The Catch and Effort data to be used in GLM analyses to produce CPUE indices for the Four Islands of the Tristan da Cunha group

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The Tristan da Cunha group of islands consist of the main island of Tristan da Cunha, and three outer islands – Gough, Nightingale and Inaccessible. Fishing at the outer islands uses two methods – longlining and powerboats – although longlining is the predominant method. Fishing around Tristan is normally by powerboats only. Fishing data are recorded differently for the outer islands and for Tristan, and are thus treated separately.

A: THE OUTER ISLANDS

(1) The logsheet raw data

Logsheet data are available from the fishing vessels for the three outer islands (Inaccessible, Nightingale and Gough). The lobsters are weighed before any processing on the ship so that the catches on the logsheets as recorded refer to live weight. Effort is recorded as the number of traps hauled. These data are available for the Season-Years 1996 – 2007, where a Season-Year is taken to run from September until August the following year, i.e. Season-Year 2002 refers to the period September 2002 to August 2003. Note no data are available for the 2006 Season-Year (the logsheets are missing).

Although the logsheet data are valuable as they record details of the catches such as location and soak-time, which are required for GLM standardisation, the logsheet entries are known to be approximate only (Edwards 2007). Longline catch and powerboat effort in particular are unreliable. There is also currently insufficient information about the different catch rates for longline monster and powerboat traps, making the standardisation of the catch rate across different types of fishing impossible. For this reason, the powerboat data are excluded from the database and from the analyses presented here.

The logsheet raw data have been electronically captured (EXCEL) and are contained in the following files:

Gough longlines raw.xls	**(contains 15552 data records)**
Night longlines raw.xls	**(contains 4901 data records)**
Inac longlines raw.xls	**(contains 5501 data records)**

Area names

The logsheets contain information on the area fished for each record. These "local" area names (column R) have been allocated a local area number (column T), and these in turn grouped into larger area-groupings (column U). Appendix 1 provides details of how the local area names have been allocated local area numbers, and grouped into larger area-groupings. Gough island has 6 area-groupings, Nightingale has 5 and Inaccessible has 9. Each island also has a category consisting of records which have unknown area (group area 0). The percentage of total logsheet records for each group area is also reported. In addition, Appendix 1 provides maps showing where these area-groupings are around each island (see Figures A1.1-3).

(2) Initial exclusions from the raw data contained in (1)

The raw data files in (1) were examined for problematic data entries. Data records containing the following problems were excluded from the database:

i) Effort reported with a zero, a dot, or some other confusing notation, e.g. 5 (20).
ii) Catch reported with "NA", "()", ".", or is left blank.
iii) Nominal CPUE value greater than 25 kg/trap.

These data files without the excluded records described above are named:

Gough 1.xls (contains 14478 data records)
Night 1.xls (contains 4724 data records)
Inac 1.xls (contains 5379 data records)

A further rule applied in developing the data files immediately above is that if there is a blank entry under "# traps hauled", then this entry is filled with the value under "# traps set".

Note that for the 1997 Inaccessible logsheets, there were cases where the catch was reported as "numbers" of lobsters rather than "kgs". The numbers of lobsters were converted to kgs of lobsters by a scalar multiplier of 0.24.

(3) Scaling of logsheet catch and calculation of adjusted CPUE

The logsheet catch records are known to be approximate. A more accurate estimate of the total longline catch is obtained from "summary sheet" records which have recorded the total packed weight of the lobsters at the factory. The total summary sheet catch values are first scaled by a multiplicative factor of 1.02313 to take into account weight lost through dessication (Edwards 2007). The powerboat catch is then subtracted from this total packed weight (both are recorded on the summary sheets) to produce the summary sheet longline catch value for each Season-Year. This last value is then used to adjust the logsheet longline catch records so that the total catches from both sources (summary sheets and logsheets) are equal. Note however that for some years there are logsheets missing. An annual adjustment coefficient k_y is thus calculated to scale the logsheet catches as follows:

$$c_{i,y}^{adj} = c_{i,y} k_y \quad (1)$$

where

$$k_y = \frac{C_y^{SS}}{C_y^{LS}\dfrac{E_y^{SS}}{E_y^{LS}}} \qquad (2)$$

and where

$c_{i,y}^{adj}$ is the *i*'th adjusted logsheet catch longline record for Season-Year *y*,

$c_{i,y}$ is the *i*'th raw logsheet longline catch record for Season-Year *y*,

C_y^{LS} is the total logsheet longline catch for Season-Year *y* (being based on the raw data files),

C_y^{SS} is the best estimate available for the total longline catch for Season-Year *y* (based on summary sheet information),

E_y^{LS} is the total logsheet longline effort for Season-Year *y* (based on the raw data files),

E_y^{SS} is the total summary sheet longline effort for Season-Year *y*.

Table 1 provides the estimates of k_y for each of the outer islands.
The longline "summary sheet" data are found in:

k for inac.xls
k for night.xls
k for gough.xls

These files also show the calculation of k_y and both the nominal and adjusted longline CPUE values.

The raw data files described in (2) i.e. (**Gough 1.xls**, **Night 1.xls** and **Inac 1.xls**) contain two further columns – one with the adjusted catch value, and the final column the adjusted CPUE value, where:

$$CPUE_y^{adj} = \frac{1}{n_y}\sum_i \frac{c_{i,y}^{adj}}{e_{i,y}}$$

where

$CPUE_y^{adj}$ is the adjusted longline CPUE value for Season-Year *y*, and

n_y is the number of longline data records for Season-Year *y*.

Note too that what is termed the "Nominal CPUE" is defined as follows:

$$CPUE_y^{nom} = \frac{1}{n_y}\sum_i \frac{c_{i,y}}{e_{i,y}}$$

(i.e. it relates to the "unscaled" raw longsheet longline catches).

(4) Further exclusions prior to GLM analyses

The following criteria were applied to exclude further data prior to the GLM standardisation analyses:

i) No area provided.

ii) No gear type provided.
iii) Negative soaktimes or missing start or end times (note that soak time is determined by subtracting the start time from the end time).
iv) Average depth is not available (note that if the end depth is not recorded the start depth is used).

For the GLM analyses, the "average" depth field is used (average of the start depth and end depth). There were some records for which only the start depth is provided – for these records the average depth is set equal to the start depth.

The final datafiles with these exclusions are named:

Gough GLM.xls (contains 14174 data records)
Night GLM.xls (contains 4336 data records)
Inac GLM.xls (contains 4629 data records)

B: TRISTAN DA CUNHA ISLAND

All lobster harvesting at the main Tristan Island is normally carried out using powerboats, with two fishermen aboard each boat. Daily catch records are kept of the total catches for each powerboat. Information of time of boat departure and return to harbour is also reported, but this information is available only for more recent years. These times are also not necessarily a reflection of the actual time spent fishing. No information on area fished is available. Data are available for 1997-2007. These data have been electronically captured (EXCEL) and are contained in:

Tristan raw.xls (contains 4012 data records)

Note that there are 260 different combinations of pairs fishermen recorded. There are also about 200 records for which a catch value is missing– these records have thus been removed from the data file and the resulting file (in which all records contain catch values) is contained in:

Tristan modified.xls (contains 3815 data records).

After an initial cleanup of the datafiles in preparation for running the GLM analyses the following modifications were made:

1) For the three outer islands, the season-year 2006 was found to contain relatively few records and these data were omitted from the GLM analyses.
2) The season-year to which each month applies was modified due to an updated record of season dates. For the outer islands the season is taken to start in September, thus month 1-8 in year y belong to the (y-1) Season-Year. For Tristan, this rule applies except for the 2004/05 season which starts 1 August, and following seasons which start 1 July.
3) A final column containing the $\ln(CPUE) + \delta$ is added, which is needed for the GLM. The final files thus used for the GLM analyses are:

New Gough GLM for Bela no 1996.xls
New Inac GLM for Bela no 1996.xls
New Night GLM for Bela no 1996.xls
New Tristan GLM for Bela.xls

References

Edwards, C.T.T. 2007. Sources of data from the lobster fisheries on Inaccessible, Nightingale, Gough and Tristan da Cunha. Technical Report MARAM/Tristan/07/Dec/05.

Table 1: The k_y values for each year *y* which are used to scale the logsheet catches multiplicatively. Not data are available for the season-year 2006.

Year	Inaccessible	Nightingale	Gough
1996*	0.90	1.02	0.95
1997	0.90	0.44	0.95
1998	0.98	1.17	0.79
1999	0.76	1.62	1.12
2000	0.88	0.90	0.99
2001	0.96	0.95	0.88
2002	1.06	0.96	1.02
2003	0.86	1.06	0.89
2004	0.91	1.04	0.89
2005	1.02	1.00	1.02
2006	NA	NA	NA
2007	0.94	0.98	1.15

* Very few logsheets available for 1996 so the k_y for 1996 is set equal to the average of the 1997-2001 values.

Appendix 1: Area names used for the outer islands.

Inaccessible Island

Area Grouping No.	Area Grouping name	Total number of logsheet records	% of total logsheet records
1	**BANK**	512	10.78
2	**N**	728	15.33
3	**NE**	67	1.41
4	**E**	352	7.41
5	**SE**	127	2.67
6	**S**	154	3.24
7	**SW**	392	8.25
8	**W**	1323	27.85
9	**NW**	357	7.52
0	**Unknown**	738	15.54
	Total	4749	

Area Grouping No.	Local area names
1	**Bank**
	Bank
	?ml bank
	N bank
	S bank
	S of bank
	SE of bank
	W bank
	NW of bank
	NW bank
	o/s bank
	SW of bank
	SW bank
	SW of W bank
	W of W bank
	N of W bank
	S of W bank
	W of bank
2	**N**
	N pt
	N of N pt
	E of N pt
	W of N pt
	NW of N pt
	WSW of N pt
	ENE of N pt
	NE of N
	NE of N pt
	SW of N pt
	SE of N pt

NNE of N pt
out N pt
WNN of N pt
WNW of N pt
warrens cliff
W of warrens cave
N side

3 **NE**
salt beach
carlisle bay
E of salt beach
NE of salt beach
NE side
E of py(?) beach

4 **E**
E pt
E of E pt
S of E pt
SE of E pt
SSE of E pt
ESE of E pt
out E pt

5 ***SE***
black spot
SE of blackspot
S off black spot
S black spot
S of black spot
ESE of blackspot
cave rock
out cave rock
SE side
Toms Beach

6 ***S***
S hill
SE of S hill
out S hill
S of S hill
SW of S hill
SSW of S hill
SSW of S hill (2nm)
W of S hill
S cliffs
off SE cliffs
S of cliffs
S of SE cliffs
off cliffs S side
S side

7 **SW**

blinder
S blinder
W blinder
hidden blinder
blinder to rk
S of blinder
SW blinder
o/s blinder
out blinder
out hidden blinder
W of blinder
SW side
pyramid rock
WNW pyramid rock
W pyramid rock
SW pyramid rocks
out pyramid rock

8 **W**

W pt
N of W pt
o/s W of W pt
o/s W pt
out W pt
SW of W pt
SSW of W pt
WNW of W pt
WSW of W pt
NW of W pt
S of W pt
W of W pt
W side

9 ***NW***

blendon hall
W blendon hall
N blendon hall
NW blendon hall
NNW blendon hall
WNW blendon hall
WSW blendon hall
SW blendon hall
out blendon hall
blenheim cottage
N hut
off hut
NE of hut
NW hut
SW of hut
W of hut
NW of hut
WNW hut
WSW hut

SW hut
NW side off hut
W hut
NW side

0 **Unknowns**
scotts cove
WE side
NE pt
W of NE pt
NW pt
NE of pt
SE pt
E of SE pt
ESE of SE pt
S of SE pt
SE of SE pt
SSE of SE pt
SW pt
SWW pt
NO DATA

Nightingale Island

Area Grouping No.	Area Grouping name	Total number of logsheet records	% of total logsheet records
1	North	1384	30.44
2	North East	496	10.91
3	South East	774	17.03
4	South	844	18.57
5	West	598	13.15
0	Unknown	450	9.90
	Total	4546	

Area Grouping No.	Local area names
1	**North**
	Middle Island
	Pin Rock
	Petrel Bay
	Stoltenhoff Island
2	**North East**
	Landing
	Huts
3	**South East**
	SE pt
	Sea Hen Rocks
4	**South**
	Neds Cove (includes S side)
5	**West**
	NW pt
	W side
0	**Unknown**
	NE S/SE pt
	WS W/SW pt

Gough Island

Area Grouping No.	Group area name	Total number of logsheet records	% of total logsheet records
1	Cave Cove	1840	12.16
2	Hawkins Bay	131	0.87
3	SE pt	1389	9.18
4	SW pt	4610	30.46
5	Gaggins pt	3001	19.83
6	N pt	3826	25.28
0	Unknown	340	2.25
	Total	15137	

Area Grouping No.	Local area names
1	**Cave Cove**
	Cave Cove
	Church Rock
	Lots Wife Cove
	NE pt
	Round Island
2	**Hawkins Bay**
	Hawkins Bay
	Penguin Island
3	**SE pt**
	Admiral
	Cavern Head
	Quest Bay
	S pt
	SE pt
	Standoff Rock
	Transvaal Bay
	Waterfall
4	**SW pt**
	Repetto Bay
	Rockhopper Point
	Saddle Island
	Scotts Cove
	Snug Harbour
	SW Island
	SW point
5	**Gaggins Point**
	Baltic Bay
	Gaggins Point
	Nereus Head
	Royalist Point
	Sea Elephant Bay

Seal Bay

6 **N pt**
Battle Bay
Flat Rock
Isolda Rock
N pt
Tristania Rock
W pt

0 **Unknown**
unknown

Figure A1.1: Map of Inaccessible island showing the positions of the area groupings.

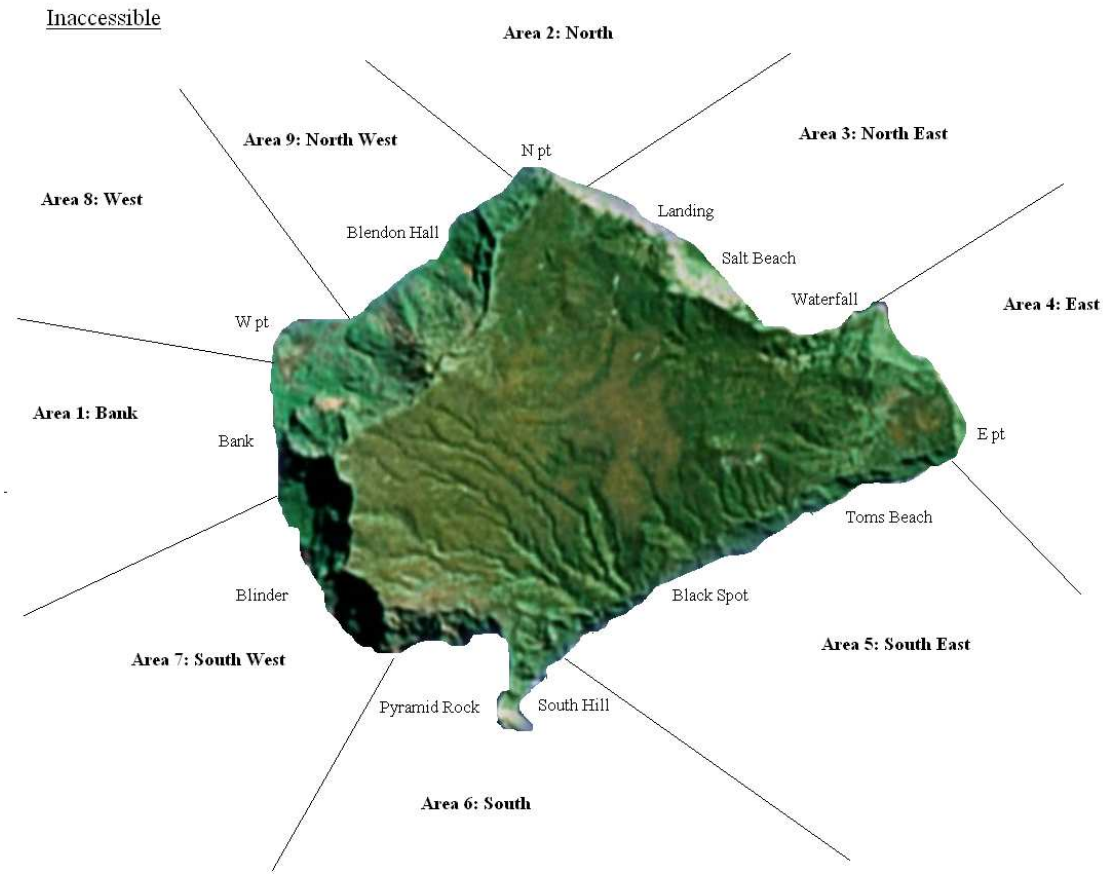

Figure A1.2: Map of Nightingale island showing the positions of the area groupings.

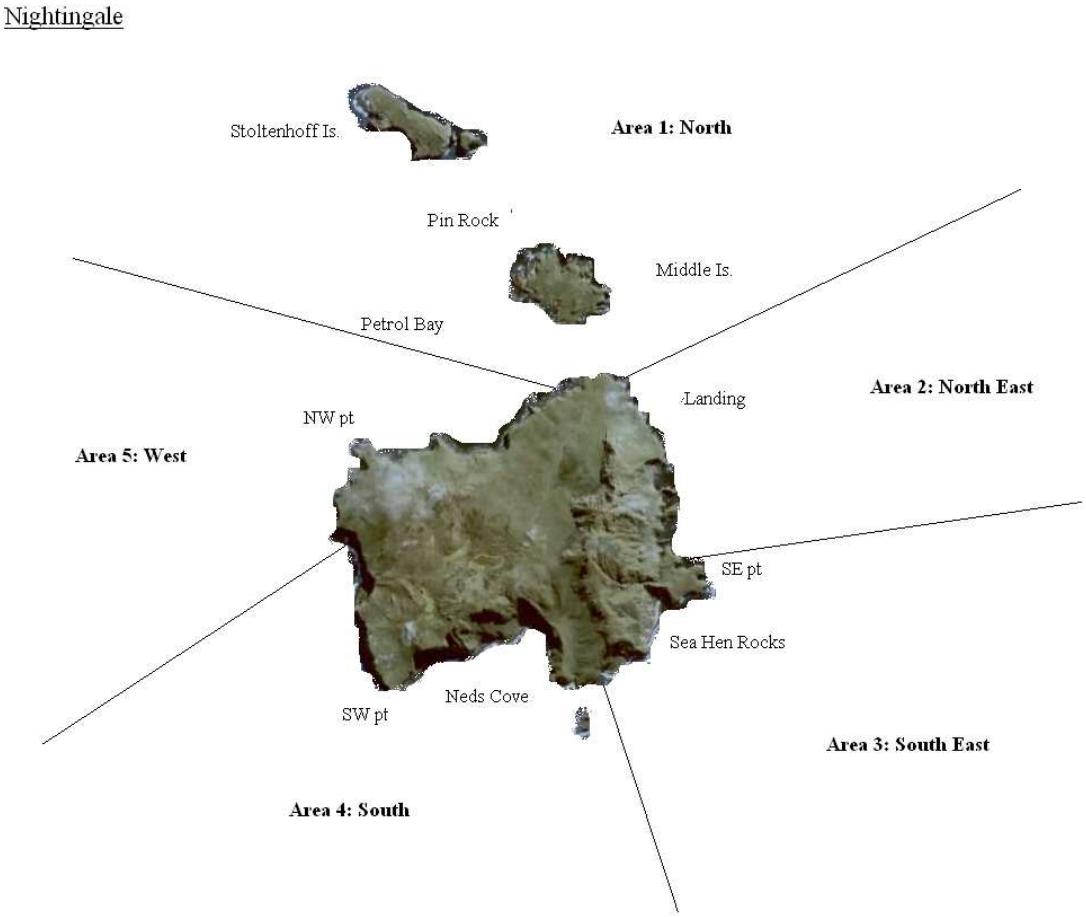

Figure A1.3: Map of Gough island showing the positions of the area groupings.