Applied Survival Function and Stochastic Process for perturbations patients of Kurdistan Region of Iraq (2015–2017)

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Abstract

The objectives for this study is carry out with stochastic model and survival function; we did small disturbances and use the simulation to study its impact on a few of the population. Although, a small worried introduced in the stochastic and survival function model to a long lived stable population in a region or parameter space where the stochastic and survival model predicts of the population. we apply this model on fertility rates, survival rates, and population base for a particular type, data was collected from population statistics and Rizgari Hospital in Erbil for perturbation patients (Secondary data) between 2015 and 2017, and again we can use model of population growth rate. The scientific researches in the environment study, find it useful to determine if the species can survive when it is introduced into a new surroundings. In addition, it can also be used as the model to determine if the population of a particular type will increase or decrease over a certain period of time, and the stochastic model is easily simulated with Monte Carlo techniques. While, the Easyfit and SPSS programs used for practical part for this study. This consequence is understood fro considering a related model with density function depended on the sex ratio which showing features.

Keywords: Survival function, Stochastic Processes, Leslie Model, and Perturbation analysis Sensitivity and Elasticity.

1-1 Introduction

The variable age is one of the factors important for this study and effected on this disease, while this structure is an established tool for the analysis of population dynamics. On the whole, it is usually assumed that the populations are sufficiently large that births and deaths can be treated as continuous time variables. These equations are determined and have been well calculated. If we are concerned in variations, then it may be more appropriate to consider the survival and stochastic model. In this case we study not only the asymptotic behavior of the mean, but also we constricted on the asymptotic behavior of the variance and covariance. The aim of this study, random simulation model easily with Monte Carlo techniques and this was also by Pollard (Pollard, J. H. 1973). We briefly sum up the age structure stochastic model and survival function with special emphasis on a Monte Carlo implementation. We structuring model briefly old random stochastic model with a particular focus on the Monte Carlo application. Note that, surprisingly small stable population if the only change in the stochastic model is the inevitable citation of the newborn sex when the number of newborn, we offer a variant of the stochastic model that helps us understand this result (Leslie, P. H 1945 and 1948). Lastly, In our conclusion, it is assumed that this effect is simple, or some variant of the Leslie model may be responsible for a small stable population observed in certain groups, for example, where a stable small population that is independent of the environment was observed.

Iraq is one of the most populous countries in the world, with a population of over 40 million. This country has many large cities which contribute considerably to this total population, largest city in Iraq is Baghdad with a population of more than 5 million. It has a population in Al Basrah of more than 2.6 million, a decent figure, but still less than half the population in

Baghdad. These are not the only cities with a population of over 1,000,000. There are three other cities with a population of more than 1,000,000, and these cities are the new Al Mosul and Old Basrah. On the other hand, Iraq 69% of its population live in center city areas of the country. In 1960, this figure fell 43 percent and will continue to increase as the number of people moving from rural areas into large urban areas, and the migrants who move into the country to get the similar opportunities.

The population of Iraq has not stopped growing in recent decades and now has a healthy growth rate. For the reason that of this sustained population enlargement, and it will be interesting to observe how the population of the country as a entire, again its large cities, cope with the added population.

There are more accurate statistics for Iraqi Kurdistan. By 2016 there were 5.4 million Kurds in the three Governments Erbil, Dohuk and Sulaymaniyah. In the Kurdish region of the Federal Republic and about 3 million Kurds in neighboring Kurdish province, which are not officially located in the Kurdistan region. The Kurdish population in Iraq is estimated to be 8.4 million or 26.5% of the total population of Iraq. While, Erbil city which is a capital city in Kurdistan Region of Iraq, still the population growing even though many people leave to Europe, and the rate of population around 2.5 million and 28% which is refuge. On the other hand, the second big city in Kurdistan Region of Iraq is Sulaymaniyah, and the rate of population over 2 million and 30% is immigrations.

1-2 Survival function and Stochastic Processes with Leslie Model

Start with a brief review of random processes and model Leslie. Consideration of the population was divided into fixed-length age groups of one year, and imagine the population are sometimes counted t = 1,2, ..., separated by a time period of the same fixed length. We assume that the proportion of the sex ratio fixed from birth to death is a specific age, but independent density (Leslie, P. H. 1948). This assumption is reasonable provided that the population is limited, and that a sufficient number of men does not reduce female reproductive success in principle, and allows one to be restricted to the female sector model of the population. In order to complete, we give a detailed model with the men and women present. And The survival function is depend on the age classes of the individual from age t to $t + 1$,

$$W_i = \frac{T(t+1)}{T(t)} \qquad (1)$$

If the age is known we can depend on equation 2, but if the age is not known we can use formula 1, then $T(t)$ can be assumed by taking average within each age group over the interval $t+1<T<t$.

$$W_i \approx \frac{T(t)+T(t+1)}{T(t+1)+T(t)} \qquad (2)$$

Where

$Y_i(t)$: The number of the age group women i at time t, and enter the following parameters.

D_i : The females and age group give birth over a period of time t, and the children of those surviving to enter the age group 1 in the next period of time.

G_0: The surviving newborns which are female.

S_i: The first woman of the age surviving the next period of time t.

$\hat{Y}_i(t)$: It refers to the number of male age group i at time t, and the introduction of similar constants $\hat{S}_i$ for the specific S_i above, and assuming the absence of any person in the age group beyond life *nth*, we have the following equations;

$$Y_1(t+1)=\sum_{j=1}^{k}G_0 D_i Y_j(t) \qquad (3)$$

$$Y_{i+1}(t+1)=S_i Y_i(t), \qquad i=1,2,3,...,k-1 \qquad (4)$$

$$\hat{Y}_1(t+1)=\sum_{j=1}^{k}D_j Y_j(t)(1-G_0) \qquad (5)$$

$$\hat{Y}_{i+1}(t+1)=\hat{S}_i \hat{Y}_i(t), \qquad i=1,2,3,...,k-1 \qquad (6)$$

We can written all equation above, separate dynamically into form.

$$H(t+1)=\psi H(t) \qquad (7)$$

Where $H=(Y,\hat{Y})$ and ψ is fitting 2n*2n matrix.

It is noted that the assumption of female domination allows the system of separation.

This means that the leslie model can be presumed from females, and solved and the result is used as inputs into the heterogeneous model for the male population. Under very general condition,(Pollard 1973, and Caswell 1989), We now turn to the question: as the viability of the long-term population growth rate depends on the matrix ψ. It is know that ψ has a positive dominant eigenvector θ, with equivalent positive eigenvector Y, normalized so that

$$|Y|=\sum_{i=1}^{k}Y_i=1 \qquad (8)$$

On the other hand, the modulus of θ sternly surpassed that of any other eigenvalue. Moreover, the other eigenvalue has an eigenvector which is non negative.

The population will grow or turn down at the exponential rate θ, and the stable population condition will be present when θ = 1. In addition, the maximum $t\to\infty$ age distribution of the population, in all cases, converges with *Y*. Now we must try the model of stochastic leslie Pollard. Before doing this way, we observe that the usual leslie model presented above is unavoidable, although the inputs of the projection matrix ψ can be given probabilistic interpretation during the survival function. To model the stochastic formulation completely, we interpret the part of D_i, S_i, and model in Lisle possibilities

D_i : The possibility that the age group i females give birth to live progeny over a period of time multiple births cannot.

S_i : Possibility a female of age group i survives to the next age group.

G_0 : Possibility a child is female. The parameter $\hat{S}_i$ is similar interpretation can be given, the population vector *H(t)* is now a stochastic variable state that the *H(t-1)*. The covariance matrix *cov*($k_i(t)$, $k_j(t)$), denote its expected value by *k(t)* and dependent on *L(t)*. Pollard (1973) showed that *k(t)* satisfied a relative like the leslie equation has also been derived for *L(t)*:

$$k(t+1)=\psi\, k(t) \qquad (9)$$

$$L(t+1)=Bk(t)+(\psi\otimes\psi)L(t) \qquad (10)$$

Where

$(\psi\otimes\psi)$: The kronecker product and *B* is the fitting matrix.

While the our model population mentioned in the following section, the execution of the birth of the baby female at each step of time t is simulated, where she directed random sample numbers of the baby. The interval for the uniform distribution is [0,1].

For the first case, each age group i born of the population of productive age. If performed ran <D_i to increase the newborn n before 1. Meanwhile, the second is to determine n, for each of the newborns, and the generation ran. If ran <G_0 increase the number of newborns before 1. Similarly, the number of simulate individual remain alive in each age group. However, the product used by Pollard where normal deviation, were born using a false normal approximation to the distribution of the binomial. It was potential, because the $H_i(t+1)$ are binomial, conditional on *H(t)*.

1-3 Stochastic processes with perturbation

Begin by looking at the implementation of the Monte-Carlo model Leslie by chance for a particular model of the population. We are of the opinion that the population of age with equal periods of the same duration of one year and the risk of death and age-specific fertility determined to give age for interdependence between women. Although we are not male model female binding, and as a rule there are more men and women in the fertility scale, which in this work we limit them to the interval 15-40 years for women and 18 to 45 years for male. The males play a negative role, otherwise they do not give birth today, although they are somehow necessary for reproduction. We have artificially assumed that the death rate is 7.5% for each year. This should set more realistic values when describing the actual cases. We have looked at female fertility in the 15-35 age groups to be fixed; all fertile females are assigned the same birth probability and we differ from 15 to 25%. We assumed G_0 = 1/2 that male and female births happen with the same probability. This too is being changed to a specific but not essential problem for our work. Finally, the initial population of 200, with equal numbers of females and males, is simulating the ensuing population of 50 independent experiments and a maximum of 3000 days.

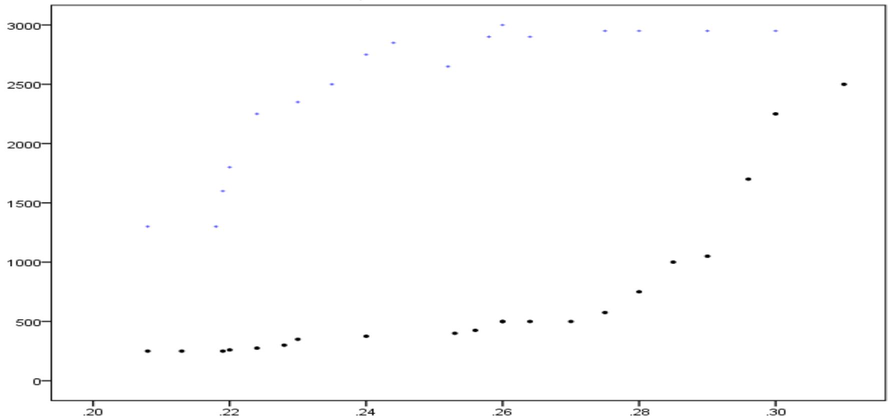

Figure1: Average survival age of population with fertility for the stochastic model (..) and for the perturbed (-)

The above Figure showed the average survival of the population after the simulation of 3000 days of experiment 50. These study whose population was not zero after 3000 days, contributed to 3000 days. The average survival rate for fertility is about 29% about 1000 days. Again Figure 2 show the simulation average survival age for the males and females of the population with sensitive and elasticity from a to f.

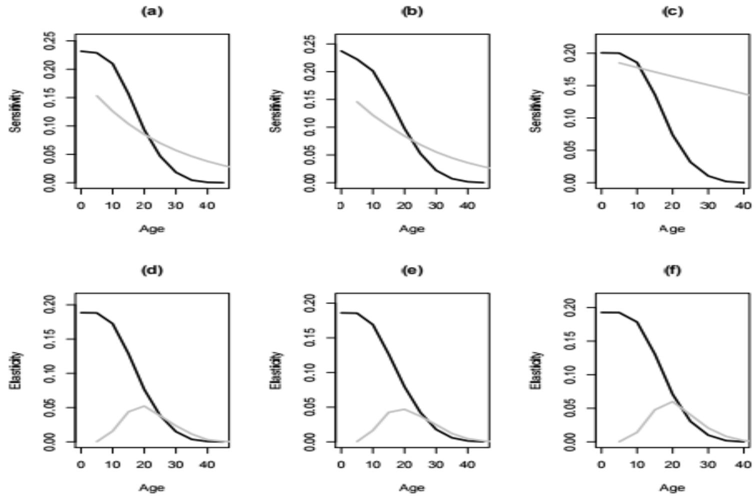

Figure 2: Average survival age of population with Sensitivities (a-c) and elasticities (d-f) for females (a,c), and males (d, f) from 2016 to 2017. Sensitivities /elasticities with respect to survival in black and fertility in grey.

1-4 The leslie model with modification

In this part, we provide a Leslie model-dependent density that does not match the simulated model above, at least partly explain the experiential consequences. The content of the model population introduced in part 1-3. Remember that women in age group 15-35 are fertile with a constant probability of D_0 from birth to surviving progeny, and that male and female births are equal to $G_0 = 1/2$. We note by the observation that the disturbed stochastic pattern and the random pattern of the pollard lead to a slightly dissimilar number of female births due to the same number of fertile females.

$$\Pr(s \ female birth \setminus k \ fertile \ females) = p(s,k,G_0 D_0) \qquad (11)$$

Where $p(n,k,\theta)$ represented the binomial distribution function.

$$p(n,k,\theta) = C_n^k \theta^n (1-\theta)^{k-n} \qquad (12)$$

The predictable number of female birth given fertile female is the following;

$$E(k) = G_0 D_0 k \qquad (13)$$

So, the perturbed model, the scheming proceeds is

$$\Pr(s \ female births / k \ fertile \ females) =$$

$$\sum_{n=s}^{k} \Pr(n \ births / k \ fertile \ females) * \Pr(s \ female newborns / n births) \qquad (14)$$

In this state, where the number n of births is even, while the number of females will be s with likelihood.

$$p(s,n,G_0) \qquad (15)$$

While, n is odd, a birth is automatically assigned to female so that the number of females is specific when $s-1$ is the remaining $n-1$ female birth that occurs with probability

$$p(s-1,n-1,G_0) \qquad (16)$$

So the consequence is

$$\Pr(D \ female births \setminus k \ fertile \ females) =$$

$$\sum_{(n\,even)n=s}^{k} p(s,k,D_0)\, p(s,n,G_0) + \sum_{(n\,odd)n=s}^{k} p(s,k,D_0)\, p(s-1,k-1,G_0) \qquad (17)$$

With this, we calculate for the perturbed model the predictable number of women who are given k fertile females.

$$\hat{E}(k) = \sum s\ pr(s\ female birth / k\ fertile\ females) \qquad (18)$$

Computation of *E(k)* and estimate *E(k)* shows that

$$\hat{E}(k) > E(k), k = 1,2,3,...,$$
$$\hat{E}(k) - E(k) \approx 1/4\ for\ k\ l\arg e \qquad (19)$$

From equilibrium (19) holds because for the large value of *K*, then the number of progeny is almost half the time. In view of the fact that, in these cases the genus which was randomly assigned to a female, it was half the time anyway, we assume that almost one out of four, one newborn is more female than for an unperturbed model.

We now observe that, as the standard and unstable model has the same fertility rate as D_0, the effect of the disturbance is to raise the efficient probability of *G* from the newborn to be a female of its nominal value G_0 to a new value of *k*. If the expression *E (k)* and the estimate of *E(k)* are equated, it follows that the predictable number of female newborns given to the number of fertile female *k* of the perturbed model corresponds to the standard model with the G_0 dependent expression density.

$$G = \frac{\hat{E}(k)}{D_0 k} \qquad (20)$$

Figure 3 shows *G* as a function of *k* number of fertile females for $D_0=1/4$, and a nominal value $G_0=1/2$.

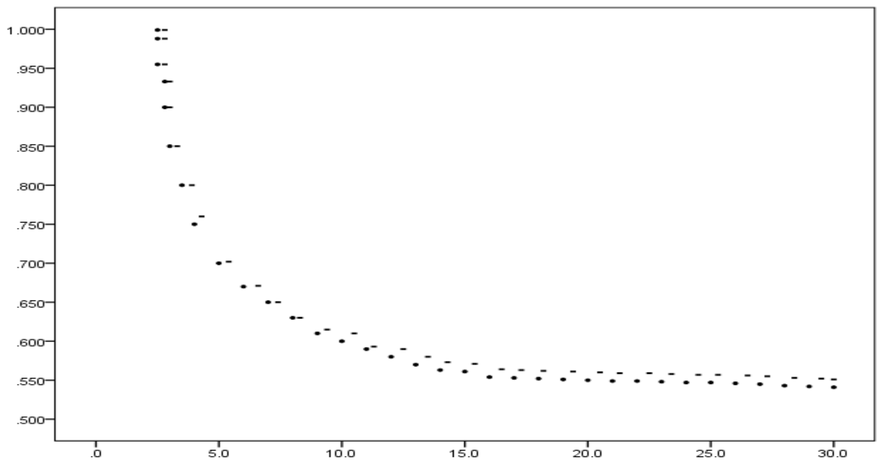

Figure3: Probability of newborn being female as a function of *k* number of fertility female for perturbed model with $G_o=1/2$, and (-) $D_0=1/4$ or (- - -) $D_0=1/5$

While, this selection of the *G* consequences in conditionally expected conditional principles, but the probability distribution function is not identical, as shown in Figure 4, it was expected that we simulate the standard pollard model, if at each step, the number of females after the probability distribution function equation (11) should be replaced by the G_0 expressed by G by formula (20), essentially the same result should be generated as a stochastic model. Assuming that the impurity effect is in this state depends on the density function we expect the female vector population Y(t) to satisfy by the following equation.

$$Y(t+1) = C(G(k)D_0)Y(t) \qquad (21)$$

Where *C(P)* is the stochastic leslie model matrix.

For a given transition matrix $C = (q_{is})$, where q_{is} is the rate of flow from ($i \to s$), which is a |P| * |P| matrix of transition rates if it fulfils the following two conditions:

a) C has no negative off-diagonal entries, i.e. $q_{is} \geq 0$ for all $i \neq s$.

b) C has row sums equal to zero, or $\sum_s q_{is} = 0$ for all i.

$$C = \begin{bmatrix} 0 & 0 & \dots & 0 & P & P & \dots & P & P \\ z_0 & 0 & \dots & 0 & 0 & 0 & \dots & 0 & 0 \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & \dots & 0 & 0 & 0 & \dots & z_0 & 0 \end{bmatrix} \quad (22)$$

$$k = \sum_{i=15}^{45} Y_i(t) \quad (23)$$

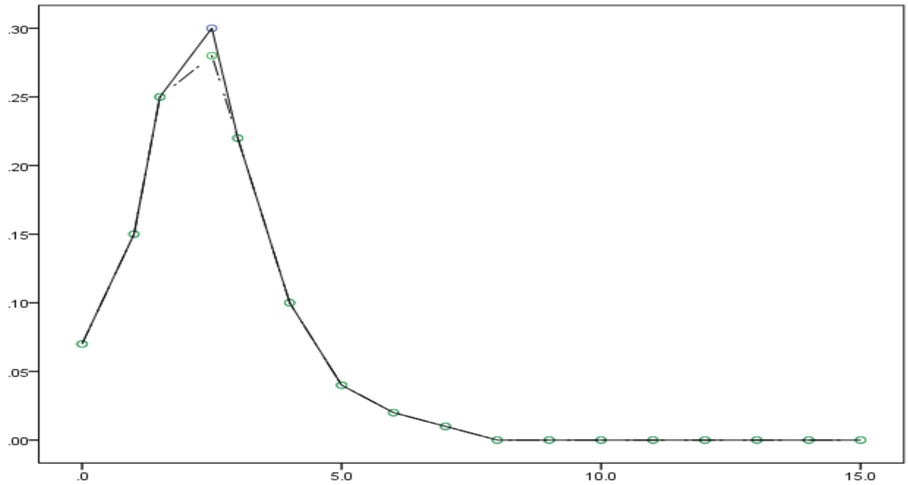

Figure 4: Probability density function for number of female newborns given k fertile females *k=30*, *D_0=1/4*, (—) perturbed model (***) standard model

In the population model, the survival function of z_0 = 0.952 results from the assumption of a continuous mortality of 4.2% per year. In theoretical, firstly the stochastic model of the restless random model with the sex ratio is dependent on the intensity with the same long run outlook. Secondly, if Y(t) shows the predictable female population vector of the model with the sex ratio depending on density function, then Y(t) suitable the stochastic determinism model equation (21). To test this assumption quantitatively, we analyzed the long run activities of the equation (21). A stable state is determined for those *k* in which the maximum value of the matrix *C (G (k) D_0* is the unit. Figure 5 illustrate graph of the maximum eigenvalue and the use of Newton's raphson method; one can display the maximum eigenvalue is the unit when *P=0.1383*

The value of *k* steady state is found by solving

$$G(k)D_0 = P \;\; or \;\; \frac{\hat{E}(k)}{k} = P \quad (24)$$

Estimate *E(k)* depends on the fertility rate. For instance if *D_0=1/4* we should *G(k)=1/1.8=0.588*

And also the value of *k* which is clear in the Figure 3 then $k = 30$, the corresponding steady state solution which is eigenvalue equal 1, normalized so that, $\sum_{i=15}^{45} \overline{Y}_i = 30$, with 30 fertile females and a fertility rate of *1/4* and probability of a newborns being male given by

1-G=1-0.588=0.412,

and the steady state of male newborns population is

30(1/4)(1-0.588)=3.090

By contrast the survival function rate z_0=0.952, one can determine the number of males in the other age groups. Although, the stability cases for the figure 5 is one which mean that the result is reliable, we can dependent on it for the differences state even the survival are lower and upper.

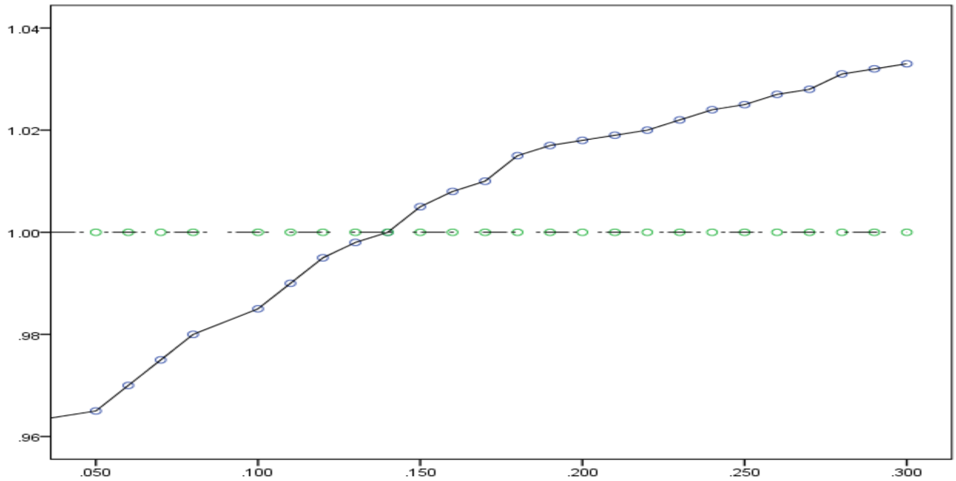

Figure 5: The dominant eigenvalue of the leslie matrix2^3, the survival function (z_0=0.925)

Finally, the result of the male population is of 75.0 and the total population (age 55 and younger). This is consistent with the long range populations gutted for the perturbed simulation model.

1-5 Discussion and Conclusions

The inferences of interest coming from this study are that the stable population arises as survival function of fertility and mortality rates and the 150-500 population location agrees with ethnographic data on the mean size of small tribal groups and may signify fundamental human characteristic for small population and their evolution. In addition to, we focused that the alternative of the stochastic model is described in part 4 results. The effected similar to that of leslie model, which leads to stable clusters for a set of parameter values. In addition, the determination of realistic values for the survival of birth and survival function to a stable population of several years, independent of the primary population. The aims of the study are finding suggests that, steadiness in a small population can be identified at least in the section. For example, Figure 1 shows that the birth and death rates are 0.2-0.3 in the middle of the fertile female mortality rates 0.03-0.06 the total of population and survival probability of 0.94-0.97 leads to a stable area where the population is a number of thousand. To sum uo, this new detection can have a considerable influence on the question of absorption capacity in speculative observation. The capacity is the population, which can theoretically support the respective ecological envelope. It was long known that small populations are stable in large numbers, the absorption capacity of these environments. If we have assumed that internal dynamic forces play an important role in determining stability, the benefit of endurance can be challenged as the first measure. On the other hand, developing the reasoning we suggest that the similarity between the theoretical model and the graphical world is not accidental. In our model, a perturbation in small population can produce dramatic effects. The adult sex ratio is in fact a product of three quantities, the ratio at birth, the difference in maturation times between male and females, and differential mortality. Finally, differential mortality is a feature of some society populations and can result in a progressive unbalanced sex ratio where males are subject to greater rates of predation. In band and tribal societies, warfare can result in significant numbers of male deaths and taking several wives is one response to male attribution, but a situation wherein there is an extra female or several females is easy to imagine, especially if there are additional environmental stresses and if women present a relative economic advantage.

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ملخص

وتتمثل أهداف هذه الدراسة في تنفيذ النموذج العشوائي ووظيفة البقاء على قيد الحياة؛ فعلنا اضطرابات صغيرة واستخدام المحاكاة لدراسة تأثيرها على عدد قليل من السكان. على الرغم من أن عدد قليل من مشاهدات أدخلت في نموذج وظيفة العملية العشوائية والبقاء على قيد الحياة إلى السكان مستقرة طويلة البقاء في منطقة أو مساحة المعلمة حيث نموذج العشوائية والبقاء على قيد الحياة يتوقع على نسبة السكان. وقد تمت تطبيق هذا النموذج على معدلات الخصوبة ومعدلات البقاء على قيد الحياة والقاعدة نسبة السكانية لنوع معين، وقد جمعت البيانات من إحصاءات السكان ومستشفى رزكاري في أربيل لمرضى الاضطراب قلق (البيانات الثانوية) بين عامي 2015 و 2017، وكذلك قمنا باستخدام نموذج السكان معدل النمو والبحث العلمي في دراسة البيئة، تجد أنه من المفيد تحديد ما إذا كان يمكن للنوع البقاء على قيد الحياة عندما يتم إدخاله في محيط جديد. وبالإضافة إلى ذلك، فإنه يمكن أيضا أن تستخدم كنموذج لتحديد ما إذا كان السكان من نوع مستمرة سوف تزيد أو تنقص على مدى فترة معينة من الزمن، ويتم محاكاة النموذج العشوائي بسهولة مع تقنيات مونت كارلو. وقد تمت استخدام في هذا الدراسة البرنامج (EasyFit) وكذلك برنامج (SPSS) المستخدمة لجزء عملي لهذه الدراسة. ومن المفهوم أن هذه النتيجة معنوية احصائيا النظر في نموذج ذات الصلة مع وظيفة الكثافة تعتمد على نسبة الجنس التي تظهر الميزات.