Ministry of Environment and Food of Denmark
Environmental Protection Agency

WFD: Coastal Water Management

Methods for establishing the maximum allowable input and need for nutrient reduction to the coastal waters

Indicators

Measures

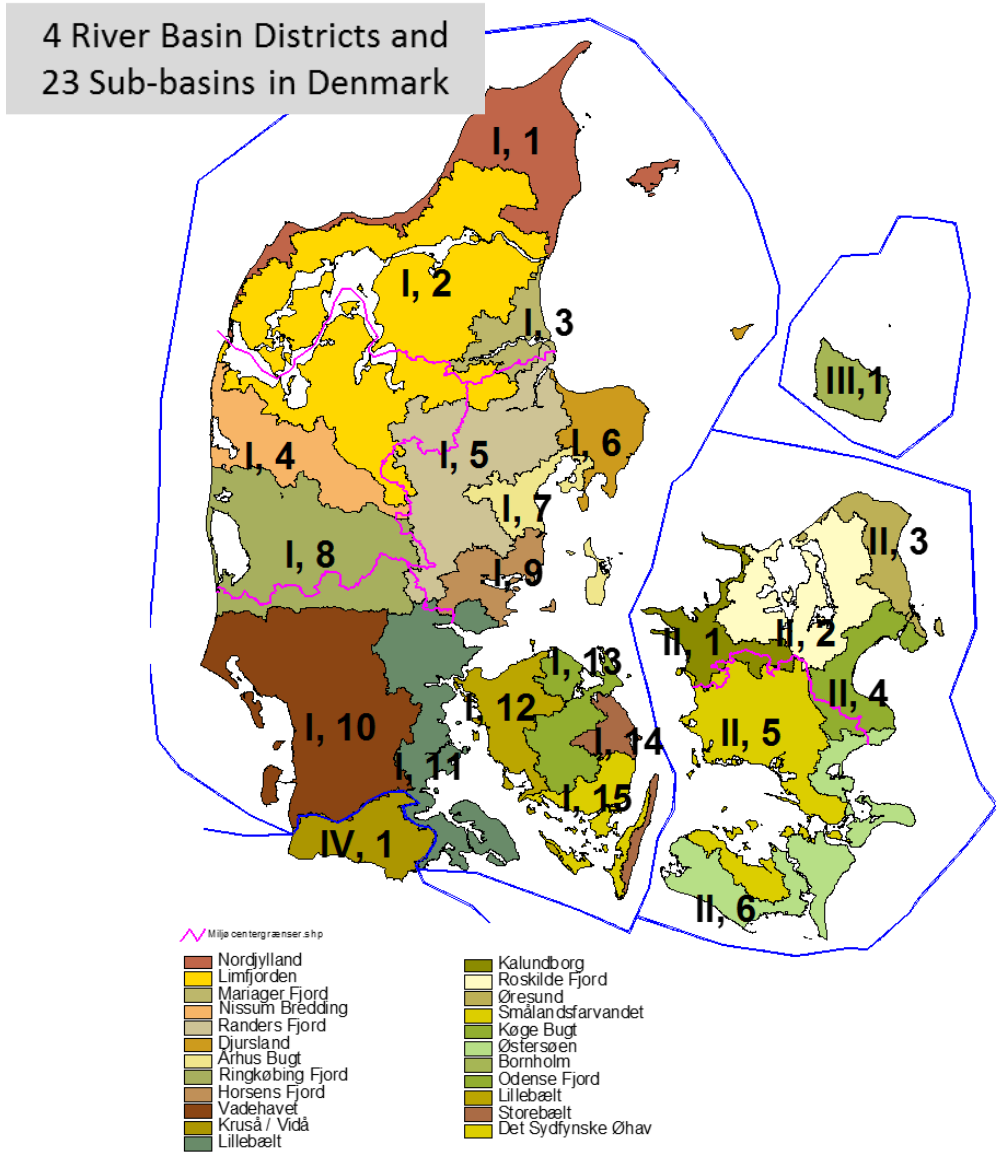
Stig Eggert Pedersen

9th Nordic WFD meeting
Waasa , Finland
21-23 May 2019
Stig Eggert Pedersen
Chiefadvisor

Danish River Basin Management Plans 2015-2021

Main characteristics:

- 4 River Basin Districts
- 23 Sub Basins
- 119 Coastal WB
- 857 Lake WB
- Aprox. 19.000 km Water Courses
- Aprox. 400 Groundwater WB

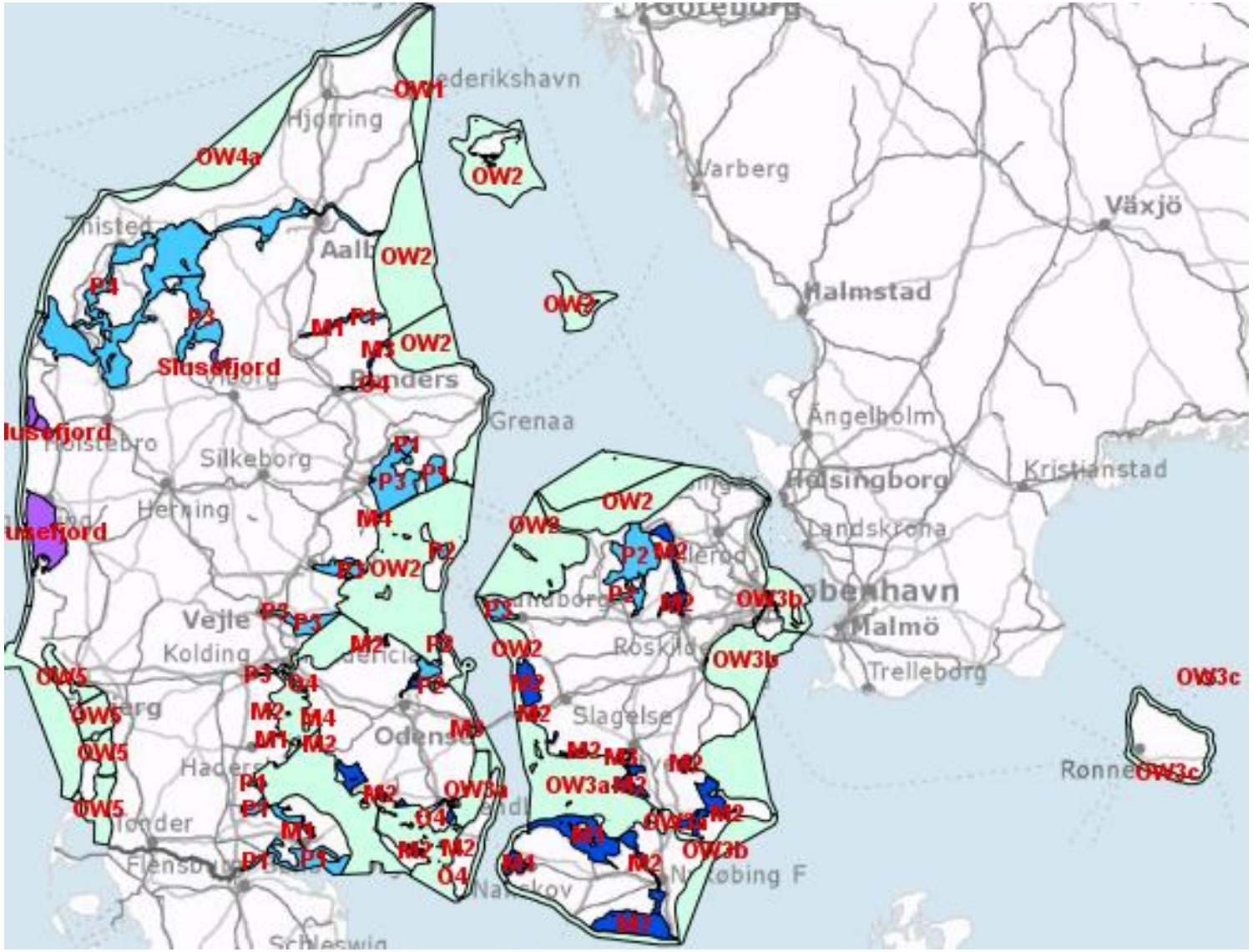


Danish RBMP 2015-2021

Coastal waters - characteristics

119 coastal waterbodies (WB) identified

- 17 types of waterbodies
  - fiord-types: 84 WB
  - Open water types: 35 WB



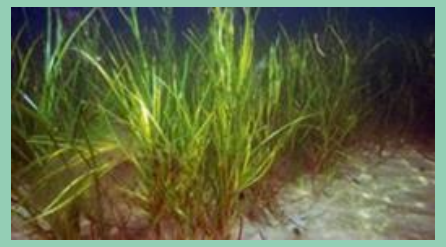
Danish RBMP 2015-2021

Coastal waters – status classification

98 % of the coastal waters do not fulfill the environmental objectives

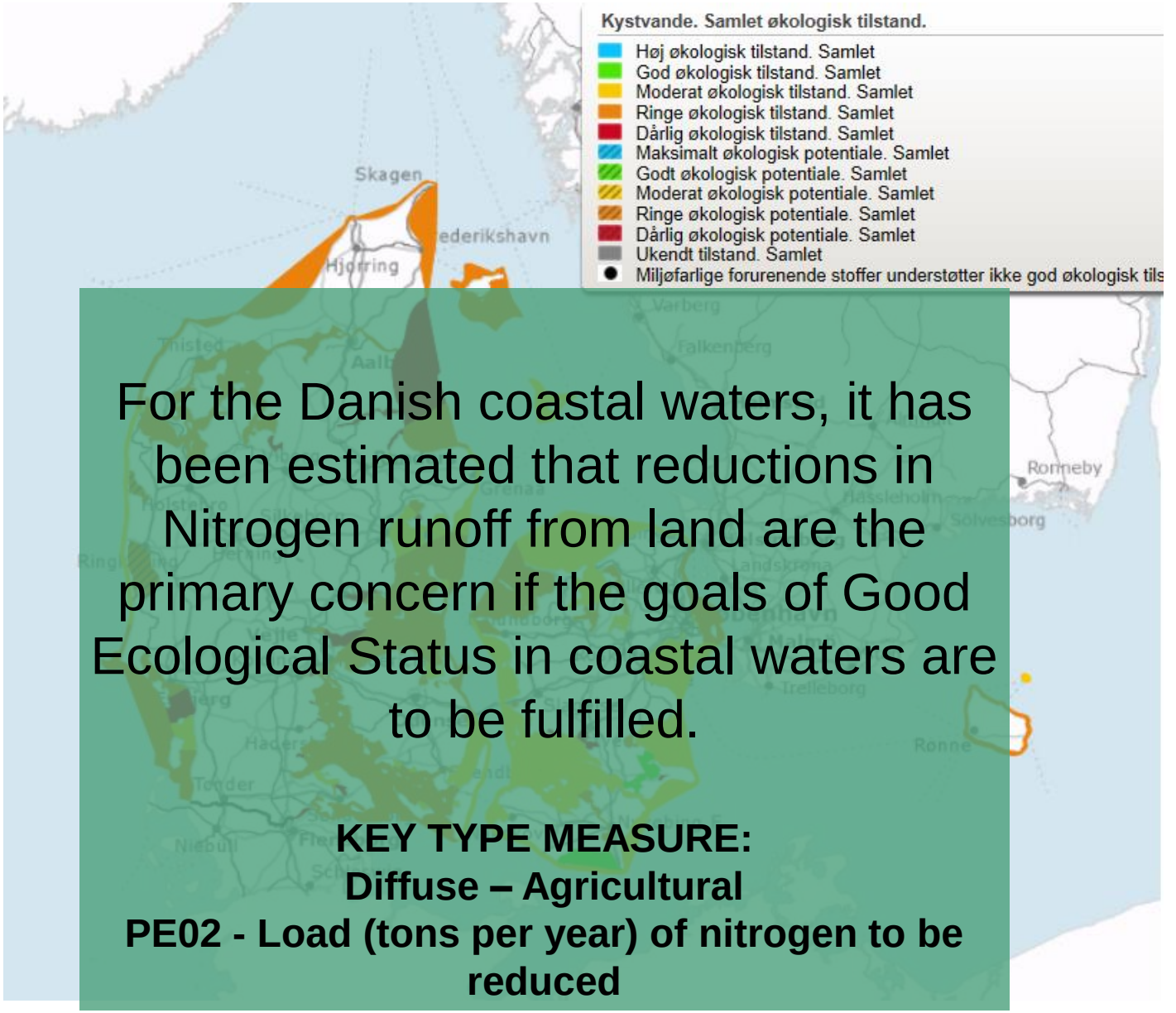
Indicators:

- Eelgrass



- Chlorophyll

- Bottom fauna index (DKI)



For the Danish coastal waters, it has been estimated that reductions in Nitrogen runoff from land are the primary concern if the goals of Good Ecological Status in coastal waters are to be fulfilled.

KEY TYPE MEASURE:
Diffuse – Agricultural
PE02 - Load (tons per year) of nitrogen to be reduced

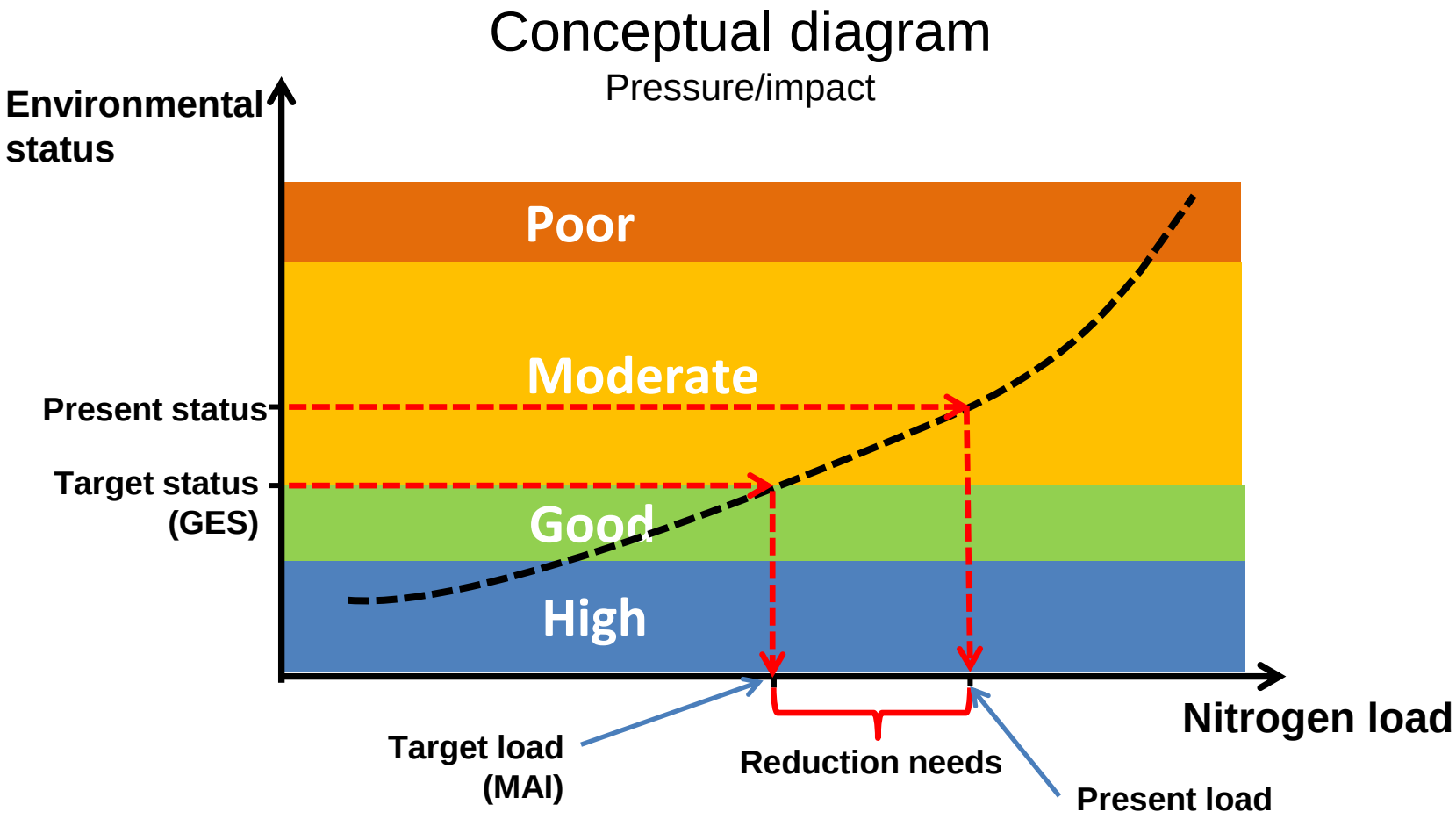
Danish RBMP 2015-2021

Modeling of target load (MAI) supporting Good Environmental Status (GES)

THE BASIS:

- Indicators defining MAI:
  - Eelgrass
  - Chlorophyll
- Ecosystem modelling tools (pressure/impact modelling):
  - Statistical and mechanistic ecosystem models covering all Danish marine WB

https://mst.dk/natur-vand/vandmiljoe/vandomraadeplaner/vandomraadeplaner-2015-2021/supplerende-oplysninger/

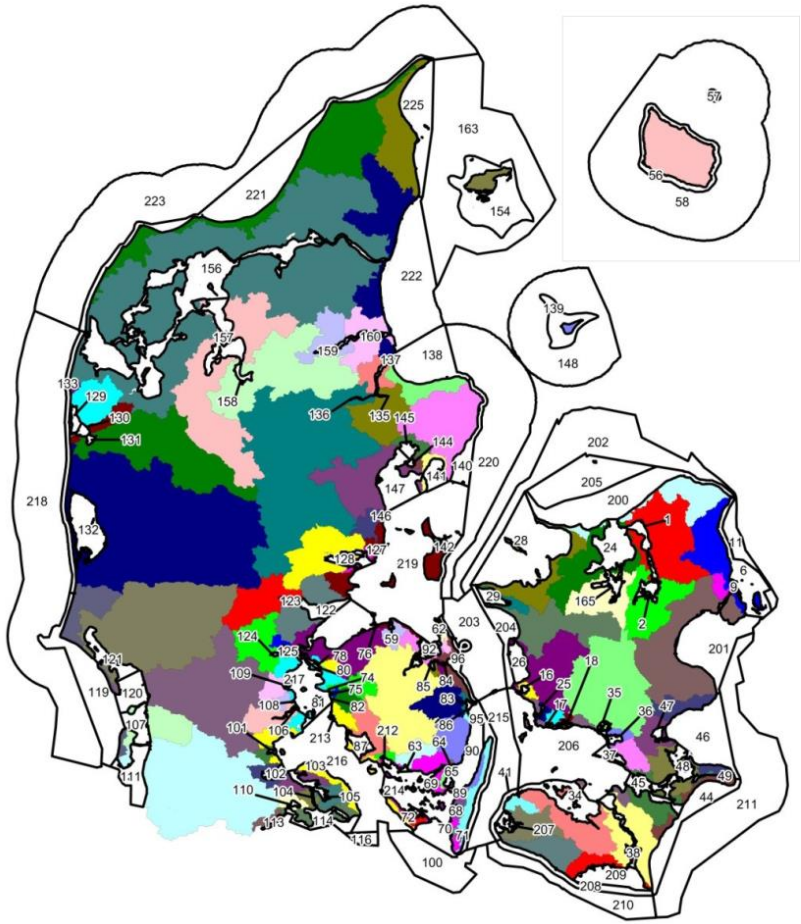


Danish RBMP 2015-2021

The calculated Maximum Allowable Input (MAI) and need for nutrient reduction is related each of the WB's

Target loads (MAI) and measures are differentiated on 90 catchments

Vandområdeplan 2015-2021 Kystvande Belastning, målbelastning, bruttoindsatsbehov og indsatser. Kvælstof		Belastning 2012	Baseline effekt* (neg. værdier = merudledning)	Baseline belastning 2021 (effekt af lempelser indregnet)	Målbelastning	Indsatsbehov (efter baseline)	Forventet effekt af kvælstofindsats 2015 - 2021								Forventet reduktion ud over målbelastning (efter 2021)	Udskudt indsats (efter 2021)
							Vådområder	Lavbunds projekter	Minivåd områder	Skovrejsning	Miljøfokus områder (MFO)	Målrettet regulering	Spildevand	Samlet effekt af indsats		
ID	Vandområde	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år	Tons/år
Vandområdedistrikt Jylland og Fyn																
Hovedvandopland 1.1 Nordlige Kattegat og Skagerrak		3 096,1	-26,6	3 122,8	3 455,2	186,3	0,0	0,2	1,2	0,2	47,4	123,7	0,2	173,9	545,0	38,7
154, 222, 225	Åbne vandomr. Gr. II – Kattegat	1 757,7	-15,8	1 773,5	2 292,2	-518,7	0,0	0,0	0,0	0,0	26,0	0,0	0,2	26,3	545,0	0,0
221	Åbne vandomr. Gr. I – Skagerrak og Vesterhavet	1 338,5	-10,9	1 349,3	1 163,0	186,3	0,0	0,2	1,2	0,2	21,5	123,7	0,0	147,6	0,0	38,7
Hovedvandopland 1.2 Limfjorden		11 911,2	525,9	11 385,3	7 758,1	3 627,2	361,5	35,8	227,3	35,9	164,9	923,4	3,7	1 766,5	0,0	1 860,8
156	Nissum Bredning, Thisted Bredning, Kås Bredning, Løgstør Bredning, Nibe Bredning og Langerak	8 627,4	341,2	8 286,2	6 164,1	2 122,1	241,5	27,7	175,4	27,7	109,4	648,0	3,3	1 237,8	0,0	884,3
157	Bjørnholms Bugt, Riisgårde Bredning, Skive Fjord og Lovns Bredning	1 548,4	56,2	1 492,2	810,2	681,9	54,7	3,9	24,5	3,9	29,4	127,5	0,2	251,5	0,0	430,4
158	Hjarbæk Fjord	1 735,3	128,4	1 606,9	783,7	823,2	65,2	4,3	27,4	4,3	26,1	147,9	0,2	277,1	0,0	546,1
	Ingen åbne vandområder															
Hovedvandopland 1.3 Mariager Fjord		880,1	111,7	768,4	586,0	182,4	23,9	3,7	23,4	3,7	11,8	71,0	0,0	137,5	0,0	44,9
159	Mariager Fjord, indre	880,1	111,7	768,4	586,0	182,4	23,9	3,7	23,4	3,7	11,8	71,0	0,0	137,5	0,0	44,9
160	Mariager Fjord, ydre															
	Ingen åbne vandområder															
Hovedvandopland 1.4 Nissum Fjord		2 022,3	-2,6	2 024,9	1 300,6	724,3	34,0	2,5	15,8	2,5	32,3	136,6	0,4	235,1	0,0	489,2
129	Nissum Fjord, ydre															

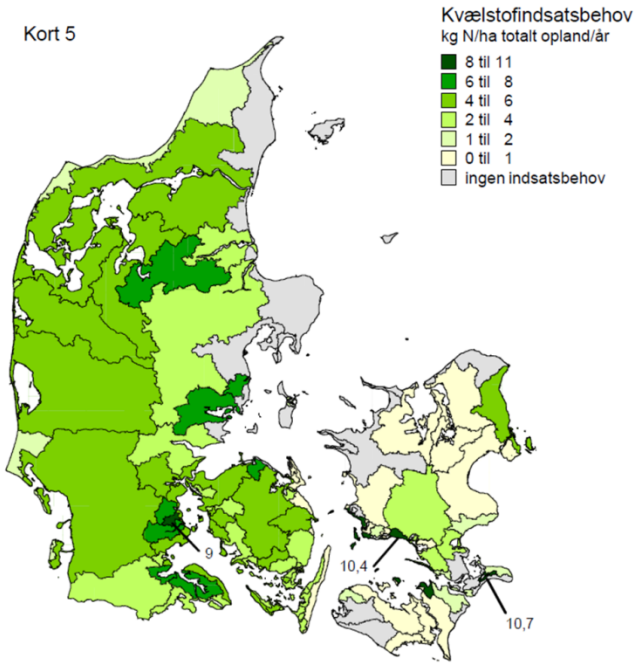


Danish RBMP 2015-2021

Coastal waters – Nitrogen reduction needs

The calculation of Nitrogen load reduction needs to support fulfilment of GES **Key figures**	**Land based load** **Tons Nitrogen/year**
• **Status load 2010-2014**	**56.800**
• Baseline 2021 – effect of measures 2010-2015 and development in land use until 2021 etc.	5.600 (decreased load)
• Baseline 2021 - effect of less restrictive nitrogen regulation 2016-2021 as a consequence of the political Agreement on Food and Agriculture Package (22 December 2015)	5.200 (increased load)
• **Baseline load 2021**	**56.450**
• **Target load supporting GES** (Max Allowable Input - MAI)	**44.700**
• **Reduction needed to obtain GES** (compared to 2010-14)	**13.100**
• Measures RBMP 2015-2021 – effect of measures	6.900
• Measures - Postponement of needed reduction to the 3rd RBMP period, 2021-2027	6.200

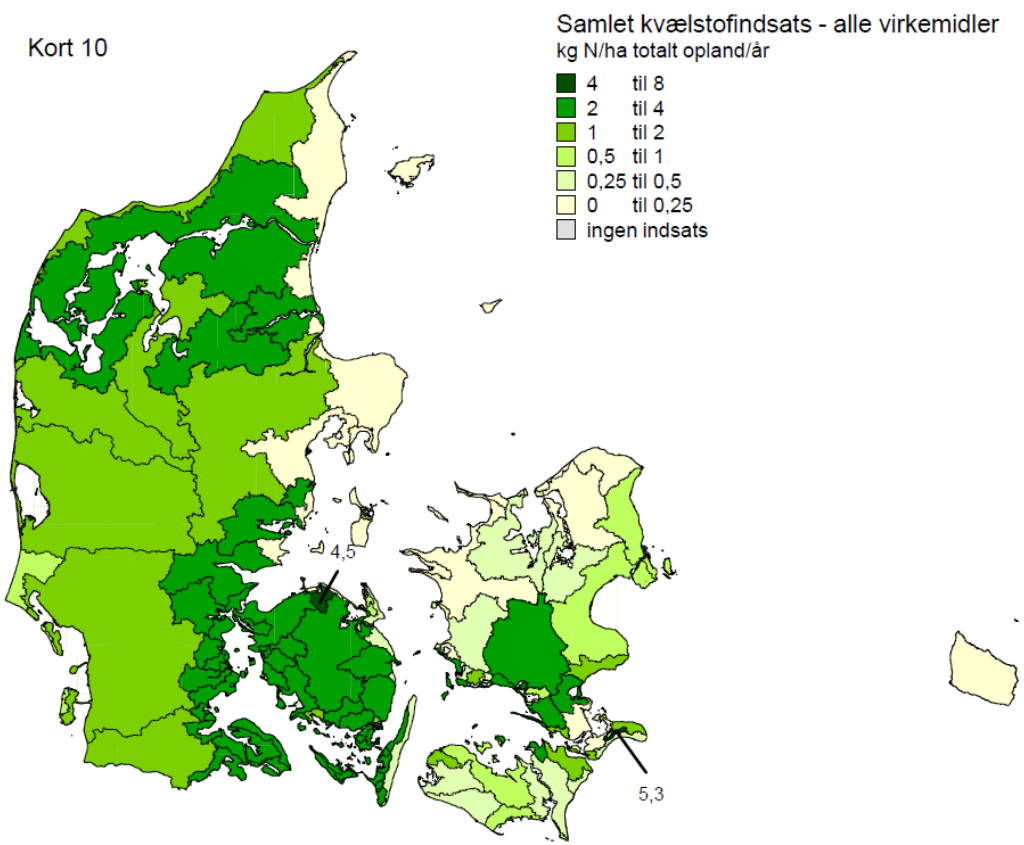
Reduction needs are distributed on 90 sub catchments



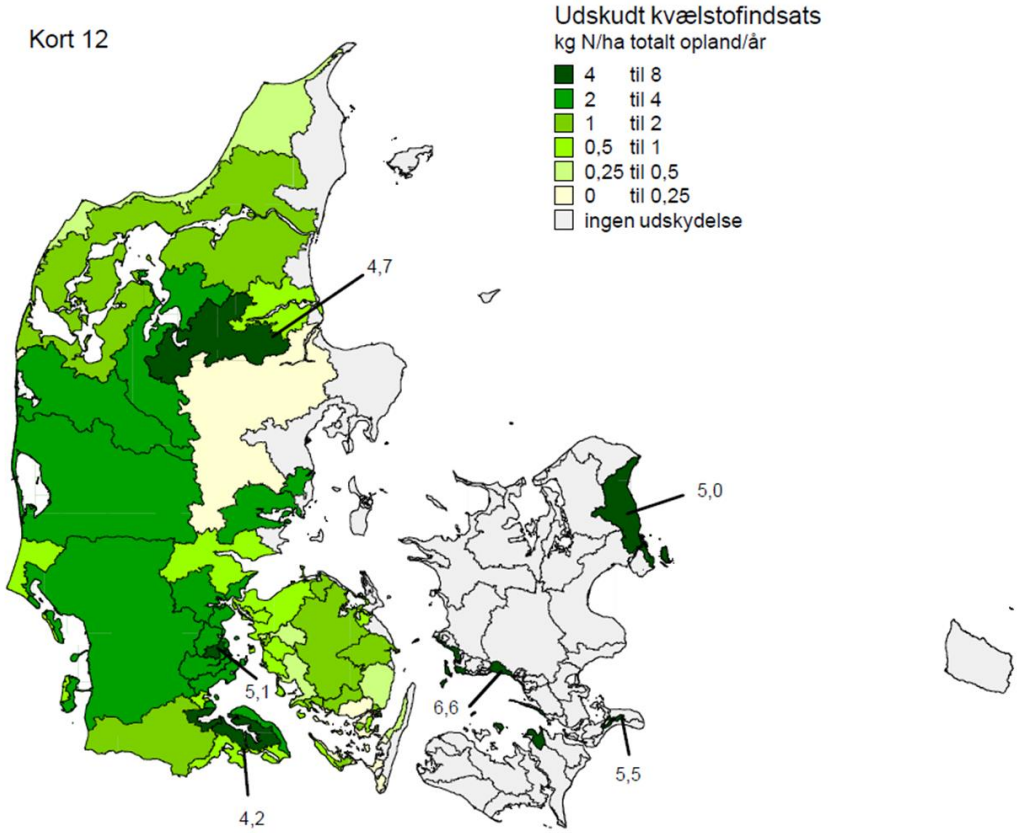
Danish RBMP 2015-2021

Coastal waters – Nitrogen action plan related the individual WB's

Nitrogen measures RBMP 2015-2021
distributed on 90 sub catchments
(6.900 tons N/år)



Postponed Nitrogen efforts/action
distributed on sub catchments
(6.200 tons N/år)



Danish RBMP 2015-2021

Coastal waters – measures

Nitrogen measures - load reductions to Danish coastal waters	Effect of measures (Tonnes N/year)
Voluntary collective measures on farmland:	**2.460**
• Establishment of wetlands (aprox.14.000 hectares)	1.253
• Set-aside of farmland on organogenic soils in river valleys, with the aim of reducing agricultural emissions of greenhouse gases, reducing nitrogen emissions to coastal waters and restoring or improving nature (approx. 4000 hectare)	150
• Establishment of small constructed wetlands (mini-wetlands)	900
• Afforestation (approx. 5.000 hectares)	150
Compulsory measures on farmland:	**4,380**
• Ecological Focus Area (EFA) - the EFA area can be established by buffer strips, catch crops, fallow land, …(approx. 5 % of agricultural land).	866
• A targeted regulation of nitrogen leaching at farm level	3513
Other measures – wastewater treatment etc.	**120**
TOTAL effect of measures	**6.960**

Vådområde ved Bygholm Å ved Kørup Bro, Horsens. Foto: Benny Andersen.

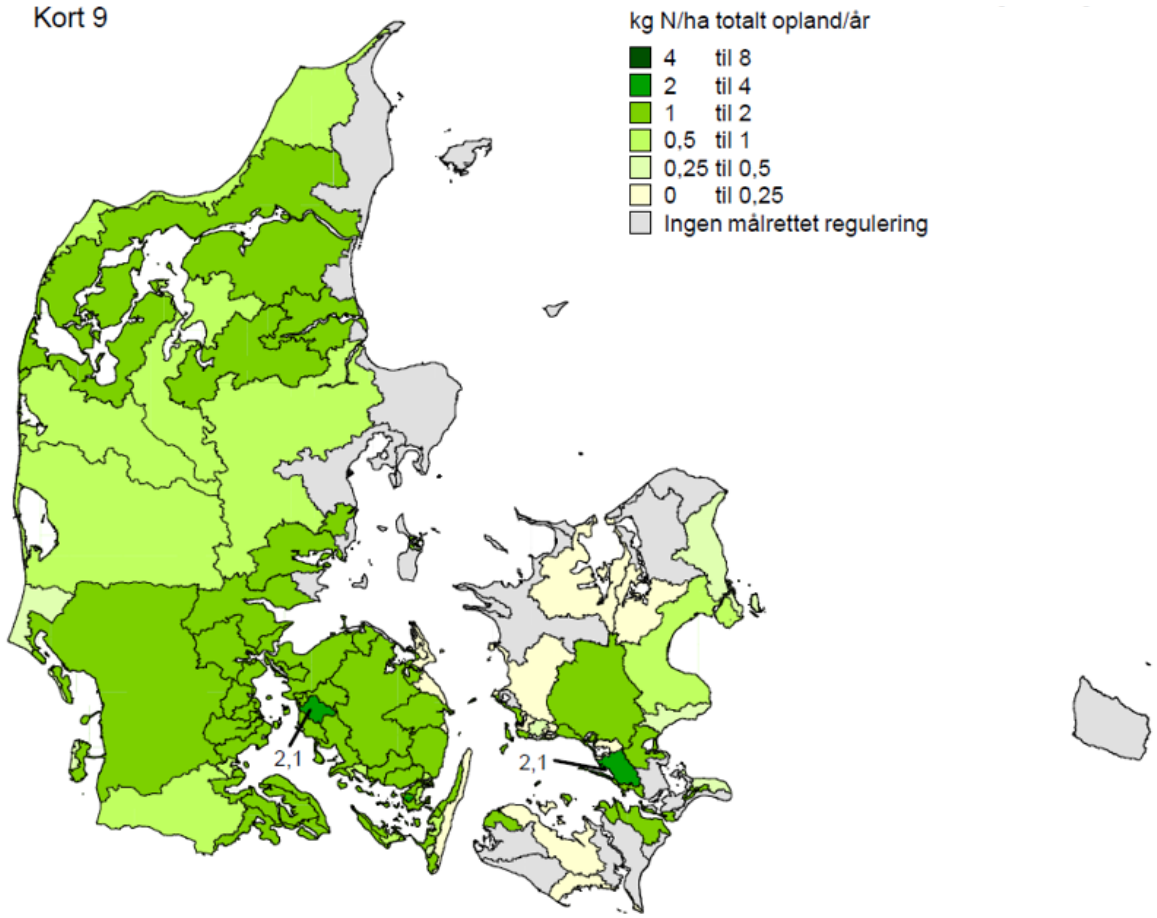
Minivådområde med åbne bassiner i oplandet til Norsminde Fjord. Foto: Susanne Brusvang Hjuler.

Danish RBMP 2015-2021

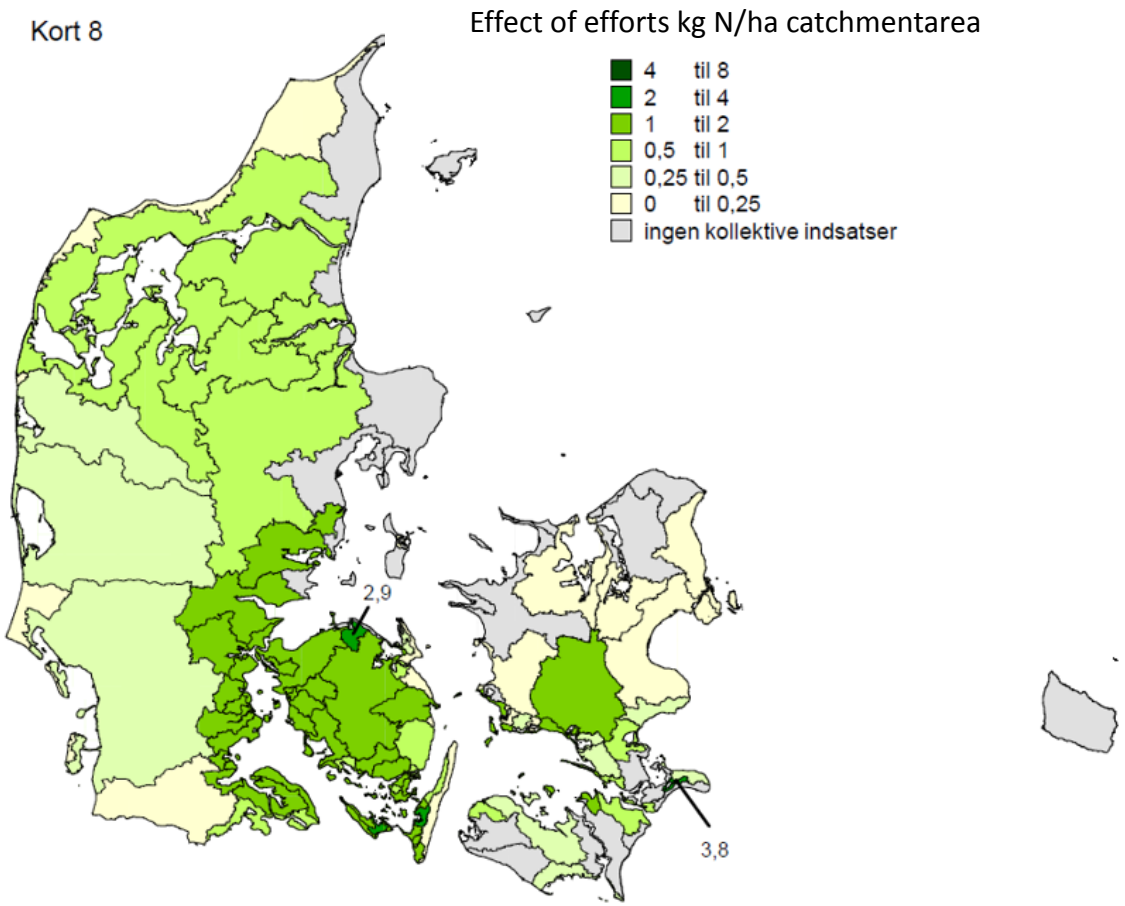
Coastal waters – measures distributed on 90 catchments

Targeted regulation of N leaching on farm level

Effect of efforts kg N/ha catchmentarea.

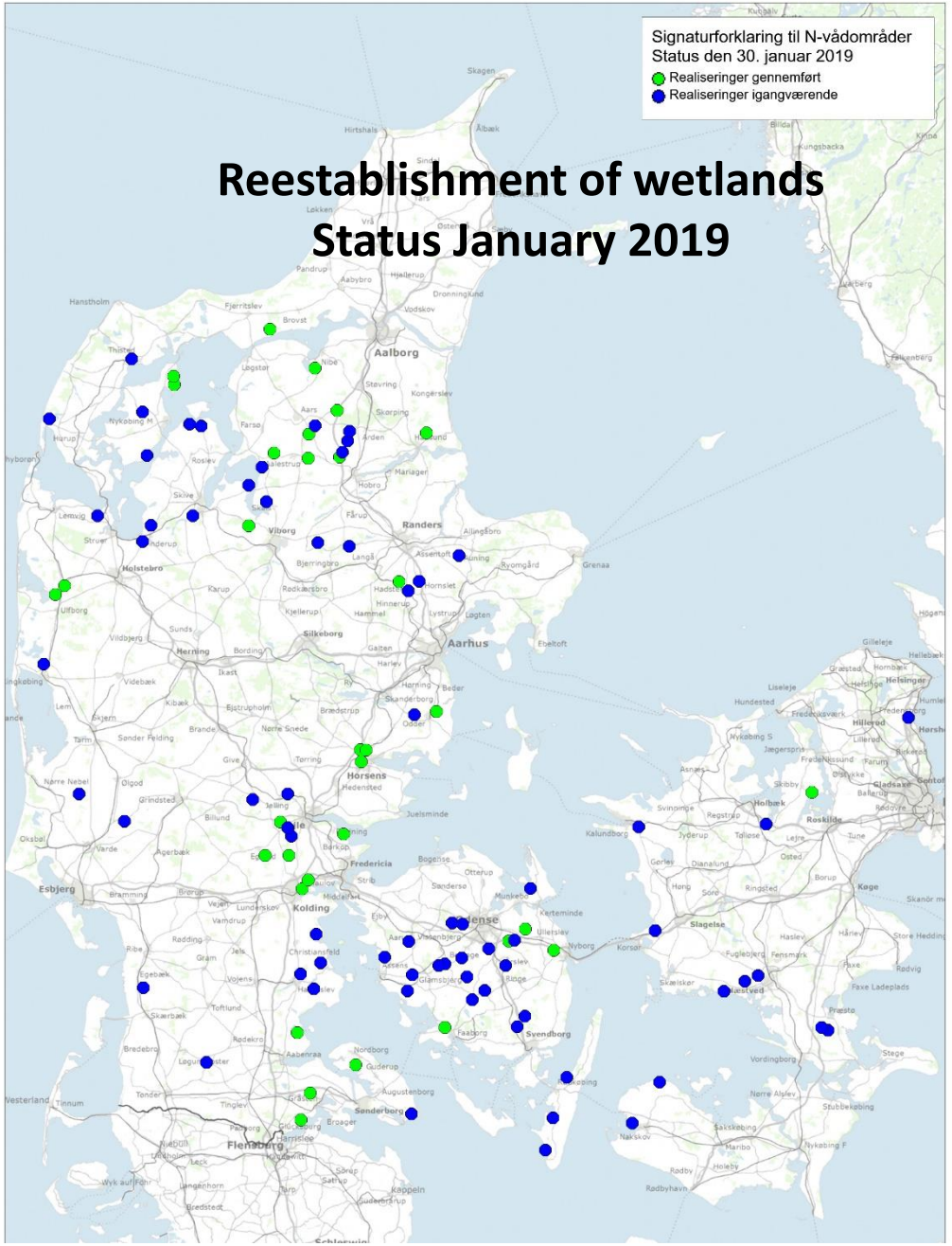


Collective efforts on farmland wetlands, set aside, afforesstation



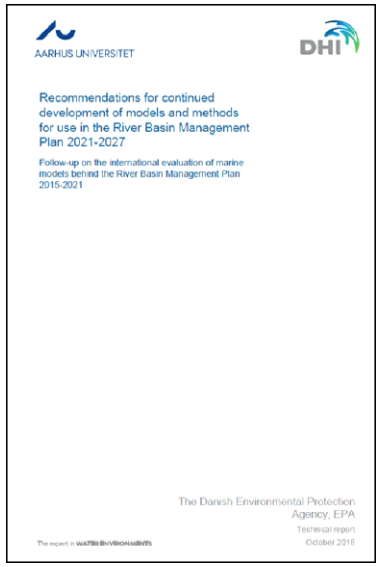
Danish RBMP 2015-2021

Coastal waters – measures



Danish RBMP 2021-2027 - preparation

Coastal waters – projects preparing 3rd cycle of RBMP's



- Project on intensified monitoring of nutrient pressures
- International evaluation of the marine ecosystem models and the model usages for the 2nd cycle RBMP
- Project on refining the characterisation of coastal WB (new improved typology and better estimation of indicator reference conditions)
- New indicators (new macroalgae index)
- Improving the marine ecosystem models according to recommendations from international evaluation (pressure/impact modelling tools)
- Update catalogue of cost effective measures
- Project investigation significance of anthropogenic pressure factors other than nutrient run-off and climate change potentially affecting the coastal environment.

Altogether aiming a more precise allocation of measures to obtain GES in coastal water bodies

https://mst.dk/natur-vand/vandmiljoe/vandomraadeplaner/vandplanprojekter/kystvandsprojekter/


Thank you for your attention…

Extras

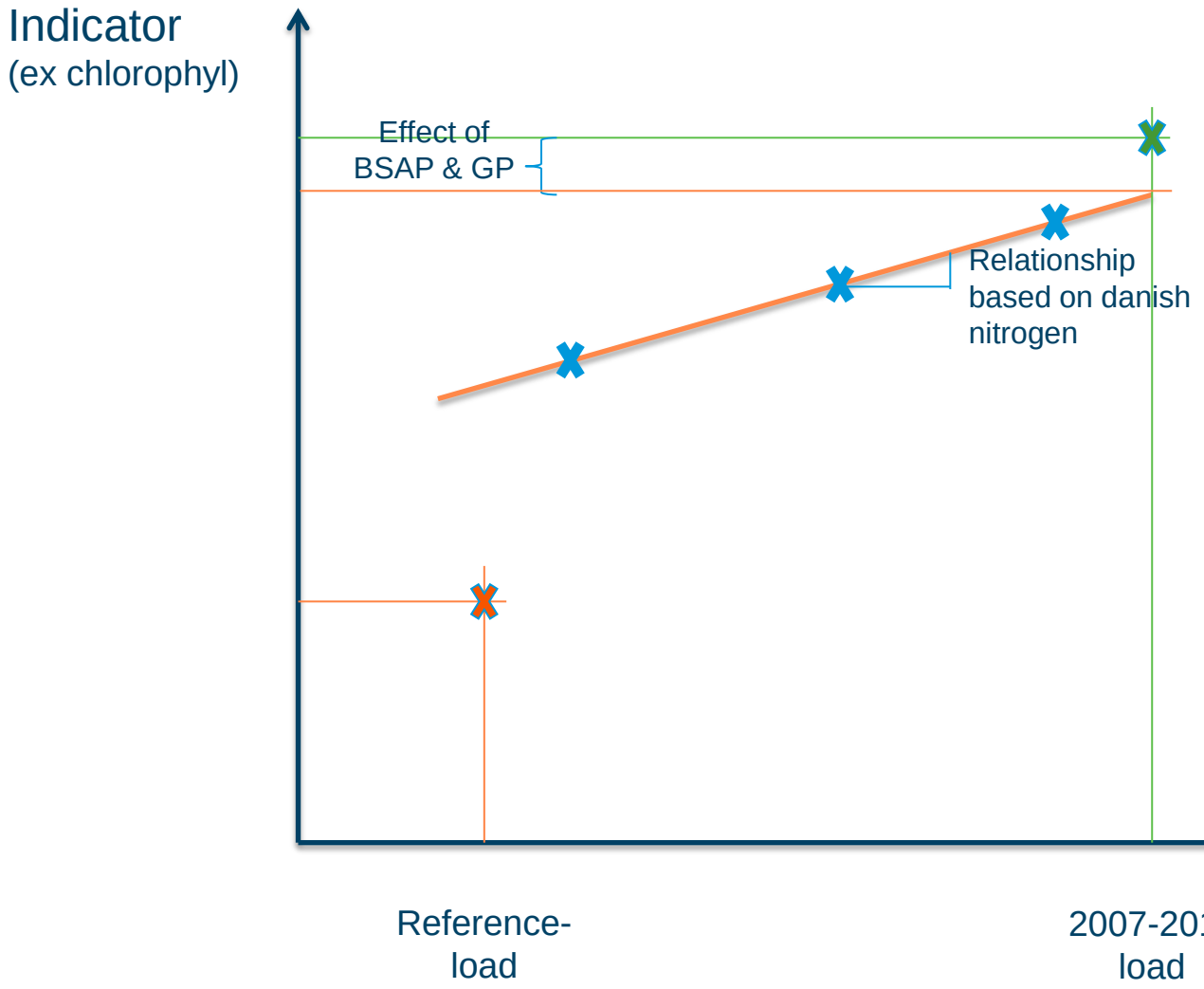
International evaluation autumn 2017 of the Danish marine ecosystem modeling approach behind the Danish River Basin Management Plan 2015-2021

Conclusion (extract) :

- **The Panel endorses the emphasis on reducing N loads from diffuse sources. In some WB's with high N-reduction needs it should be investigated if there could be an additional role for P load reduction and for seasonal regulation of the N load.**
- **The nutrient load reductions are based on solid scientific evidence and generally high-level modelling approaches, with the near lack of expert judgment in the work.**
- **The overall reductions proposed are necessary, but the panel cannot guarantee that they will be sufficient. Especially for benthic angiosperms and macrophytes, additional measures may be needed**

Link to the evaluation report and background information:
http://mfvm.dk/nyheder/nyhed/nyhed/esben-lunde-larsen-brug-for-retningsskifte-i-beskyttelsen-af-vandmiljoeet/
http://mfvm.dk/fileadmin/user_upload/MFVM/Miljoe/AU_DHI_Development_of_models_and_methods_to_support_the_establishment_of....pdf

Methods for establishing the Maximum Allowable Input (MAI)
Pressure/impact relationships (screening method)
Basic sketch – the mechanistic model tools



Status situation:
- Status Load, DK
- Status Load Baltic Sea (HELCOM)
- Status atm.deposition Baltic Sea

Scenarios:
- DK reductions (15%, 30% & 60%)
- HELCOM BSAP fulfilled
- Göteborg protokol, Atmosfære fulfilled

Reference scenario:
- Reference Load DK (year 1900)~30% of status load
- Reference load HELCOM (BNI)
- Reference deposition Atm (AU/DCE)

Ministry of Environment and Food of Denmark
Environmental Protection Agency

Autumn 2017: International evaluation of the Danish marine ecosystem modelling approach used for the RBMP 2015-2021

The recruitment of experts to conduct the evaluation:

- The Ministry has requested water management authorities in other countries (Sweden, Finland, Poland, Germany, The Netherlands and England) and the European Environment Agency, Joint Research Centre (JRC) and the European Commission (DG Environment) to nominate experts to conduct the evaluation

- 14 experts nominated, of which 9 experts subsequently indicated interest. Of these the Ministry has selected the following five experts to the evaluation panel:
  - ***Professor Peter Herman*, Deltares, the Netherlands (Chairman)**
  - ***Professor Alice Newton*, NILU – Norwegian Institute for Air Research**
  - ***Professor Gerald Schernewski,* Leibniz Institute for Baltic Sea Research, Warnemunde**
  - ***Director Bo Gustafsson*, Baltic Nest Institute (BNI), Stockholm University, Sweden**
  - ***Senior Researcher Olli Malve*, Finnish Environment Institute SYKE**

Ministry of Environment and Food of Denmark
Environmental Protection Agency

International evaluation of the Danish marine ecosystem modelling – autumn 2017

Conclusion (extract) :

- The use of indicators, the methods to determine reference conditions and required actions are WFD compliant, and the methods used are attaining the highest possible standard of WFD implementation.

- The Panel endorses the emphasis on reducing N loads from diffuse sources. In some WB's with high N-reduction needs it should be investigated if there could be an additional role for P load reduction and for seasonal regulation of the N load.

- The nutrient load reductions are based on solid scientific evidence and generally high-level modelling approaches, with the near lack of expert judgment in the work.

- The overall reductions proposed are necessary, but the panel cannot guarantee that they will be sufficient. Especially for benthic angiosperms and macrophytes, additional measures may be needed

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http://mfvm.dk/fileadmin/user_upload/MFVM/Miljoe/AU_DHI_Development_of_models_and_methods_to_support_the_establishment_of....pdf

Vandområdeplan 2021-2027

Tidsplan/milepæle for VP 3 arbejdet

Overordnet tidsplan:

- **Ultimo 2019: Basisanalyse offentliggøres**
- **Ultimo 2020: Udkast til vandområdeplaner i 6 måneders høring**
- **Ultimo 2021: Endelige vandområdeplaner 2021-2027**

Indsatsplanlægning kystvande – milepæle:

- **Primo 2019: Servicetjek på karakterisering, afgrænsning og typologisering**
- **Medio 2019: Kortlægning af andre presfaktorer end næringsstoffer afsluttet**
- **Oktober 2019: Videreudvikling af marine økosystemmodeller på baggrund af anbefalinger fra den international evaluering i 2017er afsluttet**
- **Primo 2020: Tilstandsvurdering afsluttet**
- **Medio 2020: Scenarieberegninger med marine modeller afsluttet**
  - **Beregning af referencetilstand for klorofyl (år 1900)**
  - **Beregning af indsatsbehov**
  - **Beregning af klimaeffekter**
  - **Potentiale for årstidsbestemt regulering**
  - **Mv.**

Results – *lokaliserede presfaktorer*

Pressfactor	Quality elements				Supporting parameters	
	Phytoplankton	Eelgrass	Macroalgae	Buttom fauna	Oxygen conditions	Secchi dept
Sand and gravel extraction	2	2	2	2	2	2
Clipping of dredged material	2	2	2	2	2	2
Dredging of shipping lanes and harbours	2	4	4	4	2	2
Sluices / dams	4	4	4	4	1	4
Bridges	1	2	2	2	1	1
Harbours	1	2	2	2	1	1
Windmill farms	2	2	2	2	1	1
Coastal protection	1	2	2	2	1	1
Underwater cables	1	1	2	2	1	1
Fishery	3	5	5	5	3	3
Ship traffic	2	2	2	2	2	2

Coastal waters – project on investigation significance of anthropogenic pressure factors other than nutrient runoff and climate change potentially affecting the coastal environment.

Method

Each of 11 pressure factors has been ranked according to following scale:

1) No effect of the pressure factor on the quality elements and/or supportive elements is documented in the scientific literature.
2) Potential effect(s) of the pressure factor on quality elements and/or supportive elements has been documented but the effect(s) cannot be expected to have potential significant impact at the level of entire water bodies.
3) Potential effect(s) of the pressure factor on quality elements and/or supportive elements has been documented and can be expected to have potential significant impact at the level of entire water bodies but there is not sufficient data to demonstrate the potential impact or quantify it.
4) Potential effect(s) of the pressure factor on quality elements and/or supportive elements has been documented and can be expected to have potential significant impact at the level of entire water bodies with expectedly sufficient data to demonstrate the potential impact and quantify it in few Danish water bodies (<10).
5) As 4, but for several water bodies.

Coastal waters – project on investigation significance of anthropogenic pressure factors other than nutrient runoff and climate change potentially affecting the coastal environment.

Results

Pressfactor	Quality elements				Supporting parameters	
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Harbours	1	2	2	2	1	1
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Coastal protection	1	2	2	2	1	1
Underwater cables	1	1	2	2	1	1
Fishery	3	5	5	5	3	3
Ship traffic	2	2	2	2	2	2