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OSPAR Interim Assessment 2017: Fish Indicator Data Manual (Relating to Version 2 of the Groundfish Survey Monitoring and Assessment Data Product)

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This report presents the results of marine and freshwater scientific work carried out by Marine Scotland Science.

Table of Contents

OSPAR Interim Assessment 2017
Fish Indicator Data Manual
(Relating to Version 2 of the
Groundfish Survey Monitoring and Assessment
Data Product)

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Executive Summary

This document reports on the outcomes of a workshop held at Marine Scotland Science, Marine Laboratory, Aberdeen in April 2016. The workshop was convened to examine Version 1 of the Groundfish Survey Monitoring and Assessment (GSMA) data product and revue the methods used to derive it. This data product was derived to support assessment of the state of fish species and communities, and the role of fish in the structure and functioning of marine food webs across the entire Northeast Atlantic region, from Norway to Gibraltar. As such, the data product was intended to meet the monitoring programme obligations of European Union Member States bordering the Northeast Atlantic region under the Marine Strategy Framework Directive. The job of the workshop was to ensure that the GSMA data product was fit for this purpose; that it could indeed meet the data needs necessary to calculate all fish species and community related indicators used in the upcoming OSPAR Interim Assessment 2017 (IA2017), as well indicators likely to be needed in future assessment cycles.

The workshop concluded that the data product was indeed fit for the purpose intended. Some minor issues in methodology were identified. These have subsequently been addressed, the methodology documentation (Moriarty et al. 2017) updated to reflect these changes, and a Version 2 data product produced. The Version 2 GSMA data product also takes into account any updates made by national data providers to the database held on the DATRAS portal over the intervening period between the download from which Version 1 was derived and up to approximately the end of October 2016 when data were downloaded to derive the Version 2 data product.

The main part of this document then proceeds to describe the content of the Version 2 GSMA data product. For each survey's standard monitoring programme (excludes samples collected before survey protocols became fully established and trawl

samples of extreme short and extreme long tow duration: see Moriarty et al. (2017) for further details), a series of diagnostic plots is presented that display the variation in, and relationships between, a range of key parameter values, temporal trends in sampling effort, and sampling frequency distributions for each ICES statistical rectangle covered by the survey. Charts are provided showing the locations of all trawl samples collected by each survey's standard monitoring programme. Two criteria for the inclusion of ICES statistical rectangles as part of each surveys standard survey area are presented. These include a new criterion not used in Moriarty et al. (2017) aimed at ensuring that, not only are rectangles sampled reasonably frequently, but that they are also sampled regularly throughout the course of each survey's time series. The consequences of applying these two criteria are explained and resulting standard survey areas for each individual survey data product are illustrated.

The Version 2 GSMA data product was used to support the OSPAR IA2017. This document, along with Moriarty et al. (2017), therefore, constitutes important quality assurance and audit evidence supporting the veracity of both the data product and the ensuing assessments reliant on these data.

1. Introduction

This document has primarily arisen following a workshop held at the Marine Laboratory, Marine Scotland, 375 Victoria Road, Aberdeen AB11 9DB, UK from 18 to 22 April 2016. Participants at the workshop and the main agenda items addressed are listed in the following two sub-sections. The workshop initiated the process of developing this manual, but work has continued subsequently. The content and structure of the OSPAR Groundfish Survey Monitoring and Assessment Data Product was discussed to ensure that the data product would meet assessment needs for all indicators

1.1. Participants at Workshop

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1.2. Main Agenda Issues at Workshop

1. To ensure that all indicator leads responsible for undertaking assessments and intending to use the Groundfish Survey Monitoring and Assessment (GSMA) data product fully understand the data contained therein, and that the data product is fully fit for purpose to meet all potential user's needs.
2. To consider the full suite of indicators to be used, now and in the future, in each OSPAR region (including common and candidate indicators, and any indicators that are under development and might be used in future assessment rounds).
3. To define definitive formulae and methods of calculation for each of these indicators, and thereby assess the likely data requirements for each potential indicator to ensure that the data product fully meets these needs.

4. To establish, as far as is possible, a common assessment analytical procedures for each indicator across all regions. (Not addressed in this report.)
5. To discuss how the individual indicator assessments might be integrated to derive an integrated ecosystem assessment for fish communities in the various subregions. (Not addressed in this report.)

1.3. Purpose of this Document

This document essentially provides an update to Moriarty et al. (2017). It provides a description of the Version 2 GSMA data product. Version 2 takes account of data updates made by national data providers and uploaded to the ICES DATRAS database portal by early November 2016. Data were downloaded from the DATRAS portal and processed following the procedures described by Moriarty et al. (2017) over the period 7 to 16 November 2016 to derive the Version 2 data product. This Version 2 data product takes account of all feedback from data providers following review of earlier drafts of Moriarty et al. (2017), and examination and testing of the earlier Version 1 data product. The Version 2 data product constitutes the Marine Strategy Framework Directive fish community monitoring programme for the Northeast Atlantic region to which all European Union Member States with coastlines bordering the region have contributed. This Version 2 data product was subsequently used to derive all the Descriptor 1 and Descriptor 2 indicators used to assess the state of fish species and communities, and the role of fish in marine food web structure and function (FC*x* and FW*x* indicators respectively) in the OSPAR Interim Assessment 2017.

2. Data Product Structure

The GSMA data product consists of two primary data tables for each survey, Sampling Information and Biological Information (see Moriarty et al. (2017) for full details regarding the sources and derivation of the GSMA data product).

2.1. Sampling Information

Two sampling information data products are provided. Both contain data only deemed to constitute standard monitoring programme data. Thus, only samples collected once the surveys had become fully established and routine, and collected using a standardised regular procedure (e.g. a single specified fishing gear, fished for a specified time, at a specified speed) are included. For some surveys, earlier years have been excluded if survey procedures were considered not to have been

fully standardised at the start of the full survey time series. Like-wise, trawl samples with duration less than 13 minutes or greater than 66 minutes, or collected using a non-standard fishing gear, have been omitted (see Moriarty et al. 2017 for further details). The difference between the two files is that the second file consists of a sub-set of the first, being just the trawl samples collected from within those rectangles deemed to constitute the standard survey area. Rectangles making up each survey's standard survey area have to meet two criteria:

1. They must have been sampled in at least 50% of years of the survey standard monitoring programme time series. Thus if the time series is 20 years long, only rectangles sampled in at least ten years are deemed part of the standard survey area; samples collected in rectangles not meeting this criterion have been omitted from the standard survey area file.
2. They must be sampled at least once in both the start and end periods of the time series, where these periods are defined as 20% of the times series. Thus in a 20 year time series, only rectangles sampled in at least ten years, and at least once in the first four years and once in the last four years of the times series will be deemed part of the standard survey area; samples collected in rectangles not meeting this second criterion have also been omitted from the standard survey area file.

This second criterion is a new addition implemented here for the first time. Previously, when considering the "Standard Survey Area", Moriarty et al. (2017) only considered the '50% of years' criterion, but the workshop believed that, given that these surveys have to some extent evolved over time, application of this criterion alone could result in some survey standard survey areas containing rectangles that were only sampled either towards the start, or towards the end, of the survey time series, and this was considered undesirable. Application of the second criterion, in addition to the first, ensured that any rectangles retained as part of a survey standard survey area were sampled reasonably frequently throughout the full period that the survey was in operation.

In defining these periods, the result of the division involved has always been rounded up. Thus, for example, in a 17 year time series, 50% is 8.5, so this has been rounded up to nine. The 20% start and end periods would arithmetically both be 3.4 years long, so again this has been rounded up to four years. Thus in such a time series, running perhaps from 1999 to 2015, to be included in the standard survey area, rectangles would have to have been sampled in at least nine years, and at least once in both the four year start and end periods, 1999 to 2002 and 2012 to 2015.

Both types of file have been included because the method for defining the standard survey area is based on whether ICES rectangles to be included meet the specified sampling criteria or not. This is appropriate where ICES rectangles constitute the basis for the survey design, which is generally the case in the northern parts of the Northeast Atlantic area, but may be deemed less appropriate in southern parts of the Northeast Atlantic area where the coastal continental shelf is much narrower and surveys tend to be stratified along depth bands, not ICES rectangles. Thus the Standard Survey Area data products might be more appropriate to support the assessment of environmental/fish community status in the Greater North Sea subregion and northern parts of the Celtics Seas subregion, but the full Standard Monitoring Programme data product might be more useful in the southern Celtic Seas and in the Bay of Biscay and Iberian Coast subregion. Again the provision of both types of product was requested as part of the consultation process.

Field		Unit	Description
HaulID	A27		Unique haul identifier (SurveyAcronym/Ship/Year/HaulNo)[1] (*H*)
Survey-Acronym	A13		Unique survey identifier (SubregionCountryGearTypeQuarter: e.g. GNSNedBT3)
Ship	A4		Unique vessel identifier (e.g. SCO3: *Scotia* III)
GearType	A4		Unique gear type code (BT = Beam Trawl, OT = Otter Trawl)
Gear	A6		Unique gear code (e.g. GOV = Grande Oerverture Verticale)
YearShot	S		Year that gear was shot[2]
MonthShot	S		Month that gear was shot[2]
DayShot	S		Day that gear was shot[2]
TimeShot	S	GMT	Time that gear was shot (in format HHMM)
HaulDur(min)	S	min	Duration of fishing operation[3]
ShootLat(decdeg)	N	Deg.	Latitude in decimal degrees of the haul shoot position[4]
ShootLong(decdeg)	N	Deg.	Longitude in decimal degrees of the haul shoot position[4]
ICESStSq	A5		ICES statistical rectangle where gear was shot
SurvStratum	A5		Stratum tag for stratified surveys[5]
Depth(m)	N	m	Depth tag assigned to the haul[6]
Distance(km)	N	km	Tow distance[7] ($d_{H,TOW}$)
WingSpread(m)	N	m	Mean distance between the wings during fishing operation[8,11] ($d_{H,WING}$)
DoorSpread(m)	N	m	Mean distance between the doors during fishing operation[9,12] ($d_{H,DOOR}$)
NetOpen(m)	N	m	Mean head-line height above seabed during fishing operation[10,13] ($d_{H,HEIGHT}$)
WingSwptArea(sqkm)	N	km^2	Area of seabed swept by the net[14] ($A_{H,WING} = d_{H,TOW}$ x ($d_{H,WING}$/1000))
WingSwptVol_CorF	N		Multiplier (1 / ($d_{H,HEIGHT}$/1000)): converts to 'density by wing-swept volume'[15]
DoorSwptArea_CorF	N		Multiplier ($d_{H,WING}$ / $d_{H,DOOR}$): converts to 'density by door-swept area'[16]
DoorSwptVol_CorF	N		Multiplier ($d_{H,WING}$ / ($d_{H,DOOR}$ x ($d_{H,HEIGHT}$/1000))): converts to 'density by door-swept volume'[17]

2.1.1. Notes for Sampling Information

1. This is a unique tag assigned to each haul. Using the survey acronym avoids conflict where the same haul number is used by more than one survey participant. Using 'Ship' avoids conflict where more than one vessel might be used in the survey by the same country. 'Haul No' is the same haul number used in the original national data set so hauls can still be related to original data.
2. All date components kept separate so that queries can be run on any individual component.
3. Time of hauling can be established by adding haul duration to time ("HourShot" & "MinShot") of shooting.
4. This is the latitudinal and longitudinal position in decimal degrees (e.g. 56.4333°N -01.7895°W) where the haul was shot. Ideally a mid-trawl position would be given, but haul positions were frequently missing. Only the shoot position was supplied for all hauls, although in some instances, this is an arbitrary position as it coincides with the central point of the nominal ICES statistical rectangle, which was applied when either no position data were available, or when the position data given were deemed to be incorrect.
5. This will be the same as the ICES statistical rectangle (identical to "ICESStSq") where ICES statistical rectangles constitute the survey strata (e.g. the North Sea IBTS).
6. Each haul will have a depth assignation. In most cases this is real data, either an average depth during the fishing operation, or a depth at the shoot position. But where depth data were absent in the original data, this will have been estimated. See Moriarty et al. (2017) for details.
7. This is the distance along the seabed that the trawl was towed. The values in this field will have been derived through several different procedures. See Moriarty et al. (2017) for details..
8. This is the mean distance between the wings of the net while the gear was towed between the shoot and haul positions. The values in this field will have been derived through several different procedures. See Moriarty et al. (2017) for details.
9. This is the mean distance between the trawl doors while the gear was towed between the shoot and haul positions. The values in this field will have been derived through several different procedures. See Moriarty et al. (2017) for details.
10. This is the mean height of the net headline above the seabed while the gear was towed between the shoot and haul positions. The values in this field will

have been derived through several different procedures. See Moriarty et al. (2017) for details.

11. For a beam trawl survey, the value in this field will be the width of the beam trawl.
12. For a beam trawl survey, this field is not strictly applicable. The value in this field will again be the width of the beam trawl, and so identical to the value in the "WingSpread(m)" field.
13. For a beam trawl survey, the value in this field will be the height of the beam trawl.
14. The 'standard' density values provided in the Biological Information are based on the area of seabed swept by the net, as this is deemed most appropriate for the majority of species sampled (Fraser et al., 2007). If for any reason these standard density data are considered inappropriate, then these 'standard' density estimates can be adjusted by multiplying them by an appropriate correction factor. Likely correction factors required are given in next three fields. Dividing by 1000 converts the wing spread distance in m to the equivalent distance in km.
15. For pelagic fish species, or even perhaps some bentho-pelagic species, densities based on the volume of water filtered by the net could be deemed to be more appropriate for some indicators. Multiplying the 'standard' density estimates in the Biological Information database by this correction factor will provide the required adjustment. Dividing by 1000 converts the headline height distance in m to the equivalent distance in km.
16. For the majority of demersal fish species, the area swept by the net is the appropriate swept area to use to estimate density. Only for haddock and whiting is there evidence of substantial herding by the trawl doors, such that wing swept densities infer an apparent catchability in the trawl of >1. Density estimates for species deemed likely to be herded by the trawl doors could be considered more appropriate; if so then multiplying the 'standard' density estimates in the Biological Information database by this correction factor will provide the required adjustment. There is no need to divide both measurements by 1000 to convert to km as this would simply cancel out.
17. Pelagic species might also be considered likely to be herded by the trawls doors, and as stated above, volume-filtered density estimates could be deemed more appropriate. Where both considerations are deemed pertinent, multiplying the 'standard' density estimates in the Biological Information database by this correction factor will provide the required adjustment. The first ratio, wing distance : door distance, needs no conversion to km as these would simply cancel. Only the headline height distance needs to be divided by 1000 therefore.

2.2. Biological Information

Again two types of Biological information file are provided, and since both type of file are provided to accompany each type of Sampling information file, this gives a total of four Biological information files for each survey. The principal file type has the kNN label. Data in these files include the results of the application of the k-Nearest-Neighbour procedure to resolve species density information to species density-at-length information (fish not measured, density data is for the whole catch of the species in question) and to resolve coarse taxonomic resolution level (genus or family-level, e.g Callionymus) density-at-length data to constituent species level (e.g. *Callionymus lyra*, *C. maculatus*, and *C. reticulatus*) density-at-length data (see Moriarty et al. (2017) for more details). The second file type, given the tag baseline, holds the original unresolved data (species density data and coarse taxonomic resolution level density-at-length data. Data in the baseline file types have, therefore, undergone the full quality assurance process described by Moriarty et al. (2017), with the exception of the application of the k-NN procedure. Again the provision of the baseline file type was in response to feedback from the data providers and from potential users of the data product.

The data file structure described in the table below relates primarily to the kNN file type. Some fields are absent in the baseline file type. The notes indicate which fields are missing and explains why.

Field		Unit	Description
HaulID	A27		Unique haul identifier (SurveyAcronym/Ship/Year/HaulNo)[1] (*H*)
SpeciesSciName	A45		Unique species name for each species sampled across the NE Atlantic[2] (*S*)
FishLength(cm)	S	cm	Integer numbers indicating fish length to the 'cm below'[3] (*L*)
IndivFishWght(g)	N	g	Estimated weight of individual fish of specified species and length[4] ($W_{S,L}$)
Number	N		Total number of fish of specified species and length in the catch[5] ($N_{S,L,H}$)
DensAbund(N_sqkm)	N	km^{-2}	Abundance density estimate[6,8] ($D_{nos,S,L,H} = N_{S,L,H} / A_{H,WING}$)
DensBiom(kg_Sqkm)	N	kg km^{-2}	Biomass density estimate[7,8] ($D_{biom,S,L,H} = (N_{S,L,H} \times W_{S,L}) / A_{H,WING}$)

2.2.1. Notes for Biological Information

1. This is a unique tag assigned to each haul. This field is identical to the field with the same name in the Sampling Information data table. This is the relational field linking these two tables.
2. Species names are the accepted scientific name as defined in the World Register of Marine Species (WoRMS). In the baseline file type, this field is

simply called SciName, because not all identification tags in the database are to species taxonomic resolution level.

3. All lengths in the data base are “to the cm below”: all fish of 11.0 to 11.9 cm therefore assigned a length of 11cm. Effectively, therefore, this is an integer field.
4. This is the mean weight of an individual fish of specified species and length derived from a weight at length relationship of the form $W_{S,L} = \alpha_S L^{\beta_S}$. Since all recorded lengths are to “the cm below”, the individual mean weights for each length class of each species are calculated for the half-centimetre; e.g. specified weight for a fish of recorded length 11 cm is the weight calculated for a fish of 11.5 cm from the weight at length relationship, this being the probable mean length of all fish between 11.0 and 11.9 cm. This field is missing in the baseline file type because species-specific weight at length relationships could not be applied where the fish in question have either not been identified to species, or measured to a length category, or both.
5. This is the number of fish of specified species and length obtained in the trawl sample. This is either the actual count or an estimate derived from the raising of a known sub-sample.
6. This is the local point abundance density estimate, the number of fish of species (*S*) and length (*L*) per square kilometre estimated at the spatial location of trawl sample (*H*). This is obtained by dividing the species total catch number at length ($N_{S,L,H}$) by the area swept by the net ($A_{H,WING}$).
7. This is the local point biomass density estimate, the biomass of fish of species (*S*) and length (*L*) per square kilometre estimated at the spatial location of trawl sample (*H*). This is obtained by dividing the species total catch weight at length ($N_{S,L,H}$ x $W_{S,L,H}$) by the area swept by the net ($A_{H,WING}$). This field is missing in the baseline file type because species-specific weight at length relationships could not be applied where the fish in question have either not been identified to species, or measured to a length category, or both. Thus estimates of individual fish weight could not always be determined.
8. As detailed above, if other density estimates are required (e.g. density as number/biomass per cubic metre of water filtered by the net, density as number/biomass per square metre of seabed swept by the gear, density as number/biomass per cubic metre of water filtered by the gear), then these density estimates need to be multiplied by one of the three correction factors given in the Sampling Information table for the haul in question.

3. Data Product Overview

3.1. General Comments

This section presents a summary overview of the OSPAR Groundfish Survey Monitoring and Assessment data product. Full details regarding the derivation of the data product are given in Moriarty et al. (2017).

The first section presents an overview of all the data that constitute the "Standard Monitoring Programme". However, Moriarty et al. (2017) stressed the need to define a "Standard Survey Area" for each survey and Table 1 confirms the necessity for this. It is clear that for several surveys the number of rectangles sampled in 50% of years in the time series, and in the 20% of years that constitute the start and end periods of the survey, is markedly lower than the number of rectangles actually sampled at any time by the survey.

The second section presents an overview of the final data products for the "Standard Survey Area" of each survey. For each survey the data excluded in reducing the data product to just these standard survey area data are described, along with the reasons for exclusion. In some instances, by excluding the earliest years of the survey, generally the years prior to the survey in question becoming fully established, the spatial extent of the "standard Survey Area" could be increased; more rectangles would end up meeting the two inclusion criteria. To be included with a survey "Standard Survey Area", rectangles had to be:

1. Sampled in at least 50% of years in which the survey was carried out;
2. Sampled in at least one year in periods at the start and the end of the time series, each representing at least 20% of the full time series.

For example, consider a 30 year time series, 1986 to 2015. To be included in the "Standard Survey Area" each rectangle would have to be sampled in at least 15 years, and at least once in the two six-year periods 1986 to 1991 and 2010 to 2015, to meet both criteria.

3.2. Full Standard Monitoring Programme Data Sets

Table 1 summarises the data content of each groundfish survey contributing to the data product. Further details regarding each survey can be obtained from Moriarty et al. (2017). Table 2 indicates the range (minimum and maximum values) of some of the key parameters held in the Sampling Information table. Then, for each survey,

key sampling information is displayed in two figures. The first figure illustrates key relationships between selected trawl sample information parameters and pertinent information regarding the survey, including:

i. The relationship between tow duration and tow distance, with the bounds representing the minimum and maximum acceptable tow speeds shown;
ii. The relationship between tow duration and the area swept between the wings of the trawl;
iii. The relationship between tow distance and the area swept between the wings of the trawl;
iv. The frequency distribution of tow duration;
v. The number of trawl samples collected in each year of the survey;
vi. The number of ICES statistical rectangles sampled by the survey in each year;
vii. The number of years that each individual ICES statistical rectangle was sampled over the course of the survey;
viii. Box and whisker plots of median tow speed (upper and lower quartiles indicated by the box, 95% of data range by the whisker, and outliers as dots);
ix. Box and whisker plots of the median multiplier value to convert wing-swept area density to wing-swept volume density (upper and lower quartiles indicated by the box, 95% of data range by the whisker, and outliers as dots);
x. Box and whisker plots of the median multiplier value to convert wing-swept area density to door-swept area density (upper and lower quartiles indicated by the box, 95% of data range by the whisker, and outliers as dots);
xi. Box and whisker plots of the median multiplier value to convert wing-swept area density to door-swept volume density (upper and lower quartiles indicated by the box, 95% of data range by the whisker, and outliers as dots);
xii. The relationship between wing-spread and door-spread;
xiii. The relationship between wing-spread and net-opening;
xiv. The relationship between door-spread and net-opening.

Note that where single values for WingSpread, DoorSpread, and NetOpen have been assumed, as for the beam trawl surveys, plots ix to xiv will simply show a single datum. Also note that some plots show occasional apparent outliers. These relate to 2016 data that, at the time of preparing this document, had only recently been added to the DATRAS data portal during the intervening period between derivation of the Version 1 and Version 2 data products. At the time of preparing these plots, there had not been time to refer these records back to the data providers to query their validity. However, prior to releasing the Version 2 data product, all these outliers had been referred back to the relevant data providers and either corrected, if

a transcription error, or replaced following the appropriate procedure to deal with incorrect data (Moriarty et al., 2017). These outliers predominantly related to door-spread data, which is not the primary information used to determine fish density data. Wing spread data constitute the primary information needed for this, and generally this field had few data outliers.

The second figure shows the locations of all the trawl samples plotted on a chart for each survey.

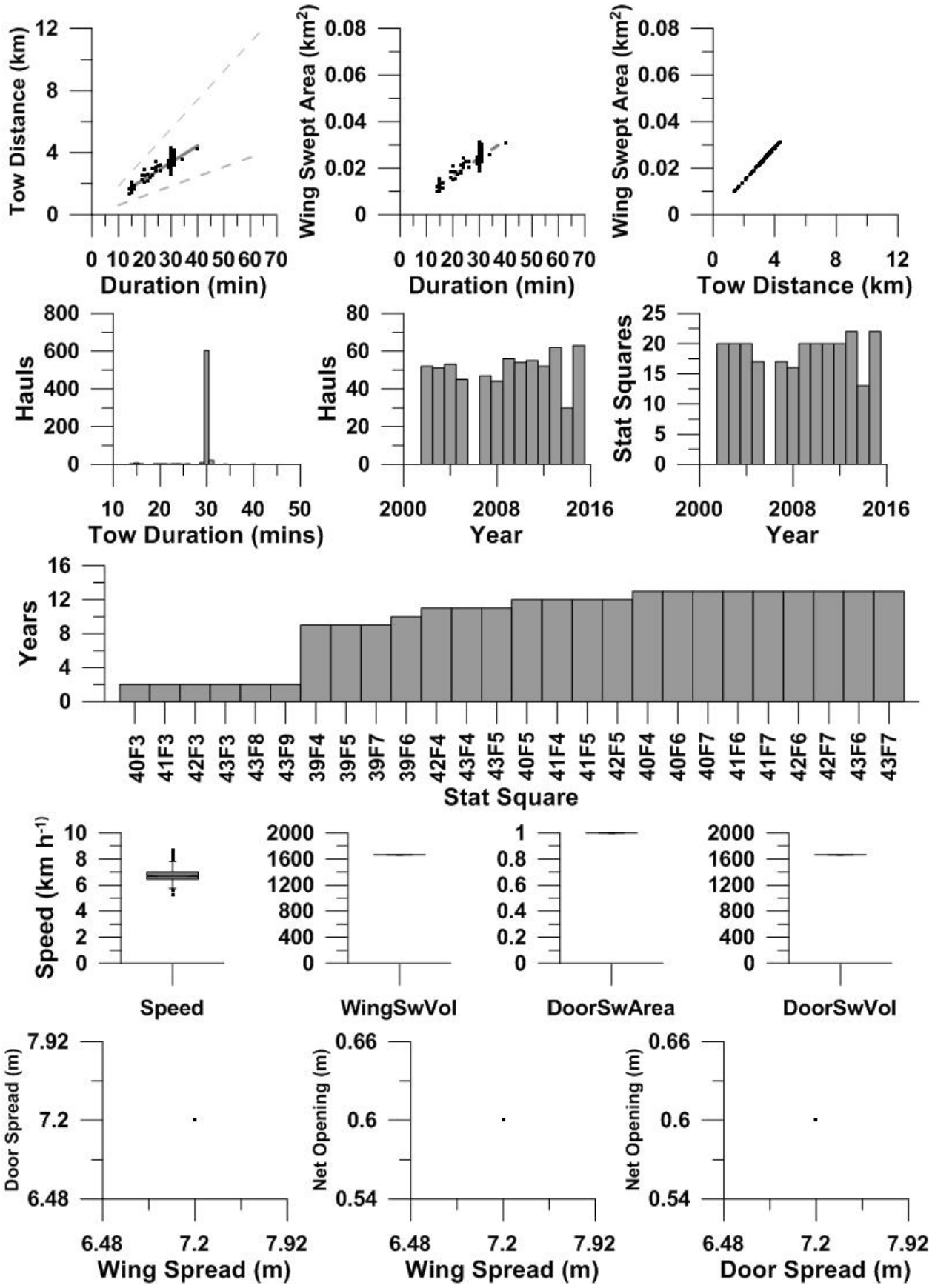
Survey	Start Year	End Year	Breaks	No. Years	Number of Trawl Samples		Number of ICES Statistical Rectangles	
					Full SMP	SSA only	Full SMP	SSA only
GNSGerBT3	2002	2015	2006	13	664	632	26	20
GNSNetBT3	1999	2015	None	17	2508	2375	123	89
GNSEngBT3	1990	2015	None	26	2386	2259	29	15
GNSIntOT1	1983	2016	None	34	13515	13207	195	171
GNSIntOT3	1998	2015	None	18	5872	5802	182	168
GNSFraOT4	1988	2015	None	28	2471	2440	16	15
CSEngBT3	1993	2015	None	23	2445	2378	32	23
CSScoOT1	1985	2016	None	32	1795	1492	69	39
CSScoOT4	1995	2015	2010	20	1310	1014	105	42
CSIreOT4	2003	2015	None	13	2118	1948	78	51
CSNIrOT1	1992	2015	None	24	1169	1073	19	12
CSNIrOT4	1992	2015	2008	23	1178	1054	19	12
CSBBFraOT4	1997	2015	None	19	2641	2572	74	65
BBIC(n)SpaOT4	1990	2014	None	25	579	502	11	7
BBIC(s)SpaOT1	1993	2014	1996, 2003	20	576	568	6	5
BBIC(s)SpaOT4	1997	2014	2013	17	510	506	6	5
BBICPorOT4	2002	2014	2003, 2004, 2012	10	866	839	22	18
WAScoOT3	1999	2015	2000, 2004, 2010	14	565	544	13	8
WASpaOT3	2001	2014	None	14	994	992	18	17

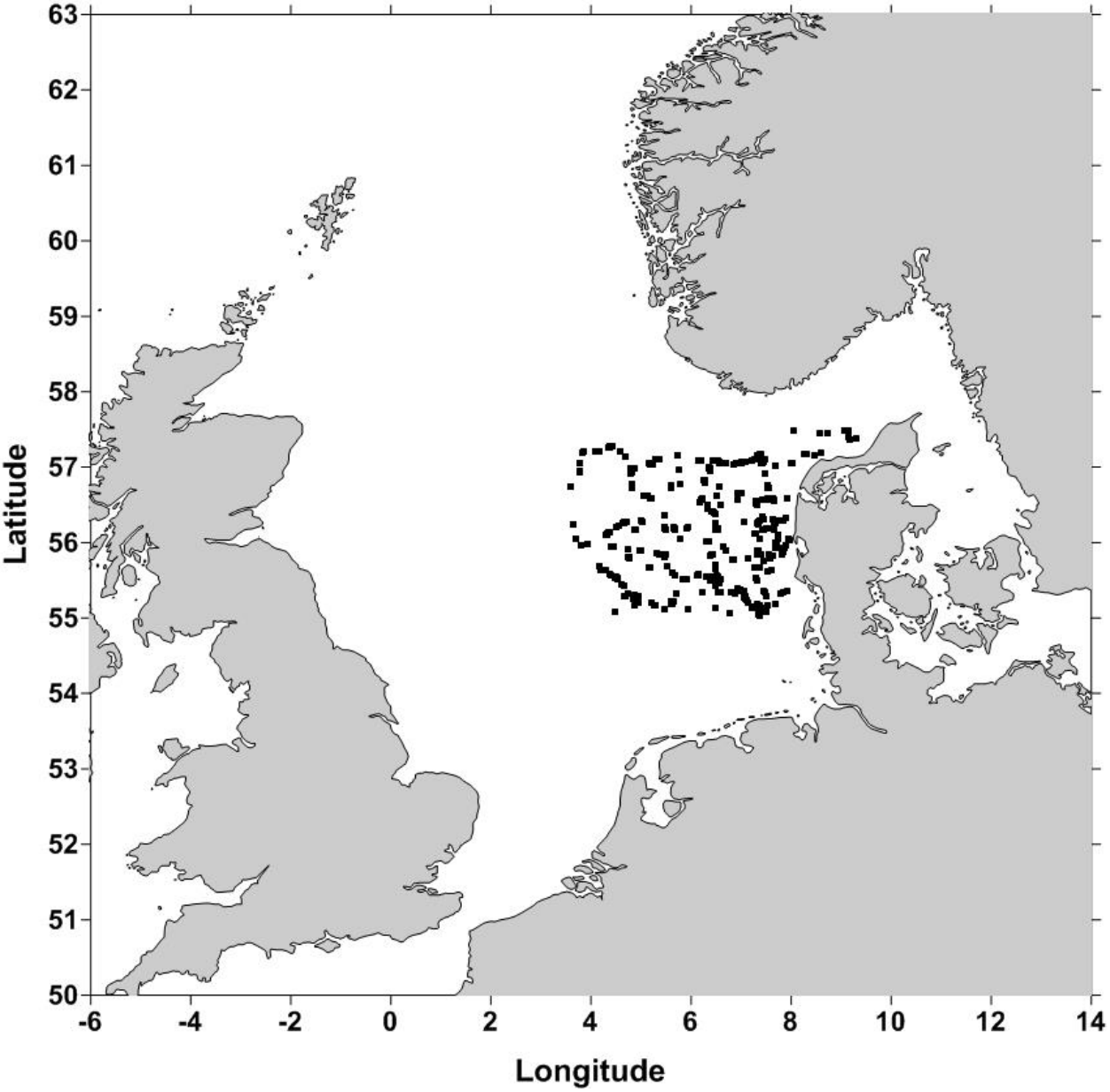
Table 1: Basic survey information. Time series start and end years, breaks in the time series if any, number of years in the time series. The total number of trawl samples collected and the total number of ICES statistical rectangles sampled in the whole standard monitoring programme (defined start and end years and standardised trawl duration of between 13 to 66 minutes) and from within the standard survey area (ICES statistical rectangles sampled in at least 50% of years that the survey was undertaken and at least once in both the start and end phases of the standard monitoring programme, in turn defined as periods of time equivalent to 20% of the number of years that the survey was undertaken).

Survey	Lat. south	Lat. north	Long. west	Long. east	Wing min.	Wing max.	Door min.	Door max.	NetO min.	NetO max.	SwptA min.	SwptA max.
GNSGerBT3	55.0212	57.4897	3.5958	9.3153	7.20	7.20	7.20	7.20	0.60	0.60	0.009958	0.031068
GNSNetBT3	51.4713	60.7518	-3.3223	8.2068	8.00	8.00	8.00	8.00	0.80	0.80	0.012032	0.085840
GNSEngBT3	48.7183	53.5917	-2.8433	2.7958	4.00	4.00	4.00	4.00	0.53	0.53	0.005932	0.029632
GNSIntOT1	49.6013	61.5843	-3.9700	12.8764	10.00	29.00	41.00	143.00	1.60	9.70	0.024076	0.217649
GNSIntOT3	51.5298	61.8833	-3.9640	12.8754	13.00	26.85	46.00	164.20	1.80	7.90	0.021723	0.113411
GNSFraOT4	49.3167	51.2567	-1.8030	2.4100	10.00	19.95	40.00	85.10	2.10	6.07	0.017863	0.103263
CSEngBT3	50.5350	54.8033	-8.0067	1.9933	4.00	4.00	4.00	4.00	0.53	0.53	0.004453	0.026496
CSScoOT1	53.4833	60.6000	-10.3192	-2.0167	10.00	26.00	40.00	129.00	3.30	7.10	0.027149	0.215928
CSScoOT4	48.0667	60.6333	-14.0167	-2.6833	13.00	25.00	50.00	118.00	2.80	6.70	0.024696	0.211166
CSIreOT4	50.0100	56.4900	-12.8410	-3.4590	12.00	31.00	30.00	153.00	3.00	7.00	0.030431	0.115754
CSNIrOT1	52.2923	54.7310	-6.1108	-3.4867	10.42	18.01	20.61	47.90	3.00	3.00	0.020728	0.108633
CSNIrOT4	52.2945	54.8112	-6.1068	-3.4750	9.73	17.69	18.54	46.60	2.40	3.50	0.018361	0.124126
CSBBFraOT4	43.3938	51.8321	-11.3465	-1.2567	13.00	30.00	47.00	119.00	2.50	6.20	0.028525	0.105810
BBIC(n)SpaOT4	43.3635	44.0453	-7.5530	-1.8987	10.66	22.80	41.50	128.83	1.40	3.30	0.030031	0.070092
BBIC(s)SpaOT1	36.0215	37.0367	-7.3433	-6.3217	11.40	23.00	37.37	183.00	1.00	3.40	0.044744	0.154468
BBIC(s)SpaOT4	36.0178	37.0405	-7.3502	-6.3233	11.30	25.00	42.22	147.64	1.00	3.20	0.049420	0.142560
BBICPorOT4	36.7883	41.8133	-10.1183	-7.4216	15.10	15.10	45.70	45.70	4.60	4.60	0.016402	0.078294
WAScoOT3	55.8203	58.3190	-15.9157	-12.9860	17.00	26.00	82.00	119.00	3.20	6.20	0.026730	0.112860
WASpaOT3	51.0610	53.9895	-14.9058	-11.2887	17.40	33.16	82.15	186.00	1.90	4.00	0.032077	0.112518

Table 2: Minimum (Min) and maximum (Max) Wing-spread (Wing), Door-spread (Door), Net-opening (NetO), Swept area (SwptA), Latitude (Lat: min = south, max = north) and Longitude (Long: min = west, max = east) values recorded in the database in each survey.

3.2.1. GNSGerBT3:

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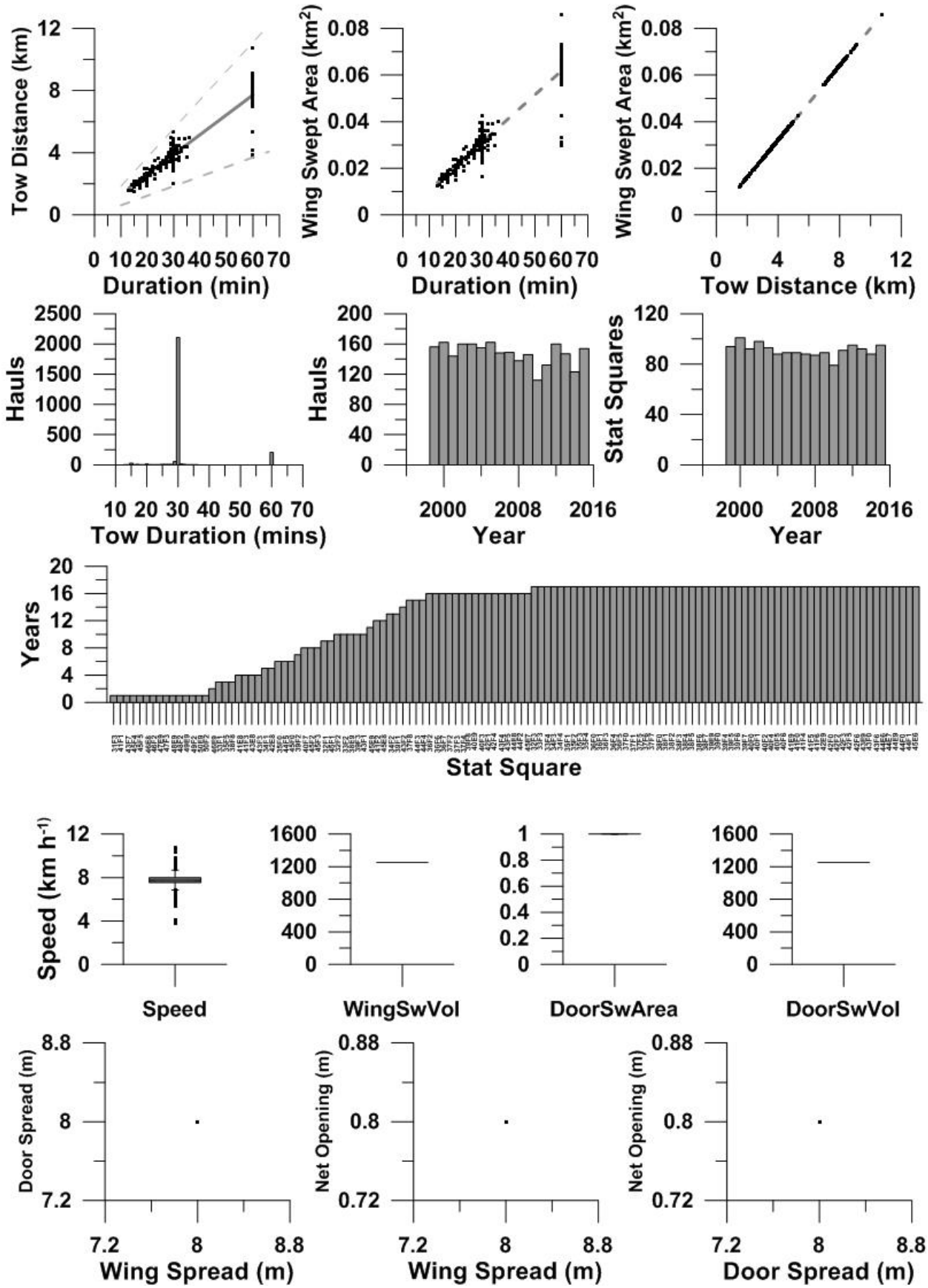
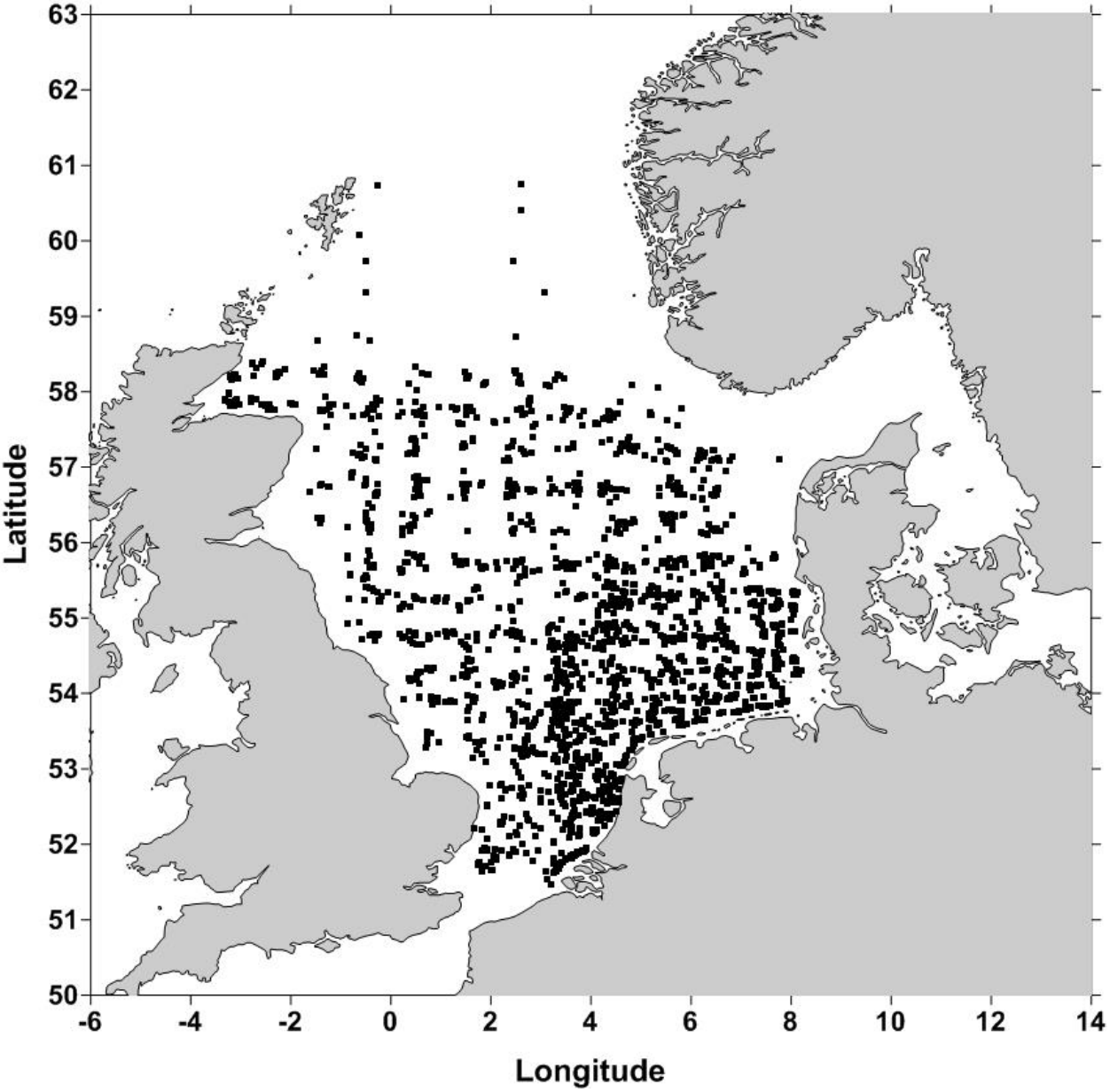
Longitude

3.2.2. GNSNetBT3

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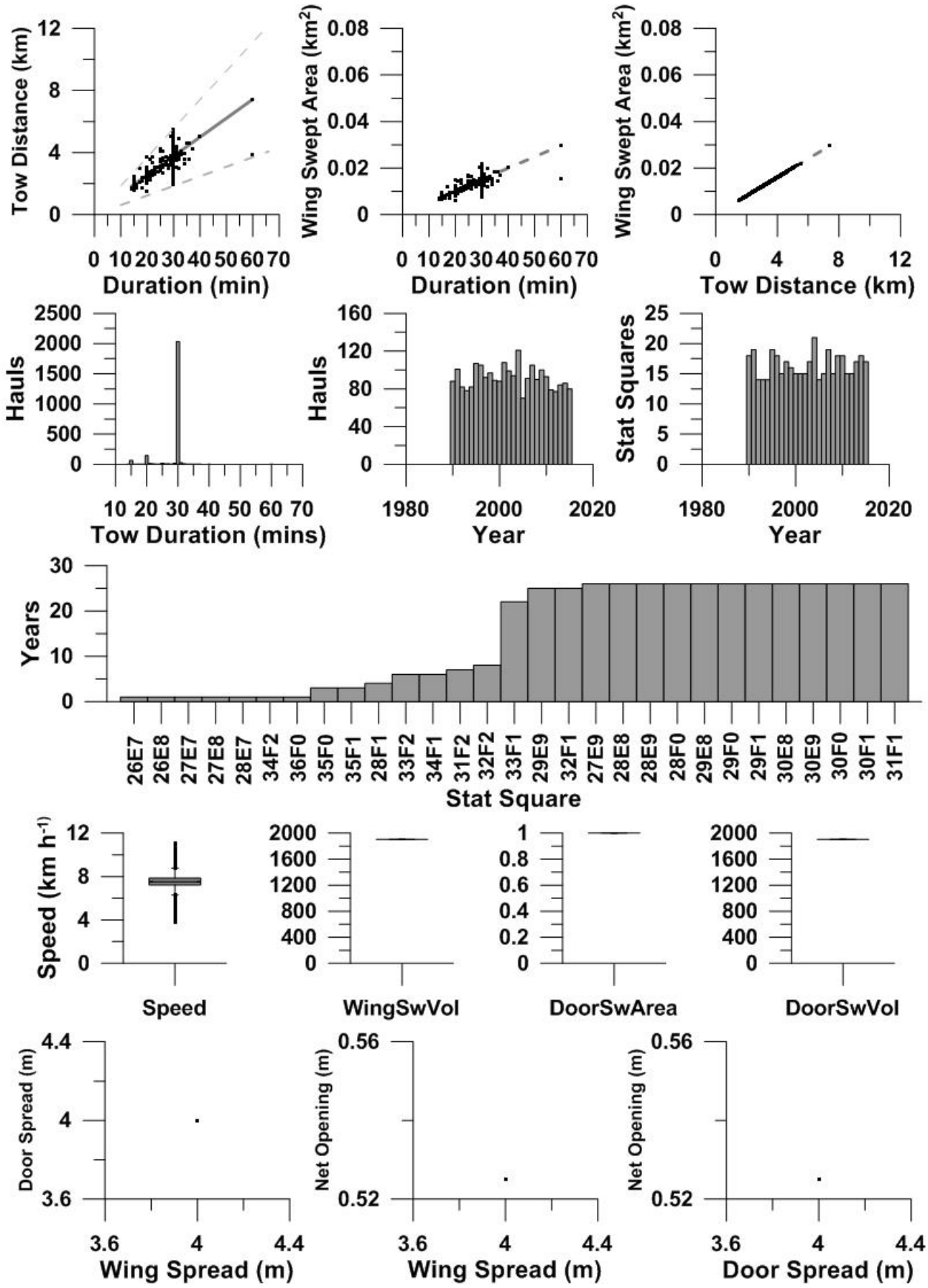
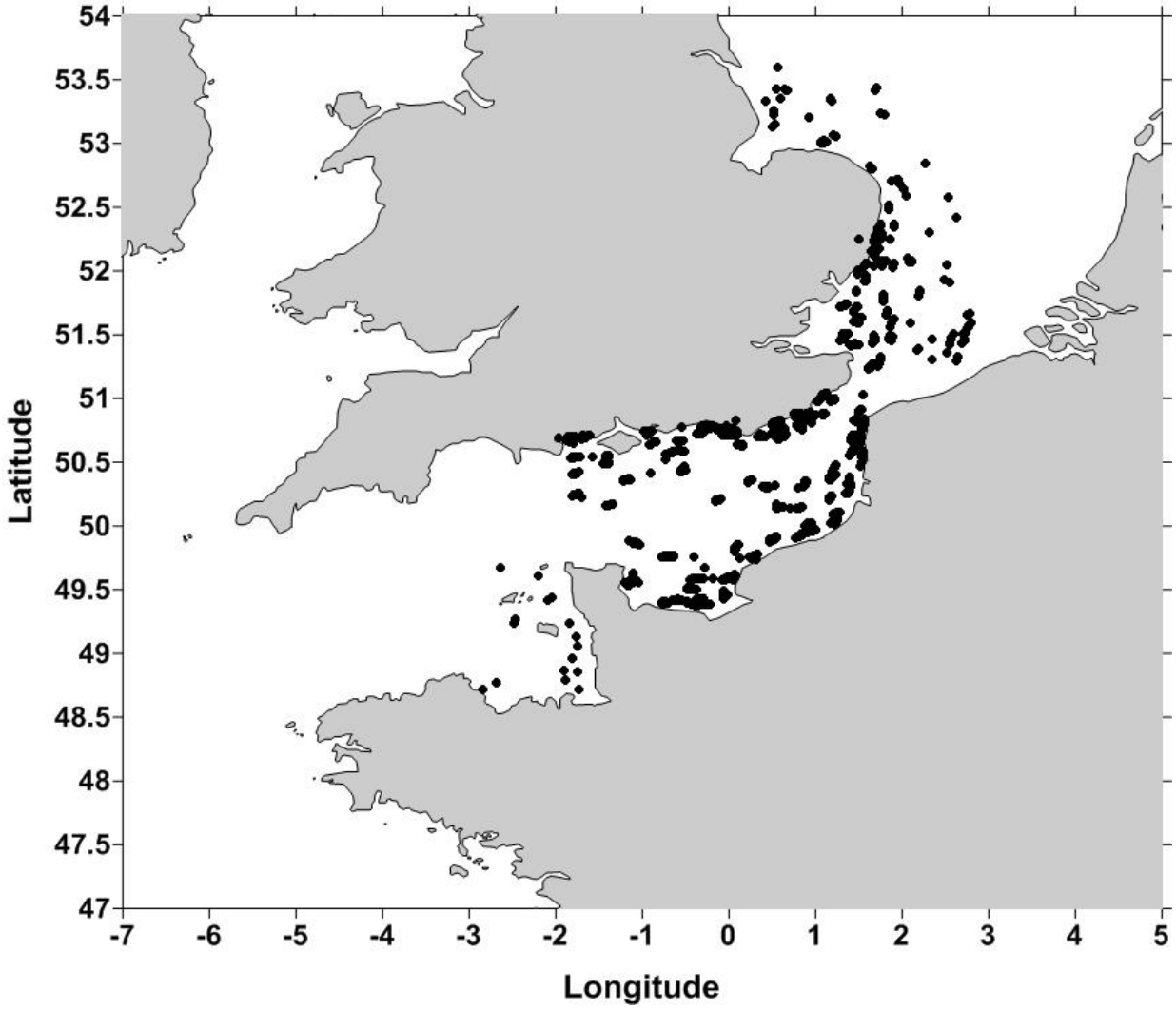
3.2.3. GNSEngBT3

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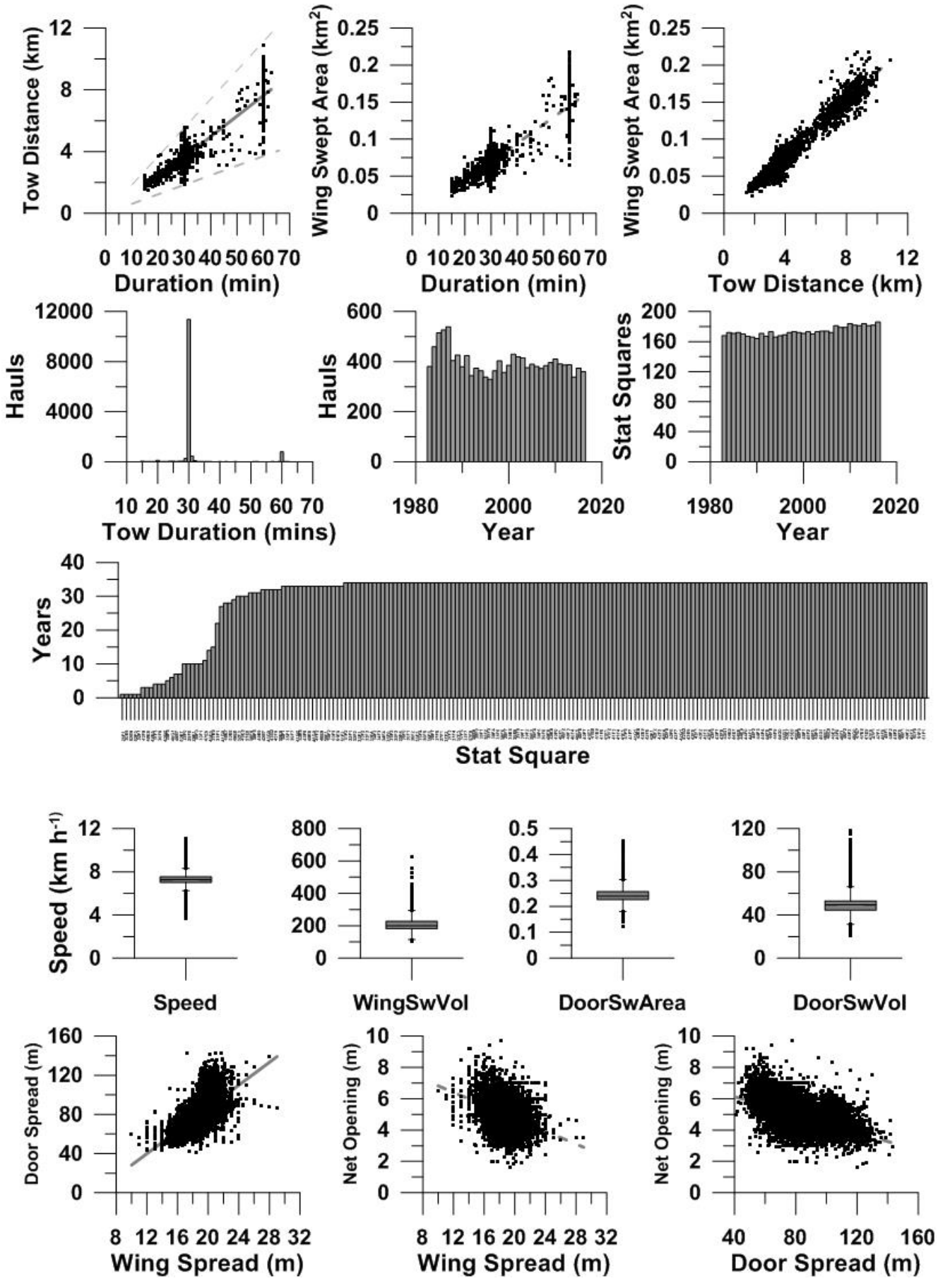
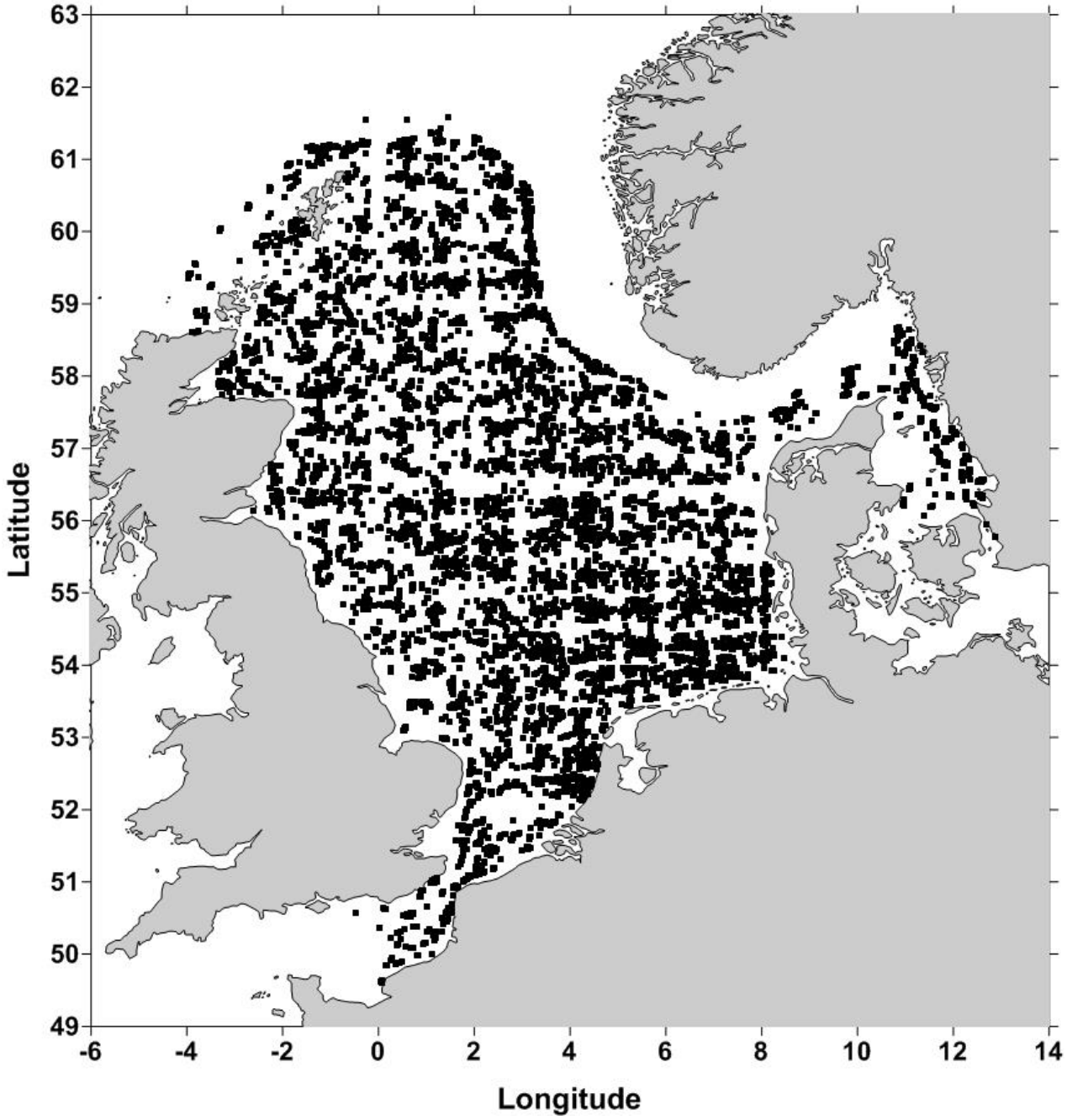
Longitude

3.2.4. GNSIntOT1

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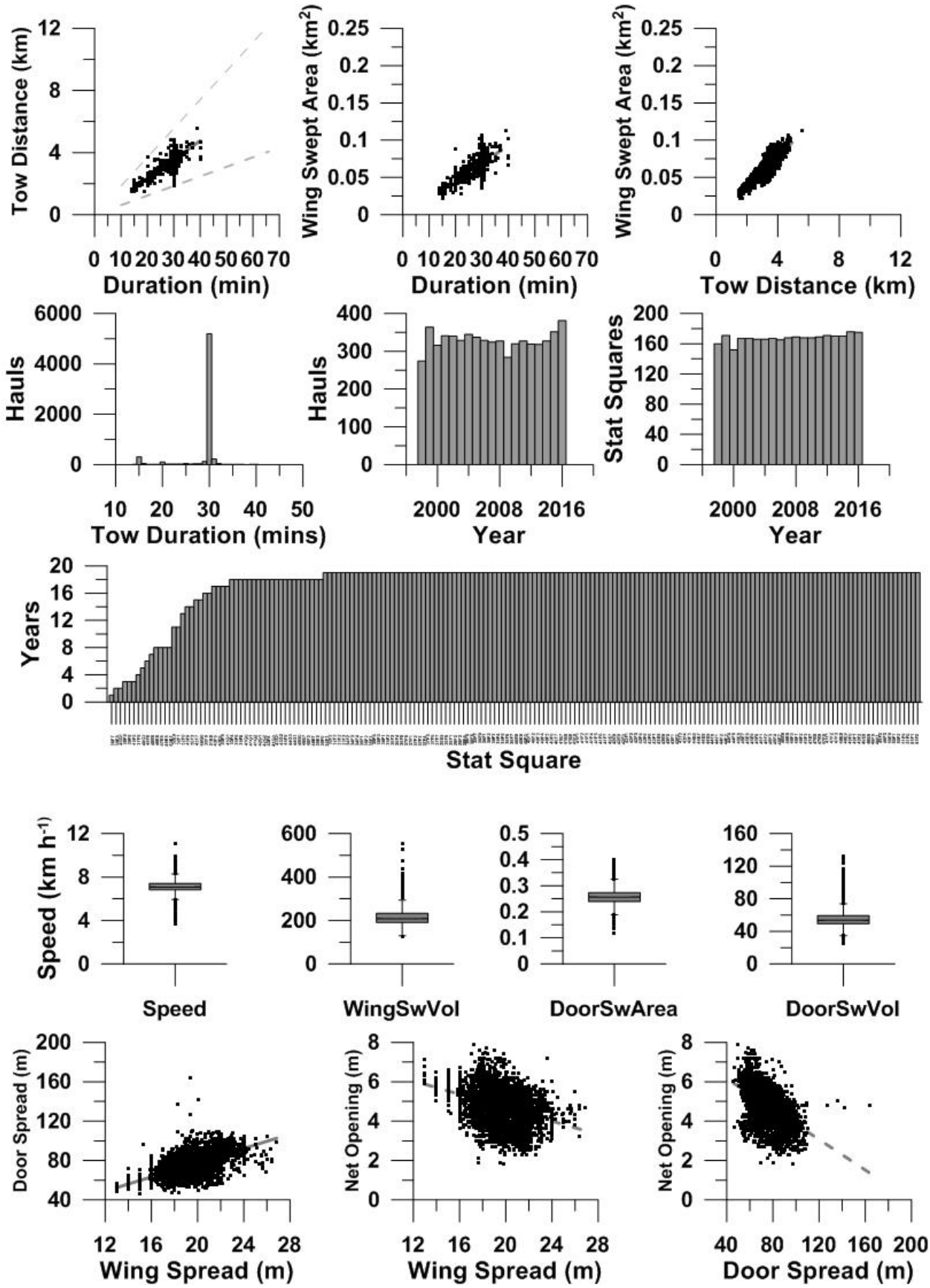
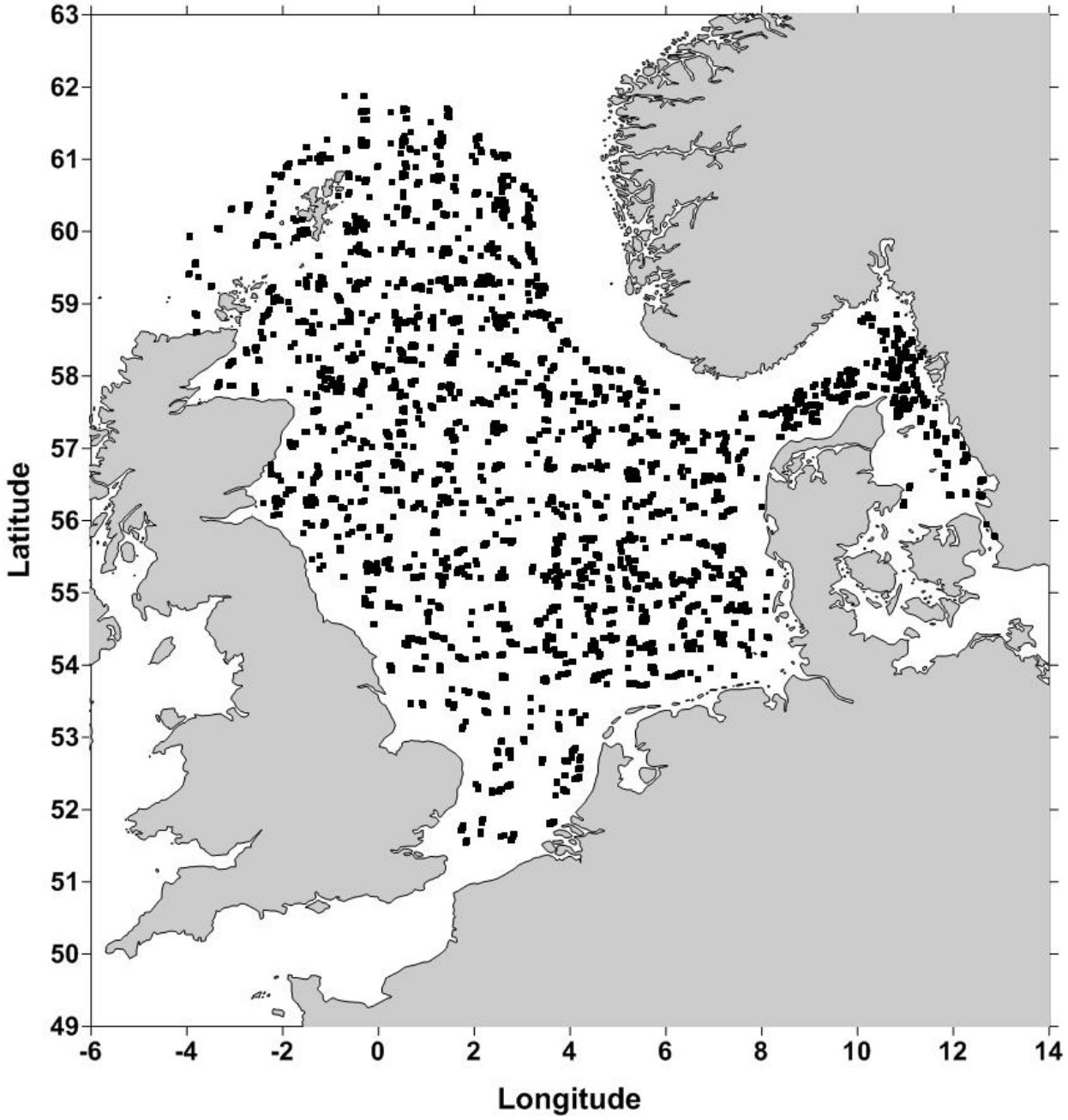
Longitude

3.2.5. GNSIntOT3

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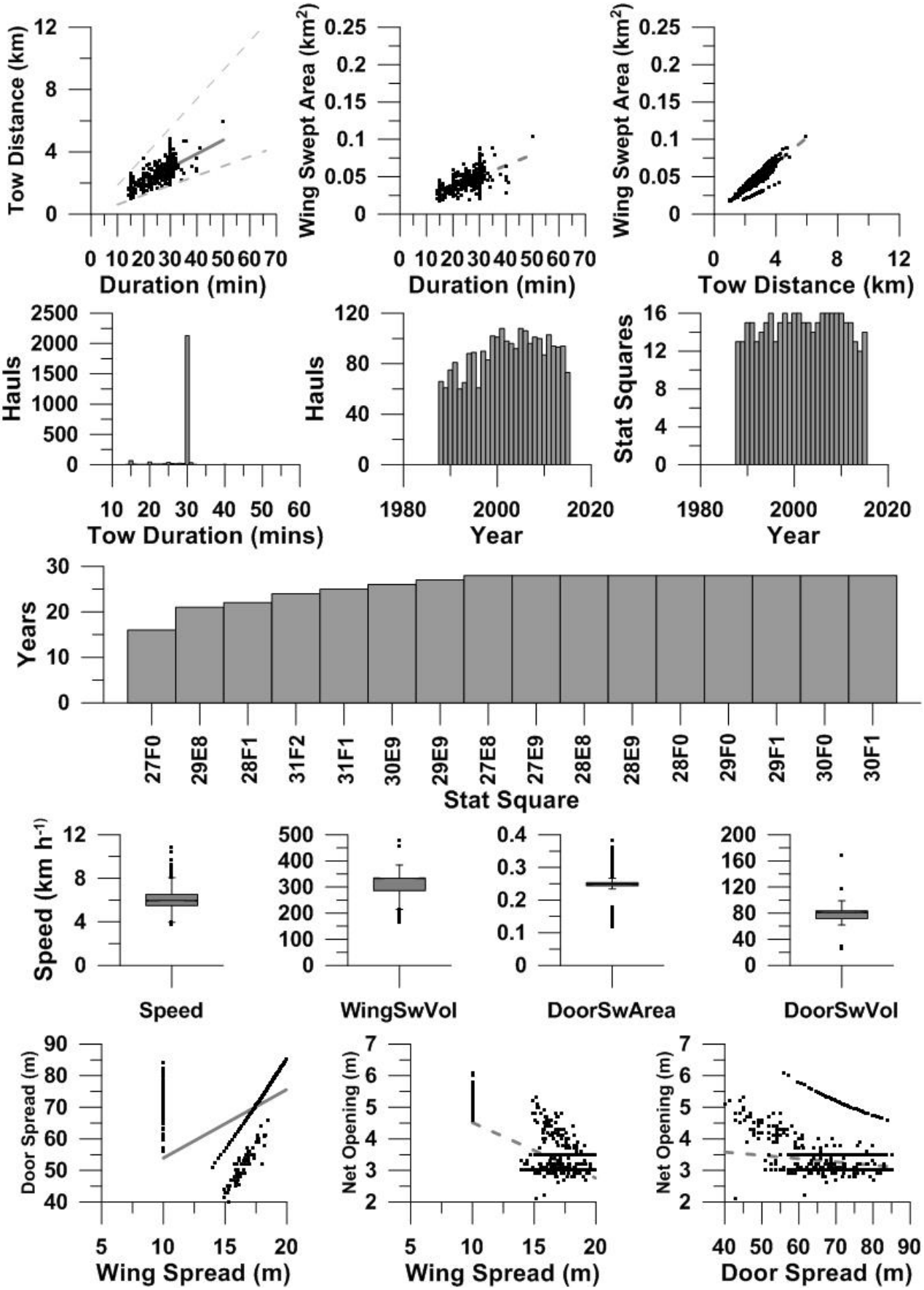
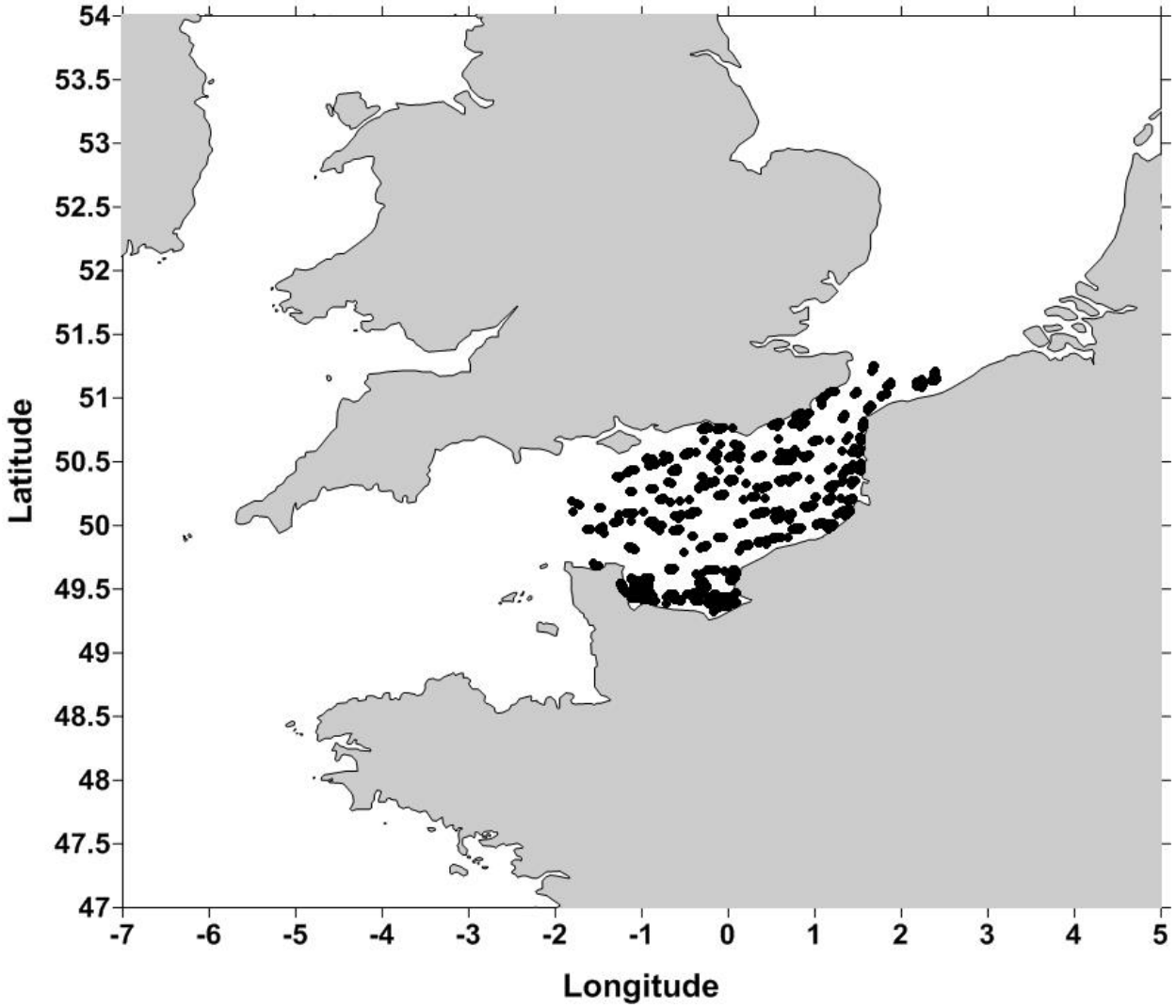
3.2.6. GNSFraOT4

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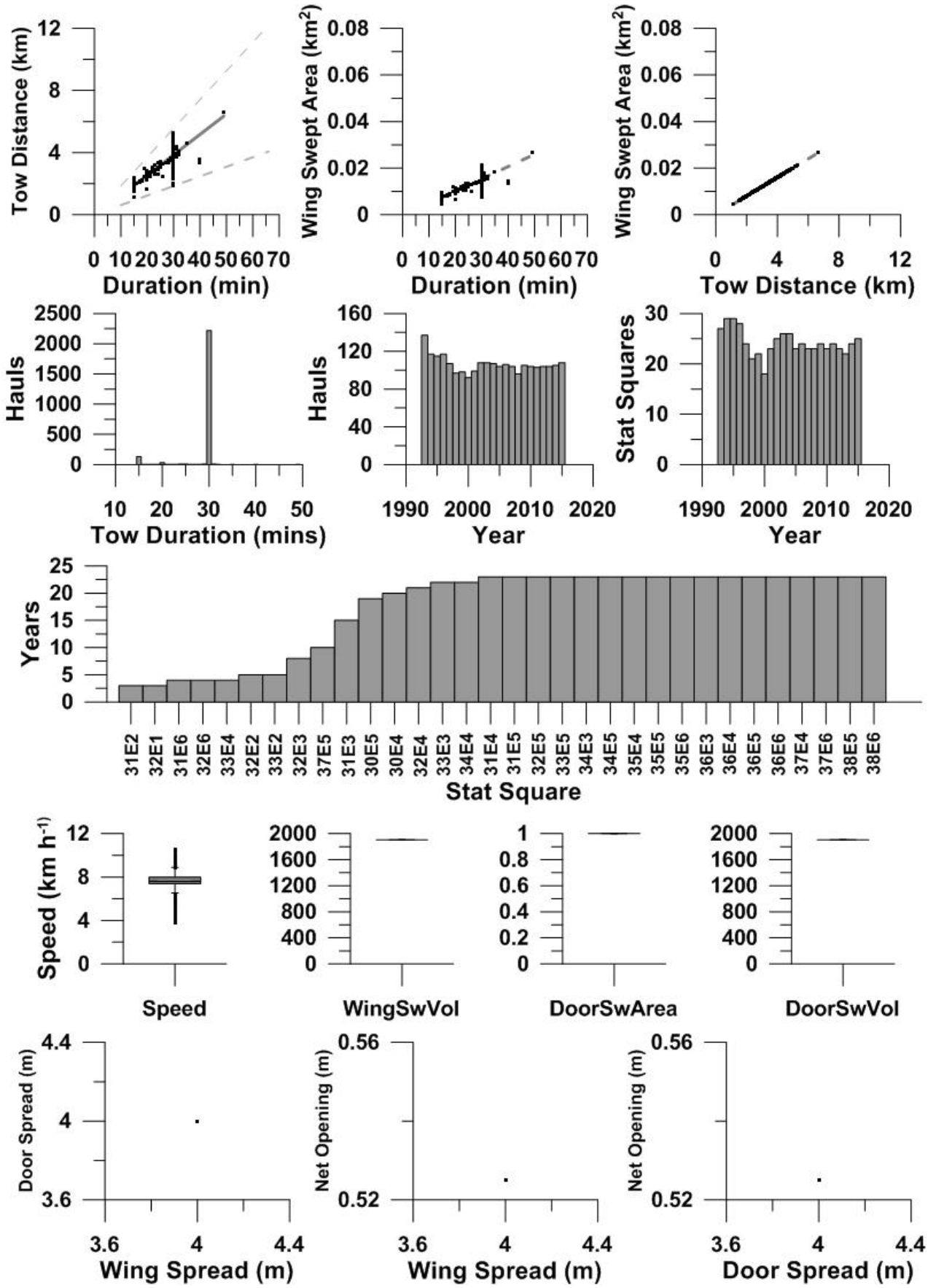
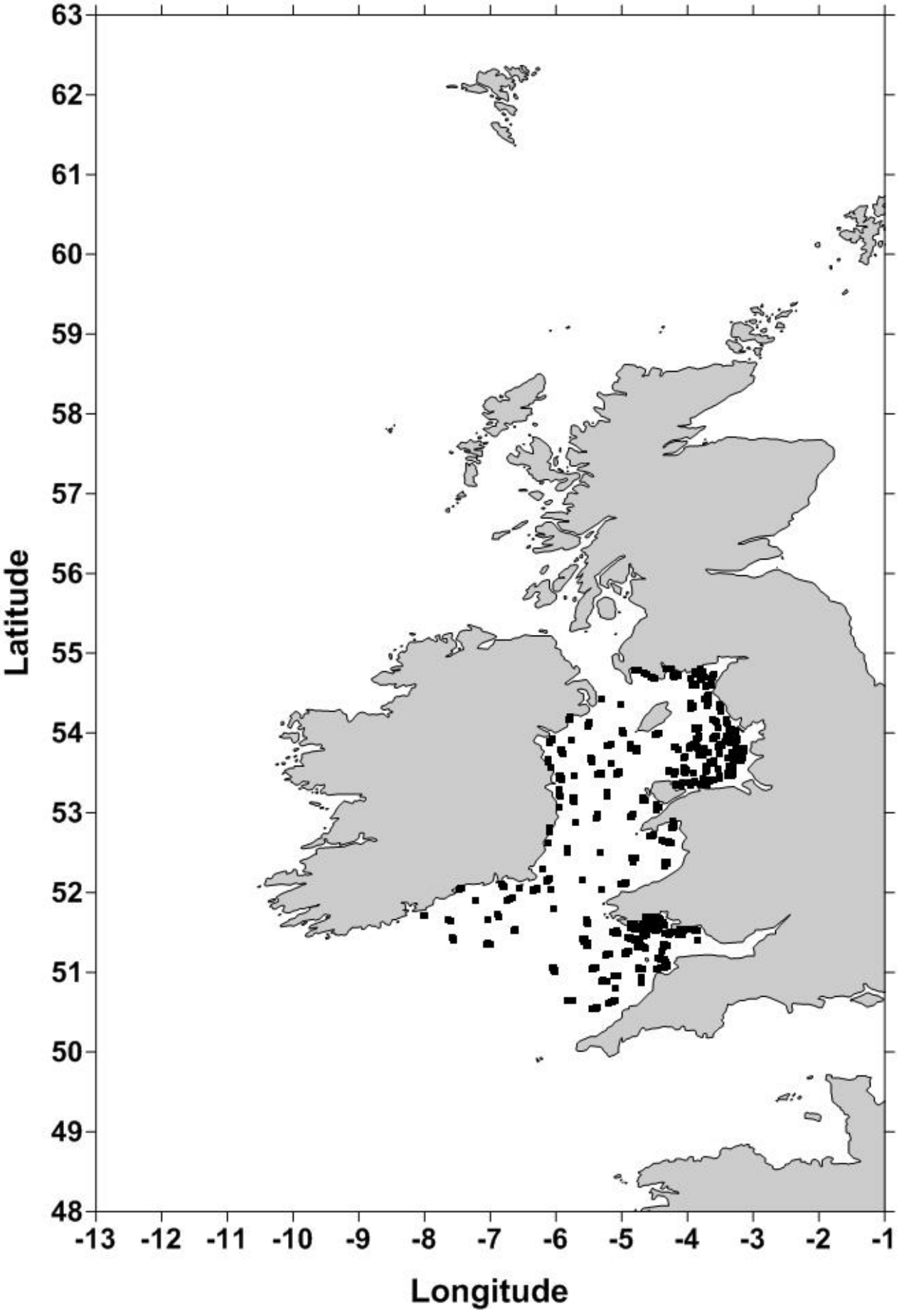
3.2.7. CSEngBT3

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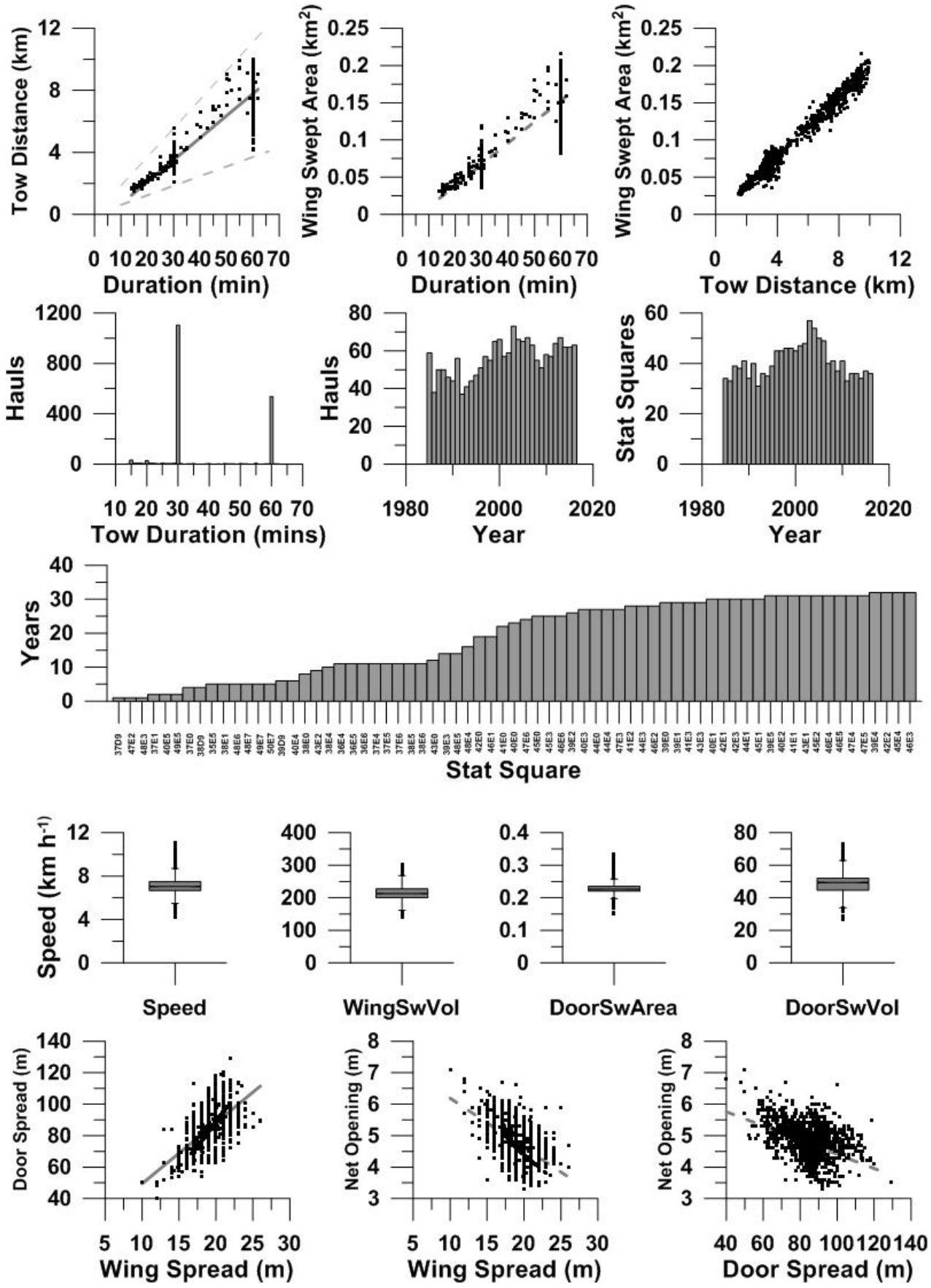
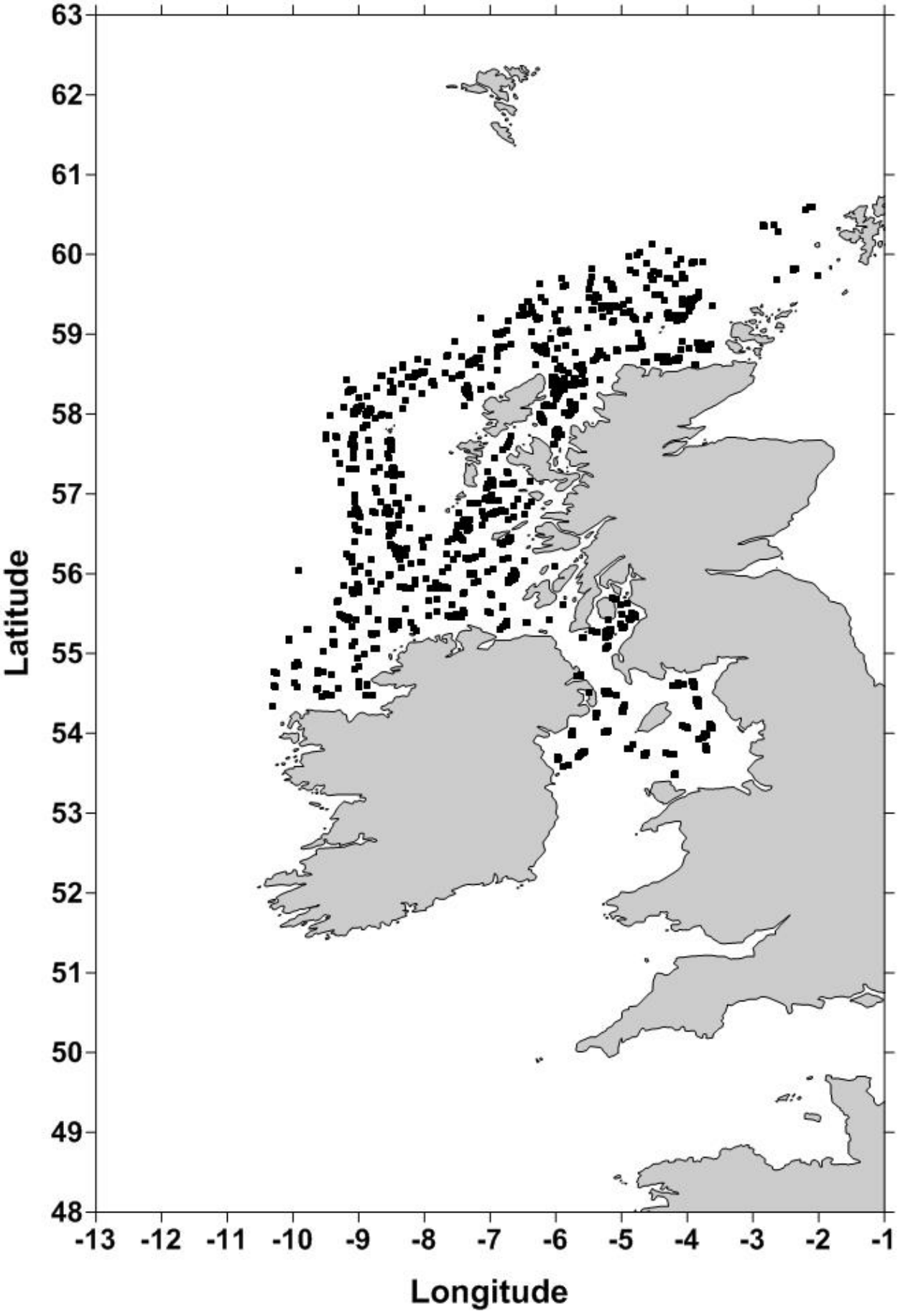
Longitude

3.2.8. CSScoOT1

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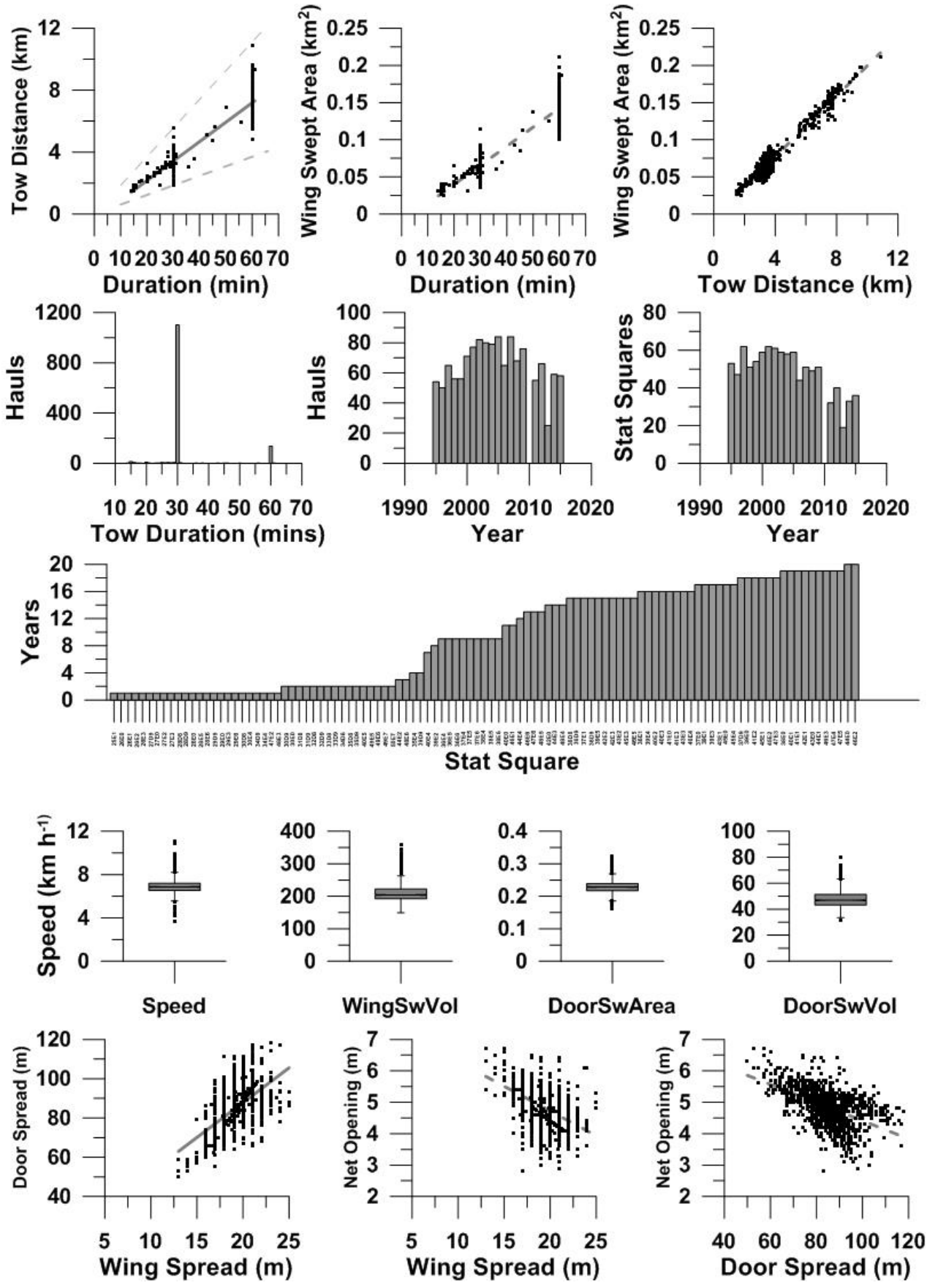
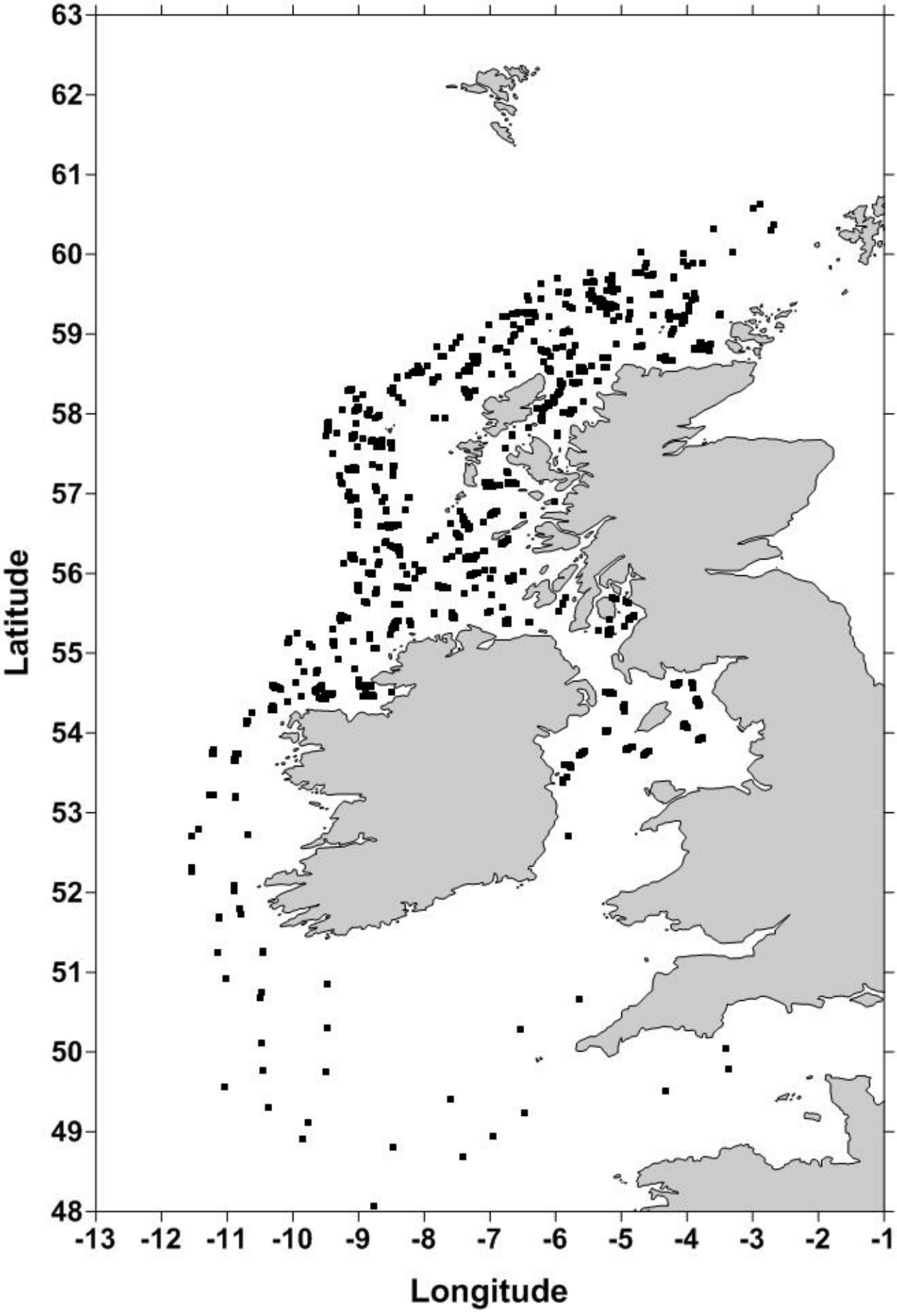
Longitude

3.2.9. CSScoOT4

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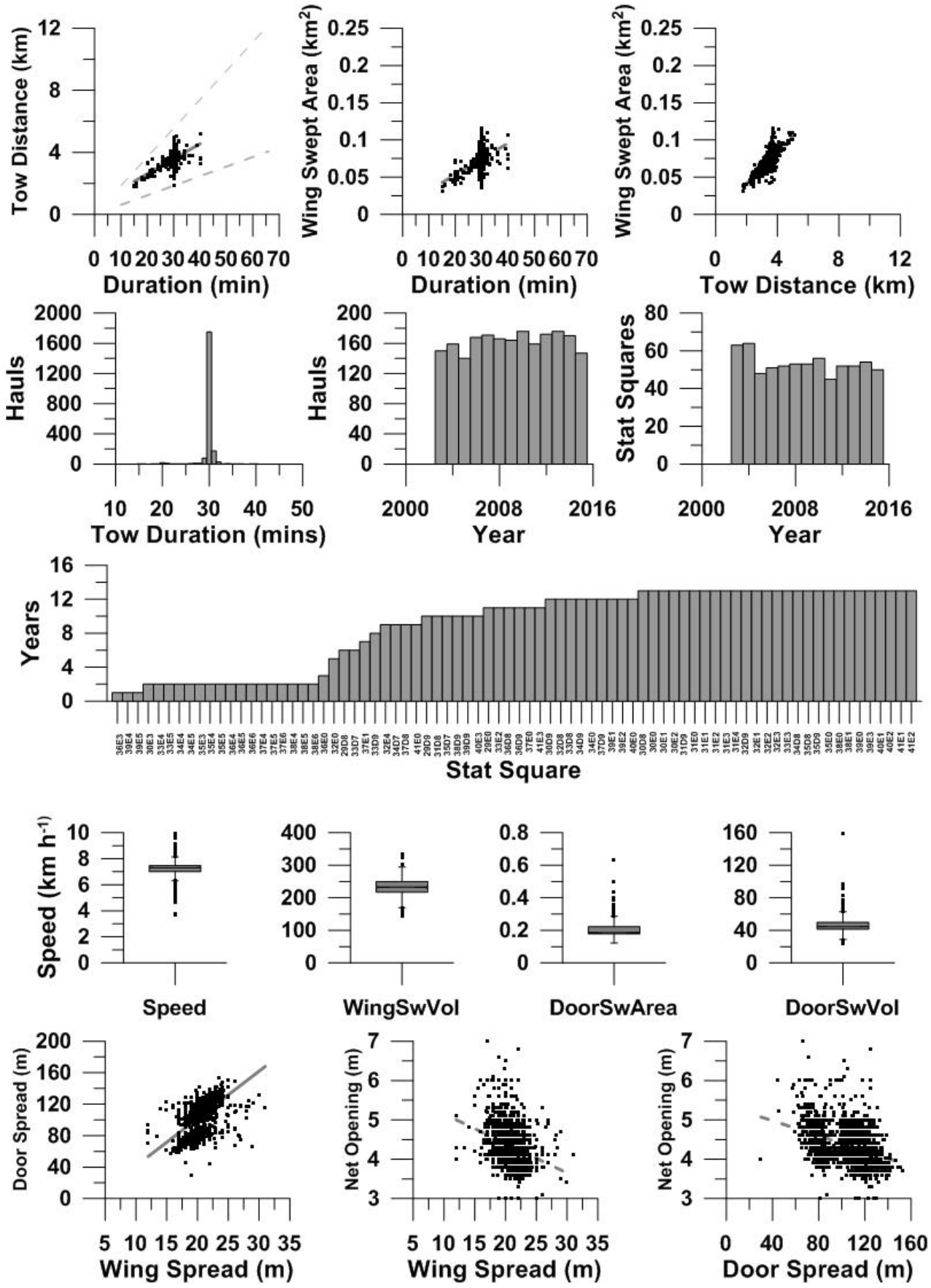
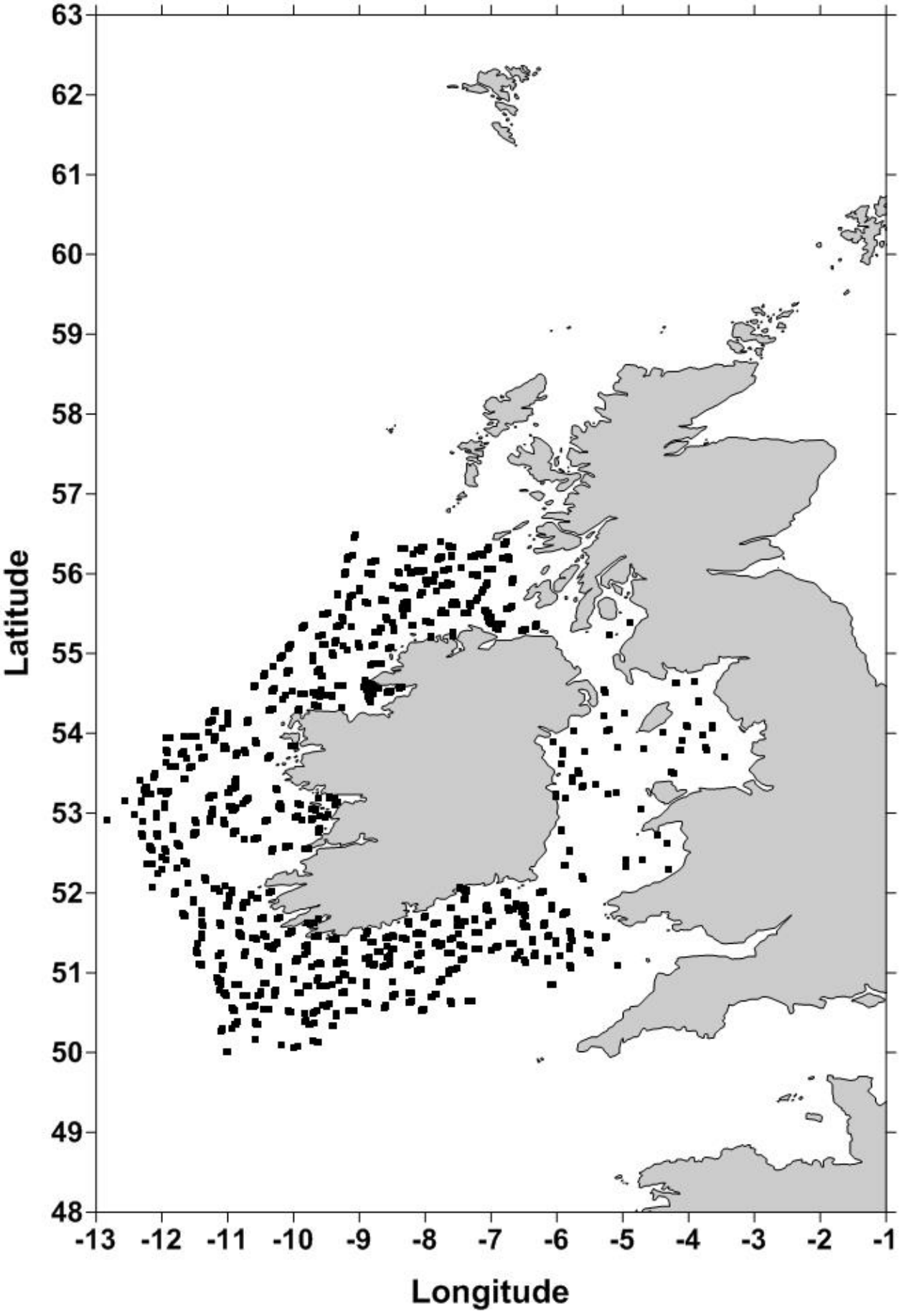
3.2.10. CSIreOT4

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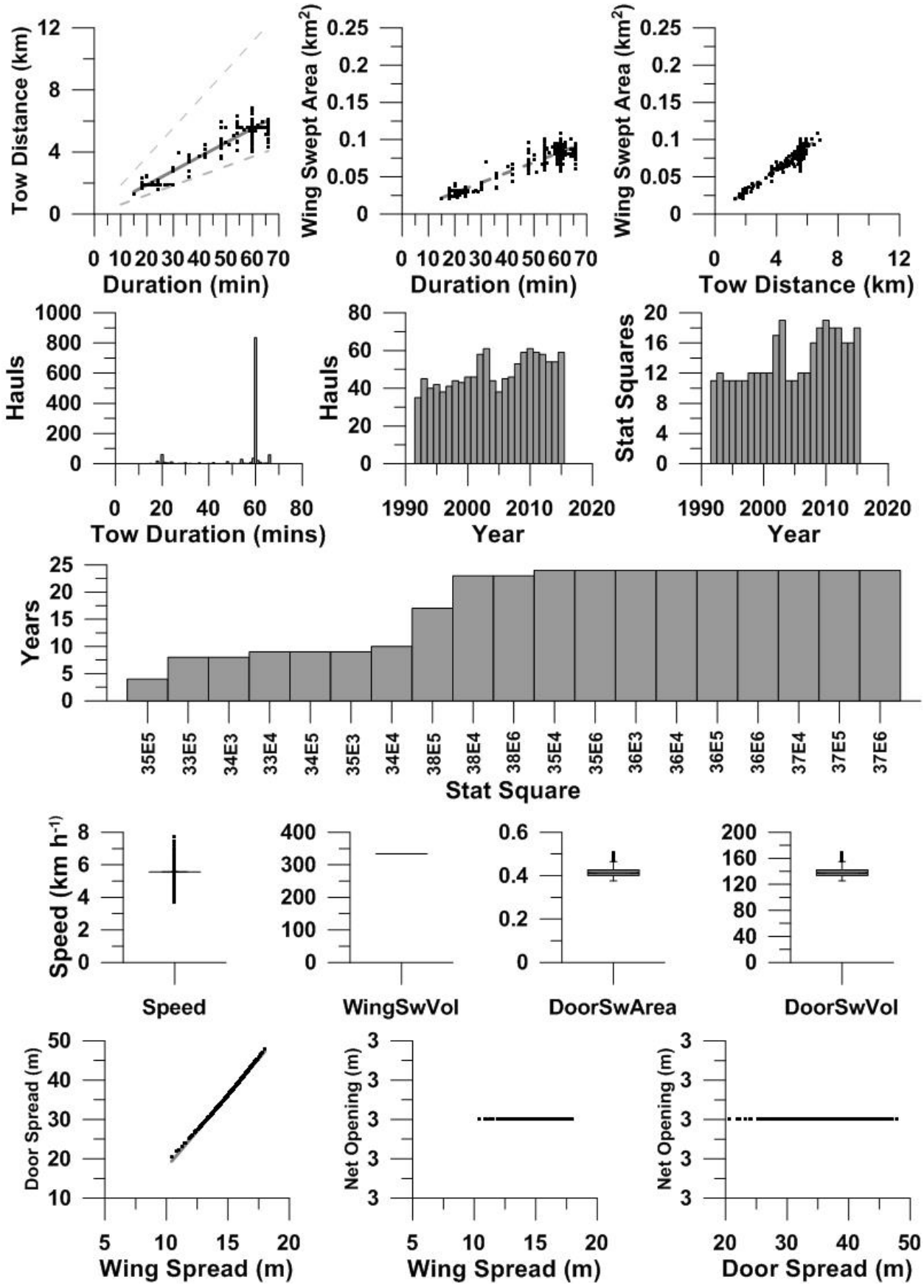
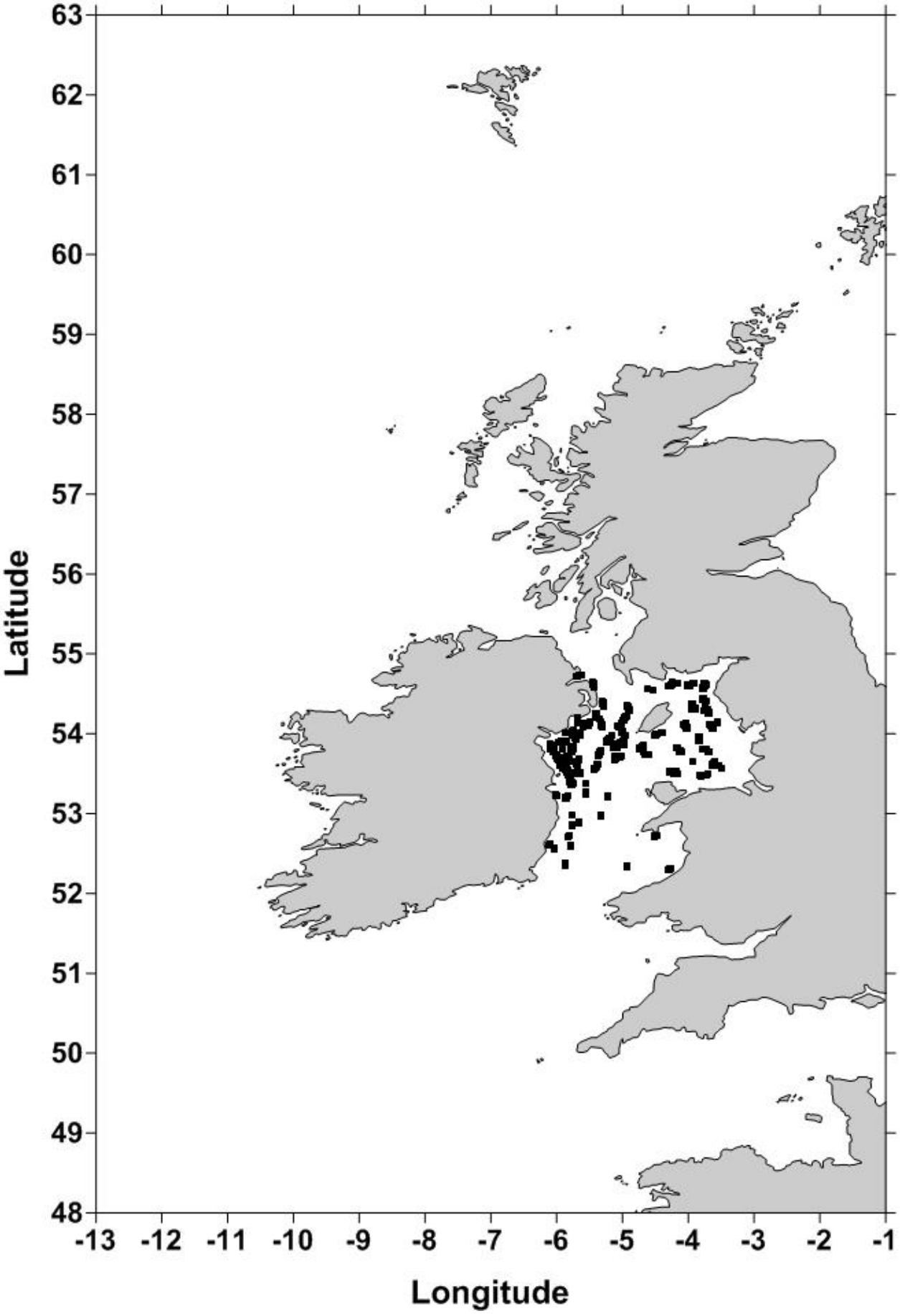
3.2.11. CSNIrOT1

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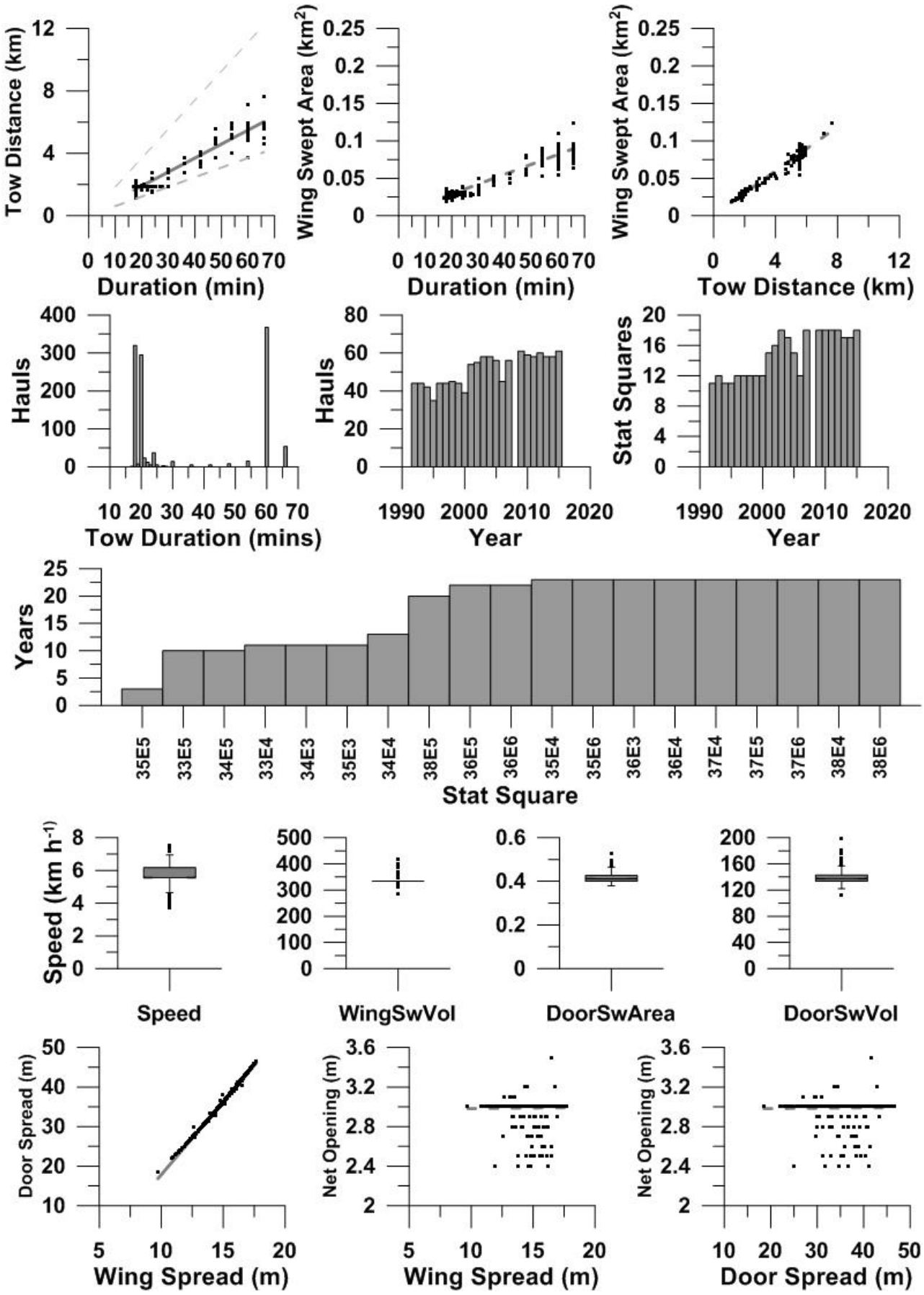
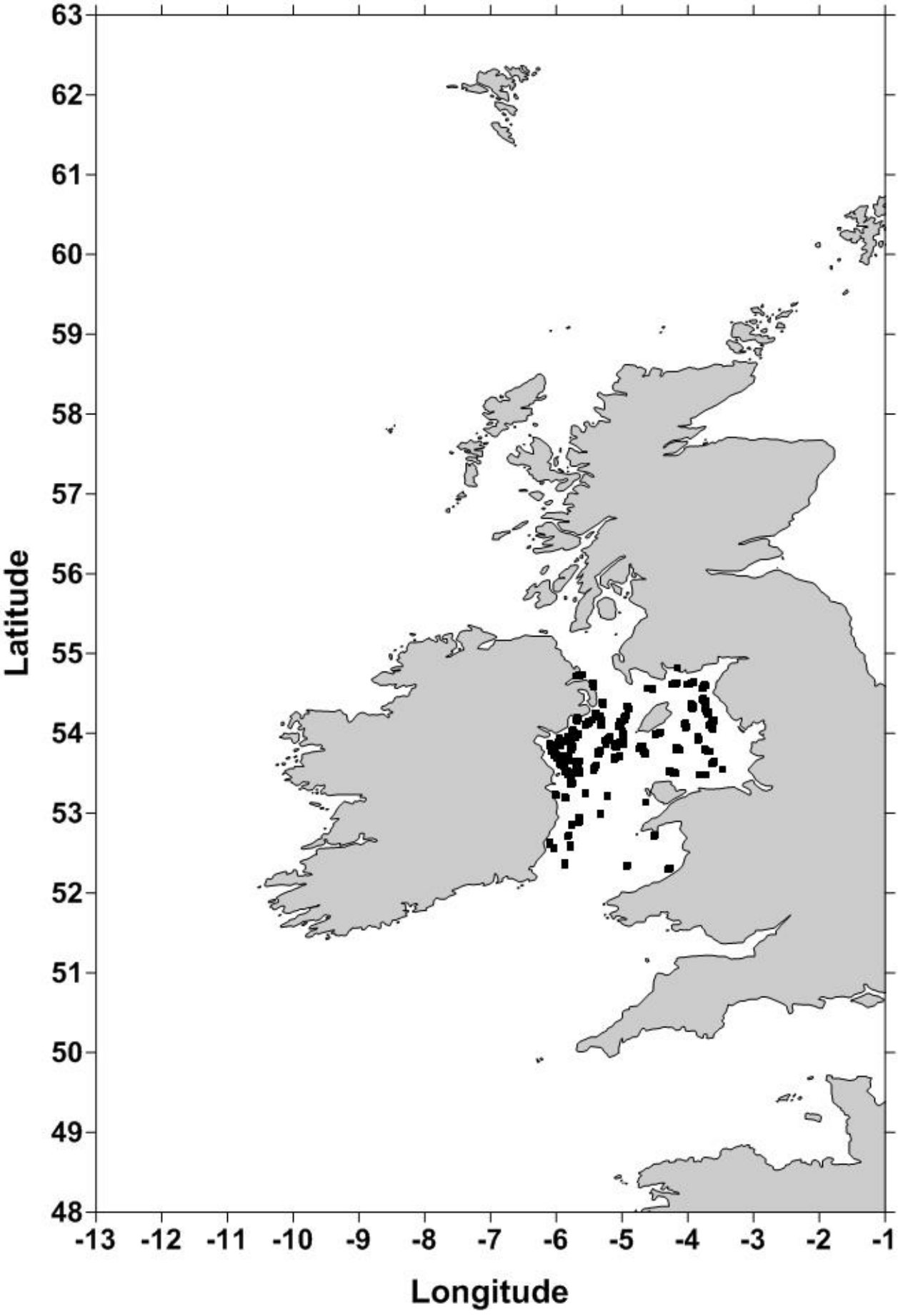
3.2.12. CSNIrOT4

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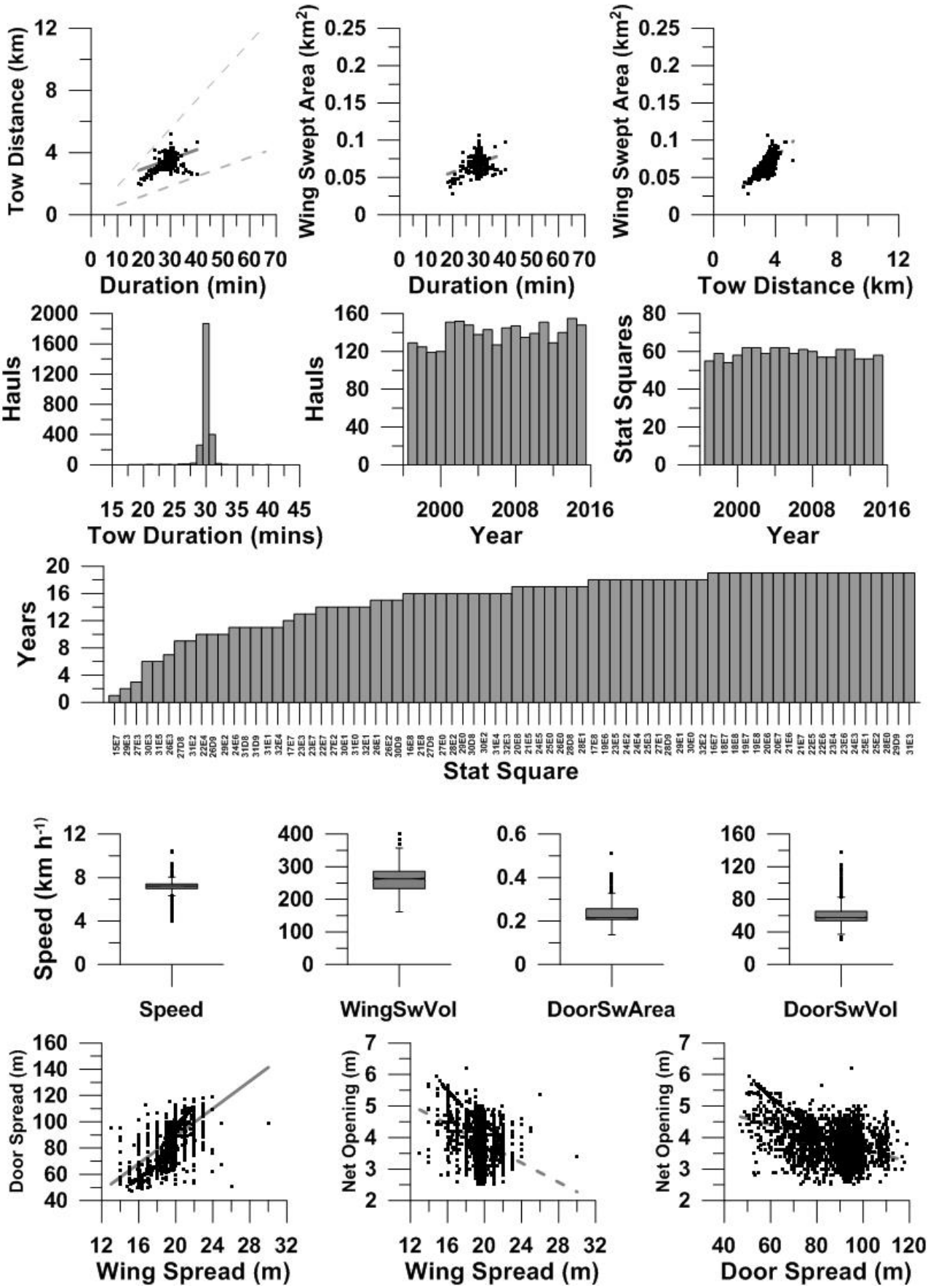
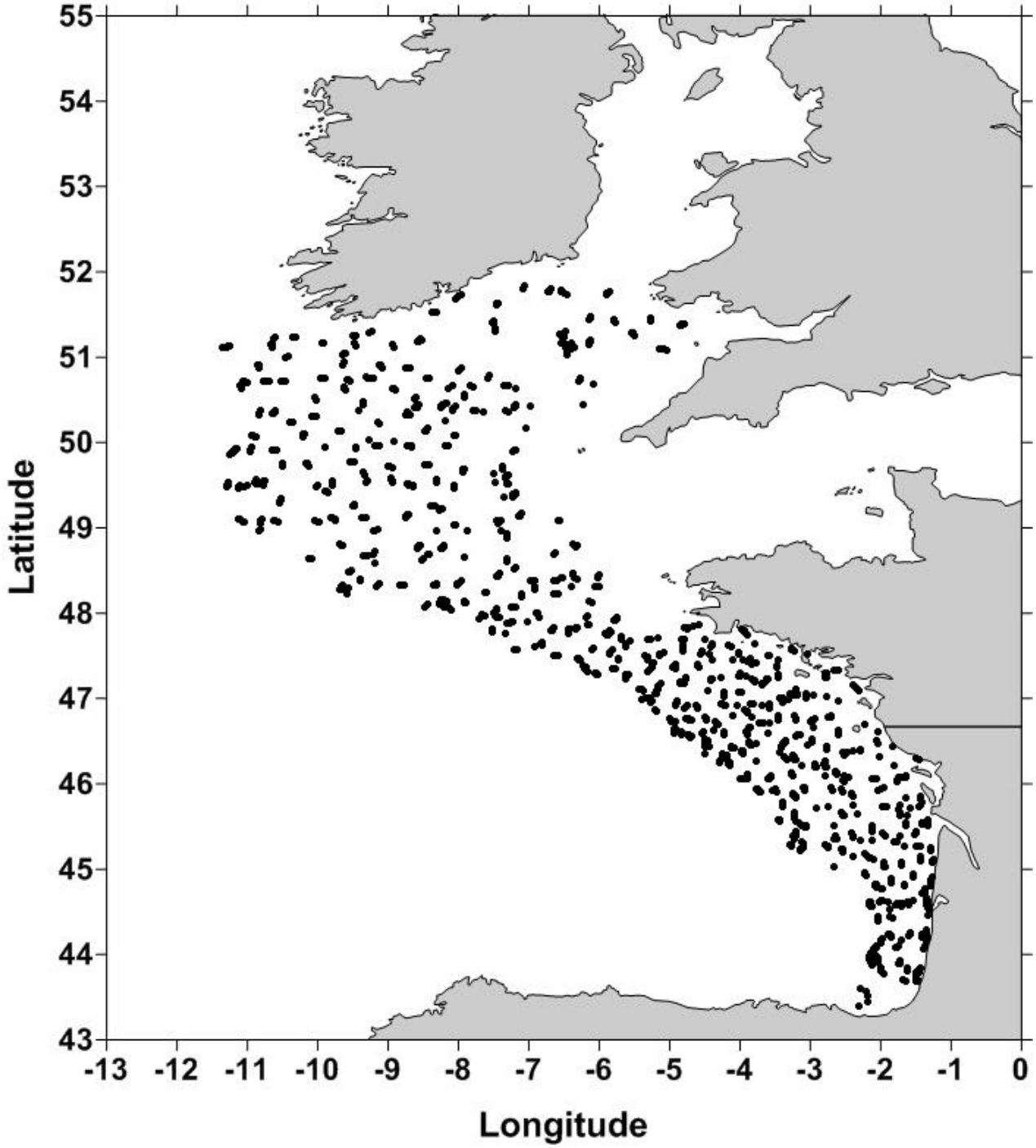
3.2.13. CSBBFraOT4

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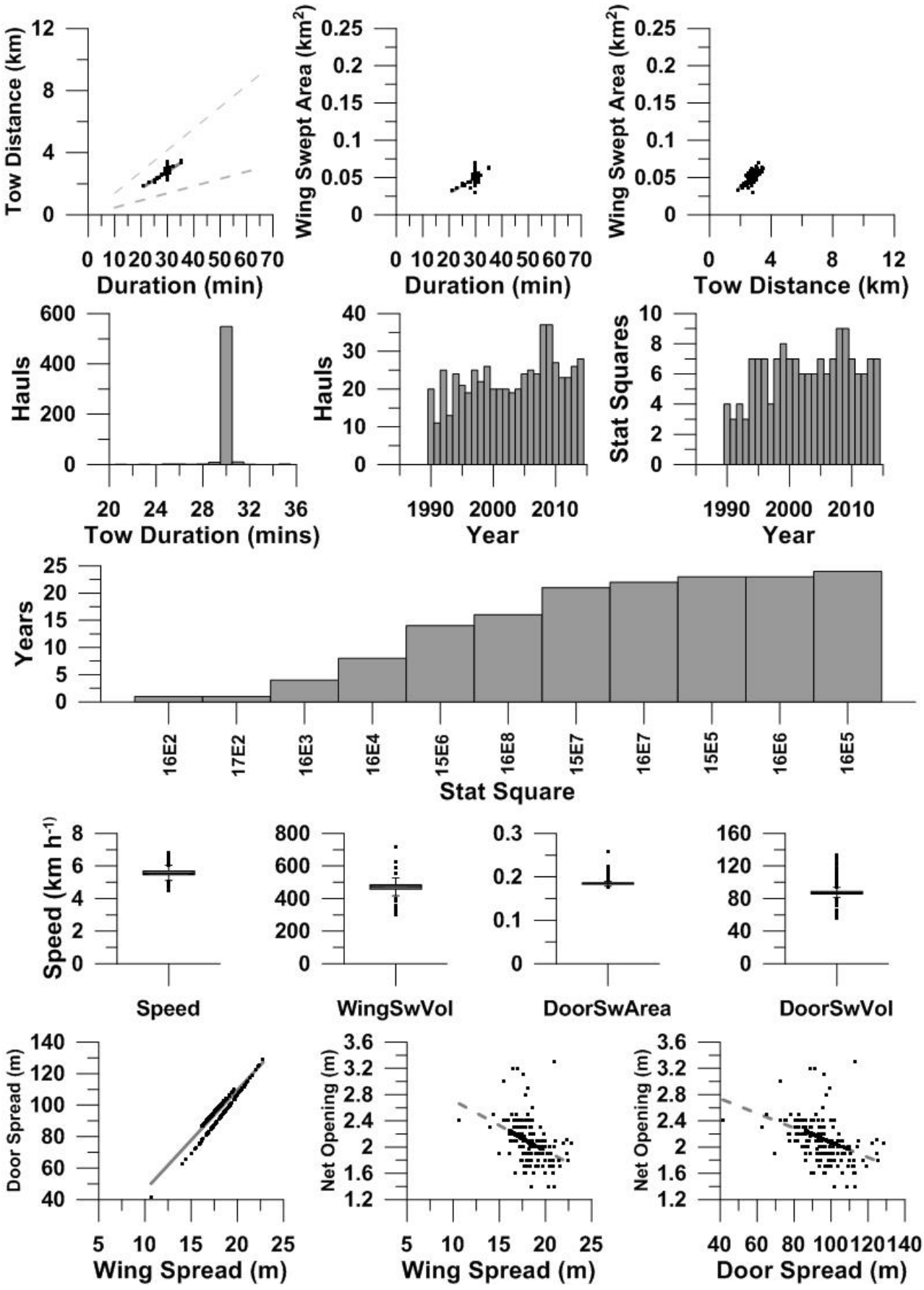
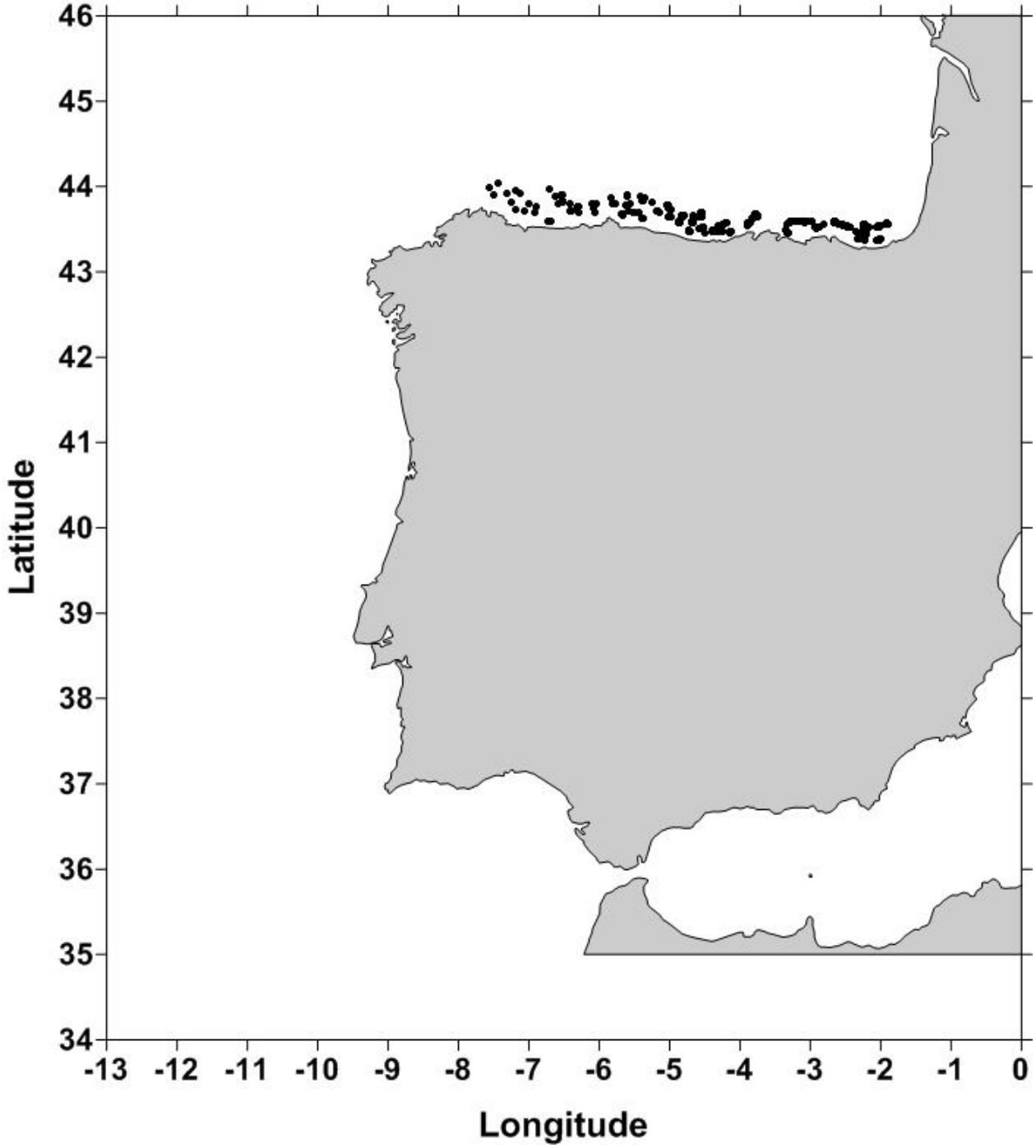
3.2.14. BBIC(n)SpaOT4

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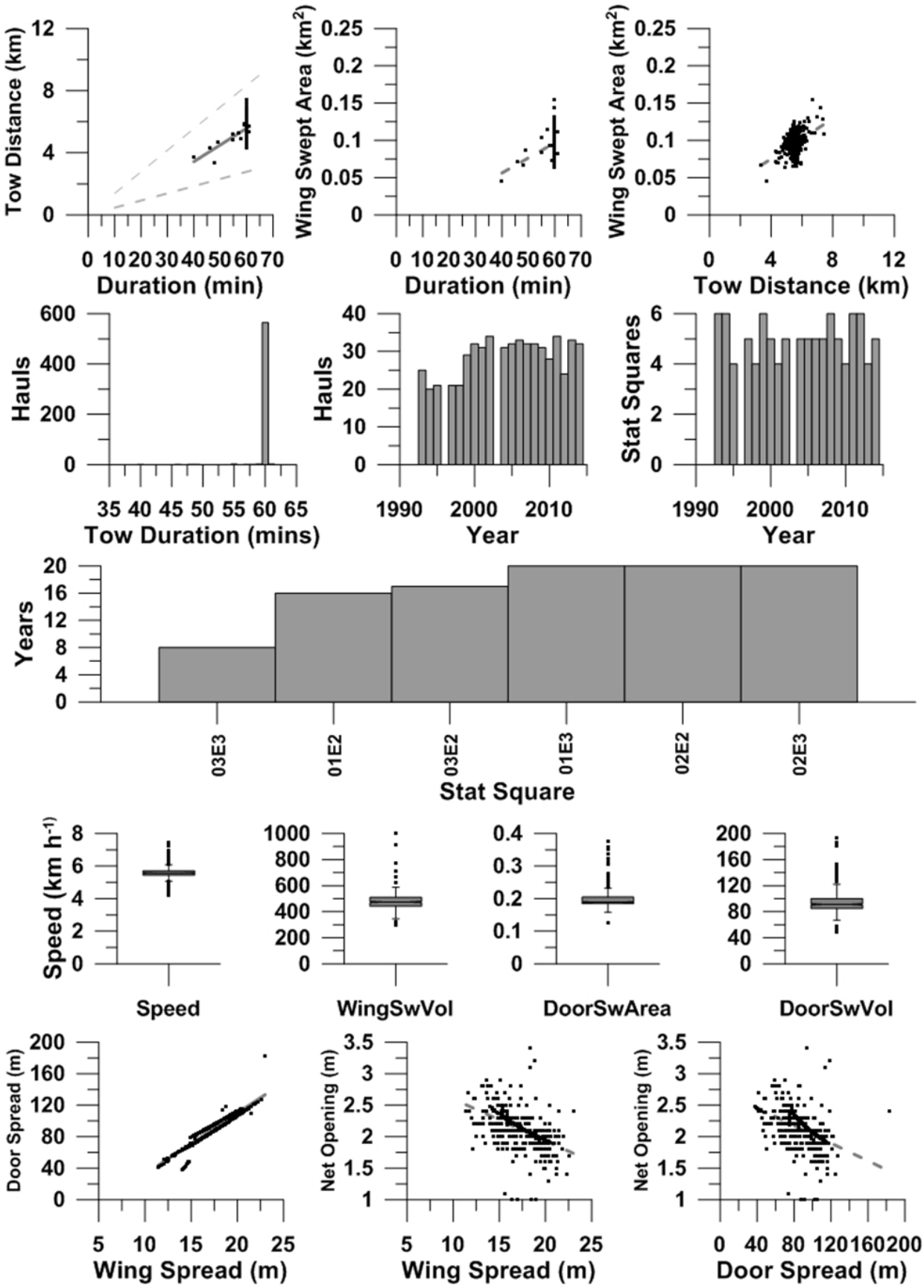
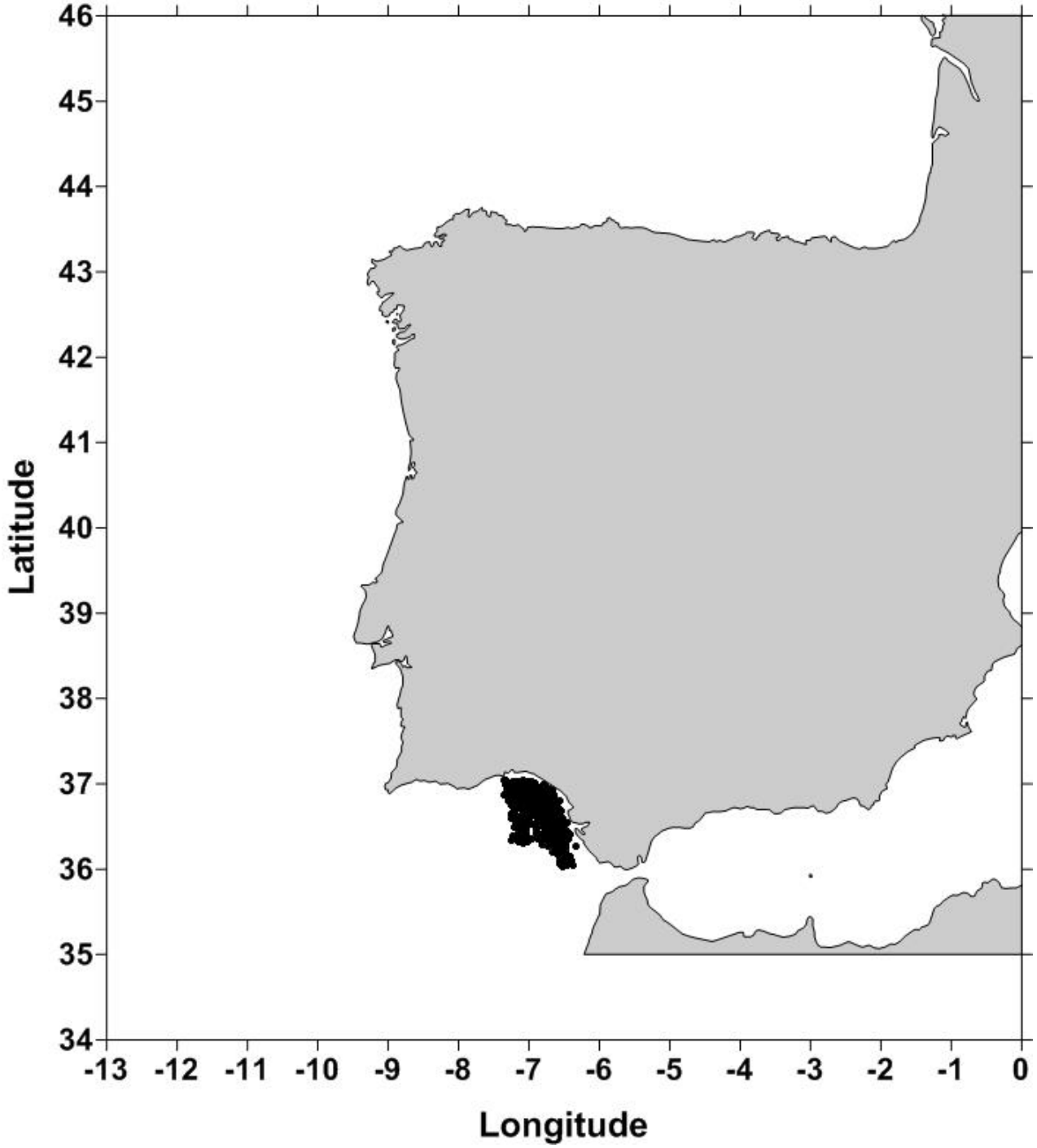
3.2.15. BBIC(s)SpaOT1

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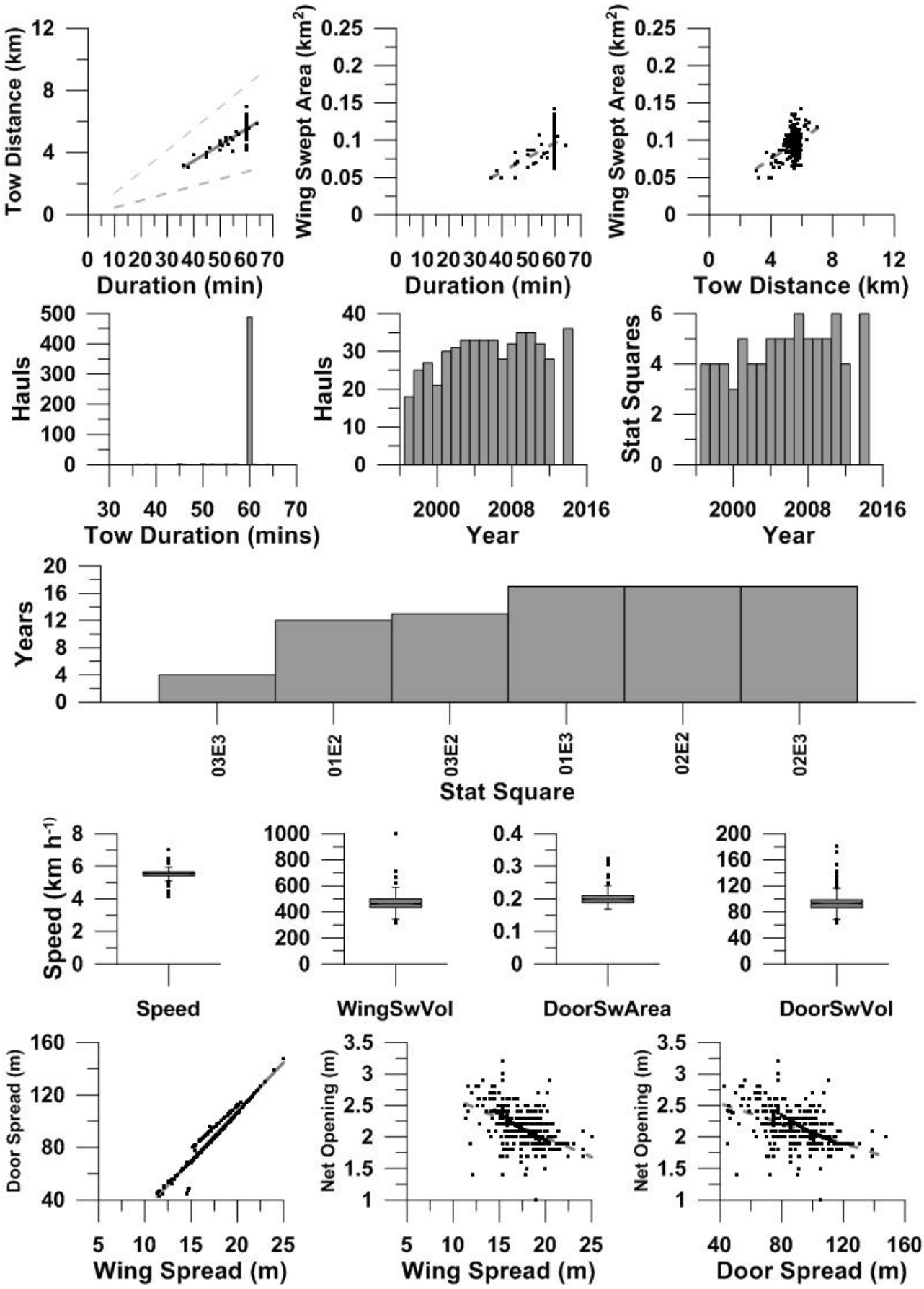
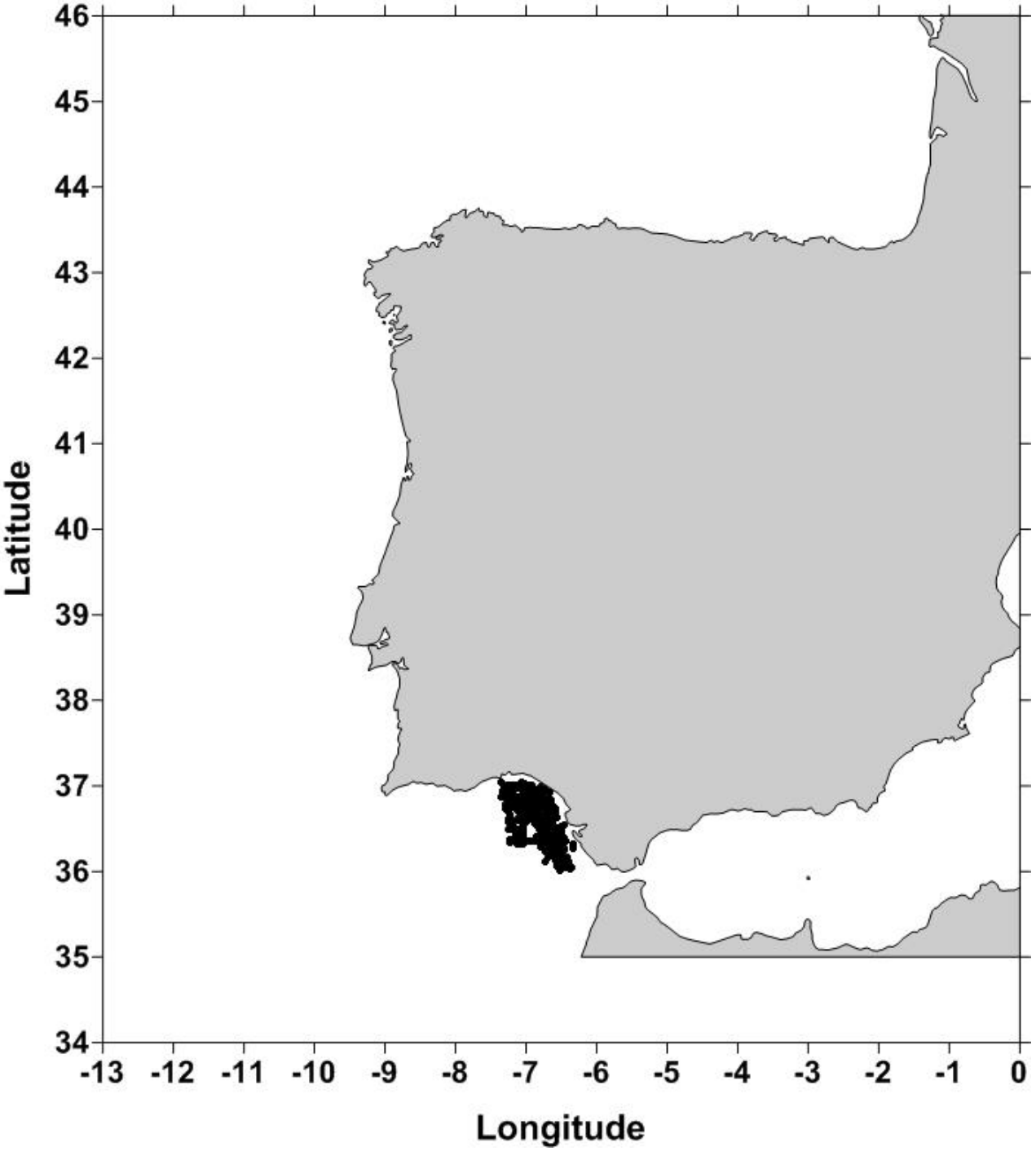
3.2.16. BBIC(s)SpaOT4

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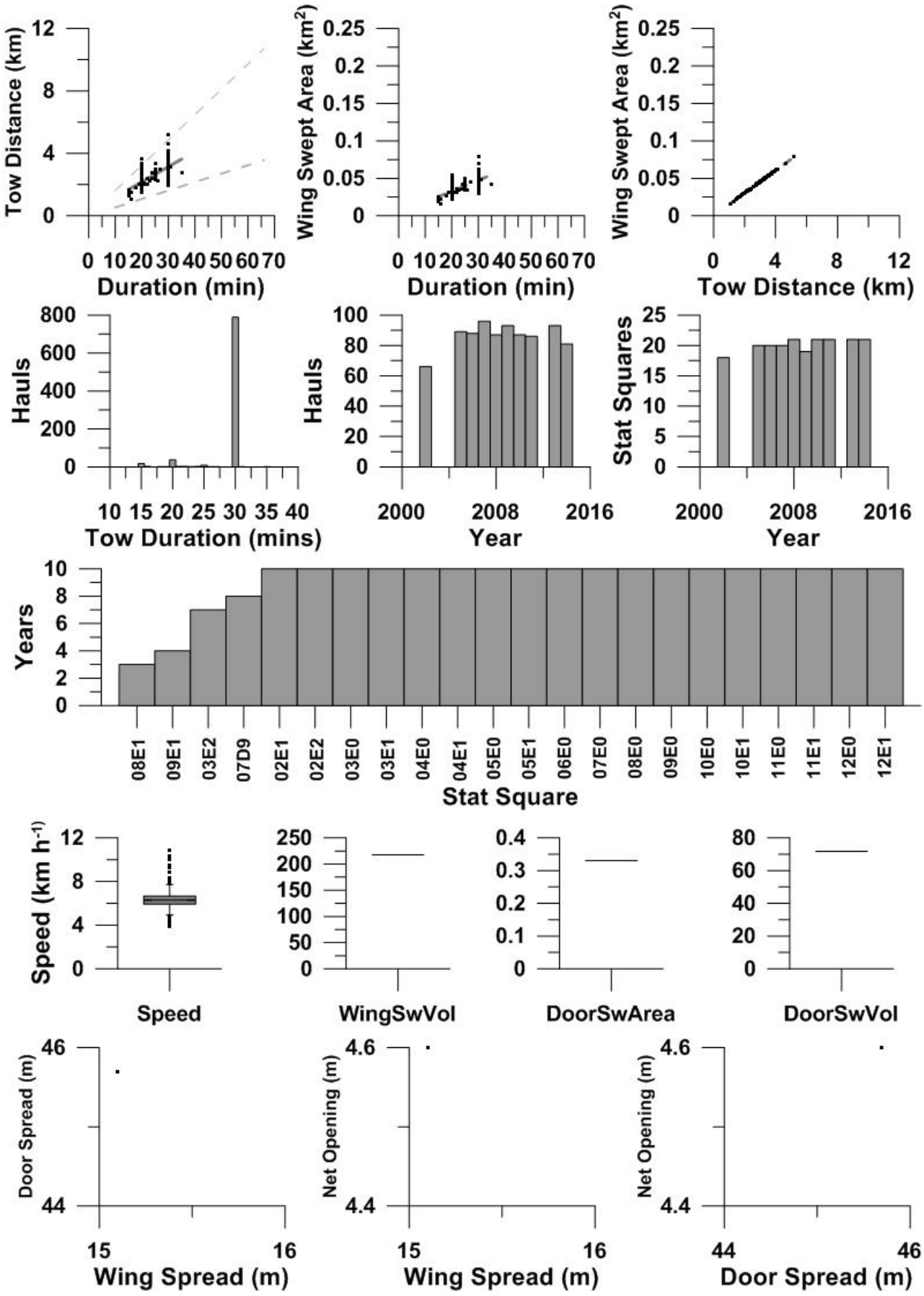
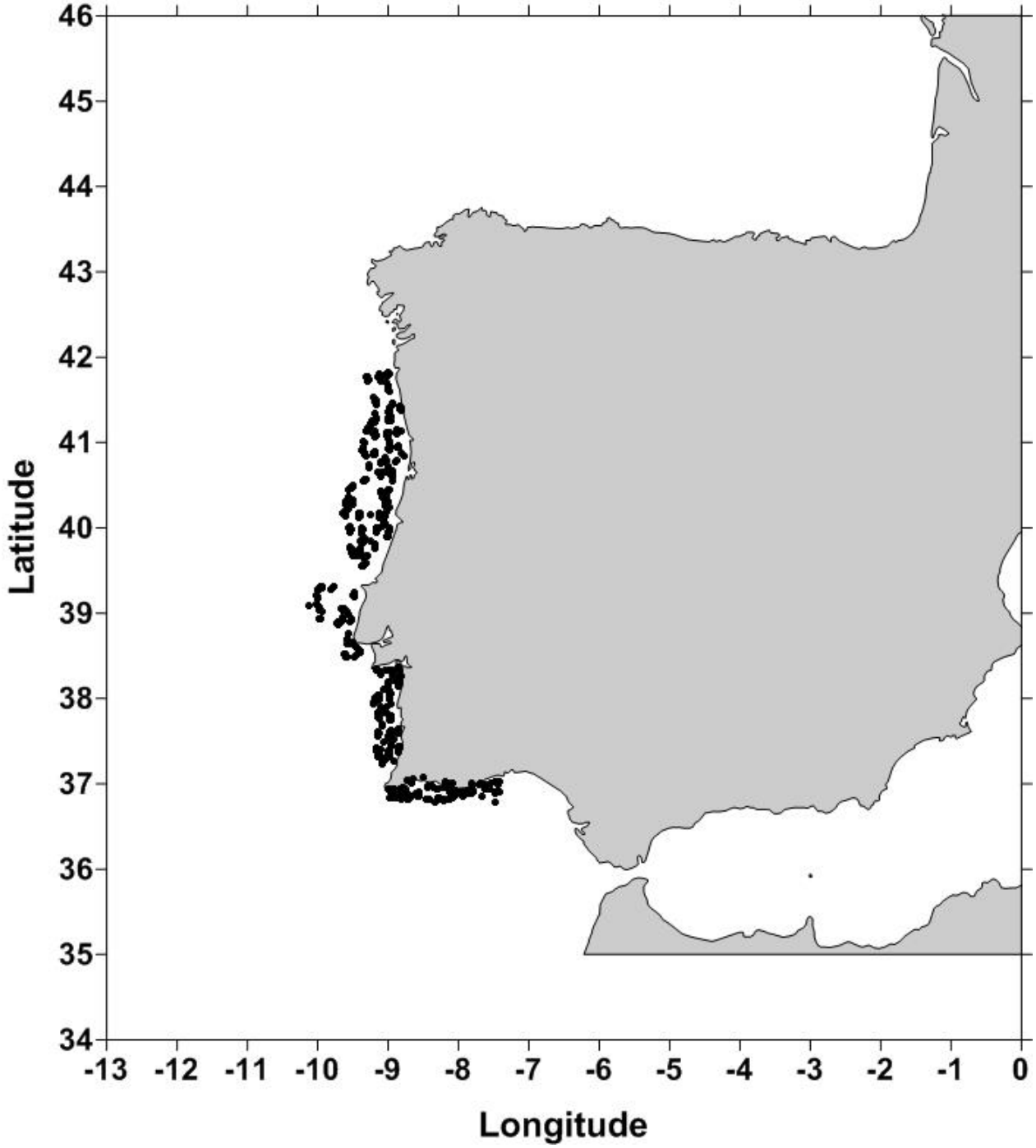
3.2.17. BBICPorOT4

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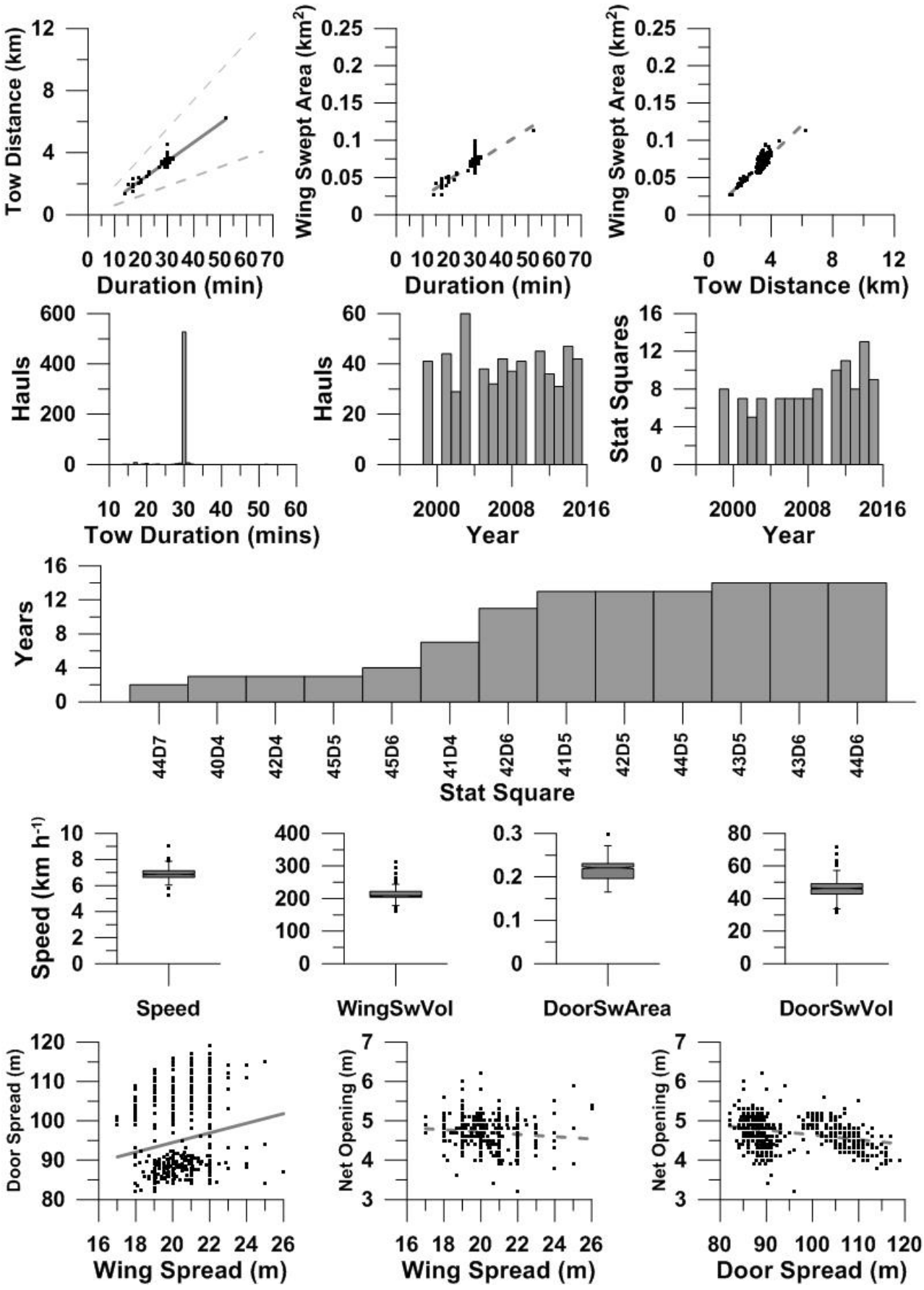
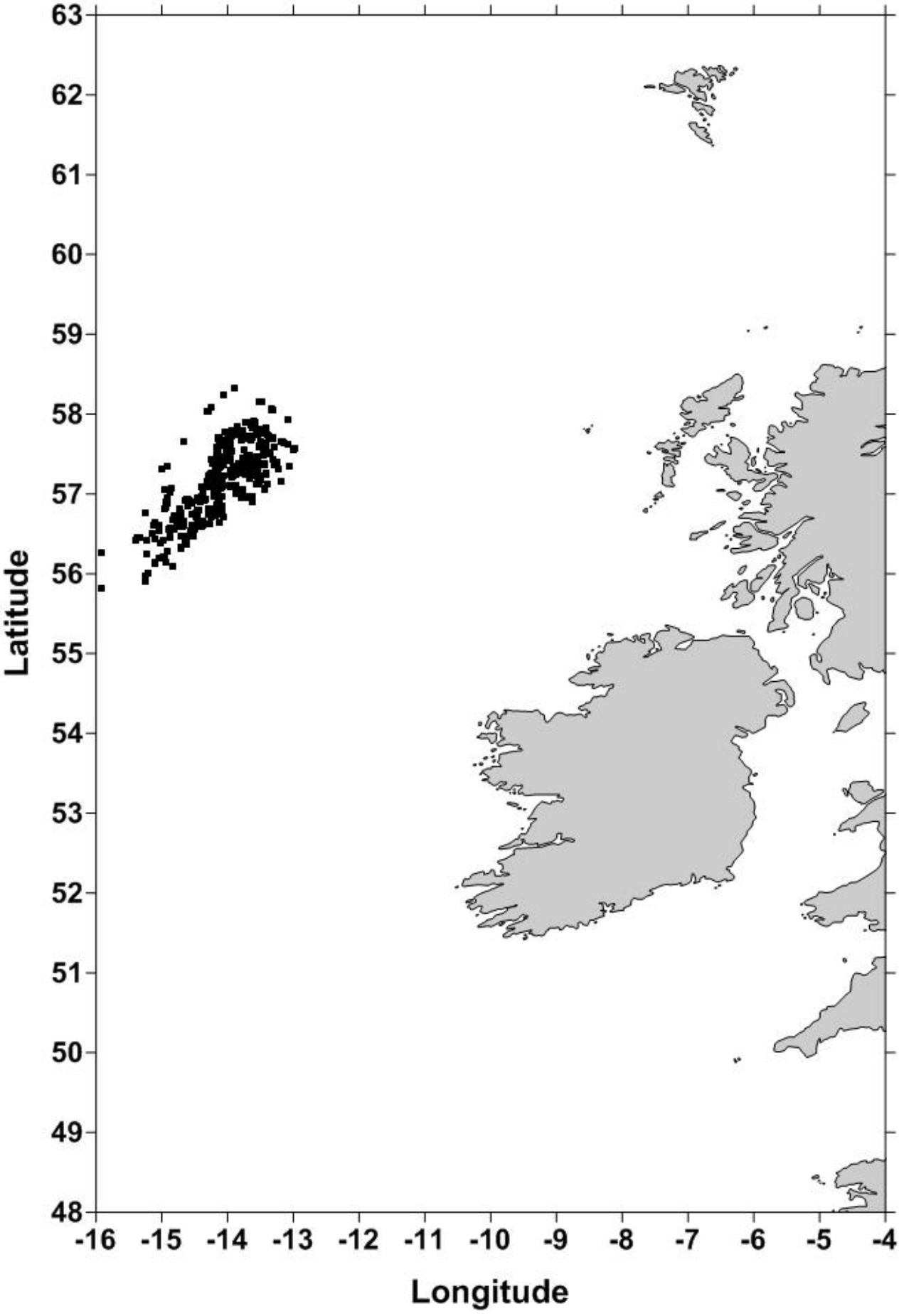
3.2.18. WAScoOT3

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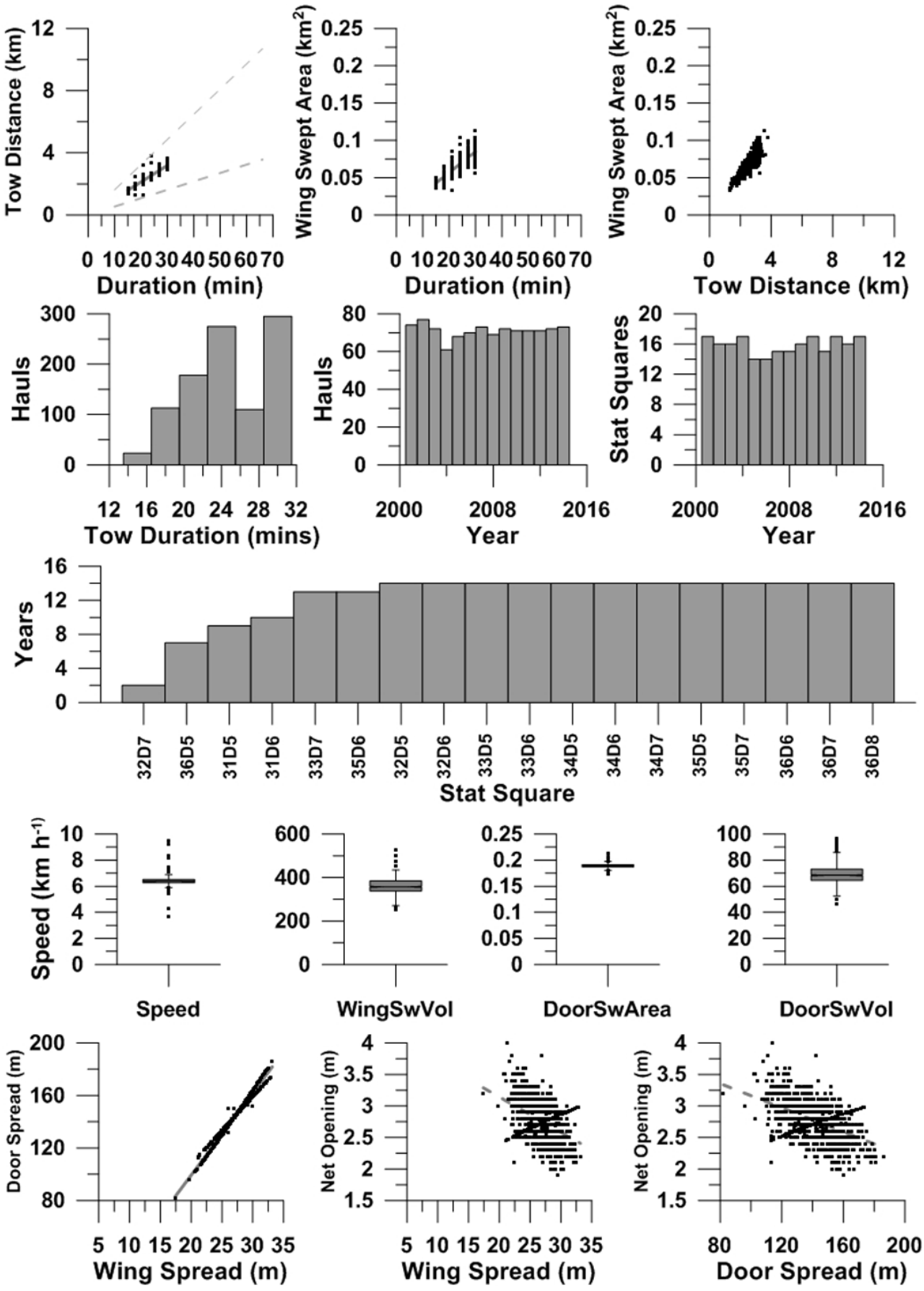
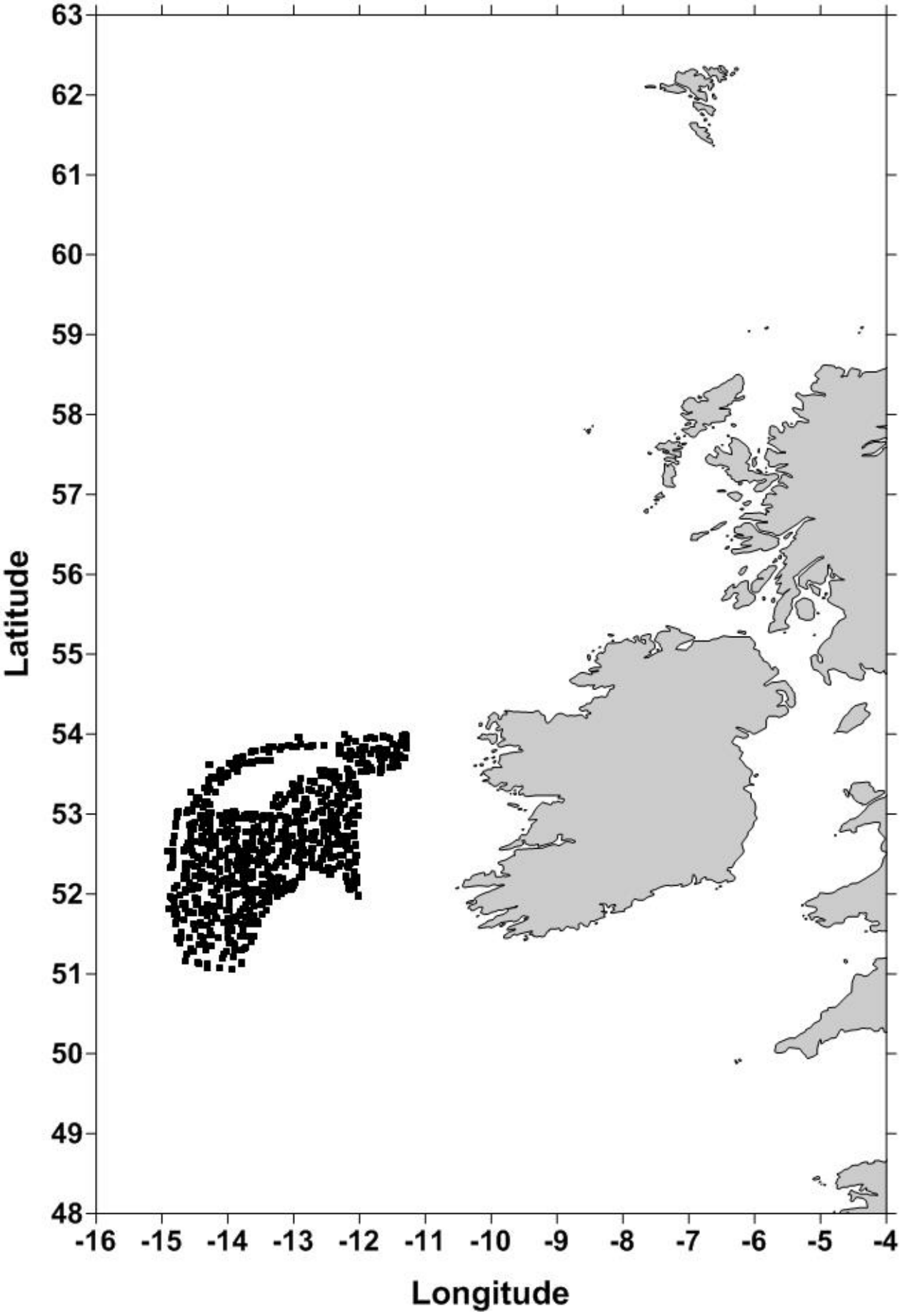
3.2.19. WASpaOT3

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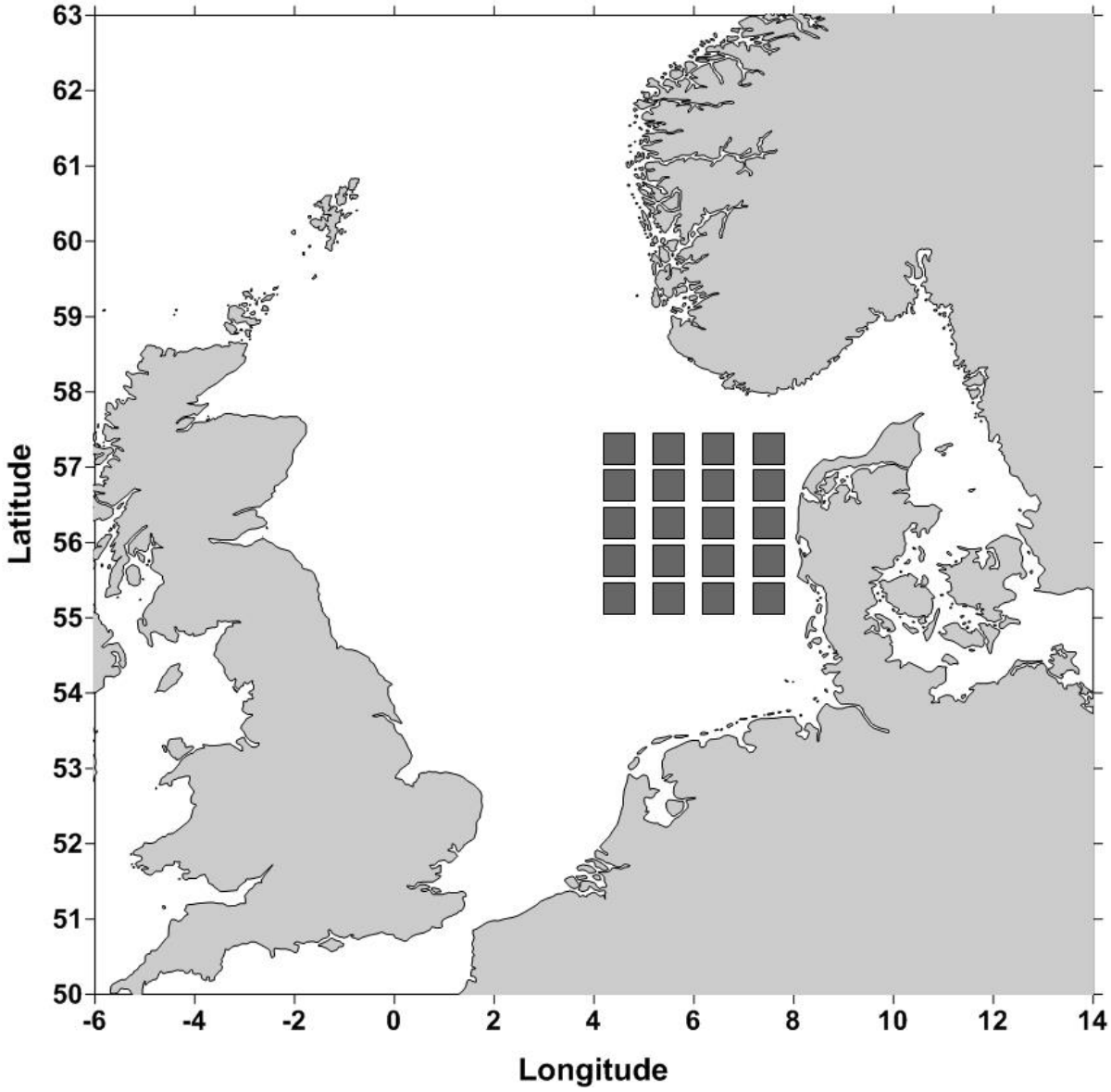
Longitude

3.3. Standardised Survey Area and Period Data Product

In this section, the steps taken to derive the standardised data product are described. Each survey is considered individually and a plot showing the survey's standard survey area is provided. A final concluding section summarises the outcome of the processes described on the overall data product.

3.3.1. GNSGerBT3

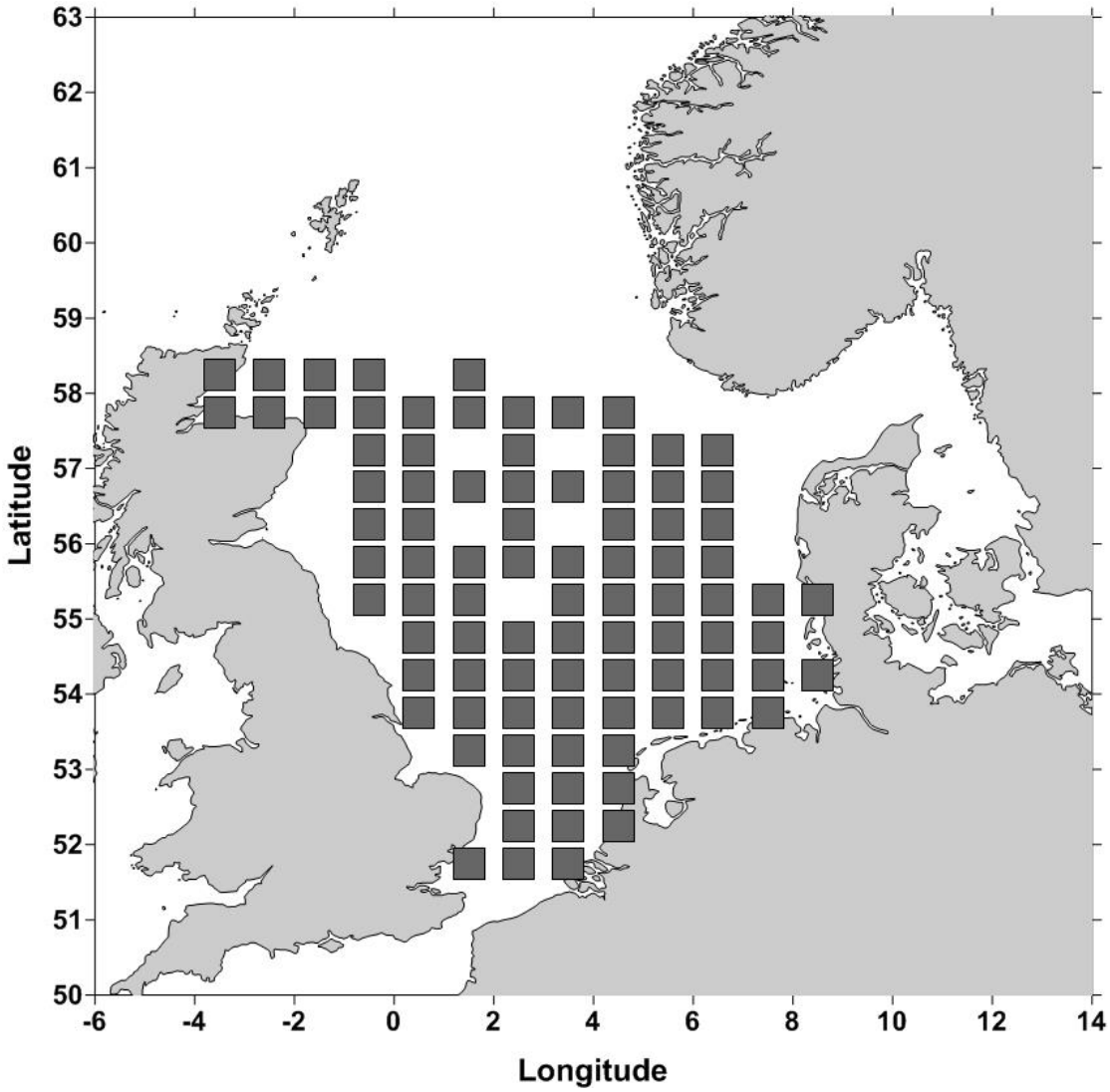
Overview of the cleaned GNSGerBT3 data revealed no inconsistency with the conclusions presented in Moriarty et al. (2017). The survey now spanned a period 2002 to 2015 with a break in 2006, giving 13 years of data. Moriarty et al. (2017) only analysed data from 2003 to 2015, so in the intervening period, the data provider has added the 2002 data onto DATRAS. The 50% of years rule requires ICES statistical rectangles to be sampled in seven years or more to be included in the standard survey area. Of the 26 rectangles sampled over the course of the entire survey, 20 met this criterion and all met the second criterion of having to be sampled in the three year periods (2002-2004 and 2013-2015) that each constituted 20% of the time series. Data for the six rectangles failing the 50% of years rule were excluded amounting to 32 hauls. These six rectangles were only sampled in 2002, 2003, 2013 and 2015. The original data set of 664 samples was reduced to 632 records collected in the 13 years 2002 to 2005 and 2007 to 2015 from 20 ICES statistical rectangles.



3.3.2. GNSNetBT3

Moriarty et al. (2017) suggest that the GNSNetBT3 survey really became established in 2000, and with this start date, the 50% of years rule implied a standard survey area of 94 ICES statistical rectangles. However, overview of the final “cleaned” data set suggests that both the number of samples collected and the number of rectangles sampled in each year had stabilised by 1999. But with a start date of 1999, the 50% of years rule only gives a standard survey area of 91 rectangles. Essentially, a start date of 1999 gives a 6.3% increase in temporal range at the cost of a 3.3% decrease in spatial range over a start date of 2000. Consequently, a start date of 1999 was adopted, giving a 17 years times series spanning 1999 to 2015 without any breaks. The data provider also suggested that a start date of 1999 was the more appropriate. The 50% of years rule therefore infers that ICES statistical rectangles must be sampled in nine or more years to be included in the standard

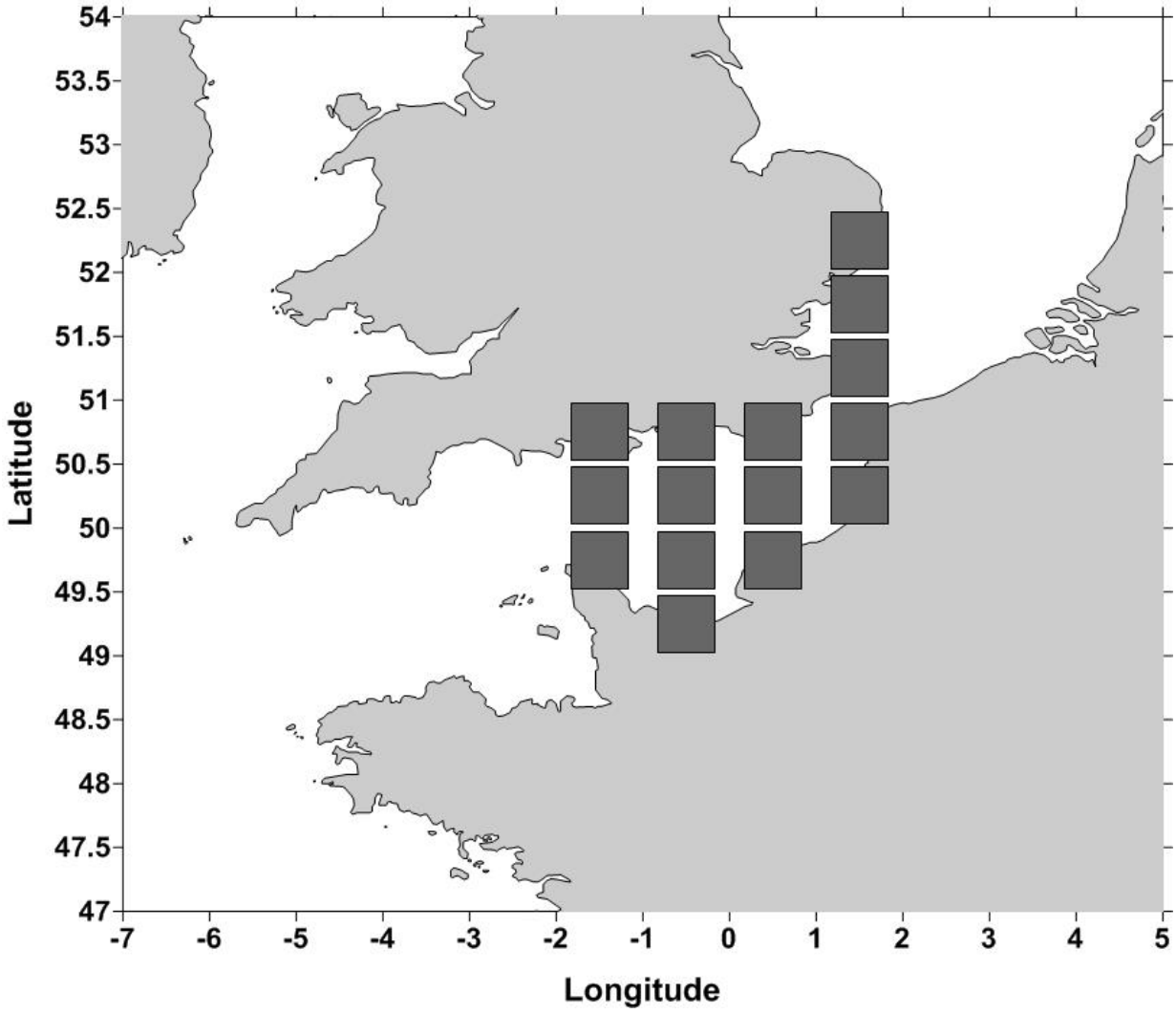
survey area; 91 rectangles met this criterion. Of these 91 rectangles, all were sampled in 2015, but two were not sampled in the four year period, 1999 to 2002, representing the first 20%ile (rounded up: 0.2 x 17 = 3.4, rounded up equals 4) of the time series. Rectangles 38E9 and 43F1 were both only sampled over the period 2006 to 2015. Data for these two rectangles were, therefore, also excluded from the data product. The standardised GNSNetBT3 Version 2 data product, therefore, consists of 2375 trawl samples spanning the period 1999 to 2015 and collected from 89 ICES statistical rectangles. Initially the full GNSNetBT3 standard monitoring programme data set for the period 1999 to 2015 consisted of 2505 trawl samples. Selecting trawls taken only in the standard survey area resulted in the exclusion of 133 samples.



3.3.3. GNSEngBT3

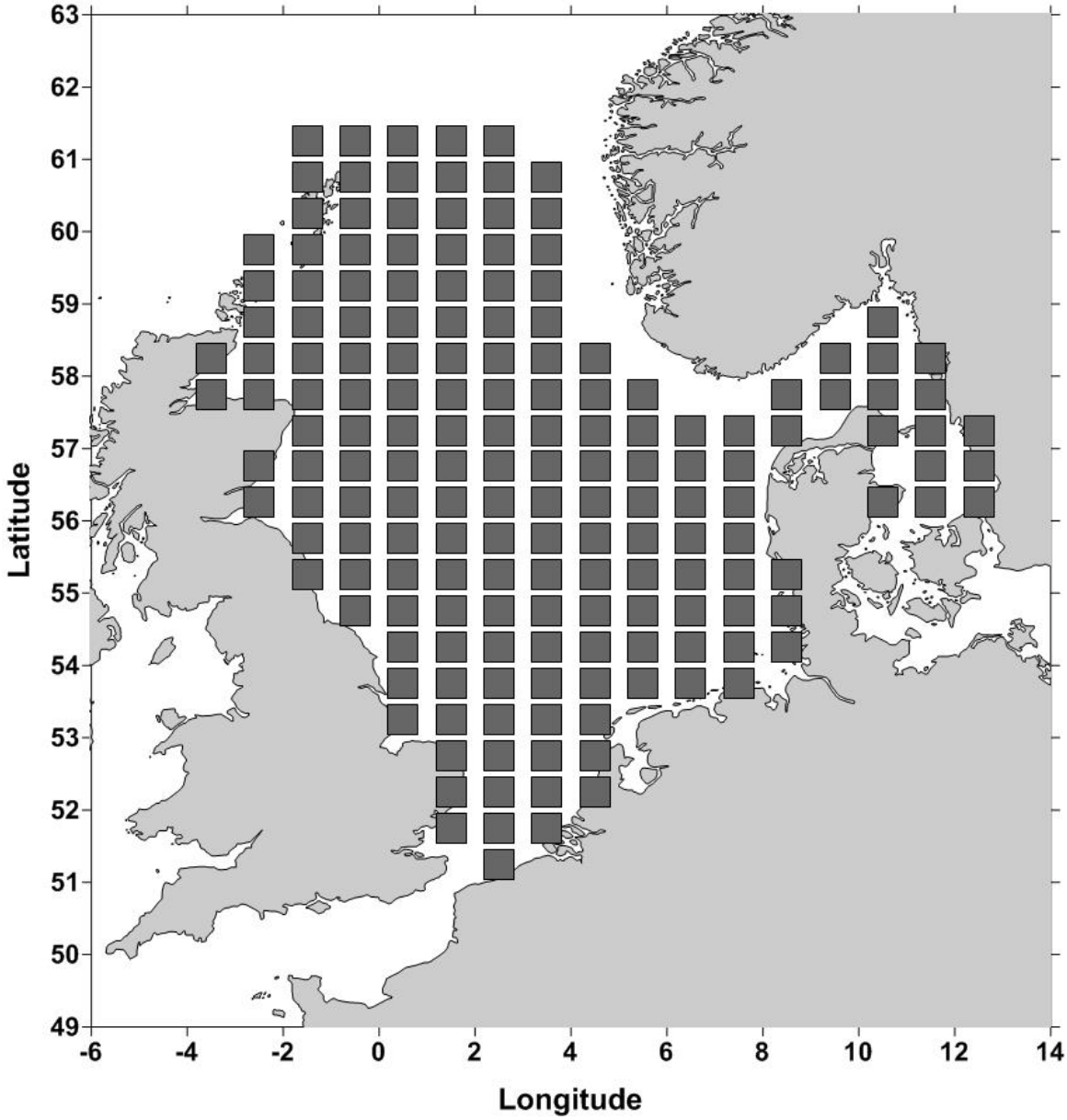
Overview of the cleaned GNSEngBT3 Version 2 data revealed no inconsistency with the conclusions presented in Moriarty et al. (2017). Moriarty et al (2017) only had

access to data up to 2014, so in the intervening period between derivation of the Version 1 and Version 2 data products, the national Data Provider had uploaded data for 2015 onto the DATRAS database. The survey, therefore, now spans a period 1990 to 2015 with no breaks, giving 26 years of data. The 50% of years rule, therefore, requires ICES statistical rectangles to be sampled in 13 years or more to be included in the standard survey area. Of the 29 rectangles sampled over the course of the entire survey, 15 met this criterion and all met the second criterion of having to be sampled in the six year periods (1990-1995 and 2010-2015) that each constituted 20% of the time series, all being sampled in both 1990 and 2015. Data for the 14 rectangles (26E7, 26E8, 27E7, 27E8, 28E7, 28F1, 31F2, 32F2, 33F2, 34F1, 34F2, 35F0, 35F1 and 36F0) failing the 50% of years rule were excluded, amounting to 127 hauls. These 14 rectangles were sampled infrequently throughout the time series. The original data set of 2386 samples was reduced to 2259 records collected in the 26 years 1990 to 2015 from 15 ICES statistical rectangles.



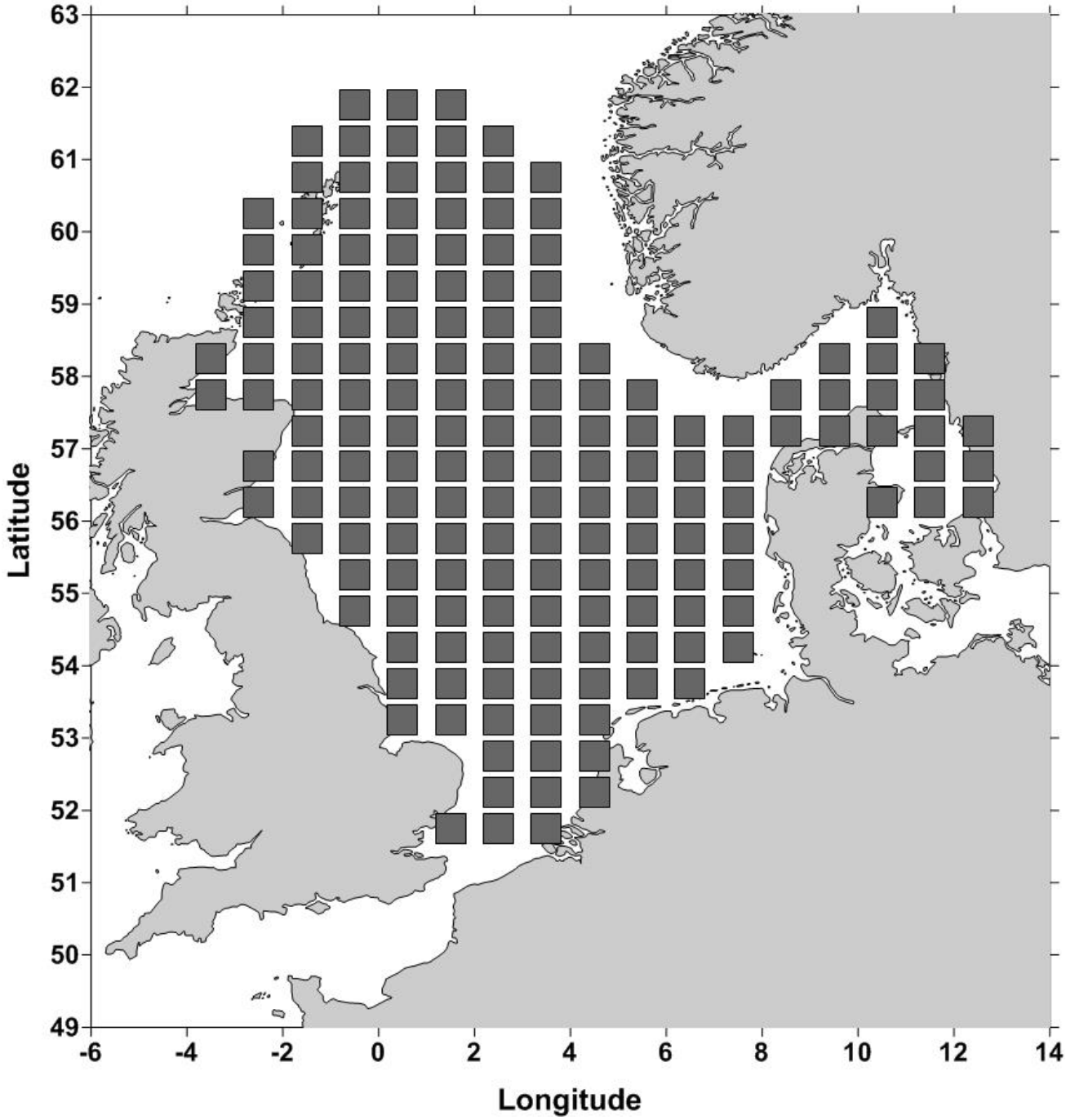
3.3.4. GNSIntOT1

The data set available to Moriarty et al. (2017) covered the period 1983 to 2015. The cleaned data summarised in the data product overview above was extended by one year, amounting to a 34 year time series spanning 1983 to 2016 with no breaks. The 50% of years rule, therefore, required ICES statistical rectangles to be sampled in 17 years or more to be included in the standard survey area. Of the 195 rectangles sampled over the course of the entire survey, 172 met this criterion. Data for the 23 rectangles (28F1, 30E9, 52E9, 52F0, 52F1, 43F9, 48E6, 49E6, 31F3, 36F8, 40G2, 35F5, 46G1, 49E7, 50E7, 28F0, 29F0, 29F1, 30F0, 30F1, 47E6, 46E6 and 37E9) failing the 50% of years rule were excluded, amounting to 253 hauls. These 23 rectangles were sampled infrequently throughout the time series. One remaining rectangle (31F1) also failed the second criterion of having to be sampled in the 7 years period (1983-1989) that constituted the earliest 20%ile of the time series. Data for 31F1, amounting to a further 55 samples, were also excluded from the data product reducing the total number of GNSIntOT1 trawl samples in the cleaned data product to 13208 from the 13516 originally. All but one rectangle (39F8) in the remaining 171 rectangles now constituting the standard survey area were sampled in 2016, and this rectangle was sampled in 2015. The remaining data still spanned the 34 year time series from 1983 to 2016 and were obtained from a standard survey area of 171 ICES statistical rectangles.



3.3.5. GNSIntOT3

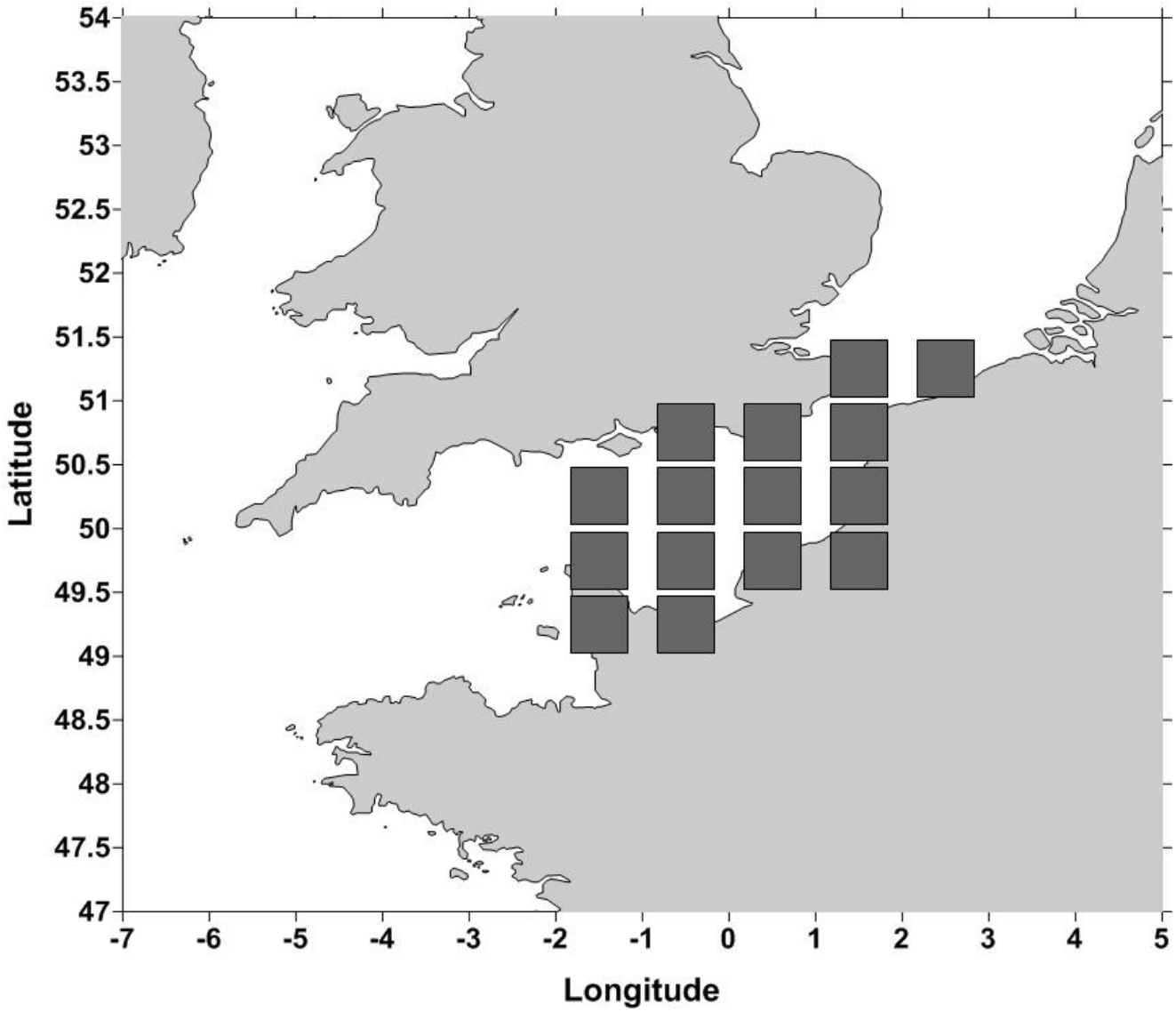
The data set available to Moriarty et al. (2017) covered the period 1998 to 2014. The cleaned data summarised in the data product overview above was extended by one year, amounting to a 18 year time series spanning 1998 to 2015 with no breaks. The 50% of years rule, therefore, required ICES statistical rectangles to be sampled in nine years or more to be included in the standard survey area. Of the 182 rectangles sampled over the course of the entire survey, 168 met this criterion. Data for the 14 rectangles (36F7, 37F8, 38F8, 39E8, 39F8, 40G2, 44F6, 45F5, 46E6, 46G1, 47E6, 48E6, 49E6 and 50E7) failing the 50% of years rule were excluded, amounting to 70 hauls. These 14 rectangles were sampled infrequently throughout the time series. This left 5802 samples remaining from the original 5872 records collected over the 18 year period 1998 to 2015 from an standard survey area of 168 ICES statistical rectangles. No rectangles failed the start and end 20%ile periods.



3.3.6. GNSFraOT4

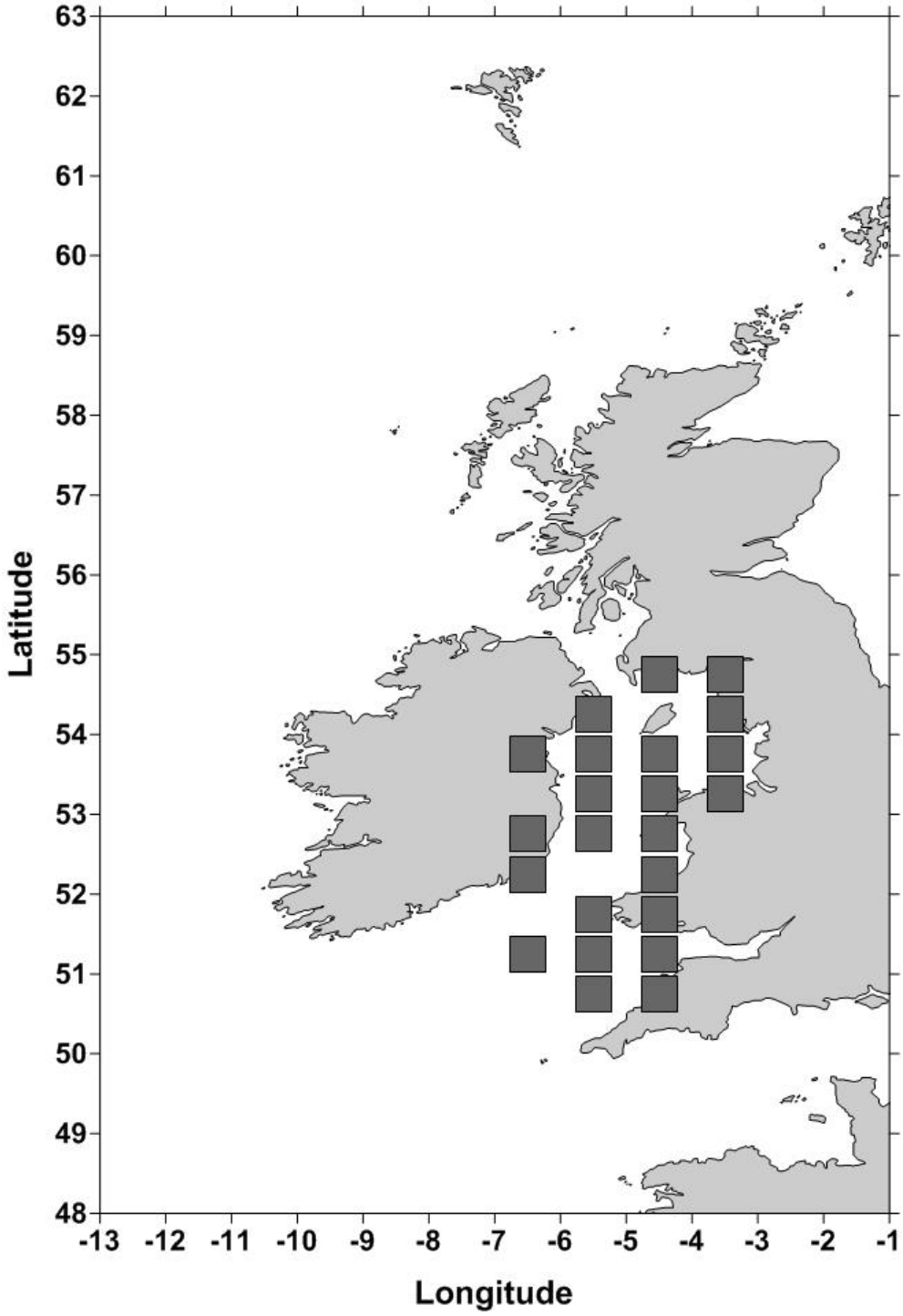
The data set available to Moriarty et al. (2017) covered the period 1988 to 2014. The Version 2 data product includes data for 2015 added to DATRAS during the intervening period by the French data provider. The time series therefore now runs for a 28 year period with no breaks. The 50% of years rule therefore required ICES statistical rectangles to be sampled in 14 years or more to be included in the standard survey area. In fact all 16 rectangles ever sampled by the survey met this criterion. However, one rectangle, 27F0, was first sampled in 1995, and so failed the criterion for being sampled in the first six years, 1988 to 1993, that represented the

early 20%ile of the time series. Data for this rectangle, amounting to 31 samples, were, therefore, excluded from the data product leaving 2440 GNSFraOT4 records from the original 2471. ,The remaining time series still spanned a 28 year period between 1988 and 2015 consisting of data collected from an standard survey area of 15 ICES statistical rectangles.



3.3.7. CSEngBT3

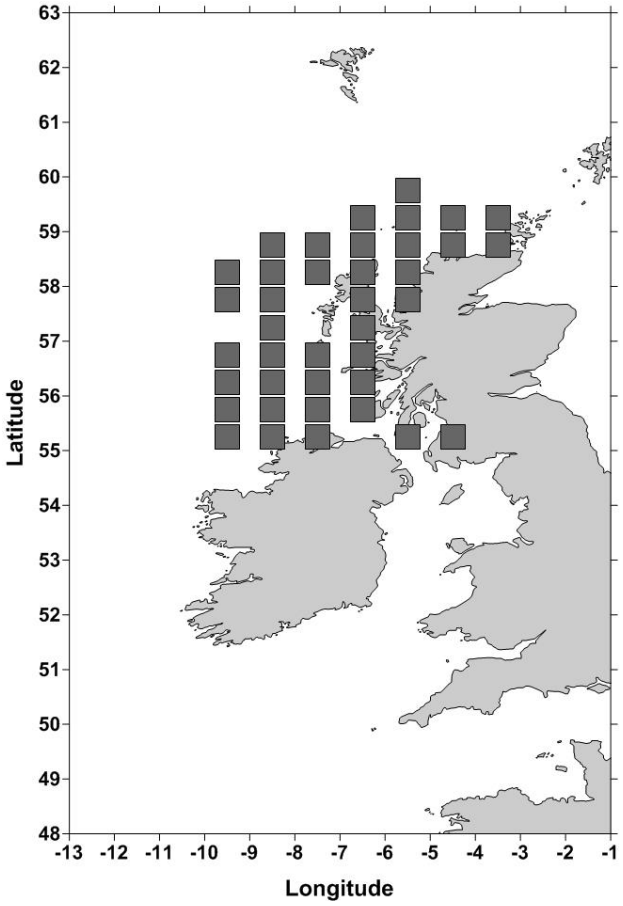
This survey spanned a 23 year period between 1993 and 2015. More recent data have yet to be uploaded to the DATRAS database, so this represents the same survey time series analysed by Moriarty et al. (2017) for the Version 1 data product. Data were collected from a total of 32 ICES statistical rectangles, but only 23 met the 50% of years rule, being sampled in 12 years or more. All 23 rectangles met the second criterion having been sampled in the start and finish five year periods, 1993-1997 and 2011-2015, which constituted the early and late 20%iles of the time series. Data for the nine ICES statistical rectangles (31E6, 32E6, 31E2, 32E1, 33E4, 32E2, 33E2, 32E3 and 37E5) that failed the 50% of years rule were excluded, amounting to 67 samples collected throughout the time series. Excluding these samples reduced the original 2445 samples to 2378, collected from a standard survey area of 23 ICES statistical rectangles over a 23 year period 1993 to 2015.



3.3.8. CSScoOT1

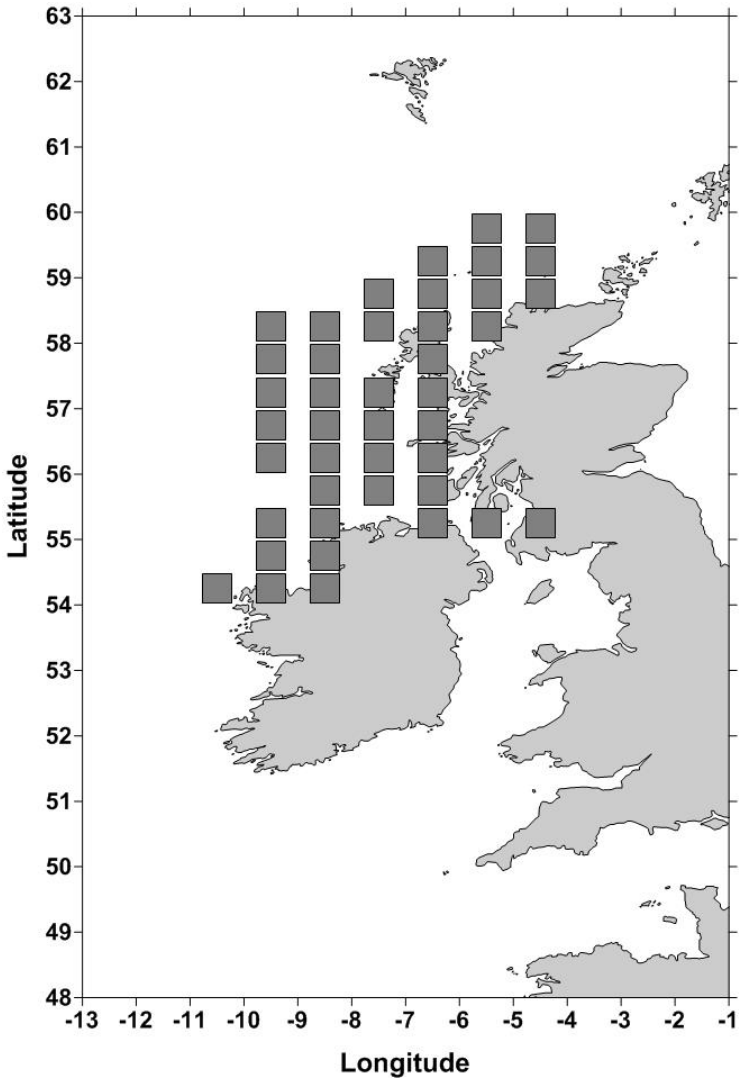
Moriarty et al. (2017) showed that during its 31 year history from 1985 to 2015 (the time series available to them at the time), this has been a highly variable survey, with a pronounced change from 60 minutes to 30 minutes duration hauls occurring in the late 1990s. Major changes in spatial coverage have also occurred, but Moriarty et al. (2017) suggest that this was largely controlled through application of the 50% of years rule. One option suggested by the overview of the data product presented above might be to restrict the time series to just the period 1999 onwards, but

examination of the data in Moriarty et al. (2017) suggests that this would not greatly enhance consistency of spatial coverage, yet the cost in temporal range would be considerable. The full standard monitoring programme time series was, therefore, considered in determining the standard survey area. Since Moriarty's et al. (2017) initial analysis, the survey time series has been extended by the addition of data for 2016. Data for 30 ICES statistical rectangles (37D9, 47E2, 48E3, 37E1, 40E5, 49E5, 37E0, 38D9, 35E5, 38E1, 48E6, 48E7, 49E7, 50E7, 39D9, 40E4, 38E0, 43E2, 38E4, 36E4, 36E5, 36E6, 37E4, 37E5, 37E6, 38E5, 38E6, 43E0, 39E3 and 48E5) that failed the 50% of years rule were excluded, amounting to 303 samples collected throughout the time series. The 39 rectangles that met the 50% of years rule also met the criterion for having been sampled in the start and finish 20%ile of time series seven year periods (1985 to 1991 and 2010 to 2016). However, two rectangles 46E6 and 47E6 were last sampled in 2010 and given the change in survey design that occurred in 2011, it is quite possible that these rectangles might not be sampled again and at the next assessment they would, therefore, drop out of the standard survey area. Exclusion of the 303 samples collected in the 30 rectangles that were insufficiently sampled reduced the CSScoOT1 data set from 1795 to 1492 samples spanning 32 years, from 1985 to 2016, collected across a standard survey area of 39 ICES statistical rectangles.



3.3.9. CSScoOT4

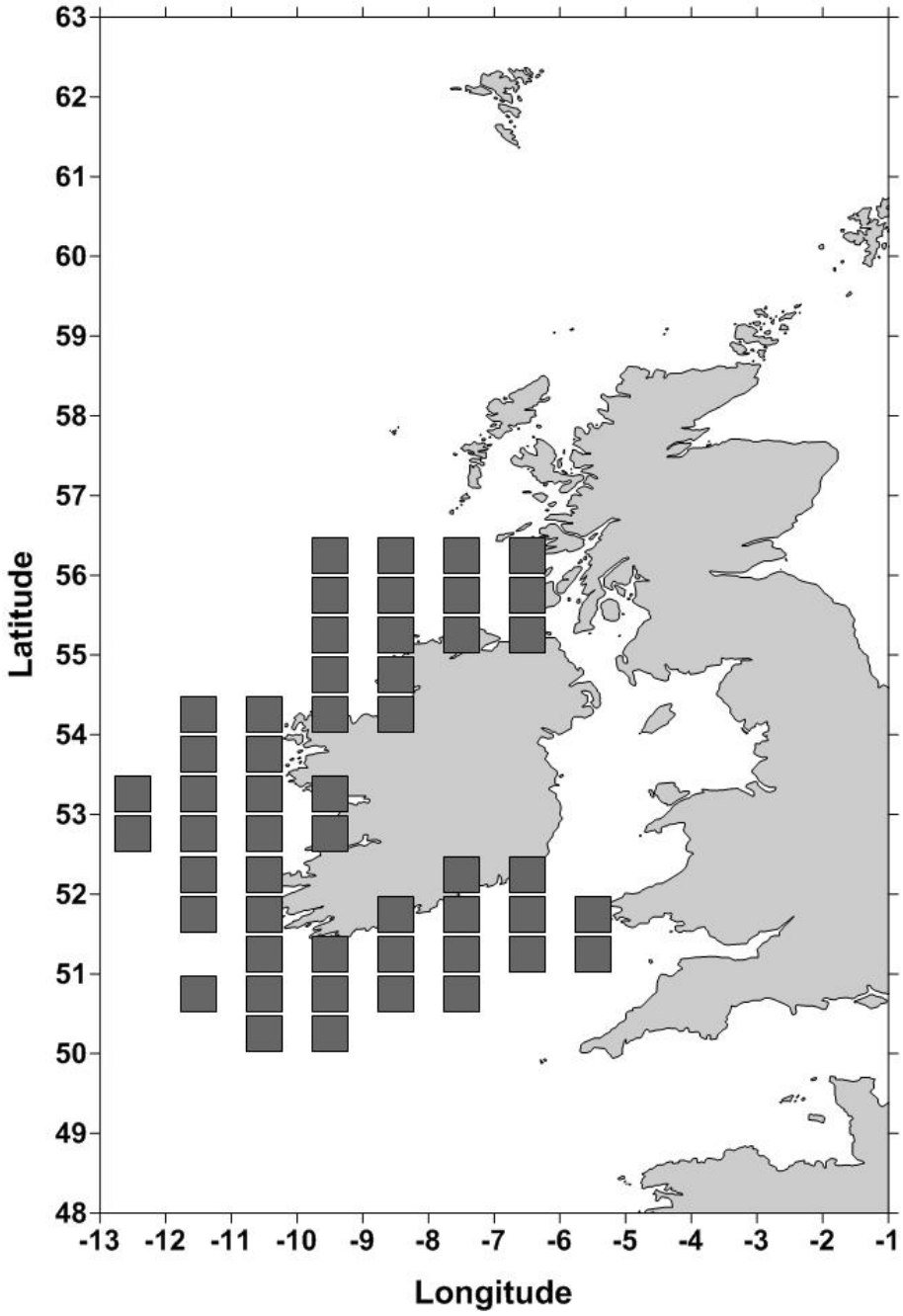
Moriarty et al. (2017) again suggest that this survey has undergone a high degree of evolution, with considerable variation in spatial coverage. Moriarty et al. (2017) initially analysed data from 1990 to 2014, but data for 2015 was uploaded to the DATRAS database in time for this Version 2 analysis. The survey, therefore, now spans the period 1990 to 2015, but with a break in 2010, so that there were only 25 years of data. Of the 113 ICES statistical rectangles ever sampled, only 48 met the 50% of years rule. However, a further 17 rectangles would then be excluded because of not being sampled in the first 5 years (20% of time series), and another four rectangles would be lost because they were not sampled in the last 20% of the time series (2011 to 2015), leaving a standard survey area of just 27 rectangles. The data product overview above suggests that sampling effort, both in terms of the number of samples collected and the number of rectangles sampled, increased from 1995 onwards. Excluding data for the 5 years 1990 to 1994 removed 210 samples, leaving 1310 samples collected over a 20 year period 1995 to 2015 (no data in 2010) from 105 rectangles. Application of the 50% of years rule removed a further 192 samples, leaving 1118 records, still covering the same time span, but now collected from just 50 ICES statistical rectangles. However, one rectangle (46E1) and seven rectangles (36D8, 36D9, 38D9, 40E0, 44E4, 46E6 and 47E6) were not sampled in the 20%ile 4 year periods (1995-1998 and 2012-2015) at the start and end, respectively, of the shortened time series. Excluding data for these rectangles left a total of 1014 CSScoOT4 samples collected from a standard survey area of 42 ICES statistical rectangles. Reducing temporal range by 20% thus achieved a 55% increase in spatial coverage. Moriarty et al. (2017) also concluded that the most appropriate start year for this survey was 1995, and the national data provider concurred with this decision.



3.3.10. CSIreOT4

Moriarty et al. (2017) had access only to data from 2003 to 2014. In the intervening period, the national Data Provider has added data for 2015 to the DATRAS database. For this Version 2 data product, this survey, therefore, now spanned a 13 year period between 2003 and 2015 with data collected from a total of 78 ICES statistical rectangles. However, only 54 of these rectangles met the 50% of years rule, being sampled in seven years or more. Of these, a further three rectangles failed to meet the second criterion of being sampled in the three year start period, 2003-2005, which constituted the early 20%ile of the time series. All 54 rectangles were sampled in the 20%ile time series three year end period. Data for the 24 ICES statistical rectangles that failed the 50% of years rule were excluded, amounting to 98 samples. Data for the three ICES statistical rectangles (31D8, 38D9, 39D9) that failed the start 20%ile rule were also excluded amounting to a further 72 samples. These exclusions reduced the CSIreOT4 data set from 2118 records to 1948,

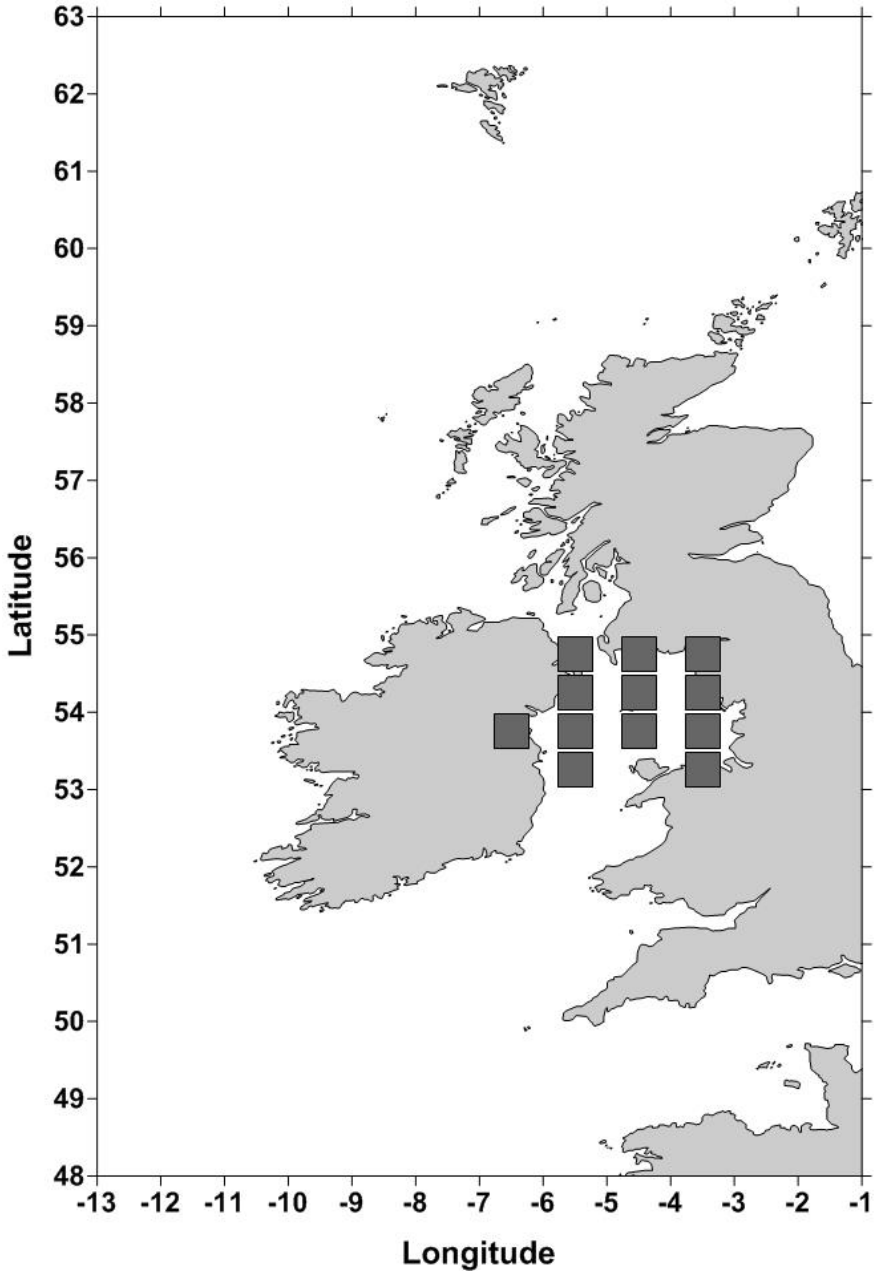
collected over the 13 year period 2003 to 2015 from a standard survey area of 51 ICES statistical rectangles.



3.3.11. CSNIrOT1

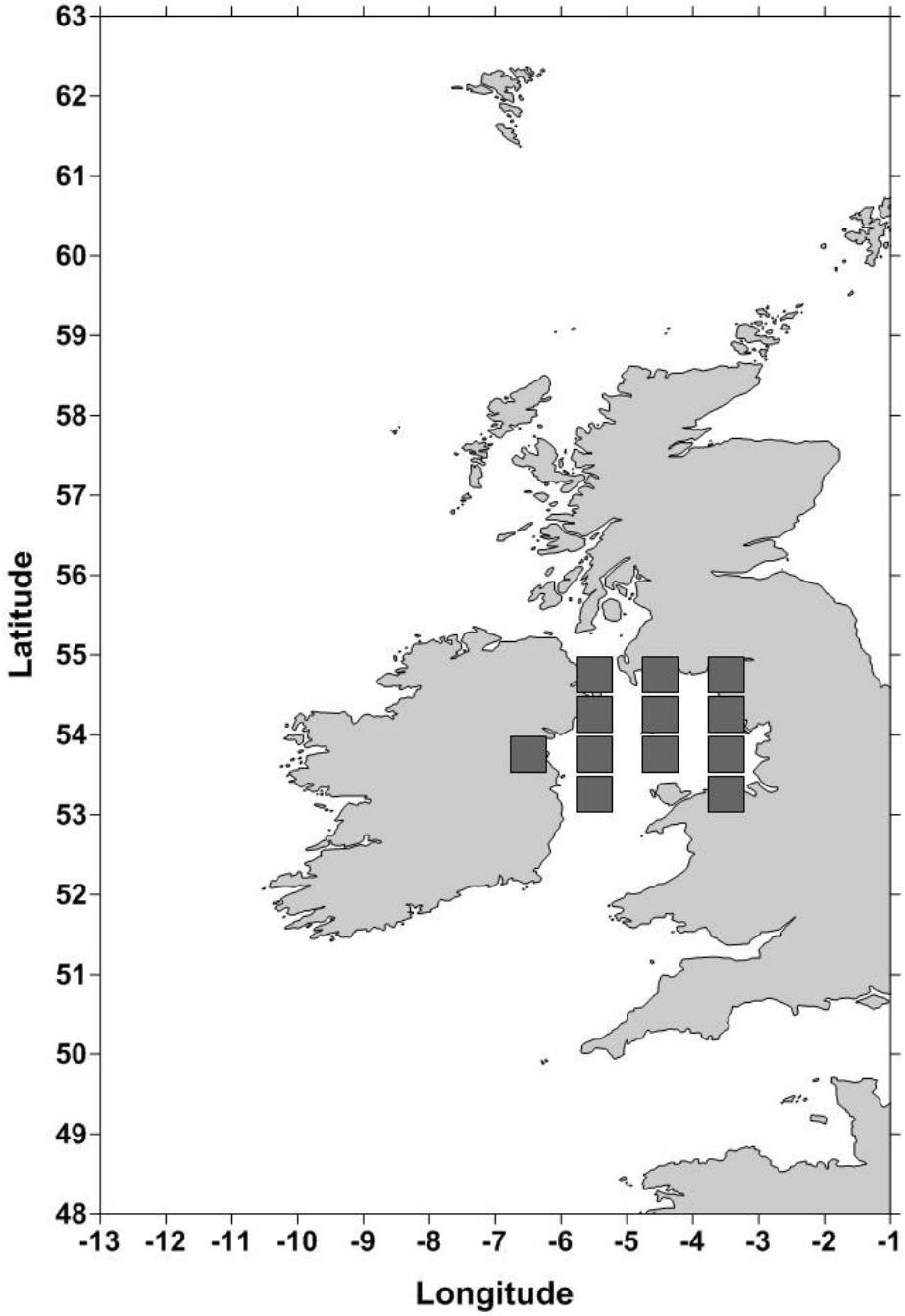
Although this survey actually commenced in 1992, Moriarty et al. (2017) initially only had access to the CSNIrOT1 data that was available on the DATRAS portal, which only started from 2008 onwards. After careful scrutiny for data quality by the national Data Provider, earlier data have subsequently been provided directly from the Data Provider for inclusion in the GSMA data product. Data for 2015 have also been

added to the DATRAS database. The CSNIrO1 survey time series, therefore, now spans a 24 year period between 1992 and 2015 with data collected from a total of 19 ICES statistical rectangles. However, only 12 of these rectangles met the 50% of years rule, being sampled in 12 years or more. Data for the seven ICES statistical rectangles (33E4, 33E5, 34E3, 34E4, 34E5, 35E3 and 35E5) that failed the 50% of years rule were excluded, amounting to 96 samples. All the remaining 12 rectangles met the time series start and end 20%ile rule having been sampled in 1992 and 2015. The exclusion reduced the CSNIrOT1 data set from 1169 records to 1073, collected over the 24 year period 1992 to 2015 from an standard survey area of 12 ICES statistical rectangles.



3.3.12. CSNIrOT4

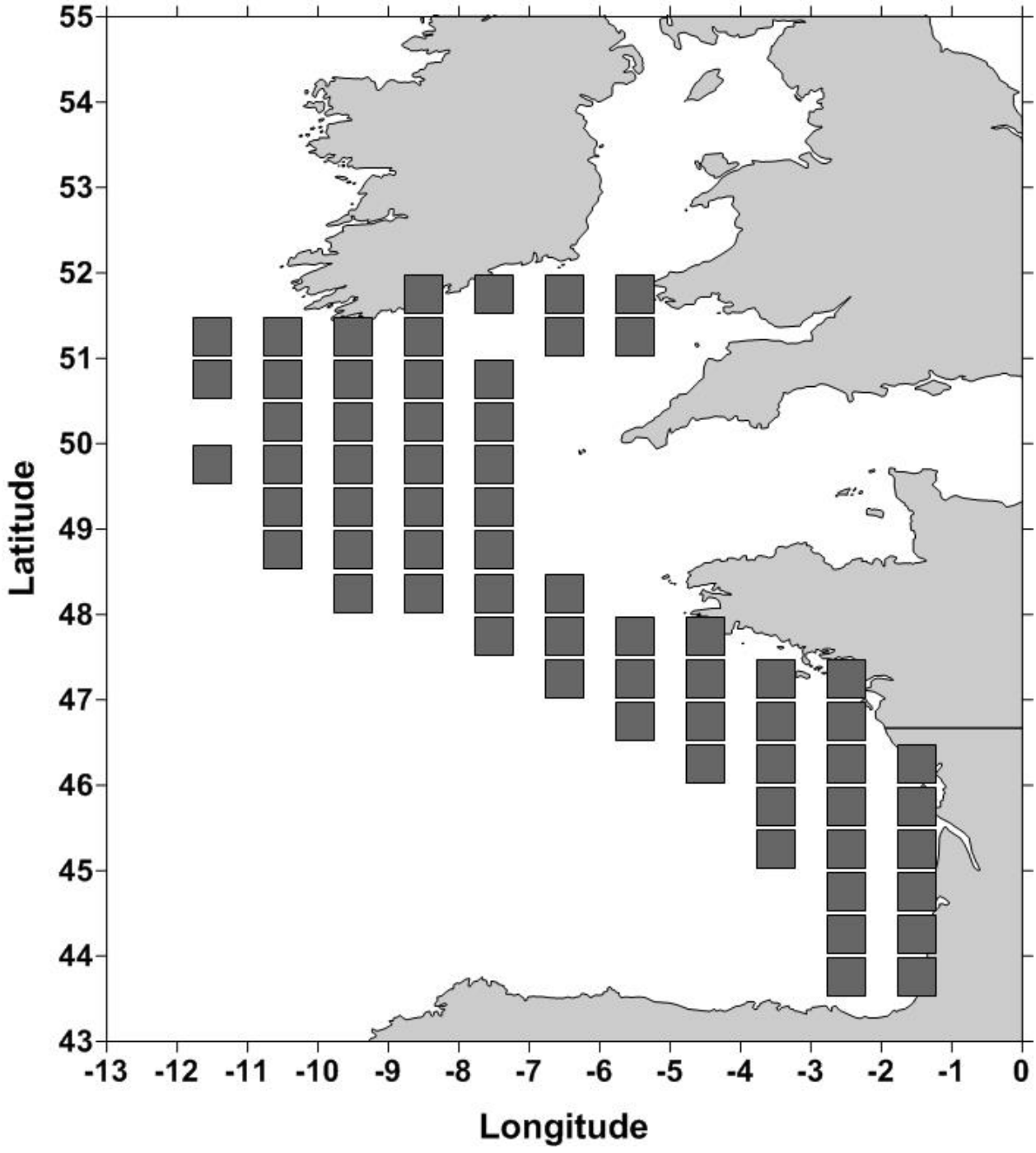
Although this survey actually commenced in 1992, Moriarty et al. (2017) initially only had access to the CSNIrOT4 data that was available on the DATRAS portal, which only started from 2008 onwards. After careful scrutiny for data quality by the national Data Provider, earlier data have subsequently been provided directly from the Data Provider for inclusion in the GSMA data product. Data for 2015 have also been added to the DATRAS database. The CSNIrO4 survey time series, therefore, now spans the period between 1992 and 2015, but with only 23 years of data because no survey took place in 2008. Samples were collected from a total of 19 ICES statistical rectangles, but six rectangles (33E4, 33E5, 34E3, 34E5, 35E3 and 35E5) failed the 50% of years rule. Excluding the samples collected from these rectangles removed data for 71 samples from the data set. One further rectangle (34E4) was not sampled in the time series 20%ile 5 year period (1992-1996), being first sampled in 2001. Excluding the data for this rectangle removed a further 53 samples. These exclusions reduced the original CSNIrO4 data set from 1178 samples to 1054 samples collected from an standard survey area of 12 ICES statistical rectangles over 23 years spanning the period 1992 to 2015, but excluding 2008.



3.3.13. CSBBFraOT4

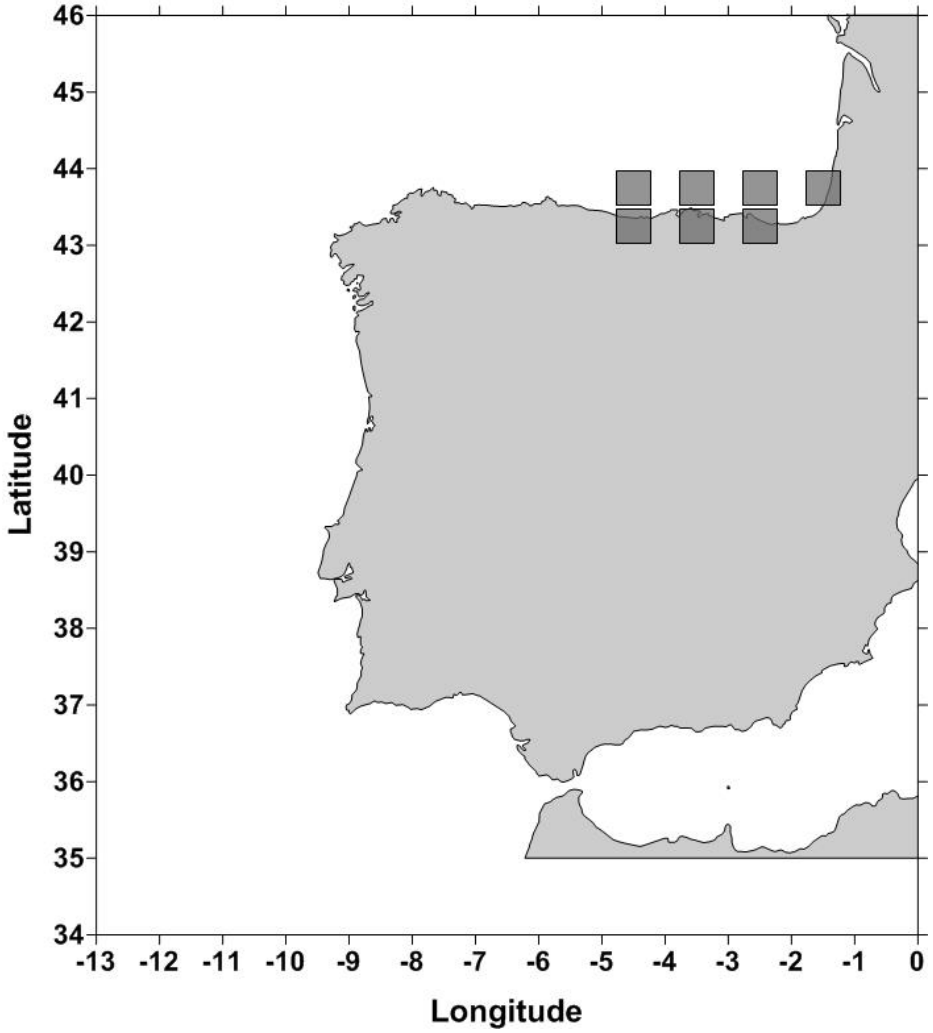
Moriarty et al. (2017) only had access to data up to 2014. Subsequently, data for 2015 have been uploaded to the DATRAS database by the national Data Provider. For this Version 2 data product used in the OSPAR IA 2017, the CSBBFraOT4 survey, therefore, now spanned a 19 year period between 1997 and 2015 with data collected from a total of 74 ICES statistical rectangles. Eight rectangles (15E7, 26E3, 27D8, 27E3, 29E3, 30E3, 31E2 and 31E5) failed the 50% of years rule, resulting in data for 52 samples being excluded. One further rectangle (24E6) was last sampled in 2011 and so failed the time series end 20%ile four year (2012-2015)

period. Excluding data for this rectangle removed a further 17 samples. These exclusions reduced the CSBBFraOT4 data from its original 2641 samples to 2572 collected over the 19 year period 1997 to 2015 from a standard survey area of 65 ICES statistical rectangles.



3.3.14. BBIC(n)SpaOT4

Spanish groundfish survey data are not routinely uploaded to DATRAS for all species sampled. These data were, therefore, made available directly from the national Data Provider. They have not, therefore, passed through exactly the same quality assurance process described for most of the other surveys by Moriarty et al. (2017). A similar approach to defining the standard monitoring programme for the BBIC(n)SpaOT4 survey was applied, i.e. including only trawl samples collected once the survey methodology had become fully established and excluding extreme short duration (<13 minutes) and extreme long duration (>66 minutes) trawl samples (Moriarty et al., 2017). Although survey work along the Spanish north coast commenced in the early 1980s, Only BBIC(n)SpaOT4 survey data from 1990 onwards, up till 2014, were made available for inclusion in the GSMA data product. Of a total of eleven ICES statistical rectangles sampled at any time by the survey over the course of its 25 year time-series, four rectangles, 16E2, 16E3, 16E4 and 17E2, failed the criteria for inclusion as part of the standard survey area. These rectangles were only irregularly sampled. Rectangle 16E4, the next rectangle to the west, was sampled in eight years, 1997 (14 samples), 1999 (two samples), 2004 (two samples), 2005 (one sample), 2008 (11 samples), 2009 (11 samples), 2010 (two samples), and 2014 (one sample). The next westerly rectangle, 16E3, was sampled in four years, 1992 (13 samples), 1997 (seven samples), 2008 (one sample), and 2009 (two samples). The next westerly rectangle, 16E2, and the rectangle immediately to the north of this, 17E2, were both only sampled in 1992, the former with nine samples collected and the latter with only one. As a consequence of this, the standard survey area for this survey covers only a limited (eastern) part of the Spanish northern continental shelf sea area. Exclusion of trawl samples not collected from within the standard survey area reduced the data set from 579 to 502 samples collected from seven ICES statistical rectangles over 25 years, 1990 to 2014.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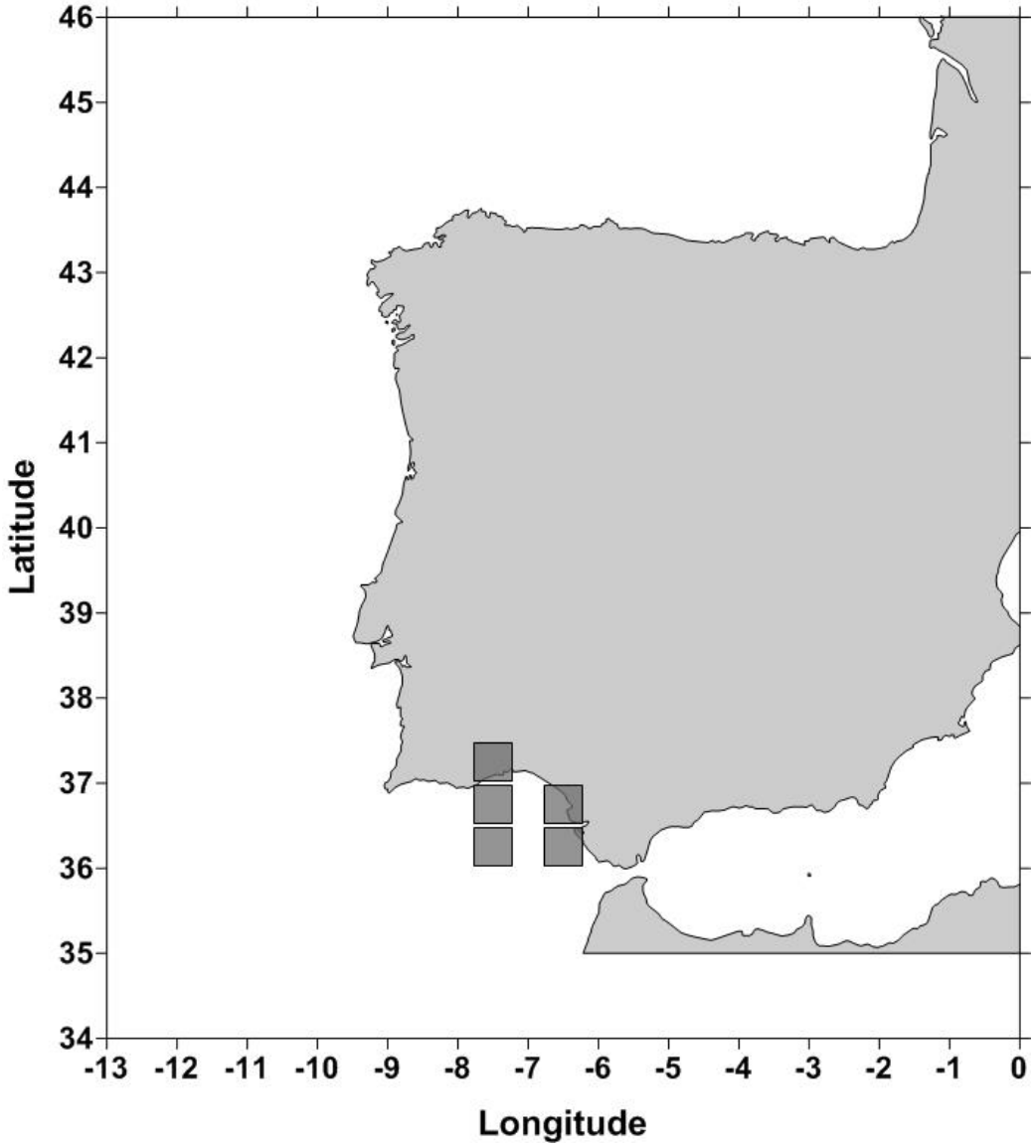
3.3.15. BBIC(s)SpaOT1

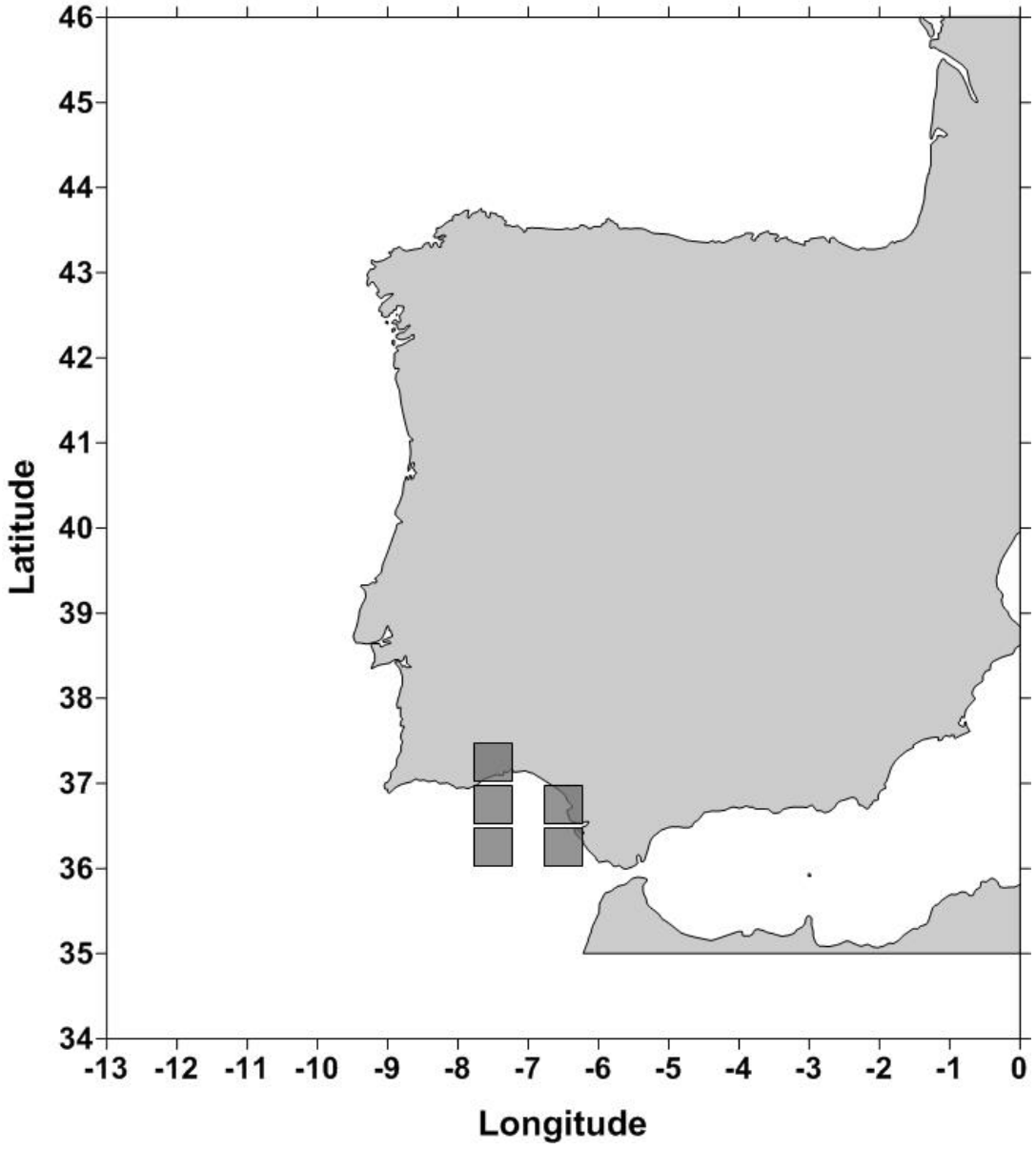
Spanish groundfish survey data are not routinely uploaded to DATRAS for all species sampled. These data were, therefore, made available directly from the national Data Provider. They have not therefore passed through exactly the same quality assurance process described for most of the other surveys by Moriarty et al. (2017). A similar approach to defining the standard monitoring programme for the BBIC(s)SpaOT1 survey was applied, i.e. including only trawl samples collected once the survey methodology had become fully established and excluding extreme short duration (<13 minutes) and extreme long duration (>66 minutes) trawl samples (Moriarty et al., 2017). Spanish first quarter survey work in the Gulf of Cadiz commenced in 1992. However, BBIC(s)SpaOT1 survey data for 1992 were not made available for consideration in the GSMA data product, so the time series for this survey runs from 1993 to 2014. No survey was carried out in 1996 and 2003, so only 20 years of data were available for this 22 year period. Of a total of six ICES statistical rectangles sampled at any time by the survey over the course of its 20 years data set, one rectangle, 03E3, failed the criteria for inclusion as part of the standard survey area. Rectangle 03E3 was only sampled in eight years of the survey: 1993, 1994, 1999, 2007, 2008, 2009, 2011 and 2012, with one sample collected in each year. Exclusion of trawl samples not collected from within the standard survey area reduced the data set from 576 to 568 samples collected from five ICES statistical rectangles over 22 years, 1993 to 2014, with breaks in 1996 and 2003.



3.3.16. BBIC(s)SpaOT4

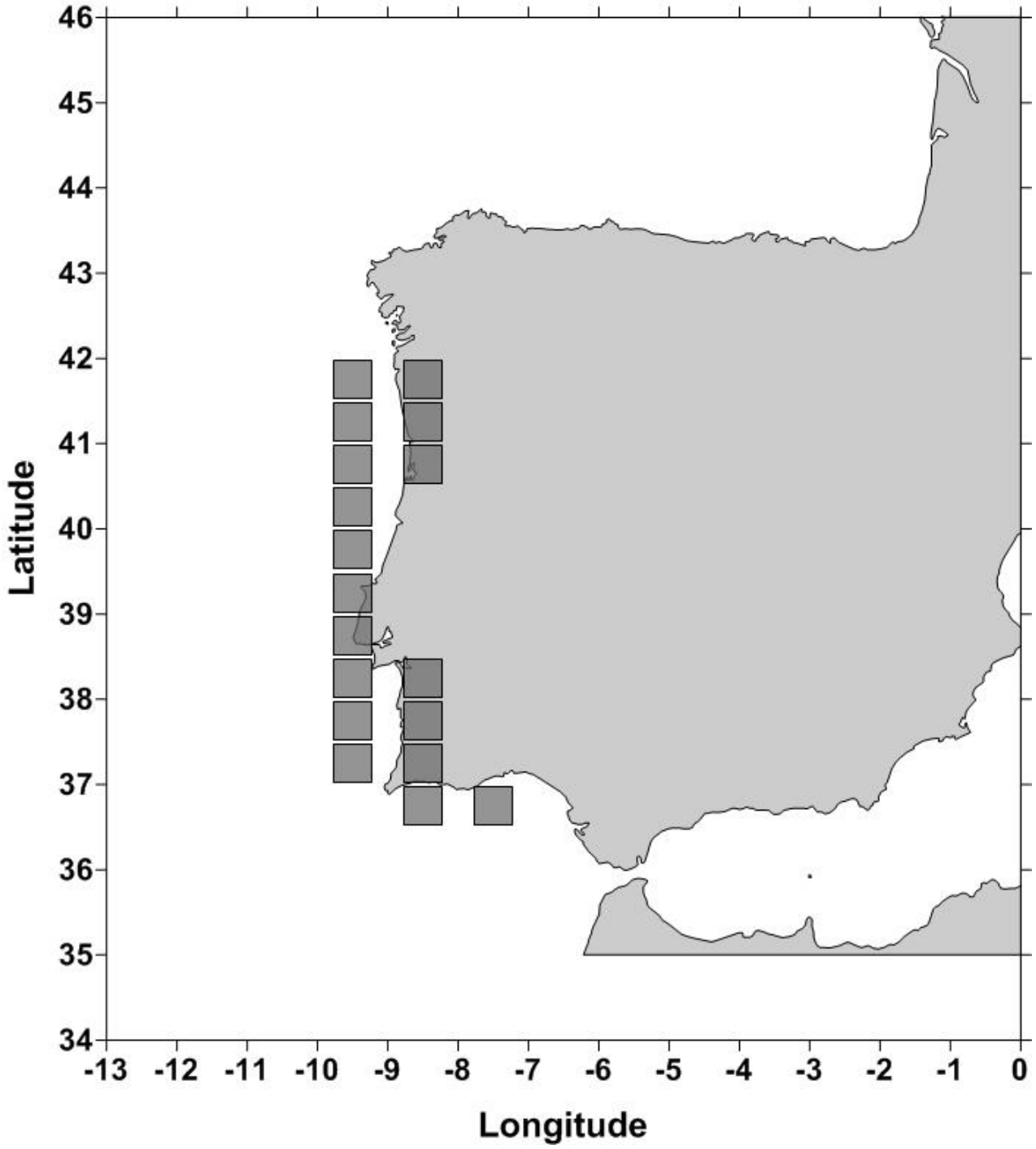
Spanish groundfish survey data are not routinely uploaded to DATRAS for all species sampled. These data were, therefore, made available directly from the national Data Provider. They have not, therefore, passed through exactly the same quality assurance process described for most of the other surveys by Moriarty et al. (2017). A similar approach to defining the standard monitoring programme for the BBIC(s)SpaOT4 survey was applied, i.e. including only trawl samples collected once the survey methodology had become fully established and excluding extreme short duration (<13 minutes) and extreme long duration (>66 minutes) trawl samples (Moriarty et al., 2017). Spanish fourth quarter survey work in the Gulf of Cadiz commenced in 1997 and BBIC(s)SpaOT4 survey data covering the full period 1997 to 2014, with the exception of 2013 when the research vessel was unavailable, were provided for inclusion in the GSMA data product. Of a total of six ICES statistical

rectangles sampled at any time by the survey over the course of its 17 years data set, one rectangle, 03E3, failed the criteria for inclusion as part of the standard survey area. Rectangle 03E3 was only sampled in four years of the survey: 2001, 2007, 2011 and 2014, with one sample collected in each year. Exclusion of trawl samples not collected from within the standard survey area reduced the data set from 510 to 506 samples collected from 5 ICES statistical rectangles over 18 years, 1997 to 2014, with a break in 2013.



3.3.17. BBICPorOT4

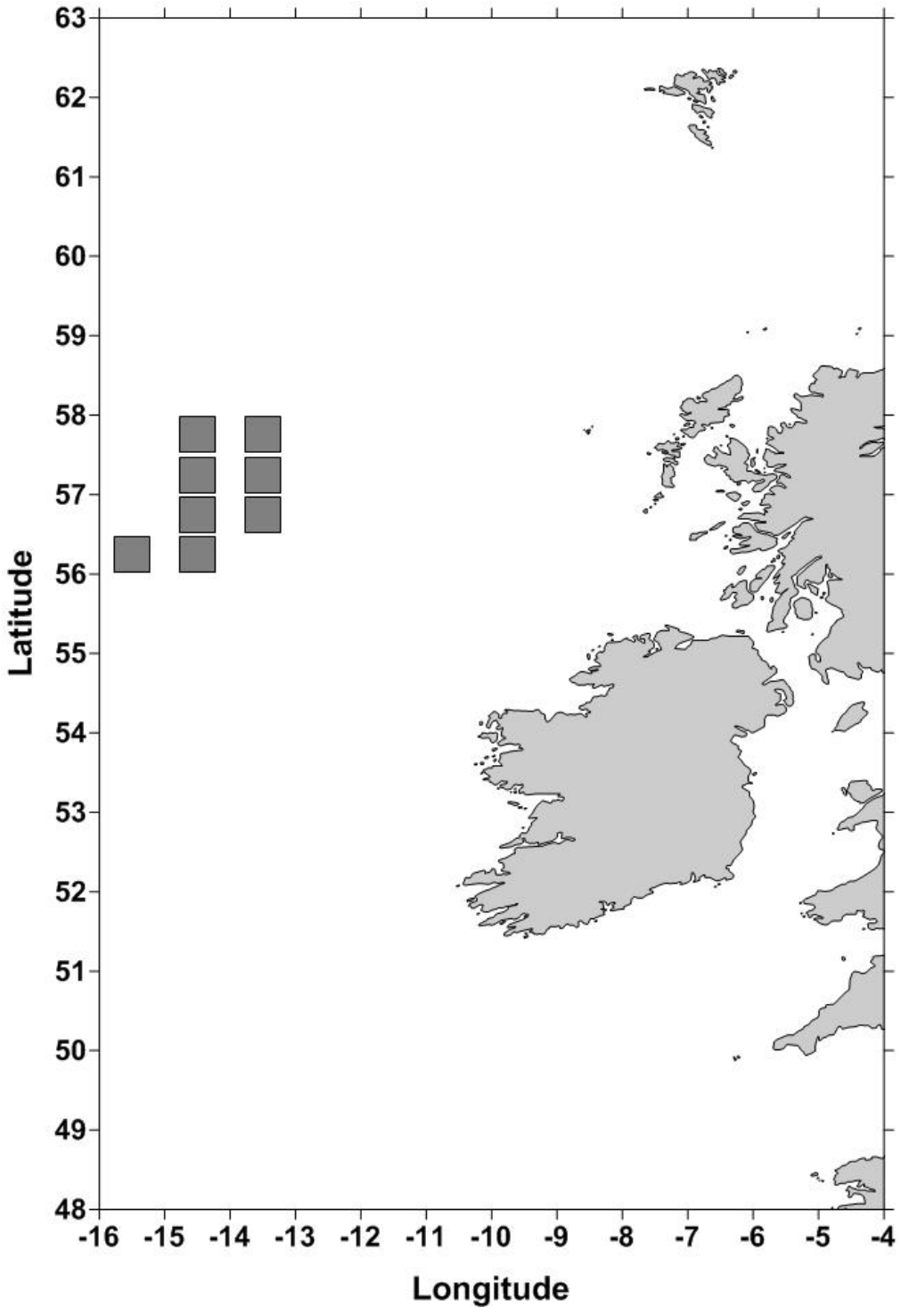
The BBICPorOT4 data set consisted of ten years of data collected over the period between 2002 and 2014 with no survey undertaken in 2003, 2004 and 2012. This is the same time series that was available to Moriarty et al. (2017); no subsequent updates to the data held on the DATRAS database have been made. Data were collected from 22 ICES statistical rectangles, but only 20 of these met the 50% of years rule, requiring the exclusion of nine samples collected in rectangles 08E1 and 09E1. In addition, two rectangles (03E2 and 07D9) were not sampled in the time series start 20%ile 4 years (2002 – 2003) period and these data were also excluded (18 samples). These exclusions reduced the BBICPorOT4 data set from its original 866 samples to 839 samples collected in ten years spanning the period 2002 to 2014 from an standard survey area of 18 ICES statistical rectangles.



3.3.18. WAScoOT3

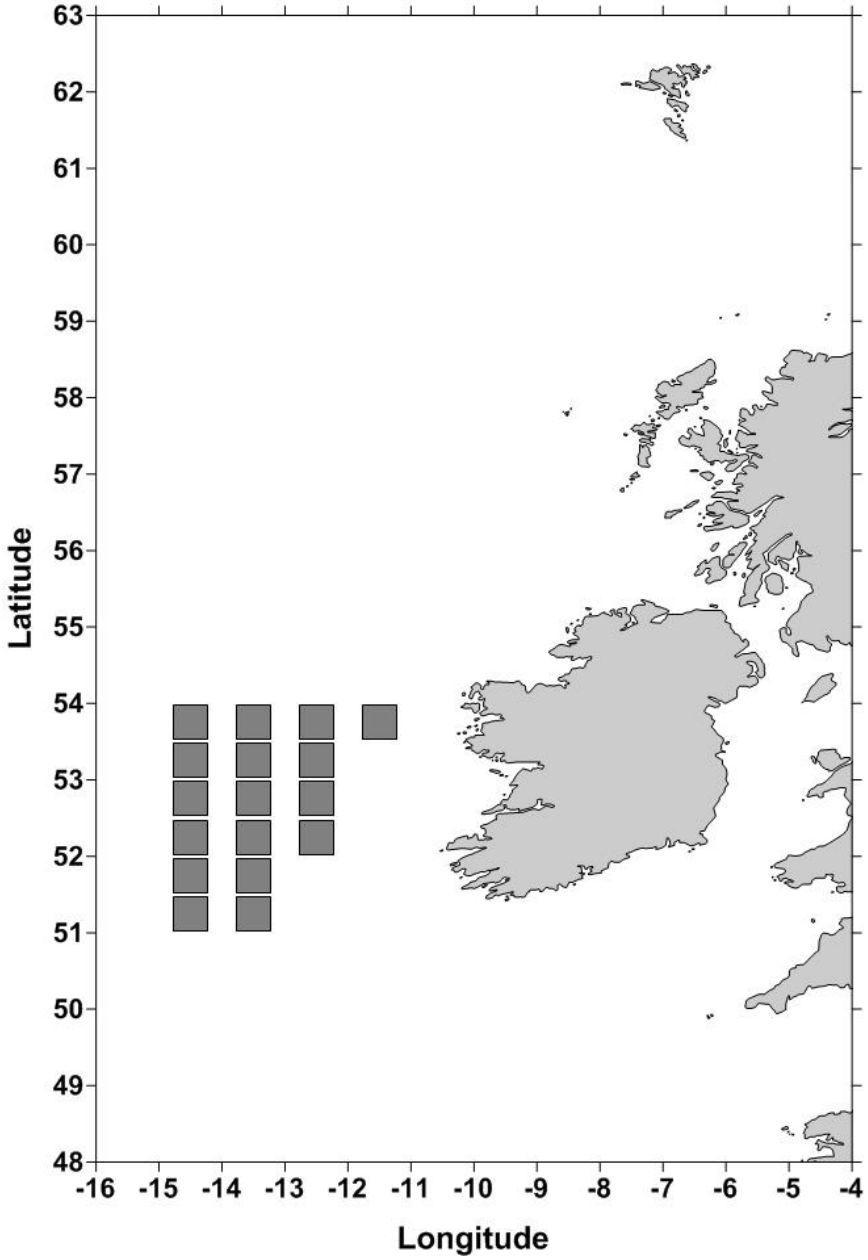
The WAScoOT3 data set consisted of 14 years of data collected over the period between 1999 and 2015, but with no survey undertaken in 2000, 2004 and 2010. This was the same time series of data available to Moriarty et al. (2017) for the original derivation of the Version 1 data product. The standard monitoring programme contained data for 565 trawl samples collected from 13 ICES statistical rectangles, but only eight of these met the 50% of years rule, requiring the exclusion

of 21 samples collected in five rectangles (40D4, 42D4, 44D7, 45D5 and 45D6). Excluding these samples left a total of 544 samples in the WAScoOT3 data set collected in 14 years between 1999 and 2015 from a standard survey area of eight ICES statistical rectangles. No rectangles failed the start and end 20%ile periods criterion.



3.3.19. WASpaOT3

Spanish groundfish survey data are not routinely uploaded to DATRAS for all species sampled. These data were, therefore, made available directly from the national Data Provider. They have not therefore passed through exactly the same quality assurance process described for most of the other surveys by Moriarty et al. (2017). A similar approach to defining the standard monitoring programme for the WASpaOT3 survey was applied, i.e. including only trawl samples collected once the survey methodology had become fully established and excluding extreme short duration (<13 minutes) and extreme long duration (>66 minutes) trawl samples (Moriarty et al., 2017). The Spanish survey on the Porcupine Bank stared in 2001 and fourteen years of data were available spanning the period 2001 to 2014. There were no breaks in this time series. Of eighteen ICES statistical rectangles sampled at any point by the survey, seventeen met the criteria for inclusion in the standard survey area. Rectangle 32D7 was sampled in just two years, in 2010 and 2014, with one sample collected in each year. Exclusion of trawl samples not collected from within the standard survey area reduced the data set from 994 to 992 samples collected from 17 ICES statistical rectangles over 14 years, 2001 to 2014.



3.4. Concluding Summary

Deriving a standard survey area for each survey, and on occasion determining the optimal survey period that provided the best compromise between survey temporal range and spatial coverage, resulted in the exclusion of 1965 samples across the 19 surveys addressed to date. This represented a 4.4% loss of data, from the full survey standard monitoring programme data sets, which already excluded any trawl samples of non-standard duration, and trawl samples collected before individual survey protocols were fully standardized (Moriarty et al. 2017). This was deemed necessary in order to derive fully standardised monitoring data products for each survey. The original complete data set of 44,162 samples across all 19 surveys was reduced to a set of 19 data products containing data obtained from 42,197 otter and

beam trawl samples taken from 392 ICES statistical rectangles across the OSPAR Northeast Atlantic Region. The standard monitoring programme – standard survey area data product for each survey therefore only contains data collected once each survey's methodology had become fully established, collected using only standard trawl durations (13 minutes to 66 minutes), and collected from a standard survey area consisting of ICES statistical rectangles sampled at least once in 50% of years that the survey had been carried out and at least once in both periods at the start and end of the time series, each of sufficient length as to represent 20% the survey time series.

Survey	Samples	Start	End	Years	Rectangles
GNSGerBT3	632	2002	2015	13	20
GNSNetBT3	2,375	1999	2015	17	89
GNSEngBT3	2,259	1990	2015	26	15
GNSIntOT1	13,207	1983	2016	34	171
GNSIntOT3	5802	1998	2015	18	168
GNSFraOT4	2,440	1988	2015	28	15
CSEngBT3	2,378	1993	2015	23	23
CSScoOT1	1,492	1985	2016	32	39
CSScoOT4	1,014	1995	2015	20	42
CSIreOT4	1,948	2003	2015	13	51
CSNIrOT1	1,073	1992	2015	24	12
CSNIrOT4	1,054	1992	2015	23	12
CSBBFraOT4	2,572	1997	2015	19	65
BBIC(n)SpaOT4	502	1990	2014	25	7
BBIC(s)SpaOT1	568	1993	2014	20	5
BBIC(s)SpaOT4	506	1997	2014	17	5
BBICPorOT4	839	2002	2014	10	18
WAScoOT3	544	1999	2015	14	8
WASpaOT3	992	2001	2014	14	17

Table 3: Summary of data held in the standardised OSPAR Groundfish Survey Monitoring and Assessment Data Product for the full Standard Monitoring Programme and Standard survey Areas.

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5. References

Fraser, H.M., Greenstreet, S.P.R., and Piet, G.J. 2007. Taking account of catchability in groundfish survey trawls: implications for estimating demersal fish biomass. ICES Journal of Marine Science, 64: 1800–1819.

Moriarty, M., Greenstreet, S.P.R. and Rasmussen, J. 2017. Derivation of Groundfish Monitoring and Assessment Data Products for the Northeast Atlantic Area. Scottish Marine and Freshwater Science Report. (in press).