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OTAGO HARBOUR: REVIEW OF EXISTING MARINE ECOLOGICAL DATA

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

Otago Harbour is a deep, drowned valley and forms the natural harbour of Dunedin / Ōtepoti. The harbour covers 48 km^2 and is ecologically, culturally and economically significant. Ecological data have previously been collected in the harbour by (or for) Otago Regional Council (ORC) for various purposes. Ecological data have also been collected for resource consent-related monitoring and for a myriad of research-based projects (by, for example, the University of Otago).

Otago Regional Council would like to make these data (and associated metadata[1]) more user-friendly and accessible to end-users to facilitate improved environmental management of Otago Harbour. Therefore, ORC requested that the Cawthron Institute (Cawthron) undertake a review and metadata summary of all marine ecological data that have been collected within Otago Harbour by (or for) ORC since 1990 (funded through the Envirolink Advice Grant 2239-ORC001).

This review identifies data and their location and summaries the key attributes of each dataset. It will help managers access all information that can contribute to environmental decision-making. The review will also give future researchers a reliable baseline for their studies. End-users of a review of existing ecological data are anticipated to include ORC, other councils, governmental organisations responsible for environmental management and / or research, communities, industry and academic research institutions.

[1] Metadata are data that describe other data.

2. METHODS

This project was limited to collating the following ORC data collected since 1990:

- data commissioned by ORC for the purposes of monitoring (e.g. state of the environment) and scientific research
- consent-related monitoring data (including Port Otago Ltd (POL), which we also note is owned by ORC).

Given the collective regional consenting responsibilities within the Otago Harbour, Dunedin City Council (DCC) data sources were also explored.

To gather information, we communicated with a range of key personnel (names and contact details were provided by ORC) who hold or know of existing data for Otago Harbour. These personnel included ORC staff and external parties, where relevant. We asked these key personnel to provide us with written lists (or other forms of communication) detailing the relevant data and where relevant information could be found. Based on these details, we then located, accessed and compiled the information. We also reviewed appropriate online resources in case we were missing important information that was not collected from the methods described above.

Information obtained for each set of data was then summarised, including assignment of key metadata (e.g. ecosystem type / habitat and who, why, when, where and how the data were collected). The purpose of this was to allow end-users to readily assess the type and amount of ecological data existing for the Otago Harbour.

Although outside the original scope for this investigation, the available spatial information of the sampling / investigation sites was also recorded (either as coordinates or maps). This was done so that ORC would have the option of integrating metadata sources into a GIS mapping package to improve data management and retrieval in the future.

3. REVIEW OF EXISTING ECOLOGICAL DATA

3.1. Marine ecological metadata list

Appendix 1 provides a list of marine ecological data and associated compiled metadata for Otago Harbour. A brief description of references is provided in Appendix 1, where appropriate. A full description of these short citations can be found in the References section. In cases where we were unable to find the full description for a reference (e.g. a reference cited in a larger report), we have included as much detail as possible.

3.2. Description of existing data

Otago Regional Council does not presently have a marine state of the environment monitoring programme and instead relies heavily on consent-related monitoring to inform decision-making within the marine space. This compilation of ORC-related marine ecological metadata highlights that there is a substantial amount (28 out of 55 entries) of consent-related monitoring data from Port Otago activities (Table 1[2]). There were also six investigations[3] commissioned by ORC, five by the DCC and another monitoring programme commissioned by Ravensdown (Dunedin) to fulfil their consent monitoring requirements (Table 1).

Overall, most metadata were in report (PDF) format, available in either the public domain or by request. The types of data compiled in this review include[4]:

- data reviews (James et al. 2007; ORC 2005; Smith 1994)
- rocky shore surveys (eScientific 2022; Stewart 2017)
- natural character (Moore 2015)
- marine mammal sighting (McGrouther 2016, 2017)
- noise levels (Laurence 2016)
- marine habitat mapping / seagrass mapping (eScientific 2022; Stewart 2013a to 2017b; Tait et al. 2020)
- beach profiles (Single 2015)
- aerial photographs (DCC 2022)
- ecological impact assessments / assessment of ecological effects (James et al. 2008; Coe 2010)

[2] There were six metadata sources (organised by the organisation that commissioned the report or study) identified through this investigation (Table 1). Data types and studies were grouped as projects or monitoring programmes when it was possible to determine the project they related to. Therefore, there were often multiple references associated with one row entry.
[3] Some investigations are multi-year and have multiple references.
[4] Representative references from Appendix 1 are included.

- water and sediment quality (Stewart & Ryder 2005)
- turbidity monitoring (Barter 2014; Berthelsen 2015, 2016, 2017; Berthelsen & Barter 2015)
- benthic physicochemistry and communities (Grove & Probert 1999; eScientific 2022)
- tidal flow data (Stewart & Ryder 2005)
- enterococci sampling (LAWA 2022)
- bathymetry (Hunter 2016)
- macrofaunal communities (Paavo 2010)
- historic anthropogenic activities (Davis 2009)
- seabirds (Sagar 2011; Birds NZ 2022)
- brachiopods (Probert 2011)
- cockles (Breen et al. 1999; MPI 2017; Beentjes 2021; Stewart 2008, 2010, 2013, 2017).

There is also a range of publicly accessible local and national marine databases (with data specific to Otago Harbour) that may help to fill some of the current gaps in biological community data for ORC (Marine Biosecurity Porthole 2022, 2022a, 2022b; Mm^2 2022) as well as water quality and sedimentation information (HHW 2022; NZOA-ON 2022; University of Otago, Department of Marine Science 2022; Portobello Marine Laboratory 2022).

We also compiled a limited amount of data outside of the harbour (Aramoana, Tairoa Head and other coastal offshore areas), which can be found in Appendix 1. These data include: microbial community time-series data (MOTS 2022), turbidity monitoring (Bell 2015) and shellfish, bacteriological and reef sampling (Stewart 2014, 2014a, 2015, 2015a, 2016, 2016a; Golder Associates (NZ) Ltd 2016). It is important to note there is also a large amount of University of Otago marine research that would likely contribute to a greater understanding of the ecology of Otago Harbour. However, these sources were not extensively reviewed because they were outside the scope for our project. We also found a plethora of information regarding the ecology of Otago Harbour prior to 1990, but this was not included because this date was the cut-off point for our data review.

There are a number of caveats associated with the compiled data and associated metadata list (Table 1). Most importantly, the list is not likely to be exhaustive, but will provide a useful starting point for investigating data sources further. There were a number of other potential data sources identified that were not accessible or not supplied by the data custodians / science providers. In some instances, the existence of a data source is known because it has been cited in other reports, but we were unable to access the data. These potential data sources have been highlighted in red

text in Appendix 1 and when no citation was found, they have been described in Table 1 'Caveats'.

Many of the data sources investigated had either maps or coordinates of sampling locations available and this has been noted in Appendix 1. This additional information will be of value for integrating metadata sources into a GIS mapping package.

Table 1. Table of data / metadata sources and caveats around metadata collection.

Data sources	No. of data entities identified	Caveats
Otago Regional Council	6	No information provided (or able to be found in the public domain) on activities, consent applications or decisions relating to contaminated sites and their discharges (e.g. HAIL* sites). These include the Glendermid Leathers Sawyers Bay Tannery site, contaminated gasworks sites and any leachates from landfills adjacent to the harbour.
Ravensdown Ltd	1	Only the 2021 report was provided, which cites seven other historic reports.
Dunedin City Council	5	No information provided (or able to be found in the public domain) on activities, consent applications or decisions relating to contaminated sites and their discharges (e.g. HAIL sites, as listed above).
Port Otago Ltd	28	Many of these ecological investigations were found in the reference lists of more recent reports.
University of Otago	7	Multiple university investigations (described in theses and papers) have been undertaken in the Otago Harbour. Some relevant references have been included, but this was outside of this project's scope so our compilation is not exhaustive.
Other	8	Some applicable databases and investigations have been included here, but it was outside of the project's scope to include these.
All (total)	55	This data list is not exhaustive. The best effort has been made to organise and locate the relevant ORC (or related) metadata within the scope of this assessment. Although out of scope, some data sources have been included for areas outside of (but in close proximity to) the harbour. These have been labelled under 'location' as 'OUTSIDE OF HARBOUR' and can be filtered out if required. No data relating to freshwater monitoring data have been included.

*Hazardous Activities and Industries List

4. SUMMARY

The comprehensive list provided in Appendix 1 supports a range of marine ecological data sources relating to Otago Harbour and provides a starting point for interrogating data sources further. End-users, such as environmental managers, iwi, industry, government and the public will be able to use this resource to streamline their exploration into what ecological data have already been collected in the marine space in and around Otago Harbour. Our review will also provide a valuable tool for assessing resource consent applications and developing monitoring plans in the Otago Harbour marine space, as managers will be able to access historic data with greater ease.

The exploration of six data sources resulted in the compilation of 55 individual data entities. Among these entries, over 25 different ecosystem characteristics were documented. This is not an exhaustive list of post-1990 marine ecological data; however, we feel our review includes most of the major reports and information that were available to us. Additional improvements to the data / metadata list could be achieved by undertaking the following:

- Further investigation into other potential data sources. There are data that we think are potentially available but we were unable to interrogate in this review because they were not supplied and / or were not publicly available (see text highlighted in red in Appendix 1).
- Geospatially defining the available metadata sources. Further improvements could be made into management and retrieval of ecological metadata by displaying and storing these metadata records geospatially. Geospatially defined metadata (i.e. sampling stations and transects) could be useful because these data could be used as a baseline for future management programmes. They would also be useful for identifying knowledge gaps (areas where no data exists) and planning for future monitoring programmes in the region.
- Review available University of Otago data. We noted that there is a large amount of University of Otago marine research that would likely improve the understanding of marine ecology in Otago Harbour.
- Review pre-1990 data. There appears to be many investigations prior to 1990 (the cut-off date for this review) that would likely improve the understanding of marine ecology in Otago Harbour.

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6. APPENDIX

Appendix 1. List of existing marine data for Otago Harbour, with associated metadata and references. Red text highlights where data is known to exist, but it was not provided or able to be found. **Bold text** indicates where further information can be obtained, such as myriad references within larger reports, coordinates, etc.

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
Otago Regional Council	Environmental status of the near shore coastal environment	ORC 2005	Otago Regional Council	Comprehensive review of the environmental status of Otago's near shore coastal environment	Review of existing water quality data, consent monitoring and ecological programmes being undertaken. State of the environment of rivers that discharge to coastal marine areas. Review of published research in Otago	Otago Harbour and Otago coastal marine area	Report	Otago Regional Council	Publicly available	Sam Thomas, Otago Regional Council	Late 1990s–2005	NA	Multiple maps	Could be created from report map
Otago Regional Council	Proposed regional coastal plan for Otago. A scientific review of Otago's coastal marine area	Smith 1994	Abigail M. Smith, Department of Marine Science, University of Otago	Background information to assist in the development of a regional coastal plan for Otago, as required by the Resource Management Act 1991	Reviews existing marine environmental data and relevant planning considerations	Otago Harbour and Otago coastal marine area	Report, tables and text	Otago Regional Council	Publicly available	Sam Thomas, Otago Regional Council	Circa 1935–1994 (references dating back this far)	NA	Multiple maps	Could be created from report map
Otago Regional Council	Otago Regional Council coastal information: seabirds and marine mammals	Sagar et al. 2002. Report not available, but was cited in Coe 2010	Paul Sagar, NIWA	Council research	Council report, internal?	Otago Harbour and outer coast	Unknown	Unknown	Not currently available	Cited in Coe 2010	Circa 2002	Unknown	Unknown	Unknown
Otago Regional Council	Sediment macrobenthos of upper Otago Harbour, New Zealand	Grove & Probert 1999	Simon Grove and Keith Probert, University of Otago	Examined benthic communities of the upper Otago Harbour and the environmental variables, natural and / or anthropogenic, that correlate most highly with the patterns of community structure	Environmental data from benthic samples (grain size, metal / metalloids, TOC, depth, algae (g), temperature and DO); 45 benthic macrofaunal samples; Multi-dimensional scaling ordination	Otago Harbour: upper harbour basin, Andersons Bay Inlet, Sawyers Bay, north-west side of the shipping channel and south-east side of the Harbour	Mean abundance tables and summary tables in report. Raw data not provided	Simon Grove and Keith Probert, University of Otago	Summarised data available online. Raw data not currently available	Online search	2 June–8 Nov. 1993	One-off	Survey map from report, Figure 1	Could be created from report map
Otago Regional Council and Dunedin City Council Working Group	Marine biology and ecology of Otago Harbour. Otago Harbour Planning Study, Stage One	Probert 1991. Report not available, but cited in Coe 2010 and Probert 2011	Keith Probert	Research	Council report, internal?	Otago Harbour	Unknown	Unknown	Not currently available	Cited in Coe 2010 and Probert 2011	Circa 1991	Unknown	Unknown	Unknown
Otago Regional Council and Dunedin City Council	Coastal environment of Otago: natural character and outstanding natural features and landscapes assessment	Moore 2015	University of Otago, Ryder Consulting Ltd and Read Landscapes	Inform the reviews of the Otago Regional Policy Statement and Dunedin City District Plan	Natural character ratings using maps and photographs	Otago Harbour and wider coastal marine area	Report, PDF	Otago Regional Council	Available on request	Sam Thomas, Otago Regional Council	2015	One-off	Multiple maps	Could be created from report maps
Dunedin City Council	Characterisation of Dunedin's urban stormwater discharges & their effect on the upper harbour basin coastal environment	Stewart & Ryder 2005	Brian Stewart and Greg Ryder, Ryder Consulting Ltd	Review of Dunedin's urban stormwater quality and quantity and its effect on the upper Otago Harbour environment	Tidal flow data, sediment grain size, sediment contaminants, algae cover, infauna; Includes a review and table of other data sources and sampling locations **More references therein**	Otago Harbour: inner port, Leith River mouth and northern side of Harbour around wastewater outfall	Raw data in report appendices	Ryder Consulting Ltd *Supplied by Otago Regional Council	The data are in the public domain, on request from Dunedin City Council	Sam Thomas, Otago Regional Council	Summary of historical data since 1981. One-off sampling in Aug., Sept., Nov. 2004	Three surveys	Survey map from report	Could be created from report map

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
Dunedin City Council	Tahuna wastewater treatment plant offshore and rocky shore monitoring, and treatment performance assessment	Stewart 2014, 2014a, 2015, 2015a, 2016, 2016a; Golder 2016	Dunedin City Council	Wastewater treatment plant consent monitoring	Offshore monitoring: Benthic soft sediment communities; Sediment metal concentrations Treatment performance monitoring. Bacteriological sampling; Shellfish sampling; Reef monitoring: Macroalgal / invertebrate cover (quadrats); size, length, frequency of three mussel species monitored (quadrats)	OUTSIDE OF HARBOUR Outer south coast discharge point, Lawyers Head outfall, adjacent Blackhead Beach	Reports	Dunedin City Council, some reports available online	Some reporting is publicly available	Dunedin City Council, online	Offshore and reef monitoring reports span from 2013–present	Annual	Survey map from report	Could be created from report map
Dunedin City Council	Green Island wastewater treatment plant	See Stewart 2004	Dunedin City Council	Wastewater treatment plant consent monitoring	Shoreline water bacterial (FC and enterococci) concentrations; Mussel tissue testing for FCs	OUTSIDE OF HARBOUR Outer south coast discharge point, Waldronville outfall, adjacent Tomahawk Beach	None	None	Summarised in ORC 2005 – SOE report	None	None	None	None	Could potentially be created from report map, but we have not seen report
Dunedin City Council	Aerial photography	DCC 2022 (https://www.dunedin.govt.nz/do-it-online/maps-and-photos)	LINZ data service	Public use, webmaps	Aerial photographs	In Otago Harbour and Otago-wide, national	LINZ images are date stamped and projected: GIS JPEG/TIFF, CAD (*.dwg), KML, PDF; Older 'Flickr' aerial images	https://data.linz.govt.nz/layer/104163-dunedin-01m-urban-aerial-photos-2018-2019/metadata/	Publicly available	LINZ data service	**2018-2019[5] 2013[6] – 1947-1990[7]**	Intermittent	https://www.dunedin.govt.nz/do-it-online/maps-and-photos	Recent projected aerial images easily mapped, older one would be more time consuming to create, i.e. 'Flickr' images
Dunedin City Council and Land Air Water Aotearoa (LAWA)	Can I swim here? Macandrew Bay (Otago Harbour)	LAWA 2022 (https://www.lawa.org.nz/explore-data/otago-region/swimming/otago-harbour-macandrew-bay/swimsite)	Otago Regional Council	LAWA shows the best available water quality information to help you decide where to swim	Long-term enterococci conc (Entero/100ml); Weekly snapshot enterococci concentration (no recent data)	Macandrew Bay, Otago Harbour	Online, downloadable CSV/Excel	https://www.lawa.org.nz/explore-data/otago-region/swimming/otago-harbour-macandrew-bay/swimsite	Publicly available	LAWA	2017–present	Twice a year	Available on LAWA website	Download location from LAWA
Port Otago Ltd	Summary of existing ecological information and scoping of further assessments for Port Otago Dredging Project	James et al. 2007	NIWA, University of Otago and Boyd Fisheries Consultants Ltd	Supports consent application for dredging; Identifies gaps in information and scopes the type of work that would be required as part of an AEE for dredging the approaches to Port Chalmers	Includes a literature review and table of other data sources, and sampling locations. **Includes many other applicable benthic, marine mammal, seabird and fisheries references**	Otago Harbour: various locations around Otago Harbour and Peninsula; Multiple maps from literature review	Within report – text, tables and maps	Port Otago Ltd. Data potentially held by NIWA (Anna John)	Owned by consent holder Port Otago Ltd. Available on request?	Sam Thomas, Otago Regional Council	1970–2007	Literature review	Multiple maps from report from multiple historic references	Could be created from report map; Maps low quality
Port Otago Ltd	Biological resources of Otago Harbour and offshore: assessment of effects of proposed dredging	James et al. 2008	NIWA	Supports consent application for dredging	Biological resources and assessment of effects of proposed dredging. **More references therein**	Otago Harbour	Unknown	Port Otago Ltd. Data potentially held by NIWA	Owned by consent holder Port Otago Ltd. Available on request?	Cited in Coe 2010	Circa 2010	Unknown	Unknown	Unknown

[5] https://data.linz.govt.nz/layer/104163-dunedin-01m-urban-aerial-photos-2018-2019/metadata/
[6] https://data.linz.govt.nz/search/?q=dunedin+aerial+2013
[7] https://www.flickr.com/photos/dccgis/albums

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
Port Otago Ltd	'Project Next Generation' dredging and wharf construction application and AEE	Coe 2010	Lincoln Coe, Port Otago Ltd	Port Otago applied for resource consents to authorise the dredging, deepening and widening of the harbour entrance and channel, inclusive of all ancillary activities and their operation and maintenance	Physical and biological characteristics of Otago Harbour and offshore areas. **Supplementary assessments for this AEE (with more references therein)**	Otago Harbour: various locations around Otago Harbour and Peninsula	Within report – text, tables and maps	Port Otago Ltd. Data potentially held by Lincoln Coe, Port Otago Ltd	Owned by consent holder Port Otago Ltd. Available on request?	Sam Thomas, Otago Regional Council	1970–2010	Literature review	Multiple maps from report from multiple historic references	Could be created from report map; Maps low quality
Port Otago Ltd	'Project Next Generation' 3-yearly environmental monitoring: in-harbour assessment 2013 (baseline), 2018 and 2021	Stewart 2013, 2018; eScientific 2022	During 2013 and 2018 – Ryder Consulting Ltd; During 2021 – eScientific	Resource consent monitoring. Monitoring for effects of incremental dredging programme carried out by Port Otago Ltd	Aerial (drone) photography and in situ habitat assessments. Seagrass: percent cover and epifauna present, biomass, blade length, aerial imagery analysis; Saltmarsh, cockle bed: infauna cores and sediment samples (particle size, heavy metals and depth of redox discontinuity layer). Percent cover of macroalgae and seagrass, and epifauna; Cockle beds: cockle biomass and population size and structure. Reference sites in Papanui Inlet; Deep channel habitats: infauna cores and sediment samples (particle size, heavy metals and depth of redox discontinuity layer); Rocky reef habitats: intertidal and subtidal photoquadrats	Otago Harbour: various locations in lower Otago Harbour; Seagrass: Harwood, Papanui Inlet; Salt marsh: Aramoana; Cockle: Pulling Point, Aramoana, Te Rauone, Papanui Inlet; Deep Channel surveys: Swinging Basin, Pulling Point; Intertidal and subtidal rocky reef: Pudding Island, Quarantine Island, Pulling Point	Aerial imagery, data tables, quadrat photography, Excel database; Tables in report (2021), data held by eScientific and previous science provider Ryder Consulting (see citations below)	Port Otago Ltd. Data held by eScientific and previous science providers	Owned by consent holder Port Otago Ltd. Available on request?	Rebecca McGrouther, Port Otago Ltd	2013–2021	Previous surveys include Stewart 2013 (baseline) and Stewart 2015	Survey map from report	Could be created from report map
Port Otago Ltd	'Project Next Generation' repeat monitoring of seagrass beds	Stewart 2013a, 2013b, 2014b, 2014c, 2015b, 2015c, 2016b, 2016c, 2016d, 2016e, 2016f, 2017a, 2017b	Ryder Consulting Ltd	Seagrass health over time and incremental capital works (dredging)-related impacts	Aerial cover, distribution, blade length, shoot density, biomass and percentage cover were used as indicators of seagrass health. Core samples were assessed for depth of redox layer and sediment grain size. Aerial photography. **Mentions other background assessments for the dredging programme application,** e.g. James et al. 2007; Paavo & Probert 2005; Paavo et al. 2008; Paavo 2009	Otago Harbour: in-harbour (Harwood) and a control/reference site (Papanui Inlet)	Within report – text, tables and maps	Port Otago Ltd. Data potentially held by Brian Stewart, Ryder Consulting Ltd, PO Box 1023, Dunedin	Owned by consent holder Port Otago Ltd. Available on request?	Files from: Berthelsen 2017. Otago Harbour: assessment of need for continued turbidity monitoring. Prepared for Port Otago Ltd. Cawthron Report No. 3102. 11 p. plus appendices	Spring 2013–winter 2017. May be ongoing	Seagrass surveys were carried out on a seasonal basis from spring 2013–winter 2017 at both an in-harbour (Harwood) and a control / reference site (Papanui Inlet) May be ongoing	Survey map from report	Could be created from report map

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
Port Otago Ltd	Beach profile surveys and morphological changes: Otago harbour entrance to Karitane	Single 2015	Dr Martin Single, Shore Processes and Management Ltd	Resource consent monitoring for inshore dredge tailings disposal consent	Field observations and surveyed beach profiles **Many other related survey references**	Otago Harbour entrance, Karitane	Excel files, beach photographs, survey profiles	Port Otago Ltd	Owned by consent holder Port Otago Ltd	Rebecca McGrouther, Port Otago Ltd	1990–present. 2014–2015 (available report). Potentially another survey in 2021	Transects established in 1990 and re-surveyed at various dates. The beach profiles 1996 and since 2013	Site from Fig 1.1 in Single 2015	Could be created from report map
Port Otago Ltd	Long term shoreline change analysis, Otago Harbour entrance to Karitane	Single 2015b	Dr Martin Single, Shore Processes and Management Ltd	Resource consent monitoring for inshore dredge tailings disposal consent	Long-term shoreline change analysis from aerial photographs. This report accompanies reports on changes to the ocean beaches between Otago Harbour and Karitane (Single 2014a, 2014c) as part of studies carried out in accordance with the conditions of Otago Regional Council Consent No. RM11.153. **Many other applicable references**	Otago Harbour entrance, Karitane	Report tables, text, photographs and maps	Port Otago Ltd	Owned by a consent holder Port Otago Ltd	Found online, but likely with Rebecca McGrouther, Port Otago Ltd	The period examined covers from about 1863–2013. Aerial photographs from 1980, 1997, 1999, 2005 and 2013	One-off	Multiple maps in report	Could be created from report map
Port Otago Ltd	Beach profile transects (as described in Single 2015)	ORC 1990 onwards; Bowden 2013, 2014, 2015	Port Otago Ltd and Paterson Pitts Ltd	Consent associated monitoring - The beach profiles have been assessed with regard to Port Otago Ltd maintenance dredging sediment deposition since 1996, and since 2013 for the present dredging consent process	Beach profile transects	OUTSIDE OF HARBOUR Aramoana	Survey profiles – also data from the channel	Port Otago Ltd	Owned by a consent holder Port Otago Ltd	No reports found, but cited in Single 2015	1990–2015	Multiple	See summary work by Single 2015	Could be created from report map, or request coordinates
Port Otago Ltd	Turbidity monitoring for Port Otago 'Project Next Generation' dredging campaign	Barter 2014; Berthelsen 2015, 2016, 2017; Berthelsen & Barter 2015	Paul Barter and Anna Berthelsen, Cawthron Institute	Design and build turbidity monitoring sites. Determine the relationship between turbidity and suspended solids concentrations. Turbidity monitoring for capital dredging effects assessment	Laboratory calibration tests, Barter 2014: nephelometric turbidity readings, suspended solid concentrations Monitoring, Berthelsen 2015, 2017 and Barter & Berthelsen 2015: turbidity readings, total suspended solid concentrations	Otago Harbour: Berthelsen 2015, 2017 and Barter & Berthelsen 2015: stations throughout harbour; Note, Barter 2014: laboratory testing	PDF report with supporting CSV, KML, PDF, Grapher files	Held by Cawthron Institute	Owned by Port Otago Ltd, held by Paul Barter, Cawthron Institute	Summary from Berthelsen 2015, 2017	2014–2016	High frequency (moored instrumentation)	Held by Cawthron Institute	GIS Shapefile
Port Otago Ltd	Turbidity monitoring for offshore Port Otago 'Project Next Generation' dredging campaign	Bell 2015	Rob Bell, NIWA; Raw turbidity data supplied by Paul Barter, Cawthron Institute	Turbidity monitoring for capital dredging effects assessment (offshore). Collection of baseline data	Offshore turbidity was measured by three surface water quality buoys using Wetlabs turbidity sensors	OUTSIDE OF HARBOUR Dredge disposal site offshore. Sites A & B (to the south and north-west of the A0 disposal area) and at C near the coast off Cornish Head	PDF NIWA report with supporting raw data available from Cawthron Institute	Held by Cawthron Institute	Owned by Port Otago Ltd, held by Paul Barter, Cawthron Institute and Rob Bell, NIWA	Summary from Bell 2015, provided by Otago Regional Council	Turbidity covers period from Aug. 2013–Jan. 2014; ADCP data covered July–Dec. 2013	High frequency (moored instrumentation)	Held by Cawthron Institute	Could be created from report map

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
Port Otago Ltd	Bathymetric surveys for Port Otago 'Project Next Generation' dredging campaign	Hunter 2016	Hunter Hydrographic Services	Consent monitoring for Consent 2010.193 and 198 (incremental capital works)	Two bathymetric plots The equipment used included Trimble 5700 RTK receiver and Trimble SBS base station, a Reson 210 echosounder, Reson Portable SPV, Trimble HydroPro software, and vessel 'White Pointer', with Terramodel and HydroPRO being used for reduction	Otago Harbour 1) the Otago coast in the vicinity of spoil ground A 2) Lower reaches of the Otago Harbour	PDF	Port Otago Ltd and Hunter Hydrographic Services	Owned by consent holder Port Otago Ltd. Available on request?	Berthelsen 2017	Feb. 2016	One-off	Maps supplied in PDF format from Hunter Hydrographic Services report	Could be created from report map
Port Otago Ltd	Habitat / biological surveys on riprap walls, Port Chalmers, for Port Otago 'Multi-purpose berth (MPB) extension' project	Stewart 2017	Brian Stewart, Ryder Consulting Ltd	Consent monitoring conditions (Condition 8 of the Coastal Permit to Consent No: 2010.197.VI) stipulate that Port Otago Ltd undertake a habitat survey in the area likely to be affected	Diver photoquadrats and general transect observations and sediment cores (85 mm) from the soft substrate at the end of each transect – species assemblages **Includes many other applicable references**	Multi-purpose berth, Port Chalmers	Tables and photos in report. No raw infauna data in appendices	Port Otago Ltd. Data potentially held by Brian Stewart, Ryder Consulting Ltd, PO Box 1023, Dunedin	Available on request?	Background project files / refs used in Cawthron Report No. 3102 (Berthelsen 2017)	2017	One-off	Map snipped from report	Could be created from report map
Port Otago Ltd	Port Otago annual marine mammal and bird sighting observations / reports for Port Otago 'Project Next Generation' dredging campaign	McGrouther 2016, 2017	Port Otago Ltd (a number of different observers, staff of Port Otago Ltd)	Consent condition (210.198, Condition 29) requires a summary report on marine mammal and feeding bird observations	Marine mammal and bird observation table and sighting forms	Areas of dredging and disposal operations: Harrington Bend, Harrington Point, Tairoa Head, north of Mole end, end of Mole, Hayward disposal ground, Port Chalmers basin, west harbour entrance, harbour entrance and cross channel	Table and raw sighting form data in report	Port Otago Ltd	Raw data in report	Berthelsen A 2017	2015, 2016–present? *May still be ongoing	Ongoing during dredging operations, reported annually	Descriptive locations and occasionally coordinates provided in raw data forms, range of locations described generally in main table	Could only be mapped from descriptions or coordinates provided in raw data forms, as no coordinates summarised
Port Otago Ltd	Benthic habitat structures and macrofauna of Te Rauone Beach and Latham Bay, Otago Harbour	Paavo 2010	Paavo and Probert, Benthic Science Ltd	Impact assessment to support Port Otago's application for dredging; Habitat mapping and macrofaunal characterisation for determining dredging and disposal effects	Drop camera (habitat classification and macrofauna). Macrofaunal sampling (Ponar grab)	Otago Harbour: most extensively mid to outer. Te Rauone Beach and Latham Bay, Otago Harbour	Report tables, no raw data in appendices	Port Otago Ltd (owner) and Benthic Science Ltd	Publicly available on Otago Regional Council website	Otago Regional Council website, citation from Paavo 2010	2008 and June 2009	One-off	Two maps snipped from report	Could be created from report map
Port Otago Ltd	Effects of dredge spoil at Shelly Beach, Otago Harbour	Bunting et al. 2003; Referenced in Single 2015b	Land and Water International Ltd	Impact assessment to support Port Otago's application for dredging; Dredging and disposal effects	Data from this investigation was briefly referenced in Single 2015b	OUTSIDE OF HARBOUR Shelly Beach, outer Otago Harbour	Unknown	Port Otago Ltd (owner); NIWA must have had access to the report; Land and Water International Ltd may have raw data on request	Not currently available	References from other Port Otago Ltd investigations	2003	One-off?	Not currently available	Not currently available
Port Otago Ltd	Benthic invertebrate survey support for Port Otago's application for dredging	Paavo & Probert 2005; Report not available, but data from this investigation was described	Paavo and Probert, Benthic Science Ltd	Impact assessment to support Port Otago's application for dredging; Dredging and disposal effects	Report unavailable, but data from this investigation was described in Fenwick and Stenton-Dozey 2016 Grab samples. Infaunal assemblages	OUTSIDE OF HARBOUR Otago dredge disposal sites: transect seaward across Blueskin	Unknown	Port Otago Ltd (owner); NIWA must have had access to the report; Paavo and Probert	Not currently available	References from other Port Otago Ltd investigations	2005?	One-off?	Report unavailable, but sampling locations from this investigation were	Could be created from report map

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
		in Fenwick and Stenton-Dozey 2016			Benthic fauna distribution towards the shore, coarse bathymetry, some meiofauna analysis	Bay, in vicinity of the Heyward and Aramoana sites		(Benthic Science Ltd) may have raw data on request					described in Fenwick and Stenton-Dozey 2016	
Port Otago Ltd	Benthic habitat structures and macrofauna of lower Otago Harbour	Paavo et al. 2008; Report not available, but data from this investigation was described in Statement of evidence by Paavo 2010, and Table 1 of Fenwick and Stenton-Dozey 2016	Paavo and Probert, Benthic Science Ltd	Impact assessment to support Port Otago's application for dredging. Dredging and disposal effects	Incremental faunal recolonisation rates around Aramoana using grabs and SSS	OUTSIDE OF HARBOUR Aramoana	Unknown	Port Otago Ltd (owner); NIWA must have had access to the report; Paavo and Probert (Benthic Science Ltd) may have raw data on request	Not currently available	References from other Port Otago Ltd investigations	2004–2005	One-off?	Report unavailable, but sampling locations from this investigation were described in Fenwick and Stenton-Dozey 2016	Could be created from report map
Port Otago Ltd	Observations of rocky shore habitats in lower Otago Harbour	Paavo 2009; Report not available, but data described in Statement of evidence by Paavo 2010	Paavo and Probert, Benthic Science Ltd	Impact assessment to support Port Otago's application for dredging; Dredging and disposal effects	Report unavailable, but data from this investigation was briefly described in Statement of evidence by Paavo 2010 Rocky shore observations	Lower Otago Harbour	Unknown	Port Otago Ltd (owner); NIWA must have had access to the report; Paavo and Probert (Benthic Science Ltd) may have raw data on request	Not currently available	References from other Port Otago Ltd investigations	2009	One-off?	Report unavailable, but sampling locations from this investigation were described in the Statement of Evidence of Paavo 2010	Not currently available
Port Otago Ltd	Te Rauone Beach-rock groynes and sand renourishment: marine mammals and wildlife monitoring	Port Otago Ltd 2020 (in draft); Report not provided, but requirement for this sampling was stated in the Port Otago Ltd 2020 EMP	A suitably qualified marine mammal expert to train the approved contractor (from Port Otago Ltd 2020 EMP)	Consent-related monitoring (Refer to Condition 16f of Consent Number RM19.441)	The contractor will complete marine mammal and wildlife sighting forms (Appendix 7 of Port Otago Ltd 2020)	Unknown: in the vicinity of the groynes; Exact locations TBD based on recommendations of suitably qualified MM expert	Handwritten forms. The contractor will complete marine mammal and wildlife sighting forms (Appendix 7 of Port Otago Ltd 2020)	Unknown	Unknown	NA	Before, during, and after rock placement, sand renourishment and subsequent top-ups	Before, during, and after rock placement, sand renourishment and subsequent top-ups	No monitoring data or reporting provided; this has been taken from the draft EMP submitted with the consent application	Monitoring locations in draft format only
Port Otago Ltd	Te Rauone and Omate Beach renourishment: seagrass aerial monitoring	Tait et al. 2020; Tait 2020	NIWA	Resource consent monitoring for Te Rauone Beach renourishment. Works due to begin Aug. 2021	Aerial drone imagery **Other ecological assessments mentioned**	Otago Harbour Adjacent proposed groynes on the southern side of the harbour	Aerial imagery, data tables	Port Otago Ltd	Owned by a consent holder, Port Otago Ltd	Rebecca McGrouther, Port Otago Ltd	Dec. 2015 and Aug. 2020; "On going monthly monitoring occurs as part of resource consent conditions" (pers. comm., Rebecca McGrouther)	One-off, but recommended to be continued on a monthly basis until approx. 1 year following the completion of the groynes	Sites indicated in Fig 3.4 in Tait 2020	Could be created from report map

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
Port Otago Ltd	Ecological impact assessment for Te Rauone Beach management scheme	Goodwin & Tocher 2020; Report not available, but was cited in Tait et al. 2020	Ryder Consulting Ltd	Relating to the consent for the construction of three rock groyne structures extending seaward out from Te Rauone Beach and the importation of sand	Ecological impact assessment	Otago Harbour Adjacent proposed groynes on the southern side of the harbour	Unknown	Port Otago Ltd. Data potentially held by Ryder Consulting Ltd, PO Box 1023, Dunedin	Not currently available	Cited in Tait et al. 2020	Circa 2020	Unknown	Unknown	Unknown
Port Otago Ltd	History of Otago Harbour – development, dredging, geomorphological / sedimentary characteristics, and marine environmental implications of the proposed reclamation at Port Chalmers	Davis 2009; Probert 1975	Duffill Watts Ltd (Davis 2009), Portobello Marine Laboratory (Probert 1975)	History of harbour development and known geomorphological and sedimentary characteristics	Historic drawings, maps, describes past dredging practices, shipping channel changes over time, summary of dredged volumes (table), disposal locations, dredge tailings used for reclamation	Otago Harbour	Report, PDF	On Otago Regional Council website: https://www.orc.govt.nz/media/3248/15-short-history-of-harbour-dredging-davis-2009-va275988.pdf	Publicly available on the Otago Regional Council website	Publicly available on the Otago Regional Council website	1868–present	NA	Diagrams and maps within the report	Could be created from report map
Port Otago Ltd	Dredging and Port Chalmers land reclamation AEE	Probert 1990a,b,c; Reports not available, but were cited in James et al. 2007	Peter Keith Probert	Consent application for Port Chalmers development (land reclamation)	Marine environmental data, exact content unknown	Port Chalmers and Otago Harbour	Unknown	Unknown	Not currently available	Cited in Coe 2010	Circa 1990	Unknown	Unknown	Unknown
Port Otago Ltd	Dredging and Port Chalmers land reclamation EIA	Royds Garden Consultants 1990a,b,c; Reports not available but were cited in James et al. 2007	Royds Garden Consultants	Consent application for Port Chalmers development (land reclamation)	Environmental data, exact content unknown	Port Chalmers and Otago Harbour	Unknown	Unknown	Not currently available	Cited in Coe 2010	Circa 1991	Unknown	Unknown	Unknown
Port Otago Ltd	Bird foraging. Field study of bird foraging and roosting sites in lower Otago Harbour, for 'Project Next Generation', dredging and disposal	Sagar 2008, 2011; Report not available, but was cited in Coe 2010 (AEE) and Sagar 2011 (an affidavit for 'Project Next Generation')	Paul Sagar, NIWA	Supplementary assessment for the consent application for 'Project Next Generation', dredging and disposal. To assess the significance of roosting sites on high shell banks in the vicinity of Port Chalmers. These areas were identified by the Department of Conservation as important areas that needed further work. The results are reported in Sagar 2008	Description of work provided in Sagar 2011: *An observational survey was carried out in March 2008 to examine foraging behaviour of wading birds through a complete tidal cycle*	Otago Harbour: in the vicinity of the Aramoana Ecological Area and the high shell banks at Port Chalmers	Sagar 2008 = Unknown. Sagar 2011: species list, primary foraging areas table, preferred habitats tables, conservation status, no raw data	Port Otago Ltd (owner). Data potentially held by Paul Sagar?	Partially available in Sagar 2011, but original Sagar 2008 report not found	Cited in Coe 2010 and Sagar 2011	The Sagar (2008) survey was carried out in March 2008	One-off	Unknown	Unknown
Port Otago Ltd (unsure but likely to be)	Report on the fishes of Otago Harbour and adjacent waters	Paulin & Roberts 1990; Report not available, but was cited (incomplete citation) in Coe 2010	Unknown	Supplementary assessment for the consent application for 'Project Next Generation', dredging and disposal	From Coe 2010: descriptions of marine fish and shellfish species in Otago Harbour	Otago Harbour	Unknown	Unknown, possibly Port Otago?	Not currently available	Cited in Coe 2010	Circa 1990	Unknown	Unknown	Unknown

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
Port Otago Ltd	Otago Harbour survey of *Pumilus antiquatus* for Port of Otago	Robinson 2010; Report not available, but was cited in Probert 2011	Unknown	Supplementary assessment for the consent application for 'Project Next Generation', dredging and disposal	See section on *Pumilus* surveys from Probert 2011. Intertidal survey. Presence / absence of the brachiopod	Seven sites within Otago Harbour: near Harington Point, Dowling Bay Point, Hamilton Bay Point, Aquarium Point near the Portobello Marine Laboratory, Pudding Island, Quarantine Island (Portobello end), and Yellow Point at Broad Bay	Intertidal survey; Presence / absence data	Port Otago Ltd (owner). Data potentially held by authors?	Not currently available	Cited in Probert 2011	Circa 2010	One-off	Unknown	Unknown
Port Otago Ltd	Underwater noise for Port Otago 'Project Next Generation' dredging campaign	Laurence 2016	Marshal Day Acoustics Ltd	Ambient noise levels in the absence of anthropogenic sources	Three Sudar 201 hydrophone units were used to record high resolution audio for the duration of rock breaking	MP1: 2327166, 5487118; MP2: 2327698, 5487305; MP3: 2328711, 5487860 (NZMG)	Graphs (time-trace of the existing ambient noise environment, levels in dB re 1 µPa RMS); Table: summary of noise measurements	Port Otago Ltd. Likely available from Marshal Day Acoustics	Owned by a consent holder Port Otago Ltd. Available on request?	Files from: Berthelsen 2017	11–24 Feb. 2016	One-off	Coordinates and map in letter	Could be created from report map, or use coordinates
Ravensdown Ltd	Ravensdown Dunedin Works: benthic monitoring	Leduc et al. 2021; Hickey 2004, 2010, 2017, 2018; Hickey & Morrisey 2012; Morrisey & Hickey 2008; Morrisey et al. 2011	Daniel Leduc, NIWA	Consent monitoring; Satisfy the requirements of Otago Regional Council Permits 2004.150 and RM12.502.01	Sediment macrobenthic communities, benthic macroalgae, and sediment chemistry contaminant analyses for a range of specified 'Impact' and 'Reference' sites	Otago Harbour: (upper/inner) 2 km from the Leith River, northern shoreline of the Harbour	Report, PDF, including graphs and maps; Raw data in appendix	Otago Regional Council compliance document database; Raw data likely with NIWA	Report supplied by Otago Regional Council via LACOIMA; Raw data in appendices. Data in public domain	Byron Pretorius, Otago Regional Council	2006, 2011, 2016 and possibly one underway for 2021?	5-yearly	Maps in PDF form in NIWA reporting; Coordinates supplied: "ravensdown coordinates", with sites listed	Could be created from report map
Birds NZ	Otago Wader Count, 1984–2020	https://www.birdsnz.org.nz/find-your-region/otago/	Birds NZ – Otago	As part of Birds NZ National Wader Census	Count data for waders and some waterbirds, e.g. shags, terns. Biannual counts in winter and summer at high tide	Otago Harbour mouth: Aramoana [salt marsh] separately, and combined for remaining areas of harbour. Also Otago Peninsula and other areas	Spreadsheet and summary collated data	Birds NZ – Otago representative birds.otago@birdsnz.org.nz	Requires written permission of the OSNZ Council	Mary Thompson	1984–2020	Annually (and summer and winter, at the Aramoana salt marsh site)	Not defined	Not defined or provided
Birds NZ	Otago Harbour Bird Study, 1977–2011	https://www.birdsnz.org.nz/find-your-region/otago/	Birds NZ – Otago	Baseline data on species present and trends over time	Count data for all water birds	All parts of Otago Harbour	Spreadsheet and map of areas of harbour (scan), summary, talk	Birds NZ – Otago representative birds.otago@birdsnz.org.nz	Available based on the Society's current policy on charging and extraction	Mary Thompson, Birds NZ, Otago Regional Representative	Monthly counts: 1977/78; 1988/89; 2009/2011 (2 years)	Monthly counts, every decade	Map supplied: ORC_EL_001_Map of areas surveyed of harbour.pdf	Needs to be created. PDF of zones of survey

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Biosecurity New Zealand, Ministry for Primary Industries (MPI)	National Marine High Risk Site Surveillance (NMHRSS)	Marine Biosecurity Porthole 2022 (https://www.marinebiosecurity.org.nz/surveillance/)	NIWA on behalf of Biosecurity New Zealand (MPI)	Detect incursions of non-native or cryptogenic organisms that have not previously been recorded in New Zealand and detect range extensions by established non-native or cryptogenic organisms that exhibit characteristics of pests	CSV downloads from 'Biosecurity porthole' Native and non-native species presence information from 5 sampling methods: benthic sleds (BSLD), crab traps (CRBTP), visual diver searches (VISD), shore wrack searches (WRACK) and crab condo traps (CONDO)	Harbour-wide, over 16,000 sampling locations	ESRI Geodatabase	NIWA, available online via https://marinebiosecurity.org.nz/search-for-species/	Downloads limited to 3000 records at a time	Kimberley Seaward, NIWA, Christchurch	Surveys completed summer and winter since 2003	Twice a year	Downloaded from data portal: CSV point data in folder	x/y data
Biosecurity New Zealand, Ministry for Primary Industries (MPI)	Port Biological Baseline Surveys (PBBS)	Marine Biosecurity Porthole 2022a	NIWA on behalf of Biosecurity New Zealand (MPI)	Standardised surveys of the native and non-native marine biodiversity within shipping ports. They provide a baseline for monitoring changes in the numbers of non-native species in port environments	CSV downloads from 'Biosecurity porthole' Sampling types: CRBTP, STFTP, SHRTP, FSHTP, CYST, HULL SC, BSLD, BGRB, PSC, PSCM	Otago Harbour, 2968 data records for Dunedin	ESRI Geodatabase	NIWA, available online via https://marinebiosecurity.org.nz/search-for-species/	Downloads limited to 3000 records at a time	Kimberley Seaward, NIWA, Christchurch	2003 and 2006	Two occasions	Downloaded from data portal: CSV point data in folder	x/y data
Biosecurity New Zealand, Ministry for Primary Industries (MPI)	Marine Invasive Taxonomic Service (MITS)	Marine Biosecurity Porthole 2022b (https://marinebiosecurity.niwa.co.nz/mits/)	NIWA on behalf of Biosecurity New Zealand (MPI)	MITS is responsible for identifying and managing collections of all marine samples collected under the MPI marine biosecurity operations	CSV downloads from 'Biosecurity porthole'; Hull inspections (Sample types: VIS, HULL SC, MISC, OPP)	Otago Harbour, 36 data records for Dunedin	ESRI Geodatabase	NIWA, available online via https://marinebiosecurity.org.nz/search-for-species/	Downloads limited to 3000 records at a time	Kimberley Seaward, NIWA, Christchurch	2005, 2014, 2016, 2019, 2022	As required	Downloaded from data portal: CSV point data in folder	x/y data
Multiple partners including regional councils, Department of Conservation and aquaculture industries	New Zealand Ocean Acidification Observing Network (NZOA-ON)	NZOA-ON 2022 (https://niwa.co.nz/oceans/research-projects/new-zealand-ocean-acidification-observing-network-nzoa-on)	Kim Currie, NIWA	Research project: ocean acidification conditions around the New Zealand coast are being measured to establish baseline conditions and to quantify future change	Water samples analysed for dissolved inorganic carbon and alkalinity. Then pH, temp., pCO2 and carbonate ion concentration and saturation states are calculated. Additional parameters are measured at the Dunedin and Firth of Thames sites to ensure these sites meet the extra requirements of the Global Ocean Acidification Observing Network (GOA-ON)	Otago Harbour mouth: http://portal.goa-on.org/ Pylon 1A original site (Sept. 2014–Aug. 2015), Pilot's Wharf, Aramoana, 45.787 S 170.718 E Current site (May 2015 and ongoing), Pylon 1A, Taiaroa Head, 45.780 S 170.720 E	CSV file	Download from https://nzodn.nz/portal/search	Data in the public domain	Kim Currie, NIWA and University of Otago	Old site – Sept. 2014–Aug. 2015; Current site – May 2015 and ongoing	Water samples every two months (some more frequent)	Sites not in-harbour; Old site (Sept. 2014–Aug. 2015) Pilot's Wharf, Aramoana, 45.787 S 170.718 E; Current site (May 2015 and ongoing) Taiaroa Head, 45.780 S 170.720 E	x/y data provided by Kim Currie

Data collected for	Study name	Citation	Collected by	Purpose of data	Data type/s	Locations	Data format	Where is data held	Data availability	Data provided by	Time period	Frequency	Mapping resources File	Mapping resources Description
Fisheries New Zealand (FNZ) and Ministry for Primary Industries (MPI)	Cockle (tuaki) (*Austrovenus stutchburyi*) survey of Otago Harbour	Breen et al. 1999; MPI 2017; Beentjes 2021	1999 and 2012 – NIWA; 2017– MPI	Monitor population status of cockles in Otago Harbour (NIWA); Discussion document (NPI)	Data / information from the Breen et al. 1999 report (not available / supplied) has been obtained from Beentjes 2021. 2020 survey: random stratified survey from 6 strata and 453 stations (= 300 x 300 mm quadrats). Data on individual cockle weight and length was collected at each quadrat as well as proportion of sea grass in each quadrat	Otago Harbour 1999, 2020: Harwood, Aramoana, Port Chalmers, Sawyers Bay, St Leonards	All survey data (2020 and 1999) are held by FNZ in a relational database (*Beach*) in Wellington. Interrogation is done using Postgres SQL	Data are held by FNZ, Wellington in the *Beach* database (database managed by NIWA, Wellington)	Raw survey data are not in the public domain and access to the data is via FNZ (contact Marine Pomarede or Alan Frazer). Report available in FNZ publication website	Mike Beentjes, NIWA, Wellington	2019 and 2020	One-off	Survey map from report	Shapefile requested from MPI; Could be created from report map
Fisheries New Zealand (FNZ)	Investigations into the effects of commercial harvest of clams (*Austrovenus stutchburyi*) in Otago Harbour (COC3), Otago. (2007, 2009, 2012, 2017)	Stewart 2008, 2010, 2013c, 2017c	Brian Stewart, Ryder Consulting Ltd	Assess effects of cockle harvesting by Southern Clams Ltd. Supporting material for effects assessment (consent application)	Cores for infaunal and depth of the redox discontinuity layer cores; Quadrats for cockle counts/lengths and macroalgal cover; Biomass and yield were calculated	Otago Harbour Area 1804: sand spit, opposite Deborah Bay, above Port Chalmers; Area 1805: sand spit, below Quarantine Island, adjacent Port Chalmers	Raw data in report appendices	Brian Stewart, Ryder Consulting Ltd, PO Box 1023, Dunedin. *Supplied by Otago Regional Council	In public domain. Council consent-related assessment, applicant	Sam Thomas, Otago Regional Council	2007 (pre-harvest), 2009 (post-harvest, phase 1), 2012 (phase 2) and 2017 (phase 3)	Four surveys completed. 1x before and 3x after harvesting	Survey map from report	Could be created from report map
University of Otago with national and international collaboration partners	Munida Microbial Observatory Time-Series	MOTS 2022 (https://www.otago.ac.nz/mots/index.html)	Kim Currie, NIWA	Research project. Four major research areas: 1. Spatiotemporal dynamics in microbial communities 2. Top-down vs bottom-up control of marine ecosystems 3. Biogeochemical cycling in pelagic waters 4. Impacts of climate change	1. Surface water analysed for pCO2, temp, salinity on transect from -45.77 S 170.72 E (Taiaroa Head) to -45.83 S 171.53 E, averaged to 0.5 km bins 2. Water samples for DRP, NO3-N, DRSi, fluorescence at station (-45.78 S 170.82 E about 7 km offshore from Taiaroa Head)	OUTSIDE HARBOUR 1. Outside harbour: on transect from -45.77 S 170.72 E (Taiaroa Head) to -45.83 S 171.53 E, averaged to 0.5 km bins 2. Outside harbour: -45.78 S 170.82 E about 7 km offshore from Taiaroa Head	CSV file	NIWA, data available on request	The data are in the public domain, on request	Kim Currie, NIWA and University of Otago	From Jan. 1998 and ongoing	Data approx. every two months	1. Outside harbour: on transect from -45.77 S 170.72 E (Taiaroa Head) to -45.83 S 171.53 E, averaged to 0.5 km bins 2. Outside harbour: -45.78 S 170.82 E about 7 km offshore from Taiaroa Head	x/y data provided by Kim Currie
University of Otago, PhD	Ecology of eelgrass, *Zostera novazelandica* Setchell, in Otago Harbour, Dunedin, New Zealand	Ismail 2002	Norhadi Ismail, University of Otago	Major aims of this study were to map the distribution and areal extent of seagrass and to understand how temporal changes in seagrass growth and production are controlled by environmental factors	Base maps for the distribution and areal extent of seagrass. Biological data (biomass, shoot density, leaf morphometries, proportional leaf growth rate and production) of the seagrass along with environmental parameters of the study site (seawater ammonium, nitrate and phosphate, air and seawater temperature, and photon flux density)	Otago Harbour: Harwood intertidal area	Within thesis – text, tables and maps	Norhadi Ismail, University of Otago	Owned by PhD student	This is the source reference for two other summary national seagrass references (by DOC and NIWA) provided by Sam Thomas, Otago Regional Council	Aerial imagery 1997–1998; Seagrass sampling Oct. 1996–Dec. 1998	Sampling was monthly (with a couple of months missed)	Survey map from report	Could be created from report map

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University of Otago and Ministry of Business, Innovation and Employment (MBIE), Curious Minds Project	Sediment and seashores project (2016–2019)	Desmond et al. 2016; Smith et al. 2017, 2019	New Zealand Marine Studies Centre, the University of Otago and eight primary and two secondary schools from Dunedin	The effect of sedimentation on rocky shore communities in Otago Harbour relating to dredging activities	Quadrats, transects (using the Mm2 methodology). Included % sediment cover	Throughout Otago Harbour	Report tables, text, photographs and maps	Reports available online. Held by New Zealand Marine Studies Centre	Publicly available	Available online	2016–2019	3 years only	Survey map from report	Could be created from report map
University of Otago, citizen science project	Marine Metre Squared Project - Otago Harbour	https://www.mm2.net.nz/	University of Otago, citizen science project	To investigate what is living in this environment and look for changes over time, which may depend on the season, weather or even human impacts	Quadrats, transects; Data outputs available online	Throughout Otago Harbour	Graphs, maps online	New Zealand Marine Studies Centre, Department of Marine Science, University of Otago	Publicly available	https://www.mm2.net.nz/	2012–present	Regularly, multiple times per year / season	Survey locations snipped from online map	Could be created from report map
University of Otago, Department of Marine Science	Otago Harbour Conditions at Portobello Marine Laboratory (PML): Otago Harbour sensor data	University of Otago, Department of Marine Science	University of Otago, Department of Marine Science	Environmental monitoring, research	Real-time (hourly) surface temperature, salinity, dissolved oxygen, pH and chlorophyll-a	Otago Harbour 1 m depth at Portobello Marine Laboratory wharf (https://goo.gl/maps/ssjt1YY3erkf62pB8)	Raw data available online, Excel file	https://harbourconditions.otago.ac.nz/	Public domain under a creative commons 4.0 licence (https://creativecommons.org/licenses/by/4.0/)	Robert Smith, University of Otago	2014–present	Hourly	OHC water quality sensor Google map location[8]	Google map pin provided
University of Otago, Department of Marine Science	Portobello Marine Laboratory (PML) long-term sea surface temperature record	https://www.orc.govt.nz/news-and-events/news-and-media-releases/2018/march/portobello-sea-surface-temperature-1953-2018	Department of Marine Science, University of Otago	Environmental monitoring, research	Sea surface temperature	Otago Harbour 1 m depth at Portobello Marine Laboratory wharf (https://goo.gl/maps/ssjt1YY3erkf62pB8)	Raw data available online, Excel file	Internal at Portobello Marine Laboratory (Dr Doug Mackie, University of Otago)	Currently available only for research purposes. We are working to open up these data for wider use	Robert Smith, University of Otago	1953–present	Daily	PML long-term sea surface temperature record Google map location[9]	Google map pin provided
University of Otago, Department of Marine Science	University of Otago, Department of Chemistry, Healthy Harbour Watchers (HHW)	Results, University of Otago, Department of Chemistry	Community groups – mainly year 12/13 school students under supervision of experts	Environmental monitoring, research	Temperature, salinity, and dissolved oxygen, pH, dissolved reactive phosphorus, nitrate/nitrite, chlorophyll-a, enterococci	Pulling Point Back Beach, Port Chalmers, Mussel Bay, Ravensbourne Boat Club, Leith River Mouth, MacAndrew Bay marina, MacAndrew Bay, stormwater outfall, Sommerville Creek	Raw data available online, Excel file	https://www.otago.ac.nz/chemistry/outreach/harbour/results/index.html https://www.otago.ac.nz/chemistry/outreach/harbour/sampling/	Publicly available and online; Latest data not included yet	Andrew Innes, University of Otago	2010–2015 data on request; 2015–2018 data online; 2018–present, data have not been uploaded	Monthly or every 2–3 months. Varies	An interactive map with sample results can be viewed here[10]	Could be created from report map, or request coordinates

[8] https://www.google.co.nz/maps/place/45%C2%B049'40.5%22S+170%C2%B038'23.6%22E/@-45.8279167,170.6398889,337m/data=!3m2!1e3!4b1!4m6!3m5!1s0x0:0x177f9ad2f36fcdf3!7e2!8m2!3d-45.827905!4d170.6398825
[9] https://www.google.co.nz/maps/place/45%C2%B049'40.5%22S+170%C2%B038'23.6%22E/@-45.8279167,170.6398889,337m/data=!3m2!1e3!4b1!4m6!3m5!1s0x0:0x177f9ad2f36fcdf3!7e2!8m2!3d-45.827905!4d170.6398825
[10] https://www.otago.ac.nz/chemistry/outreach/harbour/map/index.html