Chapter 7

PRIMARY INDUSTRY—NON-RURAL

FORESTRY

Introduction

Writing in 1891, the Government Statistician, R. M. Johnston, described the timber resources of the State as follows: "Tasmania is peculiarly a forest country. Trees of great dimension tower over and eclipse all the lesser undergrowths on plains, valleys, hills and mountain slopes. Of the 16,778,000 acres comprising the total area, there are only 75,500 acres occupied by lakes, and 488,354 acres of cultivated land only partially cleared of its timber trees. With the exception of minor areas on the tops of mountains or among the barren uplands of the Western Highlands, the whole of the rest of the country is occupied with an almost continuous virgin forest, mainly composed of the variable forms of Eucalypti (Gum Trees), one noted example of which, the Tolosa Blue Gum, has been recorded as measuring a height of 330 feet." In a later passage, he drew this conclusion: "With such a wealth of forest trees, Tasmania's sources of timber supply must be infinitely great, and, in the near future, must be of great industrial value."

It is doubtful whether this picture of an island almost completely forested was true, even when the early settlers arrived, since some of them established holdings on open savanna-like country which owed its origin to a long history of firing by the Tasmanian natives. Far away in the west and south were extensive areas of sedgeland and button-grass plain while the upper mountain country took on the appearance of moors. In the one hundred and sixty years or so since the first settlement, land clearing, timber exploitation and fires have left their mark and the Forestry Commission estimated the total forest area as 7,848,000 acres at 30th June, 1964, (i.e. approximately 46 per cent of the State's total area). By Australian standards, however, a State with 46 per cent of its area under forest is uniquely endowed.

Trees of the Tasmanian Forests

Forest Types

There are two basic types of forest in Tasmania, namely rain forest and sclerophyll forest, and their respective occurrence may be correlated with intensity of rainfall. The rain forest is principally located in the western half and also in the north-east highlands, the sclerophyll forest predominating elsewhere. In the Tasmanian situation, the sclerophyll forest can be regarded as eucalypt forest with very little loss of accuracy, so dominant are the eucalypts. The temperate rain forest is characterised by the dominance of *Nothofagus cunninghamii* (myrtle) and, to a lesser extent, of *Atherosperma moschata* (sassafras) and *Acacia melanoxylon* (blackwood). The exclusive appearance of myrtle types or of eucalypts is determined by rainfall factors. In areas with annual falls above 60 inches, the myrtle appears to exclude the eucalypts, while in areas averaging 45 to 60 inches myrtle is found as understorey cover to eucalypt

growth. Since the eucalypts are the most important Tasmanian source of timber, in general it can be said that the better quality forests grow in regions between the 30-inch and 60-inch isohyets. The most valuable eucalypts in such forests belong to the ash group and include *delegatensis*, *obliqua* and *regnans*. In areas with falls of less than 30 inches, the forests have *globulus* (blue gum), *linearis* and *pauciflora* (peppermint), *ovata* (swamp gum), *viminalis* (white gum) and also *obliqua* (stringybark).

Hardwoods and Softwoods

Tasmanian forests are now almost exclusively cut for hardwood, the principal indigenous softwoods having been heavily exploited in the past without effective regeneration; what softwoods remain are in remote and inaccessible areas. The principal varieties are *Athrotaxis selaginoides* (King Billy pine), *Dacrydium franklinii* (Huon pine) and *Phyllocladus aspleniifolius* (Celery-top pine). The scarcity of indigenous softwoods is being met, in part, by the creation of exotic plantations, the principal growth being *Pinus radiata*, but at 30th June, 1964, the softwood plantations (26,000 acres) accounted for only 0.3 per cent of the State's total forested area.

Demand for Forestry Products

Timber was always in demand as a fuel, and as a building and construction material from the days of the original settlement, but the major impetus to increased forestry activity came in 1938 when paper mills were established at Burnie, technology having advanced to the point where native hardwoods could be used as the basic raw material. The possibility of using eucalypts for paper manufacture had been investigated in the previous century by Sir Ferdinand von Mueller, the celebrated botanist, and he concluded that eucalypts provided a bark which was suitable for the manufacture of paper, not only for the coarser varieties but also for printing and writing. In actual fact, when paper making was begun at Burnie, the process involved discarding the bark and converting whole peeled billets to pulp. Shortly afterwards, the only newsprint mill in Australia was established at Boyer on the Derwent and more recently, a semi-chemical pulp mill has begun operations at Geeveston in the south. Further utilisation of forestry products has been introduced by factories producing plywood, hardboard, particle board, &c.

Forest Area

In the following table, details are shown of Tasmania's total forest area, including its location on Crown or private land:

Classification of Forest Area (Gross) at 30th June, 1964
('000 Acres)

Forest Area	Located on—		Total
	Crown Land	Private Land	
Exploitable—Hardwood ..	3,985	1,597	5,582
Softwood	18	8	26
Total	4,003	1,605	5,608
Potentially Exploitable Hardwood	779	..	779
Other Areas Classified as Forest..	944	517	1,461
Estimated Total Forest Area..	5,726	2,122	7,848

The previous table includes all forests and plantations, whether easily accessible or not, and also the forested areas in scenic reserves. The next table gives details of that part of the total area which is under reservation:

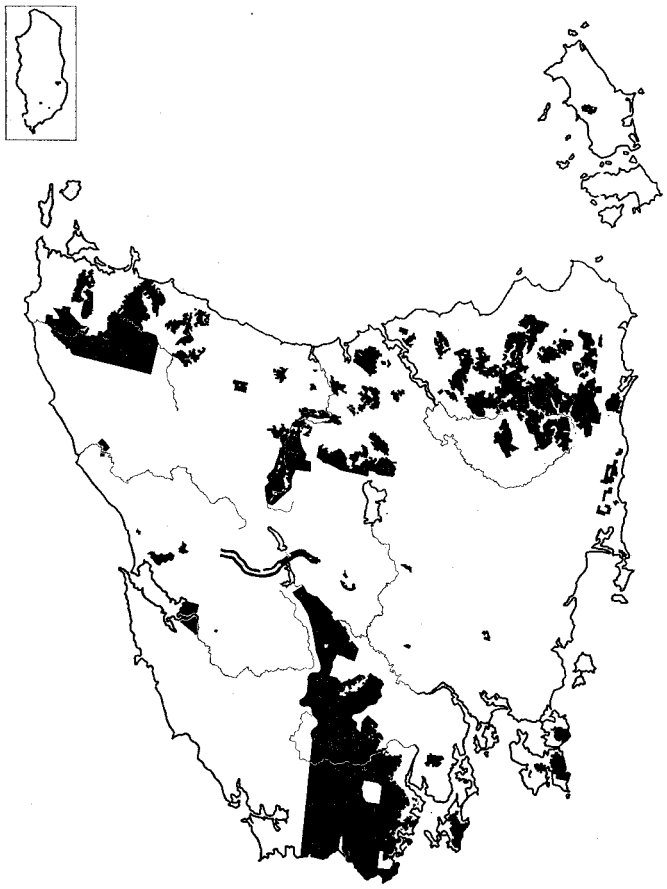
Forest Area (Gross) Under Reservation at 30th June, 1964
('000 Acres)

Particulars	Pulpwood Concessions	Exclusive Forestry Permits	Scenic Reserves (*a*)	Other	Total
State Forests (*b*)	465	263	..	1,663	2,391
Timber Reserves (*c*)	..	..	..	138	138
Other Forested Reserves	612	370	235	..	1,217
Total	1,077	633	235	1,801	3,746

(*a*) Estimated forested component of national parks and scenic reserves.

(*b*) Land permanently dedicated to timber production.

(*c*) Land reserved for timber supply, including fuel.



Distribution of State Forests

The area of plantations of exotic pines at 30th June, 1964, was 26,059 acres, of which 7,677 acres were on private land.

Classification of State Forests

The classification by the Forestry Commission of the State Forests is a continuous process and a large section still remains unclassified. The position is as follows:

Classification of State Forests at 30th June, 1964
('000 Acres)

Particulars	Area	
Commercial Forest—		
Eucalypt (sawlog quality)	492	
Eucalypt (pulpwood and firewood)	241	
Regrowth (immature forest)	191	
Rain Forest (myrtle, sassafras, &c.)	222	
Cleared Land (deforested areas)	50	
Total Productive Forest		1,196
Protection Forest—		
Scrubland and Plains	325	
Barren and Waste	255	
Total Unproductive Forest		580
Total Classified Forest		1,776
Total Unclassified Forest		763
Total State Forest		(*a*) 2,539

(*a*) Includes area as proclaimed at 30th June, 1964 (2,391,291 acres) plus 147,516 acres, the additional area disclosed by revised mapping.

The State forests are located, in the main, in four distinct regions: (i) far north-west about the axis of the Arthur River; (ii) north-eastern highlands; (iii) north and north-west of the Great Lake; (iv) from the south coast north to Lake King William.

Paper and Newsprint Industries

The establishment of paper, paper pulp and newsprint industries in the State has given rise to the need for some guarantee of assured timber supplies to the manufacturers, and therefore certain concessions and cutting rights have been awarded on Crown lands. Details follow.

Burnie and Wesley Vale

Associated Pulp and Paper Mills Ltd. and subsidiaries—manufacturer of paper and hard lining-board at Burnie and also of particle board at Wesley Vale. The company owns some forested land and holds cutting rights over Crown lands 15 miles each side of the Emu Bay railway line from the coast to the Pieman River. Particle board manufacture is based on northern *Pinus radiata* plantations.

In September, 1965, plans were announced for installation within three years of the first paper machine at Wesley Vale, the programmed output of the plant to be 30,000 tons of fine paper a year, thus increasing present capacity available at Burnie by up to 30 per cent; the first machine is to operate on imported pulp. A second machine, operating on native eucalypt pulp, is then

to be installed and the general programme, subject to favourable economic conditions, envisages duplication at Wesley Vale of the company's Burnie operations. Large areas of Crown land in the north and north-east will provide the raw material for the Wesley Vale plant.

Boyer

Australian Newsprint Mills Ltd.—manufacturer of newsprint at Boyer on the Derwent. The company's concession follows the general line of the Derwent as far north as Lake King William.

In September, 1965, plans were announced for installation of a third paper-making machine with the object of raising capacity from 90,000 to 160,000 tons of newsprint a year; subject to favourable economic conditions, the new machine should be in operation within three years.

Geeveston

Australian Paper Manufacturers Ltd.—manufacturer of paper pulp at Geeveston on the Huon River. The company's pulpwood concession includes virtually the whole D'Entrecasteaux Channel coastline and extends west as far inland as the Mt. Picton area; also included in the concession are Bruny Island and Tasman Peninsula.

Multiple Use of the Forests

The establishment of paper-making industries in Tasmania has required careful use of existing forests and the Forestry Commissioners described the process in their 1960 report as follows:

"In respect of timber products, pulpwood and sawmill logs will come from the same areas and often the same trees. In this, the co-operation of the wood-using industries is already functioning well. Sawmill logs come out of both the A.N.M. and A.P.P.M. concession areas. Pulpwood is cut from areas cut by sawmillers or in conjunction with mill-log production; sawmill edgings and offcuts are delivered to the pulp mill at Burnie." In their 1964 report, the Commissioners made this point: "The increased demand for pulpwood has led to the utilisation of trees and timber that would otherwise have been wasted."

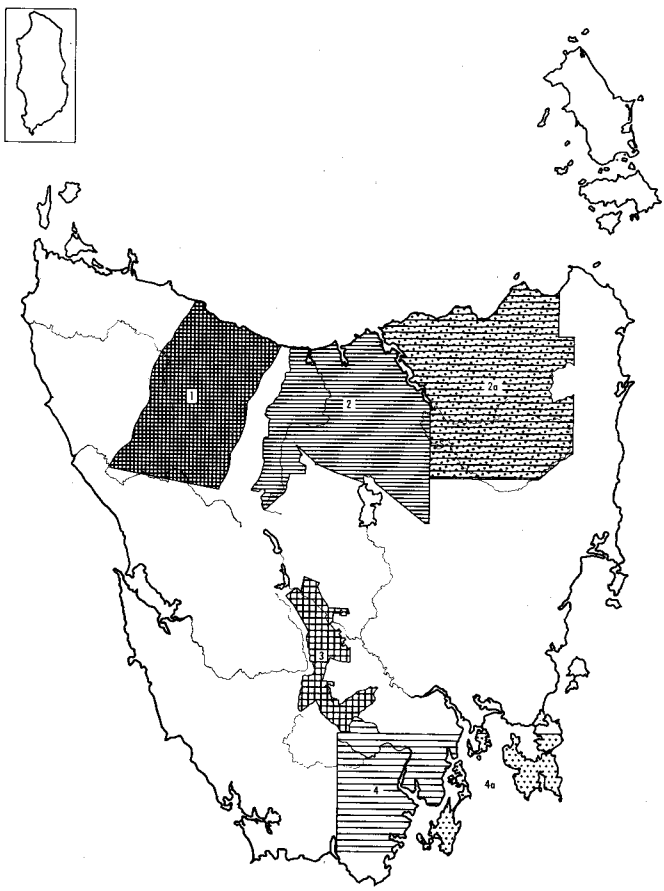
Two obvious examples of multiple use are as follows: (i) pulpwood obtained as a by-product from mill-logging; (ii) waste from sawmilling operations used as a raw material in pulp and hardboard making. Despite this rational approach to more complete utilisation of timber resources, supplies are not inexhaustible and the Commissioners sounded this warning note in their 1964 report: "In Tasmania, as well as in all the other States which depend on native forests for the supply of sawn timber, sawmilling is now dependent on the capacity of the industry to produce timber of acceptable grades and at acceptable prices from trees of lower quality than have been used in the past. Accessible virgin forests are dwindling. The problem is to maintain existing levels of production until advanced regrowth and softwood plantations can bridge the gap."

Employment in Forestry and Milling

The table that follows shows employment at the 30th June in forestry and in associated milling activities for a four-year period:

Persons Employed in Forestry and Milling at 30th June

Particulars	1961	1962	1963	1964
Persons Employed by Forestry Commission—				
Professional Staff (Foresters, &c.)	33	32	35	39
Non-professional Field Staff	85	87	96	94
Clerical Staff	80	85	88	85
Other Labour	230	298	341	399
Other Persons Working in Forestry and Milling—				
Professional Staff (Foresters, &c.)	12	15	14	13
Non-professional Field Staff	31	34	36	38
Clerical	17	23	22	24
Extraction (felling, carting, &c.), Milling (sawing, peeling, slicing or pulping)	5,265	4,831	5,463	5,797
Other Labour	126	128	116	136
Total	5,879	5,533	6,211	6,625



Disposition of timber concession areas

(1),(2) and (2a) : A.P.P.M.
(3) : A.N.M.
(4) and (4a) : A.P.M.

In the previous employment table, the extraction of forest products (felling, carting, &c.) and their processing (sawing, peeling, slicing or pulping) are treated as associated activities; however, for purposes of estimating value of production, the two types of activity are treated separately as indicated in the following section dealing with definitions.

Definition of Forest Production

The cutting of logs in a forest and the production of sawn timber in a mill seem closely related activities and may both, in fact, be conducted by a single operator with the same team of employees; similarly, the cutting of pulpwood and its later conversion to newsprint or fine paper may be viewed, in a broad sense, as a single activity. For statistical purposes, however, sawmills, paper mills, newsprint mills, &c. are classified as factories and the raw materials on which they operate—logs, &c.—are treated as the product of the forestry sector of primary industry. It necessarily follows that the definition of forest production must be restricted to include only the output of logs, hewn timber, firewood, tanning bark, &c. before such products have passed into the sector covered by factory statistics (e.g. logging is a forestry activity, sawmilling a factory activity). Some forestry products, as just defined, (e.g. fence posts and rails, hewn sleepers, firewood, &c.) may go direct to the final consumer without passing as a raw material to the factory sector.

Subsequent tables dealing with forest production give details of quantity and value; the following definitions apply:

Measurement of Volume

There are three convenient units for expressing the volume of timber, namely cubic feet, true super feet and hoppus super feet. The volume in true super feet can be derived from this relationship:

(i) Volume in true super feet = Volume in cubic feet × 12. (A true super foot is the volume equivalent to a solid body, one foot long by one foot wide by one inch thick.)

The remaining measure, hoppus super feet, is used in the forest to record log volumes and is derived from the following formula for dealing with round timber:

(ii) Volume in hoppus super feet = (One quarter the average girth in inches) squared, the result being multiplied by the length in feet and divided by 12.

The relationship between hoppus super feet and true super feet can be stated as follows:

$$\text{(iii)}\quad \frac{\text{Volume in hoppus super feet}}{\text{Volume in true super feet}} = \frac{\pi}{4} = 0.7854$$

In this section, the volume of logs, timber, etc. is expressed in true super feet, some data originally received in terms of hoppus super feet having been converted.

Value of Forest Production

Gross Value of Production is the value placed on the recorded production at the wholesale price realised in the principal markets. In cases where forestry products are consumed at the place of production or where they become raw

material for a secondary industry, these points of consumption are presumed to be the principal markets (e.g. the value of logs cut for sawmilling is the value on the mill skids, analogous to "value at the factory door" for the input of raw materials in general factory statistics).

Local Value (i.e. gross production valued at the place of production) is ascertained by deducting marketing costs from gross value. Marketing costs include freight, cost of containers, commission, and other charges incidental thereto.

In other production sectors, local value of production is further reduced by subtracting the value of materials used in the process of production, the final figure being *net value of production.* In the forestry sector, however, these data on the cost of materials are not available and therefore the only two measures available are: (i) gross value of production, and (ii) local value of production. (In logging operations, a principal material used in the process of production is fuel used in motor-driven saws, haulage vehicles and haulage equipment.)

Source of Production Data

The principal source of data are the returns of the various establishments classified as factories (e.g. sawmills, newsprint mills, paper mills, plywood mills, etc.) and these establishments report their log input, their pulpwood input or their input of sawmill edgings and offcuts; other data are available from the State Forestry Department and from the Bureau's own trade statistics showing exports.

Statistics of Forest Production

The following table shows details of forest production in 1963-64, dissection between Crown and private land being available for log and firewood production:

Forest Production, 1963-64

Product	Obtained From—		Total
	Crown Land	Private Land	
Logs for sawing, peeling, slicing or pulping—			
Forest hardwoods ..('000 sup. ft.)	441,982	183,477	625,459
Indigenous softwoods ..('000 sup. ft.)	3,215	77	3,292
Plantation grown pines ..('000 sup. ft.)	13,045	7,360	20,405
Total logs—quantity ..('000 sup. ft.)	458,242	190,914	649,156
gross value ..($'000)	(*a*)	(*a*)	11,459
Hewn and other timber (not included above)—			
Firewood (weight) .. .. ('000 tons)	31	379	410
Other (gross value) (*b*) ..($'000)	(*a*)	(*a*)	398
Gross value of hewn and other timber ($'000)	(*a*)	(*a*)	2,227
Other forest products (gross value) (*c*) ..($'000)	(*a*)	(*a*)	13
Total gross value of forest products ($'000)	(*a*)	(*a*)	13,699

(*a*) Available only in total.

(*b*) Includes sleepers, transoms, girders, bridge timbers, mining timber, poles, piles, &c.

(*c*) Principally bark for tanning.

In the previous table, log production is a composite figure including the log input of sawmills and the log equivalent of cords of pulpwood taken into paper mills and newsprint mills.

Production Summary

The next table shows details of forest production for a four-year period on a basis comparable with the 1963-64 analysis:

Forest Production

Product	1960-61	1961-62	1962-63	1963-64
Logs for sawing, peeling, slicing or pulping—				
Forest hardwoods .. (mill. super. ft.)	603.8	510.9	567.9	625.5
Indigenous softwoods (mill. super. ft.)	4.0	4.8	2.5	3.3
Plantation grown pines (mill. super. ft.)	9.9	11.5	13.8	20.4
Total logs—quantity (mill. super ft.)	617.7	527.2	584.2	649.2
gross value .. ($'000)	10,791	9,214	10,724	11,459
Hewn and other timber (not included above)—				
Firewood (weight) .. .. ('000 tons)	374	419	418	410
Other (gross value) (*a*) .. ($'000)	494	611	440	398
Gross value of hewn and other timber ($'000)	2,315	2,490	2,384	2,227
Other forest products (gross value) (*b*) ..($'000)	26	16	18	13
Total gross value of forest products ($'000)	13,132	11,720	13,126	13,699

(*a*) Includes sleepers, transoms, girders, bridge timbers, mining timber, poles, piles, &c.
(*b*) Principally bark for tanning.

Tasmanian and Australian Log Production

In the previous table, log production is defined as relating to "logs for sawing, peeling, slicing or pulping", (i.e. it includes logs destined for sawmills and also the log equivalent of pulpwood for processing in newsprint mills, paper mills, &c.). In terms of this definition, Tasmania is a major producer, the State's log production approaching 17 per cent of the Australian total in 1963-64; the ranking of the major producers was Victoria with 24.0 per cent and N.S.W. with 22.4 per cent. Considering Tasmania's small relative size and population, it is apparent that forest production is one of its more important contributions to the Australian economy.

Summary—Gross and Local Value of Production

The following table gives details of gross and local values of forestry production for a four-year period:

Gross and Local Value of Forestry Production ($'000)

Particulars	1960-61	1961-62	1962-63	1963-64
Gross Value (Gross Production Valued at Principal Markets)	13,132	11,720	13,126	13,698
Less Marketing Costs	1,662	1,540	1,812	2,060
Local Value (Gross Production Valued at Place of Production)	11,470	10,180	11,314	11,638

Values Derived From Factory Processing

For statistical purposes, some forest products are treated as passing through two sectors, namely (i) the forestry sector of primary production, and (ii) the factory sector. This treatment is necessary to the extent that the finished

product of one sector may become the raw material of another (e.g. logs from the forestry sector pass to sawmills in the factory sector). To view the timber industry as a whole, it is necessary to take account of factory processing. The next table shows details of processing in the two most important factory sub-classes, namely sawmills and paper mills:

Factory Processing of Forest Products, 1963-64
Factory Class X, Sub-class 1—Sawmills
Factory Class XII, Sub-class 9—Paper Making

Item	Sawmills	Paper Making	Total
Factories Working .. .. (No.)	305	4	309
Average Workers (*a*) .. (No.)	2,754	3,373	6,127
Value of Output .. ..($'000)	23,952	41,114	65,066
Value of Production (*b*) ..($'000)	9,366	20,677	30,043

(*a*) Average whole year, including working proprietors.

(*b*) Value of output less recorded costs of manufacture, other than labour.

The previous table does not include factory sub-classes X-2 (plywood mills), X-10 (wall and ceiling boards) or minor processors of untreated forest products; total values of output and production would be increased as much as five per cent by their inclusion. (Fuller details of factory processing appear in Chapter 8, "Secondary Industry—Manufacturing".)

Timber and Timber Products

Mill Production of Timber

Particulars of logs treated and the production of sawn, peeled and sliced timber by sawmills and plywood mills are shown in the following table; the figures have been compiled from the annual factory collections and show the geographical distribution of milling activity (pulpwood treatment is excluded):

Logs Treated and Sawn Timber Produced, 1963-64

Statistical Division	Logs Treated (True Volume)		Sawn, Peeled or Sliced Timber Produced
	Quantity	Proportion of Total	
	'000 super ft.	Per Cent	'000 super ft.
South Central	14,183	3.2	6,524
North Central	29,949	6.8	11,267
North West	146,302	33.2	54,570
North East	69,107	15.7	25,971
North Midland	33,053	7.5	12,282
Midland	53,594	12.2	19,929
South East	21,791	4.9	9,354
Southern	61,191	13.9	25,779
Western	11,161	2.6	5,181
Total	(*a*) 440,331	100.0	170,857

(*a*) Hardwood logs, 425,219,600 super feet; softwood logs, 15,111,400 super feet; approximately 20 per cent of softwood logs were indigenous, the balance coming from plantations.

In the previous table (from which the pulpwood cut for paper mills is excluded), the principal centres of sawmilling activity are shown to be the North West, the North East, the Southern and the Midland Statistical Divisions.

These are the Divisions in which the major part of the State Forests is located. If pulpwood cutting were taken into account, the only effect would be to further emphasise the relative importance of these areas in which the major pulpwood concessions also are located.

Output and Exports

The following table shows timber production by mills for a four-year period, together with exports of sawn timber:

Production and Exports of Sawn Timber

Particulars	1960-61	1961-62	1962-63	1963-64
LOGS TREATED ('000 Super Feet)				
Hardwood	408,475	364,187	397,705	425,220
Softwood	13,899	13,207	15,568	15,111
Total	422,374	377,394	413,273	440,331
SAWN, PEELED OR SLICED TIMBER PRODUCED FROM LOGS ABOVE (*a*) ('000 Super Feet)				
Hardwood	159,399	142,767	153,729	164,946
Softwood	5,135	6,218	6,135	5,911
Total	164,534	148,985	159,864	170,857
VALUE OF TIMBER AT ROUGH SAWN STAGE ($'000)				
Total	13,937	12,989	12,788	14,317
EXPORTS OF SAWN TIMBER (*b*) ('000 Super Feet)				
Total	63,421	56,800	60,591	71,398
VALUE OF EXPORTS OF SAWN TIMBER (*b*) ($'000)				
Total	9,553	8,589	9,858	11,175

(*a*) Rough sawn timber including that subsequently dressed to produce flooring, weatherboards, &c.

(*b*) Includes dressed and undressed timber.

Comparison

In the treatment of logs as defined in the previous table (i.e. basically of logs for sawmilling), Tasmania contributed 13.0 per cent to the Australian total in 1963-64. The Tasmanian volume of logs treated was below that of all States except S.A. but its production of sawn, peeled or sliced timber far exceeds the demand generated by its relatively small population, a factor which accounts for considerable Tasmanian interstate exports of timber.

Employment

The next table shows the number of sawmills and the number of persons employed:

Number of Sawmills and Persons Employed (*a*)

Particulars	1960-61	1961-62	1962-63	1963-64
Number of Sawmills	326	327	322	305
Average Number Employed During Year—				
Males	2,661	2,548	2,560	2,701
Females	53	53	37	53
Persons	2,714	2,601	2,597	2,754

(*a*) In mills; excludes those engaged on logging operations.

Production of Wood Pulp and Paper

Details of paper and newsprint production are not available for publication but wood pulp figures are an indicator of activity.

Wood pulp is the basic material in the production of paper, newsprint, &c. and is made by any one of three processes, namely mechanical, chemical, or mechanical and chemical combined; the last process is referred to as "semi-chemical". The basic technological problem in producing satisfactory pulp from some eucalypt species, and from some other pulpwoods, was related to the relative shortness of their wood fibre; in the semi-chemical process, the preliminary chemical treatment of the wood reduces the amount of grinding required and thus prevents excessive fibre destruction. The following table shows production of this material over a four-year period, together with employment details for the industry:

Factor Class XII, Sub-Class 9—Paper Making

Particulars	1960-61	1961-62	1962-63	1963-64
Number of Establishments	3	3	4	4
Average Number Employed During Year—				
Males	2,651	2,631	2,727	2,863
Females	442	411	471	510
Persons	3,093	3,042	3,198	3,373
Wood Pulp Produced (*a*) .. (Tons)	116,785	116,082	136,188	157,413

(*a*) Ground wood pulp, chemical and semi-chemical pulp.

In the previous table, figures for wood pulp should be regarded only as an index of production since the pulp is an "intermediate" product which has still to be converted to fine paper, newsprint, &c.

Role of the Forestry Commission

The State Forestry Commission is primarily concerned with the conservation of Tasmania's forests; this requires that it should exercise control over the rate at which logs and pulpwood are taken, and also that it should introduce effective measures to ensure regeneration. Other important functions include:

(i) fire prevention and suppression; (ii) road construction to give access to forests; (iii) development of plantations. Some concept of the scope of Forestry Commission activities can be obtained from the following table:

Summary—Activities of Forestry Commission (*a*)

Particulars	1960-61	1961-62	1962-63	1963-64
Production of Seedlings .. ('000)	1,772	1,333	803	823
Plantations—				
Established .. .. (acres)	1,039	935	1,224	1,235
Pruned .. .. (acres)	2,721	1,899	3,538	3,178
Thinned .. .. .. (acres)	163	235	366	489
Firebreaks—				
Constructed .. .. (miles)	28	106	47	105
Secondary Roads—				
Constructed .. .. (miles)	17	68	59	77
Improved.. .. .. (miles)	..	55	27	12
Major Roads—				
Constructed .. .. (miles)	17	24	25	24

(*a*) Source: Reports of Forestry Commission.

At 30th June, 1964, the Forestry Commission was responsible for the maintenance of 1,277 miles of major and secondary forest access roads; of this total, 1,033 miles had been constructed by the Commission, the balance by sawmillers.

Fire Protection

The Commission has a responsibility for preventing and fighting forest fires; losses through bush fires are reported in the following table:

Bush Fires (*a*)

Year	Fires Reported	Area Burnt				Cost of Suppression
		State Forest	Other Crown Land	Private Property	Total	
	No.	Acres	Acres	Acres	Acres	$
1960-61	479	119,439	224,160	91,045	434,644	252,346
1961-62	137	7,760	15,982	4,162	27,904	21,316
1962-63	126	6,001	11,640	17,641	35,282	17,918
1963-64	252	19,706	35,352	11,460	66,518	72,624

(*a*) Source: Report of the Forestry Commission.

Finances of the Forestry Commission

The main revenue of the Forestry Commission is derived from royalties, i.e. charges paid by those taking timber from Crown lands. By law, such revenue is specifically reserved for expenditure on forestry. The next table has been compiled to show the revenue and expenditure of the Commission for the last four years; expenditure exceeds revenue since money from State loan funds devoted to forestry purposes is included in expenditure.

Forestry Commission—Revenue and Expenditure
($'000)

Particulars	1960-61	1961-62	1962-63	1963-64
REVENUE				
Royalties	1,048	910	1,007	1,115
Sale of Forest Products	4	29	45	61
Other	23	25	37	35
Total	1,075	964	1,089	1,211
EXPENDITURE (*a*)				
Administration—				
Revenue Collection	94	120	128	136
Forest Management	346	374	375	383
General	245	279	331	391
Forest Works—				
Road Construction	365	433	451	763
Building and Other	53	51	66	38
Afforestation and Reforestation	387	181	287	293
Forest Protection (n.e.i.)	203	329	298	225
Mapping and Surveys	61	38	45	52
Land Purchases	7	4	5	9
Purchase, Plant and Equipment	16	60	68	96
Total	1,777	1,869	2,054	2,386

(*a*) Aggregate expenditure from all sources, i.e. Consolidated Revenue, Loan and Trust Funds.

MINING

Introduction

For statistical purposes, mining is taken to cover the operations normally thought of as mining and quarrying (i.e. the removal from underground or surface workings of ores, &c.), the recovery of minerals from ore dumps, tailings, &c. and ore dressing (i.e. concentration and other elementary treatment). It does not include the smelting and/or refining of metallic minerals or the processing of non-metallic minerals (e.g. limestone into cement). These are classified as manufacturing.

In the present Tasmanian economy, three metals have an important place: aluminium, produced at Bell Bay on the Tamar; zinc at Risdon near Hobart, and copper at Mt. Lyell on the west coast. In terms of the previous definition, the three metals are considered to be the output of manufacturing and only a small part of their value is attributable to the mining industry in Tasmania. In the case of aluminium, no Tasmanian ores or concentrates are used and no value accrues to the Tasmanian mining industry. A substantial part of the value of the aluminium is, in fact, accounted for by imported materials. Zinc is produced from both imported and locally-produced concentrates, but only the value of the local concentrates produced at Rosebery is included in the Tasmanian mining industry. Copper is produced entirely from locally-produced concentrates, the whole operation, from mining the ore to producing the refined copper, being integrated at the one location in the Mt. Lyell area. In this case, a division of the one establishment is made into mining (covering operations up to the concentration stage) and manufacturing (smelting and refining).

Source of Information

(i) Employment, Production Costs, Values of Output and Production, &c.—An annual census of mines and quarries is conducted by the Bureau of Statistics and details are collected for calendar years. The main table, covering materials used, salaries and wages, &c., is compiled for mines and quarries employing four or more persons, thus achieving uniformity with other Australian States. Value of output is shown in two ways, either for all mines and quarries, or for mines and quarries employing four or more persons.

(ii) Data appearing on quantities produced, assayed contents, &c. are obtained primarily from the State Mines Department, with supplementary information from the Bureau's annual census of mines and quarries and from the Commonwealth Bureau of Mineral Resources.

Importance of West Coast

The main mineral wealth of the State is derived from mines on the west coast, the chief centres being Queenstown (copper ores) and Rosebery (zinc-lead ores). The region lies generally within the belt of heaviest rainfall and is in the most rugged and mountainous part of the island. Vegetation reflects the heavy rainfall; Charles Gould's geological party in 1862 took 25 days to cover barely 15 miles from the Queen River to Strahan—and they were hurrying, not prospecting.

Mining towns rise and fall, the two obvious Tasmanian examples being Waratah and Zeehan. The great Bischoff tin mine explains the foundation of Waratah, galena and silver mines of Zeehan; as production declined, so did these towns. Queenstown still holds its population despite 70 years of constant exploitation of the copper ores in the region. The full account of the opening up of this very difficult country is obviously beyond the scope of this chapter but a chronology follows giving details of some of the principal events; 1936 is used as a terminal date because this was the year in which the Rosebery mines re-opened.

West Coast Mining Chronology

1642 Tasman sighted Mt. Heemskirk and Mt. Zeehan, his erratic compass suggesting that an iron mass lay somewhere to the east.

1798 Bass and Flinders circumnavigated Tasmania, naming the peaks of Heemskirk and Zeehan after Tasman's vessels.

1815 James Kelly circumnavigated Tasmania in an open whale boat, discovering Port Davey and Macquarie Harbour.

1821 Convict settlement established in Macquarie Harbour to use timber for ship building; closed down 13 years later.

1862 Charles Gould, the government geologist, sent on search for gold; entered the Linda Valley and camped close to the Iron Blow (the outcrop which eventually started the Mt. Lyell copper boom). He found small traces of unpayable gold and named the principal peaks in the area—Owen, Jukes, Sedgwick, Huxley, Darwin and Lyell.

1871 James Smith discovered tin at Mt. Bischoff. Activity in this area provided a base for penetration by land from the north.

1875 Tin smelters fired at Launceston to handle Mt. Bischoff tin.

1876 Charles Sprent crossed Pieman River, finding tin and gold near Mt. Heemskirk.

1878 Tin mining commenced at Heemskirk.

1879 Opening up of the Pieman gold-fields.

1881 Trial Harbour established as a port for the mining fields. Cornelius Lynch struck gold five miles from Mt. Lyell.

1882 Frank Long discovered silver-lead ore near Zeehan.

1883 Western miners on four fields—Mt. Bischoff (tin), the Pieman (gold), Heemskirk (tin) and King River (gold). The McDonough brothers (known as the Cooneys) and Johannes Karlson discovered the Iron Blow near Linda Creek in the Mt. Lyell area.

1885 The Iron Blow blasted in search for reef gold.

1888 The Mt. Lyell Gold Mining Company formed to work the Iron Blow. Silver boom filled Zeehan-Dundas area with syndicates and companies.

1889 Steam mill used to crush ore from the Iron Blow and produce gold.

1890 Government commenced construction of three foot six inch gauge railway Strahan to Zeehan, since Trial Harbour was unsatisfactory as a port.

1891 159 companies and syndicates in the Zeehan-Dundas silver fields. Collapse of first silver boom due to general financial crisis, bank failures, &c. The owners of the Iron Blow gold mine decided to sell out to investors interested in its possibilities as a copper mine.

1892 Mt. Lyell Mining Company carried out first copper smelting trials on Iron Blow ore.

1893 Formation of Mt. Lyell Mining and Railway Company Ltd. Discovery of complex zinc-lead ores at Rosebery; smelting technology later defeated by zinc content.

1894 Iron Blow copper mine yielded large pocket of high grade silver ore, giving a return sufficient to allow further development.

1895 Robert Carl Sticht supervised installation of copper smelting plant brought into Mt. Lyell before rail communication established to Macquarie Harbour.

1896 Sticht's copper smelting technique successful.

1897 Official opening of copper smelters and of Mt. Lyell railway from mines to Teepookana on the King River. Great copper boom in progress with dozens of companies capitalising on the name "Lyell", e.g. Mt. Lyell Anaconda, Mt. Lyell Comstock, Mt. Lyell Tharsis, &c. Bar at Macquarie Harbour entrance gave depths of only nine to 11 feet. Teepookana the chief port for the Lyell mines.

1898 Strahan Marine Board formed with commission to deepen the entrance to Macquarie Harbour. Three major railway constructions under way, each operator hoping to monopolise transport to the fields; Mt. Lyell company, with the unfinished linking of Teepookana to Strahan; the North Mt. Lyell company, building from Linda to Kellys Basin; the Emu Bay company pushing its line south from Waratah. In the same year, smelters were established at Zeehan, main prize being silver. The Mt. Lyell company put out nearly 5,000 tons of blister copper, in addition to recovering large quantities of gold and silver.

1899 Completion of Mt. Lyell line through Teepookana to Strahan. West coast mining areas had a peak population approaching 25,000 persons, railway construction employing many workers.

1900 Completion of North Mt. Lyell railway from Linda to Kellys Basin. Emu Bay line linked to Zeehan by junction with Dundas line. Over-capitalisation obvious in transport: Zeehan fields with two railways linked to two ports (Strahan and Burnie); Lyell fields with two railways linked to three ports (Strahan, Burnie and Kellys Basin). Mt. Lyell company produced nearly 10,000 tons of copper.

1901 Census established that, of State's eleven largest cities and towns, four were West Coast mining centres and two were ports serving the area. North Mount Lyell copper smelting operations at Crotty a failure.

1902 Sticht smelted Mt. Lyell copper without use of coke, i.e. he perfected pure pyritic smelting. Later operations used coke in very small quantities.

1903 Amalgamation of Mt. Lyell and North Mt. Lyell companies. Close-down of smelters at Crotty and use of Strahan as port in preference to Kellys Basin. Mixture of Iron Blow ore with North Mt. Lyell ore improved smelting operations.

1905 Export of pyritic ore for superphosphate manufacture at Yarraville.

1909 Smelters at Zeehan closed down for lack of suitable silver ore. Galena lodes not payable below the 600 foot level.

1911 Zeehan smelters re-opened but problem of profitably smelting silver ores with high zinc content still not solved.

1914 Generation of hydro-electric power at Lake Margaret by Mt. Lyell Co. and electrification of much machinery at copper refineries.

1918 First refined zinc produced at Risdon near Hobart by Electrolytic Zinc Company—basic concentrates imported from Broken Hill mines in N.S.W.

1922 Earlier direct copper smelting method at Mt. Lyell replaced by flotation process for concentration prior to smelting. Copper prices so low that many producers in Australia and overseas closed down but Mt. Lyell kept working.

1925 Electrolytic zinc process at Risdon started to use Rosebery zinc concentrates.

1928 First cathode copper produced by electrolytic process at Mt. Lyell.

1930 Mining of Rosebery zinc-lead ores suspended due to low world price of zinc.

1932 Completion of direct road link, Hobart to Queenstown.

1936 Resumption of Rosebery mining on larger scale.

While this account of events on the west coast gives some background to the present production of copper and zinc, it fails to record activity in other parts of the State or to cover the mining of numerous other minerals. The next section deals with each product separately and on a State basis.

Historical

Supply and Demand

While Tasmanian farm and factory activity over the years has displayed, in the main, an orderly pattern of growth, mining activity has been subject to frequent and severe fluctuations, the result of changes in supply and demand as reflected in the market price of particular metals. Examples of factors contributing to this relative instability are: (i) *Supply*—the possible fall in prices when major fresh discoveries are worked in other countries; (ii) *Demand*—the possible rise in prices when war, or fear of war, leads to large-scale purchases

of particular metals; (iii) *Technological change*—for example, the invention of the ball point pen; osmiridium, used for tipping fountain pen nibs and once produced in large quantities in Tasmania, suffered a resulting decline in value.

Definition of Mining

Unfolding the record of the various minerals produced in the State is made difficult by the manner in which previous official mining statistics were compiled. In current statistics, a distinction is made, in broad terms, between mining a mineral and subsequently refining it to obtain its metallic content—the second process is treated as manufacturing and included under Class IV in factory statistics. However, this distinction was not made in earlier statistics and therefore historical comparisons cannot be made with any accuracy. A further difficulty occurs with regard to the value of ores which, in older series, were valued, in the main, according to the world price for their estimated metallic content, irrespective of whether the extraction was carried out in Tasmania itself, in other States or in oversea countries. Thus the earlier historical value series is inflated and does not reflect the true earnings of mineral producers within the State. In the evolution of a proper basis for current mining statistics, the chief requirement was to satisfactorily define a border between mining and factory activities and, for Tasmanian data, this was not accomplished until 1952 when the Bureau of Census and Statistics conducted its first annual mining census.

Because of the definitional difficulties just listed, the historical account of mining in the State has been deliberately restricted largely to details of physical production, other measures such as employment, value of output, &c., not being comparable with those used in the current series commencing 1952.

Coal

Early Fields

The site of Tasmania's first mine was on Tasman Peninsula when the convicts from Port Arthur dug out 60 tons of coal in 1834. Highest production was 10,400 tons in 1840 but, within three years, the work ceased due to the poor quality of the coal and discoveries at other sites, namely Schouten Island and near Southport; in the 1850's further discoveries were made near Latrobe in the Mersey Valley and near Bicheno on the east coast. The island's principal coalfields eventually were opened up in the Fingal Valley in the north-east, and the following table shows the localities producing coal at the time of their discovery (1886):

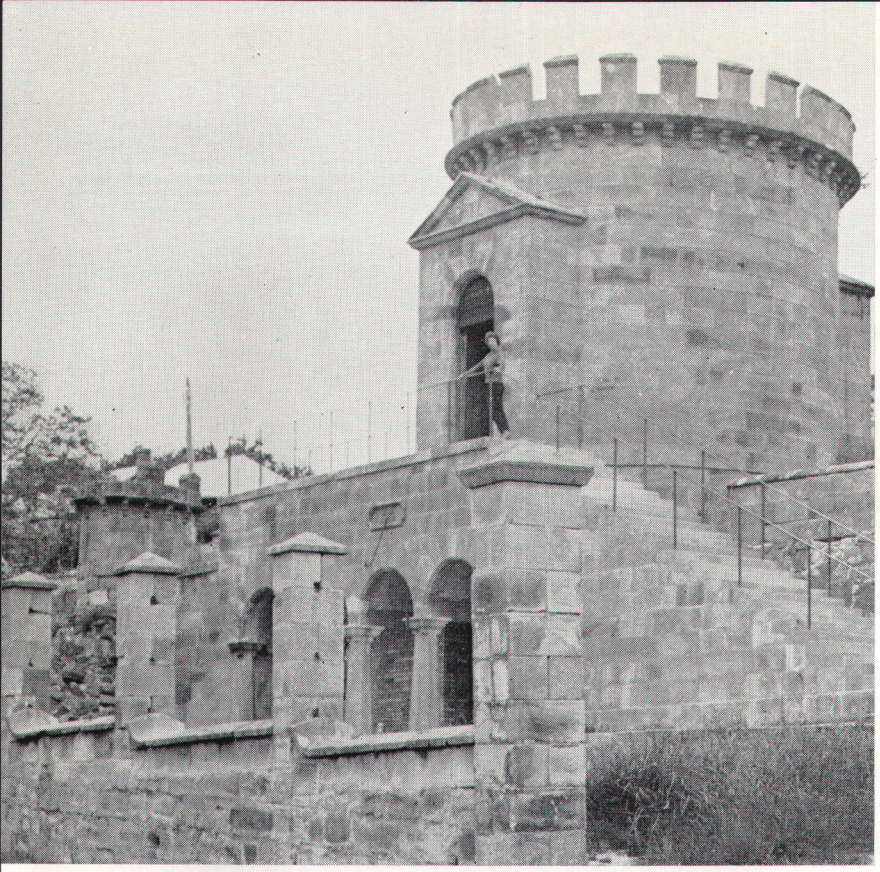
Coal Production at Tasmanian Mines, 1885, 1886 and 1890
(Tons)

Locality (*a*)	1885	1886	1890
Mersey and Latrobe	2,114	1,400	3,778
Longford	..	1,230	1,000
Oatlands	700	600	600
Hobart (New Town)	460	936	..
Richmond (Jerusalem)	1,320	605	600
Kingborough	560	500	150
Franklin (Port Cygnet)	1,500	1,300	2,738
Fingal	..	3,820	44,946
Total	6,654	10,391	53,812

(*a*) Localities as listed in 1890 in "Statistics of Tasmania".

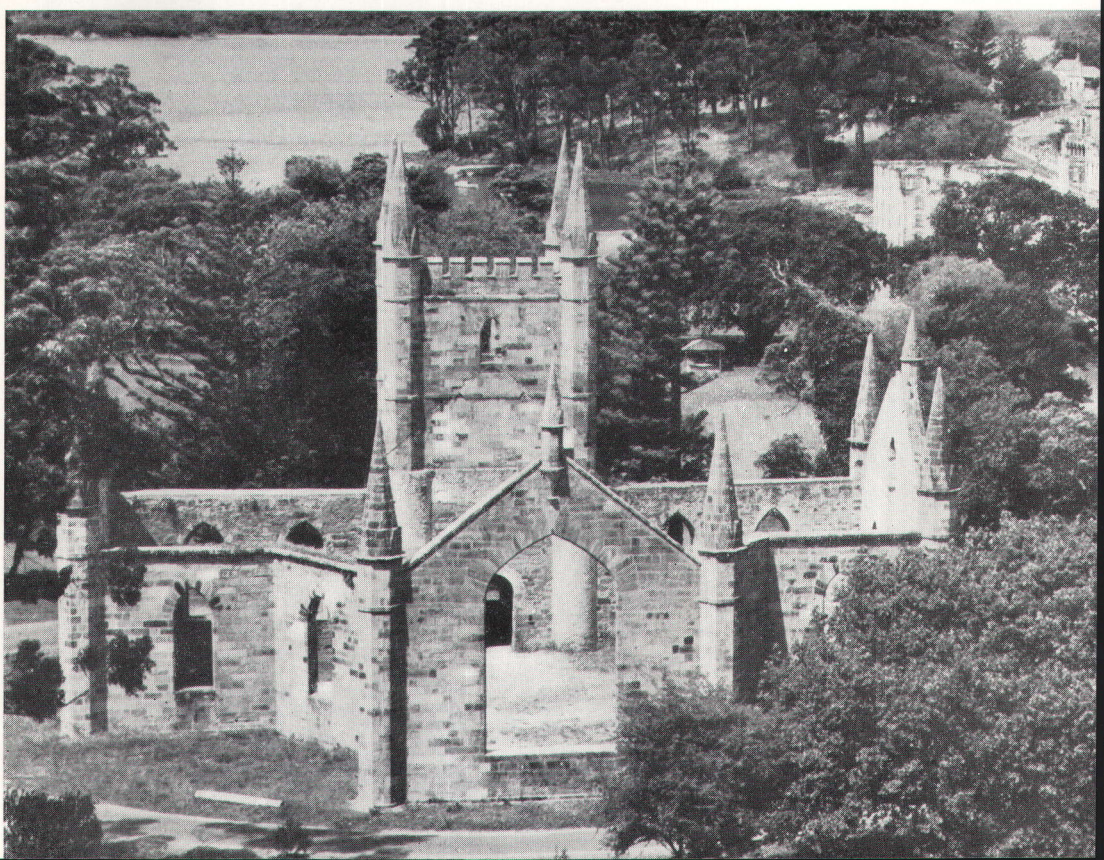
The Richmond Bridge built in 1823. (*Tourist Bureau*)

Skajit log loader at work near Maydena in concession area held by Australian Newsprint Mills Ltd.
(*The Mercury*)



Powder Magazine at Port Arthur.

Old church at Port Arthur, with Magazine in background.



Decline in Production

By 1920, annual production had reached 75,000 tons; by 1950, it exceeded 220,000 tons. The peak production year was 1959-60 with an output of over 300,000 tons but, since then, there has been a decline due to competition from oil (the introduction of diesel locomotives contributed, in minor degree, to the fall in demand but the major factor has been a change from coal to oil fuel in manufacturing industries). Throughout this whole period, from 1886 till today, the mines of the Fingal Valley have been the State's principal source of coal.

The fall in the demand for coal had an adverse effect upon employment in the Fingal Valley, and resulted in an enquiry into the possibility of generating electric power from Tasmanian coal; the subsequent report was not in favour of thermal generation, and considered expansion of existing hydro-electric works the more economic proposition. The State Government has begun plantations of exotic pines in the valley, with the aim of absorbing some of the displaced miners into forestry work.

By Australian standards, the State's black coal production has never been on a large scale and even in the year of peak Tasmanian production (1959-60), it represented only one and a half per cent of the Commonwealth total to which N.S.W. contributed nearly 80 per cent. (This total excludes brown coal which is mined in very large quantities almost exclusively in Victoria.)

Gold

Introduction

The discovery of gold in payable quantities in the 1850's was an epoch-making event in Australian history, for, as one writer aptly phrases it, this event "precipitated Australia into nationhood". The major strikes, however, were confined to Victoria and, to a lesser extent, to N.S.W., so that, if gold then had any significance for Tasmania, it was in its attraction for prospectors. Searching for this one metal, often without success, they eventually discovered those other minerals from which the State's principal mining wealth is derived.

Early Fields

The first appearance of gold mining in *Statistics of Tasmania* dated from 1866 when crushing at Fingal in the north-east produced 347 ounces from 2,872 tons of quartz; alluvial mining is also mentioned with this footnote: "It is impossible to give the quantity and value of gold obtained from alluvial diggings, although there is reason to believe that those employed thereon are doing well". In actual fact, gold had been discovered much earlier, in slate rocks near Lefroy in 1849 and then at Mangana near Fingal in 1852, the second find setting off a minor gold rush to the alluvial diggings. The early miners were secretive and able to take their wealth out of the State without record.

During 1859 the first quartz mine started operations at Fingal; in the same year James Smith (better known as "Philosopher Smith") found gold at the River Forth, and Peter Lette at the Calder. Reef gold was discovered in 1869 at Lefroy by S. Richards. The first recorded returns from the Mangana fields date from 1870; Waterhouse, 1871; Hellyer, Denison and Beaconsfield, 1872; Lisle, 1878; Gladstone and Cam, 1881; Minnow and River Forth, 1882; Branxholm, 1883; and Mt. Lyell, 1886.

Throughout the rest of the 19th century, gold was produced at a variety of locations, including Mathinna, Lefroy, Fingal, Lisle, Mangana, Corinna and Hellyer but the largest single source was the "Tasmania Mine" at Beaconsfield which began operating in 1878. The effect of Beaconsfield operations can be judged from the following State gold production figures (in ounces): 1877, 5,777; 1878, 25,249; 1879, 60,155. Employment in gold mining in 1879 was stated to exceed 2,000 men. Peak gold production for the State was reached in 1899 with 83,992 ounces but this was still only a minor contribution—just over 2 per cent—to the Australian total; a year earlier, production in W.A. had, for the first time, exceeded that in Victoria. To set Tasmanian gold mining in its correct perspective, the following production figures (in '000 oz.) are quoted for the Commonwealth in 1903: N.S.W., 254; Victoria, 767; Queensland, 669; S.A., 21; W.A., 2,065; Tasmania, 60; total, 3,836 (1903 was the peak production year for both the Commonwealth and W.A.).

Ranked in order of accumulated yield, the State's three principal gold mining centres were Beaconsfield, Mathinna and Lefroy. The 20th century witnessed a decline in Tasmanian gold mining, as such; when the "New Golden Gate" at Mathinna closed in 1912, State annual gold production had fallen to 37,973 ounces. In 1919, with the closure of the "Tasmania Mine" at Beaconsfield, annual gold production fell to 7,686 ounces.

Present Production

Today there are no gold mines, as such, operating but gold is still produced as a by-product from other minerals, principally concentrates of lead-copper, copper, lead and zinc. It is something of a paradox that the Tasmanian gold yield, in relation to the Commonwealth total, is now relatively greater than it was in the days of "pure" gold mining. The assayed gold content of Tasmanian minerals mined in 1964 was 34,376 ounces, compared with a Commonwealth total of 964,000 ounces, i.e. the Tasmanian proportion had increased to 3.6 per cent.

Tin

Mt. Bischoff

Tasmania's early gold discoveries had been discouraging when compared with the rich sources uncovered in Victoria but, in 1871, Mr. James Smith took back to Table Cape a matchbox filled with ore for smelting by Mr. E. B. Walker (usually known as "Doctor" Walker). A contemporary engineer describes the outcome thus: "At this time no one knew what ore it was; but when the first button lay bright and shining before those present, the question was asked 'Is it silver?' which the old doctor, being an expert, soon settled. The full value of the discovery did not present itself to any of these gentlemen then, as no doubt they all would have liked silver in preference to tin".

The matchbox had been filled at Mt. Bischoff which investigation showed to be the greatest tin deposit then known in the world. It lay inland over 30 miles south-west from Burnie in rugged and inhospitable country, the immediate problem being to bring in equipment and to get the ore out to the coast. The first solution was a horse-drawn tramway, later to be replaced by the 48-mile Burnie-Waratah line, opened for traffic by the Emu Bay and Mount Bischoff Railway Company in 1884. It was an extension of this line to Zeehan at the turn of the century that gave the west coast mining areas a direct rail link to the north-west coast. Thus, the original tin deposits at Mt. Bischoff, quite apart from their vast yield of a valuable metal, also played a vital part in opening up communications to the remote west coast.

Some idea of the richness of Mt. Bischoff can be gained from the following company report appearing in *Statistics of Tasmania*, 1907:

> "The Mount Bischoff Tin Mining Company, Registered.
>
> Capital, £60,000 in 12,000 shares of £5 each, 4,400 paid up to £5 per share and 7,600 paid up to £1 per share.
>
> Dividends paid to 31st December, 1907, £2,124,000 or £177 per share.
>
> Yield of 66,562 tons, Tin Ore, valued at £4,181,698".

Before production finally ceased shortly after World War II, more than 80,000 tons of tin ore had been mined from Bischoff.

Other Fields

The Bischoff discovery was followed by numerous others, first in the north-east and then at Mt. Heemskirk on the west coast; many of the north-east deposits were alluvial. Main production today is centred near Avoca in the north-east and Renison Bell on the west coast; other sources now worked are at Storeys Creek, Port Davey, King Island, Flinders and Cape Barren Islands, Coles Bay and St. Paul's Valley.

Present Production

In 1964, the assayed tin content of tin concentrates produced throughout Australia was 3,642 tons, the Tasmanian component being 990 tons. Some concept of the earlier scale of Tasmanian tin mining can be obtained from these export figures: average annual Tasmanian exports of tin, decade ending 1890, 3,800 tons; decade ending 1900, 2,650 tons. A mixture of export and production figures in the decade ending 1910 suggests that tin production had lifted to an annual average of 3,350 tons. In 1920, annual production fell to 1,310 tons and, since then, has often been below 1,000 tons with no indication of any return to the high levels recorded up to 1918 (when annual production was 1,580 tons).

Renison Bell Expansion Programme

The Renison Bell tin mine on the west coast was first worked in 1905, has closed down on a number of occasions, but is now engaged in an expansion programme which includes the building of workers' homes at near-by Zeehan; this town had suffered from the closure of the adjacent silver mines before World War I.

Silver

Early Fields

The discovery of tin at Mt. Heemskirk in 1875 encouraged the notion that here was a second Mt. Bischoff and a mining boom followed, only to collapse when the ores were found to be of a very low grade. The lure of tin, however, had brought prospectors into the area and silver-lead ore was found near Zeehan in 1882; six years later, the Zeehan-Dundas area was invaded by numerous syndicates in search of silver. The optimism of the period was reflected in the Tasmanian Government's decision to commence construction of a Zeehan-Strahan railway in 1890, Trial Harbour being too exposed a port to serve the new fields.

In 1891, there were 159 companies and syndicates operating in the Zeehan-Dundas area when a general financial crisis halted most operations. The set-back was only temporary and in 1898 a smelting plant was installed at Zeehan, over 20,000 tons of silver-lead ore being mined annually. Although the fields initially gave rich returns of silver, the ore was not comparable with that at Broken Hill and could not be obtained in payable quantities below the 600 foot level. Silver is also present in the complex ores mined at Rosebery but

the high zinc content defeated most early efforts to extract payable metals profitably. By 1909, the smelters at Zeehan closed down for lack of ore to process.

Present Production

The State still produces silver today but mainly as a by-product of copper mining at Mt. Lyell and zinc-lead mining at Rosebery; "pure" silver-lead mining is carried on at Tullah but there is no silver production from the once famous Zeehan fields. In 1964, the assayed silver content of Tasmanian mine production was 1,780,000 ounces, just under 10 per cent of the corresponding Australian total. N.S.W. and Queensland are the leading producers.

Copper

Mt. Lyell

The mining of Tasmanian copper at Mt. Lyell dates from the 1890's, the original source of ore being the Iron Blow near Linda Creek; this outcrop had been developed without much success as a gold mine after its discovery in 1883. The problems of exploitation were difficult, the complete lack of road or rail communication with Macquarie Harbour being the most challenging. Although dozens of companies and syndicates pegged claims on the Lyell fields, only two—the Mount Lyell and the North Mount Lyell—had the necessary capital to face up to the problem of transport, each deciding to build a railway to its own chosen port on the harbour. By 1900, each company had its own line, the Mt. Lyell running to Strahan, the North Mount Lyell to Kellys Basin. The absurdity of two railways and two ports serving the same field was ended in 1903 when an amalgamation occurred.

The Mt. Lyell operations were notable for a metallurgical discovery of world importance when Robert Sticht smelted copper in 1902 without use of coke, relying on the sulphur content of the pyritic ores and using a cold forced air draught in lieu of the accepted hot air method. Successful low cost smelting played a large part in establishing the industry. At the turn of the century, Mt. Lyell, with its annual output of 10,000 tons or so of copper, was the leading Australian producer; since then, other important fields in Australia have been developed and its relative importance has declined even though its annual output of copper has actually increased. For a mining field, Mt. Lyell has shown remarkable stability over its seventy years of exploitation. As the original rich finds were worked out, improvements in handling and recovery allowed the profitable processing of lower grade ores, and successful operations continue today using some ores of less than one per cent average copper content—a task impossible with the techniques available at the turn of the century. Open cut mining has been, and still is, a widely-used method although underground mining is also in progress.

Present Production

In 1964, the assayed copper content of Tasmanian mineral production was 14,879 tons, or about 14 per cent of the corresponding Australian total, Queensland being the principal producing State. Over 90 per cent of the Tasmanian total derives from Mt. Lyell ores but there is also a copper content in the ores mined at Rosebery and Williamsford.

Zinc

Rosebery

The present township of Rosebery 20 miles north of Queenstown supports a population of nearly 2,000, the principal activity being the mining of zinc ores for treatment at the Electrolytic Zinc Company's Risdon plant

near Hobart. It is therefore paradoxical that, from the discovery of zinc-lead ores near Mt. Read in 1894 until the early 1920's, the large percentage of zinc found in the region's minerals should have been the main bar to successful development of the field. Early penetration had sprung from the search for gold but once treatment of the complex Rosebery ores was attempted, the smelting techniques then available were not capable of recovering the zinc; lead, gold and silver were the metals recovered but removal of the zinc, a complete waste, made the process costly.

Risdon

In 1914, the war prevented the shipping of N.S.W. Broken Hill zinc concentrates to German and Belgian zinc works and therefore the producers decided to establish their own refinery, selecting Risdon near Hobart as the site and planning to use hydro-electric power generated from the Great Lake. Tests were made on the complex Rosebery ores and methods evolved so that both lead and zinc could be efficiently recovered. At first the Risdon plant operated on the imported Broken Hill concentrates but, by 1925, it had sufficient capacity to also process local ores brought from Rosebery. The Rosebery mines have been in continuous operation since 1925, apart from a temporary shut-down in the period 1930-1936 when depressed world zinc prices curbed production. While the primary aim is the production of zinc, by-products recoverable from the Rosebery and Williamsford ores include lead, copper, cadmium, gold and silver. In terms of total value of metallic content, the minerals mined in this area closely approach in importance those mined at Mt. Lyell.

Present Production

In 1964, the assayed zinc content of Tasmanian mine production was 50,155 tons, approximately 15 per cent of the corresponding Australian total; N.S.W. was the major producer of zinc bearing ores. (Tasmania is still the leading producer of refined zinc, the recovery process using both local and interstate concentrates. Production constitutes about 80 per cent of the Australian total.)

Lead

The mining fields at Zeehan and Dundas had been established with silver as the goal, silver-lead ores being the source; lead was produced as a by-product. Silver-lead mining has long since ceased on the Zeehan fields but is still in progress at Tullah, a few miles north-west of Rosebery.

Lead is also a constituent of the complex Rosebery and Williamsford ores and these are now the principal source of lead in the State. In 1964, the assayed lead content of Tasmanian mine production was 15,348 tons, about four per cent of the corresponding Australian total; N.S.W. and Queensland are the principal producers.

Tungsten

Tungstic oxide (WO_3) occurs in two forms: in scheelite (calcium tungstate) and wolfram (iron manganese tungstate). There is a marked distinction between the mining of scheelite and of wolfram. Whereas scheelite in Tasmania is mined mainly for its WO_3 content, wolfram is usually found in association with tin. Production of wolfram began in 1906 at Moina in the north-west but most

now comes from mixed tin-wolfram mines in the Avoca area. The tin-wolfram combination is a good basis for operations because producers can stockpile their wolfram concentrates when tungsten prices are unfavourable.

Production of scheelite has been carried out on King Island, first in the period 1917-1920, and then again from 1938 onward, apart from a short close-down in 1959. In recent years, prices were unfavourable and the industry was only able to survive with the help of a subsidy from the Tasmanian Government, the level of assistance being related to movements in world price. In 1964, the assayed tungstic oxide content of Tasmanian mine production was 993 tons; this was also the Australian total, Tasmania being the sole producer.

Sulphur

There are no known deposits of elemental sulphur in Australia, but its use is of vital importance in the heavy chemical and fertiliser industry, the principal form being as sulphuric acid. The sulphur content of the Mt. Lyell and Rosebery ores forms the basis for the manufacture of sulphuric acid. Mt. Lyell pyritic ore is concentrated and exported, while the Rosebery zinc concentrates are used to produce sulphuric acid as a by-product at the Risdon zinc plant. In 1964, the assayed sulphur content of Tasmanian mine production was 56,104 tons, approximately 16 per cent of the corresponding Australian total.

Iron Oxide and Iron Ores

Iron oxide is currently being mined at Penguin on the north-west coast for use mainly in the local manufacture of cement. Tasmania has large deposits of iron ore and in 1876, the British and Tasmanian Charcoal Iron Company established an iron works on the west bank of the Tamar; unfortunately the ores in that locality had a high chromium content, the resulting iron proved to be extremely brittle, and production ceased.

In 1956, the Tasmanian Department of Mines, in conjunction with the Commonwealth Bureau of Mineral Resources, commenced a series of geological and geophysical surveys followed by drilling. A large deposit at the Savage River was the subject of investigation by Australian-American interests, the project under review being the conversion of the ore to a slurry and its transfer by pipe-line and pumping to Brickmakers Bay, near Stanley, for shipment to Japanese ports in pellet form.

The Savage River Iron Ore Scheme

In November, 1965, Pickands Mather and Co. International and Mitsubishi Shoji Kaisha Ltd. agreed to proceed with a plan for the export of Savage River iron ore to Japan. The cost of installing the necessary plant is estimated at $62,000,000 and the target date for the start of concentrating the ore is late in 1967.

The ore deposit on the Savage River lies south-west of Mt. Bischoff in rugged country without easily accessible roads or railways; the west coast is not far from the field but no suitable harbour is available on shores open to the persistent westerly swell. The two possible outlets were Macquarie Harbour and a port site on the north-west coast—the deposit lies roughly equidistant between these points. The eventual decision was to construct a port on the north-west coast at Brickmakers Bay, and to link the ore field to the port by pipe line.

Although the basic aim is to export the ore, processing will be necessary in the State, both at the ore field and at the port. The crude ore will be mined by open-cut methods with power shovels and special trucks. At this stage, the ore will be ground to a powder and then magnetically separated from the waste; this concentration will convert the ore from its crude form—about 38 per cent iron—up to an estimated 67 per cent. The necessary electricity for this process will come from the State Hydro-Electric Commission's grid. The concentrate will then be mixed with water and pumped 52 miles to Brickmakers Bay; there it will be dried out and rolled into small balls which will be heated to high temperatures to make them into hard pellets. The final product—pellets—will then be shipped from a special pier to be constructed at Brickmakers Bay. (The new terminal has been named Port Latta.)

STATISTICS OF MINERAL PRODUCTION

Source of Data

Statistics relating to quantities of minerals produced (including assayed metallic content) are, in the main, obtained from the State Mines Department and are supplemented, where necessary, with data obtained from the annual census of mines and quarries conducted by the Bureau of Statistics, and from the Commonwealth Bureau of Mineral Resources.

Metallic Minerals

The table that follows shows the quantity of metallic minerals produced in Tasmania for a five-year period. In general, the minerals are shown as concentrates except the item reading "copper ore", and this does not refer to the total copper ore mined but only to that portion fed direct to the smelters without passing through the concentration process.

Metallic Minerals—Production

Mineral	Unit	1960	1961	1962	1963	1964
Copper Concentrate ..	Tons	46,760	48,976	49,361	55,405	49,463
Copper Ore	Tons	758	7,619	9,882	10,394	10,215
Copper Precipitate ..	Tons	26	16	13	22	51
Gold (not in Concentrates)	Ounces	308	446	417	181	106
Iron Oxide	Tons	3,497	2,309	4,082	4,221	6,808
Lead Concentrate ..	Tons	14,790	12,345	13,742	16,321	14,853
Lead-Copper Concentrate	Tons	6,797	8,057	11,192	9,309	10,214
Pyrite Concentrate ..	Tons	67,764	51,020	8,373	19,463	46,166
Tin Concentrate ..	Tons	1,233	1,217	1,507	1,435	1,438
Tungsten Concentrates-						
Scheelite Concentrate	Tons	420	1,017	988	958	1,016
Wolfram Concentrate	Tons	1,106	1,117	488	394	380
Zinc Concentrate ..	Tons	31,625	36,990	44,382	44,871	84,791

Assayed Content

In the following table, the various concentrates have been grouped to show their content in terms of individual metals. The contents stated are as determined by assay and include all pay metals and metals which are a refiner's prize; totals compiled on this basis contain no allowances for losses in smelting and refining and therefore, in general, exceed the quantities actually recoverable. The table refers exclusively to minerals mined in Tasmania and excludes minerals imported for smelting and refining:

Assayed Contents of Metallic Minerals Produced

Mineral	1960	1961	1962	1963	1964
COPPER (Tons)					
Copper Concentrate	10,733	11,308	12,785	14,919	13,158
Copper Ore	59	378	438	427	342
Copper Precipitate	6	8	6	6	20
Lead Concentrate	(*a*)	79	80	125	74
Lead-Copper Concentrate	597	731	961	1,090	1,018
Zinc Concentrate	198	239	245	238	267
Total	11,593	12,743	14,515	16,805	14,879
GOLD (Fine Oz.)					
Copper Concentrate	7,188	7,089	7,230	10,171	7,714
Copper Ore	..	153	223	134	122
Lead Concentrate	3,397	3,889	3,384	4,335	3,939
Lead-Copper Concentrate	11,006	12,572	18,021	18,820	19,271
Zinc Concentrate	2,124	2,736	2,843	2,797	3,233
Other Sources	308	446	417	165	97
Total	24,023	26,885	32,118	36,422	34,376
LEAD (Tons)					
Lead Concentrate	9,061	7,230	8,056	9,557	8,689
Lead-Copper Concentrate	2,204	2,733	4,228	2,934	3,832
Zinc Concentrate	1,775	2,290	2,470	2,491	2,827
Total	13,040	12,253	14,754	14,982	15,348
SILVER ('000 Fine Oz.)					
Copper Concentrate	47	60	73	60	53
Copper Ore	..	9	12	9	9
Lead Concentrate	448	357	388	461	398
Lead-Copper Concentrate	717	799	995	942	1,048
Zinc Concentrate	186	227	232	231	272
Total	1,398	1,452	1,700	1,703	1,780
SULPHUR (Tons)					
Lead Concentrate	2,071	2,531	2,817	3,360	3,053
Lead-Copper Concentrate	952	2,135	2,926	2,624	2,649
Pyrite Concentrate	33,375	25,053	4,131	9,537	22,437
Zinc Concentrate	18,359	22,570	26,684	26,797	27,965
Total	54,757	52,289	36,558	42,318	56,104
ZINC (Tons)					
Lead Concentrate	1,784	1,924	2,113	2,537	2,338
Lead-Copper Concentrate	1,106	1,178	1,423	1,081	1,221
Zinc Concentrate	31,625	36,990	44,382	44,871	46,596
Total	34,515	40,092	47,918	48,489	50,155

Assayed Contents of Metallic Minerals Produced—*continued*

Mineral	1960	1961	1962	1963	1964
TIN (Tons)					
Tin Concentrate..	884	879	1,058	1,005	990
TUNGSTIC OXIDE (WO_3) (Tons)					
Scheelite Concentrate	291	709	686	675	717
Wolfram Concentrate ..	806	810	349	285	276
Total	1,097	1,519	1,035	960	993
CADMIUM (Tons)					
Zinc Concentrate	56	62	72	74	77
COBALT (Tons)					
Zinc Concentrate	(*a*)	(*a*)	1	2	1
MANGANESE (Tons)					
Zinc Concentrate	172	185	264	258	243

(*a*) Under half a ton.

Fuel Minerals (Coal)

The only fuel mineral mined in Tasmania is coal and details of production are shown for a five-year period:

Production of Coal in Tasmania ('000 Tons)

Description	1960	1961	1962	1963	1964
Coal, Black—					
Semi-anthracite	2	2	2	2	2
Bituminous	296	254	270	205	149
Total	298	256	272	207	151

As indicated in the historical section of this chapter, imported fuel oils are tending to replace coal in a number of applications, chiefly industrial, and the decline in production of coal is due to the resulting fall in demand.

Non-Metallic (Excluding Fuel) Minerals

The quarrying of limestone is the earliest recorded activity in the field of non-metallic mineral mining in the State, burnt lime being sought as a base for building mortar. (The extensive shell deposits on the shores of Pitt Water near Sorell were another lime source used by the colonists in the making of mortar.) Production has gradually increased, there being a steady demand for limestone in the making of cement, in various chemical and metallurgical

processes and in the manufacture of calcium carbide; limestone also is used as a source of agricultural lime. Large exports of limestone were made in the period 1918-1947, when B.H.P. Co. Ltd. operated quarries at Melrose on the north-west coast, for material to use as a flux in metallurgical processes carried out at their Newcastle iron and steel plant.

The next table shows the Tasmanian production of non-metallic minerals for a five-year period:

Non-Metallic (Excluding Fuel) Minerals Production (Tons)

Mineral	1960	1961	1962	1963	1964
Clays—					
Brick and Shale	157,244	153,156	140,536	146,885	170,496
Kaolin	964	1,232	606	1,875	2,400
Other	16,814	20,628	29,966	24,229	31,488
Dolomite	2,678	1,108	2,217	2,623	923
Limestone (*a*)	215,208	203,342	318,538	354,465	351,518
Ochre	31	75	60	51	69
Pebbles	515	453	375	518	727
Silica	5,231	1,415	514	2,641	13,606

(*a*) Excludes quantities used directly as a building or road material.

Construction Materials

In addition to the types of mining and quarrying previously described, there is the quarrying of construction materials (for buildings, roads, &c.) such as crushed and broken stone, gravel, sand, &c. This type of activity also is taken into account when placing a value on the output from mines and quarries, measuring their level of employment, &c.

Mining Industry Statistics

In the earlier sections of this chapter, the data on mining and quarrying have been confined to physical production and metallic content by assay, but other measures such as the level of employment, values of output, &c. are also available. A definition of the field of activity classified as "mining and quarrying" appears as an introduction to the "Mining" section of this chapter.

The following table gives details of employment in mines and quarries for a five-year period:

Employment in Mines and Quarries (*a*)

Particulars	1960	1961	1962	1963	1964
Number of Mines and Quarries	58	56	61	63	42
Number Employed (*b*)—					
Working Proprietors ..	22	14	22	23	16
Salaried Employees—					
Above ground ..	273	286	282	330	288
Below ground ..	43	46	48	36	75
Wage Earners—					
Above ground ..	1,662	1,652	1,539	1,586	1,449
Below ground ..	879	818	768	667	683
Total	2,879	2,816	2,659	2,642	2,511

(*a*) Mines and quarries employing four or more persons.

(*b*) On last full working day of year shown.

Values of Output and Production

Value of Output is the selling value at the mine or quarry (i.e. exclusive of transport costs from mine or quarry to the point of sale). Value added by reduction of ores, concentrates, &c. to metals is excluded.

Value of Production is the selling value at the mine or quarry *less* the cost of power, fuel and light and the cost of certain materials and stores such as timber, explosives, &c. No allowance is made for depreciation or costs of maintenance.

The next table gives details of value of output, value of production and costs data for mines and quarries employing four or more persons:

Mines and Quarries (*a*)—Value of Output; Value of Production; Costs ($'000)

Particulars	1960	1961	1962	1963	1964
Value of Output	15,780	15,504	17,374	19,763	24,109
Less Cost of Power, Fuel and Light used	602	748	760	789	786
Less Other Costs (mainly materials)	4,536	4,716	4,758	4,984	5,965
Value of Production (*b*)	10,642	10,040	11,856	13,990	17,358
Salaries and Wages Paid (*c*)—					
Salaries	950	1,056	964	981	1,264
Wages (*d*)	6,224	6,248	6,216	6,515	6,819
Total Salaries and Wages	7,174	7,304	7,180	7,496	8,083

(*a*) Mines and quarries employing four or more persons.
(*b*) The cost of labour is *not* deducted in determining the value of production.
(*c*) Exclusive of drawings by working proprietors.
(*d*) Net amount after deducting value of explosives sold to own employees.

The previous tables on employment, output, &c. have been restricted to data obtained from mines and quarries employing four or more hands, this size level providing a basis for uniform mining statistics in all Australian States. However, the annual mining census in Tasmania seeks information from all engaged in mining and quarrying and includes operations with less than four persons employed. The following table shows the value of output for all mining and quarrying operations and also the contribution of specific types of activity:

All Mines and Quarries (*a*)—Value of Output ($'000)

Particulars	1960	1961	1962	1963	1964
Metal Mining	12,976	13,018	14,450	16,915	21,600
Fuel Mining	1,374	1,168	1,232	842	649
Non-metal (excluding Fuel) Mining (*b*)	680	532	714	788	864
Total Mining	15,030	14,718	16,396	18,545	23,113
Construction Material Quarrying	1,104	1,200	1,410	1,757	1,935
Total Mining & Quarrying	16,134	15,918	17,806	20,302	25,048

(*a*) Includes output of mines and quarries employing less than four persons.
(*b*) Includes clays, dolomite, silica, limestone, &c.

Smelting and Refining of Metals

The value of output of mining and quarrying is defined as the selling value of the product at the mine or quarry, (e.g. in metal mining, usually the selling value of specific concentrates at the mine). Earlier, reference was made to the fact that Tasmanian manufacturing industry includes the extraction and refining of metals, not only from locally produced ores and concentrates, but also from those that have been imported; in actual fact, extraction and refining in Tasmania employ more persons than mining and result in greater values, both of output and of production. The following table is compiled from factory statistics to illustrate this point:

Non-Mining Activity—Extracting and Refining Metals
Factory Class IV, Sub-Class 5—Values of Output, Production, &c.

Particulars	1959-60	1960-61	1961-62	1962-63	1963-64
Factories .. .. (No.)	3	3	3	4	4
Average Workers (*a*) .. (No.)	3,070	3,160	3,283	3,413	3,444
Value of Output ($'000)	46,652	46,181	48,472	59,020	66,238
Value of Production (*b*) ($'000)	18,408	18,433	18,079	23,699	24,065

(*a*) Average whole year, including working proprietors.

(*b*) Value of output less recorded costs of manufacture, other than labour.

In the previous table, the principal metals included are: copper (from local ores), zinc and cadmium (from local and imported ores), aluminium (from imported bauxite) and ferro-manganese alloy (from imported ores).

The value of production in the factory table does not duplicate values already recorded in the mining sector since the cost of the basic raw materials —ores or concentrates—is one of the recorded costs of manufacture deducted from the value of output.

The next table gives details of the production of zinc and copper by refinery processes:

Non-Mining Activity—Production of Zinc and Copper
(Tons)

Year	Refined Zinc	Cathode Copper	Year	Refined Zinc	Cathode Copper
1959-60 ..	117,893	11,262	1962-63 ..	136,205	11,694
1960-61 ..	125,936	9,600	1963-64 ..	138,610	11,790
1961-62 ..	129,069	11,812	1964-65 ..	138,779	12,125

Aluminium Production

The refinery for the production of alumina and refined aluminium is situated at Bell Bay on the River Tamar. The choice of Tasmania was determined by the availability of large supplies of relatively cheap hydro-electric power. Production of alumina commenced in February, 1955, and of refined aluminium

in September, 1955. Although production data are confidential, published statements indicate that the capacity of the plant, in terms of primary aluminium, was lifted to 35,000 tons in 1962 and to 52,000 tons in 1963. When the Bell Bay plant began operating, it was the sole Australian producer of aluminium but another plant has now been established at Geelong in Victoria.

FISHERIES

Description of Main Fish Varieties

This section is devoted to a discussion of the important species in the Tasmanian sea fishery. These species are not all scale fish but include elasmobranchs (sharks), molluscs (scallops, oysters, abalone), and crustaceans (crayfish). The Tasmanian fishery involves about 1,000 licensed fishermen in 500 vessels, and harvests approximately eight million pounds weight of fish annually. The catch is composed of about 40 types of which five—crayfish, shark, barracouta, scallop and salmon—are of major importance (over 90 per cent of the catch). One, the tuna, may have great potential for the future and nine other types are caught in significant quantities.

Each of the sixteen types discussed is in the order set out by the Statistics Sub-Committee of the Commonwealth/State Fisheries Conference, and each species is numbered according to the code prepared by the Fisheries Division of the Department of Primary Industry on behalf of the Conference.

The descriptions of the types of fish include their common name and scientific name, a brief description of each fish, criteria for distinguishing different species (if more than one species are caught under the same general name), notes concerning their distribution and habit, and the methods of fishing employed.

Terms Used

The following is a non-technical explanation of some of the terms used: *anal*, near the anus; *anterior*, towards the head; *caudal*, tail; *dorsal*, back; *operculum*, gill cover; *pectoral*, side of body near gills; *ventral*, pelvic.

Authorities for Reference

The descriptions of genera and species are very brief and in many cases will be insufficient for detailed scientific work, but should be effective as a general guide. Further information on identification of species may be obtained from:

Fish and Fisheries of Australia — T. C. Roughley.

Handbook of Australian Fishes — I. S. R. Munro.
(published in Fisheries Newsletter)

Vertebrate Animals of Tasmania — C. E. Lord and H. H. Scott.

Whitebait (*Lovettia sealii*-076)

Whitebait are well known as a canned fish and consist of the young of a number of species of fish. The most common constituent of Tasmanian whitebait is a species called *Lovettia sealii*. They are very small fish (about one inch long), practically transparent with conspicuous black eyes, and move from the sea to fresh water to spawn in spring or early summer. They travel in

long but narrow concentrations or in dense shoals, and are captured by scoop nets of fine mesh.

Commercial fishing began during 1941 and 1942 and reached a peak in 1947 when over a million pounds were caught. The catch has now declined to somewhere in the region of 20,000 pounds.

Flounder and Sole (*Lophonectes gallus, Paraplagusia unicolour, Pseudorhombus tenuirastrum; all species*-151)

The flat fishes are almost wholly marketed as flounder, although three distinct species make up the local catch. These are the Crested Flounder (*Lophonectes gallus*), the Deepwater Flounder (*Pseudorhombus tenuirastrum*) and the Lemon-tongued Sole (*Paraplagusia unicolour*).

There is much misunderstanding of the use of the terms "flounder" and "sole"; generally speaking, the flounder group has the caudal fin separate from the dorsal and anal fins, whereas the sole has the caudal fin reduced in size and completely fused with the dorsal and anal fins.

The crested flounder is very small, never attaining more than seven and a half inches. It is a very common fish in the catch of trawlers, and is easily recognised by the long anterior dorsal rays extending into a crest. Although it is very common in coastal waters, it is too small for commercial exploitation. The deep water flounder occurs in estuaries and shallow coastal waters. It has small spots and ring-like markings, with two blotches on the base of its tail rays; the species is also characterised by a notch on the snout.

The lemon-tongued sole is tongue shaped, the snout curled around with the mouth in a long, hooked lobe. It attains 13 inches and occurs on sandy bottoms in up to 18 fathoms. The fish is not heavily fished commercially and is usually captured at night with lights by spearing.

Cod (*Physiculus barbatus*-201)

The family Gadidae, the true cods, is represented in Tasmania by the Southern Rock Cod (*Physiculus barbatus*). Although this group includes the most important commercial fish after the herring in the Northern Hemisphere, it is not a commercially important fish in Australia.

The southern rock cod lives in rocky situations offshore and because of this and its benthonic habits, it is almost always caught on hand-lines. The fish is readily distinguishable by the presence of a fleshy barbel on the lower jaw, which probably helps in the search for food. It may grow to a length of 17 inches. Its colour is reddish brown, with dark spots at the base of its pectoral fins.

The cod is not highly prized as a food fish, its flesh being rather soft. Its importance in Northern Hemisphere fisheries derives from its supply of Vitamin A and D in the oil from its liver, as well as its food value.

Tuna and Mackerel (*Thunnus thynnus maccoyii*-301; *Thunnus alalunga germo*-303; *Katsuwonus pelamis*-315; *Auxis thazard*)

Although tuna is caught at present in Tasmanian waters in only small quantities, it is reported to be present in large numbers in coastal waters. It is an excellent canning fish and the basis of important industries in N.S.W. and overseas.

There are four major species of tuna found in Tasmanian waters. They are:

(i) Southern Blue Fin Tuna (*Thunnus thynnus maccoyii*)—a large chunky fish tapering sharply towards the tail. Dark blue above and silver below, with yellow tinges on the second dorsal fin and tail. This tuna may reach nine to 10 feet in length and 1,500 pounds and quite commonly ranges from 500-800 pounds in Australian waters. However, the average commercial fish is about 50 pounds. Open coastal waters are its habitat.

(ii) Albacore (*Thunnus alalunga germo*)—a chunky robust fish tapering sharply to the tail. Pectoral fin very long (behind the anal fin). Colour, dark green-blue above, silver below, dorsal finlets yellowish, others grey. Size—up to three and a half feet and 60 pounds but averaging five to nine pounds. Oceanic waters are its habitat.

(iii) Striped Tuna or Skipjack (*Katsuwonus pelamis*)—plump, robust, tapering sharply to the tail behind the second dorsal and anal fins. Colour—black above with metallic purple and green sheen and silvery white, characterised by five dark-grey longitudinal stripes along the sides below the lateral line. Size—may grow to 25 inches and weigh 12 pounds, but normally five to 10 pounds. Deep coastal and oceanic waters are its habitat.

(iv) Frigate Mackerel or Leadenall (*Auxis thazard*)—elongated and slightly compressed body. Colour—lead-grey colour above and silver below; the back has a pattern of oblique broken wavy lines and blotches. The frigate mackerel is the smallest of the tuna group of fishes and seldom grows larger than three pounds.

The tuna group is excellent canning fish and makes up a large proportion of fish caught overseas. Although tuna have been known to exist in Australian waters for many years, and studies and tests as long ago as 1936 showed that the fish occurs in large quantities, it was not until the 1950's that it was caught in commercial quantities. Since then, quite a large industry has been developed by N.S.W. and S.A. boats, the N.S.W. boats sometimes fishing in Tasmanian waters. In Tasmania itself, the tuna has been left to the anglers who find very good sport off the east coast.

A tuna fishery for Tasmania may be possible in the immediate future but its development has been slow due to the large capital investment involved. The method of fishing in Australia is usually by polling or trolling, using artificial lures when they are effective, or live bait of pilchards, &c. The whole of the catch is usually canned.

Barracouta (*Leionura atun*-335)

The barracouta (sometimes referred to as 'couta) and King Barracouta (*Rexea solandri*) belong to a group of fishes which includes Snake Mackerels and Snoeks and should not be confused with the savage Barracuda (*Agriosposphyraena barracuda*) of the West Indies.

The fish has an elongate compressed body covered with minute scales. The mouth is large with a wide cleft and powerful teeth. The dorsal fin is spinous (19 to 20 spinous rays) and sits back in a groove; the caudal fin is strongly forked. The colour is blue-black with silvery white sides and belly. The barracouta can grow to four feet six inches and 10 pounds but averages two and a half to three feet and three to five pounds.

Spawning occurs mainly in summer and early autumn along the eastern and northern coasts. The adults occur in shoals and although they may enter estuaries, they are usually found in ocean waters close to the coast and in open bays such as Storm Bay and Oyster Bay.

The fish is of major importance to the Tasmanian fishery and occurs in large numbers but is subject to pronounced seasonal fluctuations. It is a fish of good edible quality. Commercial fishermen use mainly "jigs" or trolling. (A jig is a slender rod attached to a short line or chain with a barbless hook; when the fish strikes it is jerked on to a shute, frees itself, and slides into the well.)

The king barracouta (or kingfish), until about eighty years ago, was one of the State's principal commercial fish but today is rarely seen or caught except in deep water. It can be distinguished from the ordinary barracouta by its more thick-set appearance, larger eyes and the possession of two lateral lines; it is a fish of excellent edible quality.

Mullet (*Mugil cephalus*-351; *Aldrichetta forsteri*-370).

The mullet is a very common fish in Australian waters but is not important commercially in Tasmania due to its rather variable edible qualities. Because it has often been the commonest and therefore the cheapest fish available, it has been looked down on; also, in certain areas, it becomes infected with a fungus (Actomyces) which gives the flesh an earthy taste and renders it quite unpalatable. In prime condition, the mullet, although rather oily, is a good table fish.

In Tasmania, there are two species of mullet; the Sea Mullet (*Mugil cephalus*) and the Yellow Eye Mullet (*Aldrichetta forsteri*). The family Mugilidae is one of the most uniform in the kingdom of fishes and there is a general similarity between the species. All have blunt heads with toothless mouths, large scales, general blue-silver colour and rarely exceed two feet in length. The only way to accurately distinguish the species is to count the spines in the anal fin and the number of scales from behind the base of the pectoral fin back to the base of the caudal fin. The sea mullet has eight anal rays and 32 to 42 lateral scales and the yellow eye mullet has 12 anal rays and 54 to 58 lateral scales.

The mullet is typically an estuarine fish which migrates upstream when about a year old, stays there for the next two years and may even enter fresh water. It then migrates in shoals and moves to the sea to spawn. It is a typical bottom-dwelling fish, feeding mainly on plant material.

Most fish are captured commercially by beach seining; anglers find the yellow eye mullet relatively easy to catch but not the sea mullet.

Trevally (*Seriolella brama*-453)

The Trevally, or more precisely, the Snotgall Trevalla, is a common school fish around the Tasmanian coast. ("Trevally" is also the name applied to a silver fish of another species.)

It has a laterally compressed body, silver in colour with darker patches. The eye is large and in the mid line of the head. The first dorsal fin is low with the middle spines being longest; the ventral fin is below the pectorals. The fish attains a length of 22 inches.

When freshly caught, the fish is of excellent quality and edible standard, its flesh white, tender and delicately flavoured. However it does not keep well and should be gutted soon after capture.

It is commonly caught by gill or mesh nets set close inshore amongst kelp; it can be caught by line.

Salmon (*Arripis trutta*-490)

The Australian salmon is not a true salmon and is completely unrelated to the salmon of the Northern Hemisphere. It probably received this name from the early colonists who confused the fish with the true salmon because of a superficial resemblance and its fighting qualities when hooked. It is commonly referred to as the native, colonial or black back salmon.

This fish belongs to the perch-like fishes, and has a spindle-shaped body, covered with moderately sized scales. The mouth has minute teeth on the jaws and roof. The dorsal fin bears nine to 11 spinous rays and the anal fin has three spines in front. The pectoral fins are small and placed directly above the ventral fins. The colour is variable but usually grey-green above with irregular black spots and blotches on the head. Young fish are olive green with a silver-white belly. In Australian waters, the fish may grow to 36 inches and 21 pounds; however, the average weight is between five and 10 pounds, and those caught in Tasmanian waters tend to be somewhat smaller.

Spawning occurs in sheltered estuaries and harbours from January to March. The fish spends the first two years of its life in these waters and migrates to offshore waters when it is eight to 10 inches long. By the age of nine years, the fish may measure 24 inches in length and weigh six to seven pounds. The salmon is found in large shoals travelling close to the coast at or near the surface of water less than 15 fathoms deep.

Although the fish is of great importance to Tasmanian fishermen, it is of variable edible quality with dark coarse flesh. Most salmon are captured commercially by beach seine nets. For the angler, it is one of the finest small-game fish in Australian waters.

Perch (*Nemadactylus macropterus*-502)

The Silver and Black Perch or Jackass-fish (*Nemadactylus macropterus*) belongs, with the Morwong, to the family Cheilodactylidae, and is readily distinguished by the great elongation of a pectoral fin ray, which is approximately twice the length of the other rays. The perch is distinguished from the morwong by a black band extending from in front of the dorsal fin to behind the gill cover. It is not a true perch, which is mainly a freshwater species.

Although the Tasmanian perch is of high quality as an edible fish, few fishermen attempt to catch them for sale due to the high cost of nets and gear.

Trumpeter (*Latridopsis forsteri*-536, *Latris lineatus*-535)

This fish is represented in Tasmania by the Bastard or Silver Trumpeter (or simply Trumpeter)—*Latridopsis forsteri*, and the Striped Trumpeter—*Latris lineatus*.

The silver trumpeter has a compressed body with length slightly more than three times its depth. Colour varies with age. It rarely exceeds two feet in length. The striped trumpeter is a handsome fish, with three prominent longitudinal olive green or brown bands along the back and a fourth one less distinct. The dorsal fins are deeply notched and are olive green splashed with pale irridescent blue. The fish grows to about four feet and 60 pounds.

Both are found near offshore reefs but the striped trumpeter is now mostly restricted to deep waters. The silver trumpeter is caught in gill nets and the striped by handlines. Although both species are excellent table fish, the striped trumpeter is more prized and is recognised as one of the best two or three table fish in Australia.

Flathead (*Neoplatycephalus fuscus*-615, *N. richardsoni*-616 *N. speculator*-617, *Trudis bassensis*-621, *Levipora laevigata*-625)

The flathead is a very common fish in Tasmanian waters and makes up a large percentage of the catch of anglers in estuaries and bays. The fish belongs to the family Platycephalidae and has a very depressed head, much broader than deep, with extensive gill slits and a scaly skin. On each side of the head, at the corner of the operculum, are two sharp spikes which can inflict a severe cut but are not venomous. The lower jaw projects in front of the upper lips so that the mouth is directed upwards.

There are five Tasmanian species of flathead of commercial value. They are:

(i) The Rock Flathead (*Levipora laevigata*)—variable colour, no exposed ridges on the head, may grow to 15 inches in length.

(ii) The Sand Flathead (*Trudis bassensis*)—space between eyes narrower than diameter of eye; lower spine on the operculum more than twice length of upper spine, and a rounded tail; an oceanic species but lives close to shore; grows to 25 inches and two and three-quarter pounds, but usually averages 16 to 17 inches and about one and a half pounds.

(iii) The Dusky or Mud Flathead (*Neoplatycephalus fuscus*)—head dusky with brown spots. It spends its time almost exclusively in estuaries and may reach four feet and 28 pounds.

(iv) The Tiger Flathead (*Neoplatycephalus richardsoni*)—jaws and palate have large canine teeth. It is a fish similar in size to the sand flathead but usually lives farther offshore and is the backbone of the commercial flathead fishery.

(v) The King or Deep Sea Flathead (*Neoplatycephalus speculator*)—very closely related to the tiger flathead, differing only in the structure of the gills.

The flathead, in general, is an excellent edible fish with white, tender and well-flavoured flesh. The fish is a bottom-dweller but although it can be caught by trawlers, the Tasmanian industry is based on hand-lines and the fish filletted, frozen and exported to the continental States.

Shark (*Mustelus antarcticus*-651; *Galeorhinus australis*-655)

Tasmania's shark fishery is confined in the main to two fish—the School or Snapper Shark (*Galeorhinus australis*) and the Gummy Shark (*Mustelus antarcticus*). The proportion of gummy shark in the catch varies seasonally from nil per cent to 100 per cent; both fish are marketed together and the flesh sold as "flake".

The school shark has a flattened head with a pointed, translucent snout. The anterior dorsal fin is situated over the interval between the pectoral and ventral fins and is twice the size of the second dorsal fin. The upper surface is slate-grey in colour, the fins are dark-grey and the belly white. This fish is reputed to grow to six feet and 170 pounds but there is no authentic record of a fish longer than five feet eight inches.

The gummy shark has an obtuse snout. The anterior dorsal fin is situated between the dorsal and ventral fins. The caudal fin is slightly elevated and has a notch in the distal lobe. The teeth are reduced to flattened crushing plates. The upper surface is ash-grey in colour and spotted, the belly white. It may grow to a length of five to six feet.

Although sharks have been fished commercially in Australia for many years, the Tasmanian industry did not begin until the early years of World War II. It has now become established as one of the most important units of the Tasmanian fishery. The fish are caught by the "long-line" method. Each line consists of a number of "fleets", each "fleet" carrying 100 to 200 hooks. Each boat carries a number of lines which can be set individually or linked together.

Unlike the scale and bony fish and some other sharks, these two varieties bear their young alive and do not lay eggs. Mating usually takes place from May to June with the young "pups" born about December. The average litter is 28 pups and therefore the reproductive potential (the rate at which the population is maintained), is low, compared with that of other fish. It follows that there is a danger of over-fishing if the fish is heavily exploited.

Garfish (*Hemiramphus Australis*-710; *Hemiramphus melanochir*-712).

The Australian garfish belong to the family Hemiramphidae, fish of this family being called "half-beaks" in the U.S.A.

The garfish may reach a length of 18 inches, but usually average about 12 inches. The fish is very slender with the lower jaw extended into a slender spine one to two inches long. Its scales are very deciduous and fall off at the slightest handling. As an edible fish, the flesh is white and tender, but the bones are small and very numerous.

The sea garfish are oceanic species but often enter estuaries and are seldom found more than a mile or two offshore. Because it swims either on or very near the surface, it is captured with seine nets. Fishing is concentrated from March to April, with most fish being caught in seine nets from sheltered ocean beaches. Occasionally a seine net is used from a boat over deeper water, the fish being frightened into the meshes of the net, as it is drawn towards the boat, by splashing the water with a paddle.

Crayfish (*Jasus lalandei*-780)

The crayfish is by far the most important unit in the Tasmanian fishery, not only in terms of pounds of fish landed, but also in monetary return. It is, of course, not a true fish or even a vertebrate (back-boned) animal. It belongs to the phylum Arthropoda (which includes insects, spiders, ticks and scorpions) and to the class Crustacea of this phylum, along with the crabs. It is more correctly referred to as a Spiny Lobster (*Jasus lalandei*).

As with crabs, the conspicuous hard outer covering is present but the pincer-like appendages are much less pronounced. The Tasmanian species is distinguished by antennules with two short flagella and the stridulating organ at the base of the antennae is absent. The rostrum is small and mostly points upward and the carapace is covered with forward-pointing spines. The abdominal tergites are sculptured.

The crayfish are caught in traps which are hemispherical, mainly made of cane and called pots. The pots are baited with fish or flesh and "shot" from dinghies or directly from the boat. The boats range from 20 feet to 70 feet

long, most having diesel engines and auxiliary sails. They operate all round the Tasmanian coast, including the Bass Strait Islands, as seasons permit, and the pots are set in from one to 50 fathoms of water.

The crayfish is boiled and either sold locally or exported to New South Wales and Victoria, or overseas to the United States. The whole fish is usually sold in Australia but only the tails, which contain most of the edible meat, are sent to the U.S.A.

Oyster (*Ostrea angasi*-831; *Crassostrea gigas*-828)

There are two types of oyster found in Tasmania—the Mud Oyster, *Ostrea angasi*, which is a native of the State, and the Japanese (or Pacific Oyster), *Crassostrea gigas*, which was first introduced into the State in 1947.

The mud oyster lives free in the adult stage but may be attached to rocks when young. The shell is large, rounded and regular in outline and the space between the valves is shallow. The upper valve is almost flat except for a slight dome near the hinge. The lower valve is dense and becomes massive with age. The lower valve is greyish-white externally but the upper valve may become brown or purple away from the hinge. The mud oyster is not common but small quantities are collected from estuaries and some marine beds are known. Although relatively few oysters are marketed now, it is evident from piles of shells (middens) that they were an important part of the diet of the aborigines.

The Japanese oyster is an attached species, markedly inequivalve and very variable in shape. The lower valve is deep and cup-shaped and rather strongly folded externally. The upper valve is rarely flat but usually slightly domed or humped. The external colour is variably white or creamy yellow with purple or reddish streaks. Internally, the shells are faintly opalescent white with a dull purple or brown border.

This oyster was first imported in 1947 to stock beds in Pittwater (near Hobart). Later stocks were imported in 1951 and 1952 and again set out in Pittwater. However, when breeding appeared to be restricted by the cold water, the stocks were transferred to Port Sorell in the north of the State and to Victoria. Although the Pacific oyster is now part of the local marine fauna, and research seems to have shown that it could be cultivated in the north of the State, no commercial fishery has been established.

Scallop (*Pecten meridionalis*-835; *Equichlamys bifrons*-836; *Mimachlamys asperrimus*-837)

The Tasmanian scallop industry is based on the Commercial Scallop, *Pecten meridionalis*. There are two other species found, the Queen Scallop, *Equichlamys bifrons*, and the Doughboy Scallop, *Mimachlamys asperrimus*, but neither is important commercially although the doughboy has been of value in the past.

The queen scallop has a large, finely-ribbed shell and is relatively rare. The doughboy has a moderately-sized shell up to four to five inches across with equally curved valves. The commercial scallop shell may reach five to six inches in diameter but only one valve is curved, the other being flat. Scallops rest unattached on the sea floor in practically all depths of water to 500 feet. The scallop lies on the curved valve and may swim short distances by producing a jet of water, generated by clapping the valves together. Spawning probably

takes place in winter but may be extended over a long period and may even take place more than once a year. The larvae settle and the adult reaches a commercial size in four to six years.

The fishery has shown three major periods of development:

1904-1918 An initial period in which fishing (by dredging) was confined to the Derwent estuary.

1918-1960 A period of varying but generally heavy commercial exploitation of beds in the D'Entrecasteaux Channel. This was the time when the fishery developed into an important primary industry.

1960-1965 The development of the oceanic beds on the east and north-east coasts in deeper water and the decline of the D'Entrecasteaux Channel beds.

Scallops are collected by dredges towed behind fishing boats and hauled to the surface on wire lines by mechanical winches. Fishing regulations limit each boat to two dredges which may be pulled simultaneously. On reaching the surface, the dredge is emptied and its contents sorted (minimum legal limit is three and a half inches shell diameter). The "size" scallops are boxed or bagged and the rest returned to the sea. From 1928 to 1963, the fishing season was restricted to three or four months as a further conservation measure. However, there seems to be some evidence to suggest that the rigid enforcement of the legal size limit is sufficient.

The sorted shells are taken to the "splitting" sheds where they are opened and the white adductor muscle and roe removed from the shell. The bulk of the catch is marketed locally.

Former Tasmanian Fisheries

The previous section deals with the species of fish, crustaceans and molluscs which are now taken in Tasmanian waters. The following marine life once had some importance in the State's economy:

Whales

Early in Tasmania's development, whaling was a principal activity, the main grounds being the bays off the mouth of the Derwent estuary and even within the Derwent itself. In the beginning, the whaler needed no ship but simply a longboat, a crew of oarsmen and a strategically placed shore observer to signal that a whale was in sight; under these circumstances, bay whaling crews might follow a variety of occupations and only take to the water when a warning was given.

Exports of whale oil were reported in official statistics as early as 1822 but 1837 appears to have been the year of best return, the "value of whale fisheries" being recorded as $270,420 (£135,210) with a deployment of 18 ships and 75 boats. The industry was completely uncontrolled and gradually the number of whales close to shore decreased. Ships engaged in whaling reached a maximum number and tonnage in 1850 (40 ships, 9,724 tons) and another forty years were to elapse before the industry ceased.

King Barracouta (*Rexea solandri*)

Barracouta (*Leionura atun*) is a familiar fish to most Tasmanians, but in the 19th century, a much larger barracouta, known as the King-fish, was caught in large numbers and averaged from 12 to 14 pounds in weight. Although odd specimens of *Rexea solandri* occasionally are found today, the species is extinct in Tasmanian waters for commercial purposes.

Shrimp

The Tamar estuary in the 19th century was the site of a commercial shrimp fishery; this product was still being marketed in the early years of the 20th century. The shrimp was described as being too small to peel, and was eaten, shell and all.

Oysters

Writing in 1891, the Government Statistician, R. M. Johnston, had this to say: "Of Molluscs there is only one of any importance, viz., the Common Mud Oyster. Although not now abundant—the beds now worked yielding about 100,000 oysters per year—it is estimated by competent authorities that, about 20 years ago, the various beds now unprofitable yielded about 44,000 bags, or 22,000,000 oysters per year. The destruction of these prolific Oyster beds has engaged much attention. Although attributed generally to reckless unrestricted dredging continued until the greater number of the beds were wholly destroyed, it is believed by some that natural causes were operating currently with the causes alleged".

FISHERIES STATISTICS

Source of Data and Method of Presentation

Statistics presented in this section have been supplied, in the main, by the Fisheries Division of the State Department of Agriculture. In the preparation of fisheries production statistics, the quantities are generally in terms of the form in which the catch is taken from the water. For example, the statistics of fish production are in terms of "estimated live weight" which is calculated from landed weights by using conversion factors for the various species. These conversion factors allow for the fact that the quantities of fish reported are frequently in a gutted, headed and gutted, or otherwise reduced condition. Crustaceans are reported on a "whole weight" basis and molluscs (edible) on a "gross (in-shell) weight" basis.

The catch is generally defined as that taken in Tasmanian waters; however, a quantity of sharks and crayfish taken by Victoria-based fishermen in Tasmanian waters, but marketed in Victoria, is included in the Victorian catch and excluded from Tasmanian figures, the logic being that the catch influences the Victorian economy.

Details of production refer only to recorded commercial production. In view of the importance of amateur fishermen in certain types of fishing, details shown cannot be taken as representing the whole catch. In addition, it is likely that the figures shown understate, to some extent, the full commercial catch since no information is available on fish taken for sale by persons not licensed as professional fishermen.

Persons Engaged in Fisheries

In the following table, which gives details collected in the Population Census at 30th June, 1961, the numbers of persons whose industry was classified to "fishing and whaling" are shown together with the numbers engaged in all primary industries and in the total work force; Australian and Tasmanian figures are compared:

Australia and Tasmania—Persons Engaged in Fisheries
Population Census, 30th June, 1961

Particulars	Australia	Tasmania
Persons Engaged in—		
Fishing and whaling .. .. (No.)	8,252	575
All primary industries .. .. (No.)	513,286	20,788
Total work force .. .. (No.)	4,225,096	130,917
Persons engaged in fishing and whaling as a proportion of—		
All primary industries .. (Per Cent)	1.6	2.8
Total work force .. (Per Cent)	0.2	0.4

Employment, Boats and Equipment

The boats used for the estuarine fisheries are mostly small vessels, propelled by diesel or petrol motors of low power. The offshore vessels range in length from 30 feet to 100 feet and almost invariably are powered by diesel engines. Refrigeration of the catch at sea is becoming more common, the four main types being ice box, ice cooling, brine tanks and dry refrigeration; many boats still have wells which serve to keep the catch alive, e.g. crayfish.

Equipment

In the Tasmanian fisheries, a wide range of equipment is used. The following table sets out the main types of fish, crustaceans and molluscs and the equipment most commonly used:

Fish Equipment Used in Tasmania

Type of Fish	Equipment Used	Type of Fish	Equipment Used
Silver Trumpeter ..	Gill net	Barracouta	Jig and Troll
Shark (edible)	Long-lines	Crayfish	Pots
Australian Salmon ..	Beach seine	Scallops	Dredge

The type of equipment used is determined, in some degree, by the nature of the narrow continental shelf surrounding Tasmania. The two nets most widely used are the gill net and the beach seine; a set net of the gill type can be worked in almost any location, irrespective of whether the bottom is rocky or not, while the beach seine is operated only over favourable bottoms. The lack of extensive banks and shoal systems, coupled with the narrowness of the continental shelf, explains why the fish population is not large and why European-type trawling has not been developed. The principal school fish is the Australian salmon and aircraft spotting has resulted in greatly increased catches which are taken close inshore by use of beach seines.

A feature of the Tasmanian fisheries is the use of dual, triple or even quadruple types of equipment from a single boat on the one voyage. Examples of possible combinations are as follows:

Dual—beach seine net and crayfish pot; crayfish pot and long line; jig and long line, &c.

Triple—crayfish pot, gill net and long line; crayfish pot, hand line and jig, &c.

Quadruple—beach seine net, crayfish pot, gill net and long line; crayfish pot, dredge, gill net and long line, &c.

Persons Engaged, Boats and Equipment

The following table shows details of persons, boats and equipment employed in the taking of fish, crustaceans and edible molluscs. The data are derived from the licensing records of the State Fisheries Division. The term "persons engaged" refers to the number of licence holders, and lacks the precision of the concept "average number employed" used in statistics of other production sectors. Many of the licensed operators are part-time fishermen and may normally follow other occupations:

Fisheries—Boats and Equipment in Use, Persons Engaged, &c.

Particulars	Unit	1960-61	1961-62	1962-63	1963-64
Boats Engaged—					
Under 25 ft.—with motor	No.	126	117	129	120
without motor	No.	6	25	13	12
25 ft. and under 35 ft.	No.	124	145	134	138
35 ft. and under 55 ft.	No.	190	193	199	202
55 ft. and over	No.	31	34	36	35
Total	No.	477	514	511	507
Value of Boats and Equipment	$'000	2,120	2,248	2,254	2,158
Persons Engaged (*a*)	No.	1,070	1,122	1,208	1,191

(*a*) Total number of persons licensed; deck hands as well as masters are subject to licensing. Includes part-time fishermen.

Production

Fish Catch

The following table shows the production of the main types of fish caught in Tasmania for a four-year period. The fish types appear in the table without any further description to identify the particular species but a specification of the commoner types appears as an introduction to this section.

Fish—Production by Type
('000 lb. Estimated Live Weight) (*a*)

Type	1960-61	1961-62	1962-63	1963-64
Mullet	12	7	12	18
Tuna	9	5	24	29
Shark	969	994	832	816
Australian Salmon	1,200	2,921	1,165	850
Flathead	74	34	45	43
Barracouta	824	2,061	1,130	1,409
Whitebait	62	22	12	21
Cod	31	30	18	9
Flounder	7	8	9	11
Trevally	25	45	35	55
Trumpeter	70	38	28	21
Garfish	56	77	138	129
Other	22	17	21	18
Total	3,361	6,259	3,469	3,429

(*a*) Estimated live weights are calculated from landed weights by conversion factors since quantities of fish are reported frequently in a gutted, headed and gutted, or otherwise reduced condition, (e.g. barracouta and shark).

Crustaceans and Molluscs

In terms of value, the most important item in the Tasmanian catch is crayfish and the next table shows details of production of this crustacean and also of molluscs:

Crustaceans and Molluscs—Production by Type

Type	1960-61	1961-62	1962-63	1963-64
CRUSTACEANS ('000 lb. Whole Weight)				
Crayfish	3,167	3,426	3,310	3,572
MOLLUSCS ('000 lb. In-shell Weight)				
Oysters	5	1	1	2
Scallops	5,296	4,772	5,871	4,260
Abalone	..	..	..	72
Total	5,301	4,773	5,872	4,334

Comparison with Other States

In 1963-64, Tasmania ranked third as a producer of crayfish, the two leading States being W.A. with 65 per cent of the Australian total and S.A. with 16 per cent; the Tasmanian catch was 13 per cent of the total and excluded a further 1.3 per cent taken in Tasmanian waters by Victoria-based fishermen.

For many years, Tasmania was the only State of the Commonwealth with a commercial scallop fishery; in 1955-56 Tasmania was joined by Queensland, but continued to retain its dominant position in the industry. In 1963, however, Tasmanian fishermen investigated beds known to exist in Port Phillip Bay and started a Victorian fishery, which in its first year, 1963-64, produced more than twice the Tasmanian fishery.

Catch Landed at Fishing Ports

In most types of fishing, there is a strong seasonal influence and the next table, showing the proportion of the total crayfish catch landed each month, indicates that the period of peak production begins in November.

Proportion of Crayfish Landed In Each Month
(Per Cent)

Month	1963	1964	Month	1963	1964
January	14.0	9.1	July	6.7	5.1
February	12.1	18.5	August	3.7	4.5
March	10.5	11.3	September (*a*) ..	1.5	0.5
April	4.0	8.0	October (*a*) ..	0.8	0.9
May	3.4	1.7	November ..	21.9	21.3
June..	4.6	3.6	December ..	16.8	15.5

(*a*) Closed season in most waters during these months.

The table that follows shows the proportion of fish and crayfish landed at Tasmanian fishing ports during 1963-64. The ports have been grouped according to location but the information relates to port of landing only, and not to the area in which the catch was made.

Proportion of Total Fish and Crayfish Landed at Each Port, 1963-64
(Per Cent)

Port	Fish	Crayfish	Port	Fish	Crayfish
Derwent and Channel			Bass Strait & Islands		
Dover	6.9	15.3	Bridport	12.6	4.5
Gordon	0.2	0.1	Currie	0.1	5.0
Hobart	10.6	7.4	Lady Barron ..	..	10.2
Kettering ..	6.8	2.7	Port Sorell ..	9.9	0.5
Margate	4.3	2.3	Smithton.. ..	0.5	1.0
Woodbridge ..	1.0	0.4	Stanley	13.7	11.7
			"Tamar" (*a*) ..	0.5	0.5
			Wynyard ..	4.9	0.1
Total ..	29.8	28.2	Total ..	42.2	33.5
East Coast & Peninsula—					
Bicheno	6.0	4.2	West Coast—		
Coles Bay ..	0.9	0.2			
St. Helens ..	4.6	11.5	Strahan	0.3	7.1
Swansea	0.1	..			
Triabunna ..	6.9	8.1			
Dunalley ..	3.5	5.2			
Port Arthur ..	5.7	2.0			
Total	27.7	31.2	Total Tasmania	100.0	100.0

(*a*) Launceston, Beauty Point and other Tamar ports.

Value of Production—Fishing

The table that follows gives details of gross and local values of edible fisheries products. The following definitions apply:

Gross Value of Production is the value placed on recorded production at the wholesale price realised at the principal markets.

Local Value (i.e. gross production valued at the place of production), is ascertained by deducting marketing costs from the gross value. Marketing costs include freight, cost of containers, commission, and other charges incidental thereto.

Fisheries—Gross and Local Value of Production
($'000)

Particulars	1960-61	1961-62	1962-63	1963-64
Gross Value of Production—				
Fish	296	510	324	312
Crustaceans (Crayfish)	1,246	1,422	1,474	1,580
Molluscs (chiefly Scallops)	378	362	456	311
Total	1,920	2,294	2,254	2,203
Less Marketing Costs	294	476	484	477
Local Value of Production ..	1,626	1,818	1,770	1,726

In other production sectors, local value is further reduced by deducting the value of materials used to arrive at the net value of production. For the fishing sector, this is not possible since data on materials used in the course of production are not available. (Petrol and diesel fuel are examples of such materials.)

Marketing

In general terms, it can be said that production of fish, crustaceans and molluscs from the Tasmanian fisheries far exceeds the demand generated by the State's relatively small population; it follows, therefore, that the industry is dependent, in large measure, on its ability to find export markets, both interstate and oversea, and this raises the problem of preserving a perishable product. In the past, shark and barracouta, when caught in large quantities, had actually been sold to orchardists as manure simply because there was no other way of disposing of the glut. Cold storage facilities are now generally available and in addition, canneries offer an alternative method of preservation, the principal cannery being located at Margate in the south. The problem of preservation has three aspects: (i) at sea; (ii) on shore; (iii) in transit to market. A survey made during 1964 indicated that approximately 14 per cent of the licensed fishing fleet had refrigerating plant of various types; in addition, some catches, e.g. crayfish, can be kept alive in boats' wells. Cold storage facilities ashore serve to hold the catch before its despatch to interstate and oversea markets while actual exports are carried by air, by refrigerated trailer on the roll-on roll-off ferries and in the refrigeration chambers of conventional ships.

The following table shows the value of exports and imports of fishery products. The fact that Tasmania has an exportable surplus, yet nevertheless imports some fishery products, is chiefly due to differences in type; the imported varieties include canned sardines, anchovies, oysters, crabs, &c., together with frozen, salted or smoked varieties of European, New Zealand or South African origin.

Fishery Products—Value of Exports and Imports

($'000)

Particulars	1960-61	1961-62	1962-63	1963-64
EXPORTS				
Fish (*a*)—Oversea	(*b*)	..	14	7
Interstate	612	572	538	363
Crayfish—Oversea	266	492	336	326
Interstate	650	596	778	684
Scallops—Oversea	..	..	..	63
Interstate	146	132	148	45
All Types—Oversea	266	492	350	396
Interstate	1,408	1,300	1,464	1,092
Total	1,674	1,792	1,814	1,488

Fishery Products—Value of Exports and Imports—*continued*
($'000)

Particulars	1960-61	1961-62	1962-63	1963-64
IMPORTS				
Fish—				
Fresh and Frozen—Oversea	66	66	98	145
Interstate	44	42	54	60
Preserved in Tins—Oversea	94	74	88	89
Interstate	54	118	138	164
Other (*c*) —Oversea	26	20	22	25
Interstate	(*b*)	2	6	11
All Types—Oversea	186	160	208	259
Interstate	98	162	198	235
Total	284	322	406	494

(*a*) Includes fresh and frozen fish and fish preserved in tins.
(*b*) Under $500.
(*c*) Includes smoked and salted fish and potted fish, extracts and caviare.

Fisheries Division

(Department of Agriculture)

Under the *Fisheries Act* 1959, provision is made for a Sea Fisheries Advisory Board to advise the Minister on questions relating to the management, control, protection, regulation and development of fisheries except in respect of salmon.

The Board consists of nine members appointed by the Governor as follows: the Director of Agriculture (or his representative); the Commissioner of Police (or his representative); a representative of Societies interested in the science of Zoology; two representatives of processors; and four representatives of professional fishermen. The Division of Fisheries is administered by a Secretary who is responsible to the Director of Agriculture.

The activities of the Division are as follows:

Law Enforcement

The *Fisheries Act* provides for regulations governing the taking of fish of particular species, oysters, scallops and seals in State territorial waters generally. Particular attention has lately been focussed on the taking of undersized and illegal crayfish and regulating of areas for the taking of scallops.

Extension and Management

Considerable advice and assistance is given to professional fishermen on all matters affecting sea fishing. The provision of facilities such as cool stores, slipways and finance is a continuing function under this heading.

Research

A joint Commonwealth/State tuna survey was commenced in February 1965, and investigations are continuing.

A research programme into the scallop fishery was begun in November, 1964. Matters receiving particular consideration are the apparent irregularity of recruitment to scallop population, and the effect on the scallop of the temperature and the salinity of the sea at given depths.

A preliminary investigation into the abalone fishery has provided information for the framing of regulations to protect the stock of this relatively new Tasmanian industry.

State officers are actively co-operating with the C.S.I.R.O. Division of Fisheries and Oceanography in its investigation of the crayfish fishery.

VALUE OF PRODUCTION

PRIMARY AND SECONDARY INDUSTRIES

Introduction

The value of production for Tasmania and the other Australian States is computed in accordance with the decisions reached at the Conferences of Australian Statisticians, and principally at the Conference held in 1935. The values shown in the tables that follow refer only to the production of primary industries and factories and exclude the building and construction industry, those industrial establishments not classified as factories, and certain agricultural and farmyard operations on areas of less than one acre.

Primary Industries

The following primary industries are those for which data are separately compiled in the value of production tables:

Primary, Rural	*Primary, Non-Rural*
Agriculture	Trapping
Pastoral	Forestry
Dairying	Fishing
Poultry	Mining and Quarrying
Bee-farming	

In respect of these primary industries, the following uniform definitions are employed:

(i) *Gross Value of Production* is the value placed on recorded production at the wholesale prices realised at the principal markets. In cases where primary products are consumed at the place of production, or where they become raw material for a secondary industry, these points of consumption are presumed to be the principal markets. Subsidies and bounties paid by the State and Commonwealth Governments to primary industries are, in general, included in gross value of production.

(ii) *Local Value* (i.e. gross production valued at the place of production) is ascertained by deducting marketing costs from the gross value. Marketing costs include freight, cost of containers, commission and other charges incidental thereto.

(iii) *Net Value of Production* represents local values *less* value of materials used in the process of production. Materials used in the process of production include seed, power, petrol and oils, fodder consumed by farm stock, manures, dips, sprays and other costs of a similar nature. No deductions from local values have been made for depreciation, certain maintenance charges, interest, or some other costs normally incurred.

Secondary Industries (Factories)

To place a value upon the production of factories, the following definitions are employed:

(i) *Value of Output* is the value of goods manufactured and includes the amount received for repair work, work done on commission, &c. The basis is the selling value *at the factory*, exclusive of all delivery charges.

(ii) *Value of Production* is the value of output *less* the value (at the factory) of the materials used, containers and packing, power, fuel and light used, tools replaced, and materials used in repairs to plant (but not depreciation charges).

In examining values for primary and secondary production, it will be seen that *gross value of production* is a concept confined to primary industries; that *local value* for primary industries is broadly analogous in concept with *value of output* for factories; that *net value of production* for primary industries is comparable with *value of production* for factories, since both are derived by deducting the value of materials used in the process of production, a procedure which eliminates possible duplication of values.

Comparing or Combining Industries

In comparing or combining production values for any of the previous industries, it is logically necessary to use only *net value of production* (primary) and *value of production* (secondary); both *gross* and *local* values will be found unsatisfactory because some degree of duplication will be involved. An obvious example of duplication can occur when the raw material for a factory process is the final product of a farm (e.g. the value of hops is contained in the *gross value of agriculture* and also in the *value of output of factories*, specifically of breweries). The primary-secondary relationship not only involves primary products becoming raw materials for factories but also factory products, (e.g. fertilisers) becoming essential materials for primary industries. Less obvious, perhaps, is the fact that one rural industry may supply the "raw material" for another rural industry (e.g. hay from *agriculture* consumed by livestock in the *pastoral* and *dairying* industries).

In the following chapter, *gross* and *local* values are shown for the various primary industries; the basic reason for publication is not to facilitate comparison and combination of these values for individual industries, or groups of industries, but rather to make explicit the process whereby *net value of production* has been computed.

In accordance with the previous definitions, net value of production for primary industries is computed by deducting the cost of materials used in the process of production from the local value. Details of such costs are not available for: (i) bee-farming; (ii) trapping; (iii) forestry; (iv) fishing. In the case of these industries, only local value can be computed.

Sources of Information—Value of Production

Primary Production, Rural

The data used are those concerning quantity of primary production (supplied principally by farmers, &c.) together with information collected from various sources on prices realised in the principal markets for different products, the costs of marketing these products and the costs of certain materials used in their production. Price and cost data are obtained from statutory

authorities, (e.g. Dairy Produce Equalisation Committee), market reports, special returns collected from wholesalers, brokers, auctioneers, etc., and from oversea and interstate trade statistics.

Primary Production, Non-Rural

(i) *Trapping*—Principal data are derived from export of skins and information on the annual mutton bird catch.

(ii) *Forestry*—Principal value data are available from the annual factory census, since forestry products are the basic raw material for sawmills, newsprint and paper mills, &c.

(iii) *Fishing*—Quantity data are supplied by fishermen and prices are collected from fish wholesalers and agents.

(iv) *Mining and Quarrying*—Principal value data are supplied by mine operators in the annual mining census.

Secondary Production

Factories—Both quantity and value data are supplied by factories in the annual factory census. Fuller details will be found in Chapter 8.

GROSS VALUE OF PRODUCTION

Rural Industries

The Rural Industries are defined, for value of production purposes, to comprise: (i) agriculture; (ii) pastoral; (iii) dairying; (iv) poultry; (v) beefarming. These industries have no relation, however, to any classification of individual rural holdings on an industry basis; a single holding would, in fact, usually produce several products, some attributable to one and some to another such industry, (e.g. wheat and oats which would be counted in agriculture, wool in pastoral and milk in dairying). The industries represent merely a convenient grouping of the aggregate production of individual products.

Agriculture

The following table shows quantity and value details for the agricultural industry in 1963-64. Also included in the table is the "unit gross value", (i.e. the average price per unit).

Gross Value of Production—Agriculture, 1963-64

Crop	Unit of Quantity	Production	Unit Gross Value	Gross Value
Cereals for Grain—			$	$'000
Barley	Bush.	414,230	1.433	592
Oats	Bush.	843,643	0.758	639
Wheat	Bush.	482,757	1.433	692
Total Cereals for Grain	..	..	..	(*a*) 1,927
Hay	Ton	249,176	16.000	3,987
Green Fodder	..	..	..	916
Field Peas—				
Blue	Bush.	98,939	3.042	301
Grey and Other	Bush.	87,594	2.775	243
Total Field Peas	..	..	..	544

Gross Value of Production—Agriculture, 1963-64—*continued*

Crop	Unit of Quantity	Production	Unit Gross Value	Gross Value
Vegetables for Stock Fodder—				
Horse Beans	Bush.	15,128	2.942	45
Turnips (Swede and White)	..	(*b*)	..	4,361
Other	..	..	..	89
Total Vegetables for Stock Fodder	..	..	..	4,495
Grass Seed—				
Clover	Cwt.	483	75.783	36
Other	Cwt.	6,878	20.608	142
Total Grass Seed	..	..	..	178
Industrial Crops—				
Hops (Dry weight)	lb.	1,580,000	0.650	1,026
Mustard	lb.	117,623	0.100	12
Total Industrial Crops	..	..	..	1,038
Vegetables for Human Consumption—				
Beans—French and Runner	'000 lb.	3,495	68.456	239
Peas—Green (Ex-shell)	'000 lb.	32,943	52.121	1,717
Potatoes	Ton	66,420	64.875	4,309
Turnips	Ton	4,061	46.600	189
Total Vegetables for Human Consumption	..	..	..	(*a*) 7,436
Orchard Fruit—				
Apples	Bush.	8,545,000	2.040	17,436
Apricots	Bush.	36,000	2.308	83
Pears	Bush.	625,000	2.258	1,410
Total Orchard Fruit	..	..	..	(*a*) (*c*) 19,042
Small Fruit—				
Currants	lb.	2,955,000	0.119	350
Loganberries	lb.	977,000	0.075	75
Raspberries	lb.	3,841,000	0.104	398
Total Small Fruit	..	..	..	(*a*) 888
All Other Crops	..	..	..	497
Total Crops	..	..	..	40,948

(*a*) Includes other crops not specified in table.

(*b*) Not available.

(*c*) Government subsidy to compulsory hail insurance scheme excluded from Apples and Pears, but included in Total Orchard Fruit.

Average Unit Gross Values

In the next table, average unit gross values for the principal crops are shown for a five-year period. The unit values have been calculated for the principal agricultural products, by dividing the total quantity produced into the total gross value of production for each unit. They therefore represent weighted average "prices" of the product in all markets (including the farm itself where quantities are retained for farm use).

Hop growing in the Derwent Valley near New Norfolk.
(*The Mercury*)

Spray irrigation for a potato crop near Scottsdale.
(*The Mercury*)

The open-cut in the Mt. Lyell copper deposit near Queenstown.
(Dept. of Film Production)

Average Unit Gross Value of Principal Crops
($)

Crop	Unit	1959-60	1960-61	1961-62	1962-63	1963-64
Cereals for Grain—						
Barley ..	Bush.	1.333	1.442	1.450	1.392	1.433
Oats	Bush.	1.150	0.967	0.975	0.758	0.758
Wheat ..	Bush.	1.375	1.400	1.600	1.475	1.433
Hay	Ton	19.025	18.450	16.408	14.158	16.000
Field Peas—						
Blue	Bush.	4.092	4.500	3.000	2.500	3.042
Grey and Other	Bush.	2.667	2.558	2.300	2.858	2.775
Vegetables for Stock Fodder—						
Horse Beans ..	Bush.	2.633	2.700	2.500	3.000	2.942
Industrial Crops—						
Hops (Dry weight) ..	lb.	0.625	0.625	0.650	0.650	0.650
Vegetables for Human Consumption—						
Peas—Green (*a*)	'000 lb.	58.808	66.575	56.442	54.242	52.121
Potatoes ..	Ton	39.550	90.358	52.483	25.175	64.875
Turnips ..	Ton	37.333	46.000	46.658	46.658	46.600
Orchard Fruit—						
Apples ..	Bush.	1.883	1.942	1.992	2.142	2.040
Pears	Bush.	2.050	2.583	1.783	2.492	2.258
Small Fruit—						
Currants ..	lb.	0.106	0.119	0.117	0.112	0.119
Raspberries ..	lb.	0.092	0.081	0.096	0.102	0.104

(*a*) Ex-shell.

The following table summarises the gross value of production of agriculture for a five-year period:

Gross Value of Production—Agriculture
($'000)

Crop	1959-60	1960-61	1961-62	1962-63	1963-64
Cereals for Grain	1,414	1,121	2,012	2,123	1,927
Hay	4,208	6,016	4,683	4,432	3,987
Green Fodder	993	1,152	932	892	916
Field Peas	587	321	487	508	544
Vegetables for Stock Fodder ..	2,917	2,099	3,440	4,039	4,495
Grass Seed	88	164	129	270	178
Industrial Crops..	1,768	1,772	1,863	1,879	1,038
Vegetables for Human Consumption	6,339	5,829	7,817	5,357	7,436
Orchard Fruit	11,350	12,149	16,876	14,716	19,042
Small Fruit	1,045	786	930	912	888
All Other Crops	270	381	501	422	497
Total All Crops ..	30,979	31,790	39,670	35,550	40,948

Three items in the previous table illustrate forcibly the duplication in values which can result from combining gross values of production for individual industries. The items are: (i) hay; (ii) green fodder; (iii) vegetables

for stock fodder, all being "raw materials" for the pastoral and dairying industries.

Pastoral, Dairying, Poultry and Bee-farming

For value of production purposes, the pastoral industry is taken to comprise the three products—wool (including wool on skins), cattle (other than culled dairy cows and bobby calves) slaughtered, and sheep and lambs slaughtered. Dairying is taken to comprise the three products—milk, dairy cattle (culled cows and bobby calves) slaughtered, and pigs slaughtered. Poultry comprises eggs and poultry slaughtered, and bee-farming honey and bees-wax produced.

The prime source of data on livestock slaughtered is information supplied by slaughtering establishments, supplemented by farmers' annual census returns giving details of slaughtering on farms. As sufficiently detailed information is not available on the types of cattle slaughtered to enable a precise dissection of total slaughterings to be made between the pastoral and dairying industries, data on the known culling rate in dairy herds is also used for this purpose.

The table that follows gives details of the gross value of production for each of the products of these industries:

Gross Value of Production—Pastoral, Dairying, Poultry and Bee-farming
($'000)

Particulars	1959-60	1960-61	1961-62	1962-63	1963-64
Pastoral—					
Shorn Wool (including Crutchings)	14,990	13,242	14,264	16,195	19,359
Other Wool (*a*)	1,518	1,216	1,488	1,577	1,993
Sheep and Lambs Slaughtered (*b*) (*c*)	4,212	4,452	3,590	4,090	4,662
Cattle Slaughtered (*b*) (*d*)	6,044	4,108	3,968	5,674	6,830
Total	26,764	23,018	23,310	27,536	32,844
Dairying—					
Milk	15,426	14,240	15,252	17,008	18,366
Cattle Slaughtered (*b*) (*d*)	1,726	1,684	1,606	1,192	1,418
Pigs Slaughtered (*b*)	2,718	2,564	2,696	3,204	3,688
Total	19,870	18,488	19,554	21,404	23,472
Poultry—					
Eggs Poultry Slaughtered	3,480	3,530	3,686	3,704	3,764
Total	3,480	3,530	3,686	3,704	3,764
Bee-farming—					
Honey	44	70	46	94	112
Beeswax	4	4	4	2	4
Total	48	74	50	96	116

(*a*) Dead, fellmongered and wool on skins exported.

(*b*) Includes adjustment for net exports of livestock.

(*c*) Excluding value of wool on skins.

(*d*) Culled dairy calves and bobby calves slaughtered are allocated to dairying; all other cattle slaughtered to pastoral.

An adjustment is made to the value of animals slaughtered to allow for the net export of livestock from the State. Otherwise, no allowance is made in the pastoral and dairying industries for the raising of livestock or their sale, except at the point of slaughter. In particular, in contrast with the practice in some other fields, (e.g. taxation), no allowance is made for changes in livestock inventories.

Primary Industries

The following table brings together gross values of production for all primary industries for a five-year period:

Gross Value of Production—Primary Industries
($ million) (*a*)

Industry	1959-60	1960-61	1961-62	1962-63	1963-64
Agriculture	31.0	31.8	39.7	35.6	40.9
Pastoral	26.8	23.0	23.3	27.5	32.8
Dairying	19.9	18.5	19.6	21.4	23.5
Poultry	3.5	3.5	3.7	3.7	3.8
Bee-farming	(*b*)	0.1	(*b*)	0.1	0.1
Total Rural	81.1	76.9	86.3	88.3	101.1
Trapping	0.6	0.4	0.4	0.5	0.5
Forestry	12.6	13.1	11.7	13.1	13.7
Fishing	1.6	1.9	2.3	2.3	2.2
Mining and Quarrying	17.9	18.8	18.9	20.8	23.4
Total Non-Rural	32.7	34.3	33.3	36.7	39.8
Total Primary	113.8	111.2	119.5	125.0	140.9

(*a*) Rounded to nearest $100,000 without adjustment to add to totals.
(*b*) Less than $50,000.

NET VALUE OF PRODUCTION—ALL RECORDED INDUSTRIES

Definition

In the preliminary section dealing with definitions, it was emphasised that *gross values of production* are unsuitable for making comparisons or for combining individual industries or groups of industries. In fact, it is impossible to make a comparison between gross value of production for primary industries and for factories, since gross value of production is not collected for factories; the primary-secondary comparison (or combination) can only be made on the basis of *net value of production* (primary industries) and *value of production* (factories).

Net Value, 1963-64

The next table shows, in detail for 1963-64, the method whereby gross values (primary industries) are reduced to local values and then further reduced to net values; also, the reduction of value of output (factories) to value of production. It will be noted that the combination of primary and secondary industries is made only in respect of the final column, where the net value of production (primary) is added to the value of production (factories).

Value of Production—All Recorded Industries, 1963-64
($ million) (*a*)

Industry	Gross Production Valued at Principal Market	*Less* Marketing Costs	Local Value, (i.e. Gross Production Valued at Place of Production)	*Less* Cost of Materials, Fuel, &c. Used	Net Value of Production
PRIMARY					
Rural—					
Agriculture ..	40.9	9.0	31.9	6.3	25.7
Pastoral	32.8	2.0	30.8	11.2	19.6
Dairying	23.5	1.0	22.5	5.7	16.8
Poultry ..	3.8	0.4	3.4	2.1	1.3
Bee-farming (*b*) ..	0.1	(*c*)	0.1	..	0.1
Total Rural ..	101.1	12.4	88.7	25.3	63.4
Non-Rural—					
Trapping (*b*) ..	0.5	(*c*)	0.5	..	0.5
Forestry (*b*) ..	13.7	2.0	11.6	..	11.6
Fishing (*b*) ..	2.2	0.5	1.7	..	1.7
Mining & Quarrying	23.4	3.1	20.3	5.8	14.5
Total Non-Rural	39.8	5.7	34.1	5.8	28.3
Total Primary	140.9	18.1	122.8	31.2	91.7

Industry	Value of Output	*Less* Cost of Materials, Fuel, &c. Used	Value of Production
SECONDARY			
Factories	341.1	188.5	152.6
ALL INDUSTRIES			
Net Value of Production, Primary and Secondary Industries			244.2

General Note: Reference is made to value definitions in the introduction to this section.

(*a*) Rounded to nearest $100,000 without adjustment to add to totals.

(*b*) Gross and local values available, but production costs not available.

(*c*) Under $50,000.

Cost of Materials, Fuel, &c. Used

In the previous table, *local value* has been reduced to *net value of production* (primary) and *value of output* to *value of production* (factories); in each case, the process involved deduction of certain costs. Full details of factory costs appear in Chapter 8, "Secondary Industry—Manufacturing"; the following table has been compiled to show details of those costs taken into account in primary industries.

Primary Industries—Recorded Costs, 1963-64
($'000)

Cost Item	Agriculture	Pastoral	Dairying	Poultry	Mining and Quarrying	Total
RURAL						
Seed	2,256	442	190	..	..	2,888
Fertilizers	1,110	2,230	956	..	..	4,296
Spraying, Sheep-Dip	1,080	110	24	..	..	1,214
Stock Feed	122	7,712	3,816	2,036	..	13,686
Water for Irrigation	98	44	44	..	..	186
Power, Fuel & Light	1,588	710	672	94	..	3,064
Total Rural	6,254	11,248	5,702	2,130	..	25,334
NON-RURAL						
Total (*a*)	..	..	..	..	(*a*) 5,838	(*a*) 5,838
RURAL AND NON-RURAL (*b*)						
Total Primary	6,254	11,248	5,702	2,130	5,838	31,172

(*a*) Includes power, fuel and light ($820,000) and cost of repairs, timber, explosives and other expendable stores used in mining and quarrying ($5,018,000).
(*b*) Costs not available for bee-farming, trapping, forestry and fishing.

Net Value—Summary

The next table summarises, for a five-year period, the net value of production for all recorded industries.

Net Value of Production—All Recorded Industries
($ million) (*a*)

Industry	1959-60	1960-61	1961-62	1962-63	1963-64
Primary, Rural—					
Agriculture	21.3	21.9	25.9	22.3	25.7
Pastoral	15.7	12.8	11.7	15.1	19.6
Dairying	13.9	13.2	13.6	15.0	16.8
Poultry	1.1	1.1	1.1	1.2	1.3
Bee-farming (*b*)	(*c*)	0.1	(*c*)	0.1	0.1
Total Rural	52.0	49.1	52.3	53.7	63.4
Primary, Non-Rural—					
Trapping (*b*)	0.6	0.4	0.3	0.5	0.5
Forestry (*b*)	11.0	11.5	10.2	11.3	11.6
Fishing (*b*)	1.4	1.6	1.8	1.8	1.7
Mining and Quarrying	10.8	11.0	10.4	12.2	14.5
Total Non-Rural	23.8	24.5	22.7	25.8	28.3
Total Primary	75.8	73.6	75.0	79.5	91.7
Secondary—					
Factories	120.4	124.9	127.9	142.0	152.6
Total Industries	196.2	198.5	202.9	221.5	244.2

(*a*) Rounded to the nearest $100,000 without adjustment to add to totals.
(*b*) Local value of production.
(*c*) Less than $50,000.

Net Value of Production, 1964-65

The following table has been compiled to give the latest data available and to compare net value of production (1964-65) with corresponding values for 1963-64:

Net Value of Production—All Recorded Industries

Industry	1963-64 (*a*)	1964-65 (*a*)	Increase, 1964-65 above 1963-64
Primary, Rural—	$ mill.	$ mill.	Per Cent
Agriculture	25.7	27.2	5.8
Pastoral	19.6	21.0	7.1
Dairying	16.8	19.0	13.1
Poultry	1.3	1.6	23.1
Bee-farming (*b*)	0.1	0.1	0.0
Total Rural	63.4	69.0	8.8
Primary, Non-Rural—			
Trapping (*b*)	0.5	0.4	—20.0
Forestry (*b*)	11.6	13.3	14.7
Fishing (*b*)	1.7	2.2	29.4
Mining and Quarrying	14.5	18.2	25.5
Total Non-Rural	28.3	34.0	20.1
Total All Primary	91.7	103.0	11.2
Secondary—			
Factories	152.6	167.3	9.6
Total Industries	244.2	270.3	10.7

(*a*) Rounded to the nearest $100,000 without adjustment to add to totals.

(*b*) Local value of production.