NUI Galway
OÉ Gaillimh

Whitaker Institute

Marine Sectoral Overview

Galway City and County Economic and Industrial Baseline Study

MARINE SECTORAL OVERVIEW

James Cunningham
Brendan Dolan
David Kelly
Chris Young

03/04/2015

Table of Contents

Acknowledgements

We wish to acknowledge the support of Liam Hanrahan, Patricia Philbin, Sharon Carroll, Niamh Farrell of Galway City Council and Alan Farrell and Brian Barrett of Galway County Council in preparing this sectoral review.

Our Approach[1]

Our approach in undertaking this overview of the marine sector was to take a global and national perspective before focusing on the regional and local level. One of the main limitations we faced preparing this sector review is the lack of quality and reliable data at the local level. The framing of the global and national level overviews against publicly available local data provides a basis and context to consider the future of the in Galway City and County.

[1] The information contained in this overview has been compiled from many sources that are not all controlled by the Whitaker Institute. While all reasonable care has been taken in the compilation and publication of the contents of this resource, Whitaker Institute makes no representations or warranties, whether express or implied, as to the accuracy or suitability of the information or materials contained in this resource.

Executive Summary Overview of the Marine Sector

Global Overview

- $1.2 trillion is the estimated worldwide economic value of marine goods and services.
- The weakness of fisheries governance is considered to be the main problem behind overfishing and stock decline.
- It is estimated that 52% of global fisheries are being fished at their maximum limit, 24% are overfished, depleted or recovering.
- Marine and coastal tourism is one of the fastest growing areas within the global marine industry.
- Approximately 9.2 billion tonnes of goods were loaded into ports worldwide, crude oil, petroleum products and gas accounts for one third of these while two thirds are dry-cargo shipments fuelled by growing Asian demand for iron ore and coal.
- Off-shore Wind Industry is the most mature of the ocean based energy sources with a global installed capacity of over 6 GW with estimates of growth to 175 GW by 2035.
- Tidal barrages and wave power are still at the demonstration stage.
- Oil is predicted to remain the dominant fuel through to 2035.
- Aquaculture, with extensive growth in Asia is expected to grow 33% to 79 million metric tons by 2021 while capture fisheries are expected to grow by only 3%.
- Marine Biotechnology industries are estimated at approximately $2.8 billion and expected to grow to $4.6 billion by 2017.

National Overview

- The latest estimated economic value of Ireland's ocean economy as of 2007 is valued at €1.44 billion or 1% GDP, providing employment for 17,000 people.

- Emerging activities consist of renewable ocean energy, marine commerce, high-tech services and marine biotechnology.
- Some 99% of Ireland's total imports and exports are transported by sea. Sea-based shipping is the second largest provider in terms of turnover, value added and employment within the established marine sector.
- Ireland's water-based tourism and leisure industry generated €453 million gross value added to the economy, employing 5,800 people in 2007.
- 190 cruise liners docked in Ireland carrying 162,797 passengers in 2012.
- 2,125 registered fishing vessels currently on the Irish Fishing Boat Register representing 2% of the European fishing fleet.
- The volume and value of fish landed by Irish vessels in home ports for 2012 amounts to 280,000 tonnes valued at €270 million.
- Ireland has the 7th largest aquaculture sector in the EU, producing 48,350 tons of aquaculture in 2007.
- The Irish seafood market is valued at €830 million with shellfish exports valued at €172 million due to an increasing demand for Irish oysters, crab and mussels.
- Oil and gas provide over 80% of Ireland's primary energy supply with €1.5 billion expected to be spent on oil and gas exploration over the next 3 years.
- In 2007 marine manufacturing accounted for approximately €265 million, with exports accounting for €12 million.
- High Tech Marine Products and Services had a turnover of €43.6 million in 2007, employing 350 people.
- Marine Commerce produces the highest turnover within the emerging marine activities.
- Marine biotechnology accounted for a turnover of €18 million in 2007, employing 185 people.
- Due to the EU target of reducing CO2 emissions by 20% by 2020 the government has set a target of generating 40% of electricity from renewable sources.

Regional and Local Overview

- There are 114 agriculture, forestry and fishing industries in Galway city and county, employing 5908 people (2011 Census).
- In 2012, Galway produced 23% of the total nationwide production of salmon, and 33% of edulis oysters.
- 8 cruise ships dock in Galway Harbour in 2014, with the same number expected to dock in Galway in 2015.
- Active water-based activities of Galway include sea angling, pleasure boating, windsurfing, scuba-diving, canoeing and water-skiing.
- There are currently 7 blue-flag beaches in Galway, with 2 in the City
- There were 35 companies involved in water based leisure activities in 2010 in Galway
- 319 registered vessels on the Irish Boat Register are owned by people living in Galway, out of a total 2,125.
- 17 aquaculture and fishing companies in Galway.
- In 2012, Galway produced 2742 tonnes of salmon of a total nationwide production of 12,000 tonnes, 1012 tonnes of rope mussels, and 15 tonnes of freshwater trout.
- Rossaveal is the main port in the west of Ireland (4kt per year, 31 vessels) and receives a mix of pelagic, demersal and shellfish species.
- In 2013, Rosaveel ranked 4th in the top 20 Irish ports in terms of monetary value of yearly haul.
- Bord Iascaigh Mhara lists 11 seafood processors in Galway County, with four of these based in Galway City.
- Galway has the best marine manufacturer to population ratio.
- The Corrib gas project has provided benefits to Galway, connecting four towns in Galway to the national gas network
- There are 10 angling clubs and related services in the City and County.
- There are 9 sailing clubs and related services in the City and County.

- A recent discovery of 61 tonnes of bullion from a British cargo ship that sank in 1941, 300 miles off the coast of Galway, underlines the potential for deep sea exploration.

- A significant public research infrastructure exists in the City and County.

Global Overview of the Marine Sector

Global Overview

Introduction

The estimated worldwide economic value of marine goods and services is $1.2 trillion (World Ocean Council, 2014). The ocean economy can be divided into established marine activities and emerging marine activities. Established activities include shipping and shipbuilding, capture fisheries, traditional maritime and coastal tourism and port facilities and handling. Emerging activities encompass off-shore wind, tidal and wave energy, deep-sea oil and gas extraction, marine aquaculture, marine biotechnology, sea-bed metal and mineral mining, tourism and leisure, ocean monitoring, control and surveillance (OECD, 2013).

1 Established Marine Activities

1.1 Shipping and Shipbuilding

China, the Republic of Korea and Japan together built 92% of the world's new ships in 2013 (UNCTAD, 2013). Although there are limited available efficiency improvement options for existing ships, it has been forecasted that new built ships will adopt hull optimisation in order to meet with the EEDI requirement in 2015. A projection of 7-8% new buildings will use smaller, gas fuelled engines by 2020. It is estimated that due to the 0.1% limit in Emission Control Areas (ECA) and the introduction of the global sulphur limit in 2020 the demand for marine distillates could increase from 30 million tonnes to 200-250 million tonnes annually. The demand for liquid natural gas (LNG) will be 8-33 tonnes with more than 1 in 10 new built ships having LNG fuelled engines. The demand for regulatory compliant, more cost effective ships will increase by 2020 including tank, bulk and container vessels and scrubbers. With the ratification of The Ballast Water Management Convention (BWMC) new water treatment systems will be installed on at least half of the world fleet (DNV report Shipping 2020, 2012).

The International Maritime Organisation's global sulphur limit and Phase 2 of the EEDI to be implemented in 2020 are the strongest drivers of change in the shipping industry. The increasing cost of fuel will drive the demand for new energy efficient ships that use alternative fuels such as LNG, power systems and light weight construction (DNV Report Shipping 2020, 2012).

1.2 Capture Fisheries

With the world's population expected to grow to 9 billion by 2050 and the already over-exploited, depleted or recovering from depletion wild fish stocks, the capture fisheries stocks are under great pressure. As well as over fishing there are growing concerns of organic pollution, toxic contamination, coastal degradation and climate change. Ensuring a sustainable global harvest and the maintenance of the biodiversity of the marine ecosystem with the ability to adapt to climate change is dependable on the fisheries governance, the national and international policy and legal frameworks (Garcia & Rosenberg, 2010).

The weakness of fisheries governance is considered to be the main problem behind overfishing and stock decline (Beddington et al. 2007). The implementation framework of the 1982 United Nations Convention on the Law of the Sea (UNCLOS) in 1994 has begun to improve the issues within the capture fisheries industry but governance of the high seas is still a major problem (Garcia & Rosenberg, 2010).

It is estimated that 52% of global fisheries are being fished at their maximum limit, 24% are overfished, depleted or recovering. Due to this, global fisheries' production is projected to slow to an average of 2.1% annual growth rate between 2005 and 2030. The effect on associated businesses will be extensive (OECD, 2008).

1.3 Traditional Maritime and Coastal Tourism

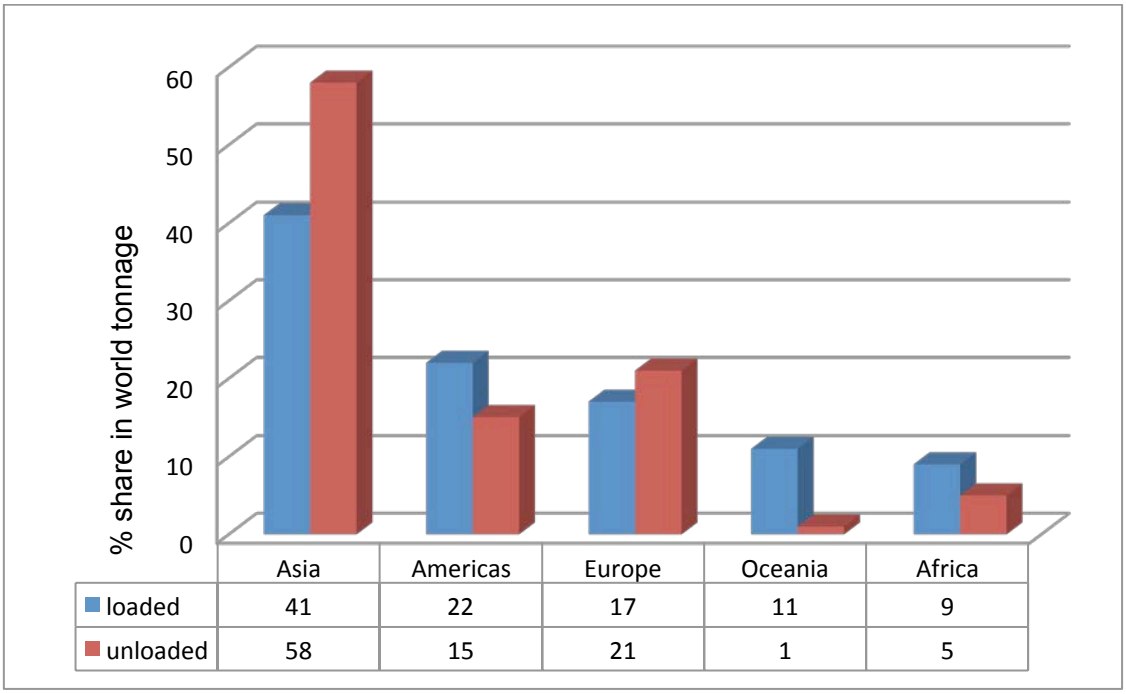
Marine and coastal tourism is one of the fastest growing areas within the global marine industry. It contributes significantly to national economy (Hall, 2001). Cruise tourism has increased 24-fold since 1970 with an estimated 16 million people boarding ocean liners annually. The average annual passenger growth rates are approximately 7.5%. This industry has not reached its maturity and will continue to grow due to rising incomes, ageing populations and increasing leisure time. A challenge remains however, of resolving the conflict between the economic benefits and the strains on the environment especially as the cruise industry expands to new destinations like the Artic (OECD, 2013).

1.4 Port Facilities and Handling

International seaborne trade performed better than the world economy in 2012 with volumes increasing by 4.3% (UNCTAD, 2013). Approximately 9.2 billion tonnes of goods were loaded into ports worldwide. One third of these goods accounts for crude oil, petroleum products and

gas while two thirds are dry-cargo shipments fuelled by growing Asian demand for iron ore and coal. The Panama Canal expansion to be completed by 2015 is driving port development in the Americas. Nicaragua plans to build a canal three times longer than the Panama Canal within 50 years while the port sector in Peru will receive a $2 billion investment by 2015. The growth of seaborne trade is greatly influenced by China's domestic demand for raw materials and leads the world in terms of port throughput (UNCTAD, 2013). Figure 1 illustrates the world seaborne trade by geographical region. Asia dominates the main loading and unloading region. Africa's impact on shipping is the lowest but is poised to expand as it exploits its rich source of resources. As almost 90% of the world's merchandise and commodity trade is transported by ships, ports are vital to the global economy. In order to handle the growth of this industry there is a greater need for planning, asset management and investment. Infrastructure such as rail and road must keep up to date with the growth of this industry. As a result ports are generally government owned. This can allow for the constraint by political forces, governance issues and regulatory risk. Privatisation in recent years is becoming more popular as many governments are facing budget deficits. Privatisation allows for many ports to handle increasing trade, larger vessels and port security (UNCTAD, 2013).

Figure 1:
World Seaborne Trade by Geographical Region, 2013



	Asia	Americas	Europe	Oceania	Africa
loaded	41	22	17	11	9
unloaded	58	15	21	1	5

Adapted from (UNCTAD, 2014).

2 Emerging Marine Activities

2.1 Off-shore Wind Industry

This is the most mature of the ocean based energy sources with a global installed capacity of over 6 GW with estimates of growth to 175 GW by 2035 (International Energy Agency, 2012). Despite this projected growth the challenges of offshore wind technology include usage of maritime space, planning restrictions, competition from other ocean activities, international boundary issues and expensive high-voltage sub-sea cables and construction vessels (International Energy Agency, 2012).

2.2 Tidal and Wave Energy

Tidal barrages and wave power are still at the demonstration stage. Only four tidal range power plants exist in the world. A large plant is in operation in South Korea and another one in France with two smaller plants in Canada and China. Other forms of wave energy include underwater tidal turbines which are close to commercialisation, salinity gradient and floating wind technologies (EY, 2013).

2.3 Deep-sea Oil and Gas Extraction

Until the development of renewable sources of energy, oil is predicted to remain the dominant fuel through to 2035 (OECD 2012). The only growing segment of the industry accounting for a third of gross oil production is offshore crude oil. It is estimated that almost half of the remaining oil is in deep offshore fields (IEA, 2012). The Artic has a predicted 30% of the undiscovered gas and 13% of the undiscovered oil.

2.4 Marine Aquaculture

As demand for fish increases and as capture fisheries remains static, growth will need to come from aquaculture. Aquaculture, with extensive growth in Asia is expected to grow 33% to 79 million metric tons by 2021 while capture fisheries are expected to grow by only 3% (OECD/FAO, 2012). The growth rate of aquaculture is expected to slow, from an average annual of 5.8% to 2.4% coming 2021 due to water constraints, limited production locations and increasing overheads. This is predicted to in turn drive up the price of fish and seafood as demand exceeds supply. The majority of future aquaculture production will move off-shore and will have to handle such challenges as issues with invasive species and fish disease

(OECD/FAO, 2012). There is however a high global demand for finfish, oysters and mussels (Department of Agriculture, Food and the Marine, 2014).

2.5 Marine Biotechnology

"Marine biotechnology, sometimes referred to as "blue biotechnology", exploits the diversity found in marine environments in terms of the form, structure, physiology and chemistry of marine organisms in ways which enable new materials to be realised." (Marine Institute, 2014). This industry is estimated at approximately $2.8 billion and is expected to grow to $4.6 billion by 2017 (OECD, 2012). Marine microbes, like bacteria demonstrate a rich source of health drugs. The marine ecosystem provides a relatively untapped resource for drug development. As well as providing human health products, marine biotechnology can potentially develop sustainable sources of alternative energy to gas and oil such as algal biofuels. Recent advances in marine biotechnology as a new source of economic growth has enticed many governments to invest in grants and development strategies in an effort to release the potential of this industry. The EU has several programmes in operation to support marine biotechnology including the AMPERA, MarinERA, MARIFISH and SEAS-ERA (OECD, 2013).

2.6 Sea-Bed Metal and Mineral Mining

Rising value and demand for minerals and metals such as copper, zinc, gold and silver and due to the limited land-based resources; sea-bed mining is becoming more prevalent. Rare and valuable elements such as yttrium, dysprosium and terbium, vital for electric vehicles, ICT hardware and renewable energy resources can be mined at the sea-bed. Although deep-sea mining for minerals is still exploratory in nature, coal has been harvested from the sea for decades (Paul & Beckford, 2014). Several countries have applied for sea-bed exploration licences including New Zealand, The Cook Islands, Brazil, Germany, Britain, China, Japan and South Korea. Technological and environmental issues are two of the principal hurdles within this new sector (Goldenberg, 2014).

2.7 Tourism and Leisure

Prospects of new forms of ocean-related tourism include underwater hotels. Such hotels are in operation and their success is generating interest with companies. The Utter Inn in Sweden floats on the surface of Lake Mälaren. Although being a one room hotel it drew worldwide attention on its opening in 2000. The world's first underwater restaurant in the Maldives has also generated great interest (Brady, 2014). The deep sea is becoming an emerging adventure

tourist destination. Deep Ocean Expeditions LLC are currently taking tourists to depths of 17,000 feet, pushing the boundaries of marine tourism (Leary, 2007).

2.8 Ocean Monitoring Control and Surveillance

The control and surveillance of the ocean is necessary to help prevent such illegal activities as piracy and poaching, the protection of conservation zones and the overall protection of the marine ecosystem. Scarce and expensive infrastructure is necessary to implement ocean monitoring consisting of marine-security vessels, satellite sensing, submersible and fixed platforms and in-situ sensors (OECD, 2012). New companies which provide high tech marine products necessary for ocean monitoring have emerged since 2003 due to new marine regulations (SEMRU, 2010).

2.9 EU Policy Objectives

2.9.1 Integrated Maritime Policy

The EU Integrated Maritime Policy seeks to provide a coherent approach to maritime issues, with increased coordination between different policy areas, and emphasizes the following cross-cutting policies: blue growth, marine data and knowledge, maritime spatial planning, integrated maritime surveillance, and sea basin strategies. The objective is to coordinate all EU policies with a marine dimension in order to safeguard environmental sustainability and quality of life in coastal regions while promoting the growth potential of maritime industries. Examples of some of the European Commission policy initiatives relating to the Irish marine sector are set out below.

2.9.2 Common Fisheries Policy (CFP)

Most recently updated in January 2014, the CFP sets out procedures for managing European fishing fleets and for conserving fish stocks, giving all European fishing fleets equal access to EU waters and fishing grounds and allowing fishermen to compete fairly. The current policy stipulates that between 2015 and 2020 catch limits should be set that are sustainable and maintain fish stocks in the long term. Regulations are set on total allowable catches, fishing licenses, boat capacity management, minimum fish and mesh sizes, design and use of gears, closed areas or seasons, and reducing of environmental impact. For example, the European Commission recently (January 2015) announced measures to avert the collapse of the declining sea bass stock. Immediately effective emergency measures will place a ban on targeting the

fish stock by trawling while it is reproducing, during the spawning season, which runs until the end of April.

2.9.3 Ocean Energy Forum

The European Commission has developed a two-step action plan to support the emerging Ocean Energy Sector with the intention of bringing innovative new technologies to bear in wave and tidal power generation through various collaborations. In the first phase (2014 – 2016), an Ocean energy forum has been set up, with TiP Ocean, the Technology and Innovation Platform for Ocean Energy, providing the technology work stream for the Forum. The outcomes of this Forum will feed into a strategic roadmap, which will provide an agreed blueprint for action in order to help the ocean energy sector move towards industrialisation. The second phase (2017 – 2020), a European industrial initiative, will be a public-private partnership that brings together industry, researchers, Member States and the Commission to set out and implement clear and shared objectives over a specific timeframe.

2.9.4 A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism

Launched on 20 February 2014, this document presented a new strategy to enhance coastal and maritime tourism in Europe in order to unlock the potential of this promising sector. The Commission has identified 14 actions which can help the sector grow sustainably and provide added impetus to Europe's coastal regions. These include proposing to develop an online guide to the main funding opportunities available for the sector (particularly SMEs), promotion of ecotourism and strategies on waste prevention, management and marine litter, and contracting a study on how to improve island connectivity and design innovative tourism strategies for (remote) islands (European Commission, 2014).

2.9.5 LeaderSHIP 2020

The aim of the LeaderSHIP 2020 strategy is to increase the competitiveness of European maritime technology and tackle the new challenges the EU shipbuilding sector is facing. The strategy gives a fresh impetus to the ship and maritime building industry in the areas of innovation, greening, application of new technologies and diversification into new emerging markets, such as off-shore wind energy. The strategy's recommendations range from the wider use of EU instruments to foster new skills, competence and qualifications, to Public Private Partnerships for new maritime research, EIB funding opportunities and smart specialisation strategies in regional policy.

National Overview of the Marine Sector

National Overview

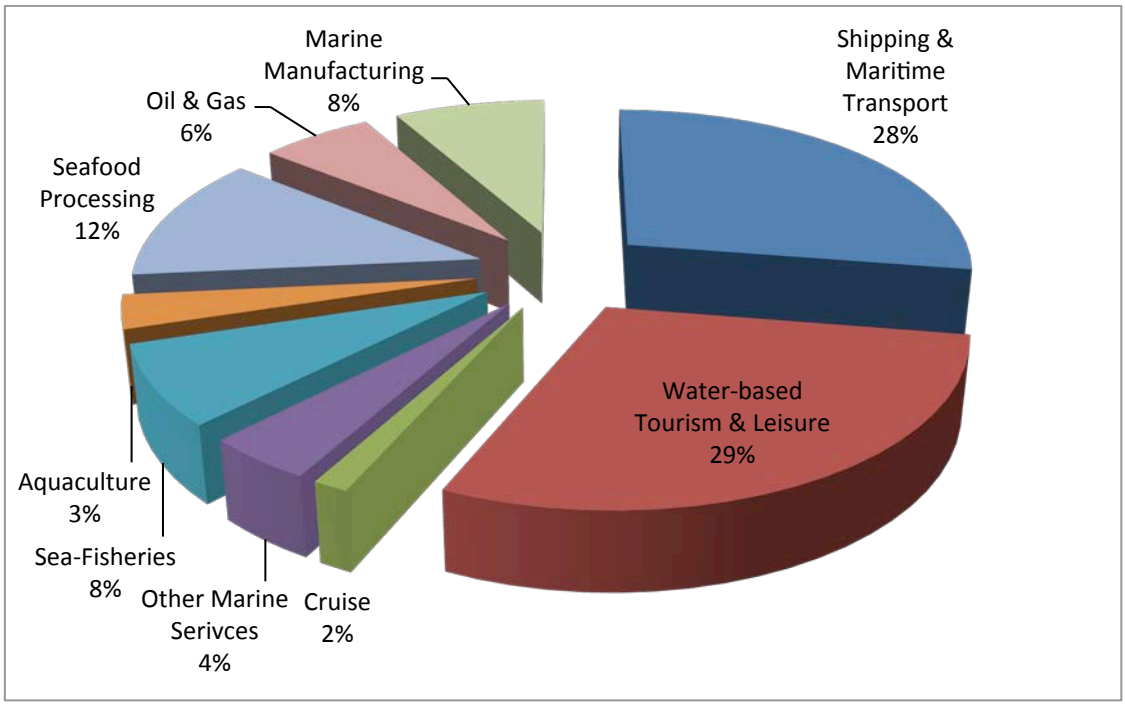
Introduction

The estimated economic value of Ireland's ocean economy as of 2007 is valued at €1.44 billion or 1% GDP, providing employment for 17,000 people (SEMRU, 2010). Ireland's ocean economy can be divided into established marine activities and emerging marine activities. Established marine activities include shipping and maritime transport, water-based tourism and leisure, seafood processing, fisheries, aquaculture, marine manufacturing, marine services and oil and gas. Emerging activities consist of renewable ocean energy, marine commerce, high-tech services and marine biotechnology (SEMRU, 2010). NUI Galway's Socio-Economic Marine Research Unit (SEMRU) provides this report with data for 2007. The Taoiseach has recently launched a plan to double Ireland's ocean economy to €6.4 billion or 2.4% GDP by 2010 (Inter-Departmental Marine Coordination Group, 2012). There has been limited research conducted on Ireland's ocean economy, but the Marine Institute published Ireland's first report in 2005 analysing Ireland's ocean economy. In 2007, the government implemented 'Sea Change' a marine knowledge R&I strategy for Ireland and then in 2010 with the SEMRU report.

3 Established Marine Activities

The established activities in the marine sector of Ireland had a turnover of €3.2 billion in 2007, employing 16,340 people (SEMRU, 2010). Employment within the fisheries sector alone provide for 10,768 jobs (Department of Agriculture, Food and the Marine, 2014). Figure 2 illustrates the percentage turnover of national industries within the established marine sector. Water based tourism and leisure and shipping and maritime transport account for 57% of the national industry turnover.

Figure 2:
Percentage Turnover of National Industries within the Established Marine Sector

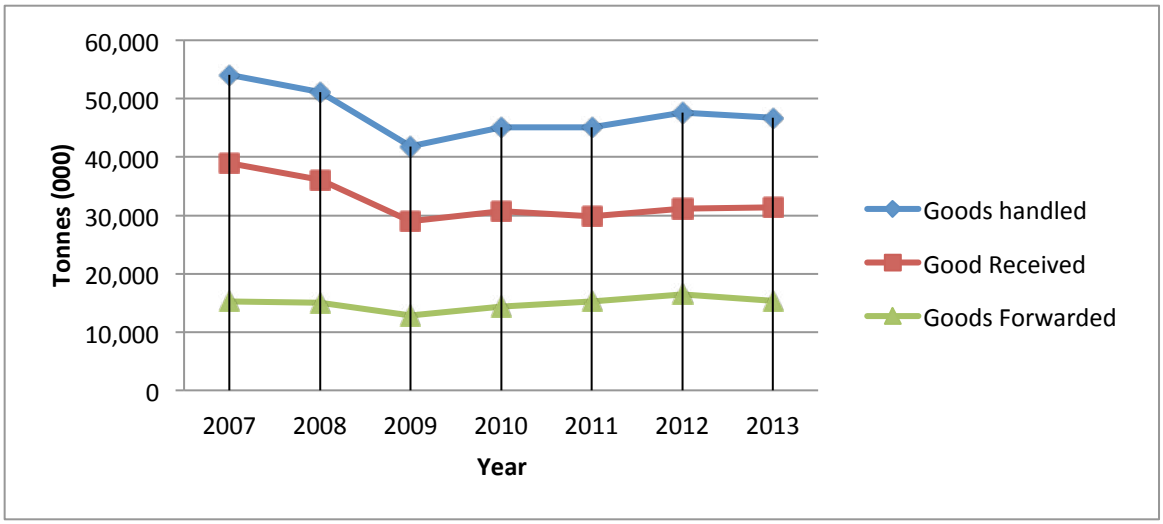


(Adapted from SEMRU, 2010)

3.1 Shipping and Maritime Transport

Some 99% of Ireland's total imports and exports are transported by sea. Sea-based shipping is the second largest provider in terms of turnover, added value and employment within the established marine sector (SEMRU, 2010). Most shipping activity in Ireland occurs around the primary nine ports of Cork, Drogheda, Dublin, Dundalk, Dun Laoghaire, Galway, New Ross, Foynes and Wicklow (SEMRU, 2010). The Port of Cork's turnover increased by over 6% in 2013 (Ashmore, 2014). The smaller port of Warrenpoint in Co. Down also displayed turnover enhancements by doubling its gross profits in 2013 (Ashmore, 2014). Figure 3 illustrates the drop in imports and exports during the peak of Ireland's recession, but also illustrates its current recovery. Irish shipping and port activity rose 2% in 2nd quarter of 2014 (IMDO, 2014).

Figure 3:
Volume of Goods Handled by Irish Ports



(Adapted from CSO, 2014).

3.2 Water-based Tourism and Leisure

Water-based tourism and leisure is the principal contributor in terms of turnover, value added and employment within the established marine industries of Ireland. Ireland's water-based tourism and leisure industry generated €453 million gross value added to the economy, employing 5,800 people in 2007 which is the most recent year for available data (SEMRU, 2010). Activities include angling, water sports such as sailing, surfing, kayaking and scuba diving as well as resort trips like whale and dolphin watching.

3.3 National Cruise Industry

Although there are currently no cruise liners that embark from Irish ports, a total of 190 liners docked carrying 162,797 passengers in 2012. The number of cruise ships visiting Ireland has increased by over 200% in the last decade with over half of the cruise ships having capacity for over 2000 passengers. It has been estimated by a Failte Ireland commissioned Red C report in 2010 that the average passenger who disembarks in Irish ports spends an average of €71, while the average crew member spends an average of €48 generating an estimated €20.3 million (McCarthy, 2013). Figure 4 illustrates the cruise ship and passenger traffic into Irish ports.

Figure 4:
Cruise Ships and Passenger Visits to Irish Ports

	2006	2007	2008	2009	2010	2011	2012
Bantry Bay							
Cruise Ships Visits to Irish Ports (Number)	5	1	7	5	9	3	7
Passenger Visits to Irish Ports (Number)	1,862	444	3,938	2,522	2,653	967	1,492
Castletownbere							
Cruise Ships Visits to Irish Ports (Number)	..	..	..	..	..	..	1
Passenger Visits to Irish Ports (Number)	..	..	..	..	..	..	42
Dublin							
Cruise Ships Visits to Irish Ports (Number)	75	40	83	76	85	85	87
Passenger Visits to Irish Ports (Number)	60,000	40,996	74,206	71,837	91,742	93,336	86,771
Shannon Foynes							
Cruise Ships Visits to Irish Ports (Number)	3	63	1	3	4	4	4
Passenger Visits to Irish Ports (Number)	1,535	55,000	315	1,166	1,045	1,403	2,640
Galway							
Cruise Ships Visits to Irish Ports (Number)	2	1	2	2	..	3	6
Passenger Visits to Irish Ports (Number)	436	460	270	650	..	737	2,023
Killybegs							
Cruise Ships Visits to Irish Ports (Number)	3	7	8	14	5	6	12
Passenger Visits to Irish Ports (Number)	1,516	2,567	2,741	5,438	2,028	1,278	4,360
Cork							
Cruise Ships Visits to Irish Ports (Number)	38	2	51	54	51	53	57
Passenger Visits to Irish Ports (Number)	32,826	800	59,716	71,557	70,409	70,431	59,898
Tralee Fenit							
Cruise Ships Visits to Irish Ports (Number)	..	..	2	..	..	..	..
Passenger Visits to Irish Ports (Number)	..	..	30	..	..	..	..
Waterford							
Cruise Ships Visits to Irish Ports (Number)	11	16	10	10	19	12	16
Passenger Visits to Irish Ports (Number)	7,573	5,458	4,629	6,296	8,885	3,850	5,571

(Adapted from CSO, 2014b).

3.4 Other Marine Services

Small and medium sized enterprises provide other marine services such as boat sales, ship surveying and seafood sales to fishmongers. In 2007 there was a €140 million turnover in other marine services, employing 570 individuals (SEMRU, 2010).

3.5 Sea Fisheries

There are 2,125 registered fishing vessels currently on the Irish Fishing Boat Register representing 2% of the European fishing fleet (Department of Agriculture, Food and the Marine, 2014). Ireland also has valuable inshore fisheries, particularly shellfish, representing a very important resource. The volume and value of fish landed by Irish vessels in home ports for 2012 amounts to 280,000 tonnes valued at €270 million (DAFM, 2014). Of the 2,125 currently registered vessels on the Irish Fishing Boat Register, 319 are owned by people living in Galway.2 The investment into Irish training for new entrants into sea fisheries include the FETAC Certificate in Commercial Fishing and the Department of Transport Engineer Officer Class 3 Certificate of Competency as well as the Department of Transport deck and engineer officer fishing Certificates of Competency. This investment seeks to grow the sea fisheries industry of Ireland (DAFM, 2014).

3.6 Aquaculture

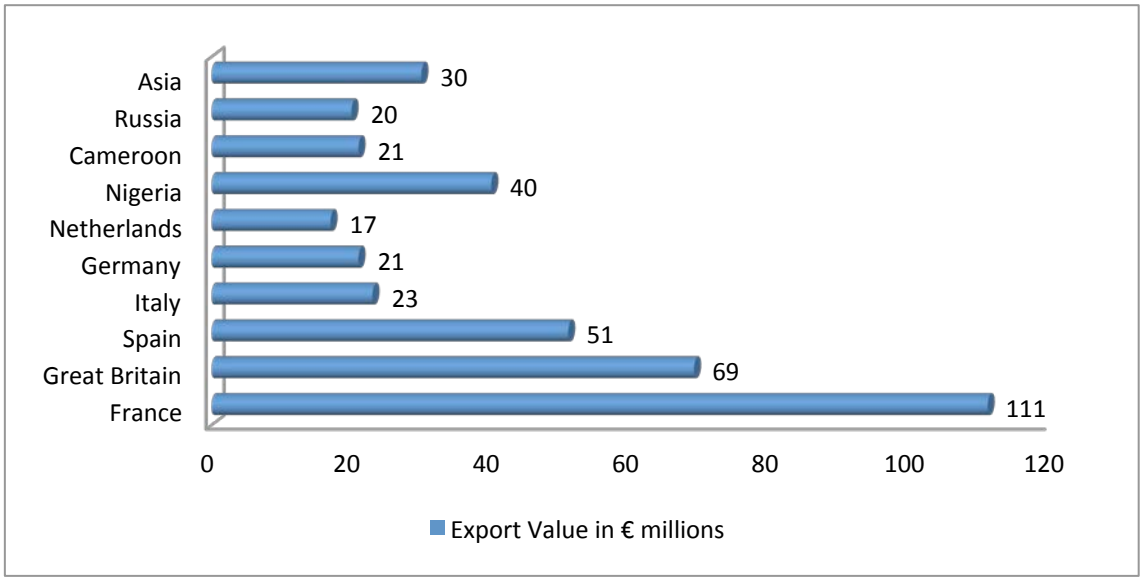
Ireland has the 7th largest aquaculture sector in the EU, producing 48,350 tons of aquaculture in 2007 (SEMRU, 2010). Ireland has the opportunity to contribute to the high global demand for finfish, mussels and oysters but must overcome the regulatory issues of EU Environmental Directives (Natura Directives) (DAFM, 2014). There is a backlog of aquaculture licence applications due to Irish breaches of the EU Birds and Habitats Directives. 137 licences were issued in 2013, representing a 19% increase for the previous year. Projections of a further 200 licences are estimated for 2014 (DAFM, 2014). The investment into aquaculture training include the FETAC Certificate in Aquaculture as well as a number of specialist courses such as a foundation in finfish and shellfish farming methods, seaweed on-growing techniques, power boat handling, farmed fish welfare and safety skills (DAFM, 2014).

[2] For the full list of registered vessels, see http://www.agriculture.gov.ie/fisheries/seafisheriesadministration/seafisheriesadministration/seafishingfleetregister/

3.7 Seafood Processing

The Irish seafood market is valued at €830 million. Due to a fall in the supply of salmon and lower international market prices, salmon exports have decreased, but due to an increasing demand for Irish oysters, crab and mussels, shellfish exports are increasing, valued at €172 million (DFM, 2014). EU exports have declined due to the on-going economic issues, whereas exports to non-EU countries have grown to €151 million. Figure 5 represents the main export destinations for Irish seafood, indicating France as being Ireland's largest importer of seafood generating €111 million, followed by Great Britain, Spain, Italy and Germany (DFM, 2014).

Figure 5:
Main Export Destinations for Irish Seafood, 2013



(Adapted from (Department of Agriculture, Food and the Marine, 2014).

3.8 Oil and Gas Exploration and Production

The oil and gas industry of Ireland is composed of oil and gas exploration and the extraction and production of gas. Ireland has sovereign rights to in excess of 900,000km2 of seabed (SEMRU, 2010). This provides for huge potential for the exploration of oil, gas, minerals and metals. Some €1.5 billion is expected to be spent on oil and gas exploration around Ireland over the next 3 years (PWC, 2014). Oil and gas provide over 80% of Ireland's primary energy supply (Irish Academy of Engineering, 2013). In 2013 oil and gas imports were approximately €6 billion illustrating the significance of this sector to Ireland as well as its overdependence on imported energy (Oireachtas, 2014). An oil and gas exploration licence was awarded to Shell in

2005 allowing them to pipe natural gas from the ocean off the west coast of Ireland and through bog lands in County Mayo. The absence of a comprehensive Marine Spatial Planning (MSP) process for integrated land and marine use planning has given rise to daily conflict in this region. Oil and gas exploration and production turnover in 2007 was €193 million, employing approximately 790 people (SEMRU, 2014).

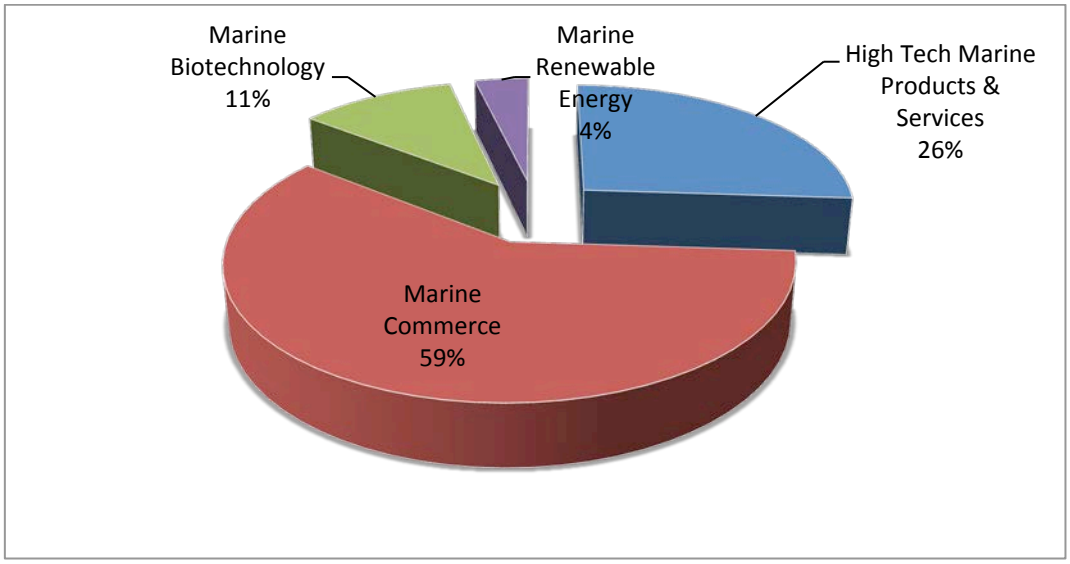
3.9 Marine Manufacturing

Small and medium sized marine manufacturing companies, employing 10-30 staff are found throughout Ireland. In 2007 this industry accounted for approximately €265 million, with exports accounting for €12 million. These companies are involved in boat manufacturing and repairs, sail and net making as well as marine instrumentation, aquaculture technology and water construction (SEMRU, 2014).

4 Emerging Marine Activities

The emerging marine sector consists of high tech marine products and services, marine commerce, marine biotechnology and marine renewable energy. Figure 6 illustrates the turnover percentages from each of the emerging industries.

Figure 6:
Percentage Turnover of Industries within Emerging Marine Sector



(Adapted from SEMRU, 2010)

4.1 High Tech Marine Products and Services

This sector had a turnover of €55.9 million in 2010, employing 391 people (SEMRU, 2014). Technology companies that supply high tech marine products and services are small to medium sized and are mainly located within the larger cities of Ireland. They have strong capabilities in the areas of information and communications. Products include, wireless and fibre communications platforms, in situ sensor networks, data management and visualisation and forecast technologies (SEMRU, 2014).

4.2 Marine Commerce

Marine Commerce produces the highest turnover within the emerging marine activities (SEMRU, 2010). It refers to legal services, banking services and insurance. In 2010, marine commerce had a turnover of €66,594, employing 78 people.

4.3 Marine Biotechnology

Marine biotechnology accounted for a turnover of €29 million in 2010, employing 304 people. The industry is comprised of seaweed harvesting and marine derived bio-products. Irish seaweed harvesting contributes to the manufacturing of medical devices, pharmaceuticals and food products. It contributes to the supply of other industries such as agriculture and horticulture, cosmetics and biofuels (SEMRU, 2014).

4.4 Marine Renewable Energy

Marine renewable energy in Ireland is of major growth and has considerable development opportunities (SEAI, 2014). Ireland is a prime location for marine renewable energy resources. The centre for Marine Renewable Energy Ireland (MaREI) carries out world-leading research on marine renewable energy (MaREI, 2014). The centre will receive investment funding of €19 million from the Department of jobs, Enterprise and Innovation through Science Foundation Ireland (SFI) generating employment and acting as a catalyst for Ireland to produce a sustainable and profitable energy supply. The offshore wind energy is primarily non-indigenous and imports knowledge and equipment while the Irish wave and tidal energy industry is indigenous to Ireland, consisting of a highly innovative group of companies focussed on the pre-commercial development side (SEMRU, 2014).

One offshore wind farm generated a turnover of €6.2 million in 2007. Wave and tidal companies invested €50 million in 2007 for the development of renewable energy.

Due to the EU target of reducing CO2 emissions by 20% by 2020 the government targets of generating 40% of electricity from renewable sources, investment into marine renewable sources of energy is essential in Ireland (SEMRU, 2010).

4.5 Integrated Marine Plan for Ireland

In July 2012 the Government published the roadmap strategy document "Harnessing Our Ocean Wealth - An Integrated Marine Plan for Ireland" with the goals of developing a thriving maritime economy, healthy ecosystems and increased engagement with the sea. This document resulted from the need for Ireland to develop an integrated system of policy and programme planning for marine affairs. Some 39 actions were identified, with 15 of these to form the basis of a strategic roadmap for the period 2012-2014. In 2014 the Government published "Harnessing Our Ocean Wealth - First Review of Progress" which focuses on the main activities carried out since the original publication and gives an overview of the plans for 2014, based around the areas of governance, maritime safety, security and surveillance, clean green marine, business development, marketing and promotion, education, infrastructure, and international cooperation.[3]

[3] These documents are available at http://www.ouroceanwealth.ie/

Regional and Local Overview of the Marine Sector

Regional and Local Overview

Introduction

The marine sector is an important sector for Galway city and county. The river Shannon provides tourism based leisure in Portumna, with the Galway port and its future plans providing commercial and tourism opportunities for City and County. Galway is the location of the Marine Institute that has developed an international reputation in marine research and is at the forefront of marine research collaborating with a range of local, national and international stakeholders. The Maritime Institute, headquartered in Galway provides R&D services, to help improve economic development and protect the marine environment (Maritime Institute, 2014). The Ryan Institute at NUI Galway is one to the leading marine research institutes, focusing on national and international, long-term, environmental, marine and energy research issues.

There are 114 agriculture, forestry and fishing industries in Galway City and County, with only 5 of these organisations based in Galway City (Geodirectory, 2014). There are 5,908 people working in agriculture, forestry and fishing industries in Galway County and 168 people working in Galway City (CSO Census 2011).

Table 1:
Breakdown of Agriculture, Forestry and Fishing Industries by Municipal District

Municipal Districts	Agriculture, Forestry and Fishing Industries
Ballinasloe	19
Connemara	34
Loughrea	26
Oranmore	24
Tuam	6
Galway City	5

(Adapted from CSO, 2011)

5 Established Marine Activities

5.1 Aquaculture

Data from the Geodirectory lists 17 aquaculture and fishing companies in Galway. For example, Connemara Abalone is an aquaculture company in Galway, which specialises in growing the highly-prized shell-fish which is a delicacy in the Japanese market (Connemara Abalone, 2014).

Bord Iascaigh Mhara (Irish Sea Fisheries Board, BIM) carried out an aquaculture survey in 2012 and found that Galway produced 2742 tonnes of salmon of a total nationwide production of 12,000 tonnes, 1012 tonnes of rope mussels, and 15 tonnes of freshwater trout. Galway also produced 187 tonnes of gigas oysters, with the total production for Ireland of 7,313 tonnes, and 83 tonnes of edulis oysters, with the total edulis production amounting to 247 tonnes (33.6%).[4]

BIM submitted for a license in 2012 to facilitate the development of a deep sea salmon farm in Galway Bay, at two sites north of Inis Oirr. This proposed deep sea fish farm in Galway Bay could produce up to 15,000 tonnes of organic salmon every year, worth €102 million annually, and with a wage flow of about €14.5 million, directly into the local economy. This level of production will help employ local people in long-term jobs. (BIM website)

Galway recently finished third in the 2013 IFA Aquaculture coastal league table confirming the cleanliness of its coastal waters (see Table 2) (IFA, 2013).

[4] For more information see http://www.bim.ie/media/bim/content/downloads/BIM%20Aquaculture%20Survey%202012.pdf

Table 2:
IFA Aquaculture Coastal League Table 2013

County Council	Total Classified Areas	Class A 2013	Class A Seasonal 2013	Class B 2013	Class C 2013	Points	Points diff 2012/13	Weighted Points
Clare	11	7	1	3	0	29	3	0.88
Mayo	21	11	3	7	0	53	0	0.84
Galway	22	8	4	10	0	52	1	0.79
Cork	23	9	0	14	1	52	2	0.75
Louth	8	6	0	1	1	17	- 4	0.71
Kerry	9	1	1	7	0	19	2	0.70
Donegal	18	3	2	13	1	36	- 6	0.67
Sligo	7	0	0	7	0	14	0	0.67
Waterford	5	0	0	5	0	10	2	0.67
Limerick	2	0	0	2	0	4	0	0.67
Wexford	7	2	0	4	1	11	- 2	0.52

5.2 Regional Cruise Industry

Galway has proposed a four stage development plan to expand its harbour, improving facilities and capabilities necessary in handling large cruise vessels (McCarthy, 2013). In 2014, 8 cruise ships docked in Galway Harbour, with the same number expected to dock in Galway Port in 2015. The luxury French cruise liner 'Le Boréal' visited Galway during 2014 on its maiden voyage, carrying 264 passengers. The largest residential liner in the world 'The World' docked in Galway in July. The number of ships and passengers docking in Galway is rising and the development of Galway's multi-million euro port at Galway harbour is critical to accommodate this increase in tourism (Galway Harbour, 2014).

Figure 7:
Cruise Ships and Passenger Visits to Irish Ports

	2006	2007	2008	2009	2010	2011	2012
Galway							
Cruise Ships Visits to Irish Ports (Number)	2	1	2	2	..	3	6
Passenger Visits to Irish Ports (Number)	436	460	270	650	..	737	2,023

(CSO, 2012)

5.3 Water-based Tourism and Leisure

Galway's water-based activities are a developing tourism and leisure location. Active water-based activities of Galway include sea angling, pleasure boating, windsurfing, scuba-diving, canoeing and water-skiing. The passive water-based activities include mammal watching, visits to islands, beaches, cruise ships and marine archaeology. This industry is underdeveloped in Galway with the exception of angling which is Galway's most important water-based tourism product. This industry experiences low levels of marketing and investment (Water Based Tourism, 2002).

Table 3:
The Range of Marine WBA in Counties Clare & Galway 2010

Activity	Clare	Galway
Adventure Centre	1	2
Aquarium/Attraction	2	1
Blue Flag Beaches	8	9
Sea Cruises	0	1
Diving	4	3
Marinas	1	0
Sailing	3	4
Sea-Kayaking	0	1
Sea-Angling	4	12
Surfing	6	0
Whale & Dolphin Watching	6	1
Wind Surfing	0	1
Total Number of Companies	35	35

(Source: Morrissey and Moran, 2011)

There are currently seven blue-flag beaches in Galway, with two in the City. These beaches are listed below, followed by the most recent figures on quality status of all bathing areas in the county.

Blue Flag Beaches in Galway

- Loughrea Lake
- Traught
- Salthill
- Silverstrand
- An Trá Mhór
- Trá an Dóilin
- Cill Muirbhthe

Figure 8:
Compliance & Quality Status of Identified Bathing Waters

Number of EU Samples	Bathing Area	Water Quality Status	Compliance with mandatory / guide valus		
			E.Coli		I.E.
			M	G	Guide
8	An Trá Mór, Coill Rua, Indreabhán	Good	✓	✓	✓
8	Loughrea Lake	Good	✓	✓	✓
5	Bathing Place at Portumna	Good	✓	✓	✓
8	Céibh an Spidéil	Sufficient	✓	×	×
8	Cill Mhuirbhigh, Inis Mór	Good	✓	✓	✓
5	Clifden Beach	Poor	×	×	×
5	Goirtín, Cloch Na Rón	Good	✓	✓	✓
5	Trá na bhForbacha, Na Forbacha	Sufficient	✓	×	✓
5	Trá na mBan, An Spidéil	Sufficient	✓	×	✓
8	Trá an Dóilín, An Ceahtrú Rua	Good	✓	✓	✓
5	Trá Chaladh Fínis, Carna	Good	✓	✓	✓
8	Traught, Kinvara	Good	✓	✓	✓

(Adpated from EPA, 2013)

Galway hosts the oldest oyster festival in the world, the Galway International Oyster & Seafood Festival. It was launched in 1954 and now draws in excess of 22,000 visitors to Galway. It celebrated its 60th anniversary in 2014, and is of huge economic benefit to Galway (Galway Oyster Festival Website, 2014).

The Volvo Ocean Race first stopped in Galway in 2009 and generated €55 million to the West of Ireland attracting 650,000 people. The 2011-2012 Volvo Ocean Race, with Galway this time as the final stop, was worth €60.5 million to the Irish economy (with a direct expenditure of

€35.5 million). Over 500,000 visitors attended over 275 events during the festival period, with 16% of those coming from outside of Ireland. The festival was supported by an investment by organisers and Galway City of €7.6 million, as well as the support of more than 1,500 volunteers (Collins et al, 2012).

The Galway Sea Festival established in 2013 continued at the end of May 2014. It is a four day event and included an International Marines Conference on sustainable energy, wind, wave and maritime resources.

5.4 Galway Fisheries

Of the 2,125 currently registered vessels on the Irish Fishing Boat Register, 319 are owned by people living in Galway.[5] There are 6 fishery harbour centres in Ireland, including Rossaveal (Ros An Mhíl) in County Galway. Rossaveal is the main port in the west of Ireland (4kt per year, 31 vessels) and receives a mix of pelagic, demersal and shellfish species (The shellfish are nearly exclusively Nephrops) (Marine Institute, 2014). In 2013, Rosaveel ranked 4th in the top 20 Irish ports in terms of monetary value of yearly haul (SFPA, 2014).

Table 4:
Top 10 Ports by Value

Port Name	Tonnes	Value (000's €)
Killybegs	170140	105133
Castletownbere	32105	57674
Dingle	12123	18198
Ros An Mhil	5796	16035
Dunmore East	11994	14757
Kilmore Quay	4465	14398
Howth	5054	12592
Greencastle	3793	8182
Union Hall	3269	7143
Clogherhead	1397	4726

Source: Sea Fisheries Protection Authority Website

[5] For the full list of registered vessels, see http://www.agriculture.gov.ie/fisheries/seafisheriesadministration/seafisheriesadministration/seafishingfleetregister/

In the South and West of Ireland (including the Irish Sea), the main pelagic species taken are blue whiting, horse mackerel and herring. The main demersal species taken are whiting, hake, monkfish, skates and rays and squid. Other important species taken in this area include scallops, crabs, and Nephrops (Marine Institute, 2014).

5.5 Seafood Processing

Bord Iascaigh Mhara lists 11 seafood processors in Galway County, with four of these based in Galway City (see Table 5).

Table 5:
Galway Seafood Processors

Company	Address
Galway City	
Four Leaf Clover	67 Henry Street , Co. Galway
Galway Bay Seafoods	New Docks, Galway City , Galway
The Fisherman	Unit 1, Ballybane Industrial Estate , Co. Galway
Gannet Fishmongers Limited	5-6 Royal Rock, Ballybane , Galway
Galway County	
Connemara Fisheries Ltd.	Cornamona, Connemara , Co. Galway
Connemara Smokehouse Ltd.	Bunowen Pier, Aillebrack , Ballyconneely, Co. Galway
Flemings Seafood	Old Coastguard Station, Ros a Mhil , Co. Galway
Galway & Aran Fishermen's Co-op.	The Pier, Rossaveal , Co. Galway
Irish Seaspray Ltd.	Tir An Fhia, Leitir Moir , Co. Galway
Kilkerrin Salmon/ISPG Ltd.	Cill Chiarain, Connemara , Co. Galway
Renvyle Fisheries Connemara Ltd.	Tullyillion, Renvyle, Connemara , Co. Galway

Source: Adapted from BIM Web Data

The Department of Marine and Food runs a Seafood Processing Business Investment Scheme which provides grant aid to support businesses. In 2014, three Galway seafood processing companies were to receive €160,000 in grant aid (see Table 6). The grant aid will assist in costs of new machinery and equipment.

Table 6:
Grants Issued to Galway's Seafood Processing Companies

Company Name	Eligible Expenditure	Grant Approved
Cill Chiarain Eisc Teoranta	€ 439,314	€ 131,794
Iasc Mara Teoranta	€ 98,500	€ 29,550
Galway Bay Seafoods Ltd	€ 20,000	€ 6,000

(Adapted from Department of Agriculture, Food and the Marine, 2014).

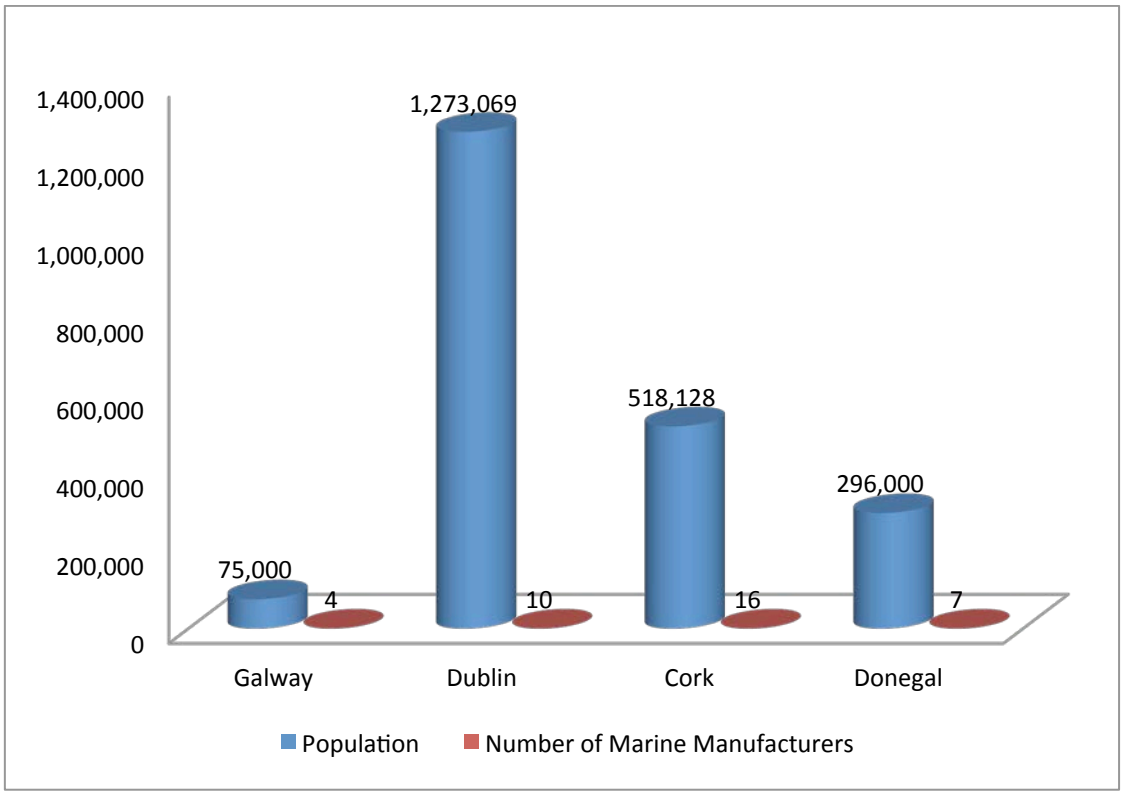
5.1 Oil & Gas Exploration and Production

The Corrib gas project, despite its controversies, has provided benefits to Galway. Bord Gáis Éireann constructed a pipeline from the Bellanaboy Bridge terminal connecting with the national grid at Craughwell in County Galway, connecting four towns in Galway to the national gas network; Athenry, Craughwell, Headford and Tuam (Council for the West, 2011). Gas Networks Ireland lists the following Galway locations as connected to natural gas lines: Ballinasloe, Claregalway, Craughwell, Galway City, Gort, Headford, Loughrea, Oranmore and Tuam.

5.2 Marine Manufacturing

The majority of Marine Manufacturing companies are small and medium sized enterprises, which employ between ten and thirty individuals. Types of marine manufacturing companies include boat manufacturing, sail making, marine instrumentation, aquaculture technology, water construction and marine industrial engineering (SEMRU, 2014). Galway has the best marine manufacturer to population ratio, illustrating its efficiency in this sector (CSO, 2014) (See Figure 9).

Figure 9:
Ratio of Marine Manufacturing to Population



(Adapted from CSO, 2014)

6 Emerging Marine Activities

6.1 Marine Renewable Energy

SEAI and the Marine Institute set up an Ocean Energy Test Site for prototypes of wave energy devices in Galway Bay in 2006. This test site facilitates the deployment of prototypes of Wave Energy Converters (WEC's). Ancillary power and communications are available on site (SEAI, 2014). This R&D project aims to develop the wave and tidal resources of Galway and Ireland. Ireland's renewable energy resources have the potential to be one of the best in the world with the wave energy resource estimated at more than 6000MW (Marine Institute, 2014). The test area of the Spiddal coast is 37 Hectares in area with a mean water depth of 23m and a tidal range of 4m.

6.2 Marine Biotechnology

There is potential for further development of this sector. A team of researchers from Irish biofuels company AER and the National University of Ireland in Galway (NUIG) have developed technology, to convert algae to a commercially-viable transport biofuel. These scientific advances can allow for brown seaweed to become a major source of energy (Department of Agriculture, Fisheries and Food, 2014).

The Galway-based biotechnology start-up company 'Algae Health' established in 2009 produces nutritional compounds from green algae. Its initial product, Astaxanthin, possesses anti-oxidant properties, 100-500 times that of Vitamin E and 10 times the anti-oxidant capacity of beta-carotene, which is extremely beneficial to human health. The global Astaxanthin market is forecasted to be worth $200 million by 2015 (Nardello, 2013).

Enterprise Ireland awarded a Commercialisation Fund for a proof of concept project which investigates the modification of a marine compound for anti-cancer therapeutic applications (Marine Biotech, 2013).

6.3 Marine Commerce

Marine commerce remains a small sub sector. The launch of a new Galway e-Commerce website 'Pro Equip' supplies retail and processing equipment as well as a range of protective clothing (MediaLAb, 2014). The Galway-based Moore Archaeological & Environmental Services Ltd (TA Moore Group) provides consultancy on Environmental Impact Assessments, surveys of marine environments, conservation management planning and ecological landscape design (MooreGroup, 2014).

6.4 Sea-bed Metal and Mineral Mining

Gold deposits have been discovered including an epithermal style mineralisation in the Silurian metasediments of Co. Galway, where values of up to 190g/t of gold over 1m have been identified. Other deposits include 'barite' found in Co. Galway (Guerin, 2014).

The Geological Survey of Ireland (GSI) and the Marine Institute, over the last 12 years have been surveying the seabed off the coast of Ireland, compiling a database of 13,000 ship wrecks (Informar, 2014). A recent discovery of 61 tonnes of bullion from a British cargo ship that sank in 1941, 300 miles off the coast of Galway, underlines the potential for deep sea exploration (Pickford, 1998).

6.5 Inland Waterways Development

The Lakelands and Inland Waterways area includes the principal waterways of the Shannon and Erne catchments, together with a 30 mile corridor on either side. Key towns and lakes within the Shannon river waterway corridor include the town of Portumna in County Galway and Lough Derg. The Lakelands and Inland Waterways Strategic Plan 2010-2015 provided infrastructure investment in the Lakelands and Inland Waterways Area including € 93,413 for the Lough Derg International Water Park and € 111,600 for Derrycahill Bridge in County Galway (Discover Ireland, 2010). There are 10 angling clubs and related services in the City and County.

Angling Clubs and Related Services:

- Galway Buccanners Sea Angling Club
- Galway Bay Sea Angling Club
- Galway Coarse Angling Club
- Blue Water Charter Fishing
- Corrib Anglers
- Delphi Fishery
- Galway Bay Fishing
- Galway Boat Charters
- Spiddal Angling School
- Terrea Queen Tours

6.6 Marine Transport and Cruises

It is possible to travel to Inishmore, (Inis Mor) Inisheer (Inis Oirr) or Inishmaan (Inis Meain) by Passenger Ferry from Doolin in Co. Clare (Seasonal) or Rossaveal in Co. Galway (All Year). Aran Island Ferries offer services from Rossaveal which is not subject to tidal issues and a fleet of 5 passenger ferries, with a maximum capacity of 294 passengers on two of these ferries. Travel time to Inis Mor from Rossaveal is 40 minutes and from Doolin is about 90 minutes. A shuttle bus to and from Rossaveal is available from Galway city and car parking is available at Rossaveal. Aran Ferries offer 4 services a day during peak season and 2 services a day between October and March. These services are a strategically important marine transport services for the County and City.

The Corrib Princess offers two ferry services between May and September, with an extra service in July and August, going from Woodquay up the River Corrib. Corrib Cruises offer a daily ferry service from Oughterard and Cong around Lake Corrib.
Finally, there are 9 sailing clubs and related services in the city and county:

Sailing Clubs and Related Services

- Ballinduff Bay Water Sports Club
- Clifden Boat Club
- Cumann Seoltóireachta An Spidéil
- Galway Bay Sailing Club
- Galway City Sailing Club
- West Galway School of Navigation
- Rusheen Bay Windsurfing
- Petersburg OEC
- Bow Waves

(Source: Irish Sailing Association Website)

6.7 Research and Development Activities

Alongside NUI Galway's Marine Institute and GMIT's Marine and Freshwater Institute, the Carna Research Station and SmartBay also carry out R&D activities in Galway Bay.

The Carna Research Station is Ireland's leading facility for the diversification of marine fish, shellfish and seaweed species. The range of species is prioritized to meet industry needs including finfish (e.g. salmon, trout, cod, turbot, and wrasse), shellfish (e.g. abalone, sea urchin, and scallop) and seaweeds (Palmaria, Porphyraand Alaria). The Carna Research Station is NUI Galway Ryan Institute's base for large scale, exploratory aquatic investigations, and both applied and basic research, on existing and novel species for aquaculture. Active research projects underway include:

- the establishment of a cod breeding and broodstock programme for Irish Aquaculture
- the development of hatchery protocols for the propagation of seaweed species
- the development of novel dietary formulations incorporating seaweed extracts for the salmon farming industry
- a breeding programme for Ballan Wrasse to control sea lice infestations
- a study of intertidal/inshore fish communities in Connemara.

Based in Galway City, SmartBay Ireland manages the national marine test facility for the development of innovative products and services for the global maritime sector. This includes the trial and validation of novel marine sensors, prototype equipment and the collection and dissemination of marine data to national and international users of the facility. Established by the Marine Institute and the third level sector, SmartBay receives funding from the Higher Education Authority (HEA) with Dublin City University (DCU) the lead research organisation

supporting SmartBay as part of the HEA funding. Other research partners include the Marine Institute, NUI Galway, NUI Maynooth, University College Dublin, Intel and IBM. Facilities include surface platforms and a sub-sea cabled observatory for the demonstration and validation of new technologies and solutions.

In summary, these research assets and infrastructure are significant and are necessary to support the future growth and development of the sector.

7 Galway Harbour

Galway Harbour Company has a mandate to sustain and grow the business of the Port of Galway. It has recently announced the final plans of its proposed new port. Plans have been made by the Galway Harbour Company to ensure that the Port remains at the heart of Galway City's economic and social development (Galway Harbour Company, 2015).

The proposed new Port of Galway consists of 23.89 hectares of land reclamation, extending 935 metres out to sea providing 660 metres of quay berth to -12 metres Chart Datum depth serviced by a -8 metre Chart Datum channel depth. The project is expected to cost €126 million (RTÉ, 2015). The development will consist of berthing facilities for general cargo vessels, oil tankers, passenger vessels, fishing vessels and container vessels. A western marina will be formed providing 216 amenity berths. The development will also contain Roll on/Roll off facilities and berths for naval and research vessels. Breakwaters will be constructed to provide requisite shelter and craft stability while berthed. The reclaimed land will provide harbour management warehousing, a coal yard, waste export, steel, scrap and container yards, ship chandlers, a marina promenade and parklands.

The development will allow for the accommodation of vessels of 12 to 20,000 tonnes instead of the existing 6,000 tonne limitation. This will allow for the Port Company to bring a significant number of cruise vessels to Galway. As Galway Harbour is located in the heart of the city, it will be a major advantage in terms of attracting cruise business (Galway Harbour Company, 2015). The development of additional marina will allow the port to cater appropriately for marine sports as well as attracting significant yachting and sailing events to Galway such as the Volvo Ocean Race. Table 7 represents some of the benefits of redeveloping the Port of Galway to Galway Harbour Company.

Table 7:
Benefits to the Galway Harbour Company

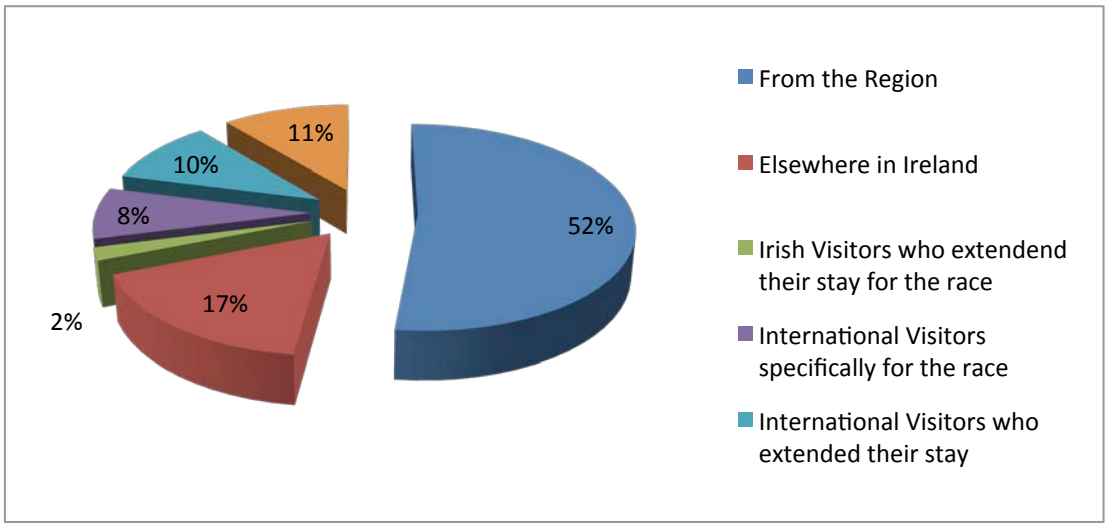
Benefits to the Galway Harbour Company
Cruise Line Business Development
Marina Business Development
Event Hosting Business Development
Marine Research Facilities Business Development
Wind and Sea Power Generation Business Development
Additional Import and Export Business Development
Recreation and Marine Leisure Facility Based Business Development
Creation of a Revitalised Hub Creating Employment

(Adapted from Galway Harbour Company, 2015).

As well as the projected benefits to the Harbour and marina area, there would be many direct tangible benefits to the City of Galway. The construction of the new harbour would positively impact employment within Galway City. Returns to the exchequer in VAT and income tax as well as savings in social welfare payments would be further benefits. The creation of indirect employment from the harbour build would improve economic activity within the city of Galway.

The Volvo Ocean Race's first ever Irish stopover in Galway in May 2009 was worth €55.8 million to the west of Ireland. Some €36.5 million was spent by race spectators who came from outside the local region. Galway received worldwide publicity from 269 media representatives from around the world including 200 journalists with a print readership and radio listenership of 234 million and a 1.327 billion global television audience (Oireachtas, 2010). The event attracted 650,000 spectators, ranking the Volvo Race as third in terms of spin-off generated by major sporting events in Ireland. Some 52% of these visitors were from the region, while 17% were from elsewhere in Ireland, with 8% being international visitors (see Figure 10).

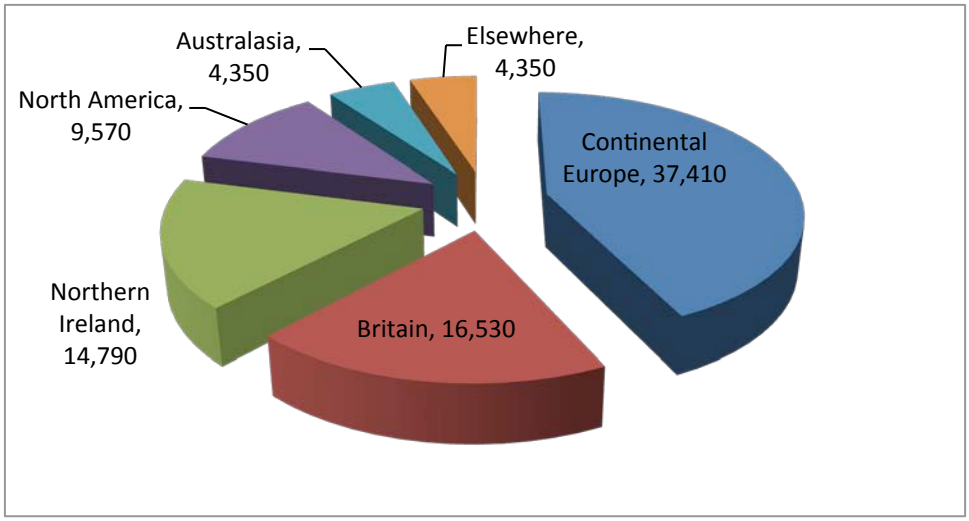
Figure 10:
Breakdown of Total Visitors to Volvo Ocean Race Galway, 2009



(Adapted from Galway Harbour Company, 2015).

The Volvo Race, 2009 attracted an estimated 87,000 overseas visitors. The majority of these were from Continental Europe followed by Britain and then Northern Ireland (see Figure 11). With the development of Galway's harbour these numbers could be increased, generating substantial expenditure for the city and county of Galway.

Figure 11:
Breakdown of International Visitors to Volvo Ocean Race Galway, 2009



(Adapted from Galway Harbour Company, 2015).

The development of the port would allow for large cruise vessels to dock at the Galway's harbour. The cruise vessels often purchase local goods and services such as refuse collection, fresh water and purchase particularly local unique produce, courier services and minor repairs, and buy-in of local entertainment at ports which they visit, all of which have an economic benefit to the area. Furthermore the cruise passengers would avail of tour opportunities such as local heritage sites. Dublin Port recently noted that in 2009 its cruise business, comprising almost 80 cruise liners carrying 120,000 passengers and crew, contributed up to €50 million to the local economy (Galway Harbour Company, 2015).

8 References

Ashmore, J. (2014) 'Ports & Shipping Review: Port of Cork Turnover Up, Cruise Boost for Donegal, Warrenpoint on the Rise and Arklow 'Greens' Dock'. [Internet] In: Afloat. Available from http://afloat.ie/port-news/port-and-shipping-news/item/26292-ports-shipping-review-port-of-cork-turnover-up-cruise-boost-for-donegal-warrenpoint-on-the-rise-and-arklow-greens-dock [Accessed 3 October 2014].

Beddington, J.R., Agnew, D.J. & Clark, C.W. (2007) 'Current problems in the management of marine fisheries'. Science, 316:1713-1716.

Connemara Abalone (2009) 'Welcome to Connemara Abalone'. In: Abalone. Available from http://www.abalone.ie/ [accessed 6 October 2014].

Collins, P., Hynes, S. and Mulligan, E. (2012) Volvo Ocean Race Finale: An Economic Impact Assessment. J.E. Cairnes School of Business and Economics, NUI Galway

Council for the West (2011) 'Examining the issue of offshore exploration', paper presented at The Joint Oireachtas Committee on Communications, Natural Resources and Agriculture, 29 November 2011, viewed at 6 October 2014, http://www.oireachtas.ie/parliament/media/committees/archivedcommittees/cnranda/Council-for-the-West-Presentation-Nov-2011.pdf

CSO (2014a) 'Tonnage of Goods Handled at Irish Ports by Type of Cargo, Statistical Indicator and Year'. Available from http://www.cso.ie/px/pxeirestat/Statire/SelectVarVal/saveselections.asp [accessed 3 October 2014].

CSO (2014b) 'Cruise Ships and Passenger Visits to Irish Ports by Port, Statistical Indicator and Year'. Available from http://www.cso.ie/px/pxeirestat/Statire/SelectVarVal/saveselections.asp [accessed 3 October 2014].

Department of Agriculture, Food and the Marine (2014) 'Annual Review & Outlook for Agriculture, Food and the Marine 2013/2014'. Available from: http://www.agriculture.gov.ie/media/migration/publications/2014/ARO2014010714.pdf [accessed 3 October 2014].

Department of Agriculture, Fisheries and Food (2014) 'Algae Breakthrough for Biofuels'. In: Department of Agriculture, Fisheries and Food, Available from http://www.irishseaweed.com/introduction.html [accessed 7 October 2014].

Department of Agriculture, Food and the Marine (2014) 'Coveney Targeting Development of Seafood Industry Announces €8 Million Investment by Seafood Processors'. In: Department of Agriculture, Food and the Marine. Available from http://www.agriculture.gov.ie/press/pressreleases/2014/may/title,75433,en.html [accessed 6 October 2014].

Department of Agriculture, Food and the Marine (2014) 'Minister Coveney Announces €23M Package for Piers and Harbours Country Wide' In: Department of Agriculture, Food and the Marine. Available from http://www.agriculture.gov.ie/press/pressreleases/2014/march/title,74597,en.html [accessed 28 January 2015].

Discover Ireland (2010) Lakelands and Inland Waterways Strategic Plan 2010-2015. Available from http://www.discoverireland.ie/getmedia/d6507dc5-1a36-4f61-a380-16e7859f0964/Lakelands-Strategic-Document-2010---1015.aspx [accessed 29 January 2015].

EPA (2013) 'The Quality of Bathing Water in Ireland'. In: *epa.* Available from http://www.epa.ie/pubs/reports/water/bathing/bathing_water_report_2013.pdf [accessed 03 March 2015].

European Commission (2014) 'A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism' In: eceuropa. Available from http://ec.europa.eu/maritimeaffairs/policy/coastal_tourism/documents/com_2014_86_en.pdf [accessed 28 January 2015].

European Commission (2013) 'Ocean Energy Forum' In: eceuropa. Available from http://ec.europa.eu/maritimeaffairs/policy/ocean_energy/forum/index_en.htm [accessed 28 January 2015].

EY (2013) 'Rising Tide: Global trends in the emerging ocean energy market' [Internet] Available from http://www.ey.com/Publication/vwLUAssets/EY-Ocean-energy-Rising-tide-2013/$FILE/EY-Ocean-energy-Rising-tide-2013.pdf [Accessed 01 October 2014].

Galway Group (2014) 'Welcome to Galway Group'. In: GalwayGroup. Available from http://www.galwaygroup.com/ [accessed 6 October 2014].

Galway Harbour (2014) 'Direct and Tangible Benefits to the City of Galway'. In: GalwayHarbour. Availble from http://www.galwayharbour.com/new_port/dp.php?c=98&id=56 [accessed 7 October 2014].

Galway Harbour Company (2015) 'Galway Port Development Plan'. In: *galwayharbour.* Available from http://www.galwayharbour.com/10215_GHC_interactive.pdf [accessed 23 March 2015].

Garcia, S.M. & Rosenberg, A.A. (2010) 'Food security and marine capture fisheries: characteristics, trends, drivers and future perspectives'. Philosophical Transactions of The Royal Society Biological Sciences, 365(1554):2869-2880.

Goldenberg, S. (2014) 'Marine mining: Underwater gold rush sparks fears of ocean catastrophe'. TheGuardian. Available from http://www.theguardian.com/environment/2014/mar/02/underwater-gold-rush-marine-mining-fears-ocean-threat [accessed 2 October 2014].

Guerin, B. (2014) 'The Mineral Resources of Ireland – Part II: "The Land of Mineral Opportunities"'. In: tara-foundation, Available from http://tara-foundation.org/Mineral-Resources-of-Ireland-Part-2.php [accessed 7 October 2014].

Hall, M. (2001) 'Trends in ocean and coastal tourism: the end of the last frontier?'. Ocean & Costal Management, 44(9-10):601-618.

Inter-Departmental Marine Coordination Group (2012) 'An integrated marine plan for Ireland - Harnessing our ocean wealth.' Available from http://www.ouroceanwealth.ie/SiteCollectionDocuments/HOOW%20Progress%20Report%202012_2013_%20English%20web.pdf [accessed 2 October 2014].

IAE (2013) ''The future of Oil and Gas in Ireland'. In: The Irish Academy of Engineering.

IFA (2013) 'IFA Aquaculture Summer/Autumn 2013'. In: *IFA.* Available from http://www.ifa.ie/wp-content/uploads/2013/11/IFA-Aquaculture-Newsletter-Aug-2013.pdf [accessed 21 March 2015].

IMDO Ireland (2014) 'Irish shipping volumes up 2% during Q2 2014'. In: Marine Institute. Available from https://www.marine.ie/home/aboutus/newsroom/news/IrishShippingvolumesupduringQ22014.htm [accessed 3 October 2014].

Informar (2014) 'Irish scientists involved in new world class offshore Geological Atlas'. In: Informar, Available from http://www.infomar.ie/press/ [accessed 7 October 2014].

International Energy Agency (2012) World Energy Outlook 2012. Paris: IEA.

Leary, D.K. (2007) International Law and the Genetic Resources of the Deep Sea. The Netherlands: Martinus Nijhoff Publishers.

MaREI (2014) 'Marine Renewable Energy Ireland'. In: MaREI, Available from http://marei.ie/ [accessed 6 October 2014].

Marine Biotech (2013) 'Building on success of marine biodiscovery research'. In: MarineBiotechProgramme, Availble from http://marinebiotechprogramme.newsweaver.com/Newsletter/1pb1egfzu3x?opc=false&s= [accessed 7 October 2014].

Marine Institute (2014) 'Ocean Energy'. In: Marine Institute, Available from http://www.marine.ie/home/OceanEnergy.htm [accessed 7 October 2014].

Marine Institute (2014) 'Atlas of Commercial Fisheries Around Ireland' In: Marine Institute, Available from http://oar.marine.ie/handle/10793/958 [accessed 29 January 2015]

McCarthy, M. (2013) Cruise Industry in Ireland: Importance and Role in Port Development. PowerPoint presentation, Port of Cork, Cork.

MediaLab (2014) 'About the project'. In: medialab, Availble from http://www.medialab.ie/?portfolio=proequip-ecommerce [accessed 7 October 2014].

MooreGroup (2014) 'About us'. In: MooreGroup, Available from http://www.mooregroup.ie/marine/ [accessed 7 October 2014].

Morrissey, K. and Moran, C. (2011). A Socio-economic study of marine-based water activities in the West of Ireland, SEMRU Working Paper

Nardello, I. (2013) '"Algae Health", a new, Galway-based, blue biotech company'. In: MarineBiotechProgramme, available from

http://marinebiotechprogramme.newsweaver.com/Newsletter/1s65picl3gj?opc=false&s= [accessed 7 October 2014].

OECD (2013) Marine Biotechnology: Enabling Solutions for Ocean Productivity and Sustainability. OECD Publishing.

OECD/FAO (2012), OECD-FAO Agricultural Outlook 2012-2021. Available from http://www.oecd.org/site/oecd-faoagriculturaloutlook/Summary%20of%20OECD%20FAO%20Agri%20Outlook%202012.pdf [accessed 2 October 2014].

OECD (2008) Environmental Outlook to 2030. Available from http://www.oecd.org/environment/indicators-modelling-outlooks/40200582.pdf [accessed 7 October 2014].

Oireachtas (2010) 'Tourism Promotion, Wednesday, 27 January 2010'. In: *oireachtasdebates.* Available from http://oireachtasdebates.oireachtas.ie/debates%20authoring/debateswebpack.nsf/takes/seanad2010012700013?opendocument [accessed 24 March 2015].

Oireachtas (2014) 'Economic Indicators'. In: Oireachtas. Available from http://www.oireachtas.ie/parliament/media/housesoftheoireachtas/libraryresearch/economicin/EconomicIndicatorsJune201424062014_173115.pdf [accessed 6 October 2014].

Paul, S. & Beckford, G. (2014) 'Countries look to seabed as a new source of valuable minerals'. Irish Independent, Business World. Available from http://www.independent.ie/business/world/countries-look-to-seabed-as-a-new-source-of-valuable-minerals-30363083.html [accessed 02 October 2014].

Pickford, N. (1998) *Lost Treasure Ships of the Twentieth Century'.* London: Pavilion Books.

PWC (2014) 'Exploring out potential PWC oil and gas survey report 2014'. In: PWC. Available from http://download.pwc.com/ie/pubs/2014-pwc-ireland-oil-and-gas-survey-16-06-2014.pdf [accessed 6 October 2014].

RTÉ (2015) 'Galway Harbour project outlined at An Bord Pleanala hearing'. In: *RTÉ.* Available from http://www.rte.ie/news/2015/0113/672225-galway-harbour/ [accessed 24 March 2015].

SEAI (2014) 'Galway Bay Test Site'. In: SEAI, Available from http://www.seai.ie/Renewables/Ocean_Energy/Galway_Bay_Test_Site/ [accessed 7 October 2014].

SEMRU (2010) 'Ireland's Ocean Economy'.

UNCATAD (2013) 'Review of Maritime Transport' [Internet] In: United Nations Conference on Trade and Development. Available from http://unctad.org/en/publicationslibrary/rmt2013_en.pdf [Accessed 01 October 2014].

UNCATAD (2014) 'Global shipping market Overview – implications for regional markets', paper presented at the Baltic Ports Conference, Bornholm, Denmark, 4-5 September 2014, viewed at 1 October 2014, <http://www.bpoports.com/BPC/Roenne/final_presentations/Valentine.pdf>.

Water-based Tourism (2002) 'A Strategic Vision for Galway'. Available from http://oar.marine.ie/bitstream/10793/539/1/WaterbasedTourismAStrategicVisionforGalway.pdf [accessed 6 October 2014].

World Ocean Council (2014) 'Business Forum on Ocean Policy and Planning'. World Ocean Council. Available from http://www.oceancouncil.org/site/faq.php [accessed 2 October 2014].

NUI Galway
OÉ Gaillimh

Whitaker Institute

Whitaker Institute for Innovation & Societal Change

Cairnes Building
National University of Ireland Galway
Galway
Ireland

T: +353 (0)91 492817
E: whitakerinstitute@nuigalway.ie
www.nuigalway.ie/whitakerinstitute