Task 2. Habitat assessment

Plaice, lemon sole, and monkfish

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Issue Date: 28 Feb. 18

Cefas Document Control

|  |  |
| --- | --- |
| Submitted to: |  |
| Date submitted: |  |
| Project Manager: |  |
| Report compiled by: |  |
| Quality control by: | Ewen Bell |
| Approved by and date: | 02/03/2018 |
| Version: | 1.0 |

|  |  |  |  |
| --- | --- | --- | --- |
| Version Control History | | | |
| Version | Author | Date | Comment |
| 1.0 | Isidora Katara | 01/03/2018 |  |
|  |  |  |  |
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Executive Summary

This report aims to provide information for the pre-assessment of two fleets in terms of impact on habitats. One of the fleets operates in the North Sea and targets lemon sole and plaice, whereas the other fleet operates in the Celtic Sea and the western part of the English Channel. The effort of these fleets was overlapped on publicly available data on habitat distributions and the overlapping area was calculated. These values can be used to identify impact and as an indicator of impact magnitude.

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# Background

As part of a pre-assessment for a fishery that aims for certification regarding sustainability, the fishery is assessed against a number of criteria. One of these is its impact on habitat. According to MSC standard for PI 2.4.3, interactions with common and VME habitats need to be identified and quantified. To that goal, we overlaid maps of fishing effort to maps of habitats and quantified the overlap in terms of area.

# Methodology

## Effort Distribution

Effort distribution was based on VMS and logbook data. The steps of the analysis can be summarised as follows:

1. Logbook trip records were selected based on a number of criteria: the vessel was included in the list of vessels provided by the client (239 vessels for plaice and lemon sole, 182 vessels for monkfish) , (ii) the trip took place in an ICES rectangle that was included in the area indicated by the client[[1]](#footnote-1), (iii) the landings of the trip included the species of interest (lemon sole or plaice for the North Sea fishery, monkfish for the Western-English Channel fishery).
2. Selected logbook records (see selection criteria above) were merged with VMS records based on temporal and spatial information and fishing operations were identified based on speed patterns. The effort was estimated based on the duration of fishing operations and the data were aggregated to a 0.05x0.05 decimal degrees (DD) grid. The analysis followed the workflow adopted by ICES for the analysis of VMS and logbook data, and the algorithms developed by (Gerritsen & Lordan 2011, Hintzen et al. 2012)

The result of this analysis was annual maps of the distribution of each fishery. The temporal extent of the data is 2012-2016.

Note: logbook and VMS data identify vessels using their RSS number. Since this number was not provided for the plaice and lemon sole North Sea fishery, it was retrieved using a query based on CEFAS internal databases and information provided by the client.

## Habitat Distribution

Habitat data were derived from 3 sources:

1. The EMODnet broad-scale seabed habitat map for Europe 2016 (EUSeaMap 2016) which ‘is a predictive habitat map which covers the seabed of a large area of European waters’ ([www.emodnet-seabedhabitats.eu](http://www.emodnet-seabedhabitats.eu)). Both substrate and habitat type layers were derived from this dataset.
2. The EMODnet OSPAR Threatened and/or Declining Habitats 2015, which is ‘a compilation of OSPAR habitat data for the northeast Atlantic, compiled on behalf of the OSPAR Commission’ (https://odims.ospar.org/). The list of threatened and/or declining species and habitats in the North-East Atlantic was established by OSPAR as part of its commitment to assess species and habitats that need to be protected. The most comprehensive dataset is in the form of points. For the purposes of this analysis, a buffer of 0.05 DD was built around the points and the resulting areas were dissolved into polygons.
3. The ICES Vulnerable Marine Ecosystems (VMEs), (and organisms considered to be indicators of VMEs) across the North Atlantic was derived from the ICES data portal (http://vme.ices.dk/download.aspx ). The dataset has been set up by the Joint ICES/NAFO Working Group on Deep-water Ecology (WGDEC). All VME indicators for all years were downloaded. The data are provided in the form of lines. Hence, for the purposes of this analysis, a 0.05 DD buffer was built around the lines and dissolved into polygons.

## Habitat – Fisheries Overlap

A GIS algorithm was developed to calculate the overlap between the fishery distribution and each of the habitats. The algorithm was applied sequentially to pairings of the fishery distribution and each of the 4 habitat layers (total of 8 pairs) and involved: (i) intersect between the grid of the distribution of the fishery for a certain year and the polygon of the habitat, and (ii) calculation of the common area (per habitat type or substrate in the case of the EUSeaMap 2016 data).

The total area of the distribution of each fishery was also calculated.

To calculate the area that is occupied by a certain habitat (i) the habitat dataset was clipped based on the areas indicated by the client and related ICES rectangles and (ii) the total area was calculated (per habitat type or substrate in the case of the EUSeaMap 2016 data).

Finally, two ratios were calculated: the proportion of fishing effort area that overlaps with a species/habitat – overlap area divided by the total fishing effort area - and the proportion of habitat area that overlaps with fishing effort – overlap area divided by the total habitat area.

## Habitat Recovery Rates

A literature search was conducted to retrieve information on habitat recovery rates. Habitat recovery can vary between habitats, gears used, location, and ecosystems. The results found in literature can be discussed during an experts’ workshop – organised in the framework of Task 5 - to validate their relevance to the area of the distribution of the two fleets.

# Results

## Habitat Distribution

Figures 1 to 4 give an overview of the habitat and species distribution maps used in the analysis. The ICES dataset on VMEs does not include VMEs in the North Sea, but the uncertainty of the dataset in some areas might be high due to lack of relevant local studies.

A close up of text on a white background

Description generated with high confidence

Figure 1 VMEs distribution derived from the ICES dataset. A 0.05 DD buffer was built around each VME for area calculation purposes.

A close up of a map

Description generated with high confidence

Figure 2 Distribution of OSPAR threatened and protected habitat and species.

A close up of a map

Description generated with high confidence

Figure 3 Substrate data derived from the EUSeaMap 2016.

A close up of a map

Description generated with high confidence

Figure 4 Data on habitat types derived from the EUSeaMap 2016. The EUNIS classification in followed (Davies et al. 2004).

## North Sea Lemon sole and Plaice

### Effort Distribution

A total of 176 vessels (using the RSS number as vessel identifier, referring to the number of unique RSSs) had logbook records in the period 2012-2016 (table 1). Tables 2 and 3 provide some more details on the gears used by the selected vessels when these catch plaice and/or lemon sole and on the catch composition for an ‘average’ trip.

The match between logbook records and VMS records – i.e. logbook records that could be linked to VMS records - ranged from 66% (2012) to 74% (2015). Indicatively, in 2013, from the 169 vessels selected in the logbook data, 153 had related VMS records (90%), from the 5060 trips, 3492 could be linked to VMS records (69%).

Table 1 Number of unique RSS numbers with logbook records per year

|  |  |
| --- | --- |
| year | vessels number |
| 2012 | 172 |
| 2013 | 169 |
| 2014 | 176 |
| 2015 | 176 |
| 2016 | 175 |

Table 2 List of gears used by the selected vessels on trips when plaice and/or lemon sole was caught. the number of logbook records is indicative of the frequency of the gear used but does not always correspond to the number of trips

|  |  |
| --- | --- |
| Gear Code | Number of logbook records |
| DRB | 3184 |
| FPO | 5532 |
| GND | 167 |
| GNS | 563 |
| GTR | 1 |
| HMD | 6 |
| LHP | 191 |
| MIS | 221 |
| OTB | 131262 |
| OTM | 115 |
| OTT | 31345 |
| PS | 26 |
| PTB | 32280 |
| PTM | 19 |
| SDN | 1190 |
| SSC | 10984 |
| TBB | 1764 |

Table 3 Species catch composition (average per trip) for the selected vessels, over the whole time series.

|  |  |
| --- | --- |
| species | Percentage of total catch |
| HAD | 28.4 |
| COD | 15.9 |
| NEP | 11.1 |
| PLE | 9.1 |
| WHG | 9.1 |
| POK | 7.9 |
| HKE | 5.7 |
| ANF | 2.8 |
| SCE | 1.9 |
| LEM | 1.0 |

A close up of a map

Description generated with high confidence

Figure 5 Fishing effort map for 2012, derived from the analysis of VMS and logbook data.

### Habitat – Fisheries Overlap

All area calculations can be found in Annex I. The results provide areas in square km and two ratios, the proportion of fishing effort area that overlaps with a species/habitat and the proportion of habitat area that overlaps with fishing effort. The largest value observed was 63% of the fishing effort area overlapping with sand substrates, while 14-16% overlap was observed with OSPAR threatened and protected habitats/species for the period 2012-2015. 0% overlap with VMEs.

Table 4 Overlap area calculations for sand and sandy-mud substrates.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Habitat or Species | year | overlap area | % effort area | % habitat area |
| Sand | 2015 | 114363.23 | 63 | 10 |
| Sand | 2012 | 97258.83 | 61 | 8 |
| Sand | 2013 | 100363.89 | 62 | 9 |
| Sand | 2014 | 108412.47 | 63 | 9 |
| Sand | 2016 | 104892.42 | 61 | 9 |
| Sandy mud to muddy sand | 2013 | 36260.09 | 22 | 9 |
| Sandy mud to muddy sand | 2016 | 37548.92 | 22 | 10 |
| Sandy mud to muddy sand | 2012 | 34811.65 | 22 | 0.09 |
| Sandy mud to muddy sand | 2015 | 35428.90 | 20 | 0.09 |
| Sandy mud to muddy sand | 2014 | 35503.42 | 21 | 0.09 |

## West & English Channel Monkfish Fishery

### Effort Distribution

A total of 177 vessels (using the RSS number as vessel identifier) had logbook records in the period 2012-2016 (table 5). Tables 6 and 7 provide some more details on the gears used by the selected vessels when these catch monkfish and on the catch composition for an ‘average’ trip.

The match between logbook records and VMS records – i.e. logbook records that could be linked to VMS records - ranged from 64% (2015) to 73% (2012). Indicatively, in 2015, from the 142 vessels selected in the logbook data, 105 had related VMS records (74%), and from the 7040 trips seen in the logbook data, 3679 could be linked to VMS records (52%).

Table 5 Number of vessels with logbook records per year.

|  |  |
| --- | --- |
| Year | vessels number |
| 2009 | 145 |
| 2010 | 146 |
| 2011 | 151 |
| 2012 | 154 |
| 2013 | 159 |
| 2014 | 168 |
| 2015 | 173 |
| 2016 | 177 |

Table 6 List of gears used by the selected vessels on trips when monkfish was caught. the number of logbook records is indicative of the frequency of the gear used but does not always correspond to the number of trips.

|  |  |
| --- | --- |
| Gear Code | Number of logbook records |
| DRB | 14038 |
| FPO | 4 |
| GNS | 5033 |
| GTR | 1504 |
| HMD | 312 |
| LHP | 3 |
| LLD | 2 |
| MIS | 46 |
| OTB | 33187 |
| OTM | 9 |
| OTT | 4832 |
| PTB | 141 |
| PTM | 21 |
| TBB | 50073 |

Table 7 Species catch composition (average per trip) for the selected vessels.

|  |  |
| --- | --- |
| species | percentage of total catch |
| CTL | 16.1 |
| ANF | 16.0 |
| GRO | 7.9 |
| PLE | 4.5 |
| LEZ | 4.5 |
| SOL | 3.0 |
| HKE | 1.6 |
| SQC | 1.4 |
| TUR | 1.2 |
| COD | 1.0 |
| OCT | 1.0 |

A close up of a map

Description generated with high confidence

Figure 6 Fishing effort map for 2016, derived from the analysis of VME and logbook data.

### Habitat – Fisheries Overlap

All area calculations can be found in Annex II. The results provide areas in square km and two ratios, the proportion of fishing effort area that overlaps with a species/habitat and the proportion of habitat area that overlaps with fishing effort. The largest value observed was 65% of the fishing effort area overlapping with coarse sediments, while 6% overlap was observed in 2016 with OSPAR threatened and protected habitats/species. 0% overlap with VMEs, as these are depicted in the ICES dataset.

Table 8 Overlap area calculations for OSPAR threatened and protected habitats and species.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Habitat or Species | year | overlap area | % effort area | % habitat area |
| ospar | 2016 | 4931.44 | 6 | 12 |
| ospar | 2015 | 3543.09 | 4 | 8 |
| ospar | 2014 | 2744.98 | 4 | 6 |
| ospar | 2013 | 1585.88 | 2 | 4 |
| ospar | 2012 | 1337.80 | 2 | 3 |

## Habitat Recovery Rates

We found two meta-analyses that summarise all available studies on the subject of recovery after a physical disruption. Collie et al. (2000) did a meta-analysis of studies on recovery rates after physical disturbance. Some of the information that the authors summarise and could be relevant to the fisheries in question can be found in table 9. In a similar study, Kaiser et al. (2006) noted that in sand habitats beam trawling has a severe initial impact but rapid recovery, while otter trawls have a delayed effect on sand habitats, in terms of both impact and recovery. The patterns are similar in muddy sand habitats. As expected fishing has severe effects on biogenic habitats that show the longest recovery periods or no recovery. Available data for the recovery of mud and biogenic communities are restricted to dredging and otter trawling.

Table 9 Recovery time after physical disturbance after Collie et al. (2000).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Gear | Habitat | Region | Scale | Depth | Recovery |
| **(m)** | **(m)** | **period (days)** |
| Inter-tidal dredging | Biogenic | East North America | 35 | 1 | 730 |
| Otter trawling | Biogenic | East North America |  | 20 | 365 |
| Otter trawling | Biogenic | Southern Europe |  |  | 1095 |
| Beam trawling | Gravel | Northern Europe | 40 | 40 | 180 |
| Inter-tidal dredging | Mud | Northern Europe | 2 | 0 | 210 |
| Otter trawling | Mud | Northern Europe | 200 | 30 | 540 |
| Otter trawling | Mud | Southern Europe | 100 | 20 | 180 |
| Hydraulic dredging | Muddy Sand | East North America | 150 | 3 | 300 |
| Inter-tidal dredging | Muddy Sand | Northern Europe | 1·5 | 0 | 365 |
| Inter-tidal dredging | Muddy Sand | South Africa | 3 | 0 | 606 |
| Beam trawling | Sand | Northern Europe | 40 | 27 | 180 |
| Inter-tidal dredging | Sand | East North America | 35 | 1 | 730 |
| Inter-tidal dredging | Sand | Northern Europe | 45 | 0 | 56 |
| Inter-tidal dredging | Sand | Northern Europe | 5 | 0 | 180 |
| Inter-tidal dredging | Sand | Northern Europe | 1 | 0 | 140 |
| Inter-tidal dredging | Sand | Northern Europe | 7 | 0 | 140 |
| Inter-tidal dredging | Sand | Northern Europe | 1 | 0 | 180 |
| Inter-tidal dredging | Sand | Northern Europe | 1 | 0 | 140 |
| Inter-tidal dredging | Sand | Northern Europe | 50 | 7 | 40 |
| Inter-tidal raking | Sand | Northern Europe | 20 | 0 | 400 |
| Inter-tidal raking | Sand | Northern Europe | 45 | 0 | 56 |
| Otter trawling | Sand | East North America | 500 | 8 | 180 |
| Otter trawling | Sand | East North America |  | 30 | 3650 |
| Otter trawling | Sand | East North America | 200 | 20 | 180 |
| Otter trawling | Sand | Eastern Australia | 1200 | 25 | 1440 |
| Otter trawling | Sand | Eastern Australia | 20 | 25 | 1440 |

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Appendix:

Attached Annexes I to II.

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1. For the North Sea the ICES rectangles indicated were 27.4.a, 27.4.b, and 27.4.c; for the

   Western-English Channel area the rectangles indicated were 27.7.b ,27.7.c ,27.7.d ,27.7.e , 27.7.f , 27.7.g , 27.7.h, 27.7.j, 27.7.k, 27.8.a, 27.8.b, 27.8.d. [↑](#footnote-ref-1)