

An integrated approach for assessing translocation as an effective conservation tool for Hawaiian monk seals

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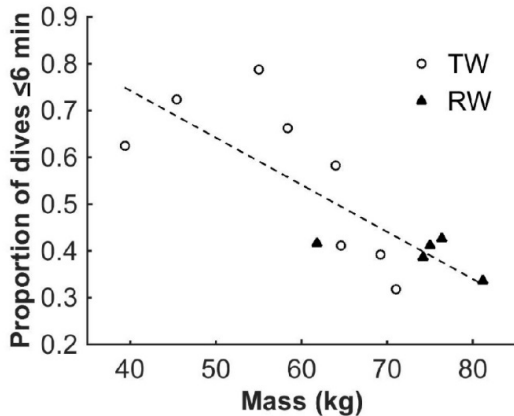


Fig. S1. Relationship between mean proportion of dives ≤ 6 min and mass ($r^2 = 0.625$, $y = -0.010x + 1.145$) for translocated weanling (TW; open circles) and resident weanling (RW; closed triangles) seals

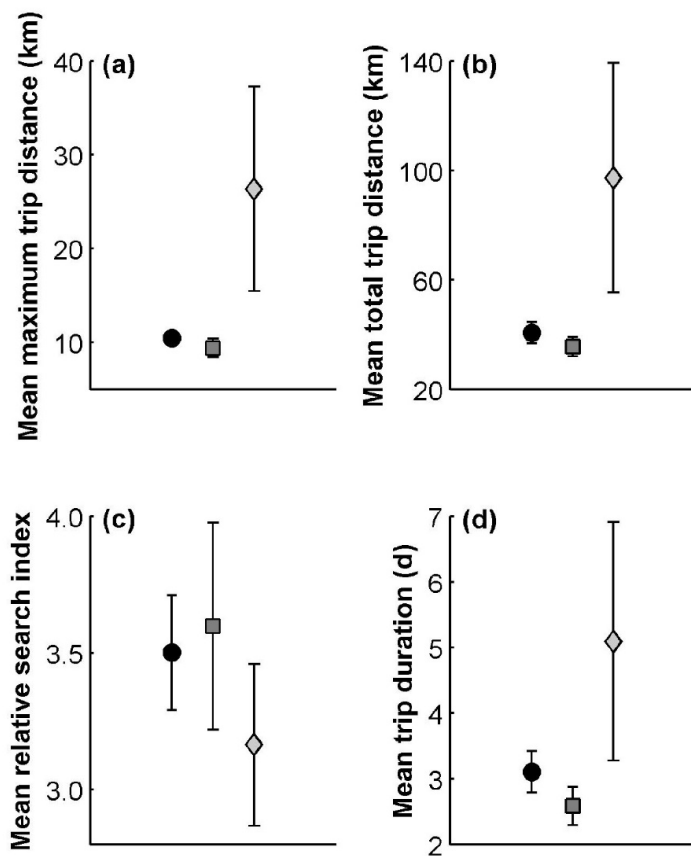


Fig. S2. Mean \pm SE for (a) maximum trip distance, (b) total trip distance, (c) relative search index, and (d) trip duration for translocated weanling (black circles), resident weanling (grey squares), and resident adult (white diamonds) seals

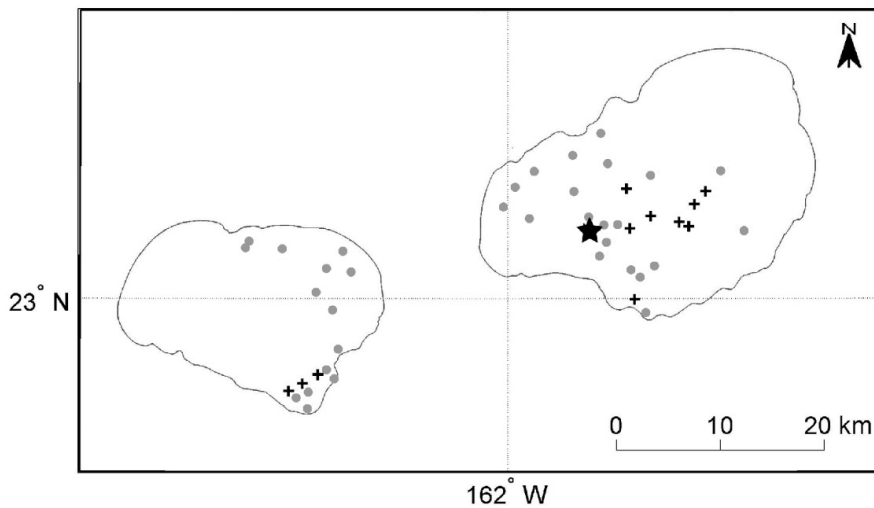


Fig. S3. Induration at 45 sites around Nihoa Island (black star) was categorized as hard-bottom (grey circles, $n = 34$) or unconsolidated (black crosses, $n = 11$) sediment. The 200 m isobath is indicated by the grey lines

Table S1. Summary of capture, satellite tracking, and re-sight data (through 2015) for resident and translocated seals. Only weanling (W) seals were weighed, and the single subadult (SA) seal was grouped with resident adult (A) seals for all analyses. Unless otherwise noted, all seals were re-sighted at Nihoa Island. AG: axillary girth; DSL: dorsal standard length

ID	Age class	Sex	Capture date	AG (cm)	DSL (cm)	Mass (kg)	Date of last transmission	Tracking duration (d)	Last sighting date
<i>Translocated</i>									
YW07	W	F	08/28/08	102.0	134.0	58.4	04/28/09	189	06/16/12
YW11	W	F	08/29/08	110.0	137.0	72.8	11/16/08	26	–
YW19	W	M	08/29/08	109.0	127.0	55.0	02/21/09	123	–
YW24	W	F	08/28/08	102.0	131.0	64.0	05/07/09	202	09/23/15 ^c
YW27	W	M	08/28/08	101.5	135.5	59.8	09/04/08	4 ^a	–
YW29	W	F	08/28/08	120.0	141.0	87.4	10/30/08	6	08/19/10
YA08	W	F	08/10/09	113.5	132.0	64.6	05/29/10	247	06/05/15
YA10	W	M	08/11/09	114.5	135.5	69.2	01/26/10	116	08/04/12
YA20	W	M	08/14/09	89.0	120.0	39.4	12/13/09	91	–
YA22	W	F	08/17/09	105.0	126.0	55.0	09/07/09	6 ^a	–
YA26	W	F	08/11/09	111.0	134.0	71.0	02/02/10	104	–
YA42	W	M	08/13/09	97.0	120.5	45.4	05/13/10	229	10/01/14
<i>Resident</i>									
RW62	W	F	09/10/08	119.0	136.0	74.2	04/03/09	152	09/26/14
RW64	W	M	09/10/08	124.5	136.0	81.2	03/10/09	115	06/09/15
RW66	W	F	09/10/08	80.0	113.5	35.6	10/14/08	34 ^a	–
RW68	W	M	09/10/08	117.0	125.5	61.8	05/31/09	226	08/04/12
RA50	W	M	09/01/09	116.0	129.5	77.4	11/04/09	64 ^a	09/19/13 ^c
RA52	W	M	09/01/09	119.0	131.0	75.0	12/26/09	44	06/07/15
RA54	W	M	09/01/09	115.0	128.0	76.4	04/13/10	132	06/09/15
RA58	W	M	09/04/09	105.0	120.5	61.8	09/28/09	24 ^a	06/02/10
R2BK	A	M	09/10/08	173.0	196.0	–	10/29/08	47	09/25/14 ^b
R2BU	A	M	09/11/08	161.0	205.0	–	12/09/08	89	06/16/12 ^b
R2BW	SA	F	09/11/08	107.0	156.6	–	09/18/08	6	06/06/15 ^b
R2BY	A	M	09/11/08	122.0	189.0	–	11/28/08	77	06/09/15
R5EE	A	F	09/01/09	141.5	210.0	–	05/01/10	241	09/13/15
R5EG	A	F	09/02/09	126.5	201.0	–	12/14/09	102	08/20/15 ^c
R5EI	A	M	09/02/09	139.5	194.5	–	11/26/09	84	06/07/15
R5EM	A	M	09/04/09	149.5	205.0	–	10/22/09	47	–
R5EP	A	F	09/04/09	130.5	186.5	–	09/25/09	20	06/07/15

^aSatellite transmissions ceased before end of post-weaning fast

^bNot sighted 2009–2011 but sighted 2012–2015

^cYW24 last sighted at French Frigate Shoals (FFS); RA50 sighted on Oahu in 2009 and last sighted on Molokai in 2013; R5EG sighted with pup at FFS in 2011–2013 and 2015

Table S2. Summary of camera drop sites with survey date and drift durations and distances. Latitude and longitude are the start drift coordinates. Sites 1 to 28 were located on the Nihoa Island (NIH) terrace, and Sites 29 to 45 were on the bank 9 km to the west of NIH. A drift distance could not be calculated for Site 15 because coordinates were not recorded at the end of the drift

Site	Date	Duration (min:s)	Distance (m)	Latitude	Longitude	Depth (m)
1	17 Nov 2010	5:00	156.4	23.071	-161.924	34.0
2	17 Nov 2010	5:00	149.7	23.063	-161.910	32.3
3	17 Nov 2010	5:00	500.8	23.064	-161.897	37.0
4	19 Aug 2011	1:00	35.8	23.095	-161.889	45.8
5	20 Apr 2011	1:43	10.9	23.107	-161.866	46.2
6	20 Apr 2011	4:15	22.8	23.117	-161.906	38.8
7	20 Apr 2011	1:42	25.3	23.143	-161.912	70.7
8	20 Apr 2011	3:20	26.2	23.124	-161.939	51.0
9	20 Apr 2011	2:08	18.0	23.110	-161.975	52.8
10	20 Apr 2011	2:00	5.4	23.097	-161.993	60.8
11	20 Apr 2011	2:28	5.4	23.079	-162.004	60.1
12	20 Apr 2011	1:43	23.4	23.070	-161.980	45.6
13	20 Apr 2011	1:57	5.8	23.093	-161.938	41.5
14	17 Nov 2010	5:00	306.3	23.048	-161.907	34.8
15	18 Nov 2010	5:00	–	23.036	-161.914	40.5
16	20 Apr 2011	4:59	129.8	23.000	-161.881	51.0
17	20 Apr 2011	2:50	53.4	22.987	-161.871	67.2
18	18 Nov 2010	5:00	79.4	23.018	-161.876	51.2
19	18 Nov 2010	5:00	76.8	23.025	-161.884	51.2
20	18 Nov 2010	5:00	81.7	23.028	-161.863	52.3
21	18 Nov 2010	5:00	28.9	23.063	-161.830	55.3
22	18 Nov 2010	5:00	189.9	23.067	-161.839	56.7
23	18 Nov 2010	5:00	236.2	23.082	-161.825	54.1
24	18 Nov 2010	5:00	241.2	23.093	-161.815	54.9
25	18 Nov 2010	3:00	185.2	23.071	-161.866	53.6
26	19 Aug 2011	1:46	59.5	23.061	-161.886	44.6
27	20 Apr 2011	2:49	63.7	23.059	-161.779	50.1
28	20 Apr 2011	2:42	47.9	23.111	-161.800	51.4
29	19 Aug 2011	1:48	62.1	23.023	-162.146	38.1
30	19 Aug 2011	1:00	32.7	23.041	-162.154	69.0
31	19 Aug 2011	1:00	40.4	23.026	-162.169	31.6
32	19 Aug 2011	1:00	44.3	23.006	-162.179	31.0
33	19 Aug 2011	1:05	48.2	22.990	-162.164	29.2
34	20 Apr 2011	1:36	8.7	22.956	-162.158	50.2
35	20 Apr 2011	1:32	37.7	22.938	-162.169	53.9
36	20 Apr 2011	1:22	29.1	22.934	-162.177	50.3
37	20 Apr 2011	2:34	56.4	22.930	-162.162	94.2
38	20 Apr 2011	1:13	35.0	22.905	-162.187	66.2
39	20 Apr 2011	1:21	23.3	22.919	-162.186	51.3
40	20 Apr 2011	1:25	44.3	22.926	-162.192	48.5
41	20 Apr 2011	1:46	44.7	22.913	-162.197	50.8
42	20 Apr 2011	1:21	46.3	22.920	-162.205	46.0
43	19 Aug 2011	1:00	34.3	23.050	-162.242	65.3
44	19 Aug 2011	1:00	34.3	23.044	-162.245	36.8
45	19 Apr 2011	2:21	88.5	23.042	-162.211	33.6

Table S3. Prevalence of infectious agents or antibodies to them. Titers below threshold values were reported as negative. TW: translocated weanling; RW: resident weanling; RA: resident adult; CF: complement fixation, MAT: microscopic agglutination test, ELISA: enzyme-linked immunosorbent assay; FPA: fluorescence polarization assay, VN: viral neutralization; IFA-IgG: immunofluorescence assay-serum immunoglobulin, Ag: antigen test, RT-PCR: reverse-transcription polymerase chain reaction, VI: viral isolation. NVSL: National Veterinary Service Laboratories, Ames, IO; CFIA: Canadian Food Inspection Agency, Ottawa, Canada; WADDL: Washington Animal Disease Diagnostic Lab, Pullman, WA; ADL: Athens Diagnostic Laboratory, Athens, GA; IDEXX: IDEXX Laboratories, Davis, CA; NWHC: National Wildlife Health Center, Madison, WI; USDA: U.S. Department of Agriculture, Beltsville, MD

	TW	RW	RA	Test (titer threshold)	Lab
<i>Chlamydomphila abortus</i>	5/12	2/4 ^a	8/9 ^b	CF (<1:10)	NVSL
<i>Leptospira borgpetersenii</i> serovar Ballum	0/12	0/4	1/9 ^c	MAT (<1:100)	NVSL
<i>Brucella</i> spp.	0/12	0/4	0/9	ELISA, FPA	CFIA
Canine adenovirus	0/11	0/4	0/9	VN (<1:4)	WADDL
Canine distemper virus	0/12	0/4	0/9	VN (<1:8)	ADL
Canine parvovirus	0/5	0/4	0/9	IFA-IgG (<1:25)	WADDL
Cetacean morbillivirus	0/12	0/4	0/9	VN (<1:8)	ADL
<i>Dirofilaria immitis</i>	0/12	0/4	0/9	Ag	IDEXX
Feline calicivirus	0/11	0/4	0/9	VN (<1:4)	WADDL
Influenza A	0/12	0/4	0/9	RT-PCR, VI, Ag	NWHC
Influenza B	0/6	-	0/4	Ag	NWHC
<i>Leptospira</i> spp. ^d	0/12	0/4	0/9	MAT (<1:100)	NVSL
Phocine distemper virus	0/12	0/4	0/9	VN (<1:8)	ADL
Phocine herpesvirus-1	0/12	0/4	0/9	VN (<1:8)	ADL
<i>Toxoplasma gondii</i>	0/12	0/4	0/9	MAT (<25)	USDA

^a+2 non-specific

^b+1 anti-complementary

^cTiter 1:100

^dSerovars Australis, Autumnalis, Bataviae, Bratislava, Canicola, Grippotyphosa, Hardjo, Hebdomadis, Icterohaemorrhagiae, Pomona, Pyrogenes, Sejroe, Swajizak, Tarassovi

Table S4. Prevalence (%) of enteric bacteria. TW: translocated weanling (n = 12); RW: resident weanling (n = 4); RA: resident adult (n = 9)

	TW	RW	RA
<i>Escherichia coli</i>	100	100	67
<i>Clostridium perfringens</i>	83	25	44
<i>Salmonella</i> spp.	33 ^a	25 ^b	0
<i>Vibrio</i> spp. ^c	0	75	44
<i>Campylobacter</i> sp. ^d	8	0	0
<i>Clostridium difficile</i>	8	0	0
<i>Edwardsiella tarda</i>	0	0	22
<i>Aeromonas hydrophila</i>	0	0	11

^aIncludes *S. muenster* and *cerro*

^b*S. arizonae*

^cIncludes *V. alginolyticus* and *parahaemolyticus*

^dNot *C. jejuni*

Table S5. Generalized linear model results comparing minimum first-year survival of 3 weanling seal groups (translocated seals and non-translocated seals from the donor and recipient sites) for the subset of weanling seals with axillary girth (AG) \geq 97 cm (smallest surviving weanling seal). Only the top 2 models and null model (intercept term only) are shown. Change in Akaike information criterion for small sample sizes (Δ AIC_C) is relative to the best fitting model (least AIC_C). df: degrees of freedom

	AIC _C	Δ AIC _C	df
AG	69.609		45
AG + group	71.172	1.563	43
Null model	72.473	2.864	46