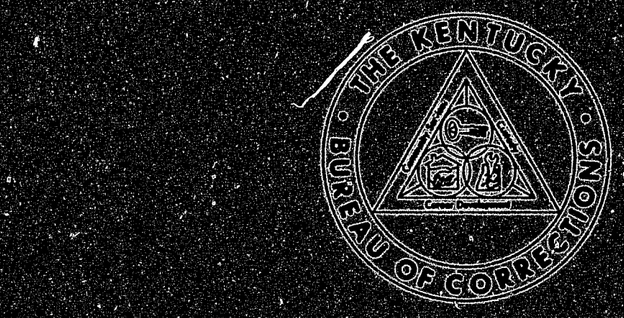
Commonwealth of Kentucky
Department of Justice
Bureau of Corrections

Office of Administrative and Fiscal Affairs
Division of Management Information Systems
Research and Evaluation Unit



A SHORT-TERM INSTITUTIONAL POPULATION PROJECTION FOR THE KENTUCKY BUREAU OF CORRECTIONS

May, 1981

Prepared By:

James C. Warmbrodt

ACKNOWLEDGEMENT

The Research and Evaluation Unit wishes to express appreciation to the members of the Bureau of Corrections' Computer Services Section, without whose assistance this project would not have been possible. Special thanks to Michael Frogge, who helped to establish the format for cases and identify variables to be extracted from ORION, and to Bill Clark, who has spent considerable time and energy developing and refining the program for the ORION extract.

A SHORT-TERM INSTITUTIONAL POPULATION PROJECTION FOR THE KENTUCKY BUREAU OF CORRECTIONS

Introduction

This report describes the methodology which has been developed by the Research and Evaluation Unit to project the future inmate population at Kentucky correctional institutions, and presents the results of projections for 1981. This document represents the third stage of the Research and Evaluation Unit's study of prison population projection. In the first stage, an extensive literature review and a survey of corrections agencies throughout the nation were conducted to identify projection techniques currently in use.[1] The second stage consisted of developing a proposed methodology to be used specifically for projecting the future inmate population of Kentucky institutions based on the needs of corrections administrators and the information resources available.[2]

The methodology which has been adopted by the Research and Evaluation Unit for initial projections is a simulation modeling technique which attempts to replicate, as closely as possible, various components of the corrections system, as well as trends in commitments and releases, to make a statement about future changes in the prison population. These projections rely on knowledge of the inmate populations' sentence distribution, Parole Board actions, time served information, and the relationship of unemployment to prison commitments to generate predicted future commitments and releases. The projection process is broken down into three basic stages which consist of forecasting anticipated

[1] "Survey of Projection Techniques", November 3, 1980.

[2] "A Proposal for Developing an Improved Prison Population Projection Methodology", October 23, 1980.

release dates for inmates already incarcerated at the start of the projection period, predicting commitments to Kentucky prisons for the projection period, and projecting anticipated release dates for predicted commitments who will also be released during the projection period.

Development of the Methodology

The feasibility of developing a simulation model methodology hinged on two factors, the ability to predict new commitments to the corrections system, and most importantly, the ability to forecast anticipated release dates for incarcerated inmates. While numerous techniques exist for predicting future commitments, projecting release dates requires information on time served, which can only be obtained from a large, versatile data base of offender information. Prior to this research effort, no data base existed which could provide the time served information for a large, recent sample of offenders necessary for this study. The magnitude of the manual data collection effort required to obtain the necessary information would have been prohibitive to the continuation of this project. Fortunately, the Computer Services Section of the Bureau of Corrections has recently developed a computer-based Offender Records Information and Operations Network (ORION) which had the potential to provide the data needed for the projections.

Since ORION contained records that were up to date for all offenders incarcerated on or after July 1, 1979, it was determined that for developing a data base for the projection, information on all offenders incarcerated between July 1, 1979 and December 31, 1980 would be needed. Specific variables to be taken from the offenders' records which were identified as being necessary for the projection were the offenders' type of commitment (new or returned), the institutional start date, race, amount of jail time credited against the total time to be served, sentence, original parole hearing date, the action taken by the Parole Board at the hearing, type of release, date of release, date of birth, minimum expiration date, and the amount of time on release prior to the most recent commitment for those who violate conditions of release and are reincarcerated as returnees.

Due to the nature of the variables required from ORION, it was expected that some difficulty would be encountered in extracting comparable information for all of the inmates. Since many inmates have been released and reincarcerated between July 1, 1979 and December 31, 1980, some several times, questions arose as to which start dates, which release dates, etc. to include in the data extract. To resolve this dilemma, it was decided that no effort would be made to follow individuals who were released and subsequently reincarcerated. Instead, each period of incarceration between start and end dates was considered a separate case, so that an offender paroled twice who violated parole both times would be counted as three individual cases. It was determined that no matter how many times an inmate was released and reincarcerated during a particular time frame, that his or her period of incarceration must fall into one of six categories to be referred to as types A, B, C, D, E, and F, in regard to the boundaries of the time frame in question. Category A cases are those in which the offender is committed prior to the start of the time frame and remains incarcerated throughout the period. Category B cases are those inmates also incarcerated prior to the beginning of the time frame, but who are released sometime during the time period. In Category C cases, the inmate is both committed and discharged within the time frame. Category D cases are those in which the inmate is committed during

the time frame, but remains incarcerated throughout the remainder of the period. In Categories E and F, where start dates and end dates fall outside the boundaries of the time frame, inmate information was not included in the analysis. An illustration of these categories is presented in Figure 1. By programming the computer to select out information for all cases fitting into the A, B, C, and D categories, it was possible to obtain information on each period of incarceration served by an inmate within the time frame. Although this selection process treats individual inmates as possibly several cases, the inclusion of start and end dates allows us to select out the actual number of inmates who were incarcerated at any point in time throughout the time frame.

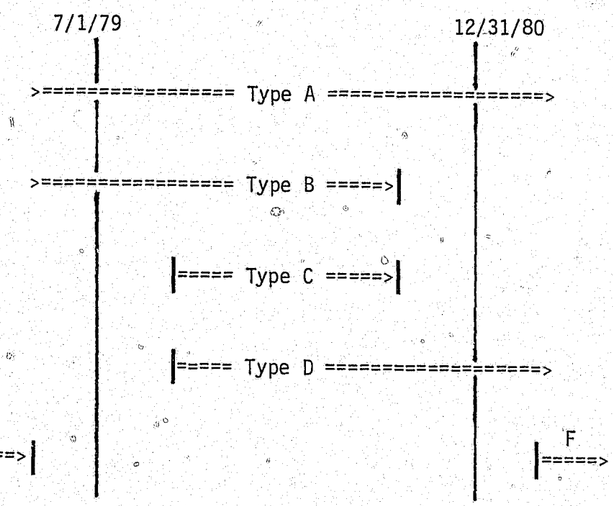
Forecasting Release Dates for the Incarcerated Population

Having compiled a data file on all inmates incarcerated between July 1, 1979 and December 31, 1980, the Research and Evaluation Unit proceeded to project anticipated release dates for all inmates incarcerated on December 31, 1980. All analysis of ORION variables and subsequent projections of release dates for those incarcerated on December 31, 1980 were performed using the Statistical Package for the Social Sciences (SPSS). Those offenders who remained incarcerated on December 31, 1980 were isolated by selecting out all those inmates whose type of outgoing action and institutional end date equalled zero. The resulting 3654 inmates were those still incarcerated at the beginning of the projection period.

To make accurate approximations of future release dates, it is necessary to identify those factors which account for differences in time served among inmates. An analysis of incoming actions and initial parole actions for these

FIGURE 1

TYPES OF INCARCERATION FOR ORION EXTRACT



3654 revealed that the inmates fell into one of the following five categories:

. New commitments who have been deferred at first review;

. New commitments who have had parole denied at first review;

. New commitments who have been recommended for parole at first review;

. New commitments awaiting intial parole review;

. Returnees.[3]

To determine if inmates grouped according to the above categories serve substantially different amounts of time, the 7949 inmates who have been incarcerated from July 1, 1979 through December 30, 1980 were divided into these categories and analyzed according to time served. The time served for each category was also broken down according to sentence, the variable which probably accounts for the greatest differences in time served among inmates. The results of this analysis indicated that the additional time served from parole review to release varied considerably between those new commitments deferred, denied, and recommended. Since no comparisons could be made with returnees and new commitments awaiting review in regard to Parole Board actions, an analysis of time served from commitment to release was made dividing the sample of 7949 solely according to whether the inmate came in on a new or returnee commitment status. Although the average time served for returnees and new commitments was almost the same for the groups as a whole, distinct differences in time served were observed when the two groups were broken down according to sentence length. It was found that new commitments with sentences of 10 years or more serve considerably more time than do returnees with comparable sentences.

[3]Includes parole violators, conditional release violators, held parole violators, shock probation violators, court ordered commitments, and returned escapees.

Time served figures usually consider only those offenders who have been released. However, calculating time served using only samples of releasees and ignoring those inmates who remain incarcerated who have served long periods of time tends to underestimate the amount of time actually being served. This is especially true for those with longer sentences, as relatively few of these inmates are released in any given period. Therefore, for this study's analysis of time served, inmates who remained incarcerated as of December 31, 1980, but had time served in excess of the average time served for releasees in the same sentence category, were included with the releasees in the calculation of average time served.

These adjusted time served figures for each of the five categories of incarcerated inmates were considered to be the amount of time an inmate could be expected to serve. For inmates in the "deferred" and "denied" categories, the additional time served indicated for each inmate's appropriate sentence was added to his or her parole hearing date to arrive at their anticipated release date. For inmates recommended for parole, there appeared to be no significant difference in additional time to serve according to sentence length. Thus, the average for the entire group was added to the parole hearing date to determine the projected release dates of the inmates, regardless of sentence length. For inmates in the "new, awaiting parole review" and "returnee" categories, the average time served according to sentence length for new commitments and returnees, respectively, were added to the inmates' commitment dates to arrive at anticipated release dates. This average time served by sentence length information is presented in Table 1. The number of incarcerated inmates whose projected release dates fall within 1981 is presented according to quarter of release in Table 2.

TABLE 1

TIME TO SERVE (IN DAYS) BY SENTENCE
ACCORDING TO INCARCERATION STATUS

Sentence	A	B	C	D	E
1	140	152	39	189	178
2	189	300		215	291
3	276	396		353	423
4	363	516		478	413
5	410	777		440	425
6	316			439	480
7	414			592	647
8	416			604	565
9	487			516	363
10	544	1489		843	653
11	542			962	689
12	584			846	884
13	582			966	896
14	737			1181	663
15	638	1225		995	759
16	640			1724	781
17	542			1117	587
18	542			1616	665
19	542			1372	665
20	430			1372	842
21-39	936			1993	1207
40-Life	2933			2470	1093
Life W/O Parole	728			5991	1342
Death	1481			4937	1284
Life	1727			3440	1284

A = new commitments, deferred (time to serve after review)
B = new commitments, denied (time to serve after review)
C = new commitments, recommended (time to serve after review)
D = new commitments, awaiting review (total time to serve)
E = returnees (total time to serve)

TABLE 2

INMATES INCARCERATED ON 12/31/80
WITH ANTICIPATED RELEASE DATES IN 1981

Quarter	Number Released
1	753
2	429
3	319
4	361
	1862

Predicting New Commitments

In the survey of state corrections agencies, unemployment was identified by many as a primary indicator of future prison commitments. Therefore, for this initial projection attempt, the Research and Evaluation Unit has used unemployment to predict future new commitments to the corrections system. Quarterly unemployment was used as the predictive variable in a linear regression formula to project future new commitments. However, there was no consensus among the states as to how much time will elapse before a change in the unemployment rate will be reflected in prison commitment figures. Therefore, the Research and Evaluation Unit produced a number of projections of new commitments using linear regression formulae which experimented with unemployment "lagged" (using previous unemployment rates in the prediction of future commitments) various amounts of time. The Evaluation Unit finally settled on predicting quarterly new commitments using the unemployment rate nine months previously. Lagging unemployment three quarters produced the highest correlation between unemployment and number of new commitments (.507) of all the combinations tried. A representation of this relationship is presented in Figure 2.

To project the number of returnees to be committed during 1981, the ratio of returnees to new commitments for the period from July 1, 1975 to December 31, 1980 was applied to the predicted commitments for each quarter of 1981. The projected number of new commitments and returnees is presented in Table 3.

Having predicted the raw numbers for 1981 commitments, the Evaluation Unit made the following assumptions based on prior population trends to further define the composition of the commitments:

FIGURE 2

LINEAR REGRESSION OF UNEMPLOYMENT AND NEW COMMITMENTS

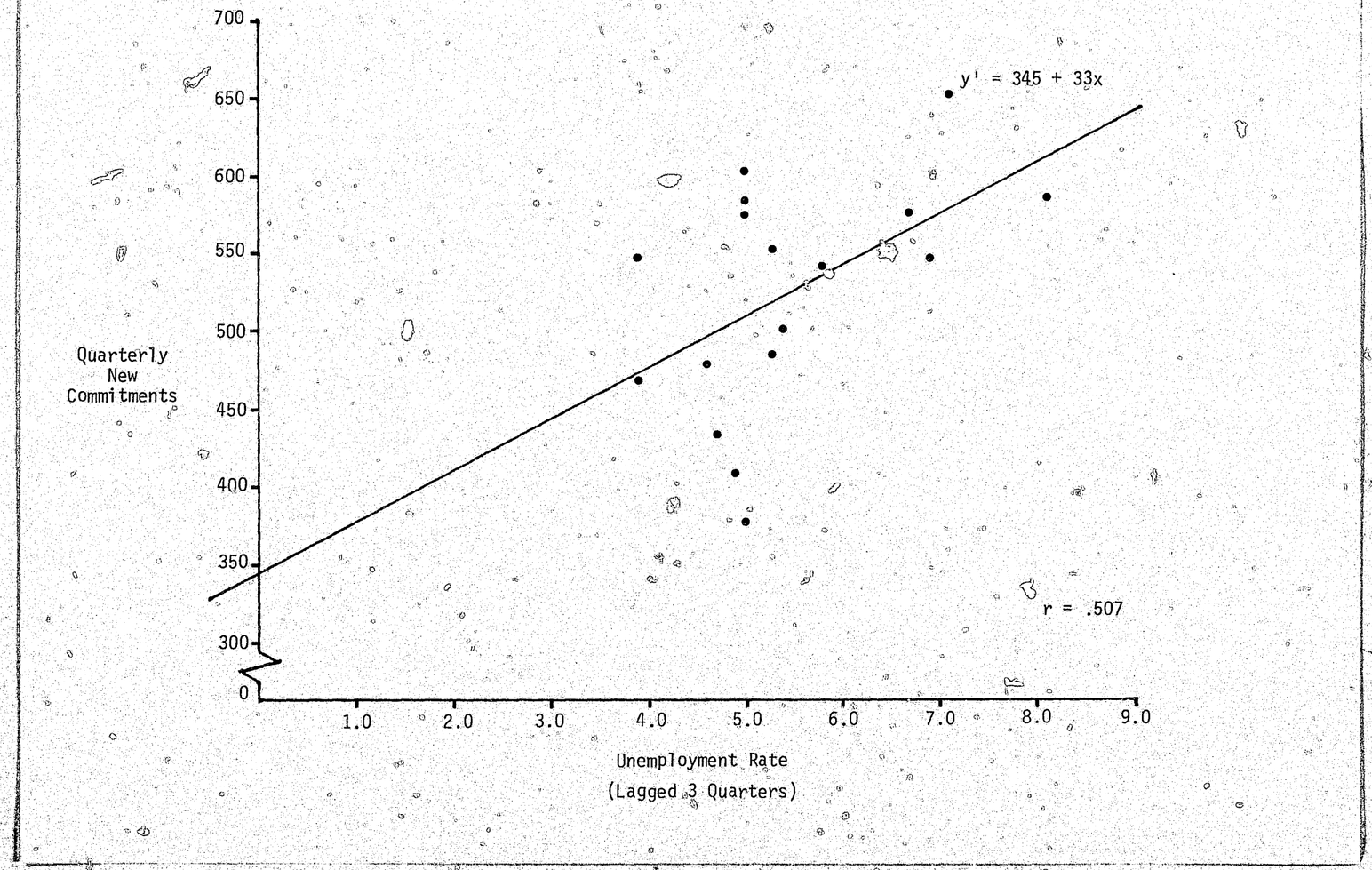


TABLE 3

PROJECTED COMMITMENTS FOR 1981

Quarter	New	Returnees	Total
1	612	228	840
2	628	234	862
3	592	220	812
4	599	223	822
	2431	905	3336

1) The distribution of sentences for both new commitments and returnees in 1981 will be the same as for those committed from July 1, 1979 to December 31, 1980. No significant changes in sentencing have been reflected in new commitments over this time period.

2) The percentages of new commitments in 1981 who will be deferred, denied, or recommended for parole by the Parole Board at their initial parole hearing will be the same as for Parole Board actions over the period from April 1, 1980 to December 31, 1980. The percentage of those who were recommended for parole at first review during this time period was much higher than in the previous eight months, due, no doubt, to the Consent Decree's mandate to reduce the inmate populations at the Reformatory and Penitentiary. It seems likely that this percentage of inmates recommended for parole will continue to remain at current levels until the institutions can comfortably meet population ceilings.

3) The average amount of additional time served after parole review by offenders committed in 1981 will be the same as the average additional time served for those incarcerated from July 1, 1979 to December 31, 1980 who had the same sentence length, commitment status, and initial Parole Board action. The additional time served will remain the same despite changes in parole regulations regarding time to be served to parole review because the new regulations were designed to reduce disparity in the parole review process, and there is no evidence to suggest they will result in an increase or decrease in additional time served.

Predicting Releases From Among New Commitments

Based on the previously mentioned assumptions, it seemed likely that a certain portion of the predicted commitments for 1981 would also be released in 1981. To determine how many would be released, it was necessary to determine the total time to serve for the predicted commitments to identify how many would have release dates falling within 1981.

The first step in determining the amount of time future commitments must serve is to break them down according to sentence length as described in the assumptions discussed previously. Next, those offenders who will be released

on shock probation must be selected out according to sentence length. Of all new commitments incarcerated from July 1, 1979 to December 31, 1980, 14.2 percent have been released on shock probation. Time served information on those offenders released on shock probation indicates that they serve an average of 65 days in the institution. That means that the majority of those committed during 1981 who will eventually be released on shock probation will be discharged during 1981.

Of the new commitments remaining, offenders in each sentence category must be divided according to the percentage it is anticipated the Parole Board will defer, deny, and recommend at the initial parole hearing. Once the predicted commitments are broken down by sentence and Parole Board action, assigning anticipated release dates is done essentially the same way as when release dates were forecast for the incarcerated population. However, for the predicted commitments, additional calculations must be made to account for changes in Parole Board regulations which were implemented in December of 1980. Although the Evaluation Unit assumes that inmates will be serving the same amount of additional time between the parole hearing and release as they did under the old parole regulations, an adjustment must be made for the amount of time inmates will serve prior to their parole hearing. This is accomplished by determining the amount of time offenders must serve for each sentence category according to the new regulations and subtracting from that the jail time which is credited toward the offender's sentence and time to parole review. It was determined that the average amount of jail credit received by new commitments is approximately 90 days.

To summarize the operations described above, the total time to serve for new commitments, according to their Parole Board action, is calculated by taking the time to review for each sentence category, subtracting the average jail time, and adding the additional time to serve for the appropriate sentence categories which were used in calculating release dates for the incarcerated inmates. Projecting the total time to serve for returnees is a somewhat simpler operation than the calculations for new commitments. Since no attempt is made to predict Parole Board decisions for returnees, the total time to serve is assumed to be the same as for returnees who were already incarcerated.

By knowing the total time to serve for the predicted commitments, it can be determined how many of them will be released in 1981. Predicted commitments meeting the following conditions will be released in 1981:

1) All those to be released on shock probation;
2) Committed in first quarter and total time to serve less than 365 days;
3) Committed in second quarter and total time to serve less than 274 days;
4) Committed in third quarter and total time to serve less than 182 days;
5) Committed in fourth quarter and total time to serve less than 91 days.

It should be noted that although many of those committed during the fourth quarter with a time served of less than 91 days will be released (or 65 days in the case of shock probationers), those committed near the end of that quarter would, in reality, remain incarcerated at the end of the year. Which leads to another problem regarding assigning release dates for predicted commitments; what part of the quarter should be utilized as the start date to which is added the total time to serve?

Since actual start dates and parole hearing dates were available for the inmates incarcerated on December 31, 1980, it was no problem to add on the additional time to serve to arrive at an exact end date. Unfortunately, there is no feasible way to accurately distribute commitments over the three months for each quarter. But, it would be inappropriate to assume that all commitments for the quarter will be committed on the same day. The compromise settled on by the Evaluation Unit was to assume that quarterly commitments will be committed on the first day of each month during the quarter, with the number of commitments being distributed evenly over the three months. Using these somewhat arbitrary commitment dates, the total time to serve can be applied to arrive at anticipated releases, thus determining the number of future commitments who will be released in 1981.

Projection Figures for 1981

Once the commitment and release components have been calculated, it is a simple task to arrive at the projection figures for 1981. To determine the projection figures, the number of predicted commitments are added to the incarcerated population at the start of the projection period, with the number of releases subtracted from this total to arrive at the projected population. The projection figures for the four quarters of 1981 are presented in Table 4. Figure 3 gives a graphic display of the projection figures in relation to previous population figures.

Comparison of Projected Population to Actual Figures

At the present time, population figures for Kentucky prisons are available for the first three months of 1981, allowing for a comparison of projected population figures to actual figures for the first quarter. The projected population

TABLE 4

Prison Population on 12/31/80: 3654

Commitments for 1981:

Quarter	New	Returned[1]	Total
1	612	228	840
2	628	234	862
3	592	220	812
4	599	223	822
	2431	905	3336

Releases for 1981:

Quarter	A[2]	B[3]	Total
1	753	59	812
2	429	264	693
3	319	328	647
4	361	396	757
	1862	1047	2909

Projected Population for 1981:

Quarter	Projected Population at End of Quarter	Actual Population at End of Quarter
1	3682	3672
2	3851	
3	4016	
4	4081	

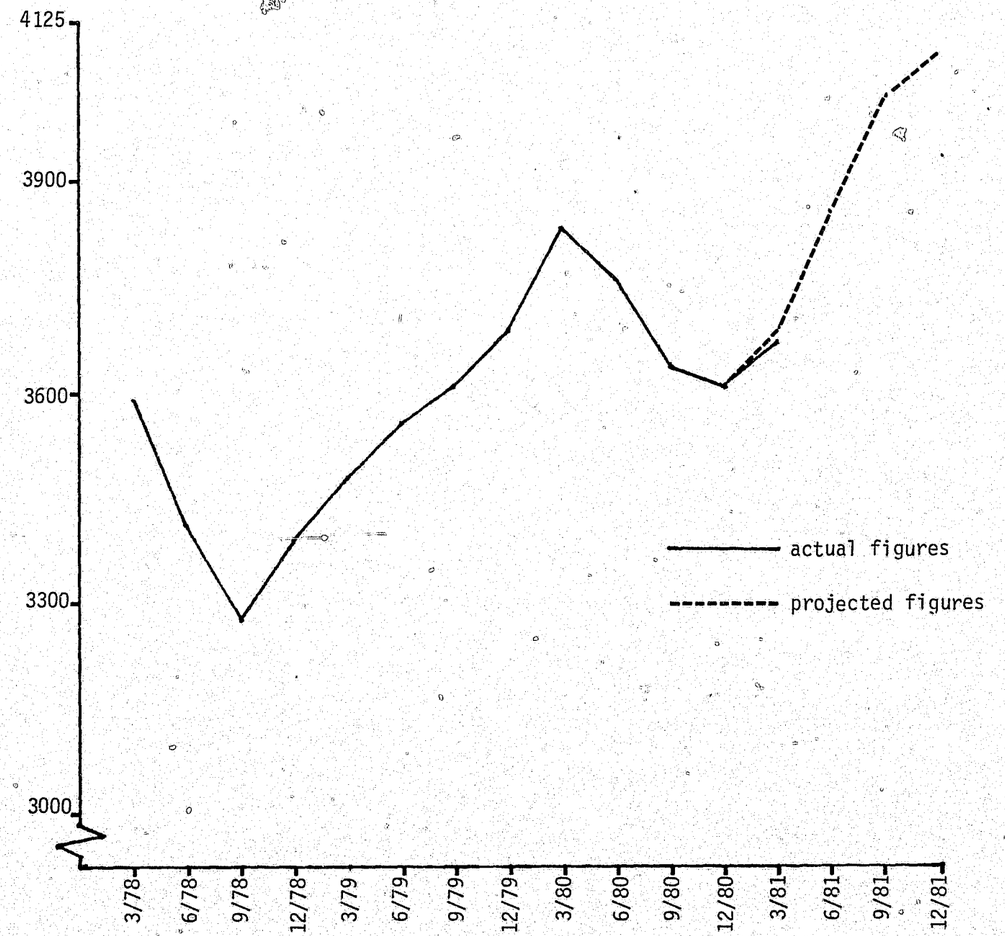
[1]Includes parole violators, conditional release violations, held parole violators, shock probation violators, court ordered commitments, and escapees returned.

[2]Inmates incarcerated on 12/31/80 who are released during 1981.

[3]Inmates committed during 1981 who are released during 1981.

FIGURE 3

QUARTERLY POPULATION FIGURES



Source: Bureau of Corrections
Monthly Population
Movement Summaries

for the end of the first quarter was 3682, while the actual population at the end of March was 3672. This error in estimate of 10, or +.3%, is well within the ±5% margin of error generally considered acceptable for population projections. However, with only one quarter's data for comparison, the Evaluation Unit will remain cautiously optimistic until more data becomes available to determine if the projections will continue to be accurate.

Limitations of Methodology

As could be expected, the attempt to develop a new projection methodology, tailored to meet the specific needs of Kentucky's Bureau of Corrections and utilizing a relatively new information system, resulted in several weaknesses in the technique. Already mentioned were several problems in extracting data variables to meet the specifications of the methodology, due to the fact that ORION was designed as a record keeping system rather than a research data source. Also, all calculations to determine total time to serve and release dates for the predicted commitments had to be performed manually rather than utilizing electronic data processing equipment, as originally intended. The feasibility of using a Texas Instruments programmable calculator to perform these operations was explored, but the TI 58's inability to store original programs for reuse, necessitating manual entry of numerous data elements each time a projection was prepared, made it a less efficient method than straight manual calculations.

As previously stated, it is too early to determine how reliable predictions using this methodology will be. However, if the projections turn out to be less accurate than necessary, it will be due, no doubt, to one or both of the following reasons:

1) Unemployment alone not being a powerful enough predictor of new commitments;

2) Changes in release policies that are not reflected in recent release or Parole Board trends.

To offset these two major sources of potential errors in projections, consideration should be given to making some adjustments in the methodology.

Multiple regression utilizing unemployment and additional predictor variables might be one method of increasing the accuracy of future projections. Another possible remedy might be to identify an "at-risk" population, fluctuations in the size of which would indicate changes in future commitments.

The best way to stay abreast of trends in releases is for policy makers to keep the Evaluation Unit informed of current and proposed policies and procedures regarding release. Input from the administration in regard to policy is essential to the preparation of accurate projections, especially with the current efforts to comply with the population reduction mandates resulting from the Consent Decree. The only official policy changes incorporated into this initial projection were the changes in parole regulations altering time to be served to parole review.

Conclusions

Despite its limitations, this methodology appears to be a considerable improvement over techniques previously utilized by the Bureau of Corrections to project the prison population. Except for the necessity of making manual calculations, the methodology has the potential to realize all of the objectives required of a projection technique that were set forth in the Evaluation Unit's proposal. The methodology requires no data which cannot be readily obtained, the projections are responsive to the fluctuations which occur in a prison population, hypothetical scenarios can be incorporated into the methodology to analyze possible policy alternatives, it is flexible, allowing for refinements in the way in which future commitments and releases are predicted, and it has the potential to produce consistently valid and reliable statistics. The fact that the methodology resulted in plausible figures for future commitments and releases without any unusual manipulation of data, and came very close to projecting accurate figures for the first quarter, is some indication that, whether or not the projections for the next three quarters are accurate, this methodology is definitely a step in the right direction for projecting future prison populations.

Until the actual population figures become available for the remaining three quarters of 1981, it is difficult to anticipate what modifications must be made to the current methodology. However, knowing of the possible shortcomings of using only unemployment as a predictor of new commitments, it would seem wise to begin exploring alternative means of predicting commitments, should the initial projections for 1981 be inaccurate. In addition, it seems likely that the need for projections within the Bureau and during the coming legislative session will require that the methodology be adaptable to various requests. For these reasons, efforts should be made to incorporate additional variables into the data set. It would be impossible to predict what kinds of information will be required in future requests for projections, but it seems absolutely necessary to include the variables of crime, county of commitment, and inmates' institution when obtaining subsequent extracts of data from ORION.

By working to improve on what seems to be a sound methodology for projecting future prison populations, the Research and Evaluation Unit will be able to provide planners and administrators with a useful information tool. The potential to provide not only future population figures, and sentence distributions and impact statements on changes in policy, should make the projections essential decision-making aids with regard to Bureau of Corrections institutions.

END