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Abstract

Peck and Heidt (1985) proposed a linear model that demonstrated that for gray fox (*Urocyon cinereoargenteus*) in Arkansas; total fur harvests from 1966-1982 were highly correlated with mean pelt values. Single variable models using linear regression analysis of current season pelt values (CSPV) and previous season pelt values (PSPV) were designed to predict total fur harvests. These models demonstrated high correlations (r = 0.93 and 0.89, respectively). In the past 15 years, markets for fur have undergone many perturbations within Arkansas and overseas resulting in great changes in mean pelt prices. In an attempt to evaluate the continued performance of the original model, pelt price and harvest data from 1983-1997 were tested for correlation using linear regression analysis. The results from these tests showed a high correlation. Two specific years (1983 and 1987) were affected strongly by political and economic events. A new model encompassing trapping seasons from 1966 through 1997 was evaluated. Mean pelt value remains a significant predictor of total gray fox fur harvest in Arkansas.

Introduction

Over the past 20 years, the Arkansas furbearer market has undergone drastic changes. In 1979, the mean pelt value of gray fox (*Urocyon cinereoargenteus*) was $42.50, which was the highest value ever recorded. This value marked the beginning of the downward trend in pelt values of gray fox. Although prices decreased steadily through 1987, they remained high enough (averaging $27.83) to maintain trapper interest and to sustain the fur harvest industry for gray fox. In 1988, the mean pelt value dropped to $11.87 and continued to decline for the next ten years, resulting in average pelt value of $7.39 (Table 1).

When Peck and Heidt (1985) examined the correlation between mean pelt value (MPV) and total fur harvest (TH), fur trappers were very active in harvesting pelts of gray fox, and there was a growing interest in management of the gray fox population through harvest limits (Heidt et al., 1984). Currently, very few trappers are harvesting gray fox, and concern for the impact of trapping on populations of gray fox has greatly declined (P. Dozhier, pers. comm.). Furbearer management now has turned its focus to concerns of possible gray fox overpopulation, as the removal of individuals from the population via trapping is no longer a significant influence. It is widely recognized that the least expensive and simplest means of furbearer management is through fur industry. Given the current fox fur market depression, gray fox management through fur industry is minimal.

Year	Total Harvest	Mean Pelt Value ($)	Exchange Rate (DM / US)	Harvest Value (U.S. Dollars)	Harvest Value (Deutchmarks)
1966	1,761	1.45	N/A	2,553	N/A
1967	561	1.50	N/A	842	N/A
1968	1,079	2.59	N/A	2,795	N/A
1969	756	2.47	N/A	1,867	N/A
1970	644	2.35	N/A	1,513	N/A
1971	734	3.21	3.33	2,356	N/A
1972	1,751	6.89	3.20	12,064	7,845
1973	2,502	13.77	2.58	34,453	38,606
1974	4,235	10.34	2.51	43,790	88,888
1975	3,765	20.78	2.59	78,237	109,913
1976	8,333	30.02	2.41	250,157	202,633
1977	5,547	28.99	2.24	160,808	360,209
1978	6,648	42.14	1.90	280,346	532,279
1979	8,777	42.50	1.77	373,023	660,250
1980	7,109	34.74	1.92	246,967	474,176
1981	4,945	26.37	2.22	130,400	289,487
1982	5,301	26.85	2.55	142,332	362,946
1983	3,434	30.64	2.68	105,218	281,984
1984	4,459	23.24	3.00	103,627	310,881
1985	4,193	15.99	2.60	67,046	174,320
1986	5,911	26.63	2.02	157,410	317,968
1987	7,865	23.86	1.68	187,659	315,267
1988	3,566	11.87	1.75	42,328	74,075
1989	1,096	5.20	1.83	5,699	10,430
1990	502	2.96	1.49	1,486	2,214
1992	1,119	7.75	1.59	8,672	13,789
1993	849	6.40	1.70	5,434	9,237
1994	1,526	8.15	1.54	12,437	19,153
1995	1,881	8.71	1.42	16,384	23,265
1996	2,130	9.86	1.51	21,002	31,713
1997	1,131	7.35	1.73	8,313	14,381

Table 1. Harvest data for the years 1966 - 1997 for gray fox in Arkansas. Exchange rates were obtained from the website http:blacktusk.commerce.ubc.ca/cgibin/fxdata. Total harvest values in Deutchmarks and dollars were computed using total harvest, mean pelt value and exchange rate value.

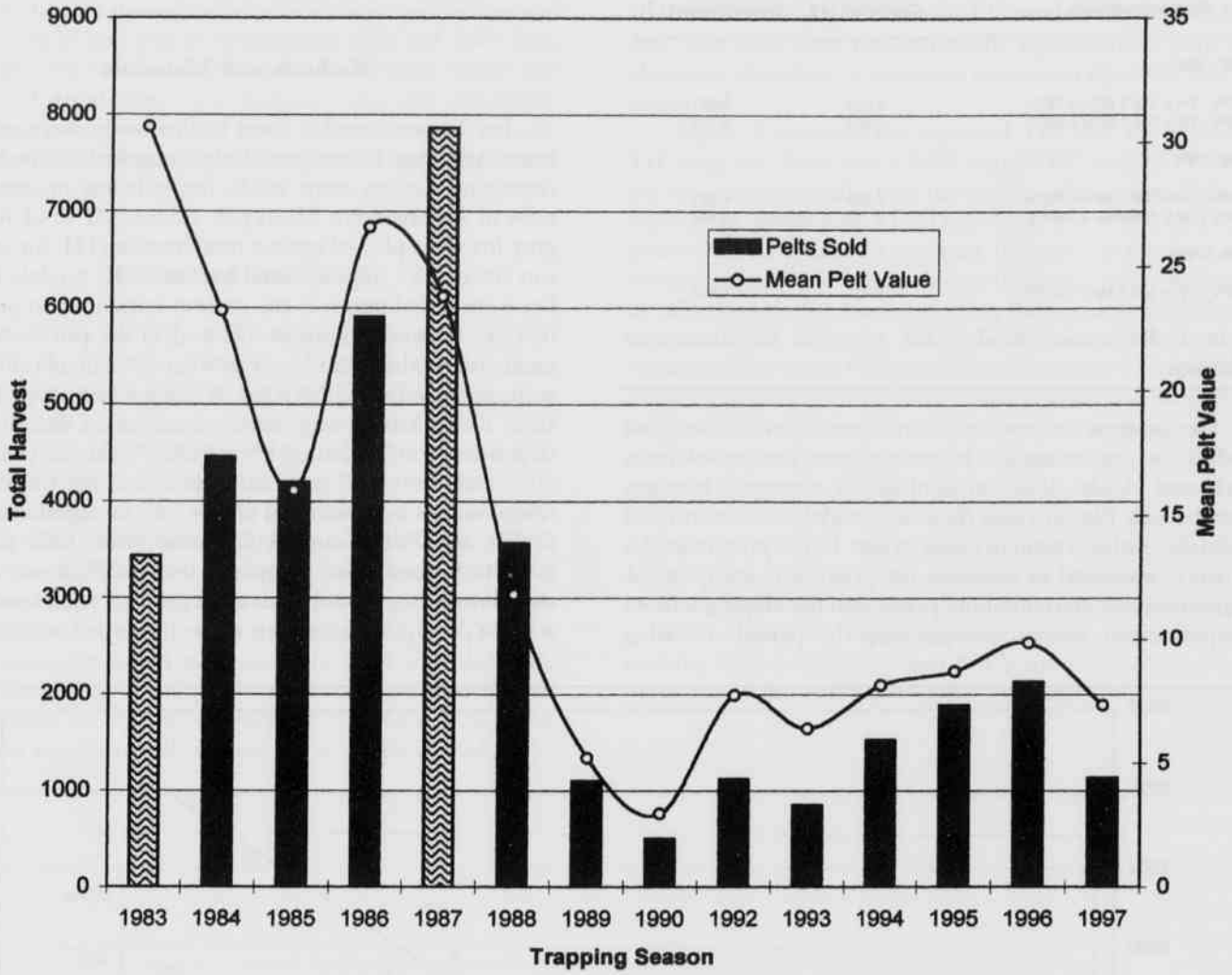

Fig. 1. Size of total gray fox fur harvest (TH) and mean pelt value (MPV) for Arkansas from 1983 - 1997.

The relationship between total harvest and mean values of gray fox pelts over the past fifteen years was influenced by political events that affected the market. The main purchaser of gray fox pelts from Arkansas is Germany (P. Dozhier, pers. comm.). In 1990, Germany's economy suffered greatly as a result of the re-unification between East and West Germany, which in turn led to the gray fox market being negatively affected. The German economy was further damaged by the breakdown of the Soviet Union in 1991, and, since that time, Germany has not recovered sufficiently from its recession to regain its position as a main purchaser of pelts from gray fox. This is evident in the fluctuating exchange rate of the Deutchmark in the years between 1986 through 1997 (Table 1). Fur-harvest analysts speculate that the gray fox market will improve only when the Chinese and Russian economies improve (P. Dozhier, pers. comm.). In the past few years, some Baltic countries such as Estonia and Lithuania have taken an interest in purchasing gray fox pelts from Arkansas. However, these countries have just recently been introduced to the free market economy, and until their economies improve, their purchases will probably not spark the gray fox market into recovery (P. Dozhier, pers. comm.).

It is significant to note that some concerns discussed by Peck and Heidt (1985) are no longer important due to global economic changes, such as 1) rapidly growing demands for furbearers and their products, 2) enactment of endangered species regulations and treaties, 3) a major decline in upland wildlife hunting opportunities, and 4) growing anti-hunting and anti-trapping sentiment. These factors are of minimal importance given the intense influence of economic factors on total pelt harvest and mean pelt values.

Regression Models	Correlation Coefficient (r)	Coefficient of Determination (r^2)
1966 - 1982		
CSPV - TH = 174.3 MPV + 707.4	0.933	0.871
PSPV - TH = 181.5 MPV + 963.9	0.893	0.797
1984 - 1997		
CSPV - TH = 230.1 MPV - 207.9	0.959	0.921
PSPV - TH = 240.9 MPV - 465.5	0.761	0.584
1966 - 1997		
CSPV - TH = 185.8 MPV + 422.9	0.935	0.876

Table 2. Regression models for gray fox fur harvest in Arkansas

We propose to revisit the pertinence of the original models for predicting the harvest of gray fox in Arkansas (Peck and Heidt, 1985), in light of the economic changes over the past fifteen years. The first model was constructed primarily during a time of rising prices. In the present study, we were interested in assessing the predictive ability of the original models during falling prices and developing a more comprehensive model incorporating the periods of rising and subsequently falling prices.

Methods and Materials

Fur harvest records used in this study were compiled from Arkansas Game and Fish Commission records. No correction factors were made for inflation or out-of-state sales of Arkansas fur. Mean pelt values (MPV) of Arkansas gray fox were plotted against total harvest (TH) for each season since 1983 (Fig. 1). Total harvest (TH) models for gray fox were based upon: 1) the current season mean pelt value (CSPV) to predict current TH and 2) the previous season mean pelt value (PSPV) to predict the current TH. Data were analyzed using SAS for Windows 6.11 (SAS Institute Inc., 1991). Linear regression equations to determine the dependence of TH on CSPV and PSPV for the years 1984-1997 and 1966-1997 were calculated, and the t-values from these models were tested at an $\alpha = 0.05$ for significance. The CSPV and PSPV models from the years 1966-1982 and 1984-1997 then were compared using a Students' t-test to determine if they were equivalent in slope and elevation ($\beta_1 = \beta_2$; $\alpha_1 = \alpha_2$). Final models were developed without use of

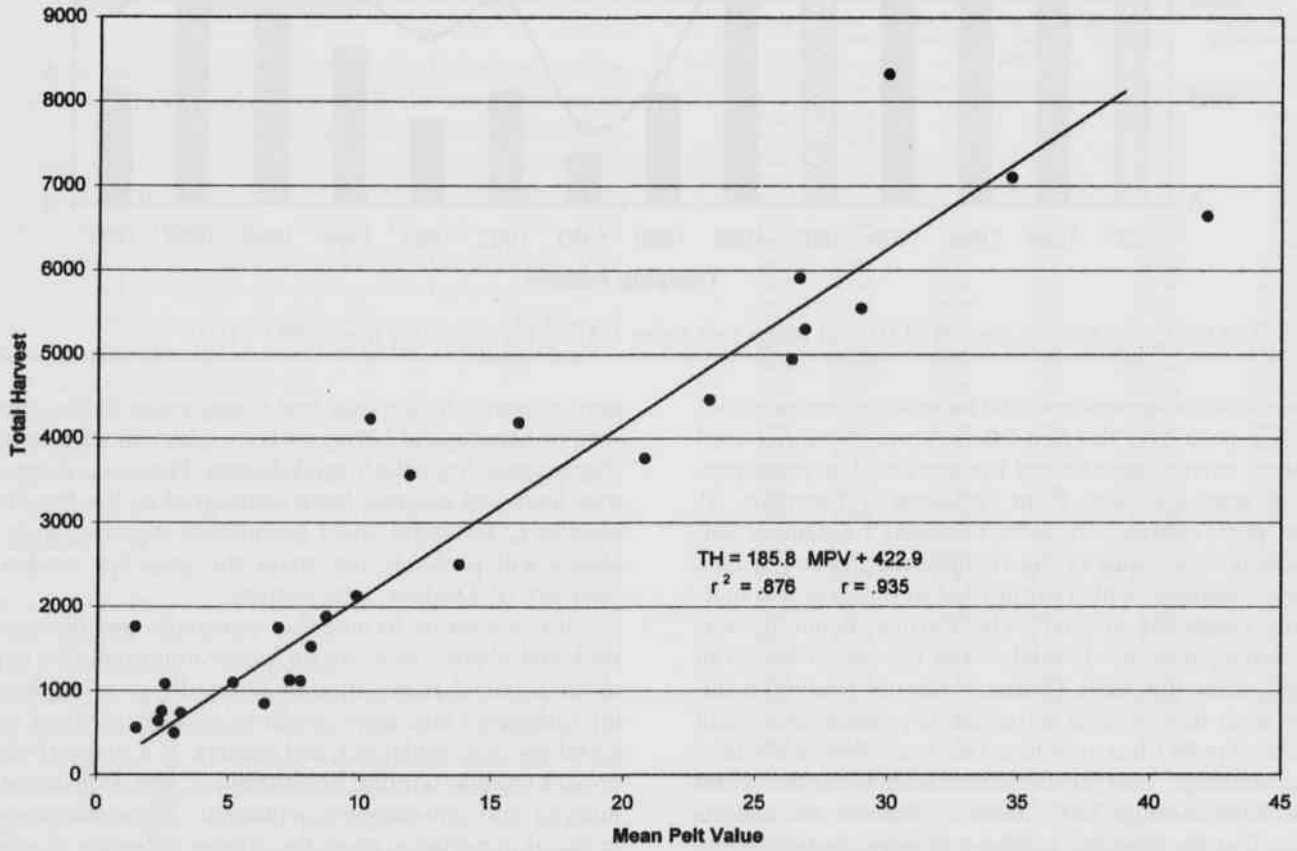

Fig. 2. A scatter diagram, regression line and equation relating mean pelt value (MPV) in dollars to total harvest (TH) for 1966-1997 Arkansas gray fox fur harvests.

data from years 1983, 1987 and 1991. Certain political and economic factors strongly affected the mean pelt values and total harvest of gray fox in Arkansas in 1983 and 1987. Data from 1991 were omitted from analysis because mean pelt value and total gray fox harvest was not available. November values were used in all calculations as they correspond with the beginning of the gray fox trapping season in Arkansas.

Results and Discussion

Table 2 lists the regression equations for gray fox harvests using the CSPV and PSPV models from the data from 1984-1997, Peck and Heidt's (1985) CSPV model using data from 1966-1982, and the final CSPV model using the 1966-1997 data. The 1966-1982 CSPV model and the 1984-1997 CSPV model were found to be statistically equivalent in slope and elevation (Zar, 1999). The linear regression analysis on the 1984-1997 TH and CSPV produced a correlation coefficient of 0.959 ($\alpha = 0.05$, $P < .0001$). The coefficient of determination ($r^2 = 0.921$) indicated that a significant degree of variability in the TH was accounted for by the CSPV. A second linear regression analysis on the 1984-1997 data analyzed TH and PSPV and produced a correlation coefficient of 0.761 with an r^2 value of 0.584 ($P < .0164$). A common regression equation with a correlation coefficient of 0.935 and r^2 value of 0.876 ($P < .0001$), was calculated for the 1966-1997 data (Fig. 2). The PSPV models from 1966-1982 and 1984-1997 were not statistically equivalent in slope and elevation; therefore, a common regression equation was not produced.

Figure 3 contrasts the reported TH with the predicted TH using the 1984-1997 CSPV and PSPV models. This figure shows graphically that the two models are sufficiently capable of predicting TH. Data from the 1984 and 1987 years were not used in creating the models because economic and political events during these two years had drastic affects on the fur market making these years anomalies in our study. In February 1983, the Commissioners of the Arkansas Game and Fish Commission voted 5-to-2 to ban all trapping of gray and red fox statewide. This ban was modified with zones closed to all fox trapping and other zones permitting gray fox trapping in November of 1983. These political decisions affected the subsequent fur harvest of 1983. A second important event that affected the Arkansas fur market was the notorious economic meltdown, Black Monday, of October 1987. On this day the stock market crashed, drastically affecting the total harvest and mean pelt values for that year. Figure 4 demonstrates graphically how well the 1966-1983 CSPV and PSPV models predicted total harvest with the exception of the 1983 and 1987 seasons.

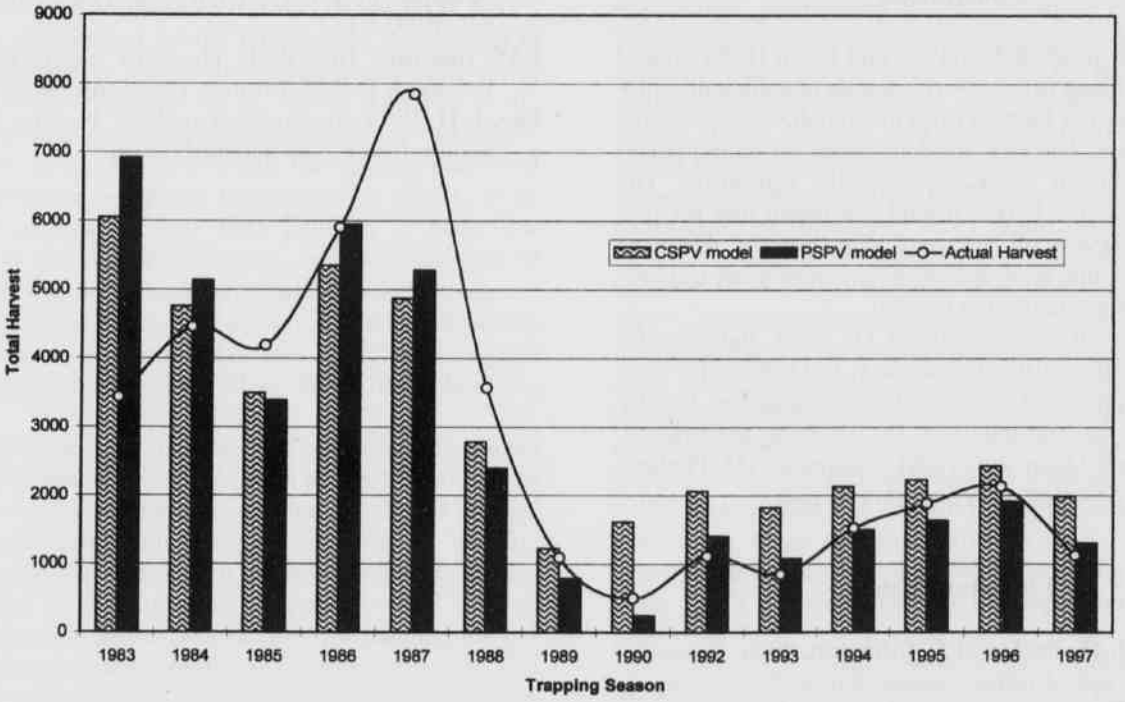

Fig. 3. Comparison of harvests of gray fox in Arkansas from 1983-1997 with predictions using 1984-1997 CSPV and PSPV models.

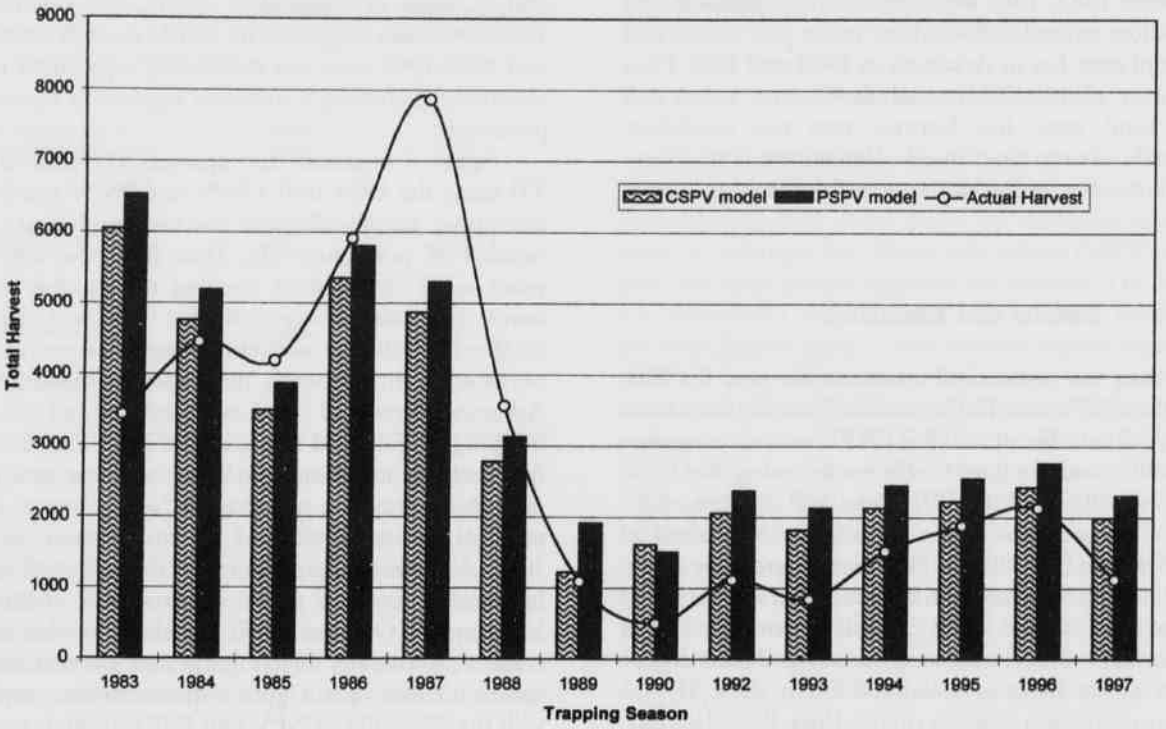

Fig. 4. Comparison of harvests of gray fox in Arkansas from 1983 - 1997 with predictions using Peck and Heidt's (1985) 1966 - 1982 CSPV and PSPV models.

Conclusions

The models proposed by Peck and Heidt (1985), based on a period of rising prices, were capable of sufficiently predicting total gray fox harvest from mean pelt values over the past fifteen years. The new models, based on falling prices over the past fifteen years, were equally significant. The combined 1966-1997 CSPV model is a useful tool for predicting total harvest of Arkansas gray fox. At this time research on the affects of decreased pressure from trappers on the gray fox population is needed.

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