

Supplementary material

Genetic structure of introduced American mink (*Neovison vison*) in Patagonia: colonisation insights and implications for control and management strategies

Mónica Mora^A, Gonzalo Medina-Vogel^B, Maximiliano A. Sepúlveda^C, Daly Noll^{A,D}, Rocío Álvarez-Varas^{A,D} and Juliana A. Vianna^{A,E}

^ADepartamento de Ecosistemas y Medio Ambiente, Facultad de Agronomía e Ingeniería Forestal, Pontificia Universidad Católica de Chile, Vicuña Mackenna 4860, Santiago 7820436, Chile.

^BCentro de Investigación para la Sustentabilidad, Universidad Andrés Bello, República 440, Santiago Centro, Santiago 8320000, Chile.

^CGerencia de Áreas Silvestres Protegidas del Estado, Corporación Nacional Forestal, Paseo Bulnes 285, Santiago 8330407, Chile.

^DDepartamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Las Palmeras 3425, Ñuñoa, Santiago 7800003, Chile.

^ECorresponding author. Email: jvianna@uc.cl

Table S1. American mink samples (*Neovison vison*) collected in Southern Chile.

Sample code	Locations	Date of collection	Latitude S	Longitude W
NV53	Valdivia	June 2007	39° 52' 04.10"	73° 20' 38.84"
NV86	Valdivia	September 2008	39° 49' 06.18"	73° 15' 38.64"
NV89	Valdivia	September 2008	39° 49' 06.18"	73° 15' 38.64"
NV87	Valdivia	August 2006	40° 14' 42.93"	73° 04' 34.79"
NV88	Valdivia	November 2008	39° 51' 40.00"	73° 20' 11.75"
VH346	Panguipulli	December 2011	39° 48' 54.58"	72° 06' 07.34"
VH486	Panguipulli	December 2011	39° 48' 54.58"	72° 06' 07.34"
VH332	Panguipulli	December 2011	39° 48' 54.58"	72° 06' 07.34"
VH526	Panguipulli	October 2012	39° 49' 06.87"	72° 05' 46.30"
VH532	Panguipulli	November 2012	39° 49' 18.57"	72° 05' 37.10"
VH516	Panguipulli	November 2012	39° 49' 58.84"	72° 07' 19.43"
VH530	Panguipulli	November 2012	39° 49' 48.21"	72° 05' 17.64"
TJ33	Neltume	July 2011	39° 46' 00.25"	71° 58' 05.20"
TJ30	Neltume	July 2011	39° 46' 00.25"	71° 58' 05.20"
TJ13	Neltume	July 2011	39° 47' 08.29"	71° 59' 26.77"
TJ27	Neltume	July 2011	39° 46' 02.14"	71° 57' 19.14"
TJ32	Neltume	July 2011	39° 46' 00.04"	71° 58' 17.09"
VH522	Neltume	July 2011	39° 45' 49.95"	71° 57' 36.69"

TJ34	Liquiñe	May 2011	39° 42' 07.35"	71° 54' 17.03"
TJ19	Liquiñe	May 2011	39° 42' 07.38"	71° 54' 16.94"
TJ20	Liquiñe	May 2011	39° 42' 07.38"	71° 54' 16.94"
VH511	Liquiñe	May 2011	39° 43' 49.43"	71° 50' 59.88"
NV12	Petrohué-TSL	No data	41° 08' 31.12"	72° 25' 02.80"
NV13	Petrohué-TSL	No data	41° 08' 31.12"	72° 25' 02.80"
NV14	Petrohué-TSL	No data	41° 08' 31.12"	72° 25' 02.80"
NV15	Petrohué-TSL	No data	41° 08' 31.12"	72° 25' 02.80"
NV19	Petrohué-TSL	No data	41° 08' 31.12"	72° 25' 02.80"
NV33	Petrohué-TSL	June 2010	41° 08' 40.68"	72° 24' 55.22"
NV34	Petrohué-TSL	June 2010	41° 08' 44.94"	72° 25' 00.46"
NV35	Petrohué-TSL	June 2010	41° 08' 05.45"	72° 22' 14.45"
NV36	Petrohué-TSL	June 2010	41° 07' 46.02"	72° 20' 36.30"
NV37	Petrohué-TSL	July 2010	41° 07' 46.02"	72° 20' 36.30"
NV38	Petrohué-TSL	December 2010	41° 10' 23.12"	72° 16' 59.90"
TJ22	Petrohué-TSL	September 2010	41° 10' 23.12"	72° 16' 59.90"
TJ16	Petrohué-TSL	September 2010	41° 07' 46.01"	72° 20' 36.30"
TJ21	Petrohué-TSL	September 2010	41° 08' 05.45"	72° 22' 14.45"
TJ12	Petrohué-TSL	September 2010	41° 08' 40.67"	72° 24' 55.22"
TJ14	Petrohué-TSL	September 2010	41° 08' 44.94"	72° 25' 00.46"
TJ15	Petrohué-TSL	September 2010	41° 07' 46.01"	72° 20' 36.30"
VH305	Petrohué-TSL	September 2011	41° 08' 46.16"	72° 25' 05.56"
VH309	Petrohué-TSL	September 2011	41° 08' 31.12"	72° 23' 48.09"
TJ35	Maullín	May 2010	41° 41' 43.61"	73° 32' 00.08"
TJ18	Maullín	May 2011	41° 40' 42.57"	73° 31' 21.37"
TJ36	Maullín	May 2011	41° 42' 21.17"	73° 30' 58.00"
TJ10	Maullín	May 2011	41° 42' 44.49"	73° 30' 41.54"
TJ25	Maullín	May 2011	41° 39' 22.22"	73° 33' 39.10"
TJ8	Maullín	May 2011	41° 40' 43.34"	73° 30' 17.95"
NV50	Maullín	February 2007	41° 23' 30.12"	73° 10' 33.72"
NV51	Maullín	February 2007	41° 23' 30.12"	73° 10' 33.72"
NV52	Maullín	February 2007	41° 23' 30.12"	73° 10' 33.72"
NV54	Maullín	February 2007	41° 23' 30.12"	73° 10' 33.72"
NV55	Maullín	March 2007	41° 23' 30.12"	73° 10' 33.72"
NV56	Maullín	March 2007	41° 23' 30.12"	73° 10' 33.72"
NV57	Maullín	March 2007	41° 23' 30.12"	73° 10' 33.72"
NV58	Maullín	March 2007	41° 23' 30.12"	73° 10' 33.72"
NV59	Maullín	March 2007	41° 23' 30.12"	73° 10' 33.72"
NV60	Maullín	April 2007	41° 23' 30.12"	73° 10' 33.72"
NV61	Maullín	No data	41° 23' 30.12"	73° 10' 33.72"

NV62	Maullín	May 2007	41° 23' 30.12"	73° 10' 33.72"
NV63	Maullín	May 2007	41° 23' 30.12"	73° 10' 33.72"
NV64	Maullín	May 2007	41° 23' 30.12"	73° 10' 33.72"
NV65	Maullín	May 2007	41° 23' 30.12"	73° 10' 33.72"
NV66	Maullín	May 2007	41° 23' 30.12"	73° 10' 33.72"
NV67	Maullín	May 2007	41° 23' 30.12"	73° 10' 33.72"
NV68	Maullín	May 2007	41° 23' 30.12"	73° 10' 33.72"
NV69	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV70	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV71	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV72	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV73	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV74	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV75	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV76	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV77	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV78	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV79	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV80	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV81	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV82	Maullín	August 2007	41° 18' 37.26"	73° 03' 32.23"
NV83	Maullín	October 2007	41° 18' 37.26"	73° 03' 32.23"
NV84	Maullín	October 2007	41° 18' 37.26"	73° 03' 32.23"
NV85	Maullín	October 2007	41° 18' 37.26"	73° 03' 32.23"
VH627	Puyuhuapi	February 2013	44° 30' 53.17"	72° 34' 04.52"
VH628	Puyuhuapi	February 2013	44° 31' 08.03"	72° 33' 47.54"
VH622	Puyuhuapi	February 2013	44° 30' 49.46"	72° 34' 06.85"
VH660	Puyuhuapi	February 2013	44° 30' 46.94"	72° 34' 08.45"
VH640	Puyuhuapi	February 2013	44° 30' 07.53"	72° 34' 55.73"
VH678	Puyuhuapi	February 2013	44° 30' 49.40"	72° 34' 06.85"
NV1	Magdalena Is.	April 2009	44° 36' 26.03"	72° 56' 24.29"
NV2	Magdalena Is.	April 2009	44° 38' 13.17"	72° 55' 19.95"
NV3	Magdalena Is.	April 2009	44° 38' 13.17"	72° 55' 19.95"
NV4	Magdalena Is.	April 2009	44° 37' 38.67"	72° 57' 13.60"
NV5	Magdalena Is.	May 2009	44° 36' 16.18"	72° 55' 20.27"
NV1	Magdalena Is.	May 2009	44° 36' 26.03"	72° 56' 24.29"
NV2	Magdalena Is.	No data	44° 38' 13.17"	72° 55' 19.95"
NV3	Magdalena Is.	July 2009	44° 38' 13.17"	72° 55' 19.95"
NV4	Magdalena Is.	September 2009	44° 37' 38.67"	72° 57' 13.60"
NV5	Magdalena Is.	September 2009	44° 36' 16.18"	72° 55' 20.27"

NV11	Magdalena Is.	No data	44° 37' 38.70"	72° 57' 13.41"
TJ28	Magdalena Is.	January 2011	44° 36' 26.30"	72° 56' 18.33"
TJ31	Magdalena Is.	January 2011	44° 37' 07.89"	72° 53' 50.71"
TJ29	Magdalena Is.	January 2011	44° 36' 26.30"	72° 56' 39.25"
TJ202	Magdalena Is.	January 2012	44° 38' 14.53"	72° 55' 21.49"
TJ195	Magdalena Is.	January 2012	44° 38' 14.53"	72° 55' 21.49"
TJ200	Magdalena Is.	January 2012	44° 37' 41.04"	72° 56' 18.33"
TJ201	Magdalena Is.	February 2012	44° 37' 45.45"	72° 56' 03.87"
TJ196	Magdalena Is.	February 2012	44° 36' 59.27"	72° 57' 30.63"
TJ194	Magdalena Is.	February 2012	44° 35' 25.87"	72° 57' 27.33"
TJ197	Magdalena Is.	February 2012	44° 35' 25.89"	72° 57' 28.10"
TJ198	Magdalena Is.	January 2012	44° 37' 41.34"	72° 57' 09.19"
TJ199	Magdalena Is.	February 2012	44° 36' 59.27"	72° 57' 30.63"
VH2	Magdalena Is.	February 2009	44° 38' 13.17"	72° 55' 19.95"
NV22	Puerto Cisnes	No data	44° 44' 02.27"	72° 34' 53.60"
TJ3	Alto Río Cisnes	January 2011	44° 29' 54.28"	71° 19' 04.45"
TJ23	Alto Río Cisnes	January 2011	44° 30' 12.89"	71° 19' 18.37"
TJ11	Alto Río Cisnes	January 2011	44° 34' 23.22"	71° 24' 36.00"
TJ24	Alto Río Cisnes	January 2011	44° 30' 12.89"	71° 19' 18.37"
TJ6	Alto Río Cisnes	January 2011	44° 44' 02.27"	71° 19' 18.37"
VH189	Puerto Cisnes	November 2010	44° 44' 02.27"	72° 34' 53.60"
VH190	Puerto Cisnes	November 2010	44° 41' 47.50"	72° 31' 39.20"
VH191	Puerto Cisnes	November 2010	44° 40' 32.65"	72° 27' 55.51"
VH192	Puerto Cisnes	November 2010	44° 44' 20.73"	72° 35' 31.30"
VH193	Puerto Cisnes	November 2010	44° 45' 18.45"	72° 35' 49.87"
VH599	Puerto Cisnes	January 2013	44° 43' 15.84"	72° 33' 45.53"
VH693	Alto Cisnes	March 2013	44° 29' 52.82"	71° 19' 01.40"
TJ2	Puerto Cisnes	January 2011	44° 43' 53.37"	72° 34' 22.19"
TJ210	Puerto Cisnes	January 2012	44° 43' 26.80"	72° 41' 24.39"
TJ209	Puerto Cisnes	January 2012	44° 43' 26.05"	72° 41' 10.91"
TJ213	Puerto Cisnes	February 2012	44° 44' 43.43"	72° 42' 14.58"
TJ211	Puerto Cisnes	January 2012	44° 43' 26.05"	72° 41' 10.91"
TJ212	Puerto Cisnes	January 2012	44° 43' 26.80"	72° 41' 24.39"
TJ214	Puerto Cisnes	December 2012	44° 44' 43.43"	72° 42' 14.58"
VH617	Puerto Cisnes	January 2013	44° 42' 24.51"	72° 41' 57.63"
IN1	Navarino Is.	March 2011	54° 56' 26.83"	68° 19' 41.83"
IN2	Navarino Is.	February 2011	54° 55' 00.02"	68° 15' 00.00"
IN3	Navarino Is.	February 2011	54° 55' 00.02"	68° 15' 00.00"
IN4	Navarino Is.	March 2011	54° 55' 00.02"	68° 15' 00.00"
IN5	Navarino Is.	February 2011	54° 56' 08.96"	67° 34' 52.22"

IN6	Navarino Is.	February 2011	54° 55' 00.02"	68° 15' 00.00"
IN7	Navarino Is.	February 2011	54° 56' 26.83"	68° 19' 41.83"
IN8	Navarino Is.	February 2011	54° 56' 26.83"	68° 19' 41.83"
IN9	Navarino Is.	February 2011	54° 56' 26.83"	68° 19' 41.83"
IN10	Navarino Is.	February 2011	54° 54' 28.25"	68° 08' 45.75"
IN11	Navarino Is.	February 2011	54° 55' 00.02"	68° 15' 00.00"
IN12	Navarino Is.	February 2011	54° 56' 26.83"	68° 19' 41.83"
IN13	Navarino Is.	March 2011	54° 55' 00.02"	68° 15' 00.00"
IN14	Navarino Is.	March 2011	54° 56' 26.83"	68° 19' 41.83"
IN15	Navarino Is.	March 2011	54° 56' 26.83"	68° 19' 41.83"
IN16	Navarino Is.	March 2011	54° 56' 26.83"	68° 19' 41.83"
IN17	Navarino Is.	March 2011	54° 55' 00.00"	67° 54' 00.00"
IN18	Navarino Is.	February 2011	54° 55' 00.02"	68° 15' 00.00"
IN19	Navarino Is.	February 2011	54° 54' 28.25"	68° 08' 45.75"
IN20	Navarino Is.	February 2011	54° 56' 26.83"	68° 19' 41.83"

Table S2. Microsatellite loci used to genotype American mink (*Neovison vison*) populations in Chile. For each locus, microsatellite ID, fragment size and number of alleles found in our samples are listed.

Locus	Fragment size(bp)	Number of alleles
Mvi4031	299-307	5
Mvi57	106-120	7
Mvis099	326-358	11
Mvi219	180-192	6
Mvi114	87-117	9
Mvis022	294-304	5
Mvis020	178-200	6
Mvi111	105-125	6
Mvi232	160-172	6
Mvis075	131-147	9
Mvi4024	256-262	3

Table S3. Average values of F_{IS} following Weir and Cockerham (1984) for each locus and population.

Val: Valdivia, PNL: Panguipulli-Neltume-Liquiñe, PTSL: Petrohué-TSL, Mau: Maullín, Puy: Puyuhuapi, MI: Magdalena Island, ARC: Alto Río Cisnes, PC: Puerto Cisnes, NI: Navarino Island.

*Significant ($p < 0.05$), TSL: Todos los Santos Lake.

Locus	Geographic sites								
	Val	PNL	PTSL	Mau	Puy	MI	ARC	PC	NI
Mvi 4031	-0.330	-0.140	0.326*	0.210*	0.170	-0.180	-0.180	-0.160	-0.190
Mvi 57	0.380	-0.150	0.575*	0.621*	0.220	-0.710	0.493*	0.060	0.180
Mvis 099	0.450	0.437*	0.180	0.060	0.210	0.160	0.130*	0.227*	0.080
Mvi 219	0.370	0.266*	0.240	0.219*	0.460	0.170*	0.020	0.324*	0.532*
Mvi 114	0.400	0.668*	1.000*	0.715*	0.500	0.407*	0.500	0.228*	0.494*
Mvis 022	-	0.667*	0.450	0.601*	-0.250	0.596*	0.470	0.019*	-0.130
Mvis 020	1.000 *	0.775*	0.566*	0.530*	0.710	0.913*	0.455*	0.877*	0.460
Mvi 111	-0.670	0.150	0.520*	0.276*	-0.190	0.280	0.310	0.379*	0.280
Mvi 232	0.500	0.110	-0.100	-0.040	0.270	-0.080	0.060	0.150	0.287*
Mvis 075	0.250	0.682*	0.655*	0.428*	-0.220	0.170	0.429*	0.110	0.320
Mvi 4024	0.500	0.333*	0.130	0.260*	-	-	-	-	1.000*

Table S4. AMOVA comparing genetic variation of American mink (*Neovison vison*) representing 9 populations within three and two groups of Chile.

Source of variation	d.f.	Sum of squares	of Fixation index	Percentage variation	of P-value
K=3					
Among groups	2	88.75	0.16	15.60	= 0.003
Among populations between groups	6	43.37	0.09	7.29	< 0.001
Within populations	297	571.39	0.23	77.10	< 0.001
Total	305	703.51			
K=2					
Among groups	1	60.85	0.12	12.23	= 0.012
Among populations between groups	7	71.27	0.12	10.85	< 0.001
Within populations	297	571.39	0.23	76.93	< 0.001
Total	305	703.51			

Table S5. Presence of recent bottleneck in American mink (*Neovison vison*) populations in Chile.

Val: Valdivia, PNL: Panguipulli-Neltume-Liquiñe, PTSL: Petrohué-TSL, Mau: Maullín, Puy: Puyuhuapi, MI: Magdalena Island, ARC: Alto Río Cisnes, PC: Puerto Cisnes, NI: Navarino Island; NLS: normal L-shaped, S: shifted.

*Significant ($p < 0.05$), ** Marginally significant ($p \approx 0.05$), TSL: Todos los Santos Lake.

	Val	PNL	PTSL	Mau	Puy	MI	ARC	PC	NI
Sing Test									
100% SMM	0.195	0.529	0.212	0.256	0.051	0.398	0.610	0.279	0.349
70% SMM	0.227	0.459	0.288	0.502	0.030*	0.032*	0.390	0.250	0.614
Wilcoxon Test									
100% SMM	0.413	0.764	0.700	0.577	0.024*	0.431	0.492	0.365	0.898
70% SMM	0.278	0.898	0.083**	0.519	0.009*	0.001*	0.032*	0.083**	0.320
Mode shift	S	NLS	NLS	NLS	S	NLS	S	S	NLS