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Memo to: Mike Armstrong, Andrew King and Robyn Niver

From: Mark Ford *Mark*

Subject: Kaleidoscope 4.2.0 Subsequent Test on Expanded Data

Below are the returned MLE *p*-values on the estimates of presence or absence of bat community composition datasets (also with runs of northern long-eared bats *Myotis septentrionalis* removed or Indiana bats *Myotis sodalis* removed) for the -1 sensitivity and 0 neutral settings. Following discussions with you, our testing protocol was changed to examine software packages against an expanded dataset with more bat species, bat passes and a larger variety of noise files, with testing performed over ten independent and randomly generated test libraries. At the -1 setting, Kaleidoscope 4.2.0 performed well with data containing both northern long-eared bats and Indiana bats as well as runs with either species removed (Table 1). Across these tests, no false negatives were returned. However, at $p < 0.1$ to $p < 0.05$ (orange), two of 10 runs produced false positives of Indiana bats and at $p < 0.05$ (red), two of 10 runs also produced false positives. With a 100% correct assessment of northern long-eared bats (10/10 runs) and 60% correct assessment of Indiana bats (6/10 runs) erring only for false positives, this version of Kaleidoscope would be acceptable for use per the U.S. Fish and Wildlife Service standard of identifying a northern long-eared bat or Indiana bat when in fact present. Following this test, we then tested the software at the 0 setting (Table 2). Per the U.S. Fish and Wildlife Service standards, this setting returned completely correct results for northern long-eared and Indiana bats (10/10 runs), though an examination of user's accuracy (specificity; Table 3) would indicate substantial misclassification occurring at the individual file level, though that does negate the desired outcome for U.S. Fish and Wildlife Service purposes for automated identification. Our recommendation at this juncture would be for the U.S. Fish and Wildlife Service to emphasize use of Kaleidoscope 4.2.0 on the 0 setting. We would also note the improvement in accurately determining eastern small-footed bat (*Myotis leibii*) presence and the continued issues with determining Southeastern myotis (*Myotis austroriparius*) and silver-haired bat (*Lasionycteris noctivagans*) presence over previous versions of the software tested. We intend to additionally test the +1 setting in the future.

cc: A. Silvis

Table 1. Kaleidoscope 4.2.0 MLE *p*-values at -1 setting in expanded random draw (10) datasets. Results are shown for each test for the full library (all), the library without *Myotis septentrionalis* (no MYSE), and the library without *M. sodalis* (no MYSO). Cells highlighted in green show MLE values correctly indicating species presence or absence of *M. septentrionalis* or *M. sodalis* in the test library at MLE < 0.05. Cells highlighted in orange indicate incorrect assessment of presence or absence at MLE > 0.05 and < 0.10. Cells highlighted in red indicate incorrect assessment of presence or absence at MLE < 0.05.

KALEIDOSCOPE 4.2.0														
Bats of North America 4.2.0 S/A:-1			EPFU	LABO	LACI	LANO	MYAU	MYGR	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
	test 1													
		all	0.00	0.00	0.00	0.46	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.38	1.00	0.00	0.01	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.45	1.00	0.00	0.00	0.00	0.00	0.74	0.00	0.00
	test 2													
		all	0.00	0.00	0.00	0.25	0.97	0.00	0.00	0.00	0.00	0.00	0.14	0.00
		no MYSE	0.00	0.00	0.00	0.27	0.58	0.00	0.00	0.00	1.00	0.00	0.27	0.00
		no MYSO	0.00	0.00	0.00	0.25	0.97	0.00	0.00	0.00	0.00	0.02	0.14	0.00
	test 3													
		all	0.00	0.00	0.00	0.41	1.00	0.00	0.01	0.00	0.00	0.00	0.25	0.00
		no MYSE	0.00	0.00	0.00	0.32	1.00	0.00	0.06	0.00	1.00	0.00	0.14	0.00
		no MYSO	0.00	0.00	0.00	0.40	1.00	0.00	0.00	0.00	0.00	0.42	0.19	0.00
	test 4													
		all	0.00	0.00	0.00	0.56	0.97	0.00	0.00	0.00	0.00	0.00	0.01	0.00
		no MYSE	0.00	0.00	0.00	0.54	0.64	0.00	0.00	0.00	1.00	0.00	0.02	0.00
		no MYSO	0.00	0.00	0.00	0.54	0.94	0.00	0.00	0.00	0.00	0.09	0.02	0.00
	test 5													
		all	0.00	0.00	0.00	0.18	1.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
		no MYSE	0.00	0.00	0.00	0.19	1.00	0.00	0.00	0.00	1.00	0.00	0.08	0.00
		no MYSO	0.00	0.00	0.00	0.18	1.00	0.00	0.00	0.00	0.00	0.29	0.08	0.00
	test 6													
		all	0.00	0.00	0.00	0.59	0.61	0.00	0.01	0.00	0.00	0.00	0.01	0.00
		no MYSE	0.00	0.00	0.00	0.55	0.45	0.00	0.04	0.00	1.00	0.00	0.01	0.00
		no MYSO	0.00	0.00	0.00	0.59	0.63	0.00	0.00	0.00	0.00	0.09	0.01	0.00
	test 7													
		all	0.00	0.00	0.00	0.10	0.86	0.00	0.13	0.00	0.00	0.00	0.90	0.00
		no MYSE	0.00	0.00	0.00	0.05	0.90	0.00	0.09	0.00	1.00	0.00	0.86	0.00
		no MYSO	0.00	0.00	0.00	0.10	0.92	0.00	0.09	0.00	0.00	0.12	0.85	0.00
	test 8													
		all	0.00	0.00	0.00	0.22	1.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00
		no MYSE	0.00	0.00	0.00	0.22	1.00	0.00	0.00	0.00	1.00	0.00	0.12	0.00
		no MYSO	0.00	0.00	0.00	0.22	1.00	0.00	0.01	0.00	0.00	0.18	0.09	0.00
	test 9													
		all	0.00	0.00	0.00	0.42	1.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00
		no MYSE	0.00	0.00	0.00	0.43	1.00	0.00	0.00	0.00	1.00	0.00	0.22	0.00
		no MYSO	0.00	0.00	0.00	0.41	1.00	0.00	0.00	0.00	0.00	0.02	0.14	0.00
	test 10													
		all	0.00	0.00	0.00	0.82	1.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
		no MYSE	0.00	0.00	0.00	0.82	1.00	0.00	0.00	0.00	1.00	0.00	0.01	0.00
		no MYSO	0.00	0.00	0.00	0.82	1.00	0.00	0.00	0.00	0.00	0.21	0.01	0.00

Table 2. Kaleidoscope 4.2.0 MLE *p*-values at 0 setting in expanded random draw (10) datasets. Results are shown for each test for the full library (all), the library without *Myotis septentrionalis* (no MYSE), and the library without *M. sodalist* (no MYSO). Cells highlighted in green show MLE values correctly indicating species presence or absence of *M. septentrionalis* or *M. sodalis* in the test library at MLE < 0.05. Cells highlighted in orange indicate incorrect assessment of presence or absence at MLE > 0.05 and < 0.10. Cells highlighted in red indicate incorrect assessment of presence or absence at MLE < 0.05.

KALEIDOSCOPE 4.2.0														
Bats of North America 4.2.0 S/A: 0			EPFU	LABO	LACI	LANO	MYAU	MYGR	MYLE	MYLU	MYSE	MYSO	NYHU	PESU
	test 1													
		all	0.00	0.00	0.00	0.04	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.04	0.12	0.00	0.00	0.00	0.00	0.95	0.00	0.00
	test 2													
		all	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00
	test 3													
		all	0.00	0.00	0.00	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.09	0.02	0.00	0.00	0.00	0.00	1.00	0.00	0.00
	test 4													
		all	0.00	0.00	0.00	0.09	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.09	0.03	0.00	0.00	0.00	0.00	1.00	0.00	0.00
	test 5													
		all	0.00	0.00	0.00	0.02	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.02	0.17	0.00	0.00	0.00	0.00	0.70	0.00	0.00
	test 6													
		all	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00
	test 7													
		all	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.01	0.00
		no MYSE	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	1.00	0.00	0.01	0.00
		no MYSO	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.70	0.01	0.00
	test 8													
		all	0.00	0.00	0.00	0.06	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.06	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.06	1.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00
	test 9													
		all	0.00	0.00	0.00	0.12	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.10	0.01	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.12	0.19	0.00	0.00	0.00	0.00	0.44	0.00	0.00
	test 10													
		all	0.00	0.00	0.00	0.19	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		no MYSE	0.00	0.00	0.00	0.19	0.01	0.00	0.00	0.00	1.00	0.00	0.00	0.00
		no MYSO	0.00	0.00	0.00	0.19	0.58	0.00	0.00	0.00	0.00	0.70	0.00	0.00

Table 3. Mean Kaleidoscope 4.2.0 user's file-level classification rates (specificity) at 0 setting in expanded random draw (10) datasets.

Species	% correct	SD	Most common mis-ID	Most common mis-ID (species only)
EPFU	70	30	LANO	LANO
LABO	70	43	NYHU	NYHU
LACI	15	11	Noise	EPFU
LANO	28	26	Noise	EPFU
MYAU	0	0	MYSE	MYSE
MYGR	57	50	MYLE	MYLE
MYLE	95	77	MYSO	MYSO
MYLU	82	46	MYSO	MYSO
MYSE	100	0	-	-
MYSO	64	62	MYLU	MYLU
NYHU	41	29	LABO	LABO
PESU	81	55	Feeding buzz	LABO