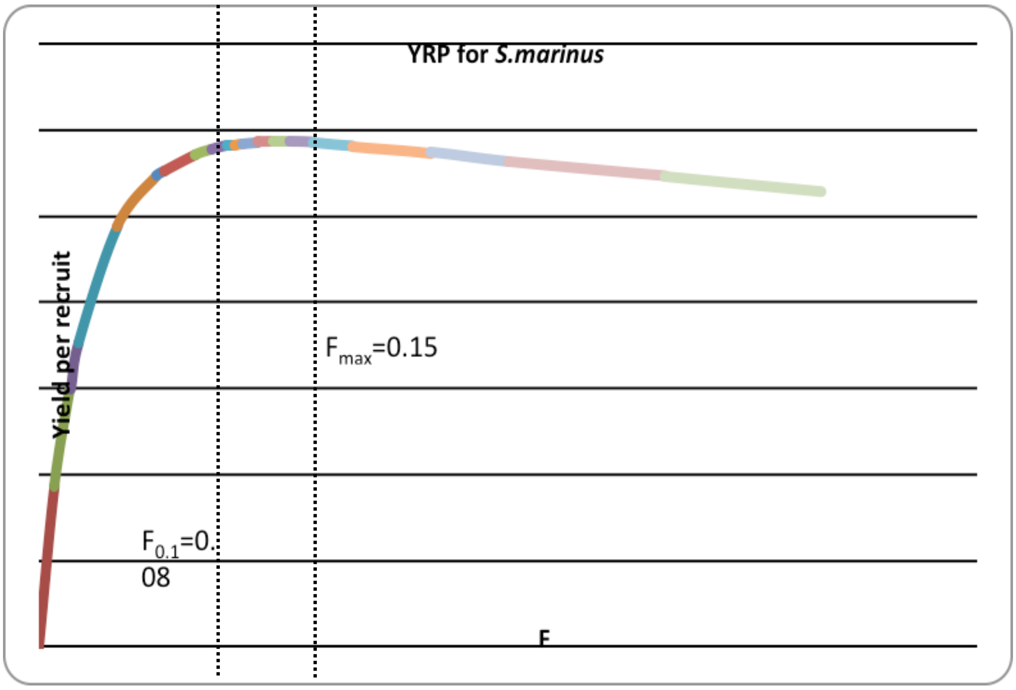


Figure E1. ***Sebastes norvegicus*** **in Sub-areas 1 and 2. Yield-per-recruit for** ***S. norvegicus*****, computed from the base case GADGET model presented at the benchmark assessment in February 2012 (WKRED).**

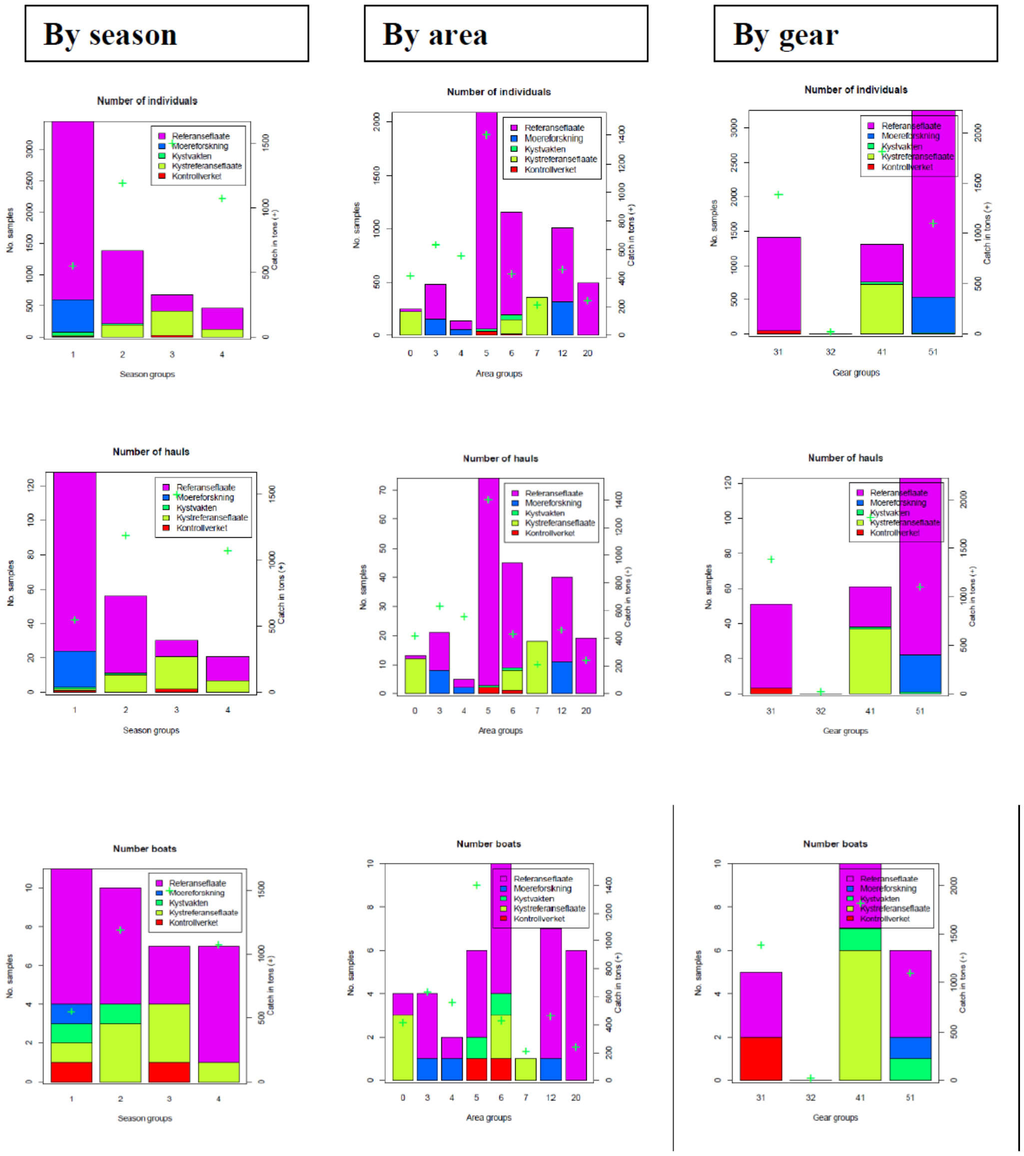


Figure E2. Overview of the Norwegian biological age samples (number individuals, number hauls/sets, number of boats) from the commercial fisheries for *S. norvegicus* in 2013 representing more than 80% of the catches and which the input data to the Gadget model are based upon. The colours denote which sampling platform has been used: High Seas Reference fleet, port sampling, Coast guard, Coastal Reference Fleet, or inspectors/observers at sea. The green crosses show the catch in tonnes for the different seasons, areas and gears.