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## **Fisheries Statistics in Marine Conservation Zones (MCZ) of English and Welsh waters**

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### **1. Introduction**

Marine and Fisheries Evidence Unite of Defra (UK) requested IMARES to produce tables of landing revenues of Dutch vessels inside a number of MCZ (Marine Conservation Zones) for gears used by the Dutch fleet. Vessels larger than 12-15m are equipped with VMS (Vessel Monitoring by Satellite) monitoring their position, speed and heading every 2 hours. These data can be used to identify position of catches as high spatial resolutions. Additional logbook data is required to assess characteristics like the gear used by different vessels, their catch composition and location of the catches at the level of an ICES rectangle. VMS and logbook data are combined in this analyses to identify the position of the fishing activity and the associated catch values at these locations and to assess to what extent Dutch fishing has taken place in MCZ.

### **2. Assignment**

Produce tables of landing revenues (Euro, catches multiplied by monthly average price) of the Dutch fishing fleet in a selected number of MCZ from 2009 to 2013 for all gears operated. The tables shown in this report provide aggregated revenues at MCZ areas by gear over the years. A second table is added showing the average revenues of MCS area's for the gears by year operated in the MCZ's.

### **3. Materials and Methods**

A summary of the process to pre-process, analyse VMS and logbook data, combine these datasets and produce tables is given below. A more detailed description on the processing and assumptions made during this process can be found in Hintzen et al. (2013) <http://edepot.wur.nl/248628>.

Fisheries department

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SUBJECT  
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Wageningen UR (Wageningen University and various research institutes) is specialised in the domain of healthy food and living environment.

IMARES, part of Wageningen UR, is a leading, independent research institute that concentrates on research into strategic and applied marine ecology.

#### Data pre-processing:

- VMS and logbook data are received from the Ministry of Economic Affairs and stored in a local database at IMARES.
- VMS records are considered invalid and therefore removed from the analyses when they :
  - o Are duplicates or pseudo-duplicates (indication of malfunctioning of VMS device)
  - o Identify an invalid geographical position
  - o Are located in a harbour
  - o Are located on land
  - o Are associated with vessel speeds > 20 knots
- Logbook records are removed from the analyses when they:
  - o Are duplicates
  - o Have arrival date-times before departure date-times
  - o Overlap with other trips

#### Link VMS and logbook data:

- VMS and logbook datasets are linked using the unique vessel identifier and date-time stamp in both datasets available. In other words, records in the VMS dataset that fall within the departure-arrival timeframe of a trip described in the logbook are assigned the unique trip number from the logbook record which allows matching both datasets
- The following gear types were found to have both VMS and logbook registrations inside the selected ICES rectangles where the MCZ are located: DRB (Dredges) OTB (Otter bottom trawls), OTT (Otter twin trawls) SSC (Scottish seines), OTM (Otter midwater trawl), LHM (Handlines and pole-lines), PTM (Pair midwater trawl) SDN (Danish seine) , GNS (standing Gillnets) and TBB (Beam trawls).

#### Define fishing activity:

- Speed recordings obtained from VMS data are used to create frequency plots of these speeds, where along the horizontal axis the speed in knots is given and the vertical axis denotes the number of times that speed was recorded. In general, 3 peaks can be distinguished in such a frequency plot. A peak near 0 knots, associated with harbour/floating, a peak around the average fishing speed and a peak around the average steaming speed. These analyses are performed separately for each gear class.
- According to the method described above, selected VMS records are associated with fishing activity. Overall vessel speeds between 1.5 and 7.5 knots/mph are characterize as fishing. For Beam trawls the selected range is 2-8 mph, Otter bottom trawls: 2-5 mph; Otter twin trawls: 2-5 mph and Scottish seines 1-7 mph.

#### Spatial distribution of revenues:

- The landings recorded in the logbooks (kg), is assigned to those VMS records that have vessel id, fishing date and fishing position (in ICES squares) in common and multiplies with the monthly auction price to obtain landing revenues associated with the record. MCZ areas located within the six mile zone of UK waters are excluded because fishing by Dutch vessels is prohibited there. The MCZ zones where Dutch fishing activity has been found are: 1; 4; 6; 7; 8; 9; 10; 13; 14; 15; 16; 17; 18; 20; 21; 24; 25 and 26.

#### Define area of interest:

- 37 MCZ areas (see appendix I) within ICES rectangles 38F0, 37F0, 41F2, 41F1, 42F1, 42F2, 34E4, 37E4, 37E5, 29E9, 27E4, 27E5, 28E5, 36E4, 36E5, 35E5, 35E4, 32E4, 31E4, 31E3, 29E2, 29E1, 30E3, 28E1, 30E8, 30E9, 31F1, 31F0, 29E4, 31E5, 31E6, 38E6, 36E9, 36F0, 34F1, 35F1, 39E8, 38E9, 30E5, 37E6, 36E6 & 40E8.

Creating tables:

- Landing value is aggregated on the MCZ per gear type and year. For those logbook records that could be linked to VMS data, the GPS location was used to assign landings to an MCZ. Landing values recorded in the logbooks from other trips than those assigned to VMS records at locations within the area of interest are used to assess additional landing values. These logbook were (area) proportionally assigned to MCZ zones within an ICES rectangle and outside the 6 mile zone. In other words, the overlap in surface area of the MCZ and ICES rectangle was used as a ratio to assign landings from logbook records to MCZ.

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#### 4. Results

Analysing the 2009-2013 VMS and Logbook data, for the whole Dutch fleet, resulted in a dataset describing the landing revenues in a number of MCZ. With this dataset tables were created to describe the landing values of the fleet distributed among the MCZ. Table 1 shows the landing values of 9 gears and 8 MCZ (2, 3, 15, 11, 19, 32 and 35).

The estimated yearly total landing revenue of the Dutch fleet in the selected MCZ is on average 1250 k€. Table 2 presents the landing values in the 8 MCZ per year and gear combination.

*Table 1: Summary of the result: Revenues (in €) per ZONE (nr) and GEAR (FAO code)*

ZONE	DRB	GNS	LHM	OTB	OTM	OTT	PTM	SDN	SSC	TBB
2	570	0	1780	1560	159010	0	51950	10670	114150	0
3	0	0	0	36760	0	0	3450	0	320	0
5	0	0	0	3020	46210	0	0	0	0	29230
11	1330	0	4850	4910	297720	2840	29120	24420	323400	0
19	1380	0	140	70	67360	0	16190	0	14700	0
32	120	100	0	0	140	0	0	0	0	20
35	0	0	0	160	0	0	0	0	0	0

The gears contributing mainly to the landing values within the MCZ are OTM, SSC and PTM (predominantly pelagic fisheries). Zones with the highest landing values are Farnes East (2) & Offshore Brighton (11).



In general, the position of landings from vessels operating VMS can be estimated with higher precision. In those cases where VMS data is lacking and the ICES rectangle notation of logbooks is guiding on spatial location of fishing activity, the allocation of landings may be biased. Therefore, appendix II shows the estimated landing revenue for both the VMS based allocations (MG) and logbook based allocations (NM). In tables 1 and 2 above, the two tables have been combined.

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## 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.

Hintzen, N.T.; Coers, A.; Hamon, K. (2013) A collaborative approach to mapping value of fisheries resources in the North Sea (Part 1: Methodology) IJmuiden : IMARES, (Report C001/13) - p. 24

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## Justification

Project number: 4301000006

The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Ir. N.T. Hintzen  
Scientists

Signature:



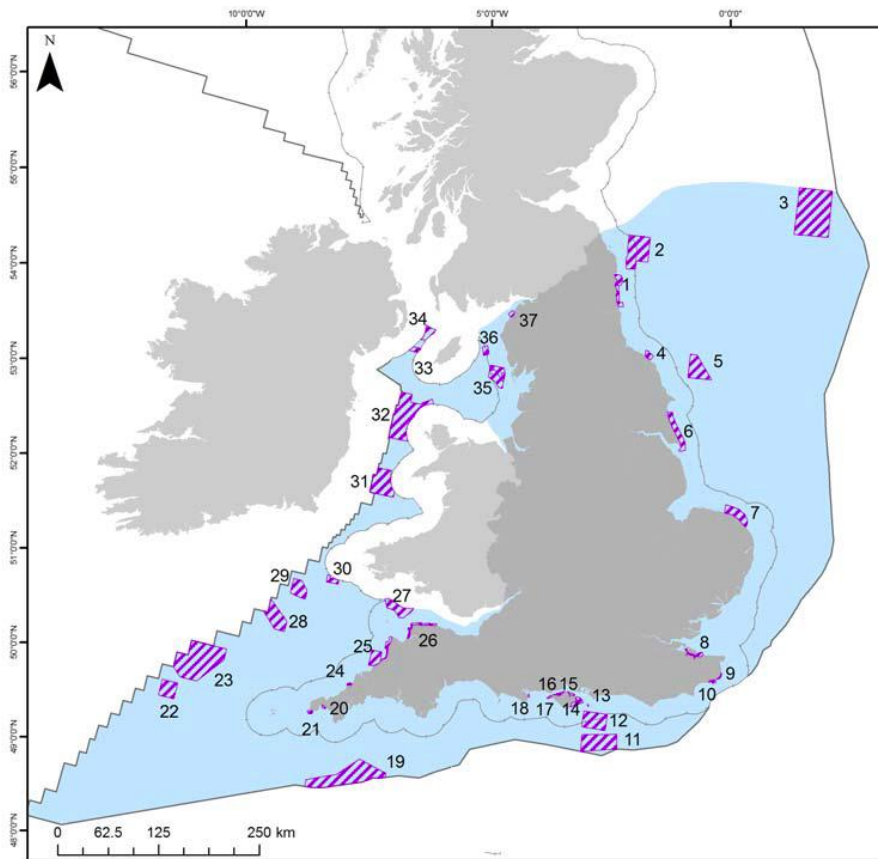
Date: 16<sup>th</sup> of July 2014

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

Signature:



Date: 16<sup>th</sup> of July 2014



**Sites for further advice**

- Candidate Tranche 2 MCZs
- UK Continental Shelf
- 12nm Territorial Seas Limit
- Secretary of State waters

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(www.ukho.gov.uk). Map produced by  
JNCC 2014. The exact limits of the UK Continental  
Shelf designated area (UKCS) are set out in  
orders under section 1(7) of the Continental  
Shelf Act 1964.  
Map Projection: Albers

*Appendix I: Location Map of the selected MCZ (1-37) & Table with MCZ names*

<b>NR</b>	<b>NAME</b>	<b>NR</b>	<b>NAME</b>	<b>NR</b>	<b>NAME</b>
1	Coquet to St Mary's	14	Bembridge	26	Bideford to Foreland Point
2	Farnes East	15	Norris to Ryde	27	North of Lundy
3	Fulmar	16	Yarmouth to Cowes	28	South of Celtic Deep
4	Runswick Bay	17	The Needles	29	Celtic Deep
5	Compass Rose	18	Studland Bay	30	East of Celtic Deep
6	Holderness Inshore	19	Western Channel	31	Mid St George's Channel
7	Cromer Shoal Chalk Beds	20	Mounts Bay	32	North St George's Channel
8	The Swale Estuary	21	Lands End	33	Slieve Na Griddle
9	Dover to Deal	22	North-West of Jones Bank	34	South Rigg
10	Dover to Folkestone	23	Greater Haig Fras	35	West of Walney
11	Offshore Brighton	24	Newquay and The Gannel	36	Mud Hole
12	Offshore Overfalls	25	Hartland Point to Tintagel	37	Allonby Bay
13	Utopia				

