JRC Scientific and Technical Reports

FP6 CEDER Project Deliverable 1.1.2 "Data Quality Report"

Assessing the quality of fisheries data
delivered by CEDER project partners.

U. Kröner (JRC)
F. Burns (FRS), D. Reid (FRS), A. J. Cotter (CEFAS), G. Pilling (CEFAS), S. Bertrand (IRD), A. Barkai (Olrac), K. Geggus (Olrac), F. Felaar (Olrac), G. Piet (IMARES), F. Quirijns (IMARES), H. S. Valgeirsdóttir (DIS)

CEDER
Catch, Effort and Discard Estimates in Real-Time

EUR 24018 EN - 2009

JRC EUROPEAN COMMISSION

ipsc Institute for the Protection and Security of the Citizen

The mission of the JRC-IPSC is to provide research results and to support EU policy-makers in their effort towards global security and towards protection of European citizens from accidents, deliberate attacks, fraud and illegal actions against EU policies.

European Commission
Joint Research Centre
Institute for the Protection and Security of the Citizen

Contact information
Address: TP 051, Joint Research Centre, Via E. Fermi 2749, 21027 Ispra (VA), Italy
E-mail: Ulrich.Kroener@jrc.ec.europa.eu
Tel.: +39 0332 78 6719
Fax: +39 0332 78 9658

http://ipsc.jrc.ec.europa.eu/
http://www.jrc.ec.europa.eu/

JRC 54606

EUR 24018 EN
ISBN 978-92-79-13738-9
ISSN 1018-5593
DOI 10.2788/39979

Luxembourg: Office for Official Publications of the European Communities

Printed in Italy

Contents

1 Introduction

1.1 Executive Summary

Addressing the uncertainties in fishing activities, the FP6 CEDER project harnessed fishery landings, logbooks, and VMS records information. The project collected data from these sources for selected fisheries[1].

This document explores the quality of aforementioned data.

In summary, it can be said that

- The VMS data quality is usually acceptable, but could be improved. Very occasionally one observes artefacts in reported positions.
- Concerning the monthly reported landings, data quality is usually acceptable, but could be improved. Sometimes negative landings are reported, or data is missing. Another difficulty is that data from FIDES CRONT is presented by the conventions behind EC reporting areas.
- Concerning the logbook data, information comes in different formats and levels of aggregation, implying extra harmonisation work needs to be performed before any sensible analysis. This area will most clearly benefit from regulations such as the ERS e-logbook.
- Fishermen often argue that they require a greater tolerance margin between their e-logbook estimates and the actual catches. We show that Icelandic Redfish fishermen estimate 60% of 364 landings, such that they will not be pursued for mis-reporting, yet exploit the 8% tolerance margin in the direction that suits them.

In the appendices, one finds detailed descriptions of selected fisheries.

1.2 Context

Addressing the uncertainties in fishing activities, the CEDER project harnessed fishery landings, logbooks, and VMS records information. The project collected data from these sources for selected fisheries. This document explores the quality of aforementioned data.

The CEDER project aims to harness observer reports[2], landings, logbooks, and VMS records information, to provide more accurate and timelier information on catches, effort, landings, discards and quota and TAC uptake. It also assesses the benefits of this information for fisheries management. The project's work package 1.1 collects data from observer reports, landings,

[1] North Sea Flatfish from England and the Netherlands, Northern Shelf Anglerfish from the UK, Scottish Pelagic (Nephrops, Mackerel, Herring), North Sea Roundfish (Cod, Haddock, Whiting) from the UK, French tropical Tuna, Greenland shrimp, and Icelandic Redfish.
[2] CEDER developed its model without the use of observer reports. It turned out that we did not really need the discard data for developing the models and algorithms.

logbooks, and VMS records. The goal of this document is to check that the data respects standards.

This deliverable falls in the work-package WP1.1 devoted to the “Collation of existing information – development of database”. The general objective of the work-package was decomposed into the following main tasks:

- Collection of historical data for the selected case studies. The official data required include; VMS (time, date & position), logbooks, landings, discards and vessel IDs. Where necessary unofficial data will be used to validate and, where necessary, condition this data, it may include; catches and discards (e.g. diaries, observer data), sighting reports (aircraft and protection vessels), and alternative data acquisition methods e.g. unofficial diaries and loggers where these exist. The data will be collated and aggregated to preserve anonymity.
- Harmonization of database formats for recording, archiving and exchange of data
- Filing of data in databases with harmonised data description
- Ensuring the quality of the data collected

1.2.1 Resolution of data

During initial development of the prototypes it became apparent that data provided by some fisheries were not at the required resolution for the development of the mathematical models. Therefore, CEDER followed two approaches. Firstly, for the purposes of developing and testing models, confidential data at the right resolution[3] were provided directly to the model developers by those CEDER members with access to it. Secondly, CEDER progressed in the development of the harmonized database, which is capable of combining data from different sources and fisheries regardless of their format or resolution. The confidential VMS high resolution data used in the modelling were not incorporated in the harmonized database in order to maintain data confidentiality and because it wasn't necessary for the development of the modelling approaches. However, the harmonized database was developed to accommodate such data, if necessary and when permitted, and demonstration datasets in the same format as those used for the modelling were imported successfully. The result of these combined approaches is firstly the development of different models using high resolution VMS data, and secondly a demonstration that such data can be incorporated into one database for more efficient linking to modelling approaches, if the data and the resources to implement the system become available in future.

1.2.2 Transposition of requirements of technical annex

For the present deliverable, the work indicated on the technical annex of the project stipulated the following:

[3] For VMS, that means very high resolution data. For Observer, discards were aggregated, so resolution is low, in order to average out individual trips.

> "Using methodologies developed for the Data Collection Regulation JRC will check that the data respects standards. Comparisons between the fisheries will be made in terms of sampling and variability. Estimates will be made as to the impact of missing data (vessels without VMS)."

Because of the aforementioned subchapter "Resolution of data", it was not possible to transpose the requirements literally. Therefore, JRC re-used the concepts of the "DCR Quality Assessment"[4]. Conceptually speaking, the "DCR Quality Assessment" checks the received data against the requirements.

Therefore, this deliverable checks the data received against the requirements set out by the data inference algorithms. Data analysed were VMS, logbook, landings, and observer reports.

This document was written by JRC with input from Olrac and others.

[4] "Assessment of quality of the data transmitted in the frame of the control exercise 2002-2003 of the Data Collection Regulation" The Control Exercise 2002-2003 launched in November 2004, was the first attempt of the Commission to retrieve and evaluate fisheries data collected by the EU Member States during the period 2002-2003. The data requests were sent via email from the Commission to the 13 fishing Member States and covered the Modules C, D, E, F, H and I of the Commission regulation EC 1639/2001. The Commission's Joint Research Centre (JRC) had been entrusted with the task to assess the quality of the data.

1.3 Scope

In order for the data to fulfil its purpose, it first has to conform to the requirements set out by the partners that develop algorithms for catch and effort estimation. Therefore, Correlation Systems provided a list of required and optional data fields. We then checked for availability of plausible data matching these requirements.

For each fishery of the CEDER project,

- VMS records information is checked against the requirements of Correlation systems[5], and completeness of the dataset is verified.
- Landings data from CRONT is checked against completeness and plausibility
- Logbook data and Observer reports are both checked against the catch and effort estimation requirements. While logbook data was required as per the technical annexes, observer data is not required, when it is not deemed necessary for the models.

EU fisheries defined are:

- North Sea Flatfish (IMARES, CEFAS): Countries GBR and NLD, Species SOL and PLE, area IV and VII
- Northern Shelf Angler (FRS): Country GBR (+SCO), species ANF, areas IIa(1), IV(1) IV (Norwegian waters) Vb(1), VI, XII, XIV, VII
- Scottish Pelagic (FRS): Country GBR (SCO), species NEP (nephrops), MAC (mackerel), HER (herring), Area VIa, IVa
- North Sea Roundfish (CEFAS, FRS): Countries UK, species COD, HAD, and WHG, area IV

[5] There are 2 other systems being built, by Sirius and FRI, but for the sake of simplicity, we will assume that requirements are the same than for the system of Correlation.

- French Tropical Tuna (IRD): Country FRA
  species YFT, SKJ, BET, FAO areas 51 and 57.

Non-EU fisheries defined are:

- Greenland Shrimp (GINR, GFLK): Country GRL
  Species PRA, ICES area XIV and NAFO area 1A-1F which is a part of FAO area 21

- North Atlantic ("Icelandic") Redfish (FRI, DIS, NEAFC): Country ISL,
  Species RED, areas XII, Va, XIVb

Several fisheries were erroneously mentioned in the technical annex:

- Peruvian Anchovy: It was never foreseen to make Peruvian data available in the CEDER project. What was foreseen was to ask Sophie Bertrand about her expertise on the Peruvian data. This means that CEDER has some examples and documentation available on Peruvian anchovy, but not more.

- Spanish Tuna: An early participant, IEO, withdrew from the project, after the technical annex was written, but before the contract was signed. IEO was the only participant able to produce such data; therefore Spanish tuna data is not available.

- Alaskan fisheries (CEDER Annex I, mentioned briefly in WP 1.3) At the very beginning of the project, CEDER thought to include some of the experiences of Alaskan fisheries. However, due to time constraints of CEDER participants and Bill Karp from the Alaska Fisheries, such an exchange never materialized.

For the sake of simplicity, this report may at times ignores

- some low-volume by-catch species for some fisheries

- some vessels from some flag states with very weak presences

This enables the report to stay focused on pertinent data, yielding a better picture of the overall situation.

The annex contains a more accurate description of the fisheries of the project:
- Description of fisheries
- Level of discarding
- Number of vessels
- Type of gear
- Legal regulations

- Geographical area
- Maps
- Common description of data (parameters measured, naming conventions)
- Years of data available
- Reliability of data

1.4 Summary of findings

1.4.1 VMS data

VMS data can be obtained, but for legal reasons, that is possible only if the party that receives it agrees to the utmost confidentiality. While restrictions on Scottish VMS data have recently been somewhat relaxed, Greenland VMS data could only be shared between the Greenland “fraction” of the CEDER project.
The VMS data quality is usually acceptable, but could be improved. Very occasionally one observes artefacts in calculated speed between positions. While it is possible for scientists to circumvent these artefacts by ignoring them, the same artefacts create false alarms for assessing VMS frauds. We would therefore recommend that such inaccuracies are further investigated.

1.4.2 Monthly landings

Because it is aggregated, monthly landings data does not nearly come with the same legal bindings as VMS data. For CEDER fisheries, all landings data can be sourced from the FIDES CRONT database, except for Icelandic Redfish, Greenland Shrimp, and French Indian Ocean tuna. Data quality is usually acceptable, but could be improved. Sometimes negative landings are reported, or data is missing. Another difficulty is that data from FIDES CRONT is presented by the conventions behind EC reporting areas. Landings are usually reported in a given EC reporting area. Such an area may cover several ICES areas, or may exclude certain parts of an ICES area. Also, when reporting given landings, the area can be changed from one year to the next. This requires any IT system to be flexible with respect to defining areas, and sometimes may require educated guesses or simplifications.

1.4.3 Logbook data

Concerning logbook data, it was imported into the Harmonized Database at different levels of aggregation. It contains haul-based, trip-based, and aggregated data at higher levels, and there is some coverage between logbook data and VMS data in the harmonized database. In turn, the high-resolution data received permitted to have additional coverage between the logbooks and the VMS.

As a general rule, discard data is not part of the logbooks, see observer reports.

The above permitted development of models raising logbook data to metier data. As stated in the technical annex, three such models have been developed, which are for EU fisheries, Greenland, and Iceland.

As a bonus, we also show that Icelandic skippers are able to guess their retained catches with high accuracy.

1.4.4 Observer data

The harmonized database contains no observer data, because such data was deemed unnecessary for the development of the models.

CEDER developed its model without the use of observer reports; these are habitually the source of discard data. We did not really need discard data for developing the models and algorithms. Instead we prepared the models for observer data, but without feeding it the actual data. At development time, it was sufficient to assume that discard data would be present later, and prepare the system(s) accordingly. For the pilot, we gathered discard data at an aggregate level from the Scottish pelagic fleet. Estimating discards from aggregates is a common approach in fisheries management.

2 VMS tracks

2.1 General Remarks on obtaining VMS tracks

It is difficult to obtain VMS data for scientific purposes, the reason being one of the member states' policy. The reasons stated are usually legal data protection requirements, or the fear that the data will be used to further the interests of other parties.

For legal reasons, Scotland was initially only able to provide data for a few pelagic vessels up to January 2008. Since that time, legislation has changed, and all VMS for the preceding 12 months have been made available.

Greenland could use the VMS data for creating the Sirius prototype. Because of legal reasons, GINR, GFLK, and Sirius IT could share such data between themselves, but were barred from forwarding them to the group. Hence, Greenland VMS data cannot be included in the data quality report.

2.2 Measurements

We checked the VMS positions on the following criteria

- If the position is obviously wrong
- If the calculated speed between successive positions is improbable (> 20 knots).
- If required columns of the data were absent. The required parts of the data are summarized above.

2.3 Main findings

For the VMS data that we were able to analyze,

- Data quality is acceptable, but could be improved in most cases.
- In a small number of cases, artefact speeds were observed when calculating speeds from VMS.
    - For most FMCs that provided data (Scotland, The Netherlands, Iceland, and France) one ends up with a small fraction of speeds that cannot be right. Only England seems to have entirely correct data.
    - The fact that close to 100% of speeds seem to be right, seems to indicate that the approach is correct.
    - We would therefore recommend that such inaccuracies are further investigated. This would remove a stumbling block for scientific research, and more importantly, assist fisheries inspectors.

2.4 Data requirements

Field asked by Correlation	Why required Effect of absence *Remedy*
Vessel Identifier	Links logbook entries with each other. If absent, logbook is worthless. *Obtain new copy of VMS records.*
Country	Vessel identifier is guaranteed unique only per country. If absent, then data cannot be raised from boat/metier to country level. *Obtain vessel register or ask source of data.*
Fleet name	Identifies a metier, meaning a set of similar ships by gear type, size class, engine power, etc. Gives meaning to the notion of CPUE. If absent, then system cannot compare boat-level CPUE figures inside of metier, or raise from boats to metier level. Also see "Area name". *Obtain vessel register or ask source of data.*
Detection Time	Locates a VMS record in time. If absent, renders the particular VMS record meaningless. *Obtain new copy of VMS records.*
Latitude	Locates a VMS record in space. If absent, renders the particular VMS record meaningless. *Obtain new copy of VMS records.*
Longitude	Same as for Latitude
Speed (km/h)	Enables those effort calculation algorithms that rely on reported speed/heading. Helps to detect abnormal positions: the calculated speed between 2 VMS positions cannot be significantly larger than the GPS speed. If absent, then speed can still be calculated. *Obtain new copy of VMS records.*
Heading (degrees to north)	Enables those effort calculation algorithms that rely on reported speed/heading. If absent, then other algorithms can still be used. *Obtain new copy of VMS records.*
Activity	Helps to validate the "effort estimation from VMS" algorithm. If this is absent for an entire type of nets (Twin beam, long line, otter trawl, purse seining, …), then that makes development of a sensible fishing detection algorithm somewhat hazardous. *Obtain new copy of VMS records.*

2.5 North Sea Flatfish, NLD

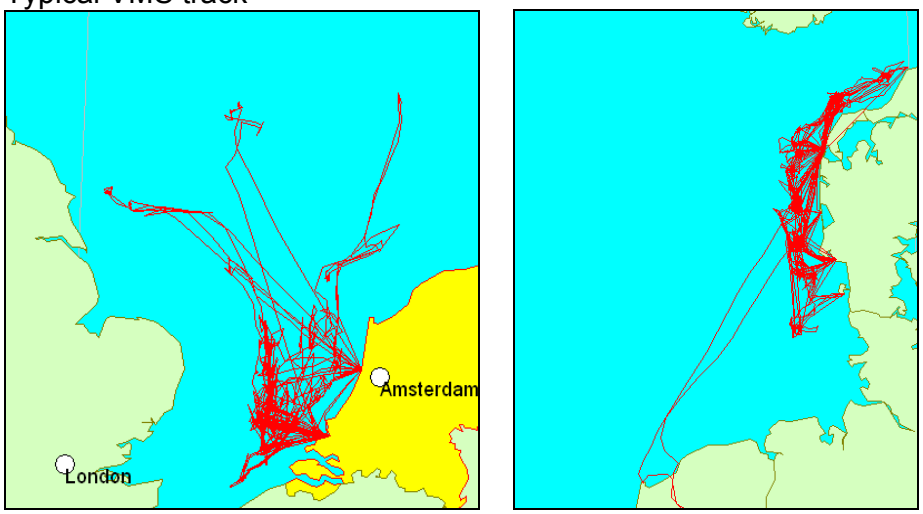
Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Yes
Fleet name	Yes
Detection Time	Yes
Latitude	Yes
Longitude	Yes
Speed (km/h)	Yes
Heading (degrees to north)	Yes
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Summary: The NSF data contains 1 year of VMS positions from 2005. All of VMS positions have a vessel ID. About half of it comes without speed/heading measurements.

Statistics summary

Total positions	245 463
Total vessels	63
Positions without vessel id	25 611 fix
Positions with absent speed, or speed = 0	121 908
Positions with speed > 0 but without heading	12
Positions with speed > 0 and heading = 0	302 (expected 123555 / 360 = 343)
Obviously wrong positions	0
Speed calculated > 20 knots	1949
Date/time of first position	01/01/2005 00:04:00
Date/time of last position	31/12/2005 23:58:00

Typical VMS track



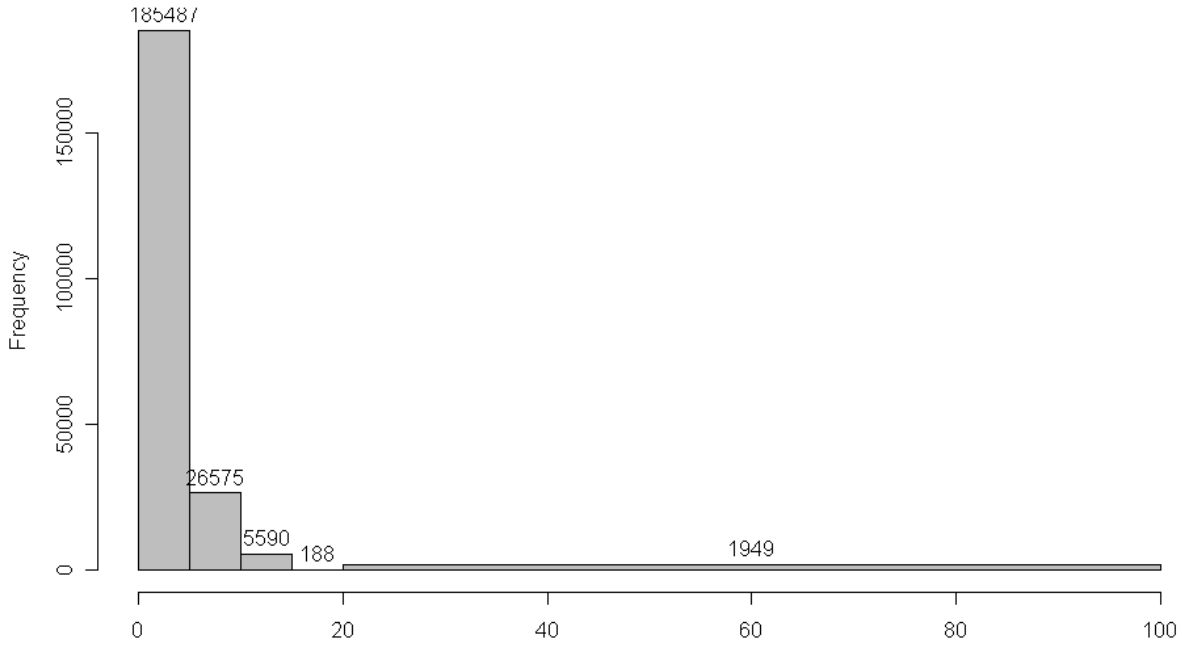
Most tracks are inside of area IV. Occasionally, boats are sometimes found in area IIIa (Skagerak). This is entirely normal, since once quota is allocated to the fishermen, they will fish in the zones where they have quota. In the above case, the skipper had quota in ICES IIIa.

Error details

Probable error type	Example
No vessel ID	A total of 25611 positions did not have a vessel ID associated with it.

Speed distribution

The calculated speed in knots is distributed as follows.



For speeds smaller than 20 knots, each histogram bucket measures 5 knots. As becomes apparent in the above diagram, a total of 1949 calculated speeds are above 20 knots, and another 188 speeds are above 15 knots. Typically, these speeds are not real, and mostly point to issues in the transmission of VMS data.

For an analysis of issues encountered and probable causes of artefact speeds, see the analysis of the Scottish VMS sample data (subchapter 2.8, page 27).

2.6 North Sea Flatfish and Roundfish, GBR 15 minute sample data

Field asked by Correlation	Provided?
Vessel Identifier	Yes (implicit)
Country	Yes (implicit)
Fleet name	No
Detection Time	Yes
Latitude	Yes
Longitude	Yes
Speed (km/h)	Yes
Heading (degrees to north)	Yes
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Summary:

The North Sea Flatfish CEFAS data contains 9 months of GPS positions, for 9 vessels, in 15 minute intervals. The data quality is perfect, save for the absent vessel's activity. However, because activity is unknown, and because there is no link between this VMS data and the logbook, the data set mainly serves to underscore that it is possible to get perfectly usable GPS positions.

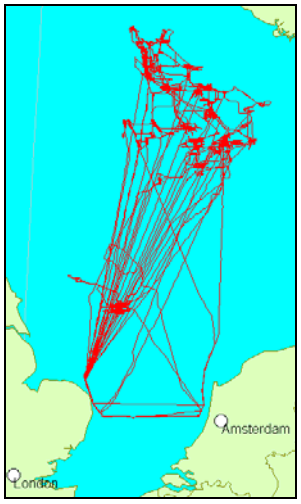
As we will see below, there are some cases in which the GPS positions are of a lesser quality, yet using a procedure as the one used for obtaining this GPS data series, it is possible to obtain reliable positions.

Totals

Total positions	73102
Total vessels	9
Positions without vessel id	(vessel ID is implicit)
Positions without speed and/or heading	0
Positions outside of assigned zone[6] (approximative)	0
Obviously wrong positions	0
Speed calculated > 20 knots	0
Date of first position	22/11/2000
Date of last position	12/08/2001

[6] Outside of ICES IV

Typical VMS tracks



Some atypical VMS tracks

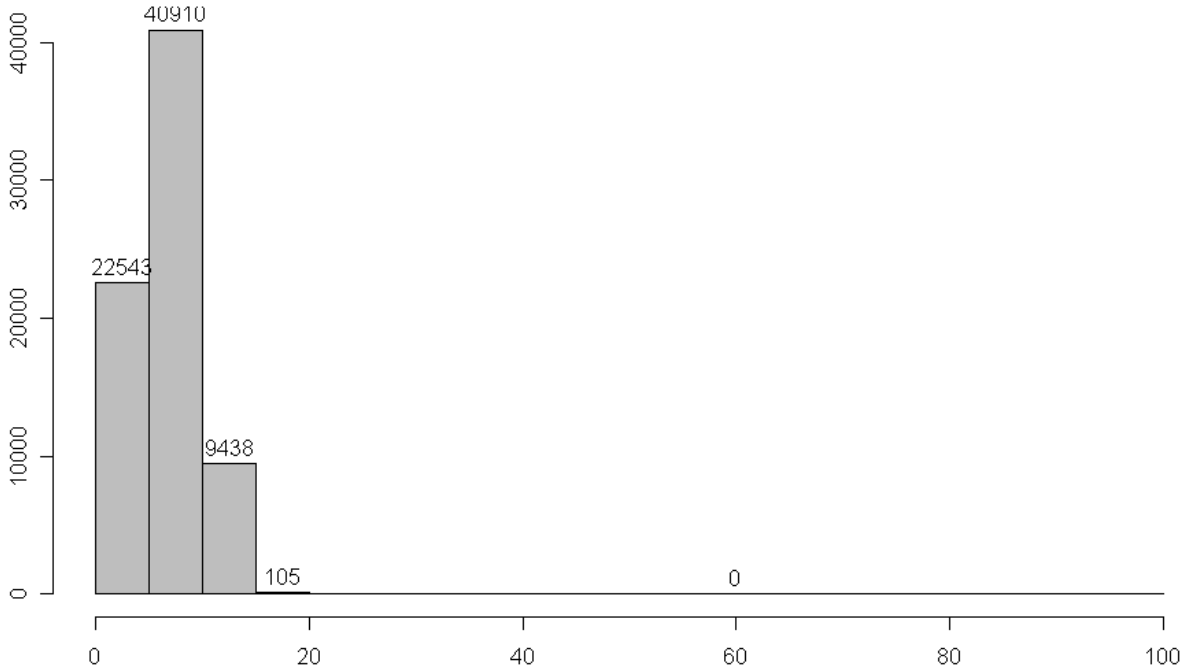
- There are no atypical VMS tracks.

Source of anomalies

- There are no anomalies.

Speed distribution

The calculated speed in knots is distributed as follows.



For speeds smaller than 20 knots, each histogram bucket measures 5 knots. As becomes apparent in the above diagram, none of the calculated speeds are entirely unlikely (above 20 knots), and 105 speeds are somewhat unlikely with values above 15 knots.

2.7 North Atlantic ("Icelandic") Redfish

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Yes (implicit ISL)
Fleet name	Yes (implied)
Detection Time	Yes
Latitude	Yes
Longitude	Yes
Speed (km/h)	No
Heading (degrees to north)	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Summary: The Redfish data contains 4 years and 3 months of VMS positions. All VMS positions have a vessel ID, none of it has speed or heading.

A small proportion is located outside of the initially expected area. Mostly these have strayed into FAO area 21. This is normal because during some times of year (July to November) fishermen fish off Greenland, while during most of the time (April to July) they fish at the Reykjanes ridge.

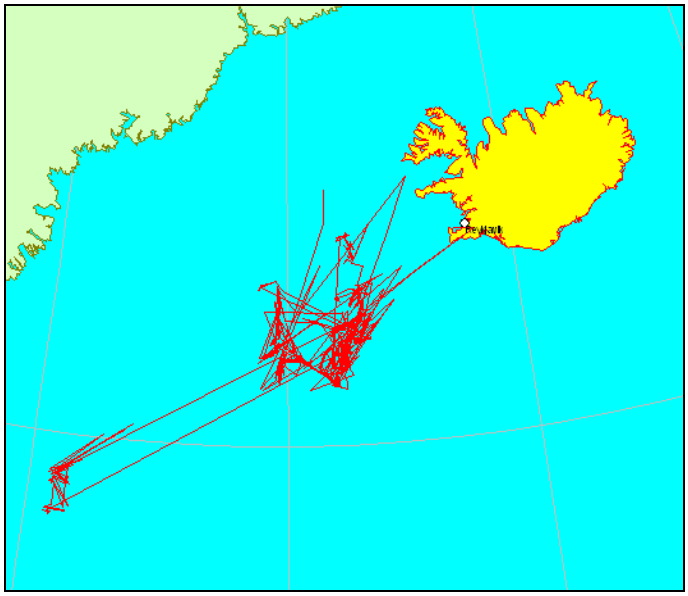
A tiny fraction of the data consists of wrong VMS positions.

Totals

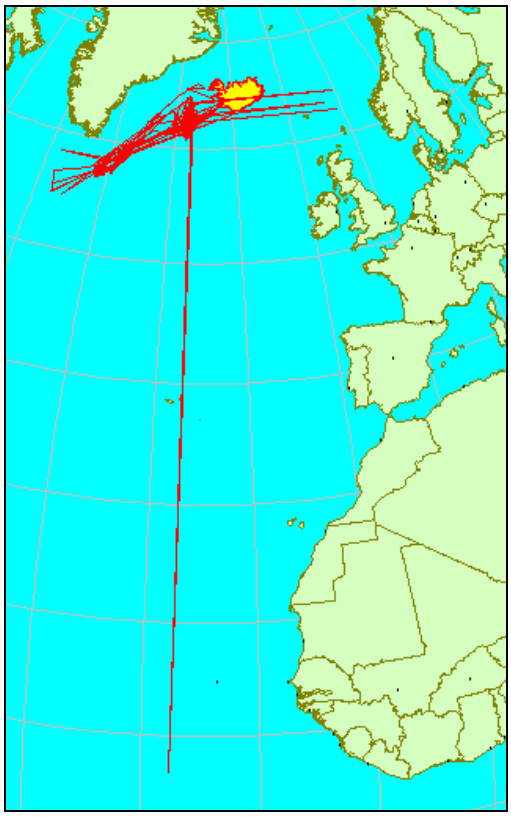
Total positions	30 513
Total vessels	22
Positions without vessel id	0
Positions without speed and/or heading	All
Positions outside of assigned zone[7] (approximative)	4 726
Obviously wrong positions	22
Speed calculated > 20 knots	190
Date of first position	17/05/2001 13:43:00
Date of last position	21/08/2005 12:25:00

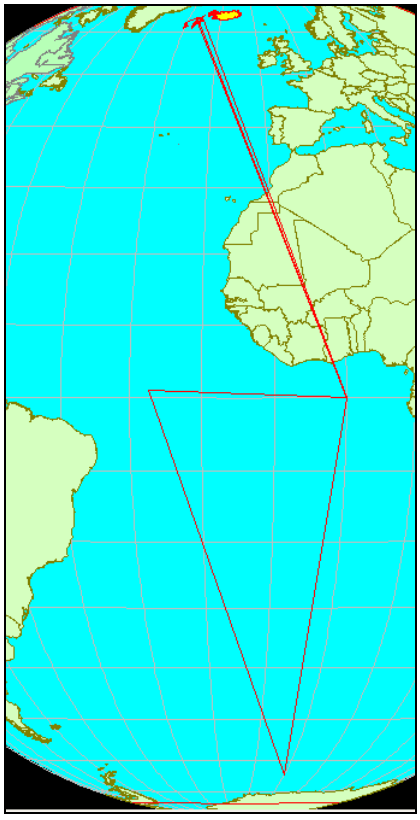
[7] Outside of FAO 27 or outside of ICES XII, XIVb, V, II, I

Typical VMS track

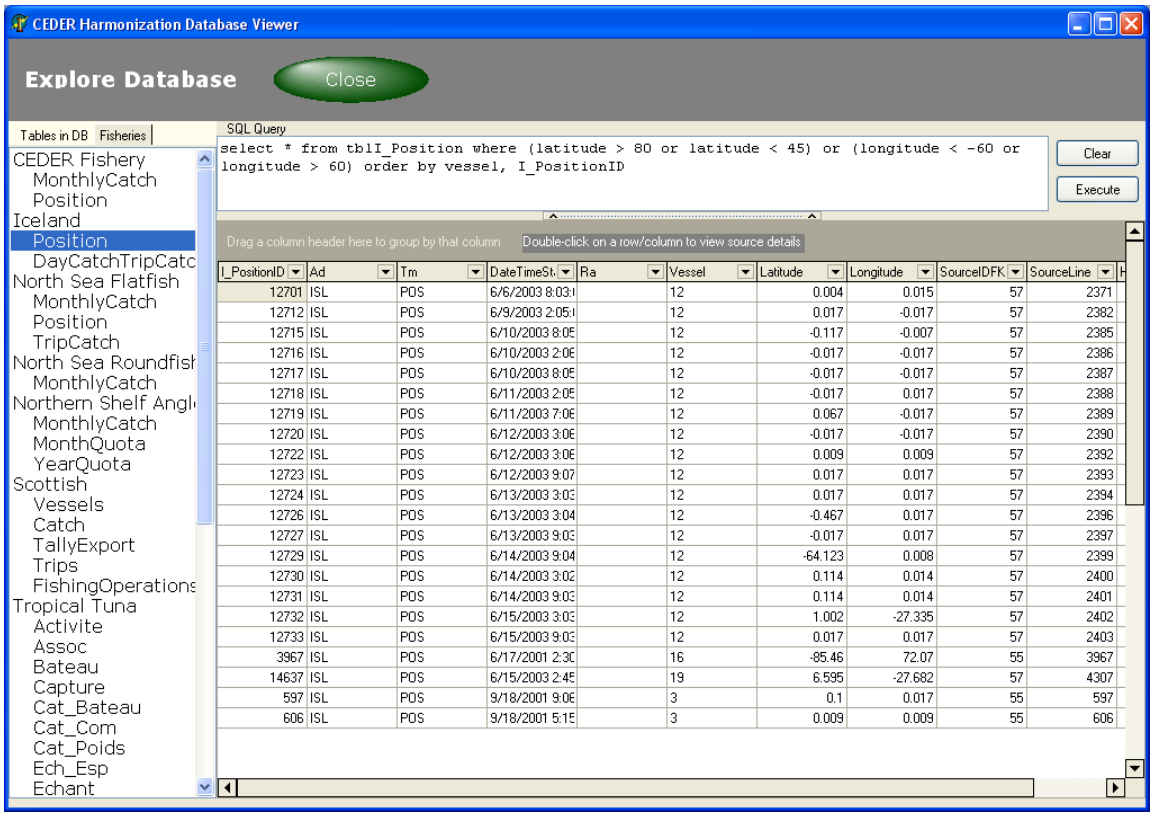


Some atypical VMS tracks





Error details



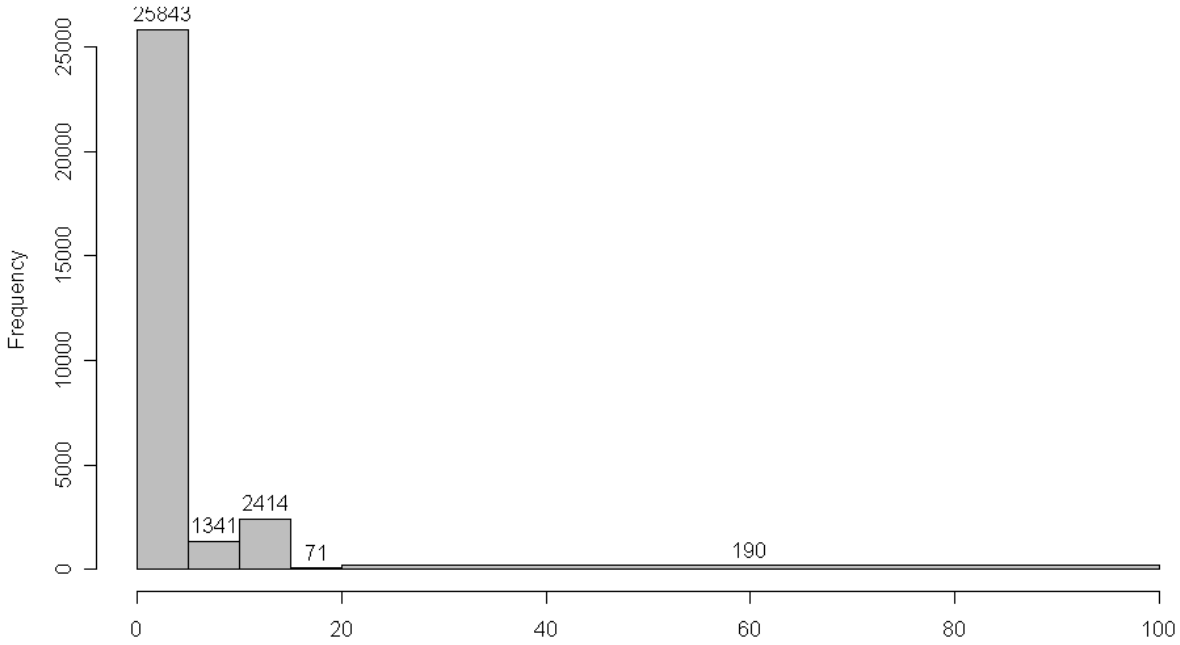
Possible error type	Example
Filing position differences instead of absolute positions	Most of the erroneous data has this issue. Latitude of 0.004 or longitude of -0.007 would not indicate the equator and/or the meridian 0, but rather differences in position with respect to the last position.
Mixing absolute and relative latitudes and longitudes	Position ID 12729, 12732.
Sign error	Vessel 16, position ID 3967: If the absolute values are correct, then the position should be 85° N and 72° E or 72° W.[8]
Off by a factor of 10	Vessel 19, position ID 14637: Most likely the position was 65.95 N, -27.682 E.[9]

[8] Original position located in the middle of Antarctica.
[9] Original position located between West Africa and Brazil.

It has to be stressed that the above are just possible sources of error, meaning that the actual causes may be quite different from the ones indicated.

Speed distribution

The calculated speed in knots is distributed as follows.



For speeds smaller than 20 knots, each histogram bucket measures 5 knots. As becomes apparent in the above diagram, a total of 190 calculated speeds entirely unlikely with values above 20 knots, and another 71 speeds are unlikely with values above 15 knots.

For an analysis of issues encountered and probable causes of artefact speeds, see the analysis of the Scottish VMS sample data (subchapter 2.8, page 27).

2.8 Scottish VMS pilot data

Due to Scottish data protection laws, it was not possible to obtain VMS data until January 2008. In January 2008, VMS data from 2007 onwards became available.

Starting on 28/02/2008, all 6 boats were emitting VMS signals at the rate of one each 15 mintues.

This concerns boats from the following fisheries:

- Northern Shelf Angler
- Scottish Pelagic
- North Sea Roundfish

Field asked by Correlation	**Provided?**
Vessel Identifier	Yes
Country	Yes (implicit)
Fleet name	Metier is given in separate file.
Detection Time	Yes
Latitude	Yes
Longitude	Yes
Speed (km/h)	Yes
Heading (degrees to north)	Yes
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Total positions	30 270
Total vessels	6
Positions without vessel id	0
Positions without heading	9
Positions without speed	6 360
Obviously wrong positions	1
Speed calculated > 20 knots	16
Date of first position	29/03/2007
Date of last position	06/05/2008

A tiny fraction of the data shows artefacts in speed, hinting at issues with GPS position equipment and/or VMS message transmission. A sizeable part of the positions does not contain speed data.

As for the metier classes, these are distributed among the boats as follows:

Quarter 1

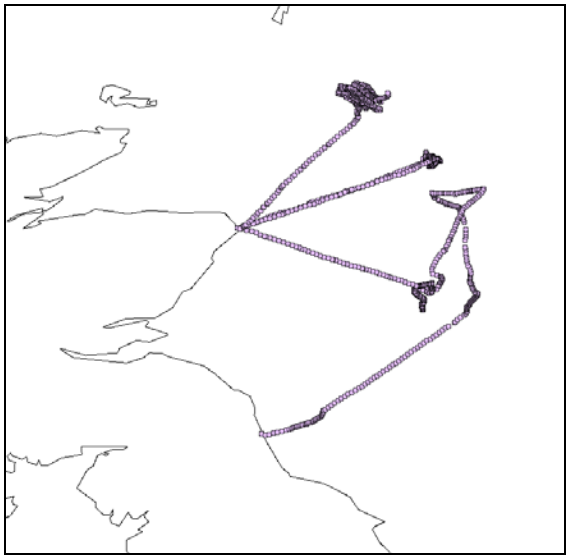
Vessel	Main Metier	Area
1	Single Trawl (80-100mm)	North Sea
2	Single/Multiple trawl 120mm+	North Sea
3	Mixed (single trawl >100mm & < 120mm)	North Sea
4	Single Trawl (80-100mm)	West Coast
5	Single/Multiple trawl 120mm+	North Sea
6	Single Trawl (80-100mm)	North Sea

Quarter 4

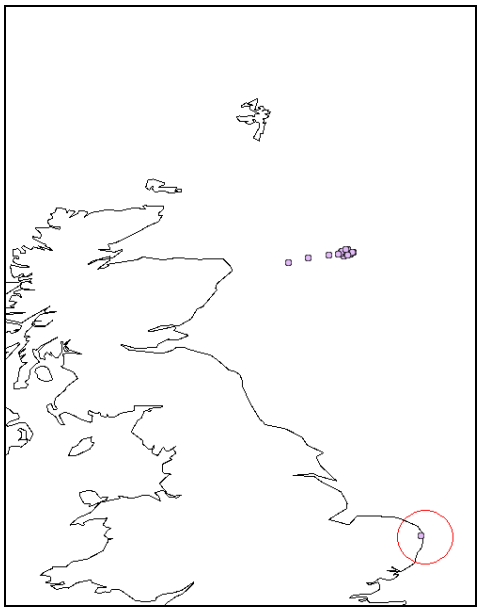
Vessel Name	Main Metier	Area
1	Single Trawl (80-100mm)	North Sea
2	Mixed (single trawl >100mm & < 120mm)	North Sea
3	Mixed (single trawl >100mm & < 120mm)	North Sea
4	Single Trawl (80-100mm)	North Sea & West Coast (50/50)
5	Single/Multiple trawl 120mm+	North Sea
6	Single Trawl (80-100mm)	North Sea

No data was supplied for quarters 2 and 3, because these quarters are not part of the pilot phase.

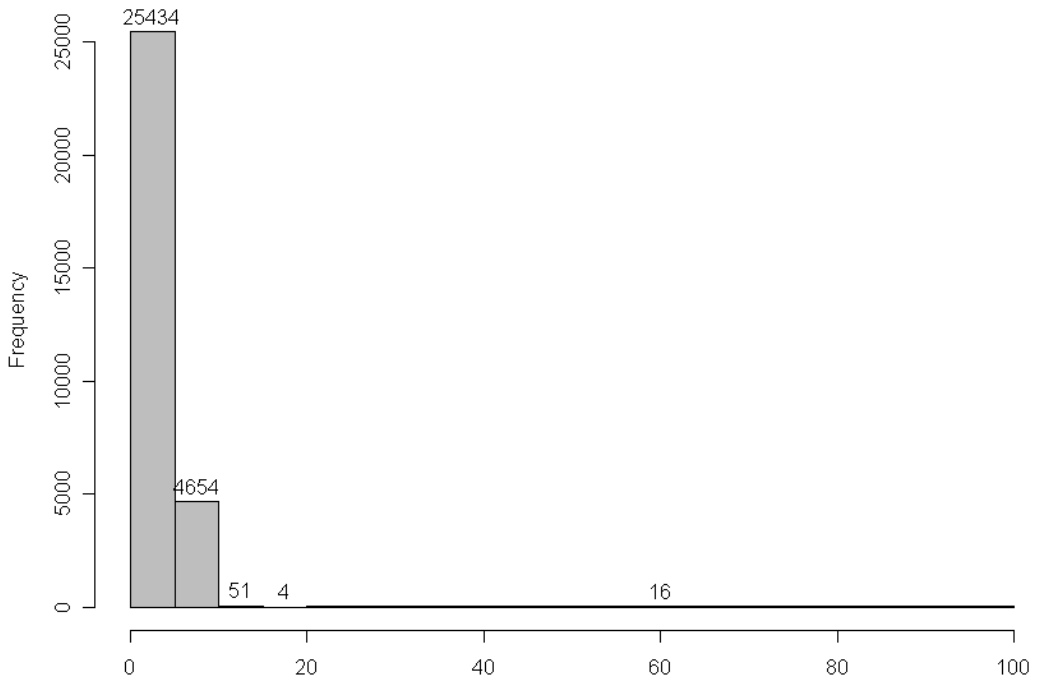
Typical VMS tracks



An atypical VMS track



The calculated speed in knots is distributed as follows.



For speeds smaller than 20 knots, each histogram bucket measures 5 knots. As becomes apparent in the above diagram, 16 of the calculated speeds are entirely unlikely (above 20 knots). Therefore, the speed distribution indicates a total of 16 artefact position values.

Error details

	vesselano integer	t_1 timestamp without	t_2 timestamp without	lat_1 double precis	lat_2 double preci	long_1 double preci	long_2 double preci	km double pre	hours double pi	calc_knots double precis
1	1	2008-03-30 03:39:00	2008-03-30 03:41:00	59.102	59.0973333	-0.5006667	-0.4706667	1.79	0.03	29
2	1	2008-03-30 03:56:00	2008-03-30 03:59:00	59.086	59.1133333	-0.4626667	-0.4913333	3.45	0.05	37.28
3	2	2008-03-30 03:31:00	2008-03-30 03:35:00	60.342	60.3193334	1.056	1.0733334	2.69	0.07	21.83
4	2	2008-03-30 03:35:00	2008-03-30 03:39:00	60.3193334	60.346	1.0733334	1.0566667	3.1	0.07	25.14
5	3	2008-03-13 08:41:00	2008-03-13 12:05:00	58.0833333	57.8833333	-5.6166667	6.6833333	724.44	3.4	115.05
6	3	2008-03-13 12:05:00	2008-03-13 13:50:00	57.8833333	58.0666667	6.6833333	-5.6166667	724.56	1.75	223.56
7	3	2008-04-22 10:05:00	2008-04-22 15:49:00	58.0333333	67.9666667	1.3166667	0.8833333	1104.74	5.73	104.04
8	5	2008-03-30 03:26:00	2008-03-30 03:30:00	59.784	59.656	-3.498	-3.508	14.24	0.07	115.37
9	5	2008-03-30 03:39:00	2008-03-30 03:41:00	59.6753334	59.816	-3.5073333	-3.494	15.66	0.03	253.66
10	5	2008-03-30 03:41:00	2008-03-30 03:46:00	59.816	59.6913333	-3.494	-3.5066667	13.88	0.08	89.94
11	5	2008-03-30 03:46:00	2008-03-30 03:56:00	59.6913333	59.8433333	-3.5066667	-3.488	16.93	0.17	54.86
12	5	2008-03-30 03:56:00	2008-03-30 04:12:00	59.714	59.8593333	-3.5046667	-3.4786667	16.23	0.27	32.85
13	6	2008-03-30 03:20:00	2008-03-30 03:26:00	60.56	60.5373333	-2.17	-2.2253334	3.94	0.1	21.26
14	6	2008-03-30 03:26:00	2008-03-30 03:31:00	60.5373333	60.5533333	-2.2253334	-2.1726667	3.38	0.08	21.93
15	6	2008-03-30 03:39:00	2008-03-30 03:41:00	60.548	60.5406666	-2.1766667	-2.2453333	3.84	0.03	62.24
16	6	2008-03-30 03:41:00	2008-03-30 03:46:00	60.5406666	60.544	-2.2453333	-2.178	3.7	0.08	23.98

Possible error type	Example
Close time intervals coupled with imprecision of GPS equipment	Rows 1 - 4: observe time delays between successive GPS positions (2-4 minutes) coupled with distances in the 3-7 km range. Similar issues with rows 8 - 12 and 14 – 16.
Error in transmission of positions	Rows 5 – 6: Boat goes from 5.6° W to 6.7° E, then back to 5.6° W. Similar issues with row 7.
Imprecision of GPS equipment or VMS transmission fault	Row 13: time delay seems appropriate, but somehow position seems to oscillate between 2 points that have a distance of 4 kilometres.

Discussion of artefact speeds

The errors reported in the above analysis can have the following causes:

- Imprecision of GPS equipment
- Errors in transmission of VMS positions
- Errors in the ways in which data is processed

Outside of a pilot project setting, this situation is made more complex by the following factors:

- Some skippers may be tempted to cheat the VMS
- There may be a greater variability in the installed base of the VMS boxes (older models, other manufacturers)

In summary, somehow, in a small number of cases, and for most FMCs that provided data (Scotland, The Netherlands, Iceland, France) one ends up with

speeds that cannot be right. The fact that close to 100% of speeds seem to be right, seems to indicate that the approach is correct.

2.9 North Sea Roundfish, GBR sample data

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Yes (implicit)
Fleet name	No Mesh size and gear type vary according to season.
Detection Time	Yes
Latitude	Yes
Longitude	Yes
Speed (km/h)	Yes
Heading (degrees to north)	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Summary: The North Sea roundfish data contains 4 years and 6 months of VMS positions, from 10 vessels, in 2 hour intervals. All VMS positions have a vessel ID, all have speed, but none have heading. None are located outside of the expected area, which is IV and VII. There are no obviously wrong VMS positions.

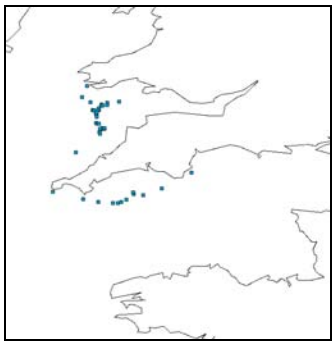
Totals

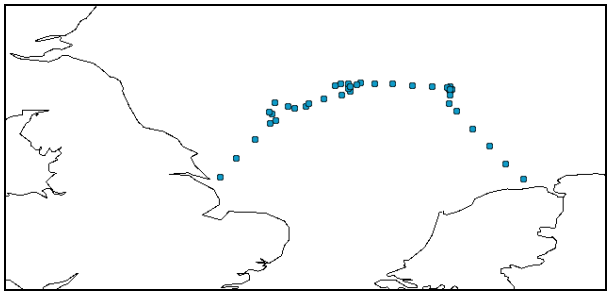
Total positions	600
Total vessels	10
Positions without vessel id	0
Positions without speed and/or heading	600[10]
Positions outside of assigned zone[11] (approximative)	0
Obviously wrong positions	0
Speed calculated > 20 knots	0
Date of first position	16:34 23/10/2000
Date of last position	17:41 05/04/2005

[10] No vessels report heading, but all report speed. The heading in the source files is calculated.
[11] Outside of ICES IV and VII

Typical VMS track

The vessels fish in the zones IV and VII.





Some atypical VMS tracks

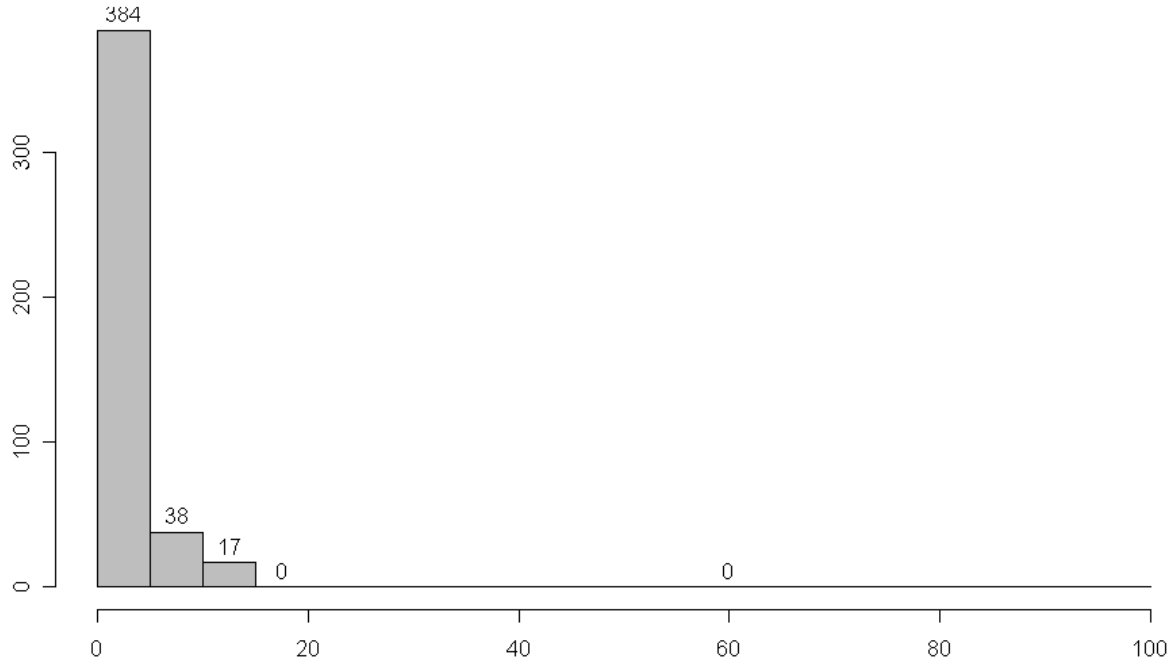
- There are no atypical VMS tracks.

Source of anomalies

- There are no anomalies.

Speed distribution

The calculated speed in knots is distributed as follows.



For speeds smaller than 20 knots, each histogram bucket measures 5 knots. As becomes apparent in the above diagram, none of the calculated speeds are entirely unlikely (above 20 knots). Neither are there any calculated speeds with values above 15 knots.

2.10 Greenland Shrimp

VMS-data could not be included in our part of the investigation. This is due to Greenland's data privacy laws.

2.11 French Tropical Tuna

Note about Spanish tropical tuna: The only Spanish partner of the project, IEO, dropped out of the project at its inception. Therefore Spanish tropical tuna data is not available.

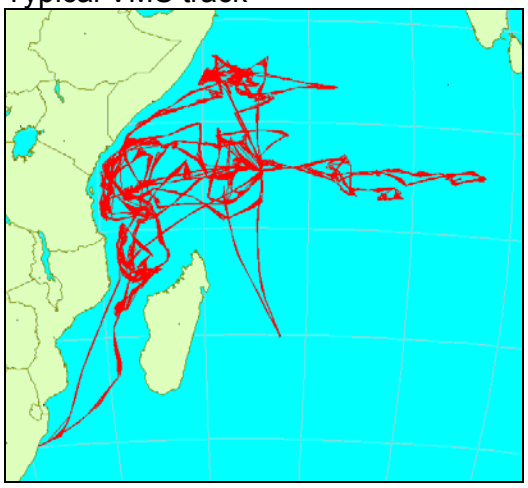
Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Yes (implied FRA)
Fleet name	Yes (purse seiners, implied)
Detection Time	Yes
Latitude	Yes
Longitude	Yes
Speed (km/h)	Partial
Heading (degrees to north)	Partial
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Summary: The Tropical Tuna data contains 1 year of VMS positions. All VMS positions have a vessel ID, only a fraction has speed or heading. A tiny fraction is located outside of the assigned area. A tiny fraction of the data consists of wrong VMS positions.

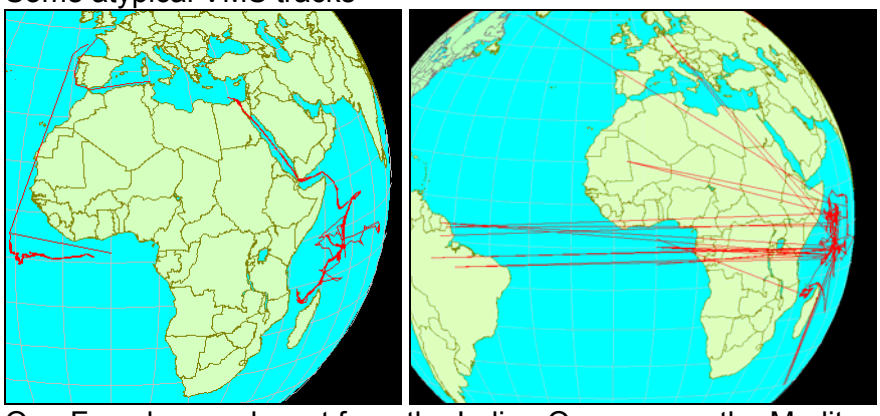
Totals

Total positions	130 310
Total vessels w/ position reports	13
Positions without vessel id	None
Positions without speed and/or heading	120 378
Positions outside of assigned zone (approximative)	91
Vessels outside of assigned zone[12] (approximative)	2
Obviously wrong positions	22
Speed calculated > 20 knots	666
Date/time of first position	01/01/2002 01:00:00
Date/time of last position	01/01/2003 00:00:00

Typical VMS track



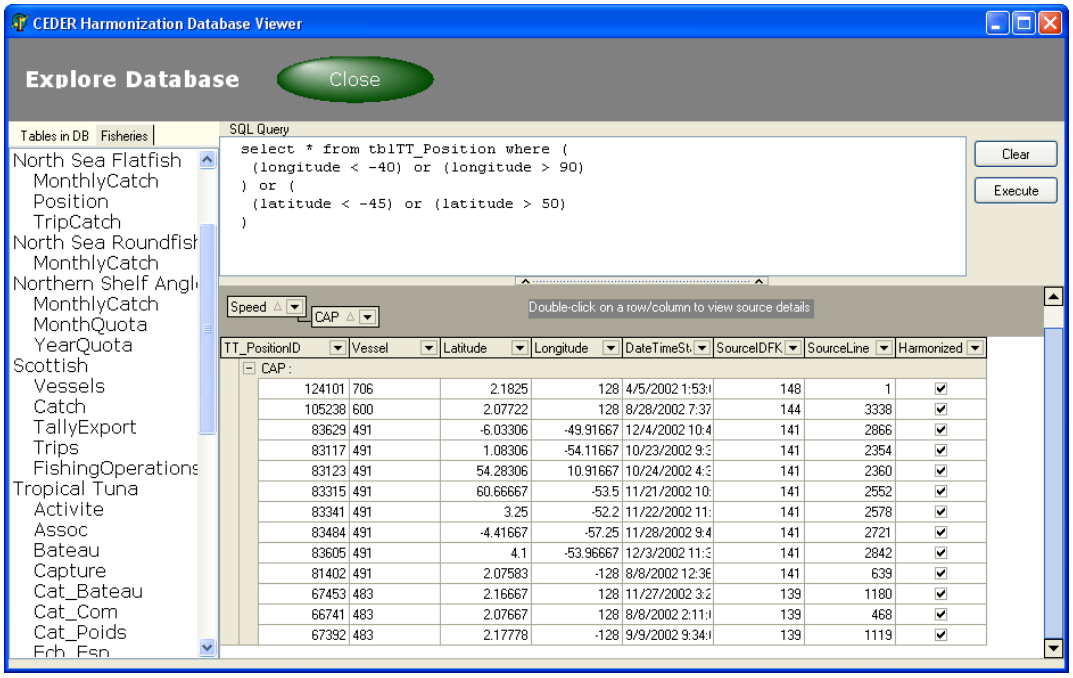
Some atypical VMS tracks



One French vessel went from the Indian Ocean, over the Mediterranean, to the French Atlantic coast, while switching off its VMS in the Mediterranean. Another vessel exhibits some very atypical positions.

[12] Outside of FAO 34, 47, 51, 57

Source of anomalies



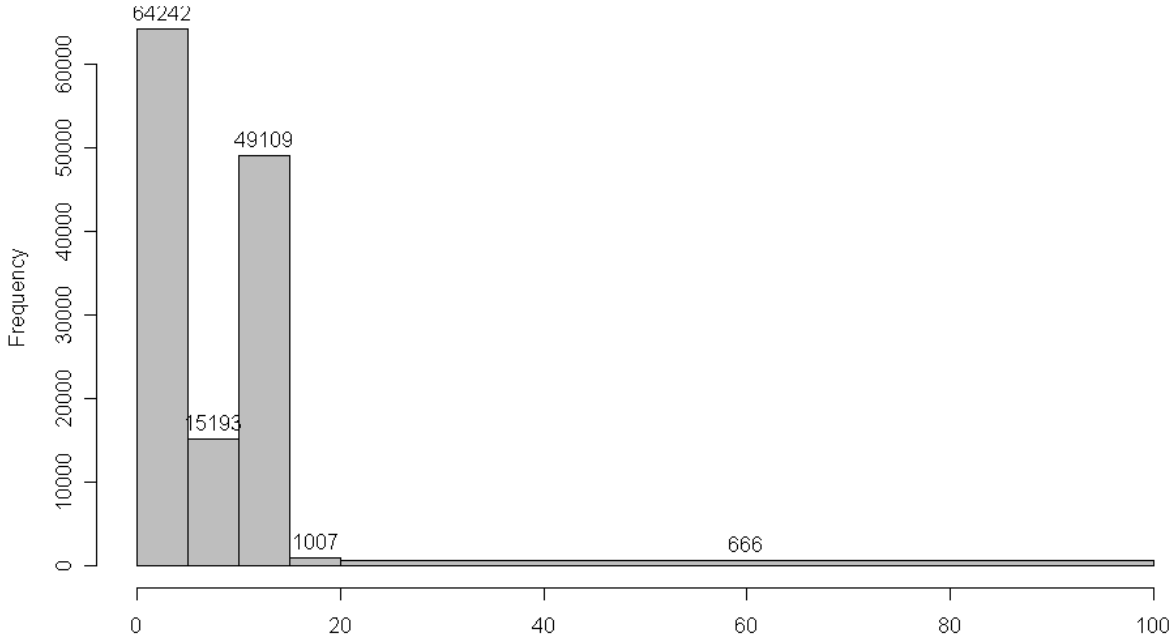
Possible error type	Example
Artefact coordinate value	Some vessels report a longitude of 128 or -128.
Problems with signal transmission, VMS box, and/or bad GPS signal reception	Vessel 491

For an analysis of issues encountered and probable causes of artefact speeds, see the analysis of the Scottish VMS sample data (subchapter 2.8, page 27).

Note: Although the errors in the French VMS positions seem to be entirely different from those in the Scottish VMS data, they must have the set of underlying causes that are cited in the Scottish case.

Speed distribution

The calculated speed in knots is distributed as follows.



For speeds smaller than 20 knots, each histogram bucket measures 5 knots. As becomes apparent in the above diagram, a total of 666 calculated speeds entirely unlikely with values above 20 knots, and another 1007 speeds are unlikely with values above 15 knots.

For an analysis of issues encountered and probable causes of artefact speeds, see the analysis of the Scottish VMS sample data (subchapter 2.8, page 27).

3 Module LA: Landings

3.1 General Remarks

For all EU fisheries, data was provided by DG FISH's FIDES database. For Greenland, Iceland, and French Tuna, data came through other channels.

3.2 Checks performed

For EU fisheries, landings data is specified as follows: Cumulative kilograms landed per month, species, area, and country.
We checked the cumulative kilos of EU landings on the following criteria:

- If the cumulative kgs is intermittently absent ("null") or negative. We ignored those cases where cumulative kgs were not given in January.
- If the cumulative kgs decrease or stay the same in the current year
- If data is otherwise absent
- The timeframe of data provided

Borderline cases were not considered (those would be unusually low[13] catches).

[13] Off by at least 1 order of magnitude from average values, or absolute kilos caught are close to zero.

3.3 Main findings

- Data quality is acceptable in most cases, but could be improved.
    - One problem is that data is presented by the conventions behind EC reporting areas. For instance, “2AC4.” refers to “ICES IV; EC waters of IIa” while “2A3AX4” refers to “IV; EC waters of IIa; that part of IIIa not covered by the Skagerrak and the Kattegat”.
        - This is not to be neglected, because it requires an advance database of area definitions that can flexibly accommodate such conventions.
    - Occasionally one finds negative kgs landed for a given month. This happens for some fisheries more than for others.
        - Such artefacts, besides putting the veracity of the data into question, require the development of extra algorithms.
    - Occasionally one finds that reporting requirements changed from one year to the next, such as GBR and NLD Plaice being reported in area “2AC4.” (IV; EC waters of IIa) up to the end of 2007, and then switching to area “2A3AX4” (IV; EC waters of IIa; that part of IIIa not covered by the Skagerrak and the Kattegat) in 2008.
        - While in the trivial case, changed area reporting can simply be included into a SQL query, there may be more complex cases which will then complicate projects from an IT and science perspective.

3.4 North Sea Flatfish

Sole and Plaice data from GBR and NLD, from area “24.” (ICES zone “IIa, IV”).

GBR, total for species SOL in area “24.”

Total rows	254
Rows where cumulative weight intermittently absent or negative	0
Rows where cumulative weight decreases or stay the same in current year	03/1989: -135
Date of first row	January 1987
Date of last row	February 2008

NLD, total for species SOL in area “24.”

Total rows	254
Rows where cumulative weight intermittently absent or negative	0
Rows where cumulative weight decreases or stay the same in current year	03/1999: 0
Date of first row	January 1987
Date of last row	February 2008

GBR, total for species PLE in area “2AC4..” (up to 2007) plus in area “2A3AX4” (from 2008 onwards):

Total rows	254
Rows where cumulative weight intermittently absent or negative	0
Rows where cumulative weight decreases or stay the same in current year	0
Date of first row	January 1987
Date of last row	February 2008

NLD, total for species PLE in area “2AC4.” (up to 2007) plus in area 2A3AX4 (from 2008 onwards):

Total rows	254
Rows where cumulative weight intermittently absent or negative	0
Rows where cumulative weight decreases or stay the same in current year	0
Date of first row	January 1987
Date of last row	February 2008

Sole and Plaice data from GBR and NLD, from all VII areas (ICES zone), which amounts to
"07A.", "7BC.", "7DE.", "7FG.", and "7HJK.".

Total rows	1056
Rows where cumulative weight intermittently absent or negative	0
Rows where cumulative weight decreases or stay the same in current year	10/1988 in 7FG.: 0 11/1988 in 07A.: 0 12/1988 in 7FG.: 0 11/2006 in 07D.: -94.4 03/2008 in 07A.: 0 03/2008 in 7FG.: 0
Date of first row	January 1987
Date of last row	March 2008

NLD, species SOL in ICES VII: The quota for Dutch sole in area VII is negligible (200 tons in 2007, with almost zero uptake), and for that reason will not be analysed.

GBR, total for species PLE in ICES VII.

Total rows	713
Rows where cumulative weight intermittently absent or negative	02/1990 in 7JK.: 0 kgs (however 01/1990 was 0 too)
Rows where cumulative weight decreases or stay the same in current year	11/2006 in 07DE.: -73.6
Date of first row	January 1987
Date of last row	March 2008

NLD, total for species PLE in ICES VII. The quota for Dutch sole in area VII is negligible (140 tons in 1997, with 100 tons uptake, thereafter almost zero uptake, quota stops in 2001).
For that reason this particular dataset will not be analysed.

3.5 North Atlantic ("Icelandic") Redfish

The participants from Iceland (FRI and DIS) are developing a system targeted at the Icelandic redfish fisheries. Because of a different regulatory background, this fishery has little in common with EU fisheries. For instance Icelandic authorities already publish landings in Icelandic ports and quota uptake daily through the internet.14.

Icelandic monthly landings can be extracted from logbook data. According to the logbook data from 2001 to 2005, fishing starts in April and stops in August (except for 2001, where it started in May and ended in September).

ISL, total for Redfish.

Total rows	60, if one counts in the same way as the FIDES data.	
Rows where cumulative weight intermittently absent or negative	1/2001 – 4/2001 1/2002 – 3/2002 1/2003 – 3/2003 1/2004 – 3/2004 1/2005 – 3/2005	10/2001-12/2001 9/2002-12/2002 9/2003-12/2003 9/2004-12/2004 9/2005-12/2005
Rows where cumulative weight decreases or stay the same in current year	Same as above	
Date of first row	January 2001	
Date of last row	December 2005	

[14] For further reference, see the CEDER 2006 activity report, in particular page 15.

3.6 Northern Shelf Anglerfish

Anglerfish (ANF) data from GBR, from areas IIa(1), IV(1) , Vb(1), VI, XII, XIV.

Zone "2AC4-C" a.k.a. ICES IIa(1), IV(1)

Total rows	122
Rows where cumulative weight intermittently absent or negative	02/1998: 0 (however 01/1998 was 0 too)
Rows where cumulative weight decreases or stay the same in current year	Same as above
Date of first row	January 1998
Date of last row	February 2008

Zone "561214 " a.k.a. ICES Vb(1), VI, XII, XIV.

Total rows	242
Rows where cumulative weight intermittently absent or negative	0
Rows where cumulative weight decreases or stay the same in current year	07/1993: -88.7
Date of first row	January 1988
Date of last row	February 2008

Zone "07. " a.k.a. ICES VII

Total rows	243
Rows where cumulative kgs intermittently absent or negative	0
Rows where zero or negative amounts are caught (except January)	11/1992: -1862.1
Date of first row	January 1988
Date of last row	March 2008

3.7 Scottish Pelagic

The following is a list of significant quotas for GBR, species NEP (nephrops), MAC (mackerel), HER (herring), areas VIa, IVa:

Species NEP, zone "2AC4-C" a.k.a. ICES IIa(1), IV(1)

Total rows	170
Rows where cumulative kgs intermittently absent or negative	0
Rows where zero or negative amounts are caught (except January)	10/2002: -987.3
Date of first row	January 1994
Date of last row	February 2008

Species NEP, zone "5BC6." a.k.a. ICES Vb) (1), VI

Total rows	254
Rows where cumulative kgs intermittently absent or negative	0
Rows where zero or negative amounts are caught (except January)	06/1996: -1139.9
Date of first row	January 1987
Date of last row	February 2008

Species MAC, zone "2CX14-" a.k.a. ICES VI,VII,VIIIa),b),d),e), EC waters of Vb, international waters of IIa, XII and XIV

Total rows	255	
Rows where cumulative kgs intermittently absent or negative	0	
Rows where zero or negative amounts are caught (except January)	7/1989: -1426 8/1990: -360 4/1991: -1970 9/1991: -168 8/1992: -858 8/1993: -57.1 5/1995: -5122 8/1997: -618.5 8/2003: -39.2 7/2004: -311.3 3/2008: 0	12/1989: -200 9/1990: -1028 7/1991: -1173 5/1992: -8325.1 9/1992: -506.7 7/1994: -15.9 12/1996: -5483.7 9/1997: -2390.9 5/2004: -165.4 11/2005: -30421
Date of first row	January 2005	
Date of last row	February 2008	

Species MAC, zone "*04A-C" a.k.a. ICES IVa - CE waters

Total rows	14	
Rows where cumulative kgs intermittently absent or negative	0	
Rows where zero or negative amounts are caught (except January)	2/2005: 0	4/2005: 0
	6/2005: 0	7/2005: 0
	8/2005: 0	9/2005: -447.1
	3/2006: 0	6/2006: 0
	8/2006: 0	9/2006: 0
	12/2006: 0	3/2007: 0
	4/2007: 0	5/2007: 0
	6/2007: 0	7/2007: 0
	8/2007: 0	9/2007: 0
Date of first row	January 2005	
Date of last row	February 2008	

Species HER, zone "5B6ANB" a.k.a. ICES EC and international waters of Vb), VIb) and VIa) N

Total rows	252	
Rows where cumulative kgs intermittently absent or negative	0	
Rows where zero or negative amounts are caught (except January)	4/1987: 0	5/1987: 0
	3/1988: 0	4/1988: 0
	7/1988: 0	4/1989: 0
	5/1989: 0	4/1990: 0
	5/1990: -4	4/1994: 0
	4/1996: 0	4/1997: 0
	5/1997: 0	4/1998: 0
	4/1999: 0	3/2000: 0
	4/2000: 0	3/2001: 0
	4/2001: 0	11/2001: -309
	3/2002: 0	4/2002: 0
	4/2003: 0	11/2003: -240
	12/2003: 0	4/2004: 0
	5/2004: 0	4/2005: 0
	3/2006: 0	6/2006: 0
	3/2007: 0	4/2007: 0
	5/2007: 0	6/2007: 0
	10/2007: 0	12/2007: -8.4
Date of first row	January 1987	
Date of last row	December 2007 (!)	

Note: there is quota assigned for 2008, but GBR had not reported before mid-April.

Species HER, zone "4AB." a.k.a. ICES EC and Norwegian waters of IV North of 53°30'N.

Total rows	81	
Rows where cumulative kgs intermittently absent or negative	2/2000: 0 2/2002: 0 4/2002: 0 3/2004: 0 5/2004: 0 3/2006: 0 9/2006: -40179.1	3/2000: 0 3/2002: 0 2/2004: 0 4/2004: 0 2/2006: 0 4/2006: 0
Rows where zero or negative amounts are caught (except January)	5/2000: 0 12/2000: -221.6 3/2001: 0 12/2001: -836.1 2/2003: 0 5/2003: 0 11/2003: 0 2/2005: 0 4/2005: 0 9/2006: -40179.1	10/2000: -996.5 2/2001: 0 4/2001: 0 12/2002: 0 4/2003: 0 10/2003: -264.4 12/2003: 0 3/2005: 0 5/2005: 0
Date of first row	January 2000	
Date of last row	September 2006 (!)	

Note: As of August 2006, 40179.1 tons were reported for all of 2006 cumulatively, but in September, -40179.1 tons were registered, making for total catches of 0 tons. From October 2006 onwards, GBR HER in 4AB. were written to the FIDES CRONT database, in ways that the SQL we wrote for CEDER could not exploit.

3.8 North Sea Roundfish

Cod, Haddock, and Whiting data from GBR, from zone "2AC4.", a.k.a. “IIa, IV”.

GBR Cod

Total rows	255
Rows where cumulative kgs intermittently absent or negative	0
Rows where zero or negative amounts are caught (except January)	0
Date of first row	January 1987
Date of last row	March 2008

Zone "2AC4." (IIa, IV”) became “2A3AX4” (IV; EC waters of IIa; that part of IIIa not covered by the Skagerrak and the Kattegat) in 2008, but only for cod.

GBR Haddock

Total rows	254
Rows where cumulative kgs intermittently absent or negative	0
Rows where zero or negative amounts are caught (except January)	0
Date of first row	January 1987
Date of last row	February 2008

Note: in 2001, area 2AC4. and 2AC4-C had separate quota. We ignored 2AC4-C as quantities were very low compared to 2AC4.

GBR Whiting

Total rows	255
Rows where cumulative kgs intermittently absent or negative	0
Rows where zero or negative amounts are caught (except January)	3/2001: -214.1 11/2004: -416.6
Date of first row	January 1987
Date of last row	March 2008

Note: in 2001, area 2AC4. and 2AC4-C had separate quota. We ignored 2AC4-C as quantities were very low compared to 2AC4.

3.9 Greenland Shrimp

Shrimp quota in Greenland are allocated according to the following "nations": GRL (Greenland), NOR (Norway), FRO (Faroe), and EUR (EU common quota). In addition, Shrimp quota is divided into NAFO (western) waters and NEAFC (eastern) waters, as well as coastal and high-sea fisheries. Greenland checks logbooks and landings against this shrimp quota.

In practice, Greenland sent the following landings for quota:

- Greenland, coastal fleet, western waters
- Greenland, high sea fleet, western waters
- Greenland, high sea fleet, eastern waters

Greenland, coastal fleet, western waters

Total rows	62
Rows where cumulative kgs intermittently absent or negative	None
Rows where zero or negative amounts are caught (except January)	None
Date of first row	January 2002
Date of last row	February 2007*

Greenland, high sea fleet, western waters

Total rows	62
Rows where cumulative kgs intermittently absent or negative	None
Rows where zero or negative amounts are caught (except January)	None
Date of first row	January 2002
Date of last row	February 2007*

* The landings data covers shrimp caught on quotas from 2002 to 2006. The landings data from January and February 2007 represent frozen shrimp from the 2006 quota which was landed and sold for processing in Greenland in 2007.

Greenland, high sea, eastern waters

Total rows	32
Rows where kgs intermittently absent	None
Rows where zero amounts are caught (except January)	2002-01 2002-06 2002-07 2002-11 2003-05 2003-07 2003-10 2004-06 2004-07 2004-11 2005-01 2005-02 2005-04 2005-05 2005-07 2005-11 2005-12 2006-01 2006-02 2006-03 2006-04 2006-05 2006-06 2006-07 2006-08 2006-09 2006-10 2006-11 2006-12 2007-01
Date of first row	January 2002
Date of last row	February 2007

Summary: Data quality for cumulative landings is perfect except for Greenlandic landings for the high sea fleet, in the Eastern waters. As landings data are only available for catches landed in for processing in Greenland and shrimps caught in eastern waters are often landed in Iceland the months with zero kgs recorded are expected.

Note: The participants from Greenland (GINR and GFLK) are developing a system targeted at the Greenland fisheries. The participants from and working for Greenland (GFLK, GINR, Sirius) are developing a system targeted at the Greenland Shrimp fishery. Just like in the Icelandic Redfish case, this fishery has certain particularities that set it apart from EU fisheries.

3.10 French Tropical Tuna

Note: The Indian Ocean tuna was extracted from the Harmonized Database using an ad-hoc query.

FRA BET in 2002

Total rows	12
Rows where cumulative kgs intermittently absent or negative	none
Rows where zero or negative amounts are caught (except January)	none
Date of first row	January 2002
Date of last row	December 2002

FRA SKJ in 2002

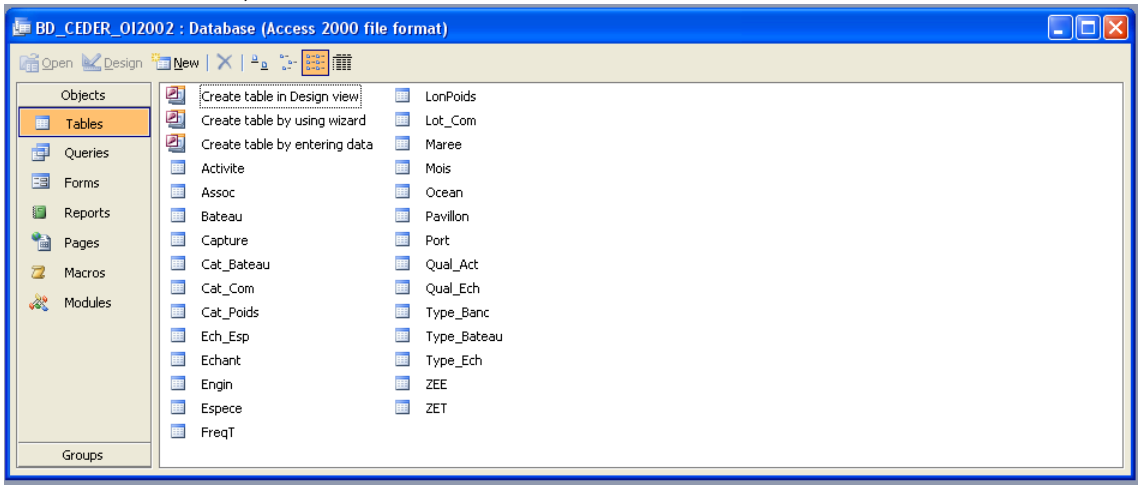
Total rows	12
Rows where cumulative kgs intermittently absent or negative	none
Rows where zero or negative amounts are caught (except January)	none
Date of first row	January 2002
Date of last row	December 2002

FRA YFT in 2002

Total rows	12
Rows where cumulative kgs intermittently absent or negative	none
Rows where zero or negative amounts are caught (except January)	none
Date of first row	January 2002
Date of last row	December 2002

Summary: French Indian Ocean tuna fisheries landing per month were only available for one year, 2002. Otherwise the data series is perfect.

In addition, the French provided a database of catches by ships for tropical tuna for the year 2002, in the Indian Ocean. Each table has been entered into the harmonized database. The DB seems to be in 3rd normal form, and has very detailed records of many parameters surrounding commercial fishing: These include boats, metiers, sea tides, engine data, harbours, flag states, date/time of catch, and so forth.



Its contents are mainly catches for YFT, SKJ, and BET, in the Indian Ocean, for year 2002, recorded for each trip. The purpose of the database is to contain all information in a disaggregated form.

4 Module LB: Logbooks

4.1 Measurements

We checked the logbook data on the following criteria

- If the logbook data is obviously wrong
- If required columns of the logbook were absent in parts of the data set.
- If discard data is present.
- If there is coverage between the logbook data set and the VMS data set. Here, “coverage” means that the same boats during the same time periods have delivered both logbooks and VMS records.

Note: If there is no such coverage, then at best, the Correlation System algorithm is limited to guessing “effort while fishing”. If there is coverage, then the algorithm could be used to compare “effort while fishing” versus actual logbook entries.

4.2 Data requirements

Field asked by Correlation	Why required Effect of absence *Remedy*
Vessel Identifier	Links logbook entries with each other. If absent, logbook is worthless. *Obtain new copy of logbooks.*
Country	In theory, vessel identifier is unique only per country. If absent, then data cannot be raised from boat/metier to country level. *Obtain vessel register or ask source of data.*
Fleet name	Identifies a metier, meaning a set of similar ships by gear type, size class, engine power, etc. Gives meaning to the notion of CPUE. If absent, then system cannot compare boat-level CPUE figures inside of metier, or raise from boats to metier level. Also see "Area name". *Obtain vessel register or ask source of data.*
Start time	Needed to cross-check hauls estimated from "effort estimation from VMS" algorithm, against actual hauls. If absent, effort estimation algorithm cannot be evaluated, and benefits from cross-checks cannot be realised[15] *Obtain new copy of logbooks.*
End time	Same as for start time.
Area name	Gives meaning to the notion of CPUE, together with fleet name (metier) and catch species: Areas differ in their average fish density per species. If absent, then CPUE does not make much sense. *Obtain new copy of logbooks.*
Catch species abb	Gives meaning to the notion of CPUE, together with "fleet name" (metier) and "area name": Areas differ in their average fish density per species. If absent, then CPUE does not make much sense. *Obtain new copy of logbooks.*
Catch weight	Same as for "catch species abb".
Discard species abb	Enables calculation of discards, if data set also permits calculation of catches. If absent, then discards cannot be evaluated. *Obtain new copy of logbooks.*
Discard weight	Same as for "discard species abb".
Activity (optional)	Helps to cross-check hauls estimated from "effort estimation from VMS" algorithm, against actual hauls.

[15] See Deliverable 3.2 Benefits to Regulators.

4.3 Findings

- Logbook information comes in different formats and levels of aggregation. We found haul-based, trip-based, and aggregated data at higher levels.
- The harmonized database contains logbooks from North Sea Flatfish, Icelandic Redfish, Scottish Pelagic, North Sea Roundfish, French Tropical Tuna.
- There are the following cases with regards to coverage between logbook and VMS data:
    - Coverage with VMS exists: North Sea Flatfish from IMARES, Icelandic Redfish, Scottish Pelagic
    - Coverage with VMS could be made on request in the case of North Sea data from CEFAS (roundfish and flatfish). In the end, this turned out to be not required, because the models could be developed without this overlap.
- Discard information came in aggregated form, and as such, was not a part of the logbooks[16].
- No logbook entries were provided for Northern Shelf Anglerfish.
- Greenland delivered logbooks on shrimp, in a form that is aggregated by month and fleet. The aggregated data shows no gaps for Greenlandic logbooks, but does show gaps for logbooks aggregated in Greenlandic waters by EU vessels. The months with gaps indicate zero catches and are due to the low number of EU vessels participating in the fishery.

Note that logbooks from Iceland and Greenland were not used in order to develop the Correlation System prototype, which limited itself to the EU fisheries, as per the project's technical annex.

As a curiosity, from the Iceland logbooks, we were able to infer that Icelandic Redfish skippers can guess their retained catches with high accuracy.

[16] This is not surprising, since logbooks do not ask this sort of information, and skippers will not record information that they do not have to, which additionally could be detrimental to them. For some fisheries, this may be subject to change with the introduction of the ERS.

4.4 North Sea Flatfish

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Yes
Fleet name	Yes
Start time	Yes
End time	Yes
Area name	Yes
Catch species abb	Yes
Catch weight	Yes
Discard species abb	No
Discard weight	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Totals

Total LB entries	31 518
Total LB vessels	256
LB entries without vessel id, catch species, catch weight, area	0
Vessels in common between VMS and LB dataset	63
Catch figure negative	0
Date of first vessel heading out	01/01/2005
Date of last vessel heading in	31/12/2005

Summary

The NSF Logbook data, provided by IMARES, contains 1 year of logbooks from 2005, for GBR and NLD vessels. There is usable coverage between the ships in the Logbook dataset and the ships in the VMS dataset, which aided in the development of the Correlation System algorithm. No obviously wrong data was found.

4.5 North Atlantic ("Icelandic") Redfish

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	No
Fleet name	No
Start time	Yes
End time	No
Area name	Yes
Catch species abb	Yes
Catch weight	Yes
Discard species abb	No
Discard weight	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	Yes

Totals

Total LB entries	7 823
Total LB vessels	28
LB entries without vessel id, catch species, catch weight, area	9
Vessels in common between VMS and LB dataset	22
Catch figure negative	0
Date of first vessel heading out	14/05/2001
Date of last vessel heading in	18/08/2005

Summary

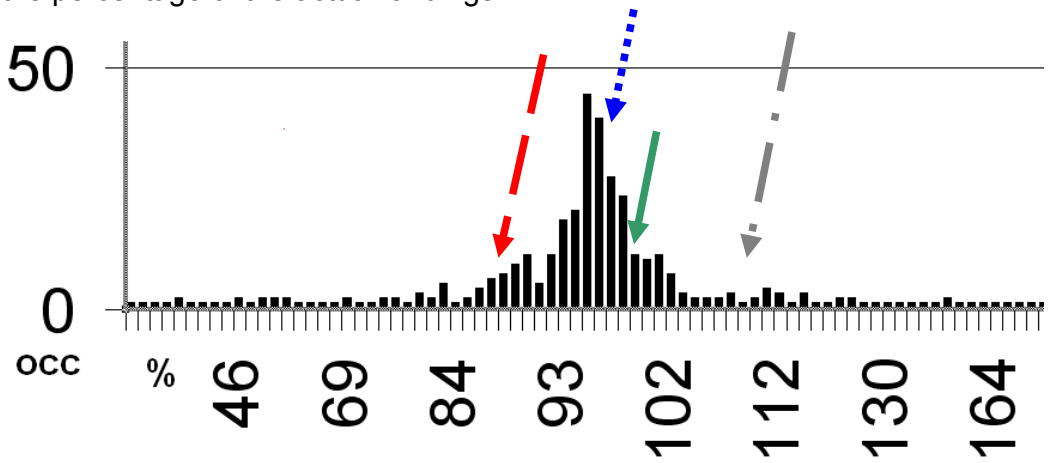
The Redfish Logbook data contains nearly 5 years of logbooks from 2001-2005; it does not contain a full 5 years because of the relatively short fishing season at the given latitude. There is usable coverage between the ships in the Logbook dataset and the ships in the VMS dataset. A tiny fraction of obviously wrong data was found.

Correlation System's algorithm did not evaluate data from the Icelandic Redfish, because that was the purpose of the Icelandic system. The latter system had access to the country and fleet name data. The end time field is missing, which is not a big problem, because tow time is more or less the same for each haul.

Exercise: We briefly explored the accuracy of skippers' haul-by-haul retained catch estimates, versus the landings by trip.

For each trip, we added all catch estimates that the skipper made. Then we compared the total estimates for each trip to the actual landings. The skipper's estimates show commonly expected features.

In the following graph, we plotted for buckets of width of a single percentage point, the number of times that the skippers guessed their total catches to be the percentage of the actual landings.



Factors affecting the above distribution are:

- The green solid arrow marks a 100% estimate. To the left of the green solid arrow one finds the bars representing the number of landings where under-estimations occurred.
- The average is thus not on the 100% mark, but slightly below that level, at 97%. The fish lose weight during processing and storage, so the fishermen compensate for this by estimating the amount of landed weight. Because their estimates count towards the remaining quotas, they tend to under-estimate rather than over-estimate the landed weight.
- Iceland has stringent criteria for judging false declarations of landed catches. This, together with the skippers' estimations counting towards remaining quota, shapes the near-Gaussian curve with centre 97% that rapidly drops off at the 92% and 100% level. This is depicted by the blue dashed arrow. This near-Gaussian curve between 92% and 102% accounts for 219 out of 364 landings, which is 60%.
- The red dashed arrow indicates 50 cases (14%) of landings where the skipper under-reported the catches by 1% to 10%. This is the typical amount of mis-reporting that if detected means that the authorities impound the catch and fine the skipper.
- The grey dot-dashed arrow depicts 33 landings (8%), where the catch was over-estimated by +3% to +16%. These could have been

inexperienced Icelandic fishermen, or EC vessels pretending to fish the mostly German quota of redfish[17].

- The more extreme the outliers become, the more likely they are due to errors in recording and processing of information, rather than poor perception. As we have learned during the project, typographical errors can introduce a weight that is wrong by an order of magnitude. Here the error would be either on a single haul or on the landings as a whole.

Note that it is common knowledge that the fishing industry works according to the model of production of raw materials. The fish processing industry will ask for a given amount of fish from the “fish production units”, meaning the boats. Therefore, if a skipper can afford it, he has electronic scales on board. In principle he is then able to precisely determine the amount of fish he has caught.

[17] The corresponding quota takes long hours of negotiation between the EC and Iceland, but is sometimes not worth exploiting by German fishermen because the fishing grounds are too far away.

4.6 Northern Shelf Angler

See “Scottish Demersal”.

4.7 Scottish Pelagic

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Implied
Fleet name	Implied
Start time	Yes
End time	Yes
Area name	Yes
Catch species abb	Yes
Catch weight	Yes
Discard species abb	No
Discard weight	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	Yes

Totals

Total LB entries	887
Total LB hauls	108
Total LB trips	15
Total LB vessels	1
LB entries without vessel id, catch species, catch weight, area	0
Vessels in common between VMS and LB dataset	1
Catch figure negative	0
Date of vessel heading out	01/01/2005
Date of vessel heading in	31/12/2005

Summary

The Scottish Pelagic Logbook data contains catches per kg per species, together with GPS location information. This data is for 1 vessel, the “data vessel”, belonging to Scotland and to a given metier class. No obviously wrong data was found. Discard data was missing.

The data can be used in order to tune the Correlation System algorithm for the pilot.

4.8 Scottish Demersal

In order to run the pilot, FRS provided the detailed landings for the six pilot vessels.

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Implied
Fleet name	Implied
Start time	Yes
End time	Yes
Area name	Yes
Catch species abb	Yes
Catch weight	Yes
Discard species abb	No
Discard weight	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Totals

Total LB entries	558
Total LB trips	45
Total LB vessels	6
LB entries without vessel id, catch species, catch weight, area	0
Vessels in common between VMS and LB dataset	6
Catch figure negative	0
Date of first vessel heading out	27/01/2008
Date of last vessel heading in	29/04/2008

Summary

The Scottish Demersal landings data contains catches in live weight equivalent in kg per species. Anglerfish catches are included. This data is for the 6 pilot vessels of the CEDER pilot. No obviously wrong data was found. Discard data was missing.

The data was used in order to run the CEDER pilot phase on the ReelCatch system written by Correlation Systems

For months March and April 2008, the perfect match between the landings data and the 15 minute VMS data permitted its full use in the ReelCatch system.

4.9 North Sea Roundfish and Flatfish

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Yes
Fleet name	No
Start time	Yes
End time	Yes
Area name	Implied
Catch species abb	Yes
Catch weight	Yes
Discard species abb	No
Discard weight	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	Yes

The GBR North Sea roundfish and flatfish logbook data contains trip-based live-weight catches for cod and plaice. The ICES rectangle is also given, and the area could be inferred. There is no GPS location information associated with the catches.

4.9.1 Roundfish

For roundfish, CEFAS supplied data on Cod. Note that none of the vessels report on Haddock and Whiting, which are the other two main roundfish species.

Totals

Total LB entries (= trips)	1 003
Total LB vessels	105
LB entries without vessel id, catch species, catch weight, area	0
Vessels in common between VMS and LB dataset	0
Catch figure negative	0
Date of vessel heading out	01/01/2005
Date of vessel heading in	31/12/2005

This data is for 105 vessels. However, without additional information, it is not possible to match up vessel IDs between the logbooks and the VMS records. No obviously wrong data was found. Discard data was missing. Activity type was provided, yet is of no particular use if there are no matching VMS records.

4.9.2 Flatfish

For flatfish, CEFAS supplied data on plaice. Note that none of the vessels report on sole or other flatfish species.

Totals

Total LB entries (= trips)	1 422
Total LB vessels	28
LB entries without vessel id, catch species, catch weight, area	0
Vessels in common between VMS and LB dataset	0
Catch figure negative	0
Date of vessel heading out	03/01/2005
Date of vessel heading in	27/12/2005

This data is for 28 vessels. However, without additional information, it is not possible to match up vessel IDs between the logbooks and the VMS records. No obviously wrong data was found. Discard data was missing. Activity type was provided, yet is of no particular use if there are no matching VMS records.

4.10 Greenland Shrimp

Shrimp quota in Greenland are allocated according to the following "nations": GRL (Greenland), NOR (Norway), FRO (Faroe), and EUR (EU common quota). In addition, Shrimp quota is divided into NAFO (western) waters and NEAFC (eastern) waters, as well as coastal and high-sea fisheries. Greenland checks logbooks and landings against this shrimp quota.

In practice, Greenland delivered cumulative logbook entries by month for the following fisheries:

- Greenland, coastal fleet, western waters
- Greenland, high seas, western waters
- Greenland, high seas, eastern waters
- European Union, high seas, western waters
- European Union, high seas, eastern waters
- Faroe, high seas, eastern waters
- Norway, high seas, eastern waters

The last 2 entries are out of scope of CEDER. We therefore focus on the GRL and EUR entries.

Greenland, coastal fleet, western waters

Total rows	60
Rows where cumulative kgs intermittently absent or negative	0
Rows where zero or negative amounts are caught (except January)	None
Date of first row	January 2002
Date of last row	December 2006

Greenland, high sea, western waters

Total rows	60
Rows where cumulative kgs intermittently absent or negative	0
Rows where zero or negative amounts are caught (except January)	None
Date of first row	January 2002
Date of last row	December 2006

Greenland, high sea, eastern waters

Total rows	60
Rows where cumulative kgs intermittently absent or negative	None
Rows where zero amounts are caught (except January)	2002-05 2002-06 2004-05 2006-01 2006-04 2006-08 2006-09 2006-10 2006-11
Date of first row	January 2002
Date of last row	December 2006

Summary: cumulative logbook entries for the Greenland fleet seem to be flawless. The zero kgs logbook catches for some months in eastern waters are due to the fact that it is the same fleet (10-20 vessels at any one time) that operates in the western waters where the quota is 10 fold that in the eastern waters which means that there are months in eastern waters where no fishing activity takes place.

European Union, high sea, eastern waters

Total rows	60
Rows where cumulative kgs intermittently absent	None
Rows where zero amounts are caught (except January)	2002-07 2003-09 2003-10 2004-10 2004-11 2004-12 2005-01 2005-04 2005-06 2006-05 2006-07 2006-11
Date of first row	January 2002
Date of last row	December 2006

European Union, high sea, western waters

Total rows	60
Rows where cumulative kgs intermittently absent	None
Rows where zero amounts are caught (except January)	2003-01 2003-02 2003-03 2003-04 2003-05 2003-06 2003-07 2003-12 2004-01 2004-02 2004-03 2004-04 2004-05 2004-06 2004-07 2004-08 2005-02 2005-03 2005-04 2005-10 2005-11 2005-12 2006-01 2006-02 2006-03
Date of first row	January 2002
Date of last row	December 2006

Summary: cumulative logbook entries for the EU fleet in Greenland waters have months with zero catches, both in Eastern and Western waters. The zero kgs logbook catches for some months are due to the low number of EU vessels participating in the fishery and the fact that it is the same vessels which participate in both the eastern and the western waters fishery

Note: The participants from Greenland (GINR and GFLK, with Sirius IT) are developing a system targeted at the Greenland Shrimp fishery.

4.11 French Tropical Tuna

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Yes
Fleet name	Partial
Start time	Yes
End time	Yes
Area name	Yes
Catch species abb	Yes
Catch weight	Yes
Discard species abb	No
Discard weight	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Totals

Total LB entries (trips)	8 287
Total LB vessels with entries	16
LB entries without vessel id, catch species, catch weight, area	0
Vessels in common between VMS and LB dataset	16
Catch figure negative	0
Date of first vessel heading out	1/1/2002
Date of last vessel heading in	31/12/2002

Summary

The French tropical tuna logbook data contains 1 year of logbooks from 2002, for 16 vessels from France. There is usable coverage between the ships in the Logbook dataset and the ships in the VMS dataset. Discards are not reported. Activity type is not reported, but the Correlation System algorithm had previously been tuned on purse seiners using a different dataset[18]. No obviously wrong logbook data was found.

[18] Namely, two Turkish purse seiners' VMS data and activity type, whose examination is outside of the scope of this report.

5 Module O: Observer reports

5.1 General Remarks concerning the European Community fisheries' observer reports

During the development of the algorithms, the project focused on obtaining logbooks and data from survey vessels, instead of observer reports.

On the one hand, getting observer reports with matching VMS records would have been difficult, because it implies the agreement of the skippers. On the other hand, it was not deemed necessary to obtain such data, since

- For the development of the models, it is not necessary to have such data, it is just necessary to foresee discard estimation and a bias correction. Indeed, we could have corrected a bias if we deemed that it would have arisen,
- For the pilot, given that the skippers are under close scrutiny, we thought it implausible that they introduce a significant bias. Concerning discards, we obtained aggregated observer data from the Scottish pelagic fleet, and that approach is accepted in fisheries science.

5.2 General Remarks concerning fisheries observer reports outside of the EU

The two non-Community pilots (namely Greenland Shrimp and Icelandic Redfish) did not proceed in the same way as the Community fisheries pilot of the project. The non-Community pilots

- Were tied to their respective fisheries authorities in a close manner,
- Could not to forward sensitive data to the rest of the CEDER group, because of legal issues,
- Had different sorts of data available, because
    - they used a more localized and/or smaller scale,
    - had different starting hypothesises and goals,

In addition, both the Greenland Shrimp and Icelandic Redfish fisheries are special cases, in that they possess some peculiarities that make them easier to work with:

- In Greenland Shrimp fisheries, all of the by-catch is thrown over board, and very little shrimp are discarded.
- In Icelandic Redfish fisheries, there is a strong correlation on a trip basis between
    - The boat's speed and its behaviour (fishing / cruising)
    - The trawl time and quantity of fish caught.

5.3 Data requirements

Same as for Logbooks.

5.4 Findings

- The following fisheries observer reports were not deemed necessary: CEDER: North Sea Flatfish, Icelandic Redfish, Northern Shelf Anglerfish, North Sea Roundfish, French Tropical Tuna
- For the pilot, the Scottish Demersal fishery submitted observer reports aggregated by quarter, metier, and species.
- Greenland, having an extensive observer programme, submitted shrimp fishery observer reports that contain
    - haul start location, start time, end location, and end time, meaning we could check for artefacts in speed just like in the case of VMS records
    - Eight (!) different estimates of discards.
- Iceland

Again, note that logbooks from Iceland and Greenland were not used in order to develop the Correlation System prototype, which limited itself to the EU fisheries, as per the project's technical annex.

The above meant that the Correlation System pilot adapted by using the aggregated Scottish observer data.

5.5 North Sea Flatfish

No observer reports provided, and none were deemed necessary for developing the models.

5.6 North Atlantic ("Icelandic") Redfish

No observer reports provided, and none were deemed necessary for developing the models.

5.7 Northern Shelf Angler

No observer reports provided, and none were deemed necessary for developing the models.

5.8 Scottish Pelagic

For the pilot phase, observer landings and discard was provided for quarters 1 and 4 of year 2007, per metier and species (Cod, Haddock, Saithe, and Whiting). The same data also includes an average trip length. Catches and discards are given in kgs per trip.

Area	Q	Metier	COD Di	COD La	HAD Di	HAD La	POK Di	POK Lar	WHG Di	WHG Lar	Avg Dur
North Sea	1	Multiple Trawl (80-100mm)	420	198	2305	393	3	0	574	533	4.80
North Sea	1	Single Trawl (80-100mm)	6	0	3	0	0	0	28	0	1.95
North Sea	4	Multiple Trawl (80-100mm)	568	0	844	612	45	180	600	654	4.90
North Sea	4	Single Trawl (80-100mm)	5	0	4	0	0	0	20	0	2.49
West Coast	1	Single Trawl (80-100mm)	18	2	9	1	0	0	15	1	1.83
West Coast	4	Single Trawl (80-100mm)	8	2	137	11	0	0	82	0	1.73
West Coast	4	Multiple Trawl (80-100mm)	75	0	14	2	0	0	54	0	1.78
West Coast	4	Mixed (single trawl >100mm & < 120mm)	1002	0	874	575	159	5	31	103	3.25
North Sea	1	Demersal fish (pair trawl 120mm+)	91	273	536	3388	128	121	60	173	-
North Sea	1	Demersal fish (Single/Multiple trawl 120mm+)	23	1123	2495	28269	2888	2810	63	1	5.53
North Sea	4	Demersal fish (pair trawl 120mm+)	5450	803	2180	12716	3577	1914	649	1276	-
North Sea	4	Demersal fish (Single/Multiple trawl 120mm+)	1042	1396	682	14192	10128	8328	215	0	3.72

The average trip duration for demersal pair trawl in the North Sea is absent.

N.B.: The above chart shows how, for an otherwise valuable species like Cod, an imperfect TAC allocation creates waste: Whereas in quarter 1, . The problem is compounded with what would seem to be the effect of a minimum landing size rule.

5.9 North Sea Roundfish

No observer reports provided, and none were deemed necessary for developing the models.

5.10 Greenland Shrimp

Greenland made observer reports available for use with this document.

Field asked by Correlation	Provided?
Vessel Identifier	Yes
Country	Yes
Fleet name	Yes
Start time	Yes
End time	Yes
Area name	Yes
Catch species abb	Yes
Catch weight	Yes
Discard species abb	No
Discard weight	No
Activity (0=Unknown, 1=Fishing, 2=Cruising, 3=Harbor)	No

Totals

Total positions	259
Total surveys	6
Observer entries without vessel id, catch species, catch weight, area	0
Vessels in common between VMS and Observer dataset	0 (see note)
Catch figure negative	0
Date of first vessel heading out	01/02/2006 [19]
Date of last vessel heading in	21/03/2007

Note: For legal reasons, Greenland could not deliver VMS records to the CEDER project.

[19] Note: A lone report from 23/01/2001 is also in the dataset but was ignored for the purpose of reporting start and end dates.

This data is based on observer surveys; it is unknown how many vessels participated in the survey. For legal reasons, Greenland could not deliver VMS records to the CEDER project. Without additional information (which is available to Greenland), it is not possible to match up vessel IDs between the logbooks and the VMS records. No obviously wrong data was found. Discard data was given, according to different measures. Activity type is implied in these haul-based records.

Of particular interest is the discard data. Measures are given according to

- Captain's estimates of all discarded fish
- Captain's estimates of discarded mixed fish
- Captain's estimates of discarded redfish
- Observer's estimates of all discarded fish
- Observer's estimates of discarded mixed fish
- Observer's estimates of discarded redfish
- On-board Scientist's estimates of all discarded fish
- On-board Scientist's estimates of discarded redfish

The Greenland observer reports come with haul start location, start time, end location, and end time. Therefore, we were able to check the observer reports for artefacts in speed, by treating them as pair-wise VMS records:

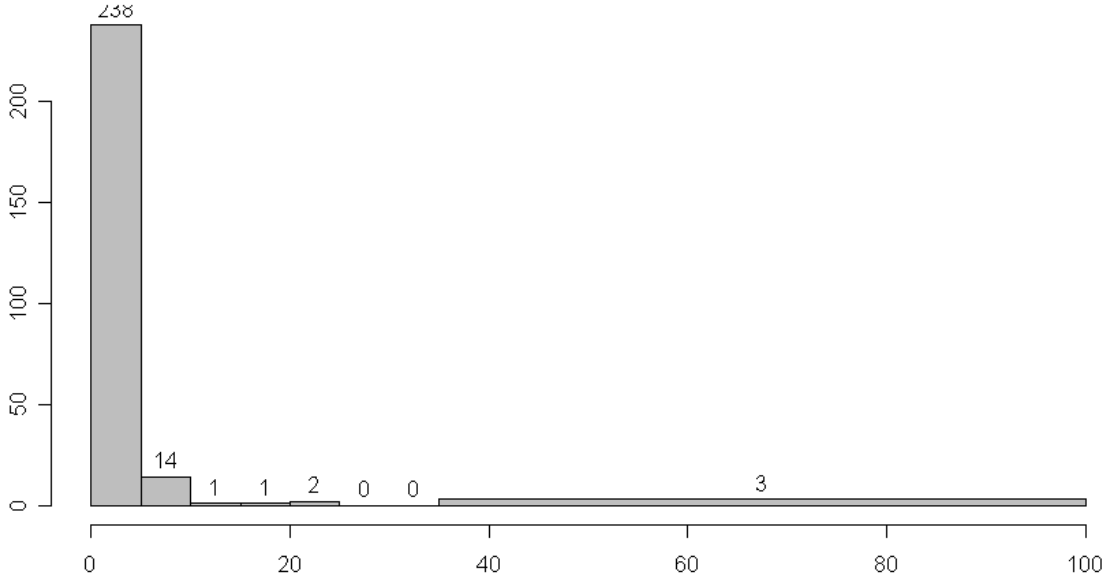
Totals

Total positions	2 * 259
Total surveys	6
Positions without vessel id	0
Positions outside of assigned zone[20] (approximative)	None
Obviously wrong positions	None
Speed calculated > 20 knots	5
Date of first position	01/02/2006 [21]
Date of last position	21/03/2007

[20] Outside of NEAFC or NAFO waters

[21] Note: A lone report from 23/01/2001 is also in the dataset but was ignored for the purpose of reporting start and end dates.

Speed distribution



For speeds smaller than 35 knots, each histogram bucket measures 5 knots. As becomes apparent in the above diagram, 5 of the calculated speeds are entirely unlikely (above 20 knots).

Taking a look at the actual entries that are causing the issues, one finds:

survey_no integer	ts_start timestamp withou	ts_end timestamp without	km double pr	hours double	speed double
2	2006-05-03 05:30:00	2006-05-03 09:40:00	352.046048	4.1666	84.4910
4	2006-08-23 07:15:00	2006-08-23 08:10:00	40.2729135	0.9166	43.9340
8	2007-01-26 20:00:00	2007-01-26 22:50:00	123.80645	2.8333	43.6963
9	2007-03-20 11:25:00	2007-03-20 16:35:00	2093.9650	5.1666	405.283
9	2007-03-18 20:25:00	2007-03-19 00:50:00	1335.4483	4.4166	302.365

Note: In the above table only, speeds are given in km/h; even when converted to knots, they remain excessive.

According to the Greenland authorities, manual entry errors are to blame for these artefacts: The start and end positions, as well as the haul's duration, are transcribed from the paper logbook into electronic form.

The participants from Greenland (GINR and GFLK) are developing a system targeted at the Greenland fisheries. The participants from and working for Greenland (GFLK, GINR, Sirius) are developing a system targeted at the Greenland Shrimp fishery. Just like in the Icelandic Redfish case, this fishery has certain particularities that set it apart from EU fisheries.

5.11 French Tropical Tuna

No observer reports provided, and none were deemed necessary for developing the models.

6 Annex 1: CEDER - Fisheries descriptions

The fisheries under consideration are:

Fishery	Institute	Responsible person	Status
North Sea flatfish	IMARES	Floor Quirijns	Done
North Atlantic Redfish	FRI, DIS, NEAFC	Helga Sigurrós Valgeirsdóttir	Done
Northern Shelf Angler Fish	FRS	Dave Reid	Done
Scottish pelagic	FRS	Dave Reid	Done
North Sea roundfish	CEFAS, FRS	John Cotter	Done
Greenland shrimp	GINR, GFLK	Mads Lund	To be received
French & Spanish Tropical Tuna	IRD	Renaud Pianet	To be received
Peruvian Anchovy	IRD	Sophie Bertrand	Done

Information described by fishery in this document:

- Description of fisheries
- Level of discarding
- Number of vessels
- Type of gear
- Legal regulations
- Geographical area
- Maps
- Common description of data (parameters measured, naming conventions)
- Years of data available
- Reliability of data

6.1 North Sea flatfish

Floor Quirijns (IMARES)

6.1.1 Description of fisheries

The North Sea flatfish fishery is mainly carried out by beam trawlers. It is a mixed fishery targeting plaice and sole in the southern North Sea. The flatfish fleet consists of Dutch, British, German and Belgian vessels. In CEDER the focus will be on the Dutch and British beam trawl fleet, because there are only partners from the United Kingdom and the Netherlands in the project.

Engine power of the vessels varies from 260 – 4000 hp. We make a distinction between euro cutters (260-300 hp) and large cutters (> 300 hp). Euro cutters are allowed to fish within the 12-milse zone and in the plaice box, large cutters are not.

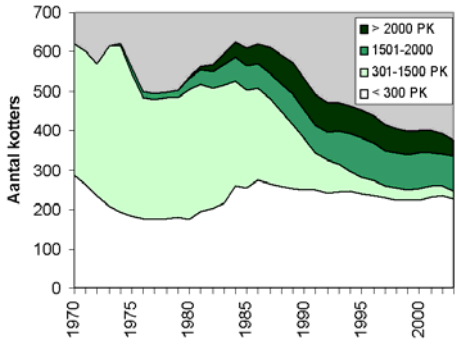
Vessels usually fish from Sunday night until Friday morning. They fish throughout day and night and need about 15 minutes for emptying the nets and setting the nets back into the water. During the weekend most of the

vessels are in the harbour, although a small group of vessels sometimes go out to see for a 2-weeks trip.

6.1.2 Number of vessels

The Dutch beam trawl fleet consisted of 500-600 vessels from 1970-1990 (Figure 1). Since 1990 the number of vessels decreased to approximately 400 in 2004. Since 1985 especially the number of vessels in the segment of 301-1500 hp decreased. The number of vessels in the < 300 hp (i.e. euro cutters) and in the > 2000 hp segment remained relatively stable. The number of vessels in the 1501-2000 hp increased.

Figure 1. Number of vessels (y-axis) per year in each engine power segment. White: < 300 hp, light green: 301-1500 hp, dark green: 1501-2000 hp and black: > 2000 hp.



6.1.3 Type of gear

The flatfish fishery is mainly carried out with beam trawls. There are 2 types of beam trawls: beam trawl with tickler chains and beam trawl with chain mats. The first type is the most abundant one. Tickler chains are used on fishing grounds with smoother sediment and chain mats are used on fishing grounds with many stones. In 2004 there were about 17 vessels using chain mats (in the segments 1501-2000 and > 2000 hp), the other beam trawlers used tickler chains.

In the southern area of the North Sea (<55˚ latitude, and east from 5˚ longitude < 56˚ latitude) the minimum mesh size is 80 mm. North from that border the minimum mesh size is 100 mm.

6.1.4 Legal regulations

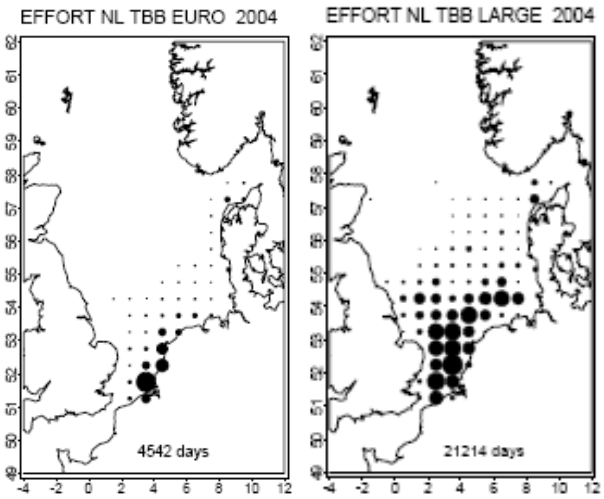
The Dutch beam trawl fleet is regulated by means of TACs and effort restriction. Each year the national quota for plaice and sole is divided in Individual Transferable Quotas (ITQs) for each vessel. Fishermen are allowed to trade their ITQ with other fishermen. Effort management is carried out by setting a restriction on the amount of days at sea to be spent by vessel.

6.1.5 Geographical area

The effort distribution as it was in 2004 is presented in Figure 2. The data presented here is based on EU logbook data. Dutch euro cutters are mainly active within the coastal zone. Large cutters fish between 51 and 58˚ latitude, from the British to the Danish coast. The main activity of this fleet segment is

concentrated in the southern areas (51-55˚ latitude). The British beam trawl fleet operates in the same area, but its main activity is concentrated more northerly than the Dutch beam trawlers.

Figure 2. Effort distribution of Dutch euro cutters (left) and Dutch large cutters (right). Source: Dutch EU logbook data.



6.1.6 Level of discarding

There are different types of discarding:

- under sized commercial fish (mainly plaice and dab)
- non commercial fish (solenette, dragonet etc.)
- benthos (sea stars, crabs etc)

The mesh size used in the beam trawl fishery in the southern North Sea (80 mm) is set for catching sole. That is why there are hardly any sole discards. Plaice is caught most efficiently at 100 mm, so in 80 mm there are relatively high amounts of plaice discards.

During the period 1999-2004 on average 8 under-sized plaice were discarded for every 2 marketable plaice (i.e. 80% of the plaice caught). Expressed in weight this coincides with 50% of discards. The average discard percentage of dab was about 90% in numbers and 80% in weight for large vessels.

6.1.7 Common description of data

6.1.7.1EU Logbook data (VIRIS)

EU logbook data are collected for inspection purposes. Every trip the fishermen fill out the days at sea and catch per species (in kg) for each ICES rectangle (~30x30 Nautical Mile). The data are available for the entire fleet. Since 1990 all landings by Dutch vessels are registered in VIRIS. VIRIS contains catch and effort data by ship, trip and ICES rectangle. From each Dutch ship length, engine power and gear are known. In the first years only the main commercial species were registered (plaice, sole, cod, whiting, dab,

turbot, brill). Since 1995 a new version of VIRIS was introduced and also landings from shrimp and from foreign vessels at Dutch auctions are registered. Since 2000 almost all landed species are registered.

The data are a valuable source of information, but there are some restrictions due to quality of the data. The ICES rectangles registered are not always the rectangles that are actually fished. Also the number of days at sea is not always filled out accurately.

RIVO researchers are allowed to use these data with certain restrictions: use of data has to be approved by managers; and data can only be presented in aggregated form. The data are made available for research once a year.

6.1.7.2VMS data

Since 2000 the inspection services use satellite registrations of fishing vessels (VMS – Vessel Monitoring System). In the VMS dataset not all fishing vessels are registered: the satellite monitoring was compulsory for vessels longer than 24 meters since the 1st of January 2000. Monitoring for vessels with a length between 21-24 m was introduced at the 1st of September 2003, and for vessels with a length between 18-21 m at the 20th of April 2004. Vessels with a length between 15-18 m will be monitored from the 1st of January 2005 onwards.

Vessel owners are asked for permission to use the data for scientific research. If the permission is given, the Inspection Service can make the data available for IMARES. Data from 5-16 euro cutters in a month are available, with an average of about 10 vessels. These vessels cover between 20 and 100 trips per month. From large cutters data from 35-130 vessels are available, covering 100-550 trips per month.

The registered data have a high level of reliability. Positions, with an accuracy of 100 meters, of the monitored vessels are registered on average each 1,5 hour. The registration frequency varies depending on the area where vessels are present. Also speed and heading of most of the vessels is registered.

6.1.7.3Haul-by-haul data

The Dutch haul-by-haul logbook data contain catch and effort information by haul. These data were collected in 2 projects: the Microdistribution Project (1994-1999) and the F-project (August 2002 – February 2007). Funding for these projects is done by the Dutch government. The gaps in the logbook data series between these projects are filled as much as possible with logbook data that were made available on request by individual fishermen.

The data availability varies between the engine power segments. Few data are available for euro cutters. The data series stretch from 1995-1997 and 2000-2002. There are many gaps in the data series and only a few vessels in the dataset. The highest amount of vessels in the dataset is found in September 2002 (9), in other months there are at the most 3 vessels in the dataset. The number of trips from euro cutters is at the most 10 in a month. The amount of data for large vessels is much higher. The data series stretch

from 1994-2002, with lows in 1998 and 2002. In 5 months there are only 2 vessels in the dataset, but in most months there are between 5 and 10 vessels in the dataset. The number of trips available varies from 2-48 in a month. In 1996 data from most vessels are registered in the dataset.

Fishermen are trusted to register the haul-by-haul information truthfully. Comparison of the data with EU logbook data and VMS data showed that this trust is justified.

6.1.7.4Discard data

Discard data from the Dutch beam trawl fleet have been collected in several programs: from 1969-1970; in 1975; from 1976-1990; from 1999-present. The current discards sampling program on the Dutch beam trawl fishery in the North Sea in 2004 was instigated as part of the EC regulations 1543/2000 and 1639/2001 on data collection in European fisheries. Annually, about 10 trips with beam trawl vessels are sampled. Samples of the discards and landings are counted and measured and raised to catches per hour, per trip, per quarter and per year.

Each discard sampling trip, two observers go onboard a vessel, sampling at least 60% of the hauls. For each sampled haul, sub-samples of the discards are measured. All fish in the sub-sample are counted and measured. Benthic invertebrates are only counted. Total and sampled volume of discards is recorded. A sub-sample of the fish landed is measured, and total and sampled landings weight is recorded. If possible, otoliths are collected from the major discarded fish species (plaice, sole, dab, cod, whiting) for age readings. All data are entered into a computer program on haul-by-haul basis and later transported into the central database.

6.2 North Atlantic Redfish

Helga Sigurrós Valgeirsdóttir (DIS)

6.2.1 Description of Fisheries

The redfish in the North-Atlantic is caught under the measurements laid out by NEAFC which was formed to recommend measures to maintain rational exploitations of fish stocks in the Atlantic and Arctic Oceans.

The fishery takes place mostly in spring and summer and in the Icelandic and Greenlandic EEZ's as well as in areas outside jurisdictions of specific nations. The last four or five seasons the fishery has also taken partially place in the NAFO regulatory area, mostly in the later stages of the season.

A special aspect of the NEAFC Atlantic Oceanic Redfish fishery is that a part of the fishery takes place inside and outside of the Icelandic EEZ (See map below) for the Icelandic vessels but outside the Icelandic EEZ for the vessels of other nationalities.

Another special aspect of this specific fishery is the ongoing debate on different stock components. Scientists claim that the redfish fishery in the area is in fact conducted from two different redfish stocks. Icelandic authorities have allocated two different quotas for the stocks but this has not been agreed upon within NEAFC and remains disputed. NEAFC lacks a tool to be able to control the fishery under these circumstances and the multi-component stock issue in light of control and enforcement remains unsolved.

In past years there has been a cut back in effort and catch and number of Icelandic vessels participating in Redfish fisheries on Reykjanes Ridge has decreased. On grounds vessels are mostly fishing at the same area, it is not unusual that they line up a row and go after each other, waiting in a queue for their turn. Therefore there is not much time spent in searching for the fish after since the fishing mostly take place in the same area.

Quotas for fisheries of Atlantic Oceanic Redfish are allocated yearly. As described above the fisheries takes place both inside and outside the Icelandic jurisdiction. Quota is allocated separately for inside and outside. Quota allocated inside (UKS) the jurisdiction vessels are only allowed to be fished there. Quota allocated outside (UKX) Icelandic jurisdiction, vessels are allowed to fish both inside Icelandic EEZ and outside.

Allocated quotas:
2001 : 32.000 tons (UKS), 13.000 tons (UKX)
2002: 35.000 tons (UKS), 10.000 tons (UKX)
2003 : 45.000 tons (UKS), 10.000 tons (UKX)
2004 : 45.000 tons (UKS), 10.000 tons (UKX)
2005 : 28.200 tons (UKS), 6.270 tons (UKX)
2006 : 23.406 tons (UKS), 5.204 tons (UKX)

Landed catch of Atlantic Oceanic Redfish fished in Reykjanes ridge:

2001 : 27.740 tons (UKS)
2002: 35.060 tons (UKS)
2003: 43.063 tons (UKS)
2004: 30.560 tons (UKS)
2005 : 12.750 tons (UKS)

6.2.2 Level of discarding

By Icelandic laws discarding is illegal. The only exception is if the fish is not suitable for human consumption. Inspectors have done measurements on discard of redfish fished in the Reykjanes Ridge. The results are that no discard takes place except discard of infected fish, but infection (Spyrion lump) in Atlantic Oceanic redfish has been a problem.

Results from measurement on discard that took place are following:
2002: Estimated as 1 %, only infected redfish.
2003: Estimated as 5-7%, only infected redfish
2004: Estimated as 1 %, only infected redfish
2005: None

6.2.3 Number of Vessels and gear

Numbers of vessels that landed redfish fished in Reykjanes ridge are:
2001: 24 vessels
2002: 24 vessels
2003: 24 vessels
2004: 22 vessels
2005: 18 vessels
Type of gear is in all cases pelagic trawl.

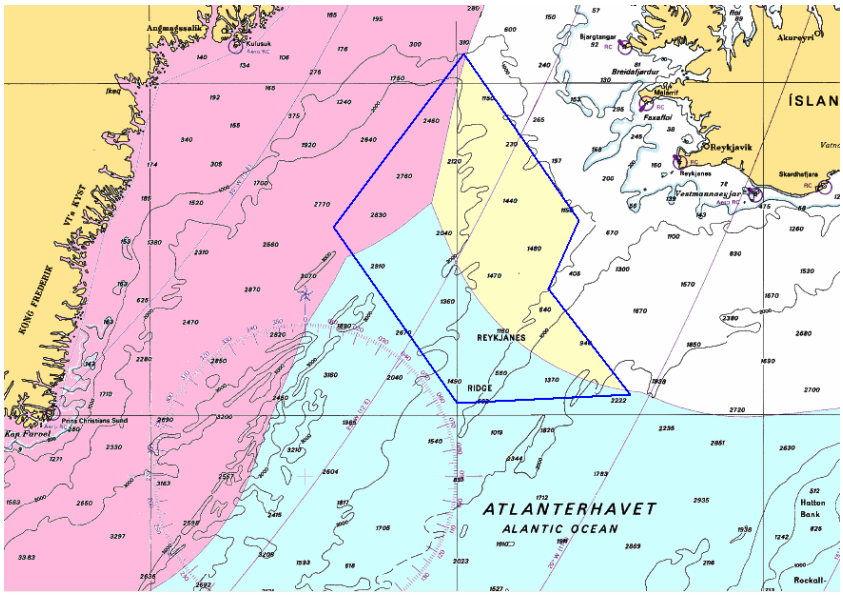
6.2.4 Legal regulations

As earlier stated the Atlantic Oceanic redfish is caught under the measurements laid out by NEAFC. Each year the Ministry of Fisheries issues a regulation built on those measurements laid out by NEAFC. This regulation contains information on messages, total annual catch allowed, fishing period etc. The regulation for 2006 is *"Regulation for fisheries of Oceanic Redfish in 2006"* and is number 201/2006 (rgl. nr. 201/2006)

As earlier stated discarding is illegal by Icelandic laws, those laws are *"The Fisheries Management Act of 1990".*

6.2.5 Geographical area and maps

Figure 1. Fishing area. The blue box marks the fishing area. “REYKJANES” marks the line of the Reykjanes rigde where the fisheries usually take place. The fisheries are conducted east of 32°W and north of 61° N.



6.2.6 Information on data

There are three different data points available on Atlantic Ocean Redfish fisheries. They are information from logbooks, information through VMS, and catch statistics. Years of data available are 5 years.

6.2.6.1Logbooks

Logbooks are not electronic for the whole fleet since it is not mandated, but there are regulations in progress regarding electronic logbooks. All information from logbooks past five years have been collected into database where we can search for specified vessels, type of gear, position, catch and fishing date. Information from logbooks are considered to be very accurate. Logbooks are under surveillance and are inspected each time inspectors visit the vessel.

6.2.6.2VMS

Position are sent every 2 hours. They include information on targeted specie, gear and position and can be filtered out for each vessel. Information on position are sent via satellite and are considered to be 100% accurate.

6.2.6.3Data on landed catch

The Directorate of Fisheries has substantial experience in gathering data on catch statistics. It runs a unique system which bases upon information of individual landings in the ports around Iceland. The harbour authorities are made responsible and they register catches on a vessel basis directly into DIS's database after weighing. It is possible to get information on landed catch for Atlantic Oceanic Redfish past five years after vessel, type of gear,

landing date, landing harbour, quantity, and fishing area (not exact position though). This information are considered to be very accurate.

6.3 Northern Shelf Angler Fish

Finlay Burns & Dave Reid (FRS Marine Lab Aberdeen)

6.3.1 Description of Fisheries

Anglerfish (*Lophius spp.)* are exploited throughout the year either as the result of a targeted fishery or as a valuable bycatch component of the mixed whitefish and *Nephrops* demersal trawl fishery. For most of the year the targeted fishery is concentrated along the continental shelf and shelf edge to the north and west of the Butt of Lewis whilst in the summer months the emphasis moves north along the shelf edge to the Flugga grounds north and west of the Shetland Isles. These areas are within ICES sub area VIa and north-western sub area IVa. Elsewhere significant quantities of anglerfish are caught and landed throughout the year in most areas where demersal trawling effort is focused. In particular the large offshore *Nephrops* fishery which is focused around the Fladen grounds (a massive area whose center is located 100 miles north east of Peterhead). This is a large mud bank which attracts a lot of effort and subsequently lands a lot of anglerfish as bycatch.

6.3.2 Number of Vessels

There are around 20 vessels that target anglerfish all year round. 2 of these are >30m, 13 are 24 - 29m, with 6 vessels <24m in length. In addition to this there are approx. 20 whitefish trawlers of varying sizes which target anglers during the summer months and at various other times during the year. The Fladen offshore *Nephrops* fleet is comprised of around 100 vessels, most of which fall into the 18 – 24m size range. Typical horsepower for the offshore *Nephrops* fleet ranges from approx. 250 – 1100, whilst horsepower in the whitefish fleet ranges from 650 – 2000. The recorded effort for the angler fishery in recent years has declined by approximately a factor of two since 1999 (see figure 1), however this has not led to an equal decline in landings recorded (see figure 2)

Figure 1. Effort in days for various components of the Scottish angler fleet since 1999.

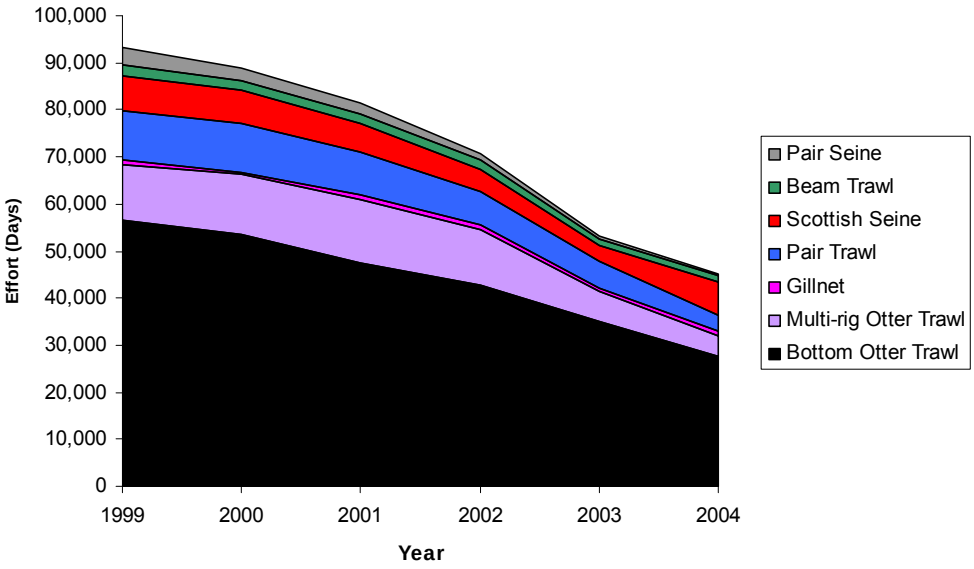
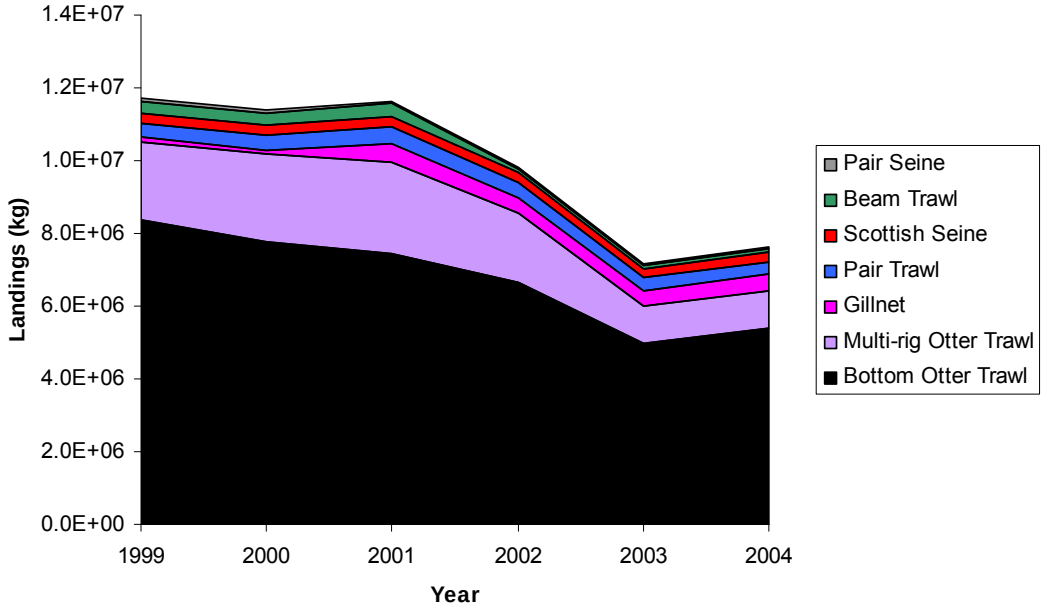


Figure 2. Landings (kg) for the fleet components shown in figure 1.



6.3.3 Type of gear

The offshore *Nephrops* fleet which target the Fladen and South Minch grounds almost exclusively use twin trawl, however the single trawl is still used extensively by older and smaller inshore *Nephrops* trawlers. The whitefish fleet which includes the targeted monkfish component use both twin rig and single net although of the larger vessels (>24m) all but one use twin rig. The fishing gear used by both fleets to target *Nephrops* /anglers is described as a 'scraper' trawl. This design is characterized by containing long

wings and short tapered body panels. The *Nephrops* 'scraper' differs in having a lower headline than the fish 'scraper'. (1.8 - 3m for *Nephrops*, compared to 3 – 5m for fish) Ground gear configuration for Nephrops scrapers can be either rubber disc clear ground gear or 'discer' rig for rougher ground incorporating 200mm, 250mm, or 300mm hoppers. For fish scrapers a heavier ground gear is used and incorporates rockhopper ground gear with hopper sizes ranging from 400mm to 475mm. Both Nephrops and fish scrapers are fished with tickler chains and in recent years 'flip-up' ropes have been introduced to reduce belly sheet damage at the mouth of the trawl. Separate regulations govern each fishery and as a result the mesh sizes used by each are different. The whitefish fleet uses mesh sizes >110mm and the Nephrops fleet <95mm.

6.3.4 Legal regulations

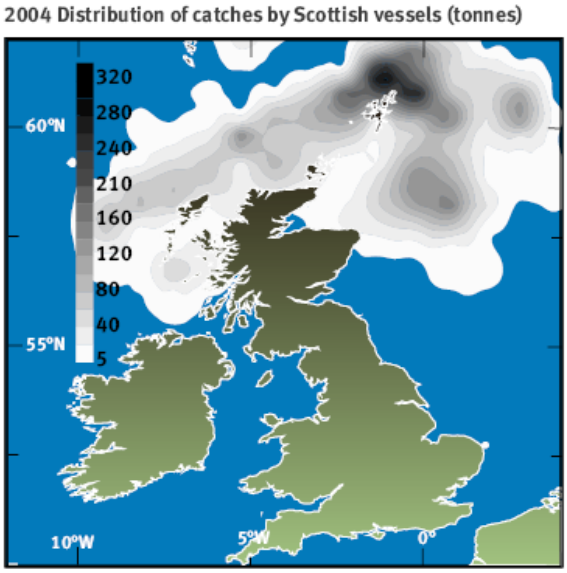
Although the northern shelf anglerfish is assessed as a single stock its exploitation is managed separately. Separate quotas exist for ICES area VI and IV respectively. Each year the national quotas for anglerfish are divided via the producer organization into Individual Transferable Quotas (ITQ's) for every vessel. Fishermen are then free to trade their ITQ with other fishermen. Effort is managed by restricting the amount of days spent at sea fishing by each vessel. UK receives around 90% of the North Sea EU angler TAC whereas the UK only receives around 40% of the West Coast TAC. Historically this may have led to substantial area misreporting, ad possibly undeclared landings.

ACFM has recommended for several years that strenuous efforts should be made to gather more accurate data on this fishery. It is recommended that it be managed on an effort rather than TAC basis, as it is recognized that there are considerable unreported landings, effort data are unreliable, and no useful survey index currently exists.

6.3.5 Geographical data

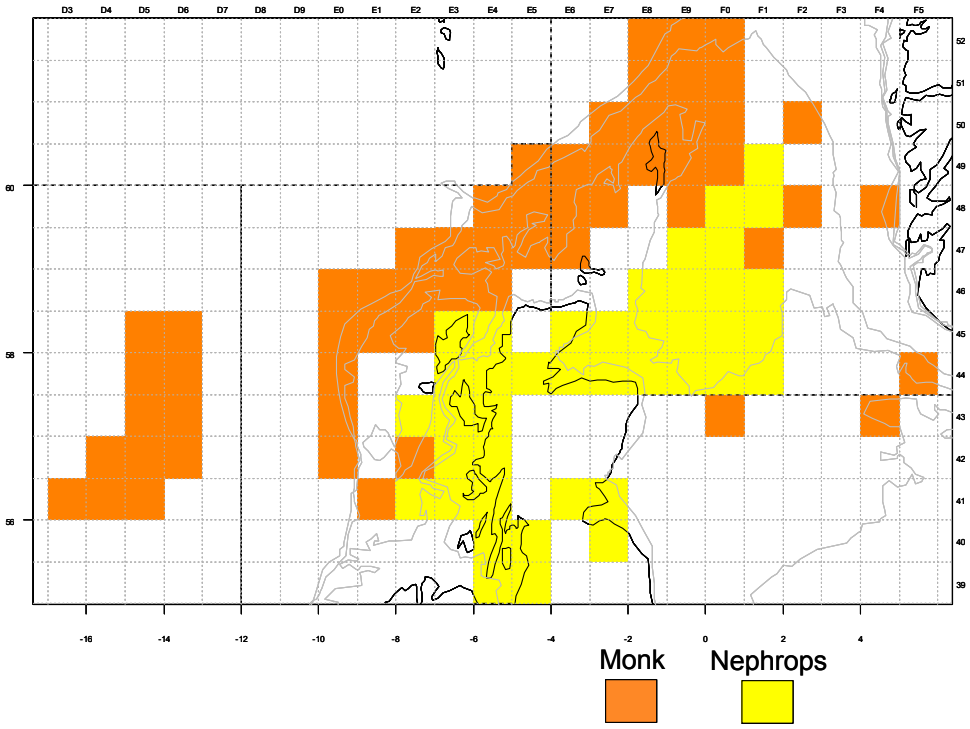
A map showing kriged commercial anglerfish landings data for 2004 is shown below in figure 3. This reaffirms the conclusion that in ICES area IVa and VIa significant quantities of anglerfish are caught and landed wherever trawling effort is directed. Angler hotspots are clearly visible around the Flugga grounds in Shetland, the deeper continental shelf edge grounds located west of the Hebrides running north east to Shetland. These are all areas where monkfish are targeted, however as we can also see significant quantities of angler are also caught in Bergen Bank which is a mixed whitefish area and also from the Fladen *Nephrops* grounds which are located 100 miles north east of Peterhead. This is an area targeted by the large offshore *Nephrops* fleet and although anglers represent only a valuable bycatch species the large fleet size mean that overall the landings here are highly significant. On the northern shelf edge the target depth for exploiting angler ranges from 100 – 800m. The larger and more mature anglerfish tend to be found in the deeper water in the north and west whereas the smaller immature anglers are ubiquitous above 56°N and in depths ranging from 100 – 300m.

Figure 3. Commercial Anglerfish catch data showing geographical distribution of catches by Scottish vessels.



A spatial analysis of the two major components of the angler fishery (targeted and *Nephrops* by-catch is shown in Figure 4. This map shows the way in which the main targeted angler fishery is concentrated along the western edge and at Rockall, while the North Sea area is dominated by the mixed fishery.

Figure 4. Main Scottish angler fisheries by métier.



6.3.6 Level of Discarding

There is no minimum landing size for anglerfish. This means that due to its considerable value only very small individuals are discarded (<=30cm). Vessels targeting angler in the deeper water (>300m) on the shelf edge west of the Hebrides encounter very few small anglerfish and therefore land almost everything they catch. However this contrasts markedly with the majority of the fleet and effort which is directed towards shallower grounds where discard rates are noticeable higher on account of the higher proportion of smaller discardable fish present. Anglerfish morphology means that even very small individuals get caught in trawl codends. Consequently shallow areas where there is significant trawling effort are likely to have similarly high discard rates relative to adjacent deeper areas. FRS has an observer programme which has been running for almost 30 years. After agreement with the skipper/owner observers are placed onboard commercial vessels to monitor discard rates for the duration of the trip. A proportion of the discarded catch is typically retained from every haul, identified and the length recorded providing abundance and a length frequency for every species in the sample (including anglerfish). This data are then aggregated to trip and then eventually to fleet level for a particular gear in a particular sampling area. A table of discarded angler weights raised to fleet level for 2004 is provided below (see table 1). This gives the raised weight of anglerfish discarded within the main sampling areas by each gear type for quarters 1 – 4. This data which is derived from observer data is then raised to ICES area level and includes all the effort within that area for a particular fishing gear. From this a crude CPUE index can be worked out whereby the raised weight is divided by the effort. This can be found in table 2. A lack of spatially resolved data coupled with limitations caused by ambiguities relating to gear makes analysing this data problematic. For light trawl there is no way of discriminating single trawl from twin trawl. This would allow the targeted anglerfish fleet to be analyzed separately from the haddock fleet.

The figures however do show quite a lot of evidence to suggest that the whitefish/targeted anglerfish fishery in the summer months around Shetland discards significant amounts of anglerfish. This is also true of the anglerfish fleet fishing the waters west of Orkney and the grounds around the Butt of Lewis (west of the Hebrides). This area is targeted all year round. The discard rates exhibited by the *Nephrops* fleet are also significant although less so than those shown by the targeted angler fleet. However given the size and effort of the *Nephrops* fleet they still contribute quite heavily to the total weight discarded within each area.

ICES area	FRS Market Sampling Area	Discarded weight of anglerfish (Tonnes)															
		Quarter 1				Quarter 2				Quarter 3				Quarter 4			
		Trawl	Light Trawl	Neph. Trawl	Pair Trawl	Trawl	Light Trawl	Neph. Trawl	Pair Trawl	Trawl	Light Trawl	Neph. Trawl	Pair Trawl	Trawl	Light Trawl	Neph. Trawl	Pair Trawl
IV	Shetland						**42.6**		**1.60**	**0.55**	**0.75**		**0.82**				
	Viking						**0.04**		**4.09**				**0.61**				
	Buchan			1.76				0.57				1.77				2.32	**4.73**
	Forties			3.27				2.29				0.80				1.27	
	Central	**0.05**						0.56									
	West Orkney						**9.99**										
VIa	Solan																
	Inner Hebs							3.59				0.05				1.39	
	Butt of Lewis		**6.59**								**2.23**				**10.4**		
	Outer Hebs		**3.50**														
	South Minch			2.44				4.52				0.57				4.57	

Table 1. Weight of anglerfish discarded by Scottish vessels for 2004 in tonnes. Weights derived from observer data and raised to fleet level. Orange boxes indicate targeted angler fishery data and mixed whitefish fleet data and green indicate *nephrops* fleet data. (Empty boxes indicate no observed data for a particular gear/quarter/area.)

ICES area	Weight of Anglerfish Discarded (CPUE – kg/hr)															
	Quarter 1				Quarter 2				Quarter 3				Quarter 4			
	Trawl	Light Trawl	Neph. Trawl	Pair Trawl	Trawl	Light Trawl	Neph. Trawl	Pair Trawl	Trawl	Light Trawl	Neph. Trawl	Pair Trawl	Trawl	Light Trawl	Neph. Trawl	Pair Trawl
IV			0.15			**3.84**	0.12	**0.99**	**1.25**	**0.04**	0.07	**0.25**			0.14	**2.63**
VIa		**8.51**	0.05				0.12			**11.0**	0.01			**31.5**	0.25	

Table 2. Weight (CPUE kg/hr) of anglerfish discarded by Scottish vessels according to fishing gear type for ICES area VIa and area IV. Orange boxes indicate targeted angler fishery data and mixed whitefish fleet data and green indicate *nephrops* fleet data. (Empty boxes indicate no observed data for a particular gear/quarter/area.)

6.3.7 Common description of data

6.3.7.1EU Logbook data (FIN)

EU logbook data are collected for inspection purposes. The logbook is provided on a trip by trip basis, and includes gear code and mesh size, vessel name and master and dates of departure and arrival. Daily entries provide catch per species (in kg) for each ICES rectangle. The data are available for the entire fleet. Rectangle information is often unreliable, the rectangle quoted may not actually be the one fished, multiple rectangles may be given as one only.

The data are entered into the national statistics system (FIN) and are then used to make quota uptake evaluations and provide rectangle aggregated data to ICES assessment working groups. The data are held centrally by SEERAD, and a mirror system is used at FRS. The system covers all quota species. Landings data have been recorded since 1970. In addition FRS operate an extensive market sampling scheme. Landings are sampled to provide age, length and weight data, stratified to provide information for all major areas, periods and gears for each species. Specific pelagic fishery areas are used and these are more detailed than the main ICES areas.

6.3.7.2Working Group data

Before the landings data are provided to the assessment working group, information from observers and from enforcement agencies are used to correct the landings to provide the best indication of landings by area. This mostly involves re-allocation of catches to location.

6.3.7.3VMS data

Since 2000 the Scottish Fishery Protection Agency (SFPA) has maintained a record of vessel movements using VMS (Vessel Monitoring System). As with other EU countries satellite monitoring was compulsory for vessels longer than 24 meters since the 1st of January 2000. Monitoring for vessels with a length between 21-24 m was introduced at the 1st of September 2003, and for vessels with a length between 18-21 m at the 20th of April 2004. Vessels with a length between 15-18 m will be monitored from the 1st of January 2005 onwards.

FRS has no right of access to these data, although negotiations are ongoing. Data currently available are fully anonymous, and are made available aggregated for ALL monitored vessels by quarter. Individual access, along the IMARES model is being developed in 2006.

Onboard logger systems linked to the vessels GPS navigation system have been installed on a small number of vessels prosecuting the *Nephrops* mixed fishery. It is planned to deploy some of these systems on targeted angler fish vessels in 2006

6.3.7.4Haul-by-haul data

There is no routine haul by haul recording system in place for any of the vessels prosecuting the angler fishery. However, a tally book scheme has been set up for vessels involved in the fishery. This is a voluntary scheme where the skippers record; location, time, catches, discards and some size information. The data are collated and anonymised by the Scottish Fishermens Federation and passed to FRS. This data is retained by FRS and has been used to provide additional information into the assessment process. Haul by haul data is also available for a small number of observer trips. Approximately 5 or 6 on targeted angler boats and more on the Nephrops boats.

6.3.7.5Discard data

Discard data are not specifically collected for the angler fishery per se. On the west coast of Scotland, observer trips were originally targeted on haddock fisheries. However in recent years most of the vessels in this area have been targeting angler fish. A specific project looking at angler catches and discards was carried out in 1999-2000, and these observations can be related to the pattern in recent work.

In the North Sea, the discard data are again mainly from the mixed fishery and are detailed in the section above. However, the bulk of the fishery is covered by the observer scheme.

Data are held in the FRS discard observer data base and provided in aggregated form (by ICES area, by quarter and gear code) to the assessment working groups.

6.4 Scottish pelagic fisheries

Dave Reid (FRS Marine Lab Aberdeen)

6.4.1 Description of fisheries

Scottish pelagic fisheries are divided into two distinct components, separated by species and time. The mackerel fishery is carried out from approximately October to March, the herring fishery from June to September.

The mackerel fishery starts in the northern North Sea generally in October and concentrates on pre-migration fish along the edge of the Norwegian Deeps in the NE North Sea. This area is mainly within the Norwegian EEZ, and is inaccessible to Scottish boats. These tend to sit along the EEZ line and wait for fish to cross. When the migration starts, the fish move to the west, generally close to the 200m contour, and the fleet will move with them. This may start in December, but can be as late as February. By February March, most catches are being taken west of Scotland, and as far south as west of Ireland. The fishery then ends for Scottish vessels. As there is an annual quota, most boats retain quota after March to allow them to fish again in the autumn. The same pattern of mackerel fishing is also prosecuted by the substantial Irish pelagic fleet. The other key nations in the mackerel fishery are Norway and Russia, although many other nations have quota. Norway tends to fish within it's own EEZ and at different times of year. Russia mostly fishes in international waters north of Shetland in the third quarter. The UK quota (mainly taken by Scottish vessels) is currently at 127,600 tonnes (30% of TAC), worth around €150m.

The Scottish North Sea herring fishery takes place from June to September and is concentrated in the northern North Sea, around the Shetland Islands, and concentrates on pre-spawning aggregations. It also tends to follow the migration south towards spawning areas in Shetland and off NE Scotland. The fishery is also prosecuted by Danish, English and Dutch vessels mainly. The UK quota (mainly taken by Scottish vessels) is currently at around 70,000 tonnes (13% of TAC), worth around €7.5m.

Fishing trips are usually around one week duration. A large amount of this time is spent steaming and scouting. Relatively little time is spent actually fishing, possibly averaging at one trawl set per day.

In late 2005 major enforcement action was taken against the two largest factories in Scotland, accounting for 60% of the mackerel landed. This, along with registration of buyers, has led to substantial changes in the operation of the fishery. Most importantly, it will be very difficult to make illegal landings in future. In addition, there may have to be retrospective changes in the official landings back to 2000. This work is ongoing.

6.4.2 Number of vessels

The Scottish pelagic fleet consists of 26 vessels. These are generally large, stern trawlers. The average vessel is 8 years old, 61m in length, with an engine of around 5700 HP, and refrigerated sea water capacity of 1500m^3. The vessels range from 45-76m long, and 1800-11000HP. In the early 1990s the fleet was larger and was dominated by purse seiners. Since then the fleet has switched to trawling and reduced in number, usually due to merging of allocations from several vessels. Eight of the vessels are based in Shetland, and the remainder in NE Scotland. In addition there are three vessels based in Northern Ireland that also prosecute this fishery.

6.4.3 Type of gear

The fleet all use large pelagic fishing nets. The nets can be operated both as single vessel trawls or in a pair trawl mode, using two similar vessels The nets are described in terms of the net opening circumference. Generally, single trawls would be approximately 1300m round, pair trawls, 1700m round. They are towed at between 4 and 5 knots. Fishing is usually on aggregations identified by sonar or echosounder, but will occasionally be more speculative, targeting more dispersed fish.

6.4.4 Legal regulations

The mackerel fishery is governed by the negotiations between Norway, Faroe Islands, and EU in 1999. This states that:
For 2000 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a
fishing mortality in the range of 0.15 - 0.20 for appropriate age groups as defined by ICES, unless future scientific
advice requires modification of the fishing mortality rate.
Should the SSB fall below a reference point of 2 300 000 tonnes (Bpa), the fishing mortality rate, referred to under
paragraph 1, shall be adapted in the light of scientific estimates of the conditions prevailing. Such adaptation shall
ensure a safe and rapid recovery of the SSB to a level in excess of 2 300 000 tonnes.
The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any
new advice provided by ICES.

The current ICES recommendation is that fishing mortality is kept below 0.17.

A number of other restrictions exist:

- There should be no fishing for mackerel in Divisions IIIa and IVb,c (southern and central North Sea) at any time of the year. This is to protect the depleted North Sea spawning component.
- There should be no fishing for mackerel in Division IVa during the period 15 February 31 July. Again for the same reason.
- A 30 cm minimum landing size is in force in Subarea IV, and 20cm in Subarea VI
- Mesh size is 32-54mm.

The Scottish fleet is required under the EU, Norway & Faroe agreement to take the bulk of its catches west of 4^{o}W. This tends to result in misreporting of catches west of this line.

The herring fishery is governed by the negotiations between EU & Norway in 2004. This states *inter alia* that:

1. Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the 800,000 tonnes (Blim).
2. Where the SSB is estimated to be above 1.3 million tonnes the Parties agree to set quotas for the directed fishery and for by-catches in other fisheries , reflecting a fishing mortality rate of no more than 0.25 for 2 ringers and older and no more than 0.12 for 0-1 ringers.
3. Where the SSB is estimated to be below 1.3 million tonnes but above 800,000 tonnes, the Parties agree to set quotas for the direct fishery and for by-catches in other fisheries, reflecting a fishing mortality rate equal to:
0.25 – (0.15*(1,300,000-SSB)/500,000) for 2 ringers and older, and
0.12 – (0.08*(1,300,000-SSB)/500,000) for 0-1 ringers.

4. Where the SSB is estimated to be below 800,000 tonnes the Parties agree to set quotas for the directed fishery and for by-catches in other fisheries, reflecting a fishing mortality rate of less than 0.1 for 2 ringers and older and less than 0.04 for 0-1 ringers.
5. Where the rules in paragraphs 2 and 3 would lead to a TAC which deviates by more than 15% from the TAC of the preceding year the Parties shall fix a TAC that is no more than 15% greater or 15% less than the TAC of the preceding year.
6. Not withstanding paragraph 5 the Parties may, where considered appropriate, reduce the TAC by more than 15% compared to the TAC of the preceding year.
7. By-catches of herring may only be landed in ports where adequate sampling schemes to effectively monitor the landings have been set up. All catches landed shall be deducted from the respective quotas set, and the fisheries shall be stopped immediately in the event that the quotas are exhausted.
8. The allocation of TAC for the directed fishery for herring shall be 29% to Norway and 71% to the Community. The by-catch quota for herring shall be allocated to the Community.
9. A review of this arrangement shall take place no later than 31 December 2007.

There are also restrictions proposed on landings from the southern part of the North Sea to protect the Downs component. Minimum landing size is 20cm.

6.4.5 Geographical area

Effort data are not a mandatory field in the log book data collected for mackerel and herring. The maps in figures 1 & 2 show the distribution of catches in 2004 recorded in the official data for the two species.

Figure 1. Recorded landings for the Scottish mackerel fishery in 2004. The main hot spot due north of Scotland is likely to be an artifact of the regulation relating to catches west of 4°W.

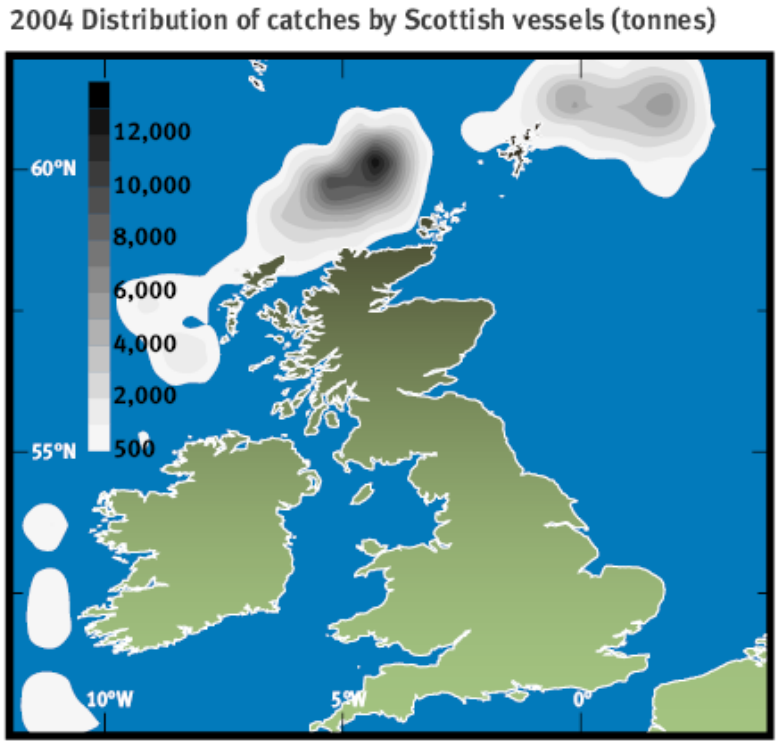
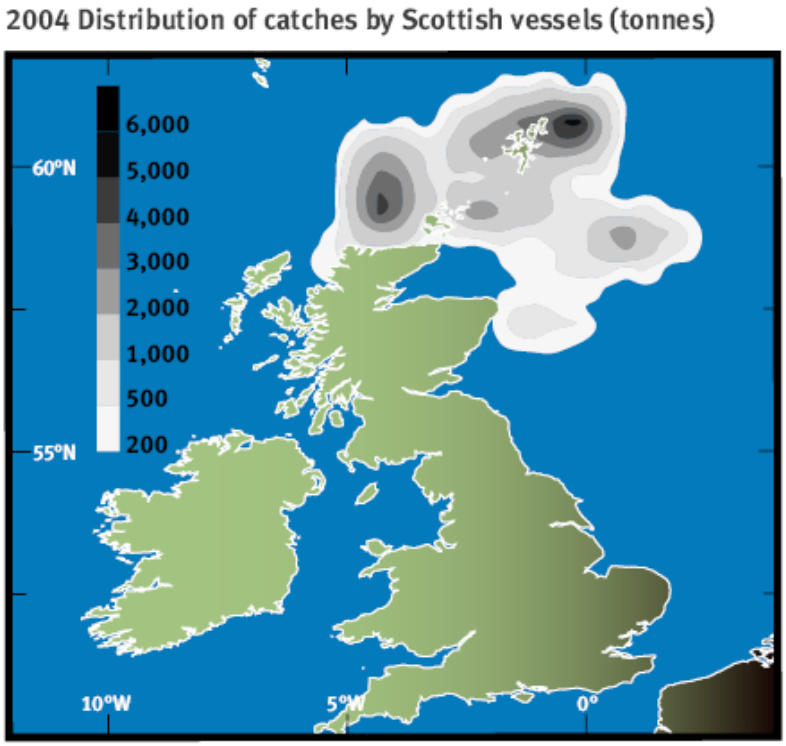


Figure 2. Recorded landings for the Scottish herring fishery in 2004. This includes landings reported as from the west of Scotland, again reported as west of 4°W, but possibly caught in the North Sea.



6.4.6 Level of discarding

Mackerel discard rates are available by year, quarter and ICES region. However as the bulk of the fishery takes place in IVa (northern North Sea) and VIa (West of Scotland) in quarters 1 & 4 the observer scheme matches this. Discard rates are raised to fleet based on effort data. In area IVa an average discard rate since 1997 of 6% of landings was recorded in both the first and fourth quarters. In area Via data are only available for the first quarter and average 7%.

Herring discard rates are also available by year, quarter and ICES region. However again, the bulk of the fishery takes place in IVa (northern North Sea) and VIa (West of Scotland) but in quarters 2 & 3, and the observer scheme matches this. Discard rates are again raised to fleet based on effort data. In area IVa an average discard rate since 1997 of 7% of landings was recorded in the second quarter and 4% in the third. In area VIa data are only available for the third quarter and average 1%.

6.4.7 Common description of data

6.4.7.1EU Logbook data (FIN)

EU logbook data are collected for inspection purposes. The logbook is provided on a trip by trip basis, and includes gear code and mesh size, vessel name and master and dates of departure and arrival. Daily entries provide catch per species (in kg) for each ICES rectangle. The data are available for the entire fleet. Rectangle information is often unreliable, the rectangle quoted may not actually be the one fished, multiple rectangles may be given as one only. Days at sea also may not be fully reliable, and in any case is regarded as an inappropriate effort indicator in pelagic fisheries.

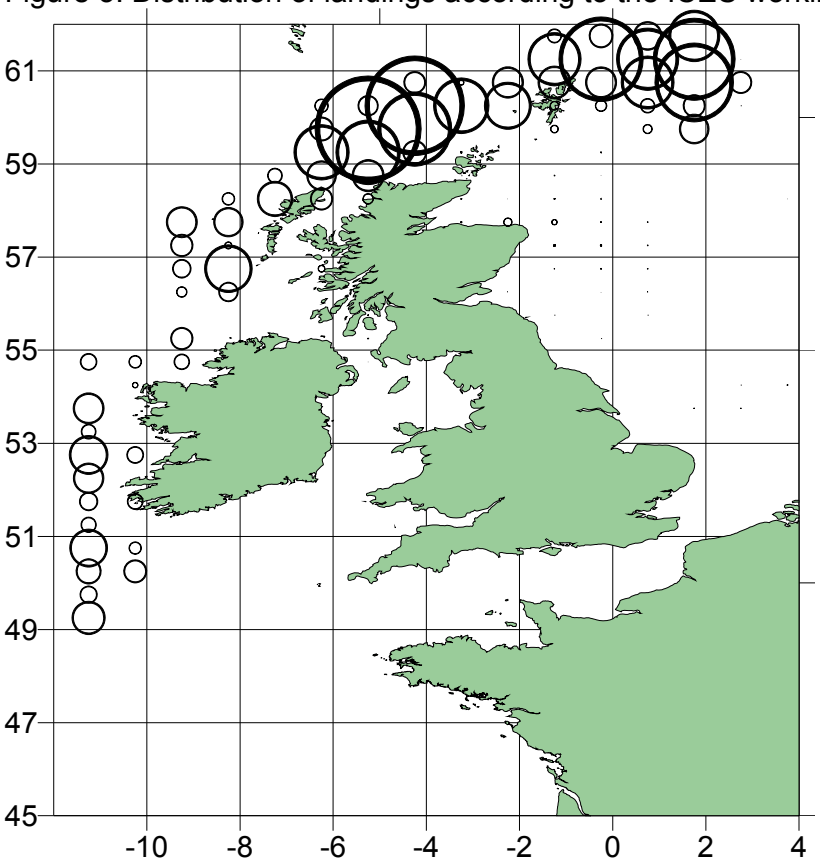
The data are entered into the national statistics system (FIN) and are then used to make quota uptake evaluations and provide rectangle aggregated data to ICES assessment

working groups. The data are held centrally by SEERAD, and a mirror system is used at FRS. The system covers all quota species. Landings data have been recorded since 1970. In addition FRS operate an extensive market sampling scheme. Landings are sampled to provide age, length and weight data, stratified to provide information for all major areas, periods and gears for each species. Specific pelagic fishery areas are used and these are more detailed than the main ICES areas.

6.4.7.2Working Group data

Before the landings data are provided to the assessment working group, information from observers and from enforcement agencies are used to correct the landings to provide the best indication of landings by area. This mostly involves re-allocation of catches to location. The distribution of WG landings is shown below. The effect of the 4° boundary is still obvious.

Figure 3. Distribution of landings according to the ICES working group.



6.4.7.3VMS data

Since 2000 the Scottish Fishery Protection Agency (SFPA) has maintained a record of vessel movements using VMS (Vessel Monitoring System). As with other EU countries satellite monitoring was compulsory for vessels longer than 24 meters since the 1st of January 2000. Monitoring for vessels with a length between 21-24 m was introduced at the 1st of September 2003, and for vessels with a length between 18-21 m at the 20th of April 2004. Vessels with a length between 15-18 m will be monitored from the 1st of January 2005 onwards.

FRS has no right of access to these data, although negotiations are ongoing. Data currently available are fully anonymous, and are made available aggregated for ALL monitored vessels by quarter. Individual access, along the IMARES model is being developed in 2006.

Data for some of the 26 vessels is able from onboard logger systems linked to the vessels GPS navigation system and echosounders. These systems are currently fitted on 5 Scottish vessels, 2 from Shetland and 3 from the NE. It is anticipated that at least 3 more will be fitted prior to the 2006 herring season. Access has also been allowed for these vessels to historical track records, going back to 2003.

6.4.7.4Haul-by-haul data

There is no routine haul by haul recording system in place for the Scottish pelagic fleet. However, all vessels participating in the logger scheme have maintained such records. In some cases access to diaries predating the scheme have been made available. Haul by haul data is also available from the pelagic observer scheme although this covers only a small percentage of the trips.

6.4.7.5Discard data

Discarding in the type of pelagic fishery operated in Scotland, can be quite difficult to quantify. In some cases a catch will be made by the vessel and the bag brought alongside for evaluation. If the fish are considered too small, or are mixed with other species (mostly herring or horse mackerel) the catch may be let go, a process known as “slipping”. Although such practices can be recorded by fishery observers, it is difficult to accurately estimate the tonnages involved. In recent years, it is estimated that slippage has been relatively uncommon. There are no grading systems in operation in the Scottish pelagic fleet, so most catches taken on board are landed.

Scotland has operated a pelagic discard observer scheme sine 1997. Between 12 and 15 observer trips are undertaken each year. Samples are taken from catch and discard data where possible, and worked up for age, length and weight. The data are retained at FRS in Aberdeen.

6.5 North Sea roundfish fisheries

John Cotter and others (Cefas)

6.5.1 Introduction

This document firstly provides brief descriptions of the current states of three international fisheries for roundfish (cod, haddock, whiting) in the North Sea. The stocks are considered to be contained within ICES divisions IVa, b, c and, depending on the species, IIIa (Skagerrak), and VIId (eastern Channel). Information is taken from the report of the North Sea and Skagerrak fish stock working group (ICES CM 2006/ACFM:09). That report should be consulted via http://www.ices.dk/reports/ACFM/2005/WGNSSK/directory.asp for fuller information on stock status, technical measures applied to the fisheries, and ecological aspects of the biology of each species. This report also presents information about the English fishing fleets prosecuting North Sea round fisheries to supplement the ICES information. These are mainly otter trawlers operating from the NE coast of England. Nephrops trawlers working off the NE coast also take a by-catch of cod.

Secondly, a summary of the data streams available to Cefas on these fisheries is given.

6.5.2 Cod

Cod are caught by virtually all the demersal gears used in IV, IIIa, and VIId, including beam trawls, otter trawls, seine nets, gill nets and lines. Most of these gears take a mixture of species. In some of them, cod are considered to be a bycatch, for example in beam trawls targeting flatfish, and in others, the fisheries are directed mainly towards cod, for example some of the fixed gear fisheries. Recently, for some sectors of the otter trawl fleet, particularly twin-rig trawlers, fuel prices, days at sea restrictions, and lack of quota for deep-water species have resulted in both changes in spatial activity and the types of gear used. Fishermen are now less likely to select more distant fishing areas and instead concentrated on home grounds in the Northern North Sea. There has been a marked reduction in the effort associated with large mesh fisheries, and an increase in the use of 70 - 90mm mesh associated with sole and Nephrops as target species.

Landings of cod are at historically low levels and the stock is now classified as an “observation” stock by ICES because updating the assessment is not considered appropriate. Much of the landings come from the Southern Bight, German Bight, the eastern central North Sea and entrance to the Skagerrak. Landings recorded in 2003 and 2004 were distributed closer to the coast than those from previous years partly as a result of the imposition of days at sea regulations in 2003. Concerning discarding of cod, the ICES WGNSSK publishes a table of absolute estimates of numbers-at-age discarded as a time-series based on data obtained by observers on Scottish fishing vessels. For the present purposes, it may be reported from observations of English trawlers by Cefas that approximately 29% of the numbers of cod caught off the English NE coast in 2004 were discarded by otter trawlers. Nephrops trawlers discarded 37%. These figures are likely to be typical of similar vessels of other nationalities operating elsewhere in the North Sea.

Cod are taken all over the North Sea but regional fisheries exist in the German Bight, in the Skagerrak, off the NE of England. The number of vessels fishing internationally for North Sea cod is not known but data on the number of vessels and other effort measures are available for the English NE coastal fisheries in 2003 and 2004. See table i. Comparison of the two years shows that fishing effort by trawlers and seiners generally decreased, reflecting declining incomes from round and prawn fisheries. Nephrops trawlers < 10 m LOA were

nearly as active as larger vessels in terms of 'Days absent from port' during 2004.

YEAR	GEAR GROUP	N VESSELS	N TRIPS	N DAYS ABSENT	HOURS FISHING
2003	Demersal trawl	87	3226	6711	75048
2003	Nephrops trawl	64	4066	4823	37927
2003	Seine	7	75	582	6745

YEAR	GEAR GROUP	N VESSELS	N TRIPS	N DAYS ABSENT	HOURS FISHING
2004	Demersal trawl	64	2149	5233 (264)	58864
2004	Nephrops trawl	47	3234	3853 (2316)	29312
2004	Seine	6	41	436 (0)	4447

Table 1. NE England. Four measures of commercial fishing effort for English and Welsh registered vessels ≥ 10m LOA landing to ports between Berwick and Grimsby in 2003 and 2004. For 2004, days absent for vessels < 10m LOA are also shown. Source: Defra Fishing Activities Database.

Management of North Sea cod is by TAC and technical measures. In 1999, the European Union and Norway agreed a long-term management plan which was intended to be 'precautionary' and consistent with provision for sustainable fisheries and greater potential yield. The plan aims to maintain a minimum level of spawning stock biomass, to restrict fishing by TAC to an F of 0.65, and to reduce discarding. The plan has been re-established annually since 1999. During spring 2001, a large area of the North Sea was totally closed to vessels catching cod but this closure was not applied again. The basic minimum mesh size for towed gears for cod from 2003 was 120 mm. Additional effort restrictions were introduced in 2003, and a formal recovery plan in 2004. The minimum landing size for cod is 35 cm, except for Danish vessels for which it is 40 cm.

6.5.3 Haddock

Haddock occur in many areas of the central and northern North Sea and Skagerrak, and are prevalent as far south as the Humber estuary. They usually inhabit depths less than 200 metres. In the North Sea, haddock is taken as part of a mixed demersal fishery along with cod, whiting, saithe, ling and blue ling. The large majority of the haddock catch is taken by Scottish light trawlers, seiners and pair trawlers. Until 2001, these gears had a minimum legal mesh size of 100 mm, and smaller quantities were taken by other Scottish vessels, including Nephrops trawlers which used mesh sizes between 70 and 100mm mesh and hence may have had higher discard rates. Vessels from other countries including England, Denmark and Norway also participate in the fishery, and haddock are also taken as a by-catch by Danish and Norwegian vessels fishing for industrial species. In Division IIIa, haddock are taken as a bycatch in a mixed demersal fishery, and in the industrial fishery there. However, landings from IIIa are small compared to those of the North Sea.

Recently, with the reduced cod quota, many vessels in the Scottish fleet have tended to concentrate more on the haddock fishery with others taking the opportunity to move between the *Nephrops* and demersal fisheries. The number of Scottish based vessels (over 10m) in the demersal sector was reduced by approximately one third during 2002 and 2003, the bulk of this being due to vessels accepting decommissioning. With fishing patterns being dictated

by restrictive TACs, many of the vessels were fishing shorter voyages so as to be able to land their fish (un-gutted haddock) in good condition.

Concerning discarding of haddock, the ICES WGNSSK publishes a table of absolute estimates of numbers-at-age discarded as a time-series. The majority of discarded fish are young but a small proportion is several years old. For the present purposes, it may be reported from observations of English trawlers by Cefas that approximately 44% of the numbers of haddock caught off the English NE coast in 2004 were discarded by otter trawlers. Nephrops trawlers discarded 22%. These figures are likely to be reasonably similar to those by trawlers of other nationalities operating elsewhere in the North Sea except that it should be noted that English trawlers tend to take haddock as a by-catch whilst targetting cod or Nephrops, whilst Scottish vessels, in particular, target haddock and may show different discarding percentages as a result.

Haddock are mainly caught in the North Sea north of a line between the Humber river in England and Esbjerg in Denmark. The number of vessels internationally targetting this species is not known but data on the number of vessels and other effort measures are available for the English NE coastal fisheries in 2003 and 2004, as presented for cod in table i, above.

Management of North Sea haddock is by TAC and technical measures. In 1999, the European Union and Norway agreed a long-term management plan which was intended to be ‘precautionary’ and consistent with provision for sustainable fisheries and greater potential yield. The plan aims to maintain a minimum level of spawning stock biomass, to restrict fishing by TAC to an F of 0.30 for appropriate age groups, and to reduce discarding. The plan entered into force in 2005. The basic minimum mesh size for towed gears for haddock from 2003 was 120 mm. Additional effort restrictions were introduced in 2003.

6.5.4 Whiting

Whiting for the most part is caught as part of a mixed fishery operating throughout the year. Adult whiting are widespread in the North Sea. They are predominantly found to the south of the Norwegian Deep and its extension around the north of the Shetland Isles, while high numbers of immature fish occur off the Scottish coast, in the German Bight and along the coast of the Netherlands. Tagging experiments, and the use of fish parasites as markers, have shown that the whiting found to the north and south of the Dogger Bank form two virtually separate populations. It is also possible that the whiting stock in the northern North Sea may contain inshore and offshore populations.

Spatial information on landings suggests three distinct areas of major catch: a northern zone, an area off the eastern English coast; and a southern area extending into the Channel. In the northern area, whiting are caught along with cod and haddock in otter trawl and seine fisheries, currently with a 120 mm minimum mesh size. The southern whiting fishery uses 80 mm nets and is, in part, regulated by catch composition rules. Whiting also comprise a bycatch in beam trawl and *Nephrops* fisheries, both of which can operate with 80 mm mesh sizes depending on area (beam trawls) or gear configuration (*Nephrops* trawls). Due to EC regulations affecting fishing activities it is known that some vessels have switched activity from the roundfish fisheries into the *Nephrops* fisheries to gain more permitted days at sea.

In 2005, fuel price increases and a lack of quota for deep-water species have resulted in some vessels formerly fishing in deep-water and along the shelf edge to move into the northern North Sea. The shift in fishing grounds is likely to result in their catches including more whiting.

Estimates of discarding of whiting are given in table ii below, based on table 5.2.2 of ICES WGNSSK2005 (p. 230). Discarding as a percentage of the human consumption catch has been consistently high in recent years, reflecting the generally low market value of this species. Results for English trawl fisheries off the NE coast are in broad agreement. In 2004, otter trawlers were estimated to discard approximately 42%, and Nephrops trawlers 67% of fish caught by number.

	Weight (thousands of tonnes)				Numbers (millions)			
Year	Human consum.	Disc-ards	Industr. bycatch	% H.c. disc.	Human consum.	Disc-ards	Industr. bycatch	% H.c. disc.
2000	29	23	9	44	114	142	55	55
2001	25	16	7	39	102	114	282	53
2002	22	17	7	44	77	96	205	55
2003	16	24	3	60	57	210	84	79
2004	14	13	1	48	47	56	42	50

Table 2. North Sea whiting. Annual weights and numbers caught and discarded by human consumption fisheries, and caught as a by-catch in industrial fisheries. Data taken from table 5.2.2 of ICES w.g. on demersal stocks of the North Sea and Skagerrak (2005). Discarded percentages relate to the human consumption catch only.

Whiting are caught throughout the North Sea. The total number of vessels fishing for whiting in the North Sea is not known. Many would be catching whiting as a by-catch, e.g. when fishing for cod, haddock, or Nephrops. Data on the number of vessels and other effort measures for the English NE coastal fisheries in 2003 and 2004, as presented for cod in table i, above, would also be indicative of the changing fishing effort available for catching whiting.

Management of whiting fisheries is by TAC and technical measures. In 2003, the minimum mesh size for towed roundfish gears was set at 120 mm but whiting are a by-catch in Nephrops and sole fisheries that use smaller mesh sizes. These fisheries are subject to by-catch limits for whiting, among other species. The minimum landing size for whiting in the North Sea is 27 cm.

6.5.5 Data available to Cefas

6.5.5.1Landings data

Landings data including weights (as live fish), length frequency distributions, age compositions, weights-at-age, origins by ICES rectangle. These data go back to the early half of the 20th century. Weights landed and geographic origins are declared for all landings on EC logbooks although less information is available for vessels under 10m length overall. The latter vessels can be particularly significant for coastal fisheries. LFDs and age compositions are estimated by sampling of landings awaiting sale in fish markets. Sampling precision of Cefas data tends to be best for division IVb where most English fishing (and thus sampling) takes place, and for cod and whiting, the most numerous species landed historically. Landed weights declared on logbooks are often suspected to be under-estimates, and the ICES rectangle specified for each haul can be in error.

6.5.5.2Effort data

Effort data are recorded accurately as days-at-sea for each trip. Hours of fishing may also be given with logbooks. In many cases this is an estimated value.

6.5.5.3Gear data

Gear data are recorded for each haul on logbooks.

6.5.5.4Vessels' data

These are available for all English registered fishing vessels, including dimensions, engine power, age, etc.

6.5.5.5Data on discarding and retention

Data on discarding and retention of cod, haddock, and whiting by English fishing vessels > 10m registered length targetting roundfish and *Nephrops* from the NE coast of England. These data are collected by an observer programme that began in 1994, operated intermittently until 2002, and since then has been steadier due to funding under the EC Data Collection Regulation. Also, since 2002, observers have been allowed to sample catches in the North Sea taken by English vessels operating from anywhere along the east coast of England, the eastern Channel, or from Dutch ports. These may include beam trawlers and netters, as well as other types of trawler. Observers record numbers-at-length for each species, and take otoliths from discards for ageing. Retained fish are aged using age compositions estimated for landings. Weights discarded can be estimated with modest precision for commercial species by applying length conversion factors specific to each species, season and division. Observers also record gear type, nominal mesh size, time and position for all fishing operations. Approximately 0.5% of the trips made by English vessels have an observer on board. Observer data tend to show poor sampling precision because of the small numbers of observed trips on each gear type in the North Sea, and because of the need to estimate raising factors (sample to catch, observed catches to total trip catch, observed trips to fleet). Note that Cefas observers do not observe vessels under 10m registered length for operational and safety reasons. Unfortunately, this excludes a large part of the English fleet operating in near-shore waters. Discarding of North Sea roundfish by English vessels tends to be high, often over 50% by number and sometimes up to 100%, e.g. for whiting caught in a small mesh fishery. Discarding of cod depends on availability but can be high when a large year-class of 1-year olds has grown to be just catchable with commercial gear.

6.5.5.6Overflight data

Overflight data obtained by Sea Fisheries Inspectors patrolling coastal fisheries in English waters using aircraft approximately twice weekly. Collection of these data began in 1985. An extensive computer archive now exists for all sightings of fishing vessels giving position, date & time, vessel identity, nationality, gear, whether fishing or not. Surveillance effort was reduced in 2000 at the same time as VMS was introduced but has since increased.

6.5.5.7VMS data

VMS data obtained by the Sea Fisheries Inspectorate based in London. This relates to English fishing vessels > 15m length overall that are required to operate satellite monitoring systems. This was approximately 260 vessels, i.e. about 7% of the English fleet in the first quarter of 2006. Collection of these data began in 2000. The archive is extensive. It records vessel identification, date&time, position, estimated speed and heading every two hours. Whether the vessel was steaming or fishing can be estimated from course and speed, though not with 100% reliability. Vessel nationality is attributed at a later stage.

6.5.5.8E-logbook data

E-logbooks are still under development. They will permit faster availability of standard logbook data including weight of each species retained on board.

6.5.5.9Survey data

Fishery-independent data are available from the surveys undertaken as part of the International Bottom Trawl Survey (IBTS) in the North Sea. These data extend back to 1977 and include catch per unit effort data for the key commercial species, as well as detailed biological information including age, weight, sex and maturity.

6.6 Greenland shrimp

No further description provided.

6.7 French and Spanish Tropical Tuna

No further description provided.

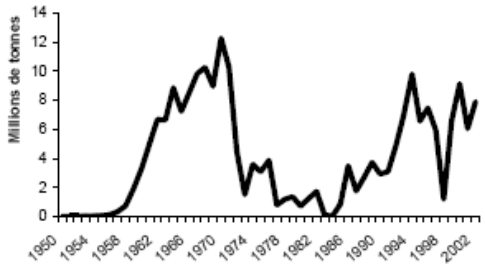
6.8 Peruvian Anchovy

Sophie Bertrand (IRD)

6.8.1 Description of fisheries

The Peruvian anchovy (Engraulis ringens) is exploited by an 1300 purse seiners (see below why in the ppt I spoke only of 800 vessels), whose fishing effort is distributed all along the Peruvian coast (about 3000 km long). Because anchovy distribution is very coastal (from the coast to about 100nm offshore, depending on the climatic conditions), the fleet is technically able to cover the entire distribution area of this species. It is the world most important mono-specific fishery in terms of landings.

Figure 1. Anchovy landings from 1950 to 2002.



6.8.2 Number of vessels & gear

There are about 1300 purse seiners in total. 800 of those are industrial: called 'traditional fishery', steel hull, most of them with carrying capacity between 100 and 400 m^3, owned by fishing enterprises, most of them without freezing system onboard (because no fish goes to human consumption, all the landings are burnt for fish meal). The other 500 are artisanal: called 'vikingas', wood hull, carrying capacity<100m^3, very coastal activity, no information at all on their activity for the moment (no observers onboard, but VMS has apparently being installed since end of 2004; information should then become available); even their exact number is not exactly known; they usually are owned by a family who also assume the fishing activity and the commercialization.

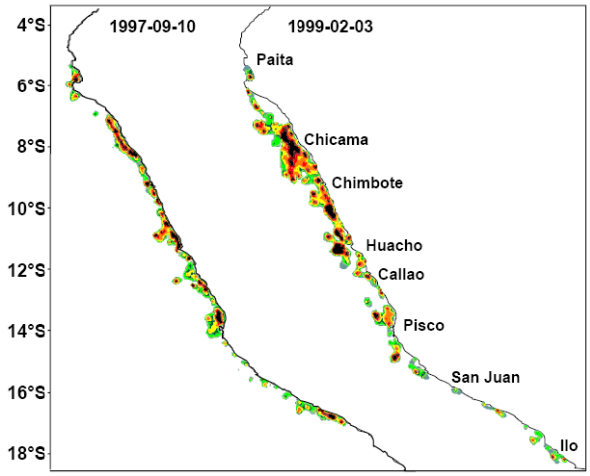
6.8.3 Legal regulations

The Peruvian fishery is regulated by means of quotas and fishing closures. Fishing closures are decided on the basis of (1) spawning season and (2) proportion of juveniles in the landings.

6.8.4 Geographical area (including maps)

Fishing effort is distributed all along the Peruvian coast (Figure 2).

Figure 2. Anchovy distribution estimated by scientific acoustic survey (colour scale represents semi-quantitatively s_A values from the acoustic survey); in this two cases, biomass estimates were roughly the same (around 6.10^6 tons), but the distribution changed significantly (more concentrated in the coastal fringe in 1997) because of climatic conditions. Cities indicated on the coast makes also part of the important landing ports.



6.8.5 Level of discarding

The level of discarding is zero: the fishery is oriented to fish meal production; catches are almost 'pure' anchovy and if other species (sardine, jack mackerel for example) are caught, they are kept also for preparing fish meal.

6.8.6 Common description of data

Being in charge of the operational management of this fishery, IMARPE (Peruvian Institute for the Sea) has been developing a real time management system (Figure 6) based on a very detailed and complete data collection network (see below) made of:

1. up to four acoustic surveys per year;
2. annual semi quantitative acoustic surveys using fishing vessels (Eureka operations);
3. “traditional” fishery data (fleet composition and characteristics, landings by vessel by fishing travel for the whole fleet from sampling in ports and fish meal factory statistics),
4. observers at sea data (various programs from the 70’s. Since 1996, 25 observers at sea all along the year collecting fishing trip references, detailed measures of effort, catch by set with exact position and biological measures).

6.8.6.1Acoustic surveys

6.8.6.2Semi quantitative acoustic surveys using fishing vessels (Eureka operations)

I learnt recently this program was stopped for several years now.

6.8.6.3“Traditional” fishery data

Fleet composition and characteristics, landings by vessel by fishing travel for the whole fleet from sampling in ports and fish meal factory statistics

6.8.6.4Observers at sea data

Various programs from the 70’s. Since 1996, 25 observers at sea all along the year collecting fishing trip references, detailed measures of effort, catch by set with exact position and biological measures.

6.8.6.5VMS data

Since 1999, exhaustive VMS data are available for the 800 industrial vessels. Since 2004 VMS data are available for 500 artisanal vessels, which is 100% of the anchovy fleet. Every hour 1 position is recorded.

Based on VMS data, some algorithms may allow determining positions of probable fishing sets. Observers at sea provide exact spatial position of fishing sets what allow to calibrate the previous algorithm for 25 daily fishing trips. Moreover, from observers at sea data, it is possible to extract a statistical distribution of catch by fishing sets according to the total number of sets of the trip. Knowing moreover landings by boat by trip, probable fishing set positions, we may estimate for the whole fleet on a daily basis fishing sets position and catch.

(end of document)

European Commission

EUR 24018 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen
Title: FP6 CEDER Project Deliverable 1.1.2: “Data Quality Report”
Authors: U. Kröner (JRC), F. Burns (FRS), D. Reid (FRS), A. J. Cotter (CEFAS), G. Pilling (CEFAS), S. Bertrand (IRD), A. Barkai (Olrac), K. Geggus (Olrac), F. Felaar (Olrac), G. Piet (IMARES), F. Quirijns (IMARES), H. S. Valgeirsdóttir (DIS)
Luxembourg: Office for Official Publications of the European Communities
2009 – 115 pp. – 21 x 29,7 cm
EUR – Scientific and Technical Research series – ISSN 1018-5593
ISBN 978-92-79-13738-9
DOI 10.2788/39979

Abstract
Addressing the uncertainties in fishing activities, the CEDER project harnessed fishery observer reports, landings, logbooks, and VMS records information. The project collected data from these sources for six selected fisheries. This document explores the quality of aforementioned data.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

LB-NA-24018-EN-C

ISBN 978-92-79-13738-9

Publications Office
Publications.europa.eu