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Why should we start talking about maximum sustainable yield?

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Nordic Marine Think Tank



Nordic Council
of Ministers



European Union
European Maritime and Fisheries Fund

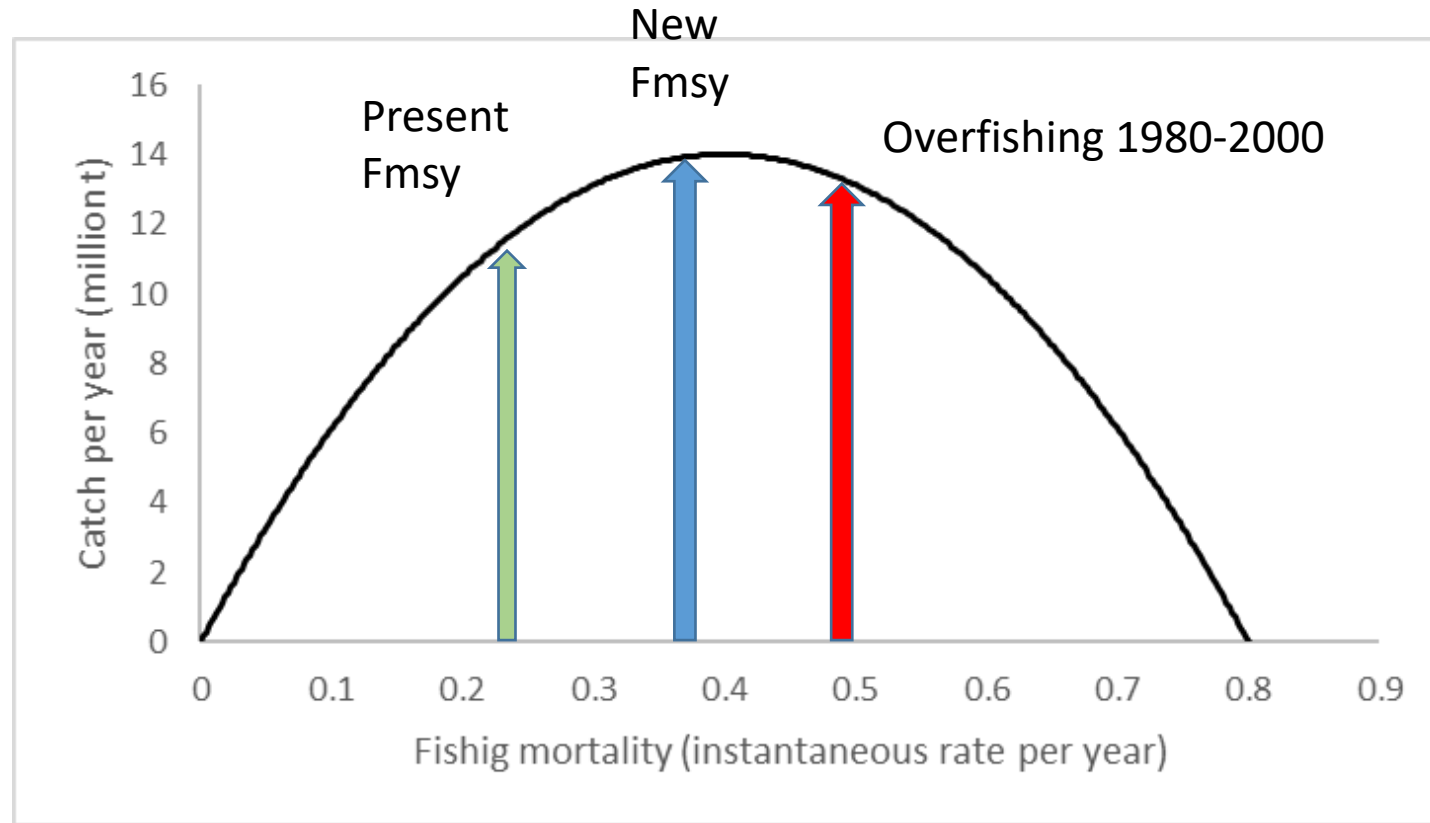


**Ministry of Environment
and Food of Denmark**
Danish Veterinary and
Food Administration

My background

- DTU AQUA 1983-1992
- International Council for the Exploration of the Sea (ICES) 1992-2016
- Nordic Marine Think Tank 2016-2019
- University of Copenhagen 2020-present
- Scientific advice on fisheries management - 39 years

What is Maximum Sustainable Yield?



Density dependence is important when fish stocks rebuild...

Like thinning the radish....

...you get a higher yield by having fewer radish/fish in the population



Because individual fish:

1. Grow better
2. Has reduced natural mortality
3. Produce more eggs

When the stock is small, individual fish:

1. Grow better
2. Have reduced natural mortality
3. Produce more eggs



Challenge

- ICES current Fmsy estimates ignores elements of density dependence → a systematic downward bias.
- The Fmsy-project found: the real Fmsy values are 50% higher than the current values.

This does not only have academic relevance.

It means that managers - following the ICES advice in the belief they get something close to the maximum sustainable yield in the long term - in fact get several million tons less per year. This represents several billion Euros per year in lost income.

Urgent change needed

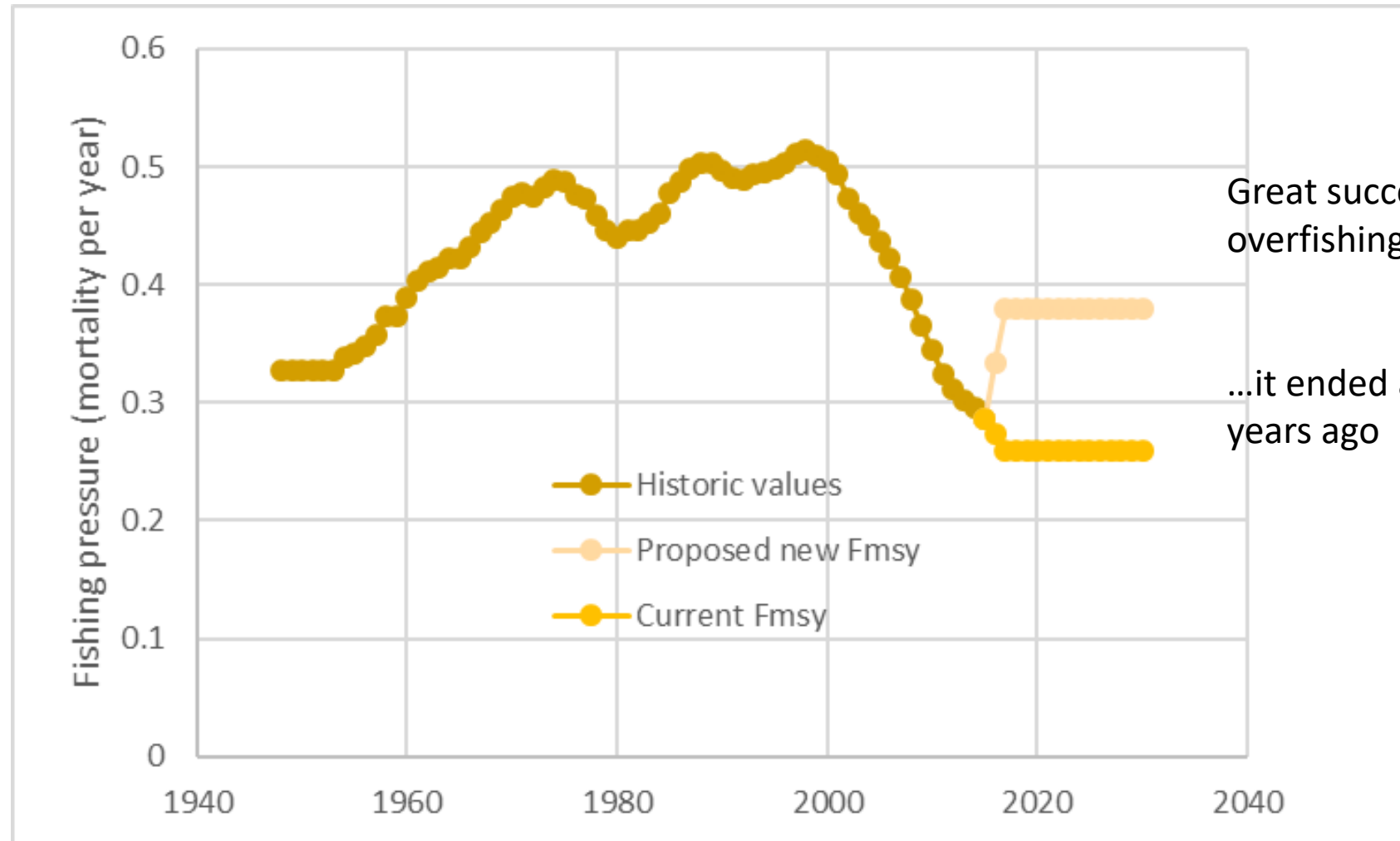
- ICES is a "super tanker" - changing ICES approach takes about 10 years – you have to reach out to 4000 scientists.
- Can society afford waiting?
- One solution is to use the new Fmsy values now.
- ...and let ICES refine the new Fmsy values over the coming 10 years.

The Fmsy-project proposes a new set of Fmsy values for 53 data rich stocks in the North Atlantic

They are:

- with no systematic bias known to science
- verified by the available science on ecosystem functioning

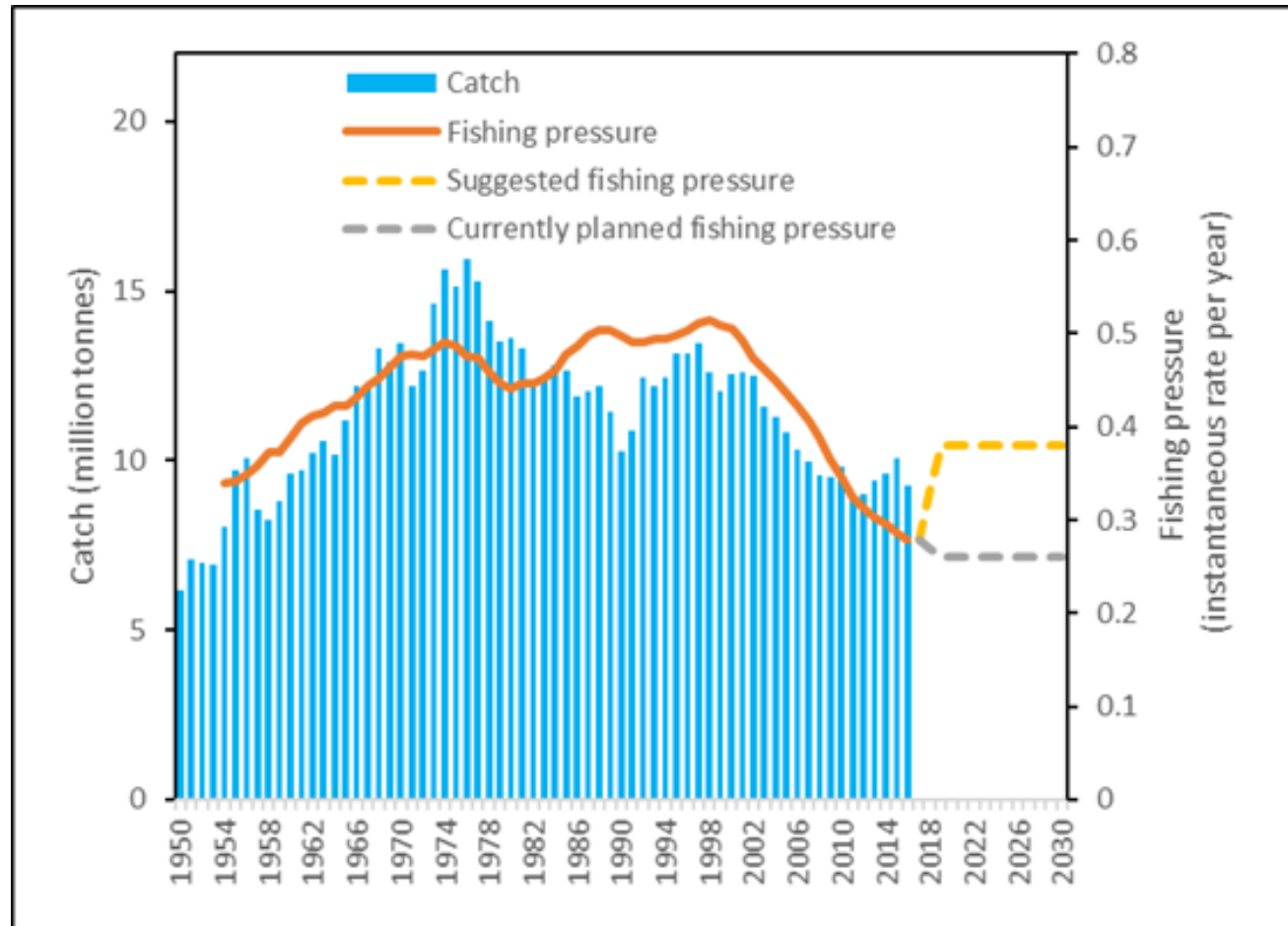
Historic fishing pressure in the Northeast Atlantic — indexed by the 53 ICES stocks in the Fmsy project.



Great success story –
overfishing has ended!!

...it ended about 10
years ago

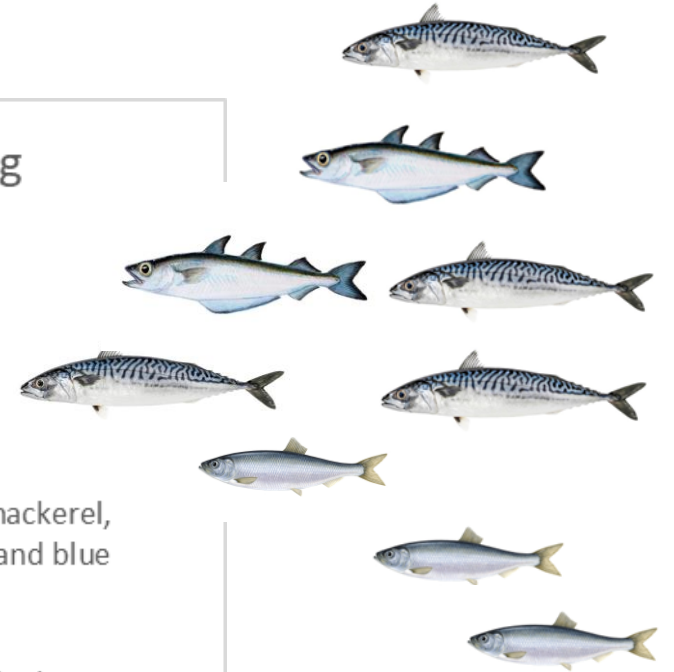
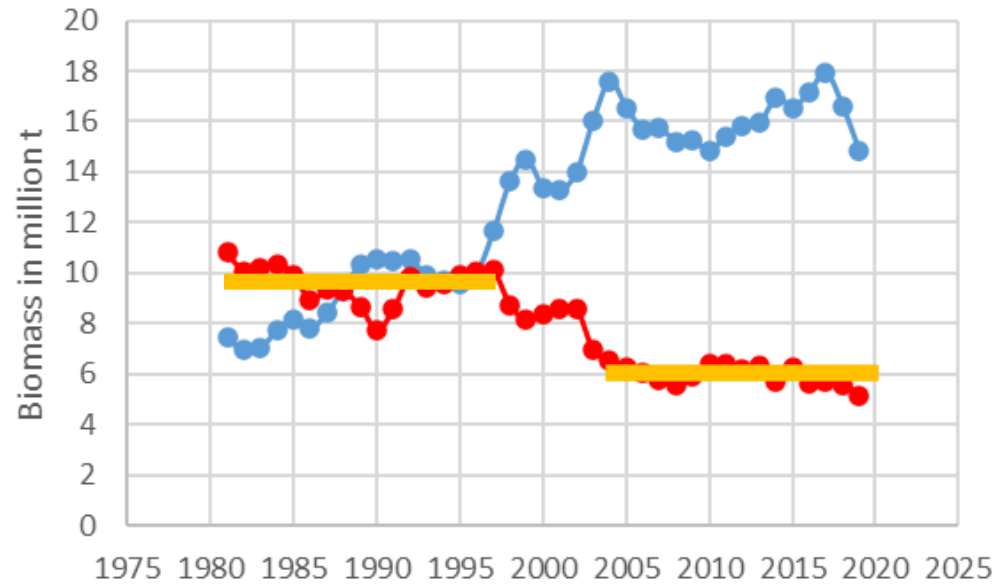
...overlayed with catch in Northeast Atlantic...



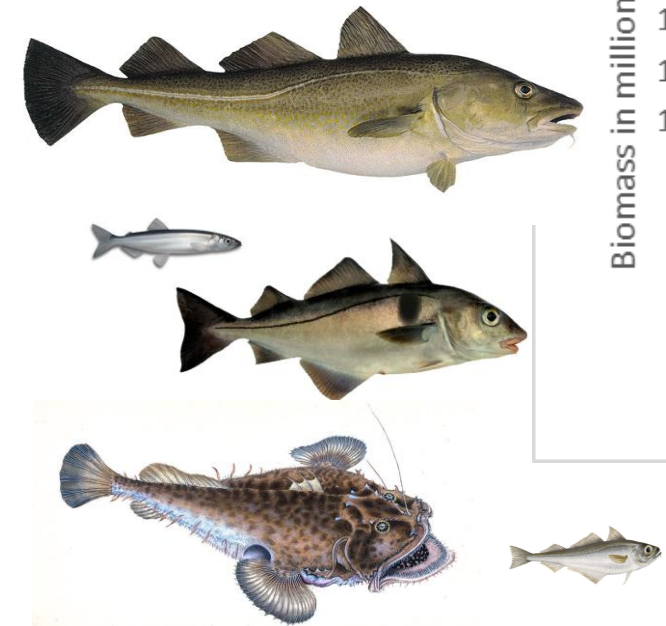
Where is the "long-term gain" for the "short-term pain"???

The "three big pelagics" likely too abundant...

Biomass (SSB) of mackerel, herring and blue whiting and catch of other species in the NE Atlantic



When the pelagics goes up → the catch of other species goes down



We suggest, managers still do not need to consider the balance between species for using the proposed set of F_{MSY} values.

- The Fmsy-project does not suggest a full multispecies approach, ...but is much closer to it than the current approach.

Example blue whiting: A sustainable gain can be obtained already in 2022 – new Fmsy = 0.44

ICES Advice on fishing opportunities, catch, and effort
whb.27.1-91214

Published 30 September 2021

Table 2 Blue whiting in subareas 1–9, 12, and 14. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2022)	F (2022)	SSB (2023)	% SSB change *	% catch change **	% advice change ***
ICES advice basis						
Long-term management strategy F = F _{MSY}	752736	0.32	4052163	19.1	-39.4	-19.0
Other scenarios						
MSY approach: F _{MSY}	752736	0.32	4052163	19.1	-39.4	-19.0
F = 0	0	0	4738902	39.2	-100	-100
F _{pa}	752736	0.32	4052163	19.1	-39.4	-19.0
F _{lim}	1695700	0.88	3214818	-5.5	36.4	82.5
SSB ₂₀₂₃ = B _{lim}	3797974	3.93	1500000	-55.9	205.6	308.7
SSB ₂₀₂₃ = B _{pa}	2838799	2.03	2250000	-33.9	128.4	205.5
SSB ₂₀₂₃ = MSY B _{trigger}	2838799	2.03	2250000	-33.9	128.4	205.5
F = F ₂₀₂₁	1113313	0.51	3728501	9.5	-10.4	19.8
SSB ₂₀₂₃ = SSB ₂₀₂₂	1479984	0.73	3403629	0	19.1	59.3
Catch ₂₀₂₂ = Catch ₂₀₂₁	1242727	0.58	3613292	6.2	0	33.7
Catch ₂₀₂₂ = Catch ₂₀₂₁ -20%	994181	0.44	3834987	12.7	-20	7.0
Catch ₂₀₂₂ = Catch ₂₀₂₁ +25%	1553403	0.78	3339158	-1.9	25	67.2
Catch ₂₀₂₂ = Advice ₂₀₂₁ -20%	743434	0.32	4060575	19.3	-40.2	-20

* SSB 2023 relative to SSB 2022.

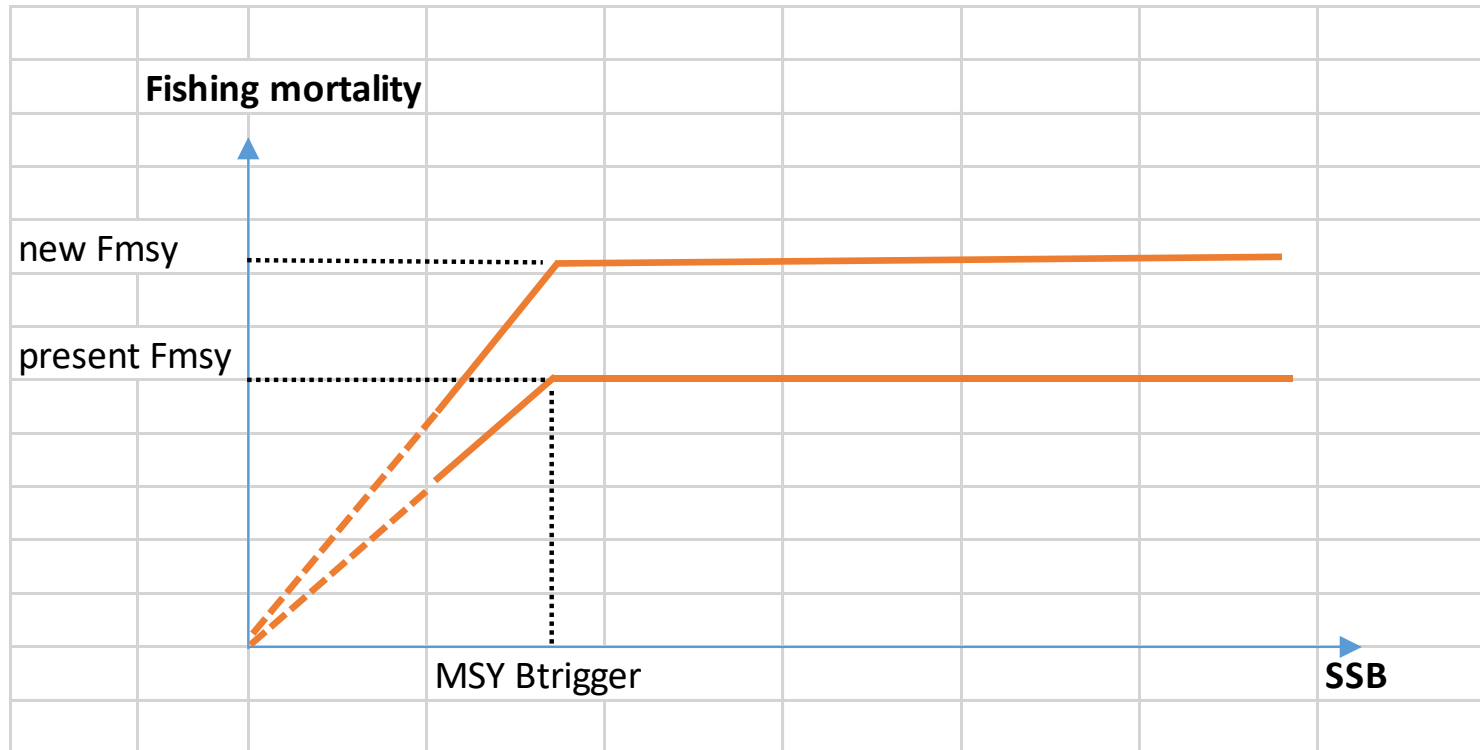
** Catch 2022 relative to expected catch in 2021 (1 242 727 tonnes).

*** Catch 2022 relative to advice for 2021 (929 292 tonnes).

This means a 241000 t higher TAC in 2022 than based on the current Fmsy

- No short term pain!
- The pain has already been taken over the past decades where overfishing was overcome.

ICES Harvest Control Rule still applies and will take care of the "precautionary approach"



Argument against the new Fmsy values

”ICES Fmsy includes a precautionary element, the new ones does not...”

Yes, right... ...and the reasons are:

- We don't think it is correct to include a management objective in a scientific concept like Fmsy. Science should be neutral, unbiased and non-political.
- The present Fmsy is not the fishing pressure that gives msy (maximum sustainable catch) – very confusing and non-transparent.
- Inconsistent with what is done on other parts of the World.
- Will make the management in the Northeast Atlantic look worse than it is, because fishing pressures will be compared with too low Fmsy values (See e.g. FAO The State of Worlds Fisheries, 2020).

But the management is still precautionary, because F is reduced when the stock is small (see previous slide) - only a 5% risk to get below Blim.

ICES use the Fmsy-project approach routinely for data-poor stocks

- Why should data rich stocks have a higher degree of precautionarity?
- It should rather be the other way around - the less data you have about a stock, the more precautionary you should be!!

Urgently need to change

— loosing at least 2-3 million t in foregone catch per year!

...not like a too low TAC in one year, where the extra amount of surviving fish can be added to the TAC the following year, because:

- the fish has been eaten by larger fish;
- reduced individual fish growth has already been realised due to food competition.

With an average price of about 1 Euros per kg, 2-3 million t is equal to a loss of 2-3 billion Euros for each year the switch to the new Fmsy values is postponed.

Conclusion

1. The new Fmsy values are without any bias known to science
2. Ecosystem functioning is much better accounted for
3. It can be implemented now
4. There is a long-term gain for yield
5. There is also a short-term gain for yield
6. ICES already use the approach for data-poor stocks

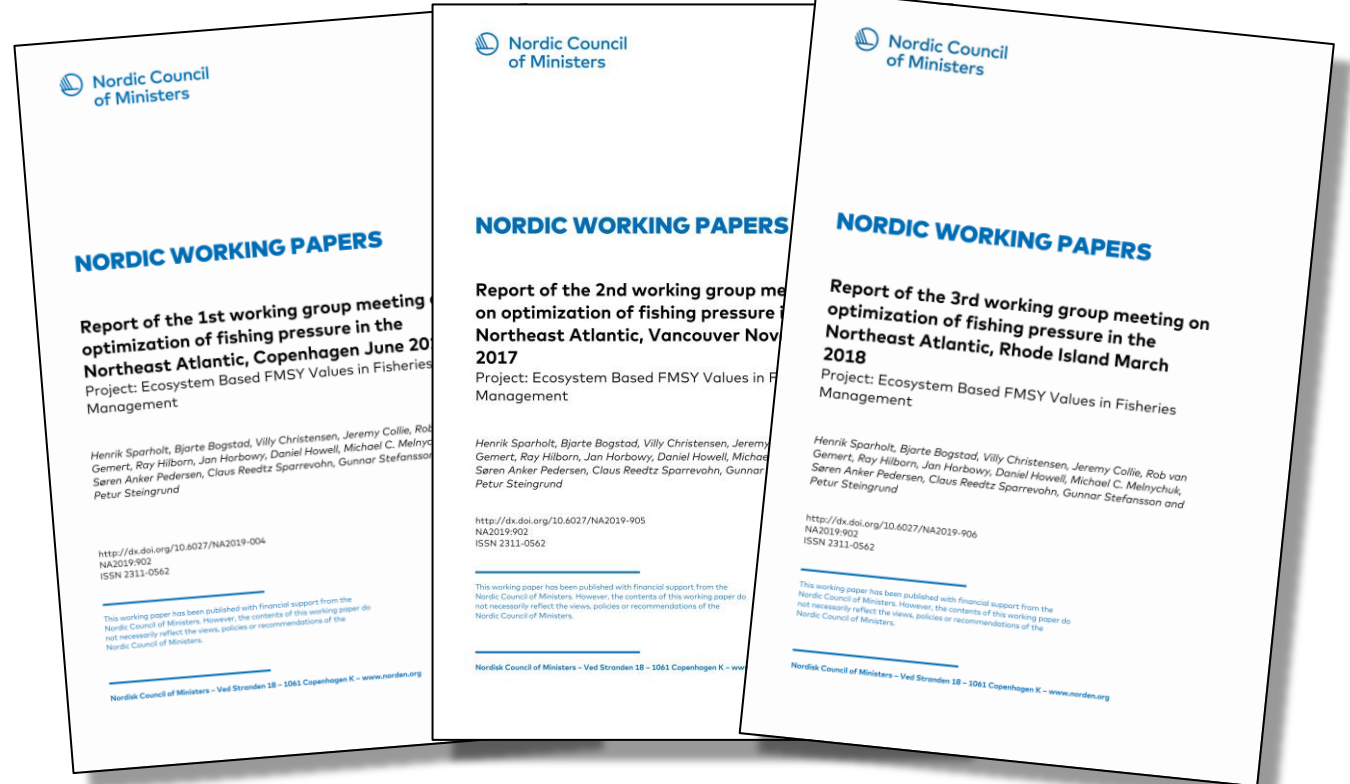
General:

Avoid a loss of 2-3 million t foregone catch per year by applying the new Fmsy values now.



Published here:

- <https://www.fmsyproject.net/reports>



Original Article

Estimating F_{msy} from an ensemble of data sources to account for density dependence in Northeast Atlantic fish stocks

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Sparholt, H., Bogstad, B., Christensen, V., Collie, J., van Gemert, R., Hilborn, R., Horbowy, J., Howell, D., Melnychuk, M. C., Pedersen, S. A., Sparrevoth, C. R., Stefansson, G., and Steingrund, P. Estimating F_{msy} from an ensemble of data sources to account for density dependence in Northeast Atlantic fish stocks. – ICES Journal of Marine Science, 78: 55–69.

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A new approach for estimating the fishing mortality benchmark F_{msy} (fishing pressure that corresponds to maximum sustainable yield) is proposed. The approach includes density-dependent factors. The analysis considers 53 data-rich fish stocks in the Northeast Atlantic. The new F_{msy} values are estimated from an ensemble of data sources: (i) applying traditional surplus production models on time-series of historic stock sizes, fishing mortalities and catches from the current annual assessments; (ii) dynamic pool model (e.g. age-structured models) estimation for stocks where data on density-dependent growth, maturity, and mortality are available; (iii) extracts from multispecies and ecosystem literature for stocks where well-tested estimates are available; (iv) the “Great Experiment” where fishing pressure on the demersal stocks in the Northeast Atlantic slowly increased for half a century; and (v) linking F_{msy} to life history parameters. The new F_{msy} values are substantially higher (average equal to 0.38 year⁻¹) than the current F_{msy} values (average equal to 0.26 year⁻¹) estimated in stock assessments and used by management, similar to the fishing pressure in the 1960s, and about 30% lower than the fishing pressure in 1970–2000.

Keywords: density dependent, ecosystem, F_{msy} , fisheries, meta-analysis, management

Introduction

Overfishing has been, and still is, a major problem worldwide. In previous decades, when many stocks in the Northeast Atlantic were overexploited and fisheries managers became increasingly

pressured to reduce effort, it became clear that management approaches had to be precautionary to promote rebuilding and limit the risk of collapses under sustained fishing pressure. More recently, this precautionary approach has been supplemented by

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Presented at
several conferences

ICES Theme session Q
(co-sponsored by PICES) --

Sustainability thresholds and
ecosystem functioning: the selection,
calculation, and use of reference
points in fisheries management



The poster features a central image of a harbor at dusk with city lights and boats. The text is arranged in a clean, modern layout with a color palette of blue, orange, and white. The title 'ICES 2018 ANNUAL SCIENCE CONFERENCE' is prominent at the top left. The dates and location are at the top right. The 'KEYNOTES' section lists three topics with their respective speakers and affiliations. The bottom of the poster contains social media information and logos for ICES, THÜNEN, and the Federal Ministry of Food and Agriculture.

ICES 2018
ANNUAL SCIENCE CONFERENCE

24-27 September 2018
University of Hamburg, Germany

KEYNOTES

Integrating ecological and economic perspectives on regime shifts in harvested marine ecosystems
Martin Quast, Kiel University, Germany & Christian Möllmann, University of Hamburg, Germany

Unexpected outcomes and unpredictable managers, fishers, and scientists
Ingrid van Putten, CSIRO Oceans and Atmosphere, Australia

Understanding deep-sea Atlantic ecosystems at ocean basin scale
Moray Roberts, University of Edinburgh, United Kingdom

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WWW.ICES.DK/ASC2018

ICES CIEM

THÜNEN

Federal Ministry of Food and Agriculture



Conference 10-11 October 2018

With managers,
stakeholders and scientists



CONFERENCE ON IMPROVED FISHERIES MANAGEMENT MODELS Copenhagen 8th October 2019

Stakeholders, managers, scientists, NGOs

Discussion points for the panel:

1. Should we implement the new Fmsy values now? – it will give a higher short-term yield as well as a higher long-term yield, but probably needs to revert to ICES default HCR.
2. Should ICES continue to apply a precautionary cut of Fmsy or is it “double” precautionarity? – it mean that the risk for the stock to get below Blim will in most years be substantially lower than 5% (which is not needed) and the cost is reduced long-term yield.



Thank you!