

Using tri-axial accelerometers to identify wild polar bear behaviors

A.M. Pagano*, K.D. Rode, A. Cutting, M.A. Owen, S. Jensen, J.V. Ware, C.T. Robbins, G.M. Durner, T.C. Atwood, M.E. Obbard, K.R. Middel, G.W. Thiemann, T.M. Williams

*Corresponding author: apagano@usgs.gov

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Table S1. Video recording schedules used by GPS-equipped video camera collars deployed on polar bears on the sea ice of the southern Beaufort Sea and on land on Akimiski Island, Nunavut.

Year – Location	Time of Day ^a	Video recording duty cycle
2014 – Sea Ice	8 am – 1 pm	1 min : 2 min
2014 – Sea Ice	1 pm – 9 pm	30 sec : 2 min
2015 – Sea Ice	8 am – 1 pm	1 min : 2 min
2015 – Sea Ice	1 pm – 10 pm	30 sec : 2 min
2015 – Sea Ice ^b	8 am – 6 pm	1 min : 2min
2015 – Sea Ice ^b	6 pm – 10 pm	30 sec : 2 min
2015 – Land	7 am – 11 am	Continuous
2015 – Land	11 am – 8 pm	1 min : 2 min

^a Times for sea ice deployments are Alaska Daylight Time. Times for on land deployments are Eastern Daylight Time.

^b Two collars in 2015 were set to record using the following duty cycle.

Table S2. Performance of a random forest model testing the effect of sampling distributions on the predictive ability of accelerometer data in discriminating the behaviors of bears on the sea ice as verified by video data.

Behavior	MCC ^a	Precision	Recall	F-measure
Uneven distribution				
Rest	0.973	0.992	0.997	0.994
Walk	0.971	0.964	0.989	0.976
Swim	0.887	0.957	0.823	0.885
Eat	0.674	0.677	0.677	0.677
Run	0.709	0.835	0.604	0.701
Pounce	0.700	0.833	0.588	0.690
Groom	0.417	0.658	0.266	0.379
Dig	0.532	0.712	0.400	0.513
Head Shake	0.818	0.839	0.798	0.818
Roll	0.754	0.821	0.696	0.753
Sub-sampled distribution				
Rest	0.954	0.999	0.983	0.991
Walk	0.970	0.988	0.962	0.975
Swim	0.765	0.621	0.943	0.749
Eat	0.516	0.333	0.807	0.472
Run	0.474	0.294	0.769	0.425
Pounce	0.807	0.923	0.706	0.800
Groom	0.301	0.137	0.672	0.227
Dig	0.487	0.483	0.493	0.488
Head Shake	0.734	0.598	0.902	0.719
Roll	0.533	0.348	0.820	0.489

Behavior	MCC^a	Precision	Recall	F-measure
Balanced distribution				
Rest	0.855	1.000	0.931	0.964
Walk	0.918	0.990	0.876	0.929
Swim	0.579	0.350	0.960	0.513
Eat	0.539	0.495	0.595	0.541
Run	0.376	0.168	0.854	0.281
Groom	0.206	0.059	0.781	0.110
Dig	0.426	0.294	0.626	0.400
Head Shake	0.446	0.214	0.932	0.348
Roll	0.584	0.419	0.821	0.555

^a Matthews' correlation coefficient

Table S3. Performance of a random forest model using accelerometer data from captive polar bears to predict behaviors from bears on the sea ice as verified by video data.

Behavior	MCC^a	Precision	Recall	F-measure
Rest	0.914	0.996	0.966	0.981
Walk	0.958	0.942	0.989	0.965
Swim	0.534	0.517	0.555	0.535
Eat	0.454	0.385	0.550	0.453
Pounce	0.342	0.133	0.882	0.231
Groom	0.158	0.078	0.361	0.128
Dig	0.140	0.320	0.063	0.105
Head Shake	0.713	0.783	0.650	0.710
Roll	0.435	0.928	0.205	0.336

^a Matthews' correlation coefficient

Table S4. Performance of a random forest model using accelerometer data from captive brown bears to predict behaviors from bears on the sea ice as verified by video data.

Behavior	MCC^a	Precision	Recall	F-measure
Rest	0.639	0.894	0.988	0.939
Walk	0.605	0.860	0.498	0.631
Eat	0.104	0.138	0.089	0.108
Groom	0.018	0.087	0.004	0.008
Head Shake	0.794	0.850	0.743	0.793

^a Matthews' correlation coefficient

Table S5. Mean (standard deviation) static acceleration (*g*) in the surge (X), heave (Y), and sway (Z) directions, and overall dynamic acceleration (ODBA (*g*)) derived from accelerometers deployed on 3 captive polar bears, 2 captive brown bears, 5 polar bears on the sea ice, and 2 polar bears on land.

Behavior	Captive Polar Bears				Captive Brown Bears				Wild Polar Bears–Sea Ice				Wild Polar Bears–Land			
	static X	static Y	static Z	ODB A	static X	static Y	static Z	ODB A	static X	static Y	static Z	ODB A	static X	static Y	static Z	ODB A
Rest	-0.06 (0.25)	-0.74 (0.30)	-0.06 (0.55)	0.04 (0.06)	0.13 (0.20)	-0.36 (0.61)	0.26 (0.60)	0.01 (0.03)	-0.07 (0.29)	-0.51 (0.38)	-0.25 (0.69)	0.02 (0.07)	-0.22 (0.29)	-0.58 (0.34)	-0.09 (0.65)	0.01 (0.03)
Walk	-0.10 (0.19)	-0.95 (0.06)	0.10 (0.20)	0.26 (0.08)	0.24 (0.14)	-0.90 (0.18)	0.21 (0.08)	0.32 (0.09)	-0.03 (0.17)	-0.99 (0.06)	-0.14 (0.22)	0.45 (0.14)	-0.09 (0.14)	-0.99 (0.04)	-0.13 (0.12)	0.29 (0.07)
Swim	-0.11 (0.43)	-0.51 (0.36)	-0.01 (0.61)	0.32 (0.21)					-0.10 (0.50)	-0.56 (0.36)	-0.37 (0.42)	0.40 (0.28)				
Eat	-0.26 (0.45)	-0.80 (0.15)	0.06 (0.24)	0.26 (0.09)	0.59 (0.18)	-0.76 (0.09)	0.16 (0.16)	0.30 (0.14)	-0.40 (0.41)	-0.76 (0.15)	-0.07 (0.25)	0.36 (0.14)	-0.49 (0.12)	-0.87 (0.08)	-0.11 (0.07)	0.17 (0.07)
Run									0.02 (0.15)	-0.91 (0.13)	-0.10 (0.22)	1.42 (0.63)				
Pounce	-0.73 (0.34)	-0.46 (0.13)	0.16 (0.21)	1.52 (0.31)					-0.45 (0.26)	-0.55 (0.19)	-0.11 (0.20)	1.51 (0.44)				
Groom	-0.50 (0.34)	-0.67 (0.27)	0.10 (0.31)	0.19 (0.23)	0.42 (0.31)	-0.74 (0.29)	0.27 (0.16)	0.09 (0.08)	-0.26 (0.38)	-0.71 (0.30)	0.00 (0.45)	0.21 (0.12)	-0.45 (0.20)	-0.77 (0.14)	-0.33 (0.24)	0.08 (0.03)
Dig	-0.64 (0.17)	-0.71 (0.13)	-0.07 (0.20)	0.31 (0.08)					-0.48 (0.39)	-0.70 (0.20)	-0.09 (0.22)	0.45 (0.22)				
Head Shake	0.02 (0.29)	-0.70 (0.26)	0.58 (0.37)	2.81 (0.67)	-0.09 (0.19)	-0.73 (0.23)	0.48 (0.20)	3.16 (0.66)	-0.26 (0.37)	-0.61 (0.34)	0.36 (0.46)	2.24 (0.79)	-0.09 (0.30)	-0.91 (0.14)	0.01 (0.28)	1.85 (0.87)
Roll	-0.18 (0.21)	0.35 (0.37)	0.35 (0.60)	1.19 (0.62)					-0.09 (0.37)	-0.20 (0.47)	0.09 (0.66)	0.98 (0.58)				

Table S6. Performance of a random forest model using accelerometer data from polar bears on land to predict behaviors from bears on land as verified by video data.

Behavior	MCC ^a	Precision	Recall	F-measure
Rest	0.979	0.998	0.999	0.999
Walk	0.957	0.950	0.966	0.958
Eat	0.950	0.947	0.956	0.951
Groom	0.742	0.894	0.618	0.731
Head Shake	0.845	1.000	0.714	0.833

^a Matthews' correlation coefficient

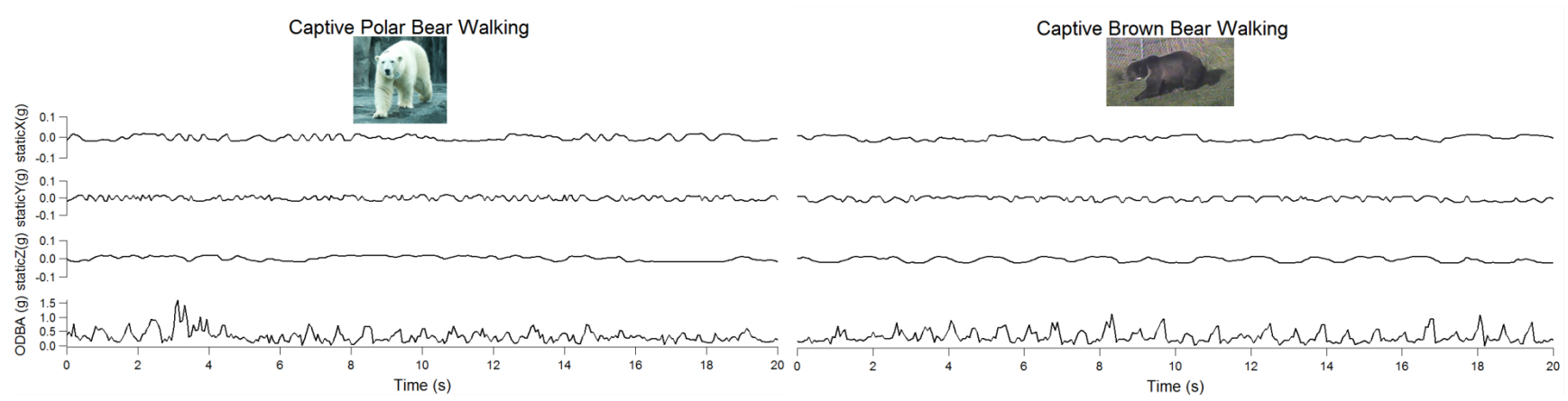


Fig. S1. Accelerometer signatures of static acceleration in the surge (X), heave (Y), and sway (Z) directions and overall dynamic acceleration (ODBA) while walking from a captive adult female polar bear (left) compared to a captive adult female brown bear (right).