**Supplementary materials.**

**Long distance runners in the marine realm: New insights into genetic diversity, kin relationships and social fidelity of Indian Ocean male sperm whales**

**By Justine Girardet et al.**

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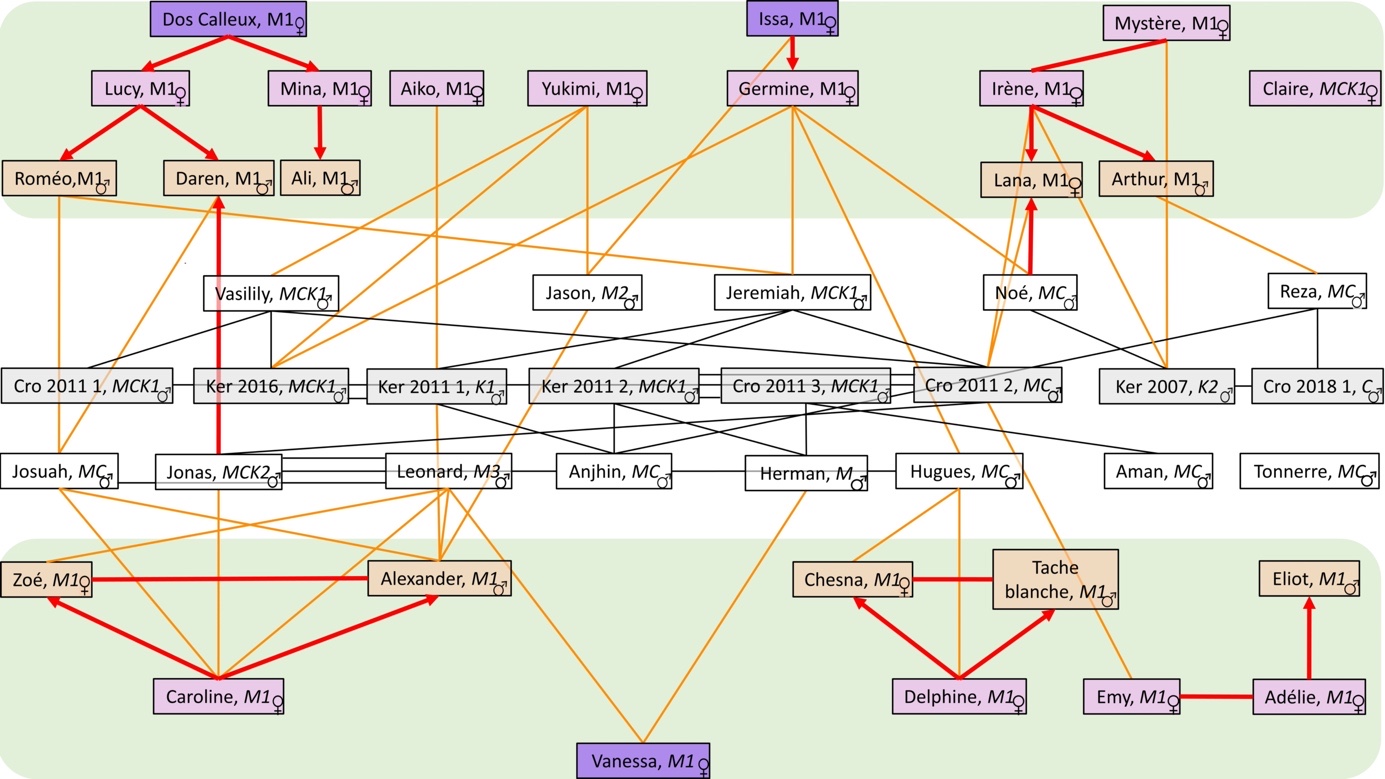
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# Figure S1. Box plot comparing the relatedness estimates for pairs of simulated individuals using four estimators

Hundred dyads of 4 kinship relations (parent offspring, full sibling, half sibling, unrelated individuals) were simulated from our dataset to estimate relatedness coefficients using 4 different estimators: L & L = Li et al. (1993), L & R = Lynch & Ritland (1999), Q & G = Queller & Goodnight (1989) and W = Wang (2002). First degree relationships (Full-Sibs and Parent-Offspring), second degree relationships (Half-Sibs) and unrelated individuals are clearly distinguished by the four tested relatedness estimators.

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# Figure S2: Schematic representation of the kin relationships between all the members of the Irène’s group and the adult males sampled off Mauritius (n=13) and in the Sub-Antarctic waters of the South of the Indian Ocean (n=8).

First-degree (red lines, arrows represent parent to offspring relationships when known and the horizontal red lines mark the full siblings) and second-degree (black lines between two adult males and orange lines between an adult male and a member of Irène’s group) relationships between the different sperm whales are represented (second degree between members of the Irène’s social group are not represented for the sake of clarity, see Sarano et al. (2021) for these relationships). The name, sex, and mitochondrial haplotypes (listed in Table S5) are indicated for each individual. Adult females are represented in purple (dark for older individuals, as estimated in the field, and light purple for the others), young sperm whales within the Irène’s social group in orange, and adult males are in white (males from Mauritius) and in light grey (males from Crozet/Kerguelen – sampling locations designated by “Cro” and “Ker”, respectively). The two green boxes represent two social subgroups identified within the Irène’s social group (Sarano et al. 2021).

Overall, there are

- 21 second degree relationships between Irene's group and males from Mauritius (9 with juveniles, 12 with adult females)

- 9 second degree relationships between Irene's group and Ker/Cro males (2 with juveniles, 7 with adult females)

- 24 second degree relationships between males (5 between males sampled in Mauritius, 5 for those sampled in Ker/Cro, 14 between Mauritius and Ker/Cro samples ).

As stated in Sarano et al. (2021), this diagram was constructed to be consistent with the analyses conducted. Although we performed different analyses that produced similar results, uncertainty exists in the relatedness estimate calculations, which might influence some of these inferred relationships.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Years/Month** | **January** | **February** | **March** | **April** | **May** | **June** | **July** | **August** | **September** | **October** | **November** | **December** |
| **2011** | 0 | 0 | 3 | 2 | 2 | 3 | 0 | 0 | 1 | 2 | 0 | 0 |
| **2012** | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **2013** | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | 1 |
| **2014** | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 |
| **2015** | 0 | 0 | 6 | 23 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| **2016** | 0 | 1 | 16 | 17 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2017** | 0 | 5 | 18 | 25 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2018** | 0 | 9 | 22 | 23 | 7 | 1 | 3 | 1 | 0 | 4 | 0 | 0 |
| **2019** | 0 | 9 | 26 | 28 | 11 | 4 | 0 | 0 | 0 | 2 | 1 | 0 |
| **2020** | 0 | 23 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **0** | **47** | **115** | **122** | **36** | **9** | **5** | **1** | **3** | **13** | **4** | **2** |

# Table S1: Number of days of field work par months and per year

The number of days of field work is indicated per month from 2011 to 2020.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Loci | nA | Range (bp) | Repeat type | Reference | Hybridation Temperature | Number of cycles | Dye label |
| Pp HO110 | 11 | 130-150 | Di | Rosel et al. 1999 | 50 | 40 | 6-Fam |
| Pp HO130 | 12 | 126-156 | Di | Rosel et al. 1999 | 55 | 40 | Hex |
| Pp HO102 | 13 | 173-199 | Di | Rosel et al. 1999 | 55 | 40 | Hex |
| Pp HO131 | 4 | 110-120 | Di | Rosel et al. 1999 | 55 | 40 | 6-Fam |
| PPHO133 | 6 | 190-200 | Di | Rosel et al. 1999 | 55 | 40 | 6-Fam |
| PPHO104 | 1 | 132 | Di | Rosel et al. 1999 | 57 | 40 | Hex |
| Ev37 | 20 | 207-249 | Di | Valsecchi & Amos (1996) | 55 | 35 | 6-Fam |
| GT211 | 9 | 186-212 | Di | Berube et al. (2000) | 55 | 35 | 6-Fam |
| GT023 | 6 | 80-90 | Di | Berube et al. (2000) | 55 | 35 | Hex |
| GT575 | 6 | 131-145 | Di | Berube et al. (2000) | 55 | 35 | Dragonfly |
| GATA417 | 4 | 175-191 | Tetra | Palsboll et al. (1997) | 55 | 35 | 6-Fam |
| GATA028 | 5 | 117-137 | Tetra | Palsboll et al. (1997) | 55 | 35 | Dragonfly |
| 199\_200 | 1 | 108 | Di | Schlötterer et al. 1991 | 55 | 35 | Hex |
| 417\_418 | 3 | 193-197 | Di | Schlötterer et al. 1991 | 55 | 35 | Hex |
| EV1 | 9 | 128-148 | Di | Valsecchi & Amos (1996) | 55 | 35 | Hex |
| EV94 | 11 | 205-225 | Di | Valsecchi & Amos (1996) | 55 | 35 | Hex |
| FCB1 | 10 | 117-141 | Di | Buchanan et al. 1996 | 55 | 35 | 6-Fam |
| FCB17 | 18 | 137-185 | Di | Buchanan et al. 1996 | 55 | 35 | 6-Fam |

# Table S2: PCR conditions, number of alleles (nA) and ranges of allele sizes for each locus.

Microsatellite loci were amplified independently in 20µL reaction mixes consisting of 10ng of genomic DNA, 1x of *HotStart Taq Mix* (Eurobio®) with 1x ThermoStar® Taq polymerase, 3mM MgCl2, 1mM of dNTPs, 10pmol of each primer (except all PPHO loci, amplified as described in Alfonsi et al. 2012). After an initial denaturing step of 10min at 94°C, N amplification cycles consisting each of three steps (denaturation for 30s at 94°C, annealing for 30s at the locus specific temperature and extension for 1min at 72°C) were conducted. A final extension of 30min at 72°C ended the reaction.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A. Sperm whales sampled in the Mauritius Island** | | | | | |
|  | Age/sex | 2017 | 2018 | 2019 | 2020 |
| ADELIE | AF | 2017\_2B | - | 2019\_22 | - |
| AIKO | AF | 2017\_03A, 2017\_03B, 2017\_04B, 2017\_05A, 2017\_05B, 2017\_06B, 2017\_07B, 2017\_32B | - | 2019\_01A | - |
| ALEXANDER | YM | - | - | 2019\_12A, 2019\_16A | 2020\_05 |
| ALI | YM | - | - | 2019\_09A, 2019\_11A | - |
| AMAN | AM | - | 2018\_46A | - | - |
| ANJHIN | AM | 2017\_30B | - | - | - |
| ARTHUR | YM | 2017\_10B | 2018\_10B, 2018\_15B, 2018\_14B, 2018\_36A | - | - |
| CAROLINE | AF | 2017\_29B | 2018\_18A, 2018\_27A | - | - |
| CHESNA | YF | - | - | - | 2020\_06 |
| CLAIRE | AF | 2017\_25B | 2018\_35B | - | - |
| DAREN | YM | - | - | 2019\_10A, 2019\_09A, 2019\_23 | - |
| DELPHINE | AF | 2017\_01B, 2017\_14B, 2017\_20B, 2017\_20C, 2017\_21B | 2018\_08A, 2018\_19A, 2018\_39A | - | - |
| DOS CALLEUX | AF | 2017\_24B | 2018\_21A, 2018\_29A | - | - |
| ELIOT | YM | 2017\_13B | 2018-28A, 2018\_36A, 2018\_38A | 2019\_13A | - |
| EMY | AF | 2017\_28B, 2017\_33B | 2018\_53B, 2018\_32A | - | - |
| GERMINE | AF | 2017\_23B, 2017\_27B | 2018\_13B | 2019\_18A | - |
| HERMAN | AM | - | - | 2019\_20, 2019\_21 | - |
| HUGUES | AM | - | - | 2019\_37, 2019\_38 | - |
| IRENE | AF | 2017\_08A, 2017\_08B, 2017\_09B, 2017\_15B, 2017\_31B | 2018\_01B, 2018\_11B, 2018\_22A | - | - |
| ISSA | AF | - | 2018\_12B, 2018\_41A | - | 2020\_02, 2020\_03 |
| JASON | AM | - | - | 2019\_24, 2019\_25, 2019\_27, 2019\_28, 2019\_32 | - |
| JEREMIAH | AM | - | - | - | 2020\_04, 2020\_07, 2020\_08 |
| JONAS | AM | - | 2018\_45A | 2019\_29, 2019\_30, 2019\_31, 2019\_36, | - |
| JOSUAH | AM | - | - | - | 2020\_04 |
| LANA | YF | - | - | 2019\_08A, 2019\_14A, 2019\_15A | - |
| LEONARD | AM | - | - | 2019\_25, 2019\_33, 2019\_34, 2019\_35 | - |
| LUCY | AF | 2017\_26B | 2018\_17B, 2018\_42A | - | - |
| MINA | AF | 2017\_11A, 2017\_11B, 2017\_12B, 2017\_17B | 2018\_09B, 2018\_20A, 2018\_10B | - | - |
| MYSTERE | AF | 2017\_16B, 2017\_16C |  | - | - |
| NOE | AM | - | 2018\_34A | - | - |
| Unknown\_2017 | AF | 2017\_18B | - | - | - |
| REZA | AM | - | - | 2019\_03A, 2019\_04A, 2019\_05A, 2019\_06A, 2019\_07A, 2019\_12A | - |
| ROMEO | YM | - | 2018\_30A, 2018\_40A | 2019\_02A, | 2020\_01 |
| Clan\_Reshna\_1 | AF | - | 2018\_03B, 2018\_04B, 2018\_05B, 2018\_06B | - | - |
| Clan\_Reshna\_2 | AF | - | 2018\_07B | - | - |
| TACHE BLANCHE | YM | - | 2018\_24A, 2018\_26A, 2018\_52B, 2018\_50B, 2018\_33A | - | - |
| TONNERRE | AM | - | - | 2019\_38 | - |
| VANESSA | AF | 2017\_22B | 2018\_25A | - | - |
| VASILILY | AM | - | 2018\_43A, 2018\_44A | - | - |
| YUKIMI | AF | - | 2018\_2B, 2018\_39A | 2019\_19 | - |
| ZOE | YF | - | 2018\_23A, 2018\_31A, 2018\_37A, 2018\_51B | - | - |

|  |  |
| --- | --- |
| **B. Sperm whales sampled in the Crozet and Kerguelen Archipelagos** | |
| Individuals (n=8) | Samples (n=9) |
| PM\_Ker\_2011\_1 | Bio\_PM\_Ker\_2011\_1 |
| PM\_Ker\_2011\_2 | Bio\_PM\_Ker\_2011\_2 |
| PM\_Ker\_2007 | Bio\_PM\_Ker\_2007 |
| PM\_Cro\_2011\_1 | Bio\_PM\_Cro\_2011\_1, Bio\_PM\_Cro\_2017\_1 |
| PM\_Cro\_2011\_2 | Bio\_PM\_Cro\_2011\_2 |
| PM\_Cro\_2011\_3 | Bio\_PM\_Cro\_2011\_3 |
| PM\_Ker\_2016 | Bio\_PM\_Ker\_2016\_1 |
| PM\_Cro\_2018 | Bio\_PM\_Cro\_2018\_1 |

# Table S3: Correlation between genetic individuals (skin samples and biopsies sharing a same genotype) and field-identified individuals.

(**A**) Samples taken off Mauritius. Grey colored boxes indicate samples of adult females and immatures (males and females) already analyzed in Sarano et al. (2021). Thirteen adult males (in white) have been sampled off Mauritius between 2017 and 2020. In the Mauritius Islands, an alphabetic name was given to all the individuals to facilitate individual specific sampling (see Sarano et al 2021). In Crozet and Kerguelen (**B**), individuals are named following the chronological order of the biopsies in the same year.

Skin samples represented in red and crossed out are the 7 skin samples attributed to incorrect individuals in the field. Their correct attributions appear in green (see Sarano et al 2021 for explanations).

AF: adult female; AM, adult male; YF, immature female; YM, immature male

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Individual | Number of obs. | Genetic  sample | Stay span  (in days) | Number of different years of resighting | Dates of observations | | | | | | | |
| 2011 | 2013 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Aman | 1 | Yes | 1 | 1 |  |  |  |  |  | 18 jul |  |  |
| Anjhin | 10 | Yes | 15 | 1 |  |  |  |  | 17, 20, 21, 25, 27, 29 apr 01, 02, 04, 05 may |  |  |  |
| Big Frosties | 1 | No | 1 | 1 |  |  | 30 jul |  |  |  |  |  |
| Centaure | 1 | No | 1 | 1 |  |  |  |  |  |  | 07 jun |  |
| Corto | 1 | No | 1 | 1 |  |  |  |  |  |  | 25 may |  |
| Daniel | 1 | No | 1 | 1 |  |  |  |  |  |  | 23 feb |  |
| Goliat | 1 | No | 1 | 1 |  |  | 23 may |  |  |  |  |  |
| Herman | 4 | Yes | 9 | 1 |  |  |  |  |  |  | 09, 12, 14, 17 apr |  |
| Hugues | 4 | Yes | 1-31 | 2 |  | 11 oct |  |  |  |  | 07, 21 oct 06 nov |  |
| Jacky | 1 | No | 1 | 1 |  |  |  |  |  | 03 aug |  |  |
| Jason | 11 | Yes | 47 | 1 |  |  |  |  |  |  | 23, 26, 29, 30 apr 03, 05, 09, 17 may 01, 07, 08 jun |  |
| Jeremiah | 1 | Yes | 1 | 1 |  |  |  |  |  |  |  | 12 mar |
| Jonas | 3 | Yes | 1-30 | 2 |  |  |  |  | GR | 18 jul | 08 may 07 jun |  |
| Josuah | 1 | Yes | 1 | 1 |  |  |  |  |  |  |  | 07 feb |
| Leonard | 11 | Yes | 47 | 1 |  |  |  |  |  |  | 23, 26, 29, 30 apr  03, 05, 09, 17 may 01, 07, 08 jun |  |
| Matsya | 1 | No | 1 | 1 | 19 may |  |  |  |  |  |  |  |
| Navin | 2 | No | 1 | 2 |  |  | 17 jul |  |  | 16 jun |  |  |
| Noe | 2 | Yes | 3 | 1 |  |  |  |  |  | 16, 18 apr and GR |  |  |
| Reza | 8 | Yes | 15 | 1 |  |  |  |  |  |  | 14, 16, 19, 20, 22, 23, 27, 28 mar |  |
| Roirené | 1 | No | 1 | 1 |  |  |  | 24 feb |  |  |  |  |
| Saladin | 1 | No | 1 | 1 |  |  |  |  | 14 mar |  |  |  |
| Titan | 2 | No | 7 | 1 |  |  | 11, 17 apr |  |  |  |  |  |
| Titus | 2 | No | 9 | 1 |  |  |  | 21, 29 sep |  |  |  |  |
| Tonnerre | 1 | Yes | 1 | 1 |  |  |  |  |  |  | 05 dec |  |
| Ulysse | 1 | No | 1 | 1 |  |  |  | 15 apr |  |  |  |  |
| Vasilily | 1 | Yes | 1 | 1 |  |  |  |  |  | 02 jul |  |  |

# Table S4: Adult male observations near Mauritius over the 9-year study period.

The number of days of observation for each male and their date, the interval between the first and last sighting, the number of years a male was observed and the existence of genetic samples are indicated. No observation was recorded in 2012 and 2014. GR: gametic recapture, see Text.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **This study** | | **40** | **189** | **216** | **251** | **266** | **269** | **297** | **609** |
| Alexander et al. 2016 | | 57 | 206 | 233 | 268 | 283 | 286 | 314 | - |
| Haplotype names | **SW\_M1** | **T** | **C** | **T** | **C** | **G** | **A** | **G** | **A** |
| C.001.002 | • | • | • | • | • | • | • | - |
| **SW\_MC** | **C** | **•** | **•** | **•** | **A** | **•** | **•** | **•** |
| A.001.001 | C | • | • | • | A | • | • | - |
| **SW\_MCK1** | **•** | **•** | **•** | **•** | **A** | **•** | **A** | **•** |
| **SW\_MCK2** | **•** | **•** | **•** | **•** | **A** | **•** | **A** | **G** |
| N.001.001 | • | • | • | • | A | • | A | - |
| **SW\_M3** | **C** | **•** | **•** | **•** | **•** | **G** | **•** | **•** |
| KK | C | • | • | • | • | G | • | • |
| **SW\_K2** | **•** | **•** | **C** | **•** | **•** | **•** | **•** | **•** |
| GG | • | • | C | • | • | • | • | - |
| **SW\_C** | **•** | **•** | **•** | **•** | **A** | **•** | **•** | **•** |
| B.001.001 | • | • | • | • | A | • | • | - |
| **SW\_K1** | **•** | **T** | **•** | **•** | **•** | **•** | **•** | **•** |
| **SW\_M2** | **C** | **•** | **•** | **T** | **•** | **•** | **•** | **•** |
|  |  |  |  |  |  |  |  |  |

# Table S5. Name and variable positions of the MCR-haplotypes (in bold).

Correspondence with the haplotype names and numberings of Alexander et al. (2016) is indicated. Position 609 of our dataset was not sequenced by Alexander et al. (2016).

Dots mark identical nucleotides. Hyphens mark undetermined nucleotides.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | rw | rl | rk | p | S |
| **ADELIE** | **ELIOT** | **0,5494** | **0,5866** | **0,53** | **PO** |  |
| **ADELIE** | **EMY** | **0,417** | **0,5314** | **0,44** | **FS** | + |
| ADELIE | Clan\_Reshna\_2 | 0,187 | 0,2007 | 0 | U |  |
| AIKO | DAREN | 0,3699 | 0,4487 | 0,38 | HS |  |
| AIKO | LUCY | 0,2086 | 0,2007 | 0,19 | HS |  |
| AIKO | MINA | 0,1472 | 0,1731 | 0,14 | HS |  |
| AIKO | MYSTERE | 0,1292 | 0,2834 | 0,14 | HS |  |
| AIKO | Ker\_2011\_1 | 0,1879 | 0,1731 | 0,2 | HS |  |
| ALEXANDER | ALI | 0,4 | 0,3936 | 0,31 | HS |  |
| **ALEXANDER** | **CAROLINE** | **0,5745** | **0,5039** | **0,53** | **PO** | \* |
| ALEXANDER | ISSA | 0,3437 | 0,3385 | 0,27 | HS |  |
| ALEXANDER | JASON | 0,2053 | 0,2282 | 0,11 | U |  |
| ALEXANDER | JOSUAH | 0,2231 | 0,2834 | 0,45 | HS |  |
| ALEXANDER | LEONARD | 0,4435 | 0,3661 | 0,36 | HS | + |
| ALEXANDER | Unknown\_2017 | 0,3111 | 0,2558 | 0,23 | HS |  |
| ALEXANDER | VANESSA | 0,0999 | 0,118 | 0,13 | HS |  |
| **ALEXANDER** | **ZOE** | **0,4591** | **0,3661** | **0,26** | **FS** |  |
| ALEXANDER | Ker\_2011\_1 | 0,1993 | 0,2007 | 0,14 | HS |  |
| ALI | DAREN | 0,2719 | 0,2834 | 0,18 | HS |  |
| ALI | DOS\_CALLEUX | 0,2945 | 0,3385 | 0,23 | HS |  |
| ALI | ISSA | 0,3317 | 0,2558 | 0,09 | U |  |
| **ALI** | **MINA** | **0,5688** | **0,5866** | **0,57** | **PO** | \* |
| AMAN | Clan\_Reshna\_2 | 0,3039 | 0,2282 | 0,22 | HS |  |
| AMAN | Cro\_2011\_3 | 0,1761 | 0,0353 | 0,13 | HS |  |
| ANJHIN | HUGUES | 0,367 | 0,3109 | 0,25 | HS |  |
| ANJHIN | JONAS | 0,1504 | 0,3109 | 0,22 | HS |  |
| ANJHIN | REZA | 0,0798 | 0,2007 | 0,13 | HS |  |
| ANJHIN | Ker\_2011\_1 | 0,2544 | 0,2007 | 0,15 | HS |  |
| ANJHIN | Ker\_2011\_2 | 0,369 | 0,2409 | 0,24 | HS |  |
| ARTHUR | CHESNA | 0,3051 | 0,2558 | 0,29 | HS |  |
| ARTHUR | DELPHINE | 0,2125 | 0,2007 | 0,23 | HS |  |
| ARTHUR | EMY | 0,1848 | 0,1731 | 0,21 | HS |  |
| **ARTHUR** | **IRENE** | **0,5368** | **0,5039** | **0,51** | **PO** | \* |
| ARTHUR | LANA | 0,2555 | 0,2007 | 0,14 | HS |  |
| ARTHUR | MYSTERE | 0,2278 | 0,3109 | 0,21 | HS |  |
| ARTHUR | REZA | 0,2463 | 0,2558 | 0,25 | HS |  |
| CAROLINE | JONAS | 0,174 | 0,2007 | 0,15 | HS |  |
| CAROLINE | JOSUAH | 0,1996 | 0,2007 | 0,23 | HS |  |
| CAROLINE | LEONARD | 0,2877 | 0,1731 | 0,22 | U |  |
| CAROLINE | Unknown\_2017 | 0,2232 | 0,2007 | 0,21 | HS |  |
| CAROLINE | VANESSA | 0,2262 | 0,118 | 0,15 | HS |  |
| **CAROLINE** | **ZOE** | **0,5837** | **0,5314** | **0,58** | **PO** | \* |
| **CHESNA** | **DELPHINE** | **0,7007** | **0,7242** | **0,73** | **PO** | \* |
| CHESNA | HUGUES | 0,3299 | 0,1727 | 0,22 | HS |  |
| CHESNA | IRENE | 0,1901 | 0,2003 | 0,12 | U |  |
| **CHESNA** | **TACHE\_BLANCHE** | **0,3509** | **0,3658** | **0,42** | **FS** |  |
| CLAIRE | ELIOT | 0,3358 | 0,2007 | 0,14 | HS |  |
| CLAIRE | Clan\_Reshna\_1 | 0,362 | 0,3661 | 0,34 | HS | + |
| CLAIRE | TACHE\_BLANCHE | 0,2821 | 0,1456 | 0,12 | HS |  |
| DAREN | DOS\_CALLEUX | 0,2875 | 0,2834 | 0,25 | HS |  |
| DAREN | EMY | 0,2621 | 0,2558 | 0,17 | U |  |
| **DAREN** | **JONAS** | **0,4578** | **0,4487** | **0,5** | **PO** | \* |
| DAREN | JOSUAH | 0,2156 | 0,2282 | 0,2 | HS |  |
| **DAREN** | **LUCY** | **0,5057** | **0,4763** | **0,5** | **PO** | + |
| DAREN | MINA | 0,2634 | 0,2282 | 0,22 | HS |  |
| DAREN | MYSTERE | 0,3634 | 0,3661 | 0,27 | HS |  |
| DAREN | ROMEO | 0,1939 | 0,1731 | 0,17 | HS |  |
| DELPHINE | HUGUES | 0,3578 | 0,2007 | 0,25 | HS |  |
| **DELPHINE** | **TACHE\_BLANCHE** | **0,5857** | **0,5866** | **0,61** | **PO** | + |
| **DOS\_CALLEUX** | **LUCY** | **0,5237** | **0,4763** | **0,5** | **PO** |  |
| **DOS\_CALLEUX** | **MINA** | **0,5701** | **0,5866** | **0,55** | **PO** | + |
| DOS\_CALLEUX | ROMEO | 0,3977 | 0,3385 | 0,33 | HS |  |
| DOS\_CALLEUX | Unknown\_2017 | 0,1936 | 0,1731 | 0,14 | HS |  |
| ELIOT | TACHE\_BLANCHE | 0,5283 | 0,5039 | 0,5 | HS | + |
| EMY | IRENE | 0,2739 | 0,3385 | 0,24 | HS |  |
| EMY | VANESSA | 0,2837 | 0,1731 | 0,15 | HS |  |
| EMY | Cro\_2011\_2 | 0,239 | 0,2282 | 0,17 | HS |  |
| GERMINE | HUGUES | 0,0835 | 0,0904 | 0,14 | HS |  |
| **GERMINE** | **ISSA** | **0,4464** | **0,3936** | **0,5** | **PO** | \* |
| GERMINE | JEREMIAH | 0,1325 | 0,1456 | 0,15 | HS |  |
| GERMINE | NOE | 0,2334 | 0,2834 | 0,2 | HS |  |
| GERMINE | Ker\_2016\_1 | 0,1722 | 0,1194 | 0,13 | HS |  |
| HERMAN | VANESSA | 0,1366 | 0,0353 | 0,14 | HS |  |
| HERMAN | Ker\_2011\_2 | 0,1762 | 0,1498 | 0,17 | HS |  |
| HERMAN | Cro\_2011\_3 | 0,2404 | 0,1731 | 0,23 | HS |  |
| **IRENE** | **LANA** | **0,5378** | **0,4763** | **0,52** | **PO** |  |
| **IRENE** | **MYSTERE** | **0,5484** | **0,6141** | **0,54** | **PO** | \* |
| IRENE | Ker\_2007 | 0,2366 | 0,332 | 0,14 | U |  |
| IRENE | Cro\_2011\_2 | 0,3263 | 0,2834 | 0,13 | HS |  |
| ISSA | JASON | 0,2636 | 0,1731 | 0,17 | HS |  |
| ISSA | MINA | 0,2043 | 0,2834 | 0,14 | HS |  |
| ISSA | Unknown\_2017 | 0,2923 | 0,2007 | 0,18 | HS |  |
| JASON | Unknown\_2017 | 0,2411 | 0,2007 | 0,11 | U |  |
| JASON | YUKIMI | 0,1801 | 0,3109 | 0,24 | HS |  |
| JEREMIAH | ROMEO | 0,1906 | 0,1731 | 0,18 | HS |  |
| JEREMIAH | Ker\_2011\_1 | 0,1422 | 0,118 | 0,17 | HS |  |
| JEREMIAH | Ker\_2011\_2 | 0,2594 | 0,1801 | 0,16 | HS |  |
| JEREMIAH | Cro\_2011\_2 | 0,2668 | 0,2007 | 0,14 | HS |  |
| JONAS | LEONARD | 0,2453 | 0,3385 | 0,21 | U |  |
| JONAS | Cro\_2011\_2 | 0,3008 | 0,3385 | 0,23 | HS |  |
| JOSUAH | LEONARD | 0,2411 | 0,3109 | 0,25 | HS |  |
| JOSUAH | ROMEO | 0,2046 | 0,1731 | 0,17 | HS |  |
| LANA | MYSTERE | 0,2695 | 0,3109 | 0,23 | HS |  |
| **LANA** | **NOE** | **0,5224** | **0,559** | **0,54** | **PO** | \* |
| LANA | Cro\_2011\_2 | 0,4126 | 0,3109 | 0,21 | HS |  |
| LEONARD | Clan\_Reshna\_2 | 0,403 | 0,3661 | 0,3 | HS |  |
| LEONARD | VANESSA | 0,0668 | 0,118 | 0,12 | HS |  |
| LEONARD | ZOE | 0,4226 | 0,2834 | 0,2 | HS |  |
| LUCY | MINA | 0,2114 | 0,2558 | 0,23 | HS |  |
| **LUCY** | **ROMEO** | **0,454** | **0,4212** | **0,5** | **PO** | \* |
| MINA | ROMEO | 0,1583 | 0,2282 | 0,26 | HS |  |
| MYSTERE | Ker\_2007 | 0,3756 | 0,4534 | 0,33 | HS |  |
| NOE | Ker\_2011\_3 | 0,397 | 0,332 | 0,28 | HS |  |
| REZA | Cro\_2018\_1 | 0,221 | 0,2282 | 0,24 | HS |  |
| Unknown\_2017 | ZOE | 0,2756 | 0,2007 | 0,14 | U |  |
| Unknown\_2017 | Cro\_2018\_1 | 0,1682 | 0,2282 | 0,14 | HS |  |
| Clan\_Reshna\_1 | Cro\_2011\_3 | 0,3956 | 0,3385 | 0,35 | HS | + |
| Clan\_Reshna\_1 | Ker\_2016\_1 | 0,2944 | 0,2712 | 0,25 | HS |  |
| VASILILY | YUKIMI | 0,1935 | 0,2834 | 0,11 | U |  |
| VASILILY | Cro\_2011\_1 | 0,1658 | 0,2007 | 0,18 | HS |  |
| VASILILY | Cro\_2011\_2 | 0,2525 | 0,2007 | 0,12 | U |  |
| VASILILY | Ker\_2016\_1 | 0,2362 | 0,2712 | 0,12 | U |  |
| YUKIMI | Ker\_2016\_1 | 0,2033 | 0,2409 | 0,1 | U |  |
| Ker\_2011\_1 | Ker\_2016\_1 | 0,2895 | 0,1801 | 0,13 | U |  |
| Ker\_2011\_2 | Cro\_2011\_2 | 0,2953 | 0,3016 | 0,2 | HS |  |
| Ker\_2011\_2 | Cro\_2011\_3 | 0,1732 | 0,2105 | 0,21 | HS |  |
| Ker\_2007 | Cro\_2018\_1 | 0,3466 | 0,3927 | 0,32 | HS |  |
| Cro\_2011\_1 | Cro\_2011\_2 | 0,3441 | 0,2282 | 0,16 | HS |  |
|  |  |  |  |  |  |  |

# Table S6. List of all the first- and second-degree relationships detected between all the individuals.

First (Parent-offspring, PO, and Full siblings, FS) and second (Half siblings, avuncular, grand parents-grandchildrens; all noted HS here) have been deduced

(1) from the calculation of the relatedness coefficient ***r*** using the Kalinowski *et al*. (2006), the Wang (2002) and the Li *et al*. (1993) estimators (respectively *rK*, *rW* and rL),

(2) from the maximum likelihood relationship (*P.*) estimated by ML relate (Kalinowsky et al. 2006) and,

(3) from the parentage analysis performed by CERVUS (*S*: **\*** confidence level 95%, **+**: confidence level 80%, **-:** parent-offspring link undetected by CERVUS).

Twenty-one first degree relationships (PO, n=16 and FS, n=5; all represented in bold) have been detected. Of these relations, two were modified to HS, and one from FS to PO (all underlined in the table):

- A FS relation between Alexander and Josuah: impossible as they do not share a mitochondrial haplotype.

- A PO relation between Eliot and Tache Blanche, impossible as Eliot and Tache Blanche are two juveniles born the same year, in 2011, and have different mothers. They most likely share the same father.

- A FS relationship between Chesna (born in 2018) and Delphine, has been changed to PO, highly more likely. No adult female sperm whales have gone missing from the Irene group since 2015, so Chesna's mother is still in the group, and that can therefore only be Delphine.

|  |  |  |
| --- | --- | --- |
| **Individuals** | **p-value FS vs PO** | **p-value PO vs FS** |
| Adélie-Emy | 0 | 0.671 |
| Alexander-Zoé | 0 | 0.583 |
| Chesna-Tache Blanche | 0 | 0.391 |
| Irène-Mystère | 0.196 | 0.025 |

# Table S7: Testing in ML Relate of Full Sibling (FS) vs Parent Offsprings (PO) hypothesis for four pairs of individuals presenting first degree relationships in the Irène’s group.

The smaller the p-value, the more likely the first relation is assumed. For the pairs Adélie-Emy, Alexander-Zoé and Chesna-Tache Blanche, the FS hypothesis is the more likely one (p-value=0) vs the PO hypothesis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Average relatedness** | | | |
|  | **rK** | **rW** | **rL** | **rGlobal** |
| Irene's social group (Adult females and juveniles) | 0.072 | 0.060 | 0.068 | 0.067 |
| All adult males | 0.053 | 0.036 | 0.043 | 0.044 |
| Males sampled in Mauritius | 0.048 | 0.027 | 0.040 | 0.038 |
| Males sampled in Crozet/Kerguelen waters | 0.059 | 0.050 | 0.048 | 0.052 |
| Irene’s group with males from Mauritius | 0.040 | 0.012 | 0.022 | 0.025 |
| Irene’s group (juveniles only) with males from Mauritius | 0.045 | 0.034 | 0.04 | 0.040 |
| Irene's group (adult female only) with Mauritian males | 0.037 | -0.001 | 0.011 | 0.016 |
| Irene’s group with males from Crozet/Kerguelen | 0.040 | 0.027 | 0.030 | 0.032 |
| Irene’s group (juveniles only) with males from Crozet/Kerguelen | 0.035 | 0.027 | 0.032 | 0.031 |
| Irene's group (adult female only) with males from Crozet/Kerguelen | 0.043 | 0.027 | 0.029 | 0.033 |
| All the individuals | 0.052 | 0.040 | 0.048 | 0.046 |

# Table S8: Average relatedness coefficients in groups and subgroups

Relatedness coefficients *rK* (Kalinowsky *et al*. 2006), *rW* (Wang 2002) and *rL* (Li *et al*. 1993) were calculated through *ML Relate* and through *Relate. rGlobal is the average value of the three coefficients (rK, rW* and *rL)*

# Supplementary material and methods: R-script for relatedness estimator calculation

library(related)

input<-readgenotypedata("profil.txt")

compareestimators(input, 100)

outfile<-coancestry(input$gdata, error.rate = 0.021, wang = 1, lynchli = 1, ci95.num.bootstrap = 500)

output<-outfile$relatedness

write.table(output, "Results.xls")

# Supplementary data 1: Individual microsatellite profiles

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 477-418b | 477-418a | Gata417a | Gata417b | GT23a | GT23b | EV1a | EV1b | EV94a | EV94b | GT211a | GT211b | GT575a | GT575b | EV37a | EV37b | GATA028a | GATA028b | PP1a | PP1b | PP2a | PP2b | PP4a | PP4b | PP7a | PP7b | PP8a | PP8b | FCB17a | FCB17b | FCB1a | FCB1b |
| ADELIE | 193 | 195 | 175 | 187 | 84 | 86 | 130 | 130 | 209 | 217 | 192 | 198 | 139 | 141 | 213 | 213 | 117 | 125 | 138 | 140 | 132 | 132 | 179 | 195 | 110 | 118 | 192 | 192 | 137 | 171 | 119 | 129 |
| AIKO | 193 | 193 | 187 | 191 | 84 | 86 | 146 | 148 | 209 | 209 | 206 | 206 | 139 | 141 | 215 | 231 | 133 | 133 | 130 | 138 | 136 | 136 | 173 | 181 | 110 | 118 | 192 | 192 | 137 | 173 | 123 | 133 |
| ALEXANDER | 193 | 195 | 187 | 191 | 84 | 86 | 130 | 130 | 209 | 209 | 206 | 212 | 139 | 141 | 211 | 223 | 133 | 137 | 140 | 146 | 130 | 136 | 179 | 187 | 110 | 118 | 192 | 192 | 157 | 169 | 117 | 141 |
| ALI | 195 | 195 | 187 | 191 | 84 | 86 | 130 | 146 | 207 | 209 | 204 | 206 | 131 | 139 | 223 | 229 | 133 | 137 | 138 | 140 | 132 | 136 | 179 | 193 | 110 | 118 | 190 | 192 | 157 | 183 | 119 | 123 |
| AMAN | 195 | 195 | 179 | 191 | 82 | 84 | 138 | 146 | 215 | 217 | 198 | 212 | 133 | 141 | 219 | 239 | 125 | 133 | 138 | 138 | 130 | 134 | 183 | 193 | 110 | 118 | 192 | 192 | 155 | 165 | 119 | 123 |
| ANJHIN | 193 | 195 | 175 | 187 | 84 | 86 | 130 | 146 | 209 | 217 | 200 | 204 | 133 | 141 | 223 | 229 | 125 | 137 | 140 | 140 | 134 | 138 | 179 | 181 | 110 | 118 | 196 | 198 | 147 | 161 | 119 | 133 |
| ARTHUR | 193 | 195 | 175 | 187 | 84 | 84 | 130 | 146 | 207 | 223 | 192 | 206 | 141 | 145 | 213 | 241 | 125 | 133 | 140 | 142 | 130 | 138 | 185 | 193 | 110 | 118 | 194 | 196 | 147 | 159 | 121 | 129 |
| CAROLINE | 193 | 195 | 187 | 191 | 82 | 86 | 130 | 130 | 207 | 209 | 198 | 212 | 131 | 139 | 211 | 223 | 133 | 133 | 146 | 150 | 136 | 148 | 181 | 187 | 110 | 118 | 192 | 192 | 165 | 169 | 117 | 121 |
| CHESNA | 195 | 195 | 187 | 187 | 86 | 86 | 130 | 138 | 205 | 207 | 192 | 200 | 139 | 141 | 229 | 241 | 125 | 133 | 140 | 142 | 128 | 130 | 185 | 189 | 110 | 118 | 194 | 194 | 161 | 185 | 119 | 121 |
| CLAIRE | 195 | 195 | 175 | 187 | 82 | 82 | 142 | 146 | 209 | 213 | 192 | 200 | 133 | 141 | 217 | 243 | 125 | 133 | 130 | 140 | 132 | 136 | 183 | 195 | 110 | 118 | 190 | 192 | 157 | 159 | 119 | 133 |
| DAREN | 193 | 195 | 187 | 191 | 84 | 86 | 146 | 146 | 209 | 211 | 206 | 212 | 139 | 141 | 213 | 241 | 117 | 125 | 138 | 140 | 134 | 136 | 173 | 181 | 110 | 118 | 192 | 196 | 173 | 183 | 119 | 123 |
| DELPHINE | 195 | 195 | 175 | 187 | 86 | 86 | 130 | 138 | 205 | 209 | 192 | 200 | 139 | 141 | 221 | 229 | 125 | 133 | 140 | 142 | 130 | 138 | 185 | 189 | 110 | 118 | 190 | 194 | 177 | 185 | 119 | 121 |
| DOS\_CALLEUX | 195 | 195 | 187 | 191 | 84 | 84 | 130 | 146 | 209 | 211 | 192 | 206 | 139 | 139 | 225 | 229 | 125 | 137 | 136 | 140 | 132 | 136 | 173 | 177 | 110 | 118 | 190 | 200 | 159 | 173 | 123 | 131 |
| ELIOT | 195 | 195 | 175 | 187 | 84 | 86 | 130 | 130 | 209 | 209 | 198 | 208 | 139 | 141 | 213 | 243 | 125 | 133 | 140 | 146 | 132 | 134 | 179 | 195 | 110 | 118 | 192 | 198 | 159 | 171 | 119 | 131 |
| EMY | 195 | 195 | 175 | 187 | 84 | 86 | 130 | 140 | 209 | 223 | 192 | 206 | 139 | 145 | 229 | 241 | 117 | 125 | 138 | 140 | 132 | 136 | 195 | 195 | 110 | 118 | 192 | 196 | 137 | 177 | 119 | 129 |
| GERMINE | 195 | 195 | 187 | 191 | 84 | 84 | 130 | 132 | 213 | 215 | 200 | 206 | 139 | 143 | 225 | 237 | 125 | 133 | 130 | 148 | 130 | 130 | 179 | 179 | 110 | 118 | 190 | 198 | 165 | 173 | 119 | 123 |
| HERMAN | 195 | 195 | 175 | 187 | 84 | 90 | 128 | 130 | 207 | 223 | 200 | 204 | 133 | 141 | 229 | 233 | 129 | 137 | 138 | 138 | 130 | 134 | 183 | 187 | 110 | 118 | 190 | 194 | 137 | 155 | 119 | 133 |
| HUGUES | 195 | 195 | 175 | 187 | 84 | 86 | 146 | 146 | 215 | 221 | 200 | 204 | 141 | 143 | 211 | 229 | 117 | 125 | 138 | 140 | 128 | 130 | 179 | 189 | 110 | 118 | 190 | 192 | 161 | 177 | 119 | 133 |
| IRENE | 195 | 195 | 175 | 187 | 84 | 84 | 130 | 146 | 207 | 209 | 192 | 206 | 139 | 145 | 221 | 241 | 125 | 133 | 140 | 140 | 130 | 134 | 193 | 197 | 110 | 118 | 192 | 194 | 159 | 175 | 119 | 129 |
| ISSA | 193 | 195 | 187 | 191 | 84 | 90 | 130 | 146 | 209 | 215 | 206 | 212 | 139 | 141 | 209 | 237 | 125 | 137 | 130 | 138 | 130 | 136 | 179 | 197 | 110 | 118 | 190 | 198 | 157 | 173 | 117 | 119 |
| JASON | 195 | 195 | 179 | 191 | 84 | 88 | 130 | 146 | 205 | 209 | 186 | 200 | 139 | 141 | 209 | 247 | 125 | 133 | 138 | 140 | 134 | 138 | 187 | 195 | 110 | 118 | 192 | 192 | 157 | 173 | 117 | 117 |
| JEREMIAH | 195 | 195 | 175 | 187 | 84 | 84 | 130 | 146 | 209 | 209 | 204 | 206 | 143 | 145 | 215 | 225 | 125 | 133 | 130 | 132 | 126 | 132 | 175 | 187 | 110 | 118 | 190 | 190 | 159 | 167 | 117 | 119 |
| JONAS | 193 | 195 | 175 | 187 | 84 | 86 | 130 | 146 | 209 | 209 | 204 | 212 | 133 | 141 | 211 | 241 | 125 | 133 | 138 | 146 | 136 | 146 | 181 | 181 | 110 | 118 | 192 | 196 | 183 | 185 | 119 | 119 |
| JOSHUA | 193 | 195 | 187 | 191 | 84 | 86 | 130 | 130 | 207 | 211 | 206 | 212 | 133 | 141 | 211 | 223 | 133 | 137 | 138 | 138 | 126 | 134 | 175 | 175 | 110 | 118 | 192 | 192 | 173 | 179 | 119 | 121 |
| LANA | 195 | 195 | 175 | 187 | 80 | 84 | 130 | 148 | 209 | 213 | 192 | 204 | 131 | 139 | 221 | 241 | 125 | 133 | 138 | 140 | 130 | 144 | 179 | 197 | 110 | 118 | 194 | 198 | 159 | 159 | 129 | 133 |
| LEONARD | 193 | 195 | 175 | 187 | 84 | 86 | 130 | 130 | 207 | 209 | 192 | 206 | 133 | 141 | 211 | 241 | 125 | 137 | 138 | 144 | 130 | 140 | 179 | 181 | 110 | 118 | 192 | 192 | 157 | 165 | 117 | 121 |
| LUCY | 195 | 195 | 179 | 191 | 84 | 86 | 144 | 146 | 209 | 211 | 204 | 206 | 139 | 141 | 213 | 225 | 117 | 125 | 136 | 140 | 132 | 136 | 173 | 183 | 110 | 118 | 190 | 192 | 161 | 173 | 123 | 123 |
| MINA | 195 | 195 | 187 | 191 | 84 | 84 | 130 | 146 | 209 | 209 | 192 | 206 | 131 | 139 | 219 | 229 | 137 | 137 | 136 | 138 | 132 | 136 | 173 | 179 | 110 | 118 | 190 | 192 | 159 | 183 | 117 | 123 |
| MYSTERE | 193 | 195 | 175 | 187 | 84 | 84 | 130 | 146 | 207 | 209 | 206 | 206 | 139 | 141 | 213 | 221 | 125 | 133 | 138 | 140 | 134 | 136 | 197 | 197 | 110 | 118 | 192 | 194 | 175 | 183 | 129 | 133 |
| NOE | 195 | 195 | 175 | 187 | 84 | 84 | 130 | 148 | 213 | 213 | 200 | 204 | 139 | 145 | 221 | 247 | 125 | 133 | 134 | 138 | 130 | 144 | 179 | 179 | 110 | 118 | 192 | 198 | 153 | 159 | 119 | 133 |
| REZA | 193 | 193 | 175 | 187 | 84 | 84 | 130 | 130 | 209 | 211 | 200 | 204 | 131 | 139 | 211 | 213 | 125 | 133 | 134 | 140 | 138 | 138 | 183 | 195 | 110 | 118 | 194 | 196 | 159 | 165 | 121 | 133 |
| ROMEO | 195 | 195 | 187 | 191 | 84 | 84 | 130 | 146 | 207 | 209 | 204 | 204 | 133 | 141 | 211 | 225 | 117 | 125 | 136 | 138 | 132 | 136 | 173 | 175 | 112 | 118 | 190 | 190 | 173 | 173 | 121 | 123 |
| Unknown\_2017 | 195 | 195 | 187 | 191 | 84 | 86 | 130 | 130 | 209 | 209 | 200 | 212 | 131 | 139 | 211 | 229 | 125 | 133 | 140 | 146 | 132 | 138 | 181 | 197 | 118 | 120 | 198 | 200 | 157 | 173 | 117 | 119 |
| Clan\_Reshna\_1 | 195 | 195 | 175 | 187 | 82 | 84 | 130 | 146 | 207 | 209 | 200 | 206 | 139 | 141 | 211 | 219 | 133 | 133 | 140 | 140 | 132 | 156 | 183 | 185 | 110 | 118 | 192 | 196 | 157 | 173 | 119 | 133 |
| TACHE\_BLANCHE | 195 | 195 | 175 | 187 | 86 | 86 | 130 | 138 | 209 | 209 | 200 | 208 | 139 | 141 | 221 | 243 | 125 | 133 | 142 | 146 | 130 | 134 | 185 | 195 | 110 | 118 | 190 | 198 | 159 | 185 | 119 | 121 |
| TONERRE | 193 | 195 | 175 | 187 | 84 | 90 | 132 | 146 | 207 | 219 | 200 | 204 | 139 | 141 | 211 | 215 | 133 | 137 | 136 | 138 | 126 | 136 | 177 | 183 | 110 | 118 | 192 | 192 | 159 | 161 | 117 | 135 |
| Clan\_Reshna\_2 | 193 | 195 | 175 | 187 | 84 | 84 | 130 | 146 | 205 | 209 | 200 | 206 | 133 | 141 | 211 | 219 | 125 | 133 | 138 | 146 | 130 | 144 | 179 | 193 | 110 | 118 | 192 | 194 | 137 | 165 | 119 | 131 |
| VANESSA | 195 | 195 | 175 | 187 | 86 | 90 | 130 | 144 | 209 | 213 | 192 | 200 | 139 | 139 | 223 | 229 | 137 | 137 | 144 | 146 | 132 | 138 | 181 | 195 | 110 | 118 | 192 | 194 | 137 | 169 | 121 | 133 |
| VASILIY | 195 | 195 | 175 | 187 | 84 | 86 | 130 | 130 | 207 | 211 | 192 | 200 | 139 | 141 | 211 | 225 | 125 | 133 | 140 | 140 | 134 | 136 | 181 | 189 | 110 | 118 | 192 | 198 | 155 | 155 | 117 | 129 |
| ZOE | 195 | 195 | 187 | 191 | 82 | 84 | 130 | 130 | 209 | 225 | 192 | 198 | 131 | 139 | 211 | 215 | 125 | 133 | 138 | 150 | 130 | 136 | 181 | 187 | 110 | 118 | 192 | 196 | 157 | 169 | 117 | 121 |
| YUKIMI | 195 | 195 | 187 | 191 | 84 | 84 | 130 | 148 | 205 | 207 | 186 | 200 | 141 | 143 | 215 | 221 | 125 | 133 | 138 | 140 | 128 | 134 | 181 | 181 | 110 | 118 | 190 | 192 | 159 | 163 | 117 | 121 |
| Ker\_2011\_1 | 193 | 193 | 175 | 187 | 82 | 84 | 130 | 130 | 209 | 211 | 186 | 200 | 141 | 143 | 215 | 229 | 133 | 137 | 130 | 140 | 136 | 138 | 181 | 187 | 110 | 118 | 190 | 192 | 169 | 171 | 119 | 123 |
| Ker\_2011\_2 | 195 | 197 | 175 | 191 | 84 | 84 | 130 | 132 | 207 | 223 | 192 | 204 | 133 | 141 | 215 | 223 | 125 | 133 | 140 | 140 | 132 | 132 | 181 | 187 | 110 | 118 | 190 | 196 | 167 | 187 | 119 | 133 |
| Ker\_2007 | 195 | 195 | 175 | 187 | 84 | 84 | 130 | 146 | 207 | 207 | 200 | 206 | 139 | 143 | 207 | 221 | 125 | 133 | 140 | 146 | 136 | 136 | 179 | 179 | 110 | 118 | 192 | 198 | 153 | 163 | 127 | 133 |
| Cro\_2011\_1 | 195 | 195 | 175 | 187 | 84 | 86 | 138 | 146 | 209 | 211 | 194 | 206 | 133 | 141 | 241 | 249 | 125 | 137 | 138 | 140 | 126 | 132 | 181 | 199 | 110 | 118 | 198 | 198 | 155 | 177 | 129 | 133 |
| Cro\_2011\_2 | 193 | 195 | 175 | 191 | 84 | 86 | 140 | 146 | 209 | 209 | 192 | 204 | 139 | 141 | 225 | 241 | 125 | 133 | 138 | 140 | 130 | 132 | 179 | 181 | 110 | 118 | 190 | 192 | 155 | 159 | 119 | 133 |
| Cro\_2011\_3 | 195 | 195 | 187 | 191 | 84 | 84 | 146 | 148 | 207 | 219 | 186 | 200 | 133 | 141 | 211 | 219 | 133 | 137 | 136 | 140 | 132 | 134 | 187 | 193 | 110 | 118 | 194 | 196 | 155 | 157 | 133 | 133 |
| Ker\_2016\_1 | 195 | 195 | 187 | 191 | 84 | 86 | 130 | 130 | 207 | 213 | 186 | 200 | 133 | 141 | 215 | 237 | 133 | 137 | 140 | 140 | 136 | 156 | 179 | 183 | 110 | 118 | 192 | 200 | 181 | 183 | 119 | 129 |
| Cro\_2018\_1 | 195 | 195 | 175 | 187 | 84 | 84 | 130 | 142 | 209 | 211 | 192 | 200 | 131 | 139 | 211 | 221 | 125 | 133 | 146 | 146 | 132 | 136 | 183 | 183 | 110 | 118 | 192 | 198 | 153 | 177 | 121 | 127 |

# Supplementary Data 2: Irène’s and Herman’s Mitogenome sequences

**> Complete mitochondrial DNA Irène GTTAGTGTAGCTTAAGTTTTTAATAAAGCAAGACACTGAAGATGTCTAGACGGACCCGCTAGTCCCACCAACACAAAGGTTTGGTCCCAGCCTTCCTATTAGCTCCCAACAGATTTACACATGCAAGCATCTACATCCCAGTGAAAATGCCCTCCAAGTCACAAAGATCAAAAGGAGCTGGTATCAAGCACGCTTCACTAGCAGCTCACAACACCTTGCTTAGCCACACCCCCACGGGACACAGCAGTGATAAAAATTAAGCCATGAACGAAAGTTTGACTAAGTCATGTTGATTAGGGTTGGTAAATTTCGTGCCAGCCACCGCGGTCATACGATTGACCCAAGCTAATAGGCATACGGCGTAAGGAGTGTTAAAGAGTTATACAAAATAAAGTCAAGCCTTGACTAAACCGTAAAAAGCCATAGTTAAAATTAAGCTAAACCACGAAAGTGACTTTAATACAATCTACTGCACGACAACTAAGACCCAAACTGGGATTAGATACCCCACTATGCTTAGCCGTAAACCCAGGTAGTCATAAAACAAGACTATTCGCCAGAGTACTACTAGCAACAGCCTAAAACTCAAAGGACTTGGCGGTGCTTCATACCCCCCTAGAGGAGCCTGTTCTATAACCGATAAACCCCGATCAACCTCACCAACCCTTGCTACTTCAGTCTATATACCGCCATCTTCAGCAAACCCTAAAAAGGAATGAAAGTAAGCATAACTATCCTACGTAAAAACGTTAGGTCAAGGTGTAACCCATGGGATGGGAAGAAATGGGCTACATTTTCTACACCATAGAACACCCTATACCCCACGAAAGTTTTTATGAAACCTAAAAACCAAAGGAGGATTTAGCAGTAAATTAAGAACAGAGTGCTTAATTGAATAAGGCCATGAAGCACGCACACACCGCCCGTCACCCTCCTCAAGTATCACAGCGAAGCCCCAATCCACTAATTTATGCCGAGCGCCCCCACAAGAGGAGACAAGTCGTAACAAGGTAAGCATACTGGAAGGTGTGCTTGGATAAAACAAGACATAGCTTAAATAAAGCATCTAGTTTACACCTAGAAGATTCCACAGCTCGTGTATATCTTGAACTAGATCTAGCCCACACATCAAATAAAGCATTCACCACCCATTCAAAGTATAGGAGATAGAAATCCAAATCACTAGTGGCGCTATAGAGAAAGTACCGTAAGGGAAAGATGAAAGATATCCTAAAAGTAAAAAAAAGCAAAGCTTACCCCTTGTACCTTTTGCATAATGAATTAACTAGTAGTAACTTAGCAAAGAGACCTTTAGTTAAACTACCCGAAACCAGACGAGCTACTTACGAACAGTACCTAGAACGAACTCATCTATGTGGCAAAATAGTGAGAAGATTTGTAAGTAGAGGTGAAAAGCCTAACGAGCCTGGTGATAGCTGGTTGTCCAAGAAAAGAATCTCAGTTCAACATTAAACAGTACCAAGAACCCCCTGAAGTTCCAATGTATGTTTAACTGTTAGTCTAAAAAGGTACAGCTTTTTAGAAATGGGTACAACCTTAACTAGAGAGTAAAACAGACACACACATGCCATAGTTGGCTTAAAAGCAGCCATCAATTAAGAAAGCGTTCAAGCTCAACAATAAAACTGTGTTATAATCCCAACAATAACAAATCAACTCCTAGTATAATTATTGGACTAATCTATATAATTATAGAAGCAATACTGTTAACATGAGTAACAAGAAAACTTTTTCTCCTCGCACAAGCTTACATCAGTAACTGATACTACACTGATAGTTAACAGCCAATAAATAAAACCCAACACCAAGCCATTTATTAAGCCCACTGTTAACCCAACACAGGCGTGCACCAAGGAAAGATTAAAAAAAGTAAAAGGAACTCGGCAAACACAAACCTCGCCTGTTTACCAAAAACATCACCTCTAGCATAACCAGTATTAGAGGCACTGCCTGCCCAGTGACTGATAGTTAAACGGCCGCGGTATCCTGACCGTGCAAAGGTAGCATAATCACTTGTTCTCTAAATAAGGACTTGTATGAACGGCCACACGAAGGTTTTACTGTCTCTTACTTTTAATCAGTGAAATTGACCTTCCCGTGAAGAGGCGGGAATAACAAAACAAGACGAGAAGACCCTATGGAGCTTCAATTAATCAACCCAATAACCCACAACCTCAAACCACCAAGGGATAAAAAAAACTTATATGGGTTGACAATTTCGGTTGGGGTGACCTCGGAGCACAAAAACCCCTCCGAGTGATTAAAGCCTAGGCCTACCAGCCAAAGCATAACATCACTTATTGATCCAAAGCTTTGATCAACGGAACAAGTTACCCTAGGGATAACAGCGCAATCCTATTCTAGAGTCCATATCGACAATAGGGTTTACGACCTCGATGTTGGATCAGGACATCCTAATGGTGCAGCCGCTATTAAGGGTTCGTTTGTTCAACGATTAAAGTCCTACGTGATCTGAGTTCAGACCGGAGCAATCCAGGTCGGTTTCTATCTGTTGCGCATTTCTCCCAGTACGAAAGGACAAGAGAAATAAGGCCAACTTTACACACGCGCCTTCAAATAACTAATGATCTAATCTTAATTAAACAAACAAGCGCAAACTAACCCTGCCCAAGACCAGGGCATTGTTGTGGTGGCAGAGTCCGGTAATTGCATAAAACTTAAACTTTTACACCCAGAGGTTCAAATCCCCTCCTCAACAGAATGTTTATAATTAACATCCTAATACTCACCCTCCCCATTCTCCTAGCCGTGGCATTCCTAACCTTAGTAGAACGTAAAACCCTGGGGTATATACAGCTCCGAAAAGGACCAAACATTGTCGGCCCACATGGCTTACTCCAACCCTTCGCCGACGCAATTAAACTATTCACCAAAGAACCCCTACGTCCAGCCACATCCTCCACCACCATATTCATCATCGCACCCATACTAGCCCTAATCCTAGCCCTCACGATATGAAGCCCCCTGCCCATACCATATCCCCTCATCAACATACACCTAGGAATCCTATTTATACTAGCAATATCCAGCCTGACTGTTTATTCCATTCTATGATCCGGCTGAGCCTCCAACTCAAAATATGCACTAATCGGAGCTCTCCGAGCAGTAGCACAAACAATCTCATACGAAGTGACACTAGCCATCATCCTCCTATCAGTCTTACTAATAAGCGGCTCCTTCACCCTATCAGCACTAGCCACAACCCAAGAACAACTTTGACTGCTCTTCCCCCTATGACCACTAACCATAATATGATTTATCTCTACCCTCGCAGAAACTAACCGAGCCCCCTTCGACCTCACAGAAGGAGAATCAGAGCTGGTCTCTGGCTTCAACGTAGAATATGCAGCAGGCCCCTTCGCCCTCTTCTTCCTAGCAGAATATGCTAACATCATCATAATAAATATACTCTCAACCATCCTATTCCTAGGAACATACCACAATCCTTACACACCAGAACTACACACAACAAATCTCATCCTCAAAACACTACTACTTACAATATCTTTCCTATGAATCCGAGCATCCTACCCCCGATTCCGATATGATCAACTGATACACCTACTCTGAAAAAATTTTCTCCCCCTAGCACTAGCCCTCTGCATATGACACATCTCATTACCCATCATAACAGCAGGAACCCCCCCTCAAACATAAGAAATATGTCTGATAAAAGAGTTACTTTGATAGAGTAAATAATAGAGGCTCAAATCCTCTTATTTCTAGAATAATAGGAGTTGAACCTATCCTTAAGAATTCAAAGTTCTTCGTGCTACCACATTGCTACACTACAATCCACAGTAAGGTCAGCTAAACAAGCTATCGGGCCCATACCCCGAAAATGTTGGTTTATACCCTTCCCATACTAATAAACCCATTCATCTCTATTATTACATTTACAACACTCATCCTAAGCACAACAATTGTAGTCATCAGCTCTCACTGACTTTTCGCCTGAGTCGGATTTGAAATAAACATGATAGCTATCATCCCCATCATAATAAAAAATTTTAACCCCCGAACCACAGAGGCCTCCACTAAATATTTCCTAACCCAAGCTACCGCATCCGCCCTACTCATAATAGCAATTATAATCAACCTGTCACACTCCGGTCAATGAACTATCACCAAGCTATTTAATCCAACAGCATCAATACTAGTAACAATTGCCCTAGCCATCAAACTAGGATTATCCCCATTCCACTTCTGAGTACCCGAAGTCACACAAGGCATCCCCCTATCCACAGGCCTAGTCCTACTCACATGACAAAAAATCGCACCTCTGTCCATTCTATACCAAATCTCACCCTCCATTAACATGAACCTAATACTAACTATATCCCTACTCTCCATTCTCATCGGGGGTTGAGGAGGACTAAACCAGACTCAACTCCGAAAAATTATAGCTTACTCATCAATCGCCCACATAGGATGAATAACCACAATCCTACCCTACAATACAACCATAACCCTACTAAACCTACTAATCTATGTCACAATAACCTTCACCATATTCATACTATTTATCCAAAACTCAACCACAACCACACTATCTCTGTCCCAGACATGAAACAAAACACCCATTACCACAACCCTTACCATACTTACCCTACTTTCCATAGGGGGCCTCCCACCACTCTCGGGCTTTATCCCCAAATGAATAATTATTCAAGAACTAACAAAAAACGAAACCCTCATCATACCAACCTTCATAGCCACCACAGCATTACTCAACCTCTACTTCTATATACGCCTCACCTACTCAACAGCACTAACCCTATTCCCCTCCACAAATAACATAAAAATAAAATGACAATTCTACCCCACAAAACGAATAACCCTCCTGCCAACAGCAATTGTAATATCAACAATACTCCTACCCCTTACACCAATACTCTCCACCCTATTATAGGAGTTTAGGTTACACTCAGACCAAGAGCCTTCAAAGCCCTAAGCAAGTATTATCCACTTAACTCCTGCATAACAAGGACTGCAAGACTATATCTTACATCAACTGAATGCAAATCAAACACTTTAATTAAGCTAAGTCCTCACTAGATTGGAGGGATACACTTCCCACGAACTTTTAGTTAACAGCTAAATACCCTAGTCAACTGGCTTCAATCTACTTCTCCCGCCGCGGGGAAAAAAAGGCGGGAGAAGCCCCGGCAGGATTGAAGCTGCTCCTTTGAATTTGCAATTCAACATGATCATTCACTACAAGGCTTGGTAAAAAGAGGACTTAACCCCTGTCTTTAGATTTACAGTCTAATGCCTACTCGGCCATCTTACCTATGTTCATAAACCGCTGATTATTCTCAACCAACCATAAGGACATCGGCACTCTATATCTACTATTCGGTGCCTGAGCGGGAATGGTGGGCACTGGCCTAAGCTTGCTAATCCGCACCGAGTTAGGCCAACCCGGTACATTAATTGGGGATGACCAAGTCTACAACGTGCTGGTAACAGCTCACGCCTTTGTGATAATTTTCTTCATAGTCATACCCATCATAATTGGCGGTTTCGGAAACTGATTAGTTCCTCTAATAATCGGAGCACCTGACATAGCCTTTCCTCGTATGAATAACATGAGCTTCTGACTACTCCCCCCTTCATTCCTACTACTAATAGCTTCTTCAATAGTCGAAGCCGGCGCAGGTACAGGCTGGACTGTTTACCCCCCTCTAGCCGGAAATTTAGCACATGCAGGAGCATCCGTAGACCTTACCATCTTTTCCCTACACCTAGCTGGTGTCTCCTCAATCCTTGGAGCCATCAACTTTATTACAACCATTATCAACATAAAACCCCCAGCCATAACTCAATACCAAACACCTCTCTTCGTATGATCTATTTTAGTCACGGCTGTATTGCTCCTCCTATCCCTACCAGTCTTAGCAGCTGGAATCACCATACTGTTAACCGACCGAAACCTAAATACAACTTTCTTTGACCCGGCAGGAGGAGGAGACCCTGTTTTGTATCAACACTTATTCTGATTCTTCGGTCACCCTGAGGTCTATATTCTAATCCTACCTGGCTTCGGAATAATCTCCCACATCGTAACTTATTATTCCGGGAAAAAAGAGCCCTTTGGATATATGGGAATAGTCTGGGCTATAATCTCTATTGGATTCTTAGGCTTTATCGTATGAGCCCACCACATATTCACTGTAGGTATGGATGTTGACACACGAGCATACTTTACATCCGCAACTATAATCATTGCCATCCCTACAGGAGTAAAAATCTTCAGCTGACTGGCAACCCTCCATGGAGGCAACATTAAATGATCTCCCGCCCTAATATGAGCCTTAGGCTTCATTTTTCTCTTTACAGTAGGTGGCTTGACTGGTATTGTCCTAGCCAACTCTTCACTAGATATCGTCCTTCACGATACATACTATGTAGTCGCCCACTTCCACTACGTTCTTTCAATAGGAGCTGTTTTTGCCATCATAGGAGGTTTCGTTCACTGATTCCCATTATTCTCAGGATATACACTTGACCCCACATGAGCAAAAATCCATTTCCTCATCATATTTGTAGGCGTAAACCTGACATTCTTCCCTCAACATTTCCTAGGCCTATCAGGCATGCCTCGACGATACTCGGACTATCCAGACGCCTATACAACATGAAACACAGTCTCATCAATAGGCTCATTCATCTCACTAACAGCAGTTATACTGATAATCTTCATTATCTGAGAAGCCTTCGCATCCAAACGAGAAGTAACATCAATACATCTTACCTCTACTAACCTCGAATGACTAAATGGGTGCCCTCCACCATATCACACATTCGAAGAACCTGTATACATCAATCCAAAATGATCAAGAAAGGAAGGACTCGAACCCTCTCTAGCTGGTTTCAAGCCAACATCATAACCTTTATGTCTCTCTTCATAAACGAGATATTAGTAAAACCTTACATAACTTTGTCAAAGTTAAATTACAAGTGAAAACCCTGTATATCTCCATGGCATACCCCCTTCAACTAGGTTTCCAAGACGCAACCTCTCCCATTATAGAGGAACTCTTACACTTTCATGATCACACCCTAATAATTGTTTTCCTAATTAGCTCTCTAGTCCTCTACATTATCACCCTAATACTAACAACCAAACTAACACATATCAACACAATAGACGCCCAAGAAGTAGAGACCATTTGAACCGTTCTCCCCGCTATCATTCTAATCCTAATCGCCCTACCATCCCTACGAATCCTCTACATAATGGACGAAATCAACAGCCCCTCTCTTACTGTAAAGACAATAGGTCACCAATGATATTGAAGCTACGAATATACCGACTACGAAGACCTGTCCTTTGACTCTTACATAATCCCAACATCGGACTTAAAACCAGGAGACCTACGACTATTAGAAGTCGACAACCGAATAGTATTGCCTATAGAAATAACAATCCGAGTCTTAGTCTCCTCCGAGGATGTCCTACACTCATGAGCTGTCCCCTCCCTAGGCCTAAAAACAGACGCAATCCCCGGGCGCCTAAACCAAACAACCTTAATATCAACACGACCAGGCTTATTCTACGGACAATGTTCAGAAATCTGCGGCTCAAACCATAGTTTCATACCAATTGTCCTCGAACTAGTACCCCTAGAAAACTTTGAAAAATGATCCATCTCCATACTGTAATCTCATCAAGAAGCTAAACTAGCGTTAACCTTTTAAGTTAAAGAATGAGAGCCAAGCCTCCCCTTGATGATATGCCACAACTAGACACATCAACATGATTTCTTACCATCCTATCCGTAATACTAACTCTCTTCACACTACTCCAACCAAAAATCTCAATACACCTTTACACCCCTAATCCCAAACCAATATCTACCAAAACACAAAAACAGCACTCCCCCTGAAACACTGCATGAACCAAAATCTATTTACCTCTTTTATAACCCCAGTAATACTAGGCATCCCCATCATCACCCTAATCATCATATTCCCAACTATCTTGTTCCCAGCACCAACCCGGCTAATTAACAACCGAACAATCTCTATCCAACAGTGATTGACCAAATTTGCATCGAAACAACTAATAATTACACACAACTCCAAGGGACAAACCTGATCCCTCCTACTTGTTTCACTTATTCTATTCATCGCCTCTACCAATCTCCTCGGAATACTACCACACTCATTTACACCTACCACACAGCTCTCAATAAATATAGGAATAGCCGTTCCCCTATGAGCCGGCACTGTCATCATAGGCTTCCGAAACAAGACAAAAGCATCTCTAGCCCACTTCTTGCCCCAAGGCACACCCACCTTCCTTATCCCTATACTAGTAATTACCGAAACTATCAGCCTATTGATCCAACCAGTAGCACTAGCCGTACGGCTAACTGCCAATATCACAGCAGGCCACCTGTTAATACACCTAATCGGAATAGCCACCCTCGCACTAATAAGCATCAGTCTATTCACAGCCTTCATCACATTCATCATTCTCACCCTCTTAACCATCCTTGAATTTGCCGTCGCCCTAATCCAAGCCTATGTTTTCACCCTCCTAGTAAGCCTGTACCTGCATGACAACACATAATGACCCACCAAACCCACTCTTACCATATAGTAAACCCAAGCCCTTGACCCCTCACAGGAGCTCTCTCAGCACTTCTTATAACATCAGGCCTAATCATGTGATTCCACTTCAACTCAACTATCCTACTAGCCCTAGGCCTTTTAACAAATATCCTGACAATATACCAATGATGACGAGACATTATCCGAGAAAGCACCTTCCAAGGTCATCACACACCAACTGTCCAAAAGGGGCTCCGATATGGAATAGTCCTATTCATCCTATCAGAGATTCTATTTTTCACTGGCTTTTTCTGAGCTTTTTACCACTCAAGCCTCGCTCCTACCCCCGAACTAGGCGGATGCTGACCACCAACAGGCATCTGCCCTCTAGACCCCTTCAAAGTACCTCTTCTCAATACTTCTGTTCTACTAGCCTCCGGCGTATCTATCACATGAGCCCACCACAGTCTCATACAAGGAGACCGCAAACAAATGCTTCAAGCCCTCTTTATCACAATCGCACTTGGTCTTTACTTCACCCTACTACAAGCATCGGAATACTACGAAACCCCCTTCACAATCTCAGACGGAGTTTACGGGTCCACTTTCTTTGTAGCCACAGGCTTTCACGGACTGCACGTTATCATTGGATCTACTTTCCTCACTGTCTGCTTTCTACGCCAAATAAAATTCCACTTCACACCAAACCATCATTTCGGCTTCGAAGCCGCAGCTTGATATTGACACTTCGTAGACGTCGTATGACTATTCCTCTACGTATCAATCTACTGATGAGGTTCATAGTCCTTTTAGTATTAACAAGTACAACTGACTTCCAATCAGTTAGTTTCGGTAAACTCCGAAAAAGAACAATAAACATTCTACTGACACTCCTAACAAACACAACACTAGCCCTGTTACTAATACTTATCGCCTTCTGACTCCCCCAGTTAAATGCATACACTGAAAAGACAAGCCCCTACGAATGTGGCTTTGACCCTATACAATCTGCCCGCCTACCCTTTTCCATAAAGTTCTTCCTAGTCGCAATTACCTTCCTTCTCTTCGACCTAGAAATCGCCCTCCTATTGCCCCTCCCCTGAGCAACCCAAACAAACAACCTAAAAACAATACTTACCACAGCCCTATTCCTAATCTCCTTATTAGCAGCTAGCCTCGCCTACGAATGAACCCAAGAAGGCCTAGAATGAGCCGAATATGGTACTTAGTTTAAAACAAAACAGGTGATTTCGACTCACTGGACTGTGATCAAACTCACAAGTACCAAATGTCCCTGATTCACATAAACGTCATAATAGCCTTCTCCATATCCCTCGTAGGTCTACTAATATACCGATCCCACCTAATATCCGCACTACTCTGCTTAGAAGGCATAGCACTATCCCTATTTATCTTTACAACCCTCACAACCCTAAATTTACACTTCACCCTAGCCAACATAGCTCCAATCATCCTTCTAGTCTTCACAGCCTGCGAGGCAGCTATTGGACTAGCTTTACTAGTCATGATTTCCAACACATATGGCACCGACTATGTCCAAAGCCTTAACCTCCTCCAATGCTAAAGTTTATTATCCCCACTATCATACTAATACCACTAACCTGACTATCAAAAAACAATCTAATCTGAATCAACTCCACAACCCATAGCCTATTAATTAGCTTTACAAGTCTACTCCTCCTTACGCAATCCAATGATAATAACCTCAACTACTCCCTTACGTTCTTCTCTGACCCCCTCTCCACACCCCTCCTAATCTTGACCATATGACTCCTCCCCCTAATACTAATAGCAAGCCAATCACACCTCCTCAAAGAGCCCCTTGCCCGAAAAAAACTCTATATCACAATATTAATCACACTACAAGTATTCCTCATCATAACATTCACCGCCACAGAACTAATCCTATTTTATATTATATTTGAAGCTACGCTAGTCCCAACCCTCATCATTATTACCCGTTGAGGTAATCAGACAGAACGACTTAATGCAGGACTTTACTTCCTCTTCTATACACTGCTCGGATCACTCCCCTTACTAGTAGCACTAACTTACCTACAAAACACAACAGGAACCCTAAACTTCCTTCTAATACAATACTGAACCCAACCCTTATCAACCTCCTGATCCAACACTTTTATATGATTAGCCTGTATAATAGCCTTCATAGTAAAGATACCCCTTTACGGACTACACTTATGACTCCCCAAAGCACATGTAGAAGCCCCCATTGCAGGCTCCATGGTACTTGCAGCCGTACTATTAAAACTCGGTGGTTACGGCATACTACGAATCACACCCATACTTAACCCACTCACAGAACACATGGCTTACCCCTTCCTCATACTCTCACTATGAGGCATAATCATAACCAGCTCCATCTGTTTACGCCAAACAGACCTAAAATCACTTATCGCATACTCCTCAATCAGCCACATAGCACTCGTTATCACAGCCATTCTCATCCAAACCCCCTGAAGCTACATAGGAGCTACCACCCTAATAATCGCCCACGGTCTCACCTCATCCATACTATTCTGCCTAGCAAATTCAAACTACGAACGAATCCACAGCCGAACCATAATCTTAGCCCGAGGCCTACAAATCTTCCTCCCATTGATAGCAACCTGATGACTACTAGCAAGCCTAACAAACCTCGCCCTACCCCCTACAATCAACCTAATCGGAGAACTATTCGTAATAATATCCATATTCTCATGATCAAATCTCACCATCATCCTAATAGGAACAAACATCGTAATCACCACCCTATACTCCCTATATATGCTAATTACCACACAGTACGGCAAACACACATACCACGTCAACAACCTCACCCCCTCCTTCACACGAGAACATACCCTAATAGCTCTACATATCATTCCCCTCCTACTTCTCTCACTAAACCCTAAAATCATTCTAGGTCCCCTCTACTGTAAATATAGTTTAAGAAAAACACTAGCTTGTGGAGCCAGTAATAGAAGACTAAAACTTCTTATTTACCGAAAAAGTACTGCAAGAACTGCTAACTCACGCTTCCATATCTAACAATATGGCTTTTTCAAGCTTTTAAAGGATGGGAGTTATCCATTGGCCTTAGGAGCCAAAAAATTGGTGCAACTCCAAATAAAAGTAATAAACCTATTTACCTCCTTTACCCTACTCACATTACTAATCTTAATTATCCCAGTCATCACACCCAGCACAAACATCCACAAAAGCAACAAGTACCAAACCTATGTAAAAAACACCGTCTCCTGCGCCTTCCTCACCAGCCTGGTCCCAATAACAATATATCTTCATACAAACCAAGAAGTACTTATCTCAAATTGACACTGAATCACCATTCAAACCCTCAAACTGACACTCAGCCTCAAAATAGACTACTTCTCACTCATATTTATGCCCGTAGCACTATTTATCACGTGGTCTATCATAGAATTCTCAATATGATATATACACTCCGACCCGCACATCAACCTATTCTTTAAATACTTACTCCTCTTCCTCATCACCATACTAATCCTCGTCACCGCCAACAATCTCTTCCAACTCCTCATCGGCTGGGAAGGGGTAGGAATTATATCTTTCCTACTCATCGGCTGATGGTTCGGACGAACAAACGCAAACACAGCCGCTCTCCAAGCAATCCTATACAACCGCATCGGAGACATTGGATTTCTCACATCAATAGCATGATTCCTCTCAAACATGAATACATGGGACCTACAACAAATCTTCGCGCTTAACCAAAATACCCCAAACCTTCCCCTCATAGGACTAATATTAGCCGCAGCTGGAAAATCAGCTCAATTTGGACTACACCCCTGACTCCCCTCTGCAATAGAGGGCCCCACTCCTGTCTCAGCCCTACTTCACTCGAGCACAATAGTTGTAGCAGGAATCTTCCTACTTATCCGCTTCCACCCTCTAATAGAAAACAACAAACTCGCCCAAACAACAGCCCTATCTCTAGGCGCTCTTACCACCCTATTTACAGCCATCTGCGCCCTCACCCAGAATGATATTAAAAAAATCATCGCCTTCTCCACCTCCAGCCAACTAGGATTGATGATAGTAACAGTCGGCCTCAACCAACCTTATCTAGCATTCCTACACATCTGCACACACGCCTTCTTCAAAGCTATACTATTCCTATGCTCCGGCTCCATCATCCACAACCTAAACAATGAACAAGACATTCGAAAGATAGGAGGACTATTCAAAGCCCTCCCTTTCACCACCACAGCCCTCATCACTGGTTGCCTCGCATTAACCGGAATACCATTCCTCACCGGATTTTACTCCAAAGACCCAATCATTGAAGCCGCCACTTCATCTTATACCAACGCCTGAGCCCTACTATTAACACTAACAGCCACCTCCCTCACAGCCGTTTACAGCACCCGCATCATCTTCTACACGCTACTAAACCAACCCCGATTCCCTCCCCACATTACCATCAACGAAAACAACCCCTCACTAATCAACCCCATCATACGATTAATACTCGGAAGCATCTTCGCCGGCTTCATCCTATCCAACAACATCCCCCCCATAACCACCCCCCTAACAACCATTCCCCTATACCTAAAACTAACCGCCCTTACAATAACAACCCTAGGCTTCATTATCGCATTTGAAATTAATCTCAATACACAAAACCTAAAATACAACCTCCCTTCAAACCCCACCAAATTCTCCCTCTCACTAGGATATTTCCCCACAATCATACACCGCCTACCCCCTGACCTATATCTAACAATAAGCCAAAAACTAGCTACCTCCTCACTAGACATGACATGACTAGAAAACATCTTACCAAAAACCACAGCCCTCATCCAACTAAAAGCCTCTATACTAACCTCAAACCAACAAGGCCTCATTAAACTATATTTCCTGTCTTTCCTCATCACCATTACCCTCTTTACACTCCTACTTAACTGCCCCGGGTAATCTCCATAATAACCACAACACCAATAAACAATGACCACCCCATAACAACTATTAACCAAGCACCATAACTATACAACGCAGCAACCCCCTCTGCCTCACCCCCAGAAAACCCAGAATCCCCTACATCACAAACTACCCAATCCCCCAACCCATTAAACCCAGACACAACCTCCACCTCTCCACCCTCCAATACATATGCCATTATCAAAAACTCAACCACCAATCCCAAAAGAAATCCTCCCAATACAACCTTATTAGAAACTCAGACCTCAGGATACTGCTCAGTAGCCATAGCCGTAGTATAACCAAACACAACCAGCATCCCCCCTAAATAAATTAAAAAGACTATTAACCCCAAAAACGAACCACCAAAACTCAAGACAATCCCACACCCCACACCACCACCTACAATCAACCCAAATCCCCCATAAATAGGCGAGGGCTTTGAAGAAACCCCCACAAAACTAACTACGAATATAATACTCAAGACAAAAACAAAATATATTATCATCATTCCTACATGGACTCAAACCACGACCAATGACATGAAAAGTCACCGTTGTTATTCAACTACAAGAACACTAATGACCAACATCCGAAAATCACACCCATTAATAAAAATCATTAACAATGCATTCATCGACCTCCCTACCCCATCAAACATTTCCTCATGATGAAACTTCGGCTCCCTACTTGGACTCTGCCTGATCATACAAATCCTAACAGGCCTATTCCTAGCAATACACTACACACCAGACACAACAACCGCTTTCTCATCAATCACACACATTTGCCGAGACGTCAATTACGGCTGGACCATCCGATACCTACATGCAAACGGAGCTTCCATATTTTTCATTTGCCTTTACACTCACATGGGCCGTGGCCTGTACTACGGCTCCTACATCTTCCAAGAAACATGAAACGTTGGAATGATACTCCTAATCACAGTAATAGCCACCGCATTCGTAGGTTACGTACTGCCCTGAGGACAAATATCATTCTGAGCCGCAACCGTTATCACAAACCTTCTATCAGCAATTCCCTATATCGGCACCACCCTAGTAGAGTGAGTTTGAGGCGGTTTCTCCGTAGATAAGGCAACACTGACACGCTTCTTCACTCTCCACTTCATCCTCCCCTTTATCACCCTAACACTAACAATAGTACATCTCCTATTTCTCCATGAAACAGGATCCAACAACCCCACAGGAATTCCCTCCAACATAGACAAAATCCCATTCCACCCCTACCACACAATCAAAGACACCATAGGTGCCCTACTACTAATCCTATCCCTACTTACACTAACCCTGTTCGCACCCGACCTGCTAGGAGATCCTGACAACTACACCCCAGCAAATCCACTAAATACCCCAACACACATCAAACCAGAATGGTATTTCCTATTCGCGTACGCCATCCTACGATCTGTCCCCAATAAACTAGGAGGCGTCTTAGCCCTACTACTCTCCATCCTAATCCTAGTATTCATCCCAATACTTCATACAGCCAAACAACGAAGCATAATATTCCGACCCTTCAGTCAATTCCTGTTCTGAACACTAATCATAGACCTACTAACTCTAACATGAATCGGAGGCCAACCCGTGGAACACCCATATGTAACTGTAGGCCAACTAGCCTCCATCCTATACTTTCTTTTAATCCTAATCCTAATACCAACAGCCAGTCTTATCGAGAACAAGCTCTTAAAATGAAGAGTCTTTGTAGTATAACAAATACCCCGGCCTTGTAAACCGGAAAAGGAGAGAGTTACGCCTCCCTAAGACTCAAGGAAGAAGCACTAAACCTCACCATCAGCACCCAAAGCTGAAATTCTACATAAACTATTCCTTGAAAAAGTGCTTCATCATAGATAAATACAAACCCACAGTGCTATGTCAGTATTAAAAATAACTCACCCAATTACATCTTTCCTACTCCCGACCATACCAATGCCCCCATGCCAATATTCAGCGTTCTCCCTGTAAATGTATACATGTACACGCTATGTATAATAGTGCATTCAATTATTTTCACTACGATCAGTGAAAGCTCGTATTAAATCTTATTAATTTTACATATTACATAAAATTATGGATCGTACATAGGACATATCCTTAAATCAACTCCAGTCCCCTGAAGTTATGAGCTCTCGGATCAGACCACGAGCTTGATCACCATGCCGCGTGAAACCAGCAACCCGCTTGGCAGGGACTCACTATTATTGTATCTCAGGCCCATTCCTCGAAAGCCGTGCTACTCCGTGGTTTTTCCAAGGCCTCTAGTTGCAATTCTCAGGGTCATAACTCGAGGCACCTGCGCTAGTTCCAGCTTTTTCCAAGGCCTCGGCTTGGACCTGAGAGCAGGAGCCTCCACCCTATTAATCACTCACGGGGGGAGTTATAGGCATCTGGTCGTTTTTTTTTTGGGGGGGGAATTTGCATCGGCTCCCCTATGGCCGACGGGGCGGCCCCGTCGCAGGCGAAGCTGGTCTTAGCCGGACCTGTGTGTATTTTTGATTGGACACGTCCTGCTAGTCAGTTTTTGAATTAATGGTTACTAGACATAATTAATTAATGGTTACAGGACATAGATCTTACTATTCCCCCCCTGGGGTCGAAATCCTCTGTCTCGTGGGGAGCTTTCTCTCCCCCCCCCCATTTAATACTAACCCCTTTCTTAGATACTCACCACCCTCCTTGACAGCTTGCCCCCTAGATTTACAAGACAATTTTTCAAAAAATCAATACTAAATCCGACACAAGCCTTATGGCACAATTGTACGAACATTTTTTCGTATATAATTGG**

**> Complete mitochondrial DNA Herman GTTAGTGTAGCTTAAGTTTTTAATAAAGCAAGACACTGAAGATGTCTAGACGGACCCGCTAGTCCCACCAACACAAAGGTTTGGTCCCAGCCTTCCTATTAGCTCCCAACAGATTTACACATGCAAGCATCTACATCCCAGTGAAAATGCCCTCCAAGTCACAAAGATCAAAAGGAGCTGGTATCAAGCACGCTTCACTAGCAGCTCACAACACCTTGCTTAGCCACACCCCCACGGGACACAGCAGTGATAAAAATTAAGCCATGAACGAAAGTTTGACTAAGTCATGTTGATTAGGGTTGGTAAATTTCGTGCCAGCCACCGCGGTCATACGATTGACCCAAGCTAATAGGCATACGGCGTAAGGAGTGTTAAAGAGTTATACAAAATAAAGTCAAGCCTTGACTAAACCGTAAAAAGCCATAGTTAAAATTAAGCTAAACCACGAAAGTGACTTTAATACAATCTACTGCACGACAACTAAGACCCAAACTGGGATTAGATACCCCACTATGCTTAGCCGTAAACCCAGGTAGTCATAAAACAAGACTATTCGCCAGAGTACTACTAGCAACAGCCTAAAACTCAAAGGACTTGGCGGTGCTTCATACCCCCCTAGAGGAGCCTGTTCTATAACCGATAAACCCCGATCAACCTCACCAACCCTTGCTACTTCAGTCTATATACCGCCATCTTCAGCAAACCCTAAAAAGGAATGAAAGTAAGCATAACTATCCTACGTAAAAACGTTAGGTCAAGGTGTAACCCATGGGATGGGAAGAAATGGGCTACATTTTCTACACCATAGAACACCCTATACCCCACGAAAGTTTTTATGAAACCTAAAAACCAAAGGAGGATTTAGCAGTAAATTAAGAACAGAGTGCTTAATTGAATAAGGCCATGAAGCACGCACACACCGCCCGTCACCCTCCTCAAGTATCACAGCGAAGCCCCAATCCACTAATTTATGCCGAGCGCCCCCACAAGAGGAGACAAGTCGTAACAAGGTAAGCATACTGGAAGGTGTGCTTGGATAAAACAAGACATAGCTTAAATAAAGCATCTAGTTTACACCTAGAAGATTCCACAGCTCGTGTATATCTTGAACTAGATCTAGCCCACACATCAAATAAAGCATTCACCACCCATTCAAAGTATAGGAGATAGAAATCCAAATCACTAGTGGCGCTATAGAGAAAGTACCGTAAGGGAAAGATGAAAGATATCCTAAAAGTAAAAAAAAGCAAAGCTTACCCCTTGTACCTTTTGCATAATGAATTAACTAGTAGTAACTTAGCAAAGAGACCTTTAGTTAAACTACCCGAAACCAGACGAGCTACTTACGAACAGTACCTAGAACGAACTCATCTATGTGGCAAAATAGTGAGAAGATTTGTAAGTAGAGGTGAAAAGCCTAACGAGCCTGGTGATAGCTGGTTGTCCAAGAAAAGAATCTCAGTTCAACATTAAACAGTACCAAGAACCCCCTGAAGTTCCAATGTATGTTTAACTGTTAGTCTAAAAAGGTACAGCTTTTTAGAAATGGGTACAACCTTAACTAGAGAGTAAAACAGACACACACATGCCATAGTTGGCTTAAAAGCAGCCATCAATTAAGAAAGCGTTCAAGCTCAACAATAAAACTGTGTTATAATCCCAACAATAACAAATCAACTCCTAGTATAATTATTGGACTAATCTATATAATTATAGAAGCAATACTGTTAACATGAGTAACAAGAAAACTTTTTCTCCTCGCACAAGCTTACATCAGTAACTGATACTACACTGATAGTTAACAGCCAATAAATAAAACCCAACACCAAGCCATTTATTAAGCCCACTGTTAACCCAACACAGGCGTGCACCAAGGAAAGATTAAAAAAAGTAAAAGGAACTCGGCAAACACAAACCTCGCCTGTTTACCAAAAACATCACCTCTAGCATAACCAGTATTAGAGGCACTGCCTGCCCAGTGACTGATAGTTAAACGGCCGCGGTATCCTGACCGTGCAAAGGTAGCATAATCACTTGTTCTCTAAATAAGGACTTGTATGAACGGCCACACGAAGGTTTTACTGTCTCTTACTTTTAATCAGTGAAATTGACCTTCCCGTGAAGAGGCGGGAATAACAAAACAAGACGAGAAGACCCTATGGAGCTTCAATTAATCAACCCAATAACCCACAACCTCAAACCACCAAGGGATAAAAAAAACTTATATGGGTTGACAATTTCGGTTGGGGTGACCTCGGAGCACAAAAACCCCTCCGAGTGATTAAAGCCTAGGCCTACCAGCCAAAGCATAACATCACTTATTGATCCAAAGCTTTGATCAACGGAACAAGTTACCCTAGGGATAACAGCGCAATCCTATTCTAGAGTCCATATCGACAATAGGGTTTACGACCTCGATGTTGGATCAGGACATCCTAATGGTGCAGCCGCTATTAAGGGTTCGTTTGTTCAACGATTAAAGTCCTACGTGATCTGAGTTCAGACCGGAGCAATCCAGGTCGGTTTCTATCTGTTGCGCATTTCTCCCAGTACGAAAGGACAAGAGAAATAAGGCCAACTTTACACACGCGCCTTCAAATAACTAATGATCTAATCTTAATTAAACAAACAAGCGCAAACTAACCCTGCCCAAGACCAGGGCATTGTTGTGGTGGCAGAGTCCGGTAATTGCATAAAACTTAAACTTTTACACCCAGAGGTTCAAATCCCCTCCTCAACAGAATGTTTATAATTAACATCCTAATACTCACCCTCCCCATTCTCCTAGCCGTGGCATTCCTAACCTTAGTAGAACGTAAAACCCTGGGGTATATACAGCTCCGAAAAGGACCAAACATTGTCGGCCCACATGGCTTACTCCAACCCTTCGCCGACGCAATTAAACTATTCACCAAAGAACCCCTACGTCCAGCCACATCCTCCACCACCATATTCATCATCGCACCCATACTAGCCCTAATCCTAGCCCTCACGATATGAAGCCCCCTGCCCATACCATATCCCCTCATCAACATACACCTAGGAATCCTATTTATACTAGCAATATCCAGCCTGACTGTTTATTCCATTCTATGATCCGGCTGAGCCTCCAACTCAAAATATGCACTAATCGGAGCTCTCCGAGCAGTAGCACAAACAATCTCATACGAAGTGACACTAGCCATCATCCTCCTATCAGTCTTACTAATAAGCGGCTCCTTCACCCTATCAGCACTAGCCACAACCCAAGAACAACTTTGACTGCTCTTCCCCCTATGACCACTAACCATAATATGATTTATCTCTACCCTCGCAGAAACTAACCGAGCCCCCTTCGACCTCACAGAAGGAGAATCAGAGCTGGTCTCTGGCTTCAACGTAGAATATGCAGCAGGCCCCTTCGCCCTCTTCTTCCTAGCAGAATATGCTAACATCATCATAATAAATATACTCTCAACCATCCTATTCCTAGGAACATACCACAATCCTTACACACCAGAACTACACACAACAAATCTCATCCTCAAAACACTACTACTTACAATATCTTTCCTATGAATCCGAGCATCCTACCCCCGATTCCGATATGATCAACTGATACACCTACTCTGAAAAAGTTTTCTCCCCCTAGCACTAGCCCTCTGCATATGACACATCTCATTACCCATCATAACAGCAGGAACCCCCCCTCAAACATAAGAAATATGTCTGATAAAAGAGTTACTTTGATAGAGTAAATAATAGAGGCTCAAATCCTCTTATTTCTAGAATAATAGGAGTTGAACCTATCCTTAAGAATTCAAAGTTCTTCGTGCTACCACATTGCTACACTACAATCCACAGTAAGGTCAGCTAAACAAGCTATCGGGCCCATACCCCGAAAATGTTGGTTTATACCCTTCCCATACTAATAAACCCATTCATCTCTATTATTACATTTACAACACTCATCCTAAGCACAACAATTGTAGTCATCAGCTCTCACTGACTTTTCGCCTGAGTCGGATTTGAAATAAACATGATAGCTATCATCCCCATCATAATAAAAAATTTTAACCCCCGAACCACAGAGGCCTCCACTAAATATTTCCTAACCCAAGCTACCGCATCCGCCCTACTCATAATAGCAATTATAATCAACCTGTCACACTCCGGTCAATGAACTATCACCAAGCTATTTAATCCAACAGCATCAATACTAGTAACAATTGCCCTAGCCATCAAACTAGGATTATCCCCATTCCACTTCTGAGTACCCGAAGTCACACAAGGCATCCCCCTATCCACAGGCCTAGTCCTACTCACATGACAAAAAATCGCACCTCTGTCCATTCTATACCAAATCTCACCCTCCATTAACATGAACCTAATACTAACTATATCCCTACTCTCCATTCTCATCGGGGGTTGAGGAGGACTAAACCAGACTCAACTCCGAAAAATTATAGCTTACTCATCAATCGCCCACATAGGATGAATAACCACAATCCTACCCTACAATACAACCATAACCCTACTAAACCTACTAATCTATGTCACAATAACCTTCACCATATTCATACTATTTATCCAAAACTCAACCACAACCACACTATCTCTGTCCCAGACATGAAACAAAACACCCATTACCACAACCCTTACCATACTTACCCTACTTTCCATAGGGGGCCTCCCACCACTCTCGGGCTTTATCCCCAAATGAATAATTATTCAAGAACTAACAAAAAACGAAACCCTCATCATACCAACCTTCATAGCCACCACAGCATTACTCAACCTCTACTTCTATATACGCCTCACCTACTCAACAGCACTAACCCTATTCCCCTCCACAAATAACATAAAAATAAAATGACAATTCTACCCCACAAAACGAATAACCCTCCTGCCAACAGCAATTGTAATATCAACAATACTCCTACCCCTTACACCAATACTCTCCACCCTATTATAGGAGTTTAGGTTACACTCAGACCAAGAGCCTTCAAAGCCCTAAGCAAGTATTATCCACTTAACTCCTGCATAACAAGGACTGCAAGACTATATCTTACATCAACTGAATGCAAATCAAACACTTTAATTAAGCTAAGTCCTCACTAGATTGGAGGGATACACTTCCCACGAACTTTTAGTTAACAGCTAAATACCCTAGTCAACTGGCTTCAATCTACTTCTCCCGCCGCGGGGAAAAAAAGGCGGGAGAAGCCCCGGCAGGATTGAAGCTGCTCCTTTGAATTTGCAATTCAACATGATCATTCACTACAAGGCTTGGTAAAAAGAGGACTTAACCCCTGTCTTTAGATTTACAGTCTAATGCCTACTCGGCCATCTTACCTATGTTCATAAACCGCTGATTATTCTCAACCAACCATAAGGACATCGGCACTCTATATCTACTATTCGGTGCCTGAGCGGGAATGGTGGGCACTGGCCTAAGCTTGCTAATCCGCACCGAGTTAGGCCAACCCGGTACATTAATTGGGGATGACCAAGTCTACAACGTGCTGGTAACAGCTCACGCCTTTGTGATAATTTTCTTCATAGTCATACCCATCATAATTGGCGGTTTCGGAAACTGATTAGTTCCTCTAATAATCGGAGCACCTGACATAGCCTTTCCTCGTATGAATAACATGAGCTTCTGACTACTCCCCCCTTCATTCCTACTACTAATAGCTTCTTCAATAGTCGAAGCCGGCGCAGGTACAGGCTGGACTGTTTACCCCCCTCTAGCCGGAAATTTAGCACATGCAGGAGCATCCGTAGACCTTACCATCTTTTCCCTACACCTAGCTGGTGTCTCCTCAATCCTTGGAGCCATCAACTTTATTACAACCATTATCAACATAAAACCCCCAGCCATAACTCAATACCAAACACCTCTCTTCGTATGATCTATTTTAGTCACGGCTGTATTGCTCCTCCTATCCCTACCAGTCTTAGCAGCTGGAATCACCATACTGTTAACCGACCGAAACCTAAATACAACTTTCTTTGACCCGGCAGGAGGAGGAGACCCTGTTTTGTATCAACACTTATTCTGATTCTTCGGTCACCCTGAGGTCTATATTCTAATCCTACCTGGCTTCGGAATAATCTCCCACATCGTAACTTATTATTCCGGGAAAAAAGAGCCCTTTGGATATATGGGAATAGTCTGGGCTATAATCTCTATTGGATTCTTAGGCTTTATCGTATGAGCCCACCACATATTCACTGTAGGTATGGATGTTGACACACGAGCATACTTTACATCCGCAACTATAATCATTGCCATCCCTACAGGAGTAAAAATCTTCAGCTGACTGGCAACCCTCCATGGAGGCAACATTAAATGATCTCCCGCCCTAATATGAGCCTTAGGCTTCATTTTTCTCTTTACAGTAGGTGGCTTGACTGGTATTGTCCTAGCCAACTCTTCACTAGATATCGTCCTTCACGATACATACTATGTAGTCGCCCACTTCCACTACGTTCTTTCAATAGGAGCTGTTTTTGCCATCATAGGAGGTTTCGTTCACTGATTCCCATTATTCTCAGGATATACACTTGACCCCACATGAGCAAAAATCCATTTCCTCATCATATTTGTAGGCGTAAACCTGACATTCTTCCCTCAACATTTCCTAGGCCTATCAGGCATGCCTCGACGATACTCGGACTATCCAGACGCCTATACAACATGAAACACAGTCTCATCAATAGGCTCATTCATCTCACTAACAGCAGTTATACTGATAATCTTCATTATCTGAGAAGCCTTCGCATCCAAACGAGAAGTAACATCAATACATCTTACCTCTACTAACCTCGAATGACTAAATGGGTGCCCTCCACCATATCACACATTCGAAGAACCTGTATACATCAATCCAAAATGATCAAGAAAGGAAGGACTCGAACCCTCTCTAGCTGGTTTCAAGCCAACATCATAACCTTTATGTCTCTCTTCATAAACGAGATATTAGTAAAACCTTACATAACTTTGTCAAAGTTAAATTACAAGTGAAAACCCTGTATATCTCCATGGCATACCCCCTTCAACTAGGTTTCCAAGACGCAACCTCTCCCATTATAGAGGAACTCTTACACTTTCATGATCACACCCTAATAATTGTTTTCCTAATTAGCTCTCTAGTCCTCTACATTATCACCCTAATACTAACAACCAAACTAACACATATCAACACAATAGACGCCCAAGAAGTAGAGACCATTTGAACCGTTCTCCCCGCTATCATTCTAATCCTAATCGCCCTACCATCCCTACGAATCCTCTACATAATGGACGAAATCAACAGCCCCTCTCTTACTGTAAAGACAATAGGTCACCAATGATATTGAAGCTACGAATATACCGACTACGAAGACCTGTCCTTTGACTCTTACATAATCCCAACATCGGACTTAAAACCAGGAGACCTACGACTATTAGAAGTCGACAACCGAATAGTATTGCCTATAGAAATAACAATCCGAGTCTTAGTCTCCTCCGAGGATGTCCTACACTCATGAGCTGTCCCCTCCCTAGGCCTAAAAACAGACGCAATCCCCGGGCGCCTAAACCAAACAACCTTAATATCAACACGACCAGGCTTATTCTACGGACAATGTTCAGAAATCTGCGGCTCAAACCATAGTTTCATACCAATTGTCCTCGAACTAGTACCCCTAGAAAACTTTGAAAAATGATCCATCTCCATACTGTAATCTCATCAAGAAGCTAAACTAGCGTTAACCTTTTAAGTTAAAGAATGAGAGCCAAGCCTCCCCTTGATGATATGCCACAACTAGACACATCAACATGATTTCTTACCATCCTATCCGTAATACTAACTCTCTTCACACTACTCCAACCAAAAATCTCAATACACCTTTACACCCCTAATCCCAAACCAATATCTACCAAAACACAAAAACAGCACTCCCCCTGAAACACTGCATGAACCAAAATCTATTTACCTCTTTTATAACCCCAGTAATACTAGGCATCCCCATCATCACCCTAATCATCATATTCCCAACTATCTTGTTCCCAGCACCAACCCGGCTAATTAACAACCGAACAATCTCTATCCAACAGTGATTGACCAAATTTGCATCGAAACAACTAATAATTACACACAACTCCAAGGGACAAACCTGATCCCTCCTACTTGTTTCACTTATTCTATTCATCGCCTCTACCAATCTCCTCGGAATACTACCACACTCATTTACACCTACCACACAGCTCTCAATAAATATAGGAATAGCCGTTCCCCTATGAGCCGGCACTGTCATCATAGGCTTCCGAAACAAGACAAAAGCATCTCTAGCCCACTTCTTGCCCCAAGGCACACCCACCTTCCTTATCCCTATACTAGTAATTACCGAAACTATCAGCCTATTGATCCAACCAGTAGCACTAGCCGTACGGCTAACTGCCAATATCACAGCAGGCCACCTGTTAATACACCTAATCGGAATAGCCACCCTCGCACTAATAAGCATCAGTCTATTCACAGCCTTCATCACATTCATCATTCTCACCCTCTTAACCATCCTTGAATTTGCCGTCGCCCTAATCCAAGCCTATGTTTTCACCCTCCTAGTAAGCCTGTACCTGCATGACAACACATAATGACCCACCAAACCCACTCTTACCATATAGTAAACCCAAGCCCTTGACCCCTCACAGGAGCTCTCTCAGCACTTCTTATAACATCAGGCCTAATCATGTGATTCCACTTCAACTCAACTATCCTACTAGCCCTAGGCCTTTTAACAAATATCCTGACAATATACCAATGATGACGAGACATTATCCGAGAAAGCACCTTCCAAGGTCATCACACACCAACTGTCCAAAAGGGGCTCCGATATGGAATAGTCCTATTCATCCTATCAGAGATTCTATTTTTCACTGGCTTTTTCTGAGCTTTTTACCACTCAAGCCTCGCTCCTACCCCCGAACTAGGCGGATGCTGACCACCAACAGGCATCTGCCCTCTAGACCCCTTCAAAGTACCTCTTCTCAATACTTCTGTTCTACTAGCCTCCGGCGTATCTATCACATGAGCCCACCACAGTCTCATACAAGGAGACCGCAAACAAATGCTTCAAGCCCTCTTTATCACAATCGCACTTGGTCTTTACTTCACCCTACTACAAGCATCGGAATACTACGAAACCCCCTTCACAATCTCAGACGGAGTTTACGGGTCCACTTTCTTTGTAGCCACAGGCTTTCACGGACTGCACGTTATCATTGGATCTACTTTCCTCACTGTCTGCTTTCTACGCCAAATAAAATTCCACTTCACACCAAACCATCATTTCGGCTTCGAAGCCGCAGCTTGATATTGACACTTCGTAGACGTCGTATGACTATTCCTCTACGTATCAATCTACTGATGAGGTTCATAGTCCTTTTAGTATTAACAAGTACAACTGACTTCCAATCAGTTAGTTTCGGTAAACTCCGAAAAAGAACAATAAACATTCTACTGACACTCCTAACAAACACAACACTAGCCCTGTTACTAATACTTATCGCCTTCTGACTCCCCCAGTTAAATGCATACACTGAAAAGACAAGCCCCTACGAATGTGGCTTTGACCCTATACAATCTGCCCGCCTACCCTTTTCCATAAAGTTCTTCCTAGTCGCAATTACCTTCCTTCTCTTCGACCTAGAAATCGCCCTCCTATTGCCCCTCCCCTGAGCAACCCAAACAAACAACCTAAAAACAATACTTACCACAGCCCTATTCCTAATCTCCTTATTAGCAGCTAGCCTCGCCTACGAATGAACCCAAGAAGGCCTAGAATGAGCCGAATATGGTACTTAGTTTAAAACAAAACAGGTGATTTCGACTCACTGGACTGTGATCAAACTCACAAGTACCAAATGTCCCTGATTCACATAAACGTCATAATAGCCTTCTCCATATCCCTCGTAGGTCTACTAATATACCGATCCCACCTAATATCCGCACTACTCTGCTTAGAAGGCATAGCACTATCCCTATTTATCTTTACAACCCTCACAACCCTAAATTTACACTTCACCCTGGCCAACATAGCTCCAATCATCCTTCTAGTCTTCACAGCCTGCGAGGCAGCTATTGGACTAGCTTTACTAGTCATGATTTCCAACACATATGGCACCGACTATGTCCAAAGCCTTAACCTCCTCCAATGCTAAAGTTTATTATCCCCACTATCATACTAATACCACTAACCTGACTATCAAAAAACAATCTAATCTGAATCAACTCCACAACCCATAGCCTATTAATTAGCTTTACAAGTCTACTCCTCCTTACGCAATCCAATGATAATAACCTCAACTACTCCCTTACGTTCTTCTCTGACCCCCTCTCCACACCCCTCCTAATCTTGACCATATGACTCCTCCCCCTAATACTAATAGCAAGCCAATCACACCTCCTCAAAGAGCCCCTTGCCCGAAAAAAACTCTATATCACAATATTAATCACACTACAAGTATTCCTCATCATAACATTCACCGCCACAGAACTAATCCTATTTTATATTATATTTGAAGCTACGCTAGTCCCAACCCTCATCATTATTACCCGTTGAGGTAATCAGACAGAACGACTTAATGCAGGACTTTACTTCCTCTTCTATACACTGCTCGGATCACTCCCCTTACTAGTAGCACTAACTTACCTACAAAACACAACAGGAACCCTAAACTTCCTTCTAATACAATACTGAACCCAACCCTTATCAACCTCCTGATCCAACACTTTTATATGATTAGCCTGTATAATAGCCTTCATAGTAAAGATACCCCTTTACGGACTACACTTATGACTCCCCAAAGCACATGTAGAAGCCCCCATTGCAGGCTCCATGGTACTTGCAGCCGTACTATTAAAACTCGGTGGTTACGGCATACTACGAATCACACCCATACTTAACCCACTCACAGAACACATGGCTTACCCCTTCCTCATACTCTCACTATGAGGCATAATCATAACCAGCTCCATCTGTTTACGCCAAACAGACCTAAAATCACTTATCGCATACTCCTCAATCAGCCACATAGCACTCGTTATCACAGCCATTCTCATCCAAACCCCCTGAAGCTACATAGGAGCTACCACCCTAATAATCGCCCACGGTCTCACCTCATCCATACTATTCTGCCTAGCAAATTCAAACTACGAACGAATCCACAGCCGAACCATAATCTTAGCCCGAGGCCTACAAATCTTCCTCCCATTGATAGCAACCTGATGACTACTAGCAAGCCTAACAAACCTCGCCCTACCCCCTACAATCAACCTAATCGGAGAACTATTCGTAATAATATCCATATTCTCATGATCAAATCTCACCATCATCCTAATAGGAACAAACATCGTAATCACCACCCTATACTCCCTATATATGCTAATTACCACACAGTACGGCAAACACACATACCACGTCAACAACCTCACCCCCTCCTTCACACGAGAACATACCCTAATAGCTCTACATATCATTCCCCTCCTACTTCTCTCACTAAACCCTAAAATCATTCTAGGTCCCCTCTACTGTAAATATAGTTTAAGAAAAACACTAGCTTGTGGAGCCAGTAATAGAAGACTAAAACTTCTTATTTACCGAAAAAGTACTGCAAGAACTGCTAACTCACGCTTCCATATCTAACAATATGGCTTTTTCAAGCTTTTAAAGGATGGGAGTTATCCATTGGCCTTAGGAGCCAAAAAATTGGTGCAACTCCAAATAAAAGTAATAAACCTATTTACCTCCTTTACCCTACTTACATTACTAATCTTAATTATCCCAGTCATCACACCCAGCACAAACATCCACAAAAGCAACAAGTACCAAACCTATGTAAAAAACACCGTCTCCTGCGCCTTCCTCACCAGCCTGGTCCCAATAACAATATATCTTCATACAAACCAAGAAGTACTTATCTCAAATTGACACTGAATCACCATTCAAACCCTCAAACTGACACTCAGCCTCAAAATAGACTACTTCTCACTCATATTTATGCCCGTAGCACTATTTATCACGTGGTCTATCATAGAATTCTCAATATGATATATACACTCCGACCCGCACATCAACCTATTCTTTAAATACTTACTCCTCTTCCTCATCACCATACTAATCCTCGTCACCGCCAACAATCTCTTCCAACTCCTCATCGGCTGGGAAGGGGTAGGAATTATATCTTTCCTACTCATCGGCTGATGGTTCGGACGAACAAACGCAAACACAGCCGCTCTCCAAGCAATCCTATACAACCGCATCGGAGACATTGGATTTCTCACATCAATAGCATGATTCCTCTCAAACATGAATACATGGGACCTACAACAAATCTTCGCGCTTAACCAAAATACCCCAAACCTTCCCCTCATAGGACTAATATTAGCCGCAGCTGGAAAATCAGCTCAATTTGGACTACACCCCTGACTCCCCTCTGCAATAGAGGGCCCCACTCCTGTCTCAGCCCTACTTCACTCGAGCACAATAGTTGTGGCAGGAATCTTCCTACTTATCCGCTTCCACCCTCTAATAGAAAACAACAAACTCGCCCAAACAACAGCCCTATCTCTAGGCGCTCTTACCACCCTATTTACAGCCATCTGCGCCCTCACCCAGAATGATATTAAAAAAATCATCGCCTTCTCCACCTCCAGCCAACTAGGATTGATGATAGTAACAGTCGGCCTCAACCAACCTTATCTAGCATTCCTACACATCTGCACACACGCCTTCTTCAAAGCTATACTATTCCTATGCTCCGGCTCCATCATCCACAACCTAAACAATGAACAAGACATTCGAAAGATAGGGGGACTATTCAAAGCCCTCCCTTTCACCACCACAGCCCTCATCACTGGTTGCCTCGCATTAACCGGAATACCATTCCTCACCGGATTTTACTCCAAAGACCCAATCATTGAAGCCGCCACTTCATCTTATACCAACGCCTGAGCCCTACTATTAACACTAACAGCCACCTCCCTCACAGCCGTTTACAGCACCCGCATCATCTTCTACACGCTACTAAACCAACCCCGATTCCCTCCCCACATTACCATCAACGAAAACAACCCCTCACTAATCAACCCCATCATACGATTAATACTCGGAAGCATCTTCGCCGGCTTCATCCTATCCAACAACATCCCCCCCATAACCACCCCCCTAACAACCATTCCCCTATACCTAAAACTAACCGCCCTTACAATAACAACCCTAGGCTTCATTATCGCATTTGAAATTAATCTCAATACACAAAACCTAAAATACAACCTCCCTTCAAACCCCACCAAATTCTCCCTCTCACTAGGATATTTCCCCACAATCATACACCGCCTACCCCCTGACCTATATCTAACAATAAGCCAAAAACTAGCTACCTCCTCACTAGACATGACATGACTAGAAAACATCTTACCAAAAACCACAGCCCTCATCCAACTAAAAGCCTCTATACTAACCTCAAACCAACAAGGCCTCATTAAACTATATTTCCTGTCTTTCCTCATCACCATTACCCTCTTTACACTCCTACTTAACTGCCCCGGGTAACCTCCATAATAACCACAACACCAATAAACAATGACCACCCCATAACAACTATTAACCAAGCACCATAACTATACAACGCAGCAACCCCCTCTGCCTCACCCCCAGAAAACCCAGAATCCCCTACATCACAAACTACCCAATCCCCCAACCCATTAAACCCAGACACAACCTCCACCTCTCCACCCTCCAATACATATGCCATTATCAAAAACTCAACCACCAATCCCAAAAGAAATCCTCCCAATACAACCTTATTAGAAACTCAGACCTCAGGATACTGCTCAGTAGCCATAGCCGTAGTATAACCAAACACAACCAGCATCCCCCCTAAATAAATTAAAAAGACTATTAACCCCAAAAACGAACCACCAAAACTCAAGACAATCCCACACCCCACACCACCACCTACAATCAACCCAAATCCCCCATAAATGGGCGAGGGCTTTGAAGAAACCCCCACAAAACTAACTACGAATATAATACTCAAGACAAAAACAAAATATATTATCATCATTCCTACATGGACTCAAACCACGACCAATGACATGAAAAGTCACCGTTGTTATTCAACTACAAGAACACTAATGACCAACATCCGAAAATCACACCCATTAATAAAAATCATTAACAATGCATTCATCGACCTCCCTACCCCATCAAACATTTCCTCATGATGAAACTTCGGCTCCCTACTTGGACTCTGCCTGATCATACAAATCCTAACAGGCCTATTCCTAGCAATACACTACACACCAGACACAACAACCGCTTTCTCATCAATCACACACATTTGCCGAGACGTCAATTACGGCTGGACCATCCGATACCTACATGCAAACGGAGCTTCCATATTTTTCATTTGCCTTTACACTCACATGGGCCGTGGCCTGTACTACGGCTCCTACATCTTCCAAGAAACATGAAACGTTGGAATGATACTCCTAATCACAGTAATAGCCACCGCATTCGTAGGTTACGTACTGCCCTGAGGACAAATATCATTCTGAGCCGCAACCGTTATCACAAACCTTCTATCAGCAATTCCCTATATCGGCACCACCCTAGTAGAGTGAGTTTGAGGCGGTTTCTCCGTAGATAAGGCAACACTGACACGCTTCTTCACTCTCCACTTCATCCTCCCCTTTATCACCCTAACACTAACAATAGTACATCTCCTATTTCTCCATGAAACAGGATCCAACAACCCCACAGGAATTCCCTCCAACATAGACAAAATCCCATTCCACCCCTACCACACAATCAAAGACACCATAGGTGCCCTACTACTAATCCTATCCCTACTTACACTAACCCTGTTCGCACCCGACCTGCTAGGAGATCCTGACAACTACACCCCAGCAAATCCACTAAATACCCCAACACACATCAAACCAGAATGGTATTTCCTATTCGCGTACGCCATCCTACGATCTGTCCCCAATAAACTAGGAGGCGTCTTAGCCCTACTACTCTCCATCCTAATCCTAGTATTCATCCCAATACTTCATACAGCCAAACAACGAAGCATAATATTCCGACCCTTCAGTCAATTCCTGTTCTGAACACTAATCATAGACCTACTAACTCTAACATGAATCGGAGGCCAACCCGTGGAACACCCATATGTAACTGTAGGCCAACTAGCCTCCATCCTATACTTTCTTTTAATCCTAATCCTAATACCAACAGCCAGTCTTATCGAGAACAAGCTCTTAAAATGAAGAGTCTTTGTAGTATAACAAATACCCCGGCCTTGTAAACCGGAAAAGGAGAGAGTTACGCCTCCCTAAGACTCAAGGAAGAAGCACTAAACCTCACCATCAGCACCCAAAGCTGAAATTCTACATAAACTATTCCTTGAAAAAGTGCTTCATCATAGATAAATACAAACCCACAGTGCTATGTCAGTATTAAAAATAACTCACCCAATTACATCTTTCCTACTCCCGACCATACCAATGCCCCCATGCCAATATTCAGCGTTCTCCCTGTAAATGTATACATGTACACGCTATGTATAATAGTGCATTCAATTATTTTCACTACGATCAGTGAAAGCTCGTATTAAATCTTATTAATTTTACATATTACATAAAATTATGGATCGTACATAGGACATATCCTTAAATCAACTCCAGTCCCCTGAAGTTATGAGCTCTCGGATCAGACCACGAGCTTGATCACCATGCCGCGTGAAACCAGCAACCCGCTTGGCAGGGACTCACTATTATTGTATCTCAGGCCCATTCCTCGAAAGCCGTGCTACTCCGTGGTTTTTCCAAGGCCTCTAGTTGCAATTCTCAGGGTCATAACTCGAGGCACCTGCGCTAGTTCCAGCTTTTTCCAAGGCCTCGGCTTGGACCTGAGAGCAGGAGCCTCCACCCTATTAATCACTCACGGGGGGAGTTATAGGCATCTGGTCGTTTTTTTTTTGGGGGGGGAATTTGCATCGGCTCCCCTATGGCCGACGGGGCGGCCCCGTCGCAGGCGAAGCTGGTCTTAGCCGGACCTGTGTGTATTTTTGATTGGACACGTCCTGCTAGTCAGTTTTTGAATTAATGGTTACTAGACATAATTAATTAATGGTTACAGGACATAGATCTTACTATTCCCCCCCTGGGGTCGAAATCCTCTGTCTCGTGGGGAGCTTTCTCTCCCCCCCCCCATTTAATACTAACCCCTTTCTTAGATACTCACCACCCTCCTTGACAGCTTGCCCCCTAGATTTACAAGACAATTTTTCAAAAAATCAATACTAAATCCGACACAAGCCTTATGGCACAATTGTACGAACATTTTTTCGTATATAATTGG**