Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Post-Development Bat Monitoring
2008 Acoustic Surveys

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

April 2010

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Lower Colorado River
Multi-Species Conservation Program

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Multi-Species Conservation Program
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Lower Colorado Region
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Abstract

Quarterly acoustic bat surveys were conducted by the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) at seven habitat creation sites along the lower Colorado River and adjacent riparian habitats. Surveys were conducted during October 2007 and February, April, and July 2008, for a total of 301 detector nights with 171,063 bat calls recorded. A permanent monitoring station was installed in April, which recorded bat calls nearly flawlessly through the end of September. A total of 164 nights were sampled at the permanent monitoring station with 32,397 bat calls recorded. The primary focus of post-development bat monitoring is on the two covered bat species, western red bat *(Lasiurus blossevillii)* and western yellow bat (*Lasiurus xanthinus),* and the two evaluation species, pale Townsend's big-eared bat (*Corynorhinus townsendii)* and California leaf-nosed bat (*Macrotus californicus).* All four species were detected at the 'Ahakhav Tribal Preserve. Three covered and evaluation species (all except the Townsend's big-eared bat) were detected at the Beal Lake Habitat Restoration Area, Palo Verde Ecological Reserve, and the Imperial Ponds Conservation Area. Two species were detected at Cibola Valley Conservation Area (yellow bat and California leaf-nosed bat) and the Cibola NWR Unit #1 (red bat and California leaf-nosed bat).

Introduction

Quarterly post-development bat monitoring was conducted utilizing Anabat bat detectors in seven LCR MSCP habitat creation areas, including Beal Lake Habitat Restoration Area, 'Ahakhav Tribal Preserve, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, Cibola NWR Unit #1, Pratt Restoration, and the Imperial Ponds Conservation Area. The principal goal of this monitoring is to assess seasonal use of the restoration sites by the two covered bat species, the western red bat (*Lasiurus blossevillii*), and the western yellow bat (*Lasiurus xanthinus*), and the two evaluation species, the pale Townsend's big-eared bat (C*orynorhinus townsendii pallescens)* and the California leaf-nosed bat (*Macrotus californicus*.

A new acoustic sampling protocol was established in early 2008 that increased the number of samples in each major habitat type to allow statistical comparisons of bat activity by habitat type. The new protocol was implemented for the April 2008 and July 2008 sample periods. This data set also includes data that preceded the new sampling design (October 2007 and February 2008). A total of 76 detector nights were completed on nine monitoring sites and four exploratory sites in the Beal Lake Habitat Restoration area. A total of 10,924 call files were collected and edited, and valid call files were identified to species or species groups. A permanent Anabat station was established at the Beal Lake Restoration Area on April 8, 2008, and has continued uninterrupted for the most part throughout the rest of the year. Post-development bat monitoring was initiated at the 'Ahakhav Tribal Preserve in April 2008. Nine sites were selected for monitoring. Thirty-six detector nights were completed with a total of 11,412 call files collected and edited. Forty-four detector nights were completed at nine monitoring sites in the Palo Verde Ecological Reserve. A total of 16,676 bat call files were collected and edited. Forty-one detector nights were completed at eight monitoring sites in the Cibola Valley Conservation and Wildlife Area. A total of 19,722 call files were collected and edited. Thirty-two detector nights were completed for

seven monitoring sites at Cibola NWR Unit #1 Conservation Area. A total of 7,441 call files were collected and edited. A total of 59 detector nights were completed for 18 sites at Imperial Ponds Conservation Area. A total of 100,247 call files were collected and edited. All four covered species were found acoustically at all of the conservation areas. The California leaf-nosed bat was by far the most common covered species. The other three covered species were only picked up minimally.

The LCR MSCP Habitat Conservation Plan includes two covered bat species: western red bat (*Lasiurus blossevillii*) western yellow bat (*Lasiurus xanthinus*), and two evaluation bat species, California leaf-nosed bat (*Macrotus californicus*), and pale Townsend's big-eared bat (C*orynorhinus townsendii pallescens*). Conservation measures for the covered bat species include conducting surveys and research to better identify covered habitat requirements and species distribution, as well as to monitor and adaptively manage covered and evaluation species habitats. Of the 7,260 acres of cottonwood-willow and honey mesquite to be created as covered species habitat, at least 765 acres will be designed and created to provide western red bat and western yellow bat roosting habitat. Conservation measures for the two evaluation bat species include conducting surveys to locate roost sites and creating covered species habitat near roost sites (Reclamation 2004).

Study Areas

Quarterly post-development acoustic bat monitoring was conducted in seven Lower Colorado River Multi-Species Conservation Program habitat creation areas during FY08. These areas included Beal Lake Habitat Restoration Project, Colorado River Indian Tribe's 'Ahakhav Preserve, Palo Verde Ecological Reserve, Cibola Valley Conservation and Wildlife Area, Cibola NWR Unit #1, Imperial Ponds Conservation Area, and the Pratt Restoration Demonstration Area.

Beal Lake Habitat Restoration Project

The Beal Lake Restoration Project is located on Havasu National Wildlife Refuge in Needles, California, within the historic floodplain of the lower Colorado River. It consists of over 200 acres (81 hectares) of cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii),* coyote willow (*S. exigua*), honey mesquite (*Prosopis glandulosa),* and screwbean mesquite (*Prosopis pubescens*) in a series of plantings that began in 2001 and were completed in 2005 (Reclamation 2005a). Table 1 and figures 1 and 2 show the study site characteristics and maps.

Table 1. Sample sites, habitat, and purpose for the Beal Lake Habitat Restoration Project

Site Name	Habitat	Purpose
N	Mesquite	Monitoring
A	Mesquite	Monitoring
BB	Mesquite	Monitoring
K	Cottonwood - sapling	Monitoring
FF	Cottonwood - sapling	Monitoring
C	Cottonwood - sapling	Monitoring
NE SC	Saltcedar	Monitoring
NW SC	Saltcedar	Monitoring
SW SC	Saltcedar	Monitoring
Beal Lake	Lakeshore	Exploratory
Pump	Channel edge	Exploratory
Topock Lake	Lakeshore	Exploratory
SE SC	Saltcedar	Exploratory
D	Cottonwood – sapling	Exploratory
MAPS	Cottonwood – intermediate	Exploratory
Sac	Saltcedar	Exploratory
Topock (south)	Lakeshore	Exploratory

Figure 1. Beal Lake Habitat Restoration Project (North Half) acoustic monitoring sites

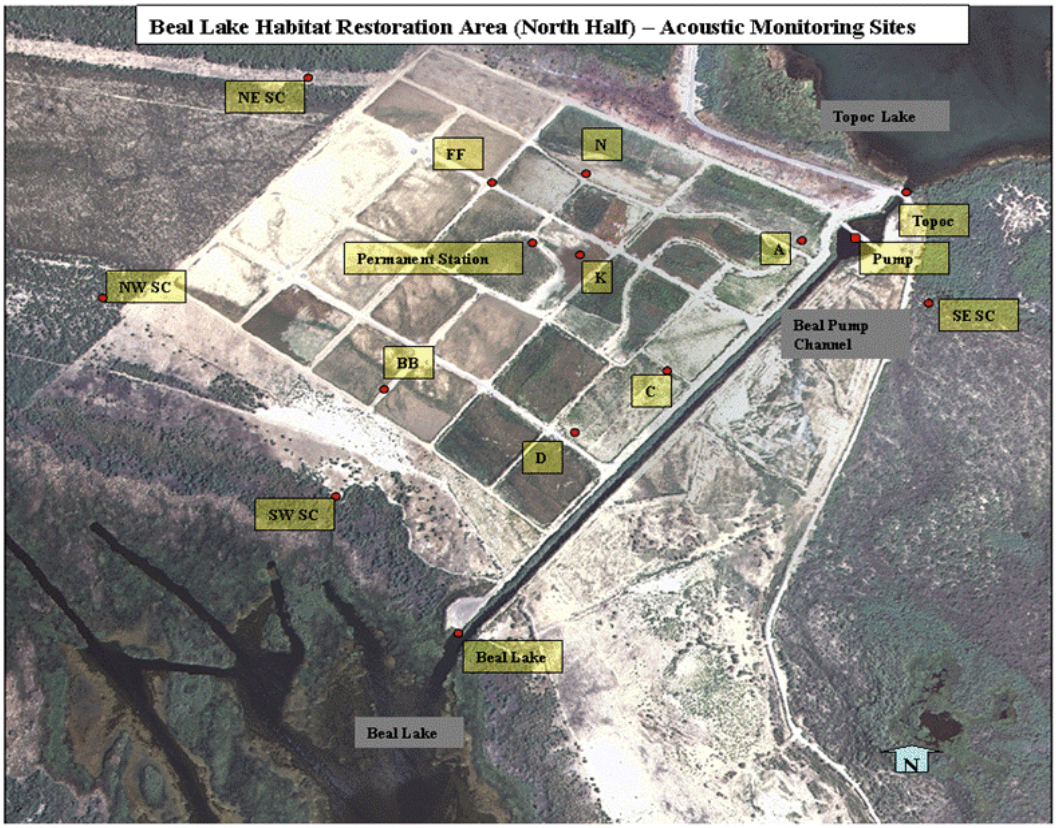
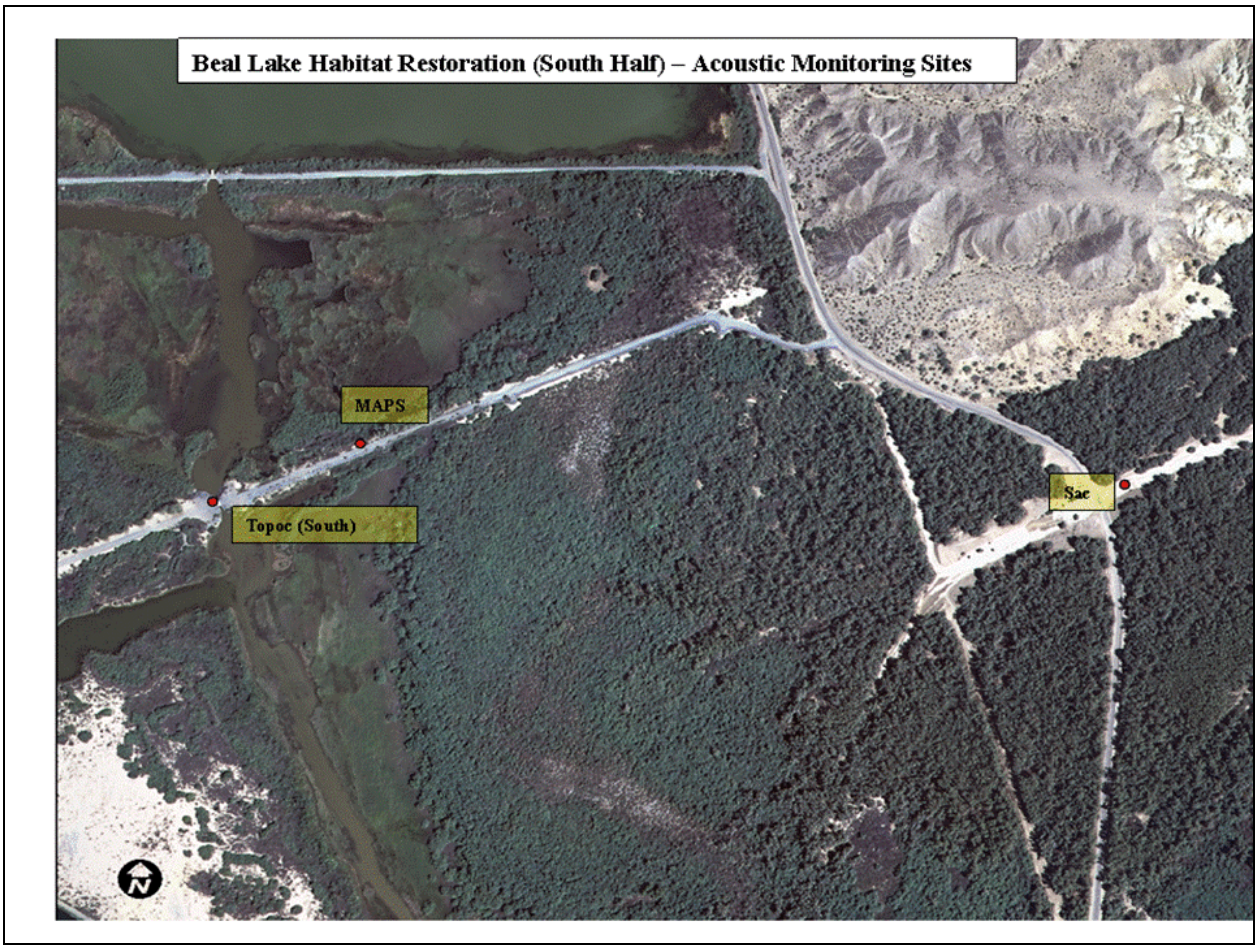


Figure 2. Beal Lake Habitat Restoration Project (South Half) acoustic monitoring sites



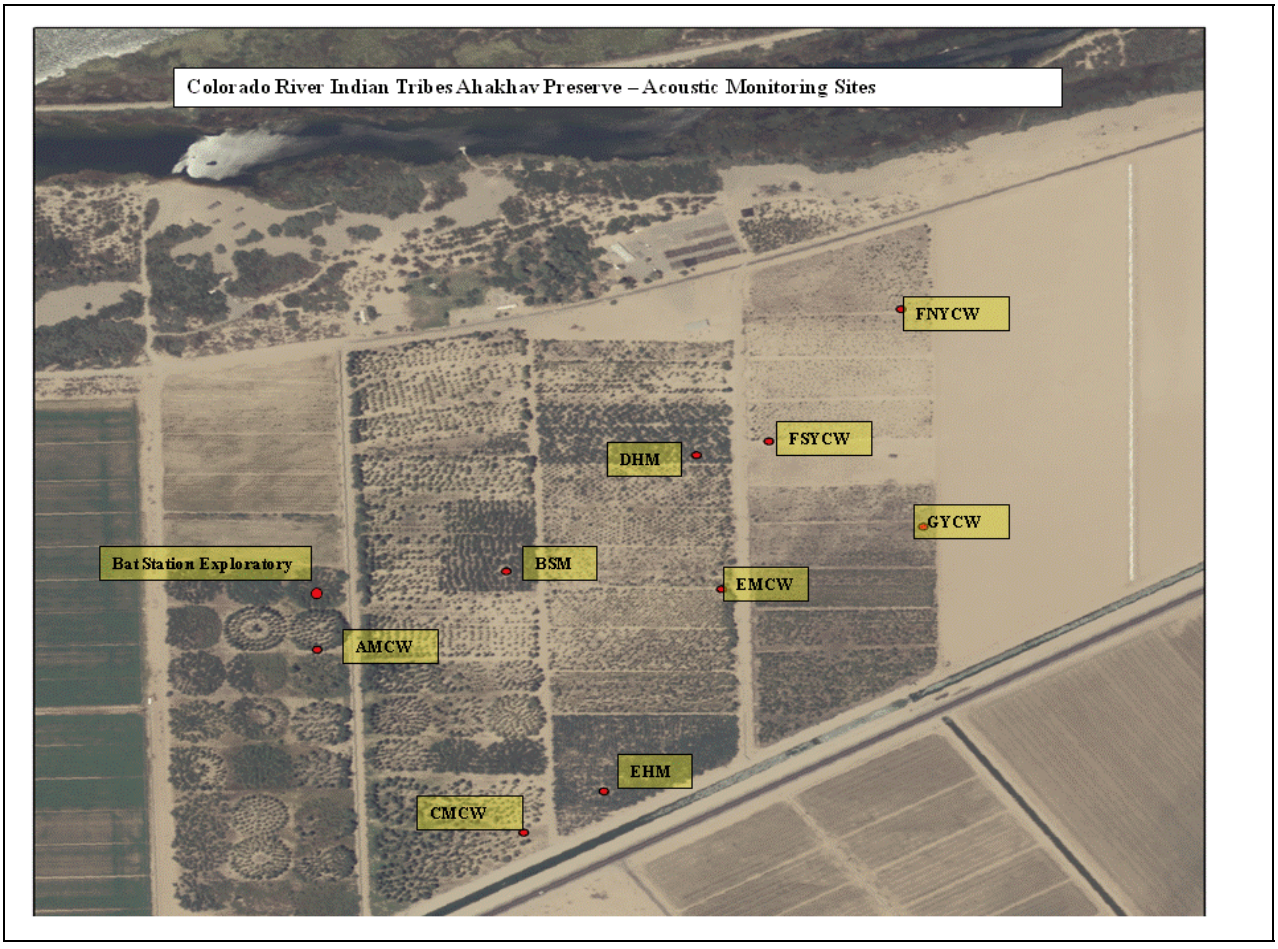
Colorado River Indian Tribes 'Ahakhav Preserve

The 'Ahakhav Preserve encompasses 154 acres (62 ha) of a mix of sapling and intermediate stage cottonwood and mesquite stands. Table 2 and Figure 3 show the study site characteristics and map.

Table 2. Sample sites, habitat and purpose, Ahakhav Preserve.

Site Name	Habitat	Purpose
EHM	Mesquite (honey)	Monitoring
DHM	Mesquite (honey)	Monitoring
BSM	Mesquite (screwbean)	Monitoring
AMCW	Cottonwood - intermediate	Monitoring
CMCW	Cottonwood - intermediate	Monitoring
EMCW	Cottonwood - intermediate	Monitoring
FSYCW	Cottonwood – sapling	Monitoring
FNYCW	Cottonwood - sapling	Monitoring
GYCW	Cottonwood - sapling	Monitoring
Bat Station	Cottonwood - intermediate	Exploratory

Figure 3. Ahakhav Preserve acoustic monitoring sites



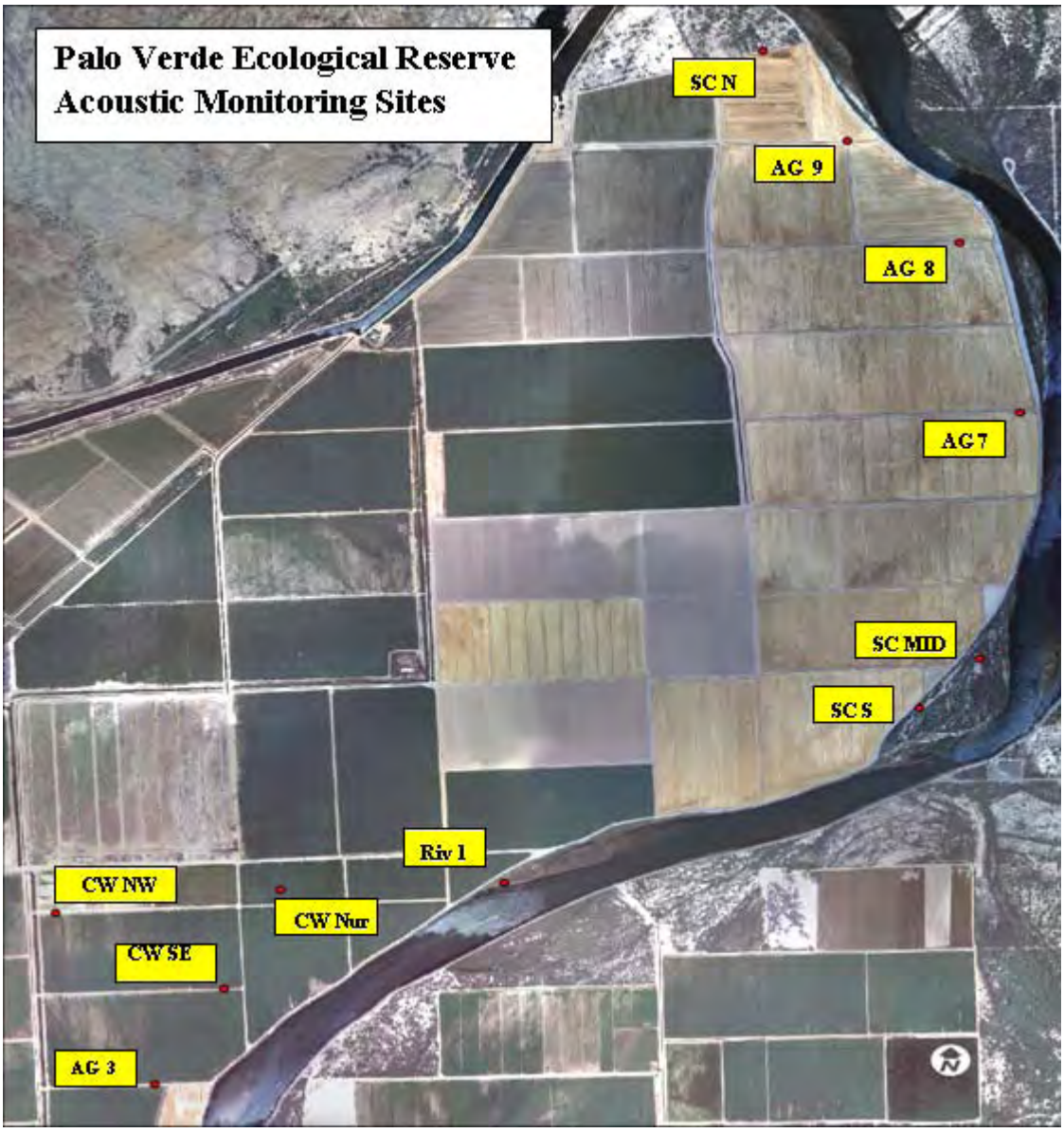
Palo Verde Ecological Reserve

The Palo Verde Ecological Reserve (PVER) encompasses 1,352 acres (536 ha) of Colorado River historic floodplain near Blythe, California, of which 1,100 acres (445 ha) of active agricultural lands were identified for habitat restoration (Reclamation 2006). There are three agriculture sites, three saltcedar sites, three intermediate cottonwood sites, and two exploratory sites (Table 3 and Figure 4).

Figure 4. Ahakhav Preserve acoustic monitoring sites

Site Name	Habitat	Purpose
SCN	Saltcedar	Monitoring
SC Mid	Saltcedar	Monitoring
SCS	Saltcedar	Monitoring
AG	Agriculture	Monitoring
AG 8	Agriculture	Monitoring
AG9	Agriculture	Monitoring
CW2NW	Cottonwood – sapling	Monitoring
CW2SE	Cottonwood - sapling	Monitoring
CWNur	Cottonwood - sapling	Monitoring
Riv1	River shoreline	Exploratory

Figure 5. Palo Verde Ecological Reserve acoustic monitoring sites



Cibola Valley Conservation and Wildlife Area

The Cibola Valley Conservation and Wildlife Area (CVCA) encompasses 1,019 acres (412.4 ha) of active agricultural lands. Phase 1, implemented in 2006, converted approximately 64 acres (25.9 ha) of active agricultural fields to cottonwood-willow habitat. Table 4 and Figure 5 show the study site locations and characteristics (Reclamation 2007a).

Table 4. Sample sites, habitat, and purpose for the Cibola Valley Conservation and Wildlife Area

Site Name	Habitat	Purpose
YCW A	Cottonwood - sapling	Monitoring
YCW D	Cottonwood - sapling	Monitoring
YCW 2	Cottonwood – sapling	Monitoring
Ag 1	Agriculture	Monitoring
Ag 2	Agriculture	Monitoring
Mesq 4	Mesquite – pre treatment	Exploratory
Bacc 2	Baccharis	Exploratory
Mesq 3	Mesquite – pre treatment	Exploratory

Figure 6. Cibola Valley Conservation and Wildlife Area acoustic monitoring sites

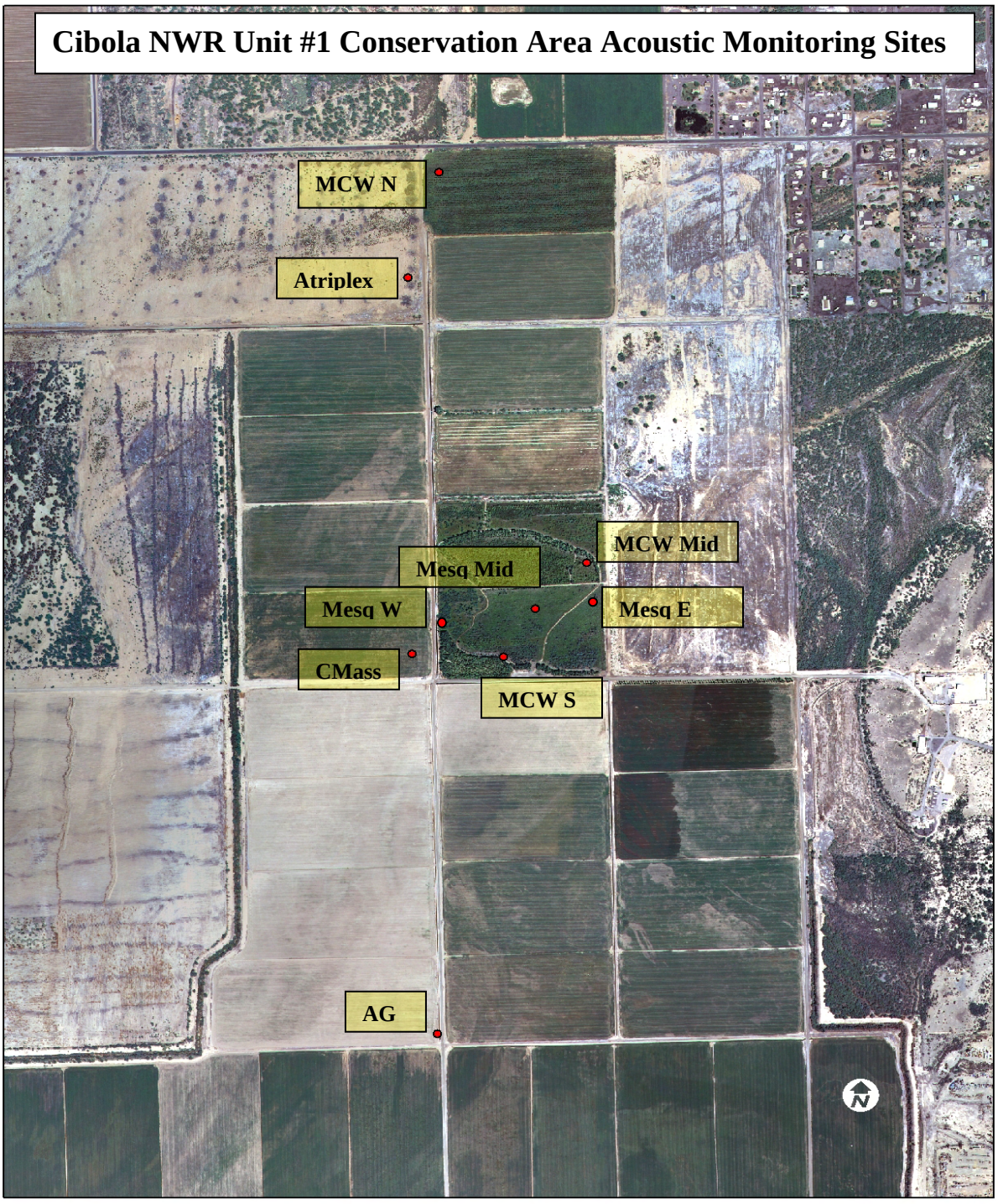
Cibola NWR Conservation Unit #1

The Cibola National Wildlife Refuge consists of 16,600 acres (6,718 ha) along 12 miles (19.3 km) of the lower Colorado River. It is divided into 6 management units numbered from 1 to 6. Reclamation has several ongoing and planned projects in Unit 1 (CNWR#1) (Garnett and Calvert 2007). Table 5 and Figure 6 show the study site locations and characteristics.

Table 5. Sample sites, habitat, and purpose for Cibola NWR Unit #1

Site Name	Habitat	Purpose
MCW N	Cottonwood - intermediate	Monitoring
MCW Mid	Cottonwood - intermediate	Monitoring
MCW S	Cottonwood - intermediate	Monitoring
Mesq W	Mesquite	Monitoring
Mesquite Mid	Mesquite	Monitoring
Mesq E	Mesquite	Monitoring
Ag	Agriculture	Monitoring
Cmass	Cottonwood – sapling	Exploratory
Atriplex	Atriplex (pre-treatment)	Exploratory

Figure 7. Cibola NWR Unit #1 Conservation Area acoustic monitoring sites



Imperial Ponds Conservation Area

The Imperial Ponds, located on Imperial NWR (previously referred to as the DU2 Ponds), were originally constructed to provide a mixture of habitat types, including isolated backwater for native fish, marsh, and riparian land cover types. The number of ponds was expanded to six in 2007, creating an additional 80 acres of backwater habitat for native fish (Figure 7). Also present in the area is a mature cottonwood-willow stand planted in 1993, referred to as the nursery (Reclamation 2005b). The riparian component of the design was largely unsuccessful, despite multiple plantings of cottonwood, willow, and mesquite trees in the terraced areas surrounding the ponds. High soil salinity was identified for the lack of success in establishing trees. The soil removed from pond expansion has been spread on adjacent fields and is bare dirt at present. Thirty-four acres will be planted with cottonwood-willow adjacent to the nursery.

Field 18 was included for pre-treatment bat monitoring, as it is scheduled for development into marsh habitat for black rails (*Laterallus jamaicensis).* In 2007, this field was untreated with a mix of saltcedar, *Phragmites*, and saltgrass. In 2008, Field 18 was converted to black rail habitat with a mixture of wetland plants and areas of shallow open water. Also included for bat monitoring was McAllister Lake, 32 acres (12.9 ha) of which is a seepage driven floodplain lake with no connection to the LCR. This lake is being used as a demonstration area for reducing salinity and improving water quality; however, no reconstruction activities have taken place. Figures 8 and 9 and Table 7 show the sample site locations and characteristics.

Figure 8. Imperial NWR (North Half) acoustic monitoring sites

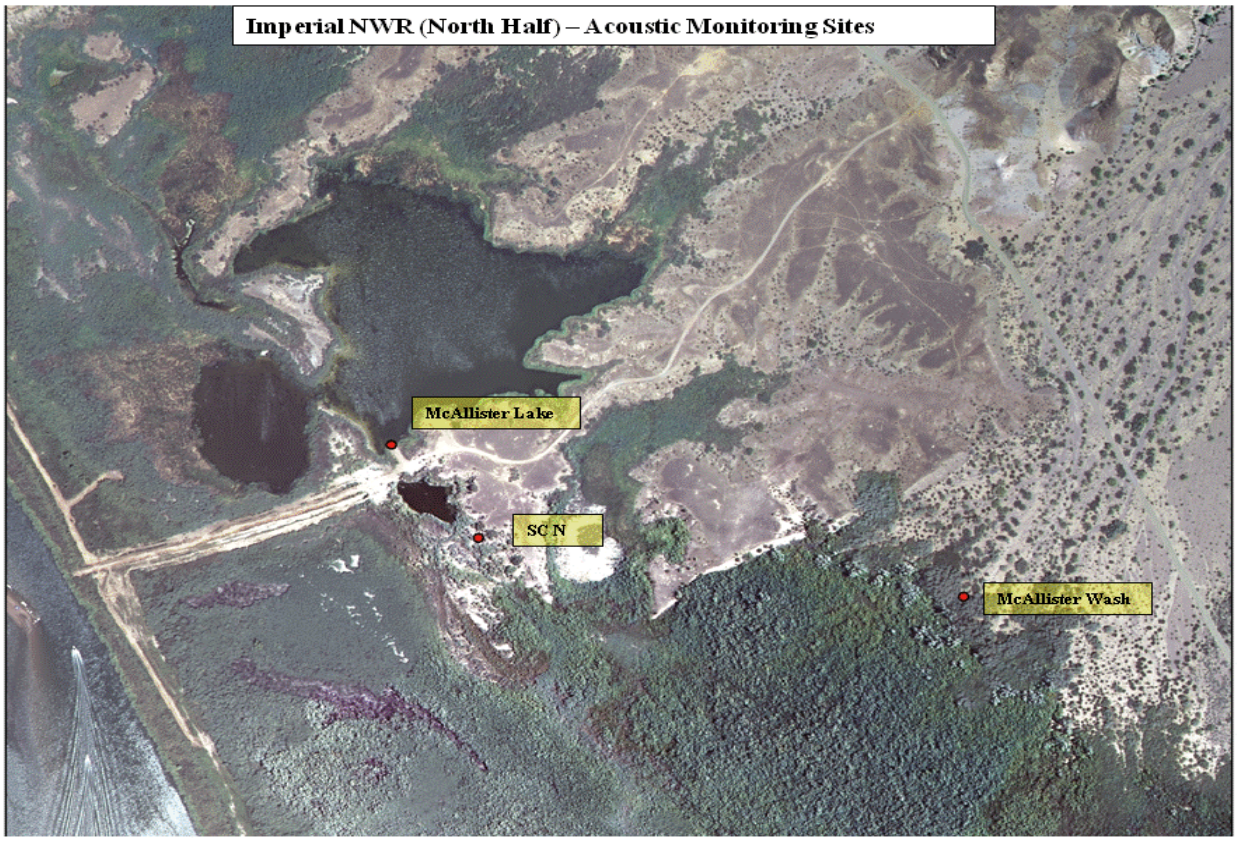
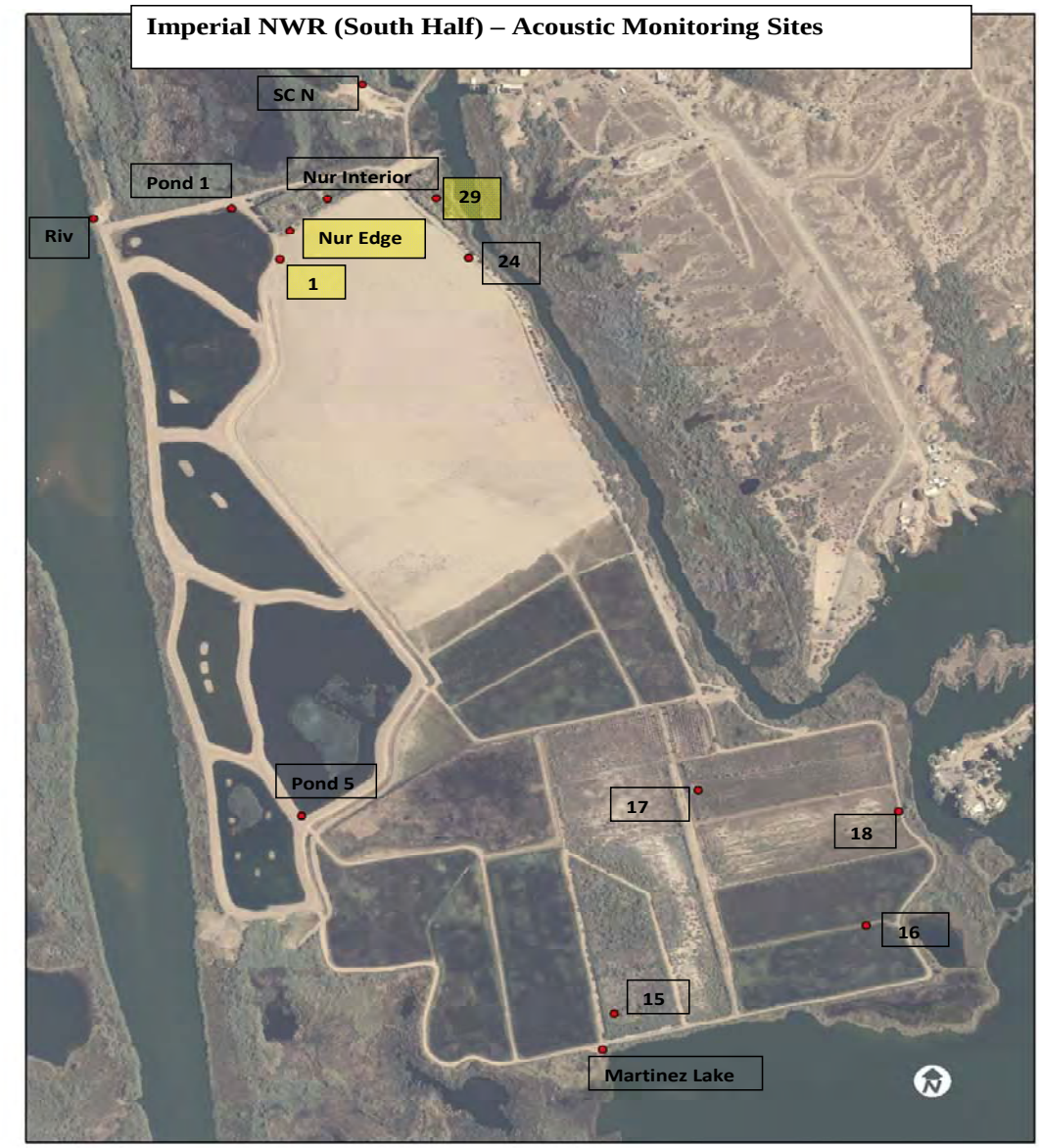


Table 7. Sample sites, habitat, and purpose for Imperial Ponds Conservation Area

Site Name	Habitat	Purpose
Mc Allister Lake	Lakeshore	Exploratory
Saltcedar N	Saltcedar	Monitoring
McAllister Wash	Saltcedar	Exploratory
Nursery Interior	Cottonwood – intermediate	Monitoring
Nursery Edge	Cottonwood edge	Exploratory
Pond 1	Lakeshore	Exploratory
Riv	River edge	Exploratory
1	Agriculture	Monitoring
24	Agriculture	Monitoring
29	Cottonwood – intermediate	Monitoring
Pond 5	Lakeshore	Exploratory
17	Cottonwood – intermediate	Exploratory
18	Marsh	Exploratory
16	Cottonwood – intermediate	Exploratory
15	Cottonwood – intermediate	Exploratory
Martinez Lake	Lakeshore	Exploratory

Figure 9. Imperial NWR (South Half) acoustic monitoring sites



Pratt Restoration Demonstration Area

The 12-acre (4.9-ha) Pratt Restoration Demonstration Area was planted with cottonwood and willow in 1999 (Reclamation 2003). At present this has matured into a healthy gallery forest. Some selective harvesting was conducted in 2005, 2006, and 2007 to create a mosaic of uneven aged, structurally diverse habitat. This site was selected for bat monitoring because it is a restoration site that contains mature cottonwood-willow habitat that is potentially suitable for the western red bat and western yellow bat. Table 6 and Figure 10 show the sample site locations and characteristics.

Figure 10. Pratt Restoration Demonstration Site acoustic monitoring sites

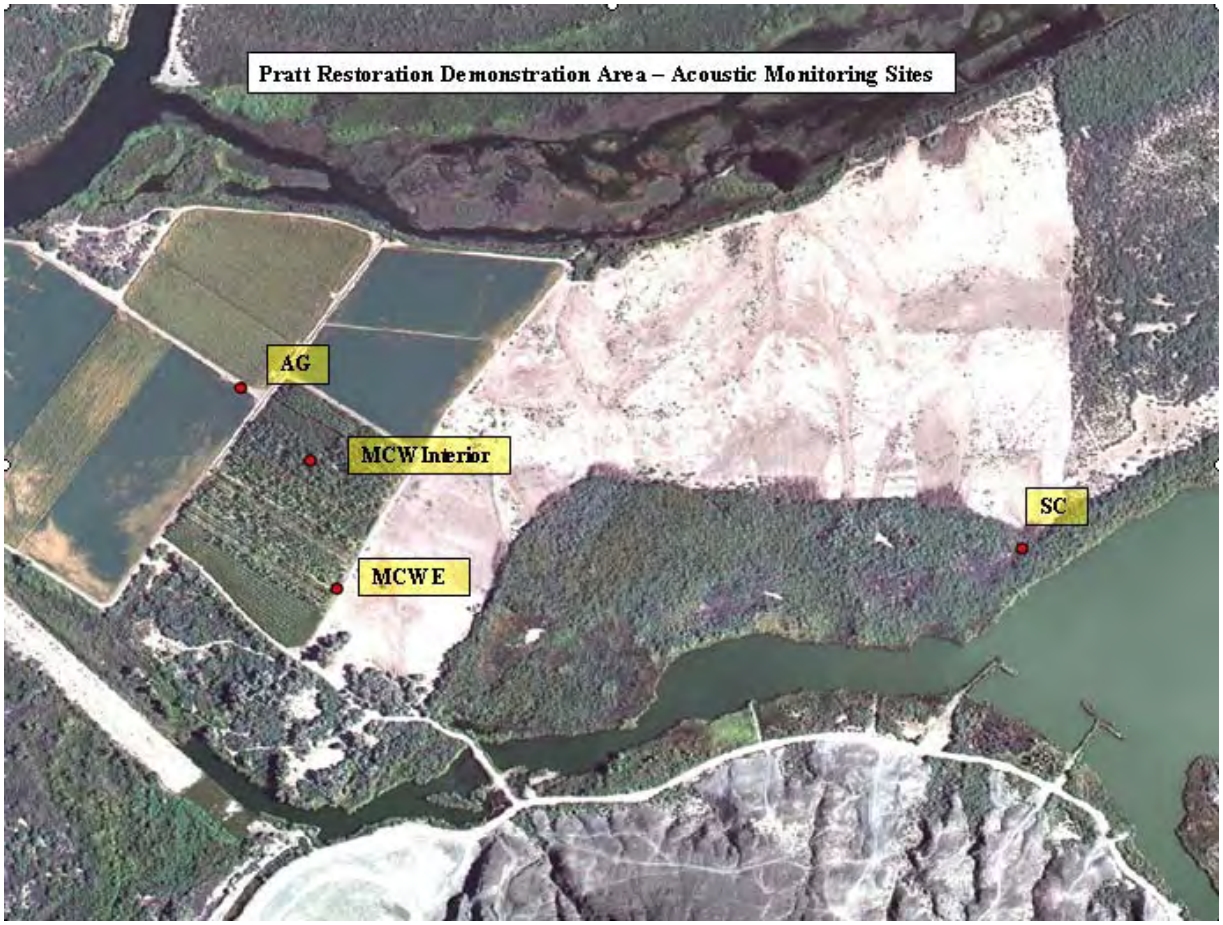


Table 6. Sample sites, habitat, and purpose for Pratt Restoration Area

Site Name	Habitat	Purpose
AG	Agricultural Field	Monitoring
MCW Interior	Cottonwood - intermediate	Exploratory
MCW E	Cottonwood - intermediate	Monitoring
SC	Saltcedar	Monitoring

Methods

Acoustic bat surveys were conducted using Anabat SD1 bat detectors as outlined by Brown (2006). Bat calls were recorded directly onto compact flash cards. Up to 12 units were deployed simultaneously in adjacent habitats and run continuously from dusk to dawn, recording all bat calls during an approximate 10-hour period from dusk to dawn. Two nights were sampled in each restoration area either consecutively or within four days of the first sample night. Sampling

was conducted quarterly during the dark phase of the moon in October 2007, and February, April, and July 2008.

Sample sites were located non-randomly in representative habitats and monitored at the same location consistently. Detectors were placed on posts at approximately 1 meter high at a 45 degree angle. This eliminated the risk of inundation of the detector during periodic irrigation of the restoration areas. In some situations detectors were placed on extendable poles reaching 6 meters or more in height to reduce or eliminate interference from intense cicada calls, particularly during the July sample period. Insect calls prevent recording of bat calls, unless the bat is calling directly in front of the detector. In some situations cicada calls cease within the first hour after sunset; however, in other cases cicada calls can continue throughout the night, rendering acoustic sampling nearly impossible. Locating the bat detector on the extendable pole and facing the detector vertically allows sampling to be conducted, even during the peak of insect activity.

Detectors were placed either along the edge of a habitat site or on a linear opening within the site that allowed access to bat foraging (swoop zones). Prior to deployment, each detector was calibrated manually using a thumb snap to achieve enough sensitivity to record as many bat calls as possible without recording excessive extraneous noises from wind, tree branches, insects, etc. Earlier work in 2007 used an electronic flea collar that produced a constant ultrasonic chirping. However, this did not prove to be any more useful in calibrating detectors than the finger snap. Depending on the unit, sensitivity ranged from 4 to 7. The standard division ratio was set at 16.

To protect detectors from rain and dust, each detector was placed in a tightly sealed plastic bag with the microphone exposed. During cloudy periods with storm activity likely, a rain guard was mounted on the detector (a flat thin metal shield placed on top of the detector extending slightly over the microphone). The shield protected the microphone from all but the most intense, windy storm events, yet allowed good exposure of the microphone to bat calls. This setup allowed the unit to be camouflaged to minimize exposure to theft or vandalism.

Sampling on multiple nights provides an assessment of the level of temporal variation within and among habitats (Williams et al. 2006). Sampling all sites within a habitat creation area simultaneously also insures that any variation in conditions that affect bat activity is consistent among sampling sites.

The following assumptions were made for this monitoring study (Hayes 2000, Sherwin et al 2000): 1) all habitats were equally accessible to all bats, 2) all bats were randomly distributed vertically from just above the ground to the upper canopy layers, and 3) any particular species was equally detectable from each habitat type. It was also assumed that all acoustic equipment had an equal ability of detecting bat echolocation calls. Another major assumption was that sampling simultaneously in a habitat creation area for a minimum of two nights per quarter was adequate to account for nightly variations in activity patterns of bats.

The installation of permanent bat monitoring stations at Beal Lake Habitat Restoration and at the Ahakhav Preserve provides continuous year-round nightly sampling. The non-random nature of bat detector location is done to select sites for optimum recording of bat calls either along habitat

edges or in openings within habitats. All field studies have some degree of spatial autocorrelation risk and this study is no exception. Sample sites within a habitat restoration area are located as far apart as possible to reduce the risk that bats foraging in one area are not also recorded foraging in nearby areas. However, with all acoustic bat studies this is difficult to assess. Data from this monitoring effort are intended to apply to the habitat restoration sites, rather than to the broader Colorado River ecosystem.

In March 2008, a new study design was developed to allow robust comparisons of bat use of three restored habitat types and two unrestored adjacent habitats. Five habitat types are included in the monitoring. At least three of the five habitat types are monitored per study area. Three bat detectors are deployed in each habitat type so that at least nine detectors are being deployed on any given night. Acoustic surveys are conducted for two days every quarter at each study area so that all seasons are sampled each year.

This study design is scalable, providing information on bat habitat use within individual restoration sites as well as information for the larger Lower Colorado River system. The primary focus is on habitat use of the four covered bat species using an index of bat activity. Bat activity levels will be compared between habitat types and bat activity levels will be evaluated for changes through time as sites mature. Landscape features such as distance to pooled water, distance to roosts (known mine colonies), canopy height, and tree density will be analyzed at the completion of surveys conducted during FY09.

The new study design was implemented during the April and July survey periods. Exploratory surveys were continued from 2007 during the October and February survey periods. Data from those surveys was used to develop the new sampling protocol. This new sampling protocol will also be used for monitoring conducted in 2010.

The first habitat type being monitored is the intermediate cottonwood-willow plantings where the average cottonwood DBH (diameter at breast height) is more than 8 cm (Figure 11). Sites with this habitat type include: ‘Ahakhav Preserve, CVCA, CNWR#1, Imperial, and Pratt.

Figure 11. Intermediate cottonwood-willow plantings with average cottonwood DBH >8cm

The second habitat type is sapling cottonwood-willow plantings where the average DBH is less than 8 cm (Figure 12). Sites being monitored include Beal, 'Ahakhav, PVER, and CVCA.

Figure 12. Sapling cottonwood-willow plantings with average DBH < 8 cm.

Mesquite plantings with an average canopy height of 3 m or more (Figure 13 is the third habitat being monitored). Sites include Beal, 'Ahakhav, and Cibola NWR Unit #1.

Figure 13. Mesquite plantings (includes both screwbean and honey mesquite), with canopy height ≥3 m

Monotypic *Tamarix* spp. (saltcedar) stands (Figure 14) are being monitored at Beal, PVER, Imperial, and Pratt.

Figure 14. Monotypic *Tamarix* spp. stands

The fifth habitat type being monitored for bat activity includes agricultural fields. These can range from bare dirt (fallow), to alfalfa, corn, or millet (Figure 15).

Figure 15. Agricultural fields include alfalfa, corn, millet, or bare dirt

Bat calls were identified to species or species group by comparing the minimum frequency, duration, and shape of each call sequence (bat pass) with reference calls from libraries of positively identified bats from throughout the western United States, as well as reference calls recorded on the LCR following the method outlined in Thomas et al. (1987). A bat pass is defined as a call sequence of duration greater than 0.5 ms and consisting of more than two individual calls (Thomas 1988; O'Farell and Gannon 1999). Filters developed by Chris Corben and modified by the author were used to aid in species identification.

One of the most challenging aspects to bat call identification is the frequent overlap of call characteristics, depending on the habitat the bat is flying over, wind, humidity, presence of ponded water, the volume of the species' calls (shouters vs. whisperers[1]), and presence of other bats of the same species or other species in the same airspace. This has been well documented by many bat researchers and summarized by the Western Bat Working Group (2004). A detailed analysis of these overlaps and guidelines for determining species identity was developed for each of the four focal bat species and is included in Appendices 1 through 4. These call guidelines serve as documentation for how each call was identified.

[1] Bats can be characterized by their echolocation calls as shouting bats and whispering bats. Big brown bats and Mexican free-tailed bats are shouters, producing calls of 110 decibels, similar to the loudness of a smoke alarm (if the bat calls were within the range of human hearing). Whispering bats such as the pallid bat produce sounds of 60 decibels or lower, similar in loudness to normal conversation. Shouters forage in open spaces while whisperers glean insects from the foliage of trees and forage in the cluttered forest interiors.

In cases where there are significant portions of the call envelope (all the characteristic calls of a species) that overlap with other bat species, a species group was assigned. Table 8 shows the species and species groups used for post-development bat monitoring.

A total of 15 bat species are known to occur along the LCR (Snow 2007). An additional species, the Arizona myotis (*Myotis occultus*), is thought to have been extirpated, but may in fact also be present along the river (Table 1) based on acoustic sampling and mist netting. Eight bat species were identified based on the presence of characteristic, diagnostic calls in the recordings. In addition, species groups were created consisting of overlapping, similar call characteristics as done by Betts (1998), Rainey et al. (2003), and the Western Bat Working Group (2004). The 45-55 kHz species group includes California myotis, Yuma myotis, and some calls of the canyon bat and California leaf-nosed bat. The 35-40 kHz species group consists of overlapping calls of the cave myotis and potentially the Arizona myotis. The issue of whether the Arizona myotis (*Myotis occultus*) still occurs on the LCR is yet to be determined. Additionally, it has yet to be determined definitively whether Arizona myotis is a subspecies of the little brown bat or is a distinct species, as the names vary from author to author. Calls of this species can overlap with the cave myotis. For the purposes of this annual report, the name *Myotus occultus* as adopted by the Arizona Game and Fish Department (2009) will be used. The 25-30 kHz group includes big brown bat, Mexican free-tailed bat, and the pallid bat. The 20-25 kHz species group includes overlapping calls of pocketed free-tailed bat, big free-tailed bat, hoary bat, and some calls of the Mexican free-tailed bat.

There are four abundant flagship species: canyon bat, Mexican free-tailed bat, California myotis, and Yuma myotis (Brown and Berry, personal communication). These flagship species (a term coined by Pat Brown, personal communication, which refers to their abundance along the Lower Colorado River) are widespread in a large array of habitats along the LCR and are considered to have stable or increasing populations. While they are important members of the mammalian community, the focus of habitat creation efforts is on restoring habitat for the two covered species, the western red bat and the western yellow bat, as well as for the two evaluation species, the California leaf-nosed bat and the pale Townsend's big-eared bat.

Call minutes is a relative activity index that eliminates the bias of overestimating bat relative abundance if multiple files of the same individual were recorded in a short period of time, or underestimating bat abundance because of multiple individuals recorded within a single file (Kalcounis et al. 1999, Brown 2006). A call minute indicates that a given species is present if it was recorded at least once within a 1-minute period, regardless of the number of call sequences recorded within that minute. The highest rating a bat species can have is 60 in an hour, indicating that the species (but not necessarily the same individual) is recorded continuously during the hour (Brown 2006, Williams 2001, Miller 2001).

Table 8. Bat species and species groups identified in the Lower Colorado River habitat creation areas.

Common Name	Scientific Name	Species Code
Individual Species		
Townsend's big-eared bat	*Corynorhinus townsendii*	Coto
Western red bat	*Lasiurus blossevillii*	Labl
Yellow bat	*Lasiurus xanthinus*	Laxa
California leaf-nosed bat	*Macrotus californicus*	Maca
Hoary bat	*Lasiurus cinereus*	Laci
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	Nyfe
Big free-tailed bat	*Nyctinomops macrotis*	Nyma
Mastiff bat	*Eumops perotis*	Eupe
Phonic Groups:		
20-25 kHz	Overlapping calls of Nyfe, Nyma, Laci, Tabr	
25-30 kHz	All calls of Epfu, Tabr, Anpa	
35-40 kHz	Overlapping calls of Myoc, Myve	
45-55 kHz	All calls of Myca, Myyu, Pahe	
Species included in the species groups listed above:		
Pallid bat	*Antrozous pallidus*	Anpa
Big brown bat	*Eptesicus fuscus*	Epfu
Mexican free-tailed bat	*Tadarida brasiliensis*	Tabr
California myotis	*Myotis californicus*	Myca
Cave myotis	*Myotis velifer*	Myve
Arizona myotis	*Myotis occultus*	Myoc
Yuma myotis	*Myotis yumanensis*	Myyu
Canyon bat	*Parastrellus hesperus*	Pahe

Results

Beal Lake Habitat Restoration Area

Exploratory surveys following the sampling protocol established in 2007 were continued at Beal Lake during the October 2007 and February 2008 sampling periods. A new sampling protocol was established in early 2008 that increased the number of samples in each major habitat type to allow statistical comparison of bat activity by habitat. The new protocol was implemented for the April 2008 and July 2008 sample periods and focused on sapling cottonwood (<8 cm DBH), mesquite, and saltcedar. The open water habitat monitoring sites at Beal Lake and Topock Marsh were discontinued. Only the pump canal connecting Beal Lake and Topock Marsh was continued because of the large amount of bat activity observed over this habitat type. A total of 76 detector nights were completed on nine monitoring sites and eight exploratory sites in the Beal Lake Habitat Restoration Area. A total of 10,924 call files were collected and edited, and valid call files were identified to species or species groups. A total of 31 bat minutes were recorded for the four covered bat species. The quarterly summaries of bat minutes recorded for the first and second sample periods in the nine monitoring and eight exploratory sites at Beal Lake are included in tables 1 and 2 in Appendix 5.

Total Number of Bat Minutes for Covered and Evaluation Species

A total of 5 western red bat minutes were recorded at the Beal Lake Habitat Restoration Area during October and July, 4 minutes of which were in the riparian restoration sites and 1 minute that was along the pump channel connecting Beal Lake with Topock Marsh (Figure 16). This compares with 13 minutes recorded for western red bats in July 2007, 9 minutes of which were obtained in riparian restoration areas compared to 4 minutes for adjacent habitat areas.

Five western yellow bat minutes were recorded at Beal. Two minutes were recorded in restoration habitat (sapling cottonwood) during spring and summer, 2 minutes were recorded in the pump channel connecting Beal Lake with Topock Marsh, and 1 minute was recorded in saltcedar in April (Figure 17). Slightly more yellow bats were recorded in 2007, with a total of 12 minutes recorded (Reclamation 2007b). However, 2008 was the first time that a yellow bat was recorded during summer in restoration areas at Beal Lake.

No minutes of bat activity were recorded for Townsend's big-eared bats in 2008 (Figure 18). This compares with 1 minute of bat activity recorded for this species in 2007. Because this is a whispering bat, these results are not unexpected as the bat has to be less than 15 ft (3 m) from the microphone in order to be recorded.

A total of 23 bat minutes were recorded for the California leaf-nosed bat at Beal Lake. Ten bat minutes were recorded on the edge of Topock Marsh and 2 minutes were recorded on the edge of Beal Lake in October. Four minutes were recorded in cottonwood/mesquite restoration areas during October and July and 3 minutes were recorded in adjacent saltcedar habitats. Only 1 minute was recorded during January on the edge of Topock Marsh and 2 minutes of activity were recorded in saltcedar habitat (Figure 19). In 2007, 166 bat minutes were recorded for this species in a wide variety of habitats and across all monitoring periods.

Mean Number of Bat Minutes for Entire Bat Assemblage

The mean number of bat minutes for all riparian restoration sites combined was compared qualitatively with those for all adjacent habitat sites (Figure 20). The most minutes of bat activity were recorded for the 45-55 kHz and 25-30 kHz species groups in both riparian restoration and adjacent habitat areas.

Seasonal habitat use of riparian and adjacent habitats by the four covered and evaluation bat species for Beal Lake Habitat Restoration Area — total number of bat minutes.

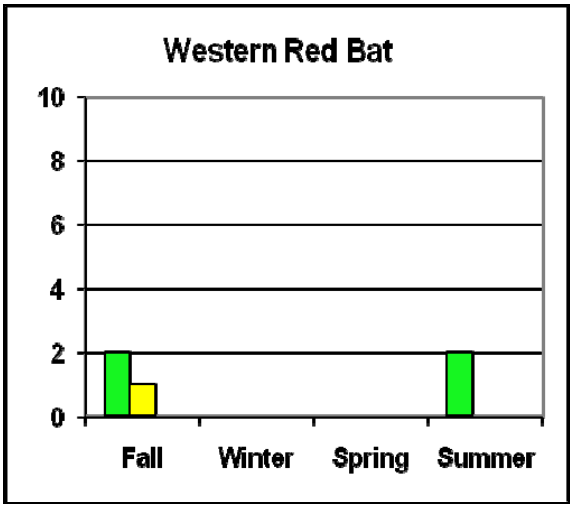


Figure 16. Western red bat

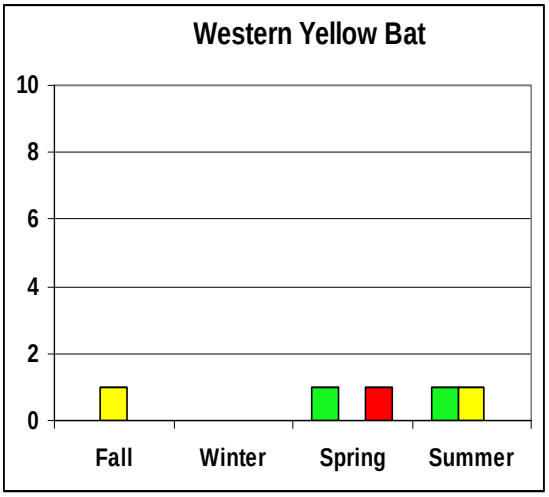


Figure 17. Western yellow bat

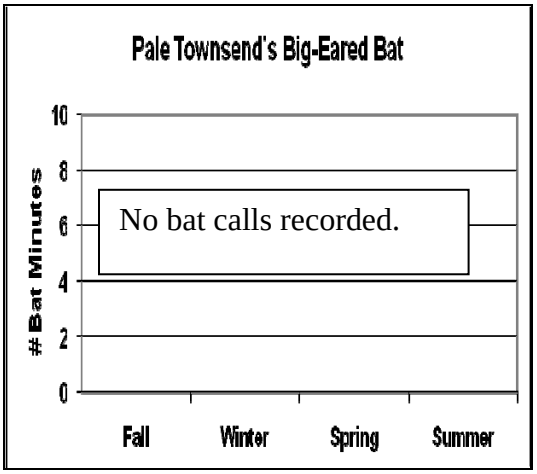


Figure 18. Pale Townsend's big-eared bat

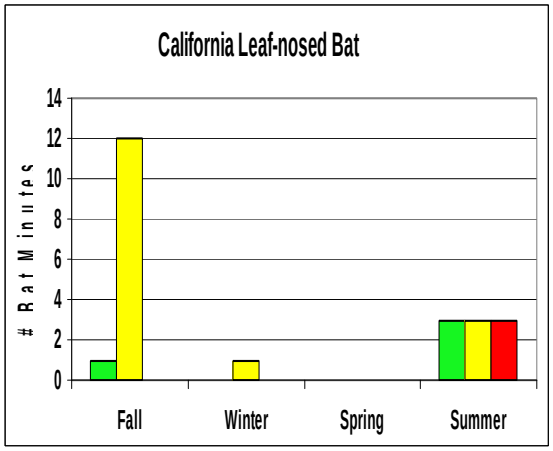


Figure 19. California leaf-nosed bat

Legend:

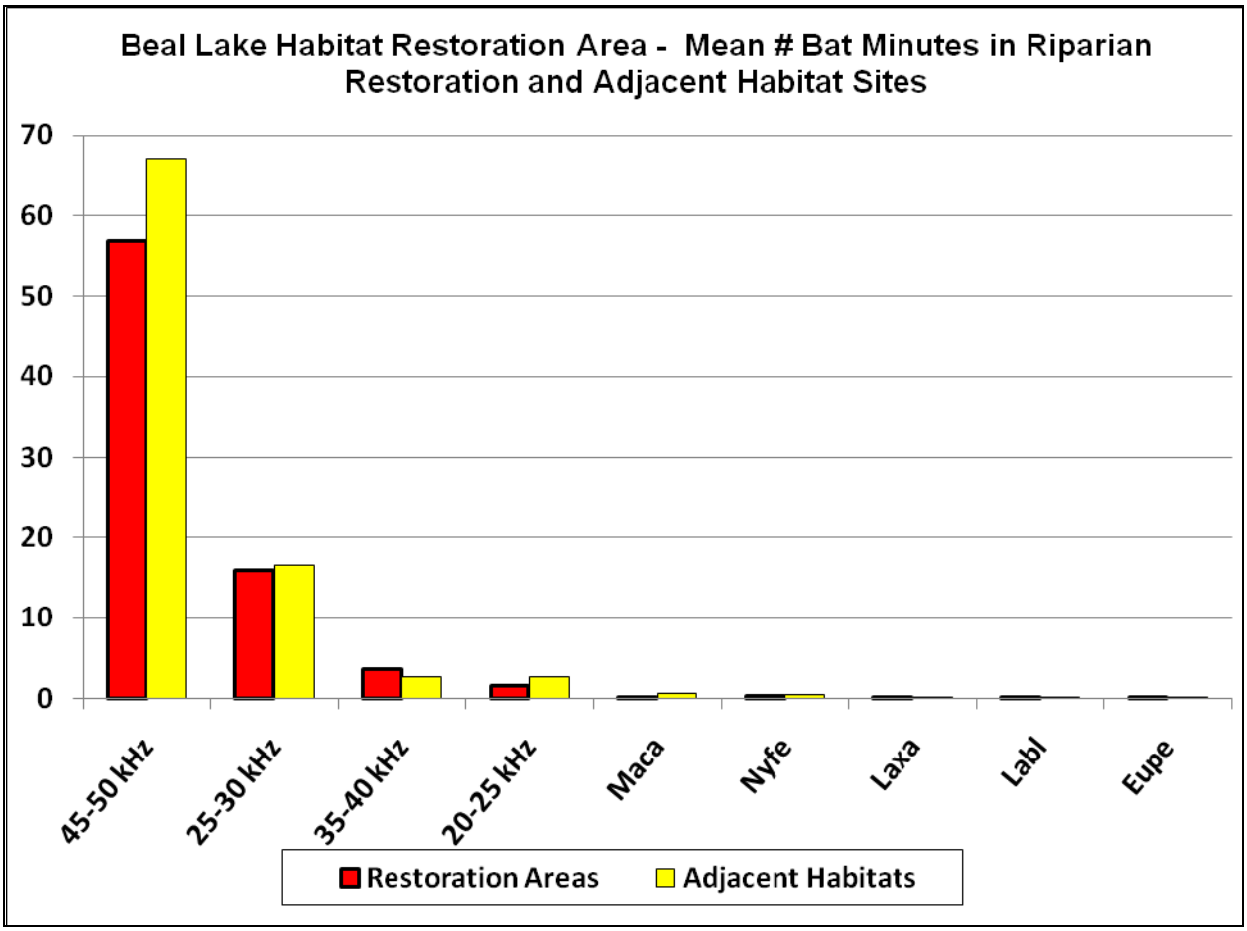
Riparian Restoration

Lakeshore/Canal Edge Sites

Saltcedar Sites

When considered in the context of the entire bat assemblage present at Beal Lake Habitat Restoration Area, the mean number of bat minutes for the covered and evaluation bat species was very small.

Figure 20. Mean Number of bat minutes in riparian restoration and adjacent habitats for the Beal Lake Habitat Restoration Project



Index of Relative Bat Activity

An index of relative bat activity was developed for riparian restoration sites and for the adjacent habitats using the total number of bat minutes for each species and species group (Table 9). The 45-55 kHz species group (which consists primarily of canyon bat , Yuma myotis, and California myotis) and the 25-30 kHz species group (which consists mostly of Mexican free-tailed bats, some big brown bats, and some pallid bats) have the highest bat activity at both riparian restoration sites and the adjacent habitat sites. As can be seen in Figure 20 and Table 9, the four focal bat species comprise a very small component of the overall bat community. Townsend's big-eared bat (Coto) was not recorded at Beal Lake during 2008 monitoring.

Table 9. Index of relative bat activity — riparian restoration sites compared with adjacent habitat sites. MSCP covered species in bold

Riparian Restoration Sites		Adjacent Habitats	
Species/Species Groups	**%**	**Species/Species Groups**	**%**
45-55 kHz	72.4	45-55 kHz	75.5
25-30 kHz	20.2	25-30 kHz	18.5
35-40 kHz	4.5	Myve	3.0
20-25 kHz	2.0	20 kHz	1.7
Nyfe	0.4	**Maca**	0.6
Maca	0.1	Nyfe	0.4
Laci	0.1	Laci	0.1
Labl	0.1	**Laxa**	0.1
Laxa	0.1	**Labl**	0.0
Eupe	0.1	Eupe	0.0

Seasonal Bat Activity for Entire Bat Community

The highest bat activity for all species and species groups occurred during the July sampling period with a mean value of 185 bat minutes per detector night[2] for the riparian restoration sites, and 193.4 bat minutes for the adjacent habitats (Table 10). The lowest bat activity occurred during February with a mean value of 0.4 bat minutes per detector night for the riparian restoration sites and 3.3 bat minutes for the adjacent habitats. The October sampling period had the second highest bat minutes for riparian restoration sites of 83.9 and 160.3 for the adjacent habitats. April numbers show a transition from winter to more temperate conditions for bats with 42.2 mean bat minutes per riparian restoration site and 41.2 mean bat minutes for the adjacent habitat sites.

Table 10. Means and standard errors of bat minutes for quarterly sampling for all Beal Lake sites

Riparian Restoration Sites			Adjacent Habitats		
Month	**Mean Bat Minutes ± SE**	**# Detector Nights**	**Month**	**Mean Bat Minutes ± SE**	**# Detector Nights**
October	83.9± 26.9	9	October	160.3 ± 38.6	8
February	0.4 ± 0.2	10	February	3.3± 1.7	12
April	42.2 ± 4.9	12	April	41.2 ± 7.0	6
July	185 ± 15.6	11	July	193.4 ± 43.8	8

Permanent Bat Monitoring Station Results for the Four Focal Bat Species

A permanent bat station was established at the Beal Lake Restoration Area (Figure 21). Sampling began on April 8, 2008. The station has remained operational through September 30, 2008 for a total of 164 days. The station was not operating for nine days in April while equipment malfunctions were corrected, and three days in July during periods of excessive heat that caused equipment shutdown. The problem of excessive heat was remedied by wrapping

[2] A detector night is defined as one Anabat detector per site, sampling from dusk until dawn.

insulating material around the control panel and bat detector. Insect noise, primarily Apache cicada (*Diceroprocta apache*) calls, reached a peak from July 12 through August 21, resulting in nightly data loss of approximately 1 hour. The Anabat bat detectors cannot record bat calls when insects such as cicadas, crickets, and katydids are calling unless the bat flies and calls directly over the microphone. During this July and August period, the Apache cicadas were calling vigorously, reaching a nearly deafening level at times. From 250 to 550 files were recorded nightly that consisted entirely of cicada calls. At the Beal site, the cicadas would cease calling about an hour after dark and normal recording of bat calls resumed. This primarily affected the canyon bat recordings as this species emerges and begins foraging before dusk.

Figure 22 shows the daily monitoring results for the western yellow bat. The only records appeared during August with 2 bat minutes of activity and in September with 2 bat minutes. This may reflect the seasonal movement of yellow bats through the area. Note that there were no western red bat minutes, California leaf-nosed bat minutes, or pale Townsend's big-eared bat minutes recorded during the six months the station was in operation.

Figure 21. Permanent bat monitoring station at Beal Lake Habitat Restoration Area

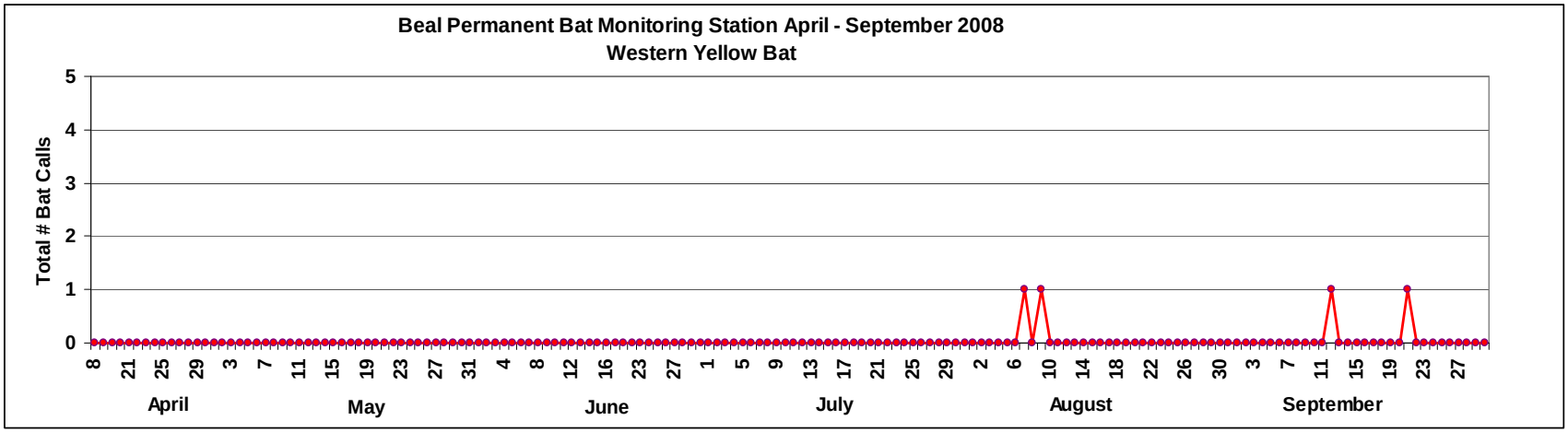


Figure 22. Total number bat calls for Western yellow bat from permanent monitoring station at Beal, April through September, 2008

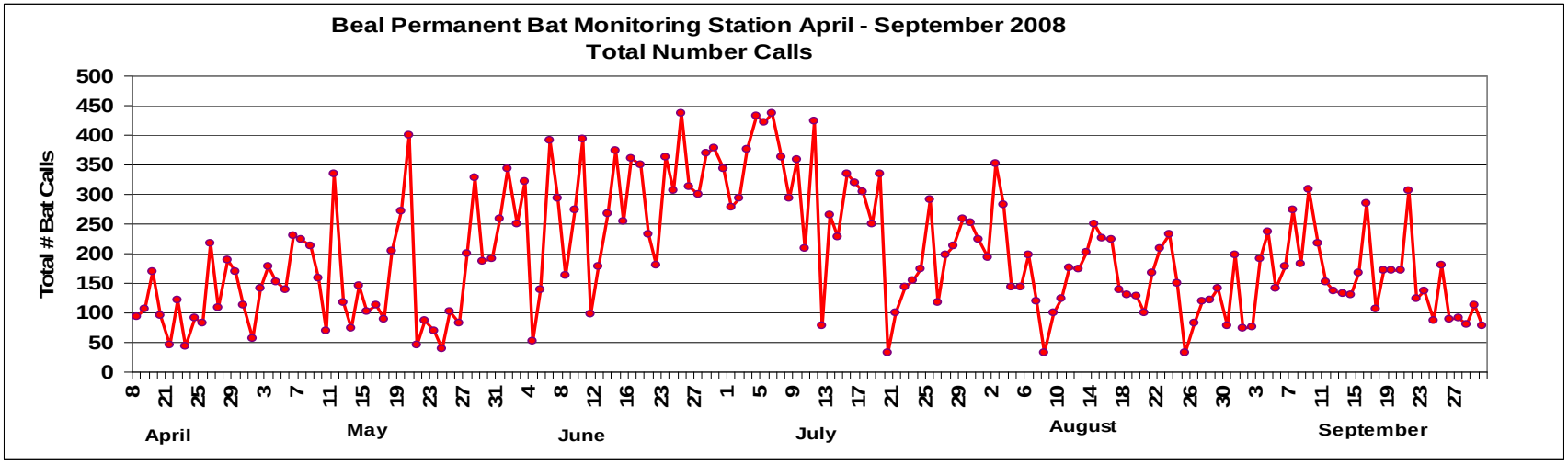


Figure 23. Total number of bat calls for all species and species groups from the permanent monitoring station at Beal Lake, April through September 2008

Figure 23 shows the total number of bat calls[3] recorded for all species and species groups and reflects the activity of the entire bat assemblage at Beal Lake. The mean number of bat calls in April was 117 per night, which gradually increased through May with a mean of 162 bat calls per night. Peak activity occurred during June with a mean of 286 calls and July with a mean of 263 calls per night. July's total number of bat calls was affected by data losses due to insect noise. Bat activity gradually began tapering off in August with a mean of 212 calls (this was likely influenced by the data losses due to insect noise). September's mean number of bat calls was 160. Two factors appear to be affecting the total number of bat calls: first, the total number of calls in July and August was reduced due to data losses from insect noise interference, and second, there is a great deal of day-to-day variation in bat activity. This is widely observed in other locations along the LCR as well as in other acoustic sampling projects. In some cases summer thunderstorms, which can be quite intense and long-lasting, particularly in midsummer, can interfere with bat foraging activities. Other factors also play a role in the amount of nightly bat activity that occurs in a given site, such as availability of insects, wind, humidity, intensity of moonlight, and as yet undetermined factors.

Colorado River Indian Tribes 'Ahakhav Preserve

Post-development bat monitoring was initiated at the 'Ahakhav Preserve in April 2008. Nine sites were selected for monitoring: three sites in sapling cottonwood (<8 cm DBH), three sites in intermediate cottonwood (>8 cm DBH), and three sites in mesquite stands. Thirty-six detector nights were completed with a total of 11,412 call files collected and edited, and valid call files were identified to species or species groups. A total of 108 bat minutes were recorded for the four covered bat species, most of which were for western yellow bats. The quarterly summaries of bat minutes recorded for the first and second sample periods in the nine monitoring areas are included in Appendix 5.

Total Number of Bat Minutes for Covered and Evaluation Species

Two western red bat minutes were recorded at the 'Ahakhav Preserve: 1 minute during spring in intermediate cottonwood, and 1 minute during summer in mesquite (Figure 24).

A total of 68 western yellow bat minutes were recorded at the 'Ahakhav Preserve (Figure 25). This is by far the greatest number of western yellow bat minutes recorded at any of the habitat creation areas. Most of the yellow bat minutes at the Preserve were recorded in intermediate cottonwood during July (40), with a large amount recorded in the sapling cottonwood habitat in July (20).

There was 1 minute of bat activity for the Pale Townsend's big-eared bat, recorded in July in intermediate cottonwood habitat (Figure 26).

The California leaf-nosed bat had 37 minutes of bat activity, most of which occurred in July in mesquite (17 minutes) and sapling cottonwood (11) habitat. A total of 7 minutes were recorded in April, of which 4 minutes were in intermediate cottonwood and 3 minutes were in mesquite.

[3] Note that the total number of bat calls is presented in Figure 23 rather than bat minutes. At this point in time only the four covered bat species were identified from the calls recorded at the bat monitoring station, which did not allow for the calculation of total bat minutes.

Seasonal habitat use of restoration areas by the four covered and evaluation bat species for the 'Ahakhav Preserve — total number of bat minutes. Note that scales vary depending on species.

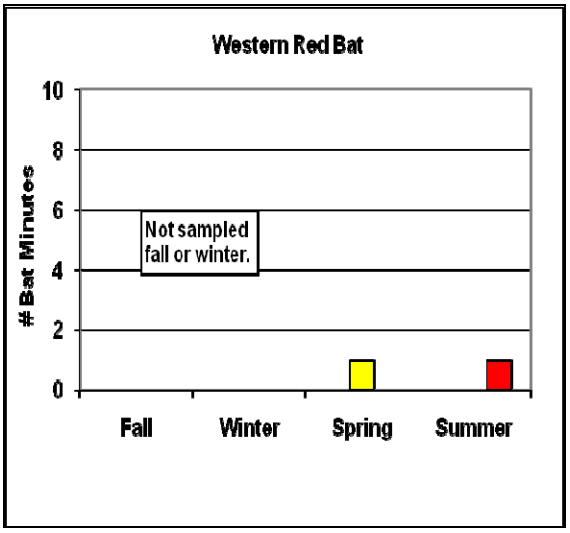


Figure 24. Western red bat

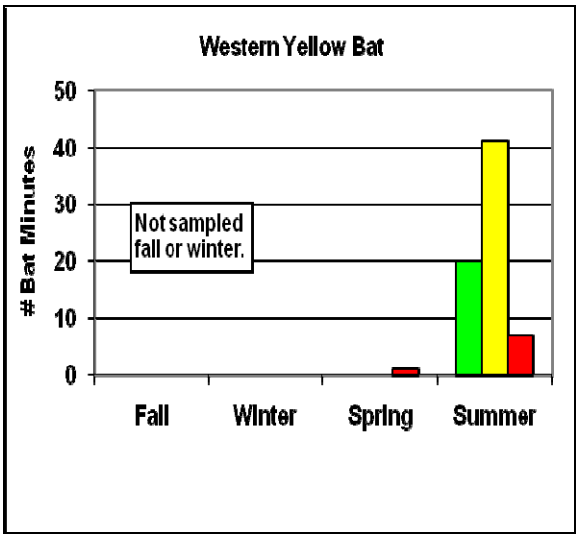


Figure 25. Western yellow bat

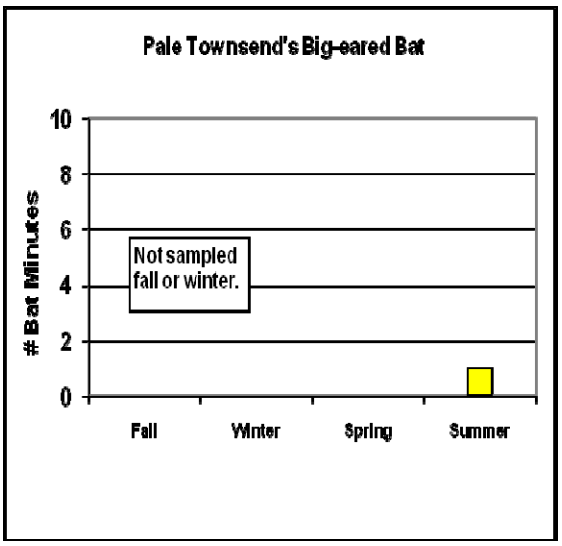


Figure 26. Pale Townsend's big-eared bat

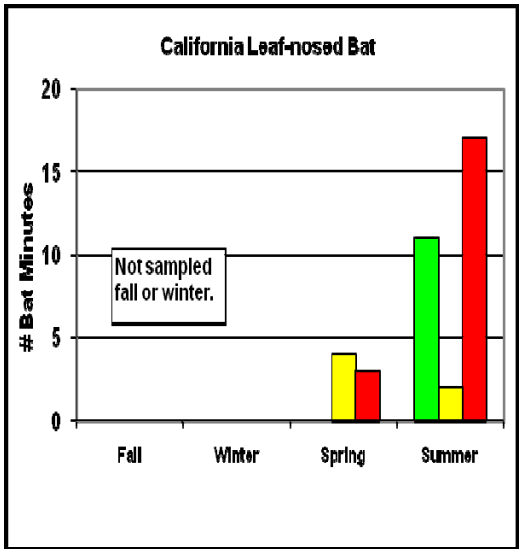
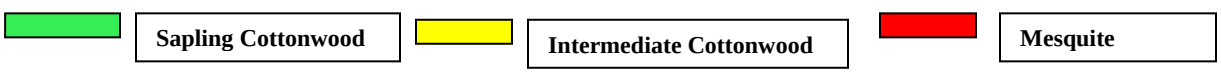


Figure 27. California leaf-nosed bat

Legend:



Mean Number of Bat Minutes for Entire Bat Assemblage

The 45-55 kHz species group had the highest mean number of bat minutes overall, most of which were recorded in sapling cottonwood stands. This group also had the highest mean number of bat minutes in mesquite stands. The 25-30 kHz species group was also well represented in the sapling cottonwood and intermediate cottonwood stands (Figure 28).

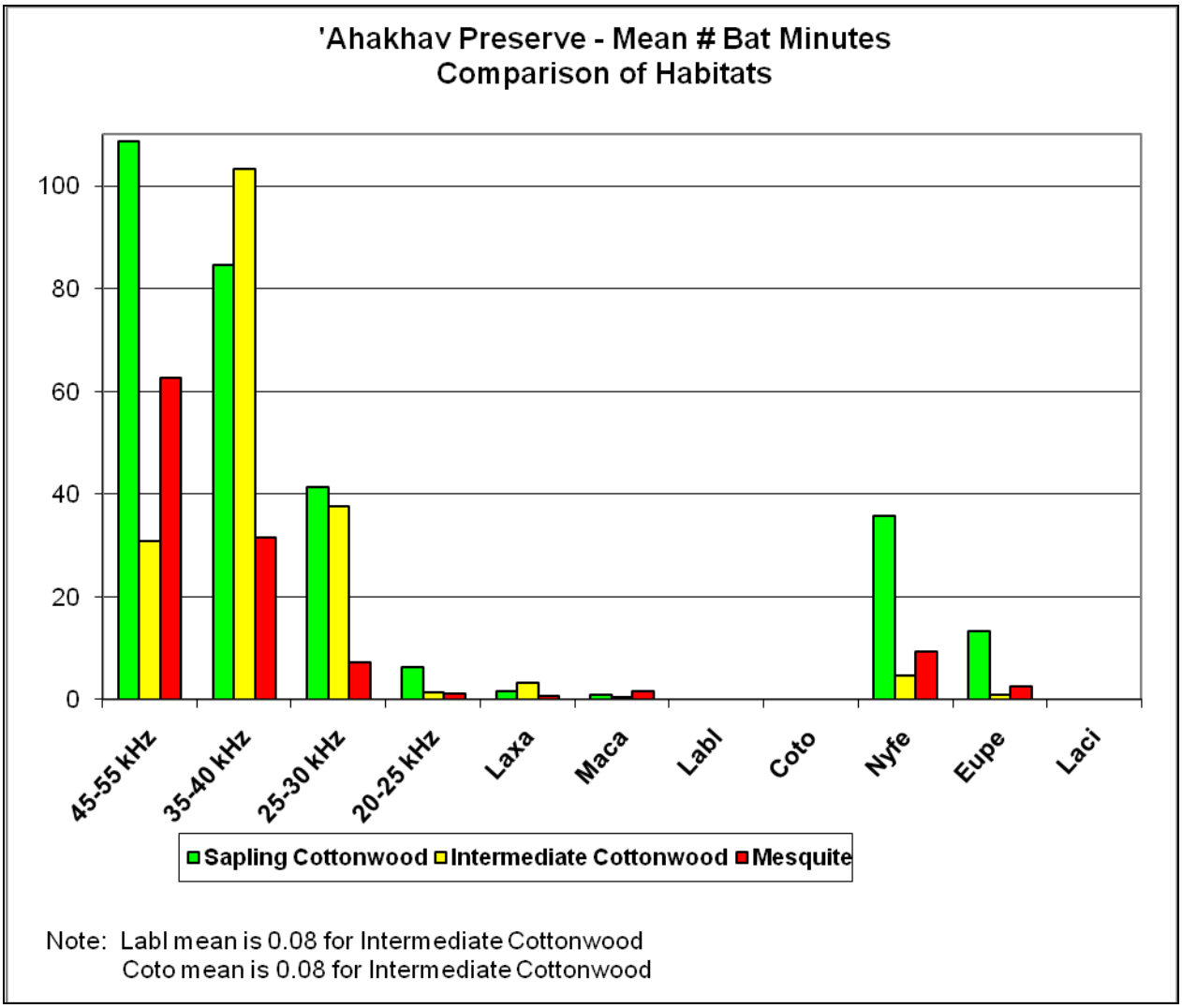


Figure 28. Mean Number of bat minutes in riparian restoration and adjacent habitats for the 'Ahakhav Preserve Habitat Creation Area

The 'Ahakhav Preserve is unique among the seven restoration areas in having very large numbers of calls in the 35-40 kHz species group. Call characteristics at this site are slightly different than most of the calls in that bandwidth range in the other restoration areas, making identification to species much more uncertain. Generally, the cave myotis is fairly diagnostic, being the only 40-kHz myotis species known to occur along the LCR. The Arizona myotis (*Myotis occultus*) is considered to have been extirpated from the LCR. However, mist-netting efforts in 2009 at the

‘Ahakhav Preserve have resulted in the capture of individuals with characteristics more in line with the Arizona myotis. Genetic sampling of tissues collected should help resolve the identification issue. In the meantime, all calls in the 35-40 kHz bandwidth have been combined into this species group. Separating out cave myotis calls remains problematic at this restoration area.

Also noteworthy is the high mean number of bat minutes in sapling cottonwood for the pocketed free-tailed bat (Nyfe) and mastiff bat (Eupe). Overall, the mesquite sites had the lowest mean number of bat minutes for the common flagship species. However, mesquite was slightly higher than mature cottonwood in mean number of bat minutes for canyon bat (Pahe), and pocketed free-tailed bat (Nyfe).

Index of Relative Bat Activity

An index of relative bat activity was developed for bat activity in sapling cottonwood, intermediate cottonwood, and mesquite habitats using the total number of bat minutes for each species and species group (Table 11). The 45-55 kHz, 35-40 kHz, and 25-30 kHz species groups in general had the highest relative abundance. The exception to this generalization was in the mesquite stands, where pocketed free-tailed bats (Nyfe) were the third most abundant. As can be seen in Table 1, the four focal bat species comprised a small relative abundance of the overall bat community at the ‘Ahakhav Preserve. The western yellow bat (Laxa), however, had one of the highest occurrences at any of the habitat creation areas, with the mature cottonwood receiving the highest percentage of activity.

Table 11. Index of relative bat activity for three habitat types at the ‘Ahakhav Preserve. MSCP covered species in bold

Sapling Cottonwood		Intermediate Cottonwood		Mesquite	
Species/Species Groups	**%**	**Species/Species Groups**	**%**	**Species/Species Group**	**%**
45-55kHz	37.2	35-40kHz	53.4	45-55kHz	53.4
35-40kHz	28.9	45-55 kHz	21.4	35-40kHz	27.0
25-30kHz	14.1	25-30kHz	19.5	Nyfe	8.0
Nyfe	12.2	Nyfe	2.4	25-30kHz	6.3
Eupe	4.6	**Laxa**	1.7	Eupe	2.2
20 kHz	2.2	20kHz	0.7	**Maca**	1.4
Laxa	0.6	Eupe	0.5	20kHz	1.1
Maca	0.3	**Maca**	0.3	**Laxa**	0.6
Coto	0.0	**Coto**	0.04	**Coto**	0.0
Labl	0.0	**Labl**	0.04	**Labl**	0.1
Laci	0.0	Laci	0.04	Laci	0.0
	100%		100%		100%

Seasonal Bat Activity for Entire Bat Community

The highest bat activity for all species and species groups occurred during the summer sampling period in July with a mean value of 370.4 bat minutes per detector night for all habitat types sampled and 31 for the spring sampling period (Table 12). Note that fall and winter were not sampled for this habitat creation area.

Table 12. Means and standard errors of bat minutes for quarterly sampling for CRIT sites — all habitats

All Habitats		
Month	Mean Bat Minutes ± SE	# Detector Nights
April	31.9 ± 4.3	18
July	370.4 ± 48.7	18

Palo Verde Ecological Reserve

Forty-four detector nights were completed on nine monitoring sites in the Palo Verde Ecological Reserve. A total of 16,676 bat call files were collected and edited. Valid call files were identified to species or species groups and bat minutes were calculated. A total of 48 bat minutes were recorded for the four covered bat species, most of which were California leaf-nosed bats and yellow bats. PVER had the second highest number of western yellow bats of the seven habitat creation areas. The quarterly summaries of bat minutes recorded for the first and second sample periods in nine sites at PVER are included in tables 5 and 6 in the Appendix.

Total Number of Bat Minutes for Covered and Evaluation Species

Three western red bat minutes were recorded in October at PVER (Figure 29), with 1 minute in a sapling cottonwood stand and 2 minutes along the edge of the lower Colorado River. This compares with 2007, when 7 minutes of western red bat activity were recorded in the riparian restoration sites and 1 minute was recorded along the river's edge.

PVER was second only to the 'Ahakhav Preserve in the number of western yellow bat minutes recorded. Seventeen bat minutes were recorded, 6 minutes of which were along the river's edge in October, 6 minutes in saltcedar in July, and 5 minutes in agriculture in October (Figure 30). In 2007, only 1 minute was recorded for the western yellow bat along the edge of the LCR in July.

No minutes of bat activity were recorded for the Townsend's Big-eared bats (Figure 31) (the same result as in 2007).

A total of 28 minutes of bat activity were recorded for the California leaf-nosed bat, most of which occurred in July in agriculture (14), with 3 minutes recorded in saltcedar in July (Figure 32). Six minutes were recorded along the river's edge in October, with only 1 minute recorded in sapling cottonwood in October. There was no activity recorded during the February sample period. Light activity was recorded in spring, with 1 minute recorded in young cottonwood, 2 minutes in saltcedar, and 1 minute in agriculture. This compares with 2007 when 22 minutes were recorded in young cottonwood and 1 minute along the river's edge.

Mean Number of Bat Minutes for Entire Bat Assemblage

The mean number of bat minutes for all riparian restoration sites combined was compared qualitatively with the adjacent agricultural, saltcedar, and river's edge habitats (Figure 33). Overall, the agricultural, saltcedar, and river's edge sites far exceeded the number of bat minutes for all species and species groups at PVER, with nearly triple the amount of bat activity. The 45-

50 kHz and 25-30 kHz species groups had the highest number of bat minutes. These species groups include the typical flagship species that are abundant throughout the Lower Colorado River (California and Yuma myotis, canyon bat, and Mexican free-tailed bat).

Particularly noteworthy is the relatively large number of minutes recorded for the pocketed free-tailed bat (Nyfe), with an average of 94.5 minutes at the river's edge site and 14.8 minutes for the saltcedar sites (adjacent to the river). The 'Ahakhav Preserve sapling cottonwood sites had the second highest number of bat minutes for this species at 36 minutes. All other habitat creation areas were much lower, ranging from 4 minutes to less than 1 minute per site for this species.

Seasonal habitat use of riparian and adjacent habitats by the four covered and evaluation bat species at Palo Verde Ecological Reserve — total number of bat minutes.

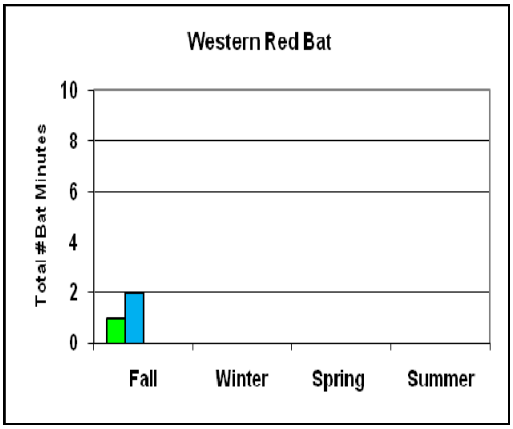


Figure 29. Western red bat

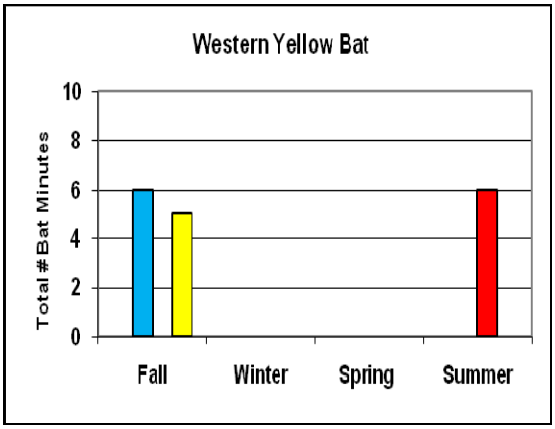


Figure 30. Western yellow bat

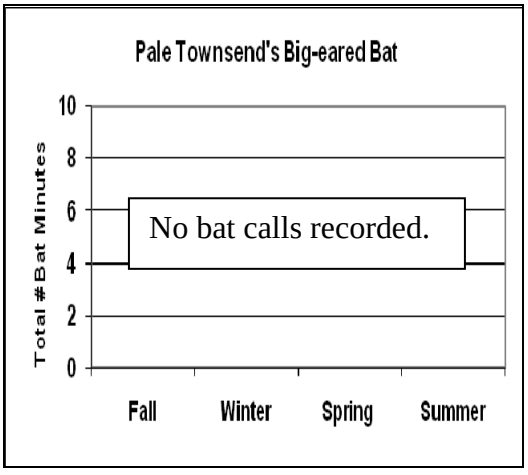


Figure 31. Pale Townsend's big-eared bat

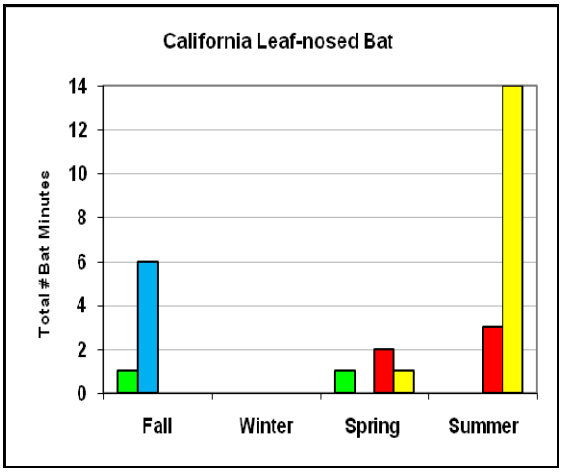


Figure 32. California leaf-nosed bat

Legend:

Riparian Restoration | Agriculture | River | Saltcedar

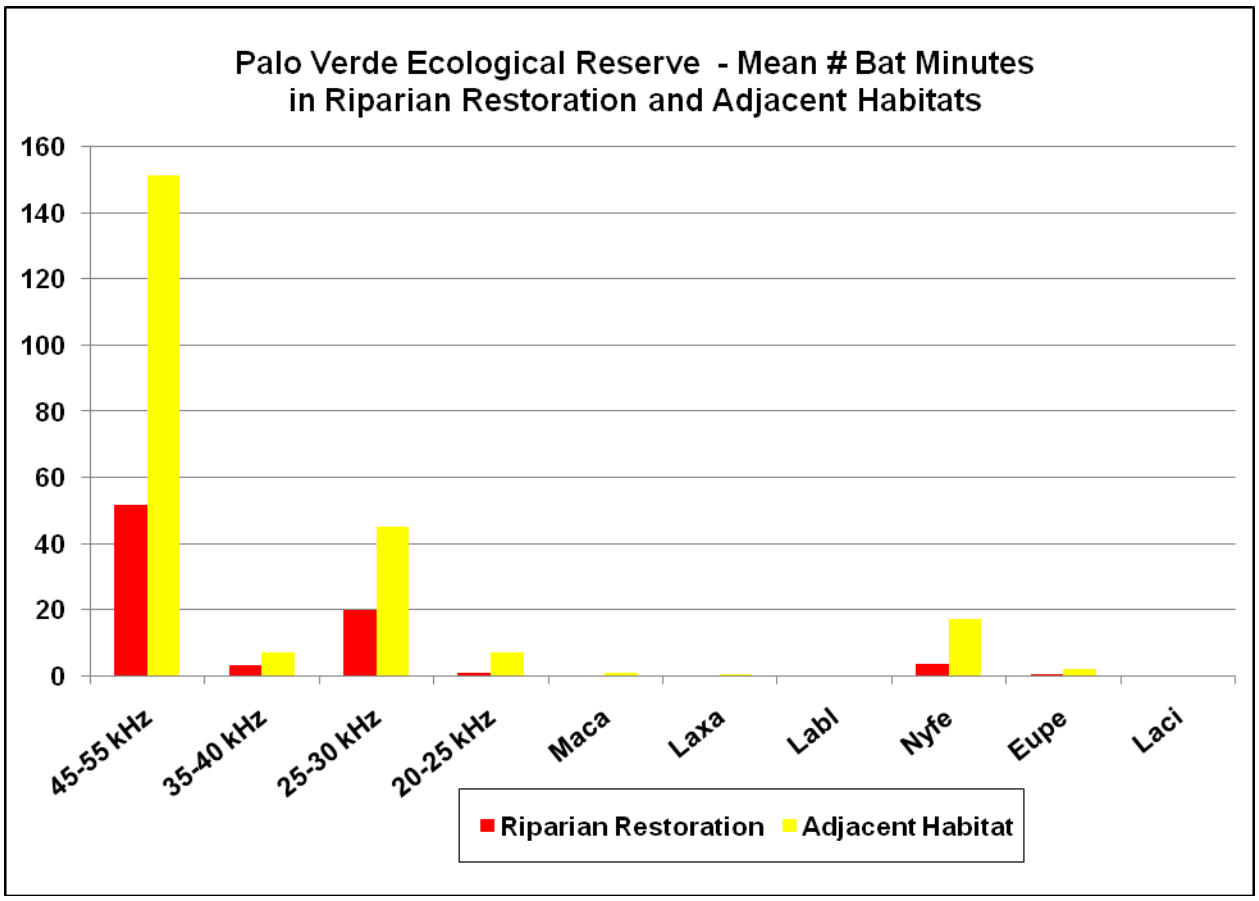


Figure 33. Mean number bat minutes in riparian restoration and adjacent habitat Sites — Palo Verde Ecological Reserve

Index of Relative Bat Activity

An index of relative bat activity was developed for riparian restoration sites and for the adjacent agricultural, saltcedar, and river's edge sites using the total number of bat minutes for each species and species group (Table 13). The 45-55 kHz species group was the most abundant in both the riparian restoration and adjacent habitats at 64.4% and 63%, respectively. The 25-30 kHz species group was the second most abundant in both riparian restoration and adjacent habitats at 24.7% and 18.8%, respectively. The four focal bat species comprised a small proportion of the relative abundance of the overall bat community. The California leaf-nosed bats (Maca) comprised 0.2% of the riparian restoration sites and 0.5% of the adjacent habitats. Western yellow bats (Laxa) were only detected in the adjacent habitats (0.3%). Pale Townsend's big-eared bats were not detected positively in either riparian restoration sites or adjacent habitats. Western red bats (Labl) comprised 0.1% of the restoration sites with 0.03% detected in the adjacent habitats.

Table 13. Index of relative bat activity — riparian restoration sites compared with adjacent habitat sites for Palo Verde Ecological Reserve. MSCP covered species in bold.

Riparian Restoration Sites		Adjacent Habitats	
Species/Species Groups	**%**	**Species/Species Groups**	**%**
45-55 kHz	64.4	45-55 kHz	63.0
25-30 kHz	24.7	25-30 kHz	18.8
Nyfe	4.6	Nyfe	7.2
35-40 kHz	4.0	35-40 kHz	6.3
20 kHz	1.4	20-25 kHz	3.0
Eupe	0.6	Eupe	0.8
Maca	0.2	**Maca**	0.5
Laci	0.1	Laci	0.1
Labl	0.1	**Labl**	0.03
Coto	0.0	**Coto**	0.0
Laxa	0.0	**Laxa**	0.3
	100%		100%

Seasonal Bat Activity for Entire Bat Community

The highest bat activity for all species and species groups occurred in July with a mean value of 209.3 bat minutes per detector night for the riparian restoration sites and 337.2 for the adjacent agriculture, river's edge, and saltcedar sites (Table 14). October had the second highest bat activity with a mean value of 90.6 for the restoration sites, and 244.0 for the adjacent habitats. The lowest number of bat minutes was recorded during the February sample with no bat calls for either the restoration sites or the agriculture/saltcedar sites. April activity increased with a mean value of 62.0 bat minutes per detector night for the restoration sites and 103.8 mean bat minutes for the adjacent habitat sites.

Table 14. Means and standard errors of bat minutes for quarterly sampling for all Palo Verde Ecological Reserve sites

Riparian Restoration Sites			Adjacent Habitats		
Month	**Mean Bat Minutes ± SE**	**# Detector Nights**	**Month**	**Mean Bat Minutes ± SE**	**# Detector Nights**
October	90.6 ± 24.8	5	October	244.0 ± 0	1
February	0 ± 0	6	February	0 ± 0	2
April	62.0 ± 16.3	4	April	103.8 ± 20.3	8
July	209.3 ± 56.6	4	July	337.2 ± 35.9	12

Cibola Valley Conservation and Wildlife Area

Exploratory surveys following the sampling protocol established in 2007 were continued at CVCA during the October 2007 and February 2008 sampling periods. A new sampling protocol was established in early 2008 that focused sampling on three young cottonwood stands in Phase 1 and Phase 3, two agricultural fields, and two young mesquite stands for the April and July 2008 sampling periods. The mesquite habitat, however, became problematic mid-way through sampling as one of the Phase 3 mesquite stands failed and was cleared and a Phase 4 mesquite habitat was not due to be planted in a reasonable enough time frame for the post-development bat monitoring effort. The mesquite habitat monitoring sites were moved to the Cibola NWR Conservation Unit #1 during the FY09 sampling.

The young cottonwood-willow stands at CVCA exhibited phenomenal growth during FY08. Additionally, there was an extraordinary amount of Apache crickets present in the stands, which produced a cacophony of calls that interfered with acoustic recording of bat calls. Unlike the cicadas at Beal Lake Habitat Restoration Area, which quieted down about an hour after sunset, the cicadas at CVCA continued chorusing most of the night. Experiments were conducted during October 2008 with detector placements. The goals of the experiments were to continue to sample the same area of riparian restoration habitat, while allowing for the rapid growth of the cottonwoods, as well as reducing or eliminating insect noise. A sampling protocol was developed for these areas that elevated the detectors near the top of the canopy in the original locations and aspects. Sampling at the edge of the cottonwood stands was not feasible as data loss due to insect noise was prohibitive. However, sampling above the canopy resulted in good quality calls of a wide variety of species. Adjusting the sampling location at these dense, rapidly growing sites represents a compromise. Sampling near the top of the canopy captures a somewhat different set of bats than does sampling along edges of the stand, or in openings within the stand. However, in this situation, the stands were extremely dense; thus, no openings within the stand could be sampled (and in turn little or no access to most bats exists within the stands except for possibly gleaners (pallid bat and the pale Townsend’s big-eared bat). As discussed previously, sampling adjacent to the edge of the stands resulted in unacceptable insect interference and loss of acoustic bat call data.

In spite of some considerable data losses due to insect noise, 19,722 call files were obtained during 41 detector nights in eight CVCA monitoring sites. The call files were edited and identified to species or species group. Bat minutes were calculated for each species and species group. A total of 121 bat minutes were recorded for the four covered bat species, the majority of which were California leaf-nosed bats (see Figure 36). The quarterly summaries of bat minutes recorded for the first and second sample periods in eight sites at CVCA are included in tables 7 and 8 in the Appendix.

Total Number of Bat Minutes for Covered and Evaluation Species

No minutes of bat activity were recorded for the western red bat or Townsend's big-eared bat during any season or habitat during FY08 (Figures 34 and 35). Three minutes of activity were recorded in agricultural sites for the western yellow bat in July (Figure 36). Eleven minutes of bat activity were recorded for the California leaf-nosed bat in restoration sites in July and four

were recorded in October (Figure 37). One minute was recorded in April and 1 minute in July in agricultural habitat. The considerable data losses due to insect noise may have influenced these results. However, in 2007 only four western red bat minutes were recorded in summer in restoration sites, no western yellow bats were recorded in any habitat at CVCA, and only one pale Townsend's big-eared bat was recorded in spring in restoration sites. The 2007 California leaf-nosed bat numbers were similar, but in 2007 most of the calls were recorded in winter (29), and none were recorded in winter in 2008. In 2007, 5 minutes were recorded for this species in summer in restoration habitat and 4 minutes in adjacent habitats. In fall, 1 minute was recorded in restoration as well as adjacent habitats.

Seasonal habitat use of riparian and adjacent habitats by the four covered and evaluation bat species for the Cibola Valley Conservation Area.

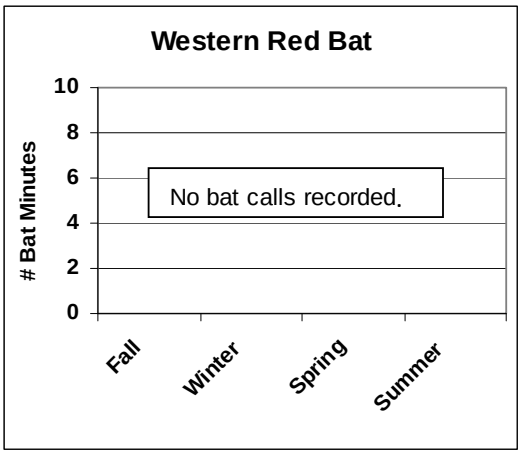


Figure 34. Western red bat

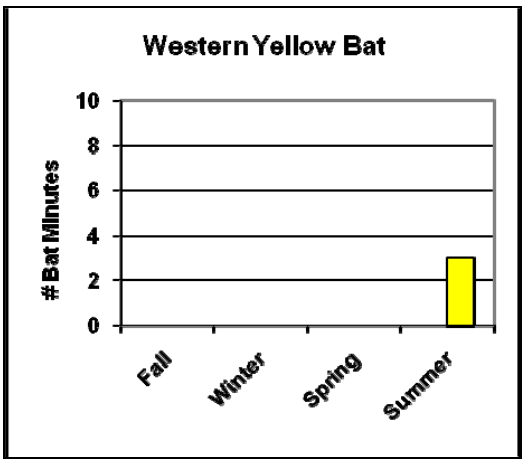


Figure 35. Western yellow bat

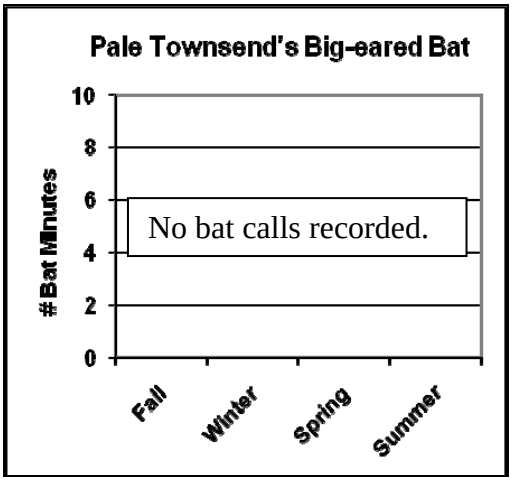


Figure 36. Pale Townsend's big-eared bat

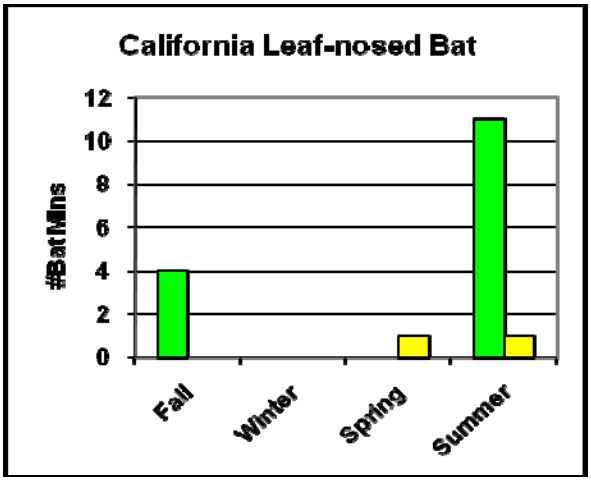


Figure 37. California leaf-nosed bat

Legend:

Riparian Restoration Sites

Agriculture

Mean Number of Bat Minutes for Entire Bat Assemblage

The mean number of bat minutes for all riparian restoration sites combined was compared qualitatively with the number of bat minutes from the adjacent agricultural habitat (Figure 38). The 25-30 kHz species group (consisting mostly of big brown bats and Mexican free-tailed bats), and the 45-55 kHz species group (consisting mostly of Yuma myotis, California myotis, and canyon bats) were the most active for both restored and adjacent agricultural sites. 2007 showed the similar pattern of abundant flagship species in both riparian restoration and adjacent habitats.

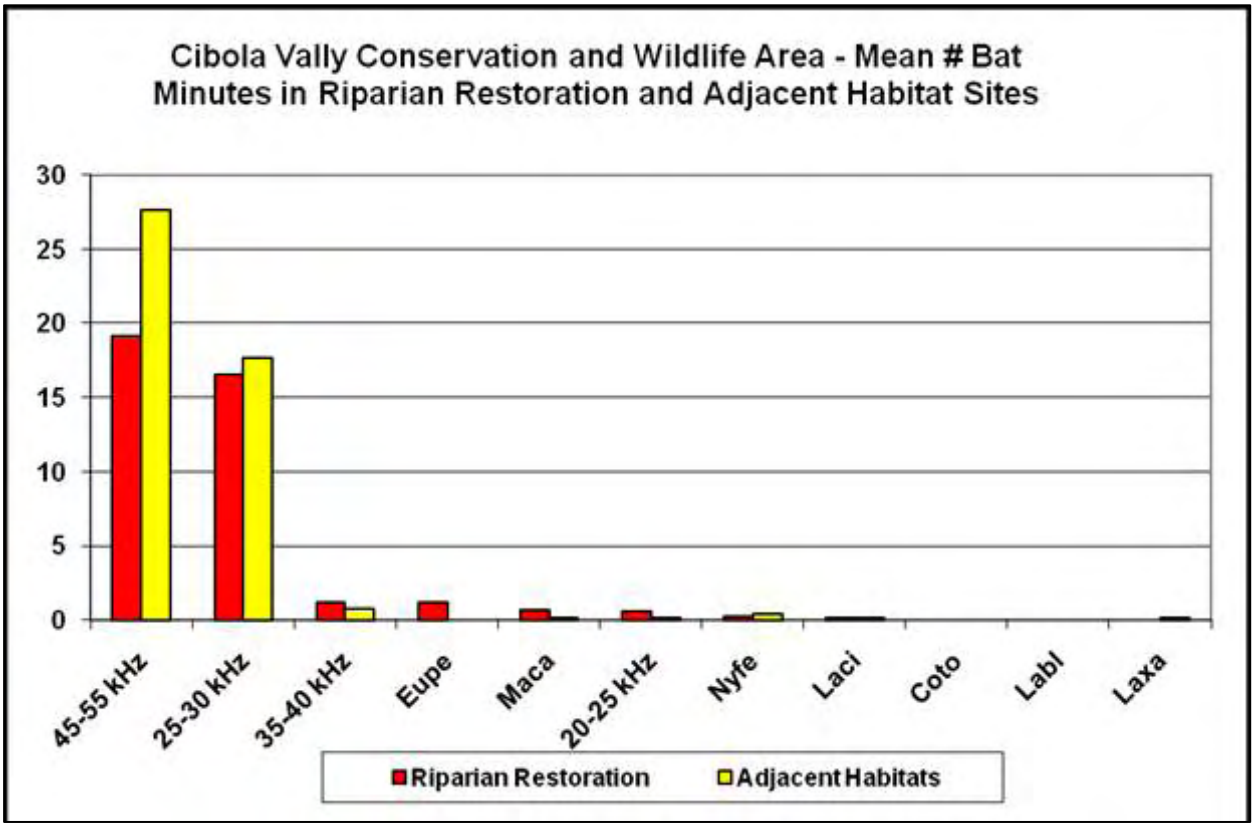


Figure 38. Mean number of bat minutes in riparian restoration and adjacent habitats for the Cibola Valley Conservation and Wildlife Area

Index of Relative Bat Activity

An index of relative bat activity was developed for riparian restoration sites and for the adjacent habitats using the total number of bat minutes for each species and species group (Table 15). The 45-50 kHz and 25-30 kHz species groups had the highest relative abundance at both riparian restoration and adjacent habitat sites. The mastiff bat (Eupe) was the third most abundant species in the restoration sites, while 35-40 kHz species group was the third most abundant in the adjacent habitats. California leaf-nosed bats comprised the fifth highest percentage for the restored sites (1.5%) and the eighth highest for adjacent habitats (0.2%). Western red bats and pale Townsend's big-eared bats were not detected at the restoration sites or the adjacent habitats. Western yellow bat minutes comprised 0.4% of the adjacent habitats, with none being recorded for the restoration sites.

Table 15. Index of relative bat activity for riparian restoration sites compared with adjacent habitat sites for the Cibola Valley Wildlife Conservation Area. MSCP covered species in bold.

Restoration		Adjacent Habitats	
Species/Species Groups	**%**	**Species/Species Groups**	**%**
45-55 kHz	51.8	45-55 kHz	58.7
25-30 kHz	38.9	25-30 kHz	37.6
Eupe	2.7	35-40 kHz	1.5
35-40 kHz	2.7	Nyfe	0.9
Maca	1.5	20-25 kHz	0.4
20 kHz	1.4	**Laxa**	0.4
Nyfe	0.7	Laci	0.2
Laci	0.4	**Maca**	0.2
Coto	0.0	**Coto**	0.0
Labl	0.0	Eupe	0.0
Laxa	0.0	**Labl**	0.0
	100%		100%

Seasonal Bat Activity for Entire Bat Community

The highest number of mean bat minutes per night was recorded in July at CVCA for both the riparian restoration areas (181 bat minutes) and the adjacent agricultural habitats (136.2) (Table 16). The second highest level of bat activity occurred during October with 52 minutes for restoration sites and 90 minutes for the adjacent habitats. The lowest activity levels occurred during February with only 0.13 mean bat minutes recorded for riparian restoration sites and no bat calls recorded for agricultural sites. April had the second lowest mean bat minutes, with 10.3 minutes for restoration sites and 12.5 minutes for adjacent habitats.

Table 16. Means and standard errors of bat minutes for quarterly sampling for all Cibola Valley Conservation Area sites

Riparian Restoration Sites			Adjacent Habitats		
Month	**Mean Bat Minutes ± SE**	**# Detector Nights**	**Month**	**Mean Bat Minutes ± SE**	**# Detector Nights**
October	52.2 ± 15.0	5	October	90.0 ± 0	1
February	0.13 ± 0.13	8	February	0 ± 0	4
April	10.3 ± 3.5	8	April	12.5 ± 3.5	6
July	181.0 ± 61.0	4	July	136.2 ± 16.6	5

Cibola NWR Unit #1 Conservation Area

Thirty detector nights were completed for seven monitoring sites at Cibola NWR Unit #1 Conservation Area. These sites include two exploratory sites in an untreated site dominated by *Atriplex*, a cottonwood mass planting site, and five long-term monitoring sites that include three mature cottonwood, one mesquite, and an agricultural field. A total of 7,441 call files were collected, edited, and identified to species or species group. Bat minutes were calculated for each species and species group. Total minutes of bat activity for the four covered bat species was 105, of which the California leaf-nosed bat was the most numerous.

Tables 9 and 10 in the Appendix show the quarterly summaries of bat minutes recorded in the seven sites at Cibola NWR Unit #1 Conservation Area. The new study design implemented during April and July 2008 sample periods combines sampling at Cibola NWR Unit#1 with CVCA. This will provide a total of three mature cottonwood sites, three young cottonwood sites, and three agricultural sites.

Total Number of Bat Minutes for Covered and Evaluation Species

One western red bat minute was recorded in an agricultural field adjacent to the Nature Trail during July (Figure 39). No western yellow bat minutes or Townsend's big-eared bat minutes were collected in any habitat during any sample period (Figures 40 and 41).

California leaf-nosed bats were more widely spread, with 13 minutes of bat activity obtained in the fall, 27 minutes in the spring, and 25 minutes in the summer in the intermediate cottonwood and mesquite sites (Figure 42). Thirty-four minutes were collected in the agriculture site in July, 1 minute in spring, and 2 minutes in fall. These numbers were much higher than those recorded in 2007, when only 6 minutes were recorded in summer for restoration sites, and 6 minutes in the fall for riparian restoration sites.

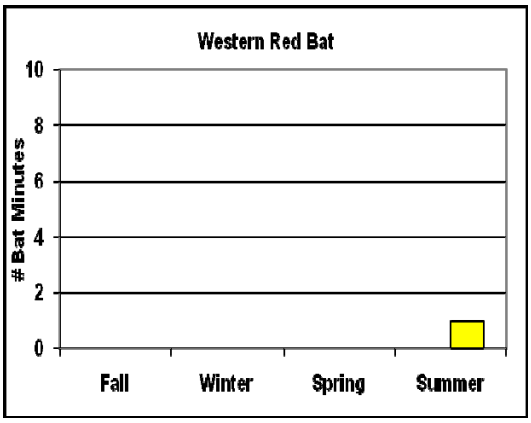


Figure 39. Western Red Bat

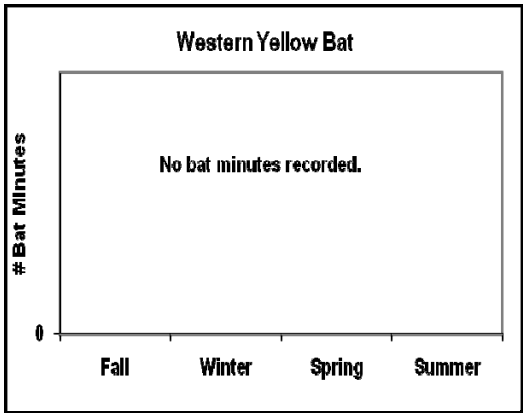


Figure 40. Western Yellow Bat

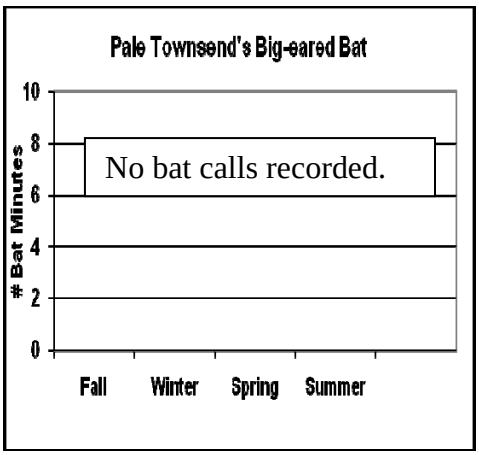


Figure 41. Pale Townsend's Big-eared Bat

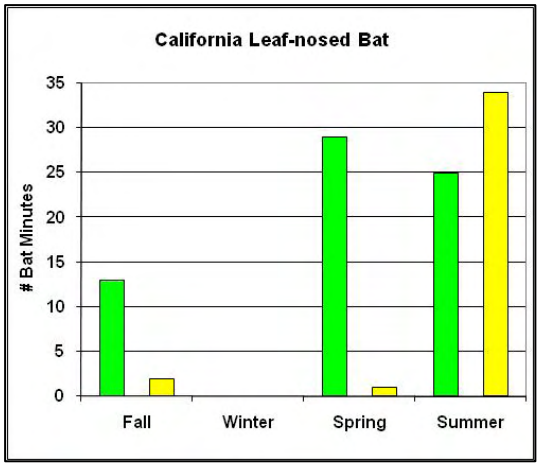


Figure 42. California leaf-nosed bat

Legend:

Restoration Sites

Agriculture

Mean Number of Bat Minutes for Entire Bat Assemblage

The mean number of bat minutes for all of the restoration sites was qualitatively compared with minutes from the adjacent habitat sites (agriculture and *Atriplex* (Figure 43)). Overall, the adjacent habitat sites had higher mean number of bat minutes for the 45-55 kHz species group (canyon bats, Yuma myotis, and California myotis) than for the 25-30 kHz species group (mostly big brown bats and Mexican free-tailed bats). The 35-40 kHz species group had most of the activity recorded in riparian restoration sites. The California leaf-nosed bat activity occurred mostly in adjacent habitats, with some occurring in restoration sites as well. The number of bat minutes for all of the rest of the species and species groups dropped off rapidly for all of the remaining species, regardless of whether in they were in restoration sites or adjacent habitat sites. Some data losses occurred in the restoration sites due to extreme insect noise, which cancelled the Anabat detector's ability to record bat calls.

Figure 43. Mean number of bat minutes — Cibola Valley NWR Unit #1 Conservation Area

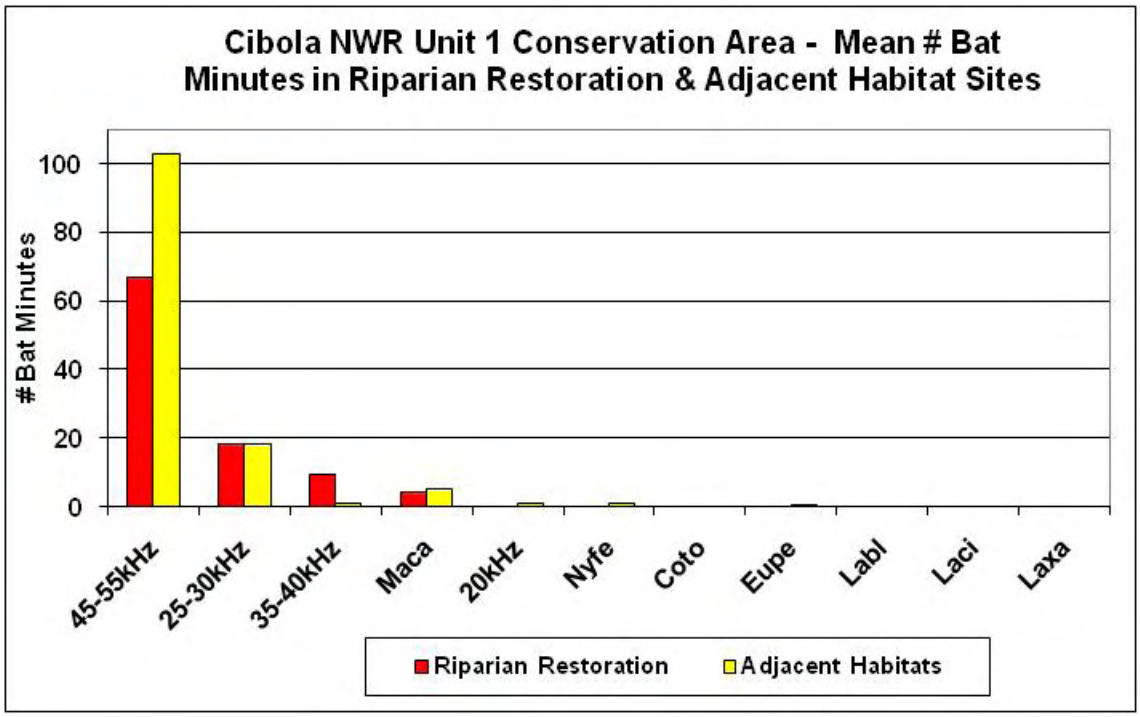


Table 17. Index of relative bat activity for restoration sites compared with adjacent habitat sites

Restoration Sites		Adjacent Habitat Sites	
Species/Species Groups	**%**	**Species/Species Groups**	**%**
45-55 kHz	67.1	45-55 kHz	78.7
25-30 kHz	18.6	25-30 kHz	14.2
35-40 kHz	9.5	**Maca**	4.0
Maca	4.1	Nyfe	1.0
20 kHz	0.4	20 kHz	0.8
Nyfe	0.3	35-40 kHz	0.8
Coto	0.0	Eupe	0.4
Eupe	0.0	**Labl**	0.1
Labl	0.0	Laci	0.0
Laci	0.0	**Laxa**	0.0
Laxa	0.0	**Coto**	0.0
	100%		100%

Index of Relative Bat Activity

An index of relative bat activity was developed for the restoration and adjacent habitat sites (Table 17). The 45-55 kHz species group was the most abundant for both the restoration sites and the adjacent habitat sites (67.1% and 78.7%, respectively). The 25-30 kHz species group was the second most abundant group in both the restoration sites and the adjacent habitat sites (18.6% and 14.2%, respectively). The third most abundant species group in the restoration site was the 35-40 kHz species group, while California leaf-nosed bats (Maca) were the third most abundant

in adjacent habitats. The pale Townsend's big-eared bat (Coto) and the yellow bat (Laxa) were not recorded in any habitats, nor were hoary bats (Laci). The western red bat (Labl) was only recorded in adjacent habitat (0.1%).

Seasonal Bat Activity for Entire Bat Community

The highest number of mean bat minutes per night was recorded in July at Cibola NWR Unit #1 for both the restoration (172.9 mean bat minutes) and adjacent habitat sites (353.5 mean minutes) (Table 18). The second most active period occurred in October in the restoration sites (43.3 minutes) and the agriculture and *Atriplex* sites with a mean of 128.0 bat minutes. The third most active period occurred in April with 33.5 mean minutes for restoration sites compared with 40.5 in adjacent agriculture/*Atriplex* habitats. As with all the other habitat creation areas, February was the least active with no bat minutes recorded for any site.

Table 18. Means and standard errors of bat minutes for quarterly sampling for all Cibola Valley Conservation Area sites

Cibola NWR Conservation Unit #1					
Restoration Sites			Adjacent Habitat Sites (Agriculture & *Atriplex*)		
Month	Mean Bat Minutes ± SE	# Detector Nights	Month	Mean Bat Minutes ± SE	# Detector Nights
October	43.3 ± 11.4	4	October	128.0 ± 0	1
February	0.0 ± 0	4	February	0.0 ± 0	2
April	33.5 ± 12.9	8	April	40.5 ± 26.5	2
July	172.9 ± 51.3	7	July	353.5 ± 25.5	2

Imperial Ponds Conservation Area

Exploratory surveys using the sampling protocol established in 2007 were continued at Imperial Ponds Conservation Area during the October 2007 and February 2008 sampling periods. A new sampling protocol was established in early 2008 that increased the number of samples in each major habitat type to allow statistical comparison of bat activity by habitat. These sites will be combined with sites at the nearby Pratt Restoration area to provide adequate sample size. A total of 59 detector nights were completed for 18 sites. A total of 100,247 call files were collected, edited, and identified to species or species group. Bat minutes were calculated for each species and species group. A total of 185 bat minutes were recorded for the four covered bat species, consisting mostly of California leaf-nosed bats. Tables 11 and 12 in the Appendix show the quarterly summaries of bat minutes recorded in restoration and non-restoration sites at Imperial Ponds Conservation Area.

Total Number of Bat Minutes for Covered and Evaluation Species

One western red bat minute was recorded on the edge of Pond 1 in October and 1 minute was recorded in agriculture in April (Figure 44). In 2007, 10 minutes of bat activity for the red bat were recorded, most of which occurred at the edge of Pond 1 during July.

Three western yellow bat minutes were recorded: 1 minute during February over Martinez Lake, 1 minute in an agricultural field in July, and 1 minute in a mature cottonwood stand in July

(Figure 45). This contrasted sharply with 2007, when a total of 70 bat minutes were recorded at the edges of Pond 1 and Pond 5 during the April sampling period. No activity was recorded for the pale Townsend's big-eared bat (Figure 46). In 2007, 2 minutes were recorded for this species in spring and 2 minutes were recorded in summer in restoration sites.

A total of 180 minutes were recorded for the California leaf-nosed bat (Figure 47). This exceeds the number of minutes recorded for the other six habitat creation areas, which ranged from 12 to 37 minutes of activity. April saw the greatest amount of leaf-nose bat activity. All habitats were used, though sampling during a single night in April in an agricultural field (Field 1) resulted in 40 minutes of bat activity. Bat activity during October, February, and July was similar, with most habitat types ranging from 8 minutes to 19 minutes of activity. In 2007, a similar pattern of habitat use was observed, though the overall numbers were less for the California leaf-nosed bat.

Seasonal habitat use of riparian and adjacent habitats by the four covered and evaluation bat species for Imperial Ponds Conservation Area

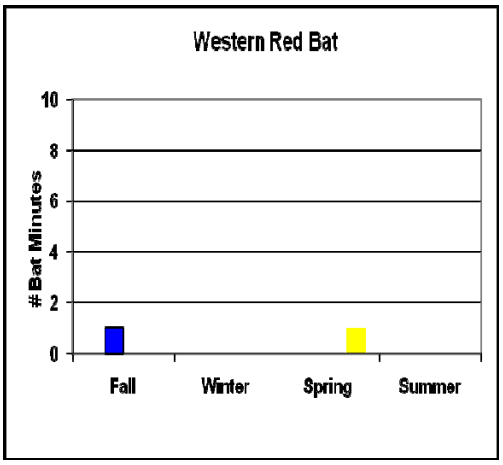


Figure 44. Western red bat

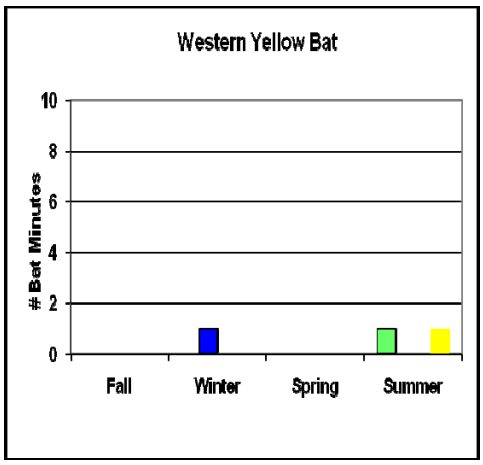


Figure 45. Western yellow bat

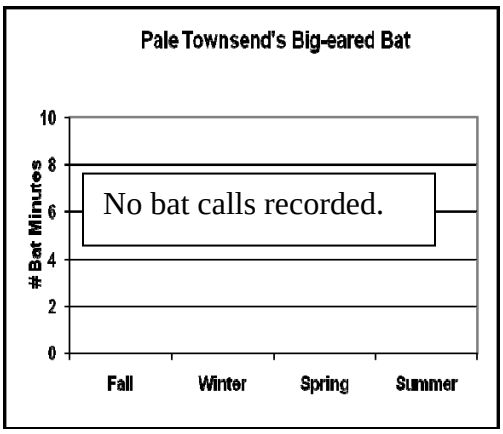


Figure 46. Pale Townsend's big-eared bat

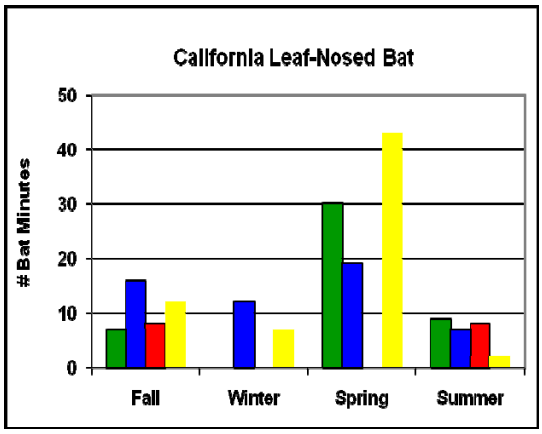


Figure 47. California leaf-nosed bat

Legend:

Intermediate Cottonwood | Pond Edge | Saltcedar | Agriculture

Mean Number of Bat Minutes for Entire Bat Assemblage

The 45-55 kHz species group (canyon bat, Yuma myotis, and California myotis) had the highest mean number of bat minutes per site in both the riparian restoration areas and adjacent habitat areas (Figure 48). A distant second were the 25-30 kHz species groups, with similar numbers for both the riparian restoration and adjacent habitat sites. The 35-40 kHz species group had a mean of 4.8 bat minutes per site in riparian restoration sites, but only 0.2 minutes per site for adjacent habitats. Of the four focal species, the California leaf-nosed bat had the highest mean number of bat minutes, most of which were in riparian restoration sites (3.2 minutes) compared with the mean number from adjacent habitats (1.5 minutes). The western red bat and pale Townsend's big-eared bat were not recorded at any habitats. The western yellow bat had a mean of 0.03 minutes per site in the riparian restoration areas and none in adjacent habitats. Interestingly, this is the only location where the big free-tailed bat (Nyma) was recorded, with a mean of 0.03 bat minute in restoration sites.

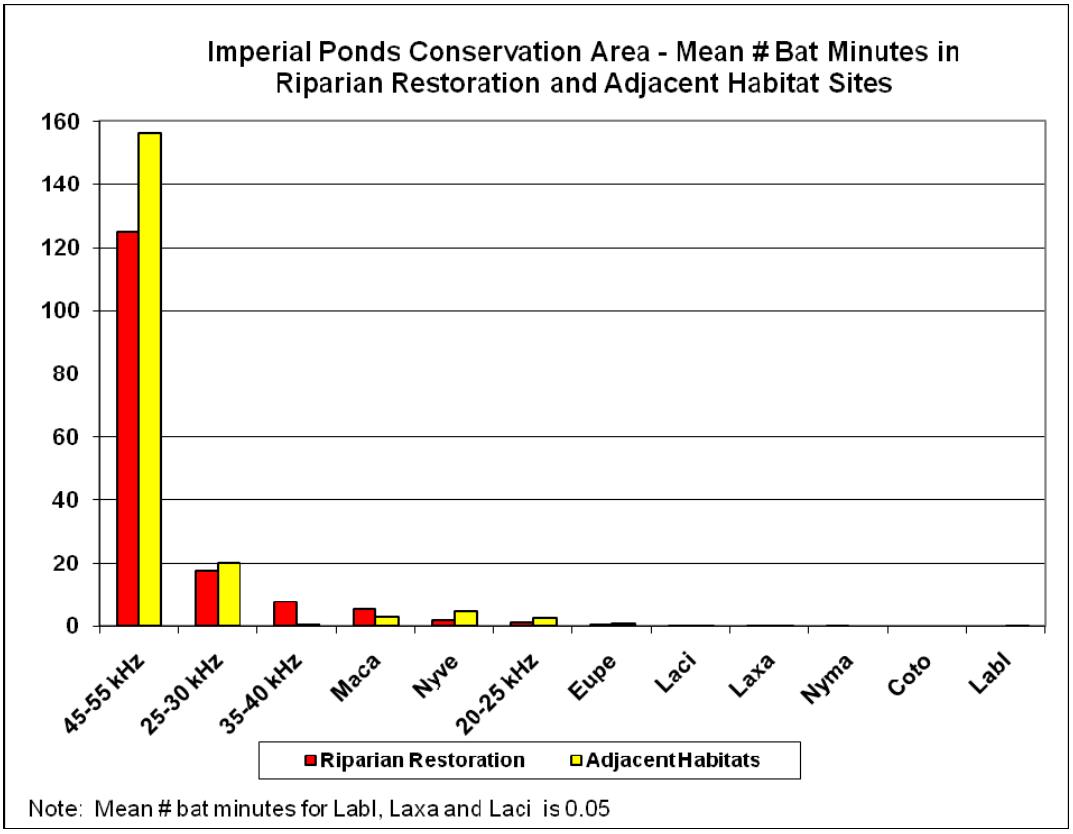


Figure 48. Mean number bat minutes in restored vs. adjacent habitat sites in the Imperial Ponds Conservation Area

Index of Relative Bat Activity

An index of relative bat activity was developed for restoration sites and adjacent habitat sites at the Imperial Ponds Conservation Area (Table 19). The 45-55 kHz species group predominated in

both riparian restoration and adjacent habitat sites. The 25-30 kHz species group was the second most abundant at both restoration and adjacent habitats. As with the other restoration sites, the 35-40 kHz species group ranked third in riparian restoration sites and only seventh in the adjacent habitat areas. The California leaf-nosed bat ranked fourth in both restoration and adjacent habitats. Only one western yellow bat was recorded in restoration habitat for an overall ranking of 0.03%. Two western red bats were recorded in pond habitat (1) and in agriculture (1) for an overall ranking of 0.05%. No pale Townsend's big-eared bats were recorded at Imperial Ponds Conservation Area in any habitats.

Table 19. Index of relative bat activity for treatment and habitat types in the Imperial Ponds Conservation Area

Restoration Sites		Adjacent Habitat Sites	
Species/Species Groups	**%**	**Species/Species Groups**	**%**
45-55kHz	79.08	45-55kHz	83.5
25-30 kHz	11.05	25-30 kHz	10.6
35-40 kHz	4.75	Nyfe	2.5
Maca	3.20	Maca	1.5
Nyfe	1.08	20 kHz	1.2
20-25 kHz	0.57	Eupe	0.3
Eupe	0.19	35-40 kHz	0.2
Laci	0.03	Labl	0.05
Laxa	0.03	Laci	0.05
Nyma	0.03	Nyma	0.00
Coto	0.00	Laxa	0.05
Labl	0.00	Coto	0.00
	100%		100%

Seasonal Bat Activity for Entire Bat Community

October had the highest mean bat minutes per site at 259.5 for restoration sites and 229 for adjacent habitats (Table 20). This is unique among the habitat creation areas, for which July had the highest number of mean bat minutes. The second highest mean bat minutes per site occurred in July in restoration areas (246.8). The adjacent habitat sites had a mean of 229.3. The third highest mean bat minutes occurred in April with 233 for restoration sites and 249 for adjacent habitat sites. Winter had the lightest use with 25.1 mean bat minutes for restored sites compared to 57.5 for adjacent habitats. In this case the ponds received a large amount of use during the winter. This level of winter activity was, however, extraordinary when compared to activity for the other six habitat creation sites, which had very low winter use. Beal Lake, for example, had a mean of 0.4 for restored vs. 0.0 for unrestored habitats; CVCA had 0.0 for both habitat types, as did Cibola NWR Unit#1 and PVER.

Table 20. Means and standard errors of bat minutes for quarterly sampling for all Imperial Ponds Conservation Area sites

Riparian Restoration Sites			Adjacent Habitats		
Month	Mean Bat Minutes ± SE	# Detector Nights	Month	Mean Bat Minutes ± SE	# Detector Nights
October	259.5 ± 117.7	4	October	229.3 ± 78.6	7
February	25.1 ± 9.7	8	February	57.2 ± 12.1	13
April	233.3 ± 57.5	4	April	249.1 ± 83.4	10
July	246.8 ± 60.6	4	July	229.8 ± 23.88	9

Pratt Restoration Demonstration Site

Fifteen detector nights were completed for five Pratt sites. A total of 4,641 call files were collected, edited, and identified to species or species group. One bat minute was recorded for the western red bat in agriculture in July (Figure 49) and 1 bat minute was recorded for the western yellow bat in saltcedar in July (Figure 50). No bat activity was recorded for the pale Townsend's big-eared bat (Figure 51). Fourteen minutes of bat activity were recorded for the California leaf-nosed bat, most of which were in July in agricultural habitat. Two minutes were recorded in restoration sites and 1 minute was recorded in saltcedar in summer (Figure 52). Tables 9 and 10 in the Appendix show the quarterly summaries of bat minutes recorded in five sites at Pratt Restoration.

Total Number of Bat Minutes for Covered and Evaluation Species

One bat minute was detected in July for the western red bat in the edge of the agricultural area. One minute was detected in July in saltcedar for western yellow bat. No detections were made of the Townsend's big-eared bat (Figure 53).

Seasonal habitat use of riparian and adjacent habitats by the four covered and evaluation bat species for Pratt Restoration Demonstration Site.

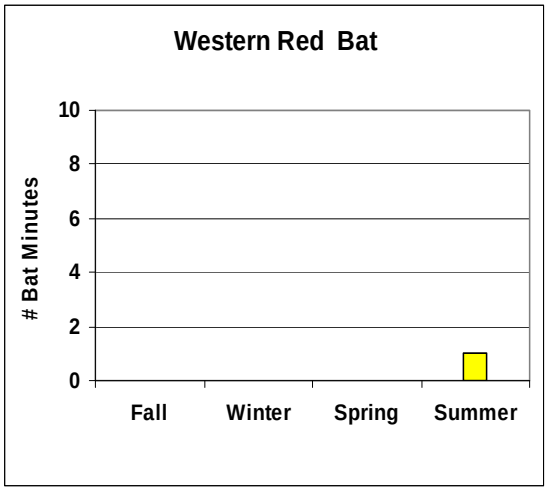


Figure 49. Western red bat

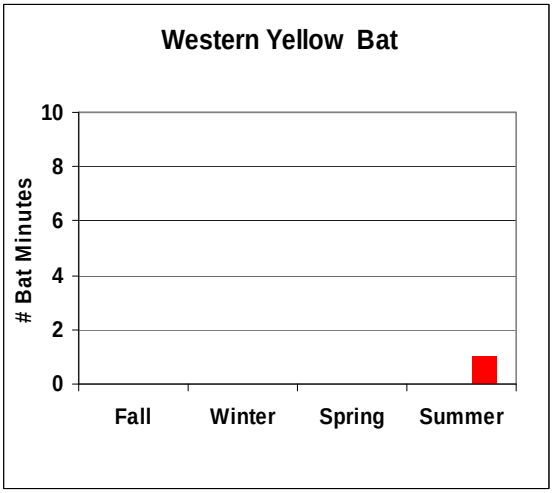


Figure 50. Western yellow bat

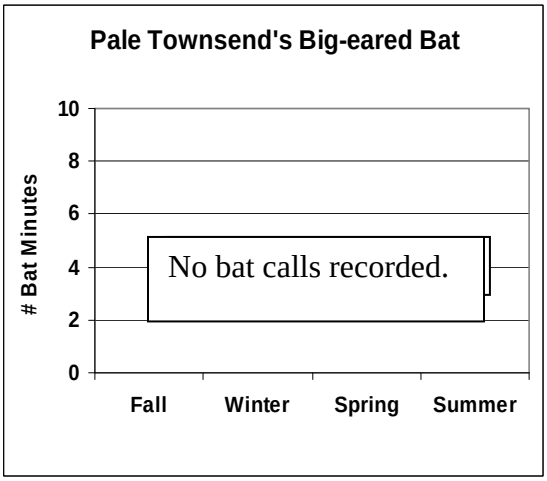


Figure 51. Pale Townsend's Big-eared Bat

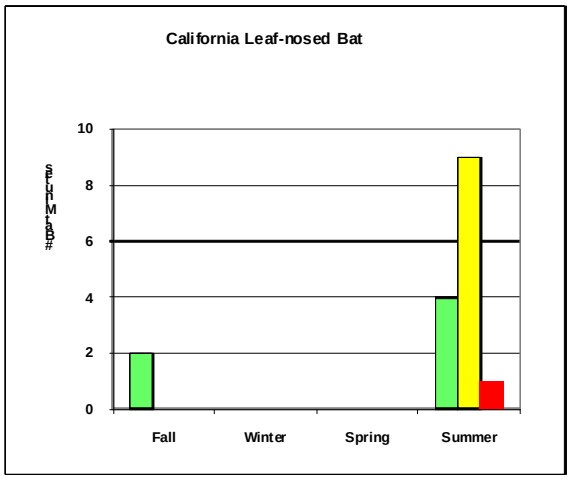


Figure 52. California Leaf-nosed Bat

Legend:

Restoration Sites

Agriculture

Saltcedar

Mean Number of Bat Minutes for Entire Bat Assemblage

As at other restoration areas, the 45-55 kHz and 25-30 kHz species groups and the canyon bat (Pahe) had the highest mean number of bat minutes, with adjacent habitats having higher number of minutes compared to minutes from restoration sites. The four covered bat species had very low numbers of bat minutes compared to minutes for the flagship species (Figure 52).

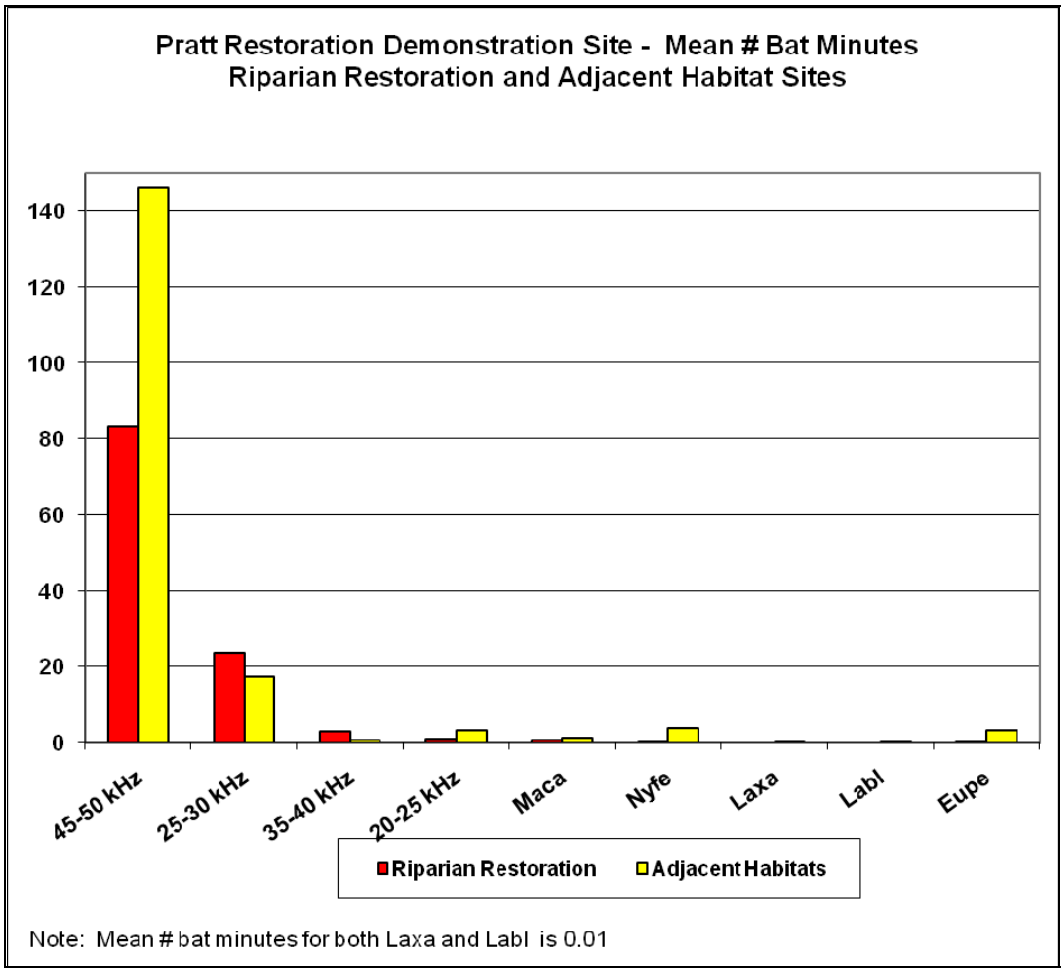


Figure 53. Mean number of bat minutes for the Pratt Restoration Demonstration Site

Index of Relative Bat Activity

An index of relative bat activity was developed for restoration and adjacent habitat sites for the Pratt site (Table 21). The 45-55kHz species group dominated the restoration sites (74.2%) and the adjacent habitat sites (83.0%). The second most abundant was the 25-30 kHz species group, with 21% relative abundance for the restoration sites and 9.9% abundance for the adjacent habitats. The third most abundant in riparian restoration sites was the 35-40 kHz species group, and for adjacent habitats the third most abundant was the pocketed free-tailed bat at 2.1%. The California leaf-nosed bat (Maca) comprised the fifth most abundant species in riparian restoration sites (0.8%) and the sixth most abundant species for adjacent habitats (0.7%). Both the western yellow bat and the western red bats were found in very small numbers in adjacent habitats (0.1%) and were not recorded in the restoration sites. The pale Townsend's big-eared bat was not recorded in either riparian restoration sites or adjacent habitats.

Table 21. Index of relative bat activity for both sites at Pratt Restoration

Riparian Restoration Sites		Adjacent Habitat Sites (Ag & SC)	
Species or Species Group	**%**	**Species or Species Group**	**%**
45-55 kHz	74.2	45-55 kHz	83.0
25-30 kHz	21.0	25-30 kHz	9.9
35-40 kHz	2.7	Nyfe	2.1
20 kHz	0.9	20 kHz	1.9
Maca	0.8	Eupe	1.8
Nyfe	0.3	Maca	0.7
Eupe	0.1	35-40 kHz	0.4
Laci	0.1	Laxa	0.1
Laxa	0.0	Labl	0.1
Labl	0.0	Laci	0.0
	100%		100%

Seasonal Bat Activity for Entire Bat Community

Table 22 lists the mean number of bat minutes for each quarterly sampling period, with standard errors and number of detector nights. The highest number of mean bat minutes per night was recorded in July at Pratt Restoration Demonstration Site for restoration areas (267 mean bat minutes per night) and 267.8 minutes for the adjacent habitats. April activity was significantly lower at 78 minutes for restoration areas and 84.8 minutes for adjacent habitats.

Table 22. Means and standard errors of bat minutes for quarterly sampling for all sites.

Restoration Areas			Adjacent Habitats		
Sample Period	**Mean Bat Minutes Per Night ± SE**	**# Detector Nights**	**Sample Period**	**Mean Bat Minutes Per Night ± SE**	**# Detector Nights**
October	32.0 ± 11.6	3	October	Not sampled	
February	Not sampled	n/a	February	Not sampled	
April	78.0 ± 24.0	2	April	84.8 ± 28.3	4
July	267.0 ± 16.0	2	July	267.8 ± 67.3	4

Discussion

Beal Lake Restoration Area

Exploratory surveys were conducted at eight sites at Beal Lake, four of which were on the edges of ponds or along the pump channel, two of which were in saltcedar stands adjacent to the restoration sites, and two of which were in cottonwood stands. The most interesting observation is that the four focal bat species often are recorded along pond edges or along the pump channel. This was the case for both 2007 and 2008, particularly for the California leaf-nosed bat. In 2008, 12 minutes were recorded in fall, 1 minute in winter, and 3 minutes in summer for this species on pond edges or channel habitat. This compares with only 4 minutes recorded in cottonwood habitats. Two of the 4 western yellow bat minutes were recorded in pond edges or channel habitats, and 1 of the 3 western red bat minutes were recorded in pond edges. While the current study design does not include monitoring pond edge or channel habitat, it may be worthwhile to continue to keep tabs on use of these important habitats. An additional detector can be deployed on the Pump Channel or along the edge of Topock Marsh. The other exploratory surveys were useful in that they lead to the inclusion of saltcedar sites in quarterly monitoring.

The Beal Permanent Bat Monitoring Station is functioning well, though it doesn't appear to be intercepting many of the focal bat species. Only 4 minutes of western yellow bat calls were recorded at the station while quarterly monitoring recorded a total of 31 minutes for all four of the focal bat species, of which 10 minutes were located in cottonwood habitats. Consideration should be given to the location of the bat station. It is located in the middle of the unit with cottonwood habitats surrounding it. It may simply be that the fairly small numbers of focal bat species in the entire area reduce the likelihood of encountering the bat station detector. Consideration should also be given to ensuring that the plate that reflects bat calls up to the detector in the bat hat is kept clean to ensure maximum recording potential. Habitat samples at Beal include three sample sites at sapling cottonwood, mesquite, and saltcedar.

'Ahakhav Preserve

Mist netting conducted in 2008 captured western yellow bats (Calvert 2008), which in turn led to the decision to include the Preserve in the post-development bat monitoring. This site has indeed proven to be a valuable site for the focal bat species, with 68 western yellow bat minutes recorded. This is the greatest number of yellow bat minutes recorded for any of the seven habitat creation areas. These were either in sapling cottonwood or intermediate cottonwood, mostly in July. This high level of use certainly indicates that yellow bats are not simply migrating or commuting through the site, but are actually using the habitat, either for foraging or roosting or both.

Another unique observation for the ‘Ahakhav Preserve riparian restoration habitat is the large number of unusual 35 to 40 kHz bandwidth calls. These calls are unlike most calls of this bandwidth at the other restoration sites and cannot readily be classified as cave myotis — the only verified 40-kHz myotis species using the Lower Colorado River. These calls may be from the Arizona myotis (*Myotis occultus*), which is thought to have been extirpated from the LCR for

many years. Pat Brown has been conducting acoustic and mist-netting surveys along the LCR for the past 30 years and speculates that this species may well be present (Pat Brown, personal communication). Mist netting conducted in 2009 resulted in the capture of individuals with morphology more in line with the Arizona myotis rather than cave myotis or possibly Yuma myotis. Tissue samples have been collected for DNA analysis. Results of these tests should help resolve the identification issue.

The 2009 post-development monitoring effort should include analysis of the habitat factors that make this site one of best sites thus far for focal bat species. Factors such as canopy complexity, nearness to the LCR, presence of openings or swoop zones within the canopy, and other factors should be examined. It may be possible to tease out what factors are particularly desirable for bat habitat. Such knowledge should help in designing and managing other habitat creation areas.

Of the seven habitat creation areas, the ‘Ahakhav Preserve has the highest number of pocketed free-tailed bat minutes (Nyfe) recorded (37 minutes), all at cottonwood sites. Habitat samples at the Preserve include three sets of samples at mesquite, intermediate cottonwood, and sapling cottonwood.

PVER

PVER was second only to the 'Ahakhav Preserve in number of western yellow bat minutes recorded (17). Six minutes were recorded along the river's edge in October, 6 minutes in saltcedar in July, and 5 minutes in agriculture in October (Figure 30). In 2007, only one western yellow bat was recorded along the edge of the LCR in July. Similarly, 28 minutes of bat activity were recorded for the California leaf-nosed bat, most of which occurred in July in agriculture (14) with 3 minutes being recorded in saltcedar in July. Six minutes were recorded along the river’s edge in October, with only 1 minute recorded in young cottonwood in October. This compares with 22 minutes recorded for 2007. Both of these species appear to be utilizing habitats that are very close to the Colorado River. As the cottonwood-willow habitats at PVER mature and additional fields are planted it is likely that focal bat use will increase.

The only exploratory site at PVER was located adjacent to the Colorado River. Acoustic sampling at this location has revealed that western red bats, western yellow bats, and California leaf-nosed bats all use the river corridor. In one particular unique event, 67 hoary bat minutes were recorded along the river during July 2007. Whether the river is used as a migratory corridor, as a foraging site, as a drinking site, or for various combinations of uses, such observations point out the importance of the river corridor to bats. Habitat samples at PVER include data from three sites in intermediate cottonwood, saltcedar, and agriculture.

CVCA

The number of bat minutes for the four focal bat species was similar between 2007 and 2008, with California leaf-nosed bat having the most minutes. Unlike PVER, most of the minutes were recorded in the riparian restoration sites in 2008 as well as in 2007. Additionally, this is one of the few habitat creation areas where pale Townsend's big-eared bat calls also were recorded in riparian restoration sites.

There has been tremendous growth of the cottonwood-willow stands; this growth has coincided with intensive irrigation. These two conditions appear to have attracted abundant insects, in particular the Apache cicada. While this is excellent from the standpoint of providing food and cover for bats, it has also required adjustments to the sampling protocol to minimize the amount of insect interference and to allow sampling in a relatively clutter-free area. In three of the sapling cottonwood sites, the detector is raised to the top edge of the canopy, which allows recording uninterrupted by insect calls, as well as allowing sampling of a wide variety of bats. It is likely that the four focal bat species will continue to respond favorably to this rapidly maturing habitat.

Exploratory sites were placed in two mesquite fields pre-treatment, and in a *Baccharis* field. The bat community sampled was typical of agricultural sites (mostly canyon bats, California myotis, big brown bats, and Mexican free-tailed bats). These were discontinued and mature mesquite sites were located in the nearby Cibola NWR Unit#1 habitat creation area.

Cibola NWR Unit #1

No western yellow bat minutes or Townsend's big-eared bat minutes were collected in any habitat during any sample period. However, two yellow bats were captured at Unit #1 in August mist netting, indicating the value of multiple sampling methods in monitoring bat use of habitat creation areas (Calvert 2008).

A western red bat minute was recorded in summer in an agricultural field adjacent to the riparian restoration sites. California leaf-nosed bats were more widely spread, with 13 minutes of bat activity obtained in fall, 27 minutes in the spring, and 25 minutes in summer in the mature cottonwood and mesquite sites. Thirty-four minutes were obtained in the agriculture site in July, 1 minute in spring, and 2 minutes in fall. The increase in bat activity in agricultural habitat in July was likely the result of insect abundance associated with maturing crops.

Two exploratory sites were placed in sapling cottonwood at the mass planting site and in *Atriplex* (pre-treatment) in a field adjacent to the restoration sites. These sites were discontinued with the adoption of a new sample design beginning in April 2008.

Habitat samples at Cibola NWR Unit #1 were combined with those of the CVCA to provide a set of three samples each of mesquite, sapling cottonwood, and agriculture.

Imperial Ponds Conservation Area

The Imperial Ponds Conservation Area had the highest mean number of bat minutes in winter of the seven habitat creation areas. Riparian restoration sites had a mean of 25 minutes of bat activity, while the adjacent habitats had a mean of 58 minutes. In this case, the ponds received a large amount of use during the winter. This level of winter activity was, however, extraordinary when compared to the other six habitat creation sites, which had very low winter use. Beal Lake, for example, had a mean of 0.4 for restored habitat versus 0 for adjacent habitats in winter; CVCA had 0 for both habitats as did Cibola NWR Unit #1 and PVER. This relatively high winter use was probably the result of milder winter temperatures when compared to the more

northerly areas, as well as the juxtaposition of ponds among mature cottonwood, saltcedar, and agriculture stands and the Colorado River.

There were 11 exploratory sites at the Imperial Ponds Conservation Area in 2008. Lakeshore sites were located at McAllister Lake, Martinez Lake, Pond 1, and Pond 5. These revealed the importance of this type of habitat to the four focal bat species. One western red bat minute was recorded in October on the edge of Pond 1 in 2008. In 2007, 12 minutes of bat activity for the red bat were recorded, most of which occurred at the edge of Pond 1 during April. This 2007 event may have recorded the passage of migrating red bats. Three western yellow bat minutes were recorded: 1 minute during February over Martinez Lake, 1 minute in an agricultural field in July, and 1 minute in a mature cottonwood stand in July. This contrasts sharply with 2007 when a total of 70 bat minutes were recorded at the edges of Pond 1 and Pond 5 during the April sampling period. It is possible that the 2007 sample coincided with migrating yellow bats passing through the area. From 8 to 19 minutes of California leaf-nosed bats were recorded during each season in the lakeshore habitats during 2008. While no pond replicates have been included in the new sample design, it is recommended that continued monitoring be conducted at one of the ponds, primarily to continue to assess the importance of these created ponds to the four focal bat species.

Additionally, four sites were placed in intermediate cottonwood plantations that have been established for several years. These were, however, marginal sites due to the lack of regular irrigation and the sparse canopies. These sites were eliminated from further sampling. There were two saltcedar exploratory sites, one of which was incorporated into the new sample design. There was also one marsh site, but it was eliminated from further consideration because of the inability to locate an adequate number of replicates.

Pratt Restoration

There was one exploratory site at Pratt Restoration in the interior of the intermediate cottonwood stand. This site became jeopardized as people increasingly began to drive through the stand. Eventually the BLM did close the road to public use in 2009. However, this site was dropped. Sample sites at Pratt Restoration were combined with those in the nearby Imperial Ponds Conservation Area to make a set of three samples of saltcedar, intermediate cottonwood, and agriculture.

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Appendix 1 — Western Red Bat Call Guide

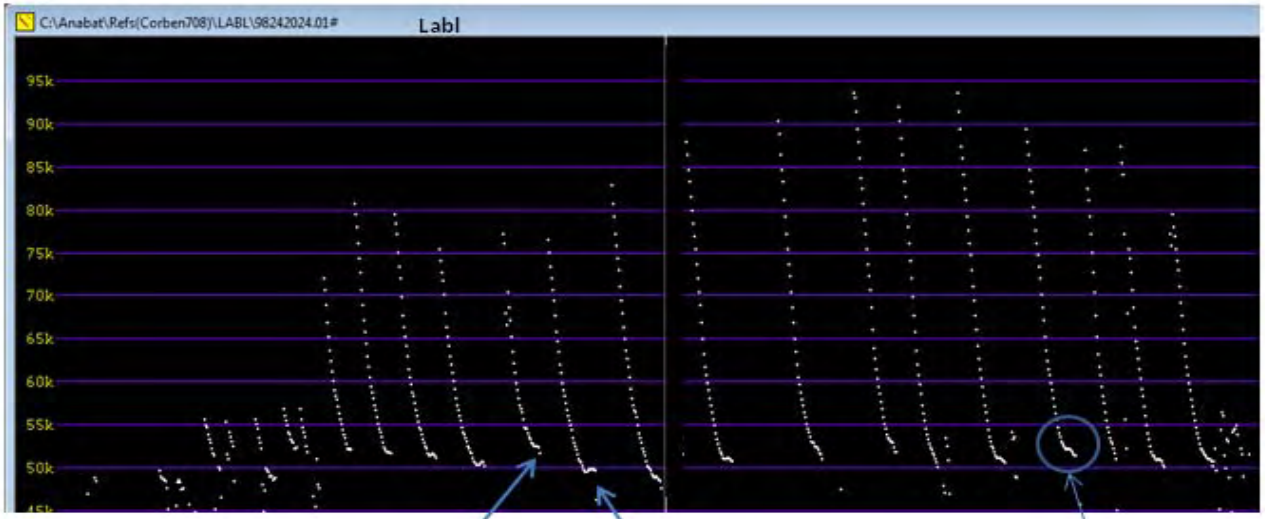
How to distinguish Labl's from very similar Pahe & Myca calls

Also Labl's can overlap Laxa's – both can have minimum frequency of ~ 35 kHz

Labl vs Myca: two nearly identical call sequences - both around 50 Khz with similar call length, time between calls.

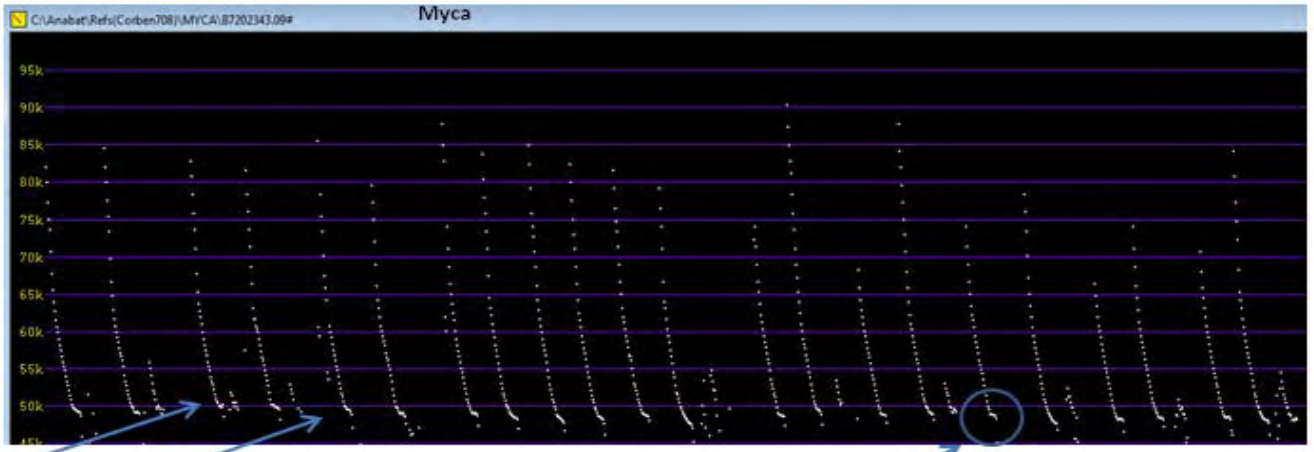
The major difference is that the Labl bounces around - while the Myca remains fairly constant.

Also the toe is warbly on the Labl, but not on the Myca.



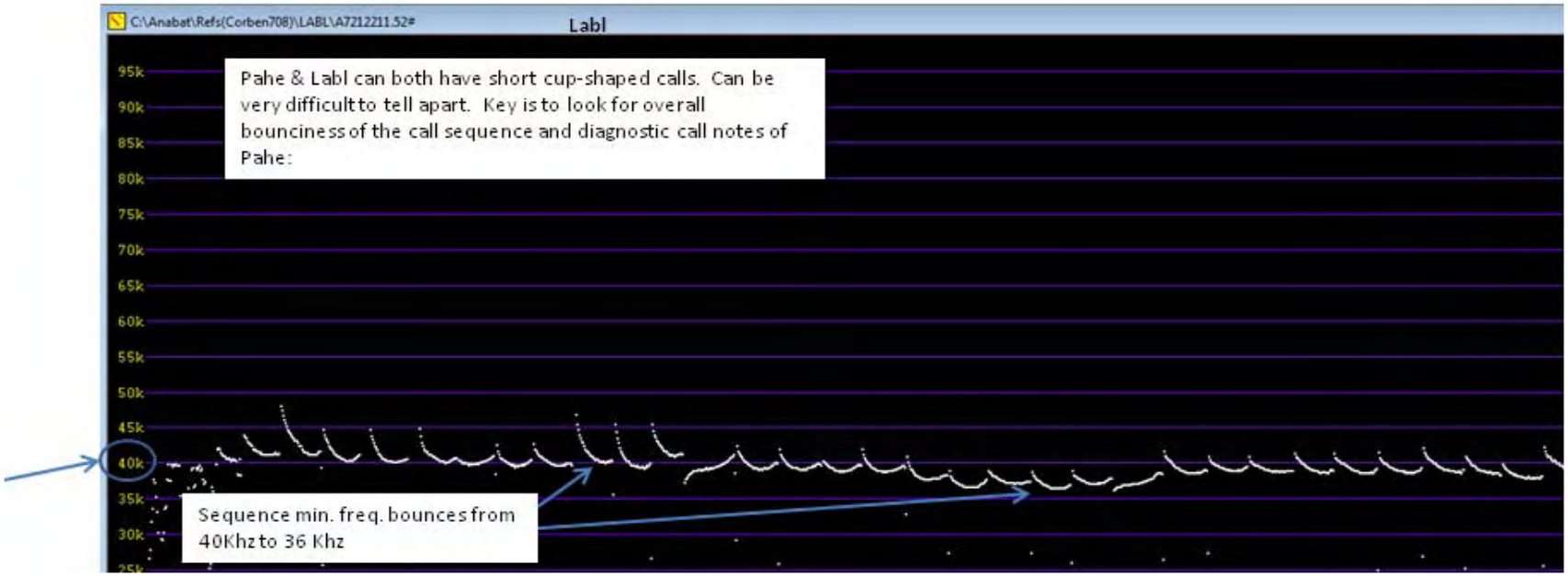
Labl shows bounciness on the minimum frequency:

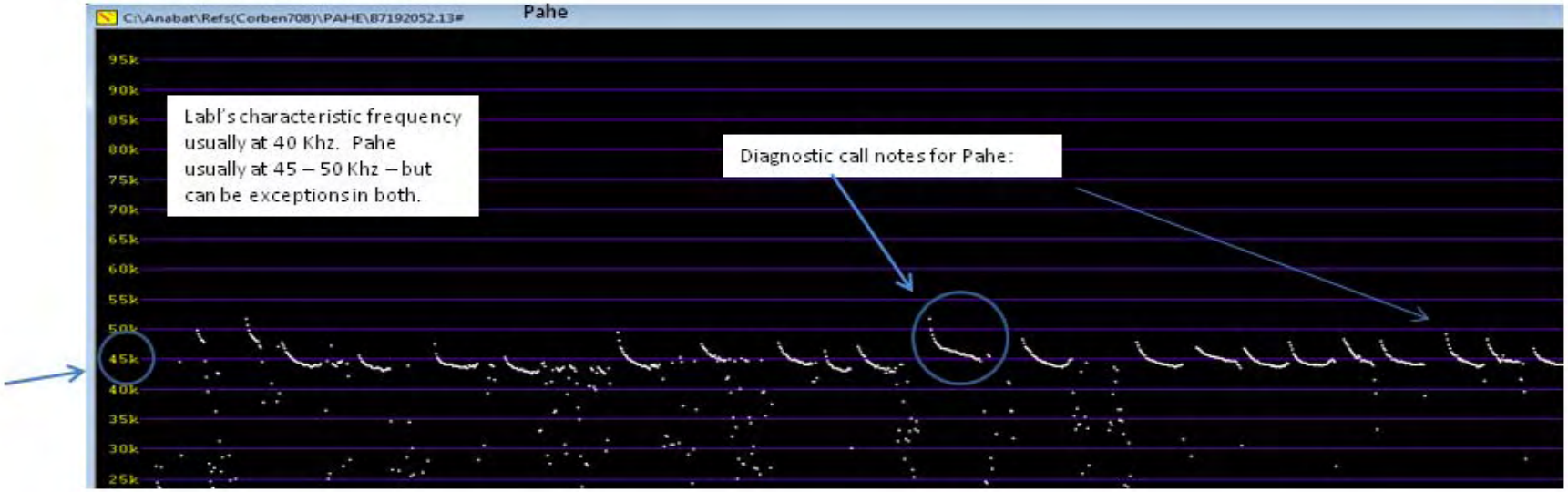
Toe can have a little warble

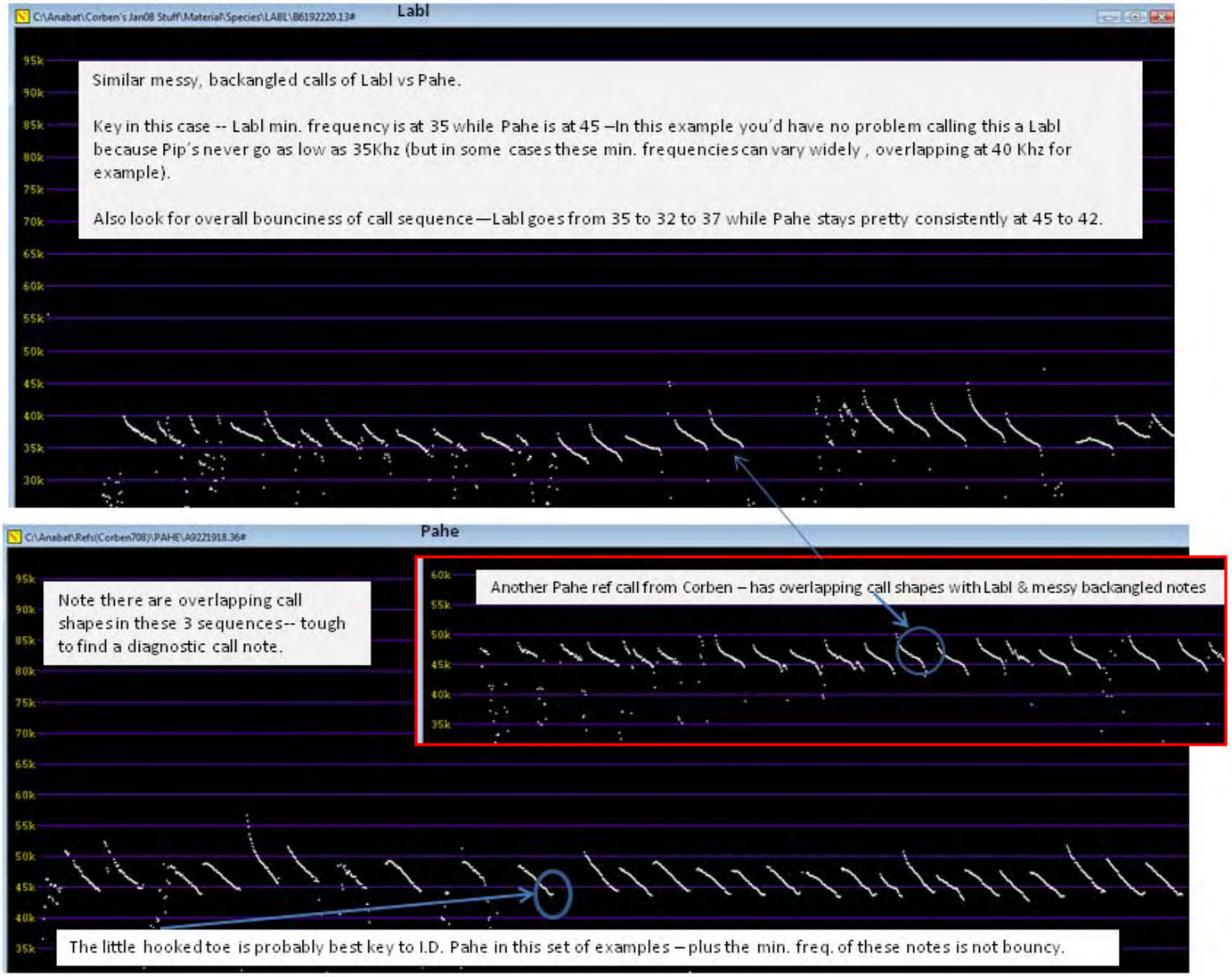


Myca minimum frequency not bouncy.

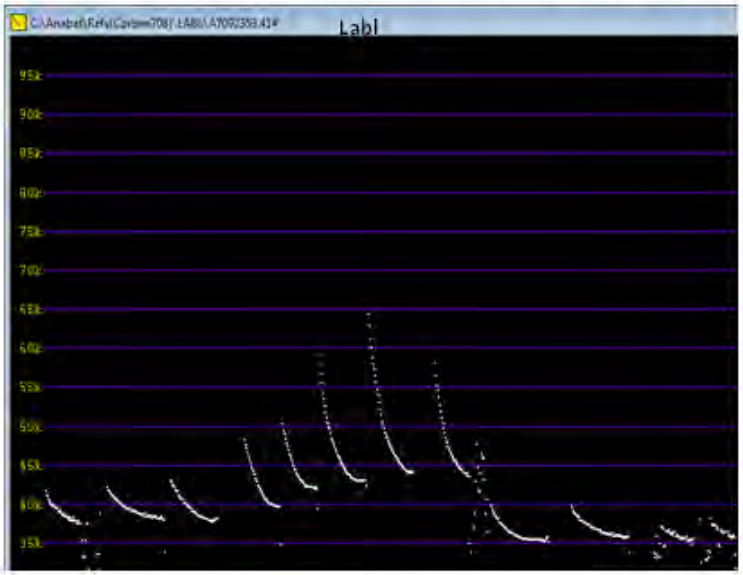
Toe does not have warbles


C:\Anabat\Refs(Corben708)\LABL\A7212211.52#
Labl
95k
90k
85k
80k
75k
70k
65k
60k
55k
50k
45k
40k
35k
30k
25k
Pahe & Labl can both have short cup-shaped calls. Can be very difficult to tell apart. Key is to look for overall bounciness of the call sequence and diagnostic call notes of Pahe:
Sequence min. freq. bounces from 40Khz to 36 Khz

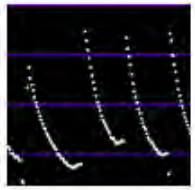

C:\Anabat\Refs(Corben708)\PAHE\87192052.13#
Pahe
95k
90k
85k
80k
75k
70k
65k
60k
55k
50k
45k
40k
35k
30k
25k
Labl's characteristic frequency usually at 40 Khz. Pahe usually at 45 – 50 Khz – but can be exceptions in both.
Diagnostic call notes for Pahe:

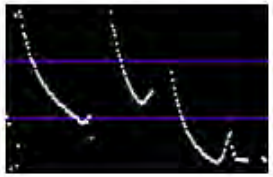

Labl
C:\Anabat\Corben's Jan08 Stuff\Material\Species\LABL\B6192220.13#
95k
90k
85k
80k
75k
70k
65k
60k
55k
50k
45k
40k
35k
30k
Similar messy, backangled calls of Labl vs Pahe.
Key in this case -- Labl min. frequency is at 35 while Pahe is at 45 –In this example you'd have no problem calling this a Labl because Pip's never go as low as 35Khz (but in some cases these min. frequencies can vary widely , overlapping at 40 Khz for example).
Also look for overall bounciness of call sequence—Labl goes from 35 to 32 to 37 while Pahe stays pretty consistently at 45 to 42.
Pahe
C:\Anabat\Refs(Corben708)\PAHE\A9221918.36#
Note there are overlapping call shapes in these 3 sequences-- tough to find a diagnostic call note.
Another Pahe ref call from Corben – has overlapping call shapes with Labl & messy backangled notes
The little hooked toe is probably best key to I.D. Pahe in this set of examples – plus the min. freq. of these notes is not bouncy.

These Labl's overlap minimum frequency with Laxa's (35 kHz).

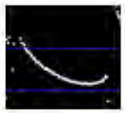


Key to distinguising from Laxa in this case is the shape of the call – Laxa's have a sharper hook while Labl's have a smooth rounded cup:

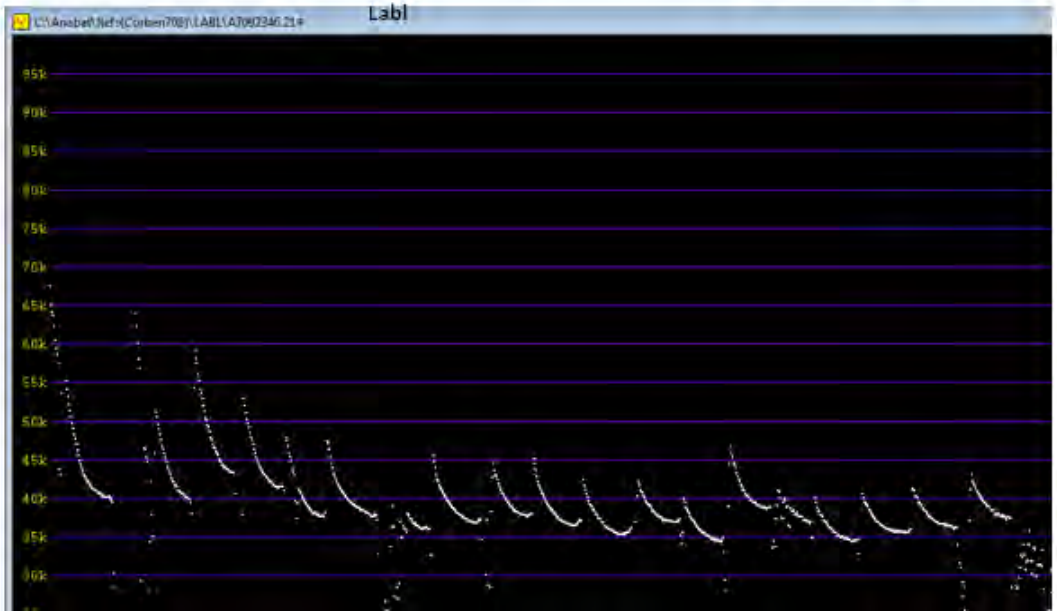




vs.



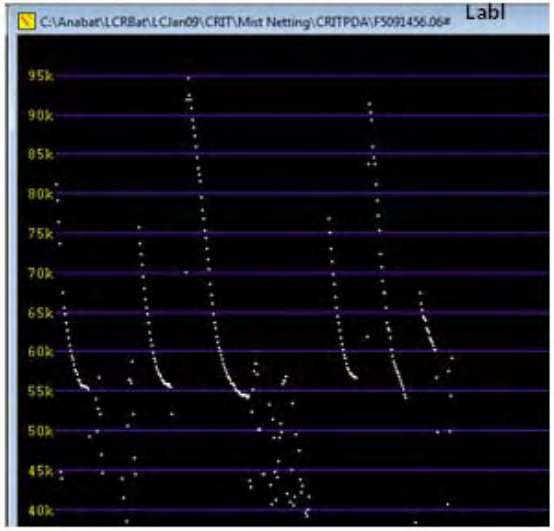
The other key is Labl sequence has call notes > 40 kHz – Laxa's do not.

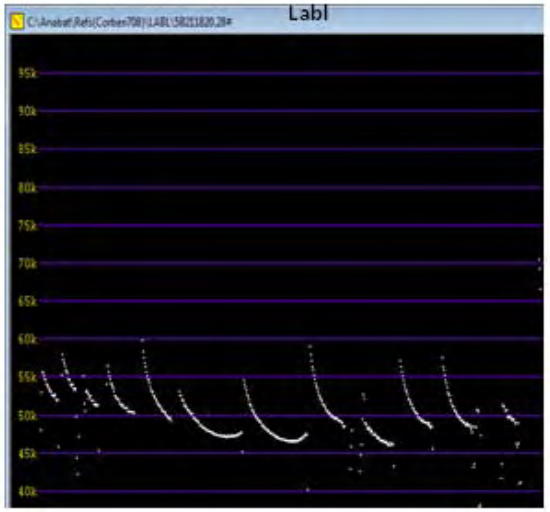


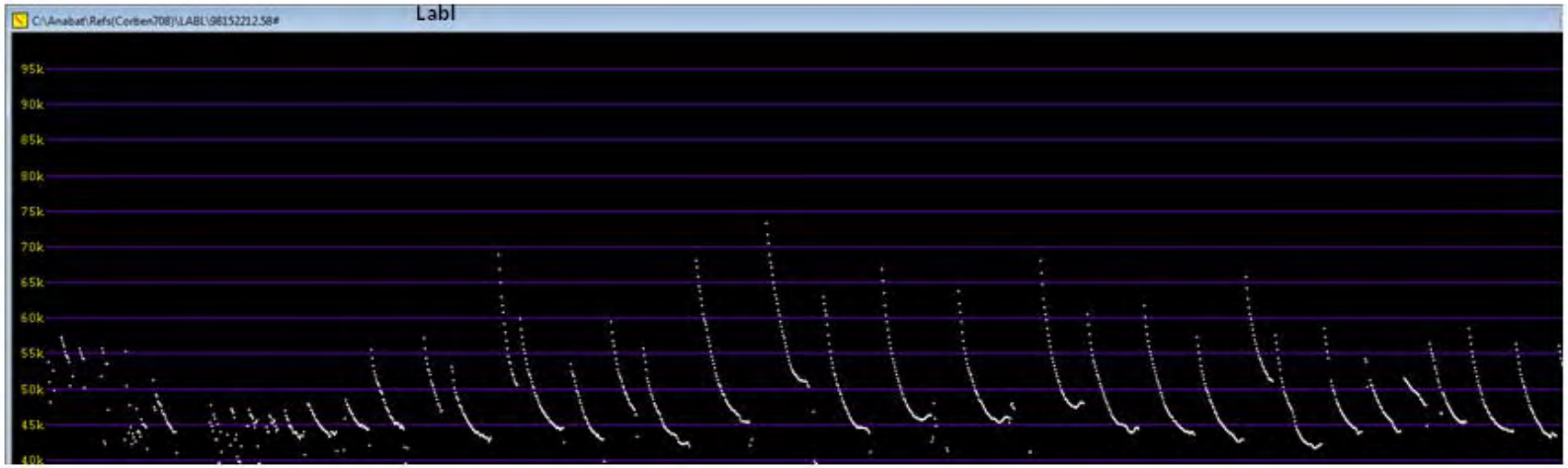
Summary – These are all diagnostic calls in the species call envelop. Stick to easily identified diagnostic call sequences like these from Chris Corben and from positively ID'd voucher calls recorded at CRIT.

Look for diagnostic calls in a call sequence, particularly with Pahe overlaps as well as Myca overlaps.

When in doubt (no diagnostic calls present) place in phonic group.



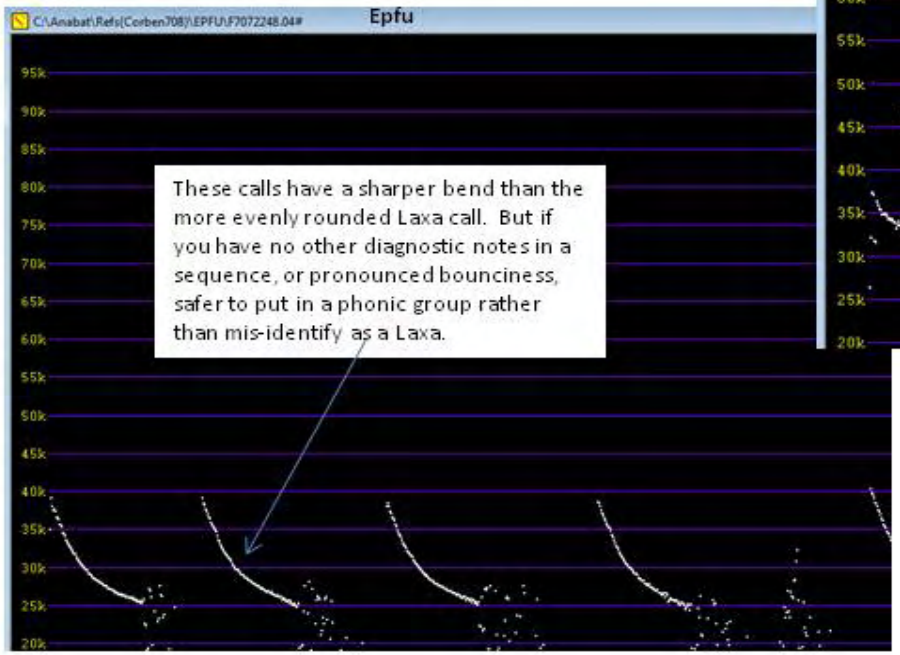


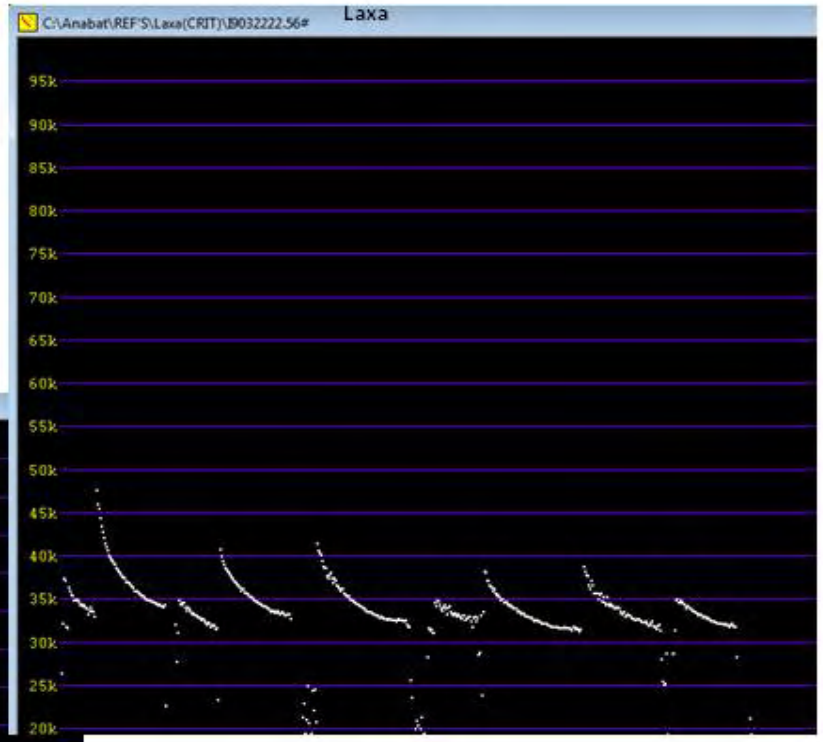


Appendix 2 — Western Yellow Bat Call Guide

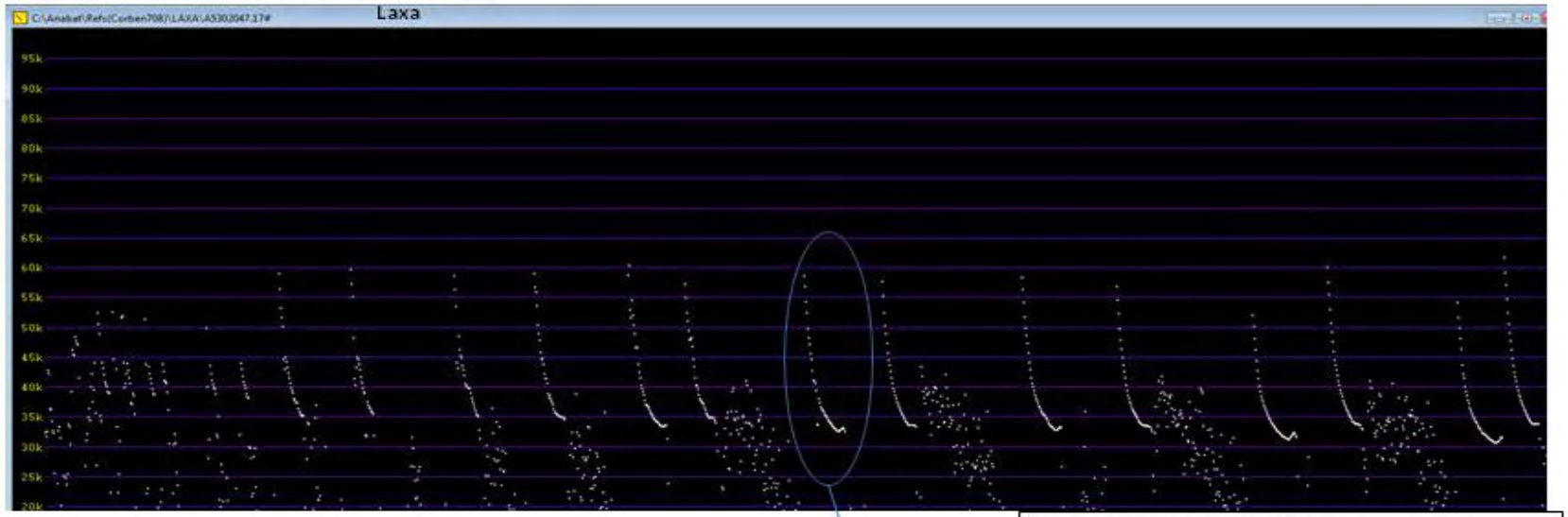
Laxa Guide
How to Distinguish From Overlapping Calls of Epfu and Myve

Laxa can overlap Epfu:

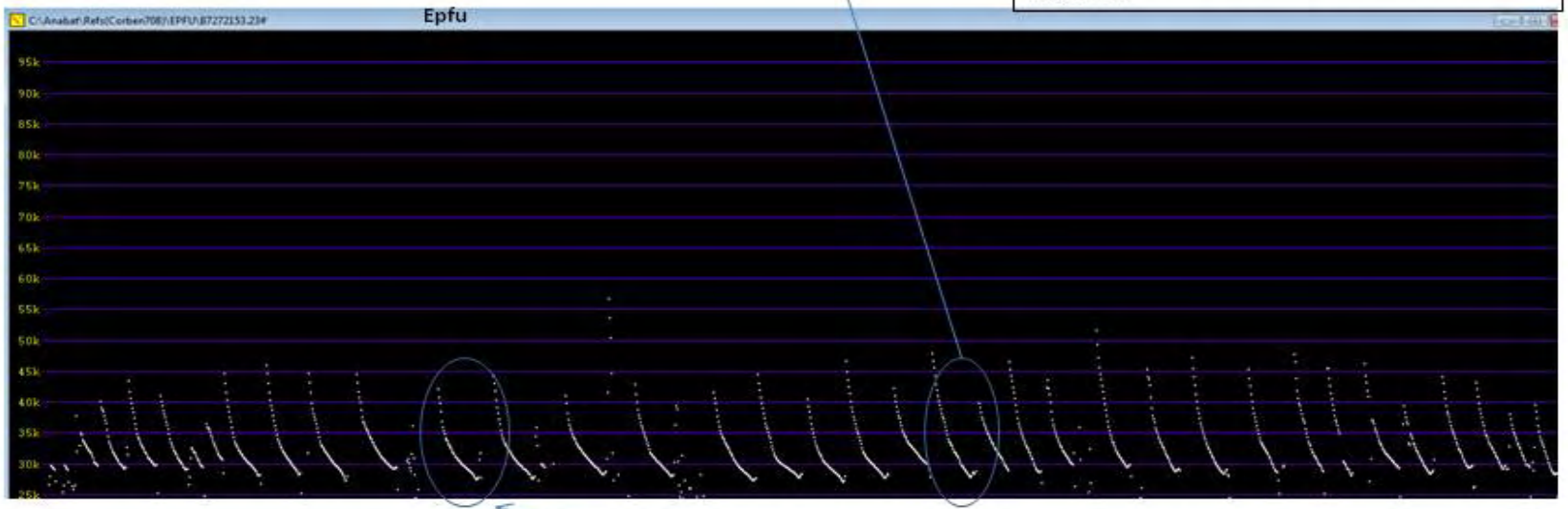




Some Laxa call notes can look like Epfu.

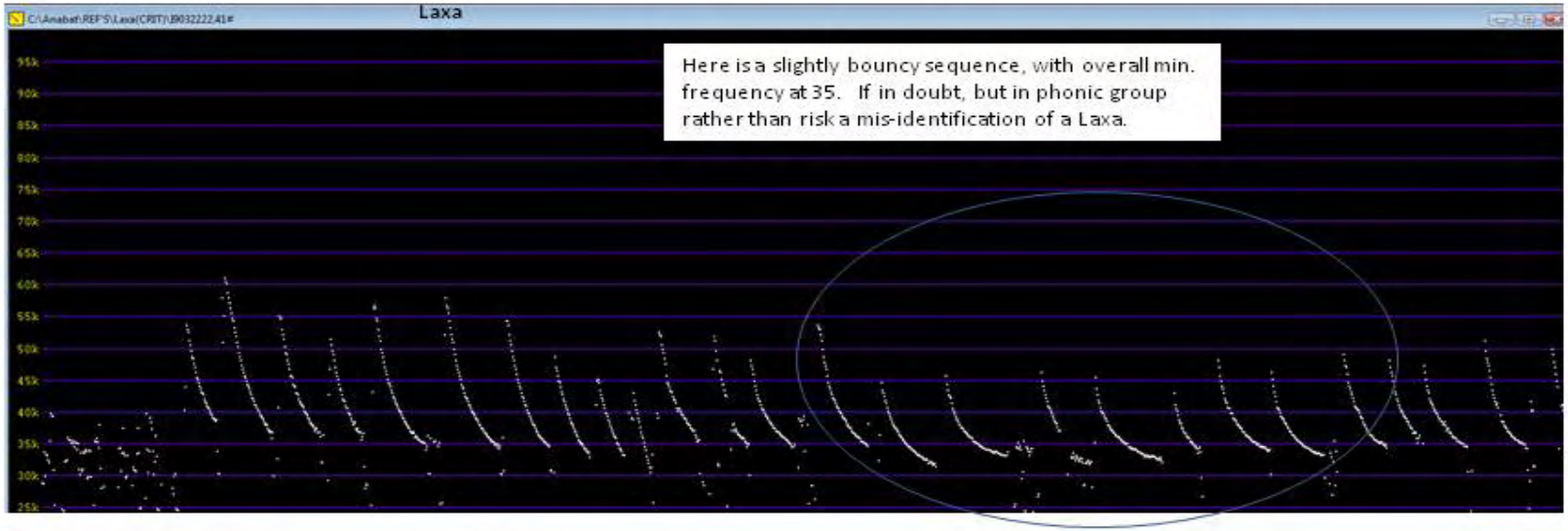


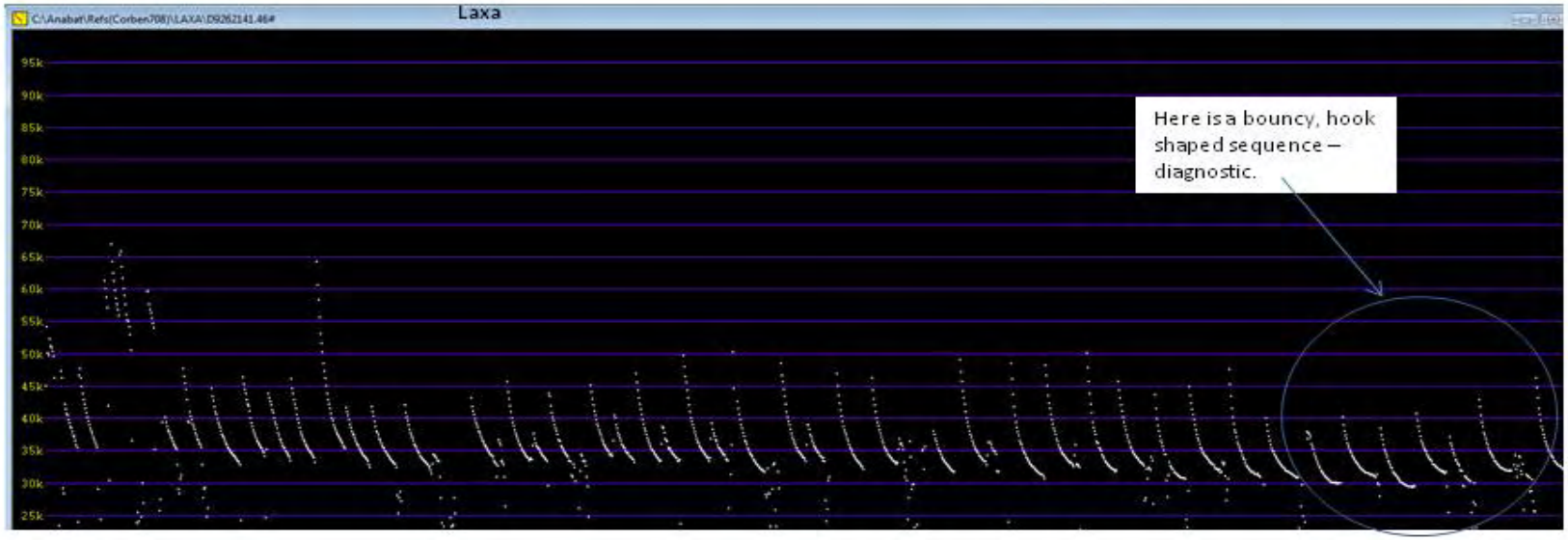
Look for cup-shaped hook & bounce in Laxa - diagnostic

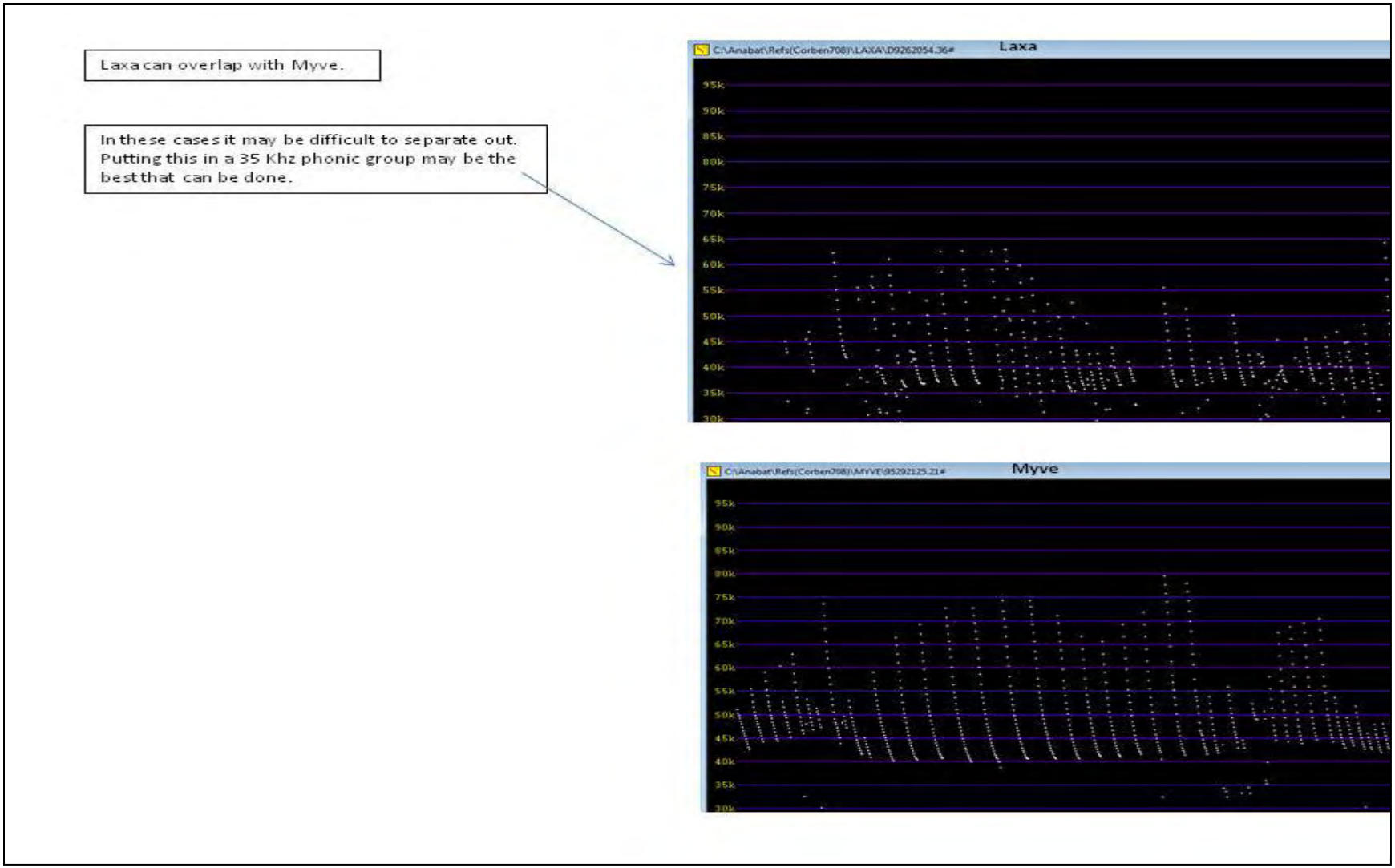


Look for diagnostic call notes for Epfu in a sequence – also min frequency does not bounce around.

Some Laxa calls are messy and non descript. Look for any diagnostic characteristics within the sequence.

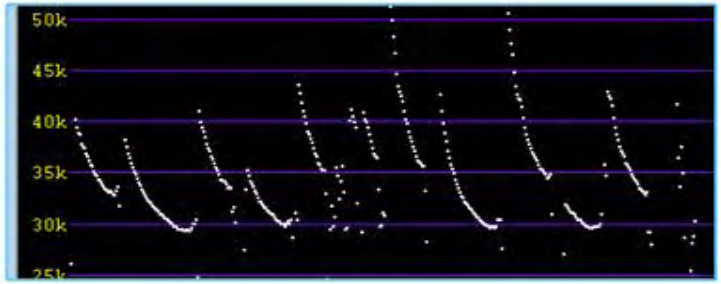


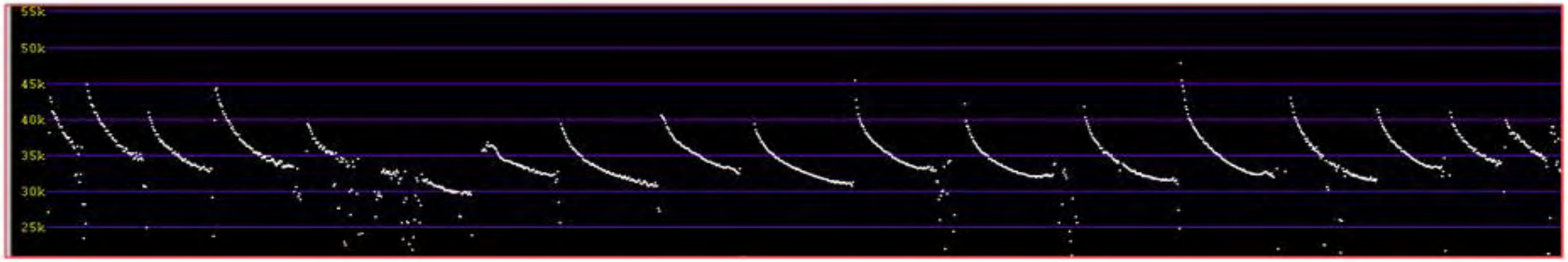


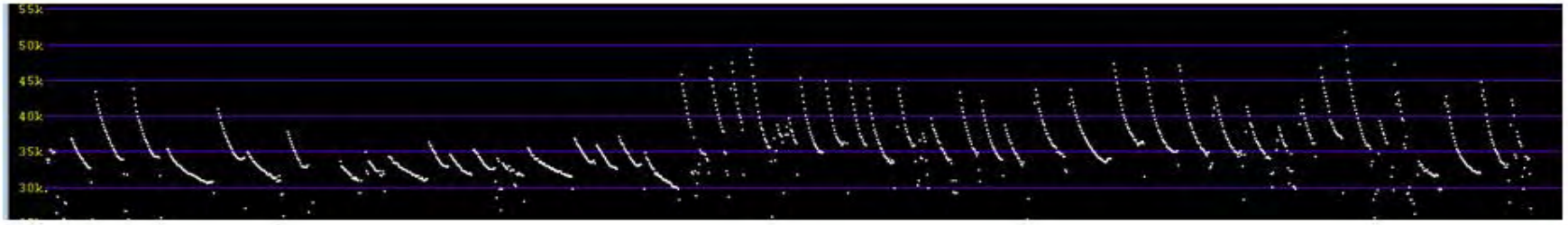


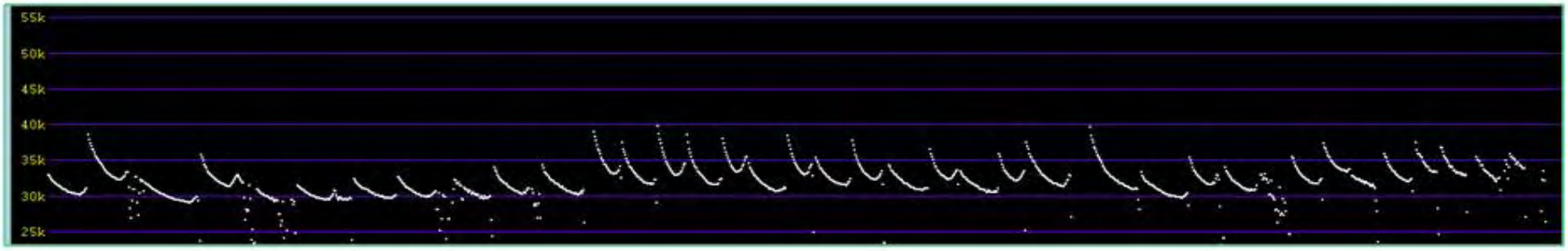
The clearest diagnostic in these two examples is that Myve are 40 kHz and greater, while Laxa are less than 40 KHz. However, if there ever was a case where a Myve took this call shape and its minimum frequency was less than 40 KHz, there could be overlap.

Summary – Laxa Call Envelop. Stick to easily identified, diagnostic calls like these examples from Chris Corben & positively identified voucher calls recorded at CRIT. If in doubt (as with some overlaps with Myve & Epfu), put into phonic groups.









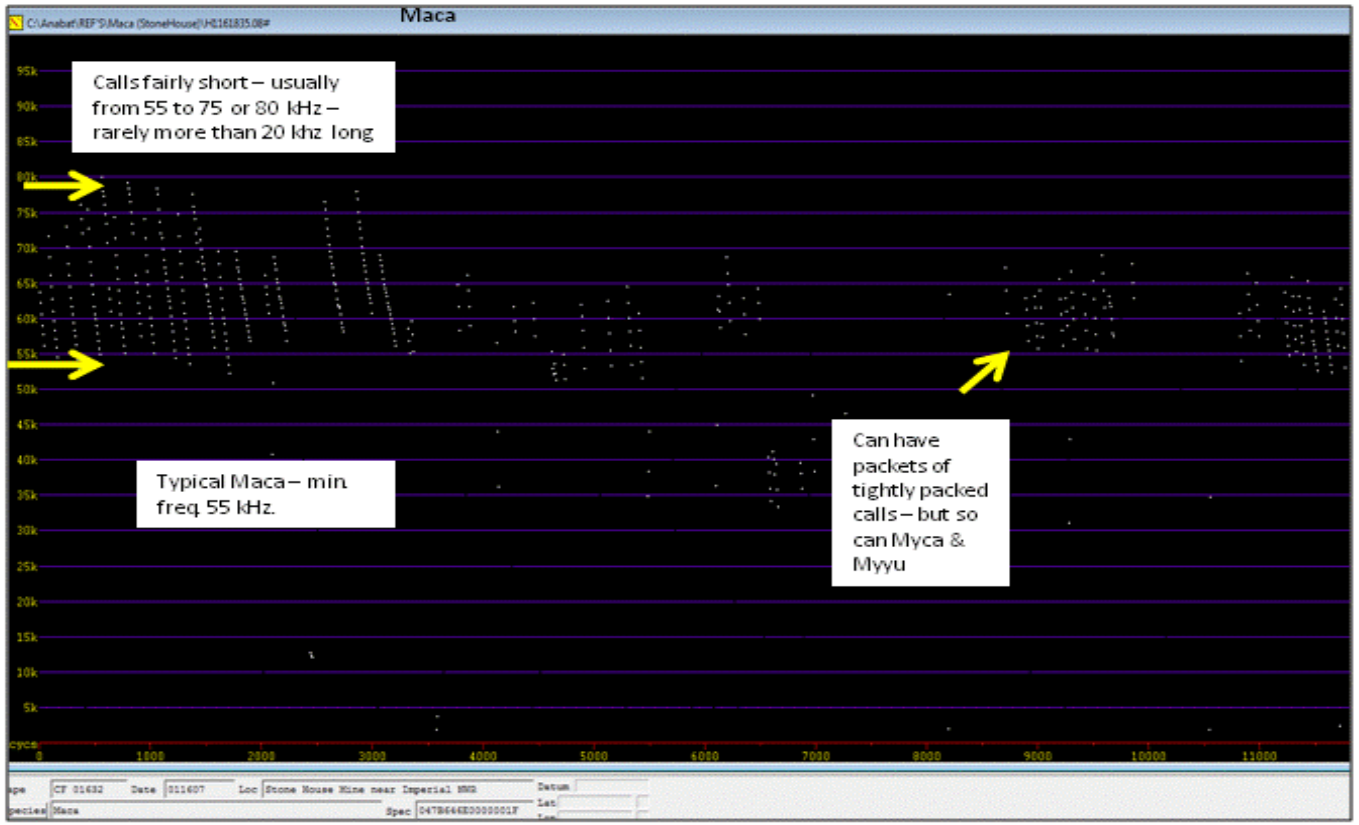
Summary – Identification Guidelines for Laxa

- Minimum frequency ≥ 29 kHz Max frequency < 40 kHz
- Calls are bouncy
- Look for cup-shaped calls – can be long and narrow or wide and short.
- Corben Laxa filter calls out a lot of Epfu's – look for cups, hooks bounciness and any diagnostic Epfu call notes to distinguish from Laxa.

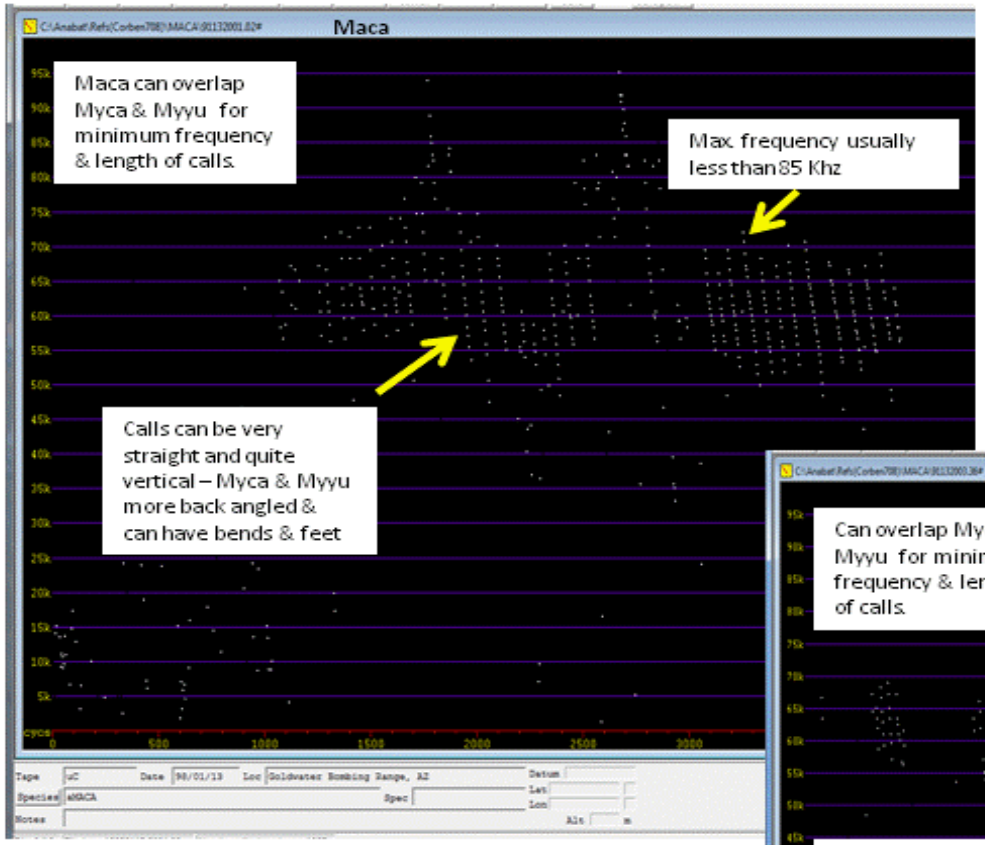
Appendix 3 — California Leaf-Nosed Bat Call Guide

Maca Guide
How to Distinguish from Overlapping Myya & Myca Calls

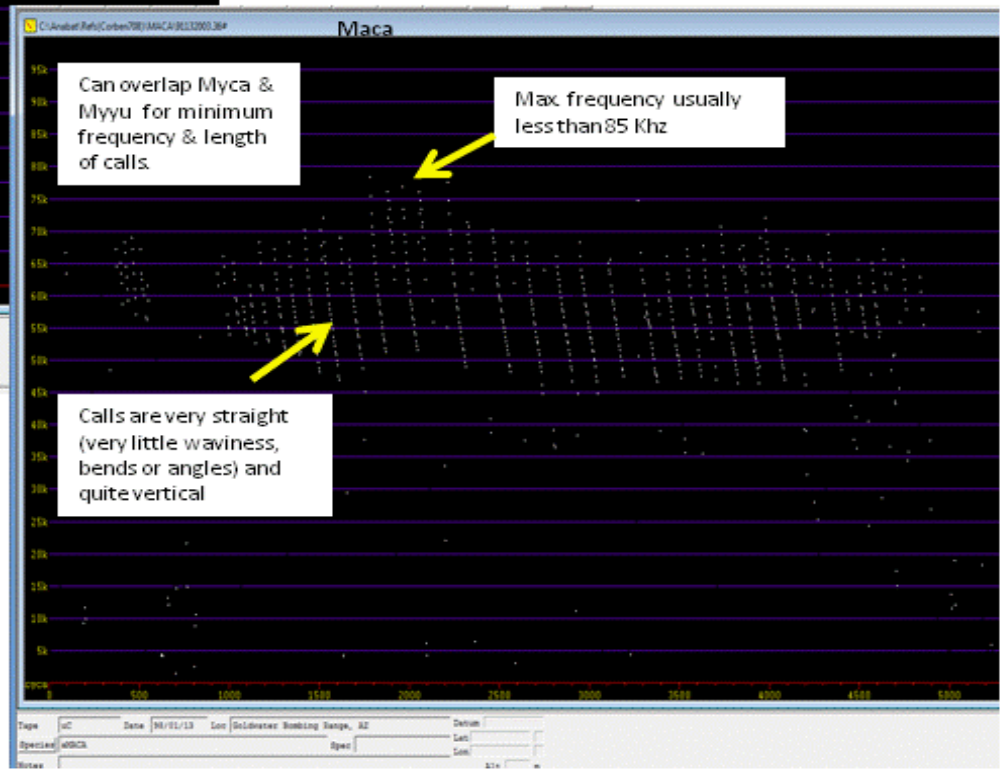
Typical Maca call. Calls usually are smooth & straight (rarely have bends, warbles, feet, angles); vertical (little or no back angle); typically are fairly short calls ranging from 50 or 55khz to 75 or 80 khz (total length of calls is usually 20 to 25 khz).



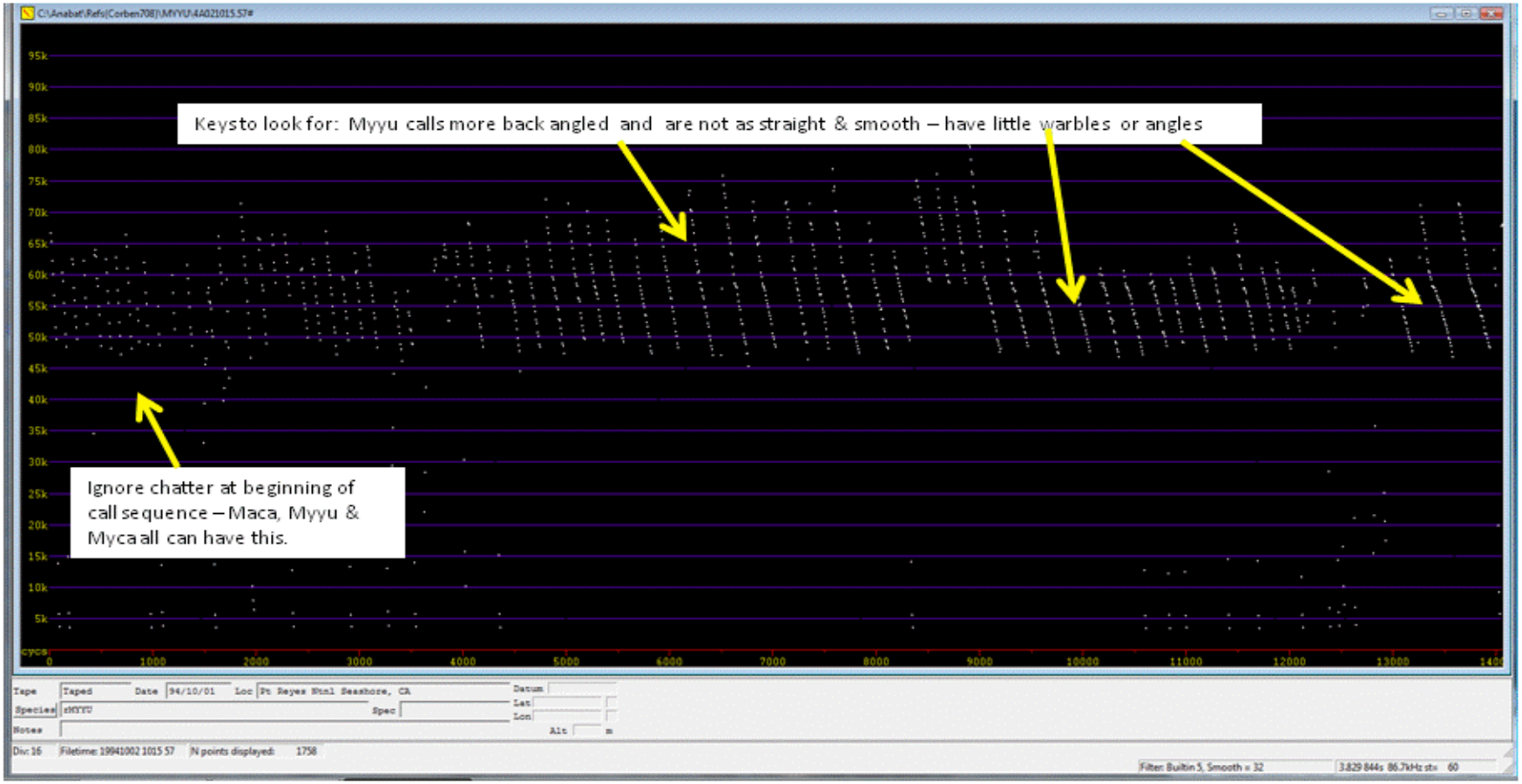
Note: These examples are all from reference calls from noted bat call experts – Chris Corben mostly, with some examples from Bill Gannon, and from Pat Brown at mines with known species. Additionally, new reference calls are being made during Allen Calvert's mist netting on positively identified bat species. All files are labeled with the species name (lower left). The location of the call is on the bottom near the center "Loc" & on the header bar on the top left of the sonogram.



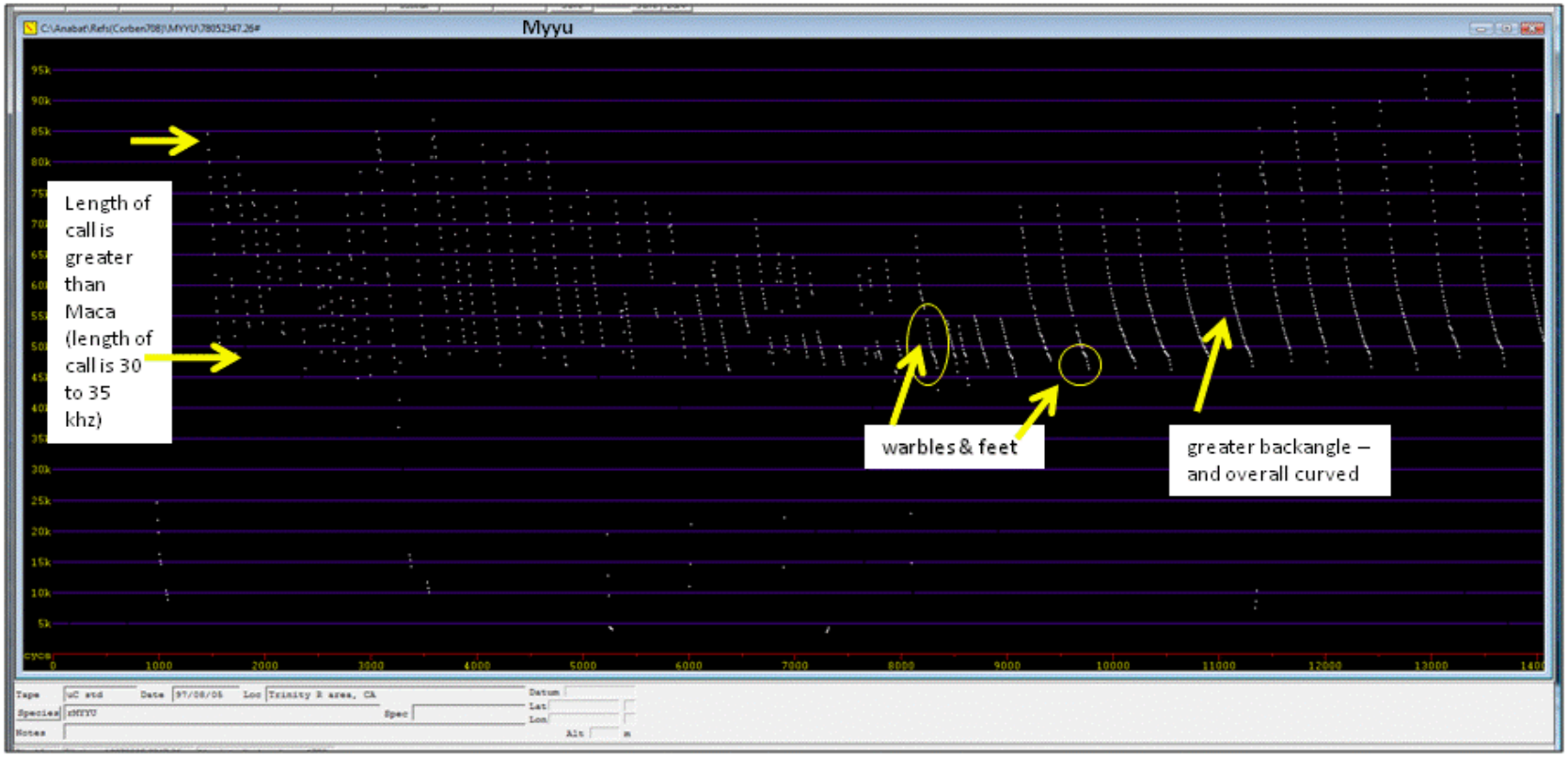
Typical Maca calls



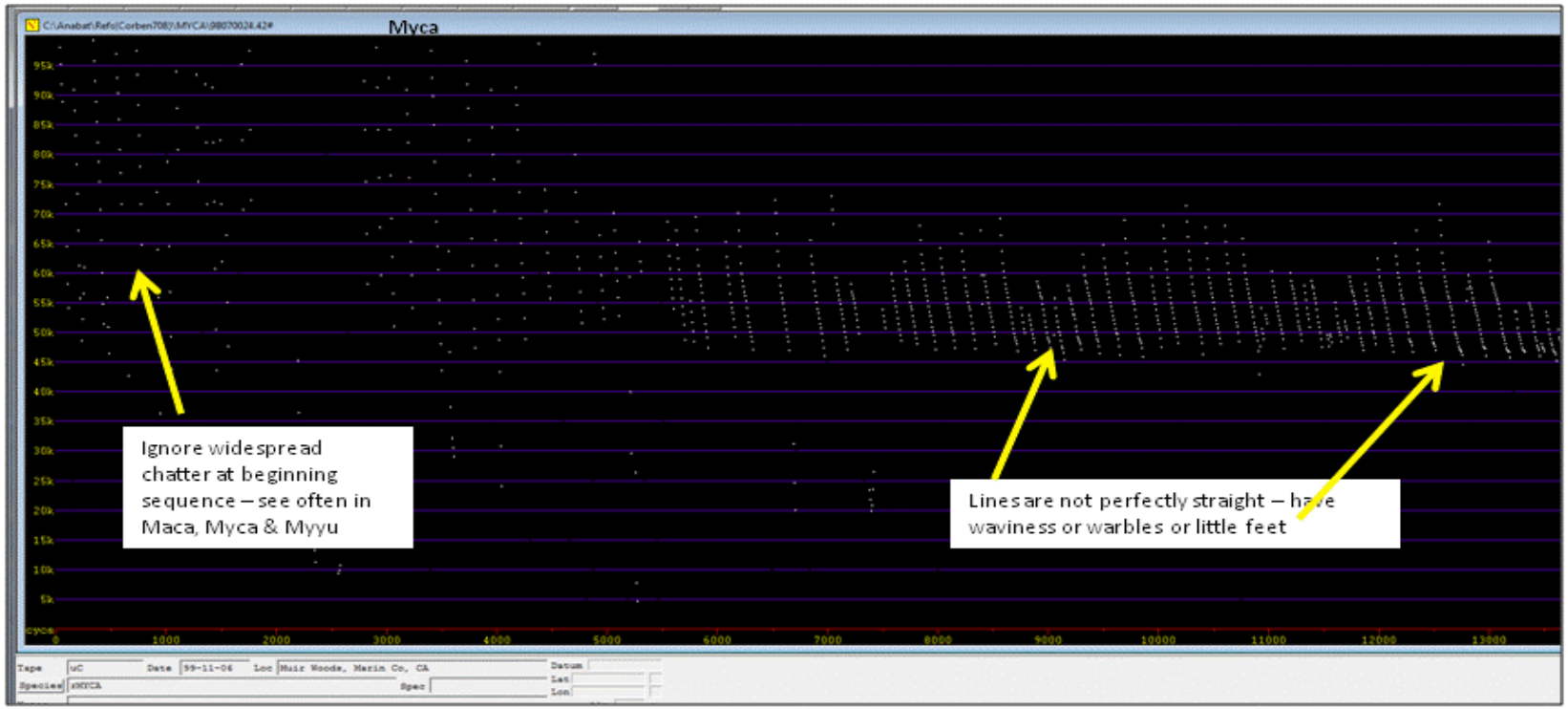
Myyu call that overlaps Maca



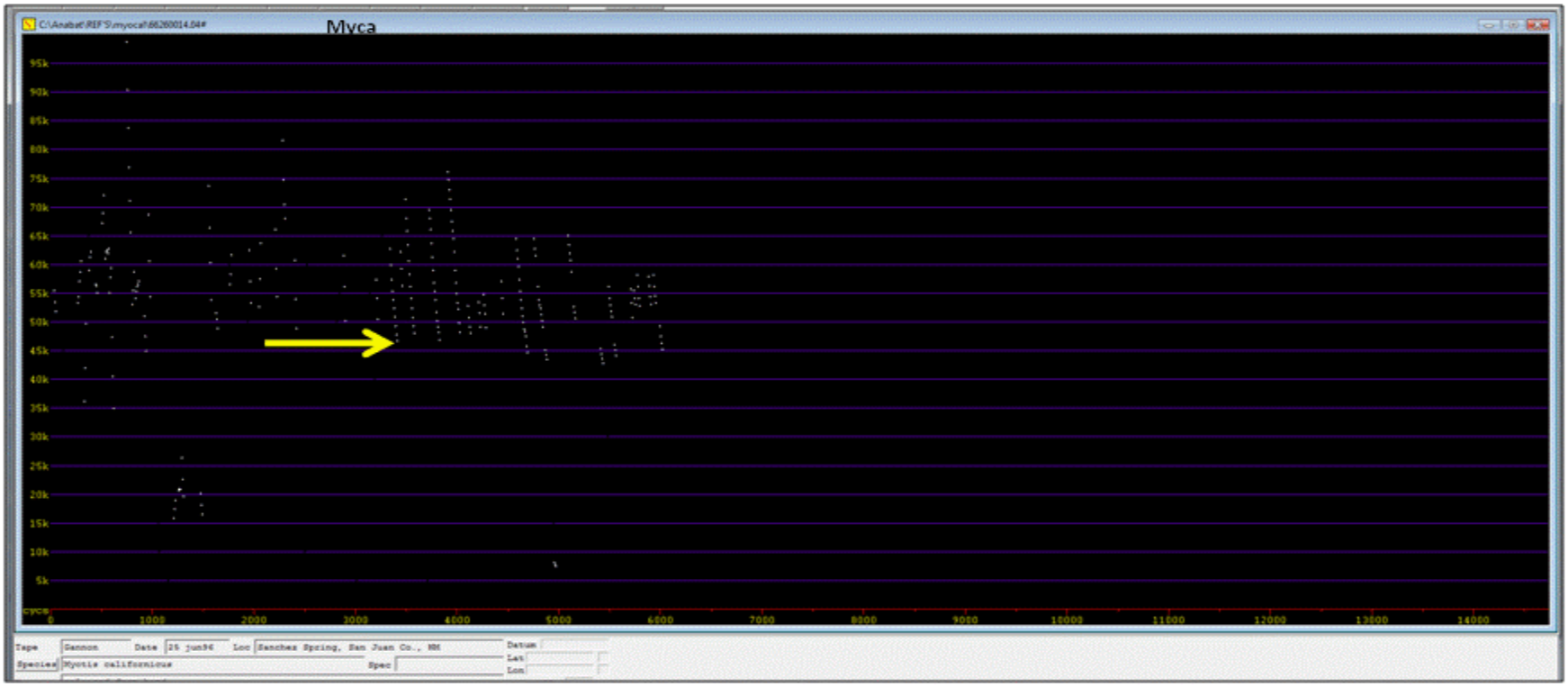
A Myyu call sequence that looks like a Maca in the beginning. Key here is to look for warbles, curves, feet – anything not super straight and nearly vertical. The beginning of the sequence is straight and vertical – but notice overall length of call is greater than usual Maca. Then the call sequence becomes more characteristic of a myotis.



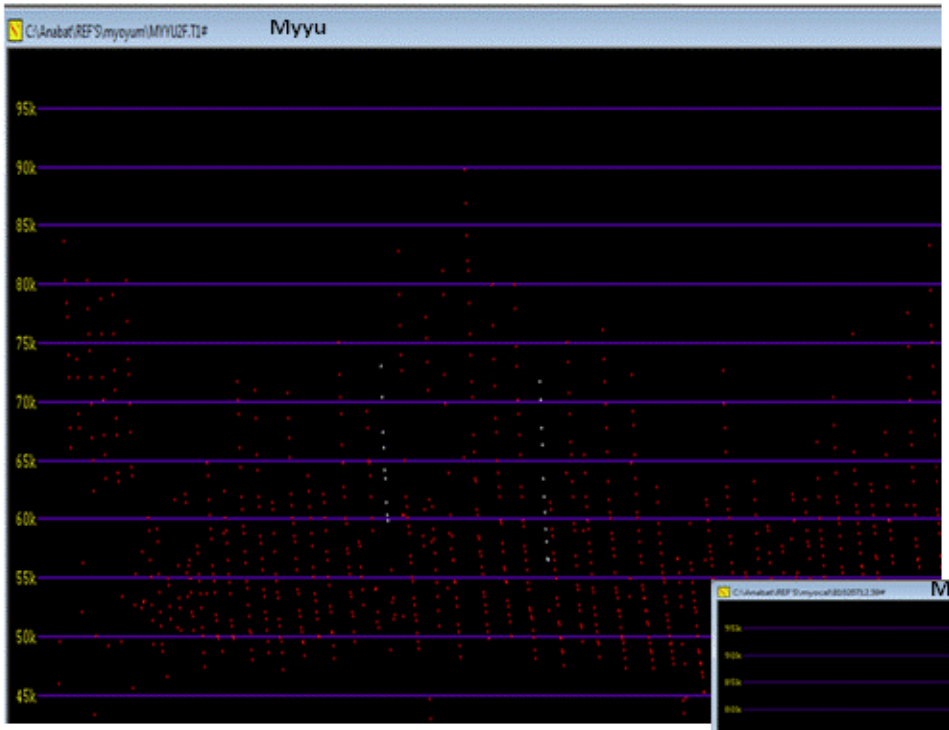
Myca call that looks a lot like a Maca. Look for overall waviness of calls – they're not perfectly straight. Also look for little feet – typical of Myca.



Another Myca that looks like a Maca.

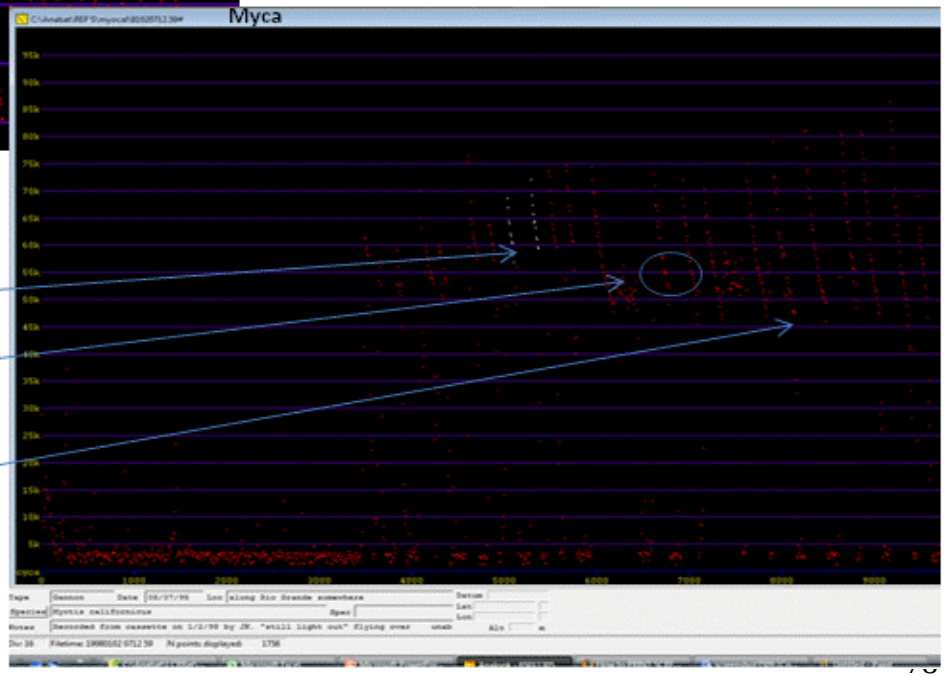


The key to distinguish it from the similar Maca is that the minimum frequency is at 45 – lower than most Maca's.



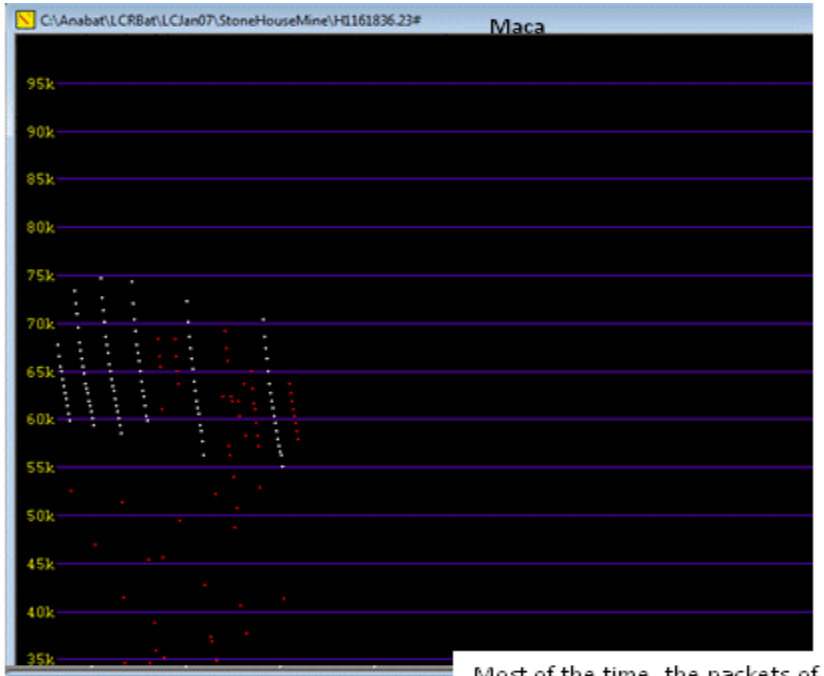
Packets of calls at ≥ 60 Khz are nearly always Maca's. Rarely you can encounter packets at 60 or 65 that are MYYU's like this example – BUT you can eliminate this from consideration – majority of calls are below 50 khz and they're long – way over 20 – 25 Khz.

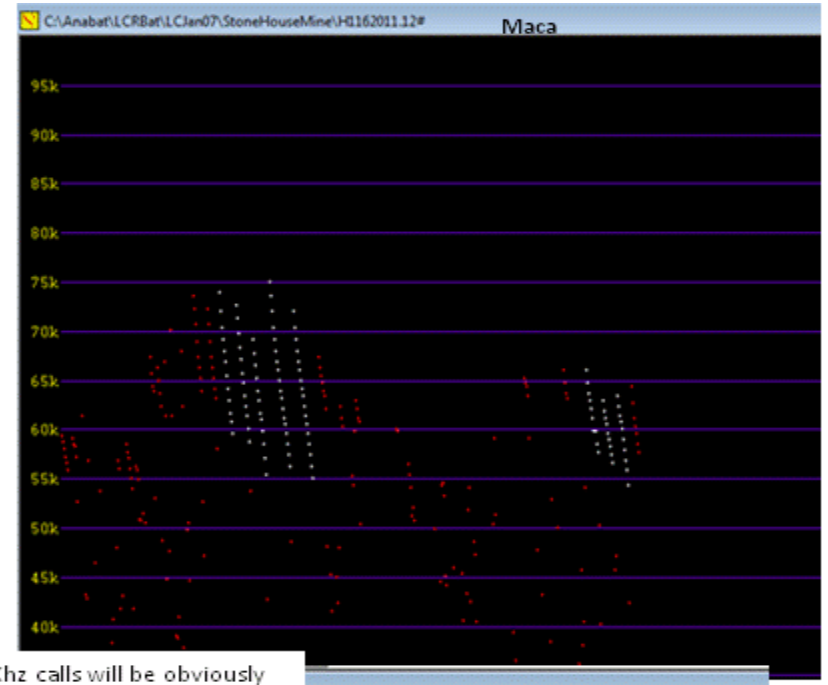
Note: The next series of calls have the Maca1 filter turned on. Red = calls that don't pass the filter – White = the filter has highlighted those.



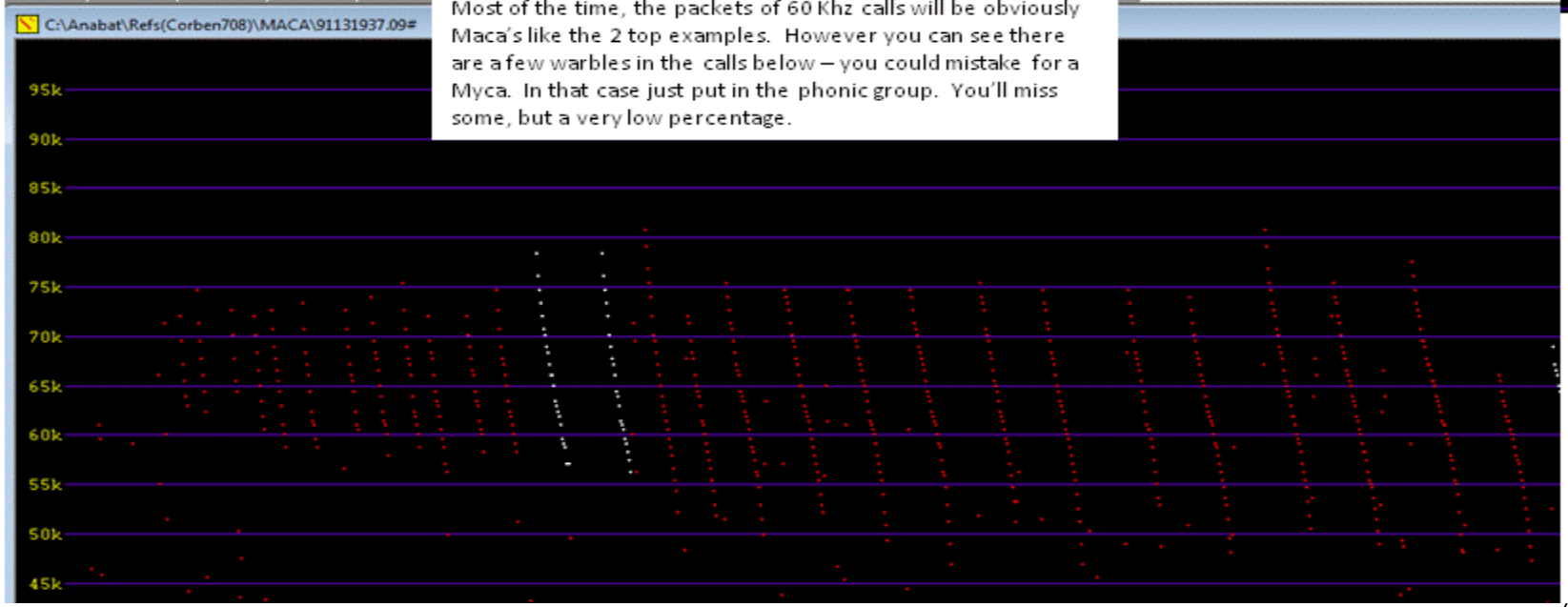
This Myca sequence has a packet of calls at 60 Khz & they're short enough to qualify as a Maca, but you can eliminate from consideration because calls are wavy, have little angles.

Actually here the calls at end of sequence are over 30 khz long – that'd disqualify it from being a Maca.





Most of the time, the packets of 60 Khz calls will be obviously Maca's like the 2 top examples. However you can see there are a few warbles in the calls below – you could mistake for a Myca. In that case just put in the phonic group. You'll miss some, but a very low percentage.



Summary – Identification Guidelines for Maca

- Minimum frequency ≥ 55 kHz
- Call length from 55 to 75 or 80 kHz (total length 20 to 25 kHz)
- Calls smooth and straight – no warbles, waviness, angles, bends or feet
- Calls quite vertical (very little back angle)

For the LCR, all relatively straight, vertical, non curved or cupped calls not fitting these criteria, but falling within the 45 – 55 kHz zone will be placed in the phonic group "45-55 kHz". These guidelines will result in greatly reducing misidentification of Myca's & Myyu's as Maca's the majority of the time. There will be a small percentage of Maca's that will be missed and placed in the 45-55 kHz phonic group.

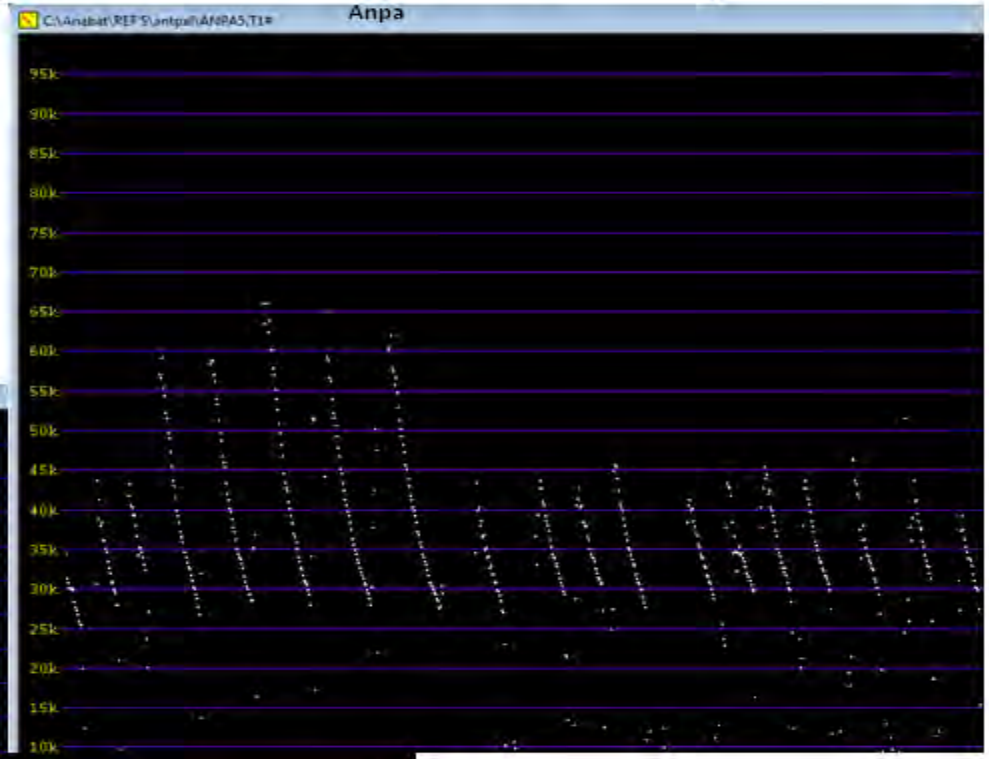
Appendix 4 — Pale Townsend's Big-eared Bat Call Guide

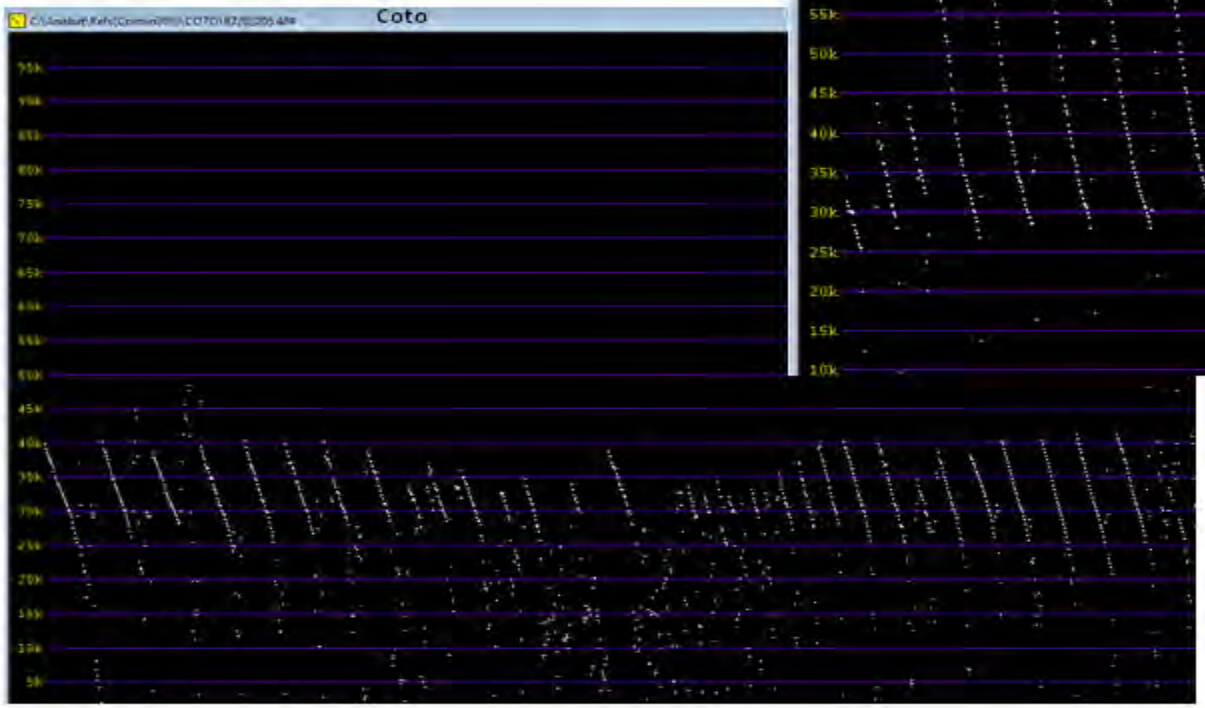
Coto Guide
How to Distinguish from Overlapping Anpa & Coto Calls

Can be overlap between Coto and Anpa on long, straight calls

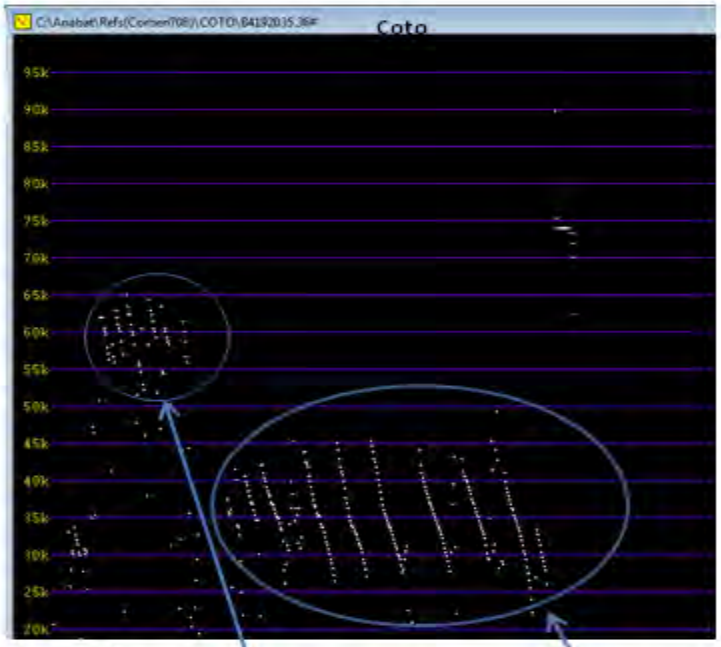
Coto harmonics often do not show up – just has what appears to be a regular series of calls. Very difficult to tell apart from Anpa.

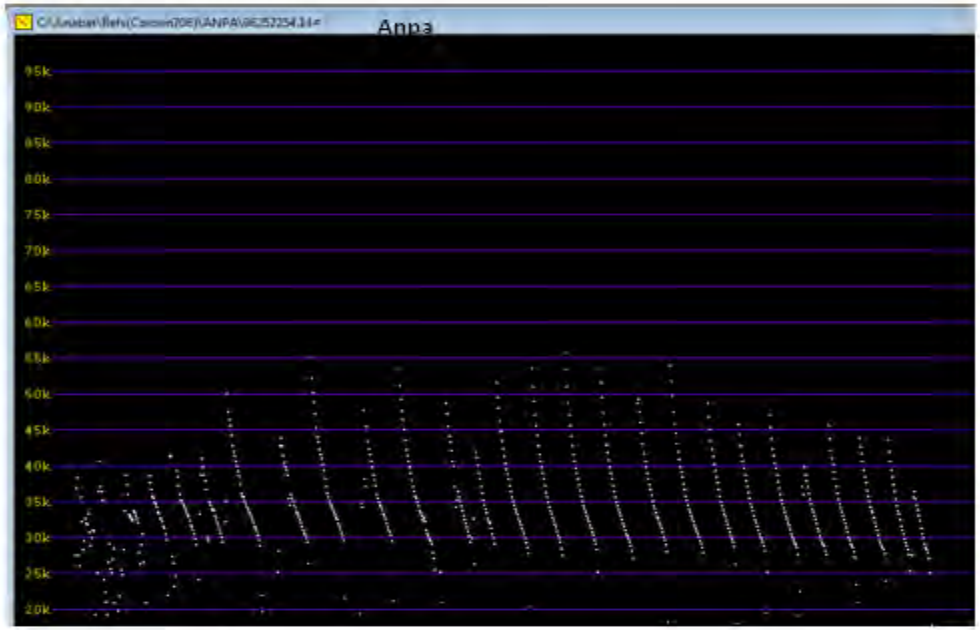
Solution – put into the 25-30 Khz phonic group.





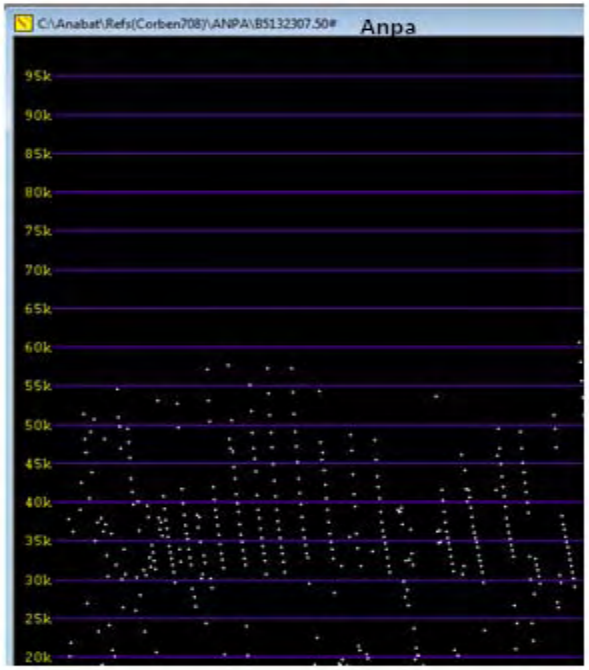
Overlapping calls of Coto & Anpa.

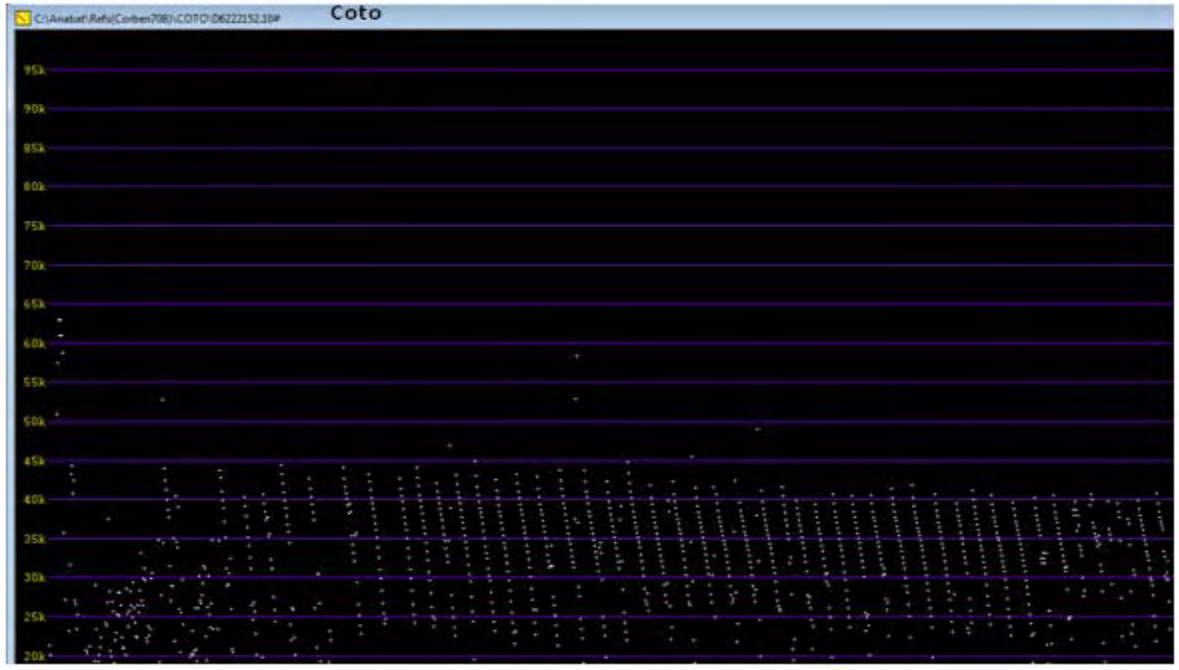




These calls of the Coto and Anpa are nearly identical. Often the Coto harmonic won't show up – you'll just see this. Cannot reliably tell apart from Anpa. Solution – put in 25-30 Khz Phonic Group.

Tightly spaced, straight calls – overlap between Anpa and Coto:



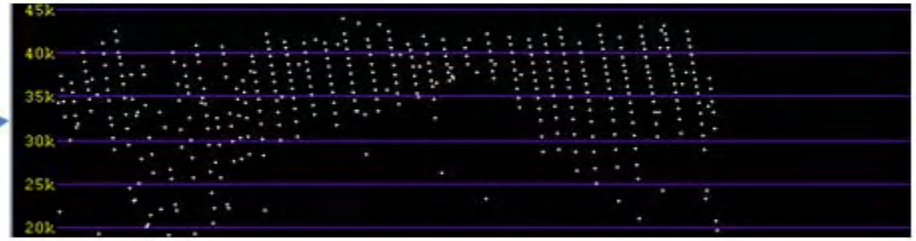


Can get overlapping packets of tightly spaced straight calls.

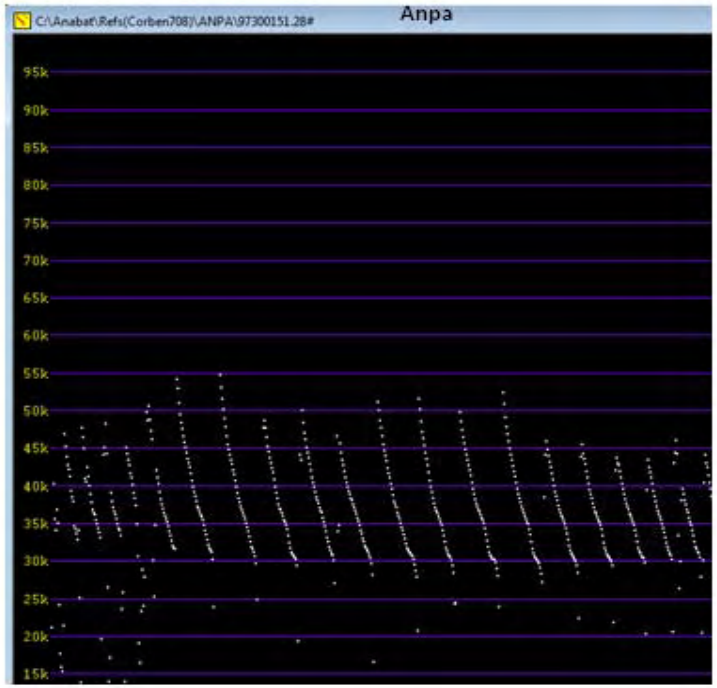
Sometimes only one harmonic appears.

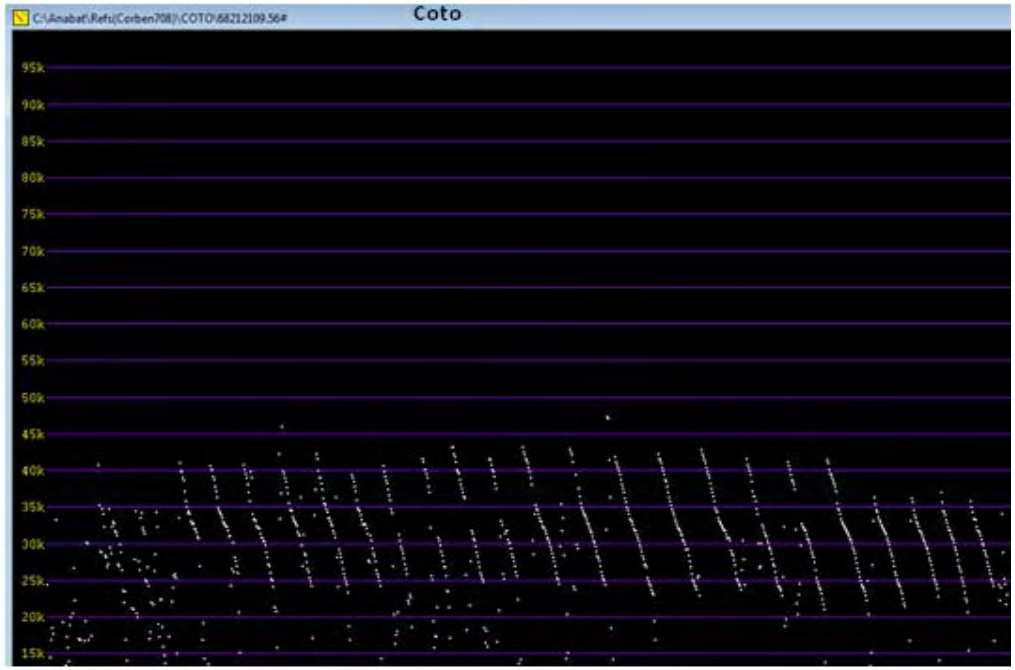
Solution: Put in 25-30 Khz phonic group.

Coto

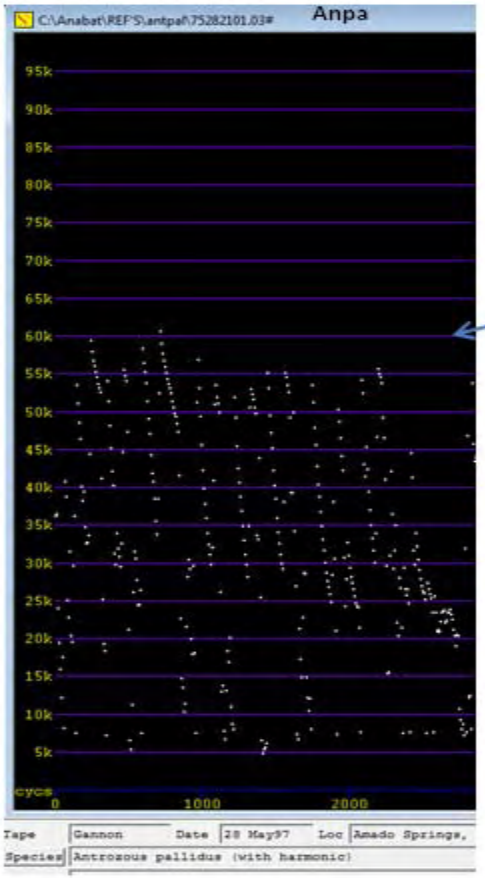


Both Anpa and Coto can have wavy calls – can't reliably separate the two based on this.

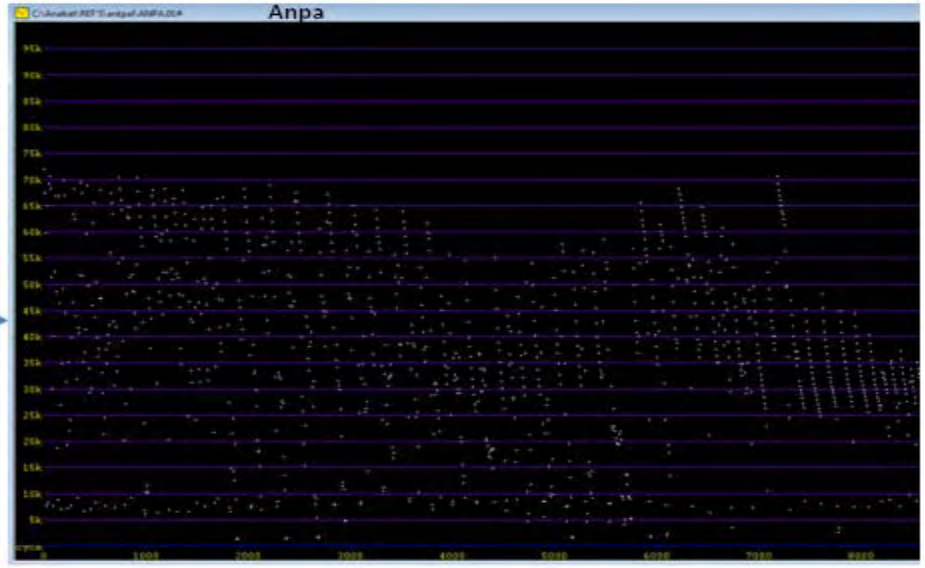


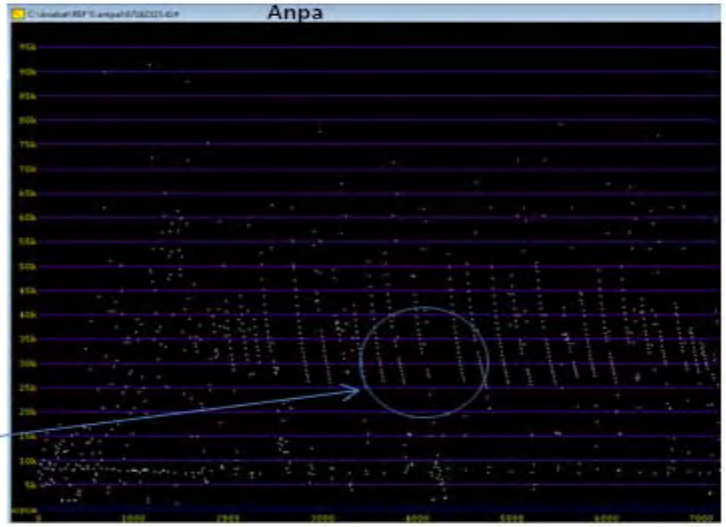


Also you can easily confuse broken calls with harmonics – in this case looks more like habitat interference than atrue harmonic.

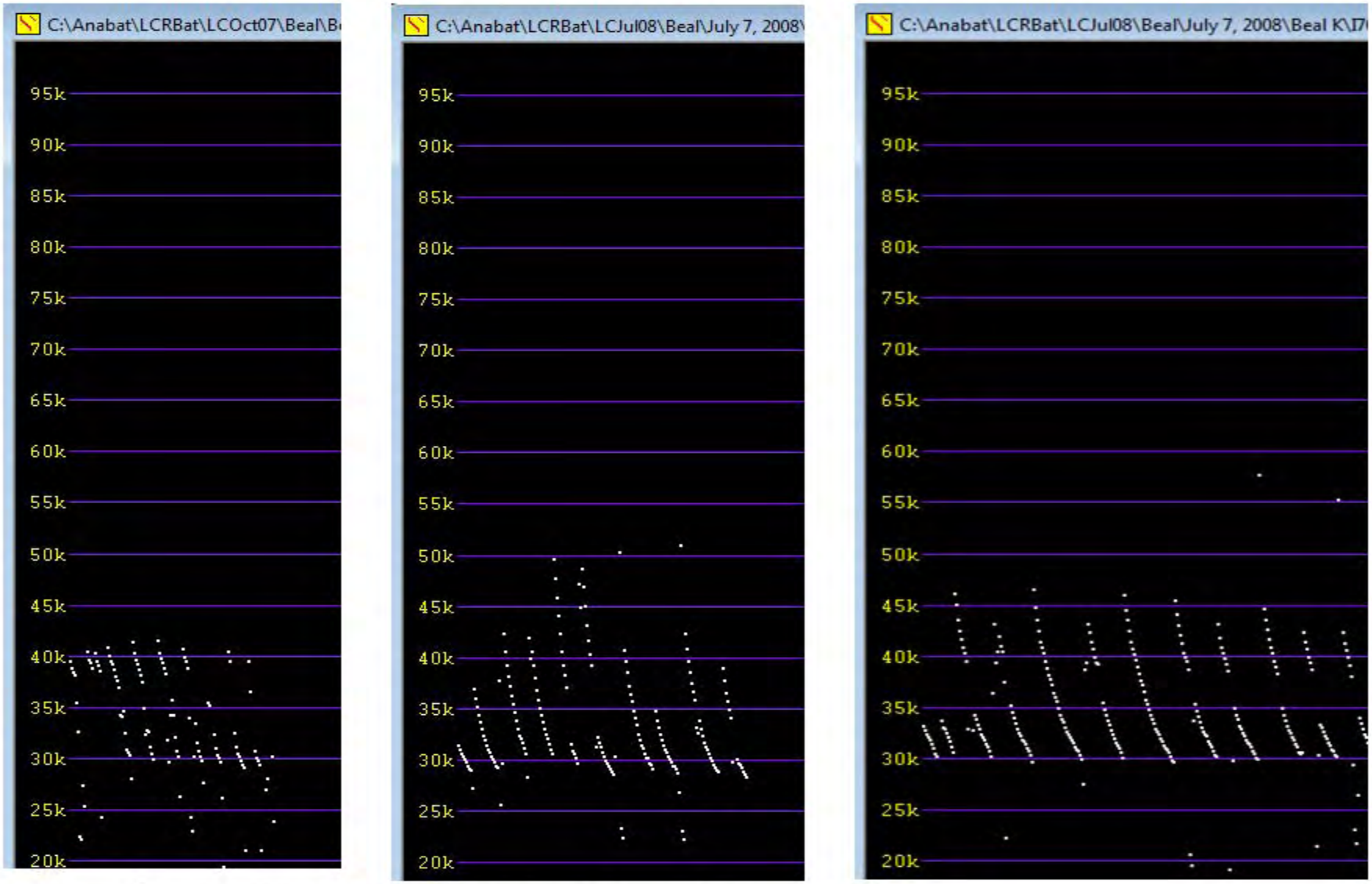


Beware: Anpa's can have harmonics as in these two cases:

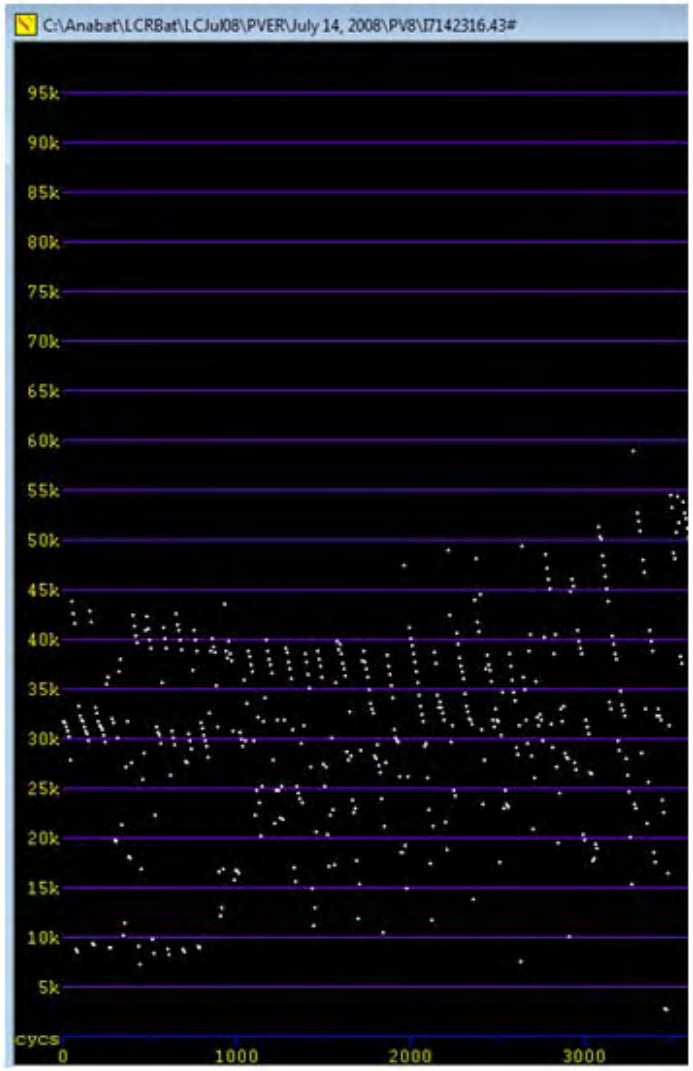


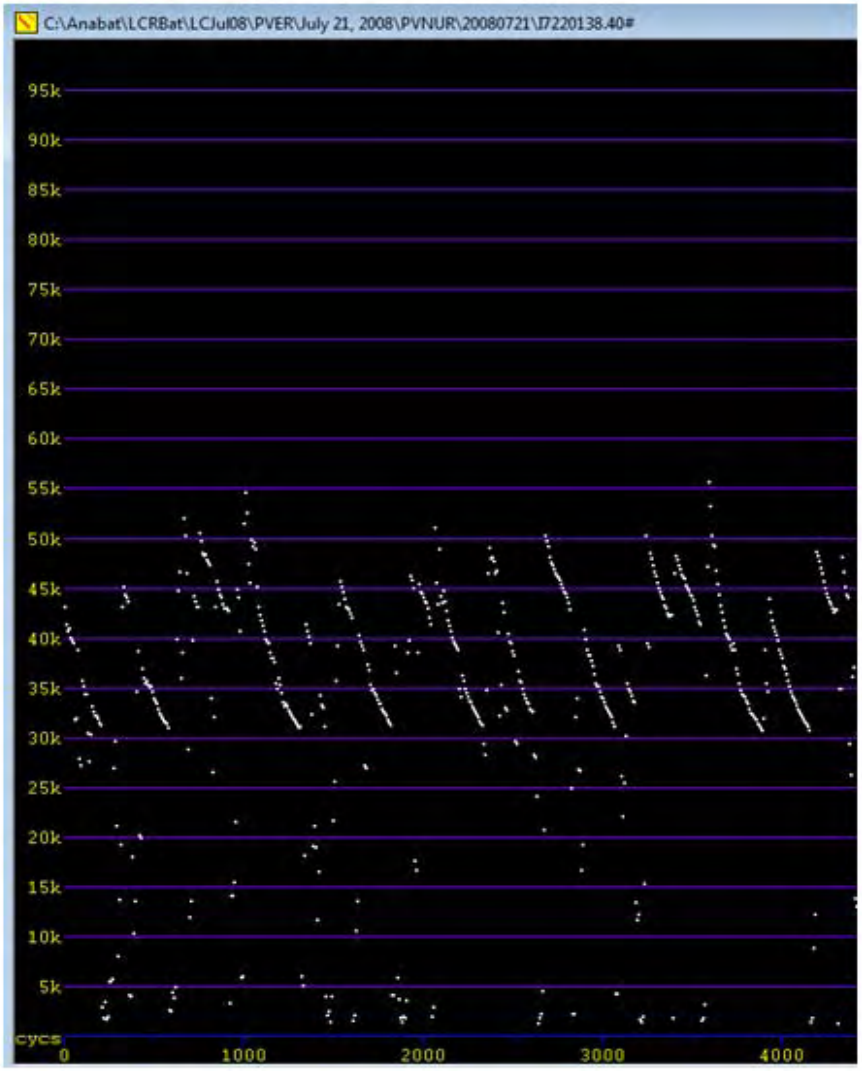


Depending on the location of the detector, you can get broken calls due to poor reception (distance, wind, vegetation) that can be confused with harmonics:



These are not Coto harmonics – they're broken calls (also may be Anpa harmonics). Don't confuse! These are NOT Coto's.

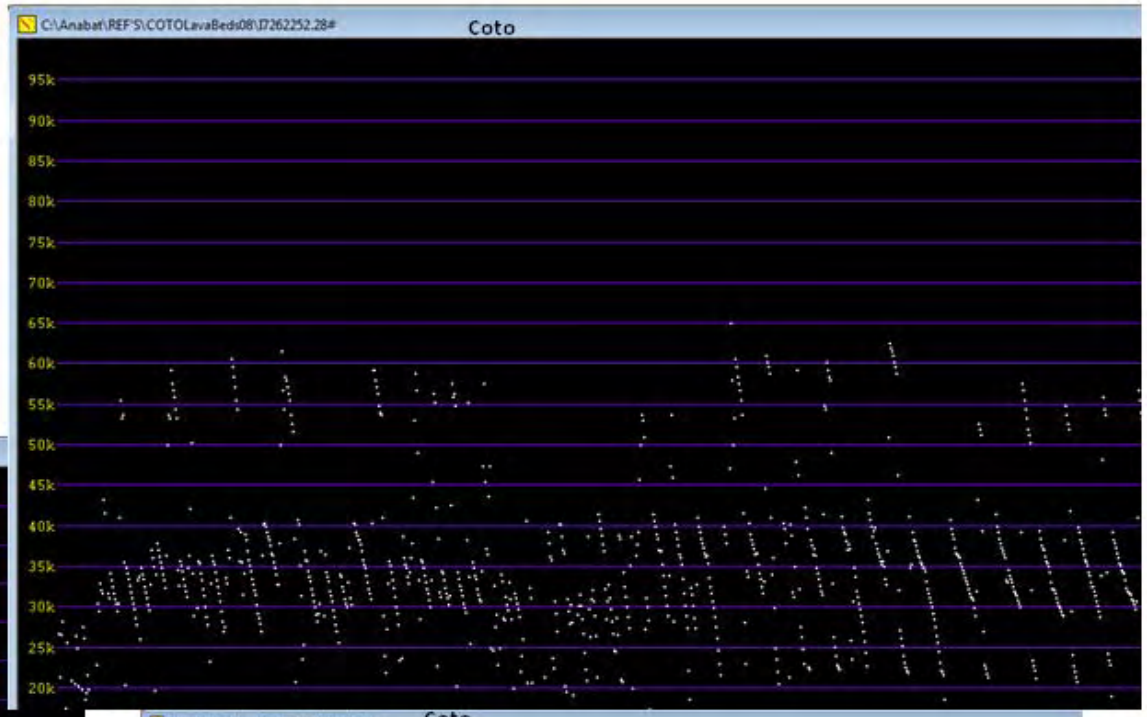


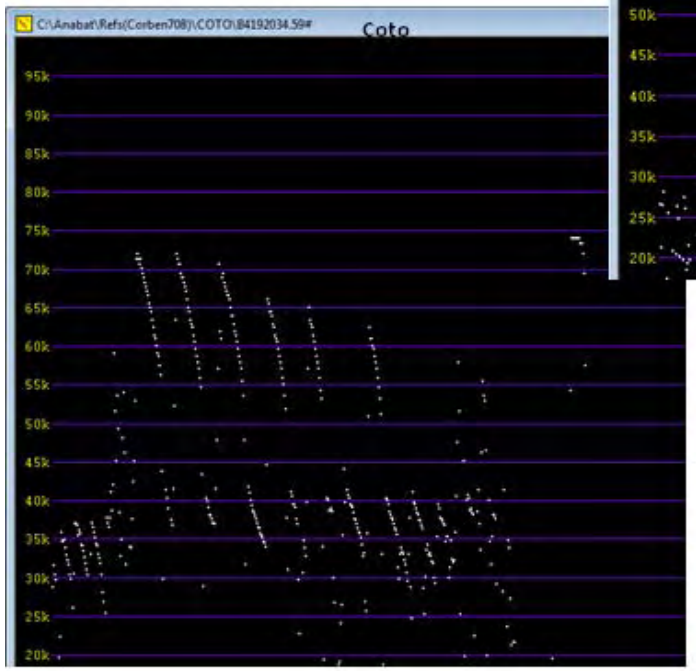


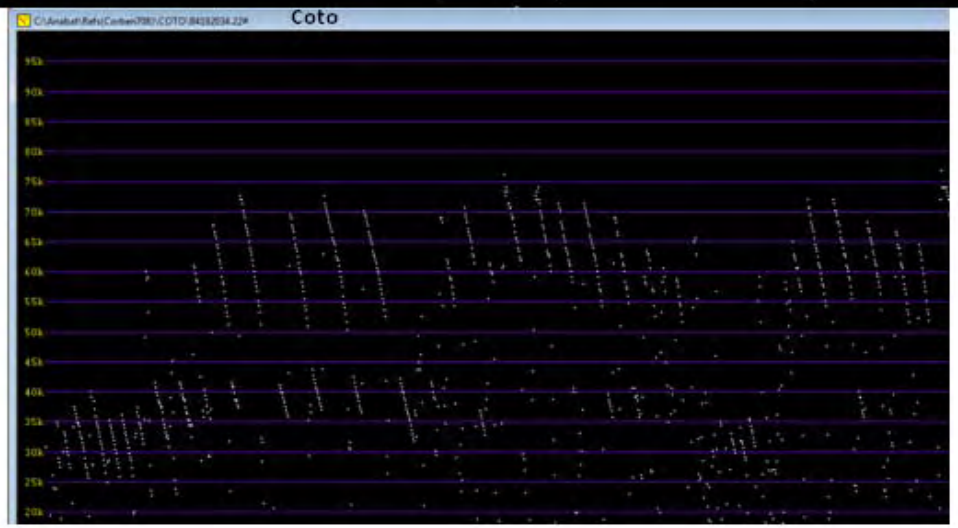
These are not quintessential Coto calls. They may have harmonics, but whose is not clear. Put in 25-30 Khz Phonic Group.

Summary: The only time a call sequence should be positively labeled a Coto is when at least two harmonics are clearly visible. All other questionable calls should be placed in the 25-30 Khz species group.

Harmonic series should be approximately 30-40khz and 50-75kh.







Appendix 5 — Data Sheets for Quarterly Bat Monitoring

Beal Lake Habitat Restoration Post Development Bat Monitoring FY 2008 Sample 1																					
Location	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxa	Maca	Myca	Myve	Myyu	Nyfe	Pahe	Tabr	Site Total	Status
October 2007																					
K	4	9			13	4		2			1		0			2		19	2	56	b
BB																				0	c
C	2	24		1	35								0				3	41		106	b
FF	3	4			5	1							0	0			2	35		50	b
PUMP	2	18		4	95	1	0	1				1	0		1	1		51	13	188	
SAC		4	1		30			2			2		0	1			1	23		64	b
TOPOC	8	27		3	163			5					8			11	4	110	1	340	
MAPS	1	9		1	161				1	2			1				2	95		273	
BEALLK	5	40			32								0				1	54		132	
Species Subtot	25	135	1	9	534	6	0	10	1	2	3	1	9	1	1	14	13	428	16	1209	
February 2008																					
K																				0	b
BB																				0	b
C																				0	b
D					1															1	b
FF					1															1	b
CONNE																				0	b
CONNW																				0	b
CONSE					2															2	b
CONSW																	1			1	b
BEALLK		2			2								0							4	b
TOPOC2		1			12								0							13	b
Species Subtot	0	3	0	0	18	0	0	0	0	0	0	0	0	0	0	0	1	0	0	22	
April 2008																					
A	4	14											0	13			2	8		41	b
BB	3	8			8				1		1		0				1	9		31	b
C	1	5			17		0						0					3		26	b
FF	1	10			9								0				2	5	2	29	b
K	2	3			15								0		1			6		27	b
N	5	6		1	4	1	0											4		21	b
PUMP																				0	a
CONNE	7	9			9								0				2	10		37	b
CONNW	3	2			6								0		1			5		17	b
CONSW	5	8	1		10								0				1	20		45	b
Species Subtota	31	65	1	1	78	1	0	0	1	0	1	0	0	13	2	0	8	70	2	274	
July 2008																					
A		18	2	1	91	2							0		8		1	142		265	
BB		27	8	1	25	8	0						2		14	1		60		146	
C																				0	c
FF		30		3	44	2	0	3		1		1	0		5			112		201	
K		24			39	11	0	1			1		0		13	0		104		193	
N		10	1		30	1		2					1		5			98		148	
CONNE		21	1		36	1	0		1	0			2		8	1		82		153	
CONNW	1	4			10	1		2					0		3			65		86	
CONSW		34	1		14			1					0		2			49		101	
PUMP		95	2	3	132	2						1	2		9			168		414	
Species Subtot	1	263	15	8	421	28	0	9	1	1	1	2	7	0	67	2	1	880	0	1707	
Grand Total	57	466	17	18	1051	35	0	19	3	3	5	3	16	14	70	16	23	1378	18	3212	

Table 1. Quarterly summary of bat minutes recorded simultaneously in 9 monitoring sites and 2 exploratory sites at Beal Lake Habitat Restoration Area, first sample.

Status Codes:	
a = Detector not deployed	e = minor data loss due to insect noise
b = No calls or few calls - detector functioning properly	f = significant data loss due to insect noise
c = Detector malfunction	g = total data loss due to insect noise
d = Partial night	No code = detector functioning properly

Beal Lake Habitat Restoration Post Development Bat Monitoring FY 2008 Sample 2																				
Location	**20Khz**	**25-30Khz**	**35Khz**	**40Khz**	**45-55Khz**	**Anpa**	**Coto**	**Epfu**	**Eupe**	**Labl**	**Laci**	**Laxa**	**Maca**	**Myca**	**Myve**	**Myyu**	**Nyfe**	**Pahe**	**Tabr**	**Site Total**	**Status**
October 2007																					
K		3			12		0							1				6		22	b
BB	1	1			10								0					15		27	b
C	1				37								0		1	1		16	2	58	b
FF	1	1			4											1		20		27	b
PUMP		1		1	46					1					1	11		51	2	114	b
SAC		2			14													4		20	b
TOPOC	1	18		4	139								2		1			128		293	b
MAPS		7		1	79								0		2			46		135	b
BEALLK	5	8		1	54	1							2				1	59		131	b
Species Subtot	9	41	0	7	395	1	0	0	0	1	0	0	4	1	5	13	1	345	4	827	
February 2008																					
K																				0	b
BB																				0	b
C																				0	b
D																				0	b
FF		2																		2	b
CONNE																				0	b
CONNW																				0	b
CONSE																	1			1	b
CONSW																				0	b
BEALLK		1																		1	b
TOPOC2		9			8								1							18	b
Species Subtot	0	12	0	0	8	0	0	0	0	0	0	0	1	0	0	0	1	0	0	22	
April 2008																					
A	12	46		2	13	1							0					1		75	b
BB	6	32		1	11	1							0		1					52	b
C	5	28		1	35						1		0							70	b
FF	5	20			18	2									3			1		49	b
K	2	16			21							1	0					1		41	b
N	6	27		1	6	1							0					1		42	b
PUMP																				0	a
CONNE	7	39			15	2						1	0				1	1		66	b
CONNW	1	16		1	10								0					1		29	b
CONSW	9	29			9	1					1		0		1			2		52	b
Species Subtota	53	253	0	6	138	8	0	0	0	0	2	2	0	0	5	0	1	8	0	476	
July 2008																					
A		29	2	1	78	3	0	6					0		6			102		227	
BB		11			13	2	0								7			64		97	
C		56	18	2	74	5	0						0		5			64		224	
FF		55			49	4		9					0		10	2		114		243	
K		26		4	50	1	0						0		10			64		155	
N		19	1	1	33		0	2	1				0		4			71		132	e
CONNE		33	4	3	30	6	0	0					0		7		1	102		186	
CONNW		14	1	1	18	2		2					1		1			84		124	
CONSW		11		4	18	2							0		2			86		123	
PUMP		72		6	81	11	0	0					1		13			174		358	
Species Subtot	0	326	26	22	444	36	0	19	1	0	0	0	2	0	65	2	1	925	0	1869	
Grand Total	62	632	26	35	985	45	0	19	1	1	2	2	7	1	75	15	4	1278	4	3194	

Table 2. Quarterly summary of bat minutes recorded simultaneously in 9 monitoring and 2 exploratory sites at Beal Lake Habitat Restoration Area, second sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

COLORADO RIVER INDIAN TRIBE AHAKHAV PRESERVE FY 2008 SAMPLE 1																				
	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxn	Maca	Myca	Myve	Myyu	Nyfe	Pahe	Tabr	Site Total	Status
April 2008																					
AMCW	2	5	2	1	14	2	0	1		1			2				3			33	
BSM	1	2	1		11								1				10			26	b
CMCW	2	2			80	1							2				2			89	b
DHM		4			9				1				1				14	1		30	b
EHM	1	2			10				1			1	0				7			22	b
EMCW					6				1				0				6			13	b
FNYCW		3		1	8				1				0				10			23	b
FSYCW		4			5												14	1		24	b
GYCW		4			5								0				14	3		26	b
Species Subtotal	6	26	3	2	148	3	0	1	4	1	0	1	6	0	0	0	80	5	0	286	
July 2008																					
AMCW		57	113	14	42	27		5	4			18	0	6	103		10	36		435	
BSM		14	9	4	135	5	0	1	6			2	3		95		15	79		368	
CMCW	**3**	133	163	112	73	11	1		1			11	1		24		10	39		582	
DHM	3		3		25				8				5		10		2	17		73	b
EHM		6	7	2	91	7						2	3		68		1	19		206	
EMCW		7	3	15	13								1		46			5		90	b
FNYCW	1	35	80	18	78	8	0	3	40			1	2		32	1	57	103		459	
FSYCW	13	93	86	24	118	6		1	52			9	4		45		92	85	4	632	
GYCW	3	74	123	46	108	15	0	1	20		0	5	2		8		48	110	1	564	
Species Subtotal	23	419	587	235	683	79	1	11	131	0	0	48	21	6	431	1	235	493	5	3409	
Species Total	29	445	590	237	831	82	1	12	135	1	0	49	27	6	431	1	315	498	5	3695	

Table 3. Quarterly summary of bat minutes recorded simultaneously in 9 monitoring sites at the Ahakhav Preserve, first sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

COLORADO RIVER INDIAN TRIBE AHAKHAV PRESERVE FY2008 SAMPLE 2																				
	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxn	Maca	Myca	Myve	Myyu	Nyfe	Pahe	Tabr	Site Total	Status
April 2008																					
AMCW	1	10	1		11						1		0				7			31	
BSM	1	4			14				2				1				17	3		42	b
CMCW	1	12			16	2			1				0				4			36	b
DHM	2	7			3				3				0				20	1		36	b
EHM	4	9	1		6				1				0				12	2		35	b
EMCW	1	1			1												2			5	b
FNYCW		1			4												4			9	b
FSYCW	7	11			15								0				15			48	b
GYCW	3	5			21	2			2				0				13			46	b
Species Su	20	60	2	0	91	4	0	0	9	0	1	0	1	0	0	0	94	6	0	288	
July 2008																					
AMCW		50	140	58	35	1			2			9	0		14		5	12		326	
BSM	**3**	12	40	57	107	1			7	1		3	3		13		12	71		330	
CMCW	**7**	120	152	172	56	3			3			2	0		22		5	37		579	
DHM		9	8	4	12												1	26		60	b
EHM		3	34	21	82	2			2				3		2		2	26		177	b
EMCW		1	5	78	16								0				2	3		105	b
FNYCW	5	44	82	62	111	2	0	2	22		0		1		15		48	80		474	b
FSYCW	31	70	101	45	173			2	15			5	2		2		73	87	1	607	b
GYCW	13	94	158	71	91	9	0		8				0		16		40	97		597	b
Species Su	59	403	720	568	683	18	0	4	59	1	0	19	9	0	84	0	188	439	1	3255	b
Species To	79	463	722	568	774	22	0	4	68	1	1	19	10	0	84	0	282	445	1	3543	

Table 4. Quarterly summary of bat minutes recorded simultaneously in 9 sites at the Ahakhav Preserve, second sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Palo Verde Ecological Reserve Post Development Bat Monitoring Sample Period 1																				
October 2	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxa	Maca	Myca	Myve	Myyu	Nyfe	Pahe	Tabr	Site Total	Status
PV2NW																					a
PV2SE		8	2		68					1			1				12	49		141	
PVNUR		2	2		9			2					0					34	1	50	e
PVRIV	19	58	10	1	351				2	2	1	6	4				134	59		647	a
Species Su	19	68	14	1	428	0	0	2	2	3	1	6	5	0	0	0	146	142	1	838	
February 2008																					
PV2NW																				0	b
PV2SE																				0	b
PV3																				0	b
PVNUR2																				0	b
Species Su	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
April 2008																					
PV2NW	1	1												3				50		55	b
PV2SE	4	1			24			1					0	3			1	72	1	107	
PVNUR					1								1	7				45	3	57	b
7	8	8			45	1							1				3	93	2	161	
8	11	4			60								1	3			3	119	0	201	
9																					
SCM	12	3			8								1				3	85		112	
SCN	4	1			17				1				0	3			1	91	2	120	
SCS	3	6			4				1					5	1			72	5	97	
Species Su	43	24	0	0	159	1	0	1	2	0	0	0	4	24	1	0	11	627	13	910	
July 2008																					
PV2NW		2	2		3								1					47		55	f
PV2SE		89	2	6	28	1							0		2			63		191	
PVNUR2		187	2	6	49	9			1				0		9		1	110		374	
7	5	49	2	13	75	8	0	1	2		1		0		1		1	127		285	
8	7	30		13	153	1	0	2	1			2	6		4		5	176		400	
9	5	34	1	6	21						1	1			4		7	118		198	
SCM	7	38	15	16	24	9	0		2				0				2	42		155	
SCN	5	65	11	8	106	7			3			2	1		8		8	118		342	
SCS	13	238	10	27	101								0				5	49		443	
Species Su	42	732	45	95	560	35	0	3	9	0	2	5	8	0	28	0	29	850	0	2443	
Species To	104	824	59	96	1147	36	0	6	13	3	3	11	17	24	29	0	186	1619	14	4191	

Table 5. Quarterly summary of bat minutes recorded simultaneously at 9 monitoring sites and 1 exploratory site at PVER, first sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Palo Verde Ecological Reserve Post Development Bat Monitoring Sample Period 2																				
October 2	**20Khz**	**25-30Khz**	**35Khz**	**40Khz**	**45-55Khz**	**Anpa**	**Coto**	**Epfu**	**Eupe**	**Labl**	**Laci**	**Laxa**	**Maca**	**Myca**	**Myve**	**Myyu**	**Nyfe**	**Pahe**	**Tabr**	**Site Total**	**Status**
PV2NW	11	3			42	3			2		2		0		1		28	44		136	
PV2SE	4	7			51								0				22	27		111	
PVNUR					4								0				1	10		15	e
PVRIV	3	20			120				3				2				55	40		243	
Species Su	18	30	0	0	217	3	0	0	5	0	2	0	2	0	1	0	106	121	0	505	
February 2008																					
PV2NW																				0	b
PV2SE																				0	b
PV3																				0	b
PVNUR2																				0	b
Species Su	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
April 2008																					
PV2NW					6	1			1								5	16		29	e
PV2SE																					c
PVNUR																					c
7		6	1		5		0	2	1					4			4	21		44	
8																					c
9																					c
SCM					9	4		4	1								5	21		44	
SCN																					c
SCS	1	8	1	1	23		0	1					1				2	13		51	b
Species Su	1	14	2	1	43	5	0	7	3	0	0	0	1	4	0	0	16	71	0	168	
July 2008																					
PV2NW		4	1		5													8		18	f
PV2SE	3	42	3	6	30				5				0		3		4	50		146	f
PVNUR2		30	1	10	41		0						0		3			41		126	e
7	5	18	2	13	102	2	0	0	3		0	1	1		14		4	117		282	
8	1	41	3	27	169	4	0		2			1	7		18		22	175		470	
9	18	34	2	9	56				1				0		3		15	148		286	
SCM	18	62	5	8	28	2			8						8		35	102		276	e
SCN	9	24	4	14	51	1			5			1	2		7		74	111		303	
SCS	20	244	15	38	48	32	0	3	13			3	0		19		28	143		606	
Species Su	74	499	36	125	530	41	0	3	37	0	0	6	10	0	75	0	182	895	0	2513	
Species To	93	543	38	126	790	49	0	10	45	0	2	6	13	4	76	0	304	1087	0	3186	

Table 6. Quarterly summary of bat minutes recorded simultaneously at 9 monitoring sites and 1 exploratory site at PVER, second sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Cibola Valley Conservation Area Post Development Bat Monitoring FY 2007 Sample 1																				
	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxn	Maca	Myca	Myve	Myyu	Nyfe	Pahe	Tabr	Site Total	Status
October 2007																					
Bac		8			2								0							10	b
C3F4	2	9			15	2		1	2		1		0				3	10		45	b
A																				0	c
D	1	9	1		44	2	0		1				2					4		64	b
Wat1	2	19	1		21	1	0				2		0				7	37		90	b
Species Su	5	45	2	0	82	5	0			0		0	2	0			10			209	
February 2008																					
Bac																				0	b
C3F4																				0	b
4																				0	b
A		1																		1	b
D																				0	b
Wat1																				0	b
Species Su	0	1	0	0	0	0	0			0		0	0	0			0			0	b
April 2008																					
C3F4					2															2	b
3Mesq																				0	b
4			1		19								1							21	b
A																				0	b
D					5															5	b
Wat1					6															6	b
Wat2		1		1	1															3	b
Species Su	0	1	1	1	33	0	0			0		0	1	0			0			37	
July 2008																					
3F4		4		1	37								2		3			4		51	e
3Mesq		113	6	2	111		0	2					8					36		278	
4																				0	c
A		9																1		10	f
D		71	5	2	25															103	
Wat1		66	1	1	34	3		3					0					27		135	e
Wat2	1	64	1	3	27	3		3				3	0				1	37		143	
Species Su	1	327	13	9	234	6	0	8	0	0	0	3	10	0	3	0	1	105	0	720	
Species To	6	374	16	10	349	11	0			0		3	13	0			11			966	

Table 7. Quarterly summary of bat minutes recorded simultaneously at 7 monitoring sites at CVCA, first sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Cibola Valley Conservation Area Post Development Bat Monitoring FY 2007 Sample 2																				
	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxn	Maca	Myca	Myve	Myyu	Nyfe	Pahe	Tabr	Site Total	Status
October 2007																					
Bac		10			7	1					1						4	2		25	f
3F4																				0	c
A	6	20	7		17	13	0		24		2		1				3	8		101	
D		8	1		27				2				1					2		41	b
Wat1																				0	c
Species Subtotal																					
February 2008																					
Bac																				0	b
3F4																				0	b
4																				0	b
A																				0	b
D																				0	b
Wat1																				0	b
Species Su	0	0	0	0	0	0	0			0		0	0	0			0			0	b
April 2008																					
3F4		7			7															14	b
3Mesq	3	2				14											1	1		21	b
4		3			20								0					1		24	b
A		3			10								0					2		15	b
D	3	1			15	1							0					5		25	b
Wat1		1			3	2												8		14	b
Wat2		2			5															7	b
Species Su	6	19	0	0	56	17	0			0		0	5	0			1			113	
July 2008																					
3F4		27	2	3	61								0					6		99	f
3Mesq		114	1		79	9	0				1		2					85		291	
4		50	1		51			4					1		3			52		162	
A																				0	g
D		29	3		18								0							50	f
Wat1		70			29			7										60	1	167	
Wat2		13			16	1		1										43		74	
Species Su	0	300	7	3	241	10	6	12	0	0	2	0	17	0	3	0	0	246	1	843	
Species To	6	319	7	3	297	27	6	12	0	0	2	0	22	0	3	0	1	246	1	1686	

Table 8. Quarterly summary of bat minutes recorded simultaneously in 7 monitoring sites at CVCA, second sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Cibola NWR Conservation Unit #1 Post Development Bat Monitoring FY 2008 Sample 1																				
	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxn	Maca	Myca	Myve	Myyu	Nyfe	Pahe	Tabr	Site Total	Status
October 2007																					
Atriplex	**1**	34	2	1	34	4		1	3				2				2	43	1	128	
Cmass	0	1	0	0	18	0	0			0		0	4	0		0	1	19		43	b
NatTrl	0	0	0	0	11	0	0			0		0	0	0	2	0			0	13	b
February 2008																					
Atriplex																				0	b
CMASS																				0	b
NatTrl																				0	b
																				0	
April 2008																					
1F6		1			6								1							8	b
AG	**1**		1		9								1				1	1		14	b
CW1		7			78								10					7		102	
CW3		1			9	1							2				1			14	b
Mesq2	**1**				3	1							1							6	b
July 2008																				0	
1F6		2	5		72								3					1		83	b
Ag		33	1		274			6					25		1			39		379	
CW1		144	33	1	175								17					1		371	
CW3	0	14			18		0			0		0	2	0	0	0		12	0	46	e
Mesq2	0	25	24	3	33	0	0			0		0	0	0	0	0			0	85	b
Species Total	3	262	66	5	740	6	0	7	3	0	0	0	68	0	3	0	5	123	1	1292	

Table 9. Quarterly summary of bat minutes recorded simultaneously in 5 monitoring sites and 2 exploratory sites, first sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Cibola NWR Conservation Unit #1 Post Development Bat Monitoring FY 2008 Sample 2																
	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxn	Maca	Myca	Myve	Myyu
October 2007																
Atriplex																
Cmass	2	2			30	2		2				0	2			
NatTrl		1			60							0	7			
February 2008																
Atriplex																
CMASS																
NatTrl																
April 2008																
1F6	**2**				7								2			
AG	**5**	8	1		15	2	0									
CW1			1		64								10			
CW3		1			9	1							2			
Mesq2	**1**				3	1							1			
July 2008																
1F6		18	3		143								3			
Ag		32			204	2		7	1	1			9			
CW1		31	29	41	245								0			
CW3		46	11	2	35								0			
Mesq2																
Species Totals	10	139	45	43	815	8	0	9	1	1	0	0	36	0	0	0

Table 10. Quarterly summary of bat minutes recorded simultaneously in 5 monitoring sites and 2 exploratory sites at Cibola NWR Unit #1, second sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Imperial Ponds Conservation Area Post Development Bat Monitoring Sample 1																					
	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxa	Maca	Myca	Myve	Myyu	Nyfe	Nyma	Pahe	Tabr	Site Totals	Status
October 2007																						
F18	4	11			49								0		1		2		58		125	
IMPEN1	1	4			12						1		0						9		27	
NurEdge	2	8		1	193	0							7				8		62	2	283	
Pond1																						a
Pond5	5	83			491					1			13			1	5		80		679	
McA	6	4			31				2								54		50		147	
McAWash																						a
RIV	1	1		2	3								1				8		30		46	
February 2008																						
1	4	11			23								1				2				41	b
15	2	3			2								0				1		1		9	b
16	1	4			24								3				4				36	b
17	1	2			3								0				1				7	b
18	2	1			1								0				1				5	b
24		2			3								0				4		1		10	b
MART	5	18			27								1				9				60	b
NUREDGE	1	12			26								0				1		3		43	b
NURINT	1				5								0				1				7	b
POND1	17	19			3												13		1		53	b
POND5	2	9			9			1					1				5				27	b
RIV	1	8			10								0				4				23	b
DOCK		20			9								0				5		1		35	b
April 2008																						
1	1	5			115						1		0						45		167	
18																						a
24	2	6			34								0				2		38		82	b
29	1	6			57	1			2				2				2		53		124	
NURINT	3	4	1		84								5						51		148	
DOCK		1			109								0				2		42		154	
SCN	2	2			75								0				1		50		130	
POND1	1	5			233	1							2				3		61		306	
July 2008																						
1	3	21		1	80			3	6				0				4		66	2	186	
18		62			216	5		11					3				1		59	3	360	
24																					0	c
29	1	52	27	2	50	2	0		1				1				5	1	34		176	
NURINT		18	2	1	118	1			1				6				2		6		155	
DOCK		23	1		42			2					3				3		64	1	139	
SCN		28			50			1	1				0						42		122	
POND1		34			61	1		7	4							1	3		113	3	227	

Table 11. Quarterly summary of bat minutes recorded simultaneously in 8 monitoring sites and 8 exploratory sites at Imperial Ponds, first sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Imperial Ponds Conservation Area Post Development Bat Monitoring Sample 2																					
	20Khz	25-30Khz	35Khz	40Khz	45-55Khz	Anpa	Coto	Epfu	Eupe	Labl	Laci	Laxa	Maca	Myca	Myve	Myyu	Nyfe	Nyma	Pahe	Tabr	Site Totals	Status
October 2007																						
F18	5	15	1		58	1							0			2			32		114	
IMPEN1		2			138						0		7						5		152	
NurEdge	2	13		1	481	1							5				2		71		576	
Pond1	1	2			200						1		2			2	8		31	4	251	
Pond5																					0	a
McA	1	1			91								1		1		4		23		122	
McAWash		1	1		161								8				1		21		193	
RIV	2		1		150								3				1		10		167	
February 2008																						
1	3	37			74								1				4		5		124	b
15		9			2												3		2		16	b
16	2	11			37								3				2				55	b
17		6			6								0				3		2		17	b
18	1	18			8								0				1		2		30	b
24	5	7			3								0				1		7		23	b
MART	7	59			50	2		3				1	9				14		14		159	b
NUREDGE		17	1		61								3						5		87	
NURINT	2	6			6														1		15	
POND1	11	39			17	1							1				8		7		84	
POND5	7	30			27								0				7		4		75	
DOCK	2	20			3								0				3		2		30	
																					0	b
April 2008																						
1		19	1	2	456	1				1			40						123		643	
18		17			188	5							1						98		309	
24		3			112	1							1						91		208	
29		4		1	189		0						12						96		302	
NURINT		8			237								11				2		101		359	
DOCK		5			237	1							4						87		334	
SCN																					0	c
POND1	1	13			407	2							13						113		549	
July 2008																						
1		13	1		104			1				1	1						131	2	254	
18		27	1		276			2	1				7	2		1			97		414	
24		19	1		147	5	0	8	6				1	2					154	1	344	
29	1	112	102	9	109	18	0		1			1	5				3		59	6	426	
NURINT		27	1	1	165	4							4	4		1			7	1	215	
DOCK		27	1		112	8	0	3	2				4	5					120		282	
SCN		29			135	2	0	8	1				1						97	3	276	
POND1		45			79			6					0	2			2		102	2	238	

Table 12. Quarterly summary of bat minutes recorded simultaneously in 8 monitoring sites and 8 exploratory sites at Imperial Ponds, second sample.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly

Pratt Restoration Post Development Bat Monitoring FY 2008 Sample 1																		
October 2007	**20Khz**	**25-30Khz**	**35Khz**	**40Khz**	**45-55Khz**	**Anpa**	**Coto**	**Epfu**	**Eupe**	**Labl**	**Laci**	**Laxa**	**Maca**	**Myyu**	**Nyfe**	**Pahe**	**Tabr**	**Site Total**	**Status**
EDGE		2	1		11								0			10		24	b
INT		1			14										1	1		17	b
Species Subto	0	3	1	0	25	0	0	0	0	0	0	0	0		1	11	0	41	
February 2008																			
EDGE				Not sampled in February 2008															a
INT																			a
Species Subto	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		
April 2008																			
AG		3			18	1							0		1	16		39	b
E	2	12	2		18	8	0								1	12		55	b
SC	2	7			20				1							12		42	b
Species Subto	4	22	2	0	56	9	0	0	1	0	0	0	0		2	40	0	136	
July 2008																			
AG		14		1	195	2				1			0			74	0	287	
E		60	4	1	129	6							3			80		283	
SC	14	25	1	1	74			2	4			1	0		3	89		214	
Species Subto	14	99	5	3	398	8	0	2	4	1	0	1	3		3	243	0	784	
Species Total	18	124	8	3	479	17	0	2	5	1	0	1	3	0	6	294	0	961	

Pratt Restoration Post Development Bat Monitoring FY 2008 Sample 2																		
October 2007	**20Khz**	**25-30Khz**	**35Khz**	**40Khz**	**45-55Khz**	**Anpa**	**Coto**	**Epfu**	**Eupe**	**Labl**	**Laci**	**Laxa**	**Maca**	**Myyu**	**Nyfe**	**Pahe**	**Tabr**	**Site Total**	**Status**
EDGE		2	3		33								2			15		55	
INT					1													1	d
Species Subto	0	2	3	0	34	0	0	0	0	0	0	0	2	0	0	15	0	56	
February 2008																			
EDGE				Not sampled in February 2008															a
INT																			a
Species Subto	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
April 2008																			
AG		25			46	3		4					0	12		68	1	159	
E		34	1		27	3	0				1					36		102	
SC		15			36				2						1	45		99	
Species Subto	0	74	1	0	109	6	0	4	2	0	1	0	0	12	1	149	1	360	
July 2008																			
AG	**4**	33			289	1			11				9		9	88		444	
E	**5**	36	5	4	139	1			1		0		1			58	1	251	
SC	7	2	2		66	1			8				1		16	23		126	
Species Subto	16	71	7	4	494	3	0	0	20	0	0	0	11	0	25	169	1	821	
Species Total	16	147	11	4	637	9	0	4	22	0	1	0	13	12	26	333	2	1237	

Table 13. Quarterly summary of bat minutes recorded simultaneously at Pratt Restoration, Sample 1 and Sample 2.

Status Codes:

a = Detector not deployed
b = No calls or few calls - detector functioning properly
c = Detector malfunction
d = Partial night
e = minor data loss due to insect noise
f = significant data loss due to insect noise
g = total data loss due to insect noise
No code = detector functioning properly