



FLYING FISHERIES

**Aerial Survey Monitoring Tools for
Environmental Impact Assessment**

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Overview

- **Introduction**

- ◆ Data Sources for Fisheries Management in the UK
- ◆ Reporting Requirements
- ◆ Custom development concept

- **Overflights Surveys**

- ◆ Data format
- ◆ Standardized mapping requirements
- ◆ Custom tool development and demonstration

- **Vessel Monitoring System**

- ◆ Data format
- ◆ Custom tool development and demonstration

- **Next Steps – Future Development Plans**

Introduction

- **Fisheries Management in the UK**

- ◆ Marine Management Organization (MMO) conducts Marine Control and Surveillance (MCS) to monitor commercial fishing activity
- ◆ Conduct 2 primary types of vessel surveillance in addition to monitoring landings data:
 - » **Overflights Surveys** – Spotter planes over fishing areas recording fishing vessels, types, activities
 - » **Vessel Monitoring System (VMS)** – GPS system providing 2 hourly point data for vessel locations
- ◆ ERM use this data to assess potential impacts from offshore developments (offshore wind, ports, aggregate dredging) and consult with the MMO and CEFAS to review findings.

Introduction

- **Reporting Requirements**

- ◆ No statutory requirement to review monitoring data but expectation from MMO and CEFAS that it will be assessed.
- ◆ No specific guidelines on best practice for assessing data – large volume of data provides many options for analysis and map production:
 - » Vessel Type
 - » Nationality
 - » Time period – sum by date, month, year, season

- **Custom development concept**

- ◆ Historically basic summary of all vessels engaged in fishing. Single set of summary maps by season.
- ◆ GIS analyst not the best person for the job – require a tool to enable fisheries specialist to query, analyze and map data

OVERFLIGHT SURVEYS

Mapping Tool Development

OVERFLIGHTS: Methodology Overview

- **Data Collection**

- ◆ Spotter planes fly over fishing grounds and record any fishing vessel >10m in length:
 - » Date
 - » Vessel ID Number
 - » Vessel Type – gear type
 - » Current Activity – Steaming, Fishing, Stationary
 - » ICES grid sub-rectangle (0.5° E-W, 0.25° N-S = 20 x 20 miles)

- **Source Data**

- ◆ Provided as separate text files:
 - » Observations
 - » Number of flights over each rectangle
- ◆ Data requires standardization to account for variations in flight frequency

OVERFLIGHTS: Standardization Method

- **Standardizing observations**

- ◆ Method recommended by CEFAS
- ◆ No. of Observations / No. of Flights
- ◆ Can be applied to any combination of vessel types, time periods
- ◆ Large number of calculations and multiple map outputs possible
- ◆ Custom tool developed in VBA

- **Reference**

Rogers, S. I., Ellis, J.R., & Dann, J. 2001. *The association between arm damage of the common starfish, *Asterias rubens*, and fishing intensity determined from aerial observation.* *Sarsia* **86**, 107-112

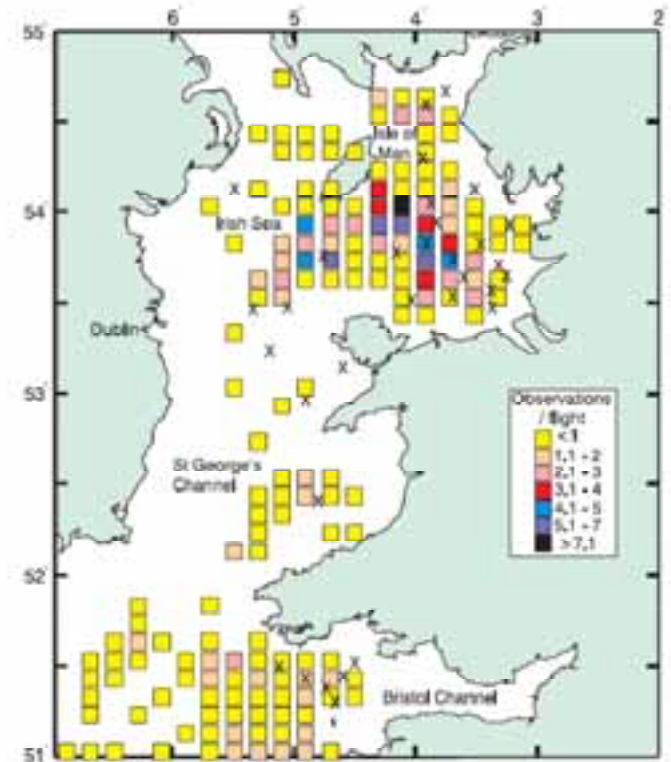
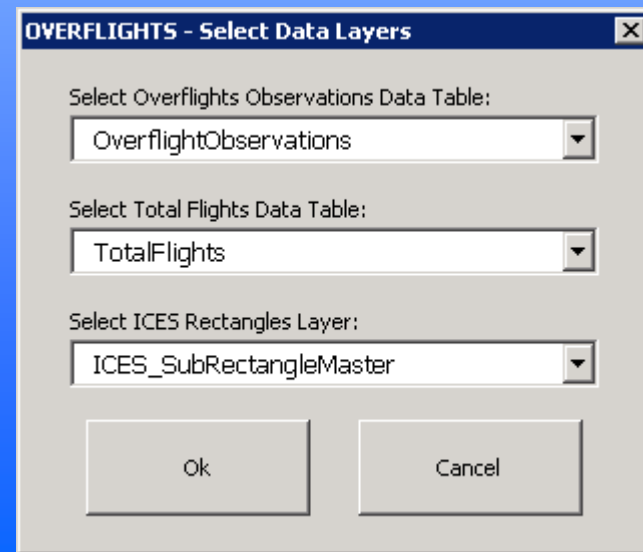
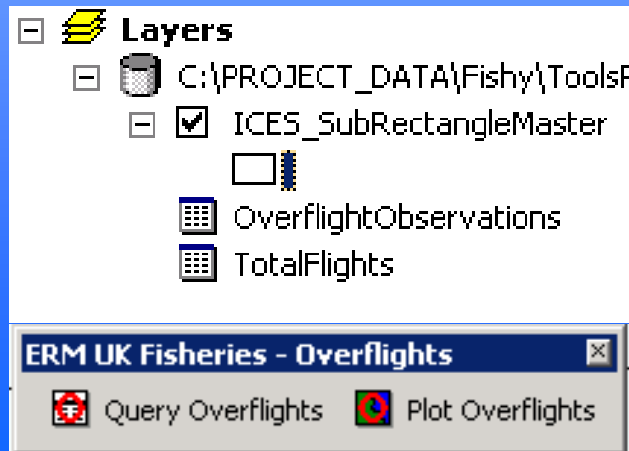


Fig. 1. The distribution of beam trawlers and dredgers in the western waters of England and Wales for the period 1 January to 31 August 1998 and 1999 combined, observed during Fishery Protection flights. Observations are standardised to account of variable frequency of observation, and are grouped by 25th of an ICES rectangle. The scale shows the number of observations per over-flight during this 16 month period.

OVERFLIGHTS: Tool Workflow

- **Process Raw Data**

- ◆ Data loaded to template geodatabase with standard schema for tables
- ◆ Rectangles for Study Area extracted from master grid
- ◆ Data loaded to mxd containing VBA code for fisheries specialist to analyze



OVERFLIGHTS: Tool Workflow

- **Select Query Parameters**
 - ◆ Nationality
 - ◆ Vessel Type
 - ◆ Activity Type
 - ◆ Time Summary
- **All options enable multi-selection of criteria**
- **Tool generates a copy of the polygon grid with standardized obs for selected parameters**

OVERFLIGHTS - Select Data of Interest

Vessel Nationality
 Use all Nationalities

- Panama
- Poland
- Portugal
- Russia
- Spain
- Sweden
- Ukraine
- United Kingdom
- Unknown

Vessel Type
 Use all Vessel Types

- BEAM TRAWLER
- BOTTOM SEINER (ANCHOR/DANISH)
- DEMERSAL SIDE TRAWLER
- DEMERSAL STERN TRAWLER
- DRIFT NETTER
- FREEZER TRAWLER (PELAGIC/DEMO)
- GILL NETTER
- HANDLINER
- INDUSTRIAL TRAWLER (SANDEFLER)

Vessel Activity
 Use all Types of Vessel Activity

- FISHING
- LAID STATIONARY
- NULL
- STEAMING

Time Summary Options

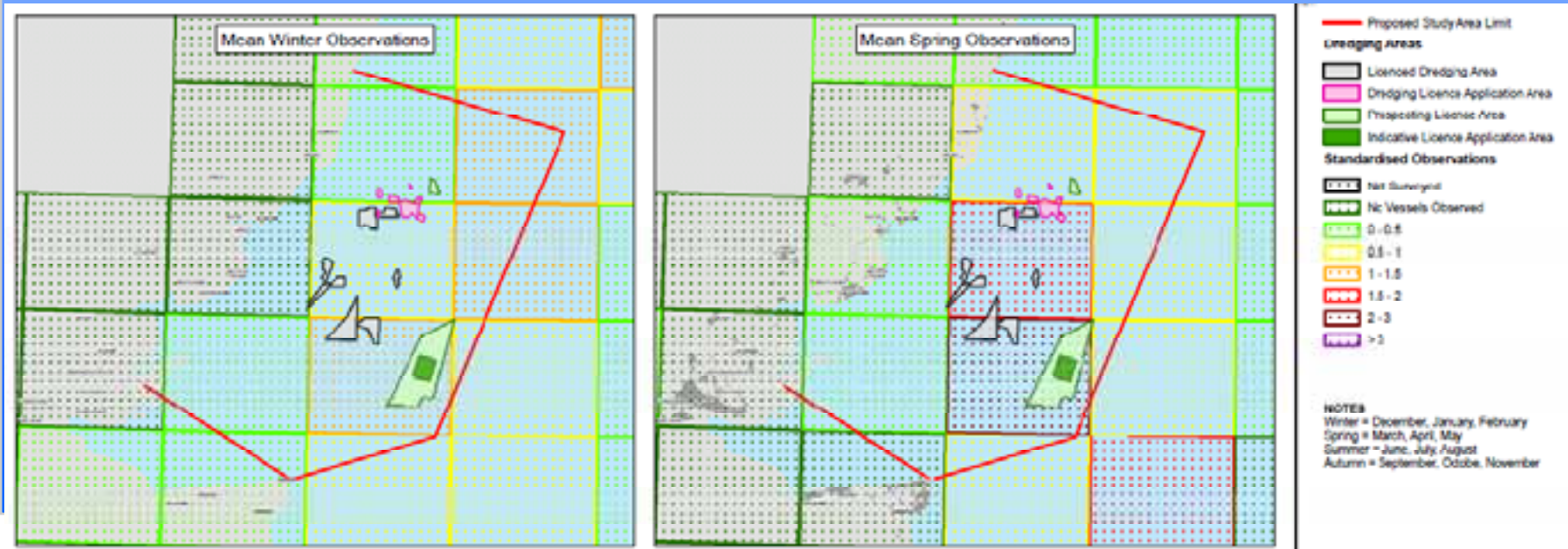
- By Month By Year (e.g. Jan 1998)
- By Season By Year (e.g. Winter 1998)
- By Year (e.g. 1998)
- Monthly Average
- Season Average

Ok Cancel

OVERFLIGHTS: Tool Workflow

• Mapping Tool

- ◆ User applies standard symbology to analysis output. User adds additional base data as needed
- ◆ User selects layer and runs tool producing individual PDF for each time period, updates layer and title for each map



VESSEL MONITORING SYTEM

Mapping Tool Development

VMS: Methodology Overview

- **Data Collection**

- ◆ GPS devices fitted to vessels >15m in length and record positions every 2 hours
 - » Vessel ID Number
 - » Vessel Type – gear type
 - » Position (Lat/Long)
 - » Speed (inconsistently recorded)
- ◆ UK VMS data does not record vessel activity

- **Source Data**

- ◆ Provided as text files – format changed over time. Requires pre-processing using custom scripts before loading to geodatabase

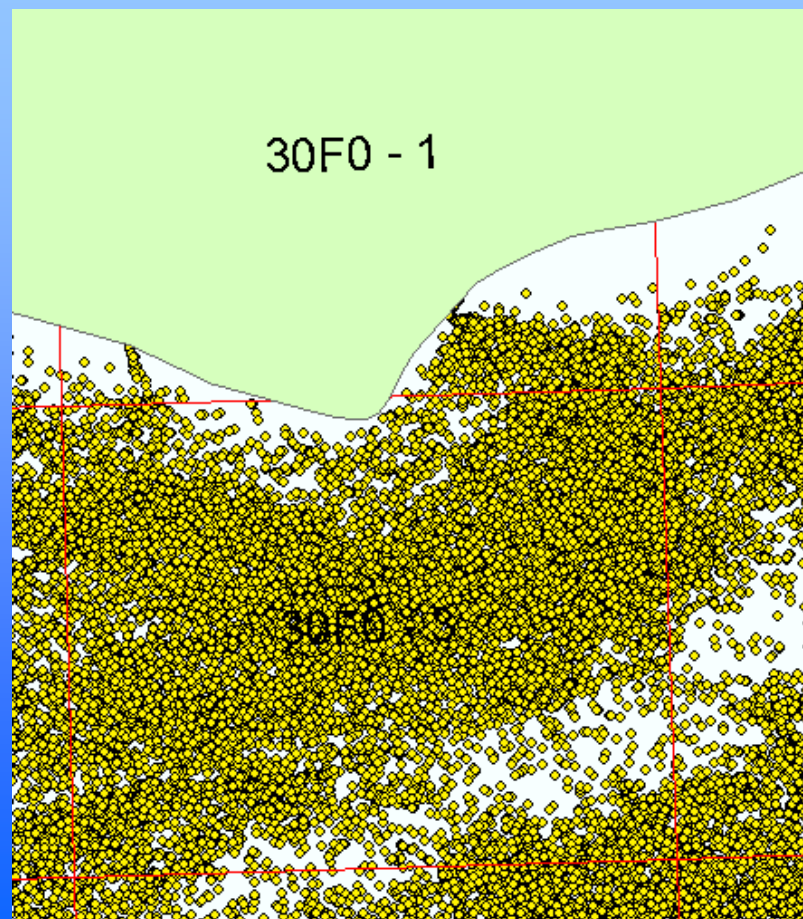
VMS: Methodology Overview

- **Analysis Methodology**

- ◆ Adapted by ERM from existing UK wide analysis
- ◆ Uses speed information in data to estimate vessel activity
- ◆ Speeds calculated from locations where speeds not available
- ◆ Activity reported on subdivisions of ICES sub-rectangles – greater data volume enables greater granularity

- **Reference**

Witt, M.J., and Godley, B.J., 2007. *A Step towards Seascape Scale Conservation: Using Vessel Monitoring Systems (VMS) to Map Fishing Activity*. PLoS ONE 2(10)



VMS: Tool Workflow

- **Process Raw Data**

- ◆ Data pre-processed and loaded to template geodatabase with standard schema for tables
- ◆ Rectangles for Study Area extracted from master grid
- ◆ Data loaded to mxd containing VBA code for fisheries specialist to analyze

34F1 - 1					34F1 - 2				
34F1 - 1A	34F1 - 1B	34F1 - 1C	34F1 - 1D	34F1 - 1E	34F1 - 1F	34F1 - 1G	34F1 - 1H	34F1 - 1I	34F1 - 1J
34F1 - 1K	34F1 - 1L	34F1 - 1M	34F1 - 1N	34F1 - 1O	34F1 - 1P	34F1 - 1Q	34F1 - 1R	34F1 - 1S	34F1 - 1T
34F1 - 1U	34F1 - 1V	34F1 - 1W	34F1 - 1X	34F1 - 1Y	34F1 - 1Z	34F1 - 1AA	34F1 - 1AB	34F1 - 1AC	34F1 - 1AD
34F1 - 3					34F1 - 4				
34F1 - 3A	34F1 - 3B	34F1 - 3C	34F1 - 3D	34F1 - 3E	34F1 - 3F	34F1 - 3G	34F1 - 3H	34F1 - 3I	34F1 - 3J
34F1 - 3K	34F1 - 3L	34F1 - 3M	34F1 - 3N	34F1 - 3O	34F1 - 3P	34F1 - 3Q	34F1 - 3R	34F1 - 3S	34F1 - 3T
34F1 - 3U	34F1 - 3V	34F1 - 3W	34F1 - 3X	34F1 - 3Y	34F1 - 3Z	34F1 - 3AA	34F1 - 3AB	34F1 - 3AC	34F1 - 3AD

VMS: Tool Workflow

- **Analysis and Mapping has four stages**
 1. Process Tables – Converts table to points, re-projects to selected local coordinate system and calculates tool specific fields (Run Once)
 2. Process Speed – Calculates speed between points for individual vessel voyages (Run Once)
 3. Query Data – Select query parameters (Run multiple)
 4. Plot Data – Generate map series from query (Run multiple)



VMS: Tool Workflow

- **Select Query Parameters**
 - ◆ Nationality
 - ◆ Vessel Type
 - ◆ Speed range
 - ◆ Time Summary
- **All options enable multi-selection of criteria**
- **Tool generates a copy of the polygon grid with standardized obs for selected parameters**

The screenshot shows a dialog box titled "VMS - Select Data of Interest" with a close button (X) in the top right corner. The dialog is divided into four main sections:

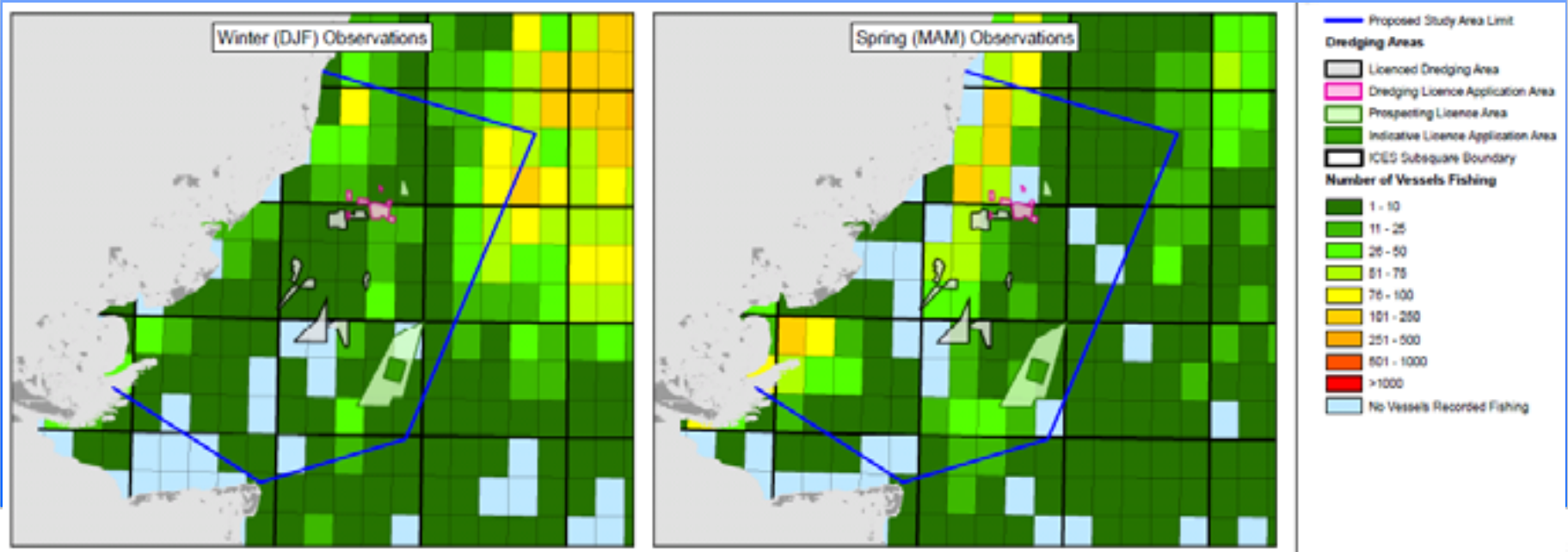
- Vessel Nationality:** Contains a checked checkbox labeled "Use all Nationalities" and a list box containing the text "UNITED KINGDOM".
- Vessel Type:** Contains a checked checkbox labeled "Use all Vessel Types" and a list box containing the following vessel types: BEAM TRAWLER, BOTTOM SEINER (ANCHOR/DANISH), DEMERSAL STERN TRAWLER, DRIFT NETTER, FREEZER TRAWLER (PELAGIC/DEME), GILL NETTER, NULL, PAIR TRAWLER (ALL), and POTTER/WHELKER.
- Vessel Speed:** Contains two radio button options: "Use Speed values from VMS log (uses calculated speed where VMS log is missing data)" (which is selected) and "Use calculated speed values only". Below these is a label "Enter speed range for vessel activity:" followed by two input fields: "Speed >=: 0" and "Speed <=: 10".
- Time Summary Options:** Contains five radio button options: "By Month By Year (e.g. Jan 1990)" (selected), "By Season By Year (e.g. Winter 1998)", "By Year (e.g. 1990)", "Monthly Average", and "Season Average".

At the bottom of the dialog are two buttons: "Ok" and "Cancel".

VMS: Tool Workflow

• Mapping Tool

- ◆ User applies standard symbology to analysis output. User adds additional base data as needed
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CONCLUSIONS

Future Developments

Conclusions

- **Benefits of Custom Tool Approach**

- ◆ The specialist is in control of the assessment with minimal GIS training
- ◆ Tools enable rapid assessment of multiple user-defined input parameters
- ◆ Multiple series of maps can be generated for different time periods
- ◆ Potential user error in bulk data processing is removed

Future Developments

- **Conversion of tools to .NET to provide more robust development platform**
- **Enhanced mapping functions to enable greater user interaction with automated mapping**
- **Development of web-based version of tools to remove need for desktop software and increase access to users**