SOSS Migration Assessment Tool Instructions

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This document describes the rationale behind, and use of, the Excel Workbook and accompanying GIS shapefile that together comprises the 'SOSS Migration Assessment Tool' (SOSSMAT). There is also an accompanying video demonstrating the use of SOSSMAT that can be found at: http://www.youtube.com/watch?v=sTt0kODhuEE&feature=share&list=PLDmgiA5KPXHQzTfVshzj2OhuRX1Zxw015

RATIONALE

Connectivity Matrix

The connectivity matrix forms an integral part of the Excel Workbook that comprises the SOSSMAT. This has already been derived. Consequently no user action is required and thus the first two sections on Lines of connectivity and Species Specific connectivity are for information only.

Lines of connectivity

Using the Station Point wizard of ET Geowizards™ within ArcGIS™, station points were first generated along the coastlines of the UK and coastlines of countries with line of sight to the UK relevant to migratory birds.

The initial station points were automatically positioned at 10km intervals along the coastlines.

These were then rationalised through manual edits to ensure a relatively even distribution along the general coastline by removing points from clusters (such as those caused by the coastline following estuaries and fjords).

Station points were then allocated to categories representing contiguous stretches of coast or country, chosen to represent distinct coastal stretches between which direct sea-crossings could be plotted.

The grid references of all station points were then exported from ArcGIS.

Based on these locations, a matrix of start and end points was generated in the statistical software SAS™ for all possible straight line sea-crossings between each station point and all other station points (approx. 1,200,000 lines).

These were filtered to remove joins that would not be required for assessment of migration through off-shore wind farms, for example lines crossing land and lines within coastal stretches other than specific exceptions where those lines crossed significant offshore stretches of sea.

These start and end points were then imported back into GIS and the 'points to polyline' tool of ET Geowizards™ used to generate all possible direct line of sight sea crossings for migrants traveling across UK waters (251,599 lines of connectivity).

Species specific connectivity

The maps accompanying the species accounts from Wright *et al*. 2012, depicting polygons encompassing the migration routes of individual species were then used to flag lines of connectivity on a species specific basis.

This was done using the 'select by location' dialogue to select all lines falling completely within each migration polygon. Note that for some species there are separate maps for breeding and passage populations - these were processed independently. Also where there are separate polygons distinguishing major migration paths from trivial or speculative migration paths only the former are considered.

Those lines falling completely within the migration polygon were coded '1' and all other lines coded '0' for the species in question. This forms the basis of the worksheet 'Connectivity Matrix' in the SOSSMAT. That worksheet is locked to prevent accidental changes.

ANALYSIS

Wind farm footprint

The ArcGIS shapefile provided 'ConnectivityLines.shp' contains the final selection of 251,599 lines of connectivity. Users will need to flag those lines of connectivity that cross the footprint(s) of the proposed wind farm and use the resulting table of attributes to populate the work sheet 'Footprints' in the SOSSMAT.

The SOSSMAT has the capacity to assess up to 10 wind farm footprints simultaneously so long as they are all situated in approximately the same offshore area. Separate copies of the SOSSMAT workbook should be used if wind farms involving different subsets of sea areas are being considered. Detailed instructions follow later in this document.

Relevant Sea-crossings

The SOSSMAT contains a worksheet 'Route Filter'. Each record represents a unique combination of start and end points associated with lines of connectivity of which there are 130 possibilities. Only cells colour coded 'green' are editable. Values in the field 'Retained for project(s)' are user defined (intuitive Y/N and not case sensitive) to determine which sea crossings will be used in the analysis. Detailed instructions follow later in this document.

Percentage of relevant population(s) using the sea crossing(s) in question that cross the wind farm footprint

Once the Footprint(s) and Route Filter worksheets have been populated, a value for percentage of the population crossing the relevant sea crossing that will pass over the wind farm footprint(s) will be automatically updated in the worksheet 'Results' of the SOSSMAT. These fields are colour coded 'blue' (columns F to O) and are not editable. The percentage is calculated as:

[The number of lines crossing the wind farm footprint, totally contained within the species migration corridor(s) and belong to a relevant sea crossing] / [The number of lines totally contained within the species migration corridor(s) and belong to a relevant sea crossing] %

Population size and Population Correction Factor

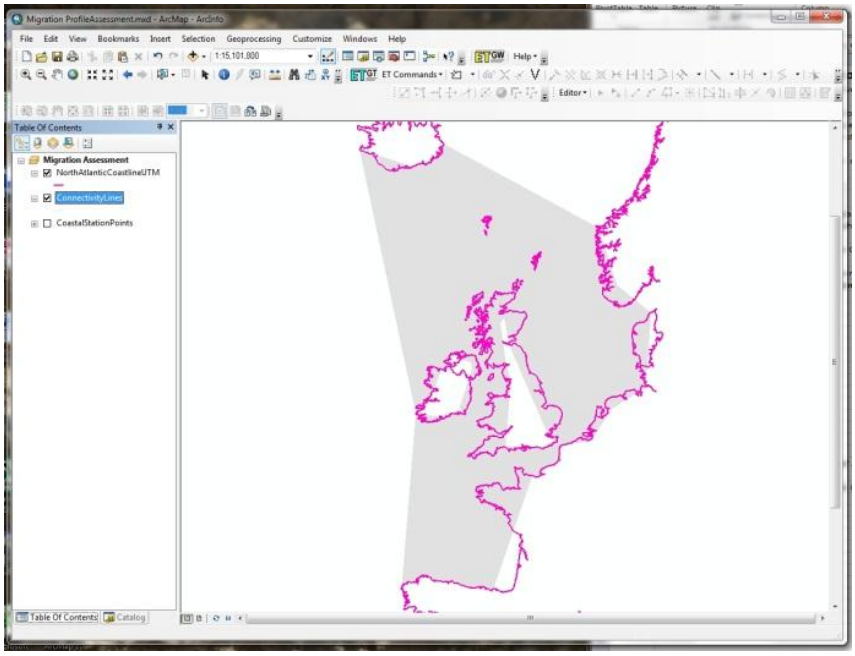
There are several other user fields in the worksheet 'Results' that allow users to take the next step in the analysis i.e. to estimate the actual number of birds that will cross the wind farm footprint(s). These cells are colour coded 'green' and are user editable. Two of these fields 'Population Size' (column C) and 'Population correction Factor' (column D) need to be populated by the user. Once populated, estimates for the number of individuals crossing the wind farm footprint will be automatically updated in the cells colour coded 'orange' (columns P to Y). Detailed instructions follow later in this document.

Detailed instructions for populating Footprints in the SOSSMAT

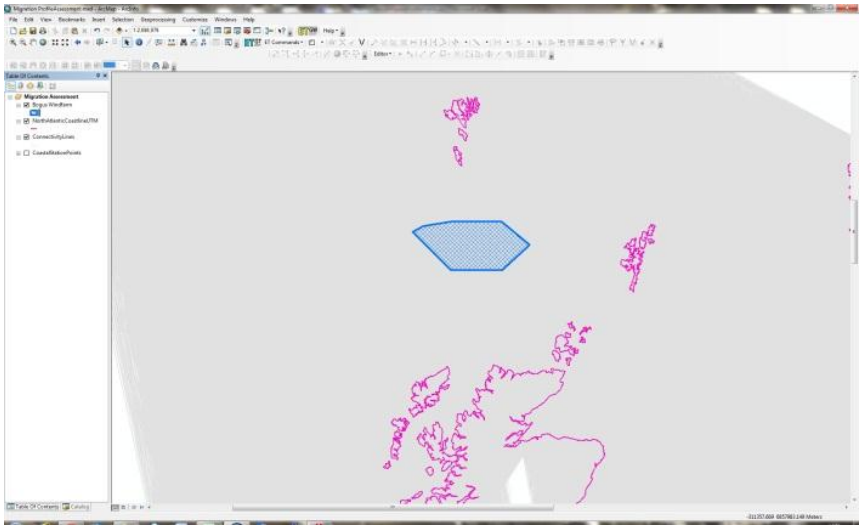
This involves a relatively straightforward GIS process. The instructions and screen shots that follow assume the use of ArcGIS™ 10. One shapefile is provided as an accompaniment to the SOSSMAT. The processes described below and ability to import the shapefile should be available in any mainstream GIS software.

The only two shapefiles required are the file 'ConnectivityLines.shp' provided with the SOSSMAT and a polygon file representing the footprint(s) of the wind farm under assessment. A European outline is reassuring but not required.

1) add the shapefile ConnectivityLines.shp to your GIS project. This shapefile contains 251599 potential lines of connectivity for all potential sea crossing involving UK waters. You probably want to un-tick the check-box to display these lines so as to speed up screen refreshes.



2) add a shapefile containing a polygon of your wind farm footprint(s).

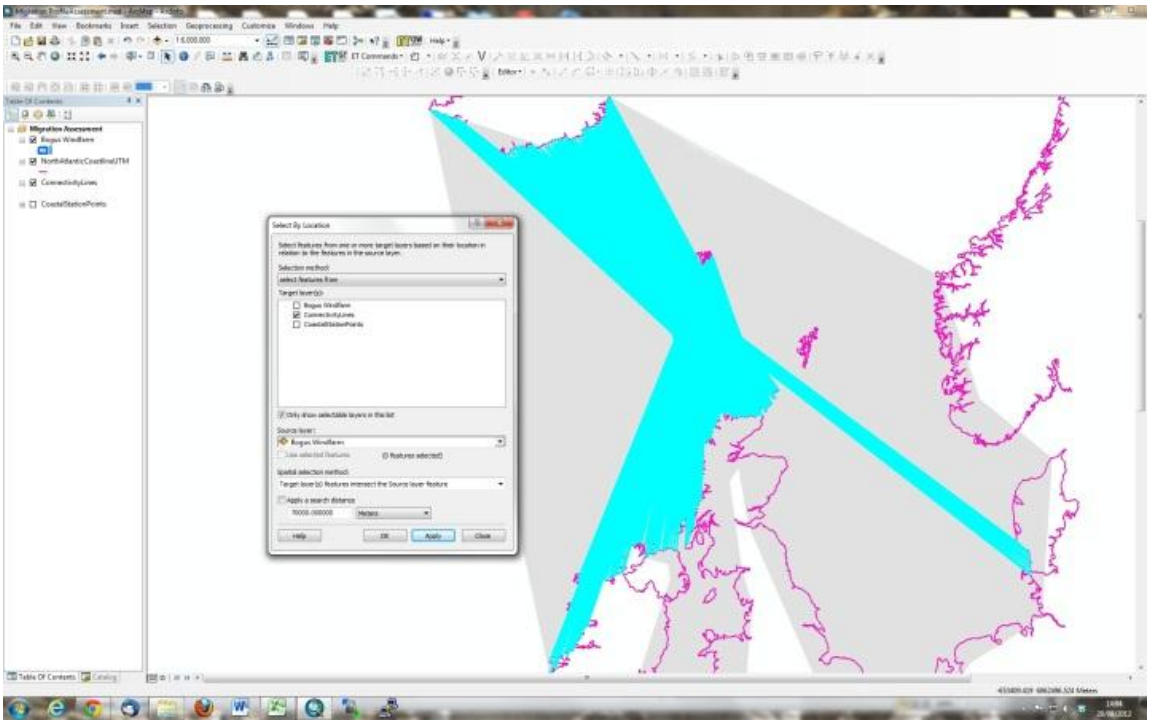


3) from the menu bar bring up the 'select by location' dialogue and set the following parameters:

- Selection method dropdown - 'select features from'
- Target layer(s) check-boxes - 'ConnectivityLines'

- Source layer dropdown – ‘your wind farm polygon layer’
- Use selected features check-box – optional (see below*)
- Spatial selection method dropdown - 'Target layer(s) features intersect the Source layer feature'

*By default if you have more than one footprint polygon all lines crossing any one of them will be selected. If however, you have previously selected one or more polygons in your footprint layer you have the option to 'use selected features' (check-box below Source layer dropdown) to restrict the selection to lines crossing those polygons you have selected. Thus if you have multiple footprints to assess you can select each in turn or combinations of several as you work through the steps that follow to populate a footprint field for each.

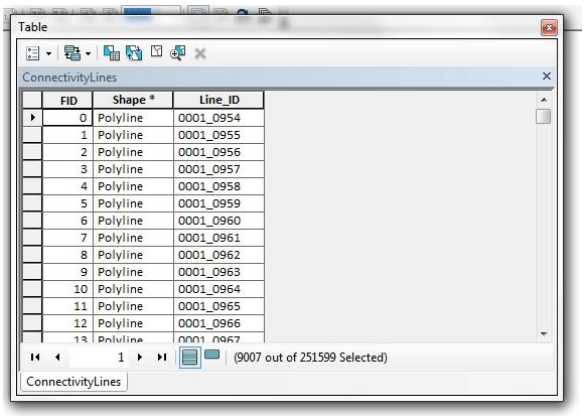


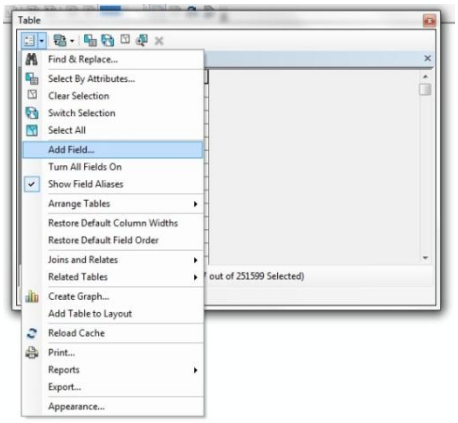
4) Now add a new field to the attribute table of ConnectivityLines

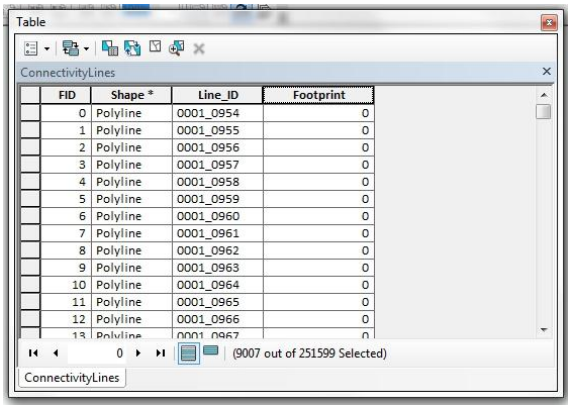
- open the attributes table of ConnectivityLines and create a new field 'Footprint1' as a short integer. It will be initialised with value '0'.
- as all those lines crossing your footprint are already selected right mouse click and select 'Field Calculator'.
- Enter 1 in the dialogue box.

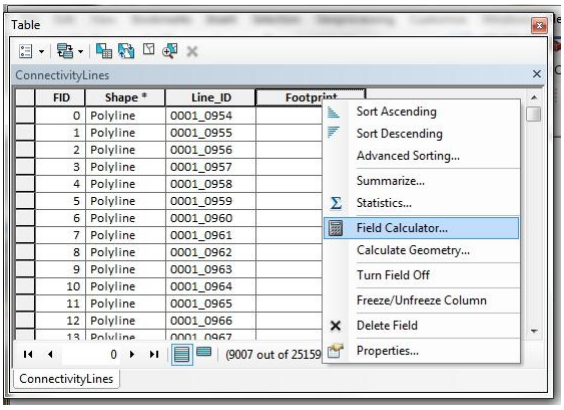
All lines crossing your footprint should now be coded '1' and all other lines '0'.

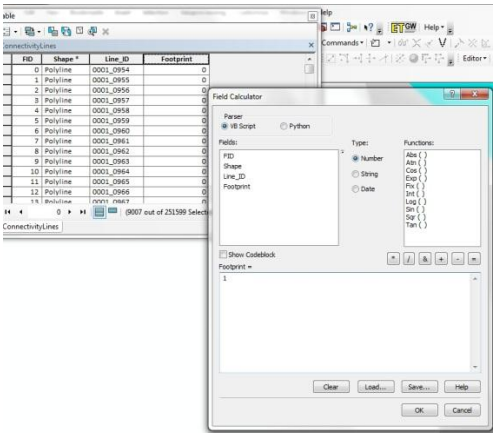
- Clear selection (very important)
- Repeat as necessary to populate Footprint2, Footprint3 ... and so on.



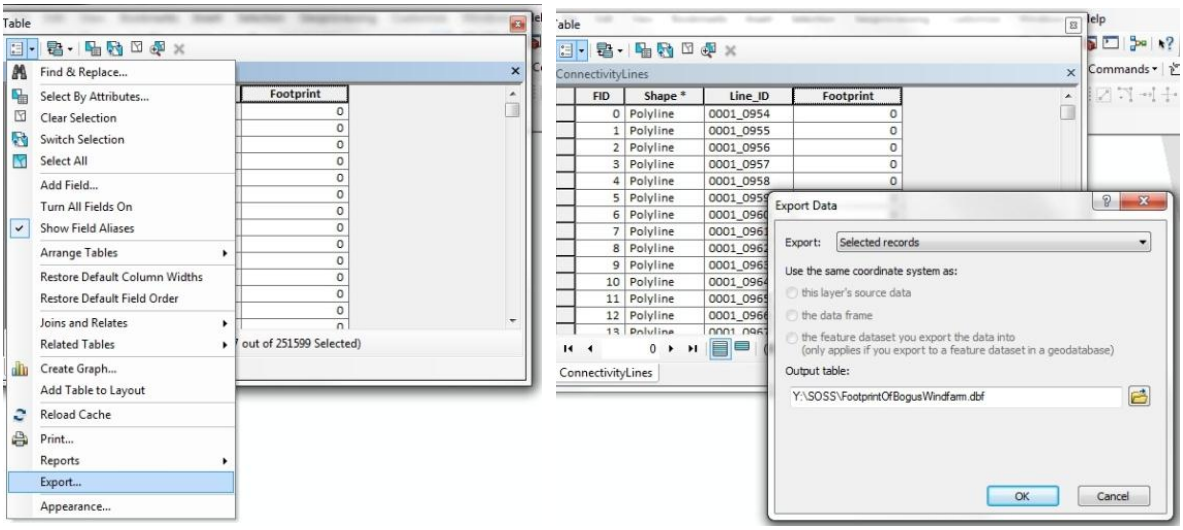




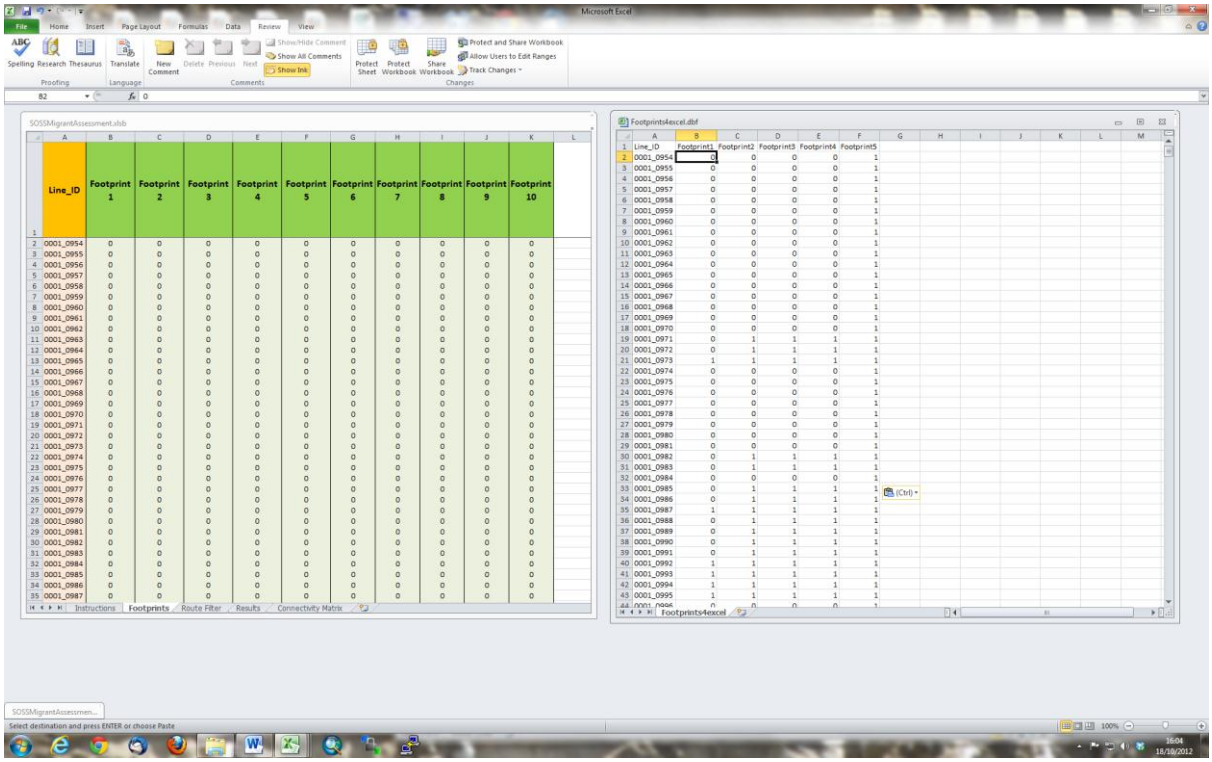




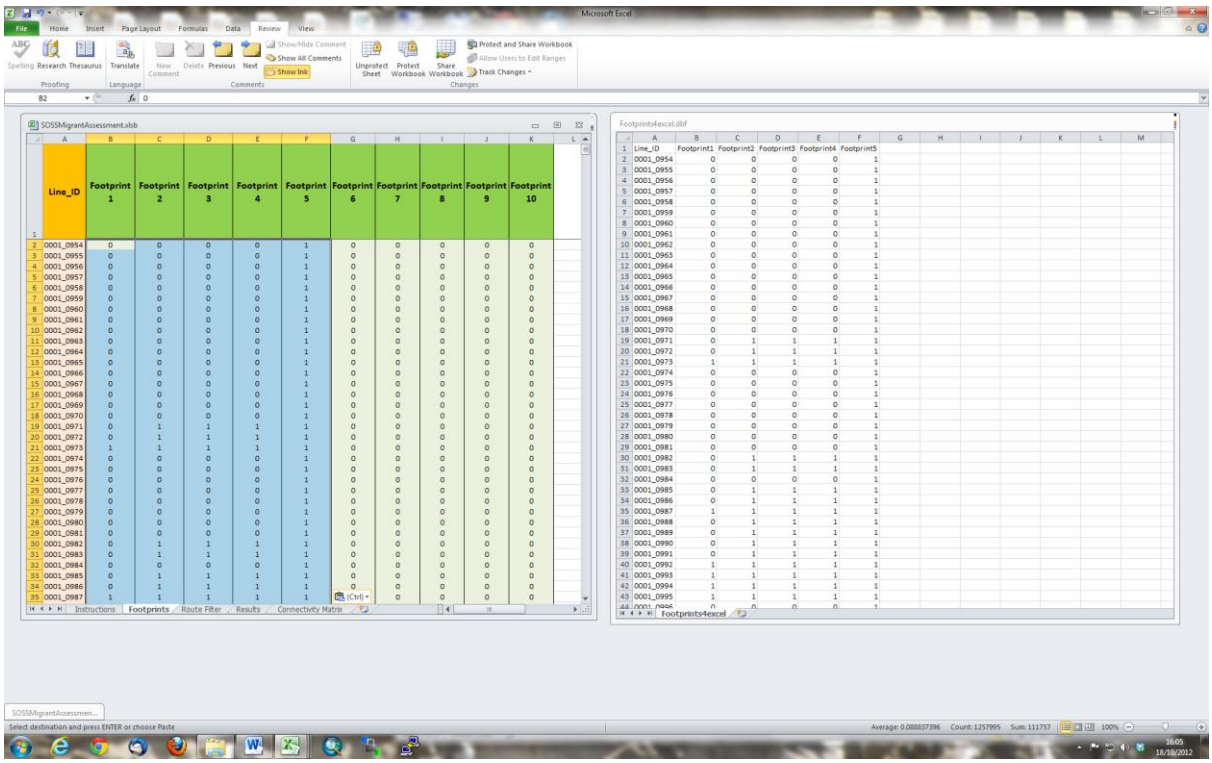
5) Ensure that no features are highlighted and then export the attribute table as a DBF file (safer than using the DBF associated with the shapefile directly for the next step in case of accidental edits). Note, if you neglect to clear the selection before the export, the exported DBF will only contain records for selected features rather than all 251,599 records. You need all 251,599 records.



6) Open the SOSSMAT Workbook and select the worksheet 'Footprints'. In Windows explorer, find the DBF file you have just exported from GIS and drag and drop it on your Excel window - a new sheet should open up containing the data just exported from the GIS.



7) Ensure both the 'Footprint' worksheet and the DBF sheet are sorted by Line_ID (this is critical). A straightforward "copy and paste" can now be used to populate the worksheet 'Footprint(s)' with up to 10 different project footprints (to highlight cells to be copied, click cell B2 of DBF, while holding down <shift> <Ctrl> then press <down arrow> followed by ,<right arrow>, then release.)



Detailed instructions for populating Route Filter in the SOSSMAT

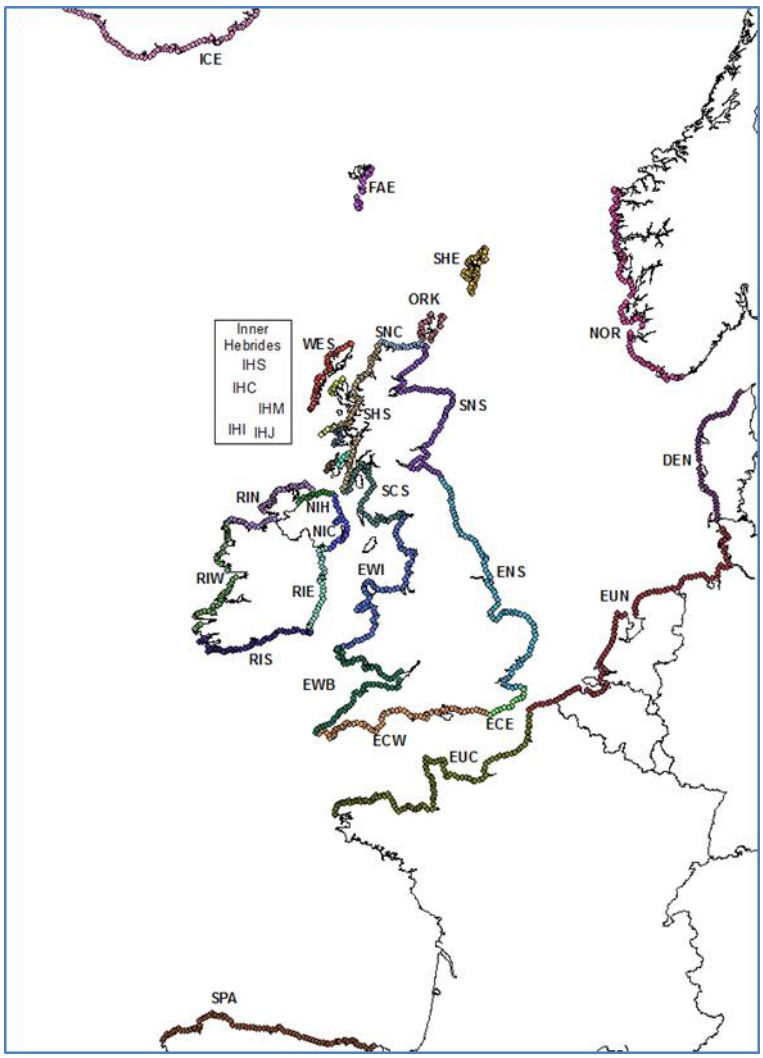
The worksheet 'Route Filter' in SOSSMAT is used to filter out sea crossings that are not pertinent to the wind farm being assessed.

It is important to understand that the selection of sea crossing flagged to be used in the process described below will be applied simultaneously to all footprints being assessed. Consequently if multiple wind farms are being assessed for which different selections of sea crossings are appropriate, it is recommended that this should be undertaken in separate copies of the SOSSMAT workbook. Alternatively, but not recommended, values for results that need to be saved could be copied to a new Excel workbook before re-evaluating which sea crossings to flag for inclusion in a new assessment.

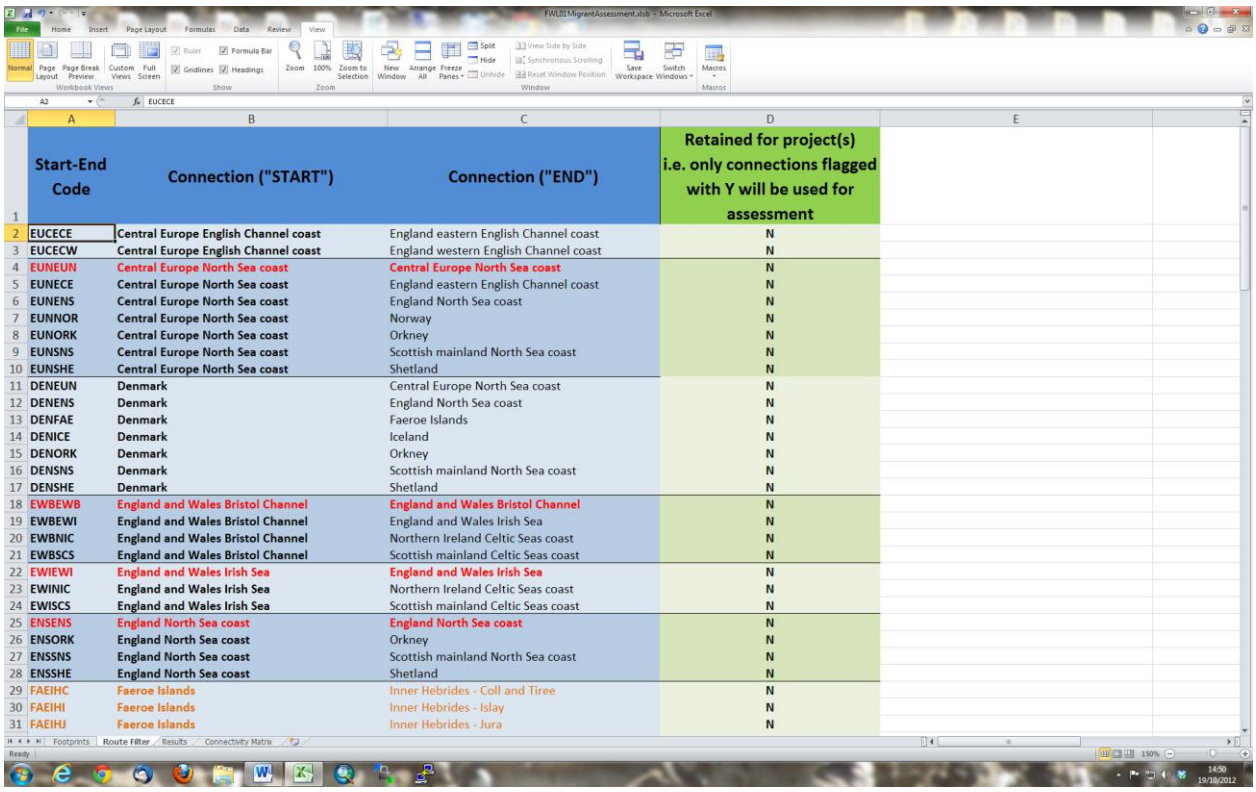
Regardless of the origins of the population being considered, it is important to only consider sea crossings relevant to the wind farm in question and not all sea crossings relevant to the migration route of the particular population. If this is not done the numbers of birds crossing the wind farm footprint can be seriously over- or under-estimated. For example Bar-tailed Godwit wintering in in Britain and Ireland all cross the North Sea, and those wintering in Ireland travel on to cross the Irish Sea. Assessment for a wind farm in the North Sea would use only lines of connectivity representing North Sea crossings against the population over-wintering in Britain and Ireland. Assessment for a wind farm in the Irish Sea would only use lines of connectivity representing Irish Sea crossings and only against the population over-wintering in Ireland. In either case, to have used the combined lines of connectivity for the North Sea and Irish Sea crossings would seriously underestimate the number of birds crossing the wind farm footprint.

Thirty different coastal zones have been defined for the purpose of migration assessment. Note that the incorporation within the names of these zones of such terms as North Sea, Hebridean Seas, Celtic Seas and so forth does not imply correspondence with boundaries that may be defined for other purposes. They are used here to distinguish stretches of coast for the purpose of distinguishing different line-of-sight sea crossings.

Coastal zones defined for the SOSSMAT	**Sea crossings considered by the SOSSMAT** Curved parentheses indicate sea crossings that are only appropriate for wind farms closer to shore, squared parentheses indicate sea crossings that should only be considered for a small suite of species terminating migration in the Western Isles and Inner Hebrides.
DEN: Denmark	**DEN →** ENS; EUN; FAE; ICE; ORK; SHE; SNS
ECE: England eastern English Channel coast	**ECE →** EUC; EUN
ECW: England western English Channel coast	**ECW →** EUC;SPA
ENS: England North Sea coast	**ENS →** DEN; EUN; NOR; ORK; SHE; (SNS)
EUC: Central Europe English Channel coast	**EUC →** ECE; ECW; RIS
EUN: Central Europe North Sea coast	**EUN →** DEN; ECE; ENS; NOR; ORK; SHE; SNS
EWB: England and Wales Bristol Channel	**EWB →** (EWB); RIS
EWI: England and Wales Irish Sea	**EWI →** (EWI); SCS; NIC; RIW
FAE: Faeroe Islands	**FAE →** DEN; NOR; ORK; RIN; SHE; SHS; SNC; WES
ICE: Iceland	**ICE →** DEN; NOR; ORK; RIN; SHE; SNC; SHS; WES; [IHC; IHI; IHJ; IHM; IHS]
IHC: Inner Hebrides - Coll and Tiree	IHC → [FAE; ICE; IHI; IHJ; IHM; IHS; SHS; WES]
IHI: Inner Hebrides - Islay	IHI → [FAE; ICE; IHC; IHJ; IHM; IHS; SHS; WES]
IHJ: Inner Hebrides - Jura	IHJ → [FAE; ICE; IHC; IHI; IHM; IHS; SHS; WES]
IHM: Inner Hebrides - Mull	IHM → [FAE; ICE; IHC; IHI; IHJ; IHS; SHS; WES]
IHS: Inner Hebrides - Skye and Lewis	IHS → [FAE; ICE; IHC; IHI; IHJ; IHM; SHS; WES]
NIC: Northern Ireland Celtic Seas coast	**NIC →** EWI; SCS
NIH: Northern Ireland Hebridean Seas coast	**NIH →** SHS; WES; [IHC; IHI; IHJ; IHM; IHS]
NOR: Norway	**NOR →** ENS; EUN; FAE; ICE; ORK; SHE; SNS
ORK: Orkney	**ORK →** DEN; ENS; EUN; FAE; ICE; NOR; SHE; SNC; SNS;
RIE: Republic of Ireland - Celtic Seas eastern coast	**RIE →** EWB; EWI
RIN: Republic of Ireland Atlantic northern coast	**RIN →** ICE; FAE; SHS; WES; [IHC; IHI; IHJ; IHM; IHS]
RIS: Republic of Ireland Celtic Seas southern coast	**RIS →** EWB; SPA
RIW: Republic of Ireland Atlantic western coast	**RIW →** ICE
SCS: Scottish mainland Celtic Seas coast	**SCS →** EWI; NIC; RIE
SHE: Shetland	**SHE →** DEN; ENS; EUN; FAE; ICE; NOR; ORK; SNC; SNS; WES
SHS: Scottish mainland Hebridean Seas coast	**SHS →** FAE; ICE; NIH; RIN; WES; [IHC; IHI; IHJ; IHM; IHS]
SNC: Scottish mainland northern coast	**SNC →** FAE; ICE; ORK; SHE
SNS: Scottish mainland North Sea coast	**SNS →** DEN; EUN; NOR; ORK; SHE; (ENS; SNS)
SPA: Spanish north coast	**SPA →** ECE; ICE; RIS
WES: Western Isles	**WES →** FAE; ICE; NIH; RIN; SHE; SHS; [IHC; IHI; IHJ; IHM; IHS]



Only the cells colour coded ‘green’ in the worksheet ‘Route Filter’ are editable. There are 130 sea-crossings to consider. The terms ‘start’ and ‘end’ have no meaning relative to the direction of migration. Note that it is not possible to sort such a table in such a way that all sea crossings involving a particular coastal zone appear together therefore ensure you have considered all rows.



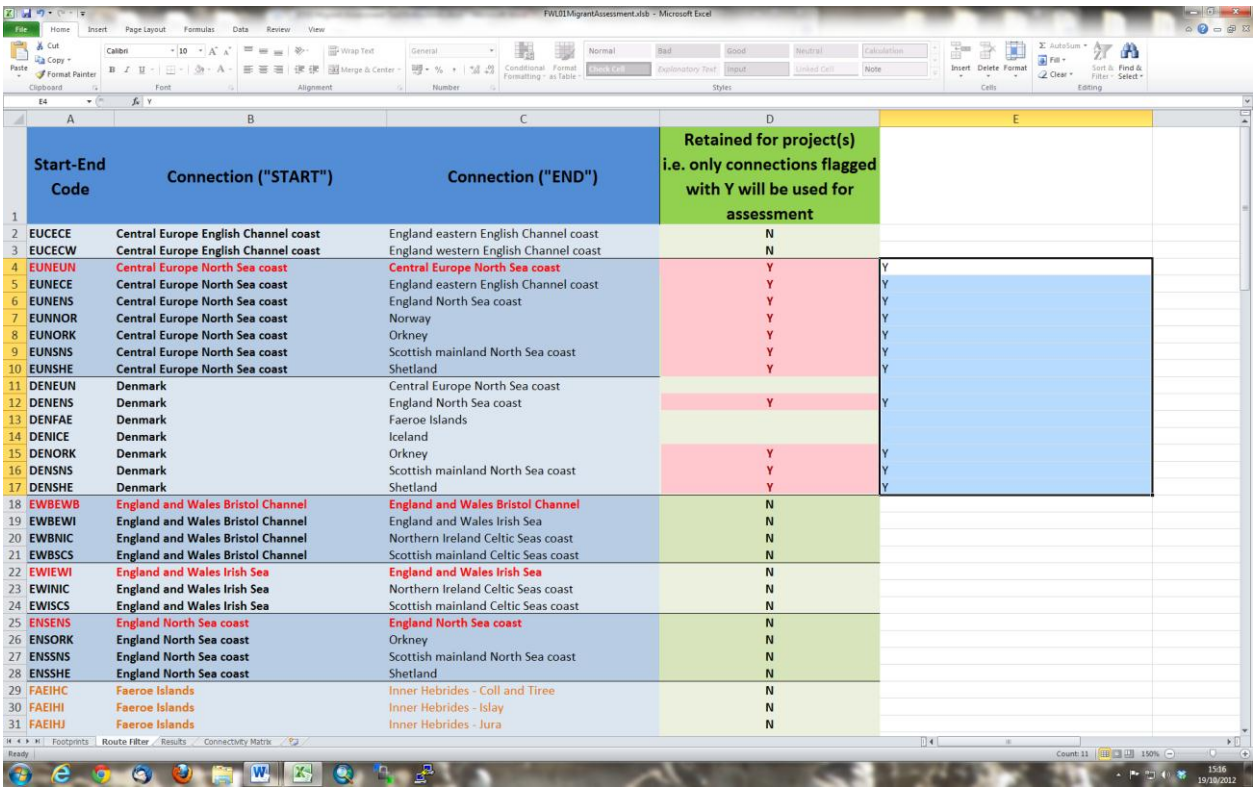
	A	B	C	D	E
1	Start-End Code	Connection ("START")	Connection ("END")	Retained for project(s) i.e. only connections flagged with Y will be used for assessment	
2	EUCECE	Central Europe English Channel coast	England eastern English Channel coast	N	
3	EUCECW	Central Europe English Channel coast	England western English Channel coast	N	
4	EUNEUN	Central Europe North Sea coast	Central Europe North Sea coast	N	
5	EUNECE	Central Europe North Sea coast	England eastern English Channel coast	N	
6	EUNENS	Central Europe North Sea coast	England North Sea coast	N	
7	EUNNOR	Central Europe North Sea coast	Norway	N	
8	EUNORK	Central Europe North Sea coast	Orkney	N	
9	EUNSNS	Central Europe North Sea coast	Scottish mainland North Sea coast	N	
10	EUNSHE	Central Europe North Sea coast	Shetland	N	
11	DENEUN	Denmark	Central Europe North Sea coast	N	
12	DENENS	Denmark	England North Sea coast	N	
13	DENFAE	Denmark	Faeroe Islands	N	
14	DENICE	Denmark	Iceland	N	
15	DENORK	Denmark	Orkney	N	
16	DENSNS	Denmark	Scottish mainland North Sea coast	N	
17	DENSHE	Denmark	Shetland	N	
18	EWBEWB	England and Wales Bristol Channel	England and Wales Bristol Channel	N	
19	EWBEWI	England and Wales Bristol Channel	England and Wales Irish Sea	N	
20	EWBNIC	England and Wales Bristol Channel	Northern Ireland Celtic Seas coast	N	
21	EWBSCS	England and Wales Bristol Channel	Scottish mainland Celtic Seas coast	N	
22	EWIEWI	England and Wales Irish Sea	England and Wales Irish Sea	N	
23	EWINIC	England and Wales Irish Sea	Northern Ireland Celtic Seas coast	N	
24	EWISCS	England and Wales Irish Sea	Scottish mainland Celtic Seas coast	N	
25	ENSENS	England North Sea coast	England North Sea coast	N	
26	ENSORK	England North Sea coast	Orkney	N	
27	ENSSNS	England North Sea coast	Scottish mainland North Sea coast	N	
28	ENSSHE	England North Sea coast	Shetland	N	
29	FAEIHC	Faeroe Islands	Inner Hebrides - Coll and Tiree	N	
30	FAEIHI	Faeroe Islands	Inner Hebrides - Islay	N	
31	FAEIHJ	Faeroe Islands	Inner Hebrides - Jura	N	

To flag a particular sea crossing for inclusion in the assessment simply enter a Y (or y – it is not case sensitive) in the editable field (column D) of the relevant row. Note that because the value you have just entered feeds into formulae in the 'Connectivity matrix' worksheet, you may get a moment of unresponsiveness as values in 251,599 cells are updated and in turn feed through into the 'results' worksheet. Cells will turn 'red' once the update has concluded.

(Tip: copy column D and paste VALUES into column E; change N to Y as appropriate in column E; copy column E and paste VALUES back into column D. In this way all the updates in other worksheets will be done in one operation and you will not have to wait between flagging each record).

The colour coding of the text in the first three columns provides a little further guidance to selecting sea crossings for inclusion in an assessment.

- **Black text:** In most cases you would make your selection from these.
- **Red text:** These are within coast zone sea crossings. These should be used only when considering wind farms relatively close to land for example in the Bristol Channel, Irish Sea, Firth of Forth and The Wash where long distance migrants may "clip the coast" as they pass through.
- **Orange text:** These are sea crossings involving the Hebrides. These should only be used for a few specific species for which the final destination is within the Hebrides (such as Greenland White-fronted Geese the majority of which winter on Islay, or Corncrake for which Coll and Tiree support the majority of the UK population) and then only for wind farms actually located within those areas. In other cases you would ignore the existence of the Hebrides and consider sea crossings to the mainland of Ireland and Scotland.



	A	B	C	D	E
1	Start-End Code	Connection ("START")	Connection ("END")	Retained for project(s) i.e. only connections flagged with Y will be used for assessment	
2	EUCECE	Central Europe English Channel coast	England eastern English Channel coast	N	
3	EUCECW	Central Europe English Channel coast	England western English Channel coast	N	
4	EUNEUN	Central Europe North Sea coast	Central Europe North Sea coast	Y	Y
5	EUNECE	Central Europe North Sea coast	England eastern English Channel coast	Y	Y
6	EUNENS	Central Europe North Sea coast	England North Sea coast	Y	Y
7	EUNNOR	Central Europe North Sea coast	Norway	Y	Y
8	EUNORK	Central Europe North Sea coast	Orkney	Y	Y
9	EUNSNS	Central Europe North Sea coast	Scottish mainland North Sea coast	Y	Y
10	EUNSHE	Central Europe North Sea coast	Shetland	Y	Y
11	DENEUN	Denmark	Central Europe North Sea coast		
12	DENENS	Denmark	England North Sea coast	Y	Y
13	DENFAE	Denmark	Faeroe Islands		
14	DENICE	Denmark	Iceland		
15	DENORK	Denmark	Orkney	Y	Y
16	DENSNS	Denmark	Scottish mainland North Sea coast	Y	Y
17	DENSHE	Denmark	Shetland	Y	Y
18	EWBEWB	England and Wales Bristol Channel	England and Wales Bristol Channel	N	
19	EWBEWI	England and Wales Bristol Channel	England and Wales Irish Sea	N	
20	EWBNIC	England and Wales Bristol Channel	Northern Ireland Celtic Seas coast	N	
21	EWBSCS	England and Wales Bristol Channel	Scottish mainland Celtic Seas coast	N	
22	EWIEWI	England and Wales Irish Sea	England and Wales Irish Sea	N	
23	EWINIC	England and Wales Irish Sea	Northern Ireland Celtic Seas coast	N	
24	EWISCS	England and Wales Irish Sea	Scottish mainland Celtic Seas coast	N	
25	ENSENS	England North Sea coast	England North Sea coast	N	
26	ENSORK	England North Sea coast	Orkney	N	
27	ENSSNS	England North Sea coast	Scottish mainland North Sea coast	N	
28	ENSSHE	England North Sea coast	Shetland	N	
29	FAEIHC	Faeroe Islands	Inner Hebrides - Coll and Tiree	N	
30	FAEIHI	Faeroe Islands	Inner Hebrides - Islay	N	
31	FAEIHJ	Faeroe Islands	Inner Hebrides - Jura	N	

The following table gives some general guidance to the sea crossings that should be considered depending on the approximate location of a given wind farm and broad guidance to species to be considered.

Wind farm location	Species to consider
Wind farms in the North Sea would need to consider sea crossings crossing the North Sea involving all combinations to/from Norway, Denmark, the North Sea coast of Central Europe, Shetland, Orkney, and the east coasts of Scotland and England.	Those migrating to winter in the UK from/via Scandinavia and the east. Those migrating to breed in the UK from the south.
Wind farms in the English Channel would need to consider sea crossings crossing the English Channel involving movement to/from the south coast of England, Central Europe.	Those migrating to winter in the UK from/via Iceland, Faeroe Islands, Scandinavia and the east. Those migrating to breed in the UK from the south.
Wind farms north of the Scottish mainland would need to consider sea crossings to/from Iceland, the Faeroe Islands, Scandinavia and the east to/from the Northern Isles, the north and Hebridean Seas coast of mainland Scotland and also those between the Northern Isles and the north mainland of Scotland.	Those migrating to winter in the UK from/via Iceland, Faeroe Islands, Scandinavia and the east.
Wind farms in the Celtic Seas would need to consider sea crossings between east coasts of Ireland and the west coast of Britain (NIC & RIE to/from EWB, EWI & SCS), for those further south also sea crossings involving the Spanish north coast, the English Channel coast of Central Europe (RIS to/from EUC & SPA) and for those towards the east possibly sea crossings within the mainland coast of Britain as these could take migrants far from shore (EWB to/from EWB and EWI to/from EWI & SCS).	Those migrating from/via Iceland, Ireland and northwest Scotland to winter in England and Wales. Those migrating through Great Britain to winter in Ireland. Those migrating from the south to breed in Scotland or Ireland.

Wind farms west and northwest of the mainland of Scotland would need to consider sea crossings from/to Iceland and the north and Hebridean Seas coast of mainland Scotland, the north and west coasts of the Republic of Ireland and the north coast of Northern Ireland. Also sea crossings between the Faeroe Islands and all the above other than the west coast of the Republic of Ireland. For species where known proportions terminate their journey in the Western Isles and the Inner Hebrides (e.g. Greenland White Fronted Goose) separate analyses using sea crossings between Iceland, the Faeroe Islands and the northwest coast of mainland Scotland with the Western Isles and the Inner Hebrides may be appropriate.	Those migrating to winter in the UK from/via Iceland and the Faeroe islands.
Wind farms within the Hebridean Seas would need to consider sea crossings flight lines from/to Iceland and the north and Hebridean Seas coast of mainland Scotland, the north coast of the Republic of Ireland and the north coast of Northern Ireland. Also sea crossings between the Faeroe Islands and all the above. For species where known proportions terminate their journey in the Western Isles and the Inner Hebrides (e.g. Greenland White Fronted Goose) separate analyses using sea crossings between Iceland, the Faeroe Islands and the northwest coast of mainland Scotland with the Western Isles and the Inner Hebrides would be appropriate.	Those migrating to winter in the UK from/via Iceland and the Faeroe Islands. Those terminating in the Western Isles or Inner Hebrides either to breed (e.g. Corncrake) or to winter (e.g. Greenland White-fronted Goose).

Whilst each species of migrant should be considered individually with reference to the maps of migration corridors, in broad terms migrants fall into a small number of distinct groups. The list below outlines some of the more common migration routes but is not meant to be exhaustive:

1) Birds from Iceland wintering in the UK (to include those from Greenland and Canada coming via Iceland)

- Individuals of these species may fly directly from Iceland making first landfall on the north and east coasts of the Republic of Ireland, the Hebridean Seas coasts of Northern Ireland and mainland Scotland, the north coast of Scotland or Orkney after which they are most likely to follow the coast or migrate overland, neither of which are of concern unless further sea crossings are involved.
- Alternatively they may travel via the Faeroe Islands, Shetland or Norway and then cross the North Sea to arrive on the GB mainland.
- Onward journeys may also cross the sea, for example birds that cross Ireland and then traverse the Celtic Seas to reach mainland Britain.

2) Birds from Scandinavia wintering in the UK (to include those from the Arctic and sub-Arctic further to the east)

- Individuals of these species may fly directly across the North Sea making first landfall in Shetland, Orkney or the east coasts of Scotland or England.
- Alternatively they may move down through Central Europe and make the North Sea or English Channel crossing from there.
- Onward journeys may also cross the sea, for example migrants heading towards southern Europe and Africa, having crossed the North Sea to mainland Britain may either follow the coast southwards or cross overland thereafter crossing the English Channel leaving from the south coast of England. Migrants with a final destination in Ireland may move across Britain, either overland or following the coast to then cross the Celtic Seas or Hebridean Seas.

3) Birds from southern Europe and Africa breeding in the UK

- Individuals of these species can be expected to arrive along the south and east coasts of England from Central Europe.
- Alternatively they may arrive on the south and east coasts of Ireland from northern Spain before moving on to their final destination.

4) Pelagic seabirds, including Fulmar, Manx Shearwater, Petrels and auks

- As a general rule these species should not be assessed using this Workbook

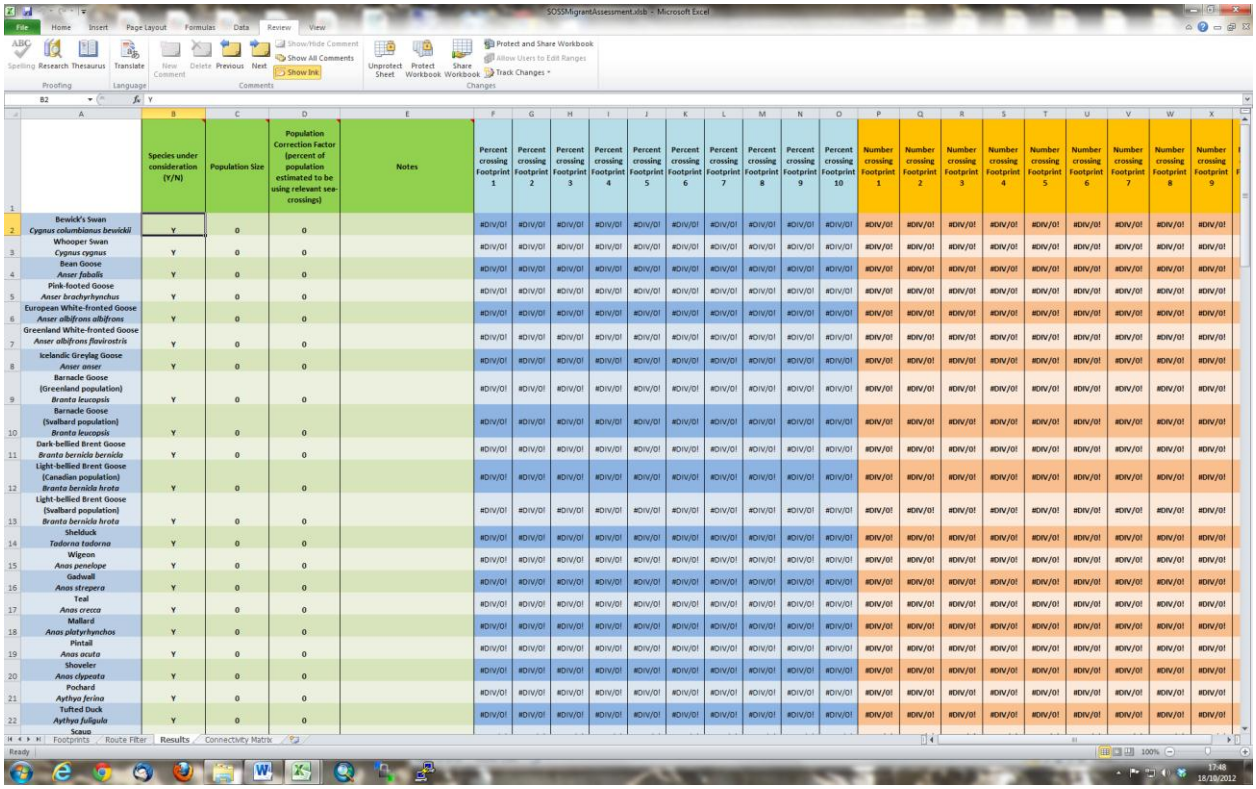
5) Land-based seabirds that follow the coastline during migration but at some distance offshore, including skuas, gulls and terns

- Although there is scope to assess migration across open seas using this Workbook, migration that hugs the coastline is not well assessed using this Workbook.

Detailed instructions for calculating numbers of birds crossing footprint in the SOSSMAT

Once the user has populated the worksheets 'Footprints' and 'Route Filter' the percentage of birds of each species estimated to cross each of the footprints being assessed will automatically be updated in the worksheet 'Results'. Percentage values are given for up to 10 footprints in the cells colour coded 'blue'. These cells are not editable.

The SOSSMAT also facilitates the next stage in the analysis which is to estimate the actual number of birds that cross each footprint being assessed. This requires two more pieces of information to be supplied by the user.



The four fields colour coded 'green' are user editable. They are as follows:

Species under consideration

This is simply available for convenience and is not referred to by any spread sheet formulae. By flagging species with a value other than the default 'Y', this field can be used in conjunction with the filter tool in Excel to hide rows for species not being assessed.

Population Size

The user should enter the sum total of all populations of a given species associated with UK waters. This is regardless of whether it is believed that the entire population are using sea crossings relative to the wind farm being assessed (the latter is dealt with next). Key sources of information include:

- SOSS guidelines (Wright *et al*. 2012)
- National and international population of waterbirds - Wetlands International, currently WPE5 (http://wpe.voidwalkers.nl/)
- Non-breeding populations of waterbirds - GB & UK (Musgrove *et al*. 2011).
- Breeding populations of all species - GB & UK (Baker *et al*. 2006).
- Non-breeding populations of waterbirds – Ireland (Crowe *et al*. 2008)
- Breeding/Non-breeding populations Britain & Ireland (Gibbons *et al*. 1993)
- More detailed view of migration routes than in general guidance notes (Wernham *et al*. 2002)
- Finally, the next Breeding/Winter Atlas for Britain & Ireland is due for publication in late 2013 and will then supersede Gibbons *et al*. 1993.

Population Correction Factor

The user should estimate the percentage of the relevant population(s) that may be using the sea crossings relevant to the wind farm location. This estimate should be made using the maps available in the SOSS guidance (Wright *et al*. 2012) as the principal reference. In the absence of any additional guidance that may be given the value entered in this field should be a straightforward estimate of the proportion of the UK coastline covered by the migration maps for the species in question that relates to the sea crossings being considered for the assessment. For example, when considering the non-breeding Redshank of the *robusta* race i.e. those coming from Iceland a reasonable estimate might be that 50% make landfall on the North Sea coast having migrated via The Faeroe Islands, Northern Isles and Scandinavia and 50% arrive along the north and west coasts of Scotland and the North and West coast of Ireland. For an assessment of a wind farm in the North Sea it would therefore be appropriate to enter a value of 50 in this field.

For most species it will be necessary to assume that the same routes will be taken during both Spring and Autumn passage. If information is available to the contrary this would be allowed for here. For example, Black-tailed Godwits of the *islandica* race probably only cross the North Sea during Spring migration when they stage in the Netherlands. Thus for a North Sea assessment only half the percentage value could be entered here. Alternatively the final estimate could be adjusted accordingly.

In some cases it may be possible to further fine tune these estimates with reference to more detailed information from the Migration Atlas (Wernham et al. 2002), other published material or data that may become available in the future (e.g. from tracking studies or radar surveys).

Notes

The notes field is provided to catalogue decisions that have been made in values entered in the preceding columns. It is suggested that details of reference sources for population estimates are recorded here. For

example, “Musgrove + Crowe – Baker” may be used to estimate the population size for a species in which a resident British breeding population (Baker) are joined in the non-breeding season by a migrant population that arrive from outside the UK and distribute throughout Britain (Musgrove) and Ireland (Crowe). Also memos regarding special circumstances (e.g. the *islandica* Black-tailed Godwit scenario above) should be recorded here.

Results

As values are added to the two compulsory fields (columns C and D) an estimate of the total number of birds that cross each footprint will be automatically displayed in the fields colour coded ‘orange’ (for up to 10 footprints.

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