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Endangered Species
Section 6 Grant Proposal

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Molecular Diversity among Massasauga Rattlesnakes: Nuclear Intron Analyses

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1 May 2006 – 31 May 2007

Missouri Department of Conservation

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Date Prepared:
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TITLE: **Molecular Diversity among Massasauga Rattlesnakes: Nuclear Intron Analyses**

EXPECTED DURATION: 1 May 2006 – 30 May 2007

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I. NEED

In 1999, the Eastern Massasauga Rattlesnake (*Sistrurus c. catenatus*; a subspecies) was designated by USFWS as a candidate for listing as a Federal Threatened or Endangered Species. In addition, a USFWS Candidate Status Review considered the possibility that extant populations of Massasauga rattlesnakes in Missouri were potentially of the eastern rather than western (i.e., *S. c. tergeminus*) subspecies. At that time, data were insufficient to taxonomically assign the Missouri specimens to subspecies, but preliminary results in 2004 suggest that Missouri extant populations belong to western rather than eastern subspecies. However, the question arose at a workshop ("Status, Threats, and Research/ Survey Needs of the Massasauga Rattlesnake with Emphasis on Midwestern Populations," 26 March 2005, Squaw Creek NWR, MO) regarding potential hybrid status of Missouri populations. Indeed, this remains an unresolved issue. MtDNA cannot effectively evaluate this question due to its maternal mode of inheritance (i.e., individuals receive mtDNA only from their mother). Thus, a Missouri specimen could have a mother belonging to the western subspecies but with the father being from the eastern subspecies. According to its mtDNA, the Missouri specimen would be erroneously classified as the western subspecies, given its mother. Because of this problem (and others), there is a growing realization that to verify management and/or taxonomic decisions, mtDNA must be complemented with a second, independent molecular marker. A reasonable choice in this regard would be one from the nuclear genome. Introns, which are non-coding segments of DNA that interrupt coding exons, are a likely choice. These markers can now be successfully amplified across divergent taxa, and they are being extensively used to corroborate or refute taxonomic decisions and to clarify questions of hybridity. By re-analyzing genetic samples using introns, information on hybridization between lineages will further address the taxonomic issues of the Massasauga Rattlesnake complex in North American, especially Missouri.

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II. RECOVERY STATUS/PRIORITY

Eastern Massasauga Rattlesnake is found in 10 states (MO, IA, MN WI, IL, IN, MI, OH, PA, and NY), and is listed as a federal candidate. The federal recovery priority for this rattlesnake is nine. In Missouri, it is listed as state endangered.

III. PROJECT OBJECTIVES

1) Apply nuclear introns to complement our ongoing mtDNA analyses of *Sistrurus* to verify the lineage between eastern and western subspecies.

This will include:

- research and development to design intron primers (one locus)
- optimize primer conditions for automated DNA sequencer
- application of markers to current *Sistrurus* samples (150 specimens).

IV. EXPECTED RESULTS OR BENEFITS

The objectives outlined in this project will further address taxonomic issues pertaining to the Massasauga Rattlesnake complex. This project will verify if hybridization between lineages (e.g., between eastern and western Massasauga rattlesnakes) has occurred, and will utilize molecular markers that provide greater statistical and scientific confidence with regard to nomenclatural changes. The results of this study could have major implications regarding the future listing of Eastern Massasauga Rattlesnake throughout its range and also influence the taxonomic status and listing within certain states.

V. PROJECT APPROACH

The Molecular Ecology Laboratory in the Department of Fish, Wildlife, and Conservation Biology at Colorado State University (CSU) contains 1800 sq. ft. of laboratory space dedicated to molecular genetics work, and offers sufficient work space for 15 people. Major equipment includes autoclave, fume hood, 3 refrigerators, 5 freezers (-20 C, -80 C), 4 PCR machines, 3 benchtop micro-centrifuges, 2 water baths, 2 dry baths, 1 refrigerated micro-centrifuge, speed-vac, electrophoresis gel rigs/ power-supplies, UV transluminator/ imaging system, micro-pipetters, vacuum system, RO and ultra-pure water purification systems. Key equipment for sequence and fragment analysis is the ABI Prism 3100 Genetic Analyzer.

Approximately 158 samples from the *Sistrurus* complex (*S. miliarius, S. c. catenatus, S. c. tergeminus,* and *S. c. edwardsii*) have been collected and analyzed using mtDNA (see Appendix). To further examine hybridization within the *Sistrurus* complex, nuclear intron primers will be researched and developed. Once these primers are developed and optimized, they will be applied to the current *Sistrurus* samples. In addition, blood samples (< ½ cc) from any additional animals collected opportunistically on private lands in Missouri during this project period will be included in the analyses.

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VI. YEAR ONE SCHEDULE: May 2006 through May 2007

Task	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Develop intron primers	X	X	X	X									
Optimize primer for sequencer		X	X	X	X								
Apply marker to 150 samples					X	X	X	X					
Report Preparation								X	X	X	X	X	
Submit Final Report													X

VII. PROJECT LOCATION:

Current samples are listed in Appendix 1. If additional samples can be provided, and if these will bridge gaps in the sampling distribution, then they will be incorporated into the analysis.

VIII. PROJECT ESTIMATED COST:

Project Budget May 2006 – May 2007	
Costs	**Amounts**
Contract to Univeristy	
Expenses/Laboratory analyses	$10,000
Project Total	**$10,000**
MDC share (25%)	$ 2,500
FWS share (75%)	$ 7,500

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Appendix 1: Sample name (Name), Number (#), Collection Date (Coll. Date), Sex (Sx), Collector, State (ST), County (CO), and Location of the samples to be used in this study.

Name	#	Coll. Date	Sx	Collector	ST	CO	Location
SC	1	XII-96	M	L. Nienaber	AZ	Cochise	Captive born at Arizona-Sonora Desert Museum (bled by ATH 4-II-00)
SC	2	XII-91	M	L. Nienaber	AZ	Cochise	Hwy. 80 (bled ATH 4-II-00)
SCCAN	1	IX-01		B. Rohde	CN	Ontario	Georgian Bay (eastern side) just S Parry Sound (via M. Spille) <shed>
SCCAN	2	IX-01		B. Rohde	CN	Ontario	Georgian Bay (eastern side) just S Parry Sound (via M. Spille) <shed>
SCCO	1		F	S. Mackessy	CO	Lincoln	Reba (028570105)
SCCO	2		F	S. Mackessy	CO	Lincoln	A1310/SM 815
SCCO	3		M	S. Mackessy	CO	Lincoln	28063780
SCCO	4			S. Mackessy	CO	Lincoln	A1322/95-83
SCCO	5			S. Mackessy	CO	Lincoln	A95-71
SCCO	6			S. Mackessy	CO	Lincoln	A1314/95-79
SCCO	7			S. Mackessy	CO	Cheyenne	97-40
SCCO	8			S. Mackessy	CO	Baca	97-59
SCE	1	22VII00	J	D.&K.Salceies	NM	Bernalillo	6 mi. N. jct. Access Rd. on Paseo del Volcan (N35 11.33 W106 48.68')
SCE	2	14VII00	J	D.&K.Salceies	NM	Bernalillo	250 ft. N. jct. Access Rd. on Paseo del Volcan (N35 7.54 W106 47.20')
SCE	3	7-VII-00	J	D.&K.Salceies	NM	Bernalillo	0.8 mi. W. jct. Access Rd. on Paseo del Volcan (N35 7.5 W106 48.09)
SCE	4	3-VII-00	J	D.&K.Salceies	NM	Bernalillo	1.3 mi. W. jct. Access Rd. on Paseo del Volcan (N35 7.5 W106 48.58)
SCE	5	22VII00	J	D.&K.Salceies	NM	Bernalillo	1.4 mi. W. jct. Access Rd. on Paseo del Volcan (N35 7.5 W106 48.68)
SCE	6	4-VII-00	J	D.&K.Salceies	NM	Bernalillo	1.2 mi. W. jct. Access Rd. on Paseo del Volcan (N35 7.5 W106 48.52)
SCE	7	14VII00	J	D.&K.Salceies	NM	Bernalillo	1.1 mi. W. jct. Access Rd. on Paseo del Volcan (N35 7.5 W106 48.43)
SCE	8	IX-00	M	C. Painter	NM	Socorro	AOR U.S. Rt. 60, 12.5 mi. E. Rio Grande River (320mm SVL)
SCE	9		M	Phx. Zoo	AZ	Cochise	Hwy. 80, S. Chiricahua Mts. <PHZ-4601>
SCE	10		F	Phx. Zoo	AZ	Cochise	Hwy. 80, S. Chiricahua Mts. <PHZ-8333>
SCE	11		F	Phx. Zoo	AZ	Cochise	Hwy. 80, S. Chiricahua Mts. <PHZ-8337>
SCE	12		F	Phx. Zoo	AZ	Cochise	Hwy. 80, S. Chiricahua Mts. <PHZ-8659>
SCIA	1	21-VI02		T. VanDeWalle	IA	Bremer	DOR County Rd. C33, 1 mi. E. Wapsipinicon River <vial29>
SCIA	2	18VII02	M	T. VanDeWalle	IA	Bremer	DOR County Rd. C33, 0.125 mi. E. Wapsipinicon River <vial21>
SCIA	3	20IV04	F	T.VanDeWalle	IA	Bremer	Buhr Access (Sec.19 T93N R11W)
SCIA	4	3-V-04	M	T.VanDeWalle	IA	Bremer	Buhr Access (Sec.19 T93N R11W)
SCIA	5	3-V-04	F	T.VanDeWalle	IA	Bremer	Buhr Access (Sec.19 T93N R11W)
SCIA	6	20IV04	M	T.VanDeWalle	IA	Bremer	Buhr Access (Sec.19 T93N R11W)
SCIA	7	3-V-04	F	T.VanDeWalle	IA	Bremer	Buhr Access (Sec.19 T93N R11W)
SCIA	8	VIII-90		J. Christiansen	IA	Scott	Pasha Farm, Just N. Davenport in eastern IA <shed> from offspring born to DU-3916
SCIL	1		-	C. Phillips	IL	Clinton	specimen 113
SCIL	2		-	C. Phillips	IL	Clinton	specimen 116
SCIL	3		-	C. Phillips	IL	Clinton	specimen 119
SCIL	4	08VI01	M	T. Anton	IL	Cook	Willow/Sanders Prairie Forest Preserve (T42N R12E, Sec. 18, SW1/4)
SCIL	5	09VI01	F	T. Anton	IL	Cook	Willow/Sanders Prairie Forest Preserve (T42N R12E, Sec. 18, SW1/4)<shed>
SCIL	6		F		IL	Carlisle	Carlisle Lake, West Spillway <pit=4327110372>
SCIL	7		F		IL	Carlisle	Carlisle Lake, South Shore State Park <pit=406E41304B>
SCIL	8		F		IL	Carlisle	Carlisle Lake, West Spillway <pit=4233423415>
SCIN	1		J	R. Grundel	IN	Porter	Indiana Dunes Nat. Lakeshore <scale clip> <500863 E 4614331 N>
SCIN	2			R. Grundel	IN	Porter	Indiana Dunes Nat. Lakeshore <dried specimen, last 20% with rattle> <494048 E 461478 N>
SCKS	1		F	S. Mackessy	KS	Barton	Cheyenne Bottoms
SCKS	2		M	S. Mackessy	KS	Barton	Cheyenne Bottoms
SCKS	3		M	S. Mackessy	KS	Barton	Cheyenne Bottoms
SCKS	4		M	S. Mackessy	KS	Barton	Cheyenne Bottoms

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SCKS	5		M	S. Mackessy	KS	Barton	Cheyenne Bottoms
SCKS	6	28IV01		D. Fogell	KS	Pottawatomie	Hwy. 63 just S. Emmett
SCKS	7	VI-02	F	D. Fogell	KS	Chase	Tallgrass Prairie Nat. Pres., 2 mi. N. and 1.25 mi. W. Strong City <SVL=510><ATH466>
SCMI	1	VI-01		K. Schuett	MI	Hillsdale	Somerset <shed – mother>
SCMI	2	VI-01		K. Schuett	MI	Hillsdale	Somerset <shed – offspring of SCMI-1>
SCMO	1	26IX01	F	F. Durbian	MO	Holt	Squaw Creek NWR (nr. Mound City, 25 mi. WNW St. Joseph) (047295269)
SCMO	2	27IX01	M	F. Durbian	MO	Holt	Squaw Creek NWR (nr. Mound City, 25 mi. WNW St. Joseph) (047111859)
SCMO	3	27IX01	M	F. Durbian	MO	Holt	Squaw Creek NWR (nr. Mound City, 25 mi. WNW St. Joseph) (047310362)
SCMO	4	27IX01	M	F. Durbian	MO	Holt	Squaw Creek NWR (nr. Mound City, 25 mi. WNW St. Joseph) (047270038)
SCMO	5	27IX01	F	F. Durbian	MO	Holt	Squaw Creek NWR (nr. Mound City, 25 mi. WNW St. Joseph) (047368109)
SCMO	6	27IX01	M	F. Durbian	MO	Holt	Squaw Creek NWR (nr. Mound City, 25 mi. WNW St. Joseph) (047316294)
SCMO	7	02-X-01	F	F. Durbian	MO	Holt	Squaw Creek NWR (nr. Mound City, 25 mi. WNW St. Joseph) (047521597)
SCMO	8	02-X-01	F	F. Durbian	MO	Holt	Squaw Creek NWR (nr. Mound City, 25 mi. WNW St. Joseph) (DOR)
SCMO	9	VI-02	J		MO	Chariton	Swan Lake NWR
SCMO	10	VI-02	M		MO	Chariton	Swan Lake NWR
SCMO	11	VI-02	F		MO	Chariton	Swan Lake NWR
SCMO	12	VI-02	M		MO	Chariton	Swan Lake NWR
SCMO	13	VI-02			MO	Chariton	Swan Lake NWR
SCMO	14	02IV05	F	R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede <E479501 N4400617> (115g) 080-292-796
SCMO	15	02IV05	M	R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede <E479840 N4400611> (255g) 072-855-009
SCMO	16	02IV05	F	R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede <E479855 N4400624> (320g) 078-017-342
SCMO	17	03IV05	M	R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede <E479866 N4400618> (370g) 024-280-051
SCMO	18	03IV05	M	R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede <E479654 N4400506> (350g) 059-602-112
SCMO	19	03IV05	F	R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede <E479737 N4400586> (212g) (059-062-271
SCMO	20	04IV05	F	R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede <E479616 N4400585> (234g) (073-032-612)
SCMO	21	04IV05	M	R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede <E479376 N4400139> (216g) (078-037-599)
SCMO	22	04IV05		R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede
SCMO	23	04IV05		R.Seigel/T.Crabill	MO	Linn	Pershing State Park at Laclede
SCNE	1	VIII-00	F	D. Fogell	NE	Pawnee	Burchard Lake
SCNE	2	VIII-00	M	D. Fogell	NE	Pawnee	Burchard Lake
SCNE	3	VIII-00	F	D. Fogell	NE	Pawnee	Burchard Lake
SCNE	4	V-99		M. Ingrasci	NE	Russell	NW of Dorrence, on road immediately S of Lake Wilson
SCNE	5	08VII02	M	D. Fogell	NE	Pawnee	Hwy. 8, 2.5 mi. S. Burchard <SVL=593><ATH-465>
SCNM	1	29VI00	M	T. LaDuc	NM	Valencia	DOR Hwy 47, 9 mi. NW Hwy. 60
SCNM	2	06-X-96		T.R. Jones	NM	Lincoln	DOR NM Hwy. 247, 3.4 mi. E jct. Lincoln Co. Hwy. B007 <TRJ 0338>
SCNM	3	18-V-98		L. Kamees	NM	Socorro	White Sands Range, 8 mi. S. Hwy. 380 on Range Rd. 7 (vials WS1A-B-C)
SCNM	4			B. Christman	NM	Otero	White Sands Missile Range (WSMR) <blood>
SCNM	5	VII-01		B. Christman	NM	Otero	3.7 mi. NW Tularosa <ESP 7864><preserved>
SCNY	1	09-VI92		G. Johnson	NY	Monroe	Nr. Rochester at Bergen Swamp (4L)
SCNY	2	09VI92		G. Johnson	NY	Monroe	Nr. Rochester at Bergen Swamp (6R)
SCNY	3	4-V-92		G. Johnson	NY	Onandaga	Cicero Swamp Wild. Manag. Area, 12 km N.Syracuse (4R6L) (c-11)
SCNY	4	18VI92	F	G. Johnson	NY	Onandaga	Cicero Swamp Wild. Manag. Area, 12 km N.Syracuse (3L6R) (c-14)
SCNY	5	20VII92	M	G. Johnson	NY	Onandaga	DOR Cicero Swamp Wild. Manag. Area, 12 km N.Syracuse (c-5)
SCOH	1	25VIII00	-	M. Spille	OH	Greene	Spring Valley (mortality in fire at Kettle Hole)
SCOH	2	25VIII00	-	M. Spille	OH	Greene	Spring Valley (mortality in fire at Kettle Hole)
SCOH	3	25VIII00	-	M. Spille	OH	Greene	Spring Valley (mortality in fire at Kettle Hole)
SCOH	4	06IX00	M	D. Wynn	OH	Wyandot	Pitt TWP, Kildeer Plains Wildl. Area (034-031-294) (445 mm SVL)
SCOH	5	06IX00	M	D. Wynn	OH	Wyandot	Pitt TWP, Kildeer Plains Wildl. Area (029-813-576) (462 mm SVL)
SCOH	6	06IX00	F	D. Wynn	OH	Wyandot	Pitt TWP, Kildeer Plains Wildl. Area (029-580-039) (63 mm SVL)
SCOH	7	VII00	M	D. Wynn	OH	Wyandot	Pitt TWP, Kildeer Plains Wildl. Area (DEW 1612) (660 mm SVL) killed
SCOH	8	06IX00	-	D. Wynn	OH	Wyandot	Pitt TWP, Kildeer Plains Wildl. Area (DEW 1613) (420 mm SVL) killed
SCOH	9	06IX00	M	D. Wynn	OH	Wyandot	Pitt TWP, Kildeer Plains Wildl. Area (DEW 1614) (500 mm SVL) DOR

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SCOH	10	VII-92	M	G. Schuett	OH	Geauga	Adult female (melanistic). <shed skin>
SCOH	11			M. Spille	OH	Greene	Spring Valley, adult
SCOH	12			M. Spille	OH	Greene	Spring Valley, sub-adult
SCOH	13	28-V-92	F	G. Johnson	OH	Champaign	Urbana township at Cedar Bog State Preserve (3R5L)
SCOH	14	28-V-92	F	G. Johnson	OH	Champaign	Urbana township at Cedar Bog State Preserve (3R5L)
SCOH	15	13-V-93	M	G. Johnson	OH	Champaign	Urbana township at Cedar Bog State Preserve (8R10L)
SCOH	16	29-V-92	F	G. Johnson	OH	Clark	Moorefield township at Prairie Road Fen (2R4L)
SCOH	17	29-V-92	F	G. Johnson	OH	Clark	Moorefield township at Prairie Road Fen (4R6L)
SCOK	1	26VIII05	F	D.Shepard/L.Vitt	OK	Beckham	Sandy Sanders WMA <elev.2017'> WTM zone 14 423764E 3880962 N <DBS601--02>
SCOK	2	26VIII05	J	D.Shepard/L.Vitt	OK	Beckham	Sandy Sanders WMA <elev.2017'> WTM zone 14 423764E 3880962 N <offspring of SCOK-1>
SCPA	1	14VII04	M	B. Jellen	PA	Butler	Snake 56--SGL site (Pry Rd.) (utms in nad83: easting592655; northing4544418)<Vial J2>
SCPA	2	27VII04	F	B. Jellen	PA	Butler	Snake 57--Jennings site (utms in nad83: easting583609; northing4540456)<vial J3>
SCPA	3	11VIII04	F	B. Jellen	PA	Butler	Snake 65--SGL95 site (Christie Rd.) (easting595232; northing4544132)<Vial J6>
SCPA	4	15I-04	F	B. Jellen	PA	Butler	Snake 82--Jennings site (utms in nad83: easting583577; northing4540586)<vial J11>
SCPA	5	14IX04	F	B. Jellen	PA	Venango	Snake 79--Tiippery site (across Frm. Felmlee) (easting614055 northing4579046)<vial J12>
SCPA	6	15IX04	F	B. Jellen	PA	Butler	Snake 83--Jennings site (utms in nad83: easting584585; northing4540627)<vial J14>
SCPA	7	22IX04	F	B. Jellen	PA	Venango	Snake 79--Tiippery site (Mary Parker/Mine) (easting612260 northing4579129)<vial J15>
SCT	1	9V00	-	K. McCoy	TX	Concho	1 mi. E. Vick (ASNHC 13040) (via A. T. Holycross)
SCT	2	24VI00	M	T. Hibbitts	TX	Parker	Hwy. 171, 3.9 mi. W. jct. FM3450 (TJH 13754) (via ATH)
SCT	3	24VI00	M	T. Hibbitts	TX	Hood	Hwy. 171 in Cresson, ~100m W. Jct. 377 (TJH 13755) (via ATH)
SCTX	1		M	A. Price	TX	Cottle	Matador Wildl. Area at jct. Hwy 62/82, 15 mi. N Paducah
SCTX	2	29-V-01		T. LaDuc	TX	Andrews	TX Hwy. 128, 8.4 mi. E NM state line (or 8.4 mi. E FM 1218) <shed TJL853-SC1>
SCTX	3	06-V-01		T. LaDuc	TX	Crockett	TX Hwy. 163, 4.5 rd. mi. S Irion Co. line <shed TJL861-SC2>
SCTX	4	26-V-01		T. LaDuc	TX	Motley	Double Helix Ranch, 5.5 km N & 4 km W Dumont (King Co.) <shed TJL862-SC3>
SCTX	5	26VI01		T. LaDuc	TX	Crockett	Crockett Co. Rd. 209, 0.2 rd. mi. W. TX Hwy. 163 <shed TJL895-SC4>
SCTX	7	19VI-99	M	Tamu-K	TX	Crockett	279(M), 011-282-823<captured at Iraan>
SCTX	8	14IX99	J	Tamu-K	TX	Galveston	286, 010-325-097,<born in captivity>
SCTX	9			GladysPorterZoo	TX	Starr	8 mi. N. La Gloria on FM 1017 <58 mi. NW McAllen -- Gladys Porter Zoo captive><blood>
SCWI	1	27VII00	F	via ATH	WI	Buffalo	1.5 mi. E. Trevino Station (1/2 way to Nelson) (#11, 64 cm SVL) (shed skin)
SCWI	2	01VIII00	F	via ATH	WI	Buffalo	Just E. Trevino Station, S. side of tracks (#9, 57 cm SVL) (shed skin)
SCWI	3	29VII00	F	via ATH	WI	Buffalo	S. Hwy. 35 approx. 0.5 mi. E. Chip R. (#35, 65 cm SVL) (shed skin)
SCWI	4	6VII00	F	via ATH	WI	Buffalo	site # 3-15-3, Nelson (63 cm SVL) (shed skin)
SCWI	5	VI-00	-	via ATH	WI	Buffalo	Found in shed at Nelson site (site 2-6-1) (shed skin)
SCWI	6	30VIII01	F	E. McCumber	WI	Buffalo	N44 26'37" W092 03'43.7" (0000F85596F) indiv. #5)
SCWI	7	02IX01	F	E. McCumber	WI	Buffalo	N44 29'48.2" W092 02'14.3" (0005FD1849) (indiv. #76)
SCWI	8	02IX01	M	E. McCumber	WI	Buffalo	N44 29'37.2" W092 02'18.6" (0005FDB588) (indiv. #78)
SCWI	9	12VII01	M	E. McCumber	WI	Buffalo	N44 29'53.8" W092 02'30.5" (0005FD202A) (indiv. #81)
SCWI	10	10-X-01	M	E. McCumber	WI	Buffalo	N44 25'38.5" W092 03'39.4" (00009650EA) (indiv. #1)
SMAR	1	X-00	F	C. Montgomery	AR	Washington	E side of Fayetteville (Fox Run Subdivision off Hwy 45)
SMAR	2	X-00	F	C. Montgomery	AR	Benton	DOR Hwy 303, 1.5 mi. N Hwy. 12
SMAR	3	VIII-00	F	K. Irwin	AR	Montgomery	230 mm SVL (vial 1)
SMAR	4	X-00	M	K. Irwin	AR	Montgomery	Nr. Norman, AR (450 mm SVL) (vials 2,4,5)
SMAR	5	8-VII-00	F	K. Irwin	AR	Marion	Promise Land Ridge (470 mm SVL) (vials 7,8,9)
SMFL	1		M	S. Mackessy	FL		
SMFL	2		M	S. Mackessy	FL		
SMFL	3		F	S. Mackessy	FL		SM 762
SMFL	4		M	S. Mackessy	FL		SM 761
SMFL	5			S. Conners	FL	Collier	DOR Patterson Rd. 2 mi. W. Fakahaatchee State Park
SMFL	6	23XI01		S. Conners	FL	Miami-Dade	DOR just SE Chekika, nr. Everglades NP boundary
SMFL	7			S. Conners	FL	Miami-Dade	SE of Chekika, nr. Everglades NP boundary <shed>
SMFL	8	27XII02		G. Pyron	FL	Franklin	St. Vincent NWR (Dune Rd. nr. Board 13) <shed> (via GWS & Cntr.NA Herpetology)
SMFL	9	7VIII03		P. Moler	FL	Putnam	~5.5 mi. SSE Hawthorne (29 32.63N 82 2.46W) <tissue>

Federal

SMFL	10	18VIII03		P. Moler	FL	Liberty	Wilma (30 09.79N 84 57.38W) <tissue>
SMFL	11	19VIII03		P. Moler	FL	Santa Rosa	Range Rd., Elgin AFB (30 37.54N 86 47.63W) <tissue>
SMFL	12	21VIII03		P. Moler	FL	Wakulla	SR 375 at Smith Creek (30 09.97N 84 39.44W) <tissue>
SMFL	13	21VIII03		P. Moler	FL	Okaloosa	Range Rd. 213 7.5 mi. E SR 85, Elgin AFB (30 38.52N 86 25.50W) <tissue>
SMGA	1	16IV03		G. Schuett	GA	Cherokee	Live animal displayed at Zoo Atlanta <shed – via GWS> miliarius morph
SMGA	2	15VI03	M	C. Ponder	GA	Ware	Waycross, on 'Swamp Road' (N. Okeefenokee Swamp) <shed> (via GWS) = smb
SMMS	1	VI01	F	VanDevender	MS	Copiah	Hood Scout Reservation, NW Hazelhurst <shed> (Smm x Sms?)
SMSC	1	15XI00	F	B. Starrett	SC	Charleston	Mt. Pleasant (32 49'22.5"N 79 52'00"W) (SVL 420) (BS-16-17-18)