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COVID-19 Effect on Birds: A statically survey

Arukshata Thakur
Department of Zoology, Bhawani Niketan (P.G.) College, Jaipur, Rajasthan, INDIA
E-mail: aruksh2@gmail.com
Yashwant Singh
Department of Mathematics, Government College, Kaladera, Jaipur, Rajasthan, INDIA
E-mail: dryashu23@yahoo.in

Abstract

In this paper, the authors have studied about the effect of COVID-19 on the population of birds. For this survey the authors selected a premises (small land area) where they found birds in plenty and they started to keep watching on their numbers since January 2020 onwards. The authors have applied the method of least squares to find the trend line series and try to reach a conclusion when the position of their numbers will become similar as Jan.2020. The authors have also described the fall and rise (or changes) the number of birds counting by line graph. An index number between time and number of birds are also given in the last.

Key words: COVID-19, Time Series, Least Square Method, Link Relatives, Chain Index, Index Numbers.

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1. Introduction

In this pandemic days, many authors, agencies, NGO's, Industries have studied on the effect of COVID-19 on human beings, and we have seen a disaster on human community. The second wave was/is more powerful and harmful than first wave and third wave is almost ready to come. Thinking about the effect of third wave our soul starts to shiver badly.

The authors were eager to know about the effect of COVID-19 on birds and animals. So they had started to study on birds. They have chosen a small compound where they found birds in plenty and stated to keep eyes on them. They also kept counting of them time to time, and surprisingly they noticed a fall in their numbers. They also found a rapid fall in the time of second wave.

The authors have made a statistically study of their counting since January 2020. By fitting Least square method, they try to a conclusion if the condition remains not much changes (or almost same) the condition will become normal (or equivalent to Jan. 2020) between April 2023 to Jun 2023.

Index Numbers: An Index number is a 'relative number' which express the relationship between two variables or two groups of variables where one of the group is used as base.

Many authors like: Spiegel, Croxton and Cowden, Kaplass, Kafta etc., have defined Index numbers in their words according to its use. Index numbers can be constructed by two types one is fixed base method and second id chain index numbers. In the fixed base method the base remains the same and does not change whole throughout the series. But with the passage of time some may have been included in the series and other ones might have been deleted, and hence it becomes difficult to compare the result of present conditions with those of the old remote period. Hence the fixed base method does not suit when the conditions change. In such a case the changing base period may be more suitable. Under this method the figure for each year are first expressed as a percentage of the preceding year (called link relatives) then they are chained together by successive multiplication to form a chain index.

Steps in construction of chain index

(1) The figure are to be expressed as the percentage of the preceding year to get link relatives.

$$\text{Link relatives of current year} = \frac{price\ of\ current\ year}{price\ of\ previous\ year} \times 100 \qquad (1.1)$$

(2) Chain index is obtained by the formula:

$$\text{Chain index} = \frac{Current\ year\ link\ relative \times Previous\ year\ link\ relative}{100} \qquad (1.2)$$

Time series: Time series is statistical data that are arranged and presented in a chronological order of time.

According to Spigel, "A time series is a set of observation taken at specified times, usually at equal intervals".

According to Ya-Lun-Chou, "A time series may be defined as a collection of reading belonging to different time period of same economic variable or complex variables".

There are various forces that affect the values of a phenomenon in a time series: these may be broadly divided into the following four categories, commonly known as the components of a time series.

1. Long term movement of Secular Trend

2. Seasonal variations

3. Cyclical variations

4. Random or irregular variations.

Method of Least Squares

The method of least squares can be used to find the trend line of best fit to a time series data.

The regression trend line (Y) is defined by the following equation:

$$Y = a + bX \quad (1.3)$$

Where Y= predicted value of the dependent variable

a= Y axis intercept or the height of the line above origin (i.e. when X=0, Y=a)

b= slope of the regression line (it gives the rate of change in Y for a given change in X) (When b is positive the slope is upwards, when b is negative, the slope is downwards)

X= independent variable (which is time in this case).

To estimate the constants a and b, the following two equations have to be solved simultaneously:

$$\sum Y = na + b\sum X \quad (1.4)$$

$$\sum XY = a\sum X + b\sum X^2 \quad (1.5)$$

To simplify the calculations, if the midpoint of the time is taken as origin, then the negative values in the first half of the series balance out the positive values in the second half so that $\sum X = 0$. In this case the above two normal equations will be as follows:

$$\sum Y = na \quad (1.6)$$

$$\sum XY = b\sum X^2 \quad (1.7)$$

In such a case the values of a and b can be calculated as under:

$$a = \frac{\sum Y}{n} \quad (1.8)$$

since $\sum XY = b\sum X^2$

$$b = \frac{\sum XY}{\sum X^2} \quad (1.9)$$

2. Main Study

In this section, the authors have made a study of calculation the number of birds starting since January 2020 and try to present a fall and rise of number of birds through a fitting of a straight line trend of the following data by Least square method and estimate the time (month and year) when the number of birds become nearly equal to number as they were in January 2020.

Months	1 (Jan20)	2 (April20)	3 (July 20)	4 (Oct. 20)	5 (Jan 21)	6 (April21)	7 (July 21)	8 (Oct.21)
Number of birds	53	37	28	22	15	05	08	13

Now, we make a table of calculation of trend line as follows:

Months	Number of birds (Y)	Deviations from 4.5	Deviations multiplied by 2 (X)	X^2	XY
1 (Jan. 20)	53	-3.5	-7	49	-371
2 (April 20)	37	-2.5	-5	25	-185
3 (July 20)	28	-1.5	-3	9	-84
4 (Oct. 20)	22	-0.5	-1	1	-22
5 (Jan.21)	15	0.5	1	1	15
6 (April 21)	05	1.5	3	9	15
7 (July 21)	08	2.5	5	25	40
8 (Oct 21)	13	3.5	7	49	91
	$\sum Y = 181$		$\sum X = 0$	$\sum X^2 = 168$	$\sum XY = -501$

Here N=8

Now by using (1.8) and (1.9), we get the values of a and b.

$a = \frac{\sum Y}{N} = \frac{181}{8} = 22.625 \cong 23$ $\qquad$ $b = \frac{\sum XY}{\sum X^2} = \frac{-501}{168} = -2.98 \cong -3$

Equation of the straight line trend is:

$$Y_c = a + bX$$

Now we want the month (or year) where the number of birds are same as Jan.20 i.e. 53. For this in above equation we put Y_c=53, a=23 and b=-3

53=23-3X for this we get X=-10 or 10 (numerically), because the deviation is 4.5 so if we take origin is Oct.2020 and after that we go up to 10, we get

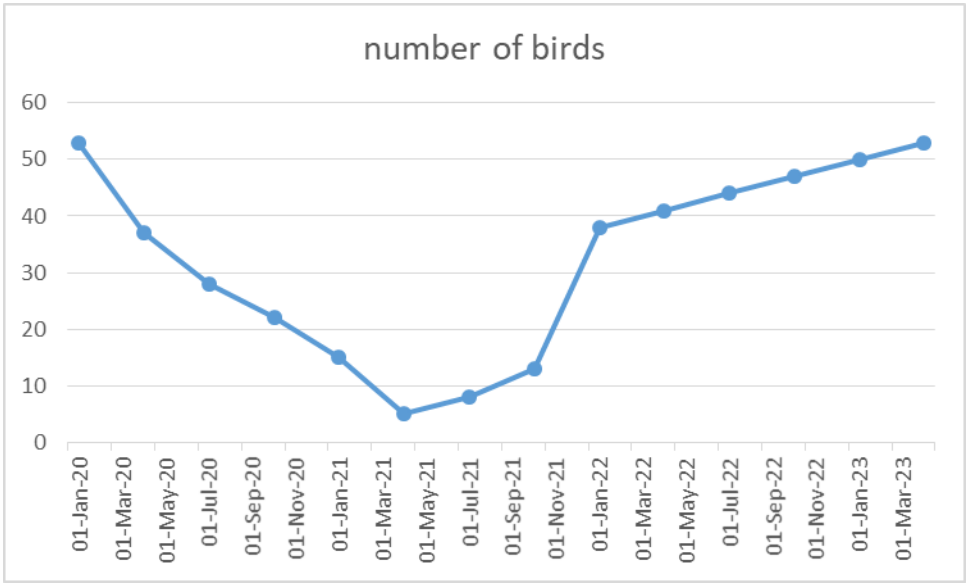
X=1 is Jan21, X=2 is April 21, X=3 is July 21, X=4 is Oct. 21, X=5 is Jan 22, X=6 is April 22, X=7 is July 22, X=8 is Oct. 22, X=9 is Jan 23, X=10 is April 23.

It means After April 23 to July 23 we can hope the situation of birds numbers are almost same. It means we can assume that the earlier position as Jan.20 will arise after April or July 23.

Now, if we take X=-5, we get Y_c=37.5$\cong$ 38, for X=-6, we get Y_c=41, for X=-7, we get Y_c=43.46$\cong$ 44

for X=-8, we get Y_c=46.44$\cong$ 47, X=-9, we get Y_c=49.42$\cong$ 50.

Now, we show the changes of numbers by drawing line graph as:



Now we construct an Index number of above find result which express a relationship between time (in months) and Number of birds.

Construction of Index number taking Jan.20 as base

Months	Number of birds	Index No. (Jan. 20 =100)
Jan.20	53	100
April 20	37	$\frac{37}{53}$x100=69.81
July 20	28	$\frac{28}{53}$x100=52.83
Oct.20	22	$\frac{22}{53}$x100=41.51
Jan.21	15	$\frac{15}{53}$x100=28.30
April 21	5	$\frac{5}{53}$x100=9.43
July 21	8	$\frac{8}{53}$x100=15.09
Oct.21	13	$\frac{13}{53}$x100=24.53
Jan 22	38	$\frac{38}{53}$x100=71.70
April. 22	41	$\frac{41}{53}$x100=77.35
July 22	44	$\frac{44}{53}$x100=83.01
Oct. 22	47	$\frac{47}{53}$x100=88.67
Jan 23	50	$\frac{50}{53}$x100=94.33
April 23	53	$\frac{53}{53}$x100=100

This means that from Jan.2020 to April 2021 the population of birds decrease after that it will start to increase and after April 23 to July 23 it will become similar as Jan.2020.

Note: The authors feel this calculation exist similar if the conditions do not change much. It means there does not exist much variation in conditions exist now.

Conclusion

The authors believe that their survey is very meaningful and it indicates that any circumstances or conditions or situations: good or bad, affects both humans and birds (or animals and other species) equally. It also indicates that our prosperities are proportional. If one suffers other also and simultaneously we can work to save both humans and birds (or animals).

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