

## Request by Poland to review the effectiveness of current conservation measures in place for the Baltic Cod

### Advice summary

ICES considers that when total catches are constrained by TACs set at sustainable levels, closures do not contribute substantially to sustainable exploitation; closures can, however, be considered as a supplement in specific circumstances. Spawning closures in particular can have additional benefits for the stock that cannot be achieved by TAC alone (e.g. increased recruitment through undisturbed spawning), though these effects cannot be demonstrated or quantified for Eastern Baltic (EB) cod.

In reviewing the effectiveness of the area closures for EB cod, ICES advises:

- The relatively small area closure presently implemented in the Bornholm Basin only partially covers the spawning area. In addition to potential positive effects, the closure has potential negative effects on the stock due to effort reallocation. Eliminating the potential negative effects so that only potential positive effects remain, would imply an expansion of the closure to cover the entire area in the Bornholm Basin within the 60 m isobath and additionally the entire Subdivision (SD) 26. Peak spawning has been observed in May–August in recent years, thus the closure in September–October is not expected to contribute much to the potential positive effects of the closure.
- The present area closures in the Gdansk and Gotland basins are considered to have a limited impact for the stock, at present hydrographic conditions.

In reviewing the effectiveness of the seasonal closures for EB cod, ICES advises:

- Seasonal closure (SD 25–26) in the period 1 July–31 August includes both potential positive and negative effects for the stock. The potential negative effects would be minimized by including June (peak spawning) in the period of closure.
- Expansion of the seasonal closure (1 July–31 August) to SD 27–32 is expected to have no or a very limited positive effect for the stock.
- Expansion of the seasonal closure (1 July–31 August) to SD 24 includes both potential positive and negative effects for the stock. The potential negative effects would be minimized by including June (peak spawning) in the period of closure. A closure in SD 24 will have consequences for EB and Western Baltic (WB) cod because of stock mixing in that area. A closure in SD 24 will cause effort reallocation to SD 22–23 with implications for Western Baltic cod stock.

### Request

ICES is requested by Poland to carry out a review of the effectiveness of the conservation measures currently in place, in particular the conservation areas and periods, for the recovery of the cod stock in the Baltic Sea.

*At the moment conservation areas are defined under art. 18 of the Regulation (EU) 2016/1139 of the European Parliament and of the Council of 6th July 2016 establishing a multiannual plan for the stocks of cod, herring and sprat in the Baltic Sea and the fisheries exploiting those stocks, amending Council Regulation (EC) No 2187/2005 and repealing Council Regulation (EC) No 1098/2007. In the opinion of numerous persons they have been introduced in an arbitrary manner, without detailed consultations with scientists and do not cover fully the cod spawning grounds, especially in the area of Bornholm.*

*In turn, the Council Regulation (EU) 2017/1970 of 27th October 2017 fixing for 2018 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulation (EU) 2017/1127 introduced conservation periods for the Western Baltic cod in subdivisions 22–24 and Eastern Baltic cod - however, only for subdivisions 25–26.*

*Poland petitioned for the introduction of a conservation period for all of the Eastern Baltic cod, based on the research of the National Marine Fisheries Research Institute. It clearly results from the research that, without a prohibition to fish the Eastern Baltic cod in the period July–August, the fishing fleet operations would be largely conducted in spawning concentration areas and in an area with a high cod spawn amounts, which in the opinion not only of the Institute might have a negative impact on the spawning effectiveness of the Eastern Baltic cod.*

*In the abovementioned circumstances, the Polish fishing authorities take the stance that the catastrophic cod stock situation in the Baltic Sea requires urgent and detailed discussion on the regional level (BALTFISH), based on authoritative scientific opinion concerning the effectiveness of the current conservation measures, in particular conservation areas and periods as well as other solutions recommended by the ICES for the cod stock recovery in the Baltic Sea.*

## Elaboration on the advice

A seasonal closure during peak spawning covering most of the distribution area of the stock should be preferred over smaller area closures. This is because area closures cause effort reallocation to other stock components during the closure, with the risk of having counterproductive effects for the cod stock.

## Basis of the advice

### ICES interpretation of the request

The closures evaluated included the presently applied closures in the three designated areas in the Eastern Baltic Sea (1 May–31 October), as specified in the Baltic Multi Annual Plan (2016), and potential modifications to these; the seasonal closure (1 July–31 August) in SD 25–26 applied for 2018; and potential expansion of this seasonal closure to SD 27–32 and to SD 24. This evaluation focuses on the Eastern Baltic cod stock.

### General approach

The review is based on the work of the ICES Workshop to evaluate the effect of conservation measures on Eastern Baltic cod (*Gadus morhua*) (WKCONGA) (ICES, 2018a). This report contains an up-to-date literature review on potential effects of spawning closures.

### Methods

The realized effects of spawning closures (e.g. increased recruitment, increased proportion of large cod in the population) on a fish stock are generally very difficult to demonstrate or quantify. This is because there is a large number of factors and processes that influence recruitment as well as size structure of the stock. Thus, it is not possible to separate out effects of the closures on EB cod stock from other factors which are known to influence the stock at the same time.

For this reason, ICES evaluated potential effects of the closures. The key focus in this approach is on the overlap between the closure and the stock component intended to be protected. If such overlap is not present, this implies that the closure cannot be beneficial. If the overlap is present the closure can potentially contribute to achieving a given objective. However, it can still not be verified that the closure actually has a positive effect on the EB cod stock.

Given the lack of specific targets for the closures, ICES identified the following potential biological objectives for EB cod spawning closures used in the evaluation:

- i) increased recruitment via undisturbed spawning, taking into account survival probability of the offspring;
- ii) increased proportion of larger/older individuals in the stock, which may also increase recruitment;
- iii) reduced total catch.

The specific questions that ICES addressed for each of the evaluated closures, by objectives, were the following:

Objectives	Criteria
Increased recruitment (via undisturbed spawning)	Is there an overlap between the closure and cod spawning activity, in time and space? Is there an overlap between the closure and spawners whose offspring has a higher survival probability?
Increased proportion of larger cod	Is there an overlap between the closure and largest individuals of cod? Does the closure decrease the proportion of largest cod in fisheries catch?
Reduced total catch (F)	Is there an overlap between the closure and cod distribution? Could the same total amount of cod be caught regardless of the closure?

ICES evaluated potential positive and negative effects of both area and seasonal closures. Potential positive effects were related to overlap between the closure and the stock component intended to be protected. Potential negative effects of the closures were generally associated with possible spatial and temporal effort reallocation.

The synthesis in tables 1 and 2 is based on the available knowledge on the potential effects of the spawning closures to be found in tables 1–3 (ICES, 2018a).

The results by individual objectives in the synthesis tables 1 and 2 were combined into an overall evaluation of each closure. No ranking of the potential positive or negative effects identified within an objective or for different objectives was applied in this process. Thus, potential positive or negative effects identified for any of the objectives were given equal weight.

ICES identified which modifications would be necessary to eliminate the potential negative effects of the present closures in relation to any of the objectives.

The ecological and hydrographic conditions in the Baltic have changed over the last decades. The present evaluation is based on the recent environmental conditions and fishing patterns observed in the Baltic Sea.

### **Results and conclusions on area closures**

ICES considers that the existing area closure in the Bornholm Basin (1 May–31 October) has potentially both positive and negative effects for EB cod (summarized in Table 1). The potential negative effects are associated to effort reallocation to areas in the Bornholm Basin where spawners may produce eggs and larvae with a higher rate of survival, and to areas where larger individuals of EB cod are relatively more abundant (i.e. in Subdivision 26 and higher). To eliminate these potential negative effects an extension of the closed area would be needed to include the area in the Bornholm Basin with water depths of 60 m or more, and additionally the entire SD 26 (Table 1). Additional benefits to cod may be obtained by including the Slupsk Furrow, where cod spawning also takes place.

The current closure includes May to October. Shortening the period of the closure to only cover the peak spawning (May–August) would not substantially reduce the potential benefits of the closure.

The present area closures in Gdansk and Gotland basins have little potential to contribute to improving the stock status given the present hydrographic conditions.

### **Results and conclusions on seasonal closures**

ICES considers that the seasonal closure from 1 July–31 August in SDs 25–26 has both potential positive and negative effects for EB cod (Table 2). The present closure does not cover the month when most intensive spawning has been observed in years since 2010 (June), and it may cause increased disturbance of spawning in June due to effort reallocation. This potential negative effect can be eliminated by including June in the period of the closure.

ICES considers that the expansion of the closure to SDs 27–32 has only minor potential benefits to the EB cod stock, because cod abundance as well as catches are very low in this area.

A potential expansion of the closure to SD 24 may have some benefits to EB cod recruitment due to undisturbed spawning, though the survival of EB cod eggs spawned in this area is generally low. Quantitative analyses on the relative contribution of spawning in SD 24 to EB cod recruitment are currently lacking. Similarly to SD 25–26, a closure in July–August would potentially increase the disturbance of peak spawning in June due to effort reallocation. Thus, to avoid possible negative effects, if a closure in SD 24 is implemented, it should also cover June. EB and Western Baltic (WB) cod are mixed in the entire SD 24. Thus, a summer closure in SD 24 has implications for WB cod due to effort reallocation to SDs 22–23.

**Table 1** Synthesis of the potential effects of existing area closures on EB cod and potential modifications to these closures. Different colour codes occurring in the same cell are based on different arguments as explained in the table.

Closure	Objective 1: Increased recruitment (via undisturbed spawning)	Objective 2: Improved size/age structure	Objective 3: Reduced total catch	Overall
Bornholm Basin 1 May–31 October	+ Partially undisturbed spawning  - Spawning and high survival outside closure, where fishing effort may be concentrated	? Distribution of larger cod within SD 25 unknown  - Effort reallocation to areas where higher proportion of larger cod in catches may occur, i.e. SD 26.	? Not analysed  0 Likely same catch can be taken in other areas	+ - Inconclusive, there are indications for potential both positive and negative effects
Gdansk & Gotland basins 1 May–31 October	0 Low survival of eggs and larvae  + - Minor effects	? Distribution of larger cod within SD 26 is unknown, though the areas are small	0 The areas are small  ? The effect is not analysed	0 No or very little potential
Modification 1: <i>area within 60 m isobath in Bornholm Basin (1 May–31 October)</i>	+ Undisturbed spawning in the entire Bornholm Basin	- Increased effort reallocation to areas where higher proportion of larger cod in catches may occur, i.e. SD 26.	+ The larger the closure the larger reduction in catch is expected	+ - Inconclusive, there are indications for potential both positive and negative effects
Modification 2: <i>area within 60 m isobath in Bornholm Basin + entire SD 26</i>	+ Undisturbed spawning in the entire Bornholm Basin  0 Low survival in the entire area of SD 26	0 Eliminates the potential negative effect from spatial effort reallocation.	+ The larger the closure the larger reduction in catch is expected	+ 0 Potential positive or no effect

Colour code	Explanation
+	Some available data/knowledge indicate that the closure can potentially contribute to achieving a given objective
-	Some available data/knowledge indicate that the closure can potentially have a negative effect for achieving a given objective
0	Some available data/knowledge indicate that the closure has no or very little potential to contribute to achieving a given objective
?	No information is presently available/analysed that would allow to say anything about the potential effects of the closure for achieving a given objective.

**Table 2** Synthesis of the potential effects of existing seasonal closure on EB cod and potential modifications of this closure. Different colour codes occurring in the same cell are based on different arguments as explained in the table.

Closure	Objective 1: Increased recruitment (via undisturbed spawning)	Objective 2: Improved size/age structure	Objective 3: Reduced total catch	Overall
A) SD 25–26 1 July–31 August	+ Partially undisturbed spawning 0 Low survival of eggs and larvae in SD 26, no spawning in the area within 20–50 m depth in SD 25 and 26 - Possible effort reallocation to June, i.e. increased disturbance of peak spawning	+ Highest proportion of larger cod in the catches in Q3 0 Low catches	+ Under the assumption of no temporal effort relocation 0 Under the assumption of temporal effort relocation	+ - Inconclusive, there are indications for potential both positive and negative effects
B) SD 25–26 expansion to June Added effects compared to A)	+ Increased period for undisturbed spawning	? Added effect from June is unknown	+ The longer the closure the larger reduction in catch is expected	+ Potential positive effect
C) expansion to SDs 27–32  1 July–31 August or 1 June–31 August Added effects compared to A) and B)	0 Low spawning activity, low survival of eggs and larvae	0 Low catches and stock abundance + High proportion of larger cod in SDs 27–32	0 Low catch + Minor effect possible	0 + minor No effect
D) expansion to SD 24 1 July–31 August  Added effects compared to A)	+ Partially undisturbed spawning 0 Low survival of eggs and larvae ? Contribution to EB recruitment unknown - Possible effort reallocation to June, i.e. increased disturbance of peak spawning	? Size structure of EB cod in SD 24 unknown (assumed same as in SD 25)	+ Some effect may occur 0 Catches are low in Q3	+ - Inconclusive, there are indications for potential both positive and negative effects
E) expansion to SD 24 1 June–31 August  Added effects compared to D)	+ Increased protection of spawning activity (less disturbance)	? 	+ Increased effect	+ Potential positive effect

Colour code	Explanation
+	Some available data/knowledge indicate that the closure can potentially contribute to achieving a given objective
-	Some available data/knowledge indicate that the closure can potentially have a negative effect for achieving a given objective
0	Some available data/knowledge indicate that the closure has no or very little potential to contribute to achieving a given objective
?	No information is presently available/analysed that would allow to say anything about the potential effects of the closure for achieving a given objective.

### Extra information

When total catches are constrained by TACs set at sustainable levels, closures do not contribute substantially to sustainable exploitation, but closures can be considered as a supplement in specific circumstances.

The effects of TAC or total catch on fishing mortality (F) and stock size can also be quantified in stock assessment models. This is different for spawning closures, which effects can generally not be quantified and it is difficult to demonstrate the effects that may occur. By ensuring that total catches do not exceed sustainable levels, TAC management also contributes to achieving the objectives related to improved size structure of the stock and increased recruitment.

Additional comments on existing or potential management measures that could contribute to achieving the potential objectives of the spawning closures are listed in the table below:

Objective 1: Increased recruitment	Objective 2: Improved size/age structure	Objective 3: Reduced total catch
<p>Management actions, other than sustainable TAC, to increase recruitment are less straightforward to implement and involve longer time scales (e.g. possible measures to improve oxygen conditions in the Baltic Sea).</p> <p>Recruitment of EB cod may also be affected by the poor nutritional condition of cod. One of the factors that likely contributes to poor condition is lack of suitable food. Spatial management of sprat could improve food availability for adult cod (ICES, 2018b). However, as many complex factors are influencing cod condition, reproduction and recruitment, the possible effect of this is unclear.</p>	<p>Specific gears that catch certain size range of cod, avoiding both the largest and smallest ones, could be used (e.g. gillnets with specific mesh size or size selective trawls).</p>	<p>TAC is the most direct way to regulate total catch. The resulting effect on stock size can be directly quantified.</p> <p>Good quality information on total catch is required for setting TACs sustainably. Full enforcement of the landing obligation would improve the precision of catch estimates as all catches are landed.</p>

### Sources and references

EU. 2016. Regulation (EU) 2016/1139 of the European Parliament and of the Council of 6 July 2016 establishing a multiannual plan for the stocks of cod, herring and sprat in the Baltic Sea and the fisheries exploiting those stocks, amending Council Regulation (EC) No 2187/2005 and repealing Council Regulation (EC) No 1098/2007. Official Journal of the European Union, L 191. 15 pp. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R1139>.

ICES. 2018a. Report of the Workshop to evaluate the effect of CONservation measures on Eastern Baltic cod (*GAdus morhua*) (WKCONGA), 14–15 August 2018, Copenhagen, Denmark. ICES CM 2018/ACOM:51. 56 pp.

ICES. 2018b. Sprat (*Sprattus sprattus*) in subdivisions 22–32 (Baltic Sea). In Report of the ICES Advisory Committee, 2018. ICES Advice 2018, spr.27.22-32.