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# Demography and spatial requirements of the endangered northern quoll on Groote Eylandt

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**Table S1**: **Top 10 POPAN models of northern quoll (*Dasyurus hallucatus*) survival (phi), capture probability (p) and recruitment (pent) at the study site on Groote Eylandt between April 2012 and October 2015.**

The model parameters (phi = survival, p = recapture, pent = recruitment) could vary by sex (g), period and/or time (t). The top ranked model used to derive population and demographic estimates is bolded.

| Model | AICc | Delta AICc | AICc Weight | Model Likelihood | Parameters | Deviance |
|---|---|---|---|---|---|---|
| **Phi(g*period) p(t) pent(g*t)** | **1210.92** | **0.00** | **0.99** | **1.00** | **36** | **1328.92** |
| Phi(g*period) p(g*t) pent(g*t) | 1219.42 | 8.50 | 0.01 | 0.01 | 41 | -1331.29 |
| Phi(g*t) p(t) pent(g*t) | 1232.33 | 21.42 | 0.00 | 0.00 | 49 | -1336.03 |
| Phi(g*t) p(g*t) pent (g*t) | 1232.68 | 21.76 | 0.00 | 0.00 | 50 | -1337.91 |
| Phi(g*period) p(period) pent(g*t) | 1245.69 | 34.78 | 0.00 | 0.00 | 31 | -1283.39 |
| Phi(g) p(g*t) pent(g*t) | 1248.01 | 37.09 | 0.00 | 0.00 | 37 | -1293.99 |
| Phi(g*period) p(.) pent(g*t) | 1249.06 | 38.15 | 0.00 | 0.00 | 27 | -1271.50 |
| Phi(g*period) p(g*period) pent(g*t) | 1249.91 | 38.99 | 0.00 | 0.00 | 34 | -1285.62 |
| Phi(g*period) p(g) pent(g*t) | 1250.90 | 39.98 | 0.00 | 0.00 | 28 | -1271.79 |
| Phi(g) p(g*t) pent(t) | 1257.16 | 46.24 | 0.00 | 0.00 | 30 | -1269.79 |

**Table S2: Density estimates for the northern quoll (*Dasyurus hallucatus*) between 2012 and 2015 at the study site on Groote Eylandt.** Density estimates for each period in each year include standard error (SE) and 95% confidence intervals (LCI and UCI). The mean density for each year is italicised and bold, and the mean for each sex overall years and periods is bolded. The model parameters of 'g0' and 'sigma' are listed with the associated SE and confidence intervals.

| Sex | Year | Period | Occasions | Density | SE | LCI | UCI | g0 | SE | LCI | UCI | Sigma | SE | LCI | UCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | Pre-breeding | 18 | 0.114 | 0.023 | 0.077 | 0.168 | 0.101 | 0.028 | 0.058 | 0.172 | 139.706 | 18.136 | 108.437 | 179.992 |
| | 2012 | Breeding | 18 | 0.089 | 0.017 | 0.061 | 0.130 | 0.054 | 0.012 | 0.035 | 0.083 | 234.731 | 31.171 | 181.146 | 304.166 |
| | 2012 | Post-breeding | 19 | 0.052 | 0.014 | 0.032 | 0.086 | 0.104 | 0.037 | 0.051 | 0.201 | 172.516 | 27.055 | 127.101 | 234.159 |
| | | | | ***0.085*** | ***0.018*** | ***0.056*** | ***0.128*** | ***0.087*** | ***0.026*** | ***0.048*** | ***0.152*** | ***182.318*** | ***25.454*** | ***138.894*** | ***239.439*** |
| | 2013 | Pre-breeding | 29 | 0.104 | 0.021 | 0.070 | 0.154 | 0.242 | 0.058 | 0.147 | 0.372 | 87.896 | 8.152 | 73.315 | 105.377 |
| | 2013 | Breeding | 29 | 0.096 | 0.017 | 0.069 | 0.135 | 0.076 | 0.014 | 0.053 | 0.108 | 192.815 | 16.800 | 162.598 | 228.648 |
| | 2013 | Post-breeding | 24 | 0.048 | 0.012 | 0.030 | 0.077 | 0.144 | 0.037 | 0.085 | 0.234 | 171.101 | 20.149 | 135.943 | 215.351 |
| **Male** | | | | ***0.083*** | ***0.017*** | ***0.056*** | ***0.122*** | ***0.154*** | ***0.036*** | ***0.095*** | ***0.238*** | ***150.604*** | ***15.034*** | ***123.952*** | ***183.125*** |
| **northern** | 2014 | Pre-breeding | 24 | 0.121 | 0.021 | 0.086 | 0.170 | 0.177 | 0.035 | 0.117 | 0.257 | 111.665 | 9.147 | 95.128 | 131.076 |
| **quolls** | 2014 | Breeding | 24 | 0.123 | 0.020 | 0.090 | 0.168 | 0.067 | 0.012 | 0.047 | 0.094 | 189.834 | 17.082 | 159.196 | 226.367 |
| | 2014 | Post-breeding | 26 | 0.054 | 0.012 | 0.035 | 0.084 | 0.106 | 0.022 | 0.070 | 0.157 | 170.669 | 17.854 | 139.107 | 209.392 |
| | | | | ***0.099*** | ***0.018*** | ***0.070*** | ***0.141*** | ***0.117*** | ***0.023*** | ***0.078*** | ***0.170*** | ***157.389*** | ***14.694*** | ***131.144*** | ***188.945*** |
| | 2015 | Pre-breeding | 23 | 0.082 | 0.019 | 0.052 | 0.128 | 0.151 | 0.036 | 0.093 | 0.236 | 98.595 | 11.771 | 78.090 | 124.486 |
| | 2015 | Breeding | 21 | 0.091 | 0.018 | 0.062 | 0.132 | 0.090 | 0.019 | 0.060 | 0.134 | 165.379 | 17.053 | 135.188 | 202.311 |
| | 2015 | Post-breeding | 24 | 0.025 | 0.007 | 0.014 | 0.043 | 0.154 | 0.067 | 0.062 | 0.332 | 239.985 | 32.502 | 184.259 | 312.565 |
| | | | | ***0.066*** | ***0.015*** | ***0.043*** | ***0.101*** | ***0.132*** | ***0.041*** | ***0.072*** | ***0.234*** | ***167.986*** | ***20.442*** | ***132.512*** | ***213.121*** |
| | **2012-2015** | | | **0.083** | **0.017** | **0.056** | **0.123** | **0.122** | **0.031** | **0.073** | **0.198** | **164.574** | **18.906** | **131.626** | **206.158** |
| | 2012 | Pre-breeding | 18 | 0.379 | 0.046 | 0.300 | 0.479 | 0.200 | 0.032 | 0.145 | 0.270 | 81.381 | 5.670 | 71.006 | 93.273 |
| | 2012 | Breeding | 18 | 0.360 | 0.059 | 0.262 | 0.496 | 0.191 | 0.046 | 0.117 | 0.297 | 59.238 | 6.459 | 47.870 | 73.305 |
| | 2012 | Post-breeding | 19 | 0.362 | 0.047 | 0.281 | 0.466 | 0.263 | 0.048 | 0.181 | 0.366 | 64.664 | 4.941 | 55.683 | 75.093 |
| | | | | ***0.367*** | ***0.051*** | ***0.281*** | ***0.480*** | ***0.218*** | ***0.042*** | ***0.147*** | ***0.311*** | ***68.428*** | ***5.690*** | ***58.186*** | ***80.557*** |
| **Female** | 2013 | Pre-breeding | 29 | 0.254 | 0.035 | 0.194 | 0.333 | 0.385 | 0.055 | 0.284 | 0.496 | 60.955 | 3.879 | 53.814 | 69.043 |
| **northern** | 2013 | Breeding | 29 | 0.229 | 0.034 | 0.171 | 0.307 | 0.481 | 0.058 | 0.370 | 0.593 | 53.967 | 2.447 | 49.379 | 58.980 |
| **quolls** | 2013 | Post-breeding | 24 | 0.225 | 0.033 | 0.170 | 0.299 | 0.369 | 0.057 | 0.266 | 0.486 | 69.466 | 4.632 | 60.964 | 79.154 |
| | | | | ***0.236*** | ***0.034*** | ***0.178*** | ***0.313*** | ***0.412*** | ***0.057*** | ***0.307*** | ***0.525*** | ***61.463*** | ***3.653*** | ***54.719*** | ***69.059*** |
| | 2014 | Pre-breeding | 24 | 0.208 | 0.031 | 0.155 | 0.279 | 0.423 | 0.062 | 0.309 | 0.547 | 62.303 | 4.024 | 54.903 | 70.701 |
| | 2014 | Breeding | 24 | 0.204 | 0.032 | 0.150 | 0.278 | 0.311 | 0.053 | 0.217 | 0.424 | 61.338 | 4.758 | 52.698 | 71.394 |
| | 2014 | Post-breeding | 26 | 0.188 | 0.028 | 0.140 | 0.251 | 0.362 | 0.051 | 0.269 | 0.467 | 73.739 | 4.477 | 65.473 | 83.048 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ***0.200*** | ***0.031*** | ***0.149*** | ***0.270*** | ***0.366*** | ***0.055*** | ***0.265*** | ***0.479*** | ***65.793*** | ***4.420*** | ***57.691*** | ***75.047*** |
| | 2015 | Pre-breeding | 23 | 0.160 | 0.026 | 0.117 | 0.219 | 0.596 | 0.083 | 0.430 | 0.743 | 66.609 | 3.707 | 59.731 | 74.278 |
| | 2015 | Breeding | 21 | 0.173 | 0.031 | 0.123 | 0.244 | 0.356 | 0.074 | 0.227 | 0.510 | 59.098 | 5.331 | 49.540 | 70.501 |
| | 2015 | Post-breeding | 24 | 0.165 | 0.027 | 0.120 | 0.227 | 0.453 | 0.076 | 0.312 | 0.602 | 70.721 | 4.751 | 62.004 | 80.662 |
| | | | | ***0.166*** | ***0.028*** | ***0.120*** | ***0.230*** | ***0.468*** | ***0.078*** | ***0.323*** | ***0.618*** | ***65.476*** | ***4.596*** | ***57.092*** | ***75.147*** |
| | **2012-2015** | | | **0.242** | **0.036** | **0.182** | **0.323** | **0.366** | **0.058** | **0.260** | **0.483** | **65.290** | **4.590** | **56.922** | **74.953** |

**Table S3: Individual home range estimates for 10 female and 29 male northern quolls (*Dasyurus hallucatus*) tracked within the study site on Groote Eylandt during 2013 and 2014.**

Quoll age, period over which the individual was tracked, total days fixes were recorded, and the total number of fixes are shown. The mean estimates (± standard error) for males and females are shown in bold. Asterisks indicates those individuals whose home range reached an asymptote.

| Quoll ID | Age | Tracking period | Days recording | GPS fixes | MCP | 95% Kernel | 50% Kernel |
|---|---|---|---|---|---|---|---|
| F1* | 2 | 14/7/13 - 14/8/13 | 27 | 176 | 17.01 | 11.22 | 3.57 |
| F2* | 2 | 17/6/14 - 27/6/14 | 11 | 93 | 7.92 | 7.72 | 2.22 |
| F3* | 2 | 18/6/14 - 22/7/14 | 32 | 169 | 14.44 | 8.86 | 2.20 |
| F4* | 2 | 18/6/14 - 06/7/14 | 19 | 173 | 24.29 | 22.46 | 6.46 |
| F5 | 2 | 18/6/14 - 29/7/14 | 40 | 201 | 18.56 | 6.99 | 2.18 |
| F6* | 2 | 25/6/14 - 10/7/14 | 16 | 157 | 401.56 | 91.04 | 20.46 |
| F7 | 2 | 25/6/14 - 17/7/14 | 19 | 78 | 7.44 | 6.54 | 2.34 |
| F8* | 1 | 26/6/14 - 07/7/14 | 12 | 111 | 12.60 | 12.03 | 2.93 |
| F9* | 3 | 02/7/14 - 23/7/14 | 22 | 204 | 6.69 | 2.55 | 0.50 |
| F10 | 2 | 24/7/14 - 07/8/14 | 15 | 121 | 20.18 | 12.16 | 2.23 |
| **Mean ± SE** | | | | | **53.07 ± 38.77** | **18.16 ± 8.27** | **4.51 ± 1.84** |
| M1* | 1 | 08/5/13 - 28/8/13 | 54 | 461 | 117.26 | 74.89 | 20.51 |
| M2* | 1 | 13/5/13 - 30/9/13 | 46 | 303 | 289.99 | 121.26 | 38.50 |
| M3* | 1 | 30/6/13 - 15/8/13 | 38 | 278 | 157.95 | 55.54 | 11.46 |
| M4* | 1 | 04/7/13 - 14/7/13 | 11 | 87 | 129.74 | 124.65 | 42.64 |
| M5* | 1 | 05/7/13 - 27/8/13 | 48 | 406 | 774.22 | 160.13 | 39.71 |
| M6* | 1 | 11/7/13 - 27/8/13 | 38 | 314 | 180.51 | 82.78 | 15.92 |
| M7* | 1 | 15/7/13 - 06/8/13 | 23 | 192 | 128.61 | 123.73 | 50.05 |
| M8 | 1 | 18/7/13 - 28/7/13 | 11 | 95 | 61.43 | 50.56 | 18.33 |
| M9 | 1 | 20/7/13 - 30/7/13 | 11 | 90 | 120.48 | 127.68 | 34.71 |
| M10* | 1 | 22/7/13 - 01/8/13 | 11 | 91 | 84.26 | 84.44 | 28.38 |
| M11* | 1 | 24/7/13 - 30/9/13 | 46 | 346 | 269.87 | 101.72 | 30.09 |
| M12* | 1 | 11/6/14 - 14/8/14 | 57 | 330 | 1680.69 | 1288.74 | 415.11 |
| M13* | 1 | 11/6/14 - 26/8/14 | 74 | 471 | 221.25 | 50.44 | 11.39 |
| M14 | 1 | 11/6/14 - 14/7/14 | 26 | 170 | 118.84 | 96.72 | 35.60 |
| M15 | 1 | 12/6/14 - 22/7/14 | 32 | 238 | 29.19 | 15.70 | 2.86 |
| M16* | 1 | 17/6/14 - 15/8/14 | 53 | 324 | 129.36 | 76.54 | 10.74 |
| M17* | 1 | 18/6/14 - 19/8/14 | 59 | 368 | 159.03 | 106.17 | 27.31 |
| M18* | 1 | 23/6/14 - 18/7/14 | 26 | 163 | 37.43 | 28.46 | 3.77 |
| M19* | 1 | 24/6/14 - 18/8/14 | 41 | 230 | 101.06 | 74.64 | 18.71 |
| M20* | 1 | 24/6/14 - 22/7/14 | 26 | 170 | 119.77 | 100.34 | 27.32 |
| M21* | 1 | 25/6/14 - 27/8/14 | 62 | 324 | 273.88 | 78.01 | 21.43 |
| M22* | 1 | 25/6/14 - 08/7/14 | 14 | 107 | 47.00 | 44.01 | 13.73 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| M23* | 1 | 25/6/14 - 11/7/14 | 17 | 122 | 98.27 | 93.06 | 22.96 |
| M24 | 1 | 26/6/14 - 18/7/14 | 23 | 158 | 71.87 | 30.67 | 7.09 |
| M25* | 1 | 02/7/14 - 09/7/14 | 8 | 74 | 106.04 | 56.55 | 18.98 |
| M26* | 1 | 03/7/14 - 04/9/14 | 21 | 92 | 87.21 | 49.82 | 16.77 |
| M27 | 1 | 04/7/14 - 05/8/14 | 20 | 101 | 221.74 | 109.59 | 30.63 |
| M28* | 1 | 08/7/14 - 07/8/14 | 22 | 152 | 263.77 | 168.68 | 63.04 |
| M29* | 1 | 23/7/14 - 06/8/14 | 15 | 136 | 166.61 | 148.30 | 44.87 |
| **Mean ± SE** | | | | | **215.43 ± 58.24** | **128.41 ± 42.07** | **38.71 ± 13.70** |

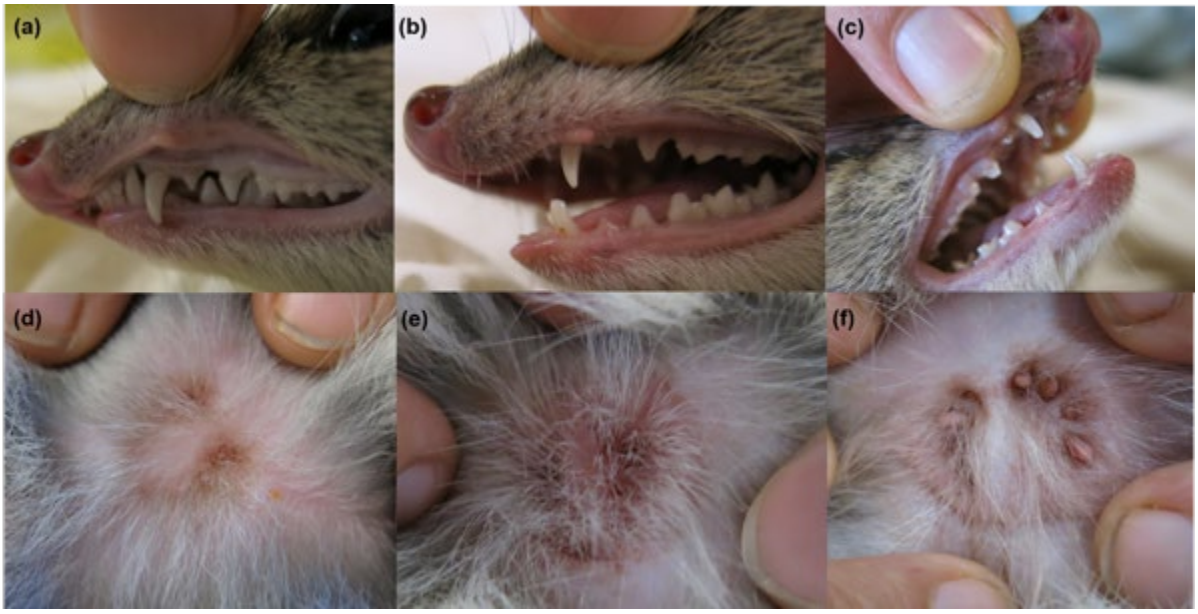


**Figure S1:** Tooth wear and pouch development used to estimate age of northern quolls (*Dasyurus hallucatus*) on Groote Eylandt. Incisors, canine and molars are (a) sharply angular for one-year females, (b) rounded for two-year females and (c) flattened for three-year old female northern quolls. Pouch development of (d) juveniles showing a near indistinguishable pouch, (e) one-year old female approaching breeding season with a deepening pink pouch and (f) a three-year old female approaching breeding that has a deep, well developed pouch with enlarged teats before the breeding season.

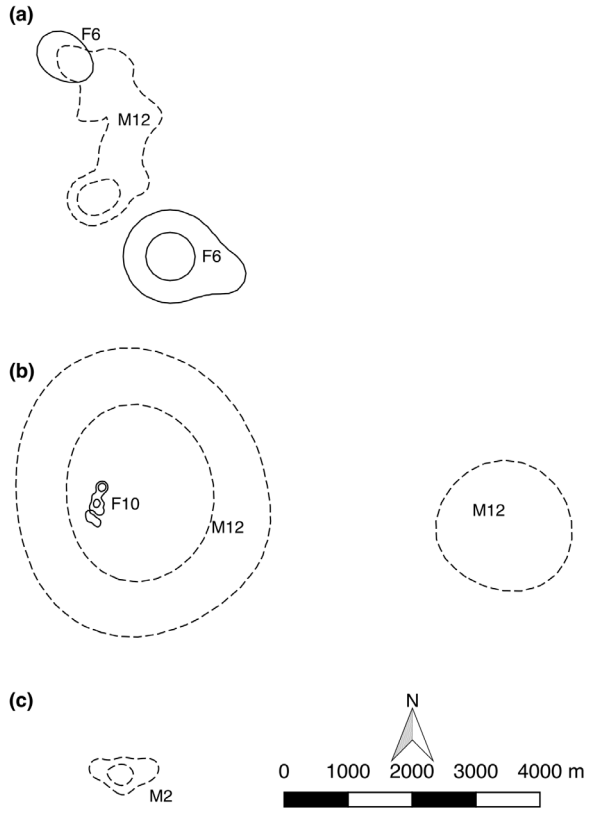


**Figure S2:** The maximum estimated 95% and 50% kernel density home range cores recorded between May 2013 and September 2014 for male (dashed lines) and female (solid lines) northern quolls (*Dasyurus hallucatus*) during (a) pre-breeding, (b) breeding and (c) post breeding on Groote Eylandt.