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Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK)

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Oostende, Belgium

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Executive Summary

The ICES Working Group for the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) met 24 April–3 May 2018 at ILVO, Oostende, Belgium. There were 28 full and part-time participants (+ two by correspondence) from 9 countries. The main terms of reference for the Working Group were: to update, quality check and report relevant data for the working group, to update and audit the assessment and forecasts of the stocks, to produce a first draft of the advice on the fish stocks and to prepare planning for benchmarks in future years. An additional terms of reference requesting a Mohn's rho calculation for Category 1 stocks was completed; this request was to assist with a workshop that will consider catch forecasts from biased assessments. Ecosystem changes have been analytically considered in the assessments for cod, haddock and whiting in the form of varying natural mortalities estimated by the ICES Working Group on Multi Species Assessment Methods (WGSAM).

Working procedures

WGNSSK met for 10 days to deal with the TORs, including one which required MSY proxy reference points to be derived for Category 3 and 4 stocks. WGNSSK was unable to make progress on MSY proxy reference points for Category 4 *Nephrops* stocks due to data quality issues, and this work has been deferred to a dedicated workshop to take place in early 2019. MSY proxy reference points were derived for the Category 3 grey gurnard stock and were reviewed.

Data were requested through a joint DCF-based data call for all assessment working groups, and the deadline for early data delivery was difficult to meet this year because the deadline was set one week earlier than expected; nevertheless, any delays did not significantly impede work progress.

The principle analytical models used for the stock assessments were SAM, XSA, TSA and the Aarts and Poos model (AAP), as well as SURBAR and a4a (for some Category 3 stocks, but advice not provided this year for these). For Category 3 stocks, SPiCT and the Length-based Indicator (LBI) approach developed within WKLIFE were used to estimate stock status relative to reference points.

WGNSSK works in close cooperation with WGMIXFISH and assessment and forecast results are directly used by WGMIXFISH to produce mixed fisheries advice. Similar links are established between WGNSSK and WGSAM to allow for an effective exchange of data and knowledge regarding multi species assessments.

Benchmarks and Inter-benchmarks in 2017/2018

Data compilation and benchmark workshops were held in November 2017 and February 2018 (respectively) for whiting (whg.27.47d), flounder (fle.27.3a4), lemon sole (lem.27.3a77d) and witch flounder (wit.27.3a47d).

For whiting, although a complex population structure has been identified in the North Sea, literature and available data did not provide a sufficient basis for revising the stock area. The feasibility of combining the Division 3.a with Subarea 4 components was explored, but data showed there were biological reasons to leave the components as separate stocks. The new assessment was run for the North Sea and Eastern Channel (27.4 and 27.7d). As before, Subarea 27.4 represents the management unit with TAC advice to be given. No changes were made to the use of survey indices. The maturity ogive, stock weights-at-age, and natural mortality were updated with new information. Catch

data was updated in Intercatch with new data submissions for 2009–2016 and a new stratification design to allocate discard ratios and age distributions. The assessment model was changed from XSA to SAM and new reference points estimated.

For flounder, age data were sparse in the surveys and catch data. Survey indices were based on the catch weight per haul, applying a general length–weight relationship with the length distribution data by haul. Indices were generated using the delta-GAM method for Q1 from IBTS data and Q3 by combining information from three beam trawl surveys and the IBTS. Length-based data show that most flounder reach maturity above 20 cm in length. Lack of data prevented analyses of interannual trends in weight-at-age or growth. Natural mortality estimates were not available for flounder. A SPiCT model was agreed upon, which obtained robust results in terms of relative fishing mortality and relative biomass. The status of the stock in relation to a proxy for F_{MSY} is determined on an annual basis by updating the SPiCT model, where the relative values of biomass and fishing mortality gives an indication for the stock status in relation to F_{MSY} and B_{MSY}.

For lemon sole, alternate survey indices were explored. The agreed-upon method was the GAM estimation for Q1 and Q3, where the Q3 incorporates both IBTS and BTS survey data. The length coverage of the surveys was concluded to be sufficiently representative of the stock as a whole, and therefore that advice could appropriately be based on survey data alone. SMALK data were used to determine the proportion mature-at-age, mean weight-at-age in the stock, and an annual length–weight relationship. Natural mortality estimates for lemon sole are not available; total mortality is an output of the survey-based assessment. Age data were sparse; therefore, an age-based assessment was not possible. The stochastic production model SPiCT was assessed but was deemed unsuitable for use as an assessment model for lemon sole at this time. The age- and survey-based assessment model SURBAR was agreed upon. No new reference points could be proposed by WKNSEA. It is proposed that the status of the stock in relation to a proxy for F_{MSY} is determined on an annual basis through the LBI methodology.

For witch flounder, the delta-GAM approach was used to generate survey indices for IBTS Q1 and Q3 for years with age data, 2009–present. Total biomass indices were also estimated for use in the SPiCT model. Witch flounder distribution does not peak at a certain depth range, indicating they are found at depths deeper than the surveys. Stock weights-at-age and a new constant maturity ogive were estimated from survey data; natural mortality was left at 0.2. A SAM assessment model was used. The catch time-series was extended back in time by using landings from 1950 to 2008. Two new surveys of fishable stock biomass for Q1 (1983 to 2008) and Q3 (1991 to 2008) were included. Age-specific information for surveys and catches were available from 2009. The stock was upgraded to a Category 1 assessment, and new reference points estimated.

An inter-benchmark protocol meeting was held during the summer of 2017 (by correspondence) for turbot (tur.27.4). During this inter-benchmark, all available input data were screened again, including a new LPUE index from UK, a Delta-GAM survey index combining several BTS surveys and, for the first time, age-based catch data from Denmark for most recent years. Also, different models to standardise the Dutch LPUE time-series were tested. The SAM model settings were reviewed, and sensitivity runs were conducted with various combinations of input data, plus-group settings, highest age used in survey indices and different length of the assessment time-series. Decisions were made on final input data and model settings. In addition, reference point proxies

were estimated. The assessment was left as a Category 3 assessment because of a strong retrospective pattern in F. During the WGNSSK 2018 meeting, a mistake was found in the assessment configuration (from the 2017 inter-benchmark) which led to questions on the persistence of the retrospective pattern on F and assessment category used to provide advice. For this reason, an inter-benchmark has been organised for the summer of 2018 to correct the mistake (the Dutch LPUE was treated as an SSB index, instead of an exploitable biomass index), re-check the model settings (plus-group, maximum age in surveys, assessment configuration), decide on the Categorisation of the stock (whether it should be upgraded to a Category 1 assessment in the light of the new results), estimate reference points, and agree a short-term forecast.

State of the Stocks

The main impression in recent years is that fishing mortality has been reduced substantially for many North Sea stocks of roundfish and flatfish compared to the beginning of the century. All fish stocks with agreed biomass reference points are above B_{lim}, and only the SSBs of cod in 4, 7.d and 20, and sole in 7.d are below MSY $B_{trigger}$ at the beginning of 2018. Several North Sea stocks are exploited around or below F_{MSY} levels; exceptions are cod in 4, 7.d and 20, haddock in 4, 6.a and 20, whiting in 4 and 7.d and sole in 4 (the latter only slightly above F_{MSY}). An important feature is that recruitment still remains poor compared to historic average levels for most gadoids.

WGNSSK is also responsible for the assessment of several flatfish species that are mainly by catch in demersal fisheries (brill, turbot in 4, turbot in 3a, witch, lemon sole, dab, flounder, striped red mullet, whiting in 3a), along with *Nephrops* in 4 outside functional units. For all of these stocks, catch advice was provided in 2015 for the first time, and again in 2017, but in 2018, it was only necessary to determine whether the perception of the stocks has changed compared to 2017; because these perceptions have not changed, no reopening was needed for any of these stocks. In 2018, assessments and advice was prepared for data-limited *Nephrops* stocks (FUs 5, 10, 32, 33 and 34), pollack and grey gurnard, along with the annual advice for Category 1 finfish and *Nephrops* stocks.

Reopening of advice was triggered for several stocks in the autumn, namely haddock in 4, 6.a and 3.a.20, whiting in 4 and 7.d, saithe in 4, 6 and 3.a, plaice in 4 and 3.a.20, and Nephrops in FU 6, 7, 8 and 34 (Annex 7).

The summary of stock status is as follows:

1) *Nephrops*: For FU 6, the stock has increased since 2015 and is currently just above MSY $B_{trigger}$, while harvest rates have dipped below F_{MSY} in 2017 after a long period of being above this level. The stock size for FU 7 declined from the highest observed value in 2008 to the lowest abundance estimate in the time-series in 2015, but has since increased strongly and is currently above MSY $B_{trigger}$, while the harvest rate has declined since 2010 and remains well below F_{MSY}. For FU 8, the stock size has been above MSY $B_{trigger}$ for most of the time-series, and the harvest rate varying and now above F_{MSY}. For FU 9, the stock has been above MSY $B_{trigger}$ for the entire time-series, while the harvest rate has fluctuated around F_{MSY} and is now just below it. The stock size of *Nephrops* in 3.a is considered to be stable, while the harvest rate for this stock is currently below F_{MSY}.

   The FUs 5, 10, 32, 33 and 34 are data limited, and new catch advice was provided in 2018 (biennial advice, for 2019 and 2020). Furthermore, FU 34 was

re-opened in the autumn of 2018 following a survey in June 2018 showing a significant increase compared to the previous year.

No new advice was provided for *Nephrops* outside the functional units in 2018.

A workshop is being planned for early 2019 to consider the framework for providing advice for *Nephrops* Category 1 and 4 stocks, including the estimation of reference points or proxies for them.

2) Cod in 4, 7.d and 20: Fishing mortality has declined since 2000, but remains above F_{MSY}. Spawning-stock biomass has increased from the historical low in 2006, but is still below MSY $B_{trigger}$. Recruitment since 1998 remains poor.

3) Haddock in 4, 6.a and 20: Fishing mortality has been fluctuating above F_{MSY} for most of the time-series and is above F_{MSY} in 2017. Spawning-stock biomass has been above MSY $B_{trigger}$ in most of the years since 2002. Recruitment since 2000 has been characterized by a low average level with occasional larger year classes, the size of which is diminishing.

4) Whiting in 4 and 7.d: Spawning-stock biomass has fluctuated around, and is now above, MSY $B_{trigger}$. Fishing mortality has been above F_{MSY} throughout the time-series, apart from 2005. Since 2002 recruitment has been generally lower than in previous years. This stock was benchmarked in 2018, during which estimates of stock weights and maturity at age were updated, which resulted in a downward rescaling of the SSB. Furthermore, new natural mortality estimates were used, the recruitment age changed from age 0 to age 1, and the assessment model changed from XSA to SAM. Reference points were adapted accordingly.

5) Saithe in 3.a, 4 and 6: Spawning-stock biomass has fluctuated without trend and has been above MSY $B_{trigger}$ since 1996. Fishing mortality has been decreasing, and it has been below F_{MSY} since 2013. Recruitment has fluctuated over time and has been below the long-term average since 2003.

6) Plaice in 4 and 20: The spawning-stock biomass is well above MSY $B_{trigger}$, and has markedly increased since 2008, following a substantial reduction in fishing mortality since 1999. Recruitment has been fluctuating around the long-term average since the mid-1990s. Since 2009, fishing mortality has been estimated at around F_{MSY}.

7) Sole in 4: The spawning-stock biomass has increased since 2007 and has been estimated at above MSY $B_{trigger}$ since 2012. Fishing mortality has declined since 1999 and is close to F_{MSY} in 2017. Recruitment has fluctuated without trend since the early 1990s, but without the large year classes that occurred in the preceding period.

8) Plaice in 7.d: The spawning-stock biomass has increased rapidly from 2010 following a period of high recruitment between 2009 and 2015, and is now well above the MSY $B_{trigger}$. Fishing mortality has declined since the early 2000s and it has been below F_{MSY} since 2009. Recruitment is currently around the average of the time-series.

9) Sole in 7.d: The spawning-stock biomass has been fluctuating without trend since the 1980s, but has decreased and is now around B_{lim}. Fishing mortality has been decreasing since 2014 and is below F_{MSY} in 2017. Recruitment has been fluctuating without trend, and there has been no strong recruitment since 2011.

10) Category 3–6 finfish stocks: In 2018, new advice has been produced for pol.27.3a4 (Category 5) and gug.27.3a47d (Category 3), but not for several other stocks (bll.27.3a47de, dab.27.3a4, fle.27.3a4, lem.27.3a47d, mur.27.3a47d, tur.27.3a, tur.27.4, whg.27.3a, all Category 3 stocks, and wit.27.3a47d, now a Category 1 stock), for which biennial advice was given in 2017; it is expected that tur.27.4 will be upgraded to a Category 1 stock following the inter-benchmark meeting this summer.

   i. Pollack (pol.27.3a4): Since 1977 there have been two periods of high catches. In recent years, catches have been low, albeit fairly stable.

   ii. Grey gurnard (gug.27.3a47d): The time-series of mature biomass index of grey gurnard from the International Bottom Trawl Survey quarter 1 (IBTS-Q1) shows a strong increase from the beginning of 1990s and has since fluctuated at a high level.

11) Norway Pout in 3.a and 4: The stock size is highly variable from year to year, due to recruitment variability and a short life span. Spawning-stock biomass has been above B_{pa} since 2007. Fishing mortality has been fluctuating at a lower level since 1995. Recruitment in 2018 was high, while recruitment in 2017 was slightly below the long-term average.