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CANADA

THE ROLE AND CONTRIBUTION OF CITIZEN SCIENTISTS

**Report of the Standing Committee on Science and
Research**

Lloyd Longfield, Chair

**NOVEMBER 2023
44th PARLIAMENT, 1st SESSION**

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NOTICE TO READER

Reports from committees presented to the House of Commons

Presenting a report to the House is the way a committee makes public its findings and recommendations on a particular topic. Substantive reports on a subject-matter study usually contain a synopsis of the testimony heard, the recommendations made by the committee, as well as the reasons for those recommendations.

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THE STANDING COMMITTEE ON SCIENCE AND RESEARCH

has the honour to present its

SIXTH REPORT

Pursuant to its mandate under Standing Order 108(3)(i), the committee has studied Citizen Scientists and has agreed to report the following:

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SUMMARY

Citizen science, sometimes called participatory research, participatory science, or even community science, is a collaboration between members of the public and professional scientists in research projects.

Public participation can take many forms, from collecting data to co-developing research questions. Citizen science addresses a variety of research questions. While many projects are related to the environmental sciences, there are also citizen science projects related to astronomy, health and the social sciences. The size and scope of citizen science projects also vary greatly. Some projects are local, while others are international.

Many citizen science projects are being conducted across Canada. The House of Commons Standing Committee on Science and Research conducted a study on the role and value of citizen scientists.

Witnesses highlighted the many positive contributions of citizen science. First and foremost, citizen science has led to significant scientific advances. In addition, it has broader positive impacts on society, including promoting scientific literacy and helping to combat the spread of disinformation. Data and discoveries from citizen science are used by governments to develop better public policy, especially in the area of environmental protection.

Citizen science studies are ideal for carrying out investigations with long timelines and broad geographical scope, features that are difficult or impossible to include in studies funded through normal funding cycles. Another important strength of citizen science, mentioned by several witnesses, is its cost-effectiveness. The participation of many volunteers and the use of mobile applications or technologies that make it easy to share information have greatly reduced the cost of data collection. These strengths make citizen science an effective option for the government.

Witnesses also spoke about equity, diversity and inclusion; the participation of Indigenous communities in citizen science projects; data management; and support for citizen science.

In light of the evidence, the Committee made five recommendations to the federal government to support citizen scientists.

LIST OF RECOMMENDATIONS

As a result of their deliberations committees may make recommendations which they include in their reports for the consideration of the House of Commons or the Government. Recommendations related to this study are listed below.

Recommendation 1

That the Government of Canada support citizen science by optimally integrating the data and results of citizen science projects into its own research programs. 20

Recommendation 2

That the Government of Canada support citizen science projects on the lands it manages, including national parks and national urban parks. 20

Recommendation 3

That the federal government invest more in its public communications efforts to encourage participation in citizen science projects. 23

Recommendation 4

That the three granting councils, namely the Social Sciences and Humanities Research Council, the Natural Sciences and Engineering Research Council, and the Canadian Institutes of Health Research, include civic engagement in the criteria for evaluating funding applications. 33

Recommendation 5

That the Government of Canada consider increasing funding to enhance the capacity of organizations conducting citizen science projects. 33



THE ROLE AND CONTRIBUTIONS OF CITIZEN SCIENTISTS

INTRODUCTION

On 26 September 2022, the Standing Committee on Science and Research (the Committee) decided to undertake a “study on the role and value of citizen scientists and develop recommendations on how to encourage and expand the roles played by citizen scientists.”¹

In the course of its study, the Committee held six meetings between 2 February 2023 and 28 March 2023, during which it heard 28 witnesses. The Committee also received one brief. The Committee would like to thank all those who took the time to participate in this study by appearing or submitting a brief.

Based on this evidence, this report describes the positive impacts of citizen science from both societal and scientific perspectives. It examines the success factors of citizen science and some of the challenges it faces. Lastly, the Committee makes five recommendations to the federal government to support citizen scientists.

WHAT IS CITIZEN SCIENCE?

Definition

Citizen science, sometimes called participatory research, participatory science, or even community science,² is defined by Mona Nemer, Canada’s Chief Science Advisor, as a “collaborative approach to research between public volunteers and professionals, [which] operates in a variety of disciplines with a common value being that it opens up the scientific enterprise to people beyond the professional communities.”³

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- 1 House of Commons, Standing Committee on Science and Research [SRSR], [Minutes of Proceedings](#), 26 September 2022.
 - 2 SRSR, [Evidence](#), 2 February 2023, 1105 (Mona Nemer, Chief Science Advisor, Office of the Chief Science Advisor); SRSR, [Evidence](#), 2 February 2023, 1150 (Rémi Quirion, Chief Scientist of Quebec, Fonds de recherche du Québec); and SRSR, [Evidence](#), 9 February 2023, 1205 (John Reynolds, Professor of Ecology and Conservation, As an Individual).
 - 3 SRSR, [Evidence](#), 2 February 2023, 1105 (Mona Nemer).



This collaboration between citizens and professional scientists can take different forms. The most common is data collection. In many citizen science projects, members of the public are asked to participate by collecting observations, which are then analyzed by professional scientists. For example, the eButterfly site collects butterfly observations from users. These data are then used by scientists to better understand the impact of human activity on biodiversity.⁴ John Reynolds, a professor of ecology and conservation, said that the collection of data or observations by the public has been going on for a long time, but what's new are "online platforms that can collect this data and display it back to people in a very friendly and useful way."⁵

Data collection, however, is not the only form of public participation in scientific research projects.⁶ People can get involved at other stages of a research project. In some cases, members of the public are involved in developing a research question or analyzing data.⁷ This process is known as co-creation. In the area of river water monitoring, for example, local community participation sometimes goes beyond simply gathering information. In a report by the International Institute for Sustainable Development (IISD) referred to in a brief to the Committee, community-based monitoring is defined as "a process where concerned citizens, government agencies, industry, academia, community groups and local institutions collaborate to monitor, track, and respond to issues of common community concern."⁸

The goals of citizen science projects also vary. Christopher Wood, Director of eBird at the Cornell Lab of Ornithology, pointed out that "[t]here's a whole continuum of citizen science projects."⁹ He added, "[t]here are some projects ... that are more on the educational aspect, which is just a matter of going out, seeing something for the first time and seeing the wonder in the world."¹⁰ One example of this is iNaturalist, a platform that collects users' observations of plants and animals. Other projects have a more explicit scientific purpose: for example, the Community Collaborative Rain, Hail

4 SRSR, [Evidence](#), 16 February 2023, 1100 (Jeremy T. Kerr, University Research Chair in Macroecology and Conservation, As an Individual).

5 SRSR, [Evidence](#), 9 February 2023, 1205 (John Reynolds).

6 SRSR, [Evidence](#), 2 February 2023, 1135 (Mona Nemer); and SRSR, [Evidence](#), 7 February 2023, 1110 (Charles Ennis, President, Royal Astronomical Society of Canada).

7 SRSR, [Evidence](#), 16 February 2023, 1105 (Nicola Lewis, Chief Executive Officer, Kids Brain Health Network).

8 G. Whitelaw et al., "Establishing the Canadian Community Monitoring Network," *Environmental Monitoring and Assessment*, No. 88, 2003, cited by the International Institute for Sustainable Development (IISD), [A Business Case for Investment in Canadian Community-Based Water Monitoring](#), November 2021, p. 41.

9 SRSR, [Evidence](#), 7 February 2023, 1150 (Christopher Wood, Director of eBird, Cornell Lab of Ornithology).

10 Ibid.

and Snow Network Canada (CoCoRaHS) is a network that collects information on precipitation observed across the country.¹¹

The scale and scope of citizen science projects also vary widely. Some projects are local, like the water quality monitoring project at Drolet Lake, which was brought up by Rémi Quirion, the Chief Scientist of Quebec.¹² Other projects are international. The eBird project, managed by the Cornell Lab of Ornithology in the United States, collected more than 225 million bird observations last year.¹³

Lastly, citizen science deals with a variety of research fields. While many projects are in the environmental sciences, citizen science projects are also in astronomy, health and the social sciences.

Domestic and International Initiatives

Several countries have launched initiatives to encourage or support citizen science in recent years. Chief Science Advisor Mona Nemer told the Committee that, “since 2017, the U.S. has had a *Crowdsourcing and Citizen Science Act*, which aims to promote innovation through open and voluntary scientific collaboration.”¹⁴ The Chief Science Advisor gave other examples. In Australia, a citizen science association has been formed. Germany created a federally funded, centralized platform to promote citizen science. The Netherlands and Belgium implemented processes to “facilitate the input of citizens and scientists” in the research agenda.¹⁵

Moreover, in 2019, in advance of the G7 summit in Biarritz, France, the science academies of the G7 countries issued a joint statement on citizen science in the Internet era.¹⁶ The statement recommended, among other things, to “[p]romote the co-development of citizen science and laboratory-based research” and to “[c]reate specific funding programs for citizen science.”¹⁷

11 SRSR, [Evidence](#), 7 February 2023, 1210 (Juliet Hull, National Volunteer Coordinator, Community Collaborative Rain, Hail and Snow Network).

12 SRSR, [Evidence](#), 2 February 2023, 1115 (Rémi Quirion).

13 SRSR, [Evidence](#), 7 February 2023, 1100 (Christopher Wood).

14 SRSR, [Evidence](#), 2 February 2023, 1105 (Mona Nemer).

15 Ibid.

16 Ibid., 1110.

17 Summit of the G7 science academies, [Citizen science in the Internet era](#), 25–26 March 2019, p. 2.



In Canada, the federal government launched the Citizen Science Portal in 2017, which is maintained by science.gc.ca and housed at Innovation, Science and Economic Development Canada (ISED).¹⁸ This online portal lists over 50 citizen science projects across the country, 17 of which are led or co-led by federal departments.¹⁹ Examples of how the federal government has used citizen science data is provided in the following sections.

Initiatives have also been launched at the provincial level. Rémi Quirion, the Chief Scientist of Quebec, told the Committee about the Engagement program, which is managed by the Fonds de recherche du Québec.²⁰ The program invites citizens to submit ideas for research projects. Citizens are then matched with scientists interested in the proposed subject. They work together for several months to develop a detailed research project, which is then evaluated by a peer committee that includes members of the public. Successful projects are awarded around \$50,000 in funding over two years.²¹

BENEFITS OF CITIZEN SCIENCE

The evidence gathered by the Committee shows the positive impacts of citizen science. The contributions of citizen science are mainly of two kinds: scientific contributions and societal contributions.

Scientific Contributions

Many witnesses highlighted the scientific advances made possible by citizen science. As the Chief Science Advisor points out:

Clearly, participatory research can be enormously beneficial for science. It can help us meet our data needs, support multidisciplinary collaboration and promote open science objectives by encouraging public involvement.²²

18 Department of the Environment, Written response to the House of Commons Standing Committee on Science and Research, March 2023, p. 1.

19 Ibid.

20 SRSR, *Evidence*, 2 February 2023, 1100 (Rémi Quirion).

21 Ibid.

22 SRSR, *Evidence*, 2 February 2023, 1105 (Mona Nemer).

Witnesses gave examples of scientific fields in which citizen science can have a positive impact. Rémi Quirion mentioned sustainable development and the circular economy, while Mona Nemer cited the environment, pollution monitoring and agriculture.²³

Some characteristics of citizen science give it advantages in making a significant scientific contribution. For one, citizen science fills gaps in the collection of data used for scientific analysis.

In many research fields, researchers lack data covering long periods of time, or face difficulties in collecting data for vast geographic areas.²⁴ Collecting the amount of data needed is also expensive. Yet Christopher Wood points out that major challenges such as the crises in biodiversity, the climate and health require a lot of data:

Information needs to be precise and relevant at global, national, provincial and local scales. Our information needs will always outstrip the resources and funding we have available to hire professional scientists in data collection. Citizen science provides the best mechanism to gather these data.²⁵

Laura Reinsborough, Riverkeeper and Chief Executive Officer of Ottawa Riverkeeper, illustrated this point with regard to monitoring rivers:

The geographic reach in such a huge watershed is so much more than what our small team can achieve. It really is exponential in allowing us to monitor across the whole watershed. It also expands our capacity for monitoring the frequency with which we could monitor and, very importantly, they bring local knowledge, which enriches the data and also informs better decision-making based on that data.²⁶

Other witnesses agreed, saying that citizen science allows for wide geographic coverage and a wealth of data that professional scientists alone cannot gather.²⁷ University of Ottawa Research Chair in Macroecology and Conservation Jeremy Kerr said that citizen scientists using the eButterfly app have collected double the number of butterfly

23 SRSR, [Evidence](#), 2 February 2023, 1145 (Rémi Quirion); and SRSR, [Evidence](#), 2 February 2023, 1145 (Mona Nemer).

24 SRSR, [Evidence](#), 16 February 2023, 1110 (Andrew Gonzalez, Director, Quebec Centre for Biodiversity Science).

25 SRSR, [Evidence](#), 7 February 2023, 1100 (Christopher Wood).

26 SRSR, [Evidence](#), 7 February 2023, 1215 (Laura Reinsborough, Riverkeeper and Chief Executive Officer, Ottawa Riverkeeper).

27 SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran, President and Chief Executive Officer, Ocean Networks Canada); SRSR, [Evidence](#), 16 February 2023, 1100 (Jeremy T. Kerr); SRSR, [Evidence](#), 7 February 2023, 1125 (Geoffrey S. LeBaron, Director, Christmas Bird Count, National Audubon Society); and SRSR, [Evidence](#), 9 February 2023, 1105 (Jason Hwang, Vice-President, Salmon, Pacific Salmon Foundation).



observations in 7 years than what professional scientists in Canada collected in 130 years.²⁸

Data obtained through citizen science also have the advantage, in some cases, of covering long periods of time, which allows scientists to follow changes in what's being studied.²⁹ For example, the Christmas Bird Count has been conducted annually since 1900, which gives scientists access to data covering over a century.³⁰ In another citizen science program, citizens are "helping to digitize hundreds of thousands of plant specimens in herbarium collections, thanks to an online platform developed by the QCBS [Quebec Centre for Biodiversity Science]. This is providing precious historical reference data now in digital form to the research community."³¹

Another important strength of citizen science, mentioned by several witnesses, is its cost-effectiveness. The participation of many volunteers and the use of apps or technologies that make it easy to share information have greatly reduced the cost of data collection. For example, Birds Canada said that "volunteer field effort represented over 1.6 million hours in 2021 alone, almost twice as much as was collected in 2018."³² In a report released in 2021, IISD conducted an estimate of the cost-effectiveness of selected community-based water monitoring projects in Canada. According to the report, a sampling program by a public sector entity would have cost 3.4 times as much to obtain the same data as the monitoring project by the Lake Winnipeg Community-Based Monitoring Network between 2016 and 2019.³³ Raegan Mallinson, Manager of the Biomonitoring Program with Living Lakes Canada, said that multidisciplinary projects "provide huge cost savings."³⁴

Because of these strengths, citizen science has resulted in significant scientific advances over the years. One example was given by Andrew Gonzalez:

28 SRSR, [Evidence](#), 16 February 2023, 1100 (Jeremy T. Kerr).

29 SRSR, [Evidence](#), 7 February 2023, 1155 (Geoffrey S. LeBaron); and SRSR, [Evidence](#), 7 February 2023, 1245 (Laura Reinsborough).

30 SRSR, [Evidence](#), 7 February 2023, 1105 (Geoffrey S. LeBaron).

31 SRSR, [Evidence](#), 16 February 2023, 1110 (Andrew Gonzalez).

32 Birds Canada, Written response to the House of Commons Standing Committee on Science and Research, 21 February 2023.

33 IISD, [A Business Case for Investment in Canadian Community-Based Water Monitoring](#), November 2021, p. 24–25.

34 SRSR, [Evidence](#), 16 February 2023, 1225 (Raegan Mallinson, Manager, Biomonitoring Program, Living Lakes Canada).

In the pan-Canadian project Bat Watch, citizens have reported the presence of over 900 bat colonies in their attics, barns or bat boxes, allowing scientists to track the impact of something called white-nose syndrome, a disease that is causing unprecedented mortality in hibernating bats in Canada.³⁵

Mona Nemer listed some of the discoveries that have been made possible by citizen science:

The discovery of five new exoplanets, achievement of the first crowdsourced redesign of a protein widely used in synthetic chemistry, help in designing ways to prevent the COVID virus from entering cells and the discovery of entirely new aspects of the earth's magnetic field are examples of things to which citizen science has contributed.³⁶

These scientific advances also result in scholarly publications. For example, in 2021–2022, Birds Canada data, most of which came from citizen scientists, were used in 533 peer-reviewed publications.³⁷ Similarly, over 300 peer-reviewed papers use data from the Christmas Bird Count, which has been running since 1900.³⁸

Societal Contributions

In addition to scientific contributions, citizen science has positive benefits for society. Witnesses highlighted scientific literacy and the fight against disinformation, growing knowledge useful for developing public policy, and benefits for the local communities involved.

35 SRSR, [Evidence](#), 16 February 2023, 1110 (Andrew Gonzalez).

36 SRSR, [Evidence](#), 2 February 2023, 1105 (Mona Nemer).

37 SRSR, [Evidence](#), 9 February 2023, 1205 (Patrick Nadeau, President and Chief Executive Officer, Birds Canada); and SRSR, [Evidence](#), 9 February 2023, 1235 (Jody Allair, Director, Community Engagement, Birds Canada).

38 SRSR, [Evidence](#), 7 February 2023, 1105 (Geoffrey S. LeBaron).



Scientific Literacy and the Fight Against Disinformation

By directly involving amateur scientists, citizen science can help increase scientific literacy among the general public and fight the spread of disinformation.³⁹ Chief Science Advisor Mona Nemer emphasized this point:

By opening up science to non-professionals, we can enhance science literacy and improve public understanding of the evidence used to make policies. We can help to equip people with the tools they need to identify and resist misinformation and make informed decisions about their lives and their communities.⁴⁰

The Chief Scientist of Quebec, Rémi Quirion, also made this point: “increasing scientific literacy, that is, providing life-long science education, is one of the most effective measures for combating disinformation.”⁴¹ It is one of the reasons that led Quebec to develop the Engagement program described above:

One of the primary objectives of the Engagement program is better understanding of the scientific approach. Participants in the program are very proud of their projects and become valuable spokespersons for explaining science, research and scientific data where they live: in their families, in their communities, and, very often, in the media and to you, our members of Parliament.⁴²

From this perspective, science education goes hand in hand with citizen science. Rémi Quirion believes “it’s the duty of government—local, provincial and national—to offer opportunities to increase scientific literacy”⁴³ throughout life. The Chief Science Advisor recommended that citizen science be integrated into educational programs at an early stage.⁴⁴

Several witnesses highlighted the participation of children and youth in citizen science, and how it benefits them. Charles Ennis, President of the Royal Astronomical Society of Canada, said that the youngest member of that organization to discover a comet,

39 SRSR, [Evidence](#), 2 February 2023, 1100 (Rémi Quirion); SRSR, [Evidence](#), 2 February 2023, 1105 (Mona Nemer); SRSR, [Evidence](#), 7 February 2023, 1145 (Christopher Wood); SRSR, [Evidence](#), 14 February 2023, 1100 (Shawn Marshall, Departmental Science Advisor, Department of the Environment); SRSR, [Evidence](#), 16 February 2023, 1110 (Andrew Gonzalez); SRSR, [Evidence](#), 16 February 2023, 1215 (Kat Hartwig, Executive Director, Living Lakes Canada); and SRSR, [Evidence](#), 16 February 2023, 1225 (Raegan Mallinson).

40 SRSR, [Evidence](#), 2 February 2023, 1105 (Mona Nemer).

41 SRSR, [Evidence](#), 2 February 2023, 1100 (Rémi Quirion).

42 Ibid.

43 Ibid., 1120.

44 SRSR, [Evidence](#), 2 February 2023, 1110 (Mona Nemer).

in 2011, was 10 years old, and that her brother discovered another one two years later.⁴⁵ This kind of participation can spark an interest in science as a career.⁴⁶

Usefulness in Developing Public Policy

The data and results of citizen science projects are also useful for informing policy. In this sense, citizen science can contribute to better public policy.

Shawn Marshall, Departmental Science Advisor with the Department of the Environment, said that there are “many different outputs for [citizen science] work, including scientific papers, but these studies also directly inform policy and legislation.”⁴⁷

Several witnesses drew the Committee’s attention to the importance of public policy being based on reliable data and taking into account available expertise. This expertise sometimes lies with local communities and among members of the public. Christopher Wood said he thinks that “in general there’s often a gap between local knowledge and where decisions are coming from.”⁴⁸ Mona Nemer said that there can be a loss of trust in institutions and in government when citizens are not consulted in the development of policies that directly affect them.⁴⁹ Citizen science can play a role in this regard.

Andrew Gonzalez said that, as regards environmental conservation policies, “rural communities and landowners working far from the city often have an extremely deep appreciation and understanding of their biological diversity.”⁵⁰ He said that because of citizen science tools they “have never been more connected or better engaged in this sharing process—the sharing of observations and information. ... We’re seeing an uptake in this and broad engagement.”⁵¹

Carl Stewart, Director of the Western Canadian Wheat Growers Association, was more reserved about the role of citizen science: “As for citizen science, well, there may be a role for it, but we worry that citizen science can easily be captured by the dominant

45 SRSR, [Evidence](#), 7 February 2023, 1125 (Charles Ennis).

46 SRSR, [Evidence](#), 9 February 2023, 1135 (Kathryn Moran); SRSR, [Evidence](#), 16 February 2023, 1100 (Jeremy T. Kerr); SRSR, [Evidence](#), 9 February 2023, 1225 (Patrick Nadeau); and SRSR, [Evidence](#), 16 February 2023, 1225 (Kat Hartwig).

47 SRSR, [Evidence](#), 14 February 2023, 1100 (Shawn Marshall).

48 SRSR, [Evidence](#), 7 February 2023, 1145 (Christopher Wood).

49 SRSR, [Evidence](#), 2 February 2023, 1145 (Mona Nemer).

50 SRSR, [Evidence](#), 16 February 2023, 1140 (Andrew Gonzalez).

51 Ibid.



ideology of the day. Instead, we would advocate, as far as agriculture is concerned, that we leave the science to scientists and practitioners.”⁵²

Local Benefits

According to the evidence, citizen science projects can also have positive benefits for the local communities where they are conducted.

The activities of Ocean Networks Canada (ONC) provide a good example. Kathryn Moran, President and CEO of ONC, said that ONC deployed its first cabled observatory in Cambridge Bay, Nunavut, in 2012.⁵³ The observatory collects data on the Arctic Ocean. While engaging with the local community to design this observatory, ONC learned that the community “wanted real-time information particularly about the thickness of the sea ice to ensure their safety.”⁵⁴ ONC collected this data as part of its observatory activities, and made the data available to the local community. This example illustrates that each community has different priorities regarding scientific knowledge and that it’s useful to engage with them.⁵⁵

In this regard, witnesses praised the initiative of Victoriaville, Quebec, which appointed a chief science advisor in January 2023.⁵⁶ This type of approach means citizen science programs could be launched “with a much more focused directive in terms of what the priorities and needs are,”⁵⁷ and the benefits back to the community would be much stronger.

Areas of Activity

The evidence illustrated the scientific and societal benefits of citizen science in two areas in particular: the environment and biodiversity, and health.

52 SRSR, [Evidence](#), 16 February 2023, 1205 (Carl Stewart, Director, Western Canadian Wheat Growers Association).

53 SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran).

54 Ibid.

55 Ibid., 1110.

56 Victoriaville, [Le premier conseiller scientifique en chef d'une ville nommé à Victoriaville](#), News release, 23 January 2023; SRSR, [Evidence](#), 9 February 2023, 1140 (Kathryn Moran); and SRSR, [Evidence](#), 9 February 2023, 1145 (Jason Hwang).

57 SRSR, [Evidence](#), 9 February 2023, 1140 (Kathryn Moran).

The Environment and Biodiversity

Many witnesses emphasized that citizen science can play a very important role in protecting the environment and biodiversity.

First, many witnesses stressed the magnitude and urgency of the biodiversity crisis. Jeremy Kerr spoke of a “human-induced mass extinction, the likes of which we have not seen since the end of the age of the dinosaurs.”⁵⁸ Patrick Nadeau, President and Chief Executive Officer of Birds Canada, said “we have lost nearly three billion birds in North America since 1970, or almost one bird out of three. This decline shows the global effects of the converging climate and biodiversity crises.”⁵⁹

Citizen science helps inform the public about these issues and can create a “collective awareness.”⁶⁰ In Canada, there is a growing public concern for conservation and topics such as “climate change, biodiversity loss, species at risk and the benefits that healthy ecosystems provide to communities.”⁶¹

Citizen science provides an opportunity to capitalize on this public interest by gathering more data and better understanding observations.⁶² The evidence provided examples relating to several areas of environmental protection.

In the field of ornithology, birds are an excellent indicator of environmental change.⁶³ Programs such as the Christmas Bird Count make it possible to “track how birds respond to climate change”⁶⁴ and how their range has shifted in response.

Other platforms collect data on various aspects of biodiversity. The eButterfly app collects data on butterflies.⁶⁵ The iNaturalist platform collects observations of plants and all types of animals.⁶⁶ John Reynolds told the Committee about a program he co-leads to

58 SRSR, [Evidence](#), 16 February 2023, 1100 (Jeremy T. Kerr).

59 SRSR, [Evidence](#), 9 February 2023, 1200 (Patrick Nadeau).

60 Ibid., 1250.

61 SRSR, [Evidence](#), 14 February 2023, 1105 (Christine Loth-Bown, Vice-President, External Relations and Visitor Experience, Parks Canada Agency).

62 Ibid.

63 SRSR, [Evidence](#), 9 February 2023, 1250 (Jody Allair); SRSR, [Evidence](#), 7 February 2023, 1100 (Christopher Wood); and SRSR, [Evidence](#), 7 February 2023, 1105 (Geoffrey S. LeBaron).

64 SRSR, [Evidence](#), 7 February 2023, 1105 (Geoffrey S. LeBaron).

65 SRSR, [Evidence](#), 16 February 2023, 1100 (Jeremy T. Kerr).

66 SRSR, [Evidence](#), 9 February 2023, 1205 (John Reynolds).



encourage the use of the iNaturalist platform to conduct biodiversity studies in British Columbia’s provincial parks.⁶⁷

In the area of climate, 843 volunteer observers from the CoCoRaHS collect data on precipitation and snow across the country.⁶⁸

With respect to water, Laura Reinsborough presented the activities of Ottawa Riverkeeper, which was founded in 2001. This organization developed a “watershed health assessment and monitoring initiative, which is a comprehensive suite of scientific monitoring for 14 different indicators of river health.”⁶⁹ Living Lakes Canada developed a variety of research programs that range from “groundwater, lake, stream and wetland monitoring to lake foreshore health assessments, biomonitoring for restoration, and a national lake blitz.”⁷⁰ Professor Mehrdad Hajibabaei presented a project called STREAM, which stands for “Sequencing The Rivers for Environmental Assessment and Monitoring,” developed at the University of Guelph with collaborators from Environment Canada, the World Wildlife Fund, or WWF-Canada, and Living Lakes Canada, and with funding from Genome Canada.⁷¹ This project uses DNA bar-coding to analyze river samples provided by volunteers to examine the health of rivers.⁷²

Working with local fishers, Ocean Networks Canada collects and analyzes data from the Pacific, Arctic and Atlantic oceans.⁷³

Lastly, Pacific Salmon Foundation described a program with the Francis Juanes Laboratory at the University of Victoria to study the diet of adult salmon using samples collected by volunteer anglers.⁷⁴ The project provides a better understanding of forage fish stocks, which are essential food sources for wild salmon.⁷⁵

67 Ibid.

68 SRSR, [Evidence](#), 7 February 2023, 1210 (Juliet Hull).

69 SRSR, [Evidence](#), 7 February 2023, 1215 (Laura Reinsborough).

70 SRSR, [Evidence](#), 16 February 2023, 1200 (Kat Hartwig).

71 SRSR, [Evidence](#), 16 February 2023, 1200 (Mehrdad Hajibabaei, Professor, As an Individual).

72 Ibid.

73 SRSR, [Evidence](#), 9 February 2023, 1115 (Kathryn Moran).

74 SRSR, [Evidence](#), 9 February 2023, 1105 (Jason Hwang).

75 Ibid.

Data collected through citizen science are useful for establishing conservation policies for both the environment and species.⁷⁶ For example, Christopher Wood said that data from eBird “power conservation around the world, from local land trusts to federal policy, from action plans aimed at individual species to corporate sustainable agriculture policies.”⁷⁷

Health

The Committee was also told about the potential benefits of citizen science in the field of health.

For example, Nicola Lewis, Chief Executive Officer of the Kids Brain Health Network, spoke about the family engagement in research (FER) program, launched in 2018.⁷⁸ This program, funded by the Kids Brain Health Network and co-led by parents and pediatric researchers at McMaster University’s CanChild centre for child disability research, aims to engage parents and caregivers in research. The FER program is a 10-week online course for families, researchers and trainees. After completing the course, parents can get involved in the research they are interested in alongside researchers through a match-making service. “They’re involved in the research right from the get-go, from the very question that’s asked and whether that is a question that is relevant and that will provide a solution that will impact our families and children.”⁷⁹ To date, 300 people from 14 countries have been trained.⁸⁰

Federal Use of Citizen Science

Many federal departments and agencies use citizen science, either directly or indirectly. The federal government also supports many citizen science projects.

Shawn Marshall noted:

76 SRSR, *Evidence*, 9 February 2023, 1245 (Patrick Nadeau); SRSR, *Evidence*, 14 February 2023, 1130 (Aura Pantieras, Director General, Wildlife Assessment and Information, Department of the Environment); and SRSR, *Evidence*, 14 February 2023, 1115 (Jennifer Provencher, Research Scientist, Ecosystem Health Research, Ecotoxicology and Wildlife Health Division, Department of the Environment).

77 SRSR, *Evidence*, 7 February 2023, 1100 (Christopher Wood).

78 SRSR, *Evidence*, 16 February 2023, 1110 (Nicola Lewis).

79 *Ibid.*, 1115.

80 *Ibid.*, 1110.



The department, [Environment and Climate Change Canada (ECCC)], has been involved in a variety of citizen science programs for decades now. Some of these programs are our own initiatives, but others are led externally. Through them our scientists engage and sometimes support the development of protocols, contribute to the data and take advantage of the data that's available.⁸¹

Shawn Marshall also gave several examples of how the Department of the Environment uses citizen science. He spoke of the North American Breeding Bird Survey, a program launched in 1966 and coordinated in Canada by Environment and Climate Change Canada's Canadian Wildlife Service, in the United States by the U.S. Geological Survey and in Mexico by the National Commission for Knowledge and Use of Biodiversity.⁸² This long-term breeding bird monitoring program relies on volunteer participation. Shawn Marshall also mentioned the Canadian Aquatic Biomonitoring Network, to which members of the public can contribute after completing a training module.⁸³ Parks Canada Agency, for its part, told the Committee that its "public engagement work through citizen science is in early stages"⁸⁴ but mentioned initiatives such as "Team Up and Clean Up the Shore" and "Take a coastie."⁸⁵

Government scientists also use data from citizen science programs run by other organizations, such as eBird and iNaturalist.⁸⁶ With respect to species at risk, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is a "federally mandated body of volunteer scientists who assess the status of species for potential inclusion in the federal Species at Risk Act."⁸⁷ Several witnesses told the Committee that COSEWIC's work is driven by citizen science, particularly with respect to bird monitoring.⁸⁸

The government also supports projects conducted by external organizations. For example, SmartICE's Sikuttiaq project aims to monitor sea ice characteristics in Nunavut and Nunavik. The project combines satellite data, drone data and, most importantly,

81 SRSR, [Evidence](#), 14 February 2023, 1100 (Shawn Marshall).

82 Ibid.; and Government of Canada, [Breeding Bird Survey overview](#).

83 SRSR, [Evidence](#), 14 February 2023, 1100 (Shawn Marshall); and Government of Canada, [Canadian Aquatic Biomonitoring Network](#).

84 SRSR, [Evidence](#), 14 February 2023, 1105 (Christine Loth-Bown).

85 Ibid.

86 SRSR, [Evidence](#), 14 February 2023, 1100 (Shawn Marshall).

87 SRSR, [Evidence](#), 9 February 2023, 1205 (John Reynolds).

88 SRSR, [Evidence](#), 7 February 2023, 1105 (Geoffrey S. LeBaron); SRSR, [Evidence](#), 9 February 2023, 1205 (John Reynolds); and SRSR, [Evidence](#), 14 February 2023, 1130 (Aura Pantieras).

Inuit knowledge. The data is used to produce real-time maps, which can be accessed by local communities through the Arctic Elder Society’s SIKU platform.⁸⁹ The Sikuttiaq project is supported by the National Research Council of Canada and Parks Canada Agency. For its part, the Department of the Environment has worked with the Arctic Elder Society and other partners to develop “functionality within the app so hunters can report dead or sick birds.”⁹⁰

Several other witnesses mentioned that their organization’s activities receive or have received government support.⁹¹ For example, the Minister of Fisheries, Oceans and the Canadian Coast Guard, the Honourable Joyce Murray, recently announced \$46.5 million in funding over five years to Ocean Networks Canada, some of which will be used for citizen science projects.⁹²

However, some witnesses felt that the government should do more to harness the potential of citizen science.

Jason Hwang, Vice-President, Salmon, Pacific Salmon Foundation, said “Canada is missing out on huge, untapped potential to engage citizen scientists, especially in areas where there’s a natural public interest in a subject.”⁹³ He believes federal government entities are “really well placed to be the guides and supporters looking at how you can match federal priorities and federal funding programs to the possibility and capacity that can be leveraged by the vast network of citizen scientists, people who are out there.”⁹⁴ Jeremy Kerr feels the same:

I think there are mechanisms, both federally and provincially, that we could encourage the public services of these governments to adopt, which would facilitate their

89 SRSR, *Evidence*, 14 February 2023, 1100 (Shawn Marshall); Government of Canada, *Successful Canadian, Inuit and UK Research Teams Announced for Major New Arctic Research Programme*, News release, 11 May 2022; and SmartICE, *Community Projects*.

90 SRSR, *Evidence*, 14 February 2023, 1135 (Jennifer Provencher).

91 For example, SRSR, *Evidence*, 7 February 2023, 1220 (Juliet Hull); SRSR, *Evidence*, 9 February 2023, 1215 (John Reynolds); SRSR, *Evidence*, 9 February 2023, 1120 (Kathryn Moran); and SRSR, *Evidence*, 16 February 2023, 1200 (Mehrdad Hajibabaei).

92 SRSR, *Evidence*, 9 February 2023, 1120 (Kathryn Moran); and Government of Canada, *The Government of Canada invests in world-class ocean monitoring system to enhance Canada’s ocean protection for the next generation*, News release, 6 February 2023.

93 SRSR, *Evidence*, 9 February 2023, 1105 (Jason Hwang).

94 *Ibid.*, 1115.



engagement with the broader knowledge-based community around the use and deployment of citizen science programs for various purposes.⁹⁵

Patrick Nadeau, on behalf of Birds Canada, suggested “to support more citizen science opportunities at federally managed sites,”⁹⁶ such as the new urban national parks proposed by Parks Canada.

With respect to water monitoring, Kat Hartwig, Executive Director of Living Lakes Canada, encouraged the government to “catch up”⁹⁷ and “support the growing momentum around Indigenous and non-Indigenous community-based water monitoring.”⁹⁸ Ottawa Riverkeeper pointed to recommendations to government in a report by the Gordon Foundation, Living Lakes Canada and World Wildlife Fund Canada, entitled *Elevating Community-Based Water Monitoring in Canada*.⁹⁹ The report recommended “capacity building, data management, regional and national collaboration, and ensuring data has a clear pathway to informed decision-making.”¹⁰⁰

In light of the evidence, the Committee recommends:

Recommendation 1

That the Government of Canada support citizen science by optimally integrating the data and results of citizen science projects into its own research programs.

Recommendation 2

That the Government of Canada support citizen science projects on the lands it manages, including national parks and national urban parks.

95 SRSR, [Evidence](#), 16 February 2023, 1135 (Jeremy T. Kerr).

96 SRSR, [Evidence](#), 9 February 2023, 1205 (Patrick Nadeau).

97 SRSR, [Evidence](#), 16 February 2023, 1225 (Kat Hartwig).

98 Ibid.

99 SRSR, [Evidence](#), 7 February 2023, 1235 (Laura Reinsborough); and The Gordon Foundation, Living Lakes Canada and WWF-Canada, [Final Recommendations: Elevating Community-Based Water Monitoring in Canada](#), April 2019.

100 SRSR, [Evidence](#), 7 February 2023, 1235 (Laura Reinsborough).

CITIZEN SCIENCE SUCCESS FACTORS AND CHALLENGES

The witnesses provided the Committee with an opportunity to learn more about what makes citizen science projects successful, as well as ways to encourage this form of research.

Participant Motivation and Involvement

Some of the evidence focused on what drives citizens to participate in citizen science projects, and the roles they can play in these projects.

The Committee was told that citizens across the country have a great interest in science.¹⁰¹ This interest is shown through intense curiosity, especially about nature. Citizen science can satisfy this curiosity by enabling citizens to develop research questions, and by connecting them to scientists.¹⁰² Citizen science also encourages people to get out and connect with nature.¹⁰³ It can foster a sense of community.¹⁰⁴ Several witnesses noted that, while the pandemic forced a temporary halt to some citizen science activities, it did not weaken the public's willingness to volunteer.¹⁰⁵

However, this high level of public interest is not enough to ensure the success of citizen science projects. Witnesses emphasized the importance of treating participants in citizen science projects as equals with scientists. Rémi Quirion said: “The key, for me, is to treat them as equals.”¹⁰⁶ Nicola Lewis emphasized that families and trainees are partnered in the Family Engagement in Research program, which allows family members to “feel like they are equal and respected members of a team.”¹⁰⁷ Jeremy Kerr spoke about the importance of recognizing the contributions of citizen scientists as “they are sometimes the most knowledgeable people about what’s going on in their communities,

101 SRSR, [Evidence](#), 2 February 2023, 1115 (Rémi Quirion).

102 Ibid; SRSR, [Evidence](#), 7 February 2023, 1130 (Christopher Wood); and SRSR, [Evidence](#), 14 February 2023, 1100 (Shawn Marshall).

103 SRSR, [Evidence](#), 7 February 2023, 1150 (Christopher Wood); SRSR, [Evidence](#), 7 February 2023, 1150 (Charles Ennis); SRSR, [Evidence](#), 9 February 2023, 1255 (Patrick Nadeau); and SRSR, [Evidence](#), 9 February 2023, 1245 (Jody Allair).

104 SRSR, [Evidence](#), 7 February 2023, 1105 (Geoffrey S. LeBaron).

105 SRSR, [Evidence](#), 7 February 2023, 1255 (Laura Reinsborough); and SRSR, [Evidence](#), 7 February 2023, 1255 (David Lawrie, Program Director, Citizen Scientists).

106 SRSR, [Evidence](#), 2 February 2023, 1115 (Rémi Quirion).

107 SRSR, [Evidence](#), 16 February 2023, 1125 (Nicola Lewis).



about the species that are present and about identifying those characteristics of biodiversity that are distinct in those places.”¹⁰⁸

In addition, several witnesses highlighted “the importance of providing meaning behind participation.”¹⁰⁹ It’s important that participants know what their work is for and how it is used.¹¹⁰

To do this, it’s necessary to understand the motivations of different participants in citizen science projects. David Lawrie, Program Director of Citizen Scientists, said “[w]hen you talk about citizen science, there’s often confusion between what science is and what activism, involvement or engagement is.”¹¹¹ There may be a difference between what motivates scientists and what motivates volunteers. Often, volunteers “want to see something that concerns them get changed, rectified or managed better.”¹¹² These motivations must be taken into account. Successful citizen science projects are characterized by “a two-way relationship. The citizen scientists gain by being involved. Those who can use the data and apply it to the decisions and things that they have to do also gain.”¹¹³ Kathryn Moran agreed: “citizens make excellent scientists because they understand that their data are beneficial to local and sometimes national decision making.”¹¹⁴

Several witnesses also emphasized the importance of collaboration and partnerships.¹¹⁵ Juliet Hull, National Volunteer Coordinator for CoCoRaHS, said that the first step in a successful citizen science project is to identify groups that are not just willing to collaborate, but are enthusiastic about it.¹¹⁶ Juliet Hull gave the example of CoCoRaHS, which has partnered with a range of groups including “agriculture groups, emergencies

108 SRSR, [Evidence](#), 16 February 2023, 1150 (Jeremy T. Kerr).

109 SRSR, [Evidence](#), 7 February 2023, 1210 (Juliet Hull).

110 Ibid.

111 SRSR, [Evidence](#), 7 February 2023, 1205 (David Lawrie).

112 Ibid.

113 SRSR, [Evidence](#), 9 February 2023, 1135 (Jason Hwang).

114 SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran).

115 SRSR, [Evidence](#), 16 February 2023, 1230 (Mehrdad Hajibabaei); SRSR, [Evidence](#), 16 February 2023, 1230 (Georgia Peck, Manager, Lakes Program, Living Lakes Canada); and SRSR, [Evidence](#), 16 February 2023, 1230 (Kat Hartwig).

116 SRSR, [Evidence](#), 7 February 2023, 1210 (Juliet Hull).

managers, universities and local schools, conservation areas, meteorologists, climatologists, ECCC and local municipality water management.”¹¹⁷

With respect to public participation, Parks Canada Agency mentioned its communications efforts to encourage volunteerism.¹¹⁸ It recommended that the government develop “communications and outreach strategies to work with schools and with communities.”¹¹⁹

In light of the evidence, the Committee recommends:

Recommendation 3

That the federal government invest more in its public communications efforts to encourage participation in citizen science projects.

Equity, Diversity and Inclusion Issues

Witnesses drew the Committee’s attention to issues of equity, diversity and inclusion. The Chief Scientific Officer believes that, to “encourage participation, we really need to be cognizant of vulnerable populations and those who are excluded generally.”¹²⁰

Developing an inclusive approach to citizen science is important for several reasons. First, from a scientific perspective, it’s important to recognize that groups that are sometimes marginalized or excluded from decision-making processes have valuable knowledge and expertise. This is the case, for example, of rural communities and farmers.¹²¹ Similarly, several witnesses stressed the importance and wealth of Indigenous knowledge.¹²²

Second, participants’ geographic diversity is important to better address gaps in data collection. Witnesses emphasized the challenges of Canada’s size and the lack of data in

117 Ibid.

118 SRSR, [Evidence](#), 14 February 2023, 1120 (Manuela Charette, Director, Brand Experience Branch, Parks Canada Agency).

119 SRSR, [Evidence](#), 14 February 2023, 1120 (Shawn Marshall).

120 SRSR, [Evidence](#), 2 February 2023, 1150 (Mona Nemer).

121 SRSR, [Evidence](#), 16 February 2023, 1140 (Jeremy T. Kerr).

122 For example, SRSR, [Evidence](#), 2 February 2023, 1150 (Mona Nemer); and SRSR, [Evidence](#), 9 February 2023, 1135 (Kathryn Moran).



many less populated areas.¹²³ Partnerships with local communities across the country are helpful in this regard. For Andrew Gonzalez, this is an important issue for reliable data:

The current situation is that, although we do have many observations of nature—in the order of millions of observations—they tend to be located in a particular part of the country, essentially toward the southern border where many people, obviously, live in Canada. There is this geographic bias in where our best information is, and that is not sufficient to assess how biodiversity across the country is changing.¹²⁴

Lastly, it's important to make sure that the intended benefits of citizen science reach the greatest number of Canadians. The participation of different groups of people, especially those who are marginalized, allows for better consideration of their needs and circumstances and for more reliable data that can be used to develop public policy, for example. Quebec's Chief Scientist, Rémi Quirion, gave the example of a research project that focuses on homeless women in Montreal.¹²⁵ It's also important that the impact of citizen science in the area of science literacy reach a broader population. Jeremy Kerr said he hopes that in the future "citizen science programs will touch everyone's lives, supporting Indigenous communities in their own languages and helping to inspire and include people who are under-represented in our scientific organizations."¹²⁶

Several witnesses also raised the issue of language. Responding to a question on how to mobilize communities using science if science is expressed only in English, thereby excluding a quarter of Canadians, the Chief Science Advisor said that it is "essential for Canada to maintain the vitality of French as a language of research, to facilitate access to knowledge expressed in French and to foster a civic dialogue in French in Canada and throughout the Francophonie."¹²⁷ She made the following recommendations:

1. Support scientific research in Francophone communities and encourage the setting up of networks of Francophone researchers across Canada and around the world. In order to do that, it would be necessary to set up a support program for scientific cooperation and researcher mobility between Canada and countries in the

123 SRSR, [Evidence](#), 16 February 2023, 1200 (Mehrdad Hajibabaei); et SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran).

124 SRSR, [Evidence](#), 16 February 2023, 1125 (Andrew Gonzalez).

125 SRSR, [Evidence](#), 2 February 2023, 1115 and 1140 (Rémi Quirion).

126 SRSR, [Evidence](#), 16 February 2023, 1100 (Jeremy T. Kerr).

127 Office of the Chief Science Advisor, Written response to the House of Commons Standing Committee on Science and Research, 20 March 2023, p. 2.

Francophonie. Just like culture and business, science deserves to have its place in Canada's relationships with countries in the international Francophonie.

2. Build on the activities of an existing organization, such as the Association canadienne-française pour l'avancement des sciences (Acfas), that is operating nationwide to promote and encourage science in French (from the practice of science to the dissemination of scientific research findings).

3. Support the publication in French of plain-language scientific articles as well as journal articles that summarize the state of knowledge and can be used by both decision-makers and the general public. There have been such publications in the past, but they ceased publication because of a lack of funding. By using digital platforms to make dissemination easier, the government could work with the Acfas and other learned societies to develop sustainable options.

4. Develop sophisticated online tools to translate scientific articles from French to English and vice versa. This would encourage the publication of scientific articles in French and ensure that they are disseminated and used around the world. These tools would also give Francophones access to scientific articles published in other languages, including English. The power of artificial intelligence could be harnessed, and the government, through the National Research Council Canada or Library and Archives Canada, could support the development of such an application and make it available.

5. Set up a French-language science office to monitor and coordinate activities and measure progress achieved. This team could be set up within a Minister's office (the office of the Minister of Official Languages or that of the Minister of Innovation, Science and Industry) or attached to the Office of the Chief Science Advisor or the Canada Research Coordinating Committee. A French-language science office would propose concrete actions to be implemented by the principal organizations that manage and distribute federal funding for research. It could be a one-stop shop for all initiatives and programs that support science in French and make it available to everyone.¹²⁸

Several organizations said that their communications are translated into both official languages.¹²⁹ Others said that they had made efforts in this area.¹³⁰ Nicola Lewis, for example, said that three instructors have been trained to deliver a French FER course.¹³¹ The Department of the Environment provided the following clarification in a written response to the Committee:

128 Ibid.

129 SRSR, *Evidence*, 7 February 2023, 1240 (Laura Reinsborough); and SRSR, *Evidence*, 16 February 2023, 1130 (Andrew Gonzalez).

130 SRSR, *Evidence*, 7 February 2023, 1110 (Charles Ennis); and SRSR, *Evidence*, 9 February 2023, 1145 (Kathryn Moran).

131 SRSR, *Evidence*, 16 February 2023, 1105 (Nicola Lewis).



ECCC contribution agreements with collaborators such as Birds Canada also include expectations that citizen science programs funded by the Government of Canada be delivered in both official languages, including bilingual websites and bilingual staff. As such, partners use government funding for translation of Canadian interfaces to international programs such as eBird.¹³²

Indigenous Participation

Several witnesses spoke about the participation of Indigenous communities in citizen science projects.

Organizations and scientists are conducting citizen science projects in partnership with Indigenous communities across the country. Laura Reinsborough explained that the Ottawa River watershed is “almost exactly the unceded land of the Algonquin Anishinabe” and that Ottawa Riverkeeper works with the Indigenous guardian program at Kitigan Zibi First Nation.¹³³ Ocean Networks Canada has developed partnerships with Indigenous communities along Canada’s three oceans. For example, it has partnered with the Maritimes tribal council in Nova Scotia.¹³⁴ In some Indigenous communities, Ocean Networks Canada uses education programs in schools to explain to teachers “how older youth can become part of citizen scientist programs.”¹³⁵ One of the goals of the organization is to grow “the Indigenous coastal communities to be truly the stewards of our coastline.”¹³⁶

The Pacific Salmon Foundation told the Committee that it “is increasingly active in involving First Nations communities and also the broad network of other stewards that really want to be involved in looking after the natural resources here in this part of the country.”¹³⁷

132 Department of the Environment, Written response to the House of Commons Standing Committee on Science and Research, March 2023, p. 1.

133 SRSR, [Evidence](#), 7 February 2023, 1230 (Laura Reinsborough).

134 SRSR, [Evidence](#), 9 February 2023, 1115 (Kathryn Moran).

135 Ibid.

136 Ibid., 1120.

137 SRSR, [Evidence](#), 9 February 2023, 1130 (Jason Hwang).

Programs led or supported by the federal government may also involve Indigenous communities. As mentioned earlier, this is the case in Nunavut, for example, with the government’s support for SmartICE programs.¹³⁸

The report *Elevating Community-Based Water Monitoring in Canada* by the Gordon Foundation, Living Lakes Canada and WWF Canada makes recommendations to the federal government regarding community-based water monitoring. Among other things, the report recommends “[i]n Indigenous monitoring contexts, give highest priority to Indigenous protocols and policies in establishing [community-based water monitoring] programs and undertaking collaborative data collection.”¹³⁹ Georgia Peck, Manager, Lakes Program, Living Lakes Canada, told the Committee that Living Lakes Canada “recently co-created a local Indigenous knowledge and values framework with the Upper Nicola Band located in Okanagan, B.C., to ensure inclusivity throughout the [foreshore integrated management planning] project.”¹⁴⁰

An important aspect of engaging Indigenous communities in citizen science activities is the integration of Indigenous knowledge.¹⁴¹ Chief Science Advisor Mona Nemer explained how the federal government integrates Indigenous knowledge into its programs. She told the Committee that “knowledge gathered by Indigenous communities belongs to the Indigenous communities. They’re the holders of the information.”¹⁴² This means that the government needs to “engage, build trust at the start and develop ways that are agreeable to the communities sharing the knowledge...and under which terms.”¹⁴³ Regarding the integration of Indigenous knowledge and Western science, Mona Nemer mentioned the federal government’s Interdepartmental Indigenous Science, Technology, Engineering and Mathematics (STEM) Cluster, and said that the government is working with Indigenous scientists “so we can be guided on how to get to a stage where we have both knowledge systems informing our policies.”¹⁴⁴

138 SRSR, [Evidence](#), 14 February 2023, 1145 (Shawn Marshall).

139 The Gordon Foundation, Living Lakes Canada and WWF-Canada, [Final Recommendations: Elevating Community-Based Water Monitoring in Canada](#), April 2019, p. 5.

140 SRSR, [Evidence](#), 16 February 2023, 1235 (Georgia Peck).

141 SRSR, [Evidence](#), 9 February 2023, 1135 (Kathryn Moran).

142 SRSR, [Evidence](#), 2 February 2023, 1150 (Mona Nemer).

143 Ibid.

144 Ibid.



The intersection of data ownership and Indigenous knowledge was also mentioned by several witnesses. This will be discussed in the next section.

Data Management

Some citizen science projects generate large amounts of data. Quality control of these data, their management and their sharing are important issues for citizen science.

Data Quality

The Committee was told that “[d]ata quality is the core challenge of citizen science.”¹⁴⁵ The reliability of citizen science data is an important issue in terms of credibility.¹⁴⁶ Geoffrey S. LeBaron, Director, Christmas Bird Count, National Audubon Society, said “[u]ntil about the 1980s, scientists were reluctant to accept citizen science datasets as valuable for analysis.”¹⁴⁷ Errors can happen in the data sets collected by participants.¹⁴⁸

Questions were also raised about the risk of individuals intentionally manipulating the observations they submit. Juliet Hull told the Committee that her organization has in the past “had to close some [precipitation monitoring] stations because people were using it to push a narrative.”¹⁴⁹

In response to these risks, and to ensure data quality, organizers of citizen science projects have taken several approaches.

First, in general, when talking about large-scale citizen science projects, “the strength of that dataset is through the brute force of large numbers.”¹⁵⁰ In such cases, a few erroneous individual observations that slip through the database are insignificant given the amount of data collected. For example, concerning birds, “[i]t’s allowing high-level

145 SRSR, [Evidence](#), 7 February 2023, 1115 (Christopher Wood).

146 SRSR, [Evidence](#), 16 February 2023, 1120 (Jeremy T. Kerr).

147 SRSR, [Evidence](#), 7 February 2023, 1105 (Geoffrey S. LeBaron).

148 For example, SRSR, [Evidence](#), 16 February 2023, 1120 (Jeremy T. Kerr); SRSR, [Evidence](#), 7 February 2023, 1250 (Juliet Hull); and SRSR, [Evidence](#), 9 February 2023, 1230 (John Reynolds).

149 SRSR, [Evidence](#), 7 February 2023, 1250 (Juliet Hull).

150 SRSR, [Evidence](#), 9 February 2023, 1210 (John Reynolds).

visualizations of migration distributions, for example, things like that, even though individual records may well have errors.”¹⁵¹

One data quality control strategy is to have unusual observations or data verified by experts. This is the solution chosen by iNaturalist: “If somebody puts in something that is crazy, like they saw a dodo, or something like that, that will get flagged, and it will come to the attention of a regional reviewer, and they can ask them about it.”¹⁵² Other organizations are taking the same approach.¹⁵³

Another method is to allow other users to identify errors. For example, John Reynolds noted that a high school student helped correct a misidentification of an orchid observed in the Yukon.¹⁵⁴

In other cases, additional measures can be taken to verify observations made by participants. For example, tests can be done for the conductivity in a creek.¹⁵⁵

Participant training and onboarding are also useful ways to improve data quality.¹⁵⁶ Lastly, many organizations have developed or adopted standardized protocols for data collection and processing, so that data are more reliable and can be compared with data from other citizen science projects.¹⁵⁷

These measures have enhanced the credibility of data from citizen science projects. Data from the CoCoRaHS network are used by the Department of the Environment for quality assurance and quality control of its own data: “Depending on the area, for example, in the Northwest Territories, the CoCoRaHS observer reports are oftentimes more accurate or trustworthy and have a lot of weight behind them.”¹⁵⁸ Numerous scientific articles are based on citizen science data, as their quality is now recognized.¹⁵⁹

151 ibid.

152 ibid.

153 SRSR, [Evidence](#), 7 February 2023, 1115 (Christopher Wood); and SRSR, [Evidence](#), 16 February 2023, 1120 (Jeremy T. Kerr).

154 SRSR, [Evidence](#), 9 February 2023, 1230 (John Reynolds).

155 SRSR, [Evidence](#), 7 February 2023, 1250 (Laura Reinsborough).

156 SRSR, [Evidence](#), 9 February 2023, 1230 (Jody Allair).

157 SRSR, [Evidence](#), 7 February 2023, 1230 (David Lawrie); and SRSR, [Evidence](#), 7 February 2023, 1250 (Juliet Hull).

158 SRSR, [Evidence](#), 7 February 2023, 1245 (Juliet Hull).

159 SRSR, [Evidence](#), 9 February 2023, 1230 (Jody Allair).



Data Management and Analysis

Another challenge related to data concerns its processing.

Citizen science projects sometimes generate vast amounts of data. For example, Ocean Networks Canada currently stores over 1.2 petabytes of data.¹⁶⁰ Organizations need sophisticated databases to manage this information.¹⁶¹

Analyzing data collected through citizen science requires complex modeling.¹⁶²

Geoffrey S. LeBaron said that the “Audubon and Patuxent Wildlife Research Center developed a toolset to analyze citizen science datasets, not just ornithological datasets but citizen science datasets in general, so those techniques were adaptable to citizen science in all fields.”¹⁶³

Data management, storage and developing the techniques needed to process them are a significant burden for organizations that launch citizen science projects. Patrick Nadeau said there needs to be investment in the infrastructure needed for these projects to work.¹⁶⁴ This includes acquiring specialized software and training specialists.

Open Data and Intellectual Property

The evidence highlighted the issue of open data from citizen science. Several witnesses mentioned the importance of sharing the results of citizen science projects, so that participants can see how their contributions have helped.¹⁶⁵ Ottawa Riverkeeper believes that “data collected by citizen scientists should be made available to the communities that collect it and are affected by it.”¹⁶⁶

160 SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran).

161 SRSR, [Evidence](#), 9 February 2023, 1215 (Jody Allair).

162 SRSR, [Evidence](#), 7 February 2023, 1120 (Christopher Wood).

163 SRSR, [Evidence](#), 7 February 2023, 1105 (Geoffrey S. LeBaron).

164 SRSR, [Evidence](#), 9 February 2023, 1225 (Patrick Nadeau).

165 SRSR, [Evidence](#), 14 February 2023, 1100 (Shawn Marshall); and SRSR, [Evidence](#), 7 February 2023, 1210 (Juliet Hull).

166 Ottawa Riverkeeper, Written response to the House of Commons Standing Committee on Science and Research, 23 February 2023.

Many of the organizations that provided evidence to the Committee said that they make the data collected through their citizen science projects public or available to researchers.

eBird data are open and accessible. The organization asks interested researchers for their research affiliation and what the purpose of the data is to better understand the use of the data.¹⁶⁷ Audubon has taken a similar approach to data from the Christmas Bird Count.¹⁶⁸

Other organizations are making their data available online. This is the case of the Royal Astronomical Society of Canada,¹⁶⁹ Ocean Networks Canada¹⁷⁰ and the CoCoRaHS network, which has developed an interactive map that the public can consult.¹⁷¹

Releasing reports is another approach taken by several organizations. These include Birds Canada and the STREAM project.¹⁷²

Several witnesses spoke about data and knowledge collected from Indigenous communities. The Committee was told several times that Indigenous communities own their knowledge and the data they collect.¹⁷³ For example, Shawn Marshall, speaking for the Department of the Environment, told the Committee:

This is something that's very important to respect. In general, where we have Indigenous partnerships, they do own the data. It's not going to be in our databases or publicly available except with their explicit, active ongoing permission. The default is that they have the ownership.¹⁷⁴

167 SRSR, [Evidence](#), 7 February 2023, 1135 (Christopher Wood).

168 SRSR, [Evidence](#), 7 February 2023, 1140 (Geoffrey S. LeBaron).

169 SRSR, [Evidence](#), 7 February 2023, 1140 (Charles Ennis).

170 SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran).

171 SRSR, [Evidence](#), 7 February 2023, 1210 (Juliet Hull).

172 SRSR, [Evidence](#), 9 February 2023, 12350 (Jody Allair); and SRSR, [Evidence](#), 16 February 2023, 1200 (Mehrdad Hajibabaei).

173 SRSR, [Evidence](#), 2 February 2023, 1150 (Mona Nemer); SRSR, [Evidence](#), 7 February 2023, 1230 (Laura Reinsborough); SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran); and SRSR, [Evidence](#), 14 February 2023, 1145 (Shawn Marshall).

174 SRSR, [Evidence](#), 14 February 2023, 1145 (Shawn Marshall).



Organizations that work in partnership with Indigenous communities said they make sure to have their consent to process and release data.¹⁷⁵ Kathryn Moran, on behalf of Ocean Networks Canada, emphasized the importance of respecting the principles of ownership, control, access and possession.¹⁷⁶

Support for Citizen Science Projects

Lastly, witnesses told the Committee about the challenges of funding citizen science projects.

In general, the level of financial support for citizen science from the federal government is still low.¹⁷⁷ In the area of community-based water monitoring, the difference in funding between Canada and the European Union is “astounding,”¹⁷⁸ according to Kat Hartwig.

Witnesses noted that many of the organizations behind citizen science projects are small and have limited resources.¹⁷⁹ The federal government provides funding for citizen science projects through several programs and agencies. For example, the CoCoRaHS network has received funding from Environment Canada and Agriculture and Agri-Food Canada, the Pacific Salmon Foundation has received funding from the British Columbia Salmon Restoration and Innovation Fund, and the STREAM project has received funding from Genome Canada.¹⁸⁰ However, this funding is usually short-term. Several witnesses emphasized the need for stable, more predictable forms of funding.¹⁸¹ According to Jason Hwang, “we need a strategy and a system, not ad hoc ideas or funding that we throw out there and hope for something good.”¹⁸²

175 SRSR, [Evidence](#), 7 February 2023, 1230 (Laura Reinsborough); SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran); SRSR, [Evidence](#), 9 February 2023, 1140 (Jason Hwang); and SRSR, [Evidence](#), 14 February 2023, 1145 (Jennifer Provencher).

176 SRSR, [Evidence](#), 9 February 2023, 1100 (Kathryn Moran).

177 SRSR, [Evidence](#), 2 February 2023, 1115 (Rémi Quirion).

178 SRSR, [Evidence](#), 16 February 2023, 1230 (Kat Hartwig).

179 For example, SRSR, [Evidence](#), 7 February 2023, 1140 (Geoffrey S. LeBaron); and SRSR, [Evidence](#), 7 February 2023, 1220 (Juliet Hull).

180 SRSR, [Evidence](#), 7 February 2023, 1220 (Juliet Hull); SRSR, [Evidence](#), 9 February 2023, 1225 (Jason Hwang); and SRSR, [Evidence](#), 16 February 2023, 1200 (Mehrdad Hajibabaei).

181 SRSR, [Evidence](#), 7 February 2023, 1220 (Juliet Hull); SRSR, [Evidence](#), 7 February 2023, 1235 (Laura Reinsborough); and SRSR, [Evidence](#), 9 February 2023, 1115 (Jason Hwang).

182 SRSR, [Evidence](#), 9 February 2023, 1105 (Jason Hwang).

Witnesses also suggested that government support be targeted so as to allow organizations involved in citizen science to better structure themselves. There are needs in the areas of human resources,¹⁸³ infrastructure¹⁸⁴ and operational expenses.¹⁸⁵

Witnesses suggested several avenues by which the federal government could better support citizen science. Jeremy Kerr said that the three granting councils, namely the Social Sciences and Humanities Research Council, the Natural Sciences and Engineering Research Council, and the Canadian Institutes of Health Research, could play a role in this area.¹⁸⁶ Two witnesses suggested that civic engagement be included in the criteria for evaluating funding applications to the councils.¹⁸⁷ The Strategic Science Fund, administered by Innovation, Science and Economic Development Canada and Health Canada, was also mentioned as a possible model for encouraging citizen science partnerships.¹⁸⁸ This program aims to support not-for-profit organizations incorporated in Canada that are engaged in research activities and that cannot access other federal funding programs.¹⁸⁹

Therefore, the Committee recommends:

Recommendation 4

That the three granting councils, namely the Social Sciences and Humanities Research Council, the Natural Sciences and Engineering Research Council, and the Canadian Institutes of Health Research, include civic engagement in the criteria for evaluating funding applications.

Recommendation 5

That the Government of Canada consider increasing funding to enhance the capacity of organizations conducting citizen science projects.

183 SRSR, [Evidence](#), 2 February 2023, 1125 (Mona Nemer); SRSR, [Evidence](#), 7 February 2023, 1255 (Laura Reinsborough); and SRSR, [Evidence](#), 7 February 2023, 1255 (David Lawrie).

184 SRSR, [Evidence](#), 9 February 2023, 1225 (Patrick Nadeau).

185 SRSR, [Evidence](#), 7 February 2023, 1255 (Laura Reinsborough); and SRSR, [Evidence](#), 7 February 2023, 1255 (David Lawrie).

186 SRSR, [Evidence](#), 16 February 2023, 1135 (Jeremy T. Kerr).

187 SRSR, [Evidence](#), 9 February 2023, 1145 (Kathryn Moran); and SRSR, [Evidence](#), 16 February 2023, 1145 (Nicola Lewis).

188 SRSR, [Evidence](#), 16 February 2023, 1105 (Nicola Lewis).

189 Government of Canada, [Strategic Science Fund: Program guide](#).

APPENDIX A LIST OF WITNESSES

The following table lists the witnesses who appeared before the committee at its meetings related to this report. Transcripts of all public meetings related to this report are available on the committee’s [webpage for this study](#).

Organizations and Individuals	Date	Meeting
Fonds de recherche du Québec Rémi Quirion, Chief Scientist of Quebec	2023/02/02	27
Office of the Chief Science Advisor Mona Nemer, Chief Science Advisor	2023/02/02	27
Citizen Scientists David Lawrie, Program Director	2023/02/07	28
Community Collaborative Rain, Hail and Snow Network Juliet Hull, National Volunteer Coordinator	2023/02/07	28
Cornell Lab of Ornithology Christopher Wood, Director of eBird	2023/02/07	28
National Audubon Society Geoffrey S. LeBaron, Director, Christmas Bird Count	2023/02/07	28
Ottawa Riverkeeper Laura Reinsborough, Riverkeeper and Chief Executive Officer	2023/02/07	28
Royal Astronomical Society of Canada Charles Ennis, President	2023/02/07	28
As an individual John Reynolds, Professor of Ecology and Conservation	2023/02/09	29
Birds Canada Jody Allair, Director, Community Engagement Patrick Nadeau, President and Chief Executive Officer	2023/02/09	29

Organizations and Individuals	Date	Meeting
Ocean Networks Canada Kathryn Moran, President and Chief Executive Officer	2023/02/09	29
Pacific Salmon Foundation Jason Hwang, Vice-President, Salmon	2023/02/09	29
Department of the Environment Shawn Marshall, Departmental Science Advisor Aura Pantieras, Director General, Wildlife Assessment and Information Jennifer Provencher, Research Scientist, Ecosystem Health Research, Ecotoxicology and Wildlife Health Division Arash Shahsavarani, Director, Water Quality Monitoring and Surveillance Division	2023/02/14	30
Parks Canada Agency Manuela Charette, Director, Brand Experience Branch Christine Loth-Bown, Vice-President, External Relations and Visitor Experience Stephen McCanny, Manager, Ecosystem Science Laboratory	2023/02/14	30
As an individual Mehrddad Hajibabaei, Professor Jeremy T. Kerr, University Research Chair in Macroecology and Conservation, Department of Biology, University of Ottawa	2023/02/16	31
Kids Brain Health Network Nicola Lewis, Chief Executive Officer	2023/02/16	31
Living Lakes Canada Kat Hartwig, Executive Director Raegan Mallinson, Manager, Biomonitoring Program Georgia Peck, Manager, Lakes Program	2023/02/16	31
Quebec Centre for Biodiversity Science Andrew Gonzalez, Director	2023/02/16	31
Western Canadian Wheat Growers Association Carl Stewart, Director	2023/02/16	31

APPENDIX B LIST OF BRIEFS

The following is an alphabetical list of organizations and individuals who submitted briefs to the committee related to this report. For more information, please consult the committee's [webpage for this study](#).

Ottawa Riverkeeper

REQUEST FOR GOVERNMENT RESPONSE

Pursuant to Standing Order 109, the committee requests that the government table a comprehensive response to this report.

A copy of the relevant *Minutes of Proceedings* (Meetings Nos. [27](#), [28](#), [29](#), [30](#), [31](#), [36](#), [52](#) and [58](#)) is tabled.

Respectfully submitted,

Lloyd Longfield
Chair

Conservative Dissenting Report
Citizen Scientists

The Conservative Party of Canada disagrees with the recommendations in this report that call for unfunded spending. This does not mean that citizen scientists do not have an important role to play but it is vital for everyone to remember that for every additional dollar spent the government must first find a dollar that it will save rather than imposing debts upon future generations through reckless spending. Reckless spending leads to runaway inflation which leads to life becoming increasingly unaffordable for more and more Canadians.

