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Quality manual part II: International data collection and raising procedures

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Samenvatting

Producten A19 tot en met A21 vormen het kwaliteitshandboek binnen onderdeel F1 van het F-project. Het kwaliteitshandboek beschrijft hoe gegevens die gebruikt worden voor de bestandsschattingen worden verzameld en opgewerkt. Het bestaat uit twee aparte rapporten. Het eerste rapport beschrijft de gegevensverzameling en gegevensbewerking die op het RIVO uitgevoerd wordt. Het tweede rapport beschrijft de internationale opwerking en bestaat uit drie delen: een algemeen deel, een deel over de internationale samenvoeging van gegevens en een deel over de bestandsschatting procedure

Het eerste deel bevat vier onderdelen: definitie van het bestand, beschrijving van de internationale visserij, van de beheersmaatregelen op deze soorten en ecosysteemaspecten. Het deel over de definitie van het bestand beschrijft de scheiding van de bestanden ten opzichte van andere bestanden en het ruimtelijke gebruik gedurende de levenscyclus. Het deel over de visserij beschrijft de bijdrage van de belangrijkste landen die vissen op de bestanden, terwijl het deel over beheer de beheersmaatregelen weergeeft. Het deel over ecosysteemaspecten beschrijft recente veranderingen in beide bestanden. Veranderingen in de groei van beide soorten zijn waargenomen en in recente jaren heeft een verschuiving plaats gevonden in de ruimtelijke verspreiding van schol.

Het tweede gedeelte beschrijft de verzameling van vijf verschillende gegevens die gebruikt worden in de bestandsschatting: biologische gegevens, gegevens over aanlandingen en discards, commerciële CPUE (vangst per eenheid inspanning) en survey gegevens. Waar mogelijk worden de gegevens van alle landen die vissen op een bepaald bestand gecombineerd om gegevens voor het gehele bestand te krijgen. Echter voor discards is het niet mogelijk om een complete tijdserie van gegevens te krijgen. Daarom is een model ontwikkeld die een discardstijdseries heeft kunnen reconstrueren. Commerciële CPUE is voor schol alleen afkomstig van Nederland en Engeland, terwijl voor tong deze daarnaast ook nog afkomstig is van België. Gegevens van de Beam Trawl Survey en Sole Net Survey zijn gebruikt als “tuning indices” in de bestandsschatting, terwijl de Demersal Fish Survey een internationaal gecombineerde survey is die bij voorspellingen gebruikt wordt.

Het laatste deel beschrijft technische aspecten van de bestandsschattingsprocedure: de historische bestandsschatting, de korte-, middellange- en langetermijnprojectie en biologische referentie punten. In elk deel wordt het gebruikte model, de model opties en de invoerkarakteristieken gegeven, behalve voor het deel over biologische referentiepunten. In deze sectie wordt een overzicht van de biologische referentiepunten voor het bestand gegeven.

Summary

Products A19 to A21 form the quality manual within working package F1 of the F project. The quality manual describes the collection of the data used in the assessments and the raising procedures in two separate reports. The first report describes the collection and raising of the national data by RIVO. This second report describes the international raising procedures and contains three sections: a general section, a section on international compilation of data and a section on the stock assessment procedure.

The first section contains four subsections: stock definition, description of the international fisheries, the management of both plaice and sole fisheries and ecosystem aspects. The section on stock definition describes both stocks in spatial segregation from other stocks and spatial use during their life cycle. The section on the fisheries describes the contribution of the main countries fishing for both stocks, while the management section describes current management of these fisheries. The ecosystem aspects section describes recent changes observed in both fish stocks. Changes in growth of both species have occurred over years and in recent years a shift in spatial distribution of plaice to the offshore has occurred.

The second section describes the compilation of five data sources used in the assessment: biological data, landings and discards data, commercial CPUE and survey data. If possible data from the countries fishing for the stock are combined to obtain data on the entire stock. However for discards data a complete time series is not available and therefore a model was developed to recreate a discards time series. Commercial CPUE for plaice is only available from the Netherlands and the UK, while for sole it is also available from Belgium as well. Data from the Beam Trawl Survey and Sole Net Survey are used as tuning indices in the assessment, while the Demersal Fish Survey is an international combined survey used for projections.

The last section describes the technical aspects of the stock assessment procedure: the historical assessment, the short, medium and long-term projections and biological reference points. In each section the model used, the model options chosen and input characteristics are given except for the section on biological reference points. In this section an overview of the reference points for each stock is given.

1. General

1.1 Stock definition

1.1.1 Plaice

Adult North Sea plaice are known to have an annual migration cycle between spawning and feeding grounds. Juvenile stages are concentrated in shallow inshore waters and move gradually offshore as they become larger. The nursery areas on the eastern side of the North Sea contribute most of the total recruitment. Sub-populations have strong homing behaviour to specified spawning grounds and rather low mixing rate with other sub-populations during the feeding season (De Veen, 1978; Rijnsdorp and Pastoors, 1995). Genetically, North Sea and Irish Sea plaice are weakly distinguishable from Norway, Baltic and Bay of Biscay stocks using mitochondrial DNA (Hoarau et al., 2004).

1.1.2. Sole

North Sea sole are considered to be a separate stock from the smaller stock in VIId. There is some movement of juvenile sole from the North Sea into VIId (ICES, 1989) and from VIId into the North Sea. Adult sole appear to be largely isolated from other regions except during the winter, when sole from the southern North Sea may enter the Channel temporarily.

1.2 Fisheries

1.2.1 Plaice

Fleets exploiting North Sea plaice have generally decreased in number of vessels in the last 10 years, partly due to the MAGP (Multi Annual Guidance Plan) policy. However, in some instances, reflagging vessels to other countries has compensated these reductions. The Dutch beam trawl fleet, one of the major operators in the mixed flatfish fishery in the North Sea, has seen a reduction in the number of vessels and also a shift towards two categories of vessels: 2000HP (the maximum engine power allowed) and 300 HP (the maximum engine power for vessels that are allowed to fish within the 12 mile coastal zone and the plaice box).

Approximately 85% of plaice landings from the UK (England and Scotland) is landed into the Netherlands by Dutch vessels fishing on the UK register. Vessels fishing under foreign registry are referred to as 'flag' vessels. The fishing pattern of flag vessels can be very different from that of other fleet segments.

1.2.2 Sole

Sole is mainly taken by beam trawlers in a mixed fishery with plaice in the southern part of the North Sea. Fishing by different countries is described below:
The Netherlands: A high proportion of the fishing effort in the North Sea is by Dutch beam trawlers fishing for plaice and sole. The introduction of the Plaice Box in 1989 resulted in a change in the distribution pattern of beam trawl vessels > 300 HP with an increase in activity outside and to the north of the Box.
UK: The English fleet consists of a large number of small otter trawlers fishing in the southern North Sea for sole mainly in the 2nd and 3rd quarters of the year. Prior to 2002, Sole was also taken as by-catch in the English beam trawl fishery (9 vessels), which fished mainly for plaice with 120mm mesh. Since 2002, these vessels do not participate in the fishery any more. These vessels landed the majority of their catch in The Netherlands.

Belgium: The Belgian fleet operates out of 2 main ports: Oostende and Zeebrugge. The majority of the fleet use beam trawl exclusively and fish for sole an plaice. The fishing grounds change throughout the year depending on catch rates, although the central and southern North Sea (IVb,c) are the preferred fishing area of the Belgian fleet.
Denmark: The main Danish fishery is a directed one for sole using fixed nets although there is also a little effort using beam trawling, and some by-catch in otter trawlers.
Germany: The German sole fishery can be divided into three segments: 7 large beam-trawl vessels >30m, 20-30 Euro-cutters and a varying number of small shrimp beam-trawl vessels catching sole during Q2 & Q3.

1.3 Management

Technical measures applicable to the flatfish beam trawl fishery before 2000 were an exemption to use 80 mm mesh cod-end when fishing south of 55° North. From January 2000, the exemption area extends from 55° North to 56° North, East of 5° E latitude. Fishing with this mesh size is permitted within that area provided that the landings comprise at least 70% of a mix of species, which are defined in the new technical measures of the EU. From January 2002, a maximum cod by-catch of 20% of the total catch is allowed. In the area extending from 55° North to 56° North, East of 5° E latitude, a maximum cod by-catch of 5% is allowed. Minimum cod-end mesh in this area is 100 mm, while above 56° North the minimum cod-end mesh is 120 mm (EC., 2001).
Some additional protection is given to plaice and sole from the closure of the plaice box along the Dutch and Danish coast. In the year 1989 to 1993 the box was closed in the second and the third quarters of the year to all vessels using towed gears and with engine power larger than 300 HP. Since 1994 the box has been closed during all quarter.

1.4 Ecosystem aspects

Changes in growth of plaice and sole in relation to changes in environmental factors have been analysed (Rijnsdorp et al., 2004) to explore changes in the productivity of the North Sea. Based on market sampling data it was concluded that both length at age and condition factor increased for juvenile plaice and sole since the mid 1960s to its highest in the mid 1970s. Adult plaice however did not show this increase. Since the mid 1980s, length at age and condition have been intermediate between the low around 1960 and the high around 1975. Growth rate of the juvenile age groups was negatively affected by intra-specific competition. Length of 0-group fish attained in autumn showed a positive relationship with the temperature in the 2nd and 3rd quarter, but for the older fish no temperature effect could be detected. Also, no correlation could be detected with the NAO (North Atlantic Oscillation) index. The overall pattern of the increase in growth and the later decline correlated with the temporal patterns in eutrophication, in particular the discharge of dissolved phosphates by the Rhine. It is concluded that the productivity of the southeastern North Sea for flatfish has decreased over the last two decades, possibly in relation to a decrease in the inflow of nutrients and an overall change in the North Sea ecosystem.
In recent years clear changes in the spatial distribution of plaice have been taking place, particularly pronounced in the 20-29 cm and the 30-39 cm length classes (Van Keeken et al., 2004c). The offshore movement of juvenile plaice could be a response to the ambient temperature or food availability, a response to intra- or inter-specific competitors, or a response to predation risk. Since sole, which has higher optimum temperatures, did not show a shift in spatial distribution, the increased offshore movement of young plaice in the 1990s will be primarily a response to the increase in summer temperature.

2. International data

2.1 Biological data

2.1.1 Plaice

Weight at age in the catch are measured weights from the various national market sampling programmes of the landings. Weight at age in the stock are those of the 1st quarter in the landings. Weight at age in the stock has varied considerably over time. For age groups 4–6, weights appear to have decreased markedly in the period 1998-2001, but have been more or less stable since 2001. Survey estimates of weights at ages 2 and 3 indicate these have not changed much either in the last 3 years.

A knife-edged maturity was used in all years, assuming full maturation at age 3. Age and length at maturation have however decreased over the past half century (Grift et al., 2003). Within an ongoing international collaboration an attempt is being made to collate international maturity data and provide annual maturity ogives for male and female plaice. These data are not yet available but preliminary annual maturity ogives, based on Dutch market samples only, are available. The maturity-at-age of females varied over time.

Natural mortality is assumed to be 0.1 for all age groups and constant over time.

2.1.2 Sole

Weight at age in the catch are measured weights from the various national market sampling programmes of the landings. Weight at age in the stock are those of the 2nd quarter in the landings. No clear trends in weights are evident over the last years, although age 7 to 13 and older show a slight decline in stock weight at age. This decline is supported by the average decline in length for these ages for the most important fleets over the last years. The sex-ratio for quarter 2 over the period 1986 to 2002 does not show an evident change, at most a small increase in the number of males at the older ages that could support the decrease in the stock weight. This increase was not further explored during the benchmark assessment in 2003 (ICES, 2003).

A knife-edged maturity was used in all years, assuming full maturation at age 3. This maturity-ogive is based on market samples of females in the sixties and seventies. A working document was presented to the WG in 2003 describing an international collaboration (COMPASS) to explore how to determine annually varying maturity ogives for North Sea flatfish from market and research samples and the consequences of such ogives on the stock assessment and the biological reference points. The explorations have so far not produced results that can be used for the assessment.

Natural mortality has been assumed constant over all ages at 0.1, except for 1963 where a value of 0.9 is used to take into account the effect of the severe winter (ICES, 1979). In 1996 additional natural mortality was observed in the cold winter of 1995/1996, but the standard value of 0.1 has been retained (ICES, 1997).

2.2 Catch data

2.2.1 Plaice

The catch weights are based on official logbook data corrected with unallocated landings, which represent the difference between official landings and the figures supplied by the WG

members. Catch numbers at age are derived from market sampling programmes. The age compositions were combined on a quarterly basis and then raised to the annual international total. Data are supplied as FISHBASE files containing quarterly numbers at age, weight at age, length at age and total landings. No SOP-correction (Sum of Product to account for the difference between the sum of catch at age times the weights at age compared to the estimated total catch) was applied to the results of the assessment. From 2002 onwards, following EU regulation (1639/2001), each country is obliged to sample landings from foreign vessels that land in their country. These samples from flag vessels are now included in the Dutch age composition. No SOP-correction was applied to the results of the assessment.

Table 2.2.1. Data provided to the Working Group by each country.

Country	Catch weight	Catch numbers at age	Weight in the catch	Length composition
The Netherlands	X	X (By sex)	X (By sex)	X (By sex)
Scotland	X			
UK (England, Wales)	X	X	X	X
UK (Northern Ireland)	X			
Germany	X	X	X	
Belgium	X	X	X	X
France	X	X	X	
Denmark	X	X	X	
Norway	X			
Sweden	X			

2.2.2 Sole

Catch data for sole are raised the same way as for plaice. Despite the data regulation that came into action in 2002, no structural sampling takes place to collect samples from national vessels, which land abroad and this constitutes a substantial part of the total landings by some countries. Some samples are taken but there is no international exchange system for this information available.

Table 2.2.2. Data provided to the Working Group by each country.

Country	Catch weight	Catch numbers at age	Weight in the catch	Length composition
The Netherlands	X	X (By sex)	X (By sex)	X (By sex)
Scotland	X			
UK (England, Wales)	X	X	X	X
UK (Northern Ireland)	X			
Germany	X	X	X	
Belgium	X	X	X	X
France	X	X	X	
Denmark	X	X	X	
Norway	X			

2.3 Discard data

2.3.1 Plaice

In the plaice assessment of 2004 a discard time series was used (ICES, 2004), which was based on reconstructed discard estimates for 1957-1998 and recent discard trip observations

from the Dutch discards sampling programme during 1999-2003 (Van Keeken et al., 2004b). The numbers of reconstructed plaice discards at age were calculated from corrected fishing mortality F, using a simulated population based on growth measurements and selection and distribution ogives.

The mean length of age groups 1 – 6 were estimated for each age group using a GLM model of the length at age (Li) estimated in surveys (SNS and BTS survey) and otolith back-calculations (Rijnsdorp et al., 2004; Van Keeken et al., 2004a). The mesh selection and sorting curves were assumed to be constant throughout the time period and corresponds to a selection factor of 2.2, a selection range of 3 cm (Van Beek et al., 1981, 1983), a cod end mesh of 80 mm and a minimum landing size of 27 cm. The distribution curves were estimated from survey data for individual years assuming that only those size classes that occur outside the coastal zone (12 nm zone and since 1989 the plaice box) are available to the fisheries. The population numbers were estimated as the sum of the catch rates per stratum (ICES rectangle) times the surface area of the stratum and used in a logistic regression which calculated the proportion of fish outside the coastal waters per cm-class for individual years since 1980. For the period 1957 – 1979, a mean distribution curve was used based on the survey data from 1970-1979.

The fishing mortality on the discards age groups 1-4 was set relative to the mean F on the ages 5 and 6, since these age groups are almost completely recruited (vulnerable) to the fishery. For these age groups the F was available from the recent VPA of landings data and was corrected for the simulated proportion of discards estimated from the growth data and mesh selection, sorting and availability curves. With the corrected fishing mortality the population numbers at age for juvenile age groups were calculated. Discard numbers at age were eventually calculated from subtracting landings numbers at age from the newly calculated catch numbers at age. Discard observations from the Dutch discard sampling program were used to estimate discards numbers at age from 1999 -2003. Discards numbers at age from the Dutch sampling program were raised to discards numbers at age of plaice in the North Sea by the ratio of the landings of the international fleet to the landings of the Dutch fleet.

2.3.2 Sole

Discarding is not considered to be a problem in the sole fishery

2.4 Commercial CPUE

2.4.1 Plaice

Commercial CPUE data are available from The Netherlands (NL beam trawl CPUE, 1989-2003; UK register landing in NL, 1991-2004 (flag vessels) and the UK (beam trawl CPUE, excluding all flag vessels; 1990-2002). The Dutch commercial beam-trawl CPUE consists of the total catch at age by the Dutch (beam trawl) fleet and the effort in horsepower days (days absent from port times the horsepower of the vessel). The NL flag vessel CPUE consists of the catches per unit of effort in the first half year. Effort is calculated on a trip basis as days fished. Effort has decreased in the NL and UK beam trawl fleets since the early/mid 1990s. The flag vessel effort increased until 2001, decreased in 2002 and is more or less the same since then. The relative CPUE of the NL and UK beam trawl fleets appear to be more or less the same since 1995. The flag vessel CPUE may show a slight increase since 1995, but the CPUE estimates fluctuate strongly from year to year. The UK commercial beam-trawl CPUE was derived from the catch at age of the beam trawlers registered in England and Wales but excluding Scottish registered vessels and Dutch flag vessels. Effort was calculated on a trip basis as hours fishing multiplied by the horsepower (HP) of the vessel.

2.4.2 Sole

Effort data is available from Belgium, UK and The Netherlands. Only the latter is used for tuning. Effort in the Netherlands commercial beam trawl is total HP effort days and this has nearly doubled between 1978 and 1994. Since 1996 the effort show a decline and the effort is around the same as it was in the early 1980s. The English effort is based on the effort from otter trawlers mainly fishing for sole in area IVc. Effort is in HP*hrs and excludes trips directed at cod or shrimps. The Belgium effort is based on fishing hours corrected for fishing power.

2.5 Survey data

Survey indices that have been used as tuning fleets are Beam Trawl Survey RV 'Isis' (BTS) and RV 'Tridens' (BTS-tri), Sole Net Survey in September-October (SNS), while Demersal Young Fish Survey (DFS) is used as a survey index for recruitment estimates.

The Beam Trawl Survey (BTS & BTS-tri) was initiated in 1985 and was set up to obtain indices of the younger age groups of plaice and sole. However, due to its spatial distribution the BTS survey also catches considerable numbers of older plaice and sole. Initially, the survey only covered the south-eastern part of the North Sea (RV Isis). Since 1996 the survey area of the BTS has been extended. The RV Tridens now covers the north-western part of the North Sea. Both vessels use an 8-m beam trawl with 40 mm stretched mesh cod-end, but the Tridens beam trawl is rigged with a modified net. The BTS-Isis survey is used as a tuning series for the plaice assessment and consists of average catches in numbers by fishing hour. Previously age groups 1 to 4 were used for tuning the North Sea plaice assessment, but the age range has been extended to 1 to 9 in the revision done by ACFM in October 2001.

The Sole Net Survey (SNS & SNSQ2) was carried out with RV Tridens until 1995 and then continued with the RV Isis. Until 1990 this survey was carried out in both spring and autumn. The gear used is a 6 m beam trawl with 40 mm stretched mesh cod-ends. The stations fished are on transects along or perpendicular to the coast. This survey is directed to juvenile plaice and sole. Ages 1 to 3 are used for tuning the North Sea plaice assessment, the 0-group index is used in the RCT3. In an attempt to solve the problem of not having the survey indices in time for the WG, the SNS was moved to spring in 2003. However, because of the gap in the spring series these data could not be used in the plaice assessment or in RCT3. The decision to move the SNS to the spring was revisited.

The Demersal Young Fish Survey (DFS) is an international survey (The Netherlands, England, Belgium and Germany) that covers the coastal and estuarine areas of the southern North Sea. This survey is directed to 0 and 1-group plaice and sole. In the Wadden Sea and Scheldt estuaries a light 3-m beam trawl is used with a 20-mm cod-end and one light tickler chain. The coastal area is fished with a 6-m beam trawl rigged with a similar net as the 3-m beam trawl. The combined index is calculated as the mean of the national indices with a weighting by country, based on the size of the nursery area. In 1998 and 1999 no estimates of the DFS were available due to bad weather conditions during the period of the survey and technical problems with one of the Dutch research vessels. The combined DFS index is only used for the RCT3 analysis and not for tuning the VPA.

3 Stock assessment

3.1 Historic stock estimation

3.1.1 Plaice

Model used: XSA
Software used: Lowestoft VPA suite

Model options chosen:
Time series weights: tapered time weighting not applied
Catchability independent of stock size for all ages
Catchability independent of age for ages >= 6
Survivor estimates shrunk towards the mean F of the final 5 years or the 2 oldest ages.
S.E. of the mean to which the estimates are shrunk = .500
Minimum standard error for population estimates derived from each fleet = .300
Prior weighting not applied

Tabel 3.1.1 Input characteristics:

Type	Name	Year range	Age range	Variable from year to year?
Caton	Catch in tones	1957-last data year	1-10+	Yes
Canum	Catch at age in numbers	1957-last data year	1-10+	Yes
Weca	Weight at age in the commercial catch	1957-last data year	1-10+	Yes
West	Weight at age of the spawning stock at spawning time	1957-last data year	1-10+	Yes
Mprop	Proportion of the natural mortality before spawning	1957-last data year	1-10+	No – set to 0 for all ages in all years
Fprop	Proportion of the fishing mortality before spawning	1957-last data year	1-10+	No – set to 0 for all ages in all years
Matprop	Proportion mature at age	1957-last data year	1-10+	No – same ogive used for all years
Natmor	Natural mortality	1957-last data year	1-10+	No – set to 0.1 for all ages in all years

Tabel 3.1.2 Tuning data:

Type	Fleet	Year range	Age range
Tuning fleet 1	NL – BTS ISIS	1985-last data year	1-9
Tuning fleet 2	NL - SNS	1982-2002	1-3
Tuning fleet 3	NL - BTS Tridens	1996-last data year	2-9

3.1.2 Sole

Model used: XSA
Software used: Lowestoft VPA suite

Model Options chosen:
Tapered time weighting not applied
Catchability dependent on stock size for ages < 2
Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 2
Catchability independent of age for ages >= 7
Survivor estimates shrunk towards the mean F of the final 5 years or the 5 oldest ages.
S.E. of the mean to which the estimates are shrunk = 2.000
Minimum standard error for population estimates derived from each fleet = .300
Prior weighting not applied

Tabel 3.1.3 Input characteristics:

Type	Name	Year range	Age range	Variable from year to year?
Caton	Catch in tones	1957-last data year	1-10+	Yes
Canum	Catch at age in numbers	1957-last data year	1-10+	Yes
Weca	Weight at age in the commercial catch	1957-last data year	1-10+	Yes
West	Weight at age of the spawning stock at spawning time	1957-last data year	1-10+	Yes
Mprop	Proportion of the natural mortality before spawning	1957-last data year	1-10+	No – set to 0 for all ages in all years
Fprop	Proportion of the fishing mortality before spawning	1957-last data year	1-10+	No – set to 0 for all ages in all years
Matprop	Proportion mature at age	1957-last data year	1-10+	No – same ogive used for all years
Natmor	Natural mortality	1957-last data year	1-10+	No – set to 0.1 for all ages in all years

Tabel 3.1.4 Tuning data:

Type	Fleet	Year range	Age range
Tuning fleet 1	NL - BTS ISIS	1985-last data year	1-9
Tuning fleet 2	NL - SNS	1970-2002	0-4
Tuning fleet 3	NL Comm BT	1990-last data year	2-9

3.2 Short term forecast

3.2.1 Plaice

Model used: age structured
Software used: WGFRANSW

Model options chosen:
Fishing mortality at age were the average over the last 3 years, scaled to the reference F(2-6).
Weight at age in the catch and in the stock are averages for the last 3 years.
Initial stock size is taken from the XSA for age 3 and older and from RCT3 for age 2. The long-term geometric mean recruitment is used for age 1 in all projection years.
Natural mortality: Set to 0.1 for all ages in all years
Maturity: The same ogive as in the assessment is used for all years
F and M before spawning: Set to 0 for all ages in all years
Weight at age in the stock: Average weight over the last 3 years
Weight at age in the catch: Average weight over the last 3 years
Stock recruitment model used: Long term geometric mean for age 1 is used
Procedures used for splitting projected catches: None

3.2.2 Sole

Model used: Age structured.
Software used: WGFRANSW.

Fishing mortality at age were the average over the last 3 years, scaled to the reference F(2-6).
Weight at age in the catch and in the stock are averages for the last 3 years.
Initial stock size: Taken from XSA for age 3 and older. The number at age 1&2 in the last data year is estimated using the geometric mean over a long period (1957 last data year).
Maturity: Set to 1 for age 3 and older in all years, same as in XSA.
F and M before spawning: Set to 0 for al ages in all years.
Weight at age in the stock: Average weight over the last 3 years.
Weight at age in the catch: Average weight over the last 3 years.
Stock recruitment model used: Long term geometric mean for age 1 is used
Procedures used for splitting projected catches: none.

3.3 Medium-Term Projections

3.3.1 Plaice

Model used: Age structured
Software used: WGMTERMc
Settings used a in short term projections

3.3.2 Sole

Not carried out during WG2004
Model used: (WG2003) Age structured
Software used: (WG2003) WGMTERMc
Settings used a in short term projections

3.4 Long-Term Projections

3.4.1 Plaice

Model used: Age structured
Software used: WGMTERMc
The input files for the medium-term analyses were used with a truncated year range at 40 years. The yield was calculated based on the long-term geometric mean (1957-2003).

3.4.2 Sole

Not carried out.

3.5 Biological Reference Points

3.5.1 Plaice

The biological reference points and the basis for the management reference point are:
B_{lim} = 160 000 tonnes
B_{pa} = 230 000 tonnes
F_{lim} = 0.74, which is the sum of the appropriate F_{HC} and $F_{discards}$.

3.5.2 Sole

The biological reference points and the basis for the management reference point are:
$\mathbf{B}_{lim}=\mathbf{B}_{loss}$=25 000 t. $\mathbf{B}_{pa}$ = 1.4 *$\mathbf{B}_{lim}$.
$\mathbf{F}_{pa}$ = 5th percentile (0.49) of $\mathbf{F}_{loss}$ implies $B_{eq} < \sim \mathbf{B}_{pa}$,
F=0.4 implies $B_{eq} > \mathbf{B}_{pa}$ and P($\mathbf{SS}_{BMT} < \mathbf{B}_{pa}$) < 10%.

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