Towards an Economic Valuation of the Hauraki Gulf: A Stock-take of Activities and Opportunities

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Executive Summary

The Hauraki Gulf is a complex ecological and geographical feature that covers 1.2 million hectares of ocean. It includes a marine park, six marine reserves, 30 major island groups, productive fishing areas, New Zealand's biggest commercial harbour, hosts the main New Zealand naval base, and contains many smaller ports and numerous marinas. New Zealand's largest metropolitan area is located on part of its shores and one of the country's main tourist attractions, the Coromandel Peninsula, is surrounded by the Hauraki Gulf.

As a result, the Hauraki Gulf is one of Auckland's most important assets and is the most important marine asset for the Waikato region. The Hauraki Gulf Marine Park Act 2000 recognised the unique importance of the Hauraki Gulf and established the Hauraki Gulf Forum.

The Hauraki Gulf has a vast array of coastal, marine, and terrestrial ecosystems which provide a wide range of benefits to both residents and visitors. Many of them represent necessary inputs to numerous economic activities that contribute a large share of Auckland's and Waikato's GDP, support cultural values and social opportunities, and provide a number of important services that support human life and health.

The environment, and some of its goods and services, can visibly enhance the quality of daily life and improve property values; while other goods and services are difficult to appreciate until they are compromised or lost. Ecosystem goods and services are defined as '*the direct and indirect benefits that mankind receives or values from natural or semi-natural habitats'.* These benefits are not just economic – they contribute to human well-being and quality of life.

Some empirical research has already been undertaken to understand and quantify some of the Hauraki Gulf economic and environmental benefits and values. However, these studies were done in isolation. As a result, Auckland Council launched a long-term research project - the Total Economic Valuation Project - to identify the benefits provided by the Hauraki Gulf and determine its total economic value. Phase 1 of this project aimed to identify the important economic activities supported by the Hauraki Gulf and identify their economic impacts, by scanning the knowledge base and presenting a stock-take of the relevant empirical research.

There are many difficulties related to the interpretation and valuation of ecosystem services, as ecosystems themselves are fundamentally complex and intertwined. Although the Hauraki Gulf has a clear geographical boundary, it contains a huge variety of complex ecosystems which interact among themselves. This presents many challenges when trying to include them in valuation frameworks or decision-making processes.

Market values are captured in the economic impact of industries that rely on the Hauraki Gulf for their operations. Commonly, an economic impact analysis calculates the value added of an economic activity (ie, values of revenues minus values spent on intermediate goods and services) and its contribution to GDP. However, in order to calculate value added, assumptions sometimes need to be made about the technical structure of a certain sector.

In general, these assessments recognise that one form of economic expenditure in an industry generates income for another sector. Existing studies identified three types of economic impact that can occur as a result of growth within a sector:

- **Direct impacts** - initial injections of revenue and expenditure that accrue to that specific sector
- **Indirect impacts** - net increase of economic activity generated by the provision of goods and services to the study sector
- **Induced impacts** - net increase of economic activity due to increased household expenditure in the study sector.

Direct, indirect, and induced impacts also occur in relation to employment.

Non-market values have no explicit monetary value or price and, therefore, are not captured by standard accounting methods. Many goods do not have a market value because, even though they form part of markets, they are unaccounted for and are treated as externalities. Examples include climate regulation (an unaccounted benefit) and pollution (a commonly unaccounted

cost). In the context of the Hauraki Gulf, non-market values relate mainly to ecosystem benefits, recreation, and cultural and spiritual values.

As ecosystem services are not fully captured in commercial markets, they are often given little or no weight in policy decisions. This may ultimately lead to environmental depletion, and undermine the economy and human well-being.

The results of phase 1 of this study, provides a stock-take of existing information, presenting a summary of existing knowledge and information gaps. The steps were to:

1. Identify the economic and cultural activities provided by the Hauraki Gulf and the social, environmental and cultural values that the Hauraki Gulf endows.
2. Identify empirical research that estimated the economic impact of the economic and cultural activities.
3. Present the preliminary results.
4. Identify knowledge gaps.

The table below summarises the result of this effort to identify the activities and values, and to categorise these into groups where a method to value the economic impact is known, partially known or unknown. These results must be interpreted and used with caution.

Table A. Known, partially known and unknown activities and values provided by the Hauraki Gulf.

Known	Partially known (already captured by some of the recreational knowns)	Unknowns and gaps
• Port • Cruise industry • Recreational marine industry • Aquaculture • Fishing : ▪ **commercial** ▪ **recreational** ▪ **customary (partially)** • Tourism • Events	• Boating and other recreational activities[1] • Marinas • Transport/ferries[2] • Property values[3] • Marine reserves (partially) • Mining	• Navy[4] • Environmental goods and services not yet accounted for Outside of scope • Option values • Existence values • Bequest values • Cultural values • Social values • Spiritual values

The table also highlights the main knowledge gaps that were identified during Phase 1. Some are partially known and could be explored through methods similar to those already adopted (contribution to GDP), while some values have been only partially assessed at present (eg, the value of coastal properties that are close to the sea and/or have a sea view is one of the significant economic impacts of the Hauraki Gulf).

Items that were already identified as being outside of scope were not considered during Phase 1.

The economic benefits can be seen as being derived from the physical environment of the Hauraki Gulf. However, not all environmental goods and services are produced and exchanged through markets - meaning that they do not have a price and are often assigned a zero value in standard accounting methods of environmental assets. The Total Economic Value (TEV)

[1] Surfing is an example.
[2] The economic impact on transport ferries in the Hauraki Gulf is already captured by the tourism and cruise ships values. However, commuting transport flows are not included and quantified. In 2011, approximately 2 million passengers commuted by ferry in Auckland (Auckland Transport) and there is increasing interest in expanding capacity.
[3] Impact of view and proximity to the sea has been estimated.
[4] A study on the economic impact of the Sydney naval bases was carried out by KPMG, using an economic impact assessment methodology: KPMG, 2011. *Economic Contribution of the Naval Bases in Sydney*. A similar example is the Canadian Navy's report *Economic Impact of the Navy on the Hampton Roads Area*, issued in 2008.

framework addresses this issue by translating some of those values into the market language of money.

The TEV framework can be used to organise all the different classes of value that might be associated with the Hauraki Gulf. This framework is usually applied in a cost-benefit analysis so, in the context of this project, it presents a tentative framework that could be used to organize, and eventually qualify or quantify, the values provided by the Hauraki Gulf.

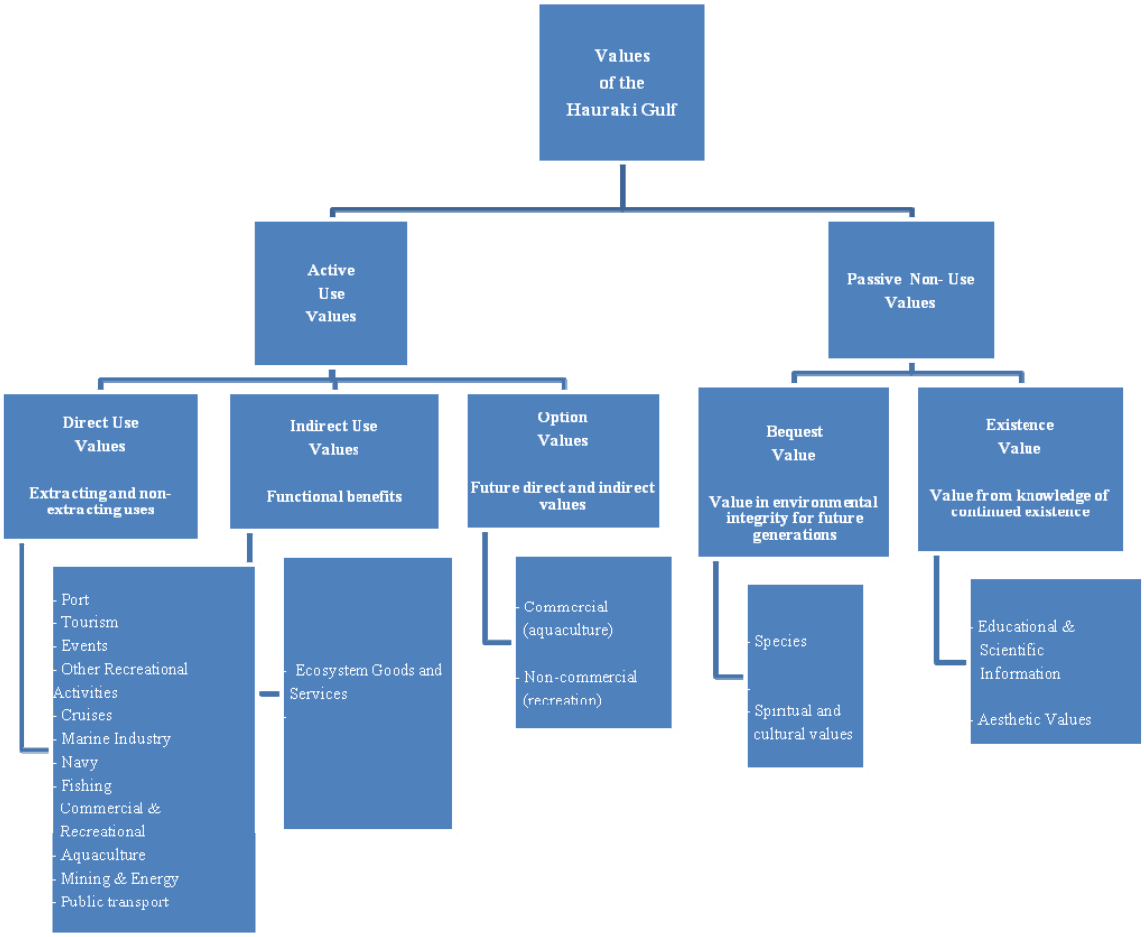

Figure A. Total economic value of the Hauraki Gulf (tentative).

Table B presents a summary of the existing empirical research of the economic and cultural activities provided by the Hauraki Gulf. The estimated total value added (ie, contribution to GDP) is presented, along with a breakdown of direct and indirect value added effects when this information is available. To provide a broader picture the employment effects have also been included. The information presented in Table B is collated from a variety of sources and research papers. As such, comparing the results between the economic and cultural activities is fraught. Specifically, the estimated impacts:

- do not refer to the same year
- are the result of different valuations, techniques, and methods
- have different assumptions that underpin the analysis
- are not necessarily independent/mutually exclusive of each other.

For the same reasons, it is not possible to 'add up' the individual estimates presented in Table B to generate a total economic impact of the Hauraki Gulf. Doing so would likely result in significant double counting of the results. This potential should not be downplayed. The Hauraki Gulf is home to a variety of interdependent activities and these individual estimates for the economic impact of each activity cannot be developed in isolation of the other activities.

Table B. Assessed economic activities in Auckland and the Hauraki Gulf.

	Year	Direct value added $\$_{2011}$ million[1]	Indirect + induced value added $\$_{2011}$ million[1]	Total value added $\$_{2011}$ million[1]	Employment[2]	
Tourism	2008	656	281	937	15,742	FTEs
Marine recreational[3]	2008	na	na	550	5781	FTEs
Recreational fishing	2010	na	na	81	na	
Aquaculture[4]	2008/2010	49	50	99	939	FTEs
Commercial fishing[5]	2010	41	na	41	1183	FTEs
Ports of Auckland	2008	113	143	257	2027	ECs
Cruise industry	2009	35	34	69	928	ECs
Sand mining	2010	na	na	10	100	FTEs

1. Direct impacts are initial injections of revenue and expenditure that accrue to that specific sector; Indirect impacts are the net increase of economic activity generated by the provision of goods and services to the study sector; Induced impacts are the net increase of economic activity due to increased household expenditure in the study sector.
2. Employment Counts (ECs) are not directly comparable to Full-Time Equivalents (FTEs) as they count equally both full- and part-time jobs. Therefore, they tend to be higher than FTEs.
3. Value added includes some indirect impacts within the marine cluster but not induced impacts.
4. Values for Auckland refer to 2008, values for the Waikato refer to 2010.
5. Including processing.

Phase 1 has identified that the economic and cultural activities in Table B contribute positively to the Auckland and Waikato regions, creating a wealth of value added. These activities also sustain significant employment opportunities. The results indicate that tourism, the recreational marine cluster and the Ports of Auckland generate significant economic impact. However, it is important to clarify what conclusions and inferences can be drawn from these estimates.

The estimates of value added do not consider any depletion of capital stock and trade-offs of these activities. In addition, the analysis does not consider, or imply, which activities could generate the biggest returns on any future investment. This means that the focus of current and future policy should not be based solely off these results. Policy should be developed after gaining an appreciation of:

- The return on investment relative to alternatives (opportunity costs)
- The scale of investment required
- The complex interaction between the activities

However, the results of Phase 1 present a useful picture. The tentative picture provided by this study shows a complex relationship between the environment and the economy. The study shows that the environment underpins all the values realised by humans, but also that the relationship between the economy and the environment in the Hauraki Gulf is mainly synergistic. This means that a thriving ecosystem is necessary to support the Auckland and Waikato economies, while thriving Auckland and Waikato economies are necessary to realise the vast untapped economic potential of the Hauraki Gulf.

The Hauraki Gulf has always been one of the most powerful economic, environmental, social, and cultural clusters for Auckland and the Coromandel. These preliminary results show that the

Hauraki Gulf is home to a cluster of economic activities that have the environment at the very core of their value proposition. These share a common interest in protecting the environment as they have a critical dependence on the flow of ecological goods and services provided by the Gulf. In other words, the Hauraki Gulf supports a complex eco-cluster.

These economic activities could further increase their value through deeper collaboration while the economic relevance of the Hauraki Gulf could grow if its ecosystems are preserved and the potential of an eco-cluster is clearly identified and valued both by the private and public sectors.

This study provided an estimate of the economic impact of the economic and cultural activities supported by the Hauraki Gulf. It also highlighted the links or interdependencies between environmental services and the economic activities. The results show that ecosystems are not economic externalities but are often the fundamental source of necessary intermediate or final services or goods.

More research is recommended to investigate the links between the economy and ecological goods and services in greater depth, since environmental services and benefits are the ultimate foundation of every market activity taking place in the Hauraki Gulf. Other research could include understanding the capital depletion costs of each activity and their trade-offs as well as understanding the ecological and environmental limits to these activities (eg, resource depletion).

In summary, the Hauraki Gulf Forum vision of the Hauraki Gulf could be paraphrased as a place which is '*celebrated and treasured*', '*thriving with fish, shellfish and kaimoana*', has a '*rich diversity of life*' supporting a '*sense of place, connection and identity*' and therefore supports a '*vibrant economy*'.

1.0 The Hauraki Gulf

1.1 Introduction

The Hauraki Gulf is a complex ecological and geographical feature that covers 1.2 million hectares of ocean. It includes a marine park, six marine reserves, 30 major island groups (see

Figure 1) and supports populations of resident whales and dolphins as well as populations of internationally significant seabirds and migratory shorebirds.

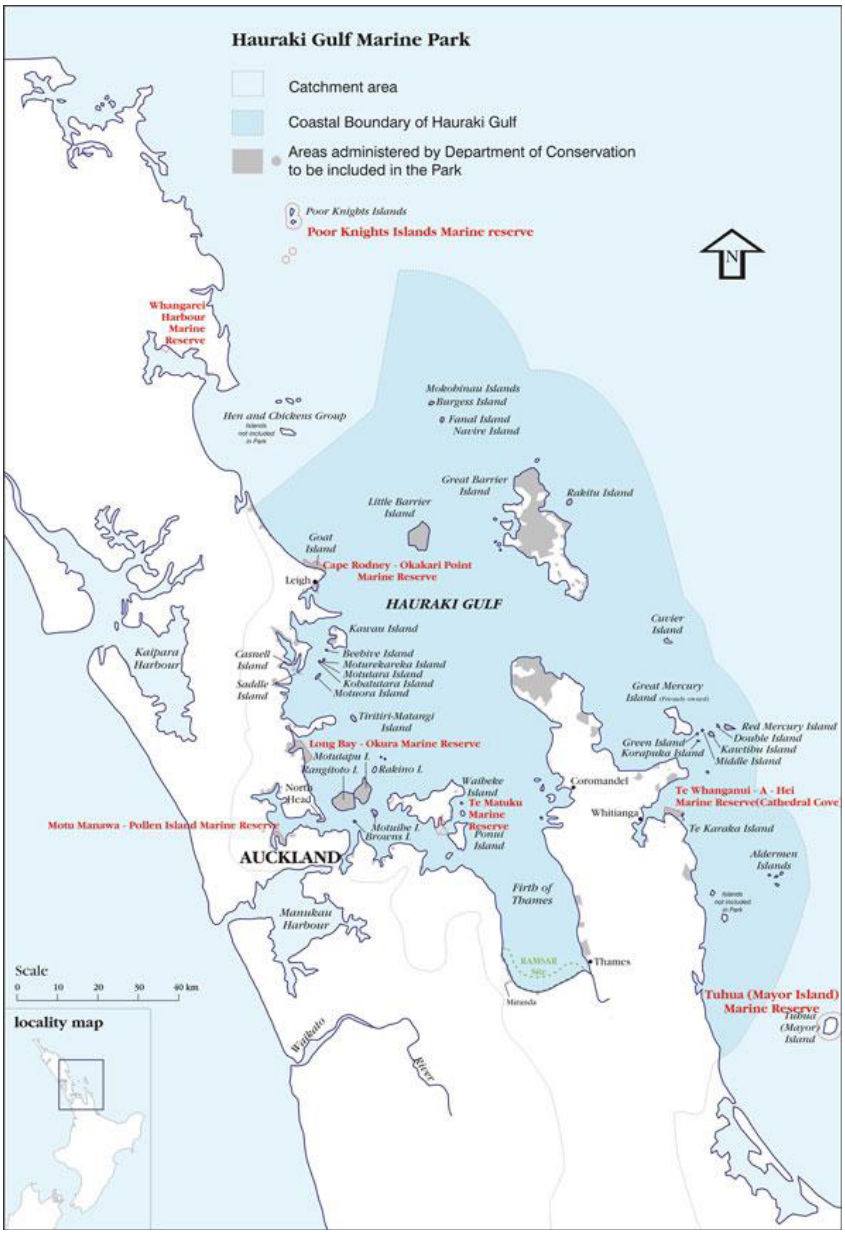

Figure 1. The Hauraki Gulf and its Marine Park.

The Hauraki Gulf also retains productive fishing areas, borders 13 regional parks, and contains important nature reserves; some of which are close to the city. It also shelters New Zealand's

biggest commercial harbour and hosts the main New Zealand naval base, as well as many smaller ports and numerous marinas. It provides a wide range of environmental benefits, such as shelter and food. These benefits have attracted human settlement in the past and continue to do so today. New Zealand's largest metropolitan area is located on part of its shores and one of the country's main tourist attractions, the Coromandel Peninsula, is surrounded by the Hauraki Gulf.

The Hauraki Gulf is not only a place where a number of economic, social, environmental, cultural, recreational and public activities take place; it also defines the very identity of the communities who live on its shores and is a crucial place for iwi cultural values.

All these activities and features generate a vast and constant flow of benefits for humans. These can be summarised as:

- benefits that are the product of activities that form part of commercial markets
- ecological benefits that are accounted for, or are not accounted for (externalities), by commercial markets: these benefits could be classified as intermediate (eg, waste treatment) or as final products (eg, fish)
- values that are not part of any commercial market.

As a result, the Hauraki Gulf is one of Auckland's most important assets and is the most important marine asset for the Waikato region.

1.2 The Hauraki Gulf Marine Park Act and the Hauraki Gulf Forum

The Hauraki Gulf Marine Park Act 2000 recognised the unique importance of the Hauraki Gulf.

The main purposes of the Act were to:

- integrate the management of the natural, historic ,and physical resources of the Hauraki Gulf, its islands and catchments
- establish the Hauraki Gulf Marine Park (HGMP)
- establish objectives for the management of the Hauraki Gulf, its islands and catchments
- recognise the historic, traditional, cultural, and spiritual relationship of the tangata whenua with the Hauraki Gulf and its islands
- establish the Hauraki Gulf Forum.[5]

The Hauraki Gulf Forum[6] comprises:

- representatives of the Ministers of Conservation, Fisheries, and Maori Affairs
- six representatives of the tangata whenua of the Hauraki Gulf and its islands (appointed by the Minister of Conservation after consultation with the tangata whenua and the Minister of Maori Affairs)
- seven representatives from the Auckland Council, including one member each from the Great Barrier Island and Waiheke Island Local Boards
- representatives of the Hauraki District Council, Matamata-Piako District Council, Thames-Coromandel District Council, Waikato District Council, and Waikato Regional Council.

[5] The Forum has a range of functions and powers, identified under the Hauraki Gulf Marine Park Act, which include consideration of issues, receiving reports, making recommendations, and commissioning activities.
[6] www.haurakigulfforum.org.nz

The forum has appointed the Auckland Council as its administering authority. The forum has the following purposes:

- to integrate the management (and, where appropriate, promote the conservation and management in a sustainable manner) of the natural, historic, and physical resources of the Hauraki Gulf, its islands and catchments, for the benefit and enjoyment of the people and communities of the Hauraki Gulf and New Zealand
- to facilitate communication, co-operation, and co-ordination on matters relating to the statutory functions of the constituent parties in relation to the Hauraki Gulf, its islands and catchments, and the forum
- to recognise the historic, traditional, cultural, and spiritual relationship of tangata whenua with the Hauraki Gulf, its islands and, where appropriate, its catchments.

Once every three years, the forum is required to prepare and publish a report on the state of the environment in the Hauraki Gulf. This report has to include information on progress towards integrated management and responses to prioritised, strategic issues.

The 2011 assessment by the forum noted that the Hauraki Gulf had undergone an incredible transformation over two human life spans. That transformation is continuing, both in the sea and around the coast, with most environmental indicators showing either negative trends or remaining at levels which are indicative of poor environmental conditions.

The forum has developed a vision for the Hauraki Gulf which refers to a place which is "*celebrated and treasured,*" which is "*thriving with fish, shellfish, kaimoana*", which has a "*rich diversity of life*" and which supports a "*sense of place, connection and identity*" and a "*vibrant economy*".

1.3 Ecosystems in the Hauraki Gulf

The Hauraki Gulf has a vast array of coastal marine and terrestrial (land-based) ecosystems which provide a wide range of benefits to both residents and visitors. Many of them represent necessary inputs to numerous economic activities that contribute a large share of Auckland's and Waikato's GDP, support cultural values and social opportunities, and provide a number of important services that support human life and health.

The environment and some of its services can visibly enhance the quality of daily life and improve property values while other services - that may not be used every day - become vital in times of trouble, such as when big storms occur or human pressure increases. Many of these services are difficult to appreciate until they are compromised or lost: people may not be aware of them or understand them, or may take them for granted.

Ecosystem goods and services are defined as '*the direct and indirect benefits that mankind receives or values from natural or semi-natural habitats.*'[7] These benefits are not just economic – they contribute to human well-being and quality of life[8] through the link between natural systems and processes and humans.

- **Ecosystem goods** – these are tangible resources that can be extracted and used by humans, such as food and raw materials. The resources must be renewable within a human timeframe to be considered as a good in this definition.
- **Ecosystem services** - the ability of an ecosystem to provide favourable conditions for humans by processing material or providing intrinsic benefits (eg, water filtration, or by dampening environmental pressures).

[7] Daily, 1997; Constanza et al., 1997; Boyd and Banzhaf, 2007.
[8] Fisher et al., 2009.

In 2000, the United Nations Millennium Ecosystem Assessment (MA) project was established with the objective of assessing the consequences of ecosystem changes to mankind. This understanding would guide strategies for the sustainable use and conservation of these ecosystems and their corresponding benefits.

More than 1300 experts were involved and the result was one of the most widely-used frameworks for defining ecosystem goods and services.[9] The framework provides a consistent typology to communicate these goods and services across a variety of ecosystems types.

1.3.1 Classifying ecosystem goods and services

The Millennium Ecosystem Assessment project classified ecosystem goods and services into four broad categories:

- **Provisioning services** – the tangible products from ecosystems (eg, wood, fibre, fresh water, food production).
- **Regulating services** - the benefits that humans receive from the maintenance of ecosystem processes (eg, air quality, water regulation and purification).
- **Supporting services** – the services that are needed to produce all the other services (eg, soil-formation services which indirectly impact food production). They are not directly used by humans but are critical to maintain the other services and may occur over long periods of time.
- **Cultural services** - the non-material benefits that humans obtain from the environment (eg, spiritual enrichment, recreation, and aesthetic experiences).[10]

While providing a widely accepted typology, the MA did not have a strong focus on marine ecosystems. A recent technical report[11] and publication[12] provide an introduction to, and a summary of, the types of goods and services provided by the marine ecosystems of the Hauraki Gulf.

In general, the terrestrial ecosystems on the islands and surrounding coastline of the Hauraki Gulf provide the same types of goods and services but a few additions are provided specifically by land-based ecosystems.

Table 1 lists the goods and services provided by the marine and terrestrial ecosystems in the Hauraki Gulf.

[9] Fisher et al., 2009; Royal Society, 2011.
[10] MA, 2003.
[11] TR2010/033.
[12] Townsend et al., 2011.

Table 1. Ecosystem goods and services obtained from coastal marine and terrestrial environments in the Hauraki Gulf. (Source: Townsend and Thrush, 2010; Constanza et al., 1997)

Supporting	Regulating	Provisioning	Cultural
▪ Resilience and resistance ▪ Habitat structure ▪ Soil formation ▪ Pollination	▪ Disturbance prevention ▪ Waste treatment, processing and storage ▪ Water regulation, including flood regulations ▪ Sediment retention ▪ Biological control, including disease regulation ▪ *Gas and climate regulation ▪ *Nutrient regulation	▪ Food provision ▪ Raw materials ▪ Genetic and medicinal resources ▪ Water supply	▪ ▪ Spiritual and cultural ▪ Recreational ▪ Aesthetic ▪ Inspirational ▪ Educational and cognitive benefits ▪ Non-use benefits ▪ Speculative benefits

*Can also be classified as supporting services

Figure 2 shows an example of multiple ecosystems services provided at a single site.

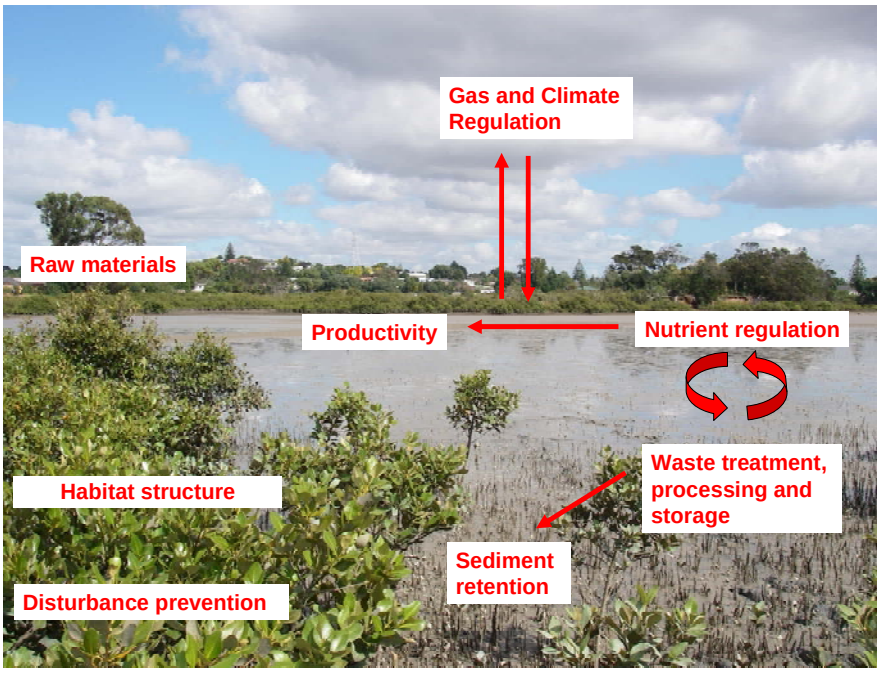

Figure 2. Example of multiple ecosystem services provided by a single site. (Source: Townsend, 2010; Photo, NIWA)

More information[13] about each category of ecosystem goods and services is provided in the following sections. Brief examples relating to the Hauraki Gulf and New Zealand are included. More detailed examples can be found in Townsend and Thrush (2010) and the other references specified.

[13] Adapted from Townsend and Thrush, 2010; Costanza et al., 1997.

1.3.2 Provisioning services

Food provision
This service is defined as the extraction of organisms for human consumption. In New Zealand, coastal food provision is a fundamental and highly valued service.

Many different species of fish are targeted but snapper is the most iconic fish species for the North Island. Other important species include tarakihi and kingfish which have high recreational and customary value.

In the local coastal environment, other important species for food provision include intertidal shellfish such as cockles, pipis, oysters, and some gastropods. Sub-tidally, mussels, scallops, kina, paua, paddle crabs, and crayfish are commercially and culturally prized.

Although the land area of the Hauraki Gulf is not a large resource in comparison to the marine environment, it does provide some food from crops (eg, vineyards on Waiheke Island) as well as livestock from limited grazing areas on some of the islands.

Renewable raw material
This service is defined as the use or extraction of renewable materials for all purposes except that of human consumption. (This definition excludes the extraction of hydrocarbons, minerals, and sand mining for construction as these are not considered renewable within a human timescale.) The definition could also include the generation of renewable energy such as tidal- and wave-generated electric power which is likely to be increasingly important for New Zealand.

In the Hauraki Gulf, shell hash for the aquaria trade and landscaping is probably the main raw material extracted although the quantities are only minor. Harvesting seaweed could be a potential extraction in the future.

Power generation from renewable sources is likely to be more important for Auckland's west coast rather than the Hauraki Gulf on the east coast of Auckland. A similar trend exists for land-based raw materials in the Hauraki Gulf, with fewer raw materials on the east coast in comparison to the west. However, there are some timber reserves in the forestry areas at Mangawhai as well as various smaller, private blocks on Great Barrier Island and Waiheke, and flax and driftwood can also be obtained from the terrestrial areas of the Hauraki Gulf.

Genetic and medicinal resources
Plants and animals may contain genetic information and biogenic chemicals that can be used by the medical and pharmaceutical industries. In New Zealand, examples include developments in anti-cancer research using species of sponge. No examples from the Hauraki Gulf are currently known but it is important to preserve that potential for the future.

1.3.3 Regulating services

Storm protection
This refers to biogenic structures or biogenically modified habitats that can mitigate environmental disturbance. Coastal plants (eg, mangroves and seagrass) and animals can create biological structures that can reduce the impact of storms, waves, and tides. These work as natural sea defences and help to protect the shores, properties, and coastal

infrastructures from erosion and storm damage. Terrestrial plants can also dampen environmental fluctuations and provide storm protection.

Cleaning the water and air by absorbing and detoxifying pollutants
This refers to the removal of organic (eg, sewage) or inorganic (eg, heavy metals) waste material through a combination of recycling, burial, and storage. Marine animals and plants that live in the mud and sand move the sediment around and play important roles in the nutrient and waste cycles. Some waste is broken down and removed, and some is stored in the sediment.

Many of the species that dwell in the soft coastal and estuarine sediments around the Auckland region play important roles in the cycling of sediments and organic and inorganic contaminants.[14] Ponds, lakes, and wetlands are well known for their usefulness in treating wastewaters from urban and rural areas[15] and are important in the Hauraki Gulf, particularly on the mainland.

Water regulation (flood and drought protection)
This refers to the role of the land and vegetation in controlling runoff into rivers and estuaries. This, in turn, regulates fluvial discharge, provides flood control and assists drought recovery. As such, it can be considered primarily as a terrestrial service.

Many different coastal plants help to regulate the speed that water runs off the land into estuaries and the sea. This is important to the environment and can also help to prevent flooding when the plants are of sufficient number and size. Plants, and some animals which live in mud and sand, can also prevent beach material from being washed away by binding the sediment together.

In the Hauraki Gulf and, in particular, the urban areas along the Gulf, a high percentage of land has been modified and concreted, with the discharge being regulated through stormwater management practices. Impervious areas accounted for 42 per cent of land within the Auckland Metropolitan Urban Limits in 2008.[16] This may have limited the capacity for the land and flora to regulate water discharge although there are substantial areas of mangroves in the upper estuaries that perform this function. Although lakes are also important for water regulation, they are likely to be less significant than vegetated areas as there are few lakes within the Hauraki Gulf catchment.

Sediment retention and generation
This refers to the role played by vegetation, lakes, wetlands, and sediment biota in the process of sediment retention and sediment generation.

Plant species such as mangroves and sea grass, in sufficient densities, prevent erosion of intertidal sediments and increase the levels of deposition. Animals, such as worms that form tube-mats, can also be important in stabilising sediments. On the land, terrestrial plants help to anchor sediment so that it remains in place as a valuable resource for other terrestrial ecosystem services (eg, soil formation), keeping it out of marine environments where sediment may have a detrimental effects on the marine ecosystems.

Some species can also play a role in sediment generation. For example, Pakiri Beach has approximately 25 kilometres of beach and sandy sediments which run offshore for about 4 kilometres to a depth of about 40 metres. In this area, like many areas around New Zealand,

[14] See Townsend and Thrush, 2010.
[15] Tanner and Sukias, 2003.
[16] ARC, 2009.

carbonate derived from the shells of bivalve molluscs makes up 40–70 per cent of the sediment by weight.[17]

Gas and climate regulation
This refers to the balance of chemical exchange between marine and terrestrial ecosystems and the atmosphere, which is influenced by the activities of organisms.

The coastal, marine, and terrestrial environment is important for balancing the air and regulating the climate. Gases like carbon dioxide (CO_2) dissolve into seawater and can be locked away in the shells of shellfish and other animals. Land plants also store CO_2 in a similar manner, storing the compound within the biomass, both above and below the ground. Unhealthy sediments can release methane, a harmful greenhouse gas.

Carbon storage in soils and biomass has been the subject of many studies, particularly to ascertain its importance in global climate change. Several of the islands in the Hauraki Gulf contain large patches of indigenous forest (eg, Rangitoto, Little Barrier, and Great Barrier Islands) which are known to be important carbon sinks. For example, terrestrial ecosystems throughout New Zealand have been estimated to harbour 2420 million tonnes of carbon, with 80 per cent of this occurring in indigenous forested ecosystems.[18]

Nutrient storage and cycling
This refers to the cycling of organic and inorganic nutrients by the activities of marine and terrestrial species. The seabed and the animals that live in it are important for nutrient cycling. The activity of these animals keeps the coastal system healthy and makes nutrients available, underpinning food production.

1.3.4 Supporting services

Maintaining biodiversity
Biodiversity has many definitions but, generally, is the variability among living organisms within and between species (eg, species richness) and within and between ecosystems (eg, ecosystem complexity). Biodiversity is the source of many ecosystem goods and is fundamental to many ecosystem services. Changes in biodiversity can influence the availability of goods and delivery of services.[19]

Biodiversity is vitally important in the maintenance of resilient and resistant ecosystems. Ecosystems and their communities may be able to absorb natural and human pressures but when disturbed, the speed at which they can recover and return to their original state is important for continued service delivery. Therefore, ecosystem resilience and resistance underpin the maintenance of all other services. Resilience and resistance may be one of the most important ecosystem services in terms of sustaining life and lifestyles.

The maintenance of food webs and trophic dynamics[20] is another important component of biodiversity. Key predators can control the abundances of prey and lower trophic levels through their trophic-dynamic relationships with species. This biological pressure may also reduce the invasion success of non-native species (eg, biological control).

Some key predators in the Hauraki Gulf include species of birds and fish. For example, snapper are an important predator of urchins which graze on kelp plants. If snapper are removed through fishing pressure, their control on the urchin populations is removed, allowing

[17] Hilton, 1990.
[18] Tate et al., 1997.
[19] MA, 2003.
[20] The interaction between species at different levels on the food web.

urchins to increase to a level where they impact the kelp populations. This results in urchin barrens - areas with urchins but no kelp.[21]

Kelp is an important contributor to productivity in the near-shore area and provides a habitat for many species. Predatory invertebrates include some crabs, worms, and molluscs. Other species exert control through non-predatory actions such as influencing the community composition through bioturbation and filtering activity.[22]

On land, birds, amphibians, reptiles, freshwater fish, and invertebrates are important upper-trophic-level predators and help to maintain the food webs. Few studies have been done on their dynamics and effects on native ecosystems: the majority of research work focuses on their effect on economically important horticultural crops.[23]

Pest eradication efforts on some Hauraki Gulf islands mean that the Hauraki Gulf is now a significantly important area for supporting the conservation of a number of threatened and iconic species; eg, tuatara, geckos, skinks, giant weta, and the very rare brown teal.

A number of other uncommon animals are being conserved on various islands and are available for visitors to experience, adding to the islands' value. Tiritiri Matangi Island is a major ecotourist area where visitors can see kokako, takahe, stitchbird, and saddleback.

Large numbers of threatened seabirds breed on the Hauraki Gulf islands. An example is the endangered black (Parkinson's) petrel, a key top predator, which breeds only on Great Barrier and Little Barrier Islands. Seabirds are well-known for their role as ecosystem engineers due to the marine nutrients they bring to their terrestrial breeding grounds, thus helping to stabilise these ecosystems.

Habitat formation

Marine and terrestrial habitats provide living space for species so these habitats are a prerequisite for the provision of all other goods and services.

Marine animals and plants change the marine environment by producing shells or root structures, and through other activities that provide space and shelter where other organisms can live. This role is similar to that of trees in a forest, which are important for other plants, birds, insects, and many other different species.

Coral reefs are the most iconic example of marine-habitat formers but many other organisms modify the topography of the sea floor in the Hauraki Gulf. Examples of these modifications include reefs created by oysters, horse mussels (*Atrina*) and mussels, shell hash from abundant bivalves, root structures from mangroves, seagrass meadows, and tubeworm mats. Less obvious, but just as important, are the habitat modifiers that work below the sediment surface such as burrowing crabs, bioturbating worms, and urchins.

Soil formation

Soil is formed in the terrestrial environment by the erosion of rock and accumulation of organic material (eg, detritus). Soils are considered natural capital[24] by supporting vegetation on land as a substrate, a nutrient, and a water source and by supporting life underground (soil life) which includes microorganisms, fungi, and other plants and animals.

Soil is linked to many of the other ecosystem services such as nutrient and water cycling, provisioning of food and raw materials, regulating carbon, and recycling of wastes. Soil quality tends to be assessed by a number of soil components that measure the physical (eg, stone

[21] Shears et al., 2002.
[22] See Townsend and Thrush, 2002.
[23] Brokerhoff et al., 2010.
[24] Dominati et al., 2010.

content), chemical (eg, pH), and biological (eg, microbial biomass) characteristics of the soil. Although no detailed records of soil quality exist for the Hauraki Gulf, the Auckland Council has a general soil register for the Auckland region.

Water supply
Water supply refers to the retention, filtering, and storage of water in lakes, streams, and underground reservoirs and aquifers. The supply of water is important for agriculture, industry, and household consumption.

The Auckland region has limited supplies of fresh water due to its geography and geology; however, the aquifers that do exist are considered as an important water source for both rural and industrial uses within the urban areas.[25]

Pollination
Pollination refers to the movement of flora and fungal gametes by terrestrial invertebrates and birds. It is critically important for plant reproduction and dispersal.

A recent study by Anderson et al. (2011) in the North Island of New Zealand, including Little Barrier and Tiritiri Matangi islands in the Hauraki Gulf, highlighted the importance of native birds as pollinators and seed dispersers. On the mainland, a lack of the native pollinators, namely bellbirds and stitchbirds, has led to an 84 per cent reduction in seed output of the native shrub *Rhabdothamnus solandri*.

1.3.5 Cultural services

Cultural services rely largely on the integrity of the entire system. All services can be linked to cultural service provision in some capacity. For example, the experience of leisure and recreation has links to productivity (eg, the act of fishing) and water clarity (eg, swimming, aesthetic value), which are in turn influenced by material processing and habitat provision.

Leisure and recreation
This refers to the use of, or engagement with, marine resources for stimulation or relaxation of the human body and mind. Leisure and recreation relate to our quality of experience which is related to the perception of a healthy environment which, in turn, is maintained by regulating services. The importance of those regulating services will vary between contact and non-contact recreational activities, with human health risk being a key driver in contact recreation.

Leisure and recreation is one of the more obvious services that the coastal system provides and it also has strong links to the tourism industry. There are many examples in the Hauraki Gulf; eg, sailing and boating are important activities in the Auckland area. Other leisure pursuits include nature watching, diving, and fishing. Inshore and shallow-water pursuits include numerous beach activities such as swimming and sunbathing, and walking on the beach - popular throughout the entire year.

Cultural and spiritual heritage
This refers to the benefits provided by marine resources that have significance for the cultural and/or spiritual identities of the community. The value of marine resources has a strong presence in Maori spirituality. Human communities living by the sea have attached importance to the marine ecosystems that are integral to the cultural definition of that community. The collection of food from marine resources (fishing and gathering) in addition to providing food has a strong cultural importance to many New Zealanders, including Maori.

[25] Crowcoft and Smaill, 2001.

Cognitive benefits
This refers to the value of natural resources to cognitive development which includes education and scientific research. Many species provide stimulation for cognitive development and much of the marine research effort in New Zealand occurs within the Hauraki Gulf. Information contained within natural systems can be adapted or exploited by humans for societal development.

Non-use benefits
This refers to the values that humans place on aspects of ecological systems or on certain species, even when humans are unlikely to interact directly with them. Non-use values cover existence and bequest.

Existence value is the contentment derived from the knowledge that an ecosystem contains a natural resource or species (eg, dolphins, seabirds, landscapes, and/or geological features) even if the landscape is never experienced personally. This can be motivated by selfish reasons or by altruism.

Bequest value is the importance placed on the availability of a natural resource or the survival of a species for future human generations.

Speculative benefits
These are also known as option use values. They describe the importance that humans place in ecosystems having attributes that may become valuable in the future; for example, in future medical research.[26]

1.4 How ecosystem benefits affect human welfare

A benefit[27] is realised at the point where human welfare is directly affected and where other forms of capital (built, human, and social) are usually needed to realise the gain in welfare. For example, clean water provision is a service for fishing while clean water for swimming is a benefit (requiring travel costs, etc.).[28]

In addition, different activities have different environmental impacts or feedback[29] on the environment. Some activities are relatively neutral while others have high negative impacts that may be either ongoing or potential (eg, a major shipping disaster in the Hauraki Gulf).

A schematic pathway that links ecosystem goods and services with the economy in the Hauraki Gulf is shown in

Figure **3**.

[26] Hanley et al., 2001.

[27] Benefit is intended as a positive contribution to human well-being.
[28] This classification avoids potential double counting, as only benefits are valued.
[29] Feedback is the response/impact of a particular activity/process on the environment.

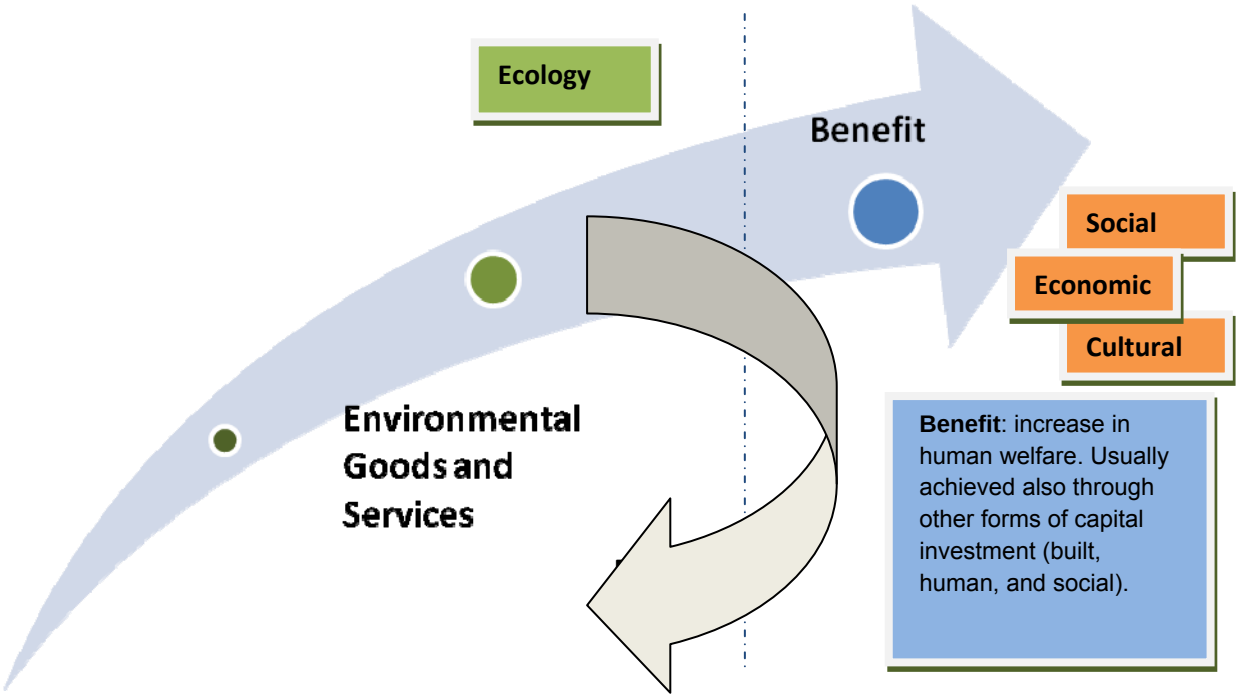

Figure 3. Ecosystem pathways and economic benefits.

2.0 The Total Economic Valuation Project

2.1 Introduction

Some empirical research has already been undertaken to understand and quantify some of the Hauraki Gulf's economic and environmental benefits and values. However, this research was mainly done in isolation and without taking into account trade-offs and interactions, while the state the Hauraki Gulf environment shows clear symptoms of depletion and degradation.[30]

As a result of this situation and these concerns, Auckland Council launched a long-term research project – the Total Economic Valuation project - to identify the benefits provided by the Hauraki Gulf and determine its total economic value.

This project has three phases, and the objectives of each phase are summarised below.

2.2 Objectives and scope

Phase 1 objectives:

- identify the environmental and economic benefits provided by the Hauraki Gulf
- Identify and build relationships with key stakeholders, partners, and knowledge holders
- review existing literature and studies on numerous aspects of the Hauraki Gulf, and identify gaps in current knowledge
- produce a general view of the total economic value of the HGMP that will specify, for each benefit, which values and methodologies are known and applicable, and which values are unknown, outdated, or obtained through weak methodologies.

Phase 2 objectives:

- re-scope the economic valuation project based on the results of Phase 1
- identify who should investigate each of the unknown values and quantify the resource needed
- possibly produce a valuation of the unknown values
- produce a report that summarises the total economic value of the HGMP, expressed in monetary terms when possible and when appropriate.

Phase 3 objectives:

- present the final report
- involve a consultation process with key stakeholders
- provide input to policies measures that will improve the environmental state of the Hauraki Gulf while maximising the sustainable economic benefits for the wider community.

2.3 Outside of scope

There is no intention to monetise all the values embedded in the Hauraki Gulf, as many values cannot be monetised. For example, spiritual values which vary dramatically from one person to another.

[30] Hauraki Gulf Forum, 2011.

Others, such as cultural, social, spiritual values were outside the scope of this Phase 1 as the valuation perspective was strictly economical. This reductionist approach is a starting point only, as numerous other values sets may be associated with the Hauraki Gulf. For example, it is a place of unique cultural and spiritual significance for Maori.

Policy goals or scenario design are also out the scope of this project. Future research could, however, investigate and develop scenarios. Therefore, the report does not make any policy recommendations, nor does it attempt to describe scenarios or trade-offs.

2.4 Difficulties and limitations

2.4.1 The complexity of ecosystems

There are many difficulties related to the interpretation and valuation of ecosystem services, as ecosystems themselves are fundamentally complex. For example, although the Hauraki Gulf has a clear geographical boundary, it does not contain one homogenous marine ecosystem. Instead, it has a wide diversity of coastal habitats and systems which range from:

- sea grass beds to seaweed
- soft sediment to reefs
- sheltered tidal creeks and coasts to exposed open coasts
- small estuaries to large harbours.

As a result, the Hauraki Gulf contains a huge variety of heterogeneous and complex ecosystems which interact among themselves. This presents many challenges when trying to include them in valuation frameworks or decision-making processes.

Due to these complexities and our incomplete knowledge, there is no clear consensus on either economic valuation frameworks or on the merit of monetising goods and services. Even a complete understanding of an ecosystem may preclude accurate accounting of its value.

At this stage, it is perhaps most useful to develop an understanding within the community of the role of the ecosystems and their values[31] by simplifying these systems, and making their links with the derived benefits clear and easy to understand.

2.4.2 Emergent research area

The economic valuation of ecosystem functions and services and the benefits they generate for humans is an emergent research area over the past decade. It is based on the recognition of complex systems, co-dependencies, and adaptive feedback between variables in both economic and natural systems.

The relationship between the environment and the economy is an area of emerging scientific knowledge. Emerging literature also highlights the complex benefits obtained from a physical space and place. These include economic, environmental, social, and cultural benefits.

2.4.3 Spatial and temporal dynamism

Marine environments are naturally complex due to their interconnectivity. Consequently, the benefits they generate often appear in different locations rather than where they originate. This means that spatial and temporal dynamism is inherent in the production of goods and services.

[31] Royal Society, 2011; Fisher et al., 2009.

Ecosystems and their services are heterogeneous in space and evolve in time. Figure **2** shows the many services and benefits provided by ecosystems provide at a relative small site. Some of these are used at the site (eg, raw materials) while others are provided at one location at one time but the benefits are realised in another location at another time (eg, gas and climate regulation).

These dynamisms have direct economic implications, particularly as people have choices and preferences. For example, Aucklanders are more willing to pay for improvements in quality at outer coastal beaches compared to middle- and upper-harbour locations.[32] However, many of the outer coastal beach services (such as sediment retention and waste processing) are generated elsewhere so the upper harbour sites need to be improved to achieve these benefits. Conversely, a location could be negatively affected by a damage originating elsewhere and in a different time (eg, agricultural sediments, stormwater).

2.4.4 Joint production

The relationship between services and benefits or values is not a direct linear relationship. Just as ecosystems can provide a number of ecosystem services, these ecosystem services can deliver multiple benefits for human welfare.[33] These are considered joint products.[34] shows how the interactions among several ecosystem services result in clean water and associated human benefits such as leisure and recreation. These ecosystem services therefore provide joint products, or multiple benefits.

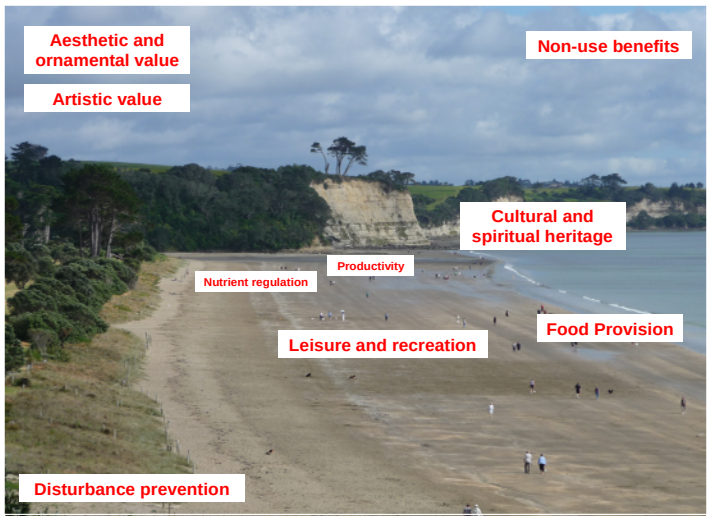

Figure 4. Joint production of benefits in Long Bay, Auckland. (Source: Townsend, 2010)

Joint production is a characteristic of ecosystem services that affects the determination of the environmental inputs provided by specific ecosystems, as they are often intrinsically interlinked.

The benefits themselves are connected through feedback loops, where human activity affects the ecosystem structure and function and, therefore, the production of goods and provision of services.

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[32] Batstone and Sinner, 2010.
[33] For example, the benefit of fishing is dependent on both the provision of stock to fish, and also on the regulating and supporting services to provide the healthy environment from which to harvest the fish. This joint production becomes more important for cultural services such as leisure and recreation where it is the quality of experience that is most important.
[34] See Daily, 1997b, for chapters regarding multiple services produced by individual systems and biomes.

2.4.5 Benefit dependence

People often understand and perceive only the benefits of ecosystem services that affect them directly - they are benefit dependent.[35] For example, someone interested in fishing may perceive snapper as a final benefit but someone interested in the availability of kelp forests perceive snapper as an intermediate ecosystem service that controls the sea urchins which eat the kelp.

An ecosystem service may be considered as final or intermediate; this depends on what is being valued, monitored, or measured, and the beneficiaries of that service.[36] This means that different stakeholders (or even different individuals) often perceive different benefits from the same ecosystem processes so, at times, they can conflict.[37] For example, in economic terms, fishing and marine reserve services are rivals.

Further complications stem from the fact that many intermediate and final ecosystem services are valuable as they provide benefits to humans, even if the stakeholders themselves do not perceive the value of these services. Climate regulation is an example of a vital service for human well-being that is probably not perceived by a large proportion of the Earth's population.[38]

2.4.6 Complexity of classification

The characteristics described in the preceding sections all interact to make the classification of ecosystem services, their goods, and their interaction with the economy particularly complex.

For example, a good can be considered as a public good, a private good, or as both while the dynamics of its consumption - its contestability - is also a function (eg, of social and regulatory systems and technological development).

This complexity also relates to the numerous and inter-related policy instruments that could be used to regulate the interaction between the economy and the environment; eg, access fees, changes in property rights, taxes, subsidies, tradable permits, national or multinational regulation, or devices to change individual or group incentives.

2.4.7 Double counting the economic impact

Another problem lies in double counting the economic impact of related activities. This problem is amplified by the application of the wider assessment methodology based on direct, indirect and induced economic impacts, as described in Chapter 3.

The problem is particularly evident with some recreational activities (eg, boating, cruise industry, tourism, events, recreational fishing, and the marine industry) as these activities often overlap, depending which one is under evaluation. For example, recreational fishing has indirect impacts on both the marine industry and tourism.

A preliminary solution, to avoid duplication and to partially overcome the lack of information, was achieved by adopting restrictive assumptions when assessing certain activities or even, for events, to not count their effects and instead assume that these were already captured elsewhere in this report. This preliminary solution needs more careful exploration in the future.

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[35] Boyd and Banzhaf, 2007.
[36] See Boyd, 2007, for a full treatment of benefit dependence.
[37] Turner et al., 2003; Hein et al., 2006.
[38] Economic valuation is typically focused on marginal changes. However, what constitutes a marginal change in regards to ecosystem processes and services is not always clear and price changes will likely not reflect the 'ecological quantities' important for the delivery of that service (Gowdy and Erikson, 2005). A number of problems in the valuation process have been identified; eg, the value people place on environmental goods and services through stated preferences techniques, are susceptible to a number of inconsistencies as well as the incommensurability of different environmental services.

Although double counting can be seen as an obvious limitation of this study, it does provide some clarity around the economic inter-relationships while preserving the main focus of the study: highlighting the intricate and intertwined relationships between the ecosystem services provided by the environment, the economy, and all the values that are related to them.

3.0 Economic valuation methodologies

3.1 Methodologies used to assess market values

Market values are captured in the economic impact of industries that rely on the Hauraki Gulf for their operations. Commonly, an economic impact analysis calculates the value added of an economic activity (ie, values of revenues minus values of intermediate goods and services). The value added can also be seen as the remuneration obtained by the production factors (work, capital, land) that generate an output.

In principle, this approach provides a more accurate assessment of an economic activity than the total values of sales or gross revenues. However, in order to calculate value added, assumptions sometimes need to be made about the technical structure of a certain sector.

These assumptions may not reflect the technology at the enterprise level, as it is derived by a wider aggregation of economic activities (as in the case of an input-output model based on ANZSIC categories). Therefore, although an input-output analysis refines the gross revenues approach, it also introduces an additional level of error. In general, though, an input-output analysis is considered to be valid and provides a common ground for comparison.

This review found that the vast majority of existing studies on the economic impact of human activities taking place in the Hauraki Gulf used a direct value-added measurement that was calculated through an input-output model and, in some cases, associated it with indirect and induced value added as well (see Figure 8).

In general, these assessments recognise that one form of economic expenditure in an industry results in income for another industry. Therefore, new economic growth in one industry is not contained within that industry but spreads and creates impacts through the economy.

The existing studies identified three types of economic impact that can occur as a result of growth within a sector:

- **Direct impacts** - initial injections of revenue and expenditure that accrue to that specific sector
- **Indirect impacts** - net increase of economic activity generated by the provision of goods and services to the study sector
- **Induced impacts** - net increase of economic activity due to increased household expenditure in the study sector.

Direct, indirect, and induced impacts also occur in relation to employment.

Multiplier analysis - an extension of standard input-output analysis - was also used to capture the strength of the links between some study sectors and the rest of the economy. Two types of multipliers were used:

- **Type I multiplier** - this captures the direct and indirect backward linkage effects associated with direct expenditures. It is summarised by the equation:
  (Direct Effect + Indirect Effect)/Direct Effect
  This type of multiplier captures the net effects of an investment in the study sector on the production chain (an increase of *x* in investment creates an impact of *y* in GDP).
- **Type II multiplier** - similar to the Type I multiplier but also including induced effects. It is summarised by the equation:
  (Direct Effect + Indirect Effect + Induced Effect)/Direct Effect

This type of multiplier captures the effect of the increase in household wages and salaries paid to the workers in the study sector.

3.2 Methodologies used to assess non-market values

A suite of methodologies has been developed over time to assess non-market values. These can be divided into two broad categories:

- market-generated data
- non-market methodologies.

3.2.1 Market-generated data methodologies

Market-generated data methodologies try to expand the realm of market values by introducing price-generating mechanisms such as:

- auctions (eg, access to coastal space)
- trading entitlements (eg, quota rights for a commercial fishery).

3.2.2 Non-market methodologies

Non-market methodologies can be sub-divided into:[39]

- Revealed preferences – these are methods based indirectly on the observed behaviour of humans

- Hedonic pricing – this is used to estimate economic values for ecosystem or environmental services that directly affect market prices. It is most commonly used to examine variations in housing prices that reflect the value of local environmental attributes. In this study, hedonic pricing was used to assess the impact of view and proximity to the sea on residential property values.

- Travel cost – this method uses data about visits to a site, or a set of sites, to construct a demand curve for an environmental resource; eg, a park. This method is primarily used to ascertain the recreational-use value of a resource based on its specific characteristics. The value of the Goat Island Marine Reserve was calculated using this method.

- Replacement-cost – these methods value an environmental benefit by determining the cost of the alternative built infrastructure required, or products that need to be purchased, to replace the service provided by the ecosystem in its current state; eg, nutrient filtering by wetlands, or shoreline protection.

- Avoided-damages – these methods assess the costs that are avoided because a given ecosystem good or service is present; eg, protection against hurricanes and floods.

[39] Barbera, M. (2010).

3.3 Stated preference methodologies

Stated preference methodologies are based on the hypothetical behaviour of humans. They include:

Contingent Valuations (CVs) – these are commonly applied metrics for valuing environmental services. They show an individual's maximum Willingness To Pay (WTP) for an improvement in environmental quality, or their minimum Willingness To Accept (WTA) and forego an improvement in environmental quality.

As CVs aim to discover people's rate of substitution between environmental quality and money, various techniques have been developed including:

- questionnaire surveys that include bidding games
- analysis of the correlation between declared value and personal characteristics of the sample (eg, income, education)
- 'take it or leave it' experiments
- trade-off games
- the Delphi technique.

CVs are usually expensive and are more useful for informing a policy change and for cost-benefits analyses.

Benefits-transfer methods – these involve applying results from existing studies to different areas; eg, estimating the value of one beach by using the value calculated for a different beach of a similar size and type in a different area.

Some benefits-transfer methods may use an economic model developed in one location to estimate the value of a resource in another location: the characteristics of the new location are substituted for those in the existing model. This provides a potential advantage over a simply transfer of the value estimates between locations.

However, it is difficult to accurately assess the many factors that affect the values of an ecosystem good or service and these factors may also vary between sites. Therefore, benefit-transfer methods should be used with caution.

3.4 The Total Economic Valuation framework

The Total Economic Value (TEV) framework, shown in Figure 5, can be used to organise all the different classes of value that might be associated with the Hauraki Gulf. Phase 1 focused only on some direct and indirect use values.

This TEV framework is usually applied in a cost-benefit analysis so, in the context of this project, it is intended only to act as a framework to organize and eventually qualify or quantify the values provided by the Hauraki Gulf.

At this stage of the project, this framework has not been adopted. It is presented here only with the aim of showing how other values - not considered strictly economic until now - could be identified and classified.

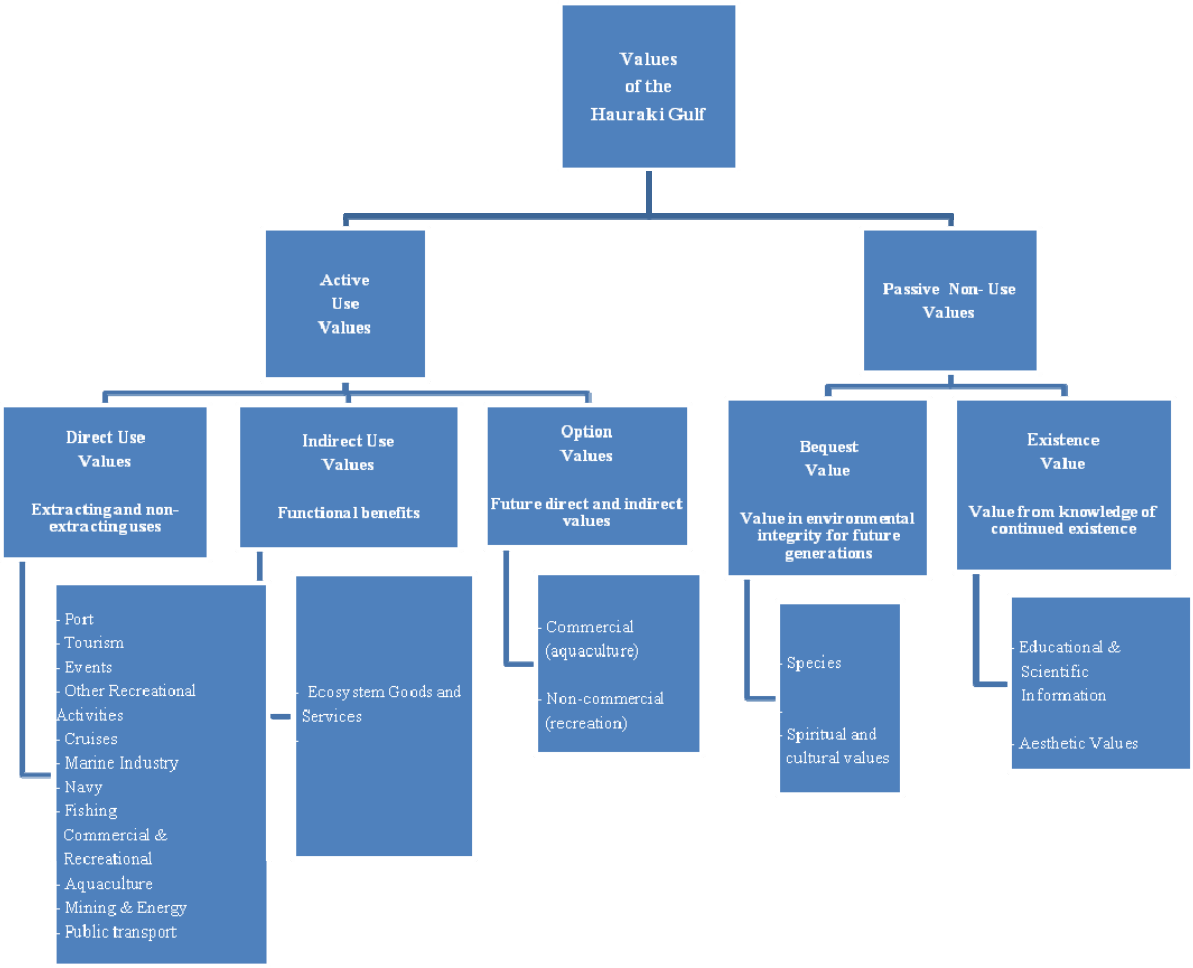

Figure 5. Total Economic Value of the Hauraki Gulf (tentative).

By focusing on the utilities of an ecosystem, the TEV incorporates both market and non-market values - not just the exchange value of natural resources that are traded in the market place.

These utilities range across a spectrum of active use values and passive use values. All values relate to benefits provided to human beings in different time and spatial frames.

3.4.1 Active use values

Active use values are classified as direct use, indirect use, and option values:

- **Direct use values** – these are consumptive and production related (eg, fisheries, water supply). Most of these values can be captured through market prices.
- **Indirect use values** – these are functional benefits that support or protect direct use activities (eg, recreation, water retention, nutrient recycling). Some of these values can be expressed in monetary terms and are market-related.
- **Option values** – these relate to the benefits associated with preserving a natural resource for a potential future direct and indirect use (eg, biodiversity as future source of medicines)

3.4.2 Passive use values

Passive use values are classified as:

- **Bequest value** (eg, preservation for future generations, including spiritual and cultural values).
- **Existence value** (eg, aesthetic, habitat, biodiversity).

3.5 Challenges and choices associated with the TEV framework

Although Phase 1 of this project focused only on some direct and indirect values, applying a TEV framework to a vast and heterogeneous space like the Hauraki Gulf poses a number of challenges and difficult choices that are outlined in the following sections.

3.5.1 Prices and values

Prices are often considered to be synonymous with value because, in a market economy, prices represent individual and social economic preferences and the information they provide drives both the individual and social allocation of scarce resources.

This process - monetisation reductionism - uses a common metric to compare relative value. In theory, it is a good process for static comparison but in practice there are many methodological assumptions which cannot be ignored.

In economic theory there is no agreed explanation of what determines prices. The theory of marginal utility has proposed a convincing answer for the use value, the exchange value, and the labour content.[40] Neoclassical economic theory asserts that, in a market economy, the market price results from the interaction between supply and demand: the price of a good or service reflects the equilibrium between the decreasing marginal utility of consumers and the increasing marginal cost of production of suppliers.

Although prices are the most useful indicators of economic values, their validity as decision tools is increasingly questioned because - in reality - goods and services are not homogeneous and prices are often distorted by other factors such as market failures (eg, externalities), tax, and other government regulations. This means that they do not reflect real marginal utilities and costs.

Possibly, the most striking market failure relates to the environment and the increasing number of situations in which multiple individuals, acting independently and rationally consulting their own self-interest, will ultimately deplete a shared limited resource - even when it is clear that it is not in anyone's long-term interest for this to happen.

Modern societies and economic theory have only recently acknowledged the scarcity of an increasing number of natural resources and entire ecosystems. Until the end of the last

[40] The most commonly quoted example to show the marginal utility explanatory force is the paradox of value (the diamond–water paradox) which uses the apparent contradiction that, although water is essential for human survival and diamonds have very limited practical uses, diamonds command a higher price in the market. The debate over value theory has not yet produced an agreed conclusion and marginal theory has been demonstrated to hold only under very unrealistic and strict conditions and to be affected by a tautological flaw. A notable contribution to this ongoing debate was made by Sraffa, P., 1960. *Production of Commodities by Means of Commodities*. Cambridge University Press.

century, there were few studies of the environment and its ecosystems, and most environmental goods and services where considered infinite or as pure public goods not to be priced.

At present, there is an increasing understanding of the enormous – and sometimes irreparable – negative externalities that economic activities can have on the environment coupled to a growing awareness of ecological phenomena and processes. This is placing scarcity, and therefore value or price, at the core of the analysis of environmental goods and services, and underlining the importance of development sustainability.

This growing understanding of the interactions between market activities and the environment is, in turn, leading to a better understanding of externalities and of policy tools to address market failures; eg, a number of calculation techniques to price non-market environmental goods and services.

However, it is not always possible - or meaningful - to calculate non-market values or prices of ecosystems. Even in the most apparently simple market place, there are numerous challenges and limits in assessing the economic impact of a human activity.

3.5.2 Property rights and goods

Value or prices are strictly related to the property rights they command and the different characteristics of goods with respect to excludability and rivalry.

A private good is typically defined as a benefit that is excludable and rivalrous. These two characteristics imply that the owners of the property right can exclude or prevent others from using the good or consuming its benefits, and that consumption by one prevents consumption by another.

Excludability and rivalry are not necessarily intrinsic and invariable characteristics of a good but they are influenced by rules and regulations as well as technical, social, and cultural conditions. Technological development can alter the capacity of exchange of property rights (eg, online auctions) and the capacity to enforce excludability (eg, encryption).

In a market economy, property rights give some level of authority over a good to an agent (an individual, state, iwi, or community). Property rights can be characterised by:

- duration
- excludability
- transferability
- quality of the title

All of these characteristics can vary and are rarely absolute. For example, right of access to coastal space, foreshore, and seabed is not absolute and the State reserves exclusive rights over aerial or underground resources, independently of their location. Ownership of a property title does not exclude consumption, especially in terms of landscape aesthetics.

Some of these rights result from national jurisdictions; others are determined locally, internationally, or globally.

3.5.3 Market failures and externalities

Market failures affect the determination of market prices, and disrupt the assumption of marginal efficiency of market transactions.[41]
Market failures are often associated with information asymmetries, non-competitive markets, principal–agent problems, externalities, or public goods. Market failures are one of the most powerful justifications for government intervention.[42]

In the context of this project, externalities have particular significance because environmental goods are often public goods and/or have poorly defined property rights.

A negative externality occurs when individual or private marginal costs and benefits differ from social ones. For example, when a cost is not accounted for in balance sheets (as is often the case with air pollution or with a build-up of sediment in estuaries), the marginal social cost of production is higher than the marginal social benefit, leading to excess production and consumption of certain goods.

Conversely, positive externalities occur when the marginal social benefit is higher than the marginal social cost, as the producer of a good cannot capture the entire benefit (eg, education). This means that positive externalities can lead to lower than optimal production of the good (a case for public education).

Under many circumstances, which can be exacerbated by technological development, open access to public goods – such as fish - can produce environmental depletion.[43]

The most common solutions used to address market failure are the creation of implicit or explicit property rights through regulation. This can be done either through prescriptive command and control approaches (eg, limits on input/output/discharge quantities, specified processes or equipment, audits) or by more flexible market-based instruments (eg, taxes, transferable permits or quotas, as in the case of fisheries in New Zealand).

In the context of the Hauraki Gulf, it is possible to check the validity of some of the (often unrealistic) assumptions under which an efficient solution to the problem of externalities could operate.[44] The Coase theorem affirms that if property rights are clearly defined and assigned, externalities such as environmental damages would be internalised and resolved by relying on the private owners being incentivised to conserve resources for the future.[45]

However, in the real world, given the frequent lack of critical knowledge about ecosystems, treating our knowledge as perfect information could be a major mistake. In addition, transaction costs are normally relevant and legal frameworks do not operate efficiently. Therefore, strengthening the markets and creating and strengthening property rights – as in the case of the fishing quota system – could mitigate rather than eliminate environmental problems, especially when scientific knowledge is uncertain.

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[41] The concept of Pareto efficiency.
[42] Government policy interventions (eg, taxes, subsidies, wage and price controls, planning and regulations) intended to correct market failures, carry the risk of government failure (eg, inefficient allocation of resources).
[43] A reference to the essay by Hardin, Garrett, 1968. The Tragedy of the Commons. *Science*, 162.
[44] The assumptions are: (i) property rights can be defined univocally, (ii) people act rationally, (iii) transaction costs (eg, lawyers' bills) are negligible.
[45] Coase, Ronald H., 1960. The Problem of Social Cost. *Journal of Law and Economics*, Vol. 3, October 1960.

3.5.4 Market value timeframes

Monetary values have different timeframes. In the context of this project, the valuation focuses on the value of the benefits produced in and through the Hauraki Gulf that flow in a given period; not on marginal changes or stocks.

Figure 6 shows values over time. The stocks (eg, biomass, value of an infrastructure, or total capital value of Auckland's real estate - officially worth $354 billion in October 2011) are measured at one specific time while the flows are measured over a period of time (eg, annual fish catch, annual value added, yearly depreciation, rent). The potentials are projections in the future (eg, forecast, projected growth).

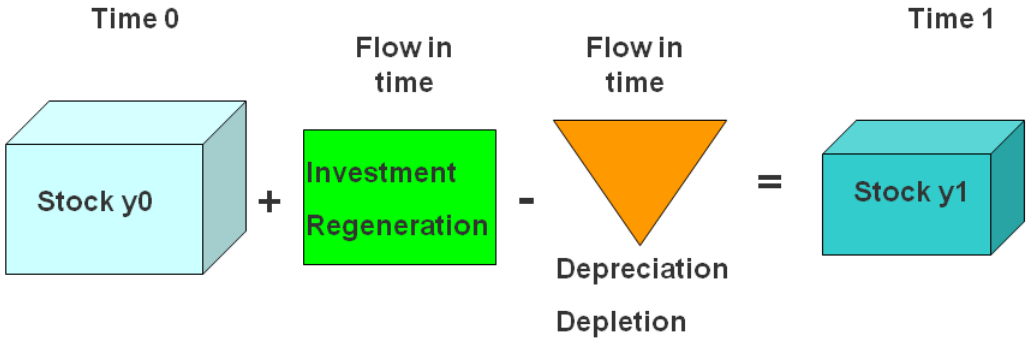

Figure 6. Values and time.

In the context of Phase 1 of this project, the market value flows (eg, value added, GDP) have been considered.[46]

3.5.5 Non-market values

Non-market values have no explicit monetary value or price and, therefore, are not captured by normal economic accounts.[47] Many goods do not have a market value because, even though they form part of markets, they are unaccounted for and are treated as externalities (see Section 3.5.3 for a discussion on market failures and externalities). Examples include climate regulation (an unaccounted benefit) and pollution (a commonly unaccounted cost).

Because ecosystem services are not fully captured in commercial markets, they are often given little or no weight in policy decisions (eg, mangroves mitigate flood risk and therefore property damage but conflict with recreational use and navigational channels). This neglect may ultimately lead to environmental depletion, and undermine the economy and human well-being.

From a general and holistic perspective, the economy is a subset of the environment so the value of environmental benefits and services is at least equal to the value of the economy they support. However, most environmental goods and services are not produced and exchanged through markets meaning that they do not have a price. Consequently, individuals and societies often assign them a zero value. The TEV framework addresses this issue by translating some of those values into the market language of money.

[46] The value of an asset can also be explained by the net benefits it generates; eg, rental property. When forecasts were available, the information was included but not used to compare different activities. Some sources also provide information on the value of stocks, which has been signalled.
[47] A number of techniques are used to assess non-market values and these are discussed elsewhere in this report.

In the context of the Hauraki Gulf's TEV, the non-market values relate mainly to ecosystem benefits, recreation, and cultural and spiritual values.

A number of techniques have been developed to translate some of these values into prices; eg, hedonic pricing and contingent valuation. These techniques try to price the good or service by assessing individuals' maximum Willingness To Pay (WTP) for an improvement in environmental quality, or their minimum Willingness To Accept (WTA) to forego an improvement in environmental quality.

Marine reserves and recreational fishing are two examples where the WTP technique has been used in this study, while hedonic price modelling methodology was used for residential property.

4.0 Preliminary results

4.1 Known and unknown benefits of the Hauraki Gulf

This section presents a summary of the preliminary results obtained through the partial assessment of some economic values of the Hauraki Gulf, both in Auckland and the Coromandel.

These results must be interpreted and used with caution.

Phase 1 of this project aimed to identify the most important economic benefits provided by the Hauraki Gulf, establish whether their economic valuation had already been undertaken using a suitable methodology, present the preliminary results, and identify knowledge gaps. Table 2 summarises the result of this effort to define the economic benefits and discriminate between known and unknowns.

Table 2. List of known and unknown benefits provided by the Hauraki Gulf.

Knowns	Partially unknown (already captured by some of the recreational knowns)	Unknowns and gaps
• Port • Cruise industry • Recreational marine industry • Aquaculture • Fishing : ▪ commercial ▪ recreational ▪ customary (partially) • Tourism • Events	• Boating and other recreational activities (eg, surfing) • Marinas • Transport/ferries[48] • Property values[49] • Marine reserves (partially) • Mining	• Navy[50] • Environmental goods and services not yet accounted for Outside of scope • Option values • Existence values • Bequest values • Cultural values • Social values • Spiritual values

4.2 Current state of knowledge

Phase 1 of this project determined the existence of value assessments and the validity of the methodologies used.

Figure 7 shows a matrix of the values of the Hauraki Gulf that were identified in this study. The vertical axis represents the identified values, while the horizontal axis represents the methodologies used to assess those values.

The values/activities are also related to their valuation methodology. For example:

- Quadrant 1
- Quadrant II groups identified activities for which an assessment methodology has not yet been identified.

[48] The economic impact on transport ferries in the Hauraki Gulf is already captured by the tourism and cruise ships values. However, commuting transport flows are not included and quantified. In 2011, approximately 2 million passengers commuted by ferry every year in Auckland (Auckland Transport) and there is increasing interest in expanding capacity.

[49] Impact of view and proximity to the sea has been estimated.

[50] A study on the economic impact of the Sydney naval bases was done by KPMG, using an economic impact assessment methodology: KPMG, 2011. *Economic Contribution of the Naval Bases in Sydney*. Another similar example is the Canadian Navy's report: *Economic Impact of the Navy on the Hampton Roads Area*, issued in 2008.

- Quadrant III represents the values already assessed.

- Quadrant IV includes identified activities for which an assessment methodology has been identified but not yet applied.

This helped to frame Phase 1 of this project by providing a gap analysis of the existing methods and measurements.

Unknown	**Methodologies**	**Known**
Known Values	**Quadrant II** Boating Marine reserves Property	**Quadrant III** Aquaculture Port Cruise industry Recreational fishing Recreational marine industry Commercial fishing Marine reserves Tourism/events Mining
Unknown	**Quadrant I** Iwi Cultural Social Spiritual Unknown unknowns	**Quadrant IV** Navy Option values Transport/ferries

Figure 7. Total economic valuation of the Hauraki Gulf: current state of knowledge.

4.2.1 Gaps and values not considered

Items that were already identified as being outside of scope were not considered (see Section 2.3).

Table 2 highlights the main gaps that were identified during Phase 1. Some are partially known and could be explored through methodologies (GDP contribution) similar to those already adopted. These are:

- boating
- marinas
- transport/ferries
- the naval base in Devonport
- marine reserves
- mining
- the impact of the Hauraki Gulf on property values (briefly described in Section 4.2.3).

Another important value set which was not been analysed relates to social values of the Hauraki Gulf. These are likely to be particularly significant given the presence of Auckland, the country's largest city, on the shores of the Hauraki Gulf. For example, easy and free access to a healthy Hauraki Gulf environment provides high social, recreational, and cultural values. Because of this availability, households can enjoy the benefits of high environmental quality and amenities by allocating only limited portions of their income to recreational and cultural activities.

Conversely, an increase of environmental degradation and a reduction in the number of public places such as parks, beaches, and reserves would negatively and disproportionately affect those on low incomes, as those with higher incomes can afford to pay and travel more to enjoy these benefits elsewhere. In addition, the need to travel further to access a clean environment would also affect general public welfare and increase the demand for already scarce transport infrastructure.

Finally, some unknowns could be simply unknown.

4.2.2 Values only partially assessed

The values of coastal properties that are close to the sea and/or have a sea view is one of the significant economic impacts of the Hauraki Gulf. It has been only partially assessed at present.

The value of the Hauraki Gulf is embedded in these coastal residential properties located in Auckland and the Coromandel. Hedonic pricing estimation results show the significant impact of water amenity on land price.

This impact increases with the quality of views and decreases with the access distance to the beach. For example, keeping all other variables constant, land of a property on the coastline of the North Shore of Auckland with wide water views could cost, on average, 59 per cent, 48 per cent and 32 per cent more than the land of properties located 2000, 500, and 100 metres away from the coast, respectively.[51]

The topographies of both Auckland and the Coromandel suggest that the value that properties derive from the Hauraki Gulf could probably account for several billions of dollars and could produce an income flow of several hundred million dollars annually.[52]

4.2.3 Assessed values

Figure 8 categorises the benefits and activities based on market and non-market values, and identifies the methodologies that were used to assess their value. The value, in turn, has been interpreted as economic impact and expressed in terms of values added (contribution to GDP).

[51] Rohani, M., 2012. See also Filippova, O., 2008; Samarasinghe, O.E. and Sharp, B., 2008.

[52] Auckland's property was valued at $354 billion in October 2011 by Auckland Council. If (i) approximately 20 per cent of the properties enjoy benefits (view, proximity) provided by the Hauraki Gulf, and (ii) 20 per cent of their value is attributable to that, and (iii) that stock value would be transformed into income by considering a 20-year homogeneous flow, then the result could be $700 million per year, only for Auckland.

	Methodologies	Values /Activities
Market values	Value added + Input Output Analysis Impacts ▪ **Direct** ▪ **Indirect** ▪ **Induced** Multipliers Gross value of catch Gross value	Tourism Recreational Marine Industry Events Aquaculture Port Cruise Industry Commercial Fishing Mining
Non-market values	Hedonic modelling (view and proximity to the sea) Willingness to Pay	Property values Recreational Fishing Marine Reserves -Goat Island

Figure 8. Assessed values and methodologies in the Hauraki Gulf.

It is clear that the vast majority of the benefits are derived directly from the market - tourism, the recreational marine industry, events, aquaculture, the port, the cruise industry, commercial fishing, and mining.[53] This should not be surprising, given the economic focus of Phase 1 of this project.

In some cases, the economic impact of these activities mainly takes into account their direct impact. In other cases the multiplier effects of indirect and induced impacts have also been accounted for through the application of input-output coefficients.[54]

[53] This does not disregard the other values but, rather, is a result of the scope of Phase 1.
[54] For a detailed explanation, see Section 3.2.

For non-market values, contingent valuation (Willingness To Pay) was used for recreational fishing and one marine reserve. For the impact of views and proximity to the sea on property prices, hedonic modelling is being implemented.

For market values, the contributions to GDP of each activity (tourism, the recreational marine industry, and events) was assessed. In some instances (aquaculture, the port, and the cruise industry), multiplier effects were added through input-output modelling.

For commercial fishing, the GDP contribution was calculated from the gross value of catch, while the gross value of production was used to assess mining activities.

4.3 Links between the Hauraki Gulf environment and the economy

This report has gathered together the available information on the environmental benefits associated with the Hauraki Gulf, and linked them to the economic benefits identified for the Hauraki Gulf.

Chapter 1 identified the ecosystem goods and services provided by the Hauraki Gulf and described the benefits derived by humans.

Table 3 shows a tentative schema of some of these pathways - the complex relationships between environmental goods and services and the economic activities analysed in this report.

Some groups of activities in Table 3 relate mainly to renewable ecosystem goods and services while others (port and mining) depend, respectively, on the physical infrastructure and non-renewable resources provided by the environment. This difference could imply that the latter group does not see ecological quality as a critical factor of their business model (often referred to as value proposition[55] in the business community).

The group of activities in Table 3 share a common interest in protecting the environment but each has a different emphasis and perspective, as they recognise that the flow of ecological goods and services is a crucial input to their economic activity and lies at the core of their value proposition.

[55] A value proposition can be defined as a promise of value to be delivered by a firm and the corresponding belief from the customer that value will be experienced.

Table 3. Ecosystem goods and services and activities in the Hauraki Gulf.

<table>
<tr><th colspan="2">Environmental goods and services[56]</th><th>Benefits</th><th>Feedback</th></tr>
<tr><td colspan="2" rowspan="3">• Supporting goods and services
• Regulating goods and services
• Provisioning goods and services
• Cultural goods and services</td><td>Commercial fishing</td><td>Extractive[57]</td></tr>
<tr><td>Aquaculture</td><td>Non-extractive but invasive[58] and exclusive</td></tr>
<tr><td>Recreational fishing</td><td>Partially non-extractive[59]</td></tr>
<tr><td colspan="2">• Recreational (non-extractive*
• Social
• Cultural
• Property values
• Public amenities</td><td>Non-extractive</td></tr>
<tr><td rowspan="2">• Physical structure
• Exhaustible resources</td><td>Shoreline and storm protection</td><td>Port
Transport
Navy</td><td>Partially extractive (dredging),[60] invasive and exclusive</td></tr>
<tr><td>Minerals and sand</td><td>Mining</td><td>Extractive, invasive and exclusive</td></tr>
</table>

*Includes tourism, events, marine reserves, boating, the recreational marine industry and the cruise industry.

This schema aims to highlight how the economy and the environment are intimately intertwined. It shows how many different sets of ecological goods and services contribute to the realisation of the human benefits associated with those activities which, in turn, have different feedbacks on the environment.

[56] See Table 1.
[57] Extractive means that an activity removes a natural resource from the environment (eg, fish, sand).
[58] Invasive and exclusive, in this context, describe an activity that occupies (or is confined to) the marine space in an exclusive and permanent way that prevents the marine space from being used by other activities (eg, marinas, aquaculture farms).
[59] Partially non-extractive, as recreational fishers value not only the catch but also the experience and, increasingly, as signalled by the Ministry of Primary Industries, they catch and release.
[60] Dredging is classified as partially extractive because it is not a continuous activity.

Table 3 provides a visualization of the links between the environment and economic activities assessed in this report. For example, the reliance of fishing on the availability of fish relates not just to the provision of biomass but is supported by a complex and intertwined set of other ecological goods and services that are often treated as a hidden input and not factored into the economic valuation.

This implies that these hidden goods and services are often disregarded in the market space (in economic terms they are externalities) and could be over-exploited, leading to environmental degradation and widespread environmental and economic damage.

Economic activities differ also in terms of their feedback on the environment and this is suggested in Table 3. For example, some economic activities such as fishing are extractive (although less so for recreational fishing as this also realises benefits from recreational aspects that are not strictly related to the catch), while other activities (eg, aquaculture, marinas, ports) are non-extractive but invasive and exclusive because they occupy an area and prevent other activities/benefits from being realised at that site.

4.4 Monetary values of assessed economic activities

Phase 1 of this project aimed to investigate the direct interaction between the economy and the Hauraki Gulf and to quantify the benefits in terms of value added.[61]

Table 4 presents the monetary values of each of the activities assessed so far. To provide a broader picture (to which all the mentioned caveats also apply), the employment generation assessments have been included too.

It is important to note these values are not homogeneous and comparisons should be made with caution. These values:

- do not refer to the same year
- present various inconsistencies
- are the result of different valuations, techniques, and assumptions
- are not necessarily mutually exclusive.[62]

It is likely that the values underestimate the Hauraki Gulf contribution to economic activity, given that some values have not been estimated, and the main contributors (eg, tourism) are likely to have been underestimated.

[61] See Chapter 2.
[62] To give an order of magnitude, the total of the assessed values could be roughly 4.2 per cent of Auckland's 2010 GDP.

Table 4. Assessed economic activities in Auckland and the Hauraki Gulf.

	Year	Direct value added $\$_{2011}$ million[1]	Indirect + induced value added $\$_{2011}$ million[1]	Total value added $\$_{2011}$ million[1]	Employment[2]	
Tourism	2008	656	281	937	15,742	FTEs
Marine recreational[3]	2008	na	na	550	5781	FTEs
Recreational fishing	2010	na	na	81	na	
Aquaculture[4]	2008/ 2010	49	50	99	939	FTEs
Commercial fishing[5]	2010	41	na	41	1183	FTEs
Ports of Auckland	2008	113	143	257	2027	ECs
Cruise industry	2009	35	34	69	928	ECs
Sand mining	2010	na	na	10	100	FTEs

1. Direct impacts are initial injections of revenue and expenditure that accrue to that specific sector; Indirect impacts are the net increase of economic activity generated by the provision of goods and services to the study sector; Induced impacts are the net increase of economic activity due to increased household expenditure in the study sector.
2. Employment Counts (ECs) are not directly comparable to Full-Time Equivalents (FTEs) as they count equally both full- and part-time jobs. Therefore, they tend to be higher than FTEs.
3. Value added includes some indirect impacts within the marine cluster but not induced impacts.
4. Values for Auckland refer to 2008; values for the Waikato refer to 2010.
5. Including processing.

These values indicate that tourism is the major contributor, followed by the recreational marine cluster, the Ports of Auckland, commercial fishing and aquaculture, and recreational fishing and the cruise industry.

It is likely that the value of tourism is underestimated as it accounts only for non-residents (foreigners or other nationals) and excludes tourism expenditure of the Hauraki Gulf residents even though almost 35 per cent of the New Zealand's population resides around the Hauraki Gulf.

The vast majority of the assessed economic values can be considered as related to recreational activities, despite the benefits to residents having been largely ignored.

From both an holistic and ecological perspective, these preliminary results show that the Hauraki Gulf's economic activity is only minimally the result of an algebraic sum of competing values or a space where the focus has to be on conflicts and trade-offs.

The tentative picture provided by this exercise shows that not only does the environment underpin all the values realised by humans, but that the relationship between the economy and the environment in the Hauraki Gulf is mainly synergistic.

This means that a thriving ecosystem is necessary to support the economy, while a thriving economy is necessary to realise the vast untapped economic potential of the Hauraki Gulf and is also compatible with an improved environmental state.

4.5 The effect of an eco-cluster

Porter (1998) defined an eco-cluster as: "*geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (for example universities, standard agencies, and trade associations) in particular fields that compete but also cooperate*".

He also points out that: "*a cluster is a form of network that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions*".

These preliminary results show that the Hauraki Gulf hosts a cluster of economic activities that have the environment at the very core of their value proposition. These economic activities also share a common interest in protecting the environment as they have a critical dependence on the flow of ecological goods and services provided by the Gulf. They could also increase their value through deeper collaboration with each other. Therefore, they could be defined as an eco-cluster.

The Hauraki Gulf has always been one of the most powerful economic, environmental, social, and cultural clusters for Auckland and the Coromandel. The economic relevance of the Hauraki Gulf could grow if its ecosystems are preserved and the potential of an eco-cluster is identified clearly by both the private and public sectors.

As the indentified gaps in the current state of knowledge refer mainly to other recreational, social, and cultural values, this preliminary conclusion is reinforced and the vision of the Hauraki Gulf as an eco-cluster of values is even brighter.

In summary, the Hauraki Gulf Forum vision of the Hauraki Gulf could be paraphrased as a place which is '*celebrated and treasured*', '*thriving with fish, shellfish and kaimoana*', has a '*rich diversity of life*' supporting a '*sense of place, connection and identity*' and therefore supports a '*vibrant economy*'.

4.6 Recommendations

This section aims to set the foundation for the future direction of this project.

4.6.1 Solutions to double counting

The problem of double counting the economic impact of related activities is amplified by the application of the wider assessment methodology based on direct, indirect and induced economic impacts, as described in Chapter 3.

A preliminary solution, to avoid duplication and to partially overcome the lack of information, was achieved by adopting restrictive assumptions when assessing certain activities or even, for events, to not count their effects and instead assume that these were already captured elsewhere in this report. This preliminary solution needs more careful exploration in the future.

4.6.2 Ecological dynamics and the relation to the economy

More research is recommended to investigate the links between the economy and ecological goods and services in more depth; eg, by including agricultural sectors such as dairying, horticulture, and viticulture. Although this report has started an exploration and discussion of some relevant aspects, a more detailed understanding of the ecological dynamics of the Hauraki Gulf and of their relation with the economy is needed.

4.6.3 Links between environmental services and economic activities

This study provided a valuation of environmental benefits (where available) and also highlighted the links or interdependencies between environmental services and the economic activities that were assessed. The results show that ecosystems are not economic externalities but are often the fundamental source of necessary intermediate or final services or goods.

As environmental services and benefits are the ultimate foundation of every market activity taking place in the Hauraki Gulf, this complex web of relationships needs to be explored further in the future.

4.6.4 Improved understanding of the Hauraki Gulf eco-cluster

A clearer understanding of the Hauraki Gulf eco-cluster should be a future objective.

5.0 Ports and freight and the Hauraki Gulf

5.1 Introduction

The Hauraki Gulf and the Waitemata Harbour provide Auckland with a unique natural feature that led to the presence of human settlements. The first settlers can be traced back to the fifteenth century when Maori settled in Tamaki Makaurau, calling it the place '*where canoes may be tethered safely*'.

The quality of the Auckland Port was the main reason why Auckland became the first capital of New Zealand after the Treaty of Waitangi. In 1871 the Auckland Harbour Board was established by an Act of Parliament to administer the port, and in 1875 the Auckland Harbour Foreshore Act was introduced, giving the Board more than 5000 acres of the Waitemata Harbour seabed. Since then, the strong demand for better port facilities has driven the development of substantial infrastructures and reclamation works around the foreshore.

Technological development drove another major change in the 1960s and 1970s, when the port was transformed from a labour-intensive operation into a more capital-intensive operation. The first container ship, *Columbus New Zealand*, arrived in 1971 and was unloaded using the first ship-to-shore container crane in New Zealand.

The port management and administration structure changed again in 1988 when the Port Companies Act (1988) established Ports of Auckland Limited (POAL). Shares in the company were listed on the New Zealand Stock Exchange, with 80 per cent being held by the Auckland Regional Authority and 20 per cent being held by the Waikato Regional Council.

5.2 Activities at the Ports of Auckland Limited

Recently, Auckland Port has added new container cranes, focused on rail and supply-chain solutions, and opened the inland Wiri Port in 2005. Reclamation work also continued, with a $60 million project to deepen the shipping lane and extend the terminal by 9.5 hectares being completed in 2007. The eastwards expansion of Auckland Port has allowed more than 70 hectares to the west to be used for alternative purposes since 1996, providing for the on-going Wynyard Quarter redevelopment.

After delisting from the New Zealand Stock Exchange in 2005, POAL is now wholly owned by Auckland Council Investments Limited, a Council-controlled investment company. POAL's profits are reinvested by Auckland Council to support infrastructure projects.

POAL is the most significant New Zealand port by value of trade handled.[63] In 2010 it handled cargo equivalent to 13 per cent of the country's total GDP – twice as much as any other New Zealand port. Total container volumes represent 63 per cent of the Upper North Island container trade, 51 per cent of the North Island container trade, and 37 per cent of New Zealand's total container trade.

The Multi Cargo Facility handles 2.8 million tonnes of bulk and breakbulk (non-containerised) cargo each year. This includes more than 70 per cent of the total vehicle imports to New Zealand. POAL also provides towage, pilotage, and linesman services to more than 1400 ship calls each year.

Auckland is the country's premiere exchange port for cruises, with 79 cruise ship calls in 2010/11 and 97 cruise ship calls projected for 2011/12.

[63] Ports of Auckland website: http://www.poal.co.nz

As New Zealand is a highly open economy, trade (both imports and exports) is hugely important and accounts for more than 40 per cent of GDP. The majority of New Zealand's trade relies on sea freight (82 per cent by volume, 99 per cent by weight). Auckland Port accounted for 50 per cent of New Zealand's imports and 24 per cent of New Zealand's exports in 2007. Overall, Auckland Port accounted for around one-third of New Zealand's annual trade.

Figures provided by Covec[64] show that around 1700 freight ships of various kinds call at Auckland (this includes 2 per cent at Manukau[65]) each year. Their freight types and volumes consist of:

- **Containers** - volumes into and out of Auckland rose 60 per cent - from 525,000 TEU containers in 2000 to 841,000 TEU in 2008, and then to 894,000 TEU containers in 2011, with average ship sizes showing a corresponding rise.[66]
- **Breakbulk cargoes** - volumes are fairly steady around 3.5 million tonnes in 2010/11, with about 75 per cent being imports (mostly fuel oil and raw materials for construction and engineering such as sand, cement, steel, and gypsum).
- **Vehicles** - 160,000 were imported in 2008.

Based on these figures, freight tonnages are estimated at:

- 8.4 million tonnes of container cargo[67] (average net weight of a container is 10 tonnes)
- 2.2 million tonnes of breakbulk cargoes
- 1.6 million tonnes (approx) of vehicles by weight (approx 1 tonne/vehicle).

Consequently, total freight volume is around 12 million tonnes[68] with the following percentage splits based on freight tonnage:

- Containers: 70 per cent
- Breakbulk cargoes: 17 per cent
- Vehicles: 13 per cent.

5.3. Methodologies

The following sections review the existing valuations of benefits provided by POAL. Three methodologies have been used to estimate the value (economic impact) of the port, namely:

- core activities – direct and flow-on
- facilitated trade
- the effect of removing the port.

An evaluation of the value of the port assets is also included.

[64] Covec, 2010. *Economic Impact of the Ports of Auckland, for POAL (as at 2008)*
[65] Market Economics Limited, 2011b. *Economic Role of the Ports of Auckland Limited 2010, 2021 and 2031*. A report prepared for the Ports of Auckland Limited, 11 October 2011.
[66] TEU (twenty-foot-equivalent containers).
[67] Plus tare weight of the empty containers themselves at 2 tonnes each is another 1.7 million tonnes, so total gross tonnage is 10 million tonnes.
[68] Net (excluding the empty weight of the containers themselves).

5.3.1. Methodology 1: Core activities - direct and flow-on[69]

In 2008, POAL commissioned Covec to estimate the overall economic impact of Auckland Port. The results showed the total economic impact on the Auckland region was around $144 million of GDP in 2008. This comprised:

- $100 million of direct value added (GDP)
- $44 million of GDP from flow-on effects.

POAL's gross output was assumed to equal its total revenue ($\$_{2008}$169 million) and then the flow-on effects were added. The flow-on effects were a combination of the:

- indirect effects on other industries (eg, heavy transport, warehousing) that receive a stimulus from supplying POAL
- induced effects of additional household spending by people who are employed as a result of the direct and indirect effects.

In 2011, Market Economics Limited (MEL) recalculated both the direct and flow-on impacts of POAL in 2010, with similar results for direct effect but a much higher estimate for the flow-on - and therefore total - effects.

MEL calculated that POAL's port activity (excluding cruise ships) created:

- total direct output of $207.6 million a year
- direct value added to the Auckland economy of $109.1 million, sustaining 652 jobs (Employment Counts) a year
- flow-on effects from direct value added that generated a further $138.5 million in value added.

These calculations show that the total impact of port activities on the Auckland economy was $247.6 million in value added and the generation of 2027 jobs.

Table 5. Direct and flow-on impacts of POAL; MEL 2010 versus Covec 2008. (Source: Covec, 2008b; MEL, 2011a.)

	Gross Output		Value Added (GDP)		Employment Counts (ECs)	
	Covec$_{\$2008}$	MEL $_{\$2010}$	Covec$_{\$2008}$	MEL $_{\$2010}$	Covec$_{2008}$	MEL $_{2010}$
Direct	$169 m	$208m	$100 m	$109m	568	652
Flow-on	$101 m		$44 m	$138m	434	1375
Total	$270 m		$144 m	$248m	1002	2027

Note: Covec's benefits do not include trade facilitation or net effects on national economy.

[69] Market Economics Limited, 2011b. *Economic Role of the Ports of Auckland Limited 2010, 2021 and 2031*. A report prepared for the Ports of Auckland Limited, 11 October 2011. (This report uses 2010 data, so all figures are in $\$_{2010}$.)

Future Projections[70]

MEL has projected that POAL's direct output (excluding cruise ships) will grow from $207.6 million in 2010 to between $276.6 and $333.5 million by 2031: an increase of 30–60 per cent.

The projection is based on their Economic Futures Model (an input-output model of the Auckland economy) and assumes that transport and storage activity grows at the same rate as the increase in trade value. There are proposals for long-term expansion and a study is considering the future form of freight transport in the upper North Island.

5.3.2 Methodology 2: Facilitated trade[71]

In 2011, MEL considered a wider impact of Auckland's ports, using 2010 data and including facilitated trade as well as core activity.

POAL is the most important port in New Zealand in terms of total freight value (calendar 2010, $\$_{2010}$). It handled $26.4 billion of exports and imports, 37 per cent of New Zealand's total seaport trade, and 31 per cent of trade across all ports (including airports).

In 2010 (to the year ending June 2011), POAL handled more than 894,000 TEU (36 per cent of the national total and the largest in New Zealand).

Much of the freight that flows through Auckland goes to, and comes from, other parts of New Zealand so only a portion is associated with the Auckland economy.

MEL estimated that, in 2010, international trade moving through POAL (facilitated trade) that was associated with the Auckland economy generated $17.8 billion in gross output for Auckland, representing value added (GDP) $4.9 billion for Auckland. Flow-on effects generated a further $7.3 billion of value added (GDP) for Auckland, for a total of $12.2 billion of value added (GDP) from facilitated trade.

The role of Auckland Port in the economy (core port activity plus facilitated trade) is $12.4 billion of value added, sustaining the equivalent of 187,000 jobs.[72] This includes $248.0 million of core port activity and $12.2 billion from trade (value added, 2010, $\$^{2010}$).[73]

Auckland Port, therefore, has a significant role in facilitating almost one-quarter (22.1 per cent) of the total Auckland economy.

POAL also handles international freight moving to and from other parts of New Zealand. The total role of POAL on the national economy (core port activity plus trade role, 2010) helped to facilitate $21.4 billion in value added and 335,000 jobs (excluding cruise ships).

Table 6. Direct and flow-on impacts of POAL in 2010. (Source: MEL, 2011b.)

	Value added GDP $\$_{2010}$ billion	Facilitated Auckland employment	Facilitated national GDP $\$_{2010}$ billion	Facilitated national employment
Direct	4.9			
Flow-on	7.3			
Total	12.2	187,000	21.4	335,000

[70] Market Economics Limited, 2011b. *Economic Role of the Ports of Auckland Limited 2010, 2021 and 2031*. A report prepared for the Ports of Auckland Limited, 11 October 2011.
[71] Market Economics Limited, 2011b. *Economic Role of the Ports of Auckland Limited 2010, 2021 and 2031.* A report prepared for the Ports of Auckland Limited, 11 October 2011. (This report uses 2010 data, so all figures are in $\$_{2010}$.)
[72] Excluding cruise ships, which are part of POAL's port activity but not part of the freight activity addressed in this section.
[73] Excluding cruise ships, which would directly and indirectly add $50 million extra GDP for a total of $298 million GDP and 800 extra jobs.

5.3.3 Methodology 3: Effects of removing Auckland Port

In 2011 MEL examined the effect of removing Auckland Port.[74]

They assumed that almost all (96–97 per cent) of POAL's international freight would be diverted through the Port of Tauranga, with a corresponding cost rise (mostly land transport costs) of $18/tonne for POAL's imports and $30/tonne for POAL's exports. This equates to 0.8 and 1 per cent of the value of the imports and exports respectively. It would also directly reduce the volumes traded by 0.4–1.6 per cent for imports and 2–5 per cent for exports (low- and high-responsiveness estimates, respectively).

Depending on the responsiveness scenario that is chosen, removing Auckland Port would cause an annual reduction in trade activity of between $301 million to $874 million in the Auckland area (see Table **7**). It is estimated that the impact on trade if Auckland Port was removed would range between $227 and $660 million worth of economic activity (GDP) in the Auckland economy. This equates to some 3480 to 10,109 jobs in Auckland.

The medium-responsiveness scenario shows a direct reduction of $587 million in Auckland's trade activity (gross output), leading to a $444 million reduction in Auckland's GDP and 6795 job losses. This represents around 0.6 per cent of productive economic activity and employment in the Auckland economy.

Table 7. Estimated effect of removing Auckland Port. (Source: MEL, 2011b.)

Scenarios/Economic Activity	Low	Medium	High
Direct effects			
Gross output ($\$_{2010}$ million)	301	587	874
GDP or value added ($m)	90	176	262
Employment (ECs)	1251	2442	3634
Flow-on effects			
GDP or value added ($\$_{2010}$ million)	137	267	398
Employment (ECs)	2230	4353	6476
Total impacts			
Gross Domestic Product ($\$_{2010}$ million)	227	444	660
Employment (ECs)	3480	6795	10,109

In addition, POAL's core activity would be removed. In 2010, directly and indirectly, this generated $248 million in value added (GDP) and supported 2000 jobs for trade activity, plus $50 million in value added (GDP) and 800 jobs for the cruise industry.

The overall impact of removing POAL (including cruise ships) from the Auckland economy would include a combination of both trade and core impacts, as shown in Table 8

[74] Market Economics Limited, 2011a.

Table 8. Impact of removing POAL under the medium-responsiveness scenario, including cruise ships. (Source: MEL, 2011b.)

	Trade impact	Core impact	Total impact
Direct output ($\$_{2010}$ million)	587	258	845
Direct GDP ($\$_{2010}$ million)	176	132	308
Flow-on GDP ($\$_{2010}$ million)	267	166	434
Total GDP ($\$_{2010}$ million)	444	298	742
Total employment	6795	2818	9613

5.4 An economic valuation of the port assets[75]

If POAL ceased to operate, most of its assets (excluding the effect of the 2–4 per cent reduction in trade) would need to be duplicated in Tauranga in the short- to medium-term.

POAL has 55 hectares of waterfront land valued at a quarter of a billion dollars ($20 million a year at 8 per cent yield). If rezoned, this is potentially worth substantially more for alternative uses. Conversely, it has plant and equipment valued at $350 million ($30 million a year excluding depreciation), some of which could probably be sold but much is a sunk cost.

The net book value of POAL's property, plant, and equipment was $604 million at 30 June 2011, excluding intangible assets and investment properties. This net book value is obtained after deducting $145 million of depreciation so the full replacement cost would be $750 million.

Of the total, $260 million is for land, based on a valuation model determined by reference to its highest and best-use, subject to current zoning. (Market evidence regarding the value of industrial land within the wider Auckland area is $150–$1350 per m^2. The average price for the 55 hectares is $450 per m^2.)

However, the net cost of the transfer would be much less because the Auckland assets would have a resale value. The movable equipment would be needed in Tauranga while the land - and possibly the buildings - would have other uses on Auckland's waterfront. Nevertheless, one-off moving costs, particularly for the plant and equipment, are likely to be incurred.

In the longer-term, the cost of replacing capital assets is already included as part of the annual output and value added (GDP) of the core activity.

5.5 Concluding remarks

A large proportion of Auckland's economy depends on international trade so the facilitating role of Auckland Port goes well beyond the value added, directly and indirectly, by its core handling activity, even when indirect and induced flow-on effects are included. However, even when this minimalist approach is adopted, as with methodology 1, this estimate still corresponds to POAL adding $250 million value per year to Auckland's GDP and 2000 jobs.

- **Methodology 1** ignores the importance of trade so underestimates the economic role of POAL.
- **Methodology** 2 assigns to POAL all the values facilitated by its related trading activities so overestimates the value of the POAL because it does not allow for any alternative diverted scenario.

[75] Ports of Auckland Financial Report, 2010–2011.

- **Methodology 3** estimates the consequences of diverting all Auckland's maritime trading flows though the Port of Tauranga, and could be the best estimate of the overall impact of Auckland Port (assuming the validity of an input-output multiplier approach). Without POAL, most of Auckland's freight could be re-routed through Tauranga but the extra transport costs would reduce Auckland exporters' competitiveness by 2–5 per cent. It could also depress the Auckland economy by nearly $700 million per year of value added (GDP), with a total loss of 9000 jobs in Auckland, although 2000 core port jobs would transfer to Tauranga and generate $250 million of value added (GDP) there.

However, when considering the scope of this project, methodology 1 (as implemented by MEL to include national effects) was adopted to value POAL. This choice was based on two main considerations:

- methodology 1 is also used to value other sectors and activities
- the closure of Auckland Port is not under consideration.

Therefore, the figures in Table 9 will be used to aggregate the value of POAL to the total economic value of the Hauraki Gulf.

Table 9. Direct and flow-on impacts of POAL. (Source: MEL, 2011a.)

	Gross output $\$_{2011}$million	Value added (GDP) $\$_{2011}$million	Employment (ECs) 2008
Direct		113	652
Flow-on		143	1,375
Total	216	257	2,027

6.0 Cruise ships and the Hauraki Gulf

6.1 Introduction

Auckland is New Zealand's main national and international transport hub and also has the country's largest variety of urban services and amenities. Both Auckland Airport and the Ports of Auckland Limited (POAL) are essential partners for the cruise industry. As a result, Auckland is the country's premiere exchange port for cruises, hosting 70 or more calls each year. It is also New Zealand's only winter cruise season port.

Auckland Port is used for stopovers and also for embarking and disembarking. This generates additional opportunities for Auckland businesses to capture pre- and post-cruise tourism activities.[76]

Most of the provedoring (provisioning of food and drink), bunkering (refuelling), and airline spend by cruise passengers in New Zealand also takes place in Auckland.

Despite all of these factors, cruise passengers do not spend most of their time in Auckland while in New Zealand. Most cruise passengers only transit from New Zealand ports.

6.2 Structure of the Auckland cruise industry

As the main international transport hub and the major city of New Zealand, Auckland is the country's main embarkation port for people joining cruises.

Three-quarters of cruise activity (weighted by expenditure) relates to large vessels (Gross Registered Tonnage (GRT) over 50,000 tons).[77] Almost all transit passengers travel on large vessels, which account for nearly 90 per cent of port days. Therefore, port facilities need to be able to handle large vessels.

The proportion of exchange passengers (those who are embarking, disembarking, or both) travelling on large vessels is around 65 per cent for international passengers and only 10 per cent for domestic exchange passengers, as most New Zealanders are travelling on smaller vessels.[78]

Most of the domestic passengers (New Zealand residents on a cruise) take winter cruises to the Pacific.[79] They contribute less than 5 per cent of port days for New Zealand ports as a whole (25,000 out of 833,000) but make up more than 10 per cent of Auckland's port days (14,000 out of 130,000) as shown in Table 10.

Crew comprise 30 per cent of port days for both Auckland and New Zealand. This means that for every 100 passengers in port, there are more than 40 crew.

International passengers account for 60 per cent of Auckland's cruise passengers but only 15 per cent of their total time in New Zealand is spent in Auckland. Domestic passengers (New Zealand residents on a cruise) spend 60 per cent of their New Zealand port days in Auckland.

[76] Covec, 2008a, calculated that the economic impact of each ship for the local economy in 2008 was around $1 million.
[77] GRT relates not to actual weight but to volume: a vessel ton is 100 cubic feet.
[78] Market Economics Limited, 2010c.
[79] For New Zealand as a whole, in the year 2009/10.

Table 10. Port days for Auckland and New Zealand, 2009/10 season. (Source: MEL, 2010c.)

	International passenger	Domestic passenger	Crew	Total person days	Ship days
Auckland	76,919	14,442	38,811	130,172	94
New Zealand	555,124	24,612	253,242	832,978	535

The vast majority of cruise passengers and crew embark or disembark (or both) in Auckland when cruising in New Zealand (see Table 11).

More than 60 per cent of cruise visitors to Auckland Port (measured in port days) are in transit (eg, they embark in Hawaii, travel through New Zealand, and disembark in Sydney) rather than embarking or disembarking in Auckland. In contrast, the national percentage of only transiting passengers is much higher, at more than 90 per cent.

Table 11. Passenger and crew activity (port days) for Auckland and New Zealand, 2009/10 season. (Source: MEL, 2010c.)

	Embarking	Disembarking	Transit
Auckland	31,390	32,704	133,104
New Zealand	32,616	33,818	836,482

Although Auckland represents the major hub in New Zealand for cruise passengers, its share of days that passengers and crew spend in New Zealand is only around 20 per cent.

The Hauraki Gulf islands (see Table 12) do not appear to be a significant attraction for major cruise ships. They attracted less than 1000 cruise ships port days in 2010, even in transit, which is less than 1 per cent of Auckland's yearly total port days.

Projections indicate a sizeable, but volatile, increase in visitors to Mercury Island (up to 4000 port days in 2011) and to Waiheke Island (up to 1000 in 2012). The only two other islands visited by cruise ships are Kawau Island and Great Barrier Island although visitor numbers are very small as these islands are not targeted by major cruise ships.

Table 12. Vessel and person stop days. (Source: MEL, 2010c.)

	Vessels			People		
	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12
Auckland	82	111	159	29,688	184,956	285,189
Waiheke Island	-	1	4	-	35	972
Kawau Island	6	1	-	222	148	-
Great Barrier Island	6	1	-	263	35	-
Mercury Island	2	2	-	156	3979	-
New Zealand	535	595	794	832,978	1,052,450	1,646,768

6.3 Methodology

In October 2010, Market Economics Limited (MEL) prepared a study for Cruise New Zealand (CNZ) which estimated the overall economic impact of the cruise industry on various regions of New Zealand, including Auckland.[80]

MEL calculated the total impact on the Auckland region in the 2009/10 season, comprised from the direct value added (Gross Regional Product, or GRP) plus indirect and induced (flow-on) effects. Their methodology mirrored that used for the valuation of the other market activities in the Hauraki Gulf. It is based on a MEL input-output model and is outlined below:

1. Auckland's share of national cruise activity is identified and split into three categories that will be defined in detail in the next sections. These are:

    - **cruise vessel-related** (eg, port costs, bunkering)
    - **cruise passenger-related** (eg, retail expenditure on shore, sightseeing)
    - **cruise crew-related** (eg, retail, recreation).

2. The cruise industry's gross output in Auckland is assumed to equal its total revenue (this would include, for example, the airfares paid by passengers to reach the embarkation port).
3. Overseas payments for airfares and ship fuel are deducted on the assumption that most of this spending flows offshore to purchase goods and services overseas. The result is an adjusted figure approximating to the local component of direct expenditure.
4. After these net revenues have been calculated, intermediate goods and services are deducted to consider only the value-added component.
5. Flow-on effects are then added. These are the sum of the value added of indirect effects on other industries (eg, transport, warehousing) that receive a stimulus from supplying the cruise industry, plus the induced effects of additional household spending by people employed as a result of the direct and indirect effects.
6. The final result gives the total regional value added (GRP) that can be attributed to the cruise industry and the jobs that it creates.

The following sections analyse the component parts of direct expenditure from the cruise industry in detail.

6.3.1 Cruise vessel-related expenditures

This covers all expenditure related to the cruise and the operation of the cruise vessel.

It includes the physical presence of the ship and the associated costs, as well as cruise-related passenger and crew activities (activities that are attributable directly to cruises in New Zealand). In particular, it includes:

- spend by vessels on ship-specific expenses associated with running, berthing, and maintenance such as port costs (eg, berthage, stevedoring, port fees), marine expenses, bunkering (fuel), and maintenance
- spend on flights to enable passengers to join the cruise
- cruise passenger spend on pre- and post-cruise packages and accommodation booked with the cruise

[80] Market Economics Limited, 2010c.

- spend by the cruise lines on crew-related expenses such as crew exchanges, crew accommodation, and re-positioning flights to move crew to and from New Zealand
- spend on provedoring and re-provisioning for all passengers and crew while on board
- spend on onboard entertainment.

6.3.2 Cruise passenger-related expenditures

This covers all incidental expenditure by passengers that occurs as a result of a cruise. It is not necessarily part of the cruise itself or directly tied to the activities of the cruise.

It includes passenger-related expenditure such as:

- all onshore retail expenditure
- all onshore café and restaurant expenditure
- sightseeing day trips and excursions, excluding those already booked with the cruise
- other onshore services such as medical expenses.

6.3.3 Cruise crew-related expenditures

This includes spending by the crew while in port, and before and after cruises, on items such as:

- retail goods
- personal services
- casinos
- recreational activities
- transport.

It excludes spending by the cruise lines that is related to crew changes.

6.4 Economic value assessment

MEL calculated that, during the 2009/10 season, the direct gross revenue from the Auckland cruise industry was $167 million, including airfares and bunkering, as previously defined in the methodology. This equates to around 60 per cent of the total cruise industry direct spend in New Zealand. However, a significant portion of this expenditure (60 per cent for Auckland) flows offshore to purchase imports that do not contribute to regional economic activity.

Passenger and crew spend closely reflects the international tourist pattern, as it is concentrated mainly in the port cities. It is focused on entertainment, sightseeing, retail, and hospitality, with less emphasis on accommodation when compared to other tourists.

Cruise line and agent spend is more focused on the major interchange ports (notably Auckland) and primarily on berthage, as well as servicing and maintaining the needs of the ship and passengers while on the cruise.

The total injection into Auckland's economy was $66.6 million of value added in 2009/10 (see Table 13).

The cruise industry also generated 928 Employment Counts[81] (ECs); 472 directly, and 456 through the indirect and induced effects on other sectors.

Table 13. Auckland region direct, indirect, and induced impacts of cruise ships for Auckland, 2009/10 season. (Source: MEL, 2010d.)

	Gross output $\$_{2009}$ million	Regional GDP $\$_{2009}$ million	Employment ECs
Direct expenditure	167.0		
Direct expenditure – adjusted	69.3		472
Flow-on (indirect plus induced)	68.3		456
Total	137.6	66.6	928

The cruise industry's impact on Auckland's economy (GRP) is shown in Table 14 and reflects the three main expenditure categories previously defined in the methodology:

- cruise passenger-related expenditure = $\$_{2009}$40.2 million (60 per cent of the total impact on GRP)
- cruise vessel-related expenditure = $\$_{2009}$20.7 million (30 per cent)
- cruise crew-related expenditure = $\$_{2009}$5.8 million (10 per cent).

Table 14. Components of the direct, indirect, induced, and total impacts of cruise ships for Auckland, 2009/10 season, $\$^{2009}$ million. (Source: MEL, 2010c.)

	Vessel	Passenger	Crew	Total
Direct expenditure	96.5	64.6	5.9	167.0
Less airfares and bunkering	75.2	22.3	0.1	97.7
Direct expenditure (adjusted)	21.3	42.3	5.8	69.3
Flow-on (indirect plus induced)	15.7	46.4	6.2	68.3
Total output	37.0	88.7	12.0	137.6
Total value added	20.7	40.2	5.8	66.6

6.5 Trends and future projections

6.5.1 Trend

The cruise industry is highly volatile with periods of substantial growth and decline. However, the overall trend (see Figure 9) shows substantial growth. The New Zealand cruise industry almost doubled in the last 10 years, a trend that corresponds to 7 per cent compound annual growth.[82]

[81] Employment Counts are not directly comparable to Full-Time Equivalents (FTEs) as they count full- and part-time jobs equally and therefore tend to be higher than FTEs.
[82] Market Economics Limited, 2010d.

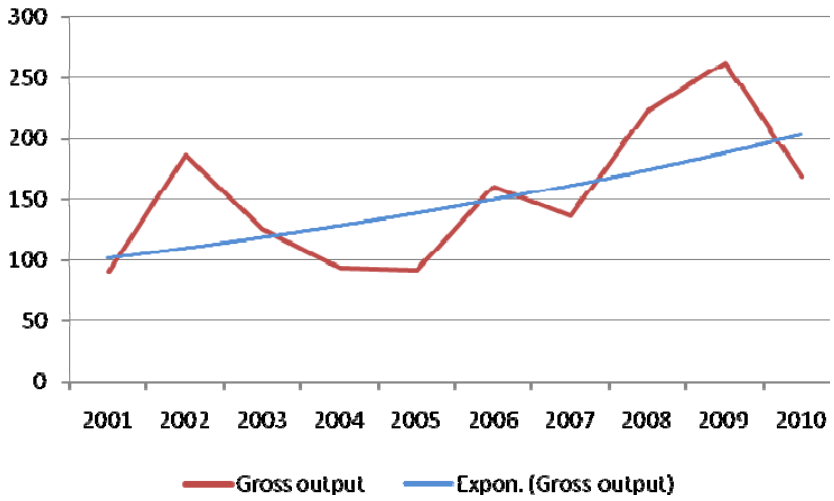

Figure 9. Cruise industry direct spend, 2001–2010, $[2011] million.

6.5.2 Future projections

Cruise industry activity in Auckland is projected[83] to grow annually by around 2.4–7.9 per cent while the Business As Usual (BAU) growth rate is expected to be around 5.4 per cent annually.

These growth scenarios show the cruise industry increasing from $50.3 million (gross output or direct expenditure) in the 2010 calendar year to between $83 million and $247.4 million in 2031.

The BAU projection for 2031 is $152 million of gross output.

6.6 Concluding remarks

Auckland's transport infrastructure, amenities, and facilities underpin the flourishing of the cruise industry in Auckland and New Zealand. The cruise industry contributed $66.6 million in the 2009/10 season, adding 928 jobs (ECs) to the local economy. Projections indicate strong growth in the future.

Auckland is the main exchange port for cruise passengers and the place where they spend most days in New Zealand. However, Auckland's share is still only around 17 per cent; similar to other areas that do not have the advantage of being the main transport hub and the largest city in the country, notably:

- Canterbury (14 per cent)
- Southland (14 per cent)
- Otago (13 per cent
- Wellington (12 per cent)
- Bay of Plenty (12 per cent).

Although the Hauraki Gulf and its islands are not usually mentioned as a specific major attraction and are not a significant part of the cruise experience, they form an essential part of the scenic backdrop and provide a variety of local excursions that help to keep Auckland on the international cruise circuit.

[83] Market Economics Limited, 2011a.

As most of the Hauraki Gulf islands do not attract a significant amount of visitors this could indicate an untapped opportunity. The appeal of the Hauraki Gulf could be increased through improved integration with the recreational opportunities offered by the cruise ships.

As the cruise industry is expected to grow significantly in the future, there will be increasing pressure on the receiving facilities and all kinds of amenities including local tourist transport, accommodation, excursions, airport connections, ship berthing, and passenger embarkation facilities. As a consequence, a new cruise ship terminal is being planned on the waterfront.

7.0 Marine recreation and the Hauraki Gulf

7.1 Introduction

The New Zealand marine industry builds more boats per capita than any other country in the world and is the largest specialised manufacturing industry in New Zealand.[84] The bulk of the marine industry, servicing both domestic and international clients, is concentrated in Auckland. Auckland generates approximately 64 per cent (or $1222 million) of the total national turnover for the marine industry.

The marine industry is classified as the largest non-primary-product-based manufacturing industry; however, it essentially relies on the presence the Hauraki Gulf. The waters of the Hauraki Gulf provide one of the largest cruising areas in the world and protection from the inclement weather of the South Pacific cyclone season.

The location of Auckland, the most populous city of New Zealand, on the shores of the Hauraki Gulf is not accidental and its development shows how the city has continued to expand around its shores. Major international events, along with a strong reputation for the range and quality of services that the Auckland marine industry can provide, attract super-yachts to Auckland's waters.[85]

The neighbouring regions of Tauranga (Bay of Plenty) and Whangarei (Northland) contribute to the industry through both additional capacity and competition with the Auckland marine industry.

7.2 Physical infrastructure

7.2.1 Westhaven

The Westhaven marine cluster specialises in refits, maintenance, retail, and services. It has more than 100 marine companies located in Westhaven, the Wynyard Quarter, and Viaduct Harbour.

This area is the focal point for a major urban development project: the vision is to redevelop and rejuvenate the western reclamation area and Tank Farm. Over the next 25 years this vision will be realised as the area is gradually transformed from a largely port-related industrial area into a mixed-use, multi-purpose, urban village.

7.2.2 Hobsonville

Hobsonville currently has two boat-building companies and a specialist training organisation. A dedicated marine cluster at Hobsonville is also under development: Yard 37 is a new 20-hectare marine industrial precinct on the upper Waitemata Harbour. It is a greenfield site with adjacent deep-water berthage.

Yard 37 will provide comprehensive and essential marine infrastructure complementary to the established marine quarter at the Viaduct Harbour. It is expected to generate widespread benefits resulting from innovative design and materials, high-technology equipment, luxurious furnishings, and the requirement for skilled labour.

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[84] Market Economics Limited, August 2008. *New Zealand Marine Industry Survey 2008*.

[85] Recent research by the Marine Industry Association has identified that over a six-month duration, a super-yacht refit is likely to contribute approximately $880,000 to the local economy. For further information, see Auckland Plus, 2009. *Auckland Marine Industry Feasibility Study*. A report prepared by Beca Applied Technologies Ltd.

7.2.3 Devonport

The Royal New Zealand Navy is based at Devonport, with maintenance capabilities and dry dock facilities, including a 15,000 tonne dry dock. Although this base is focused on the Royal New Zealand Navy, it can also provide a range of services to the commercial and recreational sectors.

7.2.4 Other areas

There are many other small-scale marine industry operations around the Auckland region in addition to those associated with marinas (eg, Pakuranga, Henderson, Beachhaven, and Sandspit).

7.2.5 Marinas[86]

The Hauraki Gulf is also home to a number of smaller-scale marine clusters which provide a range of services and facilities to the marine industry and recreational boat users.

Collectively these marinas provide 5471 berths, 141 pile moorings and 50 swing moorings across the Auckland region. Several of the marinas have haul-out facilities; however, they are all rated at less than 150 tonnes.[87]

In 2006, New Zealand marine facilities nationwide provide 205 marinas and yacht harbours, 12,000 berths and slips, 10,000 open moorings, and 260 slipways along 15,134 kilometres of sea coastline.[88]

Figure 10. Marinas in Auckland. (Source: Google Maps.)

Neighbouring and other regions provide additional facilities, capability, and labour within the national New Zealand marine industry. Auckland's closest regions are Whangarei and Tauranga.

Within the Whangarei region, a few specialist marine companies exist but most marine engineering companies draw customers from the broader marine, forestry, construction, and general engineering sectors. Whangarei marine companies service local commercial fleets and those from both Tauranga and Auckland.

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[86] http://www.nzmarinas.com/
[87] 2008 data.
[88] ICOMIA, 2006. *Recreational Boating Industry Statistics 2006*. ICOMIA, London, UK.

The Tauranga region offers boat-building, repairs, and maintenance capability from two marinas.

Although Whangerei and Tauranga both provide additional capability to the New Zealand marine industry, both regions have to address a number of challenges in order to remain operational, as they both require on-going dredging. The local infrastructure also creates constraints.

7.3 Methodology

Auckland's recreational marine industry ranges from super-yachts to personal leisure craft, and from world-class custom manufacturing to the supply of essential services and consumables.

In addition, Auckland's marine industry supports - and is supported by - a wide range of industry stakeholders ranging from material suppliers to academic and research organisations (see Figure 11)

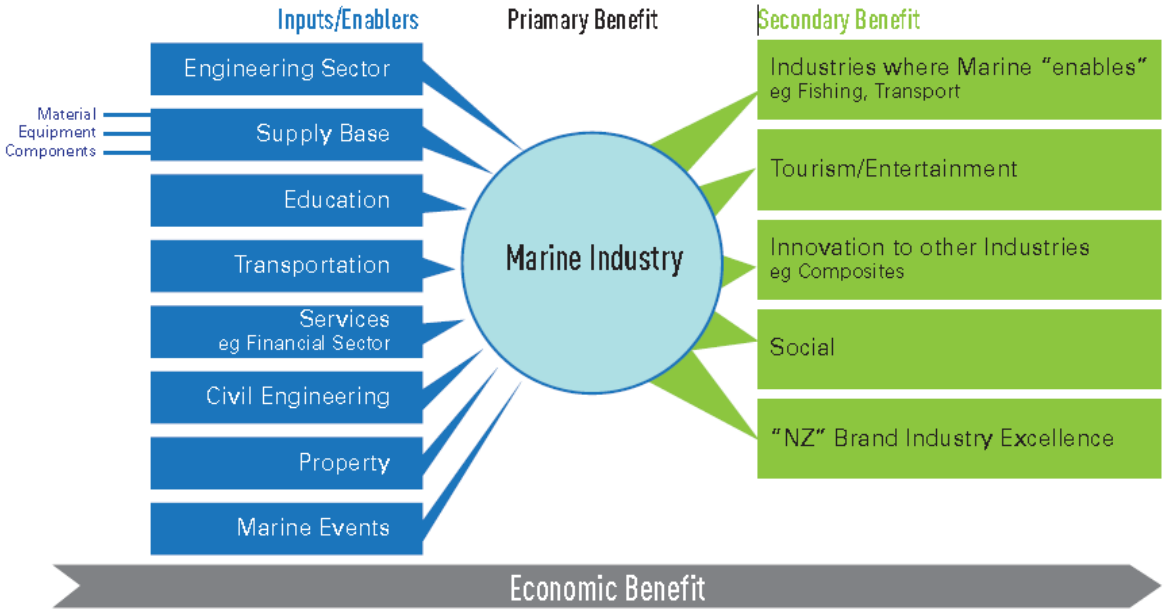

Figure 11. Auckland marine cluster. (Source: Auckland Plus, 2009.)

In 2008, Market Economics Limited (MEL) undertook a study of the New Zealand marine industry, including an assessment of the Auckland sector. The study did not assess the value of the entire marine industry cluster; only the value of the directly related sectors (see Table 12). Therefore, the scope of this valuation was narrower than those where indirect and induced impacts have been included, such as aquaculture.

This approach was useful to avoid double counting problems that could arise if MEL was unable to clarify those indirect and induced impacts. It did not prevent MEL from valuing activities (such as events) separately.

7.4 The economic value of Auckland's marine industry

In 2008, the gross output of the Auckland's marine industry was $1222 million (see Table 15).[89] The sector is integrated internationally with:

- 43 per cent of turnover related to domestic turnover
- 40 per cent related to export
- 17 per cent related to import turnover.[90]

In terms of value added (subtracting the value of intermediate goods and services used in the production process from the total value of sales), the recreation marine sector represented 0.7 per cent of Auckland's 2006 gross regional product (GRP).[91] Its contribution to Auckland's GDP is projected to increase from 0.7 per cent in 2006 to 0.9 per cent by 2031. For this report, a contribution of 0.8 per cent (approximately $\$_{2008}$513m) to Auckland's GRP was assumed for 2008.

The New Zealand recreational boat category is split into eight sub-categories:

- **Power trailer boats:** A motor boat up to 8.5 metres in length, either on a trailer or in a dry-stack.
- **Launches and yachts:** Any boat, either motor or sail, up to 30 metres in length, moored on water.
- **Super-yachts:** Any boat, either motor or sail, over 30 metres in length.

  Five manufacturers of super-yachts are located in New Zealand.
- **Racing yachts**: A sail boat of any length used for yacht racing.

  There are four manufacturers of racing yachts in New Zealand.
- **RHIB and inflatables:** Any boat, either motor or sail, with an inflatable exterior ring as part of its hull. There are seven manufacturers of RHIBs (rigid hull inflatable boats) and inflatables in New Zealand.
- **Refits and maintenance:** The process of repairing, re-equipping, or renovating the interior and/or exterior of any boat. This work can be carried out on any boat but the market is dominated by super-yacht refits.
- **Services, supplies, equipment, and component manufacturing:** This covers a wide variety of services and supplies including (but not restricted to) specialist design, engineering services, project management, manufacturing, marketing and sales of propulsion units, winches, anchors, rigging, spars and sails, personal recreational craft, and other marine components.
- **Other**: This includes (but is not restricted to) professional services, marine haulage, crew services, marina operation, consumables, marine retailing, brokerage, charter activity, finance, and insurance.

[89] The value of Gross Regional Product plus intermediate consumption.
[90] Total domestic production is comprised of domestic turnover plus export turnover.
[91] ARC, 2009a.

Table 15. Gross output of the marine industry. (Source: ARC, 2009a.)

Marine database category	Domestic turnover ($million)			Import turnover ($million)			Export turnover ($million)			Total turnover ($million)		
2008	Auckland	NZ	Auckland's percentage of total	Auckland	NZ	Auckland's percentage of total	Auckland	NZ	Auckland's percentage of total	Auckland	NZ	Auckland's percentage of total
Equipment	130	202	64	43	72	60	148	277	53	320	551	58
Refits	89	101	88	–	–	–	29	49	59	117	150	78
RHIBs*	12	26	45	20	22	90	23	24	93	54	72	75
Race yachts	8	9	85	–	–	–	19	39	49	27	47	56
Services	193	306	63	7	7	100	2	8	29	202	321	63
Super-yachts	0	24	0	–	7	0	232	249	93	232	280	83
Trailer power boats	37	143	26	32	63	50	1	16	6	70	222	31
Yachts and launches	64	83	77	103	124	82	33	55	60	200	262	76
Total	531	894	59	204	295	69	487	717	68	1222	1905	64

*Rigid hull inflatable boats

7.5 Concluding remarks

Table 16 summarises the total economic impact of Auckland's marine industry in 2008 in terms of total output, value added, and employment. The impact includes some indirect effects within the marine cluster but does not include induced effects.

Table 16. Total economic impact of Auckland marine industry, 2008/09. (Source: ARC, 2009a; Infometrics, 2012)

Output ($\$_{2011}$ million)	1310
Value added ($\$_{2011}$ million)	550
Employment (FTEs)	5781

The marine industry's contribution to Auckland's exports is much bigger than its relative value added as it represents 4.4 per cent of Auckland's exports ($11,091 million) in 2008.[92] In 2008, Auckland's marine industry exports reached NZ$487 million; 48 per cent of its total turnover. The exports are dominated by super-yachts (50 per cent), which are built almost exclusively for international use, and equipment (30 per cent).

There are no exact employment figures for the marine industry as the sector spans many industries and occupation categories. Based on the Marine Industry Association survey of 2008, an estimate of 5781 Full-Time Equivalents (FTEs) was generated for the recreational marine sub-sector in Auckland (see Figure 12).[93]

In 2008, Auckland's marine sector contained approximately 900 business units and made a significant contribution to upgrading the labour force through various training programmes. These involved more than 600 apprentices and were co-ordinated by the Boating Industry Training Organisation (BITO), a division of the Marine Industry Organisation.[94]

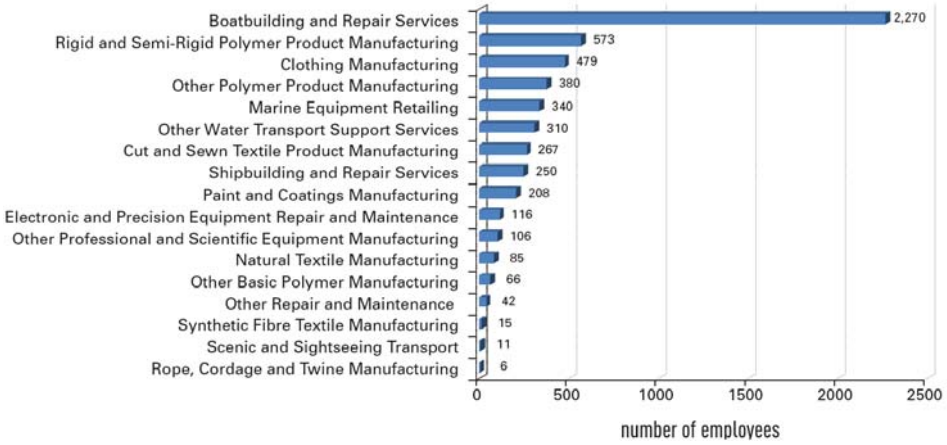

Figure 12. Employment in Auckland's recreational marine industry, 2008. (Source: ARC, 2009a)

[92] ARC, 2009a.
[93] ARC, 2009a.
[94] Statistics New Zealand, 2008. *Business Demography database 2008*.

7.6 Appendices to Recreational Marine Industry

7.6.1 Auckland's marinas

1. Bayswater Marina (http://www.bayswater.co.nz/)

Bayswater Marina is located just across the harbour from Auckland City. The marina lies at the end of a peninsula in clear view of Auckland City, with travelling times to the city ranging from 15 minutes by road to 5 minutes by regular harbour ferry. It has 415 full-length finger berths, and all berths are equipped with water and 240 volt power, with earth-leakage protection. Live aboards are welcome year round.

- Bucklands Beach Yacht Club Marina (http://www.bbyc.org.nz/)

Bucklands Beach Yacht Club Marina is located in Half Moon Bay on the Tamaki River Estuary of the Auckland Harbour. The marina comprises three piers and a floating breakwater adjacent to the larger Half Moon Bay Marina.

2. Gulf Harbour Marina (http://www.gulf-harbour.co.nz)

Gulf Harbour Marina is located on the Whangaparaoa Peninsula. With 1032 berths, it is one of the largest marinas in the Southern Hemisphere. It opens up to the more than 7000 square miles of the Hauraki Gulf. The marina is very sheltered, hidden behind a breakwater and nestled amongst a unique canal housing development and international golf course. Berth sizes range from 10.5 metres up to 50 metres. All berths have a finger alongside for ease of access and have built-in protective fenders.

- Half Moon Bay Marina (http://www.hmbmarina.co.nz/)

Half Moon Bay Marina is located in the Eastern Suburbs of Auckland, in safe calm waters near the mouth of the Tamaki River Estuary. The marina provides 500 berths plus a full-service haul-out and hard-stand facility; it is capable of storing 180 boats on the hard-stand and in trailer-park areas. The haul-out facility has 35-tonne lift capacity, while the maximum length and beam that can be lifted is 18 and 5 metres respectively.

- Hobson West Marina

Located in the Viaduct Harbour, the scene of the previous America's Cup, Hobson West Marina is at the centre of Auckland City. Westhaven Marina manages Hobson West Marina.

- Pier21 Marina Centre (http://www.pier21.co.nz/)

The Pier21 Marine Centre, adjacent to Westhaven Marina, provides a range of choice in vessel storage, maintenance and servicing. It offers (i) 48 marina berths for larger boats (up to 30 metres in length and 3 metres draft), (ii) 190 dry-stack berths in its boat park for smaller craft (up to 9.2 metres), and (iii) a hard-stand boat yard for 30 boats with covered facilities available. The facility has a 50-tonne travel-lift for vessels up to 25 metres, with all services available in near vicinity.

- Pine Harbour Marina (http://www.pineharbour.co.nz/)

Pine Harbour Marina is largely self-contained, operating 24 hours a day, 365 days a year, with a full complement of on-site trades people, 24-hour security system, 24-hour fuel service and a complete haul-out and hard-stand facility. The location of the marina in a unique lifestyle environment, along with its garden-like grounds and family atmosphere, is the major reason for

its high occupancy rate. On-site services include chandlery and food supplies, a liquor store, boat painting, boat-building, marine engineering, canopy and squab supplies, stainless steel work and brokerage.

- Viaduct Harbour Marina (http://www.viaduct.co.nz/marina)

Viaduct Harbour is a prestigious residential, commercial and entertainment precinct located in downtown Auckland City CBD. It provides 150 berths for super-yachts, local and visiting pleasure craft, and tourist and charter boats, Berths range in size up to 60 metres. Services are at available at the nearby Westhaven Marina.

- Viaduct Harbour Marine Village

Viaduct Harbour Marine Village marina is New Zealand's premier waterfront destination. Located in the heart of Auckland CBD, it lies within New Zealand's most comprehensive marine service precinct at Westhaven, with a full range of services available. There are 44 berths, ranging from 12 metres to 60 metres, with a controlling depth of 4.5 metres.

- Westhaven Marina (http://www.westhaven.co.nz/)

Westhaven Marina is New Zealand's largest and oldest marina, and is home to more than 1800 boats ranging in size from 8 metres to 30 metres. Nestled at the base of the Auckland Harbour Bridge, Westhaven offers all-weather protection and sheltered secure moorings, while being located just 3.5 kilometres from downtown Auckland. Adjacent to the marina is New Zealand's largest cluster of marine-related businesses, including sail-makers, yacht riggers, haul-out yards, engineers, boat-builders, brokers, electricians, painters and chandlery stores.

- West Park Marina http://www.westpark.co.nz/

West Park Marina, also known as the West Harbour Marina, is situated in Auckland's upper Waitemata Harbour, west of the harbour bridge and a short distance via Highway 16 from the Auckland CBD. It is enclosed by rock breakwaters on all sides, making for a very sheltered environment in all weathers. It offers haul-out (up to 35T).

- New Zealand National Maritime Museum (http://www.maritimemuseum.co.nz/)

The Museum has three heritage vessels which operate out of its own marina. Their crew run a varied range of sailing trips, from 15 minutes up to a few hours, around the Waitemata Harbour.

- Milford Marina

The Milford Marina is a short cruise up the Wairau Estuary and is home to 220 vessels, mainly of shallow draft. The marina is tidal and access is limited to approximately three hours either side of the tide. Preference is given to residents of the North Shore for permanent berthage. The membership to this incorporated society is $225 and the society operates a waiting list system for permanent berths.

- Orakei Marina

Orakei Marina opened in December 2006 and is Auckland's newest and premier marina catering for predominantly larger vessels. Situated adjacent to the Royal Akarana Yacht Club on Tamaki Drive in Okahu Bay, Orakei sits opposite North Head and the entrance to Auckland Harbour. The 180 berths consist of wet berths ranging between 12 metres and 40 metres in length.

7.6.2 Coromandel's marinas

- Pauanui Waterways

Pauanui Waterways is located on the eastern coast of the North Island's Coromandel Peninsula, which separates the Pacific Ocean from the Hauraki Gulf. Located in Tairua Harbour on Coromandel's eastern seaboard, the canal housing development comprises 150 private moorings.

- Whitianga Waterways

The Waterways is a new development, located 1500 metres upstream of Whitianga Marina. Whitianga is an established seaside town on the eastern seaboard of the Coromandel Peninsula, and its harbour has a deep, sheltered entrance which is navigable by large craft, regardless of tide or weather. Upon completion, Whitianga Waterways will have several distinct zones including unrestricted and restricted canals, a small retail zone, a standard (non-canal-front) residential zone and an airport zone, where owners with aircraft will be able to fly in and park their aircraft in their own hangar. Stage 1 of the development has just been completed, with 38 private berths.

- Whitianga Marina

The Whitianga Marina is located within an easy stroll of Whitianga township, and is situated 300 metres south of the Whitianga wharf.

8.0 Aquaculture and the Hauraki Gulf

8.1 Introduction

Mussel, oyster, and finfish farming (aquaculture) and processing are an important part of the seafood industry in the Hauraki Gulf. Marine farms are spread throughout the Hauraki Gulf at:

- Mahurangi Harbour
- Waiheke Island
- Wairoa Bay
- Firth of Thames
- Coromandel Harbour
- Manaia Harbour
- Port Charles
- Kennedy Bay
- Whangapoua Harbour
- Whitianga Harbour
- Great Barrier Island.

Both local and central government have identified aquaculture as a growth industry in Auckland and the Coromandel, and the Aquaculture Council aims to achieve an output of $1 billion by 2025.[95]

Various economic studies have focused on the contribution made to regional economies by current aquaculture activities, and on future prospects for growth in these regions. The legacy Auckland Regional Council (ARC) and the Hauraki-Coromandel Development Group have completed major studies.[96,97]

The government has also passed a number of reforms to stimulate and support the growth of the aquaculture industry. This chapter outlines the methodology and the findings of these economic studies, and gives a summary of recent reforms. It does not include an assessment of the potential effects of these reforms.

8.2 Methodology

The studies done by the legacy ARC and by Waikato both used input-output analysis for their economic impact assessments.[98] In general, these assessments recognise that one form of economic expenditure in an industry creates income for another industry. Therefore, new economic growth in the aquaculture industry is not confined to that industry but spreads and creates impacts elsewhere in the economy.

These studies identified three types of economic impact that can occur as a result of growth within the aquaculture industry:

- direct impacts - initial injections of revenue and expenditure that accrue in aquaculture farming and processing

[95] The New Zealand Aquaculture Council is an incorporated society representing the collective interests of the New Zealand aquaculture industry.
[96] ARC, 2010.
[97] Sapere, 2011.
[98] ARC, 2010; Sapere, 2011.

- indirect impacts - impacts resulting from expenditure within aquaculture farming and processing; eg, the provision of goods and services to aquaculture farming and processing

- induced impacts - impacts of household expenditure resulting from an increase in household incomes in the study area.

Direct, indirect, and induced impacts also occur in relation to employment.

Multiplier analysis (an extension of the standard input-output analysis) was also used to capture the strength of the links between the aquaculture sector and the rest of the economy. Two types of multipliers were used in both the legacy ARC and Waikato studies:

Type I multiplier. This captures the direct and indirect backward linkage effects associated with direct expenditures and is calculated as:

- (Direct Effect + Indirect Effect)/Direct Effect
- It captures the net effects associated with direct expenditures and summarises investment in the aquaculture sector on the production chain (an increase of *x* in investment creates an impact of *y* in GDP).

Type II multiplier. This is similar to the Type I multiplier but also includes induced effects and is calculated as:

- (Direct Effect + Indirect Effect + Induced Effect)/Direct Effect
- This means that it captures the effect of the increased household income as a result of wages and salaries paid to the workers in aquaculture.

Both studies assumed medium-growth intensification over time for forecasting purposes. However, the Waikato scenario included a significant development in finfish farming with 6000 tonnes produced per year.

The major limitations of this methodology are that it is a static analysis and the growth paths of the industry are assumptions. In addition, the input-output analysis does not incorporate the opportunity cost of capital expenditure, neither does it fully capture any environmental trade-offs that may be required to achieve this growth.

Overall, the methodology of these economic impact assessments follows standard rules and is applicable to the standard limitations of input-output analysis. The findings are summarised in the following section.

8.3 The economic value of aquaculture in the Hauraki Gulf

8.3.1 Auckland

In 2008, the contribution made to Auckland's GRP by the aquaculture sector was $\$_{2004}$28.2 million value added.

In Auckland, most of the impact occurs in the processing functions rather than from direct farming. In terms of direct, indirect, and induced employment, the aquaculture sector generated 507 FTEs.[99] Aquaculture processing is less labour-intensive than aquaculture farming: it generated 6.53 FTEs per $\$_{2004}$million, while aquaculture farming generated 10.

[99] The Type II output and value-added multipliers were 1.49 and 1.67, respectively.

Table 17. Total economic impact of the Auckland region aquaculture sector, 2008/09. (Source: ARC, 2010)

	Aquaculture farming impacts[1]	Aquaculture processing impacts[2]	Total economic impact
Output ($\$_{2004}$ million)			
Direct	6.6	42.2	48.7
Indirect	4.5	14.2	18.7
Induced	0.8	4.1	5.0
Total	11.9	60.5	72.4
Value Added ($\$_{2004}$ million)			
Direct	3.1	13.7	16.8
Indirect	2.2	6.7	8.9
Induced	0.4	2.0	2.5
Total	5.7	22.4	28.2
Employment (FTEs)			
Direct	66	275	341
Indirect	37	104	141
Induced	4	21	25
Total	107	400	507

1. Excludes impacts already captured in aquaculture processing.
2. Excludes impacts already captured in aquaculture farming.

The aquaculture industry has huge growth potential in New Zealand. In the 2008/09 year, the Auckland region harvested 2648 tonnes of mussels and 890 tonnes of oysters. This equates to 3 per cent of the national mussel production and 26 per cent of oyster production. During that period, the Auckland region processed almost seven times the amount of mussels harvested (17,426 tonnes).

Aquaculture's contribution to GRP is comprised of:

- aquaculture farming impacts (approximately 20 per cent of total)
- aquaculture processing impacts (approximately 80 per cent of total).

This shows that the impacts of aquaculture processing are significantly larger than those for aquaculture farming, meaning that aquaculture processing is a highly significant activity for the Auckland region. The aquaculture processing facilities in the Auckland region are also very important for the harvests from adjoining regions.

Any limitation on the expansion of aquaculture farming activities in the Auckland region will not necessarily limit the expansion of the processing activities in Auckland, as these rely on scaling effects, concentration benefits, and other infrastructural advantages.

Forecast impact

The legacy ARC modelled the effects of moderate expansion in the aquaculture industry. This included the existing farms in the Auckland region, and a medium expansion of the industry until 2025.[100]

The overall impact of this scenario suggested that there could be up to an extra $170 million ($\$_{2011}$) of direct GRP from aquaculture in Auckland by 2031; and in the Waikato, the direct GRP could increase to $115 million ($\$_{2011}$) by 2025 including the finfish farming.

Table 18. Estimated current and future impacts of aquaculture farming and processing on Auckland GRP (value added). (Source: ARC, 2010)

Year	2006	2011	2021	2031
Auckland GRP ($\$_{2009}$ thousands)				
Current situation	65,790	74,072	94,089	117,559
Future moderate expansion of aquaculture	65,790	74,080	94,172	117,718
Increase in value		8	83	159
Auckland Full-Time Employment (FTEs)				
Current situation	602	642	745	853
Future moderate expansion of aquaculture	602	643	746	855

The total economic impacts shown in Table 18 incorporate the overall effects from both aquaculture farming and processing. The timing of these effects is important, as benefits are not realised immediately after an expansion but are staged over time.

A moderate expansion of the aquaculture sector between 2009 and 2031 would increase value added or GRP by $\$_{2009}$159 million, an expansion of 0.14 per cent. Cumulatively, this would equate to an additional $\$_{2009}$1921 million in the Auckland economy (an average of $\$_{2009}$77 million per year). This, in turn, would create an additional 1622 FTEs in the regional economy by 2031. Both of these increases would occur gradually between 2009 and 2031.

8.3.2 Waikato

In 2011, Sapere studied the Coromandel aquaculture sector. A standard economic multiplier analysis, using input-output tables, was used to measure the overall impacts of the sector on the economy. The multipliers include both direct and indirect expenditure effects at both the individual business and wider consumption levels. The data to inform these multipliers was drawn from a wide range of sources including personal interviews and council-held statistics.

In 2010, the combined impact (direct, indirect, and induced) of Coromandel aquaculture on GRP was $\$_{2010}$31.4 million. Nationally, the impact was $\$_{2010}$77.4 million (see Table 19).[101] In 2010, there were approximately 300 FTEs employed directly in the aquaculture industry in the

[100] ARC, 2010, p30: '*This scenario was developed in consultation with the industry, and involved an expansion of current farming practices, an increase in oyster and mussel farms (1165ha) in intertidal areas. It was assumed that there would be an increase of 137ha for oysters, and 1269ha for mussels, given the preferences of industry and through identifying potential areas for the location of these areas. It was also assumed that all produce harvested within the region would be processed within the region for this scenario*.'

Waikato, with a further 250 employed in regions outside the Waikato. The total contribution to employment (direct, indirect, and induced effects) was 432 FTEs in the Waikato region and 1193 FTEs nationally.[102]

In the Waikato region, the total contribution of aquaculture to GRP was distributed almost evenly between aquaculture farming and aquaculture processing. However, the direct contribution differed, with 61 per cent from farming and 39 per cent from processing.

Table 19. Total economic impact of the Coromandel aquaculture sector on the Waikato region, 2010/11. (Source: Sapere, 2011)

	Aquaculture farming impacts[1]	Aquaculture processing impacts[2]	Total economic impact
Output ($_{2010}$ million)			
Direct	21.8	26.2	48.0
Indirect	3.9	9.2	13.1
Induced	5.1	5.8	10.9
Total	30.8	41.2	72.0
Value added ($_{2010}$ million)			
Direct	11.8	7.6	19.4
Indirect	1.8	4.5	6.3
Induced	2.7	3.1	5.7
Total	16.3	15.2	31.4
Employment (FTEs)			
Direct	121.1	176.3	297.4
Indirect	10.5	62.0	72.5
Induced	26.3	36.0	62.4
Total	157.9	274.2	432.3

[101] Sapere, 2011. The overall Type II output and value-added multipliers were 1.49 and 1.67, respectively.
[102] Sapere, 2011.

Table 20. Total economic impact of the Coromandel aquaculture sector on the New Zealand economy, 2010/11. (Source: Sapere, 2011)

	Aquaculture farming Impacts[1]	Aquaculture processing Impacts[2]	Total economic impact
Output ($\$_{2010}$ million)			
Direct	21.8	73.8	95.6
Indirect	15.4	34.8	50.1
Induced	11.6	29.3	40.9
Total	48.8	137.9	186.7
Value added ($\$_{2010}$ million)			
Direct	11.8	22.4	34.1
Indirect	6.4	16.2	22.6
Induced	5.9	14.9	20.7
Total	24.1	53.4	77.4
Employment (FTEs)			
Direct	121.1	430.0	551.2
Indirect	117.7	259.7	377.4
Induced	75.4	189.5	264.8
Total	314.2	879.2	1193.4

Sapere also provided growth projections to 2025 (see Table 21). The projections assumed that, by 2025, an extra 640 hectares will be farmed for mussels. Oyster farming will not increase in area but will double in output due to improved technology. The projections also assumed that new legislation will allow finfish farming which would produce approximately 5000 tonnes of kingfish.[103] This scenario could increase GRP to $96 million by 2025, including an additional $35 million per annum generated by finfish. Nationally, the Coromandel industry could contribute $195 million in GDP with 2775 FTEs.

Table 21. Growth projections of the Coromandel aquaculture sector on the New Zealand economy, value added, 2011–2025. (Source: Sapere, 2011)

Value added $\$_{2010}$ million	2011	2031
Direct	34.1	90.6
Indirect	22.6	52.5
Induced	20.7	51.8
Total	77.4	194.9
Employment (FTEs)	2011	2031
Direct	551.2	1294.6
Indirect	377.4	848.2
Induced	264.8	632.2
Total	1193.4	2774.9

[103] For the assumptions underlying these projections, see Sapere, 2011, p29.

8.4 Concluding Remarks

The values for the Auckland and Waikato regions have been partially reconciled in order to produce a valuation of the total economic impact of the aquaculture sector in the Hauraki Gulf, as shown in Table 22. Dollar values are expressed in $\$_{2011}$ but employment values have not been adjusted.

Table 22. Total national economic impact (valued added) of the aquaculture sector in the Hauraki Gulf: forecast of direct, indirect, and induced impacts, 2010–2025. (Source: Sapere, 2011; ARC, 2010, Auckland Council)

Value added GDP $\$_{2011}$ million	2009 Auckland 2010 Waikato	2021 Auckland[3] 2025 Waikato
2010 Waikato total GDP[1]	64.2	161.7
2009 Auckland total GDP[2]	34.4	49.7
Total	98.6	211.4
Employment (FTEs)		
Auckland	507	746
Waikato	432	1,190
Total	939	1,936

1. To avoid double counting, the Waikato value represents 80 per cent of the value assessed by Sapere, 2011, as approximately 20 per cent of the Waikato production is estimated to be processed in Auckland.
2. Auckland aquaculture farming contribution is only $\$_{2011}$14.5 million.
3. Moderate-expansion scenario. (Source: ARC, 2010)

In 2009/10, the total national economic impact of the aquaculture sector in the Hauraki Gulf was estimated to be $\$_{2011}$98.6 million, of which two-thirds originated in the Waikato and one-third in Auckland. These direct, indirect, and induced activities generated 939 FTEs.

Forecasts with different periods and assumptions suggest that the aquaculture sector could more than double (+114 per cent) in the next 15 years, with employment increasing by almost a thousand FTEs.

8.5 Appendices to Aquaculture

8.5.1 Multi-criteria analysis of alternative aquaculture scenarios for the Auckland region.

Methodology

Enveco was commissioned by the Auckland Regional Council (ARC) to provide additional comparative information on aquaculture effects.[104] The aim of the report was to consider the potential social, economic, environmental and cultural effects (the 'quadruple bottom line') of three indicative aquaculture scenarios in the Auckland region:

- **Scenario 1**
  A baseline scenario reflecting currently operating oyster and mussel marine farms.

- **Scenario 2**
  An expansion of current farming practices to 2025 mainly focused on oyster and mussel farms, but also allowing for 18 hectares for experimental species and finfish. The biggest expansion lies in mussel farming with more than 1000 hectares of additional space envisaged (primarily in the western Firth of Thames).

- **Scenario 3**
  An expansion of scenario 2 with the addition of four indicative co-culture areas in mid to deep waters. It involves an additional 1839 hectares of mussels and oysters, and 300 hectares of new experimental species, scallop spat-catching and finfish.

A qualitative multi-criteria analysis (MCA) can reliably compare impacts upon quadruple bottom line (QBL) categories but applies expert knowledge and professional judgement rather than numerical data. ARC and Enveco developed a set of indicators and definitions reflecting QBL effects. Indicator development took several months to allow for a robust ranking of effects.

Results

Applying the qualitative MCA approach, all three scenarios show negative environmental effects overall, with these effects intensifying as development increases. However, the three scenarios contribute positively to the economy.

When taking into consideration the scope of the social indicators, excluding the economic aspects of social effects, none of the scenarios exhibit positive outcomes.

Scenarios 2 and 3 perform well with regard to cultural (Maori) economic opportunities, whereas scenario 1 does not create any real opportunity for Maori to advance economically.

Before application of the sensitivity analysis, the MCA revealed scenario 2 to be the preferred option, followed very closely by scenario 1.

The strengths of scenario 1 lie in the fact that all effects are known with relative certainty and that there would be minimal expansion and development. Workshop participants were most confident about the assessment of this scenario in all ranking categories. Consequently, because there is minimal development under scenario 1, the only overall positive effect this scenario demonstrates is on the economy, but it is not significant. The MCA indicates that scenario 1 is 'as good as it gets' within the current policy framework.

[104] The full report can be read in Enveco, 2010. *Aquaculture Quadruple Bottom Line Assessment Multi Criteria Analysis for the Auckland Region.*

Scenario 2 exhibits positive outcomes for both economic and cultural well-beings. Effects on the social and environmental categories are negative.

Scenario 3 has the most uncertainty, predominantly in the environmental category.

Evaluation of the findings

The MCA has the ability to shed light on the many complex interfaces of aquaculture, and essentially provides a comparative analysis between scenarios, rather than a comprehensive understanding of the magnitude of individual effects.

It also provides more flexibility than a CBA, and is more comprehensive in its coverage. However, it relies on professional judgement rather than the gathering, assessment and application of numerical data. This influences the appropriate end use of the results, which are to be taken as indicative only, and the main findings should be applied with caution.

The limitations of a MCA include the reliance on the opinions of experts based on their knowledge, and the qualitative nature of the rankings and their further analysis. The findings of this particular study were also constrained by the limited available data on the scale, intensity, duration and, in particular, likely future ability to mitigate environmental effects. This difficulty was to some extent mitigated by the use of a sensitivity analysis.

Any form of analysis is also limited when it attempts to forecast effects over extensive time frames such as 25 years, which adds a considerable degree of uncertainty.

8.5.2 Legislation

The *Aquaculture Legislation Amendment Bill No. 3* was passed on 16 August 2011 and came into effect on 1 October 2011. It amends four acts: the *Resource Management Act 1991*, the *Aquaculture Reform (Repeals and Transitional Provisions) Act 2004*, the *Maori Commercial Aquaculture Claims Settlement Act 2004*, and the *Fisheries Act 1996*.

The key changes made by the reform essentially remove some barriers under the RMA. It also increases the minimum resource consent to 20, to provide certainty to the industry. The aquaculture minister has the power to gazette changes into regional coastal plans. The legislation also allows for a new 300-hectare finfish block in the Waikato. Overall, these changes are designed to increase investment and uptake in the aquaculture industry.

The key changes made by the reform are summarised below.

Aquaculture planning and consenting

- Removes the requirement for an AMA (Aquaculture Marine Area) to be in place in the coastal plan before a marine farming consent application can be made. Applying for consent now becomes a normal RMA process.

- An increase of the minimum duration for a resource consent to 20 years., but a shortened lapse period from 5 to 3 years if the consent is not used. This gives the industry some surety for investment and addresses claim-staking with non-development.

- Aquaculture cannot be a ‘permitted activity’ as it must be assessed for undue adverse effects on fisheries (UAE test). A ‘pre-request aquaculture agreement’ may be made between an applicant and affected quota holders. The agreement percentage for all quota holders has dropped from 90 per cent to 75 per cent. If an agreement is made, the Minister of Fisheries does not assess the effects, although councils still have an obligation to assess effects on fisheries from resource consent applications.

- It is now possible to request a private plan change to uplift a prohibition on aquaculture and have it heard jointly with a consent application, allowing applicants to create a zone and consent for aquaculture in one step.

Managing occupation of space for aquaculture in the coastal marine area

- Now that the reform has removed the requirement for consents only within AMAs, the primary process for allocating space for aquaculture activities returns to being 'first in-first served', which triggered the original (2001–2004) law reform.

- Mechanisms introduced in 2004 that allow for public tendering in cases of applications with high or competing demand have been retained.

- Other processes require specific provision in the coastal plan or approval of the method by the Minister of Conservation when requested by a regional council.

- Councils may ask the Minister of Conservation to approve allocation by Gazettal for any activity in the coastal marine area, not just aquaculture. This allows for a comparison between activities proposed for the same area or nearby areas with regards to cumulative effects or inter-activity effects.

- Councils may ask the Minister of Aquaculture for a stay on new applications for up to 12 months for specific aquaculture activities, where there is high or competing demand and where the coastal plan is not effective in addressing the demand.

- Councils may ask the Minister of Aquaculture to direct that applications are processed and are heard together to assess cumulative or inter-activity effects.

Frozen applications

The applications which were lodged but not notified before the moratorium in 2001 and which had been 'frozen' will now be able to be processed with the exception of those applications for spat-catching in the western Firth of Thames. Conditions have been set on these applications which do not allow these applications to be processed until 1 January 2015 unless requested by the applicants. The other unfrozen applications will be deemed to be lodged on 'Day One' of the new legislative amendments, processed in the order they were originally received.

Ministerial powers for making aquaculture regulations

The Minister of Aquaculture has powers to recommend changes to a coastal plan about aquaculture management. This can result in the Governor General being requested to gazette the changes which are then directly inserted in the coastal plan. Auckland Council specifically opposed this new proposed power in its submission on the Bill. However, there is provision for consultation with the affected council, iwi authorities, and the public.

Changes in Waikato Coastal Plan

The Waikato Coastal Plan will change to increase the range of species, including finfish. For Waikato this includes the new 300-hectare finfish block and the ability for farms to change species.

Maori Commercial Aquaculture Claims Settlement Act 2004

- Under the 2004 reforms, 20 per cent of AMA space was allocated to iwi. Now that AMAs are not required, other allocation mechanisms are provided.
- The Crown is responsible for delivering the settlement**.**
- **T**he 20 per cent allocation stands and is delivered regionally through agreements between the Crown and iwi.
- Te Ohu Kai Moana, as trustee, receives the deliverables and allocates to iwi.
- The allocations are not an actual 20 per cent slice of each case-by-case coastal permit.

9.0 Fishing and the Hauraki Gulf

9.1 Introduction

New Zealand is surrounded by a vast seabed of extended continental shelf and the world's fourth largest Exclusive Economic Zone (EEZ). The EEZ extends 200 nautical miles from the coastline and covers an area 14 times larger than the land mass.[105]

Unregulated fishing in the early 1980s produced an environmental crisis which led to the introduction of the Quota Management System (QMS) in 1986. This created new harvesting rights[106] and transformed a public resource into a private resource.

In the year ending September 2009, total fish exports were 256,854 tonnes, a 12 per cent increase from 230,351 tonnes in 2000. Fish exports contributed $1425 million in earnings to the New Zealand economy in 2009, a 6 per cent increase from $1350 million in 2000.

The Hauraki Gulf has been an important fishery area since human settlement began in New Zealand. It provides a wide range of popular fish species including snapper, kingfish, kahawai, trevally, gurnard, tarakihi and john dory as well as shellfish including scallops, rock lobster, cockles, pipi, and paua.

9.1.1 The Exclusive Economic Zone

The marine environment within the EEZ[107] contains many diverse ecosystems and more than 16,000 marine species, many of which are endemic to New Zealand (see Table 23). Despite this, the EEZ contributes only approximately 1 per cent of the total global fish production as most of it is considered to be commercially barren due to its extreme depth and lack of nutrient-rich currents.[108]

Table 23. The New Zealand marine environment, 2010. (Source: Ministry of Fisheries website, 2012)

Environment	
NZ marine fisheries waters (EEZ and Territorial Sea)	4.4 million km²
NZ coastline	15,000 km
Marine species identified(1)	16,000
Species commercially fished(2)	130
Area closed to bottom trawling (fisheries restrictions)	
Territorial Sea	17 per cent
Exclusive Economic Zone	31 per cent
Primary productivity	Moderate with some high
Ecosystems	Diverse
Climate	Sub-tropical to sub-Antarctic

[105] This right has been confirmed by the United Nations Commission on the Limits of the Continental Shelf. This extended continental shelf is in addition to the approximately four million km^2 of seabed in the New Zealand EEZ and is about six times New Zealand's total land area (about 270,000 km^2). The New Zealand Government already earns more than $100 million per annum in royalties and other income from the seabed within the EEZ. Source: New Zealand Ministry of Foreign Affairs and Trade.

[106] For a discussion on public versus private goods, see section 3.5.2.

[107] Mostly derived from Statistics New Zealand, 2010.

[108] Food and Agriculture Organization of the United Nations (FAO), 2005; Newell, Sanchirico and Kerr, 2002.

9.1.2 The Quota Management System

The QMS divides New Zealand's EEZ into ten Fisheries Management Areas[109] (FMAs) as shown in Figure 13.

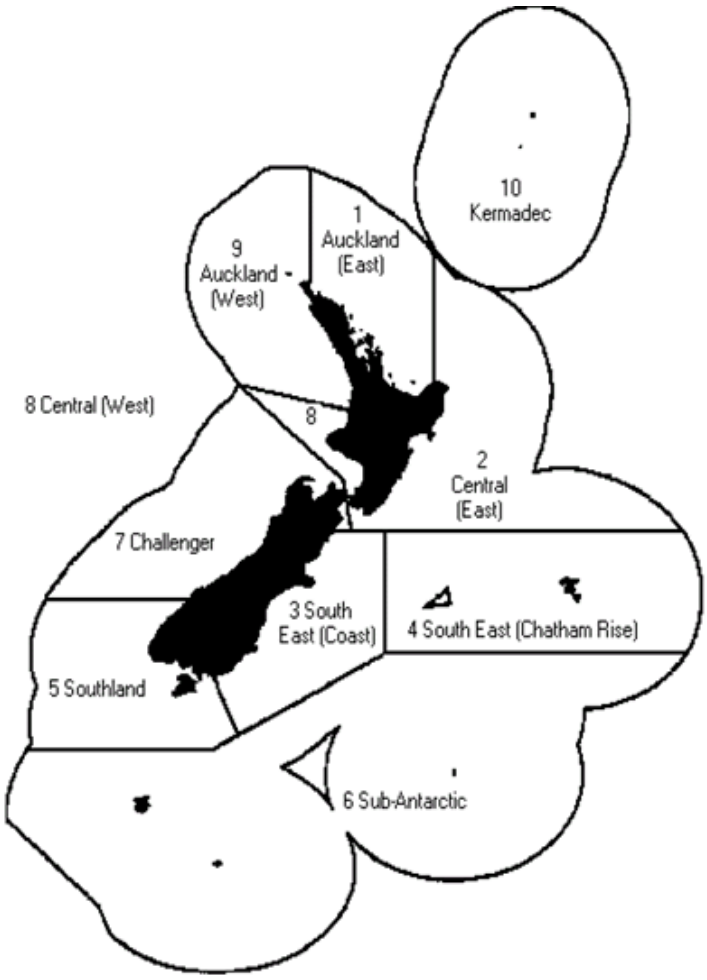

Figure 13. New Zealand Fisheries Management Areas. (Source: Ministry of Fisheries)

The fish stock of each species is assessed to identify its sustainable quota. Each fish stock is defined by a Quota Management Area (QMA). This may be the same as a single FMA or a group of FMAs, depending on the geographical distribution of that fish stock.[110]

Commercial catch limits (in tonnes) are set by the Minister of Fisheries annually for each fish stock under the QMS. These limits are referred to as Total Allowable Commercial Catch (TACC).[111] The QMS also enables commercial fishers to own individual perennial transferable quotas (ITQ).

[109] Management areas may vary between species.
[110] For example, snapper has a fish stock called SNA1 that matches FMA1.
[111] About 130 species are fished commercially within New Zealand's EEZ, and 96 of these are managed under the QMS. Catch limits vary yearly and are based on advice from the Ministry of Fisheries and submissions from the fishing industry and other interested groups.

Table 24. New Zealand's Quota Management System, 2010. (Source: Ministry of Fisheries website, 2008)

QMS stocks	
Species/species complexes in the QMS	97
Individual stocks in the QMS	633
Proportion of catch (by weight) from assessed stocks	72 per cent
Assessed stocks at or near target level	67.5 per cent
Total Allowable Commercial Catch (TACC)	599,126 tonnes
Actual commercial catch	409,449 tonnes

When the TACC has been established, individual or corporate Annual Catching Entitlements (ACE) are derived.

The ITQ and the ACE are both transferable and can be bought and sold.[112] This means that an ACE can be sold multiple times before it is actually fished.

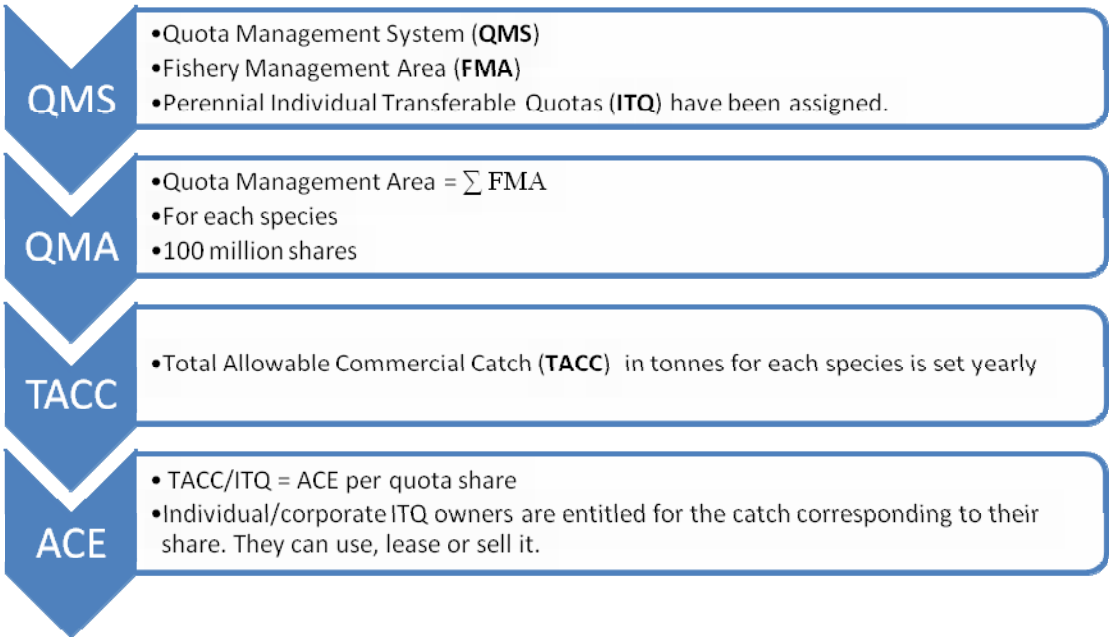

Figure 14. Commercial Quota Management System.

[112] The value of each quota is always 100 million shares. Under the QMS, only New Zealand residents can own quota (unless permission is granted by the Minister of Finance and the Minister of Fisheries). Quota owners can contract overseas companies to harvest fish. On the first day of every fishing year, the owner's quota shares generate an ACE, expressed in kilograms. On allocation, the quota and the ACE separate so the ACE can be traded independently of quota. All quota and ACE transfers must be registered with FishServe, a company that provides administrative services to the New Zealand commercial fishing industry. An ACE can be transferred up to 15 days after the end of a fishing year to allow catch to be balanced up to the end of the fishing year.

Boyd Fisheries Consultants estimate that the present market value of the ITQ rights required to extract the 2010/11 commercial finfish catch from the Hauraki Gulf Marine Park is around $130 million, based on the quota values given in the Fish Monetary Stock Account.[113] Snapper accounts for about 80 per cent of this total.[114]

In order for the TACC to be sustainable, the Ministry of Fishery has to include recreational (R) and customary fishing (C) when assessing a Total Allowable Catch.[115] Figure 18 shows how the Total Allowable Catch (TAC) equals the TACC plus recreational and customary fishing catches:

TAC = TACC + R + C

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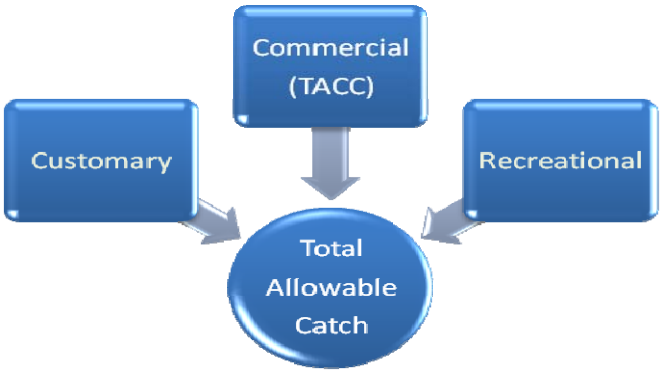

Figure 15. Total Allowable Catch and its components

The Ministry of Fishery publishes an annual report summarising the fishery status, biological status, stock assessment, and stock status for each fish stock.

9.2 Commercial fishing in the Hauraki Gulf[116]

Commercial fishing is an important sector of the New Zealand economy. It generates around 3 per cent of total export revenues and total employment (more than $1.4 billion and 5680 jobs in 2009).

Both Auckland and the Waikato benefit from the commercial fishing industry. A number of coastal communities in these regions are heavily dependent on businesses involved in the commercial fishing industry and related services sector for employment and earnings.

Historically, Auckland and the surrounding areas have relied on the commercial fishing sector within and around the Hauraki Gulf to supply the population with fresh fish, and this continues to the present day.

[113] Statistics New Zealand, 2010.
[114] Boyd Fisheries Consultants Limited, 2012, p14.
[115] These activities are regulated mainly by catch limits (quantity and size).
[116] Mostly derived from Boyd, 2012.

Table 25. New Zealand marine commercial fisheries, 2010. (Source: Ministry of Fisheries website, 2008)

Commercial Fisheries and Aquaculture	
Total seafood export value, 2009 (FOB)	$1.42 billion
Aquaculture exports	$279 million
Total seafood exports, 2009	287,508 tonnes
Total quota value	$4.017 billion
Quota holders	1556
Commercial fishing vessels	1278
Processors and licensed fish receivers	220
Direct employment (Full-Time Equivalents)	5680

Although the Hauraki Gulf Marine Park (HGMP) covers only a minor part of the FMAs of most fish stocks along the northeast coast of the North Island, it is very intensively exploited by both commercial and recreational fishers.

As an example, the HGMP includes only a small part of the stock boundaries for snapper (SNA1) (see Figure **16**) but approximately 50 per cent of the total commercial catch of snapper from the SNA1 stock comes from the HGMP area[117] and approximately one-third of the recreational catch.

[117] Boyd, 2012.

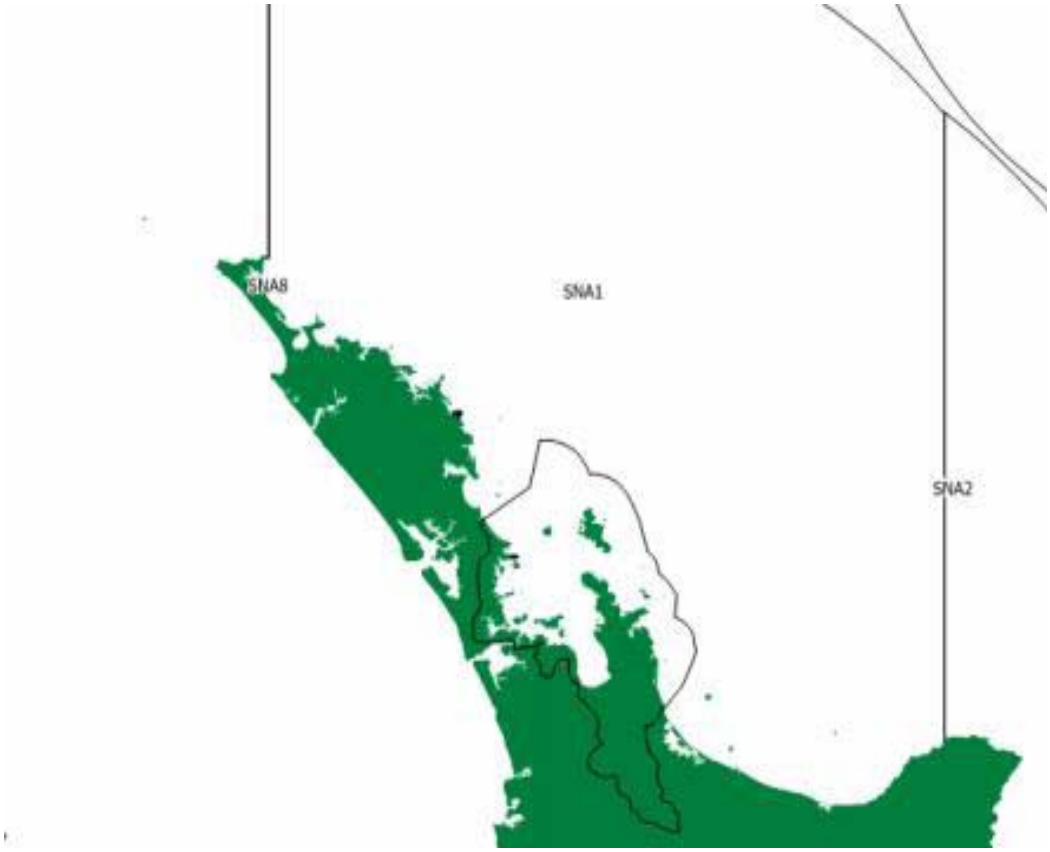

Figure 16. Location of the Hauraki Gulf Marine Park within the QMS FMA for snapper (SNA1). (Source: Boyd, 2012)

In addition to the QMS, a range of other fisheries management regulations limit and control commercial fishing activity within the waters of the HGMP. Many of these pre-date the QMS.[118]

Existing commercial fishing regulations in the immediate area of the HGMP include various effort controls (see Figure 17) but, according to the fishing industry, many of these are no longer relevant as sustainability measures because QMS catch controls make them unnecessary.[119]

[118] For example, the trawl and Danish-seine restrictions in the Hauraki Gulf date back nearly a century. Although there have been minor changes to the trawl and Danish-seine limit lines over the years, most of the Hauraki Gulf waters that lie roughly inside a line from Kawau Island to Coromandel have been closed to trawling and Danish seining for nearly 100 years. (Boyd, 2010, p5.)

[119] For a list of these controls, see Boyd, 2012, p6.

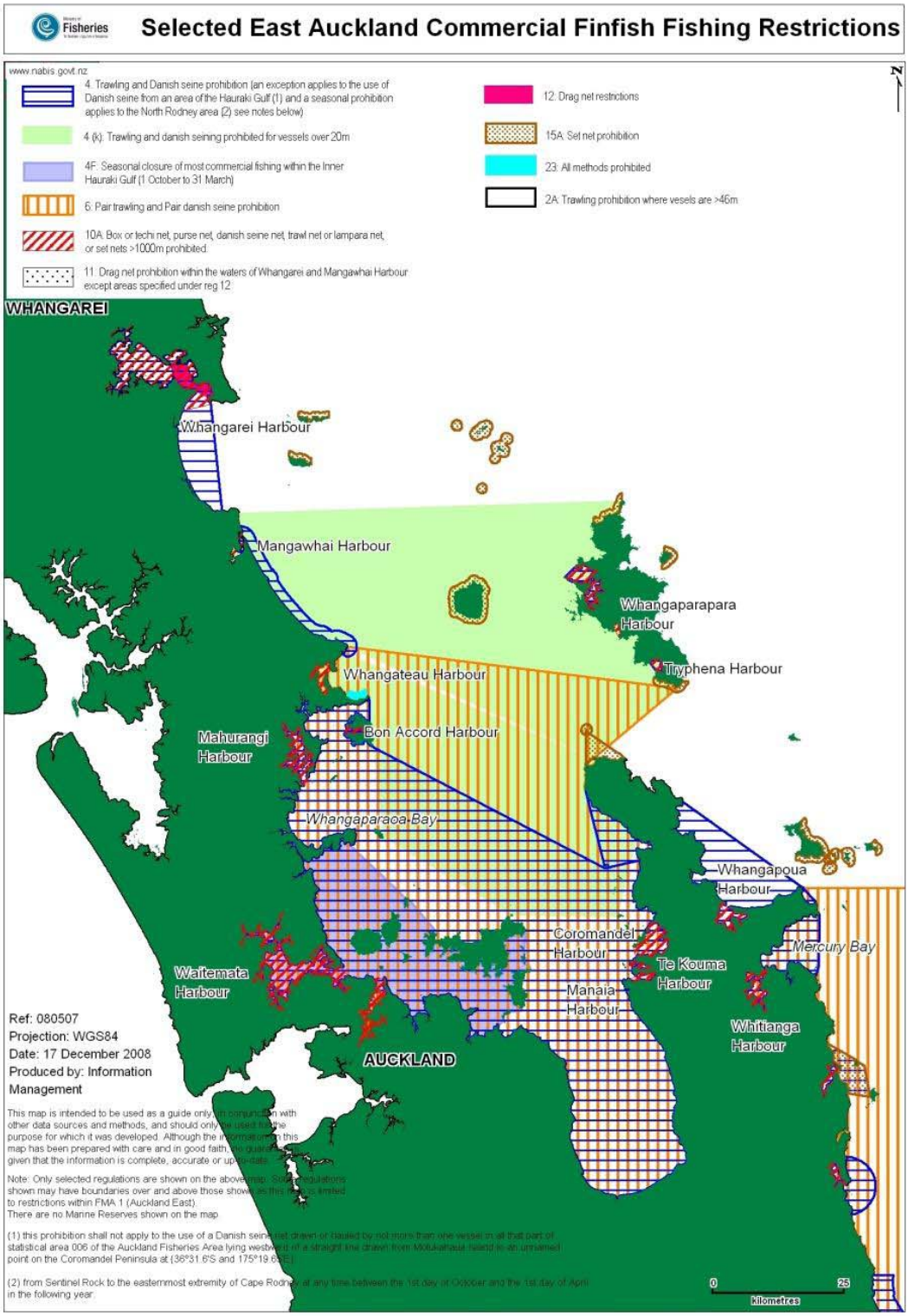

Figure 17. Commercial fishing area restrictions and prohibitions in the HGMP and surrounding area. (Source: Boyd, 2012, p7)

The commercial fishing industry believes that four factors unfairly favour recreational fishing, and could even create a sustainability problem. These factors are:

- the excessive restrictions imposed upon commercial fishing in the Hauraki Gulf
- an unregulated situation that benefits recreational fishing
- population growth
- technological developments (such as fish finders and GPS).

To support this view, they quote the 1345 tonnes estimate of recreational snapper catch (2004/05) for the waters lying inside a line from Cape Colville to Cape Rodney, and compare this with the 2010/11 commercial snapper catch of just over 1100 tonnes from the same waters. '*The fishing industry believes that the main risk to the sustainability of the snapper stock in the HGMP today is because there is no cap on the total recreational harvest*.'[120] However, they also recognise the lack of reliable data on recreational fishing when compared to the commercial catch data, which is both accurate and up-to-date.

The commercial fishing industry also believes that these restrictions are not improving sustainability. Instead, the industry says that the restrictions only increase the costs of commercial fishing in the Hauraki Gulf and, therefore, are reducing the economic gains that the QMS was intended to achieve. '*The industry would like to see a rationalisation of the current commercial fishing regulations, especially as they apply in the Hauraki Gulf*.'[121]

9.3 The economic value of commercial fishing in the Hauraki Gulf

Three main commercial fishing methods are used within the Hauraki Gulf proper (the waters inside Great Barrier and Little Barrier Islands):

- long line
- trawl
- Danish seine.

These three methods operate only throughout the areas of the Hauraki Gulf where they are permitted. Trawling and Danish seining are prohibited within the inner and middle Hauraki Gulf and therefore operate only in the more exposed waters, north of a line from Kawau Island towards Coromandel (see Figure 17). Long-liners fish more widely throughout the Hauraki Gulf except along the East Coast Bays where there is a seasonal prohibition.

Table 26 clearly shows that the main target of commercial fisheries in the Hauraki Gulf is snapper (from a minimum of 72 per cent to a maximum of 94 per cent of total catch). Other species such as gurnard, john dory, and trevally are the most common by-catch species. Therefore, commercial fisheries in the Hauraki Gulf rely substantially on snapper, as it is also the most valuable species per kilogram. [122]

[120] Boyd, 2012, p7.
[121] Boyd, 2012, p7.
[122] Boyd, 2012, p9.

Table 26. Species and commercial fishing methods in the Hauraki Gulf. (Source: Adapted from Boyd, 2012)

Species/fishing methods	Trawl (percentage)	Danish seine (percentage)	Long line (percentage)
Snapper	72	74	94
John dory	6	8	
Gurnard	4	5	
Trevally	4	4	
Kahawai	-	8	
Leatherjacket	-		
All other species	4	2	6

Within the very shallow waters of the inner Firth of Thames and other shallow harbours, small set-net vessels (and a few vessels using other passive netting methods) mainly target flat fishes, kahawai, and grey mullet. Their catch is almost all destined for local markets in the Auckland and Waikato regions. The less-expensive species such as kahawai and grey mullet are important to low-income communities.

Boyd Fisheries Consultants (2012), in a report prepared for Northern Inshore Fisheries Management Company, said:

> *In recent years, the snapper catch from the HGMP has made up slightly more than a third of New Zealand's total commercial snapper catch of about 6400 tonnes annually. The Seafood Industry Council estimates that the domestic market takes about a third of the New Zealand snapper catch, with much of this destined for the greater Auckland and Waikato regions. Snapper is also the most important inshore finfish exported from New Zealand, with an export value of $36.9 million in the year ended June 2011 (Ministry of Fisheries, 2011).*
>
> *Overall, the commercial fishery in the HGMP contributes a significant value to the local domestic economy, with much of the catch of fresh fish destined for the local Auckland and Waikato regions. The hospitality sector in particular relies substantially on the supply of fresh fish and shellfish produced by the commercial fishery operating within HGMP waters. The character and reputation of Auckland's waterfront is enhanced by the supply of clean, safe and sustainable seafood from the HGMP. Local residents and international visitors alike enjoy fresh seafood from local waters*.[123]

Boyd (2012) does not provide an economic impact assessment of the fishing industry in the Hauraki Gulf that is comparable to those available for the aquaculture sector. Therefore, in order to form an indicative estimation of the tentative value of commercial fisheries in the Hauraki Gulf, it is necessary to use data from other sources as well.

Table 27 shows total catch by species for the 2010/11 season, with the respective port and export prices.

[123] Boyd, 2012, p12.

Table 27. Hauraki Gulf Marine Park commercial fishing by species, 2010/11. (Source: Boyd, 2012)

Species	Total catch (kg)	Port price ($/kg)	Total landed value ($)	Export value ($/kg)	Total export value ($)
Snapper	2,275,752	5.35	12,175,273	10.39	23,645,063
Trevally	446,768	1.75	783,184	9.10	4,065,589
Kahawai	345,026	0.41	142,496	0.97	334,675
Flatfish	175,846	3.20	562,707	9.61	1,689,880
Jack mackerel	173,169	0.20	34,634	1.20	207,803
Gurnard	135,875	2.15	292,539	9.38	1,274,508
John dory	113,413	6.66	755,671	12.44	1,410,858
All other species	1,102,573		2,560,268		7,584,616

The port price is the amount received by fishers for landing fish to a Licensed Fish Receiver (LFR). A consumer wanting to purchase fish for local consumption would have to pay the export price - at a minimum - as this is the reserve price at the local auction.[124] Therefore, if local buyers cannot pay the LFR more than the export price, the fish will be exported.[125]

From this, it is possible to deduce that:

- snapper represents around 85 per cent of the value of commercial fisheries in the HGMP (a proportion derived from both volume and relative price)
- the corresponding revenues would be $36,191,693 (as per Table 27 and 28) assuming that 90 per cent of the fish caught in the HGMP is exported[126]
- the remaining 10 per cent is consumed locally and its price is, on average, 20 per cent higher than the export value (a value of $4,825,559).

Therefore, as shown in Table 28, the total revenue from commercial fishing in the Hauraki Gulf could be assessed at $_{2011}$41m.

Table 28. Hauraki Gulf Marine Park commercial fishing by species, 2010/11. (Source: Elaboration on Boyd, 2012)

	Export revenue ($)	Domestic revenue ($)	Total revenue ($)
Snapper	21,280,557	2,837,408	24,117,964
Trevally	3,659,030	487,871	4,146,901
Kahawai	301,208	40,161	341,369
Flatfish	1,520,892	202,786	1,723,678
Jack mackerel	187,023	24,936	211,959
Gurnard	1,147,057	152,941	1,299,998
John dory	1,269,772	169,303	1,439,075
All other species	6,826,154	910,154	7,736,308
Total	36,191,693	4,825,559	41,017,252

[124] Ministry for Primary Industry, Feedback on the Total Economic Valuation of the Hauraki Gulf: Phase One Report, Auckland, 24 May 2012.

[125] Idem. Only 10 per cent of seafood production is consumed locally (although snapper is a popular species on the local market).

[126] This assumption, based on a national average, could slightly underestimate the value of commercial fisheries in the HGMP given that Auckland is the main New Zealand local market. However, it is likely that some of the fish is sold locally because of its lower quality therefore the assigned price premium would have a partially-compensating counter-effect.

Regarding the amount of employment generated by commercial fishing, information from the Ministry of Primary Industries and the seafood industry (based on data from MEL, 2008a) makes it possible to estimate that 821 FTEs result from direct employment in Auckland and 362 FTEs in Waikato, giving a total of 1183 FTEs.

9.4 Recreational and customary fishing in the Hauraki Gulf

New Zealand is divided into three recreational management areas: north, central, and south.[127]

Recreational catch is considered by the Ministry of Fisheries as the catching of fish for non-commercial and non-customary purposes; and the fish that are caught cannot be sold. Fishing tours or trips run by a commercial venture are also categorised as recreational fishing.[128]

The *Fisheries 2030* strategy, developed by the Ministry of Fisheries, aims to maximise the benefits that New Zealanders receive from the fisheries - within environmental limits. It includes the following outcomes for amateur and customary fisheries:

- high-quality amateur fisheries that contribute to the social, cultural, and economic well-being of all New Zealanders
- thriving customary fisheries, managed in accordance with kaitiakitanga, supporting the cultural well-being of iwi and hapu.

The table below summarises national data about customary and recreational fisheries.

Table 29. New Zealand customary and recreational fisheries, 2010. (Source: Ministry of Fisheries website, 2008)

Customary fisheries	
Tangata Tiaki appointed (South Island)	142
Tangata Kaitiaki appointed (North Island)	307
Temporary closures (s 186)	6
Taiāpure - local fisheries	8
Mātaitai reserves	10
Customary take provided for within the TAC	4813 tonnes
Recreational fisheries	
Estimated participation (as a percentage of the total NZ population)[8]	19.5
Estimated annual take	25,000 tonnes

In 2004/05, the recreational harvest for the waters lying inside a line from Cape Colville to Cape Rodney included an estimated 1345 tonnes of snapper, 95 tonnes of kahawai, and two tonnes of kingfish.[129]

[127] Each area has specific regulations that apply to different fish stocks.
[128] There is no requirement to report recreational catch.
[129] Hauraki Gulf Forum, 2010, p14, citing Ministry of Fisheries figures.

The pressure on fish stocks from recreational fishing has increased. This is mainly related to the growing population, growing incomes, and technological developments such as GPS equipment, and improved gearing and boats.

Recreational fishers enjoy a high level of access to fishing areas and easy availability of fish when compared to many other countries. Considering that part of the Hauraki Gulf is directly adjacent to a major city, this access and availability can be considered as a unique feature in an urban environment.

9.5 Methodologies applied for the valuation of recreational fishing in New Zealand:

In 1999, a **Willingness To Pay** (WTP) survey was undertaken to assess the value in terms of consumer surplus[130] but no attempt has yet been made to value the contribution of recreational fishing to Gross Domestic Product (GDP) at either a national or regional level.

The information collected from the WTP survey was intended to contribute to:

- providing a definition of recreational rights
- characterising the recreational fishing sector
- establishing costs and benefits when bringing new species into the QMS
- assisting allocation decisions when setting the TAC
- enabling people to provide for their own social, economic, and cultural well-being. [131]

The 1999 survey focused on five fish species (snapper, kingfish, blue cod, kahawai, and rock lobster). The WTP was determined by asking respondents what they had spent on consumables (bait, fuel, ice, etc.) for their current fishing trip, and whether they would be willing to pay an additional *x* dollar for the trip. The responses were used to estimate the:

- value of the fishing experience
- value of recreational fish
- amount of expenditure on the five species investigated.[132]

The **Marginal Willingness To Pay** (MWTP) was identified as the marginal value of an additional kilogram of fish or an additional fish. It was calculated using regression analysis to identify the reasons for fishing beyond those of catching fish (based on survey information), and only included anglers who caught fish. The MWTP could provide useful information for policy purposes; such as fishery allocation and cost-benefit analysis.

The **Average Willingness To Pay** (AWTP) was calculated by multiplying the mean WTP of all anglers, including those who did not catch fish, by the total kilograms of fish caught and kept.[133] By including all anglers, this figure provides an estimate of the value of recreational fishing across all species surveyed in New Zealand.

The difference between the MWTP and AWTP is very relevant in the context of this report. The goal is not to assess the impact of a policy change (for which the MWTP would be the correct value to use) but rather to assess the value of recreational fishing in the Hauraki Gulf using the total economic value framework - and therefore capturing not just the use value of the fish but all the values related to the recreational fishing experience. As explained by Lindsay et al. (1999, ii–iii):

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[130] Consumer surplus describes the value over and above the market price that consumers would be willing to pay for a good or service; in this case for the fishing experience.
[131] The survey is cited in Lindsay et al., 1999. See also Williamson, 2000.
[132] This estimate does not include capital expenses such as the boat and rods, and does not include multiplier effects.
[133] The authors note that the AWTP was not the amount people said they were WTP, but was taken from the database of survey information.

'Fishers in the recreational sector may harvest the resource for a variety of reasons. Such reasons may include: informal food supplementation; for sport where fishers may go to elaborate means to meet the challenge; a quiet recreational pursuit; or to enjoy the outdoors. People also fish for spiritual and cultural reason. The variety of reasons indicate that valuations of the resource will differ and that the evaluation is mixed with valuations of visual amenity and social experiences and with other activities such as tourism. Just as the value of production (output) has been the most common form of misconception over the commercial economic value of fisheries, then the amount spent by recreational fishers to catch fish has also been a commonly misused concept.

However, as commercial economic value of fish is not its gross production value (or the amount spent by commercial fishermen catching the fish), neither is the cost associated with fishing recreational economic value.

There are two different estimates that can be used to represent the value of recreational fishing:

(1) The value of recreational fishing as a whole, to work out what fishing is worth to New Zealand. This includes experienced anglers who are willing to spend money trying to catch fish even though they are not successful. This estimate is the value of recreational fishing as social activity, and measures the value placed on the whole day. It involves the application of average willingness to pay (AWTP) estimates.

(2) The value of recreational fish, estimates the actual value of the fish caught in order to compare the value of recreational fish to commercial fish. These values estimate the value of the additional fish caught, taking into consideration all other factors that influence the willingness to pay for the day's fishing trip (in other words, it strips out the influence of all other variables on willingness to pay). It involves the application of marginal willingness to pay (MWTP) estimates.

In addition to these values, there is another way of looking at the contribution of recreational fishers to the economy, namely the direct expenditure they make.'

Lindsay et al. (1999) argues that the MWTP values best illustrate how much recreational fish are worth to recreational fishers in New Zealand. These values are the most useful for policy purposes; cost-benefit analysis, fishery allocation, legal situations, and for comparing against commercial fishing economic values.

However, Lindsay et al. (1999) affirms that AWTP values may provide more information if the purpose is to illustrate the general value of recreational fishing in New Zealand. Estimates of the total amount spent per year by a fisher targeting a particular species will provide a rough estimate of the amount of expenditure by anglers in the economy. It must be noted that these figures are based on recurrent expenditure only and do not include any capital expenditure (such as boats and rods) or multiplier effects.

In 2001, Wheeler and Damania assessed the validity of WTP estimates (including those by Lindsay et al. 1999), AWTP, MWTP, and the use of these values for policy. Wheeler and Damania noted that the AWTP captures benefits that relate to the fishing experience but which may not involve actually catching fish. These benefits may include (but are not limited to) sport, recreation, enjoying the outdoors, spiritual values, and cultural values. Conversely, the MWTP estimates the value of the fish caught:

'When valuing recreational fishing for policy purposes, both the marginal and the average values are important. If the objective is to value recreational fishing, then either consumer surplus, or the average WTP of fish may be of use. The average WTP, which is reported in

Lindsay et al. (1999), captures benefits from non-catch sources. On the other hand, if the objective is to estimate the value of recreational fish caught, the marginal WTP, which estimates the value of the additional fish caught, is the more appropriate measure. The choice of variable thus depends on the policy question.'[134]

Therefore, in the context of this report the AWTP is clearly a better indicator of the value of recreational fishing.

9.6 Economic value of recreational fishing

This report reviews the currently available information that contributes to knowledge of the value of the Hauraki Gulf recreational fishery.

Determining the value of the recreational fishery is complex as, unlike commercial fishers, recreational fishers do not have to provide any official records of their catch. Information that is collected and used to estimate catch sizes is based on aerial, boat-ramp, and telephone surveys.[135] Commercial activities such as fishing tours, which are classified as recreational fishing, also have direct economic impacts that are not calculated here.

Therefore, non-market valuation techniques have to be used to estimate the commercial value of the fish.

As mentioned earlier, recreational fishers are motivated not just by the value of the catch but also by a number of additional (and even alternative) reasons or values, which precisely reflect the holistic approach of the total economic value assessment.

When the main reason for fishing is consumption, the WTP is relatively low because of the ability to purchase fish (a close substitute to going fishing).[136] Overall, the MWTP is greater than the port (wholesale) price of commercial fish (except for rock lobster) but lower than the retail price. However**, Figure 18** shows that the AWTP is significantly higher than the retail prices for all fish species – illustrating that the activity of '*recreational fishing has far greater value than the prices consumers pay at shops*'.[137]

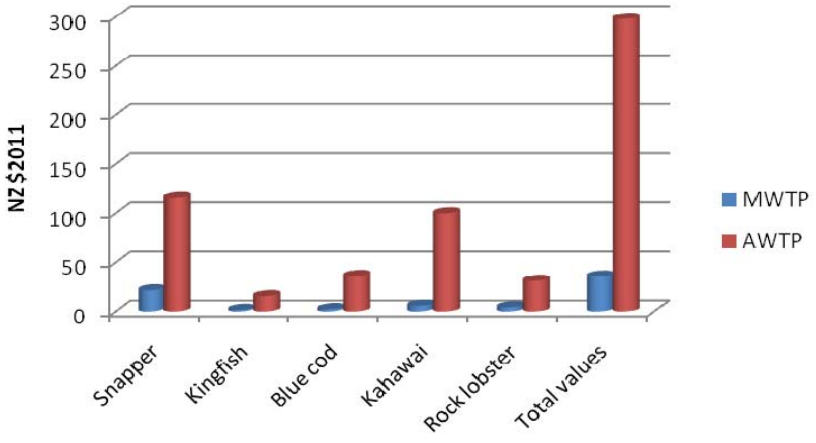

Figure 18. Total value of recreational fishing by species (expressed as MWTP and AWTP) 2006, $$_{2011}$$. (Source: Wheeler and Damania, 2001)

[134] Wheeler and Damania, 2001, p605.
[135] Hauraki Gulf Forum, 2010.
[136] Wheeler and Damania, 2001.
[137] Lindsay et al., 1999, p91.

The MWTP values were calculated on a per fish and per kilogram basis. The total MWTP was $\$_{2011}$35.5 million, made up of:

- $\$_{2011}$21.5 million for snapper
- $\$_{2011}$5.8 million for kahawai
- $\$_{2011}$4.2 million for rock lobster
- $\$_{2011}$2.4 million for blue cod
- $\$_{2011}$1.7 million for kingfish.

The AWTP values for the five fish species were estimated for recreational fishing on a per kilogram and a per fish basis.

- On a per kilogram basis, the AWTP for snapper was highest at $85.1 million, followed by kahawai at $73.6 million, rock lobster ($22.9 million), blue cod ($26.6 million), and kingfish ($11.4 million). The total AWTP for the five species was estimated at $219.6 million.
- On a per fish basis, the AWTP for kingfish was highest at $181.10 per trip, followed by kahawai ($59.65), rock lobster ($48.29), snapper ($30.85), and blue cod ($24.46).[138] The table below updates these values to $\$_{2011}$.[139]

Table 30. New Zealand recreational fishing values, $\$_{2011}$, 1999. (Source: Wheeler and Damania, 2001)

	Value per fish kept/caught		Value per kilogram				Amount spent $\$_{2011}$	
	MWTP $\$_{2011}$	AWTP $\$_{2011}$	MWTP $\$_{2011}$	AWTP $\$_{2011}$	Total MWTP value $\$_{2011}$ million	Total AWTP value $\$_{2011}$ million	Per trip	Total annual expenditure $\$_{2011}$ million
Snapper	7.8	41.9	7.9	42.3	21.5	115.5	48.6	566.4
Kingfish	26.8	245.8	4.4	40.5	1.7	15.5	67.4	173.9
Blue cod	2.2	33.2	3.3	49.5	2.4	36.1	59.9	154.0
Kahawai	4.7	81.0	3.8	65.8	5.8	99.9	34.4	206.9
Rock lobster	8.9	65.6	13.5	99.3	4.2	31.1	69.9	220.3
Total values	—	—			35.5	298.1	—	1,321.5

Although both MWTP and AWTP are good indicators of the economic value of fish and fishing trips, and include the benefits to fishers above and beyond the costs of the activity, they are not necessarily useful for providing robust figures on the contribution of recreational fishing to GDP or GRP.

GDP and GRP measure the monetary economy, therefore it is necessary to know the actual expenditure by fishers in order to determine the flow-on effects in the wider economy.

> *'Fisher expenditures, whilst a cost to fishers, can be of benefit to others, particularly those who supply goods and services to fishers. The full expenditure itself is not a measure of value, but the profits it generates for suppliers (and their suppliers), measured as value added is of relevance*.'[140]

[138] Lindsay et al., 1999.
[139] These figures have been updated to 2011 using the GDP deflator.
[140] Kerr and Latham (2011) assessed whether benefit transfer could be used to estimate the consumer surplus for recreational fishing in New Zealand. Consumer surplus consists of the values over and above the expenditure on the trip (the latter contributing to GDP). They found that there were few studies of the benefits, and those carried out were diverse in terms of

Lindsay et al. (1999) collected information on costs of consumables but cautioned against relying on these figures for various reasons, including double counting.

The value of recreational fishing differs depending on the fish species targeted. The largest total recurrent expenditure in a given year was $\$_{2011}$566 million for snapper fishing, followed by rock lobster fishing ($\$_{2011}$220 million), kahawai ($\$_{2011}$206 million), kingfish ($\$_{2011}$173 million) and blue cod ($\$_{2011}$154 million). The total annual recreational fishing expenditure in New Zealand was estimated to be $\$_{2011}$1321 million.[141]

9.6.1 Projections

No formal projections have been made regarding the value of the New Zealand recreational fishery. However, Lindsay et al. (1999) recorded some interesting socio-economic characteristics of fishers based on their survey. Recreational fishers tended to be older, with 31 per cent aged 41–50, 29 per cent aged 31–40, and only 15 per cent aged 21–30. Income levels, employment type, and employment status were also relevant.

Awareness of these factors may be useful in projecting future demands and potential issues. The demography of the populations close to the Hauraki Gulf Marine Park {HGMP) are indicated to be important to future recreational demands on this fishery, as well as population size and growth.

9.7 Overall tentative economic value of fishing in the Hauraki Gulf

Both commercial and recreational fishing catches (tonnes) in New Zealand and in the Hauraki Gulf are shown in Table 31.

The species found in the HGMP influence the value of recreational fishing in that region. For example, relatively large economic values are associated with kingfish and rock lobster (on a per fish basis). Interestingly, on a per kilogram basis, the kingfish value is relatively low. Wheeler and Damania (2001) contend that this is because the value lies in the fishing experience, rather than in the fish value. Similarly, some fishers value kahawai because of the fishing experience – for this fish, the value to fish was greater than the retail cost of the fish.[142]

methodology, geography, and time. This produced a broad range of estimates and the potential for achieving an accurate assessment for the New Zealand recreational marine fishery was '*extremely slim*'.

[141] The authors urge caution with the figure for amount spent. This may involve some double counting with expenditure of various fishers and they note that the population of fishers used to calculate the values was '*highly questionable'*.

[142] Wheeler and Damania, 2001.

Table 31. Commercial and recreational fishing catch, NZ and HGMP. (Sources: Wheeler and Damania, 2001 and Ministry of Fisheries, 2011)

	New Zealand recreational catch (tonnes) 1999[1]	Hauraki Gulf Marine Park commercial catch (tonnes) 2011[2]	Hauraki Gulf* recreational catch (tonnes) 2011[2]
Snapper	2731	2276	1345
Kingfish	380	na	na
Blue cod	729	na	na
Kahawai	1518	345	na
Rock lobster	313	na	na

*Inside the area comprised by Cape Colville and Cape Rodney.

1. Wheeler, S. and Damania, R., 2001.

2. Ministry of Fisheries, 2011.

This data has been used in the following procedure to provide a preliminary estimate of the recreational value of fishing in the Hauraki Gulf. It takes the following factors into account:

- Only the values for snapper and kahawai are comparable (although national recreational values were estimated in 1999 and commercial values for the Hauraki Gulf in 2011).
- New Zealand's population increased by 13.5 per cent between 2001 and 2011.
- Auckland's population was 31.4 per cent of total New Zealand population in 2001 and 33.7 per cent in 2011, an increase of 22 per cent in numbers and 2.3 per cent in share.[143]
- Thames, Coromandel, and the Hauraki Districts account for approximately 1 per cent of the total New Zealand population.
- The Hauraki Gulf population, being surrounded by the sea, is probably more likely to be involved in recreational fishing than the average New Zealand population.
- Technological developments have increased the catch rate of recreational fishers.

Therefore, it is reasonable to assume that the recreational values shown in Table 31 should be recalculated by:

- increasing the total catch by the same rate of population growth
- apportioning a share of the national catch to the Hauraki Gulf that corresponds to the combined share (35 per cent) of Auckland's and Waikato's Hauraki Gulf areas.

The recalculated values are shown in Table 32.

[143] Statistics New Zealand.

Table 32. Adjusted commercial and recreational fishing catch, NZ and HGMP. (Sources: Wheeler and Damania, 2001 and Ministry of Fisheries, 2011)

Species	New Zealand recreational catch (tonnes) *2011 adjusted[1]	HGMP commercial catch (tonnes) 2011[2]	HG** recreational catch (tonnes) 2011[2]	HG share of total adjusted recreational catch (tonnes) ***2011[2]
Snapper	3099	2276	1345	1085
Kingfish	432			151
Blue cod	828			290
Kahawai	1723	345		603
Rock lobster	355			124

*1999 value increased by 13.5 per cent
**Inside the area comprised by Cape Colville and Cape Rodney.
***Calculated as 35 per cent of the adjusted national catch.

1. Wheeler, S. and Damania, R., 2001.
2. Ministry of Fisheries, 2011.

It should be noted that the snapper catch weight (1085 tonnes) estimated using this assumption is 20 per cent lower than the 1345 tonnes estimated by the Ministry of Fisheries (2011).

If 35 per cent of the total national value is apportioned to the Hauraki Gulf, Table 33 shows the results.

Table 33. Adjusted MWTP, AWTP, and total annual expenditure values for recreational fishing in the Hauraki Gulf, $\$_{2011}$ million. (Source: Adapted from Wheeler and Damania, 2001)

Species	Total MWTP value $\$_{2011}$ million	Total AWTP value $\$_{2011}$ million	Total annual expenditure $\$_{2011}$ million
Snapper	7.5	40.4	198.2
Kingfish	0.6	5.4	60.9
Blue cod	(0.8)	(12.6)	(53.9)
Kahawai	2.0	35.0	72.4
Rock lobster	(1.5)	(10.9)	(77.1)
Total value	10.1	80.8	331.5

The proportion of the national recreational catch of blue cod and rock lobster that could be apportioned to the Hauraki Gulf is not clear, so these have been excluded from the following calculations. Instead, kahawai and kingfish have been included as these are not only are more likely to reflect the reality but also compensate for the elimination of the other two species.

These calculations show the following values of recreational fishing in the Hauraki Gulf:

- MWTP is $\$_{2011}$10.1 million
- total AWTP is $\$_{2011}$80.8 million
- total annual expenditure is $\$_{2011}$331.5 million.

Updated research would be useful to determine the value for recreational fishing in the regional economy given the length of time since currently available data was collected, its lack of geographic specificity, and the changing demographic nature of Auckland. This would include information on expenditure by fishers to provide regional values and more robust figures. [144]

9.8 Comparison between the valuation of recreational and commercial fishing

This section provides a comparison between the overall tentatively assessed values of recreational and commercial fishing. As discussed earlier, the AWTP is commonly considered as the most accurate value to assess the value of recreational fishing but this section also compares the MWTP. The gross value of catch for commercial fishing is used (and calculated as before).

Although these values provide useful insights, they have to be treated with extreme caution and are not significant from a strict economic perspective.[145] The main concerns about these values are that they:

- are not homogeneous market values
- were obtained by applying a number of assumptions that are difficult to verify, to different sets of data
- were not obtained through an acceptable economic impact assessment methodology; eg, commercial fishing does not include any economic impact assessment that considers the wider impact of that activity on the economy (the indirect and induced impacts)
- were estimated using different methodologies (eg, the value of recreational fishing captures a wider spectrum of values, not just those related to the use value of the catch).

Despite these concerns, it is worthwhile to compare the valuations. Figure 19 shows the two alternative valuations of recreational fishing (MWTP $10.1 million and AWTP $80.8 million) beside the commercial one ($41 million).

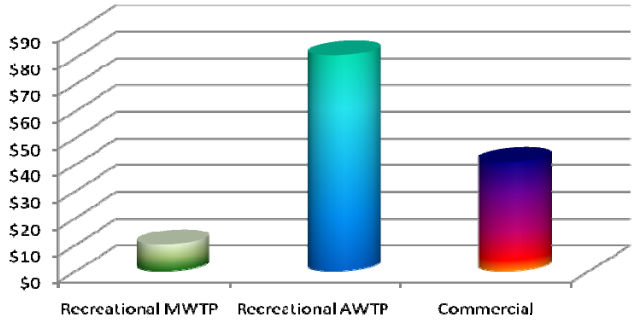

Figure 19. Estimated values of recreational and commercial fishing totals in the Hauraki Gulf. (Source: Elaboration on Wheeler and Damania, 2001; Ministry of Fisheries, 2011; Boyd, 2012)

[144] The Ministry of Primary Industries is currently undertaking a large scale multi-species survey; a multi-year research project that is examining the species, harvest, and distribution of recreational fisheries across New Zealand. Although the results of this research will not be available until next year, these may be able to assist with recreational fishing valuations and assessment in the future.

[145] A review of the Lindsay et al. (1999) study notes that: '*Consumer surplus is two to four times expenditure, indicating that value added from recreational fishing is likely to be very small in comparison to consumers' surplus*.' (Kerr and Latham, 2011, p5).

The availability of data means that it is only possible to directly compare values for snapper and kahawai.[146] Table 34 illustrates both the commercial and recreational values. The result is very different if the MWTP or the AWTP is used: while the MWTP of recreational fishing is just 50 per cent of the value of the commercial gross value of catch for these two species, the total recreational AWTP is four times that of the total commercial value.

Table 34. Recreational and commercial fishing catch and values of selected species in the Hauraki Gulf. (Source: Elaboration on Wheeler and Damania, 2001; Ministry of Fisheries, 2011; Boyd, 2012)

Species	Recreational catch	Recreational MWTP	Recreational AWTP	Commercial catch	Domestic value (10 per cent)	Commercial export value (90 per cent)	Commercial total value
	Ton	$2011 million	$2011 million	Ton	$2011 million	$2011 million	$2011 million
Snapper	1085	7.5	40.4	2276	2.8	21.3	24.1
Kahawai	603	2.0	35.0	345	0.04	0.3	0.3
Total		9.6	75.4		2.8	21.6	24.4

The difference in value is particularly significant for kahawai - $35 million recreational compared to $0.3 million commercial (see Figure 20).

If the snapper value alone is examined, the commercial gross value of the catch is equivalent to 60 per cent of the snapper recreational fishing AWTP, a value that does not seem to over-estimate the relative contribution to the local economy of both activities.

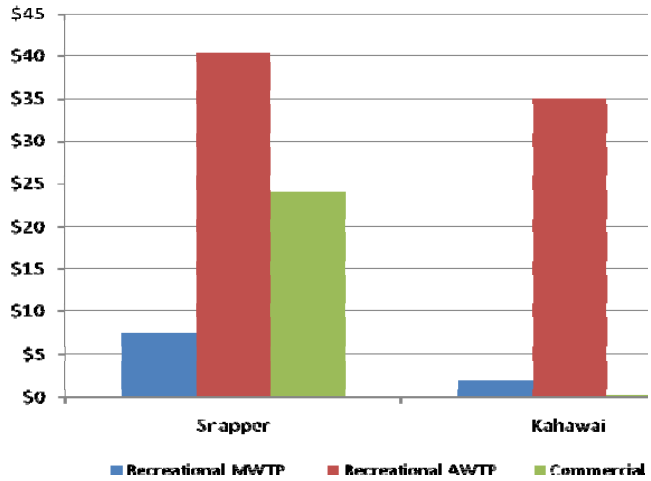

Figure 20. Comparison of the recreational (MWTP and AWTP) and commercial values of snapper and kahawai.

[146] It is useful to remember that snapper represent more than 70 per cent of the land value and 60 per cent of the export value. This comparison is significant, as pointed out by Boyd (2012, p11): '*Although there is a diverse range of fishing methods used and species taken in the commercial fishery within HGMP, snapper is by far the most valuable species. The inshore fishing industry relies on snapper for its existence. Without the income generated from the snapper fishery, commercial trawling, Danish seining and long-lining in the HGMP area would not be commercially viable. In recent years, approximately 50 per cent of the total commercial catch of snapper from the SNA1 stock has come from the HGMP area*.'

10.0 Tourism and the Hauraki Gulf

10.1 Introduction

Tourism plays a significant role in the New Zealand economy. It produces goods and services, generates foreign currency (export earnings), and creates employment opportunities.

The Hauraki Gulf has an important role to play in tourism, with the natural environment – both landscape and coastal – being considered as the Auckland region's greatest collective asset. The vast tracts of public space and parks within the Auckland region offer visitors a diversity of outdoor activities, and opportunities to explore bush, farmland, beaches, volcanic fields, and waterways.

In the year ending January 2012, more than 2.6 million international tourists visited New Zealand. The largest numbers came from Australia (44 per cent), followed by the United Kingdom (9 per cent), the United States (7 per cent), China (6 per cent), and Japan (5 per cent). More than half (53 per cent) were on holiday while the rest were visiting friends or relatives (37 per cent) or were on business (11 per cent). Their total expenditure was $5.763 billion.

Domestic tourist flows accounted for 48 million trips and 49 million nights.

The Ministry of Tourism (2012) calculated that tourist expenditure totalled $23 billion, with $9.7 billion (42 per cent) from international tourists and $13.2 billion (58 per cent) from domestic tourists. This expenditure contributed $6.9 billion of direct value added, or 3.8 per cent of total New Zealand GDP. Employment generated by tourism was 92,000 FTEs or 4.8 per cent of total employment.[147] Foreign tourist expenditure accounted for 16.8 per cent of New Zealand's total export earnings.

Tourism expenditure includes spending by all travellers; international, domestic, recreational, business, and government. In 2008, 18 per cent of all tourists visited Auckland and tourism contributed $2 billion or 4.3 per cent of Auckland's GDP.[148] Tourism is even more important to the economy in the Coromandel region.

Nature-based tourism is defined as '*international and domestic visitors, aged 15 years and over, who participate in at least one nature-based activity while travelling in New Zealand. Local residents participating in nature-based activities within their area are not included in this definition*.[149]. Statistics New Zealand defines nature-based tourism as a visit (from outside the respective region) that includes participation in at least one nature-based activity.

Nature-based activities are defined as '*outdoor activities undertaken by tourists in the natural environment*'.[150] A quarter of the tourists travelling through New Zealand and Auckland take part in nature-based activities. This includes Coromandel residents visiting Auckland, and vice versa.

This segment of the tourism industry is a valuable contributor to both the Auckland and Coromandel economies, and is expected to grow in the future.

Auckland's amenities and facilities are the main reason why holiday tourists visit and stay in Auckland. The Hauraki Gulf and its islands are not usually mentioned separately as a specific major attraction but the coastal environment is one of the main drivers behind tourism. In the Coromandel region, tourism – and nature tourism in particular – is even more important, and is crucially dependent on the attractiveness of the coastal environment.

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[147] Statistics New Zealand, 2011, Tourism Satellite Account.
[148] In 2011. Infometrics, 2012.
[149] Quoted from Ministry of Tourism, 2009.
[150] Ministry of Tourism, 2009. Tourism Sector Profile/Tourist Activity/Nature-Based Tourism.

As nature tourism grows, there will be increasing pressure on receiving facilities and amenities of all kinds including local tourist transport, accommodation, excursions, and airport connections. Similarly, improved amenities, facilities, and environmental quality will enhance the region's attractiveness to tourists.

10.2 Tourism flows related to the Hauraki Gulf: proxies and definitions

No specific study has been undertaken of the economic contribution made by the portion of tourist flows to the Hauraki Gulf area that is directly related to the Hauraki Gulf itself, so proxies must be used instead. Therefore, as this report is concerned with assessing the total economic value of the Hauraki Gulf, nature-based tourism in Auckland and the Coromandel is seen as the most suitable proxy to assess the economic impact of Hauraki Gulf-related tourism flows.

Nature-based activities are further defined as '*outdoor activities undertaken by tourists in the natural environment*'. This includes non-coastal activities, such as visits to lakes and hot pools that do not directly involve the Hauraki Gulf. However, it seems unlikely that many nature-based tourists in Auckland or Coromandel would participate exclusively in these types of outdoor activities without also participating in activities that involve a beach or some type of coastal, marine, or sea-view component. In fact, the top three nature-based activities for international visitors to Auckland are beaches, scenic drives, and cruises, all of which have a clear link to the Hauraki Gulf.[151]

Tourism is measured by trips (visits). An individual may visit more than once, which counts as multiple trips.[152] A trip could be for any purpose (including business or education) and is still be included as tourism.

Domestic tourism includes only trips from one region of New Zealand to another and includes both day trips and overnight stays. It excludes trips within the same region.

Propensity denotes the proportion of tourism that is nature-based.

10.3 Nature tourism in New Zealand, Auckland, and the Coromandel

Tourist flows are divided into domestic visitors and international visitors, depending whether the tourist lives in New Zealand or overseas.

It is important to separate these two types of visitors because their respective spend patterns and propensities to engage in nature tourism can be quite different (see Table 35).

For New Zealand as a whole, the majority (70 per cent) of international visitors engage in nature-based activities, whereas only 22 per cent of domestic trips are nature-based.[153]

However, 44 million domestic trips are made compared with 2.3 million international trips. This much greater number of total domestic trips means that domestic nature-based tourism trips (9.6 million) greatly outnumber international nature-based trips (1.6 million).

[151] Ministry of Tourism, 2009. Allocating all of Auckland's nature-based tourists to the Hauraki Gulf is an overestimation because there are other natural attractions. However, this risk is compensated for, as recreational activities in the Gulf by Auckland residents are not accounted for and, in addition, non-nature-based tourists (the vast majority of international tourist visiting Auckland) are attracted by the Gulf (eg, visiting relatives, wine tasting on Waiheke Island) but their spend is not accounted for either. This risk of overestimation is discussed later in this section.

[152] Ministry of Tourism, 2009.

[153] The number of visitors is measured by the number of trips. If an individual visits more than once, this is counted as multiple trips.

Table 35. New Zealand tourism breakdown, 2008. (Source: Ministry of Tourism, 2009)

	Domestic	Domestic percentage	International	International percentage	Total	Total percentage
Nature	9,600,000	22	1,600,000	70	11,200,000	24
Non-nature	34,400,000	78	700,000	30	35,100,000	76
Total trips	44,000,000	100	2,300,000	100	46,300,000	100

10.3.1 International tourists – purpose of trip

Almost all international holiday tourists participate in nature-based activities (92 per cent in 2008; see Table 36). Consequently this group makes up the majority of international nature-based tourists (64 per cent in 2008).

International tourists who are visiting friends or relatives make up the second largest group (25 per cent) but their overall propensity to participate in nature-based activities is lower (59 per cent).

The remaining 11 per cent of international nature-based tourists are visiting New Zealand for business, educational, or other purposes.

In 2008, the most popular areas visited by international nature-based tourists were:

- Rotorua (563,400 tourists, 36 per cent of all international nature-based tourists)
- Auckland (541,700, 35 per cent)
- Fiordland (453,700, 29 per cent)[154].

The most popular nature-based activities in Regional Tourism Organisations (RTOs) include:

- Auckland and Northland (beaches, scenic drives, cruises)
- Rotorua (geothermal)
- Waikato (glow worm caves)
- Nelson (beaches, trekking)
- Canterbury (beaches, whale watching)
- West Coast (glaciers)
- Queenstown (jet-boating)
- Fiordland (scenic boat cruise).

Ninety seven percent of international tourists to the Fiordland RTO participated in a nature-based activity. This is the highest propensity for visitors to any RTO. This was followed by the West Coast (91 per cent), Rotorua (87 per cent), and Ruapehu (86 per cent).

International tourists to the Auckland RTO had a low propensity (31 per cent) to participate in nature-based activities[155].

[154] Ministry of Tourism, 2009.
[155] Ministry of Tourism, 2009.

10.3.2 Domestic tourists – purpose of trip

Domestic nature-based tourists are also predominantly on holiday (63 per cent) while a significant number are visiting friends or relatives (25 per cent). Again, tourists on holiday have the highest propensity to undertake nature-based activities (34 per cent), followed by those visiting friends and relatives (17 per cent). These domestic propensities are much lower than those for international tourists.

Table 36. Nature-based tourists: trip purpose and propensity, 2008. (Source: Ministry of Tourism, 2009)

	International visitors (percentage)		Domestic visitors (percentage)	
	Purpose	Propensity	Purpose	Propensity
Holiday	64	92	63	34
Visit friends or relatives	25	59	25	17
Business/education/other	11	36	12	10
Total or average all purposes	100	70	100	22

10.3.3 Auckland's domestic and international tourists

The Auckland region has the country's highest number of nature-based tourists. In 2008, 1.9 million nature-based tourists visited Auckland (17 per cent of the national total). The Northland region had the next highest number with 1.2 million nature-based visitors.[156] Auckland also has a relatively high proportion of international nature tourists compared with domestic tourists: 0.54 million international compared with 1.38 million domestic.

Auckland is a major international destination and gateway but, not surprisingly, the main trip purpose is not nature tourism (see Table 37).

Only 31 per cent of international visitors to Auckland engage in nature tourism, a far lower percentage compared with other destinations in New Zealand. However, Auckland's share of the country's international visitors of all types is so high (76 per cent) that this lower percentage of nature tourists still gives Auckland a 34 per cent share of all international nature tourists who visit New Zealand.[157]

The trip purposes of domestic tourists are very similar to the national average, and are even less nature-oriented (see Table 37). Auckland's share of national domestic nature tourism is only 14 per cent, similar to its relatively low share of national domestic tourism of all kinds (15 per cent). This is because the propensity of domestic tourists visiting Auckland to engage in nature-based activities (21 per cent) is similar to the national average for domestic tourists (22 per cent).

[156] Ministry of Tourism, 2009.

[157] A complicating factor is that an international visit to New Zealand can include multiple destinations but only one destination needs include a nature-based-activity for the New Zealand visit to be considered as nature tourism. The visit would count as non-nature based for the other destinations and therefore sum to more than the national total of non-nature-based tourism.

Table 37. Auckland tourism flows, 2008. (Source: Ministry of Tourism, 2009; Elaboration by Auckland Council)

	International		Domestic		
	Numbers	Propensity (percentage)	Numbers	Propensity (percentage)	Total numbers
Nature	542,000	31	1,381,000	21	1,923,000
Non-nature	1,206,387	69	5,324,748	79	6,531,135
Total tourism	1,748,387	100	6,705,748	100	8,454,135

10.3.4 Coromandel's domestic and international tourists

Coromandel, like most New Zealand tourism destinations, is mainly a nature destination; especially for international tourists who are slightly more likely (80 per cent) to be nature-based tourists compared with the average for New Zealand destinations as a whole (70 per cent).

In 2008, Coromandel received 9 per cent of both domestic (0.86 million) and international (0.14 million) nature trips in New Zealand, a total of 1 million nature trips (see Table 38). This makes Coromandel the fifth most popular nature destination - very close to Canterbury and Rotorua which both had 1.03 million nature trips that year.

Table 38. Coromandel: domestic and international nature-based trips, 2008. (Source: Ministry of Tourism, 2009)

	Auckland (numbers)	Auckland (percentage)	Coromandel (numbers)	Coromandel (percentage)	New Zealand (numbers)	New Zealand (percentage)
International	542,000	28	141,000	14	1,600,000	14
Domestic	1,380,000	72	859,000	86	9,600,000	86
Total	1,922,000	100	1,000,000	100	11,200,000	100

10.3.5 Domestic and international tourists - Hauraki Gulf

In 2008, Auckland had 1.38 million domestic nature-based visits while Coromandel had 0.86 million – a total of 2.2 million domestic nature-based visits to the Hauraki Gulf area (see Table 39). In addition, Auckland had 0.54 million international nature-based visitors and Coromandel 0.14 million – a total of 0.7 million international nature-based visitors to the Hauraki Gulf area.

In 2008, therefore, total nature-based tourism in the Hauraki Gulf area (Auckland plus Coromandel) equated to 2.9 million trips.

The Hauraki Gulf area had 43 per cent of New Zealand's nature-based trips made by international tourists and 23 per cent of domestic nature-based trips. This gives the Hauraki Gulf area an overall average of 26 per cent of the national total of nature-tourism trips with Auckland comprising 17 per cent of the national total and Coromandel 9 per cent.

Table 39. Regional shares of New Zealand's nature-based tourist trips, 2008. (Source: Ministry of Tourism, 2009)

	International nature-based		Domestic nature-based		Total nature-based	
	Numbers	Percentage	Numbers	Percentage	Numbers	Percentage
Auckland	542,000	34	1,380,000	14	1,922,000	17
Coromandel	141,000	9	859,000	9	1,000,000	9
Total Hauraki Gulf	683,000	43	2,239,000	23	2,922,000	26
Rest of New Zealand	917,000	57	7,361,000	77	8,278,000	74
Total New Zealand	1,600,000	100	9,600,000	100	11,200,000	100

When nature-based trips to the Hauraki Gulf are compared to total tourist trips in New Zealand (including both nature and non-nature-based), they represent 30 per cent of total international trips, 5 per cent of total domestic trips, and 6 per cent of total tourist trips (domestic plus international).

These figures indicate that the Hauraki Gulf is already a relevant nature destination for international tourists but, apparently, a much less significant attraction for domestic tourists. However, the relatively low proportion of domestic trips to the Hauraki Gulf is significantly affected by the fact that more than 37 per cent of the New Zealand population already resides in Auckland or the Coromandel and does not have to travel – and be counted as tourists – in order to enjoy the Hauraki Gulf.

In addition, the recreational and cultural benefits that Auckland residents receive from the Hauraki Gulf are significant. Low-income residents benefit from the proximity of the Hauraki Gulf and guaranteed public access which results in free (or very low cost) use of its amenities: this represents a very important, and not yet accounted, value provided by the Hauraki Gulf. Otherwise, with only a small proportion of income available for recreational activities, travel costs could be an insurmountable barrier to low-income residents and affect their capacity to enjoy the Hauraki Gulf.

10.4 Methodology

In order to assess the economic impact of Hauraki Gulf-related tourism flows, a methodology based on spend per trip was used - with a variant.

The amount spent by nature-based international tourists in Auckland was also tested/estimated.[158]

The expenditure assessed by this methodology was compared with the value obtained simply by applying the share of international nature-based tourists to the total expenditure of international tourists in Auckland, as assessed by Covec (2009). This comparison aimed to provide a useful term of reference.

[158] This is the amount spent by nature-based international tourists in Auckland. This decision was determined by constraints on data availability.

10.4.1 Total expenditure

The methodology is based on spend per trip and the numbers of trips, taking into consideration the following two factors:

1. Table 39 identified total nature-based trips to the Hauraki Gulf as:

- international (variable a1)
- domestic (variable a2).

2. The trip spend of international tourists can be calculated by using the average spend per trip (as provided by the Ministry of Tourism). The average spend per trip refers to their total spend in New Zealand so only a third (33 per cent) of their spend is apportioned to Auckland or the Coromandel. There are two possibilities:

- the amount provided by Ministry of Tourism research (2009) calculated a $\$_{2008}3040$ ($\$_{2011}3258$) average spend per trip in 2008 by international nature-based tourists, which produces a 33 per cent share value of $\$_{2011}1075$ (variable b1)

- the average expenditure of $\$_{2011}2420$ per international tourist per trip in 2011, derived from the Ministry of Tourism (2012),[159] which produces a 33 per cent value of $\$_{2011}799$ (variable b2).[160]

A Domestic Travel Survey by the Ministry of Economic Tourism (2012) also provides a figure of $\$_{2011}195$ per average (both day and overnight) domestic trip (variable c).

Therefore, the gross expenditure of nature-based tourists in the Hauraki Gulf ($EXP_{NatTour}$ HG) can be calculated in two alternative ways, depending how international spend is accounted for:

(1) $EXP_{NatTour}$ HG_1 = a1 x b1 + a2 x c

$EXP_{NatTour} HG_1 = 683{,}000 \times \$_{2011}1075 + 2{,}239{,}000 \times \$_{2011}195$

$= \$_{2011}734{,}225{,}000 + \$_{2011}436{,}605{,}000$

$= \$_{2011}1{,}170{,}830{,}000$

Of this, $\$_{2011}890$ million (76 per cent) is generated in Auckland and $\$_{2011}281$ million (24 per cent) in the Coromandel.

(2) $EXP_{NatTour}$ HG_2 = a1 x b2 + a2 x c

$EXP_{NatTour} HG_2 = 683{,}000 \times \$_{2011}799 + 2{,}239{,}000 \times \$_{2011}195$

$= \$_{2011}545{,}717{,}000 + \$_{2011}436{,}605{,}000$

$= \$_{2011}982{,}322{,}000$

Of this, $\$_{2011}746$ million is generated in Auckland and $\$_{2011}236$ million in the Coromandel.

10.4.2 Comparison with expenditure share in Auckland

[159] Both nature and non-nature-based trips.
[160] International Visitor Survey.

Covec (2009) estimated that total expenditure of all visitors to Auckland in 2006 was $\$_{2006}3.745$ billion; that is, $\$_{2011}4.320$ billion of which 67 per cent ($\$_{2011}2.907$ billion) was attributed to all kinds of international visitors, both nature and non-nature-based trips.

This means that it is possible to calculate spend by international nature-based visitors to Auckland by applying their 31 per cent share (see Table 37) to the above total spend of international visitors.

This results in the following value:

$$EXP\ HG_{NatTourAKL\ share} = \$_{2011}2.907 \text{ billion x } 31\% = \$_{2011}901 \text{ million}$$

By calculating the corresponding values obtained from the methodology and its variant[161]:

$$EXP_{1NatTour}\ HG_{AKL\ trip} = 542{,}000 \text{ x } \$_{2011}1075 = \$_{2011}583 \text{ million}$$

$$EXP_{2NatTour}\ HG_{AKL\ trip} = 542{,}000 \text{ x } \$_{2011}799 = \$_{2011}433 \text{ million}$$

and comparing the two alternative results with this reference:

$$EXP_{1NatTour}\ HG_{AKL\ trip}/EXP\ HG_{NatTourAKL\ share} = 583/901\ (65\%)$$

$$EXP_{2NatTour}\ HG_{AKL\ trip}/EXP\ HG_{NatTourAKL\ share} = 433/901\ (48\%)$$

a large discrepancy relative to the comparator can be seen in both cases. This clearly indicates a high risk of underestimation of nature-based tourism impacts - as calculated by this methodology – which depends crucially on the allocation of the Ministry of Tourism spend estimations to nature-based tourists numbers.

The differences between the two results, especially when the second variant is applied, are striking and this assessment should be treated with great caution.

In addition, the spend of nature-based visitors as estimated by the Ministry of Tourism (2009) is, on average, 13 per cent higher than that by general visitors and this factor is not reflected in the calculations. As the share of international visitors who are only transiting through Auckland is significantly higher than the national share, it seems reasonable to assume that spend by international nature-based tourists in Auckland is even higher than in the rest of the country.

10.4.3 GDP impact coefficient

Finally, the net GDP impact is calculated.

GDP impact is calculated as the value-added component of all the related activities that are stimulated by the considered total expenditures. Therefore, GDP impact is composed of direct impact plus the stimulation impact of the flow-on effects arising from that direct expenditure.

Flow-on effects are a combination of indirect effects on other industries (eg, transport, warehousing) that receive a stimulus from supplying the tourism industry, plus the induced effects of additional household spending by people who are employed as a result of the direct and indirect effects.

Covec (2009) calculated that the ratio of total GDP impacts (direct plus flow-on) to gross expenditure is 80 per cent (variable αGDP) for tourism in Auckland. By applying this coefficient to the previously calculated gross expenditure ($EXP_{NatTour}$ HG) both for Auckland and the

Coromandel, the net economic impact (GDP HG) of the Hauraki Gulf-related tourism flows can be obtained:

$$GDP_{NatTour}\ HG = EXP_{NatTour}\ HG \text{ x } \alpha GDP$$

[161] Only for Auckland.

10.5 Assessed economic impact

This formula can be applied to calculate the net economic impact (GDP HG) of the Hauraki Gulf-related tourism flows (Auckland plus Coromandel):

(3) GDP HG_1 = $\$_{2011}$1,170,830,000 x 0.8 = $\$_{2011}$936,664,000

From this total, $\$_{2011}$656 million would be direct impact and the remaining $\$_{2011}$281 million would be flow-on (indirect + induced) effects.[162]

When divided by region, $\$_{2011}$681 million (73 per cent) is generated in Auckland and $\$_{2011}$255 million (27 per cent) in the Coromandel.

Alternatively, by using variable b2 (see Section 10.4.1), the net economic impact (GDP HG) of the Hauraki Gulf-related tourism flows are calculated as:

(4) GDP HG_2 = $\$_{2011}$982,322,000 x 0.8 = $\$_{2011}$785,857,600

From this alternative total, $\$_{2011}$550 million would be direct impact and the remaining $\$_{2011}$236 million would be flow-on (indirect + induced) effects.[163]

In order to mitigate the risk of underestimation mentioned earlier, the total generated from equation (3) $GDP_{NatTour}$ HG_1= $\$_{2011}$936,664,000, was used as the economic impact assessment of the Hauraki Gulf-related tourism flows.

Infometrics (2012) states that the total Auckland tourism sector employed 35,440 people in 2011 and generated a direct GDP value of $\$_{2011}$2110 million. On that basis, the job intensity ratio is 16.8 jobs per million dollars of GDP. (This has been assumed to apply to nature-based tourism and indirect and induced GDP as well.)

If this job intensity ratio is applied to the assessed GDP impact from equation (3), the following results:

(5) Employment HG = 16.8 x 937 = 15,742

Therefore, the total employment impact of Hauraki Gulf-related tourism flows can be estimated at approximately 15,742 jobs. By region, this equates to 11,453 jobs generated in Auckland and 4289 jobs in the Coromandel.

[162] Applying the coefficients and multipliers used by Covec, 2009.
[163] Applying the coefficients and multipliers used by Covec, 2009.

10.6 Trends and future projections

10.6.1 Trends in international and domestic nature-based tourists

The number of nature-based tourists for New Zealand as a whole showed a slight upward trend between 2004 to 2008, driven mainly by an increase in the domestic component.

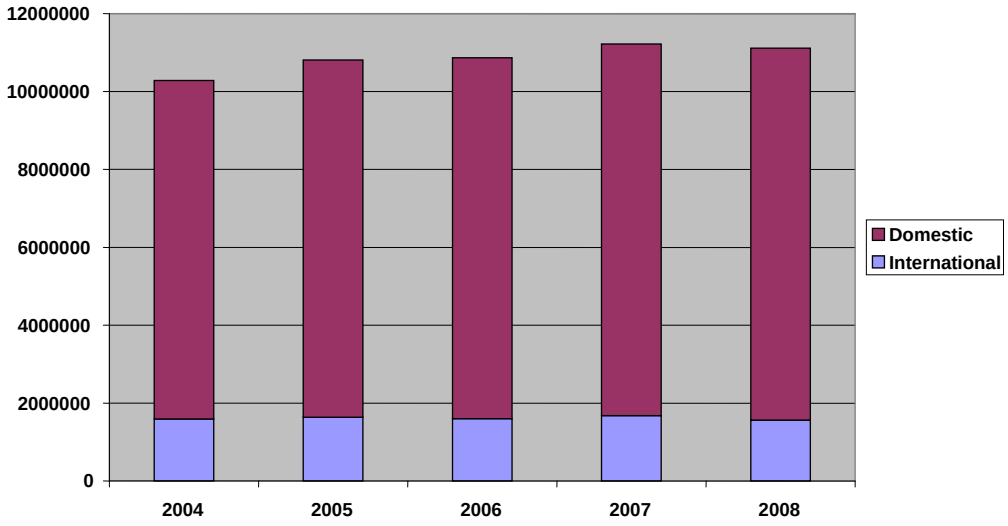

Figure 21. Numbers of nature-based tourists in New Zealand. (Source: Ministry of Tourism, 2009)

10.6.2 Trends in propensity to engage in nature tourism

No long-term future projections are available for nature tourism as such, so overall tourism must be used as a proxy.

The nature tourism component will grow at the same rate as tourism as a whole, provided that nature tourism remains as a constant proportion of total tourism. The proportion of nature-based tourism is represented by the propensity of tourists to engage in nature-based activities. Apart from a small decline when the global financial crisis struck in 2008, the propensity has remained constant over time, with a slight upward trend for domestic tourists.

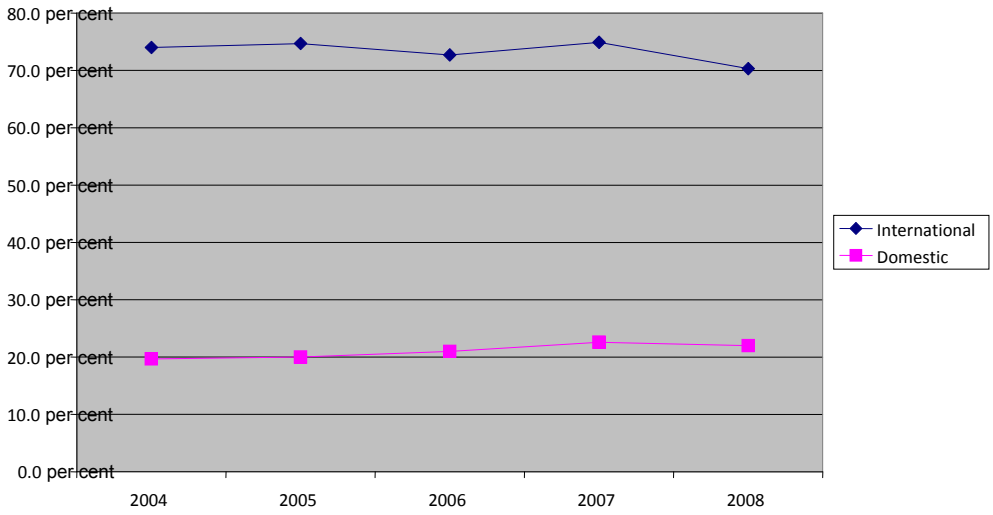

Figure 22. Propensity to engage in nature-based activities. (Source: Ministry of Tourism, 2009)

10.6.3 Future projections for tourism

Tourism is projected to grow at a slower rate than total GDP for Auckland, meaning that the Auckland region's share will decrease over time - although its absolute size will continue to increase.

Tourism industry activity in Auckland is projected to grow by around 1.4-2.0 per cent yearly between 2007 and 2031, and the Business As Usual (medium-growth) scenario is expected to be around 1.7 per cent yearly.[164]

10.7 Concluding remarks

Table 40 shows that direct GDP impacts represent the large majority (70 per cent or $\$_{2011}$656 million) of the total GDP impact. However, the share of indirect and induced impacts ($\$_{2011}$281 million) is also very significant as it generates almost one third of the total GDP impact ($\$_{2011}$937 million).

As expected, most (73 per cent or $\$_{2011}$656 million) of the benefits from nature-based tourism flows are captured by Auckland, with Coromandel representing more than a quarter of the total ($\$_{2011}$255 million). However, when the relative population size and the economy of the two regions is taken into account, Coromandel's share is much bigger relatively. This is not surprising, as the Coromandel is a very popular nature destination both for domestic and international tourists.

Employment generation from tourism is substantial, reflecting the high labour intensity of the sector.

Table 40 shows that total employment generation is 15,742 FTEs, of which 11,453 FTEs are in Auckland (76 per cent) and almost 3778 in the Coromandel.

[164] Market Economics Limited, 2009. *Economic Futures Model.*

Table 40. Summary of economic and employment impacts. (Source: Auckland Council elaboration on Covec, 2009; Ministry of Tourism, 2009 and 2012)

	$2011 million	Percentage	Employment (FTEs)	Percentage
HG - direct GDP impact	656	70	11,019	70
HG - indirect and induced GDP impact	281	30	4723	30
HG - total GDP impact	937	100	15,742	100
Auckland - total GDP impact	681	73	11,453	73
Coromandel - total GDP impact	255	27	4289	27
Hauraki Gulf - total GDP impact	937		15,742	100

Although international tourists undertake only 30 per cent of the total nature-based trips in the Hauraki Gulf, they account for almost 63 per cent of the economic impact in the Hauraki Gulf (see Table 41). Their relative importance is of particular significance to Auckland because they contribute 50 per cent of the total economic impact and their value ($2011466 million) is more than double that of domestic tourists ($2011215 million). As the Coromandel is a very popular destination for many New Zealanders, Aucklanders in particular, the domestic flows (14 per cent or $134 million) are slightly higher than international ones (see also Figure 23).

Table 41. GDP values of nature-based tourism in the Hauraki Gulf, $2011 million. (Source: Auckland Council elaboration on Covec, 2009; Ministry of Tourism, 2009 and 2012)

	International		Domestic		Total	
	Value ($2011 million)	Percentage	Value ($2011 million)	Percentage	Value ($2011 million)	Percentage
Auckland	466	50	215	23	681	73
Coromandel	121	13	134	14	255	27
Total Hauraki Gulf	587	63	349	37	936	100

The values assessed for tourism are already much higher than those of any other economic activity (despite the risk of underestimation mentioned earlier) so there is no need to further emphasise the importance of recreational activities in the economics of the Hauraki Gulf.

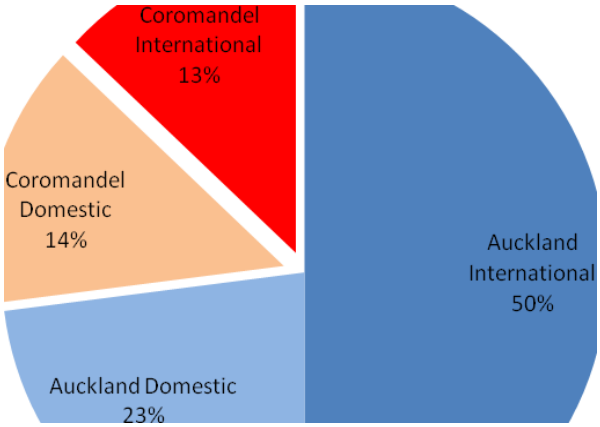

Figure 23. GDP Impact of international and domestic nature-based tourists to the Hauraki Gulf.

11.0 Events and the Hauraki Gulf

11.1 Introduction

Auckland is a popular venue for both national and international events. In 2008, events of all kinds contributed at least $$_{2008}$440 million to Auckland's GDP.[165] This included direct, indirect, and induced impacts of the initial expenditure of around $480 million. However, most of these events had no relation to the Hauraki Gulf.

The events most likely to be related to the Hauraki Gulf are:[166]

- major international yachting events such as the America's Cup, the Louis Vuitton Cup and the Volvo Ocean Race[167]
- smaller sport and recreation events relating to water, and beach-based sports such as sailing, swimming, kayaking, and beach volleyball
- general events, although the harbour contribution to general events is minimal.

Therefore, the Hauraki Gulf does play a role in generating some events related to economic activities.

11.2 Major international yachting events

11.2.1 The America's Cup

In 1999/2000, $473 million of additional GDP was generated by the America's Cup followed by a further $450 million in 2001–2003.[168]

High percentages of these impacts were generated by super-yacht construction and associated activities over relatively long periods of time, rather than during the event itself. Therefore, these have been captured by the recreational marine industry economic contribution assessment in this study.

Hosting the America's Cup conferred significant benefits on the local marine industry through purchases of super-yachts and other marine products.

11.2.2 The Louis Vuitton Cup

In 2009, $16 million of additional output was generated by the Louis Vuitton[169] Pacific Series, creating a regional GDP impact of $12 million. More than half of this impact was generated by super-yacht refits that would not have occurred in the absence of the event.

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[165] Covec, 2009a.
[166] Rugby World Cup 2011 (RWC) included a waterfront fan zone and a harbourside fireworks display that both were enhanced by their location next to the harbour. However, they could have been held at a suitable venue away from the harbour. For this reason, the RWC has not been included in these calculations.
[167] The VOR does not stop in Auckland every year, so not necessarily in the 2008 reference year.
[168] Covec, 2009a.
[169] Covec, 2009b.

The Louis Vuitton Pacific Series 2009 generated at least $9 million of business for the local marine industry. Again, this revenue would not have been generated in the absence of the event.

11.2.3 The Volvo Ocean Race

The Volvo Ocean Race (VOR) was formerly known as the Whitbread Around The World, and is held every three years. Eleven VORs have been held since the event began in 1973 and eight of these included an Auckland stopover.[170]

The direct expenditure benefits of hosting a VOR stopover are estimated at $14.1 million for New Zealand and $15.3 million for Auckland.[171] The Auckland impact is larger than the national impact because some of the money required to deliver the event is sourced from other parts of New Zealand and then spent in the Auckland economy.

This level of expenditure would generate $12–13.4 million of additional GDP nationally, and $10.7–12.3 million of additional GDP in Auckland. In addition, the media impact (advertising-equivalent value) of hosting a 16-day stopover in Auckland is estimated at $6 million.

11.2.4 Combined impact of major yachting events

The impact of hosting major yachting events varies from year to year but it is possible to estimate an annual average over the next ten years. The number of future major yachting events in Auckland cannot be accurately predicted so the following assumptions have been made:

- One America's Cup event in the next ten years (Auckland has hosted two America's Cup events in the last 20 years)
- Two Louis Vuitton Cup events in the next 10 years (there have been two Louis Vuitton events in the last 10 years)
- Two Volvo Ocean Race events in the next 10 years (there have been eight Volvo stopovers in Auckland in the last 40 years)

The combined GDP impact (annual average) for major yachting events was estimated as around $50 million, as shown in Table 42. Nearly 90 per cent of the impact arises from the America's Cup, 5 per cent from Louis Vuitton, and 7 per cent from the Volvo Ocean Race.

Table 42. GDP impact of major yachting events in Auckland.

	GDP ($million/event)	Events/10 years	GDP ($million/10 years)	GDP ($million/year)
America's Cup	450	1	450	45
Louis Vuitton Cup	12	2	24	2.4
Volvo Ocean Race	18	2	36	3.6
Total		5	510	51

11.3 Smaller events based at the beach or harbour

[170] http://www.volvooceanraceauckland.com/auckland.php
[171] Covec, 2009b.

Various regional, national, and international water sports and recreation events that directly involve the beach or harbour are held in Auckland in any year.[172] These include:

- sailing (smaller boats)
- kayaking
- life-saving
- swimming
- triathlon
- beach volleyball

The impact of water sports on the Auckland GDP is not known, as this value is not separated from other sports. This value is part of the impact of sports and recreation events which, in turn, is part of the impact of all events. The social benefits derived from these events are significant - although these benefits have not been quantified either.

In 2008, sports and recreation events were attended by 1.49 million people (25.6 per cent of total event attendances of 5.82 million). For simplicity, the GDP contribution is assumed to be directly proportional to attendance.

In 2008, events of all types contributed at least $\$_{2008}$440 million to Auckland's GDP.[173] This includes the direct, indirect, and induced impacts of the initial expenditure. From these figures, the sports and recreation share of total event GDP contribution is estimated as:

$$\text{GDP (sports)} = 25.6\% \times \$_{2008}440 \text{ million/year} = \$_{2008}113 \text{ million/year}$$

This value includes all sports, most of which have no relation to the Hauraki Gulf such as rugby, soccer, netball, tennis, cricket, and hockey. In the absence of other information, it is possible to guess that no more than one-third of these sports are water-based, giving a GDP contribution of around $\$_{2008}$40 million/year as a maximum.

As further accurate information is not available at present, these estimates are tentative and subject to substantial error margins.

11.4 Concluding remarks

Based on the assumptions stated previously, events related to the Hauraki Gulf could potentially generate up to $90 million per year of GDP[174] for Auckland (including direct, indirect, and induced impacts). This is comprised of:

- $50 million/year from major international yachting events (mostly the America's Cup)[175]
- $40 million/year from smaller water-based sports and recreation events.[176]

The impact of events is usually considered as part of tourism but, for major yachting events, the super-yacht refit component (and other marine products) might be included in the marine industry instead. Therefore, if half of the impact of major yachting events is assumed to be

related to tourism and half is assumed to generate income for the marine industry, the overall split for GDP generated by events related to the Hauraki Gulf is:

- $25 million/year included in marine industry
- $65 million/year included in tourism.

[172] Covec, 2009a.
[173] Covec, 2009a.
[174] Calculated in $\$_{2008}$.
[175] Annualised average, assuming that multiple events are secured over the next 10 years.
[176] Calculated estimate with substantial error margins.

In order to avoid double counting the large but unknown proportion of event tourism that was already captured in the tourism section, this was not included in the overall calculation of the valuation of the Hauraki Gulf-related events.

Considering that tourism and the recreational marine industry together represent more than 70 per cent of the total tentative estimated value, the exclusion of some recreational values that are not already captured should not modify the overall result significantly.

12.0 Marine reserves in the Hauraki Gulf

12.1 Introduction

The Hauraki Gulf Marine Park (HGMP) is home to six of the 30 marine reserves established in New Zealand waters, see Figure 24.

These include the first reserve (Cape Rodney–Okakari Point) established in 1975, and the most recent (Tawharanui), established in September 2011. Marine reserves aim to maintain - or restore - the intrinsic biodiversity and natural processes. No fishing is permitted nor any removal of material. No dredging, dumping, construction, or any other direct disturbance is allowed.

More than half of New Zealand's marine reserves result from external applications lodged by interest groups. These include tangata whenua, conservation groups, fishers, divers, and marine science interest groups.

Collectively, these marine reserves protect 7 per cent of New Zealand's territorial sea. However, 99 per cent of this lies in two marine reserves around isolated offshore island groups (Auckland and Kermadec). Of New Zealand's total marine environment, only 0.3 per cent is protected in marine reserves.

Currently, the highest level of protection outside of New Zealand's territorial sea is obtained through fisheries closures on trawling for 18 seamounts (underwater mountains). When these closures are included, the area of marine protection in New Zealand's marine environment is just over 3 per cent.[177]

Benefits provided by marine reserves relate to:

- science
- education
- conservation
- various forms of recreation.

12.2 Marine reserves in the Hauraki Gulf

[177] New Zealand Department of Conservation (DOC), 2011. Retrieved from: http://www.doc.govt.nz/conservation/marine-and-coastal/marine-protected-areas/marine-reserves-a-z/

Figure 24. Marine reserves in the Hauraki Gulf Marine Park. (Source: DOC, 2011)

The six marine reserves of the Hauraki Gulf Marine Park are:

1. Cape Rodney–Okakari Point (Goat Island) Marine Reserve
   This area became New Zealand's first marine reserve in 1975. It protects 547 hectares of shore and sea from Cape Rodney to Okakari Point, including the waters around Goat Island. Within ten years snapper and crayfish populations had re-established, setting off a series of changes in the ecosystem of the reserve. Nowhere else on the coast teems with such a profusion of fish life that can easily be seen by visitors.

2. Long Bay–Okura Marine Reserve
   This protects a stretch of coastline on the North Shore of Auckland. The coast here is typical of that throughout much of the Waitemata Harbour and inner Hauraki Gulf. It is moderately sheltered and formed predominantly of Waitemata sandstones and mudstones. Formally established in 1995, this marine reserve includes a variety of coastal habitats: sandy beaches, rocky reefs, estuarine mudflats, and mangroves.

3. Motu Manawa Marine Reserve
   This protects 500 hectares of the inner reaches of Auckland's Waitemata Harbour. It includes the intertidal mudflats, tidal channels, mangrove swamp, saltmarsh, and the shellbanks surrounding Pollen and Traherne islands.

4. Te Matuku Marine Reserve
   This protects 690 hectares in one of Waiheke Island's largest and least disturbed estuaries, as well as an area outside Te Matuku Bay in the Waiheke Channel.

5. Te Whanganui-A-Hei (Cathedral Cove) Marine Reserve
   When this marine reserve was gazetted in 1992, it became New Zealand's sixth marine reserve and the first for the Coromandel. It covers 9 km^2 and is administered by the Department of Conservation in partnership with Te Whanganui-A-Hei Marine Reserve Committee.

6. Tāwharanui Marine Reserve
   This marine reserve came into being in September 2011. It protects about 400 hectares on the northern coast of the Tawharanui Peninsula in Rodney District, 90 km from Auckland City. It replaced the Tawharanui Marine Park, a no-take fishing area that was

established in 1981. Scientific studies in the marine park have shown an increase in species such as snapper and crayfish.

12.3 Economic impact assessment of the Cape Rodney–Okakari Point Marine Reserve

The Cape Rodney–Okakari Point (CROP) Marine Reserve at Leigh contains an easily accessible beach with rock pools, and offers snorkelling and diving opportunities, as well as the opportunity to easily observe many species such as snapper, moki, stingrays, blue cod, and rock lobsters - even from the shore. This is considered to be the major attraction of the site.

In 2008, the Department of Conservation (DOC) commissioned Butcher Partners Limited to investigate the economic contribution of the CROP Marine Reserve to the economy of the Rodney District (now Auckland).

The Rodney Economic Development Trust (REDT) had already studied the value of the marine reserve at Leigh in 2002. The result was a simple estimate of the amount spent by visitors (300,000 a year at that time) to the marine reserve and showed the value to the local economy at $12.5 million per year at that time.[178]

12.3.1 Methodology

The methodology applied by DOC (2008) to value the CROP Marine Reserve was an economic impact analysis. This took account only of the market economic components and, therefore, had a more limited scope than a social cost-benefit analysis which would also include non-market components such as existence value.[179]

As the focus of this study was the contribution of the CROP Marine Reserve to the local economy, it looked only at the economic impact of activities associated with the marine reserve on the Rodney District. It did not look at the protection and species conservation values or the non-recreation ecosystem services associated with the marine reserve. In addition, the study did not address the economic impact of the marine reserve on local recreational or inshore commercial fisheries.[180]

Despite these limitations, the fact that the methodology applied is economic makes it easier to compare the marine reserve with most of the other values considered (eg, aquaculture).[181] In addition, as existence values are, at least partially, already captured by other estimates (eg, hedonic valuation of the premium on property values attributable to the Hauraki Gulf, see Section 4.2.3), this prevents double counting some of those values.

The study calculated:

- output (total revenues)
- value added
- household income
- employment

[178] REDT, 2003.
[179] DOC, 2008, p5.
[180] DOC, 2008, p6.
[181] DOC, 2008, p6. '*An economic impact assessment will also allow results to be viewed in a broader context with other economic activities, such as fisheries, agriculture or total tourism in the district*.'

based on:

- region visits – data was collected on the number of visitors and fees charged from the businesses with direct dependence on the marine reserve
- visitor spending questionnaires – a thousand surveys covering the spending of 3800 people
- visitor numbers – calibrated results from a permanent vehicle-counter installed by DOC.

Choice of study area

The results of an economic impact analysis depend on the size of the study area and the location in which the impacts are being measured.

The choice of study area plays a significant role in the final figures obtained. The economics of some systems studied shows that all the direct impacts occurred within the study areas. This is not the case for the marine reserve at Leigh, as many of the economic impacts associated with the marine reserve occur outside Rodney District.

DOC (2008) considered the economic impact on Rodney District of activities related to the marine reserve. The choice of geographic boundary reflected what was believed to be the most relevant, from the perspective of those who are interested in or concerned about the marine reserve; that is, the impact on the local economy.

Multipliers

Direct spending by visitors, either at the marine reserve itself or as a result of a trip to the marine reserve, has a flow-on or multiplier effect on the local economy.

Multipliers for each category of visitor spending were calculated through an economic input-output model for Rodney District generated by Butcher Partners Limited:

> *'The multipliers used for calcul*ation of total output, value added (business and personal income), household income, and employment are shown in Table 43 *and are Type II multipliers, ie, they include the induced impacts of increased household spending as visitor spending at various businesses leads to increased household incomes in those businesses. These multipliers are applied to the net increase in visitor spending attributable to the marine reserve, where the net increase is estimated by asking visitors how likely they would have been to visit the area in the absence of the marine reserve, and how much longer or shorter their trip would have been in the absence of the marine reserve.'*[182]

Table 43. Multipliers by sectors for Rodney District. (Source: DOC, 2008)

	Output multiplier	Value added spend ratio	Household income spend ratio	Employment spend ratios (FTEs/$million)

[182] DOC, 2008, p10.

		Direct	Total	Direct	Total	Direct	Total
Manufacturing	1.45	0.45	0.68	0.4	0.51	8.9	11.5
Retail margins	1.58	0.53	0.85	0.46	0.61	14.1	17.7
Food/restaurants	1.63	0.44	0.75	0.37	0.52	14.4	18
Accommodation	1.57	0.55	0.83	0.43	0.55	14.5	17.7
Activities	1.72	0.37	0.74	0.26	0.47	7.2	12.1

12.3.2 Economic value of the CROP Marine Reserve

DOC (2008) estimated that the CROP Marine Reserve received 375,000 visits in the year to 28 February 2008. In comparison, the Long Bay Marine Reserve, which lies inside the urban limits of Auckland, attracts more than one million visits annually, although its attraction lies primarily in the beach and beach activities rather than the marine reserve (DOC, 2008).

The application of the economic multipliers, calculated for the various industries to the estimated expenditure, led to an estimation of the CROP Marine Reserve's total economic impacts on Rodney District in 2007. The values are summarised in Table 44.

It was estimated that $18.6 million of total district output (total turnover, including purchases from suppliers) was dependent on the marine reserve, as was $8.2 million of business and personal income (value added) in the Rodney District, including $5.5 million of household income. The reserve created employment for 173 FTEs (full-time equivalents), including 10 jobs in marine-related activities that would otherwise not exist.

Table 44. Economic impact assessment on the Rodney District of the CROP Marine Reserve in 2007 (direct, indirect and induced impacts). (Source: DOC, 2008)

Total output ($\$_{2011}$ million)	9.2
Value added GDP ($\$_{2011}$ million)	6.2
Employment FTEs	432

An interesting observation was made by the authors of DOC (2008) study:

'Crothers and McCormack (2008) estimated the local Leigh fishers would contribute to household incomes in the town approximately $800,000 per annum. Although the household income associated with the marine reserve was calculated for all of Rodney District, the value ($5.5 million) still implies a real shift in the focus of economic activity for the area from what was once primarily a fishing village. This shift in economic value creation away from resource extraction in favour of newer economic activities such as tourism is being seen at many levels from small communities (Collins, 2008; Gibbs, 2008; Orams, 2000) up to national levels.

Crothers and McCormack (2008) record shrinkage in the Leigh-based fishing activity at a time when the tourism value for the Rodney District of the marine reserve is increasing. From an

economic activity aspect the Rodney District appears to be better off for having the CROP marine reserve.'[183]

13.0 Sand mining in the Hauraki Gulf

[183] DOC, 2008, p20.

13.1 Introduction

Coastal sand extraction (seabed mining) is an important use of coastal resources in the Auckland region, and takes place in both the Hauraki Gulf and Kaipara Harbour. Sand extraction has also occurred in the Waikato region at several coastal locations in the past but most of these operations have now stopped.[184] The only remaining sand mining in the Waikato region is on the west coast.[185]

The sand is used primarily as a fine aggregate in the production of concrete and asphalt for roading, concrete structures, and other cement-based products. Sand is also extracted for use in drainage systems and for beach nourishment projects (such as at Mission Bay) but this is usually a relatively minor share of the total.

In 2007 there were five coastal permits providing for sand extraction from the Auckland coastal marine area:

- Hauraki Gulf (near-shore, Pakiri) - two permits totalling 76,000 m^3/year
- Hauraki Gulf (off-shore, east coast near Little Barrier Island) - one permit for 2,000,000 m^3 with no annual limit but additional impact assessment requirements when quantities exceed 1,200,000 m^3 in a 24-month period
- Kaipara Harbour entrance on the west coast, flood tidal delta - two permits totalling 400,000 m^3/year for five years then increasing quantities if further conditions are met.

The availability of sea sand within the Auckland region is of significant economic benefit to the regional construction industry - and therefore to the regional economy as a whole - because transporting sand in from other parts of the country would increase the cost of roading and other infrastructural works such as wastewater drainage systems.

13.2 Methodology

In order to calculate the economic impact of sand mining, it is necessary to know the value of its output. This corresponds to the regional economy's direct expenditure on sand which, in turn, equals the quantity of sand multiplied by its market price.

Data from 2007 showed that Auckland consumes around 400,000 m^3/year of sand, with 150,000 m^3/year mined from the Hauraki Gulf and the remainder from the Kaipara Harbour.[186]

The price of sand was estimated by Seafriends (a conservation organisation based at the Seafriends Marine Conservation and Education Centre at Leigh) as part of their submission in 2000 regarding a resource consent application. According to Seafriends, the price of quality sand for concrete is close to \$25/m^3.[187] In New Zealand the cost of one cubic metre of renourished sand (for beach replenishment) is about \$40. As beach replenishment forms only a minor part of total sand use in the region, the price of \$25/m^3 has been used.

These figures are for the year 2000, so cumulative inflation of around 30 per cent should be added, bringing the current average price to approximately \$33/m^3.

The GDP impacts equal direct expenditure multiplied by GDP multipliers that reflect the direct value-added component of sand mining, plus the indirect and induced GDP impacts of the direct expenditure.

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[184] A sand mine had operated at Whiritoa on the east coast of the Coromandel for 50 years, extracting 180,000 m^3 of sand, but is now closed down.
[185] At Taharoa, south of Kawhia Harbour, and at Maioro, near Port Waikato.
[186] ARC, 2007.
[187] Seafriends, 2000.

13.3 Economic impact of sand mining in the Hauraki Gulf

Using the methodology above, the direct expenditure value of sand mined in the Hauraki Gulf is estimated as:

$$\text{Expenditure} = \$33/m^3 \times 150{,}000\ m^3/\text{year} = \$5\ \text{million/year}$$

This is a rough estimate only and the actual figure could be as high as $10 million/year.

GDP multipliers have not been calculated specifically for sand mining. However, given the relatively small scale of the industry, a high percentage error margin still results in only a small dollar variation.

Multipliers for the direct, indirect, and induced GDP impacts of an activity are typically between 0.5 and 1.0. This could be similar or possibly even higher for sand mining, given its importance to the regional economy and the higher cost of transporting it in from elsewhere.

As an initial estimate, a GDP multiplier of 1.0 was assumed, giving a total GDP impact of $5-10 million/year.

The largest employer in sand mining is McCallum Bros., who currently employ more than 60 people and supply sand to a number of concrete plants in the Auckland region.[188] Indirect and induced employment from sand mining is presumed to be of a similar order of magnitude, indicating a total employment impact of around 100 jobs.

13.4 Concluding remarks

Sand mining forms a tiny fraction of the Auckland economy but plays an important role in other important sectors, such as construction and transport.

Sand from the Hauraki Gulf could be replaced by sand extracted from elsewhere but the cost (particularly transport) could be substantially higher in percentage terms – although this is probably not significant relative to the Auckland economy overall or even relative to other impacts of the Hauraki Gulf.

Although the local sand resource is non-renewable within human timeframes, the current stock in Pakiri alone is 17 million m^3,[189] which is sufficient for the next 200 years at current extraction rates.

Sand mining can have a variety of environmental impacts that are not discussed here.

[188] McCallum Bros., 2011.
[189] Seafriends, 2000.

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- The New Zealand Sport Fishing Council
- The Northern Inshore Fisheries Management Company
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- The Ports of Auckland
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References

Anderson, S H et al. 2011. Cascading effects of bird functional extinction reduce pollination and plant density. *Science*, 331, 1068–1071.

Auckland Plus, 2009. *Auckland Marine Industry Feasibility Study*. A report prepared by Beca Applied Technologies Ltd.

Auckland Regional Council, 2007. *Sand mining on the East Coast and in the Kaipara Harbour*. Retrieved from: http://www.arc.govt.nz/albany/index.cfm?12883399-14C2-3D2D-B94C-4A5962D71573

Auckland Regional Council, 2009. *State of the Auckland Region 2009*.

Auckland Regional Council, 2009a. *The marine sector industry snapshot for the Auckland region*. October 2009.

Auckland Regional Council, 2010. *Aquaculture, economic impact in the Auckland region*. Auckland Regional Council technical report, TR2010/009, February 2010.

Barbera, M 2010. *Benefit transfer approaches*. A report written for the Auckland Council. Retrieved from: http://www.knowledgeauckland.govt.nz

Boyd Fisheries Consultants Limited, 2012. *The seafood industry within the Hauraki Gulf Marine Park.* A report prepared for Northern Inshore Fisheries Management Company.

Boyd, J and Banzhaf, S 2007. What are ecosystem services? The need for standardized environmental accounting units. *Ecological Economics*, 63(2–3), 616–626.

Brockerhoff, E G et al., 2010. Impacts of exotic invertebrates on New Zealand's indigenous species and ecosystems. *New Zealand Journal of Ecology,* 34(1), 158–174.

Cesar, H S J 2000. Coral reefs: their functions, threats and economic value, in Cesar, H S J (ed.) *Collected essays on the economics of coral reefs*, 14-39, CORDIO, Kalmar University, Sweden.

Coase, Ronald H 1960, The problem of social cost. *Journal of Law and Economics*, 3, October 1960.

Collins, John H 2008. Tourism in the Kimberley region of Western Australia. *Geographical Research*, 46(1), March 2008.

Constanza, R et al. 1997. The value of the world's ecosystem services and natural capital. *Nature*, 387, 253–260.

Covec, 2008a. *The outlook for tourism in the Auckland region*. A report prepared for Auckland Regional Council, June 2008.

Covec, 2008b. *Economic impact of POAL*. A report prepared for the Ports of Auckland Limited, December 2008.

Covec, 2009. *The outlook for tourism in the Auckland region*.

Covec, 2009a. *Measuring the economic contribution of events to Auckland*.

Covec, 2009b. *Volvo ocean race feasibility study*.

Covec, 2010. *Economic impact of the Ports of Auckland*.

Crowcroft, G and Smaill, A 2001. In: Rosen, M.R. and White, P A (eds), *Groundwaters of New Zealand*, 303–313. New Zealand Hydrological Society Inc., Wellington.

Daily, G C 1997. The potential impacts of global warming on managed and natural ecosystem: implications for human well-being. *Abstracts of Papers of the American Chemical Society*, 213.

Department of Conservation (DOC), 2008. *Economic impact analysis of the Cape Rodney Okakari Point (Leigh) marine reserve on the Rodney district*. Department of Conservation, investigation number 4052L, prepared by Louise Hunt, June 2008.

Department of Conservation (DOC), 2011. Marine reserves and other protected areas. Retrieved from: http://www.doc.govt.nz/publications/conservation/marine-and-coastal/marine-protected-areas/

Dominati, E et al. 2010. A framework for classifying and quantifying the natural capital and ecosystem services of soils. *Ecological Economics*, 69, 1858–1868.

Enveco, 2010. *Aquaculture quadruple bottom line assessment multi criteria analysis for the Auckland region.* A report prepared for the Auckland Regional Council, February 2010.

Filippova, O 2008. The influence of submarkets on water view house price premiums in New Zealand. *International Journal of Housing Markets and Analysis,* 2(1), 91–105.

Fisher, B et al. 2009. Defining and classifying ecosystem services for decision-making. *Ecological Economics*, 68, 643–653.

Gibbs, M T 2008. The historical development of fisheries in New Zealand with respect to sustainable development principles. *The Electronic Journal of Sustainable Development,* 2008.

Hanley, N et al. 2001. *Introduction to environmental economics*. Oxford University Press. Oxford.

Hardin, Garrett 1968. The tragedy of the commons. *Science*, 162.

Harvard Business School, 2009. *New Zealand's marine cluster*. A report written by Adam Ireland, Ani Satchcroft, Ben Mayson and Malte Janzarik, 8 May 2009.

Hauraki Gulf Forum, 2008. *Strategic issues*.

Hauraki Gulf Forum, 2010. Fishing the Gulf. Implementing the Hauraki Gulf Marine Park Act through fisheries management.

Hauraki Gulf Forum, 2011. *Tīkapa moana – Hauraki Gulf state of the environment report.*

Hauraki Gulf Marine Park Act 2000. New Zealand Government.

Hilton, M J 1990. *Processes of sedimentation on the shoreface and continental shelf and the development of facies, Pakiri, New Zealand.* Unpublished Doctor of Philosophy dissertation, University of Auckland.

ICOMIA, 2006. *Recreational boating industry statistics 2006*. ICOMIA, London, UK.

Infometrics, 2012. *Auckland economic profile 2011.*

Kerr, G and Latham, N 2011. *New Zealand marine recreational fishing values*. A report prepared for the New Zealand Marine Research Foundation. LEAP Research Report 29. Accessed 3 February 2012 from: http://hdl.handle.net/10182/580

King, P 1999. *The fiscal impact of beaches in California*. Public Research Institute, San Francisco State University.

KPMG, 2011. *Economic contribution of the naval bases in Sydney*.

Lindsay, S et al. 1999. *Value of New Zealand recreational fishing*. Final report for project REC9801, undertaken for New Zealand Ministry of Fisheries.

Market Economics Limited, 2008. *New Zealand Marine Industry Survey 2008*.

Market Economics Limited, 2008a. *The economic impacts of the seafood sector in New Zealand*.

Market Economics Limited, 2009. *Economic futures model.*

Market Economics Limited, 2010b. *New Zealand cruise industry study*. A report prepared for the Ministry of Economic Development, Cruise New Zealand and Tourism New Zealand, September 2011.

Market Economics Limited, 2010c. *New Zealand regional cruise industry study.* A report prepared for Cruise New Zealand.

Market Economics Limited, 2011a. *Economic impacts of the Ports of Auckland Limited, 2010, 2021 and 2031.* A report prepared for the Ports of Auckland Limited, 11 October 2011.

Market Economics Limited, 2011b. *Economic role of the Ports of Auckland Limited, 2010, 2021 and 2031*. A report prepared for the Ports of Auckland Limited, 11 October 2011.

Market Economics Limited, 2011c. *New Zealand marine industry survey 2011*. A marine industry performance review for New Zealand Marine, 15 September 2011.

McCallum Bros, 2011. *Beach replenishment*. Retrieved from: http://www.mccallumbros.co.nz/mccbeach.htm

Millennium Ecosystem Assessment (MA), (2003). *Ecosystems and human well-being: A framework for assessment*. Washington, DC: Island Press.

Ministry of Fisheries, 2008. *The state of our fisheries 2008*. A Ministry of Fisheries internet publication. Retrieved 9 February 2012 from: http://www.fish.govt.nz/ennz/Publications/The+State+of+our+Fisheries+2008/Recreational+Fisheries/default.htm

Ministry of Fisheries, 2011. *Quarterly report: fisheries and aquaculture production and trade. Period ending June 2011.* Ministry of Fisheries, Wellington, New Zealand.

Ministry of Tourism, 2009. *Tourism sector profile/tourist activity/nature-based tourism.*

Ministry of Tourism, 2012. *Key tourism statistics*, various issues. Retrieved from: http://www.med.govt.nz/sectors-industries/tourism

Moberg, F and Folke, C 1999. Ecological goods and services of coral reef ecosystems, *Ecological Economics*, 29, 215-233.

New Zealand Institute of Economic Research, 2012. *Review of draft Hauraki Gulf total economic valuation phase one report.* Report to Auckland Council, April 2012.

Orams, M 2000. Marine tourism; development, impacts and management. *The Geographical Journal*, 166(2).

Porter, M E 1998. *On competition*. Harvard Business School Press, Boston, MA.

Ports of Auckland, 2008. *Port development plan 2008*. Retrieved from: http://www.poal.co.nz/news_media/publications/POAL_port_development_plan_2008.pdf

Ports of Auckland, 2011. *Financial report, 2010–2011*. Retrieved from: http://www.poal.co.nz/news_media/reviews.htm, http://www.poal.co.nz/about_us/economic_impact.htm

Ports of Auckland, 2011a. Retrieved from: http://www.poal.co.nz/about_us

Rohani, M 2012. *Impact of the Hauraki Gulf amenity on the land price of neighbourhood properties. An empirical hedonic pricing method case study North Shore, Auckland.* Auckland Council working paper, WP2012/001.

Royal Society of New Zealand, 2011. *Ecosystem services, emerging issues*. July 2011. Retrieved from: http://royalsociety.org.nz

Samarasinghe, O E and Sharp, B 2008. The value of a view: a spatial hedonic analysis. *New Zealand Economic Papers*, 42(1), 59–78.

Sapere, 2011. *Economic impact of Coromandel aquaculture*. A report prepared by Sally Wyatt for the Hauraki-Coromandel Development Group.

Seafriends, 2000. Retrieved from: http://www.seafriends.org.nz/oceano/seasand.htm#present

Shears, N T and Babcock, R C 2002. Marine reserves demonstrate top-down control of community structure on temperate reefs. *Oecologia*, 132, 131–142.

Sraffa, P 1960. *Production of commodities by means of commodities*. Cambridge University Press, Cambridge.

Statistics New Zealand, 2008. *Business demography database 2008*. Wellington, New Zealand.

Statistics New Zealand, 2010. *Fish monetary stock account, 1996–2009*. Wellington, New Zealand.

Statistics New Zealand, 2011, *Tourism satellite account*, Wellington, New Zealand.

Tanner, C C and Sukias, J P S 2003. Linking pond and wetland treatment: performance of domestic and farm systems in New Zealand. *Water Science and Technology*, 48(2), 331–339.

Tate, K R et al. 1997. Organic carbon stocks in New Zealand's terrestrial ecosystems. *Journal of the Royal Society of New Zealand*, 27(3), 315–335.

Thrush, S and Montgomery, J 2011. *The Hauraki Gulf – Research gaps and opportunities*. A presentation to the Hauraki Gulf Forum state of the environment report meeting, 27 June 2011.

Townsend, M and Thrush, S 2010. *Ecosystem functioning, goods and services in the coastal environment.* A report prepared by the National Institute of Water and Atmospheric Research for Auckland Regional Council. Auckland Regional Council technical report, TR2010/033.

Townsend, M, Thrush, S F and Carbines, M J 2011. Simplifying the complex: an 'ecosystem principles approach' to goods and services management in marine coastal ecosystems. *Marine Ecology Progress Series (MEPS)* 434, 291–301.

Trusewich, B 2011. *Aquaculture law reform policy report.* Auckland Council.

Turner, R K et al. 2003. Valuing nature: lessons learned and future research directions. *Ecological Economics*, 46, 493–510.

Volvo Ocean Race, 2012. Retrieved from: http://www.volvooceanraceauckland.com/auckland.php

Wheeler, S and Damania, R 2001. Valuing New Zealand recreational fishing and an assessment of the validity of the contingent valuation estimates. *The Australian Journal of Agricultural and Resource Economics*, 45(4), 599–621.

Williamson, S 2000. *The economic value of New Zealand marine recreational fishing and its use as a policy tool.* Retrieved from: http://oregonstate.edu/dept/iifet/2000/papers/williamson.pdf

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Glossary

Alluvial - relating to, or derived from, alluvium.

Alluvium - a deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta.

Amenity - the qualities of a place that make it pleasant and attractive for individuals and communities.

Average Willingness To Pay (AWTP) – value to people of total consumption of a good (calculated on a per-unit basis); the maximum amount a person would be willing to pay (hypothetically, per unit) for a given total quantity of a good or service.

Benthic - relating to the flora and fauna found on the bottom of, or in the bottom sediments of, a sea or lake.

Biodiversity - the variety of life in a particular habitat or ecosystem including the totality of genes and species; and variability among living organisms including within and between species (eg, species richness) and within and between ecosystems (eg, ecosystem complexity). Also see *Ecosystem*.

Biogenic - a substance produced by life processes. It may be either constituents, or secretions, of plants or animals.

Biomass - the total mass of living organisms in a given area or volume; recently dead plant material is often included as dead biomass.

Biota - the plant and animal life of a region.

Breakbulk cargo - goods that must be loaded individually rather than in standard (20 or 40 foot) containers nor in bulk (as with oil or grain).

Bulk cargo - commodity cargo that is transported unpackaged and in large quantities as a liquid or as a mass of relatively small solids (eg, grain, coal).

Consumer surplus - the difference between a person's AWTP and what they actually pay (usually MWTP).

Contact recreation - any activity that involves contact with water. Primary Contact recreation, where the body can be fully immersed and there is the potential to swallow water, includes surfing, water skiing, diving, and swimming. Secondary Contact recreation includes activities such as paddling, wading, boating, and fishing where there is direct contact but the potential to swallow water is low.

Cost Benefit Analysis (CBA) - a systematic process for calculating and comparing the benefits and costs of a project, decision, or government policy; both market and non-market impacts are expressed in monetary terms.

CO^2 Equivalent - the amount of a greenhouse gas (eg, methane) required to produce the same greenhouse gas effect (warming of the earth's atmosphere) as a defined amount of carbon dioxide.

Ecological function - the natural processes within an ecosystem that support life; eg, the movement of water.

Ecosystems - a complex set of relationships between all living things such as plant, animal, and microorganism communities and their non-living environment (including their interaction as a functional unit).

Ecosystem Goods and Services - the direct and indirect benefits that people receive or values from natural or semi-natural habitats. The benefits that people obtain from the environment include goods (soil, food, animals, water, scenery) and services (functions such as water filtration, flood protection, pollination).

Employee Count (EC) - head count of salary and wage earners sourced from taxation data. This is mostly employees but can include a small number of working proprietors who pay themselves a salary or wage.

Exclusive Economic Zone (EEZ) - an area of sea over which a state has special rights regarding the exploration and use of marine resources. An EEZ stretches from the seaward edge of the state's territorial sea to 200 nautical miles from its coast.

Extractive - an activity that removes a natural resource from the environment. This may be either renewable (eg, fish) or non-renewable (eg, sand) either in absolute terms or in human timeframes.

Fauna - animals, especially the animals particular to a region or period, considered as a group.

Fisheries Management Areas (FMAs) - The Quota Management System divides New Zealand's Exclusive Economic Zone into 10 FMAs.

Flora - plant life, especially the plants characteristic of a particular region or period, considered as a group.

Flow-on effects – the indirect and induced economic impacts of an activity or expenditure.

Fluvial - of, relating to, inhabiting, or found in a river or stream; produced by the action of a river or stream.

Full-Time Equivalent employees (FTEs) – usually defined as the number of full-time employees plus half the number of part-time employees, where full-time is defined as working 30 hours or more per week. Sometimes calculated as Full-Time Equivalent employment (FTE) meaning the number of full-time equivalent jobs, and defined as total hours worked divided by average annual hours worked in full-time jobs.

Greenhouse Gases (GHG) - water vapour (H^2O), carbon dioxide (CO^2), nitrous oxide (NO), methane (CH_4), and ozone (O^3) are the primary greenhouse gases in the Earth's atmosphere. Also includes manufactured gases such as the halocarbons and other chlorine- and bromine-containing substances. Due to their ability to absorb and emit light of a particular wavelength they contribute to the greenhouse gas effect, where more than the normal amount of atmospheric heat is retained in the atmosphere.

Gross Domestic Product (GDP) - the market value of all goods and services produced in a country or region in a given period: the value of intermediate goods and services (imported and domestic) used in the production process is subtracting from the total value of sales.

Gross output – the total value of sales or turnover; the value of Gross Regional Product plus intermediate consumption (imported and domestic).

Hedonic pricing – decomposing the price of an item into the separate components that determine the price; often applied to variations in housing prices that reflect the economic values of local environmental attributes in order to estimate values for ecosystem or environmental services that directly affect market prices (after correcting for house size, location, and other factors).

Heritage - the legacy of tangible physical resources and intangible attributes inherited from past generations. It includes historic heritage, natural heritage, taonga tuku iho (heirlooms), and other forms of heritage such as books, works of art, artefacts, beliefs, traditions, language, and knowledge.

Heterogenous - diverse in kind or nature; composed of diverse or dissimilar parts; not homogenous or uniform.

Indirect impacts - net increase of economic activity generated by the provision of goods and services to the 'study sector'; impacts that arise as a consequence of an expenditure, through provision of goods and services for that expenditure.

Induced impacts - net increase of economic activity due to increased household expenditure in the 'study sector'; impacts of household expenditure that arise due to increased household incomes generated by the direct and indirect impacts of an expenditure.

Invasive and exclusive – (here used to mean) occupying a certain area and preventing other activities/benefits from being realised in that area.

Invertebrate - an animal without a backbone; eg, insects, snails, and starfish.

Kaimoana – seafood.

Kaitiakitanga – the process and practices of protecting and looking after the environment, sometimes translated as guardianship or stewardship.

Lentic ecosystem - contains still waters. Examples include ponds, basin marshes, ditches, reservoirs, seeps, lakes, and vernal/ephemeral pools.

Lotic ecosystem - contains flowing waters. Examples include creeks, streams, runs, rivers, springs, brooks, and channels.

mana whenua – the right to exercise customary authority.

Marginal Willingness To Pay (MWTP) – value to people of a small increase; willingness to pay money (hypothetically) in order to increase access or provision of a good or service by one more unit. Usually this equals its price or unit cost to the individual (unless the good is "lumpy").

Marine Protected Areas (MPAs) - areas of the marine environment dedicated to, or achieving through adequate protection, the maintenance and/or recovery of biological diversity at the habitat or ecosystem level in a healthy functioning state. MPAs range from no-take marine reserves to marine-protected areas that allow some extractive activities.

Multiplier - captures the direct and indirect backward linkage effects associated with direct expenditures, summarised by the equation: (Direct Effect + Indirect Effect)/Direct Effect.

Multi-Criteria Analysis (MCA) – a qualitative MCA compares impacts upon quadruple bottom line (QBL) categories and indicators but applies expert knowledge and professional judgement for a robust ranking of effects, rather than relying purely on numerical data.

Natural character - those qualities and values of the coastal environment, wetlands, lakes, rivers, and their margins that derive from the presence of natural elements, natural patterns, and natural processes. These qualities include the presence of indigenous and exotic vegetation (pasture, terrestrial, and aquatic); marine habitats; landforms, landscapes, and seascapes; the function of natural processes, and the maintenance of water and air quality. The lower the amount of human modification, the higher the level of natural character.

Natural heritage - includes indigenous flora and fauna; terrestrial, marine, and freshwater ecosystems and habitats; landscapes, landforms, geological features, soils, and the natural character of the coastline.

Natural resource accounting - assessment of the value of natural resources, including their ecosystem services, to measure the full cost of decisions that affect these resources.

Output - total sales turnover including purchases from suppliers (including imports).

POAL - Ports of Auckland Limited, the owner and operator of Auckland's main seaport on the Waitemata Harbour and a smaller seaport on the Manukau Harbour.

Portage - the practice of carrying watercraft or cargo over land to avoid river obstacles, or between two bodies of water. A place where this occurs is also called a portage.

Quadruple Bottom Line (QBL) - social, economic, environmental, and cultural effects.

Quota Management Area (QMA) – a Fisheries Management Area (FMA) or a grouping of FMAs for a given fish species and stock.

Quota Management System (QMS) - Under the QMS, commercial fishers now own individual perennial transferable quotas (ITQ), and commercial catch limits (in tonnes) are set annually for each fish stock by the Minister of Fisheries, as Total Allowable Commercial Catch (TACC).

Renewable energy - energy generated from solar, wind, hydroelectric, geothermal, biomass, tidal, wave, or ocean current sources.

Sensitive receiving environments - areas where wastewater overflows can undermine identified important natural or human uses or values in marine, freshwater and terrestrial environments.

Terrestrial – land-based.

Tangata whenua - the iwi or hapu that hold mana whenua (customary authority) over an area.

TEU - Twenty foot Equivalent Containers.

Total Economic Value (TEV) - the sum of all benefits derived by people from a resource including market and non-market values of use and non-use benefits. (This study focuses only on direct use values/activities.)

Trophic dynamics - the interaction between species at different levels on the food web.

Type II multiplier – a multiplier that includes the induced impacts of increased household spending, as spending at various businesses leads to increased household incomes in those businesses.

Unitary Plan - Auckland Council's regulatory land-use planning document prepared under the Resource Management Act (1991). The Unitary Plan will replace the existing district and some regional plans from the former city, district, and regional councils. It will contain guidance and rules about how land can be developed and how resources can be used.

Willingness To Pay (WTP) - the maximum amount a person would be willing to pay, sacrifice, or exchange in order to receive a good or to avoid something undesirable such as pollution. See also AWTP and MWTP.

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