DTU

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SEVENTH FRAMEWORK PROGRAMME

High-resolution mapping of benthic fishing pressure

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Estimating fishing pressure from VMS and logbook data

- VMS data hold high resolution information of vessel activity (position, speed and course every hour)
- The EU logbooks contain detailed information of gear type and target species through the assignment of each fishing trip to a given DCF-metier
- The EU logbooks, however, **do not** contain any information on gear size!

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Two vessels with identical gear information in EU-logbooks,

OTB_SPF_16-31_0_0

OTB_SPF_16-31_0_0

but with individual engine power information

Claim

- The EU-logbook information of fishing effort is not well suited for meeting the monintoring requirements of the MSFD (e.g. seafloor pressure)

- Key variables of gear size and geometry (e.g. OT door spread) should be incorporated

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BENTHIS WP2 mapping approach

1. Obtain Vessel and gear data from industry survey
2. Estimate vessel size ~ gear size relationships by metiers
3. Superimpose gear size on logbooks using vessel size as proxy
4. Refine activity, interpolate trawl tracks and estimate swept area by metier from VMS + logbook information
5. Map fishing intensity data at the 1*1 minute (longitude and latitude) scale by metier
6. Overlay fishing intensity and habitat maps

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Industry survey coverage

	Institutes	OT	TBB	DS	DRB
Western Baltic / North Sea	DTU Aqua	72	2	65	
	SLU	98			
North Sea	IMR	6		17	
	IMARES	5	16		
	ILVO	8	29		
	Marine Lab	115			
Western waters	MI	60			33
	IFREMER	9			
Mediterranean	CNR (Mygears-Med)	508	9		
	HCMR	37			
Black Sea	CFRI	21	22		
	Total	939	78	82	33

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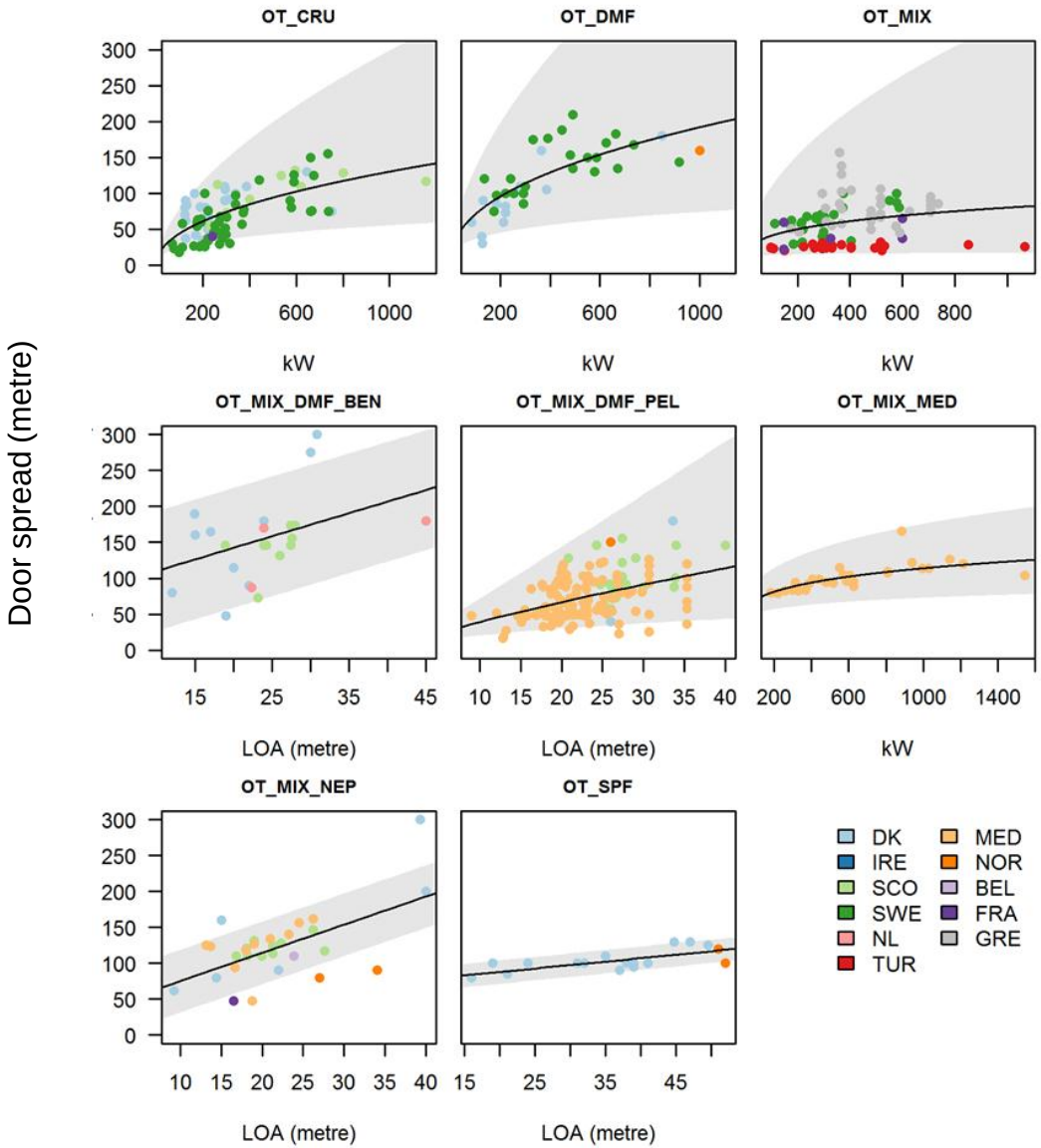
Vessel size ~ gear size relationships for 14 metiers corresponding to approx. DCF-metiers level 5½



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Assigning BENTHIS metiers (and gear size) to logbook observations

- Correspondence table

e.g. From DCF to BENTHIS métier

Obs.	DCF_metier_level_6	Benthis_metier	kW
#1	OTB_DEF_>=105_1_120	OT_DMF	200
#2	OTB_CRU_90-119_0_0	OT_CRU	360
#3	OTB_DEF_70-89_2_35	OT_DMF	1100
#4	OTB_DEF_>=120_0_0	OT_DMF	200
#5	OTB_CRU_>=120_0_0	OT_CRU	400
#6	OTB_CRU_32-69_0_0	OT_CRU	140
#7	OTB_CRU_>0_0_0	OT_CRU	200
#8	OTB_DEF_>=105_1_110	OT_DMF	700
#9	OTB_DEF_32-69_0_0	OT_DMF	240
#10	OTB_DEF_70-99_0_0	OT_DMF	90
#11	OTB_CRU_80-99_0_0	OT_CRU	144

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Coupling of VMS and logbook data

VE_REF	VE_FLT	VE_COU	VE_LEN	VE_KW	VE_TON	FT_REF	FT_DCOU	FT_DHAR	FT_DDAT	FT_DTIME	FT_LCOU	FT_LHAR	FT_LDAT	FT_LTIME
238	TBB	Atlantis	24.0000	221	NA	271253	nld	SCH	01/05/1800	08:00:00	nld	SL	01/05/1800	23:00:00
731	TBB	Atlantis	23.0000	221	NA	271268	nld	SL	01/05/1800	15:00:00	nld	SL	02/05/1800	07:00:00
742	TBB	Atlantis	22.0728	221	NA	271270	nld	SCH	01/05/1800	04:00:00	nld	SL	02/05/1800	04:00:00

Search in time window

	VE_COU	VE_REF	SI_LATI	SI_LONG	SI_DATE	SI_TIME	SI_SP	SI_HE	SI_DATIM	FT_REF
525073	Atlantis	742	52.18216	4.289418	01/05/1800	5:24:00	NA	NA	1800-05-01 05:24:00	271270
525074	Atlantis	742	52.25544	4.306891	01/05/1800	7:18:00	NA	NA	1800-05-01 07:18:00	271270
525075	Atlantis	742	52.20697	4.322240	01/05/1800	9:14:00	NA	NA	1800-05-01 09:14:00	271270
525076	Atlantis	742	52.08420	4.186282	01/05/1800	11:10:00	NA	NA	1800-05-01 11:10:00	271270
525077	Atlantis	742	52.08750	4.154232	01/05/1800	13:04:00	NA	NA	1800-05-01 13:04:00	271270
525078	Atlantis	742	52.13614	4.198466	01/05/1800	15:00:00	NA	NA	1800-05-01 15:00:00	271270
525079	Atlantis	742	52.24158	4.234063	01/05/1800	16:54:00	NA	NA	1800-05-01 16:54:00	271270
525080	Atlantis	742	52.22427	4.238616	01/05/1800	18:50:00	NA	NA	1800-05-01 18:50:00	271270
525081	Atlantis	742	52.13691	4.196747	01/05/1800	20:44:00	NA	NA	1800-05-01 20:44:00	271270
525082	Atlantis	742	52.08601	3.973636	01/05/1800	22:40:00	NA	NA	1800-05-01 22:40:00	271270
525083	Atlantis	742	51.98041	3.793745	02/05/1800	00:36:00	NA	NA	1800-05-02 00:36:00	271270
525084	Atlantis	742	51.89904	3.790675	02/05/1800	2:30:00	NA	NA	1800-05-02 02:30:00	271270

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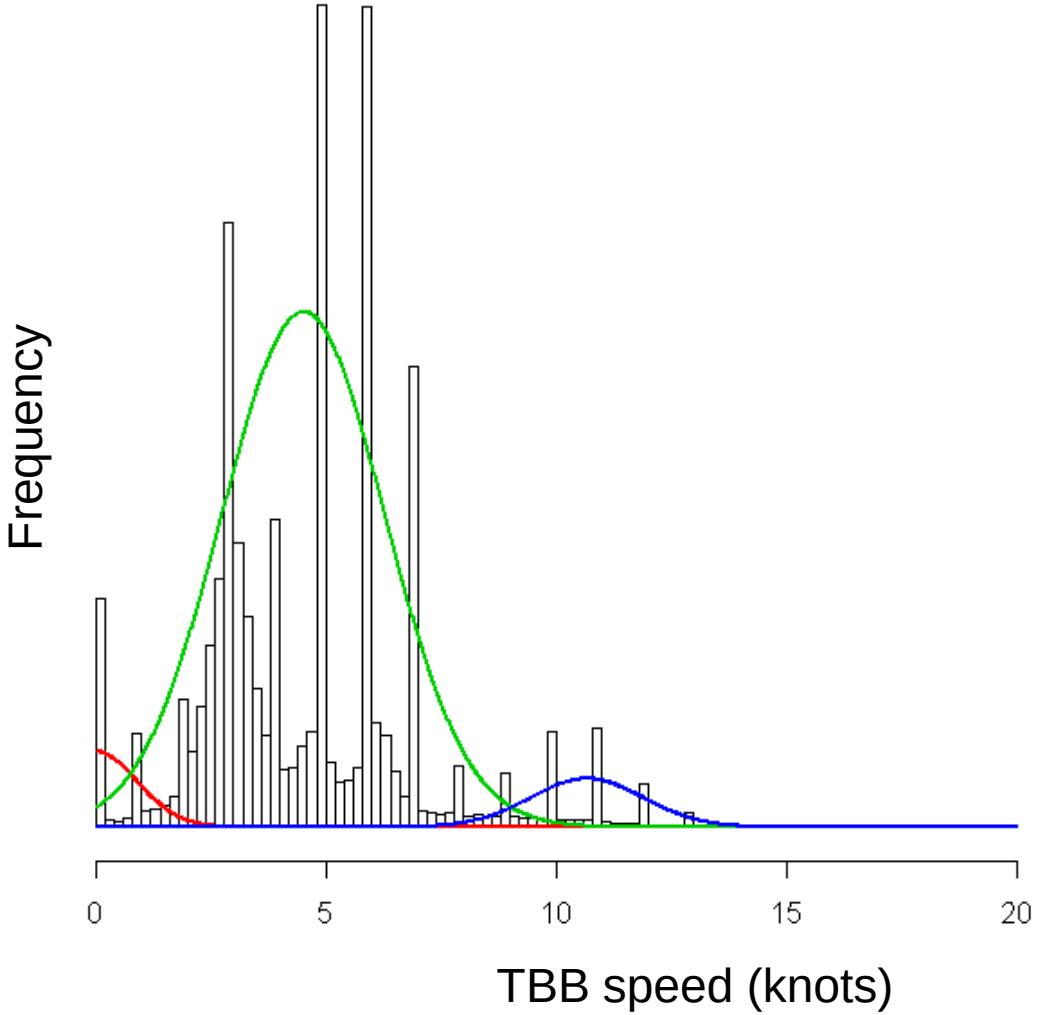
Defining activity at VMS positions

Identify the fishing activity

- Setting/hauling gears
- Fishing
- Steaming

Based on speed profile



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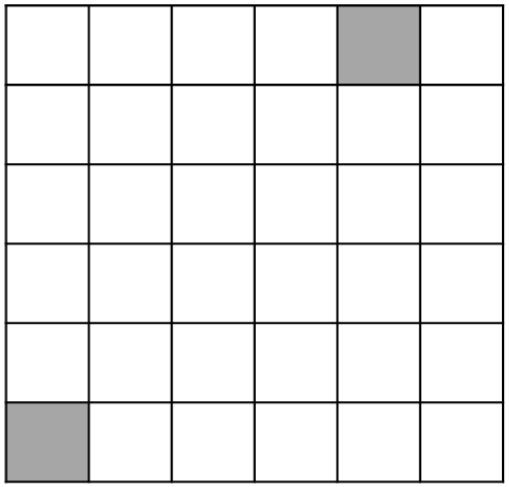
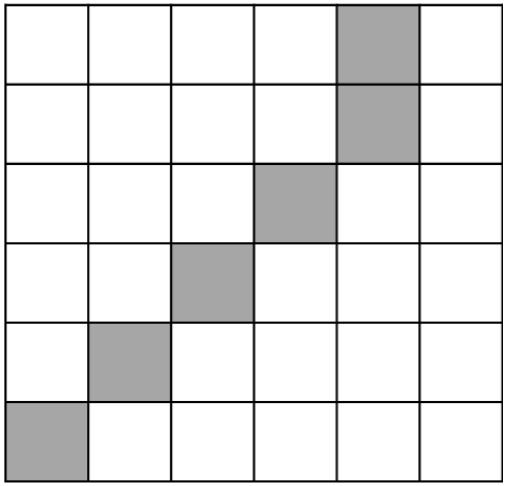
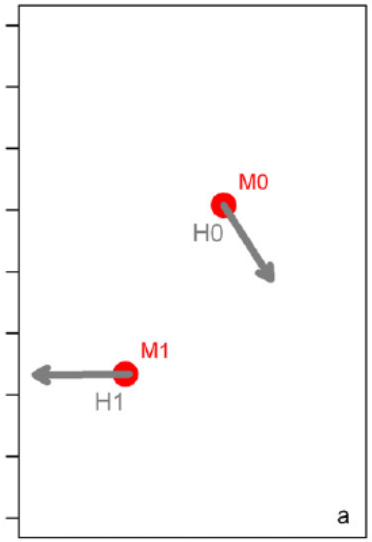
Artificially increasing ping rate

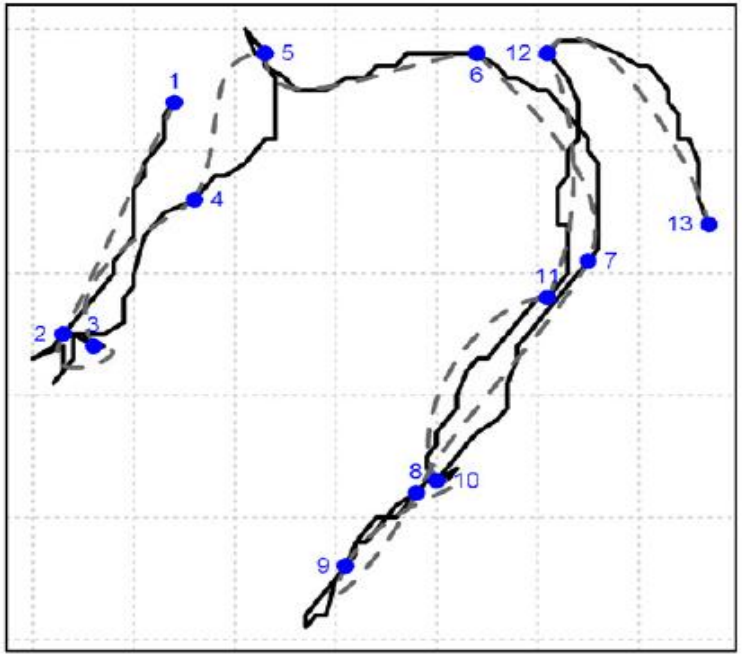
Interpolate between pings for towed gears (OT, TBB, and DRB)

- Cubic Hermite spline (Hintzen et al. 2010)









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Calculation of swept area and definition of calculation grid

For towed gears

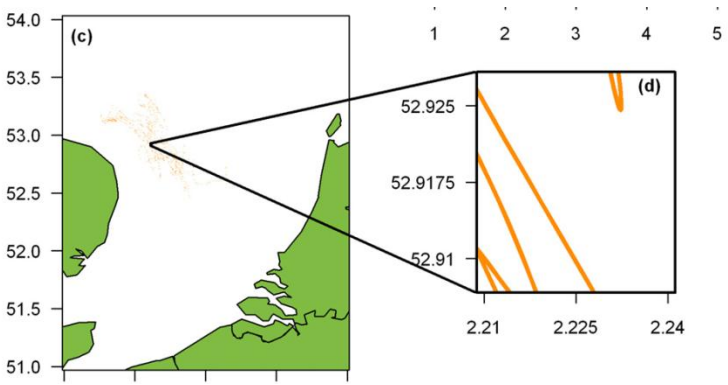
- Each interpolated GPS point is associated with distance travelled and gear width = swept area

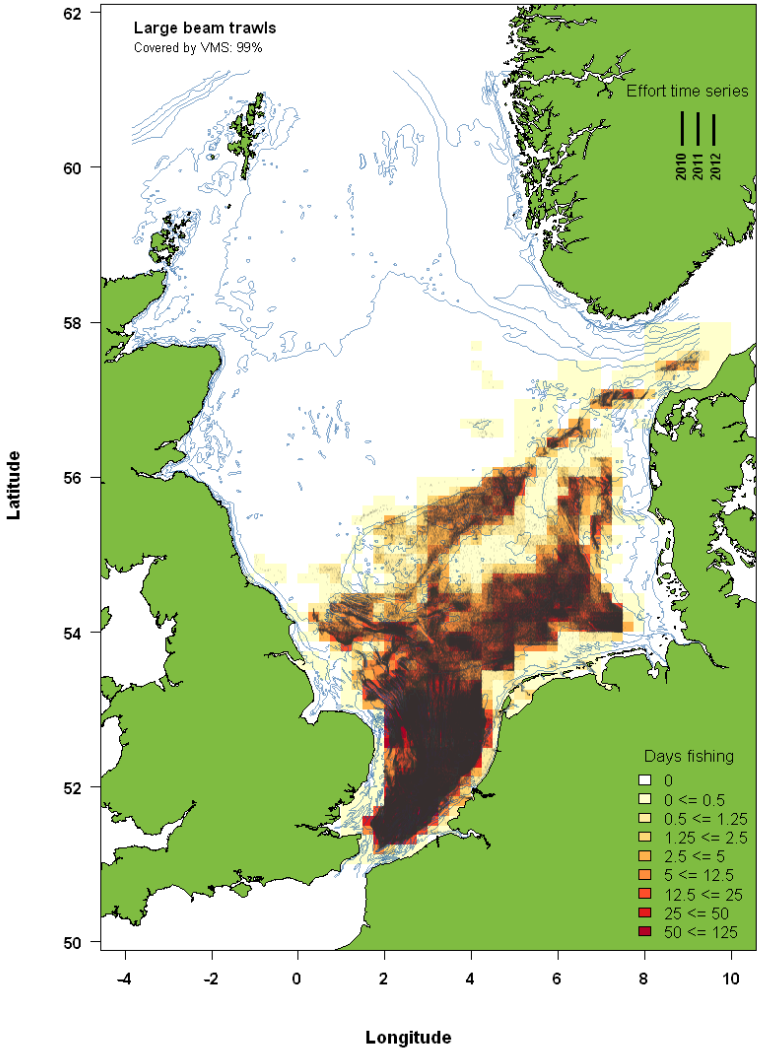
For demersal seines

- Geometrical shapes around VMS fishing positions = swept area

Define grid at 1/60 degree by 1/60 degree

- Project each GPS position and associated swept area onto the grid





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Final flat file of swept area (km^2) per 1*1 minute cells by partner by year and metier

2010	**OT_DMF**			**OT_CRU**			**Etc.**		
	Mean	Upper 95	Lower 95	Mean	Upper 95	Lower 95	Mean	Upper 95	Lower 95
Grid-cell #1	0.94	2.24	0.39	80.4	164.7	39.2			
Grid-cell #2									
Grid-cell #2									
Grid-cell #3									
Etc.									
Etc.									

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On-line R-based workflow completed by partners

BENTHIS WP2 mapping workflow:

https://code.google.com/p/vmstools/source/browse/trunk/vmstools/inst/scripts/Benthis_WP2_workflow.r

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Status – BENTHIS WP2 workflow

			Completion of BENTHIS workflow and calculation of yearly swept area in 1*1 minutes grid cells		
			2010	2011	2012
1	IMARES	Niels Hintzen	x	x	x
2	ILVO	Bart Vanelslander	x	x	x
3	CEFAS	Paulette Posen	x	x	x
4	SLU	Patrik Jonsson	x	x	x
5	MarLab	Rui Catarino	x	x	x
7	MI	Hans Gerritsen	x	x	x
8	DTU Aqua	Francois Bastardie	x	x	x
9	CNR	Jacopo Pulcinella	x	x	x
6	IFREMER	Pascal Laffargue	pending	pending	pending
10	HCMR	Chris Smith	ongoing	ongoing	ongoing
11	IMR	Genoveva Gonzalez Mirelis	ongoing	ongoing	ongoing
12	CFRI	Mustafa Zengin	ongoing	ongoing	ongoing
13	vTI, Hamburg	Heino Fock	x	x	x
14	AFBI, Belfast	Mathieu Lundy	x	x	x
15	IEO, Vigo	Manuel Marin Gonzalez	ongoing	ongoing	ongoing
16	IPIMAR, Portugal	Cristina Silva	ongoing	ongoing	ongoing
17	MFRI, Gdynia	Maciej Adamowicz	pending	pending	pending
18	Latvia	Irina Jakovleva	pending	pending	pending
19	Lithauania	Maksims Kovsars	pending	pending	pending
20	Finland	to be contacted			
21	etc.	to be contacted			

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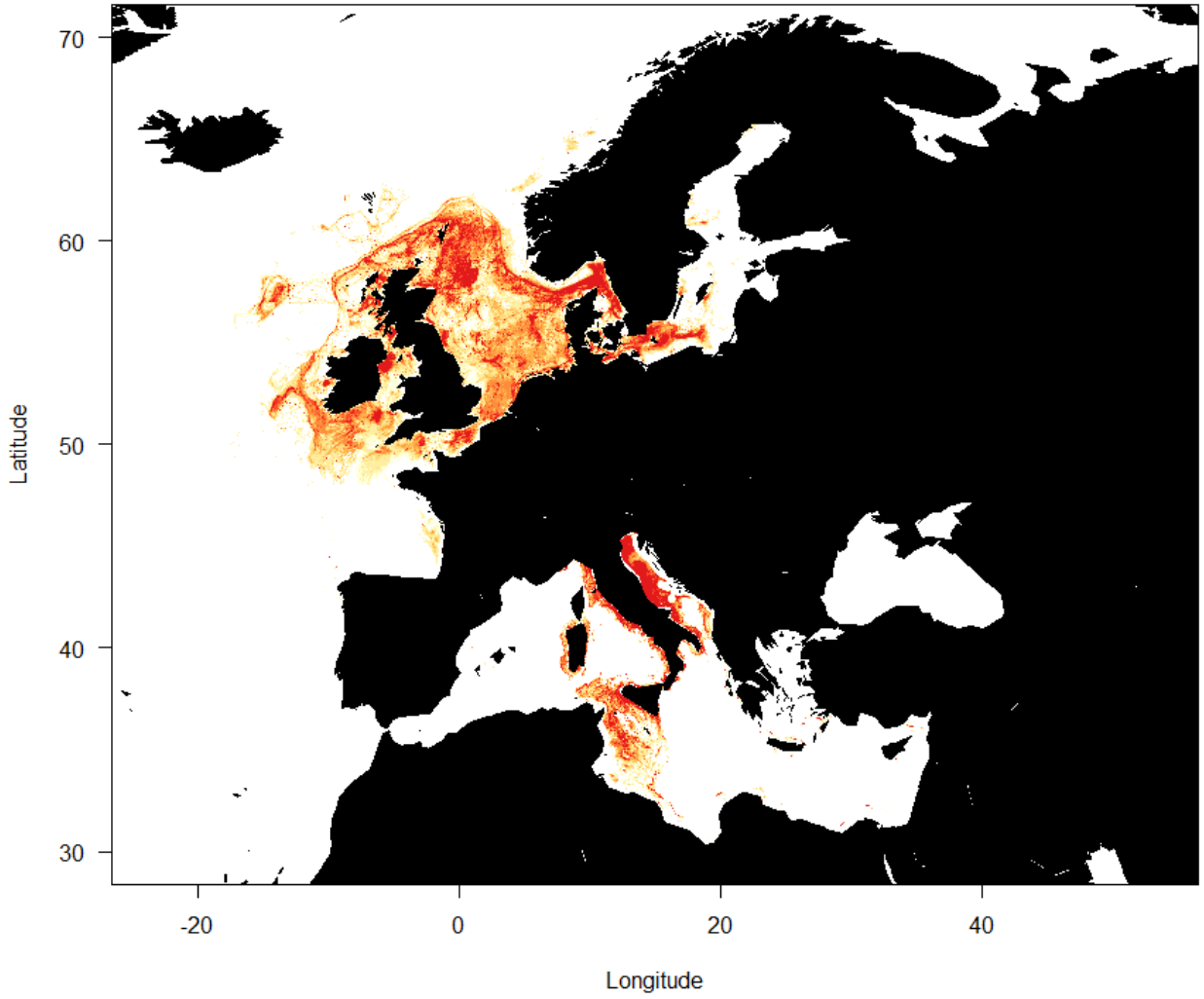
SWE, DEU, DEN, UK, IRL, N-IRL, BEL, NLD, SCO, ITALY (total swept area 2010-2012 in 1*1 minute cells)



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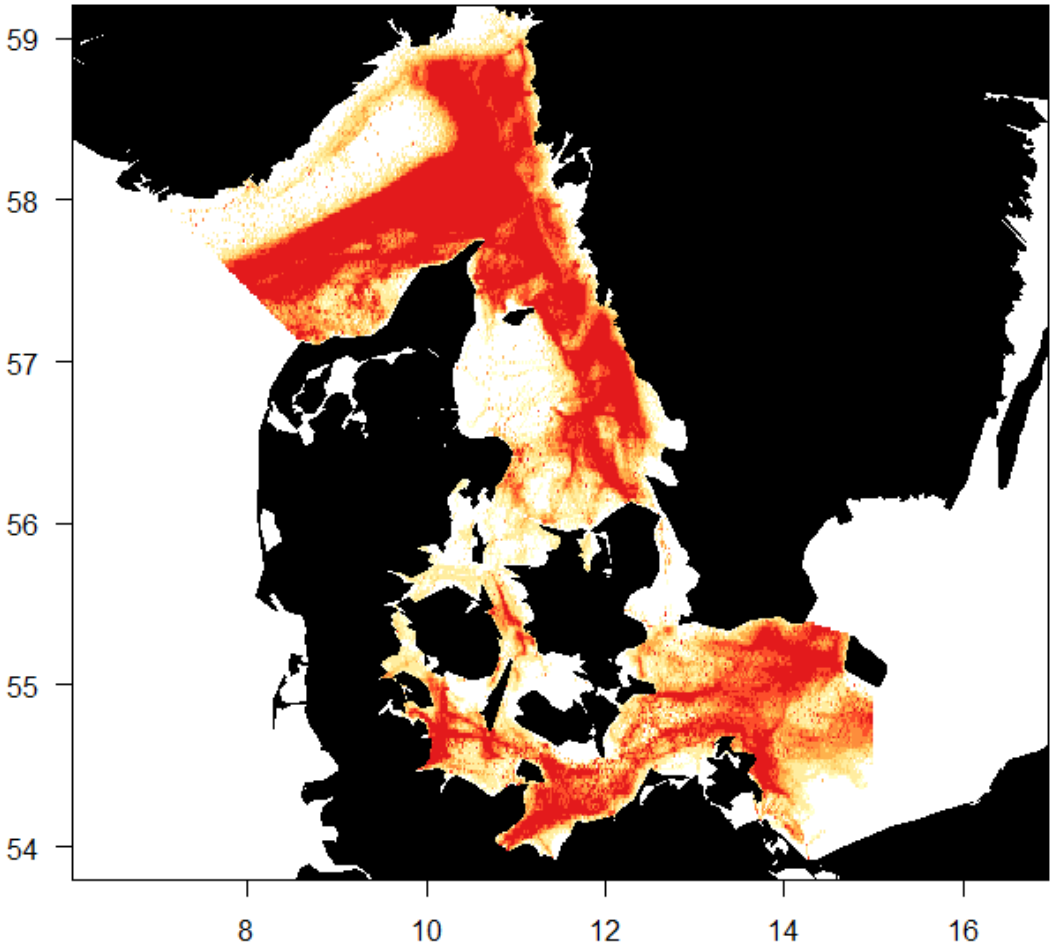
Zoom-in Skagerrak and W. Baltic (all metiers)

(total swept area 2010 - 2012 in 1*1 minute cells)



Maximum yearly intensity of approx. 100 (± 50)

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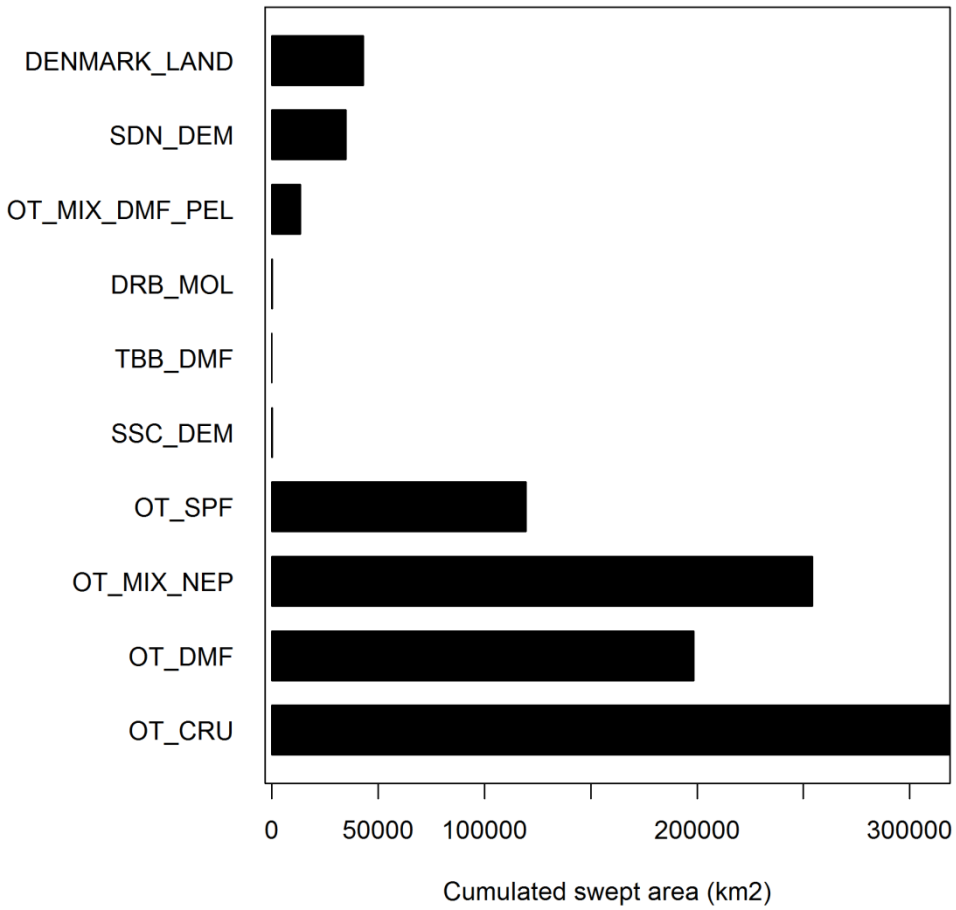
Skagerrak and W. Baltic VMS effort 2010-2012 split on metiers



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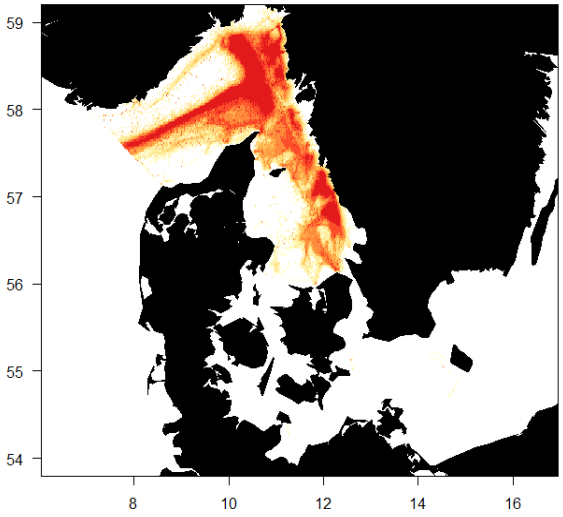
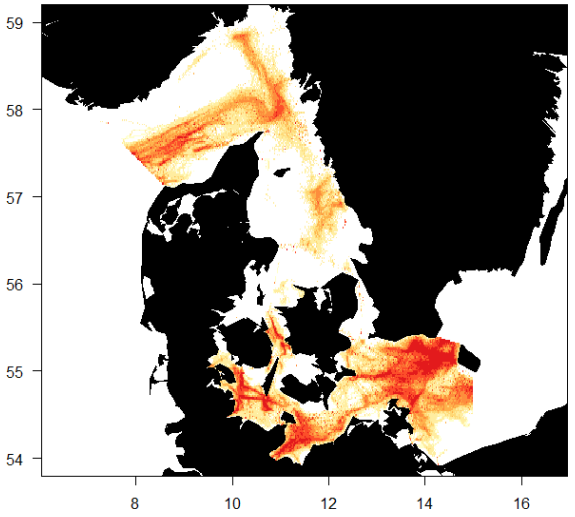
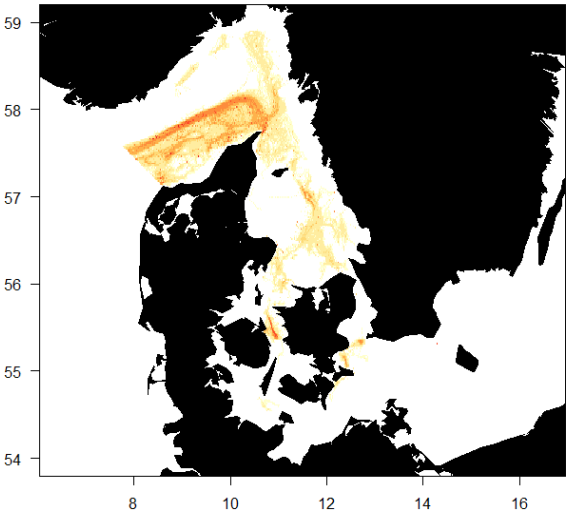
OT_CRU (single-species fishery for Pandalus and Nephrops)

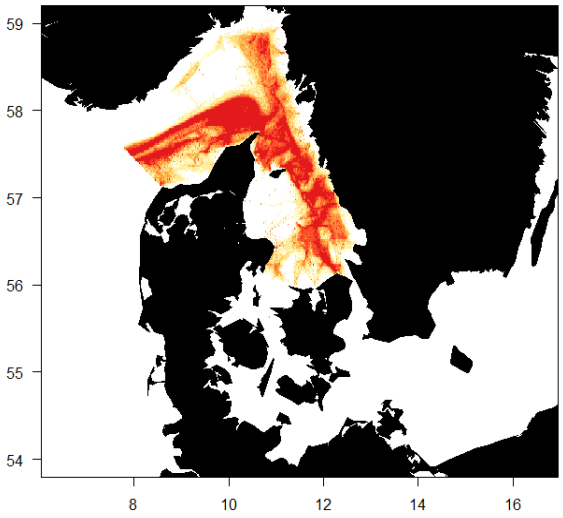


OT_DMF (single species fishery for demersal fish like cod and plaice)

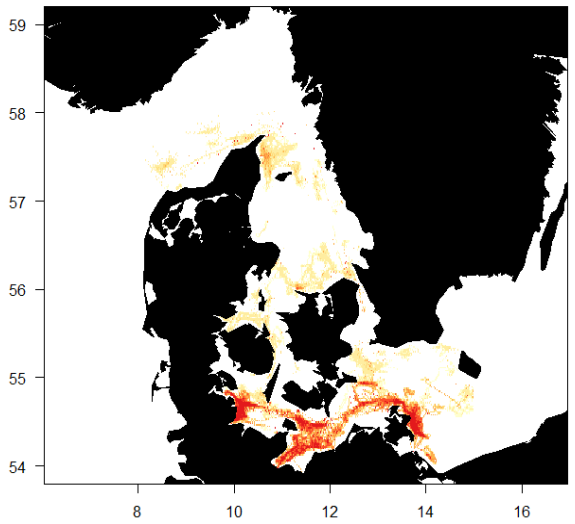


OT_MIX_DMF (mixed fishery for demersal fish such as haddock and cod)

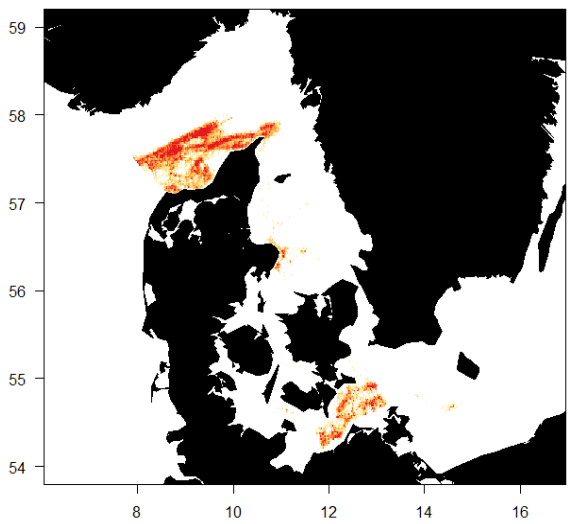




OT_MIX_NEP (mixed fishery for Nephrops and demersal fish)



OT_SPF (single-species fishery for small pelagic fish such as sprat and herring)



SDN_DEM (single species fishery for demersal fish like cod and plaice)

Overlaying effort and habitat maps

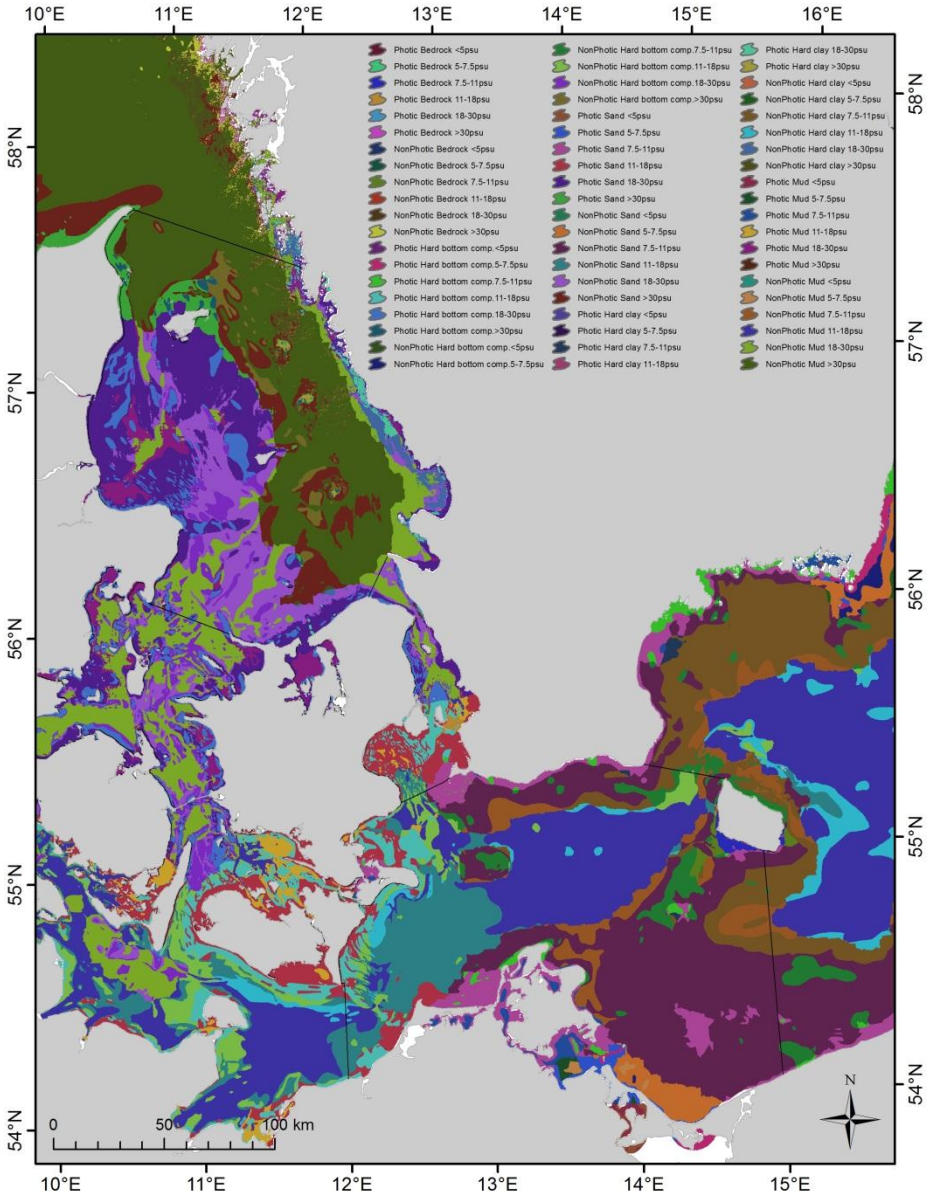
Baltic Marine Landscape map from the EU-funded BALANCE project: http://balance-eu.org/

BENTHIC MARINE LANDSCAPES

Bottom Substrate
1=Bedrock 2=Hard Bottom
3=Sand 4=Hard Clay 5= Mud.

Photic zone
1=Photic 2=Aphotic.

Salinity
1=0-5psu 2=5-7.5psu 3=7.5-11psu.
4= 11-18psu., 5= 18-30-,psu, 6=>30psu



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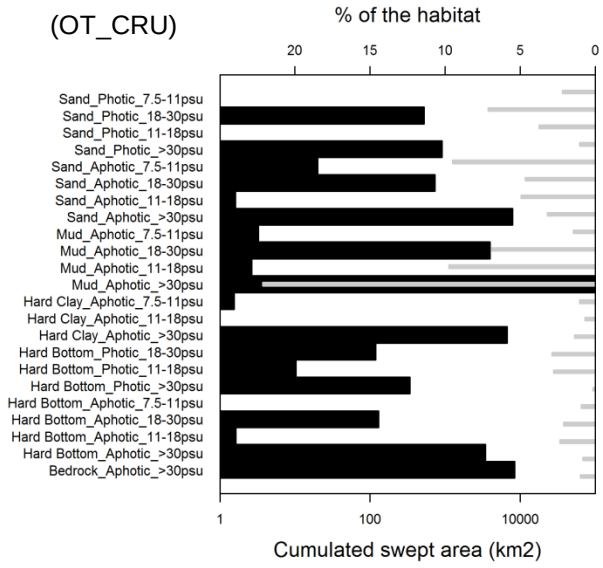
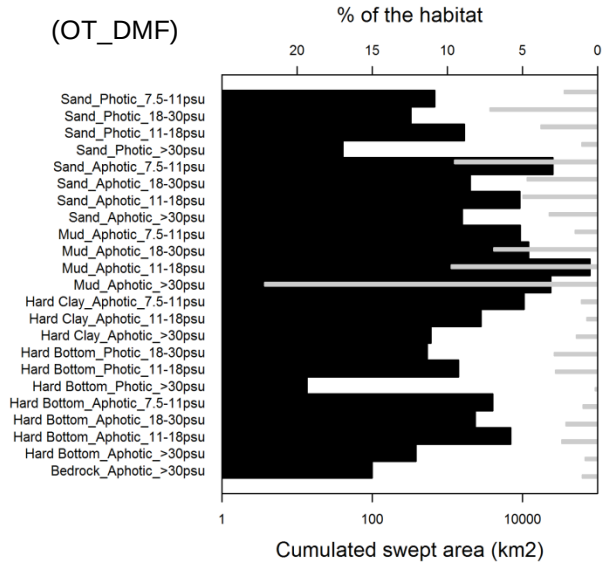
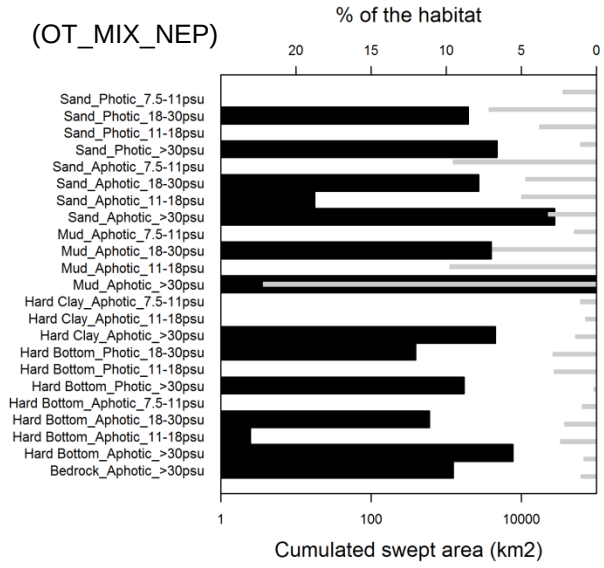
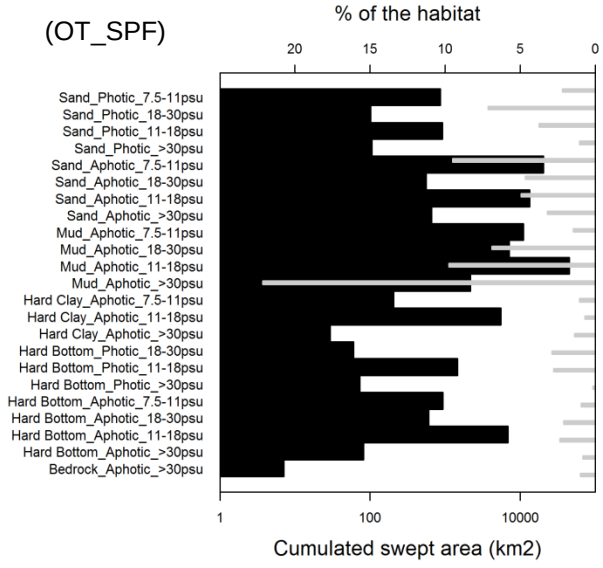
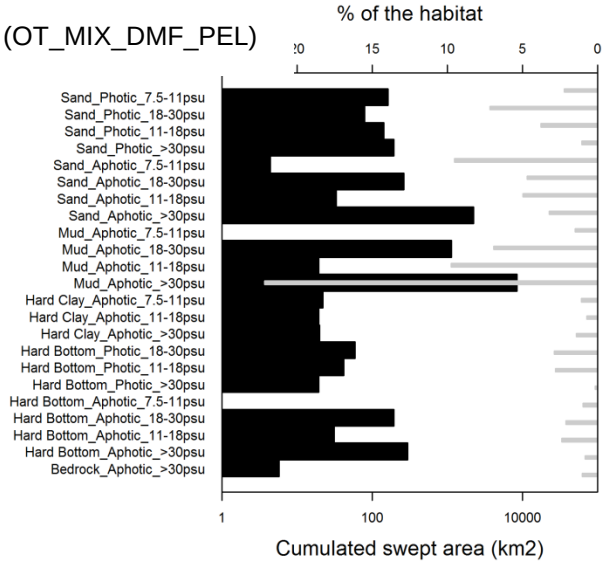
Overlaying effort and habitat maps

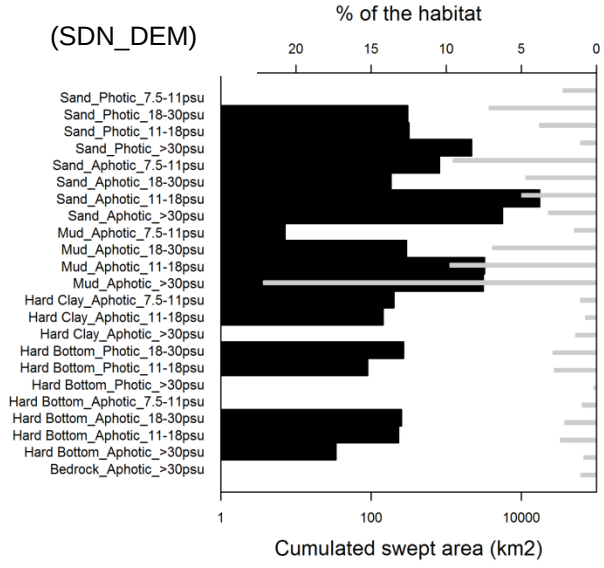












Refinements

- Assign uncertainty to pressure maps based on confidence intervals of vessel ~ gear relationships
- Split total swept area map into epifaunal and infaunal pressure level based on gear traits
- Mapping of temporal variation in fishing intensity
- Inclusion logbook (< 10m) and non-logbook vessels (< 10m)
- Inclusions of passive gears

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WAGENINGEN UR
For quality of life

ILVO
Instituut voor Landbouw- en Visserijonderzoek

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Centre for Environment Fisheries & Aquaculture Science

INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET

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GRILLI s.a.s.
Officina Meccanica Navale

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