# People, place and space: an archaeological survey of the maritime cultural landscapes of Otago Harbour, New Zealand

MATTHEW CARTER

*A maritime cultural landscape approach was applied to Otago Harbour, New Zealand, in order to investigate the interconnections between archaeological sites and maritime activities in the harbour and the wider maritime cultural landscapes they represent. Evidence of this interaction was investigated through a combination of ecological, historical and archaeological sources.*

*The evidence of these interactions was explored in relation to the themes of: navigation, abandoned watercraft and anthropogenic change, each of which represented an interdependent maritime cultural landscape that was present in Otago Harbour at various points in time. By investigating the harbour in this way the evolution of the maritime use of the harbour could be explored, providing insights into both the timing and location of sites of maritime use around the harbour.*

## INTRODUCTION

Otago Harbour is located adjacent to the city of Dunedin, New Zealand, and is the only naturally sheltered anchorage on the east coast of the South Island between Banks Peninsula and Bluff (Figure 1). This study reviews the historical and archaeological records of maritime activities in Otago Harbour to investigate past interactions between the European (non-indigenous) inhabitants of the harbour and the marine environment. The development of the local maritime cultural landscapes of the harbour is explored through an investigation of the changing relationship between the maritime environment and coastal activities. This paper demonstrates the application of a maritime cultural landscapes approach to the Otago Harbour to provide a specific and focused interpretation of the archaeological and historical records in relation to maritime activities.

This study began as an investigation for a Masters thesis and was designed to address what the author saw as a significant shortcoming in previous studies of the archaeology of Otago Harbour. Previous research of maritime archaeological sites in this area was scarce and limited to studies of

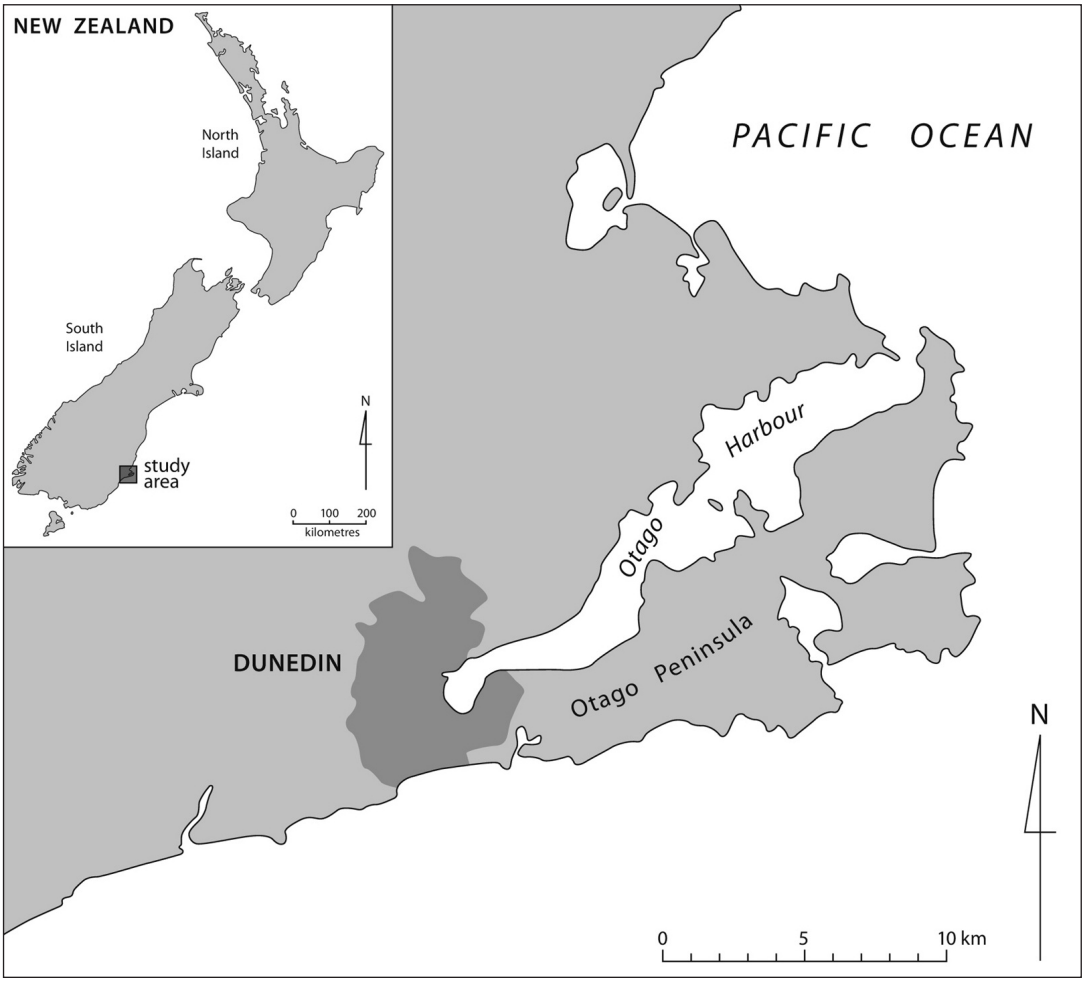


*Figure 1: Location map of Otago Harbour.*

individual sites undertaken predominantly in an *ad hoc* fashion, as the sites were destroyed during development works. As the investigation of these sites was often undertaken in isolation, it did not consider the linkages between these and other local maritime sites and their relationships to broader themes, such as the economic, political and social environment of the time. In order to provide these sites with greater context and meaning, this study investigated how to increase our understanding of these sites as components of a broader system. Through the use of a maritime cultural landscape approach, individual maritime sites were grouped thematically, allowing an exploration of the interconnections between sites and maritime activities in Otago Harbour and the wider maritime cultural landscapes they represent.

## THE LANDSCAPE APPROACH/ METHODOLOGY

The analysis of societies at a broad level is one of the significant tenets of modern archaeological enquiry. Within this area of study, the *landscape approach* has proven particularly useful for exploring the interrelationships between people and place through space and time (Knapp and Ashmore 1999:2). The landscape in such studies is the material manifestation of the relations between humans and the environment (Crumely 1994:6). Change within a landscape occurs through the interaction of cultural and natural (ecological/environmental) forces, which ensure a state of flux or disequilibrium whereby the individual both shapes – and is shaped by – the environment in which they live (Hood 1996:125; Phillips 2000:167). This approach places people at the centre of archaeological enquiry, allowing us to go beyond the insular study of artefacts to investigate how our predecessors interacted with each other and the world they lived in.

A significant development of the landscape approach has been its application to maritime archaeology. The concept of a maritime cultural landscape was first introduced by Christer Westerdahl during the maritime archaeological survey of the coast of Swedish Norrland from 1975–1980. Westerdahl sought an approach that would take a holistic view of all remnants of maritime culture on land as well as underwater. His seminal paper "The maritime cultural landscape" defined his new approach as:

> the investigation of the human utilisation (economy) of maritime space by boat: settlement, fishing, hunting, shipping and its attendant sub-cultures such as pilotage, lighthouse and sea-mark maintenance (Westerdahl 1992:5).

This approach stressed the conceptual unity of the maritime cultural remains located on land and under water that resulted from human utilisation of maritime space (Westerdahl 1992:6). In subsequent years Westerdahl has extended his definition of the maritime cultural landscape to include not only the physical manifestations of maritime culture but also the cognitive, cultural and social activities/aspects of the study area (Westerdahl 1994, 1995, 1998, 2000, 2002, 2005, 2006). The utility of this approach was soon recognised by other researchers and has since spread from Scandinavia to such diverse locations as the United Kingdom (Bannerman and Jones 1999; McErlean *et al*. 2002; Parker 1999), North America (Bell and Renouf 2003; Ford 2009), Australia (Ash 2004; Duncan 2006; Kimura 2006) and now New Zealand (Carter 2011). In his most recent paper, Westerdahl (2011) summed up the current state of the field of maritime cultural landscape studies and noted that for a holistic understanding of any maritime cultural landscape, researchers should investigate the archaeology, history, environmental studies, anthropology, cartography, oral history, toponymy and religious/cultural beliefs of a given region. Unfortunately, the scope of the study on which the current paper is based (Carter 2011) meant that it was not possible to cover such a wide range of multi-disciplinary sources. Nevertheless, this investigation has provided valuable insights into the creation of maritime cultural landscapes in Otago Harbour and has laid a significant foundation from which future studies can be undertaken.

This study was heavily influenced by the investigation of the maritime cultural landscape of Strangford Lough in Northern Ireland (McErlean *et al*. 2002). This large-scale project involved the comprehensive survey and description of all archaeological sites within the coastal, intertidal and sub-tidal zones of Strangford Lough, Ireland. The investigation of the environmental variables of the Lough demonstrated that it was not simply a static canvas on which cultural activities took place, but that it acted as a dynamic medium that both shaped and was shaped by the local people. The authors adopted a thematic approach to examine the history and archaeology of the Lough, examining fish and fishing; ports and harbours; navigation and pilotage; landing places; and shipwrecks and maritime casualties. By combining the environmental, historical and archaeological data of Otago Harbour into a number of themes similar to those of the Strangford Lough project, a cross-section of the maritime activities undertaken in the harbour could be investigated. In the present study each of these themes was investigated as an individual maritime cultural landscape and in this way Otago Harbour can be seen as comprising multiple overlapping maritime cultural landscapes.

## SOURCES OF DATA

This study combined information about the Otago Harbour from three separate disciplines – environmental studies, archaeology and documentary sources.

### Environmental studies

Analyses of the environment are critical for understanding the development of maritime cultural landscapes. As such, it was important to consider the natural processes that shaped, and were shaped by, the inhabitants of Otago Harbour. To this end, a range of regional and more specific studies were investigated, allowing such environmental variables as coastal morphology, geology, the intertidal zone, the subtidal zone and the seabed of the harbour to be analysed for their relationship with the people of the harbour.

### Archaeology

The investigation of the archaeology of the Otago region has a long history and the results of this previous work provided a foundation from which this study could analyse and link these sites. The New Zealand Archaeological Association's (NZAA) Site Recording Scheme was accessed to investigate the scope and number of maritime archaeological sites already recorded within the Otago Harbour. In addition, the New Zealand Historic Places Trust (NZHPT) Archaeological Reports Digital Library was investigated to gain access to unpublished archaeological reports relating to the archaeology of Otago Harbour. Finally, published sources relating to the archaeology of Otago Harbour were investigated. The most notable of these was Hamel's (2001) *Archaeology of Otago*, which provided a broad overview of the indigenous and historical archaeology of the region.

### Documentary sources

In order to supplement the archaeological information and to investigate more completely the maritime cultural landscapes of the harbour, the historical record was also interrogated. Both regional and more specific histories were investigated, providing information relating to the historical use of the Otago region and the various industries that were based around and within the harbour. Where more targeted information was required, primary documents, such as sailing directions and charts, historic maps, newspapers and memoirs, were investigated in the Hocken Library archives.

## THE EVOLUTION OF THE OTAGO HARBOUR ENVIRONMENT

Environmental variables have significantly influenced the way in which the inhabitants of the Otago region have interacted with their harbour. As such, an understanding of these variables is pertinent to this investigation of the maritime cultural landscapes of the harbour and are summarised below (for more detailed information, see Carter 2011).

Otago Harbour lies on the eroded remnants of a volcano that formed during the Middle to Late Miocene (Glassey *et al*. 2003:23). At the end of the last glaciation the harbour was flooded and by around 6,000 BP the Dunedin volcano was joined to the mainland, giving the harbour its modern shape. The contemporary harbour is a long and narrow inlet, which extends 21 km from the entrance in the north to the city of Dunedin in the south. With an average depth of just 3.3 m below mean sea level, nearly 30 per cent of the harbour's interior comprises sediment flats between 0 and 1.0 m above chart datum (Port of Otago Ltd 2010).

These environmental variables provide the inhabitants of the harbour with challenges as well as opportunities. Historically, the way in which these variables shaped – and were in turn shaped by – the inhabitants of the harbour can be revealed through the individuals' interactions with the marine environment. It is these interactions that created the various maritime cultural landscapes of Otago Harbour.

## THE HISTORY AND ARCHAEOLOGY OF OTAGO HARBOUR

Human occupation of Otago Harbour dates to the arrival of the first colonists from Eastern Polynesia around 1250 AD (Hamel 2001). Over the following 550 years, successive waves of Polynesian colonists entered the harbour, drawn by its plentiful marine food resources and strategic location. The arrival of the first European mariners in the harbour around 1809 signalled the start of non-Māori interest in the region. The following 200 years witnessed cycles of boom and bust for the harbour's maritime activities. Beginning with sealing and whaling, the area was shaped by successive industries such as the gold rush and the manufacturing boom of the 1860s, the export of frozen meat in the 1880s and the ongoing development of farming in the hinterland.

### Maritime archaeological sites

Each step of the expansion described above has left its mark on the harbour and today we are left with a palimpsest of these actions in the maritime archaeological record. Prior to the current study, there were 124 recorded maritime archaeological sites in the Otago Harbour, representing 23 different site types (Table 1).

**Table 1: Different types of maritime archaeological sites recorded in the NZAA site record for Otago Harbour.**

| Site Type | Number | Site Type | Number |
|---|---|---|---|
| Artillery battery | 1 | Rifle butts | 1 |
| Bond store | 1 | Sea wall | 19 |
| Customs house | 1 | Settlement | 11 |
| Fort | 1 | Shipwreck | 2 |
| Hulk | 8 | Signal flagpole | 1 |
| Jetty | 5 | Slipway | 2 |
| Landing place | 1 | Stone ramps | 6 |
| Lime burning | 1 | Torpedo boat mole | 1 |
| Midden | 51 | Warehouse | 1 |
| Pa | 1 | Whaling station | 1 |
| Quarantine | 3 | WWII trench | 1 |
| Reclamation | 6 | | |

### Historically recorded maritime sites

The investigation of documentary sources revealed a further 309 sites of interaction between people and the marine environment within Otago Harbour (Figure 2).

The maritime sites described in the documentary sources represented a wide range of activities and when these were analysed in conjunction with the recorded archaeological sites, a historical archaeological perspective was able to be applied to the maritime cultural landscapes of Otago Harbour.

## THE MARITIME CULTURAL LANDSCAPES OF OTAGO HARBOUR

In order to explore the changing relationships between the inhabitants of the harbour and the marine environment, the archaeological and historically recorded maritime sites identified were grouped into a number of interconnected themes. These themes – navigation, abandoned watercraft and anthropogenic change – represent a cross-section of the different activities that have created the various maritime cultural landscapes of the harbour. By analysing these themes as individual landscapes, a framework was provided whereby individual maritime sites were investigated for their linkages to one another and the modification/utilisation of the landscape that they represent.

### The maritime cultural landscape of navigation

The dangers associated with entering and navigating the waters of Otago Harbour have seen the wrecking of 20 ships, and the stranding of countless vessels. In order to minimise these dangers, the inhabitants of the harbour have long relied on navigation aids and the local knowledge of pilots to facilitate their safe passage throughout the harbour and beyond to the Pacific Ocean.

The most notable hazard to navigation in Otago Harbour is the entrance to harbour. For much of its early history, inbound vessels had to cross both an outer and an inner bar before reaching the narrow channel that led to the inner anchorage at Port Chalmers. Furthermore, vessels seeking to travel up the harbour to Dunedin were faced with an ever-changing and shallow estuary (Tilley 1886:173). In order to overcome these threats to navigation, the inhabitants of the harbour constructed and maintained a range of navigation aids, thus altering the environment to suit their needs.

Sixteen sites pertaining to navigational aids were identified during the source of this study. When viewed collectively, these sites constituted the maritime cultural landscape of navigation in Otago Harbour (Table 2).

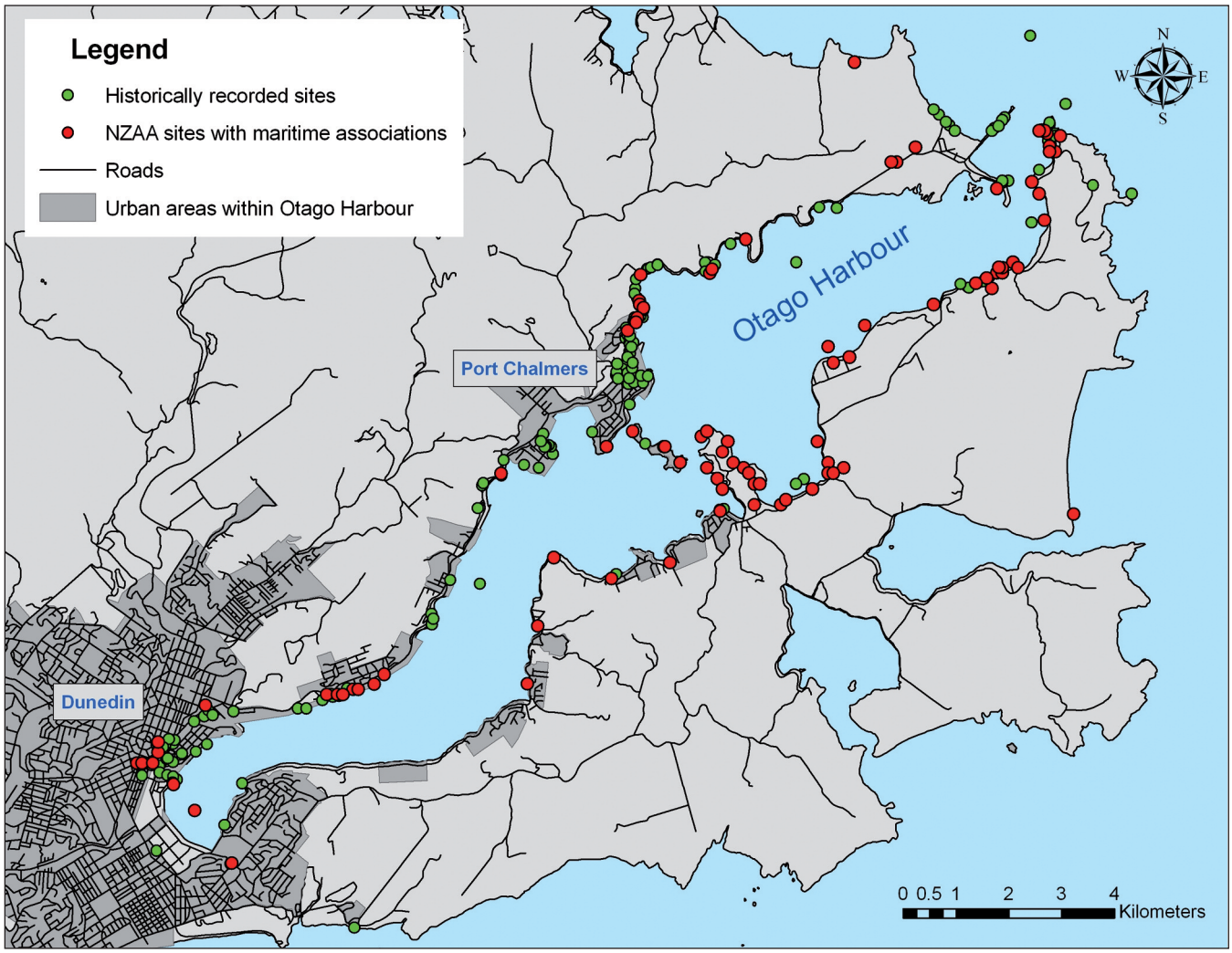


*Figure 2: Historically recorded maritime sites and the NZAA recorded maritime sites in Otago Harbour.*

**Table 2: Types and numbers of navigational aids built in Otago Harbour.**

| Site Type | Number |
|---|---|
| Aramoana mole | 1 |
| Beacon light | 1 |
| Groynes | 2 |
| Leading lights | 1 |
| Lighthouse | 1 |
| Pilot station | 2 |
| Shipping channel | 1 |
| Signal flagpole | 3 |
| Tidal training wall | 3 |
| Timeball | 1 |

The 16 recorded aids to navigation in Otago Harbour reflect not only the increasing ability of its inhabitants to harness capital to modify the marine environment, but also their responses to the advances in shipping technology during the nineteenth century. From 1809, a small but increasing number of European vessels began visiting Otago Harbour. In order to reduce the risk these vessels faced entering the harbour, buoys were installed to mark the incoming channel in 1844, and a signal flagstaff erected at Taiaroa Head in 1849 (McLean 1985:28-32). The modest nature of these navigation aids reflects the small scale of shipping entering and leaving the harbour, which provided only minimal customs duties for subsequent investment in navigation infrastructure. With the discovery of gold in Central Otago in 1861, ships carrying miners and associated goods flooded into the harbour. This saw an exponential increase in shipping and acted as a catalyst for the development of industry in the region (Chapman 1975:11). These industries relied on the increasing number of ships entering the harbour for the importation of raw materials and labour, as well as the export of their products. The need to secure the safe passage of these vessels saw the mercantile community vigorously lobby the Provincial Government for improvements to the port. Eventually, these requests could no longer be ignored and they resulted in the first major investment in navigational aids in the harbour, with a pilot station established at Pilots Beach and a lighthouse at Taiaroa Head in the 1860s (Knight 1979:30).

With the entrance to the harbour protected and a significant amount of capital still flowing through the region, demands were made by the local populace for the improvement of the shallow shipping channel that led from Port Chalmers to Dunedin. This channel significantly limited the size of vessels that could unload at the wharves in Dunedin. To compound the issue, the 1870s saw a new generation of large steamers visit the harbour. In order to overcome this size restriction to shipping and trade, in 1875 the Otago Harbour Board decided to dredge a channel six miles long (9.6 km), 70 feet wide (21 m), with a minimum depth of 14 feet (4.2 m) at low tide, along the shallow western channel (Church 1994:86). This project started in 1876 and after five years of toil, over 965,000 cubic yards of spoil had been dredged from the channel. In 1881, the Victoria Channel was officially opened. This project was a major undertaking for the Harbour Board, requiring the investment of some £118,000. However, this investment enabled vessels of over

900 tons to regularly steam to and from Dunedin, thus significantly increasing the commercial activity of the town (McLean 1985:73).

In the 1880s, the harbour entrance was the major hazard to navigation in Otago Harbour, with shoaling of the bar once again limiting the size of shipping that could safely call at the harbour. The Harbour Board sought a permanent solution in the form of a rubble training wall, or 'mole', which would direct the force of the tidal scour across the bar and thus deepen the southern channel. Construction of the Aramoana mole began in 1884, with work progressing until a halt was called in November 1887. At this time, the mole extended 4,088 feet (1.2 km) from the beach (McLean 1985:88). Although the mole had cost some £73,000, by 1887 it had already increased the depth of the southern channel from a mere 7 feet (2.1 m; in 1879) to 22 feet (6.7 m) – a gain of some 15 feet (4.6 m). This opened up the harbour for all but the largest vessels of the time (McLean 1985:89). The construction of the Aramoana mole once again showed the willingness of the inhabitants of the harbour, through their elected officials, to invest large sums of money to ensure the safety of shipping that the continued financial growth of the region depended on.

The 16 sites of navigation aids created an interlinked network around the harbour through which mariners could safely and efficiently enter, traverse and exit the harbour with minimal danger or delay. These sites reflect the methods used by the inhabitants of the harbour to alter the marine environment to aid navigation and reduce the risk to shipping. The changing scale of these works is linked to the economic growth of the port and the increasing confidence of its inhabitants. The maritime cultural landscape of navigation in Otago Harbour thus reflects the increasing willingness and capacity of the people of the harbour to alter the marine environment in progressively more radical ways in order to remain abreast of the advances in shipping technology that saw ever larger vessels frequenting their harbour.

### The maritime cultural landscape of abandoned watercraft

A significant maritime cultural landscape within Otago Harbour is manifest in the remains of abandoned hulks and other watercraft clustered in several bays around the harbour. The remains and location of these vessels provide insights into a unique form of interaction between the harbour's inhabitants and the marine environment, which reflects changing economic and social practices over the last 150 years.

Forty-three hulks and other watercraft that were abandoned in Otago Harbour between 1861 and 1950 were identified in the course of this study. These vessels were purposefully beached in specific areas of the harbour, where they were stripped of their fittings and other equipment, and finally left to the tides. Such concentrated areas of abandoned watercraft are often termed 'ships' graveyards' and there is evidence for five such areas within Otago Harbour: Careys Bay, Deborah Bay, Back Beach, Quarantine Island and Aramoana mole (Figure 3).

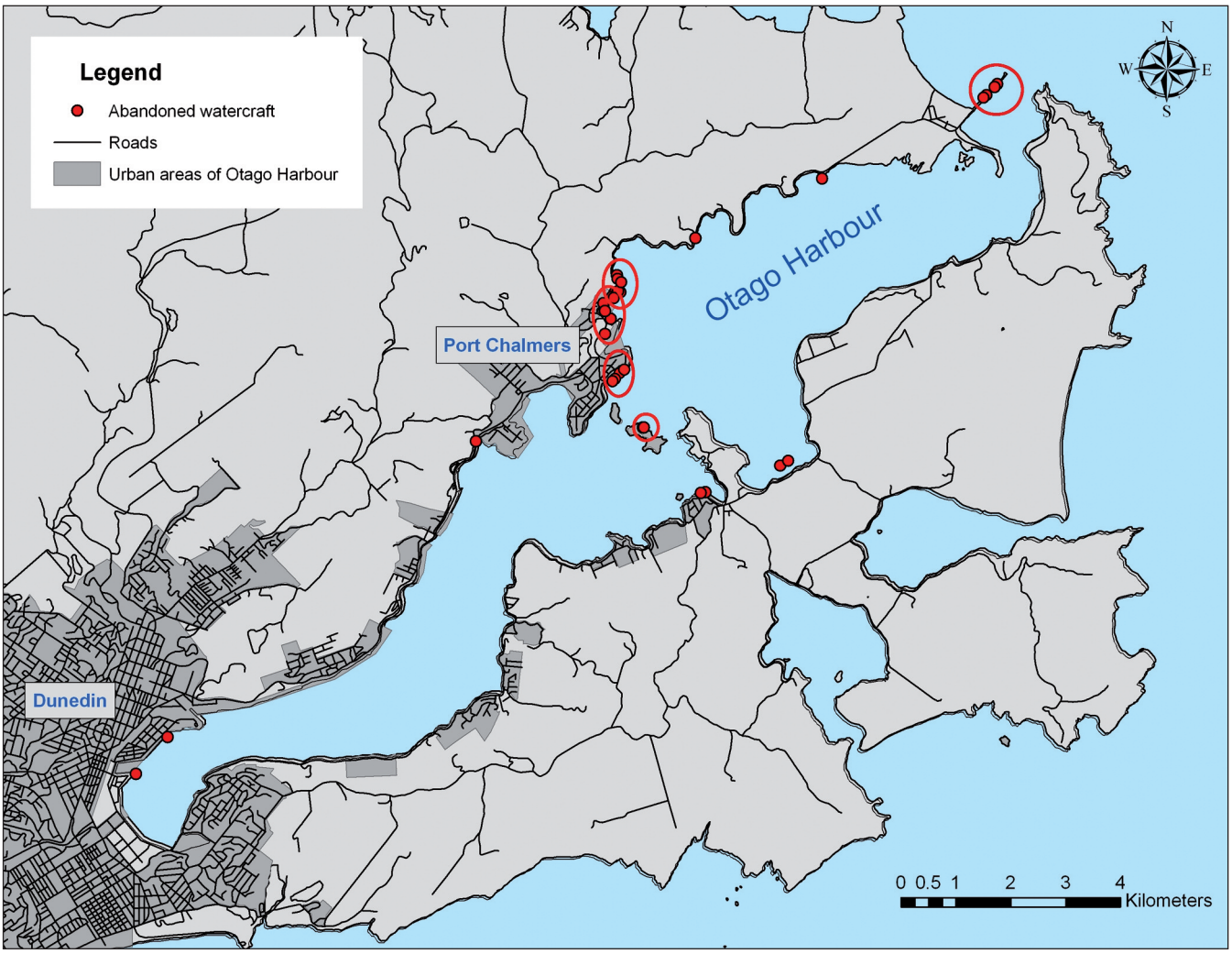


*Figure 3: Otago Harbour showing the distribution of abandoned watercraft and 'ships' graveyards'.*

Careys Bay contains the remains of 12 different vessels, the largest concentration of abandoned watercraft within the harbour. Between 1856 and 1909, Careys Bay was a working landscape in which the abandonment of vessels was an accepted and encouraged form of activity. The disposal of vessels in this location directly relates to the ship and boat-building industry in the bay, most notably through William Isbister and his 'Patent Slip'. The shallow water meant that vessels could be run aground close to shore to facilitate the stripping and salvage of valuable materials, which were subsequently reused and incorporated in newly built vessels. Increasing competition and costs of construction meant that by the 1920s, shipbuilding was no longer a major industry in Careys Bay and this was reflected in changing attitudes of the residents towards the disposal of vessels in their bay. Between 1925 and 1931, the Union Steam Ship Company had moored nine surplus vessels in the bay while they awaited a buyer or to be scrapped. Whereas in the past these vessels may have been an acceptable addition to the landscape of the bay, they were now given the unenviable name of 'Rotten Row' (Church and Philp 2008:71). The ill-feeling towards these hulks was such that the Union Steam Ship Company was forced to remove the remaining vessels and find an alternative method for ridding themselves of surplus shipping (Church and Philp 2008:74). This spelt the end of Rotten Row and with it, a unique chapter in the history of Careys Bay.

Like Careys Bay, Deborah Bay also had a boat and shipbuilding industry and was an established area for the abandonment of vessels. The major period of this activity in Deborah Bay was between 1902 and 1924. This period saw five vessels stripped by the shipbreakers J. Crammond and E. Nelson, who used the shallow bay to recover the copper, brass, iron and reusable timbers from these vessels before they were abandoned (Ledgerwood 2006:95). Although fewer vessels were stripped and abandoned in Deborah Bay than in Careys Bay, such work was undertaken in a significantly shorter time-frame, which reflected the more intensive shipbreaking industry in Deborah Bay. In addition, it appears that Crammond and Nelson concentrated their efforts on larger ships than those in Careys Bay and as such, the salvaging of materials took longer but required fewer vessels than in Careys Bay.

The ships' graveyard that was established at Back Beach was a major aspect of the waterfront environment of this area from the early 1870s until the 1960s. Between 1873 and 1904 five vessels were abandoned on the beach to facilitate the removal of their fittings and timbers for reuse by the resident boat and shipbuilders (McLean 1985:331). Once stripped, these vessels lay in various states of disrepair along the beach, until the 1960s when the Harbour Board decided to remove what was deemed as a 'hazard to young swimmers' (McLean 1985:331). Today no physical evidence of this ships' graveyard remains. The actions of the Harbour Board in removing the vessels from Back Beach reveals the changing economic and social uses of the area. Between 1873 and 1904 the beach was a working landscape that incorporated a boat and shipbuilding industry in which the abandoned vessels were an economic resource. After 1904 this industry declined and Back Beach moved from a working landscape to one of recreation. In the 1960s it was deemed that the remnants of the working landscape were no longer compatible with the current use of Back Beach and as such, the abandoned vessels were removed (Stewart 1973:55).

The ships' graveyard at Quarantine Island comprises two vessels, the *Oreti* and *Waikana*, which were beached in the 1930s. As noted above, by the 1920s the shipbuilding industry in Otago Harbour had declined significantly and surplus watercraft were no longer considered the economic unit they once were. This changing attitude was evidenced with the *Oreti* and *Waikana*, which in 1932 and 1939 respectively were moved to Quarantine Island not to facilitate their salvage, but to protect a stone jetty there from tidal currents (McLean 1985:332). It may have been the fact that these vessels were still serving a purpose meant that residents of the harbour did not complain about the use of Quarantine Island as a ships' graveyard subsequent to the disestablishment of Rotten Row.

Like Quarantine Island, the ships' graveyard at Aramoana mole differs from the other sites as vessels were intentionally beached to serve a purpose, rather than to facilitate their stripping. In 1884, work began on the £73,000 Aramoana mole as a mechanism for increasing the depth and width of the entrance to the harbour (McLean 1985:86). The exposed nature of the mole meant that it often suffered storm damage, which was expensive to repair and reduced the efficiency of the tidal scour. In the late 1920s, with the loss of Rotten Row as a viable dumping place for surplus vessels, the Harbour Board's Marine Engineer began sinking this unwanted tonnage alongside the mole in order to strengthen it (McLean 1985:329). This course of action solved two of the Harbour Board's major problems and between 1926 and 1945, at least eight vessels were scuttled at Aramoana, thus significantly strengthening and protecting the Harbour Board's investment.

The location and timing of when these ships' graveyards were established and when they were abandoned was a product of changing economic climates and social perspectives. As such, these vessels – when investigated as a maritime cultural landscape – provide insights into the harbour inhabitants' evolving relationship with the marine environment and the various economic and social factors that influenced this interaction.

## The maritime cultural landscape of anthropogenic change

The interaction between the harbour's inhabitants and the surrounding marine environment is nowhere more apparent than in the anthropogenic modification of the harbour, which has seen huge areas of the foreshore reclaimed and the construction of numerous sea walls. These reclamations and sea walls provide a unique opportunity to investigate large scale anthropogenic modification of the marine environment.

Over the last 150 years, more than 340 hectares of foreshore have been reclaimed and around 40 km of sea walls constructed along the shoreline of Otago Harbour. Through these actions, the inhabitants of the harbour have not only radically altered the shape of the marine environment to facilitate their need for building space and to facilitate transport links, but have also created some of the largest and most intact archaeological sites within the harbour.

Within the study area, six sites relating to the reclamation of the harbour have been investigated archaeologically. Petchey's (2002) excavation of the site of the old Dunedin jail revealed not only a considerable amount of information about the structure itself, but also provided insights into the process of reclamation in this area. This process involved laying down clay and rock rubble to a depth of 0.6–1.4 m, in order to raise the shoreline above the level of mean high water spring. Hamel's (2001b) excavation in Queens Gardens revealed that the reclamation in this region comprised upwards of 2 m of rock fill and about a metre of strong clay, revealing just how much fill was required to raise even a small area of the foreshore. The earthworks associated with building the Dunedin Chinese Gardens provided another opportunity to further our understanding of reclamation in this area. As described by Middleton (2007:3-4), reclamation of this area of Dunedin was undertaken in two distinct phases. The first consisted of 'several dumps of rubbish, including industrial material deposited on the seabed', followed by a second layer

of 'other hard fill material such as grey and yellow clay, a single area of hard red rock, and hard grey stone' (Middleton 2007:12). Middleton's (2008) monitoring of earthworks on the site of the Otago Polytechnic School of Art building uncovered evidence for a reclamation distinct from those previously discussed. This reclamation was undertaken at a later date (c. 1894) and was further north than the sites previously investigated (Middleton 2008:8). This excavation found that the previous reclamation method of laying down fill by the dray load had been replaced by pumping spoil directly onto the area to be reclaimed.

Geotechnical investigations on the Birch Street and Kitchener Street wharves provided Hamel (2008a) with the opportunity to investigate reclamation in this area. Hamel's work revealed that much more land-sourced fill, as opposed to dredgings, was used for the reclamation of this area. As noted by Hamel (2008a:9), this would have had to have been 'laboriously dug and carted out onto the tidal flats, in contrast to the marine sediments more easily won with the steam powered dredges of the time'.

The excavation at the site of the Great King Street Countdown supermarket added further to our knowledge of both the pre-reclamation landscape of Dunedin and the reclamation process in this area. One of the most notable features of this site was the level of the preservation of timbers buried under the reclamation fill (Hamel 2008b). This suggests that other pre-reclamation structures likely exist along the earlier foreshores of the harbour, thus presenting archaeologists with a unique form of evidence into this aspect of the past.

Between 1865 and 1948, over 40 km of sea walls were constructed along the shoreline of Otago Harbour, creating the footing on which both roads and railways were subsequently built. These sea walls have been the subject of a number of archaeological investigations – most notably those carried out by Jill Hamel over a period of almost 25 years. The sea walls and their related infrastructure have been archaeologically investigated on both sides of the harbour, offering insights into the construction of this site type. Interestingly, archaeological research has revealed that the walls from the major construction periods of 1865–1900 and 1920–1940 differ in several ways. The sea walls from the earliest period are characterised as 'very well built of trimmed rock, very carefully fitted and very smooth faced', while the 1920–1940 walls are 'less well-fitted but relatively tight, often with dressed faces, and even faced with a straight pitch' (Hamel 2004:37, Hamel pers. comm. 2010). Hamel (2004:37) also notes that although different from one another, the construction of each cohort is uniform in terms of rock source, colour and building style, with relatively consistent rock size throughout.

The reclamation of considerable areas of the foreshore, combined with the construction of lengthy sea walls, has resulted in the creation of a unique maritime cultural landscape within Otago Harbour. By the 1860s, the inhabitants of Otago Harbour were facing a chronic shortage of flat land for the industries that were rapidly burgeoning with the discovery of gold in the region. To remedy this situation, the inhabitants of the harbour began a programme of reclamations that would last over 115 years and resulted in the reclamation of over 340 hectares of foreshore. Each reclamation pushed the edge of the foreshore further into the harbour, burying the previous shoreline and the very structures that had been built upon. This work not only altered the shape of the harbour but also had a far-reaching impact on the overall tidal compartment of the harbour, a factor that was hotly debated whenever a new reclamation project was proposed.

The construction of sea walls around the edge of the harbour from 1865 to 1948 had a similar effect to the reclamations. The sea walls and associated roading were built to facilitate transport links around the harbour and resulted in the burying and realignment of much of the foreshore. When we consider that these works currently cover over 40 km of the harbour's beaches and inlets and are at least the width of a double lane road, it is evident that a significant proportion of the harbour was affected by these works.

## DISCUSSION

By incorporating the individual maritime sites around Otago Harbour into the maritime cultural landscapes of navigation, abandoned watercraft and anthropogenic change, the interconnections between these sites and the maritime activities they represent were highlighted. From this the maritime cultural landscapes described above can be combined to create a synthesis of the evolution of the human use of Otago Harbour.

It is readily apparent that European interaction with the marine environment of Otago Harbour has been heavily influenced by a range of factors that have either promoted or hindered the scale of which the inhabitants of the harbour have been able to modify the marine environment to suit their changing needs. Two such factors that significantly impacted this interaction were the economic cycles of boom and bust in the Otago region, and the societal attitudes held by the inhabitants in relation to 'progress' and the marine environment.

With the arrival of the first Europeans to the region, harbour resources could only be slowly collected and eventually used to shape the marine environment into a more familiar landscape. The first step of this process was the establishment of navigational aids, an important but in the end (initially at least) low impact modification of the natural environment. However, with increased shipping, people and money flowing into the province due to the discovery of gold in the 1860s, the inhabitants of the harbour began to have a more permanent impact on the marine environment. This boom period saw an unprecedented inflow of capital into the harbour, enabling the investment of money, expertise and labour into major works such as dredging and the first reclamations. The success of these projects further fuelled the already widely held desire of the harbour inhabitants for the modification of the marine environment to suit the financial needs of the province. This aspiration for progress, as well as the availability of capital to fulfil this ambition, was most prominent in the period 1860–1890, which saw the creation of the Victoria Channel, construction of the Aramoana mole, the establishment and expansion of the shipbuilding industry (and the related phenomena of stripping and abandoning watercraft), the reclamation of large areas of the seafloor, and the construction of roads and railways along much of the harbour foreshore. Subsequent to this boom period there was an appreciable decline in the level and scale of the modification of the marine environment and also the changing attitudes towards such work. The end of the gold rush and the depression of the 1880s combined to significantly reduce the financial reserves of the region, limiting the availability of funds for investment. The impact of these cuts was felt from the 1890s until the around the 1960s, during which time the Harbour Board went into a period of retrenchment, which was worsened by the gradual waning of both the shipping and manufacturing industries in the region. As a result of this, the relationship of the harbour inhabitants with the marine environment as a purely economic resource began to change. Industries such as shipbuilding no longer supported the number of employees they once had and, due to public discontent, such operations were increasingly restricted to

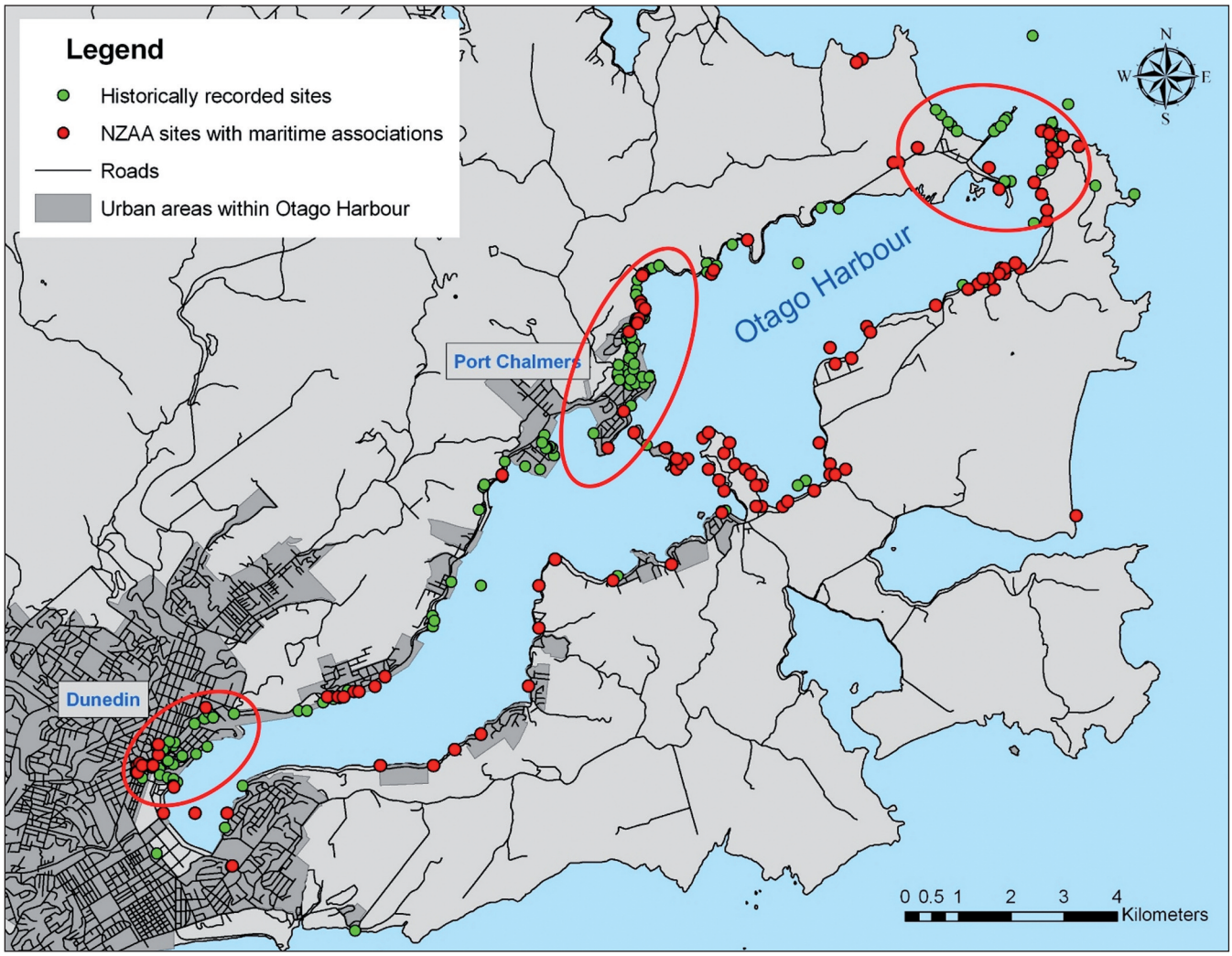


*Figure 4: Otago Harbour showing spatial patterning and clustering of maritime sites.*

particular parts of the harbour, converting what were once working landscapes into those of residential and recreational function. In addition, this changing social attitude towards the harbour saw increasingly vocal opposition to major projects such as reclamations, with more concern shown for the protection of the tidal compartment of the harbour than for the economic potential such reclaimed land would provide – a significant 'seachange' from the previous century.

The spatial patterning of the maritime sites around Otago Harbour is the product of both natural and cultural forces as they relate to the particular requirements of an industry or site type. As such, aids to navigation were located in the most dangerous parts of the harbour, ships' graveyards were typically related to areas of shipbuilding, and anthropogenic change occurred wherever there was a requirement for flat land. At a broader level however, maritime sites within Otago Harbour can be seen to cluster around particular locales, namely Dunedin, Port Chalmers and the entrance to the harbour (Figure 4).

These concentrations of sites are notable in that they reveal the areas of the harbour in which the interaction between people and the marine environment has been most intensive. The density of sites around the entrance to the harbour reflects the importance that the people placed on shipping and the lengths they were able and willing to go to in order to ensure its safe and efficient arrival and departure. The Port Chalmers area, including Careys and Deborah Bay, represents the most intensive area of past (and present) maritime activity in the harbour. In this location, environmental, economic and social variables all combined to promote the development of a port with its attendant maritime industries. The success of this area as a working maritime landscape is reflected in the large number of maritime sites representing a range of maritime cultural landscapes. As a maritime hub, Dunedin was not naturally endowed with the deep water and flat land that made Port Chalmers so attractive to maritime industry. However, the concentration of sites at Dunedin reflects the ability of the residents to combine capital and public will in order to modify the marine environment to facilitate access to shipping and the expansion of industry. In such a way, the clustering of sites in the Dunedin area is particularly revealing about the past maritime use of the harbour, especially in terms of anthropogenic change.

The results of this study strongly support the need for the systematic survey of maritime archaeological sites within a region. Prior to this study there were 124 maritime archaeological sites recorded in the New Zealand Archaeological Association's Site Recording Scheme for Otago Harbour. Investigation of these recorded sites revealed that they were typically only the most highly visible and largely intact maritime archaeological sites and that they had been recorded in an ad hoc manner, in which the 'best' sites had been selected and recorded while the vast majority of less 'glamorous' sites were ignored. In contrast, this study sought to investigate the interaction between people and the marine environment in a more holistic manner and included an additional 309 potential maritime archaeological sites that were found through the investigation of local histories,

historic maps and photographs. The sheer number and diverse range of these unrecorded sites means that they have made a vital contribution to the thematic synthesis of the maritime cultural landscapes of Otago Harbour described above. It is clear that without the inclusion of these sites, any understanding of the interaction between the inhabitants of the harbour and the marine environment would be incomplete. The present study has revealed much about the maritime archaeological resource of Otago Harbour and it is hoped that this information will be incorporated into their future management and will contribute to the research and protection of these sites in the future.

The above research used environmental studies, archaeology and historical sources to investigate the maritime cultural landscapes of Otago Harbour, thus providing insights into its changing maritime uses over time, and also laying a foundation from which future investigations can be built. From this base, such studies would benefit from incorporating a wider range of sources such as the oral history, place names, traditions and cultural beliefs of the region to provide greater detail of the social dimension of the maritime cultural landscapes of the harbour. Further, any number of additional maritime cultural landscapes could be investigated in a setting such as Otago Harbour, with almost limitless possibilities for investigating the various ways in which people shaped and were in turn shaped by their interaction with the marine environment. Future studies would also benefit from investigating Maori interaction with the marine environment and the creation and evolution of indigenous maritime cultural landscapes.

## CONCLUSIONS

This investigation of the maritime cultural landscapes of Otago Harbour has provided a new and greater understanding of some of the many ways in which the inhabitants of the harbour have interacted with the marine environment. In order to constructively investigate this relationship, a maritime cultural landscape approach was used to investigate the history of Otago Harbour. The success of this approach enabled the various activities that were performed by the inhabitants of the harbour to be understood holistically as components of individual maritime cultural landscapes.

This research has provided the information from which a synthesis of the evolution of the maritime use of Otago Harbour can be formed. This revealed the influence of economic and social factors in dictating the scale and form of interaction between the inhabitants of the harbour and the marine environment that led to the distinct spatial patterning of maritime archaeological sites in Otago Harbour. It is hoped that this study will be one of the first of many to investigate the maritime cultural landscapes of New Zealand, therefore ensuring that this crucial area of our past is not lost beneath the tides of history.

## REFERENCES


ASH, A. 2004 A nice place for a harbour or is it? Investigating a maritime cultural landscape: Port Willunga, South Australia, unpublished Honours thesis, Department of Archaeology, Flinders University, South Australia.

BELL, R., OLDMAN, J., BEAMSLEY, B., GREEN, M., PRITCHARD, M., JOHNSON, D., McCOMB, P., HANCOCK, N., GRANT, D. and R. ZYNGFOGEL 2009 Port Otago dredging project: harbour and offshore modelling, NIWA Client Report HAM2008-179, Project POL08202.

BELL, T. and M. RENOUF 2003 'Prehistoric Cultures, Reconstructed coasts: Maritime Archaic Indian Distribution in Newfoundland', *World Archaeology* 35 (3):350-370.

BENDER, B. 1993 'Landscape – Meaning and Action', in B. Bender (ed.) *Landscape Politics and Perspectives*, Berg Publishers, Oxford, pp. 1-17.

BOWMAN, H.O. 1948 *Port Chalmers: Gateway to Otago*, Capper Press, Christchurch.

CARTER, L. and R. CARTER 1986 'Holocene evolution of the nearshore sand wedge, South Otago continental shelf, New Zealand', *New Zealand Journal of Marine and Freshwater Research*, 29 (4):413-424.

CARTER, M. 2011 People, Place and Space: The Maritime Cultural Landscape of Otago Harbour, unpublished Masters thesis, Department of Anthropology, University of Otago, Dunedin.

CHAPMAN, M. 1975 The golden years of shipping industry. A study or shipbuilding and repair work in Port Chalmers, 1862-1864, unpublished Honours thesis, Department of History, University of Otago, Dunedin.

CHURCH, I. 1994 *Port Chalmers and its People*, Otago Heritage Books, Dunedin.

CHURCH, I. and A. PHILP 2008 *Around the Bay: The Community, Boatbuilders and Fishermen of Careys Bay*, Careys Bay Reunion Committee, Dunedin.

CRUMLEY, C. 1994 'Cultural Ecology: A Multidimensional Ecological Orientation', in C. Crumley, (ed.) *Historical Ecology: Cultural Knowledge and Changing Landscapes*, SAR Press, Santa Fe, pp. 1-13.

DUNCAN, B. 2006 The maritime archaeology and maritime cultural landscape of Queenscliffe: A nineteenth century Australian community, PhD thesis, School of Anthropology, Archaeology and Sociology, James Cook University, Townsville, Australia.

FORD, B. 2009 Lake Ontario maritime cultural landscape, unpublished PhD thesis, Texas A and M University, College Station, TX, USA.

GLASSEY, P., BARRELL, D., FORSYTH, J. and R. MACLEOD 2003 'The Geology of Dunedin, New Zealand and the Management of Geological Hazards', *Quaternary International* 103 (1):23-40.

HAMEL, G.E. 2001a *The Archaeology of Otago*, Department of Conservation, Wellington.

HAMEL, G.E. 2001b A Celtic cross at Dunedin's low tide mark, unpublished report for Dunedin Christian Millennium Committee and Dunedin City Council.

HAMEL, G.E. 2004 Draft conservation plan for Otago Harbour sea walls, unpublished report for Dunedin City Council.

HAMEL, G.E. 2008a A history of reclamation at the Birch Street and Kitchener Street wharves Dunedin, unpublished report to New Zealand Historic Places Trust on behalf of Otago Regional Council.

HAMEL, G.E. 2008b Structures from the mid-nineteenth century shoreline of Dunedin, unpublished report to New Zealand Historic Places Trust, Wellington.

HOOD, J. 1996 Social Relation and the Cultural Landscape, in R. Yamin and K. Methney (eds) *Landscape Archaeology: Reading and Interpreting the American Historical Landscape*, University of Tennessee Press, Knoxville, pp. 121-146.

INGLIS, G., GUST, N., FITRIDGE, I., FLOERL, O., WOODS, C., HAYDEN, B. and G. FENWICK 2006 Dunedin Harbour (Port Otago and Port Chalmers) baseline

survey for non-indigenous marine species, Biosecurity New Zealand Technical Paper No: 2005/10, prepared for Biosecurity New Zealand.

JAMES, M., PROBERT, K., BOYD, R. and P. SAGAR 2009 Biological resources of Otago Harbour and offshore: assessment of effects of proposed dredging by Port Otago Ltd, NIWA Client Report HAM2008-152, prepared for Port Otago Ltd, Dunedin.

KENDERDINE, S. 1993 'Muddy waters: Assessing the Cultural Landscape of the River Murray', *Bulletin of the Australian Institute of Maritime Archaeology* 17 (2):11-16.

KIMURA, J. 2006 Interpreting maritime cultural space through the utilisation of GIS: a case study of the spatial meaning of shipwrecks in the coastal waters of South Australia, unpublished Masters thesis, Flinders University, Adelaide, Australia.

KNAPP, A and W. ASHMORE 1999 'Archaeological Landscapes: Constructed, Conceptualized, Ideational', in A. Knapp and W. Ashmore (eds) *Archaeologies of Landscape: Contemporary Perspectives*, Blackwell Publishers, Oxford, pp. 121-146.

KNIGHT, H. 1979 *Otago Peninsula*, Allied Press Ltd, Dunedin.

LEDGERWOOD, N. 2006 *Deborah Bay. The people and Events of a Lower Otago Harbour Community*, University of Otago Print, Dunedin.

McLINTOCK, A.H. 1951 *Port of Otago*, Whitcombe and Tombs, Dunedin.

McERLEAN, T., McCONKEY, R. and W. FORSYTHE 2002 *Strangford Lough: An Archaeological Survey of the Maritime Cultural Landscape*, Blackstaff Press Ltd and the Environment and Heritage Service, Belfast.

McLEAN, G. 1985 *Otago Harbour: Currents of Controversy*, Otago Harbour Board, Dunedin.

MIDDLETON, A. 2007 Dunedin Chinese Gardens. 2 Thomas Burns Street. Earthworks monitoring report, unpublished report to New Zealand Historic Places Trust, Wellington.

MIDDLETON, A. 2008 Otago Polytechnic School of Art archaeological assessment, unpublished report to New Zealand Historic Places Trust, Wellington.

OLSSEN, E. 1984 *A History of Otago*, John McIndoe Ltd., Dunedin.

PETCHEY, P. 2002 Dunedin Law Courts archaeological investigation: old Dunedin Gaol, unpublished report for Department of Courts.

PHILLIPS, C. 2000 *Waihou Journeys: The Archaeology of 400 Years of Maori Settlement*, Auckland University Press, Auckland.

PORT OTAGO LTD. 2010 Project Next Generation: Resource Consent applications and assessment of environmental effects, unpublished report for Port Otago Ltd, Dunedin.

SINGLE, M. and J. BENN 2007 Port Otago Project Next Generation: summary of existing physical coastal environment information and scoping for further studies, Port Otago Ltd, Dunedin.

SINGLE, M., BELL, R. and P. McCOMB 2010 Physical coastal environment of Otago Harbour and offshore: assessment of effects of proposed dredging by Port Otago Ltd, prepared by Shore Processes and Management Ltd. for Port Otago Ltd.

STEWART, P. 1973 *Days of Fortune: A History of Port Chalmers, 1848–1973*, John McIndoe Ltd., Dunedin.

TILLEY, R.N. 1886 *Brett's New Zealand and South Pacific pilot and nautical almanac for the years 1887–1888*, The Star Office, Auckland.

WESTERDAHL, C. 1992 'The Maritime Cultural Landscape', *The International Journal of Nautical Archaeology* 21 (1):5-14.

WESTERDAHL, C. 1994 'Maritime Cultures and Ship Types: Brief Comments on the Significance of Maritime Archaeology', *The International Journal of Nautical Archaeology* 23 (4):265-270.

WESTERDAHL, C. 1995 'Traditional Transport Zones in Relation to Ship Types', in O. Olsen, F. Rieck, and J. Skamby Madsen (eds) *Shipshape: Essays for Ole Crumlin-Pederson*, Roskilde Viking Ship Museum, pp. 213-230.

WESTERDAHL, C. 1998 'The Norrland Survey and its Aftermath', in M. Lindstrom (ed.) *The Marine Archaeology of the Baltic Sea Are*a, Sodertorns Hogskola, Stockholm, pp. 101-104.

WESTERDAHL, C. 2000 'From Land to Sea, From Sea to Land: On Transport Zones, Borders and Human Space', in J. Litwin (ed.) *Down the River to the Sea*, Polish Maritime Museum, Gdansk, pp. 11-20.

WESTERDAHL, C. 2002 'The Ritual Landscape at Sea', in K. Kruegar and C.O. Cederland (ed.) *Maritime Archaologie heute/Maritime Archaeology Today*, Inglo Koch Verlag, Rostock, pp. 51-72.

WESTERDAHL, C. 2005 'Seal on Land, Elk at Sea: Notes on the Application of the Ritual Landscape at the Seaboard', *The International Journal of Nautical Archaeology* 34 (1):2-23.

WESTERDAHL, C. 2006 'Maritime Cosmology and Archaeology', *Deutsches Schiffahrtsarchiv* 28:7-54.