



ICES
CIEM

International Council for
the Exploration of the Sea
Conseil International pour
l'Exploration de la Mer

ICES Data Centre – DATRAS

1.3 SweptArea-based calculations – 2020

DATRAS Procedure Document

NS-IBTS swept area calculation algorithms

Contents

Summary	2
Denmark.....	2
France.....	2
Germany.....	4
Netherlands	4
Norway.....	5
Sweden.....	5
UK-England	10
UK-Scotland	15

Summary

This document describes mathematical functions for estimation of the missing values of door spread, wing spread and distance for each country for the NS-IBTS data. The mathematical functions are provided by the national institutes and are used by DATRAS to further facilitate swept-area based calculations.

The mathematical functions are calculated based on the observed values over the years of the survey. Owing to changes in the handling of the gear, changes in vessel, or the equipment on the vessels the net geometry might change. There national institutes can provide mathematical functions for specific time periods.

Some of the national institutes use different lengths of the sweeps which alters the net geometry. Therefore some national institutes provide algorithms for long and short sweeps.

Denmark

Based on the data of 2004-2015 functions for estimating door spread and wingspread are established for long and short sweeps.

Door spread (DS):

Calculated_DS = $79.386 - 33.695 * \text{EXP}(-0.028 * \text{Depth})$, for short sweeps

Calculated_DS = $104.502 - 316.682 * \text{EXP}(-0.043 * \text{Depth})$, for long sweeps

Wingspread (WS):

Calculated_WS = $5.867 + 0.206 * \text{DS}$, for short sweeps

Calculated_WS = $4.900 + 0.166 * \text{DS}$, for long sweeps

For further explanation see: [IBTSWG report Annex 7](#), page 186

France

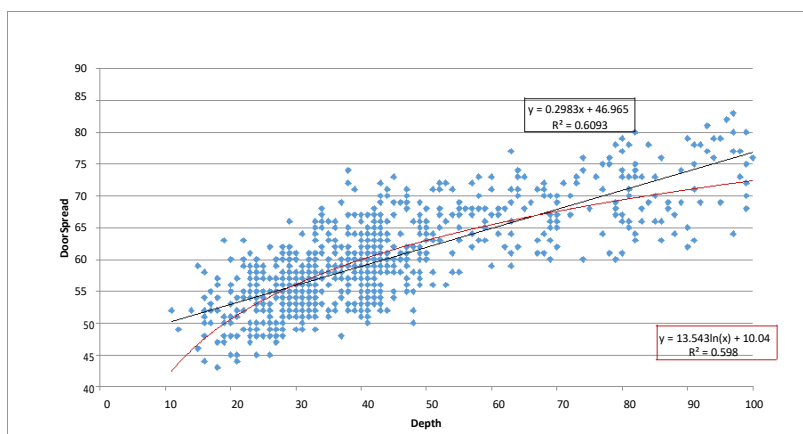
Based upon the data of 2004-2014.

The French IBTS records door spread and wings spread. Only the short 50 meters sweeps are used.

The 2004-2010 data was collected with Scanmar equipment, 2011-2014 with Marport equipment.

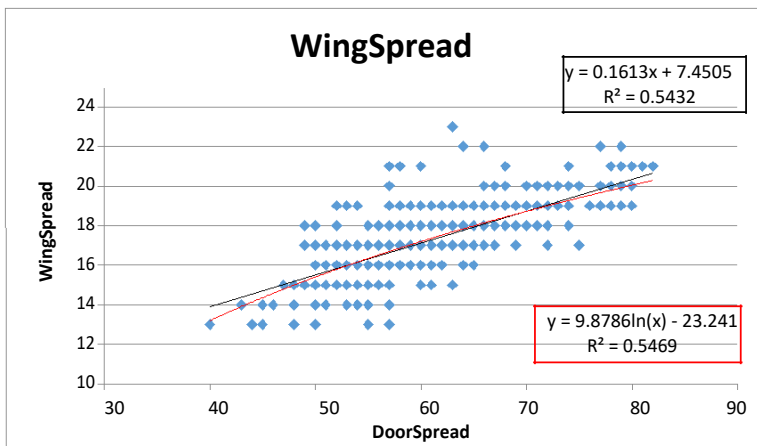
DoorSpread (DS) vs Depth (D)

Formula	R ²	p-value	Nb observations
DS = 46.965 + 0.298*D	0.60	<0.001	886 (dark line)



WingSpread (WS) vs DoorSpread (DS)

Formula	R ²	p-value	Nb observations
WS = 7.450 + 0.161*DS	0.543	<0.001	578 (dark line)



In case doorspread is missing as well, the calculated doorspread is used for estimating the wing spread.

Distance (Dist)

Based on haul duration (HaulDur, in minutes) and speed over ground (GroundSpeed, in knots)

$$\text{Dist} = \text{HaulDur} / 60 * 1852 * \text{GroundSpeed}$$

Germany

Please refer to [IBTSWG report Annex 7](#) page 205

Netherlands

Based upon the data of 2003-2020

Door spread (DS):

The Dutch IBTS records only door spread.

The 2003-2011 data was collected with Scanmar equipment, 2012-2014 with Marport equipment, 2015 + 2016 English equipment on board of the Endeavour was used, 2017-2020 new Scanmar equipment is used. The Netherlands only uses short sweeps.

The functions are estimated using nonlinear (weighted) least-squares (NLS) in R. Using the relation between depth and door spread, which amongst others depends on the amount of warp that is set at the specified depth. As there is a maximum and minimum for the door spread, these are more less set using extra weighting for these fictional points.

2003-2004 (red): Minimum 55 m at 10 m Depth; Maximum 110m at 180 m Depth

$$\text{CAL_Doorspread} = 29.544 * \log_{10}(\text{Depth}) + 14.116 * \log_{10}(\text{WarpLngt}) - 3.456$$

2005-2014 (blue): Minimum 55 m at 10 m Depth; Maximum 100m at 180 m Depth

$$\text{CAL_Doorspread} = 31.165 * \log_{10}(\text{Depth}) + 0.2974 * \log_{10}(\text{WarpLngt}) + 29.321$$

2015-2016 (green): Onboard Endeavour. Min 45m at 10m Depth; Max 100m at 180m Depth

$$\text{CAL_Doorspread} = 28.947 * \log_{10}(\text{Depth}) + 23.372 * \log_{10}(\text{WarpLngt}) - 32.476$$

2017 onwards (gold): Minimum 55 m at 10 m Depth; Maximum 100m at 180 m Depth

$$\text{CAL_Doorspread} = 15.842 * \log_{10}(\text{Depth}) + 30.868 * \log_{10}(\text{WarpLngt}) - 24.793$$

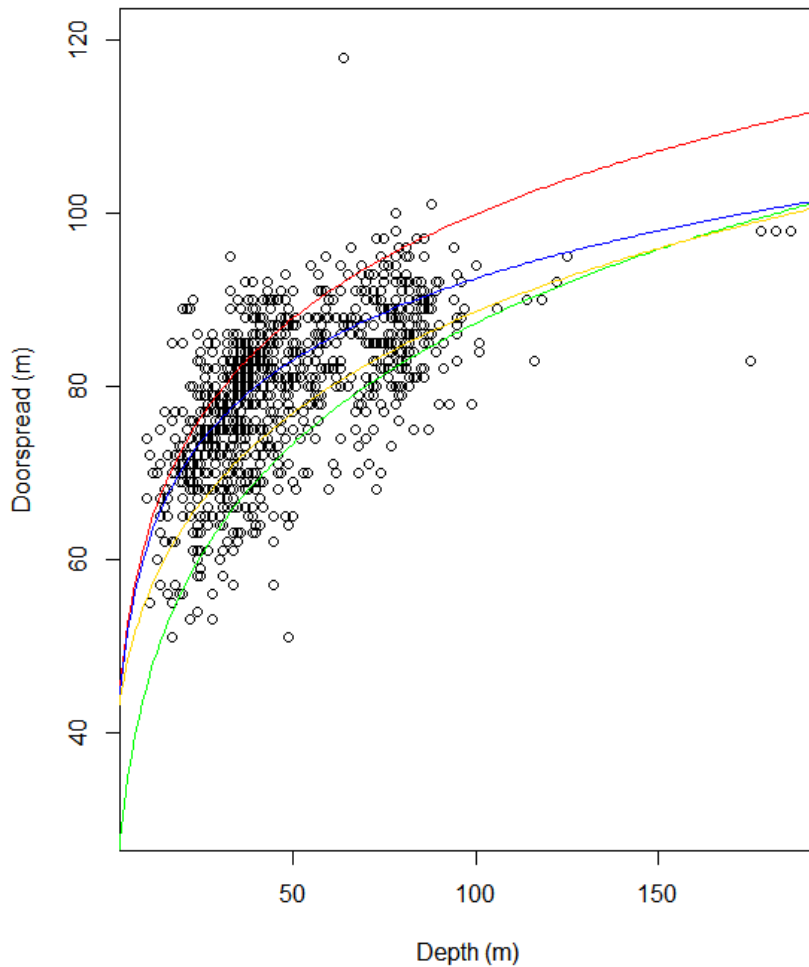


Figure: All the measured doorspread vs depth of the Dutch IBTS 2013-2020. The colored lines are the fitted functions for door spread at depth (using an average warp length at depth). In red the fit for 2003-2004; in blue 2005-2014; green 2015-2016 and in gold 2017-2020.

Wing spread (WS):

The Netherlands is not measuring wing spread, they only did it on board of the Endeavour in 2015 and 2016. For all the other years the formula estimated by Scotland is used:

$$\text{Calculated_WS} = (0.1909 * \text{DS}) + 4.011$$

In case doorspread is missing as well, the calculated doorspread is used for estimating the wing spread.

Distance (Dist):

Based on haul duration (HaulDur, in minutes) and speed over ground (GroundSpeed, in knots)

$$\text{Dist} = \text{HaulDur} / 60 * 1852 * \text{GroundSpeed}$$

Norway

Please refer to [IBTSWG report Annex 7](#) page 199

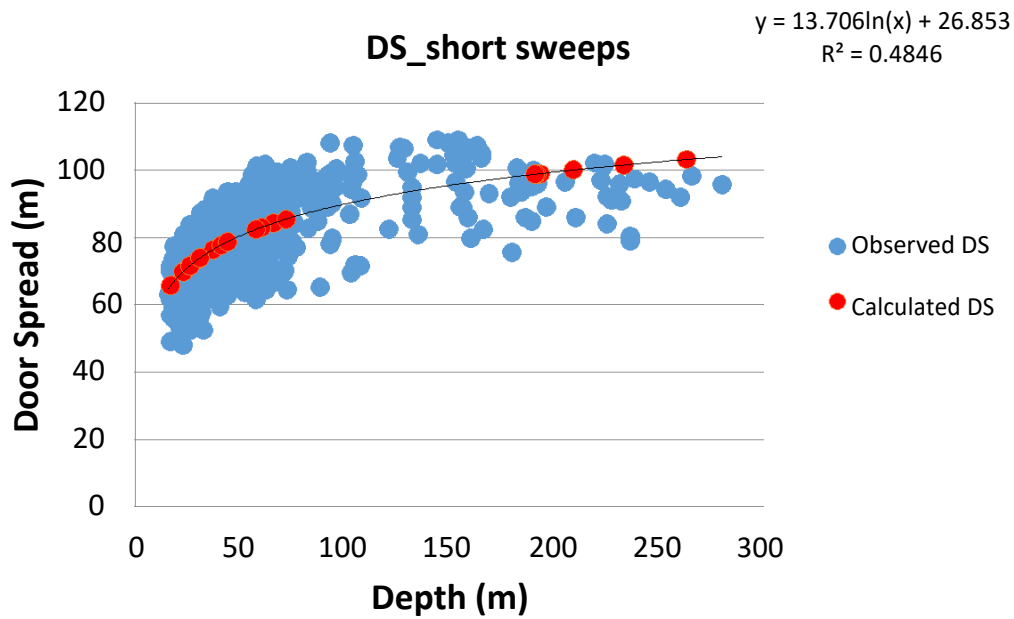
Sweden

Swedish algorithms for missing Door Spread and Wing spread values

Door spread (DS):

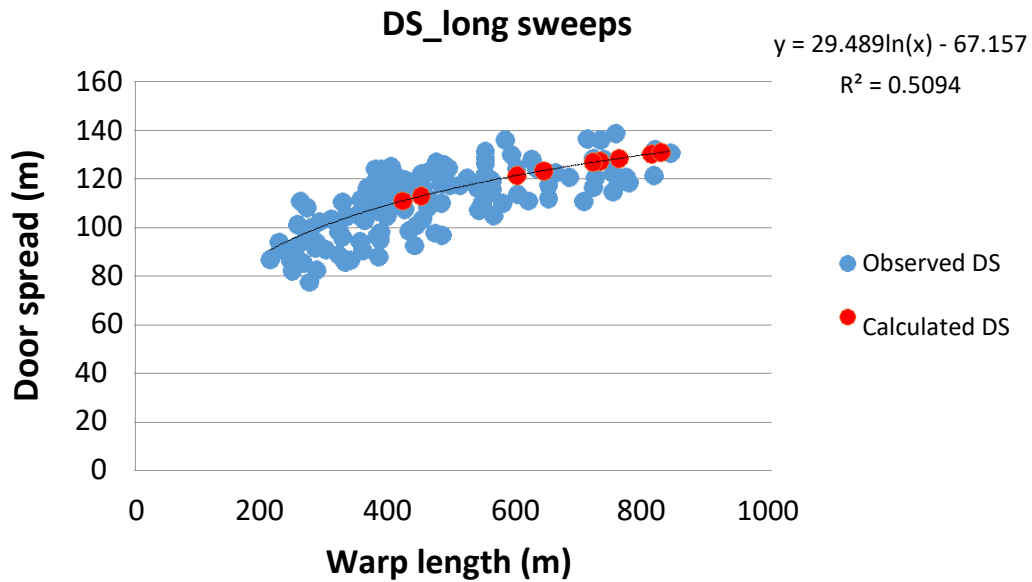
Based on depth (D)

A) For short (50-60m) sweeps: $DS_{60m\ sweeps} = 13,706 * \ln(\text{Depth}) + 26,853$



Based on Warp Length (WL)

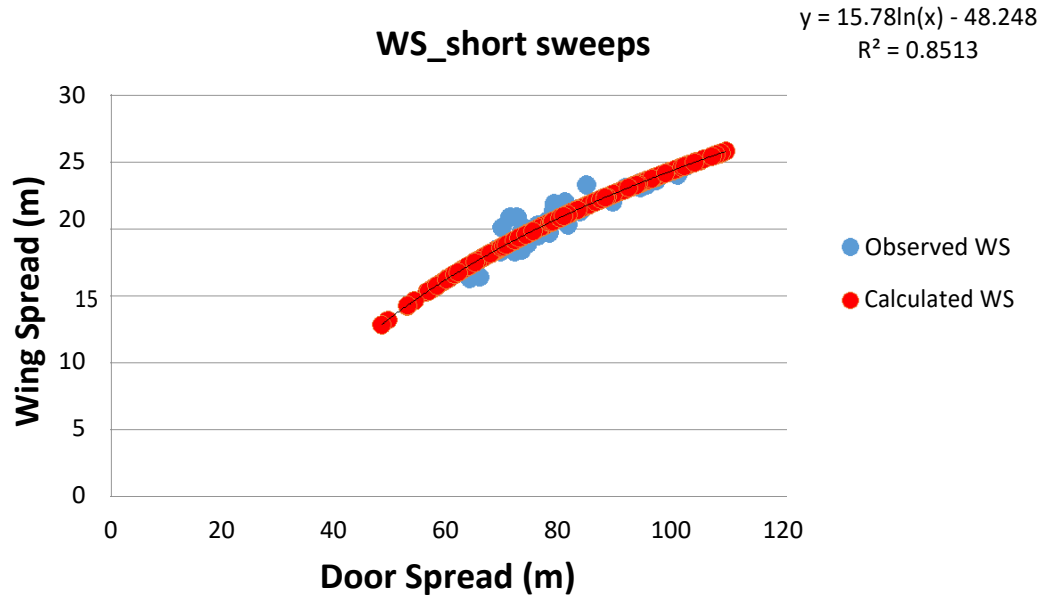
B) For long (100-110m) sweeps: $DS_{110m\ sweeps} = 29,489 * \ln(\text{WL}) - 67,157$



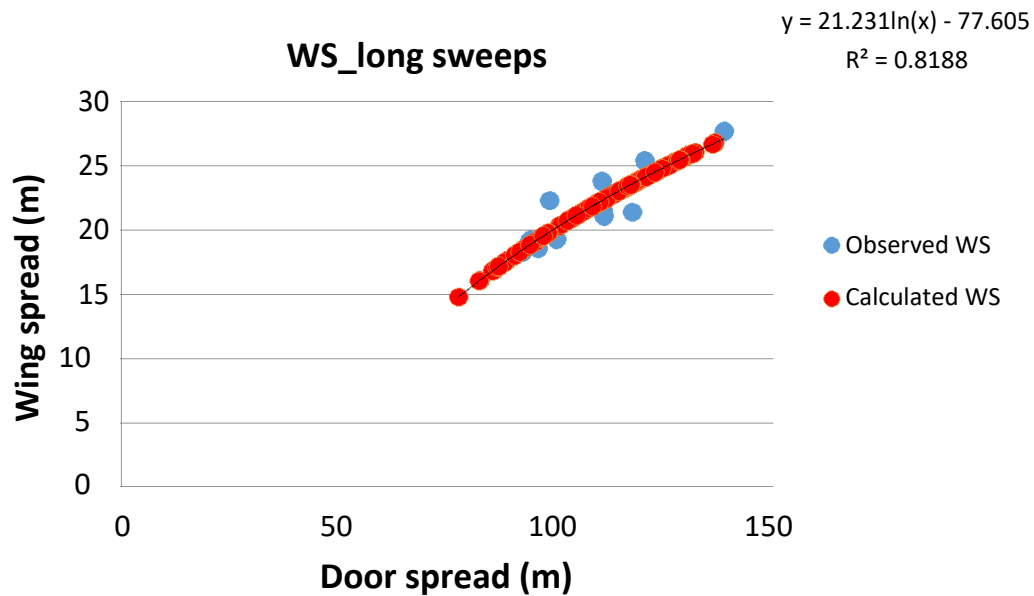
Wing spread (WS):

Based on door spread (DS)

A) For short (50-60m) sweeps: $WS_{60m\ sweeps} = 15,78 * \ln(\text{Door Spread}) - 48,248$



B) For long (100-110m) sweeps: $WS_{110m\ sweeps} = 21,231 * \ln(\text{Door Spread}) - 77,605$



Distance (Dist):

NO values missing

Country	Method by which the observed distance will be produced: The future - or already correct - entries in the HH field "Distance" (Explain how you derive this entry. Readily available in the ship's data?)
Sweden	Argos: earlier years, roughly before 2005 distance was measured on MacSea chart
	Later it was calculated as the sum of gps-loggings
	Mimer: distance was measured on MacSea chart
	Dana: 2014q3 calculated as the sum of the gps-loggings (all points)
	Dana:2011q3- same as above

UK-England

Using data **2004 – 2005 and 2007-2013** (i.e. excluding 2006)

DoorSpread	WingSpread	WrapLngt	Ave_depth	Flag	Value
Present	p/a	p/a	p/a	Observed	DoorSpread
Absent	Present	Present	p/a	Calculated	Cal_DoorSpread = $4.616 * \text{WingSpread} - 15.966$
Absent	Absent	Present	p/a	Calculated	Cal_DoorSpread = $(21.78 * \ln(\text{WarpLngt})) - 47.20$
Absent	Absent	Absent	Present	Calculated	Cal_DoorSpread = $(15.0306 * \ln(\text{Ave_depth})) + 12.6399$
p/a	Present	p/a	p/a	Observed	WingSpread
Present	Absent	Present	p/a	Calculated	Cal_WingSpread = $(0.1869 * \text{DoorSpread}) + 5.7416$
Absent	Absent	Present	p/a	Calculated	Cal_WingSpread = $(4.074 * \ln(\text{WarpLngt})) - 3.137$
Absent	Absent	Absent	Present	Calculated	Cal_WingSpread = $(2.92489 * \ln(\text{Ave_depth})) + 7.43486$

Using data **2006 only** (due to differing sweep length)

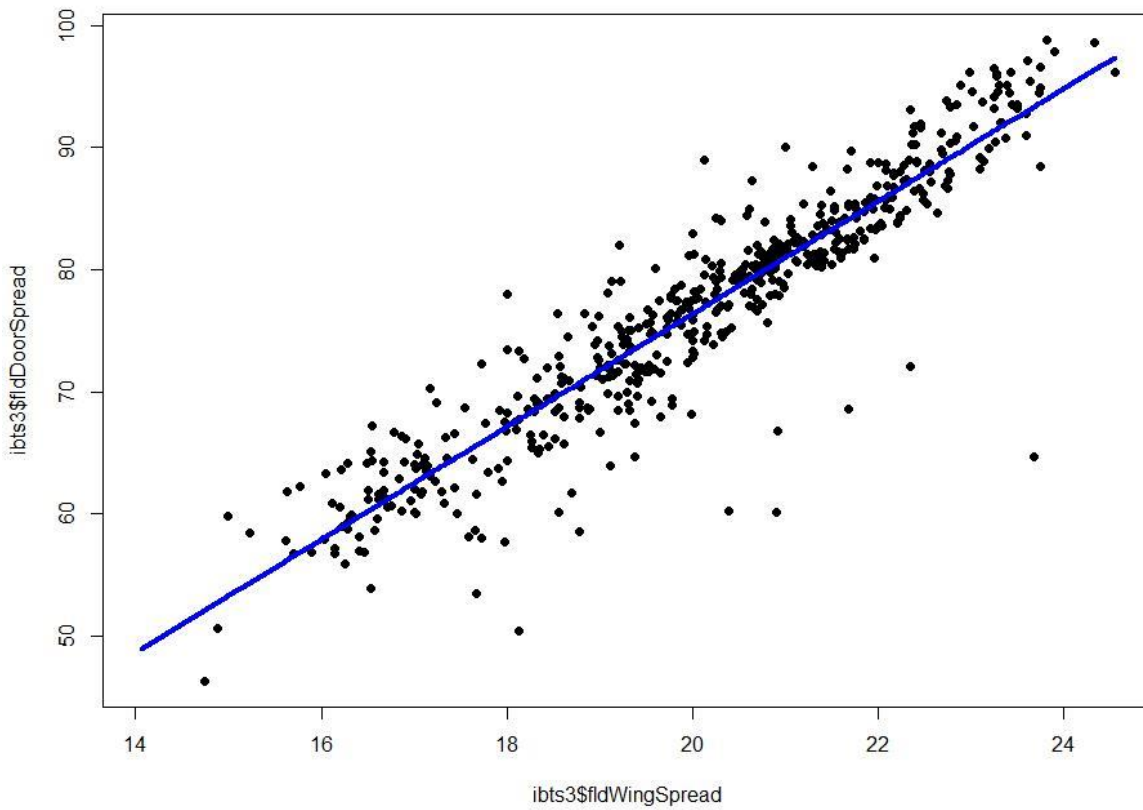
DoorSpread	WingSpread	WrapLngt	Ave_depth	Flag	Value
Present	p/a	p/a	p/a	Observed	DoorSpread
Absent	Present	Present	p/a	Calculated	Cal_DoorSpread = $3.8182 * \text{WingSpread} - 11.9066$
Absent	Absent	Present	p/a	Calculated	Cal_DoorSpread = $(16.4421 * \ln(\text{WarpLngt})) - 25.4727$

Absent	Absent	Absent	Present	Calculated	Cal_DoorSpread = $(12.4680 * \ln(\text{Ave_depth})) + 17.5865$
p/a	Present	p/a	p/a	Observed	WingSpread
Present	Absent	Present	p/a	Calculated	Cal_WingSpread = $(0.2242 * \text{DoorSpread}) + 5.7889$
Absent	Absent	Present	p/a	Calculated	Cal_WingSpread = $(4.1885 * \ln(\text{WarpLngt})) - 2.8637$
Absent	Absent	Absent	Present	Calculated	Cal_WingSpread = $(3.1495 * \ln(\text{Ave_depth})) + 8.2192$

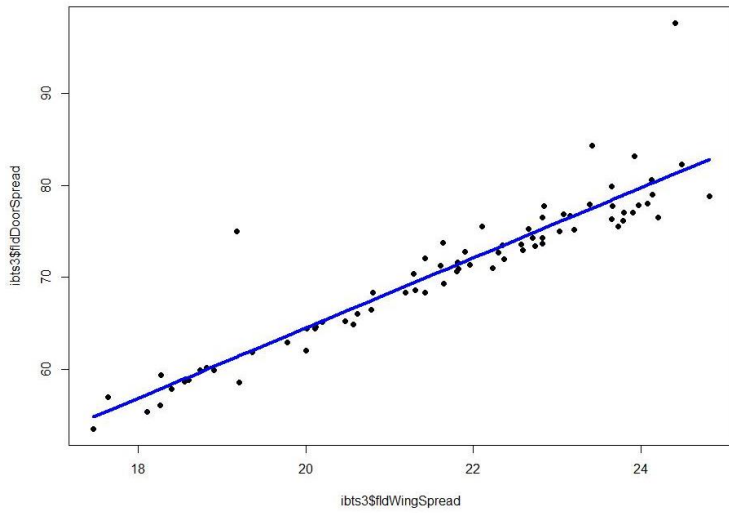
Cal_DoorSpread = 4.616*WingSpread -15.966

Multiple R-squared: 0.8626

F-statistic: 3365 on 1 and 536 DF, p-value: < 2.2e-16



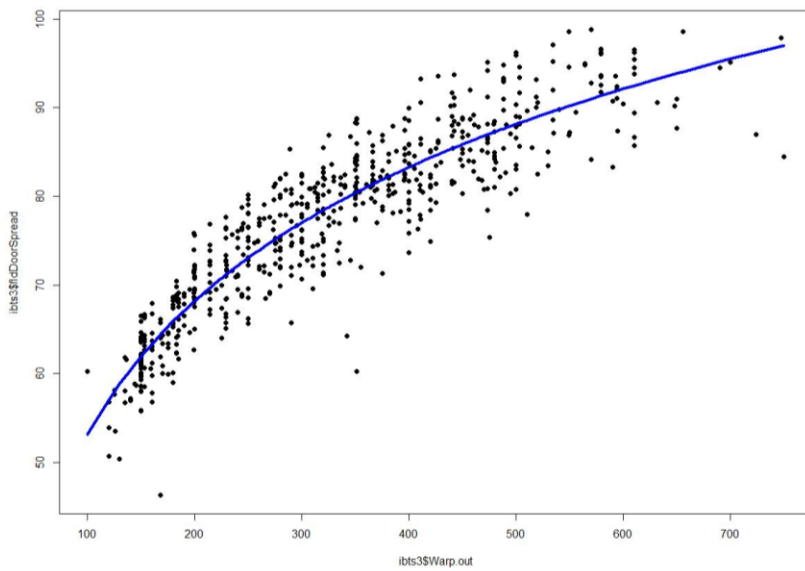
Below 2006 data only



$$\text{Cal_DoorSpread} = (21.78 * \ln(\text{WarpLngt})) - 47.20$$

Multiple R-squared: 0.8393

F-statistic: 3249 on 1 and 622 DF, p-value: < 2.2e-16

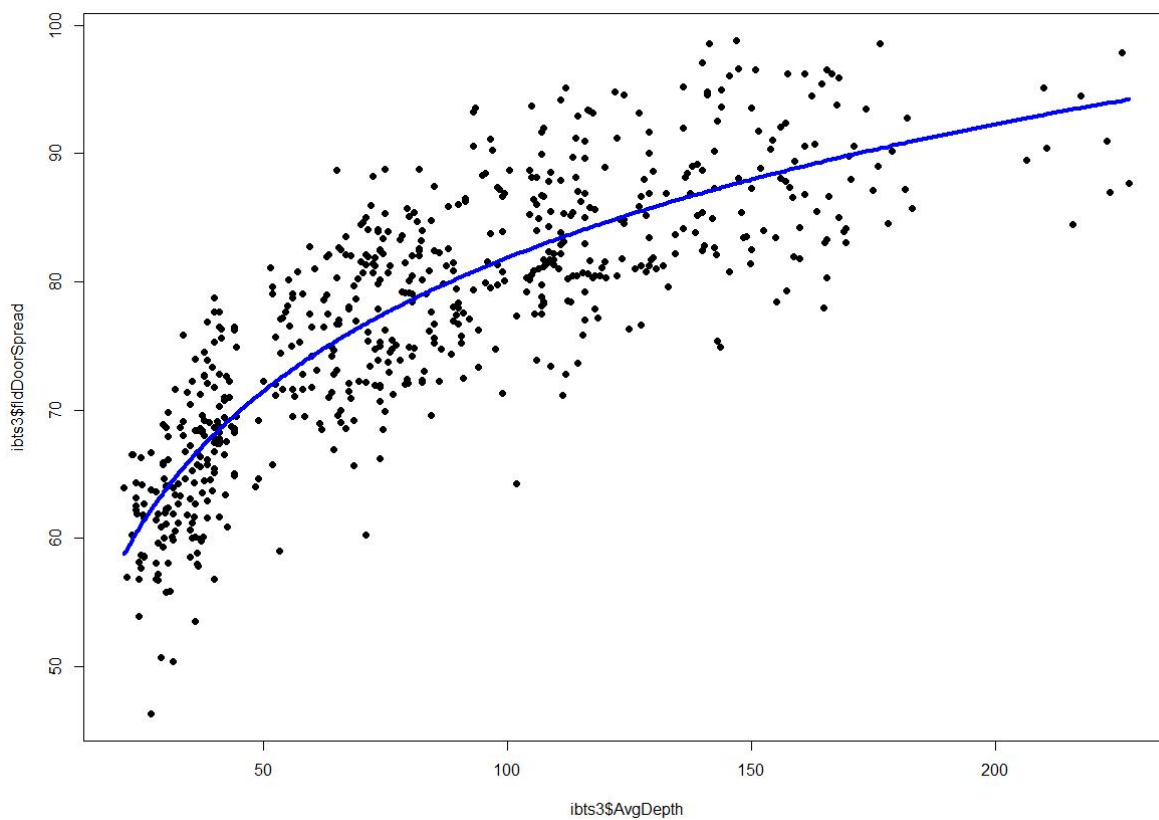


Below 2006 data only

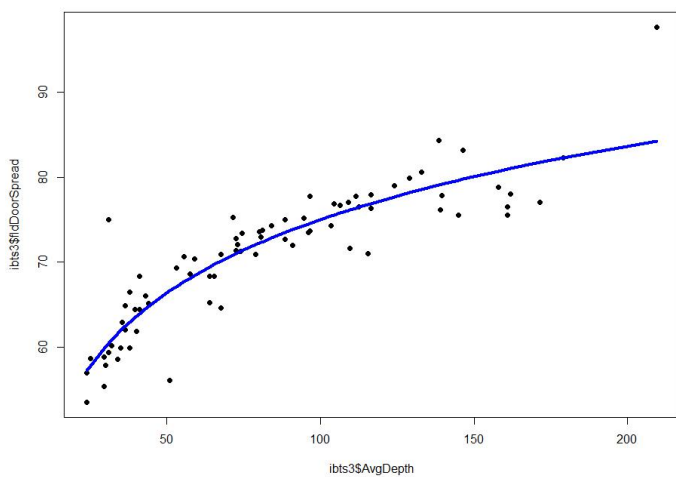
Multiple R-squared: 0.7203

F-statistic: 1605 on 1 and 623 DF, p-value: < 2.2e-16

$$\text{Cal_DoorSpread} = (15.0306 * \ln(\text{Ave_depth})) + 12.6399$$



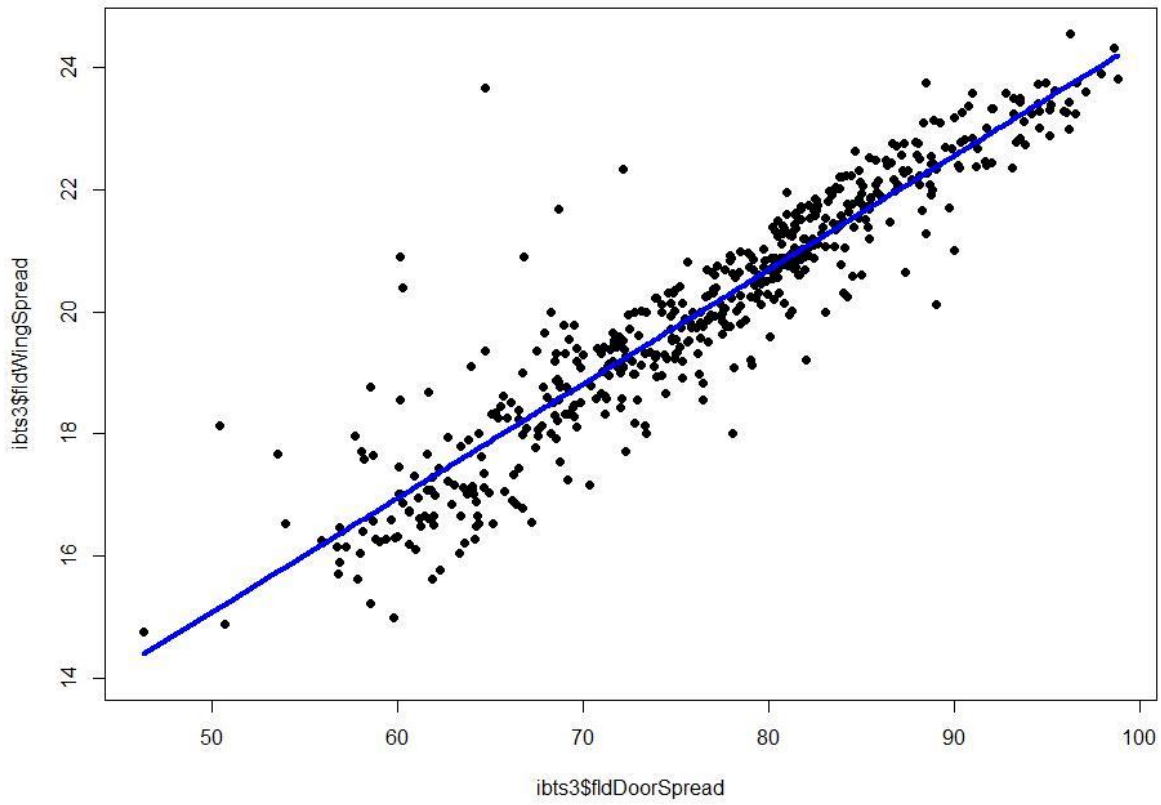
Below 2006 data only



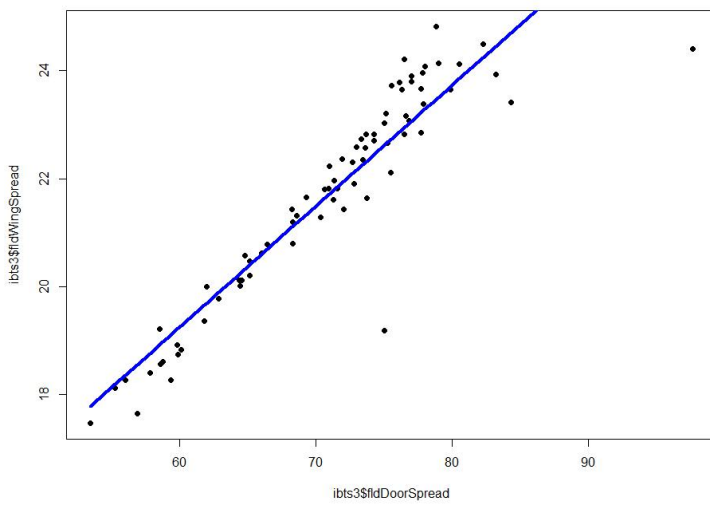
$$\text{Cal_WingSpread} = (0.1869 * \text{DoorSpread}) + 5.7416$$

Multiple R-squared: 0.8626

F-statistic: 3365 on 1 and 536 DF, p-value: < 2.2e-16



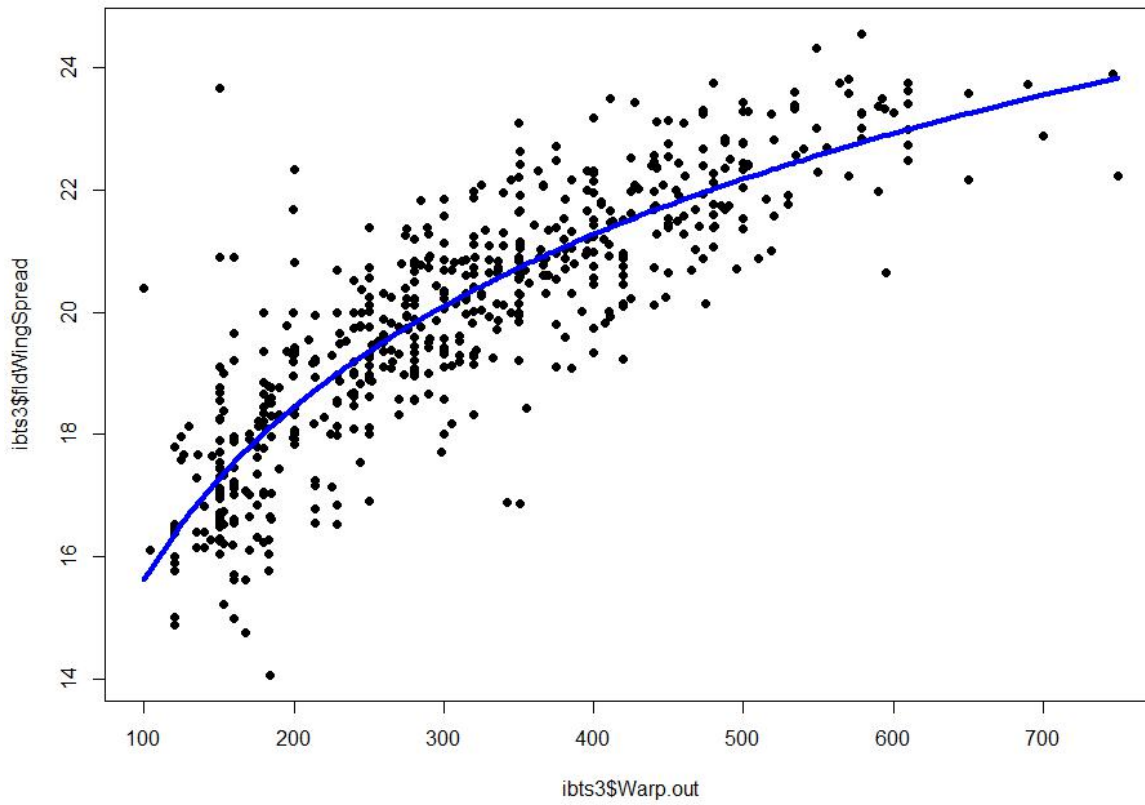
Below 2006 data only



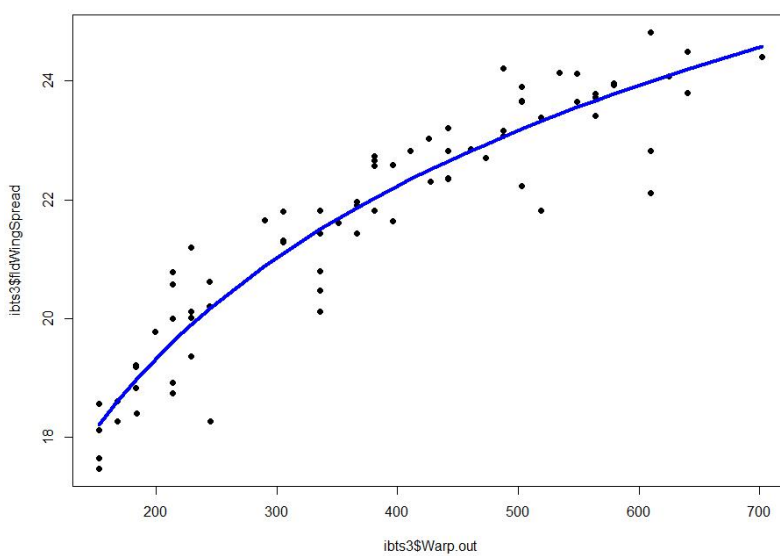
$$\text{Cal_WingSpread} = (4.074 * \ln(\text{WarpLngt})) - 3.137$$

Multiple R-squared: 0.7285

F-statistic: 1561 on 1 and 582 DF, p-value: < 2.2e-16



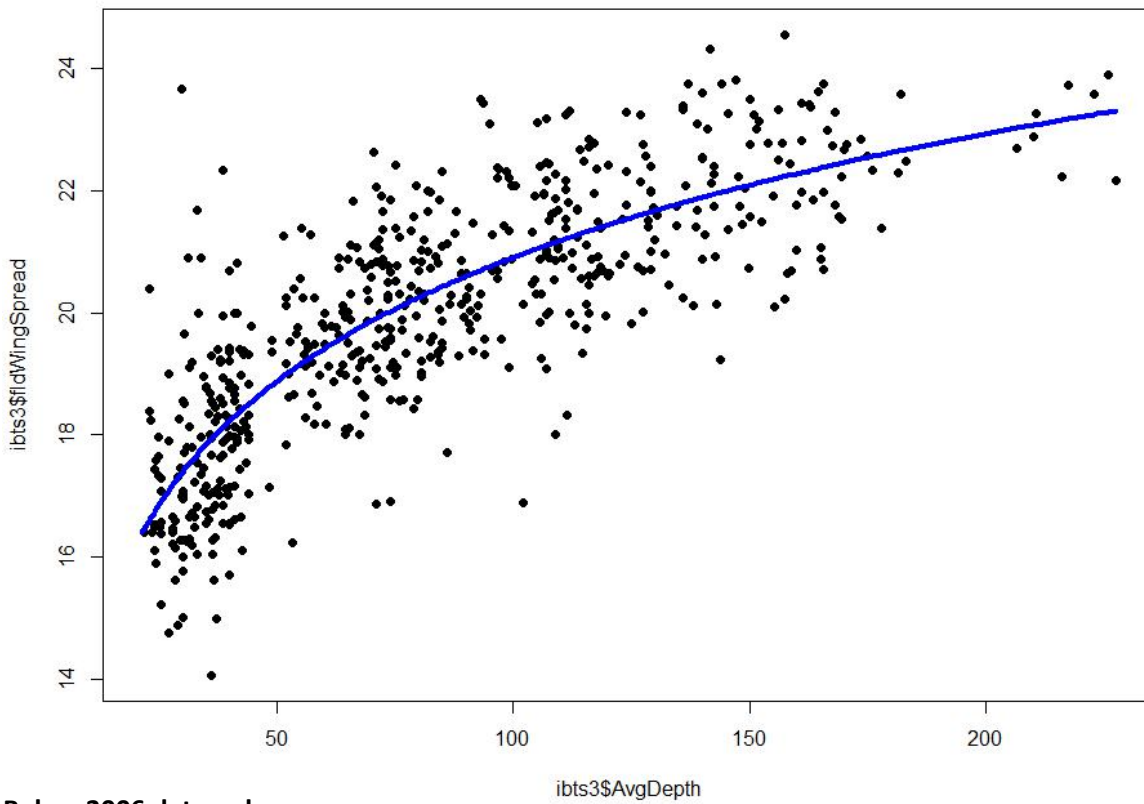
Below 2006 data only



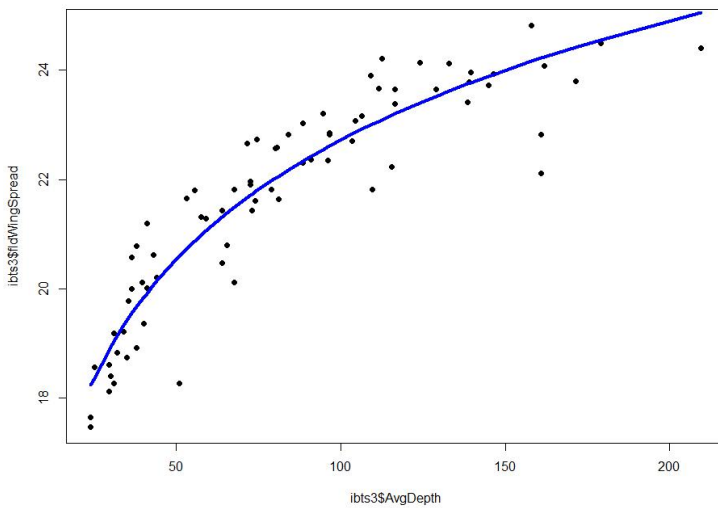
$$\text{Cal_WingSpread} = (2.92489 * \ln(\text{Ave_depth})) + 7.43486$$

Multiple R-squared: 0.6599

F-statistic: 1131 on 1 and 583 DF, p-value: < 2.2e-16



Below 2006 data only



UK-Scotland

Please refer to [IBTSWG report Annex 7](#) page 191