

Foraging zones of the two sibling species of giant petrels in the Indian Ocean throughout the annual cycle: implication for their conservation

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Supplement. This supplementary material describes examples of giant petrel tracks and details of different models tested in our analysis

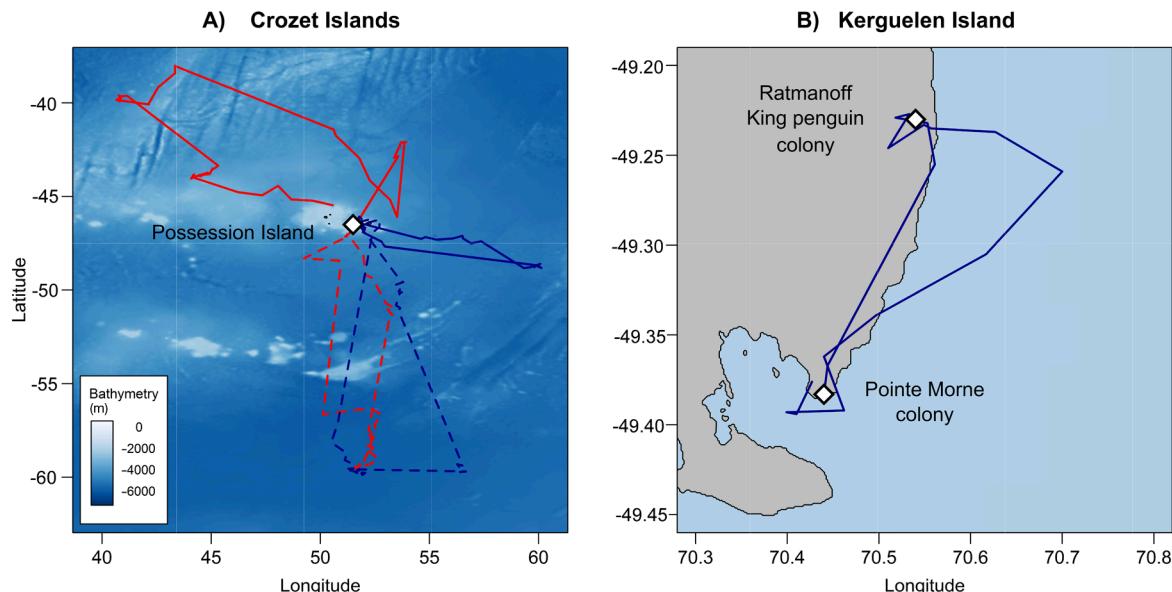


Fig. S1. (A) Example Argos tracks from Crozet, for northern giant petrel during the rearing period (solid lines) and southern giant petrel during the incubation period (dashed lines). Males are represented in blue and females in red. (B) Example track from Kerguelen for a male northern giant petrel during the rearing period

Table S1. Ranked set of the best candidate models of time spent on the water for NOGP from Crozet and Kerguelen archipelagos. Each line represents a different model. AIC, Δ AIC and Akaike weight (AICw) are presented for each model tested.

Parameters					AIC	Δ AIC	AICw
Population	Sex	Month	–	Sex*Month	36555.46	0	0.51
Population	Sex	Month	Population*Sex	Sex*Month	36555.65	0.19	0.47
–	Sex	Month	–	Sex*Month	36563.41	7.95	0.01
Population	Sex	Month	–	–	36596.39	40.93	<0.01
Population	Sex	Month	Population*Sex	–	36596.42	40.95	<0.01
Population	Sex	–	Population*Sex	–	37794.06	1238.60	<0.01
–	–	–	–	–	37816.97	1261.51	<0.01

Table S2. Ranked set of the best candidate models of time spent on the water for NOGP and SOGP from Crozet archipelago. AIC, Delta AIC and Akaike Weight (AICw) are presented for each model tested.

Parameters					AIC	Δ AIC	AICw
Species	Sex	Month	–	Species*Month	46407.3	0	0.71
Species	Sex	Month	Species*Sex	Species*Month	46409.15	1.77	0.29
Species	Sex	Month	Species*Sex	–	46486.41	79.11	<0.01
Species	Sex	Month	Species*Sex	Species*Month	46488.22	80.92	<0.01
Species	–	Species	–	Species*Month	46506.80	99.5	<0.01
Species	Sex	Month	–	–	46644.52	237.22	<0.01
Species	Sex	Month	Species*Sex	–	46646.49	239.19	<0.01
–	Sex	Month	–	–	46648.16	240.86	<0.01
Species	Sex	Month	–	–	46771.71	364.41	<0.01
Species	Sex	Month	Species*Sex	–	46773.50	366.20	<0.01
Species	Sex	–	Species*Sex	–	47426.84	1019.54	<0.01
–	–	–	–	–	47444.91	1037.61	<0.01

Table S3. *Macronectes halli* and *M. giganteus*. Variables selected in the best candidate models describing activity pattern (time spent on the water) for northern giant petrels from Crozet and Kerguelen (NOGP Kerguelen & Crozet) and northern and southern giant petrels from Crozet (NOGP & SOGP Crozet). Parameters were estimated using a model average procedure (see ‘Materials and methods: Activity data’). Reference values are: Month01, SexFemale and PopulationCrozet (NOGP Kerguelen & Crozet) and Month01, SexFemale and SpeciesNOGP (NOGP & SOGP Crozet).

NOGP Crozet & Kerguelen		NOGP & SOGP Crozet	
Parameters	Estimates	Parameters	Estimates
Intercept	2.25 ± 0.29	Intercept	2.08 ± 0.30
Month02	0.27 ± 0.24	Month02	0.30 ± 0.28
Month03	0.24 ± 0.23	Month03	0.46 ± 0.28
Month04	-0.17 ± 0.23	Month04	0.20 ± 0.28
Month05	-0.26 ± 0.23	Month05	0.15 ± 0.28
Month06	-0.73 ± 0.23	Month06	-0.38 ± 0.28
Month07	-0.59 ± 0.23	Month07	-0.43 ± 0.28
Month08	-1.12 ± 0.23	Month08	-1.17 ± 0.28
Month09	-2.25 ± 0.25	Month09	-1.64 ± 0.30
Month10	-2.54 ± 0.35	Month10	-2.11 ± 0.36
Month11	-0.66 ± 0.27	Month11	-0.40 ± 0.31
Month12	-0.30 ± 0.23	Month12	-0.27 ± 0.28
SexMale:month02	-0.23 ± 0.28	SexMale:month02	-0.30 ± 0.31
SexMale:month03	-0.55 ± 0.27	SexMale:month03	-0.83 ± 0.31
SexMale:month04	-0.43 ± 0.27	SexMale:month04	-0.93 ± 0.31
SexMale:month05	-0.39 ± 0.27	SexMale:month05	-0.98 ± 0.31
SexMale:month06	-0.27 ± 0.27	SexMale:month06	-0.70 ± 0.31
SexMale:month07	-0.82 ± 0.27	SexMale:month07	-1.05 ± 0.31
SexMale:month08	-0.38 ± 0.27	SexMale:month08	-0.51 ± 0.31
SexMale:month09	0.18 ± 0.29	SexMale:month09	-0.91 ± 0.33
SexMale:month10	0.67 ± 0.40	SexMale:month10	-0.13 ± 0.36
SexMale:month11	0.19 ± 0.31	SexMale:month11	-0.13 ± 0.35
SexMale:month12	0.12 ± 0.27	SexMale:month12	-0.01 ± 0.31
SexMale	-0.59 ± 0.34	SpeciesSOGP:month02	0.24 ± 0.31
PopulationKerguelen	-0.55 ± 0.34	SpeciesSOGP:month03	0.03 ± 0.31
PopulationKerguelen:SexMale	-0.25 ± 0.29	SpeciesSOGP:month04	0.39 ± 0.31
		SpeciesSOGP:month05	0.30 ± 0.31
		SpeciesSOGP:month06	0.48 ± 0.31
		SpeciesSOGP:month07	0.68 ± 0.31
		SpeciesSOGP:month08	1.23 ± 0.31
		SpeciesSOGP:month09	1.94 ± 0.32
		SpeciesSOGP:month10	0.65 ± 0.37
		SpeciesSOGP:month11	-0.24 ± 0.36
		SpeciesSOGP:month12	-0.42 ± 0.31
		SexMale	-0.28 ± 0.33
		SpeciesSOGP	-0.82 ± 0.33
		SpeciesSOGP:SexMale	-0.08 ± 0.16
Individual	0.48 ± 0.92	Individual	0.39 ± 1.03

Table S4. *Macronectes halli* and *M. giganteus*. Variables selected in the average models of time spent per $5 \times 5^\circ$ grid square in relation with fishing effort for adult and juvenile northern (NOGP) and southern (SOGP) giant petrels. TPPS.0: -probability of presence index. Values are coefficient \pm SD. Reference values are FishingEffortClass0, SexFemale and SpeciesNOGP

Adults		Juveniles	
Parameters	Estimates	Parameters	Estimates
Intercept	-0.98 ± 0.15	Intercept	-0.75 ± 0.28
TPPS.0	-97.18 ± 3.76	FishingEffortClass1	0.22 ± 0.19
FishingEffortClass1	0.17 ± 0.17	FishingEffortClass2	0.77 ± 0.26
FishingEffortClass2	-0.70 ± 0.22	FishingEffortClass3	0.81 ± 0.27
FishingEffortClass3	1.45 ± 0.27	FishingEffortClass4	0.31 ± 0.30
FishingEffortClass4	1.18 ± 0.32	SexMale	0.45 ± 0.35
SexMale	0.28 ± 0.18	SpeciesSOGP	0.11 ± 0.38
SpeciesSOGP	0.21 ± 0.19	SpeciesSOGP*SexMale	0.66 ± 0.46
SpeciesSOGP*SexMale	0.03 ± 0.06	FishingEffortClass1*SexMale	-0.01 ± 0.03
FishingEffortClass1*SexMale	0.01 ± 0.13	FishingEffortClass2*SexMale	-0.21 ± 0.05
FishingEffortClass2*SexMale	0.06 ± 0.16	FishingEffortClass3*SexMale	0.02 ± 0.04
FishingEffortClass3*SexMale	0.09 ± 0.20	FishingEffortClass4*SexMale	0.03 ± 0.04
FishingEffortClass4*SexMale	0.77 ± 0.25	FishingEffortClass1*SpeciesSOGP	-0.03 ± 0.02
FishingEffortClass1*SpeciesSOGP	-0.06 ± 0.21	FishingEffortClass2*SpeciesSOGP	-0.01 ± 0.03
FishingEffortClass2*SpeciesSOGP	-0.23 ± 0.27	FishingEffortClass3*SpeciesSOGP	0.03 ± 0.03
FishingEffortClass3*SpeciesSOGP	-0.79 ± 0.34	FishingEffortClass4*SpeciesSOGP	-0.01 ± 0.03
FishingEffortClass4*SpeciesSOGP	-3.47 ± 0.44		
Individual	0.20 ± 0.72	Individual	0.52 ± 0.67

Table S5. Ranked set of the best candidate models of time spent per square for adult birds. Estimates and standard deviation of the parameters, AIC, Δ AIC and Akaike weight (AICw) are presented for each model tested. TPPS.0 corresponds to presence probability index

Integer	TPPS.0	Fishing Effort Class	Species	Sex	Fishing Effort Class*Species	Fishing Effort Class*Sex	Species*Sex	AIC	DAIC	AICw
-1.03 ± 0.07	-90.24 ± 42.60	0.15 ± 0.04	0.22 ± 0.09	0.31 ± 0.09	-0.42 ± 0.07	-	-	12316.68	0	0.45
-0.99 ± 0.07	-91.29 ± 42.58	0.08 ± 0.05	0.20 ± 0.09	0.22 ± 0.09	-0.39 ± 0.07	0.15 ± 0.07	-	12317.26	0.58	0.34
-1.0 ± 0.08	-90.92 ± 42.61	0.15 ± 0.04	0.16 ± 0.11	0.26 ± 0.10	-0.42 ± 0.07	-	0.14 ± 0.18	12319.58	2.9	0.11
-0.96 ± 0.08	-92.11 ± 42.59	0.08 ± 0.05	0.14 ± 0.12	0.16 ± 0.11	-0.39 ± 0.07	0.15 ± 0.07	0.17 ± 0.18	12319.96	3.28	0.09
-0.87 ± 0.06	-91.89 ± 42.62	0.15 ± 0.04	0.16 ± 0.11	-	-0.42 ± 0.07	-	-	12323.05	6.37	0.02
-0.90 ± 0.07	-93.08 ± 42.77	-0.08 ± 0.04	0.01 ± 0.09	0.18 ± 0.09	-	0.22 ± 0.07	-	12343.16	26.48	<0.01
-0.80 ± 0.05	-93.89 ± 42.74	-	-	-	-	-	-	12344.67	27.99	<0.01
-0.9 ± 0.07	-92.50 ± 42.74	-	-0.05 ± 0.11	0.27 ± 0.11	-	-	0.13 ± 0.18	12345.37	28.69	<0.01
-0.87 ± 0.08	-93.84 ± 42.78	-0.08 ± 0.04	-0.05 ± 0.11	0.12 ± 0.11	-	0.23 ± 0.07	0.16 ± 0.18	12345.94	29.26	<0.01
-0.94 ± 0.07	-91.65 ± 42.84	0.01 ± 0.03	-0.01 ± 0.09	0.32 ± 0.09	-	-	-	12349.31	32.63	<0.01
-0.92 ± 0.08	-92.21 ± 42.85	0.01 ± 0.03	-0.05 ± 0.11	0.27 ± 0.11	-	-	0.13 ± 0.18	12352.38	35.7	<0.01

Table S6. Ranked set of the best candidate models of time spent per square for juvenile birds. Estimates and standard deviation of the parameters, AIC, Δ AIC and Akaike weight (AICw) are presented for each model tested.

Integer	Fishing Effort Class	Species	Sex	Fishing Effort Class*Species	Fishing Effort Class*Sex	Species*Sex	AIC	DAIC	AICw
-0.74 ± 0.20	0.20 ± 0.04	0.04 ± 0.34	0.35 ± 0.38	-	-	1.06 ± 0.73	4753.90	0	0.54
-0.82 ± 0.21	0.21 ± 0.04	0.26 ± 0.31	0.63 ± 0.34	-	-	-	4755.15	1.25	0.29
-0.74 ± 0.20	0.22 ± 0.04	0.04 ± 0.34	0.37 ± 0.38	-	-0.05 ± 0.09	1.06 ± 0.73	4758.51	4.61	0.05
-0.74 ± 0.20	0.21 ± 0.05	0.04 ± 0.34	0.35 ± 0.38	-0.01 ± 0.08	-	1.06 ± 0.73	4759.06	5.16	0.04
0.82 ± 0.21	0.22 ± 0.04	0.26 ± 0.31	0.65 ± 0.34	-	-0.05 ± 0.09	-	4759.78	5.88	0.03
-0.82 ± 0.21	0.21 ± 0.05	0.26 ± 0.32	0.63 ± 0.34	-0.01 ± 0.08	-	-	4760.32	6.42	0.02
-0.63 ± 0.20	0.21 ± 0.05	0.20 ± 0.34	-	-0.01 ± 0.08	-	-	4761.30	7.4	0.01
-0.74 ± 0.21	0.23 ± 0.05	0.04 ± 0.34	0.37 ± 0.38	-0.01 ± 0.08	-0.05 ± 0.10	1.06 ± 0.73	4763.59	9.69	<0.01
-0.82 ± 0.21	0.23 ± 0.05	0.27 ± 0.05	0.65 ± 0.34	0.01 ± 0.08	-0.05 ± 0.10	-	4764.86	10.96	<0.01
-0.66 ± 0.20	-	0.03 ± 0.33	0.35 ± 0.37	-	-	1.08 ± 0.73	4777.49	23.59	<0.01
-0.49 ± 0.15	-	-	-	-	-	-	4777.89	23.99	<0.01