

2011 Landings statistics and fishing activity maps based on VMS and logbook data of the Dutch fishing fleet

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Introduction

The current request for data and maps is in the context of informing the offshore wind farm Project called Hornsea, in which Poseidon Aquatic Resource Management Ltd. currently is engaged. Poseidon is a company of fisheries consultants, specializing in the development of sustainable fisheries and aquaculture. The aim of the project in general is to build 223 turbines with a combined capacity of 1,000 MW. The area of the future wind park is located in the North Sea (centre latitude 53.930° - centre longitude 1.465°) and will be of a total surface area of 540 km².

In 2011, IMARES delivered data on the Dutch fishing fleet's activities to Poseidon, covering the period 2001-2010 (data files containing landings statistics) and 2009-2010 (maps). This project is a follow-up of the 2011 request, now requesting 2012 maps and landings statistics, extended with value information of the landings.

1. Assignment

The assignment, as provided by the client in details given below, entailed to:

1. **Supply landings statistics for all Dutch flag vessels** in volume (weight in tonnes) and value (€) by year, month, ICES rectangle, ICES sub square (if available), vessel nationality, port of landing, gear type, vessel length category (under 10m, 10-15m, 15-20m, 20-25m and >25m) and species; covering the following ICES statistical rectangles 37E9, 37F0, 37F1, 37F2, 37F3, 36E9, 36F0, 36F1, 36F2, 36F3, 35F0, 35F1, 35F2 and 35F3.
2. **Supply landings statistics for a selection of vessels** as above including only: OM 2, TX 1, TX 14, TX 19, TX 36, TX 38, TX 68, TX 94, UK 1, UK 47, UK 172, UK 227, UK 246, KW 34, KW 45, KW 88, HD 4, HD 70, ST 27, LT 60, WN 1, PD 63, SC 25 and KW 88. The data will not be supplied separately for each vessel but aggregated for the above mentioned group of vessels. The aggregations will be done by year, month, ICES rectangle, vessel nationality, gear type and vessel length category (under 10m, 10-15m, 15-20m, 20-25m and over).
3. **Supply maps showing vessel activity** (number of pings) of the following gears: beam trawl, demersal seine, demersal otter trawl and pelagic otter trawl, over a grid of 1/16th of an ICES rectangle (close to 15km by 15km squares). For each gear the following three figures will be provided:
 - a. An annual overview map (i.e. 1 maps on one figure);
 - b. Annual maps split by 4 vessel length categories (under 15m, 15-20m, 20-25m and over 25m) and (i.e. 4 maps on one figure);
 - c. Monthly figures (i.e. 12 maps on one figure).

Assuming the following speeds to describe active fishing:

<u>Vessel / gear type</u>	<u>Speed</u>
Beam trawlers	3-8 knots
Demersal trawlers (targeting fish and/or Nephrops)	2-6 knots
Anchor/Danish seine & fly shooting (demersal seine)	0-6 knots
Pelagic trawler	0-9 knots

4. **Provide maps showing value** of landings rather than number of pings. Depending on price information available, value will be based on prices averaged by month or by year (the more appropriate level).

2. Materials and Methods

2.1 Data description

Extractions of Vessel Monitoring by Satellite (VMS) and logbook datasets from the IMARES fisheries database on 12-07-2012 and 01-05-2012 respectively were used for the analysis. The VMS data in the IMARES fisheries database are in of the following format:

Table 1:

Data in VMS for each ping	Data in logbook per catch / landing event
Vessel Flag	Vessel ID
Unique vessel ID	Fleet
Geographical position latitude	Home country
Geographical position longitude	Vessel length
Date	Vessel power
Time	Tonnage
Heading (degrees)	Fishing trip reference number
Vessel speed (knots)	Departure country
	Departure harbour
	Departure date
	Departure time
	Landing country
	Landing harbour
	Arrival date
	Arrival time
	Log event ID
	Catch date
	Gear
	Mesh size
	ICES rectangle
	ICES division
	Landing weight estimate of species (FAO species codes)
	Landing value of species (FAO species codes)

The logbook dataset in the IMARES fisheries database contains 309 columns containing information describing a unique sales event in the auction, (including date, time, vessel identity, origin of catch (ICES rectangle), landed quantity (per species) and price per kg related to the sale).

By combining the data from the VMS and logbook datasets, catch quantities and value can be ascribed to particular areas. Checking, cleaning, formatting and analysis of the data was performed using the R package 'vmstools' (Hintzen et al. 2012) following the workflow described by the manuscript.

A price data table containing annual, and whenever possible monthly average, prices per species is used in preparing the landings statistics documents as well as the maps showing value of catches per area. In order to prevent that individual events would influence the overall picture too much, and considering that price information is not available in a substantial number of cases, averages – rather than the actual sales slips prices are used. Whenever monthly value data were representative, these numbers were given priority over yearly averaged prices.

2.2 Cleaning VMS data

Occasionally, due to technical malfunction of equipment (on board the vessel) or a fault during data processing, VMS records become corrupted and contain faulty information. By means of searching for illogical information, such records are removed from the dataset before commencing with the formatting of the data. The VMS data are checked, and if relevant cleaned, based on the following criteria:

- Faulty headings: if the heading is a number higher than 360, the record is removed.
- Unlikely vessel speed: if the vessels speed is higher than 20 knots, the record is removed.
- Duplicates: from records of which the vessel and date and time are identical, only one is kept.

In addition, a general selection is made of the data to describe fishing activity:

- Points on land: records of vessels which are on land are removed.
- Points in harbour: records of vessels which are in harbour are removed.

Although a number of faulty records were removed, no excessive mistakes were found.

2.3 Cleaning logbook data

Similar to the VMS dataset, the logbook dataset can contain faulty records as well. The data are checked, and if relevant cleaned, based on the following criteria:

- Duplicates: from records of which the date and landing event are identical, only one is kept.
- Arrival before departure: if the arrival date is before the departure date, the record is removed.
- Excessive Landings: if the quantity landed is of an extreme order of magnitude in comparison to average landing quantities (e.g. if the highest quantity is more than approximately 30 times the second highest quantity), the record with the highest is removed.

Although a number of faulty records were removed, no excessive mistakes were found.

2.4 Price table preparation

A table with annual – and when available monthly – average prices is used in the analysis. Annex C shows a list of the species for which at least annual average prices could be calculated. Annex D shows a list of the species for which no price information was available. Considering the fact that the latter list does not contain any particularly valuable species and their aggregated landed quantity is either relatively low, it is considered that the effect of these lacking price data is negligible. It should also be noted that a number of species on the latter list are not caught in the North Sea in the first place, and so by making a selection for the indicated ICES areas, they are considered irrelevant.

Most Dutch pelagic trawlers are freezer-trawlers, which process and freeze the fish on board. Not very often, their landings are sold in the auction at the ports. Hence, it was considered that the price information from the auctions does not specifically provide a correct impression of true average prices for the majority of the pelagic catches. For this reason, annual average prices for a number of pelagic species are taken from the *Norges Sildesalgslag*; a large auction port specialised in pelagic fish located in Bergen, Norway (<http://www.sildelaget.no>). It is considered that these prices are representative for the pelagic species considered while the auction records available (few in number) in the Dutch logbooks are not considered to be representative.

The following information is used:

Table 2:

Species name	Species code	Average annual price (€)
Herring (North Sea)	HER	0.73
Mackerel	MAC	1.54
Horse mackerel	JAX	1.03
Blue whiting	BHW	0.44
Sprat (ocean)	SPR	0.28

2.5 Landings statistics for a selection of ICES rectangles

To prepare the requested tables, only logbook data are used. After cleaning the logbook dataset, a selection of the dataset is made to only include the specified ICES areas as provided by the client in the assignment. Vessel length categories are defined for each record. Thereafter, the data are aggregated by month, ICES rectangle, gear type and vessel length category.

2.6 Landings statistics for a selection of ICES rectangles and group of vessels

To prepare the requested tables, only logbook data are used. The dataset as prepared for the previous sub-assignment (see par. 2.6) is used as a starting point. A further selection of the dataset is made subsequently to only include the vessels specified in the assignment. Again, the data then are aggregated by month, ICES rectangle, gear type and vessel length category (under 10m, 10-15m, 15-20m, 20-25m and over).

2.7 Maps showing vessel activity (standardised pings)

Both VMS and logbook data are used for mapping fishing activity. First, both datasets are merged together to one, by identifying those VMS pings of a particular vessel that fall between the fishing trip departure and arrival date. Subsequently a number of 'gear categories' is identified by grouping gears (as indicated in table 3). A selection of the dataset excluding all but these specific gear categories is created. Note that PTB and PTM describe vessels that fish in pairs, towing one net together.

Table 3:

Gear category	Gear
Beam trawlers	TBB
Demersal trawlers (including fish & Nephrops)	OTB, OTT and PTB
Demersal seine	SSC, SDN
Pelagic trawler	OTM, PTM

In mapping fishing activity as the number of pings, the diversity in interval between the pings is corrected for, in order to ensure that each VMS ping is weighted such that it represents a fair 'amount of fishing activity'. By default, the average ping rate in the Netherlands is set to 2 hourly intervals. However, in a number of instances this interval rate is higher (due to malfunction of the VMS device) or lower (request for higher ping rate). Therefore, the pings are standardized to represent the average ping rate, i.e. an interval between successive pings of 1 hour is expressed as ½ a ping while an interval between successive pings of 4 hours is expressed as 2 pings. The majority of the standardized pings equal to one. In standardizing the ping rate, no biased view of fishing activity is generated.

2.8 Maps showing value of catches (€)

To show values of landings on a sub-ICES square resolution map, the values listed in the logbook data, of a specific vessel on a specific date, have to be assigned to the corresponding VMS data points. Therefore, VMS and logbook data are linked on a number of hierarchical levels. First, VMS records of a vessel are linked to the logbook data of the same vessel where they correspond on catch / ping date. The values in these logbook records are thereafter assigned (dispatched) to the matched VMS points (e.g. if there is one value in the logbook and 5 matched VMS points, each of these VMS points will hold 1/5th of the value). Second, a similar procedure is followed for those records that do not match on catch / ping date but do match on ICES rectangle or trip number. This means that VMS pings on day one of a trip can be linked to catches of day 2 or later of that same trip, as long as the VMS pings occurred in the same ICES rectangle or occurred within the same trip. In case none of these aggregation levels is possible, all non-matched records are aggregated on a gear level. This ensures that all values available in the logbook dataset are attributed to VMS pings. Only those pings associated with fishing of the VMS dataset are used in the analyses.

3. Results

The results given in this report apply only to the data analysed.

3.1 Landings statistics for a selection of ICES rectangles

The landings statistics for Dutch vessels in volume (weight in tonnes) and value (€) are delivered as an excel file (.xlsx). In total 4545 aggregated landings records are reported for 52 species.

3.2 Landings statistics for a selection of ICES rectangles and group of vessels

The landings statistics for Dutch flag vessels in volume (weight in tonnes) and value (€) are delivered as an excel file (.xlsx). In total 2016 aggregated landings records are reported for 32 species.

3.3 Maps showing vessel activity (standardised pings)

Maps showing vessel activity as standardised pings are provided in annex A. TIFF files of the individual figures are provided to the client as well.

3.4 Maps showing value of catches (€)

Maps showing value of catch in euros are provided in annex B. TIFF files of the individual figures are provided to the client as well.

References

Hintzen, N.T.; Bastardie, F.; Beare, D.J.; Piet, G.J.; Ulrich, C.; Deporte, N.; Egekvist, J.; Degel, H. (2012). VMStools: Open-source software for the processing, analysis and visualisation of fisheries logbook and VMS data. *Fisheries Research* 115-116 . - p. 31 - 43.

Justification

Report number : C096/12
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The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

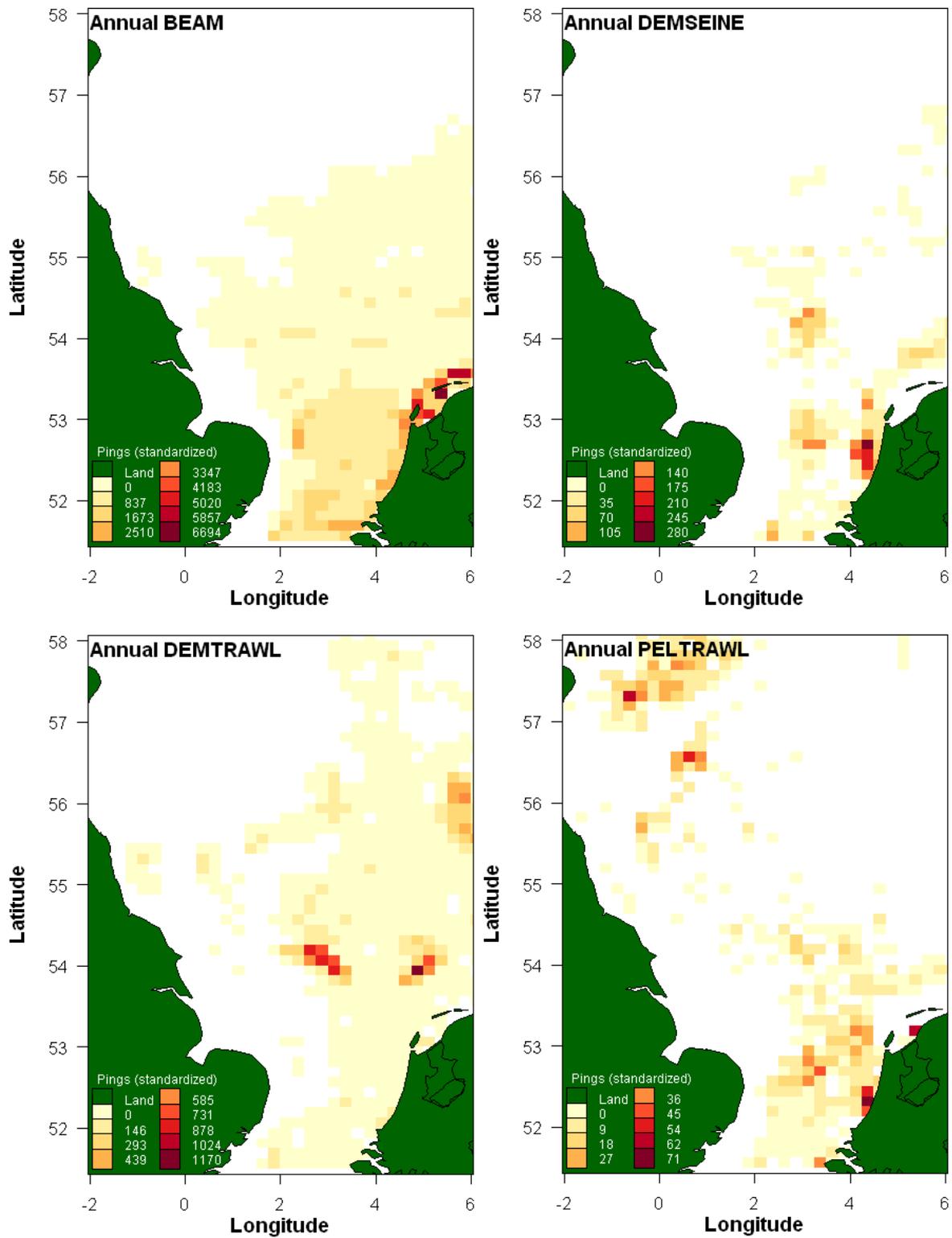
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Senior Scientist

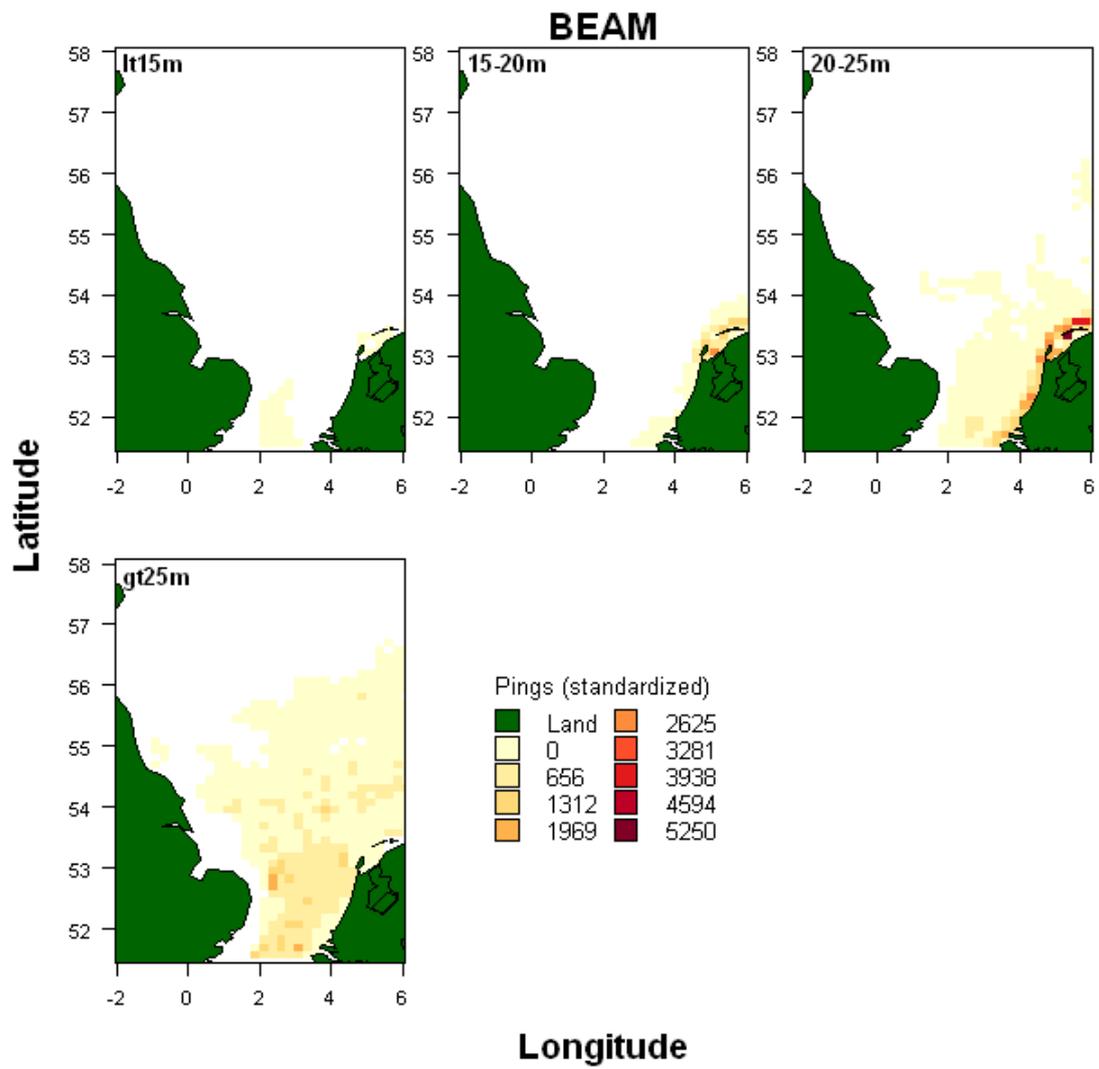
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Date: 08 August 2012

Approved: Drs. J.H.M Schobben
Head of Department

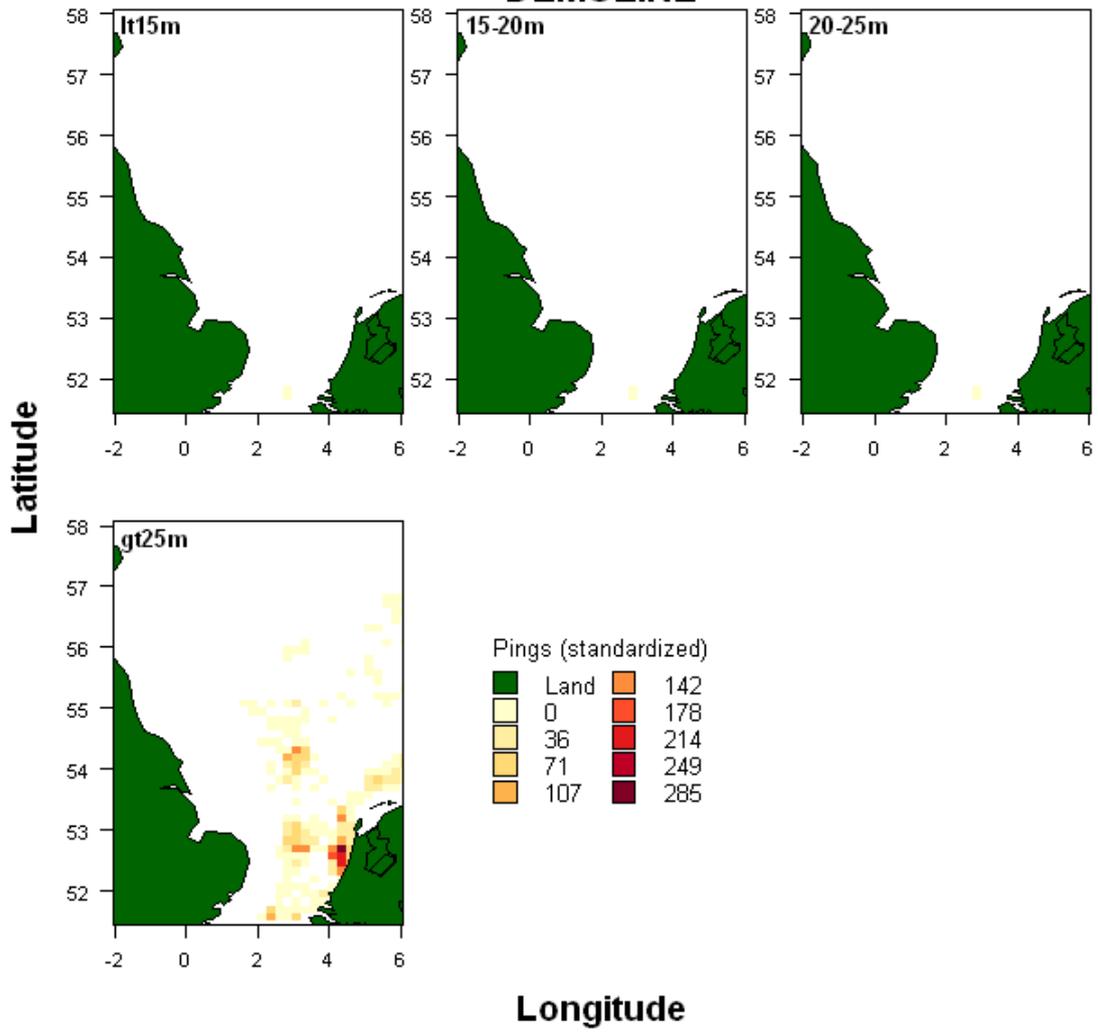
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Annex A. Maps showing vessel activity (standardised pings)

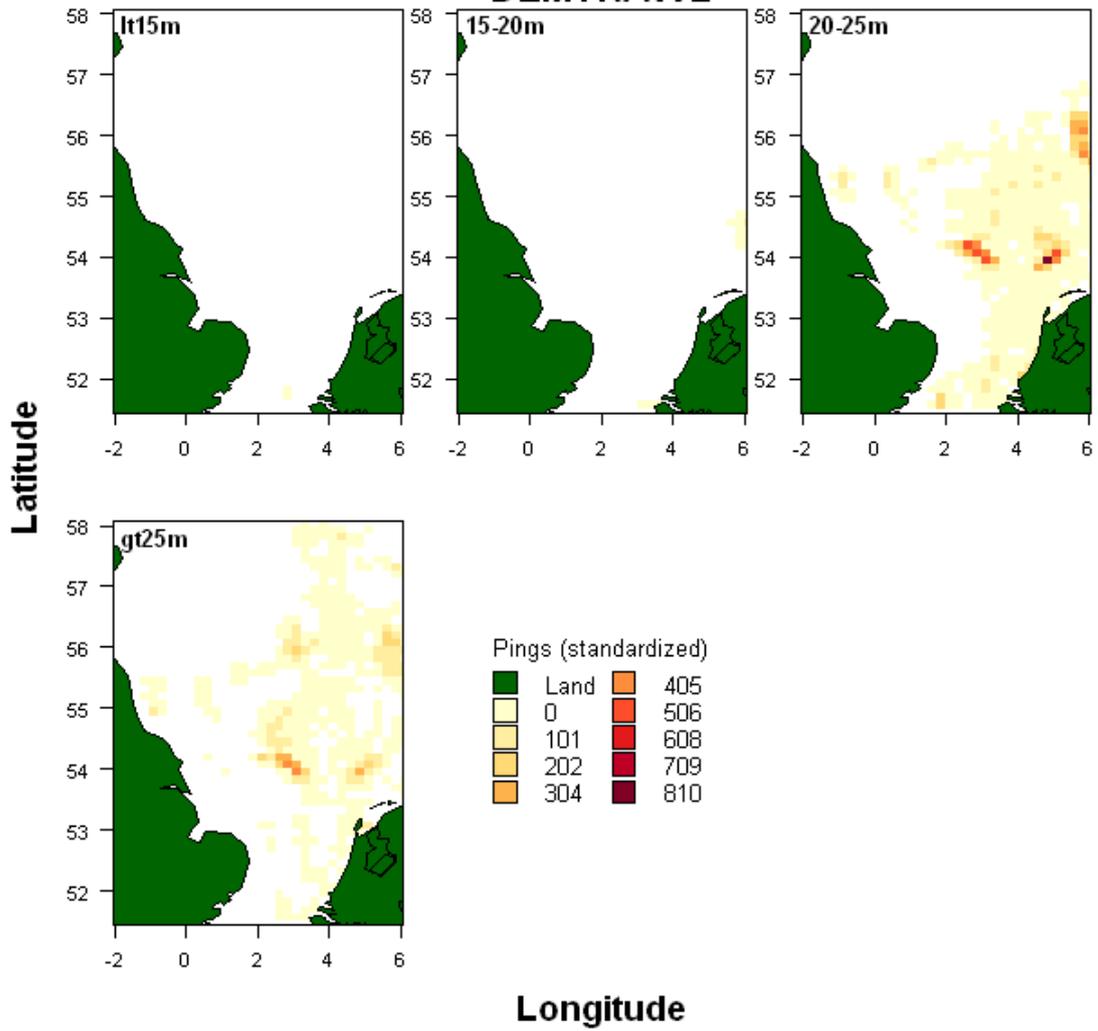


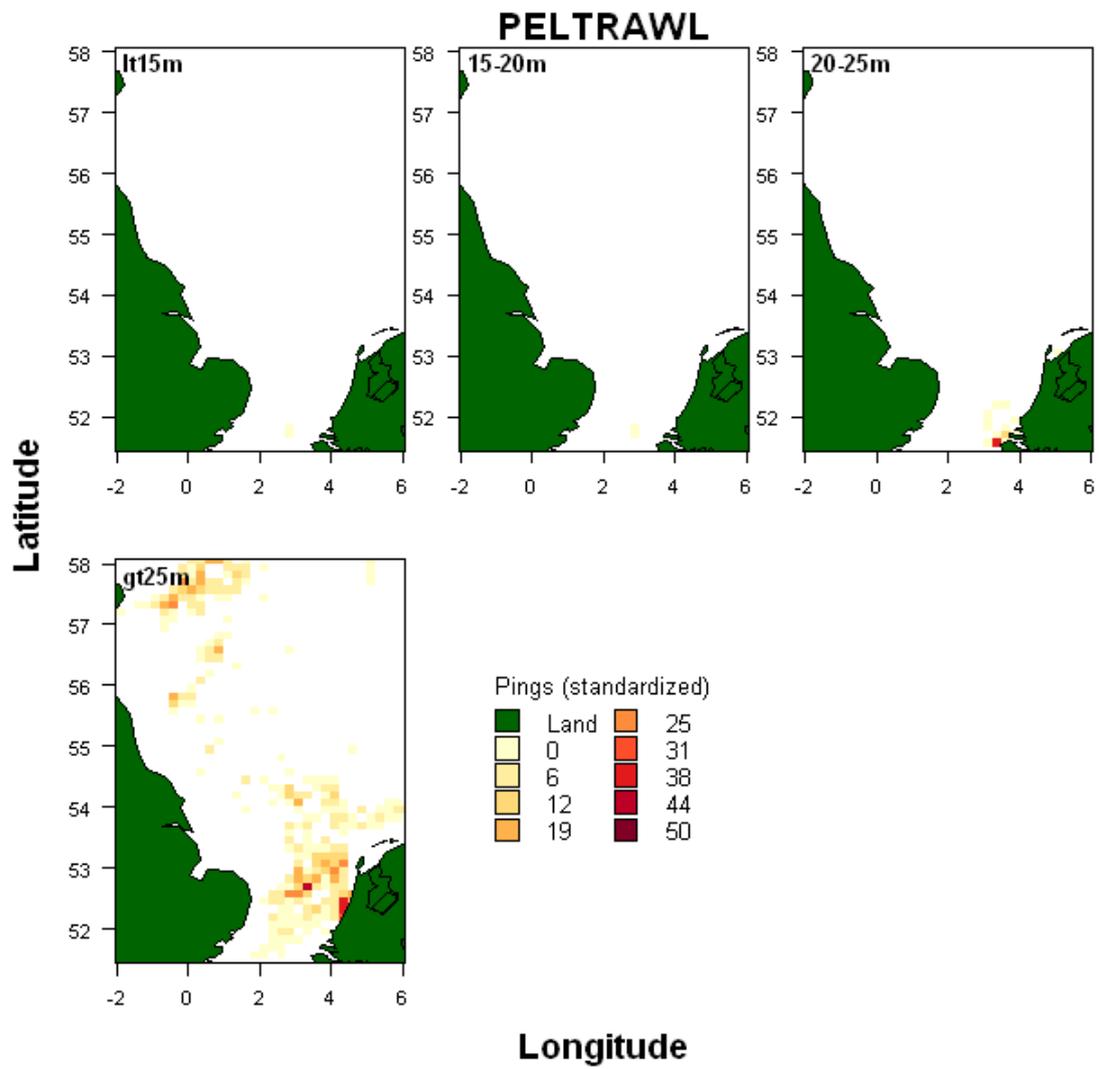


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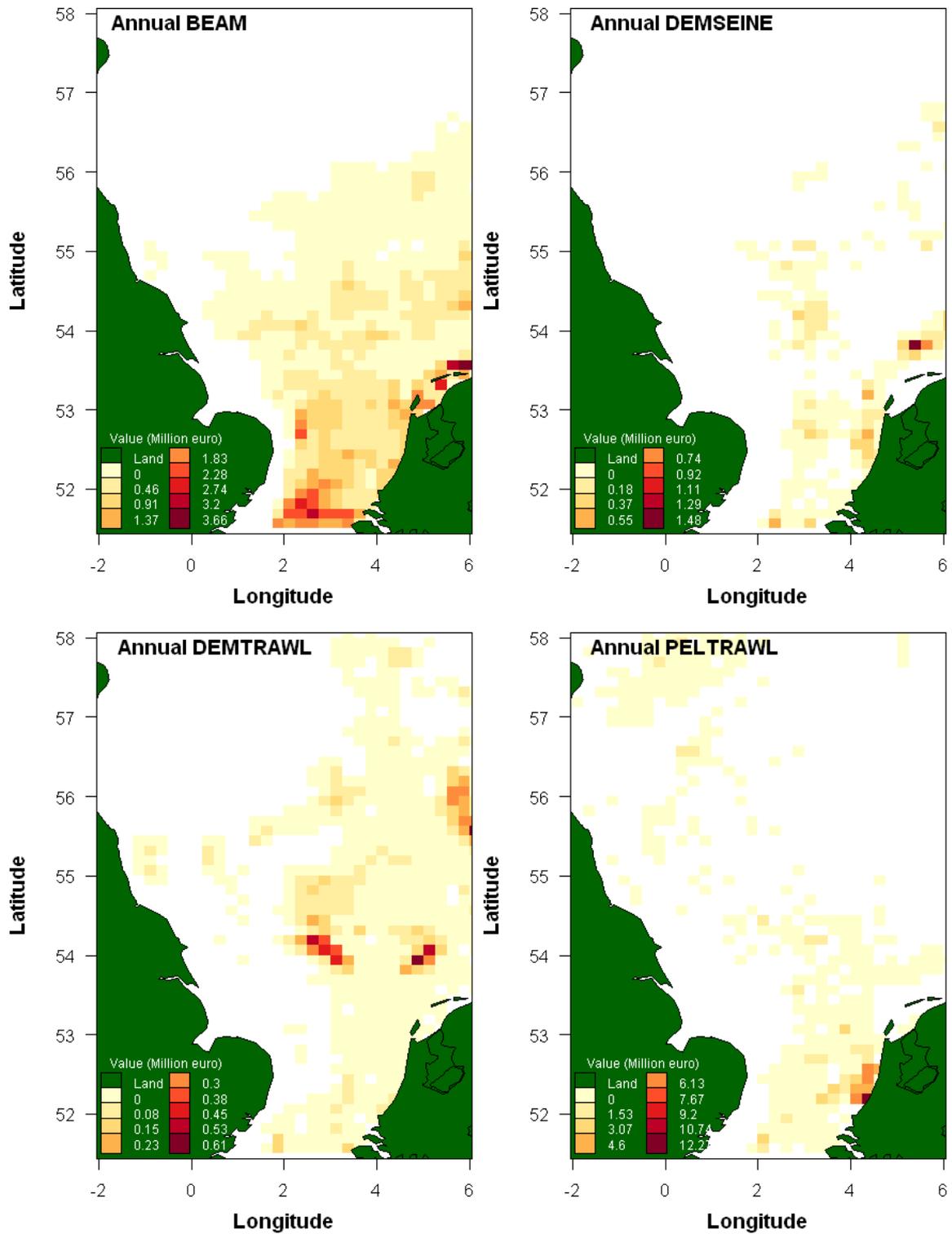


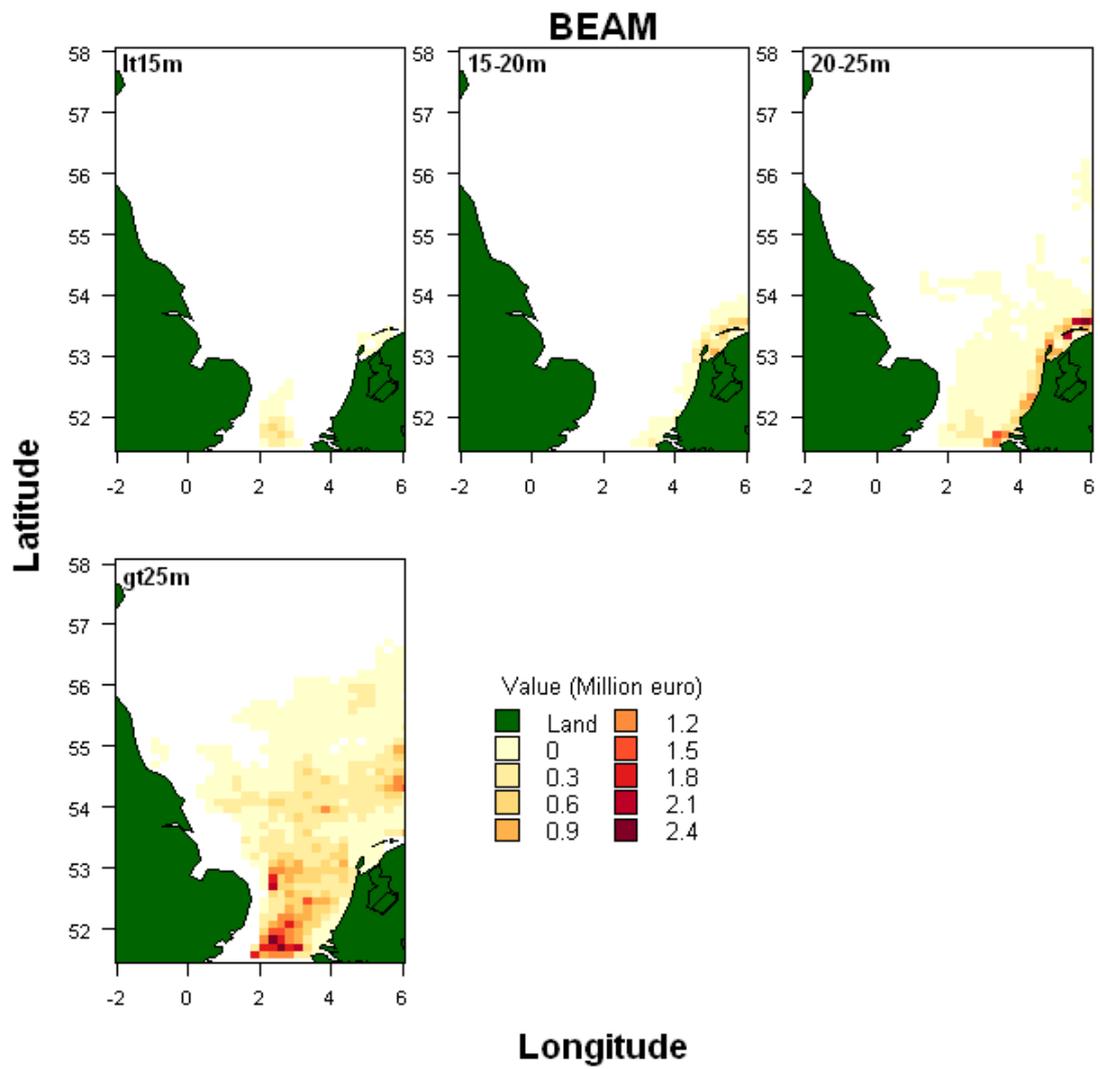
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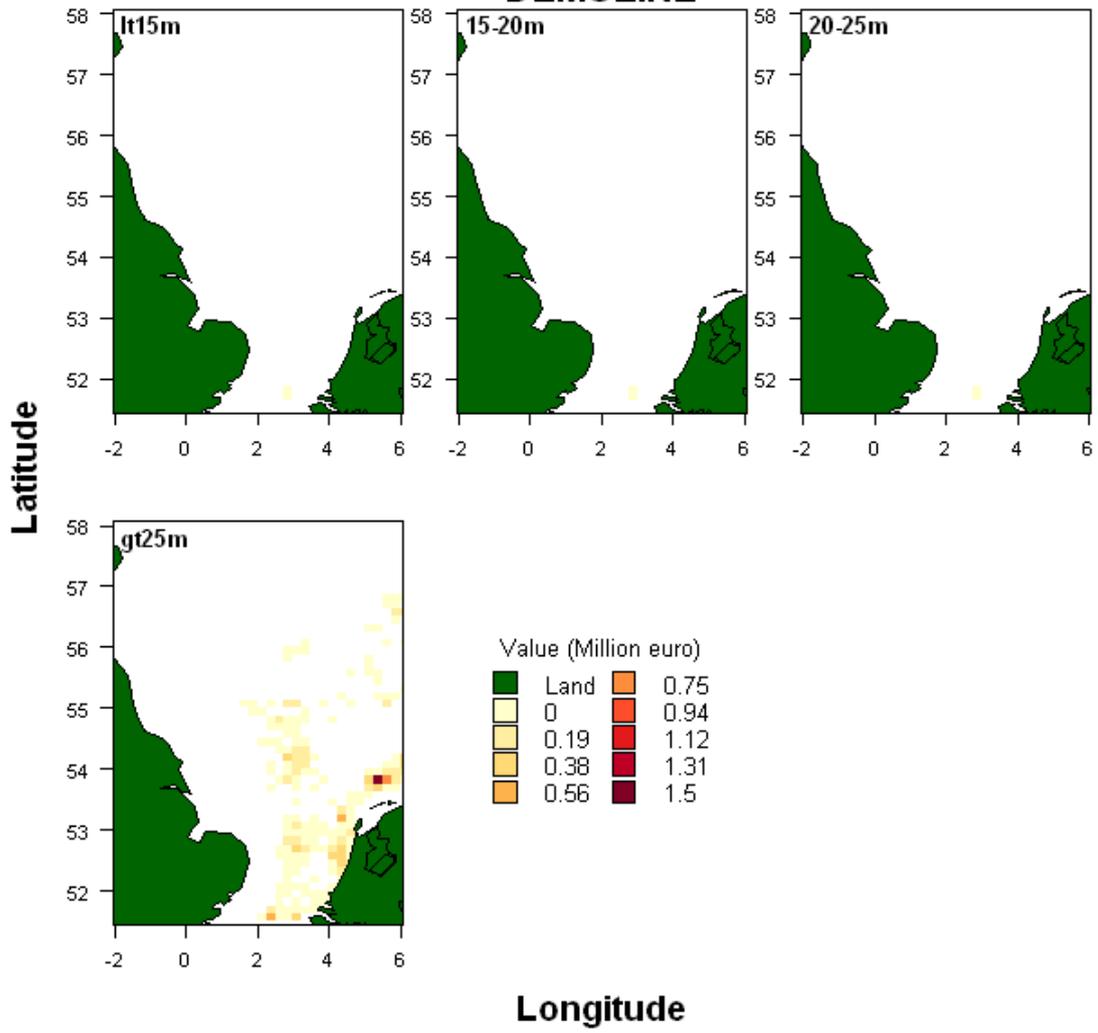


Annex B. Maps showing value of catches (€)

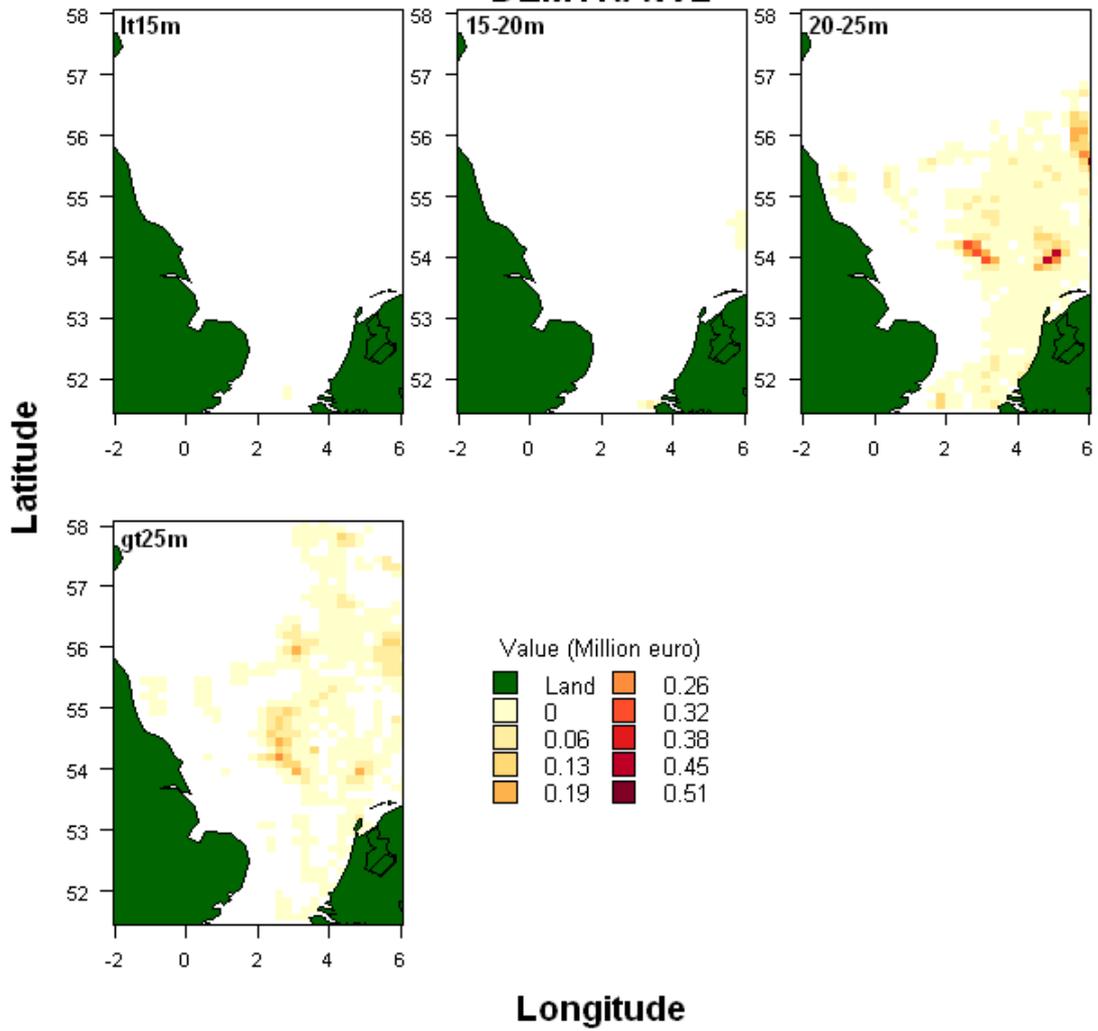




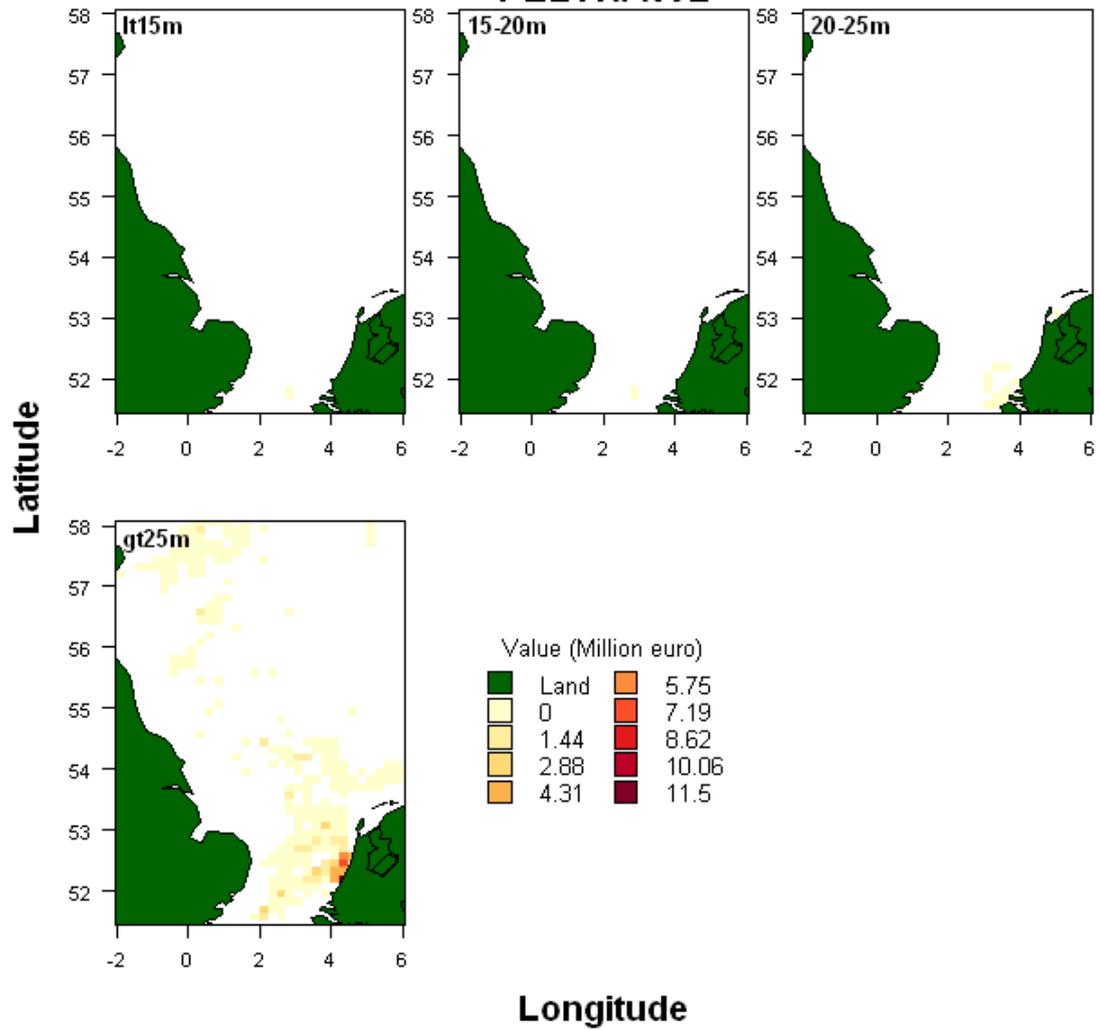
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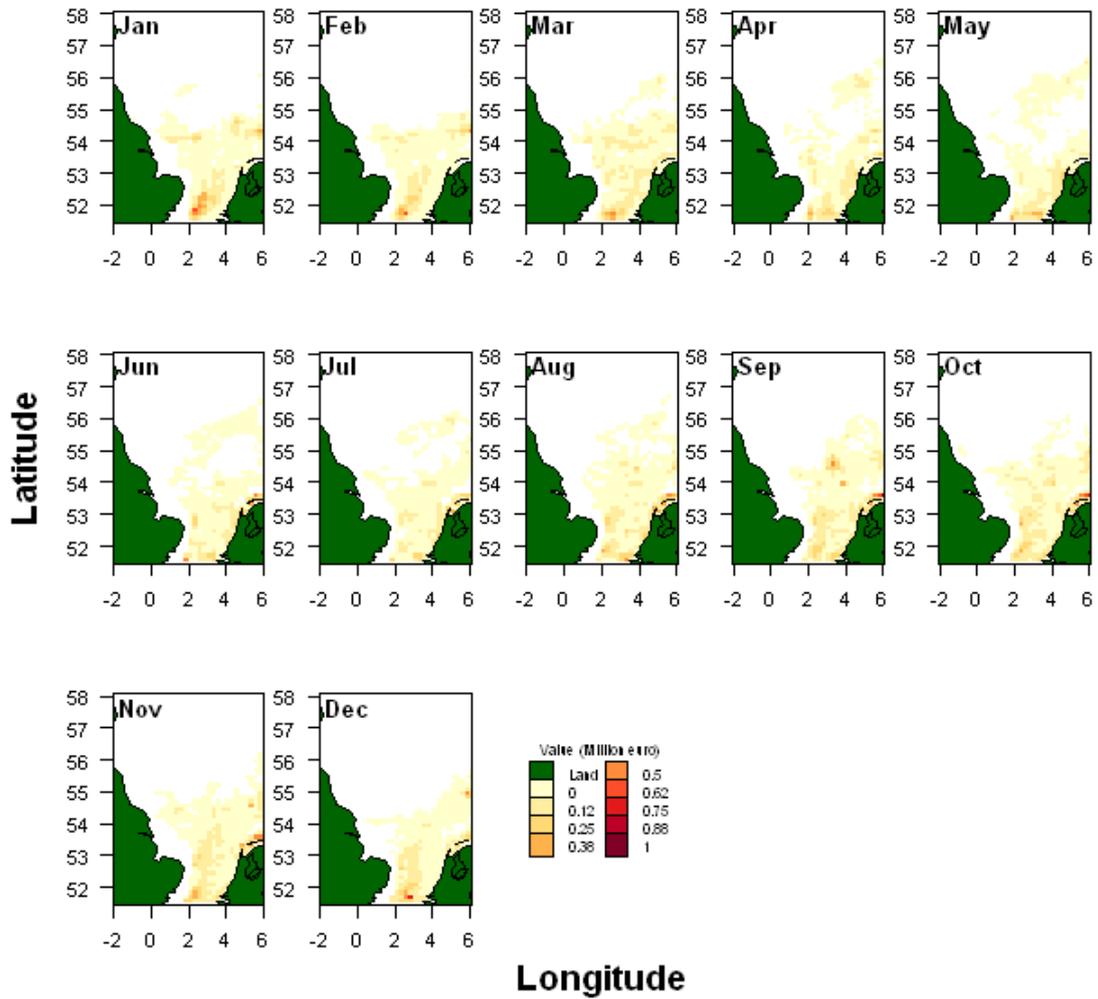
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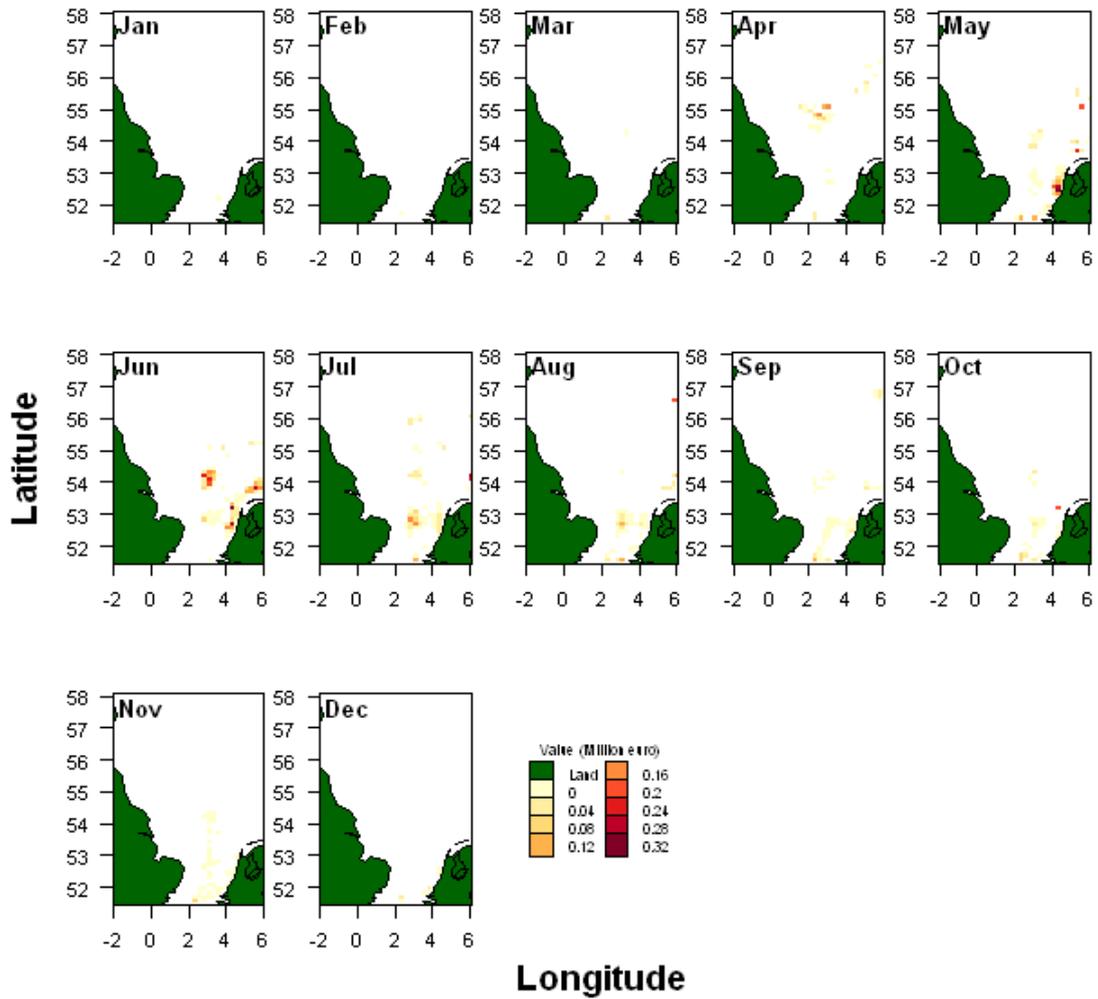
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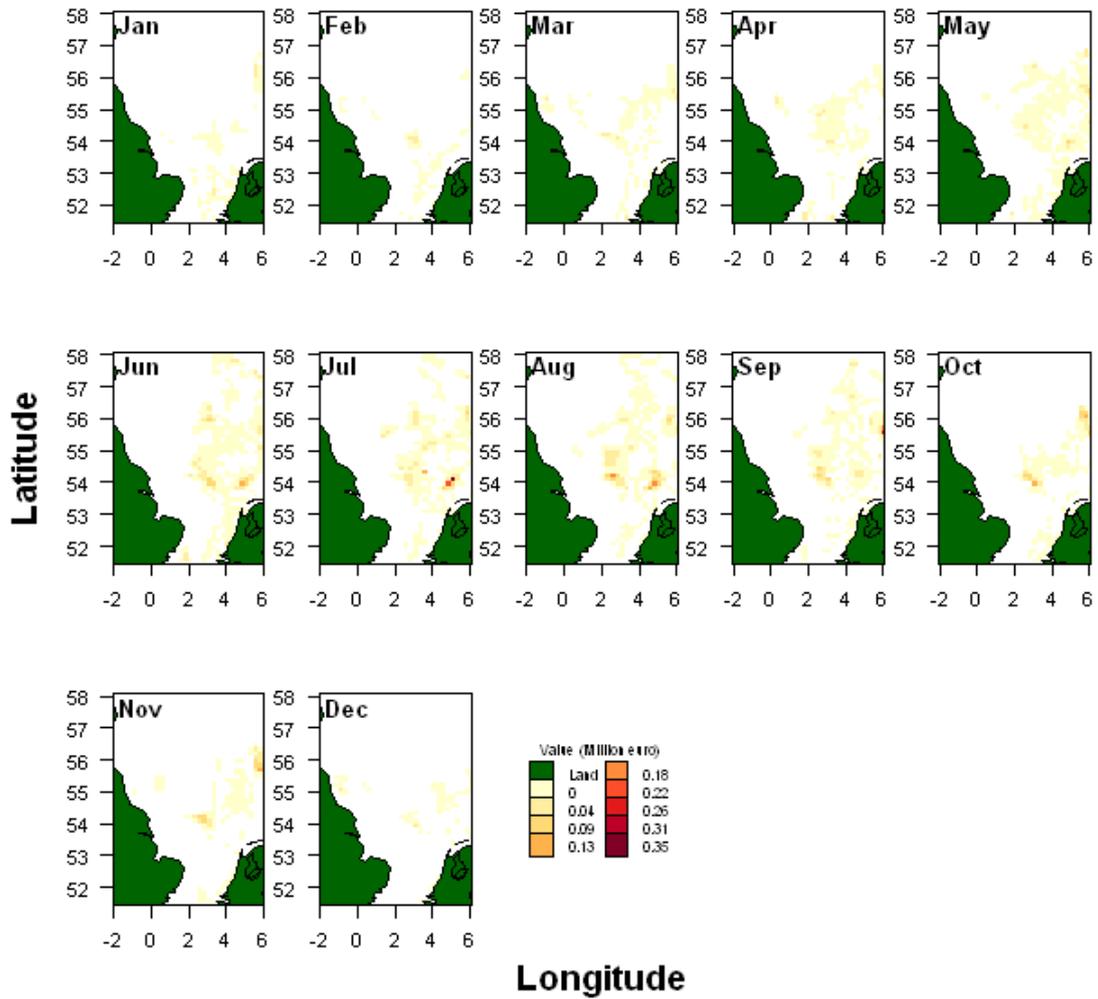
BEAM



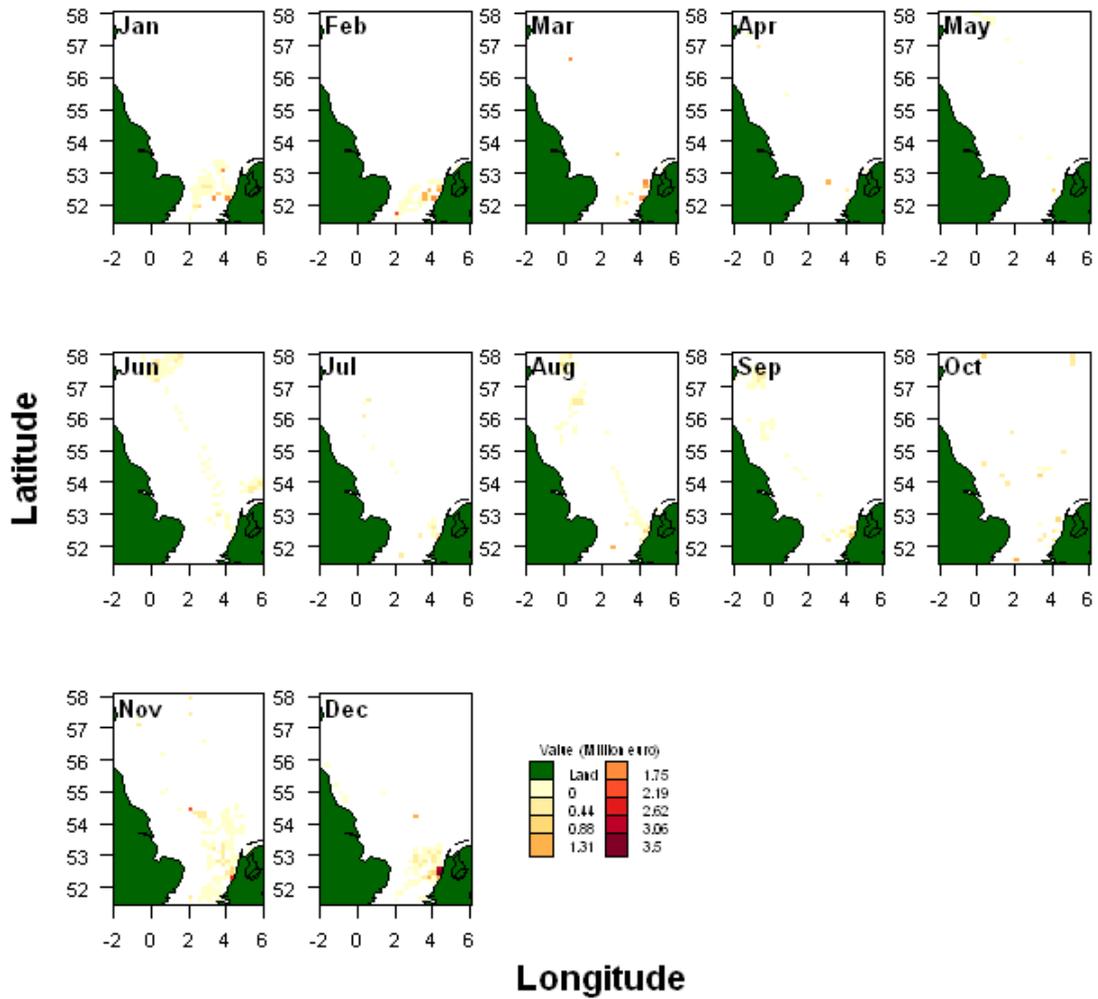
DEMSEINE



DEMTRAWL



PELTRAWL



Annex C. Indication of used prices per species (annual averages).

Species	Average annual price (€)	Species	Average annual price (€)
ANF	5.56	MGC	3.52
BIB	0.53	MOL	1.48
BLL	7.53	MON	4.21
BRB	2.12	MUL	4.32
BSS	9.64	MUR	10.02
CAA	7.43	MZZ	1.41
CAT	4.12	NEP	6.98
COD	3.45	OCC	0.81
COE	3.09	OCT	1.49
CRE	2.31	OYF	0.25
CSH	2.25	PLE	1.32
CTC	3.28	POK	3.18
DAB	0.78	POL	3.66
DGH	0.53	QSC	1.40
DGS	0.79	RJC	2.55
ELE	8.49	RJH	3.50
ERS	4.41	RJM	3.37
FBM	0.46	SBR	4.76
FCP	2.15	SBX	1.64
FLE	0.52	SCE	2.35
FPP	8.29	SMD	0.11
GAR	0.43	SME	1.05
GUG	0.56	SOL	12.13
GUR	1.32	SOS	5.88
GUU	2.86	SPR	0.51
HAD	1.99	SQU	6.49
HAL	6.56	SRX	3.10
HER	0.59	SYC	0.25
HKE	1.60	TSD	0.26
JAX	0.78	TUR	12.61
JOD	6.58	WEG	4.08
LBE	16.13	WEX	4.16
LEM	5.54	WHB	0.57
LEZ	1.42	WHE	0.55
LIN	2.45	WHG	1.35
LUM	0.12	WIT	1.25
MAA	0.91	WRA	1.23
MAC	1.21		

Annex D. Species for which no price information is available

Species	Annual average price
ANE	NA
BLU	NA
BON	NA
BUA	NA
CAX	NA
CUT	NA
FRZ	NA
LEE	NA
LHT	NA
LTA	NA
MAS	NA
PIL	NA
POP	NA
RED	NA
SAA	NA
SAE	NA