MOSAIC

Monitoring Seas and Inspiring Communities

Exploring the potential for citizen science in monitoring South Australia's Marine Parks network

MOSAIC Citizen Science Project

Final Report: January 2013

Government of South Australia

Department of Environment, Water and Natural Resources

Conservation Council SA

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EXECUTIVE SUMMARY

This project investigated the potential for citizen science projects to contribute to monitoring, evaluation and reporting of South Australia's Marine Parks network.

The concept of citizen science is introduced, with an analysis of the strengths and weaknesses of citizen science in practice.

Citizen science projects are widely varied but a number of attempts have been made to categorise them and these are discussed in the report. The Conservation Council of South Australia (CCSA) has developed a new system of categorisation of citizen science projects, which is focussed on project study design and the expected level of support.

The Monitoring Seas And Inspiring Communities (MOSAIC) project is a marine citizen science facilitation project focussed on the marine park network. As a partnership approach between the Department for Environment, Water and Natural Resources (DEWNR) and CCSA, MOSAIC has the potential to increase the effectiveness and efficiency of citizen science efforts to provide information to assist the monitoring, evaluation and reporting of the marine park network.

Key success factors are discussed and the three most critical factors are identified as:

1. robust and relevant study design
2. early stage investment in data management and feedback systems
3. high-quality volunteer management.

Current issues around governance, safety and insurance are also discussed.

Thirty one potential citizen science projects are identified across the network. This information is also summarised in a table in Appendix 1. An audit of existing citizen science projects was conducted to prevent duplication of projects (Appendix 2).

Two pilot projects were developed in greater detail and are ready to be implemented. The community participants have already indicated their willingness to be involved in the next steps.

Twenty-four specific recommendations are made throughout the text and are collated on pages 61-62.

Options for implementing citizen science activities over the next 18 months are also presented, including management of the two pilot projects and further investigation into what might be the preferred MOSAIC project partnership structure.

INTRODUCTION

In September 2012 CCSA was contracted by DEWNR to investigate the potential for citizen science to contribute to the monitoring of South Australia's (SA's) Marine Parks network.

This report discusses the benefits and challenges of citizen science projects in relation to the network and introduces the MOSAIC project.

The report recommends strategies to maximise the success and effectiveness of citizen science contributions to the monitoring, evaluation and reporting (MER) program. The report identifies two specific opportunities for citizen science pilot projects in partnership with regional communities.

As this project was initiated at the earliest possible opportunity, some key aspects of SA's Marine Parks network had not been finalised. While the benefits of early development far outweigh the drawbacks, one significant consideration was the absence of final technical documents. For example, marine park zoning was only finalised as this project was nearing completion, and therefore the report has not been able to fully describe the detail of how citizen science can best support the MER program.

Investigation of the potential for school participation in citizen science projects was specifically excluded. This report was also limited to investigating citizen science potential for the ecological monitoring aspect of marine parks, but citizen science projects could also extend to monitoring the social and economic aspects.

Over the past few months CCSA staff have met with a large number of people with an interest in citizen science across South Australia and Australia. Two regional visits have been conducted, relevant to three marine parks. A stakeholder workshop was held in Adelaide, from which emerged novel concepts and ideas. CCSA staff attended DEWNR's environmental monitoring workshop delivered by Prof. Hugh Possingham, and the 2012 Coast to Coast conference was used to discuss marine citizen science with those running these kinds of projects elsewhere in Australia. All these discussions and activities generated valuable information and support, and an embryonic marine citizen science network was established.

What has been made clear is that citizen science is not a cheap substitute for professional science; it is, essentially, a fundamentally different approach and will not be appropriate in all circumstances. It is also clear that citizen science has challenges that, if not addressed in the planning and development phase, can lead to project underperformance or failure.

However, when applied with due consideration to utilise its strengths, it can be a tool of enormous power. Citizen science has great potential to contribute to a better understanding of our unique marine environment and to a more scientifically literate society. It enriches the lives of participants through education, engagement, inclusiveness and a sense of purpose. These benefits provide foundations for further regional development and tourism that is supported by or based around marine

parks. At a time of great environmental challenge, when robust responses are demanded and when the demand for ecological information has never been higher, citizen science offers an opportunity worth embracing.

WHAT IS CITIZEN SCIENCE?

Citizen science can be described as community members voluntarily contributing to scientific research or monitoring, and is generally understood to relate to the participation of 'non-scientists' in this process.

There is no standardised definition of citizen science but, now that it is becoming a mainstream activity, there are numerous alternative definitions available:

> '… projects that engage the public in making observations and collecting and recording data'
>
> *Washington Sea Grant, Washington State University Extension and the Citizen Science Advisory Panel*

> 'Citizen science is research or monitoring conducted by individuals or communities in the interest of the general public.'
>
> *Conservation Council of Western Australia (CCWA), 2009*

> '… projects in which volunteers partner with scientists to answer real-world questions'
>
> *Citizen Science Central, Cornell Lab of Ornithology*

> '… projects or ongoing program of scientific work in which individual volunteers or networks of volunteers, many of whom may have no specific scientific training, perform or manage research-related tasks such as observation, measurement or computation'
>
> *Wikipedia*

The use of volunteers in scientific processes and activities is becoming an increasingly popular activity in many fields of study, particularly in meteorology, astronomy and ecology, where records go back many hundreds of years in some cases.

In the past citizen science was often conducted by skilled amateurs or specific interest groups, and has often had a strong emphasis on monitoring, with birds a popular choice. Bird watchers, particularly in the United Kingdom (UK) and North America, have contributed to valuable long-term bird survey datasets over decades[1]. A particularly impressive global program, eBird, highlights the high level of participation and power of citizen science in collecting 2–3 million new species-date-location records monthly from across the planet[2]. Participants also benefit by being able to store their personal bird sightings and photographs on their websites, as well as sharing and commenting on those of others.

[1] http://www.avonwildlifetrust.org.uk/wildlife/birdwatch_results.htm

[2] http://ebird.org/

Citizen science is clearly not new, but what has changed is the reason why many citizen science projects are being initiated. In the past many such projects were initiated by individuals or interest groups due to personal interests or concerns. DEWNR's interest in the use of citizen science to monitor marine parks is an example of 'demand-driven' monitoring. Citizen science in this context is likely to require reaching out beyond the 'skilled amateurs' to find those people interested in helping but who may not yet have the necessary skills. For these projects to succeed, the following are key aspects[3]:

- The project aims should be clearly defined and communicated from the beginning.
- Participants need to be carefully targeted and supported.
- Motivations and skill sets of all parties should be understood because they will vary significantly.
- Participants should feel part of a team and understand the value and relevance of their role(s).
- For long-term projects it is important to provide participants with opportunities to acquire new skills.

The early production of data about fauna and flora was 'supply driven', being the outcome of curiosity about nature and the use of leisure time to collect and describe it. Current approaches to voluntary biological monitoring can be seen as 'demand-driven', a response to planners' need for information[3].

Why citizen science?

Good citizen science can be extremely effective but this is by no means guaranteed. Some study designs may not lend themselves to citizen science and the quality of data produced by such projects has been criticised. However, well-designed and supported citizen science projects can be extremely productive, producing high-quality data while being very cost-effective.

Labour-intensive monitoring over large spatial or temporal scales plays to the strengths of citizen science. Like any tool it has its weak points but these can largely be overcome when deployed appropriately. In a demand-driven scenario, cost savings are often justifiably the primary motivator for its use, but it is not necessarily a 'cheap fix'[3]. However, the benefits of citizen science go beyond the financial benefits to support broader economic development and community stewardship.

Save resources

While there is no doubt that citizen science projects can deliver substantial cost savings, they tend not to be up-front savings. When dealing with relatively unskilled volunteers, adequate resources for initial set-up, training and support are vital to establish a successful program. However, the sheer scale of volunteer activities can

[3] Tweddle J.C., Robinson L.D., Pocock M.J.O. & Roy H.E. 2012. Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK. Natural History Museum and NERC Centre for Ecology & Hydrology for UK-EOF. Available online: www.ukeof.org.uk

mean that significantly more can be done, and after the initial set-up ongoing costs can be much lower.

An example is the scale of UK bird surveys, with 1.6 million volunteer hours per year contributed, which would have come at a cost of US$30 million[4]. This example is related to strong community interest in a country with more than three times the population of Australia, so savings of this scale are unlikely in SA but could still be significant after initial set-up. Also, given the geographical size of SA, savings related to travel might be significant when using local volunteers.

Another characteristic of citizen science is that it tends to be spatially and temporally biased - it is hardly surprising that volunteers do not cover all areas equally. However, this can be used to save money by guiding decisions about deploying professionals to areas unlikely to be visited by volunteers[5].

Scientific benefit

Statistically, citizen science harnesses the power of numbers, both in terms of the number of individual participants and the number of observations. Well-designed and executed citizen science projects can produce data of a quality comparable to that of projects conducted by professional scientists[6]. Volunteers collecting scientific data can provide a volume of observations that can reduce and often entirely eliminate potential problems with data quality.

Volunteers can cover both geographic and temporal scales that can be prohibitively expensive if done using paid professionals. Despite these benefits, there is no doubt that there can be a lack of support for citizen science projects from professional scientists. These concerns often fall into two categories. First, citizen science can be perceived as 'devaluing' the professionalism of their work, sending the message to government and the community that 'anyone' can do it. Second, professional scientists often raise concerns over the validity of the data and sometimes these concerns are entirely justified. The quality of data from citizen science projects should be a priority and professional scientists are the core group able to assist with remedying this problem. Rather than replacing professional scientists, citizen science can be utilised by researchers and can be an additional source of work for the professionals. Furthermore, citizen science can do what is just

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[4] Danielsen F., Burgess N.D., Balmford A. et al. 2009. Local participation in natural resource monitoring: a characterization of approaches. *Conservation Biology* 23, 31–42.

[5] Tulloch A., Mustin K., Possingham H., Szabo J. and Wilson K. 2012. To boldly go where no volunteer has gone before: predicting volunteer activity to prioritize surveys at the landscape scale. *Diversity and Distributions* 1–16.

[6] Gollan J., Lobry de Bruyn L., Reid N. and Wilkie L. 2012. Can volunteers collect data that are comparable to professional scientists? A study of variables used in monitoring the outcomes of ecosystem rehabilitation. *Environmental Management* 50(5), 969–978.

Collings G., Bryars S., Turner D., Brook J. and Theil M. 2008. *Examining the health of subtidal reef environments in South Australia, Part 4: Assessment of community reef monitoring and status of selected South Australian reefs based on the results of the 2007 surveys.* SARDI Publication Number RD. F2008/000511-1. South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

physically impossible for normal research teams - collecting data at unpredictable times in a large number of locations simultaneously[7] and over the long term.

Serendipity

Another benefit of a large number of science 'participants' is the increased chance of serendipitous discoveries. Exposing more minds to the information increases the chances of new problems, patterns or solutions being discovered.

For example, a volunteer with the Feral or In Peril program found the first European fan worm (*Sabella spallanzanii*) on Kangaroo Island in 2008. Without eyes in the water acting as an early warning network, the presence of this species on the island may not have been detected until much later, when it may have been harder to eradicate.

There are also numerous examples through the last few centuries of individuals who, for no particular reason, started to record peculiar data that interested them. An example is the date of the first cherry blossom in Japan, which has now proven to be an invaluable dataset relating to climate change.

Independence

By its nature citizen science is a grassroots activity, somewhat removed from vested interests. Citizen science projects can have the following benefits:

- They are able to focus on monitoring programs that governments and corporations cannot or will not undertake[8].
- The involvement of non-government organisations can give added credibility[9].
- The increased transparency that comes with public participation can have additional advantages toward community ownership of decisions. For example, if the local community has been involved in collecting and contributing data, management decisions based on that data may be more readily accepted.

Citizen science is not only science

The involvement of 'non-scientists' in citizen science by its very nature educates and engages the community. In comparison conventional science has been particularly poor at this, and education and outreach happen at the end of a project if at all. Citizen science can be seen as the overlap between education, engagement and science (Figure 1), and thus can contribute significantly to developing scientific literacy within the general community.

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[7] For example, Project BudBurst engages people from across the United States in the collection of climate change data based on the timing of leafing and the flowering of trees and flowers.

[8] Conservation Council of WA. 2009. Citizen science for ecological monitoring in Western Australia.

[9] Alastair Birtles, Minke Whale Project (pers. comm.)

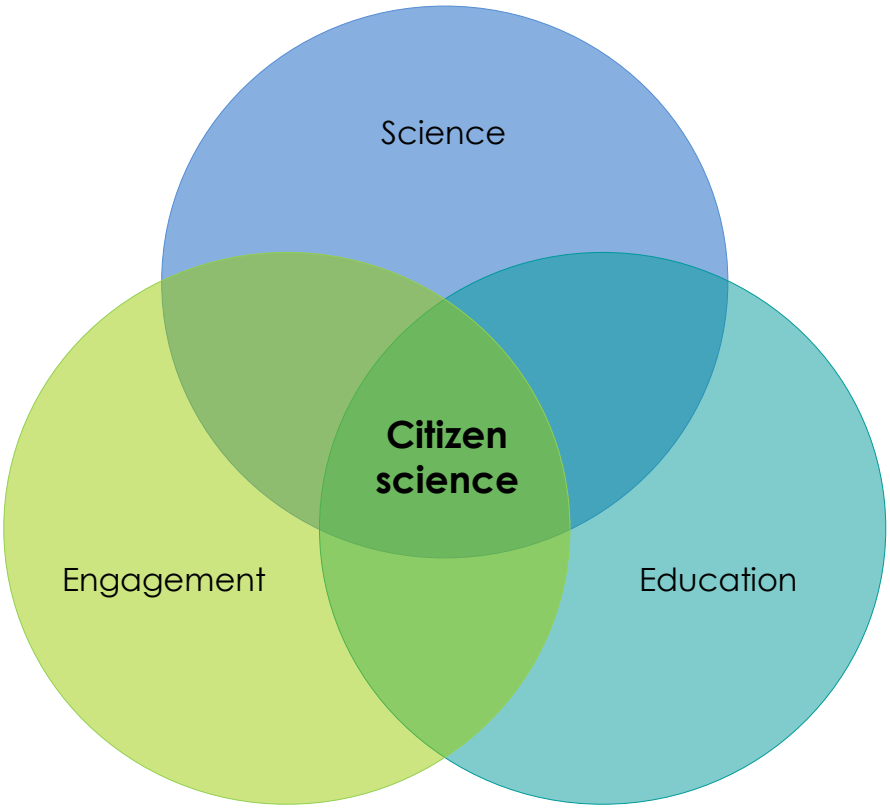

Figure 1: Showing citizen science as the overlap of science, engagement and education.
Thanks to Philip Roetman, UniSA, for the concept behind this diagram.

One of the reasons for engaging and educating the community is to achieve better conservation outcomes. With citizen science the community is already primed to receive conservation messages, and is better placed for grassroots responses to address issues and solve identified problems[10].

Informed citizens can provide independent views and local solutions to tackle issues identified through formal research. The increased education and engagement that citizen science can deliver can also enable local conservation voices to take a stronger advocacy role, thus avoiding the paradox where scientists may be well informed about a problem (e.g. a threatened species) but are not always the best advocates for a solution, for reasons including the following:

- Researchers are not necessarily good communicators.
- Some researchers feel that advocacy conflicts with their desire to be impartial scientists.
- Many researchers are employed by governments and may be limited in their ability to speak publically due to government 'code of conduct' provisions.
- Scientific language often does not resonate with the public and decision-makers.
- Researchers are often constrained by the exact nature of their work and are disinclined to talk beyond the limits of their field of knowledge.

[10] CCWA runs a number of citizen science projects based around community-led inquiry into problems they have seen.

Local conservation advocates can avoid some of these challenges and, being local, can benefit from pre-existing relationships in the community and engage with their community on an ongoing basis.

Examples of successful citizen science: case studies

SkyNet

The SkyNet program uses the spare computing power of thousands of computers around the world, via the internet, to process vast amounts of astronomical data. In its first year of operation more than 240,000 unique clients connected to SkyNet, processing more than a moderate supercomputer could do in 1.2 years. This was something that could not be afforded by the organisations behind SkyNet without the use of citizen scientists who donated the use of their computers' spare processing power.

Reef Watch and Feral or In Peril

The Conservation Council of South Australia's own award-winning programs, Reef Watch and Feral or In Peril, are some of the longest running and most successful marine citizen science programs in Australia. Reef Watch has conducted reef health monitoring surveys across SA since 1997, trained more than 3,000 dive volunteers and utilised more than 10,000 dive hours. Reef surveys are conducted on both subtidal and intertidal reefs. Volunteers have contributed to formal scientific research and identified new occurrences of invasive feral species (e.g. the first sighting of European fan worms on Kangaroo Island). Reef Watch provides training and equipment for free, as well as providing educational opportunities and experiences for the wider public. Subtidal Reef Watch data is analysed annually and the reports are freely available on the website. Data is freely available to anyone upon request.

Minke Whale Project

This monitoring program[11] makes use of tourists' and tour operators' photographic images (volunteers as 'censors') to develop a photo-identification catalogue and to monitor dwarf minke whale movements across the Great Barrier Reef region. It was established by Alastair Birtles of James Cook University and has recently completed its 17th field season. The relationship between tour operators and researchers has grown from strength to strength, with awards at the annual reporting event hotly contested in categories such as the best photo or the most photos. This is a great example of what really motivates people, as the prizes are often just a chocolate bar. This project has a successful formula, applying many of the 'key success factors' described later in this report.

[11] http://www.minkewhaleproject.org/

Citizen science challenges

There are two important challenges to a successful citizen science project. First, as discussed earlier, is robust scientific design appropriate for use in a citizen science model. Many citizen science projects are based on monitoring activities, and in the past monitoring has not always been well executed, regardless of the type of participant. Designing a project that suits a citizen science model in large part mitigates the problem.

The other challenge is related to the voluntary nature of the activity. Citizen science relies on the participation of volunteers. If those volunteers are not forthcoming the whole program may fail. Volunteer recruitment and retention are critical to program success, with high-quality volunteer management systems, and appropriate data entry interfaces key to mitigating this risk and are discussed in 'Key Success Factors'.

Citizen science models

Citizen science projects come in all shapes and sizes and a number of attempts have been made to categorise them. A useful framework for citizen science projects has been provided by Bonney *et al.* (2009)[12], who describe three major categories:

1. **Contributory projects**, which are generally designed by scientists and for which members of the public primarily contribute data.
2. **Collaborative projects**, which are generally designed by scientists and for which members of the public contribute data but also may help to refine project design, analyse data or disseminate findings.
3. **Co-created projects**, which are designed by scientists and members of the public working together and in which at least some of the public participants are actively involved in most or all steps of the scientific process.

Contributory and co-created projects are at opposite ends of a spectrum and each will work well in different circumstances. The following is an excerpt from an excellent discussion on the topic by Tweddle *et al*.[13].

> *Contributory citizen science works well for projects that:*
> • *capture the imagination of a broad audience, e.g. projects on charismatic wildlife, biodiversity and environmental health issues, public health or human interest stories, interesting and topical science questions, and projects that link to the school curriculum;*

[12] Bonney R., Cooper C., Dickinson J., Kelling S., Phillips T., Rosenberg K. and Shirk J. 2009. Citizen science: a developing tool for expanding scientific knowledge and scientific literacy. *Bioscience* 59 (11), 977–984.

[13] Tweddle J.C., Robinson L.D., Pocock M.J.O. & Roy H.E. 2012. Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK. Natural History Museum and NERC Centre for Ecology & Hydrology for UK-EOF. Available online: www.ukeof.org.uk

- *require large volumes of data that could not be collected efficiently through other routes, for example over large geographic scales or fine resolutions;*
- *involve recording regularly encountered species or phenomena. Conversely, involve species or phenomena that are not often encountered, and for which people are simply asked to 'keep an eye out', e.g. recording the arrival or spread of non-native species;*
- *require large-scale analyses that are better done by humans than by computers (e.g. identification of photos of wildlife species or museum specimens). For this, a crowd sourcing citizen science project may be appropriate, provided that the subject matter is sufficiently interesting to participants.*

Co-created citizen science works well for projects that:

- *benefit from establishing a community-led or volunteer-led monitoring scheme. All parties have a stake in the project and the longevity of involvement provides opportunities for training and sharing of expertise. It does, though, require time and ongoing commitment;*
- *involve small numbers of participants and in situations where all parties are willing to listen and adapt, so that a consensus can be reached;*
- *require repeat measurements over time (and which therefore need a greater commitment from participants);*
- *are targeted at a specific, locally relevant environmental problem or question.*

Examples of contributory citizen science projects include Feral or In Peril, the Operation Blue Tongue/Possum/Magpie/Spider projects, Great Koala Count and Dolphin Watch. Examples of co-created projects include the CCWA's six citizen science projects, all of which are variations of projects in this category.

Depending on the needs of the MER, projects at all points along this spectrum might be considered.

CCSA has developed a new categorisation system (Table 1) based on project designs specifically for this report. These categories can be used to understand the likely levels of support required to ensure successful outcomes, and to systematise and standardise the support offered. This might be in the form of smart phone applications, datasheets for field use, species ID slates, web support, data management or analysis. The intention is to minimise any unnecessary duplication of support efforts.

The ability to identify and link similar projects has potential volunteer management benefits such as shared training and resources. It can also make it more interesting for participants, by swapping information between projects or even sharing site visits.

Table 1. CCSA categorisation for citizen science project design.

Type of project	Description	Level of support
Location-based	When you go to x/y/z locations, report all frogs/birds/orchids etc., or just one species.	Low
Opportunistic	If you see x/y/z species, report/photograph them.	Low–

	Example: Feral or In Peril, Minke Whale Project	medium
Time-based census	Once a year/quarter/month, look for x. Examples: annual national frog census, annual black cockatoo surveys	Medium
Specific research project	Supporting scientific research, directed by a scientist and usually facilitated by a non-government organisation (NGO). Examples: Earthwatch Institute, Feral or in Peril, marine pest research in partnership with SARDI	High
Ecosystem health monitoring	Long-term ecosystem health monitoring. Examples: Reef Watch, Mangrove Watch, Seagrass Watch	High
'Bioblitz'	Once-off, one group/species, intensive focus. Examples: Operation Possum, Operation Magpie	High

Existing marine citizen science in South Australia

There are many marine citizen science programs already running in SA. It was important to capture these as part of this report (Appendix 1) in order to prevent duplication, but also to ensure that existing, relevant data is known and made available for input to the MER, especially where programs may have 'pre' Marine Park network data for future comparison with sanctuary zones (e.g. Fox Shark Research Foundation).

Not all programs will have relevant data but, where they do, the relevant organisations should be approached to discuss the potential for their data, both past and future, to be used to contribute to the MER.

Recommendation 1: DEWNR consider approaching CCSA to engage existing citizen science groups regarding data sharing, or data collection changes to assist with the MER.

INTRODUCING MOSAIC

The MOSAIC project is still in the early stages but has the potential to facilitate numerous different types of marine citizen science projects within SA's Marine Parks network.

More specifically it would undertake two types of activities:

- Facilitate the development of new citizen science projects specifically designed to align with the MER, in collaboration with local communities and relevant scientists, including the Marine Parks Scientific Working Group (SWG). Ideally, these new projects would be managed locally so that local communities become stewards of their marine park and the project.
- Facilitate discussion with existing marine citizen science programs to scope out their willingness to:
  - contribute their data to the MER
  - potentially make adjustments to their programs to align more closely with the needs of the MER.

Locally managed projects would still potentially be MOSAIC projects in that they fall under the 'umbrella' and could be badged as such, e.g. MOSAIC Robe. However, the exact governance structure would need to be discussed in more detail as it has implications for safety and insurance, which are covered later in this report. Existing programs that are willing to contribute data and/or make adjustments to their programs could receive some kind of recognition.

DEWNR has indicated a willingness to have MOSAIC hosted by an NGO, in which case CCSA is in an ideal position to undertake this work, with its significant experience through Reef Watch and Feral or In Peril. Other NGOs in South Australia also have the potential to host the program.

A partnership between DEWNR and CCSA that works as a facilitation program, rather than a more top-down type program, might see the two organisations taking on the following roles:

- DEWNR:
  - provides seed and ongoing base funding to ensure continuity of support and to enable leverage for additional funding applications
  - provides scientific advice and support
  - provides assistance with alignment of projects with the MER
  - provides web hosting / data storage solutions for all MOSAIC projects
  - provides analytical expertise and feedback in a timely manner

- CCSA:
  - provides project management
  - facilitates project development between all relevant project partners for new projects
  - facilitates discussions with existing programs (as above)
  - provides volunteer management and insurance

- provides assistance with funding applications.

The nature of the citizen science projects is likely to change over time, from an initial adaptation of existing projects to more specific collaborative or contributory projects identified through the MER and in partnership with communities.

STRATEGIC LINKS

The MOSAIC project has the potential to contribute to all of the following:

- South Australia's Strategic Plan:
  - Target 4. Tourism Industry
  - Target 24. Volunteering
  - Target 69. Lose no species
  - Target 71. Marine biodiversity
  - Target 72. Nature conservation
- Living Coast Strategy
- Science and Technology Innovation 10
- State Natural Resources Management Plan:
  - Guiding Target 1. Ensure people are better informed and improve capacity in NRM decision making.
  - Guiding Target 2. Involve more people in the sustainable management of natural resources.
  - Guiding Target 10. Improve condition of coastal and marine ecosystems.
  - Guiding Target 13. Limit the establishment of pests and diseases and reduce the impact of existing pests
- *Marine Parks Act 2007*
- *Fisheries Management Act 2007* (control sites as a minimum, links with Aquatic Reserves, also probably refugia and spillover, plus effort removal via buyouts)
- People in Parks (DEWNR visitor strategy)
- NatureLinks (in relevant marine parks)
- Adelaide and Mount Lofty Ranges Natural Resources Management Board Coastal Ambassadors program
- DEWNR 'science directions' strategy.

Also:

- *Inspiring Australia* (Australian Government, 2010): Citizen science is an important component of increasing scientific literacy and engagement in Australia and overseas, and as such should be seen as contributing significantly to strategies relating to scientific engagement.
- National Reserve System of Marine Protected Areas.

KEY SUCCESS FACTORS

CCSA has gathered much advice and information regarding key success factors for citizen science projects from the many readings, meetings and workshops from which we have benefited, as well as our own experience in running Reef Watch and Feral or In Peril.

Best practice citizen science project development

The process to establish a citizen science project is critical to its success. A guide for citizen science from the UK Environmental Observation Framework[14] has been published recently and provides an excellent description of the project development process, including a useful flowchart. This framework identifies five steps in project development:

1. before you start
2. first steps
3. development phase
4. live phase
5. analysis and reporting phase.

This document is thoroughly recommended and should be used widely as a basis for the development of all citizen science projects.

Recommendation 2: Use the existing citizen science project framework developed by the UK Environmental Observation Framework.

Project design

Good project design is crucial to the success of citizen science enterprises. It can:

- ensure relevance to decision-makers (i.e. to the MER)
- ensure that the strengths of citizen science are utilised appropriately
- ensure that the weaknesses of citizen science are mitigated (e.g. quality control)
- enable meaningful feedback to participants
- make effective use of volunteer contributions
- define the level of support required
- get improved conservation outcomes.

[14] Tweddle J.C., Robinson L.D., Pocock M.J.O. & Roy H.E. 2012. Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK. Natural History Museum and NERC Centre for Ecology & Hydrology for UK-EOF. Available online: www.ukeof.org.uk

Project design for environmental monitoring is challenging even without the use of citizen science, and has been the subject of much criticism.

At the DEWNR environmental monitoring workshop Prof. Hugh Possingham presented what he called the eight 'deadly sins' of environmental monitoring:

1. included no control(s) or control sites
2. scored things rather than quantified them
3. evaluated benefits but not costs
4. ignored existing data (including Indigenous knowledge)
5. gathered data and no-one analysed it
6. forgot to communicate results
7. didn't have a purpose
8. stopped counting too soon.

> *Monitoring is commonly understood as an activity designed to detect change in something we value in order to provide for timely intervention. However, it has to be said the results of many monitoring programs are not well designed, produce ambiguous results and, as a consequence, are of marginal value in informing decisions.*
>
> *CCWA, 2009*

The intended audience is also important. To whom are we communicating the results of the monitoring, what is their stake in the issue at hand and what information will satisfy them? It may be that a big technical study is not needed, but rather a few basic measurements might suffice.

Recommendation 3: DEWNR to consider a Possingham-facilitated combined workshop with Marine Parks Council, Scientific Working Group to do cost–benefit analysis on monitoring options.

DEWNR has minimised the risks of poor-quality monitoring so far by having a strong focus on the development of the MER. However, the overall design of each citizen science project will ultimately be the test as to how much these projects can contribute to the overall MER.

Given the critical importance of study design, DEWNR could utilise the existing significant asset of the Marine Parks Scientific Working Group to assess and provide advice on the merits of proposed citizen science projects.

Recommendation 4: Marine Parks Scientific Working Group expertise to be used to provide advice about the study design of proposed citizen science projects.

Data management

Data collection

Citizen science programs and projects largely focus around the activities of volunteers collecting data, whether related to meteorology, astronomy or marine biology. This tends to be the core activity around which other volunteer activities such as training, data entry and development of survey protocols are developed.

In CCSA's experience the adequate and thorough training of volunteers in data collection methods is critical in collecting good quality data. This piece of advice was also reiterated through the conversations we held with many people involved with citizen science.

As mentioned previously, the power of citizen science lies in the ability of numerous volunteers to collect large quantities of data over both spatial and temporal scales that most formal scientific studies cannot achieve.

The spatial and temporal bias common in citizen science projects can be reduced through a variety of means[15]:

- publicising the gaps, so volunteers may choose to survey known gaps
- providing incentives for volunteers to visit less preferred areas
- supplementing with professional monitors.

In addition, the use of standardised systems of measuring and recording data is essential[16].

Data entry

Citizen science volunteers are attracted to volunteering activities in the outdoors for numerous reasons[17]. However, data entry needs to be openly promoted as an essential activity for volunteers who collect data.

Ideally, the volunteers who collect the data enter their own data soon after collection. This avoids problems with others trying to interpret handwritten notes and the risk of misinterpretation. However, it has also been pointed out that volunteers who cannot participate in some of the outdoor activities might have a role in citizen science projects in data entry or other related activities that can take place either indoors or in other suitable locations.

Data storage

Given that SA's Marine Parks network is in the care of the State Government, it is most appropriate that it offer to host data storage solutions for all citizen science projects and programs taking place in SA's marine parks. This significantly reduces the skills and funding required, and the stress associated with attempting to develop data storage solutions where specialists are usually needed but often unavailable and unaffordable to regional communities.

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[15] Tulloch A., Mustin K., Possingham H., Szabo J. and Wilson K. 2012. To boldly go where no volunteer has gone before: predicting volunteer activity to prioritize surveys at the landscape scale. *Diversity and Distributions* 1–16.

[16] Carla Sbrocchi, University of Technology, Sydney (pers. comm.)

[17] Roy H., Pocock M., Preston C., Roy D., Savage J., Tweddle J., Robinson L. 2012. Understanding citizen science and environmental monitoring. Final report on behalf of UK Environmental Observation Framework.

Through consultation with other marine citizen science programs in other parts of Australia, these two recommendations were determined to be critical to the success of such programs:

Recommendation 5: Invest upfront in designing data collection systems well.

Recommendation 6: Create an online data capture system with some form of instant feedback.

However, the needs will vary depending on the design of individual projects and programs, and there are several options:

1. Use paper data collection sheets that can be photocopied easily and/or posted to the project manager, who is then responsible for data entry (which could be done by other volunteers or paid staff).
2. Use MS Excel spreadsheets and/or MS Access databases that can be used offline and emailed and/or uploaded to a data storage solution, which might or might not be online.
3. Use data systems that are hosted online.

Projects that require the use of photographs and/or video will need different kinds of data storage and management, and these are explored further below.

Following are the available options for online data collection and storage systems, with some of their advantages and disadvantages.

Biological Data Recording System (BDRS)

Depending on the complexity, longevity, funding and other resources available to different projects and programs, there are many systems that can be set up, but one that we recommend is the Atlas of Living Australia (ALA) Biological Data Recording System (BDRS).

The BDRS is open source software specifically for citizen science programs. As far as we can ascertain it is the only citizen-science-specific software available as open source in Australia. However, as with all digital systems, it has advantages and disadvantages:

Advantages

- can be customised to each unique citizen science program
- can be made to look graphically like the project host's own website
- can upload photos and videos
- can map data reports without the need for GPS locations (although these can also be uploaded) or GIS skills
- can automatically hide data that may be sensitive, e.g. protected species sightings
- can generate automatic email alerts when a specific record is entered
- allows users to be registered at three entry levels:

- ordinary users - people who can submit data and look at it but cannot change anything (except their own records, which can be modified) or see anyone's private contact details
- supervisors - people, usually scientists, who may need to see additional information such as a user's contact details to follow up on a report, or who require access to hidden data about protected species
- administrators - people who can change forms, add or delete species, add or delete users or change their status, add additional information, and who take care of all other administrative functions

- is relatively easy for non-specialists to administer.

Disadvantages

- requires specialist skills to set up, which could be expensive
- has very specialised online hosting requirements, which means that it has to be hosted by one of the following:
  - Atlas of Living Australia (ALA): a CSIRO project that has some uncertainty about its future; the ALA uses CSIRO IT infrastructure to house its own databases and hosts many other BDRS portals (CCSA has two of these hosted at no cost by the ALA), so while the ALA may have quite a short future, it is not known whether CSIRO would continue to host ALA systems in the absence of the ALA itself
  - Gaia Resources: the company that originally designed the BDRS for the ALA but hosting costs are in excess of $5,000 per year per BDRS system
  - State Government: the best option - to give the hosting details to state government IT specialists and investigate the possibility of the State Government hosting SA Marine Parks BDRS systems.

Recommendation 7: DEWNR to further investigate data storage options and potentially discuss/negotiate with CSIRO/ALA regarding the use of the BDRS for the MOSAIC program.

SA Marine Park Information Tool (SAMPIT)

During the consultative phase of SA's Marine Parks network SAMPIT was developed to capture public information from 1 km polygons across SA's waters.

The architecture that supports SAMPIT is still available for adaptation to support citizen science projects in SA's marine parks.

Advantages

- is available at no cost on state government IT infrastructure
- may require little work to adapt it for use with some citizen science projects
- can collect information at relatively large spatial scales (1 km polygons) that do not require the use of GPS locations, thus enabling protection of potentially sensitive information
- information is publicly available for viewing
- could be administered by individual citizen science project managers

Disadvantages

- has had limited corporate use as it was developed for a specific purpose by DEWNR's IT staff. While some corporate knowledge of the system remains, it has had limited use to date.
- cannot collect spatially explicit data
- may not be able to collect technically complex data such as that generated by line intercept transects
- 'SAMPIT' has negative connotations among some sectors of the community

Custom-built systems

It is possible that individual projects with unique requirements could set up their own specific data collection and storage system online. However, the skills required are usually highly specialised and very expensive; therefore, for the vast majority of local MOSAIC projects this is not a realistic option.

Photographs and videos

Projects collecting data via photographs and video footage can provide these in a variety of different ways. It is possible that digital files can be emailed directly to DEWNR staff responsible for the marine parks MER for analysis, with the option of uploading some of the better files to the DEWNR Marine Park website (and/or other websites, e.g. NRM Boards) for use as engagement and education tools. In this case it would be useful to explore Creative Commons licences for photographs and videos so that community groups and educational programs can access and use them.

CCSA's Reef Watch program is experimenting with the use of Facebook photo albums to document species photographed at intertidal reefs at different locations, thus building a visual encyclopaedia of intertidal species around the state. It can also be used as an excellent engagement tool for those who access the internet. Facebook photo albums have the advantage that they can be seen and added to by those who do not use Facebook.

There is also the option of using online systems such as Flickr, YouTube, Vimeo and many others where different albums can be created to document different categories that can be added to by different users. Flickr users can ascribe different levels of licence for use by others.

The ALA's BDRS can also upload photograph and video files as attachments to reports linked to spatial information.

Data access

DEWNR have provided an assurance that data collected by citizen science programs for the MER will be publicly accessible.

Australian Ecological Knowledge and Observation System (AEKOS)

AEKOS is a product of the Eco-informatics Facility, which is a component of the Terrestrial Ecosystem Research Network. It is worth mentioning in the context of data access because it is designed to act as a single point of access for ecological data from across Australia.

AEKOS will be able, via a licensing framework, to 'suck up' data from other datasets, such as those hosted by state government agencies (where permission is given), to enable download to individual end users, and to forward information to both the ALA and Australian National Data Service (ANDS), which collects metadata about datasets. Figure 2 describes AEKOS's role in relation to major stakeholders, collaborators, projects and users.

Recommendation 8: DEWNR to consider exploring connections to AEKOS in the future, to facilitate both metadata and data availability to the ALA, ANDS and end users.

Data analysis and interpretation

The results of the analyses of marine parks monitoring data are designed to assist DEWNR to make management decisions; therefore, the imperative for good analysis is real. Given that the main motivation for developing citizen science in SA's marine parks is to contribute to the MER, it is most appropriate that analysis be undertaken in the first instance by MER scientists. DEWNR also adds value to the data and the overall program through its capacity to interpret results.

Responsibility for data analysis of these projects is an important issue to be resolved early in the project development phase. It is often forgotten in the early stages of citizen science projects when proponents get so enthusiastic about the project that data analysis is not even discussed until a later stage, at which point it can become a significant problem.

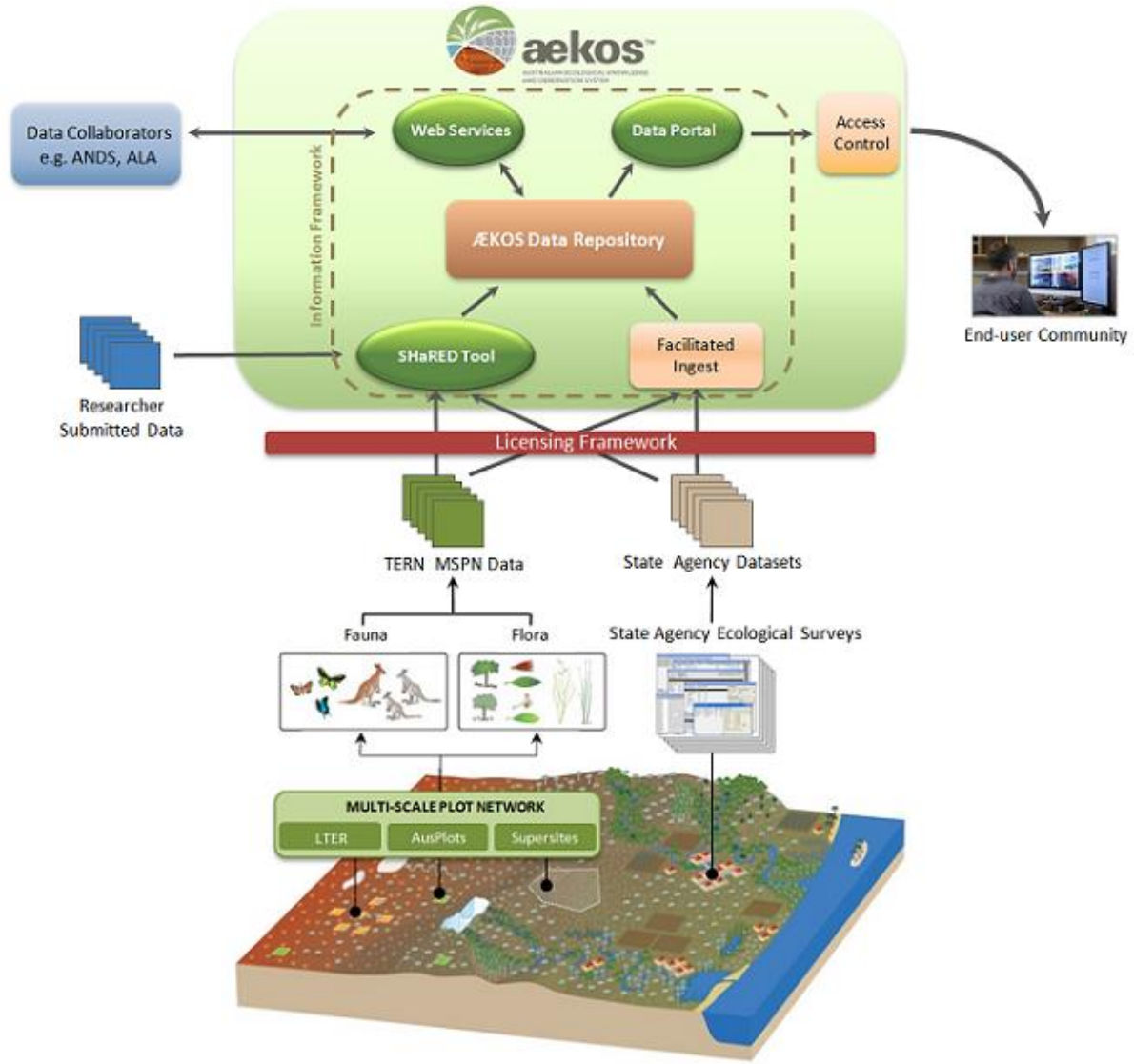

Figure 2: A pictorial representation of AEKOS's role in relation to major stakeholders, collaborators, projects and users

Data analysis is always going to remain a difficult gap to fill using citizen science, although some such projects use vast numbers of volunteers to assist in analysis such as pattern recognition. Links with academic institutions and other relevant organisations may help address this in the future, both for the actual data analysis and potentially for the provision of short courses or workshops to assist students, professionals and volunteers interested in developing skills in this area.

Recommendation 9: DEWNR and CCSA collaborate to investigate partnerships with different institutions to assist with data analysis and provide training opportunities for both students and volunteers.

As noted elsewhere in this report, providing feedback to citizen science volunteers is a critical part of the engagement process; therefore, it is recommended that analysis be undertaken regularly in order to provide feedback (annually at a

minimum). The form of the feedback could be simplified and combined with a social event.

Recommendation 10: Annual feedback on data to participants to be considered a minimum.

Quality control

This is one of the more controversial issues with regard to citizen science. Data quality is often criticised due to the use of volunteers who have varying degrees of training and skills relevant to a project.

As mentioned elsewhere in this report, one of the strengths of citizen science is its ability to use the power of numbers; therefore, getting more data can, in many cases, average out problems with quality.

Strategies to mitigate poor-quality data include:

- good project design
- good, compulsory training
- validation where possible or necessary.

Recommendation 11: Ensure that sufficient resources are provided to develop adequate training systems appropriate to each individual project.

Volunteer management

This begins at the start. Good project development and design can ensure the best possible management of volunteers and data for the best possible results. Broadly speaking, this comes down to the following principles and strategies:

Listen to them:

- engage them at the early stages when developing project objectives and methodologies
- find out how they want to be involved (e.g. level of 'immersion' - shore-based or boat-based activities, snorkel or scuba)
- listen to their feedback and involve them in project evaluation.

Look after them:

- keep them safe - provide good training, insurance etc.
- keep them happy - include social elements to project activities to bring volunteers together
- keep them satisfied and feeling valued - show that what they are doing is used, meaningful and making a difference
- keep them informed - make sure they are aware of the progress of the project, communicate often, and via preferred method, on topics of interest to the local community.

Get the best out of them:

- good project design
- provide good training and training materials
- understand their motivation(s) to participate
- invest at the front end to create an online data capture system with some form of instant feedback.

Give back to them:

- report back on the project at least annually (simplified reporting is adequate, particularly if full scientific reporting is too expensive or time-consuming)
- offer opportunities to develop skills
- give them opportunities to learn
- try to build in broader benefits of the project to individuals/community (e.g. the eBird project also provides a place for the community of participants to store photographs of bird sightings and share comments).

Be aware that some in the conservation field[18] believe that a change in volunteer preferences seems to be occurring. Due to lack of both time and money, people are less inclined to join a group or to travel a long way to volunteer (e.g. interstate or overseas), but are increasingly likely to join in with an activity in their local area that has been organised by a third party. The organisational work seems to be a disincentive, which can be overcome if this is taken on by an external agent. If there are high expectations of regional, time-poor volunteers, this observation needs to be taken into account in the overall program design.

Recommendation 12: Volunteer management aspects of a project to be prioritised equally with scientific validity, and included in project key performance indicators on an equal footing.

Recommendation 13: Consideration to be given when developing citizen science projects to some form of acknowledged and progressive skill development and accreditation, possibly a MOSAIC-wide program.

Governance/insurance/safety

The governance structure of citizen science in SA's marine parks is integrally linked to the insurance and safety situation and defines the legally responsible entity.

Friends of Parks

It has been suggested that the Friends of Parks model already in place and managed by DEWNR could potentially develop a 'Friends of Marine Parks' based on the same model.

[18] Tricia Curtis, Conservation Volunteers Australia (pers. comm.)

The implications of this system for insurance and safety are not complicated. DEWNR volunteers are all insured through SAICORP, which would probably cover snorkelling but almost certainly not diving. Diving is an extremely high-risk activity that most insurance companies will not cover in standard personal accident or volunteer insurance.

One of the arguments for not using this system is that the project may have a better chance of success if seen to be managed by an NGO, rather than government, especially in regional areas where there can be substantial antipathy towards government agencies and their staff.

Non-government organisations (NGOs)

New national safety regulations (Work Health and Safety Regulations 2012) being implemented in South Australia as of January 2013 have new provisions for occupational diving. Fortunately these provisions do not apply to volunteers, although a basic duty of care still applies. However, the provisions certainly apply to anyone who is employed to undertake diving activities, regardless of the status of their employment. The provisions require that the 'primary business unit' (as defined in the related Act) have copies of a current certificate of medical fitness and written evidence demonstrating the competence (as required by the regulations) for any person directed to undertake diving activities as part of their employment duties. The regulations also have provisions regarding the use of dive plans and dive safety logs.

Most incorporated NGOs have their own volunteer insurance that can also take the form of personal accident insurance. CCSA has such insurance, which includes coverage of snorkelling activities but not diving.

CCSA is able to cover diving activities only through contracting a consultant dive instructor who is covered through insurance with PADI, but this means that he has to dive with volunteers for every survey. This was not the original intention of Reef Watch, which intended to train dive volunteers to the point where they could do surveys on their own. However, in the 15 years of experimenting with different engagement models, Reef Watch has found that divers in SA prefer to do dive surveys with an instructor rather than alone. This has limitations in that CCSA currently only has the one dive instructor, who cannot be everywhere at once, making more work for that person in having to liaise very closely with individual divers to organise dive monitoring events.

If MOSAIC is to go ahead as a partnership between CCSA and DEWNR, then CCSA may need to look into the possibility of hiring a second diving instructor to assist with training and supervision of more dive volunteers.

Reef Life Survey, based in Tasmania, has done some research into dive volunteer insurance overseas and found that, particularly in the USA, dive volunteers are increasingly taking up diving insurance through the Divers Alert Network. This is not expensive and provides cover for recreational divers in need of emergency assistance. In Australia Reef Life Survey get their dive volunteer insurance through

the Victorian People and Parks Foundation, which is an option that could be explored in more detail if required for MOSAIC.

Recommendation 14: If the MOSAIC project were to go ahead as a partnership between DEWNR and CCSA, with CCSA as the legal body responsible for volunteers, the issue of diving insurance would need to be discussed in more detail before any volunteer diving projects were developed.

Recommendation 15: Once the MER priorities have been finalised, some prioritisation of citizen science projects at the level of marine bioregions may be worth considering.

Recommendation 16: Link projects of a similar nature across the state.

Recommendation 17: DEWNR to investigate the potential to develop citizen science projects based on existing organisation-location links.

Recommendation 18: DEWNR and CCSA to consider investigating the potential for more Aboriginal involvement in potential citizen science projects.

Recommendation 19: Once MER priorities have been established, some attempt to be made to identify more charismatic species for monitoring.

Recommendation 20: DEWNR to consider identifying bird species for monitoring due to the general community interest in bird watching .

Recommendation 21: DEWNR to investigate the need and potential for a broader Coffin Bay research project.

PROPOSED PILOT PROJECTS

There are two proposed pilot projects, each in different bioregions and both in regional areas. The first is partnering with an existing tourist operation, Rodney Fox Shark Expeditions, in the North Neptune Island sanctuary zone of the Ron and Valerie Taylor MP, Eyre Bioregion.

The second is located immediately adjacent to the 'Obelisk' at Robe, in sanctuary zone 3 in the Upper South East MP, Otway Bioregion. This pilot project is partnering with an interested community of volunteers who have had some Reef Watch intertidal training and experience and are keen to further this work.

Both groups understand that these pilot projects are only 'proposed' at this stage and both groups have specifically confirmed their interest in participating in a pilot project if this concept is progressed. Both groups have had an opportunity to comment on the relevant pilot project sections of this report, and all feedback has been incorporated.

After the initial technical study design work for the pilot projects has been completed, it would be beneficial to give participants an opportunity to have input, as some specific changes to accommodate their interests may make a big difference to their overall satisfaction and ownership of the project.

Recommendation 22: Community participants to be engaged in the project design stage.

It is recommended that both pilot projects have an initial duration of 18 months. While this is not long enough for proper results from a MER perspective, it will be long enough to establish whether this project structure will work with two very different projects, using different methods and project partners, to determine what adaptations may be required to implement future projects, and to allow time for final analysis and reporting.

Recommendation 23: Pilot projects to have an initial duration of 18 months.

Pilot Project 1: Ron & Valerie Taylor Marine Park

Sanctuary zone: North Neptune Island and South Neptune Island (Habitat Protection zone)

Participant: Rodney Fox Shark Expeditions (Fox Shark Research Foundation)

Participant type: Tourist operator

Background

The Fox Shark Research Foundation conducts great white shark (GWS) cage diving at the Neptune Islands under permit from DEWNR and is a strong supporter of marine parks. The Rodney Fox Expedition team has a long history of participation in scientific activity, both assisting other researchers and conducting their own research projects. The group already has significant scientific capacity, with qualified and experienced staff. In addition the staff have experience in using all the equipment required to run this project (with the exception of rock lobster pots).

The main focus of their operations is GWSs and they have collected considerable amounts of intellectual property in the form of GWS sighting data. Their shark-viewing cages are normally lowered to a depth of 20–30 metres. They have recorded sightings of many species in addition to GWSs including bronze whalers, short-fin makos, eagle rays, smooth rays, western blue groper (juveniles, females and males), silver trevally and Australian salmon.

A series of meetings and discussions were held with Jennifer Taylor and Rachel Robbins from Rodney Fox Shark Expeditions (RFSE) over October–December 2012, where the possibility of participation in a pilot project was discussed. This culminated in a meeting on 22nd November, where Rachel Robbins met with Simon Bryars, Patricia von Baumgarten and Kathryn Warhurst to develop the scientific and practical elements in more detail. After this meeting RFSE confirmed their wish to participate.

Possible data collection methods were discussed, taking into account:

- what data was relevant to the marine parks MER
- what was practicable for Rodney Fox staff
- cost.

Monitoring activities

Two feasible monitoring activities were identified and the study designs are currently being developed.

1. Cage-attached video camera

A GoPro underwater camera could be attached to the shark diving cage. As cage diving is always preceded by burleying, the cage would essentially be acting as an oversized BRUV. RFSE visit North Neptune Island on up to 250 days per year, normally on trips lasting 2–4 days. GPS coordinates are automatically recorded on anchoring, giving good location information. Video footage of only a proportion of those dives would be more than adequate for most study designs.

South Neptune Island is also visited but normally only around 12 times per year. If this number of visits is an inadequate sample size, the vessel could be specifically chartered for any additional trips. The costs start at around $7000/day but it might be possible to share costs with other research projects.

RFSE staff are already familiar with GoPro cameras, and a location inside the cage mounted in a top corner is practical. An initial trial by the RFSE staff was very promising and easily accommodated by staff in their usual activities. No technical problems were encountered and good-quality video footage was obtained. This project could collect baseline data almost immediately.

2. Rock lobster pot sampling

Rock lobsters are likely to show significant signs of recovery after sanctuary zone protection is implemented, and are therefore likely to be a high priority in the finalised MER. Rock lobster pot sampling (mostly non-lethal) once or twice per year could be conducted from the RFSE vessel. The vessel has a tender, ideal to set and retrieve research lobster pots, and the staff have indicated that the work associated with the pot setting is easily accommodated within their usual activities.

Sampling within a marine park would need to be permitted both by PIRSA and DEWNR, and would require the presence of an observer/researcher. This may also yield data on octopus species, a by-product of the rock lobster fishery, in which recent octopus catch per unit effort declines have been noted, raising the question of impacts on octopus populations.

Risk assessment for Pilot Project 1

This is a draft risk assessment that has been reviewed by both RFSE and DEWNR; however, a facilitated risk assessment workshop with all participants present during the project development phase would be an important step if the pilot was to proceed. This workshop could also be used to draft the contents of an MOU/contract. Pre-emptive discussions will be vital in clarifying expectations and responsibilities at the start of the process.

	Consequences				
Likelihood	Negligible	Minor	Moderate	Major	Extreme
Almost certain	Medium	High	High	Very high	Very high
Likely	Medium	Medium	High	High	Very high
Possible	Low	Medium	Medium	High	High
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Low	Medium	Medium

Risk to DEWNR	Likelihood	Consequence	Score	Mitigation
Risk of perceived favouritism	Rare	Minor	Low	None
Risk of partnership breakdown leading to loss of data and future opportunity to collect data	Possible	Major	High	Partner expectations to be discussed in detail before the project starts
Confusion over IP/data	Likely	Moderate	High	Include in a

				detailed MOU
Ownership/maintenance/ breakages/responsibilities for equipment	Almost certain	Moderate	High	Clarify details in an MOU before starting the project
Risk to RFSE				
Lack of feedback	Possible	Major	High	Ensure involvement and communication between CCSA and Rachel Robbins throughout project
Lack of support	Possible	Major	High	
Feeling of being used	Possible	Major	High	
Loss of IP	Possible	Major	High	

While a risk assessment is an important process, it is also essentially a negative one of 'how to avoid failure'. Equally important to the overall project is some combined thinking and positive visioning on what would make the project a success. This could also be included in the workshop and might involve the following:

<u>What would a successful project look like to DEWNR</u>

- effective MP monitoring
- low-cost MP monitoring
- public education of tourists re MPs
- community engagement (tour operator & tourists)
- greater understanding of the impacts of the marine park for local biodiversity
- establishment of a partnership with tourism industry for marine park implementation

<u>What would a successful project look like to RFSE</u>

- contributing to conservation efforts in SA
- business goals: having information to use for customers, a marketing asset (including clarity on what information and materials might be provided to RFSE)
- community contribution
- getting regular feedback/support
- regular support from project leaders for data retrieval
- co-authorship and acknowledgment on any peer-reviewed papers and reports arising from this study
- input into methodology and work plan
- clarity on expectations of RFSE, e.g. how often camera deployed, how data is retrieved, how this fits with existing monitoring and research obligations.

Pilot Project 2: Upper South East Marine Park

Sanctuary zone: Robe

Participant: Robe Coastcare group / Reef Watch

Participant type: Community group (not incorporated)

Background

Robe was identified as a possible pilot project site due to the active interest the community have in coastal and marine conservation. The Robe sanctuary zone received strong local support and is located in an area of local interest and identity (the Obelisk). The local mayor of the District Council of Robe, Peter Riseley (also a member of Marine Parks Council), is keen to ensure that the benefits to the community of marine park sanctuary zones are maximised. The marine park is perceived to offer potential tourism benefits, particularly in the summer tourist peak season, with interpretive signs a possibility that Council might investigate. The Robe Visitor Information Centre, near both the town centre and the sanctuary zone, is well placed to provide marine park information, merchandise and park-based activities.

The Robe Coastcare group is active and well supported by residents. Other citizen science projects are underway in this region, in particular the Beachport Bush-Bird Banding Project 2009–14 by Beachport residents David and Wendy Trudgen, and intertidal Reef Watch at Beachport and Port MacDonnell. Strong links via the Coastcare group exist between the communities at Robe, Beachport and Port MacDonnell, so some joint/comparison work could be incorporated, to provide support and social opportunities.

Reef Watch received funding via state NRM Community Grants in August 2012 to train new and existing volunteers in the use of new intertidal methodologies and data entry. Local residents of Robe, Port MacDonnell and Beachport participated in Reef Watch intertidal monitoring training in mid-November 2012, and another visit is planned for additional Reef Watch intertidal survey support and online data entry training in mid-February 2013. As part of this project the three groups will be provided with intertidal survey kits. The Robe Reef Watch intertidal site is located outside the sanctuary zone.

A number of conversations broaching the concept of a pilot project were conducted with community members via telephone, leading to an invitation to attend a Robe Coastcare meeting on 4th December 2012 (Patricia von Baumgarten, Kathryn Warhurst). The discussions resulted in support from the Robe group to proceed with the next step in a possible pilot project.

Feedback from the group has emphasised the desire for a firm commitment from DEWNR for ongoing support for this project. They have also suggested that an information night be held in Robe once the pilot project is developed. This could build interest more broadly across the community and potentially bring in more members.

Good support from Robe Council is likely although this is yet to be thoroughly investigated, and the current Coastcare and Reef Watch projects are receiving helpful support from regional DEWNR staff. The recently advertised coast and marine position within DEWNR based in the South East could offer the project technical support, and the local NRM volunteer support officer (based at the SE NRM Board) is an additional local resource for the group.

The small size of the sanctuary zone at Robe raises some challenging questions that this pilot project may help to investigate. For example, 'Are there perceivable differences between the existing Reef Watch monitoring site and the potential new monitoring site inside the sanctuary zone?', and the network-wide question, 'Are small sanctuary zones effective?'

Monitoring activities at Robe

At this stage two possible monitoring models are conceivable[19] - a Reef Watch-type ecosystem-health monitoring program (intertidal existing), possibly subtidal; and a time-based census for rock lobster / abalone / blue-throat wrasse monitoring, but obviously this is highly dependent on recommendations from the monitoring project design work.

Long-term ecosystem health: reef monitoring

It should be noted that, due to tidal and weather conditions in the south east of SA, both intertidal and subtidal monitoring can only take place between about October and April each year.

Robe Reef Watch has already begun and, if the pilot project were to proceed, some additional monitoring could be incorporated. The existing participants have indicated a willingness to do some extra monitoring.

Currently no subtidal monitoring is occurring although some residents have indicated their interest. One participant can already dive and two more want to get a basic scuba qualification (3–5 days). The Reef Watch PADI course requires four dives and some land-based training, generally occurring over several weeks, but volunteer divers must already have some recent diving experience before they can undertake this training.

Diving can be challenging in the south east, with cold water temperatures and extremely variable conditions that can change suddenly. However, this is generally less of a problem for locals, who may have more flexibility in choosing when to dive compared with divers who are travelling to Robe to dive.

Dive access is possible from shore but several Robe Reef Watch participants have private boats available, and a DEWNR trailer boat based at Canunda might be an

[19] Simon Bryars is currently developing a monitoring program for this pilot project.

option. Using privately owned boats requires owners to have suitable public liability insurance before other volunteers can work from them.

Data from Reef Watch intertidal and subtidal surveys can be entered online at any time but preferably within the season during which surveys were undertaken. Data can be entered by anyone but preferably by the volunteer who actually collected the data. Although data entry can be done by other volunteers, we have found that this is only preferable under certain circumstances:

- if it is possible to contact the original data collector for verification of some information or translation of handwriting
- If the original data collector does not have internet access or is not computer literate
- If the original data collector does not have additional time to spend on data entry.

Data can be extracted at any time from the online Reef Watch databases. The intertidal database has the capacity to allow access to the data by relevant DEWNR staff and/or scientists without accessing volunteers' private information and without the ability to change anything. This partial access is a significant advantage that will enable specific staff/scientists to view and access relevant data at any time.

The Reef Watch subtidal database currently requires data extraction by a CCSA staff member, for which additional costs are incurred for their time due to their casual status. Requests for data extraction can be made at any time, but the cost of extraction will need to be budgeted for and extraction can take 2–3 weeks due to difficulties with this database and the restricted availability of the CCSA staff member who does this.

Currently, Reef Watch subtidal data collected in the AMLR NRM Region is analysed by Dr Grant Westphalen. The primary tools used for this are the 11 indices of reef status developed by Turner *et al*.[20] although not all of them can be considered. More information about these indices can be found in any of the Reef Watch subtidal data reports, which can be found on the Reef Watch website. While the reef health indices were designed for temperate Australian reefs, specifically southern temperate reefs (which differ substantially from eastern temperate reefs), the subtidal reefs found from Cape Jaffa southwards are quite different to those north and west of Cape Jaffa. Subtidal reefs at and south of Cape Jaffa include the large bull kelp (*Durvillaea potatorum*) that creates the kelp 'forests' found in south east SA but is absent from the rest of the state. The reef health indices have never been applied to kelp forests of this nature and may not be able to be applied to them due to their substantially different nature to subtidal reefs elsewhere in the state.

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[20] Turner D.J., Kildea T.N. and Westphalen G. 2007. *Examining the health of subtidal reef environments in South Australia, Part 2: Status of selected South Australian reefs based on the results of the 2005 surveys.* South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 97 pp. SARDI Publication Number RD03/0252-6.

Reef Watch intertidal data is in a state of transition. During 2006–12 intertidal surveys were conducted using the same set of survey protocols, which were too difficult and time-consuming for volunteers. In spring 2012 Reef Watch launched a new set of intertidal monitoring surveys that are much easier and quicker to use, and Reef Watch Project Officer, Carl Charter, has been training intertidal volunteers across SA in these new surveys. While they are simpler than the original set of surveys, there are some similarities in their design, and therefore there will be some contiguity between the 2006–12 data and that collected from late 2012 using the new surveys.

In addition, Reef Watch has not until this year been able to afford to have the intertidal data analysed. However, a grant was awarded this year from the Norman Wettenhall Foundation specifically for this analysis, and it should be ready by the end of March but unfortunately not in time for this report. There is no specific set of indices or other parameters, filters or tools through which to analyse the data and therefore the only limitations on its analysis are those provided by the survey design.

Time-based census

A number of species of interest (e.g. rock lobster, abalone and blue throat wrasse) might be considered for time-based census monitoring, and the small size of the sanctuary zone may affect the likely responses. This may be monitored when diving but an alternative method might be the use of lobster pots or BRUVs. The use of lobster pots would require permits via DEWNR and PIRSA, plus observers/researchers.

Risk assessment for Pilot Project 2:

Risk to DEWNR	Likelihood	Consequence	Score	Mitigation
Risk of poor-quality data	Possible	Minor	Medium	Collect lots of data, and use good training and verification processes
Risk of low volunteer participation leading to little data collection	Possible	Major	High	Partner expectations to be discussed in detail before the project starts
Ownership/ maintenance/ breakages/ responsibilities for equipment	Almost certain	Moderate	High	Reef Watch (RW) approach: equipment remains RW property on long-term loan and it retains responsibility for replacement
Risk to Robe Coastcare				

Risk of not incorporating community participants wishes/interests into project aims	Possible	Moderate	Medium	Meet after technical report out and discuss project scope
Lack of feedback	?			Clarify expectations with group during project development, incorporate volunteer management key performance indicators
Lack of support	?			
Feeling of being used	?			

Again, like the previous pilot project, identification of project goals, positive visioning and identification of what project success means are important early steps.

THE NEXT 18 MONTHS...

From our experience so far in the development of these pilot projects, a number of reasons for high community receptiveness seem to be evident. The participants were conservation-minded, motivated individuals, but why were these two groups more enthusiastic than other groups? What might we learn from this for the future?

First, both pilot groups have already had some science or citizen science experience. The RFSE staff already have high scientific literacy, conducting their own scientific activities as well as assisting other researchers. Robe had existing Coastcare and Reef Watch groups that have been very active recently.

Tourism was a factor for both groups. While RFSE is a tourist operation, Robe has a very significant tourist influx in summer and tourism is a significant economic component to the Robe community. In each case a perception of the location as an asset that does not involve an exploitative use may have been an important factor. In the case of Robe the Mayor could envisage potential benefits to the community from marine parks and was keen to explore opportunities.

The relationships that local DEWNR staff had built in the regions and the work of the marine parks team created a valuable foundation and meant that personal networks could be followed to find local interested participants.

These lessons can be put to use during the 18-month pilot period to identify additional potential future locations with these characteristics. CCSA could then develop other pilot project proposals guided by DEWNR and MER priorities.

CCSA would project manage both pilots during the 18-month period.

For the Fox Shark Foundation project this might include:

- draft detailed project process, timelines, MOU
- preliminary workshop for all stakeholders (study design, risk assessment, goals)
- participant support throughout the year
- project evaluation (independent)
- organisation of end-of-year social event including data report or presentation to participants
- final report.

For the Robe project this might include:

- draft detailed project process, timelines, MOU (if necessary)
- public presentation to Robe community for recruitment of more volunteers
- preliminary workshop for all stakeholders (study design, risk assessment, goals) held in Robe
- additional Reef Watch intertidal training
- additional Reef Watch subtidal training
- development of additional training materials specific for MER aspects
- participant support throughout the period

- project evaluation (independent)
- organisation of end-of-year social event including data report or presentation to participants
- final report.

CCSA could work with DEWNR to develop the most effective partnership structure for the MOSAIC project to deliver ongoing support and direction for these projects in South Australia.

CCSA would be delighted to include a new citizen science category into the annual Jill Hudson Award Night to highlight the achievement of citizen science activities throughout SA. DEWNR could consider sponsoring the relevant prizes.

CCSA could approach existing citizen science groups regarding data sharing or data collection changes to assist the MER.

CCSA could also further investigate how support networks for general citizen science in SA might be established in the future.

RECOMMENDATIONS

Recommendation 1: DEWNR consider approaching CCSA to engage existing citizen science groups regarding data sharing, or data collection changes to assist with the MER.

Recommendation 2: Use the existing citizen science project framework developed by the UK Environmental Observation Framework.

Recommendation 3: DEWNR to consider a Possingham-facilitated combined workshop with Marine Parks Council, Scientific Working Group to do benefit cost–analysis on monitoring options.

Recommendation 4: Marine Parks Scientific Working Group expertise to be used to assist in the study design of proposed citizen science projects.

Recommendation 5: Invest upfront in designing data collection systems well.

Recommendation 6: Create an online data capture system with some form of instant feedback.

Recommendation 7: DEWNR to further investigate data storage options and potentially discuss/negotiate with CSIRO/ALA regarding the use of the BDRS for the MOSAIC program.

Recommendation 8: DEWNR to consider exploring connections to AEKOS in the future, to facilitate both metadata and data availability to the ALA, ANDS and end users.

Recommendation 9: DEWNR and CCSA collaborate to investigate the establishment partnerships with different institutions to assist with data analysis and provide training opportunities for both students and volunteers.

Recommendation 10: Annual feedback on data to participants to be considered a minimum.

Recommendation 11: Ensure that sufficient resources are provided to develop adequate training systems appropriate to each individual project.

Recommendation 12: Volunteer management aspects of a project to be prioritised equally with scientific validity, and included in project key performance indicators on an equal footing.

Recommendation 13: Consideration to be given when developing citizen science projects to some form of acknowledged and progressive skill development and accreditation, possibly a MOSAIC-wide program.

Recommendation 14: If the MOSAIC project were to go ahead as a partnership between DEWNR and CCSA, with CCSA as the legal body responsible for volunteers, the issue of diving insurance and the new safety regulations would need to be discussed in more detail before any volunteer diving projects were developed.

Recommendation 15: Once the MER priorities have been finalised, some prioritisation of citizen science projects at the level of marine bioregions may be worth considering.

Recommendation 16: Link projects of a similar nature across the state.

Recommendation 17: DEWNR to investigate the potential to develop citizen science projects based on existing organisation-location links.

Recommendation 18: DEWNR and CCSA to consider investigating the potential for more Aboriginal involvement in potential citizen science projects.

Recommendation 19: Once MER priorities have been established, some attempt to be made to identify more charismatic species for monitoring.

Recommendation 20: DEWNR to consider identifying bird species for monitoring due to the general community interest in bird watching .

Recommendation 21: DEWNR to investigate the need and potential for a broader Coffin Bay research project.

Recommendation 22: Community participants to be engaged in the project design stage.

Recommendation 23: Pilot projects to have an initial duration of 18 months.

APPENDIX 1 EXISTING MARINE CITIZEN SCIENCE PROGRAMS IN SOUTH AUSTRALIA

Project/program/activity	Organisation
Reef Watch subtidal	CCSA
Reef Watch intertidal	CCSA
Feral or In Peril	CCSA
FoGSV Secchi disk monitoring	Friends of Gulf St Vincent
Seabirds & shorebirds	West Coast Wetland Action Group
Mangroves	Sabine Dittman, Flinders University
Saltmarshes / soft sediments	Sabine Dittman, Flinders University
DragonSearch (no longer functioning)	Was WWF (TSN), now CCSA
SE fish tagging	
Dolphin Watch KI	WDCS
Dolphin Watch Whyalla	WDCS
Dolphin Watch Pt Pirie	WDCS
Adelaide Dolphin Sanctuary Action Group	WDCS/DEWNR
Marine Debris GSV	AMLR NRM Board/DEWNR
Adopt-a-Beach (Spencer Gulf), marine debris	PIRSA
Cryptic fish, invertebrates, other technical / hard-to-identify marine species surveys	SA Conservation Research Divers
Granite Island penguin census	AMLR NRM Board / Friends of Encounter Seabirds
Southern right whales and dolphins	SA Whale Centre
Pelicans (yellow tag reporting)	Dr Greg Johnston (Nature Foundation SA)
Beachport Bush-bird Banding Project	Australian Bat & Bird Banding Scheme
'Hoodies' (hooded plovers)	AMLR NRM Board
White sharks (Neptune Islands)	Fox Shark Research Foundation
Penguin census	KI NRM Board/DEWNR
Marine debris surveys	KI NRM Board/DEWNR
Friends of the Sea (reef surveys)	KI NRM Board/DEWNR
Hooded plovers	KI NRM Board/DEWNR
Marine debris surveys (2 sites)	GABMP/DEWNR/Yalata Aboriginal Community
Southern right whales	GABMP/DEWNR/Yalata Aboriginal Community
Mulloway	GABMP/DEWNR/Yalata Aboriginal Community
Monitoring coastal habitat change (water quality)	Port MacDonnell Landcare Group

National programs	Organisation
Atlas of Living Australia	CSIRO
National marine debris surveys	CSIRO
Climate Watch	Earthwatch Institute
RedMap	University of Tasmania
Reef Life Survey	University of Tasmania