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Contents

Executive summary **1**

1 Opening of the meeting **2**

1.1 Terms of Reference 2

1.2 Objectives and working rationale 2

1.3 Participants 3

1.4 Background information 3

2 ToR a) – Data needs regarding VMS from different ICES expert groups **4**

2.1 ICES VMS data strategy 4

2.2 VMS data needs by different expert groups 4

2.3 Types of VMS data products needed 6

3 Standardized data products for the ICES Data Centre **7**

3.1 The FishFrame – format: Logbook/VMS data according to EFLALO2/TACSAT2 7

3.1.1 The ICES Dogger Bank data call 7

3.2 The 949/2008-format 8

3.3 Combining formats 9

4 Review ongoing work for analysing VMS data and developing standardized data products and methodologies **10**

4.1 Interpolation techniques 10

4.2 Defining fishing activity by Artificial Neural Networks 10

4.3 Defining métiers by Artificial Neural Networks 11

5 Opportunities for an improved VMS data management within ICES **12**

5.1 Shortcomings at the national and international level 12

5.2 Towards an ICES VMS data strategy 13

6 Investigate the possibilities, usefulness and accessibility of AIS data for providing fishing vessel tracks **16**

7 References **17**

Annex 1: List of participants **18**

Annex 2: Agenda **19**

Annex 3: SGVMS terms of reference for the next meeting **20**

Annex 4: Recommendations **22**

Annex 5: The ICES legal position towards using VMS data **23**

Annex 6: Data exchange formats – TACSAT2 and EFLALO2 ..... **25**

Annex 7: ICES Dogger Bank data call, June 2011 27

Executive summary

The meeting of the Study Group on VMS data, its storage, access and tools for analysis (SGVMS) took place in Hamburg, Germany, from 7–9 September 2011. Heino Fock chaired the meeting with eight participants from five countries and from ICES Secretariat.

SGVMS was initiated by WGDIM in 2009 recognizing that in the context of rapidly evolving methodologies of VMS data analysis and emerging requirements with regard to advice for European policies and the ICES Science Plan, a structured approach to holding and accessing VMS data are essential.

SGVMS had to consider implications for an ICES strategic position on VMS data, and had to review further progress since its last meeting concerning data availability, data access and storage, data formats and data products, tools for analysis and quality assurance issues.

SGVMS analysed data delivery protocols based on national data availabilities, ICES EG requirements and resources needed to provide and handle data. It appeared that data delivery through SGVMS would not provide a complete as desired record to the ICES data centre. Based on requirements from EC 949/2008 and the recent ICES data call for the Dogger Bank project built upon the standards of the FishFrame database and the 'vmstools' software package, SGVMS identified a protocol through which two different data packages in two formats and resolutions are provided to be the most feasible way to efficiently deliver data, to guarantee confidentiality at all processing levels and provide data to ICES EGs in the way they are needed. One dataset contains FishFrame-formatted data, aggregated by métier (level 6) and spatial grid (preferably c-squares), the other contains the individual VMS ping data as defined by EC 949/2008, modified such that (a) fishing activity, and (b) métiers are indicated. By using and merging these two datasets, data products can be generated meeting all known demands from ICES EGs (e.g. WGDEC, WGECO), the Marine Strategy Framework Directive etc. For assessment EGs (e.g. WGDEEP), still the access to original logbook information and original VMS data are essential, since vessel information is needed to calculate precise cpue series. Here, data can be analysed in national labs before being provided to ICES.

SGVMS considered AIS data to be a potentially valuable alternative or complimentary data to VMS data to analyse fishing effort distribution, since these data are delivered at very high resolution. However, the AIS coverage within fleets, the geographic coverage to receive AIS signals in the sea and the data processing and storage of AIS need to be improved before AIS may substitute VMS.

SGVMS recommended initiating an ICES training course on 'vmstools' software in the near future.

SGVMS will meet in September 2012 in Aberdeen, Scotland.

1 Opening of the meeting

1.1 Terms of Reference

The **Study Group on VMS data, its storage, access and tools for analysis** (SGVMS) chaired by Heino Fock, Germany, will meet in Hamburg, Germany, 7–9 September 2011 to:

a) Review and consider implications for VMS data management at ICES based on the data needs as defined by ICES working groups (e.g. WGDEC and WGDEEP Use cases) taking into account the ICES strategic position on VMS data;

b) Work on standardized data products for the ICES Data Centre based on user needs. This should include:

c) development of standardized methodologies if not available;

d) quality assurance (testing and measures) for standardized data products and methodologies;

e) Review ongoing work for analysing VMS data and developing standardized data products and methodologies;

f) Enumerate the shortcomings with respect to the current systems' architecture supporting the analysis of VMS data in general and its relationship with any other data that are or may be relevant to the creation of fishery advice;

g) Investigate in general terms the options for improvement of the current system in the short, medium and long-term;

h) Investigate the possibilities, usefulness and accessibility of AIS data for providing fishing vessel tracks.

WGDIM will provide the relevant documents concerning the legal position of VMS data under the DCF to the co-chairs of SGVMS.

SGVMS will report by 1 October 2011 for the attention of SSGSUE, WGDIM and SCICOM.

1.2 Objectives and working rationale

Based on the Terms of Reference, the aim of SGVMS was defined as to provide advice to ICES on how VMS data could be treated within the ICES data strategy, to work on definitions for standardized data products that can be delivered to and be stored within ICES, and to describe tools needed to develop these data products. Since standards for holding and processing VMS data are not only required for ICES advice, the SGVMS recommendations on standardization should also aim at addressing needs to develop indicators for Commission Decision 2008/949/EC, but not at developing the indicators themselves.

Commission Decision 2008/949/EC requires to analyse VMS data resolved to fisheries métier level 6. This means that logbook information is essential to VMS analysis. Within the project *MARE/2008/10; Lot 2 – Development of tools for logbook and VMS data analysis,* the software package 'vmstools' was developed defining formats for VMS, linked logbook data and output.

This means that the SGVMS TORs were interpreted and amended in a way as such that VMS and logbook data are to be treated simultaneously in a joint analysis.

SG working rationale

Due to the small number of participants, all TORs were worked up in plenary.

1.3 Participants

Carlos Pinto	ICES	
Hans Gerritsen	Ireland	
Heino Fock	Germany	Chair
Josefine Egekvist	Denmark	
Patrik Jonsson	Sweden	
Rui Catarino	UK	
Tanja Miethe	Germany	
Torsten Schulze	Germany	

A complete list of participants and affiliations can be found in Annex 1.

1.4 Background information

SGVMS was established as a subgroup to the ICES WG on Data and Information Management (WGDIM). In 2011, WGDIM provided information on the recent ICES legal position towards VMS (Annex 5).

The main conclusion from this expertise is that unhindered use of VMS data for scientific purposes under the present and revised EU Data Collection Regulations is possible.

2 ToR a) – Data needs regarding VMS from different ICES expert groups

In TOR a), VMS data products needed by ICES expert groups were analysed in relation to the ICES strategic position on VMS data, together with implications arising from inappropriate data accuracy.

2.1 ICES VMS data strategy

VMS data will be essential to meet the requirements from the ICES Science Plan 2009–2013, especially for the subtopic 'Impacts of fishing on marine ecosystems' under the thematic area 'Understanding of interactions of human activities with ecosystems'.

To date, there is no official ICES strategic position on VMS. The WGDIM Working Document on an ICES data strategy 2010 onwards (ICES, 2010) develops the goal to manage and disseminate marine data for the ICES Area in support of the Science and Advisory programmes. "Taking into account that marine policy is looking increasingly to performance indicators for marine management, and that performance measures and indicators for fisheries are defined in 2008/949/EC, corresponding data are an essential element of the future ICES data policy. ICES must develop a strategy for managing its data, and whether it should become a regional data centre and how it will be resourced." WGDIM stated that a documented plan is required accepted by customers and stakeholders.

European policies stipulate (COM(2010)461 final) that fisheries data according to the Data Collection Framework (i.e. including VMS) shall be collected by a joint data centre and then distributed among users such as ICES, STECF and the General Fisheries Commission of the Mediterranean (GFCM). A further elaboration of this concept is laid down in the INSPIRE Directive, which will in 2013 launch a prototype network (ur-EMODnet).

Thus, the ICES strategic position on VMS data can only be to hold VMS data in way that meets the requirements of the ICES expert groups to meet the requirements of the ICES Science Plan 2009–2013. Following the SGVMS 2010 recommendation on identifying VMS data needs, WGDIM forwarded a request from WGDEC.

2.2 VMS data needs by different expert groups

VMS data are used in various aspects by different ICES EGs. Whereas WGDEC mainly focuses on ecological impacts on bottom habitats, WGDEEP and other assessment EGs aim at mapping fishing grounds and changes in the usage of space to better interpret cpue or lpue data.

Hence, each EG has specific data needs implying the need for a database able to extract very different data products.

Four types of VMS data applications are identified:

a) In their 2011 report, WGDEC in particular requested guidance from the ICES Data Centre on:

i) Establishing a database on corals and VMEs. In this respect, the ICES Data Centre is asked to provide guidance on whether provision can be made on ICES servers to store data layers such as VMS data and multi-

beam geotiffs for use each year by WGDEC. All new data (including VMS and ecological information) will be integrated into the ICES VME database.

ii) Getting access to up-to-date NEAFC and EU VMS data for deep-water areas for the 2012 WGDEC meeting. A term of reference is suggested for the ICES SGVMS to help process VMS data so that it can be used by WGDEC. Ideally this will be filtered by gear type and vessel speed so that the intensity of actual bottom fishing activity can be readily assessed.

Hence, the WGDEC request is for processed and fully analysed VMS data, and the term 'up-to-date' needs to be defined to satisfy the needs of WGDEC. VMS data are regarded essential to providing advice, since VMS data are the only spatially resolved indicator of fishing pressure of the deep sea. The indicator should be able to indicate temporal (increasing or reducing effort) and spatial variability (extent to which previously untrawled areas are being impacted) of the pressure.

The application of the indicator is exemplified for the Corner Seamount (Figure 1). In the absence of fully processed data, trawl tracks are reconstructed by joining consecutive VMS pings by straight lines. WGDEC cites a NAFO document (Thompson and Campanis, 2007), saying that "The …Corner Rise seamount was fished by a single fishing vessel probably on an almost full-time basis, with a total of … 66 trawls over 40 days, respectively (during November–December 2004). It is quite clear that a small area measuring some 16 km × 14 km on the western edge of the Corner Rise seamount was a targeted fishing area of only some 50 km2 " These estimates of number of trawls were obtained from Vessel Monitoring System data, and the probable tracks shown in Figure 1.

Apparently, the VMS data shown in Figure 1 are only coarsely resolved, and the track reconstruction is therefore only a tentative figure of the true footprint.

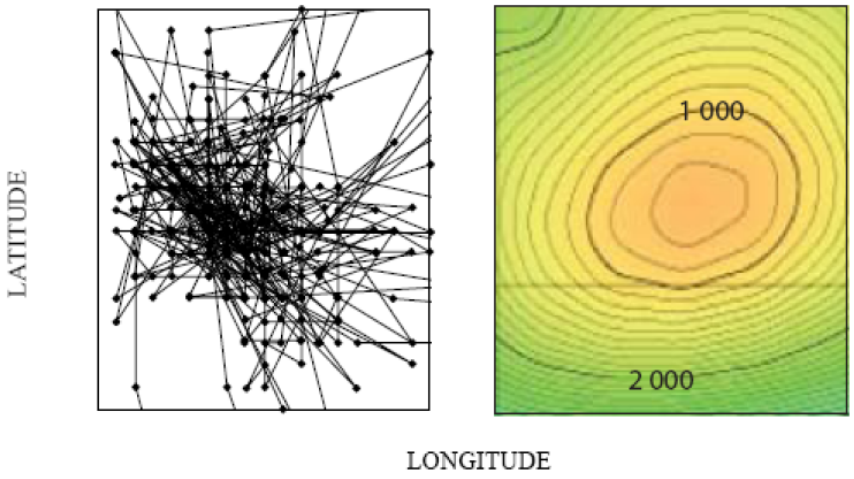

Figure 1. Left, presumed trawl tracks determined from VMS data for the summit of Corner Seamount. Right, summit contours for Corner Seamount. (From Thompson and Campanis, 2007).

b) In their 2011 report, WGDEEP pointed out that VMS data are important to derive fishing effort estimates for lpue and cpue calculations. In particular, this approach was applied to French logbook data (1987–2009) and VMS

data. Following the provision of VMS under the Data Collection Regulation (DCF), VMS data (starting back from 2003) are made available from 2010 onwards. VMS data also allows for improvement of effort data as is allows for some particular uses such as estimating the fishery footprint and fine scale changes in effort distribution. Nevertheless, data such as tally books provided to Ifremer by the French industry includes all the effort information (tow duration, depth, location) coupled with catch, while using VMS requires assumptions to identify fishing and steaming activities and coupling catch to VMS data are an unresolved issue. This is seen as a disadvantage of the VMS approach.

WKCPUE also uses VMS data to calculate cpue and lpue.

c) Ecological footprints in form of spatially resolved gridded VMS data are used by ICES EGs NWWG and WGCRAN.

d) A further application is in conjunction with needs from the European Data Collection Framework, where in EC 949/20008 a list of effort based fisheries indicators is defined based on VMS data. ICES WGECO is likely to continue its work in this field. The ecological indicators are part of the output package delivered by the 'vmstools' softare.

2.3 Types of VMS data products needed

Therefore, three different types of data products are utilized within ICES EGs:

- Raw data for logbooks and VMS to calculate cpues and lpues vessel-by-vessel depending on availability of discard data from sampling programmes. VMS is used to precisely determine the effort, mapping is of minor importance. Raw data are mostly analysed by national experts before being provided to the public, i.e. EG, so that on national level privacy rights are respected.
    - It is necessary to identify single vessels to account for vessel effects in cpue modelling. But it is possible to anonymise data afterwards.
    - Gridded cpue data can be used to show species densities.
- Gridded data that describe fishing effort on a more regional scale e.g. for purposes of environmental impact assessments. Mapping and GIS analysis are of prime importance, in conjunction with georeferenced information for other environmental factors.
    - C-square mapping as provided by the 'vmstools' package or similar fine scaled analyses are appropriate. Resolution and VMS ping interval, i.e. inter-ping distances, are interdependent, so that resolution cannot be increased to very small-scales without corresponding high resolution VMS data. Thus, with pings at 2 h intervals, limitations to the maximum resolution level exist. For this interval resolution, c-squares of a size of 0.05°*0.05° are likely the limit of spatial resolution possible. Alternatively and /or additionally, interpolations can be applied.
- Data that allow for fine scaled analysis of effort distribution in VMEs and other sensitive areas. This can be either achieved without interpolation (point mode analysis if many data points are available, see (Pedersen *et al.*, 2009) or can be augmented by track interpolation procedures to account for exact delineation of fishing activities in small areas in relation to habi-

tats, when only few VMS pings area available. The accuracy of the VMS analysis is strongly dependent on the accuracy of the VMS pings. In European waters, Regulation 2244/2003/EC stipulates the accuracy of VMS signals. In turn, data provided by NEAFC were apparently rounded and therefore may not be used to the fine scale of the habitat.

- It is important to identify métiers, but not single vessels.
- To analyse habitat effects, VMS data at highest possible resolution are required. The example provided by WGDEC shows, that coarsely resolved data give inaccurate starting points for the interpolation algorithm, so that fine scale c-square gridding would have been more appropriate to account for spatial uncertainty.
- Straight lines interpolation is a simple starting algorithm to interpolate data and to outline main areas of fishing activities. As it comes to more exact measures of fisheries effort distribution, straight lines are no longer appropriate, and other interpolation measures based on high resolution position data should be preferred.

3 Standardized data products for the ICES Data Centre

Once the type of data needed is known, the data format needs to be defined. Currently, two different frameworks concerning VMS data format are in practice.

3.1 The FishFrame – format: Logbook/VMS data according to EFLALO2/TACSAT2

Collating VMS data at the ICES data centre must comply with existing data regulations within ICES. Exchange formats for ICES fisheries data are laid down in Jansen *et al.* (Jansen, 2009) providing stipulations to establish FishFrame as a standardized data depository.

Raw data as received from logbooks, sale slips, fleet registry are to be formatted according to the EFLALO2/TACSAT2 standards so that 'vmstools' can be applied for analysis. Thus, all information is retained, but the standardized format allows for a standardized further processing. The EFLALO2 format contains information on the vessel, trip and log-event level (Annex 6). The TACSAT2 format gives individual level data on position and fishing activity (Annex 6).

Since vessel-level information is contained in these formats, ICES could receive processed and thus anonymised and aggregated data from the countries. Raw data will then be analysed on national level and data products are being delivered by the respective fisheries institutes. Métier level aggregation allows to fully anonymise data.

3.1.1 The ICES Dogger Bank data call

In June 2011, ICES issued a data call to compile VMS and landings data for the Dogger Bank marine spatial planning process, a follow-up project of the FIMPAS project. The project is quadrilateral, with Denmark, Germany, The Netherlands and UK pursuing a joint management strategy for the Dogger Bank area.

The call is listed in Annex 7, and marks the first formal ICES request for VMS based landings data. The requested output is in FishFrame format, delivered in .CSV files.

For FishFrame format, raw logbook and VMS data are processed and aggregated giving information on landings and value per species, métier and C-square (Table 1). Problems with anonymization occur only where C-squares contain a small numbers of vessels. Through the aggregation in the FishFrame format, some information will be lost. The resolution in C-squares might be too coarse for some purposes. Nevertheless, the delivered format will satisfy most data requests. Otherwise individual data calls can be made. These data can be visualized easily. The aggregated data facilitate work for the final consumers as they are not required to process raw data. So far, the FishFrame format does not have a quality indicator informing on how much VMS data were used to inform the spatial distribution of landings. This should be added. In this format individual level data are protected.

Table 1. FishFrame Exchange format specification, commercial fisheries effort statistics record (VE) based on VMS data.

Order	Name	Type	Req.	Basic checks	Comments
1	Record type *	String	M		Fixed value VE
2	Vessel Flag Country *	String	M	Code list	ISO 3166-1 alpha-3 codes. The flag country of the vessel.
3	Year *	Integer	M	Code list	1900 to 3000
4	Quarter *	Integer	M	Code list	1 to 4.
5	Month *	Integer	M	Code list	1 to 12
6	Area*	String	M	Code list	Area level 3 (level 4 for Baltic, Mediterranean, Black Sea) in the data Collection regulation (EC, 2008a, 2008b).
7	C-square *	String	M	Code list	0.05x0.05 degree, C-square reference XXXX:XXX:XXX:X
8	Fishing activity category National *	String	O	Code list	Fishing activity category – *National* coding system. Bound to the Nantes matrix level 4 as children i.e. an alternative level 5+6.
9	Fishing activity category European level 6 *	String	M	Code list	Fishing activity category – *Level 6* in the Nantes matrix (SGRN 06-03)
10	Fishing hour	Decimal numeral	M	1 to 9999999999	Fishing hour calculated from VMS data.
11	kW*fishing hour	decimal numeral	M	1 to 9999999999	
12	Tot weight	Decimal numeral	M	1 to 9999999999	Total landings of all species caught. In kg
13	Tot value	Decimal numeral	M	1 to 9999999999	Total value of all species caught. In Euro

* = The field is a key field.

3.2 The 949/2008-format

Regulation 949/2008/EC requests VMS data to be given at individual ping level data (raw position data), at least at 2 hour intervals. Each ping is assigned to specific métiers (DCF level 6, EU Data Collection Regulation 949/2008/EC). Vessels identity is not revealed (Table 2). Only in rare cases, where few vessels are included in a métier, it might be possible to trace back individual vessels. If métiers include too few vessels,

these observations could be excluded to maintain anonymity. To allow for a spatial analysis of fishing effort, the information on whether a vessel was fishing or not needs has to be included. Apparently, an activity flag is not included in 949/2008 format. The activity of a vessel must then be derived from métier specific speed profiles instead of vessel specific speed profiles, with a likely loss of precision.

Table 2. Position level of fishing vessels according to 949/2008/EC. Activity flag not mandatory for this scheme.

Variable	Code	unit
Latitude	SI_LATI	Decimal degrees
Longitude	SI_LONG	Decimal degrees
Date	SI_DATE	DD/MM/YYYY
Time	SI_TIME	HH:MM
Time since last ping	INTERVAL	HH:MM
C-Square	CSQUARE	
Métier	LE_MET	

3.3 Combining formats

Via a link between position and c-square, both formats can easily combined and merged by métier. It is important, to include an activity flag in the 949/2008 format.

4 Review ongoing work for analysing VMS data and developing standardized data products and methodologies

New publications on interpolation techniques and on defining vessel activity were reviewed and possible improvements for the VMS analysis in relation to 'vmstools' evaluated.

4.1 Interpolation techniques

Russo *et al.* (Russo *et al.*, 2011a) published an approach closely related to that from Hintzen *et al.* (Hintzen *et al.*, 2010). Whereas Hintzen *et al.* (2010) interpolate between each two point to obtain the new trawling track, Russo *et al.* (2011) include more points in the interpolation of the trawling track, i.e. the section t between points t_a and t_b is modelled from points t_{a-1}, t_a, t_b and t_{b+1}. Accordingly, the interpolation track based on the four-point modelling is more conservative than from two-point modelling.

For calculating gridded effort data in c-squares resolution, there is no preference for either technique necessary to make. However, the Russo *et al.* (2011) technique can be seen as a four-point derivative of the statistical approach of Fock (Fock, 2008), where information from fishing points is included to obtain a distribution of effort around a measured registration ping.

4.2 Defining fishing activity by Artificial Neural Networks

Seine fishery poses a problem to VMS analysis in terms of track reconstruction and fishing positions, in that tracks are arch-shaped and only incompletely covered by VMS pings on a 2 hour interval. Joo *et al.* (Joo *et al.*, 2011) present a method to identify fishing activity in particular for purse-seine fisheries by means of artificial neural networks. They take data from the Peruvian anchovy fisheries.

Based on observer data, they tested against a simple speed rule with all positions were assigned to fishing where the speed was below 3 knots. This is a very simple approach and does not take into account statistical properties of the fishing speed (mean, SE, etc.). Based on this simple criterion (e.g. threshold on speed), fishing activity is overestimated by 182%. Alternatively, a general linear regression modelling approach (GLM) identified 65% of true positives and 16% of false positives, leading to a global underestimation of the total number of fishing sets of 19%. An ANN reduces the total estimation error on the number of fishing sets to 1% (in average) and obtains 76% of true positives.

The training database is generated by matching the trips monitored with at-sea observers with the respective VMS records.

For the trawling operations analysed in European waters, such a significant discrepancy was not observed. However, speed rules applied in the VMS analysis by 'vmstools' or other approaches (Fock, 2008, Gerritsen and Jordan, 2011, Lee *et al.*, 2010) are more complex than the simple threshold approach used for the Peruvian fisheries with on average 10 – 15 % of overestimation, i.e. false positive indications of fishing activity. Thus, the good performance of the ANN is likely dependent on the simplicity of the chosen alternative. However, if speed filters do not perform well and observer data to train an ANN are available, the ANN approach might be a useful alternative.

4.3 Defining métiers by Artificial Neural Networks

Linking logbooks to VMS can be critical (Bastardie *et al.*, 2010), mainly due to the inaccuracies of logbook entries. Russo *et al.* (Russo *et al.*, 2011b) pursue a different approach in that behavior is used as a proxy for the fishing activity corroborated by means of VMS.

The presented ANN is designed to identify, for a given fishing track, the associated métier among several possibilities. The mean percentage of correct predictions obtained on the test datasets was very high (>94%), confirming that VMS data can provide information on vessel activity.

Apart from VMS data, this approach uses only one other source of information: that included in the VR, i.e. the list of authorized gears (corresponding to level 4 métiers), so this information drives the Multilayer Perception Network (MPN) by reducing the list of possible activities (level 6 métiers) for a given vessel.

The MPN was trained to recognize one among 15 possible métiers from a series of 33 variables: 12 in binary form for licensed gears, 6 probability classes for vessel speed, 3 for vessel heading and 7 for sea depth, respectively. The MPN was iteratively trained on subsamples of a large dataset corresponding to the activity of the Italian fishing fleet, for which information about métiers was collected and validated by on-board observations by scientific operators, and then tested on other subsets of the data. The variables used in the study are divided in two groups: the first describing vessel behavior, and the second containing information about the licenses of the different vessels. The ANN is trained, validated and tested on a set of fishing tracks for which métiers and logbook information are documented by at-sea-observers.

Advantages of this approach over the common analysis of catch profile data provided by landings or logbooks is that it uses only two sources of data (VR, i.e. fleet information, and VMS) which are reliable, easy to collect, and completely independent from fishers control, and thus does not depend on logbook data. This procedure can be helpful when – as for foreign vessels in national EEZs – VMS but not logbook are presented to the national agencies to analyse fishing patterns without international cooperation (e.g. Fock, 2008). In turn, with available logbook data this approach is not necessary.

5 Opportunities for an improved VMS data management within ICES

Types of data needed by ICES expert groups, data formats and products stipulated by EC regulations and the ICES FishFrame format, and the experience from collating data within SGVMS and the ICES data call for Dogger Bank data indicate a certain framework of VMS data storage within the ICES structure.

SGVMS in its present structure fails to collate VMS data in a comprehensive and complete manner, since so many national laboratories were not attending the meeting.

Based on the above information, our task was now to enumerate the shortcomings with respect to the current systems' architecture supporting the analysis of VMS data in general and its relationship with any other data that are or may be relevant to the creation of fishery advice, and to investigate in general terms the options for improvement of the current system in the short, medium and long-term, knowing that the choice of a certain data format determines the data sharing strategy and vice versa.

5.1 Shortcomings at the national and international level

At the national level there are various shortcomings with respect to the way data are maintained and made available:

- Trust – data owners are often reluctant to supply raw VMS data for scientific analysis. The industry is usually also concerned about misuse of VMS data.
- Consistency – Many cases national institutes get periodic extractions from VMS and logbook databases without full knowledge of how the data were extracted and without access to audits, versioning, or change logs. Enforcement agencies might not actually log changes to the database because their interest in mainly in real time monitoring.
- Integration – VMS, logbooks, sales notes and vessel register data are generally collected and maintained by various organizations. This inevitably leads to inconsistent data. Data integration can only be done on an ad-hoc basis.

In summary, national databases are generally not managed in a way that can guarantee transparent, standardized, integrated, agile, consistent, accurate, and timely data.

At the international level there is currently there is no structure in place to handle VMS data requests. The chair of SGVMS sent out an experimental call for raw, anonymised VMS and logbook data (in TACSAT and EFLALO format). In response, Denmark, Germany, Ireland and Scotland were able to supply these data, and Sweden was unable due to organizational restructuring. No data were received from countries that did not attend the meeting. The conclusion from this experimental data request was that because SGVMS does not have full attendance from all nations, it was not in a position to handle data requests. Apart from the absence of an organizational structure, there are a number of other obstacles at the international level:

- Trust – ICES interpretation of the DCF legislation suggests that access to primary (anonymised but not aggregated) VMS data should be made

available on request from scientific advisory bodies, public authorities or any stakeholder or citizen body with an interest in fisheries management. However, many national bodies have legal objections or other reservations about sharing primary VMS and logbook data.

- Resources – considerable resources will be required to meet data calls, although this varies depending on the approach that will be taken to handle these data calls (see next section).

5.2 Towards an ICES VMS data strategy

At the national level it is important to pursue good communication between the national fisheries labs and the organizations that collect and maintain the data. These organizations need to be aware of the legal obligations that exist for providing VMS data for fisheries science purposes.

Database management should follow best practice and should measure up to industrial standards (Connolly and Caffrey, 2011). Databases should be managed in a way that can guarantee transparent, standardized, integrated, agile, consistent, accurate, and timely data.

At the international level it would be useful to set up a memorandum of understanding (MOU) between ICES and the EU on making VMS data available. A similar MOU already exists between ICES and NEAFC.

The study group discussed a large number of possible structures to accommodate future data calls. It is likely that ICES will play a central role but the data that ICES will be asked to handle could vary from raw data to the final data product at the national level. It is possible that ICES might issue a data call for the complete VMS and logbook data in its raw form. Because this is likely to be met with objections from individual nations, it may be more realistic for ICES to collect data that are aggregated at a temporal scale of e.g. one month and a spatial scale of 0.05 decimal degrees. A third alternative would be for ICES to maintain two databases: one that holds raw VMS data linked to level 6 métier data but without vessel information or other logbook data (as specified in the DCF EC 949/2008, Annex XIII) and another database with aggregated VMS and logbook data following existing data exchange protocols like FishFrame or vmstools. These two databases could be integrated to reassign the aggregated data to individual pings in order to be able to address the majority of possible data calls while guaranteeing anonymity. A forth alternative would be a logically centralized, physically decentralized data hub. In this approach, each nation owns and maintains its own data. Secure software extracts relevant data from each of the local databases and integrates it for the specific purpose of each data request (Connolly and Caffrey, 2011). This is an ambitious approach and is technically challenging. It is not dissimilar to the system recently proposed by the US President's Council of Advisors on Science and Technology to improve healthcare for American citizens (PCAST, 2010). This system would, for example, allow clinical researchers to access aggregated medical data from individual patients' records without violating privacy concerns of individual patients. A more pedestrian approach would be for individual data calls to be issued for each specific purpose. This will require significant resources in individual labs although this may be mitigated if these data calls are accompanied by standard vmstools scripts to create the data products. The table on the next page summarizes some of the resource implications, flexibility, possible objections and likelihood of success of each of the possible approaches.

Systems' architecture	time period	Resource requirements				(Legal) objections likely?	Can address current data requests?	Can address future data requests?	Comment
		Member states		ICES					
		human	technical	human	technical				
(Annual) data call by ICES for full raw VMS and logbook data. ICES provide standard data products according to agreed templates.	short term	medium	medium	high	medium	likely	all	all	Unlikely to succeed because of objections to making the raw data available, may improve in future
	medium term	low	medium	medium	low				
	long term	low	low	low	low				
(Annual) data call by ICES for full aggregated VMS and logbook data. ICES provide standard data products according to agreed templates.	short term	medium	low	medium	medium	unlikely	most	unknown	System has limited flexibility to address full range of questions
	medium term	low	low	low	low				
	long term	low	low	low	low				
ICES maintain two databases: 1) Raw VMS data linked to level 6 métier data (but no other logbook data). 2) Aggregated VMS and linked logbook data. (c-square level)	short term	medium	low	medium	medium	unlikely	most	most	Flexible system and no major legal concerns: database 1) is already mandatory and 2) contains aggregated data
	medium term	low	low	low	low				
	long term	low	low	low	low				
Logically centralized, physically decentralized data hub. Each nation owns and maintains its own data. Secure software extracts relevant data from each of the local databases and integrates it for the specific purpose of each data request.	short term	high	high	medium	high	likely[1]	all	all	Technically possible and desirable but would require significant investment of resources
	medium term	medium	medium	low	medium				
	long term	low	low	low	low				

[1] Each country controls its own data and that raw data will not be visible to the user at any time.

Systems' architecture	time period	Resource requirements				(Legal) objections likely?	Can address current data requests?	Can address future data requests?	Comment
		Member states		ICES					
		human	technical	human	technical				
Data calls for each specific purpose accompanied by vmstools script that can be applied by each nation.	short term	medium	low	medium	low	unlikely	all	none	Easy to implement but long response time and long-term resource requirements
	medium term	medium	low	medium	low				
	long term	medium	low	medium	low				
Data calls for each specific purpose and each nation decides which methods to use.	short term	high	low	medium	low	unlikely	all	none	Quality concerns if each nation develops own methods
	medium term	high	low	medium	low				
	long term	high	low	medium	low				

6 Investigate the possibilities, usefulness and accessibility of AIS data for providing fishing vessel tracks

The Automatic Identification System (AIS) is a vessel positioning system using the VHF system. Since the positioning frequency is much higher (seconds) compared to the Vessel Monitoring System (hours) these data are potentially useful in a fishery science context. Impact assessment of fishing vessels, e g bottom trawler on benthic habitat on very small-scales are hampered by the low frequency of vessel positions. Interpretation of fishing activities is also affected by the signal frequency of the VMS, especially analysis of purse seining and the use of static gears like gillnets and longlines suffers from the low frequency. The AIS system would in these cases be of direct use in the development and testing of the VMS analysis methods and obviously also has the potential to replace the VMS as a source of information of the fishing vessel positions. SGVMS consider the AIS potentially very useful.

According to maritime conventions AIS is mandatory (Class A) for vessels >300 gross tonnage, although there are some exceptions, e g fishing vessels of length < 45 m are not forced to use AIS. For safety reasons many fishing vessels might still use the system. It is expected though that the historical and present information from AIS is scarce, covering only parts of the vessel fleet in an inconsistent way. As an example, less than 10% of the Swedish Pandalus fishing fleet appeared in the AIS database. The SGVMS does not have the knowledge of the spatial coverage of the system but it seems that most of the European coastal areas, but also the North Sea and the Baltic, are covered by AIS.

National naval or maritime agencies store data from the AIS system. As an example, in the Baltic region HELCOM is organising a regional database for the whole region. There is a sequential introduction of the AIS system in the European fishing fleet (see Council Regulation (EC) 1224/2009 for details) where boats of length; >15 m from 2014, >18 m from 2013 and >24 from 2012, must be equipped with AIS.

The AIS data have the same basic information as VMS data: vessel identification, date, time, speed and heading, but also contain additional information. It is therefore expected that the AIS data can be merged with logbook data. The SGVMS 2011 group has no practical experience with the AIS data.

Regarding the quality of the AIS data, it is reported that many vessels sends erroneous AIS positions. The SNOOP project (http://snoop.fmi.fi/) has analysed AIS data, and states following: "Yearly there are over 8 900 "ghost messages" in the Baltic Sea AIS data which means that out of 261 million messages 1 of 30 000 is garbage. If this phenomenon is truly random, then noise exists also with transmissions done with legitimate Maritime Mobile Service Identity (MMSI). There is no way to tell unless there is a clear "jump" in geographical position outside regular shipping lanes".

The future use of AIS in the EU fishing fleet will provide the member states highly detailed and consistent information on vessel tracks and it is therefore important that the national research institutes are getting access to the vessel information and take part of the planning process of storing the data. It is important that the data are stored in such way that it is useful for research, that is, AIS information such as vessel position, speed and heading should be stored at the highest possible frequency or if storage space is limited, in a "track reproducible" state, i.e. all positions are stored when speed/and or heading is changed above some threshold level.

7 References

Connolly, P. L., and Caffrey, L. 2011. Supply chaining fishery advice. ICES Journal of Marine Science, 68: 1706–1711.

PCAST. 2010. Realizing the full potential of health information technology to improve health-care for Americans: the path forward. President's Council of Advisors on Science and Technology. http://m.whitehouse.gov/blog/2010/12/08/pcast-releases-healthit-report

Bastardie, F., Nielsen, J. R., Ulrich, C., Egekvist, J., and Degel, H. 2010. Detailed mapping of fishing effort and landings by coupling fishing logbooks with satellite-recorded vessel geo-location. Fisheries Research, 106: 41–53.

Fock, H. O. 2008. Fisheries in the context of marine spatial planning: Defining principal areas for fisheries in the German EEZ. Marine Policy, 32: 728–739.

Gerritsen, H., and Jordan, C. 2011. Integrating vessel monitoring systems (VMS) data with daily catch data from logbooks to explore the spatial distribution of catch and effort at high resolution. ICES Journal of Marine Science, doi: 10.1093/icesjms/fsp137.

Hintzen, N. T., Piet, G. J., and Brunel, T. 2010. Improved estimation of trawling tracks using cubic Hermite spline interpolation of position registration data. Fisheries Research, 101: 108–115.

Jansen, T. 2009. Definition of Standard Data-Exchange Format for Sampling, Landings, and Effort Data from Commercial Fisheries. 296. 43 pp.

Joo, R., Bertrand, S., Chaigenau, A., and Niquen, M. 2011. Optimization of an artificial network for identifying fishing set positions from VMS data: An example from the Peruvian anchovy purse seine fishery. Ecological Modelling, 222: 108–1059.

Lee, J., South, A. B., and Jennings, S. 2010. Developing reliable, repeatable and accessible methods to provide high-rosulution estimates of fishing effort distributions from vessel monitoring system (VMS) data. ICES Journal of Marine Science, 67.

Pedersen, S. A., Fock, H. O., Krause, J., Pusch, C., Sell, A., Böttcher, U., Rogers, S., *et al.* 2009. Natura 2000 sites and Fisheries in German Offshore Waters. ICES Journal of Marine Science, 66: 155–169.

Russo, T., Parisi, A., and Cataudella, S. 2011a. New insights in interpolating fishing tracks from VMS data for different metiers. Fisheries Research, 108: 184–194.

Russo, T., Parisi, A., Prorgi, M., Boccoli, F., Cignini, I., Tordoni, M., and Cataudella, S. 2011b. When behaviour reveals activity: Assigning fishing effort to metiers based on VMS data using artificial neural networks. Fisheries Research, 111: 53–64.

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Annex 2: Agenda

Wednesday 7 September 2011

13.00	Introduction, Adoption of Agenda	[chair]
	National presentations and from ICES n.c.	[N.N.]
	Presentation ToR d) and e)	[Gerritsen]
15.00	Discussion of ToRs	
	Assignment of subgroup leaders	
	Work in ToR subgroups	
18.00	End of day	
	Re-convening and Plenary discussion	
19.00	**Dinner**	

Thursday 8 September 2011

9.00	Summary of Day 1 and short plenary
	Working in subgroups
11.00	ToR b) – Joint session – work on standardized data products
	'The ICES Sea Experiment – Distribution of otter board trawling in 2008 for Métiers TA1-TA3' – Collecting VMS within SGVMS

Friday 9 September 2011

9.00	Continue work
	Collate report material
12.00	End of the Study Group meeting

Annex 3: SGVMS terms of reference for the next meeting

The **Study Group on VMS data, its storage, access and tools for analysis** (SGVMS) chaired by Heino Fock and Vanessa Stelzenmüller, Germany, will meet in Aberdeen, Scotland from XX–XX September 2012 to:

a) Review and consider implications for VMS data management at ICES based on the ICES strategic position on VMS data and data needs as defined by ICES working groups, and determine resources required to accomplish the goals of the strategy;

b) Work on standardized data products for the ICES data centre;

c) Test and undertake quality assurance measures for standardized data products;

d) Review ongoing work for analysing VMS data and developing standardized data products.

SGVMS will report by XXX 2012 (via SSGSUE) for the attention of SCICOM and WGDIM.

Supporting Information

Priority	The current activities of this Group will lead ICES into issues related to the ecosystem effects of fisheries with reference to the ICES Science Plan 2009–2013 and the European Common Fisheries Policy (2008/949/EC).
Scientific justification and relation to Science Plan	Science Plan No: 4.2. Term of Reference a) VMS and logbook data are sensitive data and European states and their national agencies will presumably be reluctant to share raw data. The European Commission (COM(2010)461 final) has so far only suggested to build up a data centre to compile and distribute data among endusers. Thus, it is not yet clear how in practice VMS data will be stored and processed. In turn, ICES will need to analyse fisheries patterns to provide substantiated advice for CFP. However, by holding VMS data, even in some aggregated form, ICES and its expert groups will have the option to re-use the data time and again when the DCF states clearly that provision should be for a stated purpose. ICES in its Science Plan has decided to take a leading in research on fisheries impacts on ecosystem and research fields and purposes for where VMS data are essential, should be clearly stated. Term of Reference b) Several analysis tools are available, and it essential to not only work on case studies of a limited number of vessels, métiers or nationalities, but to start to build up a comprehensive database all fisheries for which VMS is available. Term of Reference c) SGVMS 2010 identified a series of Quality Assurance measures which will be tested and applied to the ICES dataset. Term of Reference d) Update information on available tools.
Resource requirements	Advice on the legal basis for sharing of VMS data in accordance with Data Collection Framework, VMS Control Order and European Human Rights legislation must be available. VMS and logdata are provided to study group members through their national agencies. For the storage of data in an ICES data centre/base, preparatory steps and maintenance need to undertaken by ICES. The additional resource required to undertake additional activities in the framework of this group is negligible.

Participants	The Group is normally attended by some 20–25 members and guests. If legal expertise is required, i.e. sufficient legal advice is not available beforehand, administrators from EC and others should also be invited.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	There are no obvious direct linkages with the advisory committees.
Linkages to other committees or groups	There is a very close working relationship with all groups dealing with EAM, in particular WGECO.
Linkages to other organizations	The work of this group is closely aligned with similar work in OSPAR and HELCOM.

Annex 4: Recommendations

Recommendation	For follow up by:
1. SGVMS 2011 recommends that a workshop on the 'vmstools' software should be carried out within the ICES training course programme.	SSGSUE, SCICOM

Annex 5: The ICES legal position towards using VMS data

The DCF regulation established as from 1 January 2009 states that data collected under this framework AND data collected under other legislation including most control data such as VMS data are in practice public domain with a few limitations.

You can follow this by checking the steps:

Clause 15 makes reference to transparency legislation regarding data including the Aarhus Convention and states that this framework does not override such legislation (meaning that it applies to these data)

Definition (g) in article 2 defines 'detailed data' as primary data in a form which ensures anonymity – meaning that the former approach of never having to provide primary data but only data aggregated on a large-scale is gone – there is now access to primary data which opens the door to VMS primary data as well. This definition was largely introduced to ensure access to primary (but anonymised) VMS data since aggregated VMS data will be useless for most purposes such as studies of fishing activities around specific habitats.

Definition (i) in article 2 defines 'end-users' as bodies with a research or management interest in the scientific analysis of data. This opens for the scientific community at large, for scientific advisory bodies, public authorities and basically any stakeholder or citizen body with an interest in fisheries management. This means de facto public access – there are however limitations on what data can be used for in article 18 but this is equally open.

Article 1 states that the data framework applies to Community vessels inside and outside Community waters. Since NEAFC provides access to non-community vessel VMS data this should mean that we have complete access in the NE Atlantic, although I am not sure what applies to non-Community vessels in Community waters.

Article 15 explicitly mentions VMS data as a data category covered by this regulation including access.

Article 18 states that data (including detailed data as defined above) must provide data to end-users to support scientific analysis for three purposes: as basis for advice, in the interest of public debate and for scientific publication. This means that it will be very difficult to find a purpose which would not be covered by this. Combining the definition of detailed data and end-users with this article means that any scientist can request primary VMS data (although anonymised) for scientific analysis. There is a provision which member states may use to withhold such data namely that if necessary to ensure anonymity they may refuse to provide VMS data – this option needs testing in real cases but will be interpreted to mean that this would only apply if it is known only very few vessels have participated in a fishery and that removing the vessel ID from the primary data would not be enough to ensure anonymity.

Article 20 states stipulates that member states must submit data 1 or 2 months after a request is made dependent on the purpose. It also states that the release of data may be delayed for up to three years after the date of collection if the purpose is scientific publication – this was introduced as a response to claims made by member states during the negotiations that those collecting the data should have time to publish on basis of those data before they move into the public domain. It would make sense if the scientific community would consider whether it is in its interest to maintain this in the revision of the DCF, some may say that we have shot ourselves in our feet by

claiming first publication rights here. This means in practice that member states may insist that they can only start to release data for scientific publication from 2012 since the first data collected under this regulation are from its entry into force 1 January 2009 – but they don't have to, willing states can make data available immediately if they choose.

Article 21 finally provides a process of appeal: if a member state refuses to provide data to an end-user the Commission can intervene – and there are financial sanctions available if the member states insist on refusing access.

There is also a very significant change from the former data collection regulation that there is no more a requirement to delete data again after 20 days. This absence is what opens for the establishment of permanent databases for these data – such databases must however be equipped with some facility to distinguish between purposes of extracting data from them. For scientific advice and public debate/stakeholder participation all data should be available, for scientific publication the three year moratorium after collection will apply.

Unfortunately, in the negotiations of this the majority of Member States insisted on having discrete national programmes rather than regional frameworks within which MS would organize their data collection. However, the DCF opens for and encourages regional cooperation if MS choose to do so, so a move to regional approaches (including databases) can be accommodated within this framework.

Annex 6: Data exchange formats – TACSAT2 and EFLALO2

EFLALO2 format

Type	Variable	Code	Format/Unit
Vessel	Vessel ID	VE_REF	20 character string
	Fleet	VE_FLT	DCF regulation
	Home country	VE_COU	ISO 3166 – 1 alpha-3 codes.
	Vessel length	VE_LEN	Oal (m)
	Vessel power	VE_KW	kW
	Tonnage	VE_TON	GT *(optional)*
Fishing trip	Fishing trip reference number	FT_REF	20 character string
	Departure country	FT_DCOU	ISO 3166 – 1 alpha-3 codes.
	Departure harbour	FT_DHAR	International harbour codes. UN LOCODE
	Departure date	FT_DDAT	DD/MM/YYYY
	Departure time	FT_DTIME	HH:MM
	Landing country	FT_LCOU	ISO 3166 – 1 alpha-3 codes.
	Landing harbour	FT_LHAR	International harbour codes. UN LOCODE
	Arrival date	FT_LDAT	DD/MM/YYYY
	Arrival time	FT_LTIME	HH:MM
Log event	Log event ID	LE_ID	25 character string FT_REF_number (1,2,3,etc.)
	Catch date	LE_CDAT	DD/MM/YYYY
	Log event start time	LE_STIME	HH:MM *(Optional)*
	Log event end time	LE_ETIME	HH:MM *(Optional)*
	Log event start position latitude	LE_SLAT	Decimal degrees *(Optional)*
	Log event start position longitude	LE_SLON	Decimal degrees *(Optional)*
	Log event end position latitude	LE_ELAT	Decimal degrees *(Optional)*
	Log event end position longitude	LE_ELON	Decimal degrees *(Optional)*
	Gear	LE_GEAR	3 character string. DCF metiér level 4
	Mesh size	LE_MSZ	mm stretched mesh
	ICES rectangle	LE_RECT	37F5, NA=unallocated
	ICES division	LE_DIV	10 character string (see codes in annex 1)
	Fishing activity (métier)	LE_MET	Filled in as output from Lot2 tool
	Landing weight estimate of species SP1 (FAO species codes)	LE_KG_<SP1>	Kg
	Landing value of species SP1 (FAO species codes)	LE_EURO_<SP1>	EURO
	…	…	…
	Landing weight estimate of species SPn (FAO species codes)	LE_KG_<SPn>	Kg

Type	Variable	Code	Format/Unit
	Landing value of species SPn (FAO species codes)	LE_EURO_<SPn>	EURO

TACSAT2 format (VMS data)

Type	Variable	Code	Unit
Vessel	Vessel ID	VE_REF	20 character string
Sighting operation	Latitude	SI_LATI	Decimal degrees
	Longitude	SI_LONG	Decimal degrees
	Date	SI_DATE	DD/MM/YYYY
	Time	SI_TIME	HH:MM
	Instant speed delivered	SI_SP	Knots
	Instant heading delivered	SI_HE	Degrees
	At Sea/In Harbour	SI_HARB	0: In harbour 1: At sea
	Fishing/Steeming	SI_STATE	0: Steaming 1: Fishing Filled in as output from Lot2 tool
	Fishing trip reference (FT_REF)	SI_FT	20 character string Filled in as output from Lot2 tool

Codification:

Country codes: ISO 3166 – 1 alpha-3 codes

Harbour codes: International harbour codes based on the UN LOCODE format. Harbour codes and harbour positions have been collected for the EU project ERS (Electronic Reporting System), and these codes are available on the page:

http://ec.europa.eu/fisheries/cfp/control_enforcement/ers_en.htm

Gear codes: The FAO gear codes are used:
ftp://ftp.fao.org/FI/DOCUMENT/cwp/handbook/annex/AnnexM1fishinggear.pdf

Species codes: FAO species codes are used: http://www.fao.org/fishery/collection/asfis/en

Fishing activity codes: The fishing activity codes used in FishFrame for Nantes matrix level 6.

Annex 7: ICES Dogger Bank data call, June 2011

Revised Data Call for fisheries data

Dogger Bank Process

Area ICES Division IVb

Period 2007–2009

The need is to construct an overview of the fisheries, catch (landings) by species, effort by gear, and period (year/quarter) that have taken place on the Dogger Bank area during a three year period. EMPAS worked with 2004–2006, FIMPAS with 2006–2008 and UK 2007–2009. There is no uniform dataset readily available.

The project needs data from Countries: Norway, EU (Denmark, Germany, Netherlands, UK, Belgium, and France)

It is proposed that the period should be uniformly defined as 2007–2009. The data should be broken down to quarter.

Each country is responsible and will carry costs associated with the data work. The responsibility is for data from vessels carrying the country flag.

The basis for exchange of data would be the codes used in the vmstools project. The report of this project is attached. This means for gears the 'Nantes matrix' level 6.

The proposed procedure is:

1) Each country will use vmstools (or a similar tool at the discretion of the country) to work up the VMS+logbook data from national databases

2) Accepting that each country has worked up their data (restricted to the national flag vessels) perhaps using slightly different procedures these data will be provided to ICES in the output form from vmstools (semicolon separated data, see example at the end of annex 1). ICES will combine these data in a single project and use these as a basis for the maps.

   The geographical breakdown would be at the scale of Csquare (0.05*0.05 decimal degrees) and cover all of the ICES Division IVb.

   The exchange file shall follow the exchange format for the FishFrame database, as defined in annex I. You do not need to aggregate species but may do so following : 1) Sole, 2) Plaice, 3) Herring, 4) Cod, 5) Whiting, 6) Sandeel, 7) Sprat and 8) Others If one wants to use codes please use ISO 3-alpha species codes (ASFIS).

3) Data should be submitted no later than mid July to ICES (Dogger Bank process)

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