



National Environmental Science Programme

# Perceptions and information disclosure of water quality issues in Australia

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Project C4 – National Outfall Database  
13 February 2019

*Milestone 10 – Research Plan v3 (2017)*



**National  
Outfall  
Database**



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## Preferred Citation

*Rohmana, Q. A., Fischer, A., & Gemmill, J. 2019. Perceptions and information disclosure of water quality issues in Australia. Report to the National Environmental Science Program, Marine Biodiversity Hub. Clean Ocean Foundation.*

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## Acknowledgement

This work was undertaken for the Marine Biodiversity Hub, a collaborative partnership supported through funding from the Australian Government's National Environmental Science Program (NESP). NESP Marine Biodiversity Hub partners include the University of Tasmania; CSIRO, Geoscience Australia, Australian Institute of Marine Science, Museums Victoria, Charles Darwin University, the University of Western Australia, Integrated Marine Observing System, NSW Office of Environment and Heritage, NSW Department of Primary Industries.

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## 1. INTRODUCTION

Changes to marine environment health in the coastal zone are becoming more complex, pervasive and are occurring at a much faster rate, primarily due to human-related activities (Cloern et al., 2016). Wastewater disposal into the marine environment is a key factor leading to the deterioration of coastal water quality. Poorly managed disposal can lead to increased concentrations of nutrients, organic and inorganic pollutants, as well as alter levels of turbidity, pH and bacteria (Beck and Birch, 2012, Carey and Migliaccio, 2009, Cheung et al., 2015). An increase in the level of pollutants can have an impact on coastal ecology and biodiversity and affect the health of recreational users (Boehm et al., 2017, Reopanichkul et al., 2009, Schwarzenbach et al., 2010). Often the marine-related businesses, such as oyster farm, are also affected due to high level of bacteria contamination which causes less production during harvest season (Campos et al., 2015).

In order to reduce water quality degradation, there is a need to increase communication between the relevant stakeholders and the general community. The effectiveness of science communication will enable the general public to make a sound choice regarding the environmental issues as well as helping the decision makers to improve the marine environment management (Mea et al., 2016). Public notifications, particularly in relation to water quality events, play an active role in managing health risks for both humans and the environment. However, public notification or mis-notification can be fraught with errors (Thoe et al., 2014). For instance clean beaches can be closed inadvertently because managers may feel unsure of the spatial extent of water contamination. On the other hand, contaminated beaches may remain open, because due to the time mismatch between sampling and notification (Pendleton, 2008). Around the world, programs have been developed to notify the public about water quality issues. For instance, the Beachwatch monitoring program NSW, which was started in 1989 in response to community concern about sewage pollution washing up on Sydney's beaches (Beder, 1991, OEH, 2019). However, amongst the programs, communication practices are variable and lack formal evaluations for their effectiveness (Pratap et al., 2011).

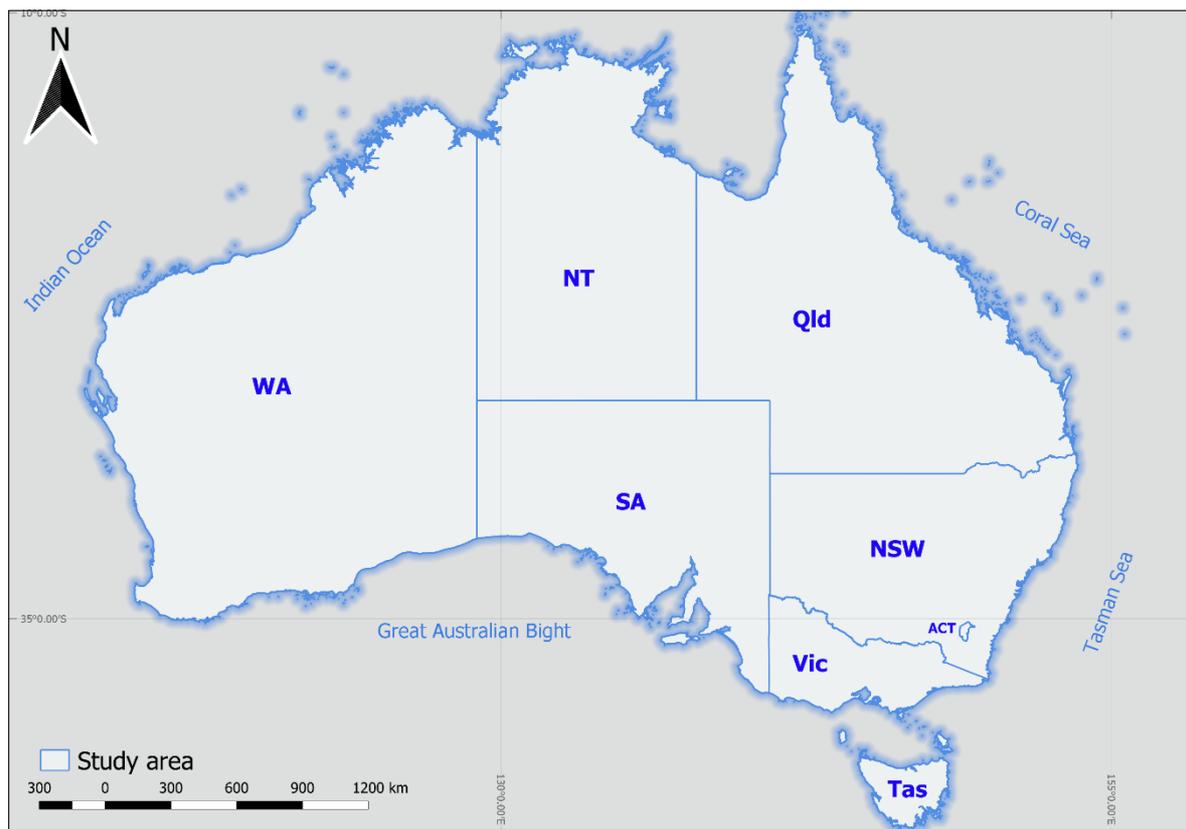
Consideration of public perception is important for assessing the effectiveness of notification programs and managing the risks and behaviour of the public with regard to recreational water usage. Public perception research is critical in this regard as a means of assessing science and policy initiatives (Gelicich et al., 2014, Jefferson et al., 2015, Treise and Weigold, 2002). The purpose of this research is to gain an understanding of user perceptions and information disclosure of water quality events around Australian coastal regions. Water quality changes may be caused by different events such as sewage release and stormwater run-off into an estuary or the coastal ocean. This may cause declines in water quality and potential health issues through contact with the affected water. Sewage runoff may occur in dry weather because of problems with, for example, mechanical failure at wastewater treatment plants. Wet weather may also cause the capacity of the wastewater treatment plants to be exceeded because of large volumes of stormwater in the sewer system. Sewage run-off has some characteristics, which may be detected by odour, sight, water discoloration, turbidity, and oily films.

This research aims to gather information about community perception of where water quality events occur, whether they are linked to weather events, and the effectiveness of communication efforts to notify the community of the occurrence of these events. This research is important as it assesses an understanding of perceptions, behaviours and expectations of the community using water bodies that may be affected by water quality events. Research has found that improved knowledge and communication of water quality in coastal areas can improve individual's management of health risk associated with bypass events.

## 2. METHODS

This study was conducted nationwide, across Australian coastal areas (Figure 1). The survey targeted key stakeholders of registered recreational user groups, environmental groups, and marine-related businesses (Table 1). The list and total number of registered

Figure 1. Study area of bypass perception research along the Australian coastal border.



groups were obtained from respective national-level, umbrella (US Legal Inc., 2016) organization websites. Registered groups on these websites were used to compile the population of key stakeholders targeted for the survey. The key stakeholder population for these groups around Australia is 3,818 (Table 1). A representative sample size was calculated at the 90% confidence interval and with a margin of error of 10%. The sample size was calculated using Cochran's sample size formula

$$n_o = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N} \left( \frac{z^2 pq}{d^2} - 1 \right)}$$

where  $z$  is the value for the selected alpha level ( $\alpha = 0.10$ ),  $p$  is the degree of variability,  $q$  is  $1-p$ ,  $d$  is the acceptable margin of error for proportion being estimated or the confidence

interval, and  $N$  is the population size (Cochran, 1977). Based on Cochran's formula a sample size of 67 was required to represent the population.

Table 1. List of targeted stakeholder groups, the total number of registered groups throughout Australia, identified by their respective survey user group type (see Appendix A, question 4) and the sources of this information.

Target Stakeholder	Amount	User Group	Source
Surf Live Saving Clubs	393	Recreational	sls.com.au
Sailing and Yacht Clubs	365	Recreational	sailing.org.au
Canoe Clubs	256	Recreational	paddle.org.au
Game Fishing Clubs	83	Recreational	gfaa.asn.au
SCUBA	148	Marine-related business	padi.com
Aquaculture	215	Marine-related business	aussiefarms.org.au
Fishing charters	271	Marine-related business	fishingcharterbase.com
Marinas	356	Marine-related business	marinas.net.au
Environmental Groups	1,731	Environmental	aegn.org.au
<b>Total</b>	<b>3818*</b>		

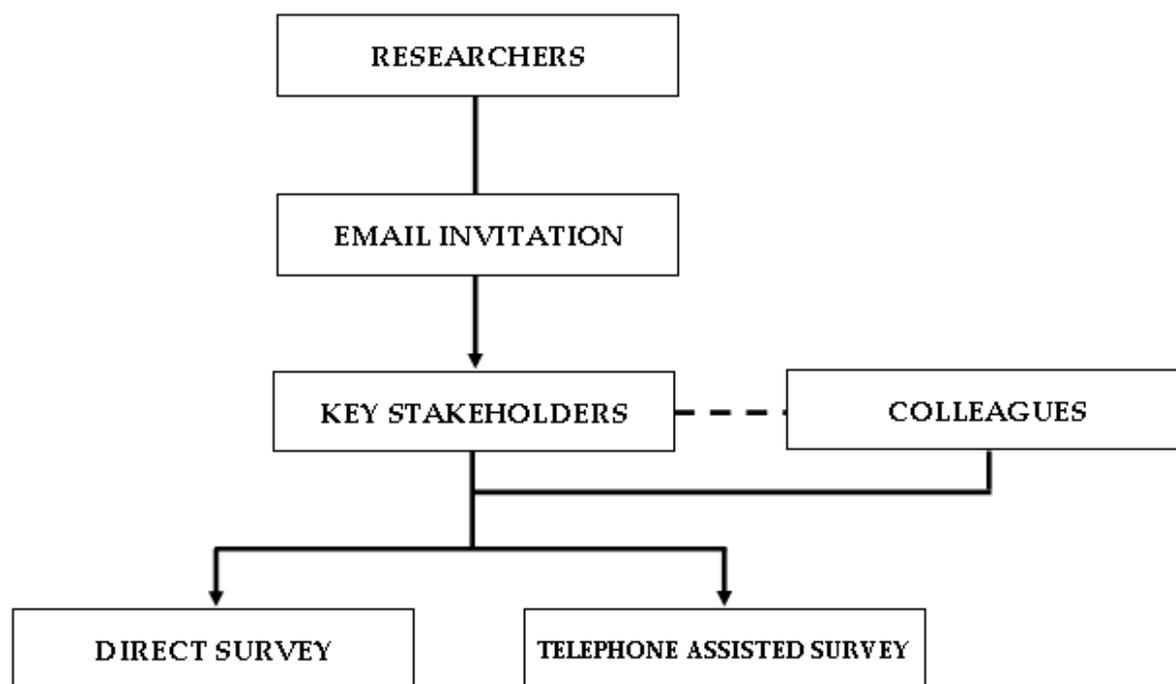
\*Population size

Specific key stakeholders were identified through publicly available contact information on umbrella organization websites. Key stakeholders were sent an email invitation requesting participation. Approximately 258 key stakeholders, representing approximately 90 people from each of the user groups, were sent invitations to participate. Participants under the age of 18 were not permitted to participate in this study. This did not bias the results, as the survey targeted key stakeholders, in leadership positions at the various organizations. Despite accessing the survey online, the participants were also allowed to receive help to complete the survey by contacting the researchers directly.

The procedure for administering the survey is shown in Figure 2. The survey was administered primarily through an online survey tool (SurveyMonkey). Participants were anonymous, and data was non-identifiable. For participants conducting a telephone-assisted survey, only the chief investigator and co-investigator had some knowledge of the identity (e.g. name, organization, position) of an individual and their survey responses. Telephone assisted surveys were entered via online portal immediately after participants responded and the results and analysis were reviewed without knowledge of the individual identifiers or survey responses. The survey itself took approximately 10-15 minutes to complete.

A survey instrument was developed to explore the aims of the project (Appendix A). It consisted of 21 questions with five sub-questions including yes no, one Likert scale, 10 multiple choices, and five open-ended style questions. This survey covered topics regarding the group identification (Q1, 2, 3, 4), residency (Q5, 67), marine environment user activities

Figure 2. Process recruitment of the survey participants.



(Q7, 8, 9, 15, 17), knowledge of what sewage runoff events are (Q10, 11, 12, 18), when sewage runoff events occur, whether they are linked to rainfall events or extreme weather conditions (Q13, 14), and communication effectiveness of the occurrence of these events to the recreational users (Q19, 20, 21). The information sheet was sent along with the direct online survey access describing the aims of the project and information that will be used for.

The development of the survey was conducted over several weeks of research and discussion between project principal investigators. Survey questions were also peer reviewed to reduce the bias within the questions. A series of survey trials were undertaken to assess the timing and general understandability of the questions and the survey format. Comments and feedback from these trials were incorporated into the survey. This study was approved by the Tasmanian Social Sciences Human Research Ethics Committee (ethics reference number: H0017209) on 26 June 2018.

## 2.1 Statistical Analysis

In order to measure the extent of relationships between pairs of variables, Kendall's Tau rank correlation (Kendall, 1938) was used to analyse the correlation between the frequency of water interaction (Q8) and water quality observation (Q10), outfall awareness (Q18) and notification agreement (Q21), frequency of water interaction (Q8) and notification agreement (Q21), and notification of event (Q19) and notification agreement (Q21). Kendall's tau ( $\tau$ ) is a non-parametric measure of relationships between columns of ranked data. Kendall's tau ( $\tau$ ) is defined as

$$\tau = \frac{(\text{number of concordant pairs}) - (\text{number of discordant pairs})}{n(n - 1)/2}$$

where  $n$  is the number of observations. The correlation coefficient ( $\tau$ ) returns a value of -1 to 1, where 0 is no relationship and 1 is a perfect relationship. If the number of concordant pairs is much larger than the number of discordant pairs then the variables are positively correlated. If the number of concordant pairs is much less than the discordant pairs, then the variables are negatively correlated. If the number of concordant and discordant pairs are about the same, then the variables are weakly correlated.

The second-order Rao Scott's chi-square test was conducted to assess the dependency probability of multiple response categorical variables (MRCVs) (Rao and Scott, 1979, Rao and Scott, 1984). Rao Scott's chi-square is a corrected version of the Pearson's chi-square test. Pearson's chi-square is computed as:

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}$$

Where  $\chi^2$  is the Pearson's cumulative test statistic,  $O_i$  is the number of observations of type  $i$ ,  $E_i$  is the expected count of type  $i$ , and  $n$  is the number of cells in the table. The Rao-Scott chi-square is the Pearson's chi-squared corrected with a generalized design effect (Rao and Scott, 1984). The chi-squared statistic is a measure of how similar two categorical probability distributions are. If the two distributions are identical, the chi-squared statistic is 0, if the distributions are very different, some higher number will result. This test was applied for Q12 (water quality issues) and 13 (cause of water quality issues), and Q7 (activity groups) and 10 (water quality observation).

## 3. RESULTS

### 3.1 Participants

Two hundred sixty-five surveys were distributed to willing survey participants. Of the 265 distributed, only 77 were completed for a 30% response rate resulting in a margin of error 11% at a 95% confidence interval. Table 2 shows that the majority of participants were recreational users (52%), followed by businesses (39%), and environmental organizations (34%). Approximately, 29%, 27%, and 21% of the participants were from Tasmania, Queensland, and New South Wales, respectively, 16% participants from Victoria, and six and one percent were participants of Western Australia and Northern Territory, respectively. Survey participants were in direct contact with water through various activities, boating (56%), work related activities (44%) (e.g. farming, monitoring and management), and swimming (43%). Almost half of the participants came in contact with water everyday (44%), 27% interacted a few times a week, and 12% and 10% about once a week and a few times a month, respectively. About 68% of the respondents said that they have been using the marine environment for more than 20 years. 32% said that they were using it for less than 20 years.

Table 2. Respondents characteristics and their marine environment usage.

Subject matter	Results
<b>Samples</b>	<b>77</b>
<b>Representation</b>	
Group	56%
Individual	44%
<b>Participant type</b>	
Recreational user	52%
Business or business association	39%
Environmental group	34%
<b>State origin</b>	
Tasmania	29%
Queensland	27%
New South Wales	21%
Victoria	16%
Western Australia	6%
Northern Territory	1%
Australian Capital Territory	0%
South Australia	0%
<b>Activities</b>	
Boating	56%
Other	44%
Swimming	43%

<b>Subject matter</b>	<b>Results</b>
Surfing/Bodyboarding/Stand-Up Paddle Boarding	42%
Kayaking	34%
Diving/Snorkeling	34%
Whale/Bird Watching	34%
Fishing	34%
Beachcombing	31%
Kite surfing/Wind-Surfing	10%
Spearfishing	4%
<b>Water interaction frequency</b>	
Every day	44%
A few times a week	27%
About once a week	12%
A few times a month	10%
Once a month	4%
Less than once a month	3%
<b>Marine environment utilization period</b>	
More than 20 years	68%
11 – 20 years	19%
6 – 10 years	8%
1 – 5 years	5%
Less than 1 year	0%

### 3.2 Water quality issues

Participants were asked if they were aware of any potential problems that had been affecting the water quality in their area of recreation or use over the preceding twelve-month period (Table 2). Approximately 52% participants answered no and 48% yes. Participants who answered, "yes," continued to answer questions regarding the observed water quality problems, including frequency, types of the problem, and causes (Table 3).

Table 3. Participants awareness of water quality issues. N is the number of samples.

<b>Answer choice (N)</b>	<b>Results</b>
<b>Samples</b>	<b>77</b>
<b>Water quality awareness</b>	
No (40)	52%
Yes (37)	48%

The reported issues were mostly due to water discoloration (65%), followed by observation of plastic debris (57%) and cloudy conditions (49%). Other reported issues (41%) were related

to cloudy conditions, presence of debris, and water discoloration. The potential causes of these issues were typically perceived to be related to heavy rain (78%), stormwater release (51%), and other pollution related events (49%), such as algal bloom, fish farm operation, urban runoff, and sewer overflows. Approximately half of the respondents who observed pollution events were aware of the potential influence of outfall discharge events on the environment (46%). As well as observing the water quality problems, the participants (84%) also perceived that these issues impacted the environment and wildlife in their areas.

In order to improve the knowledge of individual's management of health risk associated with bypass events, the participants were questioned about the communication effectiveness of any water quality events occurrence to the marine environment users. Approximately, 65% users stated that they had never been notified of any water quality event in their visited areas, while 35% respondents admitted that they were notified. In general, knowledge of water quality events was acquired by other method of communication (65%) including local observation, hearsay, and small signage, followed by personal communication (41%) and 12% from local water authorities' website.

Table 4. Water quality events based on participants observation.

<b>Water quality</b>	<b>Results</b>
<b>Samples</b>	<b>37 out of 77</b>
<b>Water quality event frequency</b>	
4 or more events	41%
2 - 3 times	35%
Once	24%
<b>Water quality issues</b>	
Water discoloration	65%
Presence of Debris - Plastics	57%
Turbid or cloudy conditions in water	49%
Other	41%
Presence of Debris - Wood	35%
Floating films (oily water)	32%
Odour	30%
Presence of Debris - Paper and cardboard	30%
Presence of Debris - Foamed products	27%
Presence of Debris - Cloth	19%
Presence of Debris - Rubber	19%
Presence of Debris - Glass and ceramic	16%
Presence of Debris – Metal	14%
<b>Water quality causes</b>	
Heavy rain	78%
Release of storm water	51%
Other	49%
Estuarine/Lagoon flushing	35%

<b>Water quality</b>	<b>Results</b>
Sewer works	30%
Hot weather	24%
Big surf/Large ocean swell	22%
Don't know	3%
<b>Impact awareness</b>	
Yes	84%
No	16%
<b>Outfall discharge (event) awareness</b>	
No	54%
Yes	46%
<b>Water quality issues notification</b>	
No	65%
Yes	35%
<b>Communication media</b>	
Other	65%
Personal communication	41%
Water authority website	12%
Newspaper	12%
Local signage	12%
Social media	12%
Radio	6%
Water bill	0%

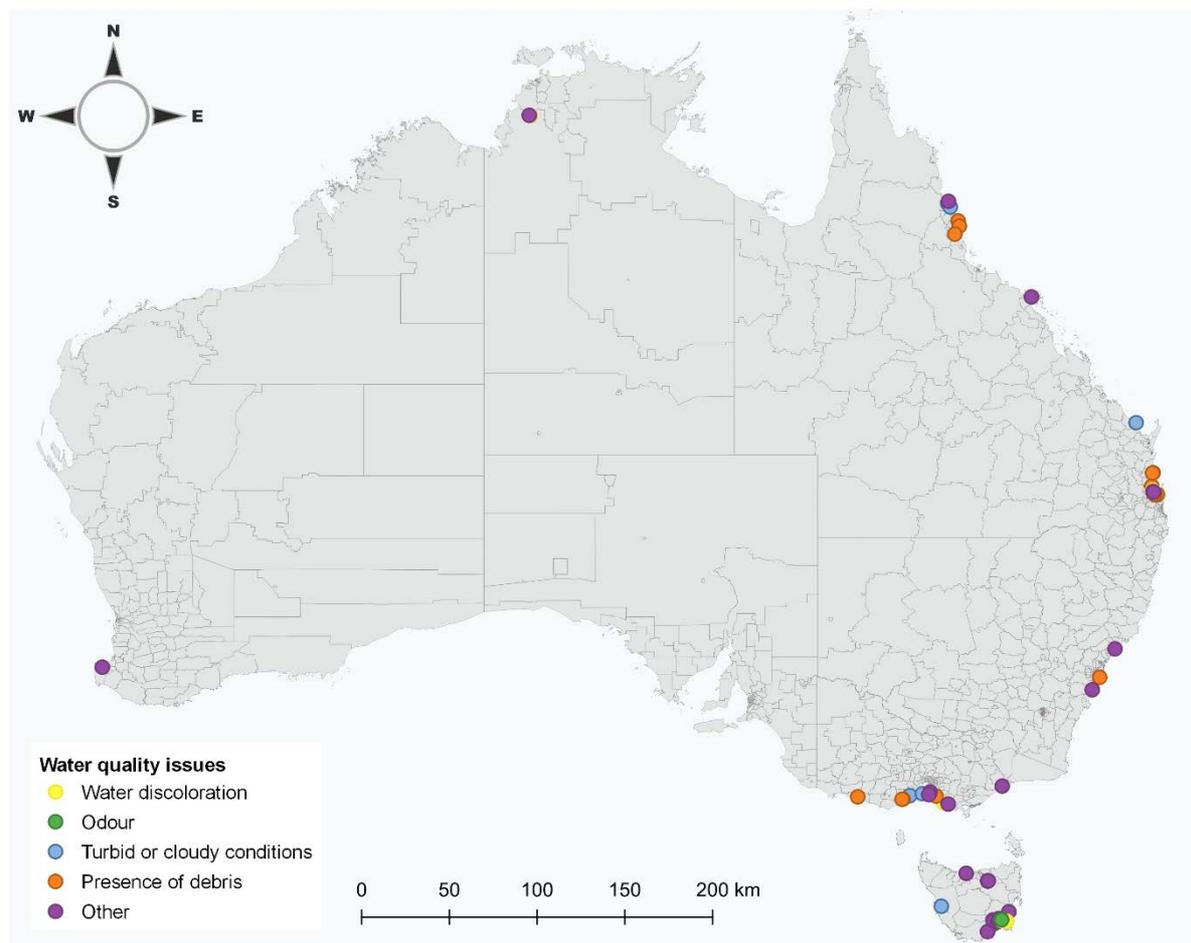
As part of the survey, the participants were also asked whether they agree or disagree with this statement "I would be informed in a timely manner if a change in water quality were to occur in the estuarine and coastal waters that I use" to gauge the communication effectiveness between marine environment users and water authorities. Surprisingly, only a small number of participants which strongly agree (8%) and agree (16%) to be expected to be notified in a timely manner (Table 4). This also proves that many of coastal and marine environment users have never been informed

Table 5. Participants' expectation that they would be notified of any water quality events.

Scale	Results
Strongly disagree	27%
Disagree	41%
Neutral	8%
Agree	16%
Strongly agree	8%

Question 15 asked respondents what type of water quality events have been observed in the 12 months. Of the 62 locations described, 6 (~10%) respondents observed water discoloration, 3 (~5%) cited unusual smells or odours, 6 (~10%) identified turbid or cloudy conditions, 17 (~30%) observed the presence of debris. Debris varied and included plastics, wood, metal, cardboard and Styrofoam. Other water quality events reported (30 (~50%)) included sewage contamination, beach erosion, high levels of bacteria and flooding. A distribution of the observed water quality events is shown in figure 3. No obvious patterns of water quality issues are evident, however, most of the reported water quality issues were reported near the major metropolitan centres on the east seaboard and in Hobart.

Figure 3. Water quality issues location based on respondents' observation.



### 3.3 Statistical Analysis

Table 6 presents the relationships between the levels of use (interaction) of coastal and marine waters and awareness, observation and judicious notification of water quality events. Surprisingly, as the level of interaction or use of the water increased, the frequency of observed water quality events did not increase ( $\tau=0.013$ ). Likewise, as the level of recreational interaction or use of the water increased, respondents did not particularly feel strongly that they were informed or not if a change of water quality had occurred ( $\tau=0.147$ ). Also, the awareness of outfall events was weakly and negatively correlated with whether the respondents felt informed in a timely manner as to whether a water quality event were to occur ( $\tau= -0.124$ ). This could mean that respondents who were aware of outfall events were not informed in a timely manner. Lastly, there was a moderate positive correlation between being notified and being notified in a timely manner. In other words, if a group was notified of

a water quality event, they felt that they were informed in a timely manner about 50% of the time.

Table 6. Kendal's rank correlation coefficient ( $\alpha = 0.05$ ).

X variable	Y variable	$\tau$ value
Frequency of interaction with water (Q8)	Observation of water quality (Q10)	0.0126
Outfall awareness (Q18)	Information statement (Q21)	-0.124
Frequency of interaction with water (Q8)	Information statement (Q21)	0.147
Notification of event (Q19)	Information statement (Q21)	0.552

Two tests using Rao-Scott chi-square were conducted to determine the dependence of one factor or variable on another. Table 7 presents the results of the tests. The cause of the water quality problem was significantly dependent on the observed water quality issues. According to the results, respondents felt that they could typically identify the cause of the problem (e.g. heavy rain, hot weather, sewer works., etc.) that was related to a specific type of water quality issue (e.g. water discoloration, odour, floating films, turbid or cloudy conditions, and the presence of debris etc.). However, the observation or awareness of water quality events was not dependent on the type of activity (swimming, surfing, boating etc.) being conducted in the water.

Table 7. Second-order Rao-Scott chi-square ( $\alpha = 0.05$ ).

Variables	Null - Hypothesis	Results
Issue (Q12) vs. cause (Q13)	The water quality issue is not related to the cause of the problem?	$X^2 = 33.39$ , $df = 19.6$ , $p = 0.0267$ , $n = 77$
Activity group (Q7) vs. water quality event awareness (Q10)	The activity is not related to the water quality observation?	$X^2 = 11.32$ , $df = 5.83$ , $p = 0.0724$ , $n = 77$

## 4. DISCUSSION AND CONCLUSION

This survey was conducted to assess the public perceptions, behaviours, and expectation of targeted communities regarding water quality events in their marine environment. The participants were recreational users, marine-related businesses or business associations, and environmental groups. Our results showed that 37 out of 77 survey participants were aware of water quality issues in the marine environment used for recreation or businesses (Table 4). These participants reported that they had observed from one to more than four water quality events in the last 12 months. The main issues reported were water discoloration, plastic debris, and turbid water, which were thought to have been most likely caused by heavy rains, stormwater released, and other pollution sources.

By stressing the effectiveness of water authorities' communication with the communities, we found that only 35% of participants reported being notified regarding the water quality issues. Approximately, 65% of the participants were notified by other communication media, such as local observation, followed by personal communications (text messages and phone call), and water authority's website. We also found that more than 75% percent believed they would not be informed in a timely manner of any changes in water quality by local authorities. The results of this survey show that respondents who were informed of a water quality event only felt informed in a timely manner about half of the time (Table 6). And, an increased frequency in the use of the marine environment did not necessarily result in an increase in the observations of more water quality events. This may point to a significant deficiency in communication between instrumentalities and stakeholders who use and observe coastal waters that warrants further study. Stakeholders considered that sewer works were one of the factors involved in 30 percent of the observed water quality events, a similar proportion to hot weather and large ocean swells, but less than heavy rain or the release of storm water and respondents seemed to be able to associate the cause of a water quality event to a related cause or problem (Table 7).

In summary, increased usage of the marine environment or type of activity conducted does not necessarily relate to increased observation or awareness of water quality events. However, if water quality events are observed in most cases the cause is relatively easy to identify. At the same time, a significant proportion of those surveyed doubted information of these events would be supplied in a timely manner. This suggests there may be issues related to the quality of the relationship (including communication) between stakeholders and relevant water authorities.

To address this issue, water authorities or any relevant stakeholders may want to increase their water quality education and communication policies. It has been proven that environmental education supports important roles from environmental awareness to environmental responsibility of the general communities (Newig, 2007, Omoogun et al., 2016). This may also reduce the health risk associated with particular water quality events, such as the risk for various types of diseases and infections, most commonly gastroenteritis or skin infections, posing a serious threat to human health in urbanized coastal regions (Betancourt et al., 2014, Boehm et al., 2017, Cheung et al., 2015). Moreover,

communication effectiveness would be able to decrease water quality events as the users will cooperate to resolve the issues – or at least those where suitable interventions are possible (Dickinson, 1996).

## REFERENCES

- BECK, H. J. & BIRCH, G. F. 2012. Spatial and Temporal Variance of Metal and Suspended Solids Relationships in Urban Stormwater-Implications for Monitoring. *Water, Air, & Soil Pollution*, 223, 1005-1015.
- BEDER, S. 1991. Controversy and closure: Sydney's beaches in crisis. *Social Studies of Science*, 21, 223-256.
- BETANCOURT, W. Q., DUARTE, D. C., VÁSQUEZ, R. C. & GURIAN, P. L. 2014. Cryptosporidium and Giardia in tropical recreational marine waters contaminated with domestic sewage: Estimation of bathing-associated disease risks. *Marine Pollution Bulletin*, 85, 268-273.
- BOEHM, A. B., ISMAIL, N. S., SASSOUBRE, L. M. & ANDRUSZKIEWICZ, E. A. 2017. Oceans in Peril: Grand Challenges in Applied Water Quality Research for the 21st Century. *Environmental Engineering Science*, 34, 3-15.
- CAMPOS, C. J. A., AVANT, J., GUSTAR, N., LOWTHER, J., POWELL, A., STOCKLEY, L. & LEES, D. N. 2015. Fate of Human Noroviruses in Shellfish and Water Impacted by Frequent Sewage Pollution Events. *Environmental Science & Technology*, 49, 8377-8385.
- CAREY, R. O. & MIGLIACCIO, K. W. 2009. Contribution of Wastewater Treatment Plant Effluents to Nutrient Dynamics in Aquatic Systems: A Review. *Environmental Management*, 44, 2015-2017.
- CHEUNG, P. K., YUEN, K. L., LI, P. F., LAU, W. H., CHIU, C. M., YUEN, S. W. & BAKER, D. M. 2015. To swim or not to swim? A disagreement between microbial indicators on beach water quality assessment in Hong Kong. *Marine Pollution Bulletin*, 101, 53-60.
- CLOERN, J. E., ABREU, P. C., CARSTENSEN, J., CHAUVAUD, L., ELMGREN, R., GRALL, J., GREENING, H., JOHANSSON, J. O. R., KAHRU, M., SHERWOOD, E. T. & XU, J. 2016. Human activities and climate variability drive fast-paced change across the world's estuarine-coastal ecosystems. *Global Change Biology*, 22, 513-529.
- COCHRAN, W. G. 1977. *Sampling Techniques*, Canada, John Wiley & Sons, Inc.
- DICKINSON, J. 1996. Public Involvement In Environmental Assessment. *Environmental Policy and Governance*, 6.
- GELCICH, S., BUCKLEY, P., PINNEGAR, J. K., CHILVERS, J., LORENZONI, I., TERRY, G., GUERRERO, M., CASTILLA, J. C., VALDEBENITO, A. & DUARTE, C. M. 2014. Public awareness, concerns, and priorities about anthropogenic impacts on marine environments. *Proceedings of the National Academy of Sciences*, 111, 15042-15047.
- JEFFERSON, R., MCKINLEY, E., CAPSTICK, S., FLETCHER, S., GRIFFIN, H. & MILANESE, M. 2015. Understanding audiences: making public perceptions research matter to marine conservation. *Ocean & Coastal Management*, 115, 61-70.
- KENDALL, M. G. 1938. A New Measure of Rank Correlation. *Biometrika*, 30, 81-93.
- MEA, M., NEWTON, A., UYARRA, M. C., ALONSO, C. & BORJA, A. 2016. From science to policy and society: enhancing the effectiveness of communication. *Frontiers in Marine Science*, 3, 168.
- NEWIG, J. 2007. Does public participation in environmental decisions lead to improved environmental quality?: towards an analytical framework. *Communication, Cooperation, Participation (International Journal of Sustainability Communication)*, 1, 51-71.
- OEH. 2019. *Beachwatch water quality program* [Online]. Sydney: The Office of Environment and Heritage, New South Wales. Available: <https://www.environment.nsw.gov.au/topics/water/beaches/beachwatch-water-quality-program> [Accessed 27 May 2019].

- OMOOGUN, A. C., EGBONYI, E. E. & ONNOGHEN, U. N. 2016. From Environmental Awareness to Environmental Responsibility: Towards a Stewardship Curriculum. *Journal of Educational Issues*, 2.
- PENDLETON, L. 2008. The economics of using ocean observing systems to improve beach closure policy. *Coastal Management*, 36, 165-178.
- PRATAP, P. L., DESAI, P. & DOREVITCH, S. 2011. Beach communications: A need for evaluation of current approaches. *Journal of water and health*, 9, 556-568.
- RAO, J. N. K. & SCOTT, A. J. 1979. Chi-squared tests for analysis of categorical data from complex surveys. *In Proceedings of the American statistical association, section on survey research methods*, 58-66.
- RAO, J. N. K. & SCOTT, A. J. 1984. On Chi-Squared Tests for Multiway Contingency Tables with Cell Proportions Estimated from Survey Data. *The Annals of Statistics*, 12, 46-60.
- REOPANICHKUL, P., SCHLACHER, T. A., CARTER, R. W. & WORACHANANANT, S. 2009. Sewage impacts coral reefs at multiple levels of ecological organization. *Marine Pollution Bulletin*, 58, 1356-1362.
- SCHWARZENBACH, R. P., EGLI, T., HOFSTETTER, T. B., GUNTEN, U. V. & WEHRLI, B. 2010. Global Water Pollution and Human Health. *Annual Review of Environment and Resources*, 35, 109-136.
- THOE, W., GOLD, M., GRIESBACH, A., GRIMMER, M., TAGGART, M. L. & BOEHM, A. B. 2014. Predicting water quality at Santa Monica Beach: evaluation of five different models for public notification of unsafe swimming conditions. *Water research*, 67, 105-117.
- TREISE, D. & WEIGOLD, M. F. 2002. Advancing science communication: A survey of science communicators. *Science Communication*, 23, 310-322.
- US LEGAL INC. 2016. *Umbrella Organization Law and Legal Definition* [Online]. US Legal. Available: <https://definitions.uslegal.com/u/umbrella-organization/> [Accessed 14 May 2019].

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## APPENDIX A – SURVEY QUESTION

### PERCEPTIONS AND INFORMATION DISCLOSURE OF WATER QUALITY ISSUES IN AUSTRALIA

#### About Yourself

**Q1. Do you represent a particular group?**

1. No, I am individual.
2. Yes, I do.

**Q2. How many people are represented in your group, organisation or business?**

\_\_\_\_\_ (please state number)

**Q3. Roughly, what percentage of you or your group/organisation/business actively use the marine environment area? \_\_\_\_\_% (please state percentage)**

**Q4. Which of the following best describes yourself or your group? (you may choose more than one)**

1. Recreational user.
2. Business or business association
3. Environmental group

**Q5. In which State/Territory do you or your group reside?**

1. Australian Capital Territory
2. New South Wales
3. Northern Territory
4. Queensland
5. South Australia
6. Tasmania
7. Victoria
8. Western Australia

- Q6. What is your residential postcode\_\_\_\_\_ (please state)?**
- Q7. What sort of activities do you or your group participate in (you may choose more than one)?**
1. Swimming
  2. Surfing/Bodyboarding/Stand-Up Paddle Boarding
  3. Kite surfing/Wind-Surfing
  4. Kayaking
  5. Boating
  6. Diving/Snorkelling
  7. Beachcombing
  8. Whale/Bird Watching
  9. Fishing
  10. Spearfishing
  11. Other (please specify) \_\_\_\_\_
- Q8. How often do you or members of your group interact with the marine environment?**
1. Everyday
  2. A few times a week
  3. About one a week
  4. Once a month
  5. A few times a month
  6. Less than once a month
- Q9. For approximately how many years you or your group have been participating in these activities?**
1. Less than 1 year
  2. 1 – 5 years
  3. 6 – 10 years
  4. 11 – 20 years
  5. More than 20 years

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### **Identification of Water Quality Events**

**Q10. Have you or your group been aware/observed any significant coastal water quality events over the last 12 months?**

1. No. If you answer "No", the survey will end here. Thank you for your participation.
2. Yes.

**Q11. Did this type of event occur more than once? If so, approximately how many times?**

1. Once
2. 2-3 times
3. 4 or more events

**Q12. For all the events you observed, what were the water quality issues? (You may choose more than one)**

1. Water discoloration
2. Odour
3. Floating films (oily water)
4. Turbid or cloudy conditions in water
5. Presence of Debris – Plastic
6. Presence of Debris - Cloth
7. Presence of Debris – Rubber
8. Presence of Debris – Wood
9. Presence of Debris – Glass and ceramic
10. Presence of Debris – Paper and cardboard
11. Presence of Debris – Foamed products
12. Presence of Debris - Metal
13. Other (please specify) \_\_\_\_\_

**Q13. What do you think caused the problem?**

1. Heavy rain
2. Hot weather
3. Sewer works
4. Estuarine/Lagoon flushing
5. Release of stormwater

- 6. Big surf/Large ocean swell
- 7. Other (please specify) \_\_\_\_\_
- 8. Don't know

**Q14. If so, do you think the change in water quality has changed the marine environment or the marine wildlife in the area?**

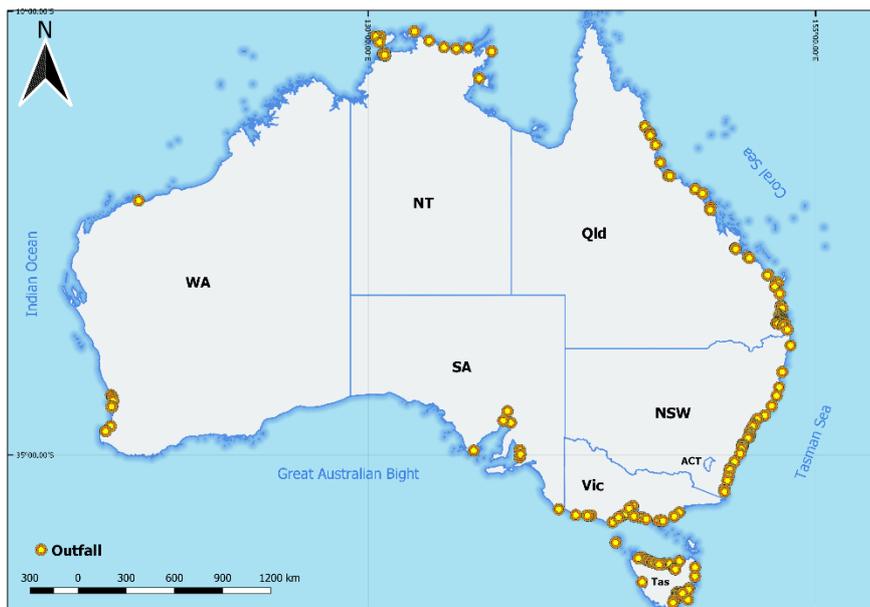
- 1. No
- 2. Yes, how? please specify \_\_\_\_\_

**Mapping your Activity**

In regard to the event(s), that you are aware of, we would now like to ask you the following questions. If the survey is administered online, then please use the online mapping tool. If the survey is being conducted by phone the map will be filled in by the interviewer.

**Q15. Please indicate the location of the water quality issue. If you have experienced more than one event, please number them in from 1 to 5 with 1 being the from the most recent and 5 being the oldest. You may list the location in the space below or open the map provided.**

Figure 4. Example map for respondents to fill.



**Q16. If you would like to, please use the space below to provide any extra detail on the observed event.**

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**Q17. What sort of activities are carried out by yourself or your group in the listed locations? These could be the same as or different to the activities you mentioned earlier. (You may choose more than one)**

1. Swimming
2. Surfing/Bodyboarding/Stand-Up Paddle Boarding
3. Kite surfing/Wind-Surfing
4. Kayaking
5. Boating
6. Diving/Snorkelling
7. Beachcombing
8. Whale/Bird Watching
9. Fishing
10. Spearfishing
11. Other (please specify) \_\_\_\_\_

### **Information Disclosure**

**Q18. Are you or your group aware of any overflow, discharge or pollution event related to sewage outfalls in your area?**

1. No
2. Yes

**Q19. Were you or your group notified about these events?**

1. No
2. Yes

**Q20. How were you notified about these events?**

1. Water authority website
2. Newspaper
3. Radio
4. Personal communication
5. Local signage

6. Water bill
7. Social media
8. Other (Please specify) \_\_\_\_\_

**Q21. How much do you agree with this statement, "I would be informed in a timely manner if a change in water quality were to occur in the estuarine and coastal waters that I use"?**

**(Please circle your response, where 1= STRONGLY DISAGREE and 5 = STRONGLY AGREE).**

<b>STRONGLY DISAGREE</b>	<b>DISAGREE</b>	<b>NEUTRAL</b>	<b>AGREE</b>	<b>STRONGLY AGREE</b>
1	2	3	4	5

Thank you for taking the time to complete this survey. Your responses are very important to the research being conducted. If you have any questions or concerns about this survey or this study, please contact Qurratu A'yunin Rohmana at [qurratu@utas.edu.au](mailto:qurratu@utas.edu.au), or Dr. Fischer on +61 03 6324 3802 or [andy.fischer@utas.edu.au](mailto:andy.fischer@utas.edu.au)

By submitting this survey, you are providing your consent for your responses to be included in this research project – thank you

## APPENDIX B – TARGETED STAKEHOLDER GROUPS

Table 8. List of detailed targeted stakeholder groups for Bypass Perception survey.

Name	State	Group
Friends of Belmont Wetlands Landcare	New South Wales	Environmental group
Trees in Newcastle	New South Wales	Environmental group
Australian Conservation Foundation (Coast Care)	New South Wales	Environmental group
Friends of Narrabeen Lagoon Catchment	New South Wales	Environmental group
Australian Wildlife Conservancy	New South Wales	Environmental group
Total Environment Centre	New South Wales	Environmental group
Marine Discovery Centre	New South Wales	Environmental group
Transition Bondi	New South Wales	Environmental group
Surfrider Foundation	New South Wales	Environmental group
Friends of Malabar Beach	New South Wales	Environmental group
Cumberland Bird Observers Club	New South Wales	Environmental group
Sutherland Shire Environment Centre	New South Wales	Environmental group
Wollongong Conservation Volunteers	New South Wales	Environmental group
Landcare Illawarra	New South Wales	Environmental group
Illawarra Intrepid Landcare	New South Wales	Environmental group
The Coastwatchers Association Inc	New South Wales	Environmental group
Mogo Local Aboriginal Land Council	New South Wales	Environmental group
South East Region Conservation Alliance	New South Wales	Environmental group
Eden Dive (Underwater Research Group of NSW)	New South Wales	Environmental group
Akwa surf Shop	New South Wales	Marine-related business
Burrill Lake Standup Paddleboard Shop	New South Wales	Marine-related business
Culburra Beach Surf School and Hire	New South Wales	Marine-related business
Central Coast Board Hire	New South Wales	Marine-related business
Borderline Surf School	New South Wales	Marine-related business
Graham Barclay Oysters	New South Wales	Marine-related business
Forster Estuary Charters	New South Wales	Marine-related business
MS Verdich & Sons Oyster Farm	New South Wales	Marine-related business
Tathra Oysters	New South Wales	Marine-related business
Manly Sailing	New South Wales	Marine-related business
Cronulla Sailing Charters	New South Wales	Marine-related business
Australis Canoes	New South Wales	Marine-related business
Unhooked Watersports	New South Wales	Marine-related business
Abyss Scuba Diving	New South Wales	Marine-related business
The Oyster Shed	New South Wales	Marine-related business
Bay Rock Oysters	New South Wales	Marine-related business
Narooma Marina	New South Wales	Marine-related business
Underwater Safaris	New South Wales	Marine-related business
Walk on Water	New South Wales	Marine-related business

Name	State	Group
Merimbula Stand Up Paddle Board	New South Wales	Marine-related business
Mitchies Jetty	New South Wales	Marine-related business
Rathlin II Fishing Charters	New South Wales	Marine-related business
Eden Marina	New South Wales	Marine-related business
Le Ba Boardriders	New South Wales	Recreational users
Coff's Coast Bodyboarding Association	New South Wales	Recreational users
Coffs Harbour Boardriders	New South Wales	Recreational users
Ulladulla Boardriders Club	New South Wales	Recreational users
Central Coast Association of Angling Clubs	New South Wales	Recreational users
Bateau Bay Family Fishing Club	New South Wales	Recreational users
Avoca Boardriders	New South Wales	Recreational users
Forresters Board riders	New South Wales	Recreational users
Forster SLSC	New South Wales	Recreational users
Lake Macquarie Yacht Club	New South Wales	Recreational users
Tathra Amateur Fishing Club	New South Wales	Recreational users
Warriewood SLSC	New South Wales	Recreational users
Narrabeen Lakes Sailing Club	New South Wales	Recreational users
Narrabeen Sailing Sub Committee	New South Wales	Recreational users
Manly Yacht Club	New South Wales	Recreational users
Bondi Surf Bathers LSC	New South Wales	Recreational users
Surf Rescue 30	New South Wales	Recreational users
Bellambi Our Place	New South Wales	Recreational users
Wollongong City SLSC	New South Wales	Recreational users
Port Kembla SLSC	New South Wales	Recreational users
Shellharbour Game Fishing Club	New South Wales	Recreational users
Shellharbour SLSC	New South Wales	Recreational users
Batemans Bay Sailing Club	New South Wales	Recreational users
Euro Fishing Association	New South Wales	Recreational users
Narooma SLSC	New South Wales	Recreational users
Bermagui SLSC	New South Wales	Recreational users
Disaster Bay Chillies	New South Wales	Recreational users
East Arnhem Regional Council - Milingimbi	Northern Territory	Government
East Arnhem Regional Council - Milyakburra	Northern Territory	Government
Tiwi Land Council	Northern Territory	Government
Compleat Angler - Fishing Tackle	Northern Territory	Marine-related business
AFANT - Arafura Blue Water Charters (Fishing Trips)	Northern Territory	Marine-related business
BH Marine (Boat & Yacht Sales)	Northern Territory	Marine-related business
Chaplin C (Fishing Trips)	Northern Territory	Marine-related business
AJ Snape Custom Fishing Sticks (Fishing Tackle)	Northern Territory	Marine-related business
Barramundi Lodge - Arnhem Land (tourism)	Northern Territory	Marine-related business
Dhipirri Barra and Sportfishing Lodge	Northern Territory	Marine-related business
Darwin Game Fishing Club	Northern Territory	Recreational users
Darwin Flyrodders Club	Northern Territory	Recreational users

Name	State	Group
Amateur Fishermen's Association of the Northern Territory	Northern Territory	Recreational users
Darwin Trailer Boat Club	Northern Territory	Recreational users
Tangaroa Blue	Queensland	Environmental group
Biopixels	Queensland	Environmental group
Landcare	Queensland	Environmental group
Bstar Turtle Rehab	Queensland	Environmental group
Conservation Volunteers Australia	Queensland	Environmental group
SeaTurtle Alliance	Queensland	Environmental group
Friends of Burrum River	Queensland	Environmental group
Coolum Coast Care	Queensland	Environmental group
Wildlife Preservation Society of Queensland	Queensland	Environmental group
Cairns and Far North Environment Centre (Woree)	Queensland	Environmental group
Cairns and Far North Environment Centre (Edmonton)	Queensland	Environmental group
North Queensland Dry Tropics (Marlin Coast)	Queensland	Environmental group
Cairns Urban Landcare & Trinity Inlet Catchment Association	Queensland	Environmental group
North Queensland Dry Tropics (Burderkin)	Queensland	Environmental group
Reef Catchments	Queensland	Environmental group
Conservation Volunteers Mackay office	Queensland	Environmental group
Mackay Conservation Group	Queensland	Environmental group
Capricorn Conservation Council	Queensland	Environmental group
Boyne Island Environmental Education Centre	Queensland	Environmental group
Gladstone Healthy Harbour Partnership	Queensland	Environmental group
Conservation & Wildlife Management Qld	Queensland	Environmental group
SOS Tin Can Bay	Queensland	Environmental group
Maroochy Wetlands Sanctuary	Queensland	Environmental group
Cooperative Research for Catchment Hydrology	Queensland	Environmental group
Petrie Creek Conservation Group	Queensland	Environmental group
Maroochy Waterwatch	Queensland	Environmental group
Twinnies Pelican and Seabird Resue	Queensland	Environmental group
Bulimba Creek Catchment Coordinating Committee	Queensland	Environmental group
Australian Fauna Management	Queensland	Environmental group
PCB Ecological Services	Queensland	Environmental group
Oxley Creek Catchment Association	Queensland	Environmental group
Ocean Crusaders	Queensland	Environmental group
eBird	Queensland	Environmental group
Osprey House Environmental Centre	Queensland	Environmental group
Nudgee Beach Environmental Education Centre	Queensland	Environmental group
Kedron Brook Catchment Centre	Queensland	Environmental group
Bayside Creeks Catchment group	Queensland	Environmental group
Queensland Wader study Group	Queensland	Environmental group
Bulimba Creek Catchment Committee	Queensland	Environmental group
Bayside Creeks Catchment group	Queensland	Environmental group

Name	State	Group
Logan River Branch Nursery (Native Plants Qld)	Queensland	Environmental group
Fraser Coast Council	Queensland	Government
Aroona Boat Tours	Queensland	Marine-related business
Nursery: Violets and Lace	Queensland	Marine-related business
Big Cat Green Island Reef Cruises	Queensland	Marine-related business
Pro Dive Cairns	Queensland	Marine-related business
Pacific Marine Group	Queensland	Marine-related business
Barra2Billfish Fishing Charters	Queensland	Marine-related business
Whitsunday Fishing World	Queensland	Marine-related business
Kayaks N things	Queensland	Marine-related business
Illawong Beach Resort	Queensland	Marine-related business
Capricorn Enterprise	Queensland	Marine-related business
Koastal Kayaks	Queensland	Marine-related business
ABC (Australian Boating College) Redcliffe Division	Queensland	Marine-related business
Surf Connect	Queensland	Marine-related business
Amity Trader Boat Rental	Queensland	Marine-related business
Redlands Kayak Tours	Queensland	Marine-related business
Blue Dive	Queensland	Recreational users
Hinchinbrook Sports Fishing Club	Queensland	Recreational users
Hervey Bay Surf Club	Queensland	Recreational users
Paddle Queensland	Queensland	Recreational users
Yorkeys Knob Boating Club	Queensland	Recreational users
North Queensland SLSC	Queensland	Recreational users
Cairns Blue Water Game Fishing Club	Queensland	Recreational users
Whitsunday Coast LSC	Queensland	Recreational users
Mackay SLSC	Queensland	Recreational users
Maroochy Sailing Club	Queensland	Recreational users
Maroochy Surf Club	Queensland	Recreational users
Redcliffe SLSC	Queensland	Recreational users
Sandgate Canoe Club	Queensland	Recreational users
Queensland Cruising Yacht Club	Queensland	Recreational users
Wynnum Redlands Canoe Club	Queensland	Recreational users
Wynnum Manly Yacht Club	Queensland	Recreational users
Greater Logan canoe Club	Queensland	Recreational users
South Brisbane Sport Fishing Club	Queensland	Recreational users
Sundowners Fishing Club	Queensland	Recreational users
Top O The Gulf Marine	South Australia	Marine-related business
Whyalla fishing charters	South Australia	Marine-related business
Port Macdonnell Offshore Angling Club	South Australia	Recreational users
Sorell Council NRM Facilitator	Tasmania	Environmental group
Port Cygnet Land & Water Care	Tasmania	Environmental group
Conservation Volunteers Launceston	Tasmania	Environmental group
Tamar Estuary & Esk Rivers NRM	Tasmania	Environmental group

Name	State	Group
Derwent Estuary Program	Tasmania	Environmental group
Midway Point Conservation	Tasmania	Environmental group
Birdlife Tasmania	Tasmania	Environmental group
Coal River Sustainable Living Group	Tasmania	Environmental group
East Risdon Reserve Volunteers	Tasmania	Environmental group
NRM South	Tasmania	Environmental group
Tasmanian Conservation Trust	Tasmania	Environmental group
Sisters Beach Community Association	Tasmania	Environmental group
Turners Beach Coast Care	Tasmania	Environmental group
Ulverstone Coast Care	Tasmania	Environmental group
Parks & Wildlife Service (Seven Mile Beach Office)	Tasmania	Government
Ranger in charge for Hartz National Park	Tasmania	Government
Bicheno Glass Bottom Boat	Tasmania	Marine-related business
Bicheno See All Fishing & Marine Tours	Tasmania	Marine-related business
Bicheno Penguin Tours	Tasmania	Marine-related business
Little Penguin Tours	Tasmania	Marine-related business
Southern Tasmania Divers	Tasmania	Marine-related business
MONA Ferry	Tasmania	Marine-related business
King Island Fishing Tours	Tasmania	Marine-related business
Southern Coast Charters	Tasmania	Marine-related business
Cygnets Wooden Boats	Tasmania	Marine-related business
Gordon River Cruises	Tasmania	Marine-related business
Strahan ATV Adventures	Tasmania	Marine-related business
West Coast Yacht Charter	Tasmania	Marine-related business
Strahan Retreat	Tasmania	Marine-related business
Ralphs Tasmanian Seafood (Shellfish import / export)	Tasmania	Marine-related business
Bass & Flinders Centre	Tasmania	Marine-related business
The Fishing Connection	Tasmania	Marine-related business
Tasmanian Jet Ski Adventures	Tasmania	Marine-related business
Seamaster Fishing Supplies	Tasmania	Marine-related business
Osborne Heli Tours	Tasmania	Marine-related business
Tasman Island Wilderness Cruise	Tasmania	Marine-related business
Mr Flathead Fishing Charters	Tasmania	Marine-related business
Hursey Seafoods	Tasmania	Marine-related business
River Breeze caravan Park	Tasmania	Marine-related business
Leven River Cruises	Tasmania	Marine-related business
Recreational users	Tasmania	Recreational users
Kingston Beach Sailing Club	Tasmania	Recreational users
Tas Fish	Tasmania	Recreational users
Cradle Coast Outrigger Canoe Club	Tasmania	Recreational users
Wynyard Yacht Club	Tasmania	Recreational users
Bridport Sailing club	Tasmania	Recreational users
Bridport Surf Life Saving Club	Tasmania	Recreational users

Name	State	Group
Port Cygnet Sailing Club	Tasmania	Recreational users
Port Esperance Sailing Club	Tasmania	Recreational users
Derwent Canoe Club	Tasmania	Recreational users
Midway Point Yacht Club	Tasmania	Recreational users
Orford Triabunna Region Chamber of Commerce	Tasmania	Recreational users
Mersey Yacht Club	Tasmania	Recreational users
Devonport SLSC	Tasmania	Recreational users
Coal River Farm	Tasmania	Recreational users
Richmond Cherry	Tasmania	Recreational users
Geliston Bay Boat Club	Tasmania	Recreational users
Bellerive Yacht Club	Tasmania	Recreational users
Buckingham Rowing Club	Tasmania	Recreational users
Somerset SLSC	Tasmania	Recreational users
Burnie Yacht Club	Tasmania	Recreational users
Scamander SLSC	Tasmania	Recreational users
Stanley Tourism	Tasmania	Recreational users
Ulverstone SLSC	Tasmania	Recreational users
Phillip Island Circuit	Victoria	Business
Point Danger Committee of Management	Victoria	Environmental group
Beach Patrol	Victoria	Environmental group
Great Ocean Road Coast Committee	Victoria	Environmental group
Friends of Williamsotwn Wetlands	Victoria	Environmental group
Clean Ocean Foundation	Victoria	Environmental group
Parks Victoria	Victoria	Government
Yumbah Abalone farm	Victoria	Marine-related business
Surf/dive school	Victoria	Marine-related business
Apollo Surf Bay Coast	Victoria	Marine-related business
Southern Coast Charters	Victoria	Marine-related business
Go Ride a Wave	Victoria	Marine-related business
Strapper Surf	Victoria	Marine-related business
Dive Victoria	Victoria	Marine-related business
Island surfboards	Victoria	Marine-related business
Port Macdonnell Offshore Angling Club	Victoria	Recreational users
SLSC (Port Fairy)	Victoria	Recreational users
Peninsula Surf Riders Club	Victoria	Recreational users
Port Albert Yacht Club	Victoria	Recreational users
Rockingham Volunteer Sea Rescue Group	Western Australia	Environmental group
Cocos Island Community Resource centre	Western Australia	Environmental group
Coastal Water Dive	Western Australia	Marine-related business
Octopus Garden Marine Charters (Bunbury)	Western Australia	Marine-related business
Yahoo Board and Surf shop	Western Australia	Marine-related business
Octopus Garden Marine Charters (Busselton)	Western Australia	Marine-related business
Christmas Island Tourism association	Western Australia	Marine-related business

Name	State	Group
Christmas Island wet and dry adventure	Western Australia	Marine-related business
Extra Divers Christmas Island	Western Australia	Marine-related business
Christmas Island Divers	Western Australia	Marine-related business
Shorefire	Western Australia	Marine-related business
H2orb	Western Australia	Marine-related business
Quinns Rocks Fishing Club	Western Australia	Recreational users
Alkimos Surf LifeSaving Club (Alkimos SLSC)	Western Australia	Recreational users
Marmion Angling and aquatic	Western Australia	Recreational users
Ocean Reef Sea Sports Club	Western Australia	Recreational users
Busselton Surf Lifesaving	Western Australia	Recreational users
Yallingup Boardriders	Western Australia	Recreational users
Perth Dinghy Sailing Club	Western Australia	Recreational users
Cockburn Power Boats Association	Western Australia	Recreational users



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