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SCICOM STEERING GROUP ON SUSTAINABLE USE OF ECOSYSTEMS

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Report of the Working Group on Spatial Fisheries Data (WGSFD)

11–13 September 2013

ICES Headquarters, Copenhagen

INTERIM REPORT

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Contents

Executive summary

The Working Group on Spatial Fisheries Data (WGSFD) met at ICES, Headquarters, Copenhagen, from 11–13 September 2013. Participants came from Denmark, France, Germany, Latvia and UK (Northern Ireland, Scotland). Data from Denmark, Germany and UK where used in the analysis of spatial indicators, while data from France and Latvia were not ready to be uploaded.

With this limited participation of five countries, WGSFD 2013 failed to produce meaningful quantitative indices for DCF indicators 5, 6 and 7 under ToR a.

Under ToR a, WGSFD 2013 developed a workflow and delivered necessary specifications of DCF indicators 5, 6, and 7 (for indicators see Commission Decision 949/2008/EC). With regards to DCF indicator 6, WGSFD recommends to not apply the routines implemented in *VMStools* software package version 0.64 and following versions for which the function *indicator* refers to its coding at version 0.64. The proposed calculation of DCF indicator 6 is easily coded in either R or SAS and mapping examples are given.

With regards to DCF indicator 7, WGSFD suggests to relate this indicator to habitat areas to indicate the amount of space untrawled on habitat level rather than for entire regions.

In light of the OSPAR request regarding the mapping of fishing activities in all OSPAR regions, WGSFD extended its meeting for 2014 by 1 additional day to cover the expected workload. WGSFD intends to invite participants from Norway, Iceland, Faroe Islands and Greenland to share VMS and logbook data according to the adopted workflow to meet this request.

WGSFD identified new developments in VMS analysis regarding tidal correction of vessel speed and interpolation procedures of VMS pings, which will be further monitored in 2014.

WGSFD 2013 elected Josefine Egekvist a new Chair for the term 2014–2016.

1 Administrative details

Working Group name

Working Group on Spatial Fisheries Data (WGSFD)

Year of Appointment

2013

Reporting year within current cycle (1, 2 or 3)

1

Chair(s)

Heino O. Fock, Germany

Meeting venue

Copenhagen, Denmark

Meeting dates

11-13 September 2013

2 Terms of Reference a) – c)

a) An annual update of an aggregated product based on VMS and logbook data giving the DCF environmental indicators 5, 6 and 7 as well as MSFD descriptor 6. The aggregated output will contain data from as many ICES member states as possible.

b) Work on standardized data products for inter alia WGDEEP, WGDEC, WGECO. Ensure standardized methods and quality assurance.

c) Review ongoing work for analysing VMS data and developing standardized data products. This might also include new technical solutions like e-logbook, AIS and CCTV data to improve the effort estimate

3 Summary of Work plan

Only few countries participated in WGSFD 2013 and therefore, WGSFD 2013 failed to produce quantitatively reliable estimates of fishing pressure indicators according to ToR a. Though prior to the meeting all participants had been preparing datasets according to TACSAT2 and EFLALO2 specifications as laid out in VMStools and previous SGVMS reports, work on ToR a took two entire days and was still not finished at the end of the meeting. Post meeting work had to be done on combining indicator datasets for doing final calculations on indicators. In addition to work on data, it must be mentioned that methodological discussions took considerable time on the first day. The results of this discussion are summarized below. It can be foreseen that methodological work will also occupy much work time in 2014, in particular for DCF indicator 6 regarding issues to calculate fishing frequencies and defining thresholds to describe aggregation.

4 List of Outcomes and Achievements 2013

4.1 ToR a: Workflow within WGSFD for the analysis of DCF indicators 5, 6 and 7

WGSFD workflow in the analysis of DCF indicators comprises analyses at three levels. Each country generates TACSAT2 and EFLALO2 datasets and conducts analysis of effort (Steps 1 and 2, Figure 1). VMS effort is reported as Fishframe formatted output (Step 4), and additionally an overview table is provided summarizing by métier the number of vessels, the number of vessels obliged to operate VMS, total catch and the number of trips (Step 5). Step 5 is essential to compare statistics between countries and to select further candidates for representation in the analysis (Step 6). Data are uploaded and merged into one dataset (Step 7) while the country code is eliminated prior to analysis of Indicators (Step 8). Hence, data at steps 1 and 2 are fully resolved national data but not provided to WGSFD, data aggregated to métiers are provided at step 4 to the attention of WGSFD, and fully anonymous data ready for storage are delivered at step 8.

4.1.1 Iterative procedure: Métiers with less than 6 vessels

Métiers with less than 6 vessels are ruled out at the national level (Step 3). This does not exactly follow the rationale of Commission Decisions 2010/93/EU and 949/2008/EC stipulating the treatment of small métiers comprising less than 10 vessels, where national clustering of métiers is recommended to generate super-métiers. For the reason of economic reporting these seems advisable, whereas for the purpose of assessing the environmental consequences of fishing, it appears more appropriate to set the threshold to 6 and to combine internationally within the same métier instead of clustering nationally across métiers (Step 6). Conducting Step 6 means to rerun the output of Fishframe formatted VMS effort (Step 4). Step 6 may be adopted when patterns of single vessels become still become too evident even after merging at international level or in case of high impact métiers with small though decisive effort (e.g. dredging). The adoption is subject to evaluation within WGSFD.

In the case of Germany (Northeast Atlantic and North Sea, Annex 3 Table 8.2) and Denmark (Annex 3 Table 8.3), combining indicator datasets would result in a further inclusion of 5 German métiers merging into larger Danish métiers, and 2 additional métiers reaching the 5+ threshold after combining so that some 1500 fishing trips of which ca. 500 belong to bottom contacting métiers could be included. This shows that combining national datasets substantially increases data coverage especially for métiers with bottom contacting gears.

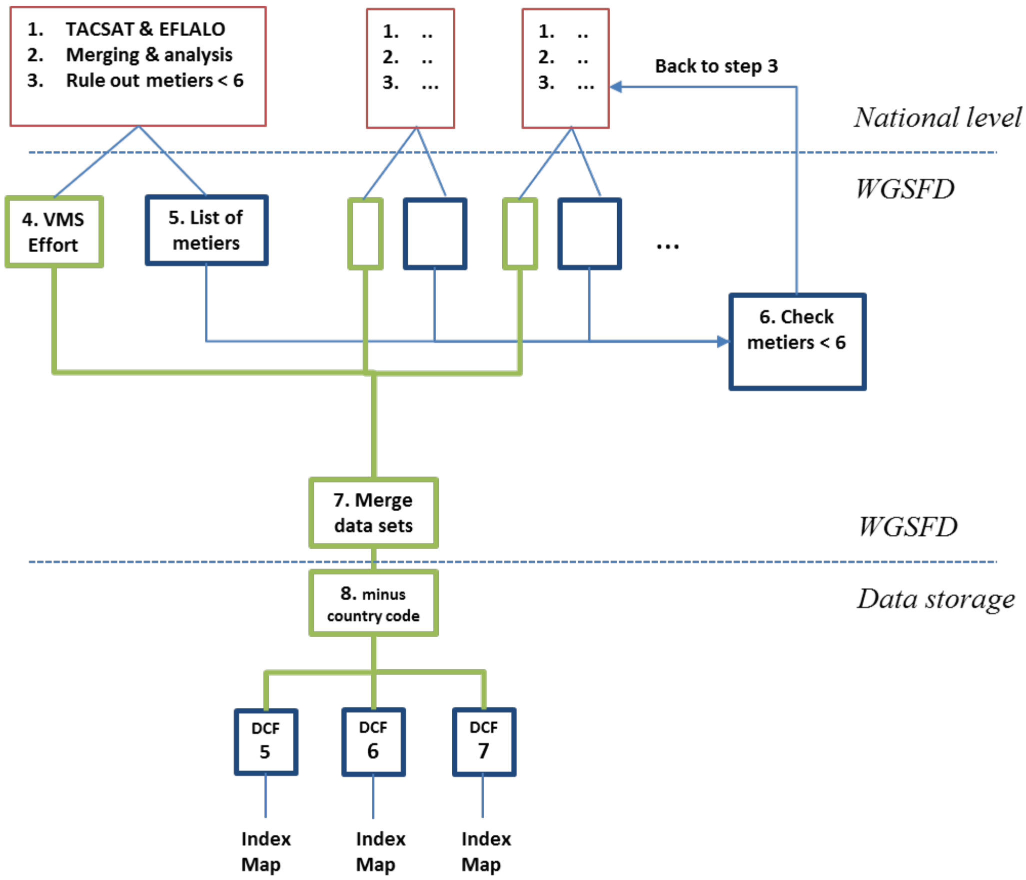

Figure 1. Workflow diagram.

4.2 ToR a: Specifications on DCF descriptors 5, 6 and 7

4.2.1 Excerpt from WGECO 2012 report

WGECO 2012 explored and calculated the pressure indicators for trawling impact on the different marine habitats based on 2 case studies:

- Distribution of fishing activities (DCF 5);
- Aggregation of fishing activities (DCF 6);
- Areas not impacted by mobile bottom gears (DCF 7).

4.2.1.1 Dutch case study

Dutch data were considered for spatial and temporal scale according to (Piet and Quirijns, 2009) in conjunction with the reconstruction of trawl tracks based on the cubic Hermite spline interpolation technique according to (Hintzen *et al*., 2010). Only vessels fishing with bottom gear were included, which makes it easier to draw assumption on gear properties (see comment in 4.2.2). All aspects of preliminary data preparation and the calculation of the pressure indices were done using the *VMStools* package and *sp* package which are available as add-on packages to the R statistical software.

Applying interpolation (see comment in 4.2.2), grids were constructed at different resolutions to compare and contrast the impact of different grid resolutions on the outcome of the analyses: a 'low' resolution grid (0.6 minutes longitude by 0.3 minutes latitude, approx. cells of 600 x 600 meters), and 'high' resolution grid (0.06 minutes longitude by 0.03 minutes latitude, approximately cells of 60 x 60 meters).

4.2.1.1.1 Distribution of fishing activities (DCF 5)

This indicator was calculated using two specific parameters: total surface area trawled and proportion of surface area trawled.

The total area trawled within each spatial grid cell was calculated based on the width of the gear, a vessel's speed and time spent in that cell. Each VMS registration is allocated to one spatial grid cell. The average time difference between the preceding and succeeding registration is taken as the time spent within the grid cell. Multiplying time spent by gear width and speed provides information on the actual trawl track (km^2) within the spatial grid cell. Aggregating all tracks within a spatial grid cell gives the total surface trawled within the specific grid cell. Aggregating over all grid cells gives the total surface area trawled.

The proportion of the area trawled is calculated by counting each grid cell that is trawled as a trawled grid cell without any consideration of how much of the grid cell is actually trawled. Aggregation over all grid cells in an area gives the total proportion of that area trawled.

4.2.1.1.2 Aggregation of fishing activity (DCF 6)

This indicator was calculated using two specific parameters: proportion of surface area fished by specific proportion of effort and proportion of surface area fished at specific trawling intensity.

Proportion of surface area fished by specific proportion of effort was calculated from the DCF 5 indicator through summation of the grid cells in decreasing order until a specific percentage of the total effort (i.e. 90%) is reached. The indicator equals the total surface area of these grid cells as a proportion of the total surface area.

Proportion of surface area fished at specific trawling intensity was calculated based on the calculations above, can derive the intensity of trawling for each of the spatial grid cells. If the area trawled within a spatial grid cell equals its total surface, trawling intensity equals 1.

4.2.1.1.3 Areas not impacted by mobile bottom gears (DCF 7)

This indicator was calculated using two specific parameters: cumulative proportion of surface area not impacted over a specific period and proportion of surface area not impacted incorporating uncertainty.

Cumulative proportion of surface area not impacted over a specific period was calculated by adding the registrations/tracks for each additional year of fishing to those of the previous year(s). The surface area of each grid cell that has not been fished is thus integrated over successive years. The total surface unfished can then be divided by the total surface area of the EEZ.

Proportion of surface area not impacted incorporating uncertainty in the estimated trawl path based on the VMS registrations and using the available interpolation techniques (Hintzen *et al.*, 2010).

4.2.1.2 Calculation: Italian case study

The Italian experience computing the DCF indicators of fishing pressure 5-Extension of fishing activities and 6-Aggregation of fishing activities.

Specification of the Indicators in Appendix XIII of the DCR identifies a 3 km x 3 km grid size as optimal for representing fleet distributions. For computation of indicator 5 is sufficient to plot fishing set position on the grid and then count the number of cells with at least one point. The value of indicator is then determined by multiplying the number of cells for 9 km$^{2.}$ Thus, the expression of the indicator 5 is:

$$E_{m,a} = n_{m,a} \times 9$$

Where $E_{m,a}$ is the value (in km^2) of the indicator at month *m*, for métier *a*, and nm,a is the number of grid cells "activated" (with at least one point).

The indicator 6 represents the minimal area in which falls the 90% of the total number of fishing points recorded in a given month. This can be computed by sorting, in a decreasing order, cells by fishing points and then cutting the series when the cumulated number of fishing points reaches the 90% of the total value. The expression of the indicator 6 is:

$$Am, a = n90_{m,a} \times 9$$

Where $A_{m,a}$ is the value (in km^2) of the indicator at month *m*, for métier *a*, and n90,a is the number of grid cells summing up the 90% of the total number of fishing points.

4.2.1.3 Synthesis and recommendations from WGECO 2012

From the two case studies presented the following issues were recommended:

- Data cleaning is necessary and should be done consistently following some protocol. This could be drafted from the experiences gained in various studies.
- In contrast to how the indicators were initially defined, i.e. providing some measure of extent expressed in e.g. km^2 they should be reported as a proportion to the total regional area or possibly only some relevant part of that region.
- Resolution of the grid cells strongly affects the value of the indicator with higher resolutions providing more realistic values two options emerge: an increase of the VMS frequency or applying the existing method to create the trawl track through interpolation and with some notion of uncertainty. Usually applies 3x3 km^2 grid which appropriate to the two hour intervals.
- The temporal resolution needs to be considered. The indicators can be calculated on a monthly or annual basis. For DCF indicator 7 is relevant to determine a cumulative impact over a number of years. In that case only the annual basis should be applied. The monthly calculation of the three indicators did not reveal any additional information to the annual indicator values other than recurring seasonal fluctuations.
- The proposed calculation of the indicator per level 6 métiers is not considered realistic. They propose to calculate the indicators using level 4 métiers.
- This group proposed addition modifications to the existing indicators or alternative indicators:
    - For the DCF indicator 5 "Distribution of fishing activity" they propose to use the "Proportion of surface area trawled".

  - For the DCF indicator 6 "Aggregation of fishing activity" they propose to use "The Proportion of surface area fished at specific trawling intensity" as the preferred indicator. This has the added benefit that it complements the DCF indicator 7.
  - The DCF indicator 7 "Areas not impacted by mobile bottom gears" is an important indicator as it not only can be used to describe fishing pressure but also the state of certain habitats or seabed integrity.
- Despite all the improvements in the methodology to calculate the indicators they only reflect the part of the fishing fleet equipped with VMS transponders which in some regions or for some fisheries excludes a large part of the fleet.

4.2.2 Conventions applied by WGSFD 2013 in light of WGECO recommendations 2012

It was agreed

- to not apply interpolation methods for VMS analysis. Interpolation seems questionable for a number of métiers and therefore was not applied throughout the entire analysis.
- to set the threshold in the analysis of DCF 5 and 7 at 0. This allows including all effort known in the analysis of the distribution of fishing activities.
- to not aim at calculating trawling intensity in terms of frequencies to specify the impact on the ecosystem in terms of times of surface trawled. Although it is evident, that trawling frequency is the ultimate parameter to understand trawling impact (Fock *et al.*, 2011, Piet and Hintzen, 2012)(see also 4.2.1.1.2), it was also recognized that for the majority of métiers gear parameters were not available during WGSFD 2013.
- to work only on data from 2012 onward reflecting the new size limit of 12 m instead of formerly 15 m for vessels to operate VMS.
- It was agreed that ICES areas delimited by the baselines serve as reference areas to calculate percentage coverage as recommended by WGECO 2012 and Piet and Hintzen (2012). However, due to low coverage of available data (see 4.3), this exercise was not undertaken.

As matter of fact, different software solutions could be applied to merge datasets and sum up effort in terms of hours fishing by rectangles at a resolution of 0.05 by 0.05 degrees all applying equivalent speed rules. Métier assignment through *VMStools* was not required since métier definition were provided with the logbooks.

Thus it was not possible to follow WGECO 2012 recommendations in that DCF6 is not interpreted in terms of trawling frequencies and intensity. Percentage values of coverage for DCF 5 and DCF 7 were not calculated taking into account that main fishing countries had not contributed data. Whereas WGECO 2012 applied these percentages to EEZ areas, here ICES areas are recommended. For DCF 7, percentage over time was not calculated due to the restriction to 2012 data.

4.2.2.1 DCF indicator 5: Distribution of fishing activities

DCF 5 is defined as 'indicator of the spatial extent of fishing activity'. The indicator was as understood as the area A_j occupied by n rectangles a_i of size 0.05*0.05 degrees by métier j for which effort E_j was greater than 0.

$$I_{DCF5,j} = A_j = \sum_n a_{i,j|Ei,j>0}$$

The indicator was based on annual values. The indicator is both mapped with binary values (0/1) and calculated as index.

4.2.2.2 DCF indicator 6: Aggregation of fishing activities

WGECO 2012 (p. 47 ff) specifies this indicator as either '2.1- Proportion of surface area fished by specific proportion of effort, or 2.2 - Proportion of surface area fished at specific trawling intensity'. Referring to the above mentioned comments (4.2.1) no intensities were calculated. Further, no proportion was calculated due to limited database.

4.2.2.2.1 VMStools function indicator

In calculating the surface area fished by a specific proportion of effort, WGSFD investigated the algorithm provided by the *VMStools* software package. The function *indicators* of *VMStools* prescribes that 'DCF 6 calculates the total area of a grid with fishing activity but keeps only the 90 per cent of the points by discarding the outer 10% points (or any other specified percentage). It uses the function tacsatMCP.r adapted from the *aspace* library. This function draws a minimum convex polygon around the central points to keep. Then these points are gridded and the total area of the cells is calculated with the surface.r function with the same optional methods as DCF 5. This total fishing area is processed by month.'

Thus, *vmstools* function *indicator* provides a geographic interpretation of aggregation starting from the midpoint of the métier distribution and moving outward. This leads to spurious aggregations patterns that do not represent main fishing grounds (Figure 2). For métier PTM_SPF_16-31_0_0, for which good coverage was obtained in WGSFD 2013, this means that important fishing ground in the Baltic are completely excluded while in the North Sea even disjointed rectangles with little effort are included in the space that is assumed to represent the main fishing pattern for this métier.

In the case of OTB_CRU_70-99_0_0, i.e. the *Nephrops* fisheries, a major fishing ground in the eastern North Sea would be likewise excluded, although this area is well known for its crustacean fisheries (Fock, 2008).

Maps are displayed at WGSFD 2013 > Data > False DCF 5 and 6 maps.

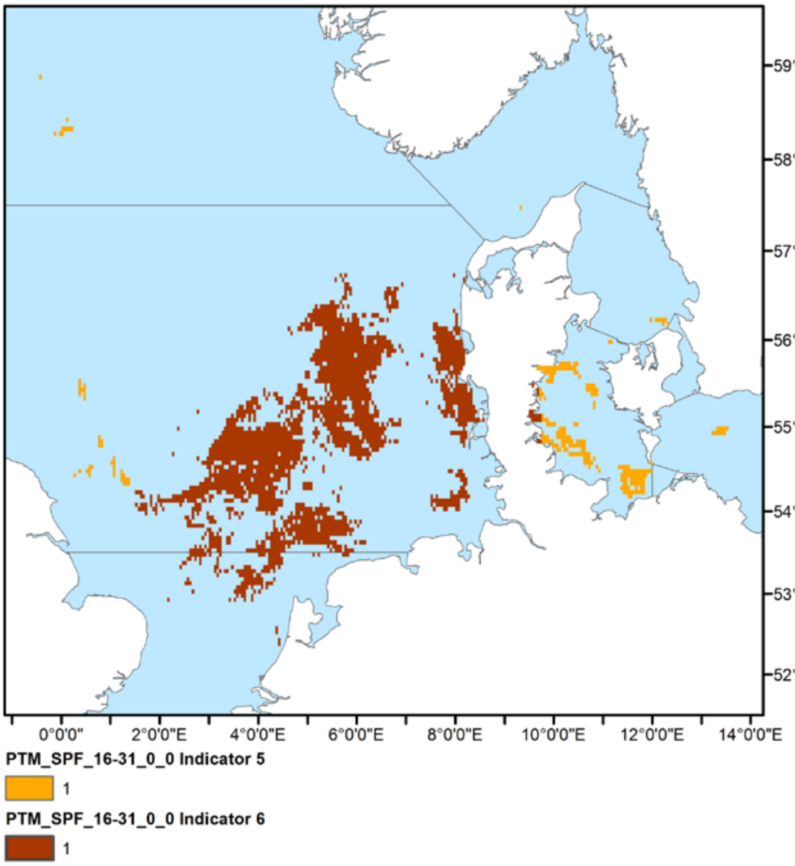

Figure 2. Métier distribution according to DCF 5 and aggregation representing DCF 6 calculated by *VMStools* function *indicator* with a threshold of 90%. Almost no areas from the Baltic are included.

4.2.2.2.2 Statistical interpretation of DCF 6

Several indicators, characterizing the extent to which fishing activity is aggregated, have been discussed. Part of the discussion has concerned the use of the Gini index computed for the positive effort values or the spreading area.

Analogous to the spreading area (SA) developed to characterize how a fish population is distributed in space taking into account variations in fish density (Woillez *et al.*, 2007; 2009), distribution of fishing effort is space (in total number of VMS pings or time spent fishing) can be described.

The spreading area is an index related to the Gini index (Gini, 1921), but which has the advantage over the Gini index of having no contribution from zero values. The Gini index (ranging from 0 to 1) equals twice the area between the Lorenz curve (in our case the graphical representation of the cumulative proportion of total effort vs. the cumulative proportion of area) and the 1: 1 line to which it would be reduced if all cell efforts were the same everywhere else. It depends on the proportion of zero values within the domain considered. By contrast, we define the SA as follows. Let T be the cumulated area occupied by the cell effort values, ranked in decreasing order, $Q(T)$ the corresponding cumulated effort, and Q the overall effort. The SA (expressed in area unit) is then simply defined as twice the area below the curve expressing $(Q–Q(T))/Q$ as a function of T:

$$\mathrm{SA} = 2\int \frac{Q - Q(T)}{Q} \mathrm{d}T .$$

So, the spreading area depends exclusively on the amount and the histogram of positive effort values. Changes in this index are likely to reveal changes in the way the total effort splits into low and high values. The area of zero values has no contribution to the spreading area (Figure 3). As $(Q–Q(T))/Q$ decreases from 1 to 0, and is convex, the SA is less than the positive area (PA), the total area where fishing occurs. It is equal to the PA when the effort is evenly spread. When normalizing the SA by the PA, we have the simple relation:

$$\frac{\mathrm{SA}}{\mathrm{PA}} + G_0 = 1,$$

where G_0 is the Gini index computed from positive values.

Zero values make no contribution to the spreading area, contrary to various indices that characterize aggregation (area coverage: Swain and Sinclair, 1994; Gini index: Myers and Cadigan, 1995; spatial selectivity index: Petitgas, 1998) which all relate to the area coverage of highest values. Therefore in the calculation of the spreading area index the delineation of the domain where data are positive is not necessary. The spreading area depends on the variation in cell effort values (and not on the overall effort) and is much less sensitive to low values of effort than the positive area.

4.2.2.2.3 WGSFD recommendation regarding DCF 6

Hence, following this statistical rationale aggregation of fishing activities can be described in 2 different ways: (1) in terms of mapping, based on the histogram of effort values, those areas are identified that cover a threshold of 90 percent of total effort and plotted based on 0/1 coded values. This is in line with the definition of 'principal fishing areas' as defined by Fock (2008), although here a threshold of 75% was applied, and allows to indicate the overlap between significant fishing areas and habitats. This produces straightforward figures of effort distinguishing between core areas and marginal areas less intensely used (Figure 4) and disjointed rectangles with little effort are mostly excluded from DCF 6. (2) As a single index value without mapping, the spreading area or the Gini index of the positive effort values could be computed routinely and serve as DCF indicator 6 to help characterize the aggregation of the fishing activity.

Maps are displayed at WGSFD 2013 > Data > DCF56_histograms.

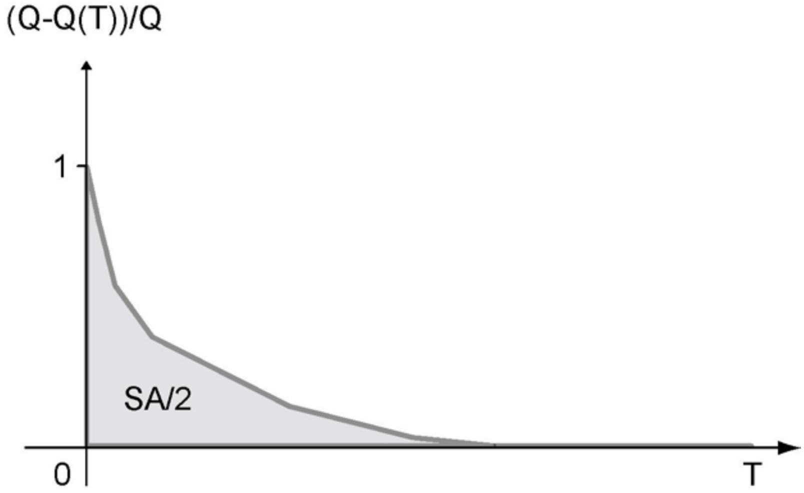

Figure 3. The spreading area (SA) is defined as twice the area below the curve expressing (*Q* − *Q*(*T*))/*Q* as a function of *T* (after Woillez *et al.*, 2009).

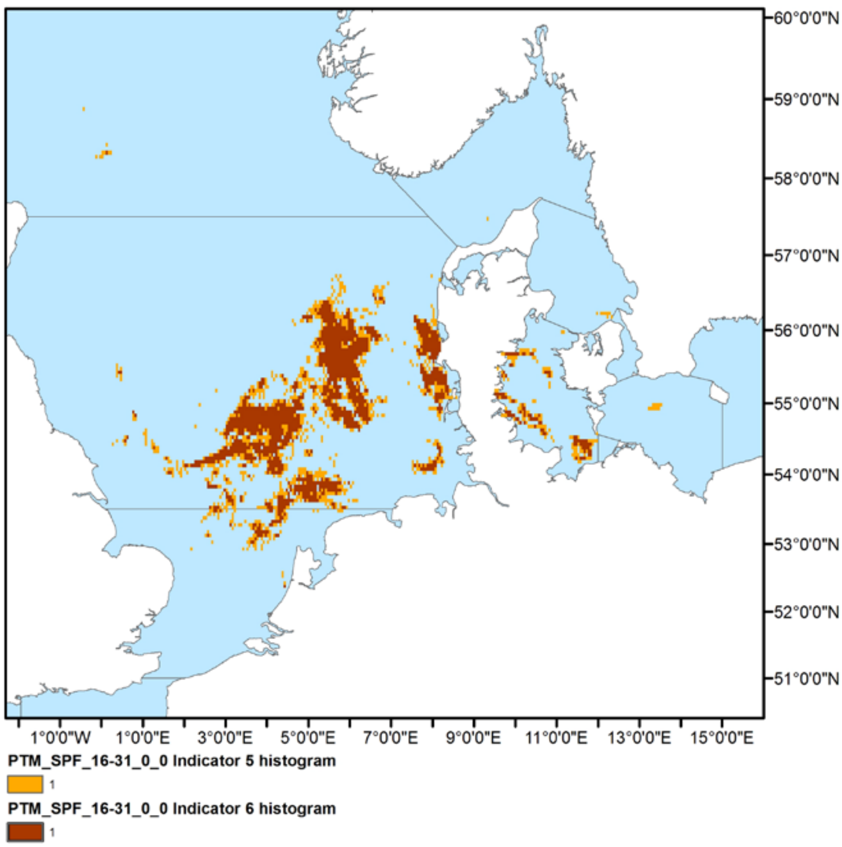

Figure 4. Métier distribution according to DCF 5 and aggregation representing DCF 6 calculated as 90%percentile cut-off in cdf histograms. It shows that each fishing ground is represented by a core area and a margin with less effort. Core areas for both the North and Baltic Sea are easily identified.

4.2.2.3 DCF indicator 7: Areas not impacted by mobile bottom gears

All PTB, OTB, TBB and S-métiers were included in the analysis of mobile bottom contacting gears *b*. Midwater gears with potential bottom contact were excluded.

DCF 7 is both mapped and calculated as index value:

$$I_{DCF7} = A_{SA} - A_b = A_{SA} - \sum_m a_{i,b|E_{i,b}>0},$$

where E_b is the effort by all bottom contacting gears in area unit a_i, m is the number of rectangles where $E_b>0$ and A_{SA} is the space of the respective ICES area.

Instead of relating the figure for DCF 7 to ICES areas it appears more reasonable to relate DCF 7 to habitat areas (Fock *et al.*, 2011). This would require habitat maps digitized and resolved to 0.05*0.05° c-squares, which were not available. It is recommendable to prepare such maps for all ICES areas. Habitats smaller than 0.05*0.05° can still be assigned to c-squares and be weighted by a multiplier indicating the portion of c-square inhabited by this habitat type (method applied in Fock *et al.*, 2011).

4.3 ToR a: Information by country and region

4.3.1 Available information during WGSFD 2013

Five countries participated in WGSFD. Data from only 3 countries were available at the meeting: Denmark, Germany and UK (for the latter only for Northern Ireland and Scotland, but not for England/Wales). Data from France and Latvia were not ready to be uploaded yet. Norwegian data were available to ICES but not worked up due to time constraints. It is recommended to invite participants from Norway to work up their data for DCF 5-7.

It is evident that results are necessarily strongly biased given that important input from major fishing countries is missing. Hence, figures and uploaded datasets are merely tentative. This is exemplified in Figure 5 comprising all information on bottom contacting gears at WGSFD 2013. Here, the southern North Sea, most of the Baltic, the Channel etc. appear mostly free of bottom fishing activity, which is truly not the case.

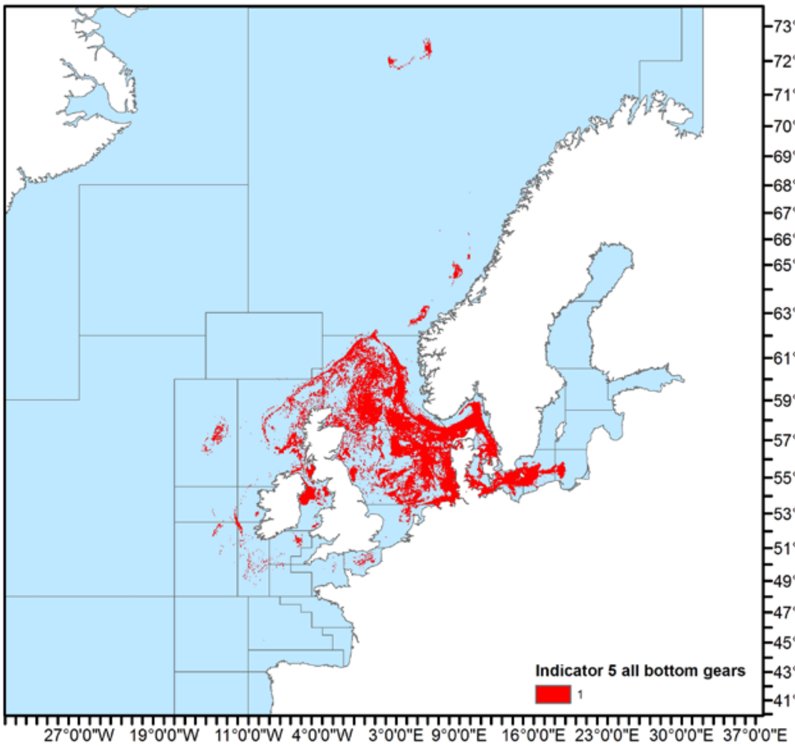

Figure 5. Based on available data for bottom contacting gears during WGSFD 2013, an assessment of DCF indicator 5 and 7 would falsely indicate unimpacted areas in the southern North Sea, the Channel, most of the Baltic etc. Therefore, results from WGSFD 2013 are not quantitatively reliable.

4.3.2 Germany: Baltic Sea

4.3.2.1 Method

Logbook (eflalo) and VMS (tacsat) data were merged using R package vmstools. Only VMS positions representing fishing activity were kept. Data for the year 2012 and vessels larger than 12m oal were included.

4.3.2.2 Métiers

The métiers were defined as DCF level 6, aggregating vessels with similar activity patterns. In order to respect confidentiality issues with the VMS data, WGSFD decided to remove métiers with 5 or less vessels having VMS. Such that for the German fisheries in the Baltic Sea out of 28 métiers only 13 métiers were kept for further analysis. The No_Matrixlevel6 métier has 18 vessels with VMS, but the combination of gear, target species assemblage and mesh sizes fall outside the métiers defined for the Baltic Sea.

4.3.3 Germany – Northeast Atlantic and North Sea

4.3.3.1 Method

Métiers were defined by trip, whereas logbook and VMS were linked on a day-by-day level; harbours were excluded, and a kernel density estimator method was applied to identify the first speed mode representative of fishing. In 2012, vessels of more than 12 m length were obliged to use VMS.

4.3.3.2 Métiers

Métiers were provided by the German data collection authority and thus not needed to be estimated according to the VMStools software. Hence, métiers are consistent with DCF data reporting protocols.

8 Métiers were included in the dataset to calculate DCF-indicators 5-7 covering 96.5% of trips and 83% of landings. In terms of fishing trips and the number of vessels included, the German fisheries are dominated from shrimp fisheries (TBB_CRU_16-31_0_0), whereas landings were dominated from pelagic fisheries (OTM_SPF_32-69_0_0) comprising target species mackerel, horse mackerel, herring and sprat.

4.3.4 Denmark

4.3.4.1 Method

Logbook and VMS data are merged by Vessel-ID and date, and also filtered by departure date/time and arrival date/time. Only VMS positions not in harbour are used, and a speed filter is applied by gear. Data from 2012 is used, and this year all Danish vessels larger than 12 m oal should have VMS.

4.3.4.2 Métiers

The métiers used for this analysis is the merged level 6 métiers, where some métiers with similar landing patterns have been merged. In order to respect confidentiality issues with the VMS data, WGSFD decided to remove métiers with 5 or less vessels having VMS. For Denmark this means that out of 67 métiers, 26 métiers are kept for further analysis. In total 69% of the trips are kept. The No_Matrix métier has 246 vessels with VMS, but the combination of gear, target species assemblage and mesh sizes fall outside the métiers defined.

4.3.5 UK – Scotland

4.3.5.1 Métiers

The métiers used for the indicator analysis are merged by level 6 métier. In order to respect confidentiality issues regarding VMS data, WGSFD decided to remove métiers with less than 6 vessels. This rule applied to the Scottish data results in an exclusion of 29 out of 49 métiers. However, these 29 métiers represent only 1.6% of the total number of trips (from vessels equipped with VMS).

4.3.6 UK – Northern Ireland

4.3.6.1 Fishery

As of 2012 logbook record indicate that landings from the Northern Irish fleet are generated from in the region of 270 vessels. The majority of vessels land catches into three Northern Irish ports with >75% of Northern Irish landings into these ports. However, considerable landings by weight are made into ports outside Northern Ireland with around 50% of total landings made in other UK and European ports.

A large proportion of the fleet (> 80%) are engaged in three fisheries, otter trawling for nephrops, pot-fishing and a fishery targeting molluscs (scallops and queen scallops). At present there is a large proportion of coverage through VMS tracking of vessels targeting nephrops and mollusc vessels. However, the pot fishery is greatly comprised of vessels <12m, not yet included in routine VMS tracking. A small number of vessels target demersal fish and small pelagic vessels and are included in the VMS programme.

The spatial distribution of the fishery is concentrated in ICES area VIIa and the southern region of VIa.

4.3.6.2 Method

Anonymised logbook and VMS data for 2012 were integrated. A unique random vessel identity was attributed to individual vessels and used to merge métier information form logbooks to vessel positions from VMS data using activity date and time to identify unique trips. Only positions deemed to be out of harbour are used with a speed filter applied to identify fishing position.

4.3.6.3 Métiers

A level six métier is attributed to fishing trips. In order to maintain confidentiality of VMS data and logbook data, métiers exploited by five or fewer are not automatically included in further analysis of fishing activity. For UK-NI this means that 5 of 13 métiers are kept for further analysis, comprising 86.4% of the total available VMS enabled fishing trips. Details of these métiers are show in Table 8.5.

4.4 ToR b: EG requests

No EG requests were handled during the meeting.

4.5 ToR c: Review on new developments

4.5.1 Influence of tide currents on speed processing

Sine wave patterns can be observed when plotting time-series of calculated scalar speed of fishing vessels (Gloaguen *et al.* submitted). Such speed profiles show distributions with 3 modes (Figure 6), that might affect the determination of fishing vessels activities, for instance when using speed thresholding. These speed distributions has been observed on French bottom trawlers operating in the English channel, with GPS data (project RECOPESCA, Leblond *et al.*, 2010) with resolution higher than VMS. The acquisition frequency was fairly regular and around 15min.

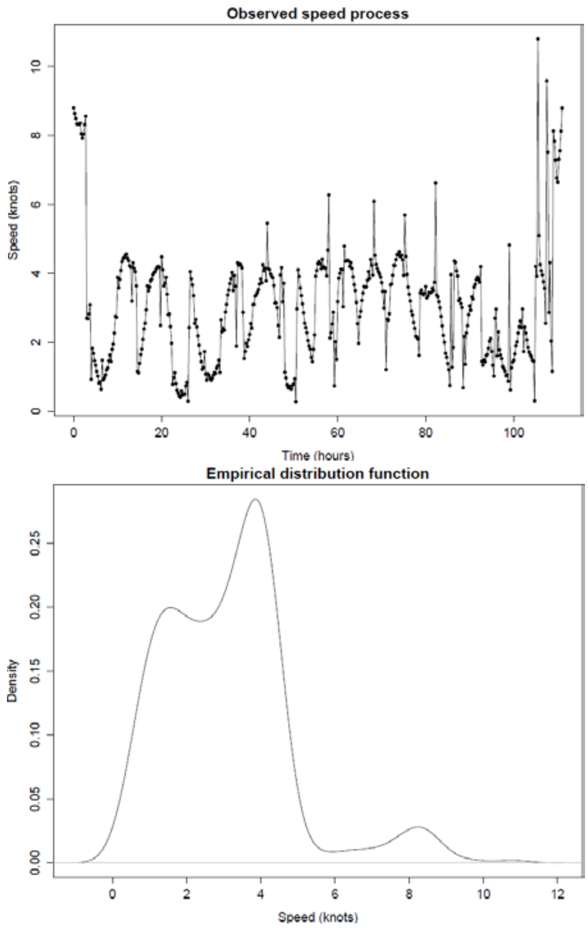

Figure 6. Right: Time-series of calculated scalar speed during a fishing trip operated by a French bottom trawler in the English Channel. Left: Empirical distribution function of speed associated with the same fishing trip.

The Channel is known to be a place where tide currents are strong. Our assumption was that they may create these sine wave patterns on speed time-series. This hypothesis was tested with the hydrographic model MARS 3D (Lazure and Dumas, 2008). The model provided sea surface currents every hour at a resolution of 4 km (grid mesh along latitudes and longitudes).

The idea was to remove the tide components from the observed speed. To do so, the closest point of the hydrographical model MARS 3D was considered, and interpolation in time was performed to estimate current components at each GPS position. Once the tide components were removed from the observed speeds, time-series of the new estimate of speed did not show sine wave patterns anymore (Gloaguen *et al.*, 2013). The speed distribution showed only two modes (Figure 7), making fishing activities determination easily doable.

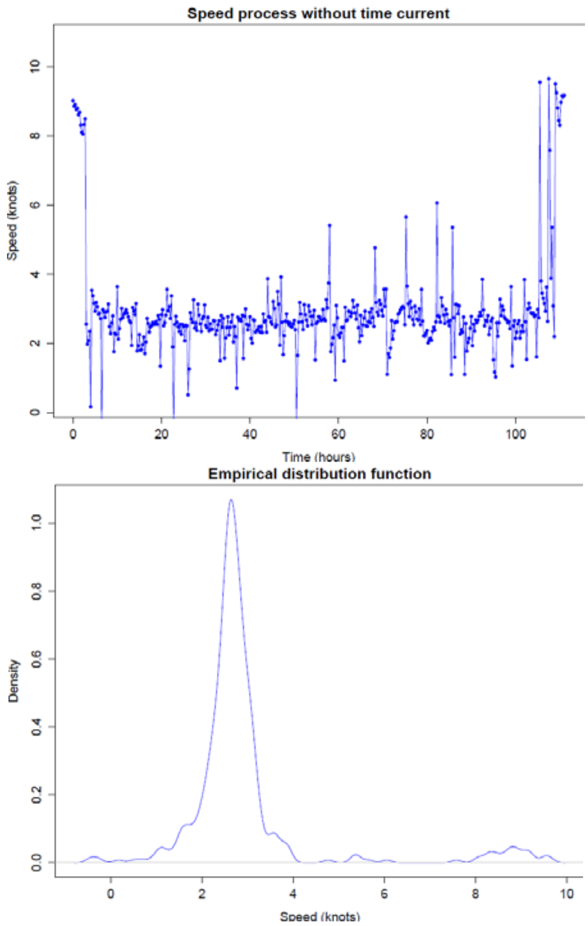

Figure 7. Right: Time-series of calculated scalar speed without the tide component. Left: Corresponding empirical distribution function of speed without the tide component.

In locations where tide currents are strong, studying speed processes may imply to remove tide currents. Methods used to determine fishing vessels activities should be tested overfishing trips with such speed characteristics, and the impact of tide currents on the methods performance should be evaluated. For VMS data, such issue may not be so important (if mean speed between two positions is calculated) as the acquisition frequency is lower (between 1h and 2h) than the GPS data. Thus it may result in collapsing the 2 modes of lower speed into a single and broad one. But this could be of importance to study recorded instantaneous speed process as it might be strongly affected by tide currents.

5 Progress report on ToRs and workplan

- *Progress in ToR a: WGSFD 2013 failed to produce quantitatively reliable estimates of ´fishing pressure indicators', given that major fishing countries did not contribute to WGSFD in 2013. However, data handling protocols were developed for WGSFD and analysis steps were critically reviewed, since SGVMS as predecessor did not evaluate DCF indicators yet.*
- *Progress in ToR b: No requests were brought to attention of the group.*
- *Progress in ToR c: Speed processing in relation to tidal currents was discussed. This subject will be reconsidered in WGSFD 2014.*
- *Changes/ Edits/ Additions to ToRs are detailed in chapter 6*
- *Results are reported to WKIND and cooperation is envisaged.*
- *WGSFD elected Josefine Egekvist new Chair 2014–2016.*

6 Revisions to the work plan and justification

ToR a 2014

- ToR a will not include only updating for 2013, but rerunning the exercise of calculating the indices for 2012 and 2013 given the tentative character of the 2012 calculations undertaken in WGSFD 2013 under the assumption that more countries will contribute 2014 than have contributed in 2013. This is undertaken iteratively year-by-year until all European countries for which DCF regulations apply have contributed.
- It is further recommended for WGSFD to elaborate on step 6 in the analysis workflow of DCF indicators 5-7.
- It is recommended to invite participants from Norway to work up their data for DCF 5-7.

ToR b in 2014

- WGSFD will address the request from WGMPCZM which is

"4. The Chair of SSGHIE should consider the most appropriate group to address the issue of standardization of VMS and non-VMS fisheries activity data analysis, with a view to making recommendations concerning methodology, units, output format etc. to enable consistent interpretation of datasets across fleets and borders. WGMPCZM should be informed when a group is taking up this issue as a ToR."

ToR c in 2014

- Scotland announced to present further results on new interpolation techniques and thus to further elaborate on work presented already at SGVMS 2012.

ToR d in 2014

- In 2014, WGSFD has received a new ToR d. With regards to this new ToR, it appears necessary to invite – besides Norway, see above – also Iceland, Faroese Islands and Greenland. WGSFD 2013 suggests delivering output at 0.05°*0.05° c-squares resolution (3 minutes by 3 minutes) instead of following the proposition to analyse effort at minute resolution. Finer resolved output can only be obtained with interpolation of tracks.

- The ToR is:

"Towards a spatial and temporal description and analysis of bottom fishing intensity in the OSPAR area on the basis of high resolution VMS and logbook data.

a) Recalling the OSPAR QSR 2010, which highlighted the continued impact of fishing pressure on marine ecosystems and importance for understanding these impacts for developing appropriate measures for the protection and conservation of marine biodiversity, within the remit of OSPAR's mandate, and

b) Noting the ongoing work within EIHA on cumulative effects and within ICG-COBAM on the development of common biodiversity indicators relating to Descriptor 6 (seabed integrity) of the MSFD, in particular BH1, BH3 and BH4, Contracting Parties have identified the need to map spatial and temporal intensity of bottom fishing;

c) It is however recognized that the delivery of this request would benefit from preparatory steps by ICES, and the results of work being undertaken outside ICES (e.g. the EU funded project BENTHIS). In this first phase for 2014, ICES is requested to work with OSPAR Contracting Parties and other relevant Competent Authorities to:

  i) collate relevant national VMS/logbook data for the exclusive use of ICES; and

  ii) propose and apply a method for the mapping of bottom fishing intensity

  iii) to prepare a first OSPAR-wide mapping of the spatial and temporal intensity of fishing activities with mobile bottom contacting gears;

d) It is requested that the advice should be delivered according to the MSFD regions and sub regions at a scale that is appropriate to inform decision-making the most appropriate temporal and spatial scale need to be determined through a dialogue process between ICES, OSPAR Contracting Parties and data providers, noting that availability of data will limit the precision that is achievable. ICES have indicated that the finest scale that can be expected would be to the nearest minute

e) There is a need to ensure good collaboration and exchange of information between relevant OSPAR subsidiary bodies and ICES working group(s) during the preparation for and implementation of this request."

7 Next meetings (Interim reports only)

10-13 June 2014, ICES HQ, Copenhagen.

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Annex 1: List of participants

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Annex 2: Recommendations

Recommendation	Adressed to
WGSFD recommends to critically review the VMStools function indicator in line with the recommendations made under 4.2.2.2.3 before it is recommended for standard use in ICES advice on MSFD and DCF issues	ACOM, ICES secretariat
WGSFD recommends to relate indicator DCF 7 to habitat types and therefore also recommends to prepare such datasets at 0.05*0.05 c-squares resolution. It is further recommended to build upon results from the BENTHIS project.	ACOM, ICES Data Centre, ICES secretariat
WGSFD requests ICES to provide storage capacity within the facilities of the ICES Data Centre for data products. Until now, products are stored on the SharePoint.	ICES Data Centre

Annex 3: Métier tables by country

Germany – Baltic Sea

Métier Level 6	Number of trips	Number of vessels	Number of vessels with VMS	Status	Total landings (ton)
OTM_SPF_16-31_0_0	38	3	3	excluded	8576
OTB_DEF_>=105_0_0	1964	57	47	included	5600
PTM_SPF_32-104_0_0	370	13	11	included	4742
PTM_SPF_16-31_0_0	29	5	5	excluded	2811
PTB_SPF_32-89_0_0	131	13	11	included	1253
PTB_SPF_32-104_0_0	175	17	15	included	769
PTB_DEF_>=105_0_0	526	31	25	included	616
OTM_DEF_>=105_0_0	41	9	9	included	602
PTB_SPF_16-31_0_0	40	6	3	excluded	420
GNS_SPF_32-109_0_0	189	8	2	excluded	264
PTM_SPF_32-89_0_0	40	6	6	included	254
SSC_DEF_>=105_0_0	10	2	2	excluded	213
GNS_DEF_110-156_0_0	248	9	3	excluded	131
PTB_DEF_32-89_0_0	21	10	7	included	129
FPO_SPF_>0_0_0	27	3	1	excluded	86
PTB_DEF_90-104_0_0	7	4	3	excluded	80
FPN_SPF_>0_0_0	11	1		excluded	79
PTB_SPF_>=105_0_0	15	11	7	included	78
OTB_SPF_16-31_0_0	5	2	1	excluded	39
No_Matrix6_0_0	108	26	18	included	31
OTB_FWS_>0_0_0	79	22	15	included	30
PTB_FWS_>0_0_0	46	13	9	included	8
GNS_FWS_>0_0_0	56	9	3	excluded	5
GNS_SPF_110-156_0_0	36	4	2	excluded	4
PTM_DEF_>=105_0_0	1	1	1	excluded	3
OTB_CRU_>0_0_0	8	8	6	included	3
OTB_CAT_>0_0_0	8	6	3	excluded	3
GNS_CAT_>0_0_0	4	2		excluded	1

Germany – Northeast Atlantic and North Sea

MÉTIER	NUMBER OF TRIPS 2012	NUMBER OF VESSELS 2012	NUMBER OF VESSELS WITH VMS 2012	STATUS	TOTAL LANDINGS (tons) 2012
DRB_MOL_0_0_0	217	7	7	Included	5250
FPO_CRU_0_0_0	4	1	1		143
GNS_CRU_100-119_0_0	62	5	.		30
GNS_DEF_100-119_0_0	113	5	5		212
GNS_DEF_120-219_0_0	47	4	4		161
GNS_DEF_90-99_0_0	11	2	2		22
GNS_DEF_>=220_0_0	16	4	4		626
OTB_CRU_70-99_0_0	101	8	8	Included	817
OTB_CRU_>0_0_0	1	1	1		3
OTB_DEF_100-119_0_0	65	6	6	Included	1023
OTB_DEF_130-279_0_0	1	1	1		156
OTB_DEF_70-99_0_0	115	15	15	Included	1245
OTB_DEF_<16_0_0	4	2	2		1708
OTB_DEF_>=120_0_0	248	16	16	Included	19946
OTB_DEF_>=130_0_0	12	4	4		7186
OTB_SPF_70-99_0_0	3	1	1		20
OTB_SPF_>=120_0_0	3	1	1		9
OTM_DEF_100-119_0_0	2	2	2		3807
OTM_DEF_100-129_0_0	2	2	2		1522
OTM_DEF_>=120_0_0	1	1	1		30
OTM_SPF_16-31_0_0	3	1	1		465
OTM_SPF_32-54_0_0	1	1	1		4886
OTM_SPF_32-69_0_0	42	6	6	Included	79878
PTB_DEF_>=120_0_0	16	1	1		205

SSC_DEF_>=120_0_0	94	2	2		2114
TBB_CRU_16-31_0_0	14738	198	188	Included	16305
TBB_CRU_70-99_0_0	4	3	3		25
TBB_CRU_<16_0_0	34	2	2		19
TBB_CRU_>=120_0_0	5	5	5		10
TBB_DEF_100-119_0_0	35	5	5		677
TBB_DEF_16-31_0_0	9	6	3		1
TBB_DEF_70-99_0_0	202	30	30	Included	1420
TBB_MOL_0_0_0	61	3	3		1475

Denmark

Métier Level 6	Number of trips	Number of vessels	Number of vessels with VMS	Status	Total landings (ton)
DRB_MOL_>0_0_0	4260	87	30	Included	39,759
FPN_ANA_>0_0_0	43	10		Excluded	1
FPN_CAT_>0_0_0	1126	61		Excluded	214
FPN_FWS_>0_0_0	34	9		Excluded	1
FPN_SPF_>0_0_0	281	23		Excluded	173
FPO_CAT_>0_0_0	50	1		Excluded	10
FPO_CRU_>0_0_0	90	1		Excluded	17
FPO_DEF_>0_0_0	60	1		Excluded	6
FYK_CAT_>0_0_0	42	5		Excluded	2
GNS_CAT_>0_0_0	50	15	1	Excluded	8
GNS_CRU_>0_0_0	612	72	15	Included	49
GNS_DEF_100-119_0_0	517	33	5	Excluded	51
GNS_DEF_110-156_0_0	12698	203	11	Included	3,291
GNS_DEF_120-219_0_0	4609	167	54	Included	6,069
GNS_DEF_50-70_0_0	24	6		Excluded	5
GNS_DEF_90-109_0_0	37	9		Excluded	3
GNS_DEF_90-99_0_0	413	43	20	Included	435
GNS_DEF_>=220_0_0	726	66	18	Included	579
GNS_FWS_>0_0_0	35	2		Excluded	13
GNS_SPF_10-30_0_0	14	3		Excluded	10

Métier Level 6	Number of trips	Number of vessels	Number of vessels with VMS	Status	Total landings (ton)
GNS_SPF_100-119_0_0	22	4		Excluded	2
GNS_SPF_110-156_0_0	30	9		Excluded	4
GNS_SPF_32-109_0_0	130	15	1	Excluded	11
GNS_SPF_50-70_0_0	18	6		Excluded	2
LHP_FIF_0_0_0	126	20	4	Excluded	372
LLD_ANA_0_0_0	213	17	1	Excluded	103
LLS_DEF_0_0_0	742	29	1	Excluded	257
LLS_FIF_0_0_0	90	3		Excluded	76
No_Matrix6	3636	464	264	Included	8,857
No_logbook6	23762	1128		Excluded	7,990
OTB_CRU_32-69_0_0	1228	12	11	Included	1,574
OTB_CRU_70-89_2_35	56	1		Excluded	6
OTB_CRU_>0_0_0	31	4		Excluded	2
OTB_DEF_16-31_0_0	46	16	16	Included	25,330
OTB_DEF_32-69_0_0	21	7		Excluded	18
OTB_DEF_70-89_2_35	2	1		Excluded	4
OTB_DEF_90-104_0_0	302	18	10	Included	102
OTB_DEF_<16_0_0	603	77	72	Included	49,241
OTB_DEF_>=105_1_120	8058	141	110	Included	19,349
OTB_MCD_70-99_0_0	147	15	14	Included	926
OTB_MCD_90-119_0_0	16422	216	186	Included	12,010
OTB_MCD_>=120_0_0	2323	78	60	Included	17,755
OTB_SPF_16-31_0_0	3	2		Excluded	18
OTB_SPF_32-69_0_0	351	25	22	Included	135,476
OTB_SPF_<16_0_0	2	2		Excluded	63
OTM_DEF_<16_0_0	3	1		Excluded	26
OTM_SPF_16-31_0_0	982	35	33	Included	12,150
OTM_SPF_32-104_0_0	84	5		Excluded	1,146
OTM_SPF_32-69_0_0	81	10	10	Included	45,116
OTM_SPF_32-89_0_0	4	1		Excluded	23
OTM_SPF_<16_0_0	1	1		Excluded	50
PS_SPF_16-104_0_0	1	1		Excluded	48
PS_SPF_16-31_0_0	1	1		Excluded	666
PTB_SPF_32-104_0_0	2	1		Excluded	37

Métier Level 6	Number of trips	Number of vessels	Number of vessels with VMS	Status	Total landings (ton)
PTM_DEF_16-31_0_0	9	4		Excluded	105
PTM_DEF_<16_0_0	213	7	7	Included	2,089
PTM_SPF_16-104_0_0	80	14	14	Included	8,397
PTM_SPF_16-31_0_0	830	59	55	Included	81,496
PTM_SPF_32-104_0_0	54	4		Excluded	791
PTM_SPF_32-69_0_0	81	6	6	Included	1,317
PTM_SPF_32-89_0_0	160	10	10	Included	2,318
SDN_DEF_90-119_0_0	1739	25	25	Included	5,297
SDN_DEF_>=120_0_0	321	17	17	Included	1,874
SSC_DEF_>=105_1_120	67	2		Excluded	258
SSC_DEF_>=120_0_0	123	5		Excluded	1,615
TBB_CRU_16-31_0_0	1686	28	28	Included	3,116
TBB_DEF_>=120_0_0	115	3		Excluded	1,505

UK – Scotland

Métier Level 6	Number of trips	Number of vessels	Status
DRB_MOL_0_0_0	2302	59	Included
FPO_CRU_0_0_0	432	18	Included
FPO_FIF_0_0_0	1	1	Excluded
FPO_MOL_0_0_0	1	1	Excluded
GNS_DEF_>=220_0_0	45	7	Included
OTB_CRU_<16_0_0	16	11	Included
OTB_CRU_>=120_0_0	40	19	Included
OTB_CRU_100-119_0_0	135	25	Included
OTB_CRU_32-69_0_0	4	4	Excluded
OTB_CRU_70-99_0_0	7344	156	Included
OTB_DEF_<16_0_0	8	2	Excluded
OTB_DEF_>=120_0_0	1712	104	Included
OTB_DEF_100-119_0_0	59	16	Included
OTB_DEF_32-69_0_0	5	2	Excluded
OTB_DEF_70-99_0_0	72	36	Included
OTB_DWS_>=120_0_0	1	1	Excluded

OTB_MOL_>=120_0_0	17	10	Included
OTB_MOL_100-119_0_0	3	3	Excluded
OTB_MOL_32-69_0_0	117	16	Included
OTB_MOL_70-99_0_0	5	4	Excluded
OTB_SPF_32-69_0_0	8	4	Excluded
OTH_N/A_0_0_0	7	1	Excluded
OTM_DEF_>=120_0_0	1	1	Excluded
OTM_SPF_<16_0_0	3	3	Excluded
OTM_SPF_32-69_0_0	256	24	Included
OTM_SPF_70-99_0_0	5	2	Excluded
OTT_CRU_>=120_0_0	12	5	Excluded
OTT_CRU_100-119_0_0	166	11	Included
OTT_CRU_70-99_0_0	1118	87	Included
OTT_DEF_>=120_0_0	512	37	Included
OTT_DEF_100-119_0_0	10	4	Excluded
OTT_DEF_70-99_0_0	80	15	Included
OTT_MOL_>=120_0_0	4	2	Excluded
OTT_MOL_70-99_0_0	1	1	Excluded
PS_LPF_0_0_0	2	2	Excluded
PTB_DEF_<16_0_0	6	1	Excluded
PTB_DEF_>=120_0_0	708	27	Included
PTB_SPF_>=120_0_0	1	1	Excluded
PTB_SPF_32-69_0_0	1	1	Excluded
PTM_LPF_<16_0_0	1	1	Excluded
PTM_LPF_>=120_0_0	4	2	Excluded
PTM_LPF_16-31_0_0	5	2	Excluded
PTM_LPF_32-69_0_0	24	4	Excluded
SDN_DEF_>=120_0_0	76	2	Excluded
SSC_DEF_<16_0_0	21	3	Excluded
SSC_DEF_>=120_0_0	585	14	Included
SSC_DEF_100-119_0_0	22	2	Excluded
TBB_DEF_70-99_0_0	8	1	Excluded

***The sum of vessels the all the vessels in the table may be greater than the number of vessels registered with VMS as vessels may use more than one gear during the year.**

UK – Northern Ireland

Table 8.5. A breakdown of the métiers used in spatial analysis of the UK-NI fishing activity

Métier Level 6	Number of vessels	Number of vessels with VMS	Number of trips	Status
DRB_MOL_0_0_0	61	38	1215	Included
FPO_CRU_0_0_0	114	3	1334	Excluded
GNS_DEF_120-219_0_0	2	1	14	Excluded
GNS_SPF_50-70_0_0	5	2	4	Excluded
GTR_DEF_120-219_0_0	1	0	1	Excluded
LHP_FIF_0_0_0	7	0	22	Excluded
OTB_CRU_70-99_0_0	145	100	7761	Included
OTB_DEF_70-99_0_0	13	13	77	Included
OTB_MOL_70-99_0_0	15	12	168	Included
OTM_DEF_100-119_0_0	6	6	22	Included
OTM_SPF_32-69_0_0	1	1	25	Excluded
PTM_SPF_32-69_0_0	2	2	36	Excluded
SSC_DEF_100-119_0_0	1	1	24	Excluded

*The sum of vessels the all the vessels in the table may be greater than the number of vessels registered with VMS as vessels may use more than one gear during the year.

Annex 4: Exchange format for the WGSFD 2013

The FishFrame VE format can be output from the *VMStools*, and contains the effort, landing weight and landing value calculated after combining logbook data with vms data.

The spatial reference c-square is documented at http://www.marine.csiro.au/csquares/

For the purpose of WGSFD 2013, to produce the DCF environmental indicators 5, 6 and 7 the format was revised to make only the fields used for calculating these indicators mandatory.

Order	Name	Type	Req.	Description
1	recordtype	String	M	FishFrame record type Fixed value VE
2	Country	String	O	Vessel flag country ISO 3166-1 alpha-3 codes. The flag country of the vessel. Not submitted: -9
3	Year	Integer	M	1900 to 3000
4	Quarter	Integer	O	1 to 4. Not sumbitted: -9
5	Month	Integer	O	1 to 12 Not submitted: -9
6	ICES_area	String	M	Area level 3 (level 4 for Baltic, Mediterranean, Black Sea) in the data Collection regulation (EC, 2008a, 2008b).
7	c_square	String	M	0.05x0.05 degree, C-square spatial reference XXXX:XXX:XXX:X
8	nationalFAC	String	O	Fishing activity category – National coding system. Bound to the Nantes matrix level 4 as children i.e. an alternative level 5+6.
9	LE_MET_level6	String	M	Fishing activity category – Level 6 in the Nantes matrix (SGRN 06-03)
10	Hours	Decimal numeral	M	Fishing hour calculated from VMS data.
11	kw_hours	decimal numeral	O	kW*fishing hour Not submitted: -9
12	Totweight	Decimal numeral	O	Total landings of all species caught. In kg Not submitted: -9
13	Totvalue	Decimal numeral	O	Total value of all species caught. In Euro Not submitted: -9

The references to code lists are the lists in the regular FishFrame exchange format description.