Emerging Animal and Plant Industries
— their value to Australia —

Second Edition

RIRDC
Innovation for rural Australia
Emerging Animal and Plant Industries
—their value to Australia—

Second Edition

by Max Foster

ABARE
Acknowledgments

The author is grateful for the generosity of the many participants in the Australia's emerging industries who gave freely and generously of the information necessary to complete this report. In each case, their enthusiasm for their industry was inspiring.

The author thanks ABARE colleagues, Terry Sheales, Ben Buetre and Peter Martin, for their constructive comments on drafts of this report.

The author also gratefully acknowledges the invaluable support, expertise and patience of RIRDC staff throughout the preparation of this report, especially Peter McInnes.

Abbreviations

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg</td>
<td>kilogram (2.20462 pounds)</td>
</tr>
<tr>
<td>t</td>
<td>tonne (1000 kilograms)</td>
</tr>
<tr>
<td>kL</td>
<td>kilolitre (1000 litres)</td>
</tr>
<tr>
<td>kt</td>
<td>kilotonne (1000 tonnes)</td>
</tr>
<tr>
<td>Mt</td>
<td>megatonne (1 000 000 tonnes)</td>
</tr>
<tr>
<td>A$</td>
<td>dollar (Australian)</td>
</tr>
<tr>
<td>$m</td>
<td>million dollars (Australian)</td>
</tr>
<tr>
<td>$b</td>
<td>billion dollars (Australian)</td>
</tr>
<tr>
<td>US$</td>
<td>dollar (United States)</td>
</tr>
<tr>
<td>US$m</td>
<td>million dollars (United States)</td>
</tr>
<tr>
<td>US$b</td>
<td>billion dollars (United States)</td>
</tr>
<tr>
<td>cif</td>
<td>cost, insurance and freight</td>
</tr>
<tr>
<td>EVAO</td>
<td>estimated value of agricultural operations</td>
</tr>
<tr>
<td>fas</td>
<td>free alongside ship</td>
</tr>
<tr>
<td>fob</td>
<td>free on board</td>
</tr>
<tr>
<td>GDP</td>
<td>gross domestic product</td>
</tr>
<tr>
<td>nc</td>
<td>not calculated</td>
</tr>
<tr>
<td>nec</td>
<td>not elsewhere classified</td>
</tr>
<tr>
<td>nes</td>
<td>not elsewhere specified</td>
</tr>
<tr>
<td>p</td>
<td>provisional</td>
</tr>
<tr>
<td>ABARE</td>
<td>Australian Bureau of Agricultural and Resource Economics</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>DAFF</td>
<td>Australian Government Department of Agriculture, Fisheries and Forestry</td>
</tr>
<tr>
<td>DBIRD</td>
<td>Department of Business, Industry and Resource Development, Northern Territory</td>
</tr>
<tr>
<td>DPIFM</td>
<td>Department of Industry, Fisheries and Mines, Northern Territory</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation of the United Nations</td>
</tr>
<tr>
<td>RIRDC</td>
<td>Rural Industries Research and Development Corporation</td>
</tr>
<tr>
<td>WTO</td>
<td>World Trade Organisation</td>
</tr>
<tr>
<td>UNCTAD</td>
<td>United Nations Conference on Trade and Development</td>
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</tbody>
</table>

Small discrepancies in totals are generally caused by rounding.

0 is used to denote nil or a negligible amount.
Australia’s rural industries make a fundamental contribution to the Australian economy and way of life. In addition to the major industries, numerous new and emerging rural industries bring opportunity, diversity and resilience to rural Australia. The fact that detailed information on the volume and value of these industries is hard to come by makes this book a valuable resource. It brings together available information about many of Australia’s new rural industries. This second edition updates and expands the coverage of RIRDC’s Emerging animal and plant industries – their value to Australia first published in 2005.

Together the selected emerging industries had an estimated gross value of production of $940 million, equivalent to 2.7 per cent of the total value of Australian farm production in 2006-07. They earned estimated export revenue of $465 million, or 6 per cent of total farm export revenue in 2006-07. These shares are likely to grow in future years because — as the term ‘emerging’ suggests — many of the emerging industries appear to have strong growth prospects.

The Rural Industries Research and Development Corporation invests in new and emerging industries on behalf of government and industry stakeholders. New rural industries provide opportunities to be captured by rural producers and investors. They also provide avenues for farmers facing climate and structural pressures to diversify and manage change. The establishment of new industries contributes to community resilience and regional development. Increasingly, new industries are also contributing to a distinctive regional character in rural Australia.

This important report provides basic statistical information for the new and emerging industries. As well as indicating the high aggregate value of a selected subset of the ‘new and emerging sector’, the report provides detailed statistical information for each new industry. It will be a useful basis for those contemplating investment or formulating policy and will help to inform RIRDC as it plans its research and development priorities into the future.

Peter O’Brien
Managing Director
Rural Industries Research and Development Corporation

“...emerging rural industries bring opportunity, diversity and resilience to rural Australia.”

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“Increasingly, new industries are also contributing to a distinctive regional character in rural Australia.”

“The importance of this report is that it provides that basic statistical information for the new and emerging industries.”
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• This publication profiles 29 emerging animal and plant industries, and provides a picture of their overall worth to the Australian economy.

• Together the selected emerging industries had an estimated gross value of production of $940 million, equivalent to 2.6 per cent of the total value of Australian farm production in 2006-07. They earned estimated export revenue of $465 million, or 6 per cent of total farm export revenue in 2006-07. These shares are likely to grow in future years because — as the term 'emerging' suggests — many of the emerging industries appear to have strong growth prospects.

• These figures represent only a subset of emerging industries (i.e. those listed in this report) and are conservative estimates of value.

• New and emerging animal and plant industries make significant contributions to the regions in which they operate by bringing diversity and resilience to the sector. They also contribute to the increasingly important niche and specialty food markets.

• The importance of this report is that it provides basic statistical information for the new and emerging industries. As well as indicating the high aggregate value of the ‘new and emerging sector’, the report provides detailed statistical information for each new industry.

• Of the emerging industries examined, those with a Gross Value of Production over $30 million per annum include game birds, goat meat, kangaroo, tree nuts, Asian vegetables, exotic tropical fruits, wildflowers and olives.

Highlights

• Arbequinas olives

• Crocodile products

• Milking dairy sheep
Executive Summary

Scope and purpose of the report
The Australian food and fibre industries use an increasingly diverse range of plant and animal products. While the key characteristics of traditional agricultural production in Australia are well documented, there is a vast array of agricultural commodities produced in Australia for which there is relatively little public information.

The purpose of this project is to help address the gap in the availability of public information on the less well-documented industries. This publication is essentially an update of a previous report published by RIRDC in November 2005 “Emerging animal and plant industries – their value to Australia”, with a number of additional chapters or sections on dairy sheep, freshwater crustaceans, wallabies, tea, tree nuts and truffles.

The Target
The report is targeted at industry and governments interested in improving productivity, trade and R&D for new animal and plant industries.

Background
The existence of public information on prospective agricultural industries is important. New and emerging industries have a key role in providing growers with the ability to spread risk through diversification, thereby offering regional resilience. This is becoming particularly important with the need to adapt to climate change. They can also confer regional distinctiveness — such as tropical fruits in Far North Queensland or truffles in Tasmania and the south west of Western Australia.

The lack of reliable statistics about emerging industries can hamper their development. The availability of information can significantly influence the availability of commercial funds because lenders and potential investors require access to reliable statistics. Only when statistics exist can effective policies be developed for the emerging agricultural industries, such as in targeting research and development and in promotion activities.

Emerging industries are often difficult to identify, particularly during their early development phase. Some are not necessarily producing new products. For example, goats have been farmed for milk for thousands of years, and have been in Australia since first settlement by Europeans. However, with recent initiatives to establish an organised industry, goats milk is classified as an emerging food industry. Other foods, such as wasabi and rambutan, are new to Australia, while others (such as crocodiles and bush foods) are indigenous to Australia but unfamiliar to the food market.

Tropical fruits. New and emerging industries can confer regional distinctiveness — such as tropical fruits in Far North Queensland or truffles in Tasmania and the south west of Western Australia.

Official statistics produced by the Australian Bureau of Statistics are an important source of information but do not cover all the agricultural commodities produced in Australia. While there are other sources of information on emerging industries, it is often difficult to access such information and to establish comparable, robust statistics on these industries. With increasing diversity of animal and plant production as producers seek to diversify away from traditional crops and livestock, there is an ongoing challenge to ensure that these products are incorporated in rural statistics.

Many of the emerging industries in Australia produce a diverse range of products. For example, goat industries can produce meat, fibres, milk, leather and a range of other by-products. RIRDC classifies around 80 different agricultural commodities as coming from emerging industries. Information on these emerging agricultural industries and new products from existing industries is highly valued by the industry, by traders and consumers in Australia and overseas. Around 50 per cent of the value of emerging livestock products comes from export sales.

Methods Used
Production valuation
The definition of gross value of production used in this analysis is that used by the Australian Bureau of Statistics. According to ABS (2007a), the gross value of commodities produced is the value placed on recorded production at the wholesale prices realised in the market place. The 'market place', in general, is the metropolitan market in each State. In
cases where commodities are consumed locally, or where they become raw material for a secondary industry, these points are presumed to be the market place. The value of livestock slaughters and other disposals is published as one figure but include two distinct components: value of livestock slaughtered; and value of net exports — that is, the total value of livestock intended for slaughter in adjacent State(s) where available (at present these can only be identified between the Northern Territory and adjacent states) and livestock exported overseas, whether for slaughter or breeding, minus the value of imports of livestock.

A feature of many emerging animal industries is that they are in the process of building up flock or herd numbers. At this stage of industry development, there is usually little production that requires slaughter of animals (for example, meat and hides) and very strong intra-industry trade and relatively high prices for breeding livestock. This trade, however, is traditionally not considered as part of the value of the industry for estimation purposes so is not included in this analysis.

Data sources
The Australian Bureau of Statistics (ABS) is a key source of Australian information for this project, particularly for trade data. ABS production data are somewhat problematical for small industries because farming establishments with estimated values of agricultural operations of less than $5000 are excluded from the estimation process. This means that ABS data often considerably underestimate the level of production of small agricultural industries.

Another highly useful source of information for a number of commodities is the Levies Revenue Service (LRS), an organisation within the Australian Government Department of Agriculture, Fisheries and Forestry. The LRS is responsible for both the collection and distribution of levies to the various statutory research and development corporations, statutory marketing authorities, Animal Health Australia and the National Residue Survey. LRS is also responsible for the distribution of the Australian Government’s matching contributions for agriculture and key industry representative bodies. The Department of Business, Industry and Rural Development in the Northern Territory was particularly useful in this respect because its activities have an orientation toward developing industries.

Knowledge of the supply chain for each commodity gives some indication of where the best place is to gather statistics for that industry. For example, the centralised nature of the marketing systems with the goat fibre industries (mohair and cashmere) made gathering of production statistics reasonably straightforward. The meat processing industry has readily identifiable points for gathering data because meat must be processed through a limited number of licensed processing establishments. Furthermore, there are regulatory bodies in each state that collect statistics on animal slaughter numbers for monitoring purposes.

Aims
This project provides a set of supply and utilisation tables for each of those agricultural industries in Australia that are defined as ‘emerging’ by RIRDC (excluding the organic industry), taking into account that each of these industries may produce a number of different products.

Information is also provided on the nature of the international market for each commodity because an understanding of this is important in guiding the gathering of appropriate information and assessing the prospects for the industry. Where no price data are available in Australia, international sources can provide reasonable indicator prices that can be employed.

Results
The contribution of each industry to the Australian economy in terms of value of production and exports is presented in the summary table. Data for either calendar year 2007 or financial year 2006-07 are included for each industry, according to the availability of data. For ease of exposition, the year discussed in the text will simply be referred to as 2006-07. It should be noted that in many cases the value of production of an industry will be less than the value of the industry’s exports. This is because there is substantial value added through processing before products are exported. For example, the tanning process with animal skins adds considerable value.

The selected emerging industries encompass a range of stages of development. For example, the exotic tropical fruit industry is at a very early stage of development, with domestic and export growth prospects based on producing something that is familiar to many Australians of Asian origin and to an increasingly affluent population throughout Asia. At the other end of the scale, the sizes of the goat fibre (cashmere and mohair) industries in Australia are considerably smaller now than they were a decade ago.

Many of the emerging industries have long and sometimes chequered histories in Australia. For example, an Australian coffee producing industry emerged, and then virtually disappeared at least once over the past century. It appears to be ‘emerging’ again because mechanical
harvesting has offset the labour cost impediment to industry development and because of an increasing willingness among coffee drinkers to pay premiums for ‘Estate grown’ coffees with pleasingly distinctive flavours.

In 2006-07, the gross value of production of the selected animal industries was an estimated $270 million, and they earned export revenue of $207 million. The biggest of these industries were the kangaroo, game bird and meat goat industries, together accounting for 80 per cent of the total value of production and 82 per cent of total exports. With the exceptions of the dairy goat and deer industries, the emerging animal industries face little competition from imports (summary table). The total value of imports of similar products to those produced by Australia’s emerging animal industries is only $7 million. This is partly because of Australia’s strict quarantine laws on livestock products. Only with venison is there serious import competition (from New Zealand).

**Kangaroo meat**

The gross value of production of the selected emerging plant industries in 2006-07 was an estimated $670 million, largely contributed by the more mature emerging industries — that is, the Asian vegetables, tree nuts, exotic fruit (mainly lychees) and wildflower industries (summary table). Most of the emerging plant industries are export oriented, with total exports in 2006-07 of $260 million.

Some emerging plant industries face strong competition from imports, particularly the coffee, olive, sesame seed and spices industries. The total value of these imports was $843 million in 2006-07, mainly made up of coffee, olives and tree nuts. There is likely to be increasing competition from Thailand for the Australia tropical fruits industry following favourable import risk assessments and the signing of the Australia-Thailand Free Trade Agreement. In the case of seasonal products such as tropical fruits, the Australian industry niche appears to lie with supplying fresh product outside the main production periods of the main exporting countries that appear to have substantially lower production costs.

Arguably, the value to society of at least some of these emerging industries is considerably higher than the estimates presented in the summary table. With some animal based industries, this is because they involve the harvesting of feral populations of animals in Australia — for example, feral pigs and camels — that have adverse environmental impacts. The industries based on the use of Australian native plants as flowers and food could be contributing to the conservation of rare Australian plants through ensuring that they are cultivated more widely than their natural habitats. Reafforestation using oil mallee and sandalwood trees in Western Australia is helping both to control salinisation of agricultural lands and reduce greenhouse gases.

Due to resource constraints, some emerging industries are not included in this compendium. These include the berry fruit, cocoa and plant fibre (such as hemp and flax) industries.

**Recommendations**

It is recommended that the statistics presented in this report are expanded and updated periodically to measure both trends in Australia and internationally as a guide for industry, government and future R&D.
Summary table: Selected Australian emerging industries: Value of production and trade

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross value of production</th>
<th>Value of trade</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Exports</td>
<td>Imports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$'000</td>
<td>$'000</td>
<td>$'000</td>
<td></td>
</tr>
<tr>
<td><strong>Animal industries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alpaca</td>
<td>2006-07</td>
<td>1 245</td>
<td>16</td>
<td>447</td>
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<tr>
<td>Buffalo</td>
<td>2006-07</td>
<td>4 972</td>
<td>4 774</td>
<td>0</td>
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<tr>
<td>Camel</td>
<td>2006-07</td>
<td>683</td>
<td>338</td>
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<tr>
<td>Crocodile</td>
<td>2006-07</td>
<td>8 950</td>
<td>8 845</td>
<td>0</td>
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<tr>
<td>Dairy sheep</td>
<td>2006-07</td>
<td>4 000</td>
<td>na</td>
<td>732</td>
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<tr>
<td>Deer</td>
<td>2006-07</td>
<td>3 003</td>
<td>3 429</td>
<td>na</td>
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<tr>
<td>Emu</td>
<td>2007</td>
<td>1 340</td>
<td>1 979</td>
<td>0</td>
</tr>
<tr>
<td>Game bird</td>
<td>2007</td>
<td>115 740</td>
<td>6 244</td>
<td>0</td>
</tr>
<tr>
<td>Game pig</td>
<td>2007</td>
<td>10 771</td>
<td>12 734</td>
<td>0</td>
</tr>
<tr>
<td>Goat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– meat</td>
<td>2006-07</td>
<td>57 208</td>
<td>89 035</td>
<td>846</td>
</tr>
<tr>
<td>– cashmere</td>
<td>2007</td>
<td>87</td>
<td>83</td>
<td>10</td>
</tr>
<tr>
<td>– mohair</td>
<td>2007</td>
<td>2 227</td>
<td>2 475</td>
<td>493</td>
</tr>
<tr>
<td>– dairy</td>
<td>2006-07</td>
<td>6 000</td>
<td>na</td>
<td>4 806</td>
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<tr>
<td>Kangaroo and wallaby</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>– kangaroo</td>
<td>2007</td>
<td>43 913</td>
<td>73 566</td>
<td>0</td>
</tr>
<tr>
<td>– wallaby</td>
<td>2005-06</td>
<td>136</td>
<td>na</td>
<td>0</td>
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<tr>
<td>Ostrich</td>
<td>2007</td>
<td>1 739</td>
<td>2 068</td>
<td>0</td>
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<tr>
<td>Possum</td>
<td>2006</td>
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<td>3</td>
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<tr>
<td>Rabbit, farmed</td>
<td>2006-07</td>
<td>2 588</td>
<td>18</td>
<td>4</td>
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<tr>
<td>Freshwater crayfish</td>
<td>2006-07</td>
<td>5 334</td>
<td>na</td>
<td>na</td>
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<tr>
<td><strong>Total, animal industries</strong></td>
<td></td>
<td>269 936</td>
<td>207 153</td>
<td>7 338</td>
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<tr>
<td><strong>Plant industries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian vegetable</td>
<td>2005-06</td>
<td>85 729</td>
<td>3 894</td>
<td>4 000</td>
</tr>
<tr>
<td>Native food</td>
<td>2007</td>
<td>6 828</td>
<td>na</td>
<td>0</td>
</tr>
<tr>
<td>Coffee</td>
<td>2006-07</td>
<td>7 780</td>
<td>42 330</td>
<td>280 750</td>
</tr>
<tr>
<td>Essential oil</td>
<td>2006, 2006-07</td>
<td>25 400</td>
<td>25 374</td>
<td>2 866</td>
</tr>
<tr>
<td>Herbs, culinary</td>
<td>2005-06</td>
<td>18 863</td>
<td>na</td>
<td>5 184</td>
</tr>
<tr>
<td>Jojoba</td>
<td>2006</td>
<td>1 148</td>
<td>0</td>
<td>247</td>
</tr>
<tr>
<td>Olive</td>
<td>2006-07</td>
<td>66 911</td>
<td>16 056</td>
<td>252 151</td>
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<tr>
<td>Pulses — adzuki beans</td>
<td>2006-07</td>
<td>2 559</td>
<td>2 682</td>
<td>1 193</td>
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<tr>
<td>Spices, culinary</td>
<td>2005-06</td>
<td>26 854</td>
<td>20 288</td>
<td>36 983</td>
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<tr>
<td>Tea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– black</td>
<td>2006-07</td>
<td>1 808</td>
<td>2 484</td>
<td>88 879</td>
</tr>
<tr>
<td>– green</td>
<td>2006-07</td>
<td>0</td>
<td>725</td>
<td>8 618</td>
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<tr>
<td>Tree nuts</td>
<td>2006-07</td>
<td>328 867</td>
<td>123 730</td>
<td>157 086</td>
</tr>
<tr>
<td>Truffle</td>
<td>2007</td>
<td>1 640</td>
<td>204</td>
<td>435</td>
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<tr>
<td>Exotic tropical fruit</td>
<td>2006, 2006-07</td>
<td>56 212</td>
<td>812</td>
<td>4 747</td>
</tr>
<tr>
<td>Wildflower</td>
<td>2006-07</td>
<td>40 000</td>
<td>20 988</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total, plant industries</strong></td>
<td></td>
<td>670 409</td>
<td>258 176</td>
<td>843 139</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>940 345</td>
<td>465 329</td>
<td>850 477</td>
</tr>
</tbody>
</table>

\(^a\) Also includes fine animal hair other than cashmere. \(^b\) Also from wild rabbits. \(^c\) Mainly coffee grown overseas that processed in Australia and then exported.
An increasingly diverse range of plant and animal products are used in Australia. While the key characteristics of mainstream agricultural production in Australia are well documented, there is a vast array of agricultural commodities produced in Australia for which there is relatively little public information. The purpose in this project is to help address this gap in the availability of public information on the less well-documented industries.

The existence of public information on emerging agricultural industries is important. The lack of reliable statistics about emerging industries can hamper their development. The availability of information can significantly influence the availability of commercial funds because lenders and potential investors require access to reliable statistics. Only when statistics exist can effective policies be developed for the emerging agricultural industries, such as in targeting research and development and in promotion activities.

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Official statistics produced by the Australian Bureau of Statistics are an important source of information but do not cover all agricultural commodities produced in Australia. While there are other sources of information on emerging industries, these are often difficult to access and to establish comparable, robust statistics on the industries.

With increasing diversity of animal and plant production as producers seek to diversify away from mainstream crops and livestock, there is an ongoing challenge to ensure that these products are incorporated in rural statistics.

Many of the emerging industries in Australia produce a diverse range of products. For example, goats can produce meat, fibres, milk, leather and a range of other by-products. RIRDC classifies around 80 different agricultural commodities as coming from emerging industries. Information on these emerging agricultural industries and new products from existing industries is highly valued by the industry, traders and consumers in Australia and overseas. Around 50 per cent of the value of emerging livestock products comes from export sales.

The aim in this project is to produce a set of supply and utilisation tables for each of those agricultural industries in Australia that are defined as ‘emerging’ by RIRDC (excluding the organic industry), taking into account that each of these industries may produce a number of different products. Information is also provided on the nature of the international market for each commodity because an understanding of this is important in guiding the gathering of appropriate information. For example, where no price data are available in Australia, international sources can provide reasonable indicator prices that can be employed.

The organic food industry has been excluded from this project because its differentiating features relate to the inputs and processes used rather than the outputs.

The output of this project is a compendium of statistics that meets a need for basic information about emerging agricultural industries in Australia. The intended outcome is better information and decision making in a dynamic segment of the agricultural industry.
Method

Production valuation
The method of calculation of the gross value of commodities produced is that used by the Australian Bureau of Statistics (ABS) — see ABS (2007a) — and is the value placed on recorded production at the wholesale prices realised in the market place. In general, the market place is the metropolitan market in each state. In cases where commodities are consumed locally, or where they become raw material for a secondary industry, these points are presumed to be the market place. Livestock slaughterings and other disposals values are published as one figure but include two distinct components:

• value of livestock slaughtered; and
• value of net exports — that is, the total value of livestock intended for slaughter in adjacent states, where available, and livestock exported overseas whether for slaughter or breeding, minus the value of imports of livestock.

A feature of many emerging animal industries is that they are in the process of building up flock or herd numbers. At this stage of industry development, there is usually little production that requires slaughter of animals (for example, meat and hides) and very strong intra-industry trade and prices with breeding livestock. This trade, however, is traditionally not considered as part of the value of the industry for estimation purposes so is not included in this analysis.

It should be noted that in many cases the value of production of an industry will be less than the value of the industry’s exports. This is because there is substantial value added through processing before products are exported. For example, the tanning process with animal skins adds considerable value.

Data sources
The Australian Bureau of Statistics is a key source of Australian information for this project, particularly for trade data. The approach in this report is to exclude re-exports and re-imports when reporting Australia-level trade data.

Another highly useful source of information for a number of commodities is the Levies Revenue Service (LRS), an organisation within the Australian Government Department of Agriculture, Fisheries and Forestry. The LRS is responsible for both the collection and distribution of levies to the various statutory research and development corporations, statutory marketing authorities, Animal Health Australia and the National Residue Survey. LRS is also responsible for the distribution of the Australian Government’s matching levy for research and development contributions. The LRS collects over 60 different levies and charges from a client base of over 10,000 levy payers. The nature of levies being applied on the products from emerging industries are outlined in Appendix B. More information on the LRS and levy arrangements is available at www.affa.gov.au/levies.

The other key sources of information in Australia are state departments responsible for agriculture and key industry representative bodies. The Department of Industry, Fisheries and Mines in the Northern Territory was particularly useful in this respect because its activities have an orientation toward developing industries.

Knowledge of the supply chain for each commodity gives some indication of where the best place is to gather statistics for that industry. For example, the centralised nature of the marketing systems with the goat fibre industries (mohair and cashmere) makes gathering of production statistics reasonably straightforward. The meat processing industry has readily identifiable points for gathering data because meat must be processed through a limited number of licensed processing establishments. Furthermore, there are regulatory bodies in each state that collect statistics on animal slaughter numbers for monitoring purposes.

For plant-based industries, a key potential collection point for information is the major markets that exist for fruit, vegetables and flowers in each of the mainland state capital cities — that is, Sydney, Melbourne, Brisbane, Perth and Adelaide. A reporting service for these markets is provided by the Ausmarket Consultants group (www.ausmarket.net.au).

The FAOSTAT database of the Food and Agriculture Organisation of the United Nations (FAO) (faostat.fao.org) was the primary source of international information on production for many of the emerging industries. The UN Commodity Trade Statistics Database (Comtrade) was the primary source for trade data. European Commission’s EUROSTAT database provided some additional trade information for products that were not provided by FAOSTAT — for example, game pigs, game birds, pasture seeds, durian fruit and cashmere products. The US Department of Agriculture (USDA) also has some useful world supply and disposal data — for example, on macadamias and pecans.

Where no FAO or USDA data were available, knowledge of the supply chain can help identify international sources of information. For example, reflecting that South Africa is the main world producer and exporter of mohair, an industry body in that country gathers a range of statistics on the world mohair industry. Another example is statistics from the flower auction system in Japan (the most important market for Australian wildflowers) provide far more detailed information on the nature of Australian wildflower shipments to Japan than do Australian export statistics.

Finally, the most important sources of information were industry participants, particularly industry associations. These information sources are acknowledged throughout the report. A list of key industry contacts is provided in Appendix C.
The emerging animal industries in Australia produce a range of products, including meat, milk, fibre, skins and fat. The estimated annual average value in Australia of the emerging livestock industries examined in this report was around $270 million in 2006-07. To put this value into context, the average annual value of Australian livestock products in the three years to 2006-07 was $18 billion (Figure 1). For all emerging animal industries, production would have been higher if it was not for severe drought in Australia in 2006-07.

The emerging aquaculture industries examined in this report were crocodiles and freshwater crustaceans. The total estimated average annual value of these two industries in Australia in the three years to 2006-07 was $14 million. The total Australian aquaculture industry was $725 million annually in the three years to 2006-07 (Figure 2).

Around 40 per cent of the total value of Australia’s emerging animal industries is based on exploiting wild resources — kangaroos, wallabies, wild pigs, feral goats, camels and possums. The value of these industries to Australia is greater than the value of their products because the culling of wild populations helps to reduce adverse impacts on agricultural production systems and damage to the environment. Wild pigs are an important cause of damage to riverine environments, while feral goats and camels are damaging sensitive rangeland and desert environments.

Another 6 per cent is based on the farming of animals that are native to Australia — crocodiles, emus and freshwater crustaceans. Crocodile and emus cannot legally be commercially harvested from the wild because of conservation concerns (though crocodile eggs can be gathered from the wild under permit).

Wild harvesting or farming of Australia’s native animals is subject to strict conservation management plans. These management plans are consistent with Australia’s obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) that aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

Farming of introduced animals — alpacas, buffaloes, deer, goats, ostriches and rabbits — makes up around a half of the total value of Australia’s emerging animal industries. The opportunity for rabbit farming has largely emerged since 1996 due to the collapse of the industry based on the harvesting of wild rabbits following the release of rabbit calicivirus in Australia.

Some of the farmers of emerging animals appear to be attempting to diversify their production away from more traditional agricultural products. There is also a strong lifestyle element to many of the emerging animal industries, with production occurring on hobby farms. Early entrants to emerging animal industries have often been able to benefit from supplying the...
The growth of some emerging animal industries is a response to Australia’s changing ethnic composition, to increasing awareness of healthy products and to changes in tastes and preferences that are related to growing incomes. The changing ethnic composition is influencing consumer preferences in the wider population, leading to increased demand for products like goat meat and milk from goats and sheep.

Growing incomes mean increasing demand for more distinctive and healthier products. All of the emerging animal industries produce meat that easily meets the distinctive quality criteria. And virtually all the meats are claimed to be healthier than traditional meats on the grounds that they have lower fat contents.

Increasing domestic demand for dairy products from buffaloes, goats and sheep reflects the influence of Australia’s changing population and increased health consciousness.

Leather is an important product of most emerging animal industries. In particular, the distinctive characteristics of leather from crocodiles, kangaroos and ostriches mean these leathers earn premium prices in world leather markets.

The oil from emus and the velvet from deer have niches in the health products market.

However, a factor that could adversely affect demand for emerging animal products is the growing attention to animal welfare issues throughout the world, especially in the wealthier countries. For example, animal welfare activists are drawing consumer attention to the nature of the harvesting of kangaroos, claiming that it is inhumane. There are also issues with halal slaughter of goats because this method does not employ stunning of animals before slaughter. (Halal certification requires animals be slaughtered by Muslims approved by accredited certifying authorities according to strict Islamic or Shariah law).

The emerging animal industries are generally highly export oriented, with more than half of all products exported. The degree of export orientation means that trade barriers are important issues for emerging animal industries.

An important factor facilitating exports of emerging industry meat is Australia’s relatively disease free status compared to many other countries in the world, maintained through Australia’s strict quarantine arrangements. In recent years, incidents of avian influenza in South Africa have severely disrupted South African exports of ostrich meat to its traditional markets in Europe, creating export opportunities for the Australian ostrich industry. However, the existence of rabbit calicivirus in Australia as a biological control for wild rabbit populations could hinder the development of export markets for Australian farmed rabbit meat.

Australia’s quarantine arrangements are also an important factor in limiting Australian imports of emerging animal products. The main Australian imports are deer meat from New Zealand. However, the quarantine barriers can be a hindrance to development of some livestock industries through imposing high costs on imports of live animals, eggs, embryos and semen for breeding purposes.

While live exports account for 7.5 per cent of the total value of Australia’s emerging animal industries, there is considerable value adding through processing. According to Wondu Business and Technology Services (2007), there are more than 180 abattoirs and processing plants (many handling a number of species) servicing Australia’s emerging animal industries (Figure 3), with costs related to processing of emerging animals of around $40 million a year. Around 30 of the abattoirs identified are licensed to export (export accredited); 20 have halal certification; 2 have kosher certification and 12 have organic certification. There are currently no export abattoirs for alpaca, buffalo or possum. The recent closing of the last export abattoir for buffaloes in the Northern Territory is posing a problem for the buffalo industry.

![Buffalo cheese](image)
Alpacas are native to South America and were initially imported from Peru, Bolivia, Chile and North America. There are two main alpaca types: Huacaya and Suri. With tight restrictions on the export of alpacas from South America there is a worldwide shortage of good alpaca breeding stock.

Alpacas are a source of leather, fibre and meat. The alpaca fibre is soft, light, warm and comfortable when worn next to the skin. Its qualities and limited supply put it in the luxury fibre category. It is processed into a range of high quality garments — suits, jackets, skirts, sweaters, scarves and headwear — and home wares such as rugs, blankets and continental quilts (as filling). Alpaca fibre comes in a range of natural colours including white, silver, many shades of grey and fawn, chocolate brown and jet black.

In South America, alpaca farming is concentrated in the Altiplano — the high altitude regions of Southern Peru, Bolivia and Chile. Alpacas not only battle a harsh climate — burning sun by day, freezing conditions at night — but also receive few of the benefits of modern animal husbandry (Australian Alpaca Association 2002). In their homeland of South America, Peru has approximately 2.5 million alpacas, Bolivia around 500,000 and there are only some 50,000 in Chile and Argentina combined. Alpacas have flourished in countries such as Australia, Canada, New Zealand and the United States under more temperate climates than their homelands and with more sophisticated animal husbandry techniques.

Over the ten years to 2006, Peruvian production of alpaca fibre ranged between a low of 3103 tonnes in 2001 and to a high of 3597 tonnes in 2005, with production of 3530 tonnes in 2006 (Ministerio de Agricultura, Peru 2007). Peruvian alpaca meat production in 2006 was over 9000 tonnes.

Prices for alpaca fibre generally differ according to fibre diameter, length and

![Figure 4: Alpaca fibre: Trends in international prices](image-url)

colour, with fine, longer, white types commanding the highest prices (Figure 4). Alpaca fibre tends to coarsen as animals age. International prices for alpaca fibre have declined substantially since the very high levels of the late 1980s.

**Australian alpaca industry**

The Australian alpaca industry was established in the late 1980s and has grown to a flock size of around 90 000 at June 2006, more than 90 per cent of which are the Huacaya alpaca type (Table 1). Reflecting that the Australian industry is in a herd building phase there is very little meat production at this stage and a substantial trade in breeding stock. In 2006-07, an estimated 108 tonnes of fibre worth $1.25 million was produced. (The unit value of production is low compared with indicator prices because a significant part of the clip has no commercial value at this stage.)

In 2006-07, the Australian industry exported 13.7 tonnes of alpaca fleece to Peru for processing. There have been imports of alpaca fibre from Peru (Table 1).

The main marketer of alpaca fibre in Australia is the Australian Alpaca Fleece Ltd (AAFL), an industry owned company established in March 2004. AAFL collects and classes alpaca fleeces then sells them to ‘strategic partners who market their products nationally and internationally in the homeware and fashion areas of retailing’ (Australian Alpaca Fleece Ltd 2004b). AAFL replaced the Australian Alpaca Cooperative which was established in 1995 under the *Cooperatives Act 1995*.

In 2006-07, AAFL received 67 tonnes of alpaca fibre, an estimated 60 per cent of the Australian alpaca clip. Using data from McLorinan (2007) and Australian Alpaca Fleece Limited (2007a,b), the estimated quality profile of AAFL receivals and price profiles for Huacaya alpaca fibre in 2006-07 are shown in Figure 5. Around 14 per cent of AAFL receivals in 2006-07 had no commercial value but this proportion was down from 27 per cent in 2003-04. White and light fawn fibre made up 52 per cent of total AAFL receivals in 2006-07, compared with 42 per cent in 2003-04. With almost no grease in alpaca fibre, processing yield is usually around 95 per cent (Australian Alpaca Association Inc. 2002).

Reflecting the herd building phase of the Australian industry and the worldwide scarcity of breeding stock, prices are very high for suitable breeding alpacas. The average price received at the National Show and Sale in Canberra in October 2006 was $40 000, with a top price of $124 000 for a male alpaca.

Table 1: Alpaca products: supply, disposal and value in Australia

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<thead>
<tr>
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<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registered alpaca numbers, 30 June '000</td>
<td></td>
<td>31</td>
<td>37</td>
<td>61</td>
<td>72</td>
<td>90</td>
</tr>
<tr>
<td>Growers no.</td>
<td></td>
<td>20</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Average herd size no.</td>
<td></td>
<td>37.8</td>
<td>45.7</td>
<td>63.8</td>
<td>82.2</td>
<td>108.4</td>
</tr>
<tr>
<td>Fibre production</td>
<td></td>
<td>317</td>
<td>387</td>
<td>576</td>
<td>778</td>
<td>1245</td>
</tr>
<tr>
<td>- gross value $'000</td>
<td></td>
<td>8.39</td>
<td>8.48</td>
<td>9.02</td>
<td>9.47</td>
<td>11.49</td>
</tr>
<tr>
<td>- unit gross value $/kg</td>
<td></td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td><strong>Meat production a</strong></td>
<td></td>
<td>11.0</td>
<td>2.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibre, not carded or combed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td></td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>3</td>
</tr>
<tr>
<td>Value $'000</td>
<td></td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>125</td>
<td>16</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td></td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>11.29</td>
</tr>
<tr>
<td><strong>Imports, fine animal hair, Peru, carded or combed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td></td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>37</td>
</tr>
<tr>
<td>Value $'000</td>
<td></td>
<td>0</td>
<td>20</td>
<td>61</td>
<td>85</td>
<td>447</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td></td>
<td>nc</td>
<td>18.46</td>
<td>15.45</td>
<td>11.59</td>
<td>11.93</td>
</tr>
</tbody>
</table>

*a Dressed weight. na Not available.*

*Source: ABS (2008b); Australian Alpaca Association Inc. (2003); Australian Alpaca Fleece Ltd; ABARE.*
Figure 5: Profiles of Huacaya fibre prices and production in Australia, 2006-07

Further information about alpacas

- Alpha Tops Group (www.alphatops.com), prices for alpaca fibre.
- Australian Alpaca Association (www.alpaca.asn.au), information from the industry representative body in Australia.
- International Alpaca Association (www.aia.org.pe), information on alpacas, mainly in Peru, including some Peruvian export data.
- The Alpaca Marketplace (www.alpacamarketplace.com), listing of alpacas (and llamas) for sale in Australia.
- The Schneider Group (www.gschneider.com/brochure/specialfibres.php), prices and other market information for alpaca fibre.
Annual world exports of buffalo meat have averaged 351,000 tonnes a year in the three years to 2005, more than 90 per cent of which were sourced from India (FAO Statistics Division 2007). Over the same period, an average 79,000 live buffaloes a year were also traded internationally. Buffalo meat is used for human and pet food, with the hides a valuable co-product. Buffaloes are also an important source of milk in some countries and mozzarella cheese was made originally from buffalo milk.

There are three broad types of domesticated buffalo throughout the world. These are: the River type, the milking animal of the Indian sub continent; the Swamp type, widely used throughout south east Asia as a draught animal; and the Mediterranean type, used for both draught and dairy purposes (Australian Buffalo Industry Council 2004).

**Australian buffalo industry**

Buffalo were introduced to the Northern Territory in the early 19th century. A large feral buffalo population soon became established, peaking in the 1980s at around 350,000, before strict disease eradication measures against bovine tuberculosis in early 1990s. The buffalo population in the Northern Territory was declared free of bovine tuberculosis in 1997.

It is estimated that there is currently a feral buffalo population in the Northern Territory of around 60,000 and a domesticated herd of around 12,000 on 30 farms. There are also very small buffalo herds in all the other states. Throughout Australia in 2006, there were 67 farms with an estimated total of 13,559 buffaloes (Australian Buffalo Industry Council, personal communication, 29 March 2007).

The buffalo herd in the Northern Territory is made up mainly of the originally introduced Swamp type. Riverine buffalo were imported in the mid 1990s and have been crossed with the Swamp buffalo to produce faster growing animals. Most of the Riverine buffalo in Australia are located at a buffalo dairy enterprise in Victoria.

Buffalo meat is claimed to be leaner and lower in cholesterol than beef (Australian Buffalo Industry Council 2004). To assist marketing, the Australian buffalo industry has introduced a label called TenderBuff™ for buffalo meat that meets its specified quality standards for the restaurant trade. Estimated production for the restaurant trade in Australia in 2006 was 29 tonnes (Australian Buffalo Industry Council, personal communication, 29 March 2007).

The value of the Australian buffalo industry in 2006-07 was nearly $5 million, mainly contributed by live exports from the Northern Territory (Table 2). The closure of the only export accredited buffalo abattoir in the Northern Territory in 2003 has meant no Territory buffalo slaughter for export since then.

Over the last five years, the main markets for live exports of Australian buffalo are Brunei, Indonesia and Malaysia (Figure 6). Indonesia has emerged as a major export market, following the signing of an animal health protocol with Australia in October 2005. A factor in the increased demand for live buffalo exports has been rebuilding after the Asian tsunami of late 2004.

### Further information about buffalo


- **Australian Buffalo Industry Council** ([buffaloastralia.org](http://buffaloastralia.org)), a range of information about the buffalo industry in each Australian state and territory and a free quarterly newsletter **Buffalo News**.
Table 2: Buffalo: supply, disposal and value in Australia

<table>
<thead>
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</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farms</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td>67</td>
</tr>
<tr>
<td>Buffalo</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td>13 559</td>
</tr>
<tr>
<td>Slaughterings</td>
<td>no.</td>
<td>1 896</td>
<td>700</td>
<td>245</td>
<td>365</td>
</tr>
<tr>
<td>Average slaughter weight</td>
<td>kg/hd</td>
<td>112</td>
<td>112</td>
<td>112</td>
<td>112</td>
</tr>
<tr>
<td>Gross value</td>
<td>$'000</td>
<td>4 981</td>
<td>2 036</td>
<td>3 254</td>
<td>4 028</td>
</tr>
<tr>
<td>Meat</td>
<td>tonnes</td>
<td>211</td>
<td>78</td>
<td>27</td>
<td>41</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>no.</td>
<td>4 054</td>
<td>2 194</td>
<td>4 118</td>
<td>4 707</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>3 505</td>
<td>1 582</td>
<td>3 089</td>
<td>3 766</td>
</tr>
<tr>
<td>– Unit value</td>
<td>$/hd</td>
<td>865</td>
<td>721</td>
<td>750</td>
<td>800</td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>623</td>
<td>72</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>2 872</td>
<td>258</td>
<td>61</td>
<td>11</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>4.61</td>
<td>3.57</td>
<td>2.27</td>
<td>2.75</td>
</tr>
<tr>
<td>Total value of exports</td>
<td>$'000</td>
<td>6 377</td>
<td>1 839</td>
<td>3 149</td>
<td>3 776</td>
</tr>
</tbody>
</table>

*Includes value of live exports.

Sources: ABS (2008b); Levies Revenue Service; DPIFM (2007a); Australian Buffalo Industry Council, personal communication, 29 March 2007; ABARE.

Figure 6: Buffaloes: live exports from the Northern Territory

The two species of camel are the dromedary or Arabian camel (*Camelus dromedarius*) with a single hump and the Bactrian camel (*Camelus bactrianus*) with two humps. Camels are used in many parts of the world, mainly as a beast of burden and as a source of milk and dung. Camels are also slaughtered for meat for human consumption and pet food. Other camel products include leather, camel wool and camel oil. There is also a camel racing industry.

There is a significant world trade in live camels (Figure 7) but only a small recorded trade in camel meat of around 250 tonnes a year. In the three years to 2005, around 54,000 camels were traded each year at a value of US$16 million (FAO Statistics Division 2007). Over the same period, Egypt accounted for nearly three quarters of the world live camel trade, with the other major importers being Oman (8 per cent), Qatar (6 per cent), Iran (5 per cent) and Indonesia (4 per cent). The main suppliers of live camels to the world trade are Sudan (61 per cent in the three years to 2005), Djibouti (14 per cent) and Niger (9 per cent).

**Australian camel industry**

The Australian camel industry is largely based on the harvesting of feral dromedary camels in the arid central regions of Australia. Australia’s feral camel population was believed to be as large as 1 million in 2007 and growing at a rate of more than 10 per cent a year. Roughly 50 per cent of feral camels are located in Western Australia, 25 per cent in the Northern Territory and most of the remainder in western Queensland and northern South Australia.

The main source of income for the Australian industry is trade in live camels (Table 3). Income from tourism is also important to the industry. Slaughter of camels for human consumption commenced at Alice Springs in the 1980s. Warfield and Tume (2000) identified annual camel meat production of 35–50 tonnes in the late 1990s that was sold in South Australia and the Northern Territory through supermarket chains. However, there does not appear to have been significant camel meat production for human consumption in Australia in recent years.

In the four years to 2006-07, shipments of live camels were made to Malaysia (68 per cent of total), and Brunei (32 per cent) (DPIFM 2007a). There have also been exports of live camels to Saudi Arabia prior to 2003.

An industry representative body is the Central Australian Camel Industry Association Inc (CACIA), made up of members from the pastoral industry, meat industry, Aboriginal communities, tourism operators, transport operators, contractors and government agencies.

**Further information about camels**

- Central Australian Camel Industry Association Inc (www.camelsaust.com.au), a range of information including trading specifications for live camels and camel meat, and a code of practice for the welfare and husbandry of camels.
- FAO’s online database (faostat.fao.org), a range of data by country, including camel numbers and meat production; volume and value of trade (live and meat); and camel milk production.
Table 3: Camels: supply, use and value in Australia

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<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slaughterings</td>
<td>no.</td>
<td>46</td>
<td>51</td>
<td>100</td>
<td>198</td>
<td>390</td>
</tr>
<tr>
<td>Meat</td>
<td>tonnes</td>
<td>15</td>
<td>17</td>
<td>33</td>
<td>65</td>
<td>129</td>
</tr>
<tr>
<td>Gross value</td>
<td>$'000</td>
<td>235</td>
<td>117</td>
<td>703</td>
<td>732</td>
<td>683</td>
</tr>
<tr>
<td><strong>Exports, live</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>no.</td>
<td>250</td>
<td>132</td>
<td>66</td>
<td>68</td>
<td>343</td>
</tr>
<tr>
<td>Value</td>
<td>$'000</td>
<td>201</td>
<td>87</td>
<td>297</td>
<td>202</td>
<td>338</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/head</td>
<td>806</td>
<td>655</td>
<td>4495</td>
<td>2974</td>
<td>984</td>
</tr>
</tbody>
</table>

Sources: DPIFFM (2007a); ABARE

Figure 7: Live camels: world imports and import prices

Crocodiles

Skins are the main product from crocodiles, with meat an increasingly valuable co-product. There are also by-products of feet, teeth and skulls (DBIRD 2002). In Australia, tourism is an important activity for some crocodile enterprises, accounting for an estimated 30 per cent of total revenue of these enterprises surveyed in 2001 (Wondu Holdings 2002). Because of its attractive appearance, suppleness and durability, skin from crocodiles is a premium leather that is used in products such as fashion accessories (shoes, belts, handbags), wallets and luggage. Crocodile meat is a succulent white meat that is low in fat and high in protein.

According to FAO Statistics Division (2008), an average of 1.4 million caimans, crocodiles and alligators were harvested annually worldwide in the three years to 2005. Caiman species that are native to South America made up slightly more than half of the total harvest (Figure 8). Colombia accounted for 42 per cent of the total harvest, the United States 26 per cent, Cambodia 6 per cent and Zimbabwe 5 per cent. Australian production represented slightly more than 1 per cent of the world total.

Trade in crocodiles and alligators is subject to the Convention on International Trade in Endangered Species (CITES) to which Australia is a signatory, along with around 150 other countries. The protected species status of crocodiles means that permits are required in Australia for crocodile products exported to, or imported from, overseas. Permits are issued by the Australian Government Department of Environment and Water.

The nature of world trade in crocodilian meat and skins is summarised in. Most skins are derived from the caiman species while most meat comes from crocodylus species. (It should be noted CITES (2005) data includes re-exports which explains why a country such as Switzerland can appear as an exporter.)

### Australian crocodile industry

There are 14 commercial crocodile farms across the Northern Territory (5 farms), Queensland (6 farms) and Western Australia [3 farms involving both freshwater (Crocodylus johnstoni) and saltwater (Crocodylus porosus) crocodiles]. Crocodile farming involves captive breeding supplemented by regulated sustainable harvesting of eggs and juveniles from the wild.

Farmed crocodiles are harvested when their belly skin measures at least 35 centimetres; this takes from 18 months to 3 years (Porosus Pty Ltd 2004).

The total value of Australian crocodile product exports in 2006-07 was $9 million, 98 per cent of which was related to skins (Table 5). Prices for crocodile skins have increased strongly in recent years due to disruption to US alligator production resulting from hurricanes and drought. Over the three years to 2006-07, the main export markets for Australia’s crocodile skins were France (58 per cent), Italy (18 per cent), Singapore (15 per cent) and Japan (7 per cent). The main export markets for Australian crocodile meat were Japan, New Zealand, Malaysia and Hong Kong.

Further information about crocodiles

- Department of Primary Industry, Fisheries and Mines, Northern Territory (www.nt.gov.au/dpifm/Primary_Industry/index.cfm) provides a range of information about crocodile farming in the Northern Territory.
- FAO’s online database (faostat.fao.org) provides data by country for crocodile and alligator production.
Table 4: Crocodilian products: world trade in meat and skins

<table>
<thead>
<tr>
<th>Genus</th>
<th>Volume</th>
<th>Main exporters</th>
<th>Main importers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meats (tonnes)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alligator</td>
<td>13.2</td>
<td>United States (100%)</td>
<td>Hong Kong (58%), Canada (20%), Japan (16%), United Kingdom (7%)</td>
</tr>
<tr>
<td>Caiman</td>
<td>negligible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crocodylus niloticus</td>
<td>299.3</td>
<td>South Africa (48%), Zimbabwe (18%), Zambia (18%)</td>
<td>Hong Kong (49%), South Africa (24%), United States (11%), Netherlands (11%), China (9%)</td>
</tr>
<tr>
<td>Crocodylus porosus</td>
<td>72.8</td>
<td>Australia (89%), Papua New Guinea (10%)</td>
<td>Japan (75%), Australia (10%), CN (4%), Germany (3%)</td>
</tr>
<tr>
<td>Other Crocodylus</td>
<td>68.5</td>
<td>Papua New Guinea (61%), Thailand (35%), Mexico (4%)</td>
<td>Australia (61%), China (20%), Germany (6%), Hong Kong (5%), Japan (4%)</td>
</tr>
<tr>
<td>Skins ('000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alligators</td>
<td>464</td>
<td>United States (68%), Singapore (5%), Switzerland (6%), France (5%), Italy (5%)</td>
<td>France (35%), Italy (14%), Singapore (14%), Mexico (7%), United States (6%)</td>
</tr>
<tr>
<td>Caiman</td>
<td>1515</td>
<td>Columbia (53%), Singapore (21%), United States (6%), Bolivia (3%), Paraguay (3%), Venezuela (3%)</td>
<td>Singapore (21%), Mexico (17%), United States (15%), Thailand (9%), Spain (7%)</td>
</tr>
<tr>
<td>Crocodylus niloticus</td>
<td>267</td>
<td>Zimbabwe (43%), Singapore (18%), South Africa (13%), Zambia (9%)</td>
<td>Singapore (25%), France (16%), Thailand (15%), United States (11%), Japan (8%), Italy (5%)</td>
</tr>
<tr>
<td>Crocodylus porosus</td>
<td>30</td>
<td>Australia (37%), Papua New Guinea (32%), Singapore (11%), Indonesia (6%)</td>
<td>Japan (34%), France (30%), Australia (15%), Singapore (8%), Italy (6%)</td>
</tr>
<tr>
<td>Other Crocodylus</td>
<td>34</td>
<td>Papua New Guinea (38%), Indonesia (20%), Thailand (18%), Singapore (10%), Japan (8%)</td>
<td>Japan (65%), Singapore (7%), Thailand (7%), Korea Rep. (6%)</td>
</tr>
<tr>
<td><em>Includes re-exports.</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: CITES (2005)*

Table 5: Crocodile products: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farms</td>
<td>no.</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Meat</td>
<td>tonnes</td>
<td>120.4</td>
<td>97.8</td>
<td>118.0</td>
<td>113.9</td>
<td>88.59</td>
</tr>
<tr>
<td>Skins</td>
<td>no.</td>
<td>24 066</td>
<td>19 568</td>
<td>23 592</td>
<td>22 780</td>
<td>17 693</td>
</tr>
<tr>
<td>Gross value</td>
<td>$'000</td>
<td>4 472</td>
<td>4 720</td>
<td>5 950</td>
<td>6 786</td>
<td>8 950</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw hides and tanned skins, freshwater crocodiles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>no.</td>
<td>99</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>30</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>– unit value</td>
<td>$/skin</td>
<td>303.86</td>
<td></td>
<td></td>
<td>1 337.67</td>
<td></td>
</tr>
<tr>
<td>Raw hides and tanned skins, saltwater crocodiles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>no.</td>
<td>21 190</td>
<td>17 215</td>
<td>20 755</td>
<td>20 041</td>
<td>15 565</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>4 371</td>
<td>4 614</td>
<td>5 816</td>
<td>6 633</td>
<td>8 748</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/skin</td>
<td>206.29</td>
<td>268.04</td>
<td>318.92</td>
<td>330.99</td>
<td>562.05</td>
</tr>
<tr>
<td>Leather</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>no.</td>
<td>3 206</td>
<td>1 068</td>
<td>162</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>26</td>
<td>18</td>
<td>10</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>– unit value</td>
<td>$/skin</td>
<td>8.10</td>
<td>16.41</td>
<td>61.42</td>
<td>199.32</td>
<td></td>
</tr>
<tr>
<td>Meat and edible offal</td>
<td>tonnes</td>
<td>7.8</td>
<td>11.1</td>
<td>5.9</td>
<td>13.8</td>
<td>5.7</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>176</td>
<td>102</td>
<td>147</td>
<td>265</td>
<td>85</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>22.48</td>
<td>9.13</td>
<td>24.84</td>
<td>19.16</td>
<td>14.95</td>
</tr>
<tr>
<td>Total export value</td>
<td>$'000</td>
<td>4 557</td>
<td>4 742</td>
<td>5 980</td>
<td>6 908</td>
<td>8 845</td>
</tr>
</tbody>
</table>

*Sources: ABS (2008b); ABARE.*
Milk from sheep is an important dairy product in many countries in the world. Apart from being consumed as milk, sheep milk is processed into yoghurts and specialty cheese.

A cheese made exclusively from sheep milk is Roquefort, a blue cheese traditionally produced in France. The name ‘Roquefort’ has protected designation of origin status under the laws of the European Union. This means that only cheese may bear that name that are made from ewe’s milk from the Lacaune breed of sheep, produced in the Roquefort region and aged in the natural Cambalou caves of Roquefort-sur-Soulzon. Feta cheese is also traditionally made from sheep milk in some regions of the world. Another sheep milk cheese is romano pecorino from Italy.

Annual world production of sheep milk averaged 8.3 million tonnes in the three years to 2006, equivalent to around 1.3 per cent of annual world production of all milk types (FAO Statistics Division 2007). The main producers of sheep milk are China (14 per cent of world production in the three years to 2006), Greece (9 per cent), Turkey (9 per cent), Italy (7 per cent), Syria (7 per cent), Iran (6 per cent), Romania (6 per cent), Somalia (6 per cent), Sudan (6 per cent) and Spain (5 per cent).

French exports of Roquefort cheese have been increasing steadily over the last ten years (Figure 9). The increased export supply has put downward pressure on export prices in constant dollars terms.

**Dairy sheep industry in Australia**

There are eight commercial dairy sheep farms in Australia, with an estimated flock size in 2006 of 4000 sheep (Stubbs and Abud 2007). The main sheep breeds used are Awassi and East Friesian. South Australia, Tasmania and Western Australia each have two commercial farms and Victoria and Queensland have one each.

Based on Stubbs and Abud (2007), total production of sheep milk in Australia in 2006-07 was around 500 000 litres, with the Victorian farm (Meredith Dairy) accounting for around 40 per cent of the total. Unlike cows’ milk in Australia that is delivered to central processors, sheep milk is usually processed on farm. The estimated gross value at the farm gate of sheep milk products was around $4 million in 2006-07 (based on Stubbs and Abud 2007).

Around 60 per cent of Australian sheep production is used to make yoghurts, and the rest into cheese. The Meredith Dairy produces a blue cheese with Roquefort characteristics; a white mould ripened cheese of a Camembert style; and also uses sheep milk (along with goat milk) in its feta cheese. Retail prices in Sydney in late August 2007 were $55.95 for 500 grams of the blue cheese and $62.90 for 150 grams of the white mould cheese.

Australia imports small quantities of Roquefort cheese from France at prices in recent years of $24–26 a kilogram (Table 6). Import price for Roquefort cheese have increased substantially in constant (2008) dollar terms since the mid 1990s (Figure 10). There are also substantial Australian imports of feta cheese that is also made from cow, goat and other milk types.

Further information about dairy sheep

- Australian Specialist Cheesemakers Association (www.australiancheese.org)
- Meredith Dairy (meredithdairy.com)
Table 6: Sheep milk: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial farms</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Dairy sheep</td>
<td>no.</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Milk</td>
<td>'000 litres</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Gross value a</td>
<td>$'000</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td><strong>Cheese imports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feta b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>1 250</td>
<td>1 317</td>
<td>1 791</td>
<td>2 067</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>6 739</td>
<td>8 466</td>
<td>9 844</td>
<td>11 671</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>5.39</td>
<td>6.43</td>
<td>5.50</td>
<td>5.65</td>
</tr>
<tr>
<td>Roquefort, from France</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>973</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>25.90</td>
<td>nc</td>
<td>nc</td>
<td>24.97</td>
</tr>
</tbody>
</table>

a Value at the farm gate of milk, yoghurt and cheese produced on farm.

b May also be made from cow, goat and other milk.

Source: ABS (2008b); Stubbs and Abud (2007); ABARE.

Figure 9: Roquefort cheese: French exports and export prices

[Graph showing Roquefort cheese exports and export prices from 1996-2006.]

Figure 10: Traditional sheep milk cheeses: Australian imports and import prices

[Graph showing sheep milk cheese imports and prices from 1988-98 to 2006-07.]

The main products from deer farming are venison and velvet antler, the immature antler that is widely used in traditional Asian (particularly Chinese) medicine. Other parts of deer are also used in traditional Asian medicine including the pizzle, tail, sinews, heart and blood (Tuckwell 2001).

Most of the world’s venison comes from feral herds in northern Europe, north America and the Russian Federation and from farmed deer in New Zealand (Pearse, SriRamaratnam and Dake 1994). The main sources of antler velvet are Russia, China, the Republic of Korea and New Zealand.

New Zealand deer industry

New Zealand is the largest producer of farmed deer, with around 3800 farms in 2006 carrying 1.7 million deer, or about half the world’s farmed deer population (Deer Industry New Zealand 2007).

In 2006-07, New Zealand exported 21 200 tonnes of venison; 241 tonnes of velvet; 331 300 deer hides (Deer Industry New Zealand 2007). The total value of exports of deer products in 2006-07 was NZ$308 million, of which venison made up 79 per cent, velvet 10 per cent, hides 3 per cent, leather 4 per cent and other co-products 4 per cent.

A surge in New Zealand deer production in the first half of the 2000s pushed New Zealand venison exports to record levels and put strong downward pressure on venison export prices (Figure 11). However, lower New Zealand venison production in the last two years has seen some recovery in prices. In 2006-07, Germany accounted for 37 per cent of New Zealand’s venison exports, Belgium 15 per cent, France 9 per cent and the United States 7 per cent, with the rest of Europe accounting for virtually all of the remainder (Deer Industry New Zealand 2007c).

Deer velvet prices, as indicated by New Zealand unit export returns, have also declined sharply in recent years under the pressure of increased export volumes (Figure 12). Republic of Korea and China each accounted for 66 per cent of New Zealand’s velvet exports in 2005-06, with China and Hong Kong each accounting for 15 per cent (Deer Industry New Zealand 2006).

Australian deer industry

In 2005-06, there were 533 farms carrying deer in Australia, with a total population of 68 600 (ABS 2008). The composition of the Australia herd is approximately 50 per cent fallow deer, 40 per cent red deer, 7 per cent rusa, and 3 per cent elk/wapiti (Tuckwell 2007). Slaughterings of deer in Australia in 2006-07 were an estimated 15 605, 40 per cent lower than the previous year and slightly over one quarter of the peak production level achieved in 1999-2000 (Table 7). The combination of extended drought and lower prices in recent years for both venison and deer velvet are causing a number of deer farmers to leave the industry.

Deer in Australia are usually sold direct to processors. A processor will purchase animals direct from the farmer and arrange the transport, slaughtering, boning, packaging and marketing. Around 85 per cent of all venison produced in Australia is exported, principally to Europe. Australia also imports venison from New Zealand. In 2004, New Zealand venison exported 728 tonnes of venison to Australia, up from 231 tonnes in 2000 (Deer Industry New Zealand 2005). The New Zealand deer industry sees Australia as a growth market for its venison.

Australian velvet is sold through pooling arrangements or at the farm gate. The largest pooling arrangement accounts for around 55 per cent of total Australian velvet sales (Tuckwell 2007) and is operated by Deer Horn and Co-Products Pty Ltd, a wholly owned company of the Deer Farmers Federation of Australia. Deer velvet makes up around a quarter of the value of deer products in Australia. The main export markets for Australian velvet are Hong Kong, China, Korea, Chinese Taipei and New Zealand.

The Deer Farmers Federation of Australia represents farmers, processors, transporters, breed organisations and any other party involved in the deer industry.
Table 7: Deer products: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– slaughterings no.</td>
<td>46 652</td>
<td>35 518</td>
<td>34 560</td>
<td>25 762</td>
<td>15 605</td>
</tr>
<tr>
<td>– volume tonnes a</td>
<td>1 505</td>
<td>1 250</td>
<td>1 278</td>
<td>901</td>
<td>603</td>
</tr>
<tr>
<td>– gross value $’000</td>
<td>3 177</td>
<td>2 263</td>
<td>2 543</td>
<td>2 188</td>
<td>1 628</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>2.11</td>
<td>1.81</td>
<td>1.99</td>
<td>2.43</td>
<td>2.70</td>
</tr>
<tr>
<td><strong>Exports, live deer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume no.</td>
<td>1 813</td>
<td>1 211</td>
<td>175</td>
<td>801</td>
<td>189</td>
</tr>
<tr>
<td>– value $’000</td>
<td>126</td>
<td>72</td>
<td>11</td>
<td>64</td>
<td>17</td>
</tr>
<tr>
<td>– unit value $/hd</td>
<td>69.63</td>
<td>59.73</td>
<td>65.67</td>
<td>80.19</td>
<td>89.10</td>
</tr>
<tr>
<td><strong>Exports, venison</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>– volume tonnes a</td>
<td>1 280</td>
<td>1 063</td>
<td>1 086</td>
<td>765</td>
<td>513</td>
</tr>
<tr>
<td>– value $’000</td>
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<td>2 116</td>
<td>2 378</td>
<td>2 046</td>
<td>1 522</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>2.32</td>
<td>1.99</td>
<td>2.19</td>
<td>2.67</td>
<td>2.97</td>
</tr>
<tr>
<td><strong>Exports, hides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume no.</td>
<td>10 527</td>
<td>18 139</td>
<td>17 798</td>
<td>13 351</td>
<td>16 987</td>
</tr>
<tr>
<td>– value $’000</td>
<td>151</td>
<td>268</td>
<td>314</td>
<td>349</td>
<td>386</td>
</tr>
<tr>
<td>– unit value $/hide</td>
<td>14.37</td>
<td>14.75</td>
<td>17.63</td>
<td>26.18</td>
<td>22.70</td>
</tr>
<tr>
<td><strong>Velvet antler</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume kg</td>
<td>26 146</td>
<td>28 686</td>
<td>19 783</td>
<td>35 884</td>
<td>62 106</td>
</tr>
<tr>
<td>– value $’000</td>
<td>2 006</td>
<td>1 261</td>
<td>644</td>
<td>567</td>
<td>1 358</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>76.72</td>
<td>43.95</td>
<td>32.57</td>
<td>15.80</td>
<td>21.84</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume kg</td>
<td>23 478</td>
<td>25 054</td>
<td>14 209</td>
<td>16 215</td>
<td>62 106</td>
</tr>
<tr>
<td>– value $’000</td>
<td>1 957</td>
<td>1 252</td>
<td>479</td>
<td>599</td>
<td>1 504</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>83.37</td>
<td>49.99</td>
<td>33.74</td>
<td>36.94</td>
<td>24.22</td>
</tr>
<tr>
<td><strong>Total value of exports</strong></td>
<td>$’000</td>
<td>5 205</td>
<td>3 708</td>
<td>3 182</td>
<td>3 059</td>
</tr>
</tbody>
</table>

* Hot carcass weight.

Sources: Tuckwell (2007); Levies Revenue Service; ABARE.

Figure 12: Deer velvet: New Zealand exports and export prices *

Further information about deer

- Deer Industry Association of Australia (www.diaa.org), range of production and marketing information for deer in Australia.
- Deer Industry New Zealand (www.deernz.org.nz), information on production and prices for deer products in New Zealand.
The emu (*Dromaius novaehollandiae*), a native of Australia, is the world's second largest living bird (only the ostrich is larger). An adult emu can weigh over 50 kilograms.

Commercial farming of emus began in Western Australia in 1987 and has spread to all other states and to some other countries, most notably the United States. Wild harvesting of emus is prohibited in all states. In 2001, there were around 145 establishments producing emus in Australia, but the number had declined to around 41 in 2006.

The main products from emus are meat, oil and skins for leather. Emu meat is a low fat, low cholesterol, high protein red meat. Emu oil, rendered from emu fat, is sold as a medicinal oil for the relief of joint pain, soft tissue injury and dermatitis, as well as a base for a range of cosmetics (O’Malley and Snowden 1999). Body and leg skin are used to make a high quality leather.

The average meat yield from an emu is 12 kilograms and the oil yield is 6 litres. Based on a model emu farming operation in Australia, Hassall and Associates (2000) found that oil would make up around 45 per cent of the total revenue of from such an operation; meat 42 per cent; leg skin 3 per cent; hides 8 per cent; and trim 2 per cent.

Emu oil is exported to a number of countries, particularly the United States. It has not been possible, however, to locate reliable data for Australian emu oil production and exports. In estimating the value of Australian emu production, assumptions were made about the volume of emu oil produced and exported. It was assumed that each emu slaughtered produces 6 litres of oil; and 80 per cent of Australian production is exported.

A similar estimate was made with emu skins where also no reliable data are available. At present, there is only limited demand for Australian emu leather in international markets though MacNamara et al. (2003) point to the potential in the US and Chinese markets if improvements can be made in the tanning process. It is assumed that one-third of emu skins from slaughtered birds are used; the domestic price for raw, salted skins is $66 a skin; and that 50 per cent of all skins produced are exported in raw, salted form.

Emu production in Australia has declined substantially from the peak of 21 000 birds slaughtered in 1996. A series of droughts in the 2000s contributed to this production decline. However, the value of emu production in recent years has been boosted by higher export prices for emu meat, though prices declined sharply in 2007 due to higher supplies (Figure 13). The value of emu production in 2007 was an estimated $1.34 million (Table 8).

In the five years to 2007, the main markets for Australia emu meat were the Malaysia (47 per cent of total Australia meat exports), United States (35 per cent), Hong Kong (10 per cent) and Switzerland (5 per cent).
Table 8: Emu products: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Production</th>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slaughterings</td>
<td>no.</td>
<td>3 714</td>
<td>6 258</td>
<td>3 549</td>
<td>4 360</td>
<td>7 393</td>
</tr>
<tr>
<td>Gross value</td>
<td>$'000</td>
<td>459</td>
<td>1 033</td>
<td>705</td>
<td>1 090</td>
<td>1 340</td>
</tr>
<tr>
<td>Meat a</td>
<td>tonnes</td>
<td>44.6</td>
<td>75.1</td>
<td>42.6</td>
<td>52.3</td>
<td>88.7</td>
</tr>
<tr>
<td>Oil b</td>
<td>kL</td>
<td>22.3</td>
<td>37.5</td>
<td>21.3</td>
<td>26.2</td>
<td>44.4</td>
</tr>
</tbody>
</table>

Exports

Meat and edible offal

| – volume   | tonnes| 38.8  | 17.5  | 19.2  | 13.2  | 18.6  |
| – value    | $'000 | 148   | 134   | 206   | 156   | 160   |
| – unit value| $/kg | 3.82  | 7.63  | 10.72 | 11.85 | 8.59  |

Oil

| – volume   | tonnes| 17.8  | 30.0  | 17.0  | 20.9  | 35.5  |
| – value    | $'000 | 431   | 1 051 | 767   | 1 088 | 1 739 |
| – unit value| $/kg | 24.20 | 35.00 | 45.00 | 52.00 | 49.00 |

Skins and leather

| – volume   | no.   | 613   | 1 033 | 586   | 719   | 1 220 |
| – value    | $'000 | 40    | 68    | 39    | 47    | 81    |
| – unit value| $/skin| 66.00 | 66.00 | 66.00 | 66.00 | 60.00 |

Total export value $'000 620 1 253 1 011 1 292 2 086

a Assumes a dressed weight of 12 kilograms a bird.
b Assumes oil production of 6 litres a bird slaughtered.

Sources: ABS (2008b); Levies Revenue Service; ABARE.

Figure 13: Emu meat: Australian exports and export prices

Further information about emus

- Emu Industry Federation of Australia (www.emuindustry.asn.au/effa.html) is the industry representative body.
Game Birds

Birds usually referred to as game birds include turkey, goose, duck, pheasant, plover, quail, grouse, partridge, guinea fowl, spatchcock and squab (pigeon). They have been traditionally harvested from the wild but most of the game birds consumed are now raised on farms.

Annual world production of meat from game birds averaged 10.8 million tonnes in 2005 and consisted mostly of meat from turkeys, ducks, geese and guinea fowl (Figure 14). This puts game bird production at about one-sixth of the size of world chicken meat production. The United States produces nearly half of the world's turkey meat and China accounts for around two-thirds of world duck meat production.

World exports of game bird meat grew strongly since 1990s but have levelled off at around 1.5 million tonnes (Figure 15). At the same time, unit export returns for game bird meat have been trending downwards in response to productivity improvements with bird production. The characteristics of the world game bird market are summarised in (Table 9).

Australian game bird industry

There are game bird industries in all states in Australia but the main producing states are New South Wales and Victoria (Leech, Shannon, Kent, Runge and Warfield 2003). In the three years to 2006, slightly more than half of the value of the Australian game bird industry came from turkey production, with the duck sector contributing another 42 per cent (Table 10). Other game bird production contributed 6 per cent of the total value of the industry.

For confidentiality reasons, no detailed breakdown is available from the Australian Bureau of Statistics for the 'other game birds' category in Table 10. Leech et al. (2003) reported estimates of game birds processed in 2001-02; these are shown in Table 11.

The Australian game bird industry seems to be highly concentrated. Leech et al (2003) say that large vertically integrated meat-chicken companies produce more than three-quarters of Australia's turkeys; two companies produce virtually all of Australia's ducks; and a single company produces 75 per cent of Australia's quails.

Around 10 per cent of Australia's game bird meat is exported and this is mainly turkey meat (Figure 16). Unit export returns in constant (2008) dollars for turkey meat have trended downwards over time. The increase since 1996 in unit export returns for other game bird meat reflects a greater proportion of higher value game birds, particularly quail, in the total. While there has been substantial growth in Australian exports of game bird meat since 1990, the small size of the Australian industry makes it difficult to compete on price with the major world producers (Leech et al. 2003).
Table 9: Game birds: key characteristics of the world market

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume</th>
<th>Value</th>
<th>Key countries (share of total volume in the three years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kt</td>
<td>million</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>5 152</td>
<td>na</td>
<td>United States (48%), France (12%), Germany (7%), Italy (5%), Brazil (4%), United Kingdom (4%)</td>
</tr>
<tr>
<td>Duck</td>
<td>3 424</td>
<td>na</td>
<td>China (67%), France (7%), Malaysia (3%), Vietnam (3%)</td>
</tr>
<tr>
<td>Goose and guinea fowl</td>
<td>2 209</td>
<td>na</td>
<td>China (93%), Egypt (2%), Hungary (2%)</td>
</tr>
</tbody>
</table>

**World trade**

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume</th>
<th>Value</th>
<th>Exporters</th>
<th>Importers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey meat</td>
<td>1 332</td>
<td>na</td>
<td>France (27%), United States (16%), Brazil (9%), Germany (9%), Canada (6%), Austria (6%)</td>
<td>Mexico (15%), Russian Federation (12%), Germany (11%), China (7%), Canada (4%), Belgium (4%), United Kingdom (4%)</td>
</tr>
<tr>
<td>Duck, goose and guinea fowl</td>
<td>201</td>
<td>na</td>
<td>China (21%), Hungary (18%), Malaysia (9%), France (8%), Poland (8%), Netherlands (7%), United States (5%)</td>
<td>China (37%), Germany (21%), Japan (5%), United Kingdom (5%), Austria (4%)</td>
</tr>
</tbody>
</table>

Average, three years to 2005.


Table 10: Game birds: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducks and drakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– slaughterings</td>
<td>'000</td>
<td>4 440</td>
<td>4 493</td>
<td>4 879</td>
<td>5 307</td>
<td>5 899</td>
</tr>
<tr>
<td>– production</td>
<td>tonnes</td>
<td>10 068</td>
<td>9 506</td>
<td>12 024</td>
<td>11 369</td>
<td>13 128</td>
</tr>
<tr>
<td>– gross value</td>
<td>$'000</td>
<td>36 492</td>
<td>34 269</td>
<td>36 644</td>
<td>39 119</td>
<td>48 326</td>
</tr>
<tr>
<td>Turkeys</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– slaughterings</td>
<td>'000</td>
<td>4 194</td>
<td>3 050</td>
<td>4 061</td>
<td>3 455</td>
<td>3 699</td>
</tr>
<tr>
<td>– production</td>
<td>tonnes</td>
<td>20 193</td>
<td>17 940</td>
<td>26 259</td>
<td>22 620</td>
<td>22 632</td>
</tr>
<tr>
<td>– gross value</td>
<td>$'000</td>
<td>51 081</td>
<td>43 013</td>
<td>56 392</td>
<td>47 094</td>
<td>56 028</td>
</tr>
<tr>
<td>Other game birds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– slaughterings</td>
<td>'000</td>
<td>5 199</td>
<td>6 247</td>
<td>7 166</td>
<td>6 959</td>
<td>7 240</td>
</tr>
<tr>
<td>– production</td>
<td>tonnes</td>
<td>7 576</td>
<td>8 579</td>
<td>9 222</td>
<td>8 711</td>
<td>7 220</td>
</tr>
<tr>
<td>– gross value</td>
<td>$'000</td>
<td>4 980</td>
<td>6 641</td>
<td>9 080</td>
<td>6 928</td>
<td>11 385</td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>4 381</td>
<td>3 636</td>
<td>5 311</td>
<td>5 240</td>
<td>5 993</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>3 156</td>
<td>3 527</td>
<td>5 074</td>
<td>4 913</td>
<td>6 244</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>0.72</td>
<td>0.97</td>
<td>0.96</td>
<td>0.94</td>
<td>1.04</td>
</tr>
<tr>
<td>Other game birds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>252</td>
<td>259</td>
<td>189</td>
<td>284</td>
<td>279</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>782</td>
<td>968</td>
<td>842</td>
<td>995</td>
<td>1 545</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>3.11</td>
<td>3.74</td>
<td>4.45</td>
<td>3.51</td>
<td>5.54</td>
</tr>
<tr>
<td>All game birds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>92 553</td>
<td>83 923</td>
<td>102 116</td>
<td>93 141</td>
<td>115 740</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>3 938</td>
<td>4 495</td>
<td>5 916</td>
<td>5 908</td>
<td>7 790</td>
</tr>
<tr>
<td>Gross value of production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total export value</td>
<td>$'000</td>
<td>3 938</td>
<td>4 495</td>
<td>5 916</td>
<td>5 908</td>
<td>7 790</td>
</tr>
</tbody>
</table>

Dressed weight.

Source: ABS (2007b and unpublished data); ABARE.

Table 11: Game birds (other than ducks and turkeys processed in Australia 2001-02)

<table>
<thead>
<tr>
<th>Species</th>
<th>No. processed</th>
<th>Average dressed weight</th>
<th>Meat, (dressed weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>kg/bird</td>
<td>t</td>
</tr>
<tr>
<td>Quail</td>
<td>6 500</td>
<td>0.24</td>
<td>1 560</td>
</tr>
<tr>
<td>Squab</td>
<td>680</td>
<td>1.90</td>
<td>1 292</td>
</tr>
<tr>
<td>Pheasant</td>
<td>60</td>
<td>0.35</td>
<td>21</td>
</tr>
<tr>
<td>Guinea fowl</td>
<td>40</td>
<td>1.10</td>
<td>44</td>
</tr>
<tr>
<td>Partridge</td>
<td>18</td>
<td>1.05</td>
<td>19</td>
</tr>
<tr>
<td>Goose</td>
<td>5</td>
<td>4.00</td>
<td>20</td>
</tr>
</tbody>
</table>

Total | 7 303 | 2 956 |

Source: Adapted from Leech, Shannon, Kent, Range and Warfield (2003).

Figure 16: Game bird meat: Australian exports and export prices
The game pig industry in Australia is based on harvesting the feral pig populations that have become established since European settlement. Game pigs are usually shot in the wild; very small numbers are trapped and slaughtered at abattoirs.

It is estimated that there are now between 13 million and 23 million feral pigs spread across all of the sparsely populated areas of Australia except the arid inland (Department of the Environment and Heritage 2004). Populations are most dense in wetlands and seasonally inundated floodplains. Feral pigs cause considerable environmental damage in Australia through destroying vegetation, competing with native wildlife for food sources, and wallowing and rooting practices that lead to soil erosion.

Australian game pig production has been considerably reduced in recent years by prolonged drought in the Eastern States of Australia (Table 12).

There is only a very small domestic demand for game pig meat (Forsyth and Parkes 2004). The main export markets for game pig meat are in the European Union, particularly Germany, France and the Netherlands.

Statistics for pig meat exports to the European Union (25 countries) in ABS (2008b) are difficult to interpret, showing a fall to very low levels from January 2002 onwards that is inconsistent with wild pig numbers killed in Australia. Trade statistics from the European Commission (2008) that have a ‘non-domestic’ (wild) swine category appear to be more accurate. Imports of Australian game pig peaked in 1999 but have declined in recent years due to a drought-induced shortage of supply in Australia (Figure 17). The main competitor to Australia in the European game pig market is the United States. Together, Australia and the United States accounted for 96 per cent of the total volume of European Union game pig imports in the three years to 2007.

Since 1999, unit import prices for the European Union market have fluctuated around $A8 a kilogram (shipped weight) in constant (2008) dollars terms (Figure 17). This implies that the average export return for game pig meat is around twice that for farmed pig meat from Australia.

Australian game pig meat cannot be exported to the potentially important markets of Canada, the United States, and the Republic of Korea because these countries require an ante-mortem examination that is not possible with pigs shot in the wild (Forsyth and Parkes 2004).

### Table 12: Game pigs: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Kill '000</th>
<th>Volume tonnes</th>
<th>Gross value $'000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td></td>
<td>139.3</td>
<td>1 567</td>
<td>8 137</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td>166.3</td>
<td>1 975</td>
<td>11 787</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>154.4</td>
<td>1 833</td>
<td>11 255</td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td>136.9</td>
<td>1 626</td>
<td>9 068</td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td>154.8</td>
<td>1 838</td>
<td>10 771</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Exports</th>
<th>Volume tonnes</th>
<th>Value $'000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td></td>
<td>1 547</td>
<td>9 731</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td>1 955</td>
<td>14 338</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>1 813</td>
<td>13 229</td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td>1 606</td>
<td>10 773</td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td>1 818</td>
<td>12 734</td>
</tr>
</tbody>
</table>

**Figure 17: Australian game pig meat: European imports and imports prices**

- Excluding intra-EU trade.
- In constant (2008) dollars.
Goats

Goats are hardy and versatile animals producing meat, milk, fibre (cashmere and mohair) and skins. They adapt to a wide range of climatic conditions and are easily integrated into wheat and sheep farms or grazing enterprises in most agricultural areas in Australia (Meat and Livestock Australia 2002).

There are a number of goat-based industries in Australia with different degrees of specialisation in these products. These can be broadly categorised as meat goats, cashmere goats, angora (mohair producing) goats and dairy goats.

**Meat goats**

Annual world production of goat meat is around 4.3 million tonnes, less than one per cent of which enters world trade (Table 13). Annual world trade in live goats averaged US$110 million in value in the three years to 2005, while the goat meat trade was valued at US$84 million. Islamic countries are the main importers of live goats; live imports enable these countries to satisfy requirements for halal slaughter. The United States is the main importer of goat meat.

**Australian meat goat industry**

Around 90 per cent of Australia’s meat production is derived from rangeland type goats, mainly from feral populations. There is also goat meat production as a byproduct of specialist goat milk, mohair and cashmere production. Increasing use is also being made of specialist meat production breeds, mainly the boer goat but also the damara.

In 2006-07, Australia slaughtered 1.35 million goats and exported 75 300 live goats (Table 14). Apparent domestic consumption of goat is currently around 800-1000 tonnes a year and is growing due to changes in the ethnic composition of the population, but more than 95 per cent of Australian goat meat production is exported.

Australian exports of live goats grew strongly in the 1990s and into the 2000s but have declined in recent years due to increases in domestic slaughter for export and the effect of extended drought on feral goat populations (Figure 18). Australia is the world’s second largest exporter of live goats, with the main markets being Malaysia (68 per cent of total Australian live goat exports in the three years to 2006-07), Singapore (16 per cent), Indonesia (5 per cent) and Brunei (3 per cent). Australia’s reduced export availabilities of live goats have meant higher export prices in recent years.

Australian exports of goat meat have increased strongly since the mid 1990s but were down in 2006-07 due to drought (Figure 19). The main export markets for Australian goat meat are the United States (53 per cent of total Australian exports), Chinese Taipei (28 per cent), Canada (5 per cent), Trinidad and Tobago (4 per cent) and Jamaica (3 per cent).
Table 14: Goat meat products: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slaughterings</td>
<td>'000</td>
<td>1 071</td>
<td>1 056</td>
<td>1 257</td>
<td>1 336</td>
<td>1 350</td>
</tr>
<tr>
<td>Meat</td>
<td>t</td>
<td>14 853</td>
<td>15 048</td>
<td>18 384</td>
<td>20 047</td>
<td>20 588</td>
</tr>
<tr>
<td><strong>Gross value</strong></td>
<td>$'000</td>
<td>39 922</td>
<td>38 384</td>
<td>44 215</td>
<td>49 947</td>
<td>57 208</td>
</tr>
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<td><strong>Exports</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Live goats</strong></td>
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<tr>
<td>– volume</td>
<td>'000</td>
<td>88.5</td>
<td>52.8</td>
<td>44.4</td>
<td>43.8</td>
<td>75.3</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>10 680</td>
<td>8 589</td>
<td>4 323</td>
<td>5 452</td>
<td>9 857</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/head</td>
<td>120.69</td>
<td>162.76</td>
<td>97.26</td>
<td>124.58</td>
<td>130.82</td>
</tr>
<tr>
<td><strong>Meat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>t</td>
<td>13 359</td>
<td>13 914</td>
<td>19 116</td>
<td>21 730</td>
<td>18 054</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>46 938</td>
<td>49 168</td>
<td>70 625</td>
<td>82 116</td>
<td>77 040</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>3.51</td>
<td>3.53</td>
<td>3.69</td>
<td>3.78</td>
<td>4.27</td>
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<tr>
<td>– volume</td>
<td>'000</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>3 030</td>
<td>1 367</td>
<td>1 868</td>
<td>1 133</td>
<td>1 828</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td><strong>Leather</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>71</td>
<td>35</td>
<td>232</td>
<td>348</td>
<td>310</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td><strong>Total value of exports</strong></td>
<td>$'000</td>
<td>60 718</td>
<td>59 160</td>
<td>77 048</td>
<td>89 049</td>
<td>89 035</td>
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<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Meat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>t</td>
<td>17.7</td>
<td>0.0</td>
<td>11.1</td>
<td>22.5</td>
<td>55.5</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>59</td>
<td>0</td>
<td>44</td>
<td>113</td>
<td>264</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>3.34</td>
<td>nc</td>
<td>3.98</td>
<td>5.02</td>
<td>4.75</td>
</tr>
<tr>
<td><strong>Leather</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>t</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>3 267</td>
<td>1 928</td>
<td>1 073</td>
<td>721</td>
<td>582</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td><strong>Total value of imports</strong></td>
<td>$'000</td>
<td>3 326</td>
<td>1 928</td>
<td>1 118</td>
<td>834</td>
<td>846</td>
</tr>
</tbody>
</table>

* Eastern states only. na Not available. nc Not calculated.
Source: ABS (2008b); National Livestock Reporting Service; Levies Revenue Service; ABARE.

Further information about goat meat
- Meat and Livestock Australia (www.mla.com.au), a range of information including the Goats on the Move newsletter.

Figure 19: Goat meat: Australian exports and export prices

Cashmere goats produce down — the cashmere fibre — under longer coarser hair. Cashmere needs special processing; the raw fibre must be dehaired to separate the fine soft cashmere from the largely worthless hair.

Cashmere is mainly produced in the cold and arid regions of central Asia. World production of raw (unseparated) cashmere was an estimated 20,000 tonnes, of which nearly three quarters was produced by China, with Mongolia accounting for the bulk of the remainder (Table 15). There is a strong upward trend in Chinese cashmere production (Figure 20).

Unspun cashmere is mostly traded in unprocessed (not carded or combed) form by China to wealthy countries that do the spinning into garments (Table 15). Increasingly, however, China is processing its own raw cashmere into garments before export.

In constant (2008) dollars, Chinese export prices of cashmere have moved broadly in the range US$60–100 a kilogram and are influenced by the level of Chinese exports (Figure 20). Chinese export prices have increased sharply since 2002 as Chinese exports have declined.

Australian cashmere industry

The Australian cashmere industry began in the 1970s, expanded during the 1980s with support from international processors has declined since then due to disruptions in its traditional markets (MacGregor 2002).

In 2006, there were an estimated 75 farms shearing around 13,000 cashmere goats, with a single farm in the Riverina region accounting for around two thirds of this total. Production of cashmere (hair in) in 2007 was estimated 4 tonnes with a gross value of $87,000 (Table 16).

In the period 1985 to 2004, the Australian Cashmere Marketing Corporation, an industry owned organisation, marketed up to 90 per cent of the Australian cashmere clip on behalf of growers. Now most of the Australian clip is delivered by growers directly to a cashmere processor located at Bacchus Marsh in Victoria.

Further information about cashmere

- The Schneider Group (www.pschneider.com), provides market report, latest market indicator prices (China, Mongolia and Iran) and monthly Chinese cashmere exports.

Table 16: Cashmere: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cashmere production, hair-in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tonnes</td>
<td>8.1</td>
<td>6.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.0</td>
</tr>
<tr>
<td>dehaired tonnes</td>
<td>2.8</td>
<td>2.3</td>
<td>1.6</td>
<td>1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>Gross value $'000</td>
<td>275</td>
<td>125</td>
<td>95</td>
<td>103</td>
<td>87</td>
</tr>
<tr>
<td>Unit gross value $/kg cashmere</td>
<td>96.90</td>
<td>55.00</td>
<td>60.00</td>
<td>65.25</td>
<td>62.00</td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not carded or combed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>volume tonnes</td>
<td>21.5</td>
<td>3.8</td>
<td>2.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>value $'000</td>
<td>87</td>
<td>189</td>
<td>199</td>
<td>0</td>
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</tr>
<tr>
<td>unit value $/kg</td>
<td>4.04</td>
<td>49.15</td>
<td>88.43</td>
<td>nc</td>
<td>nc</td>
</tr>
<tr>
<td>Carded or combed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>volume kg</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td>value $</td>
<td>0</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>83</td>
</tr>
<tr>
<td>unit value $/kg</td>
<td>nc</td>
<td>10.00</td>
<td>nc</td>
<td>nc</td>
<td>28.96</td>
</tr>
<tr>
<td>Total exports $'000</td>
<td>87</td>
<td>189</td>
<td>199</td>
<td>0</td>
<td>83</td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not carded or combed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>volume tonnes</td>
<td>61.1</td>
<td>91.8</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>value $'000</td>
<td>16</td>
<td>40</td>
<td>7</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>unit value $/kg</td>
<td>0.26</td>
<td>0.44</td>
<td>46.48</td>
<td>50.34</td>
<td>44.28</td>
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<td>Carded or combed</td>
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<td></td>
<td></td>
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<tr>
<td>volume tonnes</td>
<td>0.15</td>
<td>0.10</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>value $'000</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>unit value $/kg</td>
<td>29.44</td>
<td>52.10</td>
<td>108.33</td>
<td>nc</td>
<td>nc</td>
</tr>
<tr>
<td>Total imports $'000</td>
<td>21</td>
<td>45</td>
<td>9</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); Australian Cashmere Marketing Corporation; ABARE.

Figure 20: Cashmere: Chinese production, exports and export prices

Mohair is a wool-like fibre produced as fleece from angora goats. Mohair becomes coarser as a goat gets older. 'Kid' mohair starts at an average fibre diameter of 23 microns and is typically used in knitwear. 'Young goat' (intermediate diameter) mohair is used in suiting material while 'Adult goat' mohair — the coarsest ranging up to 36 micron — is typically used in coats and rugs.

**World mohair market**

World mohair production peaked in the late 1980s at more than 25 000 tonnes but has since declined to 5600 tonnes in 2007 (Figure 21). The decline mainly reflects factors like increased competition from manufactured fibres and the removal of subsidies on mohair production in the United States. It can be seen from Figure 9 that the world mohair market is increasingly dominated by South Africa. In 2007, South African production represented 54 per cent of the world total; Lesotho 13 per cent; United States 10 per cent; Argentina 8 per cent; Turkey 6 per cent and Australia 4 per cent.

In 2007, South Africa exported 3 478 tonnes of mohair of which 27 per cent went to Italy, China 21 per cent, France 14 per cent, United Kingdom 12 per cent, Chinese Taipei 9 per cent and Japan 5 per cent (Mohair South Africa 2008).

With reduced world mohair supplies, world mohair prices in constant dollar terms have increased sharply in recent years (Figure 21). However, current mohair prices are still much lower in constant dollar terms than in the early 1980s.

**Australian mohair industry**

Australian mohair production peaked at around 1200 tonnes in 1989 but has declined substantially since then (Mohair South Africa 2008). In 2001, there were an estimated 60 000 angora goats farmed in Australia on around 500 holdings (Peter McInnes, personal communication, 6 December 2002). Mohair production was estimated to be 203 tonnes in 2007, down 13 per cent on the previous year due mainly to the effects of severe drought. With Australian mohair prices also down due to lower world prices and a stronger Australian dollar, the gross value of production declined to $2.2 million (Table 17).

Mohair in Australia is generally sold by auction or private treaty through brokers. In past years Australia has processed up to 40 per cent of its mohair into garments and homewares.

Key participants in the Australian mohair industry are:
- Mohair Australia Limited, the peak industry organisation for mohair fibre and the angora goat industry in Australia.
- Two major mohair brokers: National Mohair Pool Proprietary Limited (Cudal, New South Wales), and Australian Mohair Marketing Organisation (Narrandera, New South Wales).

Australian mohair is also exported but it is aggregated with other animal fibre in recorded trade statistics. It is likely that the fine animal hair exports reported in Table 17 are largely made up of mohair (with perhaps some alpaca fibre). Australia also appears to import mohair. South African exports of mohair to Australia are shown in Mohair South Africa (2008) to be 11.8 tonnes in 2001, 10.2 tonnes in 2003, 7 tonnes in 2004 and 5 tonnes in 2005.

**Table 17: Mohair: supply, disposal and value in Australia**

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
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<td><strong>Production</strong></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Fibre</td>
<td>tonnes</td>
<td>300.4</td>
<td>252.9</td>
<td>245.9</td>
<td>232.7</td>
<td>202.9</td>
</tr>
<tr>
<td>Gross value, fibre</td>
<td>$'000</td>
<td>2 382</td>
<td>1 992</td>
<td>2 720</td>
<td>3 051</td>
<td>2 227</td>
</tr>
<tr>
<td>Unit gross value of fibre</td>
<td>$/kg</td>
<td>7.93</td>
<td>7.88</td>
<td>11.06</td>
<td>13.11</td>
<td>10.98</td>
</tr>
<tr>
<td><strong>Exports, fine animal hair</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>140.3</td>
<td>116.1</td>
<td>151.8</td>
<td>143.9</td>
<td>216.4</td>
</tr>
<tr>
<td>Value</td>
<td>$'000</td>
<td>1 485</td>
<td>1 268</td>
<td>1 911</td>
<td>2 277</td>
<td>2 475</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>10.59</td>
<td>10.92</td>
<td>12.59</td>
<td>15.82</td>
<td>11.44</td>
</tr>
<tr>
<td><strong>Imports, fine animal hair</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>14.0</td>
<td>17.1</td>
<td>28.4</td>
<td>67.4</td>
<td>31.2</td>
</tr>
<tr>
<td>Value</td>
<td>$'000</td>
<td>199</td>
<td>251</td>
<td>388</td>
<td>1 070</td>
<td></td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>14.23</td>
<td>14.63</td>
<td>13.67</td>
<td>15.87</td>
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</table>


Sources: ABS (2008b); Levies Revenue Service, ABARE.
Further information about mohair

- Mohair South Africa website (www.mohair.co.za), auction market reports for South Africa and statistics on production consumption and exports of mohair by key producing country.
- Mohair Australia website (www.mohair.org.au), industry data for Australia, including detailed auction and private treaty sales reports and husbandry hints. Access to the Australian herd book and other information is password protected for members only.
Goat milk is an important source of nutrient in many countries throughout the world. Global production of goat milk averaged 13.4 million tonnes a year in the three years to 2006, equivalent to 2.3 per cent of total world production of all milk types. The main producers are India (28 per cent of world production in the three years to 2006), Bangladesh (11 per cent), Sudan (11 per cent), Pakistan (5 per cent) and France (4 per cent).

Cheese types traditionally made from goat milk (chevre cheese) include feta (also traditionally made from sheep milk) and Kasseri (also made from sheep milk).

Australian dairy goat milk market

Details of the market for Australian dairy goat products are provided in Stubbs and Abd (2007). Australia has six recognised dairy goat breeds — Saanen, Toggenburg, British Alpine, Anglo Nubian, Australia Brown and Australian Melaan — the most numerous of which is the Saanen.

The estimated number of goats milked in Australia in 2006-07 was around 12 000 producing 6 million litres of milk (Stubbs and Abd 2007). State shares of this production were Victoria 30 per cent, Queensland 25 per cent, Tasmania 15 per cent, South Australia 15 per cent, Western Australia 10 per cent and New South Wales 5 per cent.

Australian goat milk is mainly sold as whole milk from farms, although there is some farmhouse processing into cheese. With an average price for goat milk of $1 a litre, the gross value of goat milk production in Australia in 2006-07 was $6 million (Table 18).

Cheese production accounts for around 60 per cent of domestic production, with a further 35 per cent consumed as whole milk or yoghurts; the remainder is processed into powder and tablets.

Australia is importing increasing quantities of chevre and other cheese types that have traditionally been made from goat milk (Table 18). However, feta and kasseri are also traditionally made from sheep milk and increasing from cows’ milk.

Further information about dairy goats

- Dairy Goat Society of Australia (home.vicnet.net.au/~dgsa).
- Dairy Goat Society of Australia, Victorian Branch (home.vicnet.net.au/~goats/dgsavictoria/)

### Table 18: Goat milk products: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farms</td>
<td>no.</td>
<td>65</td>
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<td></td>
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<tr>
<td>Goats</td>
<td>head</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>'000 litres</td>
<td>4 830</td>
<td>5 192</td>
<td>5 581</td>
<td>6 000</td>
<td></td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>4 106</td>
<td>4 673</td>
<td>5 302</td>
<td>6 000</td>
<td></td>
</tr>
<tr>
<td>Farm gate price</td>
<td>$/litre</td>
<td>0.85</td>
<td>0.90</td>
<td>0.95</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td><strong>Imports, cheese</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholly from goat milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>134</td>
<td>150</td>
<td>181</td>
<td>300</td>
<td>435</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>1 890</td>
<td>1 980</td>
<td>2 452</td>
<td>3 447</td>
<td>4 806</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>14.09</td>
<td>13.23</td>
<td>13.54</td>
<td>11.47</td>
<td>11.04</td>
</tr>
<tr>
<td>Feta</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>2 067</td>
<td>2 319</td>
<td>2 825</td>
<td>3 296</td>
<td>2 785</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>11 671</td>
<td>12 750</td>
<td>15 311</td>
<td>16 530</td>
<td>16 704</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>5.65</td>
<td>5.50</td>
<td>5.42</td>
<td>5.01</td>
<td>6.00</td>
</tr>
<tr>
<td>Kasseri</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>149</td>
<td>122</td>
<td>119</td>
<td>96</td>
<td>135</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>14 17</td>
<td>11 24</td>
<td>11 42</td>
<td>871</td>
<td>1350</td>
</tr>
<tr>
<td>Total cheese imports</td>
<td>$’000</td>
<td>14 979</td>
<td>15 854</td>
<td>18 904</td>
<td>20 847</td>
<td>22 860</td>
</tr>
</tbody>
</table>

* Excluding feta and kasseri. It is not clear how much goat milk is contained in feta and kasseri.

Sources: ABS (2008b); Stubbs and Abd (2002, 2007); ABARE.
The Australian kangaroo and wallaby industry is based on the harvesting of kangaroos from the wild by shooters. The industry has developed over the past 30 years from being based on pest control to one where greater use is made of the harvested kangaroos, mainly for pet food but also increasingly for human consumption. Kangaroo skins are also an important product of the harvesting.

Only kangaroos are harvested on the mainland of Australia and only wallabies are harvested in Tasmania.

### Kangaroos

**GVP = $43 913 000**

Kangaroo production operates under a quota system administered by the state and federal governments. Commercial harvesting is currently allowed with only four of the 55 species of kangaroos in Australia. The quotas in each state are generally set annually at 10–20 per cent of the estimated population for each of the permitted species. Kangaroo populations vary substantially from year to year depending on seasonal conditions. The state conservation agencies and the Australian Government Department of the Environment and Water Resources, have the responsibility for monitoring kangaroo populations and the sustainability of the harvesting process. There is considerable underfill of the quotas (Table 19).

The gross value of production of the kangaroo industry was an estimated $43.9 million in 2007, down considerably from the early 2000s due to the effect of severe drought on kangaroo populations (Table 19). This is a measure of the total amount paid to kangaroo shooters at the meat processing plant gates.

Kangaroo meat exports for human consumption have grown strongly over the past fifteen years (Figure 22). This reflects growing demand in Europe where kangaroo meat is considered a game meat. However, the increased supplies seem to have put downward pressure on kangaroo meat prices in constant dollar terms. The major importing countries for kangaroo meat are the Russian Federation (74 per cent of the total volume in the three years to 2007), France (5 per cent), South Africa (4 per cent) and Germany (4 per cent). Kangaroo meat is mainly used in sausage making in the Russian Federation and is lower in quality and price than the prime cuts trade with countries like France and Germany (Humphries 2005). (Steaks and other prime cuts typically make up only about 15 per cent of the total dressed weight of a kangaroo, and depending on the cut, command price premiums of $2–6 a kilogram over the other kangaroo meat.)

Kangaroo skins are an important component of the kangaroo industry, with exports totalling $26.4 million in 2007. (Because of confidentiality requirements, there are only very limited country details available for these kangaroo skin exports.) The export market for pet food was worth $0.7 million in 2007, with the major markets in recent years being Indonesia and New Zealand.

### Wallabies

**GVP = $136 000**

Commercial harvesting of wallabies is undertaken on Flinders Island and King Island in the state of Tasmania under formal management plans aimed at ensuring the sustainability of the harvest. With the new plans commencing in 2005-06, there are quotas for the harvest of Bennett’s wallaby (Macropus r. rufogriseus) and the Tasmanian Pademelon (Thylogale billardierii) on Flinders Island and of Bennett’s wallaby on King Island.

Both these species had been harvested in reasonably large quantities prior to 1986 (118 000 in 1983) but harvesting ceased until the late 1990s. More than 9000 wallabies were harvested in 2005-06 but this was much less than the combined quota of 34 750.
**Table 19: Kangaroo products: supply, disposal and value in Australia**

<table>
<thead>
<tr>
<th>Production</th>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvest quotas</td>
<td>'000</td>
<td>6 552</td>
<td>4 422</td>
<td>3 910</td>
<td>3 809</td>
<td>3 641</td>
</tr>
<tr>
<td>Kill</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– human consumption</td>
<td>'000</td>
<td>1 249</td>
<td>850</td>
<td>1 164</td>
<td>1 393</td>
<td>1 448</td>
</tr>
<tr>
<td>– petfood</td>
<td>'000</td>
<td>1 775</td>
<td>1 700</td>
<td>1 633</td>
<td>1 404</td>
<td>902</td>
</tr>
<tr>
<td>– skins</td>
<td>'000</td>
<td>450</td>
<td>442</td>
<td>315</td>
<td>368</td>
<td>637</td>
</tr>
<tr>
<td>– total</td>
<td>'000</td>
<td>3 474</td>
<td>2 992</td>
<td>3 112</td>
<td>3 166</td>
<td>2 986</td>
</tr>
<tr>
<td>Gross value</td>
<td>$m</td>
<td>34 604</td>
<td>31 730</td>
<td>45 094</td>
<td>47 914</td>
<td>43 913</td>
</tr>
</tbody>
</table>

**Meat**

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>– human consumption</td>
<td>t</td>
<td>15 033</td>
<td>10 224</td>
<td>14 008</td>
<td>16 765</td>
<td>17 421</td>
</tr>
<tr>
<td>– petfood</td>
<td>t</td>
<td>21 365</td>
<td>20 459</td>
<td>19 656</td>
<td>16 898</td>
<td>10 859</td>
</tr>
<tr>
<td>– total</td>
<td>t</td>
<td>36 398</td>
<td>30 683</td>
<td>33 664</td>
<td>33 663</td>
<td>28 279</td>
</tr>
</tbody>
</table>

**Exports**

| Meat | | | | | | |
| ---- | | | | | | |
| – volume | t | 12 317 | 9 256 | 10 153 | 13 172 | 14 212 |
| – value | $’000 | 28 485 | 23 263 | 30 532 | 44 321 | 46 433 |
| – unit value | $/kg | 2.31 | 2.51 | 3.01 | 3.36 | 3.27 |

| Pet food | | | | | | |
| ---- | | | | | | |
| – volume | t | 403 | 282 | 266 | 819 | 359 |
| – value | $’000 | 515 | 330 | 354 | 1 098 | 683 |
| – unit value | $/kg | 1.28 | 1.17 | 1.33 | 1.34 | 1.90 |

| Hides, skins, leather | | | | | | |
| ---- | | | | | | |
| – volume | '000 | 2 322 | 1 705 | 1 717 | 1 626 | 1 768 |
| – value | $’000 | 27 354 | 22 158 | 25 688 | 24 921 | 26 449 |
| – unit value | $/hide | 11.73 | 12.99 | 14.96 | 15.33 | 14.96 |

| Total export value | $’000 | 56 354 | 45 751 | 56 575 | 70 339 | 73 566 |

**Sources:** ABS (2008b); Department of the Environment and Water Resources (2007); Levies Revenue Service; ABARE.

**Figure 22: Kangaroo meat (for human consumption): Australian exports and export prices**

Further information about kangaroos and wallabies

- Department of Environment and Water Resources (www.environment.gov.au/biodiversity/trade-use/wild-harvest/kangaroo/stats.html), information on the kangaroo industry, including quotas and numbers harvested.
- Kangaroo Industry Association of Australia (www.kangaroo-industry.asn.au).

Table 20: Wallabies: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005-06</th>
<th>2006-07</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quota, commercial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Bennett’s Wallaby</td>
<td>no.</td>
<td>31 000</td>
<td>25 000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Tasmania pademelon</td>
<td>no.</td>
<td>3 750</td>
<td>2 000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– total</td>
<td>no.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>34 750</td>
<td>27 000</td>
</tr>
<tr>
<td>Commercial harvest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Bennett’s Wallaby</td>
<td>no.</td>
<td>4 392</td>
<td>0</td>
<td>0</td>
<td>8 874</td>
<td></td>
</tr>
<tr>
<td>– Tasmanian pademelon</td>
<td>no.</td>
<td>2 169</td>
<td>0</td>
<td>0</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>– total</td>
<td>no.</td>
<td>6 561</td>
<td>0</td>
<td>0</td>
<td>9 054</td>
<td>0</td>
</tr>
<tr>
<td>Meat</td>
<td>tonnes</td>
<td>98.4</td>
<td>0.0</td>
<td>0.0</td>
<td>135.8</td>
<td>0.0</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>98</td>
<td>0</td>
<td>0</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td><strong>Exports from Tasmania</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>1.3</td>
<td>1.4</td>
<td>0.0</td>
<td>4.6</td>
<td>0.0</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>16</td>
<td>17</td>
<td>0</td>
<td>59</td>
<td>0</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>12.81</td>
<td>12.59</td>
<td>nc</td>
<td>12.76</td>
<td>nc</td>
</tr>
<tr>
<td>Skins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Furskins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>no.</td>
<td>12 096</td>
<td>0</td>
<td>5 450</td>
<td>2 955</td>
<td>0</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>136</td>
<td>0</td>
<td>30</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/furskin</td>
<td>11.26</td>
<td>nc</td>
<td>5.60</td>
<td>7.54</td>
<td>nc</td>
</tr>
<tr>
<td>Total value of exports</td>
<td>$’000</td>
<td>153</td>
<td>17</td>
<td>30</td>
<td>81</td>
<td>0</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); Levies Revenue Service; ABARE.
The ostrich is a flightless bird of the ratite family of birds. They are farmed in around 50 countries for their meat, skin (leather), oil and feathers. Ostrich meat is a red meat and is very low in cholesterol and calories and is almost fat free. Ostrich leather is durable with a distinctive quill pattern and is one of the most expensive leathers in the world. There is a range of cosmetic products that use ostrich oil as the major active ingredient, including soap, massage oils and hair products. It is claimed that ostrich oil is a natural moisturiser because of its excellent penetration and emollient properties when applied to the skin (Australian Ostrich Association 2001). Feathers from ostriches are used extensively in feather dusters (because of their antistatic properties) and in the fashion industry.

Worldwide commercial slaughterings of ostriches were an estimated 350,000 in 2006-07, of which 257,000 were slaughtered in South Africa (National Department of Agriculture, South Africa 2007). There are also significant commercial ostrich flocks in China, the United States and Australia.

The Klein Karoo Co-operative Ltd, which had statutory controls over the marketing of South African ostrich products until 1993, controls around 60 per cent of world trade in ostrich products.

Based on data in National Department of Agriculture, South Africa (2007), the value to producers of a slaughter bird in South Africa in 2006-07 was broken up approximately as 67 per cent skin, 29 per cent meat and 4 per cent feathers. Ostrich oil or fat apparently has little value. The price to South African producers of ostriches in 2006-07 was an estimated US$186 ($A237) a bird.

The bulk of South African ostrich meat exports go to the European Union. However, an outbreak of avian influenza in South Africa in August 2004 resulted in a ban being imposed by the European Union on imports of South African ostrich meat and eggs. This ban was lifted in late 2005.

In 2002, 564 tonnes of ostrich feathers were sold by ostrich growers in South Africa (Statistics South Africa 2005) at an average price per kilogram equivalent to US$11.09 or $A20.38. According to Stables (2004), other world producers have yet to fully explore income from ostrich feathers, probably because feather processing is a very labour intensive process.

**Australian ostrich industry**

In 2007, the gross value of ostrich production in Australia was an estimated $1.73 million, with ostrich meat production of around 173 tonnes, most of which was exported (Table 21). Ostrich skin production in 2007 was also mainly exported.

Export prices for Australian ostrich meat declined sharply in 2007 (Figure 23). World ostrich meat prices had been high in 2005 and 2006 due to market access issues with South African ostrich meat in Europe.

In the five years to 2007, exports of Australian ostrich meat and edible offal averaged $3.8 million a year (Table 21). The main export markets were the United States (55 per cent of total volume), Switzerland (11 per cent), Honk Kong (5 per cent), Singapore (5 per cent), Japan (4 per cent) and the Netherlands (4 per cent). Over the same period, the value of ostrich skin exports averaged $1.6 million a year. Nearly 40 per cent of the volume of ostrich skin trade which was accounted for by the Republic of Korea. South Africa (23 per cent of total volume), Thailand (20 per cent) and Italy (15 per cent) were the other important markets for ostrich skins. There were also exports of live ostriches to Japan and Vietnam in this period, with especially large live shipments in 2004.
Further information about ostriches

- South African Ostrich Business Chamber (www.saobc.co.za), information about the South African ostrich industry.
- World Ostrich Association (www.world-ostrich.org), range of information on the world ostrich industry including details of industry standards for ostrich products.
- National Department of Agriculture, South Africa (www.nda.agric.za), for an annual review of the South African ostrich industry.

Table 21: Ostrich products: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slaughterings</td>
<td>no.</td>
<td>21 429</td>
<td>10 379</td>
<td>7 795</td>
<td>7 441</td>
<td>6 185</td>
</tr>
<tr>
<td>Meat production</td>
<td>tonnes</td>
<td>600</td>
<td>301</td>
<td>218</td>
<td>208</td>
<td>173</td>
</tr>
<tr>
<td>Gross value</td>
<td>$'000</td>
<td>2 728</td>
<td>2 154</td>
<td>2 939</td>
<td>2 646</td>
<td>1 731</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live ostriches</td>
<td>no.</td>
<td>400</td>
<td>2 194</td>
<td>890</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>35</td>
<td>130</td>
<td>78</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/head</td>
<td>87.23</td>
<td>59.23</td>
<td>87.81</td>
<td>nc</td>
<td>3075.00</td>
</tr>
<tr>
<td>Meat and edible offal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>612</td>
<td>374</td>
<td>162</td>
<td>148</td>
<td>125</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>3 559</td>
<td>3 357</td>
<td>2 336</td>
<td>1 823</td>
<td>1 031</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>5.81</td>
<td>8.97</td>
<td>14.45</td>
<td>12.38</td>
<td>8.25</td>
</tr>
<tr>
<td>Hides and leather</td>
<td>no.</td>
<td>53 874</td>
<td>29 614</td>
<td>4 390</td>
<td>15 510</td>
<td>16 202</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>1 819</td>
<td>833</td>
<td>180</td>
<td>893</td>
<td>1 013</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/skin</td>
<td>33.76</td>
<td>28.14</td>
<td>41.09</td>
<td>57.56</td>
<td>62.52</td>
</tr>
<tr>
<td>Total export value</td>
<td>$'000</td>
<td>5 413</td>
<td>4 320</td>
<td>2 595</td>
<td>2 716</td>
<td>2 068</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); Levies Revenue Service; ABARE.

Figure 23: Ostrich meat: Australian exports and export prices

An industry based on the harvesting from the wild of brushtail possums (*Trichosurus vulpecula* (Kerr)) has been operating in Tasmania since the early days of European settlement. Possum harvesting is currently not allowed in any other states or territories of Australia.

There is also limited harvesting of brushtail possums for commercial purposes in New Zealand where the brushtail possum was introduced from Australia in the 1930s and its possum population has now grown to pest proportions.

In Tasmania, harvesting for commercial purposes under permit is a component of the government arrangements for the control of the size of the brushtail possum population that also include a bounty paid on skins and carcasses. There is only one processor. Control measures are necessary because the establishment of crops, orchards and vineyards has seen the brushtail possum increase greatly in numbers (Tasmanian Parks and Wildlife Service 1996).

A management plan with quotas and monitoring arrangements operated in Tasmania to ensure that the brushtail possum population does not become an endangered species through over exploitation (see Tasmanian Parks and Wildlife Service 1999). A quota was first set in 1983 at 250 000 possums a year. The quota includes possums harvested under commercial permits and shot or poisoned under crop protection permits. Prior to the quota, the season was simply closed for commercial harvest when populations were assessed to be under threat of over exploitation.

Initially, the Tasmanian possum industry was largely based on fur production. At its post war peak in 1979, the industry harvested around 300 000 possums but the industry nearly disappeared in the mid 1990s after the collapse of the world market for animal fur (Figure 24).

The industry was re-established in 1995 based on meat production. Its main outlet is the Chinese market where possum is a close substitute in appearance and taste for a local delicacy, the civet cat (*Paguma larvata*). However, the civet cat was identified as a carrier of the Severe Acute Respiratory Syndrome (SARS) virus with the outbreak of this disease in China in late 2002. In 2004, the Chinese government banned the consumption of civet cat. This has also severely affected demand for possum meat in the Chinese market and the Tasmanian commercial possum harvest has again fallen to low levels in recent years after reaching 64 640 possums in 2000.

At its peak in 2000, the value of brushtail possum production for commercial purposes was around $400 000 but fell to only an estimated $87 000 in 2004 (Table 22). Possum skins were also produced, most of which were exported.

The last Wildlife Management Plan for brushtail possum expired on 31 Dec 2004 and no further harvesting has taken place. The possum furskins exported in 2005 were harvested in 2004.

The need to cull possum populations in Tasmania will create opportunities for the re-establishment of the possum harvesting industry. While identifying new markets for possum meat will be important for the future viability of the industry, additional opportunities are afforded by a resurgence in the world export market for animal fur that was worth more than US$5 billion in 2005 (UN Statistics Division 2007).
### Table 22: Possum products: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Production</th>
<th>Unit</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvest</td>
<td>no.</td>
<td>16 318</td>
<td>19 742</td>
<td>12 000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Meat</td>
<td>tonnes</td>
<td>33</td>
<td>39</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gross value</td>
<td>$'000</td>
<td>119</td>
<td>144</td>
<td>87</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Exports

<table>
<thead>
<tr>
<th>Meat</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>32</td>
<td>38</td>
<td>23</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>127</td>
<td>153</td>
<td>93</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skins</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>– volume</td>
<td>no.</td>
<td>12 096</td>
<td>0</td>
<td>5 450</td>
<td>2 910</td>
<td>45</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>136</td>
<td>0</td>
<td>30</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>11.26</td>
<td>5.60</td>
<td>6.73</td>
<td>60.00</td>
<td></td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); Greg Hocking, Department of Primary Industries, Water and Environment, Tasmania, personal communication, 16 May 2005; ABARE.
Rabbits, farmed

Rabbits are mainly produced intensively in feedlot type farms but are also shot or trapped in the wild. The main product is meat, with rabbit underfur also being used extensively in felt making processes for hats.

World production of rabbit meat is currently around 1.1 million tonnes and has grown over the ten years to 2005 at around 3 per cent a year. The main producers are China and countries in the European Union (Table 23).

Only 3–4 per cent of rabbit meat production enters world trade (Table 23). The main exporters of rabbit meat are China and member countries of the European Union. European countries are the main importers of rabbit meat. There is only a very small international trade in rabbit fur skins and tanned rabbit skins.

Export prices in constant (2008) dollar terms for rabbit meat have varied around US$4 a kilogram (Figure 25).

**Farmed rabbit industry in Australia**

The farmed rabbit industry in Australia was established after the collapse of the industry based on rabbits harvested from the wild that resulted from the deliberate introduction in Australia of rabbit calicivirus in 1996. This was enabled by the removal of state bans on rabbit farming in all states but Queensland and the Northern Territory. There are now rabbit farms in New South Wales, Victoria, South Australia and Western Australia.

Australian production of rabbit meat in 2006-07 was 324 tonnes (Table 24), three times larger than in 1998-99.

In the initial stages of the farmed rabbit industry, meat production was contributed by many small producers but there has been a trend to fewer but much larger farms. Foster (1999) estimated that there were 115 rabbit farms in Australia with an average of 57 breeding does each. By 2007, the number of farms had contracted to 43, but with an average size of 297 breeding does.

At this stage of its development, the industry is oriented toward supplying the lucrative domestic markets that offers wholesale prices of up to $15-18 a kilogram, compared to international prices of around US$4 a kilogram. In 2006-07, there were Australian rabbit meat exports of 2.5 tonnes, mainly to Germany, but this appears to have been game (wild) rabbit meat rather than farmed rabbit meat. (In the five years prior to the release of rabbit calicivirus, Australian exports of game rabbit meat averaged more than 500 tonnes a year, with a peak of 1081 tonnes in 1990-91.)

The collapse of the industry in Australia based on wild rabbits meant that rabbit furskins had to be imported to meet demand from the makers of felt hats. In 1999-2000, imports of rabbit furskins peaked at around 1.3 million but have dropped to very small quantities in recent years (Table 24). There were some initial problems with using furskins from the Australia farmed rabbit industry due to the fattiness of the skins but these now appear to have been overcome. In August 2007, the price for farmed rabbit furskins was $7.50 a kilogram, or around $0.75 a skin.

Supported by growing demand for rabbit meat, the farmed rabbit industry in Australia is likely to continue to expand. Over the next two years, there are plans to expand the industry to around 20 000 breeding does, compared to 13 000 breeding does in 2006-07. This implies a 60 per cent increase in production and this is likely to put downward pressure on domestic prices of rabbit meat and furskins.

Some processors are anticipating that production expansion will require the development of export markets and have plans for obtaining export accreditation. While average world trade prices for rabbit meat are low compared to current domestic prices, it is likely that Australia's high quality rabbit meat will attract higher prices than this.

**Figure 25: Rabbit meat: world production and trade**

![Graph showing world production and trade of rabbit meat.](image)

Table 23: Rabbit meat: key characteristics of the world market

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume a</th>
<th>Value a</th>
<th>Key countries (share of total volume in the three years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>1 104</td>
<td>na</td>
<td>China (42%), Italy (20%), France (8%), Spain (8%), Egypt (7%), Czech Republic (4%), Germany (3%)</td>
</tr>
<tr>
<td>World trade</td>
<td>39</td>
<td>$162m</td>
<td>Exporters: China (14%), Hungary (12%), Spain (12%), Argentina (11%), France (10%), Italy (9%), Czech Republic (7%), Netherlands (5%), Belgium (3%), Poland (2%), South Africa (2%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Importers: Germany (18%), Netherlands (15%), France (12%), Belgium (9%), Italy (8%), Switzerland (6%), Portugal (6%), Russian Federation (5%), Greece (4%), Czech Republic (3%)</td>
</tr>
</tbody>
</table>


Further information about farmed rabbits

- Farmed Rabbit Industry of Australia (www.fria.com.au), industry representative body in Australia, providing a regular newsletter.
- World Rabbit Science Association (world-rabbit-science.org), information on all aspects of rabbit production, including proceedings of recent conferences.

Table 24: Rabbit products: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of farms</td>
<td>no.</td>
<td>185</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>43</td>
</tr>
<tr>
<td>Average size (breeding does)</td>
<td>no.</td>
<td>100</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>297</td>
</tr>
<tr>
<td>Slaughter</td>
<td>'000</td>
<td>163</td>
<td>171</td>
<td>212</td>
<td>231</td>
<td>262</td>
</tr>
<tr>
<td>Farm gate price</td>
<td>$/rabbit</td>
<td>12.10</td>
<td>12.80</td>
<td>8.85</td>
<td>10.45</td>
<td>11.72</td>
</tr>
<tr>
<td>Gross value</td>
<td>$'000</td>
<td>1971</td>
<td>2194</td>
<td>1876</td>
<td>2412</td>
<td>3076</td>
</tr>
<tr>
<td>Carcass weight</td>
<td>kg a</td>
<td>1.45</td>
<td>1.46</td>
<td>1.49</td>
<td>1.49</td>
<td>1.46</td>
</tr>
<tr>
<td>Meat</td>
<td>tonnes</td>
<td>237</td>
<td>250</td>
<td>317</td>
<td>343</td>
<td>383</td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>2.5</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>0.2</td>
<td>1.3</td>
<td>2.3</td>
<td>2.4</td>
<td>18.3</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>12.67</td>
<td>16.38</td>
<td>12.83</td>
<td>13.69</td>
<td>7.46</td>
</tr>
<tr>
<td>Skins, furskins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000</td>
<td>10.4</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>42</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/skin</td>
<td>4.01</td>
<td>9.97</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
</tr>
<tr>
<td>Total export value</td>
<td>$'000</td>
<td>42</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skins, furskins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000</td>
<td>258</td>
<td>780</td>
<td>480</td>
<td>297</td>
<td>7</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>8</td>
<td>27</td>
<td>9</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/skin</td>
<td>31.05</td>
<td>34.96</td>
<td>19.19</td>
<td>53.29</td>
<td>506.00</td>
</tr>
</tbody>
</table>

a Dressed weight. The dress out proportion with rabbits is assumed to be 50 per cent. (-) negligible.

Sources: ABS (2008b); ABARE.
Recorded world production of freshwater crayfish is growing rapidly, reaching an average 954,000 tonnes in the three years to 2005 (FAO Statistics Division 2007) (Figure 26). The main producing countries are China (86 per cent of total production in the three years to 2005), India (4 per cent), Thailand (3 per cent), United States (3 per cent) and Bangladesh (2 per cent). Over the same period, recorded world exports averaged 32,900 tonnes a year, with a value of US$167 million a year.

A number of freshwater crayfish species are farmed in Australia, mainly:

- **marron** (*Cherax tenuimanus*), a very large freshwater crayfish native to the river systems of the high rainfall areas of Western Australia
- **the redclaw** (*Cherax quadricarinatus*), is a freshwater crayfish native to the turbid slow moving waters of northern Australia, that can tolerate a broad range of environmental conditions
- **the yabby** (mainly *Cherax destructor* and *Cherax albidus*), a semiaquatic freshwater crayfish indigenous to the inland waters and some coastal drainage areas of central and eastern Australia, but introduced to Western Australia around 1932.

Marron have also been introduced to South Africa but only around 2 tonnes is produced annually (FAO Statistics Division 2007). There is also production of redclaw in New Caledonia, Mexico and South America but Australia accounts for around 90 per cent of world production.

### Australian freshwater crayfish industry

Marron is the largest freshwater crayfish farmed in Australia and earns considerably higher prices than yabbies and redclaw (Figure 27). Marron and redclaw are usually farmed in purpose built dams, while yabbies are mostly raised in existing farm dams. Marron accounted for only 27 per cent of Australian freshwater crayfish production in the three years to 2006-07, but 40 per cent of the total value, while yabbies and redclaw accounted for 38 per cent and 36 per cent of Australian production, respectively. In 2005-06, there were 883 farms in Australia producing freshwater crayfish (Table 25).

A production advantage that Australia enjoys compared to other countries is a relatively disease free environment. In recent years, production of freshwater crayfish in Australia has been severely affected by extended drought that has led to marked reductions in water availability in farm dams (Table 25 and Figure 27). In the three years to 2006-07, Western Australia (producing marron and yabbies) accounted for 46 per cent of Australian freshwater crayfish production; Queensland (producing redclaw) 36 per cent; South Australia (marron and yabbies) 10 per cent; New South Wales (yabbies) 7 per cent; and Victoria (yabbies) 1 per cent.

Australian freshwater crayfish are mainly sold domestically; roughly 20–25 per cent of production is exported, mainly to Europe and north Asia. With redclaw, an estimated 14 per cent of total production in 2005-06 was exported, up from only three per cent in the previous year (Lobergeiger and Wingfield 2007). An export accredited marron processing plant was built at Manjimup in Western Australia in 2006.
**Figure 26: Freshwater crayfish: world production and producer prices**

![Graph showing world production and producer prices of freshwater crayfish.](image)


**Table 25: Freshwater crayfish: supply, disposal and value in Australia**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Licensed producers</td>
<td>no.</td>
<td>328</td>
<td>317</td>
<td>290</td>
<td>279</td>
<td>na</td>
</tr>
<tr>
<td>– marron</td>
<td>no.</td>
<td>233</td>
<td>231</td>
<td>233</td>
<td>317</td>
<td>na</td>
</tr>
<tr>
<td>– redclaw</td>
<td>no.</td>
<td>417</td>
<td>403</td>
<td>316</td>
<td>287</td>
<td>na</td>
</tr>
<tr>
<td>– yabbies</td>
<td>no.</td>
<td>971</td>
<td>951</td>
<td>839</td>
<td>883</td>
<td>na</td>
</tr>
<tr>
<td>– total</td>
<td>no.</td>
<td>68</td>
<td>68</td>
<td>77</td>
<td>66</td>
<td>89</td>
</tr>
<tr>
<td>Quantity</td>
<td>tonnes</td>
<td>75</td>
<td>91</td>
<td>99</td>
<td>103</td>
<td>100</td>
</tr>
<tr>
<td>– marron</td>
<td>tonnes</td>
<td>121</td>
<td>114</td>
<td>120</td>
<td>93</td>
<td>109</td>
</tr>
<tr>
<td>– redclaw</td>
<td>tonnes</td>
<td>265</td>
<td>273</td>
<td>296</td>
<td>262</td>
<td>298</td>
</tr>
<tr>
<td>– yabbies</td>
<td>tonnes</td>
<td>68</td>
<td>68</td>
<td>77</td>
<td>66</td>
<td>89</td>
</tr>
<tr>
<td>– total</td>
<td>tonnes</td>
<td>1 615</td>
<td>1 571</td>
<td>2 072</td>
<td>1 637</td>
<td>2 230</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>1 055</td>
<td>1 243</td>
<td>1 282</td>
<td>1 302</td>
<td>1 450</td>
</tr>
<tr>
<td>– marron</td>
<td>$’000</td>
<td>1 699</td>
<td>1 582</td>
<td>1 866</td>
<td>1 314</td>
<td>1 654</td>
</tr>
<tr>
<td>– redclaw</td>
<td>$’000</td>
<td>4 369</td>
<td>4 395</td>
<td>5 220</td>
<td>4 253</td>
<td>5 334</td>
</tr>
<tr>
<td>– yabbies</td>
<td>$’000</td>
<td>265</td>
<td>273</td>
<td>296</td>
<td>262</td>
<td>298</td>
</tr>
<tr>
<td>– total</td>
<td>$’000</td>
<td>5 220</td>
<td>4 253</td>
<td>5 334</td>
<td>4 253</td>
<td>5 334</td>
</tr>
</tbody>
</table>

*Source: ABARE (2007b).*

**Figure 27: Freshwater crayfish: production and producer prices in Australia**

![Graph showing production and producer prices of freshwater crayfish in Australia.](image)

*Unit gross value of production in constant (2008) dollars. Data source: ABARE (2008).*
Emerging Plant Industries

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Emerging Plant Industries

The emerging plant industries in Australia are largely horticultural industries rather than broadacre cropping industries. The estimated value in Australia of emerging plant industries reported in this compendium was $670 million in 2006-07. To put this estimated value into context, the total value of horticultural industries in Australia in 2006-07 was $9.2 billion. The value of many plant industries in Australia in 2006-07 was adversely affected by drought and cyclones. More information on the production and exports of Australia’s plant-based industries are provided in Appendix A.

A number of the emerging plant industries in Australia are based on the use of Australian native plants. The industries include foods, such as macadamias and bush tomatoes; native flowers, such as kangaroo paws and waxflowers; and essential oils, such as boronia and sandalwood. In 2006-07, these industries contributed 27 per cent of the total value of the plant based emerging industries reported in this compendium.

Like the emerging animal industries discussed earlier, production of some new crops is based on farmers wanting to diversify their production away from more traditional agricultural products. In Queensland, for example, growth in production of emerging tropical fruits appears to be related to a shift away from production of tobacco and sugar cane. Similarly, there is also an important lifestyle element to some emerging plant industries, with hobby farms being important sources of products like essential oils, olives and tree nuts.

Also like the emerging animal industries discussed earlier, Australia’s emerging plant industries are benefiting from income growth that is leading to demand for products that are more distinctive or healthier. This demand means, for example, that Australia’s emerging coffee industry can produce for premium-paying niche markets, despite having higher production costs relative to other coffee producing countries. Growing demand for emerging industry products, such as natural pyrethrum and essential oils, reflects a shift in consumer preferences toward natural products. Demand for tree nuts and green tea is being boosted by perceptions of their healthiness as a food.

Innovation has been an important reason for the successful emergence of most plant industries. For example, a viable coffee industry in Australia was virtually enabled by the development of mechanical harvesting.

With many emerging plant products, Australia faces considerable production cost disadvantages compared with its competitors in other countries. For seasonal products, such as tropical fruits, green tea and truffles, Australia’s niche appears to lie with being able to supply fresh product outside the production periods of the main world producers.

A factor that has boosted investment in some emerging plant industries since 1992 are the tax benefits that have been available to investors in managed investment schemes registered under the Corporations Act 2001. A managed investment scheme is where individuals pool their money in a common enterprise, whereby each individual leases a separate portion of the land and a ‘responsible entity’ manages that part of the land. The tax benefit was that investor contributions were treated as lease and management fees and therefore tax deductible. A draft ruling by the Australian Taxation Office in April 2007 — see ATO (2007) — flags the possibility that for future managed agricultural investment schemes, but not existing ones in compliance with the Corporations Act, investor contributions will be treated as capital expenditure and therefore not deductible. Emerging plant industries that have existing managed investment schemes include almonds, olives, sandalwood, truffles and walnuts.

The emerging plant industries in Australia are highly export oriented. This means most industries would likely benefit from reforms to world trade that remove trade barriers and domestic subsidies. For example, the green tea industry would likely benefit from the removal of the very high production subsidies paid to growers of green tea in Japan.

Unlike emerging animal industries, many of the emerging plant industries face strong competition from imports in the Australian domestic market. For example, the emerging tropical fruit industry is facing increased imports from Thailand now that Thailand has gained access to the Australian market with a number of tropical fruits and benefits from a free trade agreement with Australia.

There are environmental benefits associated with many emerging plant industries. For example, the oil mallee and sandalwood industries have benefits in regard to controlling salinity, preserving biodiversity and reducing greenhouse emissions.

There are some new and emerging industries that are not dealt with in this compendium. A more complete range of new crops industries in Australia is described in a RIRDC publication (Salvin, Bourke and Byrne 2004). The emerging plant industries not covered are mostly small at this stage.
There are more than seventy types of Asian vegetables grown in Australia. Many of these vegetables have other common names. The main Asian vegetable types and their prices in the Sydney produce market are shown in Table 26.

Production of Asian vegetables in Australia grew strongly throughout the 1990s. By 2001, the estimated wholesale value of the total Australian market for Asian vegetables was $136 million (Hassall and Associates 2003), up from an estimated $60 million in 1993-94 (Lee 1995). The estimated number of growers in 2000-01 was 1675.

According to ABS (2008), in 2005-06 there were 405 establishments in Australia, planting 1114 hectares to Asian vegetables, with an output of 17 266 tonnes. This would put the wholesale (or primary market equivalent) value of the Asian vegetable industry in Australia in 2005-06 at about $48 million. However, the ABS categorisation does not appear to include vegetables such as Japanese pumpkin, okra and taro. Including the other Asian vegetable types and using the prices for Asian vegetables reported in Table 26, the gross value of the Asian vegetable industry in Australia in 2005-06 is estimated to be $57 million.

The geographical distribution of production of Asian vegetables in Australia largely reflects to population distribution (Figure 29). This suggests that the industry is mainly oriented toward producing fresh vegetables for the domestic market.

Based on 2000-01 data, Hassall and Associates concluded that 16 per cent of Australian production of Asian vegetables was exported but that the volume of exports had not grown significantly since the mid-1990s. They cited increased competition in the export market from China and Vietnam as a reason for this lack of growth.

With vegetable trade intensifying in the 2000s, the value of Australian exports of fresh and processed vegetables to the main Asian markets has declined steadily from a peak in around 2000 (Figure 30).

The diffuse nature of the Asian vegetable industry makes it difficult to source comprehensive data. The remainder of this chapter is a compilation of the reliable data that are publicly available. A more complete statistical snapshot would require a survey of industry participants which was beyond the resources available to this project.

**Table 26: Asian vegetables**

<table>
<thead>
<tr>
<th>State</th>
<th>Production Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>New South Wales</td>
<td>39%</td>
</tr>
<tr>
<td>Queensland</td>
<td>24%</td>
</tr>
<tr>
<td>Victoria</td>
<td>21%</td>
</tr>
<tr>
<td>Western Australia</td>
<td>10%</td>
</tr>
<tr>
<td>South Australia</td>
<td>2%</td>
</tr>
<tr>
<td>Tasmania</td>
<td>0%</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>4%</td>
</tr>
<tr>
<td>South Australia</td>
<td>2%</td>
</tr>
<tr>
<td>Tasmania</td>
<td>0%</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>4%</td>
</tr>
</tbody>
</table>
Table 26: Selected Asian vegetables: average prices, Sydney market

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit ¹</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo shoot</td>
<td>$/kg</td>
<td>5.25</td>
<td>5.92</td>
<td>4.89</td>
<td>5.20</td>
<td>4.53</td>
<td>4.91</td>
</tr>
<tr>
<td>Snake bean</td>
<td>$/kg</td>
<td>3.52</td>
<td>3.72</td>
<td>3.31</td>
<td>3.93</td>
<td>3.78</td>
<td>4.22</td>
</tr>
<tr>
<td>Bitter melon</td>
<td>$/kg</td>
<td>2.70</td>
<td>2.51</td>
<td>2.03</td>
<td>2.25</td>
<td>1.97</td>
<td>2.72</td>
</tr>
<tr>
<td>Wombok (Chinese cabbage)</td>
<td>$/carton</td>
<td>9.70</td>
<td>14.41</td>
<td>12.70</td>
<td>13.41</td>
<td>12.71</td>
<td>12.58</td>
</tr>
<tr>
<td>Chicory</td>
<td>$/bunch</td>
<td>1.30</td>
<td>1.09</td>
<td>0.99</td>
<td>0.96</td>
<td>1.07</td>
<td></td>
</tr>
</tbody>
</table>

Chinese melon

- hairy                        | $/kg  | 1.42  | 1.37  | 1.30  | 1.47  | 1.35  | 1.84  |
- long                         | $/kg  | 1.88  | 1.55  | 1.38  | 1.45  | 1.62  | 1.96  |

Chinese vegetable

- buk choy                      | $/bunch | 0.50  | 0.57  | 0.56  | 0.56  | 0.58  | 0.64  |
- choy sum                      | $/bunch | 0.50  | 0.56  | 0.65  | 0.60  | 0.62  | 0.63  |
- drumstick                     | $/kg   | 7.37  | 4.95  | 5.50  | 5.04  | 4.23  | 4.81  |
- gai choy                      | $/bunch | 0.50  | 0.56  | 0.69  | 0.68  | 0.66  | 0.82  |
- gai lan                       | $/bunch | na    | na    | 0.84  | 0.73  | 0.66  | 0.82  |
Kang Kung

- $/kg | na    | na    | na    | 3.96  | 3.32  | 5.30  |
Kohl Rabi

- $/bunch | 0.99  | 1.33  | 0.96  | 1.00  | 1.08  | 1.17  |
Luffa

- angled                       | $/kg  | 2.08  | 2.09  | 2.04  | 1.88  | 1.99  | 2.30  |
- round                        | $/kg  | 1.95  | 1.71  | 1.76  | 1.66  | 1.47  | 2.08  |
Okra                          | $/kg  | 4.30  | 4.55  | 4.69  | 4.95  | 4.70  | 5.29  |
Pumpkin, Japanese

- $/kg | 1.11  | 0.47  | 0.44  | 0.65  | 0.48  | 0.39  |
Taro

- unspecified                 | $/kg  | 3.41  | 3.89  | 3.21  | 2.80  | 3.15  | 3.46  |
- Japanese                    | $/kg  | na    | na    | na    | 2.74  | 2.21  | 2.43  |
Winged bean                   | $/kg  | 9.92  | 10.30 | 10.96 | 10.50 | 8.79  | 8.53  |
Winter melon                  | $/kg  | 0.84  | 0.60  | 0.92  | na    | 0.86  | 1.15  |
Yam                           | $/kg  | 3.57  | na    | 3.42  | 3.22  | 4.00  | 4.42  |
Yambean                       | $/kg  | 1.71  | 2.38  | 3.35  | 4.45  | 3.68  | 3.53  |

¹ A carton of Asian vegetables weighs approximately 4 kilograms, while a bunch weighs approximately 400 grams. Source: Sydney Market Reporting Service.

Figure 30: Vegetables: value of Australian exports to key countries in Asia

Wombok (Chinese cabbage)

Wombok (Brassica rapa var pekinensis), also known as Chinese cabbage, is the most frequently eaten vegetable in Asia and one of the most commonly consumed Asian vegetables in Australia (Clarke 2004). It is closely related to buk choy. It is commonly eaten as a freshly cooked vegetable, for example in stir fry dishes, and is often further processed as a brined product or used in pickles such as kim-chi. Suited to temperate regions, it is grown in all Australian states but mainly south east Queensland and Western Australia.

Production of wombok in Australia has been oriented toward the export market but there is growing demand in the domestic market, reflecting the influence of the changing ethnic structure of Australia’s population (Table 27).

Australian exports of wombok grew strongly in the late 1980s and early 1990s but declined to only 1286 tonnes in drought affected 2006-07 (Figure 31). This reflects growing domestic demand and markedly increased competition in world markets from China that has led to lower export prices. After growing strongly in constant (2008) dollar terms throughout most of the 1990s, export prices have declined in the 2000s, though some improvement is evident in 2006-07 (Figure 31).

Table 27: Wombok: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>10.475</td>
<td>9.568</td>
<td>9.152</td>
<td>7.508</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>8.448</td>
<td>7.566</td>
<td>6.598</td>
<td>5.000</td>
</tr>
</tbody>
</table>

Table 28: Asian melons: supply, disposal and value, Northern Territory

<table>
<thead>
<tr>
<th>Unit</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitter melon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>tonnes</td>
<td>864</td>
<td>640</td>
<td>640</td>
<td>1610</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>2159</td>
<td>1408</td>
<td>1152</td>
<td>4025</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>2.50</td>
<td>2.20</td>
<td>1.80</td>
<td>2.50</td>
</tr>
<tr>
<td>Gourd, long melon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>tonnes</td>
<td>285</td>
<td>313</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>570</td>
<td>548</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>2.00</td>
<td>1.75</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Winter melon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>tonnes</td>
<td>122</td>
<td>122</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>182</td>
<td>182</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>1.49</td>
<td>1.49</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Other Asian melons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>tonnes</td>
<td>na</td>
<td>na</td>
<td>568</td>
<td>500</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>na</td>
<td>na</td>
<td>895</td>
<td>1625</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>na</td>
<td>na</td>
<td>1.58</td>
<td>3.25</td>
</tr>
</tbody>
</table>

Asian melons

Hairy or Fuzzy Melon (Benincasa hispida var. chien-qua) is a long light green gourd with a downy, hairy skin, sometime narrowing in the centre and fattening at the end. Hairy melons are a significant part of the diet and livelihood of local communities in south Asia. The Chinese use these gourds for a range of medicinal purposes.

Table 28: Asian melons: supply, disposal and value, Northern Territory

<table>
<thead>
<tr>
<th>Unit</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitter melon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>tonnes</td>
<td>864</td>
<td>640</td>
<td>640</td>
<td>1610</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>2159</td>
<td>1408</td>
<td>1152</td>
<td>4025</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>2.50</td>
<td>2.20</td>
<td>1.80</td>
<td>2.50</td>
</tr>
<tr>
<td>Gourd, long melon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>tonnes</td>
<td>285</td>
<td>313</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>570</td>
<td>548</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>2.00</td>
<td>1.75</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Winter melon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>tonnes</td>
<td>122</td>
<td>122</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>182</td>
<td>182</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>1.49</td>
<td>1.49</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Other Asian melons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>tonnes</td>
<td>na</td>
<td>na</td>
<td>568</td>
<td>500</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>na</td>
<td>na</td>
<td>895</td>
<td>1625</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>na</td>
<td>na</td>
<td>1.58</td>
<td>3.25</td>
</tr>
</tbody>
</table>

Sources: DPIFM (2007b); ABARE
Japanese pumpkin

There are two types of Japanese pumpkin: *Cucurbita maxima* (commonly called kabocha) and *Cucurbita moschata* (Morgan and Midmore 2003b). Japanese pumpkin is mainly grown commercially in New South Wales, Victoria, Queensland, Western Australia and Tasmania.

Japanese pumpkin is widely consumed in Australia and is also exported, particularly to Japan. However, because of quarantine restrictions against fruit fly, only pumpkins from Tasmania can be exported to Japan.

Over the last decade, annual Australian exports of pumpkins to Japan have fluctuated around 1200 tonnes with an approximate export value (costs including freight, Japan) of $1.7 million in constant Australian (2007) dollars (Figure 32). In volume terms, the Australian share of the total Japanese import market for pumpkins has averaged less than one per cent in the three years to 2006; New Zealand supplied 64 per cent and Mexico 22 per cent.

Luffa

Luffa is a tropical or subtropical Asian vegetable. Angled luffa (*Luffa acutangula*) is generally used for vegetable production while sponge or common luffa (*Luffa cylindrica L. aegyptiaca*) is used for sponge production. Luffa sponges are produced by allowing the fruit to hang on the vine until the skin hardens and the stems turn yellow. Dried luffa also used as a medicinal tea.

In Australia, luffas are mainly produced in the Northern Territory (around Darwin) in the winter months, and in the other states in the warmer months (Gosbee 2004b). The volume and value of Northern Territory luffa production is shown in Table 29. Australian production is consumed domestically; domestic (Sydney) prices for luffas are reported in (Table 26).

Table 29: Luffas: supply, disposal and value, Northern Territory

<table>
<thead>
<tr>
<th>Unit</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production t</td>
<td>115</td>
<td>133</td>
<td>132</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross value $’000</td>
<td>208</td>
<td>239</td>
<td>212</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>1.81</td>
<td>1.80</td>
<td>1.61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Smooth and angled.

Sources: DPIFM (2007a); ABARE

Figure 32: Pumpkins: Japanese imports from Australia

Okra

Okra (*Abelmoschus esculentus*) is grown in the world’s tropical and warm temperate regions of the world for its fibrous fruit.

Annual world production of okra has fluctuated around 500 000 tonnes over the last decade. India supplied 69 per cent of total world okra production in the three years to 2006-07, Nigeria 9 per cent and the Sudan 4 per cent (FAO Statistics Division 2007).

According to ABS (2008), there were 19 establishments in the Northern Territory in 2005-06 producing 317 tonnes of okra from a harvested area of 54 hectares (Table 30).

Snake bean

Snake/yardlong beans (*Vigna unguiculata*) — also known as dau gok in Chinese and dâu que in Vietnamese — are an annual plant producing a pod that is olive green, round, up to 90 centimetres long and very thin. They are grown in frost-free areas of Australia, either as a dwarf bush or climbing plant.

Snake beans are produced mainly in the Northern Territory (see Table 31) but also in northern Western Australia and northern Queensland. Northern Territory production of snake beans was down sharply in 2004 due to fusarium disease but reached a record 690 tonnes in 2005. Production is sold on the domestic market and there are no imports. The restricted supplies of snake beans meant higher domestic prices (see Sydney market prices in Table 26).

Table 30: Okra, supply, disposal and value in the Northern Territory

<table>
<thead>
<tr>
<th>Unit</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area hectares</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>648</td>
<td>988</td>
<td>1 087</td>
<td>900</td>
<td>317</td>
</tr>
<tr>
<td>Gross value $’000</td>
<td>1 783</td>
<td>2 470</td>
<td>2 989</td>
<td>2 160</td>
<td>1 129</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>2.75</td>
<td>2.50</td>
<td>2.75</td>
<td>2.40</td>
<td>3.56</td>
</tr>
</tbody>
</table>

Sources: DPIFM (2007a); ABS (2008); ABARE

Table 31: Snake beans: supply, disposal and value in the Northern Territory

<table>
<thead>
<tr>
<th>Unit</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area harvested</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production tonnes</td>
<td>253</td>
<td>228</td>
<td>114</td>
<td>690</td>
<td>300</td>
</tr>
<tr>
<td>Gross value $’000</td>
<td>696</td>
<td>512</td>
<td>456</td>
<td>3 105</td>
<td>1 400</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>2.75</td>
<td>2.25</td>
<td>4.00</td>
<td>4.50</td>
<td>4.67</td>
</tr>
</tbody>
</table>

Sources: DPIFM (2007a); ABS (2008); ABARE

---

### Figure 32: Pumpkins: Japanese imports from Australia

![Graph showing pumpkin imports from Australia](image)

Asian vegetables

Taro (large corm)

Taro (*Colocasia esculenta*) is a perennial herbaceous plant grown throughout the humid tropics and parts of the subtropics, mainly for its starchy underground tuber. The leaves and stems are also edible. There are large and small corm forms of taro; the small corm form known as Japanese taro is not dealt with in this compendium.

Taro is an important food crop in less developed countries, particularly in Africa and the South Pacific islands. Total annual world production of taro averaged 11.4 million tonnes in the three years to 2006 (FAO Statistics Division 2007) and has been growing strongly (Figure 33). There was a particularly strong world production increase in the late 1990s in response to higher prices for taro. The main taro producers are Nigeria (45 per cent share in the three years to 2006), Ghana (15 per cent), China (14 per cent) and Cameroon (10 per cent).

No details on world taro trade are available but only around 2 per cent of world taro production is exported. As an indication, world imports and import prices of starchy roots excluding cassava are shown in Figure 33. However, the increased export supplies have put considerable downward pressure on world taro prices in more recent years.

China is the main exporter of these starchy roots (excluding cassava), with a share of 40 per cent in the three years to 2005 (FAO Statistics Division 2007). The other main exporters are France (13 per cent), Costa Rica (10 per cent), Dominican Republic (6 per cent), Ghana (5 per cent) and Fiji (3 per cent). There is probably a considerable trade in taro that does not get recorded in official statistics, particularly between countries in Africa.

Australian taro industry

Taro has been produced in Australia for many years but production has grown strongly over the last decade in response to domestic demand from migrants from Asia and Pacific Islands. The main producing regions in Australia are on the wet tropical coast of north Queensland, with other lesser producing areas in the Northern Territory, central and southern Queensland, and northern New South Wales (Daniells, Petiniaud and Salleras 2004).

According to Daniells, Petiniaud and Salleras (2004) and Lemin (2006), there are around 150 taro growers in Australia producing around 1000 tonnes a year, with a gross value of $3.5 million. This production is consumed on the domestic market.

Australia also imports around 3000 tonnes of taro a year, mainly from Fiji (Daniells, Petiniaud and Salleras 2004). Australian imports of taro (called dalo in Fiji) from Fiji have been growing strongly, as have import prices in recent years (Figure 34). These prices are low compared to domestic prices; domestic (Sydney) prices for taro are shown Table 26.

According to Lemin (2006), sustained expansion of the Australian taro industry is constrained by a lack of mechanisation of production, harvesting and handling. Lemin points to the potential for mechanisation to reduce production costs by as much as 50 per cent, making Australian taro more competitive with imports and in export markets, leading to industry expansion.

Further information about taro

- Taro Growers Australia (www.tarogrowers.vze.com), including an industry newsletter Taro Topics.

Figure 33: Starchy roots: world imports and import prices (excluding cassava)


Figure 34: Taro: Australian imports from Fiji, fresh and dried

Wasabi

Wasabi (Wasabia japonica syn. Eutrema japonica) is a spicy vegetable used in Japanese cuisine. More recently it has found widespread appeal in western cuisine due to its unique flavour. Wasabi can be kept fresh for around two weeks after harvesting.

Wasabi is a cool climate crop, tolerating air temperatures ranging from mild frosts to 30 degrees Celsius (Sparrow 2004). This often means that it must be grown in shaded conditions provided by trees or shade cloth. Wasabi can be grown in soil (under shade) or in clean running streams with gravel beds. Water grown wasabi commands much higher prices than soil grown wasabi.

The main producers of wasabi are Japan and Chinese Taipei but Savage says that the unique environmental requirements of wasabi growing and shortages of cultivable land limit production in these countries to 880 hectares and 400 hectares, respectively. Emerging producers include the Republic of Korea, New Zealand, Colombia and Canada (around Vancouver on the Pacific coast).

Australian wasabi industry

Commercial quantities of soil grown wasabi have been available from Tasmania since 2000, supplying the Sydney, Melbourne and Hobart markets (Sparrow 2004). The first water grown wasabi farm was established in Tasmania in 2004. It is believed that parts of Victoria and highland New South Wales will also be suitable for wasabi production.

In 2006, there were 10 growers of wasabi in Tasmania and one in Victoria, growing 0.15 hectares of soil cultivated wasabi and a water cultivated wasabi farm of 0.2 hectares that ceased production in 2006 (personal communication, Angela Sparrow, Department of Primary Industry and Water, Tasmania, 17 October 2007). Farm gate prices in 2006 were around $45 a kilogram for wasabi stems and $35 a kilogram for wasabi leaves.

With total Australian wasabi production of around 1.5 tonnes of stems and 1.5 tonnes of leaves kilograms, the gross value of the Australian wasabi industry in 2006 was of the order of $68 000. Australian wasabi yields are still low compared to those achieved in Japan, so there is considerable scope for increased production through improved cultivation practices alone.

A peak industry body — Wasabi Growers of Tasmania — was formed in 2003 (becoming an incorporated company in 2005).

Further information about Asian vegetables

- Vinning (2005) provides very detailed Australian and international market information for taro, sweet potato and yam.
Australian native foods

Table 32: Major Australian native foods

<table>
<thead>
<tr>
<th>Common name</th>
<th>Botanical name</th>
<th>Main use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bush tomato</td>
<td><em>Solanum centrale</em></td>
<td>Berry fruit, dried as flavour additive, fresh sales</td>
</tr>
<tr>
<td>Lemon aspen</td>
<td><em>Acronychia acidula</em></td>
<td>Flavour additive</td>
</tr>
<tr>
<td>Lemon myrtle</td>
<td><em>Backhousia citriodora</em></td>
<td>Fresh or dried herb, teas, oil</td>
</tr>
<tr>
<td>Anise myrtle</td>
<td><em>Syzygium anisatum</em></td>
<td>Leaf for spice</td>
</tr>
<tr>
<td>Muntries</td>
<td><em>Kunzea pomifera</em></td>
<td>Fruit berries fresh and processed</td>
</tr>
<tr>
<td>Tasmannia pepper</td>
<td><em>Tasmannia lanceolata</em></td>
<td>Tree berries dried as black pepper substitute, leaf as spice</td>
</tr>
<tr>
<td>Dorrigo pepper</td>
<td><em>Tasmannia stipitata</em></td>
<td>Green leaf pepper</td>
</tr>
<tr>
<td>Quandong</td>
<td><em>Santalum acuminatum</em></td>
<td>Fruit used mainly in dried halved form</td>
</tr>
<tr>
<td>Warrigal greens</td>
<td><em>Tetragonia tetragoniodes</em></td>
<td>Salad leaf vegetable, pesto, sauce</td>
</tr>
<tr>
<td>Wattleseed</td>
<td><em>Acacia spp</em></td>
<td>Roasted seed used directly and milled to flour</td>
</tr>
<tr>
<td>Native currants</td>
<td><em>Coprosma nitida</em></td>
<td>Fruit used directly, dried</td>
</tr>
<tr>
<td>Riberry</td>
<td><em>Syzygium luehmannii</em></td>
<td>Fruit used directly and in processing</td>
</tr>
<tr>
<td>Desert lime</td>
<td><em>Citrus glauca</em></td>
<td>Fruit used directly, frozen</td>
</tr>
<tr>
<td>Finger lime</td>
<td><em>Citrus australasica</em></td>
<td>Fruit used directly, frozen</td>
</tr>
<tr>
<td>Round lime</td>
<td><em>Citrus australis</em></td>
<td>Fruit used directly, frozen</td>
</tr>
<tr>
<td>Kakadu plum</td>
<td><em>Terminalia ferdinandiana</em></td>
<td>Fruit used for food and pharmaceutical applications</td>
</tr>
<tr>
<td>Davidson’s plum</td>
<td><em>Davidsonia pruriens var. jerseyan</em></td>
<td>Fruit used directly</td>
</tr>
<tr>
<td>Illawarra plum</td>
<td><em>Podocarpus elatus</em></td>
<td>Fruit used directly</td>
</tr>
</tbody>
</table>

While many native plants have been identified as having market potential (see, for example, Cribb and Cribb 1989; Wallace 2003; and Altech Group et al. 1999), most remain relatively commercially undeveloped. There are significant exceptions, such as the macadamia nut industry estimated to be worth around $60 million a year, a native food processing firm successfully introducing processed native foods to a large supermarket chain and various retail activities. Since 1998 there has been a dedicated research and development program to address the issues associated with the emerging industry, including evaluation of promising plant varieties (RIRDC 2001a; CSIRO 2003).

The industry is relatively difficult to define. There is a potential for very large number of products and a range of activities, including commercial propagation, intensive and semi intensive cropping, collecting in the wild, processing, value added products and retailing. It has been estimated that there were approximately 800 participants in the native food industry in 2000 and around 85 per cent had income of less than $10 000 from native food activities (Cherikoff 2000). Most respondents to an industry survey conducted in 2000 (around 90 per cent) were using organic production methods to grow multiple species. Other estimates put...
industry employment numbers at 500 full time and 500 part time workers (Altech Group et al. 1999, p. 4). Some of the main products are listed in Table 32; estimated values of production for key native foods are shown in Table 33.

There is little information on total production and average price levels in the industry. The primary value of production, excluding macadamias but including value added activity, was estimated at around $5 million in 1996 (Phelps 1997) and around $10 million in 2000 (Cherikoff 2000). In a 1999 study (Altech Group et al. 1999), the demand for production and market information on the native food industry was examined. While there was a strong perceived demand for such information within the industry, basic information on prices and volumes was not forthcoming — mainly because the sectors were small and trading was thin.

Other key problems in determining value of production include the large number of plants involved (see, for example, Cribb and Cribb 1989; Altech Group et al. 1999), the diverse activities and the ‘cottage industry’ nature of many operations.

While there has been growth in the apparent value of production in the industry from a low base, there are encouraging signs of development. Demand for several products has increased significantly, with strong growth in demand for lemon myrtle as the base for organic tea and the establishment of a range of processed native foods such as bush tomato and native pepper through major retail outlets.

Supplies of several native foods such as quandong, riberry, native lime and lemon myrtle, are set to expand with commercial plantings previously undertaken now reaching production. Harvests of some others are currently limited by market requirements.

The industry has a range of challenges for growth. While many products currently rely on novelty value as a key demand driver, a major issue remains establishing a more robust demand for the products and being able to supply to meet those requirements. This in turn may require a different mix of supply systems because consistency of supply and price considerations are likely to assume greater importance with higher volumes.

Market development opportunities for native food products will vary widely, depending on characteristics and the trade being targeted (for a discussion of some of the issues, see Cherikoff 2000; RIRDC 2001a). For example, a key driver of demand for Kakadu plums has been from the pharmaceutical and cosmetics industry because of its high vitamin C content. Demand for some fresh products, such as bush tomato and native lime, has undoubtedly benefited from the work undertaken in establishing other processed forms. The industry is being actively promoted by marketers, growers, and by RIRDC, which has an active native foods program.

The peak industry body is Australian Native Food Industry Limited (ANFIL), established in December 2006.

An important component of the Australian native food industries are indigenous Australians. The knowledge of the food and medicinal value of native plants are derived from indigenous Australians and they do much of the commercial harvesting of bush tomatoes and wattle seed. There are a number of initiatives to advance the development of Australia’s native food industries through the involvement of indigenous communities. One arrangement is the Coles Indigenous Food Fund (CIFF), established by the supermarket chain Coles in partnership with two suppliers of native food products that source their native food inputs from indigenous communities or businesses. Funding comes from a contribution of 30 cents on the sale of each unit of native food product sold by Coles, with Coles providing 25 cents and the suppliers of the native food product providing 5 cents. CIFF is used for funding of specific projects that assist indigenous communities or businesses who are or who wish to become a part of the native foods industry supply chain.

The bush tomato (Solanum centrale) is native to the central areas of Australia with an annual rainfall of 150–300 millimetres (the Northern Territory, South Australia and Western Australia) and is an important food to aboriginal populations in these areas. The Aboriginal names for the bush tomato vary according to tribe and include ‘akatjera’ (Arrernte tribe), ‘kampurarrpa’ (Pitjantjatjara) and ‘kati kati’ (Anangu Uluru) (CSIRO Sustainable Ecosystems 2007).

The intense flavor of the bush tomato means it is largely used as a food flavouring, sauce or in chutneys.

The commercial harvest of bush tomatoes is gathered from the wild and increasingly from commercial plantings. Morse (2005) puts the annual bush harvest of bush tomatoes by Aboriginal communities in central Australia at 2–5 tonnes, with a return to gatherers of $12 a kilogram.

**Bush tomato**

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**Davidson’s plum**

There are two species of Davidson’s Plum: *Davidsonia jasseyana*, a threatened species that is native to northern New South Wales; and *Davidsonia pruriens* that is native to north east Queensland. The fruit is bright burgundy in colour, sour plum-like in taste and varies in diameter from 2-5 centimetres. The fruit is eaten fresh or is preserved.

Davidson’s plum is produced in small scale orchards in northern New South Wales and Queensland.
Lemon myrtle

Lemon myrtle (*Backhousia citriodora*) is a tree that is native to the subtropical rainforests of Queensland. The leaves have a high content of citral that gives a distinctive lemon-lime fragrance. The leaves are dried or processed to extract an essential oil. The dried leaves are used as a tea, potpourri or spice; the essential oil is used as a food and beverage flavouring, air freshener, disinfectant and in a range of body care products.

Since the early 1990s, around 1.4 million lemon myrtle trees have been established in plantations in Australia, mainly in Queensland but also in northern New South Wales. The trees are formed into hedges that can be mechanically harvested.

The leading producer of lemon myrtle is Australian Lemon Myrtle Ltd that manages 1.2 million trees in an organically certified production system.

Native limes

There are seven native limes in Australia but the three that are used as bushfoods are:
- Desert lime (*Citrus glauca*, previously called *Eremocitrus glauca*) is a tree that is native to the near desert west of Queensland and New South Wales;
- Finger lime (*Citrus australasica*), native to the subtropical rainforests of northern New South Wales and southern Queensland; and
- Round lime (*Citrus australis*), native to the rainforests of south east Queensland.

A plantation in Queensland — Australian Desert Limes — has 3500 grafted desert lime trees that are trickle irrigated, with plans to plant a further 8500 trees over the next few years. At maturity, a desert lime tree can produce up to 40 kilograms of fruit annually.

Quandong

Quandong trees (*Santalum acuminatum*) occur naturally throughout the southern half of Australia but mostly in Western Australia and South Australia. The quandong tree is parasitic on other trees; plantings in orchards require companion plantings. The companion plantings may also be productive, such as acacias producing wattle seeds.

The quandong fruit is generally bright red in colour and contains a large stone that accounts for around 50 per cent of the total weight of the fruit in the wild but less than this in irrigated orchard plantings. The somewhat tart fruit is very high in vitamin C and is a traditional food of indigenous Australians. It is eaten fresh or made into a range of food products, particularly preserves.

Australian quandong production is sourced from wild harvest (particularly by indigenous Australians) and from orchards. In 2001, there were around 26 000 quandong trees in orchards; the plantings were largely irrigated (Lethbridge 2004). The expectation was that each irrigated quandong tree would, at maturity, produce 3 to 5 kilograms of fruit a year, equivalent to 0.75 to 1.2 kilograms of dried flesh.

However, the difficulties of managing quandongs have seen many of the orchards no longer maintained and as few as three orchards with a total of around 2000 trees were still operating in 2006. It is uneconomic for the orchards to supply quandongs to the fresh market and instead they do their own processing.

In 2006, an estimated 10 tonnes of quandongs were gathered from the wild and a further 4 tonnes were harvested from orchards (Table 34).

Wattle seed

Acacia species are numerous and widely located throughout Australia. Many acacia species produce seeds that are edible though there are some species whose seeds are toxic. Wattle seeds are eaten whole or ground into a flour. Wattle seeds are high in protein and rate low on the glycaemic index, making them of value in diabetic and other specialty diets (CSIRO Sustainable Ecosystems 2007). The main edible wattle seed in Australia comes from *Acacia victoriae*. Aboriginal names for wattle seed include ‘ariepe’ (Arrernte), ‘ganabargu’ (Warlpiri), ‘ngatunpa’ (Pitjatjantjara), and ‘pulkuru’ (Pintupi).

The commercial harvest of wattle seed is mainly gathered from the wild but there is also some production from plantations. Morse (2005) puts the annual bush harvest of wattleseed by Aboriginal communities in central Australia at 3–6 tonnes, with a return to gatherers of $10 a kilogram.
Table 33: Selected Australian native foods: farm prices, production and value of production

<table>
<thead>
<tr>
<th>Common name</th>
<th>1995-96</th>
<th>2003</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farm price</td>
<td>Production</td>
<td>Farm price</td>
</tr>
<tr>
<td></td>
<td>Volume $/kg</td>
<td>Value $’000</td>
<td>Volume $/kg</td>
</tr>
<tr>
<td>Bush tomato</td>
<td>$25</td>
<td>6</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lemon aspen</td>
<td>$12</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>Lemon myrtle</td>
<td>$50</td>
<td>Oil, 7.5</td>
<td>375</td>
</tr>
<tr>
<td>Muntries</td>
<td>$12</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>Native pepper</td>
<td>$45</td>
<td>5</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quandong</td>
<td>$10</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native mint</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Wattleseed</td>
<td>$14</td>
<td>9</td>
<td>126</td>
</tr>
<tr>
<td>Riberry</td>
<td>$14</td>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>Native citrus</td>
<td>$10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Wild plums</td>
<td>$14</td>
<td>8</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1 226</td>
<td>2 945</td>
</tr>
</tbody>
</table>

*a Production in non-drought year. na not available.
Sources: Graham and Hart (1997); Various industry sources; ABARE

Table 34: Quandongs: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Unit</th>
<th>1997</th>
<th>2003</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees in orchards</td>
<td>'000</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– wild harvested</td>
<td>tonnes</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>– plantation</td>
<td>tonnes</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>– total</td>
<td>tonnes</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Farm price</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– fresh</td>
<td>$/kg</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>– dried</td>
<td>$/kg</td>
<td>na</td>
<td>60</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>50</td>
<td>450</td>
</tr>
</tbody>
</table>

Source: ABARE

Further information about Australian native foods

- Altech Group and Total Earth Care 1999, Improving Access to Bushfood Production and Marketing Information, RIRDC Publication no. 99/158, Canberra. This publication has a very comprehensive reference and contact list.
- Australian Native Foods website (www.cse.csiro.au/research/nativefoods/development/board.htm), jointly supported by RIRDC and CSIRO Land and Water, providing a directory of the Australian native foods industry and various publications of the peak industry body Australian Native Food Limited.
- Australian Bushfoods (www.ausbushfoods.com), a magazine with industry news (subscription required).
- Primary Industry and Resources, South Australia horticulture website (www.pir.sa.gov.au/pirsa/more/factsheets/horticulture), fact sheets on the production of a number of native plants that produce bush foods.
The two most important types of coffee grown commercially are *Coffea arabica* (arabica coffee), accounting for around 63 per cent of world production, and *Coffea canephora* (robusta coffee). Two other types that are grown on a much smaller scale are *Coffea liberica* (liberica coffee) and *Coffea dewevrei* (excelsa coffee).

Arabica coffee is produced in more temperate and elevated regions than robusta coffee (Table 35). Brazil, Vietnam, Indonesia and Colombia are the largest producers and exporters of green coffee beans. Countries in north America and Europe have strong export industries based on the blending and roasting of imported green coffee beans. Total world trade in coffee products averaged more than US$12 billion in the three years to 2005, around two thirds of which was trade in green beans.

There is a niche market for decaffeinated coffee stemming from health concerns over caffeine consumption. Coffee is usually decaffeinated through a chemical process, though there are some coffee varieties that are naturally low in caffeine. Based on UN Statistics Division (2008) data, decaffeinated coffee makes up around 3 per cent of world trade in green beans and around 7 per cent of world trade in roasted beans.

Mild Arabica types command price premiums compared to robusta types in world markets (Figure 35). Since the mid 1990s, the emergence of Vietnam as a major coffee producer has put downward pressure on world coffee prices.

**Australian coffee industry**

The advent of machine harvesting techniques has enabled the re-establishment of the Australian coffee industry through reducing labour costs, a key barrier to its competitiveness (Drinnan and Peasley 1997). Australia has the advantage of being free from the main diseases and pests that affect many of the coffee producing regions in the world. Australian coffee is also relatively low in caffeine which can be an advantage in some markets. However,

### Table 35: Coffee: key characteristics of the world market

<table>
<thead>
<tr>
<th></th>
<th>Volume</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kt</td>
<td>million</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arabica coffee</td>
<td>4 329</td>
<td>na</td>
</tr>
<tr>
<td>Key countries (share of total volume in the three years to 2005)</td>
<td>Brazil (39%), Colombia (16%), Ethiopia (6%), Mexico (5%), Guatemala (5%), Peru (4%), Honduras (4%), Costa Rica (3%), India (3%)</td>
<td></td>
</tr>
<tr>
<td>Robusta coffee</td>
<td>2 358</td>
<td>na</td>
</tr>
<tr>
<td>Key countries (share of total volume in the three years to 2005)</td>
<td>Vietnam (34%), Brazil (23%), Indonesia (14%), India (7%), Cote d’Ivoire (5%), Uganda (5%)</td>
<td></td>
</tr>
<tr>
<td><strong>World trade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee, green</td>
<td>5 270</td>
<td>US$7 914</td>
</tr>
<tr>
<td>Exporters: Brazil (26%), Vietnam (16%), Colombia (12%), Indonesia (7%), Guatemala (4%), Peru (3%), Honduras (3%), Ethiopia (3%), India (3%), Uganda (3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importers: United States (27%), Germany (17%), Japan (9%), Italy (7%), France (4%), Belgium (4%), Spain (3%), Netherlands (3%), Canada (3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee, roasted</td>
<td>483</td>
<td>US$2 058</td>
</tr>
<tr>
<td>Exporters: Germany (22%), Italy (14%), Belgium (12%), United States (11%), Austria (5%), Netherlands (4%), Canada (4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importers: France (14%), United States (10%), Canada (10%), Germany (8%), United Kingdom (7%), Netherlands (5%), Belgium (4%), Luxembourg (3%), Austria (3%), Spain (3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee, dry and concentrated</td>
<td>484</td>
<td>US$2 374</td>
</tr>
<tr>
<td>Exporters: Brazil (15%), Germany (13%), Singapore (9%), Malaysia (6%), Netherlands (5%), Spain (4%), United Kingdom (4%), India (4%), United States (4%), France (3%), Mexico (3%), Colombia (3%), Poland (3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importers: Russia (22%), Germany (9%), United States (7%), Singapore (5%), United Kingdom (4%), Poland (4%), Thailand (3%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Average, three years to 2006.

Sources: ABS (2008b); USDA (2007); UN Statistics Division (2008).
land with suitable climate conditions, particularly freedom from frosts, limits the extent to which coffee can be grown in Australia.

Australia imports coffee in various forms worth $281 million in 2006-07 (Table 37). Australia also exported $45 million of coffee products in 2006-07 but a large part of the export industry is based on the processing of imported coffee beans.

The Australian coffee industry is located in north eastern New South Wales and in Queensland (Table 36). In 2006-07, there was around 590 hectares of coffee planted in Australia, producing 973 tonnes of dry green beans. More than 40 per cent of this production occurred in northern Queensland, mainly in the Atherton region.

The Australian coffee industry virtually grows only the high quality arabica coffee beans used in the specialty or ‘roast and ground’ market. According to RIRDC (2003), premium prices of around $8–9 a kilogram of dry green beans have been consistently paid for Australian produced arabica, compared with the average imported price for arabica of $3–4 a kilogram. (The import unit returns shown in Table 37 include robusta beans as well as arabica.) Increases in Australian production are likely to result in downward pressure on these premiums (RIRDC 2003).

Given the constraints on suitable land, only small increases in coffee plantings are likely in the future in Australia. However, Australian coffee production is projected to increase to around 1400 tonnes by 2012, reflecting the maturing of existing coffee plantations.

Figure 35: Coffee: indicator prices and production

![Graph showing coffee indicator prices and production](image)


<table>
<thead>
<tr>
<th>Region</th>
<th>Growers no.</th>
<th>Area hectares</th>
<th>Production tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queensland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Far north</td>
<td>10</td>
<td>220</td>
<td>400</td>
</tr>
<tr>
<td>Mackay–Proserpine</td>
<td>2</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Yeppoon</td>
<td>1</td>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>Caboolture–Nambour</td>
<td>12</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>New South Wales</td>
<td>&gt;120</td>
<td>250</td>
<td>312</td>
</tr>
<tr>
<td>Total</td>
<td>&gt;142</td>
<td>590</td>
<td>973</td>
</tr>
</tbody>
</table>

Source: ABARE.
Further information about coffee

- Australian Coffee Growers Association (www.auscoffee.com)
- New South Wales Coffee Growers Association (www.nswcga.org.au)
- AustralAsian Specialty Coffee Association (www.aasca.com), information on the supply chain and consumption of coffee in Australia.
- International Coffee Organisation (www.ico.org), comprehensive market information on coffee.
- Euronext.liffe (www.liffe.com), coffee (robusta) futures prices, London.
- New York Board of Trade (www.nybot.com), coffee (arabica) futures prices.
There are many different essential oils that are used in a range of ways, including in perfumes, cosmetics, therapeutic goods and insecticides.

World trade in essential oils, terpenic byproducts and resinoids was worth an average US$1.8 billion a year in the three years to 2005, of which Australia supplied only US$17 million (United Nations Statistics Division 2007). (Terpenes are the volatile organic compounds that are extracted from essential oils and generally are associated with the characteristic fragrances of those oils.)

The composition of world trade in essential oils is outlined in Table 38. In value terms, terpenic byproducts and orange, lemon and peppermint oils are the most traded worldwide (Figure 36).

Australia is both an importer and exporter of essential oils (Table 39).

In this chapter, information is provided on the most important essential oils in terms of value in Australia: boronia, eucalyptus, lavender, peppermint and tea tree oils.

Figure 36: Essential oils: composition of world trade

### Table 38: Essential oils: characteristics of world trade*

<table>
<thead>
<tr>
<th>Spice</th>
<th>Volume (kt)</th>
<th>Value (US$m)</th>
<th>Main exporters (share of total export value)</th>
<th>Main importers (share of total import value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bergamot</td>
<td>1.0</td>
<td>25.2</td>
<td>Italy (56%), France (11%), United Kingdom (8%), Spain (4%), Germany (4%), United States (3%)</td>
<td>France (26%), United States (15%), Switzerland (8%), United Kingdom (7%), Ireland (7%), Spain (6%), Germany (5%), Netherlands (3%)</td>
</tr>
<tr>
<td>Citrus fruit</td>
<td>6.9</td>
<td>116.6</td>
<td>United States (38%), Italy (10%), Germany (6%), United Kingdom (6%), Israel (5%), Brazil (4%), Netherlands (4%), France (3%), Mexico (3%), South Africa (3%)</td>
<td>Japan (27%), United States (15%), Switzerland (6%), Germany (5%), United Kingdom (4%), France (4%), Ireland (3%), Netherlands (3%), Italy (3%)</td>
</tr>
<tr>
<td>Geranium</td>
<td>0.4</td>
<td>16.2</td>
<td>Egypt (28%), China (27%), France (24%), United Kingdom (4%), United States (3%)</td>
<td>France (20%), United Kingdom (12%), United States (11%), India (10%), Germany (7%), Spain (7%), Switzerland (7%), Singapore (3%)</td>
</tr>
<tr>
<td>Jasmine</td>
<td>0.2</td>
<td>10.3</td>
<td>France (32%), Egypt (23%), India (23%), Germany (4%), United Kingdom (3%), Spain (3%)</td>
<td>France (38%), United States (17%), Switzerland (9%), United Kingdom (8%), Japan (4%), Germany (4%), India (4%)</td>
</tr>
<tr>
<td>Lavender/lavandin</td>
<td>2.2</td>
<td>46.9</td>
<td>France (64%), United States (5%), Bulgaria (5%), Spain (5%), United Kingdom (4%), Germany (3%), Austria (3%)</td>
<td>United States (19%), United Kingdom (12%), Switzerland (11%), Germany (10%), France (5%), Netherlands (4%), Japan (4%), Mexico (3%), Spain (3%)</td>
</tr>
<tr>
<td>Lemon</td>
<td>12.0</td>
<td>152.0</td>
<td>Argentina (44%), United States (13%), Italy (9%), France (6%), Switzerland (4%), United Kingdom (3%), Mexico (3%), Spain (3%)</td>
<td>United States (30%), United Kingdom (19%), Japan (8%), China (7%), France (6%), Switzerland (4%), Brazil (4%), Ireland (3%), Germany (3%), Mexico (3%)</td>
</tr>
<tr>
<td>Lime</td>
<td>3.1</td>
<td>54.3</td>
<td>Mexico (49%), United States (18%), Peru (8%), United Kingdom (8%), Germany (4%), Brazil (4%)</td>
<td>United States (45%), United Kingdom (15%), Ireland (6%), Switzerland (4%), Japan (4%), Germany (3%), China (3%), Mexico (3%)</td>
</tr>
<tr>
<td>Orange</td>
<td>49.7</td>
<td>161.7</td>
<td>Brazil (42%), United States (23%), Germany (6%), United Kingdom (6%), Switzerland (3%), Italy (3%), Netherlands (3%)</td>
<td>United States (28%), Japan (10%), Germany (7%), Switzerland (6%), United Kingdom (6%), Canada (4%), China (4%), Ireland (4%), France (4%), Netherlands (3%), Israel (3%)</td>
</tr>
<tr>
<td>Other mints</td>
<td>9.7</td>
<td>123.2</td>
<td>United States (34%), India (30%), China (12%), France (6%), Paraguay (3%)</td>
<td>United States (16%), China (14%), France (9%), United Kingdom (8%), Japan (7%), Brazil (7%), Mexico (6), Germany (6), Paraguay (4%), Belgium (3%)</td>
</tr>
<tr>
<td>Peppermint</td>
<td>7.0</td>
<td>146.4</td>
<td>United States (56%), India (11%), Thailand (8%), Hong Kong (6%), United Kingdom (5%), China (4%)</td>
<td>United Kingdom (14%), Hong Kong (10%), United States (8), Mexico (7), Japan (7), Thailand (6), Belgium (5), France (4), Germany (4), Italy (3), China (3), Philippines (3%)</td>
</tr>
<tr>
<td>Vetiver</td>
<td>0.2</td>
<td>13.9</td>
<td>Haiti (55%), Indonesia (19%), France (8%), United States (4%), China (3%)</td>
<td>France (29%), Switzerland (18%), Spain (13%), United States (12), India (7), Germany (5), United Kingdom (4), Singapore (3%)</td>
</tr>
<tr>
<td>Other essential oils</td>
<td>35.7</td>
<td>639.0</td>
<td>France (18%), Indonesia (12%), China (11), United States (8), India (5%), Spain (5), United Kingdom (4), Germany (4)</td>
<td>United States (20), France (14), United Kingdom (8), Germany (8), Switzerland (7), Spain (5), Japan (5), Singapore (4), Mexico (3)</td>
</tr>
<tr>
<td>Terpenic byproducts</td>
<td>52.1</td>
<td>280.5</td>
<td>United States (23), India (18), Ireland (9), France (7), Germany (6), United Kingdom (5), Spain (5), Brazil (3), China (3)</td>
<td>France (14), United States (11), Ireland (7), Germany (6), Japan (5), Singapore (5), United Kingdom (5), Spain (3), Honduras (3), Rep. of Korea (3), Mexico (3), Netherlands (3)</td>
</tr>
<tr>
<td>Resinoids</td>
<td>2.7</td>
<td>44.2</td>
<td>France (33%), India (15), United States (11), Spain (10), Germany (7), United Kingdom (4), Japan (3), Morocco (3)</td>
<td>Canada (9), United States (9), Germany (9), United Kingdom (7), France (5), Netherlands (5), Cuba (4), Saudi Arabia (4), Switzerland (4), Japan (4), India (3), Singapore (3)</td>
</tr>
</tbody>
</table>

*Annual average, three years to 2005.

Table 39: Essential oils: Australian exports and imports, by type

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tonnes</td>
<td>tonnes</td>
<td>tonnes</td>
<td>$’000</td>
<td>$’000</td>
<td>$’000</td>
<td>$/kg</td>
<td>$/kg</td>
<td>$/kg</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bergamot</td>
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<td>0.9</td>
<td>103</td>
<td>93</td>
<td>43</td>
<td>8.45</td>
<td>32.44</td>
<td>49.45</td>
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<td>3.3</td>
<td>5.5</td>
<td>4.2</td>
<td>90</td>
<td>80</td>
<td>93</td>
<td>27.00</td>
<td>14.66</td>
<td>22.29</td>
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<td>1.4</td>
<td>0.9</td>
<td>39</td>
<td>38</td>
<td>23</td>
<td>25.98</td>
<td>27.50</td>
<td>24.79</td>
</tr>
<tr>
<td>Lime</td>
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<td>0.2</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>0</td>
<td>39.55</td>
<td>39.01</td>
<td>nc</td>
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<tr>
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<td>20.7</td>
<td>37.7</td>
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<td>1559</td>
<td>1130</td>
<td>28.46</td>
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<td>19</td>
<td>38</td>
<td>56</td>
<td>25.64</td>
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<td>0.0</td>
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<td>1</td>
<td>4</td>
<td>78</td>
<td>110.63</td>
<td>960.00</td>
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<tr>
<td>Lavender, lavandin</td>
<td>17.6</td>
<td>66.4</td>
<td>11.7</td>
<td>416</td>
<td>1248</td>
<td>400</td>
<td>23.63</td>
<td>18.79</td>
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<td>Peppermint</td>
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<td>4.9</td>
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<td>138</td>
<td>213</td>
<td>390</td>
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<td>43.76</td>
<td>23.98</td>
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<td>Other mints</td>
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<td>14</td>
<td>14</td>
<td>36.26</td>
<td>28.86</td>
<td>94.68</td>
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<td>1115</td>
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<td>2283</td>
<td>1973</td>
<td>18.10</td>
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<tr>
<td>Other</td>
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<td>672.5</td>
<td>623.2</td>
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<td>22571</td>
<td>30.71</td>
<td>30.07</td>
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<td>Concentrates</td>
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<td>na</td>
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<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
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<td>Total exports</td>
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<td>na</td>
<td>na</td>
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<td>32972</td>
<td>39581</td>
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<td><strong>Imports</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bergamot</td>
<td>3.2</td>
<td>3.8</td>
<td>3.6</td>
<td>136</td>
<td>139</td>
<td>131</td>
<td>42.75</td>
<td>36.70</td>
<td>36.07</td>
</tr>
<tr>
<td>Orange</td>
<td>288.9</td>
<td>404.2</td>
<td>402.9</td>
<td>1035</td>
<td>1525</td>
<td>1590</td>
<td>3.58</td>
<td>3.77</td>
<td>3.95</td>
</tr>
<tr>
<td>Lemon</td>
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<td>54.4</td>
<td>75.4</td>
<td>1037</td>
<td>1044</td>
<td>1218</td>
<td>20.47</td>
<td>19.19</td>
<td>16.16</td>
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<tr>
<td>Lime</td>
<td>16.8</td>
<td>20.4</td>
<td>32.5</td>
<td>929</td>
<td>1076</td>
<td>1093</td>
<td>55.16</td>
<td>52.83</td>
<td>33.63</td>
</tr>
<tr>
<td>Other citrus</td>
<td>13.7</td>
<td>12.5</td>
<td>34.3</td>
<td>431</td>
<td>353</td>
<td>686</td>
<td>31.51</td>
<td>28.27</td>
<td>20.01</td>
</tr>
<tr>
<td>Geranium</td>
<td>3.1</td>
<td>2.4</td>
<td>1.9</td>
<td>234</td>
<td>198</td>
<td>186</td>
<td>75.99</td>
<td>82.19</td>
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<td>Jasmine</td>
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<td>0.3</td>
<td>0.5</td>
<td>89</td>
<td>96</td>
<td>98</td>
<td>306.53</td>
<td>392.80</td>
<td>178.44</td>
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<tr>
<td>Lavender, lavandin</td>
<td>41.6</td>
<td>41.9</td>
<td>47.5</td>
<td>1924</td>
<td>1336</td>
<td>1387</td>
<td>46.25</td>
<td>31.89</td>
<td>29.18</td>
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<td>Peppermint</td>
<td>46.4</td>
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<td>50.8</td>
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<td>1328</td>
<td>1479</td>
<td>31.04</td>
<td>27.26</td>
<td>29.13</td>
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<td>30.9</td>
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<td>775</td>
<td>1025</td>
<td>35.52</td>
<td>37.24</td>
<td>33.21</td>
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<tr>
<td>Vetiver</td>
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<td>0.1</td>
<td>0.2</td>
<td>27</td>
<td>11</td>
<td>17</td>
<td>113.40</td>
<td>113.76</td>
<td>83.21</td>
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<td>Other</td>
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<td>11066</td>
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<td>Concentrates</td>
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<td>Total imports</td>
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<td>20376</td>
<td>21069</td>
<td>na</td>
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<td>na</td>
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</tbody>
</table>


Further information about essential oils

- International Federation of Essential Oils and Aroma Trades (IFEAT) (www.ifeat.org), information on the world essential oils industry, particularly through the proceedings of the annual IFEAT conference.
Boronia

Boronia oil is a highly fragrant oil produced from the flowers of a perennial shrub endemic to Australia (usually *Boronia megastigma* Nees). The shrubs flower in spring. The oil is extracted using a solvent process and is further refined into either a waxy solid (a ‘concrete’) or a liquid (an ‘absolute’). Boronia oil is used in perfumery and as food flavouring.

Traditionally, boronia oil has been produced from flowers picked in the wild but most boronia oil is now produced from plantations based on the use of selected clones and mechanical harvesting. The commercial life of a planting is around 15 years. The plantations are located mainly in the north and on the east coast of Tasmania (with some production also on Bruny Island). In recent years, wild picking of boronia in Western Australia has been almost eliminated because of the possibility of disease being spread by pickers.

There are currently 12 separate plantations in Tasmania and one in Western Australia at an early stage of establishment. The total commercial plantings are believed to be around 45 hectares. The yield with a mature plantation is around two tonnes a hectare but the industry in Tasmania is going through a replanting phase that involves lower yields in the first four or five years. Australian production of boronia flowers in 2006-07 is estimated to be 44 tonnes with a gross value of $488 000 (Table 40). This is around half the normal level of production prior to the recent replantings.

All but a small part of Australian production of boronia concrete or absolute is exported, mainly to Europe and the United States. The industry in Tasmania has been smoothing exports in recent years through releases from its stockholdings.

The main player in the boronia industry is Essential Oils of Tasmania (EOT) that processes boronia flowers from its own plantation and from the other Tasmania growers. EOT also processes other essential oils and plant extracts including peppermint, fennel, parsley (herb and seed), lavender, blackcurrant bud and mountain pepper leaf (gathered from wild stands of the native plant *Tasmania lanceolata*).

Over the medium term, the area planted to boronia is expected to remain stable in Australia at around 44 hectares. However, production will increase as the recent replantings mature to reach maximum yields. By 2011-12, production of boronia flowers is expected to be around 90 tonnes a year, producing around 200 kilograms of absolute.

Table 40: Boronia oil: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th>2006-07</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
</tr>
<tr>
<td>Growers no.</td>
<td>13</td>
</tr>
<tr>
<td>Area hectares</td>
<td>44</td>
</tr>
<tr>
<td>Yield t/ha</td>
<td>1</td>
</tr>
<tr>
<td>Volume</td>
<td></td>
</tr>
<tr>
<td>- flowers</td>
<td>44</td>
</tr>
<tr>
<td>- absolute kg</td>
<td>111</td>
</tr>
<tr>
<td>Farm gate price</td>
<td>$/t</td>
</tr>
<tr>
<td>flowers</td>
<td>11 000</td>
</tr>
<tr>
<td>Gross value kg</td>
<td>$’000</td>
</tr>
<tr>
<td>$/t</td>
<td>488</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
</tr>
<tr>
<td>Volume kg</td>
<td>100</td>
</tr>
<tr>
<td>Value $’000</td>
<td>450</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>4 500</td>
</tr>
</tbody>
</table>

*Estimates by ABARE.*

Sources: Robert McEldowney, Essential Oils of Tasmania, personal communication, 6 September 2007; ABARE.

Eucalyptus

Eucalyptus oil is extracted by steam distillation from the leaves of a number of types of eucalypt trees including blue mallee gums (*Eucalyptus polybractea*), narrow leafed peppermint gum (*Eucalyptus radiata var. Australiana*), and Tasmanian blue gum (*Eucalyptus globulus*). In recent decades countries such as Spain, Portugal, India and China, have taken over a eucalyptus oil market that once only Australia supplied (Abbott 2004). China is now the world’s largest eucalyptus oil producer, accounting for around half of world output. Most of these countries are using the Tasmanian blue gum as the source of their oil.

The main component of eucalyptus oil is 1,8-Cineole, making up to 95 per cent of the oil content with mallee types, and 60–70 per cent with blue gum types (Barton 1998).

The main uses of eucalyptus oil are as a medicine, usually to be externally applied or inhaled. For example, it may be used to treat muscle soreness, arthritis and coughs and cold. It is also used in confectionary, as a disinfectant or fragrance, and in industrial processes, particularly as a solvent.

Barton (1998) identifies a number potential industrial uses of eucalyptus oil, particularly as a solvent. Barton acknowledges that large scale penetration in these markets would require prices around half those currently prevailing for eucalyptus oil, but says that this could be possible with large scale production technologies.

Apart from their oil producing qualities, eucalypts of this type are also grown to combat salinity, preserve wildlife diversity, and to contain greenhouse gases through carbon sequestration. However, in the case of harvesting of eucalypts for oil in native forests, concerns have been expressed over the impact on biodiversity (Victorian Environment Conservation Council 2001).

World consumption of crude eucalyptus oil is estimated to be about 3000 tonnes a year, with an ex distillery value of around US$15 million (Abbott 2004; Davis and Bartle 2004).

Australian eucalyptus oil industry

Australian eucalyptus oil production is currently around 125 tonnes a year (Table 41), considerably less than the 1000 tonnes a year that was produced in the 1940s (Abbott 2004). Two companies dominate the Australian eucalyptus oil market: G. R. Davis Pty Ltd in Sydney, and Felton, Grimwade and Bickford in Melbourne. The main areas harvested in Australia are around Bendigo in Victoria, and West Wyalong in New South Wales. The harvesting process is a mechanical one in which each tree is cut off at the ground, then mulched. The trees regenerate from the stump and can be harvested every two years when they are 1–2 metres in height.
Much of the harvest in Victoria is from public land, where a royalty is paid to the Victorian government for harvesting rights. There are seven producing holding licenses for around 12 000 hectares in central Victoria but only around 800 hectares is harvested every year (Victorian Environment Conservation Council 2001). Increasingly, there are plantations of oil mallees.

For example, in a program initiated by a state government department with the aid of federal government funds, large numbers of oil-producing eucalypts (mainly blue mallee) have been planted in Western Australia. The broad aim of this program is to address environmental degradation issues, particularly salinity and greenhouse gases, through profitable growing of mallee trees.

Apart from eucalyptus oil, the intended outputs from the trees are activated carbon, charcoal and fuel for electricity generation. Another contributor to profitability could be trading in carbon credits.

Based on the 25 million trees already planted, Bartle and Shea (2002) estimate that the potential oil yield of these as yet virtually untapped Western Australian plantings is around 1000 tonnes a year, equivalent to a third of world consumption. However, increases of production of this magnitude are likely to have a substantial downward impact on world prices. The program target is plantings of 500 million mallee trees by 2025. Potential annual output from these plantings would be 35 000 tonnes of eucalyptus oil, 140 000 tonnes of activated carbon, and 75 megawatts of electricity (Oil Mallee Project 2004). An integrated processing plant commenced production in June 2006.

Production of eucalyptus oil was down in 2006-07 due to drought but higher prices boosted the gross value of the industry to $2.1 million (Table 41).

The major part of Australian production is exported. Australian eucalyptus oil exports have fluctuated around 100 tonnes a year over the past fifteen years but increased to 164 tonnes in 2003-04 (Figure 37).

Much of the increase in exports in 2003-04 is explained by re-processing then re-exporting of eucalyptus oil from southern Africa (Richard Davis, G.R. Davis Pty Ltd, personal communication, 24 March 2005). There has been some tendency for export returns to improve in constant dollar terms since the mid 1990s, boosted in part by the depreciation of the Australian dollar over that period.

The major export markets for Australian eucalyptus oil are the United States (27 per cent of the total volume of Australian eucalyptus oil exports in the three years to 2006-07), Thailand (18 per cent), New Zealand (10 per cent) and Hong Kong (6 per cent).
Lavender oil is an essential oil used mainly in the fragrance, perfume and aromatherapy industries. It is derived from plants of the genus Lavandula by steam distillation of the flowers.

There are several types of lavender oil. The mostly highly priced product comes from Lavandula angustifolia. There is also lavandin, the essential oil of the hybrid lavender plant Lavandula hybrida which has a much higher oil yield than true lavender but is generally considered to be of inferior quality because of a distinct camphor scent. Lavender is also used as fresh or dried flowers.

In 2005, 2173 tonnes of lavender and lavandin oil were traded worldwide at a total value of $US48 million (United Nations Statistical Division 2007). The largest exporter is France with a share in the total value of world trade in the three years to 2005 of 64 per cent, with the other main exporters being the United States, Bulgaria and Spain (Table 38). The main importers are the United States, the United Kingdom, Switzerland and Germany. World prices for lavender and lavandin oil have recovered from a period of oversupply in world markets in the early 2000s (Figure 38).

Australian lavender industry
In Australia, the industry consists of around 250 growers. Some operations are quite large but the majority are very small, part time operations.

Australia’s largest grower is the Bridestowe Estate in northern Tasmania which produces around 5 tonnes a hectare a year of lavender flowers from 40 hectares of plantings. Around 70 per cent of Bridestowe flower production is distilled to produce oil, with the remainingflower production being marketed as sun dried flowers.

Peterson (2002) estimated annual Australian production of lavender oil in 2001-02 at 1.7 tonnes, 1.2 tonnes of which was produced by Bridestowe Estate in Tasmania. Despite severe drought, Australian production of lavender oil in 2006-07 was an estimated 1.3 tonnes and there was probably another 1.2 tonnes produced of lavandin oil. There was also estimated dried flower production (bunches and stripped flowers) of 4.5 tonnes.

Prices for good quality Australian lavender oil was around $250–300 a kilogram in 2006-07, while the price for lavandin oil was $80–100 a kilogram. The farm gate price for lavender bunches were around $35–45 a kilogram.

The estimated gross value of Australian lavender production in 2006-07 was $566 000 (Table 42).

The industry is oriented toward the domestic market. There were Australian lavender and lavandin oil exports of 11.7 tonnes in 2006-07, but these would appear to be largely re-exports of imported product (Table 42). At the same time, there were lavender and lavandin oil imports of 47.5 tonnes worth $1.4 million.

Table 42: Lavender oil: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lavender/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lavandin oil</td>
<td>2.0</td>
<td>2.3</td>
<td>na</td>
<td>na</td>
<td>2.5</td>
</tr>
<tr>
<td>Dried flowers</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>2.5</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>494</td>
<td>661</td>
<td>na</td>
<td>566</td>
</tr>
<tr>
<td>Exports, oil a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>5.9</td>
<td>3.8</td>
<td>17.6</td>
<td>66.4</td>
</tr>
<tr>
<td>Value</td>
<td>$’000</td>
<td>303</td>
<td>248</td>
<td>416</td>
<td>1248</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>51.67</td>
<td>64.64</td>
<td>23.63</td>
<td>18.79</td>
</tr>
<tr>
<td>Imports, oil a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>37.6</td>
<td>34.6</td>
<td>35.5</td>
<td>43.2</td>
</tr>
<tr>
<td>Value</td>
<td>$’000</td>
<td>1569</td>
<td>1679</td>
<td>1961</td>
<td>2170</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>41.73</td>
<td>48.48</td>
<td>55.25</td>
<td>50.24</td>
</tr>
</tbody>
</table>

Excludes re-exports and re-imports. na Not available. Sources: ABS (2008b); McEldowney (2004); ABARE.

Figure 38: Lavender and lavandin oil: imports and import prices

Peppermint

Peppermint oil is extracted from the leaves of the perennial plant *Piperita mentha*. It mainly used as a flavouring, particularly in confectionary and toothpaste, but also in cosmetics and for medicinal purposes.

The United States accounts for more than half of world trade in peppermint oil, with India and Thailand the other major exporters. World import prices for peppermint oil has been fairly constant at around US$23 a kilogram in constant (2008) dollars over the last five years (Figure 39).

**Peppermint industry in Australia**

In Australia, peppermint is a perennial crop that is planted in autumn, has its major growth flush in spring and is harvested in late summer after it has dried off.

Table 43: Peppermint oil: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume (tonnes)</td>
<td>10</td>
<td>10</td>
<td>25</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Farm gate price ($/kg)</td>
<td>33</td>
<td>18</td>
<td>25</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>Gross value ($'000)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>332</td>
<td>187</td>
</tr>
</tbody>
</table>

**Exports**

<table>
<thead>
<tr>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (tonnes)</td>
<td>15.5</td>
<td>2.4</td>
<td>3.8</td>
<td>4.9</td>
<td>16.3</td>
</tr>
<tr>
<td>Value ($'000)</td>
<td>328</td>
<td>111</td>
<td>138</td>
<td>213</td>
<td>390</td>
</tr>
<tr>
<td>Unit value ($/kg)</td>
<td>21.14</td>
<td>45.93</td>
<td>36.65</td>
<td>43.76</td>
<td>23.98</td>
</tr>
</tbody>
</table>

**Imports**

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (tonnes)</td>
<td>42.6</td>
<td>44.7</td>
<td>46.4</td>
<td>48.7</td>
<td>26.7</td>
</tr>
<tr>
<td>Value ($'000)</td>
<td>1 608</td>
<td>1 533</td>
<td>1 440</td>
<td>1 328</td>
<td>791</td>
</tr>
<tr>
<td>Unit value ($/kg)</td>
<td>37.76</td>
<td>34.31</td>
<td>31.04</td>
<td>27.26</td>
<td>29.64</td>
</tr>
</tbody>
</table>

Australia's peppermint industry was originally established in Tasmania and is now also located in the north east of Victoria. There were 9 growers in Victoria in 1996-97 with total plantings of 127 hectares, falling to 2 growers but with 398 hectares of plantings in 2000-01. Both Victorian growers ceased peppermint production in 2002, but Victorian plantings commenced again in 2004. There are around 10 growers of peppermint in Tasmania with annual harvestings of around 90 hectares producing 6–7 tonnes.

Australian exports of peppermint oil exceeded 25 tonnes in the early 1990s but had fallen to very low levels by 2003-04 before recovering to 16 tonnes in 2006-07 (Figure 40). The main markets for Australian peppermint oil are Indonesia (41 per cent of total Australian exports in the three years to 2006-07), Malaysia (13 per cent), Singapore (9 per cent), Thailand (7 per cent), Republic of Korea (7 per cent).

Sandalwood

Sandalwood has been a valuable traded commodity for thousands of years. Sandalwood oil is typically extracted from the heartwood or roots of sandalwood trees that are at least thirty to forty years old. The oil is used in perfumes, cosmetics and therapeutic goods. The wood has a variety of uses including furniture, turned or carved woodworks, and incense and joss sticks.

There are various forms of sandalwood tree that produce sandalwood oil. The main form is *Santalum album* which is believed to have originated in Indonesia but is also grown in India (the main producer of sandalwood and exporter of sandalwood oil), China, East Timor and the Philippines. The sandalwood tree is parasitic on other trees. The species of sandalwood native to Australia is *Santalum spicatum*. There is also an African tree (*Osyris lanceolata*), native to Tanzania, the wood and oil of which is often traded as sandalwood in world markets.

Australia appears to supply around half of world sandalwood exports, with Indonesia, East Timor and India as the other main exporters. The main importers of sandalwood are Chinese Taipei, China and India. The United States and France are the main importers of sandalwood oil.
There is also demand from north Asia and the Middle East.

Sandalwood has been over exploited in India and Indonesia. In India, the government has responded by limiting exports of sandalwood and sandalwood oil to an annual quota. Growing demand and restrictions on supply have meant strong increases in sandalwood oil prices since 2000, as indicated by US import prices (Figure 41).

**Australian sandalwood industry**

The sandalwood industry was established in the 1850s in Western Australia. Virtually all Australia’s current sandalwood production comes from the native tree *Santalum spicatum* that is found throughout much of the lower half of Western Australia and parts of South Australia.

Sandalwood trees were extensively harvested in Western Australia during the clearing of land for agricultural enterprises. Near the height of this clearing process in 1924-25, 6600 tonnes of sandalwood was exported (Commonwealth Bureau of Census and Statistics 1926).

![Figure 41: Sandalwood oil: US imports and import prices](image)


Processing and marketing of all Crown land sandalwood is conducted by Wescorp International, a private company that was awarded the contract through a public tender process. Recent average prices in US dollars received by Wescorp International from marketing and selling different grades of sandalwood on behalf of the Forest Products Commission are shown in Figure 42. Depending on the grade, prices for sandalwood are 67–96 per cent higher in 2006 than in 1999.

The Commission also has arrangements to encourage Western Australian farmers to re-establish sandalwood trees on their farms (see Forest Products Commission 2004b). Apart from providing income sources for farmers and regional communities, the plantings have the environmental benefits of helping to control salinity and waterlogging; sequestering carbon; and enhancing native flora and fauna ecosystems.

There are estimated commercial plantations of *Santalum album* in mid 2006 in Australia of 1935 hectares and the total area is forecast to reach 2845 hectares by mid 2008 (Clarke 2006). Because the sandalwood tree is parasitic, it must be planted with other trees as hosts, for example acacia varieties. All but a small part of these plantings are in the Kununurra region of north west Western Australia.

The first plantings were in 1999, implying first harvestings in 2014.

The estimated supply and disposal of Australian sandalwood is shown in (Table 44). The sandalwood harvest in Australia in 2006-07 was 2369 tonnes, of which approximately 700 tonnes was consumed domestically, producing around 12 tonnes a year of sandalwood oil. Average payments to sandalwood harvesters by the Forest Products Commission were slightly less than $4000 a tonne, with payments varying according to quality. The estimated gross value of production of sandalwood in Australia in 2006-07 was around $9.4 million.

The estimated value of Australian exports of sandalwood products in 2006-07 was $12.2 million (Table 44). Around 60 per cent of Australian sandalwood exports go to Chinese Taipei (Forest Products Commission 2007). Australia supplied 43 per cent of Chinese Taipei’s sandalwood imports with Tanzania and Indonesia
Table 44: Sandalwood: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>tonnes</td>
<td>2 419</td>
<td>2 408</td>
<td>2 173</td>
<td>2 512</td>
<td>2 369</td>
</tr>
<tr>
<td>– green</td>
<td>tonnes</td>
<td>1 547</td>
<td>1 604</td>
<td>1 257</td>
<td>1 521</td>
<td>1 419</td>
</tr>
<tr>
<td>– dead</td>
<td>tonnes</td>
<td>872</td>
<td>646</td>
<td>696</td>
<td>726</td>
<td>758</td>
</tr>
<tr>
<td>– roots</td>
<td>tonnes</td>
<td>0</td>
<td>133</td>
<td>221</td>
<td>228</td>
<td>192</td>
</tr>
<tr>
<td>– bark</td>
<td>tonnes</td>
<td>0</td>
<td>25</td>
<td>30</td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td>Sandalwood oil</td>
<td>tonnes</td>
<td>6</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Average payments to harvesters *</td>
<td>$/t</td>
<td>3 788</td>
<td>3 920</td>
<td>4 349</td>
<td>4 160</td>
<td>3 984</td>
</tr>
<tr>
<td><strong>Gross value Exports</strong></td>
<td><strong>Wood</strong></td>
<td><strong>$’000</strong></td>
<td>9 163</td>
<td>9 441</td>
<td>9 452</td>
<td>10 452</td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>2 135</td>
<td>1 722</td>
<td>1 473</td>
<td>1 812</td>
<td>1 669</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>14 615</td>
<td>11 184</td>
<td>10 612</td>
<td>13 178</td>
<td>10 706</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/t</td>
<td>6 845</td>
<td>6 494</td>
<td>7 203</td>
<td>7 271</td>
<td>6 415</td>
</tr>
<tr>
<td>Oil</td>
<td>– volume</td>
<td>5</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>1 257</td>
<td>2 078</td>
<td>1 910</td>
<td>776</td>
<td>1 491</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>269</td>
<td>177</td>
<td>159</td>
<td>65</td>
<td>124</td>
</tr>
<tr>
<td><strong>Total export value</strong></td>
<td><strong>$’000</strong></td>
<td>15 872</td>
<td>13 261</td>
<td>12 522</td>
<td>13 953</td>
<td>12 198</td>
</tr>
</tbody>
</table>

* Payments by the Forest Products Commission to contractors for harvesting, delivery, regeneration and associated research.

Source: Jones (2004); Forest Products Commission (2007); ABARE.

Further information about sandalwood

- Forest Products Commission of Western Australia (www.fpc.wa.gov.au).

Australian tea tree industry

In 2006, there was around 4500 hectares of cultivated tea trees in Australia, with approximately 100 growers (RIRDC 2007). Australian tea tree oil production grew strongly throughout the 1990s, peaking at 625 tonnes in 1999-2000, but then declined to around 300 tonnes in the early 2000s in response to low prices. Production has recovered in more recent years but dipped again in 2006-07 to around 442 tonnes as two large plantations shifted out of tea tree oil production.

The farm gate price in Australia for tea tree oil averaged around $29 a kilogram in 2006-07. This is substantially below the average of around $50 a kilogram throughout the 1990s but higher than the very low prices of the mid 2000s.

No specific data are available on Australian exports of tea tree oil but indications are provided by exports of the ‘Other essential oils’ category in ABS (2008b) for New South Wales and Queensland where most tea tree oil is produced (Table 45). In 2006-07, exports of this category for these states were 446 tonnes with a total value of nearly $10 million and an average export price of $22.63 a kilogram. The main export destinations were the United States (25 per cent of the total volume of exports in the three years to 2006-07), New Zealand (20 per cent), Germany (13 per cent), United Kingdom (8 per cent) and France (6 per cent).

Table 45: Tea tree oil: supply, disposal and value in Australia

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Groovers</td>
<td>no.</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area, cultivated</td>
<td>hectares</td>
<td>4500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>300</td>
<td>540</td>
<td>517</td>
<td>522</td>
<td>442</td>
</tr>
<tr>
<td>Farm gate price</td>
<td>$/kg</td>
<td>17</td>
<td>17</td>
<td>13</td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td><strong>Value</strong></td>
<td><strong>$’000</strong></td>
<td>5 100</td>
<td>9 180</td>
<td>6 721</td>
<td>8 874</td>
<td>12 597</td>
</tr>
<tr>
<td><strong>Exports, other essential oils, New South Wales and Queensland</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>426</td>
<td>401</td>
<td>463</td>
<td>515</td>
<td>446</td>
</tr>
<tr>
<td>Value</td>
<td>$’000</td>
<td>9 972</td>
<td>8 547</td>
<td>9 698</td>
<td>8 408</td>
<td>9 963</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>23.43</td>
<td>21.32</td>
<td>20.93</td>
<td>16.34</td>
<td>22.33</td>
</tr>
</tbody>
</table>

* Essential oils, not elsewhere included.

Further information about tea tree

- Australian Tea Tree Oil Association (www.teatree.org.au), information on the Australian tea tree oil industry and development strategy.
The market for culinary herbs is a growing one in Australia, fuelled by changes to traditional eating patterns and assisted by innovative packaging and processing (Parker 2004).

According to ABS (2008), there were 553 establishments in Australia in 2005-06, planting 1049 hectares to herbs and producing nearly 5000 tonnes of herbs (Table 46). Parsley made up about one third of the total plantings.

Average prices for most fresh culinary herbs in the Melbourne market have been relatively stable over the five years to 2006-07, despite severe droughts in 2002-03 and 2006-07 (Table 47).

It is difficult to import fresh herbs into Australia because of strict quarantine requirements. Australia has been importing increasing quantities of dried herbs in recent years, with imports reaching record levels in 2006-07 (Figure 43). No data on Australian exports of herbs are available.

Table 46: Culinary herbs: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Unit</th>
<th>2005-06</th>
<th>2006-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parsley</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– producers no.</td>
<td>239</td>
<td></td>
</tr>
<tr>
<td>– area hectares</td>
<td>354</td>
<td></td>
</tr>
<tr>
<td>– production tonnes</td>
<td>2 148</td>
<td></td>
</tr>
<tr>
<td>– gross value $’000</td>
<td>6 881</td>
<td></td>
</tr>
<tr>
<td>Other herbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– producers no.</td>
<td>314</td>
<td></td>
</tr>
<tr>
<td>– area hectares</td>
<td>695</td>
<td></td>
</tr>
<tr>
<td>– production tonnes</td>
<td>2 799</td>
<td></td>
</tr>
<tr>
<td>– gross value $’000</td>
<td>11 982</td>
<td></td>
</tr>
<tr>
<td>Total herbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– producers no.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– area hectares</td>
<td>1 049</td>
<td></td>
</tr>
<tr>
<td>– production tonnes</td>
<td>4 947</td>
<td></td>
</tr>
<tr>
<td>– gross value $’000</td>
<td>18 863</td>
<td></td>
</tr>
<tr>
<td>Imports, dried herbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>1 381</td>
<td>1 534</td>
</tr>
<tr>
<td>Value $’000</td>
<td>4 394</td>
<td>5 184</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>3.18</td>
<td>3.38</td>
</tr>
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</table>

Sources: ABS (2007b, 2008), ABARE.

Further information about culinary herbs

Table 47: Fresh culinary herbs: Melbourne market prices

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<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Basil</td>
<td>Bunch</td>
<td>1.53</td>
<td>1.66</td>
<td>1.64</td>
<td>1.63</td>
<td>1.87</td>
</tr>
<tr>
<td>Basil, hydroponic</td>
<td>Bunch</td>
<td>1.60</td>
<td>1.64</td>
<td>1.64</td>
<td>1.70</td>
<td>1.70</td>
</tr>
<tr>
<td>Basil, purple</td>
<td>Bunch</td>
<td>1.98</td>
<td>1.91</td>
<td>1.71</td>
<td>1.63</td>
<td>2.00</td>
</tr>
<tr>
<td>Basil, Thai</td>
<td>Bunch</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>1.72</td>
</tr>
<tr>
<td>Chervil</td>
<td>Bunch</td>
<td>1.41</td>
<td>1.52</td>
<td>1.58</td>
<td>1.74</td>
<td>1.65</td>
</tr>
<tr>
<td>Chives</td>
<td>Bunch</td>
<td>1.39</td>
<td>1.57</td>
<td>1.58</td>
<td>1.65</td>
<td>1.71</td>
</tr>
<tr>
<td>Coriander</td>
<td>Bunch</td>
<td>0.96</td>
<td>1.01</td>
<td>0.92</td>
<td>1.10</td>
<td>1.34</td>
</tr>
<tr>
<td>Dill</td>
<td>Bunch</td>
<td>0.96</td>
<td>1.01</td>
<td>0.95</td>
<td>1.18</td>
<td>1.34</td>
</tr>
<tr>
<td>Mint</td>
<td>Bunch</td>
<td>1.34</td>
<td>1.39</td>
<td>1.63</td>
<td>1.66</td>
<td>1.65</td>
</tr>
<tr>
<td>Mint, Vietnamese</td>
<td>Bunch</td>
<td>1.48</td>
<td>1.49</td>
<td>1.55</td>
<td>1.64</td>
<td>1.60</td>
</tr>
<tr>
<td>Oregano</td>
<td>Bunch</td>
<td>1.40</td>
<td>1.50</td>
<td>1.54</td>
<td>1.62</td>
<td>1.74</td>
</tr>
<tr>
<td>Parsley, continental</td>
<td>Deck</td>
<td>7.50</td>
<td>8.04</td>
<td>7.73</td>
<td>7.69</td>
<td>8.03</td>
</tr>
<tr>
<td>Parsley, English</td>
<td>Deck</td>
<td>7.50</td>
<td>7.50</td>
<td>7.75</td>
<td>7.65</td>
<td>8.01</td>
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<td>Rosemary</td>
<td>Bunch</td>
<td>1.35</td>
<td>1.50</td>
<td>1.54</td>
<td>1.58</td>
<td>1.60</td>
</tr>
<tr>
<td>Sage</td>
<td>Bunch</td>
<td>1.42</td>
<td>1.60</td>
<td>1.73</td>
<td>1.66</td>
<td>1.67</td>
</tr>
<tr>
<td>Tarragon</td>
<td>Bunch</td>
<td>1.87</td>
<td>1.66</td>
<td>1.67</td>
<td>1.69</td>
<td>2.09</td>
</tr>
<tr>
<td>Thyme</td>
<td>Bunch</td>
<td>1.42</td>
<td>1.56</td>
<td>1.56</td>
<td>1.66</td>
<td>1.65</td>
</tr>
</tbody>
</table>

Source: Melbourne Market Price Reporting Service.

Figure 43: Dried herbs: Australian imports and import prices

Jojoba (*Simmondsia chinensis*) is an evergreen perennial bush that is native to the hot arid areas of northern Mexico and southwestern United States. The jojoba plant grows to 3–4 metres, reaches maximum yield around 15 years after planting and can live for 200 years. The oil produced from jojoba seed consists almost entirely of liquid wax esters that are suited to use in cosmetics, waxes and high pressure lubricants. Currently, about 80 per cent of jojoba oil production is used in cosmetics (International Jojoba Export Council 2004).

Commercial production of jojoba commenced in 1976. Argentina and the United States are the main producers with the only other producers being Australia, Chile, Egypt, Israel, Mexico and Peru (Figure 44). World production is expected to increase by 10 per cent a year over the next five years due to increased plantings and maturing plantations.

Statistics on trade in jojoba oil at a world level have not been available since 2002 but some idea of world trade and prices can be gained from US and EU import data. These data — see Figure 45 — suggest that world exports have increased sharply in recent years, particularly from Argentina, but that prices in constant (2008) US dollar terms are declining. ABARE estimates that world exports of jojoba oil from the major producing countries in 2006 was 1770 tonnes, with Argentina supplying 43 per cent, Israel 29 per cent, Peru 15 per cent and the United States 9 per cent. US exports of jojoba oil have declined from a peak of 391 tonnes in 1999, to only 167 tonnes in 2006.

It is projected that Australian jojoba oil production will grow at the rate of 30 per cent a year until 2015. This mainly reflects increased yields from existing plantations, rather than additional plantings.

In 2007, the Australian jojoba industry received a commercialisation grant of $35 000 from the Australian government. The grant is meant to help ‘shift the industry from a production driven marketer of bulk commodity to a market driven producer of branded, packaged, value added Australian products’.

Figure 44: Jojoba: world plantings, by country, 2006

<table>
<thead>
<tr>
<th>Country</th>
<th>Plantings, 2006: 7424 hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>46%</td>
</tr>
<tr>
<td>United States</td>
<td>31%</td>
</tr>
<tr>
<td>Australia</td>
<td>6%</td>
</tr>
<tr>
<td>Israel</td>
<td>7%</td>
</tr>
<tr>
<td>Egypt</td>
<td>3%</td>
</tr>
<tr>
<td>Mexico</td>
<td>1%</td>
</tr>
<tr>
<td>Chile</td>
<td>1%</td>
</tr>
</tbody>
</table>

Data sources: International Jojoba Export Council (2004); ABARE.
Jojoba oil: EU and US imports and import prices


Table 48: Jojoba: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Production</th>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>ha</td>
<td>380</td>
<td>400</td>
<td>450</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Seed production</td>
<td>tonnes</td>
<td>43</td>
<td>55</td>
<td>70</td>
<td>95.3</td>
<td>125</td>
</tr>
<tr>
<td>Yield, oil</td>
<td>%</td>
<td>45</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>Oil production</td>
<td>litres</td>
<td>19.4</td>
<td>23.1</td>
<td>29.4</td>
<td>40.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Gross value, oil</td>
<td>$’000</td>
<td>513</td>
<td>531</td>
<td>676</td>
<td>921</td>
<td>921</td>
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</table>

<table>
<thead>
<tr>
<th>Exports, oil</th>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Value</td>
<td>$’000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>15.0</td>
<td>29.4</td>
<td>18.9</td>
<td>22.8</td>
<td>24.2</td>
</tr>
<tr>
<td>Value</td>
<td>$’000</td>
<td>293</td>
<td>275</td>
<td>233</td>
<td>246</td>
<td>247</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>19.47</td>
<td>9.34</td>
<td>12.28</td>
<td>10.76</td>
<td>10.23</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); ABARE. na Not available.

Further information about jojoba

- International Jojoba Export Council website (www.ijec.net), information on the nature of the world market for jojoba.

Jojoba can be grown in most cereal-growing areas.
The olive industry produces two main products: table olives and olive oil. Based on FAO Statistics Division (2008) data, world production of olives in 2006 was 16.2 million tonnes, down from the record 18.3 million tonnes in 2003 (Figure 46). The main producing countries border the Mediterranean Sea (Table 49).

Around 40 per cent of total world production of olive oil enters world trade, a proportion that has been growing steadily over the past twenty years (Figure 46). The total value of world exports of olives and olive oil averaged US$5.4 billion a year in the three years to 2005, 23 per cent of which was attributable to olives (mostly preserved). The main exporters of olive oil are Spain, Italy, Greece, Tunisia and Turkey (Table 49).

Italy is also the largest importer of olive oil. Italy seems to import lower priced oil (for example, an average US$2.33 a kilogram in 2003) and exports higher priced oil (US$3.13 a kilogram in 2002). The other main importers are the United States, France, Germany and the United Kingdom.

The International Olive Oil Council (www.internationaloliveoil.org), a United Nations agency that was created in 1959 under the auspices of the United Nations Conference on Trade and Development to administer the International Agreement on Olive Oil and Table Olives, lists internationally accepted classifications for olive oil. First, any oil that is classified as 'virgin olive oil' must be obtained solely from olives using only mechanical or other physical means in conditions, particularly thermal conditions, that do not alter the oil in any way (International Olive Oil Council 2002a). This classification excludes oils obtained by the use of solvents or re-esterification methods. To be classified as ‘extra virgin’, the olive oil must also have a ‘free acidity’ content that does not exceed 0.8 per cent; ‘virgin’ 2 per cent; and ‘ordinary virgin’ 3.3 per cent.

The olive fruit has a bitter component (oleuropein) that means that it is not usually consumed directly from the tree (International Olive Oil Council 2002b). The bitter component is generally removed by soaking the fruit in sodium or potassium hydroxide, brine or by successive rinsing in water. Generally, green olives are olives harvested during the ripening cycle prior to colour change, while black olives are fully ripened ones. Green olives are processed in two principal ways: with fermentation (Spanish type) and without fermentation (Picholine or American type). Sometimes they are stoned (pitted) and stuffed with anchovies, pimento or other edible material. Olives are preserved in a range of substances including salt, brine, acetic acid and vinegar.

**Australian olive industry**

Australia is heavily dependent on olive products from foreign countries, with imports valued at $252 million in 2006-07 (Table 50). In volume terms, oil imports have been growing at a rate of 7.1 per cent a year since 1989-90, and olive imports at 4.6 per cent a year (Figure 47).

Reflecting interest in olive production in Australia, Australian exports of olive oil have grown sharply in recent years (Figure 47). Despite the increased supply, export prices have also increased in constant dollar terms.

Even without further plantings of olive trees, Australian olive oil production is projected to reach 25-30 million litres by 2013, around three times the current level of production.
Table 49: Olive products: key characteristics of the world market

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume</th>
<th>Value</th>
<th>Key countries shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olives</td>
<td>16 275</td>
<td>na</td>
<td>Spain (29%), Italy (24%), Greece (15%), Turkey (7%), Tunisia (5%), Morocco (4%). Syria (4%)</td>
</tr>
<tr>
<td>Olive oil</td>
<td>2 811</td>
<td>na</td>
<td>Spain (35%), Italy (26%), Greece (15%), Tunisia (6%), Syria (5%), Turkey (5%)</td>
</tr>
<tr>
<td>Table olives</td>
<td>1 824</td>
<td>na</td>
<td>Spain (26%), Turkey (14%), Egypt (11%), Syria (10%), Greece (7%), Morocco (5%), Algeria (4%), United States (4%)</td>
</tr>
</tbody>
</table>

World trade

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume</th>
<th>Value</th>
<th>Exports:</th>
<th>Importers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive oil, virgin</td>
<td>1 041</td>
<td>US$3 315</td>
<td>Spain (45%), Italy (24%), Tunisia (11%), Greece (11%), Syria (2%), Turkey (2%)</td>
<td>Italy (44%), United States (13%), France (9%), Spain (6%), Germany (4%), Portugal (5%), United Kingdom (4%)</td>
</tr>
<tr>
<td>Olive oil, other</td>
<td>388</td>
<td>US$1 064</td>
<td>Italy (35%), Spain (33%), Turkey (10%), Greece (9%), Portugal (3%)</td>
<td>United States (26%), Italy (19%), Spain (8%), Portugal (6%), Australia (5%), United Kingdom (5%), Japan (4%), Canada (3%)</td>
</tr>
<tr>
<td>Table olives</td>
<td>607</td>
<td>US$1 020</td>
<td>Spain (52%), Greece (14%), Morocco (12%), Turkey (7%), Argentina (3%)</td>
<td>United States (19%), Italy (13%), France (11%), Russian Federation (10%), Germany (7%), Canada (4%), United Kingdom (3%), Romania (3%), Brazil (3%)</td>
</tr>
</tbody>
</table>

a Average, three years to 2006-07; b Average, three years to 2005.
Sources: UN Statistics Division (2008); FAO Statistics Division (2008); International Olive Oil Council (2007).

Figure 46: Olives and olive oil: production, exports and export prices


Figure 47: Olive products: Australian imports and import prices

Table 50: Olives: supply disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Olives</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- for oil</td>
<td>tonnes</td>
<td>7 429</td>
<td>13 143</td>
<td>28 571</td>
<td>49 429</td>
<td>54 371</td>
</tr>
<tr>
<td>- for table olives</td>
<td>tonnes</td>
<td>1 000</td>
<td>2 000</td>
<td>2 700</td>
<td>4 000</td>
<td>3 000</td>
</tr>
<tr>
<td>- total</td>
<td>tonnes</td>
<td>8 429</td>
<td>15 143</td>
<td>31 271</td>
<td>53 429</td>
<td>57 371</td>
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<tr>
<td>Olive oil</td>
<td>tonnes</td>
<td>1 300</td>
<td>2 300</td>
<td>5 000</td>
<td>8 650</td>
<td>9 515</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>olives for oil</td>
<td>'000</td>
<td>6 264</td>
<td>12 351</td>
<td>25 069</td>
<td>39 092</td>
<td>51 581</td>
</tr>
<tr>
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<td>'000</td>
<td>5 482</td>
<td>11 333</td>
<td>12 217</td>
<td>21 562</td>
<td>15 329</td>
</tr>
<tr>
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<td>'000</td>
<td>11 746</td>
<td>23 684</td>
<td>37 286</td>
<td>60 654</td>
<td>66 911</td>
</tr>
<tr>
<td>Olive oil</td>
<td>tonnes</td>
<td>1 300</td>
<td>2 300</td>
<td>5 000</td>
<td>8 650</td>
<td>9 515</td>
</tr>
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<td>6 264</td>
<td>12 351</td>
<td>25 069</td>
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<td>11 333</td>
<td>12 217</td>
<td>21 562</td>
<td>15 329</td>
</tr>
<tr>
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<td>'000</td>
<td>11 746</td>
<td>23 684</td>
<td>37 286</td>
<td>60 654</td>
<td>66 911</td>
</tr>
<tr>
<td>Olive oil</td>
<td>tonnes</td>
<td>1 300</td>
<td>2 300</td>
<td>5 000</td>
<td>8 650</td>
<td>9 515</td>
</tr>
<tr>
<td>Gross value</td>
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<tr>
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<td>6 264</td>
<td>12 351</td>
<td>25 069</td>
<td>39 092</td>
<td>51 581</td>
</tr>
<tr>
<td>table olives</td>
<td>'000</td>
<td>5 482</td>
<td>11 333</td>
<td>12 217</td>
<td>21 562</td>
<td>15 329</td>
</tr>
<tr>
<td>total</td>
<td>'000</td>
<td>11 746</td>
<td>23 684</td>
<td>37 286</td>
<td>60 654</td>
<td>66 911</td>
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</table>

Exports

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<td>1100</td>
<td>848</td>
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<td>4.52</td>
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<td>6.23</td>
<td>5.87</td>
<td>5.38</td>
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<td>Other olive oil</td>
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<tr>
<td>- Volume</td>
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<td>650</td>
</tr>
<tr>
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<td>646</td>
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Imports

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<th></th>
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<td></td>
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<td>- Volume</td>
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<td>53 098</td>
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<td>$/kg</td>
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<td>3.26</td>
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<td>9 900</td>
<td>11 905</td>
<td>14 358</td>
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<tr>
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<td>53 098</td>
<td>47 570</td>
<td>45 035</td>
<td>54 529</td>
</tr>
<tr>
<td>- Unit value</td>
<td>$/kg</td>
<td>4.09</td>
<td>6.03</td>
<td>4.81</td>
<td>3.78</td>
<td>3.80</td>
</tr>
<tr>
<td>Other olive oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Volume</td>
<td>tonnes</td>
<td>22 797</td>
<td>20 599</td>
<td>19 855</td>
<td>18 901</td>
<td>26 472</td>
</tr>
<tr>
<td>- Value</td>
<td>$'000</td>
<td>94 387</td>
<td>87 747</td>
<td>91 774</td>
<td>104 664</td>
<td>143 094</td>
</tr>
<tr>
<td>- Unit value</td>
<td>$/kg</td>
<td>4.14</td>
<td>4.26</td>
<td>5.11</td>
<td>5.55</td>
<td>5.25</td>
</tr>
<tr>
<td>Total value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td>$'000</td>
<td>2 280</td>
<td>4 617</td>
<td>14 210</td>
<td>16 056</td>
<td></td>
</tr>
<tr>
<td>Imports</td>
<td>$'000</td>
<td>175 886</td>
<td>193 943</td>
<td>186 914</td>
<td>194 735</td>
<td>252 151</td>
</tr>
</tbody>
</table>

* Excludes re-exports and re-imports. \( ^\text{a} \) Not chemically modified.

Sources: ABS (2008b); Australian Olive Association (2006); ABARE.

Other sources of information about olives

- Australian Olive Association (www.australianolives.com.au), information about the Australian industry, including a listing of more than 100 olive processors throughout Australia.
- International Olive Oil Council (www.internationaloliveoil.org), comprehensive information on the agronomics, science and international market for olives and olive products.

Figure 48: Olive products: Australian exports and export prices

Pulses

GVP = $2 559 000

World production of pulses has increased sharply in recent years to reach a record 60 million tonnes in 2006 (Figure 49). The composition of world pulse production in the three years to 2006 is shown in Figure 50. The major pulse producer was India (with a 24 per cent share of world production in the three years to 2006), with other major producers being China (9 per cent), Canada (8 per cent), Brazil (5 per cent), Myanmar (5 per cent) and Australia (4 per cent).

India accounts for around a third of world consumption of pulses, with Brazil, China, Mexico, the United States and Nigeria being the other major consumers.

World trade in pulses has been growing at a rate of more than 5 per cent a year, despite a downward trend in pulse prices in constant dollar terms (Figure 49). The major exporters of pulses are Canada (21 per cent of total value of world exports in the three years to 2005), China (12 per cent), the United States (10 per cent), India (6 per cent), Australia (6 per cent) and Turkey (5 per cent). The major importers are India (24 per cent of total value of world imports in the three years to 2005), Italy (6 per cent), Egypt (5 per cent), Bangladesh (4 per cent), Japan (4 per cent) and Algeria (4 per cent).

Australian pulse industry

Pulse crops have become an important part of the Australian crop rotation. This is largely because of their usefulness as a break crop and because they enable production diversification. The area planted to pulses in Australia grew rapidly in the 1980s and the early 1990s but has declined sharply since 1998 (Figure 51). The decline reflects a string of poor seasons but also improved relative returns for competing crops.

The main pulse crops grown in Australia are lupins, field peas, chickpeas, faba beans and mung beans (Table 51). Other pulses grown are broad beans, navy beans, adzuki beans, vetch and lima beans. The gross value of the Australian pulse industry peaked at nearly $800 million in 2001-02 but was lower in recent years, largely reflecting an extended run of poor seasons.

Further information about pulses

### Table 51: Pulses: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th>Pulses</th>
<th>Area '000 ha</th>
<th>Production kt</th>
<th>Exports kt</th>
<th>Value of exports $m</th>
<th>Imports kt</th>
<th>Value of imports $m</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adzuki beans</strong></td>
<td>0.8</td>
<td>1.7</td>
<td>1.2</td>
<td>1.8</td>
<td>1.1</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>0.7</td>
<td>1.6</td>
<td>1.1</td>
<td>2.2</td>
<td>1.3</td>
<td>1.3</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>1.4</td>
<td>3.2</td>
<td>2.7</td>
<td>4.6</td>
<td>1.0</td>
<td>1.0</td>
<td>4.3</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>1.6</td>
<td>3.6</td>
<td>3.1</td>
<td>3.5</td>
<td>1.2</td>
<td>1.2</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Value of imports</strong></td>
<td>1.4</td>
<td>3.1</td>
<td>2.6</td>
<td></td>
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<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulses</th>
<th>Area '000 ha</th>
<th>Production kt</th>
<th>Exports kt</th>
<th>Value of exports $m</th>
<th>Imports kt</th>
<th>Value of imports $m</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chick peas</strong></td>
<td>201.0</td>
<td>136.0</td>
<td>88.5</td>
<td>52.4</td>
<td>0.1</td>
<td>0.2</td>
<td>65.0</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>151.5</td>
<td>178.0</td>
<td>163.8</td>
<td>70.6</td>
<td>0.1</td>
<td>0.1</td>
<td>58.2</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>113.3</td>
<td>115.6</td>
<td>151.2</td>
<td>65.3</td>
<td>0.1</td>
<td>0.1</td>
<td>35.9</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>105.3</td>
<td>122.8</td>
<td>211.4</td>
<td>106.4</td>
<td>0.1</td>
<td>0.1</td>
<td>104.3</td>
</tr>
<tr>
<td><strong>Value of imports</strong></td>
<td>244.1</td>
<td>232.4</td>
<td>244.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulses</th>
<th>Area '000 ha</th>
<th>Production kt</th>
<th>Exports kt</th>
<th>Value of exports $m</th>
<th>Imports kt</th>
<th>Value of imports $m</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Faba beans</strong></td>
<td>157.0</td>
<td>108.0</td>
<td>74.6</td>
<td>32.8</td>
<td>0.1</td>
<td>0.2</td>
<td>52.1</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>155.0</td>
<td>277.0</td>
<td>183.2</td>
<td>66.8</td>
<td>0.1</td>
<td>0.1</td>
<td>110.1</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>113.3</td>
<td>167.5</td>
<td>106.3</td>
<td>40.0</td>
<td>0.1</td>
<td>0.1</td>
<td>68.4</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>105.3</td>
<td>329.0</td>
<td>210.7</td>
<td>70.5</td>
<td>0.1</td>
<td>0.1</td>
<td>104.3</td>
</tr>
<tr>
<td><strong>Value of imports</strong></td>
<td>153.1</td>
<td>107.5</td>
<td>106.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Pulses</th>
<th>Area '000 ha</th>
<th>Production kt</th>
<th>Exports kt</th>
<th>Value of exports $m</th>
<th>Imports kt</th>
<th>Value of imports $m</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Field peas</strong></td>
<td>380.0</td>
<td>178.0</td>
<td>107.6</td>
<td>43.0</td>
<td>2.3</td>
<td>4.6</td>
<td>61.2</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>354.0</td>
<td>487.0</td>
<td>209.3</td>
<td>55.6</td>
<td>3.1</td>
<td>5.4</td>
<td>112.8</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>413.0</td>
<td>289.0</td>
<td>116.1</td>
<td>33.4</td>
<td>2.5</td>
<td>4.1</td>
<td>67.8</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>366.0</td>
<td>478.0</td>
<td>116.1</td>
<td>43.2</td>
<td>2.1</td>
<td>4.1</td>
<td>131.9</td>
</tr>
<tr>
<td><strong>Value of imports</strong></td>
<td>342.1</td>
<td>148.8</td>
<td>106.3</td>
<td></td>
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<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Pulses</th>
<th>Area '000 ha</th>
<th>Production kt</th>
<th>Exports kt</th>
<th>Value of exports $m</th>
<th>Imports kt</th>
<th>Value of imports $m</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lentils</strong></td>
<td>165.0</td>
<td>67.0</td>
<td>87.8</td>
<td>50.1</td>
<td>1.8</td>
<td>1.6</td>
<td>61.2</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>131.0</td>
<td>175.0</td>
<td>160.2</td>
<td>81.2</td>
<td>1.4</td>
<td>1.1</td>
<td>112.8</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>119.0</td>
<td>83.0</td>
<td>87.8</td>
<td>53.3</td>
<td>1.4</td>
<td>1.4</td>
<td>67.8</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>113.0</td>
<td>209.5</td>
<td>178.1</td>
<td>91.9</td>
<td>1.6</td>
<td>1.2</td>
<td>131.9</td>
</tr>
<tr>
<td><strong>Value of imports</strong></td>
<td>152.5</td>
<td>36.4</td>
<td>89.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulses</th>
<th>Area '000 ha</th>
<th>Production kt</th>
<th>Exports kt</th>
<th>Value of exports $m</th>
<th>Imports kt</th>
<th>Value of imports $m</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lupins</strong></td>
<td>1 024.5</td>
<td>725.5</td>
<td>207.5</td>
<td>57.3</td>
<td>1.6</td>
<td>1.7</td>
<td>211.5</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>851.0</td>
<td>1 180.0</td>
<td>645.6</td>
<td>147.7</td>
<td>1.1</td>
<td>1.1</td>
<td>278.1</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>845.0</td>
<td>937.0</td>
<td>418.5</td>
<td>88.8</td>
<td>1.4</td>
<td>1.2</td>
<td>192.9</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>809.0</td>
<td>1 285.0</td>
<td>469.5</td>
<td>99.4</td>
<td>1.6</td>
<td>1.6</td>
<td>264.8</td>
</tr>
<tr>
<td><strong>Value of imports</strong></td>
<td>746.0</td>
<td>473.0</td>
<td>173.7</td>
<td></td>
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<td></td>
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<table>
<thead>
<tr>
<th>Pulses</th>
<th>Area '000 ha</th>
<th>Production kt</th>
<th>Exports kt</th>
<th>Value of exports $m</th>
<th>Imports kt</th>
<th>Value of imports $m</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mung beans</strong></td>
<td>44.0</td>
<td>33.6</td>
<td>36.3</td>
<td>25.7</td>
<td>0.4</td>
<td>0.5</td>
<td>18.9</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>44.1</td>
<td>47.3</td>
<td>8.5</td>
<td>6.2</td>
<td>0.4</td>
<td>0.5</td>
<td>20.2</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>49.8</td>
<td>53.2</td>
<td>24.3</td>
<td>14.0</td>
<td>0.7</td>
<td>0.6</td>
<td>26.1</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>44.0</td>
<td>48.1</td>
<td>21.1</td>
<td>14.2</td>
<td>0.5</td>
<td>0.6</td>
<td>28.4</td>
</tr>
<tr>
<td><strong>Value of imports</strong></td>
<td>34.0</td>
<td>16.2</td>
<td>13.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulses</th>
<th>Area '000 ha</th>
<th>Production kt</th>
<th>Exports kt</th>
<th>Value of exports $m</th>
<th>Imports kt</th>
<th>Value of imports $m</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total pulses</strong></td>
<td>1 972.3</td>
<td>1 249.8</td>
<td>603.5</td>
<td>327.6</td>
<td>5.7</td>
<td>8.3</td>
<td>427.7</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>1 687.3</td>
<td>2 345.9</td>
<td>1 371.7</td>
<td>584.0</td>
<td>6.2</td>
<td>8.4</td>
<td>617.6</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>1 725.9</td>
<td>1 648.5</td>
<td>906.9</td>
<td>382.0</td>
<td>6.0</td>
<td>7.2</td>
<td>415.6</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>1 621.9</td>
<td>2 583.0</td>
<td>1 249.8</td>
<td>542.1</td>
<td>5.5</td>
<td>7.1</td>
<td>634.0</td>
</tr>
<tr>
<td><strong>Value of imports</strong></td>
<td>1 679.2</td>
<td>1 035.2</td>
<td>879.7</td>
<td></td>
<td></td>
<td></td>
<td>411.5</td>
</tr>
</tbody>
</table>

**Gross value of production:**

- **Adzuki beans:** $2.0m
- **Chick peas:** $65.0m
- **Faba beans:** $52.1m
- **Field peas:** $61.2m
- **Lentils:** $61.2m
- **Lupins:** $211.5m
- **Mung beans:** $18.9m
- **Total pulses:** $427.7m

**Sources:** ABS (2008b); ABARE.
Azuki (Adzuki) beans

Adzuki beans (*Phaseolus* or *Vigna angularis*) is a small russet coloured bean with a sweet nutty flavour. In Japan, it is mostly processed into a sweet bean paste called an, made up of equal parts of adzuki bean, sugar and water. An is used in cakes, buns, icecream, drinks and confectionery.

World trade in adzuki beans was valued at around US$71 million (United Nations Statistics Division 2007). The main exporter is China, supplying 57 per cent of world exports in the three years to 2005, while in the same period Japan, Republic of Korea and India accounted for more than half of the world’s imports (Table 52).

A tariff rate quota system operates in Japan to protect domestic adzuki (and other bean) production. The quota is 120 000 tonnes a year for four classes of dry legumes: azuki beans, kidney beans, broad beans and peas (for more details, see Severinghaus 2003). A tariff applies to imports but there are no quotas. This has meant that the largest Japanese an processors have started joint ventures in China where adzuki beans are grown and processed for export to Japan (Severinghaus 2003).

Patent protection applies to some preferred Japanese varieties of adzuki; Severinghaus (2003) says this means these varieties are restricted from import in Japan.

### Australian adzuki industry

In Australia, adzuki beans are grown in central and southern Queensland, northern New South Wales and the southern irrigation areas of New South Wales. Annual area planted is estimated to be around 1400 hectares, with average production of over 3000 tonnes a year. The value of the industry in 2006-07 is estimated to be $2.5 million.

About 75 per cent of production is exported (Table 51). The main export destinations for Australian adzuki beans are Chinese Taipei (67 per cent share of total volume of exports in the five years to 2006-07), Japan (23 per cent) and Thailand (10 per cent). Australia also imports small quantities of adzuki beans but the volume is declining as Australian production increases (Table 51).

Further information about adzuki beans

- Tokyo Grain Exchange (www.tge.or.jp), futures price information for adzuki (azuki) beans.

---

**Table 52: Adzuki bean: key characteristics of the world market**

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume</th>
<th>Value</th>
<th>Key countries (share of total volume in the three years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World trade</td>
<td>116</td>
<td>US$71</td>
<td>Exporters: China (57%), Myanmar (9%), Nicaragua (7%), Canada (6%), United States (5%), Honduras (2%), Australia (2%), Thailand (2%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Importers: Japan (24%), Korea, Rep. (22%), India (10%), El Salvador (6%), Philippines (4%), Malaysia (4%), United States (4%)</td>
</tr>
</tbody>
</table>

* Average, three years to 2005.  
Sesame (Sesamum indicum L.) is an ancient oil crop supplying seeds for confectionery purposes, edible oil, paste (tahini), cake and flour (Bennet 2004). It is adapted to both tropical and temperate conditions and is considered to be a drought-tolerant crop.

Based on FAO Statistics Division (2008) data, world production of sesame seed was over 3.2 million tonnes in the three years to 2006 (Figure 53). The main producers are China (21 per cent of world production in the three years to 2006), India (19 per cent), Myanmar (17 per cent) and Sudan (9 per cent). It is a high value crop, trading at US$500 to $600 per tonne on the world export market in recent years. Like most agricultural commodities, there is a strong downward trend in this price in constant dollars, reflecting the impact of ongoing productivity improvements (Figure 53).

Around a quarter of total world production of sesame seed enters world trade as seed. The main sesame seed exporters are China (20 per cent of total volume of world sesame seed exports in the three years to 2005), India (19 per cent), Myanmar (17 per cent) and Sudan (9 per cent). The main importers are Japan (17 per cent), China (16 per cent), Republic of Korea (8 per cent), Turkey (9 per cent) and the United States (5 per cent).

### Australian sesame industry

The sesame seed industry in Australia appears to be aimed at producing so-called ‘sweet’ seed types, used on products such as muesli bars. The sweet types can attract prices 50-100 per cent higher than conventional types.

Sesame is grown in the Northern Territory, Queensland and northern New South Wales, mainly as a dryland crop. Australian production reached 620 tonnes in 2000-01 but only very small quantities have been produced in recent years, mainly in Queensland. The decline reflects extended drought in eastern Australia and marketing problems in the Northern Territory. Northern Territory production comes from experimental plots and this production ceased in 2005.

Australia exports very small quantities of locally produced sesame seed and is a substantial importer of seed oil and tahini (Table 53). The total value of Australian imports of the main sesame seed products (seed, oil and tahini) was $16 million in 2006-07, 65 per cent of which was in the form of seed and 26 per cent as oil. With sesame seed, Australia’s main supplying countries were India (71 per cent of the total volume of imports over the three years to 2006-07), Mexico (15 per cent), China (7 per cent) and Guatemala (6 per cent). The main suppliers of sesame oil were Singapore (32 per cent), China (27 per cent) and Hong Kong (11 per cent), while Lebanon supplied nearly 80 per cent of the total volume of tahini imports.

### Figure 53: Sesame seed: world production, exports and export prices

**Table 53: Sesame seed products: supply, disposal and value in Australia**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>ha</td>
<td>280</td>
<td>36</td>
<td>37</td>
<td>46</td>
<td>0</td>
</tr>
<tr>
<td>Production</td>
<td>t</td>
<td>111</td>
<td>20</td>
<td>21</td>
<td>18</td>
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<td>– volume</td>
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<td>– volume</td>
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<td></td>
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<tr>
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<td>14279</td>
<td>16447</td>
<td>16650</td>
<td>14474</td>
<td>15967</td>
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</table>

Sources: ABS (2008b); Bennett (2004); ABARE.
There are many different types of spices that are used in cooking. Spices are usually the fruit, seeds, stems, roots, bark or flowers of plants, as distinct from herbs which are usually the leaves of plants. Only a selected range of traditional spices are dealt with here (Table 54). There are many other common plant products that could be considered in their dried form as spices, such as garlic, poppy seed, mustard seed, celery, liquorice and papaya seeds.

The many different regional cuisines in the world are each characterised by their own distinctive blends of spices. Factors such as migration and increased incomes are leading to the spread of regional cuisines — for example, Chinese, Indian, Japanese, Thai and Spanish — beyond their traditional borders. Combined with population growth, this is leading to increased demand for virtually all types of culinary spices.

Reflecting this increased demand, the value of world trade in constant US dollars terms has grown at about 1.2 per cent a year over the last twenty years, but growth has been slowed in recent years by the effect of prolonged drought on ginger and coriander production. The constant dollar value of Australian imports of spices grew strongly throughout the 1990s but have declined substantially since the peak of 2000-01 (Figure 57).

Ginger (both fresh and processed) accounted for 66 per cent of the total value of Australian spice exports in the three years to 2006-07, while coriander, unidentified spices and mixed spices accounted for a further 11 per cent, 9 per cent and 6 per cent, respectively (Table 55). It seems that a large component of Australian export trade in spices other than coriander and ginger is based on imports of spices in bulk that are packaged and then re-exported.

On the import side, pepper was the most important spice, accounting for 25 per cent of the total value of imports in the three years to 2006-07. Other important components of the value of imports were capsicum or pimenta spice types (14 per cent), curry (10 per cent), ginger (9 per cent), paprika (8 per cent) and vanilla (4 per cent).

Figure 54: Culinary spices: value of world trade

Reflecting this increased demand, the value of world trade in constant US dollars terms has grown at about 1.2 per cent a year over the last twenty years, but growth has slowed in recent years by the effect of prolonged drought on ginger and coriander production. The constant dollar value of Australian imports of spices grew strongly throughout the 1990s but have declined substantially since the peak of 2000-01 (Figure 57).

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Table 54: Spices: characteristics of world trade

<table>
<thead>
<tr>
<th>Spice</th>
<th>Volume (kt)</th>
<th>Value (US$m)</th>
<th>Main trading countries (share of total trade volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anise/badian seed</td>
<td>13.7</td>
<td>22</td>
<td>Exporters: Viet Nam (28%), Syria (22%), China (18%), Turkey (18%)&lt;br&gt;Importers: India (27%), United States (13%), Germany (6%), Brazil (4%), Turkey (4%), Malaysia (4%), Netherlands (3%)</td>
</tr>
<tr>
<td>Capsicum/pimenta</td>
<td>342.9</td>
<td>487</td>
<td>Exporters: China (26%), India (16%), United States (9%), Mexico (9%), Spain (7%)&lt;br&gt;Importers: United States (25%), Mexico (12%), Malaysia (9%), Sri Lanka (8%), Spain (6%), Thailand (6%)</td>
</tr>
<tr>
<td>Caraway seed</td>
<td>13.9</td>
<td>15</td>
<td>Exporters: Egypt (18%), Canada (17%), Afghanistan (12%), Finland (10%), Poland (10%), Netherlands (8%), Czech Rep. (6%), Lithuania (5%)&lt;br&gt;Importers: United States (24%), Germany (19%), India (13%), Netherlands (7%), Algeria (4%), Tunisia (4%), Austria (4%), Pakistan (3%), Russian Federation (3%), Belarus (1%)</td>
</tr>
<tr>
<td>Cardamom</td>
<td>26.7</td>
<td>118</td>
<td>Exporters: Guatemala (65%), Nepal (18%), India (6%), Indonesia (3%)&lt;br&gt;Importers: Saudi Arabia (34%), Indonesia (16%), Singapore (7%), Pakistan (7%)</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>96.3</td>
<td>116</td>
<td>Exporters: Indonesia (41%), China (28%), Sri Lanka (13%), Viet Nam (7%)&lt;br&gt;Importers: United States (21%), India (12%), Mexico (7%), Brazil (5%), Netherlands (5%)</td>
</tr>
<tr>
<td>Cloves</td>
<td>48.3</td>
<td>99</td>
<td>Exporters: Madagascar (32%), Indonesia (27%), Sri Lanka (13%), Viet Nam (7%)&lt;br&gt;Importers: Singapore (41%), India (23%), United Arab Emirates (5%)</td>
</tr>
<tr>
<td>Coriander seed</td>
<td>70.5</td>
<td>44</td>
<td>Exporters: India (29%), Bulgaria (22%), Iran (8%), Canada (7%), Morocco (5%)&lt;br&gt;Importers: Sri Lanka (16%), Malaysia (13%), Pakistan (13%), United Kingdom (5%), United States (5%), Saudi Arabia (5%), Germany (5%)</td>
</tr>
<tr>
<td>Cumin seed</td>
<td>72.7</td>
<td>88</td>
<td>Exporters: Syria (38%), Afghanistan (16%), Turkey (13%), India (11%), Iran (9%)&lt;br&gt;Importers: United States (12%), Pakistan (10%), Bangladesh (9%), Singapore (7%), Brazil (7%), Saudi Arabia (6%), Morocco (5%), United Kingdom (5%)</td>
</tr>
<tr>
<td>Curry</td>
<td>20.9</td>
<td>40</td>
<td>Exporters: India (29%), Pakistan (17%), Malaysia (11%), Thailand (9%), United Kingdom (7%), Brazil (5%)&lt;br&gt;Importers: United Kingdom (19%), Saudi Arabia (16%), Singapore (10%), Germany (8%), United States (7%), Canada (6%), Australia (5%)</td>
</tr>
<tr>
<td>Fennel/ juniper berry</td>
<td>20.4</td>
<td>22</td>
<td>Exporters: Egypt (28%), India (23%), China (10%), Turkey (7%), Macedonia (5%), Pakistan (5), Bulgaria (5%)&lt;br&gt;Importers: Germany (21%), United States (12%), Malaysia (9%), Sri Lanka (6%)</td>
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<tr>
<td>Ginger</td>
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<td>176</td>
<td>Exporters: China (62%), Thailand (14%), Nepal (7%)&lt;br&gt;Importers: Japan (33%), Pakistan (13%), United States (10%), India (9%), Malaysia (6%)</td>
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<td>Mace</td>
<td>2.6</td>
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<td>Exporters: Indonesia (71%), Netherlands (5%), Grenada (5%)&lt;br&gt;Importers: Netherlands (20%), Singapore (20%), Germany (15%), India (15%), United States (5%), Pakistan (5%)</td>
</tr>
<tr>
<td>Nutmeg</td>
<td>14.7</td>
<td>70</td>
<td>Exporters: Indonesia (54%), Grenada (13%), Sri Lanka (6%), Netherlands (6%), India (6%)&lt;br&gt;Importers: Netherlands (14%), Singapore (12%), United States (11%), Germany (10%), Brazil (7%), Belgium (5%)</td>
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<tr>
<td>Pepper</td>
<td>280.9</td>
<td>499</td>
<td>Exporters: India (17%), China (15%), Viet Nam (14%), Indonesia (11%), Brazil (8%), Peru (5%), Mexico (5%)&lt;br&gt;Importers: United States (24%), Malaysia (7%), Germany (7%), Spain (5%), Mexico (5%)</td>
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<tr>
<td>Saffron</td>
<td>1.8</td>
<td>57</td>
<td>Exporters: United Kingdom (24%), Spain (21%), Iran (14%), China (9%), India (8%)&lt;br&gt;Importers: Spain (29%), United Kingdom (18%), Saudi Arabia (6%), France (5%), Oman (5%)</td>
</tr>
<tr>
<td>Turmeric</td>
<td>42.1</td>
<td>36</td>
<td>Exporters: India (61%), United Arab Emirates (12%), Myanmar (8%)&lt;br&gt;Importers: Iran (15%), Japan (9%), Sri Lanka (8%), Bangladesh (7%), Thailand (7%), Malaysia (6%), Indonesia (6%), United Arab Emirates (5%), United States (5%)</td>
</tr>
<tr>
<td>Vanilla</td>
<td>4.6</td>
<td>533</td>
<td>Exporters: Madagascar (31%), France (21%), Germany (9%), Indonesia (6%), United States (6%), Papua New Guinea (5%)&lt;br&gt;Importers: United States (28%), Netherlands (15%), United Kingdom (10%), France (10%), Germany (5%)</td>
</tr>
<tr>
<td>Spices, n.e.s.</td>
<td>76.2</td>
<td>163</td>
<td>Exporters: India (21%), Germany (10%), Turkey (10%), Pakistan (5%)&lt;br&gt;Importers: United States (20%), Saudi Arabia (6%), Belgium (6%), Netherlands (5%)</td>
</tr>
</tbody>
</table>

* Average, three years to 2005.

Table 55: Spices: Australian exports and imports

<table>
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<td>$'000</td>
<td>$'000</td>
<td>$/kg</td>
<td>$/kg</td>
<td>$/kg</td>
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<td>129</td>
<td>91</td>
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<td>Mixed spices</td>
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<td>36983</td>
<td>3.31</td>
<td>3.09</td>
<td>3.39</td>
</tr>
</tbody>
</table>

*a Includes processed ginger.


Further information about spices


- Australian Herb and Spice Industry Association website ([www.ahsia.org.au](http://www.ahsia.org.au)).
Coriander seed

The coriander plant (*Coriandrum sativum*) is believed to be of Mediterranean origin but is now widely cultivated throughout the world both for its leaves and seeds. The seed is crushed to provide oil or a powder that is used in curry powder and other spice mixes (Jongebloed 2004).

World trade in coriander seed has grown strongly in recent years with prices steady in recent years at slightly above US$600 a tonne in constant (2008) dollars (Figure 56). The main participants in world trade of coriander seed are summarised in Table 54.

Australian coriander seed industry

Annual Australian production of coriander seed reached around 5000 tonnes in the early 1990s but declined to a little over 1500 tonnes in 2003-04. This is despite export returns being higher in constant dollar terms in recent years than in the 1990s. Contributing to the loss of interest in growing coriander for seed have been disease problems that have caused large fluctuations in yields (Hooper and Dennis 2002). South Australia typically accounts for around 40 per cent of Australian coriander production with the other major producing states being Western Australia, New South Wales and Victoria.

Australian exports of coriander seed reached nearly 4000 tonnes in the early 1990s but have declined to less than 1200 tonnes in 2006-07 (Figure 57). The main export markets for Australian coriander seed are China (24 per cent of the total volume in the three years to 2004), Thailand (16 per cent), Vietnam (11 per cent), Hong Kong (10 per cent), India (10 per cent) and Reunion (7 per cent).
Ginger

Ginger is the rhizome of the perennial plant *Zingiber officinale* and is used widely as a culinary spice and medicine. The main participants in world trade of ginger are summarised in Table 54.

World trade in ginger has been growing strongly over the last twenty years (Figure 58).

Australian ginger industry

The Australian ginger industry is mostly located in the Buderim region of Queensland. There is also very small scale production in New South Wales and the Northern Territory. In 2005-06, there were 46 ginger growers, with plantings of 232 hectares and ginger production of 7575 tonnes (Table 57).

Ginger is sold as fresh and processed product. The processing mainly involves drying and preservation (usually using sugar). Less than half of Australia’s ginger production is exported, mainly in processed form. The main industry processor is Buderim Ginger Limited which operates a production quota system, with prices linked by formula to the prices received for its ginger products.

Australian exports of ginger products peaked in 2002-03 but have been lower in recent years because of prolonged drought (Figure 59). Australia’s main export markets for ginger products are the United Kingdom (34 per cent of the total value of Australia’s exports in the three years to 2006-07), the United States (27 per cent), Germany (19 per cent), Canada (6 per cent) and New Zealand (3 per cent). There are also significant imports of ginger products, mainly from China, Fiji and India.

Further information about ginger

Buderim Ginger Pty Limited (www.buderimginger.com).

![Figure 58: Ginger: world imports and import prices](image1)

![Figure 59: Ginger products: Australian exports and export prices](image2)

### Table 57: Ginger: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Area hectares</td>
<td></td>
<td>232</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td></td>
<td>7 575</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross value $’000</td>
<td></td>
<td>22 726</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit gross value $/tonne</td>
<td></td>
<td>3 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginger – volume tonnes</td>
<td></td>
<td>262</td>
<td>163</td>
<td>186</td>
<td>204</td>
<td>199</td>
</tr>
<tr>
<td>Ginger – value $’000</td>
<td></td>
<td>822</td>
<td>699</td>
<td>757</td>
<td>844</td>
<td>883</td>
</tr>
<tr>
<td>Ginger – unit value $/kg</td>
<td></td>
<td>3.13</td>
<td>4.28</td>
<td>4.08</td>
<td>4.13</td>
<td>4.44</td>
</tr>
<tr>
<td>Ginger, preserved by sugar – volume tonnes</td>
<td></td>
<td>1 060</td>
<td>960</td>
<td>986</td>
<td>994</td>
<td>1025</td>
</tr>
<tr>
<td>Ginger, preserved by sugar – value $’000</td>
<td></td>
<td>7 247</td>
<td>6 910</td>
<td>6 726</td>
<td>6 946</td>
<td>7 330</td>
</tr>
<tr>
<td>Ginger, preserved by sugar – unit value $/kg</td>
<td></td>
<td>6.84</td>
<td>7.20</td>
<td>6.82</td>
<td>6.99</td>
<td>7.15</td>
</tr>
<tr>
<td>Ginger, in syrup – volume tonnes</td>
<td></td>
<td>1 382</td>
<td>1 306</td>
<td>1 260</td>
<td>1 293</td>
<td>1 448</td>
</tr>
<tr>
<td>Ginger, in syrup – value $’000</td>
<td></td>
<td>5 605</td>
<td>5 370</td>
<td>4 829</td>
<td>4 869</td>
<td>5 661</td>
</tr>
<tr>
<td>Ginger, in syrup – unit value $/kg</td>
<td></td>
<td>4.06</td>
<td>4.11</td>
<td>3.83</td>
<td>3.76</td>
<td>3.91</td>
</tr>
<tr>
<td><strong>Total export value $’000</strong></td>
<td></td>
<td>13 674</td>
<td>12 978</td>
<td>12 312</td>
<td>12 659</td>
<td>13 874</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginger – volume tonnes</td>
<td></td>
<td>955</td>
<td>734</td>
<td>812</td>
<td>820</td>
<td>671</td>
</tr>
<tr>
<td>Ginger – value $’000</td>
<td></td>
<td>1 449</td>
<td>1 451</td>
<td>1 803</td>
<td>2 043</td>
<td>1 533</td>
</tr>
<tr>
<td>Ginger – unit value $/tonne</td>
<td></td>
<td>1.52</td>
<td>1.98</td>
<td>2.22</td>
<td>2.49</td>
<td>2.28</td>
</tr>
<tr>
<td>Ginger, prepared or preserved – volume tonnes</td>
<td></td>
<td>244</td>
<td>441</td>
<td>422</td>
<td>329</td>
<td>700</td>
</tr>
<tr>
<td>Ginger, prepared or preserved – value $’000</td>
<td></td>
<td>1 342</td>
<td>1 782</td>
<td>1 329</td>
<td>943</td>
<td>1 607</td>
</tr>
<tr>
<td>Ginger, prepared or preserved – unit value $/tonne</td>
<td></td>
<td>5.51</td>
<td>4.04</td>
<td>3.15</td>
<td>2.87</td>
<td>2.29</td>
</tr>
<tr>
<td><strong>Total import value $’000</strong></td>
<td></td>
<td>2 792</td>
<td>3 233</td>
<td>3 133</td>
<td>2 986</td>
<td>3 139</td>
</tr>
</tbody>
</table>

Sources: ABS (2007b, 2008); ABARE

**Overview**

Tea is produced from a shrub *Camellia sinensis* that can live for over a hundred years. It comes from harvesting the new shoots of the shrub, usually consisting of two leaves and a bud. Traditionally tea has been handpicked but mechanical harvesters have also been developed.

Tea is consumed in three broad types — black, green and oolong. With black tea, processing involves crushing or tearing the leaves, exposing them to oxygen, causing a natural enzymatic (often called fermentation but actually oxidation) process. With green tea, the green leaves are typically steamed to stop any enzymatic process and then dried. With oolong tea, the processing is broadly the same as with black tea, except the period over which fermentation is allowed is shortened. Green tea makes up roughly 15 per cent of world tea consumption.

**World tea market**

India and China contribute more than half of the world's tea production (Table 58). World trade in black and green tea is worth more than US$2.04 billion and US$336 million a year, respectively. With black tea, Sri Lanka, Kenya and India are the main exporters, and the United Kingdom and the Russian Federation the main importers. With green tea, China dominates world trade with a share of around 70 per cent, while the main importers are Morocco and Japan.

**Australian tea consumption**

Over the last decade, Australian imports of black tea have been declining at an average 3.1 per cent a year but imports of green tea have been growing at 15.8 per cent a year. Over the three years to 2006-07, Australia's annual imports averaged 13 700 tonnes of black tea and 870 tonnes of green tea. The total value of Australian tea imports was nearly $94 million a year over the same period.

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td>3289.9</td>
<td>na</td>
</tr>
<tr>
<td><strong>World trade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black tea</td>
<td>924</td>
<td>US$2043</td>
</tr>
<tr>
<td>Green tea</td>
<td>151</td>
<td>US$336</td>
</tr>
</tbody>
</table>

*Average, four years to 2005.*

**Table 58:** Tea: key characteristics of the world market

*Sources: FAO Statistics Division (2008); UN Statistics Division (2008).*
Black tea  GVP = $1 808 000

Tea is grown in Australia mainly in northern New South Wales and Queensland (in the Cairns and Mossman regions), with small areas planted specifically to green tea production in Victoria, Western Australia and Tasmania. Queensland growers benefit from higher yields compared to New South Wales growers and account for nearly 90 per cent of Australian tea production.

The tea industry in Queensland and New South Wales is mainly oriented toward production of black tea but also produces ‘China style’ green tea. Most of Australia’s black tea production is sold on the domestic market and benefits in this highly competitive market from its ‘Made in Australia’ label (Chudleigh 1999). Despite this, the main Australian tea brands — Madura and Nerada — sell in the mid priced categories of tea in Australian supermarkets (based on Retail World 2006 data).

The main tea processors in Australia are Nerada and Madura. They package tea as leaf tea or tea bags, also using imported teas. In 2006, the Nerada brand had a 7.9 per cent share in volume terms of Australian supermarket sales and the Madura brand a 4.5 per cent share (Retail World 2006).

Madura also had a 26 per cent share of the green tea sales in Australian supermarkets in 2006 but this share is probably largely based on the use of imported green tea.

Tea plantings in New South Wales and Queensland were around 616 hectares in 2007, including a plantation of 106 hectares in the northern rivers region of New South Wales that seems not to have produced commercially since late 2002.

Japanese green tea  GVP = $0

In Australia, the Japanese green tea industry is located mainly in the Alpine Valleys region of Victoria but there are very small plantings that are not producing commercial quantities of green tea in Tasmania, New South Wales and Manjimup in Western Australia.

There are three harvest periods in each year in Victoria, corresponding to flushes of plant growth, starting around November. The yield and quality of green tea is highest with the November flush and declines with each subsequent harvest.

In late 2004, Ito En Australia Pty Ltd, a subsidiary of a major Japanese beverage company opened a green tea processing plant at Wangaratta in Victoria, with the aim of supplying the Japanese market. The Japanese market is a growing one due to health conscious consumers and innovations such as canned tea products. Japanese tea consumption is currently more than 100 000 tonnes but production is fairly static at around 90 000 tonnes and is not able to expand to meet the domestic shortfall (Australian Green Tea Growers Association 2006).

Ito En Australia initially contracted 11 farms with combined plantings of 72 hectares to supply fresh green tea leaves from Japanese tea varieties (mainly yabukita, sayamakoari and okukaoiri). The first commercial harvest was in November 2004. Frost and drought has severely curtailed production in 2006-07, with virtually no harvested production. Production was an estimated 126 tonnes in 2005-06 (Table 60).

There are longer term plans for further green tea farms to be established in the north east Victorian region, with a target of 250 hectares producing up to 18 tonnes from three harvests a year. Within 10 years, Ito En Australia hopes to be exporting 1000 tonnes of green tea a year to Japan. However, plans for industry expansion in Victoria are on hold at the moment due to issues with marketing of foreign produced green tea in Japan.

Another Japanese processor of green tea, Kunitaro Tea Company, has participated in a one hectare trial at Somersby on the central New South Wales coast since 1998. In 2004, Kunitaro established its own plantation of 5 hectares at Mangrove Mountain and has plans to increase this to 15 hectares.
Table 59: Tea: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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</tr>
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<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers no.</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Area 616</td>
<td>616</td>
<td>616</td>
<td>616</td>
<td>616</td>
<td>616</td>
</tr>
<tr>
<td><strong>Volume</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– green leaf tonnes</td>
<td>4763</td>
<td>7111</td>
<td>5993</td>
<td>7333</td>
<td>5649</td>
</tr>
<tr>
<td>– processed tonnes</td>
<td>1058</td>
<td>1580</td>
<td>1332</td>
<td>1627</td>
<td>1255</td>
</tr>
<tr>
<td><strong>Gross value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$'000</td>
<td>1525</td>
<td>2279</td>
<td>1921</td>
<td>2382</td>
<td>1808</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black tea volume</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $'000</td>
<td>3 698</td>
<td>3 249</td>
<td>2 381</td>
<td>3 007</td>
<td>2 484</td>
</tr>
<tr>
<td>– unit export value $/kg</td>
<td>6.94</td>
<td>7.21</td>
<td>5.11</td>
<td>6.63</td>
<td>8.91</td>
</tr>
<tr>
<td>Green tea volume</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $'000</td>
<td>844</td>
<td>709</td>
<td>846</td>
<td>1 584</td>
<td>725</td>
</tr>
<tr>
<td>– unit export value $/kg</td>
<td>17.24</td>
<td>16.11</td>
<td>21.10</td>
<td>21.98</td>
<td>15.32</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black tea volume</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $'000</td>
<td>99 705</td>
<td>85 066</td>
<td>85 056</td>
<td>80 664</td>
<td>88 879</td>
</tr>
<tr>
<td>– unit export value $/kg</td>
<td>6.74</td>
<td>6.39</td>
<td>6.41</td>
<td>6.49</td>
<td>6.90</td>
</tr>
<tr>
<td>Green tea volume</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $'000</td>
<td>4 351</td>
<td>4 360</td>
<td>6 703</td>
<td>7 940</td>
<td>8 618</td>
</tr>
<tr>
<td>– unit export value $/kg</td>
<td>7.04</td>
<td>6.09</td>
<td>5.50</td>
<td>7.24</td>
<td>8.83</td>
</tr>
<tr>
<td><strong>All tea</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value of exports $'000</td>
<td>4 542</td>
<td>3 958</td>
<td>3 228</td>
<td>4 591</td>
<td>3 209</td>
</tr>
<tr>
<td>Value of imports $'000</td>
<td>104 055</td>
<td>89 426</td>
<td>91 758</td>
<td>88 624</td>
<td>97 497</td>
</tr>
</tbody>
</table>

a Includes black and green tea.

Sources: ABS (2008b); ABARE.

Further information about tea

- Tea Industry Forum (www.tea.org.au), an industry representative body of growers, packers, manufacturers and marketers. Provides statistics on the nature of the Australian tea industry
- The Australian Growers Guide for Japanese Green Tea, prepared by the Australian Green Tea Growers Association (a free overview is available at www.alpvalleys.com.au)

Table 60: Japanese green tea: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area hectares</td>
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<td>72</td>
<td>72</td>
<td>72</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td><strong>Volume</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– green leaf tonnes</td>
<td></td>
<td>3</td>
<td>12</td>
<td>11</td>
<td>126</td>
<td>0</td>
</tr>
<tr>
<td>– processed tonnes</td>
<td></td>
<td>0.7</td>
<td>2.4</td>
<td>2.1</td>
<td>25.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Gross value $'000</td>
<td></td>
<td>2</td>
<td>8</td>
<td>7</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td></td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
</tr>
<tr>
<td><strong>Exports to Japan</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td></td>
<td>0.7</td>
<td>2.4</td>
<td>2.1</td>
<td>25.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Value $'000</td>
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<td>30</td>
<td>60</td>
<td>216</td>
<td>756</td>
<td>0.0</td>
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<tr>
<td>Unit export value $/kg</td>
<td>44.16</td>
<td>25.29</td>
<td>102.87</td>
<td>29.95</td>
<td></td>
<td></td>
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<tr>
<td><strong>Imports from Japan</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
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<td>52</td>
<td>66</td>
<td>60</td>
<td>59</td>
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<td>Value $'000</td>
<td></td>
<td>940</td>
<td>947</td>
<td>1224</td>
<td>1138</td>
<td>984</td>
</tr>
<tr>
<td>Unit import value $/kg</td>
<td>18.00</td>
<td>14.32</td>
<td>20.53</td>
<td>19.43</td>
<td>16.97</td>
<td></td>
</tr>
</tbody>
</table>

a ABARE estimates.

Sources: ABS (2008b); ABARE.
The main tree nuts are generally considered to be almonds, brazil nuts, cashews, chestnuts, hazelnuts, macadamias pecans, pistachios and walnuts (though some of these are not true nuts).

Demand for tree nuts is benefiting from increasing consumer perceptions of their healthiness as part of a balanced diet. Generally tree nuts are valuable protein sources and are high in unsaturated fats and some important vitamin and minerals. Each nut has specific nutritional characteristics that are being used by marketers to boost demand. For example, walnuts are marketed as containing high levels of omega 3 fatty acids; almonds as being high in vitamin E; or brazil nuts as being a valuable source of selenium.

In Australia, the tree nut industry has established a website ‘Nuts for Life’ (www.nutsforlife.com.au) to provide information to consumers about the nutritional and health benefits of tree nuts.

### World tree nut market

World imports of tree nuts averaged US$5.8 billion a year in the four years to 2005, of which almonds and cashews comprised nearly half (Figure 62).

The main exporter of tree nuts is the United States, with Turkey, India and Iran being the other major players (Figure 63). Australia accounts for only around 1.5 per cent of the total value of world trade, but is the largest exporter of macadamias.

### Australian tree nut industry

The estimated gross value of the Australian tree nut industry in 2006 was $550 million, of which macadamias made up around 75 per cent and almonds 20 per cent. Domestic prices for tree nuts in the Melbourne wholesale market are shown in Table 61.

Average annual value of Australian tree nut exports was $173 million in the four years to 2006-07, compared to imports of $174 million (Figure 64). Australia is a net exporter of macadamias, almonds and pecans but net importers of other tree nuts.

#### Table 61: Domestic prices for tree nuts in the Melbourne wholesale market

<table>
<thead>
<tr>
<th>Nut</th>
<th>Price (AUD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almonds</td>
<td>$1,516m</td>
</tr>
<tr>
<td>Brazil nuts</td>
<td>$104m</td>
</tr>
<tr>
<td>Cashews</td>
<td>$1,233m</td>
</tr>
<tr>
<td>Chestnuts</td>
<td>$207m</td>
</tr>
<tr>
<td>Hazelnuts</td>
<td>$835m</td>
</tr>
<tr>
<td>Pistachios</td>
<td>$736m</td>
</tr>
<tr>
<td>Walnuts</td>
<td>$508m</td>
</tr>
<tr>
<td>Other</td>
<td>$663m</td>
</tr>
</tbody>
</table>

**Almonds**

The almond tree (*Prunus dulcis*) is a deciduous tree that originated in southwest Asia. It is pollinated by bees and produces a fruit consisting of a leathery hull that covers a hard shell containing the almond nut.

Mechanical tree shakers separate the fruit from the tree. The fruit is allowed to dry on the ground and then is swept up by machines. Processing separates the hull, shell, and nut. The nut is eaten directly in raw, smoked, or blanched form, or is used in a wide range of bakery and confectionary products. The hull is a valuable animal feed and the shell is valued in uses such as garden mulch or animal beds.

**World almond industry**

The world almond market is dominated by the United States (mainly California) which accounts for around 45 per cent of world production and more than 70 per cent of world trade (Table 62). (Almond Board of California has markedly different numbers than FAO — claims 80 per cent share of world production.)

World demand for almonds is growing strongly due to rapidly growing incomes in traditional consuming countries, such as India and China, and increasing health consciousness in high income countries. The strong demand has meant a steady increase in world trade and higher almond prices in recent years (Figure 65).

Almonds are dependent on honey bees for pollination. In the United States, Colony Collapse Disorder (CCD) is reducing bee populations in the coast producing regions and is being observed in the west coast producing regions. There are concerns that in future years there will not be enough bees in the United States to enable optimal pollination of almond orchards.

**Australian almond industry.**

The main almond producing areas of Australia are located in the Adelaide, Riverland (South Australia), Sunraysia (Victoria) and Riverina (New South Wales) areas of Australia. Almonds are harvested in Australia from late February to May. The advantages that the Australian almond industry have are the ability to produce outside the northern hemisphere production period and freedom from many of the diseases and pests that affect other producing regions in the world.

In 2007, the total Australian area of almonds was 25,965 hectares, consisting of 10,916 hectares of bearing trees and 15,050 hectares of non-bearing (recently planted) trees (Almond Board of Australia 2007). The 2006-07 Australian almond harvest is estimated to have been around 26,555 tonnes (kernel).

There have been large plantings of almonds in recent years, particularly in Victoria. Australian almond production is projected to reach 46,700 tonnes (kernel) by 2008 and 77,000 tonnes by 2015 (Almond Board of Australia 2007).

The Almond Board of Australia is the peak industry body. Compulsory levies are raised to fund research and development through Horticulture Australia. The levy rates are $0.01 per kilogram for shelled almonds; $0.02 per kilogram for shelled almonds and $0.015 per kilogram for unshelled nonpareil almonds.

---

**Table 61: Tree nut prices, Melbourne market**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Almonds</td>
<td>$10.00</td>
<td>$10.37</td>
<td>$11.36</td>
<td>$15.70</td>
<td>$15.75</td>
</tr>
<tr>
<td>Brazil</td>
<td>$7.68</td>
<td>$8.50</td>
<td>$9.20</td>
<td>$15.29</td>
<td>$15.25</td>
</tr>
<tr>
<td>Cashew</td>
<td>$13.00</td>
<td>$13.10</td>
<td>$13.66</td>
<td>$15.29</td>
<td>$15.25</td>
</tr>
<tr>
<td>Chestnut</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– large</td>
<td>$6.41</td>
<td>$5.24</td>
<td>$5.00</td>
<td>$5.40</td>
<td>$6.50</td>
</tr>
<tr>
<td>– standard</td>
<td>$4.77</td>
<td>$3.66</td>
<td>$3.61</td>
<td>$3.77</td>
<td>$2.76</td>
</tr>
<tr>
<td>– medium</td>
<td>$3.50</td>
<td>$2.75</td>
<td>$2.92</td>
<td>$2.29</td>
<td>$4.24</td>
</tr>
<tr>
<td>– small</td>
<td>$2.84</td>
<td>$1.80</td>
<td>$1.25</td>
<td>$1.53</td>
<td>$3.94</td>
</tr>
<tr>
<td>– L1</td>
<td>na</td>
<td>na</td>
<td>$3.75</td>
<td>$4.66</td>
<td>$5.83</td>
</tr>
<tr>
<td>– L2</td>
<td>na</td>
<td>na</td>
<td>$4.25</td>
<td>$4.57</td>
<td>$6.87</td>
</tr>
<tr>
<td>– L3</td>
<td>na</td>
<td>na</td>
<td>$4.75</td>
<td>$5.45</td>
<td>$8.14</td>
</tr>
<tr>
<td>Hazelnut</td>
<td>$9.84</td>
<td>$12.09</td>
<td>$13.29</td>
<td>$15.29</td>
<td>$15.25</td>
</tr>
<tr>
<td>Macadamia</td>
<td>$16.51</td>
<td>$21.92</td>
<td>$23.62</td>
<td>$25.20</td>
<td>$25.25</td>
</tr>
<tr>
<td>Pecan</td>
<td>$10.78</td>
<td>$18.50</td>
<td>$18.50</td>
<td>$18.29</td>
<td>$18.25</td>
</tr>
<tr>
<td>Pistachio</td>
<td>$9.80</td>
<td>$12.50</td>
<td>$12.14</td>
<td>$9.82</td>
<td>$8.00</td>
</tr>
<tr>
<td>Walnut</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– jumbo</td>
<td>$6.75</td>
<td>na</td>
<td>$7.00</td>
<td>$6.88</td>
<td>$7.00</td>
</tr>
<tr>
<td>– large</td>
<td>$5.50</td>
<td>$5.50</td>
<td>$5.21</td>
<td>$6.00</td>
<td>$6.00</td>
</tr>
<tr>
<td>– standard</td>
<td>$4.25</td>
<td>na</td>
<td>$5.00</td>
<td>$4.88</td>
<td>$5.00</td>
</tr>
</tbody>
</table>

Data source: Melbourne Market Price Reporting Service.

---

**Figure 64: Value composition of the Australian tree nut trade**

- Almonds
- Brazil nuts
- Cashew
- Chestnuts
- Hazelnuts
- Macadamias
- Pecan nuts
- Pistachios
- Walnuts
- Other nuts

*Average, four years to 2006-07. Data source: ABS (2008b).*
The main almond processors in the Australian industry are:

- Almondco Australia Ltd (a grower owned company) that is located at Renmark in South Australia and processes almonds from around 140 growers, representing roughly 50 per cent of the Australian almond harvest.
- Nut Producers of Australia (a grower owned company) that processes around 5 per cent of Australia’s almonds at Loxton in South Australia.
- Select Harvests Limited (a publicly listed company), an integrated producer and processor centred on the Robinvale area of Victoria and processing around 40 per cent of Australia’s almonds.

Table 62: Almonds: key characteristics of the world market

<table>
<thead>
<tr>
<th>Volume &amp; Value</th>
<th>Key countries (share of total volume in the four years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>1 753</td>
</tr>
<tr>
<td>World trade</td>
<td></td>
</tr>
<tr>
<td>In shell</td>
<td>67 US$140</td>
</tr>
<tr>
<td>Shelled</td>
<td>341 US$1 521</td>
</tr>
</tbody>
</table>

*Average, four years to 2005.

Further information about almonds

- Almond Board of Australia (www.australialmonds.com) provides statistics on almond plantings and production.
- Almond Board of California Almond Board of California (www.almondboard.com) publishes an almanac that provides comprehensive statistics on Californian and world almond industries.

Figure 66: Almonds: Australian production and returns to growers

* Unshelled almonds delivered to Almondco, in constant (2008) dollars.

Data sources: Australian Almond Board; Almondco.
Table 63: Almonds: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>hectares</td>
<td>4,522</td>
<td>5,344</td>
<td>6,973</td>
<td>7,571</td>
<td>9,163</td>
</tr>
<tr>
<td>– bearing</td>
<td>hectares</td>
<td>3,049</td>
<td>3,819</td>
<td>4,551</td>
<td>6,692</td>
<td>10,570</td>
</tr>
<tr>
<td>– non-bearing</td>
<td>hectares</td>
<td>7,571</td>
<td>9,163</td>
<td>11,524</td>
<td>14,263</td>
<td>19,733</td>
</tr>
<tr>
<td>Total</td>
<td>hectares</td>
<td>7,571</td>
<td>9,163</td>
<td>11,524</td>
<td>14,263</td>
<td>19,733</td>
</tr>
<tr>
<td>Volume (kernel)</td>
<td>tonnes</td>
<td>10,093</td>
<td>11,474</td>
<td>16,178</td>
<td>15,917</td>
<td>26,555</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>56,016</td>
<td>70,450</td>
<td>105,481</td>
<td>99,800</td>
<td>186,947</td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell, fresh or dried</td>
<td>tonnes</td>
<td>1,221</td>
<td>1,892</td>
<td>1,484</td>
<td>3,327</td>
<td>5,032</td>
</tr>
<tr>
<td>– volume</td>
<td>$’000</td>
<td>5,744</td>
<td>9,093</td>
<td>8,829</td>
<td>21,352</td>
<td>28,384</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>4.70</td>
<td>4.81</td>
<td>5.95</td>
<td>6.42</td>
<td>5.64</td>
</tr>
<tr>
<td>Shelled, fresh or dried</td>
<td>tonnes</td>
<td>1,142</td>
<td>1,399</td>
<td>2,542</td>
<td>4,476</td>
<td>3,944</td>
</tr>
<tr>
<td>– volume</td>
<td>$’000</td>
<td>7,014</td>
<td>8,855</td>
<td>20,181</td>
<td>39,903</td>
<td>28,635</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>6.14</td>
<td>6.33</td>
<td>7.94</td>
<td>8.91</td>
<td>7.26</td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell, fresh or dried</td>
<td>tonnes</td>
<td>23</td>
<td>27</td>
<td>17</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>– volume</td>
<td>$’000</td>
<td>106</td>
<td>121</td>
<td>137</td>
<td>14</td>
<td>122</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>4.61</td>
<td>4.43</td>
<td>8.27</td>
<td>2.09</td>
<td>6.28</td>
</tr>
<tr>
<td>Shelled, fresh or dried</td>
<td>tonnes</td>
<td>2,828</td>
<td>2,217</td>
<td>1,621</td>
<td>2,007</td>
<td>1,904</td>
</tr>
<tr>
<td>– volume</td>
<td>$’000</td>
<td>13,874</td>
<td>11,503</td>
<td>9,480</td>
<td>20,273</td>
<td>13,580</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>4.91</td>
<td>5.19</td>
<td>5.85</td>
<td>10.10</td>
<td>7.13</td>
</tr>
<tr>
<td>All almonds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total export value</td>
<td>$’000</td>
<td>12,758</td>
<td>17,948</td>
<td>29,010</td>
<td>61,255</td>
<td>57,019</td>
</tr>
<tr>
<td>Total import value</td>
<td>$’000</td>
<td>13,980</td>
<td>11,625</td>
<td>9,617</td>
<td>20,286</td>
<td>13,702</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); ABARE.

Cashews

The cashew tree (Anacardium occidentale) is native to the tropical region of north eastern Brazil. It produces a pseudofruit called the cashew apple from the bottom of which protrudes the true fruit that is usually kidney shaped. Within the true fruit is a shell containing a single seed that is the cashew nut. The shell contains highly toxic liquid that has a number of industrial uses including resin manufacture. The cashew apple is edible but its highly perishable nature means it is often discarded after the nut is removed.

The shelling process with cashews is largely a manual one so cashews are processed in countries with low labour costs.

World cashew industry

The main producers of cashews are Vietnam and India, along with other countries in the tropics (Table 64). India is the main importer of cashews in shell, which are processed then exported to wealthy countries.

World trade in both unshelled and shelled cashews has grown strongly over the last decade (Figure 67). Import prices for unshelled cashews are much lower in recent years in constant dollar terms than ten years ago but have improved substantially for shelled cashews.

Australian cashew industry

The Australian cashew industry is located in the Mareeba region of tropical Queensland and in the Northern Territory. Under Australian conditions, cashew trees reach commercial yields at around 3 years and maximum around 5 years after planting. The harvest period is from October to January.

The Queensland industry consists of one large plantation with 48,000 trees that has been established since 1988. There is a large plantation in the Northern Territory with existing plantings of 100,000 trees (50 currently bearing fruit) and plans to increase to 250,000 trees.

Australian production in 2005-06 was only 114 tonnes, substantially below the existing production potential of around 300 tonnes (Table 65).

After some initial early stage processing,
Australian cashews are exported for further processing; there is no facility for shelling cashews in Australia. Virtually all unshelled Australian cashews are exported to Vietnam and then returned to Australia for sale as value added product (O’Farrell and Blaikie 2004). The main export destinations for shelled Australian cashews are New Zealand (49 per cent of total Australian exports in the three years to 2006-07), Canada (27 per cent), Spain (11 per cent) and the United States (11 per cent).

Australia imported cashews worth $81 million in 2006-07 (Table 65), mainly from Vietnam (87 per cent of total imports in the three years to 2006-07) and India (10 per cent).

A wide range of land in Australia has been identified as suitable for cashew production. The plans for expansion of the industry and the maturing of existing plantings suggest Australian production of cashews (in-shell) of as much as 3000 tonnes by 2011-12.

However, lack of processing facilities in Australia is a major impediment to the profitability of cashew production under Australian conditions and the current industry expectation of future production levels will be difficult to realise.

Further information about cashews

- US Department of Agriculture’s PSD Online database (www.fas.usda.gov/psdonline/), providing time series data on production, supply and distribution of macadamia nuts (in-shell basis), by key producing country.

Table 64: Cashews: key characteristics of the world market

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume</th>
<th>Value</th>
<th>Key countries (share of total volume in the four years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>2 082</td>
<td>na</td>
<td>Vietnam (32%), India (22%), Nigeria (10%), Brazil (8%), Indonesia (6%), Tanzania (5%), Côte d’Ivoire (4%), Guinea-Bissau (4%), Mozambique (3%), Benin (3%)</td>
</tr>
<tr>
<td>World trade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell</td>
<td>487</td>
<td>US$421</td>
<td>Exporters: Cote d’Ivoire (22%), Guinea-Bissau (16%), United Rep. of Tanzania (14%), Indonesia (12%), Benin (10%), Mozambique (7%), Ghana (5%), Nigeria (5%), Senegal (2%), Gambia (2%)</td>
</tr>
<tr>
<td>Shelled</td>
<td>238</td>
<td>US$998</td>
<td>Exporters: India (45%), Viet Nam (29%), Brazil (16%), United Kingdom (2%), Netherlands (2%), Indonesia (1%), Germany (1%), United Rep. of Tanzania (1%)</td>
</tr>
</tbody>
</table>

*Average four years to 2005.


Figure 67: Cashews: world imports and import prices

Table 65: Cashews: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers</td>
<td>no</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– under 6 years</td>
<td>no.</td>
<td>58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– 6 years and over</td>
<td>no.</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– total</td>
<td>no.</td>
<td>119</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume (in-shell)</td>
<td>tonnes</td>
<td>114</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell, fresh or dried</td>
<td>tonnes</td>
<td>0.0</td>
<td>5.5</td>
<td>94.2</td>
<td>37.9</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>0</td>
<td>33</td>
<td>149</td>
<td>29</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>4.91</td>
<td>6.06</td>
<td>1.58</td>
<td>0.76</td>
</tr>
<tr>
<td>Shelled, fresh or dried</td>
<td>tonnes</td>
<td>40.6</td>
<td>117.2</td>
<td>41.6</td>
<td>256.8</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>270</td>
<td>747</td>
<td>291</td>
<td>1 559</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>6.64</td>
<td>6.38</td>
<td>7.00</td>
<td>6.07</td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell, fresh or dried</td>
<td>tonnes</td>
<td>19.6</td>
<td>15.9</td>
<td>67.5</td>
<td>255.6</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>122</td>
<td>97</td>
<td>352</td>
<td>1 450</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>6.22</td>
<td>6.11</td>
<td>5.22</td>
<td>5.67</td>
</tr>
<tr>
<td>Shelled, fresh or dried</td>
<td>tonnes</td>
<td>9 317.2</td>
<td>11 498.4</td>
<td>12 311.9</td>
<td>13 279.1</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>55 243</td>
<td>58 853</td>
<td>77 211</td>
<td>83 608</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>5.93</td>
<td>5.12</td>
<td>6.27</td>
<td>6.30</td>
</tr>
<tr>
<td>All cashews</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total export value</td>
<td>$’000</td>
<td>270</td>
<td>780</td>
<td>440</td>
<td>1 588</td>
</tr>
<tr>
<td>Total import value</td>
<td>$’000</td>
<td>55 365</td>
<td>58 950</td>
<td>77 563</td>
<td>85 058</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); ABARE.
Chestnuts

There are four main varieties of chestnut: European chestnut (Castanea sativa), Chinese chestnut (Castanea mollissima), Japanese chestnut (Castanea crenata) and American Chestnut (Castanea dentata).

Unlike other nuts, chestnuts contain virtually no oil. The composition is roughly 50 per cent carbohydrate, 5–10 per cent protein, with the bulk of the remainder water. Chestnuts are a traditional source of carbohydrate in Europe and Asia.

The main producer of chestnuts is China and it is also the main exporter (Table 66). World import prices have fluctuated around US$2500 a tonne in constant (2008) dollar terms over the last decade (Figure 68).

Australian chestnut industry

The European chestnut is the most common chestnut variety in Australia. The Australian chestnut crop is harvested between March and May.

There are approximately 340 chestnut growers in Australia, with around 75 per cent of production occurring in the north east region of Victoria. Estimated Australian chestnut production in 2006-07 was 413 tonnes with a gross value of nearly $913,000. This was less than half the production level of the previous year due to drought and frost (Table 67).

Australian exports small quantities of chestnuts, mainly to China (97 per cent of total Australian exports in the three years to 2006-07).

According to Chestnuts Australia Inc (2007), Australian chestnut production could be as high as 2000 tonnes by 2009–10, with annual exports of 120 tonnes.

Further information about chestnuts

- US Department of Agriculture's PSD Online database (www.fas.usda.gov/psdonline/) providing time series data on production, supply and distribution of chestnuts, by key producing country.
- Chestnuts Australia Inc. (www.chestnutsaustralia.com.au), a range of information, including an industry newsletter.

Table 66: Chestnuts: key characteristics of the world market

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume</th>
<th>Value</th>
<th>Key countries (share of total volume in the four years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>1 092</td>
<td>na</td>
<td>China (70%), Korea, Rep. (6%), Italy (5%), Turkey (4%), Bolivia (3%), Portugal (3%), Japan (2%), Russian Federation (2%), Greece (1%), Spain (1%)</td>
</tr>
<tr>
<td>World trade</td>
<td>90.8</td>
<td>US$206.8</td>
<td>Exporters: China (33%), Italy (22%), Korea, Rep. (14%), Spain (9%), Portugal (9%), Turkey (7%), France (3%)</td>
</tr>
<tr>
<td>Exporters</td>
<td></td>
<td></td>
<td>Importers: Japan (28%), France (10%), Italy (8%), China (8%), United States (5%), Germany (4%), Spain (3%), Hungary (3%), Austria (3%), Switzerland (3%)</td>
</tr>
</tbody>
</table>

Table 67: Chestnuts: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Growers</td>
<td>no.</td>
<td>340</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- bearing</td>
<td>hectares</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- non-bearing</td>
<td>hectares</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- total</td>
<td>hectares</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>642</td>
<td>724</td>
<td>755</td>
<td>876</td>
<td>413</td>
</tr>
<tr>
<td>Value</td>
<td>$'000</td>
<td>2 450</td>
<td>2 120</td>
<td>2 180</td>
<td>2 642</td>
<td>913</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>3.90</td>
<td>6.38</td>
<td>2.17</td>
<td>2.98</td>
<td>2.94</td>
</tr>
<tr>
<td>Export volume</td>
<td>tonnes</td>
<td>5</td>
<td>12</td>
<td>20</td>
<td>22</td>
<td>12</td>
</tr>
<tr>
<td>Value</td>
<td>$'000</td>
<td>18</td>
<td>74</td>
<td>44</td>
<td>65</td>
<td>36</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>3.90</td>
<td>6.38</td>
<td>2.17</td>
<td>2.98</td>
<td>2.94</td>
</tr>
<tr>
<td>Import volume</td>
<td>tonnes</td>
<td>24</td>
<td>66</td>
<td>60</td>
<td>50</td>
<td>31</td>
</tr>
<tr>
<td>Value</td>
<td>$'000</td>
<td>95</td>
<td>231</td>
<td>373</td>
<td>179</td>
<td>158</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>3.94</td>
<td>3.52</td>
<td>6.24</td>
<td>3.58</td>
<td>5.11</td>
</tr>
</tbody>
</table>

Hazelnuts

Hazelnuts are produced from trees from the species of Corylus. The main source of hazelnuts is the common hazel (Corylus avellana) that is native to Europe and Asia. Hazelnut production is suited to regions with well drained soils, mild winters and cool summers, with yields being susceptible to environmental stresses (Baldwin 2004). Hazelnut trees begin bearing 3–6 years after planting.

Hazelnuts are consumed directly as a snackfood or used in a range of bakery and confectionary products. They are rich in...
protein, vitamin E and monounsaturated fatty acids.

Turkey typically accounts for two-thirds of world production and is also the main exporter (Table 68). European countries are the main importers.

World hazelnut prices have increased sharply in recent years due to production shortfalls in key producing countries (Figure 69). However, there are signs of recovery in world production.

Hazelnut industry in Australia

Australia is a very small producer of hazelnuts, with total plantings in 2006-07 of 55 000 trees on 30 hectares. The harvest time in Australia is February and March. Production in 2006-07 was an estimated 27 tonnes on an in-shell basis.

Australian imports mainly shelled hazelnuts with an average annual value in the three years to 2006-07 of $21.5 million. More than 90 per cent of Australia's hazelnut imports in the three years to 2005 came from Turkey, with the remainder from the United States (UN Statistics Division 2007).

---

### Table 68: Hazelnuts: key characteristics of the world market

<table>
<thead>
<tr>
<th></th>
<th>Volume *</th>
<th>Value +</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>712</td>
<td>na</td>
</tr>
<tr>
<td>World trade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell</td>
<td>28</td>
<td>US$53</td>
</tr>
<tr>
<td>Shelled</td>
<td>184</td>
<td>US$782</td>
</tr>
</tbody>
</table>

**Key countries (share of total volume in the four years to 2005)**

- **Exports**: United States (63%), Turkey (12%), Italy (7%), France (6%), Georgia (2%), Canada (2%), Spain (1%), Croatia (1%), Germany (1%), Azerbaijan (1%)
- **Importers**: Hong Kong (48%), Germany (13%), China (8%), Italy (6%), Canada (3%), USA (3%), Spain (2%), United Kingdom (2%), Russian Federation (2%), France (1%)

---

### Further information about hazelnuts

- Hazelnut Growers of Australia ([www.hazelnuts.org.au](http://www.hazelnuts.org.au)), the peak industry body providing a newsletter.
Macadamias

The macadamia nut is a high quality nut from tree species (almost completely Macadamia integrifolia but also Macadamia tetraphylla) that are native to Australia. Macadamia trees grow best in fertile, welldrained soils in high rainfall subtropical areas that are frost-free. It takes around ten years from planting for a macadamia tree to reach its maximum nut yield.

Australia is the main producer and exporter of macadamia nuts but there is now extensive production in other countries in the world (Table 70). Increased supplies from these competing countries have put downward pressure on world price in recent years (Figure 70).

Australian macadamia industry

Total plantings of macadamia trees in Australia in 2006-07 were around 15 000 hectares, 95 per cent of which are in northern New South Wales and southern and central Queensland. This includes 3750 hectares of tree that are yet to produce commercially.

Macadamia production in 2006-07 was estimated to be 41 000 tonnes on an in-shell basis, with a gross value of nearly $114 million (Table 71). With only around half of current macadamia plantings in Australia at the maximum bearing stage, substantial increases in Australian macadamia production are expected over the next five years.

Australian exports more than three quarters of its total macadamia production. The main export destinations for Australian macadamia nut are Japan, the United States and countries in Europe (Figure 71).

Table 70: Macadamias: key characteristics of the world market

<table>
<thead>
<tr>
<th>Volume *</th>
<th>Value *</th>
<th>Key countries (share of total volume in the four years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>94.8</td>
<td>na</td>
</tr>
<tr>
<td>World trade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importers: Germany</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Average four years to 2005.

Sources: US Department of Agriculture (2007).

Table 71: Macadamia nuts: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers no.</td>
<td>800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– bearing hectares</td>
<td>11 250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– non-bearing hectares</td>
<td>3 750</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– total hectares</td>
<td>15 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production t</td>
<td>29 700 43 900 36 000 39 500 41 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm gate price $/kg</td>
<td>3.20 3.45 3.45 3.08 2.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross value $'000</td>
<td>95 040 151 455 124 200 121 831 113 756</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume t</td>
<td>6 415 8 335 8 889 8 114 4 620</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $'000</td>
<td>24 305 34 924 41 307 33 709 17 266</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>3.79 4.19 4.65 4.15 3.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shelled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume t</td>
<td>4 916 5 015 7 074 5 590 3 083</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $'000</td>
<td>63 826 71 214 104 383 85 855 40 102</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>12.98 14.20 14.75 15.36 13.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume t</td>
<td>16 na na na na</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $'000</td>
<td>305 na na na</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>19.12 na na na</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shelled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume t</td>
<td>1 286 459 842 1 610</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $'000</td>
<td>9 4 034 1 592 6 772 5 611</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>6.20 14.11 3.47 8.04 3.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All macadamia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total export value $'000</td>
<td>88 131 10 6139 145 690 119 564 57 367</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total import value $'000</td>
<td>314 na na na</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Nut-in-shell basis.

Sources: Australian Macadamia Society (2007); ABS (2007a,b); ABARE.

Further information about macadamia nuts

• US Department of Agriculture’s PSD Online database (www.fas.usda.gov/psdonline/), time series data on production, supply and distribution of macadamia nuts (in-shell basis), by key producing country.
• Australian Macadamias Society (macadamias.org), information on the Australian and world macadamia nut markets.
Pecan nuts

The pecan tree (*Carya illinoinensis*) is native to the south eastern region of North America. Commercial plantings include native/seedling varieties and varieties that have been improved through selective breeding and grafting. The improved varieties are higher yielding and produce better quality nuts that earn higher prices. Maximum yields are not achieved until trees are 12–15 years old.

North American pecan nut industry

The main producer of pecans is the United States, with Mexico as the second largest producer. It can be seen from Figure 72 that there are strong ‘on’ and ‘off’ seasons with production in the United States. Around three quarters of US production comes from the improved varieties.

The United States is now a net importer of pecan nuts, sourced mainly from Mexico but also from Australia.

Australian pecan nut industry

There were around 200 growers of pecan nuts in Australia in 2005-06, with 187,000 trees (Table 72). Australian production of pecan nuts in 2005-06 was an estimated 2697 tonnes on an in-shell basis, more than 95 per cent of which came from New South Wales, with small amounts also from Queensland and Western Australia.

Stahmann Farms is the largest pecan nut producer in Australia (www.stahmannfarms.com.au), accounting for up to 90 per cent of Australian production in the past but this share has been falling as new producers enter the industry.

Further information about pecan nuts

- US Department of Agriculture’s PSD Online database (www.fas.usda.gov/psdonline/), provides time series data on production, supply and distribution of pecan nuts (in-shell basis), for the United States and Mexico only.

## Table 72: Pecans: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td>199</td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– under 6 years</td>
<td>’000</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– six years and over</td>
<td>’000</td>
<td>159</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– total</td>
<td>’000</td>
<td>187</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume (in-shell)</td>
<td>tonnes</td>
<td>1 105</td>
<td>2 404</td>
<td>2 376</td>
<td>2 697</td>
<td>3 000</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>3 437</td>
<td>8 049</td>
<td>8 426</td>
<td>10 152</td>
<td>10 591</td>
</tr>
<tr>
<td>Unit gross value</td>
<td>$/kg</td>
<td>3.11</td>
<td>3.35</td>
<td>3.55</td>
<td>3.76</td>
<td>3.53</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell, fresh or dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>143</td>
<td>37</td>
<td>56</td>
<td>1</td>
<td>368</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>785</td>
<td>164</td>
<td>293</td>
<td>10</td>
<td>1 922</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>5.47</td>
<td>4.43</td>
<td>5.25</td>
<td>19.24</td>
<td>12.69</td>
</tr>
<tr>
<td>Shelled, fresh or dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>tonnes</td>
<td>169</td>
<td>921</td>
<td>457</td>
<td>114</td>
<td>474</td>
</tr>
<tr>
<td>– value</td>
<td>$’000</td>
<td>1 723</td>
<td>8 745</td>
<td>4 867</td>
<td>1 284</td>
<td>2 568</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/kg</td>
<td>10.30</td>
<td>9.51</td>
<td>10.66</td>
<td>11.30</td>
<td>7.88</td>
</tr>
<tr>
<td>Total export value</td>
<td>$’000</td>
<td>2 508</td>
<td>8 908</td>
<td>5 160</td>
<td>1 294</td>
<td>4 489</td>
</tr>
</tbody>
</table>

Sources: ABS (2007b, 2008); ABARE.
Pistachios

The pistachio tree (*Pistacia vera*) is a desert tree, suited to regions with very hot summers, very cold winters and well drained soil. It is native to the mountainous regions of central and south western Asia, including parts of Turkmenistan, Iran and Afghanistan. Pistachios trees typically reach first commercial yields around 6 years after planting and maximum yields after 12 years.

Pistachios are processed to remove the fleshy pink outer hull, then usually heated to encourage splitting of the shell.

The main producers of pistachios are Iran and the United States and these countries are also the main exporters (Table 73). There is steadily growing world production and trade of pistachios and improving prices in recent years (Figure 74).

Australia imported 1360 tonnes of pistachios in 2006-07, worth $10.5 million. Imports were mainly sourced from the United States and Iran. In the three years to 2006-07, more than 90 per cent of Australia pistachio exports went to China and Hong Kong.

High prices for pistachios in recent years is likely to see additional plantings of around 100 hectares in Australia in 2008. With existing trees, Australia has the ability to produce around 2000 tonnes of pistachios a year by 2001–12.

Further information about pistachios

- California Pistachio Board (californiapistachioboard.org).

Figure 74: Pistachios: world imports and import prices

Table 73: Pistachio nut: key characteristics of the world market

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume *</th>
<th>Value *</th>
<th>Key countries (share of total volume in the four years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>517.7</td>
<td>na</td>
<td>Iran (47%), United States (23%), Turkey (10%), Syrian Arab Republic (10%), China (7%), Greece (2%)</td>
</tr>
<tr>
<td>World trade</td>
<td>215.3</td>
<td>$735.5</td>
<td><strong>Exporters</strong>: Iran (61%), United States (20%), Germany (6%), Netherlands (2%), Spain (1%), China (1%), Syria (1%), Turkey (1%), Belgium (1%), United Arab Emirates (1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Importers</strong>: Hong Kong (20%), Germany (10%), Spain (8%), Italy (6%), France (6%), Luxembourg (5%), Netherlands (4%), China (4%), Mexico (4%), United Kingdom (3%)</td>
</tr>
</tbody>
</table>

* Average four years to 2005.


Table 74: Pistachios: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers no.</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– bearing hectares</td>
<td>550</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– non–bearing hectares</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– total hectares</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume (in-shell) tonnes</td>
<td>400</td>
<td>1481</td>
<td>710</td>
<td>1 600</td>
<td></td>
</tr>
<tr>
<td>Unit gross value $/kg</td>
<td>5.19</td>
<td>5.59</td>
<td>5.55</td>
<td>6.47</td>
<td></td>
</tr>
<tr>
<td>Gross value $’000</td>
<td>2 077</td>
<td>8 284</td>
<td>3 941</td>
<td>10 357</td>
<td></td>
</tr>
<tr>
<td>Exports, fresh or dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>297</td>
<td>269</td>
<td>241</td>
<td>479</td>
<td>413</td>
</tr>
<tr>
<td>Value $’000</td>
<td>1 717</td>
<td>1 457</td>
<td>1 498</td>
<td>2 954</td>
<td>2 674</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>5.77</td>
<td>5.41</td>
<td>6.21</td>
<td>6.17</td>
<td>6.47</td>
</tr>
<tr>
<td>Imports, fresh or dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>756</td>
<td>1 006</td>
<td>1 144</td>
<td>827</td>
<td>1 361</td>
</tr>
<tr>
<td>Value $’000</td>
<td>4 810</td>
<td>5 344</td>
<td>8 374</td>
<td>6 546</td>
<td>10 474</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>6.36</td>
<td>5.31</td>
<td>7.32</td>
<td>7.92</td>
<td>7.70</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); ABARE.
Walnut trees require a climate with a winter chill period to benefit flowering; freedom from frosts during flowering; and a summer that is warm but not excessively hot (Adem 2003). The common English or Persian walnut (Juglans regia L.) is the main species in walnut production but the Northern Californian Black walnut (Juglans hindsii) and the Eastern Black walnut (Juglans nigra) are popular as rootstocks for grafted trees because of their increased vigour (Adem 2003). There are alternate ‘on’ and ‘off’ production years with walnut production. Walnuts are eaten fresh and used in baking and confectionary. A particular characteristic of walnuts is that they are high in omega-3 fatty acids that are widely considered to offer health benefits. Nearly half of world production of walnuts is contributed by China and the United States, with countries bordering the Mediterranean Sea also important producers (Table 75). The value of world trade in walnuts (in shell and shelled) averaged more than $550 million a year in the four years to 2005. The United States is the dominant exporter. There are countries, such as the Republic of Moldova, that import unshelled walnuts and re-export them as shelled walnut. Almost all walnut production in the United States comes from California.

The California Walnut Commission and Walnut Marketing Board oversee generic marketing (including promotion) and research activities for the 5500 walnut growers and 45 walnut handlers that make up the California walnut industry. There is a longer term downward trend in world import prices in constant (2008) dollar terms for walnuts. This mainly reflects rapidly increasing production in the United States. However, as with most other tree nuts, there has been a sharp upturn in prices in recent years (Figure 75), apparently driven by growing consumer perceptions of the healthiness of walnuts (California Walnut Commission 2007).

The walnut industry in Australia

Like almonds, there has been a massive expansion in walnut plantings in Australia in recent years. The advantages that Australia has in walnut production are being able to supply fresh walnuts (harvested in March and April) in the northern hemisphere off season and being relatively free from many of the diseases that affect other walnut producing countries. Until the recent plantings, most of Australia’s walnut production was in Tasmania, but now the bulk of future production will take place in New South Wales and Victoria. South Australia and Western Australia are also small producers of walnuts. Australian planting of walnut trees has expanded rapidly in recent years to 2268 hectares. Most of the increase occurred in the Riverina area and was undertaken by two large companies — Websters Ltd and Gunns Ltd. Websters Ltd manages the bulk of the walnut plantations in Australia, including those of Gunns Ltd.

To accommodate the expected increased production, new processing plants have been built at Violet Town and Koraleigh in Victoria.

Australian walnut production in 2006-07 was an estimated 1300 tonnes on an in-shell basis with a gross value of $5.6 million (Table 76).

Australian exports small quantities of walnuts but imported walnuts worth over $29 million in 2006-07 (equivalent to 8000 tonnes of walnuts on an in-shell basis). Based on US Department of Agriculture (2007), Australian imports of walnuts are largely sourced from the United States (country details for walnut import data in ABS (2008b) are confidential).

The increase in Australian production and imports in recent years suggest rapidly growing domestic consumption of walnuts.

Given current plantings, Australian walnut production is projected to reach around 8000 tonnes (in-shell) by 2011-12. Despite growing domestic demand, the best estimate is that at least 25 per cent of this production will need to be exported.

Further information about walnuts

• Australian Walnut Industry Association (www.walnut.net.au).
• California Walnuts (www.walnuts.org), information on the Californian walnut industry, including a regular newsletter Walnut News that provides an export market update.

Figure 75: Walnuts: world imports and import prices

![Graph showing world imports and import prices of walnuts from 1991 to 2006. Import and export prices are shown in constant (2008) dollars. Data source: UN Statistics Division (2008).]
### Table 75: Walnut: key characteristics of the world market

<table>
<thead>
<tr>
<th>Volume</th>
<th>Value</th>
<th>Key countries (share of total volume in the four years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>1 425</td>
<td>na</td>
</tr>
<tr>
<td>World trade</td>
<td>In shell</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shelled</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Average four years to 2005.*

### Table 76: Walnuts: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Growers</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– bearing hectares</td>
<td>70</td>
<td>70</td>
<td>570</td>
<td>570</td>
<td>820</td>
</tr>
<tr>
<td>– non-bearing hectares</td>
<td>610</td>
<td>860</td>
<td>360</td>
<td>808</td>
<td>1 448</td>
</tr>
<tr>
<td>– total hectares</td>
<td>680</td>
<td>930</td>
<td>930</td>
<td>1 378</td>
<td>2 268</td>
</tr>
<tr>
<td>Volume (in shell) tonnes</td>
<td>150</td>
<td>150</td>
<td>430</td>
<td>794</td>
<td>1 300</td>
</tr>
<tr>
<td>Farm gate price $/kg</td>
<td>3.78</td>
<td>4.23</td>
<td>3.50</td>
<td>3.52</td>
<td>4.28</td>
</tr>
<tr>
<td>Gross value $’000</td>
<td>567</td>
<td>635</td>
<td>1 507</td>
<td>2 793</td>
<td>5 561</td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell, fresh or dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume tonnes</td>
<td>30</td>
<td>27</td>
<td>17</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>– value $’000</td>
<td>80</td>
<td>110</td>
<td>86</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>2.69</td>
<td>4.02</td>
<td>5.09</td>
<td>10.85</td>
<td>1.07</td>
</tr>
<tr>
<td>Shelled, fresh or dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume tonnes</td>
<td>13</td>
<td>27</td>
<td>82</td>
<td>139</td>
<td>71</td>
</tr>
<tr>
<td>– value $’000</td>
<td>239</td>
<td>204</td>
<td>571</td>
<td>978</td>
<td>608</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>18.39</td>
<td>7.44</td>
<td>6.99</td>
<td>7.02</td>
<td>8.55</td>
</tr>
<tr>
<td>Imports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In shell, fresh or dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume tonnes</td>
<td>215</td>
<td>165</td>
<td>232</td>
<td>162</td>
<td>316</td>
</tr>
<tr>
<td>– value $’000</td>
<td>747</td>
<td>456</td>
<td>693</td>
<td>693</td>
<td>1311</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>3.47</td>
<td>2.77</td>
<td>2.99</td>
<td>4.28</td>
<td>4.15</td>
</tr>
<tr>
<td>Shelled, fresh or dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume tonnes</td>
<td>2 345</td>
<td>2 802</td>
<td>3 442</td>
<td>3 871</td>
<td>3 886</td>
</tr>
<tr>
<td>– value $’000</td>
<td>14 770</td>
<td>14 453</td>
<td>20 262</td>
<td>26 031</td>
<td>27 333</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>6.30</td>
<td>5.16</td>
<td>5.89</td>
<td>6.72</td>
<td>7.03</td>
</tr>
<tr>
<td>All walnuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total export value $’000</td>
<td>319</td>
<td>314</td>
<td>658</td>
<td>979</td>
<td>640</td>
</tr>
<tr>
<td>Total import value $’000</td>
<td>15 516</td>
<td>14 908</td>
<td>20 956</td>
<td>26 724</td>
<td>28 644</td>
</tr>
</tbody>
</table>

*Source: ABS (2008b); ABARE*
The northern regions of Australia are suited to growing a wide range of exotic tropical and subtropical fruits, many of which originated in Asia and are, therefore, familiar to Asian consumers. More details of the nature of these exotic fruits are available online at www.australiantropicalfoods.com.

In this chapter, information on seven tropical and subtropical fruits is reported: durian, jackfruit (jakfruit), longan, lychee, papaya, mangosteen and rambutan. Prices received in the Sydney market for these (and other) exotic tropical fruits are shown in Table 77.

Thailand is a large producer of these tropical fruits and the main world exporter of many of them (Figure 76). Australia signed a free trade agreement with Thailand in 2004 in which mangosteen, durian, lychee and longan are explicitly specified as market access priority products (See DFAT 2004).

Australia’s strict quarantine barriers aimed at preventing the introduction of exotic diseases and pests have worked against imports of some tropical fruits, particularly fresh fruits. While Australia has been importing papaya fruit for a number of years, access has only been possible for fresh durian fruit from Thailand since 1999, for mangosteens from Thailand since July 2004, and for lychee and longan fruit from Thailand and China since April 2004. Rambutan imports have yet to be allowed from any country and no applications have yet been received. (The ICON database maintained by the Australia Quarantine and Inspection Service provides details on the conditions under which more than 18,000 plant, animal, mineral and human productions can be imported into Australia — see www.aqis.gov.au/icon32/asp/ex_querycontent.asp).

No information is available on imports of longans specifically from ABS (2008b) but there is an ‘other fresh fruit category’ that indicates that imports from Thailand have increased sharply from April 2004; before that imports were almost non-existent (Figure 77). This increase is virtually all longans and lychees. The imports have led to lower prices for longans in Australia since 2004 (Table 77). However, the imports occur largely outside the harvest times for Australian produced longans and lychees.

A factor that affected the production of exotic tropical fruits was Cyclone Larry that crossed the Queensland coast on 20 March 2006. It severely reduced 2006–07 production of exotic tropical fruit and caused extensive damage to fruit trees with the result that it will be a number of years before many tropical exotic fruit industries recover.

An industry peak body, Tropical Exotic Fruit Australia Incorporated (TEFA), was established in 2007 through a merger of the Rambutan and Tropical Exotic Growers Association (RTEGA) and the Tropical Exotic Fruit sub-groups of the Northern Territory Horticultural Association.

Figure 76: Selected tropical fruits, Thai production, 2001–2006

![Figure 76: Selected tropical fruits, Thai production, 2001–2006](image)

Further information about tropical and exotic fruit

- Australian Tropical Fruit Portal (www.australiantropicalfruits.org.au), information about the Australian tropical and exotic fruit industry.
- Northern Territory Horticultural Association (www.ntha.com.au), information on tropical exotic fruit, including the newsletter of Tropical Exotic Fruit Australia (TEFA).

### Table 77: Exotic tropical fruit: Average prices, Sydney market

<table>
<thead>
<tr>
<th>Fruit type and variety</th>
<th>Unit</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carambola</td>
<td>SL tray</td>
<td>17.88</td>
<td>22.00</td>
<td>21.41</td>
<td>19.84</td>
<td>22.12</td>
<td>23.78</td>
</tr>
<tr>
<td>Durian</td>
<td>kg</td>
<td>na</td>
<td>10.39</td>
<td>12.50</td>
<td>na</td>
<td>13.50</td>
<td>23.57</td>
</tr>
<tr>
<td>Custard apple</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– African pride</td>
<td>SL tray</td>
<td>23.29</td>
<td>14.69</td>
<td>22.70</td>
<td>15.53</td>
<td>18.48</td>
<td>20.04</td>
</tr>
<tr>
<td>– Pink's mammoth</td>
<td>SL tray</td>
<td>16.53</td>
<td>17.00</td>
<td>19.34</td>
<td>22.56</td>
<td>25.42</td>
<td>na</td>
</tr>
<tr>
<td>Guava</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– white</td>
<td>kg</td>
<td>3.66</td>
<td>3.60</td>
<td>4.12</td>
<td>4.17</td>
<td>4.99</td>
<td>4.91</td>
</tr>
<tr>
<td>– pink</td>
<td>SL tray</td>
<td>11.06</td>
<td>15.59</td>
<td>15.01</td>
<td>14.82</td>
<td>14.00</td>
<td>14.93</td>
</tr>
<tr>
<td>Jackfruit</td>
<td>kg</td>
<td>3.18</td>
<td>3.26</td>
<td>2.93</td>
<td>2.90</td>
<td>3.04</td>
<td>3.12</td>
</tr>
<tr>
<td>Lime</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Kaffa</td>
<td>kg</td>
<td>5.84</td>
<td>4.04</td>
<td>3.63</td>
<td>6.89</td>
<td>4.48</td>
<td>4.50</td>
</tr>
<tr>
<td>– Tahitian</td>
<td>9L carton</td>
<td>17.62</td>
<td>15.59</td>
<td>17.54</td>
<td>15.59</td>
<td>23.51</td>
<td>14.66</td>
</tr>
<tr>
<td>Longan</td>
<td>kg</td>
<td>9.26</td>
<td>7.45</td>
<td>6.59</td>
<td>5.08</td>
<td>5.09</td>
<td>5.96</td>
</tr>
<tr>
<td>Lychee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Bengal</td>
<td>9L carton</td>
<td>14.76</td>
<td>17.02</td>
<td>18.78</td>
<td>13.48</td>
<td>22.05</td>
<td>18.43</td>
</tr>
<tr>
<td>– Fei Zi Su</td>
<td>9L carton</td>
<td>46.32</td>
<td>36.31</td>
<td>43.50</td>
<td>47.85</td>
<td>55.98</td>
<td>51.78</td>
</tr>
<tr>
<td>– Selathiel</td>
<td>9L carton</td>
<td>40.69</td>
<td>na</td>
<td>43.60</td>
<td>26.18</td>
<td>38.42</td>
<td>36.98</td>
</tr>
<tr>
<td>– Souey Tung</td>
<td>9L carton</td>
<td>46.14</td>
<td>68.00</td>
<td>75.97</td>
<td>67.44</td>
<td>55.16</td>
<td>79.14</td>
</tr>
<tr>
<td>– Tai So</td>
<td>9L carton</td>
<td>33.58</td>
<td>32.40</td>
<td>29.59</td>
<td>23.63</td>
<td>31.46</td>
<td>26.20</td>
</tr>
<tr>
<td>Mangosteen</td>
<td>850g</td>
<td>12.87</td>
<td>11.44</td>
<td>13.25</td>
<td>8.98</td>
<td>9.67</td>
<td>9.33</td>
</tr>
<tr>
<td>Papaya (pawpaw)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitaya</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– red flesh</td>
<td>SL tray</td>
<td>12.00</td>
<td>35.88</td>
<td>24.48</td>
<td>19.96</td>
<td>13.95</td>
<td>23.45</td>
</tr>
<tr>
<td>– white flesh</td>
<td>SL tray</td>
<td>32.87</td>
<td>28.93</td>
<td>31.29</td>
<td>27.54</td>
<td>33.83</td>
<td>24.55</td>
</tr>
<tr>
<td>Pomelo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– green</td>
<td>kg</td>
<td>3.07</td>
<td>2.87</td>
<td>2.81</td>
<td>2.80</td>
<td>3.21</td>
<td>2.99</td>
</tr>
<tr>
<td>– red</td>
<td>kg</td>
<td>2.16</td>
<td>2.25</td>
<td>1.49</td>
<td>2.09</td>
<td>na</td>
<td>3.15</td>
</tr>
<tr>
<td>Rambutan</td>
<td>SL tray</td>
<td>23.42</td>
<td>20.16</td>
<td>23.38</td>
<td>19.50</td>
<td>26.60</td>
<td>na</td>
</tr>
<tr>
<td>Soursop</td>
<td>kg</td>
<td>3.50</td>
<td>6.42</td>
<td>4.34</td>
<td>3.86</td>
<td>5.30</td>
<td>5.37</td>
</tr>
</tbody>
</table>

Source: Sydney Market Reporting Service. na Not available.

Figure 77: ‘Other’ fresh fruit: Australian imports from Thailand

* Excludes bananas, dates, figs, pineapples, avocados, guavas, mangoes, mangosteens, citrus, grapes, melons, apples, pears, quinces, apricots, cherries, peaches, plums, sloes, berries, currants, kiwifruit and durians. Data source: ABS (2008b).
Durian

Durian (*Durio zibethinus* L.) is a tree-borne tropical fruit with a complex flavour that some find offensive. Durian is believed to have originated in Borneo and is now extensively cultivated in south east Asia, particularly Thailand, Malaysia, Indonesia and Cambodia.

Durian fruit is mostly eaten fresh but can be frozen, dried or canned. Harvesting before ripe can mean a shelf life of 2–3 weeks with refrigeration but can be as little as 2–3 days if the fruit is damaged.

World import trade of fresh durian fruit averaged a little more than 200 000 tonnes a year in the three years to 2005, with prices in the range US$525–550 a tonne (United Nations Statistical Division 2007). Thailand provided nearly 90 per cent of world durian exports, with Malaysia providing the bulk of the remainder. Most of the Thai durian crop is harvested in the period April to August, with peak production in May. The major importers were Hong Kong (47 per cent), China (37 per cent) and Singapore (13 per cent).

**Australian durian industry**

Commercial growing of durian fruit has only recently commenced in the Northern Territory and north Queensland. Harvest times are November–February in the Northern Territory and January–April in north Queensland. There are ‘on’ and ‘off’ years for yields. Around 70 per cent of durian production occurs in north Queensland, with the Northern Territory accounting for the remainder.

Prior to Cyclone Larry in early 2006, there were 36 durian growers in Australia with around 13 000 trees; the cyclone destroyed around 8 per cent of all trees. Australia production of durian fruit in 2006 was an estimated 20 tonnes with a gross value of $250 000. The value of lost durian production in 2006 from the cyclone was estimated to be $300 000.

There are small quantities of Australian exports of durian in the past but almost none in recent years (Table 78). There are larger quantities of imports, all provided by Thailand and Malaysia. Market access for fresh durian was granted to Thailand and Malaysia in 1999 and 2004, respectively, after import risk assessments.

**Table 78: Durian fruit: supply, disposal and value in Australia**

<table>
<thead>
<tr>
<th>Unit</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growers no.</td>
<td>36</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearing trees ‘000</td>
<td>13</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>35</td>
<td>31</td>
<td>3</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Gross value $’000</td>
<td>364</td>
<td>388</td>
<td>34</td>
<td>250</td>
<td>64</td>
</tr>
<tr>
<td>Price Sydney market $/kg</td>
<td>10.39</td>
<td>12.50</td>
<td>na</td>
<td>13.50</td>
<td>23.57</td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>0.0</td>
<td>3.9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Value $’000</td>
<td>0</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>nc</td>
<td>2.98</td>
<td>0.00</td>
<td>0.00</td>
<td>2.97</td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>0.0</td>
<td>157.2</td>
<td>110.0</td>
<td>17.3</td>
<td>106.0</td>
</tr>
<tr>
<td>Value $’000</td>
<td>0</td>
<td>252</td>
<td>241</td>
<td>52</td>
<td>284</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>nc</td>
<td>1.61</td>
<td>2.19</td>
<td>3.00</td>
<td>2.68</td>
</tr>
</tbody>
</table>

* Fresh or frozen.

Sources: ABS (2008b); ABARE.

**Further information about durian**

Jackfruit

Jackfruit (Artocarpus heterophyllus Lam.) is a tropical fruit tree that is believed to have originated in the rain forests of the Western Ghats in India but has now been adapted to frost-free and humid tropical and subtropical climates. The tree typically bears fruit around three years after planting. The fruit are very large, ranging in size from 5 to 30 kilograms.

Jackfruit are a major fruit in Malaysia and Thailand. No world production or trade data are available.

Australian jackfruit industry

In Australia, jackfruit are produced in the Northern Territory and Queensland. The peak harvest period is from December to February. Annual production is 3–400 tonnes, mostly from the Northern Territory, with an average planting area of 0.5 hectares to 2 hectares (Hudson Howells 2004).

There is strong domestic demand for Australian produced jackfruit and all production is consumed domestically (Hudson Howells 2004). There are no countries that have approval to export jackfruit to Australia.

Table 79: Jackfruit: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers no.</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area hectares</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees '000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>405</td>
<td>405</td>
<td>405</td>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>Gross value $’000</td>
<td>1419</td>
<td>1 561</td>
<td>1 215</td>
<td>800</td>
<td>1 102</td>
</tr>
<tr>
<td>Price, Sydney market $/kg</td>
<td>3.22</td>
<td>3.35</td>
<td>2.81</td>
<td>3.08</td>
<td>3.18</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); DPIFM (2007b); ABARE.

Further information about jackfruit

• Australian Tropical Fruits Portal (www.australian tropicalfruits.org.au).

Longan

Longan (Dimocarpus longan or Euphoria longan) is a fruit closely related to the lychee. It is suited to production in monsoonal regions and is mainly grown in China, Thailand, Vietnam and Chinese Taipei. Longans are mainly consumed fresh but are also dried and canned.

Thailand is the main exporter of longans. Thai production of longans has increased strongly in recent years while its export prices have varied around US$485 a tonne in constant (2008) dollars (Figure 79).

Harvesting of longans in Thailand is usually from late June to August but there are techniques, such as soil drenching with potassium chlorate, which can be used to produce off-season fruit.

Australian longan industry

In Australia, longans are grown in the subtropical regions of the eastern coast of Australia as far south as northern New South Wales. The picking season extends from January to April.

Table 80: Longans: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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</tr>
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<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers no.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Area hectares</td>
<td>600</td>
<td></td>
<td></td>
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<tr>
<td>Volume tonnes</td>
<td>320</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Gross value $’000</td>
<td>2600</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price, Sydney market $/kg</td>
<td>4.37</td>
<td>5.21</td>
<td>3.54</td>
<td>3.65</td>
<td>5.19</td>
</tr>
<tr>
<td>Exports, fresh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume tonnes</td>
<td>152.5</td>
<td>18.8</td>
<td>195.5</td>
<td>153.9</td>
<td>128.5</td>
</tr>
<tr>
<td>Value $’000</td>
<td>667</td>
<td>98</td>
<td>692</td>
<td>561</td>
<td>667</td>
</tr>
<tr>
<td>Unit value $/kg</td>
<td>4.37</td>
<td>5.21</td>
<td>3.54</td>
<td>3.65</td>
<td>5.19</td>
</tr>
</tbody>
</table>

*Volume based on Thai exports reported in Customs Department, Thailand (2007); value imputed by ABARE based on domestic prices.

Sources: ABS (2008b); ABARE.

Figure 79: Longans: Thai production, exports and export prices

Lychees

Lychee (Litchi chinensis Sonn.), or lychee nut or litchi, is a tree-borne fruit with sweet, fragrant and juicy fruit and a translucent flesh. The lychee tree is native to southern China, northern Vietnam and Myanmar. It is difficult to grow, requiring frost-free conditions, and does not produce a substantial crop until 6–8 years after planting (Menzel 2002). The fruits are very susceptible to browning and rotting so they have a relatively short shelf life as fresh fruit. Lychees are also canned whole or made into a range of jellies, jams, preserves and lychee tea.

Lychees are now grown in many subtropical regions of the world. World lychee production is led by China with a total output of 1.2 million tonnes in an ‘on’ year and 0.8 million tonnes in an ‘off’ year, less than 2 per cent of which typically enters the world fresh food trade. Other key producers are India (0.5 million tonnes), Vietnam (0.1 million tonnes), Thailand (0.1 million tonnes), Chinese Taipei, Philippines, Madagascar, Australia and South Africa. Total world trade is probably less than 40 000 tonnes. Key exporters are China, Thailand, Madagascar and South Africa.

Australian lychee industry

Lychees have been grown commercially in Australia since the 1970s. The harvest period in Australia is November to February but the main production period is December to January.

There are many different varieties of lychees grown in Australia, with differing agronomic and quality characteristics. Australian domestic prices (Sydney market) for a range of lychee varieties are shown in Table 77.

There are around 250 lychee growers in Australia and more than 90 per cent of Australian lychee production occurs in Queensland. The 2006-07 lychee crop was harvested before Cyclone Larry but an estimated 8 per cent of all lychee trees in Queensland were destroyed. Based on levies data from the Levies Revenue Service, Australian production of lychees in 2006-07 was 2414 tonnes in 2006-07, up 900 tonnes on the previous harvest and with a gross value of $11.2 million (Table 81). The levy data also suggests that 586 tonnes of lychees were processed domestically.

Until recently approximately 20–35 per cent of the Australian crop has been exported, mainly to China (via Hong Kong). Singapore and Europe (QDPI 2003). However, exports have probably been substantially lower than this in recent years due to market access problems with China (via Hong Kong).

Australian exports of fresh lychees in 2006-07 were an estimated 141 tonnes; there may also have some exports in processed form. Australia has imported up to 124 tonnes annually from Thailand since it gained import approval in April 2004 (Table 81).

Further information about lychees

- Australian Lychee Growers Association (australianlycheecomau.ozstaging.com), peak industry body.
- Australian Tropical Fruits Portal (www.australianropicalfruits.org.au)
Mangosteen

Mangosteen (*Garcinia mangostana* L.) is a tree-borne tropical fruit with a thick reddish-purple rind with a flesh that is segmented like that of an orange. The fruit is usually eaten fresh, but can also be canned, frozen or made into juice, preserves and syrup. The tree is believed to have originated from the Malaysia archipelago.

Thailand accounts for more than 90 per cent of world mangosteen production and almost all of world exports. Annual Thai production is around 200 000 tonnes a year but 2006 was poor production year (Figure 81). Malaysia, the Philippines and Indonesia are also producers of relatively small quantities of mangosteens.

Thai export prices for mangosteens have declined as its exports have increased (Figure 81).

**Australia mangosteen industry**

In Australia, a planting takes around nine years to fruit and up to twelve years to provide commercial fruit, but once they are established, they are low maintenance trees. The harvest period in Australia is January to March.

Australia had plantings of around 14 000 trees on about 50 hectares in far north Queensland and the Northern Territory. However, around 6 per cent of the plantings in Queensland were destroyed by Cyclone Larry in March 2006 (Cyclone Recovery Taskforce 2006). Estimated Australian production of mangosteens in 2006-07 was 120 tonnes, with a gross value of around $950 000.

Small quantities of mangosteen fruit were exported from Australia in the early 2000s but the crop now appears to be entirely sold on the domestic market.

Imports of mangosteens into Australia have been allowed from Thailand since April 2004. In 2006-07, imports accounted for around two thirds on domestic consumption (Table 82).

![Figure 81: Mangosteen: Thai production, exports and export prices](image)

**Table 82: Mangosteen: supply, disposal and value in Australia**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Volume</strong></td>
<td>tonnes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gross value</strong></td>
<td>$’000</td>
<td>1 100</td>
<td>1 157</td>
<td>300</td>
<td>950</td>
<td></td>
</tr>
<tr>
<td><strong>Price, Sydney market</strong></td>
<td>$/kg</td>
<td>8.17</td>
<td>11.00</td>
<td>9.64</td>
<td>8.34</td>
<td>7.92</td>
</tr>
<tr>
<td><strong>Exports, mangosteen and guava</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
<td>1.5</td>
<td>6.1</td>
</tr>
<tr>
<td>Value</td>
<td>$’000</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>9</td>
<td>68</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>0.00</td>
<td>nc</td>
<td>0.00</td>
<td>5.66</td>
<td>11.10</td>
</tr>
<tr>
<td><strong>Imports, fresh, from Thailand</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Volume</td>
<td>tonnes</td>
<td>0.0</td>
<td>0.0</td>
<td>215.9</td>
<td>178.4</td>
<td>103.0</td>
</tr>
<tr>
<td>Value</td>
<td>$’000</td>
<td>0</td>
<td>0</td>
<td>2 903</td>
<td>3 108</td>
<td>2 808</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>nc</td>
<td>nc</td>
<td>11.16</td>
<td>13.21</td>
<td>11.95</td>
</tr>
</tbody>
</table>

* Fresh or dried. ** Volume based on Thai exports reported in Customs Department, Thailand (2007); value imputed by ABARE based on domestic prices.

Sources: ABS (2008b); ABARE.

Further information about mangosteens


Papaya and pawpaw

Papaya and paw paw (both *Carica papaya* L.) are slightly pear-shaped fruit with yellow or golden skin and yellow flesh (paw paw) or orange to red flesh (papaya). The papaya is believed to have originated in Central America but is now extensively cultivated throughout the tropical and subtropical regions of the world. The papaya plant lives for around five years but is often replanted more often than this in commercial plantations (Chay-Prove 2003). Papaya is consumed mainly as a fresh fruit but is also canned (usually as pulp), made into jams, or dried and crystallised.

World production and exports of papayas have grown strongly over the last decade, despite a generally downward trend in prices in constant dollar terms (Figure 82). World production of papayas averaged 6.6 million tonnes in the three years to 2006, produced mainly by Brazil (24 per cent of total production), Mexico (12 per cent), India (12 per cent), Nigeria (12 per cent) and Indonesia (9 per cent). World papaya production peaked in 2002 at 6.9 million tonnes, twice the level of production in 1985.

Around 4 per cent of world papaya production typically enters world trade as fresh or dried papayas; a large but unknown quantity is further processed for export. The main exporters of fresh or dried papayas are Mexico (34 per cent of world exports in the three years to 2006), Malaysia (22 per cent), Brazil (17 per cent) and Belize (11 per cent). The United States accounts for nearly half of world imports of fresh or dried papayas, with China (11 per cent) and Singapore (10 per cent) the other major importers.

**Australian papaya industry**

Australia’s papayas are grown mainly in the tropical regions of Innisfail and Mareeba in northern Queensland. Small amounts are also grown in the Northern Territory, southern Queensland, the Kimberley and Carnarvon regions of Western Australia, and northern New South Wales (Primary Business Solutions 2002). Fruit are harvested all year round in Australia but
Pitaya (dragonfruit)

Pitaya (various *Hylocereus* spp), also called dragon fruit, is a tropical cactus from the rainforests of Central and northern South America (Diczbalis and McMahon 2004). It is suited to a dry, tropical climate.

In the Americas, the pitaya is grown commercially from Argentina through to Texas in the United States. Vietnam is also a large commercial producer and Malaysia is an emerging producer.

**Australian pitaya industry**

The pitaya was introduced to Queensland in the 1970s and its commercial production has spread to the Northern Territory, Western Australia and New South Wales (Diczbalis and McMahon 2004). The peak production period is from January to March but fruit can be available as early as September.

In Australia, there is a white fleshed pitaya (*Hylocereus undatus*) and red fleshed pitaya (*Hylocereus polyrhizus*). The red fleshed pitaya earns higher prices (Table 84).

There are 25 growers in the Northern Territory, with average plantings of 0.5 hectares to 2.5 hectares (Hudson Howells 2004). Production in 2006-07 was 60 tonnes with a gross value of $416 000 (Table 84).

Australian production is disposed of on the domestic market and no country has approval to export pitayas to Australia.

**Further information about pitaya (dragon fruit)**


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**Pitaya**

Further information about pitaya


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**Further information about papaya**


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**Table 83: Papaya: supply, disposal and value in Australia**

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Growers</th>
<th>Area (hectares)</th>
<th>Volume (tonnes)</th>
<th>Gross value ($'000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td></td>
<td>no.</td>
<td>623</td>
<td>8,976</td>
<td>9,900</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td>650</td>
<td>9,952</td>
<td>15,233</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td>675</td>
<td>12,956</td>
<td>27,521</td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td>474</td>
<td>8,147</td>
<td>24,016</td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
<td>9,810</td>
<td>40,132</td>
</tr>
</tbody>
</table>

**Prices, Sydney market**

<table>
<thead>
<tr>
<th>Year</th>
<th>Red flesh</th>
<th>Yellow flesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>13.84</td>
<td>18.63</td>
</tr>
<tr>
<td>2004</td>
<td>16.51</td>
<td>16.63</td>
</tr>
<tr>
<td>2005</td>
<td>14.86</td>
<td>16.02</td>
</tr>
<tr>
<td>2006</td>
<td>24.65</td>
<td>31.46</td>
</tr>
<tr>
<td>2007</td>
<td>18.32</td>
<td>19.24</td>
</tr>
</tbody>
</table>

**Exports, fresh**

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume (tonnes)</th>
<th>Value ($'000)</th>
<th>Unit value ($/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>0.7</td>
<td>1</td>
<td>2.02</td>
</tr>
<tr>
<td>2004</td>
<td>1.4</td>
<td>5</td>
<td>3.50</td>
</tr>
<tr>
<td>2005</td>
<td>0.8</td>
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<td>2006</td>
<td>3.8</td>
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<td>4.18</td>
</tr>
<tr>
<td>2007</td>
<td>8.0</td>
<td>19</td>
<td>2.41</td>
</tr>
</tbody>
</table>

**Data source:** Levies Revenue Service; ABS (2004ab, 2007); ABARE

there are production peaks in autumn and spring.

**Further information about papaya**


**Figure 82: Papaya: world exports and export prices**


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**Sources:** Levies Revenue Service; ABS (2004ab, 2007); ABARE
Table 84: Pitaya (dragonfruit): supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production, Northern Territory</strong></td>
<td></td>
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</tr>
<tr>
<td>Growers</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>hectares</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>45.0</td>
<td>54.0</td>
<td>54.0</td>
<td>55.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>542</td>
<td>596</td>
<td>401</td>
<td>335</td>
<td>416</td>
</tr>
<tr>
<td><strong>Price, Sydney market</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White flesh</td>
<td>$/SL tray</td>
<td>22.32</td>
<td>32.42</td>
<td>21.83</td>
<td>17.89</td>
<td>20.37</td>
</tr>
<tr>
<td>Red flesh</td>
<td>$/SL tray</td>
<td>45.00</td>
<td>32.00</td>
<td>28.88</td>
<td>29.06</td>
<td>47.68</td>
</tr>
</tbody>
</table>

Sources: ABS (2008b); DPIFM (2007b); ABARE.

Rambutan

Rambutan (Nephelium lappaceum) is a red or yellow tropical fruit that is round to oval in shape, with hairlike protrusions. The rambutan is highly perishable, which makes it difficult to handle and gives it a short shelf life. Fruiting may occur twice in one year.

The main producers and exporters are Thailand, Malaysia and Indonesia, with Honduras emerging as a significant exporter in recent years. Thai rambutan production has been declining in recent years and its fresh exports have fallen to very low levels (Figure 83).

Canned rambutan is an important component of the world rambutan trade. Singapore is the largest importer of rambutan products, with growing demand from other Asian countries, the United States and Europe.

Australian rambutan industry

The harvest period in Australia is from November to January, with small quantities around June from a secondary fruiting. Around 85 per cent of Australian production takes place in northern Queensland, with the remainder in the Northern Territory. Fruit yields can vary widely from year to year.

Australian rambutan production in 2006-07 was an estimated 140 tonnes, down substantially on the peak production year of 2004-05, due to the damage to trees cause by Cyclone Larry in early 2006. Around 60 per cent of 2005-06 rambutan production in Queensland and an estimated 23 per cent of all rambutan trees in Queensland were lost due to the cyclone (Cyclone Recovery Taskforce 2006).

Australian rambutan growers gained access to the Japanese market in 2000 where the rambutan is considered a luxury item. Most Australian rambutan exports go to this market. In 2002-03, Australian rambutan exports to Japan peaked at 85 tonnes with an estimated value of $1.2 million (Table 85). In recent years, however, Australian rambutan exports to Japan have declined to almost nothing because of markedly lower Australian production and the strength of the Australian dollar compared with the Japanese yen.

Table 85: Rambutan: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growers</td>
<td>no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>hectares</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>690</td>
<td>742</td>
<td>681</td>
<td>270</td>
<td>140</td>
</tr>
<tr>
<td>Gross value</td>
<td>$’000</td>
<td>4 319</td>
<td>4 885</td>
<td>4 407</td>
<td>2 503</td>
<td>1 204</td>
</tr>
<tr>
<td><strong>Price, Sydney market</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export price *</td>
<td>$/kg</td>
<td>8.86</td>
<td>10.36</td>
<td>6.47</td>
<td>9.27</td>
<td>8.60</td>
</tr>
<tr>
<td><strong>Exports, fresh to Japan</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>tonnes</td>
<td>85</td>
<td>34</td>
<td>23</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Value</td>
<td>$’000</td>
<td>1 187</td>
<td>565</td>
<td>400</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>Unit value</td>
<td>$/kg</td>
<td>13.95</td>
<td>16.72</td>
<td>17.66</td>
<td>19.75</td>
<td>0.00</td>
</tr>
</tbody>
</table>

* Based on data in Japan Customs (2007); value is adjusted to remove freight costs to Japan.
Sources: ABS (2008b); Japan Customs (2007); ABARE.

Further information about pitaya (dragon fruit)


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**Figure 83: Rambutan: Thai production, exports and export prices**

Truffles

Truffles are the fruiting body of various types of fungi that typically form in a symbiotic relationship on the roots of certain trees. Truffles are used as food flavouring. Fresh truffles have a shelf life of around 3 weeks, though this can be lengthened through processes such as vacuum storage. Truffles are also canned or bottled.

The most sought after truffle is the French black or Perigord truffle (*Tuber melanosporum*), named for the region in France where it originated. The other main truffle types are white truffles (*Tuber magnatum* (Piedmont) or *Tuber borchii* (Tuscan), typically associated with the Piedmont region of Italy; the Chinese truffle (*Tuber sinense, Tuber indicum, and Tuber hinalese*) from Asia; and the black summer truffle (*Tuber aestivum/uncinatum*), commonest in central Europe but also found in Turkey and north Africa. The Chinese truffle is relatively plentiful and much lower in quality and hence price than the truffles that originate in Europe.

The focus of the Australian truffle industry is on the French black truffle, though at least one grower in Tasmania also produces the summer truffle (*Tuber aestivum*). The black truffle typically forms on the roots of oak and hazelnut trees. The truffles mature during the winter months, emitting an intense perfume that enables trained pigs or dog to be used to detect their presence. Properties from which truffles are gathered are called truffières.

French black truffles are mostly gathered from naturally occurring populations in woodlands in France, Italy and Spain. In the early 1970s, a technique was developed for inoculating the roots of oak and hazelnut trees. With this method, the first truffles are usually found four to seven years after planting and maximum yields are reached after around twelve years.

**World truffle industry**

The characteristics of the world truffle industry are summarised in Table 86. There are few reliable production statistics for the world truffle industry. The main producers of high quality truffles are France, Italy and Spain, with China a large producer of the much lower priced Chinese truffle. There are increasing numbers of what are termed artificial truffières in Australia, New Zealand and the United States but aggregate production is still small.

French black truffle production was around 1000 tonnes at the beginning of the twentieth century, but has declined to only 8–40 tonnes over the last decade due to destruction of natural growing areas, particularly due to the two world wars (Amaranthus 2007). Amaranthus puts average wholesale prices for black truffles in Europe at US$600–1200 a kilogram.

Recorded production of truffles in France in 2007-08 was 12.1 tonnes, with an average price of €593 a kilogram (Ministère de l’Agriculture et de la Pêche 2007). The weekly pattern of production and prices in France in the last two seasons (see Figure 84) shows production peaked in January of each year. Prices were very low at the beginning of the season when quality is poor. Another trough in prices is evident in around January when weekly production was highest.

**Australian black truffle industry**

The Australian truffle industry was established in 1992 when trees inoculated with the spore of *Tuber melanosporum* (French black truffle) were planted in Tasmania. The first Australian grown black truffle was found in Tasmania in 1999. In 2006, around 30 truffières had been established in Tasmania and the cooler parts of the Australian mainland. The mainland truffières are located as far north as Orange in New South Wales but are mostly located in the Southern Highlands and Southern Tableland regions of New South Wales; the Bendigo and Gippsland regions of Victoria and the Manjimup region of Western Australia.

Estimated production of black truffles in Australia in 2007 was 800 kilograms, around two-thirds of which was produced in Western Australia (Lee 2008). The estimated gross value of production in 2007 was $1.64 million (Table 87). Australia has traditionally exported some truffles of very low quality (not black truffles) and appears to import high quality truffles (Table 87).
The main players in the Australian black truffle industry are Perigord Truffles of Tasmania, Truffles Australis (Tasmania), Tasmanian Truffle Enterprises and The Wine and Truffle Company (Western Australia).

As well as producing truffles on its own properties, Perigord Truffles of Tasmania (PTT) enters into joint ventures with other farmers in which they provide the trees and the expertise. PTT also operates a tree nursery with a capacity to produce 30 000 inoculated trees per year, with plans to increase this capacity to 40 000 trees.

The Wine and Truffle Company operates the Hazel Hill truffière in Manjimup in Western Australia. From around 13 000 oak and hazelnut trees established in 1999 on 21 hectares, there was truffle production of 0.5 kilogramms in 2003, 4 kilogramms in 2004, 26 kilogramms in 2005 and 104 kilogramms in 2006. The Company is also associated with another truffières being established in Western Australia, with 30 000 trees on 75 hectares. This property is projected to produce 3 kilogramms a hectare by 2012, rising to 70 kilogramm a hectare by 2020.

Prices received for Australian produced truffles benefit from being able to supply fresh truffles in the off season for northern hemisphere producers. Amaranthus (2007) says that the minimum price guaranteed by one of the largest European truffle traders for Australian truffles is around A$1500 a kilogram. As at April 2007, Wine and Truffle Company located at Manjimup in Western Australia was listing truffle prices as:

- Icon, $3.50 a gram
- Premium, perfumed, some damage but overall intact, $3.00 a gram
- Good, slightly less perfumed, sliced or part of truffle, $2.50/g.
- Bits, $2.00/g.

Based on the number and age structure of inoculated trees growing in Australia in 2007, Australian truffle production is projected to rise to around 2 tonnes in 2010. This level of production would probably put considerable downward pressure of prices currently available for Australian-produced French black truffles.

Table 86: Truffles: key characteristics of the world market

<table>
<thead>
<tr>
<th>Item</th>
<th>Volume - Value</th>
<th>Key countries (share of total value in the three years to 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World trade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh or chilled</td>
<td>842 - 32.0</td>
<td>Exporters: Italy (38%), Spain (28%), France (14%), Croatia (5%), China (4%) Importers: France (41%), Japan (11%), United States (9%), Germany (8%), Switzerland (8%), Belgium (4%), United Kingdom (3%), Italy (2%)</td>
</tr>
<tr>
<td>Prepared or preserved</td>
<td>2 102 - 15.4</td>
<td>Exporters: Italy (46%), France (24%), Spain (11%), China (4%), Morocco (3%) Importers: France (24%), United States (20%), Germany (9%), Switzerland (7%), Belgium (6%), United Kingdom (5%), Japan (5%), Netherlands (4%), Spain (3%)</td>
</tr>
</tbody>
</table>

* Average three years to 2005.

Table 87: Truffles: supply disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th>Unit 2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
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<tbody>
<tr>
<td><strong>Production (French black)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Truffieres no.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Area hectares</td>
<td></td>
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<tr>
<td>Trees ’000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross value $’000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit gross value $/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports, all types</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh or chilled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume kg</td>
<td>7 152</td>
<td>11 815</td>
<td>13 484</td>
<td>12 200</td>
<td>12 100</td>
</tr>
<tr>
<td>– value $’000</td>
<td>39</td>
<td>73</td>
<td>77</td>
<td>94</td>
<td>201</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>5.51</td>
<td>6.16</td>
<td>5.71</td>
<td>7.73</td>
<td>16.59</td>
</tr>
<tr>
<td>Prepared or preserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume kg</td>
<td>40</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $’000</td>
<td>1</td>
<td>3</td>
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</tr>
<tr>
<td>– unit value $/kg</td>
<td>13.50</td>
<td>660.00</td>
<td></td>
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</tr>
<tr>
<td>Imports, all types</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh or chilled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume kg</td>
<td>245</td>
<td>220</td>
<td>227</td>
<td>279</td>
<td>458</td>
</tr>
<tr>
<td>– value $’000</td>
<td>116</td>
<td>147</td>
<td>216</td>
<td>260</td>
<td>278</td>
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<tr>
<td>– unit value $/kg</td>
<td>473.02</td>
<td>667.54</td>
<td>953.42</td>
<td>932.01</td>
<td>606.77</td>
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<tr>
<td>Provisionally preserved</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>– volume kg</td>
<td>12</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– value $’000</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>– unit value $/kg</td>
<td>455.75</td>
<td></td>
<td>1498.00</td>
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<tr>
<td>Dried, whole or pieces</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume kg</td>
<td>3 600</td>
<td>1 324</td>
<td>3 213</td>
<td>781</td>
<td>2 278</td>
</tr>
<tr>
<td>– value $’000</td>
<td>15</td>
<td>41</td>
<td>77</td>
<td>35</td>
<td>16</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>4.07</td>
<td>31.00</td>
<td>23.95</td>
<td>44.32</td>
<td>7.04</td>
</tr>
<tr>
<td>Prepared or preserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume kg</td>
<td>1 534</td>
<td>1 170</td>
<td>2 711</td>
<td>5 012</td>
<td>2 484</td>
</tr>
<tr>
<td>– value $’000</td>
<td>140</td>
<td>55</td>
<td>90</td>
<td>197</td>
<td>141</td>
</tr>
<tr>
<td>– unit value $/kg</td>
<td>91.20</td>
<td>46.89</td>
<td>33.20</td>
<td>39.40</td>
<td>56.63</td>
</tr>
<tr>
<td>All truffles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total export value $’000</td>
<td>39</td>
<td>73</td>
<td>77</td>
<td>95</td>
<td>204</td>
</tr>
<tr>
<td>Total import value $’000</td>
<td>270</td>
<td>243</td>
<td>383</td>
<td>492</td>
<td>435</td>
</tr>
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</table>

Sources: ABS (2008b); Lee (2008); ABARE.
The value of world trade in cut flowers (fresh and dried) and foliage (fresh and dried) averaged US$6.3 billion a year in the three years to 2005, with fresh cut flowers making up more than 80 per cent of the total. The Netherlands accounts for around half of the value of world trade, with the other major exporters being Colombia (11 per cent of the total value in the three years to 2005), Ecuador (5 per cent), Kenya (5 per cent) and Israel (3 per cent). The main importers are Germany (18 per cent share of total value in the three years to 2005), United Kingdom (16 per cent), United States (15 per cent), Netherlands (11 per cent), France (9 per cent) and Japan (4 per cent).

The beauty and novelty of many of Australia's native plants and foliage make them a valued component of floral arrangements in many parts of the world. A wide range of Australian native plants are now being grown commercially in countries other than Australia, particularly Israel, Colombia, Kenya, South Africa and Zimbabwe. The most popular plants grown in these countries are waxflower, kangaroo paw, banksia and eucalypt (for foliage).

**Australian wildflower industry**

The Australian wildflower and native plant industry was initially based on harvesting from the wild but most production is now from artificial propagation on commercial farms. Each of the states and territories of Australia have in place arrangements to ensure the wild harvesting of Australian native flora is undertaken in sustainable ways. For example, Western Australia and New South Wales have management plans agreed with the Commonwealth Department of the Environment and Heritage under state and Commonwealth legislation (see CALM 2003; NSW National Parks and Wildlife Service 2002). The arrangements include licensing systems; quotas for specific areas and species; and monitoring of harvested and traded quantities.

A list of Australian wildflower and native plants (by species and common name) in order of their importance as an export is shown in Table 88. Some plants from the proteaceae family that are native to Southern Africa, such as proteas, are widely grown in Australia and are usually included in the wildflowers category.

There are few statistics on the volume and value of production of flowers and foliage in Australia. Karingal Associates (1997) estimated the total value of the fresh cut flower and foliage domestic market to be $142 million wholesale and $285 million retail. Of this total, wildflowers were estimated to make up only 10–15 per cent.

According to ABS (2008), there were 1111 establishments in 2005-06, growing 5539 hectares of cut flowers, mostly in Victoria (41 per cent) and Western Australia (19 per cent). There was another 419 hectares of undercover production of cut flowers in 2005-06. The total sales of the cut flower and flower seed growing business in 2005-06 was $336 million, down from $385 million in the previous years (ABS 2007).

Based on the assumptions that around 33 per cent of Australian production of wild flowers is exported and that wildflowers make up 15 per cent of the value of Australian cut flower production, the value of the wildflower industry in 2005-06 was very roughly $40 million. Lower wildflower production in recent years is partly explained by adverse seasonal conditions.

The value in constant (2008) dollar terms of Australia's exports of cut flowers, foliage and live plants (here called 'flower' exports)
grew strongly to a peak of $46 million in 2001-02, but have since declined steadily
to $30 million in 2006-07. A factor causing
this decline has been an extended drought
in Australia. It should be noted that Brooks
(2001) and Sutton (2002) both concluded
that the export statistics used here from
the Australian Bureau of Statistics could
considerably underestimate the value of
exports to at least some countries. This is
because prices received are not known with
any certainty until the flowers are sold at
auction in the destination country.

The share of wild flowers in the total
value of Australian flower exports has
grown from only 17 per cent in 1988-89
to a fairly constant 70 per cent over the
5 years to 2006-07. The value in constant
(2008) dollar terms of Australian exports
of wildflowers, native plants and foliage
peaked in 2001-02 at about $37 million
dollars (Figure 86). The export values of
foliage, waxflowers and proteas are larger
than in the mid-1990s, while wild picked
and artificially propagated Australian
native flowers and plants have declined
substantially.

The most important export markets for
Australian wildflowers, foliage and native
plants are Japan (36 per cent of the total value
of exports in the three years to 2006-07),
the Netherlands (30 per cent), the United
States (16 per cent), Germany (6 per cent)
and Canada (4 per cent). Western Australia
accounted for 34 per cent of the total value
of exports in this period, Queensland
28 per cent, Victoria 24 per cent, and New
South Wales 13 per cent.

The value in constant (2008) dollar terms
of Australian imports of cut flowers, mosses
and foliage has been growing at an average
annual rate of 5.5 per cent since 1994-95
and reached a record $45 million in 2006-07
(ABS 2008b). These imports were mostly
sourced from the Netherlands (52 per cent
of the total value in the three years to
2006-07), Singapore (14 per cent), New
Zealand (6 per cent), India (5 per cent),
China (3 per cent), Kenya (3 per cent) and
Thailand (3 per cent).

### Table 88: Australian wildflower species

<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Chamelaucium</em> spp.</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>Waxflower</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td><em>Anigozanthos</em> spp.</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td><em>Kangaroo Paw</em></td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td><em>Thyrtomone</em> spp.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><em>Stirlingia</em> spp.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><em>Protea</em> spp.</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td><em>Protea</em></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><em>Banksia</em> spp.</td>
<td>21</td>
</tr>
<tr>
<td>10</td>
<td><em>Banksia</em></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><em>Leucadendrum</em> spp.</td>
<td>22</td>
</tr>
<tr>
<td>12</td>
<td>Leucadendron</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td><em>Caustis</em> spp.</td>
<td>23</td>
</tr>
<tr>
<td>14</td>
<td>Koala Fern Foliage</td>
<td>24</td>
</tr>
<tr>
<td>15</td>
<td>Scholtzia spp.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Scholtzia</td>
<td>25</td>
</tr>
<tr>
<td>17</td>
<td><em>Eucalyptus</em> spp.</td>
<td>26</td>
</tr>
<tr>
<td>18</td>
<td><em>Eucalyptus</em> foliage</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td><em>Boronia</em> spp.</td>
<td>27</td>
</tr>
<tr>
<td>20</td>
<td><em>Boronia</em></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td><em>Leucospermum</em> spp.</td>
<td>28</td>
</tr>
<tr>
<td>22</td>
<td>Leucospermum</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td><em>Ozothamnus</em> spp.</td>
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</tr>
<tr>
<td>24</td>
<td>Rieflower</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td><em>Eriostemon</em> spp.</td>
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</tr>
<tr>
<td>26</td>
<td>Eriostemon</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Telopea spp.</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Australian Flower Export Council (2003).*

### Figure 85: Cut flowers and foliage: value of world trade

![Figure 85: Cut flowers and foliage: value of world trade](image-url)

### Table 89: Wildflowers: supply, disposal and value in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross value</td>
<td>$'000</td>
<td>52 000</td>
<td>42 000</td>
<td>45 000</td>
<td>42 000</td>
</tr>
<tr>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kangaroo paws a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000 stems</td>
<td>1 212</td>
<td>1 133</td>
<td>938</td>
<td>1 203</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>426</td>
<td>401</td>
<td>377</td>
<td>502</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/stem</td>
<td>0.35</td>
<td>0.35</td>
<td>0.40</td>
<td>0.42</td>
</tr>
<tr>
<td>Proteas a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000 stems</td>
<td>4 567</td>
<td>6 058</td>
<td>6 285</td>
<td>5 793</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>2 997</td>
<td>3 055</td>
<td>3 165</td>
<td>3 334</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/stem</td>
<td>0.66</td>
<td>0.50</td>
<td>0.50</td>
<td>0.58</td>
</tr>
<tr>
<td>Wax flowers a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000 stems</td>
<td>19 549</td>
<td>17 843</td>
<td>15 470</td>
<td>14 991</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>8 125</td>
<td>5 952</td>
<td>5 299</td>
<td>4 289</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/stem</td>
<td>0.42</td>
<td>0.33</td>
<td>0.34</td>
<td>0.29</td>
</tr>
<tr>
<td>Other Australian native species a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000 stems</td>
<td>16 991</td>
<td>16 916</td>
<td>24 046</td>
<td>17 836</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>7 354</td>
<td>4 012</td>
<td>6 002</td>
<td>5 647</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/stem</td>
<td>0.43</td>
<td>0.24</td>
<td>0.25</td>
<td>0.32</td>
</tr>
<tr>
<td>Wild picked, fresh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000 stems</td>
<td>9 035</td>
<td>7 760</td>
<td>8 703</td>
<td>5 184</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>931</td>
<td>1 353</td>
<td>1 821</td>
<td>867</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/stem</td>
<td>0.10</td>
<td>0.17</td>
<td>0.21</td>
<td>0.17</td>
</tr>
<tr>
<td>Wild picked, dried or preserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>'000 stems</td>
<td>3 715</td>
<td>3 239</td>
<td>3 645</td>
<td>2 098</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>1 700</td>
<td>1 494</td>
<td>1 575</td>
<td>1 129</td>
</tr>
<tr>
<td>– unit value</td>
<td>$/stem</td>
<td>0.46</td>
<td>0.46</td>
<td>0.43</td>
<td>0.54</td>
</tr>
<tr>
<td>Foliage</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>– volume</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>– value</td>
<td>$'000</td>
<td>6 346</td>
<td>5 905</td>
<td>5 829</td>
<td>6 781</td>
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<tr>
<td>– unit value</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
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<tr>
<td>Total export value</td>
<td>$'000</td>
<td>27 879</td>
<td>22 171</td>
<td>24 067</td>
<td>22 550</td>
</tr>
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</table>

* Artificially propagated.


---

Figure 86: Wildflowers: value of Australian exports*

---

* Estimate only as prices received are unknown.
## Appendix A: Value of Australian farm and fisheries production and exports

### Table A. 1: Gross value of Australian livestock production

<table>
<thead>
<tr>
<th>Year</th>
<th>Cattle and calves</th>
<th>Cattle exported live</th>
<th>Sheep</th>
<th>Lambs</th>
<th>Sheep exported live</th>
<th>Pigs</th>
<th>Poultry</th>
<th>Wool</th>
<th>Milk</th>
<th>Eggs</th>
<th>Honey and beeswax</th>
<th>Total livestock</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-03</td>
<td>5,842</td>
<td>569</td>
<td>468</td>
<td>1,161</td>
<td>408</td>
<td>911</td>
<td>1,281</td>
<td>3,318</td>
<td>2,795</td>
<td>294</td>
<td>75</td>
<td>17,158</td>
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<tr>
<td>2003-04</td>
<td>6,341</td>
<td>318</td>
<td>454</td>
<td>1,318</td>
<td>266</td>
<td>879</td>
<td>1,281</td>
<td>2,397</td>
<td>2,809</td>
<td>336</td>
<td>74</td>
<td>16,511</td>
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<tr>
<td>2004-05</td>
<td>7,455</td>
<td>374</td>
<td>418</td>
<td>1,327</td>
<td>207</td>
<td>906</td>
<td>1,304</td>
<td>2,196</td>
<td>3,194</td>
<td>353</td>
<td>77</td>
<td>17,827</td>
</tr>
<tr>
<td>2005-06</td>
<td>7,325</td>
<td>358</td>
<td>444</td>
<td>1,378</td>
<td>291</td>
<td>890</td>
<td>1,229</td>
<td>2,093</td>
<td>3,343</td>
<td>398</td>
<td>49</td>
<td>17,802</td>
</tr>
<tr>
<td>2006-07</td>
<td>7,550</td>
<td>437</td>
<td>380</td>
<td>1,387</td>
<td>289</td>
<td>944</td>
<td>1,302</td>
<td>2,278</td>
<td>3,178</td>
<td>405</td>
<td>38</td>
<td>18,231</td>
</tr>
</tbody>
</table>

*Note: The gross value of production is the value placed on recorded production at the wholesale prices realised in the market place. The point of measurement can vary between commodities. Generally the market place is the metropolitan market in each state and territory. However, where commodities are consumed locally or where they become raw material for a secondary industry, these points are presumed to be the market place.

*Note: Prices used in these calculations exclude GST.

*Sources: ABS (2007a); ABARE.*

### Table A. 2: Gross value of Australian fisheries products

<table>
<thead>
<tr>
<th>Year</th>
<th>Tuna</th>
<th>Other fin fish</th>
<th>Prawns</th>
<th>Rock lobster</th>
<th>Abalone</th>
<th>Scallops</th>
<th>Oysters</th>
<th>Pears</th>
<th>Other molluscs</th>
<th>Other crustaceans</th>
<th>Total fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-03</td>
<td>317</td>
<td>585</td>
<td>367</td>
<td>463</td>
<td>216</td>
<td>33</td>
<td>62</td>
<td>124</td>
<td>64</td>
<td>63</td>
<td>2,313</td>
</tr>
<tr>
<td>2003-04</td>
<td>280</td>
<td>581</td>
<td>360</td>
<td>411</td>
<td>198</td>
<td>25</td>
<td>77</td>
<td>122</td>
<td>73</td>
<td>66</td>
<td>2,207</td>
</tr>
<tr>
<td>2004-05</td>
<td>172</td>
<td>569</td>
<td>309</td>
<td>427</td>
<td>233</td>
<td>47</td>
<td>74</td>
<td>122</td>
<td>68</td>
<td>60</td>
<td>2,105</td>
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<tr>
<td>2005-06</td>
<td>175</td>
<td>597</td>
<td>302</td>
<td>470</td>
<td>226</td>
<td>25</td>
<td>84</td>
<td>122</td>
<td>64</td>
<td>49</td>
<td>2,133</td>
</tr>
<tr>
<td>2006-07</td>
<td>164</td>
<td>702</td>
<td>263</td>
<td>462</td>
<td>231</td>
<td>36</td>
<td>89</td>
<td>122</td>
<td>68</td>
<td>58</td>
<td>2,216</td>
</tr>
</tbody>
</table>

*Note: The gross value of production is the value placed on recorded production at the wholesale prices realised in the market place. The point of measurement can vary between commodities. Generally the market place is the metropolitan market in each state and territory. However, where commodities are consumed locally or where they become raw material for a secondary industry, these points are presumed to be the market place.

*Note: Prices used in these calculations exclude GST.

*Sources: ABS (2007a); ABARE.*
## Table A.3: Gross value of Australian crop production

<table>
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<tr>
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<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Grains and oilseeds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Winter crops</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>984</td>
<td>1 750</td>
<td>1 233</td>
<td>1 445</td>
<td>1 013</td>
</tr>
<tr>
<td>Canola</td>
<td>389</td>
<td>686</td>
<td>503</td>
<td>486</td>
<td>202</td>
</tr>
<tr>
<td>Chickpeas</td>
<td>65</td>
<td>58</td>
<td>36</td>
<td>57</td>
<td>153</td>
</tr>
<tr>
<td>Field peas</td>
<td>61</td>
<td>113</td>
<td>68</td>
<td>132</td>
<td>38</td>
</tr>
<tr>
<td>Lupins</td>
<td>212</td>
<td>278</td>
<td>193</td>
<td>265</td>
<td>125</td>
</tr>
<tr>
<td>Maize</td>
<td>72</td>
<td>88</td>
<td>81</td>
<td>72</td>
<td>90</td>
</tr>
<tr>
<td>Oats</td>
<td>210</td>
<td>279</td>
<td>172</td>
<td>255</td>
<td>174</td>
</tr>
<tr>
<td>Rice</td>
<td>153</td>
<td>180</td>
<td>101</td>
<td>255</td>
<td>51</td>
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<tr>
<td>Sorghum</td>
<td>300</td>
<td>319</td>
<td>270</td>
<td>286</td>
<td>344</td>
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<tr>
<td>Soybeans</td>
<td>7</td>
<td>27</td>
<td>15</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>Sunflowerseed</td>
<td>10</td>
<td>20</td>
<td>21</td>
<td>42</td>
<td>13</td>
</tr>
<tr>
<td>Other oilseeds</td>
<td>30</td>
<td>44</td>
<td>36</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>Triticale</td>
<td>84</td>
<td>126</td>
<td>93</td>
<td>120</td>
<td>89</td>
</tr>
<tr>
<td>Wheat</td>
<td>2 692</td>
<td>5 636</td>
<td>4 317</td>
<td>5 194</td>
<td>2 522</td>
</tr>
<tr>
<td><strong>Industrial crops</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton lint and cotton seed</td>
<td>844</td>
<td>689</td>
<td>1 222</td>
<td>1 105</td>
<td>514</td>
</tr>
<tr>
<td>Sugar cane (cut for crushing)</td>
<td>1 019</td>
<td>854</td>
<td>980</td>
<td>1 056</td>
<td>1 183</td>
</tr>
<tr>
<td>Wine grapes</td>
<td>1 143</td>
<td>1 539</td>
<td>1 377</td>
<td>1 171</td>
<td>898</td>
</tr>
<tr>
<td><strong>Horticulture</strong></td>
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<tr>
<td>Table and dried grapes</td>
<td>192</td>
<td>166</td>
<td>220</td>
<td>212</td>
<td>243</td>
</tr>
<tr>
<td>Fruit and nuts (excl grapes)</td>
<td>2 216</td>
<td>2 184</td>
<td>2 547</td>
<td>2 537</td>
<td>2 800</td>
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<tr>
<td>Vegetables</td>
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<td>2 380</td>
<td>2 315</td>
<td>2 752</td>
<td>2 545</td>
</tr>
<tr>
<td>Other horticulture</td>
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<td>1 385</td>
<td>1 372</td>
<td>1 433</td>
<td>1 495</td>
</tr>
<tr>
<td>Other crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total crops</strong></td>
<td>16 045</td>
<td>20 837</td>
<td>18 717</td>
<td>20 682</td>
<td>16 418</td>
</tr>
</tbody>
</table>

* Linseed, safflowerseed and peanuts.

* Value delivered to gin.

* Mainly fodder crops.

Note: The gross value of production is the value placed on recorded production at the wholesale prices realised in the market place. The point of measurement can vary between commodities. Generally the market place is the metropolitan market in each state and territory. However, where commodities are consumed locally or where they become raw material for a secondary industry, these points are presumed to be the market place.

Note: Prices used in these calculations exclude GST.

Source: ABS (2007a); ABARE.
### Table A. 4: Value of farm exports

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<tr>
<td></td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
</tr>
<tr>
<td><strong>Grains and oilseeds</strong></td>
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</tr>
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<td>Barley</td>
<td>955</td>
<td>1 239</td>
<td>1 275</td>
<td>1 108</td>
<td>833</td>
</tr>
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<td>Canola</td>
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<td>453</td>
<td>397</td>
<td>331</td>
<td>108</td>
</tr>
<tr>
<td>Chickpeas</td>
<td>52</td>
<td>71</td>
<td>65</td>
<td>106</td>
<td>168</td>
</tr>
<tr>
<td>Cottonseed</td>
<td>82</td>
<td>62</td>
<td>55</td>
<td>53</td>
<td>31</td>
</tr>
<tr>
<td>Lupins</td>
<td>57</td>
<td>148</td>
<td>89</td>
<td>99</td>
<td>38</td>
</tr>
<tr>
<td>Oats</td>
<td>44</td>
<td>38</td>
<td>36</td>
<td>47</td>
<td>20</td>
</tr>
<tr>
<td>Peas</td>
<td>43</td>
<td>56</td>
<td>33</td>
<td>43</td>
<td>80</td>
</tr>
<tr>
<td>Rice</td>
<td>371</td>
<td>145</td>
<td>173</td>
<td>171</td>
<td>345</td>
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<tr>
<td>Sorghum</td>
<td>17</td>
<td>61</td>
<td>96</td>
<td>33</td>
<td>13</td>
</tr>
<tr>
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<td>3 475</td>
<td>3 488</td>
<td>3 296</td>
<td>2 765</td>
</tr>
<tr>
<td>Other oilseeds</td>
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<td>33</td>
<td>21</td>
<td>22</td>
</tr>
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<td><strong>Industrial crops</strong></td>
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<tr>
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<td>1 098</td>
<td>1 454</td>
<td>1 510</td>
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<td>Wine</td>
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<td>2 545</td>
<td>2 748</td>
<td>2 799</td>
<td>2 993</td>
</tr>
<tr>
<td><strong>Other crops</strong></td>
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<td>3 213</td>
<td>3 322</td>
<td>3 270</td>
<td>3 226</td>
</tr>
<tr>
<td><strong>Meat and live animals for slaughter</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef and veal</td>
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<td>3 793</td>
<td>4 584</td>
<td>4 272</td>
<td>4 634</td>
</tr>
<tr>
<td>Live cattle</td>
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<td>318</td>
<td>374</td>
<td>358</td>
<td>437</td>
</tr>
<tr>
<td>Lamb</td>
<td>533</td>
<td>602</td>
<td>673</td>
<td>767</td>
<td>748</td>
</tr>
<tr>
<td>Live sheep</td>
<td>408</td>
<td>266</td>
<td>207</td>
<td>291</td>
<td>289</td>
</tr>
<tr>
<td>Mutton</td>
<td>442</td>
<td>380</td>
<td>398</td>
<td>432</td>
<td>458</td>
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<td>Pig meat</td>
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<td>181</td>
<td>150</td>
<td>143</td>
<td>142</td>
</tr>
<tr>
<td>Poultry meat</td>
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<tr>
<td><strong>Wool</strong></td>
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</tr>
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<td>505</td>
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<td>339</td>
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<td><strong>Dairy products</strong></td>
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<td>Butter</td>
<td>224</td>
<td>183</td>
<td>188</td>
<td>225</td>
<td>179</td>
</tr>
<tr>
<td>Cheese</td>
<td>800</td>
<td>739</td>
<td>877</td>
<td>837</td>
<td>824</td>
</tr>
<tr>
<td>Casein</td>
<td>128</td>
<td>123</td>
<td>116</td>
<td>89</td>
<td>113</td>
</tr>
<tr>
<td>Skim milk powder</td>
<td>408</td>
<td>388</td>
<td>420</td>
<td>529</td>
<td>505</td>
</tr>
<tr>
<td>Wholemilk powder</td>
<td>380</td>
<td>322</td>
<td>324</td>
<td>334</td>
<td>275</td>
</tr>
<tr>
<td>Other dairy products</td>
<td>558</td>
<td>544</td>
<td>568</td>
<td>561</td>
<td>546</td>
</tr>
<tr>
<td><strong>Other livestock exports</strong></td>
<td>2 535</td>
<td>2 419</td>
<td>2 496</td>
<td>2 436</td>
<td>2 577</td>
</tr>
<tr>
<td><strong>Total farm exports</strong></td>
<td>27 865</td>
<td>26 550</td>
<td>27 911</td>
<td>27 807</td>
<td>27 795</td>
</tr>
</tbody>
</table>

* Includes the grain equivalent of malt.

† Field peas and cowpeas.

‡ Includes the wheat equivalent of flour.

§ Includes soybeans, linseed, sunflowerseed, safflowerseed and peanuts. Excludes meals and oils.

‖ Excludes cotton waste and linters.

§§ Excludes breeding stock.

* On a balance of payments basis. ABS recorded trade data adjusted for changes in stock levels held overseas by Wool International.

* Source: ABS (2008b); ABARE.
## Appendix B: Levies applicable to emerging industries in Australia

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Levy arrangements</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond</td>
<td>In shell, 1c/kg&lt;br&gt;Shelled, 2c/kg&lt;br&gt;Nonpareil in shells, 1.5c/kg</td>
<td>Funding for research and development carried out via Horticulture Australia Limited.</td>
</tr>
<tr>
<td>Buffalo</td>
<td>$5.33/head on Australian produced buffaloes that are exported live&lt;br&gt;$10.33/head on buffaloes slaughtered for human consumption at Australian abattoirs</td>
<td>Funding for research and development via RIRDC, and the activities carried out by the Brucellosis and Tuberculosis Eradication Council.</td>
</tr>
<tr>
<td>Chestnut</td>
<td>Domestic, 10c/kg&lt;br&gt;Export, 10c/kg</td>
<td>Funding for promotion, research and development carried out via Horticulture Australia Limited.</td>
</tr>
<tr>
<td>Deer</td>
<td>$7.75/head payable on live deer produced in and exported from Australia&lt;br&gt;10.5c/kg (hot dressed weight) on deer slaughtered at an abattoir and intended for human consumption&lt;br&gt;3.5 per cent of the sale (or declared) value of deer velvet produced and sold in Australia&lt;br&gt;3.5 per cent of the sale (or declared) value of deer velvet produced in Australia and exported</td>
<td>Funding for research and development via RIRDC, and residue testing administered by the National Residue Survey.</td>
</tr>
<tr>
<td>Goat</td>
<td>1.5 per cent of the sale value of shorn goat fibre&lt;br&gt;37.7c/head for all transactions where ownership of the goat changes hands&lt;br&gt;3c/head for all wild (game) goats killed for human consumption and processed at a licensed establishment</td>
<td>Funding for research and development via RIRDC and Meat and Livestock Australia, and residue testing administered by the National Residue Survey.</td>
</tr>
<tr>
<td>Game pig</td>
<td>25c/head</td>
<td>Funding residue testing administered by the National Residue Survey.</td>
</tr>
<tr>
<td>Horse</td>
<td>$5/head for horses slaughtered for human consumption</td>
<td>Funding for the residue testing program which is administered by the National Residue Survey.</td>
</tr>
<tr>
<td>Kangaroo</td>
<td>7c/head for all wild (game) kangaroos killed for human consumption by shooting and that are processed at a licensed establishment&lt;br&gt;From 2004, 3c/head for all macropods killed for pet food</td>
<td>Funding for research and development via RIRDC, and residue testing administered by the National Residue Survey.</td>
</tr>
<tr>
<td>Lychee</td>
<td>8c/kg for fresh lychee, 1c/kg for processing lychee and 8c/kg for export lychee</td>
<td>Funding for research, development and marketing activities of Horticulture Australia Limited.</td>
</tr>
<tr>
<td>Macadamia</td>
<td>Dried kernel, 25.21c/kg&lt;br&gt;Nut-in-shell, 8c/kg</td>
<td>Funding for research, development and promotion by Horticulture Australia Limited, and residue testing administered by the National Residue Survey.</td>
</tr>
<tr>
<td>Papaya</td>
<td>Fresh, 2c/kg&lt;br&gt;Processing, 0.25c/kg&lt;br&gt;Export, 2c/kg</td>
<td>Funding for research, development and promotion by Horticulture Australia Limited.</td>
</tr>
<tr>
<td>Pasture seed</td>
<td>Category 1 (medics), $10/t;&lt;br&gt;Category 2 (lucerines), $15/t&lt;br&gt;Category 3 (clovers), $15/t&lt;br&gt;Category 4 (subclovers), $11/t&lt;br&gt;Category 5 (serradella), $10/t</td>
<td>Funding for research and development via RIRDC.</td>
</tr>
<tr>
<td>Pulse</td>
<td>Levy calculated as a percentage of the farmgate value at the rates of 1.015 per cent for field peas, lupins and chick peas; and 1.000 per cent for mung beans, pigeon peas, peanuts, navy beans, vetch, cow peas and lentils</td>
<td>Funding for research and development activities of the Grains Research and Development Corporation, and residue testing administered by the National Residue Survey for field peas, lupins and chick peas.</td>
</tr>
<tr>
<td>Ratite (emu and ostrich)</td>
<td>Applied to all ratites slaughtered for human consumption in Australia at the rate of $0.75/head for emus and $1.25/ head for ostriches</td>
<td>Funding for research and development via RIRDC, and residue testing administered by the National Residue Survey.</td>
</tr>
</tbody>
</table>
### Appendix C: Contacts for selected Australian emerging industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Association</th>
<th>Address</th>
<th>Contact Details</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alpaca</strong></td>
<td>Australasian Alpaca Breeders Association</td>
<td>PO Box U383</td>
<td>WOLLONGONG UNIVERSITY NSW 2500</td>
<td>Tel: +61 2 4227 5975, Fax: +61 2 8572 9408, Email: <a href="mailto:info@aaba.com.au">info@aaba.com.au</a>, Website: <a href="http://www.aaba.com.au">www.aaba.com.au</a></td>
</tr>
<tr>
<td><strong>Alpaca</strong></td>
<td>Australian Alpaca Association</td>
<td>PO Box 1076</td>
<td>MITCHAM NORTH VIC 3132</td>
<td>Tel: +61 3 9873 7700, Fax: +61 3 9873 7711, Email: <a href="mailto:alpaca@alpaca.asn.au">alpaca@alpaca.asn.au</a>, Website: <a href="http://www.alpaca.asn.au">www.alpaca.asn.au</a></td>
</tr>
<tr>
<td><strong>Alpaca Fleece Ltd</strong></td>
<td></td>
<td>Unit 2, 114 Fairbairn Road</td>
<td>SUNSHINE VIC 3020</td>
<td>Tel: +61 3 9311 0933, Fax: +61 3 9311 0499, Email: <a href="mailto:info@australianalpacafleece.com.au">info@australianalpacafleece.com.au</a>, Website: <a href="http://www.australianalpacafleece.com.au">www.australianalpacafleece.com.au</a></td>
</tr>
<tr>
<td><strong>Aquaculture</strong></td>
<td>Aquaculture Council of Western Australia</td>
<td></td>
<td></td>
<td>Dan Machin, Executive Officer, PO Box 55, MT HAWTHORN WA, 6915, Tel: +61 8 9492 8814, Mobile: 0438 964 303, Fax: +61 8 9244 2934, Email: <a href="mailto:acwa@wafic.org.au">acwa@wafic.org.au</a>, Website: <a href="http://www.aquaculturecouncilwa.com/">www.aquaculturecouncilwa.com/</a></td>
</tr>
<tr>
<td><strong>Asian vegetables</strong></td>
<td>Wasabi Growers of Tasmania</td>
<td>565 Racecourse Rd</td>
<td>WINNALEAH TAS 7265</td>
<td>Tel: +61 03 6354 2310, Fax: +61 03 6354 2310, Email: <a href="mailto:secret@talga.com.au">secret@talga.com.au</a>, Website: <a href="http://www.talga.com.au">www.talga.com.au</a></td>
</tr>
<tr>
<td><strong>Taro Growers Australia</strong></td>
<td></td>
<td>PO Box 620</td>
<td>GORDONVALE QLD 4865</td>
<td>Email: <a href="mailto:secretary@talga.com.au">secretary@talga.com.au</a>, Website: <a href="http://www.talga.com.au">www.talga.com.au</a></td>
</tr>
<tr>
<td><strong>Buffalo</strong></td>
<td>Australian Buffalo Industry Council</td>
<td></td>
<td></td>
<td>Stuart Kenny, NT BIC Executive Officer, PO Box 36828, WINNELLIJE NT 0821, Tel: +61 8 8981 5976, Email: <a href="mailto:buffalono@ntbic.com.au">buffalono@ntbic.com.au</a>, Website: <a href="http://www.buffaluanaustralia.org">www.buffaluanaustralia.org</a></td>
</tr>
<tr>
<td><strong>Camel</strong></td>
<td>Central Australia Camel Industry Association</td>
<td>PO Box 3895</td>
<td>ALICE SPRINGS NT 0871</td>
<td>Tel: +61 8 8952 7917, Mobile: 0419 846 780, Fax: +61 8 8952 7917, Email: <a href="mailto:bevseidel@bigpond.com">bevseidel@bigpond.com</a>, Website: <a href="http://www.camelsaust.com.au">www.camelsaust.com.au</a></td>
</tr>
<tr>
<td><strong>Coffee</strong></td>
<td>Australian Coffee Growers Association</td>
<td>MAREEBA QLD 4880</td>
<td></td>
<td>Email: <a href="mailto:admin@auscoffee.com">admin@auscoffee.com</a>, Website: <a href="http://www.auscoffee.com">www.auscoffee.com</a></td>
</tr>
</tbody>
</table>

### Deer
<table>
<thead>
<tr>
<th>Industry</th>
<th>Association</th>
<th>Address</th>
<th>Contact Details</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Deer Industry Association of Australia</strong></td>
<td></td>
<td></td>
<td></td>
<td>Jim Moir, President, RMB 8032, HORSHAM VIC 3201, Tel: +61 3 53848240, Mobile: 0427 387 689, Fax: +61 3 5384 8241, Email: <a href="mailto:jmoir@hotmail.net.au">jmoir@hotmail.net.au</a>, Website: <a href="http://www.diaa.org">www.diaa.org</a></td>
</tr>
</tbody>
</table>

### Emu
<table>
<thead>
<tr>
<th>Industry</th>
<th>Federation of Australia</th>
<th>Address</th>
<th>Contact Details</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emu Industry Federation of Australia</strong></td>
<td></td>
<td>PO Box 57</td>
<td>WAGIN WA 6315</td>
<td>Tel: +61 8 9861 2060, Fax: +61 8 9861 1212, Email: <a href="mailto:hillcrest2@westnet.com.au">hillcrest2@westnet.com.au</a>, Website: <a href="http://www.emuindustry.asn.au/effa.html">www.emuindustry.asn.au/effa.html</a></td>
</tr>
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</table>

### Essential oils
<table>
<thead>
<tr>
<th>Industry</th>
<th>Association</th>
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<th>Contact Details</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Essential Oil Producers Association of Australia</strong></td>
<td></td>
<td>GOONELLABAH NSW 2480</td>
<td></td>
<td>Tel: +61 2 6624 2453, Fax: +61 2 66 283 264, Email: <a href="mailto:southwell@optusnet.com.au">southwell@optusnet.com.au</a>, Website: <a href="http://www.epaa.com.au">www.epaa.com.au</a></td>
</tr>
<tr>
<td><strong>Australian Lavender Growers Association</strong></td>
<td></td>
<td>PO Box 1296</td>
<td>RICHMOND NORTH VIC 3121</td>
<td>Tel: +61 2 4356 1025, Email: <a href="mailto:secretary@talga.com.au">secretary@talga.com.au</a>, Website: <a href="http://www.talga.com.au">www.talga.com.au</a></td>
</tr>
<tr>
<td><strong>Australian Tea Tree Industry Association</strong></td>
<td></td>
<td></td>
<td></td>
<td>Secret, Secretary, PO Box 20, Email: <a href="mailto:secretary@attia.org.au">secretary@attia.org.au</a>, Website: <a href="http://www.teatree.org.au">www.teatree.org.au</a></td>
</tr>
<tr>
<td><strong>Essential Oils of Tasmania</strong></td>
<td></td>
<td>PO Box 162</td>
<td>KINGSTON TAS 7051</td>
<td>Tel: +61 3 6229 4222, Fax: +61 3 6229 2957, Email: <a href="mailto:eot@netspace.net.au">eot@netspace.net.au</a></td>
</tr>
</tbody>
</table>

### Goat
<table>
<thead>
<tr>
<th>Industry</th>
<th>Association</th>
<th>Address</th>
<th>Contact Details</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Australian Cashmere Growers Association</strong></td>
<td></td>
<td>KELLYVILLE NSW 2155</td>
<td></td>
<td>Mobile: 0500 500 284, Email: <a href="mailto:cashmere@acga.asn.au">cashmere@acga.asn.au</a>, Website: acga.org.au</td>
</tr>
<tr>
<td><strong>Dairy Goat Society of Australia</strong></td>
<td></td>
<td>PO Box 9048</td>
<td>TRARALGON VIC 3844</td>
<td>Tel: +61 3 5176 0388, Fax: +61 3 5176 0388, Email: <a href="mailto:dgsasec@bigpond.net.au">dgsasec@bigpond.net.au</a>, Website: home.vicnet.net.au/%7Edgsa/welcome.htm</td>
</tr>
</tbody>
</table>

---

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Goat Industry Council of Australia
Denise Riches
President
PO Box 1435
VICTOR HARBOUR SA 5211
Tel: +61 8 8552 6704
Fax: +61 8 8552 6730
Email: jnkdpi@bigpond.com
Website: www.gica.com.au

Mohair Australia Ltd
PO Box 22
NARRANDERA NSW 2700
Tel: +61 6959 2089
Fax: +69591817
Email: mohair@mohair.org.au

The Boer Goat Breeders’ Association of Australia
c/- ABRI, University of New England
ARMIDALE NSW 2351
Tel: +61 2 6773 5177
Fax: +61 2 6772 1943
Website: www.australianboergoat.com.au

Herb and spice
Australian Herb and Spice Industry Association
PO Box 45
BUNDABERG QLD 4670
Tel: +61 7 4153 3007
Fax: +61 7 4153 1322
Website: www.ahsia.org.au

Jojoba
Jojoba Australia Pty Ltd
Information and Marketing Division
PO Box 288
LEETON NSW 2705
Tel: +61 2 6953 6238
Mobile: 0437 500 391
Fax: +61 2 6953 8111
Email: orders@jojocare.com.au
Website: www.jojocare.com.au

Kangaroo
Kangaroo Industry Association of Australia
John Kelly
Development Manager
Tel: +61 3 6326 8639
Mobile: 0417 585 163
Email: kiaa@bigpond.net.au
Website: www.kangaroo-industry.asn.au/

Pulse
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Level 3
100 New South Head Road
EDGECLIFF NSW 2027
Tel: +61 2 9327 8588
Fax: +61 2 9327 1633
Email: ggibson@pulseaus.com.au
Website: www.pulseaus.com.au

Rabbit
Farmed Rabbit Industry of Australia Ltd
Chris Bushell
President
PO Box 95
MALLALA SA 5502
Tel: +61 8 8527 2049
Mobile: 0418 840 618
Email: bushmin@twpo.com.au
Website: www.fria.com.au

Tea
Australian Green Tea Growers’ Association
PO Box 286
MOUNT BEAUTY VIC 3699
Tel: +61 3 5754 5240
Email: agtga@bigpond.com

Tree nuts
Australia
John Kenez
Walnut Tree Association
5 Rolls Court
GLEN WAVERLY VIC 3150
Tel: +61 3 9802 8670
Fax: +61 3 9802 8670
Email: awiasec@walnut.net.au
Website: www.walnut.net.au

Australian Chestnut Growers Association
PO Box 130
CHILTERN VIC 3683
Tel: +61 3 5726 1155
Fax: +61 3 5726 1320
Email: info@macadamias.org.au

Australian Macadamia Society
Industry Development Officer
Suite 1, 113 Dawson St
LISMORE NSW 2480
Tel: +61 2 66224933
Fax: +61 2 6622 4932
Email: anic@riverland.net.au

Australian Pecan Growers Association
PO Box 52
BERRI SA 5341
Tel: +61 8 8582 2055
Fax: +61 8 8582 3503
Email: admin@chestnutsaustralia.com.au
Website: www.chestnutsaustralia.com.au

Australian Nut Industry Council
Secretary
PO Box 590
LISMORE NSW 2480
Tel: +61 2 6547 2782
Fax: +61 2 6547 2782

Austrian Chestnut Growers Association
PO Box 73
POREPUNKAH VIC 3740.
Tel: +61 3 5756 2052
Email: secretary@hazelnuts.org.au
Website: www.hazelnuts.org.au

Australian Pecan Growers Association
Secretary
PO Box 590
LISMORE NSW 2480
Tel: +61 2 6547 2782
Fax: +61 2 6547 2782

Exotic fruit
Australian Lychee Growers Association
65 Groves Rd
YEPPON QLD 4703
Tel: +61 7 4939 7018
Fax: +61 7 4939 7018
Email: grovegrow@bigpond.com
Website: www.australianlycheecomau.ozstaging.com

Tropical Exotic Fruit Association
TEFA Secretariat
PO Box 2007
PALMERSTON NT 0831
Tel: +61 8 8983 3233
Fax: +61 8 8983 3244
Email: info@tefa.com.au

Flowers
Australian Flower Export Council
Tel: +61 3 9258 6150
Email: exportcouncil@australianflowers.com.au
Website: www.australianflowers.org

Wildflowers Australia
Executive Officer
Tel: +61 7 5494 4935
Email: management@wildflowersaustralia.com.au
Website: www.wildflowersaustralia.com.au

Appendix C
References


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ABS 2008b, International Trade, electronic data service, cat. no. 5464.0, Canberra.

ABS 2008c, Agricultural Commodities: Small Area Data, Australia, 2005-06, cat. no. 7125.0, Canberra.


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Savage, G., Wasabi or Japanese Horseradish, Animal and Food Sciences Division, Food Group, Lincoln University, Canterbury, New Zealand (www.coppersfolly.co.nz/research/wasabi-review-paper.pdf).


This publication profiles 29 emerging animal and plant industries, and provides a picture of their overall worth to the Australian economy.

Together, these emerging industries had an estimated gross value of production of $912 million, equivalent to 2.6 per cent of the total value of Australian farm production in 2006-07. They earned an estimated export revenue of $465 million, or 6 per cent of total farm export revenue in 2006-07.

New and emerging animal and plant industries make significant contributions to the regions in which they operate by bringing diversity and resilience to the sector. They also contribute to the increasingly important niche and specialty food markets.

The importance of this report is that it provides basic statistical information for the new and emerging industries. As well as indicating the high aggregate value of the ‘new and emerging sector’, the report provides detailed statistical information for each new industry.

Of the emerging industries examined, those with a Gross Value of Production over $30 million per annum include game birds, goat meat, kangaroo, tree nuts, Asian vegetables, exotic tropical fruits, wildflowers and olives.

The Rural Industries Research and Development Corporation (RIRDC) manages and funds priority research and translates results into practical outcomes for industry.

Our business is about developing a more profitable, dynamic and sustainable rural sector. Most of the information we produce can be purchased or downloaded for free from our website www.rirdc.gov.au.