Agenda Item 5.1 | Review of New Information on other Matters Relevant for Small Cetacean Conservation

Population Size, Distribution, Structure and Causes of Any Changes

Document Inf.5.1.b

Small Cetaceans in European Atlantic waters and the North Sea (SCANS-III): Revised Proposal

Action Requested

- Take note

Submitted by St. Andrews University

NOTE:
DELEGATES ARE KINDLY REMINDED
TO BRING THEIR OWN COPIES OF DOCUMENTS TO THE MEETING

Small Cetaceans in European Atlantic waters and the North Sea (SCANS-III): Revised Proposal

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Background

A series of large scale surveys for cetaceans in European Atlantic waters was initiated in 1994 (SCANS; Hammond et al. 2002) and continued in 2005 (SCANS-II; Hammond et al. 2013) and 2007 (CODA 2009) to provide estimates of abundance needed to put bycatch in a population context and to allow EU member States to discharge their responsibilities under the Habitats Directive. The frequency of these surveys was intended to be approximately decadal; a third survey is now due.

In the mid-1990s, the primary need was for the first comprehensive estimates of abundance, especially of harbour porpoise in the North Sea and adjacent waters to put estimates of bycatch into a population context. The need for ongoing surveys is to continue to provide the information on distribution and abundance of cetaceans required by Member States to report on Favourable Conservation Status under the Habitats Directive and to report on Good Environmental Status (GES) under the Marine Strategy Framework Directive (MSFD).

Without results from a new large scale multinational survey, Member States will not have current information on cetacean distribution and abundance at a regional scale to fulfil the requirements of the MFSD. Without this information, the available information for the North East Atlantic Marine Region will be patchy and will allow only a partial assessment of GES at best. The successful completion of this project will contribute to Member States' comprehensive assessment of GES for cetaceans in the North East Atlantic Marine Region in 2018. The timing of the survey is designed so that results will be available in time for preliminary assessments in 2017 and for reporting on GES in 2018. Results will also be invaluable for informing the next round of assessments under the Habitats Directive.

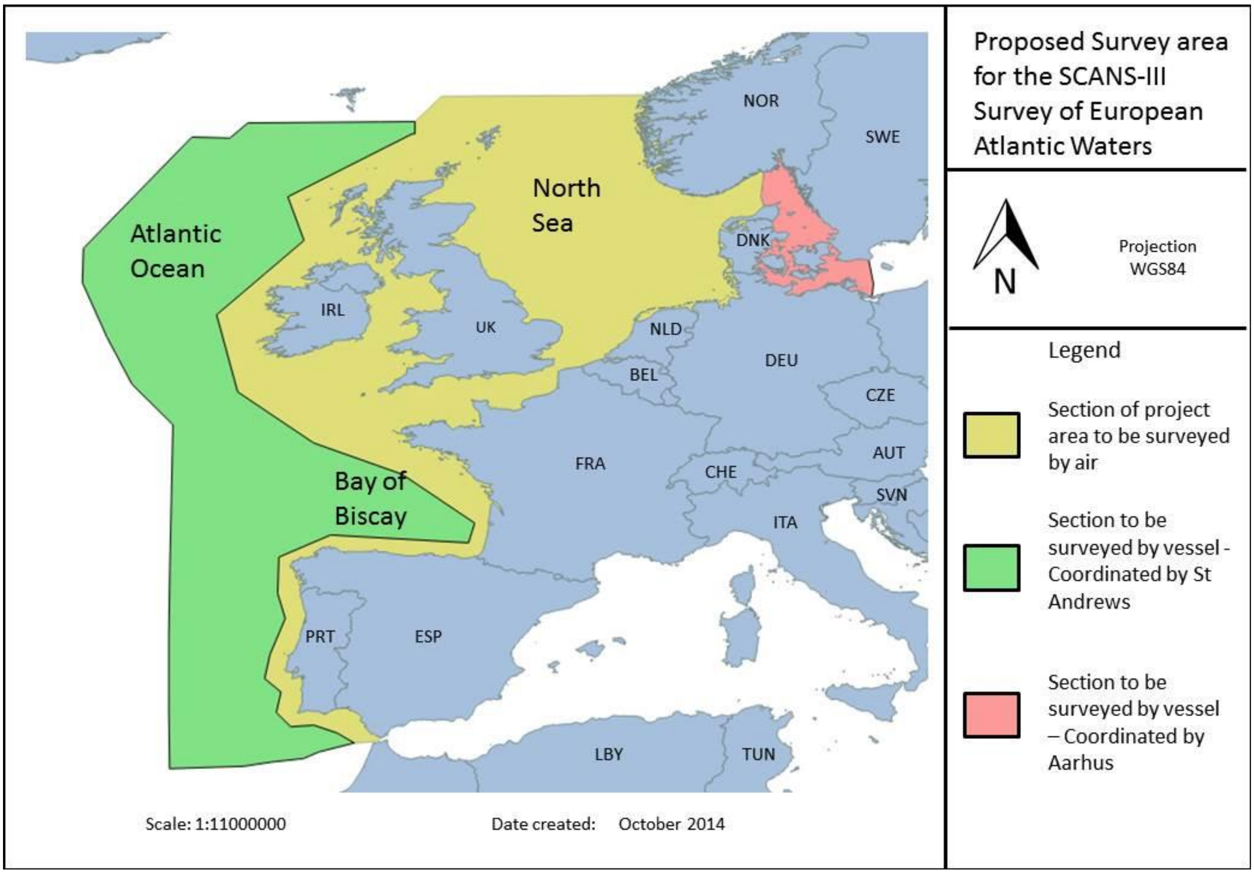
It had been hoped that this work could be part funded under the EU LIFE Nature funding stream, and the proposal was submitted in 2014. However, this bid was not successful. Following this news, the project team has sought to confirm funding from EU Member States, and we have received positive indications from Governments that there is support for a large-scale survey of European Atlantic Waters. The following document is a revised project description developed by the SCANS-III project team.

Project objective

The European Atlantic is changing rapidly and it is essential that EU Member States have access to up-to-date robust information on the status of key species so that future monitoring can be directed effectively and efficiently to achieve and maintain favourable conservation status of species and good environmental status of European Atlantic waters. Consequently, the objective of SCANS-III is to estimate the abundance of all cetacean species in shelf and oceanic waters of the European Atlantic in summer 2016. This is aimed to be achieved through a large-scale multinational aerial and shipboard survey of all European Atlantic waters in July 2016. This is the most appropriate survey month because of the higher probability of good sighting conditions, and also so that results are comparable with those from surveys conducted in 1994, 2005 and 2007.

Project Area

SCANS-III aims to survey waters covered by both the SCANS-II and the CODA projects but extended to the 200nm limit in waters of the whole European Atlantic. Continental shelf waters (including areas surveyed in SCANS-II) will mostly be covered by aerial survey. Offshore waters (including areas surveyed in CODA) and the Skagerrak, Kattegat and Belt Seas will be covered by ship survey.
However, the realised survey area will depend on available funding. Currently, there is no commitment from Spain or Portugal to allow the survey to extend south of the Bay of Biscay. Surveying Norwegian waters requires collaboration with Norway.



Participating organisations

Aarhus University, Denmark
Royal Belgian Institute of Natural Sciences, Belgium
University of Veterinary Medicine Hannover, Germany
University of La Rochelle, France
University College Cork, Ireland
IMARES, Netherlands
Instituto da Conservação da Natureza, Portugal
Instituto Español de Oceanografia, Spain
University of St Andrews, UK

Project Phases:

The SCANS-III project will comprise four phases: Preparation, Implementation, Analysis and Reporting.

1. Preparation

This phase will provide all survey aircraft and ships with the equipment and software that enables accurate data collection. It lays the groundwork for the implementation phase through the sourcing and preparation of necessary field equipment, and the production of a robust survey design.

1.1 Preparation of aerial survey equipment

It is not necessary to design a new data collection system for aerial survey from scratch because the existing system works well. However, some programming updates will be required to allow for the inclusion of minke whales and dolphin species within the recording system, and to bring the system up to date to allow compatibility with the operating systems on new laptops (the current version runs on Windows XP, which is no longer supported). A total of seven sets of aerial equipment will be required – one for each of six survey aircraft, and one spare set. Equipment will be collated and set-up by IMARES which will be responsible for the implementation of the aerial phase of the fieldwork.

1.2 Preparation of visual data collection equipment for ships

Survey ships require equipment and software to facilitate accurate data collection, including accurate measurement of distances and angles to sightings and software to allow data to be validated at sea on a daily basis. The primary task is to maintain the essential functionality of the SCANS-II data collection system (Gillespie *et al.* 2010; SCANS-II 2008) in terms of providing accurate measurement of times, angles and distances (Leaper *et al.* 2010) while improving the overall reliability of the system.

The Logger software system used during SCANS-II is no longer supported and does not work on all modern (Windows 8) computers. Much of the functionality of Logger data entry forms is now built into the PAMGuard software (Gillespie *et al.* 2008), but it will be necessary to complete work on data entry forms within PAMGuard, in particular developing sub-forms and button action responses.
Whereas during SCANS-II the focus was on automatic triggering of camera data to measure distances and angles, increases in affordable storage mean that for SCANS-III we will be able continuously to record high definition video data for a fraction of the cost of developing a smart camera control system.

Camera hardware will be largely off the shelf, but some bespoke hardware development will be required for sighting button connections from the primary observer platform and hardware for combined binocular and camera tripod and monopod mounts. The work will be co-ordinated by the same team at the University of St Andrews that was primarily responsible for developing the system used on SCANS-II. The work will be completed in spring 2016.

An important outcome of this work will be a simplified data collection system that is straightforward for other researchers to use thus contributing to more effective cetacean surveys in other regions as well as better data from SCANS-III. Developments to PAMGuard software will be fully open source under the GNU General Public License V3 (Free Software Foundation Inc., 2007) guaranteeing free access to source code for all users and developers.

1.3 Preparation of acoustic equipment for ships

It is not necessary to design a new towed hydrophone system because the existing one works well. One set will be required for each of the survey ships.

1.4 Update of aerial survey data collection software

The aerial survey data collection software functions well but does not run on modern computer systems. It will be updated.

1.5 Survey design for aerial and ship surveys

This important precursor to fieldwork implementation will design the overall structure of the surveys (subareas or blocks) and also the placement of transects within the survey blocks.

Survey blocks

Design-based estimates of abundance will be made within survey blocks, each of which will be designed to receive equal coverage probability (see below). A robust design of survey blocks is important to ensure that estimates of abundance are as precise as possible, within the constraints of a multispecies, multinational survey. It will take into account the following factors:

Existing knowledge of the distribution of the species to be surveyed
Each species has different ecological requirements and its distribution reflects this. For example, at a large spatial scale, some species are primarily shelf dwellers (e.g. harbour porpoise, white-beaked dolphin), some inhabit deeper (off-shelf) waters (e.g. pilot whale, sperm whale, beaked whales), and some are found in both these habitats (e.g. bottlenose dolphin, common dolphin, minke whale). Within these broad habitat types, at smaller spatial scales, all species tend to be distributed patchily, the scale of which varies among species.

Survey blocks will, as far as possible, reflect existing knowledge of the distribution of species so that design-based estimates of abundance in blocks are as precise as possible. This aspect of survey design has recently been debated in the literature (MacLeod 2014; Hammond *et al.* 2014).

National or local regional boundaries
A driving need for this project is to estimate abundance at a large spatial scale because cetaceans are widely distributed and highly mobile species, and the MSFD requires assessment at a regional scale. However, EU Member States also have reporting responsibilities in their waters under the Habitats Directive and national legislation. In addition, there are some locally important regions (e.g. Irish Sea, Kattegat and Belt Seas) for which estimates of abundance are valuable. Survey block design will aim to facilitate the estimation of abundance in these areas.

Logistics
Survey design is ultimately constrained by logistics. Block design will take account of the physical limitations of aircraft (e.g. range) and ships (e.g. speed), the physical features of the environment (e.g. islands, convoluted coastline), and any local restrictions to surveying certain areas.

Transect lines

Once survey blocks have been determined, a survey design for transect placement within each block is required. This part of the design must provide equal (or known) coverage probability across each survey block to allow design-based estimation of abundance. Survey design will be undertaken in software DISTANCE (Thomas *et al.* 2010) to ensure equal coverage probability. Transect placement will either be equal-spaced parallel lines or zig-zag lines, depending on the survey type (aerial or ship), the size of the block, and logistics.

Once the survey design is finalised, sets of transect lines to be surveyed will be generated randomly using DISTANCE.

1.6 Training for cruise leaders

Experienced observers and cruise leaders will be recruited for aerial and ship surveys. Cruise leaders will attend two days of training prior to the start of the survey to ensure that protocols and methodologies are conducted in a standardised manner across all survey platforms.

2. Implementation

2.1 Aerial surveys

Implementation of aerial surveys will be undertaken by IMARES.

The target study area to be covered by aerial survey comprises all coastal and shelf waters of the European Atlantic including the North Sea. Ireland will be conducting aerial surveys using equivalent methodology and it is intended to plan the SCANS-III surveys around the areas covered by Ireland in the expectation that results can be amalgamated. Discussions are underway with colleagues in Norway regarding the possibility of an aerial survey in Norwegian coastal waters in July 2016.

Multiple aircraft will operate simultaneously to cover the study area in one month (July 2016). The survey area will be stratified into survey blocks (see above). Each aircraft will be allocated particular blocks; however, there will be flexibility to reposition aircraft to areas where survey conditions are best to maximise efficiency. Aerial survey teams will consist of three people – a cruise leader and two observers.

Six high-winged aircraft will be needed, each equipped with two bubble windows to allow a downward view of the track line, a necessity for robust aerial survey sampling. Additional fuel tanks will increase the time an aircraft can survey (i.e. endurance). Survey speed will be 90-100 knots.

Suitable aircraft are currently available in the UK, France, Germany and Denmark. The teams will be allocated to the home airports of the aircraft were possible to facilitate maintenance necessities. Experience from previous SCANS surveys has shown the importance of allowing sufficient time for all relevant national agencies to be informed about the planned survey. Special flying permits might be necessary to survey at the survey altitude of 600 feet, to ensure safe passage through military areas and to fly over or in the vicinity of offshore wind farms.

The circle-back method to estimate the probability of seeing animals on the transect line (Hiby 1998; Hiby & Lovell 1998) will be used for harbour porpoise, as in previous SCANS surveys, but also for dolphins and minke whales. If insufficient data are obtained for dolphins or minke whales to estimate the probability of seeing animals on the transect line, estimates will be partially corrected in the same way as for SCANS and SCANS-II using independent data on availability (Hammond *et al.* 2002; 2013).

Constraints and assumptions:

Aerial surveys cannot be conducted in bad weather. By conducting the survey in July, as in previous surveys, we expect there to be sufficient good weather available within the survey window. If 2016 has exceptionally poor weather, survey effort may be less than planned or the survey period may be extended slightly if resources allow. This should not affect ability to obtain accurate estimates of abundance but may result in estimates with poorer precision.

Aircraft require maintenance on a strict schedule depending on the number of flight hours. Although all steps will be taken to ensure that maintenance does not interfere with the survey plan, it is possible that an unscheduled break will be needed, potentially requiring contingency plans to be implemented.

In some areas it is possible that the desired survey coverage may be difficult to obtain due to unpredictable events, such as military activities.

2.2 Ship Surveys

The ship surveys will be coordinated by the University of St Andrews and, in the Skagerrak-Kattegat-Belt Seas, by Aarhus University.

The target study area to be covered by ship surveys comprises the Skagerrak-Kattegat-Belt Seas and offshore waters to the west of the continental shelf. The Skagerrak-Kattegat-Belt Seas area will be surveyed for 2 weeks in July 2016. At least another three ships surveying for one month each in July 2016, will be required to survey waters to the west of Scotland, Ireland, France, Spain and Portugal.

Data collection methodology will follow that used in previous ship surveys (SCANS-II and CODA; Hammond *et al.* 2013; CODA 2009). The primary mode of data collection will be visual observation with two teams of observers located on each survey vessel using the trial configuration or “BT” method (Borchers *et al.* 2006; Laake & Borchers, 2004). Details of this method, as used in the SCANS-II and CODA surveys, are given in Hammond *et al.* (2013). A rotation of observers on each platform will operate and a total of eight observers will be needed on each vessel.

Surveying will occur for at least 10 hours a day when sighting conditions are favourable (sea conditions up to and inclusive of a maximum of Beaufort scale 4). Survey effort will be recorded real-time using software linked to the Global Positioning System (GPS) of the ship. Sightings data will be recorded by an automated data collection system (see above). Pre-prepared data sheets and audiotape will be available as back-up. Cruise leaders and observers will process, check and back up data at the end of each survey day.

In addition to visual observations, acoustic data will be collected using a 300m-long towed hydrophone array deployed from the stern of each ship. The hydrophone will be linked directly to an on-board PC running PAMGUARD software with additional hard drives for storing acoustic data generated during the survey.

Constraints and assumptions:

The only risk to implementation is exceptionally bad weather during July 2016. July is consistently the month with the best weather but, if weather is exceptionally bad in July 2016, this will result in less survey effort under acceptable conditions and estimates of abundance that are less precise than anticipated. However, this will not affect the accuracy of the estimates or the overall outcome of the project.

3. Data analysis

3.1 Validate datasets collected from aerial and shipboard surveys

An essential part of data analysis is to validate all datasets to ensure accuracy and consistency in the data. Datasets from the aerial and ship surveys will already be validated as part of the Implementation phase. However, there will be a requirement for final data validation, which will be undertaken using standard and purpose written software, ensuring that any errors and inconsistencies are identified and corrected and that any modifications to the source data are documented.

3.2 Estimate abundance and map distribution

a) Design-based estimation of absolute abundance

Data analyses will be based primarily on design-based line transect abundance estimation methods for visual data (e.g. Hammond *et al.* 2013). This analysis will generate estimates of abundance that are robust to violations of the usual line transect sampling assumptions that occur on cetacean surveys: animals missed on the transect line either through being underwater (availability bias) or not being detected (perception bias) and, for some species, animals responding to survey ships. Analyses will be conducted in software DISTANCE using so-called mark-recapture distance sampling (MRDS) methods that account for these features of the survey, as done previously in analysis of data from SCANS-II and CODA (Hammond *et al.* 2013; CODA 2009).

If sufficient acoustic data on sperm whales are collected on the ship surveys, estimates of abundance will be made using methods described in Lewis *et al. (*2007).

b) Model-based estimation of abundance

Using the survey data validated and prepared for design-based abundance estimation, density surface modelling will be undertaken to generate modelled maps of how abundance is distributed spatially at a much finer scale than the design-based estimates for survey blocks. Modelling methods used will be similar to those used to analyse SCANS-II and CODA data (Hedley & Buckland 2004; Hammond et al. 2013; CODA 2009). Using these model-based methods, abundance estimates can be generated for any appropriate defined area, such as MSFD Regional Seas or Assessment Units, and not just for designed survey blocks.

c) Factors influencing habitat use

The analytical methods used to generate model-based abundance (see above) also provide information on which natural (e.g. depth, seabed slope, sea surface temperature) and anthropogenic (e.g. shipping) features of the environment most influence density of cetacean species. Information from this modelling will also be valuable to inform area-based management.

d) Compare estimates of abundance and distribution in 2016 with those in 1994 and 2005/07

As part of SCANS-II, estimates of abundance for harbour porpoise, white-beaked dolphin, and minke whale for 2005 were compared with 1994 estimates from SCANS (Hammond *et al*. 2002; SCANS-II 2008; Hammond *et al*. 2013). The new estimates for 2016 from this project will be compared with those from 1994 and 2005 and also those from offshore waters in 2007 (CODA 2009). The wider areas surveyed in 2005/07 and 2016 will allow comparison of abundance estimates for many more species: harbour porpoise; bottlenose, common, striped, white-beaked and white-sided dolphins; pilot, sperm, and beaked whales; and minke and fin whales.

Data from SCANS were re-analysed using model-based methods as part of the SCANS-II project to allow modelled density surfaces to be compared between 2005 and 1994 (Hammond *et al*. 2013). A similar reanalysis will be undertaken in this project to model changes in distribution of key species over the last 20+ years.

4. Reporting

On completion of the project a report will be produced that describes the work done and the results achieved. Preliminary results will be available early in 2017 to inform initial MSFD assessments. Final results will be reported in time to inform MSFD assessments in 2018.

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Indicative Budget

	Item	CPU €[1]	Units	Total (€)
Survey Preparation	Update of software and equipment for the visual recording teams on the vessel, as well as building the data recording equipment	29,592	1	29,592
	Build kit and prepare equipment prior to surveys			25,900
	Update of aerial survey data collection software			3,000
	Training of cruise leaders prior to aerial survey			9,400
	Training of cruise leaders prior to vessel survey			4,700
	Total			**72,592**

	Item	CPU €[1]	Units	Total (€)
Ship surveys co-ordinated by St Andrews – unit cost	1 month ship charter (all vessel costs included)	276,000	1	276,000
	Cruise leader	12,000	1	12,000
	Observers	9,000	7	63,000
	Travel to vessel	250	8	2,000
	Hydrophone and Associated Electronics	13,200	1	13,200
	Visual survey kit (comprises 1* laptop, 2 * video camera, 2 * HD video camera, bespoke camera mounting, Shipping boxes, Data recorder kit (bespoke), hard drives for back up, angle boards)	19,200	1	19,200
	Binoculars for vessels (big-eyes; 7 x 50s) plus stands	3,480	1	3,480
	Total			**388,880**

	Item	CPU €[1]	Units	Total (€)
Ship survey co-ordinated by Aarhus	3 weeks ship charter (all vessel costs included)	97,986	1	**97,986**
	Cruise leader	15,645	1	**15,645**
	Observers	6,048	7	**51,156**
	Travel to vessel	250	8	**2,000**
	Hydrophone and Associated Electronics	13,200	1	**13,200**
	Visual survey kit (comprises 1* laptop, 2 * video camera, 2 * HD video camera, bespoke camera mounting, Shipping boxes, Data recorder kit (bespoke), hard drives for back up, angle boards)	19,200	1	**19,200**
	Binoculars for vessels (big-eyes; 7 x 50s) plus stands	3,480	1	**3,480**
	Aarhus staff time - preparations and planning	685	50	**34,250**
	Total			**236,917**

[1] VAT @ 20% included for equipment. Personnel costs are subject to change.

Aircraft - unit cost	1 month aircraft charter (all costs included)	55,250	1	55,250
	Cruise Leader	12,000	1	12,000
	Observers	9,000	2	18,000
	Travel & Subsistence (for 3 people)	16,000	1	16,000
	Equipment	3,120	1	3,120
	Total			**104,370**

Data analysis	Design based analysis of shipboard survey data and density surface modelling of all data	51,902
	Analysis of acoustic data	22,550
	Analysis of aerial survey data	47,117
	Total	**133,430**

The following table shows the indicative costs of the two current survey planning scenarios. Scenario 2 covers the area that is expected to be able to be surveyed with currently indicated financial contributions:

Scenario	**Cost**
1. Entire area (6 aircraft, 4 ships)	€ 2,236,000
2. Continental shelf (North Sea, Skagerrak, Kattegat, Belt Seas, shelf waters west of Britain and Ireland, Celtic Shelf, Channel) + offshore waters west of Britain and Ireland + Bay of Biscay (part) (6 aircraft, 2.5 ships)	€ 1,652,500