

# ICES MSY approach



**ICES**  
**CIEM**

Science for sustainable seas



Stock categories (based on available knowledge)		Advice basis
1	Stocks with an accepted analytical assessment and forecast	MSY approach
2	Stocks with an analytical assessment and forecast accepted for trends only	MSY approach
3	Stocks with abundance or biomass indices indicative trends	Precautionary approach MSY approach being developed
4	Stocks with reliable catch and biological data	Precautionary approach MSY approach being developed
5	Only landings available	Precautionary approach
6	Only landings available and largely discarded	Precautionary approach

## Common Fisheries Policy - Objectives



- The CFP shall ensure that fishing and aquaculture activities are environmentally sustainable in the long-term and are managed in a way that is consistent with the objectives of achieving economic, social and employment benefits, and of contributing to the availability of food supplies.
- The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield.
- The CFP shall implement the ecosystem-based approach to fisheries management so as to ensure that negative impacts of fishing activities on the marine ecosystem are minimised, and shall endeavor to ensure that aquaculture and fisheries activities avoid the degradation of the marine environment.

**ICES defines yield to be catch above the minimum catch/conservation size (wanted catch).**

**F reflects the total F used by ICES to provide advice.**

PA Reference point	Purpose	Basis
$B_{lim}$	A deterministic biomass limit below which a stock is considered to have reduced reproductive capacity.	The biomass at which recruitment is observed to begin to decline with spawning-stock biomass (SSB): the change point of a segmented regression.

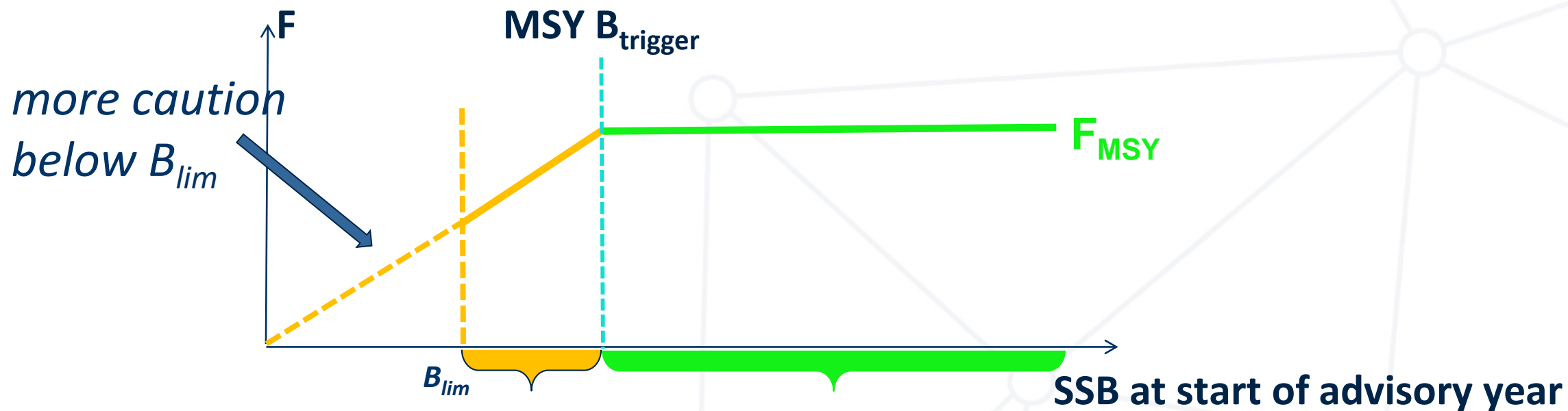
MSY Reference point	Purpose	Basis
$F_{MSY}$	The F expected to give maximum sustainable yield in the long term.	F giving maximum yield given current assessment/advice error, biology and fishery parameters, constrained so that the long-term probability of $SSB < B_{lim}$ is $\leq 5\%$ when applying the ICES MSY Advice Rule (AR):
MSY $B_{trigger}$	A lower bound to the biomass for MSY exploitation.	MSY $B_{trigger}$ is the 5th percentile on the distribution of SSB when fishing at $F_{MSY}$ , however never set below $B_{pa}$

# ICES MSY approach (Category 1 stocks)

1.  $F_{MSY}$  should initially be calculated as the  $F$  which gives maximum yield ( $F_{MY}$ ) based on an evaluation with the inclusion of stochasticity in population (i.e., recruitment,  $M$ , maturity, growth) and fishery (e.g. selectivity) as well as assessment/advice error.
2. To ensure consistency between the precautionary and the MSY frameworks,  $F_{MSY}$  is not allowed to be above  $F_{pa}$ ; therefore, if the  $F_{MSY}$  value calculated initially is above  $F_{pa}$ ,  $F_{MSY}$  is reduced to  $F_{pa}$ .
3. MSY Btrigger should be selected to safeguard against an undesirable or unexpected low SSB when fishing at  $F_{MSY}$ , following the process described below.
4. The ICES MSY AR should be evaluated to check that the  $F_{MSY}$  and MSY Btrigger combination fulfils the precautionary criterion of having a less than 5% annual probability of  $SSB < B_{lim}$  in the long term.
5. If the precautionary criterion evaluated in point 4 is not met, then  $F_{MSY}$  should be reduced from the value calculated above until the precautionary criterion is met.

# ICES MSY approach

- ✓ Maximize long term average yield
- ✓ Safeguard against low SSB
- ✓ Stay within precautionary boundaries



Category 1 and 2 stocks

# Norway, EU, Faroes request to evaluate LTMS for mackerel: Results



Base-case: weights-at-age as during 2011-2015, i.e. low

## No TAC constraint:

Long-term yield (median value) for different ( $F_{target}$ ,  $B_{trigger}$ ) combinations, identifying combinations that are precautionary and result in highest long-term yield on average:

$B_{trigger}$	0.1	0.13	0.15	0.16	0.17	0.18	0.19	0.2	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.3	0.31	0.32	0.33	0.34	0.35
600	557	618	647	658	668	677	684	691	696	699	702	703	703	703	702	701	699	696	693	688	684	679	674
1940	557	618	647	659	669	678	685	691	697	701	704	706	706	707	707	707	706	705	703	700	697	694	691
2000	557	618	647	659	669	678	685	692	697	701	704	706	707	708	708	707	706	706	704	702	699	696	694
2200	557	618	647	659	669	678	686	692	698	702	705	708	710	711	711	711	711	710	709	707	706	705	703
2400	557	618	647	660	670	679	687	693	699	703	708	711	713	715	716	717	717	715	716	716	715	714	714
2570	557	618	648	660	670	680	688	695	700	706	709	714	717	719	721	722	723	723	723	724	724	724	723
2600	557	618	648	661	671	680	688	695	701	706	710	715	718	720	721	723	724	724	725	725	725	726	724
2800	557	619	649	662	672	682	690	697	703	709	714	719	723	725	727	730	732	733	734	735	735	735	734
3000	557	619	649	663	674	684	693	701	707	714	719	724	728	732	735	738	740	741	742	741	740	737	732
3200	557	620	651	664	676	686	696	704	711	719	724	729	734	739	743	744	746	746	745	742	738	731	724
3400	558	621	653	666	678	689	699	708	716	724	730	736	741	745	747	747	747	744	739	734	727	721	713
3600	558	623	655	668	681	693	704	714	722	730	736	742	746	747	745	743	741	735	729	723	716	709	701
3800	559	624	657	671	685	698	709	719	728	735	740	744	744	743	740	735	730	724	718	712	706	700	693
4000	560	627	660	675	689	702	714	724	731	735	738	738	736	732	727	721	717	712	707	702	697	692	687
4200	561	629	663	679	693	706	717	725	730	731	730	728	723	720	714	710	706	702	697	694	690	685	681
4400	562	631	667	683	697	708	716	721	722	721	718	714	710	706	702	700	696	694	690	687	683	680	675
4600	564	634	670	685	698	706	711	711	710	707	705	702	699	695	693	690	688	687	683	680	677	675	672
4800	566	637	672	684	694	698	698	698	697	696	694	692	689	685	685	682	681	679	676	674	672	670	667
5000	568	639	670	679	684	685	686	685	685	685	684	683	680	678	677	676	674	673	671	668	667	665	664



# EU Baltic Multiannual Plan for cod, herring and sprat stocks (MAP)



## CONSERVATION REFERENCE POINTS FOR SPAWNING STOCK BIOMASS (as referred to in Article 5)

Stock	Conservation reference points	
	Column A Minimum spawning stock biomass reference point (in tonnes) as referred to in Article 5(2) ( $MSY B_{trigger}$ )	Column B Limit spawning stock biomass reference point (in tonnes) as referred to in Article 5(3) ( $B_{lim}$ )
Western Baltic cod	38 400	27 400
Eastern Baltic cod	Not defined	Not defined
Central Baltic herring	600 000	430 000
Gulf of Riga herring	60 000	Not defined
Bothnian Sea herring	316 000	Not defined
Bothnian Bay herring	Not defined	Not defined
Western Baltic herring	110 000	90 000
Baltic sprat	570 000	410 000

# EU Baltic Multiannual Plan for cod, herring and sprat stocks (MAP)



Stock	Target fishing mortality ranges consistent with achieving maximum sustainable yield ( $F_{MSY}$ )	
	Column A (Part of the range of $F_{MSY}$ as referred to in Article 4(2) and (3))	Column B (Part of the range of $F_{MSY}$ as referred to in Article 4(4))
Western Baltic cod	0,15-0,26	0,26-0,45
Eastern Baltic cod	Not defined	Not defined
Central Baltic herring	0,16-0,22	0,22-0,28
Gulf of Riga herring	0,24-0,32	0,32-0,38
Bothnian Sea herring	0,11-0,15	0,15-0,18
Bothnian Bay herring	Not defined	Not defined
Western Baltic herring	0,23-0,32	0,32-0,41
Baltic sprat	0,19-0,26	0,26-0,27

# EU Baltic Multiannual Plan for cod, herring and sprat stocks (MAP)



The  $F_{MSY}$  ranges in the MAP are consistent with the ranges provided by ICES in 2015.

These were evaluated to result in no more than 5% reduction in long-term yield compared with MSY.

The ranges are considered precautionary if  $F$  is adjusted by the factor  $SSB/MSY B_{trigger}$  when  $SSB$  is below  $MSY B_{trigger}$ .

# EU Multiannual Plan for cod, herring and sprat stocks (MAP)

## Article 4 Targets



1. The target fishing mortality shall be achieved as soon as possible and, on a progressive, incremental basis, by 2020 for the stocks concerned, and it shall be maintained thereafter within the ranges set out in Annex I and in line with the objectives laid down in Article 3(1).
2. In accordance with Article 16(4) of Regulation (EU) No 1380/2013, fishing opportunities shall be fixed in accordance with the objectives and targets of the plan and shall comply with the target fishing mortality ranges set out in Annex I, column A, to this Regulation.
3. Notwithstanding paragraphs 1 and 2, fishing opportunities may be fixed at levels corresponding to lower levels of fishing mortality than those set out in Annex I, column A.
4. Notwithstanding paragraphs 2 and 3, fishing opportunities for a stock may be fixed in accordance with the fishing mortality ranges set out in Annex I, column B, provided that the stock concerned is above the minimum spawning stock biomass reference point set out in Annex II, column A:
  - (a) if, on the basis of scientific advice or evidence, it is necessary for the achievement of the objectives laid down in Article 3 in the case of mixed fisheries;
  - (b) if, on the basis of scientific advice or evidence, it is necessary to avoid serious harm to a stock caused by intra- or inter-species stock dynamics; or
  - (c) in order to limit variations in fishing opportunities between consecutive years to not more than 20 %.

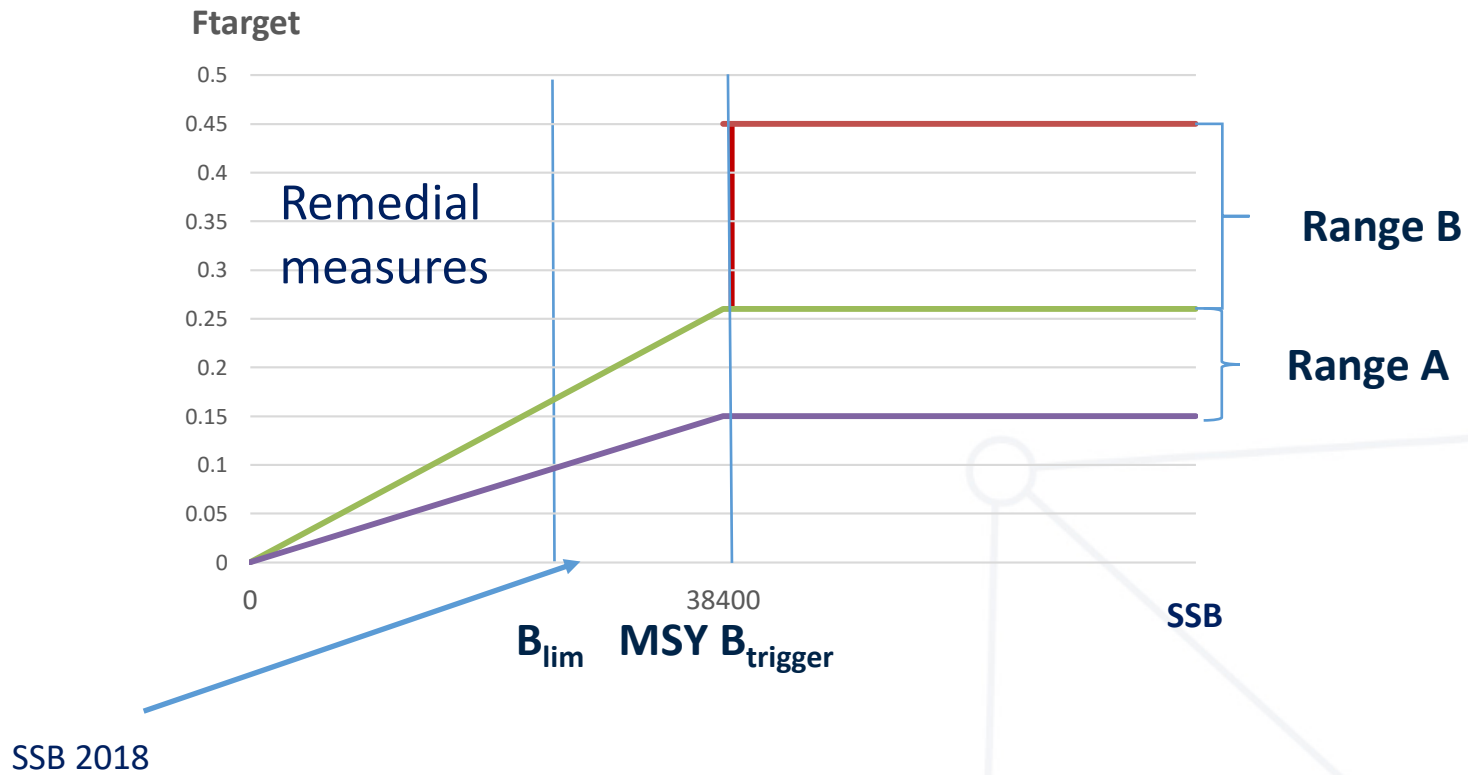
The application of this paragraph shall be explained by a reference to one or more of the conditions set out in points (a) to (c) of the first subparagraph.

# EU Multiannual Plan for cod, herring and sprat stocks (MAP)



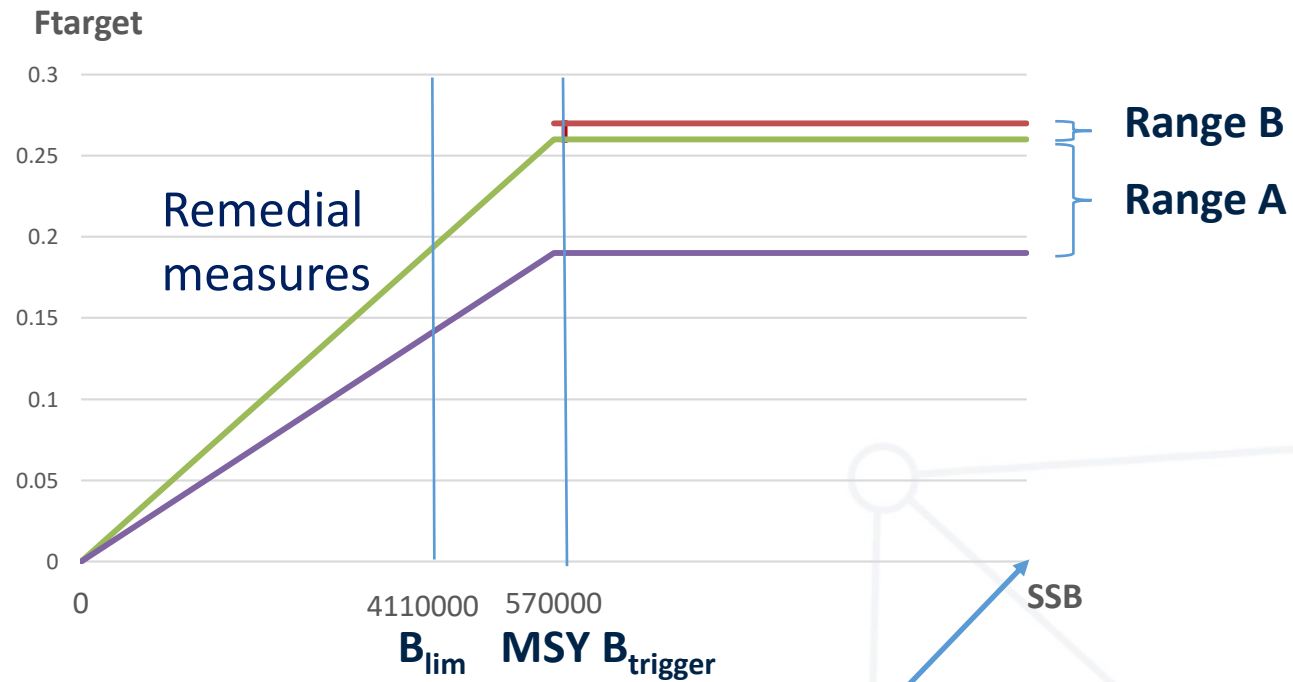
5. Where, according to scientific advice, the MSY exploitation rate is achieved for the stock concerned by 2020, fishing opportunities for that stock may be fixed in accordance with paragraph 4 thereafter.
6. Where, on the basis of scientific advice, the Commission considers that the fishing mortality ranges set out in Annex I no longer correctly express the objectives of the plan, the Commission may as a matter of urgency submit a proposal for revision of those ranges.
7. Fishing opportunities shall in any event be fixed in such a way as to ensure that there is less than a 5 % probability of the spawning stock biomass falling below the limit spawning stock biomass reference point (Blim) set out in particular in Annex II, column B.

# ICES understanding of the harvest control rule in the MAP.



## Western Baltic cod

# ICES understanding of the harvest control rule in the MAP.



**Sprat**

SSB 2018

SSB