

Beyond the horizon: Mapping future challenges and opportunities for the CLLMM region using a horizon scan approach

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The Coorong, Lower Lakes and Murray Mouth (CLLMM) Research Centre has the objective of developing and delivering locally driven, innovative, and impactful research that reflects community and First Nations priorities to provide an evidence base to address critical needs of the CLLMM region. The CLLMM Research Centre will also bring together our First Nations, local community and scientists to create and share knowledge, and support our well-informed and engaged community and empower our future generations to be part of the solution.

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Table of Contents

EXECUTIVE SUMMARY	1
ACKNOWLEDGEMENTS	2
1 INTRODUCTION	3
2 METHODS	6
2.1 PHASE 1- SURVEY	6
2.1.1 Survey Design.....	6
2.1.2 Data Collection	6
2.1.3 Data Analysis.....	7
2.2 PHASE 2 - WORKSHOP	8
2.2.1 Workshop Design	8
3 RESULTS	10
3.1 PHASE 1 SURVEY RESULTS.....	10
3.1.1 Survey participants.....	10
3.1.2 How did our participants describe their relationship to the CLLMM region?	11
3.1.3 Impacts of Climate Change in the CLLMM region	11
3.1.4 Biggest Challenges in the CLLMM Region in the Next Fifteen Years.....	11
3.1.5 Productive Opportunities for the CLLMM Region in the Next Fifteen Years.....	13
3.1.6 Important and Novel Questions Suggested by Participants.....	14
3.2 PHASE 2 WORKSHOP RESULTS	15
3.2.1 Results from the Workshop and Interviews	15
4 CONCLUSION.....	18
5 REFERENCES.....	23
6 APPENDICES	25
APPENDIX A. HORIZON SCAN SURVEY FLYER	25
APPENDIX B. AGENDA USED ON DAY OF HORIZON SCAN WORKSHOP.....	26
APPENDIX C. PRESENTATION USED ON DAY OF HORIZON SCAN WORKSHOP	27
APPENDIX D. THE HANDOUT PARTICIPANTS FILLED DURING THE HORIZON SCAN WORKSHOP PROCESS	29
APPENDIX E. PHASE 1 CLLMM HORIZON SCAN SURVEY CONTENT ANALYSIS RESULTS: HOW PARTICIPANTS DESCRIBED THEIR RELATIONSHIP TO THE CLLMM REGION	33
APPENDIX F. PHASE 1 CLLMM HORIZON SCAN SURVEY THEMATIC ANALYSIS RESULTS: PERCEPTIONS OF FUTURE IMPACTS OF CLIMATE CHANGE IN THE CLLMM REGION.....	37
APPENDIX G. PHASE 1 CLLMM HORIZON SCAN SURVEY THEMATIC ANALYSIS RESULTS: PERCEPTIONS OF BIGGEST CHALLENGES IN THE CLLMM REGION IN THE NEXT FIFTEEN YEARS	43
APPENDIX H. PHASE 1 CLLMM HORIZON SCAN SURVEY THEMATIC ANALYSIS RESULTS: PERCEPTIONS OF POSITIVE/PRODUCTIVE OPPORTUNITIES FOR THE CLLMM REGION IN THE NEXT FIFTEEN YEARS	49
APPENDIX I. PHASE 1 CLLMM HORIZON SCAN SURVEY THEMATIC ANALYSIS RESULTS: IMPORTANT AND NOVEL RESEARCH QUESTIONS SUGGESTED BY PARTICIPANTS	55
APPENDIX J. RANKED TOPIC RESULTS FROM THE WORKSHOP PROCESS WITH SEPARATE CRITERIA RANKINGS	61

Executive Summary

The Coorong, Lower Lakes and Murray Mouth (CLLMM) region covers approximately 142,500 hectares and includes areas of local, national, and international significance. The CLLMM region is highly vulnerable due to the combined pressures of upstream water regulation, inherent ecological sensitivity and climate change. Climate change impacts will be increasingly realised as declining freshwater inflows, increasing ambient temperatures, and rising sea levels pose significant challenges to the region. The region is ecologically, culturally, and socially important which makes the CLLMM a highly valued and dynamic landscape involving diverse stakeholders, including First Nations community and organisations, community and community organisations, researchers, industry, and management agencies. Increasingly, incorporating local knowledge through community consultation is recognised as essential to effective environmental research and management.

To support shared contributions that guide the future direction of knowledge generation in the region, we applied an inclusive two-phase horizon scan methodology to engage a diverse range of stakeholders. Phase 1 involved a survey (N=639) capturing perspectives on key challenges, opportunities, and novel unasked questions. Phase 2 consisted of a stakeholder workshop to identify priority issues through deeper analysis of the survey data. Results from the survey highlighted a wide range of themes, reflecting the region's complexity. The outcomes of the horizon scan readily synthesise into five main pillars:

1. Water Security and System Management,
2. Climate Change and Future Extremes,
3. Ecosystems, Biodiversity, and Fauna,
4. Environmental Protection, Rehabilitation, and Restoration, and
5. Human Systems, Governance, and Community Engagement.

The pillars reflect the top five challenges, opportunities and novel unasked questions of the horizon scan. The identified pillars direct research that will enhance predictive understanding through forecasting and scenario planning. Additionally, they improve the evidence-base for biodiversity conservation and restoration actions. Further, the pillars support better governance and collaboration, strengthened education, science communication, and community-based involvement. A focus on this research direction will generate knowledge to support integrative and adaptive management under uncertainty that can translate into robust decision-making and action to shape the future of the CLLMM region.

Acknowledgements

We acknowledge the cultural connections to the land and connected waters, as well as the cultural significance of waterbirds that exist between people of the Ngarrindjeri and Boandik Nations across the Coorong, Lower Lakes, and Murray Mouth region. We recognise that First Nations peoples' spiritual, social, cultural, and economic practices come from their lands and waters, and they continue to maintain their cultural heritage, economies, languages, and laws which are of ongoing importance. We are committed to fostering and nurturing ongoing relationships with First Nations communities in the CLLMM region as we collectively work toward healthy, resilient and thriving lands, waters, ecosystems and communities across the region.

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1 Introduction

The CLLMM region spans approximately 142,500 hectares and contains areas of local, national, and international significance. It includes one of the most important waterbird habitats in the Murray-Darling Basin and supports a unique mix of freshwater, estuarine, and marine wetland environments. These ecosystems provide critical habitat for threatened wildlife, rare plants, and species of national and international conservation concern. The region is also home to several towns and communities that rely on its ecological health for cultural, social, and economic wellbeing. This complexity makes the CLLMM region a dynamic and highly valued landscape, with a wide range of stakeholders including First Nations groups, community organisations, researchers, industry, and government agencies.

The region is increasingly vulnerable to the impacts of climate change, with declining freshwater inflows, increasing ambient temperatures, and rising sea levels posing significant challenges for its management (Dang et al. 2026). In the face of these challenges and building on existing initiatives such as the CLLMM Research Centre, there is a need for an inclusive approach to systematically identify emerging issues, knowledge gaps, and priority areas across ecological, social, cultural, and economic domains.

The incorporation of local knowledge into environmental research and management has a long history, particularly through participatory approaches such as Participatory Action Research (PAR), community-based natural resource management and collaborative environmental governance (Kindon et al., 2007). Emerging from broader social and environmental movements of the 1960s and 1970s, these approaches sought to involve communities not only as sources of knowledge, but as active participants throughout the research and decision-making process. In its most ambitious forms, participation extended across the entire research cycle, including the identification of priorities, development of research questions, implementation of research activities, interpretation of findings and the development of management actions (Kindon et al., 2007).

While contemporary environmental research often employs more targeted forms of engagement, such as community consultation, stakeholder engagement and citizen science, the value of incorporating local knowledge remains widely recognised (Antwi et al., 2025; Benham, 2017; Kiss et al., 2022). From a research perspective, engagement with local communities can improve the relevance of research, broaden perspectives, identify knowledge gaps and contribute to more socially just and contextually appropriate outcomes (Black et al., 2024; Wheeler and Root-Bernstein, 2020). From a community perspective, involvement in research and planning processes can increase agency and influence over decisions that affect local environments and livelihoods (Dare et al., 2014; Dushkova and Ivlieva, 2024).

Beyond these practical benefits, collaboration between researchers, managers and communities can foster the trust, transparency and mutual respect required to address increasingly complex environmental challenges (Kappel and Holmen, 2019). At its

heart, community consultation is essential not only for fostering stronger collaborative relationships that facilitate more sustainable outcomes, but also for addressing blind spots in preparing for future challenges.

Horizon scanning is a widely used foresight approach that seeks to identify future opportunities, threats and emerging issues sufficiently early to support proactive planning and decision-making (Sutherland and Woodroof, 2009; Sutherland et al., 2023, 2026). More broadly, horizon scanning has been defined as the systematic gathering, analysis and interpretation of information about emerging trends, drivers and potential future developments to inform strategic action (Hines et al., 2019; Shackleton et al., 2017).

Horizon scanning can be implemented using a range of qualitative and quantitative techniques, including literature reviews, expert elicitation, stakeholder consultation and structured assessment frameworks, depending on the objectives and decision context (Angelstam et al., 2021). While some horizon scanning exercises specifically aim to identify novel or poorly recognised issues with the potential for significant future impact (e.g. Sutherland et al., 2026), others are designed to systematically assess and synthesise stakeholder knowledge regarding future challenges, opportunities and information needs to support strategic planning and resource allocation. Across these applications, a common feature is the structured examination of future-oriented information sources to identify issues that may require attention before their full impacts are realised (Hines et al., 2019; Sutherland, 2022).

Horizon-scanning typically engages a range of stakeholders, including experts, practitioners, and policymakers, though community members can also be incorporated into this process to address the gap between researcher and local community knowledge. Horizon scanning therefore represents a replicable, participatory process that can guide future research, inform decision-making, and support communities in shaping a resilient future. Horizon scans have successfully been used previously in conservation and environmental sciences to identify diverse threats and opportunities in both specific and more generally focused areas of research. For example, Herbert-Read et al. (2022) performed a marine and coastal horizon scan to identify substantial threats and opportunities specifically for marine environments, including alterations to marine ecosystems, changes in resource extraction, and the emergence of new technologies. By comparison, a more broadly focused example is that of Sutherland et al. (2022), who used the approach to identify 15 emerging global conservation issues. Their assessment revealed potential impacts ranging from satellite megaconstellations to deep-sea mining. Further, while horizon scans are often used to identify such large global issues and impacts, they also have a history of successfully being implemented in establishing how such impacts will relate to more localised contexts (Macinnis-Ng et al., 2024). Therefore, the versatility of the approach, along with the diversity of threats and opportunities it can identify, makes horizon scanning appropriate in the context of the CLLMM region and the challenges the region is likely to face.

This project conducted the first horizon scan for the Coorong, Lower Lakes and Murray Mouth region as an inclusive process to identify and assess emerging challenges and opportunities that could impact the region's future across a near-future (10–15 years) window, while also exploring potential research questions of value from the region's diverse stakeholders. By bringing together a wide range of perspectives, it aimed to capture diverse knowledge, experiences, and concerns. These findings can highlight critical areas needing attention and uncover new opportunities for action and research projects. The outcomes of this horizon scan provide strong forward-thinking direction on near-future priorities that are connected to the needs and priorities of the region's communities.

2 Methods

2.1 Phase 1- Survey

2.1.1 Survey Design

A brief survey which took approximately five minutes to complete was developed to capture community perspectives relevant to the horizon scan. The survey was available both online via the Qualtrics platform and in paper form to maximise accessibility and participation. The survey included basic demographic questions covering gender, age, postcode, and involvement in local groups or organisations within the CLLMM region. To better understand the types of participants reached, we also asked the following question: "Using any keywords that you prefer, how would you briefly describe your relationship to the CLLMM region? (Provide up to 3 responses)". Participants were then asked the following closed ended question on climate change perceptions: "Do you believe climate change will impact the CLLMM region? (Yes / No / I don't know)". Those who answered 'yes' then responded to an open-ended question asking how what they value within the region may be affected by climate change.

The core of the survey consisted of the three horizon scan items, which asked respondents to identify and prioritise the following:

1. What do you think will be the biggest challenges in the CLLMM region in the next fifteen years? (Up to 3 responses, listed in order of importance),
2. What do you think will be the most important and novel (i.e., unasked and unaddressed) research questions in the CLLMM region in the next fifteen years? (Up to 3 responses, listed in order of importance), and
3. What positive/productive opportunities do you think there are for the CLLMM region in the next fifteen years (Up to 3 responses, listed in order of importance).

The 15-year horizon was decided upon for the survey after consultation with CLLMM community representative group. The horizon scan items were adapted from previous horizon scan research (Esmail et al., 2023; Parker et al., 2014).

2.1.2 Data Collection

A multichannel recruitment strategy was used to reach a broad and diverse cross-section of the CLLMM community (Figure 1). A video and flyer were created to aid promotion (Appendix A). Social media campaigns across several platforms promoted the survey widely through organisational and community pages, helping engage digitally active residents. The survey was promoted at more than ten regional-based events, such as Goolwa Rotary markets, to provide direct in-person engagement and enabled participation from people less active online. Engagement with First Nations groups ensured culturally appropriate recruitment and supported the inclusion of their

perspectives in the horizon scan. Emails to the CLLMM Research Centre distribution list and Research Centre newsletter articles targeted stakeholders already involved in regional projects or community networks. To reach audiences less connected to digital platforms, newspaper articles, radio interviews, posters at boat ramps and community notice boards, and a letterbox drop were employed.

Collectively, these approaches were intended to maximise accessibility and encourage participation from a broad range of community members. The relative effectiveness of the individual recruitment channels was not formally evaluated, nor was the influence of recruitment pathways on respondent demographics assessed. Consequently, while considerable effort was made to reach diverse community sectors, the extent to which individual approaches contributed to the final participant profile cannot be determined.



Figure 1. Examples of the promotion of the Horizon Scan survey.

Most participants accessed the survey via an anonymous link (74.02%), followed by QR codes (13.46%), and paper copies (12.52%). In total, 892 surveys were submitted. However, screening of the resulting data revealed many submissions to be blank or contain incoherent information, suggesting they had been not started by participants or had been completed by online bots. Inter-rater review and cleaning of the data resulted in 253 submissions being removed. Partially completed surveys were included in the data set, leaving a valid sample of $N = 639$. Data collection began in September 2025 and continued until the end of December 2025.

2.1.3 Data Analysis

Data were downloaded from Qualtrics and entered into Microsoft Excel (V. 2601). Collected paper copies were manually entered into the same spreadsheet.

The data were then cleaned prior to analysis. Cleaning involved reviewing survey submissions for completeness and quality. Responses containing substantial missing data across key survey questions were excluded from analysis. Responses that contained nonsensical, unintelligible, or irrelevant text that could not be meaningfully interpreted were also removed. No substantive changes were made to valid participant responses.

The responses from each question were subsequently divided into separate worksheets in Excel for separate analysis. For analysis of responses to the question “Using any keywords that you prefer, how would you briefly describe your relationship to the CLLMM region? (Provide up to 3 responses)”, content analysis using a manifest analysis approach was used (Bengtsson, 2016). Data were first explored, followed by code generation, and subsequent categorisation. For the responses to all other open-ended questions of the survey, data were analysed using thematic analysis with an inductive approach (Braun and Clarke, 2021). Data were explored with a focus on familiarisation, followed by code generation and categorisation into themes. For both content analysis and thematic analysis, complete coding was used, meaning responses may have scored simultaneously in multiple categories or themes. This means there is at times some overlap between themes (for example, dependent on the context of the response, a participant mentioning algal blooms may score in both a water quality theme and a specific harmful algal bloom theme). Further, broader theme scores were calculated as a result of any of their sub-themes having scored at least once. Thus, theme percentages are not the sum totals of sub-theme percentages. For demographic information on participants, the data was entered into IBM SPSS (V. 3.0) and subjected to descriptive analysis.

2.2 Phase 2 - Workshop

Phase 2 involved conducting a workshop designed to understand what priorities were highest in terms of identifying future research impact pathways. Workshop design built on the previous work and results of the Phase 1 survey and focused on the Research Centre Advisory Forum (RCAF), who had contributed to the development of the project and survey. The workshop process was limited by time constraints. Therefore, it was decided to focus on a single area of the Phase 1 results for the session. Consequently, the topic of future challenges for the region was selected. Thus, the most prominent results from the Phase 1 survey question “What do you think will be the biggest challenges in the CLLMM region in the next fifteen years?” were used to provide the topics of focus for the workshop. The workshop was conducted on March 19th, 2026, at the CLLMM Research Centre in Goolwa. Follow up interviews were then separately conducted with a range of stakeholders and decision makers who could not make the workshop. Participants that were invited to the workshop included local Aboriginal rangers, representatives from local organisations, representatives from other government and non-government organisations, scientists, and engaged community members. Participation and interest in the project were high across both workshop participants and interviewees.

2.2.1 Workshop Design

The workshop represented the second stage of the horizon scanning process and was designed to bring stakeholders together to discuss, refine and evaluate the issues identified through the survey. The survey component focused on the identification of future challenges, opportunities and novel research needs within the CLLMM region,

while the workshop focused on assessing the relative significance and management relevance of the issues identified.

Participants were asked to evaluate and rate priority areas against a set of predefined criteria (Table 1). These criteria were selected to support decision-making and strategic planning by considering dimensions such as urgency, feasibility, knowledge gaps and stakeholder relevance. While some horizon scanning approaches place particular emphasis on assessing novelty, likelihood and impact of emerging issues (e.g. Sutherland et al., 2026), horizon scanning processes are applied in diverse ways depending on the objectives of the exercise (Wintle et al., 2020). In this study, the objective was to identify future challenges, opportunities and research needs for the CLLMM region and subsequently prioritise these according to their perceived importance for future management and research investment.

For this purpose, we prepared a handout which was used to document participants' responses (see Appendix D).

Table 1. Workshop criteria for ranking CLLMM horizon scan survey challenges.

CRITERIA	DEFINITION AND PURPOSE
Importance/ Criticalness	How critical is the topic for decision-making for the future of the region/water research/sustainability? A simple ranking exercise where individuals ranked each topic in order of perceived importance. People were able to rank topics the same, or differently. In this way it was gauged how people saw the equivalent importance of certain issues without making them choose between them.
Urgency/Timeliness/Timing	How time-sensitive is addressing this topic to decision-making for the region? Given this is horizon scanning, it was also important to align the above priorities with a temporal dimension. Thus, assessing if the topic was perceived to be relevant and important over the short, medium, or long term.
Feasibility and Capacity	This was used to glean ideas from the workshop participants as to whether or not they thought the topic could actually be addressed – i.e. are there any 'low hanging fruit' that could be done with fewer resources and people, and/or which topics required higher end investment and more expertise.
Impact on Decision-making	To what extent will addressing this topic improve decision-making for the region? Will addressing this topic help contribute to tangible changes in decision-making (e.g. management, policy, and community), or improve how the CLLMM is managed and conserved in the future?
Knowledge gap	Does the topic address a critical gap in our knowledge about how to manage and conserve the CLLMM in the future?
Relevance to stakeholders	How meaningful and applicable is the topic to the groups and stakeholders of the CLLMM region?

3 Results

3.1 Phase 1 Survey Results

3.1.1 Survey participants

More respondents identified as female (39.12%) than male (33.02%), with just over a quarter choosing not to report their gender. The sample was largely composed of older age groups, with the highest representation from those aged 61–70 years (29.42%), followed by 51–60 years (17.53%) and 71–80 years (16.75%). Just under half of respondents (46.17%) lived within 30 km of Goolwa, while 7.67% lived elsewhere within the CLLMM region and 43.98% resided outside the immediate area. For a more detailed description of Phase 1 participant demographics, see Table 2.

Table 2. CLLMM Horizon Scan Survey Participant Demographic Information

DEMOGRAPHIC	% OF PARTICIPANTS (NUMBER OF PARTICIPANTS)
Gender	
Female	39.12 (250)
Male	33.02 (211)
Other	0.78 (5)
Not Reported	27.07 (173)
Age Group	
18–20	1.25 (8)
21–30	6.10 (39)
31–40	9.55 (61)
41–50	15.02 (96)
51–60	17.53 (112)
61–70	29.42 (188)
71–80	16.75 (107)
81+	3.76 (24)
Not Reported	0.63 (4)
Postcode	
Local to Goolwa (<30km)	46.17 (295)
Local to CLLMM Region (<40km, excluding Goolwa)	7.67 (49)
Not local to Goolwa or the CLLMM Region	43.98 (281)
Not Reported	2.19 (14)

3.1.2 How did our participants describe their relationship to the CLLMM region?

The survey resulted in a wide variety of responses. This was unsurprising given the survey deliberately asked participants to provide open-ended responses, enabling people to describe their relationship however they wanted to. Twenty-five percent of participants mentioned their role as a resident, while 11.58% mentioned tourism. Many participants (14.55%) referred to the natural environment in their descriptions (e.g. "biodiversity", "nature"), while 9.86% specifically referred to environmental stewardship (e.g. "advocacy", "environmental protection") and 8.14% described working in the region. Others (7.51%) described sociocultural aspects of the region's community (e.g. "culture", "community"), while 8.45% described using the area for general recreation, with specific mentions including birdwatching, fishing, swimming, boating, and camping. Others focused on describing the quality of their relationship with the CLLMM region including being positive, strong, and involved. For full results on how participants described their relationship, see Appendix E.

3.1.3 Impacts of Climate Change in the CLLMM region

Most participants (83.79%) responded believing that climate change will impact the CLLMM region, while 5.95% reported believing that climate change would not impact the region, and 10.33% related not knowing. Of the participants that said climate change would impact the CLLMM region, impacts to fauna (28.33%), flora (21.75%), and biodiversity (20.97%) were commonly discussed. However, one of the other most mentioned themes was that of reduced freshwater in the region (27.07%). Weather events were also discussed including increased temperatures (marine or atmospheric) (13.15%), droughts (7.36%), and storms (7.04%) alongside other related impacts including sea-level rise (12.83%), algal blooms (10.80%), and increased salinity (9.86%). Various other impacts regarding human wellbeing were also noted, however less frequently, including impacts on First Nations communities (2.35%), economic impacts (5.63%), and impacts on recreation (4.85%). For full results of how participants perceived climate change to potentially impact the CLLMM region, see Appendix F.

3.1.4 Biggest Challenges in the CLLMM Region in the Next Fifteen Years

The diversity in the challenges identified by participants is reflected in the fact that 43 subthemes were identified in the data (see Figure 2). At a macro level, the most frequent challenge themes were identified as water-based challenges (39.91%), nature and ecosystems challenges (33.80%), climate and weather challenges (32.08%), direct impacts from humans (25.82%), and management challenges (23.00%). At a more nuanced level, each of these categories contained multiple subthemes, which are detailed as follows:

- Water based challenges: Reduced or unpredictable water availability (24.57%), water quality and health (10.95%), algal blooms (10.17%), and salinity (9.23%),
- Climate and weather challenges: Changes in climate and climate extremes (13.46%), increasing temperatures (8.45%), drought (7.67%), sea-level rise (6.89%), extreme weather events (4.85%), flooding (3.44%), and bushfires (1.56%),

- Nature & ecosystems challenges: Environment and ecosystems (18.78%), threats to fauna (15.65%), threats to flora (11.74%), and invasive species (5.01%),
- Direct impacts from humans: Increased population (12.36%), impacts from industry (7.04%), pollution (10.64%), and impacts from recreation (3.29%), and
- Management challenges: Human management system challenges (13.30%), water management systems (7.82%), balancing the needs of humans with nature (3.60%), barrage management (2.19%), and human adaption challenges (2.19%).

For full results of participants perceived challenges for the CLMM region, see Appendix G.

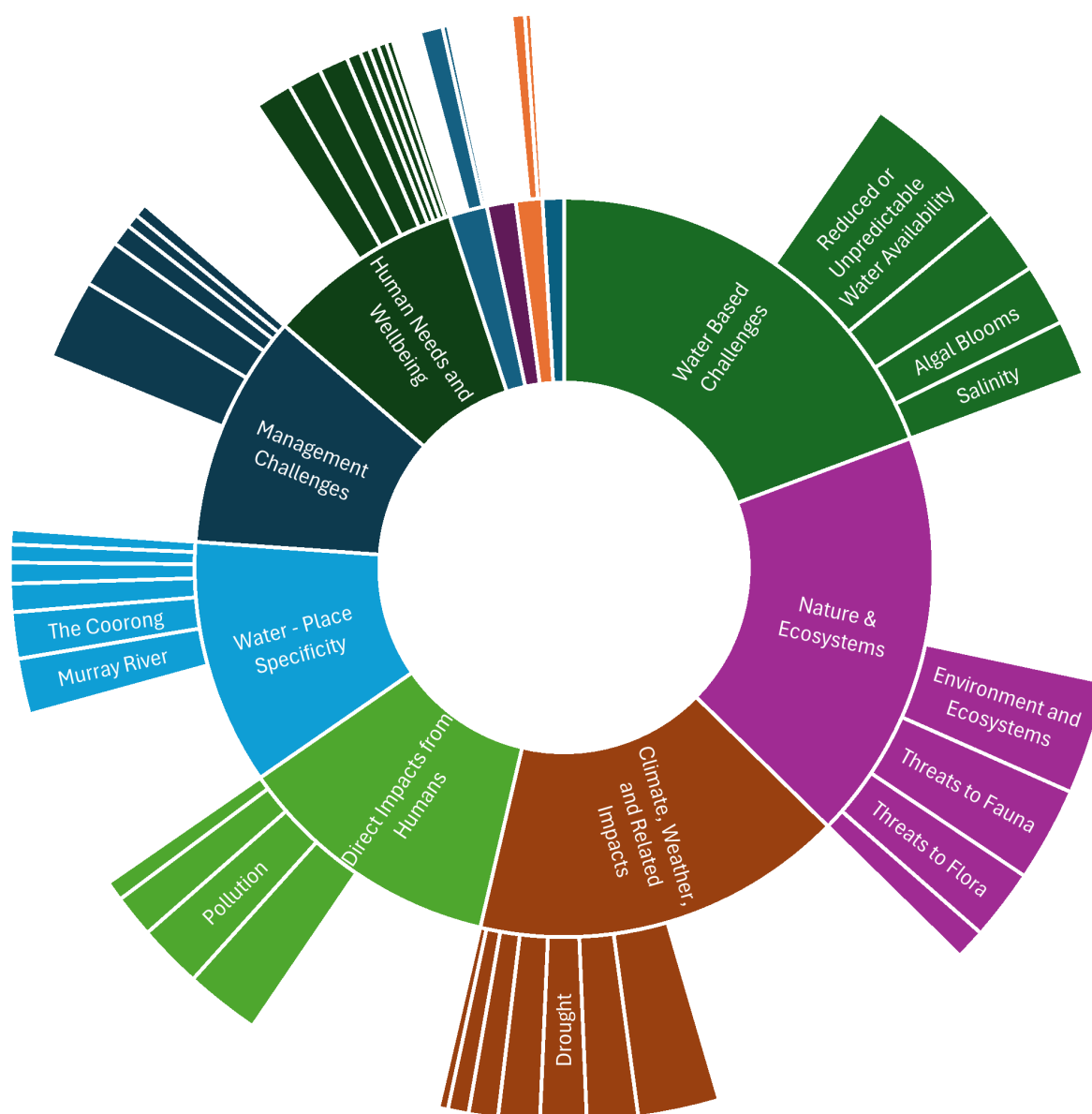


Figure 2. Results from Thematic Analysis of the Biggest CLMM Region Challenges over the Next 15 Years as Reported by Participants.

3.1.5 Productive Opportunities for the CLMM Region in the Next Fifteen Years

When asked to identify productive or positive opportunities for the region, participants again identified a wide diversity of options. These were broadly determined to fit into nine different themes, each comprised of various sub-themes (see Figure 3). For complete statistics, see Appendix H. Broadly speaking, the most highly identified theme was that of community and sociocultural opportunities, with opportunities centring around education and science communication (18.15%) and community collaboration (17.68%) being the most popular. The second most popular theme focused on economic opportunities for the region, with tourism (17.68%) being by far the most identified opportunity in this category. The third most popular theme focused on environmental opportunities. This theme contained the most popular of any subtheme within this section, namely, environmental protection and restoration opportunities (20.81%).



Figure 3. Results From Thematic Analysis of the Biggest CLMM Region Opportunities Over the Next 15 Years as Reported by Participants.

3.1.6 Important and Novel Questions Suggested by Participants

Responses to this question contained a high diversity of suggestions that were subsequently categorised into seven different themes and 38 subthemes (see Figure 4). The high variability of participants' suggested questions makes subthemes more relevant in analysis than themes in this section.

Of the subthemes, the most frequently identified topic focused on biodiversity (25.20%). Example questions included: "How can we improve/rehabilitate the surrounding plant and animal life in our waters such that a healthy balance is restored?" and "What changes are occurring annually in fish stocks, what issues are evident and what should be done to address them?".

The next most popular topic was water & water systems health (16.59%), with examples including: "What would a healthy but variable estuarine Lower Lakes ecosystem look like?" and "how to cycle the water level in lakes to encourage restoration [sic]".

Similarly popular was the topic of environmental protection and rehabilitation (15.34%), with examples being "*How do we protect the environment and our way of life in the face of climate change. [sic]*" and "*Solution to current environmental issues*".

Also highly suggested were questions focusing on waterways management (12.52%) (e.g. "How to maintain enough water flow and releases to ensure ecosystem remains healthy"), climate change (12.52%) (e.g. "*What adaptive changes to the effects of climate change can be observed along the CLLMM?*") and government and management (12.52%) (e.g. "*How to get government, developers etc. on board with solutions that balance human use of the region...*"). For full results regarding important and novel questions, see Appendix I.



Figure 4. Results From Thematic Analysis of Novel Research Questions for the Region Over the Next 15 Years as Reported by Participants.

3.2 Phase 2 Workshop Results

3.2.1 Results from the Workshop and Interviews

The workshop process focused on the three most prominent challenges for the CLMM Region themes as identified by survey participants during Phase 1, i.e. water-based challenges, nature & ecosystems challenges, and climate and weather challenges. Thus, the following subthemes were presented for scoring and subsequent discussion: Reduced or Unpredictable water availability, water quality and health, algal blooms, salinity, environment and ecosystems, threats to fauna, threats to flora, invasive species, changes in climate and climate extremes, increasing temperatures, drought, sea-level rise, extreme weather events, flooding, and bushfires. Workshop participants were also provided the opportunity to suggest additional topics for scoring and

discussion. This was done with the intention of identifying potential blind spots missed in the phase 1 survey, given the higher average levels of expertise present in the workshop. However, it is worth noting that even though some new relevant challenges were identified (e.g. acid sulphate soils), no new additions scored more highly than those presented from the phase 1 results. The most prominent results from the analysis of workshop responses are presented in Table 3. Overall, as Table 3 highlights, water and climate emerged as the themes of most concern. Within these, water availability, water quality and health, changes in climate and climate extremes, and drought were identified as core challenges. However, while these priorities emerged as the most substantial, analysis of the criteria on which they were scored reveals nuances. For example, water availability scored the highest across all criteria except for in knowledge gap, where it scored lowest. The topic of the harmful algal bloom instead scored highest in knowledge gap (while markedly lower in each other criteria), closely followed by changes in climate and climate extremes. The tables in Appendix J highlight more nuances between topics when applied between the different criteria.

Table 3. Highest Six Challenge Themes as Identified by the Horizon Workshop with Phase 1 Horizon Survey Results Comparison.

THEME	SUBTHEME	HORIZON WORKSHOP RESULTS % SCORE (ACTUAL SCORE)	HORIZON SURVEY RESULTS % SCORE (FREQUENCY)
Water	Reduced or Unpredictable Water Availability	86.33 (518)	24.57 (157)
Water	General Water Quality and Health	83.83 (503)	10.95 (70)
Climate	Changes in Climate and Climate Extremes	82.50 (495)	13.46 (86)
Climate	Drought	82.42 (494.5)	7.67 (49)
Climate	Sea-level Rise	80.75 (484.5)	6.89 (44)
Nature	Environment and Ecosystems	80.67 (484)	18.78 (120)

Plenary discussions following subtheme scoring revealed interesting considerations for the sub-themes. Water availability was often recognised as primarily a socio-political challenge, rather than a strictly research challenge, but was also related to all the other listed challenges. Specific water-availability topics discussed included upstream irrigation efficiency, government coordination and regulation enforcement, and the increased valuing of environmental water. While water quality was recognised as being closely related to water availability, as a standalone theme it held greater research capacity. Pollution from agricultural run-off, acid sulphate soils, and turbidity were often specifically recognised. Water quality regulation would likely involve the greater valuing and utilisation of natural systems. However, inconsistent funding plus the enormity and complexity of monitoring systems were key barriers to progress. While the 2025 South Australian harmful algal bloom was recognised as being a water quality issue, participants posed that more research was needed into causes and impacts of the bloom. Changes in climate were recognised as a compounding factor with other

challenges listed and a factor that may render many current management systems and planning redundant. While climate change challenges were also recognised as a socio-political challenge, the essentialness of local mitigation strategies was also recognised. Drought and sea-level rise were prominent associated challenges. Further, while drought mitigation strategies were recognised as having improved since the millennium drought, they were likely insufficient to meet future challenges.

The participants also raised additional topics that were not specifically focused on during the workshop but were nevertheless identified during the Phase 1 survey. These included the need for bird flu planning (invasive species and diseases), dune erosion, barrage management, water and local urban expansion, and need for the increased capacity of First Nations collaboration in research. However, most notably, communicating research was frequently recognised as possibly the biggest challenge we could be addressing. While the CLLMM Research Centre was recognised as being invaluable in this regard, more could be achieved, particularly in translating research into practical and sustained outcomes.

4 Conclusion

The internationally significant CLLMM region faces a challenging future. The intensifying influence of climate change pressures, including reducing freshwater inflows, increasing temperatures and rising sea level, will fundamentally alter the ecosystem functioning that underpins the viability of the region. Proactive and adaptive decision-making is necessary to cope with the changes that are coming to the region. This decision-making must rely on robust science and knowledge generation. The science that is to inform decision-making, and the decision-making itself, must reflect the expertise and experience of the collective as no one group or organisation owns the future of the region.

The present project delivered a horizon scan for the region that canvassed the near-future challenges, opportunities and novel questions from a diverse range of stakeholders. The large number of themes and subthemes identified during the thematic analysis process of the survey data demonstrates the complexity and broad range of interests in the CLLMM region. Overall, the results from the workshop consolidated and affirmed the results from the survey regarding perceived challenges for the region. Water-based challenges represented the most noteworthy concern, with water availability representing its most prominent facet. However, meeting this challenge appeared to involve more investigation into how to implement large scale practical outcomes rather than addressing specific knowledge gaps in the issue itself. This finding is consistent with the workshop's suggestion that communicating research represents a key yet addressable challenge. Across all criteria, water quality, changes in climate and climate extremes, and drought and sea-level rise were ranked highly. Further, the top ranked themes were all seen as comparatively urgent. However, environment and ecosystem challenges were also consistently high across criteria, and differences over knowledge gaps revealed a desire to know more about algal blooms. Importantly, the horizon scan identified substantial opportunities alongside future challenges. Participants consistently highlighted education, science communication, community collaboration, environmental restoration, tourism, and stronger First Nations partnerships as pathways through which the region can proactively shape a positive future.

The horizon scan outcomes reflect the views of an expansive range of interests and participant backgrounds. Efforts were taken to ensure contributions were sourced from a wide range of demographics, including those residing both in and out of the region, and in more regional areas, though there were still challenges in recruiting all the different stakeholders invested in the CLLMM region. Further, specific efforts were implemented to ensure that the collaboration and contributions of the region's First Nations communities were integrated into the process. The high level of engagement in the survey also suggests that community members and the broader public are keen to contribute to the identification of future priorities in the region. The horizon scanning process should be repeated regularly to ensure priorities remain relevant as environmental, social and management conditions change. It should also be noted

that horizon scanning is intended to identify issues requiring attention rather than determine the timeframes within which they should be addressed. The topics highlighted in this report therefore provide a foundation for further assessment, planning and prioritisation by relevant stakeholders.

Some limitations should be considered when interpreting the results. First, respondents were asked about climate change impacts before completing the horizon scanning questions. This may have primed participants to consider climate-related challenges when identifying future issues and opportunities within the CLLMM region. As alternative questionnaire versions were not employed, the magnitude of any potential question-order effect cannot be determined. Second, while the horizon scanning process identified a broad range of future challenges, opportunities and research needs, many of the highest-ranked issues reflected well-recognised concerns within the CLLMM region, including water availability, climate change and ecosystem condition. This outcome likely reflects the emphasis in this study on stakeholder-identified priorities and subsequent evaluation against management-relevant criteria. Consequently, the process was particularly effective at identifying issues perceived as important by participants but may have been less sensitive to highly novel, emerging or currently under-recognised issues than horizon scanning approaches that explicitly assess novelty, likelihood and potential impact. Future horizon scanning exercises in the region could therefore benefit from complementary methods specifically designed to identify and evaluate emerging issues that may not yet be prominent within stakeholder discussions.

The outcomes of the horizon scan readily synthesise into five main pillars: (1) Water Security and System Management; (2) Climate Change and Future Extremes; (3) Ecosystems, Biodiversity, and Fauna; (4) Environmental Protection, Rehabilitation, and Restoration; and (5) Human Systems, Governance, and Community Engagement (Table 4).

Table 4. Synthesis of the outcomes of the horizon scan into research pillars underpinned by priority subthemes.

Pillar	Aspect	Subtheme	Synopsis
Water Security and System Management	Challenges	Reduced or Unpredictable Water Availability (24.57%)	This pillar recognises the CLLMM as an interconnected physical, ecological, and management system, in which freshwater inflows and water availability are primary drivers of condition, and management decisions represent the key lever for influence. It reinforces the need for a whole-of-system approach to water management under uncertainty, and directs integrated, systems-based research to improve predictive understanding, inform adaptive management, including the provision of water for the environment, to support long-term ecological, cultural, and socio-economic outcomes for the region.
	Opportunities	NA	
	Novel questions	- Water and Water Systems Health (16.59%) - Water and Waterways Management (12.52%)	
Climate Change and Future Extremes	Challenges	Changes in Climate and Climate Extremes (13.46%)	Climate change is another key driver shaping future conditions in the CLLMM region. This pillar focuses on understanding long-term climate trends (including freshwater inflow, rising temperatures, sea-level rise), and the increasing frequency and severity of climate extremes, such as drought, and how these interact. Research under this pillar supports improved forecasting, risk assessment, and scenario planning to inform adaptive management and build environmental, cultural, and socio-economic resilience across the region.
	Opportunities	NA	
	Novel questions	Climate Change and Temperature Rise (12.52%)	
Ecosystems, Biodiversity, and Fauna	Challenges	- Environment and Ecosystems (18.78%) - Threats to Fauna (15.65%)	This pillar focuses on the ecological integrity of the region, encompassing habitats and biodiversity. It recognises the region as a complex, interconnected ecosystem facing multiple pressures, and emphasises research that improves understanding of ecosystem function, species vulnerability, and ecological thresholds. Research under this pillar will support evidence-based conservation, prioritisation of research effort for threatened species and habitats, and strategies to strengthen ecological resilience under changing environmental conditions.
	Opportunities	NA	
	Novel questions	Biodiversity (25.2%)	
Environmental Protection, Rehabilitation, and Restoration	Challenges	NA	This pillar focuses on translating knowledge into action through environmental protection, rehabilitation, and restoration. It emphasises research that supports the design, implementation, and evaluation of interventions aimed at improving ecosystem condition, restoring degraded habitats, and enhancing system resilience. Research under this pillar will strengthen the evidence base for restoration priorities, tests innovative and adaptive approaches, and supports long-term recovery of environmental values under changing climatic and water availability conditions.
	Opportunities	Environmental Protection and Restoration (20.81%)	
	Novel questions	Environment Protection and Rehabilitation (15.34%)	

Human Systems, Governance, and Community Engagement	Challenges	• Human Management System Challenges (13.30%)	This pillar focuses on the human dimensions that shape outcomes in the CLLMM region, including governance, communication of science , management capacity, community engagement, and socio-economic opportunities. It recognises that effective decision-making, strong institutions, and meaningful participation are critical to translating science into impact. Research under this pillar will support improved governance and collaboration, strengthens education and science communication, enables community-based involvement, and helps realise sustainable social and economic benefits, including tourism, grounded in a healthy and resilient environment.
	Opportunities	• Education and Science Communication (18.15%) • Tourism (17.68%) • Community-based Opportunities (17.68%) • Improving Management / Governance (14.87%)	
	Novel questions	• Human Management System Challenges (12.52%)	

The pillars reflect the top five challenges, opportunities and novel questions, and provide a sound, instructive basis for the generation of research projects to address priorities for the region. The identified pillars direct research that will enhance predictive understanding through forecasting and scenario planning, improve the evidence-base for biodiversity conservation and restoration actions whilst supporting better governance and collaboration, strengthened education and science communication and community-based involvement. Alignment with each pillar will offer the opportunity to deliver high impact, visible research along with the capacity to gather long-term datasets to understand changes over time. Collectively, a focus on this research direction will generate knowledge to support integrative and adaptive management under uncertainty that can translate into robust decision-making and action to shape the future of the CLLMM region.

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6 Appendices

Appendix A. Horizon Scan Survey Flyer

HELP SHAPE THE FUTURE OF THE CLLMM

The Horizon Scan survey will identify future opportunities, challenges and unanswered questions for the Coorong, Lower Lakes and Murray Mouth (CLLMM)



University of
South Australia



CLLMM
RESEARCH CENTRE

Complete the survey and go into the draw to WIN a \$150 gift card

Scan the QR code to take this short 5-minute survey



For more information or paper copies of the survey visit
CLLMM Research Centre
92 Barrage Road, Goolwa
www.clmmresearchcentre.org



This research project has been approved by the UniSA Ethics Committee, Ethics Protocol #207200. All participants must be over 18 years old

Appendix B. Agenda Used on Day of Horizon Scan Workshop

Workshop agenda

Overview and Results (20 mins) (Andrew)

Process (Melissa)

- ▶ Individual scoring, sheet 1 – ranking the issues (15 mins)
- ▶ Individual scoring, sheet 2 – ranking the other criteria (15 mins)

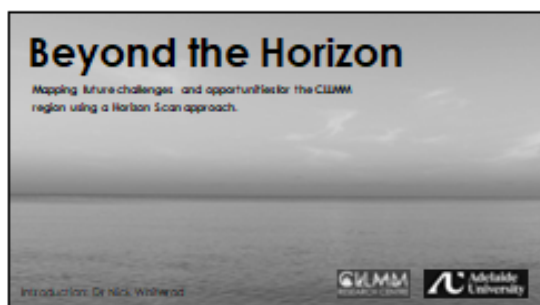
Break out into groups to discuss scores (20 mins)

Plenary discussion (15 mins)

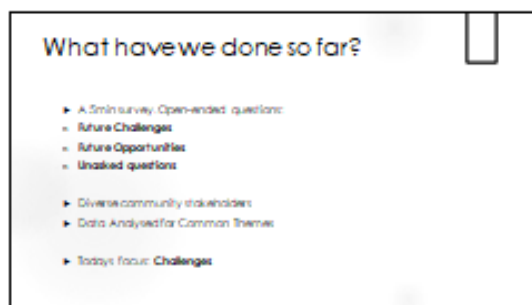
- ▶ Presenting of final top ideas and topics (Andrew and Bri)
- ▶ Seek agreements on final priorities, cross-cutting themes, emerging risks and anything has not been accounted for so far (Melissa)

Next steps (Nick)

Appendix C. Presentation Used on Day of Horizon Scan Workshop



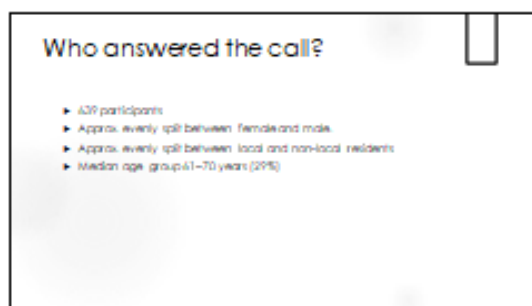
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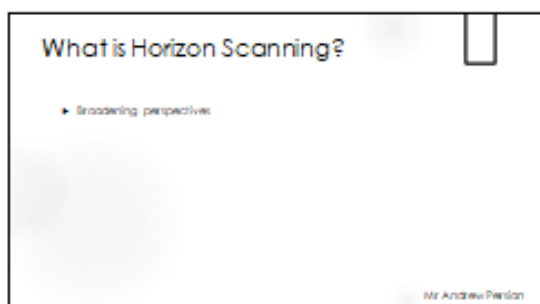
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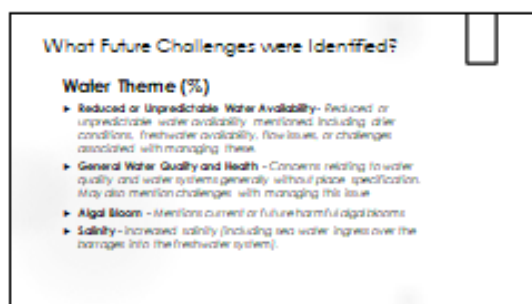
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3



6

What Future Challenges were Identified?

Nature Theme (%)

- **Environment and Ecosystems** - biodiversity challenges, including habitat/biodiversity loss or change. May mention of need to protect the "environment".
- **Threats to fauna** - Native fauna challenges
- **Threats to flora** - Native flora challenges
- **Invasive species** - Invasive flora or fauna. May also mention invasive diseases (including bacteria, viruses, fungi - not Algae which scored separately).

7

Break Out Groups

- Hand back your sheets
- Have a break and grab a cuppa
- Discuss your responses in groups of 2 or 3

Prof. Melissa Nursey-Gray

10

What Future Challenges were Identified?

Climate Theme (%)

- **Climate Change and Extremes** - Impacts of climate change in mentioned or referred to. May mention climate extremes or erratic fluctuations.
- **Extreme weather events** - Extreme weather occurrences, including storms, high winds, storm surges, weather volatility.
- **Drought** - Future drought challenges
- **Flooding** - Future flood challenges
- **Bush fires** - Future Bush fire risks and challenges.
- **Sea level Rise** - Any mention of rising sea levels being a concern.

8

Plenary Discussion

- What did your results say? (Andrew and Br)
- Seek agreement on final priorities
- Seek agreement on cross cutting themes, emerging risks
- Feedback on anything unaccounted for

Prof. Melissa Nursey-Gray

11

This is where you come in.

Individual Scoring

- Sheet 1: Ranking the issues (15 mins)
- Sheet 2 - Ranking the other criteria (15 mins)

Prof. Melissa Nursey-Gray

9

Conclusion and Next Steps

Dr Nick Whitford

12

Appendix D. The Handout Participants Filled During the Horizon Scan Workshop Process

TASK 1 How critical is the topic for decision-making necessary for the future of the region?

As presented in the presentation, the survey and interviews to date have identified a suite of issues that have emerged as of key importance. A summary of these is presented in the Table below.

In this part of the workshop, we would like you now to individually rank the issue in turn based on how topic for decision-making necessary for the future of the region.

We do not want you to rank them in order of priority or against each other, but to assess each independently and decide /rank them 1 – 5, where 1 is the lowest and 5 is the highest. You may thus rank more than one issue the same. The idea in this exercise is to understand which of the topics you rate the highest and most worthy of pursuing as research into the future.

TASK 2 What are the factors that are making this topic more important?

We are looking to get insight into what gives the topic its importance rank using the five criteria below. Again, provide a 1-5 score for each criterion. Basically, highest score any sub theme can get is 30. So, it will be interesting to see which one's float to the top.

Theme/sub themes	TASK 1	TASK 2				
	Importance/Rank (1-5)	Urgency/ Timing (1-5)	Feasibility & capacity (1 – 5)	Decision- making Impact (1 – 5)	Knowledge Gap (1 – 5)	Relevance to Stakeholders (1 – 5) & list key stakeholders
Theme- Water		5	5	5	5	5
Sub theme - Reduced or Unpredictable Water Availability- <i>Reduced or unpredictable water availability mentioned. Including drier conditions, freshwater availability, flow issues, or challenges associated with managing these. May be for human or environmental use</i>						
Sub theme - General water quality and health - <i>Concerns relating to water quality and water systems generally without place specification. May also mention challenges with managing this issue</i>						
Sub theme - Algal Blooms- <i>Mentions algal blooms/HABs (Harmful Algal Bloom)</i>						
Sub theme - Salinity- <i>increased salinity (including sea water ingress over barrages into freshwater system).</i>						
Sub theme - Any other you think is important? Please describe then rank						

Theme/sub themes	TASK 1	TASK 2				
	Importance/Rank (1-5)	Urgency/ Timing (1-5)	Feasibility & capacity (1 – 5)	Decision- making Impact (1 – 5)	Knowledge Gap (1 – 5)	Relevance to Stakeholders (1 – 5) & list key stakeholders
Theme- Nature						
Sub theme - Environment and Ecosystems- <i>biodiversity challenges, including habitat/biodiversity loss or change. May mention of need to protect the "environment".</i>						
Sub theme - Threats to Fauna- <i>Native fauna challenges</i>						
Sub theme - Threats to Flora- <i>Native flora challenges</i>						
Sub theme - Invasive species- <i>Invasive flora or fauna. May also mention invasive diseases (including bacteria, viruses, fungi - not Algae which is scored separately).</i>						
Sub theme - Environment and Ecosystems- <i>biodiversity challenges, including habitat/biodiversity loss or change. May mention of need to protect the "environment".</i>						

Theme/sub themes	TASK 1	TASK 2				
	Importance/Rank (1-5)	Urgency/ Timing (1-5)	Feasibility & capacity (1 – 5)	Decision- making Impact (1 – 5)	Knowledge Gap (1 – 5)	Relevance to Stakeholders (1 – 5) & list key stakeholders
Theme- Climate						
Sub theme - Changes in Climate and Climate Extremes- <i>Impacts of climate change in mentioned or referred to. May mention climate extremes or erratic fluctuations.</i>						
Sub theme - Extreme weather events-extreme weather occurrences, including storms, high winds, storm surges, weather volatility.						
Sub theme - Increasing temperatures- Any mention of atmospheric, marine, or freshwater temperature increases.						
Sub theme - Drought- <i>Future drought challenges</i>						
Sub theme - Flooding- <i>Future Flood challenges</i>						
Sub theme - Bushfires- <i>Future Bushfire risks and challenges.</i>						
Sub theme - Sea-level Rise- <i>Any mention of rising sea levels being a concern.</i>						
Sub theme - Any other you think is important – please describe and rank						

Appendix E. Phase 1 CLLMM Horizon Scan Survey Content Analysis Results: How Participants Described Their Relationship to the CLLMM Region

Category	Code	Definition	Examples	Frequency % (n)
Residence and Visitation	Home/Resident	Any mention of living in the area. Resident, home, Local. Residential. Community Member	"Resident", "home", "local".	25.04 (160)
	Ratepayer	Mentions their role/rights as citizen, taxpayer, or land holder.	"Ratepayer"	1.41 (9)
	Visitor, Tourist, or tourism	Mentions role as tourist or visitor, holiday, or associated tourism related activities with the area (e.g. "Sightseeing").	"Tourist", "visitor", "holiday", "tourism", "Sightseeing".	11.58 (74)
Identity, Social, and Cultural	Family	Mentions family, parenting, or their children/grandchildren etc.	"Family", "daughter".	1.10 (7)
	Social Focus	Any socially focused reference. Includes culture, community, friends, community groups, or reference to the people of the area (not including Family, which score separately).	"Culture", "community", "scouts".	7.51 (48)
	Spirituality and/or Connection	Mentions spiritual importance or strong connection.	"Spiritual", "soulful", "connected"	4.54 (29)
	Lifestyle	Mentions "Lifestyle"	"Lifestyle"	0.47 (3)
	First Nations	Reference to first nations or use of associated terminology.	"On country", "Ngarrindjeri Country"	0.78 (5)
	Volunteer	Mentions role as volunteer in area.	"Volunteer"	1.25 (8)
Environment	Nature/Environment	Mentions ecological value. May also reference this as their role.	"Ecology", "biodiversity", "environment", "nature", "conservationist"	14.55 (93)
	Fauna	Mentions birds, fish, or other animals (Note: "wildlife", "species", or similar without specification double score here and in "Flora").	"Birds", "fish", "fauna"	4.23 (27)
	Flora	Mentions plant life (Note: "wildlife", "species", or similar without specification double score here and in "Fauna").	"Vegetation", "trees", "flora"	2.35 (15)
	Water	Mentions water or waterways focus.	"water", "waterway", "wetland", "inflow".	2.82 (18)
	Land	Dry land focus.	"Floodplains", "shore", "coast".	0.63 (4)
	Life	"Life" mentioned.	"Life"	0.31 (2)
	Beauty	Beauty or pristine quality mentioned.	"Unspoilt", "pristine", "majestic", "stunning".	2.66 (17)

	Remote	Remoteness mentioned.	"Remote"	0.31 (2)
Positive Emotions	Love	Love and associated intimate emotions.	"Love", "personal", "yearning", "beloved".	4.54 (29)
	Passionate	Passion and strong emotions.	"Enthusiastic", "passionate", "emotional".	3.13 (20)
	Respect	Emotions associated with respect.	"Respect", "wonder", "admire", "captivated".	2.50 (16)
	Hope	Emotions associated with hope.	"Hopeful", "Confident"	0.63 (4)
	Gratitude	Emotions associated with gratefulness or associated happiness.	"Thankfulness", "appreciation", "privileged", "happy".	1.88 (12)
	Exciting	Emotions associated with excitement or stimulation.	"Uplifting", "inspiring", "enthusiastic".	0.78 (5)
Negative Emotions	Unhappy	Emotions associated with unhappiness.	"Heartache", "sad", "heartbreak", "unhappy".	0.63 (4)
	Concerned	Emotions associated with concern, anxiety, or frustration.	"Concerned", "worried", "frustrated", "pessimistic".	5.16 (33)
	Sense of loss	Emotions or words associated with loss. E.g.	"Destruction", "remorse", "tragedy", "guilt", "apologetic".	0.63 (4)
Advocacy and Stewardship	Conservation	Mentions responsibility, management of, or need to protect/rehabilitate area. May include as a mention of their role.	"Responsibility", "management", "advocacy", "environmental protection", "advocate".	9.86 (63)
	Importance	Mentions importance of area.	"Important", "valuable", "asset", "special", "unique", "iconic".	3.13 (20)
	Heritage	Heritage mentioned.	"Cultural Heritage", "heritage guardian".	0.47 (3)
Relaxation and Recreation	Recreation	Mentions recreation generally or associated terms.	"Recreation" "fun", "play", "enjoyment", "exploring"	8.45 (54)
	Birdwatching	Mentions birdwatching.	"Birdwatching", "twitcher"	1.25 (8)
	Fishing	Mentions fishing	"Fishing", "recreational angler"	3.29 (21)
	Exercise	Mentions sport or exercise activities.	"Fitness", "sport", "regatta", "cyclist".	1.41 (9)
	Walking	Mentions recreational walking.	"Walking", "hiking", "bush walking"	0.63 (4)
	Swimming-Based Water Recreation	Mention of swimming-based recreational activities, including swimming, surfing, and snorkelling.	"Swimming", "surfing"	1.41 (9)
	Boating Recreation	Mentions boat-based recreation.	"Boating", "sailing", "kayaking", "canoeing", "rowing".	5.48 (35)
	Camping	Mentions camping or caravanning.	"Camping", "caravanning".	1.56 (10)

	Beach/Beach Going Rest and Leisure	Mentions beach or beach going Mentions area's capacity to boost mental/emotional wellbeing or associated words and emotions.	"Beach Goer" "Peace", "serenity", "relaxing", peaceful. "soothing", "sanctuary".	0.63 (4) 4.54 (29)
Threats	Climate Change Endangered	Mentions Climate Change. Refers to treats to the area.	"Climate change". "Endangered", "threatened", "degraded".	0.94 (6) 0.78 (5)
Education, Interest, and Investigation	Interest and understanding Education	Mentions being interested or enjoying a deep understanding of the area. Mentions of educational themes.	"Interested", "curiosity", "understanding". "Training", "informative", "learning", "awareness".	6.42 (41) 3.44 (22)
	Science and Research	Mentions research or science.	"Observation", "monitoring", "knowledge".	6.57 (42)
Economic and Resources	Livelihood or vocation Investment or use	Vocational identity or employment association. Mentions investment (with the idea of future returns) or use of area as/for resources.	"Professional", "work", "researcher" "...user of the region", "investor"	8.14 (52) 1.10 (7)
	Economic	Mentions business or economic references.	"Economic", "business".	0.78 (5)
Relationship Qualities	Positive	Generally positive relationship mentioned.	"Positive"	2.82 (18)
	Strong	Generally strong relationship mentioned	"Strong", "devoted", "committed"	2.04 (13)
	Involved	Mentions being involved or similar.	"Involved", "immersed", "embedded".	0.78 (5)
	Creativity	Mentions creative theme.	"Photography", "creative".	0.63 (4)
	Partnership	Reciprocal, Dependence, supportive.		1.10 (7)
Specific Place	Coorong	Mentions Coorong	"Coorong"	1.56 (10)
	Lower Lakes	Mentions Lower Lakes	"Lakes"	0.78 (5)
	Murray Mouth	Mentions Murray Mouth	"Murray Mouth"	0.16 (1)
	Murray River	Mentions Murray River	"Murray River"	1.41 (9)
	Ocean	Mentions Ocean	"Ocean"	0.47 (3)
	Other place specificity	Mentions another local place specifically	"Goolwa", "Hindmarsh Island".	2.04 (13)
Time based	Long term	Focuses on long term relationship, either historical or into future. History.	"Long term".	5.63 (36)
	Memories	Refers to memories or nostalgia themes. Including childhood.	"Grew up", "childhood", "memories", "nostalgia"	0.78 (5)
	Frequent	Mentions frequent association.	"Frequent", "regular", "periodic".	1.56 (10)
	Occasional	Mentions occasional association with area.	"Occasional", "infrequent".	1.88 (12)
Little or No Connection	Little or No Connection	Little or no relationship or connection.	"Uninvolved", "casual".	4.23 (27)

CLLMM Research Centre	CLLMM Research Centre	Possibly Discussing Research Centre rather than Region	CLLMM rather than Region	"Information provider, general knowledge and unaffiliated"	9.86 (63)
Other	Other	Low scoring or outliers		"inactive", "unity".	5.95 (38)

Appendix F. Phase 1 CLMM Horizon Scan Survey Thematic Analysis Results: Perceptions of Future Impacts of Climate Change in the CLMM region

Value Theme	Subtheme	Definition	Examples/Descriptions of text	Frequency % (n)
Weather events	Extreme weather events	Related concerns about impacts of storms, storm surges, high winds, or extreme weather events in general.	"More extreme weather", "More wild weather, including winds and extremes of temperature"	7.04 (45)
	Changing/unpredictable weather	Discusses impacts of, or mentions, changing or unpredictable weather patterns.	"Changing weather patterns", "The unpredictable weather & lack of good rains has impacted on our trees & shrubs."	4.54 (29)
	Drought and dryer climate	Increased drought, or reduced rainfall/drier climate, or impact thereof.	"More severe droughts...", "decline in ability of the system to recover from droughts"	7.36 (47)
	Increased flooding	Impacts of, or reference to increased frequency/severity of flooding.	"More extreme flood events...", "Increase in flood events..."	6.10 (39)
	Bushfires	Impacts of, or reference to, increased frequency/severity of bushfires	"Bushfires more likely...", "...perhaps bushfire in park over the road."	2.82 (18)
	Increased Temperatures	Water, land, or atmospheric increases or changing fluctuations in temperature mentioned.	"Warming of land and water...", "we'll get more consequences from rising sea temps..."	13.15 (84)
Impacts from Weather or Climate Change	Sea-Level Rise	Sea level or greater tides referred to.	"Sea level rise", "Sea level rise will push sea water into the lower lakes and lower River Murray and will drown shallow Coorong mudflats..."	12.83 (82)
	Algal Bloom	Mentions current or future likelihood of algal blooms/HABs	"Harmful algal blooms", "algal blooms impacting the sea life"	10.80 (69)
	Increasing Salinity	Increase in salt in the CLMM system, including from sea water ingress over barrages.	"Reduced flows down the River Murray will exacerbate the salinisation of the system.", "Salinity of Lakes Alexandrina and Albert will increase dramatically..."	9.86 (63)

	Erosion	Erosion mentioned.	"Increased erosion of shorelines", "the erosion of the local beaches."	4.23 (27)
Water	Reduced or Erratic Freshwater Levels	Reduced freshwater flow or rainfall, or increased evaporation, or more water demand. Water security impacts. Reduced or changed water quality levels mentioned as having impact or being valued. (Water born pollution double scores here and in "Pollution".)	"Overall reduction in freshwater from the MDB", "drier climate", "Negative impacts on Water levels"	27.07 (173)
	Reduced Water Quality		"Lower river flows from upstream could impact flora and fauna and water quality.", "water quality decline"	12.36 (79)
Nature and Environment	Impact on Natural Environment or Habitats	Mentions impacts on the environment or habitats.	"Loss of species and habitats.", "I believe the precious environment is going to suffer..."	15.18 (97)
	Fauna Impact	Any mention of native fauna (Note "wildlife", "sea life", and "species" scores both here and in "Flora").	"...which affects everything from the Murray cod populations to the bird migration patterns.", "Wildlife, particularly aquatic species"	28.33 (181)
	Flora Impact	Any mention of native flora (note: "wildlife", "sea life", and "species" scores both here and in "Fauna").	"Lower river flows from upstream could impact flora...", "Vegetation", Support plant growth"	21.75 (139)
	Biodiversity Breakdown or Impacts	Mentions ecosystems, biodiversity, or ecology as being valued or impacted. Invasive fauna, flora, or introduced diseases. (Does not include "algal bloom" mentions which score in own category.)	"Loss of biodiversity", "...and other devastating microbial infestations leading to ecosystem imbalance..."	20.97 (134)
	Invasive Species or Diseases		"...endemic species may fail to thrive, and non-endemic species find conditions conducive to them.", "invasive species"	1.88 (12)
Call to Action	Already Occurring Events	Mentions that impacts that are already occurring.	"Climate change is already messing with water levels and salinity...", "The Coorong and lakes have already been adversely affected by the (historic)	3.76 (24)

Biopsychosocial Wellbeing	Worsening Situation	Refers to the current issues which will continue to become more impactful.	construction of barrages and drains." "...its already happened and will continue to get worse", "Further demise of biodiversity and the continued loss of unique species."	1.56 (10)
	Action needed	Lack of action/more action needed regarding the discussed issue.	"...we need immediate help and support to keep oceans and estuaries in good health...", "needed more than ever"	1.56 (10)
	Individuals' Wellbeing	Impacts on individuals' health and wellbeing, including mental or physical.	"I had to move away from the dunes closer to the beach when I started coughing", "...safety of human engagement in it"	1.88 (12)
	Social Impacts	Impacts on social groups and relationships. Includes family, community, or other social wellbeing impacts.	"Impacts on communities", "Reducing community cohesion."	5.16 (33)
	Culture or Spirituality	Culture, spirituality, or nature connection impacts referred to.	"Deep loss of crucial natural/cultural resources causing a shift in what practices are possible...", "loss of cultural values", "Degradation of this sacred environment and the spiritual strength it affords us is detrimental to human mental health." "Ngarrindjeri	3.91 (25)
	First Nations Impacts	Mentions value and or impact on the area's Australian Aboriginal culture, way of life, wellbeing, social justice, or otherwise.	Ramindjeri land and water and all life that lives in our lands and in our waters will be impacted by climate change", "These changes also threaten traditional Indigenous cultural practices and relationships with land.", "First Nations wellbeing".	2.35 (15)
	Economic, Livelihoods, and Industry	Mentions economic, employment, financial, or industry impacts.	"...and the local community's livelihood.", "changed economic outcomes including business, tourism and land value."	5.63 (36)
	Strained or Reduced Resources and Infrastructure	Reduced resources for	"Reduced amenity values", "I imagine a	5.32 (34)

		humans, including but not limited to infrastructure, amenities, or funding.	need for government to spend more on adapting to climate change and therefore less money for other things."	
	Impact on Human Habitability	Mentions impact to home, or liveability of area. Includes current or future impacts for themselves or others.	"Sea level rise and flooding of my home", "Waterfront houses will be severely impacted"	4.07 (26)
	Food Production	Reduced food or produce for humans.	"Reducing agricultural productivity.", "...heat and low rainfall impact on gardening - fruit, veggies, herbs..."	2.66 (17)
	Primary Industries	Impacts on primary industries, including agriculture, fisheries, and aquaculture.	"Impacts on micro-economics: primary industries...", "stock feed shortages", "More houses less productive farming land."	4.23 (27)
	Tourism	Mentions of tourism and/or its associated industry being valued or impacted.	"Tourism impacts.", "Algal blooms will impact fishing & tourism."	2.66 (17)
Recreation and Appreciation	Recreation	Any mention of recreation being valued or impacted. E.g. swimming, walking, recreational fishing, camping.	"Algal blooms will limit recreational activity in the river", "Camping and fishing"	4.85 (31)
	Appreciation and Enjoyment	A reduction in access to, or the ability to, appreciate or enjoy the area's natural spaces, may refer to its pristine nature or beauty being affected.	"Enjoyment of beaches/coast: will be reduced by increased windy/extreme weather conditions.", "the environment will be less enjoyable to visit", "Pristine Coorong"	4.38 (28)
Direct Anthropogenic Impacts	Pollution	Water born or land based. Includes mentions of run off, rubbish, or higher nutrient levels in the water.	"...and high nutrient levels,", "contaminants from upstream", "The clean look of the area would be changed with things like rubbish pollution..."	4.07 (26)
	Population Increases	Impacts of increases in local human population. Includes mentions of housing	"Too much development and too many powerboats could impact the wildlife too", "...or allow the	0.94 (6)

		development in the area.	area to be over-developed to the extent it's ruined beyond repair."	
	Barrage Functionality or Management	Mentions the functioning or management of the area's barrages.	"Sea level rise will impact the Lower Lakes and Coorong, the barrages will not function properly, salt water will get in the lakes", "Operation of the Barrage"	2.35 (15)
Place Specificity	Lower Lakes	Mentions the Lower Lakes being impacted.	"Sea level rise will push sea water into the lower lakes...", "Salinity of Lakes Alexandrina and Albert will increase dramatically changing the natural environment of the area including fish, birds and vegetation."	4.85 (31)
	Coorong	Mentions the Coorong being impacted.	"Coorong sea-level rise", "the Coorong is struggling", "The Coorong is such a unique and amazing place, and I worry that it will be at best reduced and worse case lost."	8.92 (57)
	The Murray River/MDB	Mentions the Murray River or Murray Darling Basin (includes "river flow" references).	"Reduced Murray River flow", "...and limited water coming down the Murray will change the landscape and ecosystem"	10.02 (64)
	The Ocean	Mentions the sea or ocean.	"Well, the ocean has already been impacted and has died", "I doubt the ocean will fully recover because I do not see a drop in temperatures any time soon."	3.13 (20)
	Ocean Beach/Coastline	Mentions of ocean beaches or coastline.	"The beaches and the Coorong are really at the forefront of impact of climate change", "Ocean beach"	5.16 (33)
	Waterways/ River Systems	Mentions waterways and river systems as a whole. Includes "wetlands".	"Health of the wetlands", "The river system is incredibly fragile and it's being treated, at times, with contempt by users across the system."	3.13 (20)
	Dunes	Mentions the areas dunes. Includes	"Further erosion of the sand and dunes", "erosion of coastal	1.41 (9)

		mentions of "sandhills".	dunes and therefore loss of habitat"	
	Surrounding Land	Impacts on the CLMM regions surrounding dry land mentioned.	"Reduced rainfall will also change the adjacent land which will impact use and runoff into the waterways", "Quality of soil..."	2.66 (17)
	Other specific places	Mentions of other specific places that are low scoring.	"The Goolwa Channel", "Clayton Bay"	0.63 (4)
General Poor Outcomes	General Poor Outcomes	Acknowledges negative impacts with a non-specific context. May also acknowledge negative unknowns.	"Destruction", "of course it will", "Badly", "Short term apparent degradation of flora and habitat, then something different."	10.95 (70)
Other	Other	Low scoring and outlier subthemes.	"Reduce ozone pollution", "may result in greater use of the desal plant"	8.45 (54)
	Little or No Impact	Anthropic climate change is considered overblown or non-existent.	"If we look at the next 1000/10,000/100,000 years, etc, who knows? In the next 100 years, not a great lot", "The whole world will be impacted by climate although I don't believe it is as bad as it played up to be.	1.88 (12)
	Possible Benefits	Speculates on possible benefits, or self-correction, of systems or environment as a result of climate change.	"Hyper salinity in the Coorong until rising sea levels can fix what we have ruined", "A lack of inflows and salinisation will adversely affect the ecosystem, but there could be improvements once sea levels rise sufficiently for greater hydrological exchange with the Southern Ocean."	0.63 (4)
	Don't Know	Mentions not knowing or unsure. May think change will occur but cannot speculate how.	"I can't predict the effect climate change will have", "I'm not sure how things will be impacted..."	1.88 (12)

Appendix G. Phase 1 CLMM Horizon Scan Survey Thematic Analysis Results: Perceptions of Biggest Challenges in the CLMM Region in the Next Fifteen Years

Value Theme	Subtheme	Definition	Examples/Descriptions of text	Frequency % (n)
Land Based Challenges	General Land Health and Management	General threats to the health of surrounding land or difficulties in its management. May mention soil quality or degradation.	"Continuing poor land management on farms and lifestyle blocks...", "To much cleared lands.", "...soil quality"	0.94 (6)
	Erosion	Erosion mentioned, including of beaches, dunes, or other land areas.	"Damage to the Coorong NP foredune from increased sea level...", "beach and dunes erosion"	3.76 (24)
	Any "Land Based Challenges" score present.	Any "Land Based Challenges" score present.	NA	4.69 (30)
Land - Place Specificity	Coastline and Ocean Beaches	Ocean beach or coastline mentioned.	"The beaches are getting hammered by storms and just washing away."	2.19 (14)
	Dunes	Dunes or sandhills mentioned	"Bigger and more frequent storm surges on ocean beaches affecting sand dunes"	1.10 (7)
Water Based Challenges	Reduced or Unpredictable Water Availability	Reduced or unpredictable water availability mentioned. Including drier conditions, freshwater availability, flow issues, or challenges associated with managing these. May be for human or environmental use.	"Lower inflow from the river", "Water availability and allocation.", "Lack of flow to Coorong", "Water security and managing extreme droughts."	24.57 (157)
	General water quality and health	Concerns relating to water quality and water systems generally without place specification. May also mention challenges with managing this issue.	"Degrading water quality", "Health of the water"	10.95 (70)
	Algal Blooms	Mentions algal blooms/HABs (Harmful Algal Bloom)	"Algal blooms", "Ongoing ecological devastation from the algal bloom.", "Likely continuation of nutrient/ eutrophication / algal issues."	10.17 (65)
	Salinity	Any mention of increased salinity (including sea water ingress over barrages into freshwater system).	"...salinization", "The water's getting saltier and there's less of it"	9.23 (59)
	"Water Based Challenges" Theme	Any "Water Based Challenges" score present.	NA	39.91 (255)
Water - Place Specificity	Murray River	Specifically identifies Murray River or MDB	"Water - the need for solid environmental	9.23 (59)

Nature & Ecosystems	Lower Lakes health	(Murray Darling Basin), including flow, quality or health mentioned Specifically identifies Lower Lakes - including water flow, quality, and health	flows for the Murray.", "...keeping river levels high" "Lakes drying", "Low freshwater flows into lakes"	3.44 (22)
	Murray Mouth	Specifically identifies challenges associated with Murray Mouth flow or health. Including opinions for or against dredging.	"Murray mouth blockage", "... but the beaches and Murray mouth are facing some current changes"	4.69 (30)
	Ocean Water	Specifically identifies Ocean, including water quality, and health	"Ocean will remain out of bounds and infested by <i>Karenia</i> ", "Quality of ocean"	2.50 (16)
	The Coorong	Specifically identifies the Coorong (including mention of the South Lagoon), be it water quality or general health.	"Water quality in the Coorong", "...and lack of flow into the Coorong."	7.67 (49)
	Coorong South Lagoon	Specifically identifies Coorong South Lagoon, including water quality, salinity, health.	"Management of water release through barrages so that this water flows into the Southern lagoon", "South Lagoon continual suffering, hyposaline"	2.97 (19)
	Environment and Ecosystems	Any mention of biodiversity challenges, including habitat/biodiversity loss or change. May mention of need to protect the "environment".	"Loss of habitat through urban development", "Declining health of the ecosystem (fish, birds, vegetation) from salinity and water quality."	18.78 (120)
	Threats to Fauna	Native fauna challenges ("wildlife" or "species" double score here and in flora)	"Makes me worry about the fish and birds I love seeing.", "Sustainable fish stocks in the Coorong", "Migratory Birds" "...trees dying", "submerged and fringing macrophytes", "Increased average temperatures of river and ocean changing the flora and fauna in the region"	15.65 (100)
	Threats to Flora	Native flora challenges ("wildlife" or "species" double score here and in flora)	"Introduced species", "invasive species", "Dealing with invasive life forms", "Introduction of novel diseases and/or species that negatively impact wildlife and people"	11.74 (75)
	Invasive species	Invasive flora or fauna. May also mention invasive diseases (including bacteria, viruses, fungi - not Algae which is scored separately).		5.01 (32)

	Nature & Ecosystems Theme	Any "Nature & Ecosystems" score present.		33.80 (216)
Direct Impacts from Humans	Increased Population	Concerns regarding increased human development in area (including housing etc) or increasing population generally. Impacts caused by industries, including primary industries and tourism. May mention agricultural run off or resulting high nutrient content of water. May mention reduced water flow from industry needs, including upstream or in eastern states. (does not include housing/building industry, which scores in population increases)	"Uncontrolled housing development", "increased population"	12.36 (79)
	Impacts from Industry		"Lack of flow to Coorong and Lower Lakes due to industry being allowed to take too much water upstream", "Impact of harvesting juvenile mullock in the Coorong", "Commercial fishing - over fish"	7.04 (45)
	Pollution	Increasing land based or waterborne pollution (including eutrophication or nutrient levels, or nutrient dynamics). May include refuse/litter	"...lack of detention ponds to prevent pollutants from entering waterways...", "Health of the river system through nutrients and pollutants released upriver."	10.64 (68)
	Impacts from Recreation	Mentions the harmful impacts of recreational activities on area. Including 4WD, boats, jet skis, recreational fishing, beach driving.	"Increasing 4WD impact on dunes and beaches", "powered boats and jet skis on the river"	3.29 (21)
	Direct Impacts from Humans	Any "Direct Impacts from Humans" score present.	NA	25.82 (165)
Management Challenges	Water Management Systems Challenges	Challenges associated with managing freshwater availability and allocation. (Does not include Barrage Management). May highlight competing water demands.	"Manage the water from upstream Z", "water management and security", "Resolving the conflicts around the allocation and use of water flows in the Murray Darling Basin."	7.82 (50)
	Barrage Management	Challenges or deficiencies created by barrages. May mention better management needed, or the need to remove them entirely.	"Management of water release through barrages so that this water flows into the Southern lagoon", "Barrage operations", "Removal of the barrages to restore natural estuary"	2.19 (14)
	Human Management System Challenges	Challenges associated with government, planning, management, funding, policies, or implementation of	"Interference by Government action, not always for the best!", "under prepared local and	13.30 (85)

		initiatives. May also refer to poor/insufficient infrastructure, or decision-making processes.	state governments, indifference from national policymakers", "piecemeal and poorly coordinated when implemented."	
	Balancing the needs of humans with nature	The need to encourage humans to live in ways that don't damage the environment is highlighted. May refer to ecosystem services or "sustainability" (in relation to conservation).	"Conflict between water needs for the environment, agriculture, and towns.", "Planning future development to ensure biodiversity and connectivity of ecosystems..."	3.60 (23)
	Human Adaption Challenges	Challenges associated with adaption processes/capacity/stressors on humans and human systems, including social, economic, or wellbeing.	"Supporting communities to adapt to climate change impacts like increasing temperatures and drier conditions, combined with increased frequency of extreme events.", "Coping with the ecological grief and anxiety within communities,"	2.19 (14)
	Management Challenges Theme	Any "Management Challenges" score present.	NA	23.00 (147)
Climate, Weather, and Related Impacts	Changes in Climate and Climate Extremes	Impacts of climate change is mentioned or referred to. May mention climate extremes or erratic fluctuations.	"More frequent and intense climate extremes", "Climate change", "Weather pattern changes"	13.46 (86)
	Extreme weather events	Mentions extreme weather occurrences, including storms, high winds, storm surges, weather volatility. (not bush fire, which scores separately)	"Bigger and more frequent storm surges on ocean beaches affecting sand dunes", "Extreme weather events and heat waves due to historical land clearance"	4.85 (31)
	Increasing temperatures	Any mention of atmospheric, marine, or freshwater temperature increases.	"Rising temperatures.", "Higher land and water temperatures"	8.45 (54)
	Drought	Future drought challenges	"Water security and managing extreme droughts.", "Drought in the MDB causing lakes to run dry similar to Millennium Drought."	7.67 (49)
	Flooding	Future Flood challenges	"Climate change causing flooding...", "Managing flooding..."	3.44 (22)
	Bushfires	Future Bushfire risks and challenges.	"Climate Change i.e. increasing temperatures, bushfires and changing water	1.56 (10)

	Sea-level Rise	Any mention of rising sea levels being a concern.	supply", "bushfires: increasing in number & severity" "Sea level rise and associated erosion.", "More frequent overtopping of the barrages due to storm surges and sea level rises."	6.89 (44)
	Climate, Weather, and Related Impacts Theme	Any "Climate, Weather, and Related Impacts" score present.	NA	32.08 (205)
Human Needs and Wellbeing	Human wellbeing	Mental or physical health impacts on humans.	"Human despondency", "increasing discontent and stress about increasing climate change impacts"	2.35 (15)
	Community Wellbeing and Collaboration	Changes/challenges to community or society, the need for increased community consultation, or barriers to cohesion, coordination, or collaboration.	"Economic impact on communities here", "Building a collaborative community.", "Communities fearing for their future" "Balancing environmental protection with community, cultural, and economic needs in a changing climate.", "Shortages of funds and manpower for local groups restrict the advancement of cultural and public services;"	6.10 (39)
	Cultural Impacts	Impacts or challenges associated with local culture, regardless of specific cultural identity.	"All the young people are leaving because there's no work here anymore.", "falling economic wellbeing"	1.10 (7)
	Economic impact	Economic threats including loss of jobs, income, or financial opportunities. (from a citizen perspective rather than industry, which scores in "Industry Challenges") Reduced ability to meet the needs of industries. Including primary industries, tourism or others. May include "reduced productivity", "reduced natural resources" when in context or similar. May discuss repurposing of agricultural land for urban development.	"Loss of the fishing industry.", "low productivity", "The rapid rate of subdivision & the loss of agricultural land & natural scrub."	4.85 (31)
	Industry Challenges			5.63 (36)
	Impact on First Nations	Impacts on first nations peoples. May discuss the lack of integration of knowledge from these	"Maintaining First Nation's cultural heritage.", "First Nation's engagement",	1.56 (10)

	Infrastructure and Liveability Loss	sources or lack of recognition. Challenges associated with tangible liveability threats (not "livelihood, which scores in "economic impact"	"protecting cultural sites and totems" "Effects on human occupation etc of low-lying areas.", "Lack of infrastructure to manage change" "Optimising the recreational experiences in the Coorong, in particular recreational fishing", "Can't pursue recreation activities = fishing, rowing, sailing."	1.56 (10)
	Reduced Recreation and Relaxation Capacity	Reduced ability to use natural spaces for recreational or relaxation activities.		1.41 (9)
	Human Needs and Wellbeing Theme	Any "Human Needs and Wellbeing" score present.	NA	15.96 (102)
Science and Science Communication	Science and Science Communication	Challenges in the production and/or distribution of research. May also discuss educating the community regarding best practices or in how to adapt to environmental changes	"Inability of people to realise there is problem let alone how to deal with it", "Funding for research and conservation, social awareness", "Critique of scientific claims in lay terms"	5.32 (34)
Other	Other	Low scoring or outliers	"Seal population", "keeping all stakeholders happy"	6.26 (40)
	Unsure	Participant mentions not knowing or being unsure about challenges.	"No idea", "Unsure"	0.94 (6)
Little or No Challenges	Change Acceptance	Acknowledges that Climate Change or other issues are happening and stressing the need for society or culture to accept it as a given.	"Celebrating what it is, not agonising over the change."	0.16 (1)
	No challenges	No challenges present or "NA" etc written.	"No challenges"	0.31 (2)

Appendix H. Phase 1 CLMM Horizon Scan Survey Thematic Analysis Results: Perceptions of Positive/Productive Opportunities for the CLMM Region in the Next Fifteen Years

Value Theme	Subtheme	Definition	Examples/Descriptions of text	Frequency % (n)
Economic Opportunities	Tourism	Tourism opportunity identified.	"Growing nature-based and educational tourism (e.g., seeing conservation projects, bird watching).", "Tourism"	17.68 (113)
	Local Employment and Businesses	Increasing local employment, business, products, or brands.	"Small business", "growing business and creating more job opportunities in a range of sectors.", "Support industries that are not high water-users", "New ways to make more from less especially to do with water/fishing/agriculture", "promotion of regenerative farming practices that prioritise soil health, water management and biodiversity"	6.57 (42)
	Sustainable Business and Industry	Potential or need for economic enterprises/industries to embrace sustainability, climate adaption, or conservation. Including primary industries. (Ecotourism and sustainable tourism also score here in addition to tourism)	"Educating, enthusing and employing participants through eco-tourism opportunities", "Sustainable Tourism and Eco-Tourism Development"	13.77 (88)
	Ecotourism	This category already scores in both "Tourism" and "Sustainable Business and Industry". This code is provided to identify specific mentions of ecotourism.		5.32 (34)
Research and Innovation	Energy Solutions	Discusses sustainable/alternative energy sources implementation or increasing use of.	"All this wind could probably power heaps of stuff if they put up some turbines or whatever.", "Renewable Energy and green infrastructure Development"	2.03 (13)
	Role Modelling	Identifies the opportunity for the region to become a leading example of resilience and adaption.	"Becoming a world-leading example of how to adapt a region to climate change.", "Lead the way in climate-adaptive, culturally & community inclusive water and ecosystem management"	3.29 (21)
	Continued or Expanded Research	Highlights the needs for, or benefits of, research in the area. Including increased monitoring.	"Promote research-based projects to improve/rehabilitate local eco systems.", "Keeping the research	12.52 (80)

Environmental	Human Adaptation Capacity	Opportunities focusing on (or mentions of) human resilience and adaptation.	centre in Goolwa would be essential.", "research into just how far upriver will the impacts at the bottom of the river bed" "Transitioning agriculture to adapt to climate change", "People will make positive changes to their lifestyle." "Restoring submerged and emergence macrophytes, which may need to be wrapped up with control of carp.", To revegetate as many areas as possible with native flora to support bird life and fish stocks", "...work on conserving and enhancing habitat and building resilience for resident species at the most ecologically meaningful scale with the best prospects for success." "Release of the carp herpes virus could be a game changer for native fish.", "Stop delaying full regulatory reform of the Dog and Cat Management Act and start serious funding of Science and Practical eradication measures for feral pests such as Cats, deer, rabbits, carp and other declared species." "Address the health of the Southern Lagoon", "Close monitoring of salinity and toxicity of Coorong and lakes with careful flushing with fresh water"	2.50 (16)
	Environmental Protection and Restoration	Opportunities to rehabilitate, protect or improve the areas environment (including ecosystem, habitat, and species).		20.81 (133)
	Invasive species control	Mentions controlling invasive species, including fauna, flora, or diseases.		3.76 (24)
	Improving/protecting the Coorong	Opportunities for increased water flows, habitats, or ecosystems in the Coorong or south lagoon specifically.		2.03 (13)
	Improved Ecosystem Services	Improving the environment will result in ecological outcomes that directly benefit humans.		2.82 (18)
	Species Monitoring	Opportunities or need for monitoring of	"More fish tagging", "Community being	2.19 (14)

		endemic flora or fauna.	able to connect with the environment through monitoring."	
Water	Improving flows or water security	Mentions increasing water quantities or availability.	"Improving freshwater flows to maintain the health of the Northern Lagoon", "Innovative water delivery to improve water quality and distribution outcomes", "Additional flows to Coorong from SE, not Murray". "Getting water quality and quantity right", "Identify and reestablish the presence of reduced aquatic flora and fauna such as molluscs and crustaceans to aid in purifying the water of the region."	4.38 (28)
	Improving water quality	Need or opportunity to improve water quality, including fresh or saltwater systems.	"Close monitoring of salinity and toxicity of Coorong and lakes with careful flushing with fresh water", "Salinity control."	2.97 (19)
	Addressing Salinity	Mentions countering, monitoring, or addressing salinity.	"Water release management to control salinity and algal blooms", "Can biochar be used to treat algal blooms".	1.10 (7)
	Countering Algae	Mentions solutions or prevention of future algal blooms.		0.78 (5)
Governance and Management	Improving management/governance	Opportunities are provided by improving governance, government collaboration, or socio-economic management of the area (E.g. regulations, laws and enforcement, improved funding or incentives, improved infrastructure, regulatory bodies). Suggestions or need for improved water management at either micro or macro scales. Includes water allocations, MDB plan, HCHB, barrages	"SA and Local Government reform", "Opportunities depend on the willingness of governments, business, community organisations and the population to work together.", "more public transport", "Funds available"	14.87 (95)
	Improving Water Management	(removal or otherwise), dredging. (Relates specifically to the management of water and water systems, not improving socio-	"HCHB interventions", "Implementation of the M.D. Basin Plan", "Increased understanding of wetland ecosystems leading to improved management of available water"	11.42 (73)

		economic systems (i.e. governance)		
	Remove Barrages!	Specifically mentions removing the barrages.	"Remove the barrages.", "Return to salt water"	0.78 (5)
	Control/sustainable housing developments	Mentions the need to stop, limit, adapt, or restrict housing development in the area.	"Sustainable residential development", "Draw attention to protecting the nature and landscape of the Southern Fleurieu from developers"	2.19 (14)
Community, Sociocultural, and Collaboration	Community based opportunities	Community based opportunities, including citizen science, consultation, collaboration, or improvements in/use of local culture.	"Generate solutions using research and citizen science.", "Lead the way in climate-adaptive, culturally & community inclusive water and ecosystem management"	17.68 (113)
	Education and Science Communication	Highlights opportunity for increased education of the public. (e.g. public awareness or science communication). May include familiarisation practices depending on context.	"Creating more user-friendly outdoor activities that explore nature", "Raising awareness about the unique environment and how it must be enhanced and preserved for the future.", "Educating, enthusing and employing participants through eco-tourism opportunities."	18.15 (116)
	Increased First Nations Involvement	Opportunities associated with increased first nations collaboration. Depending on context, may use the term "traditional cultural" or 'cultural heritage'. (Note: the term "culture" does not score without sufficient context to specify First nations. Such mentions are included in "Community Based Opportunities".)	"Education for wider community on First Nations sustainable practices applicable today", "Building a knowledge base recognising First Nations practices and contemporary resources"	9.08 (58)
	Inter-stakeholder collaboration	Opportunities associated with organisations/stakeholders communicating and collaborating. Including cross organisational, interstate, and the public.	"Promoting economic tourism in and about the CLMM region through a cohesive, collaborative body.", "Establish respectful and collaborative relationships between scientist, managers,	8.76 (56)

	Benefits of growing local population	Highlights opportunities associated with local human population increasing.	landholders and First Nations." "More people give more opportunities - see as a positive and adjust accordingly", "Population growth bringing more opportunities to the area."	1.25 (8)
Recreation	Recreation Opportunities	Positive recreational opportunities. (Includes single mentions of the activity e.g. "Fishing".)	"Recreation, fishing, hunting", "rec fishing and promotion of the Coorong as a whole area for everyone to enjoy.", "More activities on the river e.g. windsurfing, kayak, sailboat hire." "Need to control more the impact of too many people using recreational areas at once i.e., too many people cockling for cockles on Goolwa beach...", "Lobby Alexandrina Council to stop big 4WD Crushing sea grass and microbes in the sand"	4.07 (26)
	Recreation Impacts	Highlights detrimental impacts of recreation or discusses how it should be better managed.	"Blue and teal carbon sequestration opportunities.", "Blue-carbon from rehabilitating wetlands". "Transitioning agriculture to adapt to climate change", "Many community members are highly motivated to help address issues around climate change and other environmental degradation", "Climate resilient infrastructure" "Innovative Agriculture and Aquaculture practices, and Renewable Energy and green infrastructure Development", "Invest in research to deliver solutions to foster environmental resilience"" Technology to improve more	1.41 (9)
Human Impact Mitigation	Blue and/or Teal Carbon Sequestration	Mentions Blue and/or Teal Carbon Sequestration or Capture.	"Blue and teal carbon sequestration opportunities.", "Blue-carbon from rehabilitating wetlands". "Transitioning agriculture to adapt to climate change", "Many community members are highly motivated to help address issues around climate change and other environmental degradation", "Climate resilient infrastructure" "Innovative Agriculture and Aquaculture practices, and Renewable Energy and green infrastructure Development", "Invest in research to deliver solutions to foster environmental resilience"" Technology to improve more	0.78 (5)
	Countering Climate Change	Mentions opportunities or need to counter/adapt to climate change.	"Blue and teal carbon sequestration opportunities.", "Blue-carbon from rehabilitating wetlands". "Transitioning agriculture to adapt to climate change", "Many community members are highly motivated to help address issues around climate change and other environmental degradation", "Climate resilient infrastructure" "Innovative Agriculture and Aquaculture practices, and Renewable Energy and green infrastructure Development", "Invest in research to deliver solutions to foster environmental resilience"" Technology to improve more	3.60 (23)
	Practical implementations Research and Development	Highlights the need for the research and development of technology, initiatives, innovations, or implementations to mitigate human activity to the environment (tangible rather than collaborative or social governance based).	"Blue and teal carbon sequestration opportunities.", "Blue-carbon from rehabilitating wetlands". "Transitioning agriculture to adapt to climate change", "Many community members are highly motivated to help address issues around climate change and other environmental degradation", "Climate resilient infrastructure" "Innovative Agriculture and Aquaculture practices, and Renewable Energy and green infrastructure Development", "Invest in research to deliver solutions to foster environmental resilience"" Technology to improve more	3.29 (21)

	Countering Pollution	Pollution and rubbish countering, removal, or reduction.	efficient [sic] use of water in the system" "Rubbish clean up", "Reduction of toxic pesticides and fertiliser from farms upstream..." "Provide timely and well researched information to local population on potential health exposures due to events or changes in CLLM region..." "Building local energy-efficient, climate-resilient housing retrofits that keep older residents safe and comfortable."	2.35 (15)
	Human Health Impacts	Investigation into physical and/or mental health issues resulting from human environmental impacts.	"Nil.", "Nothing positive will happen. Death and destruction will occur. Weather will continue to become bad." "Not sure", "You're the experts, you tell me :)" "15 years is not long in the context of large programs.", "Help to regulate some ethics". "To expand beyond research and have a physical presence in environmental projects in the CLLMM region.", "Brilliant venue"	0.78 (5)
Other	Little or None	No opportunities identified		1.41 (9)
	Don't Know	Relates not knowing or being unsure.		4.23 (27)
	Other	Low scoring or outliers.		6.42 (41)
	Talking about CLLMM research Centre	Participant appears to be referring to the CLLMM Research Centre rather than CLLMM Region.		0.47 (3)

Appendix I. Phase 1 CLMM Horizon Scan Survey Thematic Analysis Results: Important and Novel Research Questions Suggested by Participants

Value Theme	Subtheme	Definition	Examples/Descriptions of text	Frequency % (n)
Research and Interventions	Human Systems - Government and Management	Questions regarding the capacity of human systems to deal with challenges. Including governance, management processes, funding, initiatives and research.	"How to get government, developers etc. on board with solutions that balance human use of the region...", "What policy, market, and legal architectures (tenure, additionality, benefit-sharing) are needed to channel revenues to on-Country management and to fair and equitable transitions for local irrigators and communities?", "Program funding sustainability"	12.52 (80)
	Promoting action	Questions around improving implementations, action, or awareness. (e.g. science communication). Includes research into what goals we should be aiming for, or in how to educate the public.	"Awareness raising of issues within the community", "Why are people SO opposed to new cultural practices", "How to help people understand and prepare for coming ecosystem changes?", "How can the everyday person help".	9.86 (63)
	Human Adaption Challenges	Questions regarding the challenges (or investigation thereof) that humans will experience while adapting to future challenges.	"The true cost of change and adaptation - it will be the inconvenient truth", "How can we adapt to the impacts of climate change to maximise benefit to our precious natural environment", "Climate adaptation from multiple perspectives (species physiological adaptation, economic, social)."	5.16 (33)
	Barrages and Saltwater Flow into the Lakes	Questions regarding the investigation of barrage function or the impacts of their removal. May also suggest changing lakes to a tidal system, or infrastructure additions for lake to sea water management.	"What and where will be the impact if the barrages are removed and the CLMM region is allowed to be flooded with seawater.", "How quickly can the freshwater environment upstream of the barrages adjust to higher and more frequent overtopping of the barrages?"	4.07 (26)
	Water and Waterways Management	Questions regarding regulation and management of water and waterways, including management of the Murray River, dredging the Murray	"How to maintain enough water flow and releases to ensure ecosystem remains healthy", "Impacts of dredged sand build up at the Murray Mouth on the natural environment.", "How can we	12.52 (80)

	Predicting Impacts	Mouth, or management of the Coorong's waters. Questions about predicting threats and outcomes and potentially meeting/mitigating them.	get more water into our CLLMM region?" "Predict impacts and identify mitigations", "Impact of temperature increases e.g. 2 degree / 3 degree global warming on major endemic and introduced species (including economic crops) currently in region", "How will the Coorong look in 100 years' time?"	7.36 (47)
Industry and Energy	Primary Industries' Needs	Questions about the needs of primary industries, how these will be affected, or their sustainability increased.	"How we can use freshwater to support fisheries so we can use the CLLMM for food", "What industries/food productions/recreational activities might need to find other locations with suitable resources available and how would this happen"	3.76 (24)
	Impacts of Primary Industries	Questions mentioning the impacts of primary industries on the environment.	"The water quality and volume are significantly affected by farming practices throughout the MDB", "How to prevent chemicals and fertilizers from entering the system", "What is the impact of commercial net fishing for juvenile mullocky in the Coorong on the biomass of mullocky statewide?"	7.98 (51)
	Tourism	Questions regarding tourism in the area. Includes impacts, mitigation, needs or ways to improve or reduce.	"How can tourism fund and educate conservation in our regions", "Exploring the relationship between biodiversity and tourism", "Tourism is important, but needs careful regulation to prevent the negative aspects of over tourism that are happening elsewhere"	2.19 (14)
	Energy needs	Questions around the impacts of energy production. Includes sustainable solutions, or mitigating current impacts (e.g. carbon systems)	"Are renewables really environmentally friendly", "Desalination plant and green energy options", "Tools to ensure an environmentally sustainable transition to renewables"	0.94 (6)
Community Wellbeing and Collaboration	Individuals' Wellbeing	Questions focusing on individuals' wellbeing levels and/or safety. Including physical and mental health.	"How any decline in the health of the CCLLMM waterways will impact psycho-social health of residents and visitors.", "How can community mental and physical health be maintained in the face of declining River Health?"	4.23 (27)
	Society and Community	Questions focusing on community or	"Socio-economic studies on community resilience.", "How do we attract people to live	6.89 (44)

		societal factors or impacts.	and work in the area?", "How could we have supported the environment + the land whilst still growing as a community?"	
	Culture	Questions mentioning culture, either its impact, need for change, or threats to.	"How do we protect the environment and our way of life in the face of climate change.", "Identifying which areas of native growth around CLLMM exist, their cultural and environmental significance, and how protect them during rapid development.", "What sustainable water management strategies can adapt to climate change and preserve cultural heritage?"	3.60 (23)
	Economic	Questions focusing on economic opportunities, impacts, or capacities.	"There has not been any study on the economics of greater environmental flows", "How can we, both as individuals and corporations, mitigate the impact that the changing climate has on... the economy"	3.76 (24)
	First nations	Questions that highlight the need for increased collaboration and consultation with, or support of/impacts on, first nations people and their knowledge and culture.	"Someone should actually ask the Ngarindjeri families what they think instead of just talking about them. They know this place better than anyone.", "How do we genuinely and effectively bring together Indigenous knowledge with Western science for land management?", "Protecting indigenous heritage and knowledge"	6.10 (39)
	Community collaboration and consultation	Questions on how to increase community input, collaboration, and consideration in research.	"What can we do to unite the various citizen and scientific communities in the region?", "Engaging local Community in mitigation activities they can adopt and apply", "How to expand citizen science projects to be relevant and inspiring to a wider range of local residents?"	8.14 (52)
Environmental Questions	Environment Protection and Rehabilitation	Questions regarding the environment in general, including its protection, rehabilitation, or resilience.	How do we protect the environment and our way of life in the face of climate change.", "Solution to current environmental issues", "What restoration efforts can be undertaken".	15.34 (98)
	Biodiversity.	Questions regarding biodiversity, ecology, ecosystems. Includes mentions of fauna and flora.	"How can we improve/rehabilitate the surrounding plant and animal life in our waters such that a healthy balance is	25.20 (161)

			restored?", "What changes are occurring annually in fish stocks, what issues are evident and what should be done to address them"	
	Invasive species	Questions regarding invasive species research or focus, including invasive flora, fauna, or diseases.	"How can we protect our river system from added nutrients and introduced species", "How to remove cats effectively."	5.63 (36)
	Land Health and Impacts	Questions regarding the management, protection, or restoration of dry land surrounding the CLLMM area.	"How we are impacting the region with our recreational activities Sand dune erosion caused by vehicles on beaches"	2.35 (15)
	Water and Water Systems Health	Questions regarding the protection or restoration of water systems, (may include mention water pollution/nutrient run off). May mention impact of low flows or water quality.	"What would a healthy but variable estuarine Lower Lakes ecosystem look like?", "how to cycle the water level in lakes to encourage restoration", "Water quality stability"	16.59 (106)
	Algal Bloom	Any mention of research needed into the current algal bloom, its eradication, its impacts, or potential for future outbreaks.	"How do we manage marine algal blooms?", "Impact of algal blooms on fish and aquatic identify forms"	4.38 (28)
	The Coorong	Questions mentioning or focusing on the Coorong/South lagoon, its current or future health, or management.	"Affect [sic] of consistent water levels coming in and out of the Coorong irregularly changing/eroding the shoreline.", "How will the Coorong survive and adapt?"	5.63 (36)
Future Proofing	Climate Change and Temperature rise	Mentions of climate change, or rising temperatures, and/or their impacts as the focus of, or component of, the question.	"What adaptive changes to the effects of climate change can be observed along the CLLMM?", "How can we reduce temperature [sic] increases"	12.52 (80)
	Extreme weather events impacts	Specifically mentions extreme weather or weather events	"Recognition of impact of increased wind events on both river/lakes and ocean, and its impact on residents as well", "Prepare for extreme weather conditions."	0.63 (4)
	Water Security	Questions regarding reduced water levels, flow, or water quality as a resource that is threatened.	"How to ensure fresh water for those in the area (especially when the demand on Murray water upstream becomes greater).", "Reduction in river flows", "How to deliver sufficient freshwater inputs amongst competing water demands in the MDB under a drier climate"	7.36 (47)

	Drought	Mentions drought (may refer to impacts of, frequency, or as a background concern for the research question).	"Analysis of drought recovery on biodiversity across CLLMM as a case study of climate change.", "How can we build ecosystem resilience ahead of anticipated climate impacts, including drought?"	2.19 (14)
	Flooding	Mentions flooding (may refer to impacts of, frequency, or as a background concern for the research question).	"Impact of Flooding and sea level changes", "How will you protect from flooding"	1.41 (9)
	Sea level rise	Mentions sea-level rise (may refer to impacts of, frequency, or as a background concern for the research question).	"To enhance resilience to the impacts of sea-level rise and river flooding. [sic]", "What if the sea level rises are greater than predicted - what will be the effect on the shoreline?"	4.07 (26)
	Erosion	Mentions erosion (may refer to impacts of, frequency, or as a background concern for the research question).	"How do we manage the eroding coastline of Younghusband/Sir Rishard Peninsula?", "Sand dune erosion caused by vehicles on beaches"	2.50 (16)
	Salinity	Mentions salinity (may refer to impacts of, frequency, or as a background concern for the research question).	"How can we effectively manage water flows and salinity levels to maintain ecosystem health?", "Which combinations of native plant species are most resilient to future salinity and water-level changes around Lake Alexandrina?"	3.13 (20)
	Impacts of/needs of recreation	Questions focusing on human recreation. Including it needs or impacts.	"Impact on natural areas from increased use for recreation", "addressing recreation vs conservation conflict in the face of expanding population/public use", "Access for boating recreation".	3.13 (20)
	Increasing populations	Questions focusing on rising populations. Includes mentions of local housing development and associated pressures.	"How do we balance expanding housing needs with local environment protection?", "Increased population in Goolwa/Hindmarsh Island increasing effluent and pressure on the environment."	6.10 (39)
	Pollution	Questions regarding investigation of pollution, water born or otherwise. May include discussion of "run off", "chemicals", or "nutrients" (as contamination).	"How can nutrient outflow from the Murray be significantly reduced?", "How to stop run off farms", "dealing with effects of chemicals and pesticides"	3.76 (24)
Big Pictures: Systems Interactions	Human Systems Interacting	Questions on the interplay of multiple human factors,	"How does a local group positively impact a global issue.", "How to balance	3.76 (24)

	with Human Systems	systems, or motivations, and their impacts or needs.	differing priorities in the region."	
	Human Systems interacting with Environmental Systems	Questions on the interplay of human systems with environmental systems (including factors, motivations, impacts, and/or needs)	"What practical, low-cost methods can landowners use to help restore the land and water health?", "How is the best environmental outcome achieved with many different stakeholders all trying to be seen, heard and funded by the same basic sources."	10.02 (64)
	Environmental Systems Interacting with Environmental Systems	Questions on the interplay of multiple environmental factors or systems, and their impacts or needs.	"How the health of the CCLLMM waterways impact upon the health of the wider region: Encounter Bay, Backstairs Passage, KI and the SV & S Gulfs and the great Southern Reef.", "How much connectivity is there between the CLLMM and other important wetland habitats, from local to basin to continental and worldwide scales?"	2.50 (16)
Other	Other	Low scoring or outlier questions and topics.	"Effect of anti-climate change corporate activists on regeneration activities.", "How to overcome misguided and outdated fear of darkness and reliance on artificial light which defiantly maintains a barrier between humans, our origins and nature"	7.20 (46)
NA	NA, None, or Don't Know.	Responses of NA, none, or not knowing.	"Not a clue", "Don't know", "That's too hard for me on the spot. I'd like to do that in a group."	4.85 (31)
	Questioning Climate Change	The participant questions the premise of climate change.	"The myth of climate change, been living here 30 years and have seen it all many times previously.", "Changing of the seasons due to constant global change for the last 10000 years a natural process of the globe still growing and therefore changing"	0.47 (3)

Appendix J. Ranked Topic Results from the Workshop Process with Separate Criteria Rankings

Table 11. Workshop Total Results Listed in Sequential Order from Highest to Lowest with Phase 1 Horizon Scan Totals for Comparison

Theme	Subtheme	Workshop Survey Totals % (survey score)	Horizon Scan Total % (n)
Water	Reduced or Unpredictable Water Availability	86.33 (518)	24.57 (157)
Water	General water quality and health	83.83 (503)	10.95 (70)
Climate	Changes in Climate and Climate Extremes	82.50 (495)	13.46 (86)
Climate	Drought	82.42 (494.5)	7.67 (49)
Climate	Sea-level Rise	80.75 (484.5)	6.89 (44)
Nature	Environment and Ecosystems	80.67 (484)	18.78 (120)
Climate	Extreme weather events	80.00 (480)	4.85 (31)
Nature	Invasive species	77.58 (465.5)	5.01 (32)
Nature	Threats to Fauna	76.25 (457.5)	15.65 (100)
Climate	Increasing temperatures	76.17 (457)	8.45 (54)
Water	Algal Blooms	76.08 (456.5)	10.17 (65)
Nature	Threats to Flora	75.33 (452)	11.74 (75)
Water	Salinity	73.00 (438)	9.23 (59)
Climate	Flooding	69.92 (419.5)	3.44 (22)
Climate	Bushfires	66.00 (396)	1.56 (10)

Table 12. Workshop Criteria Results Listed in Sequential Order from Highest to Lowest, Criteria: Importance

Theme	Theme	% (Sum)
WATER	Reduced or Unpredictable Water Availability	95.00 (95)
NATURE	Environment and Ecosystems	92.00 (92)
CLIMATE	Changes in Climate and Climate Extremes	89.00 (89)
CLIMATE	Drought	89.00 (89)
WATER	General water quality and health	87.00 (87)
CLIMATE	Sea-level Rise	86.00 (86)
NATURE	Threats to Flora	85.00 (85)
NATURE	Invasive species	84.00 (84)
CLIMATE	Extreme weather events	84.00 (84)
NATURE	Threats to Fauna	83.50 (83.5)
CLIMATE	Increasing temperatures	83.00 (83)
WATER	Salinity	77.00 (77)
WATER	Algal Blooms	73.00 (73)
CLIMATE	Flooding	70.50 (70.5)
CLIMATE	Bushfires	66.50 (66.5)

Table I3. Workshop Criteria Results Listed in Sequential Order from Highest to Lowest, Criteria: Urgency

Theme	Subtheme	% (Sum)
WATER	Reduced or Unpredictable Water Availability	91.00 (91)
WATER	General water quality and health	88.00 (88)
NATURE	Environment and Ecosystems	87.00 (87)
CLIMATE	Drought	86.00 (86)
CLIMATE	Changes in Climate and Climate Extremes	84.00 (84)
NATURE	Threats to Fauna	82.50 (82.5)
NATURE	Threats to Flora	81.50 (81.5)
NATURE	Invasive species	80.00 (80)
CLIMATE	Extreme weather events	79.00 (79)
WATER	Algal Blooms	77.00 (77)
CLIMATE	Sea-level Rise	75.00 (75)
WATER	Salinity	72.00 (72)
CLIMATE	Increasing temperatures	73.00 (73)
CLIMATE	Flooding	68.50 (68.5)
CLIMATE	Bushfires	61.50 (61.5)

Table I4. Workshop Criteria Results Listed in Sequential Order from Highest to Lowest, Criteria: Feasibility and Capacity

Theme	Subtheme	% (Sum)
WATER	Reduced or Unpredictable Water Availability	82.00 (82)
WATER	General water quality and health	77.00 (77)
CLIMATE	Drought	77.00 (77)
CLIMATE	Sea-level Rise	76.00 (76)
WATER	Salinity	74.00 (74)
NATURE	Environment and Ecosystems	73.00 (73)
CLIMATE	Changes in Climate and Climate Extremes	73.00 (73)
CLIMATE	Extreme weather events	73.00 (73)
CLIMATE	Increasing temperatures	73.00 (73)
NATURE	Threats to Flora	72.00 (72)
NATURE	Threats to Fauna	71.00 (71)
CLIMATE	Flooding	71.00 (71)
NATURE	Invasive species	69.00 (69)
CLIMATE	Bushfires	68.00 (68)
WATER	Algal Blooms	66.00 (66)

Table 15. Workshop Criteria Results Listed in Sequential Order from Highest to Lowest, Criteria: Decision Making

Theme	Subtheme	% (Sum)
WATER	Reduced or Unpredictable Water Availability	94.00 (94)
WATER	General water quality and health	84.00 (84)
CLIMATE	Drought	82.00 (82)
CLIMATE	Sea-level Rise	82.00 (82)
CLIMATE	Changes in Climate and Climate Extremes	81.00 (81)
NATURE	Invasive species	80.00 (80)
CLIMATE	Extreme weather events	80.00 (80)
NATURE	Environment and Ecosystems	79.00 (79)
NATURE	Threats to Fauna	78.00 (78)
WATER	Algal Blooms	75.00 (75)
WATER	Salinity	75.00 (75)
NATURE	Threats to Flora	74.00 (74)
CLIMATE	Increasing temperatures	73.00 (73)
CLIMATE	Flooding	73.00 (73)
CLIMATE	Bushfires	65.00 (65)

Table 16. Workshop Criteria Results Listed in Sequential Order from Highest to Lowest, Criteria: Knowledge Gap

Theme	Subtheme	% (Sum)
WATER	Algal Blooms	77.50 (77.5)
CLIMATE	Changes in Climate and Climate Extremes	75.00 (75)
CLIMATE	Extreme weather events	75.00 (75)
CLIMATE	Sea-level Rise	74.50 (74.5)
WATER	General water quality and health	70.00 (70)
NATURE	Invasive species	70.00 (70)
CLIMATE	Increasing temperatures	70.00 (70)
CLIMATE	Drought	68.50 (68.5)
NATURE	Environment and Ecosystems	67.00 (67)
NATURE	Threats to Fauna	62.00 (62)
WATER	Salinity	61.00 (61)
CLIMATE	Bushfires	61.00 (61)
CLIMATE	Flooding	60.50 (60.5)
NATURE	Threats to Flora	60.00 (60)
WATER	Reduced or Unpredictable Water Availability	59.00 (59)

Table 17. Workshop Criteria Results Listed in Sequential Order from Highest to Lowest, Criteria: Relevance to Stakeholders

Theme	Subtheme	%
WATER	Reduced or Unpredictable Water Availability	97.00
WATER	General water quality and health	97.00
CLIMATE	Changes in Climate and Climate Extremes	93.00
CLIMATE	Drought	92.00
CLIMATE	Sea-level Rise	91.00
CLIMATE	Extreme weather events	89.00
WATER	Algal Blooms	88.00
NATURE	Environment and Ecosystems	86.00
CLIMATE	Increasing temperatures	85.00
NATURE	Invasive species	82.50
NATURE	Threats to Fauna	80.50
NATURE	Threats to Flora	79.50
WATER	Salinity	79.00
CLIMATE	Flooding	76.00
CLIMATE	Bushfires	74.00

