



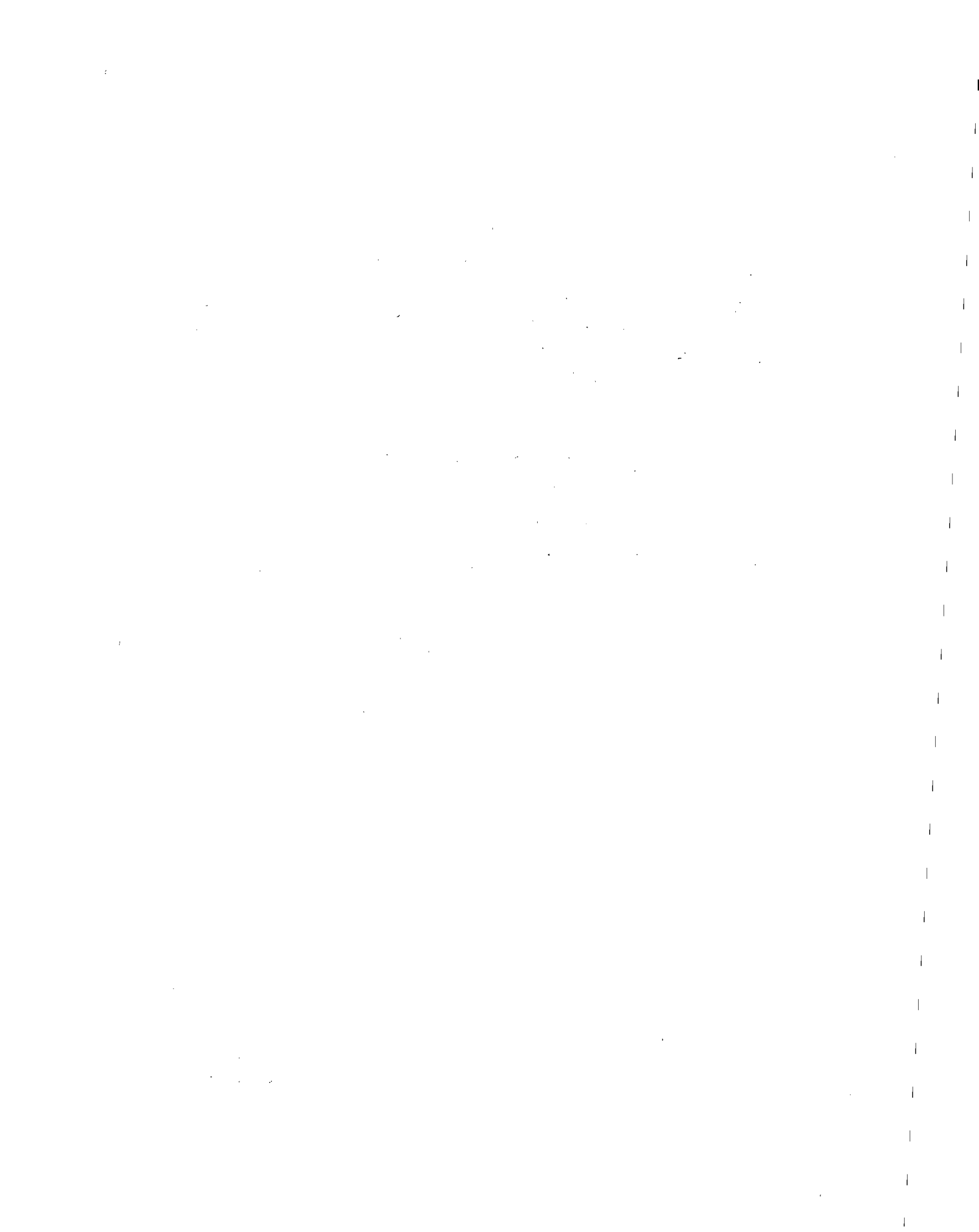
1. Report No. DOT-TSC-OST-74-43		2. Government Accession No. PB246129 	
4. Title and Subtitle REVIEW AND ANALYSIS OF GASOLINE CONSUMPTION IN THE UNITED STATES FROM 1960 TO THE PRESENT		5. Report Date September 1975	
		6. Performing Organization Code TSC-220	
7. Author(s) Helen Condell and Rita Folan		8. Performing Organization Report No. DOT-TSC-OST-74-43	
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. OP-509/R5801	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Assistant Secretary for Policy, Plans and International Affairs Washington D C 20590		13. Type of Report and Period Covered Final Report Jan. 1960 - April 1974	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract <p>This report is a presentation and analysis of the monthly gas consumption data for each of the 50 states and the District of Columbia.</p> <p>The data, obtained from the Federal Highway Administration, covers the period from January 1960 through April 1974. Included is a series of charts containing a regression analysis performed on the selected data for each state, growth rates for each state, and a ranking of the states with respect to different parameters. Also included is a series of graphs depicting monthly gas consumption for each state.</p>			
<p>REPRODUCED BY:  U.S. Department of Commerce National Technical Information Service Springfield, Virginia 22161</p> <p>PRICES SUBJECT TO CHANGE</p>			
17. Key Words Gasoline Fuel Consumption		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages	22. Price

PREFACE

This document presents a technical and visual summary of FHWA gasoline data available from the years 1960 through 1974. The regression analysis performed on the data may be used along with the graphics section of the report to determine the reliability of the reporting systems of the various states with respect to time.

Research and analysis was provided by the Information Division at Transportation Systems Center (TSC); the graphs were produced with the aid of Zeta Plotter of Tymshare, Inc.

Robert Murphy, Raytheon Service Company, edited the report. V.M. Christiansen and C. Segerstedt, RSC, provided technical typing.



FIGURES

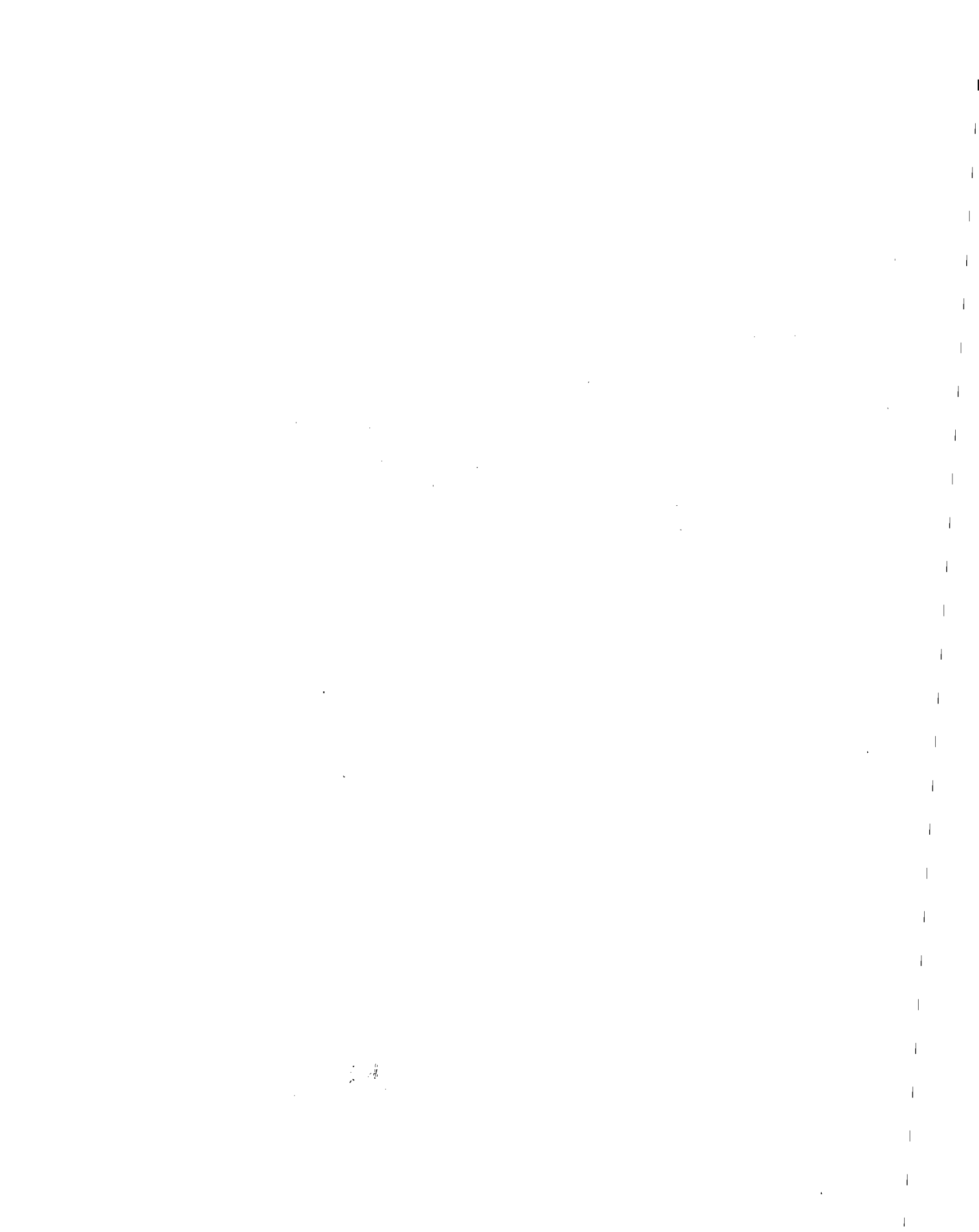
<u>Figure</u>		<u>Page</u>
1	Monthly Gas Consumption by State, Guide to Figures.....	13
2	Monthly Gas Consumption, California and New York.....	14
3	Monthly Gas Consumption, Texas and Ohio.....	15
4	Monthly Gas Consumption, Pennsylvania and Iowa.....	16
5	Monthly Gas Consumption, Illinois and New Jersey.....	17
6	Monthly Gas Consumption, Michigan and Indiana.....	18
7	Monthly Gas Consumption, Florida and Massachusetts.....	19
8	Monthly Gas Consumption, North Carolina and Washington.....	20
9	Monthly Gas Consumption, Georgia and Louisiana.....	21
10	Monthly Gas Consumption, Missouri and Nebraska.....	22
11	Monthly Gas Consumption, Virginia and Kentucky.....	23
12	Monthly Gas Consumption, Tennessee and Connecticut.....	24
13	Monthly Gas Consumption, Wisconsin and Kansas.....	25
14	Monthly Gas Consumption, Minnesota and Oklahoma.....	26

FIGURES (CONT.)

<u>Figure</u>		<u>Page</u>
15	Monthly Gas Consumption, Alabama and South Carolina.....	27
16	Monthly Gas Consumption, Maryland and Colorado.....	28
17	Monthly Gas Consumption, Oregon and South Dakota.....	29
18	Monthly Gas Consumption, Mississippi and West Virginia.....	30
19	Monthly Gas Consumption, Arizona and Rhode Island.....	31
20	Monthly Gas Consumption, Arkansas and Montana.....	32
21	Monthly Gas Consumption, New Mexico and Nevada.....	33
22	Monthly Gas Consumption, Utah and Wyoming...	34
23	Monthly Gas Consumption, Maine and Hawaii.....	35
24	Monthly Gas Consumption, North Dakota and Alaska.....	36
25	Monthly Gas Consumption, Idaho and Delaware.....	37
26	Monthly Gas Consumption, New Hampshire and Vermont.....	38
27	Monthly Gas Consumption, District of Columbia.....	39
28	Monthly Gas Consumption, United States.....	40

TABLES

<u>Table</u>		<u>Page</u>
1	RESULTS OF LINEAR REGRESSION ANALYSIS PERFORMED ON GAS CONSUMPTION TOTALS, JAN. 1960-DEC. 1972.....	2
2	ANNUAL GASOLINE CONSUMPTION GROWTH RATES.....	6
3	RANKING OF STATES ACCORDING TO 1960 AND 1972 GAS CONSUMPTION TOTALS AND COMPOUND GROWTH RATES, 1960-1972.....	9



1. INTRODUCTION AND SUMMARY

The following tables represent a presentation and analysis of the monthly gas consumption data for each of the 50 states, the District of Columbia and the United States as a whole. The data was obtained from the Federal Highway Administration (FHWA) Highway Statistics Division. From 1960 through 1972 the monthly gas consumption totals for each state were computed by subtracting the monthly totals on FHWA Table MF-25 (Highway Use of Special Fuels by Month) from the corresponding totals in Table MF-22 (Total Motor Fuel Consumption by Months). These tables are issued annually in the FHWA publication of Highway Statistics. From January 1973 through April 1974* the monthly gas consumption data was taken from FHWA Table MF-33G (Comparison of Gross Gallons of Motor Gasoline Sold by Month and Year from Available States), a new report issued periodically by FHWA. This data is comparable to the previous data from 1960 through 1972.

The first table contains the results of a linear regression analysis performed on the monthly gas consumption totals from January 1960 to December 1972 for each of the 50 states, the District of Columbia, and the United States as a whole. The range January 1960 to December 1972 was chosen so that any gross fluctuations in gas consumption that might have occurred in late 1973 and early 1974 would not affect the regress. Column one contains the slope of the regression line given in gal/mo per year. Column two contains the y-intercept of the regression line in gallons at time t=January, 1960. Column three contains the standard error of the estimate in gallons/month which measures the amount of deviation of the observed points from the estimated points of the regression line.

Confidence intervals for each regression line can be found from this data (col. 1-3). These confidence intervals are in actuality hyperbolic curves sketched on either side of the regression range. However, the curves about the observed points on which the regression is performed are essentially linear. In our case, the regression included

*Missing April 1974 data for Alaska, Illinois, Iowa, New Jersey, Oklahoma and Wyoming.

TABLE 1. RESULTS OF LINEAR REGRESSION ANALYSIS PERFORMED
ON GAS CONSUMPTION TOTALS, JAN. 1960 - DEC. 1972

REGRESSION ANALYSIS

STATE		SLOPE IN	INTERCEPT	STANDARD
		GAL/MO PER YEAR	AT t=60	ERROR
		1	2	3
ALABAMA	(27)*	5354.3	75408	7160.6
ALASKA	(36)	334.2	7272	3341.2
ARIZONA	(31)	3827.6	36156	5360.5
ARKANSAS	(32)	3382.9	46354	6559.1
CALIFORNIA	(14)	30059.0	442640	33800.0
COLORADO	(28)	3951.4	51350	10600.0
CONNECTICUT	(24)	3932.2	60742	5102.3
DELAWARE	(37)	729.7	14377	1886.7
DISTRICT OF COLUMBIA	(39)	315.7	16811	848.9
FLORIDA	(19)	13595.0	129940	19400.0
GEORGIA	(21)	9516.1	91876	10900.0
HAWAII	(35)	390.3	15391	2728.5
IDAHO	(37)	1196.7	21626	5321.4
ILLINOIS	(17)	11884.0	254460	23400.0
INDIANA	(18)	6906.1	136766	15900.0
IOWA	(16)	3449.2	93762	23300.0
KANSAS	(25)	2496.3	77906	12000.0
KENTUCKY	(23)	5101.9	66844	8426.6
LOUISIANA	(21)	5225.3	70588	8914.7

* Numbers refer to page on which graph of state appears.
(e.g. Alabama appears on page 27)

TABLE 1. RESULTS OF LINEAR REGRESSION ANALYSIS PERFORMED
ON GAS CONSUMPTION TOTALS, JAN. 1960 - DEC. 1972
(CONTINUED)

REGRESSION ANALYSIS				
STATE		SLOPE IN		STANDARD ERROR
		GAL/MO PER		
		YEAR	INTERCEPT AT t=60	
		1	2	3
MAINE	(35)	1279.1	25989	5738.1
MARYLAND	(28)	6043.4	68014	7347.2
MASSACHUSETTS	(14)	5911.4	112734	10500.0
MICHIGAN	(18)	13608.0	207140	23200.0
MINNESOTA	(26)	5190.5	102140	17900.0
MISSISSIPPI	(30)	3656.6	48936	6645.8
MISSOURI	(22)	6577.5	129990	15100.0
MONTANA	(32)	833.9	24135	8041.6
NEBRASKA	(22)	1772.3	48477	8090.9
NEVADA	(33)	1380.3	12021	3406.5
NEW HAMPSHIRE	(38)	1361.8	14080	3394.4
NEW JERSEY	(17)	7749.4	155014	15300.0
NEW MEXICO	(33)	1683.0	30035	4770.9
NEW YORK	(14)	12960.0	330130	35200.0
NORTH CAROLINA	(20)	8463.3	112008	12800.0
NORTH DAKOTA	(36)	667.8	25131	9527.9
OHIO	(15)	12560.0	244080	21000.0
OKLAHOMA	(26)	4102.1	71816	7904.8
OREGON	(29)	3528.5	52110	9408.4

TABLE 1. RESULTS OF LINEAR REGRESSION ANALYSIS PERFORMED
ON GAS CONSUMPTION TOTALS, JAN. 1960 - DEC. 1972
(CONTINUED)

STATE		SLOPE IN	INTERCEPT	STANDARD
		GAL/MO PER YEAR	AT t=60	ERROR
		1	2	3
PENNSYLVANIA	(16)	11428.0	250170	35600.0
RHODE ISLAND	(31)	921.1	18666	2269.3
SOUTH CAROLINA	(27)	4606.6	53316	6847.5
SOUTH DAKOTA	(29)	735.7	28261	6512.8
TENNESSEE	(24)	6340.8	85488	11000.0
TEXAS	(15)	20857.0	283500	28600.0
UTAH	(34)	1846.2	24155	4729.3
VERMONT	(38)	791.8	9677	2071.2
VIRGINIA	(23)	7920.1	89476	12500.0
WASHINGTON	(20)	4867.7	74422	11300.0
WEST VIRGINIA	(30)	1831.3	36471	4998.9
WISCONSIN	(25)	5619.6	101936	16900.0
WYOMING	(34)	716.6	13797	5603.2
UNITED STATES	(40)	282380.0	4559800	459000.0

gas consumption totals only through 1972. Since we are dealing with only 14 additional months, hence 14 additional observation points, the confidence interval bands will be approximately linear throughout. For example, a 95% confidence interval about a regression line for a specified state can be constructed by multiplying the standard error of the estimate for that state by 1.96 and adding + that value to each regression point (e.g. $R.P. + 1.96 \overline{S.E.}$). The regression points are found by multiplying the slope of the regression line by the time (in years of this century) minus 60 and adding this to the y-intercept at $t=60$ (e.g. $R.P = y + m(x-60)$). These two lines could then be extended to include all of the data given, that is, through April 1974. Since a 95% confidence interval implies that each gas consumption figure has a 95% probability of falling within the specified range, it can then be seen whether or not any gross deviations in gas consumption occur and where. (For an illustration of this process, see the accompanying figure for California on page 13.)

The second table represents yearly gasoline consumption growth rates for each of the states, the District of Columbia, and the United States as a whole. Column one gives the compound growth rate for 1960 through 1972, which measures the constant percentage by which gas consumption increases each year. This rate was computed by taking the formula for compound growth $P(1+r)^n + A$ and solving for the rate: $r = \sqrt[n]{\frac{A}{P}} - 1$. Here A is the annual consumption total for 1972, P is the total for the initial year 1960 and $n=13$, the total number of years under consideration. Columns two and three represent the gas consumption growth rates for the years 1972 and 1973, that is the percent increase or decrease in gas consumption from one year to the next.

The third table represents a ranking of the states with respect to different parameters. Column one has the states ranked according to the 1960 gas consumption totals, column two according to the 1972 totals, and column three according to the compound growth rates for 1960-1972. (See second table, column one.)

TABLE 2. ANNUAL GASOLINE CONSUMPTION GROWTH RATES

STATE		COMPOUND	GROWTH RATE	GROWTH RATE	GROWTH RATE
		GROWTH RATE	1972 (IN %)	1973 (IN %)	
		60-72 (IN %)	1	2	3
ALABAMA	(27)*	4.5	6.5	5.5	
ALASKA	(36)	4.5	2.9	-1.2	
ARIZONA	(31)	5.9	1.2	8.8	
ARKANSAS	(32)	4.8	9.0	4.7	
CALIFORNIA	(14)	4.4	6.8	2.7	
COLORADO	(28)	4.8	9.1	4.2	
CONNECTICUT	(24)	4.1	5.4	0.8	
DELAWARE	(37)	3.9	7.1	5.8	
DISTRICT OF COLUMBIA	(39)	1.4	-0.05	6.4	
FLORIDA	(19)	5.8	1.1	1.1	
GEORGIA	(21)	5.6	8.2	5.9	
HAWAII	(35)	1.5	6.3	5.8	
IDAHO	(37)	3.6	6.1	5.4	
ILLINOIS	(17)	3.1	5.7	7.1	
INDIANA	(18)	3.3	5.9	4.3	
IOWA	(16)	2.4	3.5	9.1	
KANSAS	(25)	2.5	7.2	1.8	
KENTUCKY	(23)	4.6	5.8	4.7	
LOUISIANA	(21)	4.6	9.2	5.5	

TABLE 2. ANNUAL GASOLINE CONSUMPTION GROWTH RATES (CONTINUED)

STATE		COMPOUND	GROWTH RATE	GROWTH RATE	GROWTH RATE
		60-72 (IN %)	1972 (IN %)	1973 (IN %)	
		1	2	3	
MAINE	(35)	3.3	5.9	2.2	
MARYLAND	(28)	5.2	7.0	4.2	
MASSACHUSETTS	(19)	3.6	6.2	2.7	
MICHIGAN	(18)	4.0	6.4	3.0	
MINNESOTA	(26)	3.2	4.6	2.9	
MISSISSIPPI	(30)	4.6	9.1	2.5	
MISSOURI	(22)	3.3	4.8	3.3	
MONTANA	(32)	2.6	7.6	7.1	
NEBRASKA	(22)	2.7	6.4	2.8	
NEVADA	(33)	6.9	10.5	5.8	
NEW HAMPSHIRE	(38)	5.2	5.9	2.9	
NEW JERSEY	(17)	3.6	9.0	1.8	
NEW MEXICO	(33)	3.9	7.1	7.1	
NEW YORK	(14)	2.7	3.5	3.4	
NORTH CAROLINA	(20)	4.8	8.7	4.1	
NORTH DAKOTA	(36)	2.1	4.8	4.9	
OHIO	(15)	3.3	5.6	5.0	
OKLAHOMA	(26)	3.9	6.8	12.0	
OREGON	(29)	4.4	6.8	3.2	

TABLE 2. ANNUAL GASOLINE CONSUMPTION GROWTH RATES (CONTINUED)

STATE		COMPOUND	GROWTH RATE	GROWTH RATE	GROWTH RATE
		GROWTH RATE	1972 (IN %)	1973 (IN %)	1973 (IN %)
		60-72 (IN %)	2	3	
		1			
PENNSYLVANIA	(16)	3.2	8.8	-1.8	
RHODE ISLAND	(31)	3.3	5.4	1.2	
SOUTH CAROLINA	(27)	5.0	8.3	5.3	
SOUTH DAKOTA	(29)	2.2	5.8	2.2	
TENNESSEE	(24)	4.7	9.2	7.9	
TEXAS	(15)	4.6	7.2	7.2	
UTAH	(34)	4.7	9.1	4.5	
VERMONT	(38)	4.7	7.1	0.28	
VIRGINIA	(23)	4.9	7.1	5.6	
WASHINGTON	(20)	3.8	4.1	4.3	
WEST VIRGINIA	(30)	3.3	3.4	6.9	
WISCONSIN	(25)	3.5	6.6	2.7	
WYOMING	(34)	3.5	8.8	4.8	
UNITED STATES	(40)	4.4	6.9	5.0	

TABLE 3. RANKING OF STATES ACCORDING TO 1960 AND 1972 GAS CONSUMPTION TOTALS AND COMPOUND GROWTH RATES, 1960 - 1972

STATE	1960		1972		COMPOUND GROWTH RATES: 60-72
	TOTAL GAS CONSUMPTION		TOTAL GAS CONSUMPTION		
	1		2		3
ALABAMA (27)*	20		20		19
ALASKA (36)	51 (LOW)		51 (LOW)		23
ARIZONA (31)	34		33		2
ARKANSAS (32)	33		32		9
CALIFORNIA (14)	1 (HIGH)		1 (HIGH)		20
COLORADO (28)	29		29		11
CONNECTICUT (24)	27		28		22
DELAWARE (32)	48		46		26
DISTRICT OF COLUMBIA (39)	46		50		51 (LOW)
FLORIDA (19)	9		8		3
GEORGIA (21)	16		13		4
HAWAII (35)	44		48		50
IDAHO (37)	42		40		29
ILLINOIS (17)	5		6		42
INDIANA (18)	10		10		37
IOWA (16)	18		22		47
KANSAS (25)	22		27		46
KENTUCKY (23)	26		24		16
LOUISIANA (21)	23		21		17

TABLE 3. RANKING OF STATES ACCORDING TO 1960 AND 1972 GAS CONSUMPTION TOTALS AND COMPOUND GROWTH RATES, 1960 - 1972 (CONTINUED)

STATE	1960		1972		COMPOUND GROWTH RATES: 60-72
		TOTAL GAS CONSUMPTION		TOTAL GAS CONSUMPTION	
		1		2	3
MAINE	(35)	38		38	38
MARYLAND	(28)	25		19	6
MASSACHUSETTS	(19)	13		15	30
MICHIGAN	(18)	7		7	24
MINNESOTA	(26)	14		18	40
MISSISSIPPI	(30)	31		31	15
MISSOURI	(22)	11		12	34
MONTANA	(32)	41		41	45
NEBRASKA	(22)	32		34	43
NEVADA	(33)	49		45	1 (HIGH)
NEW HAMPSHIRE	(38)	45		43	5
NEW JERSEY	(17)	8		9	31
NEW MEXICO	(33)	36		36	25
NEW YORK	(14)	2		3	44
NORTH CAROLINA	(20)	12		11	10
NORTH DAKOTA	(36)	40		42	49
OHIO	(15)	6		5	36
OKLAHOMA	(26)	24		25	27
OREGON	(29)	30		30	21

TABLE 3. RANKING OF STATES ACCORDING TO 1960 AND 1972 GAS CONSUMPTION TOTALS AND COMPOUND GROWTH RATES, 1960 - 1972 (CONTINUED)

STATE		1960	1972	COMPOUND
		TOTAL GAS CONSUMPTION	TOTAL GAS CONSUMPTION	GROWTH RATES: 60-72
		1	2	3
PENNSYLVANIA	(16)	4	4	41
RHODE ISLAND	(31)	43	44	35
SOUTH CAROLINA	(27)	28	26	7
SOUTH DAKOTA	(29)	37	39	48
TENNESSEE	(24)	19	17	13
TEXAS	(15)	3	2	18
UTAH	(34)	39	37	14
VERMONT	(38)	50	49	12
VIRGINIA	(23)	17	14	8
WASHINGTON	(20)	21	23	28
WEST VIRGINIA	(30)	35	35	39
WISCONSIN	(25)	15	16	32
WYOMING	(34)	47	47	33
UNITED STATES	(40)			

Following the tables is a series of 25 figures (on pgs. 13-38) with two states per figure and two single figures, one representing the District of Columbia, (on pg. 39) and the other representing the United States as a whole (on pg. 40). Each figure has the monthly gas consumption totals for its respective states plotted against time with the y-axis scaled according to lowest and highest monthly gas consumption totals.

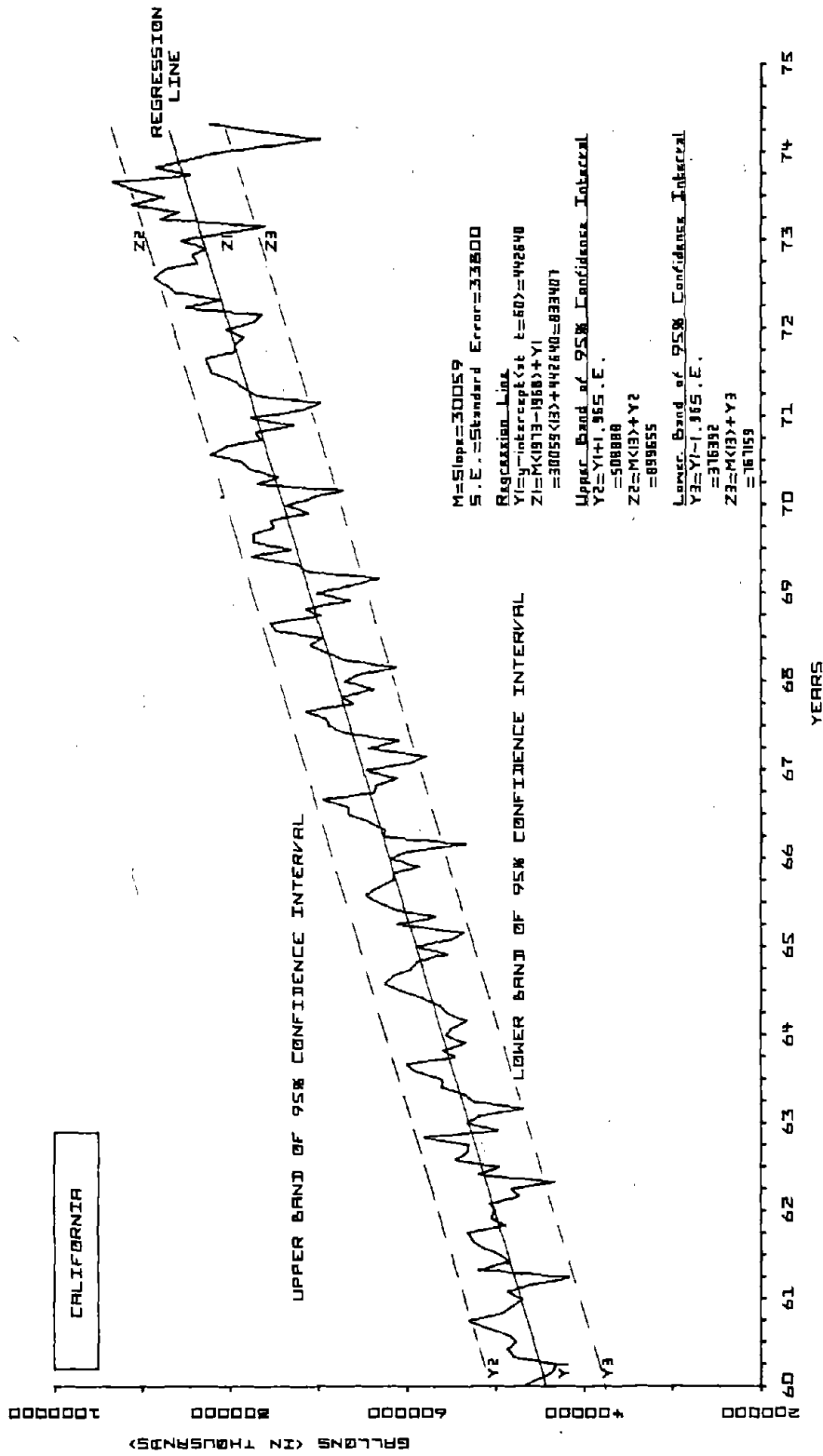


Figure 1. Monthly Gas Consumption by State, Guide to Figures

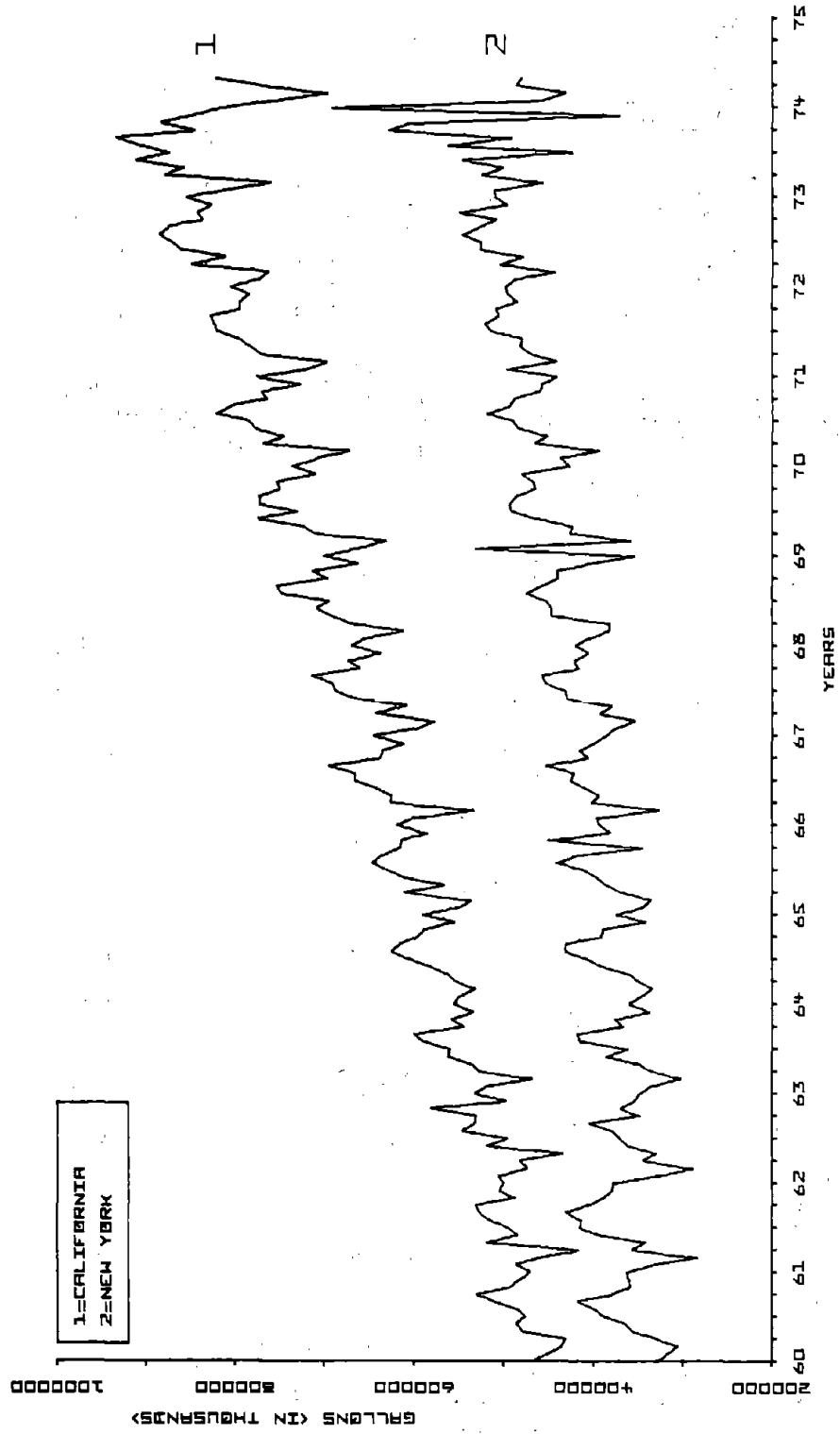


Figure 2. Monthly Gas Consumption, California and New York

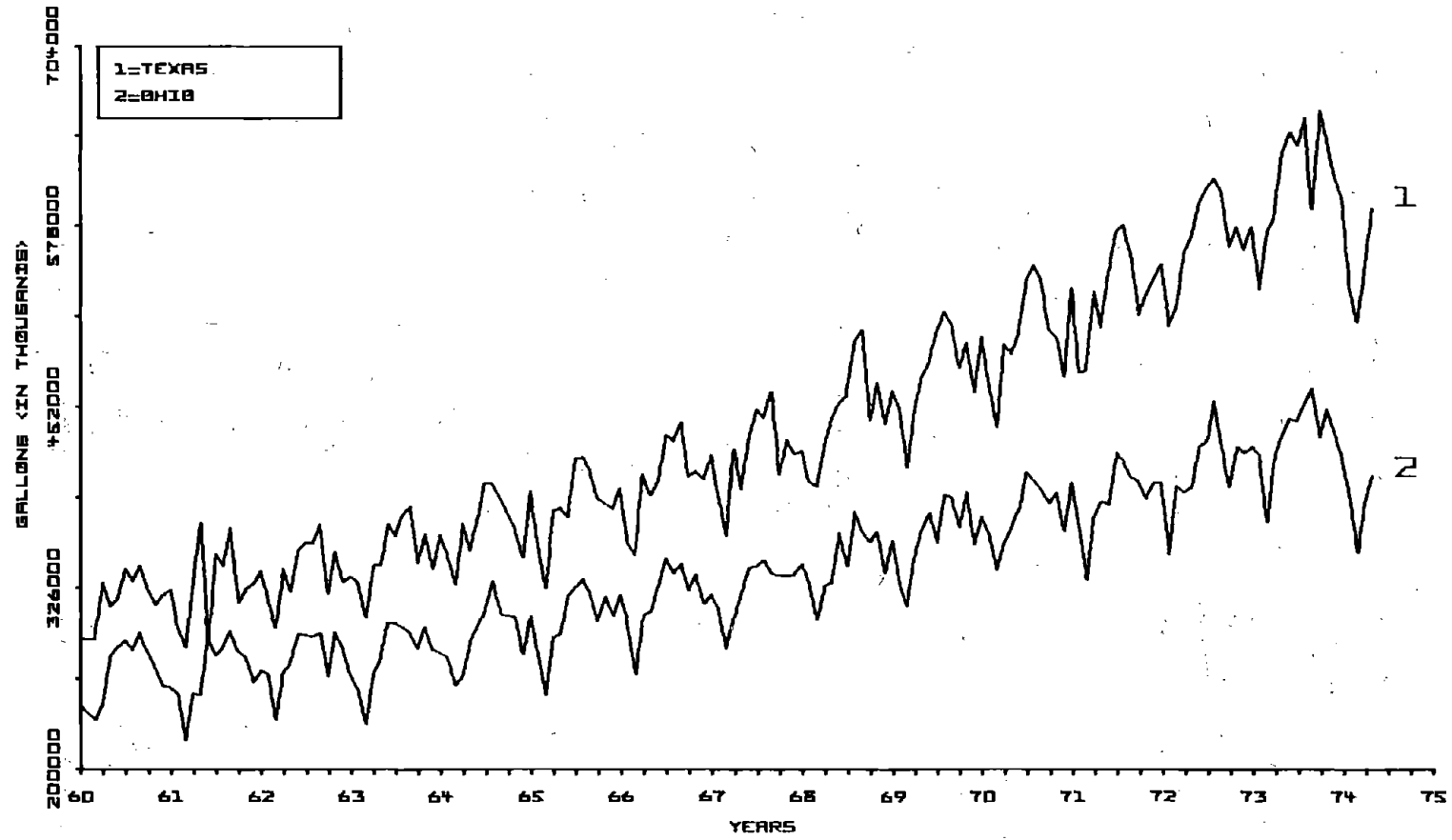


Figure 3. Monthly Gas Consumption, Texas and Ohio

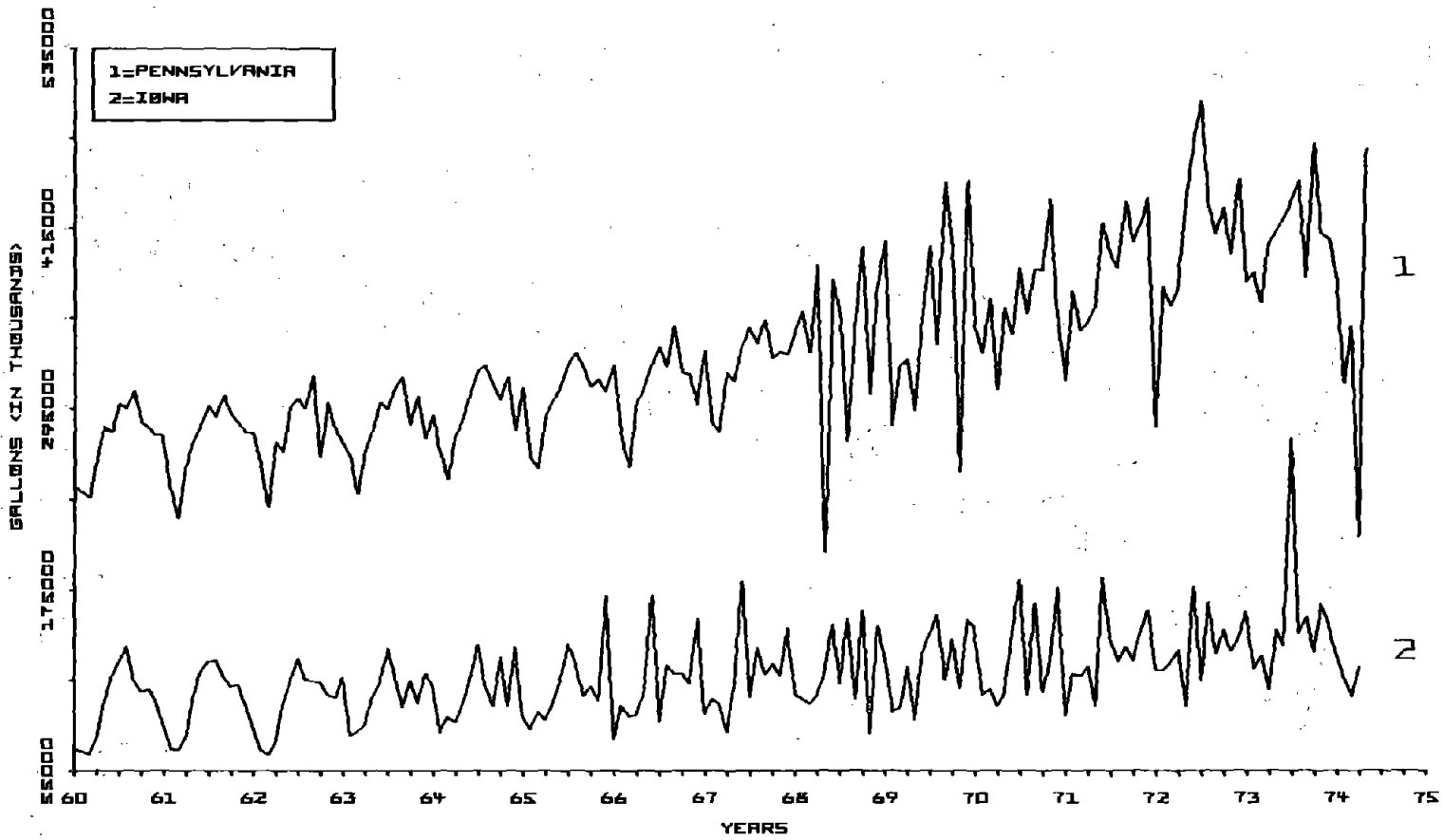


Figure 4. Monthly Gas Consumption, Pennsylvania and Iowa

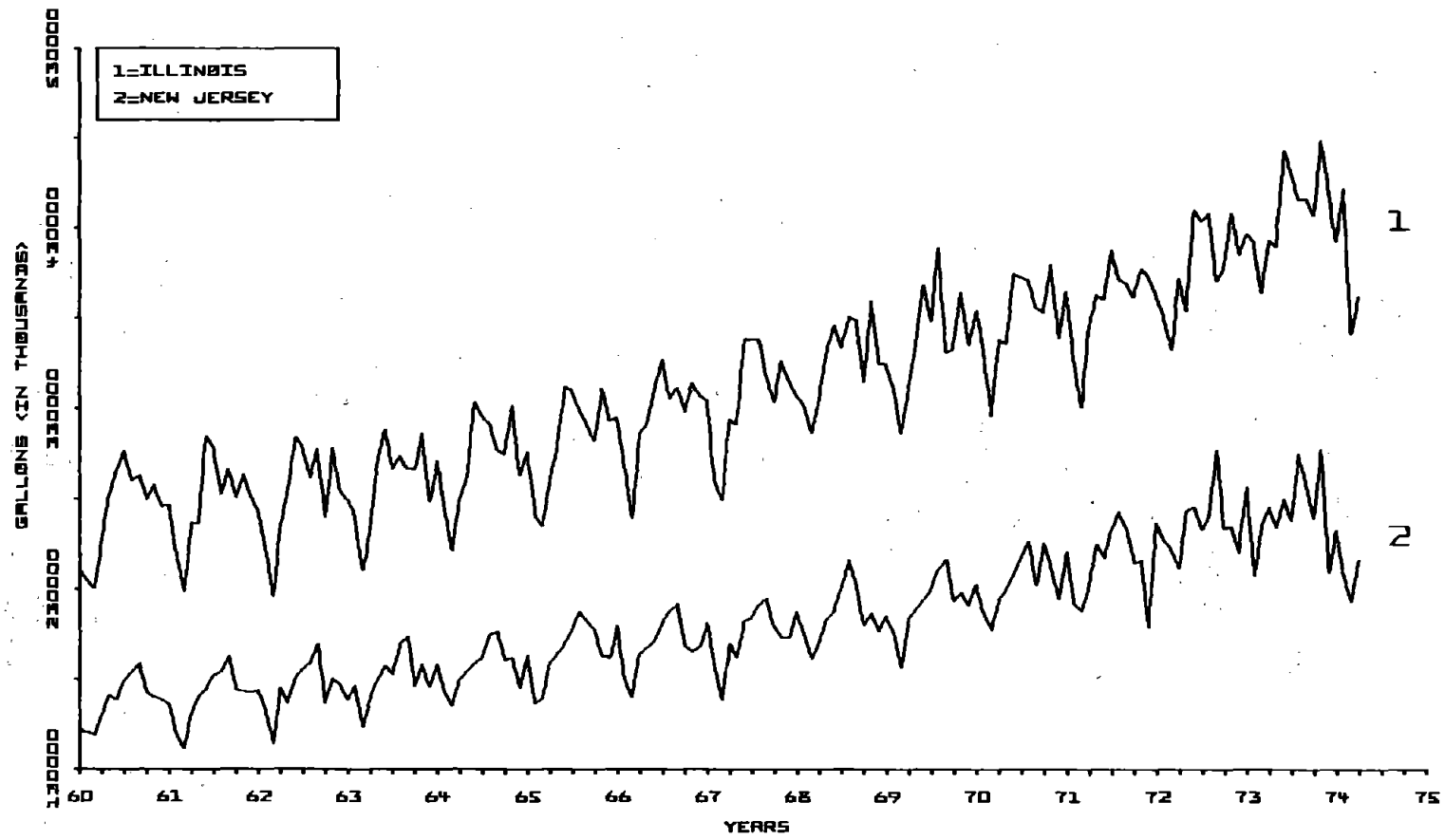


Figure 5. Monthly Gas Consumption, Illinois and New Jersey

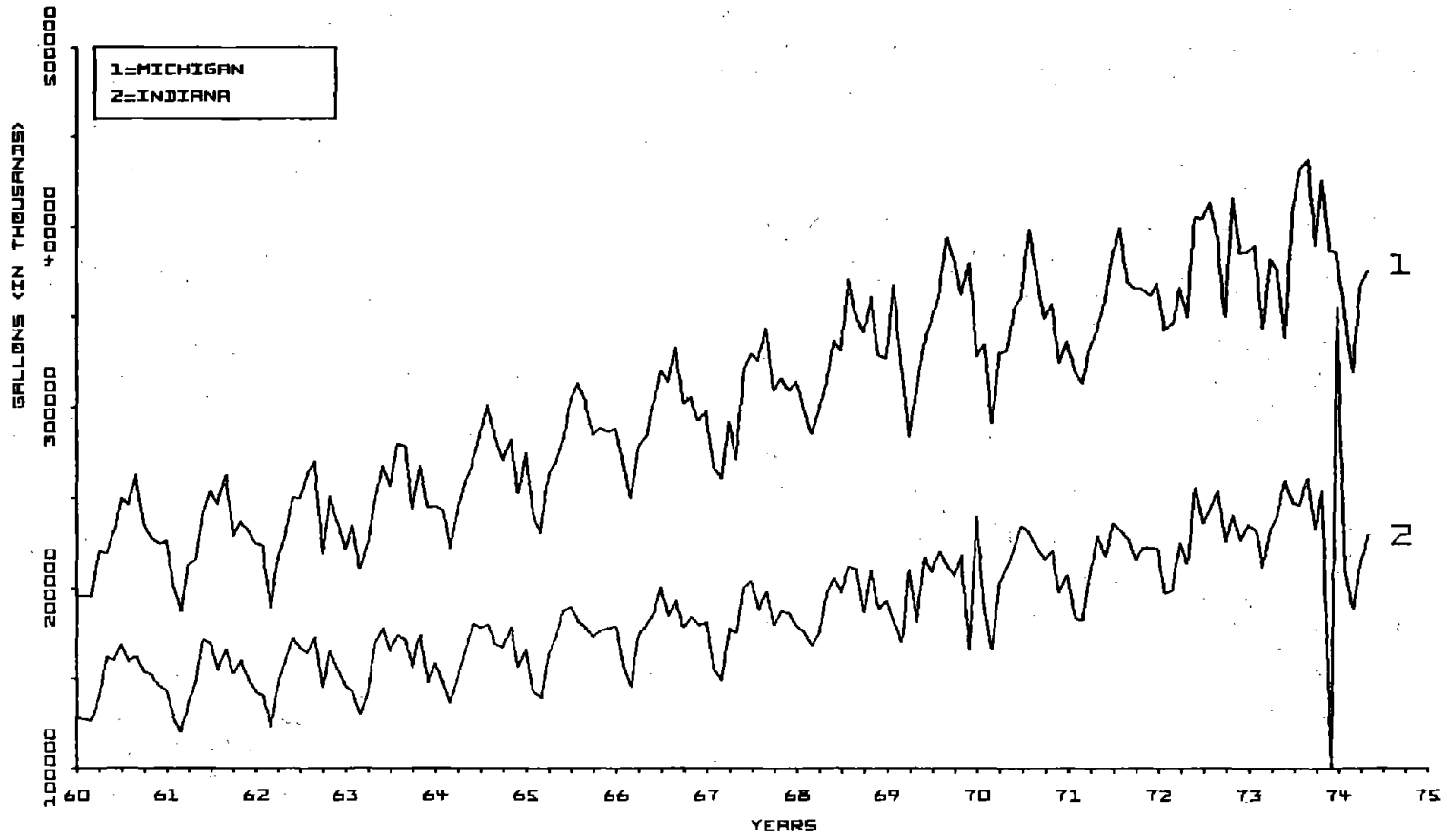


Figure 6. Monthly Gas Consumption, Michigan and Indiana

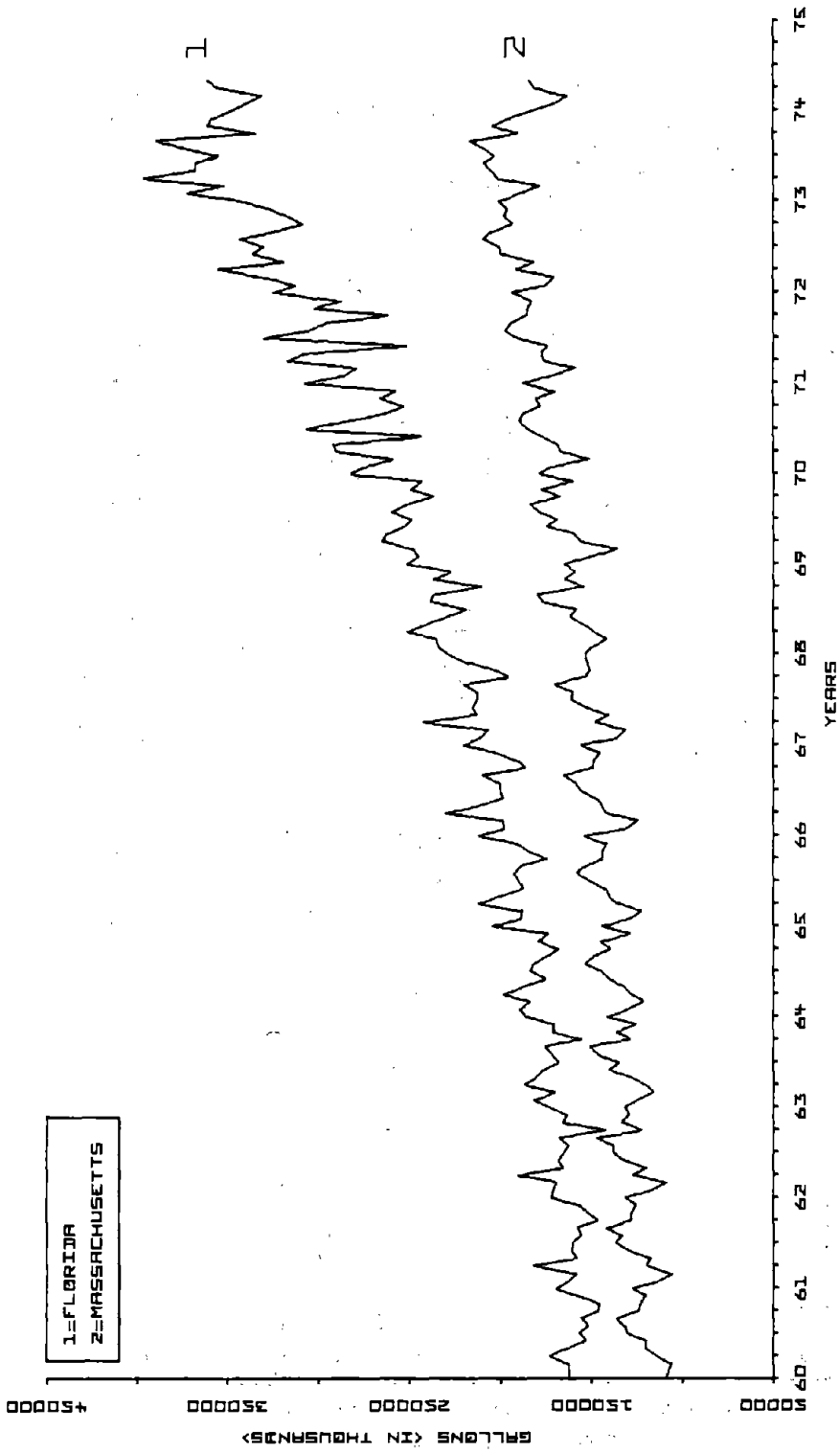


Figure 7. Monthly Gas Consumption, Florida and Massachusetts

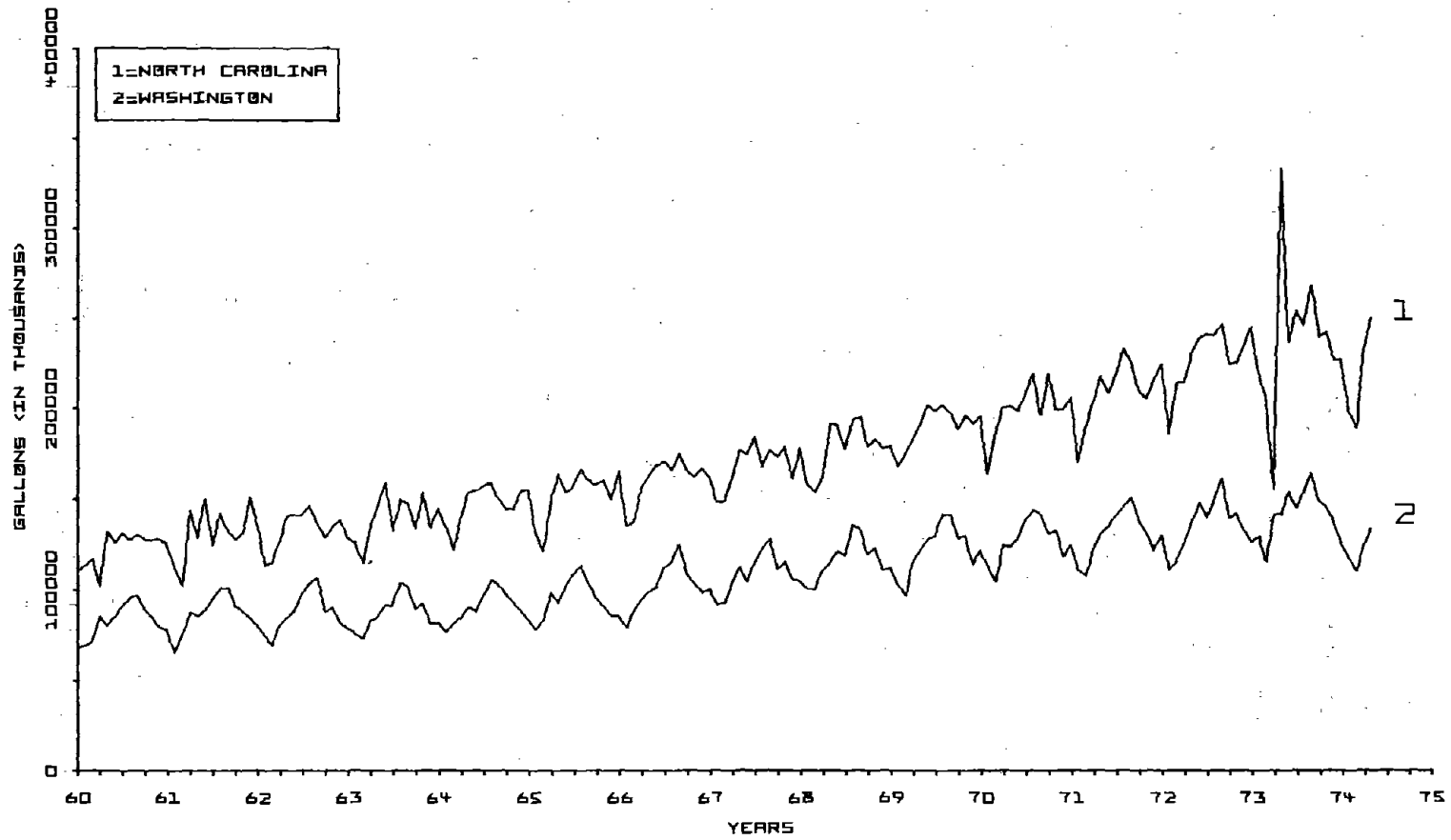


Figure 8. Monthly Gas Consumption, North Carolina and Washington

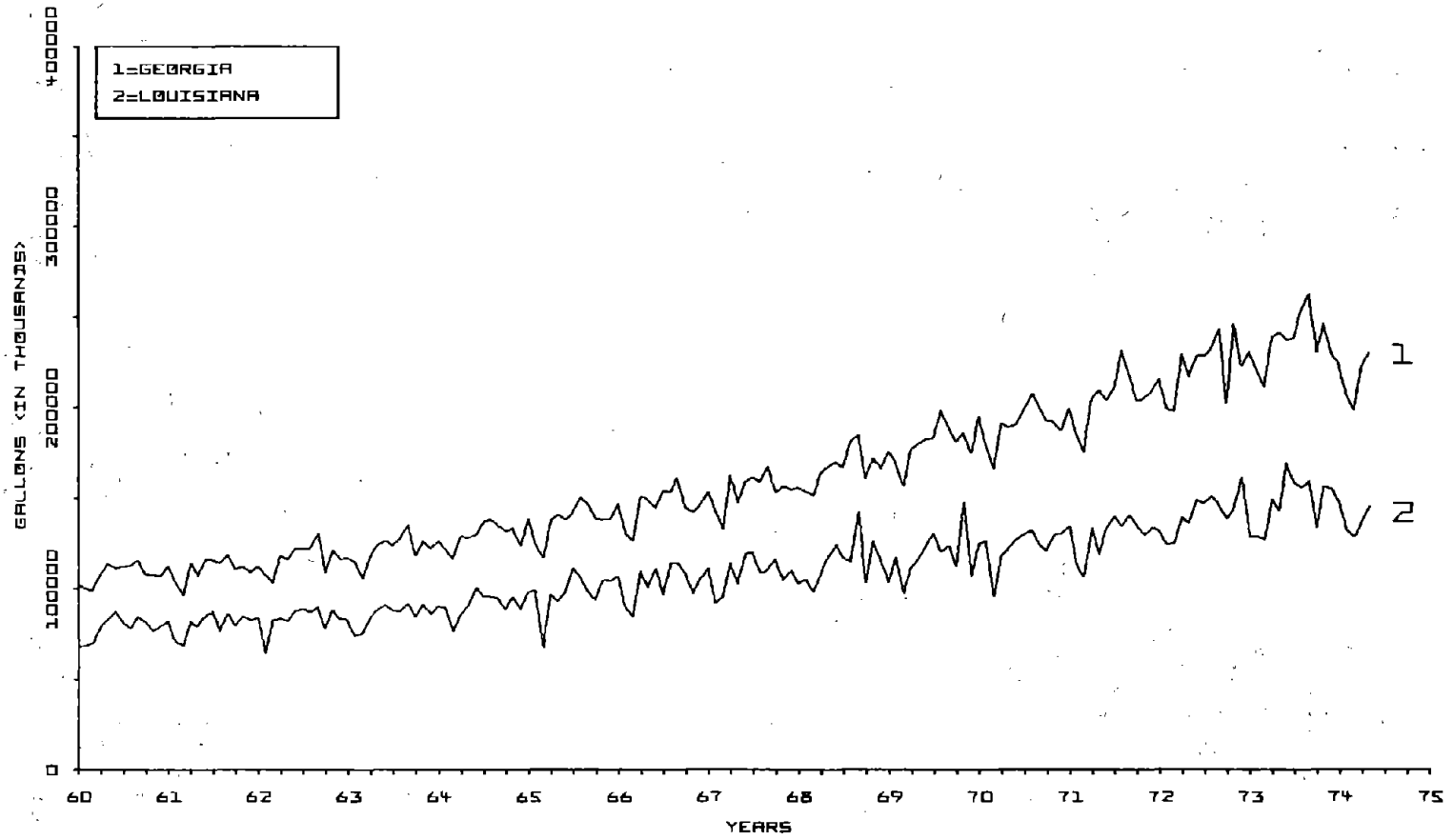


Figure 9. Monthly Gas Consumption, Georgia and Louisiana

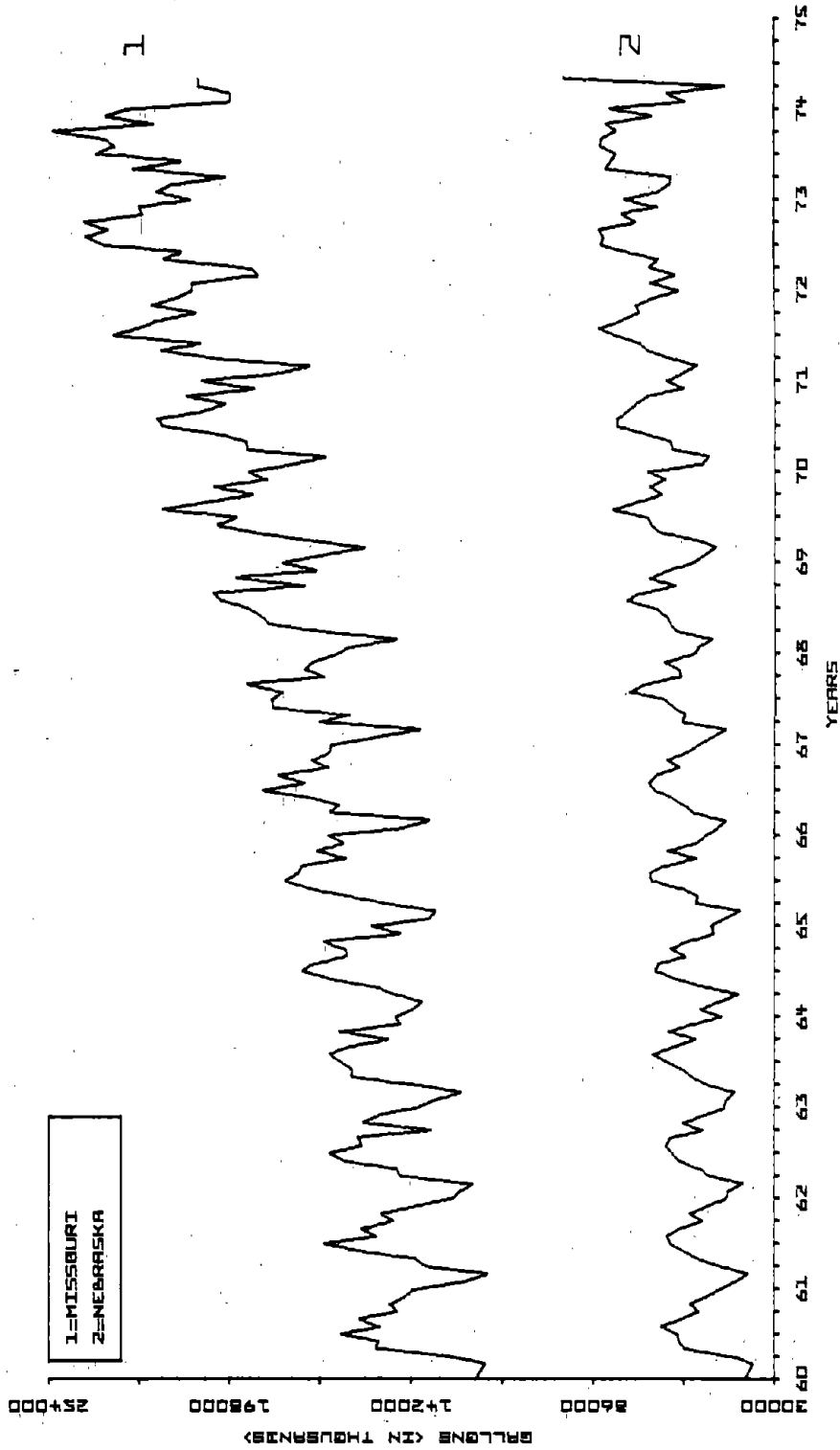


Figure 10. Monthly Gas Consumption, Missouri and Nebraska

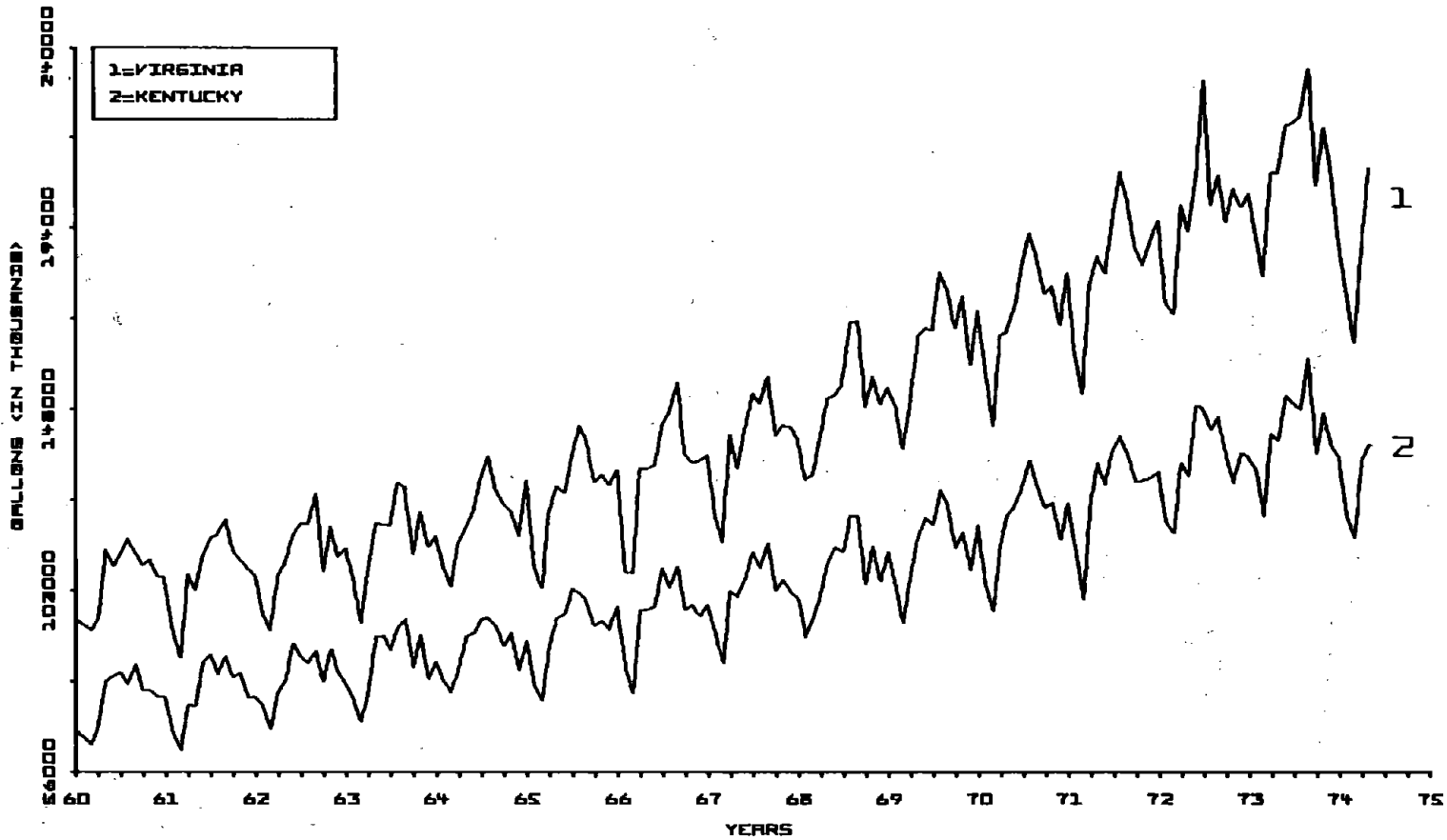


Figure 11. Monthly Gas Consumption, Virginia and Kentucky

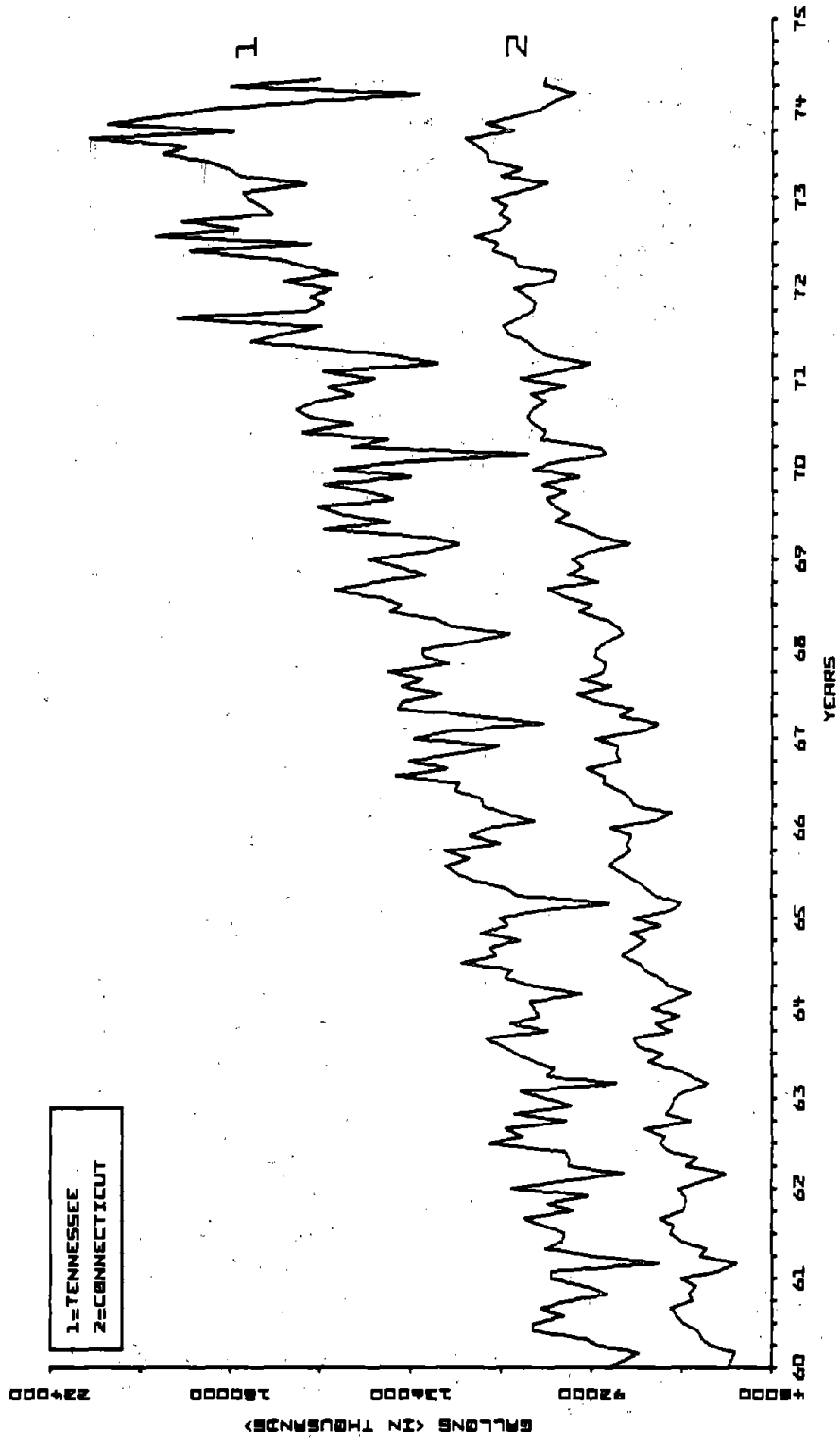


Figure 12. Monthly Gas Consumption, Tennessee and Connecticut

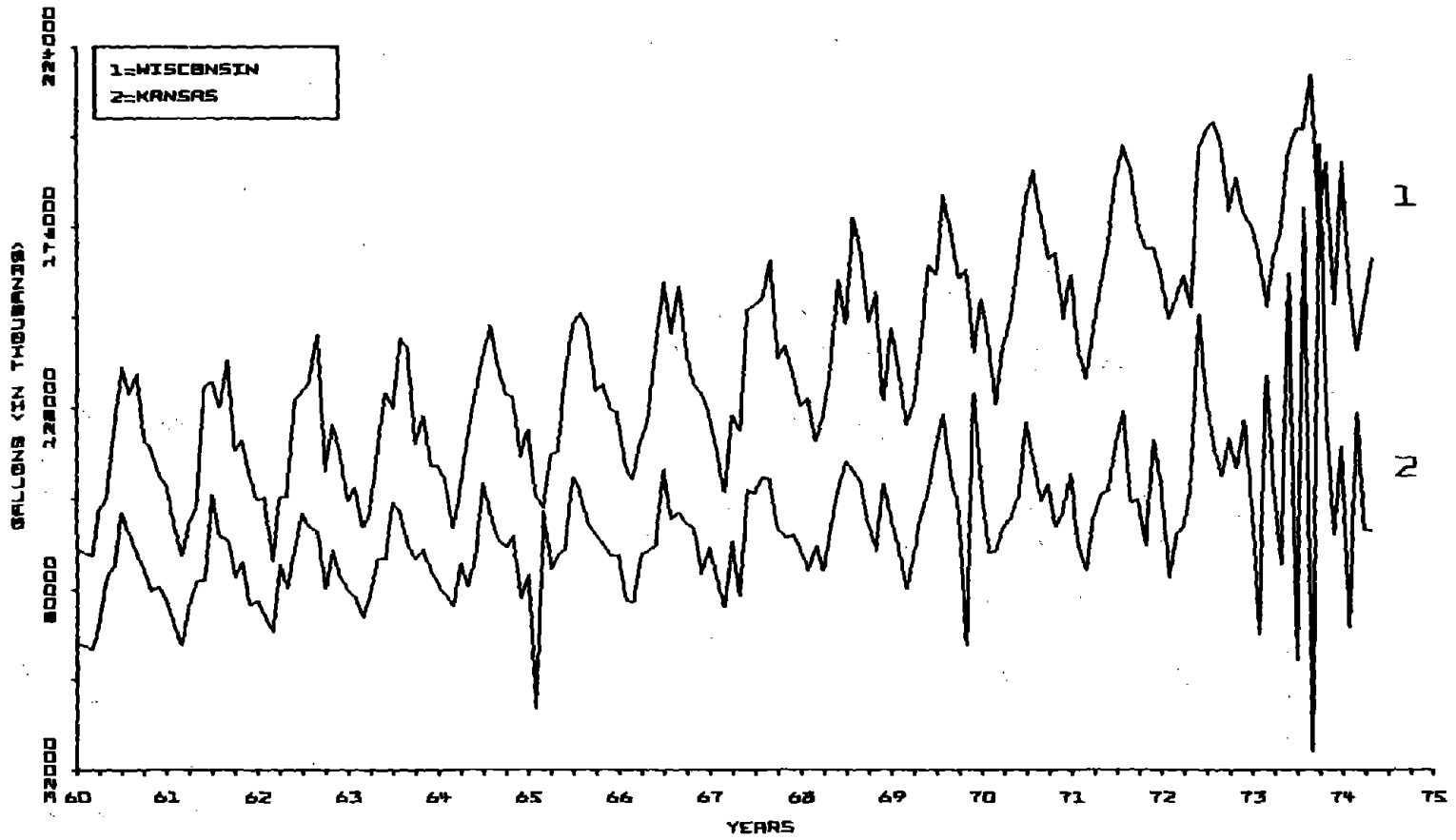


Figure 13. Monthly Gas Consumption, Wisconsin and Kansas

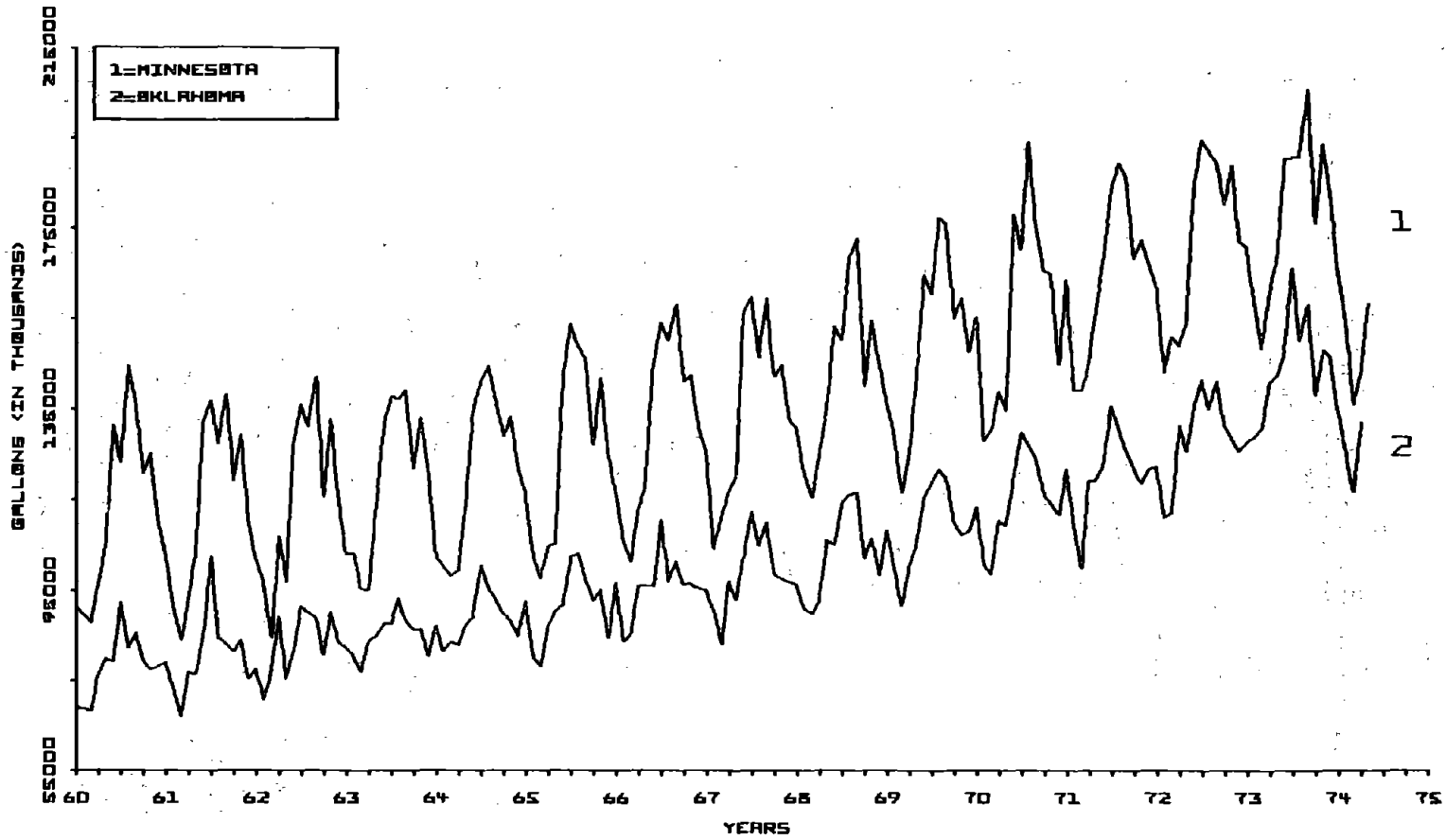


Figure 14. Monthly Gas Consumption, Minnesota and Oklahoma

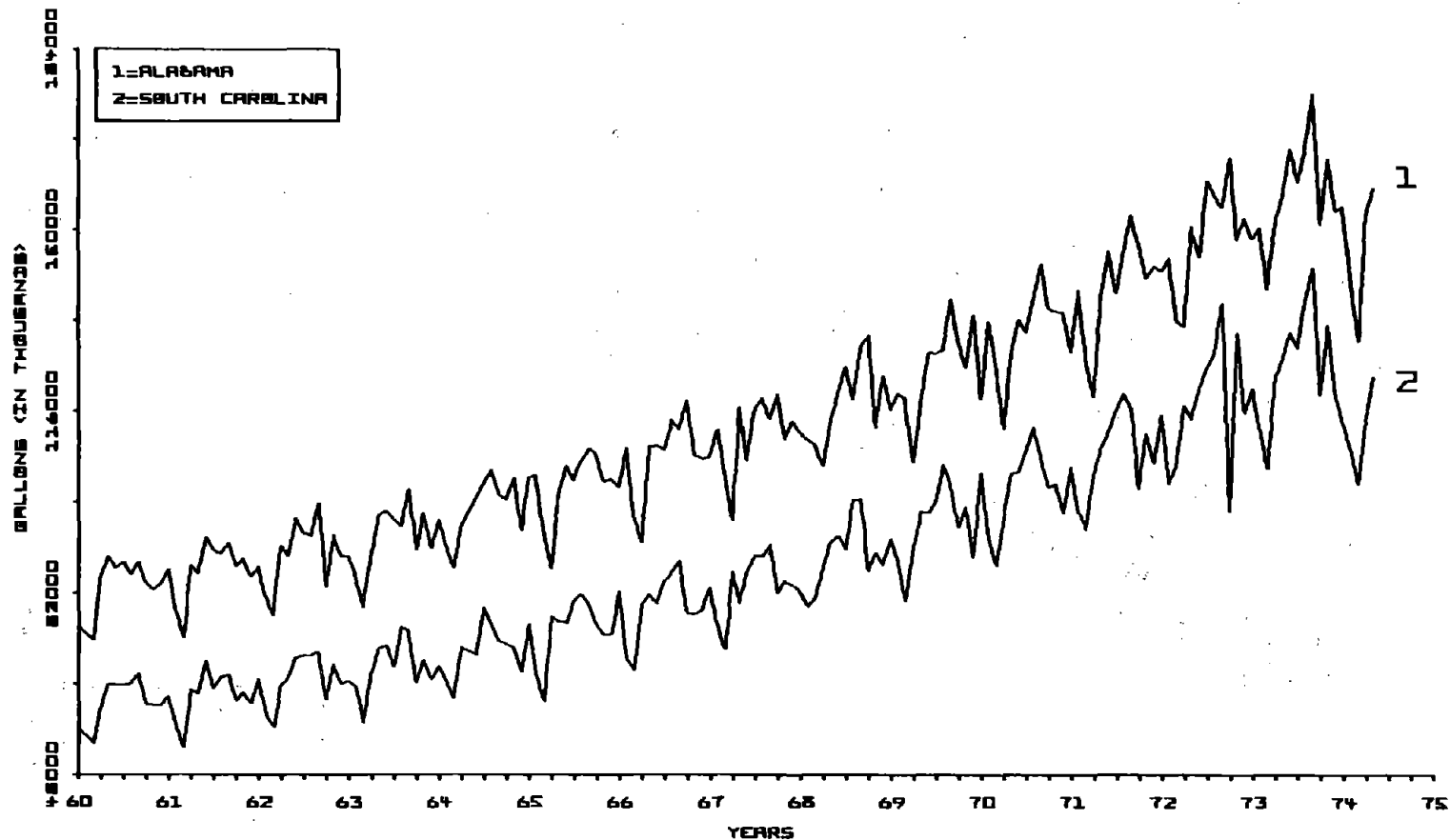


Figure 15. Monthly Gas Consumption, Alabama and South Carolina

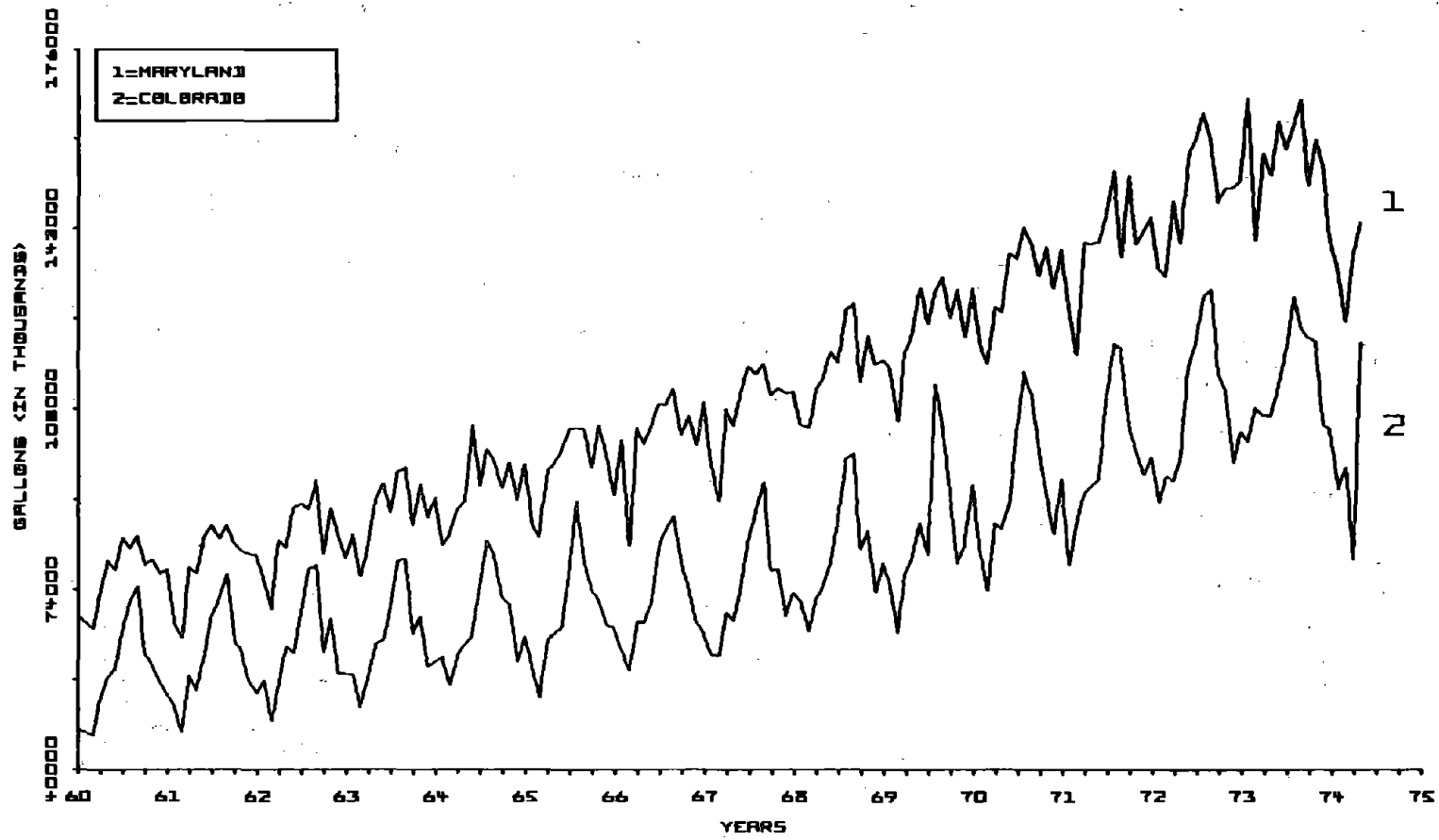


Figure 16. Monthly Gas Consumption, Maryland and Colorado

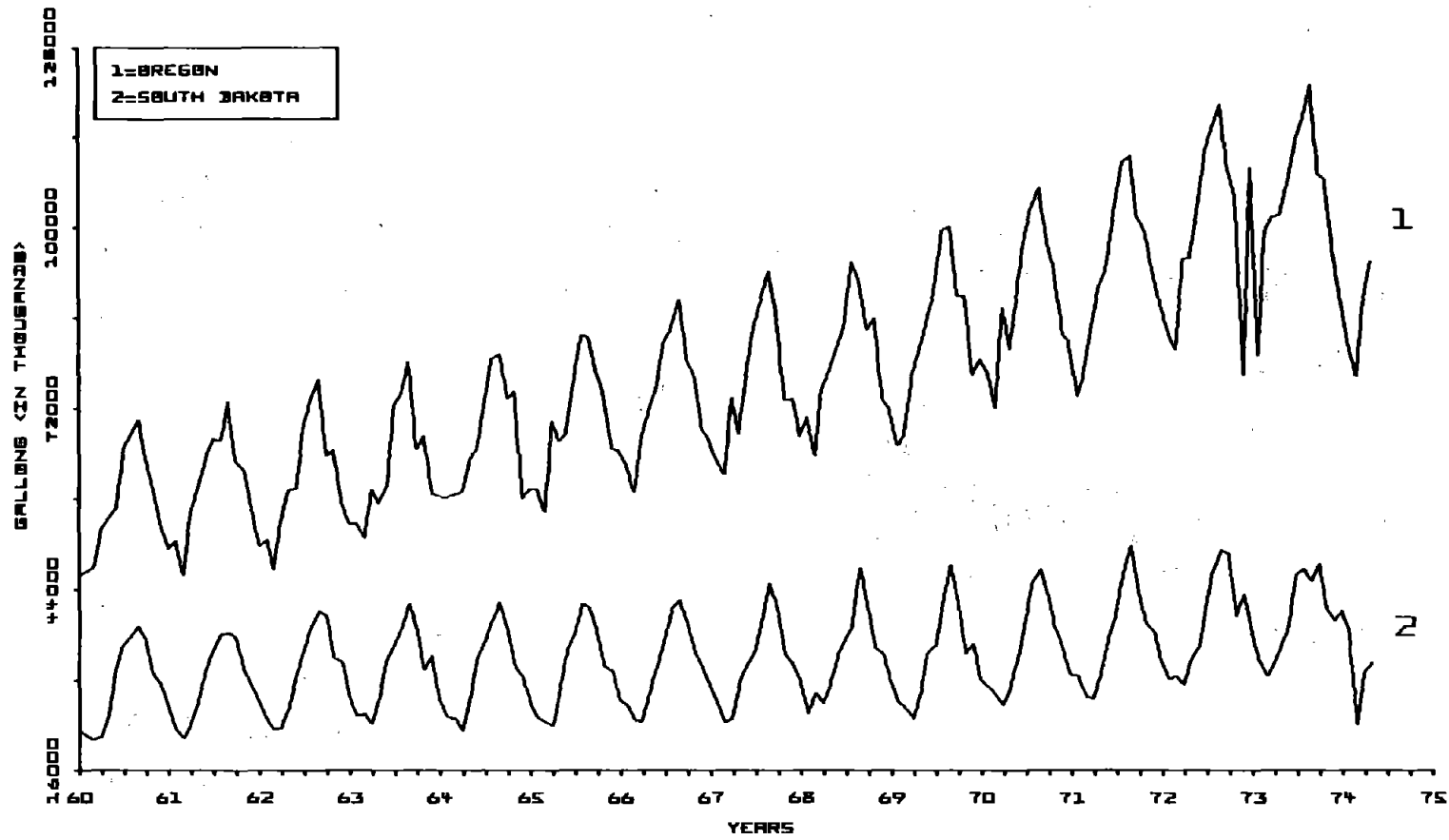


Figure 17. Monthly Gas Consumption, Oregon and South Dakota

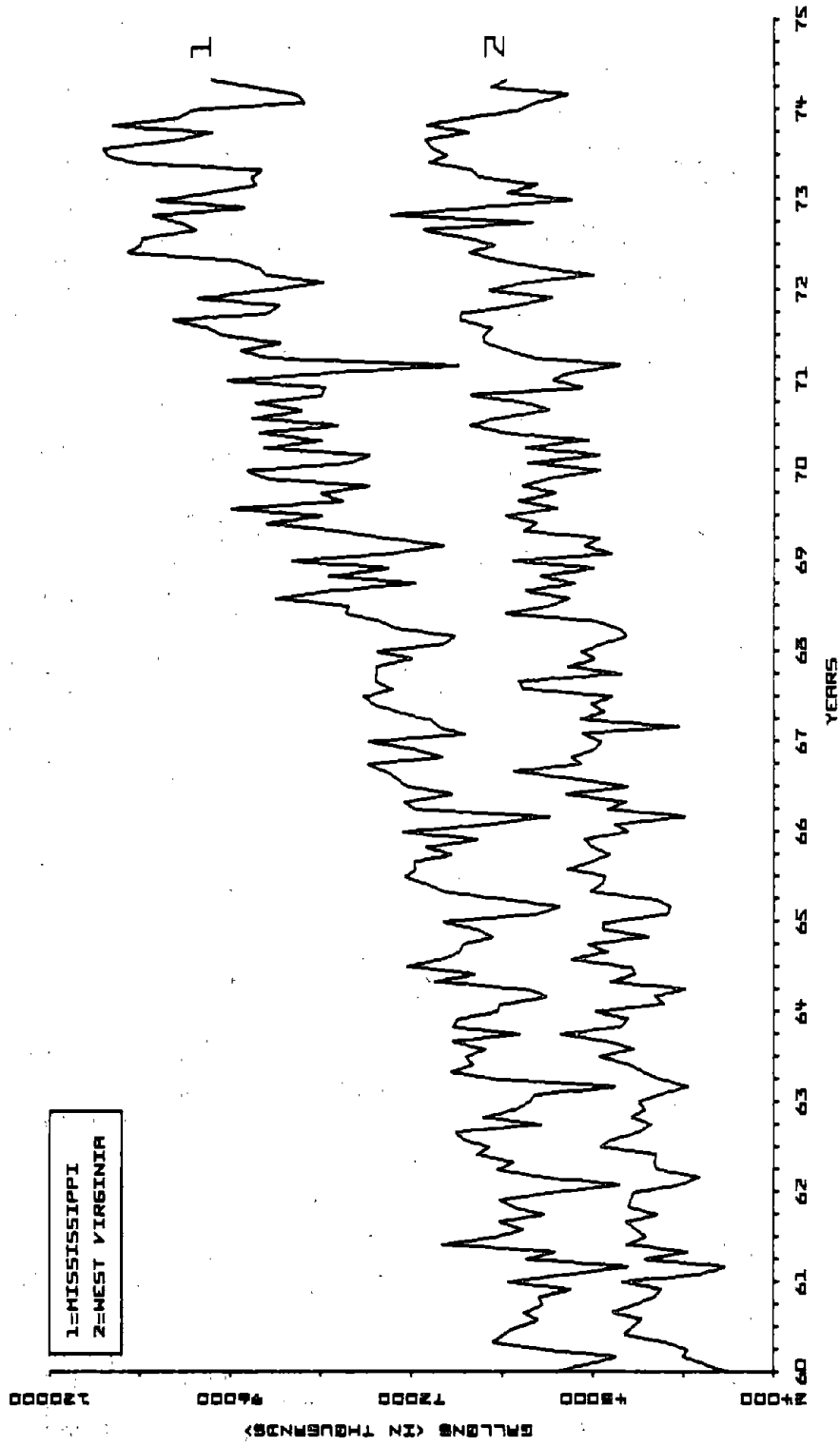


Figure 18. Monthly Gas Consumption, Mississippi and West Virginia

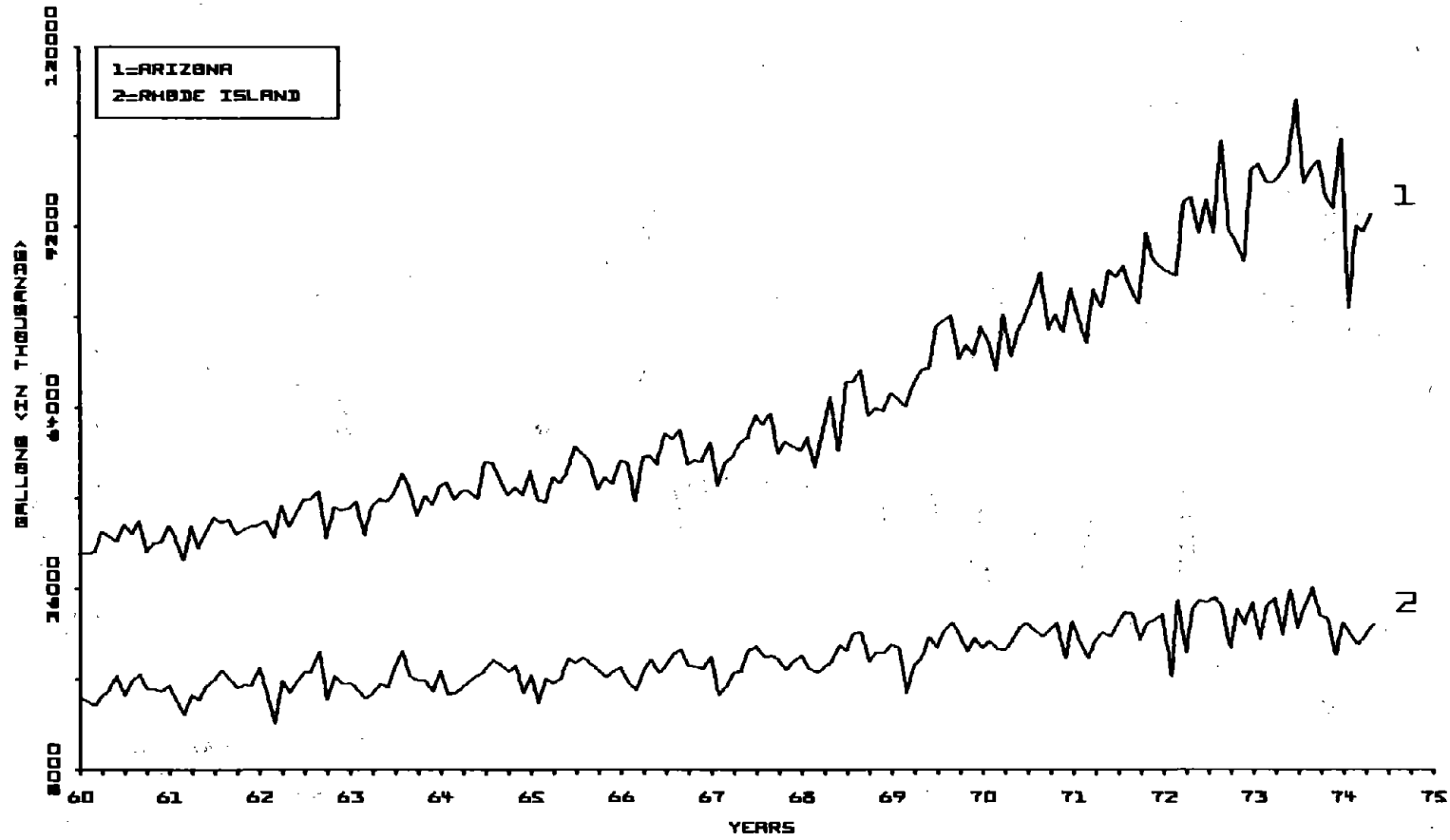


Figure 19. Monthly Gas Consumption, Arizona and Rhode Island

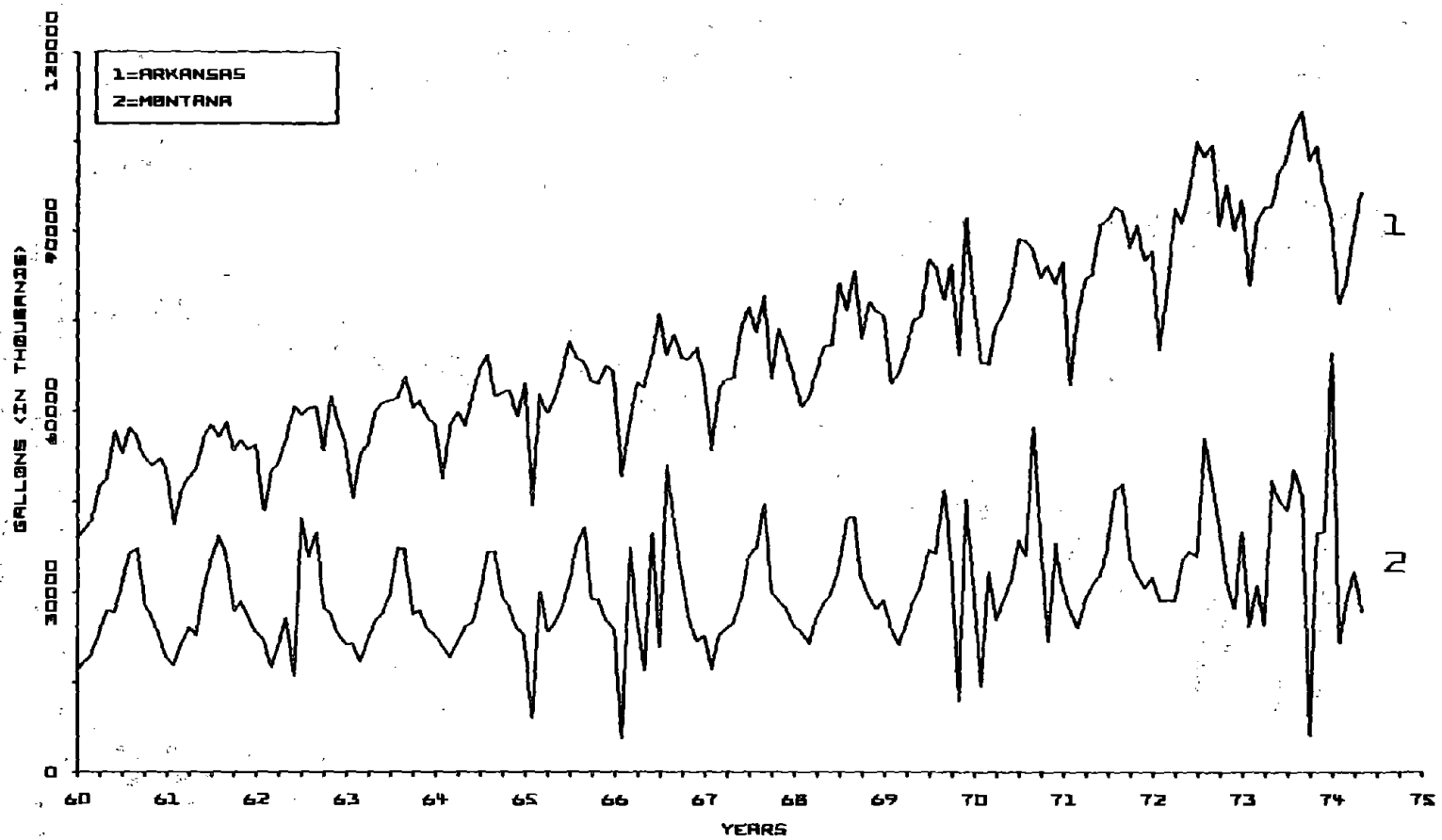


Figure 20. Monthly Gas Consumption, Arkansas and Montana

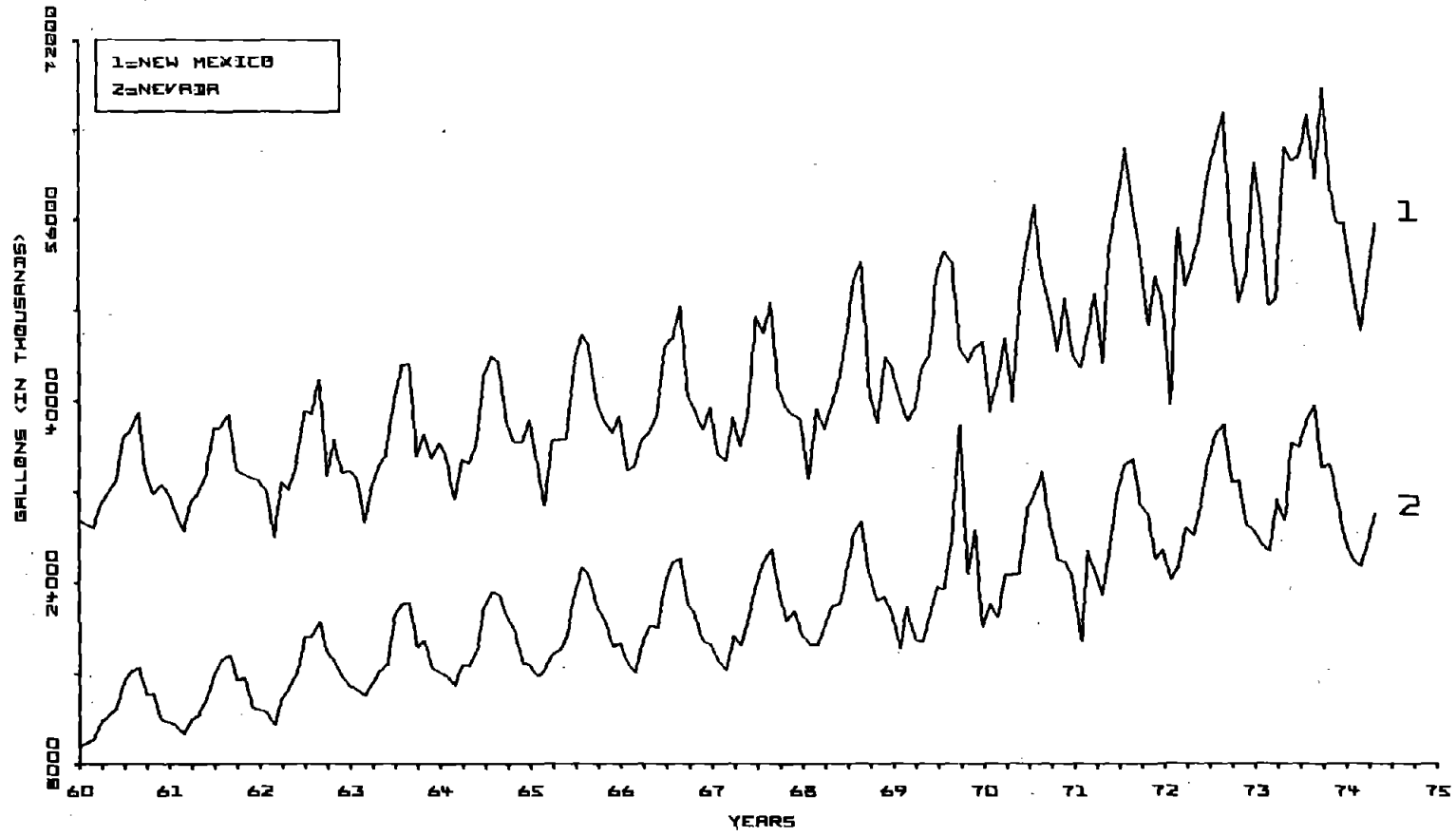


Figure 21. Monthly Gas Consumption, New Mexico and Nevada

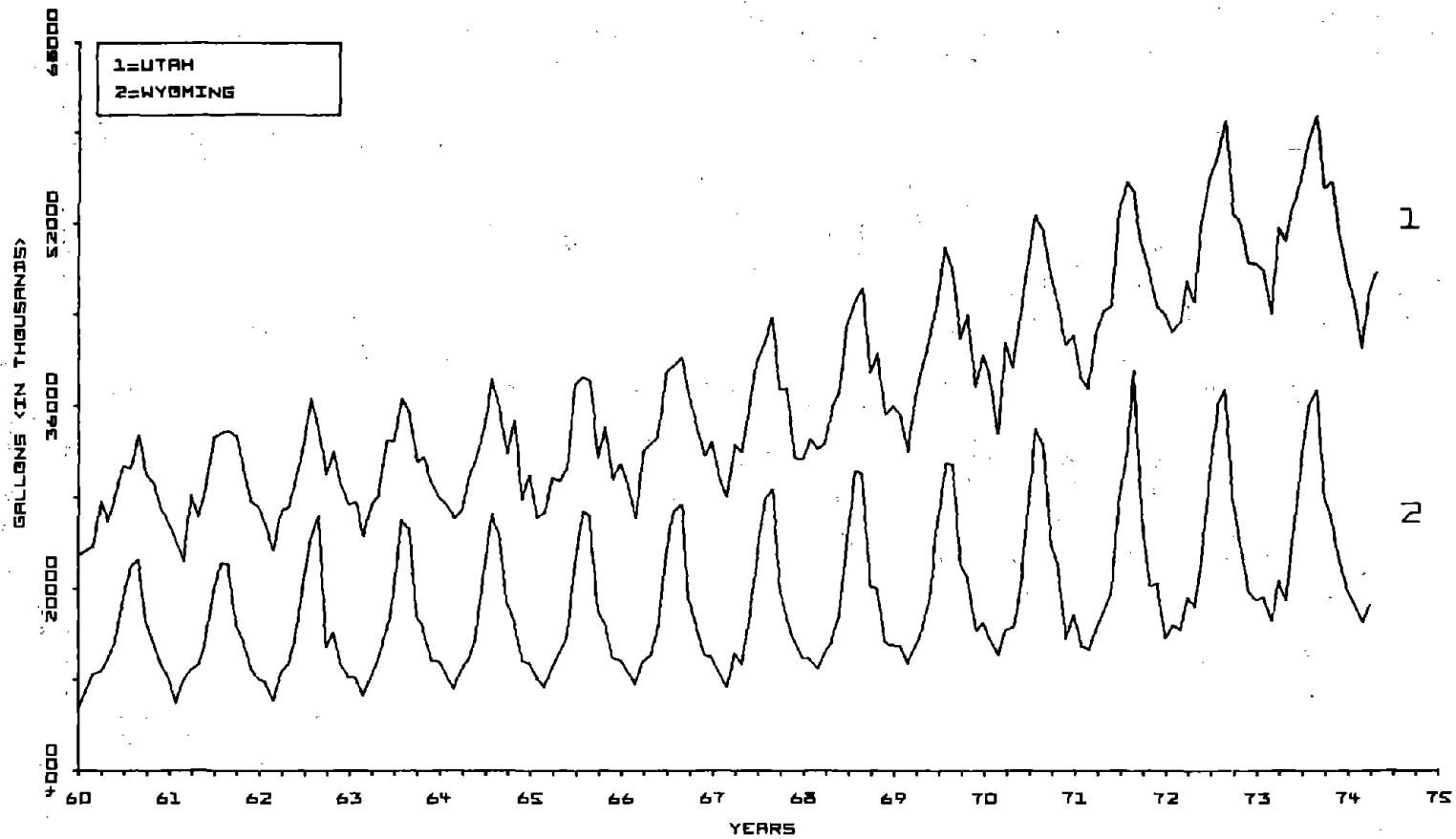


Figure 22. Monthly Gas Consumption, Utah and Wyoming

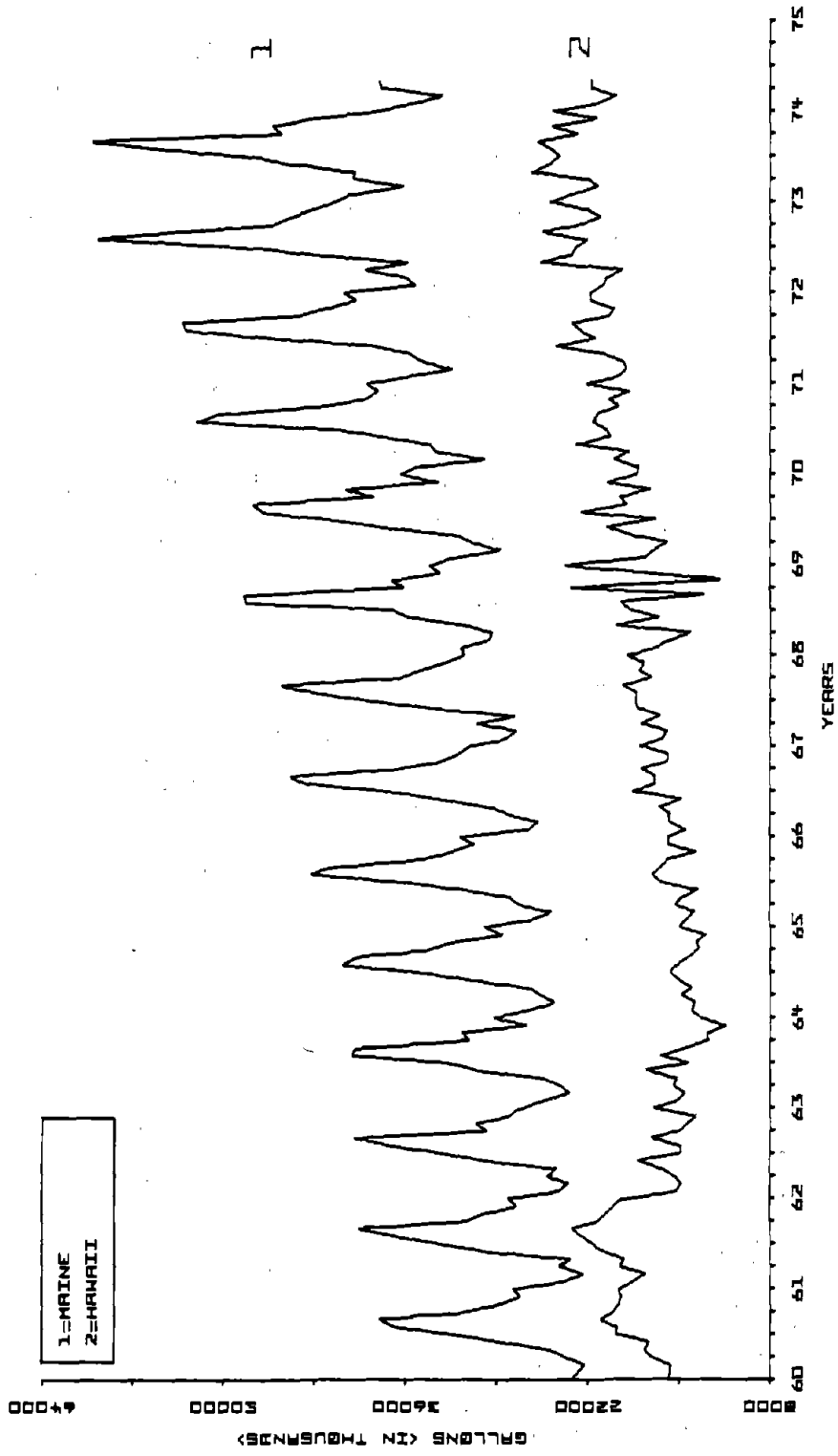


Figure 23. Monthly Gas Consumption, Maine and Hawaii

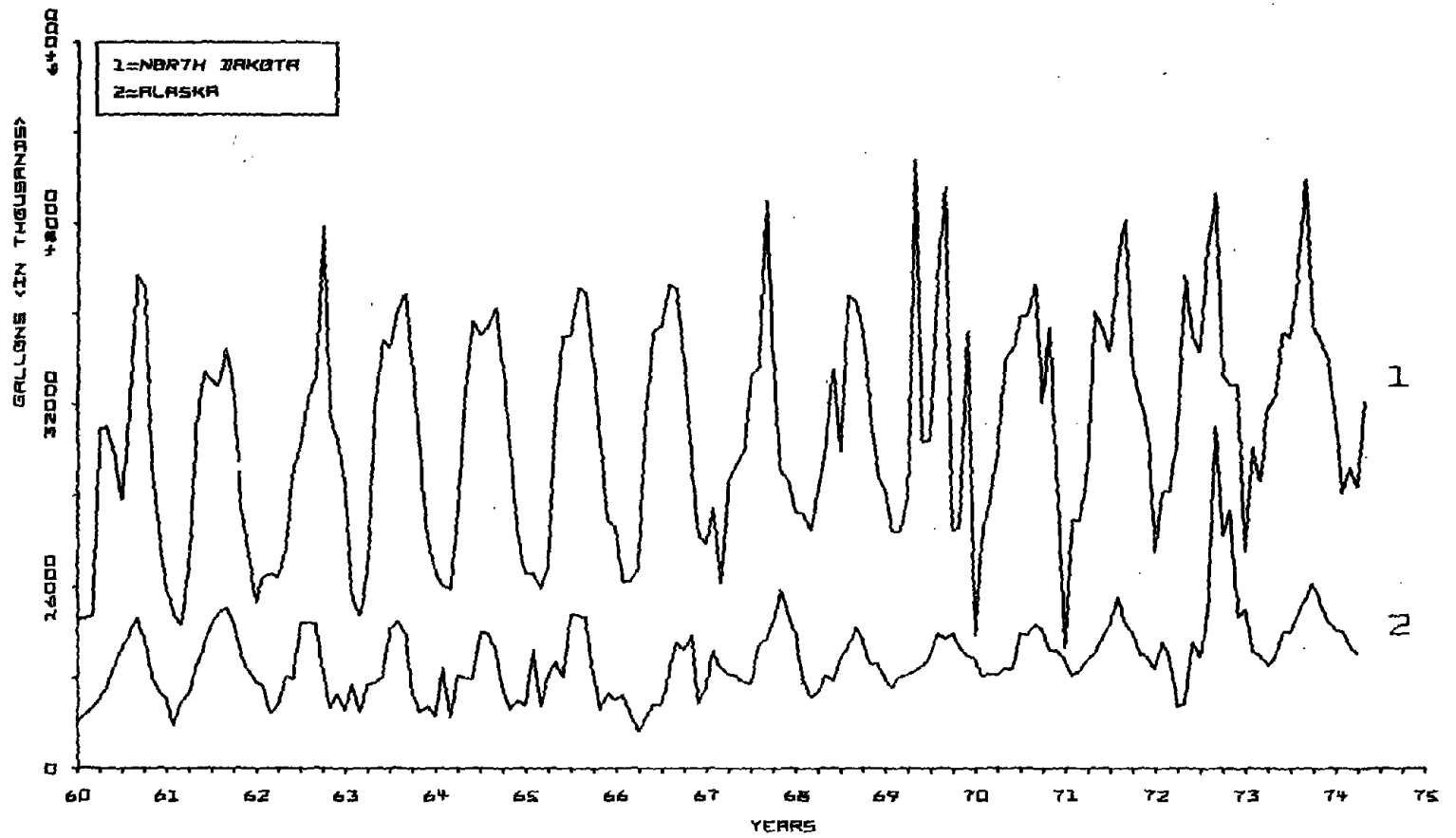


Figure 24. Monthly Gas Consumption, North Dakota and Alaska

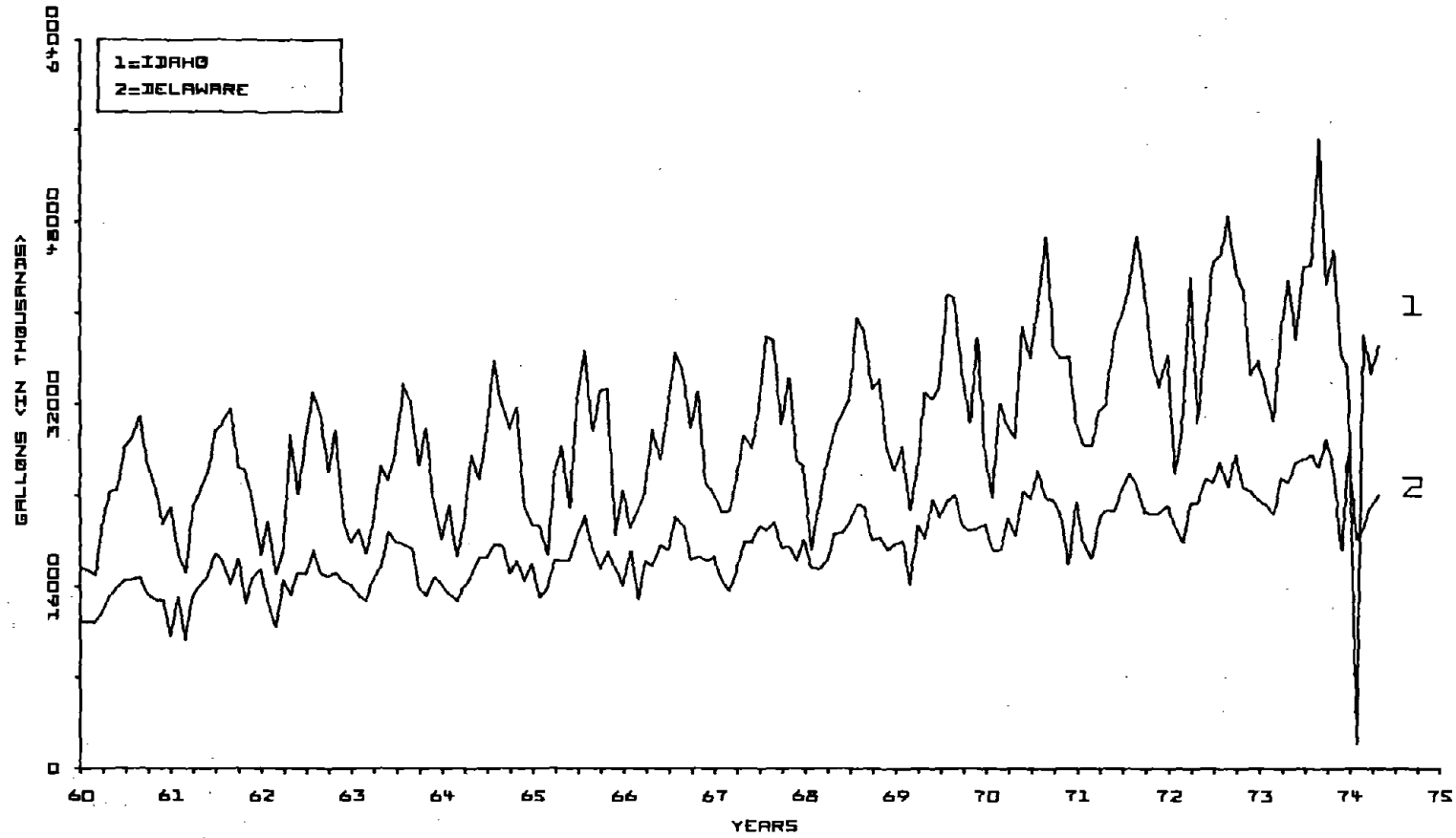


Figure 25. Monthly Gas Consumption, Idaho and Delaware

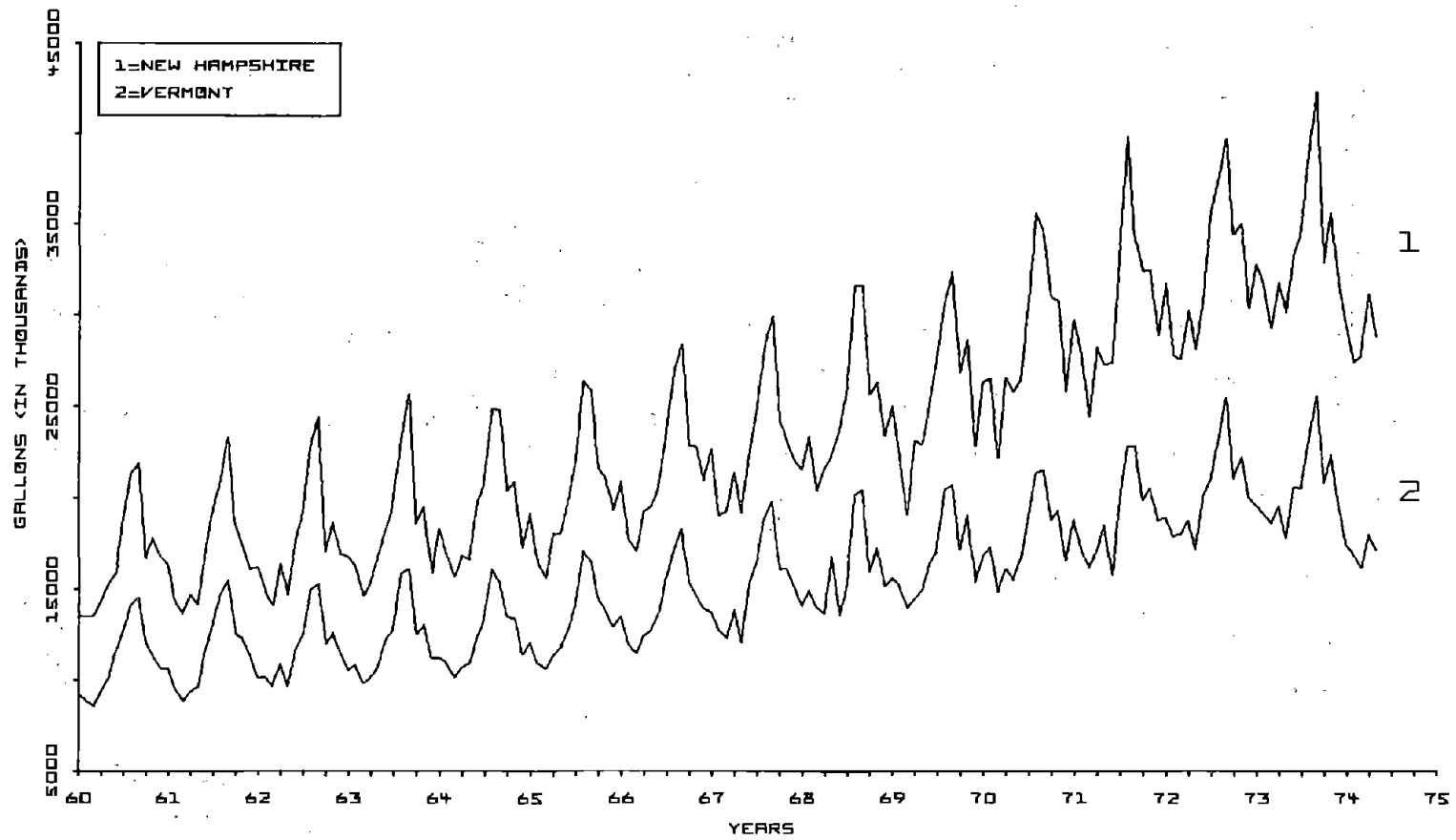


Figure 26. Monthly Gas Consumption, New Hampshire and Vermont

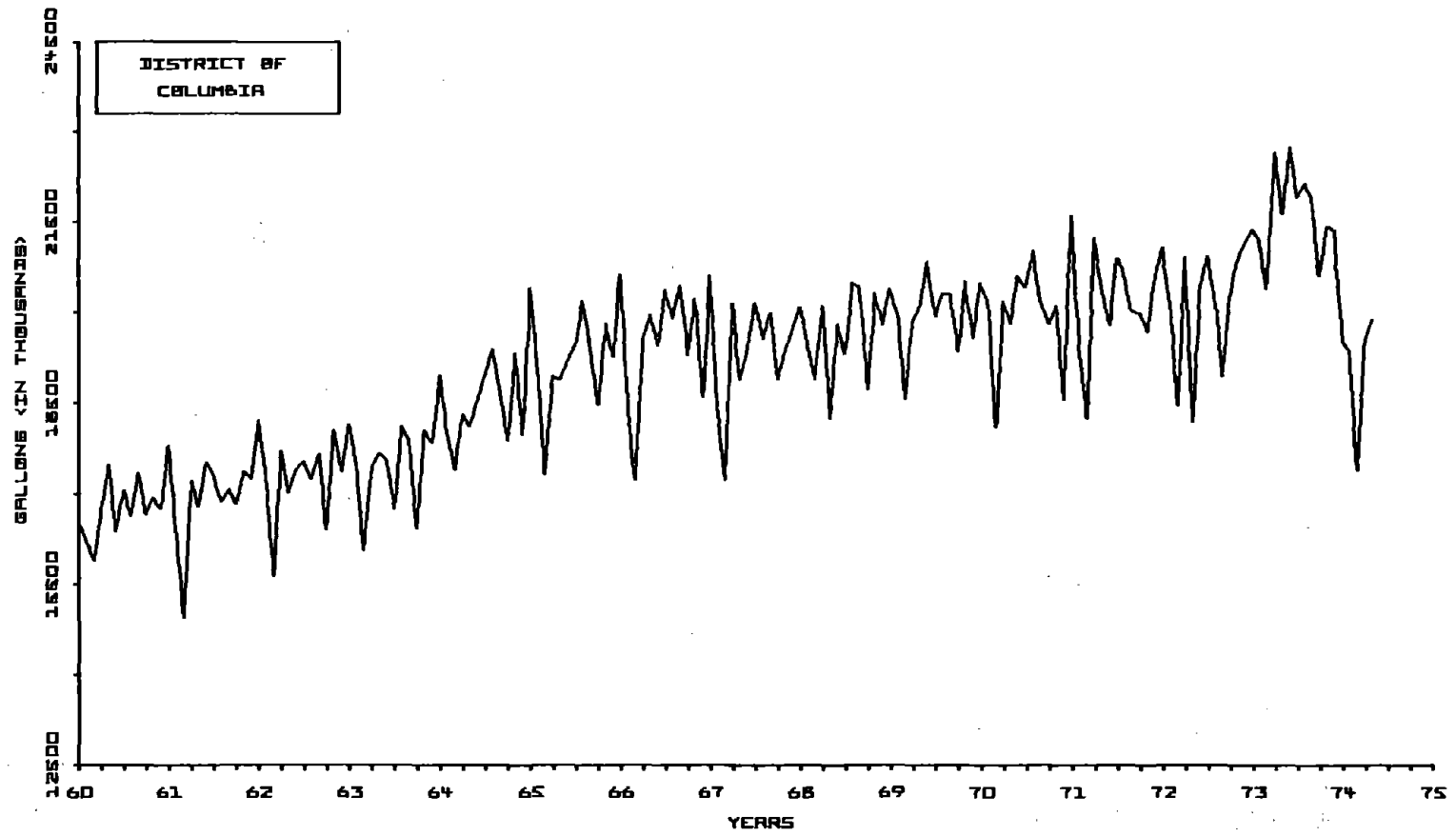


Figure 27. Monthly Gas Consumption, District of Columbia

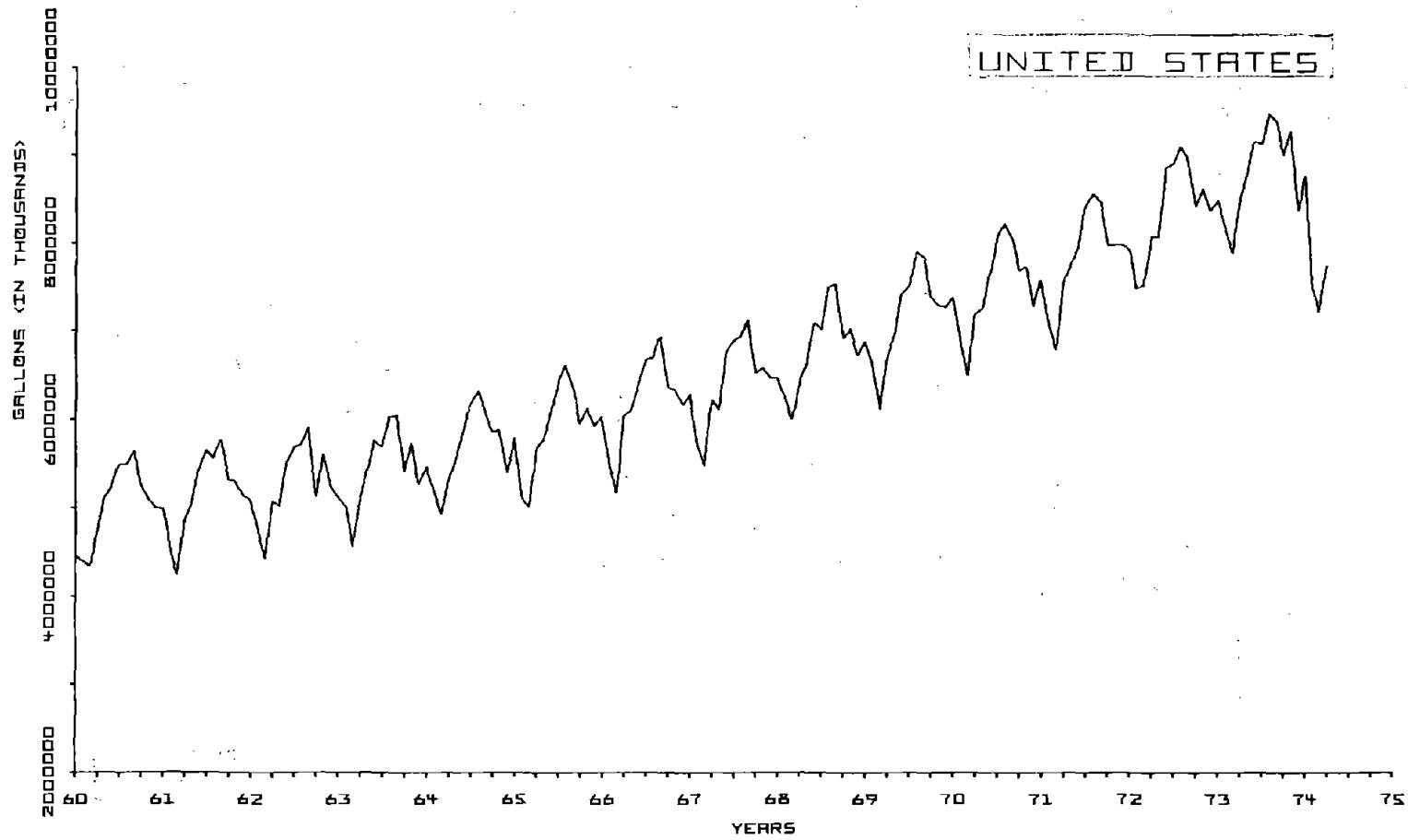


Figure 28. Monthly Gas Consumption, United States

APPENDIX
FURTHER REGRESSION
ANALYSIS OF GAS
CONSUMPTION DATA

This appendix was prepared in response to a suggestion that further regression analysis of the gas consumption data might be more beneficial than the basic linear regressions previously run on the data.

Regression analysis and graphic illustrations of state and total U.S. monthly gas consumption data have been presented in the report's main text. The regressions performed, however, were basic linear regressions not allowing for the seasonality trends in the data. Consequently, three new models were constructed which did incorporate these seasonality patterns. The total U.S. gas consumption data from January 1960 to December 1972 was then fitted to each for purposes of comparison. The following gives a brief description of the models used and the results of each regression done.

I. Model 1:

$$Y = A_1 + A_2 e^{A_3 (t-60)} + A_4 \cos [(t-60) \cdot 2\pi + A_5] + \epsilon$$

This model allows for both the upward exponential trend and the marked seasonality patterns of the U.S. data. Since the model is nonlinear in the parameters A_3 and A_5 it was necessary to use a nonlinear least squares regression to obtain a fit for the data. This regression is done by means of stepwise Gauss - Newton iterations on the parameters A_1 , A_2 , A_3 , A_4 , A_5 or, in other words, a series of approximations converging to the true values of the parameters. However, there is no guarantee convergence will occur and the computer time spent is costly. In our case, convergence did result and we obtained a good fit for the data. The fitted values of the gas consumption model were as follows:

$$Y = 3605100 + 1325800e^{.1(t-60)} + 523560 \cos [(t-60) \cdot 2\pi + 5.27]$$
 Although a good fit for the data values was obtained, this model would prove too costly to use on a series of data points as, for instance, on each of the 50 states monthly gas consumption totals. Consequently a linear version of this model was desired which would result in a similar fit for the data yet would be less costly to use. The following model adequately satisfied this purpose.

II. Model 2:

$$\begin{aligned}
 Y = B_1 + B_2(t-60) + B_3(t-60)^2 + B_4 \cos \frac{2\pi(t-60)}{12} \\
 + B_5 \sin \frac{2\pi(5-60)}{12} + e
 \end{aligned}$$

Since this model is linear in the parameters, we were able to use a multiple linear regression to obtain a fit for the data. Here, too, the results proved to be very good. An R^2 coefficient of .97 indicates that this model explains 97% of the variations in United States monthly gas consumption over the years 1960 - 1972. The gas consumption estimations determined by this model closely resemble those determined by model 1, yet model 2 is less costly and less time consuming to use. The fitted parameters of this gas consumption model were as follows:

$$\begin{aligned}
 \hat{Y} = 4997720 + 7291.18(5-60) + 102.198(5-60)^2 - 407900 \cos \frac{2\pi(t-60)}{12} \\
 - 328090 \sin \frac{2\pi(t-60)}{12}
 \end{aligned}$$

III. Model 3:

$$Y = A_1 + A_2(t-60) + A_3(t-60)^2 + \sum_{i=1}^{11} B_i C_i + e$$

Model 3 is the econometric model using the dummy variable C_i to adjust for the monthly seasonality. A multiple linear

regression of the data using this model resulted in an R^2 coefficient of .99 indicating that 99% of the variations in U.S. monthly gas consumption over the years 1960 - 1972 could be explained by this model. The parameter values fitted by this model were as follows:

$$A1 = 5005090$$

$$A2 = 7203.94$$

$$A3 = 102.134$$

$$B1 = -514923 = (\text{Coefficient used to determine January value})$$

$$B2 = -823888 = (\text{Coefficient of February})$$

$$B3 = -240477 = (\text{Coefficient of March})$$

$$B4 = -114822 = (\text{Coefficient of April})$$

$$B5 = 267020 = (\text{Coefficient of May})$$

$$B6 = 441737 = (\text{Coefficient of June})$$

$$B7 = 574938 = (\text{Coefficient of July})$$

$$B8 = 555923 = (\text{Coefficient of August})$$

$$B9 = 27713.8 = (\text{Coefficient of September})$$

$$B10 = 93410.7 = (\text{Coefficient of October})$$

$$B11 = -168141 = (\text{Coefficient of November})$$

Example:

To calculate the value for January 1960, one would use

$$\hat{Y} = 5005090 + 720394(t-60) + 102.134(t-60)^2 - 514923$$

Here $C1 = 1$ and $C2 = 0 = C3 = \dots = C11$

In conclusion, model 3 gives the best fit for the total U.S. gas consumption data. Models 1 and 2 give good fits although model 1 may be too costly to use in most cases. For purposes of analysis, these same models can be applied to any of the individual state's gas consumption data displaying similar seasonality patterns as the total U.S.

