Summary of ICES advice on the exploitation of Baltic Sea fish stocks in 2017

1 June 2016

On 31 May 2016, the International Council for the Exploration of the Sea (ICES) published advice regarding the exploitation of the Baltic Sea fish stocks for 2017.[1] Here we provide a summary of the ICES advice and the status of the Baltic stocks.

[1] Full ICES advice is available at http://www.ices.dk/publications/library/Pages/default.aspx

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SUMMARY TABLE

Table showing ICES advice for 2017 including the total commercial catch in tonnes, percentage difference from advice for 2016, and the 2017 EU quota corresponding to ICES advice

Stock by management area, subdivision	Advised total commercial catch (t) for 2017, across the stock's full range & including third country catch	% Change from ICES advice for 2016	2017 EU commercial quota corresponding to ICES advice, adjusted for management areas and reduced by third country quotas
Cod, Western Baltic, 22-24	917 (3 475)*	-55%*	917
Cod, Eastern Baltic, 25-32	26 994	-8%	25 644^
Herring, Western Baltic Spring Spawners, 20-24	56 802	8%	28 401**
Herring, Central Baltic, 25-29 & 32	216 000	7%	182 549***^
Herring, Gulf of Riga, 28.1	23 078	-12%	27 429***
Herring, Bothnian Sea, 30	134 556	39%	140 998^^
Herring, Bothnian Bay, 31	6 442	-3%	
Sprat, Baltic, 22-32	314 000	53%	273 000^
Plaice, Kattegat, Belts & Sound, 21-23	8 333	-4%	7 861+
Plaice, Baltic, 24-32	2 587	20%	
Salmon, Baltic, 22-31 (*count of fish*)	116 000	0%	89 320++
Salmon, Gulf of Finland, 32 (*count of reared fish*)	11 800	0%	9 558++
Sea trout, Baltic, 22-32	0	0%	Not quota managed
Brill, Baltic, 22-32	18	-22%	
Dab, Baltic, 22-32	3 069	3%	
Flounder, Belt Sea & Sound, 22-23	3 650	20%	
Flounder, Southern Baltic, 24-25	34 690	20%	
Flounder, Eastern Gotland & Gulf of Gdansk, 26 & 28	2 527	-3%	
Flounder, Northern Baltic, 27 & 29-32 (*landings*)	329	20%	
Turbot, Baltic, 22-32 (*landings*)	194	-2%	

* Brackets include total catch (commercial + recreational), and advice comparison is with this #
** Reflects TAC splitting procedure in negotiated agreement for Baltic catch (SD 22-24)
*** Adjusted for the relative quota shares of each stock caught in the adjacent management area
^ Preliminary estimate based on 2016 Russian quota or prior TAC sharing arrangement
^^ Bothnian Bay & Bothnian Sea herring are managed under one TAC
+ Estimated plaice catch in the Kattegat (SD 21) is deducted to determine the Baltic area quota
++ After removing unreported, misreported, and discarded catch

INTRODUCTION

ICES provides scientific advice to clients within the context of international agreements on fisheries, conservation, and sustainable development. Within this framework ICES responds to policy needs such as regular EU requests for advice related to the goals of the Common Fisheries Policy (CFP), including Maximum Sustainable Yield (MSY).[2]

Total catch, total commercial catch and Total Allowable Catch (TAC)

Readers of ICES advice must understand that "total catch" and "total commercial catch" are not always synonymous with Total Allowable Catch (TAC).

ICES advises the total commercial catch for a stock whenever possible. Total catch represents the total fishing mortality for a stock from all stakeholders and across the stock's full range, possibly across multiple management areas. Total commercial catch is fishing mortality only from commercial fishing.

For fisheries under the landing obligation, the corresponding TAC (or EU quota, if the TAC reflects third country catches) represents total commercial catch. For fisheries not yet under the landing obligation, the corresponding TAC represents only commercial landings. As of 1 January 2017, all catches of plaice in the Baltic will fall under the landing obligation in addition to herring, sprat, salmon, and cod.[3]

Differences between ICES total catch and regulatory TAC or quota

	total catch	**Total Allowable Catch (TAC), or quota**
Framework	scientific	management, informed by science
Constraint	stock range	management area
Stakeholder	all	commercial
Fishing Mortality	total	dependent on landing obligation

ICES may highlight distribution issues related to stock mixing, interspecies relationships, or management area mismatches, but holds no preference for any distribution method excepting those which could exceed the advised total catch. For example, stock mixing between the Baltic cod stocks in subdivision (SD) 24. Readers must examine ICES advice closely and be familiar with the management of a relevant stock to determine what portion of the advised total catch represents the advised TAC.

[2] Council Regulation (EU) 1380/2013
[3] Commission Delegated Regulation (EU) 1396/2014

Definitions and Basis of ICES advice

MSY, at its core, is a fisheries exploitation concept which seeks the largest long-term stable catch possible. Global use and interpretation of the MSY approach has evolved in complexity since the early 20th century but the concept remains the same: an overfished population is unable to support MSY.

The current EU policy interpretation of MSY uses the surplus production concept. This assumes that from an abundant fish population in a stable environment, fisheries can sustain a maximum stable and predictable catch. This is the foundation of the MSY approach which Europe adopted in 2013 in the reformed CFP, and that ICES has developed into its own MSY approach when providing advice on fishing opportunities. MSY estimates are inherently flawed due to assumptions of stability (equilibrium) in an ecosystem and a fishable biomass, and ICES "considers MSY estimates to be valid only in the short term".[4]

Key metrics used in the MSY approach, based on EU requests, include spawning stock biomass (SSB) and fishing mortality rate. Fishing mortality (F) represents the instantaneous rate at which individual fish are killed by fishing, as a proportion of the total fish in a year class. This should not be confused with fishing effort (f), which is a measure of fishing intensity.

Within ICES advice, F is averaged annually across the dominant year classes harvested. Fishing mortality rates in line with the MSY approach, including the long-term upper limit F_{MSY}, are estimated to maximise the average long-term catch. Fishing at this rate depends on a resilient fishable population and extreme confidence in scientific data. Fish age, size, condition, growth rate, distribution, and SSB are just some of the factors that determine if a fish population can support a given fishing mortality rate, in addition to numerous other ecosystem factors and interspecies interactions. These biological data are inherently uncertain in fisheries, and precaution is necessary.

The SSB, commonly measured in tonnes, represents only those fish mature enough to reproduce. In the context of MSY and additional surplus production assumptions, SSB_{MSY} (or simply B_{MSY}) is the SSB that would support F_{MSY}. B_{MSY} in reality is a moving target dependent on a wide range of natural factors in addition to fishing mortality. Additionally, the productivity of year classes within a SSB can vary greatly, and overall SSB productivity can change dramatically over time. This introduces uncertainty when SSB is considered in isolation, as is currently the case in the setting of fishing opportunities. The currently developing Marine Strategy Framework Directive should integrate more comprehensive factors for what constitutes a healthy stock and sustainable fishing mortality, resulting in improved EU requests for advice and a move away from surplus production.

[4] Pg 4 *in* ICES. 2016. ICES Advice Basis. Available at: http://www.ices.dk/community/advisory-process/Pages/Basis-for-ICES-Advice.aspx

Precaution and the MSY approach

Changes in F over time will influence SSB, while these two metrics are not directly related. Within the MSY approach and equilibrium assumptions, ICES created $B_{trigger}$ as a precautionary SSB reference level intended to trigger a management response. ICES describes $B_{trigger}$ as the lower bound of SSB fluctuations around B_{MSY}, recently proposing 5% of B_{MSY} to define this fluctuation.[5] Because B_{MSY} is uncertain, $B_{trigger}$ is conceptually determined instead by observing the fished biomass over time when fished at F_{MSY}. Until such data exist ICES equates $B_{trigger}$ to an older precautionary biomass level, B_{pa}, even though the two concepts have a different basis.[6] Where data does exist, ICES resisted integrating the new $B_{trigger}$ values into advice because imposing "*biomass limits based on percentiles of B_{MSY} directly may result in unachievable expectations, therefore a transition process from $MSY_{Btrigger} = B_{pa}$ is suggested.*"[7]

In extreme cases stocks could be depressed through natural or fishing mortality to the lowest reference point, B_{lim}. This represents the SSB below which recruitment in a fish stock is impaired, risking failure. Fishing a stock to such a low level is disastrous for the fished stock and for dependent fishing communities. Recognising this danger, coupled with fisheries stock assessment uncertainty, ICES developed a precautionary buffer called B_{pa}. Generally B_{pa} is B_{lim} multiplied by 1.4, representing a slightly larger SSB to provide managers response time to reduce fishing mortality.

In 2012, ICES developed a framework for quantitative advice regarding data-limited stocks. The framework categorises all stocks into six different categories from data-rich to data-poor. Data-limited advice is essentially based on a combination of biomass indices and landings data (depending on what is available) and a ±20% "uncertainty cap" applied to the previous years' advice or so-called *status quo* landings. Although ICES considers all data categories precautionary, ICES references the precautionary approach specifically when providing advice on data limited stocks, and the MSY approach when providing advice on data-rich stocks.

[5] ICES. 2016. Report of the Workshop to consider FMSY ranges for stocks in ICES categories 1 and 2 in Western Waters (WKMSYREF4), 13–16 October 2015, Brest, France. ICES CM 2015/ACOM:58.
[6] The reference biomass level B_{pa} is based on preventing impaired stock recruitment.
[7] *Ibid.*, p. 174.

What happens next?

In June, the Commission publishes a policy statement describing the general principles they will use when proposing fishing opportunities, or quotas, for the coming year. Specific Commission quota proposals come later in the year following consideration of scientific advice. The Baltic Sea Advisory Council (BSAC) also considers the scientific advice for Baltic fish stocks and produces its own advice for regional Member States of BALTFISH and the Council.

The Commission will most likely publish its proposal for Baltic fishing quotas in September. Subsequently, Fisheries Council Working Groups will discuss the Commission's proposal prior to the Council's October meeting, where they negotiate the 2017 fishing quotas.

Recently, negotiations on the Baltic multiannual plan have been concluded by the European Parliament and Council. They have developed and agreed on a framework for management of Baltic stocks in the Baltic multiannual plan, including ranges of fishing exploitation rates and precautionary stock biomass levels for cod, sprat, and herring. However the Council maintains sole decision-making power to set annual fishing opportunities in line with the plan. The new Baltic multiannual plan should be in force at the beginning of 2017, though it is unclear as of the publication date of this summary if the new plan will guide the setting of fishing opportunities for the coming year.

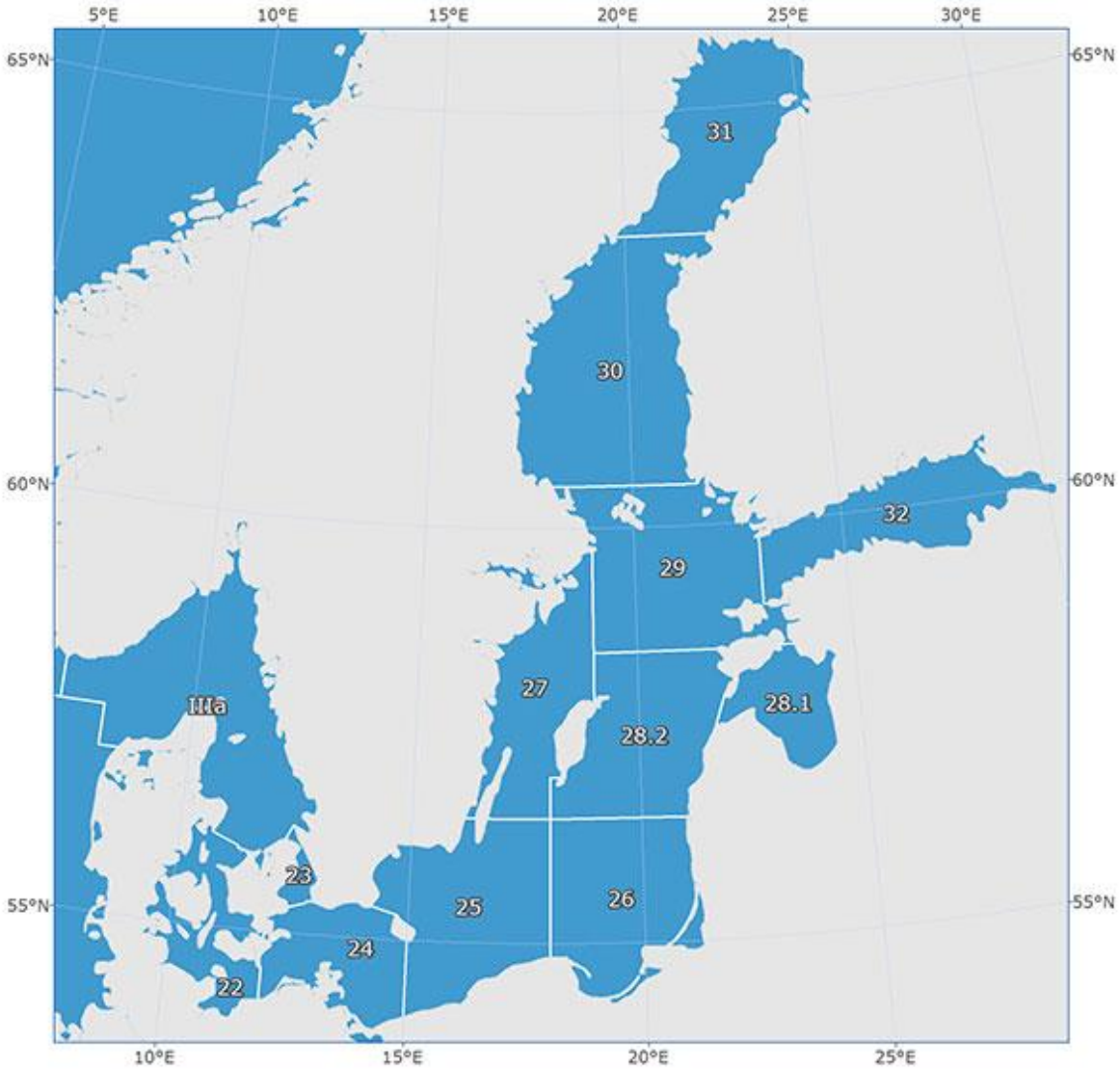
Until a new plan is approved and ICES has reviewed such a plan as precautionary within their own framework, ICES advice will reflect the ICES MSY approach, or precautionary approach, as data quality permits.[8]

[8] In 2007, the European Commission adopted a multi-annual plan for eastern and western Baltic cod (Council Regulation (EC) 1098/2007). ICES determined this plan was no longer suitable for the basis of their advice in 2009.

DETAILED SUMMARY OF ICES ADVICE

ICES provides total catch advice applicable to a stock across its total range. The Commission applies a TAC to a stock by management area.

Map of the Baltic Sea showing management subdivisions[9]



[9] FAO. 2016. [FAO major fishing areas] http://www.fao.org/fishery/area/Area27/en

Cod in Subdivisions 22–24, Western Baltic

Western Baltic cod (*Gadus morhua*) is severely overfished.[10] The SSB peaked in the early 1980s and reached a record low in 2013, Overall fishing mortality is, and has consistently been, well above F_{MSY}. The most recent stock assessment revised the historic SSB downward and the fishing mortality rate upward. This stock has not grown as expected in the previous assessment, and the SSB has remained below B_{lim}, outside of safe biological limits and near collapse, for nearly a decade. In addition, recruitment to the fishable stock in 2016 is the lowest in the 1994-present time series. There is a risk of recruitment failure given the low biomass in this extremely stressed stock.

Despite a relative abundance of older 'mother' cod, the age and size distribution of cod in this stock is not representative of a healthy stock due in part to 17 consecutive years of poor recruitment. Scientists are unable to explain the continued decline in recruitment. It is unclear if low water temperatures in early 2015 have impacted juvenile cod mortality. Regardless of the reason, caution is necessary for all further exploitation of this stock until conditions improve.

In addition to the poor status of the stock, mixing between this and eastern Baltic cod in SD 24 complicates quota setting for the Western Baltic Cod Management Area (SD 22-24). Reallocating a portion of the Eastern Baltic Cod TAC to SD 24 would account for this unavoidable stock mixing, but this introduces an additional risk to overfishing western Baltic cod. ICES notes the need to protect the weaker western Baltic cod stock when considering any reallocation of the eastern Baltic cod quota to SD 24, particularly that "... *it must be ensured that the catch of EB cod allocated to the western Baltic management area is not taken in subdivisions 22–23*" where stock mixing is not a concern.

The ICES advice for 2017 incorporates recreational catch for the second year in a row, where data exist. As for the 2016 advice, only German recreational fishery data are represented while the data on Danish and Swedish recreational fisheries continues to mature. Recreational catches are not restricted through Council decisions on fishing opportunities, nor has the Commission requested that ICES provide information related to recreational catch allocation. This caused confusion for decision makers interpreting ICES advice for 2016, which included both recreational and commercial catch as 'total catch.' For 2017 ICES deducted the estimated recreational catch first to arrive at advice specific to commercial catch only.

The total commercial catch advice for western Baltic cod is 917 tonnes. This catch is a portion of the total catch represented in ICES advice, which is 3 475 tonnes. To arrive at the total commercial catch advice, ICES deducted 2 558 tonnes of assessed recreational catch. Accounting for the ratio of eastern Baltic cod in SD 24, the 'status quo' allocation could include up to 673 tonnes of additional quota. This would result in a total Western Baltic Management Area quota of 1 588 tonnes and an Eastern Baltic Management Area quota of 26 321 tonnes, but only if separate sub-TACs are allocated and managed for areas SD 22-23 and SD 24.

[10] Our previous stock summary stated 2010 as the lowest assessed SSB. The most recent assessment revised the lowest SSB to 2013.

The landing obligation became effective in the Baltic in 2015, but discarding still occurs according to both scientific and anecdotal reports, ranging from 5-10%. Bycatch species in this fishery primarily consist of flatfishes, especially flounder, which can be substantial at times. Undersized cod bycatch has increased in recent years as well, though moderated in the short term with the reduction of Minimum Conservation Reference Size from 38cm to 35cm.

In 2001 the International Baltic Sea Fisheries Commission introduced fishing gear modifications, including the "Bacoma" cod-end. BSAC unanimously advised in 2015 that these measures on regulated cod-ends are ineffective, due to increased flounder and juvenile cod bycatch which interferes with the selectivity of the gear. Reconciling selectivity under the landing obligation, the new Baltic multiannual management plan, and the Commission-proposed Technical Measures Framework should allow for increased bycatch selectivity and avoidance.

In accordance with the MSY approach, ICES advises that the commercial catch of western Baltic cod should not exceed 917 tonnes.

Cod in Subdivisions 25–32, Eastern Baltic

Due to favourable environmental conditions and strong year classes towards the end of the 1970s, the eastern Baltic cod stock reached its highest recorded biomass levels in 1980–1982. From an early 1980s high of approximately 640 000 tonnes, high fishing mortality and poor environmental conditions encouraged a stock decline to only 87 000 tonnes by 1992. Fishing mortality remained high on this depressed stock through the 2000s. The Helsinki Commission and the International Union for Conservation of Nature labelled eastern Baltic cod as "vulnerable" due to the threat of synergistic effects of eutrophication and climate change.[11]

Following the 2015 ICES benchmarking exercise, ICES determined that eastern Baltic cod is data-limited and could not complete an analytical assessment. Key issues in the analytical assessment include the failure to confidently age cod, or quantify changes in cod growth and natural mortality. These issues, among others, increase uncertainty to such a degree that an analytical assessment is unusable.

Lacking an analytical assessment, ICES develops catch advice based on the ICES data limited framework. Comparing trawl survey data from the last five years, ICES estimates that the Eastern Baltic cod stock size has decreased by less than 20%. This converts into a total commercial catch advice for eastern Baltic cod of 26 994 tonnes.

As described in the section on western Baltic cod, stock mixing occurs between the western and eastern cod stocks in SD 24. Accounting for the ratio of eastern Baltic cod in

[11] HELCOM, 2013. Species Information Sheet Gadus Morhua: http://www.helcom.fi/baltic-sea-trends/biodiversity/red-list-of-species/red-list-of-fish-and-lamprey-species

SD 24, the 'status quo' allocation for the Western Baltic Management Area could include up to 673 tonnes of additional quota. This would result in a total Western Baltic Management Area quota of 1 588 tonnes and an Eastern Baltic Management Area quota of 26 321 tonnes, but only if separate sub-TACs are allocated and managed for areas SD 22-23 and SD 24.

Cod in the eastern Baltic is also harvested by Russia. According to recent communication with the Commission, the Russian share is calculated at 5% of the total Baltic cod TAC, in line with a previously negotiated TAC sharing arrangement. The Russian fishery is exclusively on the eastern Baltic cod stock, thus the corresponding EU quota for eastern Baltic cod should be reduced in line with the agreement, resulting in an EU quota of 25 644 tonnes.

In 2014 and 2015 the Baltic experienced several significant inflows of oxygen-rich sea water, ending a decade-long stagnation in the central Baltic.[12] While the inflow appears to have impacted cod condition positively, previous expectations that the inflow would benefit cod productivity and recruitment have not yet materialized.

Discarding of cod is considered to be a more substantial issue in the eastern Baltic than in the western Baltic. Observer data indicates that undersized cod represent nearly 13% of the total catch in tonnes, or 24% in numbers (18 million individuals), while landings data of undersized cod represent less than 2%. This mismatch, due to discarding of undersized cod in circumvention of the landing obligation, is likely itself an underestimation of the true discard rate. Scientific observers in some Member States have been unable to board and observe fishing activities, and ICES has obtained information that fishers are illegally modifying their gear to increase catch rates of all cod, subsequently discarding undersized catch.

In accordance with the precautionary approach, and the adjustments noted above, the EU portion of the TAC corresponding to ICES advice would be no more than 25 644 tonnes.

[12] Mohrholz V., Naumann M., Nausch G., Krüger S. and U. Gräwe. 2015. Fresh oxygen for the Baltic Sea – An exceptional saline inflow after a decade of stagnation. Journal of Marine Systems, 148: 152-166.; Karnicki, S., BSAC General Assembly, 26 April 2016.

Herring in Subdivisions 20-24, Western Baltic Spring Spawners

Western Baltic spring spawning herring (*Clupea harengus*) is one of the more complex stocks to assess. Interannual variability in the migration patterns, migrations between the Baltic and North Sea management areas, catch distribution among fisheries, and stock mixing with central Baltic herring all add to the complexity. The stock biomass declined substantially from the early 1990s amid increased fishing mortality and reduced recruitment, reaching its lowest estimated SSB in 2011. Since that low, relative reductions in fishing mortality appear to be permitting growth in the SSB and the stock is now within safe biological limits, though recruitment is still low.

The total catch advised across the range of this stock is 56 802 tonnes. This stock is subject to a TAC setting procedure in annually negotiated agreements between the EU and Norway.[13] The interpretation of this TAC rule allocates half of the advised catch to the Baltic SD 22–24, and the other half to the North Sea, or 28 401 tonnes.

In accordance with the MSY approach and the quota split noted above, the Baltic quota corresponding to ICES advice would be no more than 28 401 tonnes.

Herring in Subdivisions 25–29 & 32, Central Baltic Sea, excluding Gulf of Riga

This is the largest of the Baltic herring stocks, composed of a number of local populations. Following a SSB decline below B_{lim} in the late 1990s, the stock has shown a steady increase and is now well above MSY $B_{trigger}$. Fishing mortality has remained below F_{MSY} since 2004. New data shows that the 2014 year-class of herring is the fourth largest since 1974.

The assumed 2017 commercial catch of this stock in the Gulf of Riga, outside of the Central Baltic, is 4 574 tonnes.

The assumed 2017 commercial catch from the Gulf of Riga herring stock in the Central Baltic is 223 tonnes.

The corresponding TAC for this management area, recognising stock mixing, would be no more than 211 649 tonnes, a slight reduction from the advised total catch of no more than 216 000 tonnes. Both EU and Russian fisheries pursue this stock. Russia no longer adheres to a previously negotiated TAC sharing agreement and quotas are determined unilaterally. In order to not exceed scientific advice, Russian quotas must be reduced from the overall total catch to determine the EU quota. The Russian quota for 2016, 29 100 tonnes, may be used to preliminarily estimate the EU quota until the 2017 Russian quota is available. Reduced by the 2016 Russian quota, the total EU quota would be 182 549 tonnes.

Discards are considered negligible. Due to the introduction of the Landing Obligation, interspecies quota transfers are legally permitted up to 9%, within conservation

[13] Regjeringen, 4 December, 2014. Press Release. Quota agreement with EU in 2015. https://www.regjeringen.no/no/aktuelt/Kvoteavtale-med-EU-for-2015/id2342929/

constraints. The ICES advice does not consider any of these transfers, and notes that any future transfers should not result in overall harvests exceeding scientific advice.

In accordance with the MSY approach and the adjustments noted above, the EU portion of the TAC corresponding to ICES advice would be no more than 182 549 tonnes.

Herring in Subdivision 28.1, Gulf of Riga

The Gulf of Riga is a semi-enclosed ecosystem of the Baltic Sea with lower salinity than the main basin, with the smallest and slowest growing individual herring in the Baltic. Herring is the dominant marine species in the Gulf, with few natural predators. Fishing mortality has been close to, but generally over, F_{MSY}, and has increased significantly in 2015 according to the current assessment.

Recruitment of Gulf of Riga herring is highly dependent on environmental conditions, particularly water temperature and zooplankton abundance. Since 1989 the majority of winters have been mild, favouring herring reproduction. Current recruitment appears roughly average although there has been high variation within the time series.

ICES advises that 2017 catches should be no more than 23 078, though stock mixing with Central Baltic herring results in a greater corresponding TAC.

The assumed 2017 commercial catch of this stock in the Central Baltic, outside of the Gulf of Riga, is 223 tonnes.

The assumed 2017 commercial catch from the Central Baltic herring stock in the Gulf of Riga is 4 574 tonnes.

The corresponding TAC for this management area, recognising stock mixing, would be no more than 27 429 tonnes, an increase from the advised total catch. Discards are considered negligible.

In accordance with the MSY approach and the adjustments noted above, the TAC corresponding to ICES advice would be no more than 27 429 tonnes.

Herring in Subdivision 30, Bothnian Sea

Due to low salinity and low mean temperature, herring in the Gulf of Bothnia is slow-growing and relatively small. The spawning stock biomass of Bothnian Sea herring tripled in the late 1980s, only to then drop by 40% by 1999. Since 2003, this stock's SSB has grown to the highest levels assessed in 20 years. While still high, ICES has dramatically revised the stock's estimated SSB downward in 2015 due to a necessary change in the

assessment to handle ongoing uncertainty concerns. These concerns should diminish over time as the acoustic survey time-series grows.

Following a large decrease in the advice for 2016 relative to the change in assessed SSB (from 181 000 tonnes in 2015 to 96 613 tonnes for 2016), ICES has increased its advice substantially to 134 556 tonnes for 2017. Discarding is considered negligible.

Bothnian Sea and Bothnian Bay herring are incorporated into one TAC although assessed separately, and the delineation between stocks is still uncertain. While a combined TAC risks overfishing the smaller stock in Bothnian Bay, ICES finds that this risk is low given the current stock development and fishing effort distribution.

In accordance with the MSY approach and adjustments for the combined management area, the TAC corresponding to ICES advice for SD 30 & 31 would be no more than 140 998 tonnes, of which 134 556 tonnes are from SD 30.

Herring in Subdivision 31, Bothnian Bay

This small herring stock exists at the herring's most northerly range, under relatively extreme environmental conditions. A combination of low salinity, long winters, ice cover and cool summers affect this stock's growth.

ICES categorises Bothnian Bay herring as data-limited and bases their 2017 advice on an exploratory assessment. Although uncertain, the survey index shows a relatively stable trend with a slight decrease, resulting in a precautionary increase in advice for catches no more than 6 442 tonnes. Discarding is considered negligible.

In accordance with the MSY approach and adjustments for the combined management area, the TAC corresponding to ICES advice for SD 30 & 31 would be no more than 140 998 tonnes, of which 6 442 tonnes are from SD 31

Sprat, Baltic Subdivisions 22-32

Sprat (*Sprattus sprattus*) is managed as a single stock across the Baltic Sea. Declining to below B_{lim} in the early 1980s, sprat has since recovered to well above $B_{trigger}$ reaching a maximum assessed SSB in 1996 of 1.9 million tonnes. Sprat stocks have since declined and rebounded, corresponding to relative changes in fishing mortality. ICES re-evaluated the assessment for this year, resulting in substantial estimated increases in biomass from 2012 to a predicted SSB for 2016 approaching the 1996 high.

Cod and clupeid stocks (including sprat and herring) share a strong predator-prey relationship. Higher cod SSB in the early 1980s contributed to lower sprat populations. As cod declined, sprat recovered. The revised assessment correlates natural mortality via predation on sprat with eastern Baltic cod biomass and cod stomach content analysis.

The revised assessment also estimates decreasing fishing mortality from 2012 to the present, predicted to be below F_{MSY} in 2016. This would be the first time fishing mortality is within long-term sustainable levels since 1994. ICES resulting total catch advice for 2017, reflecting increasing SSB and decreasing fishing mortality, is 314 000 tonnes, a 53% increase over previous advice. This significant increase is largely attributable to the stock biomass being revised upward.

Both EU and Russian fisheries pursue this stock. A previously negotiated TAC sharing agreement split the sprat stock provided a Russian quota of 10.08%, however Russia no longer adheres to this agreement and quotas are determined unilaterally. In order to not exceed scientific advice, Russian quotas must be reduced from the overall total catch to determine the EU quota. The Russian quota for 2016, 41 000 tonnes, may be used to preliminarily estimate the EU quota until the 2017 Russian quota is available. Reduced by the Russian quota, the total EU quota would be 273 000 tonnes.

At present sprat is more abundant in areas outside of the cod's range. ICES estimates that 45% of the total 2015 sprat catch was taken in the southern Baltic, SD 25 and 26. Decreasing fishing effort on sprat in SD 25 and 26 would make more sprat available as feed for cod, improving cod condition. Increasing effort northward in the Baltic to SD 27–32 would also optimize the yield and growth of sprat and herring by reducing competition within these stocks for prey. Because of the species interactions between cod and clupeids and possible management concerns to improve cod condition, ICES advises a spatial management plan be devised and implemented for clupeid stocks.

Discarding is considered negligible.

In accordance with the MSY approach and the adjustments noted above, the EU portion of the TAC corresponding to ICES advice would be no more than 273 000 tonnes.

Salmon in the Baltic Sea

ICES advises on Baltic salmon (*Salmo salar*) catch within two management areas: the Main Basin and the Gulf of Bothnia (SD 22–31), and the Gulf of Finland (SD 32). Within these management areas Baltic salmon exist in a large number of river-specific populations ranging from healthy to vulnerable.

The last Baltic-wide management plan for Baltic salmon ended in 2010. The European Commission proposed a new plan in 2011 (COM(2011)470) which is still in negotiation. Currently salmon stocks are managed through EU quotas annually set in Council and individual Member State management of local salmon rivers. However the lack of an approved long-term management plan for Baltic salmon is particularly serious as Baltic salmon is listed under the Habitats Directive, obliging Member States to ensure "favourable conservation status". Salmon management targets are also included in the Water Framework Directive and the Marine Strategy Framework Directive.

Baltic salmon are particularly vulnerable to environmental conditions in their home spawning rivers. Dams and other forms of habitat destruction can prevent salmon from spawning at all. In many parts of the Baltic Sea region, particularly in the South, natural salmon populations have declined or disappeared.

In some larger rivers, hydropower companies are obliged to carry out major restocking programs, releasing salmon smolt (young salmon), in order to compensate for the loss of habitat and migration obstacles resulting from hydropower installations. The process of restocking is costly and ineffective. Today, reared fish die in high numbers before maturing to spawning adults. Although 5.5 million reared salmon smolts are released each year, compared to 2.9 million produced in the wild, salmon catches consist of between 72 and 92% wild fish.

Despite some positive developments, such as improved habitats in both spawning and nursery areas and subsequent increases in natural reproduction, the wild salmon in several rivers have not recovered. Juvenile salmon suffer higher than expected mortality. The reasons for this low survival are still largely unknown.

Baltic salmon populations remain depressed due to a combination of environmental factors including hydro-power and habitat destruction. Further problems include fishing mortality, substantial misreporting, low post-smolt survival and poor reproduction of some populations. Fisheries in open sea areas or coastal waters pose a greater threat to depleted stocks than fisheries in estuaries and rivers.

ICES advises that management of salmon fisheries should be based on the status of individual river stocks, and that fisheries on mixed stocks should be reduced as they present particular threats to stocks that do not have a healthy status.

Salmon in Subdivisions 22–31, Baltic Sea excluding Gulf of Finland

ICES assesses 29 rivers divided into 5 assessment units based on salmon biology and genetics. Since 1997 wild smolt production has increased substantially from very low values, particularly in the North. Smolt production in the Southeast shows no signs of improvement. Increases in smolt production are mainly due to increases in 2–3 rivers. The situation in the southernmost rivers is unchanged or deteriorating.

To evaluate the status of specific salmon runs, ICES uses the smolt production in 2014 relative to projected natural smolt production capacity on a river-by-river basis. The target for rebuilding stocks is to reach at least 75%[14] of the estimated potential smolt production for each river. As an interim objective for weak stocks, 50% of the potential smolt production is used. Potential salmon biotope may still be underestimated in a number of salmon rivers such as the Pite River resulting in an incorrect potential smolt production. Out of 29 stocks assessed, only 4 rivers show a high probability of reaching the 75% target in the near future, while 18 rivers are less than 30% likely to reach this goal. Of those rivers, 7 are less than 30% likely to meet even the interim goal.

The rivers Rickleån, Kågeälven, and Öreälven in the Gulf of Bothnia, Emån in southern Sweden, and several other rivers in the Southeastern Main Basin are especially weak and desperately need longer-term stock-specific rebuilding measures.

Although not incorporated into the assessment, recent data suggests that M74 syndrome is increasing. M74 syndrome is caused by an unbalanced salmon diet focused predominantly on young sprat, which lack adequate thiamine for the salmon's reproduction cycle. This deficiency is passed onto salmon eggs young salmon fry causing high mortality.[15]

ICES advises a total commercial catch at sea of 116 000 individual fish. ICES estimates the fishery will correctly report only 77% the total commercial salmon catch, with an additional 6% misreported, 7% unreported, and 10% unwanted. The handling of unwanted catch is less clear in the advice, but represents continuing discards in the historic catches table, including illegal and legal discarding through the exemption on seal-damaged fish. Thus the amounts of misreported, unreported, and unwanted catch must be deducted from the total commercial catch to determine the EU quota.

In accordance with the MSY approach and accounting for the reported catch, the EU quota corresponding to ICES advice would be no more than 89 320 individual fish.[16]

[14] In the HELCOM Baltic Sea Action Plan and Finland, the target is 80 % of potential smolt production.

[15] Keinänen, M., Uddström, A., Mikkonen, J., Casini, M., Pönni, J., Myllylä, T., Aro, E., and Vuorinen, P. J. 2012. The thiamine deficiency syndrome M74, a reproductive disorder of Atlantic salmon (*Salmo salar*) feeding in the Baltic Sea, is related to the fat and thiamine content of prey fish. ICES Journal of Marine Science, 69: 516–528

[16] The International Baltic Sea Fisheries Commission implemented a Baltic TAC sharing agreement between the EU and Russia in 1993, including a Russian salmon TAC share of 1.9% in SD 22-31 and 9.3% in SD 32. Russia no longer adheres to this arrangement and quotas are set unilaterally. However there is no targeted fishery for salmon in Russia and relatively minor bycatch in the sea and coastal fisheries. While a shared stock, no reduction to the EU quota appears necessary.

Salmon in Subdivision 32, Gulf of Finland

This area contains a few small, wild populations with mixed reared and wild salmon caught in some rivers. The wild salmon populations are genetically distinct from each other, which indicate that these still are original salmon stocks, meaning that they have not reproduced with reared salmon. Reared salmon are easily identified by their missing adipose fin. This fin is removed before releasing a reared salmon into the wild. TAC management alone has been insufficient to improve the condition of wild salmon in the Gulf of Finland. This, among other reasons, triggered a 2016 EU special request on management measures for salmon in the Gulf of Finland.

ICES considers salmon stocks in the Gulf of Finland data-limited and advises using the precautionary approach. Very little data on wild smolt production is available for the assessment, consisting mainly of limited electrofishing surveys. Recreational sea and river catch is uncertain. In ICES expert judgement, all wild salmon rivers in the Gulf of Finland are well below the 75% potential smolt production target and generally not showing signs of recovery.

According to ICES, a reduction in the TAC alone would most likely not safeguard wild populations from exploitation. Instead, ICES advises the development of more selective harvesting methods that target reared salmon.

In response to the EU special request, ICES does not advise any quota transfers from SD 22-31 into SD 32. Any attempts to capture main basin salmon which migrate into the Gulf of Finland will likely increase catches on the local stocks, and ICES finds no biological basis to allow a higher harvest of local stocks. The assessment of Baltic salmon would however benefit from the inclusion of Gulf of Finland stocks, though ICES cannot determine the timeline to develop this combined assessment. In addition to setting TACs in line with ICES advice, which has not been done since 2011, ICES advises additional effort controls and improved enforcement to reduce illegal catches. Regarding a Finnish pilot study on sea trout survival from the Finnish gillnet fishery, ICES found that the pilot study was unrepresentative of salmon survival for a wide range of reasons, and did not advise any landing obligation exemptions based on the study.

Assuming a similar amount of restocking to previous years, ICES advises a total commercial catch at sea of 11 800 reared salmon, including a revised 2016 estimate of 81% wanted, reported catch, 16% unwanted catch and 3% unreported catch. The historic catch table clarifies that unwanted catch is all discarded for 2015, despite the implemented landing obligation, thus the amounts of unreported, and unwanted catch must be deducted from the total commercial catch to determine the EU quota.

In accordance with the precautionary approach and accounting for the reported catch, the EU quota corresponding to ICES advice would be no more than 9 558 individual reared fish. ICES advises no targeted fishing for wild salmon and that bycatch of wild salmon be minimised.

Sea trout

ICES advice for sea trout in 2017 is the same as for 2016. New data has not changed ICES perception of the stock.

The Baltic Sea region contains approximately 630 sea trout stocks (*Salmo trutta*), of which 511 of those stocks are thought to remain wild and unmixed with reared fish. The status of the stocks varies considerably, as does the quality of their habitats in the rivers.

Sea trout is caught in rivers, coastal areas and the open sea. It does not migrate as extensively as salmon, but longer migrations do occur within the Baltic main basin. Nominal commercial catches of sea trout in the main basin have declined from around 1 000 tonnes in 2002 to 189 tonnes in 2015. Nominal recreational catches have varied greatly between 2001 and 2014. ICES notes that the data on recreational catches is incomplete, and it could be as much as three times the estimated commercial catch.

The majority of the catches contain mixed stocks, which is problematic for the weaker stocks. Discards of undersized sea trout take place mainly in the coastal fisheries, particularly in the gillnet fishery, but there are no clear estimates available for any fisheries. There are also strong indications that significant amounts of salmon are misreported as sea trout.

There is no TAC set for sea trout, but national regulations include *inter alia* minimum landing size, local and seasonal closures, and minimum mesh sizes for the gillnet fishery. Minimum mesh sizes, reduction of fishing effort, minimum legal landing sizes, as well as temporal and spatial closures are all viable options to reduce trout bycatch. Existing fishing restrictions should be maintained and habitat improvements are needed in many rivers. Fishing mortality should particularly be reduced in the Gulf of Bothnia and portions of the southern Baltic Sea.

Based on precautionary considerations, ICES advises that catches in the Gulf of Bothnia (SD 30 & 31) and fishing intensity in SD 22, 24, and 26 should be reduced to the extent possible, if a complete cessation of fishing is not feasible, to safeguard the remaining wild populations in the region. ICES advises that habitat improvements are necessary in trout spawning rivers around the Baltic.

Flatfishes in the Baltic Sea

Five flatfish species are found in the Baltic Sea: Baltic flounder (*Platichtys flesus*), turbot (*Scophthalmus maximus*), brill (*Scophthalmus rhombus*), plaice (*Pleuronectes platessa*) and dab (*Limanda limanda*). The fishing for these species is mostly for human consumption, although a large part of the flatfish caught in the Baltic today is bycatch in the cod trawl fishery. There are currently no management plans for flatfishes in the Baltic, and Plaice is the only species under TAC management. The knowledge concerning most stocks is limited.

Plaice, dab, and brill have a limited distribution in the Baltic Sea, mainly confined by their tolerance of low salinity. Plaice is common in the western Baltic and extends eastwards to the Gulf of Gdansk and northwards to the Gotland area. Dab has a similar, somewhat more westerly distribution, whereas brill is almost exclusively found in SD 22–24. There are at least two plaice populations and indications of three different dab populations in the region. According to the annual scientific trawl survey, plaice stocks appear to be increasing strongly. The dab stock size has also increased over the last decade, whereas brill seems to fluctuate considerably between years and no significant trends can be detected.

Plaice

Plaice is the only flatfish species in the Baltic Sea subject to EU quota management. The landing obligation will apply to plaice catches beginning in 2017, thus total catch advice will correspond to a TAC for the Baltic management area. ICES advice identifies a western stock (SD 21–23) and an eastern, or Baltic, stock (SD 24–32). The corresponding Baltic TAC must be reduced by plaice catch in SD 21.

For the western stock, ICES applies the MSY approach for the 2016 advice resulting in total catch advice not to exceed 8 333 tonnes. ICES estimates that 36.7% of SD 21-23 plaice is caught in SD 21, resulting in 5 274 tonnes in SD 22-23.

ICES categorises the Baltic plaice stock as data-limited, and provides advice in line with their precautionary approach. The resulting advice for Baltic plaice given the estimated increase in SSB is 2 587 tonnes. Adding the advised 5 274 tonnes in SD 22-23 results in a Baltic TAC corresponding to advice of 7 862 tonnes.

Both plaice stocks are subject to high levels of discarding as bycatch, but with the landing obligation this bycatch should be landed beginning in 2017.

In accordance with the MSY approach and adjustments for the combined Baltic plaice management areas SD 22-32, the TAC corresponding to ICES advice would be no more than 7 862 tonnes.

Turbot

Turbot is found throughout the Baltic Sea in limited amounts. The species is sedentary and does not migrate to spawn, which makes local populations sensitive to high fishing pressure. Within a precautionary framework, ICES finds the turbot stock stable for the last nine years. More than half of the reported turbot landings come from SD 22, with relatively substantial landings in SD 24-25. Landings across the Baltic increased from several dozen tonnes in the 1960s to over 1000 tonnes in the mid-1990s, declining steadily to a few hundred tonnes today.

In accordance with the precautionary approach, ICES advises that turbot landings should not exceed 194 tonnes.

Dab

ICES categorises the dab stock as data-limited, with minor change from last year according to the indexed trawl surveys.

In accordance with the precautionary approach, ICES advises that the total catch of dab should not exceed 3 069 tonnes.

Brill

ICES categorises the brill stock as data-limited. As in the advice for 2016, brill shows an indexed decrease in excess of 20%. The relative decrease in advice is limited to 20%, resulting in the catch advice for 2017.

In accordance with the precautionary approach, ICES advises that the total catch of brill should not exceed 18 tonnes.

Flounder

Flounder is the most widespread and abundant flatfish in the Baltic Sea. ICES provides advice for four different stocks of flounder. However, the exact number of stocks is uncertain. Most commercial flounder landings are bycatch in fisheries for cod, although there are some targeted flounder fisheries, particularly in subdivisions 24 and 25.

Recreational catch is substantial relative to commercial catch in the northern Baltic Sea (SD 27 & 29-32). ICES estimates that Swedish and Finnish recreational catch exceed commercial catch in these countries. Estonian recreational catch is estimated to be almost a

third of the commercial catch. Data quality on recreational fishing is low however and could not be included in the assessment.

ICES categorises all four flounder stocks as data-limited. Through indexed trawl surveys, most flounder stocks show positive trends in stock size, except for flounder in the waters east of Gotland and the Gulf of Gdansk (SD 26 & 28). ICES could estimate discard rates for all stocks this year except for the northern Baltic Sea stock, permitting advice based on total catch. For the northern Baltic sea stock ICES advises landings only, though discarding does occur.

In accordance with the precautionary approach, ICES advises that:

- **total catch of flounder in the Belt Seas and the Sound should not exceed 3 650 tonnes;**
- **total catch of flounder in the southern Baltic Sea should not exceed 34 690 tonnes;**
- **total catch of flounder in the waters east of Gotland and the Gulf of Gdansk should not exceed 2 527 tonnes;**
- **flounder landings in the northern Baltic Sea should not exceed 329 tonnes.**