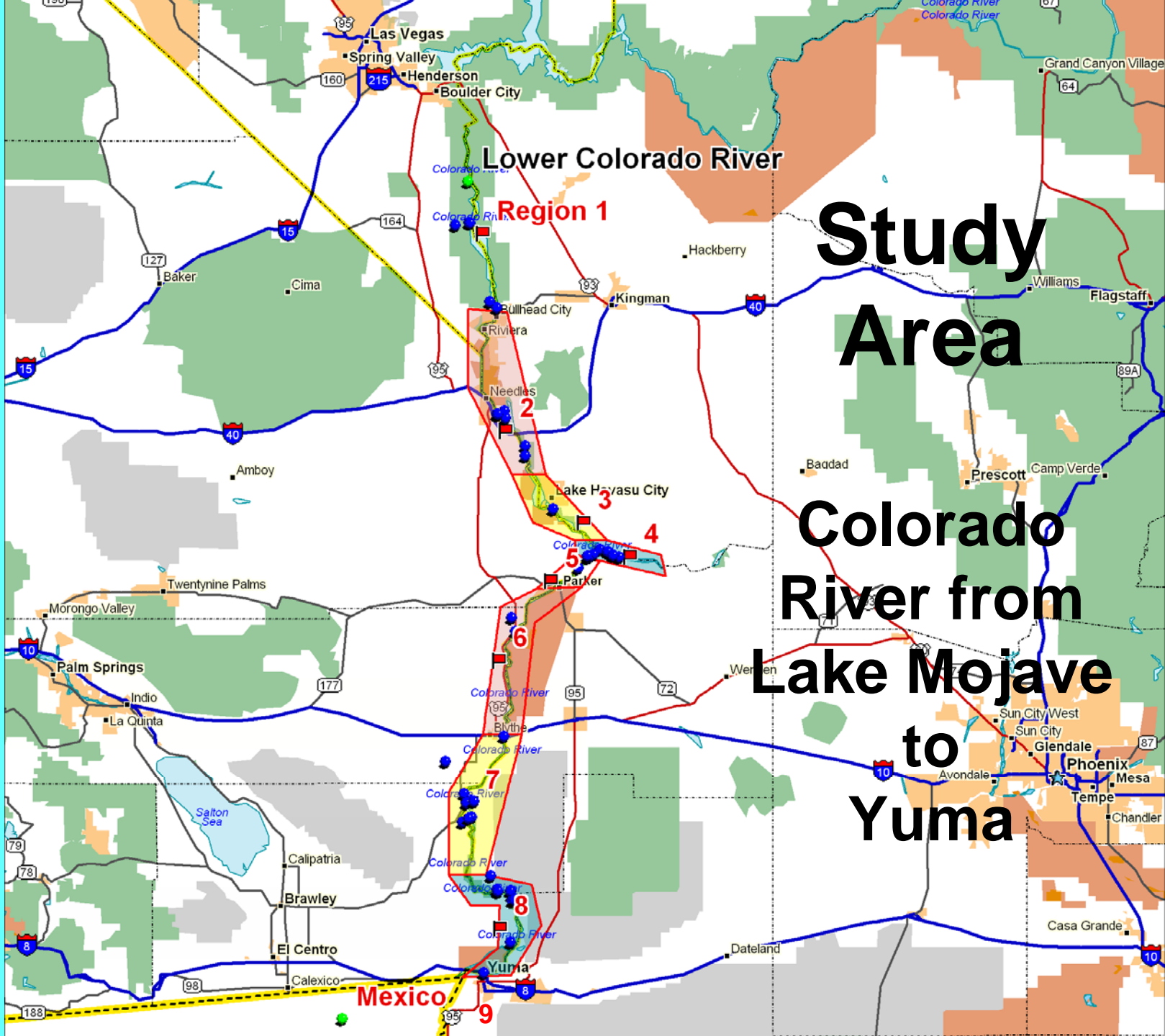


MONITORING PROTOCOL FOR LOWER COLORADO RIVER BAT SPECIES



**Funding provided by
Bureau of Reclamation
Bureau of Land Management**





Lower Colorado River

Region 1

Study Area

Colorado River from Lake Mojave to Yuma

Mexico

9

8

7

6

5

4

3

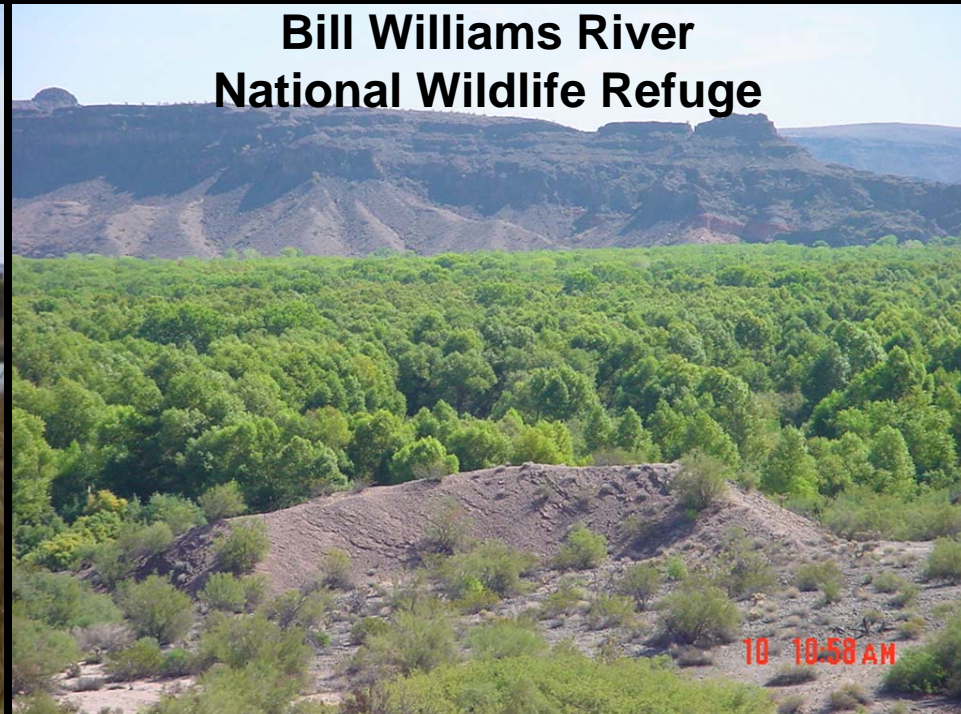
2

1

Havasu National Wildlife Refuge



Bill Williams River
National Wildlife Refuge



Cibola National Wildlife Refuge



Imperial NWR



GOALS

- To provide a better understanding of the past versus current bat assemblage along the Lower Colorado River
- To establish a long-term monitoring protocol for bats utilizing current technology
- To identify potential species-specific threats to bats
- To assist in the protection of critical roosts

Bats versus Birds

- Fly
 - Neotropical Migrants
 - Residents
 - Different survey techniques for different species
 - Preybase Important
 - Communication signals distinctive
 - **Distinctive echolocation signals that can be archived**
 - **Foraging areas can be up to 50km from roosts**
 - **Population numbers and trends possible from colonial roosts**
 - **Historic and recent guano can be used for bat species ID, prey and contaminant analysis**
- Fly
 - Neotropical Migrants
 - Residents
 - Different survey techniques for different species
 - Preybase Important
 - Communication signals distinctive
 - **Usually nest near foraging habitat**
 - **Usually easier to observe**
 - **Have more political power/more funding**

Bats Detected Along the Lower Colorado River 2001 - 2002

Common name	Scientific name	Abbreviation	ID Method	Evidence of Reproduction	Month	LCR Region	Relative Abundance
American leaf-nosed bats	Phyllostomidae						
California leaf-nosed bat	<i>Macrotis californicus</i>	Maca	A, R, M	Y	All	All but 3	M
Plain-nosed bat family	Vespertilionidae						
Western pipistrelle	<i>Pipistrellus hesperus</i>	Pihe	A, M	Y	All	All	H
Yuma myotis	<i>Myotis yumanensis</i>	Myyu	A, R, M	Y	All	All	H
California myotis	<i>Myotis californicus</i>	Myca	A, M	Y	All	All	H
Big brown bat	<i>Eptesicus fuscus</i>	Epfu	A, R, M	Y	All but Ja	All but 3	M
Pallid bat	<i>Antrozous pallidus</i>	Anpa	A, R, M	Y	All but S	All	M
Cave myotis	<i>Myotis velifer</i>	Myve	A, R, M	Y	M, Ju, A, O	All but 3, 9	M
Red bat	<i>Lasurus blossevilli</i>	Labl	A, M		Ja, M, Ju, Jy, Au, O	2, 4, 8	L
Yellow bat	<i>Lasurus xanthinus</i>	Laxa	A		M, Ju, A	4, 7, 8	L
Hoary bat	<i>Lasurus cinereus</i>	Laci	A		F, M	4, 8	L
Townsend's big eared bat	<i>Corynorhinus townsendii</i>	Coto	R, M	Y	M	4, 6	L
Free-tailed bat family	Molossidae						
Mexican free-tailed bat	<i>Tadarida brasiliensis</i>	Tabr	A, R, M	?	All	All	H
Pocketed free-tailed bat	<i>Nyctinomops femorosaccus</i>	Itfy	A		All but S	All	M
Western mastiff bat	<i>Eumops perotis</i>	Eupe	A		M, Ju, A, O	All but 9	M
Big free-tailed bat	<i>Nyctinomops macrotis</i>	Ityma	A		M, O	1, 7, 8	L
Keys					Month	Acoustic minutes	
Evidence of Reproduction	ID Method				All = Every visit	H = > 2500	
Y = yes	A = acoustic				Ja = January	M = 100-2500	
ie: pregnant or lactating	ie: audible call or computer file				F = February	L = < 100	
females or juveniles caught	M = caught in mist net				M = May		
	R = roost found				Ju = June		
	ie: guano, hand net, outflight				Jy = July		
					A = August		
					S = September		
					O = October		



**Red bat with
twins**



Red Bat Capture Site



Bill Williams National Wildlife Refuge

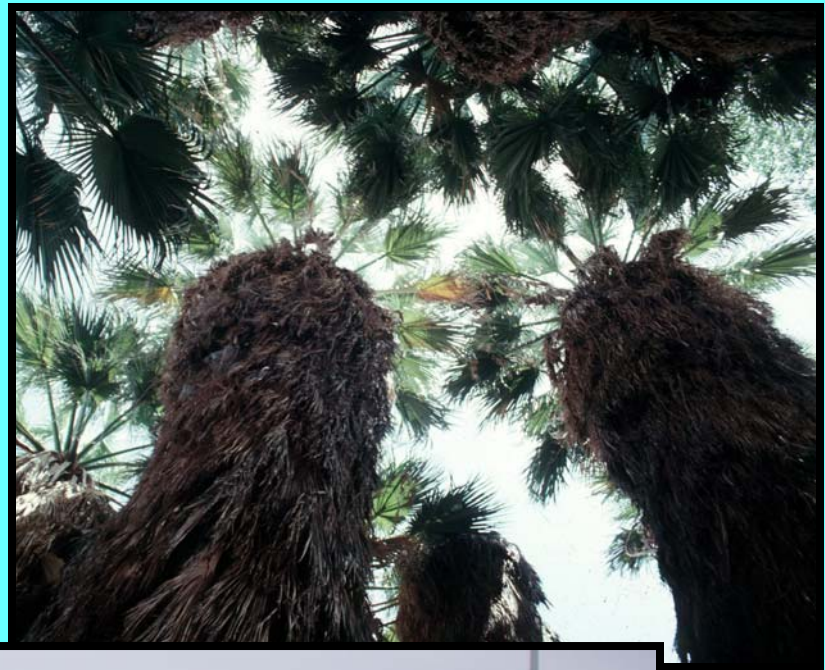
January 28, 2002

30 9:27 AM

Red Bat Foraging Habitat Bill Williams River



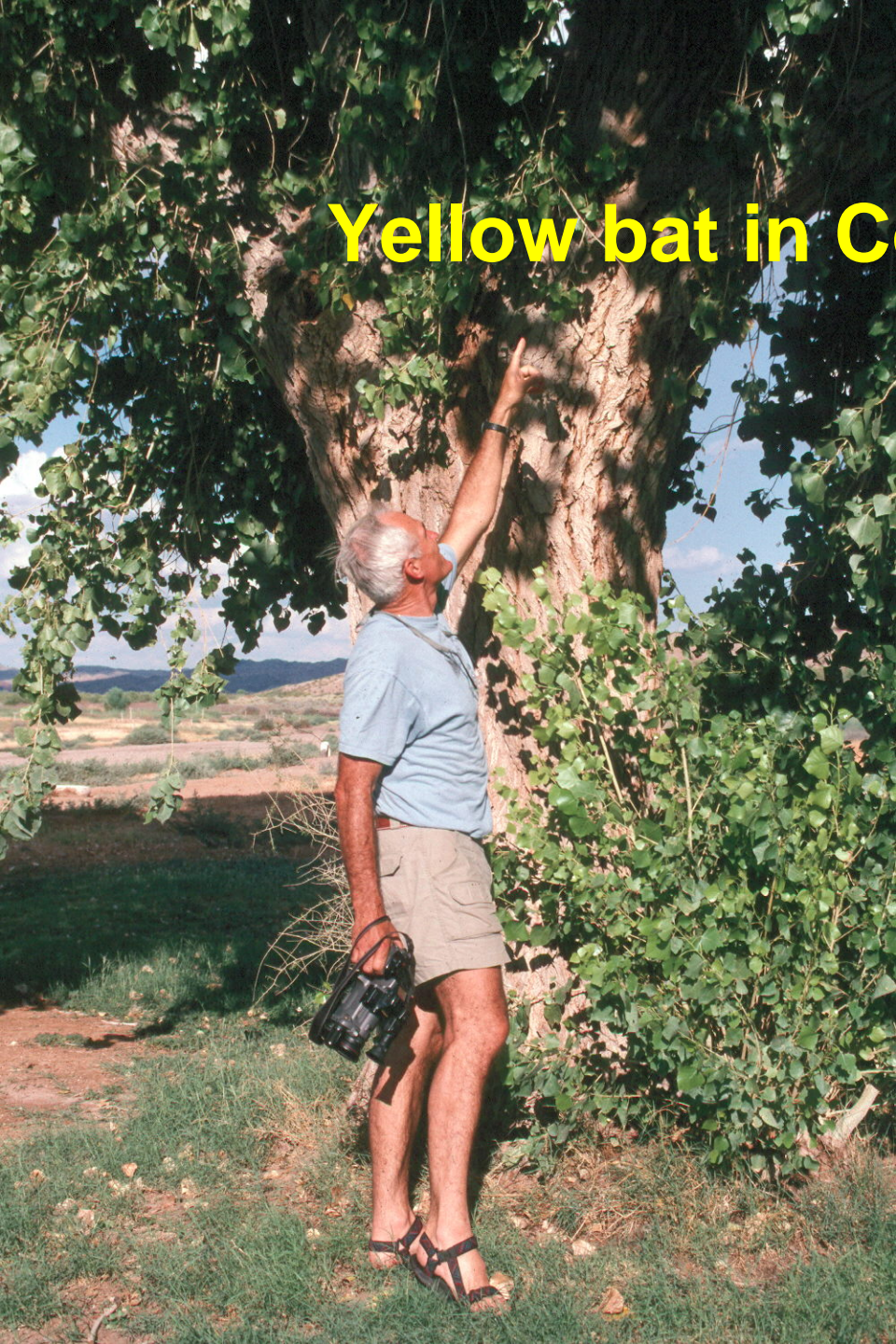
**Yellow bat in
palm tree**



Cienega Springs



Yellow bat in Cottonwood tree



Hoary bat







10 3:59



Bat

Bob

Hoary bat in Palo verde tree



Townsend's big-eared bat



Corynorhinus townsendii

Townsend's Big-eared Bat



Alice Mine, Riverside Mountains



Historically large colonies in abandoned mines along the Colorado River

Foraged in cottonwood riparian

Marked declines attributable to loss of cottonwood riparian and roost disturbance



Macrotus californicus
California Leaf-nosed bat





Winter Roost



Banded Macrotus released



Foraging Habitat



Tree Lizard Chewed by Macrotus

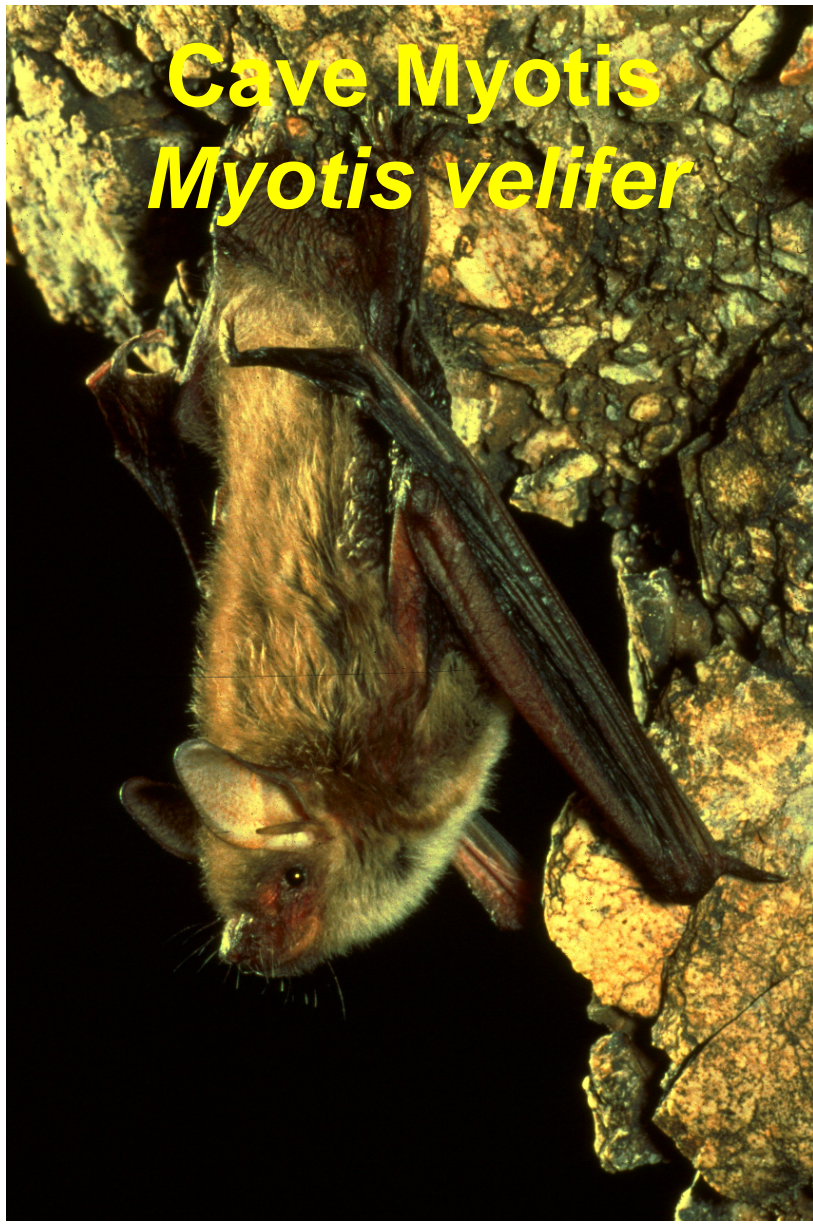


23 4:02 PM

Cibola NWR Bridge



Cave Myotis
Myotis velifer



Arizona myotis



1
AC 2457
Myotis
L.A. CO

Myotis
L.A. CO

Myotis occultus



Myotis occultus were "shot over water in a back eddy of the river. Here the bats arrived in considerable numbers at early dusk to drink, flitting down to the water's surface and dipping several times before flying off among the willows and cottonwoods" (Grinnell, 1914).

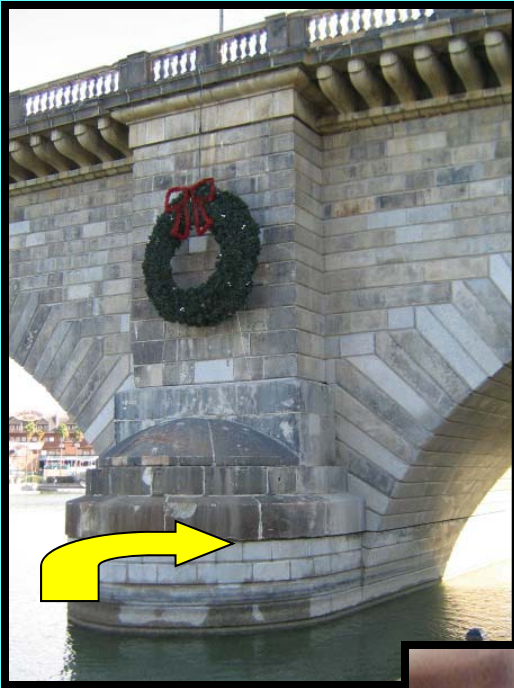


Palo Verde Bridge



London Bridge

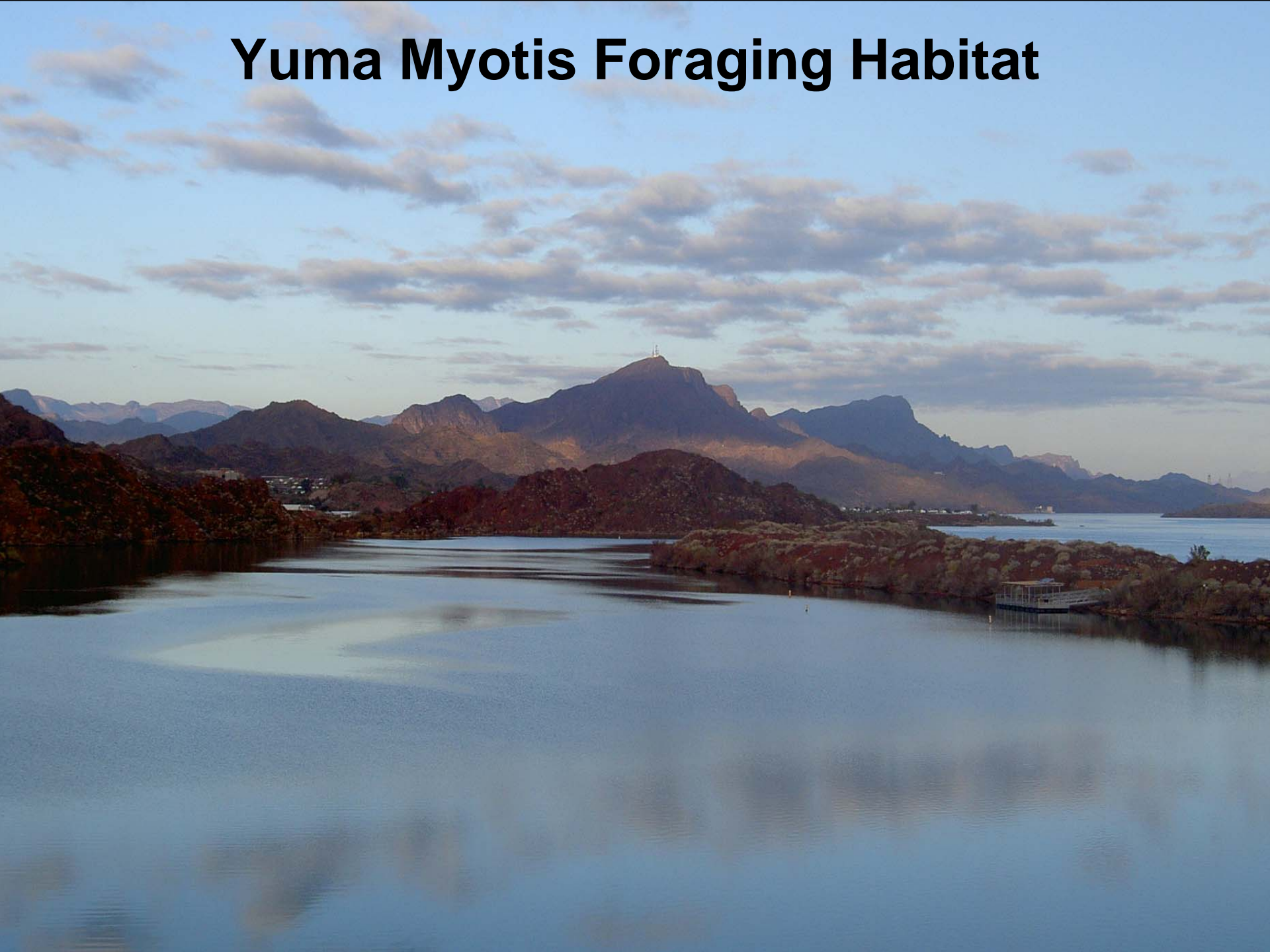
Yuma Myotis Bat Roost



Bat Exit Crack



Yuma Myotis Foraging Habitat



MONITORING PROTOCOL

- Roost surveys (mines, bridges, buildings)
- Mist-netting and harp trap near roosts and in foraging areas
- Acoustic surveys (remote Anabat)

Species Preferred Monitoring Methods

Species	Acoustic	Roost
Red bat	yes	no
Yellow bat	yes	no
Hoary bat	yes	no
Townsend's	no	yes
CA leaf-nosed	no	yes
Cave myotis	yes	yes

Mine Selection Criteria

- Historic roosts
- LCR MSCP Species
- Maternity colonies
- Large colonies
- Accessible
- Protected by gates or location
- Different areas along the LCR

LCR Mine Monitoring

Site	Ownership	State/County	Bat Species	survey times	Exit Counts	Gate
Homestake Shafts	LMNRA	NV/Clark	Maca, Myve	Ja/F and Ap/May	Ja/F=~250; Ap/My=~75	scheduled
Jackpot	HNWR	AZ/Mojave	Maca, Myve	Ja/F and Ap/May	Ja/F=~100; Ap/My=~50	no
Gold Dome	HNWR	AZ/Mojave	Maca, Myve, Myyu	Ja/F and Ap/May	Ja/F=~800; Ap/My=~1,000	no
Islander	Lake Havasu BLM	CA/San Bernardino	Maca, Myyu, Tabr	Ja/F and Ap/May	Ja/F=~30*; Ap/My=~5,500	some
Californian	Lake Havasu BLM	CA/San Bernardino	Maca, Myve	Ja/F and Ap/May	Ja/F=~500; Ap/My=~4,500	no
Mountaineer	Palm Springs BLM	CA/Riverside	Maca, Coto, Myve, Epfu, Anpa	Ja/F and Ap/May	Ja/F=~700; Ap/My=capture	scheduled?
Stonehouse (Hodge)	Palm Springs BLM	CA/Riverside	Maca, Myve	Ja/F and Ap/May	Ja/F=~4,000; Ap/My=~2,000	yes
Hart	Yuma BLM	AZ/La Paz	Maca	Ja/F and Ap/May	Ja/F=~2,000; Ap/My=~500	scheduled
Eureka	INWR	AZ/Yuma	Maca, Myyu	Ap/May	~3,000	yes
Golden Dream 1	INWR	CA/Imperial	Myyu	Ap/May	~1,000	no
Golden Dream 4	INWR	CA/Imperial	Maca	Ap/May	~400	no
3C	EI Centro/Yuma BLM	CA/Imperial	Maca, Myyu	Ja/F and Ap/May	Ja/F=~2,000; Ap/My=~3,000	yes
Key						
California leaf-nosed bat	<i>Macrotus californicus</i> (Maca)					
Cave myotis	<i>Myotis velifer</i> (Myve)					
Yuma myotis	<i>Myotis yumanensis</i> (Myyu)					
Townsend's big-eared	<i>Corynorhinus townsendii</i> (Coto)					
Pallid bat	<i>Antrozous pallidus</i> (Anpa)					
Big brown bat	<i>Eptesicus fuscus</i> (Epfu)					
Mexican free-tailed bat	<i>Tadarida brasiliensis</i> (Tabr)					

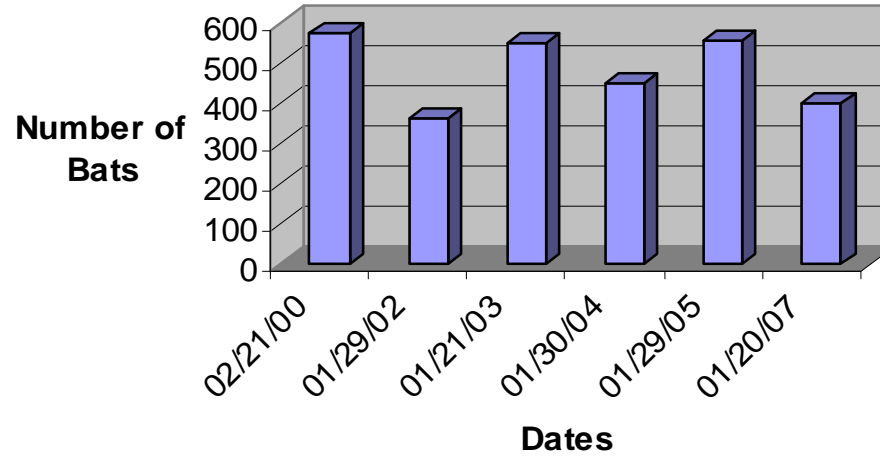
External Mine Surveys



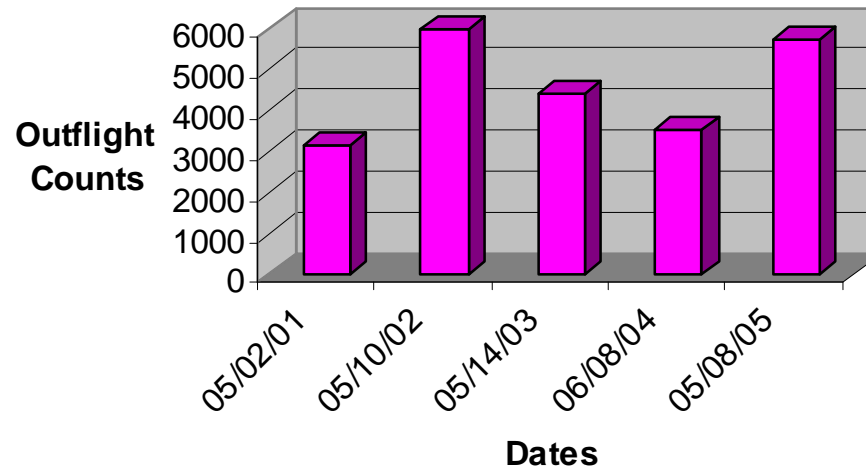
Pat in Californian Mine 1975



Californian Mine Winter Surveys California Leaf-nosed Bats



Californian Mine Spring Surveys Cave Myotis



Moon Phase Effect

January 2003

Mine

Exit Count

Moon

No Moon

3 C



1515

2491

Queen

26

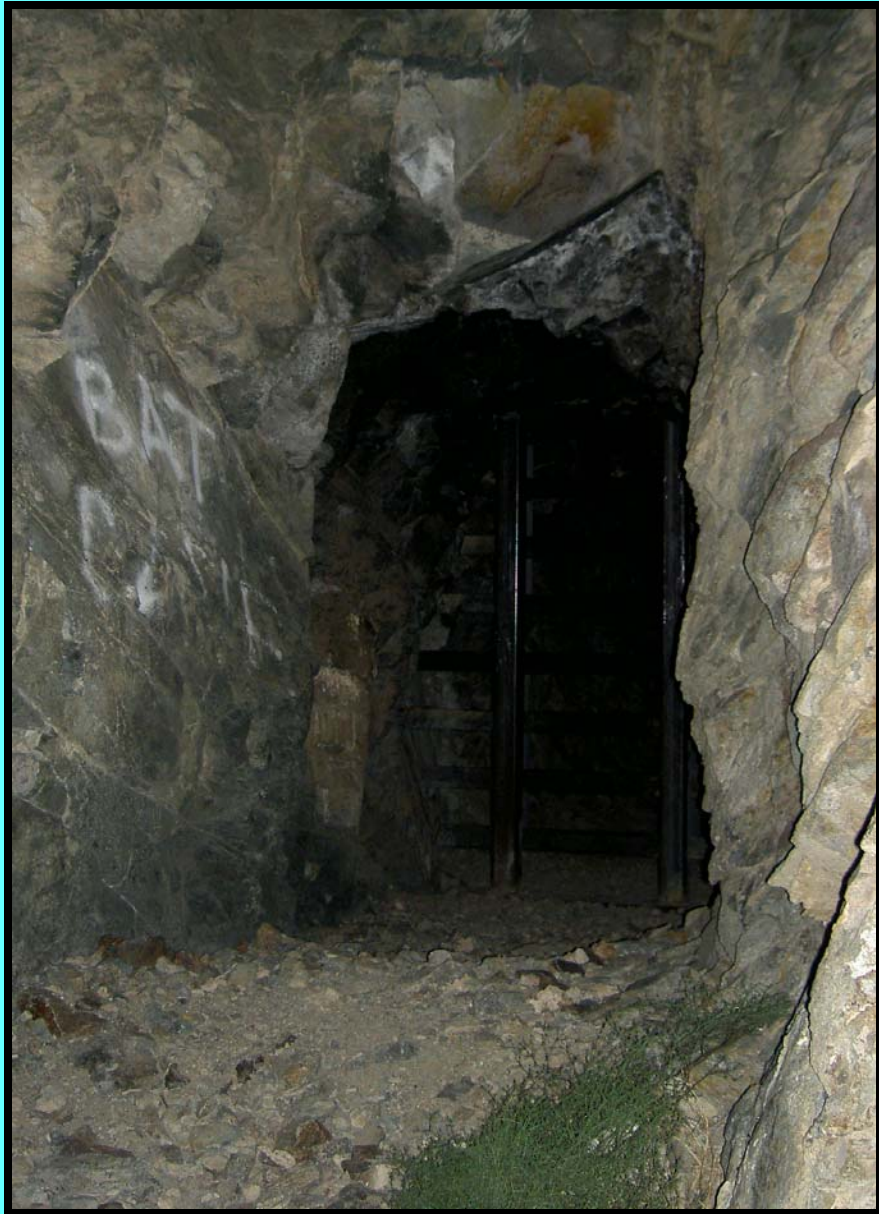
144

American Boy

12

172

Stonehouse Mine, Two Gated Adits



Upper Stonehouse Outflight



Jackpot Mine

External



Internal



Echolocation



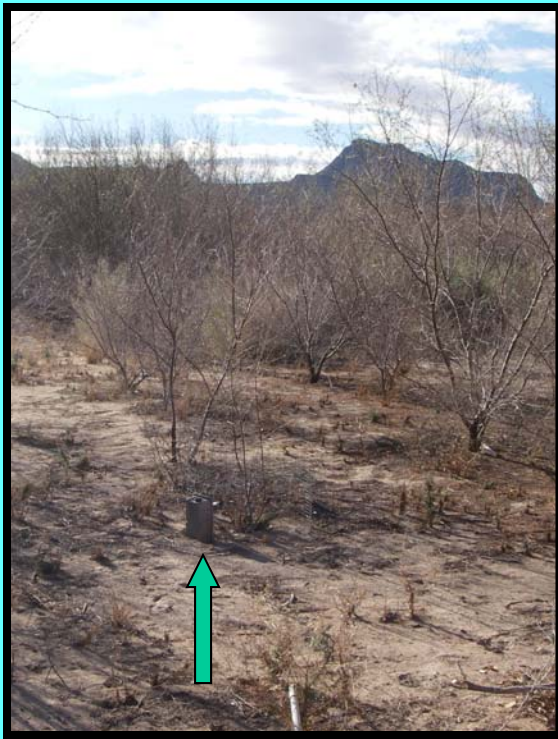
Acoustic Monitoring



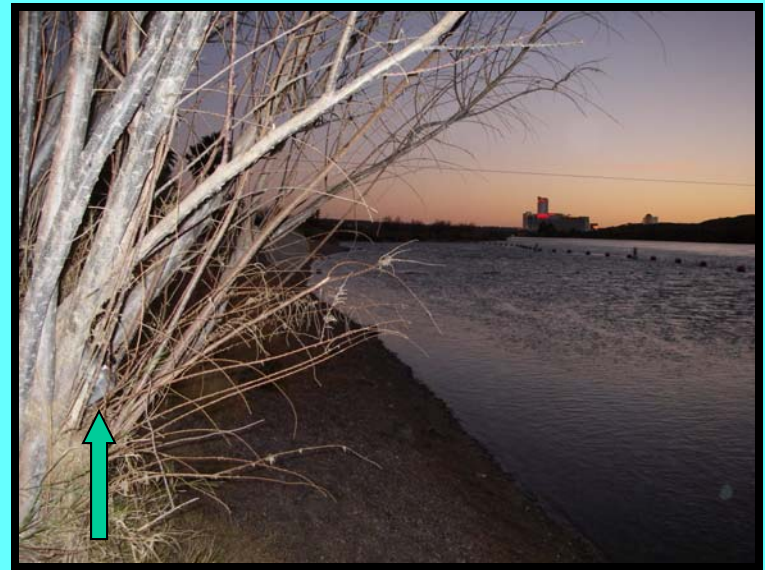
Acoustic Monitoring Site Selection Criteria

- Secure site
- Relatively easy access
- Different habitats in same general area
- Control sites
- Revegetation sites
- Different regions along the LCR

Anabat Monitoring Sites



BLM
Monkeyhead

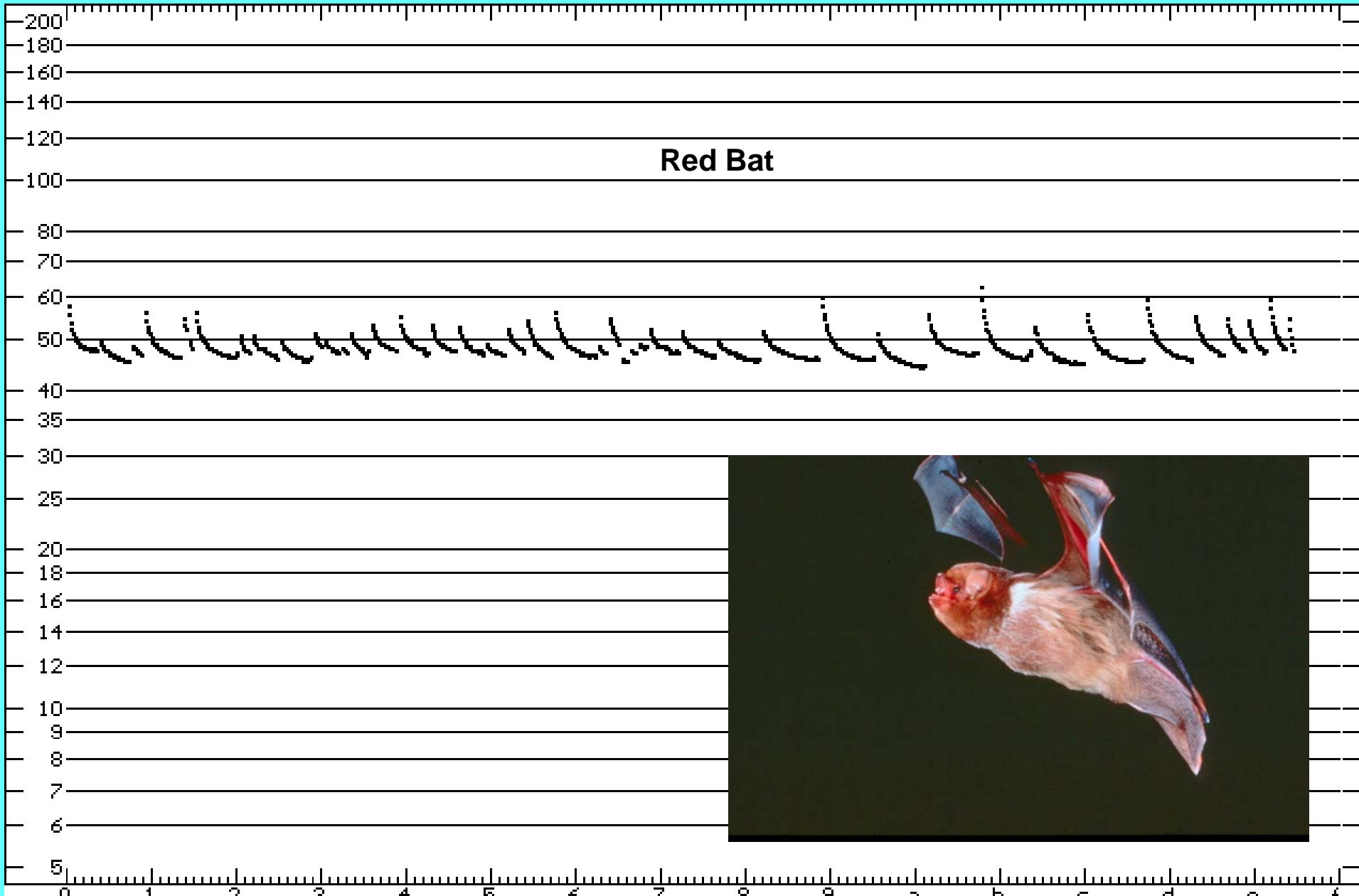


Laughlin

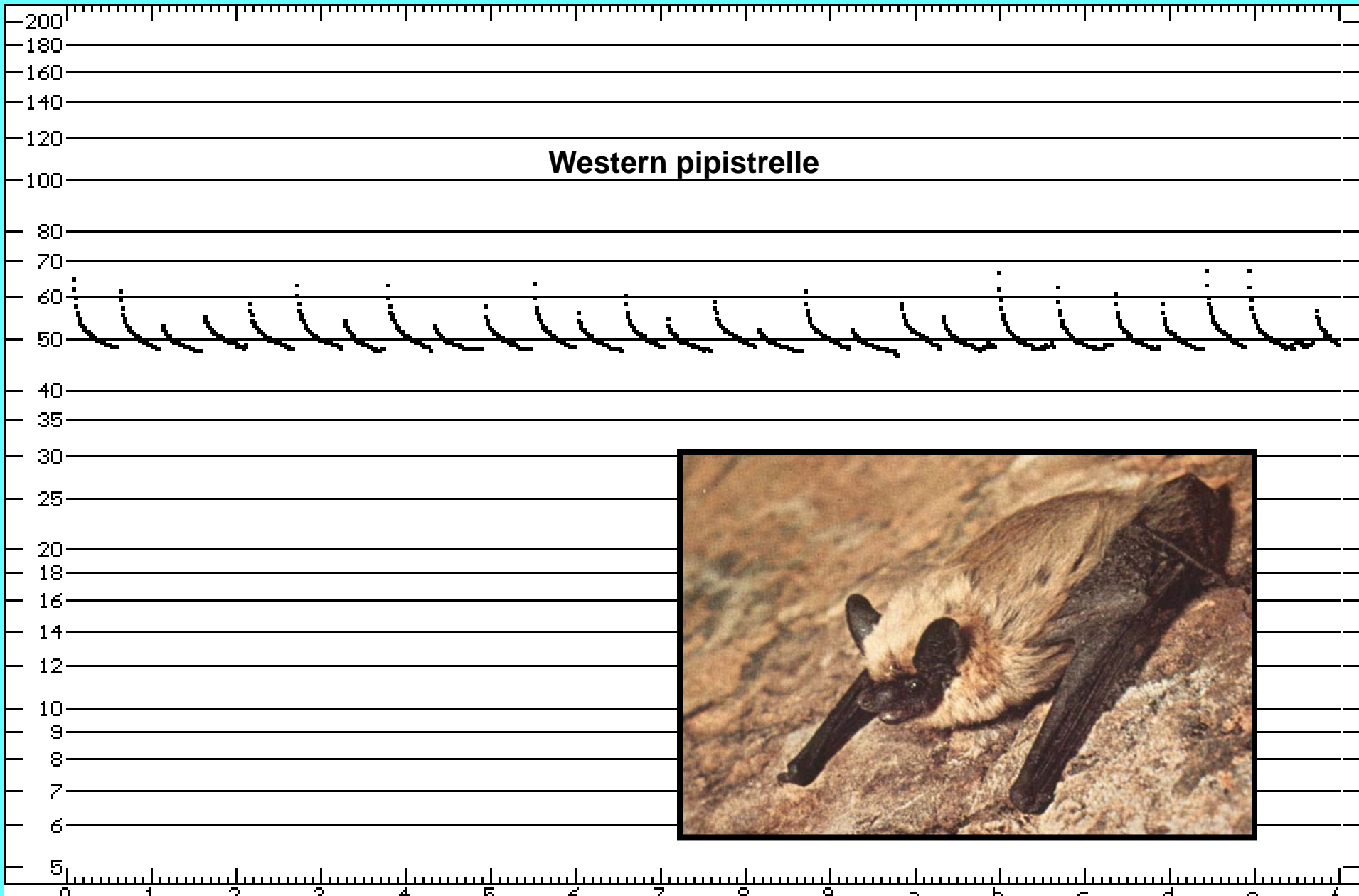
Bill Williams
NWR

BOR
Reveg
Near
Cibola



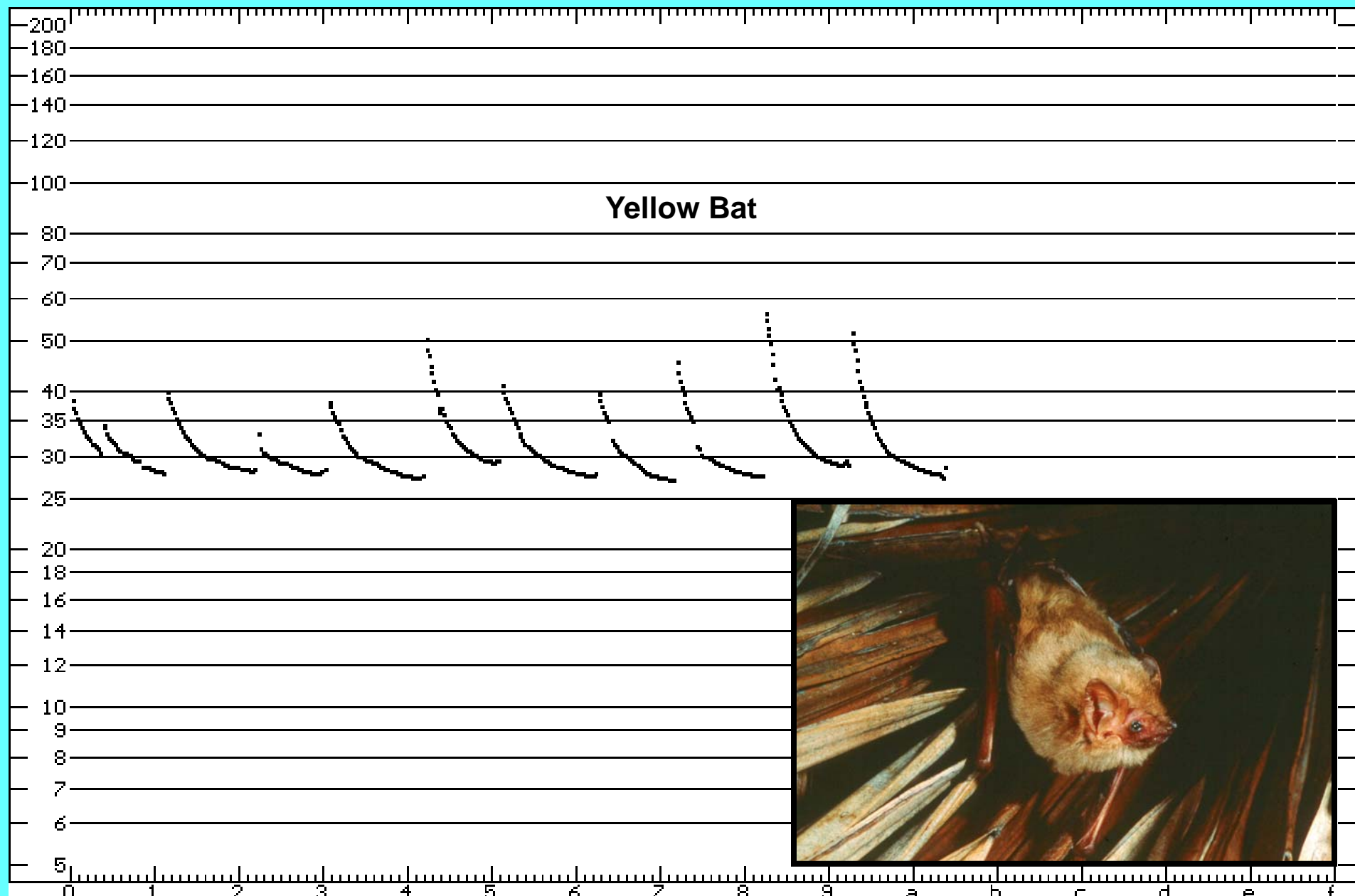


Tape: _____ Date: 06/27/02 Loc: Cottonwood grove, Imperial NWR, AZ
 Sp: Lab1 _____ Spec: _____
 Note: full moon, 105 degrees, wind 2 mph
 GPS: N 32 59 51.27 W 114 29 37.90
 C6272250.29# Div 16 Type 132 2002/06/27 2250:29
 TOT 150ms TK 10ms f7 COMP St 853 FILT 5
 ANALOOK Version 4.9f 23 Jun 2002



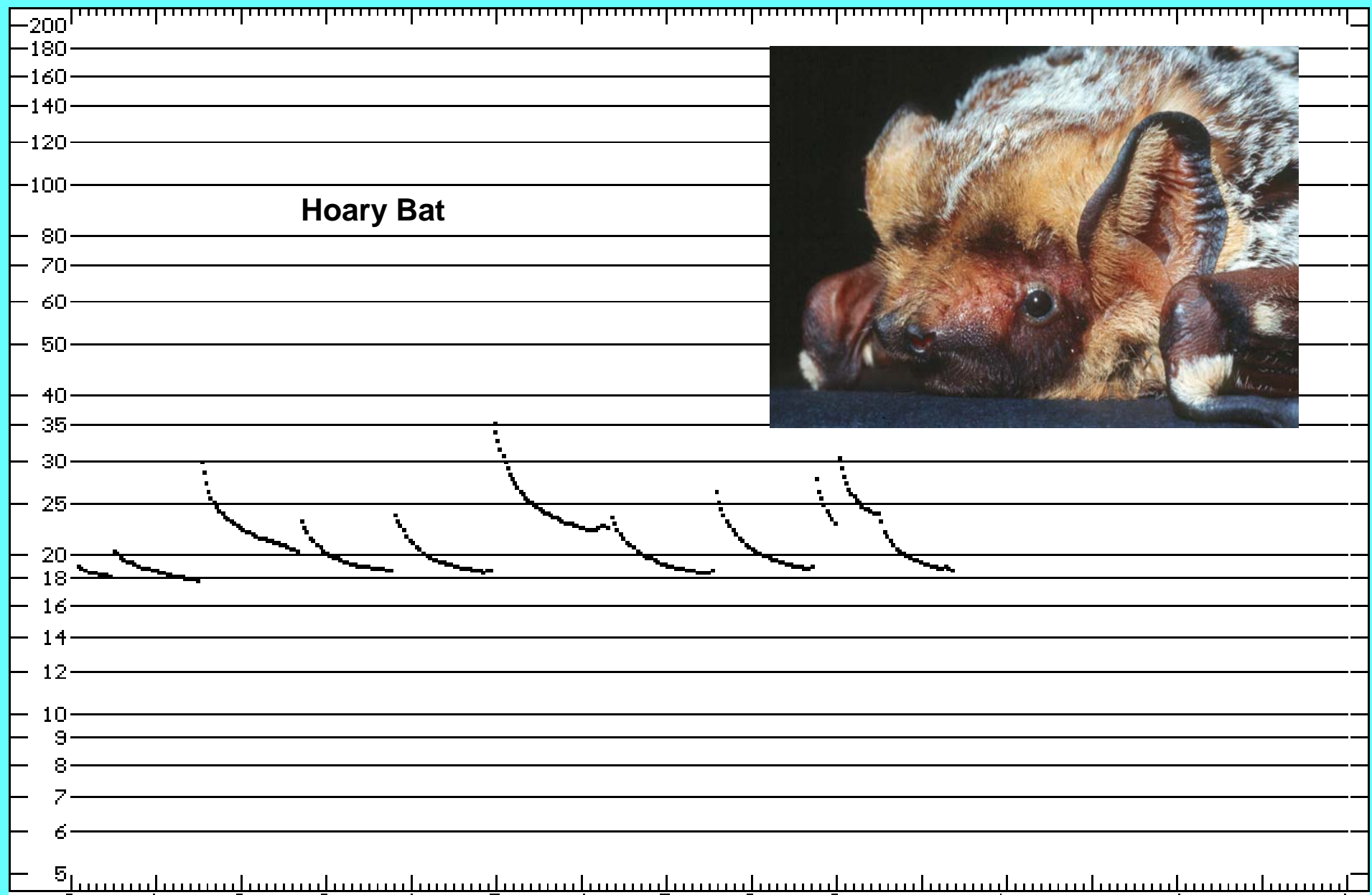
Tape: Computer Date: 5/10/02 Loc: Quail Hollow, Parker Strip
 Sp: Pihe Spec:
 Note: wind 5-10 kts, no moon, temp in 80's
 34:15.612 114:09.521 430 ft msl
 C5101957.50# Div 16 Type 131 2002/05/10 1957:50
 TOT 150ms TK 10ms f7 COMP St 0 FILT 5
 ANALOOK Version 4.9f 23 Jun 2002

Yellow Bat



Tape: Computer Date: 5/09/02 Loc: Bill Williams river lower pool
Sp: Laxa Spec:
Note: wind calm, no moon, temp 70
34:16.089 114:02:758 550 ft msl
C5092142.11# Div 16 Type 131 2002/05/09 2142:11
TOT 150ms TK 10ms f7 COMP St 1276 FILT 5
ANALOOK Version 4.9f 23 Jun 2002

Hoary Bat



Tape: Computer Date: 5/09/02 Loc: Bill Williams river lower pool
Sp: Laci Spec:
Note: wind calm, no moon, temp 70
34:16.089 114:02:758 550 ft msl
C5092119.52# Div 16 Type 131 2002/05/09 2119:52
TOT 150ms TK 10ms f7 COMP St 684 FILT 5
ANALOOK Version 4.9f 23 Jun 2002

Townsend's Big-eared Bat



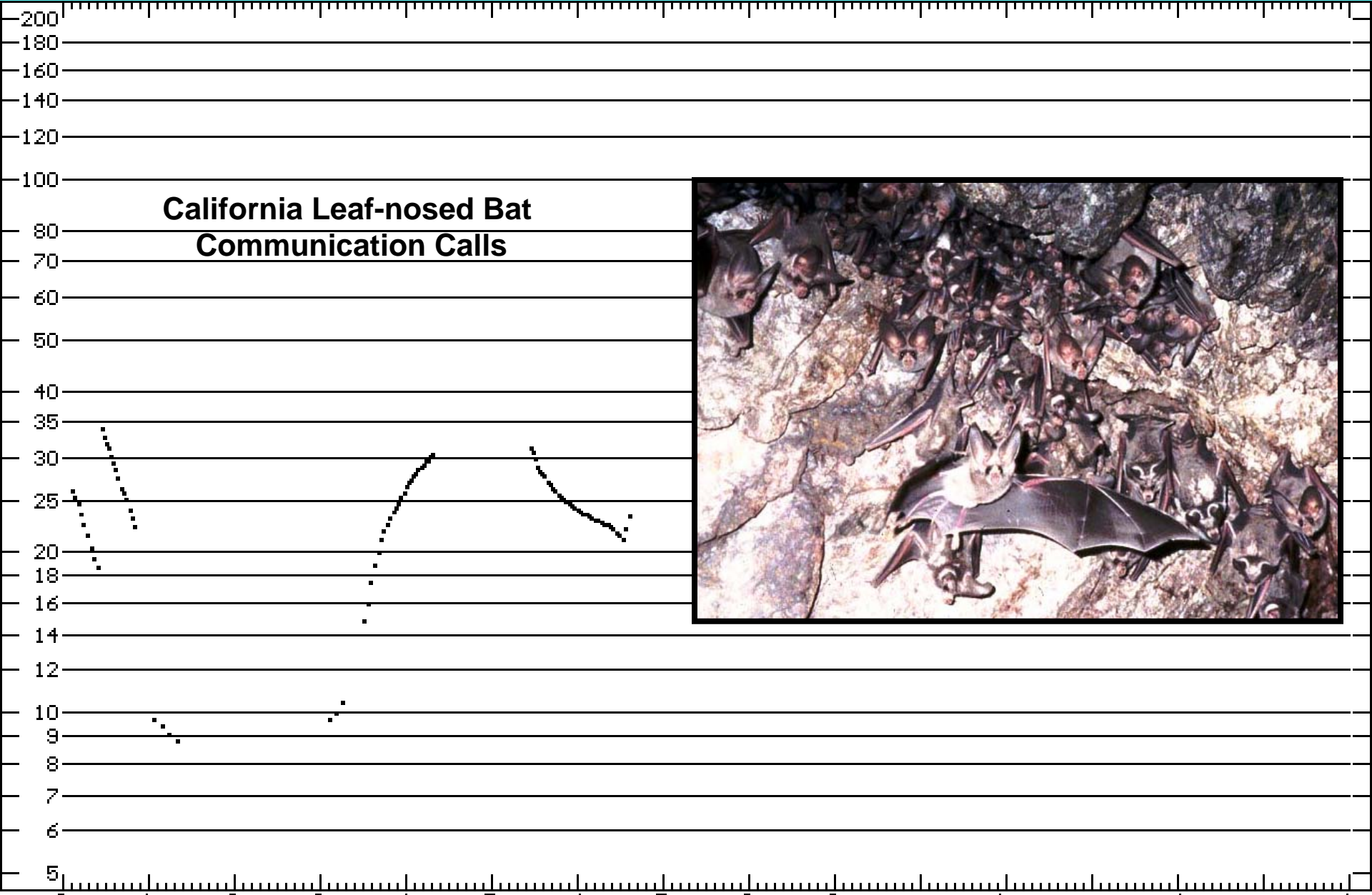
Tape: Date: 06/25/02 Loc: Black Rock Mine (BLM land) Spec:
Sp: Coto
Note: Full moon, 100 degrees, 2-4 mph wind
GPS: N 33 05 18.42 W 114 35 35.20
C6252034.49# Div 16 Type 132 2002/06/25 2034:49
TOT 150ms TK 10ms f7 COMP St 2 FILT 5 Edit Mode: Mark OFF Points
ANALOOK Version 4.9f 23 Jun 2002

California Leaf-nosed Bat



0 1 2 3 4 5 6 7 8 9 a b c d e f
Tape: Computer Date: 7/5/01 Loc: Golden Dream Macroctus North adit
Sp: Maca Spec: Macroctus califor
Note: Hot, humid, overcast night with full moon
33:01.826 114:33.609 350 ft msl
B7052124.59# Div 16 Type 131 2001/07/05 2124:59
TOT 150ms TK 10ms f7 COMP St 2 FILT 5
ANALOOK Version 4.9f 23 Jun 2002

California Leaf-nosed Bat Communication Calls



Tape: Computer Date: 7/5/01 Loc: Golden Dream Macrotus North adit
 Sp: Maca Spec: Macrotus californicus
 Note: Hot, humid, overcast night with full moon
 33:01.826 114:33.609 350 ft msl
 B7052126.15# Div 16 Type 131 2001/07/05 2126:15
 TOT 150ms TK 10ms f7 Real St 3329 FILT 5 Edit Mode: Mark OFF Points
 ANALOOK Version 4.9f 23 Jun 2002

Cave Myotis



Tape: Computer Date: 5/09/02 Loc: Mosquito flat willow overlook Spec:
Sp: Myve
Note: wind calm, no moon temp 75
34:17.031 114:04.332 500 ft msl
C5092139.34# Div 16 Type 131 2002/05/09 2139:34
TOT 150ms TK 10ms f7 COMP St 0 FILT 5
ANALOOK Version 4.9f 23 Jun 2002

Table 4
Minutes of Acoustic Detection

Date	Identifier	Region	Start	Stop	Anpa	Coto	Ephi	Eupe	Iabl	Iaol	Lasa	Maoa	Myoa	Myve	Myyu	Ny*	Nyma	Phle	Tabr	Total	
10/16/01	RV CMWR	7	1833	1851														15	2	27	
10/16/01	3 slashes CMWR	7	1736	1810														25	1	29	
10/16/01	EGO T CMWR	7	1832	39	1							6	29		26	1	1	10	2	81	
10/16/01	RV CMWR	7	240	508											1	1				4	
02/10/02	RV CMWR	7	1829	1907												2				2	
05/15/02	RV CMWR	7	2332	351	9										1	1			3	14	
05/16/02	ISBR CMWR	7	1920	2311	4			2				122	14		9	11		18	54	244	
05/16/02	RV CMWR	7	1935	439	13			1			1		7	1	11	7		60	19	120	
05/16/01	RV INWR	8	2016	510	2			2				27	43		39	3		80	34	200	
05/16/01	CO T INWR	8	1839	229	2			7	1			1	147		69	5		100	14	348	
05/16/01	RCR INWR	8	2249	2255				3					1					1	8	13	
05/16/01	RV INWR	8	29	512				4				17	18		12			7	7	55	
07/05/01	Golden Dream all	8	2051	2145	10			3				23	1		8			26	12	83	
07/05/01	Golden Dream short	8	2030	2040				1			1	5	5		10			8	5	35	
07/05/01	RV INWR	8	5	525				3	11			6	27		13	1		49	6	116	
10/13/01	MY INWR	8	128	606					2						2	1		1	60	66	
10/13/01	CO T INWR	8	1934	42	3			4				2	39		25	3	2	21	9	108	
10/13/01	RG INWR	8	1953	37								1	8		16	2		20	3	90	
10/13/01	RV INWR	8	2014	607					1			1	37		3	3		4	11	60	
10/14/01	Metzquit PI INWR	8	1822	2345	1			1				4		1	10	1		42	5	56	
10/14/01	RG INWR	8	1825	2323	8			28				2	9		25	5	1	80	10	168	
10/14/01	RV INWR	8	1838	603					7				59		17	1		67	4	155	
02/15/02	MY INWR	8	1819	302								9	38		26	1		237	287	601	
02/15/02	RV INWR	8	1737	522								2	19		5	2		44	126	198	
02/16/02	RB GD Mine INWR	8	1754	1844						1		8	5		11			24	4	53	
02/17/02	RV INWR	8	1803	2025								1			1			1	10	13	
05/13/02	CO T INWR	8	106	514	2			4				4	80		38	23		36	16	173	
05/13/02	RG INWR	8	36	443				2				4	8		24	10		3	11	52	
05/13/02	RV INWR	8	2320	528	3			13		1		11	54		22	2		90	96	212	
05/14/02	Bureka	8	1947	2128															10	10	
05/14/02	Golden Dream	8	1933	2112								4			18			47	1	70	
05/14/02	RV INWR	8	1939	500	4				6			5	28	1	45	3		144	76	323	
05/15/02	MY INWR	8	1939	454	7			205				4	13	2	45	38		149	254	727	
05/18/02	CO T INWR	8	1946	2111	41			44					2					84	3	174	
05/19/02	CO T INWR	8	1948	248	10			17			1		79		89	2		61	3	232	
05/23/02	BW INWR	8	1936	537	8			4	12			2	68		121	10		219	25	469	
05/10/02	BW INWR	8	1932	517	9			17	1			1	95		240	26		230	49	629	
05/10/02	BW INWR	8	1929	513	9			1	1			18	307		215	7		145	21	724	
05/25/02	Black Rock	8	1936	2117	4			2				2	19		18			13	1	62	
05/27/02	CO T INWR	8	1932	123	70			23	2	5		12	126	1	121	2		274	5	644	
06/28/02	BC wash	8	2009	553	22			6		2		8	116		295	1		458	102	1010	
07/05/02	Bureka	8	1950	2059					1				9		57			15	1	62	
07/18/02	BW INWR	8	2002	535	16			6				20	291	1	318	10		231	7	900	
08/12/02	CO T INWR	8	2018	600	160			269	10	4	10	8	290	1	276	1		280	16	1288	
08/13/02	BW INWR	8	2003	600	11			9	7		1	8	199		158	11		189	25	578	
09/13/02	Bureka	8	1845	2000								3	9		26			15	1	54	
05/10/01	30 Mine	9	1947	2029								6	3		36					45	
07/10/01	Winkhausen	9	2026	2101	3			5							4			1	1	14	
02/15/02	30 Mine	9	1854	2034								6	6		13	1		3	7	36	
Total Minutes by Species																					
						712	5	1014	156	27	42	24	859	3415	456	3578	466	7	5072	3319	19163

Cottonwood Revegetation



9 5:22 PM

Permanent Anabat Monitoring Stations



CONCLUSIONS

- *Myotis occultus* is probably extirpated along the Lower Colorado River
- Only four known remaining maternity colonies for *Myotis velifer* in mines along the LCR
- Only one known maternity colony of *Corynorhinus townsendii* in a mine along the LCR
- *Myotis yumanensis* has benefited by the creation of lakes and is now ubiquitous along the LCR
- *Lasiurus xanthinus* may have expanded their range along the LCR by the introduction of exotic palms
- *Macrotus californicus* populations appear to be stable in mines along the LCR

Hypothesis for the Declines

- The removal and replacement of native floodplain vegetation that supported the insect diets of these bats
- The heavy pesticide spraying in agricultural areas (conducted principally at night) that would directly reduce the preybase and indirectly poison the bats
- The disturbance of roosts by the increased resident and recreational human population along the Colorado River

Field assistance and/or logistical support

Angela Gatto, Christine and Greg Bates (Lake Havasu BLM); Dr. Kathleen Blair and Dick Gilbert (Bill Williams River NWR); John Earle, Greg Wolf, Jack Allen and Aimee Haskew (Havasu NWR); Brenda Zaun, Geary Hund, and Tom Alexander (Cibola NWR); Guy Wagner, Ken Edwards, Juliette Gutierrez, Jackie and Jim Ferrier (Imperial NWR); Kirke King (Phoenix FWS); Lin Piest, Beatriz Vizcarra and Katy Hinman (AGFD); Nancy Andrews and Betsy Bolster (CDFG); Bryan Moore and Tom Cullen (Lake Mead NRA); Joe Kahl, Theresa Olson and Allen Calvert (Bureau of Reclamation); Susanna Henry and Lindsay Smythe (Kofa NWR);; Morgan Ruelle and Jason Tinant (Ridgecrest BLM); Grant Harter (Needles BLM).



