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AUSTRALIAN INSTITUTE
OF MARINE SCIENCE



THE AIMS INDEX OF MARINE INDUSTRY

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AIMS: Australia's tropical marine research agency.

Deloitte Access Economics undertook this analytical work for AIMS. Drawing on experience in developing and updating the AIMS Index in the past, Deloitte Access Economics also drew on its in-house Deloitte Access Economics Regional Input-Output Model (DAE-RIO-M) to estimate the flow-on and total economic contribution of the marine industry.

Front cover: *Looking south-west over Bayview and Charles Darwin National Park toward the Darwin CBD – this image illustrates the diversity of activity related to Australia’s marine economy – coastal urban development (Bayview and Tipperary Waters Marina), marine/coastal environmental protection (Charles Darwin NP), marine recreation (sailing vessels on Frances Bay), vessel maintenance (Pearl Marine ship yard), entertainment (Stokes Hill precinct) and port activities (Darwin City Port).*

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Foreword

Australia truly is a marine nation. It has the third largest Exclusive Economic Zone in the world and its total marine territories (10.2 million square kilometres) are 32% larger than the size of the Australian mainland (7.69 million square kilometres).

The Australian Institute of Marine Science (AIMS) is Australia's tropical marine research agency. Its mission is to provide the research and knowledge of Australia's tropical marine estate required to support growth in its use, effective environmental management and protection of its unique ecosystems. The Institute's research supports government in development of marine policy; it enables evidence-based decisions by the public and private sectors, including the traditional owners of vast tracts of our coastline and sea country; and it provides trusted advice to the community at large about the state of our unique tropical marine ecosystems.

More than 85% of our population lives within 50 km of the ocean, and more than 70% of Australia's territory is beneath the ocean. It is therefore not surprising to see the important role the ocean plays in defining the national identity of Australians. But our ocean territory is also critically important as a source of food, in the control of our climate, to national security and to the national economy. The latter value – the value of the marine industry to the national economy – is the focus of this report.

The AIMS Index of Marine Industry has been developed to provide a regular update of the economic value of Australia's marine environment. It confines its focus to economic output and value-add of marine-based sectors to allow comparison with other sectors of the Australian economy.

This year's update affirms that Australian marine industries, collectively referred to as our "Blue Economy" have grown at a rate much faster than our national economy since the last AIMS Index (which used 2012 data), and since 2001-02 have increased in value by 126%. There is potential for further growth, and AIMS' mission is to assist the sustainable development of this incredibly valuable sector of the nation's future prosperity.

John Gunn

Chief Executive Officer, Australian Institute of Marine Science

Executive summary

Introduction

The AIMS Index of Marine Industry has been developed to provide a regular update of the economic value of Australia's marine environment. It confines its focus to accessible economic data to allow comparison with other economic sectors. Originally developed for AIMS in 2008, this 2016 version is the sixth edition of the Marine Index, the first update since the 2014 AIMS Index.

Study Approach

This study assesses the economic contribution of the Australian marine industry. It follows the same methodological approach as previous editions of the Index, with some important changes and additions. These additions - recreational fishing, marinas and boating infrastructure and water transport – broaden how the marine industry is defined. Furthermore, the way in which tourism activities are measured has changed. Data have been updated to 2013-14, the latest year for which updated estimates consistently exist across most major categories¹. This update to 2013-14 represents two new years' of data presented since the previous 2014 report, which went to 2011-12.

In addition to the direct contribution of the marine industry to total output, which is an estimate of the income that is directly earned by the marine industry, this report considers the flow-on and total economic contribution of the marine industry. This recognises that, for every dollar earned by marine industry, activity is also stimulated elsewhere in the economy. By analysing both, this report provides a comprehensive estimate of the size and importance of the marine industry.

Direct contribution to output

In 2013-14 the total measurable contribution to economic output based on the marine environment in Australia was \$53.8 billion using the same definition as the 2014 report, up from \$48.1 billion in 2012-13. This represents 1.8% of total national industry output for the 2013-14 year.² Using the updated and broader definition (i.e. including recreational fishing, marine and boating infrastructure, water transport and updated tourism values), the direct contribution of the industry to output was \$73.1 billion.

Table i: Total contribution to output from marine-related activities in 2013-14 (\$ million)

Marine resource activities and industries	
Fishing	
Marine-based aquaculture	\$994.4
Commercial fishing (wild captures fisheries)	\$1,503.3
Recreational fishing	\$2,164.8
Offshore oil & gas exploration and extraction	
Oil exploration	\$3,512.0
Oil production	\$9,144.5
LPG	\$1,265.1
Natural gas	\$16,304.7
Marine-related service activities and industries	
Boat/ship building, repair & maintenance services and infrastructure	
Shipbuilding & repair (civil and defence)	\$2,966.0
Boatbuilding & repair (including recreational vessels)	\$1,235.0
Marinas and boating infrastructure	\$699.3
Marine equipment retailing	\$1,393.0
Marine tourism and recreational activities	
Domestic consumption of tourism goods and services	\$23,815.3
International consumption of tourism goods and services	\$4,239.0
Water Transport	
Water-based transport of passengers and freight	\$3,847.0
TOTAL (measurable value from marine-related activities)	\$73,083.3
TOTAL (measurable value from marine-related activities using previous definition for comparison with 2011-12 data)	\$53,783.2

¹ For activities and industries where 2014-15 estimates exist, these have been included in the footnotes of the report.

² Based on national value of production of \$3.0 trillion in 2013-14 – source: ABS (2016b) *8155.0, Australian Industry, 2014-15*.

Total economic value (direct + flow-on value added)

The total economic value of the marine industry is measured by the value-add that it generates directly, plus the indirect contribution made to other industries, which is also measured in value-add terms. This is presented in Table ii.

Value added is a different concept to output. It is commonly used to measure economic contribution because the output of one industry, measured by the value of production, often becomes the input of another. This can lead to double-counting and give a misleading estimate of an industry's contribution to the economy. In contrast, an industry's value added does not include the value that is created by upstream industries. An industry's value added is measured by the value of what it produces, net of inputs from other industries, and is therefore smaller than its total output. The value-add for each industry are summed to measure Gross Domestic Product (GDP), which is the primary indicator of the size of a country's economy. This approach avoids double-counting outputs that flow between industries.

In total, Australia's marine industry contributed \$42.0 billion to value-add in 2013-14, with a further indirect \$32.2 billion of value added in other industries. This amounts to a total economic contribution of \$74.2 billion in value added, or 4.8% of national gross domestic product in that year.³

The marine industry's total employment was estimated as almost 400,000 FTE workers: 193,000 FTE workers directly employed in the industry, with a further 202,000 FTE workers in indirect employment (considering upstream industries only).

Table ii: Direct and indirect economic contribution by marine sub-sector, 2013-14 (\$ million)

	Direct value of production	Direct value added	Indirect value added	Total value added
Marine resource activities and industries				
Fishing				
Marine-based aquaculture	\$994.4	\$662.7	\$255.7	\$918.4
Commercial fishing (wild captures fisheries)	\$1,503.3	\$824.0	\$551.3	\$1,375.3
Recreational fishing	\$2,164.8	\$2,164.8	\$1,523.8	\$3,688.6
Offshore oil & gas exploration and extraction				
Oil exploration	\$3,512.0	\$1,859.4	\$1,518.4	\$3,377.8
Oil production	\$9,144.5	\$5,961.4	\$2,801.8	\$8,763.2
LPG	\$1,265.1	\$824.8	\$387.6	\$1,212.4
Natural gas	\$16,304.7	\$10,629.2	\$4,995.6	\$15,624.8
Marine-related service activities and industries				
Boat/ship building, repair & maintenance services and infrastructure				
Shipbuilding & repair (civil and defence)	\$2,966.0	\$1,234.0	\$2,117.7	\$3,351.7
Boatbuilding & repair (including recreational vessels)	\$1,235.0	\$429.0	\$736.2	\$1,165.2
Marinas and boating infrastructure	\$699.3	\$250.5	\$402.2	\$652.7
Marine equipment retailing	\$1,393.0	\$223.3	\$157.4	\$380.7
Marine tourism and recreational activities				
Domestic consumption of tourism goods and services	\$23,815.3	\$13,128.4	\$13,895.2	\$27,023.6
International consumption of tourism goods and services	\$4,239.0	\$2,336.8	\$2,473.3	\$4,810.1
Water transport				
Water-based transport of passengers and freight	\$3,847.0	\$1,409.0	\$1,586.1	\$2,995.1

Note: Each sub-sector was analysed separately. Consequently, the results of the indirect value added are not additive. Total indirect contribution was estimated by removing expenditure associated with 'marine sub-sectors' to avoid double-counting.

³ Based on Australian GDP of \$1.56 trillion in 2013-14. Source: ABS (2016e)

1 Introduction

1.1 Purpose of this study

The AIMS Index of Marine Industry has been developed to provide a regular update of the economic value of Australia's marine environment. It confines its focus to accessible economic data to allow comparison with other economic sectors (e.g. marine-based industries already contribute more to the Australian economy than the agricultural sector).

The value of Australia's marine industry has more than doubled in the last ten years and is projected to continue to grow. Deloitte Access Economics identifies ocean resources as being one of the top 25 future growth sectors in the Australian economy, with future growth earmarked at 4.4% per annum over the coming years⁴. This, together with estimates by the Oceans Policy Science Advisory Group, that predict Australia's oceans will contribute \$100 billion to the Australian economy by 2025⁵, highlights the need for marine research to unlock knowledge and understanding required to support sustainable growth.

The National Marine Science Plan 2015-25⁶ provides a decadal plan to focus investment and science to fulfil the blue economy's potential⁷. It outlines the research, infrastructure, skills, partnerships and investment that will drive the required changes over the next 10 years. With challenges ranging from marine sovereignty and security, energy security, food security, biodiversity conservation, sustainable urban coastal development and climate change adaptation to resources allocation, the plan proposes a number of actions. They include improved decision-support tools, models and forecasts, industry and government partnerships, national collaborations, the application of cross-disciplinary skills, the funding of national research vessels, increased exploration, mapping and monitoring, and the development of marine baselines and a monitoring program.

In addition to the contribution from existing activities and industries such as tourism, ports, transport, shipbuilding, offshore oil and gas, aquaculture and wild fisheries, the plan identifies opportunities for further economic gains from biotechnology, wind, wave and tidal energy and innovation-based growth in established sectors.

The ocean's ecosystem services, such as climate regulation, temperature and freshwater variability, carbon dioxide absorption, nutrient cycling, coastal protection and oxygen production, are estimated to already be worth \$25 billion⁸. This additional value is not included in the data provided in this report, but it provides further grounds for raising the profile of our marine sector in policy and investment decisions. Capturing the full value that our oceans provide is critical for appropriate decision-making.

1.2 Approach to the valuation

The value of Australia's marine industry

Industries associated with Australia's marine environment contribute significant benefits to our economy and society. Despite this, there is not a consolidated 'marine industry' category that reports this contribution to Gross Domestic Product (GDP), Gross State Product (GSP), employment, and infrastructure at a national, State/Territory and regional level.

⁴ Deloitte Access Economics (2014)

⁵ Oceans Policy Science Advisory Group (2013)

⁶ National Marine Science Committee (2015)

⁷ A blue economy is defined as one in which ocean ecosystems bring economic and social benefits that are efficient, equitable and sustainable. It is sometimes used interchangeably with 'marine economy' or 'marine industry'.

⁸ Eadie and Hosington (2011)

AIMS has commissioned the analysis in this report to bring together published economic data on the value of the Australian marine industry sector.

This is the sixth edition of the AIMS Index of Marine Industry. Originally developed for AIMS in 2008, it provides the most recent available assessment of the economic value of the marine industry. The industry groupings and definitions used in the Index are the same as those used in the previous editions. They were developed through discussion with representatives from a wide range of organisations involved with the marine industry in Australia⁹. Collection of available information for these groupings provides information on the scale of Australia's marine industry and also highlights where information gaps exist in relation to each sub-sector of the marine industry. The industry groupings should be seen as an initial framework for considering the scope and scale of activities which are considered to be part of the 'marine industry'.

Approach to estimating the direct contribution of Australia's marine industry

The main barrier to collecting the consistent and comparable data required to estimate the economic value of Australia's marine industry is that there is no single definition of which activities constitute this sector – that is, there is no agreed 'marine industry' grouping.

This inconsistency has limited the identification of issues and trends affecting marine-related industries and activities. While a number of studies have estimated the value of marine-related activities at a regional level, this has not been done at a national level (see Section 2.3.2). The methodology of this Index broadly follows the framework used by Allen Consulting (2004).¹⁰

Sub-sector definitions and data sources are limited to quantifiable aspects of activities associated with the marine environment. Data is compiled from sources that are available, comparable and reliable. This necessarily means that economic transactions and industry groupings are emphasised and that data is focussed on value flows rather than on value stocks.

Alternative approaches, which would make it possible to think about valuing the social, environmental and other non-tangible dimensions of the marine environment, are not considered in this exercise. That is not to say that those benefits are not significant: recreational activities such as fishing, boating and marine tourism can have significant social, health and well-being benefits¹¹, but they are more difficult to capture and compare to more traditional economic values. There are also non-use values associated with the marine environment, such as households' willingness to pay for an improvement in fishing ecosystems.¹²

While this approach gives a limited construction of 'valuation', the focus on data that is accessible and repeatable means the performance of the marine industry can be measured and compared over time. Where possible the data is updated to reflect any changes in the source data that may have occurred between issues.

All data have been updated to 2013-14 – the most recent year for which data is available for all data sources. However, to illustrate trends over time two more years of new data are presented in the report: 2012-13 and 2013-14. Where more recent data was available, this is shown in the relevant footnotes.

For some sub-sectors, definitions have changed somewhat. 2013-14 data is provided for both the old and new definition, to enable comparison with the 2011-12 data provided in the 2014 Index.

⁹ AIMS (2008)

¹⁰ Definitions vary internationally. For instance, what is called 'marine industry' in this report is known as 'ocean industries' in Canada. McIlgorm (2016) provides a useful study discussing some of the idiosyncrasies of ocean economy valuation studies in the Asia-Pacific region.

¹¹ See for instance McManus et al. (2011).

¹² See for instance Rolfe & Windle (2012).

The report also reflects more recent literature and estimates. It includes:

- Consideration of the National Marine Science Plan 2015-2025,
- More detail on recreational fishing, including a discussion of recent relevant studies and the development of an estimate of this activity;
- Inclusion of marinas and boating infrastructure in the industry definition;
- Inclusion of water transport; and
- Discussion of the size of the aquaria sub-sector.

Approach to estimating the flow-on contribution of Australia's marine industry

In addition to the direct contribution of the marine industry to output, which is an estimate of the income that is directly earned by Australia's marine industry, this report considers the flow-on (or 'indirect') contribution of the marine industry.

This recognises that, for every dollar earned by marine industry, revenue is also stimulated elsewhere in the economy. For example, for every dollar of aquaculture income, there is also income triggered for those who provide upstream inputs to aquaculture (e.g. feed, energy, materials), and those who are downstream, in the aquaculture supply chains (food processors, transport, trade etc.).

By analysing both, this report provides a more comprehensive estimate of the size and importance of the marine industry that can easily be compared to other Australian or international industries.

The indirect contribution was estimated using the Deloitte Access Economics Regional Input-Output Model (DAE-RIO-M). Industry metrics presented in this report include value added and employment.

2 The economic value of Australia's marine industry

2.1 Value in 2013-14

A summary of the major and most recent available data about marine industry activities in Australia is provided in Table 2.1.

The information summarised the table shows that there are a number of categories for which there is no suitable data available (N/A). For sub-sectors where data is available, comparable and reliable, the values have been aggregated to provide a total measurable value for 2013-14 (see Table 2.2).

Table 2.1: Summary statistics for the Australian marine industry, 2013-14

	Industry Value added (2013-14 \$m)	Value of Production (2013-14 \$m)	Industry employment (2013-14)	Other
Marine resource activities and industries				
Fishing				
Marine-based aquaculture ¹³	n/a	\$994.4	5,111 employees, 76% full-time share	-
Commercial fishing (wild capture fisheries) ¹⁴	n/a	\$1,503.3	3,594 employees, 62% full-time share	-
Recreational fishing ¹⁵	n/a	\$2,164.8 (expenditure)	n/a	3.36m fishers in 2000-01, 82% marine fishing
Indigenous fishing ¹⁶	n/a	n/a	In 2000-01, around 37,000 indigenous people participated	2000-01 harvest: 1.89m fish, 0.84m crustaceans, 1.15m molluscs, 0.93m others
Offshore oil & gas exploration and extraction				
Oil exploration ¹⁷	n/a	\$3,512.0	n/a	-
Oil production ¹⁸	n/a	\$9,144.5	n/a	-
LPG ¹⁹	n/a	\$1,265.1	n/a	-
Natural gas ²⁰	n/a	\$16,304.7	n/a	-
Marine-related service activities and industries				
Boat/ship building, repair & maintenance services and infrastructure				
Shipbuilding & repair (civil and defence) ²¹	\$1,234	\$2,966.0	9,513 employees	-
Boatbuilding & repair (including	\$429	\$1,235.0	5,441 employees	-

¹³ ABARES (2015)

¹⁴ Ibid.

¹⁵ DAFF (2003). The \$2.645 billion expenditure figure is based on the 2003 study, inflated to 2013-14\$ (from \$1.855 billion in 2000-01). Only marine fishing was included, by applying the share of harvest of marine species (offshore, coastal and estuary) relative to all harvest (which also includes river and lakes/dams). This share is 82%.

¹⁶ Ibid.

¹⁷ ABS (2016a) Cat No 8412.0, June 2016. Oil exploration in 2014-15 is \$2,537.3 million.

¹⁸ APPEA (2016)

¹⁹ Department of Industry (2014). Export revenue only.

²⁰ Ibid. Export revenue only.

²¹ ABS (2016b) Cat No 8155.0, 2014-15. Shipbuilding and repair (civil and defence) was \$3,232 million in 2014-15.

	Industry Value added (2013-14 \$m)	Value of Production (2013-14 \$m)	Industry employment (2013-14)	Other
recreational vessels) ²²				
Marinas and boating infrastructure ²³	n/a	\$699.3	3,304 employees (2012-13)	-
Marine equipment retailing ²⁴	\$223.3	\$1,393.0	3,460 employees	Wages & salary \$166.2m
Marine tourism and recreational activities				
Domestic consumption of tourism goods and services ²⁵	\$13,128.4	\$23,815.3	159,000 tourism-related employees	Assumption: 40% of domestic tourism
International consumption of tourism goods and services ²⁶	\$2,336.8	\$4,239.0	28,300 tourism-related employees	Assumption: 19% of international tourism
Aquaria ²⁷	n/a	n/a	n/a	2006-07: \$304m retail sales, \$233m gross value of production.
Water transport				
Water-based transport of passengers and freight ²⁸	\$1,409.0	\$3,847.0	11,000	-
Marine environment management				
Marine safety (Australian Maritime Safety Authority – AMSA) ²⁹	n/a	n/a	374 AMSA employees	Operating expenditure \$204.9m

In 2013-14, the total measurable contribution to economic output based on the marine environment in Australia was \$53.8 billion, using the 2014 definition (Table 2.2).

The updated definition includes recreational fishing, water transport and marine & boating infrastructure, which were previously excluded. It also measures the value of tourism goods and services using the gross value of production, rather than the industry value-added, which is consistent with other activity/industry groups. Using this updated definition, the industry value of output was \$73.1 billion.

By way of comparison, in 2013-14:

²² Ibid. Boatbuilding and repair (including recreational vessels) was \$1,139 million in 2014-15.

²³ Recreational Marine Research Centre (2013)

²⁴ IBISWorld (2016). Marine equipment retailing was \$1,377 million in 2014-15.

²⁵ ABS (2016c) Cat No. 5249.0, 2014-15. The Tourism Satellite Accounts (TSA) provides data on domestic and international tourism value add (\$32,821 million and \$12,299 million respectively for 2013-14). For employment (a total of 546,500), the same ratio of domestic to international tourism was used as for value add. Consistent with the 2014 Index, domestic and international marine tourism were estimated as 40% and 19% of domestic and international tourism respectively, using the methodology first outlined by the Review Committee on Marine Industries, Science and Technology in Australia (1989).

²⁶ Ibid.

²⁷ FRDC/DAFF (2008). This figure includes \$129 million in ornamental fish sales, \$171 million in accessories sales (tanks, filters, lights, etc.) and \$4 million in 'other' sales (live rock, coral and aquatic plants).

²⁸ ABS (2016c) Cat No 8155.0, 2014-15. The most recent report shows that by 2014-15 this has increased to an industry value add of \$1,543 million and industry income of \$4,236 million, while employment is unchanged at 11,000.

²⁹ AMSA (2015). The most recent report shows that by 2014-15 the number of employees has increased to 384, while operating expenditure has decreased to \$202.0 million.

- The gross value of all agricultural production in Australia was \$53.6 billion³⁰;
- Sales and service income from coal mining totalled \$45.9 billion³¹;
- Sales and service income from primary metal and metal product manufacturing totalled around \$44.9 billion³²; and
- Sales and service income from motor vehicle and motor vehicle parts retailing totalled around \$53.4 billion.³³

Table 2.2: Total measurable value from marine-related activities in 2013-14 (\$ million)

Marine resource activities and industries	
Fishing	
Marine-based aquaculture	\$994.4
Commercial fishing (wild captures fisheries)	\$1,503.3
Recreational fishing	\$2,164.8
Offshore oil & gas exploration and extraction	
Oil exploration	\$3,512.0
Oil production	\$9,144.5
LPG	\$1,265.1
Natural gas	\$16,304.7
Marine-related service activities and industries	
Boat/ship building, repair & maintenance services and infrastructure	
Shipbuilding & repair (civil and defence)	\$2,966.0
Boatbuilding & repair (including recreational vessels)	\$1,235.0
Marinas and boating infrastructure	\$699.3
Marine equipment retailing	\$1,393.0
Marine tourism and recreational activities	
Domestic consumption of tourism goods and services ³⁴	\$23,815.3
International consumption of tourism goods and services ³⁵	\$4,239.0
Water Transport	
Water passenger and freight transport	\$3,847.0
TOTAL (measurable value from marine-related activities)	\$73,083.3
TOTAL (measurable value from marine-related activities using the same definition as in 2014 Index, for comparison with 2011-12 data)	\$53,783.2

It should be noted that the value estimate provided is not a complete value – economic data is unavailable for many marine activities and there are non-economic values which are not captured by this approach.

2.2 Changes over time

In order to form an idea of the sector's performance over time (Chart 2.1), we compare the levels of economic activity for marine industry sub-sectors, for which reliable data on economic activity is collected annually.

Over the last ten years the marine industry value of output has more than doubled, an increase of 129% to \$53.8 billion (using the 2014 definition). Looking in more detail at the 12 months to June 2014, the value of the sector increased by 11%.

This increase was driven by:

- The increase in value of oil production. This was \$9.2 billion in 2013-14, compared with \$7.0 billion in 2012-13, although it is still below the 2011-12 production level of \$9.7 billion.
- The increase in value of natural gas exports to \$16.3 billion in 2013-14. This a 16% increase over the value of this sector in 2012-13 and a 30% increase since 2011-12, the period of the last report.

³⁰ ABS (2016d) Cat No 7503.0, 2014-15.

³¹ ABS (2016b) Cat No 8155.0, 2014-15.

³² Ibid.

³³ Ibid.

³⁴ Note the difference in definition: value of production rather than value added used.

³⁵ Note the difference in definition: value of production rather than value added used.

- A 4% increase in marine tourism and recreational activities between 2012-13 and 2013-14. This sector has shown a steady increase over time with an average year on year growth of 5% since 2001-02.

Moderating these increases were recent contractions in the total level of activity in:

- Marine-based aquaculture;
- Shipbuilding and repair (civil and defence); and
- Marine equipment retailing.

Overall, the increase in natural gas, oil production and tourism related industries more than offset decreases in other sectors, resulting in an overall increase in the production value of the marine industry of 11% in the 12 months to June 2014 (using the old definition of the sector). This compares with the Australian economy as a whole, which, in the 12 months to June 2014 grew by 3.9%.³⁶

Chart 2.1: Comparison over time: measurable Industry Value of Production from selected marine-related activities, 2001-02 to 2013-14 (\$ million)

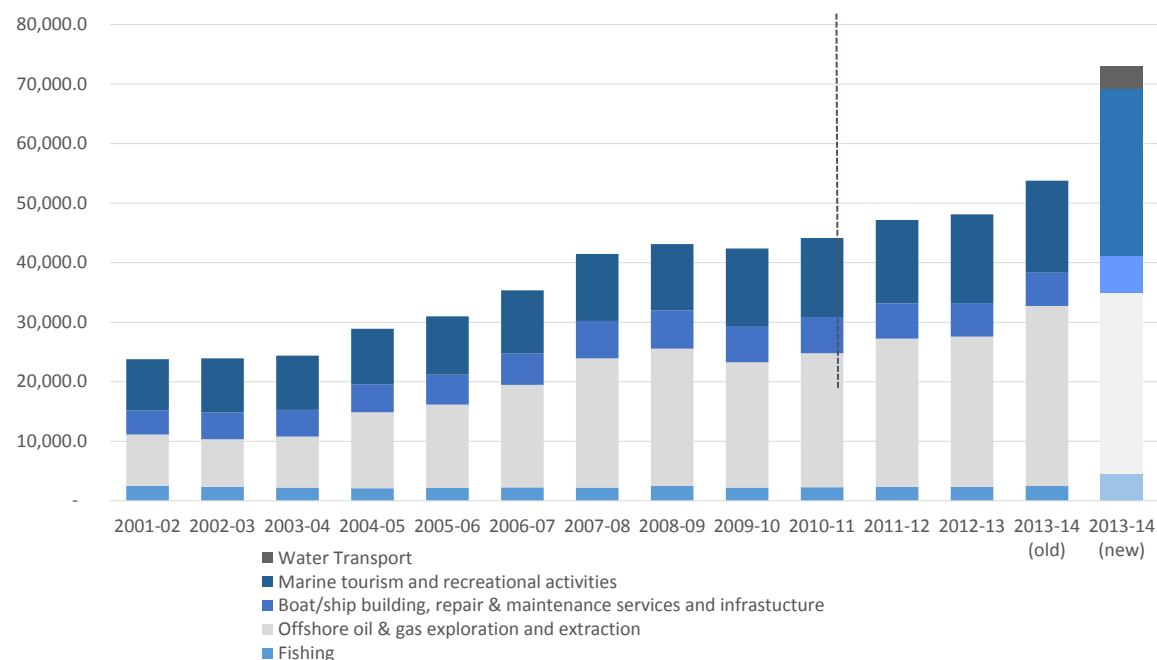


Table 2.3 provides the detailed data for each industry sub-sector’s value of output from 2001-02 to 2013-14. References for this table are the same as those used for Table 2.1.

³⁶ ABS (2016e) Cat No 5206.0, June 2016. Gross Domestic Product: Chain Volume Measure

Table 2.3: Total of measurable Industry Value of Production from marine-related activities, 2001-02 to 2013-14

Marine resource activities and industries														
Value of output (\$m)	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14 (old)	2013-14 (new)
Fishing														
Marine-based aquaculture	731.2	708.9	724.6	634.1	742.3	805.7	868.4	866.7	877.6	954.3	1,054.1	1,052.5	994.4	994.4
Commercial fishing (wild capture fisheries)	1,783.9	1,655.5	1,499.2	1,490.2	1,461.0	1,445.9	1,362.7	1,392.8	1,335.0	1,316.5	1,302.0	1,360.8	1,503.3	1,503.3
Recreational fishing														2,164.8
Total fishing	2,515.1	2,364.4	2,223.8	2,124.9	2,203.4	2,251.6	2,231.0	2,470.2	2,212.6	2,270.8	2,356.1	2,356.1	2,497.6	4,662.4
Offshore oil & gas exploration and extraction														
Oil exploration	719.6	922.4	791.2	829.8	937.8	1,727.3	2,541.1	3,318.4	2,745.5	2,558.9	2,246.1	3,430.2	3,512.0	3,512.0
Oil production	4,441.0	3,472.7	4,898.5	7,866.6	7,570.3	9,229.8	12,123.6	8,637.7	9,411.5	8,465.3	9,708.3	6,978.2	9,144.5	9,144.5
LPG	856.3	981.1	717.3	861.3	1,037.1	1,038.0	1,182.0	1,043.5	1,105.0	1,068.0	971.4	1,088.2	1,265.1	1,265.1
Natural gas (export revenue)	2,613.0	2,607.0	2,174.0	3,199.0	4,416.0	5,220.0	5,854.0	10,078.7	7,788.7	10,437.0	11,949.5	13,741.0	16,304.7	16,304.7
Total offshore oil & gas	8,629.9	7,983.2	8,581.0	12,756.7	13,961.2	17,215.1	21,700.7	23,078.4	21,051.0	22,529.2	24,875.3	25,237.6	30,226.3	30,226.3
Boat/ship building, repair & maintenance services and infrastructure														
Shipbuilding & repair (civil and defence)	1,796.4	1,839.0	1,696.0	1,721.0	1,797.0	1,777.0	1,954.0	1,997.2	2,724.0	2,722.0	2,825.0	3,098.0	2,966.0	2,966.0
Boatbuilding & repair (including recreation vessels)	818.0	1,037.0	1,108.0	1,251.0	1,488.0	1,688.0	1,829.0	1,869.4	1,207.0	1,203.0	1,055.0	1,048.0	1,235.0	1,235.0
Marinas & boating infrastructure														699.3
Marine equipment retailing	1,411.6	1,632.8	1,670.3	1,709.6	1,743.8	1,804.8	2,486.8	2,559.3	2,166.8	2,148.7	2,054.7	1,459.7	1,393.0	1,393.0
Total boat/ship services	4,026.0	4,508.8	4,474.3	4,681.6	5,028.8	5,269.8	6,269.8	6,425.9	6,097.8	6,073.7	5,934.7	5,605.7	5,594.0	6,293.3
Marine tourism and recreation activities														
Domestic consumption of tourism goods and services	7,336.8	7,783.6	7,725.6	7,909.2	8,326.0	9,012.4	9,553.6	9,344.8	11,047.6	11,235.6	11,948.8	12,638.8	13,128.4	23,815.3
International consumption of tourism goods and services	1,271.9	1,292.2	1,376.7	1,419.5	1,468.7	1,611.6	1,725.2	1,798.5	1,963.7	204.0	2,064.5	2,294.3	2,336.8	4,239.0
Total tourism	8,608.7	9,075.8	9,102.3	9,328.7	9,794.7	10,624.0	11,278.8	11,143.3	13,011.3	13,279.4	14,013.3	14,933.1	15,465.2	28,054.3
Water transport														
Water-based transport of passengers and freight														3,847.0
Total water transport														3,847.0
TOTAL	23,779.7	23,932.2	24,381.4	28,891.9	30,988.1	35,360.5	41,480.3	43,117.8	42,372.7	44,153.1	47,179.4	48,132.5	53,783.1	73,083.3

Note: The last three columns have been updated in this version of the AIMS Index, with new data available for both 2012-13 and 2013-14.

2.3 Marine industry sub-sectors: definitions, data issues and trends

The following paragraphs outline briefly some of the key issues associated with each of these categories.

2.3.1 Commercial fishing and aquaculture

Commercial fisheries includes marine-based aquaculture and wild-catch from both Commonwealth and State and Territory fisheries, for which data is collected across jurisdictions. Marine-based aquaculture operations are those in coastal waters or in ponds requiring a sea water source – while there are some inland operations using salt water, these are not included in this definition.

The value of fisheries and aquaculture production declined between 2001-02 and 2009–10 but then increased by 1% to reach \$2.5 billion in 2013–14. Commercial fisheries in particular have experienced an upward trend. The value of production rose by 4% to \$2.5 billion in 2013-14 (compared to the previous year), driven by a 10% increase in the value of wild-caught fisheries products. Aquaculture production value declined somewhat, dropping back to a value of production of less than \$1 billion in 2013-14. The largest species, in terms of value, are rock lobster (\$586 million, wild-catch), salmonids (\$543 million, mostly aquaculture), prawns (\$337 million, mostly wild-catch), abalone (\$165 million, mostly wild-catch) and tuna (\$147 million, mostly aquaculture). Tasmania, Western Australia and South Australia dominate in terms of value of production and employment.³⁷

Employment in commercial fishing and aquaculture has been trending downward for the last decade, from around 15,000 employees in 2003-04 to around 8,700 employees in 2013-14.

2.3.2 Recreational fishing

Quantifying the economic value of recreational fishing is challenging because of the difficulties of collecting and comparing data about activities which occur in a relatively informal way and across a fragmented sector. In addition to any intrinsic environmental or heritage value, the fish caught by recreational fishers could be seen to represent an economic value; they are not, however, part of a market transaction, and determining how much they are worth therefore would require alternative approaches to valuation.

Currently, the only data available about recreational fishing's economic impact is for fishing-related expenditure such as fishing gear or bait. It also includes some activities which could be considered tourism or other services (such as travel and accommodation). Expenditure on vessels used for recreational fishing was not included. Using this as the primary economic activity definition, recreational fishing would be considered a marine-related service industry rather than a marine resource industry.

The focus of recreational fishing is on locals. As such it differs from marine tourism, which includes expenditure by domestic and international visitors. Tourism Research Australia (TRA) undertakes a National Visitor Survey, which collects data on respondent's recent travel from around 120,000 Australian residents each year, and an International Visitor Survey, which samples around 40,000 departing, short-term international travellers each year. In both surveys, respondents are being asked whether they went fishing on their trip. This does not mean that fishing was the main purpose of the trip, but simply that it was one of the activities. As such, fishing-related expenditure by visitors would be captured in those surveys.

The information presented in Table 2.1, which is now included in the updated 2013-14 value, is based on a 2003 study that observed that 3.36 million Australian engaged in recreational fishing spending \$1.855 billion in 1999-00 (\$2.75 billion in 2013-14\$).³⁸ This suggests an annual expenditure of \$552 per fisher (\$819 in 2013-14\$). Marine fishing (offshore, coastal and estuary) accounts for 82% of the estimated harvest (which also includes river and lakes/dams). Expenditure items included fishing gear, bait/berley, fees and licences, boat/trailer, dive gear, camping gear and clothing as well as more general items such as travel and accommodation.

³⁷ ABARES, 2015

³⁸ DAFF (2003)

There have been several more recent studies that have placed an economic value on recreational fishing; however these have been for one particular state or region. For example in 2013-14 the economic impact of recreational fishing in Victoria was valued at \$2.6 billion in direct output, \$1.6 billion in direct value added and resulting in 16,257 direct jobs.³⁹ The estimate from NRIFS compares to an average annual spending of \$326 per angler in 2013-14 (for 830,000 anglers) estimated by Ernst and Young (2015) for Victorian recreational anglers. Expenditure items in that study included tackle, bait and equipment (20%), food, accommodation and transport (40%), boat excluding the initial purchase price (29%) and other (11%). Anglers were also assumed to own 0.5 boats on average that are used for recreational fishing; spending \$15,100 on average on recreational fishing boats, which equates to approximately \$2,200 per annum.

Other studies include the Victorian Southern Bluefin Tuna Recreational Fishery, which was valued at between \$5.6 million and \$7.6 million in 2012⁴⁰; and a study on the economic contribution of the Great Barrier Reef Marine Park which valued the expenditure on recreational fishing in the Great Barrier Reef at \$57.7 million in 2011-12.⁴¹

2.3.3 Indigenous fishing

Native fishing is linked to core cultural values and beliefs in Aboriginal and Torres Strait Islander communities. While Indigenous people are included in the population basis used to calculate the number of recreational anglers, Indigenous fishermen that live in Indigenous communities and fish for cultural or food reasons are not included in the estimates of the recreational and commercial fishing industries of this study. The 2003 DAFF report remains the most recent source for data on Indigenous fishing. It estimated that there are 37,000 Indigenous fishers who spent 420,000 fishing days in 1999-2000.

2.3.4 Offshore oil and gas exploration, extraction and processing

The energy resources industries – including petroleum, LPG, and LNG – make up a significant portion of marine-based economic activity. In addition to the value arising from the domestic or export sale of resources extracted offshore, which is reliably reflected in production statistics, there is substantial activity generated through exploration and the development and ongoing maintenance of infrastructure (e.g. pipelines).

2.3.5 Other resource extraction

A number of emerging activities have been identified, with little current impact but the potential for an increasing contribution in the future. These activities include desalination, carbon capture, bioprospecting, seabed mining and tidal power. Due to a lack of reliable estimates, these activities have not been included in total value of output.

2.3.6 Boat and ship building and maintenance equipment, services and infrastructure

The ANZSIC Manufacturing division includes marine equipment and supplies including activities such as the manufacture of winches, diving equipment, marine engines, acoustics equipment, sails and marine flooring. This is not currently separated out from general transport-related manufacturing.

Marine equipment retailing (ANZSIC 5245) is also in this category, although some activities such as retail of recreational and sporting equipment should be excluded, and counted among the recreational and leisure category.

In addition, this category includes activities in marinas and boating infrastructure. In 2013, the Recreational Marine Research Centre released the 2013 Health of the Marina Industry Survey report. The value of this sector is \$699.3 million in 2013-14 dollars.

³⁹ Ernst and Young (2015)

⁴⁰ Deloitte Access Economics (2013a)

⁴¹ Deloitte Access Economics (2013b)

2.3.7 Marine tourism

Assessing the value of marine tourism is perhaps the most challenging part of valuing the marine industry. At the same time, the very substantial contribution of this sector to the economies of marine and coastal communities means that its importance should be recognised.

Tourism activities differ from other industry categorisations, as these activities are defined by the classification of the consumer rather than, as is more typical, of the producer. The ABS develops its Tourism Satellite Account (TSA) based on internationally agreed standards for measuring tourism activity. Internationally, approaches to defining the 'marine' components of tourism vary considerably. While there is consensus on approaches to the development of general tourism statistics, there does not yet appear to be a single framework for consistently identifying the portion of this attributable to marine tourism. While the tourism survey made it relatively straightforward to report tourism activity, the contributions in relation to marine tourism should be viewed as broad indicators of economic activity rather than precise estimates. The only existing methodology for this apportionment was developed by the Review Committee on Marine Industries, Science and Technology in Australia (1989). This report classified 19% of international and 40% of domestic tourism as marine tourism.

This grouping should also include marine-related cultural and recreational activity by local people who are not counted in typical 'tourism' datasets, including fishing; boating/sailing; snorkelling scuba diving; charter and game fishing. There is currently no single dataset which identifies this activity. In addition, there is a degree of 'double counting' involved in relation to marine tourism and other marine sectors, given that nearly all of the broad (ANZSIC) industry groups are involved to greater or lesser extent in tourism.

An example where the economic impact of tourism in a specific region has been studied in depth is a Deloitte Access Economics report for the Great Barrier Reef Marine Park Authority⁴². This report, an update of a 2006-07 analysis, found that tourism expenditure in the Great Barrier Reef Catchment Area totalled over \$6.4 billion in 2011-12.

It is likely that for an accurate assessment of the economic impact of marine tourism to be compiled, similar detailed regional studies of major marine-based tourism destinations would be required.

2.3.8 Water transport, services to water transport and ports

The challenge of capturing and appropriately attributing the value of all water-based passenger and freight transport activity that, strictly speaking, occurs in Australia or Australian waters is considerable, given the frequently multinational nature of transport operators.

Therefore, in order to avoid double counting and to present a reliable base line level, this sector⁴³ is restricted to include only the industry sub-sectors for which the ABS collects and publishes data on the gross value of production. In terms of freight activity, the sector includes coastal sea freight services between domestic ports, international sea freight transport, harbour and ferry freight and river transport. However, estimates exclude land-based port and water terminal operations and stevedoring services, since the ABS does not publish value-add or income estimates relating to these activities⁴⁴.

2.3.9 Marine environment management

This grouping includes activities which provide management services for the marine environment, including scientific research and development and knowledge transfer, the establishment and operation of environmental management programs, and marine safety activities. In general, the major challenge to establishing the level of activity in this area is that it often occurs in a relatively diffuse way, spread across research institutes, universities, and the national, state, and even local levels of government.

⁴² Deloitte Access Economics (2013)

⁴³ ANZSIC 2006 Subdivision 48: Water Transport

⁴⁴ These activities are grouped with Airport operations and other transport support services in Subdivision 52

3 Total economic contribution

Economic contribution studies provide an estimate of the impact of an industry on the economy at a particular point in time, both directly through the industry's own operations, and indirectly as the impact of its activities filter through the economy.

Financial measures, such as revenue and cost of goods sold, are used to estimate an industry's **direct contribution** to the economy. This direct contribution is calculated using the income approach to Gross Domestic Product (GDP) which sums returns to capital and returns to labour. Returns to capital are calculated through Gross Operating Surplus, and returns to labour through wages.

This approach is consistent with the framework used by the Australian Bureau of Statistics in compiling the *Australian National Accounts*.

In addition to this direct component, the demand for upstream inputs and further interlinkages with other sectors of the economy are modelled. This expenditure drives the **indirect contribution** to value added.

3.1 Methodology

This chapter calculates the economic contribution of the various marine sub-sectors for the 2013-14 financial year. The contribution is split into direct and indirect components. The direct component is based on the value added measure – the returns to labour (wages) and the returns to capital (profit). It was calculated using data from a variety of industry reports and the 2013-14 ABS Input-Output tables.

Direct contribution

While revenue (or production value) is more commonly reported in financial accounts, value added provides a more accurate assessment of an industry's contribution to the overall economy. This is because value added does not include the value that is created by upstream industries. The direct contribution therefore isolates the value created by each sub-sector.

The returns to capital, or gross operating surplus (GOS), is determined by calculating the ongoing operational profit and operational costs, prior to the impacts of interest, tax, depreciation and amortisation. The returns to labour are calculated by aggregating compensation provided to employees either through wages or other employment benefits.

Indirect contribution

The second aspect involves measuring the flow-on contribution of each industry's activities. The indirect contribution calculates the value added created by the businesses that produce inputs for the industry in question. It estimates the profit and wages that are generated through an industry's expenditure on inputs. Inputs purchased overseas are not included in the analysis.

Many of the marine-related sub-sectors represent a proportion of a larger Input Output Industry Group (IOIG). For instance, the IO industry "Oil and gas extraction" includes both offshore and onshore gas and oil extraction. The offshore oil and gas extraction sub-sectors are, therefore, a subset of the larger IOIG (see Table 3.1 below). It was assumed that each marine sub-sector's industrial profile has the same ratios of GOS, value added, labour income, input expenditure and FTE per million dollars of output as its larger IOIG.

Table 3.1: Marine sub-sector as a percentage of their relevant IOIG

	IOIG	Marine sub-sector as a % of IOIG
Marine resource activities and industries		
Fishing		
Marine-based aquaculture	Aquaculture	73%
Commercial fishing (wild captures fisheries)	Fishing, hunting and trapping	81%
Recreational fishing	n/a	n/a
Offshore oil & gas exploration and extraction		
Oil exploration	Water, Pipeline and Other Transport	39%
Oil production	Oil and gas extraction	71%
LPG	Oil and gas extraction	71%
Natural gas	Oil and gas extraction	71%
Marine-related service activities and industries		
Boat/ship building, repair & maintenance services and infrastructure		
Shipbuilding & repair (civil and defence)	Ships and Boat Manufacturing	100%
Boatbuilding & repair (including recreational vessels)	Ships and Boat Manufacturing	100%
Marinas and boating infrastructure	Sports and Recreation	1%
Marine equipment retailing	Retail Trade	0.4%
Marine tourism and recreational activities		
Domestic consumption of tourism goods and services	n/a	n/a
International consumption of tourism goods and services	n/a	n/a
Water transport		
Water transport	Water, Pipeline and Other Transport	39%

The following example demonstrates how the expenditure for a representative sub-sector, in this case the commercial fishing sector, was calculated. Using the supply and use tables, derived from the ABS, Deloitte Access Economics calculated how much the *Fishing, and hunting and trapping* IOIG spends on each IOIG as a percentage of total production. These ratios were then multiplied by the total production value of the commercial fishing sub-sector. This provided a breakdown of estimated expenditure of the commercial fishing sub-sector which was used to determine the indirect effect using the Deloitte Access Economics IO model. A further discussion of the methodology is provided in Appendix A.

3.2 Economic contribution results

3.2.1 Value added

3.2.1.1 Value added by marine sub-sector

The first step in determining the economic contribution of the marine industry involved estimating the direct value added based on the data presented in Table 2.2, which provided the total measurable value from marine-related activities in 2013-14. Table 3.2 below presents both the value of production and the corresponding value added, which is considered to be the marine industry's direct contribution.

Using the approach outlined in Section 3.1, the indirect contribution (expressed as indirect value added) was then calculated for each sub-sector. It is important to note that each sub-sector was analysed separately. Consequently, the results of the indirect value added in Table 3.2 are not additive going down the table, as many of the sub-sectors supply to each other. For instance, the boatbuilding industry supplies its products to the fishing industry. The indirect value added of the fishing industry would, therefore, include some of the direct value added of the boatbuilding industry.

Table 3.2: Direct and indirect economic contribution by marine sub-sector (\$ million), 2013-14

	Direct value of production	Direct value added	Indirect value added	Total value added
Marine resource activities and industries				
Fishing				
Marine-based aquaculture	\$994.4	\$662.7	\$255.7	\$918.4
Commercial fishing (wild captures fisheries)	\$1,503.3	\$824.0	\$551.3	\$1,375.3
Recreational fishing	\$2,164.8	\$2,164.8	\$1,523.8	\$3,688.6
Offshore oil & gas exploration and extraction				
Oil exploration	\$3,512.0	\$1,859.4	\$1,518.4	\$3,377.8
Oil production	\$9,144.5	\$5,961.4	\$2,801.8	\$8,763.2
LPG	\$1,265.1	\$824.8	\$387.6	\$1,212.4
Natural gas	\$16,304.7	\$10,629.2	\$4,995.6	\$15,624.8
Marine-related service activities and industries				
Boat/ship building, repair & maintenance services and infrastructure				
Shipbuilding & repair (civil and defence)	\$2,966.0	\$1,234.0	\$2,117.7	\$3,351.7
Boatbuilding & repair (including recreational vessels)	\$1,235.0	\$429.0	\$736.2	\$1,165.2
Marinas and boating infrastructure	\$699.3	\$250.5	\$402.2	\$652.7
Marine equipment retailing	\$1,393.0	\$223.3	\$157.4	\$380.7
Marine tourism and recreational activities				
Domestic consumption of tourism goods and services	\$23,815.3	\$13,128.4	\$13,895.2	\$27,023.6
International consumption of tourism goods and services	\$4,239.0	\$2,336.8	\$2,473.3	\$4,810.1
Water transport				
Water transport	\$3,847.0	\$1,409.0	\$1,586.1	\$2,995.1

3.2.1.2 Total value added of the marine industry

In order to determine the total contribution of the marine industry, any potential double-counting had to be eliminated. An estimation was done on the total direct and indirect contribution of the marine industry. This largely followed the methodology established in Section 3.1 above, however, if the expenditure for each industry in question was to another marine sub-sector industry it was removed from the expenditure bundle. This was to avoid double counting of the indirect value added.

In total, the Australian marine industry contributed to \$42.0 billion value added in 2013-14, with a further indirect value added of \$32.2 billion. This amounts to a total contribution of \$74.2 billion in value added, as shown in Table 3.3. This represents 4.8 per cent of national gross domestic product in 2013-14.

Table 3.3: Total direct and indirect economic contribution of the Australian marine industry (\$ million), 2013-14

	Direct value of production	Direct value added	Indirect value added	Total value added
Marine industry	\$73,083.3	\$41,937.2	\$32,214.5	\$74,151.7

3.2.2 Employment contribution

3.2.2.1 Employment contribution by marine sub-sector

Table 3.4 below presents an estimation of the direct and indirect full time equivalent (FTE) employment effects of each marine sub-sector. As already noted, each sub-sector was analysed separately and the results of the indirect employment are therefore not additive going down the table.

Table 3.4: Direct and indirect employment (FTE) by marine sub-sector, 2013-14

	Direct employment (FTE)	Indirect employment (FTE)	Total (FTE)
Marine resource activities and industries			
Fishing			
Marine-based aquaculture	2,363	1,837	4,200
Commercial fishing (wild captures fisheries)	4,410	3,962	8,373
Recreational fishing	n/a	14,306	14,306
Offshore oil & gas exploration and extraction			
Oil exploration	13,787	9,450	23,236
Oil production	5,201	18,768	23,968
LPG	719	2,597	3,316
Natural gas	9,273	33,463	42,736
Marine-related service activities and industries			
Boat/ship building, repair & maintenance services and infrastructure			
Shipbuilding & repair (civil and defence)	8,837	14,870	23,707
Boatbuilding & repair (including recreational vessels)	3,680	5,169	8,849
Marinas and boating infrastructure	3,661	2,918	6,579
Marine equipment retailing	2,939	959	3,898
Marine tourism and recreational activities			
Domestic consumption of tourism goods and services	107,014	78,373.26	185,387
International consumption of tourism goods and services	19,048	13,950.11	32,998
Water transport			
Water transport	12,317	11,196	23,513

3.2.2.2 Total employment contribution of the marine industry

In total Australia's marine industry employed just over 193,000 full time equivalent workers in 2013-14.

Again, indirect employment in the different sub-sectors, as presented in Table 3.4, was not additive. Hence, the same approach as for value added as applied to determine total indirect employment. As shown in Table 3.5, the marine industry supported a further 202,000 FTE workers in indirect employment (considering upstream industries only), amounting to a total employment contribution of almost 400,000 FTE workers.

Table 3.5: Total direct and indirect employment (FTE) contribution of the Australian marine industry, 2013-14

	Direct employment (FTE)	Indirect employment (FTE)	Total (FTE)
Marine industry	193,248	202,017	395,265

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Appendix A: Economic contribution framework

Economic contribution studies are intended to quantify measures such as value added, exports, imports and employment associated with a given industry or firm, in a historical reference year. The economic contribution is a measure of the value of production by a firm or industry.

All direct, indirect and total contributions are reported as gross operating surplus (GOS), labour income, value added and employment (with these terms defined the table below).

Definitions of economic contribution estimates

Estimate	Definition
Gross operating surplus (GOS)	GOS represents the value of income generated by the entity's direct capital inputs, generally measured as the earnings before interest, tax, depreciation, and amortisation (EBITDA).
Labour income	Labour income is a subcomponent of value add. It represents the value of output generated by the entity's direct labour inputs, as measured by the income to labour.
Value added	Value added measures the value of output (i.e. goods and services) generated by the entity's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value added across all entities in the economy equals gross domestic product. Given the relationship to GDP, the value added measure can be thought of as the increased contribution to welfare.
Employment (FTE)	Employment is a fundamentally different measure of activity to those above. It measures the number of workers (measured in full-time equivalent terms) that are employed by the entity, rather than the value of the workers' output.
Direct economic contribution	The direct economic contribution is a representation of the flow from labour and capital committed in the economic activity.
Indirect economic contribution	The indirect contribution is a measure of the demand for goods and services produced in other sectors as a result of demand generated by economic activity.
Total economic contribution	The total economic contribution to the economy is the sum of the direct and indirect economic contributions.

Source: Deloitte Access Economics (2016)

Value added

The measures of economic activity provided by this contribution study are consistent with those provided by the Australian Bureau of Statistics. For example, value added is the contribution the sector makes to total factor income and gross domestic product (GDP).

There are a number of ways to measure GDP, including:

- expenditure approach – measures expenditure: of households, on investment, government and net exports; and
- income approach – measures the income in an economy by measuring the payments of wages and profits to workers and owners.

Below is a discussion measuring the value added by an industry using the income approach.

Measuring the economic contribution – income approach

There are several commonly used measures of economic activity, each of which describes a different aspect of an industry's economic contribution:

- Value added measures the value of output (i.e. goods and services) generated by the entity's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value added across all entities in the economy equals gross domestic product. Given the relationship to GDP, the value added measure can be thought of as the increased contribution to welfare.

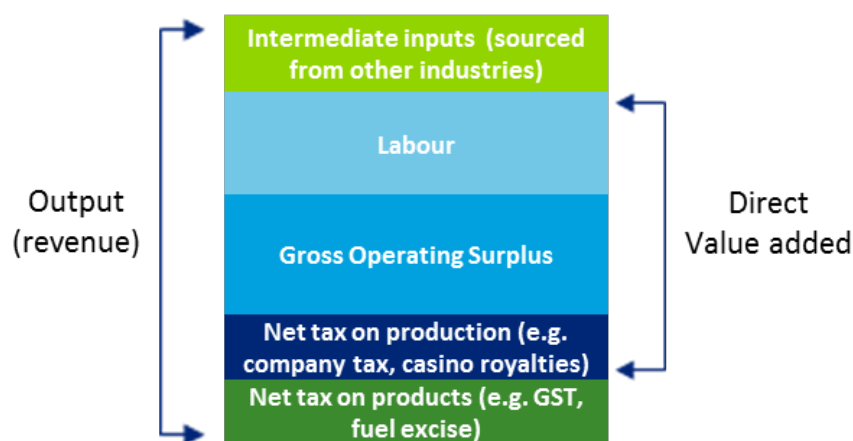
Value added is the sum of:

- Gross operating surplus (GOS) represents the value of income generated by the entity's capital inputs, generally measured as the earnings before interest, tax, depreciation and amortisation (EBITDA).
- Tax on production less subsidy provided for production. Note: given the manner in which returns to capital before tax are calculated, company tax is not included or this would double-count that tax. In addition it excludes goods and services tax, which is a tax on consumption (i.e. levied on households).
- Labour income is a subcomponent of value added. It represents the value of output generated by the entity's direct labour inputs, as measured by the income to labour.

Figure A.1 shows the accounting framework used to evaluate economic activity, along with the components that make up output. Output is the sum of value added and the value of intermediate inputs used by the industry.

The value of intermediate inputs can also be calculated directly by summing up expenses related to non-primary factor inputs.

Figure A.1: Economic activity accounting framework



Source: Deloitte Access Economics.

Contribution studies generally outline employment generated by a sector. Employment is a fundamentally different measure of activity to those above. It measures the number of workers that are employed by the entity, rather than the value of the workers' output.

Direct and indirect contributions

The **direct** economic contribution is a representation of the flow from labour and capital in the company.

The **indirect** contribution is a measure of the demand for goods and services produced in other sectors as a result of demand generated by the direct economic activity of an industry. Estimation

of the indirect economic contribution is undertaken in an input-output (IO) framework using Australian Bureau of Statistics IO tables which report the inputs and outputs of specific sectors of the economy (ABS 2013).

The total economic contribution to the economy is the sum of the direct and indirect economic contributions.

Other measures, such as total revenue or total exports are useful measures of economic activity, but these measures alone cannot account for the contribution made to GDP. Such measures overstate the contribution to value added because they include activity by external firms or industries supplying inputs. In addition, they do not discount the inputs supplied from outside Australia.

Limitations of economic contribution studies

While describing the geographic origin of production inputs may be a guide to a firm or industry's linkages with the local economy, it should be recognised that these are the type of normal industry linkages that characterise all economic activities.

Unless there is unused capacity in the economy (such as unemployed labour) there may not be a strong relationship between a firm or industry's economic contribution as measured by value added (or other static aggregates) and the welfare or living standard of the community. The use of labour and capital by demand created from the industry comes at an opportunity cost as it may reduce the amount of resources available to spend on other economic activities. This is not to say that the economic contribution, including employment, is not important. As stated by the Productivity Commission in the context of Australia's gambling industries⁴⁵:

Value added trade and job creation arguments need to be considered in the context of the economy as a whole ... income from trade uses real resources, which could have been employed to generate benefits elsewhere. These arguments do not mean that jobs, trade and activity are unimportant in an economy. To the contrary they are critical to people's well-being. However, any particular industry's contribution to these benefits is much smaller than might at first be thought, because substitute industries could produce similar, though not equal gains.

In a fundamental sense, economic contribution studies are simply historical accounting exercises. No 'what-if', or counterfactual inferences – such as 'what would happen to living standards if the firm or industry disappeared?' – should be drawn from them.

The analysis – as discussed in the report – relies on a national IO table modelling framework and there are some limitations to this modelling framework. The analysis assumes that goods and services provided to the sector are produced by factors of production that are located completely within the state or region defined and that income flows do not leak to other states.

The IO framework and the derivation of the multipliers also assume that the relevant economic activity takes place within an unconstrained environment. That is, an increase in economic activity in one area of the economy does not increase prices and subsequently crowd out economic activity in another area of the economy. As a result, the modelled total and indirect contribution can be regarded as an upper-bound estimate of the contribution made by the supply of intermediate inputs.

Similarly the IO framework does not account for further flow-on benefits as captured in a more dynamic modelling environment like a Computerised General Equilibrium (CGE) model.

Input-output analysis

Input-output tables are required to account for the intermediate flows between sectors. These tables measure the direct economic activity of every sector in the economy at the national level. Importantly, these tables allow intermediate inputs to be further broken down by source. These

⁴⁵ Productivity Commission (1999), *Australia's Gambling Industries*, Report No. 10, AusInfo, Canberra, (page 4.19).

detailed intermediate flows can be used to derive the total change in economic activity associated with a given direct change in activity for a given sector.

A widely used measure of the spill-over of activity from one sector to another is captured by the ratio of the total to direct change in economic activity. The resulting estimate is typically referred to as 'the multiplier'. A multiplier greater than one implies some indirect activity, with higher multipliers indicating relatively larger indirect and total activity flowing from a given level of direct activity.

The IO matrix used for Australia is derived from the ABS 2013-14 IO tables (2013). The industry classification used for IO tables is based on the Australian and New Zealand Standard Industrial Classification (ANZSIC), with 114 sectors in the modelling framework.