New Art's Commerce and Science College

Ahmednagar

Department of statistics (2020-21)

Project On

DBT STAR SCHEME

"Study Of Bats Distribution In The Collage Campus"

Performed By,

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◈ Introduction :

Bats are mammals of the order Chiroptera , making them the only mammals naturally capable of true and sustained flight. Bats are the second largest order of mammals (after the rodents), with about 1,240 species of bats worldwide. About 70% of bat species are insectivores. They provide valuable pest management service to our cities and natural areas through the predation of night time flying insects, including adult mosquitoes.

Most of the rest are fruit eaters: some bats are important pollinators and make it possible for us to harvest certain fruits and flowers. A few species feed on animals other than insects, such as the vampire bats that feed on blood. Arizona has an amazing diversity of bats with at least 28 species representing four families. They can be found statewide, in all habitats including: desert, grassland, woodland, and urban habitats.

The smallest bat, Western pipistrelle , also known as the canyon bat, measures only 2.5 inches long; while the largest bat, Western mastiff (Eumops perotis californicus), is up to 7.5 inches long. As the human population in Arizona increases, so does the wildland/urban interface.

This leads to increased human encounters with wild bats. This document provides a general overview of bat biology and behavior with emphasis on urban environments, use of integrated pest management (IPM) techniques that are in keeping with bat conservation guidelines, and disease awareness and prevention efforts.

◈ Biology and Behavior of Bats :-

➢ Echolocation :

Bats are not blind. In fact they can see almost as well as humans. However, most bats use “echolocation” to help them find prey, shelter, etc., during their night time activities . Echolocation involves emitting a sound and listening to the echo of that sound as it “bounces” off objects.

This ultrasonic ability helps bats interpret the distance, size, speed, and even texture of an object. Echolocation is particularly useful to bats for locating small, flying insect prey at night, such as moths and gnats.

- **Nectivorous :**

bats feed on pollen and nectar. As they move from one plant to the next they provide valuable pollination services (similar to bees). Two of the three species of nectivorous bats in the United States are found in Arizona: the lesser long-nosed bat, Leptonycteris curasoae yerbabuenae (an endangered species), and the Mexican long-tongued bat, Choeronycteris mexicana. These bats give birth and raise their young in southern Arizona from early spring through summer. In the fall, they migrate south to overwinter in Mexico.

They feed on pollen and nectar, and are critical to the pollination of columnar cacti (saguaro, organ pipe) and agaves. In Mexico they also feed on the fruit of these plants, ultimately aiding seed dispersal by transporting seeds in their feces. Biologists calculate that the pollination of agaves and various cacti would drop approximately 97% without our nectivorous bats. Their diet is supplemented by the many hummingbird feeders in southern Arizona that are “robbed” each night by these hungry bats.

◈Life Cycle :-

There is a great variation in the mating and rearing behaviors of bats. Most bats mate during the fallwinter of 2006-2007, WNS has spread from the northeastern to the central United States at an alarming rate. Millions of bats in 25 U.S. states and 5 Canadian provinces have died from this devastating disease.

WNS causes bats to awaken more often during hibernation and use up the stored fat reserves that are needed to get them through the winter. Infected bats often emerge too soon from hibernation and are often seen flying around during winter. These bats usually freeze or starve to death.

Symptoms of WNS can include a visible white fungal growth on the bat's muzzle and/or wing tissue (Figure 2), but this is not a completely reliable indicator. In the eastern U.S., infected bats may display abnormal behaviors in their hibernation sites (hibernacula), such as movement toward the mouth of caves and daytime flights during winter.

These abnormal behaviors may contribute to the untimely consumption of stored fat reserves causing emaciation, a characteristic documented in a portion of the bats that die from WNS. Western bats behave differently and may not exhibit the same behaviors.

WNS has not been found in Arizona yet, but could exist in the deeper cooler caves in higher elevations in the state. Report suspected WNS observations to the Arizona Game and Fish Department, the U.S. Fish and Wildlife Service or the USGS National Wildlife Health Center.

With fertilization of the egg delayed until the spring. Bats are the only mammals inwhich delayed fertilization occurs. Alternatively, a few speciesof bats wait until spring to mate. Beginning in April, many bats form maternity colonies consisting of adult females and their offspring - in the warmer, lower elevations of Arizona maternity colonies have been reported as sometimes starting as early as March. In some cases, maternity colonies also include non-reproducing yearling females who participate in the rearing duties. These colonies can be quite large, depending on the particular species of bat. Maternity colonies

◈ Evening Inspections :-

- Begin inspection at dusk and continue after dark. Note bat activity overhead, bats that appear to enter or exit the building, and any exploitable openings that can be seen with a flashlight .
- Be alert for activity underneath building tiles or roofing sheets.

- Wear gloves and use a flashlight to thoroughly inspect the interior of a potential roost for bat activity.
- Areas under porches, eaves, and other unenclosed locations are often temporary night roosts – adopted while digesting or resting – and do not necessarily indicate an infestation in the building. These bats will move on.
- There are ways to discourage night roosting bats – when they appear seasonally, it is typically short term, but night roosting can also be a longer-term issue that homeowners want addressed.
- Mylar strips, creating a false ceiling with netting, or turning a fan on to create airflow, are a few ways to discourage bats from areas.

Figure : **Bats rely on echolocation to reveal the position of objects, including prey. Image by Shung**

Most bats hear and vocalize at frequencies well beyond that of humans. While we hear sounds ranging from 15 Hz to 20,000 Hz, bat calls range from 9,000 Hz to 200,000 Hz. Ultrasonic equipment can be used to convert the higher frequency vocalizations emitted by bats to within range of our hearing abilities.

To hear an example of this, Most species of bats also have an acute sense of smell, which is helpful for species that rear their young in large maternity colonies. These mothers rely on olfactory and spatial cues to help zero in on their baby amidst millions of other young bats.

◈ Sample collection :-

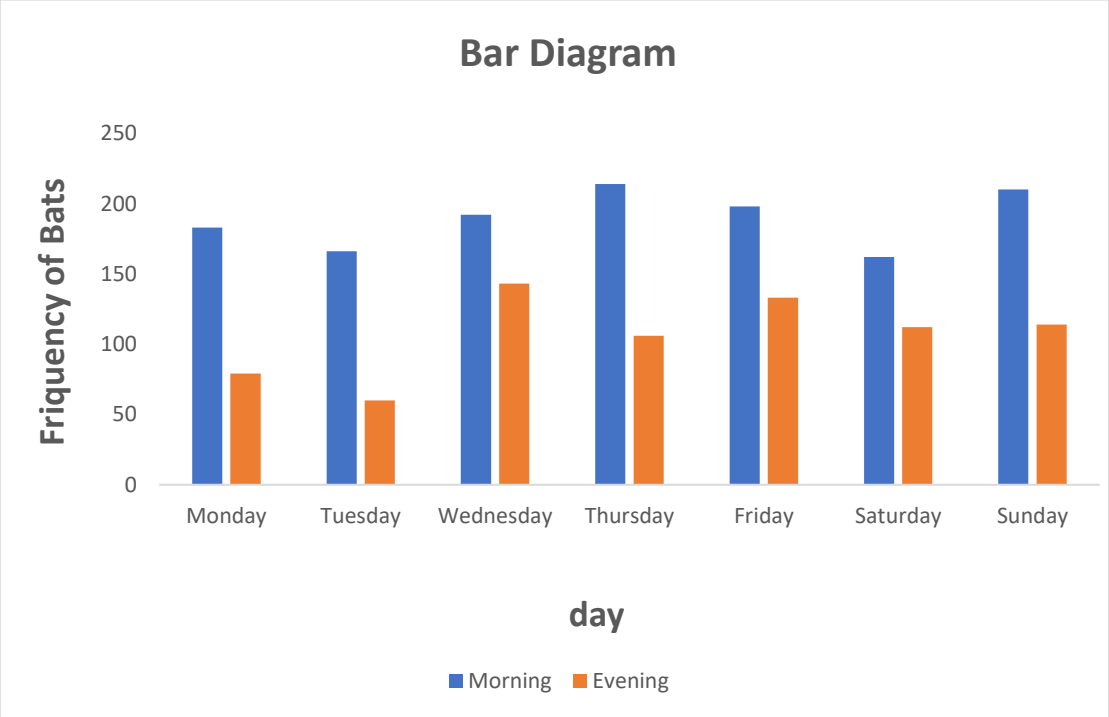
We Take a photograph of bats randomly.
Then we count Bats on photograph and prepare a observation table for Bats .

Morning Pics :

◈ Observation Table :-

Obs.No	Day	Morning	Evening
1	Monday	183	79
2	Tuesday	166	60
3	Wednesday	192	143
4	Thursday	214	106
5	Friday	198	133
6	Saturday	162	112
7	Sunday	210	114
Total	**-**	**1325**	**747**
Average	**-**	**189**	**107**

◈ Graphical Representation :-



◈ Calculation :-

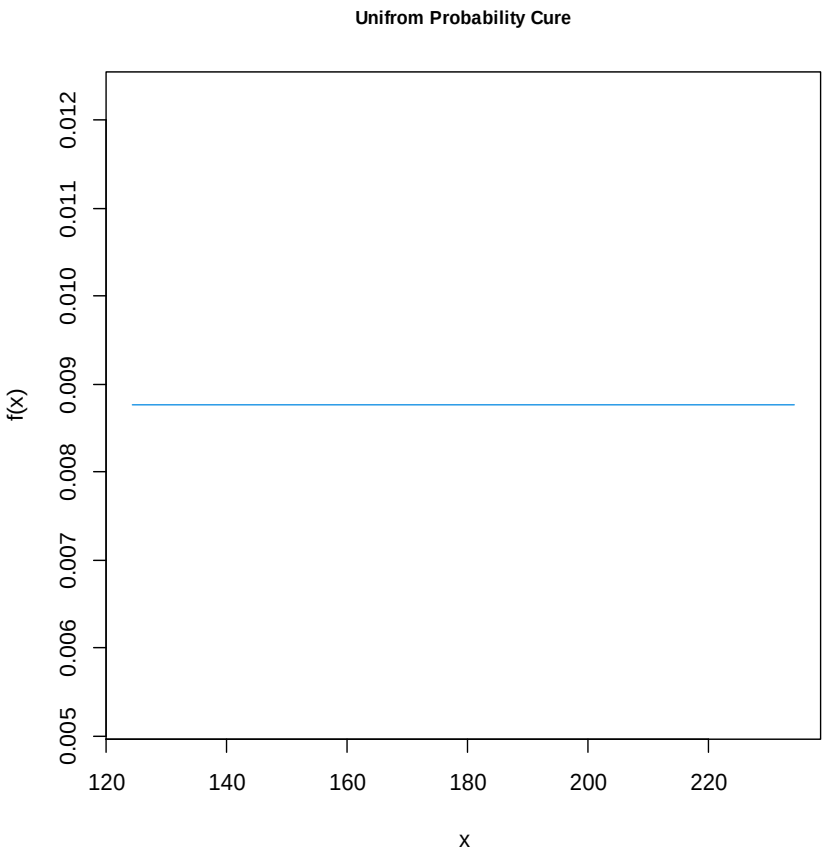
※ Fitting of Uniform Distribution :- Morning Count of Bats

```
Morning=c(183,166,192,214,198,162,210);Morning
[1] 183 111 192 214 198 162 210
> n=length(Morning);sn
[1] 7
> mean(Morning)
[1] 189.4286
> (n-1)*var(Morning)/n
[1] 1086.245

a=124.3433
b=238.5139

x=seq(a,b,10);x
 [1] 124.3433 134.3433 144.3433 154.3433 164.3433 174.3433 184.3433
194.3433
 [9] 204.3433 214.3433 224.3433 234.3433
> pr=dunif(x,a,b);pr
 [1] 0.008758822 0.008758822 0.008758822 0.008758822 0.008758822
0.008758822
 [7] 0.008758822 0.008758822 0.008758822 0.008758822 0.008758822
0.008758822
> s=c("a=124.3433","b=238.5139");s
[1] "a=124.3433" "b=238.5139"
> plot(x,pr,"l",col=4,main="Unifrom Probability
Cure",ylab="f(x)",xlab="x",cex.main=0.8)
```

◈ uniform Probability Curve :- Morning



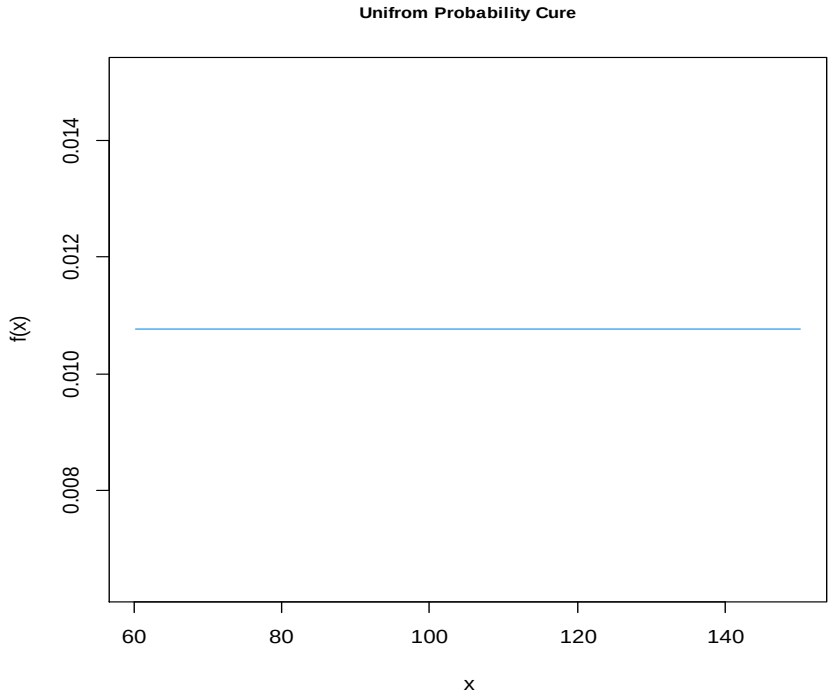
※ Fitting of Uniform Distribution :- Evening Count of Bats

```
Evening=c(79,60,143,106,133,112,114);Evening
[1]  79  60 143 106 133 112 114
> n=length(Evening);n
[1] 7
> mean(Evening)
[1] 106.7143
> (n-1)*var(Evening)/n
[1] 719.9184
```

a=60.2412
b=153.1874

```
x=seq(a,b,10);x
 [1]  60.2412  70.2412  80.2412  90.2412 100.2412 110.2412 120.2412
130.2412
 [9] 140.2412 150.2412
> pr=dunif(x,a,b);pr
 [1] 0.01075891 0.01075891 0.01075891 0.01075891 0.01075891
0.01075891
 [7] 0.01075891 0.01075891 0.01075891 0.01075891
> s=c("a=124.3433","b=238.5139");s
[1] "a=124.3433" "b=238.5139"
> plot(x,pr,"l",col=4,main="Unifrom Probability
Cure",ylab="f(x)",xlab="x",cex.main=0.8)
```

◈ uniform Probability Curve :- Evening



◈ Chi-Square Goodness of Fit Test :-

Chi-Square goodness of fit test is a non-parametric test that is used to find out how the observed value of a given phenomena is significantly different from the expected value.

In Chi-Square goodness of fit test, the term goodness of fit is used to compare the observed sample distribution with the expected probability distribution.

Chi-Square goodness of fit test determines how well theoretical distribution (such as normal, binomial, or Poisson) fits the empirical distribution.

In Chi-Square goodness of fit test, sample data is divided into intervals. Then the numbers of points that fall into the interval are compared, with the expected numbers of points in each interval.

◈ Procedure for Chi-Square Goodness of Fit Test :- For Morning count of Bats

Null hypothesis H_0 : In Chi-Square goodness of fit test, the null hypothesis assumes that there is no significant difference between the observed and the expected value.

Alternative hypothesis H_1 : In Chi-Square goodness of fit test, the alternative hypothesis assumes that there is a significant difference between the observed and the expected value

◈ Test Statistic :-

$$\chi^2 = \frac{(O - E)^2}{E}$$

◈ Degrees Of Freedom :-

Df = k – 1 Where k is the number of days

Df = 6

◈ Table Value :-

χ^2_6 **= 12.59**

◈ Observation table :-

Observe Frequency (O)	Expected Freqvency €	(O – E)	$(O - E)^2$	$\frac{(O - E)^2}{E}$
183	191.43	-8.43	71.06	0.37
166	191.43	-25.43	646.68	3.38
192	191.43	0.57	0.32	0.00
214	191.43	22.57	509.40	2.66
198	191.43	6.57	43.16	0.23
162	191.43	-29.43	866.12	4.52
210	191.43	18.57	344.84	1.80

◈ Test Statistic :-

$$\chi^2 = \frac{(O - E)^2}{E}$$

$$\chi^2 = 12.96$$

◈ Decision Rule :-

Here $\chi^2 = 12.96 > \chi^2_6 = 12.59$ we reject at 5% LOS.

◈ Conclusion :-

On the basis of sample data we can conclude that there is a significant difference between the observed and the expected value. Given distribution is Good fit for data.

◈ Chi-Square test of Goodness of Fit Test :- For evening count of Bats

Null hypothesis H_0 : In Chi-Square goodness of fit test, the null hypothesis assumes that there is no significant difference between the observed and the expected value.

Alternative hypothesis H_1 : In Chi-Square goodness of fit test, the alternative hypothesis assumes that there is a significant difference between the observed and the expected value

◈ Degrees Of Freedom :-

Df = k – 1 Where k is the number of days

Df = 6

◈ Table Value :-

χ^2_6 = 12.59

◈ Observation Table :-

Observe Value	Expected Value	(O – E)	$(O - E)^2$	$\frac{(O - E)^2}{E}$
79.00	106.71	-27.71	768.08	7.20
60.00	106.71	-46.71	2182.23	20.45
143.00	106.71	36.29	1316.65	12.34
106.00	106.71	-0.71	0.51	0.00
133.00	106.71	26.29	690.94	6.47
112.00	106.71	5.29	27.94	0.26
114.00	106.71	7.29	53.08	0.50

◈ Test Statistic :-

$$\chi^2 = \frac{(O - E)^2}{E}$$

$\chi^2 =$ **47.22**

◈ Decision Rule :-

Here $\chi^2 = 47.22 > \chi^2_6 = 12.59$ we reject at 5% LOS.

◈ Conclusion :-

On the basis of sample data we can conclude that there is a significant difference between the observed and the expected value. Given distribution is Good fit for data.