



# THE AIMS INDEX OF MARINE INDUSTRY

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AUSTRALIAN INSTITUTE  
OF MARINE SCIENCE

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:    *Aerial of Hardy Reef and Hook Reef*  
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# Foreword

The AIMS Index of Marine Industry was first released in 2008. Now, ten years later, we are pleased to offer this 7th edition. The Index was 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, and shows how these are trending over time. Australia's marine jurisdiction is the third largest in the world after France and the USA, with an exclusive economic zone (EEZ) covering 10.2 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 sustainable use, effective environmental management and protection of its unique ecosystems. The Institute's research supports government in development of marine policy, enables evidence-based decisions by the public and private sectors, works in partnership with the traditional owners of our coastline and sea country, and provides trusted advice to the community at large about the state of our unique tropical marine ecosystems. In 2018, AIMS launched its Strategy 2025 which provides a clear and concise description of AIMS key research and development priorities for the next 7 years.

Australia's population is concentrated in the coastal zone, with more than 85% living within 50 km of the ocean. More than 70% of Australia's territory lies beneath the ocean. The sea is part of our national identity, and of deep cultural significance to our indigenous peoples. It is home to a wondrous and amazing diversity of life, including our iconic coral reefs. But our marine estate is also a significant and growing source of wealth for all Australians.

This year's update confirms the significant contribution our marine industries (collectively referred to as our "Blue Economy") make to our national economy. In 2015-16 (the most recent available data) the blue economy was worth \$68.1 billion. Over the past decade, it has been one of the fastest growing parts of our economy, and as a whole, is larger than our agricultural sector. And while this analysis does not include important environmental and social values (which are considerable), it does show just how important the oceans are, in an economic sense, to our island-continent nation. Growth in the sustainable use of our oceans is vital to Australia's future prosperity. AIMS is here to help ensure that this occurs in a way that also preserves and protects our oceans' unique ecosystems now and in the future.

Paul Hardisty

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 contribution 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 2018 version is the seventh edition of the Marine Index, the first update since the 2016 AIMS Index.

## Study Approach

This study assesses the economic contribution of the Australian marine industry. It follows the same methodological approach as the 2016 edition of the Index, which broadened how the marine industry is defined relative to pre-2014 editions. Data has been updated to 2015-16, the latest year for which updated estimates consistently exist across most major categories.<sup>1</sup> This update to 2015-16 represents two additional years of data presented since the 2016 report, which contained estimates to 2013-14.

In addition to the direct contribution of the marine industry, which is the income that is directly earned by the marine industry, this report considers the flow-on and total economic contribution of the marine industry to the national economy. 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 contribution of the marine industry to the economy.

## Marine industry output

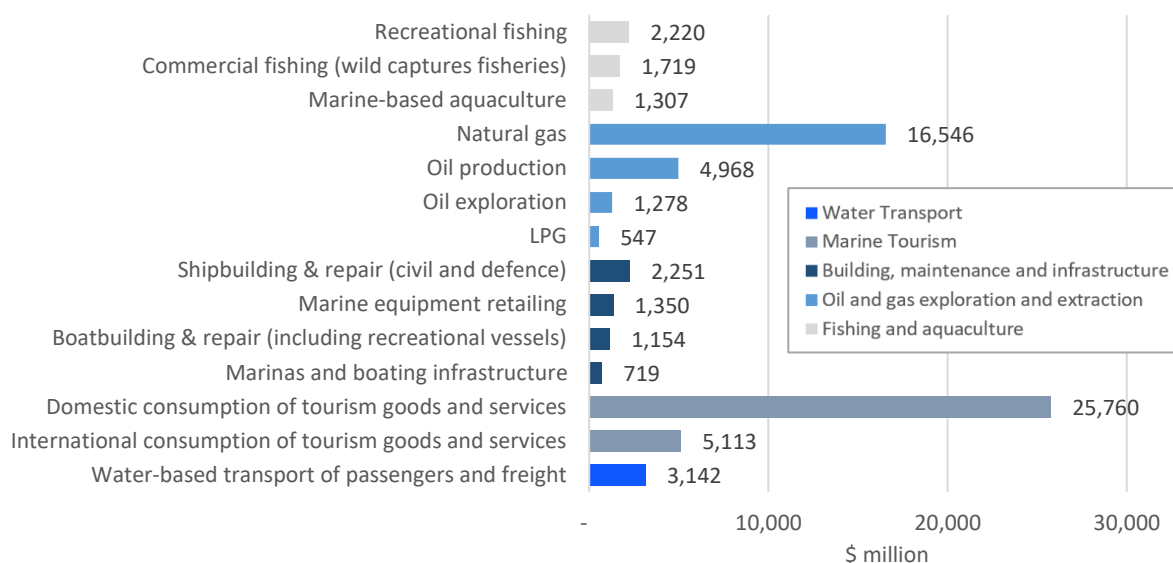
In 2015-16 the total measurable output (or income) based on the marine environment in Australia was \$68.1 billion (using the updated definition as per the 2016 report), down from \$71.5 billion in 2014-15. This decrease was primarily driven by a fall in the value of oil production and exploration activities, both of which reflect a significant decrease in the global oil price. This value represents 2.2% of total national industry output for the 2015-16 year.<sup>2</sup>

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

<sup>2</sup> Based on national value of production of \$3.0 trillion in 2015-16 – source: ABS (2018b) *8155.0, Australian Industry, 2016-17*.

Chart i: Total output (income) from marine-related activities in 2015-16 (in 2015-16 \$ million)



Data source: Various government publications and industry reports – see Appendix A

### Total economic value (direct + flow-on value-add)

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

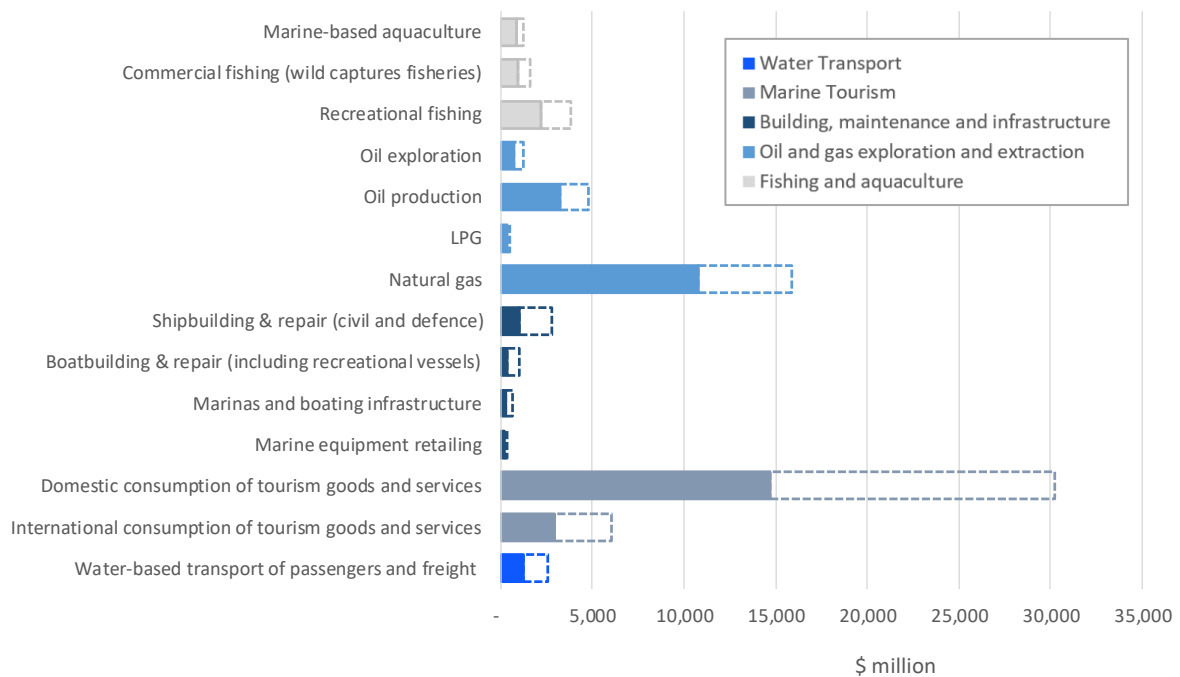
Value-add is a different concept to output. It is commonly used to measure economic contribution because the output of one industry, measured by the value of production, often becomes the input of another. This can lead to double-counting and give a misleading estimate of an industry's contribution to the economy. In contrast, an industry's value-add does not include the value that is created by upstream industries. An industry's value-add 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 directly contributed \$39.8 billion to value-add in 2015-16, with a further indirect \$31.6 billion of value-add in other industries. This amounts to a total economic contribution of \$71.4 billion in value-add, or 4.3% of national gross domestic product in that year.<sup>3</sup>

The marine industry's total employment was estimated as 393,000 FTE workers: 197,000 FTE workers directly employed in the industry, with a further 196,000 FTE workers in indirect employment (considering upstream industries only).

<sup>3</sup> Based on Australian GDP of \$1.66 trillion in 2015-16. Source: ABS (2018e)

Chart ii Direct (solid colour) and indirect (dashed line) economic contribution by marine sub-sector, 2015-16 (in 2015-16 \$ million)



Source: Deloitte Access Economics modelling, using various government publications and industry reports (see Appendix A)



# 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.

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 has identified 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 years.<sup>4</sup> Estimates by the Oceans Policy Science Advisory Group predict Australia's oceans will contribute \$100 billion to the Australian economy by 2025.<sup>5</sup> Given the importance of the industry, it's important that marine research continues to unlock the knowledge and understanding required to support sustainable growth.

The National Marine Science Plan 2015-25<sup>6</sup> provides a decadal plan to focus investment and science to fulfil the blue economy's potential.<sup>7</sup> 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 billion to the Australian economy.<sup>8</sup> This ecosystem value is not included in the economic data provided in this report, but it provides further grounds for raising the profile of the 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 provide 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.

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

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<sup>4</sup> Deloitte Access Economics (2014)

<sup>5</sup> Oceans Policy Science Advisory Group (2013)

<sup>6</sup> National Marine Science Committee (2015)

<sup>7</sup> 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'.

<sup>8</sup> Eadie and Hosington (2011)

This is the seventh 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 Australia.<sup>9</sup> 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, for example, Section 2.3.2, for a summary of region-level studies on the value of recreational fishing). The methodology of this Index broadly follows the framework used by Allen Consulting (2004).<sup>10</sup>

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 benefits<sup>11</sup>, 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.<sup>12</sup>

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 2015-16 – the most recent year for which data is available for all data sources. However, to illustrate trends over time 2014-15 data is also presented. Where more recent data was available, this is shown in the relevant footnotes.

For some sub-sectors, the definitions for marine industries changed somewhat in the previous study (refer to the 2016 study<sup>13</sup> for a description of how definitions changed). In order to ensure that previous estimates can be compared with the most recent estimates, estimates are outlined using both the old and new definitions in Appendix A (Table A.7). However, the most recent estimates (2014-15 and 2015-16) presented in the main body of this report reflect the updated definitions.

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<sup>9</sup> AIMS (2008)

<sup>10</sup> 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.

<sup>11</sup> See for instance McManus et al. (2011).

<sup>12</sup> See for instance Rolfe & Windle (2012).

<sup>13</sup> AIMS (2016)

### **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 to the national economy.

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-add and employment.

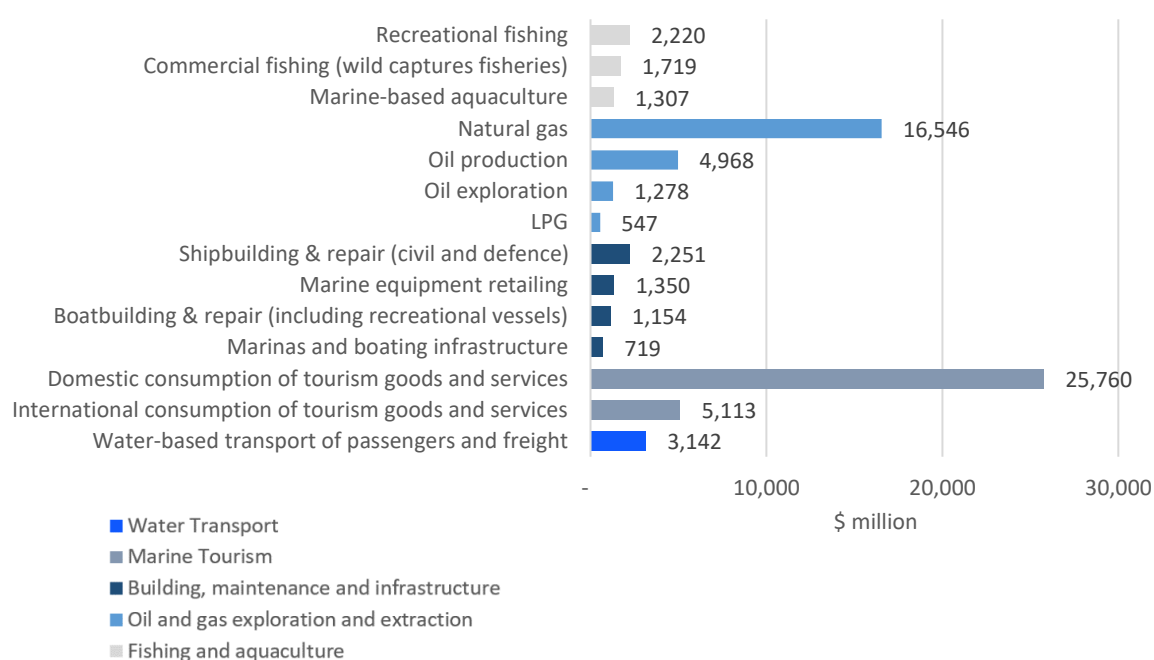
## 2 The output of Australia's marine industry

### 2.1 Output in 2015-16

In 2015-16, the total measurable output (income) attributable to the marine environment in Australia was \$68.1 billion, using the most recent definition adopted in the previous edition of the AIMS Index of Marine Industry. By way of comparison, in 2015-16:

- Total output of all agricultural production in Australia was \$56.0 billion;<sup>14</sup>
- Sales and service income from coal mining totalled \$44.2 billion;<sup>15</sup>
- Sales and service income from primary metal and metal product manufacturing totalled around \$49.8 billion;<sup>16</sup> and
- Sales and service income from heavy and civil engineering construction totalled around \$67.9 billion.<sup>17</sup>

Chart 2.1: Total measurable output (income) from marine-related activities in 2015-16 (in 2015-16 \$ million)



Data source: Various government publications and industry reports – see Appendix A

It should be noted that the total output figure of \$68.1 billion does not capture all values of the marine industry – economic data is unavailable for many marine activities and there are non-economic values which are not captured by this approach.

<sup>14</sup> ABS (2017) Cat No 7503.0, 2015-16.

<sup>15</sup> ABS (2018b) Cat No 8155.0, 2015-16.

<sup>16</sup> Ibid.

<sup>17</sup> Ibid.

## 2.2 Changes over time

In order to gain an understanding of the industry's changing output over time (Chart 2.2), we compare the levels of economic activity for marine industry sub-sectors, for which reliable data on economic activity is collected annually.

Using the marine industry definition used prior to the 2016 report, between 2001-02 and 2015-16, marine industry output has more than doubled.

However, going against the long-term trend, marine industry output contracted between 2013-14 and 2015-16.

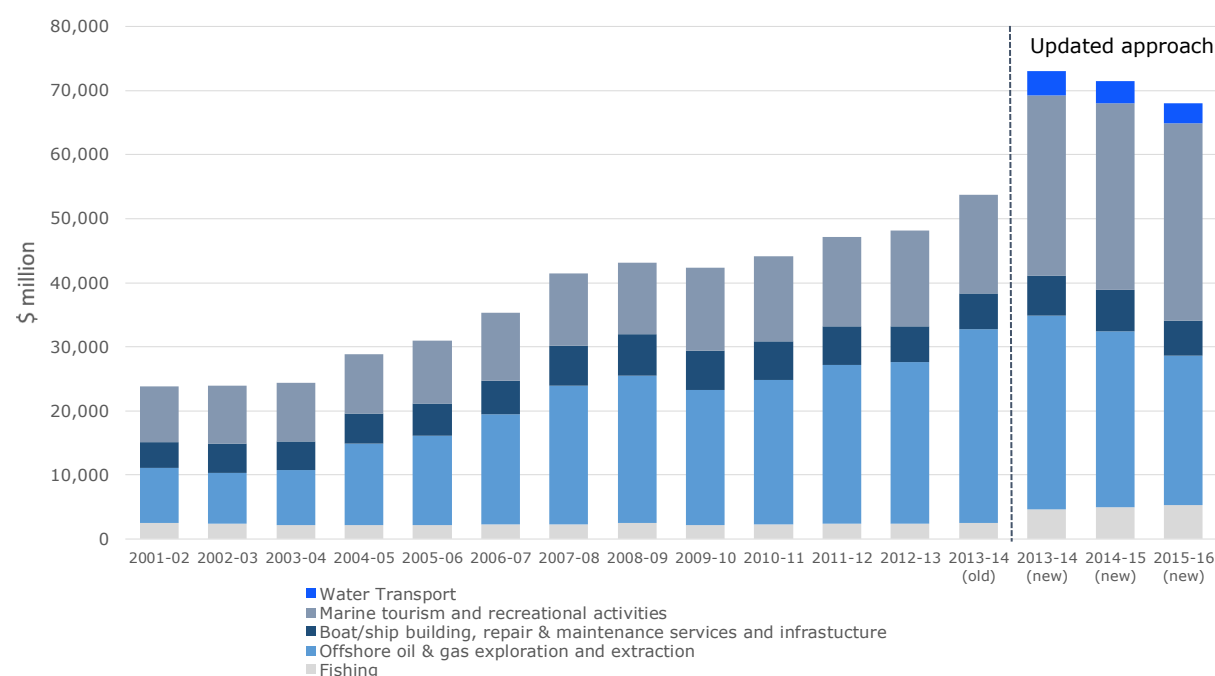
This decrease of the last two years was primarily driven by:

- A decrease in the value of oil production and exploration activities, both of which reflect a significant decrease in the global oil price. The value of output from offshore oil and gas activities (including exploration and production) decreased from \$30.2 billion in 2013-14, to \$23.3 billion in 2015-16.
- A 24% fall in shipbuilding and repair output, and a 7% decline in the boatbuilding and repair sector, over the two years to 2015-16.
- An 18% fall in output from the water-based transport sector.

Moderating these decreases over the same period were increases in the total output in the domestic and international marine-based tourism sector, which grew by 10% in the two years to 2015-16; and the marine fishing and aquaculture sector, which grew by 22% over the same period.

Overall, however, the decrease in offshore oil and gas production and exploration values more than offset increases in other sectors, resulting in an overall fall in output from the marine industry of 7% in the two years to 2015-16.<sup>18</sup> If the output of the oil and gas sectors had remained constant over this period, total marine industry output would have increased by 3%.

Chart 2.2: Comparison over time: measurable output (income) from selected marine-related activities, 2001-02 to 2015-16 (\$ million, nominal)



Data source: Various government publications and industry reports – see Appendix A

<sup>18</sup> By comparison - the Australian economy as a whole grew by 5.2% between 2013-14 and 2015-16. Source: ABS (2018d) Cat No 5206.0, June 2018. Gross Domestic Product: Current prices

Appendix A contains a table with detailed data for each industry sub-sector's output from 2001-02 to 2015-16.

## **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 (including estuaries) or in on-land based ponds requiring a sea water source – other inland operations using seawater are not included in this definition.

The value of fisheries and aquaculture production increased by 12% year-on-year in 2014-15 and again by 9% in 2015-16 to \$3.1 billion. In those years, the value of output grew in both the aquaculture and commercial fishery sectors. The major species in 2015-16, in terms of value, were rock lobster (\$695 million, wild-catch), prawns (\$388 million, mostly aquaculture), salmonids (\$718 million, mostly aquaculture), abalone (\$160 million, mostly wild-catch) and tuna (\$171 million, mostly aquaculture). Tasmania, Western Australia and South Australia dominated in terms of value of output.<sup>19</sup>

Like the value of output, employment in the sector has also increased in the two years to 2015-16. There were a combined 11,000 people employed in the commercial fisheries and aquaculture sectors in 2015-16, up from 8,700 in 2013-14.<sup>20</sup>

### **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. Although the fish caught by recreational fishers represent an economic value they are not part of a market transaction. 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 expenditure on 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 2015-16 value, is based on a 2003 study from the Department of Agriculture, Fisheries and Forestry (DAFF) that observed that 3.36 million Australians engaged in recreational fishing, spending \$1.855 billion in 1999-00 (\$2.7 billion in 2015-16\$).<sup>21</sup> This suggests an annual expenditure of \$552 per fisher (\$840

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<sup>19</sup> ABARES, 2017

<sup>20</sup> ABARES, 2017

<sup>21</sup> DAFF (2003)



in 2015-16\$). 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.

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-add and resulting in 16,257 direct jobs.<sup>22</sup> The estimate from DAFF 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 2012,<sup>23</sup> and a study on the economic, social and icon value of the Great Barrier Reef Marine Park which valued expenditure on recreational fishing in the Great Barrier Reef at \$70 million in 2015-16.<sup>24</sup>

### **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. The Recreational Marine Research Centre (2015) released the 2014-15 Health of the Marina Industry Survey report, which estimated the value of revenues in the sector at \$719 million (in 2015-16\$).

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<sup>22</sup> Ernst and Young (2015)

<sup>23</sup> Deloitte Access Economics (2013a)

<sup>24</sup> Deloitte Access Economics (2017)

### **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 foundation.<sup>25</sup> This report found that tourism activity associated with the Great Barrier Reef generated \$5.7 billion in value-add to the Australian economy 2015-16.

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 sector<sup>26</sup> 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 activities.<sup>27</sup>

### **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.

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<sup>25</sup> Deloitte Access Economics (2017)

<sup>26</sup> ANZSIC 2006 Subdivision 48: Water Transport

<sup>27</sup> 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-add.

### 3.1 Methodology

This chapter calculates the economic contribution of the various marine sub-sectors for the 2015-16 financial year. The contribution is split into direct and indirect components. The direct component is based on the value-add measure – the returns to labour (wages) and the returns to capital (profit). It was calculated using 2015-16 data from a variety of industry reports, and ABS Input-Output tables (from 2013-14, maintaining a consistent approach to the previous 2016 edition).

#### Direct contribution

While revenue (or production value) is more commonly reported in financial accounts, value-add provides a more accurate assessment of an industry's contribution to the overall economy. This is because value-add 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-add 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-add, 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
<b>Marine resource activities and industries</b>		
<b>Fishing</b>		
Marine-based aquaculture	Aquaculture	73%
Commercial fishing (wild captures fisheries)	Fishing, hunting and trapping	81%
Recreational fishing	n/a	n/a
<b>Offshore oil &amp; gas exploration and extraction</b>		
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%
<b>Marine-related service activities and industries</b>		
<b>Boat/ship building, repair &amp; maintenance services and infrastructure</b>		
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%
<b>Marine tourism and recreational activities</b>		
Domestic consumption of tourism goods and services	n/a	n/a
International consumption of tourism goods and services	n/a	n/a
<b>Water transport</b>		
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 B.

## 3.2 Economic contribution results

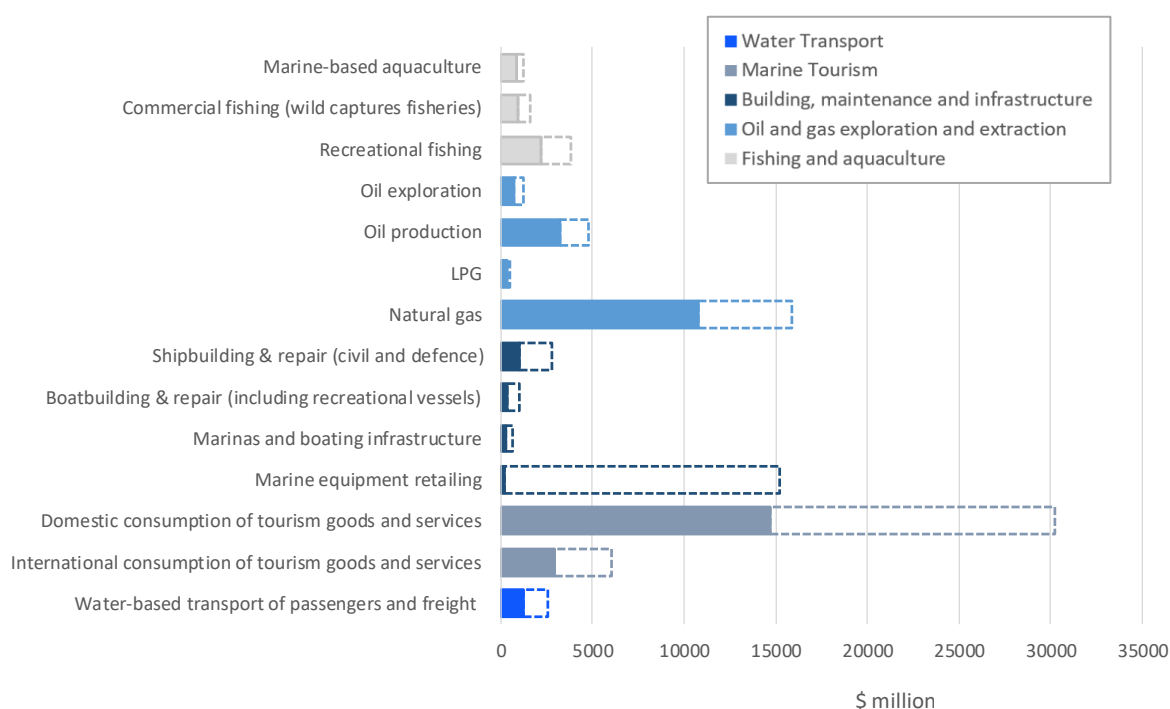
### 3.2.1 Value-add

#### 3.2.1.1 Value-add by marine sub-sector

The first step in determining the economic contribution of the marine industry involved estimating the direct value-add based on the data presented in Table 2.2, which provided the total measurable value from marine-related activities in 2015-16. Table 3.2 below presents both the value of production and the corresponding value-add, 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-add) was then calculated for each sub-sector. It is important to note that each sub-sector was analysed separately. Consequently, the indirect value (as it is shown in the Chart 3.1 below) are not additive, 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-add of the fishing industry would, therefore, include some of the direct value-add of the boatbuilding industry.

Chart 3.1: Direct (solid colour) and indirect (dashed line) economic contribution by marine sub-sector, 2015-16 (in 2015-16 \$ million)



### 3.2.1.2 Total value-add 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-add.

In total, we estimate the Australian marine industry created \$39.8 billion in value-add in 2015-16, with a further indirect value-add of \$31.6 billion. This amounts to a total contribution of \$71.4 billion in value-add, as shown in Table 3.2. This represents 4.3 per cent of national gross domestic product in 2015-16.

Table 3.2: Total direct and indirect economic contribution of the Australian marine industry 2015-16 (in 2015-16 \$ million)

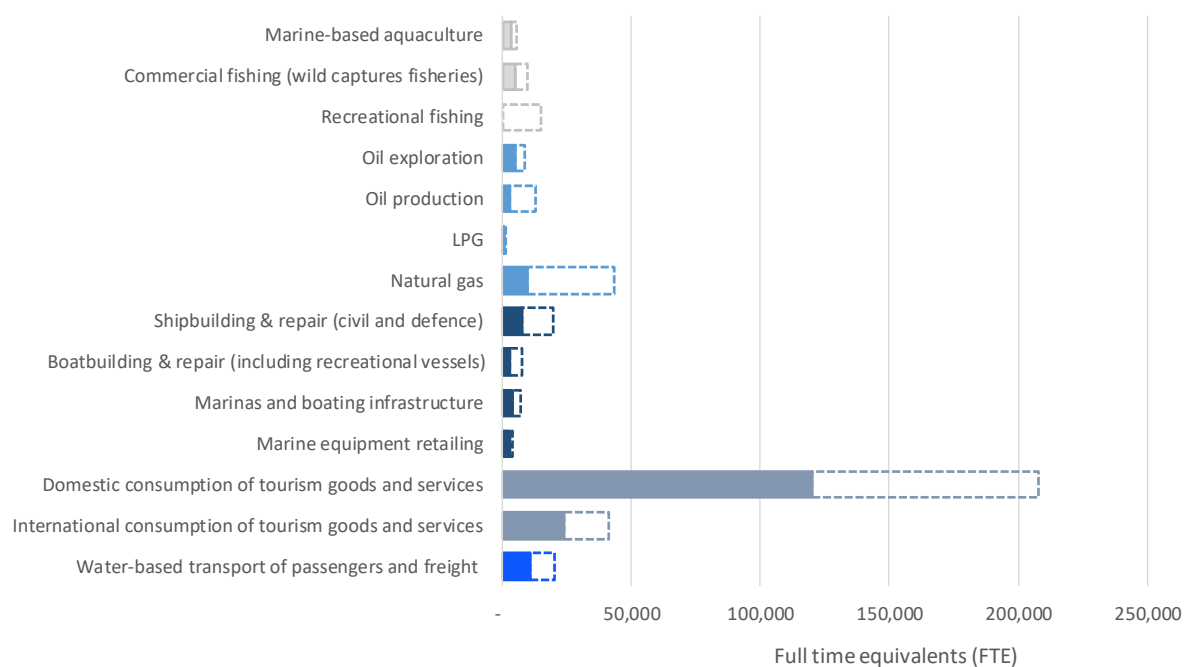
	Direct value-add	Indirect value-add	Total value-add
Marine industry	\$39,771	\$31,617	\$71,388

## 3.2.2 Employment contribution

### 3.2.2.1 Employment contribution by marine sub-sector

Chart 3.2 below presents an estimation of the direct and indirect full time equivalent (FTE) employment effects of each marine sub-sector. Domestic consumption of tourism goods and services account for the largest share of employment overall, reflecting the relatively labour-intensive nature of tourism industries.

Chart 3.2: Direct (solid colour) and indirect (dashed line) employment (FTE) by marine sub-sector, 2015-16



### 3.2.2.2 Total employment contribution of the marine industry

In total Australia's marine industry employed approximately 197,000 full time equivalent workers in 2015-16.

Again, indirect employment in the different sub-sectors, as presented in Table 3.4, was not additive. Hence, the same approach as for value-add was applied to determine total indirect employment. As shown in Table 3.3 below, the marine industry supported a further 196,000 FTE workers in indirect employment (considering upstream industries only), amounting to a total employment contribution of 393,000 FTE workers.

Table 3.3: Total direct and indirect employment (FTE) contribution of the Australian marine industry, 2015-16

	Direct employment (FTE)	Indirect employment (FTE)	Total (FTE)
<b>Marine industry</b>	196,857	196,153	393,011



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# Appendix A: Data tables

## Summary statistics for Australian Marine subsectors

A summary of the major and most recent available data regarding marine industry activities in Australia, from publicly available sources, is outlined in Table A.1 below.

The information summarised in the table shows that there are a number of categories for which there is no suitable data available (shown as n/a). For sub-sectors where data is available, comparable and reliable, the values have been aggregated to provide a total measurable value for 2015-16 (see Table 2.2).

Table A.1 Summary statistics for Australian marine subsectors, 2015-16

	Industry Value-add (2015-16 \$m)	Value of Production (2015-16 \$m)	Industry employment (2015-16)	Other
<b>Marine resource activities and industries</b>				
<b>Fishing</b>				
Marine-based aquaculture <sup>28</sup>	n/a	\$994	5,385 employees, 78% full-time share	-
Commercial fishing (wild capture fisheries) <sup>29</sup>	n/a	\$1,503	5,600 employees, 78% full-time share	-
Recreational fishing <sup>30</sup>	n/a	\$2,200 (expenditure)	n/a	3.36m fishers in 2000-01, 82% marine fishing
Indigenous fishing <sup>31</sup>	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
<b>Offshore oil &amp; gas exploration and extraction</b>				
Oil exploration <sup>32</sup>	n/a	\$1,278	n/a	-
Oil production <sup>33</sup>	n/a	\$4,968	n/a	-
LPG <sup>34</sup>	n/a	\$547	n/a	-
Natural gas <sup>35</sup>	n/a	\$16,546	n/a	-
<b>Marine-related service activities and industries</b>				
<b>Boat/ship building, repair &amp; maintenance services and infrastructure</b>				
Shipbuilding & repair (civil and defence) <sup>36</sup>	\$1,023	\$2,251	7,703 employees	-

<sup>28</sup> ABARES (2017)

<sup>29</sup> Ibid.

<sup>30</sup> DAFF (2003). The \$2.7 billion expenditure figure is based on the 2003 study, inflated to 2015-16\$ (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%.

<sup>31</sup> Ibid.

<sup>32</sup> ABS (2018a) Cat No 8412.0, June 2018. Offshore oil exploration expenditure totalled \$949 million in 2016-17, and \$681 million in 2017-18.

<sup>33</sup> Estimate derived using APPEA (2017) for \$AUD/barrel and Department of the Environment and Energy (2018) for offshore production volume (in barrels)

<sup>34</sup> Department of the Environment and Industry (2017). Export revenue only.

<sup>35</sup> Ibid. Export revenue of Liquefied Natural Gas only.

<sup>36</sup> ABS (2018b) Cat No 8155.0, 2014-15. The value of production in shipbuilding and repair (civil and defence) was \$2,289 million in 2016-17.

	<b>Industry Value-add (2015-16 \$m)</b>	<b>Value of Production (2015-16 \$m)</b>	<b>Industry employment (2015-16)</b>	<b>Other</b>
Boatbuilding & repair (including recreational vessels) <sup>37</sup>	\$358	\$1,154	5,025 employees	-
Marinas and boating infrastructure <sup>38</sup>	n/a	\$719	3,270 employees (2014-15)	-
Marine equipment retailing <sup>39</sup>	\$213	\$1,350	3,460 employees	Wages & salary \$166.2m
<b>Marine tourism and recreational activities</b>				
Domestic consumption of tourism goods and services <sup>40</sup>	\$14,701	\$25,760	193,000 tourism-related employees	Assumption: 40% of domestic tourism
International consumption of tourism goods and services <sup>41</sup>	\$2,918	\$5,112	18,300 tourism-related employees	Assumption: 19% of international tourism
Aquaria <sup>42</sup>	n/a	n/a	n/a	2006-07: \$304m retail sales, \$233m gross value of production.
<b>Water transport</b>				
Water-based transport of passengers and freight <sup>43</sup>	\$1,208	\$3,437	9,000 employees	-
<b>Marine environment management</b>				
Marine safety (Australian Maritime Safety Authority – AMSA) <sup>44</sup>	n/a	n/a	384 AMSA Employees (2014-15)	Operating expenditure \$204.4m

<sup>37</sup> Ibid. The value of production in Boatbuilding and repair (including recreational vessels) was \$1,183 million in 2016-17.

<sup>38</sup> Recreational Marine Research Centre (2015)

<sup>39</sup> IBISWorld (2018). Marine equipment retailing was \$1,354 million in 2014-15.

<sup>40</sup> ABS (2018c) Cat No. 8155.0, 2016-17. 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).

<sup>41</sup> Ibid.

<sup>42</sup> 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).

<sup>43</sup> ABS (2018c) Cat No 8155.0, 2016-17. The most recent report shows that by 2016-17 this industry value add has fallen \$1,153 million and industry income of \$3,207 million, while employment has fallen to 8,000.

<sup>44</sup> AMSA (2016).

## Economic contribution results – value-add

Table A.2 Direct and indirect economic contribution by marine sub-sector (\$ million), 2015-16

	Direct value of production	Direct value-add	Indirect value-add	Total value-add
<b>Marine resource activities and industries</b>				
<b>Fishing</b>				
Marine-based aquaculture	1,307	871	336	1,207
Commercial fishing (wild captures fisheries)	1,719	942	630	1,573
Recreational fishing	2,220	2,220	1,563	3,783
<b>Offshore oil &amp; gas exploration and extraction</b>				
Oil exploration	1,278	677	553	1,229
Oil production	4,968	3,239	1,522	4,761
LPG	547	357	168	525
Natural gas	16,546	10,787	5,070	15,856
<b>Marine-related service activities and industries</b>				
<b>Boat/ship building, repair &amp; maintenance services and infrastructure</b>				
Shipbuilding & repair (civil and defence)	2,251	1,023	1,756	2,779
Boatbuilding & repair (including rec. vessels)	1,154	358	614	972
Marinas and boating infrastructure	719	258	414	671
Marine equipment retailing	1,350	213	150	363
<b>Marine tourism and recreational activities</b>				
Domestic consumption of tourism goods & services	25,760	14,701	15,560	30,261
International consumption of tourism goods & services	5,113	2,918	3,088	6,006
<b>Water transport</b>				
Water transport	3,142	1,208	1,360	2,568

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

Table A.3 Direct and indirect economic contribution of all marine industries (\$ million), 2015-16

	Direct value of production	Direct value-add	Indirect value-add	Total value-add
Marine industries	68,074	39,771	31,617	71,388

## Economic contribution results – employment

Table A.4 Direct and indirect employment (FTE) by marine sub-sector, 2015-16

	Direct employment (FTE)	Indirect employment (FTE)	Total (FTE)
<b>Marine resource activities and industries</b>			
<b>Fishing</b>			
Marine-based aquaculture	3,105	2,414	5,519
Commercial fishing (wild captures fisheries)	5,043	4,531	9,573
Recreational fishing	n/a	14,671	14,671
<b>Offshore oil &amp; gas exploration and extraction</b>			
Oil exploration	5,018	3,439	8,457
Oil production	2,826	10,197	13,022
LPG	311	1,124	1,435
Natural gas	9,410	33,958	43,369
<b>Marine-related service activities and industries</b>			
<b>Boat/ship building, repair &amp; maintenance services and infrastructure</b>			
Shipbuilding & repair (civil and defence)	7,326	12,327	19,653
Boatbuilding & repair (including recreational vessels)	3,071	4,314	7,384
Marinas and boating infrastructure	3,766	3,002	6,767
Marine equipment retailing	2,803	915	3,718
<b>Marine tourism and recreational activities</b>			
Domestic consumption of tourism goods and services	119,833	87,761	207,594
International consumption of tourism goods and services	23,786	17,420	41,205
<b>Water transport</b>			
Water transport	10,560	9,599	20,159

Note: Each sub-sector was analysed separately. Consequently, the values in the 'indirect employment' column are not additive. Total indirect employment was estimated by removing activity associated with 'marine sub-sectors' to avoid double-counting.

Table A.5 Direct and indirect employment (FTE) contribution of all marine industries, 2015-16

	Direct employment (FTE)	Indirect employment (FTE)	Total (FTE)
Marine industries	196,857	196,153	393,011



## Changes in output over time

Table A.6 Total of measurable Industry Value of Production from marine-related activities, 2001-02 to 2015-16

Marine resource activities and industries															New figures			
Value of output (\$m, nominal)	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)	2014-15 (old)	2014-15 (new)	2015-16 (old)	2015-16 (new)
Fishing																		
Marine-based aquaculture	731	709	725	634	742	806	868	867	878	954	1,054	1,053	994	997	1,187	1,187	1,307	1,307
Commercial fishing (wild capture fisheries)	1,784	1,656	1,499	1,490	1,461	1,446	1,363	1,393	1,335	1,317	1,302	1,361	1,503	1,173	1,265	1,265	1,311	1,311
Commonwealth Fisheries														341		350		439
Recreational fishing														2,165		2,198		2,220
Total fishing	2,515	2,364	2,224	2,125	2,203	2,252	2,231	2,470	2,213	2,271	2,356	2,356	2,498	4,638	2,452	4,967	2,618	5,246
Offshore oil & gas exploration and extraction																		
Oil exploration	720	922	791	830	938	1,727	2,541	3,318	2,746	2,559	2,246	3,430	3,512	3,512	2,537	2,537	1,278	1,278
Oil production	4,441	3,473	4,899	7,867	7,570	9,230	12,124	8,638	9,412	8,465	9,708	6,978	9,145	9,145	7,254	7,254	4,968	4,968
LPG	856	981	717	861	1,037	1,038	1,182	1,044	1,105	1,068	971	1,088	1,265	1,265	811	811	547	547
Natural gas (export revenue)	2,613	2,607	2,174	3,199	4,416	5,220	5,854	10,079	7,789	10,437	11,950	13,741	16,305	16,305	16,896	16,896	16,546	16,546
Total offshore oil & gas	8,630	7,983	8,581	12,757	13,961	17,215	21,701	23,078	21,051	22,529	24,875	25,238	30,226	30,226	27,498	27,498	23,340	23,340
Boat/ship building, repair & maintenance services and infrastructure																		
Shipbuilding & repair (civil and defence)	1,796	1,839	1,696	1,721	1,797	1,777	1,954	1,997	2,724	2,722	2,825	3,098	2,966	2,966	3,238	3,238	2,251	2,251
Boatbuilding & repair (including recreation vessels)	818	1,037	1,108	1,251	1,488	1,688	1,829	1,869	1,207	1,203	1,055	1,048	1,235	1,235	1,152	1,152	1,154	1,154
Marinas & boating infrastructure														699		712		719
Marine equipment retailing	1,412	1,633	1,670	1,710	1,744	1,805	2,487	2,559	2,167	2,149	2,055	1,460	1,393	1,393	1,372	1,372	1,350	1,350
Total boat/ship services	4,026	4,509	4,474	4,682	5,029	5,270	6,270	6,426	6,098	6,074	5,935	5,606	5,594	6,293	5,762	6,474	4,755	5,474
Marine tourism and recreation activities																		
Domestic consumption of tourims goods and services	7,337	7,784	7,726	7,909	8,326	9,012	9,554	9,345	11,048	11,236	11,949	12,639	13,128	23,815	13,912	24,477	14,701	25,760
International consumption of tourism goods and services	1,272	1,292	1,377	1,420	1,469	1,612	1,725	1,799	1,964	204	2,065	2,294	2,337	4,239	2,610	4,591	2,918	5,113
Total tourism	8,609	9,076	9,102	9,329	9,795	10,624	11,279	11,143	13,011	13,279	14,013	14,933	15,465	28,054	16,522	29,069	17,618	30,873
Water transport																		
Water based transport of passengers and freight														3,817		3,481		3,142
Total water transport														3,817		3,481		3,142
TOTAL	23,780	23,932	24,381	28,892	30,988	35,361	41,480	43,118	42,373	44,153	47,179	48,133	53,783	73,029	52,234	71,488	48,330	68,074

Note: The last four columns have been updated in this version of the AIMS Index, with new data available for 2014-15 and 2015-16.

# Appendix B: Economic contribution framework

Economic contribution studies are intended to quantify measures such as value-add, 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-add 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-add	Value-add 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-add across all entities in the economy equals gross domestic product. Given the relationship to GDP, the value-add 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-add

The measures of economic activity provided by this contribution study are consistent with those provided by the Australian Bureau of Statistics. For example, value-add 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-add 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-add 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-add across all entities in the economy equals gross domestic product. Given the relationship to GDP, the value-add measure can be thought of as the increased contribution to welfare.

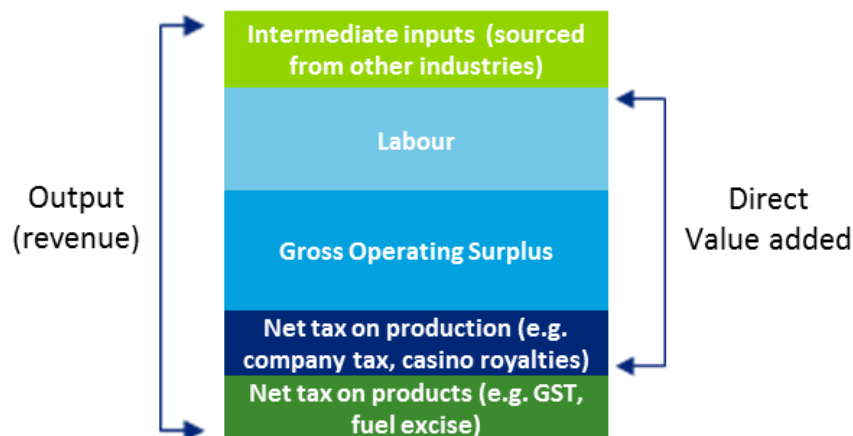
Value-add is the sum of:

- 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-add. 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-add 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 B.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-add 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-add (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 industries<sup>45</sup>:

Value-add 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 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.

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

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.





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AUSTRALIAN INSTITUTE  
OF MARINE SCIENCE

AUSTRALIAN INSTITUTE OF MARINE SCIENCE

PMB 3, Townsville MC  
Townsville 4810 - Queensland, Australia  
P. +61 7 4753 4444 F. +61 7 4772 5852

**[www.aims.gov.au](http://www.aims.gov.au)**

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