

## Supplemental Materials

### Appendix 4: Survey Responses

**Table 2** State of residence reported by survey respondents.

State	Respondents (number)
New South Wales	19
Victoria	15
Queensland	11
Western Australia	6
Australian Capital Territory	7
South Australia	7
Tasmania	5
International	5
Grand Total	75

**Table 3** Areas of work reported by survey respondents.

Occupational domains	Respondents (number)
Sciences	55
Education	6
Data and IT	4
Business/Finance	2
Communications	2
Public Policy	2
Tourism	2
Defence	1
Geography	1
Grand Total	75

**Table 4** Specific discipline of survey respondents who have a scientific background (n=55).

Science domain	Respondents (number)
Ecology	20
Environmental sciences (industry-based)	11
Marine sciences	9
Ornithology	4
Astronomy	2
Botany	2
Entomology	2
Zoology	2
Chemistry	1
Engineering	1
Geochemistry	1
Grand Total	55

**Table 5** Age category and gender of survey respondents.

Age category	Females	Males	Grand Total
2 (21-30)	5		5
3 (31-40)	16	4	20
4 (41-50)	17	5	22
5 (51-60)	2	11	13
6 (61-70)	3	8	11
7 (71-80)		1	1
Grand Total	44	31*	75

\* two males did not identify their age group

**Table 6** The total number of connections, the average number of connections, and the intra-state connections amongst practitioners for each state.

State/Territory	Interactions in the network	Average number of connections	Intra-state interactions* (proportion)
New South Wales	228	24.89	101 (0.44)
Queensland	111	21.00	41 (0.37)
Victoria	104	14.60	53 (0.51)
South Australia	86	23.86	23 (0.27)
Australian Capital Territory	71	15.57	15 (0.21)
Western Australia	11	6.60	5 (0.45)
Tasmania	57	22.40	15 (0.26)
International	55	20.40	11 (0.20)
Total	723	19.54	266 (0.37)

\*for the international respondents, these values represent their interactions with each other

**Table 7** Inter- and intra-gender interactions of the 75 citizen science practitioner respondents.

Gender interaction type	Interactions	Proportion of total interactions
Female : Female	311	0.43
Male : Male	83	0.12
Female : Male	329	0.45
Total number of interactions	723	

**Table 8** Connection and network statistics for citizen science practitioner network by gender.

Gender	Average Degree	Average shortest Path Length	Average Betweenness Centrality	Average Closeness Centrality	Average Neighbourhood Connectivity
Female	22	2.00	0.01490	0.51	24.90
Male	16	2.17	0.01490	0.48	22.57
Grand Total	<b>20</b>	<b>2.07</b>	<b>0.01490</b>	<b>0.50</b>	<b>23.92</b>

**Table 9** Connection and network statistics for citizen science practitioner network by age grouping.

Age category	Respondents (number)	Average Degree	Average Shortest PathLength	Average Betweenness Centrality	Average Closeness Centrality	Average Neighbourhood Connectivity	Average Clustering Coefficient
Up to 40 years	26	22.56	1.99	0.018	0.51	24.80	0.65
40 and 60 years	35	19.43	2.04	0.014	0.50	24.77	0.63
Over 60 years	12	13.58	2.30	0.010	0.46	21.01	0.47
Not disclosed	2	19.50	2.27	0.032	0.49	15.56	0.19
Grand Total	75	19.54	2.07	0.015	0.50	23.92	0.60

**Table 10** Connection and network statistics for citizen science practitioner network by network role (involvement in network support activities).

Involvement	Respondents (number)	Average Degree*	Average Shortest Path Length	Average Betweenness Centrality	Average Closeness Centrality	Average Neighbourhood Connectivity	Average Clustering Coefficient
Respondent is on management committee, working group leader, keynote speaker or organising committee member	12	47.08	1.67	0.053	0.61	21.69	0.50
Respondent has no visible role	63	14.21	2.15	0.008	0.48	24.35	0.62
Grand Total	75	19.54	2.07	0.015	0.50	23.92	0.60

**Table 11** Network connection statistics related to occupational domains of citizen science practitioners.

Domain simplified	Number	of	Average	Average	Average	Average	Average	Average
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	practitioners	number of connections to other practitioners	shortest path length	betweenness centrality	closeness centrality	neighbourhood connectivity	clustering coefficient
Ecology	20	21.20	2.07	0.015	0.50	21.36	0.50
Education/communication/business	12	17.42	2.05	0.005	0.50	29.17	0.82
Environmental sciences (industry-based)	11	14.64	2.10	0.004	0.48	25.64	0.73
Marine sciences	9	22.50	2.01	0.021	0.51	22.77	0.57
Other sciences	13	19.23	1.96	0.013	0.52	26.12	0.53
Zoology/botany	10	22.20	2.28	0.037	0.48	18.91	0.50
Grand Total	75	19.54	2.07	0.015	0.50	23.92	0.60

**Table 12** Presence at meetings and relationship to network status.

Attendance at face-to-face meetings	Number of respondents	Average number of connections made (total new connections)	Average Degree	Average Shortest Path Length	Average Betweenness Centrality	Average Closeness Centrality
Attended National Meeting 1 (Brisbane)	17	4.4 (75)	38.65	1.76	0.04242	0.58
Did not attend National Meeting 1	58		13.84	2.17	0.00669	0.47
Attended National Meeting 2 (Canberra)	41	7.2 (296)	26.05	1.90	0.02003	0.53
Did not attend National Meeting 2	34		11.45	2.29	0.00852	0.45
Attended another CS event	34	3.6 (122)	27.00	1.91	0.02126	0.53
Did not attend another CS event	41		13.20	2.21	0.00950	0.47
Attended Meeting 1 and 2	12		46.00	1.67	0.05243	0.61
Average for all respondents (n=75)			19.54	2.07	0.01490	0.50

**Table 13** Open responses related to benefits of citizen science network, organised into themes (N=214).

Benefits	Number of responses	% of total responses	Comments
Ideas	44	21%	As a researcher, I get benefits from interacting with others working in similar areas, regardless of their status (citizen scientist, professional researcher, whatever) The primary benefit for the FIELD is helping to advance innovations and avoid duplication of efforts Support for improving citizen science programs - discuss opportunities & ideas - given code "ideas", related to practice
Relationship	35	16%	ACSA conferences provide a fantastic platform for networking with others Interacting is crucial to building strong relationships, projects and networks
Practice	33	15%	Sharing experiences leads to solutions I think it's really important to have contact with a community of practice to hear about what worked and what didn't, it's a more efficient way of working and helps formulate ideas and approaches Innovation
Knowledge	29	14%	I love seeing the different concepts come to life Early access to research information Hear about what else is occurring locally to globally, and what programs could be replicated locally to engage community & gather data - given code "knowledge" - related to practice
Collaboration	28	13%	There is a lot of good work that can happen online, and as different associations build platforms we should make sure to share infrastructure (i.e., let's talk!!). It is a great way to learn and build by collaborating with people who have diverse academic and/or work backgrounds Cross collaboration and leverage opportunities
Inspiration	16	7%	It's the lifeblood of thoughtful creativity and development A sense of hope in helping Just that the benefits are all positive and benefit everyone involved

Benefits	Number of responses	% of total responses	Comments
			Understanding Making the world a better place through citizen science
Avoid duplication	10	5%	I see many synergies between existing projects. I like that interacting with others in the field allows me to not duplicate, or learn from other ways of doing things, including engaging citizens in meaningful science and finding ways to include science in the lives of those who do not have it. I very much value the perspectives and questions from those outside my project to improve the research, educational value and engagement of School of Ants. Also, I love talking about ants :) Saves doubling up on some work, and can help with data flow between them
Resources	5	2%	Improved standards There are probably greater opportunities to pool resources [Through our projects, we gain] Access to world class university based instruments for scientific testing.
Funding	4	2%	Possible shared funds/grant partnerships
Access to data	3	1%	
Impact	3	1%	I believe that the growing network of citizen scientist in Aust will bring with it a greater legitimacy of our activities in the eyes of other scientists Feeling that I'm doing something positive for our planet Building capacity world-wide for citizen science
Reach	2	1%	Benefits are currently often localised (i.e. I currently work with a few people across Victoria, but that's about it), but it would be great to find ways to increase the reach of local projects and collaboration and I think that the ACSA state chapters will/can assist with this. interdisciplinary and intercultural work
Personal development	1	0%	



Benefits	Number of responses	% of total responses	Comments
Other			<p>It's so much fun! It actually means working transdisciplinary - not only talking about it.</p> <p>Too easy to think you're the only ones working in this space. Such interactions keep you fresh and pushing boundaries.</p> <p>I think social media plays a much greater role at connecting us (here in Australia and with folks overseas) than your survey explores.</p> <p>Twitter has been an invaluable platform to make and strengthen connections with others in this field.</p>

**Table 14** Descriptions of barriers of the citizen science network, organised by themes (N=173).

Barriers	Number of responses	% of total responses	Comments
Time	44	25%	Having the time to actually interact People's time for interaction beyond their day-to-day duties
Lack of connection	33	19%	Not knowing who is working on what Having common agendas or communication points
Distance	26	15%	Australia is a big block, annual get togethers around the country in various locations would be good, not too grandiose, simply create opportunity for networking Opportunity. We are dispersed geographically and by the different work we do. Not enough opportunities to come together and converse about what interests us.
Funding	20	12%	Funders' requirements encouraging territoriality
Communication	8	5%	Not enough online Reliance on social media - unless you're plugged in you miss stuff Many different ways of getting in contact and not everyone is on Twitter
Opportunities to meet	7	4%	To effectively interact one needs location, knowledge and purpose. Casual meetings are not likely, given the limited numbers working in similar fields. The Canberra meeting last year was a great opportunity meet and talk, but travel to similar events around the country is costly on a retirement budget. I have a small local network of workers plus other professionals interested and with needed skills. This compensates for not having a wider network. The establishment of a local citizen science chapter has been an excellent initiative to reduce barriers related to interacting with other citizen science professionals.

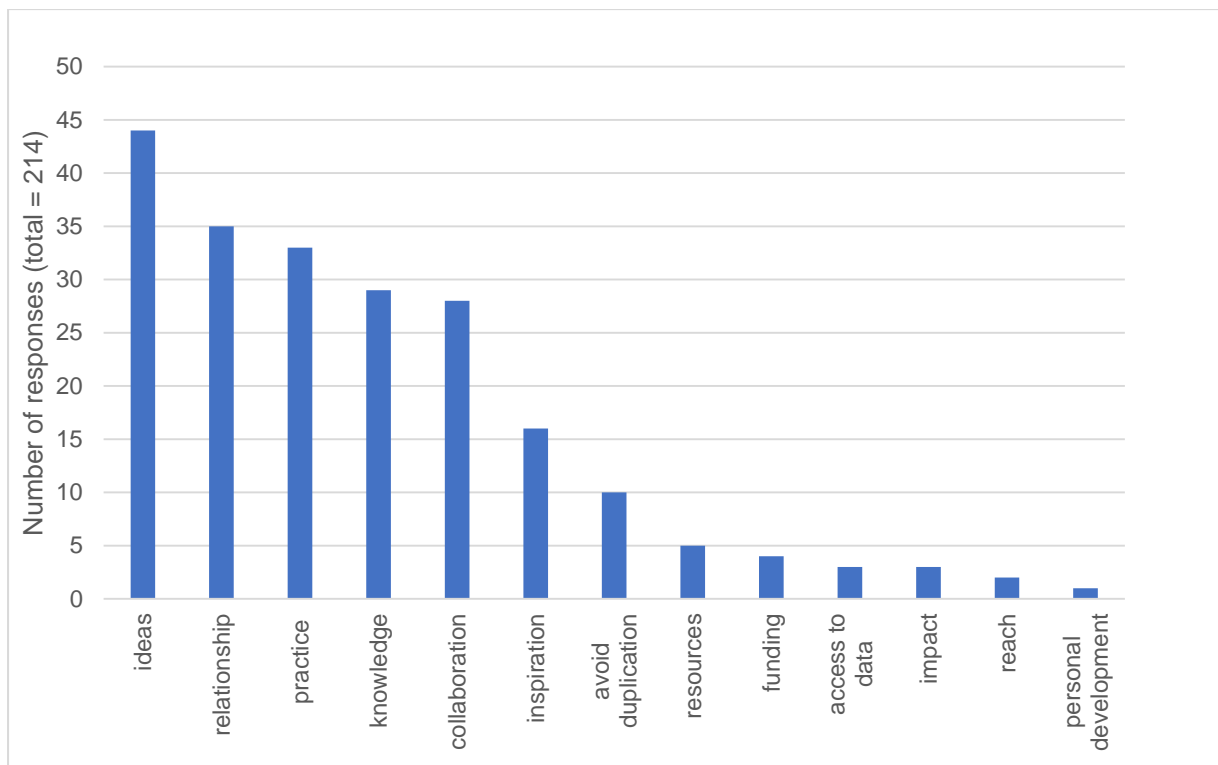
Barriers	Number of responses	% of total responses	Comments
Disciplinary barrier	6	3%	Communication. Language / buzz words can be different Silo-thinking - sometimes it seems that people still remain a little closed-minded towards other fields/ways of thinking
Inter-personal	6	3%	Strong personalities
Lack of coordination	5	3%	Fragmentation between people hindering growth from common experiences
Institutional bureaucracy	3	2%	I've been struck by a dichotomy with those I've met in citizen science - on the one hand there have been open, sharing people wanting to collaborate and grow existing projects; on the other hand there are people whose institutional agendas mean that they have to invent their 'own' project, even if it means doubling up, or directly competing with an existing project. I think most projects have the capacity to be national in geographic scope, given the right resources and clever ways of creating engagement and local context. Having said that, the wonderful people working in citizen science are full up with running their own great projects to have the space to interact too much! Government restrictions (e.g. IT, data sharing etc.) Organisational/bureaucratic structures
Lack of leadership	3	2%	Citizen science is still a very ad-hoc field and could benefit from better institutional support to assist with longer-term planning and evaluation to enable projects to achieve good outcomes into the future. Lack of long-term planning to enable projects to achieve long-term positive outcomes
Resistance to sharing	3	2%	Territoriality of organisations and individuals
Standards	3	2%	Standard methodologies and indicators for respective citizen science research programs
Too many	3	2%	Too many "opportunities" to interact

Barriers	Number of responses	% of total responses	Comments
different networks			Too many people to work with
Resistance to collaboration	1	1%	I have often come across a strong sense of ownership of CS projects, which is great - people should feel proud of their work. However, it also seems as if this sometimes creates a barrier to collaboration. I have found it difficult to progress collaboration sometimes and I don't know if this is the only barrier.
Technology	1	1%	Just to expand on the notion of reciprocity; in many respects it is far easier for me to collect, manage, store and serve local data matching the needs of various interest groups than it is to collect and upload the data to the various interest groups. The absence of an integrated data standard strikes me as being an ongoing barrier to effective collaboration i.e. it would make my 'work' easier if researchers were able to 'pull' rather than me having to 'push' data into the 'network'.
Other			<p>These encounters tend to be ad-hoc I see the barriers coming down The barriers are the same but stronger for interacting with citizen scientists vs professional researchers. There is nobody working locally in my research area - so meeting colleagues necessarily involves travel. Professional researchers are generally supported for conference travel, but citizen scientists are not - removing a potential venue for interaction.</p> <p>Some form of face to face meetings are crucial to building relationships and projects and networks.</p> <p>We would be keen to see a local chapter established but don't who's out there in NSW and what projects are being worked on. Be good to have more ways to communicate, training opportunities &amp; seminars also offer networking potential. Networking outside ones immediate project partners can be beneficial. Finding</p>

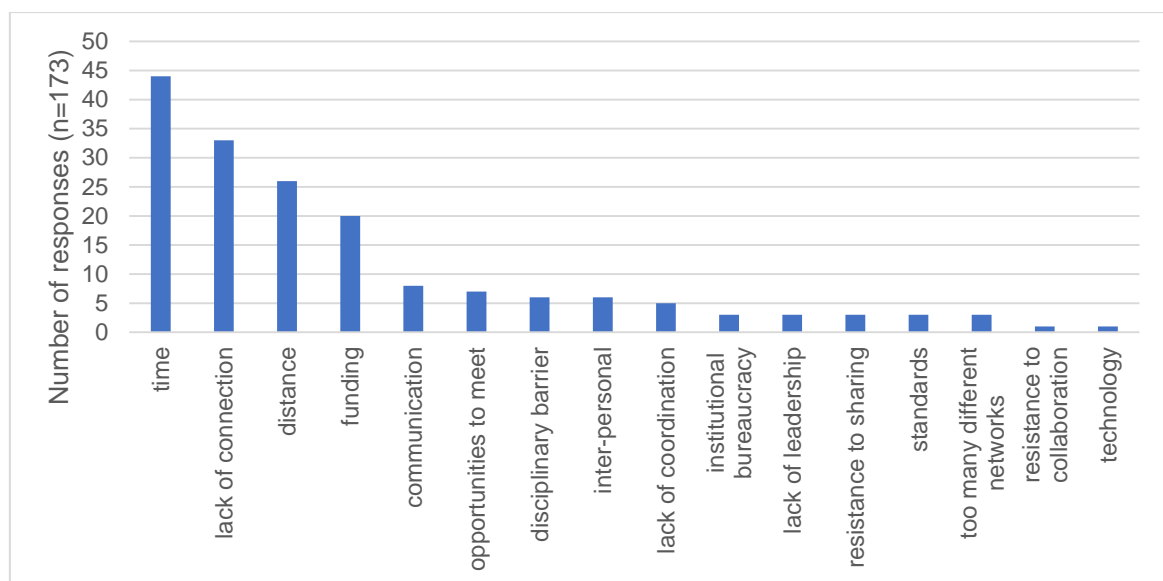
Barriers	Number of responses	% of total responses	Comments
			others who share enough common interest to make networking viable is not easy, plus it competes for limited resources.

**Table 15** Benefits and barriers of participating in the citizen science community of practice. Six respondents did not identify any benefits and twenty-five did not identify any barriers.

Benefits	Number of respondents identifying this benefit	Barriers	Number of respondents identifying this barrier
Ideas	26	Funding	12
Practice	13	Time	9
Collaboration	9	Distance	7
Knowledge	8	Lack of connection	6
Relationship	5	Communication	4
Inspiration	3	Disciplinary barrier	4
Impact	2	Lack of leadership	3
Funding	1	Lack of coordination	2
Avoid duplication	1	Opportunities to meet	1
No answer	6	Resistance to sharing	1
		Too many different networks	1
		No answer	25
Total	75	Total	75



**Figure 1** Benefits of citizen science network, as described by survey respondents.



**Figure 2** Barriers to the citizen science network, as described by survey respondents.

Sbrocchi, C, Pecl, G, van Putten, EI & Roetman, P. A Citizen Science Community of Practice: Relational Patterns Contributing to Shared Practice. *Citizen Science: Theory and Practice*, In press.

## **References**

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