**SUPPLEMENTARY INFORMATION**

**Kinship genomics approach to study mating systems in a depleted sea turtle rookery**

Shritika S. Prakash1, \*, Monal M. Lal2, Peter H. Dutton3, Ciro Rico1,4, Susanna Piovano1

1 School of Agriculture, Geography, Environment, Ocean and Natural Sciences, The University of the South Pacific, Laucala Campus, Laucala Bay Road, Suva, Fiji

2 Australian Centre for Pacific Islands Research and School of Science, Technology and Engineering, University of the Sunshine Coast, Maroochydore, QLD 4558, Queensland, Australia

3 NOAA Fisheries Southwest Fisheries Science Center, La Jolla, CA, USA

4 *Present address*: Instituto de Ciencias Marinas de Andalucía (ICMAN), Campus Universitario Rio San Pedro, Consejo Superior de Investigaciones Científicas, Puerto Real, Spain

\* Corresponding author: Shritika S. Prakash, School of Agriculture, Geography, Environment, Ocean and Natural Sciences, The University of the South Pacific, Laucala Campus, Laucala Bay Road, Suva, Fiji, shritika.prakash@usp.ac.fj

**Appendix S1.** Multiple paternity in clutches of wild sea turtles. Only those references reporting the number of clutches with multiple paternity were retained in Figure 1. (n.a. = not available)

|  |  |  |  |
| --- | --- | --- | --- |
| Clutches with multiple paternity, in percentage (number of clutches) | Max number of sires | Technique used (number of loci) | Reference |
| Loggerhead turtle *Caretta caretta* |
| 22% (36) | 2 | Microsatellites (7) | Lasala et al., 2020 |
| 31% (70) | 2 | Microsatellites (4) | Moore & Ball, 2002 |
| 33% (3) | 3 | Microsatellites (2) | Bollmer et al., 1999 |
| 48% (25) | 2 | Microsatellites (4) | Tedeschi et al., 2015 |
| 70% (51) | 7 | Microsatellites (7) | Lasala et al., 2018 |
| 75% (72) | 7 | Microsatellites (5) | Lasala et al., 2013 |
| 95% (20) | 5 | Microsatellites (4) | Zbinden et al., 2007 |
| n.a. (45) | 2 | Allozymes (13)  | Harry & Briscoe, 1988 |
| Green turtle *Chelonia mydas* |
| 5% (10) | 2 | Microsatellites (3) | Purnama et al., 2013 |
| 9% (22) | n.a. | Microsatellites (5) | Fitzsimmons, 1998 |
| 21% (94) | 3 | Microsatellite (13) | Wright et al., 2013 |
| 47% (24) | 3 | Microsatellites (6) | Ekanayake et al., 2013 |
| 61% (18) | >2 | Microsatellites (5) | Lee & Hays, 2004 |
| 62% (22) | 10 | Microsatellites (9) | Turkozan et al., 2019 |
| 75% (16) | 5 | Microsatellites (3) | Chassin-Noria et al., 2017 |
| 92% (12) | 5 | Microsatellites (4) | Alfaro-Núñez et al., 2015 |
| 100% (3) | 2 | Microsatellites | Ireland et al., 2003 |
| Leatherback turtle *Dermochelys coriacea* |
| 62% (50) | 2 | Microsatellites (3) | Crim et al., 2002 |
| n.a. (35) | 3 | Microsatellites (3) | Figgener et al., 2016 |
| n.a. (38) | 2 | Microsatellites (7) | Stewart & Dutton, 2011 |
| n.a. (n.a.) | 3 | Microsatellites (7) | Stewart & Dutton, 2014 |
| Hawksbill turtle *Eretmochelys imbricata* |
| 6% (50) | 3 | Microsatellites (12) | González-Garza et al., 2015 |
| 10% (41) | 3 | Microsatellites (6) | Gaos et al., 2018 |
| n.a. (12) | 2 | Microsatellites (5) | Joseph & Shaw, 2011 |
| n.a. (67) | 2 | Microsatellites (33) | Natoli et al., 2017 |
| n.a. (85) | 2 | Microsatellites (32) | Phillips et al., 2013 |
| Kemps’ ridley turtle *Lepidochelys kempii* |
| 44% (25) | 3 | Microsatellites (3) | Kichler et al., 1999 |
| Olive ridley turtle *Lepidochelys olivacea* |
| 20% (10) | 2 | Microsatellites (2) | Hoekert et al., 2002 |
| 61% (26) | 4 | Microsatellites (2) | Jensen et al., 2006 |
| 75% (8) | 3 | Microsatellites (2) | Duran et al., 2015 |
| Flatback turtle *Natator depressus* |
| 69% (16) | 3 | Microsatellites (4) | Theissinger et al., 2009 |

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**Appendix S2**. Full-sibling family assignments determined by COLONY2 software across 217 individual hawksbill turtles. Individuals were collected from three nests at Treasure Island (Set A and Set C, n = 93 and n = 94 respectively) and from a single nest at Bounty Island (Set B, n = 30), Fiji, in the South Pacific. All family inclusion probabilities generated were p ≥ 0.001, with the exception of family number 7, whose value was p = 0.067.

|  |  |
| --- | --- |
| **Full-sibling family no. (size)** | **Membership assignments** |
| 1 | A\_001 | A\_002 | A\_003 | A\_004 | A\_005 | A\_006 | A\_009 | A\_011 | A\_012 |
| (n=61) | A\_013 | A\_016 | A\_018 | A\_019 | A\_020 | A\_021 | A\_022 | A\_023 | A\_026 |
|  | A\_027 | A\_029 | A\_030 | A\_035 | A\_036 | A\_040 | A\_041 | A\_046 | A\_047 |
|  | A\_049 | A\_050 | A\_051 | A\_052 | A\_055 | A\_058 | A\_059 | A\_061 | A\_062 |
|  | A\_064 | A\_066 | A\_067 | A\_068 | A\_069 | A\_070 | A\_071 | A\_072 | A\_073 |
|  | A\_074 | A\_075 | A\_076 | A\_077 | A\_079 | A\_080 | A\_082 | A\_083 | A\_084 |
|  | A\_085 | A\_088 | A\_089 | A\_090 | A\_091 | A\_092 | A\_093 |  |  |
| 2 | A\_007 | A\_010 | A\_015 | A\_017 | A\_024 | A\_028 | A\_031 | A\_034 | A\_037 |
| (n=16) | A\_038 | A\_039 | A\_044 | A\_045 | A\_057 | A\_060 | A\_081 |  |  |
| 3 | A\_008 | A\_014 | A\_025 | A\_032 | A\_042 | A\_043 | A\_048 | A\_053 | A\_054 |
| (n=16) | A\_056 | A\_063 | A\_065 | A\_078 | A\_086 | A\_087 | A\_094 |  |  |
| 4 | B\_001 | B\_002 | B\_003 | B\_004 | B\_005 | B\_006 | B\_007 | B\_008 | B\_009 |
| (n=30) | B\_010 | B\_011 | B\_012 | B\_013 | B\_014 | B\_015 | B\_016 | B\_017 | B\_018 |
|  | B\_019 | B\_020 | B\_021 | B\_022 | B\_023 | B\_024 | B\_025 | B\_026 | B\_027 |
|  | B\_028 | B\_029 | B\_030 |  |  |  |  |  |  |
| 5 | C\_013 | C\_017 | C\_018 | C\_019 | C\_020 | C\_021 | C\_022 | C\_023 | C\_024 |
| (n=76) | C\_025 | C\_027 | C\_028 | C\_029 | C\_030 | C\_031 | C\_032 | C\_033 | C\_034 |
|  | C\_035 | C\_036 | C\_037 | C\_038 | C\_039 | C\_040 | C\_041 | C\_042 | C\_043 |
|  | C\_044 | C\_045 | C\_046 | C\_047 | C\_048 | C\_049 | C\_050 | C\_051 | C\_053 |
|  | C\_054 | C\_055 | C\_056 | C\_057 | C\_058 | C\_059 | C\_060 | C\_061 | C\_062 |
|  | C\_063 | C\_064 | C\_065 | C\_066 | C\_067 | C\_068 | C\_069 | C\_070 | C\_071 |
|  | C\_072 | C\_073 | C\_074 | C\_075 | C\_076 | C\_077 | C\_078 | C\_079 | C\_080 |
|  | C\_081 | C\_082 | C\_083 | C\_085 | C\_086 | C\_087 | C\_088 | C\_089 | C\_090 |
|  | C\_091 | C\_092 | C\_093 | C\_094 |  |  |  |  |  |
| 6 | C\_001 | C\_002 | C\_003 | C\_004 | C\_005 | C\_006 | C\_007 | C\_008 | C\_009 |
| (n=16) | C\_010 | C\_011 | C\_012 | C\_014 | C\_015 | C\_016 | C\_026 |  |  |
| 7(n=2) | C\_052 | C\_084 |  |  |  |  |  |  |  |

**Appendix S3**. Full-sibling parentage assignments were inferred using COLONY2 software across 217 individual hawksbill turtles collected from six nests at Treasure Island (Set A and Set C, n = 93 and n = 94, respectively, three nests each) and from a single nest at Bounty Island (Set B, n = 30), Fiji, in the South Pacific. Mother and father identities are based on the reconstruction of genotypes of the contributing parents. Note that the mother and father designations are arbitrary and represent only opposite sexes.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Full-sibling family no.** | **Offspring****ID** | **Father****ID** | **Mother****ID** | **Full-sibling family no.** | **Offspring****ID** | **Father****ID** | **Mother****ID** | **Full-sibling family no.** | **Offspring****ID** | **Father****ID** | **Mother****ID** |
| 1 | A\_001 | \*1 | #1 | 4 | B\_01 | \*4 | #4 | 5 | C\_013 | \*5 | #5 |
| 1 | A\_002 | \*1 | #1 | 4 | B\_02 | \*4 | #4 | 5 | C\_017 | \*5 | #5 |
| 1 | A\_003 | \*1 | #1 | 4 | B\_03 | \*4 | #4 | 5 | C\_018 | \*5 | #5 |
| 1 | A\_004 | \*1 | #1 | 4 | B\_04 | \*4 | #4 | 5 | C\_019 | \*5 | #5 |
| 1 | A\_005 | \*1 | #1 | 4 | B\_05 | \*4 | #4 | 5 | C\_020 | \*5 | #5 |
| 1 | A\_006 | \*1 | #1 | 4 | B\_06 | \*4 | #4 | 5 | C\_021 | \*5 | #5 |
| 1 | A\_009 | \*1 | #1 | 4 | B\_07 | \*4 | #4 | 5 | C\_022 | \*5 | #5 |
| 1 | A\_011 | \*1 | #1 | 4 | B\_08 | \*4 | #4 | 5 | C\_023 | \*5 | #5 |
| 1 | A\_012 | \*1 | #1 | 4 | B\_09 | \*4 | #4 | 5 | C\_024 | \*5 | #5 |
| 1 | A\_013 | \*1 | #1 | 4 | B\_10 | \*4 | #4 | 5 | C\_025 | \*5 | #5 |
| 1 | A\_016 | \*1 | #1 | 4 | B\_11 | \*4 | #4 | 5 | C\_027 | \*5 | #5 |
| 1 | A\_018 | \*1 | #1 | 4 | B\_12 | \*4 | #4 | 5 | C\_028 | \*5 | #5 |
| 1 | A\_019 | \*1 | #1 | 4 | B\_13 | \*4 | #4 | 5 | C\_029 | \*5 | #5 |
| 1 | A\_020 | \*1 | #1 | 4 | B\_14 | \*4 | #4 | 5 | C\_030 | \*5 | #5 |
| 1 | A\_021 | \*1 | #1 | 4 | B\_15 | \*4 | #4 | 5 | C\_031 | \*5 | #5 |
| 1 | A\_022 | \*1 | #1 | 4 | B\_16 | \*4 | #4 | 5 | C\_032 | \*5 | #5 |
| 1 | A\_023 | \*1 | #1 | 4 | B\_17 | \*4 | #4 | 5 | C\_033 | \*5 | #5 |
| 1 | A\_026 | \*1 | #1 | 4 | B\_18 | \*4 | #4 | 5 | C\_034 | \*5 | #5 |
| 1 | A\_027 | \*1 | #1 | 4 | B\_19 | \*4 | #4 | 5 | C\_035 | \*5 | #5 |
| 1 | A\_029 | \*1 | #1 | 4 | B\_20 | \*4 | #4 | 5 | C\_036 | \*5 | #5 |
| 1 | A\_030 | \*1 | #1 | 4 | B\_21 | \*4 | #4 | 5 | C\_037 | \*5 | #5 |
| 1 | A\_035 | \*1 | #1 | 4 | B\_22 | \*4 | #4 | 5 | C\_038 | \*5 | #5 |
| 1 | A\_036 | \*1 | #1 | 4 | B\_23 | \*4 | #4 | 5 | C\_039 | \*5 | #5 |
| 1 | A\_040 | \*1 | #1 | 4 | B\_24 | \*4 | #4 | 5 | C\_040 | \*5 | #5 |
| 1 | A\_041 | \*1 | #1 | 4 | B\_25 | \*4 | #4 | 5 | C\_041 | \*5 | #5 |
| 1 | A\_046 | \*1 | #1 | 4 | B\_26 | \*4 | #4 | 5 | C\_042 | \*5 | #5 |
| 1 | A\_047 | \*1 | #1 | 4 | B\_27 | \*4 | #4 | 5 | C\_043 | \*5 | #5 |
| 1 | A\_049 | \*1 | #1 | 4 | B\_28 | \*4 | #4 | 5 | C\_044 | \*5 | #5 |
| 1 | A\_050 | \*1 | #1 | 4 | B\_29 | \*4 | #4 | 5 | C\_045 | \*5 | #5 |
| 1 | A\_051 | \*1 | #1 | 4 | B\_30 | \*4 | #4 | 5 | C\_046 | \*5 | #5 |
| 1 | A\_052 | \*1 | #1 |  |  |  |  | 5 | C\_047 | \*5 | #5 |
| 1 | A\_055 | \*1 | #1 |  |  |  |  | 5 | C\_048 | \*5 | #5 |
| 1 | A\_058 | \*1 | #1 |  |  |  |  | 5 | C\_049 | \*5 | #5 |
| 1 | A\_059 | \*1 | #1 |  |  |  |  | 5 | C\_050 | \*5 | #5 |
| 1 | A\_061 | \*1 | #1 |  |  |  |  | 5 | C\_051 | \*5 | #5 |
| 1 | A\_062 | \*1 | #1 |  |  |  |  | 5 | C\_053 | \*5 | #5 |
| 1 | A\_064 | \*1 | #1 |  |  |  |  | 5 | C\_054 | \*5 | #5 |
| 1 | A\_066 | \*1 | #1 |  |  |  |  | 5 | C\_055 | \*5 | #5 |
| 1 | A\_067 | \*1 | #1 |  |  |  |  | 5 | C\_056 | \*5 | #5 |
| 1 | A\_068 | \*1 | #1 |  |  |  |  | 5 | C\_057 | \*5 | #5 |
| 1 | A\_069 | \*1 | #1 |  |  |  |  | 5 | C\_058 | \*5 | #5 |
| 1 | A\_070 | \*1 | #1 |  |  |  |  | 5 | C\_059 | \*5 | #5 |
| 1 | A\_071 | \*1 | #1 |  |  |  |  | 5 | C\_060 | \*5 | #5 |
| 1 | A\_072 | \*1 | #1 |  |  |  |  | 5 | C\_061 | \*5 | #5 |
| 1 | A\_073 | \*1 | #1 |  |  |  |  | 5 | C\_062 | \*5 | #5 |
| 1 | A\_074 | \*1 | #1 |  |  |  |  | 5 | C\_063 | \*5 | #5 |
| 1 | A\_075 | \*1 | #1 |  |  |  |  | 5 | C\_064 | \*5 | #5 |
| 1 | A\_076 | \*1 | #1 |  |  |  |  | 5 | C\_065 | \*5 | #5 |
| 1 | A\_077 | \*1 | #1 |  |  |  |  | 5 | C\_066 | \*5 | #5 |
| 1 | A\_079 | \*1 | #1 |  |  |  |  | 5 | C\_067 | \*5 | #5 |
| 1 | A\_080 | \*1 | #1 |  |  |  |  | 5 | C\_068 | \*5 | #5 |
| 1 | A\_082 | \*1 | #1 |  |  |  |  | 5 | C\_069 | \*5 | #5 |
| 1 | A\_083 | \*1 | #1 |  |  |  |  | 5 | C\_070 | \*5 | #5 |
| 1 | A\_084 | \*1 | #1 |  |  |  |  | 5 | C\_071 | \*5 | #5 |
| 1 | A\_085 | \*1 | #1 |  |  |  |  | 5 | C\_072 | \*5 | #5 |
| 1 | A\_088 | \*1 | #1 |  |  |  |  | 5 | C\_073 | \*5 | #5 |
| 1 | A\_089 | \*1 | #1 |  |  |  |  | 5 | C\_074 | \*5 | #5 |
| 1 | A\_090 | \*1 | #1 |  |  |  |  | 5 | C\_075 | \*5 | #5 |
| 1 | A\_091 | \*1 | #1 |  |  |  |  | 5 | C\_076 | \*5 | #5 |
| 1 | A\_092 | \*1 | #1 |  |  |  |  | 5 | C\_077 | \*5 | #5 |
| 1 | A\_093 | \*1 | #1 |  |  |  |  | 5 | C\_078 | \*5 | #5 |
| 2 | A\_007 | \*2 | #2 |  |  |  |  | 5 | C\_079 | \*5 | #5 |
| 2 | A\_010 | \*2 | #2 |  |  |  |  | 5 | C\_080 | \*5 | #5 |
| 2 | A\_015 | \*2 | #2 |  |  |  |  | 5 | C\_081 | \*5 | #5 |
| 2 | A\_017 | \*2 | #2 |  |  |  |  | 5 | C\_082 | \*5 | #5 |
| 2 | A\_024 | \*2 | #2 |  |  |  |  | 5 | C\_083 | \*5 | #5 |
| 2 | A\_028 | \*2 | #2 |  |  |  |  | 5 | C\_085 | \*5 | #5 |
| 2 | A\_031 | \*2 | #2 |  |  |  |  | 5 | C\_086 | \*5 | #5 |
| 2 | A\_034 | \*2 | #2 |  |  |  |  | 5 | C\_087 | \*5 | #5 |
| 2 | A\_037 | \*2 | #2 |  |  |  |  | 5 | C\_088 | \*5 | #5 |
| 2 | A\_038 | \*2 | #2 |  |  |  |  | 5 | C\_089 | \*5 | #5 |
| 2 | A\_039 | \*2 | #2 |  |  |  |  | 5 | C\_090 | \*5 | #5 |
| 2 | A\_044 | \*2 | #2 |  |  |  |  | 5 | C\_091 | \*5 | #5 |
| 2 | A\_045 | \*2 | #2 |  |  |  |  | 5 | C\_092 | \*5 | #5 |
| 2 | A\_057 | \*2 | #2 |  |  |  |  | 5 | C\_093 | \*5 | #5 |
| 2 | A\_060 | \*2 | #2 |  |  |  |  | 5 | C\_094 | \*5 | #5 |
| 2 | A\_081 | \*2 | #2 |  |  |  |  | 6 | C\_052 | \*5 | #6 |
| 3 | A\_008 | \*3 | #3 |  |  |  |  | 6 | C\_084 | \*5 | #6 |
| 3 | A\_014 | \*3 | #3 |  |  |  |  | 7 | C\_001 | \*6 | #7 |
| 3 | A\_025 | p\*3 | #3 |  |  |  |  | 7 | C\_002 | \*6 | #7 |
| 3 | A\_032 | \*3 | #3 |  |  |  |  | 7 | C\_003 | \*6 | #7 |
| 3 | A\_042 | \*3 | #3 |  |  |  |  | 7 | C\_004 | \*6 | #7 |
| 3 | A\_043 | \*3 | #3 |  |  |  |  | 7 | C\_005 | \*6 | #7 |
| 3 | A\_048 | \*3 | #3 |  |  |  |  | 7 | C\_006 | \*6 | #7 |
| 3 | A\_053 | \*3 | #3 |  |  |  |  | 7 | C\_007 | \*6 | #7 |
| 3 | A\_054 | \*3 | #3 |  |  |  |  | 7 | C\_008 | \*6 | #7 |
| 3 | A\_056 | \*3 | #3 |  |  |  |  | 7 | C\_009 | \*6 | #7 |
| 3 | A\_063 | \*3 | #3 |  |  |  |  | 7 | C\_010 | \*6 | #7 |
| 3 | A\_065 | \*3 | #3 |  |  |  |  | 7 | C\_011 | \*6 | #7 |
| 3 | A\_078 | \*3 | #3 |  |  |  |  | 7 | C\_012 | \*6 | #7 |
| 3 | A\_086 | \*3 | #3 |  |  |  |  | 7 | C\_014 | \*6 | #7 |
| 3 | A\_087 | \*3 | #3 |  |  |  |  | 7 | C\_015 | \*6 | #7 |
| 3 | A\_094 | \*3 | #3 |  |  |  |  | 7 | C\_016 | \*6 | #7 |
|  |  |  |  |  |  |  |  | 7 | C\_026 | \*6 | #7 |