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**ANALYSIS OF COMPONENT LEVELS IN INDIVIDUAL  
HERD MILK AT THE FARM LEVEL**

**PACIFIC NORTHWEST AND ARIZONA  
FEDERAL MILK MARKETING ORDERS**

**2007**

Staff Paper 09-01

Lori Espe

February 2009

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# **ANALYSIS OF COMPONENT LEVELS IN INDIVIDUAL HERD MILK AT THE FARM LEVEL**

## **PACIFIC NORTHWEST AND ARIZONA FEDERAL MILK MARKETING ORDERS**

**2007**

Lori Espe

Abstract

Component levels in producer milk pooled on the Pacific Northwest (FO 124) and Arizona (FO 131) Federal Milk Marketing Orders were analyzed for 2007 to determine average levels, regional and seasonal variation, and, when possible, the statistical relationship between components. Handlers regulated under the Pacific Northwest Order report butterfat, protein, and other solids. Handlers regulated under the Arizona Order report butterfat only. Producer milk pooled was also valued using Federal order minimum producer prices for the respective orders. For 2007, a monthly average total of 798 producers were pooled on the Pacific Northwest and Arizona Orders. During 2007, these producers delivered 10.8 billion pounds to the two markets. The milk shed of the two Federal orders includes Arizona, California, Idaho, Oregon, and Washington.

Major findings of this study include:

1. The 2007 average component levels for the Pacific Northwest Order were 3.70% butterfat, 3.09% true protein, and 5.71% other solids. The 2007 average butterfat level for the Arizona Order was 3.59%.
2. In both orders, butterfat levels decrease during the summer months and increase in the late fall and winter. In the Pacific Northwest Order, protein showed the same seasonality as butterfat.
3. Although the volume of producer milk, number of producers, and average milk production per producer varies greatly between regions, there are relatively small differences in aggregate component levels between geographic regions within the milk sheds of the two orders.
4. The Pacific Northwest Order's linear regression in 2007 for protein is  $PRO\% = 1.424 + 0.447 * BF\%$ , with an R-squared of 0.68.
5. The Pacific Northwest Order's regressions for estimating other solids using butterfat have a very poor correlation (R-squared of less than 0.1). The monthly regressions show a negative relationship; other solids levels appear to be independent of butterfat levels.

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# **ANALYSIS OF COMPONENT LEVELS IN INDIVIDUAL HERD MILK AT THE FARM LEVEL**

## **PACIFIC NORTHWEST AND ARIZONA FEDERAL MILK MARKETING ORDERS**

**2007**

Lori Espe <sup>1</sup>

### **I. INTRODUCTION**

This study examines milk component levels in milk pooled on the Pacific Northwest (FO 124) and Arizona (FO 131) Milk Marketing Orders during 2007. The milk components for the Pacific Northwest Order include butterfat, protein, and other solids and butterfat only for the Arizona Order. Protein and other solids were not included in any analyses concerning the Arizona Order because they were not used as a basis for pricing milk in 2007, and handlers were not obligated under the order to report information on protein and other solids levels.

Component levels in producer milk pooled on the Pacific Northwest and Arizona Orders were analyzed to determine average component levels, regional and seasonal variation, and the statistical relationship between components. Producer milk pooled on each order in 2007 was valued using Federal order minimum producer prices for the respective orders.

For 2007, a monthly average total of 798 producers were pooled on the Pacific Northwest and Arizona Orders. During 2007, these producers delivered 10.8 billion pounds to the two markets.

Beginning January 2000, true protein was used as a basis for pricing milk under the Pacific Northwest Order. Prior to January 2000, crude (Total Nitrogen) protein was used. True protein does not include non-protein nitrogen which is included in crude protein. Due to this change, references to protein levels prior to January 2000 are not directly comparable to protein levels after January 2000 without taking into account the effects of the change in testing for protein. In general, crude protein test levels are about 0.19 percentage points higher than true protein test levels. In a like manner, other solids levels associated with true protein levels are about 0.19 percentage points higher than those associated with crude protein test levels.

During 2007, the Pacific Northwest Order milk shed was comprised of producers located in Washington, Oregon, California, and Idaho. The Arizona Order milk shed was comprised of producers located in Arizona and California. The milk shed of the two orders includes various geographic and climatic regions. These regions range from very dry climates (Arizona, Central Washington, Southern Idaho, and Eastern Oregon) to very wet climates (western and coastal regions of Oregon and Washington). Geographically, the Cascade Mountain Range, Pacific

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<sup>1</sup> Lori Espe is an Agricultural Economist with the Market Administrator's Office, Bothell, Washington. Assisting Ms. Espe were John Mykrantz and Dan Nguyen of the Pacific Northwest (FO 124) and Arizona (FO 131) Orders' staff.

Ocean, and Columbia River provide general geographic and climate demarcations that may impact how dairy operations are managed.

## II. DATA AND METHODOLOGY

The data included in this study comprises all producer milk pooled on the Pacific Northwest and Arizona Orders. The data was collected from producer payrolls submitted by handlers to the market administrator's office. Components available for the Pacific Northwest Order were butterfat, protein, and other solids (other solids is nonfat solids less protein). Protein and other solids were not included for the Arizona Order because they were not used as a basis for pricing milk in 2007, and handlers were not obligated under the order to report information on protein and other solids levels. Up until February 1997, the Pacific Northwest Order did not require handlers to report protein and other solids. Under the previous pricing system, butterfat and nonfat solids were the components used in determining minimum order values. Any reference to 1997 annual averages for protein and other solids for the Pacific Northwest Order does not include data for January 1997.

Eligible producer milk and producers which were not pooled were not included in this analysis. Eligible producer milk is Grade A milk production that qualifies to be but is not pooled on the respective order. The exclusion of milk not pooled was due to the unavailability of the information, and it often represented less than three handlers and was, therefore, restricted.

The Pacific Northwest and Arizona Orders were divided into seven regions. (See Map A-2.) The small number of producers in Northern California pooled on the Pacific Northwest Order made it necessary to combine them with another region (Western Oregon, Region 5). Region 5 has a similar climate and was geographically adjacent to the two California counties. The Arizona and Southern California producers were also combined for reasons of confidentiality. Other than the identified exceptions, order and/or state lines were considered as primary boundaries. The regions within states were defined based on climate conditions and geography. The regions are as follows: Western Washington (Region 1), Central Washington (Region 2), Eastern Washington (Region 3), Northern Idaho (Region 4), Western Oregon and Northern California (Region 5), Central/Eastern Oregon and Southern Idaho (Region 6), Arizona and Southern California (Region 7).

In Oregon and Washington, the west side of the Cascade Mountain Range has more precipitation and is characterized by a milder climate than the eastern side of the states<sup>2</sup>. The region east of the Cascade Mountain Range has a drier climate with warmer summers and colder winters. In Eastern Washington, the precipitation rate begins to increase slightly. Idaho was split into Northern and Southern Idaho. Northern Idaho is wetter and more mountainous compared to Southern Idaho. Arizona is very dry year round with much less precipitation and many days with average temperatures much higher than the other regions studied.

Ordinary Least Squares regression analysis was used to determine relationships between components.

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<sup>2</sup> Climate information based on Western Regional Climate Center precipitation maps.

### III. SEASONAL VARIATION IN MILK COMPONENT LEVELS

In 2007, producers associated with the Pacific Northwest Order delivered 7.0 billion pounds. For 2007, producer milk tested, on average, 3.70% butterfat, 3.09% protein, and 5.71% other solids.

In the Pacific Northwest Order, producer milk butterfat percentages decrease in the spring and increase in the fall and winter. Table 1 shows the monthly and annual average component levels for the Pacific Northwest Order. Milk production per cow typically is less, and animals are fed more stored feed in the fall and winter. In the spring, during the flush of milk production, the feeding of more fresh grass increases the total pounds produced but decreases the percentage of butterfat and protein content of milk. The spring flush is additionally impacted by the biological cycle of cows and the increase in temperature in the spring. Butterfat levels in the Pacific Northwest Order in 2007 were the highest in November and December at 3.80% and lowest in June at 3.60%.

The seasonal cycle of protein levels is similar to butterfat but with a lesser degree of variation. Protein levels in 2007 were highest in November at 3.19% and lowest in July at 2.98%. Other solids levels were much more consistent throughout the year when compared to the seasonal changes in butterfat and protein levels. Other solids levels reached a peak of 5.74% in September, a low of 5.65% in February, and showed very little seasonality.

<b>Table 1</b> <b>Monthly Component Levels</b> <b>Pacific Northwest Order</b> <b>2007</b>			
Month	Butterfat - percent -	Protein - percent -	Other Solids - percent -
January	3.79	3.13	5.66
February	3.76	3.12	5.65
March	3.72	3.08	5.69
April	3.66	3.06	5.71
May *	3.63	3.05	5.72
June *	3.60	3.02	5.73
July *	3.61	2.98	5.72
August	3.62	3.03	5.73
September	3.68	3.09	5.74
October	3.77	3.18	5.72
November	3.80	3.19	5.71
December	3.80	3.17	5.72
Weighted Average	3.70	3.09	5.71

\* Eligible milk not pooled.

<b>Table 2</b> <b>Monthly Component Levels</b> <b>Arizona Order</b> <b>2007</b>	
Month	Butterfat - percent -
January	3.75
February	3.66
March	3.56
April	3.53
May	3.52
June	3.54
July	3.53
August	3.53
September	3.53
October	3.64
November	3.64
December	3.71
Weighted Average	3.59

In 2007, producers associated with the Arizona Order delivered 3.8 billion pounds. For 2007, producer milk tested, on average, 3.59% butterfat. Butterfat levels in the Arizona Order follow a similar seasonal pattern as the Pacific Northwest Order. The butterfat levels decrease in the spring and rise again in the fall. (See Table 2 above.) Butterfat levels in the Arizona Order in 2007 were highest in January at 3.75% and lowest in May at 3.52%.

For 2007, the monthly and annual weighted average butterfat and protein levels were less than the mean averages for both components. (See Tables 3 and 4 and Appendix Tables A-1 and A-2.) This difference in relative levels of the weighted average and the mean would indicate that individual producers who deliver smaller amounts of milk (on a monthly basis) have higher levels of these components in their milk than their larger counterparts. Conversely, on the Pacific Northwest Order, the other solids weighted average is higher than the mean, indicating that producers who deliver larger amounts of milk have higher levels of other solids in their milk than their smaller counterparts.

During 2007, for the Pacific Northwest Order, producers' individual monthly average butterfat tests ranged from 2.60% to 5.86%; protein tests ranged from 2.17% to 4.42%, and other solids levels ranged from 4.78% to 5.93%. (See Table 3.) Most monthly average component tests are within one standard deviation of the mean.<sup>3</sup> Based on the definition of a standard deviation, most producers had butterfat tests ranging from 3.46% to 4.24%. Similarly, most protein tests ranged from 2.93% to 3.35%, and most other solids tests ranged from 5.59% to 5.77%. (See Appendix Table A-1 for monthly component statistics.)

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<sup>3</sup> By definition, for a *normal distribution*, approximately 68% of observations are within one standard deviation of the mean.

In 2007, Arizona Order producers' butterfat tests ranged from 2.62% to 4.86%. (See Table 4.) Based on the definition of a standard deviation, most producers had butterfat tests ranging from 3.31% to 3.95%. (See Appendix Table A-2 for monthly component statistics.)

<b>Table 3</b> <b>Component Levels: Weighted Average, Mean, Median,</b> <b>Standard Deviation, Minimum, and Maximum</b> <b>Pacific Northwest Order</b> <b>2007</b>			
	Butterfat	Protein	Other Solids
	%	%	%
Weighted Average	3.70	3.09	5.71
Mean	3.85	3.14	5.68
Median	3.76	3.10	5.70
Standard Deviation	0.39	0.21	0.09
Minimum	2.60	2.17	4.78
Maximum	5.86	4.42	5.93

<b>Table 4</b> <b>Component Levels: Weighted Average, Mean, Median,</b> <b>Standard Deviation, Minimum, and Maximum</b> <b>Arizona Order</b> <b>2007</b>	
	Butterfat
	%
Weighted Average	3.59
Mean	3.63
Median	3.58
Standard Deviation	0.32
Minimum	2.62
Maximum	4.86

#### IV. REGIONAL VARIATION IN MILK COMPONENT LEVELS

Differences in climate, breeds of cattle, common management practices, feeds, and other characteristics of dairy operations can reveal varying milk component levels on a geographic basis. The data was divided into seven regions based on the geographic location of the dairy farms. The seven regions are primarily based on a combination of relatively homogeneous climates and state and Federal order borders.

Regions 1 through 6 are associated with the Pacific Northwest region and are defined in Appendix Map A-2. Table 5, below, provides 2007 milk production, average number of producers, and component tests for each region. In 2007, the region with the most milk

associated with the Pacific Northwest Order was Region 2 followed by Regions 1,5,3,6 and 4. With the exception of Regions 4 and 5, component levels for each region appear to vary only slightly.

<b>Table 5</b>			
<b>Various Statistics by Region For 2007</b>			
<b>Region 1 (Western Washington)</b>		<b>Region 2 (Central Washington)</b>	
Milk Production	2,269,765,640	Milk Production	2,695,078,266
Average Number of Producers	317	Average Number of Producers	102
Average Pounds Per Producer	7,160,144	Average Pounds Per Producer	26,422,336
Butterfat Test	3.67%	Butterfat Test	3.64%
Protein Test	3.07%	Protein Test	3.06%
Other Solids Test	5.70%	Other Solids Test	5.70%
<b>Region 3 (Eastern Washington)</b>		<b>Region 4 (Northern Idaho)</b>	
Milk Production	478,186,423	Milk Production	12,074,789
Average Number of Producers	38	Average Number of Producers	8
Average Pounds Per Producer	12,583,853	Average Pounds Per Producer	1,509,349
Butterfat Test	3.67%	Butterfat Test	3.80%
Protein Test	3.10%	Protein Test	3.10%
Other Solids Test	5.72%	Other Solids Test	5.71%
<b>Region 5 (Western Oregon, Northern California)</b>		<b>Region 6 (Central/Eastern Oregon, Southern Idaho)</b>	
Milk Production	1,353,035,504	Milk Production	210,723,977
Average Number of Producers	227	Average Number of Producers	13
Average Pounds Per Producer	5,960,509	Average Pounds Per Producer	16,209,537
Butterfat Test	3.90%	Butterfat Test	3.72%
Protein Test	3.18%	Protein Test	3.14%
Other Solids Test	5.74%	Other Solids Test	5.70%
<b>Region 7 (Arizona/Southern California)</b>			
Milk Production	3,798,787,280		
Average Number of Producers	93		
Average Pounds Per Producer	40,847,175		
Butterfat Test	3.59%		
Protein Test	n/a		
Other Solids Test	n/a		

n/a = not applicable

Region 7 represents the Arizona Order. In general, comparing all the regions, Region 7 had the most milk pooled in 2007, with 3.8 billion pounds, while Region 1 had the most producers (317 producers on average). Average milk production per producer was the highest in Region 7 with an average of 40.8 million pounds per producer for the year. The highest butterfat levels in 2007 were in Region 5 with annual tests of 3.90%, while Region 7 had the lowest annual butterfat test of 3.59%. Protein levels in Region 5 (3.18%) and other solids levels in Region 5 (5.74%) were the highest for each of those components.

Producer milk, number of producers, and average milk production per producer varied greatly between regions. Some differences in component levels were also evident. In 2007, butterfat levels in Regions 4 and 5 were noticeably higher than the other regions, while Region 7 was much lower than the other regions. Protein levels in Regions 5 were 0.12% higher than Region 2. Other solids levels by region varied only 0.04% between the high and low for the year 2007.

Changes in producer numbers and milk marketed between November 2006 and November 2007 followed the national trend of increased milk production by fewer producers. Although November is a representative month, this comparison shows effects of handlers' pooling decisions and changes in Federal Order regulations between 2006 and 2007. On a regional basis, the movement of milk production in Washington State from Western Washington to Central Washington continued. Region 2, Central Washington, increased in milk production by 19.7 million pounds between November of 2006 and 2007, with an increase of only one producer. Region 1, Western Washington, decreased by 4.3 million pounds of milk and decreased by 39 producers. (See Table 6.) For Region 6, changes in producer numbers and producer milk are a result of handler pooling decisions and not indicative of the reductions in those areas. Producer milk in Region 7 increased by 31.5 million pounds in 2007 and had an increase of one producer. Region 5, Western Oregon, faces many of the same environmental issues and urban encroachment problems as Region 1, Western Washington. In prior years, Region 5 was able to maintain production levels despite decreasing producer counts; however, in 2007, Region 5 showed decreases in producer numbers and producer milk.

<b>Table 6</b> <b>Producer Milk and Producers by Region for November 2007 and 2006</b>						
	<b>Producer Milk</b>			<b>Producers</b>		
	November 2007	November 2006	Change	November 2007	November 2006	Change
Region 1	179,397,704	183,689,322	-4,291,618	306	345	-39
Region 2	222,588,558	202,853,300	19,735,258	103	102	1
Region 3	40,788,087	35,472,131	5,315,956	38	41	-3
Region 4	948,598	945,949	2,649	8	8	0
Region 5	105,171,153	112,474,571	-7,303,418	220	245	-25
Region 6	8,044,812	60,956,359	-52,911,547	11	20	-9
Region 7	308,359,879	276,876,746	31,483,133	94	93	1
Total	865,298,791	873,268,378	-7,969,587	780	854	-74

## V. STATISTICAL RELATIONSHIP AMONG MILK COMPONENTS

Regression analysis was used to analyze the linear relationship between milk component levels. The analysis revealed that the only significant relationship between components was between butterfat (BF) and protein (PRO). Regressions of nonfat solids and protein and nonfat solids and butterfat were found to be insignificant and not included in this study. This latter finding was expected and is due to: (1) the nonfat solids level is, by definition, protein plus other solids; and (2) other solids levels appear random and show little seasonal variation. (See Appendix Tables A-4 and A-5 and Figures A-5 and A-6.)

The Pacific Northwest Order had 8,454 observations in 2007. This year's regressions are similar to other Federal order publications.<sup>4</sup> Appendix Figures A-5 and A-6 show graphical representations of the linear regressions for May and November 2007.

The butterfat and protein regression equations for the Pacific Northwest Order were calculated for 2000 through 2007. (See Table 7 below.) Over the 2000 - 2007 periods, the general trend of the regression is toward a lower intercept but a steeper slope. This would suggest that, in general, a change in the butterfat level is associated with a larger change in the protein level in 2007 compared to previous years.

**Table 7**  
**Pacific Northwest Order**  
**Comparison of Regression Results: Butterfat Level as a Predictor of Protein Levels**  
**2000 through 2007**

<u>Year</u>	<u>Equation</u>	<u>Correlation</u>
2000	TRUE PRO% = 1.526 + 0.414 BF%	R <sup>2</sup> = 0.600
2001	TRUE PRO% = 1.535 + 0.417 BF%	R <sup>2</sup> = 0.599
2002	TRUE PRO% = 1.488 + 0.426 BF%	R <sup>2</sup> = 0.649
2003	TRUE PRO% = 1.452 + 0.432 BF%	R <sup>2</sup> = 0.661
2004	TRUE PRO% = 1.434 + 0.439 BF%	R <sup>2</sup> = 0.652
2005	TRUE PRO% = 1.438 + 0.438 BF%	R <sup>2</sup> = 0.663
2006	TRUE PRO% = 1.418 + 0.444 BF%	R <sup>2</sup> = 0.626
2007	TRUE PRO% = 1.424 + 0.447 BF%	R <sup>2</sup> = 0.679

<sup>4</sup> See *Analysis of Component Levels and Somatic Cell Count in Individual Herd Milk at the Farm Level, 2007*, Upper Midwest Marketing Area, Staff paper 08-01, December 2008.

## VI. MINIMUM ORDER VALUE OF MILK PRODUCTION

The use of monthly component prices allows for the evaluation of the minimum order value of milk components in a hundredweight of milk.

The minimum order value at test of producer milk pooled on the Pacific Northwest Order in 2007 averaged \$19.28 per hundredweight. The weighted average value of each component comprising the \$19.28 per hundredweight was: \$5.43 for butterfat; \$10.83 for protein; \$2.40 for other solids; and a producer price differential of \$0.62.<sup>5</sup>

The value of producers' milk at test pooled on the Arizona Order in 2007 averaged \$19.07 per hundredweight. The weighted average value of skim and butterfat portions of the \$19.07 per hundredweight was: \$5.30 for butterfat; and \$13.77 for skim.<sup>6</sup>

There is an apparent inverse relationship between the size-range of producers' production and the butterfat and protein levels in their milk. An inverse relationship between size-range and certain component levels may be due to the relative prevalence of high component testing breeds among smaller herd sizes (e.g. Jerseys) compared to lower component testing breeds (e.g. Holsteins). The weighted average component levels by size-range of milk production are summarized in Appendix Table A-7 and Figure A-7. The inverse relationship between size-range and producer butterfat and protein levels is more apparent on the Pacific Northwest Order than in the levels of butterfat on the Arizona Order. On the Pacific Northwest Order, there appears to be a positive relationship between the size-range of a producer's production and the other solids levels in their milk. The difference in component levels, in turn, translates to an inverse relationship between size-range and minimum order value per hundredweight.

The aggregated value of milk production by size-range of milk production is summarized in Appendix Table A-8 and Figure A-8. For the Pacific Northwest Order, on average, using 2007 Federal order prices, producers with 200,000–300,000 pounds of production were valued more per hundredweight, \$18.29, than other producers. Producers with 4-6 million pounds of production averaged the lowest amount per hundredweight, at \$16.56. This relationship is generally indicative of the fact that smaller herds typically have higher component levels than larger herds. On the Arizona Order, using skim-butterfat values, a relationship between size-range and value per hundredweight was less evident. The Arizona Order data was broken down further for producers over one million pounds into smaller increments (e.g. 4-5 million pounds, 5-6 million pounds, 6-7 million pounds) to determine whether the size-range categories used masked any relationships. Using smaller increments does not indicate producers pooled on the Arizona Order who have more milk deliveries have a lower value of milk per hundredweight.

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<sup>5</sup> The producer price differentials for the Pacific Northwest Order are subject to applicable location adjustments. The effects of the location adjustments are not dealt with in this study.

<sup>6</sup> The producer prices for the Arizona Order are subject to applicable location adjustments. The effects of the location adjustment are not dealt with in this study.

## VII. SUMMARY

This paper analyzes milk components associated with the Pacific Northwest and Arizona Orders. Handlers regulated under the Pacific Northwest Order report butterfat, protein, and other solids. Handlers regulated under the Arizona Order report butterfat, only. For each order, producer information was collected from handler payrolls submitted to the market administrator's office. Component levels were examined using a variety of measures including: annual averages, seasonal and regional averages, relationships between components, frequency distributions and scatter plots of regressions, and the value of milk components by size-range of production.

Weighted average component levels for the Pacific Northwest Order in 2007 were: 3.70% butterfat, 3.09% protein, and 5.71% other solids. Butterfat percentages peaked in November and December and reached a low in June. Protein percentages peaked in November and reached a low in July. Other solids demonstrated very little seasonal change.

Although the volume of producer milk, number of producers, and average milk production per producer varies greatly between regions, there are only small differences in aggregate component levels between geographic regions within the milk sheds of the two orders.

The linear relationship between butterfat and protein on the Pacific Northwest Order was:

$$\text{Protein} = 1.42431 + 0.4465 * \text{Butterfat} \quad (R^2 = 0.6794)$$

In 2007, the Pacific Northwest Order's weighted average price received for milk was \$19.28 per hundredweight, at test.

The annual average butterfat level for the Arizona Order in 2007 was 3.59%. Butterfat levels peaked in January and reached a low in May. In 2007, the Federal order weighted average price received for milk was \$19.07 per hundredweight, at test.

In general, for the Pacific Northwest Order, as producers' monthly deliveries increase, the weighted average value of the milk, at Federal order prices, decreases.

## **APPENDIX**

Table A-1

**STATISTICAL DATA FOR PRODUCERS ON THE  
PACIFIC NORTHWEST ORDER INCLUDED IN COMPONENT ANALYSIS**

**2007**

<u>Month</u>	<b>Butterfat</b>						<u>Number of Observations</u>
	<u>Weighted Average</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Median</u>	<u>Minimum</u>	<u>Maximum</u>	
	- % -	- % -	- % -	- % -	- % -	- % -	
January	3.79	3.94	0.39	3.85	3.00	5.41	753
February	3.76	3.90	0.37	3.80	2.94	5.86	748
March	3.72	3.86	0.36	3.77	3.11	5.71	726
April	3.66	3.80	0.37	3.71	2.86	5.11	715
May	3.63	3.76	0.37	3.68	2.63	5.07	698
June	3.60	3.72	0.35	3.64	2.69	5.03	693
July	3.61	3.71	0.34	3.63	2.79	4.95	689
August	3.62	3.75	0.35	3.66	2.61	4.99	689
September	3.68	3.83	0.38	3.74	2.60	5.16	688
October	3.77	3.94	0.41	3.84	2.64	5.42	686
November	3.80	3.99	0.42	3.89	2.87	5.69	686
December	3.80	3.99	0.42	3.89	3.14	5.45	683
For the Year	3.70	3.85	0.39	3.76	2.60	5.86	8,454

<u>Month</u>	<b>Protein</b>						<u>Number of Observations</u>
	<u>Weighted Average</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Median</u>	<u>Minimum</u>	<u>Maximum</u>	
	- % -	- % -	- % -	- % -	- % -	- % -	
January	3.13	3.18	0.22	3.13	2.17	3.94	753
February	3.12	3.16	0.20	3.11	2.63	3.89	748
March	3.08	3.12	0.19	3.09	2.52	3.88	726
April	3.06	3.11	0.20	3.07	2.57	3.96	715
May	3.05	3.10	0.21	3.05	2.38	4.05	698
June	3.02	3.07	0.19	3.02	2.52	3.98	693
July	2.98	3.04	0.19	2.99	2.52	3.75	689
August	3.03	3.08	0.19	3.03	2.74	3.79	689
September	3.09	3.15	0.19	3.10	2.79	3.93	688
October	3.18	3.24	0.21	3.18	2.50	4.10	686
November	3.19	3.24	0.22	3.18	2.59	4.42	686
December	3.17	3.22	0.22	3.16	2.58	4.17	683
For the Year	3.09	3.14	0.21	3.10	2.17	4.42	8,454

Table A-1 (Continued)

**STATISTICAL DATA FOR PRODUCERS ON THE  
PACIFIC NORTHWEST ORDER INCLUDED IN COMPONENT ANALYSIS**

**2007**

<u>Month</u>	<b>Other Solids</b>						<u>Number of Observations</u>
	<u>Weighted Average</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Median</u>	<u>Minimum</u>	<u>Maximum</u>	
	- % -	- % -	- % -	- % -	- % -	- % -	
January	5.66	5.64	0.11	5.66	4.78	5.86	753
February	5.65	5.64	0.11	5.65	5.17	5.89	748
March	5.69	5.68	0.10	5.69	5.21	5.93	726
April	5.71	5.69	0.09	5.70	5.23	5.90	715
May	5.72	5.69	0.09	5.71	5.13	5.92	698
June	5.73	5.70	0.08	5.72	5.32	5.89	693
July	5.72	5.70	0.08	5.71	5.35	5.86	689
August	5.73	5.71	0.08	5.72	5.19	5.87	689
September	5.74	5.71	0.09	5.73	5.21	5.87	688
October	5.72	5.69	0.09	5.71	5.26	5.89	686
November	5.71	5.68	0.09	5.69	5.08	5.89	686
December	5.72	5.69	0.09	5.71	5.19	5.93	683
For the Year	5.71	5.68	0.09	5.70	4.78	5.93	8,454

Table A-2

**STATISTICAL DATA FOR PRODUCERS ON THE  
ARIZONA ORDER INCLUDED IN COMPONENT ANALYSIS**

**2007**

<u>Month</u>	<b>Butterfat</b>						<u>Number of Observations</u>
	<u>Weighted Average</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Median</u>	<u>Minimum</u>	<u>Maximum</u>	
	- % -	- % -	- % -	- % -	- % -	- % -	
January	3.75	3.78	0.31	3.71	3.21	4.86	92
February	3.66	3.70	0.30	3.64	3.23	4.79	92
March	3.56	3.61	0.28	3.58	3.05	4.72	92
April	3.53	3.57	0.30	3.51	2.97	4.79	92
May	3.52	3.56	0.30	3.50	2.93	4.79	92
June	3.54	3.55	0.29	3.50	2.97	4.61	93
July	3.53	3.55	0.30	3.50	2.82	4.70	93
August	3.53	3.57	0.31	3.51	2.96	4.72	93
September	3.53	3.56	0.31	3.52	3.04	4.74	93
October	3.64	3.67	0.31	3.63	2.78	4.77	94
November	3.64	3.68	0.35	3.64	2.62	4.82	94
December	3.71	3.77	0.35	3.71	2.89	4.86	92
For the Year	3.59	3.63	0.32	3.58	2.62	4.86	1,112

**Table A-3**

**WEIGHTED AVERAGE COMPONENT LEVELS BY REGION  
2007**

**Butterfat**

	<u>Region 1</u>	<u>No.*</u>	<u>Region 2</u>	<u>No.*</u>	<u>Region 3</u>	<u>No.*</u>	<u>Region 4</u>	<u>No.*</u>
	-% -		-% -		-% -		-% -	
January	3.73	337	3.76	102	3.79	39	3.88	8
February	3.71	337	3.73	102	3.73	39	3.84	8
March	3.69	333	3.65	102	3.68	39	3.83	8
April	3.63	327	3.58	103	3.64	38	3.74	8
May	3.61	315	3.53	101	3.61	38	3.75	8
June	3.59	310	3.51	101	3.56	38	3.70	8
July	3.60	309	3.54	101	3.53	38	3.64	8
August	3.63	307	3.54	102	3.52	38	3.71	8
September	3.66	308	3.60	101	3.65	38	3.84	8
October	3.73	305	3.71	102	3.73	38	3.91	8
November	3.75	306	3.76	103	3.77	38	3.93	8
December	3.74	305	3.75	102	3.79	38	3.91	8
For the Year	3.67	317	3.64	102	3.67	38	3.80	8
	<u>Region 5</u>	<u>No.*</u>	<u>Region 6</u>	<u>No.*</u>	<u>Region 7</u>	<u>No.*</u>		
	-% -		-% -		-% -			
January	3.97	243	3.72	24	3.75	92		
February	3.94	231	3.71	31	3.66	92		
March	3.91	234	3.74	10	3.56	92		
April	3.88	229	3.69	10	3.53	92		
May	3.84	227	3.67	9	3.52	92		
June	3.82	227	3.62	9	3.54	93		
July	3.79	224	3.55	9	3.53	93		
August	3.81	223	3.60	11	3.53	93		
September	3.88	222	3.75	11	3.53	93		
October	3.98	222	3.90	11	3.64	94		
November	4.00	220	3.90	11	3.64	94		
December	4.00	220	3.83	10	3.71	92		
For the Year	3.90	227	3.72	13	3.59	93		

**Table A-3 (Continued)**

**WEIGHTED AVERAGE COMPONENT LEVELS BY REGION  
2007**

**Protein**

	<u>Region 1</u>	<u>No.*</u>	<u>Region 2</u>	<u>No.*</u>	<u>Region 3</u>	<u>No.*</u>	<u>Region 4</u>	<u>No.*</u>
	-% -		-% -		-% -		-% -	
January	3.10	337	3.11	102	3.14	39	3.15	8
February	3.09	337	3.10	102	3.15	39	3.15	8
March	3.06	333	3.06	102	3.11	39	3.11	8
April	3.04	327	3.02	103	3.08	38	3.05	8
May	3.02	315	3.00	101	3.05	38	3.04	8
June	3.00	310	2.98	101	3.00	38	3.00	8
July	2.99	309	2.93	101	2.95	38	3.00	8
August	3.04	307	2.99	102	3.01	38	3.06	8
September	3.08	308	3.07	101	3.08	38	3.11	8
October	3.15	305	3.17	102	3.19	38	3.20	8
November	3.15	306	3.18	103	3.21	38	3.19	8
December	3.13	305	3.15	102	3.19	38	3.17	8
For the Year	3.07	317	3.06	102	3.10	38	3.10	8
	<u>Region 5</u>	<u>No.*</u>	<u>Region 6</u>	<u>No.*</u>	<u>Region 7</u>	<u>No.*</u>		
	-% -		-% -		-% -			
January	3.21	243	3.16	24	N/A	N/A		
February	3.19	231	3.16	31	N/A	N/A		
March	3.17	234	3.04	10	N/A	N/A		
April	3.17	229	3.05	10	N/A	N/A		
May	3.17	227	3.01	9	N/A	N/A		
June	3.13	227	3.00	9	N/A	N/A		
July	3.09	224	2.98	9	N/A	N/A		
August	3.12	223	3.07	11	N/A	N/A		
September	3.18	222	3.18	11	N/A	N/A		
October	3.25	222	3.28	11	N/A	N/A		
November	3.25	220	3.27	11	N/A	N/A		
December	3.23	220	3.25	10	N/A	N/A		
For the Year	3.18	227	3.14	13	N/A	N/A		

**Table A-3 (Continued)**

**WEIGHTED AVERAGE COMPONENT LEVELS BY REGION  
2007**

**Other Solids**

	<u>Region 1</u>	<u>No.*</u>	<u>Region 2</u>	<u>No.*</u>	<u>Region 3</u>	<u>No.*</u>	<u>Region 4</u>	<u>No.*</u>
	-% -		-% -		-% -		-% -	
January	5.65	337	5.65	102	5.66	39	5.64	8
February	5.64	337	5.63	102	5.65	39	5.63	8
March	5.68	333	5.68	102	5.70	39	5.69	8
April	5.70	327	5.70	103	5.71	38	5.71	8
May	5.70	315	5.72	101	5.73	38	5.72	8
June	5.71	310	5.72	101	5.73	38	5.74	8
July	5.71	309	5.72	101	5.73	38	5.73	8
August	5.72	307	5.73	102	5.75	38	5.73	8
September	5.73	308	5.74	101	5.76	38	5.73	8
October	5.71	305	5.72	102	5.73	38	5.73	8
November	5.70	306	5.70	103	5.71	38	5.72	8
December	5.72	305	5.72	102	5.73	38	5.73	8
For the Year	5.70	317	5.70	102	5.72	38	5.71	8
	<u>Region 5</u>	<u>No.*</u>	<u>Region 6</u>	<u>No.*</u>	<u>Region 7</u>	<u>No.*</u>		
	-% -		-% -		-% -			
January	5.71	243	5.66	24	N/A	N/A		
February	5.71	231	5.65	31	N/A	N/A		
March	5.73	234	5.74	10	N/A	N/A		
April	5.74	229	5.76	10	N/A	N/A		
May	5.74	227	5.76	9	N/A	N/A		
June	5.74	227	5.76	9	N/A	N/A		
July	5.75	224	5.76	9	N/A	N/A		
August	5.76	223	5.77	11	N/A	N/A		
September	5.76	222	5.78	11	N/A	N/A		
October	5.74	222	5.76	11	N/A	N/A		
November	5.72	220	5.75	11	N/A	N/A		
December	5.73	220	5.75	10	N/A	N/A		
For the Year	5.74	227	5.70	13	N/A	N/A		

\* Number of producers included in monthly average component level.

N/A = not applicable, Arizona Order, Area 7, did not use protein and other solids.

Table A-4

**LINEAR RELATIONSHIPS BETWEEN VARIOUS MILK COMPONENTS  
2007**

**Butterfat Levels as a Predictor of Protein  
Protein = c + b (Butterfat)**

**Pacific Northwest Order**

	<u>c</u>	<u>b</u>				
	<u>Constant</u>	<u>Butterfat</u>	<u>Standard</u>	<u>R-Squared</u>	<u>Standard</u>	<u>Number of</u>
		<u>Coefficient</u>	<u>Error of b</u>	<u>(Adjusted)</u>	<u>Error</u>	<u>Comparisons</u>
January	1.36101	0.46116	0.01195	0.66419	0.12710	753
February	1.48963	0.42793	0.01197	0.63114	0.12131	748
March	1.51174	0.41735	0.01226	0.61487	0.11928	726
April	1.51353	0.42008	0.01203	0.63049	0.11858	715
May	1.41830	0.44839	0.01291	0.63378	0.12473	698
June	1.37268	0.45621	0.01178	0.68405	0.10830	693
July	1.34206	0.45796	0.01175	0.68832	0.10344	689
August	1.42960	0.44153	0.01136	0.68698	0.10394	689
September	1.54321	0.42000	0.01094	0.68214	0.10968	688
October	1.61720	0.41024	0.01121	0.66152	0.12155	686
November	1.48239	0.44182	0.01101	0.70163	0.11997	686
December	1.50568	0.42980	0.01095	0.69301	0.11990	683
For the Year	1.42431	0.44653	0.00334	0.67941	0.11953	8,454

Table A-5

**LINEAR RELATIONSHIPS BETWEEN VARIOUS MILK COMPONENTS  
2007**

**Butterfat Levels as a Predictor of Other Solids**

$$\text{Other Solids} = c + b (\text{Butterfat})$$

**Pacific Northwest Order**

	<u>c</u>	<u>b</u>				
	<u>Constant</u>	<u>Butterfat</u>	<u>Standard</u>	<u>R-Squared</u>	<u>Standard</u>	<u>Number of</u>
		<u>Coefficient</u>	<u>Error of b</u>	<u>(Adjusted)</u>	<u>Error</u>	<u>Comparisons</u>
January	5.85864	-0.05644	0.01035	0.03678	0.11009	753
February	5.81578	-0.04622	0.01035	0.02473	0.10495	748
March	5.84160	-0.04311	0.00971	0.02515	0.09447	726
April	5.86495	-0.04671	0.00900	0.03505	0.08870	715
May	5.87486	-0.04813	0.00914	0.03692	0.08835	698
June	5.84061	-0.03693	0.00828	0.02659	0.07609	693
July	5.81334	-0.03046	0.00880	0.01570	0.07753	689
August	5.87049	-0.04384	0.00895	0.03234	0.08189	689
September	5.92148	-0.05500	0.00825	0.05951	0.08272	688
October	5.99741	-0.07736	0.00777	0.12540	0.08422	686
November	6.03365	-0.08977	0.00779	0.16145	0.08489	686
December	6.05632	-0.09093	0.00741	0.17991	0.08113	683
For the Year	5.92348	-0.06234	0.00256	0.06549	0.09169	8,454

Table A-6

**MONTHLY PRODUCER COMPONENT PRICES  
2007**

<b>Pacific Northwest Order</b>				
<u>Month</u>	<u>Butterfat Price</u> \$ / pound	<u>Protein Price</u> \$ / pound	<u>Other Solids Price</u> \$ / pound	<u>Producer Price Differential 1/</u> \$ / hundredweight
January	1.3009	2.4053	0.3183	0.07
February	1.3112	2.4125	0.4170	(0.37)
March	1.3769	2.4329	0.5257	(0.25)
April	1.4657	2.5212	0.6008	0.15
May	1.5706	2.9424	0.5791	0.27
June	1.6457	3.7059	0.5831	0.02
July	1.6110	4.2068	0.5534	0.60
August	1.5872	3.9412	0.4368	2.01
September	1.5101	4.3929	0.2890	1.58
October	1.4092	4.1695	0.2286	2.21
November	1.4077	4.3081	0.2461	1.60
December	1.4348	4.7061	0.2637	(0.30)
<b>Simple Average</b>	<b>1.4693</b>	<b>3.5121</b>	<b>0.4201</b>	<b>0.63</b>

1/ The producer price differentials for the Pacific Northwest Order are subject to applicable location adjustments. The effects of the location adjustments are not dealt with in this study.

<b>Arizona Order</b>		
<u>Month</u>	<u>Skim Price 2/</u> \$ / hundredweight	<u>Butterfat Price 2/</u> \$ / pound
January	9.85	1.3185
February	9.97	1.3130
March	10.70	1.3708
April	11.74	1.4570
May	13.10	1.5509
June	15.11	1.6328
July	16.98	1.6300
August	17.23	1.5980
September	17.35	1.5457
October	17.13	1.4411
November	17.12	1.4199
December	16.37	1.4365
<b>Simple Average</b>	<b>14.39</b>	<b>1.4762</b>

2/ The producer prices for the Arizona Order are subject to applicable location adjustments. The effects of the location adjustments are not dealt with in this study.

**Table A-7**

**AGGREGATED COMPONENT TESTS BY SIZE-RANGE  
PRODUCER MILK DELIVERIES  
2007**

(See Figure A-7)

**Pacific Northwest Order**

<u>Size Range</u>		<u>Butterfat</u> - % -	<u>Protein</u> - % -	<u>Other Solids</u> - % -
<u>Equal to or more than</u> - pounds -	<u>Less than</u> - pounds -			
	50,000	4.16	3.26	5.56
50,000	100,000	4.00	3.20	5.62
100,000	200,000	3.94	3.17	5.66
200,000	300,000	3.92	3.17	5.69
300,000	400,000	3.95	3.18	5.70
400,000	500,000	3.83	3.13	5.70
500,000	600,000	3.80	3.13	5.71
600,000	700,000	3.71	3.09	5.73
700,000	1,000,000	3.73	3.09	5.71
1,000,000	2,000,000	3.68	3.09	5.72
2,000,000	3,000,000	3.69	3.09	5.72
3,000,000	4,000,000	3.66	3.08	5.71
4,000,000	6,000,000	3.59	3.04	5.70
6,000,000		3.58	3.06	5.71
Weighted Average		3.70	3.09	5.71

**Table A-7 (Continued)**

**AGGREGATED COMPONENT TESTS BY SIZE-RANGE  
PRODUCER MILK DELIVERIES  
2007**

(See Figure A-7)

**Arizona Order**

Size Range		<u>Butterfat</u> - % -
<u>Equal to or</u> <u>more than</u>	<u>Less</u> <u>than</u>	
- pounds -	- pounds -	
	100,000	3.51
100,000	200,000	3.63
200,000	300,000	3.52
300,000	400,000	3.57
400,000	500,000	3.58
500,000	600,000	3.53
600,000	700,000	3.60
700,000	1,000,000	3.69
1,000,000	2,000,000	3.70
2,000,000	3,000,000	3.59
3,000,000	4,000,000	3.73
4,000,000	5,000,000	3.65
5,000,000	6,000,000	3.52
6,000,000	7,000,000	3.53
7,000,000		3.52
Weighted Average		3.59

Table A-8

**AGGREGATED COMPONENT VALUES BY SIZE-RANGE  
PRODUCER MILK DELIVERIES  
2007**

(See Figure A-8)

**Pacific Northwest Order**

Size Range		Aggregated Component Values 1/ - dollars -	Producer Milk - pounds -	Percent of Producer Milk - % -	Producers - % -	Percent of Producers - % -	Weighted Average Value - dollars/cwt. -
Equal to or more than - pounds -	Less than - pounds -						
	50,000	\$ 2,318,873.67	11,445,720	0.16%	368	4.35%	20.26
50,000	100,000	10,106,239.72	50,385,698	0.72%	656	7.76%	20.06
100,000	200,000	45,078,494.01	227,878,589	3.25%	1,539	18.20%	19.78
200,000	300,000	50,347,774.70	252,744,870	3.60%	1,020	12.07%	19.92
300,000	400,000	50,285,690.61	253,795,896	3.62%	735	8.69%	19.81
400,000	500,000	45,977,400.14	236,021,449	3.36%	522	6.17%	19.48
500,000	600,000	52,110,978.22	269,112,540	3.83%	491	5.81%	19.36
600,000	700,000	46,118,848.46	238,540,687	3.40%	368	4.35%	19.33
700,000	1,000,000	131,097,917.96	677,075,002	9.65%	794	9.39%	19.36
1,000,000	2,000,000	320,201,732.40	1,664,672,272	23.72%	1,168	13.82%	19.24
2,000,000	3,000,000	177,302,480.57	916,628,092	13.06%	372	4.40%	19.34
3,000,000	4,000,000	114,795,034.66	597,306,904	8.51%	179	2.12%	19.22
4,000,000	6,000,000	101,059,341.71	535,156,894	7.62%	113	1.34%	18.88
6,000,000		206,742,710.81	1,088,099,986	15.50%	129	1.53%	19.00
Total/Weighted Average		\$ 1,353,543,517.63	7,018,864,599	100.00%	8,454	100.00%	19.28

Table A-8 (Continued)

**AGGREGATED COMPONENT VALUES BY SIZE-RANGE  
PRODUCER MILK DELIVERIES**

**2007**

(See Figure A-8)

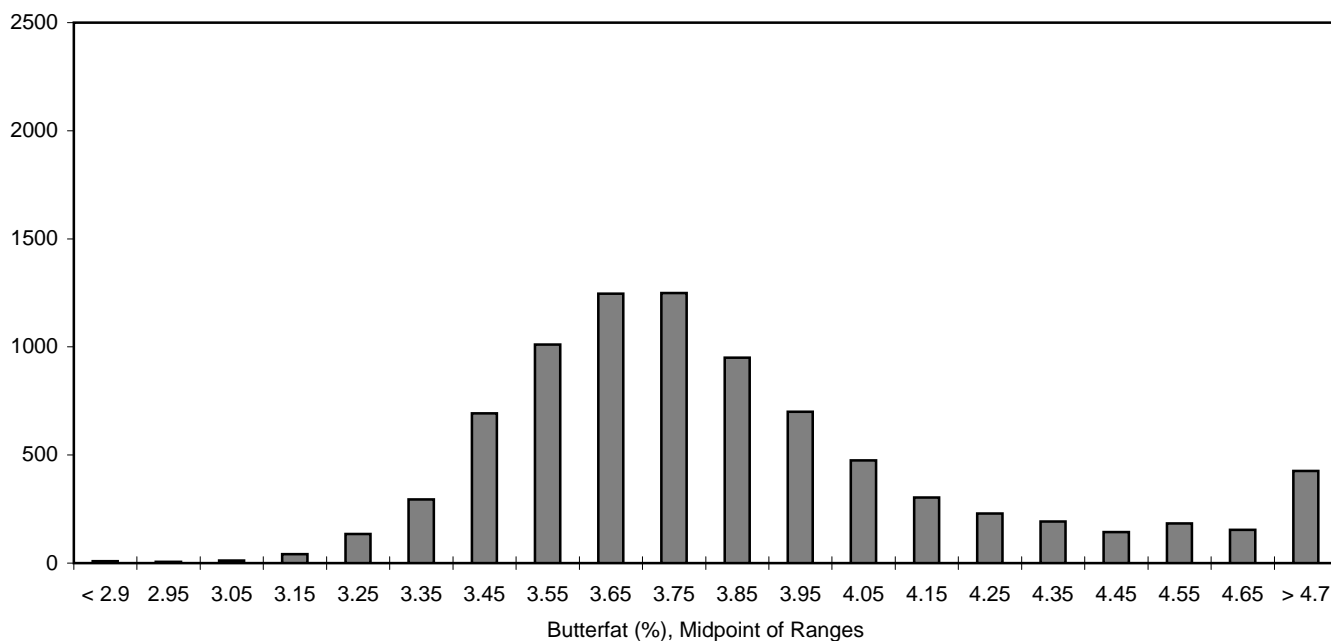
**Arizona Order**

Size Range		Aggregated Component Values 1/	Producer Milk	Percent of Producer		Percent of Producers	Weighted Average Value
Equal to or more than	Less than			Milk	Producers		
- pounds -	- pounds -	- dollars -	- pounds -	- % -	- % -	- % -	- dollars/cwt. -
	100,000	\$ 126,218.71	667,274	0.02%	14	1.26%	18.92
100,000	200,000	62,340.00	302,759	0.01%	2	0.18%	20.59
200,000	300,000	1,023,986.00	5,422,047	0.14%	21	1.89%	18.89
300,000	400,000	721,088.04	3,734,985	0.10%	11	0.99%	19.31
400,000	500,000	2,311,712.89	11,397,777	0.30%	25	2.25%	20.28
500,000	600,000	2,835,178.57	14,677,679	0.39%	27	2.43%	19.32
600,000	700,000	2,708,830.47	14,319,790	0.38%	22	1.98%	18.92
700,000	1,000,000	11,627,469.71	56,751,165	1.49%	65	5.85%	20.49
1,000,000	2,000,000	82,561,940.94	431,858,188	11.37%	294	26.44%	19.12
2,000,000	3,000,000	66,585,476.60	349,727,013	9.21%	141	12.68%	19.04
3,000,000	4,000,000	90,933,993.88	476,086,396	12.53%	140	12.59%	19.10
4,000,000	5,000,000	102,815,766.06	512,930,757	13.50%	112	10.07%	20.04
5,000,000	6,000,000	89,094,992.91	477,901,792	12.58%	89	8.00%	18.64
6,000,000	7,000,000	46,261,752.12	249,668,952	6.57%	39	3.51%	18.53
7,000,000		224,810,239.19	1,193,340,706	31.41%	110	9.89%	18.84
Total/Weighted Average		\$ 724,480,986.08	3,798,787,280	100.00%	1,112	100.00%	19.07

1/ Based on Federal order minimum prices. Producer prices for the two orders are subject to location adjustments. The effects of the location adjustments are not dealt with in this study.

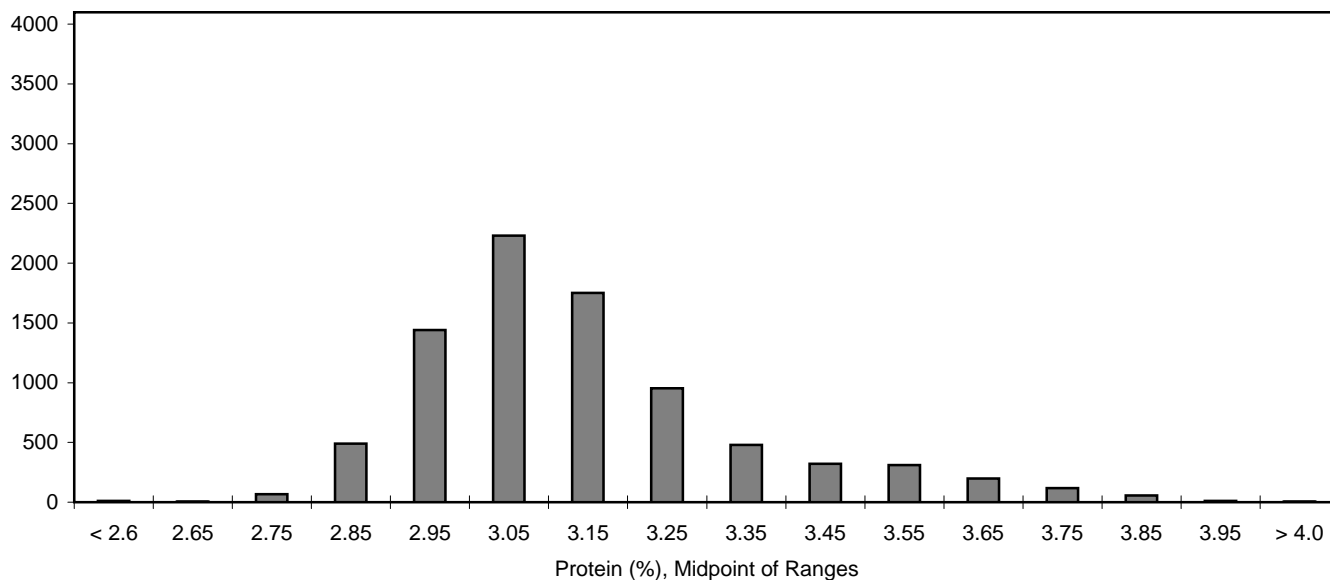
**Figure A-1**  
**FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE BUTTERFAT LEVELS**  
**PACIFIC NORTHWEST ORDER**  
**2007**

Number of Observations

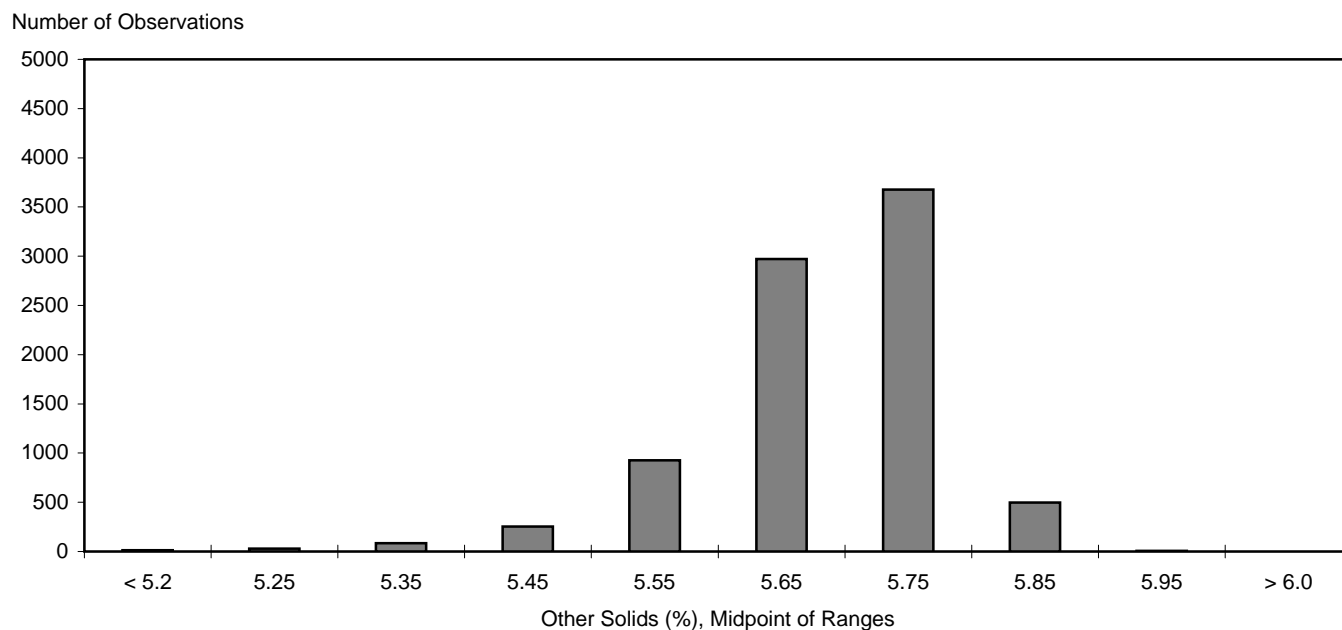


**Figure A-2**  
**FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE PROTEIN LEVELS**  
**PACIFIC NORTHWEST ORDER**  
**2007**

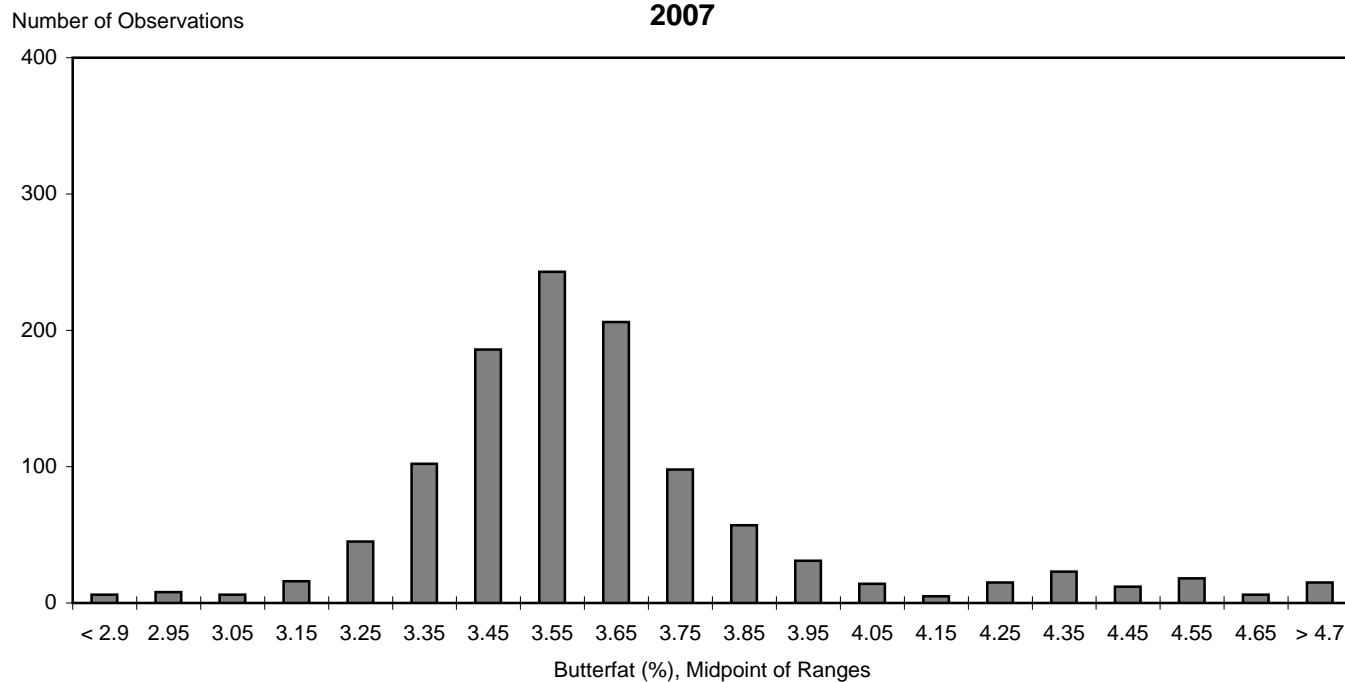
Number of Observations



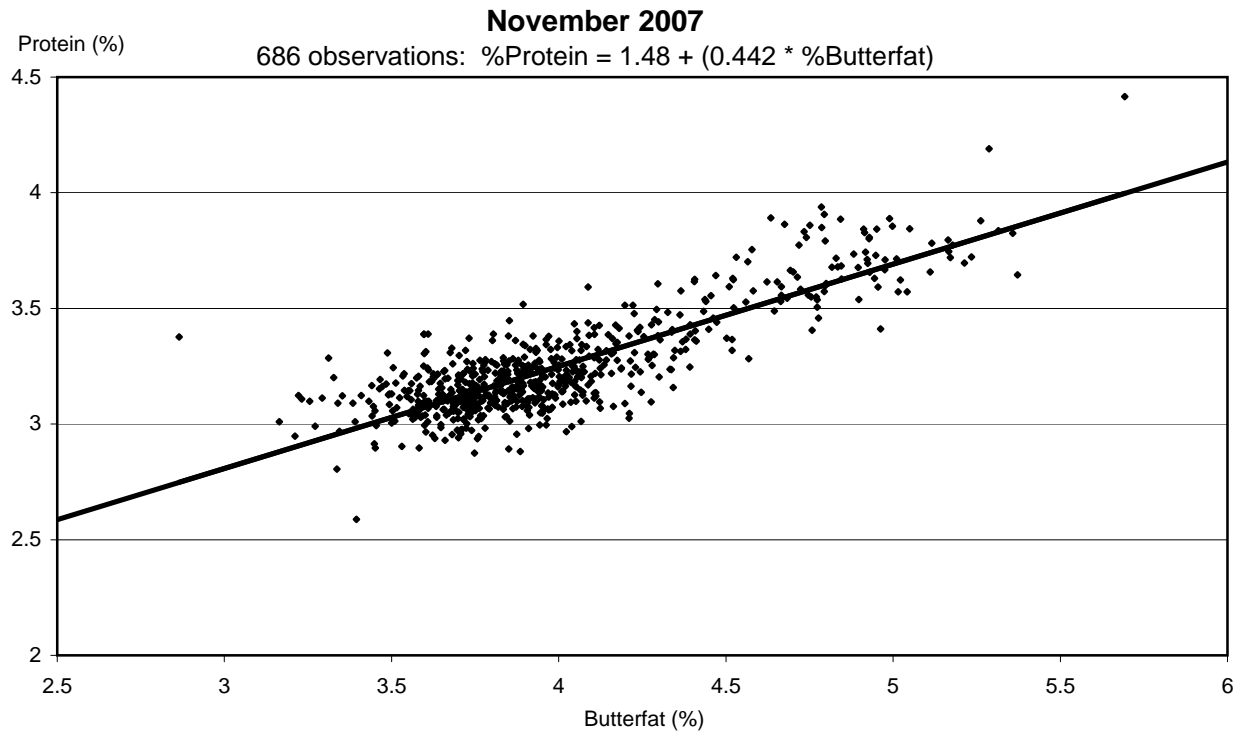
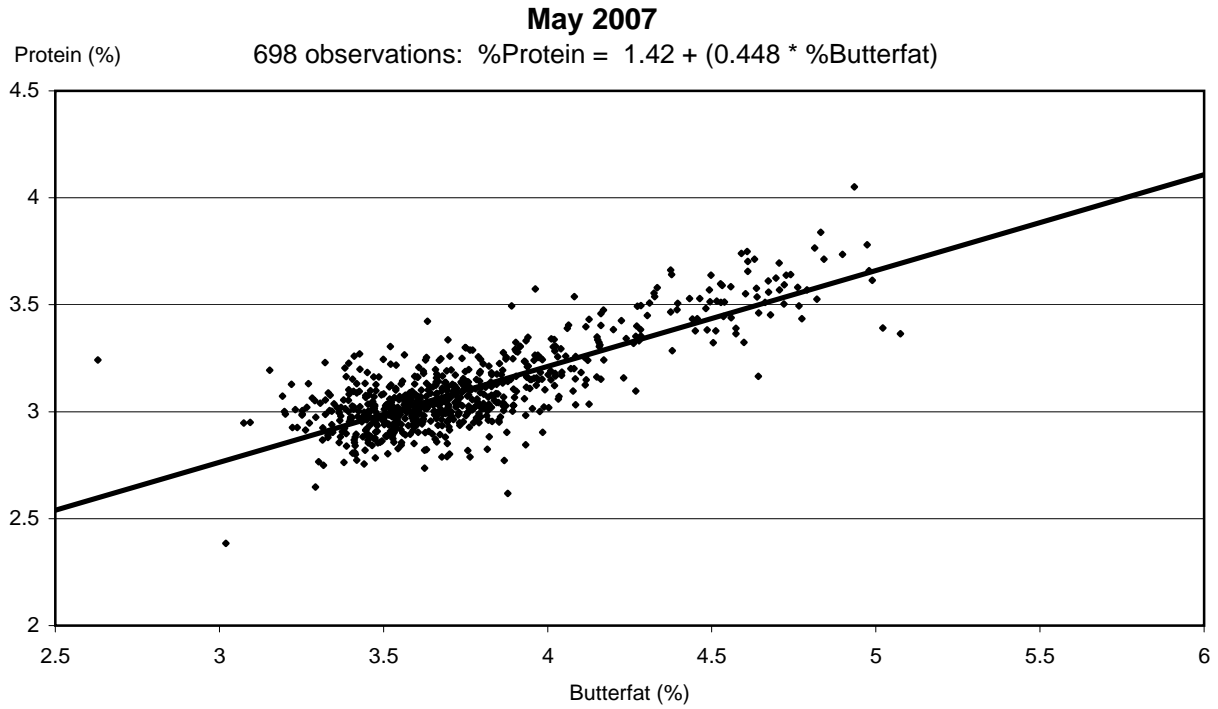
**Figure A-3**  
**FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE OTHER SOLIDS**  
**LEVELS: PACIFIC NORTHWEST ORDER**  
**2007**



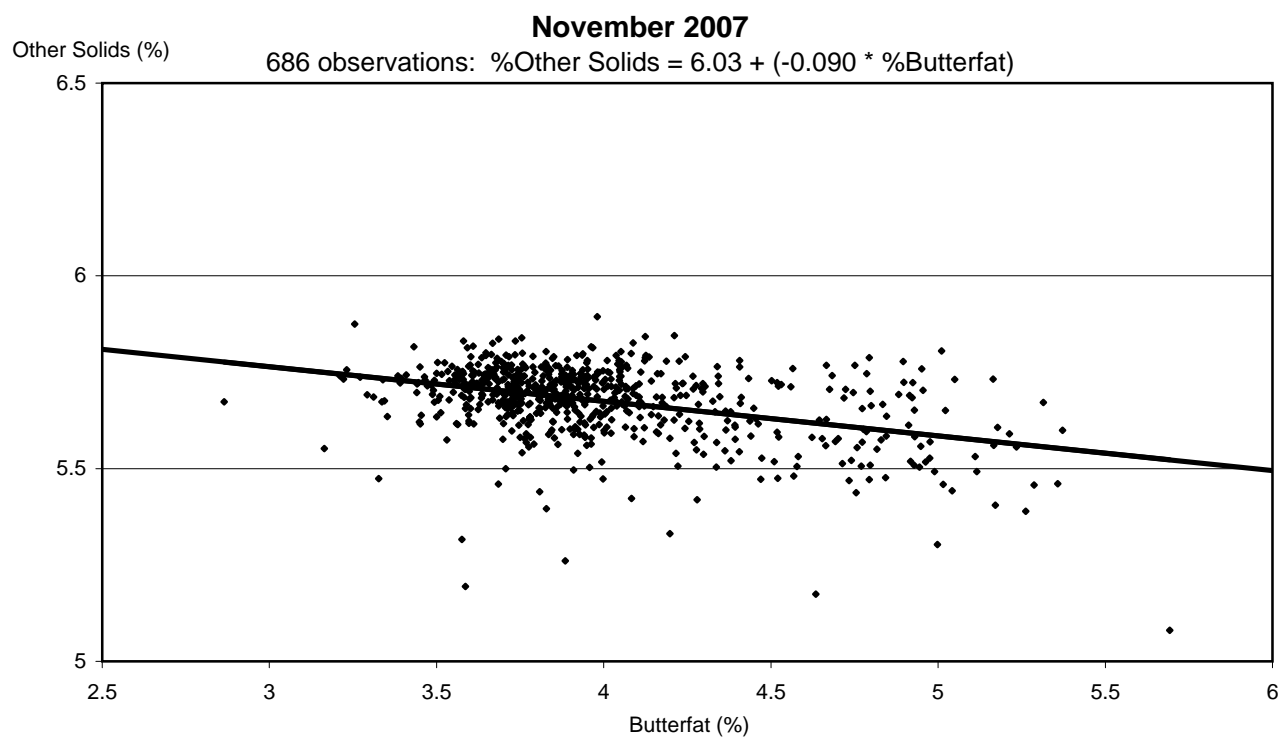
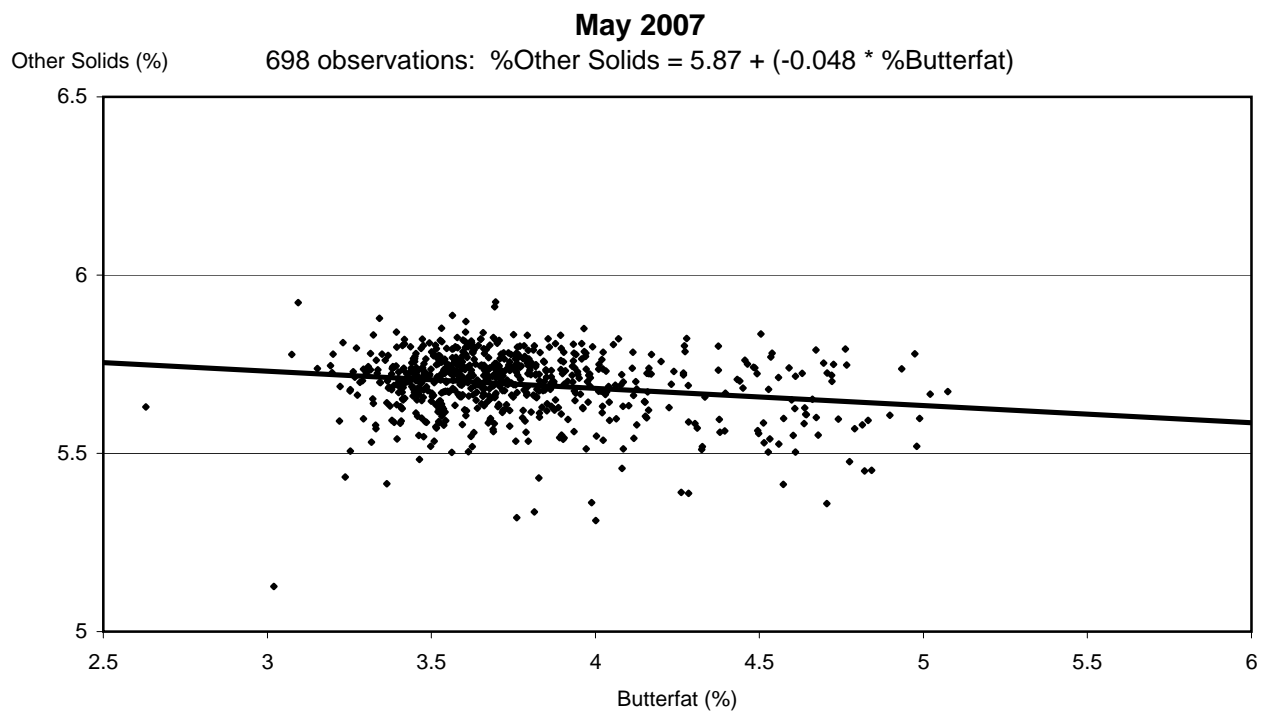
**Figure A-4**  
**FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE BUTTERFAT LEVELS**  
**ARIZONA ORDER**  
**2007**



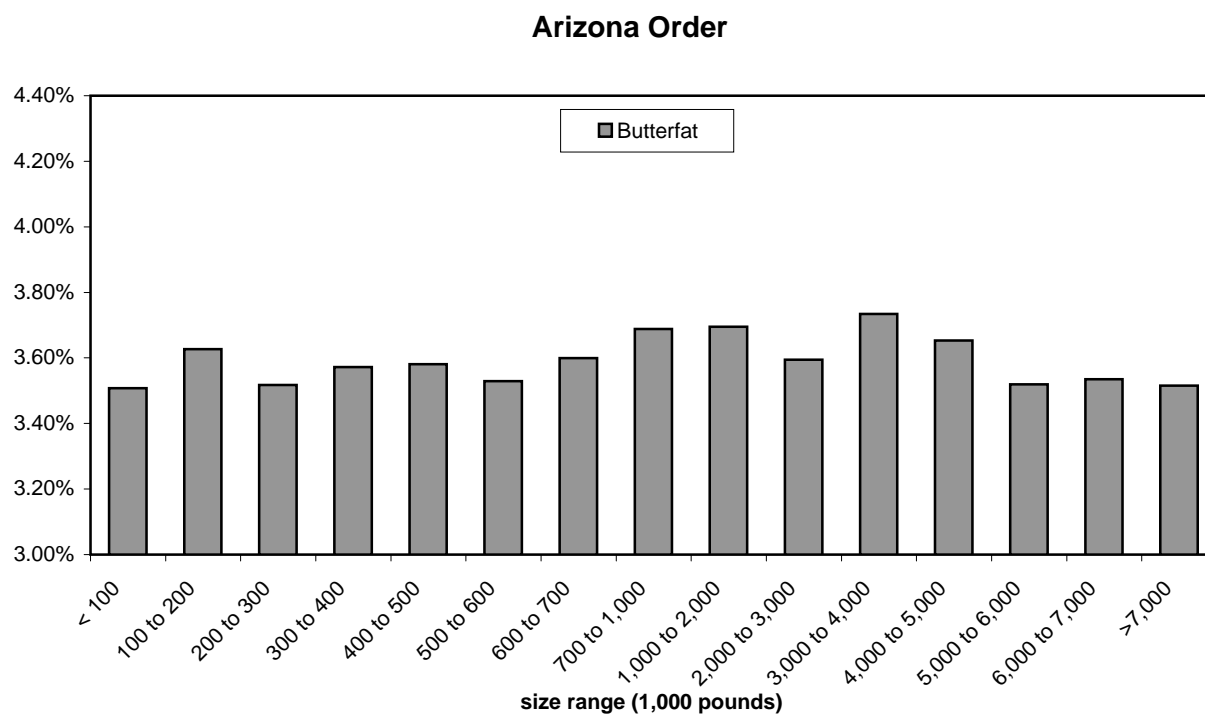
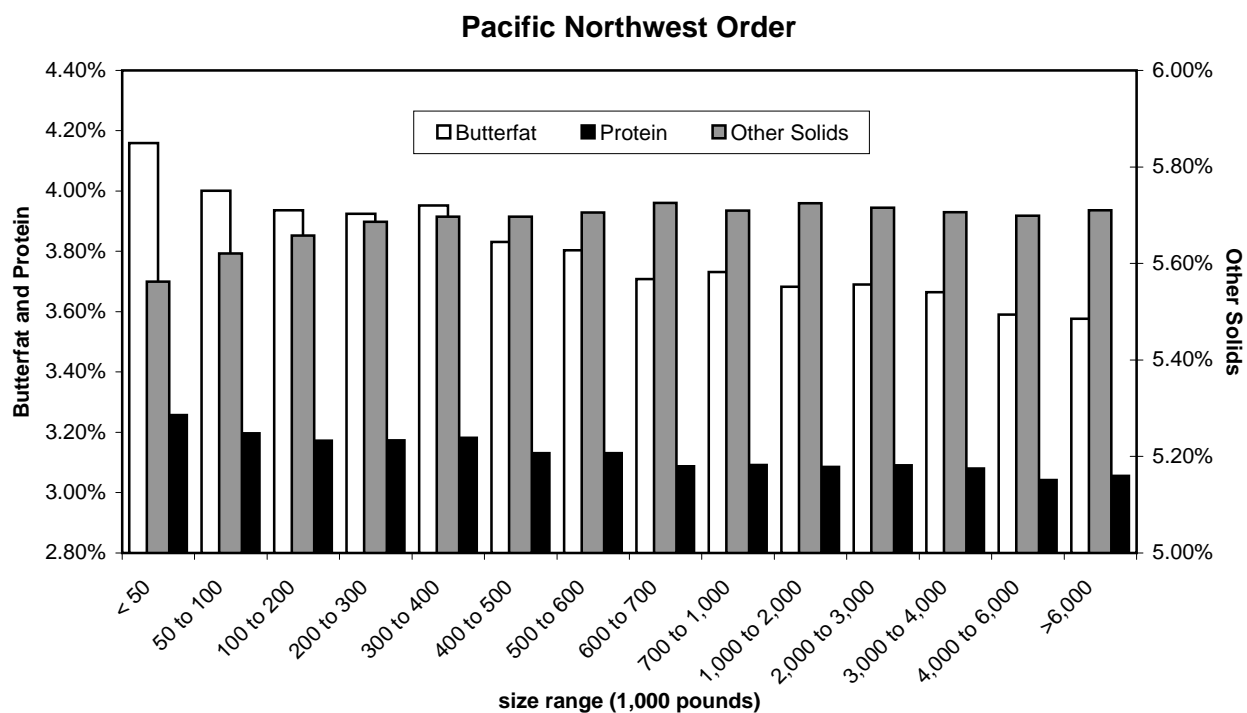
**Figure A-5**  
**SCATTER PLOT OF PROTEIN AND BUTTERFAT**  
**MAY AND NOVEMBER 2007**  
**Pacific Northwest Order**



**Figure A-6**  
**SCATTER PLOT OF OTHER SOLIDS AND BUTTERFAT**  
**MAY AND NOVEMBER 2007**  
**Pacific Northwest Order**

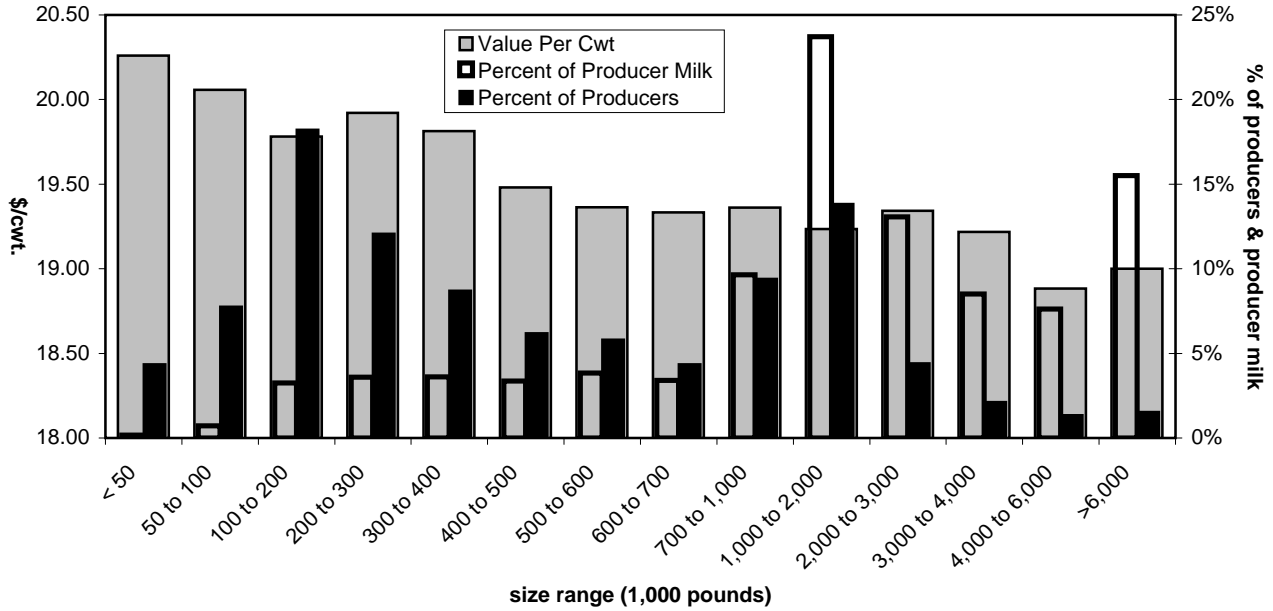


**Figure A-7**  
**WEIGHTED AVERAGE COMPONENT LEVELS**  
**BY SIZE-RANGE OF PRODUCER MILK DELIVERIES**  
**2007**

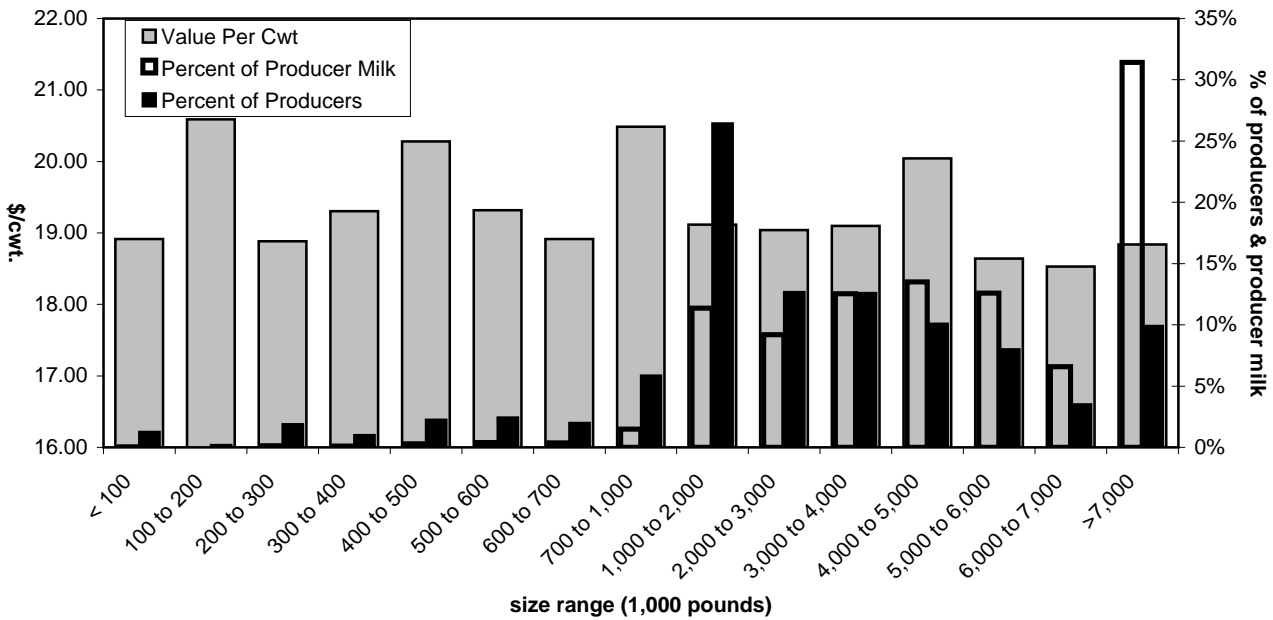


**Figure A-8**  
**WEIGHTED AVERAGE VALUES AND PERCENT OF PRODUCERS & PRODUCER MILK**  
**BY SIZE-RANGE OF PRODUCER MILK DELIVERIES**  
**2007**

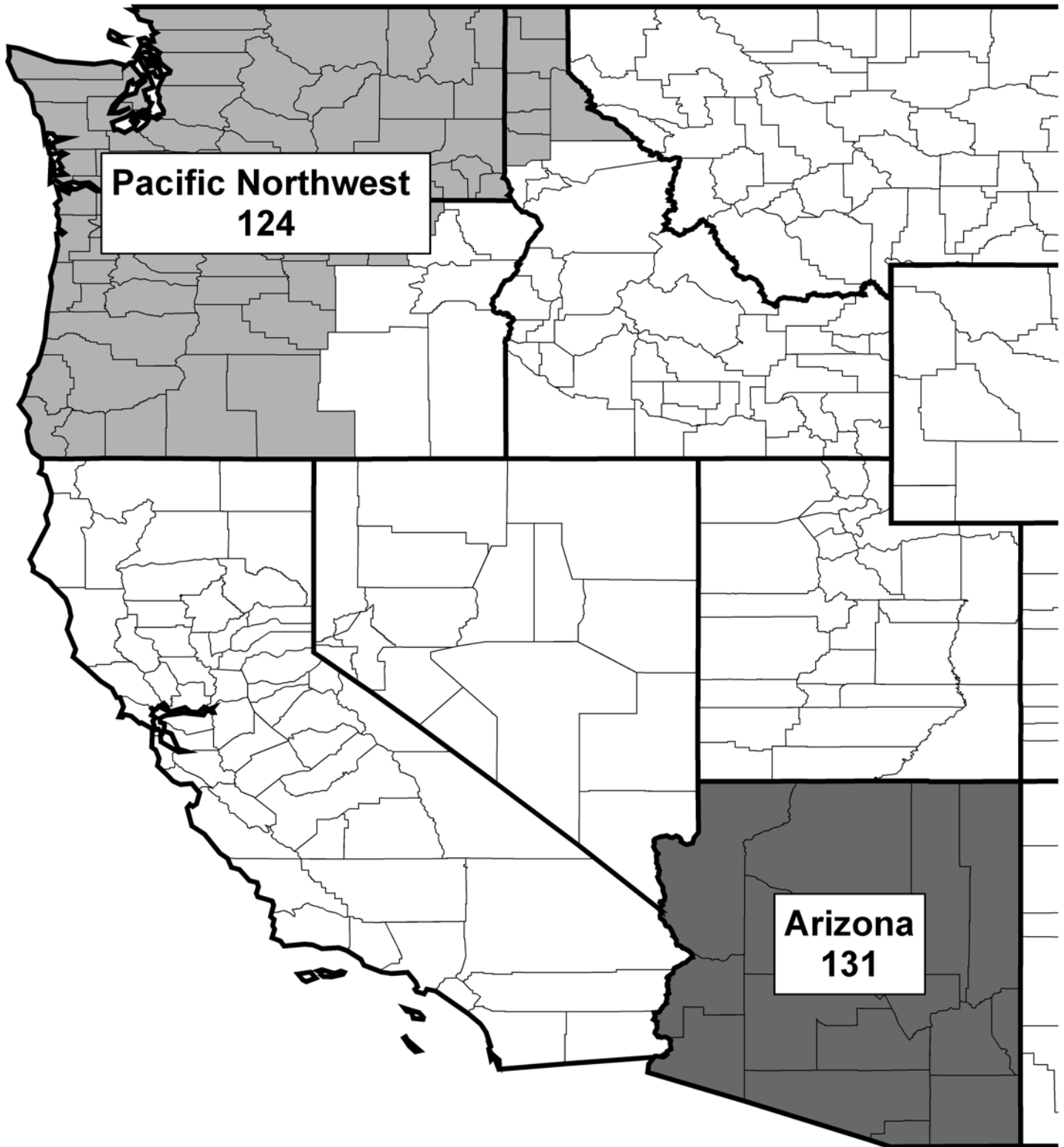
**Pacific Northwest Order**



**Arizona Order**



**MAP A-1**  
**Marketing Area of the Pacific Northwest (FO 124)**  
**and Arizona (FO131) Federal Orders**



**MAP A-2**  
**Geographic Regions Encompassing The Pacific Northwest and**  
**Arizona Order Milk Sheds, 2007**

