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Piloting of social, cultural and economic indicators for the Gladstone Healthy Harbour Partnership Report Card

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Final report November 2014

ISBN: 978-1-4863-0480-6

CSIRO OCEANS & ATMOSPHERE RESEARCH

Citation

Sean Pascoe, Renae Tobin, Jill Windle, Toni Cannard, Nadine Marshall, Zobaidul Kabir, Nicole Flint, 2014. Piloting of social, cultural and economic indicators for the Gladstone Healthy Harbour Partnership Report Card. CSIRO Final report for the Gladstone Healthy Harbours Partnership. 182 pp.

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Important disclaimer

Contents

Figures

Tables

Acknowledgments

The study was undertaken with financial support from the Gladstone Healthy Harbour Partnership (GHHP), CSIRO Oceans and Atmosphere Flagship, Central Queensland University and James Cook University. Useful comments and guidance were provided by John Rolfe (Central Queensland University), Susan Rockloff (Central Queensland University), John Kirkwood (GHHP) and members of the GHHP Independent Science Panel.

We would also like to thank the participants of the focus group who helped with survey design, the Gladstone community members and managers who participated in our surveys and the social scientists who participated in the social science survey.

Executive summary

Report cards are increasingly used to provide ongoing snap-shots of progress towards specific ecosystem health goals. While most report cards focus on the biophysical components of the system, there is a growing interest in including the social and economic implications of ecosystem management, to provide a greater social-ecological system understanding. The Gladstone Healthy Harbour Partnership (GHHP) proposed the development of such a report card on the health of the Gladstone Harbour area.

The key aim of this report is to develop and pilot a system for the collection and analysis of data relating to appropriate cultural, social and economic indicators. This is one part of a coordinated approach led by the GHHP to develop a broader report card on the management of the Gladstone Harbour region.

Objectives, components and sub-components for the report card

The cultural, social and economic objectives for the management of the Harbour were identified by the GHHP through prior work. These guided data collection for this project.

In developing the report card (to report against these objectives), a standard nomenclature was developed for all projects by the GHHP to describe different levels of information in the report card. The main areas – cultural, social and economic – have been termed *components*. The specific objectives relating to each component have been referred to as *sub-components* in the analysis. These are informed by *indicators*, which in turn may have one or several *measures*. For clarity, the term objectives is only used in this report when referring to a management perspective, whereas the term sub-component is used if we are discussing the modelling and/or report card data.

Each sub-component was weighted to reflect the relative importance of the management objective, according to responses to an online survey tool which collected opinions from a selection of 'experts' (i.e. those with a management or industry role), (n=31), and community members (n=200). The surveys applied three commonly used approaches to determine potential weights of applied by the general community and key stakeholder and management groups: i.e. simple ranking approaches, scoring based approaches and the Analytic Hierarchy Process (AHP) based on a series of pair-wise comparisons. The resulting weights were very similar between the expert and community groups.

Collecting and modelling the data

The key indicator groups and indicators were defined by the GHHP, with the addition of some further (perception based) indicators for the Cultural component. The appropriate measures for each indicator were derived through a project team workshop. These measures were then collected as primary data via a Computer Assisted Telephone Interview (CATI) community survey of local residents (n=400), and available secondary data from other sources. The community survey was pre-tested and fine-tuned via a Focus Group Discussion with local residents in Gladstone. The links between indicators and measures were developed via a survey of social scientists (n=19), using the same ranking and scoring methods as for the ranking of sub-components.

Many of the social and cultural measures were largely qualitative in nature, with community survey questions designed to be answered on a 10-point agree-disagree scale. This ensured that answers were comparable with other studies in the region and will enable elicitation of trends over time.

Most of the economic measures were more quantitative in nature, requiring different approaches. A section of the CATI survey was devoted to eliciting the non-market economic values of recreation in the Gladstone Harbour area, via the Travel Cost Method (TCM). Using secondary data, we developed measures of capacity utilisation for the commercial fishing and shipping industries in the Harbour area and adjacent waters, which represent the current level of output relative to past levels, or levels in other areas operating under similar conditions. The measure of socio-economic status applied in the analysis was the index of

economic resources (IER), which is a composite measure of the economic wellbeing of a community. It takes into account income extremes (both high and low) in a population, as well as household ownership, costs of living and other indicators relevant to economic wellbeing in a community; information available from census data.

An estimate of performance requires measurement against some benchmark or baseline level of each measure, indicator and sub-component. In the study, an A-E scale was used for the final objectives assessment, and also used for the indicator and measure assessment. For the 1-10 scale cultural and social measures, a simple translation of 1-10 "satisfaction" scale (i.e. agree-disagree scaling used in the community survey) to A-E scale can be made. For much of the secondary data, a range of different baselines and benchmarks were used, depending on the availability and form of the data. In most cases, the data were compared to similar data for other regions and/or time periods, and a distribution of "potential" outcomes generated against which the current value could be evaluated.

The relationship between the measures, indicators and the sub-components was developed using a Bayesian Belief Network (BBN) approach. Bayesian networks are essentially graphical models to which probabilities of certain outcomes given certain situations or observations can be assigned. Bayesian network models provide a probability of an outcome rather than a discrete (deterministic) outcome. From the probability distribution (determined by the weights and relationships determined via the expert, community and social scientist surveys described above), a mean (expected) outcome and confidence interval was determined, and a final 'score' applied to each indicator group, sub-component and component.

Results

To elucidate how community members relate to the Gladstone Harbour area, survey respondents were initially asked to list the first three words that come to mind when they think of the Harbour area. The resulting word clouds highlighted the initial dominant response of "Beautiful". Other dominant words were included "Fishing", "Pollution", "Busy", and "Industry", highlighting the diverse values of aesthetics and other uses of, and impacts on, the area.

Grading systems

Several alternative grading systems were considered, all involving an A-E scale and a numerical score. The BBN produced a numerical score based on the weighted average of the A-E values in the distribution of outcomes. This could be translated to an average A-E score (5 grades), with different variants. One variant involved intermediate grades (e.g. B+, A-) to indicate that the results were near the top or bottom of the range. Another involved defining a "pass" grade, where D and E indicated a below 50% score, and A, B, C indicated an above 50% score.

The overall score card results are given in Table 1 illustrating the outcomes under the different grading approaches. Further details on each component, using the intermediate scoring approach are given below.

Table 1. Pilot Report Card Scores

	Weighted Mean Score	Std Deviation	Average BBN Grade	Inter-mediate Grade	"Pass" Grade
Overall Cultural performance	63%	11%	B	B-	C
Key indicators					
• Attitudes to Gladstone Harbour	80%	12%	A	A-	B
• Condition of non-indigenous cultural heritage sites	69%	23%	B	B	B
• Continuity	57%	22%	C	C+	C
• Measures of distinctiveness	55%	21%	C	C	C
• Proportion of known indigenous sites protected	50%	28%	C	C	C
• Self efficacy	55%	20%	C	C	C
• Self esteem	69%	24%	B	B	B
• Traditional owners consulted	59%	23%	C	C+	C
• Traditional sites protected	55%	24%	C	C	C
• Values of Gladstone Harbour	64%	11%	B	B-	C
Key sub-components					
• Cultural Heritage	58%	14%	C	C+	C
• Sense of Place	64%	10%	B	B-	C
Overall Social performance	58%	10%	C	C+	C
Key indicators					
• Air and water quality	46%	18%	C	C	D
• Barriers to access	64%	14%	B	B-	C
• Harbour health	53%	17%	C	C	C
• Harbour safety	38%	12%	D	D+	D
• Satisfaction with access to the Harbour	67%	21%	B	B	B
• Satisfaction with Harbour recreational activities	70%	16%	B	B	B
• Satisfaction with ramps, public access and spaces	60%	14%	C	C+	C
Key sub-components					
• Liveability	64%	18%	B	B-	C
• Harbour usability	60%	11%	C	C+	C
• Harbour access	61%	11%	B	B-	C
Overall Economic Performance	82%	10%	A	A-	B
Key indicators					
• Commercial fishing	66%	13%	B	B	B
• Shipping activity	83%	10%	A	A-	B
• Tourism related sectors	60%	10%	B	B-	C
• Land based recreation	76%	18%	B	B+	B
• Beach recreation	71%	19%	B	B	B
• Recreational fishing	67%	20%	B	B	B
• Employment	72%	6%	B	B	B
• Socio-economic status	90%	3%	A	A	A
Key sub-components					
• Direct economic footprint	83%	10%	A	A-	B
• Economic stimulus to community	87%	7%	A	A	A
• Recreational value	75%	16%	B	B+	B

Cultural Component

The cultural component scored a B- overall, with mixed results within (see Figure 1). The Cultural Heritage sub-component received a lower score (C+) than Sense of Place sub-component (B-), largely related to the perception of the level of protection afforded to traditional sites (for which information was missing). There was a lack of information from secondary sources regarding the proportion of known sites protected. Community members held a strong identity with the Gladstone Harbour area, and attitudes towards the Gladstone Harbour area was the highest scoring indicator group within Sense of Place. Community members agreed the area is a key part of the community, part of who they are, and a great asset to the region and to Queensland. Community members also considered multiple values important for the area (a slightly greater proportion considered the economic values more than other values), and felt proud to live in the community (related to self-esteem), with values and self-esteem scoring a B and B-, respectively.

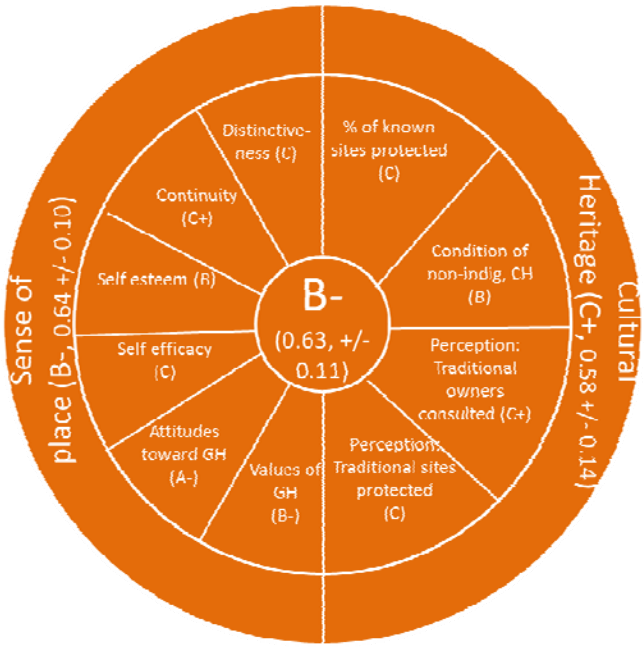


Figure 1. Weighted resulting scores for measures and sub-components within the Cultural component.

Social component

The social component scored a C+ overall (Figure 2), primarily brought down by issues with Harbour safety (D+, driven by secondary data on oil spills and marine safety incidents). Harbour access received a B- score, with most people satisfied with their level of access, their most recent trip to the area, and the quality of ramps and facilities. There were concerns about the health of Harbour area in terms of air and water quality, however (perceptions of health received a C score). Most people did agree the Harbour area improves their quality of life and wellbeing, giving liveability a score of B-.

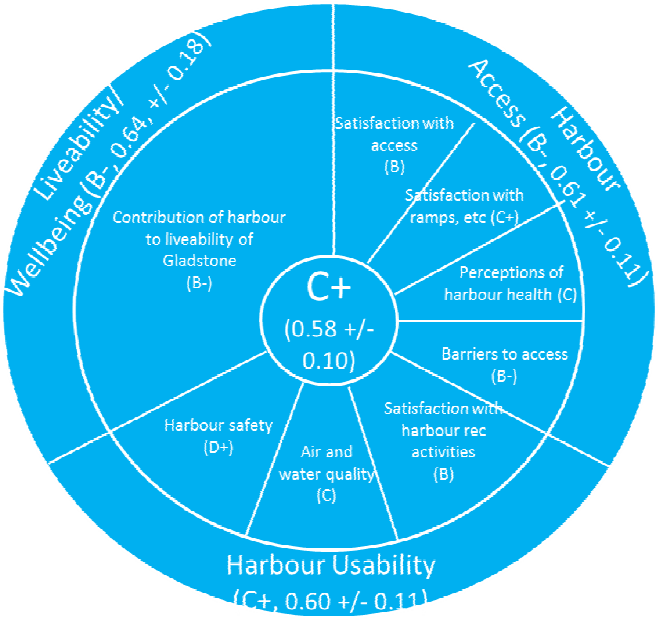


Figure 2. Weighted resulting scores for measures and sub-components within the Social component

Economic Component

The economic component scored the highest of all the components (A-), (Figure 3), with a high score for the economic stimulus sub-component (A) driven by a high comparative socio-economic status of the Gladstone community (A). The results for the economic performance were mixed, with high performance of shipping activity (A-), mixed performance within the fishing sector (with an overall grade of B+), and decline in activity within the tourism sector (but overall grade of B-). Recreational value was considered in terms of non-market value of recreation and satisfaction with recreation, and received a high score of B+. The annual (non-market) value of recreational trips in Gladstone was estimated as $84m.

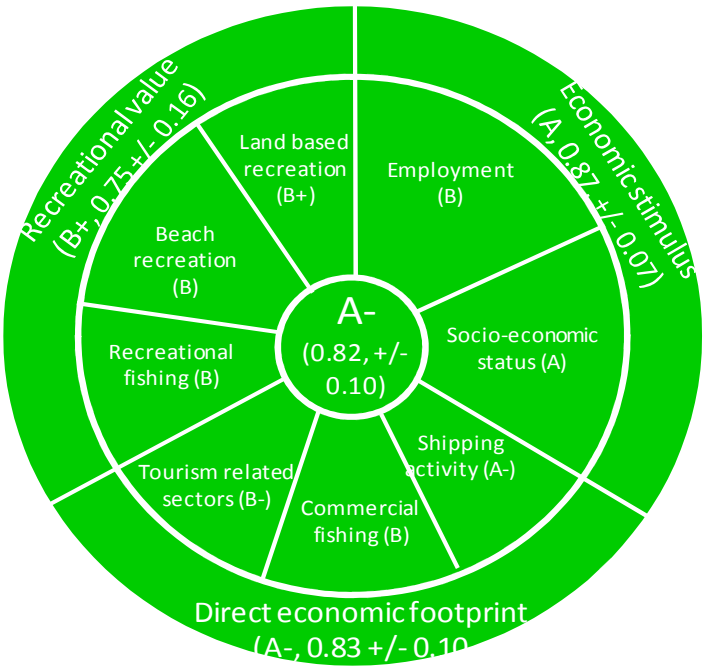


Figure 3. Weighted resulting scores for measures and sub-components within the Economic component

What worked well

The project demonstrated that it is possible to develop a cultural, social and economic report card relating to the broader management of a natural resource-based area. Data collected via the community surveys worked particularly well, especially for the social component. The use of the 1-10 scale enabling the probability distributions of "satisfaction" to be directly incorporated into the BBN models for each component, and including a built in benchmark (namely a score of fully satisfied (10)), overcoming an issue experienced with other indicators.

The scale questions also allowed comparisons with previous research – namely the Social and Economic Long Term Monitoring Program (SELTMP) for the Great Barrier Reef (GBR), which includes relevant data for Gladstone residents and the entire GBR coast. We found very similar results for many indicator groups. For example, residents in the current Gladstone survey hold a similar level of personal connection to the Gladstone Harbour area as do residents of Gladstone and the GBR coast for the GBR; except perhaps as an exclusive place for their recreational activities. Further, while perception of current and future potential health of the Harbour area is not high, this opinion does not differ from those referring to the GBR for both Gladstone and GBR coastal residents.

The TCM used for estimating recreational use value worked relatively well, and resulted in estimates comparable to other studies. Synergies provide strong support for the total annual value of beach recreation for the Gladstone community at $23 million.

The use of the BBN to tie together the different components and indicators also worked well, allowing qualitative data to be combined with quantitative data in a consistent framework, and enabling the capture of heterogeneity in community satisfaction and also sub-component importance. The use of social science experts to determine the key linkages between measures, indicators and sub-components, and the use of experts and community members to determine the relative importance of and links between sub-components and components was also very beneficial.

Limitations

The CATI community survey, while an efficient way of collecting the data in an expedient manner, may have introduced some biases into the report card analysis. In particular, the sample was over-represented by the older age groups and under represented by the younger age groups. Further, while most primary data collection worked well for the purpose, the usefulness of the TCM could be improved through internet surveys, where respondents are able to view the questions and cognitively process the information presented. This would allow more complex questions to be included, improving the quality of the outputs. Further, the TCM lacked sufficient observations to develop a robust estimate of recreational fishing values, as only a relatively small proportion of the sample surveyed actively engaged in recreational fishing.

Several issues emerged around the use of secondary data. These related primarily to quality, scale and relevance of the available data, and identification of an appropriate benchmark. This applies in particular to the economic measures. Further, there is a substantial amount of secondary data that are still lacking, such as information on the proportion and quality of Cultural Heritage sites protected, and regionally specific information for other key user groups such as recreational fishing and marine tourism.

While the sub-components and resulting measures were developed with the Gladstone Harbour area in mind, many of the measures used may not fully reflect the outcomes of Harbour management. In particular, the economic measures are likely to be influenced by a wide range of factors both external and internal to the region. Given this, the economics section of report card in particular needs to be considered in the context of broader economic conditions. Factoring this into the report card score is complex and has not been adequately considered in this study due to time and resource constraints.

Future data collection needs

The question of how frequently to collect data relevant to future report cards involves assumptions about the lag time which may be experienced before any changes to economic, social and cultural Harbour health indicators become measurable. The time between environmental change and the economic, social and cultural response to the change is not well understood or reported, and we recommend this as an area for future research as more data are collected in Gladstone Harbour.

Frequency of collection also depends in part on other surveys underway in the area, in two ways: with many surveys already being conducted, respondents are likely to show survey fatigue; however other surveys may also provide opportunities to coordinate with other research occurring (e.g. SELTMP). Such opportunities should be explored. A longitudinal study of those who indicated willingness to provide further information, while a subset of the larger random sample, may also reduce problems of survey fatigue.

Social values are highly variable. Although we do not know how social values change, there is merit in considering annual surveys of the highly sensitive satisfaction based measures (and biennial collection of less sensitive measures) to elicit clear trends, and to allow detection of changing populations. Secondary data could also be updated annually at low cost. Recreational (travel cost) values may be estimated less frequently (every 5 years), although there is a more urgent need for a targeted recreational fishing value estimate. The relative importance of different sub-components within each component is likely to change over time, but is unlikely to change rapidly. Hence there is no need to do the sub-component weightings survey annually (suggest 5 yearly unless there are substantial changes in the region).

While this report provides a snap shot of current measures, as more data are collected in Gladstone Harbour it will be possible to incorporate trend reporting and later more formal trend analysis into the Gladstone Healthy Harbour report card. The extension of modelling approaches to predict changes in the social, cultural and economic health of Gladstone Harbour resulting from changes in other indicators or from management actions would allow the different components of the report card to be better integrated, and may also prove useful for linking the ecosystem modelling work currently underway to expected report card outcomes.

1 Introduction and background

1.1 Introduction

Report cards are used in a wide range of areas as a communication tool to inform key stakeholders about the relative performance of an industry or activity. Originating in schools as a means of informing parents about students' progress, they have evolved to report on the relative performance of schools, universities and health care to provide an incentive for these industries to improve their performance (Palmer and Filoso 2009; Mitchell and Parkins 2011; Foley *et al.* 2012; Pickett *et al.* 2013). Variations of the report card system have also been applied to the food industry to inform consumers about healthy eating choices and/or sustainability of the product (Boncoeur *et al.* 2002; Moilanen *et al.* 2009b), and has been extended to assessing relative regional economic performance of local governments (Bull *et al.* 2013).

The use of report cards to provide snap-shots of progress towards the achievement of specific ecosystem health goals has become increasingly popular since the 1990s (Overton *et al.* 2013). Within Australia, environmental based report cards have been developed for the Great Barrier Reef, the Fitzroy Basin, Tamar Valley and south east Queensland. These report cards generally focus on the environmental performance directly, based on monitoring a range of environmental indicators and assessing these against some preferred state.

Most environmentally-oriented report cards are focused on the biophysical components of the system. However, there is growing interest in ecosystem based management (EBM) approaches, and the corresponding concepts of ecologically sustainable development (ESD), both of which also consider the economic and social implications of ecosystem management.

The key aim of this project is to develop and pilot a system for the collection and analysis of data relating to appropriate economic, social and cultural indicators for the purposes of developing a broader report card on the management of the Gladstone Harbour region.

1.2 Background

The Gladstone Healthy Harbour Partnership (GHHP) was established to provide support for improved decision making with respect to environmental management of Gladstone Harbour (Figure 4) (McIntosh *et al.* 2014). To assist in this decision making, the GHHP proposed the development of an annual "report card" on the health of the Harbour, and to identify priorities for future improvements and/or restoration projects.

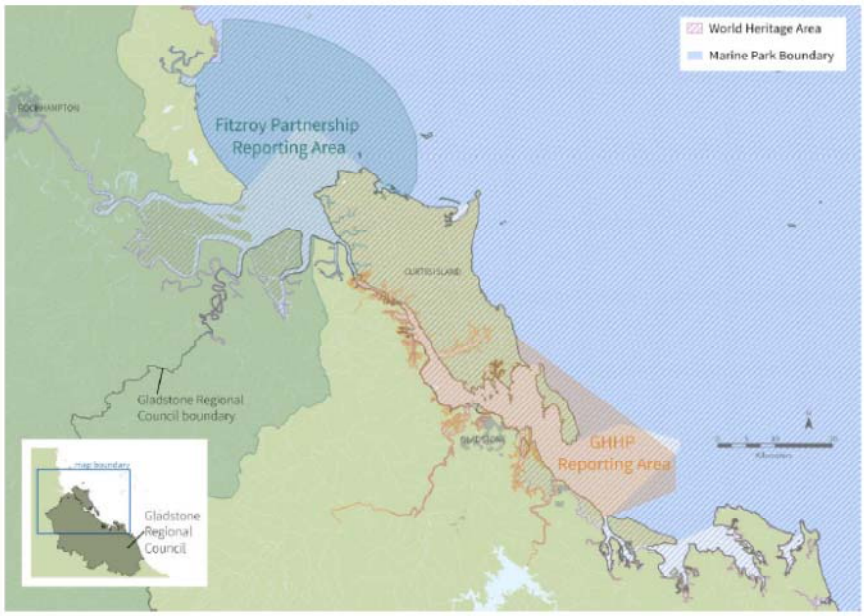


Figure 4. The GHHP area
Source: (McIntosh et al. 2014)

As with any natural resource management system, the first step is to identify what the system hopes to achieve. Sub-components for the region have been identified already by the Partnership (McIntosh et al. 2014), and are presented in Box 1 below. A key purpose of the report card is to identify the extent to which these sub-components are being achieved.

The sub-components identified by the Partnership extend the standard triple bottom line (environment, society, economy) by explicitly considering also cultural aspects. While it could be argued that cultural sub-components may form part of either social or economic sub-components, their separate identification provides them with a higher level recognition of their importance to the local communities.

This project is a part of a coordinated approach led by the GHHP. The following projects have already been completed, and reports and outputs are available at www.ghhp.org.au

- Mapping and Synthesis
- Review of Report Cards
- Qualitative Modelling
- Report Card Framework
- Gladstone GHHP e-Portal

Similarly, several other projects are now underway which all combine to work towards the release of the first full Gladstone Healthy Harbour report card in November 2015 including:

- Gladstone Harbour model
- Connectivity indicators
- Statistical pilot project
- Data & Information Management System

Several more projects are expected to commence later in 2014 including:

- Measures of stewardship e.g. agriculture, urban etc. (currently under development)
- Seagrass monitoring
- Fish recruitment indicators

Box 1: Objectives identified by the GHHP

Environmental objectives

- Maintain/improve habitat function and structure of key ecosystems
- Maintain/improve connectivity of water within and between Gladstone Harbour, related rivers, estuaries and adjacent waters
- Maintain sustainable populations of fauna species reliant on the harbour and waterways
- Maintain water and sediment quality at levels compliant with the appropriate guidelines

Cultural objectives

- Registered cultural heritage sites associated with the harbour and waterways are protected
- The Gladstone community's sense of identity and satisfaction with the condition of the harbour is increased

Social objectives

- Maintain (relative to an agreed reference point) or Improve easy access to the harbour waters and foreshore for recreation and community uses
- Maintain (relative to an agreed reference point) or improve a safe harbour for all users (e.g. swimming, boating and foreshore activities)

Economic objectives

- The Gladstone Harbour is managed to support shipping, transport and a diversity of industries
- Economic activity in the Gladstone Harbour continues to generate social and economic benefits to the regional community

2 Methods

The development of a successful report card involves a series of logical steps (Overton et al. 2013), summarised in Figure 5.

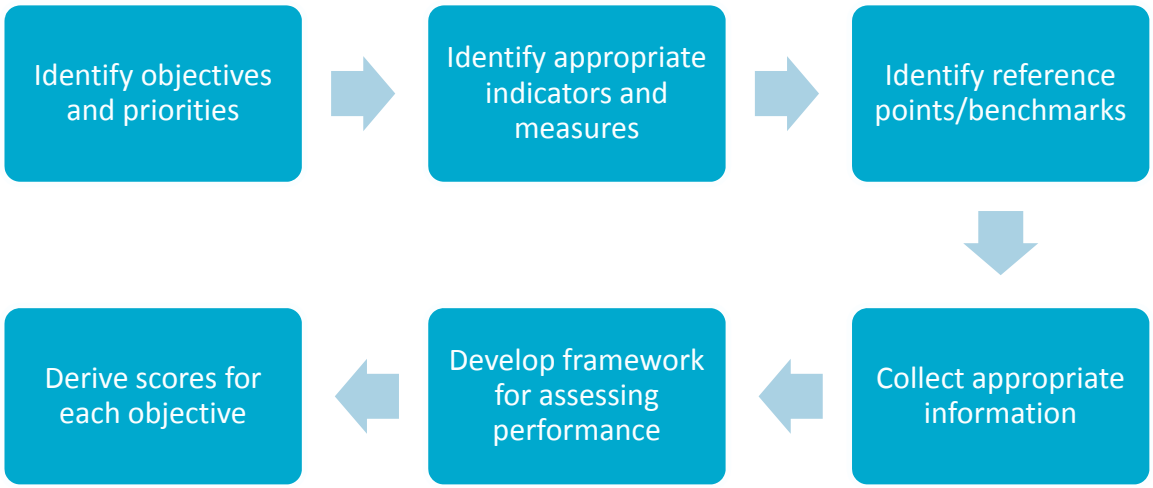


Figure 5. Flow chart for report card development

The methods associated with each stage of the process are detailed in the following sections. An overview of the terminology used in the project is given in Appendix A.

2.1 Identifying objectives and priorities

Clear objectives definition for any natural resource management is fundamental to management success (Harland *et al.* 2001). Objectives provide a transparent guide to what the management aims to achieve, identify potential conflicting activities, guide elements of the decision making process, and ensure accountability of the management agency to the broader community (Chen and Paulraj 2004). Assessing the relative importance of different objectives is important when assessing overall performance of management as well as determining which objectives require greater attention in terms of information collection.

2.1.1 SUB-COMPONENTS AND OBJECTIVES

Numerous studies on social and economic objectives and indicators have been undertaken for fisheries (e.g. Sutton and Tobin 2009; Pascoe *et al.* 2013; Pascoe *et al.* 2014a; Triantafillos *et al.* 2014) and coastal

management (e.g. Nagurney 2010). As noted previously, GHHP (McIntosh et al. 2014) have defined a set of cultural, social and economic management objectives for the Harbour (Box 1). For the purposes of this study, these form the basis for the main components examined, with the objectives defining the key sub-components that were individually assessed (Table 2).

Table 2. Cultural, social and economic sub-components

Component	Sub-component
Cultural	Registered cultural heritage sites associated with the Harbour and waterways are protected
	The Gladstone community's sense of identity and satisfaction with the condition of the Harbour is increased
Social	Maintain or improve easy access to the Harbour waters and foreshore for recreation and community uses
	Maintain or improve a safe Harbour for all users
	Enhance liveability and wellbeing in the region
Economic	The Gladstone Harbour is managed to support shipping, transport and a diversity of industries
	Economic activity in the Gladstone Harbour continues to generate social and economic benefits to the regional community
	Enhance values of recreational and environmental assets

2.1.2 SUB-COMPONENT WEIGHTING

In the context of the GHHP report card, the contribution of each sub-component in Table 2 to the overall cultural, social or economic components needs to be determined. [1]

A range of methods have been applied in the literature to assess weights, each with advantages and disadvantages (Cameron and Trivedi 1986; Hellerstein 1991; Morey *et al.* 1991; Whitehead and Haab 1999; Lipton and Hicks 2003). In this study, we apply three commonly used approaches to determine potential weights of the general community and key stakeholder and management groups. These include simple ranking approaches, scoring based approaches and the Analytic Hierarchy Process (AHP) (Saaty 1980) based on a series of pair-wise comparisons. Each method relies on a selected group of individuals (e.g. key stakeholders) to indicate a preference for each sub-component within a set of sub-components. They differ in how these preferences are captured and analysed, both between and within the different approaches. Studies of weight convergences suggest that while correlations between outcomes of different approaches may be high in some cases, the final set of weights is dependent on the method used (George and New 2013).

Three approaches were applied in the study. Firstly a ranking approach was undertaken largely as an aid to the participants to sort out which sub-component was most important and the ordinal standing of each remaining sub-component/s. This is the simplest approach, and provides an opportunity for respondents to rank sub-components before having to determine relative importance. While rankings may be used to

[1] Ideally, the relative importance of the three main categories (cultural, social, and economic) would also be determined in order to allow an overall performance measure to be derived. However, GHHP requested that these be treated equally for the report card and no higher level aggregation undertaken.

provide weights (as seen in the next section), the primary purpose of this step was to act as a prompt for the more complex rating approaches.

The second approach was a scoring approach where respondents were required to allocate the top ranked sub-component a score of 100, and then provide a score (0-100) for the other sub-components relative to this. This is used to provide a more continuous weight measure for subsequent use in the analysis.

The third approach was the Analytic Hierarchy Process (AHP), involving pair-wise comparisons of sub-components. This has several theoretical and practical advantages over the scoring approach (outlined below), but is also subject to potential problems of inconsistency. This is the preferred weighting system, but the choice of weighting system used in the final analysis (AHP or scoring) was based on the level of inconsistency in the AHP and the degree of similarity (measured as variance in the scores between individuals) in the derived weights for each scoring system.

The weighting methods considered are detailed below.

Ranking approaches

Ranking based approaches require individuals to simply rank sub-components from most important (with a rank of 1) to least important (with a rank of *n* where *n* is the number of sub-components compared). Examples of ranking based systems in coastal and natural resource management applications include Smith *et al.* (2008), Buckworth *et al.* (2013) and Sheppard and Meitner (2005).

There is a wide range of approaches for deriving weights from ordinal rankings ranging from linear models with fixed or variable slopes, to inverse relationships. Empirical analysis suggests that linear based model with variable slopes are more appropriate (Burgin 2008), although these methods also differ in their derived weights, particularly as the number of sub-components being weighted increases (Roberts and Goodwin 2002).

The approach used in this study is the rank order distribution (ROD) weights proposed by Roberts and Goodwin (2002). This method was found to be the most reliable over a wide range of comparisons. The method for deriving the weights is mathematically complex and is provided in Roberts and Goodwin (2002), and the resultant set of weights is provided in Table 3 for up to 10 comparisons. In the analysis, these weights were used and allocated to the stated rank provided by survey respondents.

Table 3. Rank order distribution weights

Rank	Number of comparisons								
	2	3	4	5	6	7	8	9	10
1	0.6932	0.5232	0.418	0.3471	0.2966	0.259	0.2292	0.2058	0.1867
2	0.3068	0.324	0.2986	0.2686	0.241	0.2174	0.1977	0.1808	0.1667
3		0.1528	0.1912	0.1955	0.1884	0.1781	0.1672	0.1565	0.1466
4			0.0922	0.1269	0.1387	0.1406	0.1375	0.1332	0.1271
5				0.0619	0.0908	0.1038	0.1084	0.1095	0.1081
6					0.0445	0.0679	0.0805	0.0867	0.0893
7						0.0334	0.0531	0.0644	0.0709
8							0.0263	0.0425	0.0527
9								0.0211	0.0349
10									0.0173

Source: Roberts and Goodwin (2002)

In most ranking studies, equal ranking of one or more sub-components is not permitted. However, as equal ranking is possible in the other approaches the standard ranking approach was modified to allow for this. The final weights were determined by

$$w_{i,j} = \hat{w}_{i,j} / \sum_i w_{i,j} \quad (1)$$

where $\hat{w}_{i,j}$ is the initial weight of sub-sub-component *i* (in main sub-component group *j*) derived based on the rank of the sub-component and $w_{i,j}$ is the final weight used in the analysis.

Scoring approaches

Scoring based methods, or direct rating methods, involve allocating a score, for example 100, to the most preferred (first ranked) sub-component, then allocating a lower score somewhere between 1 and 100 for subsequent sub-components based on their relative importance. Direct rating methods have been applied in a number of coastal and resource management studies (Mead 2008; Kiesecker *et al.* 2009; Business and Biodiversity Offsets Programme 2012).

As with ranking approaches, there have been several different approaches proposed for weight derivation from scoring based systems. These include direct rating approaches such as the max100 approach, where the highest ranked sub-component is allocated 100 points and subsequent (lower) sub-components allocated less than 100 points; and the min10 approach where the least preferred sub-component is allocated 10 points and the higher ranked sub-components allocated higher points relative to these (Roberts and Goodwin 2002). Alternative approaches include direct point allocation where the set of all sub-components are allocated 100 points, and individuals share these 100 points out across all sub-components (so that they sum to 100) (Roberts and Goodwin 2002). In all cases, the final weight is determined by:

$$w_{i,j} = S_{i,j} / \sum_i S_{i,j} \quad (2)$$

where $S_{i,j}$ is the initial score given to each sub-component *i* (i.e. between 1 and 100) and $w_{i,j}$ is the final weight used in the analysis.

Several studies have suggested that the direct rating approach involving setting the higher ranked sub-component a score of 100 is the most reliable in test-retest studies (Bottomley and Doyle 2001; Lipton and Hicks 2003; Hayes and Morrison-Saunders 2007)

Analytic Hierarchy Process (AHP)

AHP has been used in a number of marine and coastal applications to determine management sub-component importance and assist in decision making (Farrow 1998; Leung *et al.* 1998; Soma 2003; Mardle *et al.* 2004; Wattage and Mardle 2005; Nielsen and Mathiesen 2006; Himes 2007; Pascoe *et al.* 2009; Reis 2011; Pascoe et al. 2013), and is the most common approach used for preference elicitation in a wide range of applied natural resource case studies. AHP is based upon the construction of a series of pair-wise comparison matrices which compare sub-components to one another, and a hierarchical structure that groups similar sub-components into subgroups, and builds the hierarchy with progressive layers of groupings. The pair-wise comparison method makes the process of assigning weights much easier for participants because only two sub-components are being compared at any one time rather than all sub-components having to be compared with each other simultaneously. Preferences are expressed on a nine point scale, with a 1 indicating equal preference, and a 9 indicating an extreme preference for one of the sub-components. Preferences are assumed symmetrical, such that if A against B has a preference of $a_{AB} = 9$, then $a_{BA} = 1/a_{AB} = 1/9$. For each set of comparisons, a matrix of scores can be developed, given by:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix} \quad (3)$$

The scores are normalised by dividing through each element of the matrix by the sum of the column *j* (i.e. summed over *i*, such that $\bar{a}_{ij} = a_{ij} / \sum_i a_{ij}$), and the weight associated with each sub-component can be estimated as the average of the normalised scores across the row *i*. That is, $w_i = \sum_j \bar{a}_{ij} / n$, where *n* is the number of sub-components being compared.

The pair-wise comparisons and analyses are undertaken at the different levels of the hierarchy. That is, pair-wise comparison and analyses are made at different levels of aggregation, and the weight w_i^{ℓ} is estimated (the superscript ℓ indicating the level of the sub-component in the hierarchy). The analysis within each level of aggregation in the hierarchy is then undertaken, and the weights of the individual sub-components are determined by the product of their initial weight estimate (i.e. when compared with the other sub-components that they are grouped with) multiplied by the weight of the higher order aggregation (i.e. which is compared with other higher order aggregations). This reduces the number of direct comparisons that need to be made, as only sub-components at the same level and within the same broader sub-component need to be compared.

Preference weightings are highly subjective, and inconsistency is a common problem facing AHP, particularly when decision makers are confronted with many sets of comparisons (Goodstein 2010). Respondents do not necessarily cross check their responses, and even if they do, ensuring a perfectly consistent set of responses when many sub-components are compared is difficult. The discrete nature of the 1-9 scale can also contribute to inconsistency, as a perfectly consistent response may require a fractional preference score. Reis (2011) also suggests that inconsistency can arise through errors in entering judgments; lack of concentration and inappropriate use of extremes.

The degree of consistency in the results can be assessed using the consistency index (CI), given by

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (4)$$

where $\lambda_{\max}$ is the maximum eigenvalue of the matrix A (see equation 1), given by $\lambda_{\max} = \sum_i \sum_j a_{ij} w_i$ (Duke and Aull-Hyde 2002). This is compared to a randomly generated value for an n x n matrix (Random Indicator or RI) to derive a consistency ratio, CR, where CR=CI/RI. Values of CR≤0.1 are generally considered acceptable (Saaty 1980), although higher measures are often accepted in fisheries analyses (Himes 2007).

Weighting survey

An online survey tool was developed for eliciting weights using the above approaches (see Appendix). Two separate surveys were conducted. The first was of the general community, and the second was of individuals with responsibility for management of the region, either directly (e.g. local government, industry) or via industry (e.g. advisory role, key stakeholder group).

2.2 Indicators and measures

The key indicators associated with each sub-component were also largely defined by the GHHP (Table 4). A project team workshop at the start of the project also suggested some additional (perception based) indicators for the cultural heritage sub-component.

Many of the indicators for the social and cultural sub-components are difficult to quantify directly, as many are conceptual rather than tangible. As a result, several measures are associated with some indicators (effectively indicators of the indicators).

The appropriate measures associated with each indicator were derived through a project team workshop, and based on previous experiences in developing measures of social indicators for marine based industries (Tobin *et al.* 2010; Triantafillos et al. 2014). The key criteria for inclusion involved the measure having:

1. A direct relationship with the indicator/sub-component; and
2. Be measurable (either through survey or secondary data)

The measures associated with the indicators are illustrated in Figure 6 (Cultural sub-components), Figure 7 (Social sub-components), and Figure 8 (Economic sub-components). Most of the social and cultural measures are perceptions based, and consequently derived from a community survey (see below). Several of the measures are derived from secondary data. These are further detailed in the section on data collection.

Table 4. Key indicators

Sub-component	Key Indicators
Protection of cultural heritage sites	• Perceptions that traditional sites are well protected • Perception that traditional owners are appropriately consulted • Condition of non-indigenous cultural heritage sites • Proportion of known indigenous sites protected
Enhance sense of place	• Distinctiveness/uniqueness of the area • Continuity • Self esteem • Self efficacy • Attitudes • Values
Enhance access to the Harbour	• Satisfaction with access to the Harbour • Satisfaction with access to ramps and public spaces • Perceptions of Harbour health • Barriers to access
Enhance usability of the Harbour	• Satisfaction with Harbour recreational activities • Air and water quality • Harbour safety
Enhance liveability and wellbeing in the region	• Liveability measures
Enhance economic performance of Harbour based industries	• Commercial fishing performance • Shipping activity • Tourism
Enhance economic stimulus to the broader community	• Socio-economic status of the community (Access to economic resources) • Employment
Enhance values of recreational and environmental assets	• Recreational non-market value

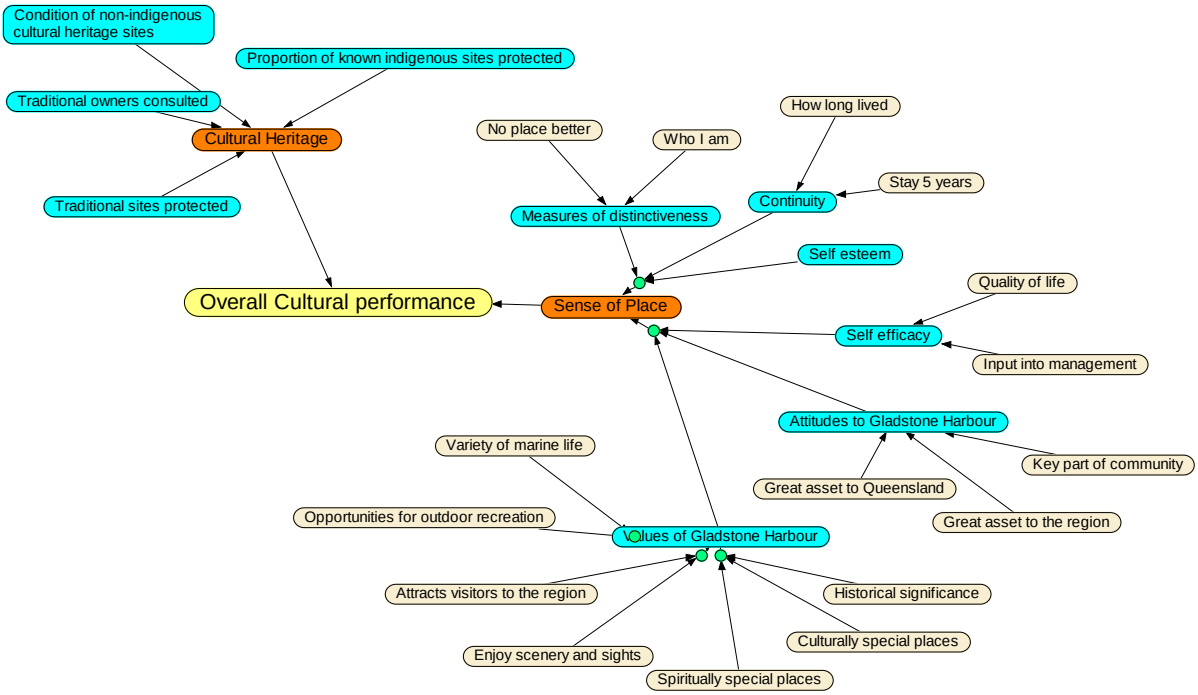


Figure 6. Linkages between measures, indicators and cultural sub-components

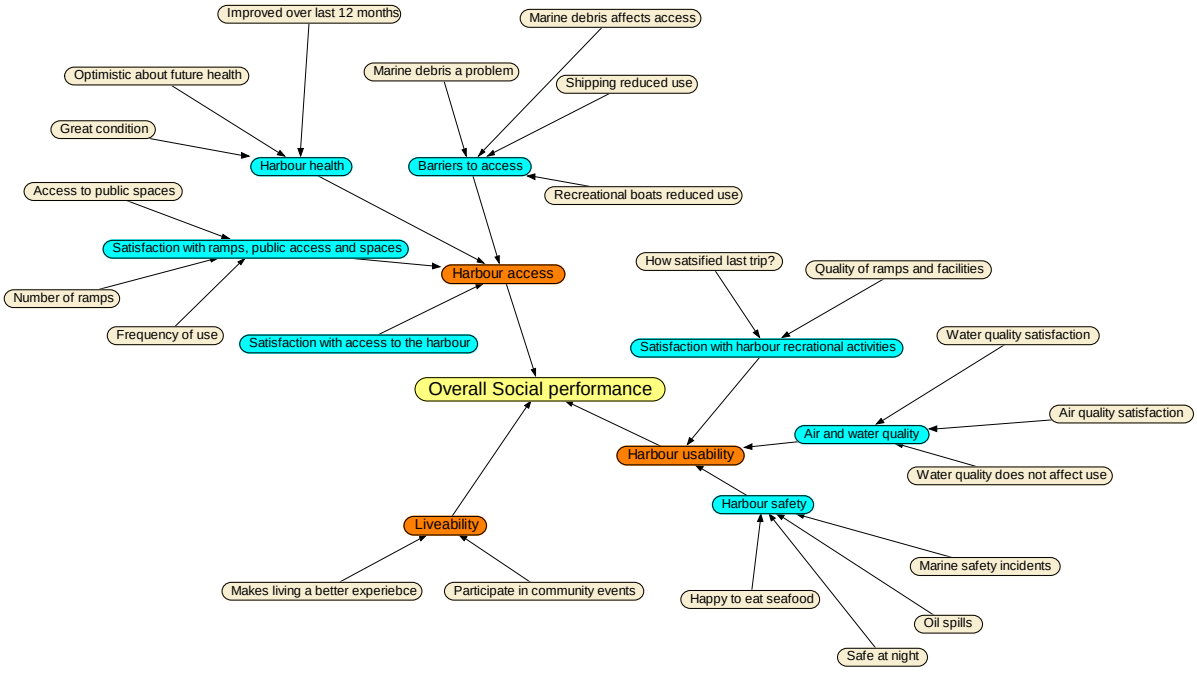


Figure 7. Linkages between measures, indicators and social sub-components

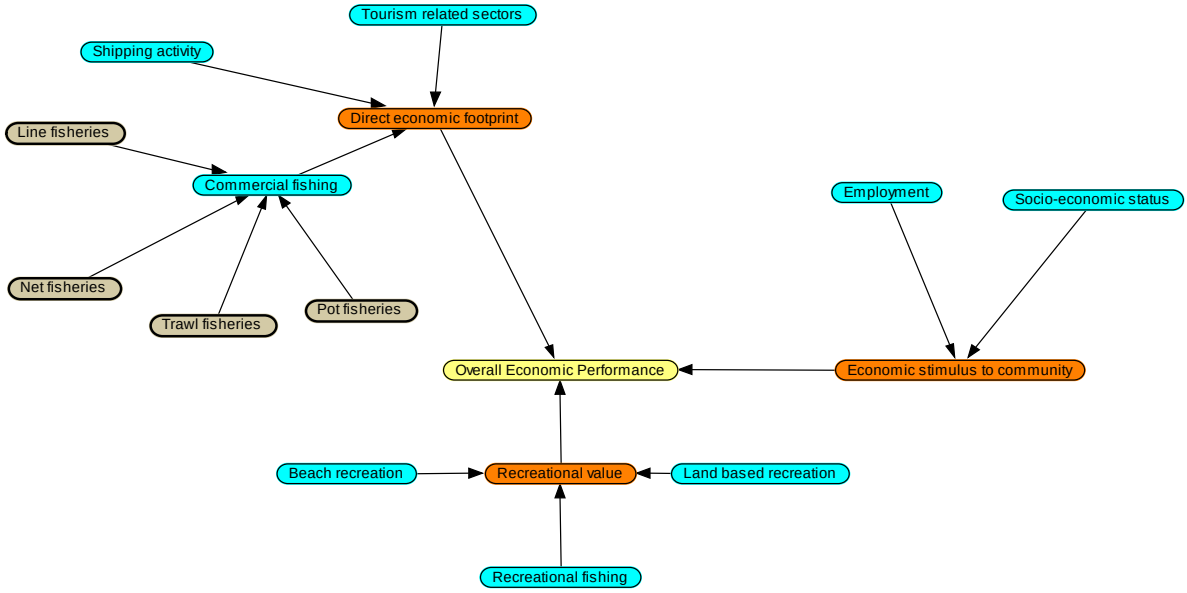


Figure 8. Linkages between measures, indicators and economic sub-components

The link between indicators and the measures were developed through a survey of social scientists using the ranking and scoring methods described above. Differences in opinion as to how these measures and indicators related to each other, and also how the indicators relate to the sub-components were used to develop a probabilistic approach to measuring success, described in the following sections.

2.2.1 SOCIAL AND CULTURAL MEASURES

Many of the social and cultural measures were largely qualitative in nature, and obtained through a community survey (see below sections). Most of the survey questions directly relate to the social and cultural measures, while others provide information also for derivation of economic measures. The appropriate measures and questions were developed by the project team, heavily based on those used within the Social and Economic Long Term Monitoring Program (SELTMP) for the Great Barrier Reef (Marshall et al. 2014).

All questions were designed to be answered on a 10-point agree-disagree scale, to ensure answers were comparable with other studies in the region and to enable elicitation of trends over time. The measures are defined in terms of the percentage of respondents who fall within each category of the statement (e.g. agree or strongly agree with the statements, with any negatively worded questions reversed).

Further details on these measures are provided in the section describing the survey.

2.2.2 ECONOMIC PERFORMANCE MEASURES

Most of the economic performance measures were more quantitative in nature, requiring different approaches to their measurement.

Capacity utilisation

Capacity utilisation is a productivity measure that measures how well an individual or industry is performing relative to other similar individuals/industries given the level of fixed inputs (i.e. the Harbour), or itself over time. Comparing the performance of a single individual/industry over time provides a relative

measure of how well the industry or individual is performing in any one year relative to their peak performance. Lower levels of capacity utilisation indicate that the same fixed inputs could have produced more output, and hence productivity has declined. This may be through either changes in demand for the service (in the case of shipping for example) or inefficiencies in the system through other changes (e.g. management).

Measures of capacity utilisation were developed for the fishing and shipping indicators. These represent the current level of output relative to past levels, or levels in other areas operating under similar conditions. Capacity output is estimated using Data Envelopment Analysis (DEA), which is particularly well suited for industries that are multi-output in nature.

DEA is well established in the economics literature for productivity analysis (Färe *et al.* 1989; Färe and Grosskopf 2000; Färe *et al.* 2000). It has been extensively used in fisheries in particular (Reid *et al.* 2003; Tingley *et al.* 2003; Vestergaard *et al.* 2003; Walden *et al.* 2003; Herrero 2005; Pascoe and Tingley 2006; Maravelias and Tsitsika 2008; Tsitsika *et al.* 2008), but is also applied in a wide range of other multi-output industries (Färe et al. 1989; Coelli and Perelman 2000; Drechsler *et al.* 2007).

The general form of the output-oriented DEA model for firms producing *m* outputs using *n* inputs is given by:

$$Max\ \Phi_1 \tag{5}$$

Subject to

$$\Phi_1 y_{1,m} \le \sum_j z_j y_{j,m} \quad m \in M \tag{6}$$

$$\sum_j z_j x_{j,n} \le x_{1,n} \quad n \in N \tag{7}$$

$$\sum_j z_j = 1 \tag{8}$$

where Φ_1 is a scalar showing by how much the production of each firm can increase output, $y_{j,m}$ is amount of output *m* by firm *j*, $x_{j,n}$ is amount of input *n* used by firm *j* and z_j are weighting factors. For estimation of capacity utilisation, only fixed inputs are considered in the analysis (i.e. included in the set *N*). The constraint in equation (8) imposes variable returns to scale. Without this restriction, constant returns to scale are imposed.[2]

Capacity output is defined as Φ_1 multiplied by observed output (*y*), using fixed inputs only in the model. This also assumes that all inputs are used efficiently at their optimal capacity. Therefore, this measure more precisely represents the technically efficient capacity utilization (TECU), and is given by:

$$TECU = y \bullet (\Phi_1 y)^{-1} = \Phi_1^{-1} \quad . \tag{9}$$

[2] "Returns to scale" describes the relationship between changes in fixed inputs and outputs. Increasing returns occurs when output increases (decreases) more than proportional with an increase (decrease) in fixed input use (e.g. boat size), all else being equal. Decreasing returns to scale exists when output increases (decreases) at a lesser rate than fixed input use. Constant returns exists when the rate of output and input change are the same. Variable returns to scale allows for increasing, constant and decreasing returns within the same fleet.

The measure of TECU ranges from zero to 1, with 1 being full capacity utilization (i.e. the vessel is catching as much as is possible given its fixed input use). Values less than 1 indicate that the firm or industry is operating at less than its full output potential given the set of fixed inputs.

Revenue based index

For tourism, and to some extent fisheries also, identifying levels of fixed inputs and also output mixes is not possible. In the case of fisheries, the fixed input (the boats) are also used outside of the area of the Harbour, so changes in capacity utilisation may reflect a wide range of non-Gladstone Harbour related effects (e.g. changes in relative prices or costs, changes in stocks in response to short term environmental fluctuations). For tourism, multiple types of operations exist (hotels, motels, restaurants etc) with different mixes of activities. Information is not available on all of these activities separately. Given this, for these sectors, productivity measures based on changes in total revenue over time were also used as performance measures.

Index of economic resources

The measure of socio-economic status applied in the analysis was the index of economic resources (IER). The IER is a composite measure of the economic wellbeing of a community. It takes into account income extremes (both high and low) in a population, as well as household ownership, costs of living and other indicators relevant to economic wellbeing in a community (Pink 2013).

The IER is formally calculated from census data, but a revised estimate of the IER for the Gladstone region was derived from information collected in the community survey. The key components of the IER and their relative weights (loadings) derived by the Australian Bureau of Statistics (Pink 2013) are given in Table 5. Further details on the derivation of the loadings and measures are provided by Pink (2013). The loadings are common to all regions.

The key income indicators have been adjusted to allow for consumer price index increases since 2011. Equivalised income is the household income normalised by the number of household members, with the normalisation factor have a value of 1 for a single adult, with an additional 0.5 for each additional adult and an additional 0.3 for each child.

The weightings of the IER components were developed such that at the sum of the impacts for the “average” region equals zero. The index for the normalised mean region was set to 1000, so that the score for the Gladstone region can be approximated by adding 1000 to the derived value. The estimate is an approximation only, and assumes that all other regions did not equally improve their performance since 2011 (otherwise the re-normalised distribution would reduce the estimated Gladstone score). It also assumes that the results from the survey are representative of the conditions of the population as a whole (as the 2011 values are census based).

Table 5. Components and loadings in the estimation of the index of economic resources

Indicator	Description	Loading
Income		
• **INC_LOW**	% of people with stated annual household equivalised income between $1 and $20,799	-0.79
• **INC_HIGH**	% of people with stated annual household equivalised income greater than $52,000	0.63
Employment		
• **UNEMP_RATIO**	% of people aged 15 years and over who are unemployed	0.57
• **UNINCORP**	% of occupied private dwellings with at least one person who is an Owner of an Unincorporated Enterprise	0.49
Housing		
• **OWNING**	% of occupied private dwellings owning dwelling without a mortgage	0.33
• **MORTGAGE**	% of occupied private dwellings owning the dwelling they occupy (with a mortgaged on the main dwelling)	0.66
• **HIGHMORTGATE**	% of occupied private dwellings paying mortgage greater than $2,800 per month	0.67
• **LOWRENT**	% of occupied private dwellings paying rent less than $166 per week (excluding $0 per week)	-0.72
• **GROUP**	% of occupied private dwellings who are group occupied private dwellings	-0.31
• **LONE**	% of occupied private dwellings that are lone occupied private dwellings	-0.66
• **OVERCROWD**	% of occupied private dwellings requiring one (1) or more extra bedrooms	-0.54
• **HIGHBED**	% of occupied private dwellings with four (4) or more bedrooms	0.74
Other		
• **ONEPARENT**	% of one-parent families with dependent offspring only	-0.66
• **NOCAR**	% of occupied private dwellings with no car	-0.77

Source: Pink (2013)

Valuation of recreational activity

One of the three economic indicators to be assessed in the GHHP report card is the economic value of recreation. There are two components of value that can be assessed. The first is the commercial value of recreation and tourism, with both direct use and indirect use values. These values can be determined from financial records of commercial tourist operators and are assessed as part of the 'economic performance' indicator. The second type of recreation values are classified as non-market values. These are values associated with local and regional residents who use the Harbour area for recreational purposes but their activity is not reflected in the financial records of commercial service providers. Economists refer to these as non-market values because they are not captured in formal market estimates. Non-market values for recreation comprise of both use and non-use values. The latter relates to economic values held by people who might not currently use the Harbour for recreation but might wish to do so in the future or they might value the fact that other people can use it.

A section of the CATI survey (see next section) was devoted to eliciting the non-market economic values of recreation. While it is possible to assess both use and non-use recreation values in a community survey, practical limitations restricted the valuation to focus on use values only. The Travel Cost Method (TCM) was applied as the valuation format.

The TCM is the standard approach used to estimate recreational values and has been widely used over the past 50 years. However, there have been relatively few recent applications in Australia. The basic concept underlying the TCM is that outdoor recreational benefits at a specific site can be derived from a demand function relating the number of trips made by visitors to the site, to the actual cost of a visit. Early applications of the TCM employed standard regression techniques to identify the relationship between visit rates and independent variables such as travel costs and population characteristics. Count data models are now commonly applied in travel cost analysis, where the dependent variable is a count that represents

discrete events, such as the number of trips. These models differ from the classical regression models in that the response variable is a non-negative and integer-valued probability density. The distribution in count data models is also characterised by higher concentration on lower discrete values (e.g. on one or two trips per year) which is a common feature of individual travel behaviour. These properties have made count data very popular for modelling recreation demand through the individual travel cost models (e.g. Shrestha *et al.* 2002).

Count data models such as Poisson or negative binomial models can be applied to analyse travel cost data. It is assumed that the dependent variable (number of trips) follows a standard Poisson distribution, where the probability of an individual taking V_i trips can be modelled as:

$$\text{Prob}\,(V = \mathrm{V_i}) = \text{Exp}(-\lambda_i) * \lambda_i^{V^i}/V_i! \qquad (10)$$

where, λ_i is both the mean and the variance of the random variable V (expected number of trips), takes strictly positive values and is a function of all the explanatory variables.

An important property of the Poisson regression models is equi-dispersion and the assumption that the mean is equal to the variance. However, in most travel cost surveys a large number of visitors make only a few trips to the reference site, while a limited number of visitors may visit the site more regularly. As a result, the variance is expected to be significantly higher than the mean, causing a problem in the Poisson models which is known as over-dispersion. Negative binomial models are a more general form of a count data model than the Poisson model, where the assumption about the equality of the mean and variance is relaxed by incorporating an additional error term to account for systematic differences (Haab and McConnell 2002). An attractive feature of the model is that by assuming that the coefficient on travel cost is representative of cost tradeoffs, the consumer surplus (value) per trip can be simply estimated as:

$$\text{Consumer surplus/trip} = -1/\beta_{\text{travel cost}} \qquad (11)$$

Travel cost calculations

To populate a count data model, it is important to collect information about both the number of trips and the costs of the trips involved. Typically a sample of the population or recreational visitors are surveyed and asked about their frequency of visits to a site, as well as the costs of their average or most recent visit. As it is often difficult for people to identify their travel costs accurately, particularly in general population surveys, it is common to estimate travel costs indirectly as a function of travel distance, vehicle type, and travel time. In this study, where the activity involved the use of a boat, additional information was collected about fuel costs.

Information about trip frequency (in the last 12 months) was collected in a categorical format, with additional information about the associated range provided if required. All information was then adjusted into a non integer value for analysis (Table 6).

Table 6. Visitation frequency rates in the last 12 months

Response category	Range	# trips per year (rate applied)
4-7 times a week	150-300	225
2-3 times a week	80-149	115
About once a week	40-79	60
About once every 2 weeks	20-39	30
About once a month	7-19	13
About 4-6 times a year	4-6	5
3 times per year	3	3
2 times per year	2	2
About once a year	1	1

Travel costs were estimated indirectly by using information about travel distance, travel time and the method of travel for each respondent. While it is common practice to collect information about a range of different types of vehicle used, in this study, only three categories of travel mode were specified (walk, bicycle or motor vehicle). There were three reasons for this. First it reduced the complexity of the survey. Second, it was difficult to distinguish between small medium and large car sizes in a telephone survey. Three, there was very little differentiation in costs per kilometre vehicle costs specified by the Australian Taxation Office for work-related car expenses (1.6-2.6 litre engine = 76 ¢ and 2.6 litre plus = 77¢). Costs for smaller vehicles such as motor cycles are lower at 65¢, but these typically comprise a very low proportion of the sample (motorcycles accounted for less than 1% of the total sample in Windle and Rolfe (2013)).The transport costs applied are given in Table 7.

Table 7. Vehicle costs by travel methods

Travel method	Cost per km
Walking	$0.00
Bicycle	$0.00
Motor vehicle	$0.765

Respondents who had made a boat trip or used a jet ski were asked for details about the distance they travelled and their fuel use or cost. Fuel costs were included in the travel cost assessment for any related recreational trips. No other trip expenditure was included in the analysis. Expenditure on food and incidentals was not counted on the basis that it may have been incurred independently of respondents taking the trip. Some costs, such as bait for fishing, could be considered as trip specific expenditure. However, it is difficult to get accurate cost information about specific items of expenditure as people are more likely to remember their total expenditure, or expenditure on large items such as fuel, which was already taken into consideration.

There is no uniform approach to the treatment of travel time and on-site time in the travel cost literature. There is general agreement that values for recreation time at the travel site should be excluded from the analysis (Rolfe and Gregg 2012). However, there is little consensus about the treatment of travel time. Some case studies have included travel time as a cost, using some proportion of standard wage rates (e.g. a third). In contrast, Rolfe and Gregg (2012) did not include a cost estimate for travel time, arguing that travel time is often complicated to measure and assess accurately, may be part of the recreation experience, or

have minor effects. If the costs of travel time are not included in the travel cost estimate then values for land-based recreation are based solely on vehicle cost, and people who walk or cycle along the foreshore for recreation (with no vehicle cost) will have no associated travel cost.

In this study, the cost of travel time was included for each adult in the travel group at the rate of one third of the Queensland average hourly earnings (i.e. $33.60 per hour in 2012[3]). A rate of 25% ($8.4 per hour) was also applied in the sensitivity testing.

Multi-destination and multi-purpose trips complicate the estimation of travel cost models, as only a proportion of the travel costs can be attributed to the relevant site. Some people who visit a beach or the Harbour may not spend all their time at that site (multi-destination) or visit for other reasons (multi-purpose). To account for this, respondents were asked to indicate the proportion of the total trip time (excluding travel time) that they spent on the recreational activity. This proportion was applied pro rata to the travel cost associated with the trip.

The final travel cost estimate comprised of four components: travel vehicle cost, travel time cost, boat use (fuel) costs and the proportion of time spent at the site.

$$\mathrm{TC}i = \big((\text{distance} * \mathrm{vc}i) + (\text{time} * \$11.2/\text{adult}) + \text{boat cost}\big) * \%\ \text{time at site} \qquad (12)$$

Where TC_i is the travel cost for a travel party (travelling in the same vehicle); *distance* is the two-way distance travelled to the site (km); *time* is the two-way time to travel to the site (hrs); and vc_i is the vehicle cost per kilometre for travel method i.

Most people do not travel alone and typically in travel cost analysis results are calculated for the group in which the respondent travels (if applicable). The results are generally reported as the value of a trip per group, but can also be apportioned amongst the adults in the group to provide a trip value estimate per adult. Details of both per trip and per adult trip are provided below.

Once the travel cost of each trip is established, the total travel cost and other explanatory variables become a function of trip frequency in the travel cost model.

2.3 Define benchmarks and baselines

An estimate of performance requires measurement against some benchmark or baseline level of each measure, indicator and sub-component. In the study, an A-E scale was used for the final assessment, and also used for the indicator and measure assessment.

Most measures were derived from a social survey with a 1-10 scale (1 being very unsatisfied 10 being very satisfied). For these measures, a simple translation of 1-10 “satisfaction” scale to A-E scale can be made (Table 8).

[3] Australian Bureau of Statistics 2012 6306.0 - Employee Earnings and Hours, Australia, May 2012. Australian Bureau of Statistics, Canberra.

Table 8. Satisfaction based benchmarks

Satisfaction scale	Report card grade	General interpretation
9-10	A	Very good
7-8	B	Good
5-6	C	Moderate
3-4	D	Poor
1-2	E	Very poor

For much of the secondary data, a range of different baselines and benchmarks were used, depending on the availability and form of the data. In most cases, the data were compared to similar data for other regions and/or time periods, and a distribution of "potential" outcomes generated against which the current value could be evaluated. For the key economic performance measures, a formalised modelling approach exists for doing this (capacity utilisation) which is explained further in the following sections. In these cases, a score between 0 and 1 is produced (or 0 and 100 depending on the measure), and the same proportional allocation to grades is made as for the survey derived data. Details on the benchmarks and baselines used are provided in the results section for each of the components.

As with any report card reporting system, there is the problem of shifting baselines, particularly when obtaining information on perceptions or satisfaction. For example, new comers to the area may be satisfied with the current state of the Harbour as they do not have a prior point of reference to compare current conditions to. This has been highlighted as a particular problem in marine and conservation science, as only degraded conditions have been experienced and perceptions of good or bad are relative to the degraded state rather than the pristine state (Walker *et al.* 2009). Individuals measure change against their personal recollections of the past (Bonnie and Wilcove 2008), and hence differences in perception may reflect differences in benchmarks.

This is potentially a problem for both the survey based information as well as the secondary data. For example, more recent residents may express a higher satisfaction with Harbour conditions than those who have lived here longer and have experienced a wider range of conditions. [4]

2.4 Collection of appropriate information

The analysis used both primary and secondary data. Primary data relating to the social, cultural and economic measures was collected through a computer assisted telephone interview (CATI) survey of 400 residents. Secondary data were obtained from a range of sources.

Additional surveys were also undertaken to obtain coefficients for the modelling framework. These are described in the following section describing this framework.

2.4.1 COMMUNITY CATI SURVEY

A key source of information for the report card was a survey of local residents. A section of the questionnaire for Gladstone residents was devoted to exploring community perceptions of social and cultural values for the GHHP report card. The related questions were developed in collaboration with the project team, heavily based on those used within the Social and Economic Long Term Monitoring Program (SELTMP) for the Great Barrier Reef (Marshall et al. 2014). All questions were designed to be answered on a

[4] While this was not tested for all indicators, a weak but negative correlation was found between length of stay in the region and satisfaction with recreation.

10-point agree-disagree scale, to ensure answers were comparable with other studies in the region and to enable elicitation of trends over time.

A CATI (computer assisted telephone interview) survey was applied as the most practicable means of conducting the community survey of 300-400 residents. An internet survey (with a commercial provider engaged to host the survey and provide access to respondents through an internet panel), would be the most preferred method as the quickest and cheapest option. However, membership of internet panels is still very low in regional areas of Queensland and, unfortunately, it would be unrealistic to expect the required responses could be obtained in Gladstone. While snowballing approaches may be possible, or recruitment through advertising in the community, it is not recommended that an open internet survey be conducted as the survey can then been prone to 'highjacking' by special interest groups. A mail-out survey is also not recommended as the survey collection period can be lengthy, the cost of collection is high, and response rates typically very low. Further, it may be unrepresentative of the broader community if some interest or stakeholder groups provide a disproportionate share of the returns.

The CATI technique is widely used and it helps collect data quickly, accurately and often inexpensively (Kerr and Sharp 2008; Moilanen *et al.* 2009a; Levrel *et al.* 2012). The CATI survey was undertaken by an independent Australian based data collection agency selected based on an open tender (Quality and Cost based criteria). Data were collected by utilising random dialling technique to contact households in the Gladstone Local Government Area (LGA). The survey was administered by trained research interviewers and monitored for quality assurance, while ensuring compliance with strict research protocols.

The resident survey focused primarily on collecting data relevant for the *social* and *cultural* indicators. However, information for some *economic* indicators was also collected – in particular those which relate to the economic values of recreation and environmental assets, which were assessed through the application of non-market valuation techniques. Non-market values were, therefore, also elicited from local residents in the survey based around the travel cost approach and visitation numbers to the beaches, Harbour and shore side, building on previous studies in or near the region (Dunford *et al.* 2004; Prayaga *et al.* 2010).

The most relevant valuation technique for assessing recreation values is the travel cost method, where the value for using a recreation site is assessed in terms of the investment that people have made to reach the site (travel costs, travel time and other access and site costs). The choice modelling technique can be used for valuing both non-use values such as biodiversity protection and use values such as recreation, while the contingent behaviour method can be used to identify how recreation values may change with different environmental and access conditions. The contingent valuation method can also be applied to assess the environmental values, but is more limited in scope than the choice modelling technique.

However the preferred survey collection mode (CATI survey) imposed some limitations on the valuation technique that could be most appropriately applied. An application of the choice modelling technique would provide the most multifaceted data set, but the methodology was not suitable for application in a telephone survey where people cannot see the survey material, and do not have time for considered reflection as the interview process tends to be quite rapid. A CATI survey suits the collection of data for a travel cost method evaluation with follow up questions that provide information for a contingent behaviour analysis.

Survey Design Testing

As part of the development of survey design, a Focus Group Discussion was held at Gladstone on the 5th August 2014, to check the interpretation of survey questions. The aim of this pre-test was to fine-tune the survey questions based on the comments from the participants of the focus group.

The focus group was organised with the local residents of Gladstone Harbour Area. A snowball sampling technique was applied to recruit the participants. A total of 16 participants for the focus group were targeted. Although 16 participants gave their consent to attend the focus group voluntarily, only 8 participants actually attended. However, this group represented a broad range of experience, with ages ranging from 18 to 65, years of experience living in the region ranging from 2 to 65 years, and an equal

gender balance (i.e. 4 males and 4 females). The duration of the focus group undertaken was one and a half hours.

Three project team members facilitated the focus group process. The participants were first briefed on the purpose of the project and aim of the workshop. The draft survey questionnaires were distributed among the participants. The participants were then requested to carefully read the questions and take notes about the questions they found difficult to understand, misleading or irrelevant. In general, the participants were requested to check the questions against the following criteria:

- The question is free from jargon
- The question is simple and grammatically correct
- The same idea is not contained in another question
- Questions capture current views
- Questions are relevant to Gladstone Harbour Area
- Meaning and interpretation of questions is clear
- Time period is clear
- Survey area (Gladstone Harbour Area) is clear to everyone
- Appropriateness of response category
- Order of questions

In total, there were 72 questions involving demographic, economic, social and cultural dimensions. The participants read the questions and took note about the issues they identified. Finally, an interactive discussion was held between the facilitators and the participants around the issues identified to reach a decision on the questions need to be modified, removed, added or revised to streamline the survey design.

The participants identified a number of questions that required rewording, revision, more clarity and rationalization. The participants suggested rewording or modifying some questions, reordering a couple of questions and revising some questions in terms of the response category or scale. The respondents also suggested re-defining (or more clearly defining) the 'Gladstone Harbour Area'. The questions were then reworded, modified, reordered or streamlined accordingly particularly those were deemed to be priority of modification. The final survey is included in Appendix B .

2.4.2 SECONDARY DATA SOURCES

A range of secondary data sources were also used to derive some measures. These included Gladstone Regional Council, the Australian Bureau of Statistics, Gladstone Ports Corporation Limited (GPCL), the Queensland Department of Agriculture, Fisheries and Forestry (QDAFF), the Office of Economic and Statistical Research and Tourism and Events Queensland.

The call for proposals suggested that the report card should be based on data for 2013-14. This was not available from all external sources due to time lags in compilation and release of the data. For example, commercial fisheries data are complete for the 2013 calendar year and 2012-13 financial year, but incomplete for 2014 (as the year is not yet over), but also incomplete for the 2013-14 financial year due to lags in uploading and validating the logbook information from fishers. The analysis was based on the most recent data available, and detailed in the results section.

2.5 Development of a framework for assessing performance

The relationship between the measures, indicators and the sub-components was developed using a Bayesian Belief Network (BBN) approach. Such an approach was used to link social indicators to sub-components in a national project on social sub-components of fisheries management (Healy 1994).

Bayesian networks are essentially graphical models to which probabilities of certain outcomes given certain situations or observations can be assigned. These probabilities can be derived through the use of expert opinion (in which case the models are generally described as Bayesian Belief Networks or BBNs), or derived from observations. Bayesian networks have been applied to fisheries in numerous cases, particularly when the effects of qualitative as well as quantitative factors are of interest (e.g. Little *et al.* 2004; Pollino *et al.* 2007; Cole 2010; Martin-Ortega *et al.* 2011; van Putten *et al.* 2013).

Bayesian network models provide a probability of an outcome rather than a discrete (deterministic) outcome. From the probability distribution, a mean (expected) outcome and confidence interval can be determined. The Bayesian Network "learns" from the data by comparing the observed outcomes with the different combinations of inputs, and hence from any combination of inputs one can derive a probability of different outcomes occurring.

For consistency, the Bayesian Network model was derived using the same data that were used to derive the regression tree models. The Bayesian Network model, however, is less "rules" based, and is able to consider all information that is available – even that which is not used in the "rules" of the regression tree. A further advantage of the Bayesian Network is that the inputs can also be given a probability distribution. That is, when there is uncertainty as to which category the species fall into then probabilities can be (subjectively) assigned to different levels, and these can be used to determine the most likely outcome.

The Bayesian Networks were derived using NETICA (www.norsys.com).

2.5.1 BBN STRUCTURE

An illustration of the structure of the BBN to be developed is given in Figure 9. The complete set of linkages that make up the BBNs has been presented in Figure 6, Figure 7 and Figure 8. How each indicator combines to inform the sub-component is determined through a combination of impact weighting and subjective assessment based on expert knowledge. The individual sub-component performances are aggregated to provide an overall core area performance. As noted previously, the project derived sub-component weights using a range of approaches, and evaluated which was most appropriate.

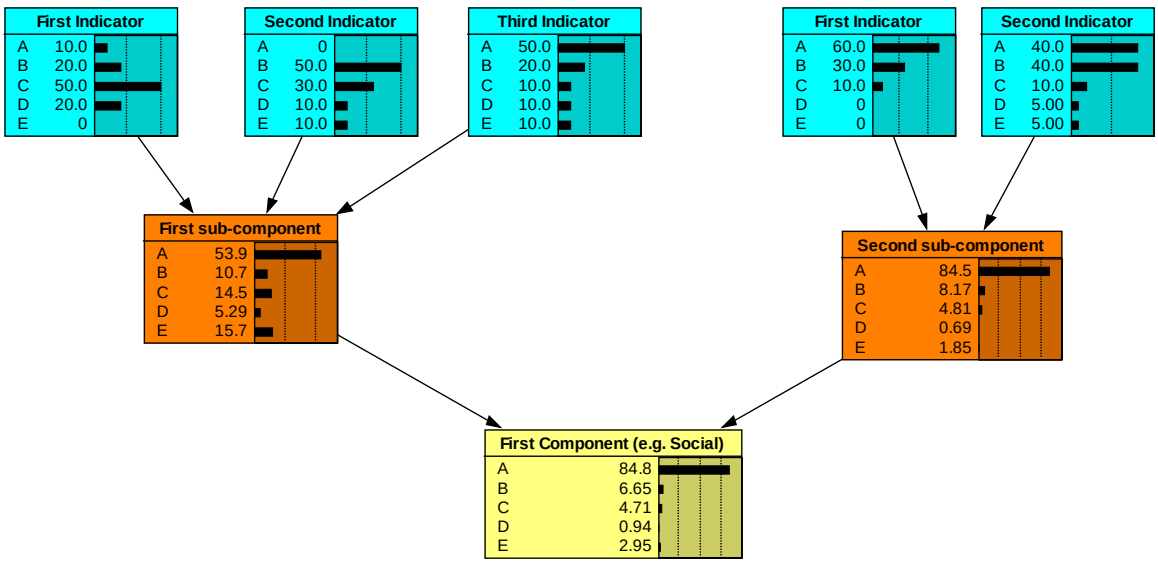


Figure 9. Example structure of the BBN for a given component

The weights that form the conditional probability tables that link the different components of the BBN were derived using a set of online survey of members of the Partnership, the ISP and other nominated experts or stakeholders involved in the workshop.

2.5.2 EXPERT AND COMMUNITY SURVEYS

As noted previously, additional surveys were undertaken to determine the conditional probability tables that link the sub-components to the overall core area, and the indicators to the sub-components and measures to the indicators. The sub-components survey was sent to 200 local residents who had responded to the CATI survey and had agreed to participate in a follow-on survey. A variant of the survey was also sent to 60 key stakeholders in the region who have a direct involvement in managing the direction of the Gladstone region, either through business, governance or scientific input. The aim of the two different surveys was to be able to contrast the general community's views (the consumer of the outcomes) with those of the managers (the producers of the outcomes).

A further online survey was developed aimed at social scientists in particular to develop the contingency probability tables linking the indicators to the sub-components, and the measures to the indicators. This was sent to 60 social scientists active in marine or coastal social science research.

2.5.3 SENSITIVITY ANALYSIS

Sensitivity analysis can be used to measure the degree to which findings at any node (e.g. the indicator measure) can influence the outcomes (or beliefs) at another node (e.g. the sub-component value), given the set of findings currently entered. For the purposes of this study, it can indicate which indicators will be the most informative in determining the sub-component scores. The results are indicative only, as the sensitivity analysis considers only individual sensitivities – evidence in combination may have a larger impact that the "sum" of the individual impacts (Jensen and Nielsen 2007).

"Evidence" in BBNs is often uncertain in itself, and the cost of increasing the precision may be high. Sensitivity analysis can also be viewed as a means of determining which variables (indicators) require the most attention to get accurate data (or at least more precise assessments) as these will be the ones that the outcomes are most sensitive to (Jensen and Nielsen 2007).

Sensitivity analysis can also be used as part of the model evaluation. The sensitivity measures can be compared with a priori expectations about importance of particular nodes (indicators) to ensure that the model is behaving as expected (Chen and Pollino 2012). If the plotted sensitivity function does not behave as expected, this may indicate errors in the network structure or the conditional probability tables (CPTs) (Pollino et al. 2007).

Two forms of sensitivity analysis are commonly considered: mutual information (entropy reduction) and the expected reduction of real variance. Entropy relates to the uncertainty of a variable (*Q*) characterised by a probability distribution, *P*(*q*) (Korb and Nicholson 2003; Pollino et al. 2007). Entropy reduction reports the expected degree to which the joint probability of *Q* and *F* diverges from what it would be if *Q* were independent of *F*. That is, it is a measure of the mutual information shared between the two nodes. If *I*(*Q,*F) is equal to zero, *Q* and *F* are mutually independent (Pollino et al. 2007)

The mutual information (I) between Q and F is measured in "bits". The expected reduction in entropy of Q (measured in bits) due to a finding at F[5].

$$I = \sum_{q} \sum_{f} \log_2 \left[\frac{P(q)}{P(q)P(f)} \right] \qquad (13)$$

[5] http://www.norsys.com/WebHelp/NETICA/X_Sensitivity_Equations.htm

where *q* is a state of the query variable (i.e. the sub-component) and *f* is a state of the varying variable (the indicator). The measure is logged with a base of 2, which is traditional for entropy and mutual information so that the units of the results will be "bits".

Variance Reduction refers to the expected reduction in variance of the expected real value of Q due to a finding at F.

$$Vr = \sum_q P(q)\left[X_q - \sum_q P(q) X_q \right]^2 - \sum_q P(q|f)\left[X_q - \sum_q P(q|f) X_q \right]^2 \qquad (14)$$

where *Xq* is the numeric “real” value corresponding to state q (i.e. the sub-component). In this case, "real" refers to the expected value of continuous nodes, or discrete nodes which have a real numeric value associated with each state. In our model, all nodes are continuous, with a value ranging from 0 (zero) to 1.

The results of the sensitivity analysis depend strongly on network parameters and on the current states of all observable nodes (Bednarski *et al.* 2004). In our analysis, we assumed no prior information on the states of the nodes, with each state having an equal probability. The analysis hence assesses the effect on the sub-component node from moving from no information to full information (i.e. moving to either a zero or 100 percent likelihood of a state), given that no information (uninformed priors) exist in the other nodes not be adjusted.

3 Results

3.1 Community CATI Survey

3.1.1 KEY DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

The sample of survey respondents were divided evenly by gender (51% male, 49% female), and spread across all age group categories (Figure 10), but fewer individuals were obtained from the younger age categories below that of 35 years (i.e. fewer within the following categories: 18-24 years and 25-34 years), and more from the older age categories (compared with the 2011 census distribution). Eleven percent of respondents identified themselves as Traditional Owners of the area.

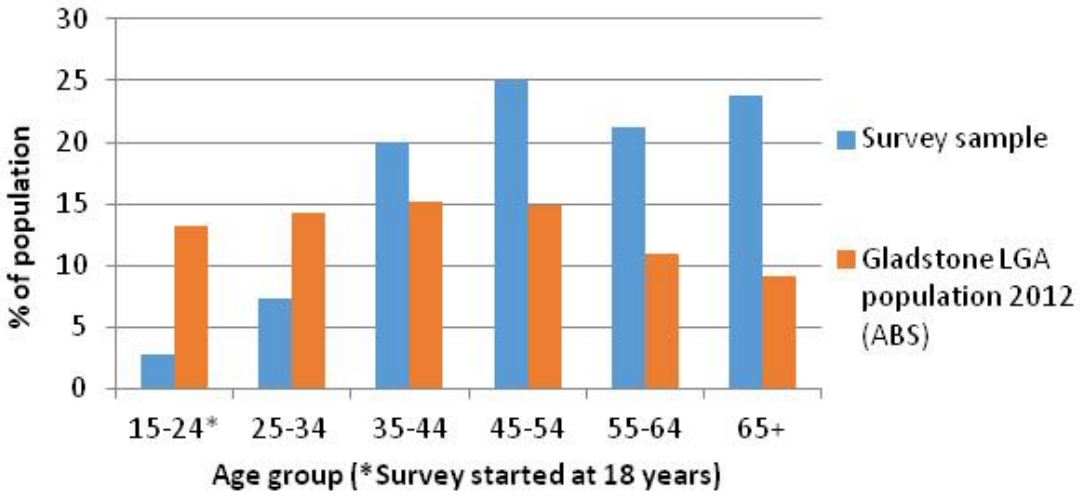


Figure 10. The age structure of the population and sample (n=400) in the Gladstone Harbour region.

There is a significant difference between the sample and population in all age categories apart from the 33-44 years age group, see Table 9.

Table 9. Comparison of sample and population age distribution

Age	Survey	ABS census data	Sig. diff.
18 -24 years	3%	11%	*
25-34 years	7%	18%	*
35-44 years	20%	20%	
45-54 years	25%	19%	*
55-64 years	21%	13%	*
65 + years	24%	19%	*

* Indicates a statistical difference between the sample and the population when applying the normal approximation to the binomial test

Respondents were surveyed across all income categories. There were fewer individuals earning between $65,000-$78,000 and more in the highest income category (>$156,000) (Figure 12).However, this was broadly consistent with the income distribution from the 2011 census (Table 10).

Most respondents owned their home without a mortgage (41%) or with a mortgage (41%), rather than renting (14%). Those with a mortgage (n=163) typically did not pay greater than $3,000/month (83%). Of those that rent (n=55), most (78%) payed more than $175/week in rent. Respondents' homes typically contained 3 bedrooms (45% of respondents) or 4 bedrooms (39%). Most households (98%) owned a car.

Table 10. Comparison of sample and census income distribution

Income	Survey	ABS census data	Sig. diff.
(Less than $20,799) Less than $399 weekly	12%	8%	*
($20,800-$41,599) $400 -$799 weekly	13%	13%	
($41,600-$64,999) $800 - $1249 weekly	10%	12%	
($65,000-$77,999) $1250 - $1499 weekly	5%	7%	
($78,000-$103,999) $1500 - $1999 weekly	18%	15%	
($104,000-$129,999) $2000 - $2499 weekly	12%	11%	
($130,000-$155,999) $2500 - $2999 weekly	11%	16%	*
($156,000+) $3000+ weekly	20%	20%	

* Indicates a statistical difference between the sample and the population when applying the normal approximation to the binomial test

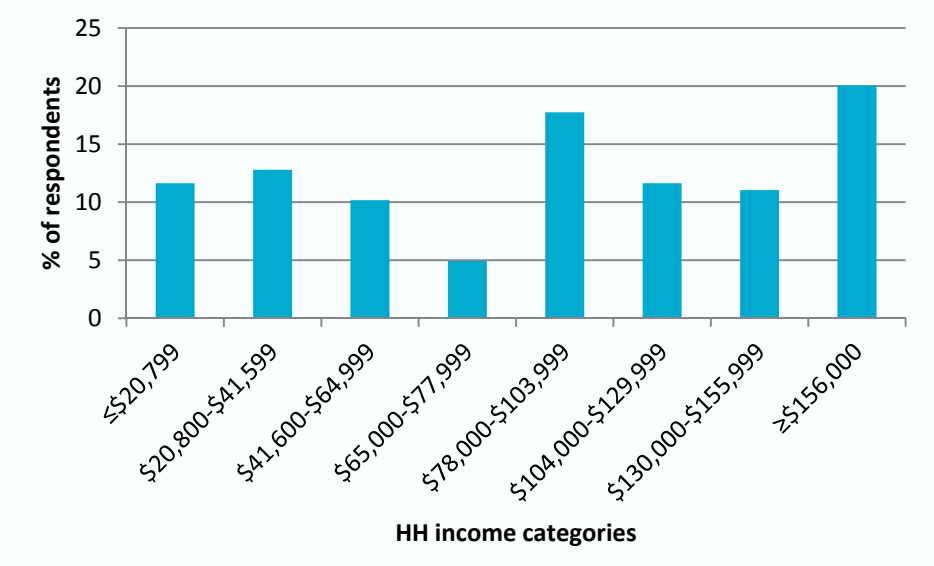


Figure 11. The income categories of respondents within the survey sample (n=400).

Most households consisted of 2 adults (66% of households), while only 13% had 1 adult in the household. Most (62%) also had no children in the household (Figure 12). Few households included an unemployed adult (14% of households) or a self-employed adult (16%).

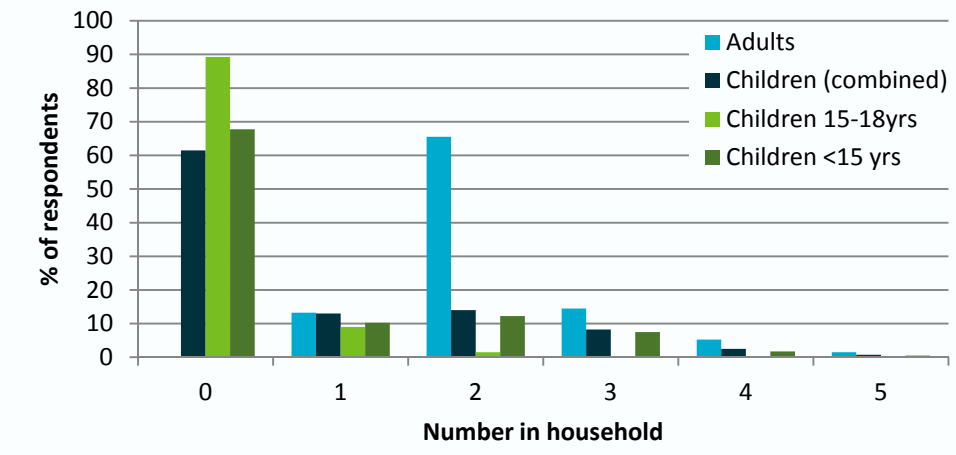


Figure 12. The number of adults and children in respondents' households (n=400).

Most (63%) of the survey respondents lived in the broader Gladstone urban area, while 14% lived in the southern beach areas of the Harbour. A further 20% lived outside the urban or beach areas, but within a radius of 20 km from the coast. The final 3% of respondents lived in other areas but within the Gladstone District.

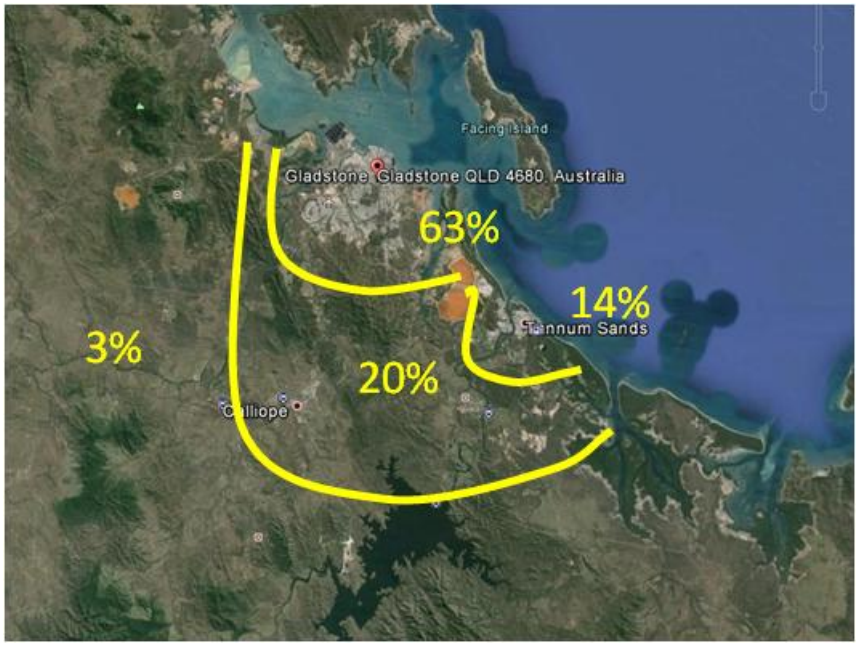


Figure 13. Approximate geographical distribution of the sample.

(Derived from Google earth)

3.1.2 WORD CLOUD ANALYSIS

At the start of the survey, the community CATI survey participants were asked "When you think of the Gladstone Harbour area, what are the first three words that come into your mind?" The responses were prepared and subsequently analysed to produce two word clouds.

Word clouds provide a means to visually identify key recurring issues or themes in an area, and have been used in a wide range of applications ranging from predicting future policy directions from political speeches

(Mazzotta *et al.* 1994) to the analysis of key issues around environmental sustainability (Unsworth and Bishop 1994).

The preparation of the data followed a process whereby two or more worded responses were hyphenated to create one word – for instance, where a respondent stated 'Dirty Water', this became 'Dirty-Water'. All entries of the word 'None' were removed since the word was given by respondents to indicate that they could not or would not give three words as requested. Only two instances of the word 'none' were recorded in the first word response, whereas 16 instances were recorded for the second word, and 54 instances for the third word (approximately 13%).

All spelling errors from the word responses were detected and corrected e.g. 'Excessable' was edited to become 'Accessible'. The only indeterminable word was 'Draid', it was left in the word set since it may have some unknown significance. Similarly, all plural words were altered to singular except where plural was more appropriate e.g. Boat became Boats, and Beach became Beaches.

Some terms required revision for consistency. For example, 'Ships' and 'Industrial Ships' were altered to 'Shipping', and 'Polluted' was changed to 'Pollution'. Similarly, 'Beauty' and 'Beautifully' were revised to 'Beautiful', except in cases where beautiful (or similar) was used as an adjective (e.g. Beautiful-Spot; Beautiful-Islands; Beautiful-Harbour). Some prepositions were removed e.g. 'Nice-to-be-on' became Nice; 'Not as clear as it used to be' became Not-clear; LNG Liquid and Gas and LNG Gas Line both became LNG.

The resulting word set was analysed using the open source web-based app Wordle to produce the word cloud image (see www.wordle.net). The cloud gives greater prominence (larger font size) to those words that appear most frequently.

We prepared two results, the first (Figure 14) based on just the first word supplied by the respondent in answering the question. The second word cloud (Figure 15) was produced from an analysis of all three words given by the respondents (first, second and third) to this question in the survey. The word sets can be viewed in Appendix B.

Figure 14. Word cloud of first word response by CATI survey respondents.

Figure 15. Word cloud of all three words given as a response by CATI survey respondents.

The results suggest that most people view the region positively, as an area of beauty. However, negative aspects were also fairly dominant, with pollution, busy, and dirty appearing frequently. Other dominant aspects, such as fishing and shipping, are ambiguous in their interpretation. For example, some people (e.g. recreational fishers) may view fishing as a positive attribute, while others may see it as just a part of economic activity in the region (neither good nor bad). Similarly, some may view shipping as a negative feature, while others see it as a major part of economic activity in the region.

3.2 Cultural indicators and measures

The measures for the cultural indicators were largely derived from the CATI survey, although in some instances secondary data were also used. A summary of the data sources for the key cultural measures and indicators is presented in Table 11. In all cases, the results were presented as a distribution, in most cases based on the outcomes using a 10 point scale from the CATI survey.

3.2.1 CULTURAL HERITAGE

Half of the CATI respondents (51.8%) believed that the traditional sites and customs in the Gladstone Harbour area were well protected (mean 5.89, SE 0.14). More than half of the respondents (59.8%) believed that the Traditional Owners of the region were well consulted by the regional managers (mean 6.38, SE 0.13).

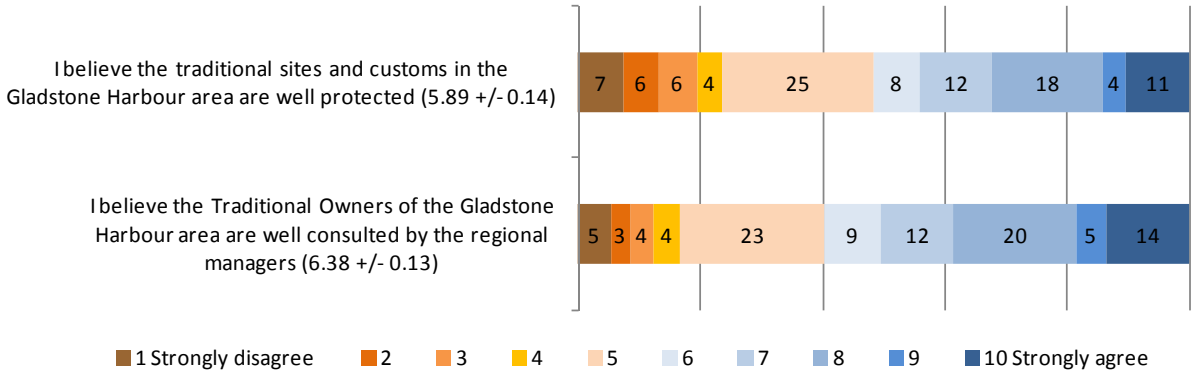


Figure 16. Agreement scales for questions relating to perceptions of protection of cultural heritage (n=361 and 341, respectively). Percentage of respondents is included within the bars.

Information on the proportion and/or quality of indigenous sites protected was not available. The default setting of equal likelihood of all outcomes was applied in the BBN. There are 724 site points recorded on the State's Aboriginal cultural heritage database within the Port Curtis Coral Coast native title claim area (Gregory Heath, Regional Coordinator for Central Queensland, Cultural Heritage, Department of Aboriginal and Torres Strait Islander and Multicultural Affairs, Personal Communication September 2014). However, information on the quality and importance of these sites, and the proportion of sites not registered, is not available. A separate study is being developed by the GHHP to try and fill this information shortfall.

Information on non-indigenous heritage sites is provided through the local heritage register (http://www.gladstone.qld.gov.au/local-heritage-register#ae). The condition of heritage listed sites (given the highest level of protection) is not recorded. The condition of non-listed sties is monitored and recorded, and used to derive the B-E scale as indicated in Table 11.

Table 11. Indicators and measures data and baselines: Cultural component

Sub-component	Indicator	Measure	Data source	Distribution or point?	Baseline/benchmark
Cultural Heritage	Traditional sites protected	Traditional sites protected	CATI survey	Distribution	10 point scale
	Traditional owners consulted	Traditional owners consulted	CATI survey	Distribution	10 point scale
	Proportion of known indigenous sites protected	Proportion of known indigenous sites protected	-	-	-
	Condition of non-indigenous cultural heritage sites	Condition of non-indigenous cultural heritage sites	Local heritage register	Distribution	A=Listed; B= not listed, good condition; C= not listed, fair condition; D=not listed, poor condition; E=not listed, unknown condition
Sense of Place	Measures of distinctiveness	No place better	CATI survey	Distribution	10 point scale
		Who I am	CATI survey	Distribution	10 point scale
	Continuity	How long lived in the area	CATI survey	Distribution	Proportion of life in the area (0-100%)
		Stay 5 years?	CATI survey	Distribution	10 point scale
	Self esteem	Self esteem	CATI survey	Distribution	10 point scale
	Self efficacy	Quality of life	CATI survey	Distribution	10 point scale
		Input into management	CATI survey	Distribution	10 point scale
	Attitudes to Gladstone Harbour	Key part of community	CATI survey	Distribution	10 point scale
		Great asset to the region	CATI survey	Distribution	10 point scale
		Great asset to Queensland	CATI survey	Distribution	10 point scale
	Values of Gladstone Harbour	Variety of marine life	CATI survey	Distribution	10 point scale
		Opportunities for outdoor recreation	CATI survey	Distribution	10 point scale
		Attracts visitors to the region	CATI survey	Distribution	10 point scale
		Enjoy scenery and sights	CATI survey	Distribution	10 point scale
		Spiritually special places	CATI survey	Distribution	10 point scale
		Culturally special places	CATI survey	Distribution	10 point scale
		Historical significance	CATI survey	Distribution	10 point scale

3.2.2 SENSE OF PLACE

All indicators and measures relating to the sense of place sub-component were derived from the CATI survey.

A measure of continuity (how long lived in the area) was derived from a combination of the age of the respondent and the number of years they had lived in the region, with the later divided by the former to provide a percentage of their life living in the area. This was considered more appropriate than just years living in the area as younger respondents would be disadvantaged by the single measure. From the survey, respondents had been living in Gladstone between 6 months and 79 years (mean 26.5 years, SE 0.81).

Respondents felt proud that they lived in the Gladstone community (82% agree, mean 7.57, SE 0.13) (Figure 17) and most (77%) planned to be a resident of the region in the next 5 years (mean 7.45, SE 0.16).

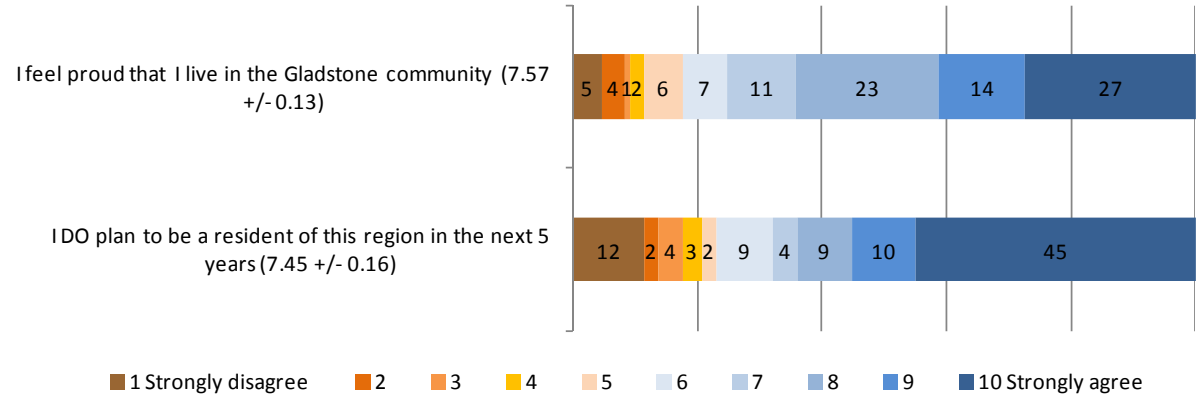


Figure 17. Agreement scales for questions relating to continuity and self-esteem, within sense of place (n=398 and 391, respectively). Percentage of respondents is included within the bars.

Respondents to the survey strongly identified with the Gladstone Harbour area (Figure 18). For example, 92.2% of respondents agreed that the Gladstone Harbour was a key part of the Gladstone community (mean 8.53, SE 0.09). For 73.3% of respondents, the Gladstone Harbour was seen to improve the quality of life, and 65.8% of respondents suggested that the Gladstone Harbour is part of who they are (mean 7.57, SE 0.12). Respondents were divided (50% agreed) however, regarding whether there were better places than the Harbour for the recreational activities they do (mean 5.46, SE 0.15).

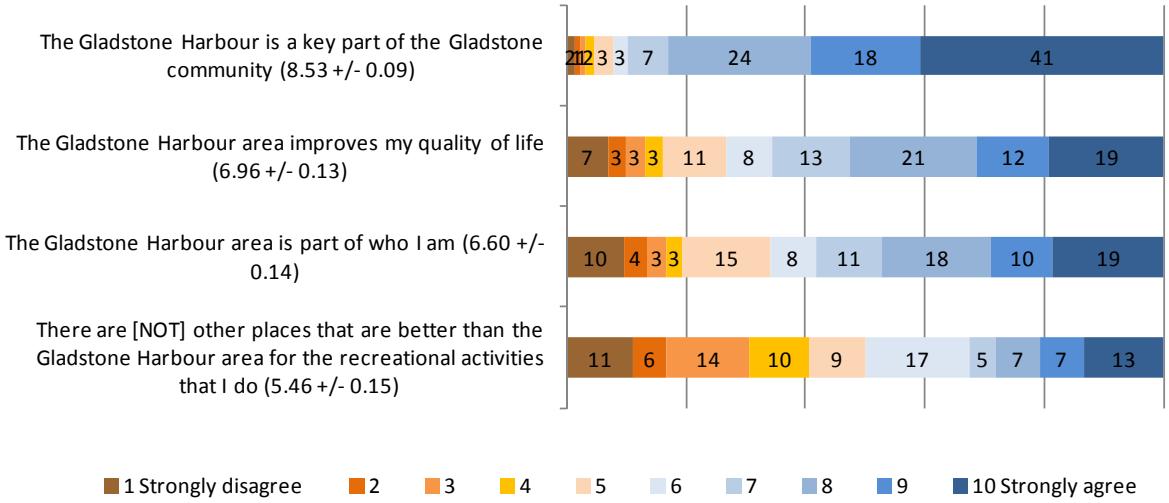


Figure 18. Agreement scales for questions relating to self-efficacy, uniqueness, and attitudes towards the Harbour, within sense of place (n=391-398). Percentage of respondents is included within the bars.

Respondents to the survey were slightly more likely to value the economic and recreational aspects of the region over the environmental and cultural values (Figure 19). For example, 92.4% and 91.4% of respondents respectively agreed that the Gladstone Harbour was a great asset for the economy of Queensland and for the economy of region (mean 8.63, SE 0.09 and mean 8.54, SE 0.11). Some 90.4% of people valued the Gladstone Harbour for the recreational opportunities provided (mean 8.21, SE 0.09). The scenery and sights were valued by 88% of respondents (mean 8.05, SE 0.10). The Gladstone Harbour was valued for the variety of marine life it supported by 83.5% of respondents (7.62, SE 0.11) and because it attracts visitors to the region by 76.7% of respondents (mean 7.23, SE 0.11). Spiritually special places, culturally special places and places of historical significance within the Harbour area were valued by 47.7%, 45.2% and 52.9% of respondents respectively (means 5.5, 5.42, 5.79 and SE 0.14, 0.13, 0.13).

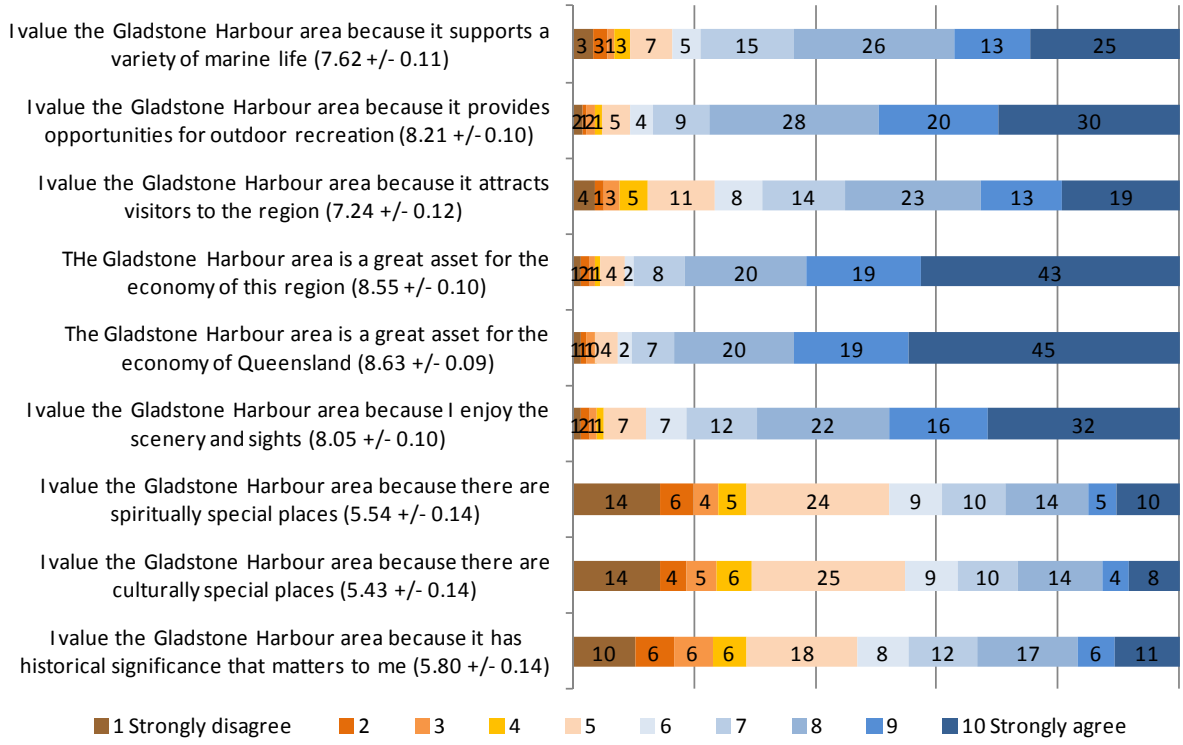


Figure 19. Agreement scales for questions regarding the value of environmental, economic, social and cultural aspects of the Gladstone Harbour (n=377-399). Percentage of respondents is included within the bars.

3.3 Social indicators and measures

The measures for the social indicators were also largely derived from the CATI survey, although in some instances secondary data were also used. A summary of the data sources for the key social measures and indicators is presented in Table 12. In most cases, the results were presented as a distribution based on the outcomes using a 10 point scale from the CATI survey. In some cases, involving secondary data, a point estimate of the score was derived and compared to a distribution of similar scores from other regions and time periods.

Table 12. Indicators and measures data and baselines: Social component

Sub-component	Indicator	Measure	Data source	Distribution or point?	Baseline/benchmark
Harbour access	Satisfaction with access to the Harbour	Satisfaction with access to the Harbour	CATI survey	Distribution	10 point scale
	Satisfaction with ramps, public access and spaces	Access to public spaces	CATI survey	Distribution	10 point scale
		Number of ramps	CATI survey	Distribution	10 point scale
		Frequency of use	CATI survey	Distribution	more,same,less
	Harbour health	Great condition	CATI survey	Distribution	10 point scale
		Optimistic about future health	CATI survey	Distribution	10 point scale
		Improved over last 12 months	CATI survey	Distribution	10 point scale
	Barriers to access	Marine debris a problem	CATI survey	Distribution	10 point scale
		Marine debris affects access	CATI survey	Distribution	10 point scale
		Shipping reduced use	CATI survey	Distribution	10 point scale
		Recreational boats reduced use	CATI survey	Distribution	10 point scale
Harbour usability	Satisfaction with Harbour recreational activities	How satisfied last trip?	CATI survey	Distribution	10 point scale
		Quality of ramps and facilities	CATI survey	Distribution	10 point scale
	Air and water quality	Water quality satisfaction	CATI survey	Distribution	10 point scale
		Air quality satisfaction	CATI survey	Distribution	10 point scale
		Water quality does not affect use	CATI survey	Distribution	10 point scale
	Harbour safety	Happy to eat seafood	CATI survey	Distribution	10 point scale
		Safe at night	CATI survey	Distribution	10 point scale
		Oil spills	Maritime Safety Queensland	Point	Time series 2001-02 to 2012-13, all ports
		Marine safety incidents	Dept. Transport and Main Roads	Point	Time series 2007 to 2013, all ports
Liveability	Makes living a better experience	Happy to eat seafood	CATI survey	Distribution	10 point scale
	Participate in community events	Safe at night	CATI survey	Distribution	10 point scale

3.3.1 LIVEABILITY AND WELLBEING

From the CATI survey, 92% of respondents believe the Gladstone Harbour is a key part of the Gladstone community (mean 8.53, SE 0.09), and 73.3% of respondents agreed the Gladstone Harbour improved their quality of life (mean 6.96, SE 0.13). Similarly, 80% of respondents agreed Gladstone Harbour makes living in Gladstone a better experience (mean 7.47, SE 0.12) (Figure 20). However, only half of the respondents regularly participated in community events in the Harbour area (mean 5.52, SE 0.14).

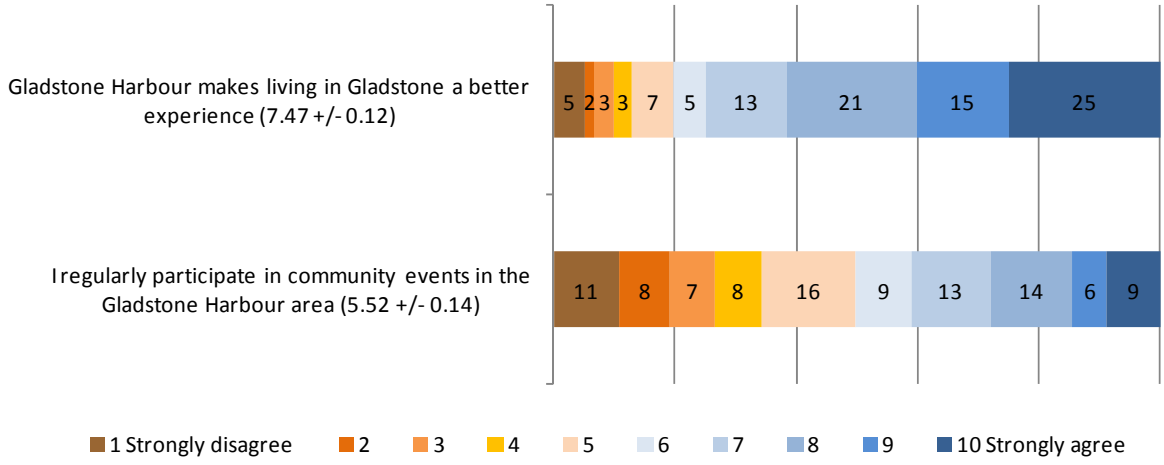


Figure 20. Agreement scales for questions regarding the contribution of the Gladstone Harbour to liveability and well-being (n=398 and 397, respectively). Percentage of respondents is included within the bars.

3.3.2 HARBOUR ACCESS

From the CATI survey, almost all respondents (99%) had visited the Harbour area in the previous 12 months. Most (93%) of those people had visited specifically for recreation. Most respondents (see Figure 21) also believed they had fair access to the Harbour, and were satisfied with the level of access to public spaces (means 7.34 and 7.35 respectively, SE 0.11 each). Respondents were also satisfied with the number of boat ramps (means 6.88, SE 0.12). However, less than half of the survey respondents (41.9%) felt that they were able to have input into the management of the Gladstone Harbour if they choose to (mean 4.98, SE 0.15).

Most respondents agreed the amount of shipping (71%) and recreational boating activity (81%) in the Harbour has not reduced their use of the area (means 6.89 and 7.51, SE 0.16 and 0.13 respectively). Similarly, most agree marine debris (82%) and water quality in the Harbour does not affect their access or frequency of use (respectively) (means 7.55 and 6.15, SE 0.12 and 0.16, respectively), (Figure 21).

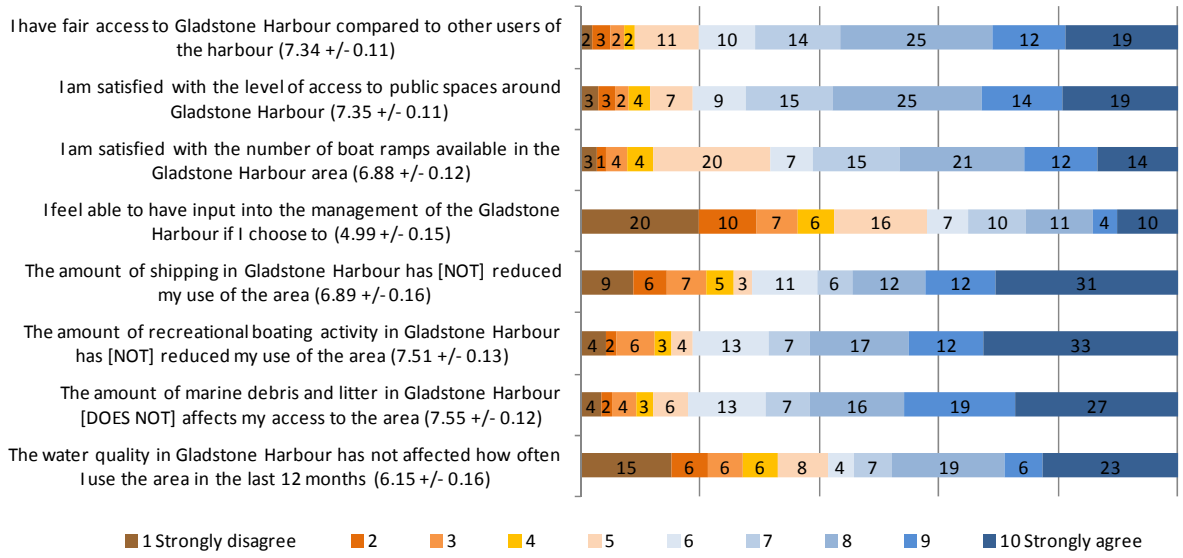


Figure 21. Agreement scales for questions regarding perceptions of access to the Gladstone Harbour area (n=355-398). Percentage of respondents is included within the bars.

3.3.3 HARBOUR USABILITY

From the CATI survey, most people (89%) who had visited the Gladstone Harbour area for recreation were satisfied with their trip (mean 8.0, SE 0.10 for the 10-point scale question). Perceptions of the useability and condition of the Harbour were mixed (Figure 22). Most (61.4%) believed that the Harbour area was in great condition (mean 5.96, SE 0.14), and a slight majority (56.1%) were optimistic about the future health of the Harbour (mean 6.04, SE 0.14). However, only 48.4% believed that the health of the Harbour had improved in the past year (mean 5.54, SE 0.14). The majority (70.8%) were satisfied with the quality of the boat ramps (mean 6.81, SE 0.12), and 52.2% were not concerned about marine debris and litter (mean 5.44, SE 0.14). On the other hand, only 33.4% were not concerned about water quality (mean 4.34, SE 0.16), and 27.5% were not concerned about air quality (mean 3.85, SE 0.15) in the Harbour area. Slightly more optimistically, 55.9% were happy to eat seafood caught in the Harbour area (mean 5.70, SE 0.17). Some 61.6% of respondents felt safe being in the Harbour area at night time (mean 6.20, SE 0.14).

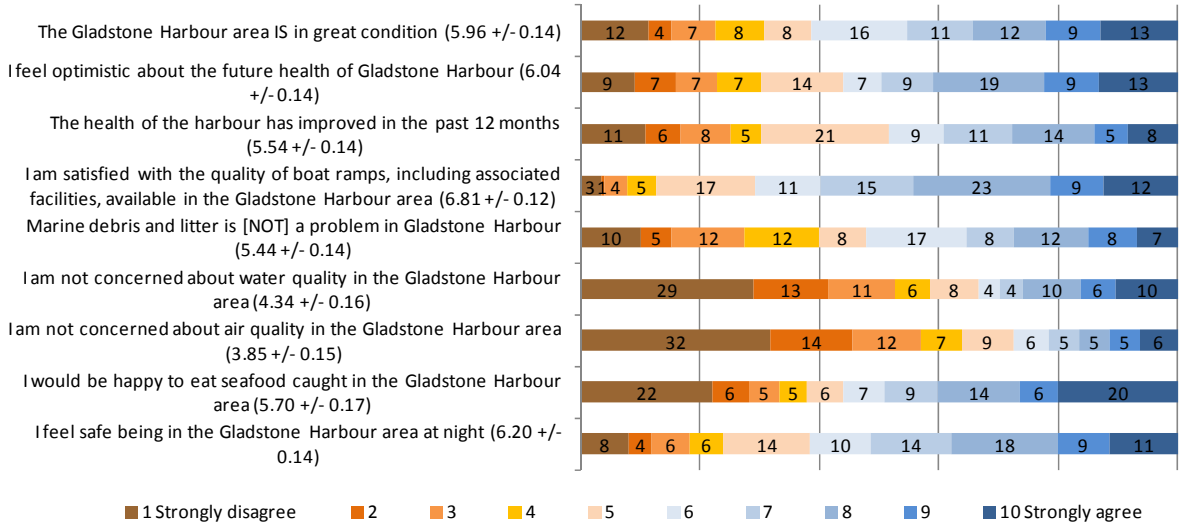


Figure 22. Agreement scales for questions regarding perceptions of useability of the Gladstone Harbour area (n=367-398). Percentage of respondents is included within the bars.

A key aspect of the Harbour safety component was the number of oil spills and the number of maritime incidents. The performance measures for these were derived from secondary data. Oil spill information was obtained from Marine Safety Queensland (2013), which included the number of reported oil spills in all major Queensland maritime regions (Brisbane, Cairns, Gladstone, Gold Coast, Mackay and Townsville) over the period 2001-02 to 2012-13. These were normalised per 10,000 registered vessels (to allow for different levels of boat traffic in each port), and a distribution of oil spill incident rates derived (Figure 23). In 2012-13 (the last year of the data), 6.04 incidents per 10,000 vessels were observed in Gladstone, which falls at the 85th percentile. As a higher value is less desirable than a low value in this case, the report card measure used was hence 0.15 (i.e. 100%-85%).

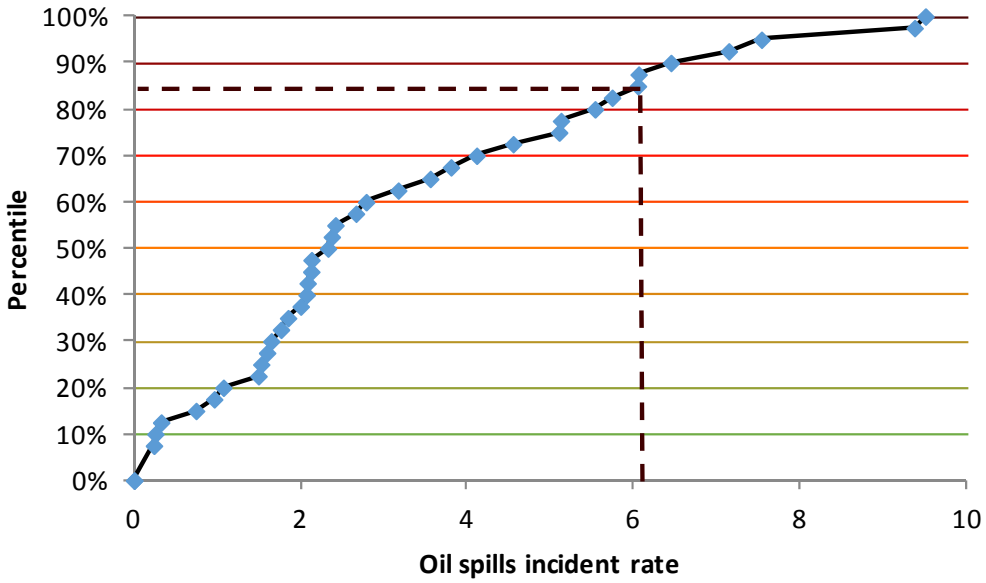


Figure 23. Oil spill incident rates distribution

Similarly, the number of reported marine safety incidents for the same maritime regions as above was derived from Department of Transport and Main Roads (2014) and earlier issues, and again normalised per 10,000 registered vessels. Again, a distribution of safety incident rates was constructed covering the period 2007-2013 inclusive. In 2013 (the last year of the data), the incident rate in Gladstone was 45 incidents per 10,000 vessels, which falls at the 76th percentile. As a higher value is less desirable than a low value in this case, the report card measure used was hence 0.24 (i.e. 100%-76%).

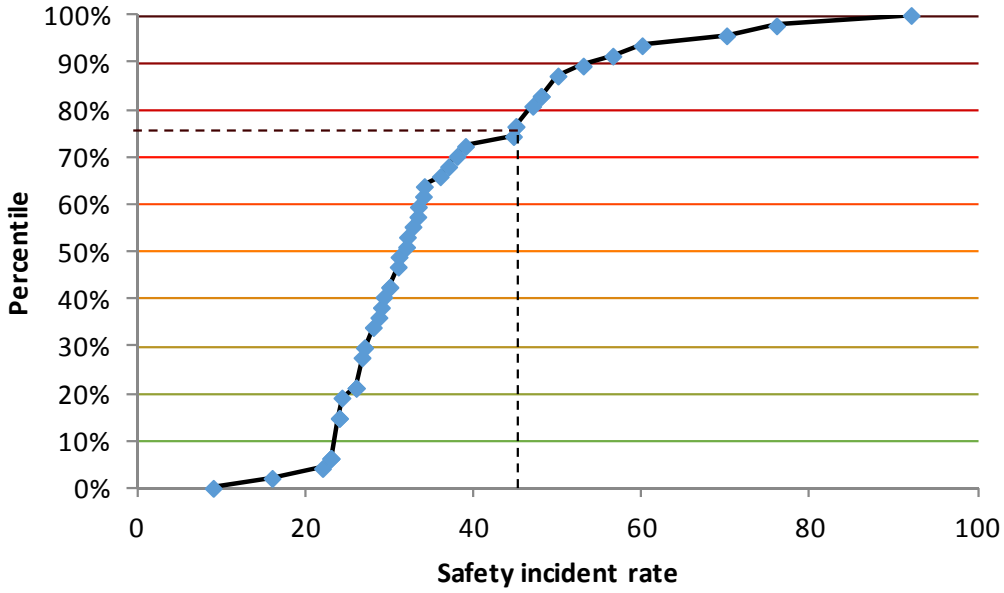


Figure 24. Maritime safety incident rates distribution

3.4 Economic indicators and measures

The measures for the economic indicators were largely derived from the secondary data, although some were derived from information collected in the CATI survey. A summary of the data sources for the key economic measures and indicators is presented in Table 13.

Table 13. Indicators and measures data and baselines: Economic component

Sub-component	Indicator	Measure	Data source	Distribution or point?	Baseline/benchmark
Direct economic footprint	Commercial fishing	Line fisheries productivity	QFIsh	Point	time series, 1990-91 to 2013-14
		Net fisheries productivity	QFIsh	Point	time series, 1990-91 to 2013-14
		Trawl fisheries productivity	QFIsh	Point	time series, 1990-91 to 2013-14
		Pot fisheries productivity	QFIsh	Point	time series, 1990-91 to 2013-14
	Shipping activity	Shipping activity productivity	Gladstone Ports Corporation Limited	Point	Time series
	Tourism related sectors	Tourism related sectors expenditure	economy.id.com.au	Point	Last 10 years expenditure
Economic stimulus to community	Employment	Employment	Queensland Office of Economic and Statistical Research	Point	Queensland 2013 distribution
	Socio-economic status	Socio-economic status (IER)	CATI survey, ABS	Point	Australian 2011 distribution
Recreational value	Beach recreation	Beach recreation satisfaction	CATI survey	Distribution	10 point scale
	Recreational fishing	Recreational fishing satisfaction	CATI survey	Distribution	10 point scale
	Land based recreation	Land based recreation satisfaction	CATI survey	Distribution	10 point scale

3.4.1 ECONOMIC STIMULUS TO THE COMMUNITY

The two key indicators of the economic stimulus to the community were the unemployment rate and the index of economic resources for the Gladstone region.

Index of economic resources

The index of economic resources (IER) is a composite measure of the economic wellbeing of a community. It takes into account income extremes (both high and low) in a population, as well as household ownership, costs of living and other indicators relevant to economic wellbeing in a community.

The IER is formally calculated from census data, but a revised estimate of the IER for the Gladstone region was derived from information collected in the CATI survey. The key components of the IER, their relative weights (loadings) and the survey derived values are given in Table 14. Further details on the loadings and measures are provided by Strange *et al.* (2002).

The weightings of the IER components were developed such that at the sum of the impacts for the "average" region equals zero. The index for the normalised mean region was set to 1000, so that the score for the Gladstone region can be approximated by adding the 65 to this, giving an index score of 1065.

The estimate is an approximation only, and assumes that all other regions did not equally improve their performance since 2011 (otherwise the re-normalised distribution would lower the estimated Gladstone score). It also assumes that the results from the survey are representative of the conditions of the population as a whole (as the 2011 values are census based).

Table 14. Estimated IER for 2014 based on survey results

Indicator	Survey results	Loading	Impact on IER
Income			
• **INC_LOW**	13	-0.79	-11
• **INC_HIGH**	46	0.63	29
Employment			
• **UNEMP_RATIO**	5	0.57	-3
• **UNINCORP**	16	0.49	8
Housing			
• **OWNING**	46	0.33	15
• **MORTGAGE**	41	0.66	27
• **HIGHMORTGATE**	7	0.67	5
• **LOWRENT**	3	-0.72	-2
• **GROUP**	15	-0.31	-4
• **LONE**	12	-0.66	-8
• **OVERCROWD**	3	-0.54	-2
• **HIGHBED**	28	0.74	21
Other			
• **ONEPARENT**	1	-0.66	-1
• **NOCAR**	2	-0.77	-1
Total IER			1065

The distribution of IER scores from the 2011 census, and the relative position of the revised Gladstone score are shown in Figure 25. The revised estimated score (1065) is higher than the previous score (1039) from the 2011 census data, and based on the distribution of results in the 2011 census would place Gladstone in the top 10% of all local government areas in Australia. This is largely driven by the high proportion of residents who fall into the high income group, the relatively high proportion of home ownership (with and without a mortgage) and the relatively large size of the houses in the region.

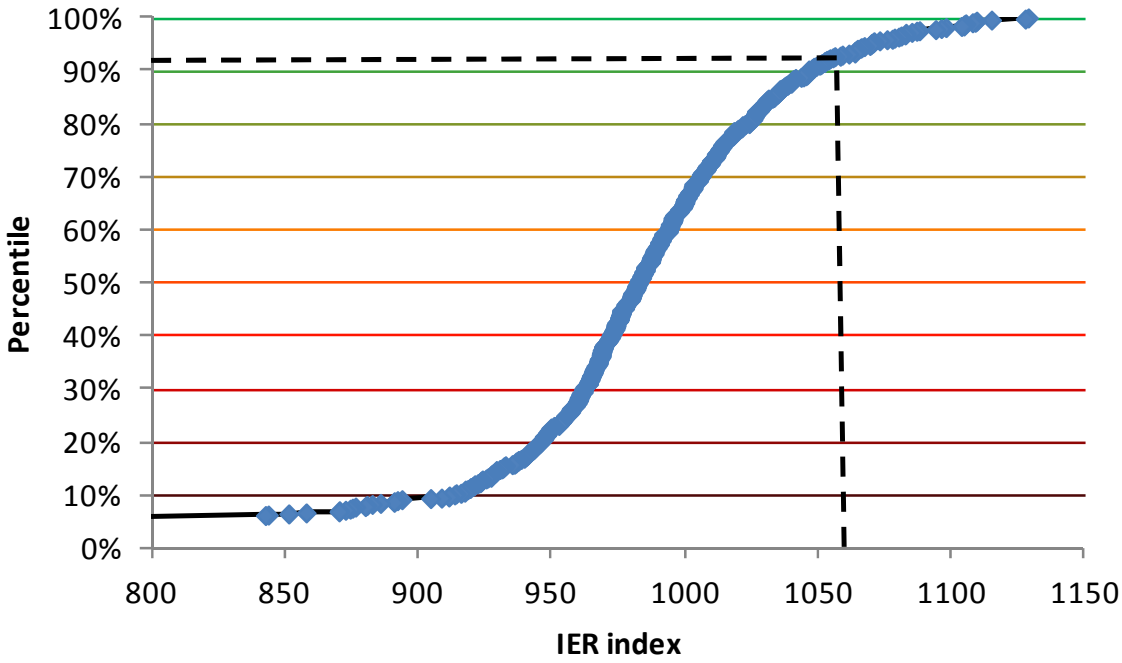


Figure 25. Distribution of IER scores, Australia 2011, and estimate for Gladstone 2014

Unemployment

Unemployment forms part of the IER measure, but is also a useful indicator on its own of regional economic performance.

Unemployment statistics at the local government area (LGA) level for Queensland were obtained from the Queensland Office of Economic and Statistical Research (OESR).[6] The most recent available data were for the 2013 December quarter. Unemployment in the Gladstone LGA was compared with rates in all Queensland LGAs (Figure 26). The rate (4.8%) was in the top 30% within the State, giving a score of 0.73 for this indicator.

[6] These and other statistics are available from http://statistics.oesr.qld.gov.au/qld-regional-profiles

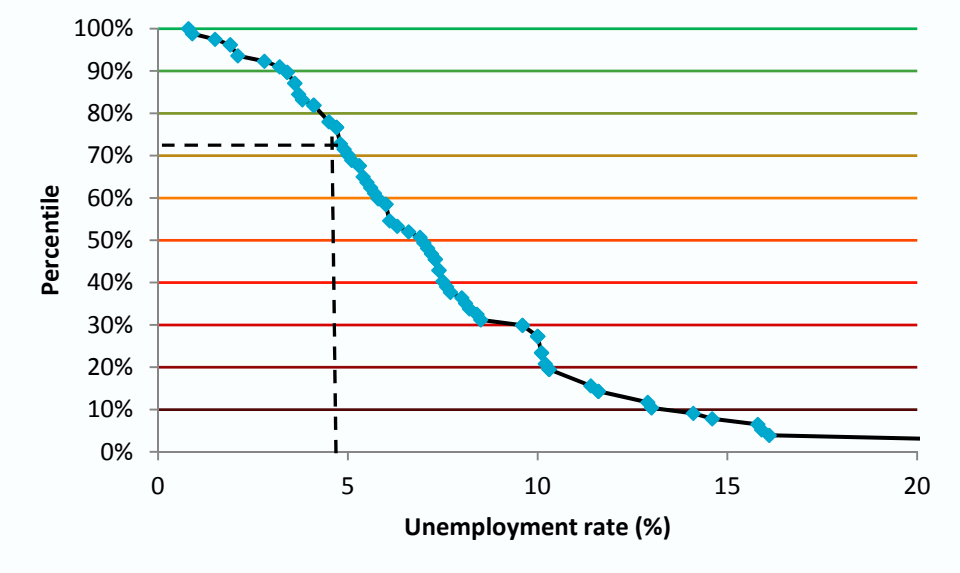


Figure 26. Distribution of unemployment rates, Queensland December 2013

3.4.2 ECONOMIC PERFORMANCE OF HARBOUR BASED INDUSTRIES

Three key industries were considered for this measure: the level of shipping, commercial fishing and tourism. The outcome of each measure (i.e. the score) was weighted by its relative revenue share to determine an overall performance measure. Given the dominance of shipping in terms of value generated in the regional economy ($889 million in 2013-14), this tends to dominate the overall economic performance measures. In contrast, fishing ($5 million in 2013-14) and tourism ($77 million) have a smaller influence on the economic performance sub-component score.

Measures of total turnover for other Harbour based industries were also considered. This proved problematic due to insufficient appropriate data so was not incorporated into the final BBN analysis. Details of the analysis are presented below.

Shipping

Information on monthly shipping movements (by cargo type and destination/origin) is provided by the Gladstone Ports Corporation Limited (GPCL).[7] Coal exports have dominated shipping activity in most months; generally comprising around two thirds of export based shipping (Figure 27). The remainder includes alumina and aluminium, cement and cement products, agricultural products and general cargo. Around half of the inward bound shipping is related to bauxite (used in aluminium production), while most of the remainder provides inputs for other local industry. Shipping movements therefore act as a barometer for regional economic activity.

The total quantity of ship movements has generally increased over the last decade, but at a relatively slow rate. This mostly reflects changes in onshore economic activity, although not all of this activity takes place in the Gladstone region (e.g. coal is brought into the region). In 2012-13 (the last year with available financial statistics), GPCL generated $889m in revenue (Flores and Thatcher 2002).

[7] www.gpcl.com.au/OperationsDevelopment/TradeStatistics.aspx

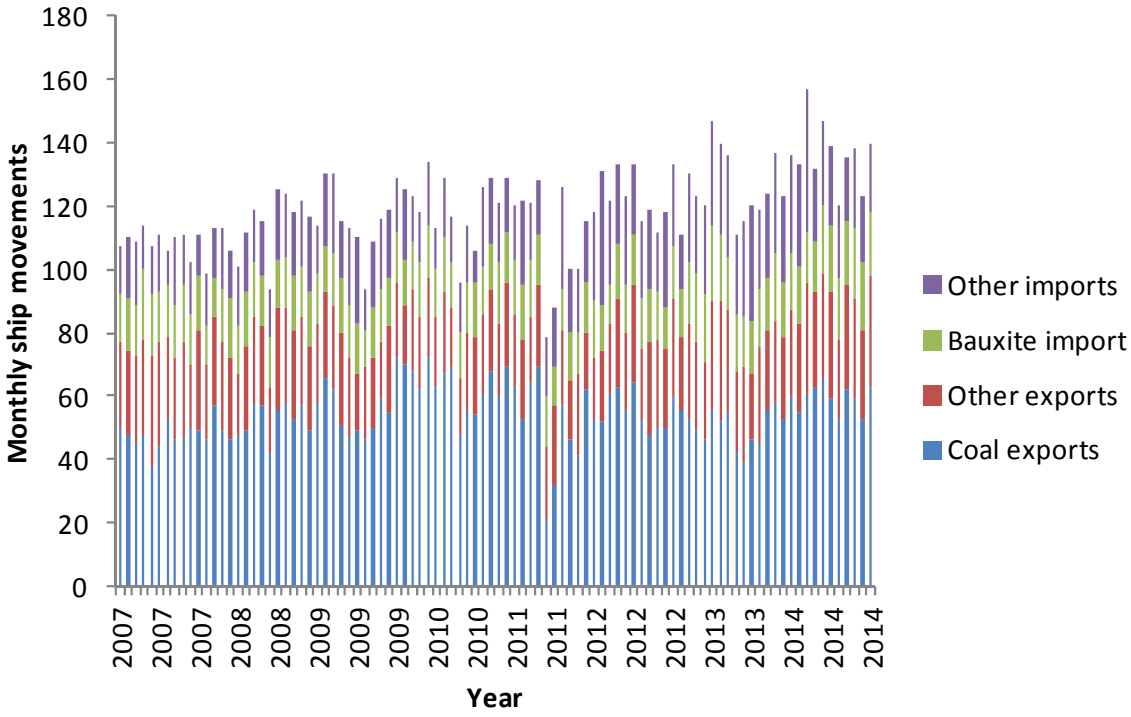


Figure 27. Ship movements, 2006-07 to 2013-14, Gladstone Harbour

The monthly ship movement information was used to estimate capacity utilisation measures. The outputs used were the four types of activities in Figure 27 (coal exports, other exports, bauxite imports, other imports). The input measure (the Harbour) was set to 1. The output was not compared with other Harbours as these would be operating under very different conditions (e.g. local industries, access constraints etc).

As expected, given the fairly stable but slight increase in activity over time, capacity utilisation was fairly high across the period examined (2006-07 to 2013-14) (Figure 28). Planned development in the Fisherman's Landing area is expected to increase the capacity (in terms of berths) by 50% in the non-coal exporting area. To capture this, an artificial observation was created using the maximum observed coal shipments, and a 50% increase in the absolute observed other shipments (imports and exports). Based on this future scenario, capacity utilisation is still relatively high with a median of around 80%.

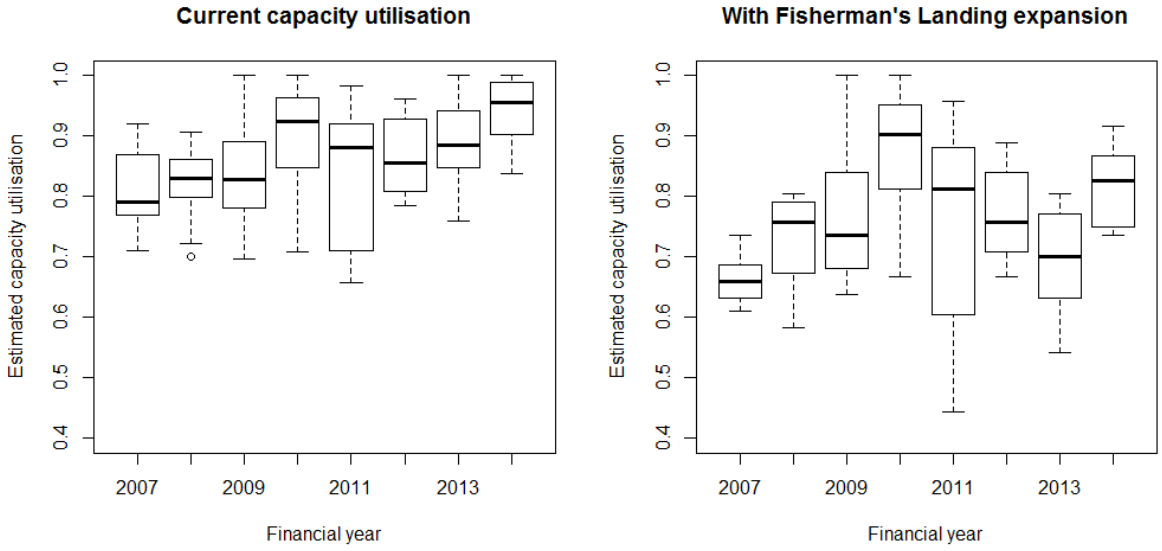


Figure 28. Estimated distributions of capacity utilisation scores over time (2006-07 to 2013-14) under current and expected future infrastructure conditions

For the purposes of the BBN analysis, the capacity utilisation relative to the expected future capacity was used (rather than the current capacity utilisation). The distribution of these scores across the 2013-14 financial year is shown in Figure 29.

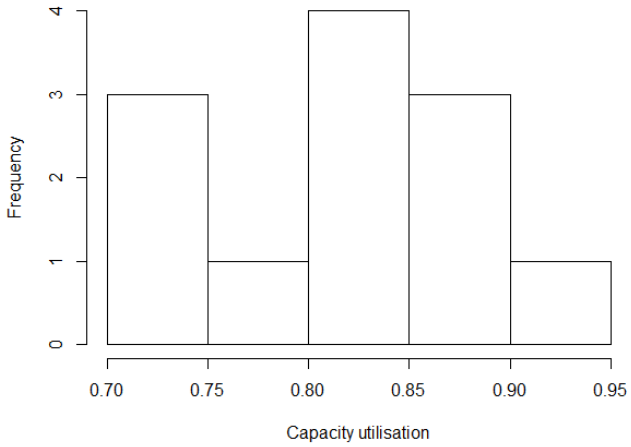


Figure 29. Distribution of monthly capacity utilisation scores, 2013-14, relative to expected future capacity

Commercial fishing

The total value of fish and crustaceans (i.e. crabs and prawns) in the waters adjacent to the Gladstone region was estimated to be approximately $5 million in 2013-14, based on catch by fishing method data from the Qfish data base (http://qfish.daff.qld.gov.au/) in area S30 (which covers Gladstone Harbour) and average prices for different species derived from ABARES fisheries statistics (Skirtun *et al.* 2013).

Over the last decade, fishing gross value of production from the Gladstone Harbour area has fluctuated between $3m and $5m in real terms, with no apparent trend. Similar fluctuations have been observed in nearby fishing areas adjacent to major centres (e.g. Mackay and the area adjacent to Yeppoon, close to Rockhampton) (Figure 30).

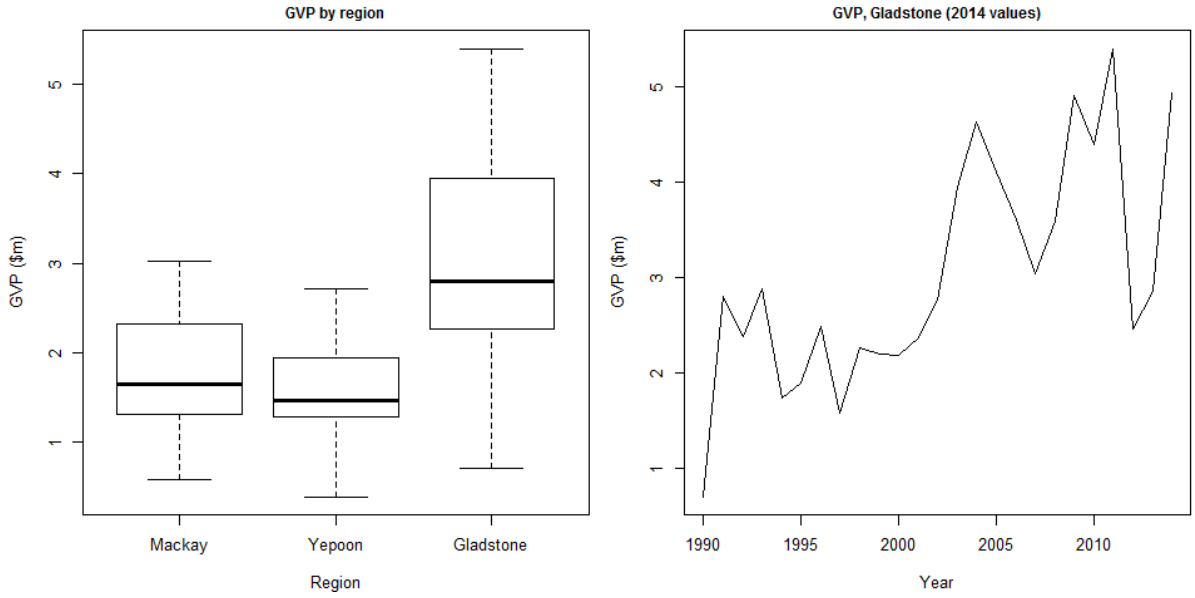


Figure 30. Gross value of fisheries production in inshore coastal waters, Gladstone and nearby regions

Capacity utilisation was not estimated per se, as fishing in the area formed only part of the total fishing activity of the Gladstone fleet. However, catch and fishing effort (in days fished) were used to derive a relative productivity measure using DEA. This reflects the productivity of the area (not necessarily the fleet), and is closely related to an index of catch per unit of effort. For comparison, the waters adjacent to Mackay (area O25) and Rockhampton/Yeppoon (area R29) were included in the analysis over the period 1989-90 to 2013-14 (inclusive), based on data from the Qfish data base Figure 31. The productivity measure was derived for each of four fleets (line, net, otter trawl and pots).

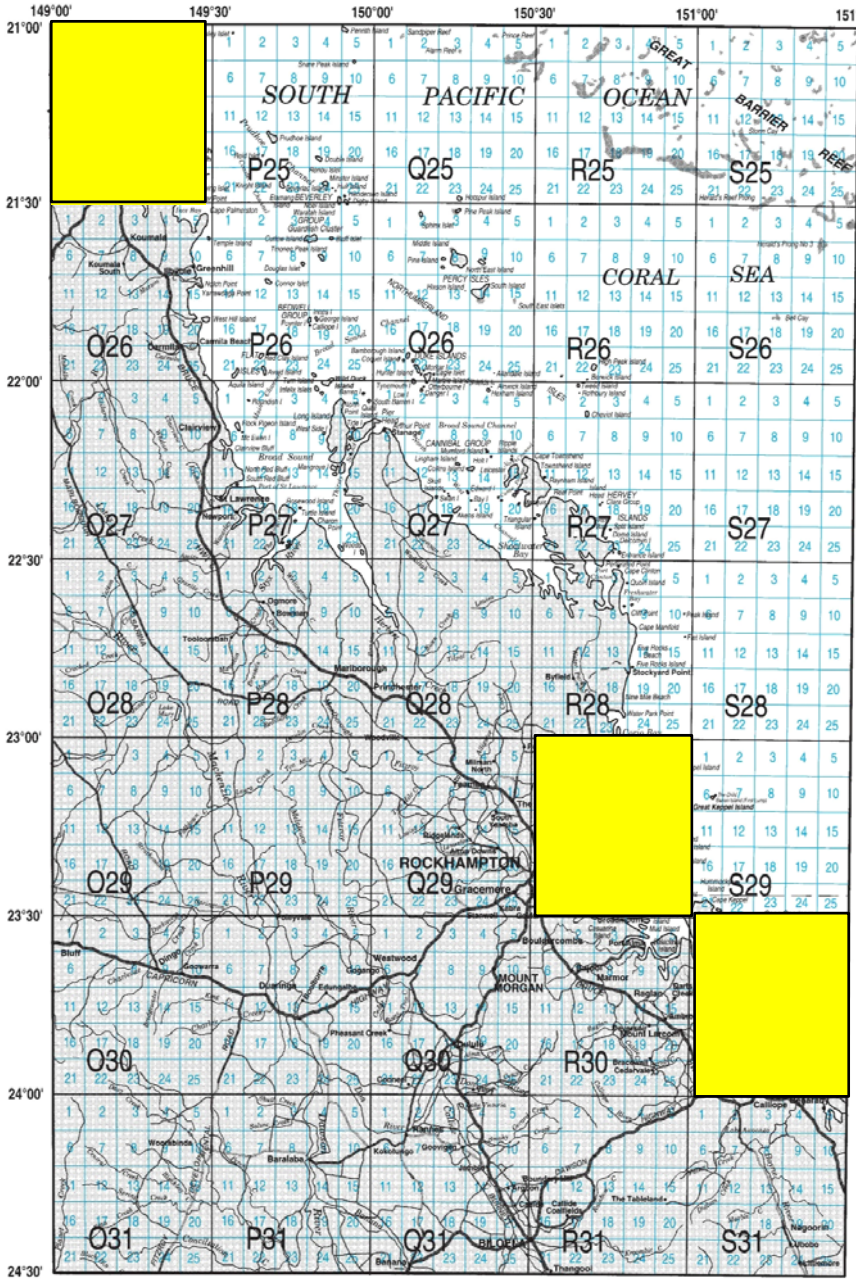


Figure 31. Fishing areas compared for the productivity analysis

Source: http://www.business.qld.gov.au/industry/fisheries/commercial-fishing/monitoring-and-reporting/reporting-commercial-fishers/queensland-logbook-maps

Productivity of the different fleets varied substantially (Figure 32). Line fishing has virtually disappeared from within the Gladstone Harbour region, and at best only represented a small proportion of the fishing activity of this group of vessels. Net productivity has also declined in recent years, but has tended to fluctuate widely since 2009. Trawl productivity also fluctuates widely, but has generally been increasing since 2009 with 2013-14 (represented as 2014 in the figure) being the most productive year over the last decade. While most of the trawl activity occurs outside the Harbour, it is likely that local stock abundance and fishing activity is affected by Harbour activity. Pot (i.e. crab) fisheries have been productive in the region over much of the last decade, performing well in 2013-14.

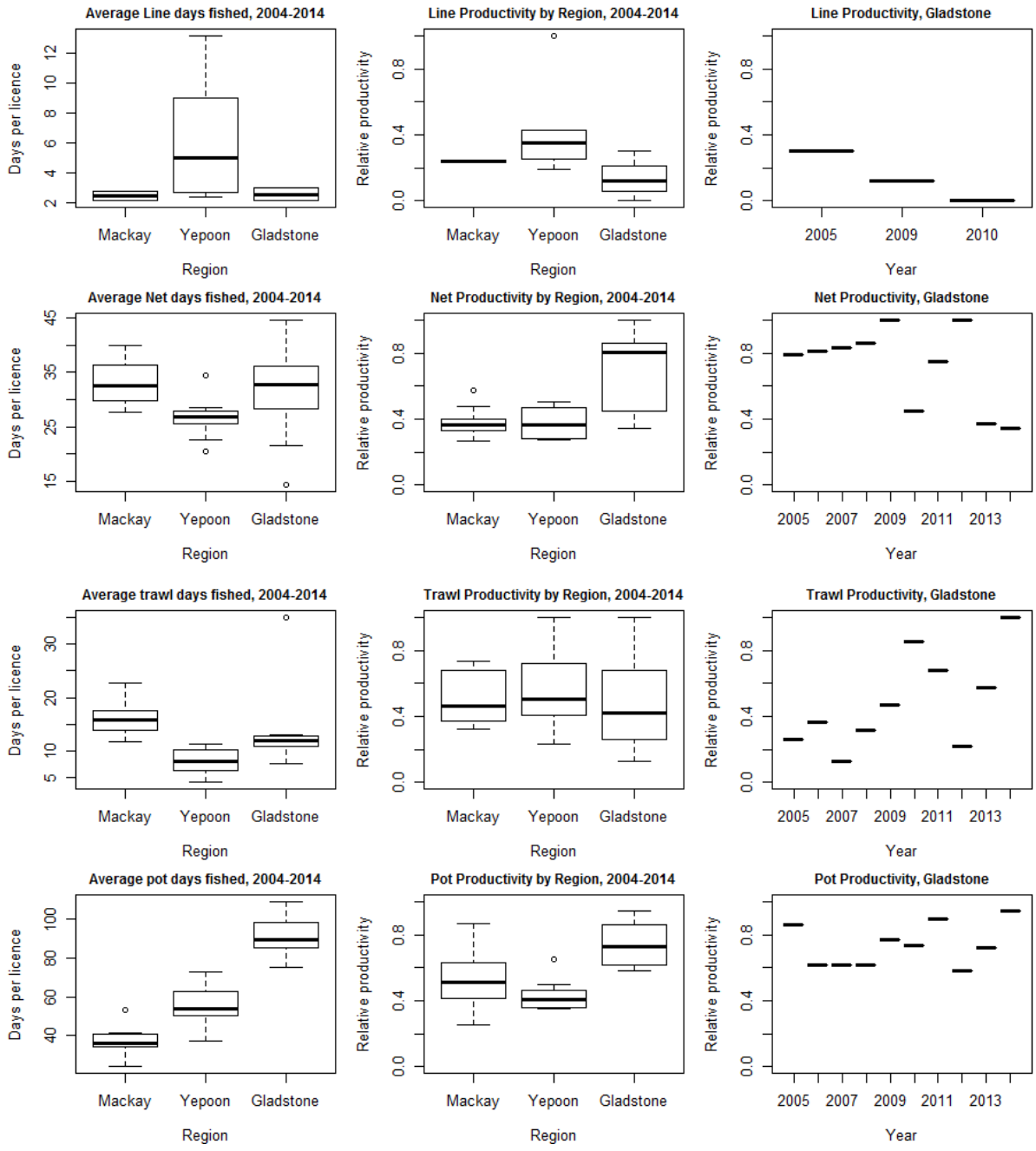
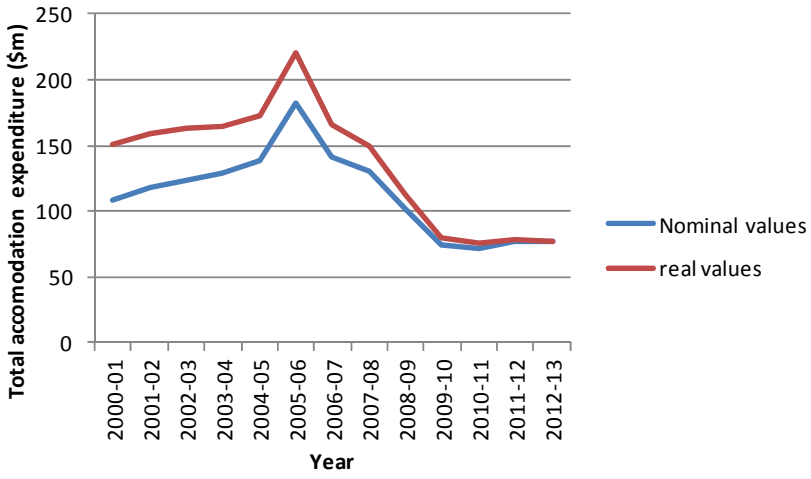


Figure 32. Capacity utilisation in the fishing fleets, 2005-2013

The overall fisheries performance measures based on a weighted average (with uncertainty) of the individual components. The average gross value of production (in 2013-14 prices) over the last decade of each sector and the standard deviation of these values were used to derive the conditional probability tables linking each fishery to the overall performance measure.

Tourism

Total tourism expenditure in the Gladstone District Council area has generally decreased since 2005-06 in both real (2013-14 prices) and nominal terms (Figure 33), with the industry having a gross value of production (based on total expenditure) of $77m in 2012-13 (the last year for which data are available, http://economy.id.com.au/gladstone, ABS (2013b)). However, tourism expenditure in the region has been relative constant since 2009-10. Given how tourism expenditure also includes business travel expenditure, which includes accommodation of temporary workers staying in hotel, motel and short term apartment rentals, the decline post 2005-06 may represent a reduction in construction work in the region and remaining workers moving to more permanent residences, or into camps on Curtis Island that would not be included in these figures.



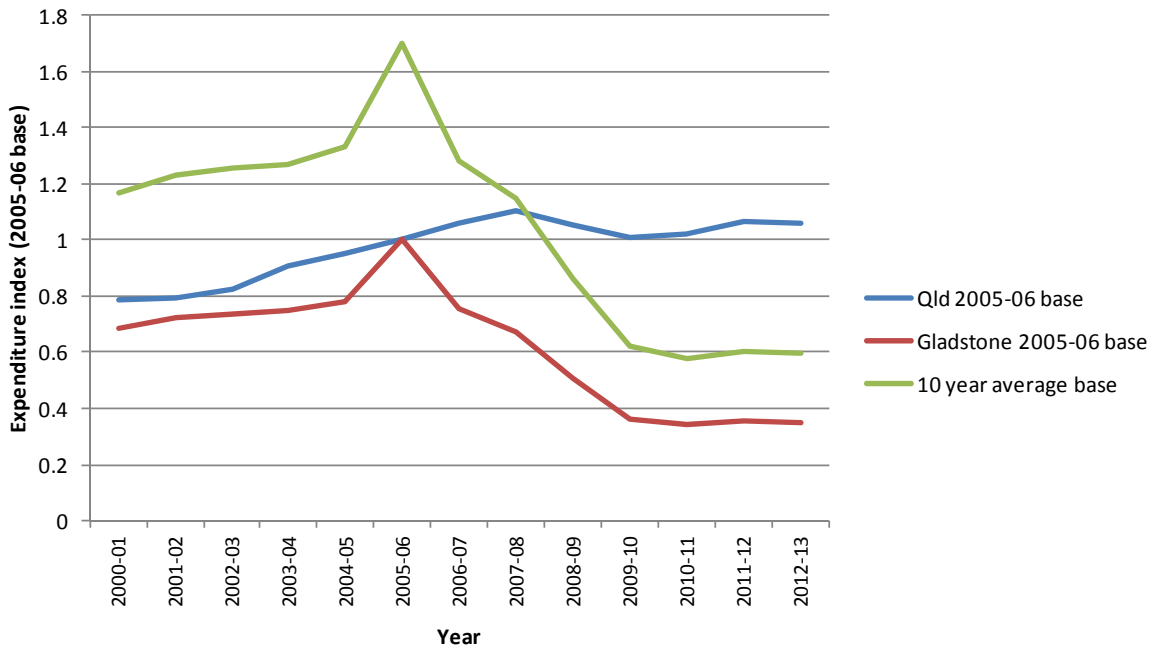
Source: http://economy.id.com.au/gladstone

Figure 33. Gross value of production, tourism industry, Gladstone 2000-01 to 2012-13

In contrast, tourism expenditure in Queensland has been generally increasing over much of the period of the data, but also remaining fairly constant since 2007-08 (Figure 34)(ABS 2013b; a). Given the substantial structural changes in the region, identifying an appropriate benchmark for tourism is difficult. Based on the best performance of the sector over the last decade, then current performance is relatively low. However, if performance over the last 4-5 years represents the "post-development" status quo of the industry, and previous expenditure levels considered unsustainable short term gains, then the industry may be considered to be performing reasonably well under the new economic environment.

Given the uncertainty, a 10 year average was used as the benchmark for tourism in the region. Based on this, the earlier years received a score in excess of 1, reflecting the temporary and unsustainable nature of the activity. In contrast, the more recent years receives a score or around 0.6, indicating below capacity activity.[8]

[8] Average accommodation occupancy rates in 2012-13 were also around 62% in the broader southern great barrier reef tourism region indicating considerable excess capacity in the sector (Tourism and Events Queensland 2014).



Source: ABS (2013a)

Figure 34. Expenditure index (real values, 2012-13 prices), Gladstone and Queensland 2000-01 to 2012-13

Turnover of Harbour based industries

The total turnover and employment of Harbour based industries were proposed as additional indicators for the direct economic footprint component of the analysis (McIntosh et al. 2014). There were two main difficulties encountered with these measures. First, direct information on turnover (or gross value product) was not available, although information on the number of businesses by turnover category was. Second, the categorisation was very broad, with some (or many in some cases) of the businesses in each category not being Harbour related.

Seven key sectors were considered as having a high component of Harbour related activity:

- Accommodation & Food Services;
- Agriculture, Forestry & Fishing;
- Construction;
- Manufacturing;
- Mining;
- Professional, Scientific & Technical Services; and
- Transport, Postal & Warehousing

The total number of these businesses remained relatively stable over the last five years, with most growth in businesses coming from the other (assumed mostly non-Harbour) sector (Figure 35). These were derived from the OESR database,[9] with the most recently available information for 2012-13. More detailed GVP estimates were only available for 2011, so were not considered.

[9] qrsis.oesr.qld.gov.au/pls/qis_public/QIS1110W$UDQCTL1.ProcessActions

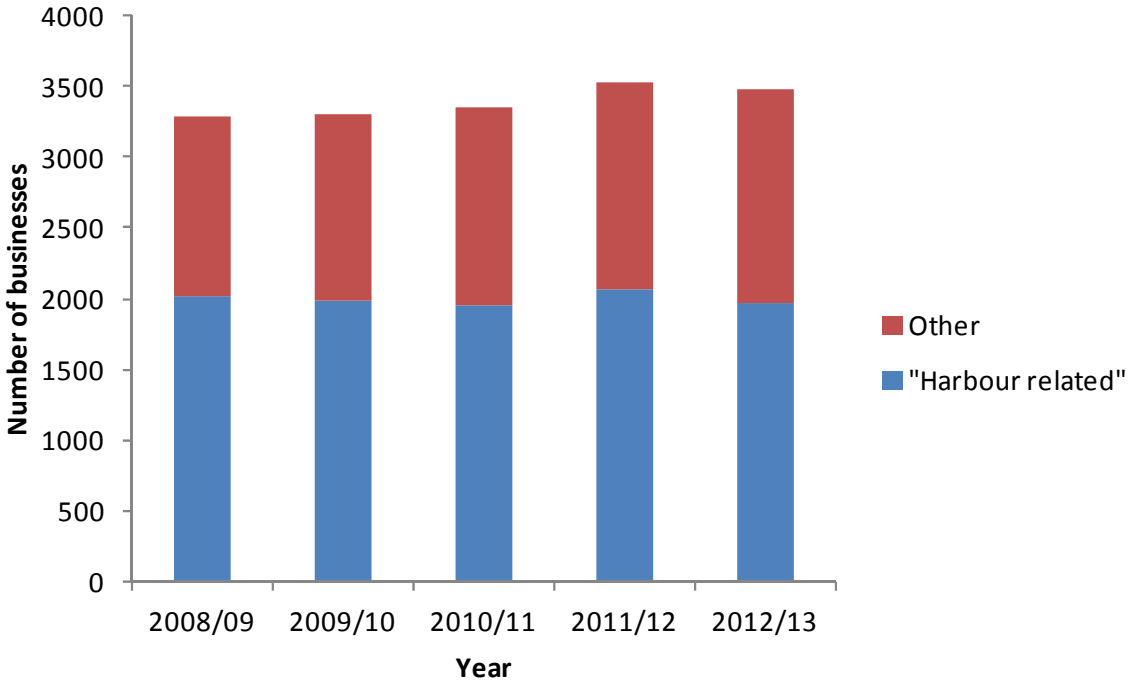


Figure 35. Number of Harbour related and other business, Gladstone, 2008-09 to 2012-13

Information was reported on business numbers by turnover category (0-$100k, $100k-$200k, $200k-$500k, $500k-$2m, >$2m), summarised in Figure 36. Harbour based businesses by turnover size. While total business numbers were fairly constant, there was a growth in the larger size businesses and a contraction in the number of smaller businesses.

An attempt was made to estimate changes in GVP of these industries through using the mid-point of the turnover range for the intermediate ranges. For the larger companies with greater than $2m annual turnover, several values were used in the imputation. The results of this were unsatisfactory, as the total derived values were less than the estimated value of turnover of some of the larger key industries in the region (captured in the capacity utilisation analysis as the weights between sectors).

Given this, and the fact that the most recent information was for 2012-13 only, these were not pursued further as worthwhile indicators. The three sectors captured in the remainder of the analysis are more representative of changes in performance of the key Harbour based industries.

Employment by sectors was also not considered for similar reasons as a direct economic footprint indicator. Employment measures (unemployment in particular) are included as an indicator of community flow-on benefits, which is a more appropriate indicator.

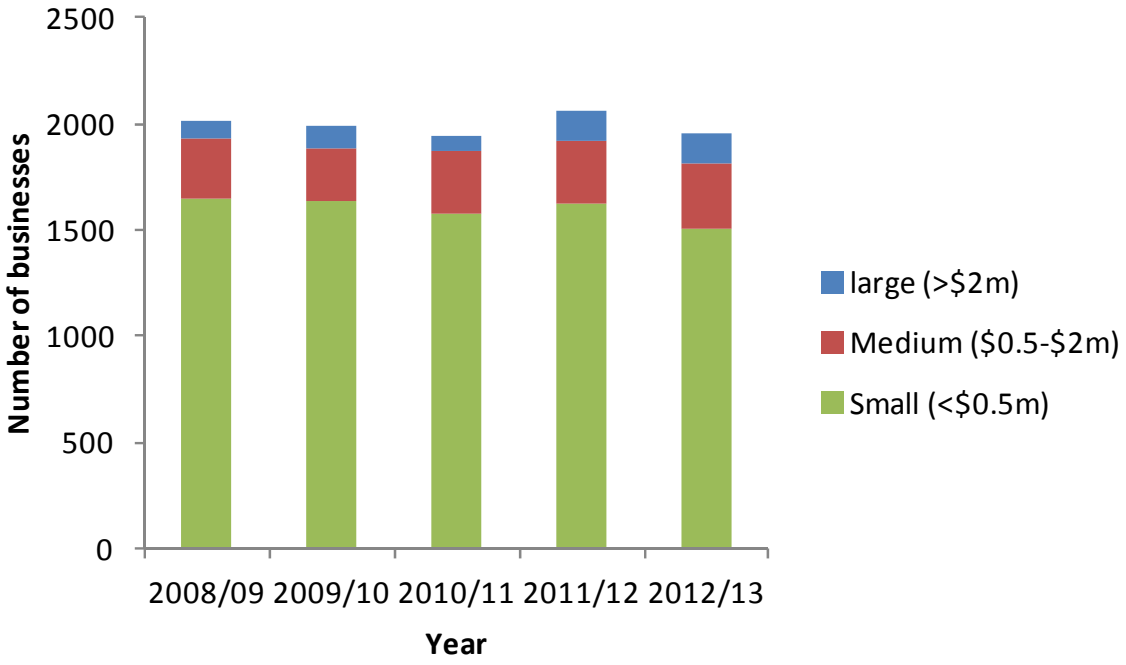


Figure 36. Harbour based businesses by turnover size

3.4.3 RECREATION ACTIVITY AND VALUATION RESULTS

A section of the community CATI survey was devoted to eliciting the economic values of recreational activity. The Travel Cost Method was applied as the valuation format.

Details on the frequency of recreational use of the Harbour area were collected for four separate types of activity:

- Beach recreation (mainland beaches)
- Boat-based recreational fishing
- Water-based recreation: all other non-fishing activity
- Land based recreation: all other non-beach activity

Collecting detailed travel cost data for each type of activity would have made the survey too lengthy and difficult. Consequently, full travel cost details were collected for

- the type of activity the respondent did most frequently, and
- the last trip of this type the respondent made.

Full details of the data analysis are outlined in the following sections with a general overview of recreational activity followed by the valuation results. The latter is divided into four sections. First some general information is provided, followed by the main results which provide details about a general recreation trip. Information is then presented about two specific types of recreational activity: beach recreation and land-based recreation, with insufficient data to estimate activity specific results for recreational fishing or water-based recreation. The results are summarised in the final section with a few caveats to qualify the findings.

A total of 400 responses were collected in the Gladstone community survey. Only three respondents (1%) had not visited the Gladstone Harbour area in the last 12 months, and 349 respondents (87%) had visited the Harbour for recreational purposes. More people (24%) reported using the Harbour less often in the last 12 months than those who used it more often (9%). It is not clear exactly why these respondents reduced their recreational activity in the Harbour, but there was some age-related influence, with significantly more respondents in older age groups reporting a reduction in recreation and significantly more respondents in younger age groups reporting an increase[10].

Land-based activity was much more prevalent than water-based activity, with 94% of respondents having participated in land-based recreation and 93% having visited a beach in the last 12 months. There were higher trip frequencies rates for land-based recreation. However, it should be noted that although the intention was to keep the two activities separate, in practice some respondents appeared to incorporate the two activities and it was likely that land-based recreation included some visits to the beach. A third (33%) of respondents had participated in recreational fishing and 54% had participated in other water-based recreation, although again there appeared to be some overlap between the two categories. Details of trip frequency rates are provided in Table 15.

Table 15. Recreational activity and frequency of participation

Response category	# trips/year	Beach		Rec fishing		Other water		Other land	
	(applied)	#	%	#	%	#	%	#	%
4-7 times a week	225	13	3	2	1	2	1	18	5
2-3 times a week	115	17	4	1	0	3	1	27	7
About once a week	60	36	9	4	1	15	4	41	10
About 1 every 2 wks	30	44	11	23	6	23	6	57	14
About once a month	13	77	19	25	6	48	12	87	22
About 4-6 times a yr	5	91	23	32	8	62	16	84	21
3 times per year	3	33	8	16	4	22	6	27	7
2 times per year	2	41	10	14	4	25	6	24	6
About once a year	1	20	5	15	4	16	4	12	3
Never	*0*	*28*	*7*	*268*	*67*	*184*	*46*	*23*	*6*
Total		**400**	**100**	**400**	**100**	**400**	**100**	**400**	**100**

Other general warm-up questions indicated that Tannum Sands and Boyne Island were the most popular beaches to visit (Figure 37); swimming was the most popular (non-fishing) water-based activity (Figure 38); and walking, picnicking and relaxing were the most popular land-based recreational activities (Figure 39).

[10] Two new age groups created: 1. = 45 plus years; 2= 55plus years. There was a significant difference (Pearson Chi-Square crosstab) in both groups between those who increased or decreased their recreation activity at the 5% level.

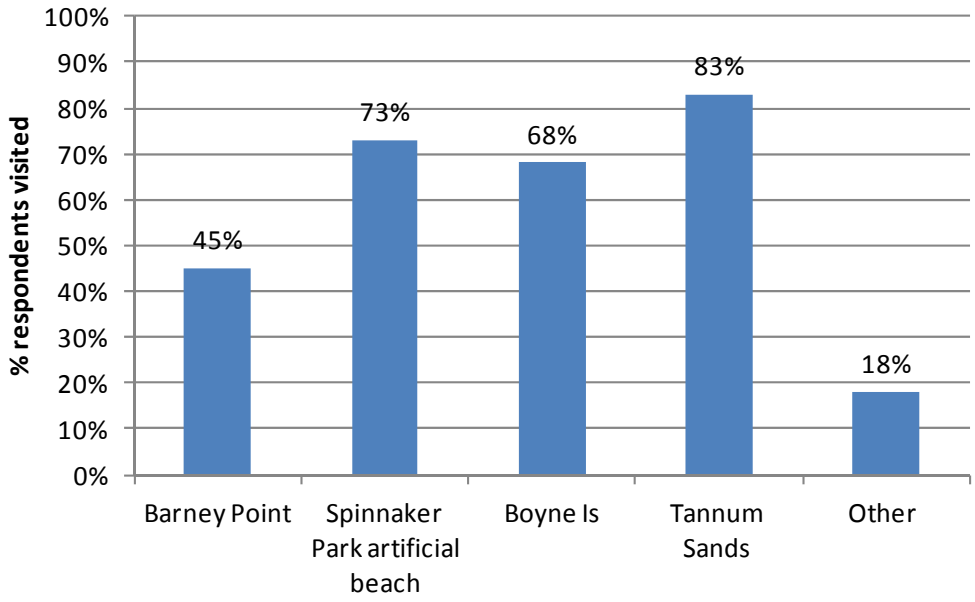


Figure 37. The most popular beaches visited by surveyed Gladstone residents

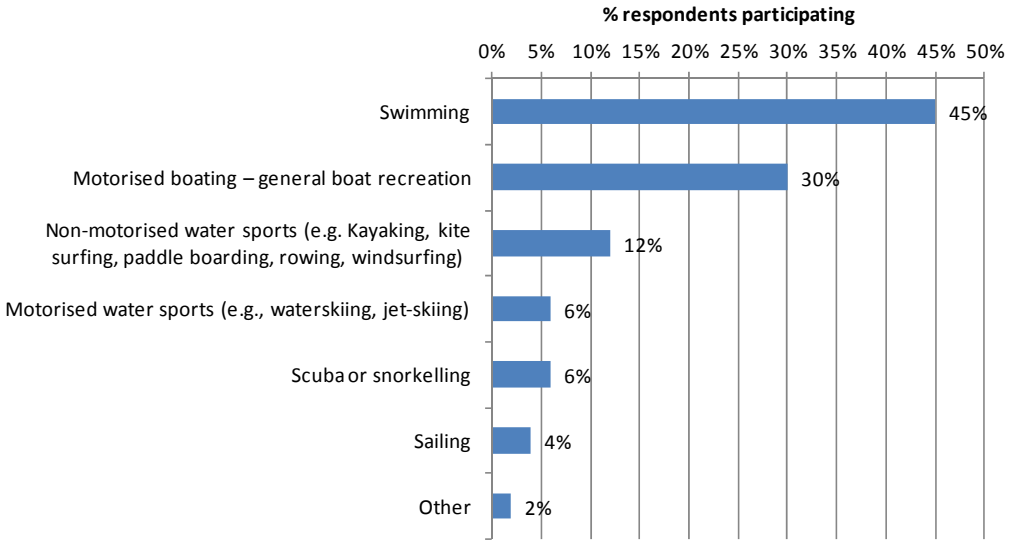


Figure 38. Popular water-based recreational activities listed by recreational visitors

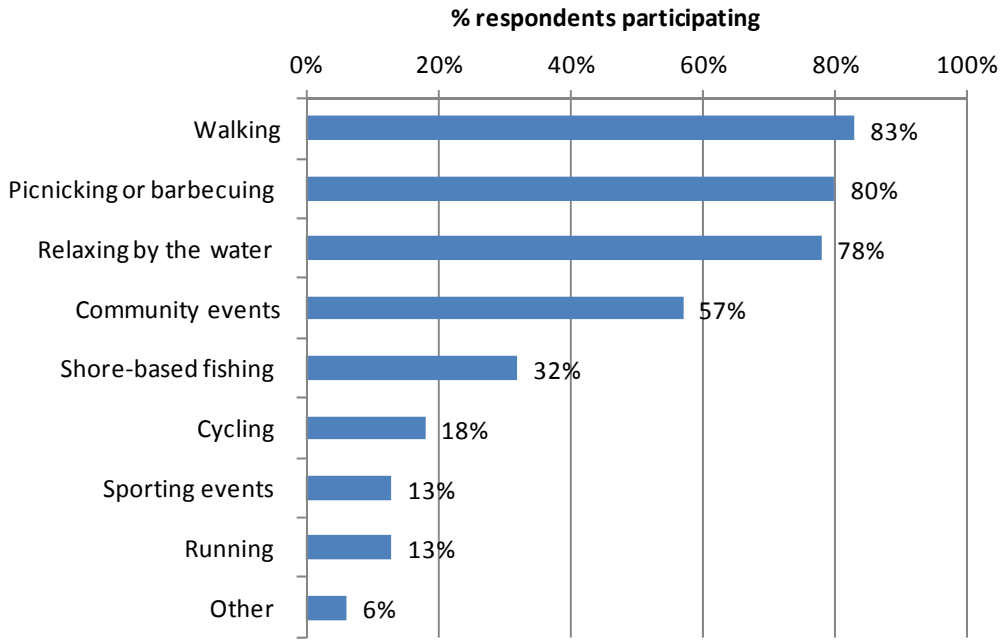


Figure 39. Popular land based activities listed by recreational visitors

Respondents were also asked to indicate their level of satisfaction with the trip for which they provided detailed information for the valuation analysis (on a scale from 1 = very unsatisfied to 10 = very satisfied). Overall, respondents reported high levels of satisfaction with a mean score of 8.0 (n=382). Even those who reported using the Harbour less frequently for recreation in the last 12 months had a mean satisfaction rating of 7.0. Satisfaction scores were the lowest for recreational fishing and highest for other water-based recreation (Table 16, Figure 40). The score for land-based recreation was significantly higher (Independent samples T test at the 5% level) than scores for beach recreation or recreational fishing.

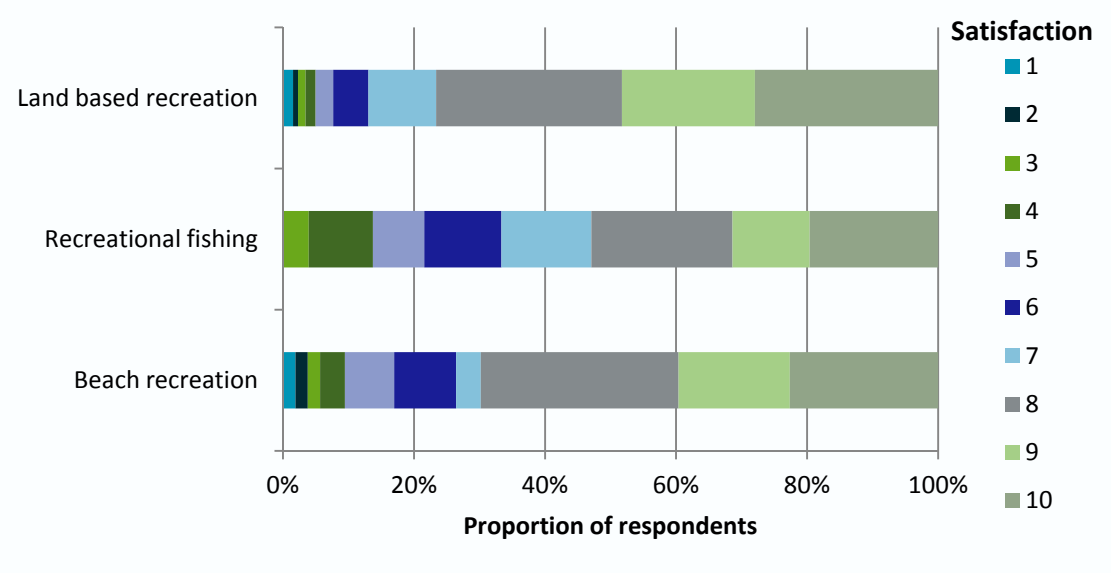


Figure 40. Satisfaction with recreational activities

3.4.4 OVERVIEW OF VALUATION RESULTS

Respondents were asked to nominate the type of recreational trip they did most frequently. However, there were some discrepancies between this 'stated' most frequent recreational trip type and frequency details already provided for each recreational category. This difference was important because trip frequency was the dependent variable in the valuation equation (Equation 1). Consequently, two separate variables were created. The first, referred to as the 'stated' recreational category, applied frequency details from the recreational category nominated by the respondent. The second, referred to as the 'adjusted' recreational category, applied frequency details from the recreational category with the most frequent participation based on information provided by the respondent in previous questions. Where more than one category had similar frequency rates the stated category was maintained. Details of the stated and adjusted recreational categories are provided in Table 16.

Table 16. Most frequent type of recreational activity (applied in travel cost analysis)

	Stated recreation category			Adjusted recreation category		
	#	*%*	*Mean satisfaction rating*	*#*	*%*	*Mean satisfaction rating*
Beach recreation	53	13.3	7.7	74	18.5	7.7
Recreational fishing	51	12.8	7.3	30	7.5	7.2
Other water based recreation	11	2.8	8.4	16	4.0	8.4
Other land based recreation	261	65.3	8.2	256	64.0	8.2
Other[1]	21	5.3		21	5.3	
None	3	0.8		3	0.8	

[1] These mainly comprised of visits to the islands and could not be clearly allocated to a specific recreational category with relevant trip frequency details. The information was not included in the travel cost analysis.

Full case specific travel cost information was collected from 376 respondents with the following summary details:

- Travel mode: 93% reached the Harbour by car; 6% walked and 1% cycled.
- The average one-way travel distance was 10.72, km ranging from 0 to 50 km.
- The average one-way travel time was 13.75 minutes, ranging from 1 to 45 mins.
- The average # adults per trip was 2.1, ranging from 1 to 6.
- The average # children per trip was 0.8, ranging from 0 to 10.
- The average cost of fuel (n= 68) was $63.46 per trip ranging from $1.5 to $525.
- Most respondents (88%) spent all their time on the recreation activity. Where relevant, the average proportion of time spent on the recreation activity was 52%.

Details of the trip frequencies applied in the travel cost analysis are outlined in Table 17.

Table 17. Trip frequency details applied in the travel cost analysis

Response category	# trips/year (applied)	Stated category #	Stated category %	Adjusted category #	Adjusted category %
4-7 times a week	225	19	4.8	25	6.3
2-3 times a week	115	26	6.5	36	9.0
About once a week	60	38	9.5	51	12.8
About 1 every 2 wks	30	68	17.0	64	16.0
About once a month	13	87	21.8	84	21.0
About 4-6 times a yr	5	79	19.8	69	17.3
3 times per year	3	24	6.0	19	4.8
2 times per year	2	26	6.5	20	5.0
About once a year	1	9	2.3	8	2.0
Not applicable	*0*	24	6.0	24	6.0
Total		**400**	**100**	**400**	**100**

Full sample models

The data were analysed using ©LIMDEP statistical software and all models were developed using ©NLogit5. Two primary decisions were made in determining which models to present. The first was to decide how to deal with extreme values known as 'outliers' and the second related to the inclusion of explanatory socio-demographic variables. Three cases were identified as being outliers (Figure 41) and these (the same for both 'stated' and 'adjusted' categories) were removed from the data analysis.

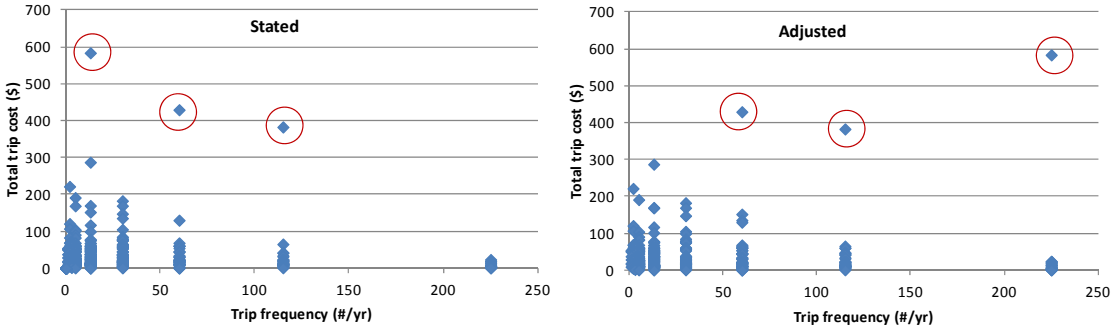


Figure 41. The relationship between total trip cost and trip frequency

In an exploratory analysis of the data, a range of socio-demographic variables were included in the travel cost models with varying degrees of influence. The intention was to determine which variables had a consistent influence on the dependant variable (trip frequency). Variables were included in a stepwise manner and if significant they were retained and removed if not significant. Seven variables were identified as significant in the 'stated' frequency category and these were also applied for comparison in the 'adjusted' frequency model. Variables that were included but found not to have a significant influence on trip frequency (stated version) were: gender; the number of adults in the

travel group; the time spent on the recreational activity; whether people owned a boat; whether it was a boat related trip; and the number of children in the household.

Both the final travel cost models (Table 18) are significant with high Chi square values and statistically robust with high McFadden R squared values. Both models have highly significant Alpha values indicating there was significant overdispersion, supporting the application of negative binomial models. As expected, travel costs were a significantly negative influence on trip frequency (the dependent variable). In the 'stated' category model, older respondents; those who participated in recreational activity less often in the last 12 months; those with more children in the travel group; those with more adults in their household, and those who owned their home but still had a mortgage, were all negatively associated with trip frequency. People with higher incomes, and those who lived in the region for longer were both positively associated with trip frequency. There were some differences in the influence of these variables in the 'adjusted' category model.

Table 18. Full sample travel cost (zero truncated negative binomial) models

		'Stated' category frequency			'Adjusted' category frequency		
Variable	*Description*	*Coefficient*		*St Err*	*Coefficient*		*St Err*
Constant		4.7743	***	0.4683	4.9090	***	0.5039
Cost per trip	Total cost of trip per group	-0.0092	***	0.0017	-0.0085	***	0.0020
Age[1]	Age categories 1-6	-0.2274	***	0.0732	-0.1901	**	0.0739
Income[1]	Categories 1-8 (category midpoint ($) applied)	0.0002	***	0.0001	0.0002	***	0.0001
Yrs in area[1]	Yrs respondent lived in Gladstone region	0.0118	**	0.0052	0.0075		0.0047
Visit less often	Respondent visited the Harbour less often in the last 12 months	-0.3990	**	0.1600	-0.2043		0.1659
Children in trip	# children in travel group	-0.0618	**	0.0293	-0.0626	*	0.0342
Adults in hse[1]	# adults in respondent's household	-0.3186	***	0.1098	-0.2781	**	0.1204
Mortgage[1]	Respondent owned home with a mortgage	-0.3184	*	0.1699	-0.5080	***	0.1756
Alpha	*Dispersion factor*	*1.9252*	***	*0.2860*	1.7683	***	0.2377
Model statistics							
Sample size		373			373		
Log Likelihood		-1620			-1707		
AIC/N		8.739			9.208		
McFadden R^2		0.818			0.830		
Chi[2]		14536			16916		

*** significant at the 1% level; ** significant at the 5% level; significant at the 10% level

[1] Details are provided in the summary information for the community survey

The value estimates for recreational trips were estimated with a constant and travel cost variable only (in all cases) to reduce any confounding effect of the socio-demographic variables across different models. Three sets of models were developed for comparison. The first group were aggregate models with travel costs estimated on a per trip basis. Estimates of trip per adult values were estimated by applying the average number of adults per trip across all relevant cases. The second group of models were case specific models with travel costs estimated on a per trip per adult basis. The results from these models were compared to the results calculated on an aggregate basis to provide an indication of the robustness of the results. The third group of models were applied were designed as a sensitivity analysis. Instead of apportioning the cost of travel time at one third of the Queensland average hourly earnings ($33.60), a rate of 25% ($8.4 per hour) was applied. All value estimates from these models are presented in (Table 19).

To extrapolate the values from the sample to the population of Gladstone, information was applied from the Queensland Government Statistician's Office (QGSO) and the Australian Bureau of Statistics (ABS) 2011 Census data. Two assumptions were made. First, to extrapolate the total trip value, it was assumed that the information provided by the respondent represented details of a household trip. While this may have been true for most situations, it would not have been true in all cases. It was estimated there were 22,841 households in Gladstone, based on an average household size of 2.8 persons (ABS 2011 Census) and a population of 52,352 in 2013 (QGSO). Second, to extrapolate the value of a trip per adult to the Gladstone population only adults between 18 and 80 years were given consideration. It was estimated there were 45,982 adults in this age group assuming the proportion of adults (18-80) was 72% of the population; the same as in the ABS 2011 Census. This extrapolation assumed that information on trip frequency supplied by the respondent, applied to all adults in the group, which would not have been true in all cases of recreation activity.

Table 19. Value estimates for recreational trips

	Stated	(95% CIs)	Adjusted	(95% CIs)
1. Total trip cost models				
Mean trip value	$99.66	($75.80 - $145.45)	$109.19	($77.85 - $182.78)
Users: **Avg # trips per year (n=373)**	35.00		42.59	
Full sample**: Avg # trips per year (n=400)**	33.11		40.72	
Users: **Annual value of recreation trips**	$3,488	($2,653 - $5,091)	$4,650	($3,316 - $7,785)
Full sample**: Annual value of recreation trips**	$3,300	($2,510 - $4,816)	$4,446	($3,170 - $7,442)
Gladstone population**: # households**	22,841		22,841	
Gladstone: **annual value of recreation trips (*full sample* extrapolation)**	$75.37M	($57.33M - $110.00M)	$101.56M	($72.41M - $170.00M)
Mean trip value per adult				
Avg # adults per trip	2.09		2.09	
Mean trip value per adult	$47.78	($36.34 - $69.74)	$52.35	($37.32 - $87.63)
Mean annual value per adult *(full sample)*	$1,582	($1,203 - $2,309)	$2,132	($1,520 - $3,568)
Gladstone population**: # adults 18-80 yrs**	45,982		45,982	
Gladstone: **annual value of adult recreation trips (*full sample* extrapolation)**	$72.74M	($55.33M - $106.18M)	$98.02M	($69.88M - $164.08M)
2. Trip cost/adult models				
Trip value per adult	$46.78	($35.85 - $67.26)	$47.76	($35.55 - $72.74)
Mean annual value per adult *(full sample)*	$1,549	($1,187 - $2,227)	$1,945	($1,448 - $2,962)
Gladstone: **annual value of adult recreation trips (*full sample* extrapolation)**	$71.22M	($54.58M - $102.40M)	$89.43M	($66.56M - $136.20M)
3. Sensitivity testing: Time valued at 25% avg wage rate				
Mean total trip value	$96.12	($73.17 - $140.05)	$106.02	($75.60 - $177.38)
Mean trip value per adult (case specific models)	$46.41	($35.58 - $66.74)	$47.43	($35.27 - $72.39)

The results from the first group of models based on total trip cost estimates indicate the following:

1. The value of a recreation trip was estimated at $100 (ranging from $76 to $145) in the stated version and was higher at $109 (ranging from $78 to $183) in the adjusted version.
2. The value of a trip per adult was estimated at $48 (ranging from $36 to $70) in the stated version and at $52 (ranging from $37 to $88) in the adjusted version.
3. The annual value of recreation trips for the Gladstone population was estimated at $75.53 million (ranging from $57M to $110M) in the stated version and was higher at $101.56 million (ranging from $72M to $170M) in the adjusted version.
4. The annual value of adult recreation trips for the Gladstone population was estimated at $72.74million (ranging from $55M to $106M) in the stated version and was higher at $98.02 million (ranging from $70M to $164M) in the adjusted version.

The relative similarity in the separate extrapolation methods provides some assurance in the robustness of the results.

The second group of models were developed where the trip costs were calculated for each individual response on a cost per trip per adult basis. Prior analysis identified three outliers which were removed from the subsequent analysis (Figure 42). Two of these were the same as those removed from the total trip cost analysis and the other differed.

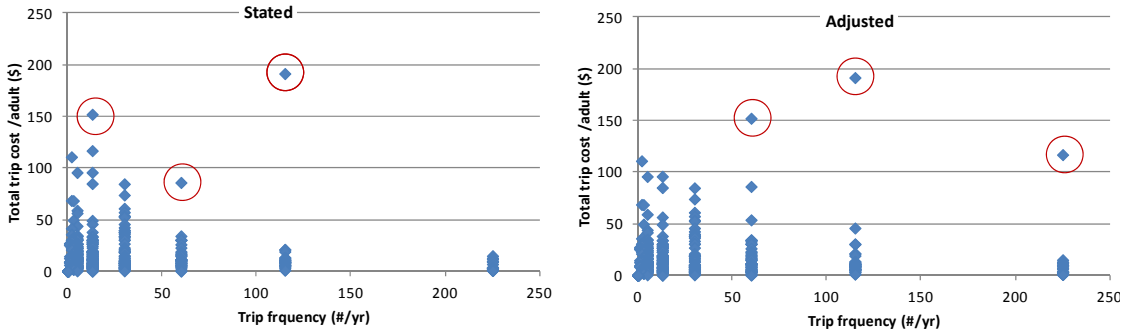


Figure 42. The relationship between total trip cost per adult and trip frequency

The per adult trip values estimated from these models were approximately the same in the stated and adjusted versions, and the same as that estimated for the stated version of the total trip cost model. However, the total annual values were again higher in the adjusted version due to the higher annual trip frequency rates.

- The value of a trip per adult was estimated at $47 (ranging from $36 to $67) in the stated version and at $48 (ranging from $36 to $73) in the adjusted version.
- The annual value of adult recreation trips for the Gladstone population was estimated at $71.22 million (ranging from $55M to $102M) in the stated version and was higher at $89.43 million (ranging from $67M to $136M) in the adjusted version.

Again, the similarity in the value of recreational trips per adult calculated either on an aggregate or on an individual case specific basis provides some reassurance in the robustness of the different models.

In the third set of models, the cost of travel time was apportioned at 25% instead of one third of the Queensland average hourly earnings. The results (Table 19) indicate that the values estimates were not overly sensitive to changes in the cost allocation. Applying the new rate of $8.4 per hour represented a reduction of 25% compared to the initial estimate of $11.2 per hour. However, the new value estimates were only 1% lower in the case specific models with values of $46 per trip compared to $47 per trip in the stated version, and $47 per trip compared to $48 per trip in the adjusted version. This was due to the relatively short travel time to reach the Harbour, with an average one-way trip time of 14 minutes.

Activity specific models

The second part of the data analysis involved the estimation of activity specific models with details presented in Table 20. It was possible to develop robust models for land-based recreation as over 60% of survey respondents provided detailed information. It was also possible to estimate significant models for beach recreation with between 13 % (stated) and 18% (adjusted) of respondents providing detailed information. There were too few responses to estimate travel cost models for general water-based recreation. It was also not possible to estimate significant models for

recreational fishing, with too few responses in the adjusted sample (n=30). Although the sample size was similar for the stated sample (n=51) as for beach recreation (n=53), it was possible to estimate significant models for beach recreation but not for recreational fishing. This was due to the high fuel costs involved in some fishing trips that did not adversely impact on trip frequency and so trip cost was not a significant influence on trip frequency. The relationship between trip cost and trip frequency for breach recreation and recreational fishing is compared in Figure 43.

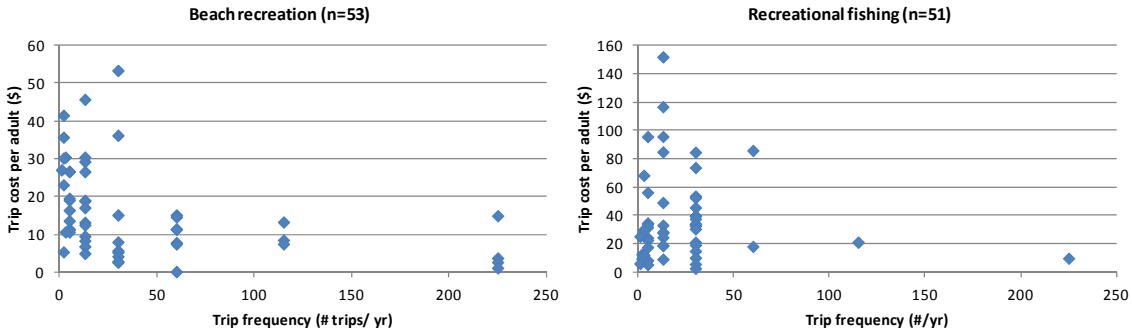


Figure 43. Trip frequency and cost details for beach and recreation fishing

In 68 cases (17%), details about travel costs included information about boat use. It was possible to estimate significant models with the adjusted sample data, but not for the stated sample. It appeared that the stated sample was more realistic in this case than the adjusted sample. In the former, 69% of respondents had stated their most frequent trip was for recreation fishing. When the adjusted category was applied, details only related to recreational fishing in 40% of cases and 29% were categorised as land-based recreation. This meant that the frequency data for the adjusted sample was unlikely to be accurate and, no further details of either model are provided.

The models were estimated (without socio-demographic variables) based on the cost per trip per adult (coefficient values only are reported). Details of the estimated values per trip are reported, but derived from separate models (model details are not reported). All values were extrapolated to the Gladstone population based on the same assumptions made for the full sample estimates outlined above. Full information is presented in Table 20.

Table 20. Activity specific (zero truncated negative binomial) models and value estimates

	Beach recreation		Land-based recreation	
Model variables	*Stated*	*Adjusted*	*Stated*	*Adjusted*
Constant	4.192***	4.495***	3.813***	3.777***
Cost per adult trip	-0.048***	-0.049***	-0.037***	-0.012***
Alpha	1.755***	1.295***	2.404***	2.336***
Model statistics				
Outliers removed	0	1	1	3
Sample size	53	73	260	253
Log Likelihood	-237	-353	-1139	-1135
AIC/N	9.058	9.773	8.786	8.997
McFadden Rsrd	0.822	0.824	0.843	0.846
Chi sqrd	2195	3318	12237	12444
Value estimates				
Trip value/adult	$20.97	$20.56	$26.87	$30.60
(95 % CI)	($15-$37)	($13-$46)	($20-$42)	($23-$47)
***Users*: Avg # trips/yr**	40.87	53.05	36.21	39.48
***Full sample*: Avg # trips/yr**	25.04	25.04	32.54	32.54
Mean annual value per adult *(full sample)*	$525	$515	$874	$996
Gladstone: Annual value of adult recreation trips	**$24.14M**	**$23.67M**	**$40.20M**	**$45.79M**
(95 % CI)	($17-$42M)	($15-$53M)	($30-$62M)	($34-$71M)
Total trip value estimates[1]				
Total trip value	$35.01	$45.40	$61.44	$85.37
(95 % CI)	$26-$53	$29-$105	$48-$85	$62-$135
Avg # adults/trip	2.20	2.26	2.03	2.02
Trip value/ adult	$16.13	$20.08	30.26	42.19
***Users*: Avg # trips/yr**	40.87	48.30	36.21	39.56
***Full sample*: Avg # trips/yr**	25.04	25.04	32.54	32.54
Annual value per trip *(full sample)*	$877	$1,137	$1,999	$2,778
Gladstone: annual value of recreation trips	**$20.02M**	**$25.97M**	**$45.67 M**	**$63.45 M**
(95 % CI)	($15-$30 M)	($17-$60 M)	($36-$63 M)	($46-$101M)

*** significant at the 1% level; ** significant at the 5% level; significant at the 10% level;

[1] Estimated from separate models

The value of beach recreation trips was lower than the estimates for land-based recreation. The trip values were lower and there was also a lower average trip frequency rate across the total sample.

1. The value of a beach recreation trip per adult was estimated at approximately $21 per adult trip (ranging from $13 to $46).
2. The value of a beach recreation trip was estimated at between $35 and $45 per trip (ranging from $26 to $105).
3. The annual value of beach recreation trips for the Gladstone population was estimated at between $20 million and $26 million (ranging from $15M to $60M) depending on the valuation method applied.

The value of other land-based recreation trips was lower than the general value estimates for a non-specific recreational activity outlined above. One of the reasons would be the lower costs involved in undertaking the activity and the absence of boat related costs. However, the inclusion of some boat related costs in the 'adjusted' sample (albeit it small at n=20 [as explained above]) would suggest that the 'stated' sample might provide a more accurate measure of value in this case.

1. The value of a land-based recreation trip (excl beach recreation) per adult was estimated at approximately $27 per adult trip (ranging from $20 to $42).
2. The value of a land-based recreation trip was estimated at approximately $61 per trip (ranging from $48 to $85).
3. The annual value of land-based recreation trips for the Gladstone population was estimated at between $40 million and $46 million (ranging from $30M to $63M) depending on the valuation method applied.

Summary of travel cost models and value estimates

A number of different travel cost models were developed, with some sensitivity testing, to provide an indication of the robustness of the valuation estimates. Overall, there is considerable overlap in the value estimates, providing confidence in the results. However, as expected, there is considerable heterogeneity in the data and it is important to consider the ranges as well as mean value estimates. A summary of the values for general recreation, land-based recreation, and beach recreation are provided below (Table 21).

Table 21. Summary recreation value estimates

	General recreation ***Avg stated/ adjusted***	Land-based recreation ***'stated' version***	Beach recreation ***Avg stated/ adjusted***
Total trip value (CIs)	$104 ($76-$183)	$61 ($48 - $85)	$40 ($26 - $105).
Trip value/ adult (CIs)	$48 ($36 - $73)	$27 ($20 - $42)	$21 ($13 - $46)
***Users*: Avg # trips/yr**	35.00 - 42.59	36.21	40.87 - 53.05
***Full sample*: Avg # trips/yr**	33.11 - 40.72	32.54	25.04
Annual value per trip *(full sample)*	$3,873 ($2,510 - $7,442)	$1,999 ($1,569 - $2,755)	$1,007 ($652 - $2,620)
Mean annual value per adult *(full sample)*	$1,747 ($1,187 - $2,962)	$874 ($645 - $1,355)	$520 ($331 - $917)
Gladstone: Annual value of recreation trips **(CIs)**	**$84 million**[1] ($55M - $170M)	**$43 million** ($30M - $63M)	**$23 million** ($15M - $60M))

[1] Average of total trip values from aggregate models and total tip/ adult values from case specific models.

There are four important caveats to consider in applying these results. First, the community survey was conducted in a telephone interview which limited participation by younger people in the community. This may have affected participation in recreational activity in two ways. First, the type of activity and the associated costs may be different for younger people compared to older people. Second, the frequency of undertaking recreational activity may differ between younger and older age groups. The latter was evidenced in the main models with increased age significantly associated with lower trip frequency rates. There was also a significant relationship between age and whether respondents had increased or decreased their recreational activity in the last 12 months. This meant that the frequency of recreational trips and the elicited valuation estimates were quite conservative, and values would likely have been higher if the sample better matched the population in terms of age.

Second, all models are based on the relationship between trip frequency and travel cost. Information provided by survey respondents about travel costs is likely to be quite robust for land-based recreational activity. Larger sample sizes are needed to provide more confidence in the on-water, boat-based costs of recreation.

Three, there is no way of knowing how robust or accurate was the information about trip frequency. Certainly there was some discrepancy between some responses in the frequency information provided for the different recreational categories and then the category nominated as their most frequent activity for which case specific details were collected. Such discrepancies are well known amongst travel cost method data analysts. Collecting this type of information on a more regular basis might help improve respondent recall.

Four, while information was collected for four distinct recreational categories, it appears that there was some overlap between specific and general categories, i.e., between beach and other land-based recreation as well as between recreational fishing and other water-based recreation. As a result, the estimates for land-based recreation probably also include some beach recreation trips.

It is recommended that future surveys concentrate on collecting further details about a specific recreational activity to supplement the database.

Development of recreational measures

For the report card analysis, the values per trip for the beach, land and fishing recreational activities (and their associated standard errors) were used to develop the conditional probability tables linking the measure to the sub-component, effectively weighting each measure by its relative (non-market) value. The measures used were the level of satisfaction with each of the recreational activity derived from the CATI survey, based on a 10 point satisfaction scale.

3.5 Community sub-components survey results

The primary aim of the community sub-components survey was to elicit general weights for each of the three key sub-components within each component. These weights are subsequently used to develop the conditional probability tables that link the sub-components to the outcomes in the BBNs.

As noted in the methods section, the three weighting methods[11] were undertaken in order to determine which is the most appropriate for the purposes of the report card. Each has theoretical

[11] The three methods were: a simple ranking (i.e. 1st, 2nd, 3rd etc); a scoring system with the highest ranked sub-component having a score of 100, and others having a lower relative score; and the Analytic Hierarchy Process (AHP) where sub-components are compared in a pair-wise manner. Details on each of these methods were presented in the methods section.

and practical advantages and disadvantages, and the most appropriate approach can only be determined based on the outcome of the survey. The key criteria for assessing which approach to use was based on a) respondent confidence in their answers; b) level of inconsistency in the Analytic Hierarchy Process (AHP) approach (the preferred approach); and c) the level of variability in weights between individuals.

3.5.1 SAMPLE SIZE AND RESPONSE RATE

The online survey was run over the period 11 September 2014 to 21 September 2014 using SurveyMonkey. A total of 228 initial invitations were sent out (based on those who agreed to participate from the CATI survey). Of these, 7 emails were incorrect (a transcription error during the CATI survey) and three people had previously opted out of SurveyMonkey surveys (so the email was not sent). As a result, the effective sample was 218 individuals.

In total, 83 responses to the community survey were received, representing a response rate of approximated 38%. With the exception of the 18-24 age group (none of which participated in the sub-components survey), the distribution of responses was fairly representative by age, income and gender (Figure 44).

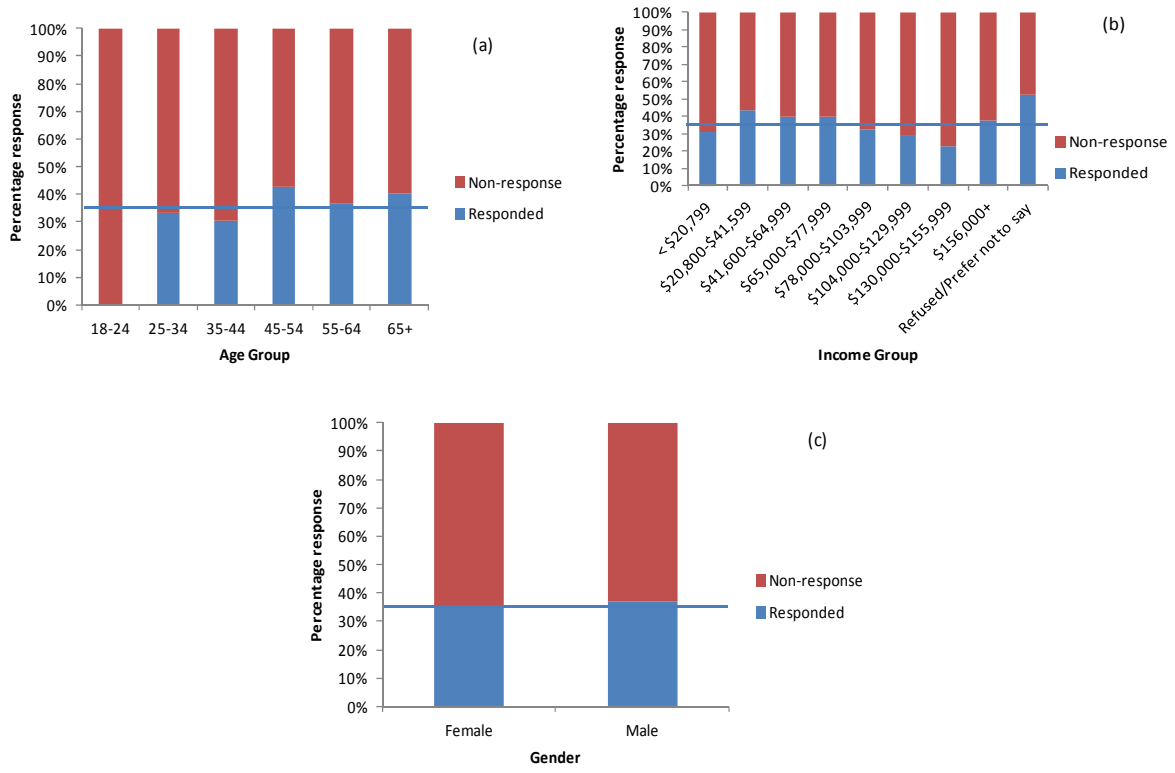


Figure 44. Comparison of respondents versus non-respondents by a) age group, b) income group and c) gender. The horizontal line in each graph represents the overall average response rate.

3.5.2 CONFIDENCE ABOUT THE APPROACHES

After completing the survey, respondents were asked to assess their degree of confidence in completing the survey using a 5 point scale (1 being very unsure, 5 being very sure and 3 being neutral). Very few respondents thought they were unsure about their rankings of the different types of sub-components or the weighting methods (Figure 45). Based on this, it can be concluded that the derived weights are fairly representative of the individual's preferences.

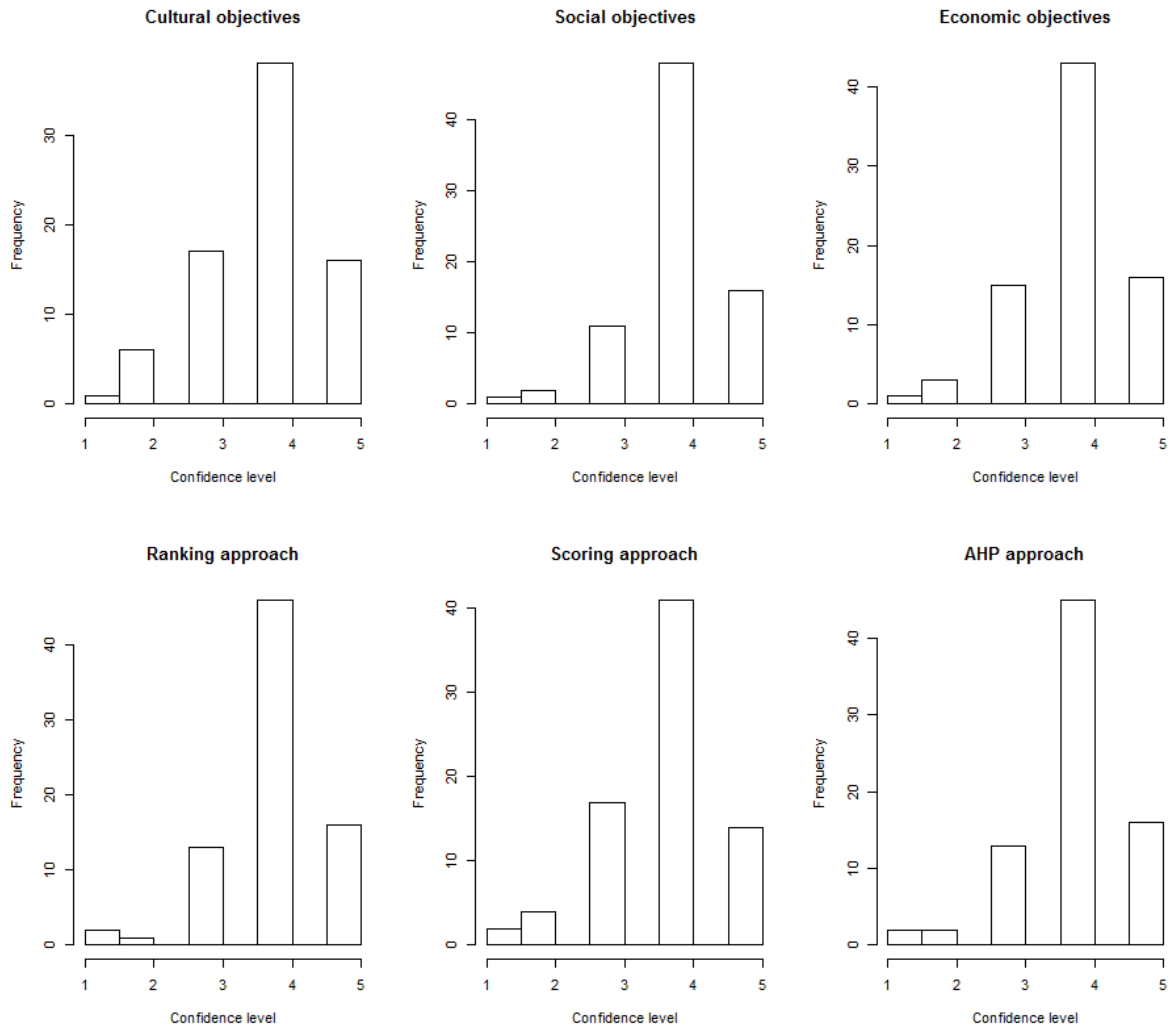


Figure 45. Distribution of self-reported confidence in individuals' scores about the different sub-components and also weighting methods.

3.5.3 CULTURAL SUB-COMPONENTS

The general community preference was for enhancing sense of place over cultural heritage (Figure 46). Despite the high confidence individuals placed in their responses using each method, correlation between the derived individuals scores was relatively low (Figure 47 and Table 22). Given the limited range that the weights derived from ranking method scores can take (i.e. only three values, allowing for equal preference), a positive but low correlation between rank based results and the other two

might be expected. However, the AHP weights tended to have a higher correlation with the rank-based weights than the score-based weights.

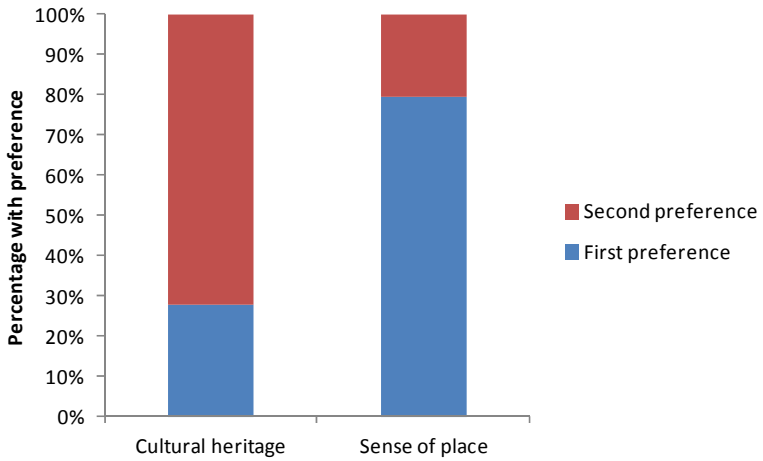


Figure 46. Preferences for each cultural sub-component based on the ranking method results

The correlation coefficients[12] between the different weighting approaches are the same for both cultural heritage and sense of place (Table 22) namely as there were only two options, so the weight of one is one less the weight of the other. With only one pair-wise comparison, inconsistency is not a problem for the AHP, so this has not been considered.

Table 22. Correlation between the individual scores using the different weighting methods: Cultural sub-components

	Rank	Scores	AHP
Cultural heritage			
• **Rank**	1.000	0.527	0.651
• **Scores**	0.527	1.000	0.569
• **AHP**	0.651	0.569	1.000
Sense of Place			
• **Rank**	1.000	0.527	0.651
• **Scores**	0.527	1.000	0.569
• **AHP**	0.651	0.569	1.000

[12] While significance scores associated with the correlation coefficients are not report, given the ample size, any correlation coefficient greater than 0.1 is statistically significantly greater than zero (i.e. no correlation), although a low score indicates a weak correlation.

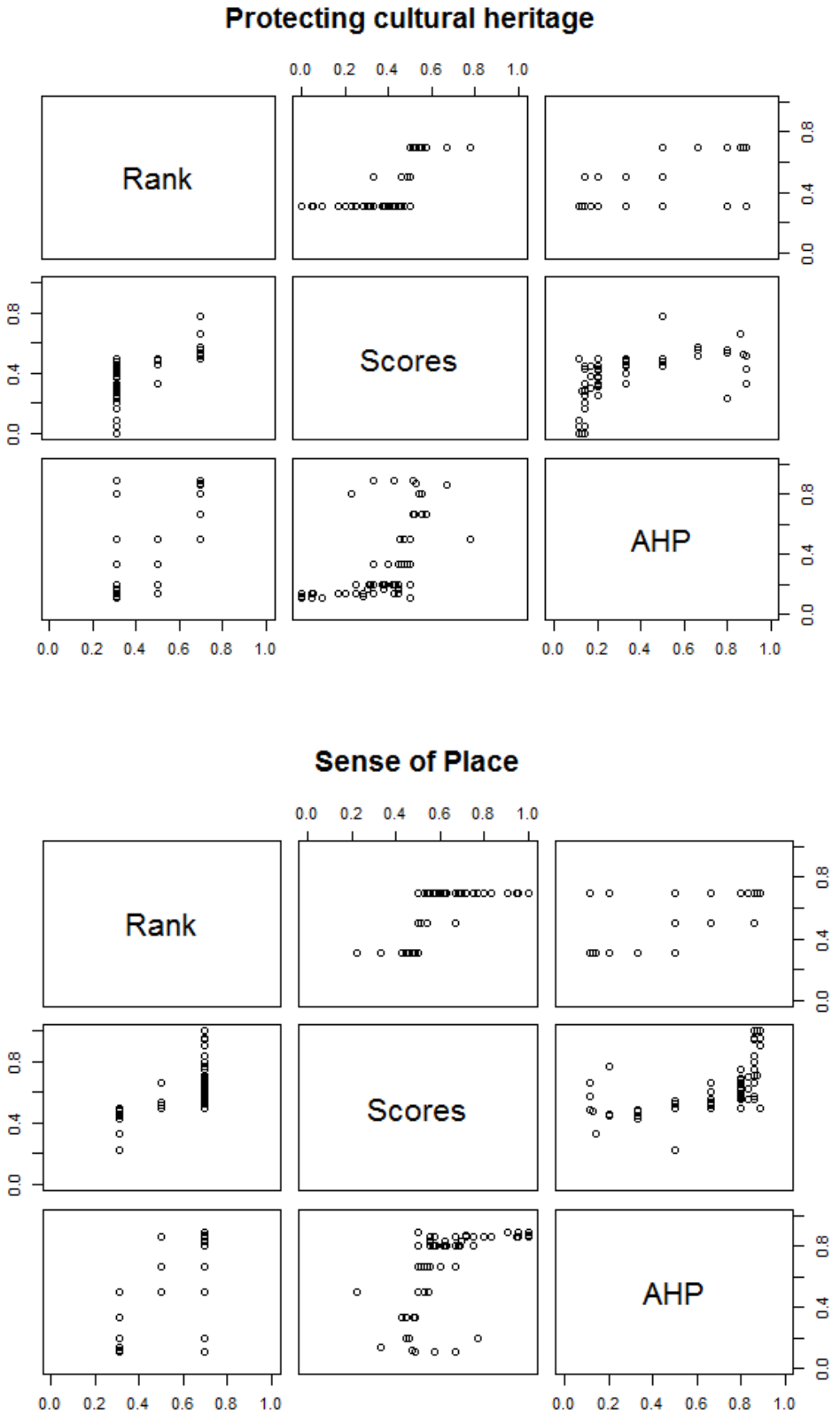


Figure 47. Comparison of individual scores using the different methods: a) cultural heritage and b) sense of place.

A comparison of the distributions of the weights using each approach is also shown in Figure 48. In each figure, the dark line represents the median value, the box represents the bounds of the upper 75th and lower 25th percentile, and the dotted line the range of the 95% confidence interval. From this, the median scores for the AHP and Rank method are most similar, but the distribution of weights from the scoring method is tighter than that of the AHP weights. The wider distribution of the AHP weights is also evident in the scatter plots in Figure 48, potentially contributing to the lower correlation with the Scoring method.

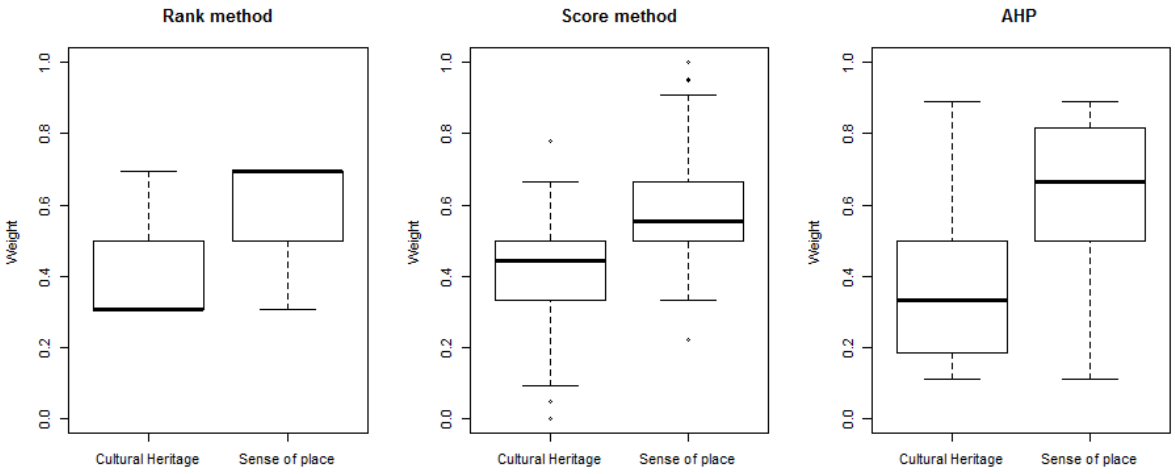


Figure 48. Distribution of relative weights by method

3.5.4 SOCIAL SUB-COMPONENTS

Preferences for the social sub-components were more mixed. Liveability and Wellbeing had a higher proportion of first preferences than the other two sub-components (Figure 49), although all three sub-components received first, second and third preferences.

As with the cultural sub-components, the correlations between the different weighting methods were not high (Figure 50), ranging from 0.44 (lowest) to 0.67 (highest) (Table 23). As with the cultural sub-components, the weights derived from the AHP and scoring approaches were relatively poorly correlated.

As with the cultural sub-components, the AHP weights had a substantially higher variability than the scoring derived weights (Figure 51). In contrast, the variability of the scoring derived weights was fairly low, suggesting a high degree of consistency in the preferences relative to the AHP derived weights. Based on the scoring approach results, the sub-sub-components are fairly evenly weighted, with a slight preference towards liveability and a lower preference for Harbour usability.

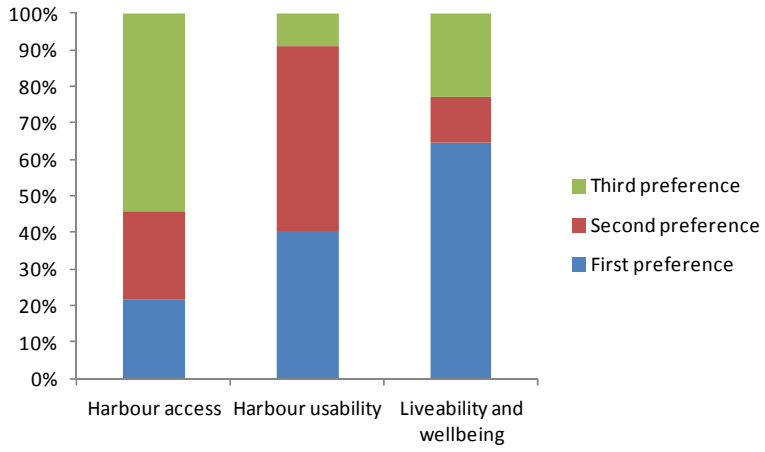


Figure 49. Preferences for each social sub-component based on the ranking method results

Table 23. Correlation between the individual scores using the different weighting methods: Social sub-components

	Rank	Scores	AHP
Harbour access			
• **Rank**	1.000	0.558	0.612
• **Scores**	0.558	1.000	0.448
• **AHP**	0.612	0.448	1.000
Harbour usability			
• **Rank**	1.00	0.519	0.597
• **Scores**	0.519	1.000	0.443
• **AHP**	0.597	0.443	1.000
Harbour liveability			
• **Rank**	1.000	0.670	0.660
• **Scores**	0.670	1.000	0.642
• **AHP**	0.660	0.642	1.000

As there were three sets of comparisons in the AHP for the social weights, the potential for inconsistency to influence these results exists. Most respondents were consistent in their responses, with a high proportion (greater than 50%) having a consistency measure less than 10% (the usual acceptable level of inconsistency) (Figure 52). However, a small number of individuals had very high inconsistency levels, potentially resulting in some extreme values in the data.

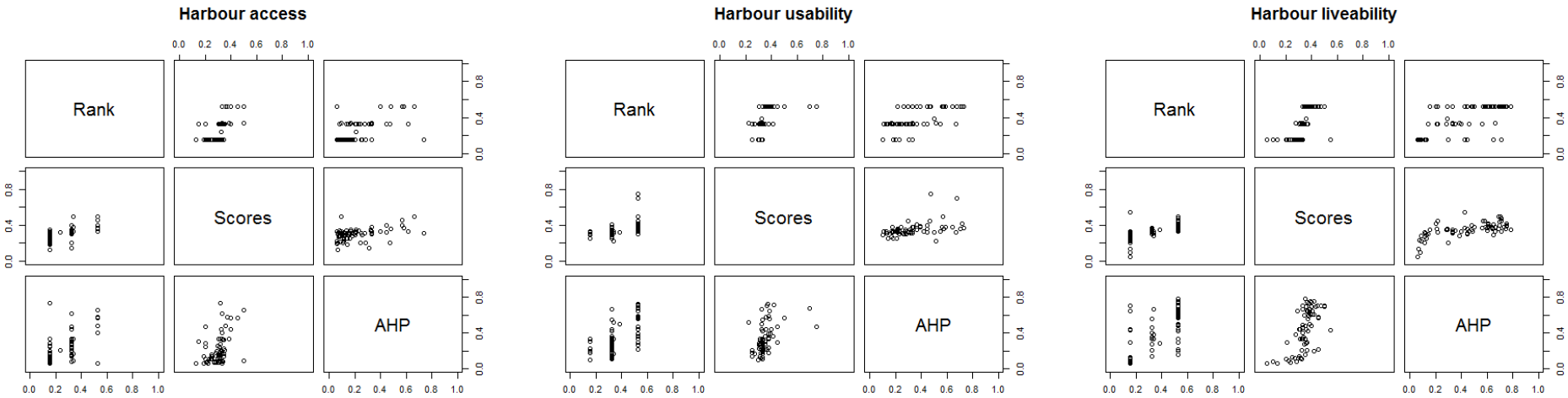


Figure 50. Comparison of individual scores using the different methods: a) Harbour access; b) Harbour usability and c) Harbour liveability.

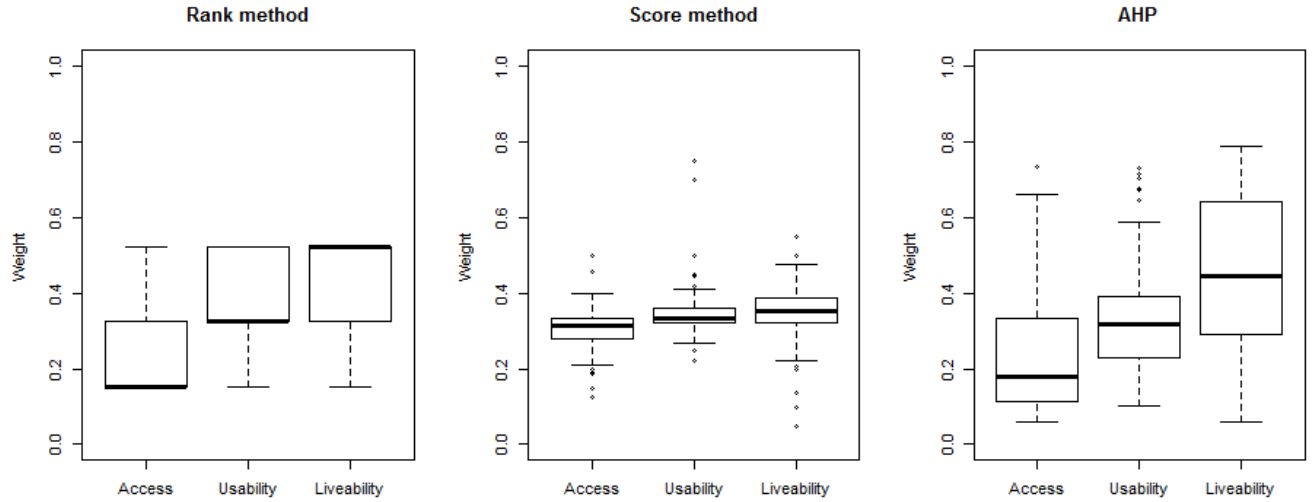


Figure 51. Distribution of relative weights by method: Social sub-components

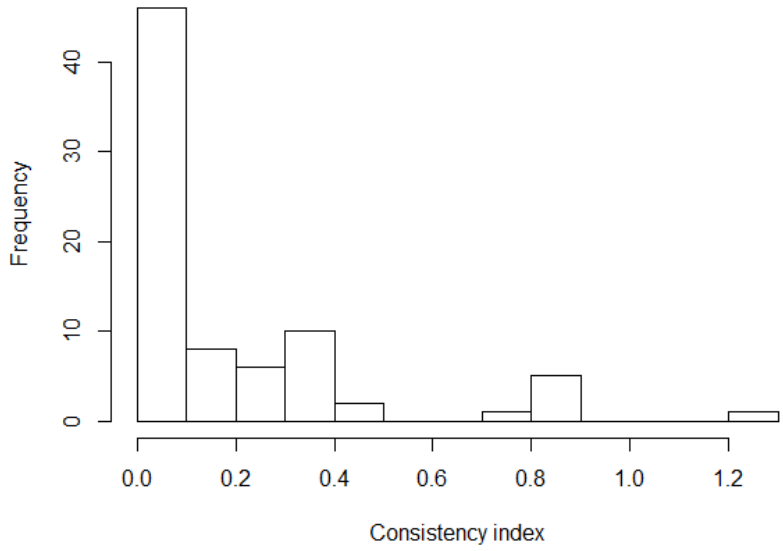


Figure 52. Distribution of inconsistency scores: Social sub-components

3.5.5 ECONOMIC SUB-COMPONENTS

There was substantial variability in terms of importance ranks of the three economic sub-components between individuals. From the rankings analysis, the recreational values sub-component received a higher proportion of first preferences, while the community stimulus received the most second preferences and the economic performance of Harbour industries the most third preferences (Figure 53).

The correlations between the different weighting methods were generally higher than for the social and cultural sub-components (Figure 48 and Figure 54), ranging from 0.44 (lowest) to 0.76 (highest) (Table 24). As with the cultural and social sub-components, the weights derived from the AHP and scoring approaches were relatively poorly correlated, although the AHP and Rank weights were more highly correlated.

As with the cultural and social sub-components, the AHP weights had a substantially higher variability than the scoring derived weights (Figure 55). In contrast, the variability of the scoring derived weights was again fairly low, suggesting a high degree of consistency in the preferences. Based on the scoring approach results, the sub-sub-components are again fairly evenly weighted, with a slight preference towards recreational benefits and a lower preference for economic performance of the Harbour industries.

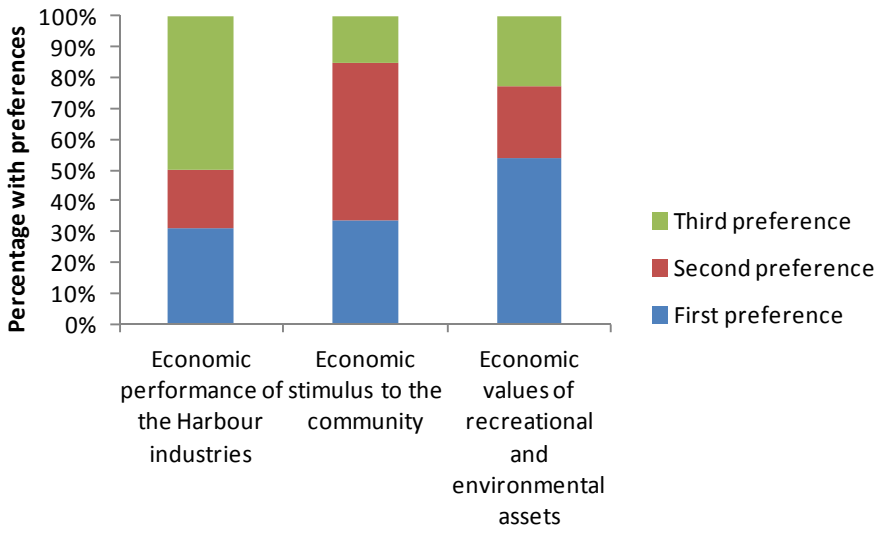


Figure 53. Preferences for each social sub-component based on the ranking method results: Economic sub-components

Table 24. Correlation between derived weights from the different methods: economic measures

	Rank	Scores	AHP
Economic performance of Harbour industries			
• **Rank**	1.000	0.624	0.759
• **Scores**	0.624	1.000	0.586
• **AHP**	0.759	0.586	1.000
Economic stimulus to the community			
• **Rank**	1.000	0.549	0.539
• **Scores**	0.549	1.000	0.445
• **AHP**	0.539	0.445	1.000
Economic values of recreational and environmental assets			
• **Rank**	1.000	0.657	0.761
• **Scores**	0.657	1.000	0.561
• **AHP**	0.761	0.561	1.000

Again, as there were three sets of comparisons in the AHP for the economics weights, the potential for inconsistency to influence these results exists. Most respondents were consistent in their responses, with a high proportion (around 50%) having a consistency measure less than 10% (the usual acceptable level of inconsistency) (Figure 56). However, as with the cultural sub-components, a small number of individuals had very high inconsistency levels, potentially resulting in some extreme values in the data and reducing their reliability.

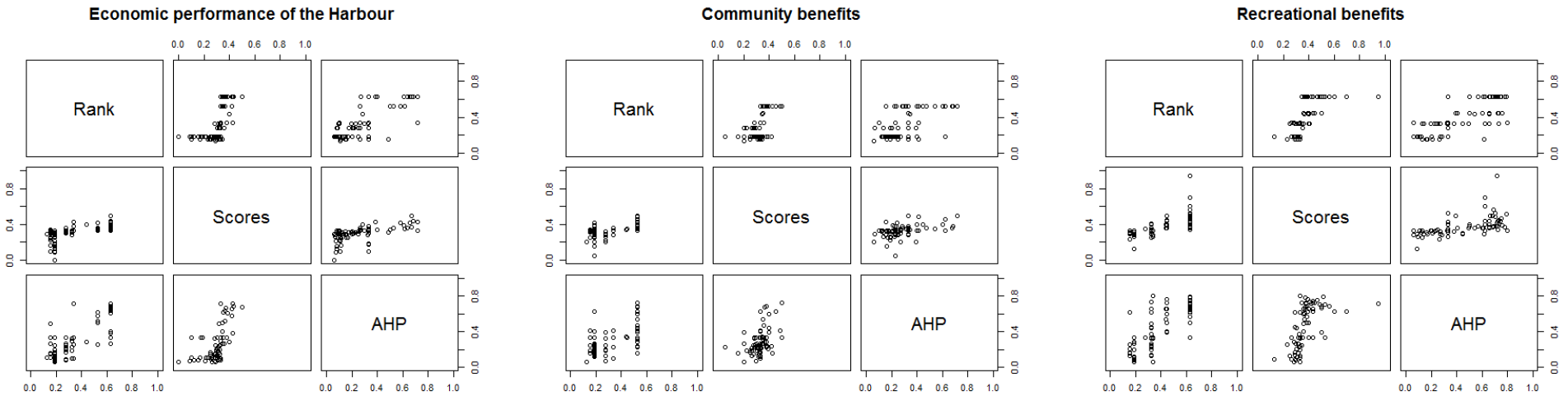


Figure 54. Comparison of individual scores using the different methods: a) Harbour industries; b) community benefits and c) recreational benefits

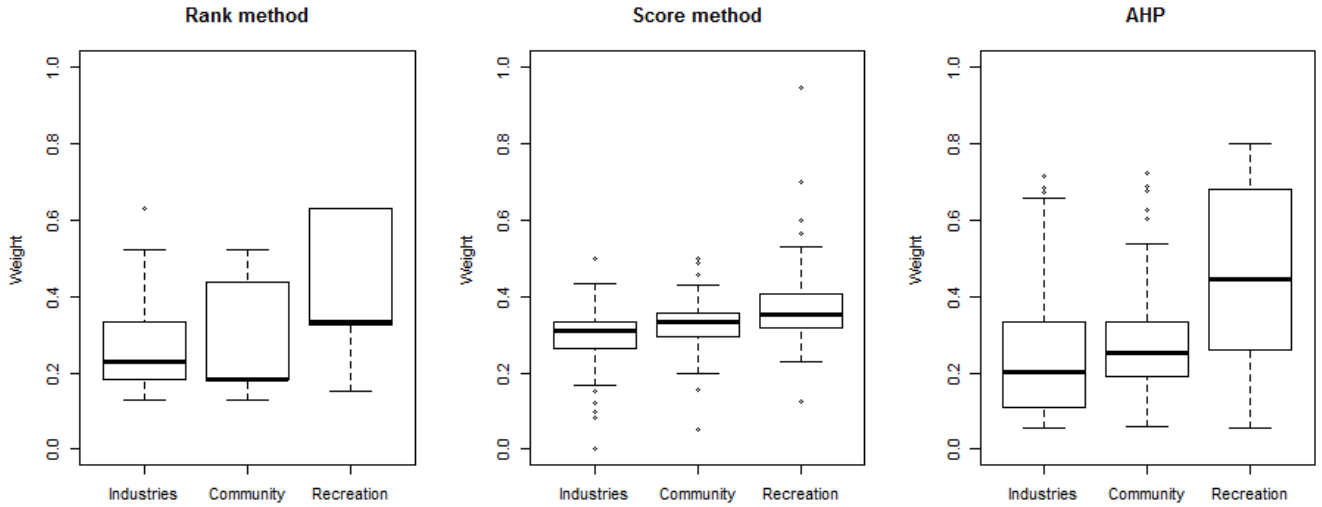


Figure 55. Distribution of relative weights by method: Economic sub-components

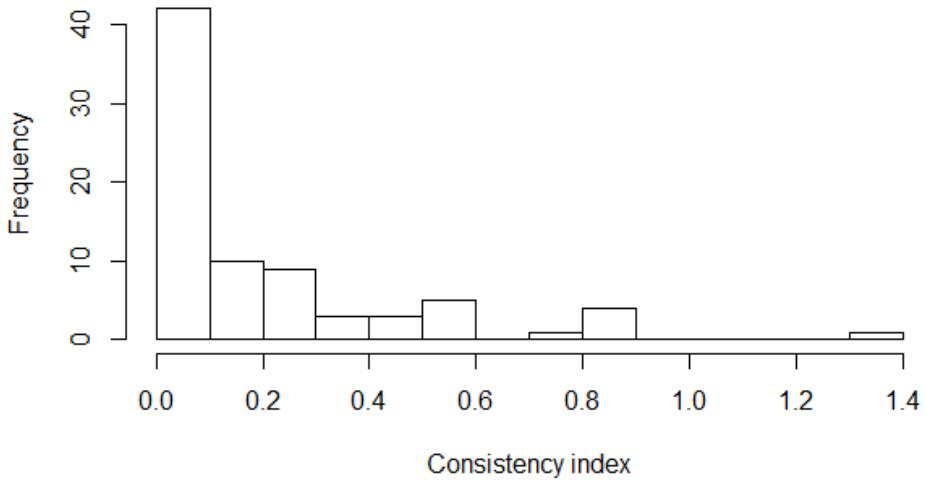


Figure 56. Distribution of inconsistency scores: Economic sub-components

3.5.6 CONDITIONAL PROBABILITY TABLES

A key aim of the community sub-components survey, other than to provide useful information on community preferences, was to develop contingency tables linking the sub-sub-component combinations to the main sub-components (i.e. cultural, social and economics sub-components). To derive the contingency tables, the potential combinations of outcomes (A-E) for each sub-sub-component were multiplied by the set of community preferences in order to determine the distribution of combined outcomes for the broader sub-component.

Formally, this is given by $O = WC^T$, where *W* is an *m*n* matrix of weights, where *n* is the number of sub-sub-components, and *m* is the number of respondents, *C* is a 5^n**n* matrix of sub-component outcome combinations. The product of these two matrices, *O*, is an *m*5*^{n} matrix representing the score individual *m* would give to the outcome (based on their individual weights) under the combination of outcomes (i.e. A,A; A,B, etc). These are aggregated over all individuals to provide a probability of a particular sub-component outcome given a set of sub-sub-component outcomes. To operationalise the probability estimation, the outcomes A-E were given nominal values of [0.9,0.7,0.5,0.3,0.1], being the means of their ranges as defined by the CATI surveys and other indicators.

The resultant probability of a particular outcome for the culture sub-component given the outcomes under the sub-sub-component are illustrated in Table 25. As expect, a combination of (A,A) produces an outcome of A for the main sub-component with 100 percent probability. Conversely, a combination of (E,E) produces an outcome of E with 100 percent probability. Other combinations provide a mix of probabilities, reflecting the differences in the weightings of the different individual surveyed. For example, a combination of (A,B) results in a 12.5% probability of an A and an 87.5% probability of a B for the overall cultural sub-component.

Similar tables were produced for the cultural and economic sub-components, although as these are 125 rows long (i.e. n^m combinations where n is the number of grades (5) and m is the number of sub-components (up to 3)) each are not presented below.

Only the weights derived from the scoring approach were used in the derivation of the contingency tables. These seemed the most consistent between individuals (i.e. the lowest variance) while still providing the opportunity for weights to vary (more so than from the ranking approach). The AHP weights, while often considered superior, were not used due to the large amount of inconsistencies (around 50%), which would have reduced the available information for use in the analysis.

Table 25. Conditional probability table results based on weights: cultural sub-components

Sub-component		Cultural component outcome probability				
Heritage	Place	A	B	C	D	E
A	A	100.0	0.0	0.0	.0	0.0
A	B	12.2	87.8	0.0	0.0	0.0
A	C	1.2	85.4	13.4	0.0	0.0
A	D	0.0	35.4	53.7	11.0	0.0
A	E	0.0	2.4	64.6	23.2	9.8
B	A	64.6	35.4	0.0	0.0	0.0
B	B	0.0	100.0	0.0	0.0	0.0
B	C	0.0	35.4	64.6	0.0	0.0
B	D	0.0	1.2	81.7	17.1	0.0
B	E	0.0	0.0	12.2	78.0	9.8
C	A	13.4	85.4	1.2	0.0	0.0
C	B	0.0	87.8	12.2	0.0	0.0
C	C	0.0	0.0	100.0	0.0	0.0
C	D	0.0	0.0	12.2	87.8	0.0
C	E	0.0	0.0	1.2	85.4	13.4
D	A	9.8	78.0	12.2	0.0	0.0
D	B	0.0	17.1	81.7	1.2	0.0
D	C	0.0	0.0	64.6	35.4	0.0
D	D	0.0	0.0	0.0	100.0	0.0
D	E	0.0	0.0	0.0	35.4	64.6
E	A	9.8	23.2	64.6	2.4	0.0
E	B	0.0	11.0	53.7	35.4	0.0
E	C	0.0	0.0	13.4	85.4	1.2
E	D	0.0	0.0	0.0	87.8	12.2
E	E	0.0	0.0	0.0	0.0	100.0

3.6 Manager sub-components survey results

As with the community sub-components survey, the main aim of the managers' survey was to elicit sub-component weights for use in developing conditional probability tables for the BBNs. This allows reporting of outcomes from two perspectives – the perspective of the general community (those

who must live with management decisions) and those of the regional leaders who influence directly (or indirectly) the management directions.

Identifying the scores from the two perspectives is important if the relative importance of the different outcomes differ, as what might be ideal from one perspective (e.g. the managers') may not be considered appropriate from the other (e.g. community's). Managers are likely to develop plans based around their own perceptions of the priorities for the region, and if these differ from the actual priorities of the broader community then they will be seen as operating poorly.

3.6.1 SAMPLE SIZE AND RESPONSE RATE

The online survey was run over the period 20 September 2014 to 27 September 2014 using SurveyMonkey. A total of 77 invitations were sent out to members of the GHHP ISP, GHHP Management Committee, local councillors, GAPDL Directors, Gladstone Chamber of Commerce and Industry Directors, Gladstone Engineering Alliance Committee members, and a range of other stakeholders representing commercial and recreational fishing and conservation management. In total, 31 responses to the survey were received, representing a response rate of approximated 40%.

Many of the respondents had multiple roles in terms of regional management (for example, some local councillors also participated in other industry-related groups). Most key stakeholder groups were represented (Figure 57), with those identifying as representing tourism management and traditional owners being the least represented (no individuals identified as representing traditional owners).

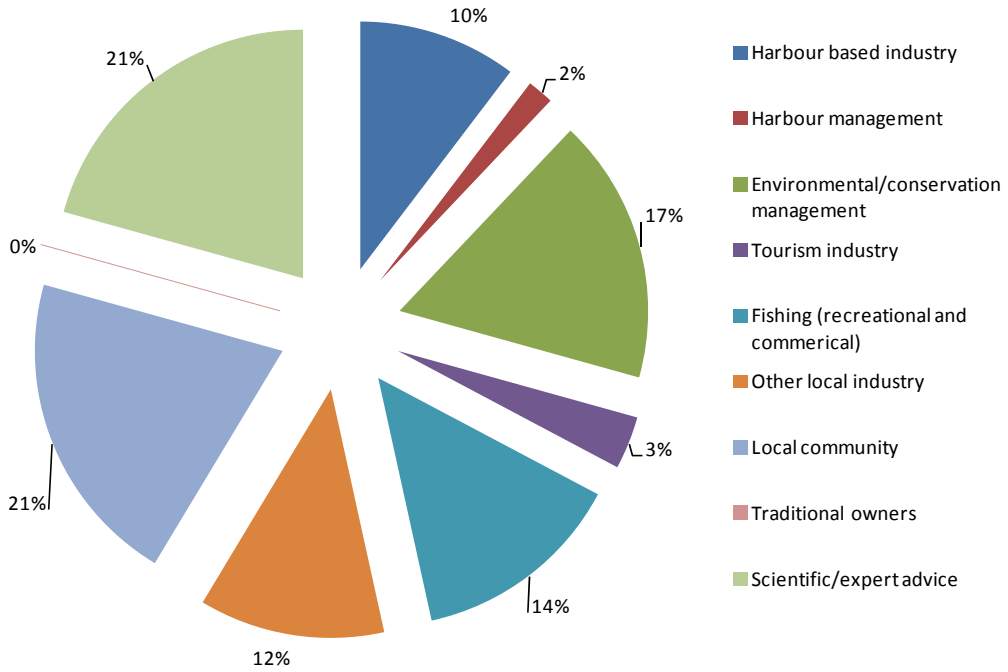


Figure 57. Respondent representation for the managers' sub-component rating surveys

3.6.2 CONFIDENCE ABOUT THE APPROACHES

As with the community sub-components survey, respondents were asked to assess their degree of confidence in completing the survey using a 5 point scale (1 being very unsure, 5 being very sure and 3 being neutral). Respondents were fairly confident about their rankings of the different types of sub-components and the ranking methods used (Figure 58). Average confidence ratings were 4 or greater for all sub-components and methods. Based on this, it can be concluded that the derived weights are fairly representative of the individual's preferences.

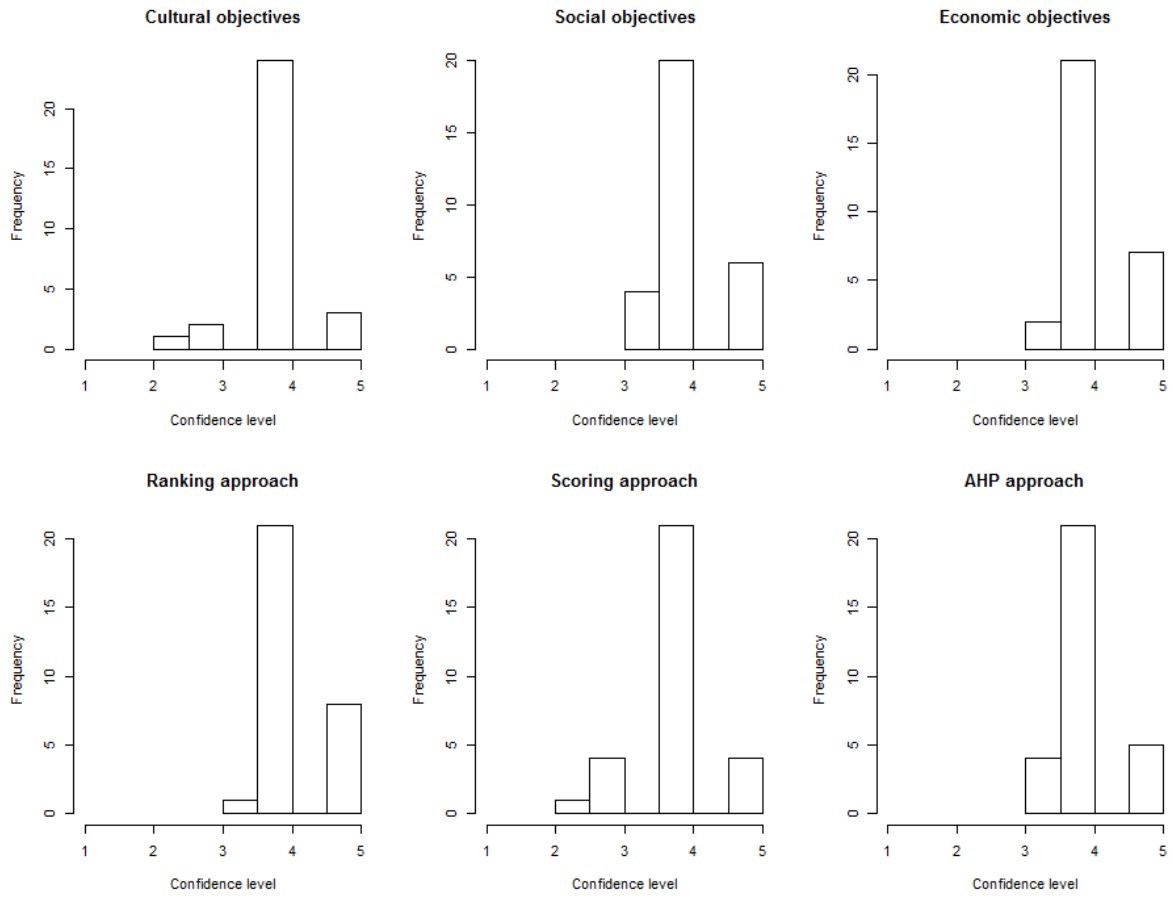


Figure 58. Distribution of self-reported confidence in individuals' scores about the different sub-components and also weighting methods (managers)

3.6.3 CULTURAL SUB-COMPONENTS

A comparison of the distributions of the weights using each approach is shown in (Figure 59). As with the community survey results, the median scores for the AHP and Rank method are most similar, but the distribution of weights from the scoring method is tighter than that of the AHP weights.

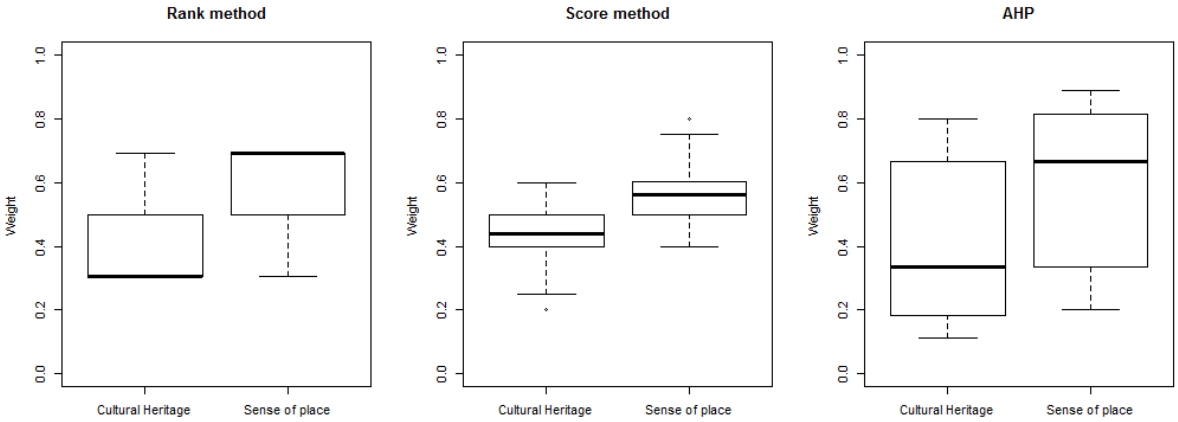


Figure 59. Distribution of relative weights by method: Cultural sub-components (managers)

The correlation coefficients[13] between the different approaches are the same for both cultural heritage and sense of place (Table 26). As there were only two options, the weight of one is one less the weight of the other. The ranking and scoring methods had the highest correlation. While the median weights from rank and AHP methods were similar, there was lower correlation between the individual preferences.

Table 26. Correlation between the individual scores using the different weighting methods: Cultural sub-components (managers)

Ranking method	Rank	Scores	AHP
Rank	1.000	0.715	0.647
Scores	0.715	1.000	0.629
AHP	0. 647	0. 629	1.000

With only one pair-wise comparison, inconsistency is not a problem for the AHP, so this has not been considered.

3.6.4 SOCIAL SUB-COMPONENTS

The distributions of the managers' social sub-components weights by method are presented in Figure 60. As with the community sub-components, the liveability sub-component was considered the most important and the Harbour access sub-component the least. The difference between the median weights was least for the score method, which also had the tightest distributions around the

[13] While significance scores associated with the correlation coefficients are not report, given the ample size, any correlation coefficient greater than 0.2 is statistically significantly greater than zero (i.e. no correlation), although a low score indicates a weak correlation.

median. In contrast, there was considerable variation around the median weights from the rank and AHP approaches.

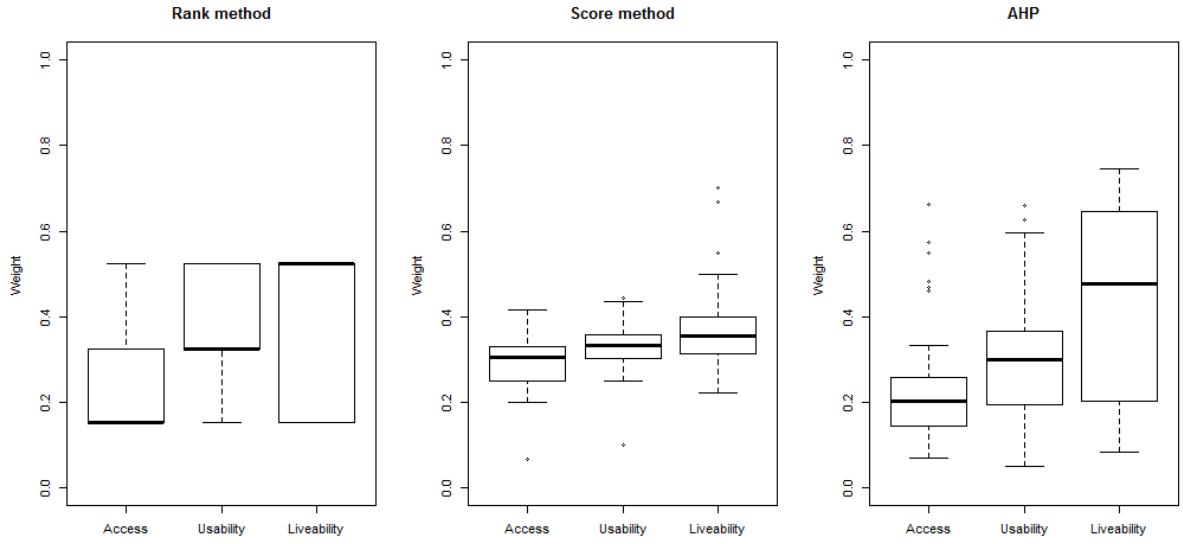


Figure 60. Distribution of relative weights by method: Social sub-components (managers)

While the AHP and rank methods produced similar median scores and distributions, the correlation between the AHP and other two methods was generally low (Table 27). The rank and scoring methods has the highest correlations.

Table 27. Correlation between the individual scores using the different weighting methods: Social sub-components (managers)

	Rank	Scores	AHP
Harbour access			
• **Rank**	1.000	0.614	0.437
• **Scores**	0.614	1.000	0.147
• **AHP**	0.437	0.147	1.000
Harbour usability			
• **Rank**	1.00	0.734	0.699
• **Scores**	0. 734	1.000	0.716
• **AHP**	0. 699	0.716	1.000
Harbour liveability			
• **Rank**	1.000	0.680	0.566
• **Scores**	0.680	1.000	0.360
• **AHP**	0.566	0.360	1.000

As there were three sets of comparisons in the AHP for the social weights, the potential for inconsistency to influence these results exists. Only around half of the respondents were consistent in their responses, having a consistency measure less than 10% (the usual acceptable level of inconsistency) (Figure 61), with around half of the remainder having consistency scores less than 20%. Two individuals had very high inconsistency levels (greater than 100%), potentially resulting in some extreme values in the data, and the low correlations between the AHP and other scoring methods.

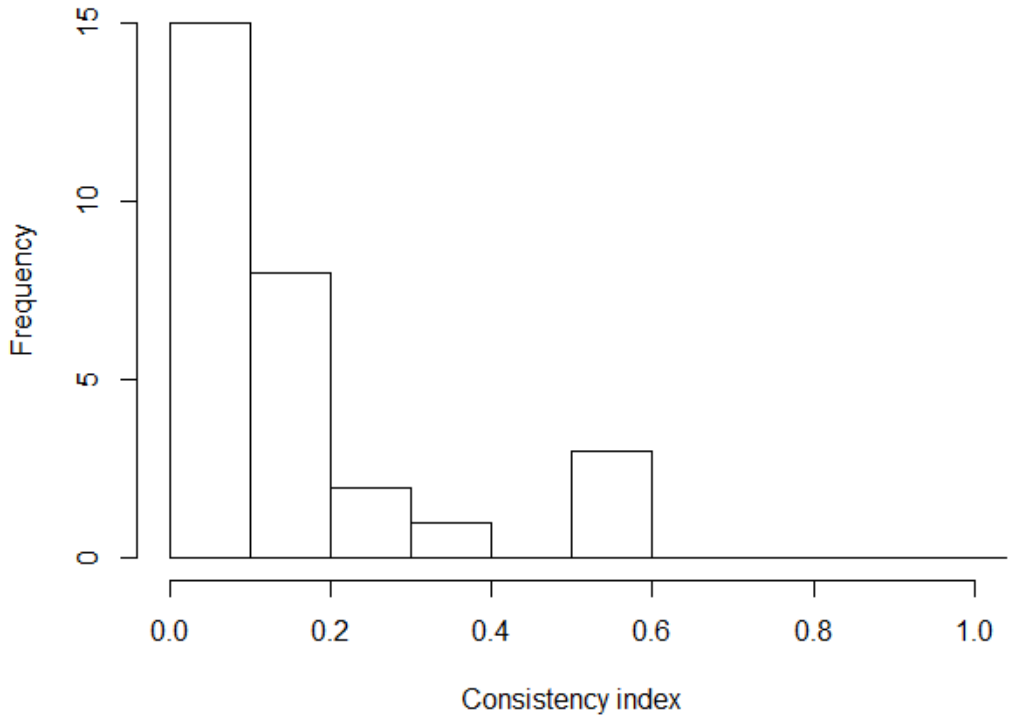


Figure 61. Distribution of inconsistency scores: Social sub-components (managers)

3.6.5 ECONOMIC SUB-COMPONENTS

The relative importance of the three economic sub-components is shown in Figure 62. Unlike the other sub-components, the median importance differs between the rank and other two methods. Community stimulus was ranked lowest using the rank weighting method. All three sub-components were relatively equal in importance from the scoring method, while recreational benefits was considered the most important based from the AHP.

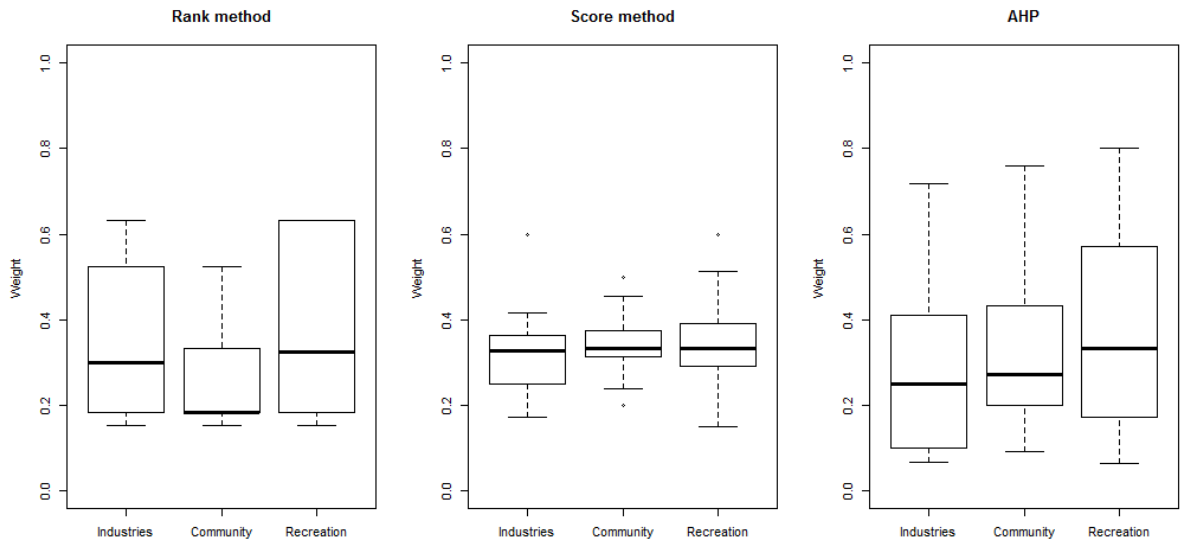


Figure 62. Distribution of relative weights by method: Economic sub-components (managers)

The correlation between approaches was also the lowest for the community stimulus sub-component (Table 28).

Table 28. Correlation between derived weights from the different methods: economic measures (managers)

	Rank	Scores	AHP
Economic performance of Harbour industries			
• **Rank**	1.000	0.624	0.759
• **Scores**	0.624	1.000	0.586
• **AHP**	0.759	0.586	1.000
Economic stimulus to the community			
• **Rank**	1.000	0.549	0.539
• **Scores**	0.549	1.000	0.445
• **AHP**	0.539	0.445	1.000
Economic values of recreational and environmental assets			
• **Rank**	1.000	0.657	0.761
• **Scores**	0.657	1.000	0.561
• **AHP**	0.761	0.561	1.000

As with the other sub-components, inconsistency was a problem with the AHP measures, again with only half of the respondents providing acceptably consistent results (Figure 61). As a result, the reliability of the AHP measures are largely questionable. While a subset of consistent observations could be used, this reduces the sample size considerably.

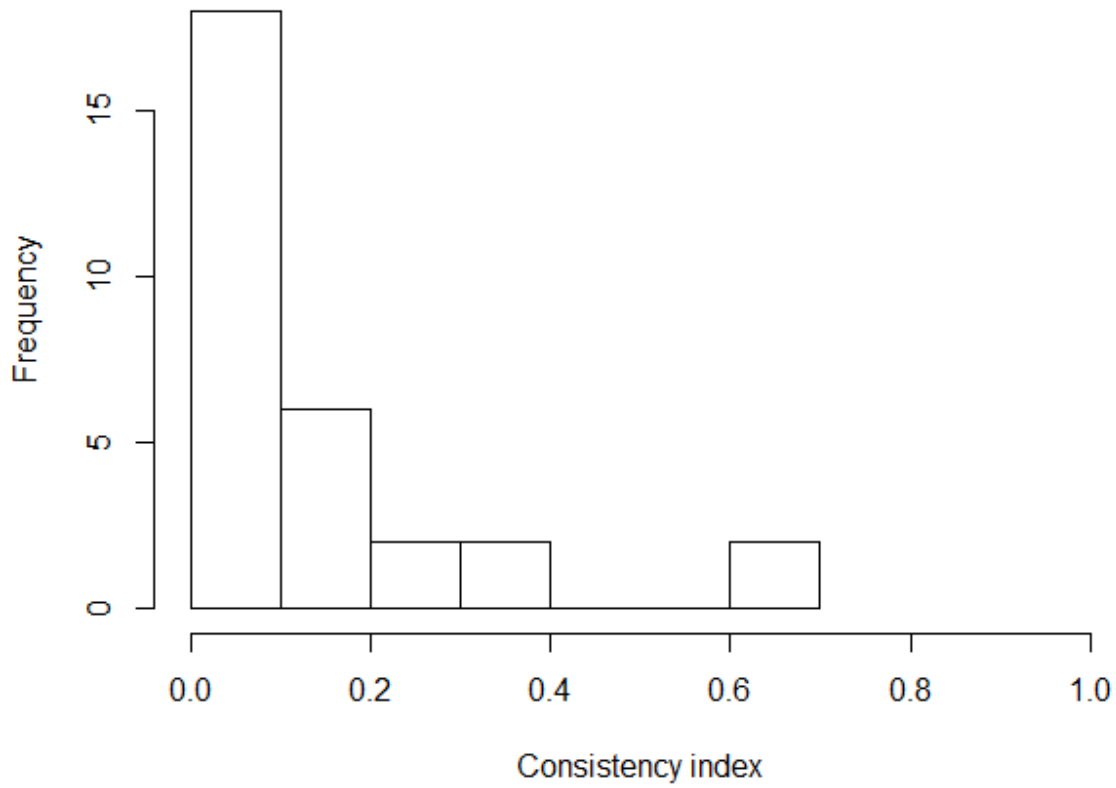


Figure 63. Distribution of inconsistency scores: Economic sub-components (managers)

3.6.6 CONDITIONAL PROBABILITY TABLES

As with the community survey, the conditional probability tables were derived for each sub-component component. The cultural component table is presented in Table 29, based on the scoring method results, for illustrative purposes. These are relatively consistent with the community results (Table 25), with the slight differences reflecting a slightly higher importance weight given by managers for the heritage sub-component (and a slightly lower weight for the sense of place sub-component). Similar slight variations are seen also for the other two components, although the results are fairly consistent overall.

Table 29. Conditional probability table results based on weights: cultural sub-components (managers)

Sub-sub-component		Cultural component outcome probability				
Heritage	Place	A	B	C	D	E
A	A	100.0	0.0	0.0	0.0	0.0
A	B	19.4	80.6	0.0	0.0	0.0
A	C	0.0	96.8	3.2	0.0	0.0
A	D	0.0	32.3	67.7	0.0	0.0
A	E	0.0	0.0	77.4	22.6	0.0
B	A	67.7	32.3	0.0	0.0	0.0
B	B	0.0	100.0	0.0	0.0	0.0
B	C	0.0	32.3	67.7	0.0	0.0
B	D	0.0	0.0	93.5	6.5	0.0
B	E	0.0	0.0	19.4	80.6	0.0
C	A	3.2	96.8	0.0	0.0	0.0
C	B	0.0	80.6	19.4	0.0	0.0
C	C	0.0	0.0	100.0	0.0	0.0
C	D	0.0	0.0	19.4	80.6	0.0
C	E	0.0	0.0	0.0	96.8	3.2
D	A	0.0	80.6	19.4	0.0	0.0
D	B	0.0	6.5	93.5	0.0	0.0
D	C	0.0	0.0	67.7	32.3	0.0
D	D	0.0	0.0	0.0	100.0	0.0
D	E	0.0	0.0	0.0	32.3	67.7
E	A	0.0	22.6	77.4	0.0	0.0
E	B	0.0	0.0	67.7	32.3	0.0
E	C	0.0	0.0	3.2	96.8	0.0
E	D	0.0	0.0	0.0	80.6	19.4
E	E	0.0	0.0	0.0	0.0	100.0

3.7 Social indicators survey results

3.7.1 SAMPLE SIZE AND RESPONSE RATE

The online survey was run over the period 11 September 2014 to 21 September 2014 using SurveyMonkey. A total of 60 initial invitations were sent out to social scientists who have previously been involved in Australian marine or coastal social science studies. The list of potential social scientists was developed within the project team based on known individuals. Of these, one person

had previously opted out of SurveyMonkey surveys (so the email was not sent). As a result, the effective sample was 61 individuals.

In total, 19 responses to the survey were received, representing a response rate of approximated 31%.

3.7.2 CONFIDENCE ABOUT THE APPROACHES

After completing the survey, respondents were asked to assess their degree of confidence in completing the survey using a 5 point scale (1 being very unsure, 5 being very sure and 3 being neutral). With the exception of the cultural heritage sub-sub-components, most respondents expressed a high degree of confidence in their responses regarding the different sub-sub-components (Figure 64).

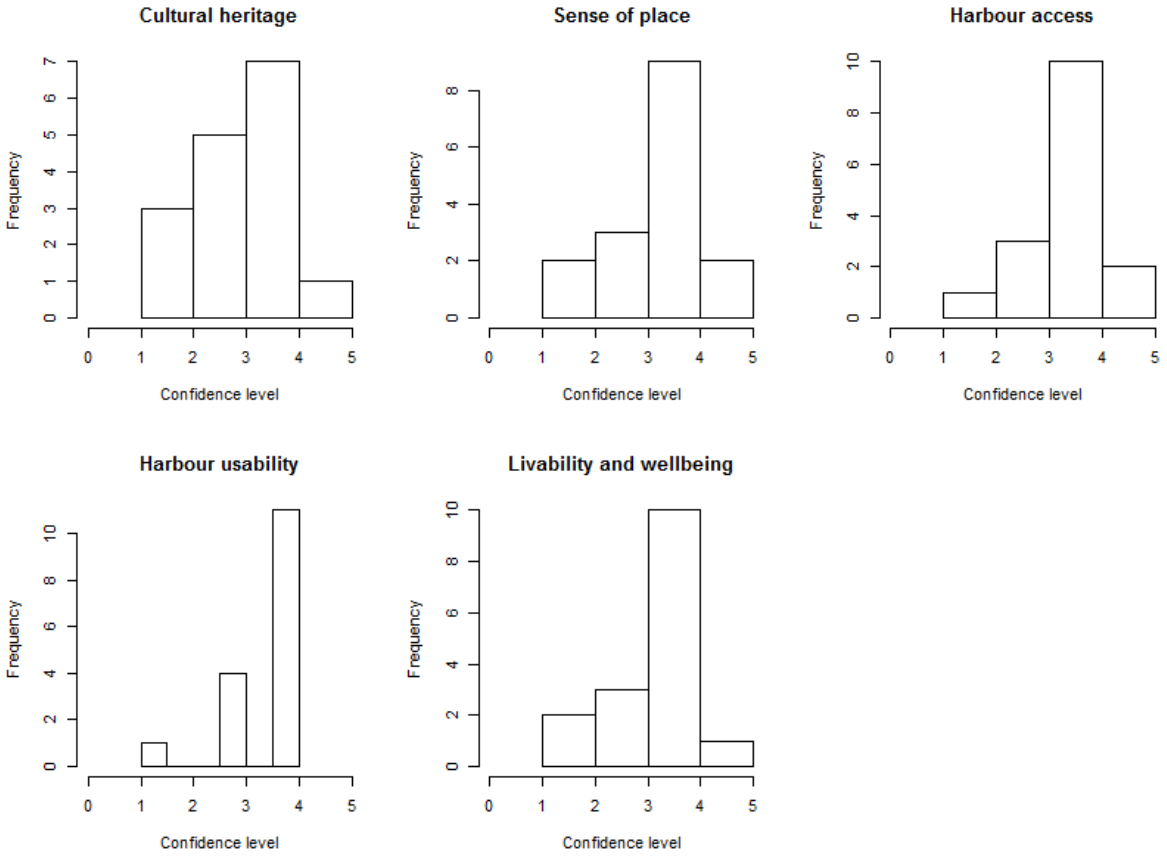


Figure 64. Distribution of self-reported confidence in individuals' scores about the sub-different sub-components

Very few respondents thought they were unsure about their rankings (i.e. a score less than 3) of the different ranking methods (Figure 65), although a small proportion were more confident with the ranking approach than the scoring approach. Based on this, it can be concluded that the derived weights are fairly representative of the individual's preferences.

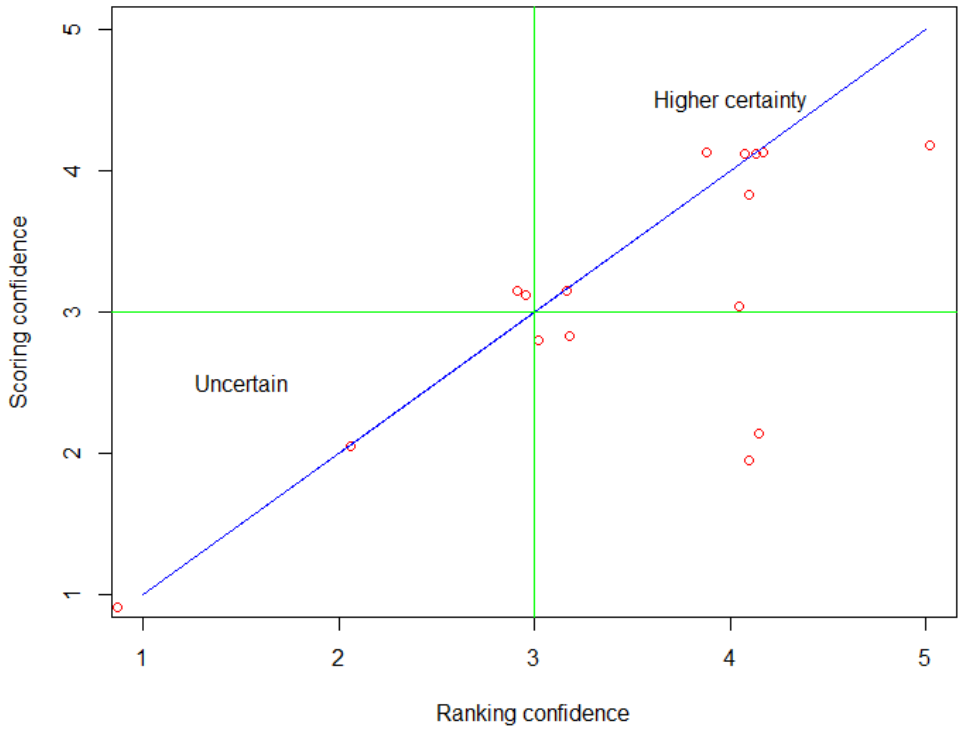


Figure 65. Confidence in the weighting approaches (social science surveys)
Note. A small random variation has been added to each point to separate them on the graph (otherwise they overlap).

3.7.3 CULTURAL HERITAGE SUB-COMPONENT

Four key indicators were chosen to provide information for the cultural heritage sub-sub-component (Figure 66). As with the community sub-components survey, the relative importance of each was first determined, then how these combine to provide an overall sub-component score was also determined (i.e. the contingency table linking the indicator outcomes to the sub-component outcomes).

The ranks given to each indicator are presented in Figure 67. There was general agreement between the respondents that the proportion of known indigenous sites protected was the primary indicator of the sub-sub-component, and the condition of non-indigenous cultural heritage sites was clearly ranked second by most respondents. The other two indicators received a wide mix of preferences.

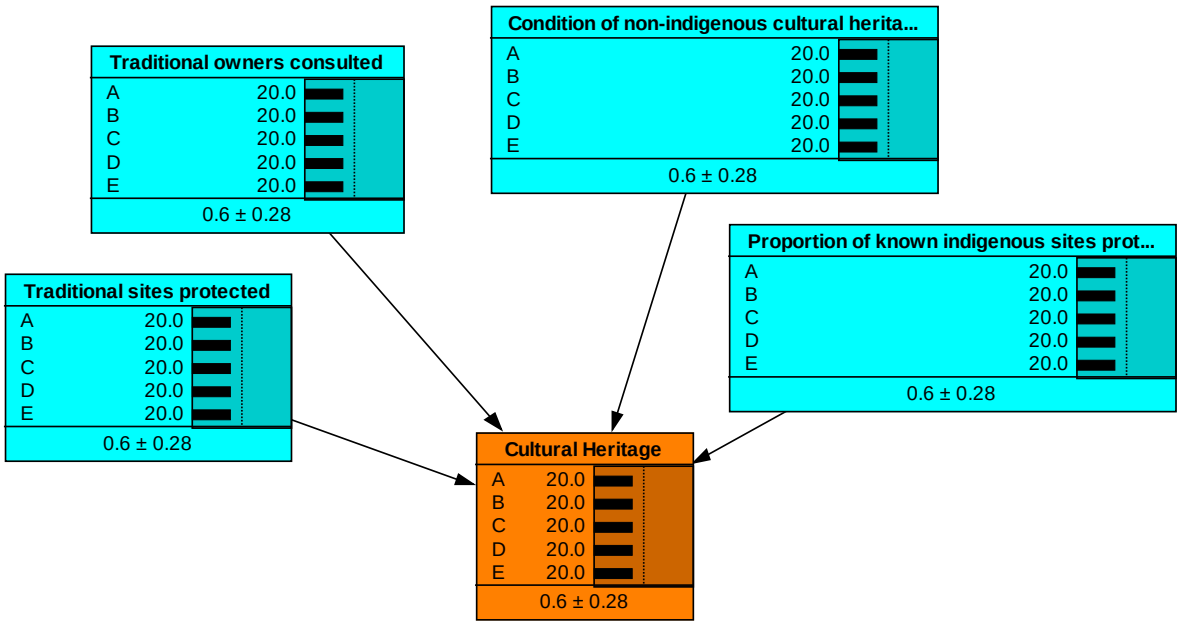


Figure 66. Indicators determining the cultural heritage outcome

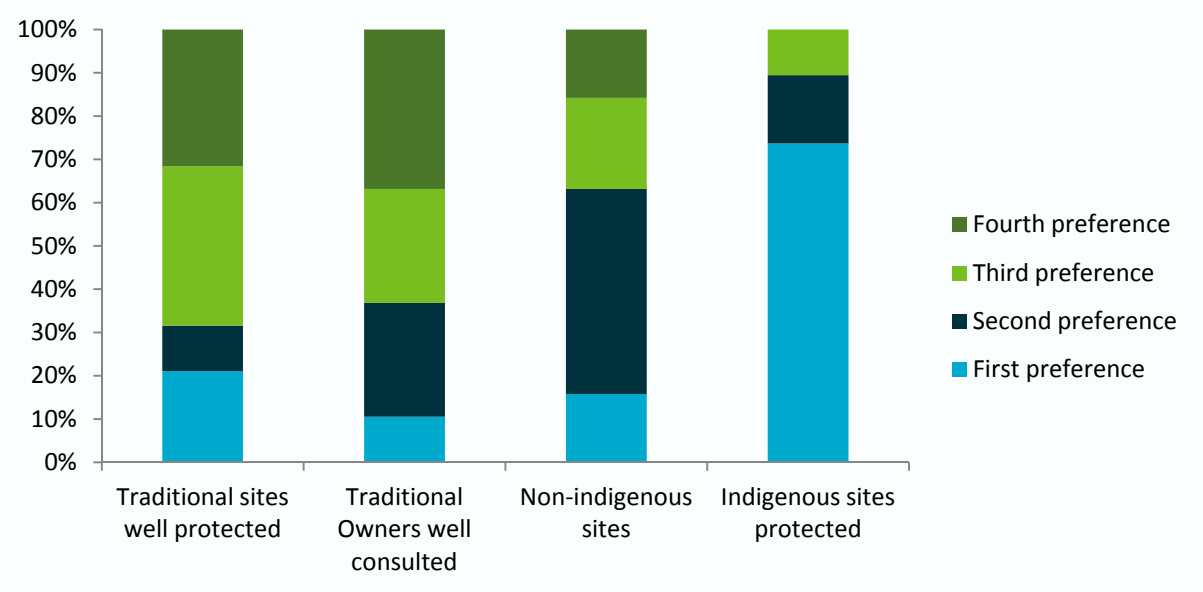


Figure 67. Importance ranking of each of the indicators: Cultural Heritage

A comparison of the distributions of the weights for each indicator using each approach is also shown in Figure 68. In each figure, the dark line represents the median value, the box represents the bounds of the upper 75th and lower 25th percentile, and the dotted line the range of the 95% confidence interval. From this, the general trends from both methods are fairly similar, but the distribution of weights from the scoring method is tighter than that of the rank-based weights.

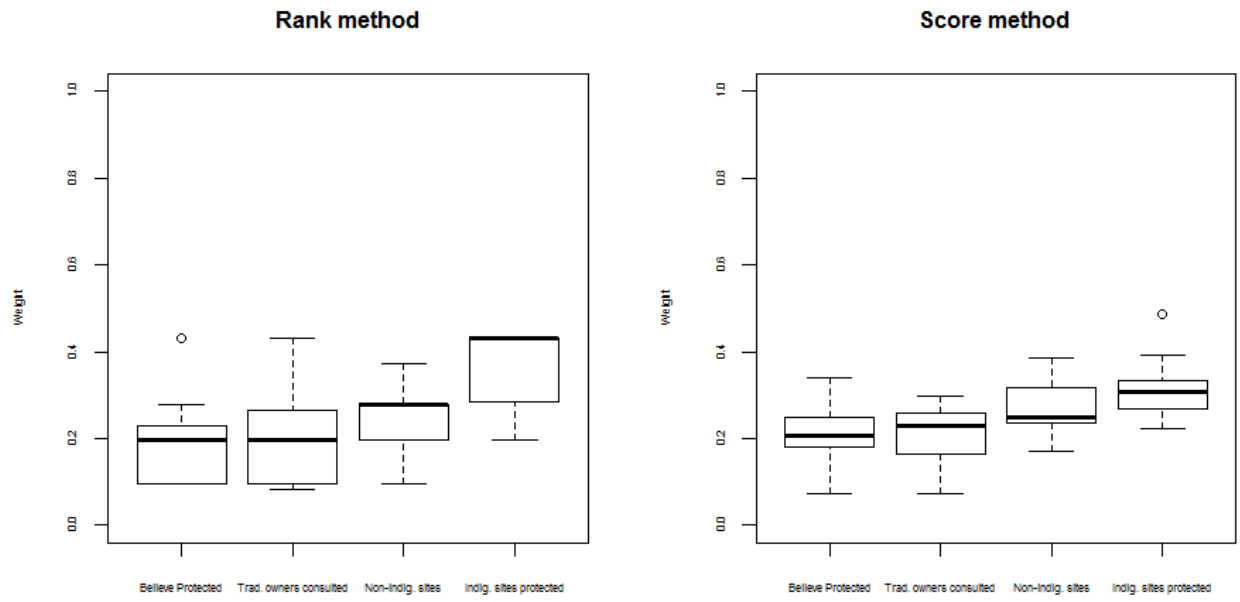


Figure 68. Distribution of relative weights by method: Cultural Heritage

3.7.4 SENSE OF PLACE SUB-COMPONENT

The sense of place sub-sub-component has six main indicators, five of which also have two or more different measures (Figure 69). As such it is the most complex of the sub-sub-components considered in the study. The analysis considers first the relationship between the six key indicators and the sub-sub-component, and then between the measures and the indicator values.

In terms of simple ranking, the values indicator had a clear first preference by the majority of respondents (Figure 70). After that, however, preferences varied considerably (Figure 71). Similar trends were also observed from the score based weights.

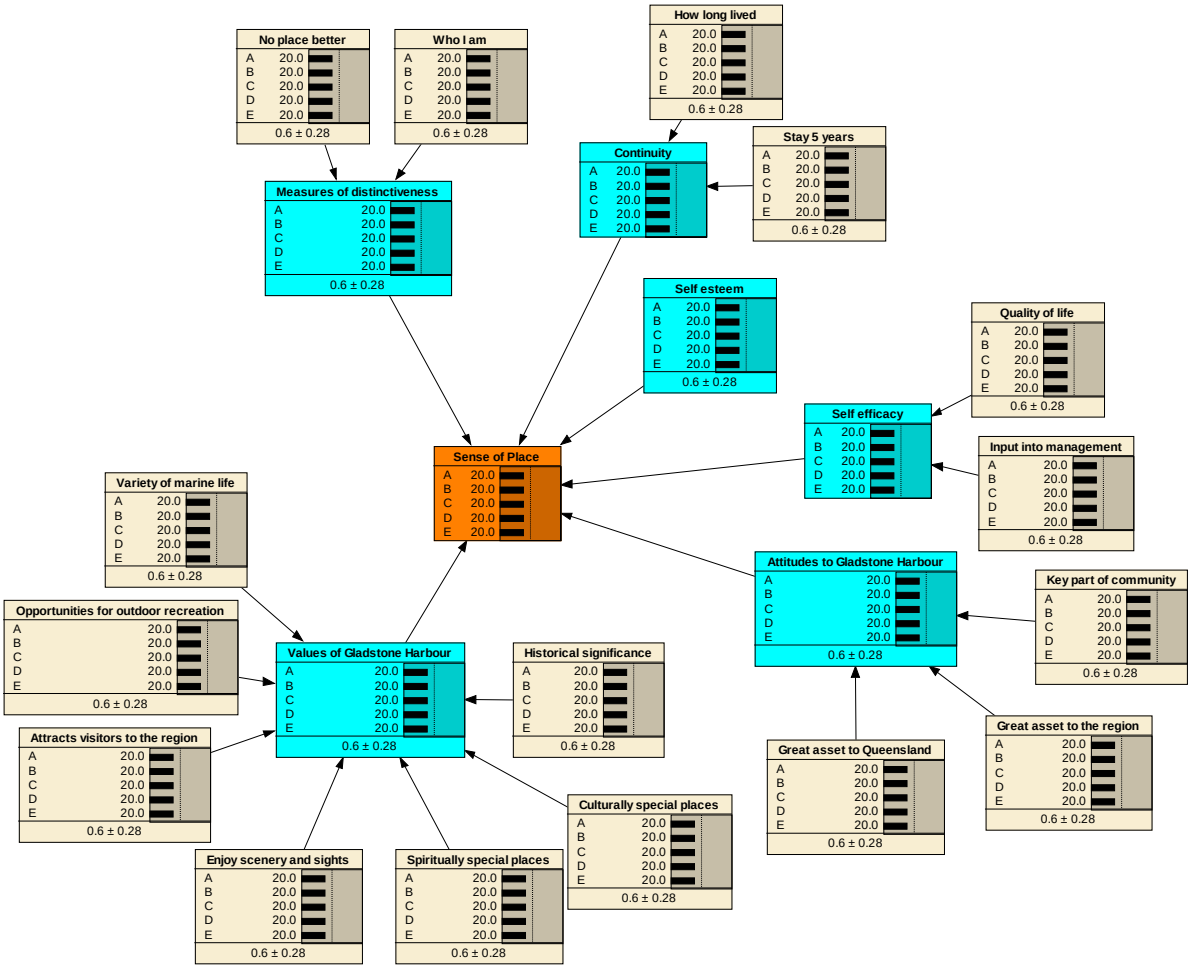


Figure 69. Key linkages within the Sense of Place sub-sub-component

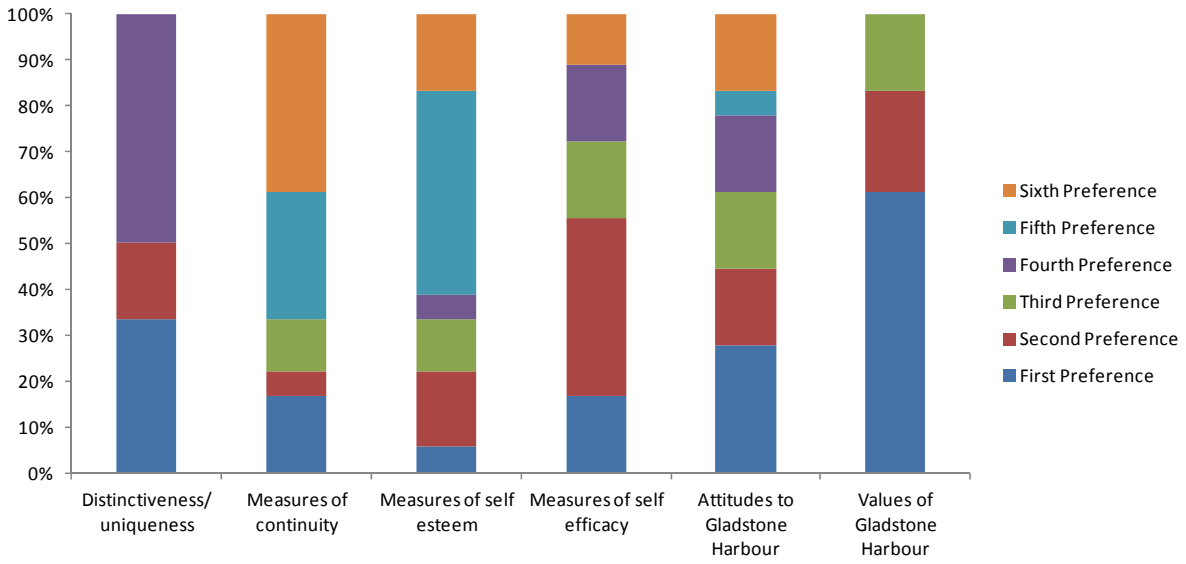


Figure 70. Importance ranking of each of the indicators: Sense of Place

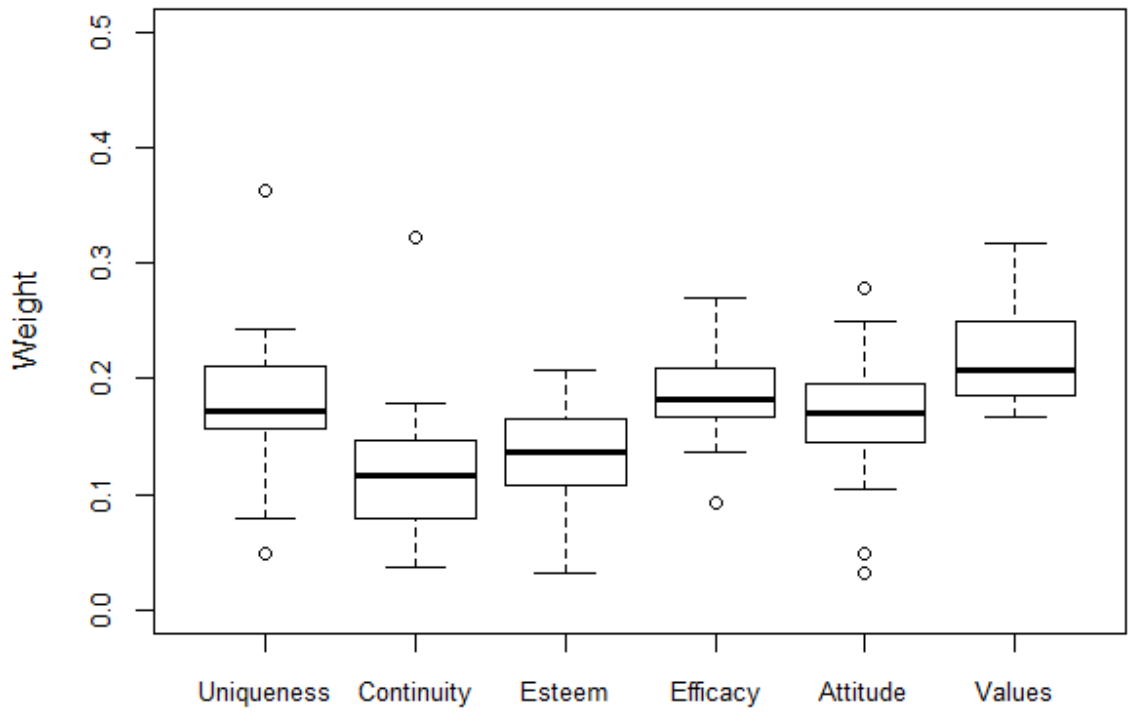


Figure 71. Scoring derived weights for each of the indicators: Sense of Place

The relative importance of each measure in defining the indicator is shown in Figure 72. The median scores in each case were fairly evenly balanced, although there was considerable variability in the perception of the importance of the different measures.

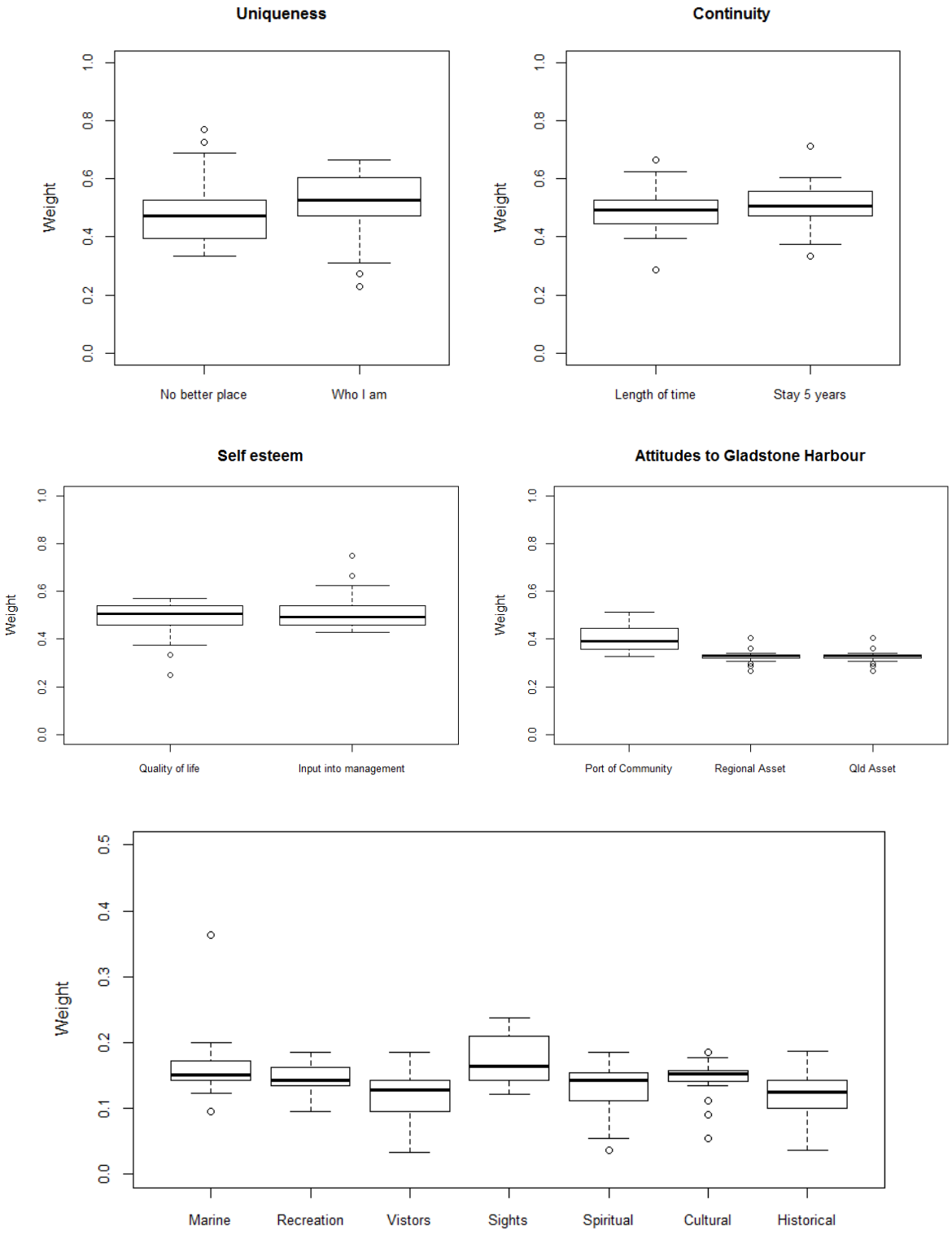


Figure 72. Contribution of each measure to a) uniqueness, b) continuity, c) self esteem, d) attitudes and e) values

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3.7.5 SOCIAL SUB-COMPONENTS

Harbour access

The key linkages from measures to indicators to sub-component for the Harbour access sub-component is illustrated in Figure 73.

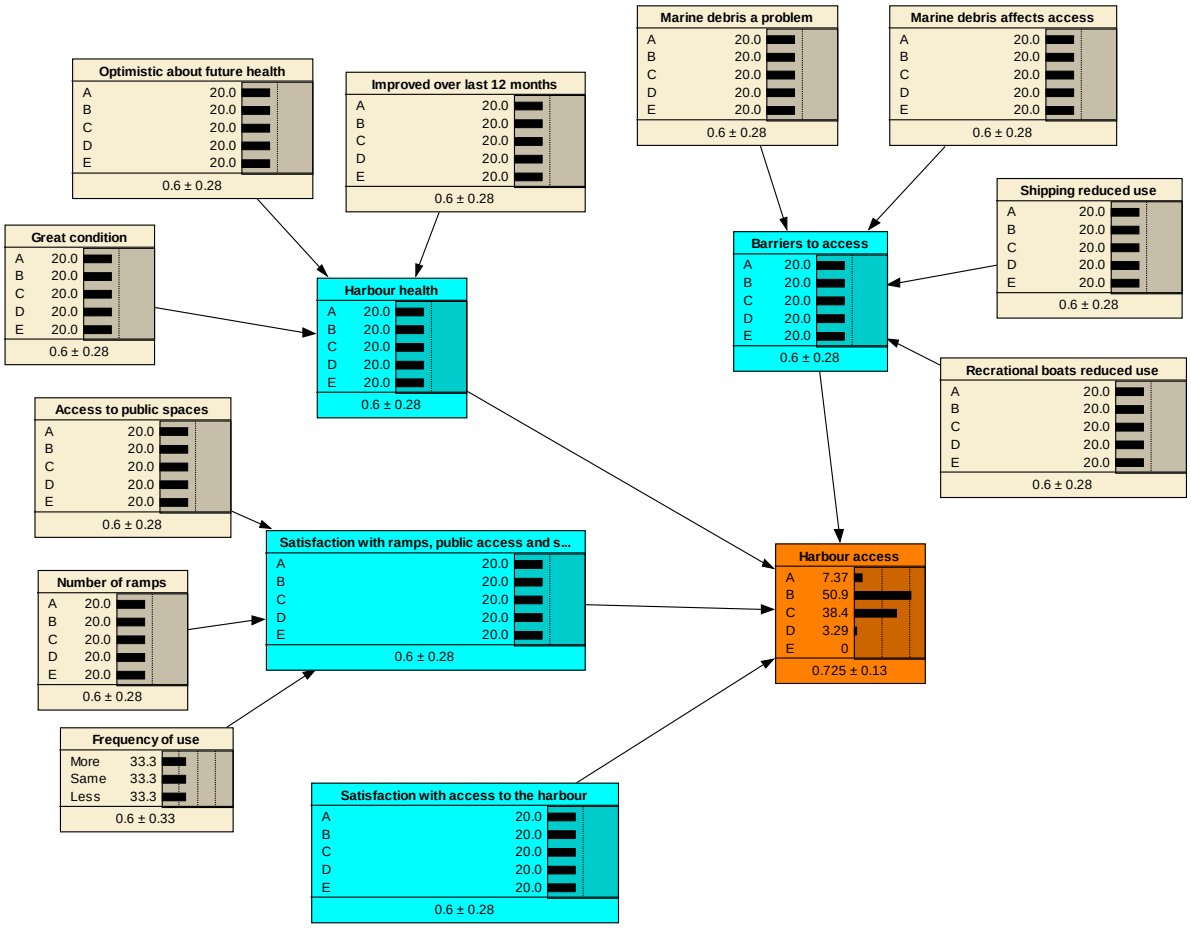

Figure 73. Key linkages within the Harbour access sub-sub-component

The individual indicators were considered of fairly equal importance in defining the sub-component (Figure 74). Similarly, the measures relating to each indicator were also considered fairly equally important (Figure 75).

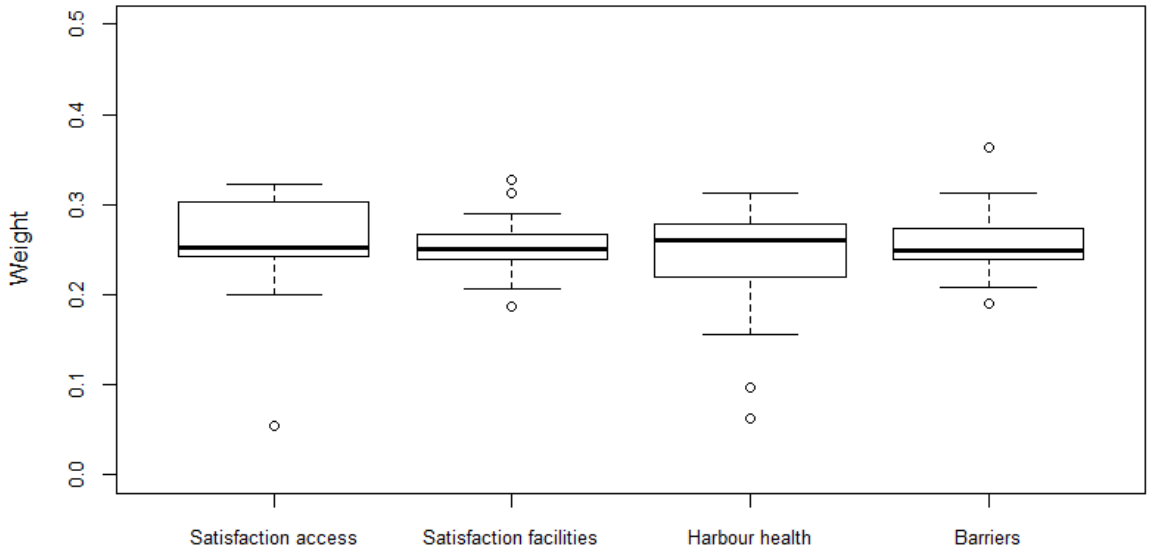

Figure 74. Indicator importance for Harbour access

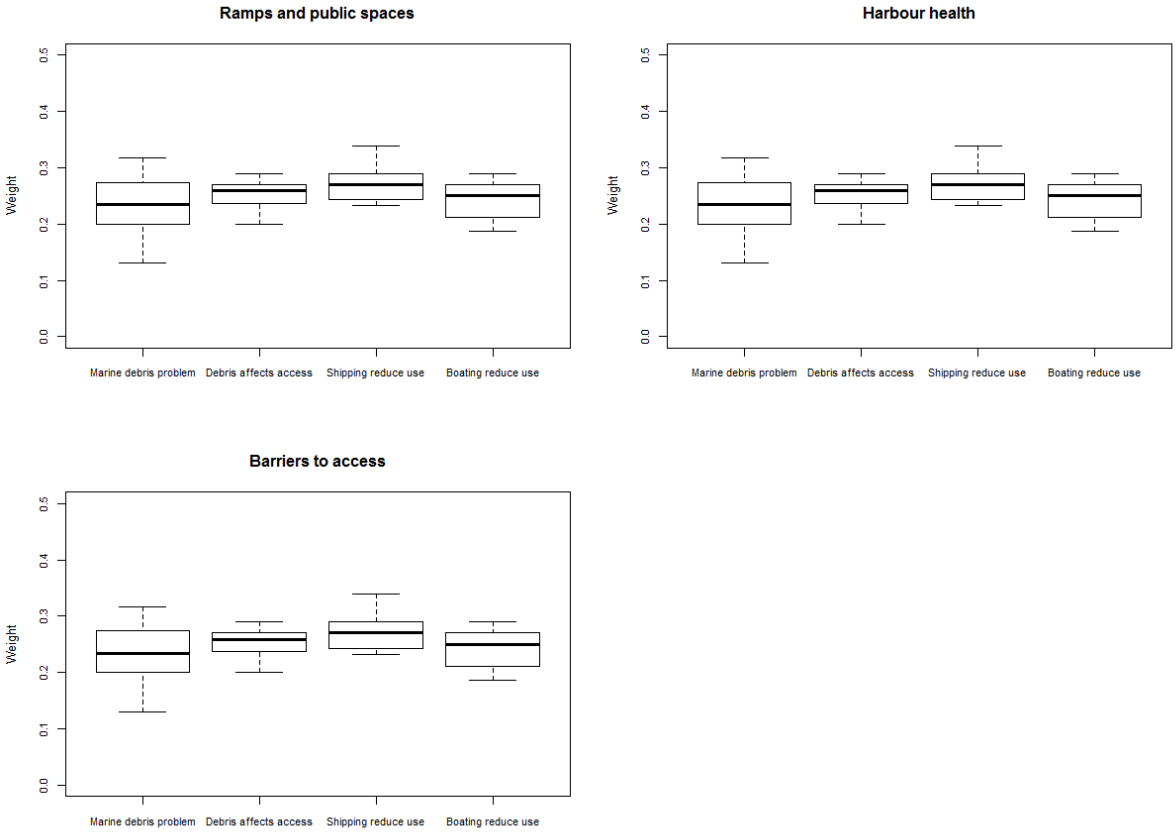

Figure 75. Contribution of each measure to a) access to ramps and public spaces; b) Harbour health; and c) barriers to access

Harbour usability

The key linkages from measures to indicators to sub-component for the Harbour usability sub-component are illustrated in Figure 76.

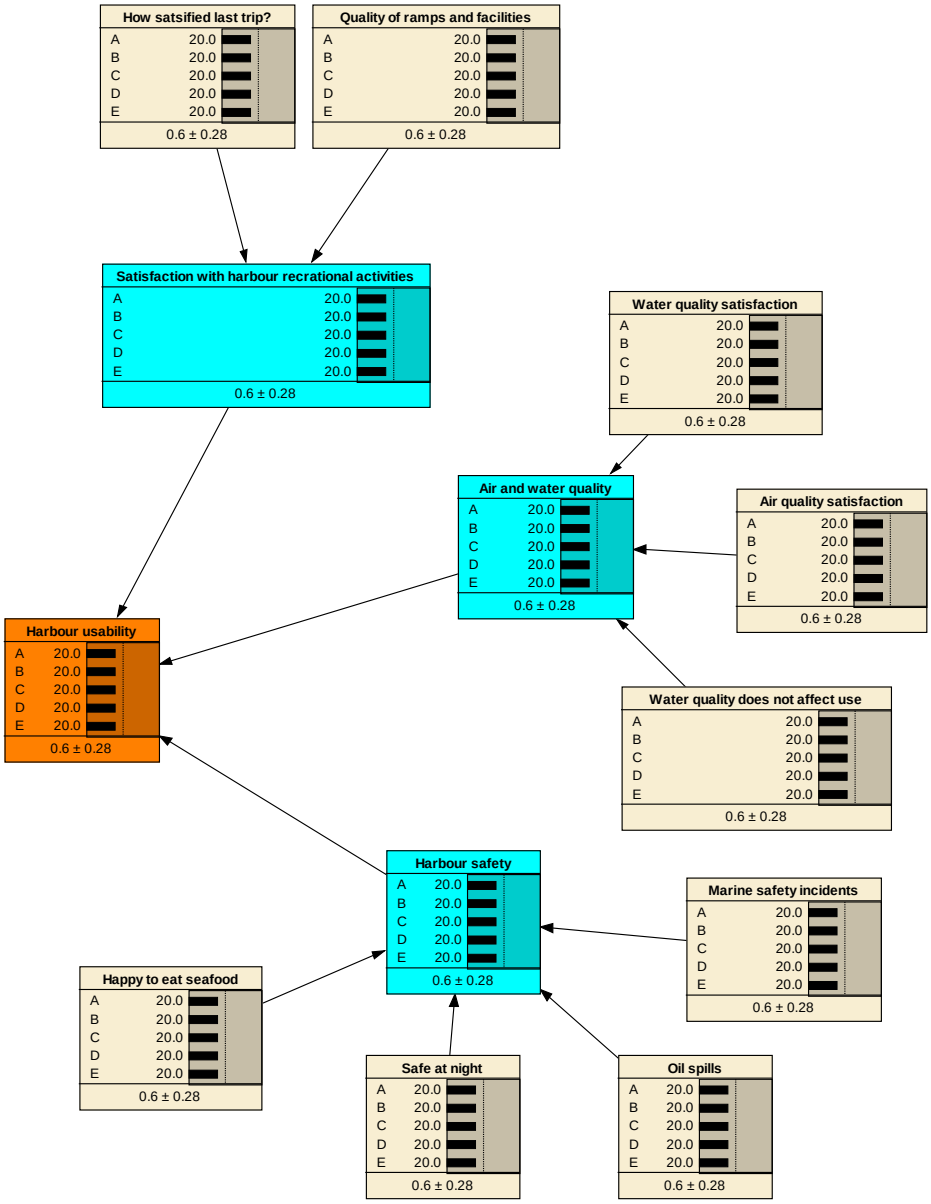

Figure 76. Key linkages within the Harbour usability sub-sub-component

Safety was generally considered the most important of the three indicators in defining the sub-component (Figure 77), although there was substantial variability around all three indicators. As with the previous measures, the measures relating to each indicator were also generally considered fairly equally important (Figure 78), although satisfaction with the last trip was generally given a higher weighting in defining recreational satisfaction.

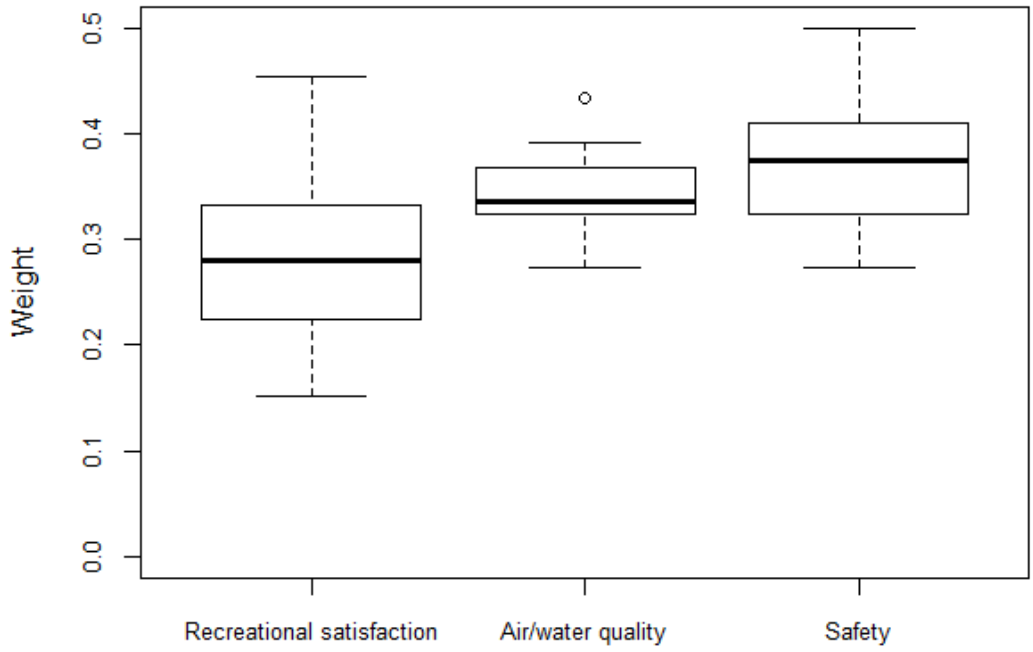

Figure 77. Indicator importance for Harbour usability

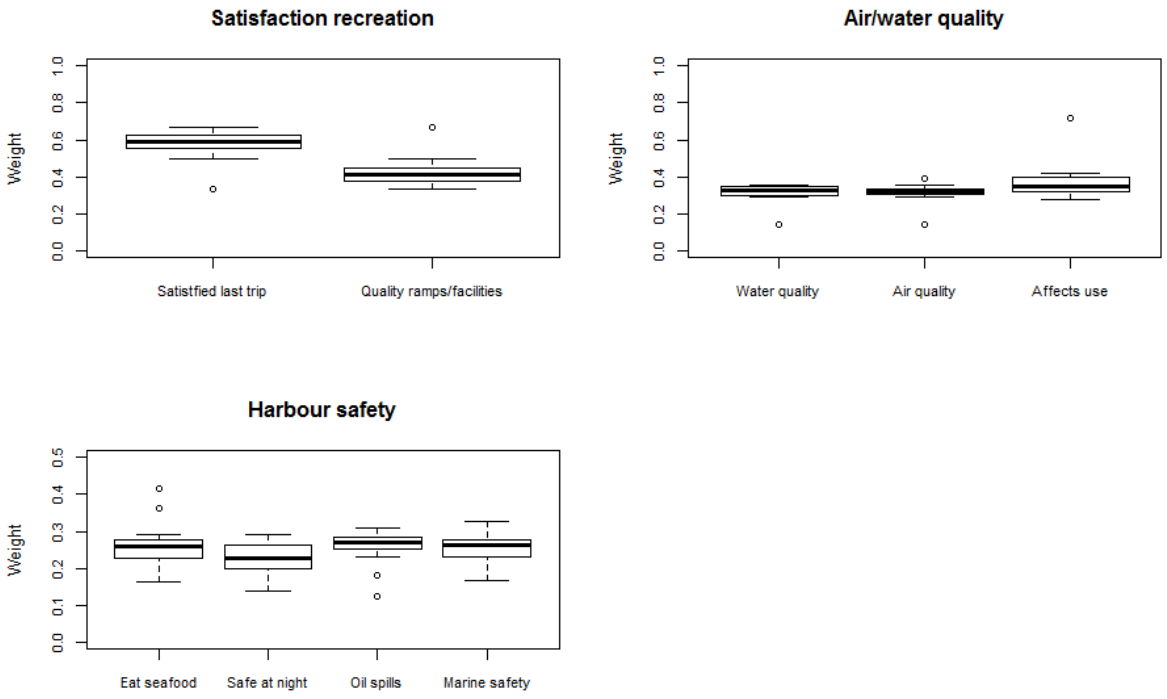

Figure 78. Contribution of each measure to: a) satisfaction with recreation; b) air and water quality; and c) Harbour safety

Liveability and wellbeing

The liveability and wellbeing sub-component had only two indicators, both of which were directly measured in the community survey (Figure 79). Of these, “the Harbour makes living a better experience” was considered to have more importance (Figure 80).

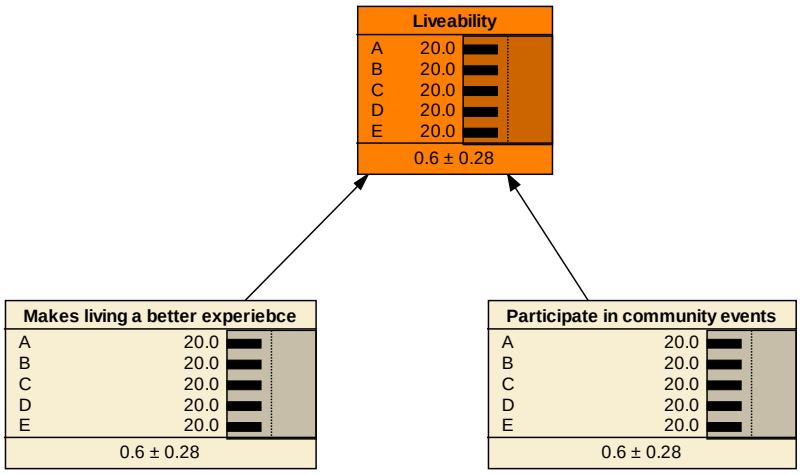

Figure 79. Key linkages within the liveability and wellbeing sub-sub-component

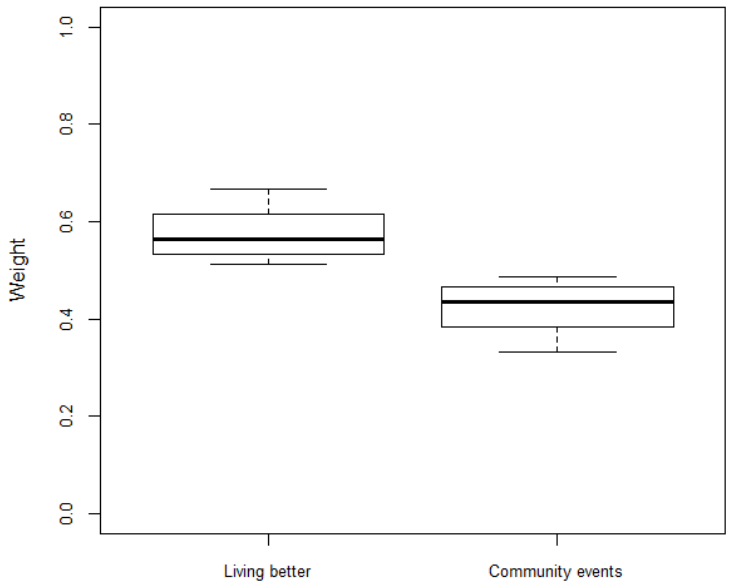

Figure 80. Contribution of each measure/indicator to liveability

3.8 Bayesian Belief Networks and (preliminary) report card scores

The BBN was populated with data collected from the different surveys and other secondary sources in order to derive the preliminary report card scores (Figure 81). The information collected from the social science expert group was used to develop the relevant conditional probability tables, which link the measures to indicators and indicators to the social and cultural sub-components. Similarly, the link between the sub-components and main component area were derived from the community and manager sub-components surveys. Separate BBNs were derived for the cultural, social and economic components.

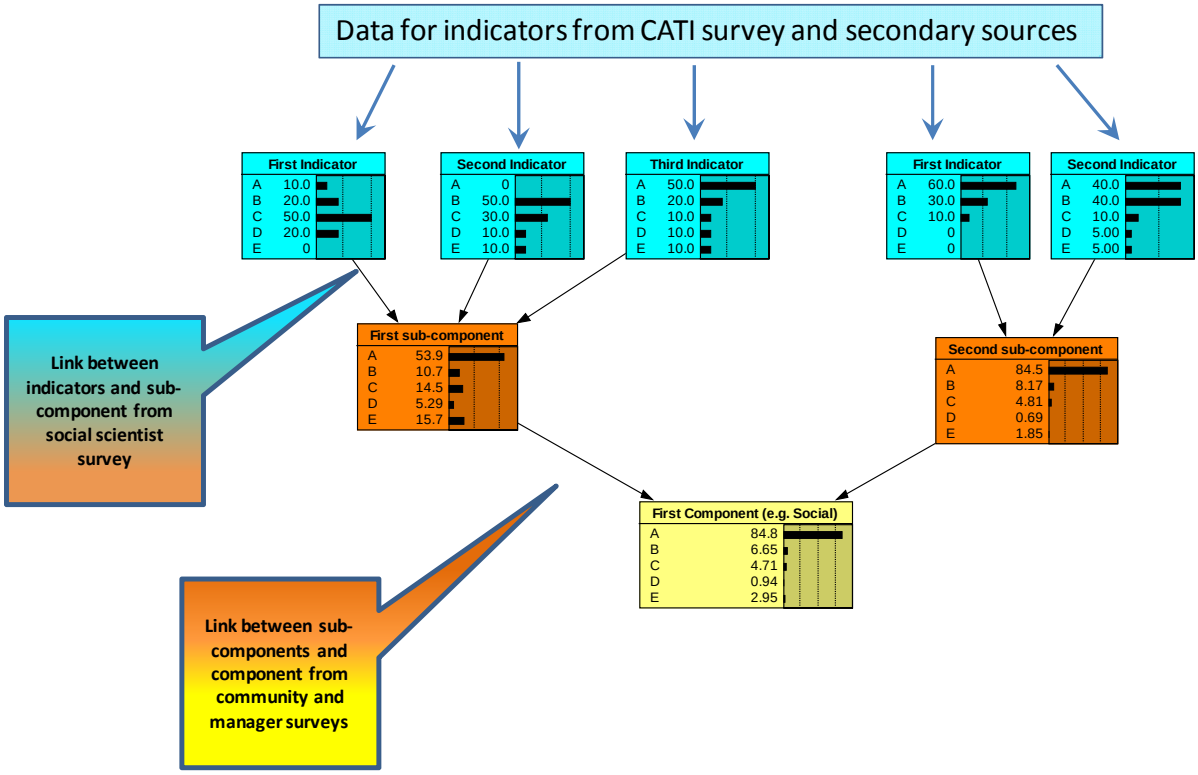

Figure 81. Data inputs into the BBN

For the economic sub-components, revenue shares of each industry were used to derive the overall regional economic performance sub-component measure. Both community benefit indicators (employment and IER) were given equal weighting for the community benefits sub-component. Only one indicator was obtained for the recreational asset sub-component.

The data derived from the survey and other sources were applied to the three BBNs. These capture two forms of uncertainty – uncertainty in the indicator measure (through the distributions of results from the surveys) and uncertainty in indicator and sub-component importance (derived from the community and social science expert surveys). As a result, the BBNs produce a probability distribution of a given outcome based on the available information as well as a mean score (and standard deviation).

The fully populated BBNs are presented in Figure 82 (Cultural), Figure 83 (Social) and Figure 84 (Economic), based on the community priorities for each of the sub-components. In these figures, the yellow box represents the final “core sub-component” outcome, the orange boxes the sub-sub-

components, the blue boxes the indicators and the grey boxes the measures. The horizontal bars represent the probability of a particular outcome.

For example, from Figure 82, there is a 65 percent likelihood that the overall cultural sub-component would receive a B score, and 32 percent likelihood that it would receive a C score. The probability of either an A or D score is less than 3 percent combined. The overall weighted average score of 0.631 places it at the bottom end of the B range (i.e. 0.6 to 0.8), so an appropriate grade may be considered a B^{-}.

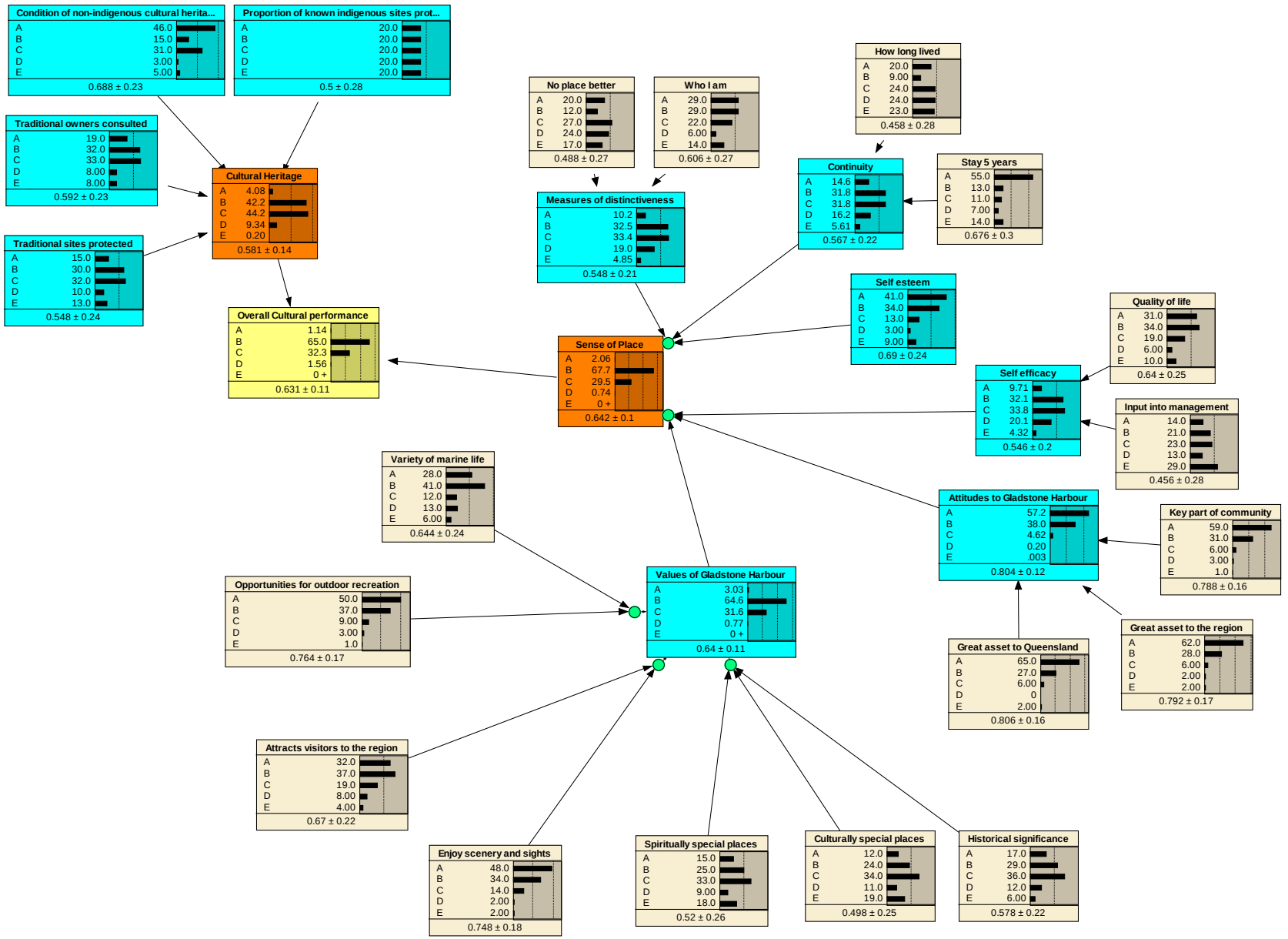

Figure 82. Fully populated cultural BBN with results

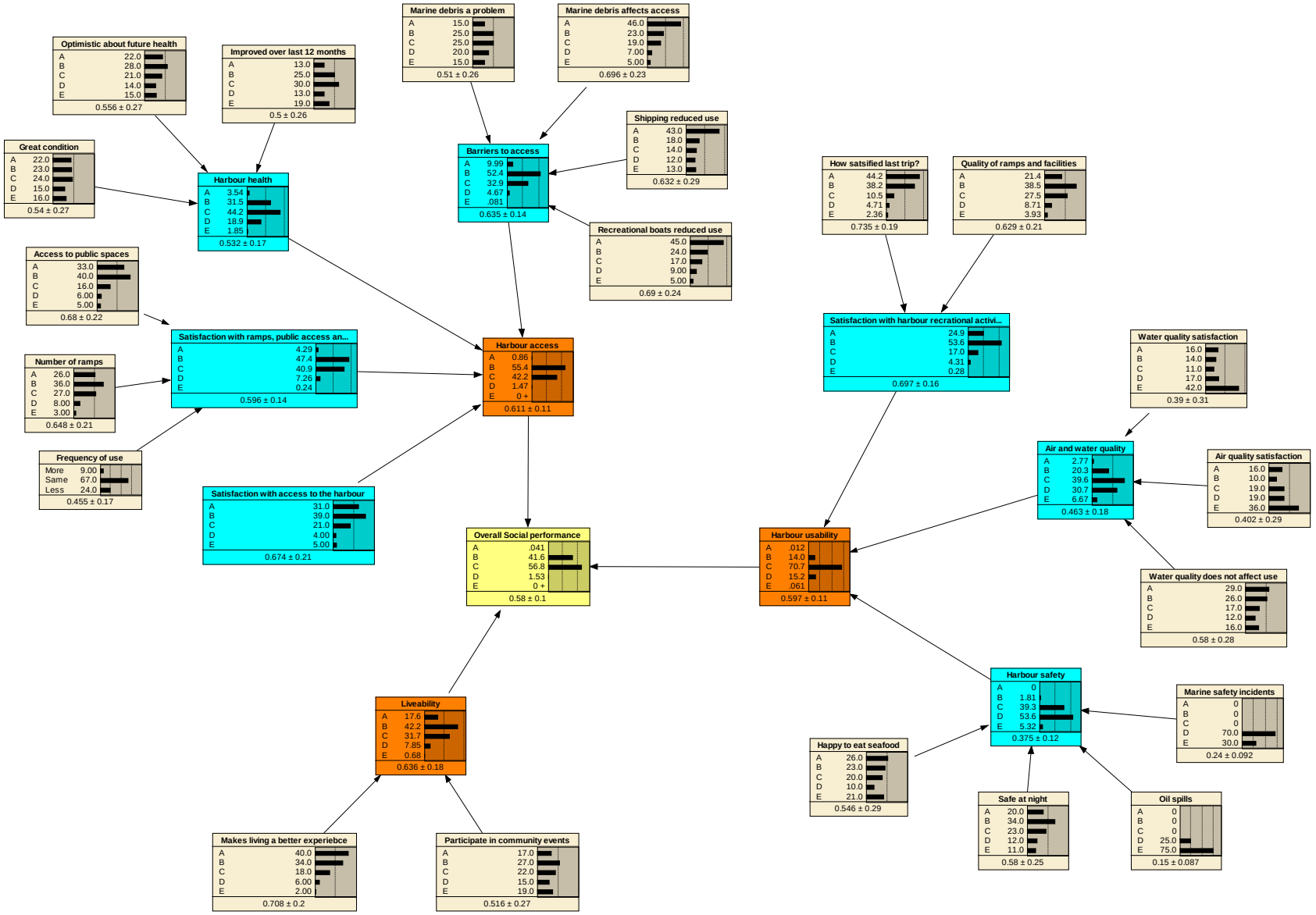

Figure 83. Fully populated social BBN with results

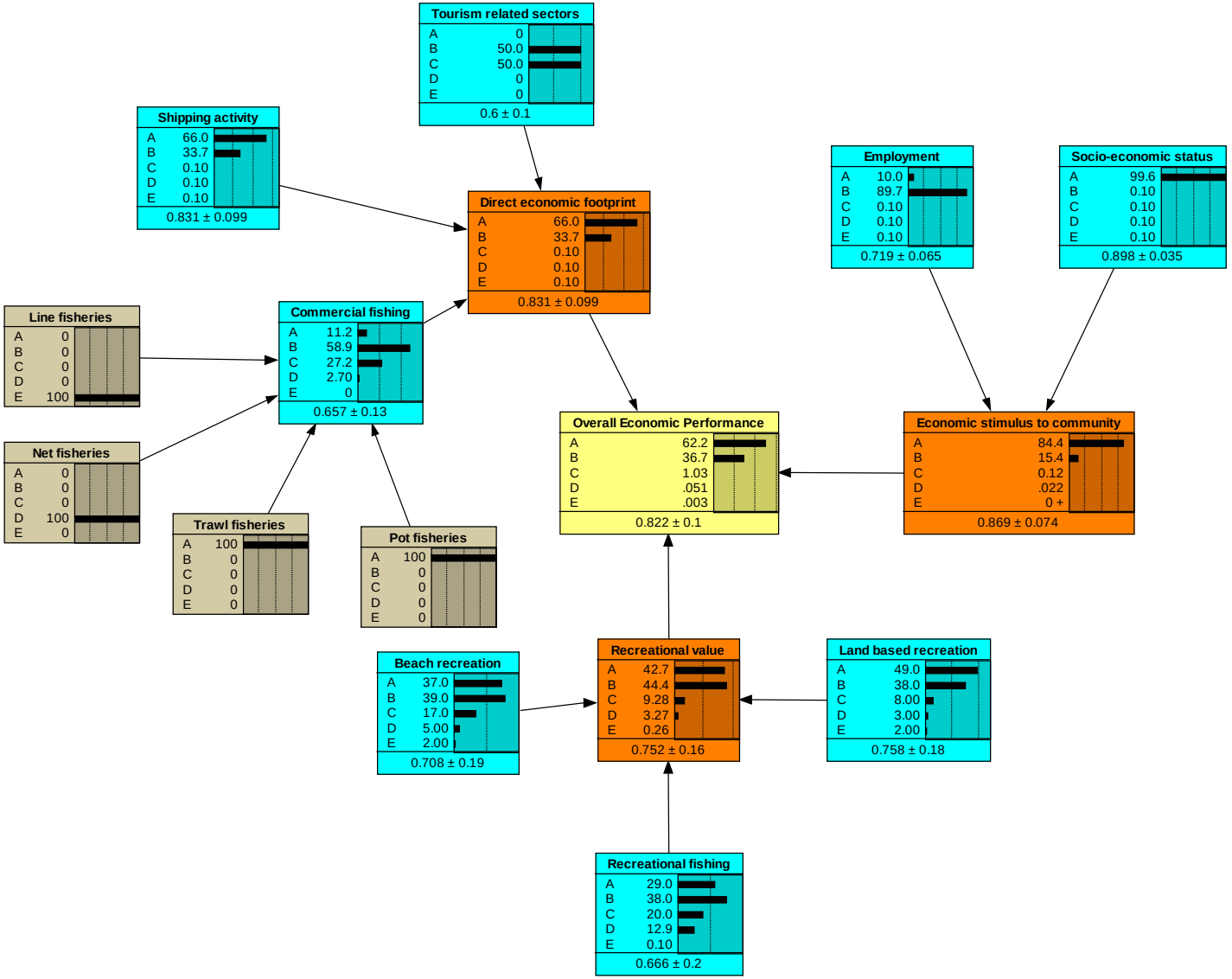

Figure 84. Fully populated economic BBN with results

3.8.1 COMMUNITY VERSUS MANAGER PERSPECTIVES

As noted earlier, if managers have different priorities than the broader community, then the regional performance from one perspective may be very different to that of the other. Fortunately, the results of the managers' survey suggested that the regional resource and business managers had similar priorities to that of the broader community. This can be confirmed by replacing the contingent probability tables derived from the community sub-components survey with those derived from the managers' survey. This resulted in only marginal change in the probabilities of the different outcomes (Table 30). The mean values in each component were not statistically different between the models. As seen in the previous sections, the managers' preferences were largely in line with those of the community, and this is also reflected in the similarity of outcomes using the BBNs.

Table 30. Final outcomes using community and manager sub-component weights

Community weightings	Managers' weightings
Overall Cultural performance A 1.14 B 65.0 C 32.3 D 1.56 E 0 + 0.631 ± 0.11	**Overall Cultural performance** A 1.24 B 61.8 C 35.6 D 1.34 E 0 + 0.626 ± 0.11
Overall Social performance A .018 B 32.8 C 64.2 D 2.95 E 0 + 0.56 ± 0.1	**Overall Social performance** A 0.27 B 34.6 C 62.2 D 2.90 E .008 0.565 ± 0.11
Overall Economic Performance A 62.2 B 36.7 C 1.03 D .051 E .003 0.822 ± 0.1	**Overall Economic Performance** A 63.3 B 36.0 C 0.72 D .008 E 0 + 0.825 ± 0.1

3.8.2 SUMMARY OF PRELIMINARY REPORT CARD SCORES

Report card scores are generally presented on an A-E scale, with a single score for each output. The output from the BBN can also be converted to such a scale. As seen in Table 30, the output from the BBN provides a distribution of grades as well as a mean score value and standard deviation. In generating an average numeric score, each level has been allocated a score based on the midpoint of the potential range. For example, A has a range of 80-100%, so has a numeric score of 90%, C has a range of 40-60% with a numeric score of 50%, and E a range of 0-20% with a mid-point score of 10%. Subsequently, the BBN potentially produces a truncated range of numeric scores for each outcome of between 10% and 90%.

A range of different approaches for the conversion of this average score to a report card score is possible. The BBN is based on the ranges indicated above (i.e. A=80-100%), primarily as most of the data feeding into the BBN has a limited distribution (i.e. the social and cultural information are largely derived from a 10 point scale). However, the average scores produced are more continuous, and alternative approaches are possible to assign final grades.

Several report card systems include subcategories within each grade, primarily to show progression within a grade even if chances are not observed between grades. For example, a "+" grade may be assigned if the outcome is in the top 25% of the range, and a "-" outcome if the grade is in the bottom quartile of the range. A further alternative is to have a clearly defined "fail" based system with a cut-off at 50%, and a grade of D and E indicating a "fail", while A, B and C represent a "pass". The potential A-E scores and their corresponding numeric scores are given in Table 31.

Table 31. Potential conversion from numeric to A-E score

Score range		A-E Grades		
Lower level	Upper level	BBN grades	Intermediate categories	50% "Pass" grade
85	100	A	A	A
80	84	A	A-	B
75	79	B	B+	B
70	74	B	B	B
65	69	B	B	B
60	64	B	B-	C
55	59	C	C+	C
50	54	C	C	C
45	49	C	C	D
40	44	C	C-	D
35	39	D	D+	D
30	34	D	D	D
20	24	D	D-	E
15	19	E	E+	E
0	14	E	E	E

The resultant key outcomes in terms of overall A-E grade from the BBN are given in Table 32, Table 33, Table 34 for the cultural, social and economic components respectively. Both the intermediate (+/-) grade and Pass-based grade are presented for comparison.

Table 32. Cultural component outcomes

	Weighted Mean Score	Std Deviation	Inter-mediate Grade	"Pass" Grade
Key indicators				
Attitudes to Gladstone Harbour	80%	12%	A-	B
Condition of non-indigenous cultural heritage sites	69%	23%	B	B
Continuity	57%	22%	C+	C
Measures of distinctiveness	55%	21%	C	C
Proportion of known indigenous sites protected	50%	28%	C	C
Self efficacy	55%	20%	C	C
Self esteem	69%	24%	B	B
Traditional owners consulted	59%	23%	C+	C
Traditional sites protected	55%	24%	C	C
Values of Gladstone Harbour	64%	11%	B-	C
Key sub-components				
Cultural Heritage	58%	14%	C+	C
Sense of Place	64%	10%	B-	C
Component outcome				
Overall Cultural performance	63%	11%	B-	C

Table 33. Social sub-component outcomes

	Weighted Mean Score	Std Deviation	Inter-mediate Grade	"Pass" Grade
Key indicators				
Air and water quality	46%	18%	C	D
Barriers to access	64%	14%	B-	C
Harbour health	53%	17%	C	C
Harbour safety	38%	12%	D+	D
Satisfaction with access to the Harbour	67%	21%	B	B
Satisfaction with Harbour recreational activities	70%	16%	B	B
Satisfaction with ramps, public access and spaces	60%	14%	C+	C
Key sub-components				
Liveability	64%	18%	B-	C
Harbour usability	60%	11%	C+	C
Harbour access	61%	11%	B-	C
Component outcome				
Overall Social performance	58%	10%	C+	C

Table 34. Economic component outcomes

	Weighted Mean Score	Std Deviation	Inter-mediate Grade	"Pass" Grade
Key indicators				
Commercial fishing	66%	13%	B	B
Shipping activity	83%	10%	A-	B
Tourism related sectors	60%	10%	B-	C
Land based recreation	76%	18%	B+	B
Beach recreation	71%	19%	B	B
Recreational fishing	67%	20%	B	B
Employment	72%	6%	B	B
Socio-economic status	90%	3%	A	A
Key sub-components				
Direct economic footprint	83%	10%	A-	B
Economic stimulus to community	87%	7%	A	A
Recreational value	75%	16%	B+	B
Component outcome				
Overall Economic Performance	82%	10%	A-	B

3.8.3 SENSITIVITY OF THE RESULTS TO MEASURES

A key feature of BBN analysis is that the sensitivity of the outcome to changes in each measure can be derived directly from the model. This is particularly useful when considering how frequently to update information, or how much precision is required. Measures to which the outcomes are more sensitive require more frequent updating and higher reliability of data.

The key sensitivity measures for the cultural performance component are presented in Table 35. Three measures of sensitivity (variance reduction, mutual information and variance of beliefs, described in the methods section) are presented in order of decreasing sensitivity. That is, the higher the values, the more sensitive the overall result is to that measure, indicator or sub component. The Type column represents the type of Node variable, either sub-component (SC), indicator (I) or measure (M). A type of S also indicates it is derived from secondary data. Some Nodes have more than one type. A general rule of thumb is that variables that contribute less than 1% to variance reduction (or mutual information) are considered to be relatively uninformative individually. However, many of the measures that fall into this category relate to the indicators of values and attitudes towards Gladstone Harbour, which themselves are more influential on the outcome. Hence there is a cumulative effect of these measures that is not apparent from the individual effects.

The sensitivity measures for the social component are given in Table 36. As with the cultural component, many measures have only a small individual impact on the overall outcome. The least sensitive measures are derived from secondary data, which are the most easily obtained. It is also likely that many of the measures below the 1% sensitivity level are unlikely to change substantially from one year to the next, so a lower frequency of data collection for these measures may be warranted.

The sensitivity measures for the social component are given in Table 37. The outcome is most sensitive to recreational value, particularly land based recreational values. Employment, socio-economic status and commercial fishing have a lesser impact on the outcome. These are not likely to change substantially from one year to the next, so could be updated less frequently than other indicators and measures.

Table 35. Sensitivity analysis, Cultural component

Node	Variance Reduction		Mutual Info		Variance of Beliefs	Type
	Measure	Percent	Measure	Percent		
Overall Cultural performance	0.01117	100.00	1.09780	100.00	0.25388	
Sense of Place	0.00510	45.60	0.37861	34.50	0.09199	SC
Cultural Heritage	0.00235	21.00	0.15695	14.30	0.02638	SC
Self efficacy	0.00115	10.30	0.07995	7.28	0.01822	I
Proportion of known indigenous sites protected	0.00069	6.13	0.04584	4.18	0.00940	I/M/S
Input into management	0.00052	4.61	0.03548	3.23	0.00779	M
Condition of non-indigenous heritage sites	0.00045	4.02	0.02865	2.61	0.00571	I/M/S
Quality of life	0.00042	3.79	0.02768	2.52	0.00661	M
Values of Gladstone Harbour	0.00039	3.52	0.02651	2.41	0.00588	I
Traditional sites protected	0.00027	2.44	0.01764	1.61	0.00365	I/M
Attitudes to Gladstone Harbour	0.00025	2.23	0.01657	1.51	0.00381	I
Measures of distinctiveness	0.00025	2.22	0.01582	1.44	0.00361	I
Self esteem	0.00024	2.15	0.01491	1.36	0.00367	I/M
Traditional owners consulted	0.00023	2.02	0.01451	1.32	0.00298	I/M
Continuity	0.00014	1.25	0.00898	0.82	0.00203	I
Who I am	0.00011	1.03	0.00730	0.67	0.00170	M
No place better	0.00009	0.80	0.00583	0.53	0.00132	M
Key part of community	0.00008	0.75	0.00548	0.50	0.00130	M
Stay 5 years	0.00007	0.63	0.00446	0.41	0.00103	M
Great asset to the region	0.00007	0.62	0.00453	0.41	0.00106	M
How long lived in the area	0.00005	0.47	0.00345	0.31	0.00076	M
Variety of marine life	0.00005	0.43	0.00317	0.29	0.00071	M
Great asset to Queensland	0.00005	0.41	0.00298	0.27	0.00069	M
Culturally special place	0.00004	0.40	0.00292	0.27	0.00066	M
Enjoy scenery and sights	0.00004	0.35	0.00259	0.24	0.00058	M
Spiritually special place	0.00004	0.34	0.00247	0.23	0.00056	M
Historical significance	0.00002	0.20	0.00146	0.13	0.00033	M
Attracts visitors to the region	0.00002	0.16	0.00116	0.11	0.00026	M
Opportunities for outdoor recreation	0.00002	0.15	0.00109	0.10	0.00025	M

Table 36. Sensitivity analysis, Social sub-components

Node	Variance Reduction		Mutual Info		Variance of Beliefs	Type
	Measure	Percent	Measure	Percent		
Overall Social performance	0.01088	100.00	1.08715	100.00	0.26321	D
Liveability	0.00426	39.20	0.34942	32.10	0.08673	SC
Makes living a better experience	0.00209	19.20	0.15774	14.50	0.03582	M
Participate in community	0.00161	14.80	0.11607	10.70	0.03088	M
Harbour usability	0.00161	14.80	0.11799	10.90	0.02736	SC
Harbour access	0.00157	14.40	0.11173	10.30	0.03070	SC
Air and water quality	0.00054	4.96	0.03719	3.42	0.00954	I
Satisfaction with access	0.00039	3.59	0.02676	2.46	0.00723	I/M
Harbour safety	0.00030	2.74	0.02026	1.86	0.00514	I
Harbour health	0.00027	2.52	0.01857	1.71	0.00533	I
Satisfaction with Harbour	0.00025	2.32	0.01713	1.58	0.00414	I
Water quality does not affect access	0.00018	1.65	0.01216	1.12	0.00302	M
Barriers to access	0.00017	1.59	0.01173	1.08	0.00332	I
Satisfaction with ramps, etc	0.00017	1.53	0.01127	1.04	0.00319	I
How satisfied last trip?	0.00015	1.39	0.01022	0.94	0.00242	M
Water quality satisfaction	0.00015	1.34	0.00980	0.90	0.00265	M
Air quality satisfaction	0.00014	1.29	0.00945	0.87	0.00254	M
Happy to eat seafood	0.00012	1.13	0.00827	0.76	0.00213	M
Optimistic about future	0.00009	0.81	0.00594	0.55	0.00172	M
Great condition	0.00007	0.67	0.00491	0.45	0.00143	M
Improved over last 12 months	0.00007	0.67	0.00486	0.45	0.00141	M
Safe at night	0.00007	0.61	0.00449	0.41	0.00112	M
Quality of ramps and facilities	0.00006	0.59	0.00432	0.40	0.00110	M
Access to public spaces	0.00006	0.52	0.00378	0.35	0.00107	M
Shipping reduced use	0.00005	0.48	0.00350	0.32	0.00100	M
Frequency of use	0.00004	0.37	0.00267	0.25	0.00077	M
Number of ramps	0.00004	0.35	0.00252	0.23	0.00072	M
Marine debris affects access	0.00003	0.28	0.00203	0.19	0.00058	M
Marine debris a problem	0.00003	0.27	0.00200	0.18	0.00058	M
Recreational boats reduces access	0.00003	0.27	0.00196	0.18	0.00056	M
Marine safety incidents	0.00001	0.10	0.00075	0.07	0.00019	M/S
Oil spills	0.00001	0.09	0.00068	0.06	0.00018	M/S

Table 37. Sensitivity analysis, Economic component

Node	Variance Reduction		Mutual Info		Variance of Beliefs	Type
	Measure	Percent	Measure	Percent		
Overall Economic performance	0.01048	100.00	1.03099	100.00	0.24658	
Recreational value	0.00461	44.00	0.38973	37.80	0.08980	SC
Land based recreation	0.00404	38.60	0.31982	31.00	0.07535	M
Direct economic footprint	0.00151	14.40	0.10818	10.50	0.03283	SC
Shipping activity	0.00151	14.40	0.10818	10.50	0.03283	I/M/S
Economic stimulus to community	0.00092	8.78	0.06352	6.16	0.01931	E
Recreational fishing	0.00009	0.89	0.00641	0.62	0.00188	I/M
Beach recreation	0.00006	0.61	0.00436	0.42	0.00129	I/M
Employment	0.00002	0.23	0.00162	0.15	0.00045	I/M/S
Socio-economic status	0.01048	100.00	1.03099	100.00	0.24658	I/M
Tourism occupancy	0.00461	44.00	0.38973	37.80	0.08980	I/M/S
Commercial fishing	0.00000	0.00	0.00000	0.00	0.00000	I/S
Trawl fisheries	0.00000	0.00	0.00000	0.00	0.00000	M/S
Pot fisheries	0.00000	0.00	0.00000	0.00	0.00000	M/S
Net fisheries	0.00000	0.00	0.00000	0.00	0.00000	M/S
Line fisheries	0.00000	0.00	0.00000	0.00	0.00000	M/S

4 Discussion and conclusions

4.1 Project aims and outcomes

Performance metrics are becoming increasingly common in many areas involving management of public assets and resources. In schools, universities and hospitals, for example, the development and publication of report cards are aimed at providing incentives for the individual institutions to improve their performance, as well as to identify which areas may be in need of increased attention. Similarly, report cards in environmental settings provide an incentive for improvement of resource and environmental management and feedback to managers on what is or is not working, and which areas may be in need of greatest change.

The key aim of this project was to develop and pilot a system for the collection and analysis of data relating to appropriate economic, social and cultural indicators for the purposes of developing a broader report card on the management of the Gladstone Harbour region. A socio-cultural-economic report card goes beyond what is normally considered in resource and environmentally focused report cards, which have tended to consider biophysical factors affected by the resource management. However, the move to management frameworks based around concepts of ecologically sustainable development (ESD) and ecosystem based management (EBM) requires consideration of the broader social and economic impacts of management as well as the environmental effects.

A key outcome of the project was a preliminary set of report card scores relating to each of the three components, demonstrating the feasibility of such an approach as a proof of concept. However, the development of these measures was not without issue, not all of which can be resolved in this study, and may take several iterations and trials before a “definitive” set of appropriate measures (and systems for their measurement and scoring) can be developed.

Fundamental to the development of a report card is the identification of a set of sub-components against which performance is to be measured. These had been developed in previous studies, along with indicators to be assessed (and measures also) (McIntosh et al. 2014), so were not reconsidered in this study. The report card that was developed was based around these sub-components, indicators and measures. In brief, they included measures of satisfaction with the Harbour, recreational amenities and the local environment, liveability measures, measures of cultural heritage protection and values relating to the cultural aspects of the Harbour, economic performance of Harbour based industries, recreational values and benefits to the local community.

4.2 What worked well

The project demonstrated that it is possible to develop a social, economic and cultural report card relating to the broader management of a natural resource-based area.

The social component worked particularly well, as did the cultural and economic indicators derived from the community survey. While a fairly large community survey was required to collect this information, the information derived was directly applicable to the estimation of social performance measures. The questions developed for the social survey benefited from previous studies in the

region, in particular the SELTMP program. Similarly, questions relating to non-market values of recreational use also worked well, allowing travel cost based estimates to be derived.

A key advantage of the social survey information was that it was largely collected on a 1-10 scale, enabling the probability distributions of "satisfaction" to be directly incorporated into the BBN "models" of the region for each component. This also included a built-in benchmark, namely a score of fully satisfied (10), overcoming an issue experienced with other indicators.

4.2.1 GHHP RESULTS COMPARED TO SELTMP

We compared the results found within this CATI Gladstone Harbour survey with available matching questions from the 2013 SELTMP survey for residents of the Gladstone LGA as well as residents of the Great Barrier Reef (GBR) coastal region. What needs to be remembered is that the CATI survey for this project explored perceptions of the Gladstone Harbour Area, while the SELTMP surveys explored the perception of the GBR (which includes everything from the mainland beaches to the outer edge of the GBR World Heritage Area).

In general, we found many similarities between the disparate datasets, both within the region, and between residents of the Gladstone region and the GBR region. In some instances we found that a weaker connection between Gladstone residents and the Gladstone Harbour existed compared with the connection between GBR residents and the GBR. In terms of sense of place indicators, contributing to the Cultural Component (Table 38), continuity was similar in terms of intentions to remain in the region. The Gladstone Harbour area received very similar scores to the GBR in terms of contributing to Gladstone residents' quality of life and wellbeing, although the contribution of the GBR to quality of life and wellbeing was slightly higher for the overall SELTMP sample. Gladstone and GBR coastal residents perceived similar links of the Harbour area and the GBR to their identity, but fewer Gladstone residents agreed that there were not better places for their recreation than the Gladstone Harbour area, compared to the GBR. The types of values people consider important for each area were similar, except for tourism value (slightly lower for the Gladstone Harbour area). In a relative sense, the contribution of the Gladstone Harbour area to the economy of the region scored slightly higher than other values, whereas for the GBR, biodiversity and aesthetics scored slightly higher than other values (although the economic contribution was still scored highly). Gladstone residents are satisfied with their level of access to the Gladstone Harbour area and the GBR (as are other GBR coastal residents) (Table 39). Perceptions of condition and future optimism about health of the Harbour area and the GBR were not high (though still with a majority of positive responses), but were similar across sites, and between Gladstone and GBR residents for the GBR.

These comparisons highlight that residents in the current Gladstone survey hold a similar level of personal connection to the Gladstone Harbour area as do residents of Gladstone and the GBR coast for the GBR; except perhaps as an exclusive place for their recreational activities. Gladstone residents tend to consider the economic contribution of the Harbour area slightly more than other values; although values such as biodiversity, recreation and scenery are also important. While the perception of current and future potential health of the Harbour area is not high, this opinion does not differ from those referring to the GBR for both Gladstone and GBR coastal residents.

Table 38. Comparison of responses to questions related to the Cultural Component between the Gladstone CATI survey, and SELTMP 2013 for residents of the Gladstone region specifically, as well as the GBR coast overall. Any wording differences are noted in italics, with the Gladstone CATI question wording listed first, and the SELTMP wording differences following '/'

Sub-component	Indicator Group	Question	Gladstone CATI survey	SELTMP Gladstone residents	SELTMP GBR residents
Sense of Place	Continuity	I plan to be a resident of this region in the next 5 years	77% agree (mean 7.45 $^{+}/_{-}$0.16)	71% agree (mean 6.85 $^{+}/_{-}$ 0.22)	77% agree (mean 7.68 $^{+}/_{-}$ 0.06)
	Self-efficacy	The *GH area / GBR* contributes to my quality of life and well-being	73% agree (mean 6.96 $^{+}/_{-}$0.13)	75% agree (mean 6.82 $^{+}/_{-}$ 0.16)	80% agree (mean 7.50 $^{+}/_{-}$ 0.04)
	Distinctiveness	The *GH area / GBR* is part of who *I am / my identity*	66% agree (mean 6.60 $^{+}/_{-}$0.14)	59% agree (mean 5.74 $^{+}/_{-}$ 0.18)	63% agree (mean 6.44 $^{+}/_{-}$ 0.05)
		There are [NOT] other places that are better than the *GH area / GBR* for the recreational activities that I *do / enjoy*	50% agree (mean 5.46 $^{+}/_{-}$0.15)	65% agree (mean 6.25 $^{+}/_{-}$ 0.17)	66% agree (mean 6.44 $^{+}/_{-}$ 0.05)
	Values of the Harbour / GBR	I value the *GH area / GBR* because it supports a variety of *marine life / life such as fish, corals*	84% agree (mean 7.62 $^{+}/_{-}$0.11)	96% agree (mean 8.87 $^{+}/_{-}$ 0.11)	96% agree (mean 9.10 $^{+}/_{-}$ 0.03)
		I value the *GH area / GBR* because it provides *opportunities for outdoor recreation / supports a desirable and active way of life*	90% agree (mean 8.21 $^{+}/_{-}$0.10)	92% agree (mean 8.15 $^{+}/_{-}$ 0.14)	93% agree (mean 8.50 $^{+}/_{-}$ 0.03)
		I value the *GH area / GBR* because it attracts *visitors to the region / people from all over the world*	77% agree (mean 7.24 $^{+}/_{-}$0.12)	80% agree (mean 7.52 $^{+}/_{-}$ 0.17)	86% agree (mean 8.00 $^{+}/_{-}$ 0.04)
		The *GH area / GBR* is a great asset for the economy of this region	91% agree (mean 8.55 $^{+}/_{-}$0.10)	96% agree (mean 8.61 $^{+}/_{-}$ 0.12)	96% agree (mean 8.90 $^{+}/_{-}$ 0.03)
		I value the GH area because I enjoy the scenery and sights / The aesthetic beauty of the GBR is outstanding	88% agree (mean 8.05 $^{+}/_{-}$0.10)	97% agree (mean 8.94 $^{+}/_{-}$ 0.09)	97% agree (mean 9.10 $^{+}/_{-}$ 0.03)

Table 39. Comparison of responses to questions related to the Social Component between the Gladstone CATI survey, and SELTMP 2013 for residents of the Gladstone region specifically, as well as the GBR coast overall. Any wording differences are noted in italics, with the Gladstone CATI question wording listed first, and the SELTMP wording differences following '/'

Sub-component	Indicator Group	Question	Gladstone CATI survey	SELTMP Gladstone residents	SELTMP GBR residents
Harbour access	Satisfaction with access	I have fair access to *GH / GBR* compared to other *users of the Harbour / user groups*	80% agree (mean 7.34 $^{+}/_{-}$0.11)	78% agree (mean 7.24 $^{+}/_{-}$0.16)	80% agree (mean 6.49 $^{+}/_{-}$0.05)
Harbour useability	Community views	The *GH area / place that I most recently visited in the GBR* is in great condition	61% agree (mean 5.96 $^{+}/_{-}$0.14)	64% agree (mean 6.48 $^{+}/_{-}$0.19)	63% agree (mean 6.54 $^{+}/_{-}$0.05)
		I feel optimistic about the future *health of GH / of the GBR*	56% agree (mean 6.04 $^{+}/_{-}$0.14)	59% agree (mean 5.85 $^{+}/_{-}$0.17)	62% agree (mean 6.18 $^{+}/_{-}$0.05)

4.2.2 RECREATIONAL TRIP VALUATION: COMPARISON WITH OTHER STUDIES

In Queensland, the TCM has been applied in two other broad-based population studies to estimate recreational values for beach recreation by local residents. Rolfe and Gregg (2012) estimated the value of beach recreation for local residents along the Queensland coast from Bundaberg to Cairns. Results were reported for different regions, including Gladstone, (see Table 20 for details) and provide some useful comparisons. Their results for Gladstone were very similar to those reported in this study and provide strong support for the total annual value of beach recreation for the Gladstone community at $23 million. Although the value of travel time was not costed, the average trip value per adult ($48) was double the estimated value of $21 reported in this study. The average distance travelled was also very similar. However, the annual trip frequency was much lower at 8.4 trips per year compared to 25 trips per year in this study. In comparison, the value estimates were considerably higher for the Capricorn region with longer travel distances.

Table 40. Comparison with beach recreation values from Rolfe and Gregg (2012)

	Gladstone	Capricorn	All regions	This study
Sample size	132	212	1440	400
Per Trip per adult WTP	$48	$57	$35	$21
(95% CI)	($32 -$94)	($38 -$116)	($32 -$39)	($13 -$46)
Approximate annual visit frequency	8.4	n/a	20	25
Average distance of beach from home	15 km	31 km	n/a	11 km
Total annual value ($M)	$24	$108	$587	$23

Source: Rolfe and Gregg (2012)

The other recent TCM valuation of beach recreation conducted by Windle and Rolfe (2013) surveyed 1000 Brisbane residents to estimate the value beach recreation in their area. However, as travel distances were much higher, the value estimates were also higher at $40 per trip (ranging from $32 to $54) for Gold Coast beaches and $90 per trip (ranging from $73 to $117) for Sunshine Coast beaches. Average annual trip frequency across the full sample was much lower at 3.9 trips per year to Gold Coast beaches and 3.7 trips per year to Sunshine Coast beaches.

There were insufficient observations to develop a robust estimate of recreational fishing values, as only a relatively small proportion of the sample surveyed actively engaged in recreational fishing. Other studies have been undertaken in Queensland, which may provide some indication of the potential recreational fishing value. In particular, the TCM has been applied in previous studies to estimate recreational fishing values for the Capricorn Coast (Prayaga et al. 2010) and for Moreton Bay (Pascoe *et al.* 2014b). Prayaga et al. (2010) estimated the value of a recreational fishing trip at $385 per trip and $167 per trip per adult. These values appear high, but the average one way travel distance (to the boat ramp) was high at 78 kilometres. Pascoe et al. (2014b) estimated the value of recreation fishing in Moreton Bay at between $129 and $239 per trip and at between $58 and $108 per trip per adult depending on the cost calculation method applied. The lower values of the Moreton Bay study are supported by the evidence from a TCM study at Portland, Victoria where the recreational value of the non-commercial southern bluefin tuna catch at was estimated to be between $33 and $132 per person per visit (Ezzy *et al.* 2012).

However, both these studies conducted by on site interviews to survey recreational users and were not population based surveys restricted to local residents, unlike this study. Note for example, the long average travel distances in the Prayaga et al. (2010) study. As such, these estimates would not be recommended for

a benefit transfer to this study, and further, more targeted, studies may be required in the region to adequately determine recreational fishing values.

4.2.3 BAYESIAN BELIEF NETWORK AND PREFERENCE ELICITATION

The use of the BBN to tie together the different components and indicators also worked well. This allowed qualitative data to be combined with quantitative data in a consistent framework, and also allowed the capture of heterogeneity in community satisfaction and also sub-component importance. This heterogeneity is obfuscated by single aggregate metrics (such as a mean). While such a single metric is used to determine the final grade, the uncertainty around this is transparent, along with the uncertainty around each measurement and indicator value feeding into the final score.

Aggregation along the BBN requires additional information about the relative importance of a measure or indicator in determining the next level outcome. A number of different groups and approaches were used to develop the conditional probability tables that link the parent and child nodes in the BBN. Social science experts were surveyed to determine the key linkages between measures and indicators, and between indicators and sub-sub-components. Both community members (a subset of those surveyed in the CATI survey) and managers were surveyed to establish the relative importance of each sub-component, and to develop the links between these sub-components and the overall component.

The use of experts for the technical components (linking measures to indicators to sub-components) and community and managers for the link between the sub-components and components was found to be a useful approach. While there was heterogeneity in opinion about these relationships, this heterogeneity could be fully captured in the development of the conditional probability tables. This is a strength of the BBN approach, where as such heterogeneity would be more problematic in more deterministic modelling or aggregation processes.

The weight distributions derived from the community and managers' sub-components surveys were very similar. As a result, the final outcomes derived from the BBN were similar from both the community and manager perspective.

The use of expert opinion is a relatively common feature of BBNs, particularly when deriving the relationships between different nodes of the network. In our study, these relationships, and much of the data input, were derived from surveys of the general community as noted above. The use of community survey for populating the main measures and also the contingent probability tables in the BBN is a more democratic approach and avoids any potential bias associated with the selection and participation of different stakeholder groups

4.3 Key issues for further consideration

4.3.1 SECONDARY DATA

Several issues emerged around the use of secondary data. These related primarily to quality and relevance of the available data, as well as the identification of an appropriate benchmark.

For the cultural measures, secondary data were available for the protection of non-indigenous cultural heritage sites on the level of protection and the quality of the site. These covered registered sites only, and culturally-important but unregistered sites were not considered as a result. The system of scoring these sites on an A-E scale, while based on a logical structure, is also arbitrary to some degree.

Information on the level of protection of indigenous sites was also unavailable. While the total number of sites registered in the region is known, the importance of these sites is not recorded. Similarly, the proportion of known important but unregistered sites is also unknown. A separate study is being developed by the GHHP to address this, so better estimates may be available for the first report card in 2015.

Information on oil spills and marine pollution, both affecting the Harbour safety indicator in the social component, were normalised against the number of registered vessels in the Gladstone area, and compared with similar normalised values in other maritime regions along the Queensland coast. While these data are official records and the best available, there are several potential issues with their application. Firstly, there is likely to be substantial misreporting, particularly of small oil spills from recreational vessels across all regions. Second, the number of vessels registered to a region (commercial and recreational) does not necessarily reflect the degree of activity on the water. Working harbours such as Gladstone may have their vessels more fully utilised than other regions, so the number of actual sea days per vessel may be higher, distorting the rate of impacts. Similarly, vessels registered elsewhere but operating in the Gladstone area are not included in the normalisation process. The relative poor performance of Gladstone in both oil spills and marine incidents compared with other regions of Queensland may therefore be an artefact of the data. The overall impact of these measures individually on the final outcome for the component is small, although if both were fully "A"s (rather than "D"s and "E"s at present) then the component outcome would increase from a "C+" to a "B-", all other things being equal.

4.3.2 ECONOMICS MEASURES

The key economic performance measures were largely derived from secondary data. A measure of capacity utilisation over time was used for shipping and the fishing industry as this provides an inbuilt benchmark, namely full capacity utilisation. This is one of several economic productivity measures that is used in a wide range of industries to assess their performance. Underutilised capacity indicates that the same output could have been produced with fewer fixed resources, or that greater output could have been produced given the same fixed inputs. Measures were directly estimated for the fishing industry using QDAFF data, and the shipping industry based on Gladstone Port Corporation Ltd data.

An issue facing the development of a score for the shipping industry was that it has seen continual expansion over the last decade, and is expected to continue to expand into the future. The industry is more active than it has even been, but is not as active as it is likely to be in the future. Some allowance for known short term expansion of Harbour shipping capacity was considered in the analysis, but it is likely that there will continue to be shifting benchmarks into the future.

For the tourism industry, a relative measure of expenditure in the sector over time was used, although the outcome was heavily dependent on the baseline used. A particular issue for the measure of the tourism industry is the impact that development in the region has had on the increase and apparent decline in the industry over the last decade. The tourism industry is not specifically tourism related, with accommodation and related services used by non-residential workers (i.e. fly-in-fly-out). Use of these services increased substantially during the development of the Curtis Island facilities, which contributed to the apparent large increase in the sector up to 2005-06. However, as workers moved to facilities on Curtis Island, the demand for accommodation services declined. The figures since 2009-10 are most likely reflective of the actual (sustainable) tourism activity.

Incorporating recreational values into the economics component was also complex. Considerable work was undertaken to estimate recreational use values for the region (as outlined above). However, as this is the first work in the area there was no baseline or benchmark against which to rate it. To overcome this, a combination of qualitative satisfaction information (also used in the social analysis) was used to develop a satisfaction measure for each recreational component, and the values and trip numbers used to determine appropriate weights for combining these measures. The final recreational value score is therefore a combination of value and satisfaction. This seems an appropriate measure given that the non-market values are reflective of utility measures, while satisfaction is also a relative utility measure. Nevertheless, further consideration as to how to best incorporate these values is warranted.

4.3.3 CATI SURVEY

The CATI survey, while an efficient way of collecting the data in an expedient manner, may have introduced some biases into the report card analysis. In particular, the sample was over-represented by the older age groups and under represented by the younger age groups. This may have had implications for a range of the social measures, as well as measures relating to recreational use of the Harbour. Similarly, the qualification question asked in the survey was that the respondent was resident in the Gladstone region, which extends westward for some distance. While location was requested, limiting respondents to areas closer to the Harbour may have been beneficial from a credibility perspective (as there may be concerns that respondents not near the Harbour may be biasing the results), although would have made the task of getting sufficient respondents more difficult.

Telephone interviews require some cognitive ability (to mentally retain and process information) and may not provide respondents with sufficient time to fully consider their responses. It is preferable if respondents can see the questionnaire so that they process the information in their own time and provide considered responses. In addition, there are advantages in being able to provide visual aids and information, and other reference material that respondents can refer to throughout the survey. For example, being able to provide respondents with a map, outlining the boundaries of the Gladstone Harbour area would have been much easier than having to provide a verbal explanation on the telephone.

The use of a CATI survey also limits the ability to implement stated preference economic valuation techniques. For example, in this project it was not possible to include a valuation of the economic non-market values for environmental assets which would be possible in a paper-based or internet survey.

It is recommended that future surveys are collected in a combination of telephone and online/internet format, with the latter being the most cost effective and efficient survey collection method. In capital cities it is possible to get access to an internet panel of respondents through a commercial service provider. In regional areas such as Gladstone, internet panels are currently limited in size (approximately 100 respondents), although numbers are increasing. However, the benefits of conducting an internet survey would justify the allocation of additional time and resources to recruit respondents to complete an internet survey.

In an internet survey it would be possible to apply stated preference valuation methods to address some of the current gaps which are identified in the 'future data collections' section below.

4.3.4 LINKING OUTCOMES TO HARBOUR MANAGEMENT

Many of the measures used may not fully reflect the outcomes of Harbour management. In particular, the economic measures are likely to be influenced by a wide range of factors both external and internal to the region. For example, the key export of the region (affecting the shipping measure) is coal, which will largely depend on economic conditions overseas. Similarly, tourism may be affected by changes in exchange rates as well as adverse reports on the state of the GBR in general. The fishing industry is also affected by broader fisheries management, activities in other regions, and prices of inputs (e.g. fuel) and outputs.

Given this, the economics section of report card in particular needs to be considered in the context of broader economic conditions. Factoring this into the report card score is complex and has not been adequately considered in this study due to time and resource constraints.

4.4 Future data collections: some considerations

4.4.1 CO-ORDINATION AND TIMING

The residents of Gladstone are potentially one of the most surveyed groups in Queensland. In addition to the SELTMP surveys and the surveys in this project, three other known surveys were being conducted in the region. These other surveys were largely collecting different information, but there is a risk that survey fatigue may jeopardise future data collections.

Given this, there are likely to be benefits in co-ordinating survey activities with other regular surveys, particularly the SELTMP for social indicator questions. This could involve expansion of the SELTMP survey and additional questions specifically for Gladstone, or the information collected in the GHHP could also be made available to SELTMP (and coverage expanded to meet SELTMP needs).

Related to this is the question of how frequently data should be gathered for effective monitoring and reporting involves assumptions about the lag time which may be experienced before any changes to economic, social and cultural Harbour health indicators become measurable. It is not yet known how long it would take, for example, for an increase in Harbour accessibility to be reflected in social health scores. Similarly, the time taken for any deterioration of water quality in Gladstone Harbour to impact upon scores for economic indicators such as fishing and recreation is unknown, and probably varies considerably depending on circumstances.

It is feasible that community response to large scale environmental changes (or perceived large scale changes) may result in changes in at least some of the social, cultural and economic indicators within a relatively short time period of weeks to months. Conversely, gradual changes in Harbour health may not register effects on economic, social and cultural indicators for longer, e.g. a year or more. A return to previous social, cultural and economic scores following the gradual remediation of environmental health issues (or perceived issues) may take longer still.

The time between environmental change and the economic, social and cultural response to the change has not been well reported in the literature and we have been unable to identify any previous studies that have attempted to quantify such lags. Hence we recommend this as an area for future research as more data are collected in Gladstone Harbour. Although we don't know how variable social values change, there is merit in considering annual surveys of the key satisfaction based measures (a subset of the information collected in the CATI survey) so that trends are not missed, and so that we can pick up the changing population. There is also a need to improve participation of younger people in the surveys. Recreational (travel cost) values may be estimated less frequently, but usage is important to assess on a more regular basis.

The relative importance of different sub-components within each component is likely to change over time, but short run changes may reflect a response to a particular incident (e.g. major oil spill) than a true overall preference. Consequently, there is no need to do the sub-component weightings survey annually, and to do so may introduce more noise than information. [14]

Given this, a potential schedule for survey-based data collection is presented in Table 41. Annual surveys of the most sensitive information only would reduce the size and cost of the ongoing analyses, and reduce the risk of survey fatigue in the general population. Ideally, the same panel would be surveyed on an ongoing basis (rather than new people every time). Less sensitive information can be updated every second year. Secondary data – which are readily available – can also be updated every year at low cost. Recreational values can be re-estimated every 5 years, although there is a more urgent need for a targeted recreational fishing value estimate (detailed next section). Community weightings used to assign weights between sub-components should also be reassessed less frequently, with every 5 years being appropriate as a general

[14] Similarly, a major event may have a short term impact on satisfaction measures, so when data are collected from the community needs to take into account events that have happened in recent months.

suggestion, but more frequently (e.g. 3 years) if there are substantial changes in the region (or anecdotal evidence of changes in community attitudes).

Table 41. Potential data collection schedule

Measure	Source	Annual	Biennial	5 years
Cultural				
• All secondary data	Secondary	X		
• Sensitive measures (sensitivity >1%)	Survey	X		
• Sensitive measures (sensitivity <1%)	Survey		X	
Social				
• All secondary data	Secondary	X		
• Sensitive measures (sensitivity >1%)	Survey	X		
• Sensitive measures (sensitivity <1%)	Survey		X	
Economic				
• Secondary data relating to economic performance	Secondary	X		
• Unemployment	Secondary		X	
• Recreational trip frequency	Survey	X		
• Recreational satisfaction (also part of social)	Survey	X		
• Recreational values (travel cost)	Survey			X
• Access to Economic Resources	Survey/secondary		X	
Community sub-components weightings	Survey			X

The linkages between the key measures, indicators and sub-components were derived from a survey of social science experts. These, in theory, should not change, although there may be benefits in running a similar survey again when updating the community sub-component weightings.

4.4.2 CURRENT GAPS

All questionnaire surveys are limited in the amount of information that can be collected and there is always a trade-off between collecting additional information and respondent fatigue. In this survey, there was insufficient information to estimate the recreational values of recreational fishing trips or for general water-based recreation. Both types of recreation, but recreational fishing in particular, will have relatively high economic values; higher than the average values reported here. The survey format also restricted the application of stated preference valuation techniques.

Given this, future data collections may wish to address some or all of the following knowledge gaps:

- Estimating the economic values for recreational fishing trips
- Estimating the economic values of other (non-fishing) water-based recreation

- Estimating the non-use values for recreation which are known to be quite high and could potentially double the economic value of recreation
- Estimating the marginal values associated with any specific changes in the Gladstone Harbour that are likely to impact on recreational activity such as reductions in water quality; increases in shipping activity; reduced catch rates in recreational fishing
- Estimating the non-market economic values of environmental assets
- Estimating marginal economic values for changes in the condition of environmental assets, i.e. that could potentially link to changes recorded in the report cards
- There are important non-market economic values associated with some social and indicators and there is potential to estimate some of these economic values in future surveys. Further research would be required to determine which social indicators attracted significant economic values

4.4.3 TRENDS

As more economic, social and cultural data are collected in Gladstone Harbour it will be possible to incorporate trend reporting and later more formal trend analysis into the Gladstone Healthy Harbour report card. For example the Chesapeake Bay Report Card provides graphical trend reports for each indicator and the overall index through time. It also uses regression analysis to identify trends in indicators[15]. Trend itself is then scored for each indicator, against a five point scale ranging from significantly improving through to significantly declining[16]. Such trend analysis and scoring would be a useful tool for tracking changes in economic, social and cultural indicators (and potentially other indicators) in Gladstone Harbour. It should be noted that this reinforces the need to ensure the repeatability of data collection techniques.

Given this, GHHP could consider incorporating social, cultural and economic trend reporting from year 3 and trend analysis and scoring from approximately year 5 or 6 (pending availability of sufficient data).

Similarly, the availability of more time series data on economic, social and cultural indicators will allow for extension of modelling approaches to predict the changes in these indicators that might result from changes in other Harbour health indicators (e.g. ecological or water quality indicators), or from taking particular management actions. Such predictive approaches are increasingly being explored in climate change research, for example modelling the likely climate change impacts on socio-economic vulnerability (Dunford *et al.* 2014), forestry management (Yousefpour *et al.* 2014), marine industries (Metcalf *et al.* 2014) and beach-based tourism (Amengual *et al.* 2014).

Given this, GHHP could consider extension of modelling approaches to predict changes in the social, cultural and economic health of Gladstone Harbour that might result from changes in other indicators or from management actions. This would allow the different components of the report card to be better integrated, and may also prove useful for linking the ecosystem modelling work currently underway to expected report card outcomes.

[15] Chesapeake Bay – Methods (2012). Available at: http://ian.umces.edu/ecocheck/report-cards/chesapeake-bay/2012/methods/ Accessed on 9 October 2014.
[16] Chesapeake Bay Report Card 2013. Available at: http://ian.umces.edu/press/report_cards/publication/447/2013_chesapeake_bay_report_card_2014-05-23/ Accessed on 9 October 2014.

5 Conclusion

The aim of the project was to test a range of indicators and pilot the development of a social, cultural and economic report card for the Gladstone Healthy Harbour Partnership.

Data were collected from a wide range of sources, with heavy reliance on a community survey for many of the indicators and also to develop appropriate weightings. Most secondary data sources used were not entirely up-to-date, and in many cases not an exact fit for what was needed. This is to be expected as these data are collected by different groups for different reasons, and are used for their reporting purposes which do not necessarily correspond to the needs of GHHP. Similarly, there is a time delay between their collecting the data and releasing the final data, so secondary data will not be as timely as primary data. However, as indicators they are largely appropriate, given a number of assumptions (as indicated in the main body of the report). If the report cards are to proceed, arrangements may be made with some of the secondary data producers to provide more targeted data (if possible).

The framework for integrating the measures was a Bayesian Belief Network (BBN). This provided a means to link qualitative and quantitative information in a systematic and transparent manner. The BBN was able to capture uncertainty in the measurement, as well as uncertainty in the relationships between measures and indicators through the conditional probability tables. The outcomes from each component can be expressed as a probability distribution of a single A-E score.

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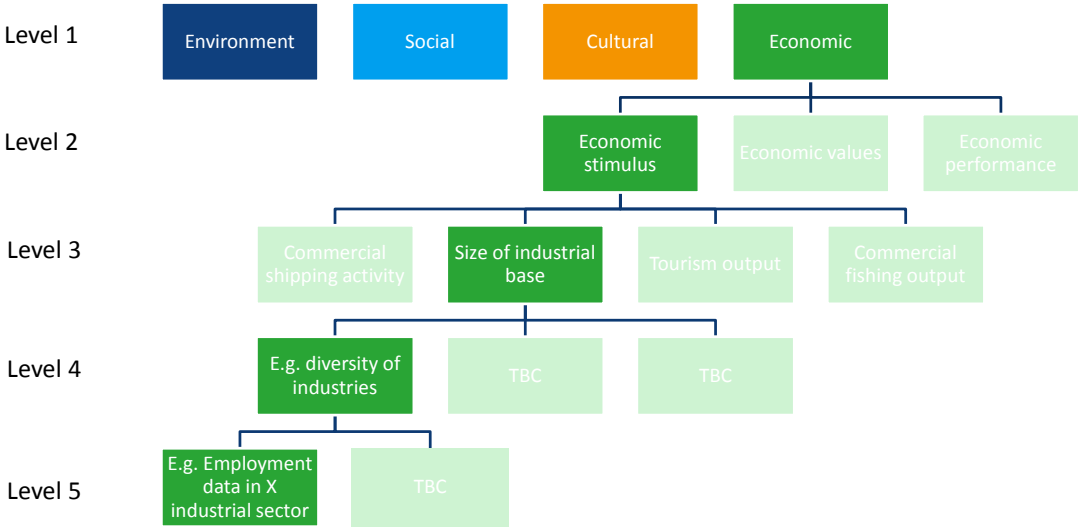
Appendix A Report carding nomenclature



Level/Name	Explanation	Example 1	Example 2	Example 3
1 Component	Highest level of aggregation. Has a 'grade' (e.g. A, B, C) which is underpinned by a 'score' (but the grade is the focus for communication purposes).	Environment	Environment	Social
2 Sub-component	The primary areas that make up each component. Each includes a 'score' *(and possibly a 'grade' for communication purposes? Although another set of 'As, Bs and Cs' might be too confusing?).*	Water and sediment quality	Habitats	Access to the Harbour
3 Indicator groups	This includes indicators groups at levels 3. Each group consists of several indicators. Like all levels of data aggregation, these will each be associated with a 'score'.	Water quality	Seagrass	People using the Harbour
4 Indicators	An aspect of a system that can be used to indicate its condition. These may comprise a single measurement, or an aggregation of several measurements. This is the level for which a 'score' will be calculated.	Phys/chem, nutrients, metals, oyster metal accumulation	Seagrass Biomass	Number of people accessing boat ramps
5 Measurements	Lowest level of detail, pertaining to data and numerical values.	pH, EC, DO, TN, TP, etc.	Biomass of species 1 per unit area	Number of boat ramps and location of boat ramps

Other nomenclature

Term	Definition
Asset	A particular feature of value to the GHHP for monitoring and reporting purposes, e.g. seagrass meadows or swimmable beaches.
Baseline	*(Preferred nomenclature. No longer using 'reference condition')* A point of reference from which to measure change. When calculating the report card scores, monitoring results at a given point in time and space are compared against a pre-determined baseline in order to establish how far the indicator has varied from the baseline. This enables the assessment of trends in condition across years, and for comparisons of differences between sites.
Grade	The result reported overall for each of the four report card components, e.g. A, B, C. Underpinned by 'scores' (see below).
Indicator	Indicators are numerical values which provide insight into the state of the environment, or human health etc. As the environment is highly complex, indicators provide a simple, practical way to track changes in the state of the environment over time.
Raw data	Raw data or primary data are defined as data collected from a source. Raw data have not been subjected to processing or any other manipulation except for quality control (QC) and quality assurance (QA) to ensure their accuracy.
Reference condition	*(Not preferred nomenclature – see 'baseline')*
Report card	Reports cards measure performance and progress in the form of grades or scores. Report cards can be used to synthesise and summarise complex, systematically collected scientific information from multiple sources into a small number of grades around distinct themes.
Guidelines	Science based numerical concentration limits or descriptive statement recommended to support a designated water use. Guidelines are not legally enforceable.
Scores	Numerical values on a standardised scale for ease of comparison e.g. 0-100. Scores can be calculated for different levels of aggregation of results e.g. a score can be calculated for the water and sediment quality indicator group, and there's also a score for physical and chemical indicators underneath that. Available in technical documentation, not communications for the general public.

Appendix B Community CATI Survey Design

GHHP social, cultural and economic indicators survey questions

To be read to respondents:

Hello! My name is _____

We are calling you today to request your participation in a survey on the social and economic status of Gladstone Harbour. The project is funded by the Gladstone Healthy Harbours Partnership, and is being run by CSIRO, Central Queensland University and James Cook University. The aim of the project is to develop a report card on Gladstone Harbour. We would like to ask you about your use of the Harbour and your perceptions about the Harbour quality. The information will help managers to make better decisions about how the Harbour is managed.

The survey will take about 15 mins to complete. Your participation is entirely voluntary and you are free to not answer any questions that you would prefer not to. All of your responses will remain strictly confidential.

Would you be happy to participate in this survey? Do you have any questions at this stage?

1) Do you live in the Gladstone region? Yes/No (screening question)
Possible age and gender screening questions here? -tba

2) In what suburb, town, or locality of the Gladstone region do you live? _____

3) How long have you lived in the Gladstone region? _____ (years) _____ (months)

4) Do you own a boat? Yes/No

We will be asking you a number of questions about your use of Gladstone Harbour and the surrounding areas. The area that we are interested in includes the coast and waters up to the Narrows, including Graham Creek, to the north, and extending south to Tannum Sands and Colosseum Bay. To the east it extends just past the east coast of Facing Island. We will call this the Gladstone Harbour area from now on.

5) When you think of the Gladstone Harbour area what are the first three words that come into your mind _____ _____ _____ (exclude uninformative words e.g. the, it, like, well and plural words)

In this section of the survey we are going to ask you some questions about how you use the Gladstone Harbour area for recreation. We are going to ask you about three different types of recreational activity. The first relates to your use of beaches, the second to all water-based activity, and the third to shore-based activity.

6) a) In the previous 12 months, did you visit the Gladstone Harbour area at all? _____ Yes/No

If yes: b) were any of these visits for recreation (not including visits where you paid a tour or ferry operator)? _____ Yes/No

7) In the previous 12 months, do you think you used the Gladstone Harbour area for any recreation activity more or less often than the year before, or about the same? _____ More/ less / about the same

8) In the previous 12 months, how frequently did you use a boat ramp in the Gladstone Harbour area? *Please read out the list of categories (LHS).and record a single response in one of the two columns (some people might know the exact amount which is why we have provided the ranges) These instructions apply to all the frequency questions.*

Response category		**Range**	
Never		**0**	
4-7 times a week		150-300	
2-3 times a week		80-149	
About once a week		40-79	
About once every 2 weeks		20-39	
About once a month		7-19	
About 4-6 times a year		4-6	
3 times per year		3	
2 times per year		2	
About once a year		1	

9) In the previous 12 months have you visited the following beaches in the Gladstone Harbour area?

	Y/N
Barney Point	
Spinnaker Park artificial beach	
Boyne Is	
Tannum Sands	
Other (please specify)	

10) In the previous 12 months, how often have you visited a **beach** on the mainland in the Gladstone Harbour area? For example, Barney Point, Spinnaker Park artificial beach, Boyne Is, Tannum sands. Do not consider beaches further south than Tannum Sands.

Response category		**Range**	
Never		**0**	
4-7 times a week		150-300	
2-3 times a week		80-149	
About once a week		40-79	
About once every 2 weeks		20-39	

Response category		Range	
Never		**0**	
About once a month		7-19	
About 4-6 times a year		4-6	
3 times per year		3	
2 times per year		2	
About once a year		1	

We would now like you to think about any water-based activity you may have undertaken in the Gladstone Harbour and surrounding area in the last year. We are interested in trips for boating, fishing (from a boat), water-sports, swimming etc.

We do not want you to include trips on the ferry or commercial boat cruises or other activities where you paid a commercial operator. We are also only interested in trips where you spend the majority of the trip in the Gladstone Harbour area. We are not interested in trips where you travelled through the Harbour to get to somewhere else.

11) In the last 12 months, did you undertake any **boat-based recreational fishing** in the Gladstone Harbour? YES/NO
    a. If YES how often have you been **recreational fishing** in the Gladstone Harbour area?

Response category		Range	
Never		**0**	

4-7 times a week		150-300	
2-3 times a week		80-149	
About once a week		40-79	
About once every 2 weeks		20-39	
About once a month		7-19	
About 4-6 times a year		4-6	
3 times per year		3	
2 times per year		2	
About once a year		1	

12) In the last 12 months, did you undertake any of the following other water-based activities in the Gladstone Harbour area?

(Read the following list and get a yes/no response)

	Y/N
Motorised boating –general boat recreation	
Motorised water sports (e.g., waterskiing, jet-skiing)	
Non-motorised water sports (e.g. Kayaking, kite surfing, paddle boarding, rowing, windsurfing)	
Sailing	
Swimming	
Scuba or snorkelling	
Other(specify)	

a. IF YES In the last year, how often have you done other **water-based recreation** in the Gladstone Harbour area?

Response category		**Range**	
Never		**0**	
4-7 times a week		150-300	
2-3 times a week		80-149	
About once a week		40-79	
About once every 2 weeks		20-39	
About once a month		7-19	
About 4-6 times a year		4-6	
3 times per year		3	
2 times per year		2	
About once a year		1	

13) In the last 12 months did you undertake any of the following **shore-based activities** in the Gladstone Harbour area?

(Read the following list and get a yes/no response)

	Y/N

	Y/N
Walking	
Cycling	
Running	
Picnicking or barbecuing	
Shore-based fishing	
Relaxing by the water	
Sporting events	
Community events	
Other (specify)	

14) In the last year, how often have you done **shore-based recreation** in the Gladstone Harbour area?

Response category		**Range**	
Never		**0**	
4-7 times a week		150-300	
2-3 times a week		80-149	
About once a week		40-79	
About once every 2 weeks		20-39	
About once a month		7-19	
About 4-6 times a year		4-6	
3 times per year		3	
2 times per year		2	
About once a year		1	

15) We would now like you to think about the recreational activity or type of trip that you do **most frequently** in the Gladstone Harbour area**.**
Was this?

A beach recreation trip	
A recreational fishing trip	
Other water-based recreation (not fishing)	
A shore-based recreation trip	

Other, please specify	

16) Thinking back to the **last time** you did this activity (from the above question), how did you get to where you first accessed the Gladstone Harbour area from your home? i.e. What form of transport did you use? (more than one response allowed)

Walk	
Bicycle	
Motor vehicle	
Other	

17) Approximately how many kilometres is it from your home to where you first accessed the Harbour? _____ kms

18) Approximately how long did it take to get there (one way) _____ hrs _____ mins

19) How many people did you go with? Count only those, including yourself, in the same vehicle as you.

No of adults (including yourself)	
No of children (16 yrs and under)	

20) Approximately how long did your recreational activity last? _____ hrs (use proportion if required)

21) Did you spend most of your time doing this activity or do other activities as well such as shopping or visiting friends?

Spent most of the time doing this activity	Yes/No
If you did other things as well, approximately what proportion of your time was spent doing the recreational activity *Do not include travel time*	% of time

22) Did your activity involve the use of a boat or jet ski? _____ Yes/ No

If yes

23) Approximately how many kms or nautical miles did you travel by boat? _____ kms or _____ nautical miles

24) Roughly how many Litres or $ worth of fuel did you use? _____L or $ _____

25) Thinking of this recreational trip to the Gladstone Harbour area, how satisfied were you overall with your experience? *On a scale for 1 to 10 where 1= very unsatisfied to 10= very satisfied.*

Very unsatisfied				Very slightly unsatisfied	Very slightly satisfied				Very satisfied
1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

We are now going to ask you a few questions about the recreational facilities around the Gladstone Harbour area.

Do you agree or disagree with the following statements on a scale from 1 to 10 with 1=strongly disagree to 10=strongly agree (*also allow a don't know or non response)*

	Strongly Disagree				Very slightly	Very slightly				Strongly Agree	**No Answer**
	1	2	3	4	5	6	7	8	9	10	
26) I am satisfied with the level of access to public spaces around Gladstone Harbour											
27) I am satisfied with the number of boat ramps available in the Gladstone Harbour area											
28) I am satisfied with the quality of boat ramps, including associated facilities, available in the Gladstone Harbour area											
29) I have fair access to Gladstone Harbour compared to other users of the Harbour											
30) There are other places that are better than the Gladstone Harbour area for the recreational activities that I do											
31) The amount of shipping in Gladstone Harbour has reduced my use of the area											
32) The amount of recreational boating activity in Gladstone Harbour has reduced my use of the area											

We are now going to ask you some more general questions about your impression of the Gladstone Harbour area.

Do you agree or disagree with the following statements on a scale from 1 to 10 with 1=strongly disagree to 10=strongly agree (*also allow a don't know or non response)*

With 1=strongly disagree to 10=strongly agree	Strongly Disagree				Very slightly	Very slightly				Strongly Agree	**No Answer**
	1	2	3	4	5	6	7	8	9	10	
33) The Gladstone Harbour area is not in great condition											
34) I feel optimistic about the future health of Gladstone Harbour											
35) The health of the Harbour has improved in the past 12 months											
36) Marine debris and litter is a problem in Gladstone Harbour											
37) The amount of marine debris and litter in Gladstone Harbour affects my access to the area											
38)											
39)											

With 1=strongly disagree to 10=strongly agree	Strongly Disagree				Very slightly	Very slightly				Strongly Agree	**No Answer**
	1	2	3	4	5	6	7	8	9	10	
40) I am not concerned about water quality in the Gladstone Harbour area											
41) I am not concerned about air quality in the Gladstone Harbour area											
42) The water quality in Gladstone Harbour has not affected how often I use the area in the last 12 months											
43) I would be happy to eat seafood caught in the Gladstone Harbour area											
44) I feel safe being in the Gladstone Harbour area at night											
45) Gladstone Harbour makes living in Gladstone a better experience											
46) I regularly participate in											

With 1=strongly disagree to 10=strongly agree	Strongly Disagree				Very slightly	Very slightly				Strongly Agree	No Answer
community events in the Gladstone Harbour area											

We are now going to ask you some questions about your general perceptions on how the Harbour is managed and how important it is to you.

Do you agree or disagree with the following statements (1-10)?

With 1=strongly disagree to 10=strongly agree	Strongly Disagree				Very slightly	Very slightly				Strongly Agree	No Answer
	1	2	3	4	5	6	7	8	9	10	
47) I feel able to have input into the management of the Gladstone Harbour if I choose to											
48) I believe the traditional sites and customs in the Gladstone Harbour area are well protected											
49) I believe the Traditional Owners of the Gladstone Harbour area are well consulted by the regional managers											

With 1=strongly disagree to 10=strongly agree	Strongly Disagree				Very slightly	Very slightly				Strongly Agree	No Answer
	1	2	3	4	5	6	7	8	9	10	
50) I feel proud that I live in the Gladstone community											
51) The Gladstone Harbour area is part of who I am											
52) The Gladstone Harbour area improves my quality of life											
53) I do not plan to be a resident of this region in the next 5 years											
54) The Gladstone Harbour is a key part of the Gladstone community											

We are now going to ask you questions about what you value about Gladstone Harbour. Do you agree or disagree with the following statements (1-10)?

With 1=strongly disagree to 10=strongly agree	Disagree				Very	Very				Agree	**No**
	1	2	3	4	5	6	7	8	9	10	
55) I value the Gladstone Harbour area because it supports a variety of marine life											
56) I value the Gladstone Harbour area because it provides opportunities for outdoor recreation											
57) I value the Gladstone Harbour area because it attracts visitors to the region											
58) The Gladstone Harbour area is a great asset for the economy of this region											
59) The Gladstone Harbour area is a great asset for the economy of Queensland											
60) I value the Gladstone Harbour area because I enjoy the scenery and sights											
61) I value the Gladstone Harbour area because there are spiritually special places											
62) I value the Gladstone Harbour area because there are culturally special places											
63) I value the Gladstone Harbour area because it has historical significance that matters to me											

ECONOMIC AND DEMOGRAPHIC

We are now going to ask some questions about you and your household. This is to help us compare your responses with other studies in the area and also other respondents.

64) What is your age?

18-24	25-34	35-44	45-54	55-64	65+
☐	☐	☐	☐	☐	☐

65) Are you male ☐ or female? ☐

66) Do you identify as a traditional owner of the area? Yes ☐ No ☐

67) What is your approximate household income?

Weekly	**≤$399**	**$400 - $799**	**$800 - $1249**	**$1250 - $1499**	**$1500 - $1999**	**$2000 - $2499**	**$2500 - $2999**	**≥$3000**
Annual	**≤$20,799**	**$20,800- $41,599**	**$41,600- $64,999**	**$65,000- $77,999**	**$78,000- $103,999**	**$104,000- $129,999**	**$130,000- $155,999**	**≥$156,000**
	☐	☐	☐	☐	☐	☐	☐	☐

68) How many adults (> 18 years old) live in your household? ☐

69) How many children 15 years and older old live in your household? ☐

70) How many children younger than 15 years old live in your household? ☐

71) Is any adult in the household unemployed? (exclude stay at home mums/dads not actively seeking work, or retirees) Yes ☐ No ☐

72) Is any adult in the household self employed? Yes ☐ No ☐

73) Is your home:

Owned with a mortgage?	Owned without a mortgage?	Rented?
☐	☐	☐

a. I*f owned with a mortgage*, is your mortgage repayment greater than $3000/month
Yes ☐ No ☐

b. *If rented*, is your rent payment greater than $175/week
Yes ☐ No ☐

74) Does your household have a car? Yes ☐ No ☐

75) How many bedrooms does your house have? ☐

Final questions: and then thank them for their participation

73. Would you be willing to complete a small exercise in another online survey. This is about determining the relative importance of the different indicators that will be using in the Gladstone Harbour report cord?

If yes, please collect an email address._____

74.This survey will be conducted on an annual basis to collect information for the Gladstone Harbour report card. Would you be willing to be contacted again next year to answer some more questions about the Gladstone habour.

If yes, please collect an email address._____

That is the end of the survey

Combined results from the surveys will help ensure the opinions of the people living in the Gladstone area are considered in the management of the Harbour. You will be able to access the final report online at the end of the year. If you wish to receive further information about the survey, I can give you the contact details for the project leader, Dr Sean Pascoe from the CSIRO, who can forward further details to you. Would you like these? (if yes then provide email sean.pascoe@csiro.au)

Thank you for your participation

Appendix C Word sets

Set of first word responses:

Terrific; Special; Like; Muddy; Beautiful; Dirty-Water; Unuseable; Buggered; Pollution; Alright; Beautiful; Beach; Boats; Industry; Great; Close; Was-Pretty; Nothing-Wrong; Underutilised; Good; Relaxing; Port-Industry; Useful; Destroyed; Great-Place; Pollution; Industrial; Islands; Busy; Beautiful; Ferries; Pollution; Busy; Good; Beautiful; Boats; Nice; Pristine; Beautiful; Pollution; Big; Boats; Pristine; Scenic; Export; Crabbing; Okay; Busy; Shipping; Money; Pigsty; Picturesque; Unclean; Pollution; Relaxing; Facilities; Stuck; Fishing; Great; Big; Mutated; Controversial; Beautiful; Port; Sea-Creatures; Busy; Good; Grotty; Great-Fishing; Beautiful; Beautiful; Clean; Good-Fishing; Industrialised; Fishing; Industry; Tidal; Coal-Dust; Beautiful; Reef; Changed; Eat; Beach; Coal; Water; Good; Deep; Beautiful; Nice; Water; Boat; Dirty; Beautiful; Muddy; Destroyed; Deep-Water; Beautiful; Fishing; Industrial; Pretty; Two-Islands; **Draid**; LNG; Fishing; Fun; Scenic; Good-Area; Barge; Water; Calm; Friendly; Worried; Fishing; Work; Dirty; Dredging; Fishing; Nice-Beaches; Tide; Fishing; Distant; Fishing; Fishing; Good; Beautiful; Water; Big; Beautiful; Panorama; Dolphins; Healthy; Fishing; Harbour; Marina; Big; LNG; Shipping; Clean; Fisherman; Pollution; Nice; Unclear; Busy; Industrial; Beautiful; Work; Busy; Wet; Murky; Disease; Crabbing; Gladstone-Port; Big; Pretty; Crabbing; Acceptable; Lot-Of-Activity; Port; Lacking-Facilities; Boats; Beautiful-Spot; Industrial; Busy; Fishing; Industry; Harbour; Family; Easy-To-Get-To; Tannum-Sands; Beach; Spectacular; Swings; Large; Port; Mess; Wrecked; Boats; Busy; Sandbanks; Busy; Not-Able-To-Use; Pollution; Sun; Auckland-Hill; Pretty; Beautiful; Dredging; Island; Dredging; Family-Area; Shipping; Beautiful; Fishing; Industry; Dirty; Busy; Beautiful; Fishing; Ruined; Industry; Birds; Recreation; Dirty; Fish; Safe; Shipping; Scenic; Big; Mess; Marina; Industry; Beautiful; Big-Change; Beautiful-Spot; Beautiful; Shipping; Shipping; Industrial; Windy; Harbour; Marina; Narrows; Ocean; Disgusting; Fishing; Pollution; Interesting; Smell; Marina; Beautiful; Backyard; Fishing; Lovely; Fishing; Boat-Traffic; Health; Busy; Overcrowded; Fishing; Ruined; Pollution; Great; Beautiful; Busy; Industry; Picturesque; Pollution; Beautiful; Industry; Untidy; Industry; Big; Love-It; Barramundi; Boats; Scenic; Coal; Dirty; Fishing; Clean; Coffee-Shop; Natural-Port; Beautiful; Large; Beautiful; Crowded; Deterioration; Industry; Great; Dirty; Clean; Fishing; Unclean; Shipping; Marina; Industry; Pretty; Industry; Dolphins; Gorgeous; Recreation; Beautiful; Nice; Fishing; Clean; Dirty; Wrecked; Boating; Nice; Busy; Beach; Pollution; Beautiful-Harbour; Marina; Industry; Destroyed-Family; Cold; Pollution; Pollution; Beautiful; Fishing; Nice-Looking; Big-Boats; Dredging; Industry; Too-Busy; Harbour; Protected; Calming; Muddy; Fishing; Muddy; Sucks; Clear; Large; Family; Marina; Beach; Water; Good; Industry; Queensland; Curtis-Island; Water; Coal; Crabs; Sunny; Lovely; Beautiful; Dolphins; Crap; Disgraceful; Water; Coal; Fishing; Danger; Water; Pristine-Conditions; ; Harbour; Fresh; Busy; Enjoyable; Beautiful; Pretty; Pollution; Sailing; Waves; Boats; Busy; Fishing; Misinformation; Busy; Fishing; Pleasant; Tourism; Pollution; Nice; Lovely-Place; Mess; Beautiful-Islands; View; Mangroves; Pretty; Busy; Blue-Water; No-Fish; Industry; Industry; Fantastic; Love-It; Beautiful; Dredging; Mud; Pollution; Colour-Of-Water-Deteriorated; Pollution; Sad; Busy; Boats; Boating; Fishing; Walk; Ugly; Nice; Pollution; Pollution; Wharfs; Accessible; Beautiful; Water; ; Pollution; Busy-Port; Threatened; Underused; Beautiful; Pollution; Parks; Relaxing;

All words together

Terrific; Special; Like; Muddy; Beautiful; Dirty-Water; Unuseable; Buggered; Pollution; Alright; Beautiful; Beach; Boats; Industry; Great; Close; Was-Pretty; Nothing-Wrong; Underutilised; Good; Relaxing; Port-Industry; Useful; Destroyed; Great-Place; Pollution; Industrial; Islands; Busy; Beautiful; Ferries; Pollution; Busy; Good; Beautiful; Boats; Nice; Pristine; Beautiful; Pollution; Big; Boats; Pristine; Scenic; Export; Crabbing; Okay; Busy; Shipping; Money; Pigsty; Picturesque; Unclean; Pollution; Relaxing; Facilities; Stuck; Fishing; Great; Big; Mutated; Controversial; Beautiful; Port; Sea-Creatures; Busy; Good; Grotty; Great-Fishing; Beautiful; Beautiful; Clean; Good-Fishing; Industrialised; Fishing; Industry; Tidal; Coal-Dust; Beautiful; Reef; Changed; Eat; Beach; Coal; Water; Good; Deep; Beautiful; Nice; Water; Boat; Dirty;

Beautiful; Muddy; Destroyed; Deep-Water; Beautiful; Fishing; Industrial; Pretty; Two-Islands; **Draid**; LNG; Fishing; Fun; Scenic; Good-Area; Barge; Water; Calm; Friendly; Worried; Fishing; Work; Dirty; Dredging; Fishing; Nice-Beaches; Tide; Fishing; Distant; Fishing; Fishing; Good; Beautiful; Water; Big; Beautiful; Panorama; Dolphins; Healthy; Fishing; Harbour; Marina; Big; LNG; Shipping; Clean; Fisherman; Pollution; Nice; Unclear; Busy; Industrial; Beautiful; Work; Busy; Wet; Murky; Disease; Crabbing; Gladstone-Port; Big; Pretty; Crabbing; Acceptable; Lot-Of-Activity; Port; Lacking-Facilities; Boats; Beautiful-Spot; Industrial; Busy; Fishing; Industry; Harbour; Family; Easy-To-Get-To; Tannum-Sands; Beach; Spectacular; Swings; Large; Port; Mess; Wrecked; Boats; Busy; Sandbanks; Busy; Not-Able-To-Use; Pollution; Sun; Auckland-Hill; Pretty; Beautiful; Dredging; Island; Dredging; Family-Area; Shipping; Beautiful; Fishing; Industry; Dirty; Busy; Beautiful; Fishing; Ruined; Industry; Birds; Recreation; Dirty; Fish; Safe; Shipping; Scenic; Big; Mess; Marina; Industry; Beautiful; Big-Change; Beautiful-Spot; Beautiful; Shipping; Shipping; Industrial; Windy; Harbour; Marina; Narrows; Ocean; Disgusting; Fishing; Pollution; Interesting; Smell; Marina; Beautiful; Backyard; Fishing; Lovely; Fishing; Boat-Traffic; Health; Busy; Overcrowded; Fishing; Ruined; Pollution; Great; Beautiful; Busy; Industry; Picturesque; Pollution; Beautiful; Industry; Untidy; Industry; Big; Love-It; Barramundi; Boats; Scenic; Coal; Dirty; Fishing; Clean; Coffee-Shop; Natural-Port; Beautiful; Large; Beautiful; Crowded; Deterioration; Industry; Great; Dirty; Clean; Fishing; Unclean; Shipping; Marina; Industry; Pretty; Industry; Dolphins; Gorgeous; Recreation; Beautiful; Nice; Fishing; Clean; Dirty; Wrecked; Boating; Nice; Busy; Beach; Pollution; Beautiful-Harbour; Marina; Industry; Destroyed-Family; Cold; Pollution; Pollution; Beautiful; Fishing; Nice-Looking; Big-Boats; Dredging; Industry; Too-Busy; Harbour; Protected; Calming; Muddy; Fishing; Muddy; Sucks; Clear; Large; Family; Marina; Beach; Water; Good; Industry; Queensland; Curtis-Island; Water; Coal; Crabs; Sunny; Lovely; Beautiful; Dolphins; Crap; Disgraceful; Water; Coal; Fishing; Danger; Water; Pristine-Conditions; ; Harbour; Fresh; Busy; Enjoyable; Beautiful; Pretty; Pollution; Sailing; Waves; Boats; Busy; Fishing; Misinformation; Busy; Fishing; Pleasant; Tourism; Pollution; Nice; Lovely-Place; Mess; Beautiful-Islands; View; Mangroves; Pretty; Busy; Blue-Water; No-Fish; Industry; Industry; Fantastic; Love-It; Beautiful; Dredging; Mud; Pollution; Colour-Of-Water-Deteriorated; Pollution; Sad; Busy; Boats; Boating; Fishing; Walk; Ugly; Nice; Pollution; Pollution; Wharfs; Accessible; Beautiful; Water; ; Pollution; Busy-Port; Threatened; Underused; Beautiful; Pollution; Parks; Relaxing; Beautiful; Environment; Coral; Industrial; Quality; Busy; Boats; Busy; Dirty; Job-Orientated; Overpopulated; Dead-Harbour; Pressured; Tidal; Relaxing; Great-For-Fishing; Improved; Scenic; Gas; Lookout; Cleanliness; Pollution; Beautiful; Busy; Flat; Busy; Industry; Pollution; Changing; Contentious; Nice-Swimming; Fish; Beautiful; Dolphins; Fishing; Beaches; Abused; Wanting; Sad; ; Good; Not-Busy; Difference-In-Water-Temperature; Unseen-Danger; Fishing; Beaches; Mud Flats; Water; Congested; Relaxing; Busy; Mudcrabs; Fish; Ruined; ; Destroyed; Bit-Polluted; ; Laid-Back; ; Harbour; Shipping; Sailing; ; Mine; Excellent; Clean; Beautiful-Harbour; World-Best-Harbour; Fruitful; Pleasurable-For-Sailing; Ruined; ; Not-Good; Pretty; ; Nice; Dirty; Fish; Beautiful; Liveable; Pristine; Idealistic; Port; Great; Fishing; Boating; Busy; Fisherman; Clean; ; Work; Shipping; Deep-Water; Shipping; Disaster; Ruined; Industrial; Fishing; Harbour; Fishing; Beautiful; Sheltered; Fishing; Entertainment; Scenic; Muddy; Not-Good; ; Weekends; Holidays; Water; Way; Shipping; Islands; Fish; Dirty; Enjoyable; Turbid; Maintained; Lovely; Export; ; Fishing; Tidal; Dredging; Clean; Good; Fun; Fishing; Don't-Use; Druggy; Beautiful; Reef; Fishing; Camping; Tranquil; Peaceful; Family-Friendly; Very-Nice; Nice-Area; Unspoiled; Busy; ; Water-Quality; Dredging; Port; Fishing; Currents; Fish; QAL; LNG; Beach-Walks; Parks; Industry; Coastline; Big; Developed; Swim; Never; River; Fishing; Beach; Fishing; Boat; Fishing; Beautiful; Clean; Water; Port; Clean; Nice; Barge; Scenic; Beautiful; Lovely; Ferry; Pollution; Misused; Unorganised; Industrial; Recreational; Fishing; Terrible; Contamination; Industry; Coal; Gas; Fishing; World-Best-Harbour ; Water; Water-Sports; Shipping; ; Walking-Tracks; Accessible; Reefs; ; Boats; Fishing; Harbour ; Festival; ; Crabbing; Boating; Vast; ; Recreational; Lovely; Nice; Fishing; Busy; Blue; Construction; Boats; Industry; Recreation; Clean; Accessible; Regrets; Shipping; Industry; Shipping; Green; ; Pollution; Filthy; Fishing; Spoiled; Industry; Playtime; Relaxing; Fun; Traffic; Light; Water; ; Tides; Parking; Parks; Watersports; Overcrowded; Dredging; Traffic; Fishable; Productive; Busy; Harbour-Traffic; Pollution; Environment; Dirty; ; Busy; Asset; Glorious; Views; Water; ; Parklands; Fishery; Industrial; Boating; ; Marina; Scenic; Tannum-Beach; Esplanade; Fish; ; Busy; Port; Fishing; ; Coal; Gas-Line; Dredging; Lack Of Fish; Dredging; Fishing-Ruined; Harbour; ; Changing; Busy; Boating; ; Pollution; Boat; Fishing; Recreation; Busy; Extensive; Dirty; Turbid; Fishing; Shipping; Facing-Island; ; Curtis-Island; Beautiful; Busy; Quiet; Family; Populated; Traffic; Busy; Dirty; Islands;

Marine; Underused; Under-Provided; Coal; Dredging; Pristine; ; Unique; Water-Quality; Hazardous; Diverse; Barges; ; Picturesque; Empty; ; Well-Kept; Exports; Fishing; Fun; Safe; Busy; Windy; Pollution; Fishing; Sea; ; Untouched; Pristine; Looks ; Nice; Port; Sad; Ship; Industry; Disgraceful; Pitiful; Pollution; Feeding-Grounds; Animals; Sand; Beautiful; ; Shipping; Islands; Accessible; ; More; Lovely; Dredging; Dying-Fish; Fishing; Beautiful; Spinnaker; Marina; Nice; ; Pristine; Amazing; Fishing; Dirty; Port-Facilities; Riverside-Parks; Pollution; Disappointing; Fishing; Boating; Beaches; Fishing; Enclosed; Safe; Crabbing; Islands; Nice Island; ; Good; ; Not-As-Clear ; Eyesore; Uncrowded; Busy; ; Silo; Jetties; Breeze; ; Beautiful; Commercial; Harbour; Beautiful; Humid; Pollution; Soup; Ideal; Leisure; Dredging; Beautiful; Industry; Shipping; Clean; User-Friendly; Pollution; Shipping; Spinnaker-Park; Tannum-Beach; Business; Shipping; Fishing; Availability; Busy; Messy ; Industrial; Accessible; Water; ; Fish; Industry; Coal; Coastline; Murky; Busy; Rough; Busy; ; Parks; ; Harbour-Festival; Facing-Island; ; Shipping; Boats; Fish; Appalling; Too-Regulated; Scenic; Look-Out; Filthy; Dead-Fish; Sediment; Fishing; Boats; Dirty-Water; Home; Top-Spot; Relaxing; Fishing; Relaxation; Scenery; Nice; Lifeblood; Boating; Lifestyle; Minimal-Damage; Beautification; Doubt; ; Harbour; Scenic; Changing; Balance-Shifted; Industry; Boating; Camping; Dirty; Spoiled; Busy; ; Fantastic; Terrific; People; ; Construction; Sheltered; Deep; Mudflats; Damage; Family Friendly; Busy; Contaminated; Industrial; Accessible; Good-Fishing; Jobs; Prosperity; Open; Busy; Fishing; Pollution; Busy; Shipping; Magnificent; Wonderful; Mudcrabs; Prawns; Curtis Island; Dolphins-Absent; Beautiful; Industrial; Export; ; Industrial; Crowded; Small-Place-Being-Dumped-On; ; ; Pleasant; Nice; Walking; Lovely; Tourism; Pretty; Peaceful; Family; Potential; Pretty; Home; Pretty; Overused; Fishing-Not-Good; Fishing; Government-Bureaucracy; Dredging; Crabbing; Beautiful; Harbour; Diseased-Fish; Pollution; Clear; Boats; Industry; Usage; Dormant; Dead; Biggest-Harbour; People-Talking-About-The-Harbour; Coal-Terminal; Beach; Ruined; ; Ugly; Good; ; Recreation; Islands; Peace; Tranquillity; User-Friendly; ; Family; Good; ; Water; ; Dredging; Pleasure Boating; Not-Built-Up; Boating; Swimming; Breezy; ; Busy; Messy; Unkempt; Destroyed; Filthy; Fishing; Waterviews; Serves-A-Purpose; Scenic; Congested; ; Sand; Water; Industry; Ports-Corporation; Safe; ; Islands; Coal-Terminal; Pretty; ; Blue-Water; Fishing-Industry; Lost-Everything; **LNG**; Fishing; Toxic; Dirty; Diseased-Fish; Overcrowded; Relaxing; Clean; Seafood; Spinnaker; Pretty; ; Busy; LNG; Ocean; Nice; Popular; Fishing; Islands; Tourist-Attraction; Industry; Industry; Not-Natural; Easy-Access; Quiet; Damaged; Under-Utilised; Heavy-Use; Tidal; Boating; Swimming; Busy; ; Ruined; ; Stuffed; Blue; Sky; Busy; Industry; Relaxing; Mates; Port; Water; Marina-Playground; ; Spinnaker-Park; Industrial; Port; Pleasure; Fun; Pollution; Unusable; Great; Fantastic; Water; Ports; Dirty; Cluttered; Smoke; ; Horrible-Fishing; Fish; Chips; Hot; Picnic; Views; Water; Dry; Australia; Walk-Trail; Island; Horrible; Pollution; Shocking; Crap; Ships; Fishing; Fishing; Islands; Boat; Rivers; Shame; ; Ruined; Picnic; Playgrounds; Dishonest-Reporting; ; Outside-Interference; Pollution; Industrial; Clean; Pleasing; Dolphins; Windy; Scenic; Picturesque; Fish; Reef; Picturesque; Fresh; Sick-Fish; Overnetted; Beach; Islands; Green; Water; Fishing; Crabbing; Activity; Recreation; Boating; ; Beautiful; Misrepresentation; Dangerous; Fish; Boating; Lookout; Relaxation; Fishing; Well-Kept; Fishing; Dredging; Not-Nice; Blue-Water; Peaceful; Beautiful; Magnificent; No-Dredging; ; Busy; Clean; Fishing; Catching; Sandflies; Mud; Gross; ; Beautiful; People; ; Nice; Boats; ; Pollution; Dangerous; Shallow; Marina; Clean; Fishing; Playground; Unbelievable; Luckiest-Part-Of-The-World; Happy; ; Nice; Interesting; Fishing; Crabbing; Mangroves; Fish; Harmful; Turtles; Busy; ; Mutation; Brown; Lost; Betrayed; Sailing; ; Picnics; Water; ; Family; ; Fun; Crabbing; Beaches; Fine; ; Industry; Unattractive; Reef; Beaches; Sheltered; Good-Port; Fishing-Spots; Islands; Well-Maintained; Recreation; Boating; Fishing; Coal; Shipping; Busy; Dirty; Fishing; Local-Waterways; In-Trouble; Endangered; Pretty; Industrial; Scenic; Easy-Access; Not-Good; Bad-Fishing; Marina; Water; Kids; Fishing; ;

Appendix D Experts social and cultural indicators Survey

Social indicators survey

Mapping social and cultural indicators to objectives

The Gladstone Health Harbour Partnership (GHHP) have commissioned CSIRO, JCU and CQU to look to developing a social, cultural and economic "report card" on the health of the Harbour. A separate community survey is underway collecting information on a range of indicators that will be used in the development of the annual report card. As part of the study, we need to link the indicators to the set of objectives defined by the GHHP. The aim of this is to develop a measure of how well the objective has been achieved based on the set of indicators.

The aim of this survey is to determine key expert views on the relative importance of the different indicators in terms of determining the outcomes of the stated objectives of the GHHP, and also how much weight to give to each question response when measuring the indicators (where more than one question relates to an indicator). These views will help determine the degree to which the broader social and cultural objectives of the Partnership are being achieved, and will be used in the development of a Report Card on the social and cultural health of Gladstone Harbour.

Why me?

You have been contacted as you a recognised expert in terms of social and/or cultural aspects of marine and coastal management.

Participation in the survey is voluntary, but as there are relatively few experts like yourself in Australia we are hoping you will agree to participate. We are tracking who responds to the survey mainly so that we can send a reminder to non-respondents. As an incentive to participate, we are offering **two prizes of a $75 gift card**. We will randomly draw the two winners from the list of those who have completed the survey by the **19th September 2014.**

Instructions

You will be presented with 2 different approaches to assessing the relative relevance of the indicators in relation to the objectives. Both approaches involve choosing your response from a drop down menu.

1. The first is a simple ranking of indicator relevance. You will be asked to rank the indicators from first to nth (n=number of indicators).

2. The second is a scoring based system. You will be asked to allocate 100 points to the indicator you have ranked number 1, then allocate points between 1-100 to the other indicators based on how relevant they are compared to the top ranked indicator. (Unfortunately, SurveyMonkey is not able to automatically allocate 100 points to the first-ranked indicator, so you will have to do this manually - sorry).

What if I have problems completing the survey?

The survey should be relatively straight forward, although some of the comparisons might be tricky. Please do your best in terms of assigning a score to each indicator. Equal scores and ranks are OK if you truely believe that they have equal relevance. The survey should take between 15-20 minutes to complete (probably closer to 20). If you do have problems please contact Sean Pascoe (email: sean.pascoe@csiro.au, phone: 07 3833 5966). There is also an opportunity to leave feedback or comments at the end of the survey.

Confidentiality

Your individual responses will not be identifiable in any form in any related output from the study. Only aggregate information will be released. The project team will have access to individual responses for the purposes of completing the analysis, but these will not be disclosed to any third party in an identifiable form.

Thank you for your assistance with this project.

Social indicators survey

Cultural heritage objective and indicators

The first set of indicators relates to the Cultural heritage objective of the GHHP:

*1. **Cultural heritage objective**: That registered cultural heritage sites associated with the harbour and waterways are protected*

This objective considers both indigenous and non-indigenous cultural heritage, and is based on four indicators - two based on perceptions and the others based on measures:

1. A perception based indicator from the community survey asking "*I believe the traditional sites and customs in the Gladstone Harbour area are well protected*" with a 10 point scale (1= strongly disagree; 10=strongly agree);
2. A perception based indicator from the community survey asking "*I am confident the Traditional Owners of the Gladstone Harbour region are well considered by management*" with a 10 point scale (1= strongly disagree; 10=strongly agree);
3. A measure of the condition of registered non-indigenous cultural heritage sites; and
4. The proportion of known indigenous cultural heritage sites protected.

In the first column, please rank the general indicator from first to fourth in order of relevance in describing how well the objective is met. You can rank indicators equally if they are equally important (e.g. first, second, third, third).

In the second column, give the indicator you scored highest (i.e. first) in the first column a score of 100. Give each other indicator an importance score relative to this using the drop down menu. For example, a lower ranked indicator may have score of 90 if you believe it is very close in relevance, or might have a score of 35 if you think it is much less relevant than the first ranked indicator. If you believe indicators are equally relevant then both would have an equal score (e,g. using the above example you may score them 100,90,35,35).

*Cultural heritage indicators

	Rank (first to fourth)	Score (set First=100)
Perception: "*I believe the traditional sites and customs in the Gladstone Harbour area are well protected*"		
Perception: "*I believe the Traditional Owners of the Gladstone Harbour region are well consulted by regional managers*"		
Measure: Condition of non-indigenous cultural heritage sites		
Measure: Proportion of known indigenous sites protected		

Social indicators survey

Sense of place objective and indicators

The second set of indicators relates to the "Sense of place" objective of the GHHP:

Sense of place objective: *The Gladstone community's sense of identity and satisfaction with the condition of the harbour is increased.*

"Sense of place" is a combination of characteristics that makes a place special and unique. It involves the human experience in a landscape, the local knowledge and folklore. Areas that have a strong sense of place have an identity and character recognized immediately by a visitor and valued deeply by residents.

The indicators are all derived from a community survey and relate to perceptions of the local residents. There are two levels of indicator. The first level is the broad indicator and the second level consists of the questions relating to the broad indicator (each using a 10 point scale (1= strongly disagree; 10=strongly agree)). Several questions may relate to each indicator. The broad indicators and related survey questions are:

1) Measures of distinctiveness/uniqueness

- *There are no other places that are better than the Gladstone Harbour region for the recreational activities that I do*
- *The Gladstone harbour region is part of who I am*

2) Continuity

- *How long have you lived in the Gladstone region?*
- *I plan to be a resident of this region in the next 5 years*

3) Self esteem

- *I feel proud that I live in the Gladstone community*

4) Self efficacy

- *The Gladstone Harbour region improves my quality of life*
- *I feel able to have input into the management of the Gladstone Harbour if I choose to*

Social indicators survey

5) Attitudes to Gladstone Harbour

- *The Gladstone Harbour is a key part of the Gladstone community*
- *The Gladstone Harbour region is a great asset for the economy of this region*
- *The Gladstone Harbour region is a great asset for the economy of Queensland*

6) Values of Gladstone Harbour

- *I value the Gladstone Harbour region because it supports a variety of marine life*
- *I value the Gladstone Harbour region because it provides opportunities for outdoor recreation*
- *I value the Gladstone Harbour region because it attracts visitors to the region*
- *I value the Gladstone Harbour region because I enjoy the scenery and sights*
- *I value the Gladstone Harbour region because there are spiritually special places*
- *I value the Gladstone Harbour region because there are culturally special places*
- *I value the Gladstone Harbour region because it has historical significance that matters to me*

In the first column, please rank the general indicator in order of importance/relevance in describing how the "Sense of place" objective is met. You can rank indicators equally if they are equally relevant. For example, you may believe that distinctiveness is the main factor affecting sense of place, and continuity the least. In this case you would rank distinctivess first and continuity last. You will be given an opportunity to assess how the actual questions relate to the indicators in the next question.

In the second column, give the indicator you ranked first in the first column a score of 100. Give each other indicator a score relative to this using the drop down menu.

Social indicators survey

*Broad indicators of "Sense of place"

	Rank (first to sixth)	Score (First=100)
Measures of distinctiveness/uniqueness		
Measures of continuity		
Measures of self esteem		
Measures of self efficacy		
Attitudes to Gladstone Harbour		
Values of Gladstone Harbour		

Social indicators survey

Sense of place: linking survey questions to indicators

Most of the survey key indicators of "sense of place" have several underlying questions. The aim of this part of the survey is to determine how to asses the overall indicator given the range of different responses to each question by assigning weights to each question. You may believe they are all equal, or that responses to some questions are more influential than others.

As before, in the first column, please rank the survey question in order of relevance in describing the indicator. You can rank questions equally if they are equally relevant.

In the second column, give the question you scored first in the first column a score of 100. Give each other question a score relative to this using the drop down menu based on its relevance to the indicator. You can give equal scores to the questions if you think they equally relate to the indicator.

*Measures of distinctiveness/uniqueness

	Rank (first, second)	Score (First=100)
"There are no other places that are better than the Gladstone Harbour region for the recreational activities that I do"		
"The Gladstone harbour area is part of who I am"		

*Continuity

	Rank (first, second)	Score (First=100)
Length of time living in the Gladstone region		
"I plan to still be a resident of this region in the next five years"		

*Self efficacy

	Rank (first, second)	Score (First=100)
"*The Gladstone Harbour area improves my quality of life*"		
"I feel able to have input into the management of the Gladstone Harbour if I choose to"		

Social indicators survey

Sense of place: linking survey questions to indicators (continued)

As before, in the first column, please rank the survey question in order of relevance in describing the indicator. You can rank questions equally if they are equally relevant. In the second column, give the question you scored first in the first column a score of 100. Give each other question a score relative to this using the drop down menu based on its relevance to the indicator. You can give equal scores to the questions if you think they equally relate to the indicator.

*Attitudes to Gladstone Harbour

	Rank (first, second, third)	Score (First=100)
"The Gladstone Harbour is a key part of the Gladstone community"		
"The Gladstone Harbour area is a great asset for the economy of this region"		
"The Gladstone Harbour area is a great asset for the economy of Queensland"		

Social indicators survey

*Values of Gladstone Harbour

	Rank (first to seventh)	Score (First=100)
"I value the Gladstone Harbour area because it supports a variety of marine life"		
"I value the Gladstone Harbour area because it provides opportunities for outdoor recreation"		
"I value the Gladstone Harbour area because it attracts visitors to the region"		
"I value the Gladstone Harbour area because I enjoy the scenery and sights"		
"I value the Gladstone Harbour area because there are spiritually special places"		
"I value the Gladstone Harbour area because there are culturally special places"		
"I value the Gladstone Harbour area because it has historical significance that matters to me"		

Social indicators survey

Harbour access objective

The next set of indicators relates to the Harbour access objective of the GHHP:

***Harbour access**: Maintain or improve easy access to the harbour waters and foreshore for recreation and community uses*

The objective has four main indicators, each which involve one or more questions:

1) Satisfaction with access to the harbour

- *I have fair access to Gladstone Harbour compared to other users of the harbour*

2) Satisfaction with availability of ramps, public access and spaces

- *I am satisfied with the level of public access and spaces to the Gladstone Harbour area*
- *I am satisfied with the number of boat ramps available in the Gladstone Harbour area*
- *Do you think you used the harbour and surrounding area for any recreation activity mentioned above more or less often than the year before, or about the same? (More/ less / about the same)*

Social indicators survey

3) Perceptions on health of the harbour

- *The Gladstone Harbour area is in great condition*
- *I feel optimistic about the future health of the Gladstone Harbour*
- *The health of the harbour has improved in the last 12 months*

4) Barriers to access and use of the harbour

- *Marine debris and litter is a problem in Gladstone Harbour*
- *The amount of marine debris and litter in Gladstone Harbour affects my access to the area*
- *The amount of shipping activity in Gladstone Harbour has reduced my use of the area*
- *The amount of recreational boating activity in Gladstone Harbour has reduced my use of the area*

Information is also collected in the community survey about frequency of use of the harbour, activities undertaken and boat ownership. These information will be used for contextualising the report card outcomes rather than as an input into the report card per se.

The aim of this part of the survey is to determine the relative importance of each broader indicator in defining "Harbour access", based on the description of each indicator (in terms of the underlying questions). You may believe all are equally important or that some elements are more important than others.

In the first column, please rank the general indicator in order of relevance in describing how the "Harbour access" objective is met given the context of the questions used in measuring the indicator (above). You can rank indicators equally if they are equally relevant. In the second column, give the indicator you ranked first in the first column a score of 100. Give each other indicator a score relative to this using the drop down menu.

*Main indicators relating to the harbour access objective

	Rank (first to fourth)	Score (First=100)
Satisfaction with access to the harbour		
Satisfaction with availability of ramps, public access and spaces		
Perceptions of health of the harbour		
Barriers to access		

Social indicators survey

Harbour access objective: linking survey questions to the indicators

Most of the survey key indicators of "harbour access" have several underlying questions. The aim of this part of the survey is to determine how to asses the overall indicator given the range of different responses to each question by assigning weights to each question. You may believe they are all equal, or that responses to some questions are more influential than others.

As before, in the first column, please rank the general indicator in order of relevance in describing how the "Harbour access" objective is met given the context of the questions used in measuring the indicator (above). You can rank indicators equally if they are equally relevant. In the second column, give the indicator you ranked first in the first column a score of 100. Give each other indicator a score relative to this using the drop down menu.

*Satisfaction with availability of ramps, public access and spaces

	Rank (first to third)	Score (First=100)
"I am satisfied with the level of access to public spaces around Gladstone Harbour"		
"I am satisfied with the number of boat ramps available in the Gladstone Harbour area"		
Change in Usage: *"Do you think you used the harbour and surrounding area for any recreation activity more or less often than the year before, or about the same?"*		

*Perceptions of health of the harbour

	Rank (first to third)	Score (First=100)
"The Gladstone Harbour region is in great condition"		
"I feel optimistic about the future health of the Gladstone Harbour"		
"The health of the harbour has improved in the last 12 months?"		

Social indicators survey

*Barriers to access

	Rank (first to fourth)	Score (First=100)
"Marine debris and litter is a problem in Gladstone Harbour"		
"The amount of marine debris and litter in Gladstone Harbour affects my access to the area"		
"The amount of shipping in Gladstone Harbour has reduced my use of the area"		
"*The amount of recreational boating activity in Gladstone Harbour has reduced my use of the area*"		

Social indicators survey

Harbour usability objective

The next set of indicators relates to the Harbour usability objective of the GHHP:

***Harbour usability**: Maintain or improve a safe harbour for all users (e.g. swimming, boating and foreshore activities)*

The objective has three main indicators, each which involve one or more questions:

1) Satisfaction with harbor recreational activities

- *Thinking of your most recent recreational trip to the Gladstone Harbour region, how satisfied were you overall with your experience?*
- *I am satisfied with the quality of boat ramps, including associated facilities, available in the Gladstone Harbour area*

2) Perceptions of air and water quality in the harbour area

- *I am not concerned about water quality in the Gladstone Harbour area*
- *I am not concerned about air quality in the Gladstone Harbour area*
- *The water quality in Gladstone Harbour has not affected how often I use the area in the last 12 months*

3) Safety of harbour for public usage

- *I would be happy to eat seafood caught in the Gladstone Harbour area*
- *I feel safe being in the Gladstone Harbour area at night*
- Measure: Number of oil and chemical spills in the Harbour
- Measure: Number of marine safety incidents in the Harbour

The aim of this part of the survey is to determine the relative importance of each broader indicator in defining "Harbour usability", based on the description of each indicator (in terms of the underlying questions). You may believe all are equally important or that some elements are more important than others.

In the first column, please rank the general indicator in order of relevance in describing how the "Harbour access" objective is met given the context of the questions used in measuring the indicator (above). You can rank indicators equally if they are equally relevant. In the second column, give the indicator you ranked first in the first column a score of 100. Give each other indicator a score relative to this using the drop down menu.

*Main indicators relating to the harbour usability objective

	Rank (first to third)	Score (First=100)
Satisfaction with harbour recreational activities		
Perceptions of water quality		
Safety of harbour for public usage		

Social indicators survey

Harbour usability objective: linking survey questions to the indicators

Most of the survey key indicators of "harbour usability" have several underlying questions. The aim of this part of the survey is to determine how to asses the overall indicator given the range of different responses to each question by assigning weights to each question. You may believe they are all equal, or that responses to some questions are more influential than others.

*Satisfaction with harbour recreational activities

	Rank (first to second)	Score (First=100)
"Thinking of your most recent recreational trip to the Gladstone Harbour region, how satisfied were you overall with your experience?"		
"I am satisfied with the quality of boat ramps available in the Gladstone Harbour area"		

*Perceptions of air and water quality

	Rank (first to third)	Score (First=100)
"I am not concerned about water quality in the Gladstone Harbour area"		
"I am not concerned about air quality in the Gladstone Harbour area"		
"The water quality in Gladstone Harbour has not affected how often I use the area in the last 12 months"		

*Safety of harbour for public usage

	Rank (first to fourth)	Score (First=100)
"I would be happy to eat seafood caught in the Gladstone Harbour area"		
"I feel safe being in the Gladstone Harbour area at night"		
Measure: Number of oil and chemical spills in the harbour		
Measure: Number of marine safety incidents in the harbour		

Social indicators survey

Liveability and wellbeing objective

The next set of indicators relates to the Liveability and Wellbeing objective of the GHHP:

***Liveability and wellbeing**: Contribution of the harbour to liveability of Gladstone*

The objective has only one indicator, involving two questions:

Contribution of the harbour to liveability of Gladstone

- *Gladstone Harbour makes living in Gladstone a better experience*
- *I regularly participate in community events in the Gladstone Harbour area*

*Contribution of the harbour to liveability of Gladstone

	Rank (first to second)	Score (First=100)
"Gladstone Harbour makes living in Gladstone a better experience"		
"I regularly participate in community events in the Gladstone Harbour area"		

Social indicators survey

Some questions about you and your answers

The purpose of these questions is to gain an idea of how confident you are about your responses, which groups you think you represent (may be more than one); and how you found the survey questions.

*How confident are you about your responses relating to the different sub-objectives in each category?

	Very unsure	Unsure	Neither sure nor unsure	Sure	Very sure
Cultural heritage?	◯	◯	◯	◯	◯
Sense of place?	◯	◯	◯	◯	◯
Harbour access?	◯	◯	◯	◯	◯
Harbour usability?	◯	◯	◯	◯	◯
Liveability and wellbeing?	◯	◯	◯	◯	◯

*How confident are you about your responses for each of the three approaches used?

	Very unsure	Unsure	Neither sure nor unsure	Sure	Very sure
Ranking (First, second, etc)	◯	◯	◯	◯	◯
Scoring (1-100)	◯	◯	◯	◯	◯

Social indicators survey

Thank you

If you wish to be included in the random draw for the gift vouchers, please enter your details below:

Name

Email Address

Thank you for participating in this study.

For further information about the survey and how it will be used, please contact Sean Pascoe (sean.pascoe@csiro.au).

If you would like to make comments about the survey, please do so below.

Appendix E Community sub-component weightings Survey

Community objectives survey

GHHP Report Card
Objective importance survey

The aim of this survey is to determine community views on the relative importance of the stated objectives of the Gladstone Healthy Harbour Partnership (GHHP) (http://www.healthyharbour.org.au/). These views will help determine the degree to which the broader social, cultural and economic objectives of the Partnership are being achieved, and will be used in the development of a Report Card on the health of Gladstone Harbour.

The project to help develop the report card framework is being undertaken in partnership between the CSIRO Oceans and Atmosphere Flagship, Central Queensland University and James Cook University. You have already had some involvement with this project through the recent community telephone survey in which you participated (thank you).

Why me?

You have been contacted as you have recently participated in a telephone survey collecting information for the development of the report card, and expressed a willingness to undertake a supplementary survey.

As an incentive to participate in the survey, we are offering the chance to win one of ten $50 gift vouchers. Your responses will be automatically linked to your email address, and ten respondents will be drawn at random on the **19th September 2014**.

Instructions

You will be presented with 3 different approaches to assessing the relative importance of the objectives.

1. The first is a simple ranking of objectives. You will be asked to rank the objectives from 1 to n (n=number of objectives).

2. The second is a scoring based system. You will be asked to allocate 100 points to the objective you have ranked number 1, then allocate points between 1-100 to the other objectives based on how important they are compared to the top ranked objective.

Both the first and second approaches involve choosing your response from a drop down menu.

3. In the third approach, you will be asked to assess the relative importance of sets of objectives. Two objectives will be presented at a time and you will be asked to indicate which you think is more important and by how much. If they are equally important you will be able to indicate that also.

What if I have problems completing the survey?

The survey should be relatively straight forward, and should take only 10 minutes or so to complete. If you do have problems please contact Sean Pascoe (email: sean.pascoe@csiro.au, phone: 07 3833 5966). There is also an opportunity to leave feedback or comments at the end of the survey.

Confidentiality
Your individual responses will not be identifiable in any form in any related output from the study. Only aggregate information will be released. The project team will have access to individual responses for the purposes of completing the analysis, but these will not be disclosed to any third party in an identifiable form.

Thank you for your further assistance with this project.

Community objectives survey

Cultural objectives

On this page, you will be asked to compare the two cultural objectives identified by the GHHP. These are:

*1. **Cultural heritage objective**: That registered cultural heritage sites associated with the harbour and waterways are protected*

*2. **Sense of place objective:** The Gladstone community's sense of identity and satisfaction with the condition of the harbour is increased. "Sense of place" is a combination of characteristics that makes a place special and unique. It involves the human experience in a landscape, the local knowledge and folklore. Areas that have a strong sense of place have an identity and character recognized immediately by a visitor and valued deeply by residents.*

***1. In the first column, please rank the general objective in order of importance to you using the drop down. You can rank objectives equally if they are equally important.**

In the second column, give the objective you scored highest (i.e. 1) in the first column a score of 100. Give each other objective an importance score relative to this using the drop down menu. For example, the second ranked objective may have score of 90 if they are very close in importance to you, or might have a score of 50 if you think the first ranked objective is twice as important as the second ranked objective. If you believe they are equaly important then both would have a score of 100.

	Rank (first or second)	Score (First=100)
Cultural heritage		
Sense of place		

***2. The next exercise asks you to compare the objectives directly against each other, and indicate which is the most important (and by how much). You can use the results from the first question as a guide. For example, if you scored objective A as 100 and objective B as 90, you might say that objective A is "*slightly more important*" than objective B, or even "*more important*", depending on how you feel about the strength of the relationship.**

- **Not all points are labelled. Unlabelled points are mid-way between the adjacent labelled points.**

	A is most important		**A** is much more important than **B**		**A** is more important than **B**		**A** is slightly more important than **B**	**Both are equally important**	**B** is slightly more important than **A**		**B** is more important than **A**		**B** is much more important than **A**		**B** is most important
(**A**) *Cultural heritage*; versus (**B**) *Sense of place*	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Community objectives survey

Social objectives

On this page, you will be asked to compare the three social objectives identified by the GHHP

*1. **Harbour access**: Maintain/Improve easy access to the harbour waters and foreshore for recreation and community uses*
*2. **Harbour usability**: Maintain/Improve a safe harbour for all users (e.g. swimming, boating and foreshore activities)*
*3. **Liveability and wellbeing**: Contribution of the harbour to liveability of Gladstone*

***3. In the first column, please rank the general objective in order of importance to you using the drop down. You can rank objectives equally if they are equally important. In the second column, give the objective you scored highest (i.e. 1) in the first column a score of 100. Give each other objective an importance score relative to this using the drop down menu.**

	Rank (first, second, third)	Score (First=100)
Harbour access		
Harbour usability		
Liveability and wellbeing		

***4. The next exercise asks you to compare the objectives directly against each other, and indicate which is the most important (and by how much). You can use the results from the first question as a guide.**

- **Not all points are labelled. Unlabelled points are mid-way between the adjacent labelled points.**

	A is most important		**A** is much more important than **B**		**A** is more important than **B**		**A** is slightly more important than **B**	**Both are equally important**	**B** is slightly more important than **A**		**B** is more important than **A**		**B** is much more important than **A**		**B** is most important
(**A**) *Harbour access*; versus (**B**) *Harbour usability*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(**A**) *Harbour access*; versus (**B**) *Liveability and wellbeing*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(**A**) *Harbour usability*; versus (**B**) *Liveability and wellbeing*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Community objectives survey

Economic objectives

On this page, you will be asked to compare the three economic objectives identified by the GHHP

*1. **Economic performance of the Harbour industries:** The Gladstone Harbour is managed to support shipping, transport and a diversity of industries*
*2. **Economic stimulus to the community:** Economic activity in the Gladstone Harbour continues to generate social and economic benefits to the broader regional community*
*3. **Economic values of recreational and environmental assets**: Value of recreational activity in the Harbour and of the natural environmental assets is maintained or improved*

***5. In the first column, please rank the general objective in order of importance to you using the drop down. You can rank objectives equally if they are equally important. In the second column, give the objective you scored highest (i.e. 1) in the first column a score of 100. Give each other objective an importance score relative to this using the drop down menu.**

	Rank (first, second, third)	Score (First=100)
Economic performance of the Harbour industries		
Economic stimulus to the community		
Economic values of recreational and environmental assets		

Community objectives survey

***6. The next exercise asks you to compare the objectives directly against each other, and indicate which is the most important (and by how much). You can use the results from the first question as a guide.**

- **Not all points are labelled. Unlabelled points are mid-way between the adjacent labelled points.**

	A is most important		**A** is much more important than **B**		**A** is more important than **B**		**A** is slightly more important than **B**	**Both are equally important**	**B** is slightly more important than **A**		**B** is more important than **A**		**B** is much more important than **A**		**B** is most important
(**A**) *Economic performance*; versus (**B**) *Economic stimulus to the community*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(**A**) *Economic performance*; versus (**B**) *Economic values of recreational and environmental assets*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(**A**) *Economic stimulus to the community*; versus (**B**) *Economic values of recreational and environmental assets*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Community objectives survey

Some questions about you and your answers

The purpose of these questions is to gain an idea of how confident you are about your responses, and how you found the survey questions.

*7. How confident are you about your responses relating to the different sub-objectives in each category?

	Very unsure	Unsure	Neither sure nor unsure	Sure	Very sure
Cultural objectives?	◯	◯	◯	◯	◯
Social objectives?	◯	◯	◯	◯	◯
Economic objectives?	◯	◯	◯	◯	◯

*8. How confident are you about your responses for each of the three approaches used?

	Very unsure	Unsure	Neither sure nor unsure	Sure	Very sure
Ranking (First, second, etc)	◯	◯	◯	◯	◯
Scoring (1-100)	◯	◯	◯	◯	◯
Direct comparisons (A vs B)	◯	◯	◯	◯	◯

Community objectives survey

Thank you

9. If you would like to be entered into the draw for the gift vouchers, please enter your details below:

Name

Email Address

10. Thank you for participating in this study. For further information about the survey and how it will be used, please contact Sean Pascoe (sean.pascoe@csiro.au). If you would like to make comments about the survey, please do so below.

Appendix F Management groups survey on sub-component weightings

GHHP Report Card
Objective importance survey

The aim of this survey is to determine key stakeholder, expert and community views on the relative importance of the stated objectives of the Gladstone Healthy Harbour Partnership (GHHP). These views will help determine the degree to which the broader social, cultural and economic objectives of the Partnership are being achieved, and will be used in the development of a Report Card on the health of Gladstone Harbour.

The project to help develop the report card framework is being undertaken in partnership between the CSIRO Oceans and Atmosphere Flagship, Central Queensland University and James Cook University.

Why me?

You have been contacted as you have a role either with the GHHP, with one of the partner organisations, or are involved with management of the harbour, region or with an industry affected by the Harbour to some degree.

Instructions

You will be presented with 3 different approaches to assessing the relative importance of the objectives.

1. The first is a simple ranking of objectives. You will be asked to rank the objectives from 1 to n (n=number of objectives).

2. The second is a scoring based system. You will be asked to allocate 100 points to the objective you have ranked number 1, then allocate points between 1-100 to the other objectives based on how important they are compared to the top ranked objective. For example, if the second ranked objective is close to the first, you may choose to allocate it 95 points. Conversely, if the second ranked objective is much less important, you may choose to allocate it 50 points. In either case, you would allocate the third ranked objective less points than the two higher ranked objectives depending on how important it was relative to the first objective. You may allocate equal points to some or all objectives if you feel they are equally important.For example, you may allocate both the second and third objective 80 points if both are highly important. With the exception of the first ranked objective (which has an allocation of 100 points always), you may allocate any number of points (less than 100) to the other objectives depending on how important you feel they are relative to the first objective.

Both the first and second approaches involve choosing your response from a drop down menu.

3. In the third approach, you will be asked to assess the relative importance of sets of objectives. Two objectives will be presented at a time and you will be asked to indicate which you think is more important and by how much. If they are equally important you will be able to indicate that also.

What if I have problems completing the survey?

The survey should be relatively straight forward, and should take only 10 minutes or so to complete. If you do have problems please contact Sean Pascoe (email: sean.pascoe@csiro.au, phone: 07 3833 5966). There is also an opportunity to leave feedback or comments at the end of the survey.

Confidentiality

Your individual responses will not be identifiable in any form in any related output from the study. Only aggregate information will be released. The project team will have access to individual responses for the purposes of completing the analysis, but these will not be disclosed to any third party in an identifiable form.

Thank you for your assistance with this project.

objectives survey

Cultural objectives

On this page, you will be asked to compare the two cultural objectives identified by the GHHP. These are:

*1. **Cultural heritage objective**: That registered cultural heritage sites associated with the harbour and waterways are protected*

*2. **Sense of place objective:** The Gladstone community's sense of identity and satisfaction with the condition of the harbour is increased.*
"Sense of place" is a combination of characteristics that makes a place special and unique. It involves the human experience in a landscape, the local knowledge and folklore. Areas that have a strong sense of place have an identity and character recognized immediately by a visitor and valued deeply by residents.

***1. In the first column, please rank the general objective in order of importance to you using the drop down. You can rank objectives equally if they are equally important.**

In the second column, give the objective you scored highest (i.e. 1) in the first column a score of 100. Give each other objective an importance score relative to this using the drop down menu. For example, the second ranked objective may have score of 90 if they are very close in importance to you, or might have a score of 50 if you think the first ranked objective is twice as important as the second ranked objective. If you believe they are equaly important then both would have a score of 100.

	Rank (first or second)	Score (1-100)
Cultural heritage		
Sense of place		

***2. The next exercise asks you to compare the objectives directly against each other, and indicate which is the most important (and by how much). You can use the results from the first question as a guide. For example, if you scored objective A as 100 and objective B as 90, you might say that objective A is "*slightly more important*" than objective B, or even "*more important*", depending on how you feel about the strength of the relationship.**

- **Not all points are labelled. Unlabelled points are mid-way between the adjacent labelled points.**

	A is most important		**A** is much more important than **B**		**A** is more important than **B**		**A** is slightly more important than **B**	**Both are equally important**	**B** is slightly more important than **A**		**B** is more important than **A**		**B** is much more important than **A**		**B** is most important
(**A**) *Cultural heritage*; versus (**B**) *Sense of place*	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

objectives survey

objectives survey

Social objectives

On this page, you will be asked to compare the three social objectives identified by the GHHP

1. ***Harbour access***: *Maintain/Improve easy access to the harbour waters and foreshore for recreation and community uses*
2. ***Harbour usability***: *Maintain/Improve a safe harbour for all users (e.g. swimming, boating and foreshore activities)*
3. ***Liveability and wellbeing***: *Contribution of the harbour to liveability of Gladstone*

***3. In the first column, please rank the general objective in order of importance to you using the drop down. You can rank objectives equally if they are equally important.**

In the second column, give the objective you scored highest (i.e. 1) in the first column a score of 100. Give each other objective an importance score relative to this using the drop down menu. For example, the second ranked objective may have score of 90 if they are very close in importance to you, or might have a score of 50 if you think the first ranked objective is twice as important as the second ranked objective. If you believe they are equaly important then both would have a score of 100. The scores for the third will be less than (or equal to) the score of the second objective

	Rank (first, second, third)	Score (1-100)
Harbour access		
Harbour usability		
Liveability and wellbeing		

objectives survey

***4. The next exercise asks you to compare the objectives directly against each other, and indicate which is the most important (and by how much). You can use the results from the first question as a guide. For example, if you scored objective A as 100 and objective B as 90, you might say that objective A is "*slightly more important*" than objective B, or even "*more important*", depending on how you feel about the strength of the relationship.**

- **Not all points are labelled. Unlabelled points are mid-way between the adjacent labelled points.**

	A is most important		**A** is much more important than **B**		**A** is more important than **B**		**A** is slightly more important than **B**	**Both are equally important**	**B** is slightly more important than **A**		**B** is more important than **A**		**B** is much more important than **A**		**B** is most important
(**A**) *Harbour access*; versus (**B**) *Harbour usability*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(**A**) *Harbour access*; versus (**B**) *Liveability and wellbeing*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(**A**) *Harbour usability*; versus (**B**) *Liveability and wellbeing*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

objectives survey

Economic objectives

On this page, you will be asked to compare the three economic objectives identified by the GHHP

*1. **Economic performance of the Harbour industries:** The Gladstone Harbour is managed to support shipping, transport and a diversity of industries*
*2. **Economic stimulus to the community:** Economic activity in the Gladstone Harbour continues to generate social and economic benefits to the broader regional community*
*3. **Economic values of recreational and environmental assets**: Value of recreational activity in the Harbour and of the natural environmental assets is maintained or improved*

***5. In the first column, please rank the general objective in order of importance to you using the drop down. You can rank objectives equally if they are equally important.**

In the second column, give the objective you scored highest (i.e. 1) in the first column a score of 100. Give each other objective an importance score relative to this using the drop down menu. For example, the second ranked objective may have score of 90 if they are very close in importance to you, or might have a score of 50 if you think the first ranked objective is twice as important as the second ranked objective. If you believe they are equaly important then both would have a score of 100. The scores for the third will be less than (or equal to) the score of the second objective

	Rank (first, second, third)	Score (1-100)
Economic performance of the Harbour industries		
Economic stimulus to the community		
Economic values of recreational and environmental assets		

objectives survey

***6. The next exercise asks you to compare the objectives directly against each other, and indicate which is the most important (and by how much). You can use the results from the first question as a guide. For example, if you scored objective A as 100 and objective B as 90, you might say that objective A is "*somewhat more important*" than objective B, or even "*more important*", depending on how you feel about the strength of the relationship.**

- **Not all points are labelled. Unlabelled points are mid-way between the adjacent labelled points.**

	A is most important		**A** is much more important than **B**		**A** is more important than **B**		**A** is slightly more important than **B**	**Both are equally important**	**B** is slightly more important than **A**		**B** is more important than **A**		**B** is much more important than **A**		**B** is most important
(**A**) *Economic performance*; versus (**B**) *Economic stimulus to the community*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(**A**) *Economic performance*; versus (**B**) *Economic values of recreational and environmental assets*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
(**A**) *Economic stimulus to the community*; versus (**B**) *Economic values of recreational and environmental assets*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

objectives survey

Some questions about you and your answers

The purpose of these questions is to gain an idea of how confident you are about your responses, which groups you think you represent (may be more than one); and how you found the survey questions.

*7. Which group(s) do you think you represent? You may tick more than one

- [ ] Harbour based industry
- [ ] Harbour management
- [ ] Environmental/conservation management
- [ ] Tourism industry
- [ ] Fishing (recreational and commerical)
- [ ] Other local industry
- [ ] Local community
- [ ] Traditional owners
- [ ] Scientific/expert advice
- [ ] Other (please specify)

*8. How confident are you about your responses relating to the different sub-objectives in each category?

	Very unsure	Unsure	Neither sure nor unsure	Sure	Very sure
Cultural objectives?	◯	◯	◯	◯	◯
Social objectives?	◯	◯	◯	◯	◯
Economic objectives?	◯	◯	◯	◯	◯

*9. How confident are you about your responses for each of the three approaches used?

	Very unsure	Unsure	Neither sure nor unsure	Sure	Very sure
Ranking (First, second, third)	◯	◯	◯	◯	◯
Scoring (1-100)	◯	◯	◯	◯	◯
Pairwise comparisons (A vs B)	◯	◯	◯	◯	◯

objectives survey

Thank you

10. Thank you for participating in this study. For further information about the survey and how it will be used, please contact Sean Pascoe (sean.pascoe@csiro.au). If you would like to make comments about the survey, please do so below.

Appendix G Secondary data sources

Table 42. Summary data on rec. fishing, oil spilling and social events

Indicators	Gladstone Harbour Area	
Recreational fishing in GHH		**Sources of data**
Number of people participates in recreational fishing in a year.	12000 (in 2013). One-thirds of participants are shore fishers and two-thirds are boat fishers.	(a) Recreational fishing report 2013 (Sawynok, B., Platten, J., Parsons, W., and Sawynok, S., 2013, Assessing Trends in Recreational Fishing in Gladstone Harbour and Adjacent Water ways, Infofish Australia). This assessment is undertaken by Infofhish Australia and QGC under the project called '**Gladstone Recreational Fishing Project– Gladfish'** . This program taken over from the 2005-2012 CapReef citizen science monitoring program. (b) Personal contact: Bill Saywnok (Infofish Australia)
	In 2013, about 7200 boats for recreational fishing were registered. Boat registrations in the Gladstone Regional Council area increased by 33.5% from 2006--2013.	
Any particular event on RF?	Yes, Boyne Tannum Hookup event.	
Participants in this recreational fishing event	About 3000 entrants	
Number of annual fishing trips	Total 59000 recreational fishing days were made in 2013. Number of fishing days increased by 19.3% between 2011-2012 and 2012-2013.	
Catch rate (kept only)	Catch rates ranged from a low of 8.5 fish/trip in winter 2010 to a high of 24.9 fish/trip in autumn 2008. For fish kept the catch rate ranged from a low of 0.02 fish/trip in summer 2011-12 to a high of 7.9 fish/trip in autumn 2008.	
Oil spills in GHH		
How many ships at GH per year?	Over 1500 commercial/trade ships arrive at the port's berths	Marine safety Queensland, 2013, Summary of oil spills and other marine pollution events reported to Marine Safety Queensland, Queensland Government.
How much oil spilled in a year?	Exact figure is unknown. However, amount of oil spilled ranges from 0.5 litres to 3000 litres for an incident.	
Number of incidents	Total 24 (in 2014)	
Festival/events in Gladstone Harbour		
Participation in Harbour Festival	60000 (Gladstone Harbour week-long festival)	(a) Gladstone Harbour Festival and Events (http://gladstonefestival.com).

How many events?	A week-long Gladstone Harbour Festival is organised annually each year and this festival consists of many events.	(b) Gladstone Harbour and Festival office at Gladstone Regional Council (this office organise Gladstone Harbour Festival and Events) *(c) Bill Saywnok (Infofish Australia)
How many people participate in the events/festival?	About 60,000 visitors pass through the festival and attend various events and enjoy	
Raft Race event	About 15000 participants in 2013	
*Boyne Tannum Hookup (recreational fishing event)	This is a public event organised once in a year. Average number of participants/entrants is 3000.	

Sources:

(a) Sawynok, B., Platten, J., Parsons, W., and Sawynok, S., 2013, Assessing Trends in Recreational Fishing in Gladstone Harbour and Adjacent Water ways, Infofish Australia.

(c) Gladstone Harbour Festival and Events (http://gladstonefestival.com)

(b) Marine Safety Queensland, 2013

FESTIVALS AND EVENTS IN GLADSTONE HARBOUR AREA

At the Gladstone Harbour an important festival is organised each year called Gladstone Harbour Festival. This is a 'free' community festival with so much on offer for people of all ages and capabilities. This festival has been continuing for 52 years since 1962. This is a week-long festival organised at Easter time each year. Over 60,000 visitors pass throughout the week-long festival at the Gladstone Harbour. Most of the visitors are locals and residents of surrounding areas in Gladstone Harbour Area.

Many events are organised during this festival (Table 1). Street parade is one of the important events where people more than 3000 people take part in this event.

Events	**Description**	Comments
Fireworks display	Four fireworks displayed in 2014 at the Gladstone Harbour Festival sponsored by companies and port corporation.	
Opening Night Celebrations	This event feature the Beatnix Show includes musical instruments used by Beatles.	
Family Fun Night	Organised by Gladstone Port Corporation. This is a free main stage entertainment featuring live shows by Fireman Sam, Peppa Pig etc.	
Talent Quest & Battle of the Bands	Local talents show their performance at stages in this competition.	

Other festival events

Junior Harbour Festival Queen Quests: The Junior Queen Quests offer all entrants the chance to build confidence, show off their personalities and gain invaluable experience in a formal judging and presentation ceremony, make new friends, and the possibility of winning some prizes.

GLNG & ZINC's Talent Quest & Battle of the Bands: An evening of unique entertainment starring the Gladstone Regions finest talent. A solo artist performs as part of a group or individually and competes for prizes.

NRG's Great Raft Race: In this competition, colourful rafts and their crews float, splash and paddle their way to the finish line for fantastic cash prizes. Companies or business entrepreneurs and local communities, schools take part in this event. There are 15 teams where each of the teams consists of 8 members took part in 2014. About 15000 thousand locals enjoyed this event.

The Gladstone Ports Corporation's Marina Main Stage: This event comes alive from 6.30pm every evening throughout the Gladstone Harbour Festival with an abundance of amazing free entertainment for the entire family (Gladstone Harbour Festival and Events 2013 at http://gladstonefestival.com)

Recreational fishing in Gladstone Harbour/Region

Recreational fishing is an important social activity in the Gladstone Harbour Area. An event called Boyne Tannum Hookup is organised among public. Some other events are organised by fishing clubs and these events are limited to club members.

Number of people participating in recreational fishing

In 2010 it was estimated that there were 42,000 or 20% of residents in the Fitzroy region aged 5 years or more that went fishing. Based on an estimated population of 210,000 for the region, a population of 150,000 for the Rockhampton region and 60,000 for the Gladstone region in that year it is estimated that 12,000 residents went fishing in the Gladstone region in 2010. This does not include visitors to the area that went fishing (Sawyok et al. 2013).

Number of events of recreational fishing/competitive recreational fishing organized in a year

There are many fishing competitions that are held by local fishing clubs that are open to members only. There is only one major fishing competition open to the public being the Boyne Tannum Hookup.

This is an annual fishing competition that is held each year on the Queen's birthday weekend in June. This is one of the largest fishing competition in Queensland often attract 3000 entrants (Sawynok et al. 2013)

Number of people attending (competitors and supporters) in these events in a year

It is estimated that there are around 3,000 entrants to the competition each year however only around 1/3 actually fish. The balance enters the event to be eligible for the prizes. The event was held over 3 days in May 2014. Each evening there are a number of draw prizes made with entrants required to be in attendance. It is estimated that around 3-4,000 people attend each evening (Sawynok et al. 2013).

Number of boats for recreational fishing

At June 2013 boat registrations for motorboats up to 8m in length (the range most used for recreational fishing) there were 7,200. This was a 33.55 increase since 2006 when there were 5,400 registrations. There was a 2.4% increase from 2012-13 (Sawynok et al. 2013).

Average number of trips made by per recreational fisher

In 2010 it was estimated that there were 72,000 days fishing from boats and 63,000 days fishing from the shore in the Fitzroy Region. Based on a median of 2 fishers per boat and 1 fisher fishing from the shore, this equates to 207,000 fishing days. Based on the breakdown between Rockhampton and Gladstone it is

estimated that 59,000 fishing days occurred in the Gladstone region. This equates to around 5 fishing trips per recreational fisher per year (Sawynok et al. 2013).

Amount of catch per trip

Catch rates fluctuate from season to season. Catch rates for Gladstone for each season from autumn 2006-spring 2013 are available in the Gladfish 2013 report. Catch rates ranged for fish kept ranged from a low of 8.5 fishes/trip in winter 2010 to a high of 24.9 fish/trip in autumn 2008. For fish kept the catch rate ranged from a low of 0.02 fish/trip in summer 2011-12 to a high of 7.9 fish/trip in autumn 2008. There is no clear decrease or increase in catch rates over that time (Sawynok et al. 2013).

Number of Barramundi caught/trip ranges from 0.6-3.7 from Spring 2009 to Spring 2012 while the number of Barramundi caught/trip ranges from 0-0.2 during the Autum 2006 to winter 2009.

OIL SPILL INCIDENTS GLADSTONE HARBOR AREA

The main sources of oil[17] spill are ships (commercial and recreational) ships. Some oil is spilled from industrial activities in land. Average 1500 commercial ships visit Gladstone Harbor each year. More than 7400 recreational ships are registered with Gladstone Regional Council. In addition to the commercial fleet, over 250 commercials ships are currently employed on construction activities in the port (Queensland Government, 2013).

In January 2006, 25 tonnes of heavy fuel oil spilled into the Port of Gladstone in Queensland, Australia, from the breached hull of a bulk carrier ship. While approximately 18 tonnes of the oil was recovered, a certain amount of oil was deposited in the intertidal areas of Port Curtis leaving a highly visible, viscous residue (Melville et al. 2009).

There have been a number of oil spill incidents occurred in Gladstone Harbor Area. The nature, extent of spill depends on the sources type (commercial or recreational ship, land based industry, tankers etc). Table-1 shows the number of incidents occurred over time from mostly from ships and some from land (industries). While it is not possible to know the amount of oil spilled in each year, the amount of spilled oil ranges from .5 liter to 3000 liters (Queensland Marine Safety Authority, 2013).

Table 43. Oil spill incidents in Gladstone Harbor Area and other port areas in Queensland (2002-2013)

Year	Gladstone	Mackay	Townsville	Cairns
2002	6	6	3	12
2003	6	13	1	27
2004	4	12	4	24
2005	2	2	2	23
2006	7	3	6	12
2007	6	9	5	13
2008	17	11	5	5
2009	9	2	6	8
2010	7	3	4	6
2011	16	11	5	10
2012	25	15	16	10
2013	24	4	16	20

Sources: Queensland Marine Safety Authority, 2013

[17] This include petroleum products and fuel oil

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