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## Analysis of Western Australian wool quality on a shire basis

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# Technical Bulletin

## Analysis of Western Australian Wool Quality on a Shire Basis

No. 91



A/Prof. John Stanton  
Lindy Coss



**CURTIN**  
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## Definition

To define:

- the differences between shires;
- the extent of change within a shire over five years; and
- the correlated changes between correlated characteristics within shire.

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## Summary

Western Australia produces wool in a wide range of environments from high rainfall areas in the south-west of the State through to semi-arid regions in the north and east of the State. Perceptions about the quality of the raw wool tend to be strongly influenced by the production region. To understand the specifications of raw wool from these various regions, a detailed comparative analysis of the specifications of the raw wool was undertaken. This analysis used the information available in the Fremantle auction catalogues which define the specifications and the Wool Selling Area (WSA) for each individual sale lot. The location of the district was further refined by expanding the production district from 20 WSA to 104 shires.

The weight of wool sold (greasy and clean fibre weights), the pre-sale test certificate information (diameter, yield and vegetable matter content) and the staple measurements (staple length, staple strength and proportion of mid breaks) were used from the individual sale lots. These were collected over a five-year period from the 1989/90 selling season through to 1993/94. The results for the individual specifications were tabulated for each shire using a long term average, annual averages and quarterly averages. Attempts were made to express the relative importance of the region (WSA and shire within WSA) and season (year and season within year) with respect to the individual specifications.

The distributions of the specifications across the State were mapped into shire boundaries to show (a) the change in the long term average of the specifications between neighbouring shires across the State, and (b) annual changes from the long term shire average which were designed to show the effect of yearly changes in production within the shire, presumably arising from environmental or management changes.

This document is designed to be a reference for the WA wool production sector to discuss the changes identified, as well as their cause and control, and for the users of the WA wool clip to identify the quality of wool produced in specific regions, and the stability of these specifications across time.

# **ANALYSIS OF WESTERN AUSTRALIAN WOOL QUALITY ON A SHIRE BASIS**

**A/Prof. John Stanton and Lindy Coss**

## **1. Introduction**

Analyses of the quality of the WA wool clip and comparison with the eastern States have been finished and the results distributed (Stanton 1994).

The response by individual growers to the information has been one of interest, but the results have little relevance to their individual wool enterprises. The objective of this project is therefore to develop a set of information about wool quality which would be relevant to the individual Western Australian wool producer, as well as being useful to the Agriculture Western Australia officers serving groups of producers.

Recently shire information on wool quality has been used in the Wool Market Awareness workshops to aid discussion on wool measurements. The grower response to this limited set was positive as they could identify with the shire (and its boundaries) as well as being able to relate changes in their wool with the wool from neighbouring properties within the shire. A full list of shires with their respective wool selling area (WSA) is shown in Appendix 1.

An analysis was therefore undertaken to prepare results which would relate to shires and to present the results in a variety of forms that allow rapid digestion of the available information.

### **1.1 Objective**

The objectives for the project (from Agriculture Western Australia point of view) were to:

- define the differences between shires;
- define the extent of change within a shire over five years;
- define the correlated changes between correlated characteristics within shire.

These results would:

1. Form a set of benchmarks for research and development programs.
2. Allow examination of the volatility that exists at the shire level for individual characteristics. It is important to identify this volatility as either between year or within year. These production variances (i.e. production risk) can be combined with price analyses (i.e. market risk) over the same period to facilitate risk management.
3. Form the basis for the forecasting work as it may be more relevant to analyse quality shifts at the shire level and sum these changes to develop changes in State quality (i.e. changes in the Fremantle sales) than undertake an exhaustive analysis at the Fremantle level. It may be that the precision of the sum of the individual shire forecasts is superior to the single Fremantle/State forecasts.

## 1.2 Review of State analyses

The analysis of the Western Australian wool clip has been undertaken (Stanton, 1994) by analysing the wool presented for sale at auction in Fremantle for five consecutive years between 1988 and 1993. This report also compared Fremantle results with results at sale at auction in all other Australian centres. This analysis showed that the long-term average of the WA clip is close to the results from the 'Rest' for most measured wool characteristics. It also showed that there are significant shifts in these Fremantle averages between years.

There were also significant shifts in the Fremantle characteristics between months within a year (Stanton and Chambers, 1992). Monthly differences were also evident within a region (Wool Selling Area), and there were differences between regions in these monthly patterns.

Therefore the understanding of changes in the supply of wool to Fremantle needs to include time and regional effects.

## 1.3 Review options

The time options available were:

- to use a long-term average description of production (in this case a five-year average);
- to include a series of year averages as well as the long-term average to identify changes between years;
- to include within year as well as between-year effects. This may be necessary as the majority of WA wool production comes from a Mediterranean climate which is strongly seasonal. These within-year effects can be measured on a seasonal basis or on a shorter time basis such as monthly.

The limitations to increasing the time resolution of the analyses (i.e. down to the monthly level) include the increase in the size of the analyses, the associated difficulties in defining significant changes within the results and the presentation of the results in a useable form. To illustrate this the number of permutations (N) to consider are:

- for five-year long-term average and yearly averages  $N=1+5$
- for five-year long-term average, five-year seasonal averages and yearly seasonal averages  $N=1+4+(5*4)$
- for five-year long-term average, five-year monthly average and yearly monthly averages  $N=1+12+(5*12)$

Similarly the regional options available were:

- State-wide ( $N=1$ );
- by wool selling area (WSA) where ( $N=17$ );
- by local government area (LGA). These are also known as shires ( $N=104$ ).

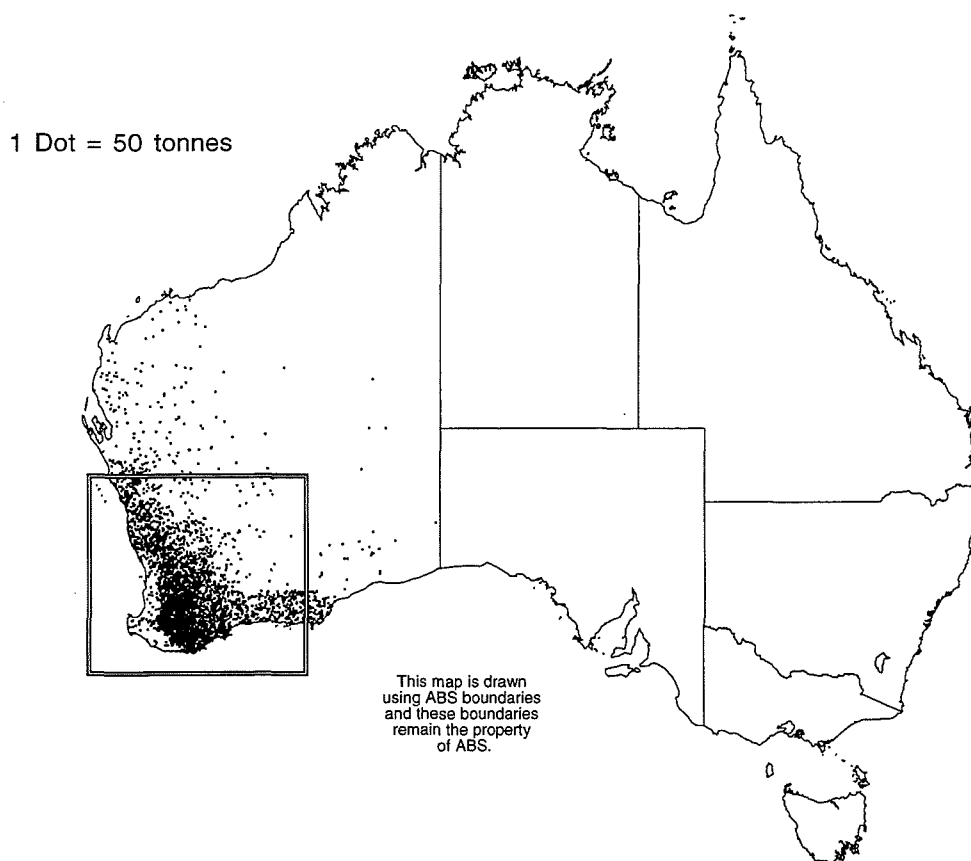
The analysis also increases in complexity when year or seasonal effects are suspected of having significant interactions with the regional effects.

In this analysis, various options for the time and regional effects were considered. The best options were selected after considering:

- which option best explains between season/between region differences;
- the data available to support each option;
- the presentation of the analysis results in an interpretable manner.

As a result of these considerations, this analysis was designed to use shire information on an annual basis, and on quarterly periods. These were reported for individual shires across Western Australia. In the higher wool producing region of the south-west of Western Australia (see Map 1) maps of the average characteristics were generated to show the pattern of these characteristics at the shire level. In addition, the mapping was extended to quantify the changes in these shire results between years from the shire's long-term average.

**Map 1. Distribution of wool production in Western Australia, averaged over five years from July 1989 to June 1993. Each dot represents 50 tonnes of greasy wool. The boxed region is used in subsequent maps of wool quantities and qualities. Data from ABS dataset.**



## **2. Methodology**

### **2.1 Datasets**

There are a number of datasets that were used to provide information on the wool production and wool qualities of the Western Australian clip.

#### **2.1.1 Auction dataset**

The auction dataset contains the catalogue information from each sale lot sold at auction in Fremantle over the period July 1989 to June 1994. This information contains the wool selling area (WSA) which is supplied by the broker, wool brand which is recorded from the bale, and test results which are supplied by AWTA.

#### **2.1.2 AgWA dataset**

The information used from this dataset included the wool brands used and the location of WA properties using these brands. It was used to append the shire information to the auction dataset using the brand information common to both datasets. About 70 per cent of sale lots in the auction dataset were matched allowing the shire data and wool data to be combined. The number of brands matched per shire varied between shires. The number of brands per shire used in these analyses are listed in Appendix 2.

#### **2.1.3 ABS Agricultural Statistics (general summary)**

The yearly series of Australian Bureau of Statistics (ABS) information on sheep numbers and wool production is available on a shire basis in the ABS Ag Stat dataset. Part of this series coincides with the period for the auction dataset. Therefore estimates of total wool produced can be related to the wool quality estimates and weight of wool sold at auction.

#### **2.1.4 ABS Livestock Products**

This monthly ABS series contains the broker and receipts of taxable wool by month for each State of Australia. This can be used to estimate the monthly production of wool on a shire basis.

### **2.2 Analyses**

As discussed in the Review Options (Section 1.3) there are a number of different time and regional units available, and the choice of the units to use relies on:

- the availability of the data at that unit size;
- the ability to interpret the results from that unit size;
- the ability of the unit size to explain the variance in the characteristic.

The availability of the data was fixed by the records accessible by the project. All available information has been used. Some analyses were therefore not undertaken because the data was unavailable.

The ability to interpret the results is related to the size of the matrix produced and how that matrix can be presented. Tables provide exact results but prove difficult to use when identifying a 'pattern' or 'trend'. Mapping the matrix provides a visual method to assess patterns and trends but does not supply exact results. Providing both forms of results allows them to complement each other. However, there is still a limit to the amount of information that can be presented in a useable format.

In these analyses it was decided to use season by shire as a suitable minimum size unit to work with rather than use month by shire (the two smallest units) which would have resulted in information overload. In these analyses the four seasons were nested within a selling year. This is because the seasons only exist within a selling year. Similarly each shire exists within only one WSA, so the shires were nested within WSA. The calendar months included in the seasons are shown below.

Quarter	Calendar months
Q1	January, February, March
Q2	April, May, June
Q3	July, August, September
Q4	October, November, December

An analysis of variance was undertaken for each characteristic to explain the variance which could be attributed to selling year, season, WSA or shire within WSA. The results for the analysis of variance for each characteristic are presented as a table in the appropriate sections. In general these tables show:

- The degrees of freedom (df) for each term. The corrected total df is the total number of sale lots used in the analysis minus one.
- The variance explained by the model (Model Sum of Squares), the residual or unexplained variance (the Error Sum of Squares) and the total variance (Total Sums of Squares). The proportion of variance explained is calculated as the Model Sums of Squares divided by the Total Sums of Squares).
- The F value is a statistical measure to test the significance of the model in explaining the variance of the characteristic. Therefore the higher the F statistic, the higher the ability of the model to explain the variance in the data.
- The level of significance achieved ( $Pr>F$ ) measures the probability that the model is detecting real effects using the model. Highly significant results in the F statistic will have  $Pr>F$  values of 0.0001. Values larger than 0.0001 have lower significance.

The components of variance table shows the relative contribution of the individual model terms in explaining the variance in the characteristic. This table shows:

- Each component used in the model (under Source).
- The Type III SS which is the partial sums of squares for each component. This has been calculated as essentially independent of the other terms, to assist with the interpretation.
- The Mean Square for each component which corrects the partial Sum of Squares for the degrees of freedom.
- The F statistic and the  $Pr>F$  statistics are the same as above. High F values suggest that the term in the model has made a large contribution to explaining the overall variance in the data.

### 2.3 Analyses performed

Estimations were made of total wool production and a range of wool quality at the shire level. Estimates were also be made of the production and quality of sale lots within various micron categories.

Wool production and wool quality estimates are generated for each WA shire except for the following; Broome, Derby-West Kimberley, Halls Creek, Wyndham-East Kimberley (all of W01) and East Pilbara (from W02), as these are very low producers. From W15 only Swan, Mundaring and Serpentine/Jarrahdale are included. Perth and surrounding suburbs are not included as these are obviously not wool **production** areas. When the ABS data shows high levels of wool shorn in these areas, it is thought to be the presence of transient 'shipper' flocks.

### 2.3.1 Total wool production

The greasy wool production figures per shire are taken from the ABS Ag Stats dataset because this dataset is a more complete estimate of production by shire than the matched auction data. This was because the matched auction dataset includes only the sale lots sold at auction (not wool sold privately, which can be up to 30 per cent of the State production) and the matching process only identified about 70 per cent of the auction dataset.

The long-term average wool production figures were a simple average of the five years of data. The deviations from this long-term average are calculated as the production figure for a particular year over the long-term average production, expressed as a percentage difference.

### 2.3.2 Average quality of wool characteristics

#### *Measured wool characteristics*

Wool characteristics which were measured for the individual sale lots and reported in the sale catalogues are available in the auction dataset. Therefore the matched sale lots which are allocated to a known shire can be used to generate wool quality estimates for that shire. These wool characteristics include the core test results (diameter, Schlumberger yield and vegetable matter percentage) and the staple measurements (staple length, strength and percentage mid breaks) when they were available.

#### *Predicted wool characteristics*

Prediction of processing performance of the raw wool was done using the TEAM prediction equations for estimating hauteur and the coefficient of variation of hauteur (CV(H)).

The analysis of the average of wool characteristics is done using merino combing fleece wool only. This ensures the age structure of the flocks (i.e. the proportion of weaners and lambs) and the amount of skirtings do not affect the estimate of the average quality, especially in estimates of length and vegetable matter. However, other factors cannot be controlled in the comparisons within the merino combing fleece wool between shires, such as the ratio of ewes to wethers, and these may influence the estimate of the average.

The calculation of averages for wool characteristics used a clean weight adjusted average. This was done to remove yield differences between shires. Deviations for individual shires from the long-term shire average were calculated as the average for a particular year over the long-term average, expressed as a percentage difference.

All available lots were used in the calculation of the averages. As a result the analyses of core test results (diameter, yield and vegetable matter) used more sale lots than the analyses of staple measurements (length, strength and percentage mid breaks) and predicted characteristics (hauteur, CV(H)). The average staple testing rate of these lots was 34 per cent over the period, and was much lower in the first year of the analysis. The lower numbers used may lead to an increase in the unexplained variance in the estimates.

### 2.3.3 Production and quality by micron group

Changes in wool quality may occur differently in the different diameter groups. Location of production for wool with specific diameter ranges can be achieved using the matched auction dataset. Production is expressed as clean weight to remove the yield differences between the different diameter groups. As the matched auction dataset was used, the quantity within micron groups were only part of the total production. The wool quality can also be estimated on wool within specific micron ranges. The calculation of production and quality was repeated using three micron groups shown below.

Micron class	Midpoint diameter	Minimum diameter	Maximum diameter
Fine	19.5	18.6	20.5
Medium	21.5	20.6	22.5
Broad	23.5	22.6	24.5

## 2.4 Results presentation

The presentation of the total production and average quality figures is difficult because of the volume of information present. All results are presented in a tabular form so that exact figures can be extracted. Because of difficulties in collating results from adjacent areas (either WSAs or shires) the results from the analyses have also been displayed in a series of maps. This allows easier interpretation the results from adjacent areas. The maps only show the south-west portion of the State (see Map 1) which includes the higher greasy wool production areas of Western Australia.

### 2.4.1 ABS LGA maps

ABS Local Government Area (or shire) boundaries for Western Australia are available. These ABS boundaries are subject to copyright requirements which are acknowledged on each of the maps. From these boundaries a number of maps were produced.

#### *Map of shire boundaries and major towns*

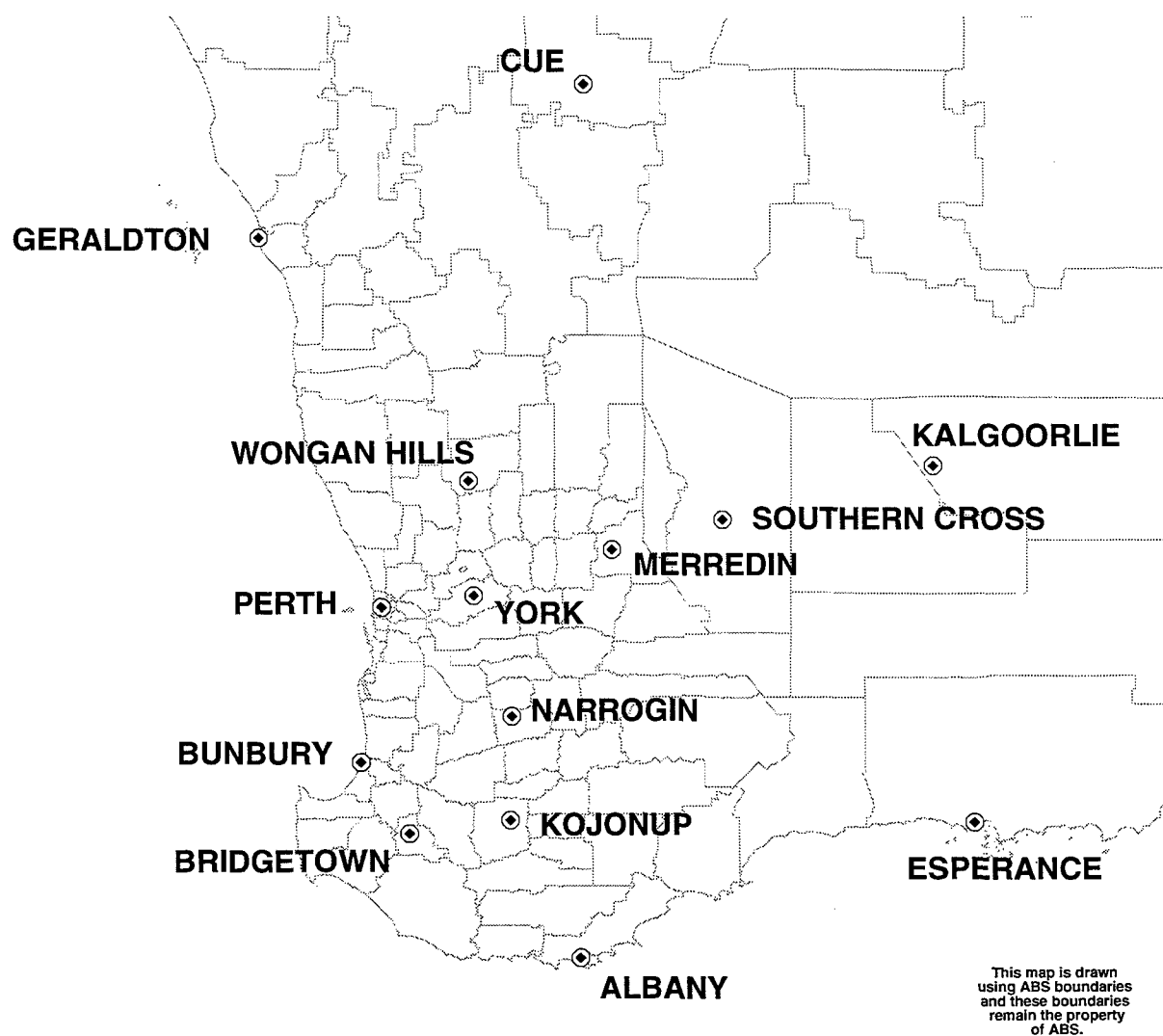
The shire boundaries of the south-west section of the State and several major towns are shown in Map 2.1. This map is used to provide an orientation when interpreting the results in Sections 3.1 to 3.13.

#### *Maps showing WSAs and shires*

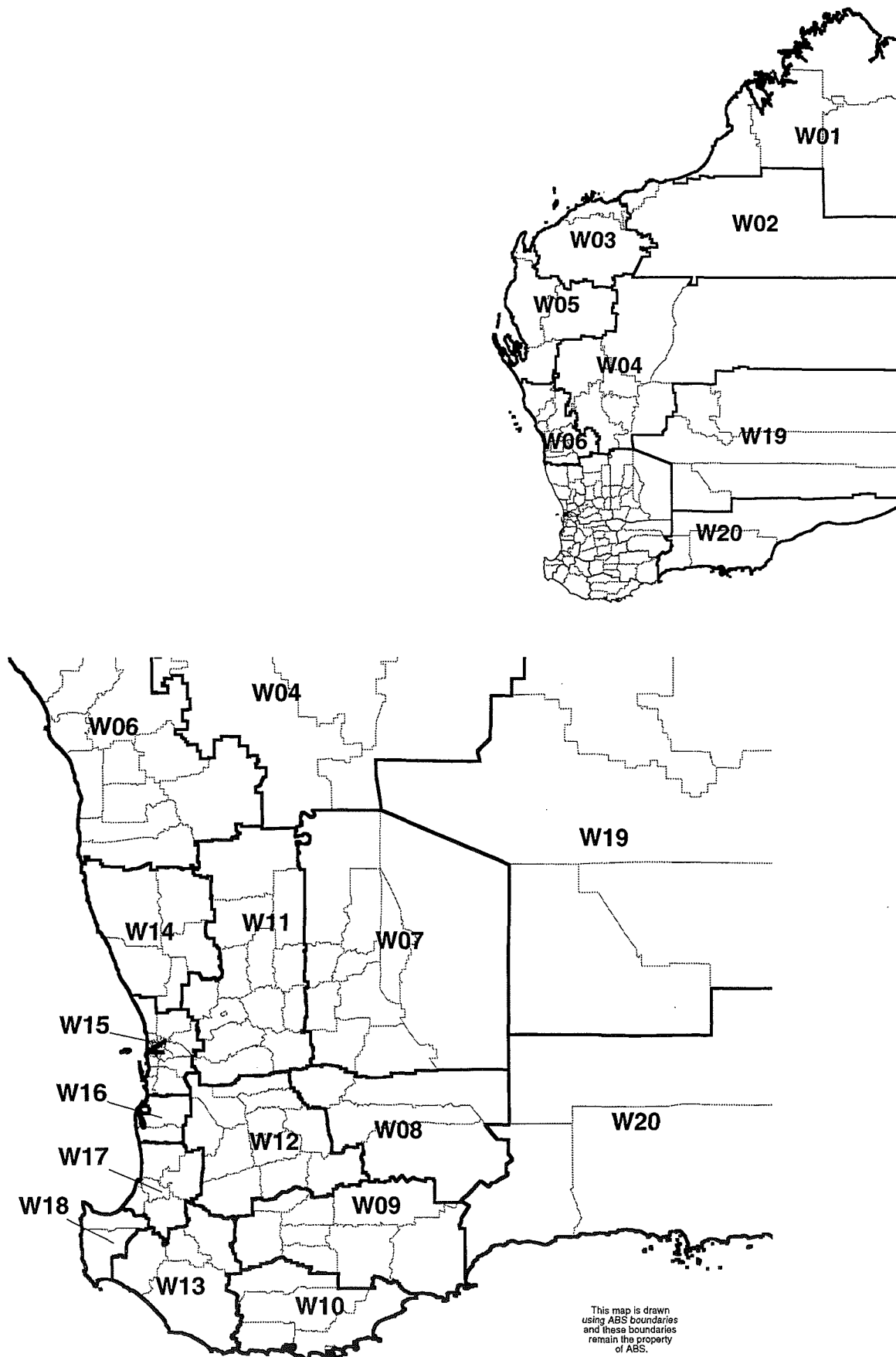
Each wool selling area (WSA) combines several shires (and each shire is in only one WSA). (No shire is split by a WSA boundary.) The WSAs are shown over the shire boundaries in Map 2.2. A complete list of individual shires together with shire number, the corresponding wool selling area and shire name is in Appendix 1. The shire number and shire boundaries have also been mapped in Map A1 in Appendix 1.



Map 2.1. Shire boundaries and major towns in the south-west region of Western Australia.



Map 2.2. WSA boundaries and shire boundaries in Western Australia.



*Maps of total production and average quality results*

The ABS shire boundaries can be used to graphically illustrate the production and quality results. There are three different techniques used:

1. The long-term average production was mapped using colour gradations in the large coloured map for Section 3.1 'Greasy wool production by shire for 1989/90 to 1993/94'. This map shows production levels using a green gradation. Areas of high production with a dark green shading fade to white for the low production shires that have less than 1000 tonnes annually.
2. The long-term average quality was mapped using discrete ranges with the colours indicating shires at, above and below the State long-term average. The State long-term average was white, above average was a range of green, below average was a range of yellow. It depends on the characteristic being mapped whether a high figure is favourable or unfavourable (e.g. staple strength – green is sound wool, diameter – green is broad wool). These maps are designed to show which shires are away from the State average and the pattern of this spread across shires.
3. The annual average production/quality (expressed as deviations from the long-term average year) are mapped using discrete ranges. An average year is white, an above average year is a shading of blue, a below average is a shading of red. The ranges are calculated using the standard deviation of the overall State results. As in the other range maps, it depends on the characteristic being mapped whether a high figure can be viewed as favourable or unfavourable (e.g. staple strength – blue is strong wool, diameter – blue is broad wool). These maps show whether each shire had an 'above average' year or a 'below average' year and the pattern of the year over the State (e.g. the Staple Strength – 1991/92 map shows that the whole State had a below average year). These maps can be examined together to show more complex patterns.

### 3. Results

#### 3.1 Total greasy wool production

##### 3.1.1 Annual production by State

Estimates of wool production from WA are available directly from the ABS Ag Stats data and only indirectly from the AWC auction catalogue information. The ABS information allows a more complete estimate of the annual greasy wool production by shire. However, as no quality breakdown is available in the ABS data, the results relate to total production, and not merino combing fleece wools.

Therefore the ABS Ag Stats data was used to generate the estimated greasy wool production for each shire over the five-year period from July 1989 to June 1994. The long-term State greasy wool production is 186,393 tonnes. The State greasy wool production for the individual years ranged from 205,415 tonnes to 175,491 tonnes (as shown in Table 3.1.1).

**Table 3.1.1. Greasy wool production for Western Australia over the period July 1989 and June 1994. Results are from ABS Ag Stats dataset**

Period	Greasy wool production (tonnes)	Yearly production as a percentage difference from long-term production (%)
5-year average	186,393	0.0
89/90	194,473	+4.3
90/91	205,415	+10.2
91/92	176,967	-5.1
92/93	179,620	-3.6
93/94	175,491	-5.8

The change in wool production across years is due to seasonal differences, and to some extent the management response to the removal of the Reserve Price System in July 1991. The reduction in production levels in 91/92 suggest a drastic response to the Reserve Price System removal, but is associated with reductions in diameter and strength and increases in VM% which suggest that the immediate market responses may have been exaggerated by widespread poor seasonal conditions. It is also possible that dramatic changes occurred in managerial inputs which affected the feed supply (such as applications of fertiliser to pasture and supplementary feeding of sheep in summer).

##### 3.1.2 Annual production by shire

The annual greasy wool production by shire is available from the ABS Ag Stats data and is shown in Table 3.1.2. The results show the weight produced in each year, the long-term average and the proportion of the State clip supplied by the shire, calculated from the long-term shire and State production figures.

The highest average production comes from Esperance. The smaller production levels come from the marginal areas along the south-west coast, the outskirts of Perth and from the pastoral regions.

**Table 3.1.2. Greasy wool production (tonnes) for individual shires for five selling years between 1989/90 and 1993/94, the five-year average greasy wool production for each shire, and the percentage of the shire of total State production. Results are from ABS Ag Stats dataset**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Avg. year	% of total
Albany (S)	W10	4851	5371	4877	4678	4623	4880	2.618
Ashburton (S)	W03	724	614	611	695	722	673	0.361
Augusta-Margaret River (S)	W18	390	416	318	287	285	339	0.182
Beverley (S)	W11	2935	3104	2624	2594	2466	2745	1.473
Boddington (S)	W12	1482	1487	1489	1435	1278	1434	0.769
Boyup Brook (S)	W13	5579	5894	5562	5340	5421	5559	2.983
Bridgetown-Greenbushes (S)	W13	812	823	725	744	742	769	0.413
Brookton (S)	W12	2210	2267	1831	1873	1844	2005	1.076
Broomehill (S)	W09	2240	2288	2115	2140	2266	2210	1.186
Bruce Rock (S)	W07	1841	2107	1599	1678	1457	1736	0.932
Busselton (S)	W18	447	440	418	337	334	395	0.212
Capel (S)	W17	37	43	24	19	12	27	0.015
Carnamah (S)	W06	1158	1097	996	1039	979	1054	0.565
Carnarvon (S)	W05	1847	2278	2289	2034	1984	2086	1.119
Chapman Valley (S)	W06	1904	2005	1855	1600	1614	1796	0.963
Chittering (S)	W14	723	656	547	565	570	612	0.328
Collie (S)	W17	124	169	124	151	153	144	0.077
Coolgardie (S)	W19	120	157	144	166	194	156	0.084
Coorow (S)	W06	2001	1933	1624	1756	1582	1779	0.955
Corrigin (S)	W08	2260	2701	2041	2051	1986	2208	1.185
Cranbrook (S)	W10	5102	5477	4645	4776	5044	5009	2.687
Cuballing (S)	W12	1616	1768	1510	1539	1515	1589	0.853
Cue (S)	W04	258	221	120	150	231	196	0.105
Cunderdin (S)	W11	1390	1356	1107	1119	1085	1211	0.650
Dalwallinu (S)	W11	2123	2133	1792	1769	1643	1892	1.015
Dandaragan (S)	W14	4537	4406	4296	4541	3987	4353	2.336
Dardanup (S)	W17	86	99	87	94	77	89	0.048
Denmark (S)	W10	440	386	283	252	285	329	0.177
Donnybrook-Balingup (S)	W17	408	436	397	349	338	386	0.207
Dowerin (S)	W11	1291	1350	1083	1024	925	1135	0.609
Dumbleyung (S)	W12	2459	2704	2346	2320	2342	2434	1.306
Dundas (S)	W20	536	620	506	543	588	558	0.300
Esperance (S)	W20	15426	16754	13129	13931	13528	14554	7.808
Exmouth (S)	W05	113	200	214	190	215	186	0.100

**Table 3.1.2 (cont.). Greasy wool production (tonnes) for individual shires for five selling years between 1989/90 and 1993/94, the five-year average greasy wool production for each shire, and the percentage of the shire of total State production. Results are from ABS Ag Stats dataset**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Avg. year	% of total
Gingin (S)	W14	842	826	749	707	549	735	0.394
Gnowangerup (S)	W09	5166	5021	4378	4181	4356	4620	2.479
Goomalling (S)	W11	1457	1452	1215	1187	1013	1265	0.679
Greenough (S)	W06	1649	1728	1397	1365	1225	1473	0.790
Harvey (S)	W17	148	140	129	88	82	117	0.063
Irwin (S)	W06	962	1063	918	930	832	941	0.505
Jerramungup (S)	W09	5180	5500	4606	4655	4491	4886	2.622
Kalgoorlie/Boulder (C)	W19	1010	879	786	850	944	894	0.480
Katanning (S)	W09	2408	2185	1994	1954	2116	2131	1.144
Kellerberrin (S)	W07	1083	1130	879	917	813	964	0.517
Kent (S)	W09	3947	4231	3758	3992	4059	3997	2.145
Kojonup (S)	W09	8066	8427	7715	7783	7977	7994	4.289
Kondinin (S)	W08	2165	2675	2036	2086	1898	2172	1.165
Koorda (S)	W11	896	929	688	770	715	800	0.429
Kulin (S)	W08	2949	3347	2881	3047	3074	3060	1.642
Lake Grace (S)	W08	5005	5724	4653	5271	4950	5121	2.747
Laverton (S)	W19	79	70	64	123	151	97	0.052
Leonora (S)	W19	722	594	491	511	512	566	0.304
Manjimup (S)	W13	688	713	513	472	492	575	0.309
Meekatharra (S)	W04	741	701	495	576	588	620	0.333
Menzies (S)	W19	415	363	330	330	293	346	0.186
Merredin (S)	W07	1378	1590	1227	1363	1141	1340	0.719
Mingenew (S)	W06	1462	1416	1390	1271	1144	1337	0.717
Moora (S)	W14	3397	3375	2658	2865	2573	2973	1.595
Morawa (S)	W06	982	1062	903	943	904	959	0.514
Mount Magnet (S)	W04	509	520	424	534	592	516	0.277
Mount Marshall (S)	W07	1523	1600	1302	1348	1242	1403	0.753
Mukinbudin (S)	W07	958	1059	843	862	772	899	0.482
Mullewa (S)	W06	1489	1738	1538	1413	1199	1475	0.792
Mundaring (S)	W15	66	77	88	43	50	65	0.035
Murchison (S)	W04	1028	1166	998	1061	1104	1071	0.575
Murray (S)	W16	162	244	191	127	104	166	0.089
Nannup (S)	W13	137	168	130	104	55	119	0.064
Narembeen (S)	W07	1921	2306	1794	2004	1801	1965	1.054
Narrogin (S)	W12	2822	2968	2711	2717	2704	2784	1.494

**Table 3.1.2 (cont.). Greasy wool production (tonnes) for individual shires for five selling years between 1989/90 and 1993/94, the five-year average greasy wool production for each shire, and the percentage of the shire of total State production. Results are from ABS Ag Stats dataset**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Avg. year	% of total
Northam (S)	W11	1508	1585	1433	1381	1288	1439	0.772
Northampton (S)	W06	2986	3069	2874	2624	2464	2803	1.504
Nungarin (S)	W07	422	507	346	385	339	400	0.214
Perenjori (S)	W06	1386	1382	1243	1318	1223	1311	0.703
Pingelly (S)	W12	2352	2487	1987	2070	1889	2157	1.157
Plantagenet (S)	W10	7749	8261	6596	6746	6974	7265	3.898
Port Hedland (T)	W02	49	43	45	53	47	48	0.026
Quairading (S)	W11	1698	1917	1551	1622	1495	1657	0.889
Ravensthorpe (S)	W20	4668	4667	3625	4042	4227	4246	2.278
Roebourne (S)	W03	323	413	341	373	351	360	0.193
Sandstone (S)	W04	256	257	277	240	292	265	0.142
Serpentine-Jarrahdale (S)	W15	108	101	138	67	65	96	0.051
Shark Bay (S)	W05	397	440	480	489	417	445	0.239
Swan (S)	W15	148	201	156	167	328	200	0.107
Tambellup (S)	W09	2204	2287	1978	2134	2281	2177	1.168
Tammin (S)	W11	801	842	674	725	694	747	0.401
Three Springs (S)	W06	1813	1962	1751	1706	1576	1762	0.945
Toodyay (S)	W11	1212	1308	1104	1109	947	1136	0.610
Trayning (S)	W07	684	786	571	633	606	656	0.352
Upper Gascoyne (S)	W05	941	868	759	557	665	758	0.407
Victoria Plains (S)	W14	2852	2918	2869	2471	2282	2678	1.437
Wagin (S)	W12	3258	3291	3044	3092	3138	3164	1.698
Wandering (S)	W12	1924	1951	1877	1896	1771	1884	1.011
Waroona (S)	W16	82	65	82	32	30	58	0.031
West Arthur (S)	W12	5175	5490	5287	5365	5476	5359	2.875
Westonia (S)	W07	700	786	642	688	541	671	0.360
Wickepin (S)	W12	2534	2677	2404	2529	2459	2521	1.352
Williams (S)	W12	4190	4237	4183	4295	4477	4276	2.294
Wiluna (S)	W04	373	320	241	247	298	296	0.159
Wongan-Ballidu (S)	W11	1663	1769	1369	1524	1369	1539	0.826
Woodanilling (S)	W09	1682	1815	1642	1666	1745	1710	0.917
Wyalkatchem (S)	W11	753	806	628	700	603	698	0.374
Yalgoo (S)	W04	823	965	857	895	978	904	0.485
Yilgarn (S)	W07	1671	1870	1784	1575	1516	1683	0.903
York (S)	W11	2194	2312	1919	1971	1810	2041	1.095





### 3.1.3 Maps of greasy wool production by shire

The long-term average weights by shire are shown in the coloured map 'Greasy wool production by shire for 1989/90 to 1993/94' in this Section 3.1. The highest level of wool production is in the south-western agricultural regions of the State. The high rainfall regions in the south-west coastal area and the coastal plain south of Perth have low production levels.

The main band of wool production appears to follow the rainfall *isohyets* from the south coast to the northern coast around Geraldton.

The highest weight from a single shire is Esperance (Table 3.1.2) and is shown in the large coloured map for 3.1 in the highest production colour range (as dark green

The deviations of the individual year production from the long-term average are shown in the right hand series of coloured maps (for the selling years 1989/90 to 1993/94). These show the annual changes from the shire's long-term average production. Some of the patterns visible are a widespread depression in wool production in 1991/92 when most shires reported lower than average wool production, and changes in both directions in 1993/94 (average or above around Narrogin and in the eastern and northern pastoral shires, and below average north of Perth), presumably due to inconsistency in the season.

### 3.1.4 Monthly production by State

Seasonal changes in the State's greasy wool production can be estimated from the ABS Livestock Products series (as quoted in the Wool International's 'Australian Wool Compendium'). This series provides the greasy weight of wool received by dealers and brokers each month. This is used to estimate the production profile by month, on the assumption that the greasy wool is sent by the producer to store at the completion of shearing.

The proportion of the annual greasy wool production across the State is shown on a monthly basis in Table 3.1.3. This table shows the high level of production due to shearing in the spring and autumn periods.

**Table 3.1.3. Proportion of greasy wool production delivered by month in Western Australia, averaged over the period July 1990 to June 1994. Results are for all greasy wool received by brokers and dealers in Western Australia**

Month	Greasy wool received by brokers and dealers (% of annual)
January	5.3
February	7.8
March	8.7
April	5.7
May	3.8
June	2.3
July	6.4
August	13.0
September	16.0
October	16.1
November	10.3
December	4.6

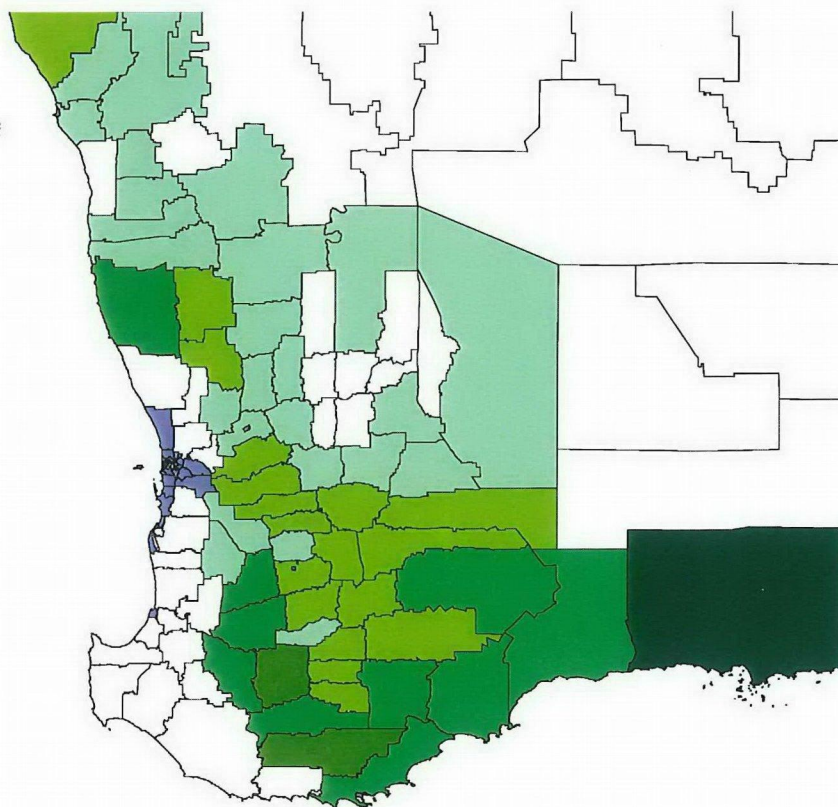
Monthly production by shire is not presented as the ABS results are not available at the shire by month level.

# Western Australia

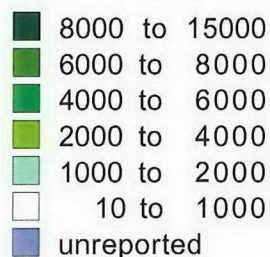
## Greasy wool production by shire for 1989/90 to 1993/94

Annual State average = 186393 tonnes

### Annual shire average



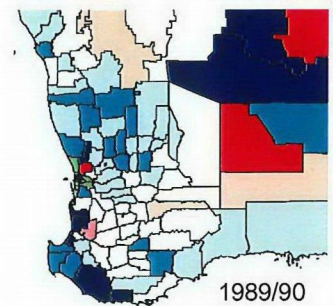
### Weight Range (tonnes)



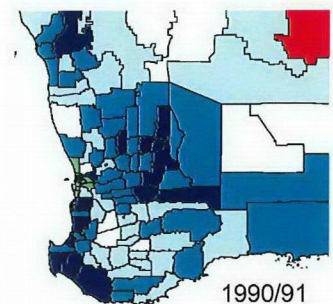
Dr John Stanton and Lindy Coss

These maps are drawn  
using ABS boundaries  
and these boundaries  
remain the property  
of ABS

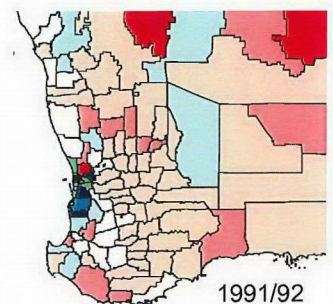
### Percentage change in shire average



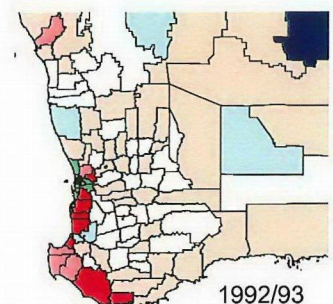
1989/90



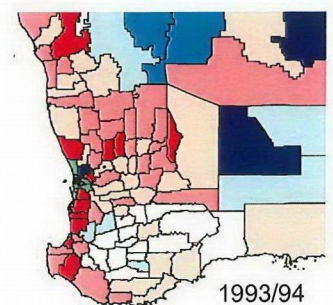
1990/91



1991/92



1992/93



1993/94

### 3.2 Wool supplied to auction by micron group

The previous total wool production results can be supplemented with estimates of merino combing fleece wool of particular diameters coming from these shires. This was done using the matched auction dataset. The proportion of clean wool available at auction in each micron class over the five-year period is shown below.

Micron class	Midpoint diameter ( $\mu\text{m}$ )	% clean weight
Fine	19.5	10.8
Medium	21.5	50.2
Broad	23.5	38.9

The distribution of the supply in each micron group is shown for:

fine          average of 19.5  $\mu\text{m}$  with a range from 18.6  $\mu\text{m}$  to 20.5  $\mu\text{m}$  (Table 3.2.1)  
medium      average of 21.5  $\mu\text{m}$  with a range from 20.6  $\mu\text{m}$  to 22.5  $\mu\text{m}$  (Table 3.2.2)  
broad        average of 23.5  $\mu\text{m}$  with a range from 22.6  $\mu\text{m}$  to 24.5  $\mu\text{m}$  (Table 3.2.3)

*NOTE: The results below are based on the clean weight, of merino combing fleece only, and only for the matched brands which have the shire identified. Therefore:*

- (a) *these results will not equate to the ABS greasy wool production results in Section 3.1, and*
- (b) *are only indicative of the breakdown of the production between and within the shires into micron groups.*

Tables 3.2.1 to 3.2.3 have results of 'na' where no wool was identified in the matched auction dataset as coming from these shire, and/or year combinations.

#### **Within-shire weights by micron group:**

The clean weight of the matched sale lots from each shire falling in a particular diameter class has been compared with the total State supply at auction from that diameter class. This is expressed as a shire percentage for each diameter class and is shown in Table 3.2.4. The shire result can be compared with the overall proportion of the State clip in each category is also shown in this table.

**Table 3.2.1. Weight of clean fine wool (averaging 19.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	72	152	213	131	99	133
Ashburton (S)	W03	7	12	50	12	20	20
Augusta-Margaret River (S)	W18	9	16	26	17	12	16
Beverley (S)	W11	105	96	216	103	185	141
Boddington (S)	W12	136	118	137	98	136	125
Boyup Brook (S)	W13	315	341	824	495	342	463
Bridgetown-Greenbushes (S)	W13	26	27	54	24	15	29
Brookton (S)	W12	42	50	127	46	60	65
Broomehill (S)	W09	42	122	113	64	51	78
Bruce Rock (S)	W07	55	25	115	20	66	56
Busselton (S)	W18	13	20	24	23	17	19
Capel (S)	W17	6	12	13	1	na	8
Carnamah (S)	W06	56	101	127	26	71	76
Carnarvon (S)	W05	6	12	41	20	45	25
Chapman Valley (S)	W06	27	33	61	24	15	32
Chittering (S)	W14	4	14	15	7	18	12
Collie (S)	W17	29	30	42	28	38	34
Coolgardie (S)	W19	na	na	0	na	na	0
Coorow (S)	W06	34	49	49	31	37	40
Corrigin (S)	W08	59	16	101	36	54	53
Cranbrook (S)	W10	180	246	446	232	154	252
Cuballing (S)	W12	53	54	121	38	43	62
Cue (S)	W04	3	25	8	4	2	8
Cunderdin (S)	W11	38	23	50	16	26	31
Dalwallinu (S)	W11	47	75	110	36	76	69
Dandaragan (S)	W14	69	242	212	91	241	171
Dardanup (S)	W17	6	16	10	3	na	9
Denmark (S)	W10	7	13	11	8	2	8
Donnybrook-Balingup (S)	W17	24	21	31	18	28	24
Dowerin (S)	W11	62	30	52	8	26	36
Dumbleyung (S)	W12	85	48	128	52	33	69
Dundas (S)	W20	16	17	56	4	29	24
Esperance (S)	W20	137	380	840	68	238	333
Exmouth (S)	W05	3	na	10	1	na	5

**Table 3.2.1 (cont.). Weight of clean fine wool (averaging 19.5 µm) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	24	47	51	46	54	44
Gnowangerup (S)	W09	72	128	320	126	54	140
Goomalling (S)	W11	22	32	52	15	22	28
Greenough (S)	W06	25	50	60	32	19	37
Harvey (S)	W17	3	2	4	4	1	3
Irwin (S)	W06	20	19	45	19	20	25
Jerramungup (S)	W09	98	119	192	63	68	108
Kalgoorlie/Boulder (C)	W19	7	9	2	0	8	5
Katanning (S)	W09	38	144	215	120	84	120
Kellerberrin (S)	W07	12	14	50	16	20	22
Kent (S)	W09	70	76	124	42	43	71
Kojonup (S)	W09	375	559	790	537	397	532
Kondinin (S)	W08	45	19	130	22	75	58
Koorda (S)	W11	24	18	28	5	16	18
Kulin (S)	W08	76	25	120	24	70	63
Lake Grace (S)	W08	71	62	325	32	95	117
Laverton (S)	W19	na	na	na	na	na	na
Leonora (S)	W19	12	23	9	1	5	10
Manjimup (S)	W13	12	28	37	19	13	22
Meekatharra (S)	W04	4	18	32	2	13	14
Menzies (S)	W19	na	1	3	1	3	2
Merredin (S)	W07	51	23	92	10	67	48
Mingenew (S)	W06	9	21	37	13	25	21
Moora (S)	W14	133	183	265	99	188	174
Morawa (S)	W06	23	47	61	16	32	36
Mount Magnet (S)	W04	4	11	11	0	5	6
Mount Marshall (S)	W07	16	19	48	9	34	25
Mukinbudin (S)	W07	9	34	47	13	16	24
Mullewa (S)	W06	24	36	56	21	14	30
Mundaring (S)	W15	4	2	1	2	1	2
Murchison (S)	W04	na	na	na	1	2	1
Murray (S)	W16	3	4	6	5	3	4
Nannup (S)	W13	3	4	3	0	na	2
Narembeen (S)	W07	39	18	91	25	55	46
Narrogin (S)	W12	106	120	182	70	83	112

**Table 3.2.1 (cont.).** Weight of clean fine wool (averaging 19.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	47	46	58	27	36	43
Northampton (S)	W06	39	52	60	41	57	50
Nungarin (S)	W07	4	13	24	1	11	11
Perenjori (S)	W06	22	36	82	16	35	38
Pingelly (S)	W12	28	93	137	60	63	76
Plantagenet (S)	W10	186	311	662	314	157	326
Port Hedland (T)	W02	6	4	6	5	4	5
Quairading (S)	W11	44	44	102	38	55	57
Ravensthorpe (S)	W20	90	375	452	35	58	202
Roebourne (S)	W03	3	27	64	10	12	23
Sandstone (S)	W04	0	13	0	na	na	5
Serpentine-Jarrahdale (S)	W15	1	3	7	6	5	5
Shark Bay (S)	W05	na	0	1	1	4	2
Swan (S)	W15	11	29	18	5	11	15
Tambellup (S)	W09	81	180	237	122	78	140
Tammin (S)	W11	10	4	24	1	9	10
Three Springs (S)	W06	20	34	73	18	30	35
Toodyay (S)	W11	27	20	28	4	13	19
Trayning (S)	W07	9	8	36	7	13	14
Upper Gascoyne (S)	W05	na	na	3	1	8	4
Victoria Plains (S)	W14	65	105	103	48	75	79
Wagin (S)	W12	143	212	309	154	83	180
Wandering (S)	W12	86	60	121	91	101	92
Waroona (S)	W16	3	9	1	na	na	4
West Arthur (S)	W12	198	321	406	350	194	294
Westonia (S)	W07	28	19	59	6	28	28
Wickepin (S)	W12	70	35	194	38	54	78
Williams (S)	W12	234	275	292	150	258	242
Wiluna (S)	W04	10	6	5	1	2	5
Wongan-Ballidu (S)	W11	50	51	81	16	40	48
Woodanilling (S)	W09	27	69	70	40	25	46
Wyalkatchem (S)	W11	18	11	24	1	20	15
Yalgoo (S)	W04	20	42	39	5	34	28
Yilgarn (S)	W07	42	37	92	26	51	50
York (S)	W11	70	69	145	107	92	96



**Table 3.2.2. Weight of clean medium wool (averaging 21.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	729	1023	987	867	550	831
Ashburton (S)	W03	42	38	39	58	62	48
Augusta-Margaret River (S)	W18	73	97	71	67	34	68
Beverley (S)	W11	429	553	540	365	476	473
Boddington (S)	W12	343	516	545	462	389	451
Boyup Brook (S)	W13	1234	1682	1352	1434	1136	1367
Bridgetown-Greenbushes (S)	W13	194	220	210	127	144	179
Brookton (S)	W12	243	332	347	311	302	307
Broomehill (S)	W09	290	534	472	370	286	390
Bruce Rock (S)	W07	373	296	417	224	302	323
Busselton (S)	W18	59	79	64	72	56	66
Capel (S)	W17	27	23	19	27	16	22
Carnamah (S)	W06	226	347	312	255	221	272
Carnarvon (S)	W05	361	370	376	383	422	382
Chapman Valley (S)	W06	179	208	256	191	150	197
Chittering (S)	W14	61	71	70	34	54	58
Collie (S)	W17	113	131	104	81	80	102
Coolgardie (S)	W19	15	14	17	1	5	11
Coorow (S)	W06	151	194	151	105	151	150
Corrigin (S)	W08	266	277	321	208	228	260
Cranbrook (S)	W10	1077	1213	1053	1114	846	1061
Cuballing (S)	W12	272	382	332	203	266	291
Cue (S)	W04	32	72	51	13	46	43
Cunderdin (S)	W11	172	227	246	121	159	185
Dalwallinu (S)	W11	344	403	415	239	309	342
Dandaragan (S)	W14	593	808	933	757	831	784
Dardanup (S)	W17	22	60	60	31	24	40
Denmark (S)	W10	72	112	45	57	60	69
Donnybrook-Balingup (S)	W17	66	92	67	62	107	79
Dowerin (S)	W11	286	250	214	132	143	205
Dumbleyung (S)	W12	430	411	501	339	241	384
Dundas (S)	W20	127	179	170	71	167	143
Esperance (S)	W20	1712	2470	2897	1226	1458	1952
Exmouth (S)	W05	19	32	15	24	2	18

**Table 3.2.2 (cont.). Weight of clean medium wool (averaging 21.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	113	173	149	130	94	132
Gnowangerup (S)	W09	755	960	989	742	587	807
Goomalling (S)	W11	152	164	200	111	143	154
Greenough (S)	W06	181	246	235	182	140	197
Harvey (S)	W17	27	27	24	10	8	19
Irwin (S)	W06	97	104	117	87	119	105
Jerramungup (S)	W09	600	752	740	467	443	600
Kalgoorlie/Boulder (C)	W19	81	106	84	35	111	83
Katanning (S)	W09	383	497	565	345	338	426
Kellerberrin (S)	W07	109	135	181	109	123	131
Kent (S)	W09	270	419	469	251	227	327
Kojonup (S)	W09	1865	2315	2134	1846	1724	1977
Kondinin (S)	W08	362	301	529	265	297	351
Koorda (S)	W11	157	169	156	78	126	137
Kulin (S)	W08	460	373	491	299	320	389
Lake Grace (S)	W08	646	652	1039	521	558	683
Laverton (S)	W19	4	12	2	2	3	5
Leonora (S)	W19	97	118	44	41	86	77
Manjimup (S)	W13	177	207	137	142	130	159
Meekatharra (S)	W04	85	117	45	80	75	80
Menzies (S)	W19	11	29	6	16	8	14
Merredin (S)	W07	264	227	288	175	220	235
Mingenew (S)	W06	162	183	186	133	135	160
Moora (S)	W14	578	681	606	439	536	568
Morawa (S)	W06	197	244	197	159	142	188
Mount Magnet (S)	W04	22	110	94	37	99	72
Mount Marshall (S)	W07	189	201	269	140	145	189
Mukinbudin (S)	W07	99	168	184	123	92	133
Mullewa (S)	W06	176	244	310	116	179	205
Mundaring (S)	W15	20	19	13	9	38	20
Murchison (S)	W04	2	11	na	11	11	9
Murray (S)	W16	34	26	22	20	9	22
Nannup (S)	W13	9	15	8	7	6	9
Narembeen (S)	W07	290	193	332	219	186	244
Narrogin (S)	W12	501	586	483	421	383	475



**Table 3.2.2 (cont.). Weight of clean medium wool (averaging 21.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	232	320	292	179	216	248
Northampton (S)	W06	222	400	334	272	245	295
Nungarin (S)	W07	53	55	65	34	30	47
Perenjori (S)	W06	198	217	193	187	180	195
Pingelly (S)	W12	279	531	465	379	385	408
Plantagenet (S)	W10	1590	2074	1622	1572	1268	1625
Port Hedland (T)	W02	8	3	3	0	3	4
Quairading (S)	W11	241	276	261	188	234	240
Ravensthorpe (S)	W20	785	1035	1170	508	655	831
Roebourne (S)	W03	71	45	30	53	112	62
Sandstone (S)	W04	26	59	48	6	36	35
Serpentine-Jarrahdale (S)	W15	20	44	20	15	45	29
Shark Bay (S)	W05	34	57	78	70	77	63
Swan (S)	W15	81	101	84	44	48	72
Tambellup (S)	W09	481	620	590	538	454	537
Tammin (S)	W11	82	89	105	50	59	77
Three Springs (S)	W06	155	188	197	151	166	171
Toodyay (S)	W11	145	165	194	137	137	156
Trayning (S)	W07	65	83	76	36	74	67
Upper Gascoyne (S)	W05	55	62	66	77	90	70
Victoria Plains (S)	W14	333	458	534	346	416	418
Wagin (S)	W12	636	774	787	618	548	673
Wandering (S)	W12	341	442	471	348	323	385
Waroona (S)	W16	27	29	14	10	11	18
West Arthur (S)	W12	1090	1413	1585	1286	1258	1326
Westonia (S)	W07	128	140	145	123	134	134
Wickepin (S)	W12	408	498	404	378	369	412
Williams (S)	W12	868	1046	1064	999	975	990
Wiluna (S)	W04	33	76	43	21	41	43
Wongan-Ballidu (S)	W11	227	272	252	127	195	215
Woodanilling (S)	W09	225	287	218	166	139	207
Wyalkatchem (S)	W11	107	121	94	79	98	100
Yalgoo (S)	W04	156	205	181	104	231	176
Yilgarn (S)	W07	243	241	272	193	207	231
York (S)	W11	430	476	464	419	424	443

**Table 3.2.3. Weight of clean broad wool (averaging 23.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	982	1030	391	802	937	828
Ashburton (S)	W03	8	8	27	52	22	23
Augusta-Margaret River (S)	W18	31	73	42	34	31	42
Beverley (S)	W11	255	441	111	308	236	270
Boddington (S)	W12	49	166	177	183	114	138
Boyup Brook (S)	W13	262	523	150	389	516	368
Bridgetown-Greenbushes (S)	W13	46	100	37	44	93	64
Brookton (S)	W12	216	403	101	255	183	232
Broomehill (S)	W09	346	242	140	246	454	286
Bruce Rock (S)	W07	266	505	194	397	255	323
Busselton (S)	W18	33	76	17	37	9	35
Capel (S)	W17	9	16	1	1	4	6
Carnamah (S)	W06	178	171	190	282	159	196
Carnarvon (S)	W05	592	559	370	469	318	462
Chapman Valley (S)	W06	253	387	304	207	265	283
Chittering (S)	W14	30	59	75	59	26	50
Collie (S)	W17	26	64	15	40	16	32
Coolgardie (S)	W19	85	56	47	33	54	55
Coorow (S)	W06	100	136	88	147	94	113
Corrigin (S)	W08	284	513	207	267	255	305
Cranbrook (S)	W10	536	613	191	434	775	510
Cuballing (S)	W12	127	196	114	185	191	162
Cue (S)	W04	88	27	26	59	78	55
Cunderdin (S)	W11	247	295	131	237	208	224
Dalwallinu (S)	W11	238	252	187	310	277	253
Dandaragan (S)	W14	535	424	377	731	441	502
Dardanup (S)	W17	57	7	6	27	46	29
Denmark (S)	W10	60	53	27	39	41	44
Donnybrook-Balingup (S)	W17	34	58	34	18	26	34
Dowerin (S)	W11	140	254	46	217	152	162
Dumbleyung (S)	W12	249	521	216	361	497	369
Dundas (S)	W20	147	182	117	291	183	184
Esperance (S)	W20	2558	2665	1223	3315	2685	2489
Exmouth (S)	W05	6	15	na	5	1	7

**Table 3.2.3 (cont.). Weight of clean broad wool (averaging 23.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	102	103	62	60	39	73
Gnowangerup (S)	W09	1128	896	445	664	920	810
Goomalling (S)	W11	243	269	155	238	243	230
Greenough (S)	W06	134	233	209	226	168	194
Harvey (S)	W17	13	19	3	11	14	12
Irwin (S)	W06	106	167	124	149	86	127
Jerramungup (S)	W09	548	727	415	746	782	644
Kalgoorlie/Boulder (C)	W19	242	214	200	126	220	200
Katanning (S)	W09	417	330	171	202	473	319
Kellerberrin (S)	W07	183	244	83	208	159	175
Kent (S)	W09	278	384	199	281	400	309
Kojonup (S)	W09	759	783	357	445	939	657
Kondinin (S)	W08	371	682	166	481	336	407
Koorda (S)	W11	96	93	55	177	91	102
Kulin (S)	W08	339	678	236	583	427	453
Lake Grace (S)	W08	728	1187	447	1069	1026	891
Laverton (S)	W19	30	17	na	13	12	18
Leonora (S)	W19	265	103	81	76	122	129
Manjimup (S)	W13	82	91	19	37	68	59
Meekatharra (S)	W04	163	83	16	121	65	90
Menzies (S)	W19	72	43	34	33	42	45
Merredin (S)	W07	231	396	142	326	196	258
Mingenew (S)	W06	254	272	211	218	204	232
Moora (S)	W14	466	476	212	593	361	422
Morawa (S)	W06	97	142	46	133	97	103
Mount Magnet (S)	W04	112	47	20	152	101	86
Mount Marshall (S)	W07	254	238	111	287	201	218
Mukinbudin (S)	W07	120	120	52	125	101	104
Mullewa (S)	W06	125	227	110	224	159	169
Mundaring (S)	W15	7	12	8	4	14	9
Murchison (S)	W04	12	13	na	33	16	18
Murray (S)	W16	12	41	12	16	16	19
Nannup (S)	W13	1	3	2	1	5	2
Narembeen (S)	W07	294	432	150	434	230	308
Narrogin (S)	W12	234	376	140	363	376	298

**Table 3.2.3 (cont.).** Weight of clean broad wool (averaging 23.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average weight for each shire. Results are expressed in clean tonnes. These results are for comparative use only, and are not estimates of total wool production from these shires

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	152	233	148	227	163	185
Northampton (S)	W06	371	427	411	301	323	367
Nungarin (S)	W07	44	58	30	70	57	52
Perenjori (S)	W06	90	98	60	135	105	98
Pingelly (S)	W12	237	401	231	276	326	294
Plantagenet (S)	W10	1229	1363	366	718	1269	989
Port Hedland (T)	W02	na	na	na	na	0	0
Quairading (S)	W11	166	264	112	188	119	170
Ravensthorpe (S)	W20	966	749	240	1406	1089	890
Roebourne (S)	W03	77	7	31	30	45	38
Sandstone (S)	W04	49	15	18	38	33	31
Serpentine-Jarrahdale (S)	W15	25	21	32	60	61	40
Shark Bay (S)	W05	43	49	46	49	18	41
Swan (S)	W15	40	87	20	21	18	37
Tambellup (S)	W09	364	255	108	266	593	317
Tammin (S)	W11	145	168	85	180	151	146
Three Springs (S)	W06	136	152	85	237	90	140
Toodyay (S)	W11	105	173	101	158	116	130
Trayning (S)	W07	86	134	65	138	107	106
Upper Gascoyne (S)	W05	87	111	47	85	53	77
Victoria Plains (S)	W14	376	468	238	575	324	396
Wagin (S)	W12	346	377	256	340	670	398
Wandering (S)	W12	91	287	105	134	93	142
Waroona (S)	W16	7	26	1	3	3	8
West Arthur (S)	W12	281	317	194	314	637	349
Westonia (S)	W07	113	138	75	158	65	110
Wickepin (S)	W12	402	662	275	424	504	453
Williams (S)	W12	274	444	344	444	435	388
Wiluna (S)	W04	77	21	20	74	41	47
Wongan-Ballidu (S)	W11	199	282	161	279	211	226
Woodanilling (S)	W09	192	139	92	110	241	155
Wyalkatchem (S)	W11	74	88	47	88	74	74
Yalgoo (S)	W04	121	97	33	174	124	110
Yilgarn (S)	W07	241	299	177	290	217	245
York (S)	W11	132	326	80	172	138	170

**Table 3.2.4. Percentage of the State's fine, medium and broad wool sold from each shire. This uses the five-year average weight for each shire for each diameter class divided by the State five-year average weight for each diameter class. The proportion of State clip is measured as the percentage of the wool from all shires in these analyses (Tables 3.2.1 – 3.2.3) that fall in the respective diameter categories**

Shire	WSA	Fine (19.5 µm)	Medium (21.5 µm)	Broad (23.5 µm)
Proportion of State clip		10.8%	50.2%	38.9%
Albany (S)	W10	1.9	2.6	3.3
Ashburton (S)	W03	0.3	0.2	0.1
Augusta-Margaret River (S)	W18	0.2	0.2	0.2
Beverley (S)	W11	2.1	1.5	1.1
Boddington (S)	W12	1.8	1.4	0.6
Boyup Brook (S)	W13	6.8	4.3	1.5
Bridgetown-Greenbushes (S)	W13	0.4	0.6	0.3
Brookton (S)	W12	0.9	1.0	0.9
Broomehill (S)	W09	1.1	1.2	1.2
Bruce Rock (S)	W07	0.8	1.0	1.3
Busselton (S)	W18	0.3	0.2	0.1
Capel (S)	W17	0.1	0.1	0.0
Carnamah (S)	W06	1.1	0.9	0.8
Carnarvon (S)	W05	0.4	1.2	1.9
Chapman Valley (S)	W06	0.5	0.6	1.1
Chittering (S)	W14	0.2	0.2	0.2
Collie (S)	W17	0.5	0.3	0.1
Coolgardie (S)	W19	0.0	0.0	0.2
Coorow (S)	W06	0.6	0.5	0.5
Corrigin (S)	W08	0.8	0.8	1.2
Cranbrook (S)	W10	3.7	3.3	2.1
Cuballing (S)	W12	0.9	0.9	0.7
Cue (S)	W04	0.1	0.1	0.2
Cunderdin (S)	W11	0.4	0.6	0.9
Dalwallinu (S)	W11	1.0	1.1	1.0
Dandaragan (S)	W14	2.5	2.5	2.0
Dardanup (S)	W17	0.1	0.1	0.1
Denmark (S)	W10	0.1	0.2	0.2
Donnybrook-Balingup (S)	W17	0.4	0.2	0.1
Dowerin (S)	W11	0.5	0.6	0.7
Dumbleyung (S)	W12	1.0	1.2	1.5
Dundas (S)	W20	0.4	0.4	0.7
Esperance (S)	W20	4.8	6.1	10.1
Exmouth (S)	W05	0.1	0.1	0.0

**Table 3.2.4 (cont.).** Percentage of the State's fine, medium and broad wool sold from each shire. This uses the five-year average weight for each shire for each diameter class divided by the State five-year average weight for each diameter class. The proportion of State clip is measured as the percentage of the wool from all shires in these analyses (Tables 3.2.1 – 3.2.3) that fall in the respective diameter categories

Shire	WSA	Fine (19.5 $\mu$ m)	Medium (21.5 $\mu$ m)	Broad (23.5 $\mu$ m)
Proportion of State clip		10.8%	50.2%	38.9%
Gingin (S)	W14	0.6	0.4	0.3
Gnowangerup (S)	W09	2.0	2.5	3.3
Goomalling (S)	W11	0.4	0.5	0.9
Greenough (S)	W06	0.5	0.6	0.8
Harvey (S)	W17	0.0	0.1	0.0
Irwin (S)	W06	0.4	0.3	0.5
Jerramungup (S)	W09	1.6	1.9	2.6
Kalgoorlie/Boulder (C)	W19	0.1	0.3	0.8
Katanning (S)	W09	1.8	1.3	1.3
Kellerberrin (S)	W07	0.3	0.4	0.7
Kent (S)	W09	1.0	1.0	1.2
Kojonup (S)	W09	7.7	6.2	2.7
Kondinin (S)	W08	0.8	1.1	1.6
Koorda (S)	W11	0.3	0.4	0.4
Kulin (S)	W08	0.9	1.2	1.8
Lake Grace (S)	W08	1.7	2.1	3.6
Laverton (S)	W19	0.0	0.0	0.1
Leonora (S)	W19	0.1	0.2	0.5
Manjimup (S)	W13	0.3	0.5	0.2
Meekatharra (S)	W04	0.2	0.3	0.4
Menzies (S)	W19	0.0	0.0	0.2
Merredin (S)	W07	0.7	0.7	1.0
Mingenew (S)	W06	0.3	0.5	0.9
Moora (S)	W14	2.5	1.8	1.7
Morawa (S)	W06	0.5	0.6	0.4
Mount Magnet (S)	W04	0.1	0.2	0.3
Mount Marshall (S)	W07	0.4	0.6	0.9
Mukinbudin (S)	W07	0.3	0.4	0.4
Mullewa (S)	W06	0.4	0.6	0.7
Mundaring (S)	W15	0.0	0.1	0.0
Murchison (S)	W04	0.0	0.0	0.1
Murray (S)	W16	0.1	0.1	0.1
Nannup (S)	W13	0.0	0.0	0.0
Narembeen (S)	W07	0.7	0.8	1.2
Narrogin (S)	W12	1.6	1.5	1.2

**Table 3.2.4 (cont.). Percentage of the State's fine, medium and broad wool sold from each shire. This uses the five-year average weight for each shire for each diameter class divided by the State five-year average weight for each diameter class. The proportion of State clip is measured as the percentage of the wool from all shires in these analyses (Tables 3.2.1 – 3.2.3) that fall in the respective diameter categories**

Shire	WSA	Fine (19.5 $\mu$ m)	Medium (21.5 $\mu$ m)	Broad (23.5 $\mu$ m)
Proportion of State clip		10.8%	50.2%	38.9%
Northam (S)	W11	0.6	0.8	0.7
Northampton (S)	W06	0.7	0.9	1.5
Nungarin (S)	W07	0.2	0.1	0.2
Perenjori (S)	W06	0.6	0.6	0.4
Pingelly (S)	W12	1.1	1.3	1.2
Plantagenet (S)	W10	4.8	5.1	4.0
Port Hedland (T)	W02	0.1	0.0	0.0
Quairading (S)	W11	0.8	0.8	0.7
Ravensthorpe (S)	W20	2.9	2.6	3.6
Roebourne (S)	W03	0.3	0.2	0.2
Sandstone (S)	W04	0.1	0.1	0.1
Serpentine-Jarrahdale (S)	W15	0.1	0.1	0.2
Shark Bay (S)	W05	0.0	0.2	0.2
Swan (S)	W15	0.2	0.2	0.1
Tambellup (S)	W09	2.0	1.7	1.3
Tammin (S)	W11	0.1	0.2	0.6
Three Springs (S)	W06	0.5	0.5	0.6
Toodyay (S)	W11	0.3	0.5	0.5
Trayning (S)	W07	0.2	0.2	0.4
Upper Gascoyne (S)	W05	0.1	0.2	0.3
Victoria Plains (S)	W14	1.2	1.3	1.6
Wagin (S)	W12	2.6	2.1	1.6
Wandering (S)	W12	1.3	1.2	0.6
Waroona (S)	W16	0.1	0.1	0.0
West Arthur (S)	W12	4.3	4.2	1.4
Westonia (S)	W07	0.4	0.4	0.4
Wickepin (S)	W12	1.1	1.3	1.8
Williams (S)	W12	3.5	3.1	1.6
Wiluna (S)	W04	0.1	0.1	0.2
Wongan-Ballidu (S)	W11	0.7	0.7	0.9
Woodanilling (S)	W09	0.7	0.6	0.6
Wyalkatchem (S)	W11	0.2	0.3	0.3
Yalgoo (S)	W04	0.4	0.5	0.4
Yilgarn (S)	W07	0.7	0.7	1.0
York (S)	W11	1.4	1.4	0.7

### 3.2.1 Maps of clean wool supplied to auction by shire by micron group

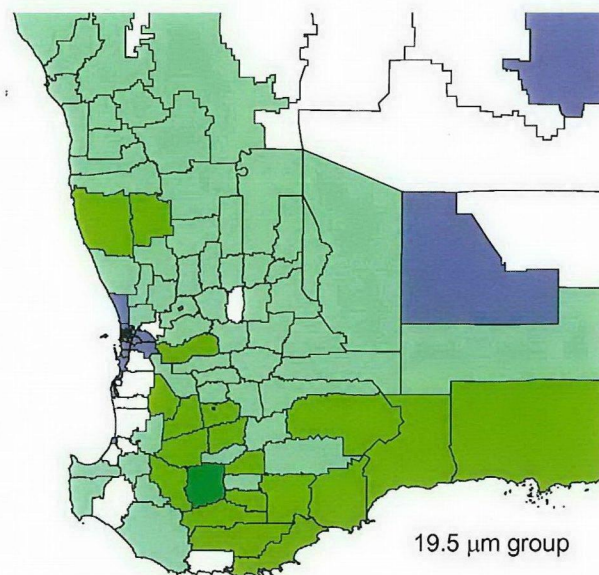
The long-term average weights by shire are shown in the following coloured map for this Section 3.2, 'Clean wool production by shire by micron group for 1989/90 to 1993/94 (as sold at auction)'. The colour range is common to all three maps, allowing comparison of supply levels in the different micron groups between maps.

The highest levels of fine wool supply occur in the Kojonup shire. The medium wool weights are highest in Kojonup, Cranbrook, Plantagenet, West Arthur, Boyup Brook and Esperance. The strong wool supply is highest from the Esperance shire.



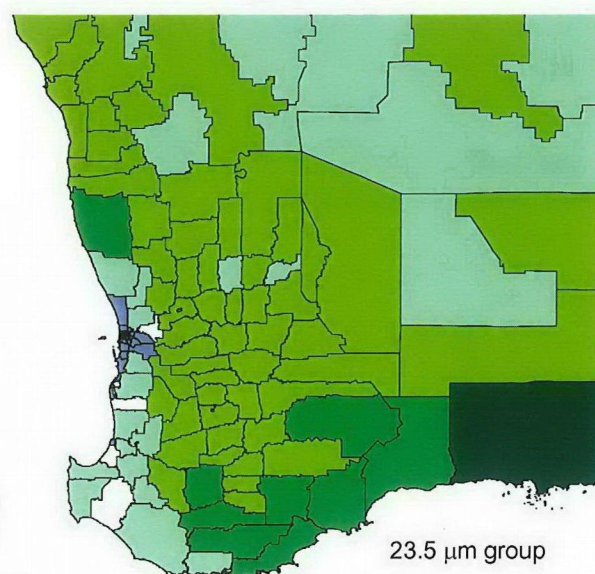
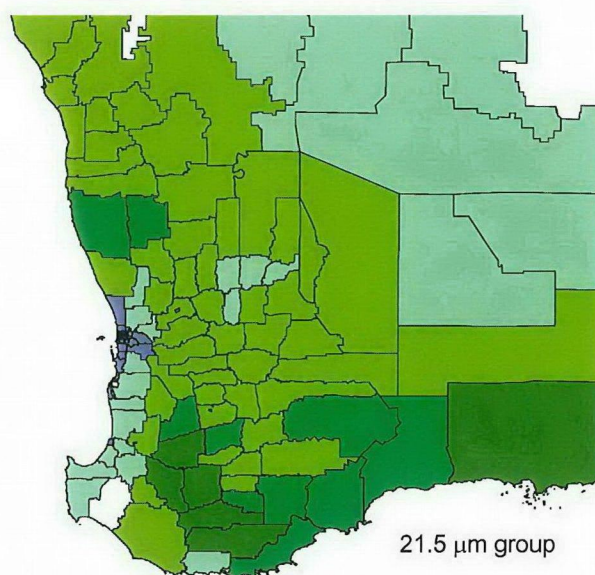
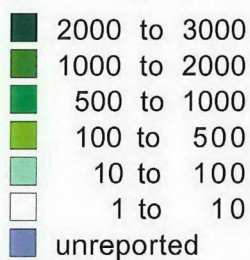
# Western Australia

Clean wool production  
by shire  
by micron group for  
1989/90 to 1993/94  
(as sold at auction)



## Annual shire average

Weight Range (tonnes)



These maps are drawn  
using ABS boundaries  
and these boundaries  
remain the property  
of ABS.

### 3.3 Average fibre diameter

The matched AWC dataset was used to generate the estimated average fibre diameter by shire for the five-year period from July 1989 to June 1994. The long-term State average diameter is 22.27  $\mu\text{m}$ . The changes about this average between years are shown in Table 3.3.1. The average diameter for the individual years ranges from 22.53  $\mu\text{m}$  to 21.66  $\mu\text{m}$ .

The SD of the yearly means is the between sale lots standard deviation, and can be used as a measure of the range of diameter in the raw wool sold on an annual basis in Fremantle.

**Table 3.3.1. Average fibre diameter for Western Australia over the period July 1989 to June 1994. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Period	Average fibre diameter ( $\mu\text{m}$ )	
	Mean	SD
5-year average	22.27	1.49
89/90	22.40	1.41
90/91	22.33	1.43
91/92	21.66	1.42
92/93	22.53	1.52
93/94	22.43	1.50

#### 3.3.1 Variation in diameter due to year, season and WSA, shire effects

While the differences of fibre diameter evident in the above table are due to between-year effects, it could also be assumed that differences exist between seasons within a year. Attempts have been made to identify and quantify these and other causes of change in diameter of sale lots in Fremantle sales.

Table 3.3.2 contains the results of a statistical analysis done to examine the ability of the model (using time (year, season) and regional (WSA, shire) effects and their interactions) to explain the variance of diameter between sale lots. The model is highly significant, but only explains 16.0 per cent of the total variance (model SS total sums of squares) in diameter. So 84.0 per cent of the total variance has been included in the error variance (see Section 2.2 for an explanation). This indicates that the error variance contains important effects not included in the model and random effects.

Therefore the results in Table 3.3.2 suggest that only a small proportion of variance in diameter is due to macro effects such as year, season and region, and although these are significant, the majority of variance is due to factors other than those included in the model. These other factors could include between-flock and between-property differences within shires e.g. strain differences and other flock management effects, and between-month differences within season.

**Table 3.3.2. Analysis of variance in diameter due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	193	95026	492.36	263.54	0.0001
Error	266246	497421	1.87		
Corrected total	266439	592448			

The relative importance of the individual terms included in the model in explaining the variance in diameter are shown in Table 3.3.3. All sources of variance included were highly significant as the significance level ( $Pr>F$ ) equals 0.0001 for all terms in the model (sources). Their relative importance is indicated by the size of the F value, with the larger F indicating higher importance. Season and year appear to be the more important terms (of the terms used in this analysis) when explaining the variance in diameter.

**Table 3.3.3. Components of variance in diameter (year and season nested within year, WSA and shires nested within WSA) and WSA by year interaction**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	1031	257.74	137.96	0.0001
Season (within selling year)	15	9931	662.10	354.39	0.0001
WSA	18	11159	619.95	331.83	0.0001
Shire nested in WSA	84	15998	190.45	101.94	0.0001
WSA x selling year	72	13543	188.09	100.68	0.0001

The nature of the shire and year changes in diameter are shown in Table 3.3.4. This is a listing based on the average fibre diameter of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average for each shire.

**Table 3.3.4. Average fibre diameter for ( $\mu\text{m}$ ) individual shires for five selling years between July 1989 and June 1994, and the five-year average diameter for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	22.8	22.5	21.8	22.4	22.8	22.5
Ashburton (S)	W03	21.8	21.2	21.1	22.5	21.9	21.8
Augusta-Margaret River (S)	W18	22.3	22.3	21.9	22.1	21.8	22.1
Beverley (S)	W11	22.1	22.3	21.3	22.2	21.7	21.9
Boddington (S)	W12	21.3	21.7	21.7	21.8	21.5	21.6
Boyup Brook (S)	W13	21.5	21.7	20.9	21.4	21.7	21.5
Bridgetown-Greenbushes (S)	W13	21.8	22.1	21.4	21.8	22.2	21.9
Brookton (S)	W12	22.5	22.6	21.5	22.3	22.1	22.2
Broomehill (S)	W09	22.8	22.0	21.8	22.1	22.8	22.3
Bruce Rock (S)	W07	22.2	23.0	21.7	22.9	22.2	22.4
Busselton (S)	W18	22.0	22.2	21.4	21.7	21.2	21.8
Capel (S)	W17	21.9	21.8	21.0	21.7	21.9	21.6
Carnamah (S)	W06	22.2	21.9	21.8	22.7	22.0	22.1
Carnarvon (S)	W05	23.0	23.0	22.6	22.8	22.4	22.8
Chapman Valley (S)	W06	22.8	22.8	22.6	22.7	22.9	22.8
Chittering (S)	W14	22.4	22.3	22.2	22.8	21.9	22.3
Collie (S)	W17	21.5	21.8	21.0	21.6	21.3	21.5
Coolgardie (S)	W19	23.8	23.5	23.5	24.8	24.6	24.0
Coorow (S)	W06	22.2	22.1	22.0	22.5	21.9	22.1
Corrigin (S)	W08	22.4	23.1	21.9	22.8	22.4	22.6
Cranbrook (S)	W10	22.1	22.1	21.2	21.8	22.4	21.9
Cuballing (S)	W12	21.9	22.1	21.5	22.4	22.2	22.0
Cue (S)	W04	23.8	21.7	22.1	23.9	23.1	23.0
Cunderdin (S)	W11	22.7	23.0	22.0	23.1	22.7	22.7
Dalwallinu (S)	W11	22.4	22.2	21.9	22.7	22.3	22.3
Dandaragan (S)	W14	22.5	21.9	21.8	22.7	21.9	22.1
Dardanup (S)	W17	22.9	21.5	21.1	22.8	22.9	22.2
Denmark (S)	W10	22.5	22.1	22.0	22.3	22.4	22.3
Donnybrook-Balingup (S)	W17	21.8	22.1	21.5	21.5	21.6	21.7
Dowerin (S)	W11	22.0	22.5	21.5	22.9	22.4	22.3
Dumbleyung (S)	W12	22.1	22.6	21.8	22.5	23.1	22.4
Dundas (S)	W20	23.1	22.9	22.1	23.6	22.9	22.9
Esperance (S)	W20	23.0	22.6	21.7	23.4	23.0	22.7
Exmouth (S)	W05	21.6	22.3	20.7	21.9	22.5	21.8

**Table 3.3.4 (cont.). Average fibre diameter ( $\mu\text{m}$ ) for individual shires for five selling years between July 1989 and June 1994, and the five-year average diameter for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	22.4	22.0	21.6	21.7	21.3	21.8
Gnowangerup (S)	W09	22.8	22.4	21.8	22.4	22.9	22.5
Goomalling (S)	W11	22.8	22.8	22.2	23.2	22.8	22.8
Greenough (S)	W06	22.5	22.4	22.2	22.6	22.5	22.4
Harvey (S)	W17	22.2	22.4	21.7	22.3	23.1	22.3
Irwin (S)	W06	22.5	22.7	22.4	23.0	22.1	22.5
Jerramungup (S)	W09	22.5	22.4	22.0	22.8	22.9	22.5
Kalgoorlie/Boulder (C)	W19	23.9	23.2	23.5	24.7	23.4	23.7
Katanning (S)	W09	22.5	22.0	21.5	21.8	22.5	22.1
Kellerberrin (S)	W07	22.9	23.1	22.0	23.1	22.6	22.8
Kent (S)	W09	22.3	22.4	21.7	22.7	22.9	22.4
Kojonup (S)	W09	21.8	21.7	21.2	21.5	22.0	21.6
Kondinin (S)	W08	22.4	23.1	21.7	22.9	22.4	22.6
Koorda (S)	W11	22.1	22.2	21.7	22.8	22.3	22.2
Kulin (S)	W08	22.3	22.9	21.9	23.0	22.7	22.6
Lake Grace (S)	W08	22.6	22.9	21.7	23.1	22.9	22.7
Laverton (S)	W19	23.4	22.9	21.8	23.5	23.9	23.3
Leonora (S)	W19	23.5	22.5	22.9	24.7	23.6	23.5
Manjimup (S)	W13	22.2	22.1	21.3	21.8	22.2	22.0
Meekatharra (S)	W04	23.4	22.3	21.5	23.2	22.5	22.8
Menzies (S)	W19	24.4	23.0	23.3	24.4	24.1	23.9
Merredin (S)	W07	22.3	23.0	21.8	23.0	22.2	22.5
Mingenew (S)	W06	23.0	22.9	22.4	23.0	22.7	22.8
Moora (S)	W14	22.3	22.2	21.5	22.7	22.0	22.1
Morawa (S)	W06	22.1	22.1	21.4	22.5	22.2	22.0
Mount Magnet (S)	W04	23.5	22.1	21.8	23.5	22.9	22.8
Mount Marshall (S)	W07	22.7	22.7	22.0	23.1	22.6	22.6
Mukinbudin (S)	W07	22.5	22.3	21.6	22.6	22.6	22.3
Mullewa (S)	W06	22.3	22.5	21.8	22.9	22.5	22.4
Mundaring (S)	W15	21.7	22.4	22.0	22.0	22.1	22.1
Murchison (S)	W04	24.7	22.6	na	23.8	22.5	23.6
Murray (S)	W16	22.2	22.9	22.0	22.4	22.3	22.4
Nannup (S)	W13	21.0	21.4	21.6	21.5	22.7	21.6
Narembreen (S)	W07	22.5	23.2	21.8	23.0	22.5	22.7
Narrogin (S)	W12	21.9	22.1	21.5	22.4	22.4	22.1

**Table 3.3.4 (cont.). Average fibre diameter ( $\mu\text{m}$ ) for individual shires for five selling years between July 1989 and June 1994, and the five-year average diameter for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	22.2	22.3	22.0	22.6	22.3	22.3
Northampton (S)	W06	22.8	22.6	22.6	22.7	22.6	22.6
Nungarin (S)	W07	22.3	22.4	21.3	22.9	22.3	22.2
Perenjori (S)	W06	22.1	21.9	21.4	22.3	22.1	21.9
Pingelly (S)	W12	22.5	22.3	21.7	22.4	22.3	22.2
Plantagenet (S)	W10	22.3	22.3	21.3	21.9	22.6	22.1
Port Hedland (T)	W02	20.8	20.2	20.3	20.1	20.8	20.5
Quairading (S)	W11	22.2	22.4	21.5	22.4	21.9	22.1
Ravensthorpe (S)	W20	22.7	22.1	21.3	23.3	22.9	22.5
Roebourne (S)	W03	22.5	21.0	21.3	22.3	22.1	21.9
Sandstone (S)	W04	23.2	21.6	22.0	23.7	22.8	22.6
Serpentine-Jarrahdale (S)	W15	22.8	22.0	22.6	22.9	22.6	22.6
Shark Bay (S)	W05	22.7	22.8	22.5	22.6	21.8	22.5
Swan (S)	W15	22.0	22.3	21.6	22.0	21.5	22.0
Tambellup (S)	W09	22.2	21.8	21.2	21.9	22.5	22.0
Tammin (S)	W11	23.3	23.5	22.5	23.6	23.2	23.3
Three Springs (S)	W06	22.4	22.3	21.8	22.8	21.9	22.2
Toodyay (S)	W11	22.3	22.6	22.1	22.8	22.4	22.4
Trayning (S)	W07	22.6	22.8	21.9	23.2	22.7	22.6
Upper Gascoyne (S)	W05	23.2	23.1	22.4	22.7	22.3	22.8
Victoria Plains (S)	W14	22.5	22.4	21.9	22.9	22.2	22.4
Wagin (S)	W12	22.0	21.9	21.5	22.0	22.6	22.0
Wandering (S)	W12	21.6	22.2	21.6	21.8	21.5	21.8
Waroon (S)	W16	22.0	22.3	21.5	22.2	22.0	22.1
West Arthur (S)	W12	21.7	21.6	21.3	21.6	22.1	21.7
Westonia (S)	W07	22.4	22.5	21.6	22.7	21.9	22.2
Wickepin (S)	W12	22.5	22.8	21.9	22.6	22.7	22.5
Williams (S)	W12	21.6	21.8	21.6	22.0	21.8	21.8
Wiluna (S)	W04	22.8	21.9	22.2	23.6	22.8	22.7
Wongan-Ballidu (S)	W11	22.5	22.6	22.0	23.2	22.7	22.6
Woodanilling (S)	W09	22.4	21.9	21.7	22.1	22.8	22.2
Wyalkatchem (S)	W11	22.3	22.3	21.8	22.8	22.2	22.3
Yalgoo (S)	W04	22.6	22.1	21.4	23.1	22.2	22.3
Yilgarn (S)	W07	22.3	22.6	21.8	22.8	22.4	22.4
York (S)	W11	21.8	22.2	21.3	21.8	21.7	21.8



### 3.3.2 Maps of average fibre diameter by shire

The five-year average results for individual shires are displayed on the large map in this Section 3.3, 'Fibre diameter by shire for 1989/90 to 1993/94', which is coloured using a three-part colour scale – white for shire results closest to the State average, with the shires supplying broader diameters shown in grades of green, and the shires with finer diameters in grades of yellow. This map shows that the finer wool is found in the high rainfall region in the south-west region of the State. The broadest diameter merino fleece wool is delivered from the Eastern Goldfields (around Kalgoorlie).

The deviations of the individual year average fibre diameter from the long-term average are also shown in the series down the right hand side of this map for the selling years 1989/90 to 1993/94. These maps are designed to show the pattern of change in shire annual average diameters from the long-term shire average. These maps are coloured using a three-part colour scale – white for shires with annual results about their long-term shire average, with increases in the shire annual average diameter shown in grades of blue, and the decreases in the shire annual average diameter in grades of red.

Wide-scale changes in diameter can be seen across the State in 1991/92, and across the north-eastern pastoral shires in 1990/91. In contrast, the 1992/93 season, the majority of supply from individual shires was at above average diameter, with the exception in the south-west shires which were at or below their long-term average diameter.

### 3.3.3 Seasonal changes in average fibre diameter by shire

The analysis of variance in diameter in Table 3.3.3 showed that the season effect is highly significant (given the model used) in explaining differences in diameter. These differences have been summarised across shires and are shown on a monthly basis for all matched merino combing fleece offered in Fremantle over a five-year period (Table 3.3.5).

**Table 3.3.5. Average fibre diameter for WA by month for the period July 1989 to June 1994, and the long-term average fibre diameter. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

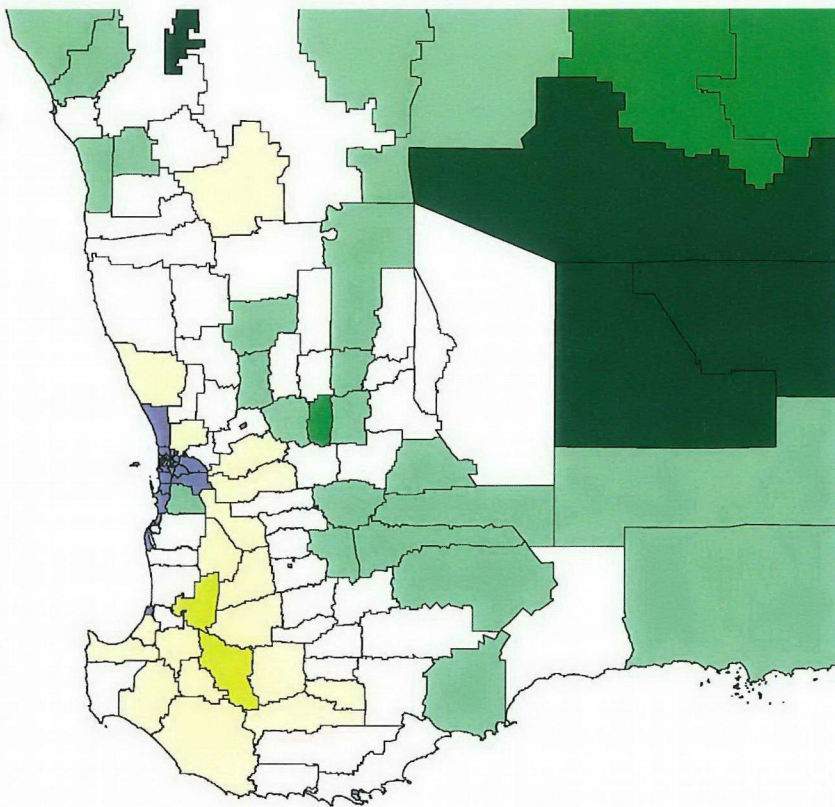
Period	Average fibre diameter ( $\mu\text{m}$ )
5-year average	22.27
January	22.04
February	22.03
March	22.41
April	22.54
May	22.56
June	22.65
July	22.59
August	22.43
September	22.33
October	22.14
November	21.96
December	22.02

# Western Australia

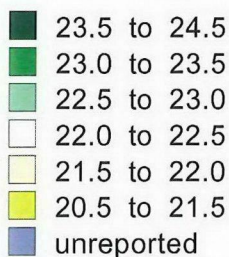
Fibre diameter  
by shire for  
1989/90 to 1993/94

Five-year State average = 22.3  $\mu\text{m}$

Five-year shire average



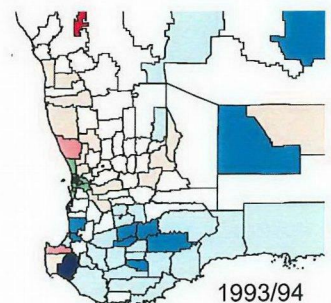
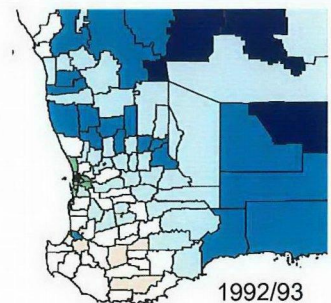
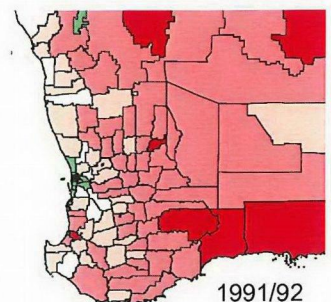
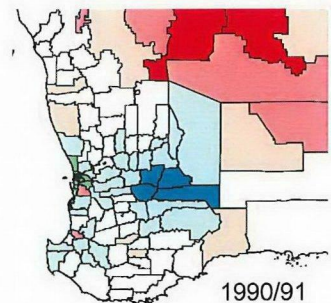
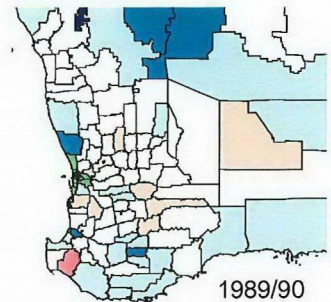
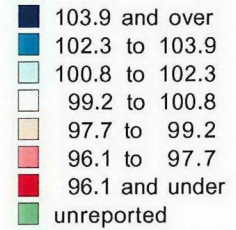
Micron Range



Dr John Stanton and Lindy Coss

These maps are drawn  
using ABS boundaries  
and these boundaries  
remain the property  
of ABS

Percentage change  
in shire average





To reduce the volume of information being presented in the following shire tables, the 12 months were condensed into four seasons:

Months 1, 2 & 3 = Q1

Months 4, 5 & 6 = Q2

Months 7, 8 & 9 = Q3

Months 10, 11 & 12 = Q4

**Table 3.3.6. Average fibre diameter ( $\mu\text{m}$ ) for individual shires in each quarter between July 1989 and June 1994, and the five-year average diameter for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Albany (S)	W10	22.4	22.7	22.7	22.3	22.5
Ashburton (S)	W03	21.8	20.7	21.9	22.4	21.8
Augusta-Margaret River (S)	W18	21.8	22.7	22.3	22.1	22.1
Beverley (S)	W11	21.9	22.2	22.1	21.7	21.9
Boddington (S)	W12	21.7	21.9	21.7	21.4	21.6
Boyup Brook (S)	W13	21.5	21.4	21.6	21.4	21.5
Bridgetown-Greenbushes (S)	W13	21.8	21.9	22.1	21.8	21.9
Brookton (S)	W12	22.0	22.2	22.6	22.0	22.2
Broomehill (S)	W09	22.5	22.4	22.2	22.1	22.3
Bruce Rock (S)	W07	22.4	22.5	22.5	22.2	22.4
Busselton (S)	W18	21.6	21.7	22.3	21.8	21.8
Capel (S)	W17	21.2	22.8	22.1	21.6	21.6
Carnamah (S)	W06	21.7	22.4	22.4	21.8	22.1
Carnarvon (S)	W05	22.7	23.0	22.7	22.5	22.8
Chapman Valley (S)	W06	22.9	23.2	22.8	22.3	22.8
Chittering (S)	W14	22.5	22.3	22.2	22.0	22.3
Collie (S)	W17	21.2	21.1	21.9	21.7	21.5
Coolgardie (S)	W19	23.1	24.1	23.8	24.1	24.0
Coorow (S)	W06	21.8	22.4	22.5	21.8	22.1
Corrigin (S)	W08	22.5	22.8	22.7	22.3	22.6
Cranbrook (S)	W10	21.8	22.4	21.9	21.8	21.9
Cuballing (S)	W12	22.0	22.0	22.1	21.9	22.0
Cue (S)	W04	22.6	23.2	22.8	22.5	23.0
Cunderdin (S)	W11	22.7	22.7	22.9	22.4	22.7
Dalwallinu (S)	W11	22.2	22.8	22.3	21.9	22.3
Dandaragan (S)	W14	21.9	22.5	22.4	22.0	22.1
Dardanup (S)	W17	22.3	21.4	22.9	22.7	22.2
Denmark (S)	W10	22.2	22.4	22.4	22.3	22.3
Donnybrook-Balingup (S)	W17	21.6	21.5	22.3	21.7	21.7
Dowerin (S)	W11	21.9	22.3	22.5	22.1	22.3
Dumbleyung (S)	W12	22.4	22.9	22.4	22.2	22.4
Dundas (S)	W20	23.0	23.2	22.8	22.9	22.9
Esperance (S)	W20	22.8	23.1	22.7	22.5	22.7
Exmouth (S)	W05	21.6	22.7	22.2	21.4	21.8

Table 3.3.6 (cont.). Average fibre diameter ( $\mu\text{m}$ ) for individual shires in each quarter between July 1989 and June 1994, and the five-year average diameter for each shire

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Gingin (S)	W14	21.8	22.3	21.9	21.6	21.8
Gnowangerup (S)	W09	22.7	22.8	22.4	22.2	22.5
Goomalling (S)	W11	22.7	23.3	22.7	22.4	22.8
Greenough (S)	W06	22.4	23.1	22.5	22.2	22.4
Harvey (S)	W17	21.8	22.9	23.1	21.4	22.3
Irwin (S)	W06	22.4	23.0	22.4	22.5	22.5
Jerramungup (S)	W09	22.5	22.9	22.5	22.3	22.5
Kalgoorlie/Boulder (C)	W19	23.2	24.0	23.5	23.2	23.7
Katanning (S)	W09	22.2	22.4	22.0	21.9	22.1
Kellerberrin (S)	W07	22.9	22.9	22.6	22.7	22.8
Kent (S)	W09	22.4	22.5	22.6	22.1	22.4
Kojonup (S)	W09	21.6	21.7	21.7	21.6	21.6
Kondinin (S)	W08	22.6	22.6	22.6	22.3	22.6
Koorda (S)	W11	22.2	22.4	22.2	22.1	22.2
Kulin (S)	W08	22.6	22.8	22.6	22.5	22.6
Lake Grace (S)	W08	22.8	23.0	22.6	22.4	22.7
Laverton (S)	W19	22.9	23.3	23.7	22.1	23.3
Leonora (S)	W19	23.4	23.6	23.0	23.1	23.5
Manjimup (S)	W13	21.9	22.4	21.9	22.0	22.0
Meekatharra (S)	W04	22.6	23.1	22.5	22.4	22.8
Menzies (S)	W19	23.1	24.3	23.9	23.3	23.9
Merredin (S)	W07	22.6	22.6	22.6	22.2	22.5
Mingenew (S)	W06	23.0	23.0	22.7	22.7	22.8
Moora (S)	W14	22.1	22.6	22.1	21.9	22.1
Morawa (S)	W06	22.2	22.4	21.9	21.7	22.0
Mount Magnet (S)	W04	22.6	22.9	23.1	23.0	22.8
Mount Marshall (S)	W07	22.9	23.1	22.5	22.3	22.6
Mukinbudin (S)	W07	21.8	22.4	22.5	22.0	22.3
Mullewa (S)	W06	22.6	22.5	22.4	22.1	22.4
Mundaring (S)	W15	22.0	22.2	22.3	21.9	22.1
Murchison (S)	W04	na	23.7	22.8	na	23.6
Murray (S)	W16	22.7	23.0	22.6	22.2	22.4
Nannup (S)	W13	21.1	22.3	23.1	21.5	21.6
Narembeen (S)	W07	22.6	22.9	22.7	22.5	22.7
Narrogin (S)	W12	22.1	22.3	22.1	21.9	22.1

**Table 3.3.6 (cont.). Average fibre diameter ( $\mu\text{m}$ ) for individual shires in each quarter between July 1989 and June 1994, and the five-year average diameter for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Northam (S)	W11	22.3	22.2	22.5	22.1	22.3
Northampton (S)	W06	22.7	23.0	22.7	22.3	22.6
Nungarin (S)	W07	22.4	22.1	22.6	21.8	22.2
Perenjori (S)	W06	22.0	22.1	22.1	21.7	21.9
Pingelly (S)	W12	22.3	22.6	22.2	22.0	22.2
Plantagenet (S)	W10	21.9	22.2	22.4	22.1	22.1
Port Hedland (T)	W02	20.6	20.5	20.6	20.2	20.5
Quairading (S)	W11	22.2	22.7	22.0	21.7	22.1
Ravensthorpe (S)	W20	22.6	22.6	22.6	22.1	22.5
Roebourne (S)	W03	22.4	22.3	21.8	21.4	21.9
Sandstone (S)	W04	22.3	22.9	22.2	23.3	22.6
Serpentine-Jarrahdale (S)	W15	22.6	22.8	21.9	22.0	22.6
Shark Bay (S)	W05	22.5	22.2	22.2	22.4	22.5
Swan (S)	W15	22.2	22.2	21.9	21.7	22.0
Tambellup (S)	W09	22.1	22.1	22.0	21.7	22.0
Tammin (S)	W11	23.8	23.5	23.2	22.9	23.3
Three Springs (S)	W06	22.5	22.5	22.3	22.0	22.2
Toodyay (S)	W11	22.4	22.8	22.5	22.3	22.4
Trayning (S)	W07	22.5	22.9	22.6	22.5	22.6
Upper Gascoyne (S)	W05	22.6	23.4	22.3	22.6	22.8
Victoria Plains (S)	W14	22.4	22.6	22.4	22.3	22.4
Wagin (S)	W12	21.9	22.2	22.1	21.8	22.0
Wandering (S)	W12	21.9	21.9	21.7	21.5	21.8
Waroona (S)	W16	22.1	23.1	21.7	22.0	22.1
West Arthur (S)	W12	21.7	21.8	21.8	21.5	21.7
Westonia (S)	W07	22.1	22.7	22.3	21.7	22.2
Wickepin (S)	W12	22.9	22.9	22.3	22.1	22.5
Williams (S)	W12	21.7	22.0	22.2	21.6	21.8
Wiluna (S)	W04	22.7	22.8	22.2	20.8	22.7
Wongan-Ballidu (S)	W11	22.2	23.0	22.9	22.0	22.6
Woodanilling (S)	W09	22.3	22.3	22.1	22.0	22.2
Wyalkatchem (S)	W11	22.1	22.5	22.4	22.0	22.3
Yalgoo (S)	W04	22.3	22.7	22.3	21.8	22.3
Yilgarn (S)	W07	22.5	22.7	22.4	22.1	22.4
York (S)	W11	21.6	22.1	21.9	21.6	21.8

### 3.4 Average yield

The matched AWC dataset was used to generate the estimated average yield by shire for the five-year period from July 1989 to June 1994. The long-term State average Schlumberger yield for the merino combing fleece wool is 67.4 per cent. The effect of year on this average is shown in Table 3.4.1. The average yield for the individual years ranges from 65.9 per cent to 68.4 per cent.

The SD of the yearly means is the between sale lots deviation, and can be used as a measure of the range of yields in the raw wool sale lots sold on an annual basis in Fremantle.

**Table 3.4.1. Average yield for Western Australia over the period July 1989 and June 1994. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Period	Average yield (%)	
	Mean	SD
5-year average	67.39	4.84
89/90	67.27	4.60
90/91	67.20	5.01
91/92	65.92	4.91
92/93	68.47	4.39
93/94	68.14	4.81

#### 3.4.1 Variation in yield due to year, season and WSA, shire effects

The changes in yield evident in the above table are due to between-year effects. It is assumed also that differences exist between seasons. The existence of differences also needs to be proved and quantified between WSAs, and between shires within WSA.

Table 3.4.2 contains the results of a statistical analysis done to examine the ability of the model (using time (year, season) and regional (WSA, shire) effects and their interactions) to explain the variance of yield between sale lots. The model is highly significant, and explains 43.3 per cent of the total variance. This suggests that a large part of the variance in yield occurs between shires and WSAs over time. This level of 43 per cent variance explained can be compared with the result of 16 per cent for diameter. The remainder of the variance (56.7 per cent) is likely to occur between flocks and between properties within shires.

**Table 3.4.2. Analysis of variance in yield due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	193	2682472	13898.82	1047.95	0.0001
Error	264682	3510433	13.26		
Corrected total	264875	6192905			

As the overall model was significant, the relative importance of the individual terms of the model in explaining the variance in yield was analysed and is shown in Table 3.4.3. All terms of the model were significant. WSA and season made by far the largest contributions in explaining the variance in yield.

**Table 3.4.3. Components of variance in yield-year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction. The partial Sums of Squares showing the relative contribution of the components to the variance in yield**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	6499	1624.64	122.50	0.0001
Season (within selling year)	15	455288	30352.53	2288.54	0.0001
WSA	18	940202	52233.44	3938.33	0.0001
Shire nested in WSA	84	249272	2967.52	223.75	0.0001
WSA x selling year	72	122998	1708.31	128.80	0.0001

The average yield of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average are shown in Table 3.4.4.

**Table 3.4.4. Average yield (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average yield for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	70.1	70.3	68.1	70.5	70.9	70.0
Ashburton (S)	W03	57.7	58.2	60.6	65.1	59.9	61.0
Augusta-Margaret River (S)	W18	71.9	71.5	70.0	71.3	71.1	71.2
Beverley (S)	W11	68.6	68.9	67.2	69.3	68.6	68.5
Boddington (S)	W12	69.6	69.5	69.8	70.7	69.2	69.8
Boyup Brook (S)	W13	70.2	70.4	69.5	70.5	70.2	70.2
Bridgetown-Greenbushes (S)	W13	71.5	71.6	71.2	72.6	71.4	71.6
Brookton (S)	W12	68.2	68.7	67.0	69.2	68.8	68.4
Broomehill (S)	W09	69.9	69.5	69.3	70.5	70.6	69.9
Bruce Rock (S)	W07	65.3	66.0	63.0	67.0	66.4	65.5
Busselton (S)	W18	71.3	71.6	70.4	72.1	70.9	71.3
Capel (S)	W17	71.9	71.7	71.6	72.1	72.1	71.8
Carnamah (S)	W06	63.8	63.5	63.9	65.9	64.0	64.3
Carnarvon (S)	W05	59.6	59.8	59.5	60.4	60.4	59.9
Chapman Valley (S)	W06	62.2	63.2	62.7	62.2	63.6	62.8
Chittering (S)	W14	67.7	67.2	67.4	69.3	67.1	67.7
Collie (S)	W17	71.2	71.7	71.0	71.9	70.4	71.3
Coolgardie (S)	W19	65.0	65.1	66.5	65.9	66.8	65.8
Coorow (S)	W06	63.9	63.2	63.5	66.3	65.2	64.4
Corrigin (S)	W08	66.0	66.8	63.9	67.1	67.0	66.1
Cranbrook (S)	W10	71.4	71.2	70.5	71.4	72.2	71.4
Cuballing (S)	W12	68.0	68.4	67.4	69.4	68.9	68.4
Cue (S)	W04	63.8	63.8	60.8	63.1	63.8	63.3
Cunderdin (S)	W11	65.6	66.0	63.0	66.9	65.6	65.5
Dalwallinu (S)	W11	63.5	63.5	63.0	64.1	64.1	63.6
Dandaragan (S)	W14	64.8	64.5	64.8	67.6	65.8	65.6
Dardanup (S)	W17	65.3	60.9	56.6	68.1	63.6	62.9
Denmark (S)	W10	74.6	73.3	73.2	75.1	74.8	74.2
Donnybrook-Balingup (S)	W17	72.5	72.4	71.6	72.9	72.4	72.3
Dowerin (S)	W11	66.1	66.2	63.4	67.6	66.8	66.1
Dumbleyung (S)	W12	66.4	66.2	65.1	67.9	68.7	66.8
Dundas (S)	W20	62.5	62.4	59.0	67.0	65.6	63.5
Esperance (S)	W20	66.2	64.1	62.5	69.5	66.8	65.8
Exmouth (S)	W05	53.0	54.6	53.1	56.3	60.1	54.5

**Table 3.4.4 (cont.). Average yield (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average yield for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	67.2	67.1	67.0	68.1	67.5	67.3
Gnowangerup (S)	W09	69.2	68.8	67.5	69.1	70.1	68.9
Goomalling (S)	W11	65.5	65.6	63.9	67.3	66.4	65.7
Greenough (S)	W06	62.9	64.0	63.8	64.0	64.6	63.9
Harvey (S)	W17	69.8	67.8	67.4	69.8	69.1	68.7
Irwin (S)	W06	63.4	64.8	63.2	64.4	64.2	64.0
Jerramungup (S)	W09	68.6	68.7	67.4	70.4	70.2	69.0
Kalgoorlie/Boulder (C)	W19	64.9	63.7	65.1	66.1	66.3	65.3
Katanning (S)	W09	68.7	68.6	67.4	69.1	70.0	68.8
Kellerberrin (S)	W07	65.1	65.8	63.2	66.8	66.5	65.5
Kent (S)	W09	66.9	67.2	65.7	69.6	70.2	67.8
Kojonup (S)	W09	69.9	69.7	69.4	70.0	70.4	69.9
Kondinin (S)	W08	66.2	66.4	64.1	68.5	67.8	66.6
Koorda (S)	W11	64.4	64.3	62.6	65.1	64.2	64.1
Kulin (S)	W08	67.1	67.1	64.9	68.7	68.6	67.3
Lake Grace (S)	W08	66.8	66.4	64.0	69.0	68.5	66.9
Laverton (S)	W19	62.0	61.6	63.9	59.0	60.8	61.2
Leonora (S)	W19	67.2	66.7	64.2	66.4	68.1	66.8
Manjimup (S)	W13	73.2	72.7	72.5	73.5	73.4	73.0
Meekatharra (S)	W04	65.4	65.8	65.8	64.2	65.1	65.2
Menzies (S)	W19	66.8	65.9	64.4	66.7	67.5	66.5
Merredin (S)	W07	65.4	65.4	63.6	67.1	66.8	65.6
Mingenew (S)	W06	62.8	62.6	62.8	64.6	63.9	63.3
Moora (S)	W14	65.9	65.8	64.8	68.0	66.8	66.3
Morawa (S)	W06	63.8	64.0	62.3	63.9	63.6	63.6
Mount Magnet (S)	W04	65.9	66.8	64.6	66.0	66.2	66.0
Mount Marshall (S)	W07	65.4	64.7	62.9	65.9	65.0	64.8
Mukinbudin (S)	W07	64.5	64.0	62.4	64.6	64.3	63.9
Mullewa (S)	W06	61.2	61.7	61.1	62.3	63.6	61.9
Mundaring (S)	W15	69.4	72.0	72.6	72.6	70.6	71.2
Murchison (S)	W04	61.7	61.5	na	61.7	60.1	61.3
Murray (S)	W16	68.3	69.4	70.0	69.7	66.4	69.0
Nannup (S)	W13	68.6	70.2	67.2	70.7	68.4	69.1
Narembeen (S)	W07	65.8	66.3	64.2	68.0	67.3	66.4
Narrogin (S)	W12	68.5	68.8	67.8	69.0	69.2	68.7



**Table 3.4.4 (cont.). Average yield (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average yield for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	67.4	68.1	66.8	68.8	67.7	67.8
Northampton (S)	W06	61.9	62.2	62.5	62.4	63.4	62.5
Nungarin (S)	W07	62.8	62.4	59.7	64.3	64.5	62.6
Perenjori (S)	W06	64.7	64.8	63.3	64.6	64.5	64.4
Pingelly (S)	W12	67.4	68.1	66.0	68.4	68.3	67.7
Plantagenet (S)	W10	71.4	71.5	69.9	71.4	72.1	71.3
Port Hedland (T)	W02	56.3	56.0	52.9	58.8	58.7	56.3
Quairading (S)	W11	65.3	66.0	62.8	66.9	66.4	65.4
Ravensthorpe (S)	W20	67.1	65.5	62.4	69.9	67.9	66.7
Roebourne (S)	W03	61.6	60.0	59.3	61.9	60.9	60.8
Sandstone (S)	W04	65.1	66.3	63.2	64.1	65.1	64.9
Serpentine-Jarrahdale (S)	W15	62.9	65.0	63.5	67.8	65.3	65.2
Shark Bay (S)	W05	58.7	60.9	57.8	57.6	60.0	59.0
Swan (S)	W15	69.0	69.7	69.1	71.5	69.1	69.6
Tambellup (S)	W09	69.4	68.9	68.4	69.2	70.2	69.3
Tammin (S)	W11	66.0	66.7	64.2	67.8	66.2	66.3
Three Springs (S)	W06	64.2	64.1	63.1	65.8	63.6	64.2
Toodyay (S)	W11	69.2	69.3	69.4	70.6	69.1	69.5
Trayning (S)	W07	65.2	64.5	62.5	66.6	66.6	65.1
Upper Gascoyne (S)	W05	61.7	61.9	62.5	60.9	63.2	62.0
Victoria Plains (S)	W14	67.9	67.7	66.5	69.3	67.9	67.9
Wagin (S)	W12	67.3	67.5	66.9	68.0	68.6	67.7
Wandering (S)	W12	68.5	69.9	68.7	69.9	68.5	69.2
Waroon (S)	W16	69.4	69.5	68.0	67.3	67.8	69.0
West Arthur (S)	W12	68.6	68.6	68.4	69.3	69.0	68.8
Westonia (S)	W07	63.8	63.4	62.8	64.0	63.6	63.5
Wickepin (S)	W12	66.4	66.7	65.5	67.8	68.0	66.9
Williams (S)	W12	69.3	69.8	69.5	70.8	70.2	69.9
Wiluna (S)	W04	64.7	63.4	60.6	63.7	65.1	63.7
Wongan-Ballidu (S)	W11	65.1	64.7	63.7	65.9	65.3	64.9
Woodanilling (S)	W09	68.3	68.6	67.9	69.1	69.4	68.6
Wyalkatchem (S)	W11	65.2	65.2	62.9	66.7	65.9	65.2
Yalgoo (S)	W04	64.7	65.4	63.7	66.0	66.5	65.4
Yilgarn (S)	W07	64.3	63.7	61.3	65.3	64.5	63.8
York (S)	W11	68.1	69.4	67.2	69.3	68.9	68.6

### 3.4.2 Maps of average yield by shire

The five-year average results for individual shires are displayed on the large map in Section 3.4, 'Yield by shire for 1989/90 to 1993/94', which is coloured using a three-part scale – white for shire results which are closest to the State average, with the shires supplying higher yields shown in grades of green, and the shires with lower yields in grades of yellow. This map shows that the cleaner wool is found in the high rainfall region in the south-west region of the State. The lower yielding merino fleece wool is delivered from the northern agricultural and parts of the pastoral region.

The deviations of the individual year average yield from the long-term average are shown in the right hand side of this map for the selling years 1989/90 to 1993/94. These maps are designed to show the pattern of change in shire annual average yield from the long-term shire average, both within year in adjacent shires, and between years. These maps are coloured using a three-part colour scale – white for shires with annual results about their long-term shire average, increases in the shire annual average yield shown in grades of blue, and the decreases in the shire annual average yield in grades of red.

Wide-scale reduction in yield can be seen for the 1991/92 selling season, followed by an increase in yield in the majority of shires in the next two selling seasons.

### 3.4.3 Seasonal changes in average yield by shire

Season effects have been shown to have a strong influence on the yield of sale lots offered in Fremantle. The results in Table 3.4.5 show the long-term changes in yield by month, and illustrate the effect of month of the catalogue offering, with the highest yield in the December offering, and the lowest yield from the April/May offerings.

**Table 3.4.5. Average yield for Western Australia by month for the period July 1989 to June 1994. Results show the long-term average, and the monthly average yield**

Period	Yield (%)
5-year average	67.4
January	69.5
February	68.1
March	66.5
April	64.8
May	64.7
June	65.1
July	65.8
August	66.2
September	67.4
October	68.4
November	69.4
December	70.1

To reduce the volume of information being presented in the following tables, the 12 months were condensed into four seasons:

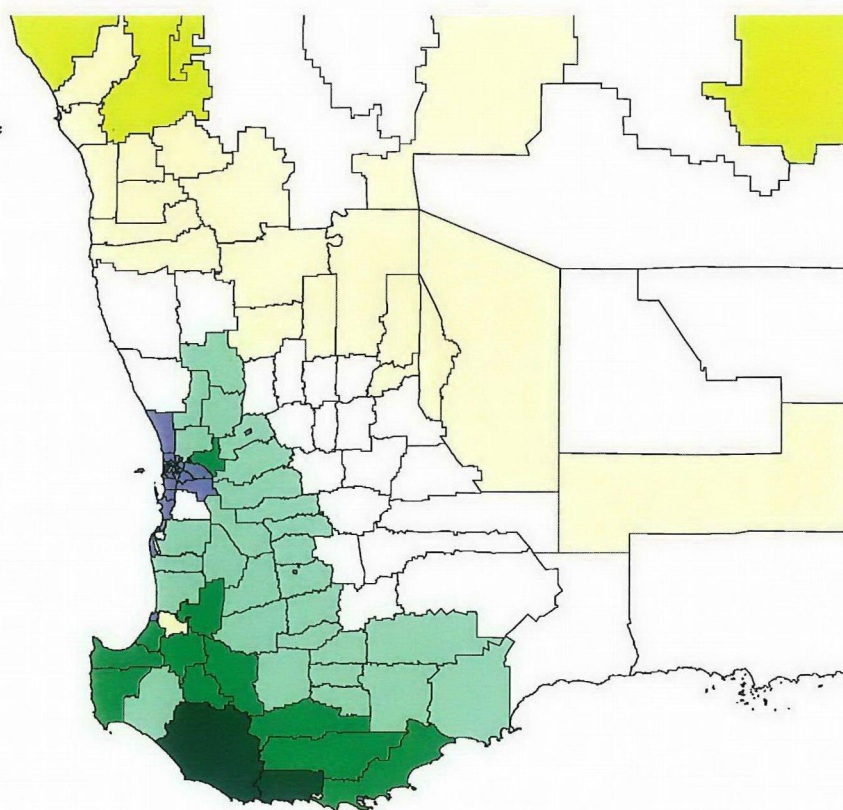
- Months 1, 2 & 3 = Q1
- Months 4, 5 & 6 = Q2
- Months 7, 8 & 9 = Q3
- Months 10, 11 & 12 = Q4

# Western Australia

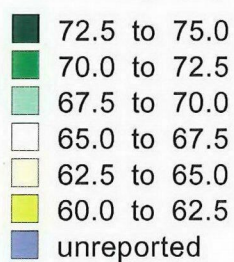
Yield  
by shire for  
1989/90 to 1993/94

Five-year State average = 67.4 %

Five-year shire average



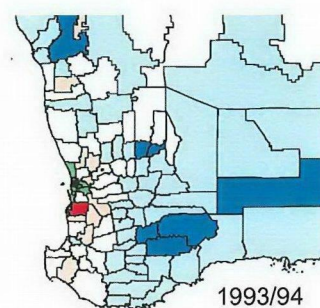
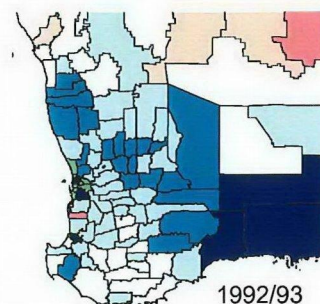
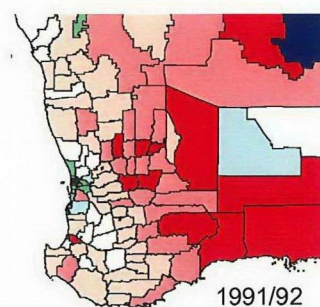
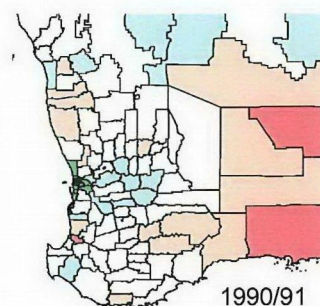
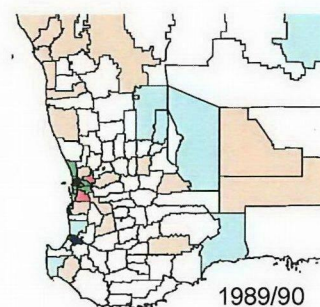
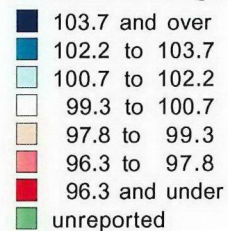
Yield Range (%)



Dr John Stanton and Lindy Coss

These maps are drawn using ABS boundaries and these boundaries remain the property of ABS

Percentage change in shire average



**Table 3.4.6. Average yield (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average yield for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Albany (S)	W10	71.1	66.9	68.7	70.9	70.0
Ashburton (S)	W03	60.9	56.3	61.2	65.0	61.0
Augusta-Margaret River (S)	W18	71.7	69.8	65.7	73.2	71.2
Beverley (S)	W11	68.2	66.6	68.3	69.7	68.5
Boddington (S)	W12	68.4	68.1	70.8	71.8	69.8
Boyup Brook (S)	W13	70.5	67.3	68.8	71.3	70.2
Bridgetown-Greenbushes (S)	W13	71.8	70.2	70.1	72.0	71.6
Brookton (S)	W12	68.4	65.6	68.2	69.7	68.4
Broomehill (S)	W09	69.9	68.4	69.7	71.4	69.9
Bruce Rock (S)	W07	64.8	64.3	65.6	67.3	65.5
Busselton (S)	W18	72.2	70.6	69.3	71.2	71.3
Capel (S)	W17	72.5	67.6	71.8	72.1	71.8
Carnamah (S)	W06	64.2	58.7	65.2	66.8	64.3
Carnarvon (S)	W05	59.0	60.2	61.6	59.9	59.9
Chapman Valley (S)	W06	61.3	57.8	62.5	66.3	62.8
Chittering (S)	W14	68.9	66.4	66.1	69.1	67.7
Collie (S)	W17	71.6	68.6	69.5	71.5	71.3
Coolgardie (S)	W19	64.0	64.6	64.9	69.1	65.8
Coorow (S)	W06	62.9	59.4	64.4	66.4	64.4
Corrigin (S)	W08	65.9	63.5	66.2	67.6	66.1
Cranbrook (S)	W10	71.7	69.1	70.2	72.3	71.4
Cuballing (S)	W12	68.1	66.5	68.4	70.2	68.4
Cue (S)	W04	65.1	62.8	62.6	63.4	63.3
Cunderdin (S)	W11	64.8	63.7	65.9	66.7	65.5
Dalwallinu (S)	W11	63.5	61.0	63.6	65.9	63.6
Dandaragan (S)	W14	64.8	61.8	65.3	67.2	65.6
Dardanup (S)	W17	62.7	59.7	73.1	71.8	62.9
Denmark (S)	W10	74.5	73.1	74.5	74.6	74.2
Donnybrook-Balingup (S)	W17	73.3	71.2	68.3	73.1	72.3
Dowerin (S)	W11	66.3	63.2	66.1	67.2	66.1
Dumbleyung (S)	W12	66.8	65.2	66.9	68.0	66.8
Dundas (S)	W20	63.1	61.6	63.0	65.8	63.5
Esperance (S)	W20	66.0	62.1	65.8	68.1	65.8
Exmouth (S)	W05	50.9	53.6	57.4	54.2	54.5

Table 3.4.6 (cont.). Average yield (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average yield for each shire

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Gingin (S)	W14	66.3	64.1	67.8	68.6	67.3
Gnowangerup (S)	W09	68.6	67.6	69.0	69.9	68.9
Goomalling (S)	W11	66.1	63.7	65.4	67.8	65.7
Greenough (S)	W06	62.9	58.9	64.1	65.4	63.9
Harvey (S)	W17	70.1	66.9	67.1	70.3	68.7
Irwin (S)	W06	65.2	59.1	63.4	65.8	64.0
Jerramungup (S)	W09	68.4	66.7	69.4	70.7	69.0
Kalgoorlie/Boulder (C)	W19	66.2	64.0	67.4	68.2	65.3
Katanning (S)	W09	69.2	66.6	68.6	70.0	68.8
Kellerberrin (S)	W07	64.3	63.8	65.5	67.0	65.5
Kent (S)	W09	67.6	65.9	67.9	68.8	67.8
Kojonup (S)	W09	70.1	67.6	69.5	71.3	69.9
Kondinin (S)	W08	66.7	64.7	66.4	68.2	66.6
Koorda (S)	W11	64.0	61.6	64.0	66.2	64.1
Kulin (S)	W08	67.3	64.6	67.0	68.6	67.3
Lake Grace (S)	W08	67.0	65.1	66.6	68.8	66.9
Laverton (S)	W19	62.8	61.8	59.5	63.2	61.2
Leonora (S)	W19	67.2	66.9	66.0	67.4	66.8
Manjimup (S)	W13	73.7	70.8	68.9	72.9	73.0
Meekatharra (S)	W04	63.8	65.4	65.4	66.4	65.2
Menzies (S)	W19	64.5	67.2	66.6	65.7	66.5
Merredin (S)	W07	65.4	63.5	65.3	67.2	65.6
Mingenew (S)	W06	62.7	58.9	62.9	65.5	63.3
Moora (S)	W14	65.3	63.4	66.7	68.1	66.3
Morawa (S)	W06	65.5	59.8	62.2	65.4	63.6
Mount Magnet (S)	W04	65.6	65.9	66.8	66.7	66.0
Mount Marshall (S)	W07	65.5	63.2	64.5	65.6	64.8
Mukinbudin (S)	W07	63.2	62.0	64.2	65.7	63.9
Mullewa (S)	W06	62.6	58.0	61.7	63.8	61.9
Mundaring (S)	W15	70.8	68.3	71.9	71.7	71.2
Murchison (S)	W04	na	61.7	59.5	na	61.3
Murray (S)	W16	69.8	66.9	66.8	70.3	69.0
Nannup (S)	W13	70.2	64.3	70.8	69.9	69.1
Narembeen (S)	W07	65.6	65.0	66.2	67.4	66.4
Narrogin (S)	W12	68.6	67.2	68.7	69.6	68.7

Table 3.4.6 (cont.). Average yield (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average yield for each shire

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Northam (S)	W11	68.3	65.7	67.3	69.1	67.8
Northampton (S)	W06	61.3	59.4	62.8	64.5	62.5
Nungarin (S)	W07	62.5	58.6	63.4	65.3	62.6
Perenjori (S)	W06	64.6	61.8	64.2	66.2	64.4
Pingelly (S)	W12	67.0	65.5	68.0	69.3	67.7
Plantagenet (S)	W10	72.8	69.0	69.5	71.5	71.3
Port Hedland (T)	W02	56.4	54.7	56.1	59.4	56.3
Quairading (S)	W11	65.4	62.9	66.2	66.4	65.4
Ravensthorpe (S)	W20	66.8	63.1	67.5	69.2	66.7
Roebourne (S)	W03	60.1	59.8	61.4	60.9	60.8
Sandstone (S)	W04	64.4	65.4	64.2	66.1	64.9
Serpentine-Jarrahdale (S)	W15	64.4	64.4	68.0	69.9	65.2
Shark Bay (S)	W05	59.6	53.9	57.3	50.2	59.0
Swan (S)	W15	72.6	66.7	68.1	69.6	69.6
Tambellup (S)	W09	69.9	67.4	69.1	70.4	69.3
Tammin (S)	W11	65.4	64.5	66.7	67.2	66.3
Three Springs (S)	W06	63.5	60.8	63.9	66.3	64.2
Toodyay (S)	W11	70.1	66.9	69.5	70.1	69.5
Trayning (S)	W07	65.2	61.8	65.1	67.5	65.1
Upper Gascoyne (S)	W05	60.9	61.7	61.3	63.5	62.0
Victoria Plains (S)	W14	68.1	66.1	67.0	69.3	67.9
Wagin (S)	W12	67.4	65.1	68.1	69.5	67.7
Wandering (S)	W12	68.2	67.7	70.0	71.2	69.2
Waroon (S)	W16	69.1	66.1	67.4	70.4	69.0
West Arthur (S)	W12	68.3	67.1	69.1	70.8	68.8
Westonia (S)	W07	62.2	61.8	64.6	65.7	63.5
Wickepin (S)	W12	67.1	64.6	66.9	68.1	66.9
Williams (S)	W12	68.9	67.3	70.3	71.5	69.9
Wiluna (S)	W04	67.2	63.0	62.4	59.7	63.7
Wongan-Ballidu (S)	W11	64.7	62.7	65.2	66.5	64.9
Woodanilling (S)	W09	69.0	67.7	68.8	69.2	68.6
Wyalkatchem (S)	W11	64.4	64.3	64.9	66.7	65.2
Yalgoo (S)	W04	65.0	64.7	65.8	66.9	65.4
Yilgarn (S)	W07	64.2	62.0	63.7	64.8	63.8
York (S)	W11	67.2	66.3	68.6	69.6	68.6



### 3.5 Average vegetable matter content

The matched AWC dataset was used to generate the estimated vegetable matter content by shire for the five-year period from July 1989 to June 1994. The long-term State average vegetable matter content is 0.96 per cent. The effect of year on this average is shown in Table 3.5.1. The average vegetable matter content for the individual years ranges from 0.88 per cent to 1.11 per cent.

The SD of the yearly means is the between sale lots standard deviation, and can be used as a measure of the range of vegetable matter content in the raw wool sold on an annual basis in Fremantle.

**Table 3.5.1. Average vegetable matter content for Western Australia over the period July 1989 to June 1994. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Period	Vegetable matter content (%)	
	Mean	SD
5-year average	0.96	0.83
89/90	0.92	0.79
90/91	0.96	0.80
91/92	1.11	0.86
92/93	0.94	0.84
93/94	0.88	0.81

#### 3.5.1 Variation in vegetable matter content due to year, season and WSA, shire effects

The differences of vegetable matter content evident in the above table illustrate the between-year effects. It is assumed that differences also exist between seasons. The existence of differences also needs to be confirmed and quantified between WSAs, and between shires within WSA.

Table 3.5.2 contains a statistical analysis done on time (year, season), regional (WSA, shire) effects and their interactions designed to examine their contributions to the variance of vegetable matter content between individual sale lots offered in Fremantle. The model used to explain the variance in vegetable matter content is highly significant, and explains 26.2 per cent of the total variance. This level of explained variance is higher than for diameter but still represents a small proportion of the total variance (total sums of squares) in vegetable matter content. The error variance contains effects not included in the model and random effects. Therefore the results in Table 3.5.2 suggest that a small but significant proportion of variance in vegetable matter content is due to the model which included macro effects such as year, season and region. Other factors could include, for example, between-flock and property differences within shires (for example, strain differences and other flock management effects) and between-month differences within season.

**Table 3.5.2. Analysis of variance in vegetable matter content due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	193	47518	246.21	532.86	0.0001
Error	266227	134087	0.50		
Corrected total	266420	181605			

The relative importance of the individual terms in explaining the variance in vegetable matter content is shown in Table 3.5.3. All terms except selling year are highly significant, with season and WSA being by far the most important. The relative size of the F values for year and season suggest that the annual result is stable, but that there are large changes across seasons. These changes are also occurring over wide areas of production, and so are better explained by WSA than by using the individual shires.

**Table 3.5.3. Components of variance in vegetable matter content-year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	7	1.81	3.59	0.0062
Season (within selling year)	15	16709	1113.95	2211.73	0.0001
WSA	18	10977	609.86	1210.86	0.0001
Shire nested in WSA	84	8522	101.45	201.43	0.0001
WSA x selling year	72	2315	33.16	63.86	0.0001

The average fibre vegetable matter content of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average are shown in Table 3.5.4.



**Table 3.5.4. Average vegetable matter content (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average vegetable matter content for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	0.5	0.5	0.7	0.6	0.4	0.5
Ashburton (S)	W03	1.2	1.1	0.6	0.6	1.0	0.8
Augusta-Margaret River (S)	W18	0.5	0.5	0.6	0.6	0.5	0.5
Beverley (S)	W11	1.0	1.0	1.1	1.0	1.0	1.0
Boddington (S)	W12	1.2	1.3	1.4	1.1	1.3	1.2
Boyup Brook (S)	W13	0.9	1.0	1.2	1.0	0.8	1.0
Bridgetown-Greenbushes (S)	W13	0.7	0.7	0.8	0.6	0.6	0.7
Brookton (S)	W12	0.9	0.8	1.0	0.8	0.8	0.9
Broomehill (S)	W09	1.0	1.1	1.2	1.1	0.9	1.1
Bruce Rock (S)	W07	0.8	0.8	0.8	0.7	0.8	0.8
Busselton (S)	W18	0.5	0.5	0.5	0.4	0.4	0.5
Capel (S)	W17	0.8	0.6	0.6	0.7	0.5	0.6
Carnamah (S)	W06	1.1	1.3	1.2	1.0	1.2	1.2
Carnarvon (S)	W05	1.7	1.7	1.6	2.3	1.8	1.8
Chapman Valley (S)	W06	1.0	1.0	1.0	1.1	1.2	1.1
Chittering (S)	W14	1.5	1.3	1.2	1.0	1.0	1.2
Collie (S)	W17	0.7	0.6	0.9	0.7	0.7	0.7
Coolgardie (S)	W19	1.8	1.7	1.4	2.3	2.7	2.0
Coorow (S)	W06	0.8	0.9	0.9	0.8	0.9	0.9
Corrigin (S)	W08	0.7	0.6	0.7	0.6	0.6	0.6
Cranbrook (S)	W10	0.6	0.7	0.8	0.7	0.5	0.7
Cuballing (S)	W12	1.1	1.1	1.2	0.9	0.9	1.0
Cue (S)	W04	2.3	2.2	2.0	2.5	2.5	2.3
Cunderdin (S)	W11	0.8	0.7	0.9	0.7	0.8	0.8
Dalwallinu (S)	W11	0.7	0.7	0.8	0.8	0.8	0.8
Dandaragan (S)	W14	1.1	1.4	1.3	0.9	1.0	1.1
Dardanup (S)	W17	1.9	2.4	2.9	1.4	1.9	2.1
Denmark (S)	W10	0.4	0.5	0.6	0.3	0.3	0.4
Donnybrook-Balingup (S)	W17	0.5	0.6	0.6	0.5	0.5	0.5
Dowerin (S)	W11	0.7	0.6	0.8	0.5	0.6	0.6
Dumbleyung (S)	W12	0.9	0.8	0.8	0.7	0.6	0.8
Dundas (S)	W20	1.7	1.8	1.6	1.4	1.4	1.6
Esperance (S)	W20	0.8	0.9	1.1	0.7	0.7	0.8
Exmouth (S)	W05	1.6	1.5	1.2	1.5	2.1	1.5

**Table 3.5.4 (cont.). Average vegetable matter content (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average vegetable matter content for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	1.2	1.5	1.4	1.1	1.0	1.3
Gnowangerup (S)	W09	0.7	0.8	1.0	0.9	0.6	0.8
Goomalling (S)	W11	0.9	0.9	1.0	0.8	0.9	0.9
Greenough (S)	W06	1.0	1.0	0.9	1.0	1.0	1.0
Harvey (S)	W17	0.7	0.8	0.7	0.6	0.5	0.7
Irwin (S)	W06	0.9	0.9	1.1	1.0	0.8	1.0
Jerramungup (S)	W09	0.7	0.8	0.9	0.7	0.6	0.7
Kalgoorlie/Boulder (C)	W19	1.2	1.1	1.0	1.7	1.5	1.3
Katanning (S)	W09	0.9	1.0	1.2	1.0	0.8	1.0
Kellerberrin (S)	W07	0.7	0.7	0.8	0.8	0.7	0.8
Kent (S)	W09	0.7	0.7	0.9	0.7	0.6	0.7
Kojonup (S)	W09	1.0	1.2	1.3	1.2	0.9	1.1
Kondinin (S)	W08	0.7	0.7	0.8	0.6	0.7	0.7
Koorda (S)	W11	0.9	0.9	0.9	0.8	0.9	0.9
Kulin (S)	W08	0.7	0.6	0.7	0.6	0.6	0.7
Lake Grace (S)	W08	0.8	0.8	0.9	0.7	0.7	0.8
Laverton (S)	W19	1.7	1.5	1.3	1.9	1.8	1.7
Leonora (S)	W19	1.2	1.3	1.3	1.9	1.8	1.5
Manjimup (S)	W13	0.5	0.5	0.5	0.5	0.4	0.5
Meekatharra (S)	W04	2.0	2.0	1.8	2.1	2.6	2.1
Menzies (S)	W19	1.2	1.3	1.4	1.5	1.7	1.4
Merredin (S)	W07	0.9	0.9	1.0	0.8	0.9	0.9
Mingenew (S)	W06	1.1	1.1	1.0	0.9	0.9	1.0
Moora (S)	W14	0.9	1.0	1.1	0.8	0.9	0.9
Morawa (S)	W06	1.2	1.1	1.1	1.2	1.4	1.2
Mount Magnet (S)	W04	1.8	1.7	2.0	2.5	2.6	2.2
Mount Marshall (S)	W07	0.9	1.0	1.1	0.9	1.0	1.0
Mukinbudin (S)	W07	1.0	1.2	1.1	1.2	1.0	1.1
Mullewa (S)	W06	1.2	1.4	1.4	1.7	1.5	1.4
Mundaring (S)	W15	0.8	0.7	0.7	0.7	1.0	0.8
Murchison (S)	W04	2.4	1.9	na	2.0	2.0	2.1
Murray (S)	W16	0.6	0.7	0.8	0.7	1.0	0.7
Nannup (S)	W13	0.9	0.6	0.9	0.6	0.7	0.7
Narembeen (S)	W07	0.7	0.7	0.6	0.6	0.7	0.7
Narrogin (S)	W12	0.9	1.0	1.1	0.8	0.7	0.9

**Table 3.5.4 (cont.). Average vegetable matter content (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average vegetable matter content for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	1.2	1.1	1.3	1.1	1.1	1.2
Northampton (S)	W06	1.2	1.1	1.1	1.2	1.2	1.2
Nungarin (S)	W07	2.0	1.7	1.9	1.6	1.6	1.7
Perenjori (S)	W06	0.8	0.9	0.8	0.8	1.2	0.9
Pingelly (S)	W12	1.2	1.2	1.5	1.1	1.0	1.2
Plantagenet (S)	W10	0.5	0.5	0.7	0.6	0.5	0.6
Port Hedland (T)	W02	1.5	1.2	1.0	0.6	1.2	1.2
Quairading (S)	W11	0.9	0.8	0.9	0.8	0.8	0.8
Ravensthorpe (S)	W20	1.0	1.2	1.6	0.8	0.8	1.1
Roebourne (S)	W03	0.8	0.6	0.6	0.5	0.6	0.7
Sandstone (S)	W04	2.1	1.9	2.1	3.2	2.9	2.4
Serpentine-Jarrahdale (S)	W15	1.3	1.3	1.3	1.0	0.8	1.1
Shark Bay (S)	W05	2.3	2.0	2.8	3.2	2.7	2.6
Swan (S)	W15	0.8	0.8	0.8	0.7	0.9	0.8
Tambellup (S)	W09	0.7	1.0	1.1	1.0	0.7	0.9
Tammin (S)	W11	0.6	0.6	0.6	0.5	0.6	0.6
Three Springs (S)	W06	1.0	1.0	1.3	0.9	1.1	1.1
Toodyay (S)	W11	1.0	1.0	1.0	0.9	0.9	1.0
Trayning (S)	W07	1.0	1.1	1.2	0.9	1.0	1.0
Upper Gascoyne (S)	W05	1.7	1.7	2.0	2.4	1.7	1.9
Victoria Plains (S)	W14	0.9	1.0	1.1	0.8	0.9	0.9
Wagin (S)	W12	1.1	1.1	1.2	1.1	0.9	1.1
Wandering (S)	W12	1.3	1.1	1.4	1.2	1.2	1.2
Waroona (S)	W16	0.6	0.6	0.5	0.5	0.7	0.6
West Arthur (S)	W12	1.4	1.5	1.6	1.3	1.2	1.4
Westonia (S)	W07	1.8	1.8	1.8	1.9	2.0	1.9
Wickepin (S)	W12	0.9	0.9	1.0	0.8	0.8	0.9
Williams (S)	W12	1.1	1.1	1.3	1.0	1.0	1.1
Wiluna (S)	W04	1.4	1.5	1.2	2.2	1.8	1.6
Wongan-Ballidu (S)	W11	0.6	0.6	0.7	0.6	0.6	0.6
Woodanilling (S)	W09	1.1	1.2	1.3	1.1	0.8	1.1
Wyalkatchem (S)	W11	0.7	0.7	0.7	0.7	0.6	0.7
Yalgoo (S)	W04	2.4	2.1	2.4	2.7	2.5	2.4
Yilgarn (S)	W07	1.4	1.7	1.9	1.6	1.6	1.6
York (S)	W11	1.0	0.9	1.2	1.0	1.0	1.0



### 3.5.2 Maps of average vegetable matter content by shire

The five-year average results for individual shires are displayed on the large map in Section 3.5, 'Vegetable matter by shire for 1989/90 to 1993/94', which is coloured using a three-part colour scale – white for the shire results closest to the State average, with the shires supplying higher vegetable matter content wool shown in grades of green, and shires within lower vegetable matter content wool in grades of yellow. This map shows the higher levels of vegetable matter in the northern and pastoral regions of the State. The lowest vegetable matter content was delivered from the south coast and some of the eastern agricultural regions. Above average levels are also seen in shires around West Arthur.

The deviations of the individual year average vegetable matter content from the long-term average are shown in the series on the right hand side of this map for the selling years 1989/90 to 1993/94. These maps are designed to show the pattern of change in shire annual average vegetable matter content from the long-term shire average. These maps are coloured using a three-part colour scale – white for shires with results about their long-term shire average, with increases in the shire annual average vegetable matter content shown in grades of blue, and the decreases in the shire annual average vegetable matter content in grades of red.

It should be noted that the high levels of vegetable matter shown in 1991/92 on the south coast and Esperance and the subsequent reductions in the next two selling years are opposite to the pattern of changes in diameter for these shires, with 1991/92 being low and the next years at or above average diameter.

### 3.5.3 Seasonal changes in average vegetable matter content by shire

The non-significance of selling year in explaining the variance in vegetable matter content could be due to the time-frame of one year being too long to account for the differences. The differences by month are listed below and show a greater range of results.

**Table 3.5.5. Average vegetable matter content for WA over the period July 1989 to June 1994. Results show the long-term average, and the monthly average vegetable matter content**

Period	Vegetable matter content (%)
5-year average	0.96
January	0.86
February	1.14
March	1.38
April	1.44
May	1.47
June	1.32
July	1.08
August	0.92
September	0.76
October	0.65
November	0.59
December	0.61

To reduce the volume of information being presented in the following tables, the 12 months were condensed into four seasons:

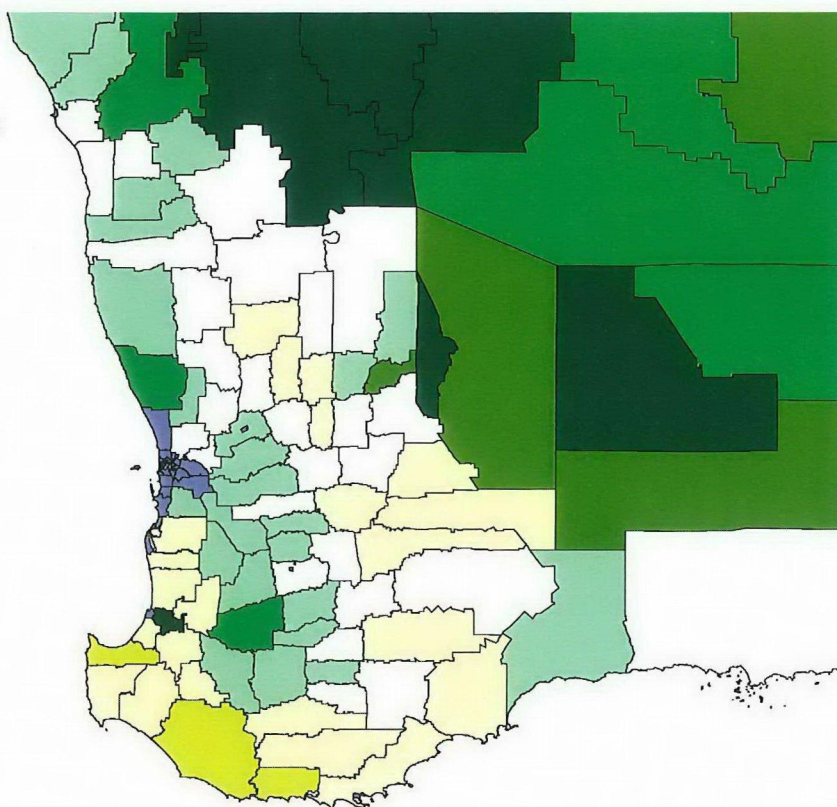
Months 1, 2 & 3 = Q1  
 Months 4, 5 & 6 = Q2  
 Months 7, 8 & 9 = Q3  
 Months 10, 11 & 12 = Q4

# Western Australia

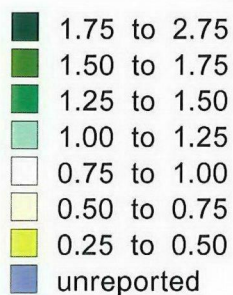
## Vegetable matter content by shire for 1989/90 to 1993/94

Five-year State average = 0.96 %

### Five-year shire average



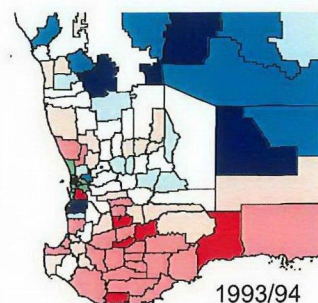
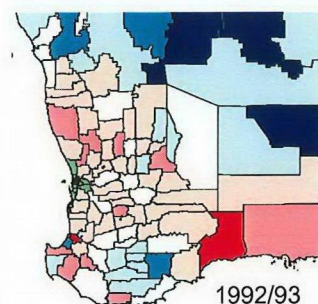
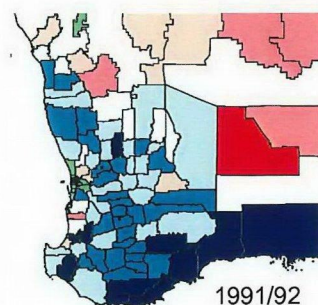
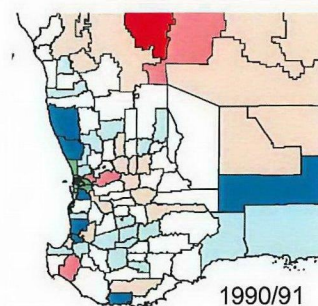
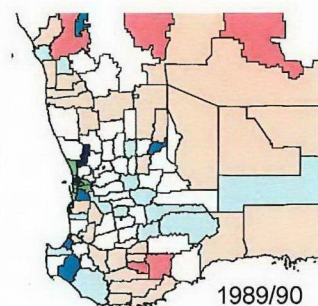
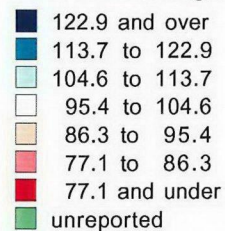
### Vegetable Matter Range (%)



Dr John Stanton and Lindy Coss

These maps are drawn  
using ABS boundaries  
and these boundaries  
remain the property  
of ABS

### Percentage change in shire average



**Table 3.5.6. Average vegetable matter content (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average vegetable matter content for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Albany (S)	W10	0.5	0.9	0.6	0.3	0.5
Ashburton (S)	W03	1.0	1.2	0.8	0.5	0.8
Augusta-Margaret River (S)	W18	0.5	0.8	1.0	0.3	0.5
Beverley (S)	W11	1.2	1.4	1.0	0.8	1.0
Boddington (S)	W12	1.6	1.7	1.0	0.6	1.2
Boyup Brook (S)	W13	1.0	1.8	1.1	0.6	1.0
Bridgetown-Greenbushes (S)	W13	0.8	1.2	0.9	0.5	0.7
Brookton (S)	W12	1.1	1.5	0.8	0.6	0.9
Broomehill (S)	W09	1.4	1.5	1.0	0.5	1.1
Bruce Rock (S)	W07	1.1	1.1	0.6	0.5	0.8
Busselton (S)	W18	0.4	0.6	0.6	0.4	0.5
Capel (S)	W17	0.5	1.2	0.8	0.5	0.6
Carnamah (S)	W06	1.5	2.0	0.9	0.8	1.2
Carnarvon (S)	W05	1.9	1.8	1.6	1.9	1.8
Chapman Valley (S)	W06	1.5	1.5	1.0	0.8	1.1
Chittering (S)	W14	1.4	1.4	1.0	0.8	1.2
Collie (S)	W17	0.8	1.7	0.8	0.5	0.7
Coolgardie (S)	W19	2.5	2.0	1.6	2.1	2.0
Coorow (S)	W06	1.1	1.5	0.8	0.7	0.9
Corrigin (S)	W08	0.7	0.9	0.6	0.5	0.6
Cranbrook (S)	W10	0.7	1.1	0.8	0.4	0.7
Cuballing (S)	W12	1.2	1.4	0.9	0.6	1.0
Cue (S)	W04	2.4	2.3	2.0	2.5	2.3
Cunderdin (S)	W11	1.0	1.0	0.7	0.5	0.8
Dalwallinu (S)	W11	1.1	1.0	0.6	0.5	0.8
Dandaragan (S)	W14	1.4	1.8	1.1	0.8	1.1
Dardanup (S)	W17	2.1	2.6	0.8	0.9	2.1
Denmark (S)	W10	0.3	0.6	0.4	0.3	0.4
Donnybrook-Balingup (S)	W17	0.5	0.8	0.7	0.4	0.5
Dowerin (S)	W11	0.8	0.9	0.6	0.5	0.6
Dumbleyung (S)	W12	1.0	1.0	0.7	0.5	0.8
Dundas (S)	W20	1.6	1.6	1.9	1.1	1.6
Esperance (S)	W20	1.0	1.3	0.6	0.5	0.8
Exmouth (S)	W05	1.7	0.9	1.1	1.7	1.5



**Table 3.5.6 (cont.). Average vegetable matter content (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average vegetable matter content for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Gingin (S)	W14	1.6	2.0	1.1	1.0	1.3
Gnowangerup (S)	W09	1.0	1.1	0.8	0.6	0.8
Goomalling (S)	W11	1.0	1.2	0.8	0.6	0.9
Greenough (S)	W06	1.4	1.4	0.9	0.8	1.0
Harvey (S)	W17	0.8	1.2	0.4	0.5	0.7
Irwin (S)	W06	1.1	1.5	1.0	0.8	1.0
Jerramungup (S)	W09	1.0	1.0	0.7	0.5	0.7
Kalgoorlie/Boulder (C)	W19	1.3	1.3	1.1	1.4	1.3
Katanning (S)	W09	1.1	1.4	0.9	0.6	1.0
Kellerberrin (S)	W07	1.0	1.3	0.6	0.5	0.8
Kent (S)	W09	1.0	1.1	0.7	0.5	0.7
Kojonup (S)	W09	1.2	1.8	1.0	0.6	1.1
Kondinin (S)	W08	1.0	0.9	0.6	0.4	0.7
Koorda (S)	W11	1.0	1.2	0.9	0.6	0.9
Kulin (S)	W08	0.8	1.0	0.6	0.5	0.7
Lake Grace (S)	W08	0.9	1.0	0.7	0.5	0.8
Laverton (S)	W19	1.7	1.6	1.8	1.8	1.7
Leonora (S)	W19	1.3	1.6	1.2	1.5	1.5
Manjimup (S)	W13	0.4	0.8	0.7	0.4	0.5
Meekatharra (S)	W04	2.6	2.0	1.8	2.0	2.1
Menzies (S)	W19	1.9	1.3	0.9	1.8	1.4
Merredin (S)	W07	1.0	1.2	0.9	0.6	0.9
Mingenew (S)	W06	1.4	1.5	0.8	0.7	1.0
Moora (S)	W14	1.2	1.3	0.9	0.7	0.9
Morawa (S)	W06	1.4	1.3	1.0	0.8	1.2
Mount Magnet (S)	W04	2.4	2.2	1.8	2.0	2.2
Mount Marshall (S)	W07	1.3	1.1	0.9	0.8	1.0
Mukinbudin (S)	W07	1.4	1.4	1.0	1.0	1.1
Mullewa (S)	W06	1.9	1.6	0.9	1.3	1.4
Mundaring (S)	W15	0.9	1.6	0.7	0.6	0.8
Murchison (S)	W04	na	2.2	1.5	na	2.1
Murray (S)	W16	0.7	1.2	1.0	0.5	0.7
Nannup (S)	W13	0.6	1.5	0.7	0.5	0.7
Narembreen (S)	W07	0.8	1.0	0.6	0.5	0.7
Narrogin (S)	W12	1.0	1.3	0.9	0.6	0.9



**Table 3.5.6 (cont.). Average vegetable matter content (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average vegetable matter content for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Northam (S)	W11	1.4	1.9	1.0	0.7	1.2
Northampton (S)	W06	1.5	1.6	1.0	1.0	1.2
Nungarin (S)	W07	1.9	2.5	1.4	1.3	1.7
Perenjori (S)	W06	1.2	1.2	0.7	0.6	0.9
Pingelly (S)	W12	1.8	1.7	0.9	0.7	1.2
Plantagenet (S)	W10	0.5	1.0	0.7	0.4	0.6
Port Hedland (T)	W02	1.1	1.2	1.3	0.9	1.2
Quairading (S)	W11	1.0	1.2	0.8	0.6	0.8
Ravensthorpe (S)	W20	1.2	1.6	0.8	0.6	1.1
Roebourne (S)	W03	0.6	0.7	0.6	0.7	0.7
Sandstone (S)	W04	2.6	2.1	2.0	2.0	2.4
Serpentine-Jarrahdale (S)	W15	1.2	1.1	0.7	0.5	1.1
Shark Bay (S)	W05	2.7	2.7	2.2	4.1	2.6
Swan (S)	W15	0.6	1.2	1.0	0.6	0.8
Tambellup (S)	W09	1.0	1.4	0.8	0.6	0.9
Tammin (S)	W11	0.8	0.8	0.5	0.4	0.6
Three Springs (S)	W06	1.4	1.5	1.0	0.7	1.1
Toodyay (S)	W11	1.0	1.8	1.0	0.8	1.0
Trayning (S)	W07	1.0	1.5	1.0	0.8	1.0
Upper Gascoyne (S)	W05	2.3	1.7	1.7	1.8	1.9
Victoria Plains (S)	W14	1.1	1.4	0.8	0.6	0.9
Wagin (S)	W12	1.4	1.5	1.0	0.6	1.1
Wandering (S)	W12	1.6	1.6	1.0	0.6	1.2
Waroon (S)	W16	0.7	0.9	0.8	0.5	0.6
West Arthur (S)	W12	1.7	1.9	1.1	0.7	1.4
Westonia (S)	W07	2.7	2.2	1.3	1.1	1.9
Wickepin (S)	W12	1.0	1.2	0.8	0.6	0.9
Williams (S)	W12	1.5	1.9	0.9	0.6	1.1
Wiluna (S)	W04	0.9	1.8	1.6	2.3	1.6
Wongan-Ballidu (S)	W11	0.8	0.8	0.6	0.5	0.6
Woodanilling (S)	W09	1.2	1.6	0.9	0.7	1.1
Wyalkatchem (S)	W11	0.8	0.7	0.7	0.5	0.7
Yalgoo (S)	W04	2.5	2.6	2.1	1.9	2.4
Yilgarn (S)	W07	2.0	2.1	1.5	1.4	1.6
York (S)	W11	1.5	1.5	1.0	0.8	1.0

### 3.6 Average seed and shive level

The matched AWC dataset was used to generate the estimated average seed and shive level by shire for the five-year period from July 1989 to June 1994. The long-term State average seed and shive level is 0.66 per cent. The effect of year on this average is shown in Table 3.6.1. The average seed and shive level for the individual years ranges from 0.84 per cent to 0.46 per cent.

**Table 3.6.1. Average seed and shive level for Western Australia over the period July 1989 to June 1994. Results show the long-term average, and the annual average seed and shive level. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Period	Average seed and shive (%)	
	Mean	SD
5-year average	0.66	0.66
89/90	0.46	0.62
90/91	0.55	0.66
91/92	0.84	0.69
92/93	0.74	0.67
93/94	0.71	0.64

#### 3.6.1 Variation in seed and shive level due to year, season and WSA, shire effects

The differences of seed and shive level evident in the above table are due to between-year effects. It is also assumed that differences exist between seasons. The existence of differences also need to be proved and quantified between WSAs, and between shires within WSA.

Table 3.6.2 contains the results of a statistical analysis done to examine the ability of the model (using time (year, season) and regional (WSA, shire) effects and their interactions) to explain the variance in seed and shive levels between sale lots. The model used to explain the variance in seed and shive level is highly significant, and explained 24.0 per cent of the total variance. This level of variance explained is similar to the vegetable matter level in Section 3.3.

**Table 3.6.2. Analysis of variance in seed and shive level due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	193	27864	144.37	429.64	0.0001
Error	263260	88463	0.34		
Corrected total	263453	116326			

The relative importance of the individual terms in explaining the variance in seed and shive level is shown in Table 3.6.3. All sources of variance tested were highly significant. The most important effects were season and WSA. These were the same terms that dominated the analysis of vegetable matter content in Section 3.5. This suggests that the changes in seed and shive levels occur over months (not years), and occurs over a wide area (that is, WSAs) and not just within shires.

**Table 3.6.3. Components of variance in seed and shive level-year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	131	32.76	97.50	0.0001
Season (within selling year)	15	8276	551.76	1642.00	0.0001
WSA	18	6248	347.12	1033.00	0.0001
Shire nested in WSA	84	2778	33.07	98.41	0.0001
WSA x selling year	72	1120	15.56	46.32	0.0001

As these patterns of change are similar to that of total vegetable matter content, no maps have been included for this section. For map information on vegetable matter content, readers are advised to use the map in Section 3.5.

The average seed and shive level of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average are shown in Table 3.6.4.

**Table 3.6.4. Average seed and shive level (%) for individual shires in each selling year between July 1989 and June 1994, and the five-year average seed and shive level for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	0.3	0.4	0.5	0.4	0.4	0.4
Ashburton (S)	W03	0.9	0.9	0.5	0.6	0.8	0.7
Augusta-Margaret River (S)	W18	0.3	0.4	0.4	0.5	0.4	0.4
Beverley (S)	W11	0.5	0.7	0.9	0.8	0.9	0.8
Boddington (S)	W12	0.7	0.9	1.1	0.9	1.1	0.9
Boyup Brook (S)	W13	0.5	0.6	0.9	0.8	0.7	0.7
Bridgetown-Greenbushes (S)	W13	0.4	0.5	0.7	0.5	0.5	0.5
Brookton (S)	W12	0.4	0.5	0.9	0.7	0.8	0.6
Broomehill (S)	W09	0.5	0.7	0.9	0.8	0.8	0.7
Bruce Rock (S)	W07	0.3	0.4	0.7	0.6	0.7	0.5
Busselton (S)	W18	0.2	0.3	0.4	0.3	0.3	0.3
Capel (S)	W17	0.5	0.4	0.5	0.7	0.4	0.5
Carnamah (S)	W06	0.6	0.7	1.1	0.8	1.0	0.8
Carnarvon (S)	W05	1.1	1.2	1.3	1.8	1.4	1.4
Chapman Valley (S)	W06	0.6	0.7	0.8	0.9	1.0	0.8
Chittering (S)	W14	1.1	0.8	0.8	0.8	0.8	0.8
Collie (S)	W17	0.4	0.5	0.8	0.5	0.6	0.6
Coolgardie (S)	W19	0.5	1.0	0.8	1.2	1.2	0.9
Coorow (S)	W06	0.5	0.6	0.9	0.7	0.8	0.7
Corrigin (S)	W08	0.4	0.4	0.5	0.5	0.5	0.5
Cranbrook (S)	W10	0.4	0.5	0.7	0.6	0.5	0.5
Cuballing (S)	W12	0.5	0.6	1.0	0.7	0.7	0.7
Cue (S)	W04	1.6	1.6	1.4	1.9	2.0	1.7
Cunderdin (S)	W11	0.3	0.3	0.7	0.6	0.7	0.5
Dalwallinu (S)	W11	0.3	0.4	0.6	0.6	0.7	0.5
Dandaragan (S)	W14	0.6	0.9	1.1	0.8	0.9	0.8
Dardanup (S)	W17	0.1	0.2	2.0	0.9	1.5	0.9
Denmark (S)	W10	0.2	0.3	0.2	0.3	0.3	0.3
Donnybrook-Balingup (S)	W17	0.4	0.4	0.5	0.4	0.4	0.4
Dowerin (S)	W11	0.3	0.4	0.7	0.5	0.6	0.5
Dumbleyung (S)	W12	0.4	0.5	0.7	0.6	0.5	0.5
Dundas (S)	W20	0.3	0.5	0.6	0.6	0.6	0.5
Esperance (S)	W20	0.1	0.3	0.5	0.4	0.5	0.4
Exmouth (S)	W05	1.5	1.3	1.1	1.4	1.9	1.3

**Table 3.6.4 (cont.). Average seed and shive level (%) for individual shires in each selling year between July 1989 and June 1994, and the five-year average seed and shive level for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	0.6	0.9	1.1	0.9	0.8	0.9
Gnowangerup (S)	W09	0.4	0.6	0.8	0.7	0.5	0.6
Goomalling (S)	W11	0.5	0.5	0.8	0.7	0.8	0.7
Greenough (S)	W06	0.6	0.7	0.8	0.9	0.8	0.8
Harvey (S)	W17	0.4	0.6	0.6	0.5	0.4	0.5
Irwin (S)	W06	0.6	0.7	1.0	0.8	0.7	0.8
Jerramungup (S)	W09	0.4	0.5	0.7	0.5	0.5	0.5
Kalgoorlie/Boulder (C)	W19	0.7	0.8	0.8	1.3	1.1	0.9
Katanning (S)	W09	0.4	0.6	0.8	0.7	0.7	0.6
Kellerberrin (S)	W07	0.4	0.4	0.6	0.5	0.5	0.5
Kent (S)	W09	0.4	0.3	0.7	0.5	0.5	0.5
Kojonup (S)	W09	0.6	0.8	1.0	1.0	0.8	0.8
Kondinin (S)	W08	0.4	0.5	0.6	0.5	0.5	0.5
Koorda (S)	W11	0.4	0.5	0.7	0.7	0.7	0.6
Kulin (S)	W08	0.4	0.4	0.6	0.5	0.5	0.5
Lake Grace (S)	W08	0.4	0.5	0.6	0.5	0.5	0.5
Laverton (S)	W19	0.7	1.0	0.9	1.4	1.3	1.0
Leonora (S)	W19	0.7	1.0	1.0	1.5	1.4	1.1
Manjimup (S)	W13	0.4	0.4	0.4	0.4	0.3	0.4
Meekatharra (S)	W04	1.5	1.4	1.3	1.7	2.0	1.5
Menzies (S)	W19	1.0	0.8	1.2	1.3	1.5	1.1
Merredin (S)	W07	0.3	0.4	0.6	0.5	0.5	0.5
Mingenew (S)	W06	0.7	0.9	0.8	0.8	0.8	0.8
Moora (S)	W14	0.5	0.6	1.0	0.7	0.8	0.7
Morawa (S)	W06	0.5	0.7	0.8	0.9	1.0	0.8
Mount Magnet (S)	W04	1.1	1.1	1.6	2.0	2.1	1.6
Mount Marshall (S)	W07	0.4	0.4	0.7	0.8	0.7	0.6
Mukinbudin (S)	W07	0.4	0.6	0.8	1.0	0.7	0.7
Mullewa (S)	W06	0.7	0.9	1.0	1.3	1.1	1.0
Mundaring (S)	W15	0.5	0.4	0.6	0.6	0.9	0.6
Murchison (S)	W04	1.9	1.6	na	1.5	1.4	1.6
Murray (S)	W16	0.3	0.5	0.7	0.5	0.9	0.5
Nannup (S)	W13	0.8	0.2	0.5	0.4	0.5	0.4
Narembeen (S)	W07	0.3	0.4	0.5	0.5	0.5	0.4
Narrogin (S)	W12	0.6	0.5	0.8	0.7	0.6	0.6

**Table 3.6.4 (cont.). Average seed and shive level (%) for individual shires in each selling year between July 1989 and June 1994, and the five-year average seed and shive level for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	0.6	0.7	1.2	0.9	1.0	0.9
Northampton (S)	W06	0.7	0.8	0.9	1.0	1.0	0.9
Nungarin (S)	W07	0.5	0.6	1.0	0.9	0.7	0.8
Perenjori (S)	W06	0.4	0.5	0.6	0.6	0.9	0.6
Pingelly (S)	W12	0.4	0.5	1.2	0.9	0.9	0.8
Plantagenet (S)	W10	0.3	0.3	0.6	0.5	0.4	0.4
Port Hedland (T)	W02	1.4	0.8	0.9	0.5	1.1	1.0
Quairading (S)	W11	0.5	0.5	0.8	0.8	0.8	0.6
Ravensthorpe (S)	W20	0.3	0.5	1.2	0.6	0.6	0.6
Roebourne (S)	W03	0.5	0.3	0.5	0.5	0.6	0.5
Sandstone (S)	W04	1.8	1.2	1.6	2.7	2.4	1.9
Serpentine-Jarrahdale (S)	W15	0.7	0.5	0.9	0.8	0.6	0.7
Shark Bay (S)	W05	1.9	1.4	2.2	2.8	2.2	2.1
Swan (S)	W15	0.4	0.4	0.4	0.6	0.8	0.5
Tambellup (S)	W09	0.3	0.5	0.9	0.8	0.6	0.6
Tammin (S)	W11	0.4	0.3	0.6	0.5	0.6	0.5
Three Springs (S)	W06	0.5	0.5	1.0	0.8	0.9	0.8
Toodyay (S)	W11	0.5	0.7	0.9	0.8	0.9	0.8
Trayning (S)	W07	0.5	0.4	0.8	0.6	0.6	0.6
Upper Gascoyne (S)	W05	1.3	1.2	1.6	2.1	1.5	1.5
Victoria Plains (S)	W14	0.4	0.7	1.0	0.6	0.7	0.7
Wagin (S)	W12	0.5	0.5	1.0	1.0	0.8	0.8
Wandering (S)	W12	0.5	0.6	1.1	1.0	1.1	0.9
Waroona (S)	W16	0.5	0.6	0.4	0.5	0.6	0.5
West Arthur (S)	W12	0.6	0.6	1.3	1.1	1.0	1.0
Westonia (S)	W07	0.4	0.4	0.9	0.7	0.9	0.7
Wickepin (S)	W12	0.5	0.5	0.8	0.7	0.7	0.7
Williams (S)	W12	0.6	0.6	1.1	0.9	0.9	0.8
Wiluna (S)	W04	0.8	1.0	1.0	1.8	1.4	1.2
Wongan-Ballidu (S)	W11	0.4	0.5	0.6	0.5	0.5	0.5
Woodanilling (S)	W09	0.6	0.7	1.0	0.9	0.7	0.8
Wyalkatchem (S)	W11	0.4	0.4	0.5	0.5	0.5	0.5
Yalgoo (S)	W04	1.7	1.6	1.9	2.1	1.9	1.8
Yilgarn (S)	W07	0.4	0.5	0.7	0.6	0.6	0.6
York (S)	W11	0.5	0.4	1.1	0.9	0.9	0.8

### 3.6.2 Seasonal changes in average seed and shive level by shire

The monthly changes in seed and shive in sale lots follows a similar pattern to the vegetable matter content, with maximum levels of 0.99 per cent in April/May and minimum levels of 0.42 per cent in November.

**Table 3.6.5. Average seed and shive level for Western Australia over the period July 1989 to June 1994. Results show the long-term average, and the monthly average seed and shive level**

Period	Vegetable matter content (%)
5-year average	0.66
January	0.61
February	0.84
March	0.90
April	0.99
May	0.99
June	0.93
July	0.65
August	0.59
September	0.51
October	0.44
November	0.42
December	0.45

### 3.7 Average staple strength

The matched AWC dataset was used to generate the estimated average staple strength by shire for the five-year period from July 1989 to June 1994. The long-term State average staple strength is 33.88 N/ktex. The effect of year on this average is shown in Table 3.7.1. The average staple strength for the individual years ranges from 34.6 N/ktex. to 31.1 N/ktex.

The SD of the yearly means is the between sale lots standard deviation, and can be used as a measure of the range of staple strength in the raw wool sold on an annual basis in Fremantle.

**Table 3.7.1. Average staple strength for Western Australia over the period July 1989 to June 1994. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Period	Staple strength (N/ktex)	
	Mean	SD
5-year average	33.88	7.19
89/90	34.68	6.72
90/91	33.41	6.89
91/92	31.10	6.22
92/93	34.38	6.99
93/94	34.16	7.76

#### 3.7.1 Variation in staple strength due to year, season and WSA, shire effects

The differences of staple strength evident in the above table are due to between-year effects. It is assumed also that differences exist between seasons within these years. The existence of differences also need to be proved and quantified between WSAs, and between shires within WSA.

Table 3.7.2 contains the results of a statistical analysis done to examine the ability of the model (using time (year, season) and regional (WSA, shire) effects and their interactions) to explain the variance of staple strength between sale lots. The model is significant, but only explains 11.0 per cent of the total variance (total sums of squares) in strength. So 89.0 per cent of the total variance has been included in the error variance. This error variance contains effects not included in the model and random effects.

Therefore the results in Table 3.7.2 suggest that only a small proportion of variance in staple strength is due to macro effects such as year, season and region, and the majority of variance is due to factors other than those included in the model. These other factors could include between-flock and between-property differences within shires (for example, strain differences and other flock management effects) and between-month differences within season.

**Table 3.7.2. Analysis of variance in staple strength due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	192	504073	2625.38	56.90	0.0001
Error	88667	4091371	46.14		
Corrected total	88859	4595445			



The relative importance of the individual terms in explaining the variance in staple strength is shown in Table 3.7.3. All terms in the analysis were highly significant. However the effect of season (within selling year) dominates the other terms in the model.

**Table 3.7.3. Components of variance in staple strength-year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	4009	1002.13	21.72	0.0001
Season (within selling year)	15	222718	14847.86	321.78	0.0001
WSA	18	48774	2709.69	58.72	0.0001
Shire nested in WSA	84	46375	552.08	11.96	0.0001
WSA x selling year	71	63287	891.36	19.32	0.0001

The average staple strength of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average are shown in Table 3.7.4.

**Table 3.7.4. Average staple strength (N/ktex) for individual shires in each selling year between July 1989 and June 1994, and the five-year average staple strength for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	34.9	34.3	33.2	34.8	32.9	34.1
Ashburton (S)	W03	26.3	24.9	26.4	32.8	28.7	28.6
Augusta-Margaret River (S)	W18	40.1	31.2	32.5	32.2	32.2	33.7
Beverley (S)	W11	34.0	34.3	31.4	34.9	34.5	34.2
Boddington (S)	W12	34.5	32.6	32.8	33.8	35.1	34.0
Boyup Brook (S)	W13	37.2	31.6	32.4	34.5	35.0	34.6
Bridgetown-Greenbushes (S)	W13	35.3	32.7	31.5	31.7	33.3	33.3
Brookton (S)	W12	33.6	34.2	30.5	35.6	35.5	34.6
Broomehill (S)	W09	33.9	34.1	32.1	33.8	36.0	34.5
Bruce Rock (S)	W07	31.9	33.4	28.2	34.2	33.0	32.7
Busselton (S)	W18	29.8	28.9	30.1	33.6	33.3	31.1
Capel (S)	W17	39.7	27.4	28.0	33.0	28.4	33.9
Carnamah (S)	W06	32.9	32.7	30.6	33.8	33.3	32.9
Carnarvon (S)	W05	33.9	32.8	33.4	29.3	34.5	33.0
Chapman Valley (S)	W06	33.2	34.0	32.3	32.2	33.9	33.2
Chittering (S)	W14	37.3	36.9	27.7	38.1	30.5	33.4
Collie (S)	W17	35.3	29.6	36.1	33.7	33.9	33.3
Coolgardie (S)	W19	42.4	40.5	40.3	40.2	46.6	42.5
Coorow (S)	W06	32.7	30.4	30.4	34.2	31.7	32.0
Corrigin (S)	W08	32.6	34.6	29.9	34.6	33.6	33.5
Cranbrook (S)	W10	37.2	34.4	32.2	34.9	34.7	34.9
Cuballing (S)	W12	34.1	36.4	31.6	33.8	36.1	34.6
Cue (S)	W04	34.1	34.9	33.3	35.8	34.6	34.6
Cunderdin (S)	W11	32.1	34.2	27.8	35.5	34.8	33.9
Dalwallinu (S)	W11	33.9	33.0	30.9	34.6	34.5	33.9
Dandaragan (S)	W14	34.2	32.4	30.2	33.8	31.9	32.7
Dardanup (S)	W17	39.7	33.8	33.0	40.2	38.0	38.6
Denmark (S)	W10	42.1	35.5	36.7	41.0	36.0	38.3
Donnybrook-Balingup (S)	W17	35.6	28.9	31.0	30.7	29.5	30.7
Dowerin (S)	W11	31.6	32.3	27.8	34.5	32.2	32.2
Dumbleyung (S)	W12	35.0	34.6	32.6	34.2	36.0	34.9
Dundas (S)	W20	38.8	36.7	34.1	36.2	37.1	36.8
Esperance (S)	W20	33.8	31.9	27.7	36.7	34.1	33.8
Exmouth (S)	W05	na	34.9	na	28.0	35.9	33.3

**Table 3.7.4 (cont.). Average staple strength (N/ktex) for individual shires in each selling year between July 1989 and June 1994, and the five-year average staple strength for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	38.0	34.1	31.1	33.3	34.0	34.3
Gnowangerup (S)	W09	33.8	33.5	33.0	34.0	34.8	34.0
Goomalling (S)	W11	34.0	35.5	30.0	35.7	35.9	34.9
Greenough (S)	W06	33.9	33.4	32.7	33.2	33.1	33.3
Harvey (S)	W17	37.4	41.4	na	36.5	35.4	37.1
Irwin (S)	W06	32.1	31.7	32.6	36.1	33.8	33.4
Jerramungup (S)	W09	33.1	33.2	33.3	35.2	34.6	34.2
Kalgoorlie/Boulder (C)	W19	41.0	36.5	36.6	38.9	41.0	39.1
Katanning (S)	W09	35.9	36.0	33.5	32.6	34.6	34.5
Kellerberrin (S)	W07	31.5	32.3	27.5	32.7	33.1	32.1
Kent (S)	W09	35.5	33.2	30.8	35.8	35.1	34.5
Kojonup (S)	W09	35.3	32.1	31.9	32.9	34.0	33.6
Kondinin (S)	W08	32.9	34.6	29.9	34.5	33.0	33.5
Koorda (S)	W11	29.4	32.8	28.7	34.1	33.0	32.4
Kulin (S)	W08	34.2	34.2	29.8	33.0	35.3	34.0
Lake Grace (S)	W08	34.6	33.8	28.8	35.6	34.5	34.2
Laverton (S)	W19	31.8	35.1	na	31.4	30.9	32.5
Leonora (S)	W19	35.2	35.5	34.6	37.7	38.7	36.5
Manjimup (S)	W13	36.7	30.5	30.6	29.7	31.8	32.5
Meekatharra (S)	W04	32.6	36.2	33.1	31.8	34.9	33.6
Menzies (S)	W19	36.0	33.3	31.6	36.9	37.5	35.7
Merredin (S)	W07	32.1	31.7	27.8	34.0	31.0	31.7
Mingenew (S)	W06	33.6	32.0	31.1	33.1	32.6	32.6
Moora (S)	W14	33.1	33.9	31.6	34.9	34.0	33.9
Morawa (S)	W06	34.8	32.8	26.6	31.5	34.7	33.1
Mount Magnet (S)	W04	40.2	34.0	25.2	28.4	34.9	33.5
Mount Marshall (S)	W07	34.1	32.4	27.8	32.4	33.5	32.6
Mukinbudin (S)	W07	34.4	33.4	29.6	34.4	32.5	33.3
Mullewa (S)	W06	31.3	31.6	28.6	29.7	32.9	31.0
Mundaring (S)	W15	35.8	31.8	28.9	32.6	39.6	34.7
Murchison (S)	W04	33.0	35.9	na	32.1	32.0	32.9
Murray (S)	W16	34.1	35.7	28.8	30.8	32.6	32.9
Nannup (S)	W13	33.4	28.4	na	30.0	28.6	30.1
Narembeen (S)	W07	31.1	31.6	29.0	31.9	31.1	31.2
Narrogin (S)	W12	34.9	36.3	32.3	34.0	35.0	34.7

**Table 3.7.4 (cont.). Average staple strength (N/ktex) for individual shires in each selling year between July 1989 and June 1994, and the five-year average staple strength for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	35.8	33.5	27.3	32.2	32.8	32.3
Northampton (S)	W06	34.5	32.5	32.1	32.5	33.2	33.0
Nungarin (S)	W07	33.7	31.6	31.1	33.9	33.9	33.1
Perenjori (S)	W06	31.8	32.1	29.0	31.2	31.3	31.3
Pingelly (S)	W12	32.9	34.6	31.7	33.8	34.7	34.1
Plantagenet (S)	W10	35.0	33.1	31.8	33.5	32.3	33.3
Port Hedland (T)	W02	30.0	na	25.0	25.3	24.6	26.4
Quairading (S)	W11	33.7	33.4	28.3	34.9	32.8	32.9
Ravensthorpe (S)	W20	33.6	33.6	29.6	36.9	36.1	34.9
Roebourne (S)	W03	29.6	30.2	28.6	30.6	30.1	29.7
Sandstone (S)	W04	35.4	32.2	26.9	38.0	32.1	33.2
Serpentine-Jarrahdale (S)	W15	35.5	30.3	36.4	36.8	35.0	34.9
Shark Bay (S)	W05	29.1	31.8	29.5	31.7	34.7	31.6
Swan (S)	W15	31.4	31.8	32.7	35.8	34.4	32.6
Tambellup (S)	W09	35.6	34.3	32.7	35.0	34.2	34.5
Tammin (S)	W11	32.7	34.1	26.9	35.1	33.5	33.5
Three Springs (S)	W06	33.5	32.6	31.8	32.5	32.7	32.7
Toodyay (S)	W11	32.4	33.9	26.3	33.8	32.7	32.7
Trayning (S)	W07	33.8	30.6	29.6	35.7	33.6	33.4
Upper Gascoyne (S)	W05	35.1	33.1	24.6	30.0	32.5	32.4
Victoria Plains (S)	W14	35.0	34.0	30.3	35.0	33.2	33.8
Wagin (S)	W12	34.8	34.8	33.8	34.3	33.4	34.1
Wandering (S)	W12	34.0	36.3	33.1	33.8	34.9	34.3
Waroona (S)	W16	36.9	34.6	34.0	na	36.5	36.4
West Arthur (S)	W12	36.1	32.0	32.7	33.8	34.8	34.2
Westonia (S)	W07	30.9	28.9	31.6	34.4	32.0	32.4
Wickepin (S)	W12	33.6	35.9	30.9	34.3	35.9	34.9
Williams (S)	W12	35.7	33.3	33.0	32.8	32.7	33.4
Wiluna (S)	W04	33.6	38.2	32.1	36.5	39.5	36.9
Wongan-Ballidu (S)	W11	31.9	34.3	29.8	36.5	33.9	33.9
Woodanilling (S)	W09	35.5	35.5	36.1	36.8	35.2	35.7
Wyalkatchem (S)	W11	33.8	33.4	28.2	35.2	35.9	34.4
Yalgoo (S)	W04	34.8	33.5	28.8	31.7	34.1	32.9
Yilgarn (S)	W07	35.0	31.7	30.2	33.6	33.9	33.1
York (S)	W11	35.1	33.7	27.2	34.2	33.9	33.7



### 3.7.2 Maps of average staple strength by shire

The five-year average results for individual shires are displayed on the large map for Section 3.7, 'Staple strength by shire for 1989/90 to 1993/94', which is coloured using a three-part colour scale – white for shire results closest to the State average, with the shires supplying higher strength wool shown in grades of green, and the shires with lower strength wool in grades of yellow. This map shows that the weaker wool is found scattered through the eastern wheatbelt and northern agricultural region of the State. The high strength merino fleece wool is delivered from the Goldfields/Kalgoorlie region.

The deviations of the individual year average staple strength from the long-term average are also shown in the series down the right hand side of this map for the selling years 1989/90 to 1993/94. These maps are designed to show the pattern of change in shire annual average strength from the long-term shire average. These maps are coloured using a three-part colour scale – white for shires with annual results about their long-term shire average, with increases in the shire annual average staple strength shown in grades of blue, and the decreases in the shire annual average staple strength in grades of red.

### 3.7.3 Seasonal changes in average staple strength by shire

The analysis of variance in staple strength showed that the season is highly significant in explaining differences in staple strength. These differences are shown on a monthly basis for all matched merino combing fleece offered in Fremantle over a five-year period.

**Table 3.7.5. Average staple strength for Western Australia over the period July 1989 to June 1994. Results show the long-term average, and the monthly average staple strength**

Period	Staple strength (N/ktex)
5-year average	33.88
January	32.60
February	33.69
March	36.00
April	36.58
May	36.05
June	35.73
July	35.38
August	33.80
September	32.88
October	32.12
November	31.97
December	32.13

To reduce the volume of information being presented in the following tables, the 12 months were condensed into four seasons:

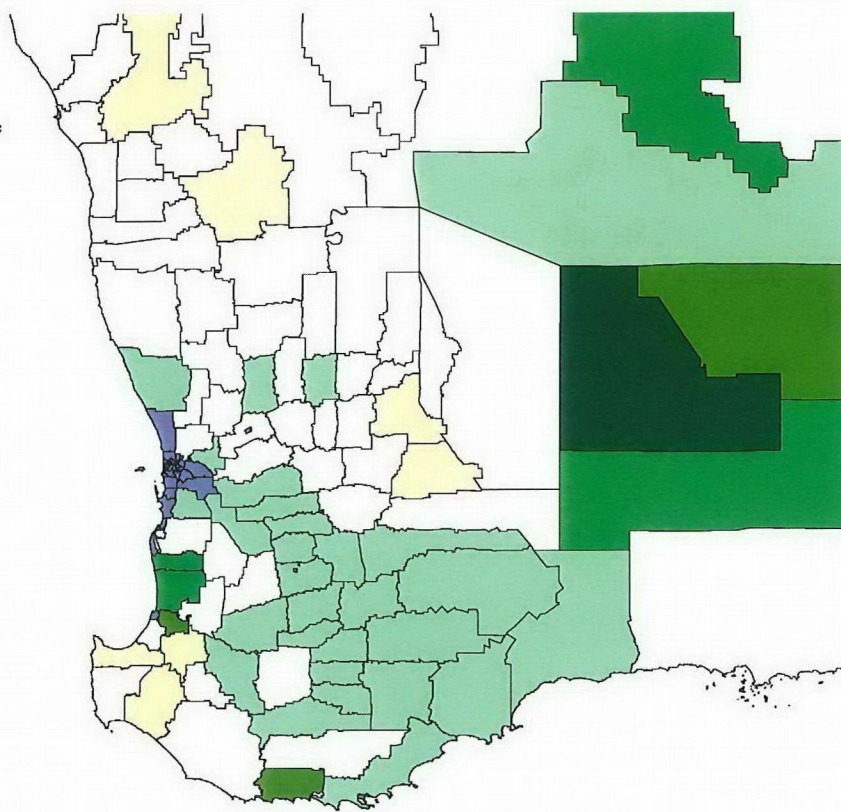
Months 1, 2 & 3 = Q1  
 Months 4, 5 & 6 = Q2  
 Months 7, 8 & 9 = Q3  
 Months 10, 11 & 12 = Q4

# Western Australia

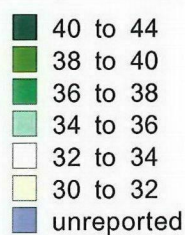
Staple strength  
by shire for  
1989/90 to 1993/94

Five-year State average = 33.9 N/ktex

Five-year shire average



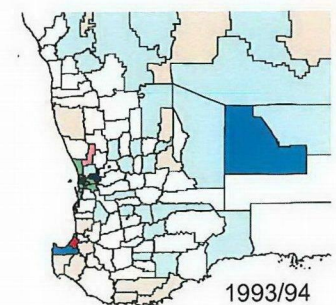
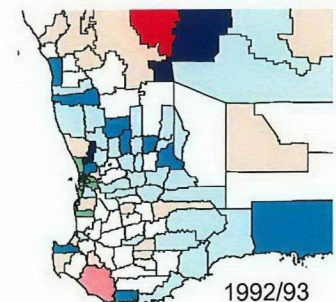
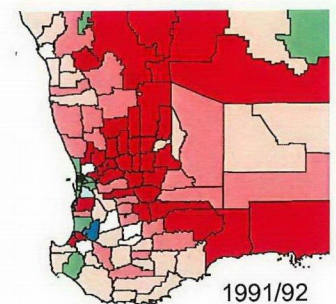
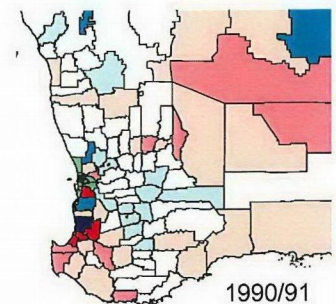
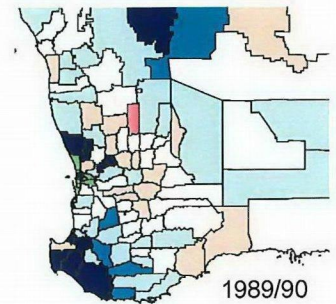
Staple Strength Range (N/ktex)



Dr John Stanton and Lindy Coss

These maps are drawn  
using ABS boundaries  
and these boundaries  
remain the property  
of ABS

Percentage change  
in shire average





**Table 3.7.6. Average staple strength (N/ktex) for individual shires in each quarter between July 1989 and June 1994, and the five-year average staple strength for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Albany (S)	W10	35.7	35.6	34.0	31.9	34.1
Ashburton (S)	W03	35.9	29.9	26.0	30.1	28.6
Augusta-Margaret River (S)	W18	27.7	39.9	33.6	34.0	33.7
Beverley (S)	W11	34.1	35.5	34.3	33.4	34.2
Boddington (S)	W12	34.5	33.6	34.8	33.7	34.0
Boyup Brook (S)	W13	35.5	35.6	33.8	33.1	34.6
Bridgetown-Greenbushes (S)	W13	33.2	33.5	32.0	33.6	33.3
Brookton (S)	W12	34.3	35.4	35.1	33.8	34.6
Broomehill (S)	W09	36.1	36.3	33.8	31.7	34.5
Bruce Rock (S)	W07	34.5	34.2	32.2	31.0	32.7
Busselton (S)	W18	30.5	28.9	32.7	31.3	31.1
Capel (S)	W17	30.2	41.9	47.1	31.5	33.9
Carnamah (S)	W06	32.1	34.7	33.5	31.0	32.9
Carnarvon (S)	W05	32.1	34.2	33.1	31.8	33.0
Chapman Valley (S)	W06	34.1	34.5	33.9	30.9	33.2
Chittering (S)	W14	35.0	31.6	35.5	30.3	33.4
Collie (S)	W17	32.5	40.5	31.9	33.4	33.3
Coolgardie (S)	W19	38.0	42.2	44.6	42.6	42.5
Coorow (S)	W06	29.9	35.6	33.3	30.6	32.0
Corrigin (S)	W08	32.0	35.9	33.7	32.3	33.5
Cranbrook (S)	W10	35.5	40.2	34.3	32.8	34.9
Cuballing (S)	W12	34.9	35.2	35.0	33.4	34.6
Cue (S)	W04	37.4	34.6	34.0	27.1	34.6
Cunderdin (S)	W11	33.7	35.7	33.4	33.4	33.9
Dalwallinu (S)	W11	33.0	36.5	34.2	32.0	33.9
Dandaragan (S)	W14	32.9	37.0	33.2	31.0	32.7
Dardanup (S)	W17	37.9	38.1	40.0	47.8	38.6
Denmark (S)	W10	35.6	40.6	45.6	39.6	38.3
Donnybrook-Balingup (S)	W17	29.5	29.9	33.1	31.6	30.7
Dowerin (S)	W11	30.4	33.6	33.4	31.0	32.2
Dumbleyung (S)	W12	35.7	37.5	33.5	33.4	34.9
Dundas (S)	W20	39.8	38.4	33.2	35.9	36.8
Esperance (S)	W20	35.3	36.5	32.4	30.7	33.8
Exmouth (S)	W05	na	34.9	31.4	na	33.3



Table 3.7.6 (cont.). Average staple strength (N/ktex) for individual shires in each quarter between July 1989 and June 1994, and the five-year average staple strength for each shire

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Gingin (S)	W14	34.2	35.2	36.5	30.9	34.3
Gnowangerup (S)	W09	38.3	36.5	32.3	32.0	34.0
Goomalling (S)	W11	35.9	36.2	35.3	32.2	34.9
Greenough (S)	W06	32.7	37.2	34.0	31.5	33.3
Harvey (S)	W17	38.9	45.5	34.3	36.9	37.1
Irwin (S)	W06	36.9	38.4	33.2	31.5	33.4
Jerramungup (S)	W09	35.8	37.4	32.2	31.3	34.2
Kalgoorlie/Boulder (C)	W19	39.3	38.9	43.6	37.0	39.1
Katanning (S)	W09	34.4	37.3	33.7	33.3	34.5
Kellerberrin (S)	W07	32.2	33.5	32.8	30.4	32.1
Kent (S)	W09	39.4	38.1	33.3	31.1	34.5
Kojonup (S)	W09	33.5	35.2	33.6	32.4	33.6
Kondinin (S)	W08	34.9	35.4	32.8	30.8	33.5
Koorda (S)	W11	31.9	33.6	33.9	30.6	32.4
Kulin (S)	W08	34.7	37.9	33.0	32.9	34.0
Lake Grace (S)	W08	37.7	37.1	32.6	30.7	34.2
Laverton (S)	W19	30.4	33.1	31.7	na	32.5
Leonora (S)	W19	35.4	36.6	37.6	32.7	36.5
Manjimup (S)	W13	31.1	34.6	33.4	35.3	32.5
Meekatharra (S)	W04	35.3	33.9	32.3	32.3	33.6
Menzies (S)	W19	32.7	36.1	40.2	33.5	35.7
Merredin (S)	W07	31.9	35.0	32.1	30.0	31.7
Mingenew (S)	W06	33.6	35.1	32.2	31.5	32.6
Moora (S)	W14	34.5	36.0	34.4	31.9	33.9
Morawa (S)	W06	34.1	34.2	34.1	29.2	33.1
Mount Magnet (S)	W04	32.0	35.9	38.6	31.5	33.5
Mount Marshall (S)	W07	33.3	35.6	32.9	29.8	32.6
Mukinbudin (S)	W07	32.6	35.8	32.0	33.5	33.3
Mullewa (S)	W06	29.7	35.6	32.9	28.7	31.0
Mundaring (S)	W15	33.0	42.8	29.0	33.2	34.7
Murchison (S)	W04	na	33.8	27.0	na	32.9
Murray (S)	W16	31.2	38.7	32.9	31.9	32.9
Nannup (S)	W13	31.6	30.1	na	28.0	30.1
Narembeen (S)	W07	33.1	32.5	30.9	30.0	31.2
Narrogin (S)	W12	34.2	37.2	34.3	33.7	34.7

**Table 3.7.6 (cont.). Average staple strength (N/ktex) for individual shires in each quarter between July 1989 and June 1994, and the five-year average staple strength for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Northam (S)	W11	30.5	33.6	33.7	30.7	32.3
Northampton (S)	W06	33.0	34.8	33.2	31.6	33.0
Nungarin (S)	W07	32.3	33.5	35.0	31.0	33.1
Perenjori (S)	W06	33.0	32.3	31.1	29.5	31.3
Pingelly (S)	W12	33.4	35.1	34.6	33.1	34.1
Plantagenet (S)	W10	32.3	36.5	34.1	32.6	33.3
Port Hedland (T)	W02	na	30.0	24.7	25.2	26.4
Quairading (S)	W11	32.4	33.9	34.0	30.9	32.9
Ravensthorpe (S)	W20	37.7	37.6	32.7	31.4	34.9
Roebourne (S)	W03	25.0	30.6	30.0	25.1	29.7
Sandstone (S)	W04	33.2	33.4	29.3	32.5	33.2
Serpentine-Jarrahdale (S)	W15	34.2	36.1	34.1	32.4	34.9
Shark Bay (S)	W05	31.6	28.4	33.7	26.4	31.6
Swan (S)	W15	31.3	33.2	33.0	33.6	32.6
Tambellup (S)	W09	35.8	36.4	34.1	32.9	34.5
Tammin (S)	W11	33.9	33.4	33.7	32.6	33.5
Three Springs (S)	W06	34.6	34.2	32.9	30.6	32.7
Toodyay (S)	W11	32.1	33.1	35.1	31.6	32.7
Trayning (S)	W07	32.9	35.6	33.0	33.9	33.4
Upper Gascoyne (S)	W05	28.2	35.8	28.7	31.9	32.4
Victoria Plains (S)	W14	34.8	34.6	34.0	32.5	33.8
Wagin (S)	W12	35.1	35.8	33.6	32.1	34.1
Wandering (S)	W12	34.3	35.1	35.4	33.2	34.3
Waroon (S)	W16	42.5	33.0	37.3	35.4	36.4
West Arthur (S)	W12	35.3	35.3	32.4	32.4	34.2
Westonia (S)	W07	34.6	35.0	33.1	28.2	32.4
Wickepin (S)	W12	36.7	36.9	33.6	32.8	34.9
Williams (S)	W12	33.9	35.8	33.0	32.5	33.4
Wiluna (S)	W04	39.1	36.6	34.2	na	36.9
Wongan-Ballidu (S)	W11	33.1	34.1	35.4	32.2	33.9
Woodanilling (S)	W09	37.5	37.7	32.4	32.3	35.7
Wyalkatchem (S)	W11	34.6	34.5	35.3	32.0	34.4
Yalgoo (S)	W04	32.3	36.0	33.0	28.3	32.9
Yilgarn (S)	W07	34.8	36.1	32.5	30.6	33.1
York (S)	W11	32.3	35.0	34.0	33.5	33.7

### 3.8 Average staple strength by micron group

Results of staple strengths described were supplemented with estimates of staple strength of merino combing fleece wool of particular diameter groups coming from these shires. This was done using the matched AWC dataset, and the following diameter classes:

fine	average of 19.5 $\mu\text{m}$ with a range from 18.6 $\mu\text{m}$ to 20.5 $\mu\text{m}$ (Table 3.8.2)
medium	average of 21.5 $\mu\text{m}$ with a range from 20.6 $\mu\text{m}$ to 22.5 $\mu\text{m}$ (Table 3.8.3)
broad	average of 23.5 $\mu\text{m}$ with a range from 22.6 $\mu\text{m}$ to 24.5 $\mu\text{m}$ (Table 3.8.4)

Note that the estimates were done on a reduced number of sale lots which had this staple information available, compared to the diameter, vegetable matter and yield estimates which were available for all sale lots.

The average annual staple strength for these micron groups is shown in Table 3.8.1. The average strength over the five years shows the finer wool has a lower strength and the broad micron group has the highest strength. The changes in strengths are evident in all the micron groups. The difficulty in interpreting these changes is that the strength and diameter are correlated, in that when the diameter is reduced through low nutrition, the strength will also be reduced. So Table 3.8.1 should not be seen as evidence that all fine wools are tender.

**Table 3.8.1. Average staple strength for the micron groups in Western Australia over the period July 1989 to June 1994. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Micron group	Average staple strength (N/ktex)		
	Fine	Medium	Broad
5-year average	29.8	32.4	35.2
89/90	31.1	33.8	35.5
90/91	29.6	31.9	34.9
91/92	28.5	30.4	33.0
92/93	30.2	32.5	35.5
93/94	30.0	32.4	35.2

Results were calculated annually for the five-year period for each shire. The first years of the analysis had low numbers of staple measurement results available for the State. Therefore some shires had very low numbers of tested lots available for the analysis. The actual number of staple measurements used in the analysis is shown in Appendix 4. The annual average strength for the individual shires over the five-year period is shown in Table 3.8.2.

**Table 3.8.2. Average staple strength of the fine wool (averaging 19.5 µm) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 29.8 N/ktex**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	31.1	28.4	25.0	29.2	29.1	29.2
Ashburton (S)	W03	28.7	20.0	23.6	26.6	26.9	24.8
Augusta-Margaret River (S)	W18	27.3	33.0	29.4	28.6	32.7	29.2
Beverley (S)	W11	30.9	29.2	29.2	30.7	32.0	31.0
Boddington (S)	W12	31.4	30.2	31.9	30.2	30.0	30.5
Boyup Brook (S)	W13	32.2	26.0	31.2	30.4	29.2	30.2
Bridgetown-Greenbushes (S)	W13	32.2	na	24.6	24.4	27.9	27.7
Brookton (S)	W12	29.0	26.8	30.0	32.9	33.7	31.9
Broomehill (S)	W09	34.3	32.6	31.9	33.1	34.4	33.4
Bruce Rock (S)	W07	30.8	31.1	26.0	25.5	28.4	28.5
Busselton (S)	W18	27.6	23.8	31.5	31.2	37.4	30.0
Capel (S)	W17	28.6	28.0	na	28.0	na	28.5
Carnamah (S)	W06	27.7	28.3	28.4	31.4	32.3	29.5
Carnarvon (S)	W05	22.0	26.0	29.2	29.8	31.0	29.5
Chapman Valley (S)	W06	27.9	29.4	22.1	25.4	28.3	26.6
Chittering (S)	W14	29.0	39.3	17.0	34.7	28.1	30.4
Collie (S)	W17	29.8	33.9	35.6	29.4	31.3	32.0
Coolgardie (S)	W19	na	na	na	na	na	na
Coorow (S)	W06	25.8	21.1	25.0	31.5	30.6	27.6
Corrigin (S)	W08	31.7	23.7	23.8	29.9	29.4	28.3
Cranbrook (S)	W10	31.6	28.5	30.3	30.9	30.3	30.4
Cuballing (S)	W12	31.6	36.7	29.3	34.2	35.5	33.4
Cue (S)	W04	27.7	34.0	26.4	31.7	35.2	30.8
Cunderdin (S)	W11	27.4	27.5	20.8	33.8	32.0	28.9
Dalwallinu (S)	W11	29.8	28.0	27.9	29.3	30.9	29.8
Dandaragan (S)	W14	27.5	28.7	25.9	28.8	29.5	28.6
Dardanup (S)	W17	na	20.4	33.0	na	na	22.3
Denmark (S)	W10	41.3	33.5	26.8	38.2	33.6	35.8
Donnybrook-Balingup (S)	W17	33.8	29.4	27.3	28.1	26.5	29.3
Dowerin (S)	W11	28.9	26.1	21.5	29.0	28.4	27.1
Dumbleyung (S)	W12	31.8	25.5	28.3	32.9	28.3	30.0
Dundas (S)	W20	30.4	32.6	27.0	na	32.0	31.6
Esperance (S)	W20	27.4	30.5	26.8	33.4	28.1	28.3
Exmouth (S)	W05	na	na	na	na	na	na

Table 3.8.2 (cont.). Average staple strength of the fine wool (averaging 19.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 29.8 N/ktex

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	31.3	25.7	28.1	27.5	32.5	29.4
Gnowangerup (S)	W09	31.5	27.9	26.9	30.8	29.3	29.2
Goomalling (S)	W11	27.7	28.8	24.3	29.7	31.4	28.7
Greenough (S)	W06	30.4	24.9	35.0	32.9	29.0	29.5
Harvey (S)	W17	37.9	na	na	35.0	na	36.6
Irwin (S)	W06	31.1	28.7	na	32.0	24.5	29.3
Jerramungup (S)	W09	28.3	28.4	29.3	28.6	31.9	29.9
Kalgoorlie/Boulder (C)	W19	na	33.6	na	43.0	35.9	34.9
Katanning (S)	W09	34.5	33.3	28.5	30.6	28.8	30.4
Kellerberrin (S)	W07	26.3	29.0	21.5	28.6	27.4	26.6
Kent (S)	W09	32.8	26.7	26.3	31.3	26.8	28.8
Kojonup (S)	W09	31.8	30.1	29.7	30.6	28.7	30.1
Kondinin (S)	W08	29.3	31.6	29.8	27.1	29.3	29.4
Koorda (S)	W11	27.5	26.2	23.6	30.2	27.4	26.6
Kulin (S)	W08	31.5	24.8	26.0	28.8	29.1	29.3
Lake Grace (S)	W08	29.7	27.9	27.7	28.7	27.4	27.9
Laverton (S)	W19	na	na	na	na	na	na
Leonora (S)	W19	38.6	32.0	34.0	25.0	31.3	34.1
Manjimup (S)	W13	26.0	21.9	28.0	30.2	29.4	25.8
Meekatharra (S)	W04	31.6	29.3	25.9	39.0	37.6	33.4
Menzies (S)	W19	na	27.0	na	na	45.3	43.6
Merredin (S)	W07	27.2	25.8	23.2	37.3	30.0	29.3
Mingenew (S)	W06	29.5	21.7	28.8	26.3	25.9	25.6
Moora (S)	W14	29.4	28.0	27.8	27.3	28.9	28.5
Morawa (S)	W06	28.1	24.7	27.3	21.1	27.7	26.4
Mount Magnet (S)	W04	39.0	32.3	27.0	na	38.1	32.6
Mount Marshall (S)	W07	28.0	na	22.3	24.1	30.3	27.4
Mukinbudin (S)	W07	29.4	32.5	31.3	33.9	31.2	31.8
Mullewa (S)	W06	23.2	30.1	30.2	25.0	34.2	28.7
Mundaring (S)	W15	31.0	na	na	na	na	31.0
Murchison (S)	W04	na	na	na	na	31.9	31.9
Murray (S)	W16	30.4	32.5	27.9	23.6	35.0	28.9
Nannup (S)	W13	34.0	22.0	na	na	na	29.4
Narembreen (S)	W07	30.3	25.9	29.4	24.9	27.6	27.7
Narrogin (S)	W12	33.1	32.1	27.8	29.8	30.5	30.8

**Table 3.8.2 (cont.).** Average staple strength of the fine wool (averaging 19.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 29.8 N/ktex

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	32.1	27.0	24.0	28.5	30.2	28.9
Northampton (S)	W06	33.9	30.0	28.2	32.5	32.2	31.8
Nungarin (S)	W07	33.5	22.4	na	na	31.7	30.3
Perenjori (S)	W06	26.7	28.2	25.6	31.2	26.9	27.5
Pingelly (S)	W12	34.5	31.1	26.4	28.2	31.9	30.4
Plantagenet (S)	W10	29.6	28.5	31.5	30.7	31.9	30.6
Port Hedland (T)	W02	29.8	na	25.0	25.3	23.2	26.0
Quairading (S)	W11	31.0	28.5	24.4	26.4	29.5	28.2
Ravensthorpe (S)	W20	31.7	33.5	27.3	35.1	29.9	31.6
Roebourne (S)	W03	37.0	30.9	25.9	32.0	19.9	26.5
Sandstone (S)	W04	na	28.5	na	na	na	28.5
Serpentine-Jarrahdale (S)	W15	na	25.0	27.0	33.0	32.6	30.9
Shark Bay (S)	W05	na	na	na	35.0	34.4	34.5
Swan (S)	W15	35.0	30.0	na	31.0	32.3	31.8
Tambellup (S)	W09	32.2	33.1	31.4	32.1	31.2	32.0
Tammin (S)	W11	22.1	36.0	28.0	na	32.0	30.3
Three Springs (S)	W06	27.2	23.6	23.2	26.2	28.1	26.4
Toodyay (S)	W11	30.3	26.7	27.0	33.2	32.5	29.4
Trayning (S)	W07	23.0	na	27.6	30.0	29.5	28.3
Upper Gascoyne (S)	W05	na	na	na	na	25.0	25.0
Victoria Plains (S)	W14	29.1	27.9	26.4	28.4	29.7	28.5
Wagin (S)	W12	31.4	34.1	32.2	31.3	32.6	32.2
Wandering (S)	W12	28.0	27.1	30.8	30.1	32.6	30.6
Waroona (S)	W16	34.6	na	na	na	na	34.6
West Arthur (S)	W12	33.5	29.4	31.4	29.4	30.0	30.4
Westonia (S)	W07	28.7	27.0	28.5	29.7	29.2	28.6
Wickepin (S)	W12	31.3	33.0	29.5	26.2	31.7	30.5
Williams (S)	W12	32.7	30.1	29.6	28.1	28.4	29.7
Wiluna (S)	W04	30.5	na	na	32.0	28.0	30.3
Wongan-Ballidu (S)	W11	28.9	30.3	24.4	32.5	29.8	29.4
Woodanilling (S)	W09	30.1	31.7	27.6	27.6	28.4	29.0
Wyalkatchem (S)	W11	30.3	37.0	24.7	27.0	37.9	34.8
Yalgoo (S)	W04	34.2	30.1	26.8	36.9	36.2	32.1
Yilgarn (S)	W07	32.9	26.1	30.4	31.9	30.1	30.2
York (S)	W11	29.9	23.8	27.6	32.2	31.1	30.2

**Table 3.8.3. Average staple strength of clean medium wool (averaging 21.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 32.4 N/ktex**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	32.9	32.4	32.4	34.0	31.3	32.7
Ashburton (S)	W03	26.4	25.6	29.7	34.5	27.5	28.7
Augusta-Margaret River (S)	W18	34.8	29.2	32.7	30.7	29.2	31.2
Beverley (S)	W11	32.7	33.1	31.9	34.3	34.7	33.8
Boddington (S)	W12	35.1	31.7	31.8	33.5	35.7	33.9
Boyup Brook (S)	W13	37.7	31.2	33.3	35.0	34.6	34.8
Bridgetown-Greenbushes (S)	W13	35.3	32.3	30.4	30.3	31.5	32.6
Brookton (S)	W12	32.6	29.9	30.2	33.8	34.5	33.2
Broomehill (S)	W09	32.4	32.4	31.6	32.8	35.4	33.2
Bruce Rock (S)	W07	31.3	29.4	27.9	30.0	31.9	30.5
Busselton (S)	W18	33.1	29.4	28.7	33.0	31.7	31.4
Capel (S)	W17	41.2	27.5	28.0	33.2	29.0	34.7
Carnamah (S)	W06	32.4	31.8	31.3	32.9	32.6	32.3
Carnarvon (S)	W05	30.8	31.2	31.8	27.6	32.9	31.1
Chapman Valley (S)	W06	31.9	31.4	30.0	31.6	32.5	31.5
Chittering (S)	W14	36.0	33.7	23.1	33.1	29.4	31.5
Collie (S)	W17	35.9	29.8	36.0	33.7	34.1	33.8
Coolgardie (S)	W19	43.2	38.5	38.5	na	39.8	40.3
Coorow (S)	W06	32.2	28.4	27.1	31.7	30.3	30.2
Corrigin (S)	W08	31.3	30.1	28.3	32.0	31.5	30.8
Cranbrook (S)	W10	36.0	32.4	31.8	33.4	32.5	33.4
Cuballing (S)	W12	34.7	34.6	31.3	31.7	35.8	33.8
Cue (S)	W04	30.8	35.0	33.5	35.4	32.9	33.2
Cunderdin (S)	W11	31.7	30.4	27.4	31.4	33.3	31.3
Dalwallinu (S)	W11	32.4	32.2	25.8	32.7	33.5	32.6
Dandaragan (S)	W14	32.0	32.3	28.4	32.0	31.7	31.6
Dardanup (S)	W17	42.2	35.0	na	37.0	35.6	36.8
Denmark (S)	W10	40.1	35.6	37.2	39.5	35.4	37.2
Donnybrook-Balingup (S)	W17	35.8	28.4	31.6	30.2	28.9	30.2
Dowerin (S)	W11	31.0	29.8	27.9	32.1	31.1	30.5
Dumbleyung (S)	W12	34.2	32.9	30.9	31.1	32.0	32.6
Dundas (S)	W20	33.4	34.7	33.4	27.1	35.1	34.0
Esperance (S)	W20	31.2	30.3	27.4	32.7	31.4	30.7
Exmouth (S)	W05	na	36.0	na	28.0	31.0	31.1

**Table 3.8.3 (cont.). Average staple strength of clean medium wool (averaging 21.5 µm) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 32.4 N/ktex**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	36.0	35.0	31.5	33.9	34.4	34.4
Gnowangerup (S)	W09	31.3	32.2	32.5	31.6	31.8	31.8
Goomalling (S)	W11	33.2	32.8	27.6	31.6	33.2	32.2
Greenough (S)	W06	31.2	32.3	29.7	30.3	32.3	31.4
Harvey (S)	W17	37.1	41.0	na	38.0	38.8	37.9
Irwin (S)	W06	31.1	28.8	30.1	33.8	31.8	31.2
Jerramungup (S)	W09	31.6	31.1	31.0	32.2	32.4	31.8
Kalgoorlie/Boulder (C)	W19	36.9	36.1	34.7	43.7	39.5	37.6
Katanning (S)	W09	34.6	35.3	33.2	32.6	32.6	33.4
Kellerberrin (S)	W07	30.4	27.8	24.4	30.5	31.9	29.8
Kent (S)	W09	36.1	32.9	29.0	33.6	31.0	32.6
Kojonup (S)	W09	34.9	31.3	32.2	32.7	33.5	33.2
Kondinin (S)	W08	32.2	30.7	29.3	29.6	31.3	30.8
Koorda (S)	W11	28.1	32.3	28.9	32.3	31.3	30.7
Kulin (S)	W08	33.4	30.1	28.8	29.9	32.3	31.4
Lake Grace (S)	W08	32.8	29.9	27.9	31.7	30.9	30.8
Laverton (S)	W19	na	32.3	na	na	28.3	30.9
Leonora (S)	W19	35.1	36.0	32.6	36.9	38.0	36.2
Manjimup (S)	W13	36.0	28.6	30.9	28.6	30.2	31.3
Meekatharra (S)	W04	32.5	35.0	33.5	25.1	33.7	32.6
Menzies (S)	W19	34.5	32.0	22.1	33.5	38.8	33.5
Merredin (S)	W07	33.3	27.8	27.6	31.4	29.5	29.7
Mingenew (S)	W06	32.0	30.7	29.6	30.7	31.4	31.0
Moora (S)	W14	32.9	32.1	30.7	32.9	33.6	32.8
Morawa (S)	W06	33.2	32.0	26.2	28.7	32.3	31.1
Mount Magnet (S)	W04	31.9	33.8	25.1	28.3	32.1	30.9
Mount Marshall (S)	W07	31.4	30.5	28.2	30.0	31.3	30.3
Mukinbudin (S)	W07	34.2	33.0	28.6	32.1	32.1	32.4
Mullewa (S)	W06	30.4	30.0	27.2	28.4	30.9	29.4
Mundaring (S)	W15	34.7	28.4	na	27.0	39.4	35.2
Murchison (S)	W04	41.0	37.2	na	29.9	30.4	33.0
Murray (S)	W16	34.8	31.1	27.8	32.6	31.4	32.3
Nannup (S)	W13	33.0	33.0	na	30.0	27.3	30.2
Narembeen (S)	W07	31.9	28.4	27.9	30.3	29.3	29.5
Narrogin (S)	W12	34.5	34.5	33.1	32.8	33.3	33.7



**Table 3.8.3 (cont.). Average staple strength of clean medium wool (averaging 21.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 32.4 N/ktex**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	34.6	32.2	26.8	28.7	31.8	30.7
Northampton (S)	W06	32.3	29.0	30.9	31.0	31.5	30.8
Nungarin (S)	W07	31.4	25.1	30.4	27.1	32.9	30.2
Perenjori (S)	W06	31.7	30.4	29.2	28.9	30.8	30.3
Pingelly (S)	W12	30.3	32.4	31.4	32.1	33.1	32.4
Plantagenet (S)	W10	34.8	32.6	31.5	32.1	30.9	32.5
Port Hedland (T)	W02	31.0	na	na	na	26.8	27.9
Quairading (S)	W11	32.6	32.2	28.5	33.5	32.1	31.8
Ravensthorpe (S)	W20	30.6	32.8	29.6	33.5	33.1	32.1
Roebourne (S)	W03	25.5	29.6	28.1	29.9	28.1	27.9
Sandstone (S)	W04	34.4	32.5	25.7	27.5	31.5	31.1
Serpentine-Jarrahdale (S)	W15	33.7	28.5	27.7	36.1	32.7	31.3
Shark Bay (S)	W05	29.7	29.2	27.5	30.0	34.4	30.8
Swan (S)	W15	32.1	31.7	32.7	32.7	36.1	32.8
Tambellup (S)	W09	35.3	33.6	32.1	34.1	31.5	33.4
Tammin (S)	W11	31.1	32.4	23.7	33.7	33.8	31.9
Three Springs (S)	W06	31.5	32.7	31.1	29.8	32.0	31.4
Toodyay (S)	W11	31.4	30.8	25.2	32.1	32.2	31.0
Trayning (S)	W07	31.8	28.0	27.1	30.8	33.3	31.1
Upper Gascoyne (S)	W05	31.1	31.2	23.6	23.7	32.0	29.0
Victoria Plains (S)	W14	34.8	32.8	30.3	30.5	32.1	31.8
Wagin (S)	W12	34.9	33.6	34.0	34.2	31.3	33.4
Wandering (S)	W12	34.0	36.8	31.8	33.7	34.6	34.2
Waroona (S)	W16	36.1	37.0	34.0	na	36.7	36.2
West Arthur (S)	W12	35.8	31.7	32.7	33.5	33.9	33.8
Westonia (S)	W07	30.0	27.9	28.7	28.4	30.4	29.6
Wickepin (S)	W12	33.2	33.1	27.3	31.0	33.1	32.3
Williams (S)	W12	35.8	32.3	32.7	32.6	32.8	33.3
Wiluna (S)	W04	29.0	37.9	32.1	35.9	37.3	36.2
Wongan-Ballidu (S)	W11	31.0	31.6	28.6	31.6	33.7	31.9
Woodanilling (S)	W09	34.3	32.8	31.6	34.8	32.8	33.6
Wyalkatchem (S)	W11	33.7	29.7	28.3	33.4	34.2	32.6
Yalgoo (S)	W04	33.5	32.6	28.3	25.1	32.1	31.0
Yilgarn (S)	W07	33.1	28.9	28.7	30.8	31.8	30.8
York (S)	W11	35.1	33.9	26.9	34.2	33.8	33.6

**Table 3.8.4. Average staple strength of clean broad wool (averaging 23.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 35.2 N/ktex**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	35.8	36.0	34.1	35.8	33.6	35.1
Ashburton (S)	W03	19.0	na	na	32.6	31.3	31.7
Augusta-Margaret River (S)	W18	47.3	33.3	34.4	35.4	34.5	36.1
Beverley (S)	W11	36.6	35.7	32.1	36.6	35.9	35.9
Boddington (S)	W12	36.4	36.1	36.2	36.7	38.1	36.8
Boyup Brook (S)	W13	39.2	33.6	35.5	36.8	40.3	37.8
Bridgetown-Greenbushes (S)	W13	37.0	32.7	35.4	35.9	35.6	35.0
Brookton (S)	W12	33.4	36.2	31.4	37.6	36.8	36.0
Broomehill (S)	W09	34.7	36.4	32.8	35.1	36.1	35.5
Bruce Rock (S)	W07	32.9	35.0	29.2	36.2	35.1	34.7
Busselton (S)	W18	24.1	30.5	34.9	37.4	39.0	31.8
Capel (S)	W17	44.3	27.3	na	na	23.0	34.6
Carnamah (S)	W06	34.4	35.7	31.4	33.9	34.6	34.2
Carnarvon (S)	W05	34.7	33.6	34.0	29.7	36.7	33.9
Chapman Valley (S)	W06	33.4	35.3	34.7	32.7	34.2	34.2
Chittering (S)	W14	37.3	39.4	28.7	39.1	34.4	34.4
Collie (S)	W17	35.3	27.8	37.2	36.2	35.8	32.5
Coolgardie (S)	W19	42.4	40.1	39.6	38.2	44.7	41.4
Coorow (S)	W06	33.9	34.3	42.2	34.8	34.3	34.5
Corrigin (S)	W08	33.6	35.8	31.1	34.6	34.9	34.6
Cranbrook (S)	W10	39.4	37.3	36.0	38.3	35.7	37.3
Cuballing (S)	W12	33.3	37.8	33.7	35.2	36.4	35.8
Cue (S)	W04	35.5	34.2	33.2	33.0	35.5	34.8
Cunderdin (S)	W11	33.4	34.7	29.5	36.4	35.3	35.0
Dalwallinu (S)	W11	35.3	35.2	34.3	35.6	35.7	35.5
Dandaragan (S)	W14	36.2	33.5	33.3	34.9	33.0	34.3
Dardanup (S)	W17	38.5	37.0	na	42.0	38.8	39.2
Denmark (S)	W10	44.3	35.7	39.3	40.9	36.6	39.4
Donnybrook-Balingup (S)	W17	37.7	29.5	31.1	34.7	35.1	33.2
Dowerin (S)	W11	33.4	34.6	33.4	35.3	33.0	34.2
Dumbleyung (S)	W12	37.4	35.4	34.8	36.1	36.7	36.2
Dundas (S)	W20	38.0	35.9	35.1	36.7	37.2	36.8
Esperance (S)	W20	34.7	32.4	27.7	36.6	35.0	34.6
Exmouth (S)	W05	na	34.4	na	na	39.0	35.6

**Table 3.8.4 (cont.). Average staple strength of clean broad wool (averaging 23.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 35.2 N/ktex**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	40.1	36.7	34.9	35.4	36.6	37.2
Gnowangerup (S)	W09	34.9	34.7	35.6	36.0	36.3	35.6
Goomalling (S)	W11	34.2	36.8	30.4	36.1	36.5	35.6
Greenough (S)	W06	36.0	34.3	34.6	33.2	33.8	34.1
Harvey (S)	W17	39.1	41.8	na	na	33.9	36.0
Irwin (S)	W06	33.0	32.3	33.6	36.9	36.3	34.6
Jerramungup (S)	W09	33.4	35.3	36.1	35.6	34.7	34.9
Kalgoorlie/Boulder (C)	W19	40.7	36.6	36.1	37.7	40.4	38.6
Katanning (S)	W09	37.0	37.4	37.0	33.4	36.6	36.4
Kellerberrin (S)	W07	31.5	32.7	28.5	33.5	33.4	32.8
Kent (S)	W09	35.3	34.1	35.2	35.4	36.3	35.5
Kojonup (S)	W09	37.3	34.3	34.0	35.3	36.6	36.1
Kondinin (S)	W08	33.8	35.6	31.5	35.9	34.5	35.0
Koorda (S)	W11	31.2	33.9	37.0	34.7	35.8	34.3
Kulin (S)	W08	35.7	35.8	32.2	33.9	36.9	35.5
Lake Grace (S)	W08	35.7	34.8	31.3	36.2	35.9	35.5
Laverton (S)	W19	31.5	38.3	na	31.0	37.0	32.9
Leonora (S)	W19	34.8	35.5	35.1	36.2	38.1	35.8
Manjimup (S)	W13	39.2	34.7	32.0	33.9	33.9	35.7
Meekatharra (S)	W04	31.8	38.3	33.5	32.8	35.0	33.6
Menzies (S)	W19	36.4	33.1	31.4	36.8	35.4	35.0
Merredin (S)	W07	31.9	33.5	27.9	33.9	32.8	32.9
Mingenew (S)	W06	34.1	32.8	32.1	33.8	33.9	33.5
Moora (S)	W14	33.6	36.7	33.1	36.1	36.3	35.7
Morawa (S)	W06	38.5	35.9	27.8	34.9	37.9	36.5
Mount Magnet (S)	W04	39.3	35.5	24.6	28.3	36.0	34.3
Mount Marshall (S)	W07	34.9	34.3	32.2	32.8	34.4	33.9
Mukinbudin (S)	W07	34.8	34.0	30.3	35.2	32.7	34.0
Mullewa (S)	W06	33.6	33.1	32.5	30.4	34.6	32.6
Mundaring (S)	W15	45.0	36.4	28.9	38.0	41.0	34.6
Murchison (S)	W04	30.2	35.1	na	30.3	33.0	31.8
Murray (S)	W16	36.0	36.5	36.0	36.0	33.2	35.3
Nannup (S)	W13	na	na	na	na	30.5	30.5
Narembeen (S)	W07	30.0	32.1	31.7	33.2	33.2	32.4
Narrogin (S)	W12	36.7	38.5	34.5	34.8	36.0	36.1

**Table 3.8.4 (cont.). Average staple strength of clean broad wool (averaging 23.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average staple strength for each shire. The State average for this diameter group was 35.2 N/ktex**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	37.7	35.3	29.0	34.3	34.4	34.4
Northampton (S)	W06	34.9	34.5	33.0	34.1	34.1	34.2
Nungarin (S)	W07	39.7	33.9	31.1	34.3	34.5	34.2
Perenjori (S)	W06	32.7	35.2	30.1	33.7	34.0	33.6
Pingelly (S)	W12	35.3	35.8	32.9	36.6	36.7	36.1
Plantagenet (S)	W10	35.7	34.4	33.8	36.3	33.4	34.7
Port Hedland (T)	W02	na	na	na	na	na	na
Quairading (S)	W11	34.6	35.0	30.2	36.8	35.2	35.0
Ravensthorpe (S)	W20	34.7	34.4	31.4	37.0	36.3	35.9
Roebourne (S)	W03	31.8	na	31.3	31.0	34.8	32.5
Sandstone (S)	W04	35.4	34.0	30.7	38.0	32.5	34.9
Serpentine-Jarrahdale (S)	W15	39.0	32.3	38.4	36.4	35.6	36.1
Shark Bay (S)	W05	28.7	33.1	31.7	33.3	36.4	32.1
Swan (S)	W15	30.1	32.1	na	41.0	32.4	32.5
Tambellup (S)	W09	36.6	36.4	35.8	37.1	35.4	36.0
Tammin (S)	W11	30.8	33.2	24.0	35.2	32.7	33.1
Three Springs (S)	W06	36.7	33.4	35.7	34.9	34.9	35.1
Toodyay (S)	W11	35.2	38.4	28.2	35.3	33.4	34.9
Trayning (S)	W07	34.1	31.8	34.4	36.4	33.9	34.7
Upper Gascoyne (S)	W05	34.8	33.0	29.2	32.0	33.2	33.2
Victoria Plains (S)	W14	36.0	35.6	30.7	36.6	35.0	35.5
Wagin (S)	W12	35.0	35.8	33.9	34.8	34.6	34.8
Wandering (S)	W12	38.0	40.7	38.8	37.7	38.3	38.3
Waroon (S)	W16	41.2	34.2	na	na	35.6	37.3
West Arthur (S)	W12	37.4	35.8	36.2	37.1	36.9	36.9
Westonia (S)	W07	32.8	30.0	35.6	37.9	35.2	35.6
Wickepin (S)	W12	33.9	36.4	33.0	36.2	37.4	36.2
Williams (S)	W12	37.3	35.4	34.9	34.2	34.3	34.9
Wiluna (S)	W04	34.5	39.6	na	36.2	40.8	37.0
Wongan-Ballidu (S)	W11	32.9	35.9	29.9	36.3	34.3	34.7
Woodanilling (S)	W09	37.1	39.0	40.9	40.9	35.7	37.5
Wyalkatchem (S)	W11	34.2	36.4	30.1	36.3	37.3	36.1
Yalgoo (S)	W04	35.3	37.4	32.2	33.3	36.3	35.1
Yilgarn (S)	W07	36.0	33.4	31.6	34.4	34.9	34.3
York (S)	W11	37.1	35.2	29.6	34.6	35.6	35.3

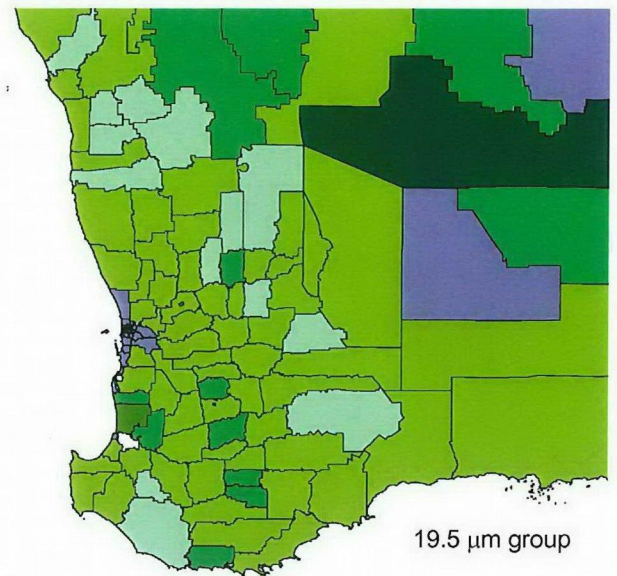
### **3.8.1 Maps of staple strength by shire by micron group**

The long-term average staple strength by shire is shown for Section 3.8 in the map 'Staple strength by shire by micron group for 1989/90 to 1993/94'. The colour range is common to all three maps, allowing comparison of strength in the different micron group maps.

In general the maps show that the finer wools are weaker than the broader wools. This pattern holds across most shires within the State.

# Western Australia

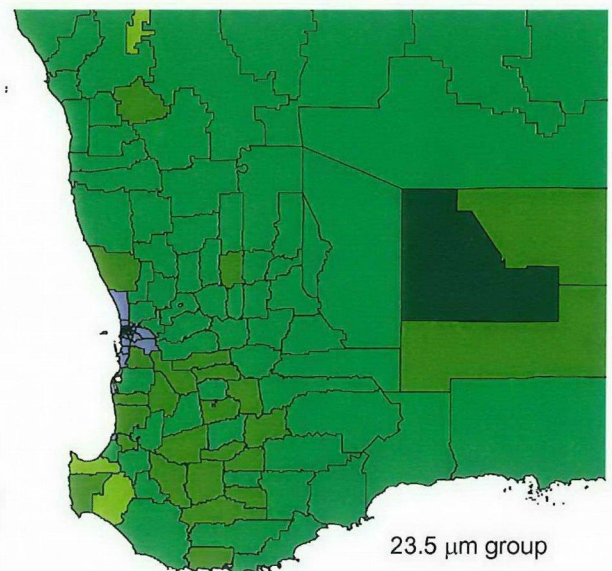
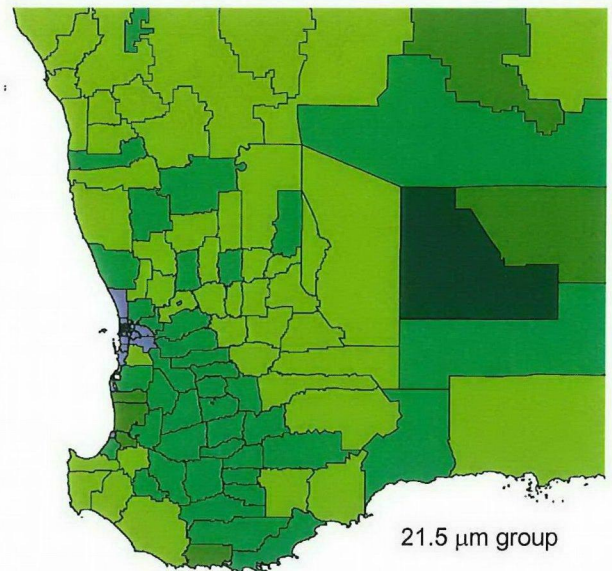
Staple strength  
by shire  
by micron group for  
1989/90 to 1993/94



## Five-year shire average

Staple Strength Range (N/ktex)

40 to 44
36 to 40
32 to 36
28 to 32
24 to 28
20 to 24
unreported



### 3.9 Average staple length

The matched AWC dataset was used to generate the estimated average staple length by shire for the five-year period from July 1989 to June 1994. The long-term State average staple length is 91.6 mm. The effect of year on this average is shown in Table 3.9.1. The average staple length for the individual years ranges from 87.4 mm to 93.8 mm.

The SD of the yearly means is the between-sale lot deviation, and can be used as a measure of the range of staple lengths in the raw wool sale lots sold on an annual basis in Fremantle.

**Table 3.9.1. Average staple length for Western Australia over the period July 1989 to June 1994. Results show the long-term average, and the annual average staple length. Results are for all matched merino combing fleece sale lots sold at auction with staple measurements in Fremantle**

Period	Average staple length (mm)	
	Mean	SD
5-year average	91.6	8.64
89/90	91.05	8.59
90/91	91.41	8.53
91/92	87.39	7.87
92/93	93.80	8.44
93/94	91.48	8.58

#### 3.9.1 Variation in staple length due to year, season and WSA, shire effects

The differences of staple length evident in the above table are due to between-year effects. It is assumed also that differences exist between seasons. The existence of differences also needs to be proved and quantified between WSAs, and between shires within WSA.

Table 3.9.2 contains the results of a statistical analysis done to examine the ability of the model (using time (year, season) and regional (WSA, shire) effects and their interactions) to explain the variance of staple length between sale lots. The model is highly significant, but only explains 14.4 per cent of the total variance (total sums of squares) in staple length. So 85.6 per cent of the total variance has been included in the error variance. This error variance contains effects not included in the model, and random effects.

Therefore the results in Table 3.9.2 suggest that only a small proportion of variance in staple length is due to macro effects such as year, season and region, and the majority of variance is due to factors other than those included in the model. These other factors include between-flock and between-property differences within shires (for example, strain differences and other flock management effects) and between-month differences within season.

**Table 3.9.2. Analysis of variance in staple length due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	192	954594	4971.85	77.60	0.0001
Error	88692	5682360	64.07		
Corrected total	88884	6636955			

The relative importance of the individual model terms in explaining the variance in staple length are shown in Table 3.9.3. All sources of variance were significant. Of the terms used in the model, season made the highest contribution to explaining the variance in staple length.

**Table 3.9.3. Components of variance in staple length-year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	9269	2317.17	36.17	0.0001
Season (within selling year)	15	263512	17567.49	274.20	0.0001
WSA	18	71781	3987.85	62.24	0.0001
Shire nested in WSA	84	72407	861.99	13.45	0.0001
WSA x selling year	71	133316	1877.69	29.31	0.0001

The average staple length of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average are shown in Table 3.9.4.



**Table 3.9.4. Average staple length (mm) for individual shires for five selling years between July 1989 and June 1994, and the five-year average staple length for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	97.3	94.4	91.0	95.7	95.2	95.4
Ashburton (S)	W03	88.4	81.6	78.3	91.9	88.8	86.6
Augusta-Margaret River (S)	W18	92.1	95.2	88.3	93.0	91.5	92.7
Beverley (S)	W11	89.1	90.4	86.8	93.1	89.2	90.2
Boddington (S)	W12	89.1	91.8	91.6	93.5	90.4	91.5
Boyup Brook (S)	W13	92.0	92.0	87.3	93.6	93.8	92.7
Bridgetown-Greenbushes (S)	W13	92.8	94.9	90.2	93.9	93.2	93.2
Brookton (S)	W12	90.2	95.4	91.8	94.4	89.7	91.9
Broomehill (S)	W09	93.0	91.9	90.4	94.0	93.5	93.1
Bruce Rock (S)	W07	88.6	93.2	86.6	95.7	89.4	91.3
Busselton (S)	W18	90.4	90.0	92.4	93.8	86.6	90.7
Capel (S)	W17	87.8	95.7	83.8	96.7	96.6	92.5
Carnamah (S)	W06	90.9	88.1	86.3	93.6	89.5	90.0
Carnarvon (S)	W05	87.9	89.3	89.0	89.6	85.7	88.1
Chapman Valley (S)	W06	90.4	92.1	90.8	91.9	91.3	91.3
Chittering (S)	W14	88.1	90.5	88.9	93.1	93.3	90.9
Collie (S)	W17	92.0	90.3	93.1	93.6	93.0	92.2
Coolgardie (S)	W19	91.0	89.5	93.4	94.8	94.9	92.8
Coorow (S)	W06	86.5	88.7	83.5	92.8	88.7	88.9
Corrigin (S)	W08	87.6	94.1	81.4	92.7	88.1	89.7
Cranbrook (S)	W10	92.8	92.0	86.3	92.4	94.1	92.1
Cuballing (S)	W12	87.2	88.9	85.0	93.5	89.9	89.5
Cue (S)	W04	93.4	82.9	85.5	91.4	88.4	89.8
Cunderdin (S)	W11	88.5	93.6	84.7	94.1	90.2	91.3
Dalwallinu (S)	W11	87.5	89.2	87.6	91.8	88.8	89.2
Dandaragan (S)	W14	90.2	89.8	88.0	95.5	90.4	91.6
Dardanup (S)	W17	86.9	77.9	86.0	93.4	92.8	89.6
Denmark (S)	W10	94.4	91.8	86.8	89.1	94.5	92.5
Donnybrook-Balingup (S)	W17	90.9	92.5	88.8	92.0	92.9	92.0
Dowerin (S)	W11	87.0	90.9	84.2	91.8	88.6	89.2
Dumbleyung (S)	W12	88.5	93.0	85.3	91.9	92.6	91.3
Dundas (S)	W20	94.5	91.6	89.5	96.2	88.5	92.1
Esperance (S)	W20	90.5	91.7	87.6	96.8	93.0	92.9
Exmouth (S)	W05	na	81.9	na	90.5	82.2	84.2

**Table 3.9.4 (cont.). Average staple length (mm) for individual shires for five selling years between July 1989 and June 1994, and the five-year average staple length for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	86.2	89.8	89.1	92.0	89.7	89.6
Gnowangerup (S)	W09	93.6	92.9	88.6	94.1	93.5	93.2
Goomalling (S)	W11	88.9	92.1	87.7	93.6	89.3	90.6
Greenough (S)	W06	87.6	90.0	87.6	91.1	89.1	89.4
Harvey (S)	W17	90.7	79.7	na	81.9	93.8	90.1
Irwin (S)	W06	87.4	89.0	89.4	91.2	87.1	89.0
Jerramungup (S)	W09	90.8	91.4	89.2	96.4	92.9	92.9
Kalgoorlie/Boulder (C)	W19	95.6	91.8	95.5	96.9	93.3	94.6
Katanning (S)	W09	94.3	90.4	89.6	90.8	93.3	92.0
Kellerberrin (S)	W07	88.0	95.1	83.8	93.7	87.9	90.6
Kent (S)	W09	90.5	93.0	87.8	93.2	95.5	93.0
Kojonup (S)	W09	92.3	91.8	88.7	92.7	94.1	92.6
Kondinin (S)	W08	90.3	93.5	84.9	94.2	88.1	90.9
Koorda (S)	W11	86.9	88.5	80.9	95.1	86.4	88.8
Kulin (S)	W08	89.8	95.2	88.0	94.5	90.4	92.0
Lake Grace (S)	W08	90.4	93.3	84.4	93.6	90.8	91.4
Laverton (S)	W19	93.0	88.8	na	89.2	91.3	90.9
Leonora (S)	W19	92.6	85.8	93.0	96.4	92.9	92.3
Manjimup (S)	W13	93.3	93.5	89.2	95.0	96.0	94.1
Meekatharra (S)	W04	93.0	85.1	89.2	91.0	88.7	89.9
Menzies (S)	W19	97.9	90.1	96.9	98.6	95.0	95.8
Merredin (S)	W07	87.0	91.5	83.9	93.3	85.9	89.0
Mingenew (S)	W06	88.0	90.9	87.1	94.0	91.6	90.9
Moora (S)	W14	88.1	90.6	83.3	93.0	88.9	89.8
Morawa (S)	W06	90.0	90.9	85.2	93.5	89.7	90.5
Mount Magnet (S)	W04	89.6	83.4	81.8	96.5	90.7	89.5
Mount Marshall (S)	W07	90.0	91.1	82.5	92.3	90.1	90.2
Mukinbudin (S)	W07	85.2	87.9	78.9	92.1	89.5	88.1
Mullewa (S)	W06	87.3	91.8	86.2	92.1	88.5	89.4
Mundaring (S)	W15	91.6	89.0	94.7	93.5	84.0	89.0
Murchison (S)	W04	95.3	82.6	na	87.6	91.8	89.6
Murray (S)	W16	92.0	86.5	84.6	92.2	92.7	89.7
Nannup (S)	W13	83.7	88.2	na	90.4	97.2	91.0
Narembeen (S)	W07	89.2	93.6	84.3	95.5	88.2	91.3
Narrogin (S)	W12	88.8	90.0	88.0	93.1	89.9	90.3

**Table 3.9.4 (cont.). Average staple length (mm) for individual shires for five selling years between July 1989 and June 1994, and the five-year average staple length for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	87.1	91.7	87.8	92.6	89.3	90.1
Northampton (S)	W06	90.4	90.8	88.1	90.2	89.2	89.8
Nungarin (S)	W07	85.5	92.0	85.9	93.5	87.9	89.6
Perenjori (S)	W06	86.8	86.9	81.7	89.8	86.7	87.1
Pingelly (S)	W12	91.9	92.7	84.3	93.9	91.6	91.9
Plantagenet (S)	W10	95.9	95.5	89.8	96.2	95.5	95.3
Port Hedland (T)	W02	72.7	na	71.0	78.3	82.6	77.4
Quairading (S)	W11	87.7	91.6	84.3	90.4	85.8	88.1
Ravensthorpe (S)	W20	90.2	88.4	81.7	95.5	90.3	90.6
Roebourne (S)	W03	88.5	73.9	84.0	89.8	86.3	86.0
Sandstone (S)	W04	88.8	83.4	91.0	89.4	91.4	88.5
Serpentine-Jarrahdale (S)	W15	89.5	90.5	87.7	94.3	90.2	90.8
Shark Bay (S)	W05	84.5	86.3	84.3	87.6	84.1	85.4
Swan (S)	W15	94.7	90.5	84.7	92.4	87.6	91.0
Tambellup (S)	W09	92.5	90.7	86.8	92.6	95.9	93.0
Tammin (S)	W11	88.3	90.4	87.3	93.5	89.2	90.4
Three Springs (S)	W06	87.6	89.3	86.9	93.0	88.2	89.4
Toodyay (S)	W11	89.4	92.7	89.5	90.2	89.0	90.2
Trayning (S)	W07	89.2	94.0	81.6	95.2	90.4	90.8
Upper Gascoyne (S)	W05	89.0	87.4	86.5	88.9	84.3	87.5
Victoria Plains (S)	W14	87.3	89.1	86.4	92.0	89.6	89.8
Wagin (S)	W12	90.6	89.8	88.8	93.1	93.1	91.7
Wandering (S)	W12	88.1	88.3	85.9	91.6	88.6	89.3
Waroon (S)	W16	89.8	85.6	85.0	na	90.6	89.5
West Arthur (S)	W12	90.9	91.2	87.3	92.0	92.3	91.4
Westonia (S)	W07	92.6	91.9	83.9	93.6	85.5	89.8
Wickepin (S)	W12	87.7	90.7	88.5	93.0	90.9	90.6
Williams (S)	W12	89.9	92.3	90.6	94.3	91.6	92.0
Wiluna (S)	W04	90.2	84.1	81.3	92.2	88.8	89.8
Wongan-Ballidu (S)	W11	86.3	91.4	88.0	92.9	88.8	89.9
Woodanilling (S)	W09	88.3	86.4	85.9	91.4	91.9	89.8
Wyalkatchem (S)	W11	89.3	90.8	86.7	92.3	87.4	89.4
Yalgoo (S)	W04	87.3	87.3	84.6	92.5	88.5	88.2
Yilgarn (S)	W07	86.9	91.6	83.9	94.1	88.6	89.8
York (S)	W11	86.3	90.5	86.6	91.4	88.6	89.3

### 3.9.2 Maps of average staple length by shire

The five-year average results for individual shires are displayed on the large map in this Section 3.9, 'Staple length by shire for 1989/90 to 1993/94', which is coloured using a three-part colour scale – white for shire results closest to the State average, with the shires supplying longer staple lengths shown in grades of green, and the shires with shorter staple lengths in grades of yellow. This map shows that the longest wool is found in the southern shires around the Albany region and in the Kalgoorlie region. The shorter merino fleece wool is delivered from the northern agricultural and pastoral regions.

The deviations of the individual year average staple length from the long-term average are also shown in the series down the right hand side of this map for the selling years 1989/90 to 1993/94. These maps are designed to show the pattern of change in shire annual average staple length from the long-term shire average. These maps are coloured using a three-part colour scale – white for shires with annual results close to their long-term shire average, with increases in the shire annual average length shown in grades of blue, and the decreases in the shire annual average length in grades of red.

### 3.9.3 Seasonal changes in average staple length by shire

The analysis of variance in staple length showed that the season effect is highly significant in explaining differences in staple length. These differences are shown on a monthly basis for all matched merino combing fleece offered in Fremantle over a five-year period (see Table 3.9.5).

**Table 3.9.5. Average staple length for Western Australia over the period July 1989 and June 1994. Results show the long-term average, and the monthly average staple length. Results are for all matched merino combing fleece sale lots sold at auction with staple measurements in Fremantle**

Period	Staple length (mm)
5-year average	91.6
January	92.6
February	91.2
March	90.6
April	89.6
May	88.5
June	88.4
July	90.0
August	91.0
September	92.4
October	93.7
November	94.0
December	94.1

To reduce the volume of information being presented in the following tables, the 12 months were condensed into four seasons:

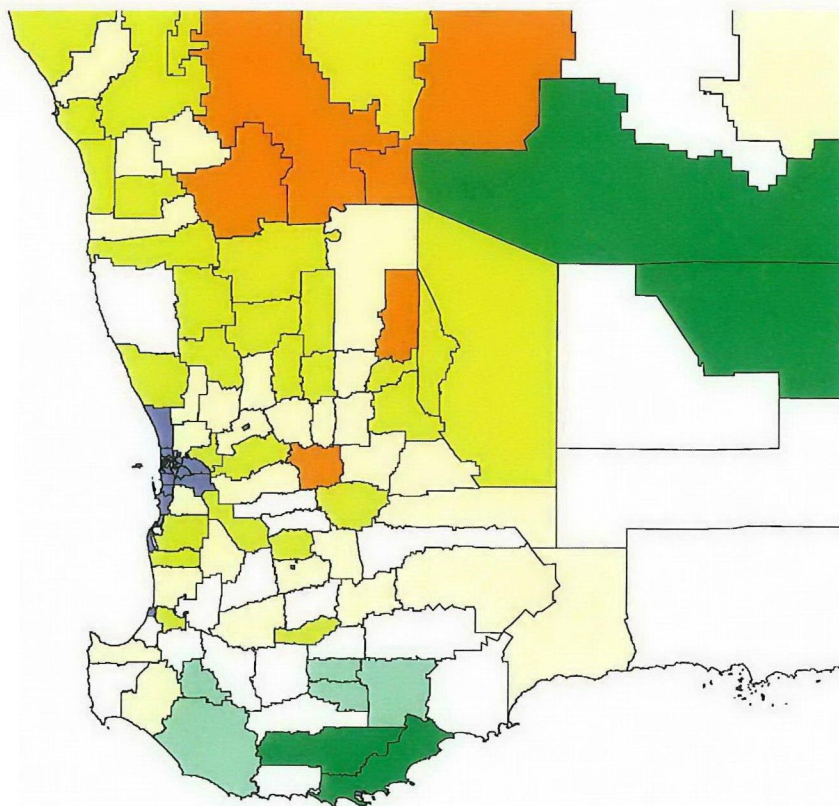
Months 1, 2 & 3 = Q1  
 Months 4, 5 & 6 = Q2  
 Months 7, 8 & 9 = Q3  
 Months 10, 11 & 12 = Q4

# Western Australia

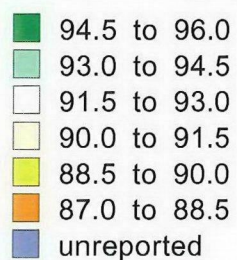
Staple length  
by shire for  
1989/90 to 1993/94

Five-year State average = 91.6 mm

Five-year shire average



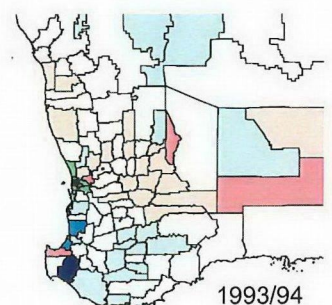
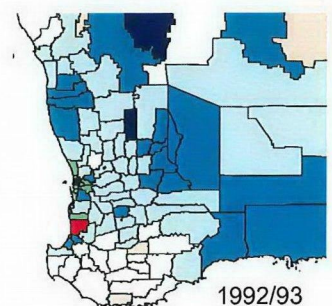
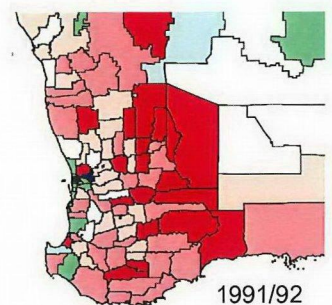
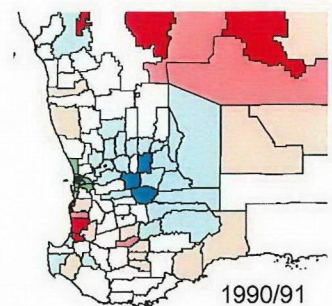
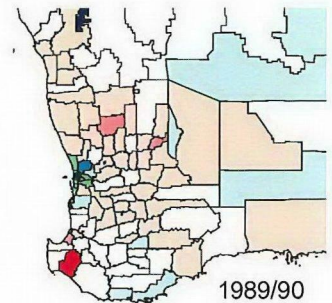
Staple Length Range (mm)



Dr John Stanton and Lindy Coss

These maps are drawn  
using ABS boundaries  
and these boundaries  
remain the property  
of ABS

Percentage change  
in shire average



**Table 3.9.6. Average staple length (mm) for individual shires in each quarter between July 1989 and June 1994, and the five-year average staple length for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Albany (S)	W10	95.3	91.8	94.2	97.8	95.4
Ashburton (S)	W03	77.8	78.7	88.4	96.4	86.6
Augusta-Margaret River (S)	W18	95.4	91.2	86.7	93.6	92.7
Beverley (S)	W11	90.7	85.2	90.1	92.3	90.2
Boddington (S)	W12	90.4	90.6	93.9	92.9	91.5
Boyup Brook (S)	W13	92.2	90.2	92.4	94.7	92.7
Bridgetown-Greenbushes (S)	W13	93.1	90.5	90.9	94.4	93.2
Brookton (S)	W12	92.7	88.2	92.3	92.8	91.9
Broomehill (S)	W09	92.2	90.6	92.3	97.4	93.1
Bruce Rock (S)	W07	89.3	89.1	91.6	94.2	91.3
Busselton (S)	W18	91.2	83.7	88.1	93.3	90.7
Capel (S)	W17	93.9	83.6	85.1	94.7	92.5
Carnamah (S)	W06	88.3	87.7	89.9	92.9	90.0
Carnarvon (S)	W05	87.1	88.0	90.1	89.1	88.1
Chapman Valley (S)	W06	89.4	88.8	91.6	93.3	91.3
Chittering (S)	W14	90.6	92.4	86.9	85.4	90.9
Collie (S)	W17	91.6	86.9	90.4	93.5	92.2
Coolgardie (S)	W19	88.6	91.7	90.4	96.4	92.8
Coorow (S)	W06	85.9	82.5	89.7	92.2	88.9
Corrigin (S)	W08	90.6	85.4	90.3	91.4	89.7
Cranbrook (S)	W10	91.4	86.7	91.9	94.7	92.1
Cuballing (S)	W12	90.2	83.3	91.0	93.1	89.5
Cue (S)	W04	95.0	88.7	89.7	100.6	89.8
Cunderdin (S)	W11	90.5	87.5	92.7	92.3	91.3
Dalwallinu (S)	W11	88.9	88.2	89.3	90.2	89.2
Dandaragan (S)	W14	90.6	86.2	91.6	93.6	91.6
Dardanup (S)	W17	90.7	90.1	93.0	74.0	89.6
Denmark (S)	W10	93.6	90.7	86.7	94.2	92.5
Donnybrook-Balingup (S)	W17	93.3	90.3	89.8	91.9	92.0
Dowerin (S)	W11	87.7	87.8	88.1	91.1	89.2
Dumbleyung (S)	W12	91.2	88.0	92.0	93.7	91.3
Dundas (S)	W20	92.1	87.5	91.2	96.6	92.1
Esperance (S)	W20	92.7	90.7	92.5	95.5	92.9
Exmouth (S)	W05	na	81.9	86.9	na	84.2



Table 3.9.6 (cont.). Average staple length (mm) for individual shires in each quarter between July 1989 and June 1994, and the five-year average staple length for each shire

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Gingin (S)	W14	88.1	88.2	90.8	89.4	89.6
Gnowangerup (S)	W09	91.0	89.5	94.5	95.8	93.2
Goomalling (S)	W11	91.0	85.3	92.0	93.1	90.6
Greenough (S)	W06	87.3	83.2	90.7	91.7	89.4
Harvey (S)	W17	88.4	78.4	93.4	90.5	90.1
Irwin (S)	W06	84.3	85.4	89.4	90.4	89.0
Jerramungup (S)	W09	91.3	89.8	93.9	96.5	92.9
Kalgoorlie/Boulder (C)	W19	92.5	95.1	93.4	94.4	94.6
Katanning (S)	W09	91.1	88.8	92.5	94.5	92.0
Kellerberrin (S)	W07	89.3	86.2	91.6	92.5	90.6
Kent (S)	W09	90.9	87.2	93.9	96.1	93.0
Kojonup (S)	W09	93.3	89.2	91.6	94.8	92.6
Kondinin (S)	W08	90.9	88.0	91.3	93.3	90.9
Koorda (S)	W11	88.9	86.1	88.5	91.3	88.8
Kulin (S)	W08	90.2	87.5	92.6	94.3	92.0
Lake Grace (S)	W08	88.9	89.5	92.3	94.0	91.4
Laverton (S)	W19	94.4	91.3	87.6	na	90.9
Leonora (S)	W19	90.9	92.1	95.1	92.1	92.3
Manjimup (S)	W13	95.9	88.7	90.7	93.0	94.1
Meekatharra (S)	W04	90.8	87.8	94.4	90.7	89.9
Menzies (S)	W19	92.5	95.1	100.8	98.3	95.8
Merredin (S)	W07	87.9	84.1	89.5	91.2	89.0
Mingenew (S)	W06	89.6	85.7	89.9	94.5	90.9
Moora (S)	W14	87.7	86.5	89.6	93.3	89.8
Morawa (S)	W06	92.6	88.3	88.6	91.2	90.5
Mount Magnet (S)	W04	88.7	89.9	89.0	92.3	89.5
Mount Marshall (S)	W07	89.1	87.4	90.9	91.5	90.2
Mukinbudin (S)	W07	85.9	83.8	90.1	91.0	88.1
Mullewa (S)	W06	90.5	87.9	88.5	89.6	89.4
Mundaring (S)	W15	93.0	79.7	95.0	90.6	89.0
Murchison (S)	W04	na	88.8	94.3	na	89.6
Murray (S)	W16	93.7	81.9	90.0	90.5	89.7
Nannup (S)	W13	87.3	87.7	na	97.8	91.0
Narembeen (S)	W07	89.4	88.7	91.2	93.4	91.3
Narrogin (S)	W12	89.9	87.9	90.6	91.6	90.3

Table 3.9.6 (cont.). Average staple length (mm) for individual shires in each quarter between July 1989 and June 1994, and the five-year average staple length for each shire

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Northam (S)	W11	89.1	87.1	90.1	92.6	90.1
Northampton (S)	W06	86.2	85.9	90.8	92.9	89.8
Nungarin (S)	W07	89.6	86.1	90.0	91.7	89.6
Perenjori (S)	W06	86.7	84.2	87.7	89.4	87.1
Pingelly (S)	W12	92.6	88.4	90.7	95.4	91.9
Plantagenet (S)	W10	96.1	91.2	94.3	96.6	95.3
Port Hedland (T)	W02	na	72.7	77.9	81.2	77.4
Quairading (S)	W11	83.8	87.4	88.5	88.8	88.1
Ravensthorpe (S)	W20	89.5	88.0	92.4	92.6	90.6
Roebourne (S)	W03	84.5	84.0	86.1	95.8	86.0
Sandstone (S)	W04	86.0	90.2	99.4	100.3	88.5
Serpentine-Jarrahdale (S)	W15	91.8	89.7	89.6	91.4	90.8
Shark Bay (S)	W05	85.5	75.5	89.6	70.6	85.4
Swan (S)	W15	94.9	91.3	89.1	88.1	91.0
Tambellup (S)	W09	92.7	89.7	92.8	95.9	93.0
Tammin (S)	W11	88.2	87.2	91.6	92.7	90.4
Three Springs (S)	W06	87.1	85.5	90.0	91.8	89.4
Toodyay (S)	W11	86.5	83.6	88.4	92.7	90.2
Trayning (S)	W07	90.8	88.3	90.6	93.0	90.8
Upper Gascoyne (S)	W05	85.8	85.7	94.0	88.6	87.5
Victoria Plains (S)	W14	90.0	88.1	89.5	91.1	89.8
Wagin (S)	W12	91.8	88.2	92.0	94.9	91.7
Wandering (S)	W12	89.3	86.4	90.9	90.6	89.3
Waroon (S)	W16	93.2	85.0	91.8	87.7	89.5
West Arthur (S)	W12	91.7	88.4	92.5	93.0	91.4
Westonia (S)	W07	89.3	88.0	90.5	91.2	89.8
Wickepin (S)	W12	88.3	87.3	92.3	93.7	90.6
Williams (S)	W12	91.2	89.7	91.5	93.4	92.0
Wiluna (S)	W04	91.0	89.1	90.6	na	89.8
Wongan-Ballidu (S)	W11	89.4	87.5	90.9	91.4	89.9
Woodanilling (S)	W09	90.7	87.2	89.5	93.4	89.8
Wyalkatchem (S)	W11	88.1	88.7	89.2	91.5	89.4
Yalgoo (S)	W04	87.2	88.3	93.1	89.1	88.2
Yilgarn (S)	W07	86.8	85.9	91.1	91.5	89.8
York (S)	W11	89.3	87.0	88.2	90.4	89.3



### 3.10 Average percentage mid break

The matched AWC dataset was used to generate the estimated average percentage mid break by shire for the five-year period July 1989 to June 1994. The long-term State average percentage mid break is 57.7 per cent. The effect of year on this average is shown in Table 3.10.1. The average percentage mid break for the individual years ranges from 54.4 per cent to 61.2 per cent.

The SD of the yearly means is the between-sale lots standard deviation, and can be used as a measure of the range of percentage mid breaks in the raw wool sold on an annual basis in Fremantle.

**Table 3.10.1. Average percentage mid break for Western Australia over the period July 1989 to June 1994. Results show the long-term average, and the annual average percentage mid break. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Period	Average percentage mid break (%)	
	Mean	SD
5-year average	57.7	24.9
89/90	54.4	24.6
90/91	61.0	24.4
91/92	49.8	25.2
92/93	61.2	24.4
93/94	57.3	25.1

#### 3.10.1 Variation in percentage mid break due to year, season and WSA, shire effects

The change in percentage mid break evident in the above table is due to differences between years. It is assumed also that differences also exist between seasons. The existence of differences also needs to be quantified between WSAs, and between shires within WSA.

Table 3.10.2 contains the results of a statistical analysis done to examine the ability of the model (using time (year, season) and regional (WSA, shire) effects and their interactions) to explain the variance of percentage mid break between sale lots. The model is significant, and explains 17.7 per cent of the total variance. So 82.3 per cent of the total variance has been included in the error variance. This error variance contains effects not included in the model and random effects.

Therefore the results in Table 3.10.2 suggest that only a small proportion of variance in percentage mid break is due to macro effects such as year, season and region, and the majority of variance is due to factors other than those included in the model. These other factors could include between-flock and between-property differences within shires, for example, strain differences and other flock management effects, and between-month differences within season.

**Table 3.10.2. Analysis of variance in percentage mid break due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	192	9809262	51089.91	99.40	0.0001
Error	88656	45566113	513.97		
Corrected total	88848	55375375			

The relative importance of the individual terms included in the model in explaining the variance in percentage mid break is shown in Table 3.10.3. All sources of variance included were highly significant. However the most important contribution (using the F values) is season within years. This accounts for most of the accounted variance in Table 3.10.2.

**Table 3.10.3. Components of variance in percentage mid break-year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	24796	6198.88	12.06	0.0001
Season (within selling year)	15	6244285	415285.68	809.95	0.0001
WSA	18	150415	8356.40	16.26	0.0001
Shire nested in WSA	84	442349	5266.06	10.25	0.0001
WSA x selling year	71	1245420	17541.13	34.13	0.0001

The average percentage mid break of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average are shown in Table 3.10.4.

**Table 3.10.4. Average percentage mid break for individual shires for five selling years between July 1989 and June 1994, and the five-year average percentage mid break for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	51.9	48.8	47.9	56.4	60.9	54.5
Ashburton (S)	W03	63.9	86.9	78.0	80.3	79.8	78.2
Augusta-Margaret River (S)	W18	55.8	47.0	40.8	71.0	48.9	52.6
Beverley (S)	W11	54.6	65.0	52.9	70.0	55.6	60.4
Boddington (S)	W12	53.8	53.8	47.7	63.1	61.5	57.8
Boyup Brook (S)	W13	63.9	56.7	60.7	58.1	60.8	60.1
Bridgetown-Greenbushes (S)	W13	65.1	59.3	31.0	58.8	65.8	60.3
Brookton (S)	W12	53.4	69.6	57.2	63.4	54.3	58.9
Broomehill (S)	W09	52.5	59.2	37.6	52.5	50.8	51.3
Bruce Rock (S)	W07	46.1	71.6	40.6	71.8	51.3	58.6
Busselton (S)	W18	52.0	52.0	54.6	67.8	50.4	55.9
Capel (S)	W17	50.9	70.6	85.0	70.3	65.0	62.2
Carnamah (S)	W06	56.6	57.2	41.5	66.8	45.2	54.6
Carnarvon (S)	W05	59.8	52.8	40.6	44.8	57.7	53.8
Chapman Valley (S)	W06	57.3	63.8	55.5	58.2	53.9	57.7
Chittering (S)	W14	43.0	52.2	30.8	60.4	60.8	49.4
Collie (S)	W17	74.1	79.9	71.6	63.3	62.7	71.0
Coolgardie (S)	W19	53.2	58.2	63.4	54.0	63.6	58.3
Coorow (S)	W06	58.3	62.4	52.9	68.5	50.4	59.2
Corrigin (S)	W08	49.3	68.3	40.8	68.5	49.2	56.9
Cranbrook (S)	W10	61.5	58.3	44.1	57.5	65.4	58.9
Cuballing (S)	W12	47.3	64.3	48.9	65.5	56.6	57.3
Cue (S)	W04	42.5	46.4	43.4	42.2	40.0	42.3
Cunderdin (S)	W11	53.7	73.9	39.5	76.9	51.7	62.5
Dalwallinu (S)	W11	53.0	65.9	44.1	62.0	52.7	56.6
Dandaragan (S)	W14	57.7	58.2	54.2	71.5	52.7	60.2
Dardanup (S)	W17	34.8	65.8	32.0	35.0	51.0	44.1
Denmark (S)	W10	60.7	40.1	45.3	54.3	59.8	53.6
Donnybrook-Balingup (S)	W17	62.3	59.7	46.3	65.4	71.7	64.3
Dowerin (S)	W11	59.0	66.6	56.9	70.7	58.0	63.3
Dumbleyung (S)	W12	40.7	67.4	51.5	58.2	58.2	57.1
Dundas (S)	W20	46.3	58.0	48.4	58.2	57.5	55.1
Esperance (S)	W20	48.7	58.1	48.7	58.8	57.5	56.0
Exmouth (S)	W05	na	29.6	na	36.7	91.2	43.9

Table 3.10.4 (cont.). Average percentage mid break for individual shires for five selling years between July 1989 and June 1994, and the five-year average percentage mid break for each shire

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	48.1	58.3	47.7	59.9	48.6	53.5
Gnowangerup (S)	W09	60.4	71.6	53.7	58.8	62.0	61.9
Goomalling (S)	W11	53.2	74.6	57.3	72.5	57.1	62.9
Greenough (S)	W06	52.2	62.7	62.3	61.6	52.6	58.4
Harvey (S)	W17	67.7	43.4	na	77.1	80.5	70.2
Irwin (S)	W06	55.4	64.5	64.0	63.7	58.5	61.3
Jerramungup (S)	W09	47.1	62.2	48.0	62.1	62.5	58.2
Kalgoorlie/Boulder (C)	W19	53.7	50.1	55.5	57.1	55.3	54.3
Katanning (S)	W09	61.7	69.6	54.1	54.5	60.8	60.3
Kellerberrin (S)	W07	51.8	71.8	50.7	74.1	54.8	62.7
Kent (S)	W09	54.4	67.6	58.7	72.0	71.0	66.8
Kojonup (S)	W09	55.3	55.2	48.8	54.4	61.8	56.6
Kondinin (S)	W08	50.4	61.6	40.9	65.2	49.0	55.5
Koorda (S)	W11	45.9	53.1	48.7	69.9	48.1	54.7
Kulin (S)	W08	55.5	70.0	57.4	64.6	56.3	60.8
Lake Grace (S)	W08	51.0	66.3	39.1	62.6	55.9	57.6
Laverton (S)	W19	61.8	74.5	na	46.9	51.0	60.7
Leonora (S)	W19	43.7	48.2	52.8	43.7	41.9	44.6
Manjimup (S)	W13	58.5	46.5	50.7	65.0	60.0	56.5
Meekatharra (S)	W04	48.6	52.0	38.5	37.6	38.3	45.1
Menzies (S)	W19	48.2	50.8	57.0	43.2	45.4	47.7
Merredin (S)	W07	49.4	63.0	34.7	68.2	51.8	56.8
Mingenew (S)	W06	55.1	55.7	49.4	63.7	55.0	56.7
Moora (S)	W14	56.2	68.1	50.6	71.3	55.2	61.8
Morawa (S)	W06	48.1	57.6	41.3	50.9	47.8	49.9
Mount Magnet (S)	W04	53.2	58.6	63.8	45.2	46.5	51.4
Mount Marshall (S)	W07	58.0	62.6	47.0	65.4	50.5	57.5
Mukinbudin (S)	W07	54.6	61.3	47.4	67.2	47.5	56.7
Mullewa (S)	W06	61.3	57.2	62.8	52.0	53.5	56.6
Mundaring (S)	W15	60.2	78.9	24.7	62.6	50.0	55.8
Murchison (S)	W04	26.6	43.5	na	33.4	43.3	35.6
Murray (S)	W16	67.9	56.7	54.3	76.8	65.2	64.6
Nannup (S)	W13	42.0	25.2	na	87.5	84.7	61.8
Narembeen (S)	W07	55.2	69.0	44.8	71.0	48.8	60.2
Narrogin (S)	W12	48.9	65.7	60.1	68.9	67.7	62.9

**Table 3.10.4 (cont.). Average percentage mid break for individual shires for five selling years between July 1989 and June 1994, and the five-year average percentage mid break for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	55.8	69.3	56.1	70.8	51.2	60.8
Northampton (S)	W06	57.3	60.4	56.5	51.8	47.8	54.0
Nungarin (S)	W07	50.3	47.7	28.3	56.0	39.7	44.8
Perenjori (S)	W06	55.3	60.6	41.3	61.8	47.9	53.9
Pingelly (S)	W12	55.4	70.0	51.8	64.2	55.3	59.8
Plantagenet (S)	W10	62.1	54.9	53.0	60.3	64.0	60.3
Port Hedland (T)	W02	79.3	na	69.0	53.2	78.7	71.9
Quairading (S)	W11	45.2	71.2	43.6	73.5	49.6	57.6
Ravensthorpe (S)	W20	46.3	65.4	41.5	58.0	57.7	56.2
Roebourne (S)	W03	70.5	70.1	51.4	57.0	78.2	66.7
Sandstone (S)	W04	47.0	52.5	65.8	45.4	51.0	51.2
Serpentine-Jarrahdale (S)	W15	67.9	58.5	44.9	56.0	56.4	54.9
Shark Bay (S)	W05	45.5	51.7	53.9	50.9	57.0	52.1
Swan (S)	W15	47.2	46.6	54.8	62.4	56.2	50.4
Tambellup (S)	W09	53.9	62.0	45.9	55.4	63.8	58.2
Tammin (S)	W11	41.3	69.3	55.7	73.7	52.2	60.4
Three Springs (S)	W06	60.7	59.8	59.5	65.6	51.4	58.9
Toodyay (S)	W11	61.6	73.5	70.9	60.0	56.2	63.0
Trayning (S)	W07	52.6	68.1	33.6	73.6	49.4	56.3
Upper Gascoyne (S)	W05	62.6	47.2	81.6	50.5	49.0	53.4
Victoria Plains (S)	W14	55.7	63.5	45.2	65.6	55.8	59.1
Wagin (S)	W12	51.9	63.8	48.4	62.0	59.7	58.1
Wandering (S)	W12	58.6	54.7	56.6	59.0	57.9	58.0
Waroona (S)	W16	48.7	37.1	68.0	na	70.9	55.3
West Arthur (S)	W12	53.9	54.8	49.8	48.7	55.2	52.9
Westonia (S)	W07	58.9	68.1	49.8	66.8	42.5	56.0
Wickepin (S)	W12	40.3	66.9	49.8	59.7	60.7	58.3
Williams (S)	W12	56.0	61.9	57.4	63.6	59.7	60.1
Wiluna (S)	W04	37.5	44.0	49.3	47.4	45.7	44.5
Wongan-Ballidu (S)	W11	59.3	69.5	47.5	67.6	53.4	60.6
Woodanilling (S)	W09	49.2	61.2	45.0	62.0	58.4	56.2
Wyalkatchem (S)	W11	47.5	65.6	34.8	65.8	58.7	57.6
Yalgoo (S)	W04	50.9	46.7	53.4	52.8	55.1	51.9
Yilgarn (S)	W07	51.7	69.4	39.5	71.6	43.8	56.6
York (S)	W11	56.7	66.9	57.8	65.5	55.9	60.5



### 3.10.2 Maps of average percentage mid break by shire

The five-year average results for individual shires are displayed on the large map for this Section 3.10, 'Proportion of mid breaks by shire for 1989/90 to 1993/94', which is coloured using a three-part colour scale – white for shire results closest to the State average, with the shires supplying high mid break wool shown in grades of green, and the shires with low mid break wool in grades of yellow. This map shows a diffuse pattern between shires (as suggested in Table 3.10.3). However a generalisation could be that the western shires tend to have higher mid break results, and the northern pastoral shires have lower mid break results.

The deviations of the individual year average mid breaks from the long-term average are also shown in the series down the right hand side of this map for the selling years 1989/90 to 1993/94. These maps are designed to show the pattern of change in shire annual average mid breaks from the long-term shire average. These maps are coloured using a three-part colour scale – white for shires with annual results close to their long-term shire average, with increases in the shire annual mid break results shown in grades of blue, and the decreases in the shire annual average mid break results in grades of red. It should be noted that response in 1991/92, when diameter was lower and strength was lower, was for mid break results also to be lower, illustrating the sensitivity of mid break results to seasonal differences, and possibly to be independent of the strength result. In 1993/94 the southern shires increased the mid break result, and the shires to the north and east of Perth reduced the mid break result.

### 3.10.3 Seasonal changes in average percentage mid breaks by shire

The analysis of variance in percentage mid breaks showed that the season effect is highly significant in explaining differences in percentage mid breaks. These differences are shown on a monthly basis for all matched merino combing fleece offered in Fremantle over a five-year period.

**Table 3.10.5. Average percentage mid break for Western Australia over the period July 1989 to June 1994. Results show the long-term average, and the monthly average percentage mid break. Results are for all merino combing fleece sale lots sold at auction in Fremantle**

Period	Percentage mid break
5-year average	57.7
January	54.7
February	53.8
March	49.1
April	46.6
May	45.5
June	45.5
July	51.1
August	54.9
September	63.4
October	70.5
November	71.9
December	66.0

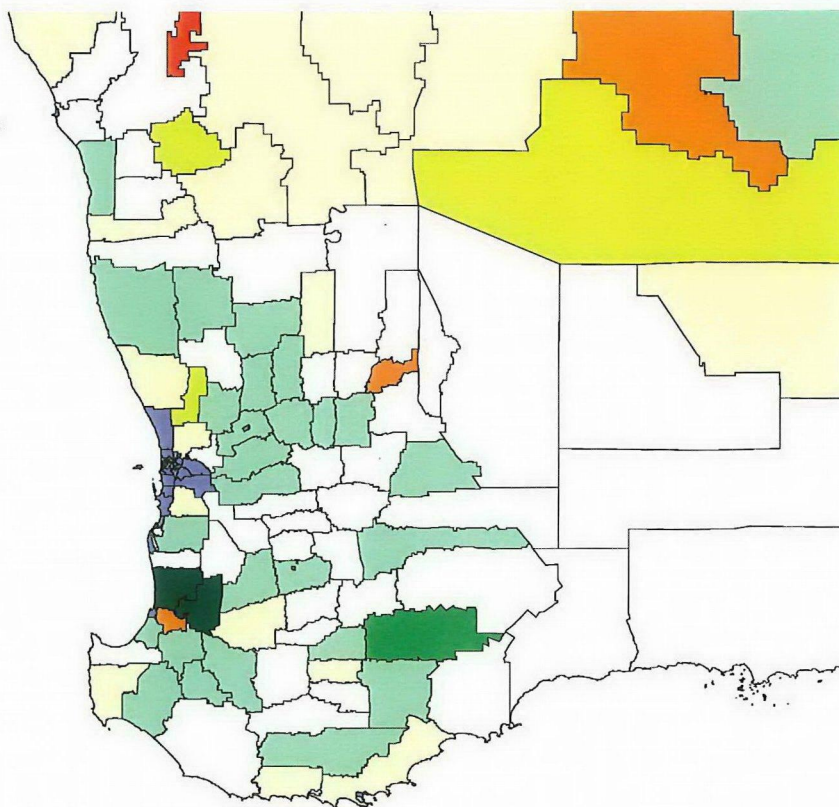


# Western Australia

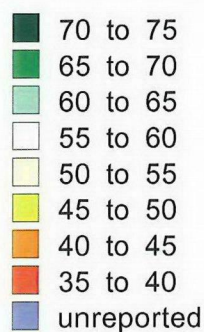
## Proportion of mid breaks by shire for 1989/90 to 1993/94

Five-year State average = 57.7 %

### Five-year shire average



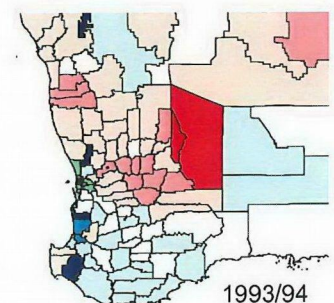
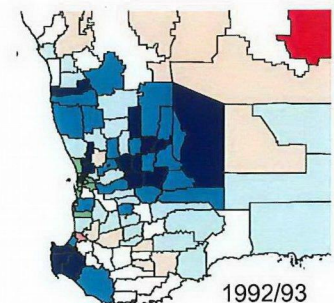
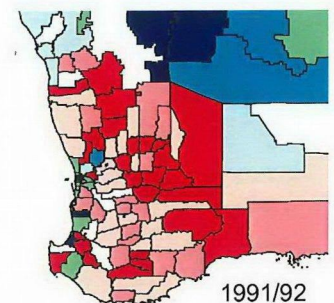
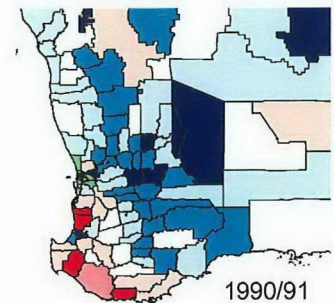
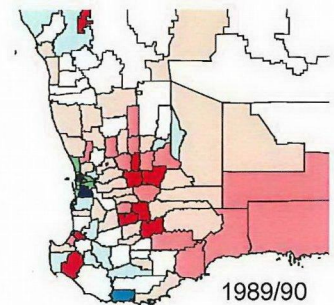
### Proportion Mid Breaks (%)



Dr John Stanton and Lindy Coss

These maps are drawn  
using ABS boundaries  
and these boundaries  
remain the property  
of ABS

### Percentage change in shire average





To reduce the volume of information being presented in the following tables, the 12 months were condensed into four seasons:

Months 1, 2 & 3 = Q1

Months 4, 5 & 6 = Q2

Months 7, 8 & 9 = Q3

Months 10, 11 & 12 = Q4

**Table 3.10.6. Average percentage mid break for individual shires in each quarter between July 1989 and June 1994, and the five-year average percentage mid break for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Albany (S)	W10	46.5	40.5	53.7	70.1	54.5
Ashburton (S)	W03	72.2	73.2	81.7	79.5	78.2
Augusta-Margaret River (S)	W18	48.5	41.5	46.6	73.5	52.6
Beverley (S)	W11	58.7	47.6	59.0	68.4	60.4
Boddington (S)	W12	52.8	47.0	57.1	71.5	57.8
Boyup Brook (S)	W13	53.5	49.5	58.6	75.1	60.1
Bridgetown-Greenbushes (S)	W13	53.9	35.0	52.8	74.3	60.3
Brookton (S)	W12	51.8	48.7	60.9	64.2	58.9
Broomehill (S)	W09	43.0	36.7	51.1	75.5	51.3
Bruce Rock (S)	W07	53.7	48.6	59.8	68.9	58.6
Busselton (S)	W18	58.9	63.5	50.7	54.0	55.9
Capel (S)	W17	71.5	55.4	37.4	65.0	62.2
Carnamah (S)	W06	55.1	46.9	50.9	65.6	54.6
Carnarvon (S)	W05	59.2	48.4	46.0	65.5	53.8
Chapman Valley (S)	W06	52.6	48.3	59.3	62.7	57.7
Chittering (S)	W14	47.0	49.8	49.6	70.5	49.4
Collie (S)	W17	66.6	52.9	13.6	78.7	71.0
Coolgardie (S)	W19	50.6	54.0	56.1	68.4	58.3
Coorow (S)	W06	49.6	50.1	60.2	66.7	59.2
Corrigin (S)	W08	47.7	46.5	58.4	67.3	56.9
Cranbrook (S)	W10	46.6	39.8	51.3	75.1	58.9
Cuballing (S)	W12	58.7	46.0	57.0	66.2	57.3
Cue (S)	W04	48.3	37.5	61.0	64.3	42.3
Cunderdin (S)	W11	55.3	55.6	65.0	67.5	62.5
Dalwallinu (S)	W11	53.3	49.7	56.4	64.6	56.6
Dandaragan (S)	W14	56.8	47.7	55.6	68.4	60.2
Dardanup (S)	W17	44.5	48.0	24.0	36.7	44.1
Denmark (S)	W10	49.7	53.3	45.8	69.6	53.6
Donnybrook-Balingup (S)	W17	60.8	57.1	52.7	76.5	64.3
Dowerin (S)	W11	58.4	58.2	64.5	65.5	63.3
Dumbleyung (S)	W12	52.8	43.7	60.9	68.6	57.1
Dundas (S)	W20	54.4	41.6	61.5	62.6	55.1
Esperance (S)	W20	49.9	45.4	64.1	65.7	56.0
Exmouth (S)	W05	na	29.6	60.3	na	43.9

**Table 3.10.6 (cont.). Average percentage mid break for individual shires in each quarter between July 1989 and June 1994, and the five-year average percentage mid break for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Gingin (S)	W14	49.3	35.8	55.4	62.6	53.5
Gnowangerup (S)	W09	56.6	44.5	65.6	76.5	61.9
Goomalling (S)	W11	61.1	49.2	67.2	69.5	62.9
Greenough (S)	W06	57.7	50.5	52.8	66.6	58.4
Harvey (S)	W17	63.5	52.1	80.0	68.8	70.2
Irwin (S)	W06	65.6	44.6	57.4	71.7	61.3
Jerramungup (S)	W09	54.5	40.2	67.6	72.8	58.2
Kalgoorlie/Boulder (C)	W19	53.5	49.2	71.3	63.7	54.3
Katanning (S)	W09	55.8	46.1	61.6	72.4	60.3
Kellerberrin (S)	W07	57.6	56.1	64.9	67.3	62.7
Kent (S)	W09	61.7	52.0	68.6	75.7	66.8
Kojonup (S)	W09	51.2	42.0	50.0	75.6	56.6
Kondinin (S)	W08	43.9	49.5	59.5	68.1	55.5
Koorda (S)	W11	54.7	44.6	53.4	64.0	54.7
Kulin (S)	W08	55.1	42.2	62.0	70.3	60.8
Lake Grace (S)	W08	47.4	45.2	61.6	71.6	57.6
Laverton (S)	W19	47.0	66.8	48.8	na	60.7
Leonora (S)	W19	47.6	41.4	59.2	57.0	44.6
Manjimup (S)	W13	57.0	33.8	44.3	76.6	56.5
Meekatharra (S)	W04	58.2	35.9	57.9	45.2	45.1
Menzies (S)	W19	52.5	41.1	64.2	58.3	47.7
Merredin (S)	W07	48.1	48.3	57.2	64.9	56.8
Mingenew (S)	W06	48.8	44.2	58.0	64.5	56.7
Moora (S)	W14	59.0	51.1	61.4	70.5	61.8
Morawa (S)	W06	44.8	41.8	52.9	61.1	49.9
Mount Magnet (S)	W04	52.3	42.8	59.8	57.7	51.4
Mount Marshall (S)	W07	58.3	47.1	56.4	64.4	57.5
Mukinbudin (S)	W07	50.4	52.7	57.6	66.7	56.7
Mullewa (S)	W06	53.0	50.9	55.2	65.0	56.6
Mundaring (S)	W15	86.0	54.8	18.0	63.6	55.8
Murchison (S)	W04	na	37.0	27.3	na	35.6
Murray (S)	W16	55.8	43.9	69.6	70.0	64.6
Nannup (S)	W13	55.2	35.8	na	83.7	61.8
Narembeen (S)	W07	45.8	53.4	59.8	70.3	60.2
Narrogin (S)	W12	59.8	54.6	64.0	69.1	62.9

**Table 3.10.6 (cont.). Average percentage mid break for individual shires in each quarter between July 1989 and June 1994, and the five-year average percentage mid break for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Northam (S)	W11	54.6	54.9	59.3	70.4	60.8
Northampton (S)	W06	50.9	46.9	50.6	65.5	54.0
Nungarin (S)	W07	31.6	45.0	48.4	47.9	44.8
Perenjori (S)	W06	48.2	43.7	53.9	66.0	53.9
Pingelly (S)	W12	55.0	46.8	61.7	73.1	59.8
Plantagenet (S)	W10	49.1	47.1	60.5	75.1	60.3
Port Hedland (T)	W02	na	79.3	70.8	66.3	71.9
Quairading (S)	W11	53.5	45.2	58.7	64.7	57.6
Ravensthorpe (S)	W20	51.2	43.6	65.2	64.1	56.2
Roebourne (S)	W03	81.1	52.8	73.9	78.3	66.7
Sandstone (S)	W04	52.4	46.2	56.7	70.6	51.2
Serpentine-Jarrahdale (S)	W15	53.7	50.9	75.1	77.5	54.9
Shark Bay (S)	W05	49.3	75.6	62.0	77.7	52.1
Swan (S)	W15	38.6	51.3	56.4	57.1	50.4
Tambellup (S)	W09	50.2	41.2	57.3	75.9	58.2
Tammin (S)	W11	49.6	52.1	64.4	67.4	60.4
Three Springs (S)	W06	53.0	44.9	58.1	70.1	58.9
Toodyay (S)	W11	62.3	40.1	53.3	71.1	63.0
Trayning (S)	W07	53.0	50.3	55.1	68.0	56.3
Upper Gascoyne (S)	W05	53.7	49.3	42.7	66.1	53.4
Victoria Plains (S)	W14	57.0	50.8	57.2	67.9	59.1
Wagin (S)	W12	55.5	42.6	60.9	72.6	58.1
Wandering (S)	W12	54.1	52.7	50.0	73.2	58.0
Waroona (S)	W16	86.9	14.0	38.6	71.4	55.3
West Arthur (S)	W12	44.6	46.0	54.2	71.9	52.9
Westonia (S)	W07	55.2	45.8	51.1	69.3	56.0
Wickepin (S)	W12	52.3	44.0	61.9	70.9	58.3
Williams (S)	W12	53.4	47.1	53.7	72.4	60.1
Wiluna (S)	W04	49.4	41.1	54.1	na	44.5
Wongan-Ballidu (S)	W11	58.5	54.8	62.8	64.5	60.6
Woodanilling (S)	W09	56.4	43.4	56.7	79.1	56.2
Wyalkatchem (S)	W11	65.9	54.7	57.4	57.4	57.6
Yalgoo (S)	W04	51.4	41.5	62.7	69.7	51.9
Yilgarn (S)	W07	50.2	51.9	57.1	65.6	56.6
York (S)	W11	55.2	58.3	56.8	64.4	60.5

### 3.11 Average hauteur

The matched AWC dataset was used to generate the estimated average hauteur by shire for the five-year period from July 1989 to June 1994. The long-term State average hauteur is 69 mm. The effect of year on this average is shown in Table 3.11.1. The average hauteur for the individual years ranges from 65.8 mm to 70 mm.

**Table 3.11.1. Average hauteur for WA over the period July 1989 to June 1994. Results show the long-term average, and the annual average hauteur. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Period	Average hauteur (mm)	
	Mean	S D
5-year average	68.98	6.48
89/90	69.57	6.18
90/91	68.26	6.19
91/92	65.83	6.44
92/93	70.09	6.35
93/94	69.17	6.57

#### 3.11.1 Variation in hauteur due to year, season and WSA, shire effects

The differences of hauteur evident in the above table are due to between-year effects. It is assumed also that differences exist between seasons. The existence of differences also needs to be proved and quantified between WSAs, and between shires within WSA.

Table 3.11.2 contains the results of a statistical analysis done to examine the ability of the model (using time (year, season) and regional (WSA, shire) effects and their interactions) to explain the variance of hauteur between sale lots. The model is highly significant, and explains 13.9 per cent of the total variance in hauteur. So 86.1 per cent of the total variance has been included in the error variance which contains both effects not included in the model and random effects.

Therefore the results in Table 3.11.2 suggest that only a small proportion of variance in hauteur is due to macro effects such as year, season and region, and the majority of variance may occur at a more local level, and finer time frame. However hauteur is calculated using both staple and core test results. As each of these individual test results have a particular set of factors contributing to their variance, identifying single factors which provide a clear description of the variance in a compound predicted term such as hauteur is always going to be difficult.

**Table 3.11.2. Analysis of variance in hauteur due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	192	518032	2698.09	74.44	0.0001
Error	88654	3213326	36.25		
Corrected total	88846	3731358			

The relative importance of the individual terms in explaining the variance in hauteur is shown in Table 3.11.3. All terms had a significant impact on the variance in hauteur. However season and WSA were the strongest terms in the model for explaining the variance in hauteur.

**Table 3.11.3. Components of variance in the model to explain the variance in hauteur: year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	5952	1487.93	41.05	0.0001
Season (within selling year)	15	117259	7817	215.67	0.0001
WSA	18	63922	3551.24	97.98	0.0001
Shire nested in WSA	84	45239	538.57	14.86	0.0001
WSA x selling year	71	66118	931.23	25.69	0.0001

The average hauteur of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average are shown in Table 3.11.4.

**Table 3.11.4. Average hauteur (mm) for individual shires for five selling years between July 1989 and June 1994, and the five-year average hauteur for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	73.6	71.9	69.6	71.9	70.3	71.7
Ashburton (S)	W03	62.5	53.7	53.9	65.4	61.4	60.2
Augusta-Margaret River (S)	W18	72.8	71.0	67.5	67.0	69.0	70.0
Beverley (S)	W11	68.0	67.6	65.2	68.4	67.5	67.5
Boddington (S)	W12	67.4	68.0	68.9	68.7	67.7	68.1
Boyup Brook (S)	W13	69.2	67.4	63.6	69.2	69.4	68.6
Bridgetown-Greenbushes (S)	W13	69.0	69.7	68.7	68.1	68.2	68.7
Brookton (S)	W12	69.1	69.8	66.6	70.6	68.8	69.3
Broomehill (S)	W09	70.4	68.5	68.6	70.3	72.0	70.7
Bruce Rock (S)	W07	67.5	68.2	65.3	69.9	67.8	68.1
Busselton (S)	W18	66.2	65.7	66.6	67.6	65.2	66.3
Capel (S)	W17	70.5	67.1	54.8	68.7	68.0	68.6
Carnamah (S)	W06	68.6	66.1	65.5	69.2	68.8	67.9
Carnarvon (S)	W05	67.3	68.3	70.0	67.7	66.2	67.6
Chapman Valley (S)	W06	68.6	69.1	68.4	68.5	69.6	68.9
Chittering (S)	W14	70.7	70.1	67.8	72.3	67.1	69.3
Collie (S)	W17	67.1	62.8	68.2	68.4	67.7	66.4
Coolgardie (S)	W19	75.4	72.4	74.0	77.0	77.6	75.6
Coorow (S)	W06	65.9	65.2	62.9	68.7	67.1	66.5
Corrigin (S)	W08	67.3	69.9	63.5	69.2	68.1	68.1
Cranbrook (S)	W10	70.3	69.1	65.8	69.2	69.8	69.2
Cuballing (S)	W12	67.4	67.7	64.6	69.3	69.5	68.2
Cue (S)	W04	72.8	66.5	68.2	72.9	69.9	71.0
Cunderdin (S)	W11	67.6	68.9	64.4	69.2	70.0	68.8
Dalwallinu (S)	W11	67.9	66.2	67.3	69.5	68.5	68.1
Dandaragan (S)	W14	68.4	67.2	65.5	69.3	67.3	67.9
Dardanup (S)	W17	72.4	60.3	66.0	75.4	73.0	72.1
Denmark (S)	W10	74.6	71.7	68.7	71.1	71.2	72.0
Donnybrook-Balingup (S)	W17	68.1	66.4	66.1	65.9	64.6	65.9
Dowerin (S)	W11	65.1	66.9	62.0	68.2	66.7	66.4
Dumbleyung (S)	W12	69.4	69.1	65.9	69.4	71.4	69.7
Dundas (S)	W20	76.1	71.2	69.8	73.8	69.3	71.9
Esperance (S)	W20	70.2	68.5	64.4	74.0	70.6	70.5
Exmouth (S)	W05	na	68.2	na	68.7	59.4	66.6

Table 3.11.4 (cont.). Average hauteur (mm) for individual shires for five selling years between July 1989 and June 1994, and the five-year average hauteur for each shire

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	69.6	67.4	66.5	67.7	68.0	68.0
Gnowangerup (S)	W09	70.1	67.5	66.8	70.4	70.4	69.6
Goomalling (S)	W11	69.0	68.3	65.5	69.8	69.4	68.9
Greenough (S)	W06	68.0	67.4	66.2	68.3	67.9	67.7
Harvey (S)	W17	68.3	69.2	na	61.1	68.4	68.1
Irwin (S)	W06	66.0	66.3	67.0	69.8	66.5	67.3
Jerramungup (S)	W09	69.5	68.1	68.5	72.1	70.0	70.1
Kalgoorlie/Boulder (C)	W19	77.1	72.1	73.8	76.5	74.8	75.0
Katanning (S)	W09	71.1	67.4	67.5	67.7	69.8	68.9
Kellerberrin (S)	W07	67.7	69.4	63.0	68.0	67.5	67.7
Kent (S)	W09	69.4	68.2	64.7	69.3	70.5	69.0
Kojonup (S)	W09	69.6	67.6	66.2	68.4	69.3	68.6
Kondinin (S)	W08	68.7	70.3	65.1	70.4	67.9	68.9
Koorda (S)	W11	65.6	67.8	61.3	69.9	66.9	67.2
Kulin (S)	W08	68.3	69.9	64.7	69.8	69.8	69.2
Lake Grace (S)	W08	69.7	69.5	64.0	71.1	69.7	69.6
Laverton (S)	W19	69.2	66.2	na	70.2	68.4	68.6
Leonora (S)	W19	73.5	68.9	71.8	77.3	75.2	73.7
Manjimup (S)	W13	71.0	69.7	66.0	67.4	70.0	69.6
Meekatharra (S)	W04	71.0	67.6	69.5	70.4	69.5	69.8
Menzies (S)	W19	76.5	69.8	72.7	78.3	75.5	75.1
Merredin (S)	W07	67.0	67.7	64.1	69.3	65.2	66.9
Mingenew (S)	W06	68.3	68.6	67.0	70.0	69.4	68.9
Moora (S)	W14	67.2	67.1	63.9	68.7	67.6	67.5
Morawa (S)	W06	70.0	67.9	63.3	69.9	69.7	68.9
Mount Magnet (S)	W04	73.0	64.1	57.9	70.8	70.3	68.6
Mount Marshall (S)	W07	68.7	67.5	61.6	68.0	69.0	67.8
Mukinbudin (S)	W07	66.7	66.2	60.8	68.7	68.3	67.0
Mullewa (S)	W06	64.8	68.3	62.3	68.0	67.6	66.5
Mundaring (S)	W15	69.4	63.9	72.0	70.0	67.8	67.9
Murchison (S)	W04	75.3	67.7	na	70.0	70.4	71.0
Murray (S)	W16	67.5	67.7	61.9	64.5	68.4	66.3
Nannup (S)	W13	65.8	67.1	na	61.7	65.4	65.4
Narembeen (S)	W07	66.9	68.3	64.1	68.8	66.9	67.5
Narrogin (S)	W12	68.3	68.4	65.2	68.3	67.5	67.8



**Table 3.11.4 (cont.). Average hauteur (mm) for individual shires for five selling years between July 1989 and June 1994, and the five-year average hauteur for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	67.5	67.1	63.3	67.2	67.9	66.8
Northampton (S)	W06	69.2	68.1	67.0	68.8	68.6	68.4
Nungarin (S)	W07	66.2	69.4	67.3	70.6	68.7	68.9
Perenjori (S)	W06	66.0	65.2	63.0	66.5	66.1	65.8
Pingelly (S)	W12	68.8	68.1	65.1	69.2	69.7	68.9
Plantagenet (S)	W10	71.1	70.7	66.7	70.4	69.6	70.1
Port Hedland (T)	W02	51.7	na	49.0	58.1	55.1	54.1
Quairading (S)	W11	68.3	66.9	63.1	66.8	66.1	66.4
Ravensthorpe (S)	W20	69.8	66.0	62.6	73.4	70.0	69.5
Roebourne (S)	W03	64.1	55.0	62.6	67.0	61.3	62.7
Sandstone (S)	W04	70.6	63.7	63.6	71.7	68.9	67.9
Serpentine-Jarrahdale (S)	W15	67.8	67.1	71.1	73.7	70.3	70.7
Shark Bay (S)	W05	64.7	66.0	62.9	67.1	64.9	65.2
Swan (S)	W15	71.1	68.9	65.0	70.3	66.9	69.1
Tambellup (S)	W09	70.4	67.4	66.1	69.7	70.7	69.6
Tammin (S)	W11	70.2	68.5	64.8	69.7	69.5	69.1
Three Springs (S)	W06	66.6	66.8	64.9	68.2	67.2	67.0
Toodyay (S)	W11	65.9	67.3	62.1	68.0	67.2	66.8
Trayning (S)	W07	68.9	67.3	63.7	70.2	69.1	68.6
Upper Gascoyne (S)	W05	68.8	67.8	57.2	67.3	66.3	67.2
Victoria Plains (S)	W14	67.7	67.3	65.5	69.5	67.7	68.0
Wagin (S)	W12	69.0	67.3	68.0	69.3	69.4	68.9
Wandering (S)	W12	66.4	68.2	64.5	68.0	67.1	67.2
Waroon (S)	W16	69.9	68.0	63.0	na	67.9	68.8
West Arthur (S)	W12	69.5	67.1	66.0	69.4	69.6	68.9
Westonia (S)	W07	67.6	65.3	63.9	69.2	66.0	67.1
Wickepin (S)	W12	68.9	68.9	66.9	70.1	69.6	69.2
Williams (S)	W12	68.5	68.1	67.2	68.6	67.7	68.1
Wiluna (S)	W04	71.1	68.7	64.3	72.7	72.1	71.7
Wongan-Ballidu (S)	W11	65.5	68.1	67.2	71.0	68.7	68.5
Woodanilling (S)	W09	68.7	66.5	68.3	69.4	70.0	69.1
Wyalkatchem (S)	W11	69.0	67.2	65.9	69.5	67.8	68.2
Yalgoo (S)	W04	67.9	67.5	62.4	69.0	66.9	67.0
Yilgarn (S)	W07	67.9	66.2	64.8	68.4	68.8	67.6
York (S)	W11	66.2	66.7	61.6	67.5	67.0	66.7

### 3.11.2 Maps of average hauteur by shire

The five-year average results for individual shires are displayed on the large map for Section 3.11, 'Estimated hauteur by shire for 1989/90 to 1993/94', which is coloured using a three-part colour scale – white for shire results closest to the State average, with the shires supplying longer hauteur results shown in grades of green, and the shires with a shorter hauteur in grades of yellow. This map shows that the longer hauteur wool is found in the Albany region, and from Esperance and north through the Eastern Goldfields (around Kalgoorlie).

The deviations of the individual year average hauteur from the long-term average are also shown in the series down the right hand side of this map for the selling years 1989/90 to 1993/94. These maps are designed to show the pattern of change in shire annual average hauteur from the long-term shire average. These maps are coloured using a three-part colour scale – white for shires with annual results about their long-term shire average, with increases in the shire annual average hauteur shown in grades of blue, and the decreases in the shire annual average hauteur in grades of red.

The 1991/92 results show a general depression of hauteur across all shires but a recovery in the next two years.

### 3.11.3 Seasonal changes in average hauteur by shire

The analysis of variance in hauteur showed that the season effect is highly significant in explaining differences in hauteur. These differences are shown on a monthly basis for all matched merino combing fleece offered in Fremantle over a five-year period (Table 3.11.5).

**Table 3.11.5. Average hauteur for Western Australia over the period July 1989 to June 1994. Results show the long-term average, and the monthly average hauteur. Results are for all matched merino combing fleece sale lots sold at auction in Fremantle**

Period	hauteur (mm)
5-year average	68.98
January	69.3
February	69.0
March	70.8
April	71.2
May	70.3
June	69.9
July	69.8
August	68.8
September	68.1
October	67.5
November	67.2
December	68.2

To reduce the volume of information being presented in the following tables, the 12 months were condensed into four seasons:

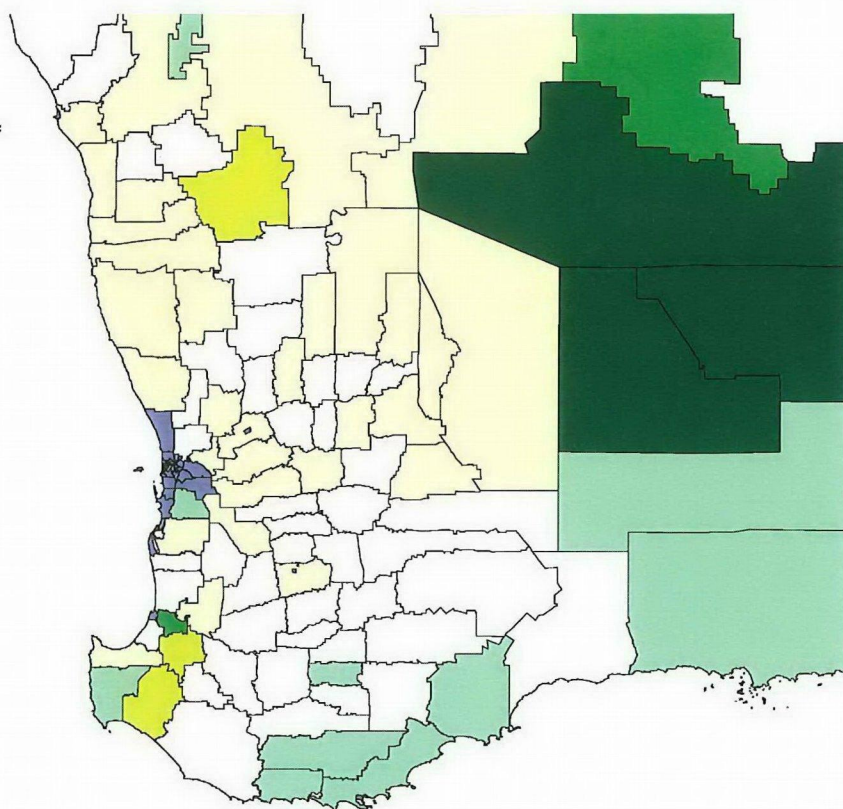
Months 1, 2 & 3 = Q1  
 Months 4, 5 & 6 = Q2  
 Months 7, 8 & 9 = Q3  
 Months 10, 11 & 12 = Q4

# Western Australia

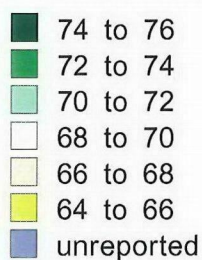
Estimated Hauteur  
by shire for  
1989/90 to 1993/94

Five-year State average = 69.0 mm

Five-year shire average



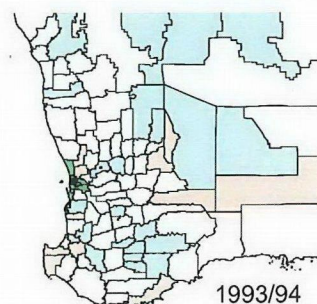
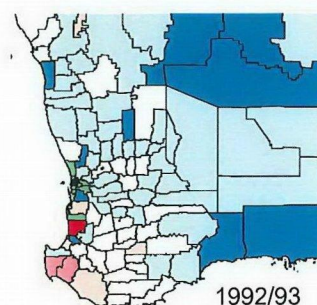
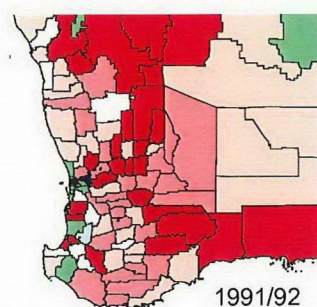
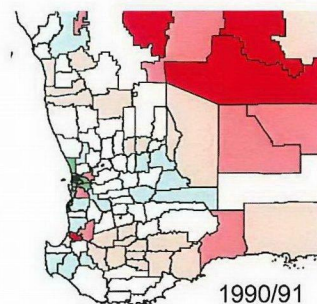
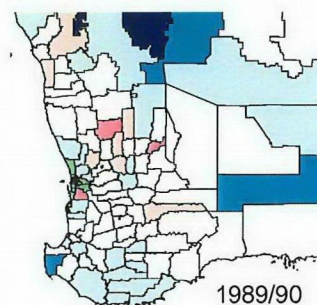
Estimated Hauteur Range (mm)



Dr John Stanton and Lindy Coss

These maps are drawn  
using ABS boundaries  
and these boundaries  
remain the property  
of ABS

Percentage change  
in shire average



**Table 3.11.6. Average hauteur (mm) for individual shires in each quarter between July 1989 and June 1994, and the five-year average hauteur for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Albany (S)	W10	73.6	72.3	71.1	69.8	71.7
Ashburton (S)	W03	59.8	56.7	59.4	66.8	60.2
Augusta-Margaret River (S)	W18	68.8	74.2	66.8	68.1	70.0
Beverley (S)	W11	67.9	67.6	67.8	67.2	67.5
Boddington (S)	W12	68.6	69.1	70.2	66.8	68.1
Boyup Brook (S)	W13	69.7	69.2	68.2	67.0	68.6
Bridgetown-Greenbushes (S)	W13	69.3	69.4	68.3	67.9	68.7
Brookton (S)	W12	70.0	69.2	69.7	68.7	69.3
Broomehill (S)	W09	72.2	71.9	69.7	68.7	70.7
Bruce Rock (S)	W07	68.4	69.6	67.6	67.4	68.1
Busselton (S)	W18	65.5	59.0	66.7	68.4	66.3
Capel (S)	W17	66.2	68.2	74.6	68.2	68.6
Carnamah (S)	W06	65.9	68.8	68.4	67.3	67.9
Carnarvon (S)	W05	65.9	69.0	69.4	66.0	67.6
Chapman Valley (S)	W06	69.2	70.1	69.1	68.0	68.9
Chittering (S)	W14	70.3	69.0	68.3	61.3	69.3
Collie (S)	W17	66.1	68.9	69.9	66.5	66.4
Coolgardie (S)	W19	71.3	75.7	75.7	75.6	75.6
Coorow (S)	W06	64.9	66.4	67.6	66.3	66.5
Corrigin (S)	W08	69.1	68.7	68.2	66.9	68.1
Cranbrook (S)	W10	70.6	71.7	69.5	67.4	69.2
Cuballing (S)	W12	68.5	66.3	69.0	68.7	68.2
Cue (S)	W04	74.4	71.0	67.8	69.7	71.0
Cunderdin (S)	W11	69.1	68.7	68.8	68.4	68.8
Dalwallinu (S)	W11	67.5	70.8	68.2	66.2	68.1
Dandaragan (S)	W14	67.6	69.0	68.9	66.9	67.9
Dardanup (S)	W17	72.2	71.1	77.0	70.2	72.1
Denmark (S)	W10	71.5	73.0	73.1	71.2	72.0
Donnybrook-Balingup (S)	W17	66.8	65.4	67.7	64.1	65.9
Dowerin (S)	W11	65.2	67.2	66.2	66.5	66.4
Dumbleyung (S)	W12	70.7	71.4	68.5	68.7	69.7
Dundas (S)	W20	73.6	72.5	67.7	73.2	71.9
Esperance (S)	W20	72.1	72.2	68.2	68.9	70.5
Exmouth (S)	W05	na	68.2	64.7	na	66.6

**Table 3.11.6 (cont.). Average hauteur (mm) for individual shires in each quarter between July 1989 and June 1994, and the five-year average hauteur for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Gingin (S)	W14	67.9	70.3	69.4	64.7	68.0
Gnowangerup (S)	W09	71.7	71.2	68.9	67.7	69.6
Goomalling (S)	W11	70.0	69.4	69.1	67.5	68.9
Greenough (S)	W06	66.2	68.1	69.4	66.8	67.7
Harvey (S)	W17	67.9	69.4	68.0	68.0	68.1
Irwin (S)	W06	65.8	70.6	67.8	65.8	67.3
Jerramungup (S)	W09	70.7	72.5	68.2	68.5	70.1
Kalgoorlie/Boulder (C)	W19	73.6	76.2	73.7	71.9	75.0
Katanning (S)	W09	69.1	70.7	68.4	68.0	68.9
Kellerberrin (S)	W07	68.2	67.2	67.8	67.4	67.7
Kent (S)	W09	71.3	69.6	68.8	67.6	69.0
Kojonup (S)	W09	69.8	69.3	69.0	66.8	68.6
Kondinin (S)	W08	71.2	69.5	68.0	67.3	68.9
Koorda (S)	W11	67.1	67.9	67.5	66.4	67.2
Kulin (S)	W08	69.5	71.3	68.7	68.6	69.2
Lake Grace (S)	W08	71.5	71.7	68.6	67.3	69.6
Laverton (S)	W19	70.8	68.0	69.0	na	68.6
Leonora (S)	W19	72.0	74.1	73.6	69.3	73.7
Manjimup (S)	W13	70.1	70.1	69.8	67.4	69.6
Meekatharra (S)	W04	69.4	69.9	69.5	70.4	69.8
Menzies (S)	W19	70.6	76.2	78.1	72.9	75.1
Merredin (S)	W07	68.0	67.1	67.1	66.0	66.9
Mingenew (S)	W06	69.7	69.1	67.8	69.3	68.9
Moora (S)	W14	67.3	68.5	67.5	67.0	67.5
Morawa (S)	W06	71.2	69.9	67.8	65.9	68.9
Mount Magnet (S)	W04	67.1	71.3	70.5	68.7	68.6
Mount Marshall (S)	W07	67.5	70.2	68.2	66.0	67.8
Mukinbudin (S)	W07	66.6	66.9	67.2	67.0	67.0
Mullewa (S)	W06	67.0	69.1	67.1	64.2	66.5
Mundaring (S)	W15	64.0	67.0	73.0	67.2	67.9
Murchison (S)	W04	na	71.0	70.7	na	71.0
Murray (S)	W16	69.4	68.9	65.9	65.1	66.3
Nannup (S)	W13	65.0	66.7	na	65.4	65.4
Narembeen (S)	W07	69.6	67.9	66.8	66.9	67.5
Narrogin (S)	W12	68.0	69.2	67.7	66.8	67.8

**Table 3.11.6 (cont.). Average hauteur (mm) for individual shires in each quarter between July 1989 and June 1994, and the five-year average hauteur for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Northam (S)	W11	65.8	66.8	67.8	66.2	66.8
Northampton (S)	W06	67.0	68.2	69.6	67.7	68.4
Nungarin (S)	W07	70.4	67.1	69.6	68.4	68.9
Perenjori (S)	W06	67.4	66.3	66.0	64.2	65.8
Pingelly (S)	W12	69.9	69.7	68.1	68.3	68.9
Plantagenet (S)	W10	71.4	71.0	70.3	68.5	70.1
Port Hedland (T)	W02	na	51.7	53.8	56.8	54.1
Quairading (S)	W11	64.1	69.1	66.7	64.7	66.4
Ravensthorpe (S)	W20	71.1	71.2	68.1	67.6	69.5
Roebourne (S)	W03	57.1	64.7	61.4	63.6	62.7
Sandstone (S)	W04	66.2	69.9	71.1	71.7	67.9
Serpentine-Jarrahdale (S)	W15	71.2	71.4	65.1	65.2	70.7
Shark Bay (S)	W05	65.6	54.7	67.5	50.9	65.2
Swan (S)	W15	72.0	69.6	67.5	67.1	69.1
Tambellup (S)	W09	71.1	70.9	69.5	67.8	69.6
Tammin (S)	W11	69.9	68.6	69.2	68.6	69.1
Three Springs (S)	W06	68.1	67.3	67.5	65.8	67.0
Toodyay (S)	W11	64.8	66.3	68.1	66.6	66.8
Trayning (S)	W07	68.9	70.0	68.2	68.4	68.6
Upper Gascoyne (S)	W05	64.4	68.8	69.9	65.4	67.2
Victoria Plains (S)	W14	69.2	68.9	67.7	67.0	68.0
Wagin (S)	W12	69.8	69.7	68.6	67.6	68.9
Wandering (S)	W12	67.8	66.8	69.6	65.2	67.2
Waroon (S)	W16	69.1	69.0	72.5	65.6	68.8
West Arthur (S)	W12	70.6	68.7	68.4	66.4	68.9
Westonia (S)	W07	68.7	69.1	68.3	63.7	67.1
Wickepin (S)	W12	70.2	70.8	68.6	67.7	69.2
Williams (S)	W12	68.7	69.7	68.7	66.7	68.1
Wiluna (S)	W04	73.0	71.5	69.4	na	71.7
Wongan-Ballidu (S)	W11	68.3	68.4	69.5	67.5	68.5
Woodanilling (S)	W09	70.5	70.3	67.0	66.2	69.1
Wyalkatchem (S)	W11	66.8	68.5	68.3	68.3	68.2
Yalgoo (S)	W04	66.3	70.1	67.9	62.3	67.0
Yilgarn (S)	W07	68.0	68.3	67.7	66.1	67.6
York (S)	W11	66.9	66.8	66.6	66.6	66.7



### 3.12 Average hauteur by micron group

The above hauteur results were supplemented with estimates of hauteur of matched merino combing fleece wool of particular diameters coming from these shires. This was done using the matched AWC datasets, and the following diameter classes:

fine	average of 19.5 $\mu\text{m}$ with a range from 18.6 $\mu\text{m}$ to 20.5 $\mu\text{m}$ (Table 3.12.2)
medium	average of 21.5 $\mu\text{m}$ with a range from 20.6 $\mu\text{m}$ to 22.5 $\mu\text{m}$ (Table 3.12.3)
broad	average of 23.5 $\mu\text{m}$ with a range from 22.6 $\mu\text{m}$ to 24.5 $\mu\text{m}$ (Table 3.12.4)

The hauteur was predicted using the TEAM equations from the raw wool staple measurements. Therefore the estimates were done on a reduced number of sale lots which had this staple information available.

Results were calculated annually for the five-year period for each shire. The first years of the analysis had low numbers of staple measurement results available for the State. Therefore some shires had very low numbers of staple test results available for the analysis. The actual number of staple measurements used in the analysis is shown in Appendix 4. The results are shown in Tables 3.12.1 to 3.12.4 and in the accompanying maps.

**Table 3.12.1. Average hauteur for the micron groups in Western Australia over the period July 1989 to June 1994. Results are for all matched merino combing fleece sale lots sold at auction with staple measurement in Fremantle**

Micron group	Average hauteur (mm)		
	Fine	Medium	Broad
5-year average	61.2	67.0	71.4
89/90	61.9	67.7	71.7
90/91	60.7	66.3	70.6
91/92	59.0	65.1	69.9
92/93	62.8	67.8	71.9
93/94	61.4	67.3	71.5

**Table 3.12.2. Average hauteur of the fine wool (averaging 19.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 61.2 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	63.4	63.1	58.7	64.6	64.1	63.7
Ashburton (S)	W03	53.5	54.7	50.9	53.4	53.9	52.2
Augusta-Margaret River (S)	W18	62.7	68.0	60.3	59.5	66.1	61.7
Beverley (S)	W11	58.5	60.6	61.6	63.0	61.7	61.6
Boddington (S)	W12	62.6	60.6	65.5	63.6	62.8	62.8
Boyup Brook (S)	W13	64.3	62.8	60.7	63.9	64.5	63.5
Bridgetown-Greenbushes (S)	W13	64.1	na	61.3	59.1	60.8	61.7
Brookton (S)	W12	58.4	60.2	59.6	62.2	63.6	61.9
Broomehill (S)	W09	63.7	61.2	63.8	62.7	59.7	61.9
Bruce Rock (S)	W07	61.6	64.8	58.2	61.3	60.9	61.1
Busselton (S)	W18	59.9	58.8	61.3	61.3	64.0	60.9
Capel (S)	W17	64.5	63.0	na	66.0	na	64.5
Carnamah (S)	W06	60.0	59.9	58.8	62.7	60.2	59.9
Carnarvon (S)	W05	59.2	59.4	57.6	58.3	56.6	57.4
Chapman Valley (S)	W06	57.7	55.0	62.4	58.9	55.2	57.8
Chittering (S)	W14	56.0	64.4	68.0	59.9	70.4	67.7
Collie (S)	W17	64.5	62.9	66.3	64.7	62.1	63.9
Coolgardie (S)	W19	na	na	na	na	na	na
Coorow (S)	W06	58.8	56.7	54.0	62.7	61.9	59.8
Corrigin (S)	W08	57.9	64.4	57.5	60.5	60.2	59.6
Cranbrook (S)	W10	65.5	62.2	61.6	64.2	62.4	63.1
Cuballing (S)	W12	59.6	61.9	55.3	61.6	61.6	59.9
Cue (S)	W04	61.8	58.0	65.8	62.2	59.3	61.7
Cunderdin (S)	W11	60.5	54.2	56.8	61.8	61.6	59.6
Dalwallinu (S)	W11	59.7	59.7	57.1	62.3	61.2	60.5
Dandaragan (S)	W14	59.2	61.2	58.4	64.6	61.5	61.3
Dardanup (S)	W17	na	59.5	66.0	na	na	60.5
Denmark (S)	W10	71.6	69.4	57.9	62.0	63.1	66.6
Donnybrook-Balingup (S)	W17	63.7	60.0	64.2	57.4	60.2	61.1
Dowerin (S)	W11	59.0	62.1	54.2	62.2	61.9	59.7
Dumbleyung (S)	W12	63.5	61.6	57.5	59.9	62.3	61.9
Dundas (S)	W20	62.3	61.0	63.0	na	58.6	59.4
Esperance (S)	W20	63.5	60.4	58.0	61.6	62.1	60.5
Exmouth (S)	W05	na	na	na	na	na	na



**Table 3.12.2 (cont.). Average hauteur of the fine wool (averaging 19.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 61.2 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	57.4	61.1	59.3	60.9	61.4	60.8
Gnowangerup (S)	W09	57.9	60.6	57.8	61.7	60.2	59.9
Goomalling (S)	W11	58.5	56.3	57.5	65.2	61.9	59.6
Greenough (S)	W06	61.7	60.7	57.8	61.9	59.6	60.4
Harvey (S)	W17	62.7	na	na	57.2	na	60.3
Irwin (S)	W06	59.2	54.2	na	66.0	57.2	58.4
Jerramungup (S)	W09	62.4	60.6	60.2	66.4	64.7	63.3
Kalgoorlie/Boulder (C)	W19	na	60.3	na	53.0	60.6	60.2
Katanning (S)	W09	64.8	61.5	56.5	61.0	61.0	60.4
Kellerberrin (S)	W07	60.4	59.2	54.0	58.5	57.9	57.7
Kent (S)	W09	63.4	57.7	58.0	63.5	58.8	60.3
Kojonup (S)	W09	62.9	62.6	61.3	64.2	62.0	62.7
Kondinin (S)	W08	60.1	58.0	60.5	65.0	59.4	60.0
Koorda (S)	W11	57.0	61.4	56.6	58.4	60.5	58.8
Kulin (S)	W08	60.0	51.8	56.2	61.9	60.9	59.7
Lake Grace (S)	W08	62.4	59.9	56.8	55.0	60.0	58.8
Laverton (S)	W19	na	na	na	na	na	na
Leonora (S)	W19	65.1	63.1	68.8	57.0	68.4	64.8
Manjimup (S)	W13	58.1	61.6	59.0	61.8	58.7	60.3
Meekatharra (S)	W04	57.6	58.6	51.3	62.0	63.3	59.9
Menzies (S)	W19	na	62.0	na	na	61.6	61.6
Merredin (S)	W07	59.9	55.9	60.1	61.0	57.8	58.5
Mingenew (S)	W06	62.2	58.2	53.4	62.0	58.9	58.7
Moora (S)	W14	59.9	59.0	59.2	61.1	60.6	60.2
Morawa (S)	W06	60.7	58.5	59.8	57.6	61.7	60.1
Mount Magnet (S)	W04	64.0	58.8	56.0	na	59.6	58.8
Mount Marshall (S)	W07	57.6	na	55.0	54.2	62.4	59.2
Mukinbudin (S)	W07	59.5	55.0	53.8	60.8	57.9	55.8
Mullewa (S)	W06	56.4	59.8	59.1	54.3	59.1	58.1
Mundaring (S)	W15	60.0	na	na	na	na	60.0
Murchison (S)	W04	na	na	na	na	62.3	62.3
Murray (S)	W16	58.8	61.8	58.7	59.6	65.0	60.0
Nannup (S)	W13	61.0	63.0	na	na	na	61.8
Narembeen (S)	W07	60.5	58.8	60.8	61.3	59.2	60.0
Narrogin (S)	W12	62.9	60.3	57.7	61.3	60.5	60.8

**Table 3.12.2 (cont.). Average hauteur of the fine wool (averaging 19.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 61.2 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	58.5	64.9	54.2	61.2	59.8	59.6
Northampton (S)	W06	63.0	57.2	57.2	62.1	59.4	59.6
Nungarin (S)	W07	54.1	58.6	na	na	61.4	58.4
Perenjori (S)	W06	57.4	54.1	57.1	58.7	57.6	57.3
Pingelly (S)	W12	60.0	62.3	56.5	62.3	62.6	61.8
Plantagenet (S)	W10	62.8	64.2	62.5	64.7	64.5	63.8
Port Hedland (T)	W02	49.9	na	49.0	58.1	55.4	53.6
Quairading (S)	W11	58.9	57.7	54.9	58.0	56.9	57.0
Ravensthorpe (S)	W20	62.5	59.5	55.7	62.5	60.7	59.2
Roebourne (S)	W03	62.0	53.7	50.5	53.0	49.0	51.4
Sandstone (S)	W04	na	56.0	na	na	na	56.0
Serpentine-Jarrahdale (S)	W15	na	62.0	59.0	60.0	59.5	59.7
Shark Bay (S)	W05	na	na	na	55.0	60.7	59.7
Swan (S)	W15	66.0	56.0	na	74.0	58.1	59.2
Tambellup (S)	W09	63.1	60.1	60.2	62.6	63.7	61.9
Tammin (S)	W11	57.2	60.0	54.0	na	56.9	56.6
Three Springs (S)	W06	60.3	56.1	52.1	62.3	60.6	59.1
Toodyay (S)	W11	58.9	57.4	56.2	58.4	60.7	58.5
Trayning (S)	W07	53.0	na	57.0	56.0	60.0	57.8
Upper Gascoyne (S)	W05	na	na	na	na	54.0	54.0
Victoria Plains (S)	W14	63.7	57.2	59.3	61.0	60.1	60.0
Wagin (S)	W12	61.1	60.7	60.3	60.7	59.7	60.5
Wandering (S)	W12	59.7	61.5	58.5	62.2	63.0	61.7
Waroon (S)	W16	67.2	na	na	na	na	67.2
West Arthur (S)	W12	64.2	63.2	59.5	64.2	61.5	62.7
Westonia (S)	W07	60.5	55.6	54.9	59.4	59.1	58.1
Wickepin (S)	W12	60.8	60.7	59.2	59.2	61.0	60.3
Williams (S)	W12	63.5	61.4	61.2	62.2	61.5	62.0
Wiluna (S)	W04	59.5	na	na	66.0	67.0	63.2
Wongan-Ballidu (S)	W11	58.4	60.7	57.2	59.5	60.8	59.7
Woodanilling (S)	W09	56.1	59.1	57.9	61.9	58.1	58.6
Wyalkatchem (S)	W11	58.4	66.6	55.9	53.0	60.9	60.5
Yalgoo (S)	W04	60.1	62.0	60.7	58.8	61.0	61.0
Yilgarn (S)	W07	61.4	60.6	63.7	65.8	62.8	62.9
York (S)	W11	61.2	60.7	58.5	61.2	60.9	60.7

**Table 3.12.3. Average hauteur of clean medium wool (averaging 21.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 67.0 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	71.1	70.1	67.0	69.9	68.3	69.6
Ashburton (S)	W03	63.4	53.5	58.6	61.9	58.1	59.3
Augusta-Margaret River (S)	W18	70.5	69.3	68.1	64.7	67.5	68.4
Beverley (S)	W11	67.9	65.4	65.5	67.7	67.8	67.2
Boddington (S)	W12	68.1	67.8	68.3	68.2	68.4	68.2
Boyup Brook (S)	W13	68.9	66.2	65.7	69.7	68.9	68.5
Bridgetown-Greenbushes (S)	W13	68.7	67.0	67.9	66.5	66.5	67.4
Brookton (S)	W12	66.4	68.0	65.8	69.1	68.0	67.9
Broomehill (S)	W09	67.4	67.0	67.3	69.3	70.3	68.7
Bruce Rock (S)	W07	66.0	64.5	63.9	66.2	66.6	65.7
Busselton (S)	W18	69.5	66.4	68.4	69.8	68.2	68.5
Capel (S)	W17	70.9	67.0	60.0	68.8	68.0	69.2
Carnamah (S)	W06	66.8	65.4	66.0	66.4	68.2	66.6
Carnarvon (S)	W05	64.7	64.3	67.0	65.2	63.7	64.5
Chapman Valley (S)	W06	66.7	65.7	64.7	65.7	67.0	66.0
Chittering (S)	W14	67.7	68.3	62.7	70.1	65.4	66.7
Collie (S)	W17	67.4	62.7	68.9	68.9	68.5	67.0
Coolgardie (S)	W19	66.6	68.6	65.4	na	64.3	66.7
Coorow (S)	W06	64.3	63.3	63.1	67.2	65.9	64.9
Corrigin (S)	W08	65.7	65.9	62.2	66.8	65.2	65.3
Cranbrook (S)	W10	68.8	67.9	66.0	68.3	68.0	67.9
Cuballing (S)	W12	68.4	66.6	65.1	68.4	68.0	67.4
Cue (S)	W04	66.6	64.3	65.9	64.4	66.6	65.8
Cunderdin (S)	W11	64.3	65.8	62.7	64.9	67.7	65.7
Dalwallinu (S)	W11	65.7	65.1	62.9	65.3	67.0	65.9
Dandaragan (S)	W14	66.4	66.1	64.7	67.6	67.2	66.8
Dardanup (S)	W17	68.1	59.7	na	70.3	70.4	67.6
Denmark (S)	W10	72.9	72.0	66.8	70.1	70.2	71.1
Donnybrook-Balingup (S)	W17	69.1	66.1	64.8	67.2	64.4	65.8
Dowerin (S)	W11	64.6	65.0	62.1	65.4	65.2	64.6
Dumbleyung (S)	W12	68.9	66.5	65.7	67.2	66.6	67.2
Dundas (S)	W20	64.4	68.4	66.6	65.9	66.9	66.9
Esperance (S)	W20	65.6	65.1	64.1	69.7	67.0	66.3
Exmouth (S)	W05	na	67.0	na	68.7	57.0	66.4

**Table 3.12.3 (cont.). Average hauteur of clean medium wool (averaging 21.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 67.0 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	68.6	66.8	68.0	67.4	70.6	68.3
Gnowangerup (S)	W09	66.6	65.5	65.9	67.8	67.6	66.9
Goomalling (S)	W11	65.7	64.2	63.9	67.3	67.5	66.3
Greenough (S)	W06	65.3	65.6	64.9	66.5	65.9	65.7
Harvey (S)	W17	68.4	68.0	na	65.0	68.7	68.3
Irwin (S)	W06	65.0	60.8	64.9	66.0	61.9	63.7
Jerramungup (S)	W09	66.8	65.3	65.5	68.9	66.9	66.9
Kalgoorlie/Boulder (C)	W19	70.4	67.4	67.7	64.6	69.5	68.4
Katanning (S)	W09	69.8	66.8	68.1	68.3	67.5	67.9
Kellerberrin (S)	W07	65.8	67.6	62.5	63.5	66.6	65.2
Kent (S)	W09	67.6	65.0	62.6	66.0	65.9	65.6
Kojonup (S)	W09	69.2	67.0	67.1	68.5	68.7	68.4
Kondinin (S)	W08	67.6	66.4	64.5	64.7	66.5	66.1
Koorda (S)	W11	63.1	66.2	61.1	63.6	65.0	64.2
Kulin (S)	W08	67.2	67.2	63.2	66.1	67.7	66.7
Lake Grace (S)	W08	66.8	65.4	63.1	67.4	65.2	65.7
Laverton (S)	W19	na	64.4	na	na	67.3	65.4
Leonora (S)	W19	67.3	66.0	68.6	68.5	69.2	67.7
Manjimup (S)	W13	70.3	67.9	66.9	65.7	69.1	68.3
Meekatharra (S)	W04	65.2	64.6	69.8	67.8	67.2	66.1
Menzies (S)	W19	67.1	65.9	58.0	71.8	68.6	67.0
Merredin (S)	W07	66.3	64.4	62.9	66.6	63.5	64.5
Mingenew (S)	W06	65.6	65.5	65.0	67.6	66.8	66.2
Moora (S)	W14	65.9	65.5	62.4	66.4	67.5	66.3
Morawa (S)	W06	68.5	67.0	63.2	65.6	67.3	66.7
Mount Magnet (S)	W04	65.8	63.1	57.7	67.7	66.7	63.8
Mount Marshall (S)	W07	64.8	64.9	62.3	63.6	66.0	64.4
Mukinbudin (S)	W07	64.2	67.5	62.0	65.9	66.7	65.7
Mullewa (S)	W06	63.7	65.3	60.8	65.6	65.1	63.8
Mundaring (S)	W15	72.0	61.5	na	71.0	67.8	66.9
Murchison (S)	W04	59.0	66.1	na	68.3	68.1	66.9
Murray (S)	W16	69.9	65.2	64.8	64.4	64.7	66.0
Nannup (S)	W13	69.3	70.0	na	61.7	65.3	66.6
Narembeen (S)	W07	65.9	64.5	63.1	67.0	66.1	65.5
Narrogin (S)	W12	67.9	66.4	66.1	67.3	66.1	66.9

**Table 3.12.3 (cont.). Average hauteur of clean medium wool (averaging 21.5 µm) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 67.0 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	65.6	65.0	63.2	63.4	66.7	65.0
Northampton (S)	W06	65.2	64.2	64.0	65.6	66.4	65.3
Nungarin (S)	W07	65.7	64.5	62.4	63.5	65.1	64.4
Perenjori (S)	W06	64.6	64.0	63.7	64.0	65.5	64.6
Pingelly (S)	W12	66.4	65.8	62.6	67.6	68.4	67.4
Plantagenet (S)	W10	70.1	70.2	67.3	69.1	68.4	69.2
Port Hedland (T)	W02	60.0	na	na	na	54.7	56.1
Quairading (S)	W11	66.6	65.1	62.2	65.6	65.7	65.0
Ravensthorpe (S)	W20	66.2	64.4	62.7	67.7	67.3	65.8
Roebourne (S)	W03	60.1	55.9	66.4	66.5	59.2	61.1
Sandstone (S)	W04	65.5	64.9	62.1	70.2	66.1	64.9
Serpentine-Jarrahdale (S)	W15	65.6	66.1	68.4	67.1	67.0	66.8
Shark Bay (S)	W05	61.6	61.4	58.4	63.5	64.3	62.1
Swan (S)	W15	70.4	67.0	65.0	69.0	66.7	67.9
Tambellup (S)	W09	69.3	66.8	67.0	69.0	68.1	68.3
Tammin (S)	W11	67.0	66.4	62.1	66.9	67.4	66.4
Three Springs (S)	W06	64.4	67.3	66.4	66.8	66.4	66.3
Toodyay (S)	W11	65.0	65.8	60.8	65.5	65.1	64.9
Trayning (S)	W07	68.0	63.7	65.1	64.4	67.7	66.5
Upper Gascoyne (S)	W05	62.6	62.6	54.8	67.0	64.6	63.6
Victoria Plains (S)	W14	65.7	65.9	65.6	65.9	66.0	65.9
Wagin (S)	W12	68.6	65.6	68.1	68.6	66.7	67.6
Wandering (S)	W12	65.8	68.2	64.9	68.9	66.9	67.4
Waroona (S)	W16	68.6	60.0	63.0	na	67.5	67.6
West Arthur (S)	W12	69.4	67.0	67.3	69.4	68.9	68.7
Westonia (S)	W07	65.7	65.0	62.8	64.6	65.0	64.9
Wickepin (S)	W12	67.5	66.2	65.3	66.9	67.0	66.8
Williams (S)	W12	68.3	66.9	66.8	68.1	67.2	67.6
Wiluna (S)	W04	65.3	67.1	64.3	69.7	68.4	67.9
Wongan-Ballidu (S)	W11	63.5	65.2	65.5	65.7	67.2	65.7
Woodanilling (S)	W09	66.9	64.8	66.2	67.8	68.2	67.1
Wyalkatchem (S)	W11	68.0	64.7	66.3	68.4	67.1	67.1
Yalgoo (S)	W04	64.8	66.3	61.0	62.9	64.6	64.2
Yilgarn (S)	W07	65.5	62.4	62.6	65.2	67.5	65.0
York (S)	W11	66.4	65.6	62.5	67.4	67.3	66.7

**Table 3.12.4. Average hauteur of clean broad wool (averaging 23.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 71.4 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	75.0	73.6	72.8	73.9	71.5	73.3
Ashburton (S)	W03	69.0	na	na	72.8	70.7	71.9
Augusta-Margaret River (S)	W18	77.8	72.6	72.2	72.0	71.0	72.8
Beverley (S)	W11	71.3	69.6	67.7	70.5	71.3	70.5
Boddington (S)	W12	71.1	72.3	71.8	73.1	70.4	71.9
Boyup Brook (S)	W13	73.7	71.4	68.6	73.3	74.9	73.5
Bridgetown-Greenbushes (S)	W13	73.3	70.8	71.8	73.4	70.4	71.3
Brookton (S)	W12	70.0	70.5	72.3	72.6	71.4	71.4
Broomehill (S)	W09	72.4	72.1	73.1	73.5	73.2	73.0
Bruce Rock (S)	W07	70.0	69.6	68.9	71.4	70.5	70.3
Busselton (S)	W18	66.2	67.7	78.5	71.8	78.0	69.6
Capel (S)	W17	74.3	67.8	na	na	68.0	70.9
Carnamah (S)	W06	70.9	69.5	69.3	70.2	72.5	70.6
Carnarvon (S)	W05	68.1	70.3	71.4	68.7	69.9	69.3
Chapman Valley (S)	W06	70.1	71.6	71.3	71.4	70.9	71.1
Chittering (S)	W14	73.4	72.1	68.8	73.5	68.5	70.9
Collie (S)	W17	67.4	62.9	68.8	69.9	71.3	66.4
Coolgardie (S)	W19	75.2	71.8	73.9	72.5	76.1	74.2
Coorow (S)	W06	69.7	69.0	69.5	70.0	70.4	69.8
Corrigin (S)	W08	70.0	71.3	65.9	70.3	71.2	70.4
Cranbrook (S)	W10	73.4	71.6	70.7	72.2	71.5	72.0
Cuballing (S)	W12	68.8	70.3	68.3	70.4	71.7	70.6
Cue (S)	W04	72.4	68.8	70.6	71.1	71.8	71.5
Cunderdin (S)	W11	70.2	69.6	68.5	69.9	71.7	70.4
Dalwallinu (S)	W11	70.7	69.3	71.9	71.9	71.4	71.2
Dandaragan (S)	W14	70.7	70.1	69.0	70.3	70.0	70.2
Dardanup (S)	W17	73.4	60.0	na	78.0	73.9	74.3
Denmark (S)	W10	76.1	71.5	74.7	72.7	72.6	73.4
Donnybrook-Balingup (S)	W17	72.0	69.6	69.6	69.7	70.5	70.2
Dowerin (S)	W11	68.1	68.6	69.9	69.6	68.5	68.9
Dumbleyung (S)	W12	72.7	70.8	67.9	71.4	72.4	71.6
Dundas (S)	W20	74.6	71.8	72.8	73.0	71.6	72.6
Esperance (S)	W20	71.7	70.4	67.3	74.1	71.9	72.0
Exmouth (S)	W05	na	68.8	na	na	61.0	66.8

**Table 3.12.4 (cont.). Average hauteur of clean broad wool (averaging 23.5  $\mu\text{m}$ ) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 71.4 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	71.7	71.6	71.0	72.5	71.9	71.9
Gnowangerup (S)	W09	72.1	69.3	70.9	73.2	71.6	71.7
Goomalling (S)	W11	70.5	70.0	68.4	69.7	70.6	70.1
Greenough (S)	W06	70.6	69.3	68.0	69.4	70.2	69.5
Harvey (S)	W17	70.3	70.2	na	na	68.3	68.9
Irwin (S)	W06	68.1	68.9	68.7	70.6	71.5	69.7
Jerramungup (S)	W09	71.8	70.8	72.5	73.1	71.1	71.8
Kalgoorlie/Boulder (C)	W19	76.5	73.9	74.7	73.8	75.4	75.0
Katanning (S)	W09	71.9	70.1	73.0	70.4	72.6	71.9
Kellerberrin (S)	W07	68.6	68.7	66.6	69.5	68.8	68.9
Kent (S)	W09	72.2	72.0	71.5	71.4	71.9	71.8
Kojonup (S)	W09	72.9	70.8	71.0	71.7	72.6	72.2
Kondinin (S)	W08	70.2	71.5	68.6	72.0	70.3	71.1
Koorda (S)	W11	68.9	70.3	71.1	71.6	70.8	70.8
Kulin (S)	W08	71.1	70.9	68.6	71.1	71.7	71.2
Lake Grace (S)	W08	72.5	70.6	69.9	72.3	71.8	71.7
Laverton (S)	W19	68.5	68.2	na	67.7	71.0	68.4
Leonora (S)	W19	73.1	71.0	72.4	74.9	75.3	73.4
Manjimup (S)	W13	73.1	73.7	70.0	75.3	70.1	72.5
Meekatharra (S)	W04	71.9	71.9	72.2	70.3	72.2	71.5
Menzies (S)	W19	75.7	69.6	71.5	75.9	74.7	73.9
Merredin (S)	W07	69.6	69.2	66.2	69.8	69.4	69.2
Mingenew (S)	W06	69.6	70.3	69.1	70.7	71.4	70.5
Moora (S)	W14	69.9	70.3	68.7	70.3	70.9	70.3
Morawa (S)	W06	74.0	71.6	67.1	74.4	73.2	73.2
Mount Magnet (S)	W04	72.7	70.8	62.6	70.9	72.9	71.9
Mount Marshall (S)	W07	70.2	69.9	65.7	69.7	70.9	70.1
Mukinbudin (S)	W07	69.6	67.8	65.8	70.1	70.7	69.6
Mullewa (S)	W06	67.8	71.8	67.5	68.7	70.5	69.7
Mundaring (S)	W15	77.0	67.2	72.0	69.0	68.0	70.6
Murchison (S)	W04	72.7	68.7	na	68.9	72.6	70.2
Murray (S)	W16	68.6	68.9	67.0	71.8	70.8	69.5
Nannup (S)	W13	na	na	na	na	65.5	65.5
Narembeen (S)	W07	67.4	69.3	68.1	69.8	68.6	69.0
Narrogin (S)	W12	72.6	70.4	70.3	69.5	69.5	70.1

**Table 3.12.4 (cont.). Average hauteur of clean broad wool (averaging 23.5  $\mu$ m) available at auction by shire for five selling years between 1989/90 and 1993/94, and the five-year average hauteur for each shire. The State average for this diameter group was 71.4 mm**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	71.7	69.5	66.1	69.8	70.9	70.0
Northampton (S)	W06	71.6	71.1	69.1	71.7	71.3	71.1
Nungarin (S)	W07	74.5	71.3	71.4	71.1	70.7	71.2
Perenjori (S)	W06	68.6	68.7	63.7	69.8	70.4	69.3
Pingelly (S)	W12	71.6	69.7	68.7	71.3	71.9	71.1
Plantagenet (S)	W10	72.9	72.4	70.1	74.1	70.7	72.1
Port Hedland (T)	W02	na	na	na	na	na	na
Quairading (S)	W11	71.3	69.2	70.0	68.8	71.2	70.0
Ravensthorpe (S)	W20	71.4	69.6	68.3	74.0	70.8	71.8
Roebourne (S)	W03	66.7	na	69.9	67.5	66.2	67.4
Sandstone (S)	W04	71.6	67.5	68.7	71.0	71.2	70.9
Serpentine-Jarrahdale (S)	W15	72.0	67.4	70.8	74.5	71.1	71.7
Shark Bay (S)	W05	66.9	67.7	68.6	71.1	71.4	68.5
Swan (S)	W15	72.4	71.9	na	72.1	74.4	72.3
Tambellup (S)	W09	73.3	72.8	71.3	73.2	72.8	72.9
Tammin (S)	W11	70.8	67.9	65.4	69.3	69.8	69.2
Three Springs (S)	W06	69.0	67.2	65.7	69.8	69.7	68.9
Toodyay (S)	W11	72.1	70.6	65.8	70.3	70.0	70.1
Trayning (S)	W07	68.3	69.0	67.5	71.1	70.8	70.2
Upper Gascoyne (S)	W05	68.7	68.3	68.8	67.3	68.3	68.1
Victoria Plains (S)	W14	69.4	69.7	67.3	70.6	70.9	70.2
Wagin (S)	W12	71.8	70.4	71.4	71.5	71.4	71.4
Wandering (S)	W12	72.4	72.8	70.0	72.1	72.4	72.1
Waroona (S)	W16	75.9	69.5	na	na	69.1	71.9
West Arthur (S)	W12	72.3	71.4	70.0	73.0	72.3	72.3
Westonia (S)	W07	72.4	68.3	69.4	72.0	70.2	71.0
Wickepin (S)	W12	70.9	70.0	69.7	72.3	71.4	71.0
Williams (S)	W12	72.4	71.3	70.5	71.0	71.2	71.2
Wiluna (S)	W04	72.2	75.1	na	72.0	75.1	73.0
Wongan-Ballidu (S)	W11	69.1	70.1	70.0	70.6	70.9	70.3
Woodanilling (S)	W09	72.1	70.0	72.6	72.5	71.3	71.7
Wyalkatchem (S)	W11	70.7	69.6	70.5	69.9	69.9	70.0
Yalgoo (S)	W04	71.1	73.1	69.7	70.6	71.4	71.3
Yilgarn (S)	W07	70.3	69.0	68.3	70.0	70.5	69.8
York (S)	W11	67.6	69.7	68.1	70.0	69.2	69.4



### 3.12.1 Maps of average hauteur by shire by micron group

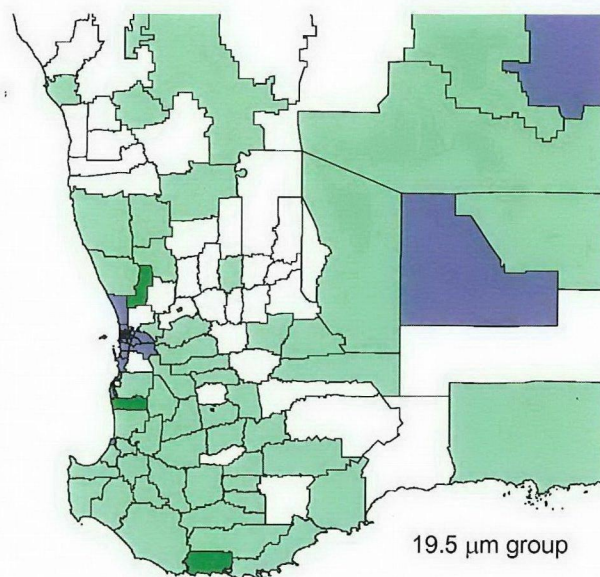
The maps of average hauteur by micron group show the lower hauteur range for the fine micron group (from Table 3.12.1) is evident in nearly all shires. A potential pattern might be present where the 19.5 micron group in the shires of the eastern wheatbelt are in the lowest hauteur range, and the higher rainfall shires move into the second lowest hauteur range. Conversely the 23.5 micron group is in the high hauteur ranges in all shires.

The 21.5 micron group is predominantly in the middle hauteur range (65 to 70 mm) with the exception of some northern agricultural and pastoral shires which are slightly shorter in this fibre diameter group.

Overall, these results suggest that there is a correlation in the State supply profile between increasing diameter and increasing hauteur, and that this effect is applicable across most shires.

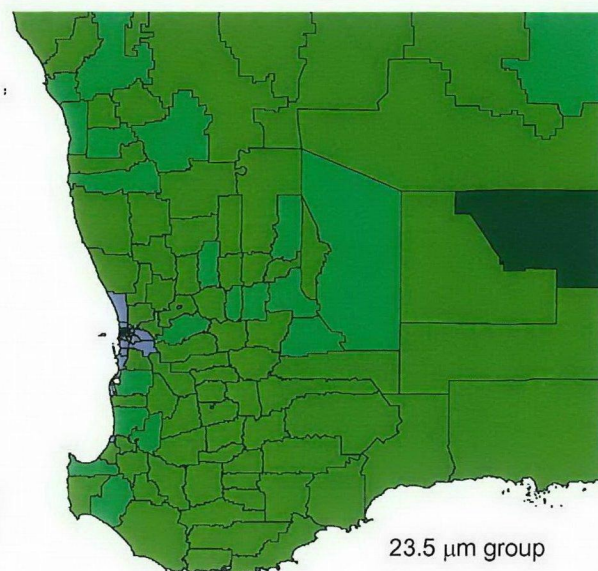
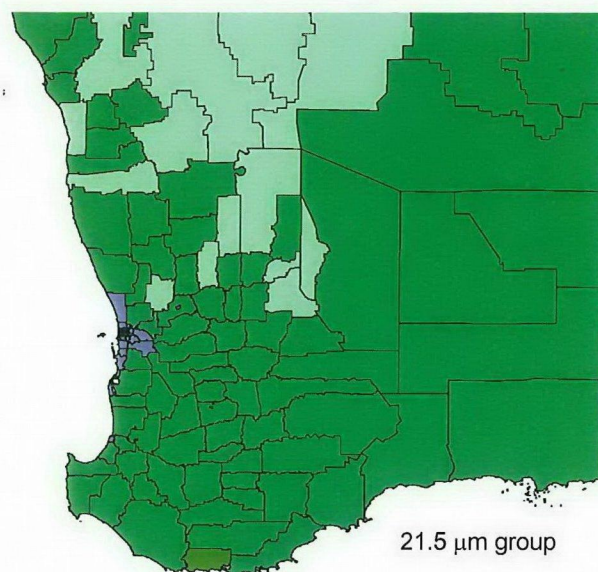
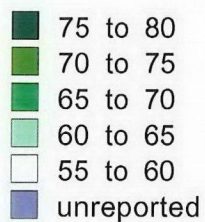
# Western Australia

Estimated Hauteur  
by shire  
by micron group for  
1989/90 to 1993/94



## Five-year shire average

Estimated Hauteur Range (mm)



### 3.13 Average CV(H)

The matched AWC dataset was used to generate the estimated average CV(H) by shire for the five-year period from July 1989 to June 1994. The long-term State average CV(H) is 51.2 per cent. The effect of year on this average is shown in Table 3.13.1. The average CV(H) for the individual years ranges from 50.3 per cent to 51.8 per cent.

The SD of the yearly means is the between-sale lots standard deviation, and can be used as a measure of the range of CV(H) in the raw wool sold on an annual basis in Fremantle.

**Table 3.13.1. Average CV(H) for WA over the period July 1989 to June 1994. Results show the long-term average, and the annual average CV(H). Results are for all matched merino combing fleece sale lots sold at auction with staple measurements in Fremantle**

Period	Average CV(H) (%)	
	Mean	SD
5-year average	51.17	5.33
89/90	50.30	5.03
90/91	51.81	5.11
91/92	51.00	4.82
92/93	51.65	5.28
93/94	50.98	5.67

#### 3.13.1 Variation in CV(H) due to year, season and WSA, shire effects

The differences of CV(H) evident in the above table are due to between-year effects. It is assumed also that differences exist between seasons. The existence of differences also needs to be proved and quantified between WSAs, and between shires within WSA.

Table 3.13.2 contains a statistical analysis done on time (year, season), regional (WSA, shire) effects and their interactions to examine their contributions to the variance of CV(H). The model used to explain the variance in CV(H) is highly significant, although it explains only 20.4 per cent of the total variance. So 79.6 per cent of the total variance has been included in the error variance. This error variance contains effects not included in the model and random effects.

Therefore the results in Table 3.13.2 suggest that a small proportion of variance in CV(H) is due to macro effects such as year, season and region, and the majority of variance is due to factors other than those included in the model. These other factors could include between-flock and between-property differences within shires, for example, strain differences and other flock management effects, and between-month differences within season. Also CV(H) is calculated using both staple and core test results. As each of these individual test results has a particular set of factors contributing to their variance, identifying single factors which provide a clear description of the variance in a compound predicted term such as CV(H) is unlikely.

**Table 3.13.2. Analysis of variance in CV(H) due to year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Sum of Squares	Mean Square	F value	Pr>F
Model	192	514322	2678.76	118.25	0.0001
Error	88654	2008350	22.65		
Corrected total	88846	2522672			

The relative importance of the individual terms in explaining the variance in CV(H) are shown in Table 3.13.3. All sources of variance included were highly significant. However the season effect (within a year) dominates the other terms of the model, to such an extent that season would account for the majority of the variance explained by the model.

**Table 3.13.3. Components of variance in CV(H)-year and season (nested within year), WSA and shires (nested within WSA) and WSA by year interaction**

Source	df	Type III SS	Mean Square	F value	Pr>F
Selling year	4	1269	317.19	14.00	0.0001
Season (within selling year)	15	381390	25426.00	1122.37	0.0001
WSA	18	10390	577.20	25.48	0.0001
Shire nested in WSA	84	18515	220.41	9.73	0.0001
WSA x selling year	71	29595	416.83	18.40	0.0001

The average CV(H) of merino combing fleece wool sold at auction and matched by brand from each shire in each of the five years, and the five-year average are shown in Table 3.13.4.

**Table 3.13.4. Average CV(H) (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average CV(H) for each shire**

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Albany (S)	W10	50.7	50.3	50.1	51.1	52.6	51.2
Ashburton (S)	W03	54.5	58.9	56.3	55.1	56.7	56.2
Augusta-Margaret River (S)	W18	48.3	51.3	50.1	54.0	51.1	50.9
Beverley (S)	W11	50.5	52.0	51.2	52.7	50.7	51.4
Boddington (S)	W12	50.6	51.7	50.3	52.3	51.1	51.4
Boyup Brook (S)	W13	51.0	52.6	52.5	51.7	51.8	51.8
Bridgetown-Greenbushes (S)	W13	51.7	52.7	49.6	53.2	53.2	52.4
Brookton (S)	W12	50.4	53.3	52.9	51.4	50.0	51.2
Broomehill (S)	W09	50.8	51.7	50.0	51.1	49.7	50.5
Bruce Rock (S)	W07	50.6	53.5	51.1	53.4	50.8	52.0
Busselton (S)	W18	52.6	53.1	53.1	53.9	50.7	52.8
Capel (S)	W17	47.4	55.6	58.0	54.5	54.6	51.9
Carnamah (S)	W06	51.0	51.3	50.4	52.5	49.7	51.0
Carnarvon (S)	W05	50.5	50.2	48.4	50.5	49.8	50.1
Chapman Valley (S)	W06	50.9	51.6	51.2	51.7	50.3	51.1
Chittering (S)	W14	47.1	49.0	50.5	49.3	53.3	50.2
Collie (S)	W17	53.2	56.3	52.8	52.7	52.9	53.8
Coolgardie (S)	W19	45.4	47.2	48.5	46.4	46.0	46.4
Coorow (S)	W06	50.9	52.8	51.4	52.5	50.9	51.8
Corrigin (S)	W08	50.4	52.6	50.0	52.3	49.8	51.1
Cranbrook (S)	W10	50.8	51.3	50.2	51.4	52.3	51.3
Cuballing (S)	W12	49.5	50.8	50.4	52.2	49.8	50.5
Cue (S)	W04	48.5	47.3	47.6	47.6	47.7	47.9
Cunderdin (S)	W11	50.8	53.3	50.9	53.5	49.5	51.7
Dalwallinu (S)	W11	49.7	52.4	49.9	51.2	49.8	50.6
Dandaragan (S)	W14	50.8	51.4	51.6	53.6	51.6	52.1
Dardanup (S)	W17	44.9	50.5	48.0	46.3	47.9	46.9
Denmark (S)	W10	48.1	48.4	48.3	48.0	51.2	49.1
Donnybrook-Balingup (S)	W17	51.2	54.0	51.7	54.1	55.9	54.1
Dowerin (S)	W11	51.8	52.9	52.6	52.6	51.5	52.3
Dumbleyung (S)	W12	48.4	52.3	49.9	51.1	50.2	50.6
Dundas (S)	W20	46.9	49.6	49.0	50.2	49.2	49.1
Esperance (S)	W20	49.7	51.9	52.5	50.5	50.9	51.0
Exmouth (S)	W05	na	46.1	na	50.0	55.0	48.9

Table 3.13.4 (cont.). Average CV(H) (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average CV(H) for each shire

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Gingin (S)	W14	47.2	51.2	50.8	52.1	50.2	50.4
Gnowangerup (S)	W09	51.7	53.6	51.0	51.5	51.5	51.9
Goomalling (S)	W11	49.7	52.8	52.1	52.4	49.8	51.1
Greenough (S)	W06	49.6	51.7	51.3	51.8	50.7	51.1
Harvey (S)	W17	51.0	43.6	na	52.2	54.1	51.4
Irwin (S)	W06	51.3	52.3	51.8	50.6	50.7	51.3
Jerramungup (S)	W09	50.3	52.1	49.9	51.7	51.7	51.3
Kalgoorlie/Boulder (C)	W19	46.8	48.5	49.5	48.3	47.1	47.9
Katanning (S)	W09	51.2	51.9	50.6	51.4	51.7	51.4
Kellerberrin (S)	W07	50.6	53.8	51.8	54.1	50.5	52.3
Kent (S)	W09	50.1	53.2	52.5	52.6	52.9	52.4
Kojonup (S)	W09	50.8	52.2	51.0	51.8	52.2	51.7
Kondinin (S)	W08	50.5	51.7	50.1	52.0	50.0	51.0
Koorda (S)	W11	51.2	50.2	51.1	53.0	49.8	51.1
Kulin (S)	W08	50.7	53.2	52.7	52.6	50.0	51.5
Lake Grace (S)	W08	49.8	52.3	50.8	51.1	50.4	50.9
Laverton (S)	W19	51.8	52.6	na	48.4	50.9	51.2
Leonora (S)	W19	47.9	47.6	49.5	47.0	46.3	47.4
Manjimup (S)	W13	50.5	51.4	52.0	54.5	53.3	52.1
Meekatharra (S)	W04	50.3	48.0	48.5	49.1	48.0	49.1
Menzies (S)	W19	48.8	49.6	51.3	47.6	47.5	48.6
Merredin (S)	W07	50.0	52.7	50.4	52.6	51.0	51.7
Mingenew (S)	W06	49.7	51.2	50.1	52.1	50.8	51.0
Moora (S)	W14	50.7	52.6	50.2	52.7	50.5	51.5
Morawa (S)	W06	48.7	51.5	52.0	51.3	49.0	50.1
Mount Magnet (S)	W04	46.5	50.0	54.4	51.6	48.8	49.7
Mount Marshall (S)	W07	50.6	52.2	51.8	52.9	50.1	51.5
Mukinbudin (S)	W07	49.4	51.3	50.2	51.9	50.4	50.8
Mullewa (S)	W06	52.2	51.5	53.3	52.0	50.3	51.7
Mundaring (S)	W15	50.4	54.6	50.8	52.0	47.3	50.6
Murchison (S)	W04	47.7	46.3	na	47.5	49.1	47.7
Murray (S)	W16	53.2	49.5	53.0	55.5	52.4	52.5
Nannup (S)	W13	48.0	50.1	na	57.7	58.3	53.8
Narembeen (S)	W07	51.8	53.7	50.8	54.3	51.0	52.7
Narrogin (S)	W12	49.7	51.0	51.8	52.9	51.9	51.5

Table 3.13.4 (cont.). Average CV(H) (%) for individual shires for five selling years between July 1989 and June 1994, and the five-year average CV(H) for each shire

Shire	WSA	89/90	90/91	91/92	92/93	93/94	Average year
Northam (S)	W11	49.6	53.1	53.5	53.7	50.5	52.1
Northampton (S)	W06	50.3	51.5	50.9	50.3	49.9	50.5
Nungarin (S)	W07	49.1	50.8	48.9	51.2	48.5	49.7
Perenjori (S)	W06	50.9	51.7	50.1	52.5	50.3	51.1
Pingelly (S)	W12	51.3	53.1	49.9	52.3	50.3	51.4
Plantagenet (S)	W10	52.1	52.0	51.7	52.5	53.4	52.5
Port Hedland (T)	W02	54.1	na	55.0	52.1	57.8	55.1
Quairading (S)	W11	49.2	53.4	51.3	52.8	49.9	51.4
Ravensthorpe (S)	W20	49.6	52.0	50.2	50.0	49.8	50.3
Roebourne (S)	W03	54.1	52.8	51.9	51.8	55.5	53.6
Sandstone (S)	W04	47.6	50.0	54.8	46.6	50.3	49.5
Serpentine-Jarrahdale (S)	W15	51.5	52.1	46.9	48.8	49.3	49.3
Shark Bay (S)	W05	49.9	50.3	51.5	49.7	49.5	50.2
Swan (S)	W15	51.0	50.3	50.5	50.6	50.3	50.5
Tambellup (S)	W09	50.3	51.8	50.1	50.9	52.5	51.4
Tammin (S)	W11	48.5	52.0	52.2	52.8	49.6	51.0
Three Springs (S)	W06	51.0	51.7	51.7	53.0	50.4	51.5
Toodyay (S)	W11	52.3	53.8	56.1	51.3	51.2	52.4
Trayning (S)	W07	49.9	54.3	49.1	52.9	50.4	51.2
Upper Gascoyne (S)	W05	50.3	49.7	58.6	50.7	48.6	50.2
Victoria Plains (S)	W14	49.7	51.3	50.8	51.4	51.1	51.0
Wagin (S)	W12	50.4	51.7	49.7	51.7	51.9	51.3
Wandering (S)	W12	51.0	49.6	51.0	51.5	50.5	50.9
Waroona (S)	W16	48.9	48.9	52.0	na	51.8	50.0
West Arthur (S)	W12	49.8	51.9	50.4	50.4	50.7	50.6
Westonia (S)	W07	52.8	54.6	50.6	52.2	49.5	51.4
Wickepin (S)	W12	48.7	51.4	51.0	51.2	50.5	50.6
Williams (S)	W12	50.2	52.4	51.8	53.1	52.1	52.0
Wiluna (S)	W04	48.1	46.1	48.2	48.2	46.3	47.4
Wongan-Ballidu (S)	W11	51.4	52.4	50.6	51.1	49.9	51.0
Woodanilling (S)	W09	49.3	50.2	47.9	50.6	50.7	50.1
Wyalkatchem (S)	W11	49.6	52.5	50.4	51.7	49.9	50.7
Yalgoo (S)	W04	48.9	48.9	51.8	51.2	50.5	50.2
Yilgarn (S)	W07	49.2	53.7	49.5	53.4	49.1	51.2
York (S)	W11	50.2	52.6	54.1	52.1	50.7	51.6

### 3.13.3 Seasonal changes in average CV(H) by shire

The analysis of variance in CV(H) showed that the season effect (within a year) is highly significant in explaining differences in CV(H). These differences are shown on a monthly basis for all matched merino combing fleece offered in Fremantle over a five-year period (Table 3.13.5).

**Table 3.13.5. Average CV(H) for Western Australia over the period July 1989 and June 1994. Results show the long-term average, and the monthly average CV(H). Results are for all merino combing fleece sale lots sold at auction in Fremantle**

Period	CV(H) (%)
5-year average	51.17
January	51.39
February	50.69
March	48.76
April	47.80
May	47.90
June	48.21
July	49.43
August	50.92
September	52.64
October	54.06
November	54.44
December	53.46

To reduce the volume of information being presented in the following tables, the 12 months were condensed into four seasons:

Months 1, 2 & 3 = Q1  
 Months 4, 5 & 6 = Q2  
 Months 7, 8 & 9 = Q3  
 Months 10, 11 & 12 = Q4



**Table 3.13.6. Average CV(H) (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average CV(H) for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Albany (S)	W10	49.3	48.3	51.1	54.6	51.2
Ashburton (S)	W03	50.8	54.0	58.0	56.6	56.2
Augusta-Margaret River (S)	W18	53.2	46.4	49.8	53.8	50.9
Beverley (S)	W11	51.3	48.3	51.3	53.1	51.4
Boddington (S)	W12	50.1	49.7	51.3	53.9	51.4
Boyup Brook (S)	W13	50.4	49.3	52.0	54.9	51.8
Bridgetown-Greenbushes (S)	W13	51.5	49.7	51.2	54.1	52.4
Brookton (S)	W12	50.8	48.5	51.3	52.3	51.2
Broomehill (S)	W09	48.4	47.5	50.7	55.5	50.5
Bruce Rock (S)	W07	50.2	48.9	52.8	54.5	52.0
Busselton (S)	W18	53.7	54.2	51.3	52.3	52.8
Capel (S)	W17	55.1	46.8	42.3	53.5	51.9
Carnamah (S)	W06	51.1	48.4	50.6	53.6	51.0
Carnarvon (S)	W05	50.9	48.9	49.6	52.3	50.1
Chapman Valley (S)	W06	49.5	48.3	51.3	53.2	51.1
Chittering (S)	W14	49.1	51.2	49.0	54.0	50.2
Collie (S)	W17	53.6	47.1	48.7	54.9	53.8
Coolgardie (S)	W19	46.8	45.5	44.9	48.8	46.4
Coorow (S)	W06	51.0	47.8	51.5	54.0	51.8
Corrigin (S)	W08	50.6	47.7	51.5	53.3	51.1
Cranbrook (S)	W10	49.3	45.6	50.7	54.8	51.3
Cuballing (S)	W12	50.6	47.9	50.7	52.7	50.5
Cue (S)	W04	48.1	47.1	50.8	55.5	47.9
Cunderdin (S)	W11	50.6	49.1	52.6	52.6	51.7
Dalwallinu (S)	W11	50.5	47.7	50.6	52.9	50.6
Dandaragan (S)	W14	51.4	47.6	51.3	54.3	52.1
Dardanup (S)	W17	47.3	47.6	45.0	40.0	46.9
Denmark (S)	W10	50.1	47.2	44.5	51.2	49.1
Donnybrook-Balingup (S)	W17	53.9	53.3	51.1	55.7	54.1
Dowerin (S)	W11	52.1	50.6	52.0	53.2	52.3
Dumbleyung (S)	W12	49.4	46.9	52.2	53.1	50.6
Dundas (S)	W20	47.7	45.7	52.0	51.0	49.1
Esperance (S)	W20	49.3	47.8	52.9	54.1	51.0
Exmouth (S)	W05	na	46.1	52.1	na	48.9

**Table 3.13.6 (cont.). Average CV(H) (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average CV(H) for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Gingin (S)	W14	49.3	47.0	50.1	53.2	50.4
Gnowangerup (S)	W09	48.7	47.9	53.3	55.4	51.9
Goomalling (S)	W11	50.2	47.5	51.9	53.7	51.1
Greenough (S)	W06	51.0	47.2	50.4	53.3	51.1
Harvey (S)	W17	50.1	42.9	54.3	51.2	51.4
Irwin (S)	W06	49.5	46.0	51.0	53.8	51.3
Jerramungup (S)	W09	49.7	47.0	53.7	55.0	51.3
Kalgoorlie/Boulder (C)	W19	47.7	47.1	48.8	50.6	47.9
Katanning (S)	W09	50.6	47.8	52.1	54.0	51.4
Kellerberrin (S)	W07	51.1	50.1	52.7	53.7	52.3
Kent (S)	W09	49.1	48.0	53.3	55.6	52.4
Kojonup (S)	W09	51.0	48.5	50.7	55.2	51.7
Kondinin (S)	W08	48.7	48.5	52.2	54.2	51.0
Koorda (S)	W11	51.1	48.4	50.8	53.5	51.1
Kulin (S)	W08	50.0	46.7	52.4	53.6	51.5
Lake Grace (S)	W08	47.4	47.5	52.4	54.7	50.9
Laverton (S)	W19	50.8	52.1	48.4	na	51.2
Leonora (S)	W19	48.0	46.9	49.4	51.2	47.4
Manjimup (S)	W13	52.7	48.1	49.3	53.8	52.1
Meekatharra (S)	W04	49.8	47.6	52.1	49.7	49.1
Menzies (S)	W19	50.2	47.3	49.4	51.8	48.6
Merredin (S)	W07	49.8	48.1	51.9	53.8	51.7
Mingenew (S)	W06	49.2	47.2	51.4	53.0	51.0
Moora (S)	W14	50.4	48.4	51.4	54.1	51.5
Morawa (S)	W06	49.3	47.9	50.1	53.3	50.1
Mount Magnet (S)	W04	50.4	47.5	48.7	51.6	49.7
Mount Marshall (S)	W07	50.7	47.7	51.6	54.1	51.5
Mukinbudin (S)	W07	49.6	48.2	52.0	52.5	50.8
Mullewa (S)	W06	51.6	48.4	50.9	54.0	51.7
Mundaring (S)	W15	57.0	45.6	50.0	52.2	50.6
Murchison (S)	W04	na	47.3	50.3	na	47.7
Murray (S)	W16	52.2	45.3	53.4	54.0	52.5
Nannup (S)	W13	51.7	50.4	na	58.4	53.8
Narembreen (S)	W07	49.3	50.4	53.2	54.8	52.7
Narrogin (S)	W12	51.0	48.7	51.9	53.3	51.5

**Table 3.13.6 (cont.). Average CV(H) (%) for individual shires in each quarter between July 1989 and June 1994, and the five-year average CV(H) for each shire**

Shire	WSA	Q1	Q2	Q3	Q4	Average year
Northam (S)	W11	52.1	50.0	51.4	54.5	52.1
Northampton (S)	W06	49.4	48.1	50.2	53.1	50.5
Nungarin (S)	W07	48.0	48.6	49.8	51.4	49.7
Perenjori (S)	W06	49.2	48.5	51.5	54.2	51.1
Pingelly (S)	W12	50.9	48.2	51.4	54.3	51.4
Plantagenet (S)	W10	51.5	48.9	51.9	55.1	52.5
Port Hedland (T)	W02	na	54.1	55.8	55.1	55.1
Quairading (S)	W11	50.5	48.5	51.4	53.1	51.4
Ravensthorpe (S)	W20	48.0	46.9	52.9	53.3	50.3
Roebourne (S)	W03	57.9	50.5	54.9	58.3	53.6
Sandstone (S)	W04	49.4	48.9	52.8	54.2	49.5
Serpentine-Jarrahdale (S)	W15	49.4	47.8	53.7	55.0	49.3
Shark Bay (S)	W05	49.8	54.1	50.9	55.0	50.2
Swan (S)	W15	50.4	50.2	50.7	50.5	50.5
Tambellup (S)	W09	49.7	47.8	51.3	55.1	51.4
Tammin (S)	W11	48.9	49.1	51.7	52.8	51.0
Three Springs (S)	W06	49.2	48.5	51.4	54.4	51.5
Toodyay (S)	W11	51.8	48.0	50.1	54.2	52.4
Trayning (S)	W07	50.8	48.3	51.5	53.0	51.2
Upper Gascoyne (S)	W05	51.2	48.0	51.0	52.6	50.2
Victoria Plains (S)	W14	50.1	49.0	51.2	53.0	51.0
Wagin (S)	W12	50.5	48.1	51.8	54.7	51.3
Wandering (S)	W12	50.2	49.4	49.8	54.0	50.9
Waroona (S)	W16	52.8	47.0	47.5	52.1	50.0
West Arthur (S)	W12	49.0	48.8	51.8	54.3	50.6
Westonia (S)	W07	49.5	48.6	50.8	55.5	51.4
Wickepin (S)	W12	48.3	47.1	52.2	54.0	50.6
Williams (S)	W12	50.7	48.6	51.3	54.4	52.0
Wiluna (S)	W04	47.6	46.9	49.6	na	47.4
Wongan-Ballidu (S)	W11	50.7	49.5	50.9	52.7	51.0
Woodanilling (S)	W09	49.2	47.0	51.7	55.3	50.1
Wyalkatchem (S)	W11	51.2	49.8	50.5	51.8	50.7
Yalgoo (S)	W04	50.2	47.2	52.6	55.0	50.2
Yilgarn (S)	W07	48.7	48.2	52.0	53.6	51.2
York (S)	W11	51.1	50.2	51.0	52.3	51.6

#### 4. Conclusion

The tabulation and mapping of the Western Australian wool characteristics has been completed for the period June 1989 to July 1994.

The analysis was designed to quantify the average specifications, and the changes to these specifications over time and between regions. The analyses showed that the behaviour of the individual characteristics differed over time and between regions, and generalisations were therefore difficult across characteristics.

During the period of the analysis, the total wool production for the State fell significantly. It has been assumed that the reduction in wool production was not the cause for changes in the individual characteristics. However, if the reduction in wool production was not evenly distributed across all types of sheep (such as ewe flocks, wether flocks and weaners and lambs), this assumption would need to be re-evaluated. In addition, there may have been changes in the average results due to the large increases in the adoption of the staple measurements during this period, and these also may be correlated with the type of wool being tested.

The design of the analyses also assumed that there was no underlying trend in the data being analysed. So no attempt was made, for example, to identify long-term changes in fibre diameter or staple strength. This type of analysis would need annual effects (as short term cyclical or seasonal effects) and other irregularities (or background noise) to be removed before trend information could be identified. It was assumed that an extended period would be needed for such an analysis.

No attempt has been made to explain the biology or the economic rationalisation which gave rise to these changes. The biology referred to is not only at the individual sheep level, but would include flock and property responses within regions. Hence the biology would need to be interacted with the resource capability of the properties to understand the changes being described. Economic analyses over this period would also need to incorporate elements of the wool producers' expectations about the future of the wool industry as the Minimum Reserve Price Scheme was removed in the middle of the period being analysed.

Furthermore, no attempt has been made to prepare and analyse detailed correlations between these changes in characteristics, because without specific relationships to analyse, such work would generate large amounts of redundant information. However, initial divisions of the wool production on a diameter classification were attempted to explore the quality of information that was available. The results showed regional differences in the correlated staple strength and hauteur results for these diameter categories. These examples suggest two possibilities: (a) where these relationships are expected to exist, the use of the average result needs to be handled with care, and (b) the data would support further analysis based on classifications such as diameter class.

### Potential applications

The information generated in this report also has application for individual producers or regional groups of wool producers. The results allow producers to compare their production to the average for the region, and for the season of production. They can also use the information from neighbouring regions or from the State for extended comparisons. So while their result may be satisfactory for the shire, comparisons over a wider group may indicate a different level being achieved by other groups. However, it must be emphasised that these results do not represent benchmarks which generally concentrate on the top levels of performance.

The analyses showed the relative importance of the shire and WSA in explaining the differences for single characteristics. If the shire exceeded the WSA in relative importance, then presumably localised effects may be the cause of these differences. If the WSA was more important, then the cause is wider than shire and presumably covers a number of neighbouring shires.

Similarly the changes over time (monthly or annual differences) can be used to identify if the effect is seasonal, or is dependent on the year being described. If the major effect is monthly, then it is assumed the effect will be repeated across years (as the analysis nested month within year). If the effect was heavily modified by year, then the cause is not appearing regularly, but irregularly on a yearly basis. Further analysis of some of these causes of effects may yield useful information.

**Appendix 1.**

A list of WA shires and their respective wool selling area (WSA) sorted by WSA. The shire number relates these shires to Map A1 at the end of this section.

WA Shire	Shire number	WSA
Broome (S)	1	W01
Derby-West Kimberley (S)	2	W01
Halls Creek (S)	3	W01
Wyndham-East Kimberley (S)	4	W01
East Pilbara (S)	5	W02
Port Hedland (T)	6	W02
Ashburton (S)	7	W03
Roebourne (S)	8	W03
Cue (S)	9	W04
Meekatharra (S)	10	W04
Mount Magnet (S)	11	W04
Murchison (S)	12	W04
Sandstone (S)	13	W04
Wiluna (S)	14	W04
Yalgoo (S)	15	W04
Carnarvon (S)	16	W05
Exmouth (S)	17	W05
Shark Bay (S)	18	W05
Upper Gascoyne (S)	19	W05
Carnamah (S)	20	W06
Chapman Valley (S)	21	W06
Coorow (S)	22	W06
Geraldton (C)		W06
Greenough (S)	23	W06
Irwin (S)	24	W06
Mingenew (S)	25	W06
Morawa (S)	26	W06
Mullewa (S)	27	W06
Northampton (S)	28	W06
Perenjori (S)	29	W06
Three Springs (S)	30	W06

A list of WA shires and their respective wool selling area (WSA) sorted by WSA. The shire number relates these shires to Map A1 (cont.).

WA Shire	Shire number	WSA
Bruce Rock (S)	31	W07
Kellerberrin (S)	32	W07
Merredin (S)	33	W07
Mount Marshall (S)	34	W07
Mukinbudin (S)	35	W07
Narembeen (S)	36	W07
Nungarin (S)	37	W07
Trayning (S)	38	W07
Westonia (S)	39	W07
Yilgarn (S)	40	W07
Corrigin (S)	41	W08
Kondinin (S)	42	W08
Kulin (S)	43	W08
Lake Grace (S)	44	W08
Broomehill (S)	45	W09
Gnowangerup (S)	46	W09
Jerramungup (S)	47	W09
Katanning (S)	48	W09
Kent (S)	49	W09
Kojonup (S)	50	W09
Tambellup (S)	51	W09
Woodanilling (S)	52	W09
Albany (S)	53	W10
Albany (T)		W10
Cranbrook (S)	54	W10
Denmark (S)	55	W10
Plantagenet (S)	56	W10

A list of WA shires and their respective wool selling area (WSA) sorted by WSA. The shire number relates these shires to Map A1 (cont.).

WA Shire	Shire number	WSA
Beverley (S)	57	W11
Cunderdin (S)	58	W11
Dalwallinu (S)	59	W11
Dowerin (S)	60	W11
Goomalling (S)	61	W11
Koorda (S)	62	W11
Northam (S)	63	W11
Northam (T)		W11
Quairading (S)	64	W11
Tammin (S)	65	W11
Toodyay (S)	66	W11
Wongan-Ballidu (S)	67	W11
Wyalkatchem (S)	68	W11
York (S)	69	W11
Boddington (S)	70	W12
Brookton (S)	71	W12
Cuballing (S)	72	W12
Dumbleyung (S)	73	W12
Narrogin (S)	74	W12
Narrogin (T)		W12
Pingelly (S)	75	W12
Wagin (S)	76	W12
Wandering (S)	77	W12
West Arthur (S)	78	W12
Wickepin (S)	79	W12
Williams (S)	80	W12
Boyup Brook (S)	81	W13
Bridgetown-Greenbushes (S)	82	W13
Manjimup (S)	83	W13
Nannup (S)	84	W13
Chittering (S)	85	W14
Dandaragan (S)	86	W14
Gingin (S)	87	W14
Moora (S)	88	W14
Victoria Plains (S)	89	W14



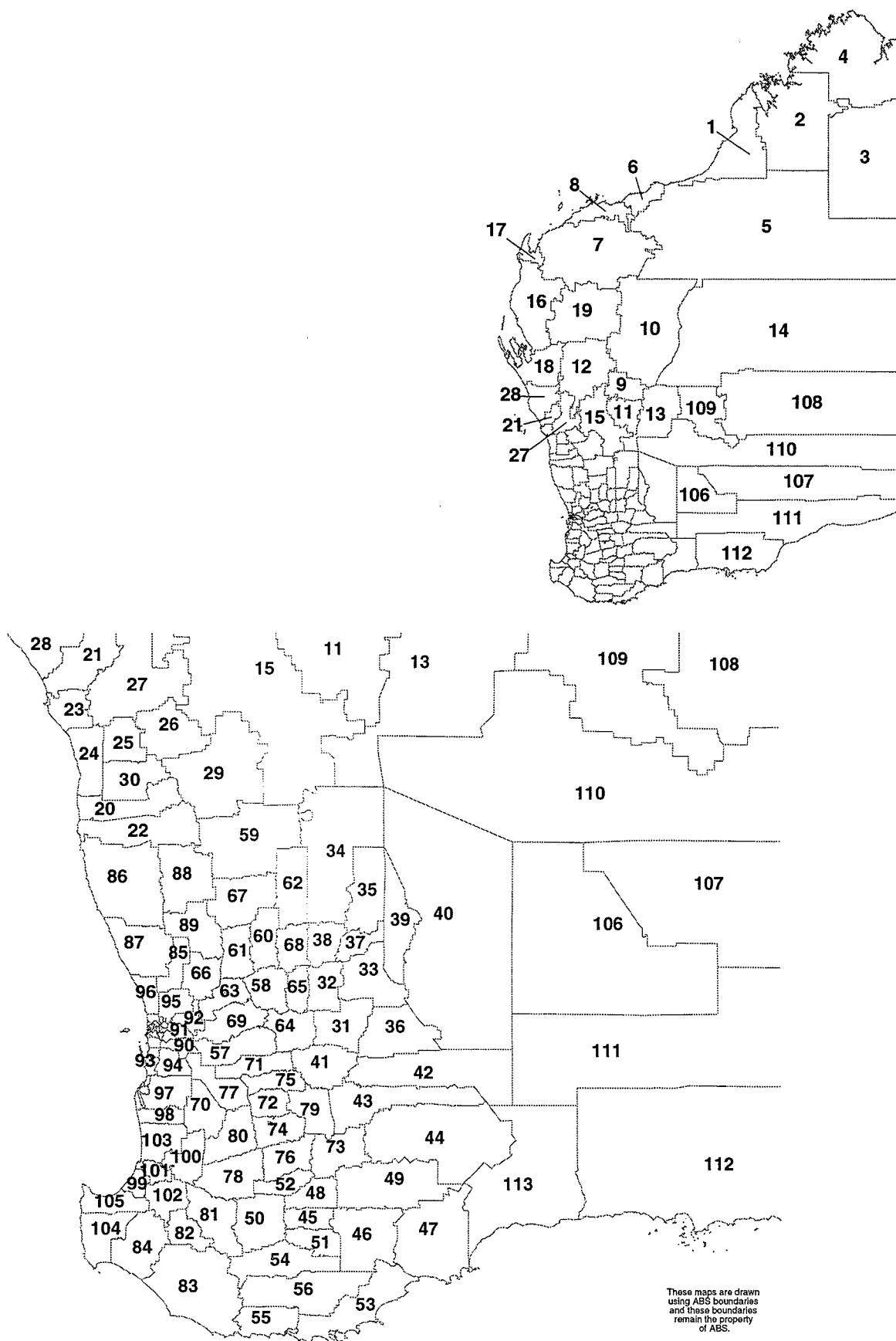
A list of WA shires and their respective wool selling area (WSA) sorted by WSA. The shire number relates these shires to Map A1 (cont.).

WA Shire	Shire number	WSA
Armadale (C)	90	W15
Bassendean (T)		W15
Bayswater (C)		W15
Belmont (C)		W15
Canning (C)		W15
Claremont (T)		W15
Cockburn (C)		W15
Cottesloe (T)		W15
East Fremantle (T)		W15
Fremantle (C)		W15
Gosnells (C)		W15
Kalamunda (S)	91	W15
Kwinana (T)		W15
Melville (C)		W15
Mosman Park (T)		W15
Mundaring (S)	92	W15
Nedlands (C)		W15
Peppermint Grove (S)		W15
Perth (C)		W15
Rockingham (C)	93	W15
Serpentine-Jarrahdale (S)	94	W15
South Perth (C)		W15
Stirling (C)		W15
Subiaco (C)		W15
Swan (S)	95	W15
Wanneroo (C)	96	W15
Mandurah (C)		W16
Murray (S)	97	W16
Waroona (S)	98	W16
Bunbury (C)		W17
Capel (S)	99	W17
Collie (S)	100	W17
Dardanup (S)	101	W17
Donnybrook-Balingup (S)	102	W17
Harvey (S)	103	W17

A list of WA shires and their respective wool selling area (WSA) sorted by WSA. The shire number relates these shires to Map A1 (cont.).

WA Shire	Shire number	WSA
Augusta-Margaret River (S)	104	W18
Busselton (S)	105	W18
Coolgardie (S)	106	W19
Kalgoorlie/Boulder (C)	107	W19
Laverton (S)	108	W19
Leonora (S)	109	W19
Menzies (S)	110	W19
Dundas (S)	111	W20
Esperance (S)	112	W20
Ravensthorpe (S)	113	W20

**Map A1** Maps of Western Australia showing the WA shires and their boundaries. The lower map is an expansion of the boxed section defined in Map 1 (page 3).



**Appendix 2.**

**Number of brands used in the analyses by year by shire. Where small numbers of brands have been matched to shire the averages will have lower precision.**

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Albany (S)	W10	254	268	236	220	202
Ashburton (S)	W03	6	6	6	4	6
Augusta-Margaret River (S)	W18	39	48	43	35	33
Beverley (S)	W11	115	124	110	98	95
Boddington (S)	W12	50	51	48	46	43
Boyup Brook (S)	W13	187	201	196	198	182
Bridgetown-Greenbushes (S)	W13	77	83	74	65	66
Brookton (S)	W12	72	82	80	75	73
Broomehill (S)	W09	65	67	63	61	57
Bruce Rock (S)	W07	93	101	92	86	86
Busselton (S)	W18	35	49	40	31	29
Capel (S)	W17	8	10	5	4	4
Carnamah (S)	W06	77	82	78	67	61
Carnarvon (S)	W05	42	42	39	39	38
Chapman Valley (S)	W06	79	88	77	66	66
Chittering (S)	W14	31	34	27	27	20
Collie (S)	W17	23	23	21	21	21
Coolgardie (S)	W19	4	5	5	4	5
Coorow (S)	W06	60	66	58	46	49
Corrigin (S)	W08	87	100	87	80	77
Cranbrook (S)	W10	154	159	154	152	147
Cuballing (S)	W12	59	63	61	54	50
Cue (S)	W04	11	12	11	9	11
Cunderdin (S)	W11	87	92	82	73	76
Dalwallinu (S)	W11	130	127	115	105	100
Dandaragan (S)	W14	124	131	132	130	114
Dardanup (S)	W17	7	7	5	5	2
Denmark (S)	W10	53	53	40	34	28
Donnybrook-Balingup (S)	W17	53	56	55	43	46
Dowerin (S)	W11	91	90	74	72	65
Dumbleyung (S)	W12	99	107	107	91	86
Dundas (S)	W20	49	50	50	49	44
Esperance (S)	W20	388	414	405	375	359
Exmouth (S)	W05	2	2	1	2	1

Number of brands used in the analyses by year by shire. Where small numbers of brands have been matched to shire the averages will have lower precision (cont.).

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Gingin (S)	W14	51	71	60	48	49
Gnowangerup (S)	W09	182	184	180	164	159
Goomalling (S)	W11	84	88	90	79	77
Greenough (S)	W06	74	84	71	72	62
Harvey (S)	W17	15	14	12	12	12
Irwin (S)	W06	26	28	25	26	22
Jerramungup (S)	W09	142	142	132	135	127
Kalgoorlie/Boulder (C)	W19	12	11	12	11	12
Katanning (S)	W09	91	91	96	82	84
Kellerberrin (S)	W07	74	80	76	71	70
Kent (S)	W09	82	84	83	71	71
Kojonup (S)	W09	231	247	245	226	217
Kondinin (S)	W08	116	120	116	113	104
Koorda (S)	W11	59	54	59	48	46
Kulin (S)	W08	113	119	107	101	101
Lake Grace (S)	W08	217	225	218	202	212
Laverton (S)	W19	3	4	1	4	4
Leonora (S)	W19	21	22	19	21	20
Manjimup (S)	W13	76	73	60	54	46
Meekatharra (S)	W04	18	18	13	16	13
Menzies (S)	W19	7	9	6	8	7
Merredin (S)	W07	118	119	113	103	94
Mingenew (S)	W06	48	52	43	44	44
Moora (S)	W14	145	147	142	135	125
Morawa (S)	W06	63	75	56	55	54
Mount Magnet (S)	W04	15	14	11	15	13
Mount Marshall (S)	W07	88	81	83	73	67
Mukinbudin (S)	W07	58	61	56	53	45
Mullewa (S)	W06	76	74	67	66	53
Mundaring (S)	W15	16	22	18	15	17
Murchison (S)	W04	1	1	0	1	1
Murray (S)	W16	22	32	21	18	15
Nannup (S)	W13	5	8	6	3	3
Narembeen (S)	W07	98	105	98	96	87
Narrogin (S)	W12	92	104	96	88	86

Number of brands used in the analyses by year by shire. Where small numbers of brands have been matched to shire the averages will have lower precision (cont.).

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Northam (S)	W11	116	124	116	104	101
Northampton (S)	W06	104	127	122	107	109
Nungarin (S)	W07	22	28	31	26	25
Perenjori (S)	W06	68	69	70	63	61
Pingelly (S)	W12	66	74	69	69	70
Plantagenet (S)	W10	348	360	313	279	274
Port Hedland (T)	W02	3	2	3	2	2
Quairading (S)	W11	68	75	68	64	56
Ravensthorpe (S)	W20	177	188	181	171	161
Roebourne (S)	W03	6	5	6	5	6
Sandstone (S)	W04	15	14	13	13	14
Serpentine-Jarrahdale (S)	W15	9	17	12	11	11
Shark Bay (S)	W05	7	7	7	7	7
Swan (S)	W15	42	58	45	31	33
Tambellup (S)	W09	86	92	86	81	83
Tammin (S)	W11	52	50	49	47	45
Three Springs (S)	W06	49	49	48	48	43
Toodyay (S)	W11	55	64	59	60	50
Trayning (S)	W07	37	42	39	38	37
Upper Gascoyne (S)	W05	9	9	7	9	9
Victoria Plains (S)	W14	105	112	103	92	90
Wagin (S)	W12	118	121	120	110	110
Wandering (S)	W12	45	47	44	42	44
Waroona (S)	W16	10	11	8	8	7
West Arthur (S)	W12	124	123	123	117	117
Westonia (S)	W07	35	37	35	31	31
Wickepin (S)	W12	121	122	112	94	96
Williams (S)	W12	116	128	123	105	104
Wiluna (S)	W04	12	12	5	10	9
Wongan-Ballidu (S)	W11	95	101	94	86	93
Woodanilling (S)	W09	46	46	41	39	34
Wyalkatchem (S)	W11	44	43	44	42	43
Yalgoo (S)	W04	18	17	17	19	20
Yilgarn (S)	W07	91	91	91	89	90
York (S)	W11	102	109	102	101	98

**Appendix 3.**

Number of sale lots with core measurements by year by shire. Where small numbers exist, the averages derived for core measurements will have lower precision.

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Albany (S)	W10	1481	1789	1482	1684	1395
Ashburton (S)	W03	55	48	84	78	81
Augusta-Margaret River (S)	W18	131	195	155	121	112
Beverley (S)	W11	620	852	823	713	751
Boddington (S)	W12	330	493	571	487	445
Boyup Brook (S)	W13	1264	1698	1939	1899	1593
Bridgetown-Greenbushes (S)	W13	255	319	318	225	236
Brookton (S)	W12	347	544	546	556	461
Broomehill (S)	W09	497	644	602	559	602
Bruce Rock (S)	W07	600	725	755	677	578
Busselton (S)	W18	117	205	158	164	126
Capel (S)	W17	32	37	31	22	15
Carnamah (S)	W06	367	523	578	476	404
Carnarvon (S)	W05	655	650	573	712	602
Chapman Valley (S)	W06	429	529	617	451	426
Chittering (S)	W14	90	122	141	107	93
Collie (S)	W17	132	149	157	163	123
Coolgardie (S)	W19	84	74	51	54	80
Coorow (S)	W06	259	336	299	283	271
Corrigin (S)	W08	474	632	593	552	487
Cranbrook (S)	W10	1300	1405	1420	1509	1382
Cuballing (S)	W12	323	436	457	364	384
Cue (S)	W04	130	127	95	106	127
Cunderdin (S)	W11	398	507	468	394	421
Dalwallinu (S)	W11	578	683	682	573	594
Dandaragan (S)	W14	972	1166	1364	1341	1288
Dardanup (S)	W17	55	60	51	46	47
Denmark (S)	W10	163	171	121	137	122
Donnybrook-Balingup (S)	W17	133	182	179	139	181
Dowerin (S)	W11	440	464	363	343	315
Dumbleyung (S)	W12	630	778	798	730	734
Dundas (S)	W20	281	320	335	360	320
Esperance (S)	W20	3245	3979	4048	3774	3413
Exmouth (S)	W05	18	40	26	26	4

Number of sale lots with core measurements by year by shire. Where small numbers exist, the averages derived for core measurements will have lower precision (cont.).

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Gingin (S)	W14	243	323	310	250	207
Gnowangerup (S)	W09	1391	1411	1565	1274	1358
Goomalling (S)	W11	400	455	523	453	431
Greenough (S)	W06	322	464	486	470	323
Harvey (S)	W17	38	50	43	38	23
Irwin (S)	W06	194	234	287	235	190
Jerramungup (S)	W09	964	1129	1189	1167	1086
Kalgoorlie/Boulder (C)	W19	224	214	221	235	267
Katanning (S)	W09	650	746	848	591	699
Kellerberrin (S)	W07	337	438	407	413	336
Kent (S)	W09	437	622	644	528	568
Kojonup (S)	W09	2035	2392	2515	2206	2233
Kondinin (S)	W08	583	827	785	690	640
Koorda (S)	W11	275	280	284	303	280
Kulin (S)	W08	663	798	800	762	702
Lake Grace (S)	W08	1120	1540	1729	1524	1522
Laverton (S)	W19	38	31	4	28	19
Leonora (S)	W19	292	214	135	222	239
Manjimup (S)	W13	251	306	231	210	190
Meekatharra (S)	W04	188	170	101	216	140
Menzies (S)	W19	93	73	52	83	63
Merredin (S)	W07	492	615	610	518	468
Mingenew (S)	W06	326	425	406	338	335
Moora (S)	W14	1001	1093	1091	1112	1007
Morawa (S)	W06	293	415	342	311	271
Mount Magnet (S)	W04	144	155	132	215	235
Mount Marshall (S)	W07	451	417	469	473	435
Mukinbudin (S)	W07	210	302	308	268	217
Mullewa (S)	W06	314	433	475	408	360
Mundaring (S)	W15	36	53	37	30	72
Murchison (S)	W04	18	21	0	35	24
Murray (S)	W16	51	90	65	64	40
Nannup (S)	W13	12	29	21	10	13
Narembeen (S)	W07	519	591	593	638	461
Narrogin (S)	W12	589	636	651	675	663



Number of sale lots with core measurements by year by shire. Where small numbers exist, the averages derived for core measurements will have lower precision (cont.).

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Northam (S)	W11	461	605	524	501	464
Northampton (S)	W06	580	805	863	715	649
Nungarin (S)	W07	90	119	142	109	86
Perenjori (S)	W06	297	350	363	331	318
Pingelly (S)	W12	355	633	607	565	569
Plantagenet (S)	W10	2242	2701	2374	2251	2227
Port Hedland (T)	W02	17	8	12	7	9
Quairading (S)	W11	384	474	478	435	375
Ravensthorpe (S)	W20	1214	1495	1496	1563	1413
Roebourne (S)	W03	115	69	103	77	114
Sandstone (S)	W04	95	98	86	65	82
Serpentine-Jarrahdale (S)	W15	43	77	78	83	88
Shark Bay (S)	W05	51	59	105	101	73
Swan (S)	W15	128	184	150	94	92
Tambellup (S)	W09	732	782	870	824	875
Tammin (S)	W11	304	329	275	293	273
Three Springs (S)	W06	256	334	355	346	267
Toodyay (S)	W11	247	324	344	341	241
Trayning (S)	W07	133	191	189	168	177
Upper Gascoyne (S)	W05	111	108	85	122	115
Victoria Plains (S)	W14	630	829	830	886	700
Wagin (S)	W12	768	900	1097	937	1012
Wandering (S)	W12	339	480	499	450	396
Waroon (S)	W16	31	53	20	17	13
West Arthur (S)	W12	952	1223	1451	1391	1406
Westonia (S)	W07	208	227	269	257	195
Wickepin (S)	W12	752	862	854	775	809
Williams (S)	W12	848	1093	1220	1172	1179
Wiluna (S)	W04	104	97	48	110	74
Wongan-Ballidu (S)	W11	479	601	621	535	503
Woodanilling (S)	W09	332	350	315	273	341
Wyalkatchem (S)	W11	210	213	205	195	198
Yalgoo (S)	W04	228	219	212	271	331
Yilgarn (S)	W07	436	504	576	505	470
York (S)	W11	513	654	682	642	524

**Appendix 4.**

**Number of sale lots with staple measurements by year by shire. Where small numbers exist, the averages derived for staple measurements or predicted top characteristics will have lower precision.**

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Albany (S)	W10	583	471	171	685	753
Ashburton (S)	W03	19	12	32	35	47
Augusta-Margaret River (S)	W18	46	55	22	33	38
Beverley (S)	W11	129	143	155	352	478
Boddington (S)	W12	117	136	96	256	302
Boyup Brook (S)	W13	449	326	206	652	833
Bridgetown-Greenbushes (S)	W13	62	40	26	50	95
Brookton (S)	W12	85	77	50	158	245
Broomehill (S)	W09	160	90	95	243	370
Bruce Rock (S)	W07	187	229	120	252	314
Busselton (S)	W18	23	34	21	29	38
Capel (S)	W17	18	7	3	13	9
Carnamah (S)	W06	119	187	107	198	226
Carnarvon (S)	W05	328	240	96	174	266
Chapman Valley (S)	W06	136	166	163	145	245
Chittering (S)	W14	38	26	27	36	50
Collie (S)	W17	44	31	19	55	50
Coolgardie (S)	W19	43	42	29	40	62
Coorow (S)	W06	90	142	37	115	158
Corrigin (S)	W08	177	251	113	195	312
Cranbrook (S)	W10	619	545	369	684	783
Cuballing (S)	W12	78	72	74	126	184
Cue (S)	W04	69	32	29	64	81
Cunderdin (S)	W11	98	135	62	171	231
Dalwallinu (S)	W11	170	175	60	200	373
Dandaragan (S)	W14	294	397	223	683	781
Dardanup (S)	W17	20	11	1	14	27
Denmark (S)	W10	62	47	21	48	65
Donnybrook-Balingup (S)	W17	41	43	24	39	84
Dowerin (S)	W11	142	153	78	181	208
Dumbleyung (S)	W12	133	204	73	167	309
Dundas (S)	W20	88	92	52	134	169
Esperance (S)	W20	588	789	495	1358	2006
Exmouth (S)	W05	0	3	0	2	2

Number of sale lots with staple measurements by year by shire. Where small numbers exist, the averages derived for staple measurements or predicted top characteristics will have lower precision (cont.).

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Gingin (S)	W14	66	87	32	96	106
Gnowangerup (S)	W09	582	356	210	534	766
Goomalling (S)	W11	133	102	79	211	255
Greenough (S)	W06	114	173	80	170	181
Harvey (S)	W17	12	4	0	4	13
Irwin (S)	W06	69	79	32	95	84
Jerramungup (S)	W09	305	172	178	463	622
Kalgoorlie/Boulder (C)	W19	180	145	148	176	231
Katanning (S)	W09	165	150	172	214	399
Kellerberrin (S)	W07	98	104	63	181	204
Kent (S)	W09	117	113	103	184	308
Kojonup (S)	W09	821	499	409	916	1333
Kondinin (S)	W08	160	281	122	340	444
Koorda (S)	W11	63	51	35	99	143
Kulin (S)	W08	205	206	96	263	392
Lake Grace (S)	W08	299	409	185	552	955
Laverton (S)	W19	8	5	0	7	4
Leonora (S)	W19	207	115	63	139	185
Manjimup (S)	W13	81	78	18	56	70
Meekatharra (S)	W04	134	90	33	112	68
Menzies (S)	W19	67	39	20	48	43
Merredin (S)	W07	88	171	90	177	238
Mingenew (S)	W06	121	164	90	189	228
Moora (S)	W14	280	337	152	540	704
Morawa (S)	W06	69	72	41	97	139
Mount Magnet (S)	W04	80	73	33	94	150
Mount Marshall (S)	W07	113	48	67	179	187
Mukinbudin (S)	W07	61	65	33	84	88
Mullewa (S)	W06	118	139	119	181	217
Mundaring (S)	W15	4	7	3	2	8
Murchison (S)	W04	12	13	0	27	22
Murray (S)	W16	12	21	12	17	12
Nannup (S)	W13	3	3	0	2	6
Narembeen (S)	W07	121	162	105	271	239
Narrogin (S)	W12	240	148	110	278	367

Number of sale lots with staple measurements by year by shire. Where small numbers exist, the averages derived for staple measurements or predicted top characteristics will have lower precision (cont.).

Shire	WSA	89/90	90/91	91/92	92/93	93/94
Northam (S)	W11	85	120	95	149	208
Northampton (S)	W06	165	241	101	215	392
Nungarin (S)	W07	15	25	19	30	44
Perenjori (S)	W06	70	57	41	122	194
Pingelly (S)	W12	47	91	54	251	336
Plantagenet (S)	W10	948	685	335	911	1283
Port Hedland (T)	W02	3	0	1	4	5
Quairading (S)	W11	103	135	95	148	212
Ravensthorpe (S)	W20	351	449	226	670	815
Roebourne (S)	W03	53	16	45	29	60
Sandstone (S)	W04	58	37	19	27	47
Serpentine-Jarrahdale (S)	W15	5	27	19	33	49
Shark Bay (S)	W05	30	39	31	35	52
Swan (S)	W15	31	43	5	13	27
Tambellup (S)	W09	272	201	183	400	611
Tammin (S)	W11	48	65	33	103	165
Three Springs (S)	W06	77	75	46	118	160
Toodyay (S)	W11	42	73	30	118	122
Trayning (S)	W07	32	23	35	67	98
Upper Gascoyne (S)	W05	57	48	9	53	55
Victoria Plains (S)	W14	105	183	129	399	422
Wagin (S)	W12	248	178	153	307	535
Wandering (S)	W12	84	49	62	239	245
Waroona (S)	W16	13	3	1	0	10
West Arthur (S)	W12	282	248	179	514	788
Westonia (S)	W07	31	27	13	85	105
Wickepin (S)	W12	219	298	129	281	552
Williams (S)	W12	287	283	188	494	699
Wiluna (S)	W04	38	19	2	67	58
Wongan-Ballidu (S)	W11	132	198	80	202	283
Woodanilling (S)	W09	107	54	44	117	206
Wyalkatchem (S)	W11	64	42	29	90	120
Yalgoo (S)	W04	136	120	112	158	227
Yilgarn (S)	W07	126	128	94	189	223
York (S)	W11	95	103	55	244	291

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