Community conservation data in New Zealand: A review of community-collected conservation data and suggestions for improvement

Honours Dissertation (GEOG420)

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Abstract

New Zealand is a place of high biodiversity, and over 600 community conservation groups work to help improve the state of the environment through restoration and conservation efforts. The work undertaken by these groups is diverse, including pest trapping, species monitoring, tree plantings, weed control and environmental court cases. In order to support these activities many groups collect data and information, mostly about the activities they undertake but also on their desired outcomes. Previous research has looked at the objectives and monitoring practices of community conservation groups, but has not considered data management practices. Investigating these practices is especially useful considering that research suggests there are benefits to the increased sharing and linking of biodiversity datasets, such as improving the understanding of national trends in biodiversity, and discovering new information. However, there are many potential issues, both technical and practical, that may impede this.

To understand more about community conservation data this research used semi-structured interviews to create six case studies examining groups' data management practices in depth, including on data sharing already taking place and its perceived value. These were then summarised into a table from which themes across case studies were identified. The themes were then validated and extended with literature to provide suggestions on improving data management.

Practical and social themes identified included looking at the perceived and potential value in data sharing; the value of knowledge sharing and information discoverability; problems with ownership and management; access to resources and funding; and issues with an over-supply of potential solutions and data storage. Technical themes discussed include the sustainability of systems and the difficulties with incompatible systems.

This research is relevant because the increase in work done by community conservation groups means there is a need to future-proof by improving data management practices. An area of future research could involve undertaking small-scale real-world trials, to validate some of the many recommendations made by literature, which could then provide solid grounds to pursue more funding to support community conservation groups with their data and monitoring efforts.

Table of Contents

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University of Canterbury, New Zealand | Te Whare Wānanga o Waitaha

Cover Illustration: Keulemans (1888)

Glossary

Terms and abbreviations

- **AEE**
  Assessment of Environmental Effects, a required document under the Resource Management Act that identifies the effects of proposed activities on the environment
- **beech masting**
  high level of beech seed production in a given period, resulting in an increase of predator numbers (due to increased food availability)
- **citizen science**
  the collaborative collection of scientific data by the general public
- **CRI**
  Crown Research Institute. Seven science research businesses owned by the New Zealand Government: AgResearch, ESR, GNS Science, Manaaki Whenua/Landcare Research, NIWA, Plant & Food Research and Scion.
- **DOC**
  Department of Conservation (*Te Papa Atawhai*), a New Zealand government department
- **endemic**
  species that exist only in one geographic region
- **GIS**
  Geographic Information Systems, referring to systems that store and present geospatial data (e.g. maps)
- **hui**
  a social gathering or assembly (from Māori)
- **kākā, kea, whio**
  endangered bird species endemic to New Zealand
- **mustelids**
  refers to carnivorous mammals from the *Mustelidæ* family, including weasels (*Mustela nivalis*), stoats (*Mustela erminea*) and ferrets (*Mustela putorius furo*)

- **NZ**
  New Zealand

- **pests**
  introduced plants and animals that pose a major threat to native species. There are many pest animal species, but some the most damaging are possums (*Trichosurus vulpecula*), rats (*Rattus rattus, R. norvegicus, R. exulans*), stoats (*Mustela erminea*) and wasps (including *Vespula germanica, V. vulgaris*). Introduced pest plants include wilding conifers (such as *Pinus contorta*) and wild ginger (*Hedychium gardnerianum*).

- **RMA**
  Resource Management Act. A significant piece of environmental legislation passed in 1991 governing the sustainable management of natural and physical resources.

- **Top of the South**
  A term used to refer to the top part of the South Island (Nelson/Tasman/Marlborough)

- **ungulates**
  referring to any animals which walk on the tips of their toes (usually hooves), including goats, tahr, chamois, pigs, deer and horses. Feral ungulates are considered to be a pest.

List of Figures and Tables

1. Introduction

Background

The biodiversity of New Zealand is among the most diverse and distinct in the world due in part to its isolation, large variations in climate and geology, and its relatively late settlement by humans (Ministry for the Environment, 2015). Approximately 91% of land-based animals species (including insects) and 78% of plant species are endemic to the country (Gordon, 2013), and many are threatened with extinction due to human pressures and invasive species (Ministry for the Environment, 2015).

The government department that is responsible for managing conservation in New Zealand, the Department of Conservation (DOC), was established by the Conservation Act (1987). As stated in the Act, the aims of DOC are to protect natural and historic heritage, and protect nature both for its own sake and for future generations to enjoy. In addition to DOC, there are over 600 community environment groups in New Zealand that also contribute to environmental restoration and conservation (Peters, Hamilton, & Eames, 2015; Department of Conservation, n.d.).

Community conservation groups can be defined as non-governmental, localised groups contributing to conservation or environmental restoration, and are usually comprised of volunteers and subscribed members, though occasionally can include some full or part time staff (Peters, Hamilton, & Eames, 2015; Hardie-Boys, 2010). Their existence can be attributed to both environmental, economic and social factors, including declining biodiversity (Ministry for the Environment, 2015), ongoing underfunding of agencies tasked with protecting the environment (Ross, 2009; Moloney, 2014) and the increasing 'conservation conscience' among the general public (Young, 2004). This 'environmental awakening' in the general public underlies environmental restoration in New Zealand, "highlighting the importance of human relationships with nature." (Peters, Hamilton, & Eames, 2015, p. 180). In economic terms, community conservation groups also enable more work to be completed than if it were carried out by paid personnel (Hardie-Boys, 2010).

Definitions

Before considering the research context, it is necessary to provide definitions of some of the terms used. The terms 'community conservation groups' and 'community environmental groups' are comparable but can be slightly different in their focus. Given the

background of the groups interviewed, the term 'community conservation group' is preferred for this research, but used in a broad sense.

The term 'data' is also used in a general sense, and can encompass data collected for operational purposes as well as data relating to biodiversity. Operational data refers to data collected to help support the activities of the group, e.g. trap information. Biodiversity data refers to data collected to measure the effects of the groups' activities, e.g. bird counts and vegetation surveys. Data can be in both categories, e.g. species caught in traps.

Research context

Community-based monitoring

There is much diversity in the work undertaken by community conservation groups, including reforestation, pest control (including trapping), habitat enhancement, weed control and educational programmes (Peters, Hamilton, & Eames, 2015; Sullivan & Molles, 2016). In order to support their activities, it is often necessary to collect data and information about their outputs (i.e. work done) and outcomes (i.e. results) to understand what is being achieved. Because of the diversity in the work undertaken, it follows that the data that are being collected will vary significantly in its type, collection method, storage and dissemination. This is a point reinforced by a wide-ranging study of community conservation groups that found "[Little] is also known about groups' monitoring and evaluation activities… for example how monitoring data generated by community groups are used" (Peters, Hamilton, & Eames, 2015, p. 187).

To address this lack of knowledge, Peters, et al., (2016) conducted further research into the current state of New Zealand community-based environmental monitoring. An online questionnaire was answered by 296 groups, providing a broad overview of current monitoring practices, challenges, and aspirations for future monitoring. The paper highlighted some of the issues that need addressing in order to obtain more useful monitoring data, including issues with funding and technical expertise.

Similarly, Sullivan & Molles (2016) looked at monitoring conducted by community groups using an informal survey sent to people working in biodiversity professions and community groups, resulting in 17 responses commenting on the activities of 24 groups. Sullivan & Molles focussed their paper specifically on biodiversity monitoring, with questions centred around monitoring standards, the role of community groups in biodiversity monitoring overall, and potential methods of encouraging more groups to make their data

public. The paper highlighted the benefits of community-collected data being shared more widely, but also the difficulty of getting groups to share their data, and the necessity to ensure it is in a consistent form in order to be used more widely.

Common to both papers was the notion that if data were better managed, its use would be maximised in helping provide long-term and large-scale datasets that could be used in tandem with those collected by national and regional agencies, such as government departments, universities and crown research institutes (CRIs). Whilst both papers give a broad overview of the current biodiversity monitoring methods undertaken by community groups, neither paper specifically examines the processes by which groups presently manage their data.

Therefore, exploring community conservation groups' data management practices is an area for further research. By understanding the issues with data management, it is then possible to make suggestions for improvements. Additionally, the paper by Sullivan & Molles (2016) is a review article, that is, a summary of the topic combined with a relatively informal survey, so conducting more research to corroborate the article is of benefit.

Benefits of sharing and connecting data

Considerable research has been undertaken showing the benefits to both sharing data, and connecting disparate biodiversity data. Consequently, once more is known about community conservation groups' existing data, a logical next step would be to see whether more value could potentially be obtained through these practices.

Both Sullivan & Molles (2016) and Peters, et al. (2016) outline some of the benefits of increased biodiversity data sharing, such the ability to integrate with regional and national databases to provide a more complete picture of biodiversity nationally, so long as standards are used to ensure comparability. Sharing data from many groups could also provide more robust knowledge on the circumstances and location under which certain monitored species are thriving, in turn contributing to national understanding of biodiversity trends (Sullivan & Molles, 2016).

This is supported by Soberón & Peterson (2004), whose article discusses how an increase in the amount of primary biodiversity data that are shared has meant that different datasets are able to be combined, producing results at resolutions that are orders of magnitude higher than what was previously possible. However, simply sharing biodiversity data itself does not necessarily help—it needs to be able to be used effectively. Stucky, et al.

(2014), state that simply aggregating biodiversity data is not automatically useful, especially considering the increasing volume of information that is available. Instead, in order to gain a better understanding of the data in a wider context, it is necessary to not only collate it, but also provide the means to link it together in a standardised manner. This is also noted by Wieczorek, et al. (2012), who state that "information must be in a digital form, accessible, discoverable and integrated" (Wieczorek, et al., 2012, p. 1), and Page (2008), who showed that the linking of disparate data sources can lead to the discovery of new information.

Presently there are a number of national biodiversity databases that collate specific biodiversity data, administered by New Zealand crown entities such as Landcare Research, a CRI that manages the National Vegetation Survey Databank and the New Zealand Organisms Register (Sustainable Future Institute Limited, 2011). Additionally, there are also systems that collate differing biodiversity data, such as the Biodiversity Projects Database which is managed by DOC (Department of Conservation, n.d.), and to some extent on 'data.govt.nz', the government's principal data catalogue (New Zealand Government, n.d.). However, most of these main biodiversity sources do not contain any information from community conservation groups, and the datasets are often simply discrete pieces of data (such as spreadsheets) that are not linked with other datasets.

There are a number of technical, social and practical barriers to improved data sharing and connectivity. From a technical perspective, there are competing approaches on how biodiversity information can be linked. Wieczorek, et al. (2012), suggest using 'Darwin Core', a set of standards based off 'Dublin Core', a long-standing schema developed to describe web resources. Dublin Core was created in 2009 to "facilitate the sharing of information about biological diversity" (Darwin Core Task Group, 2015), and involves having every resource (i.e. taxa, observations, specimens etc.) structured with a particular ontology. However, Page (2016) argues that this approach is too difficult and/or time consuming to introduce, and that implementations so far have not actually made any significant process in linking data. He instead suggests a more lightweight approach using a more modern technology called JSON-LD. Both approaches have some merit, however it is worth noting that Page's article is written as more of an opinion piece than a standard academic article. Additionally, Stucky, et al. (2014) discuss the development of a tool known as the 'BiSciCol Triplifier', which is designed to convert biodiversity data into the Darwin Core standard, reducing some of the barriers to using that linked data technology.

In terms of social and practical barriers, Enke, et al. (2012) examine the social aspects of biodiversity sharing, such as the reasons why there is sometimes some reluctance to share information, and Page (2008) looks at some of the difficulties with linking data with shared identifiers, due to the fact that each different dataset is usually designed to suit the needs of different communities. Additionally, Costello, et al. (2013) highlights that there can often be data quality issues with public biodiversity databases, so they outline a publication process that could go some way to addressing quality issues. An example of this is the citizen science website NatureWatch, which allows the general public to upload pictures of species observations, whereby they can be checked by scientists to ensure their quality and validity (Sullivan & Molles, 2016).

Overall, whilst not without its challenges, the consensus is that improved sharing practices along with the better linking of data will lead to an enhanced understanding of biodiversity. Hence, combining this knowledge with research into community-collected conservation data should lead to a better understanding of whether more value can be obtained.

Aim and relevance of research

Given that prior research has not looked at community conservation groups' data management practices, the main aim of this research is to first determine what sort of data are presently being collected by these groups and how they are currently managing it. Secondly, given that previous research suggests there are benefits to connecting information, this research aims to look at whether more value can be obtained from this community-collected data, potentially through improved sharing and connectedness. This also includes examining possible issues and barriers that may need to be considered.

To provide a framework for the research, six specific research questions were determined based on the aims:

RQ-01: What types of community-collected conservation data exist, and who has ownership of it?

RQ-02: What methods are used to collect and store the data?

RQ-03: How is the data used, and is it presently shared with others?

RQ-04: How can the data be better shared and connected?

RQ-05: What are some of the barriers to sharing the data?

RQ-06: What benefit is there in improving the sharing and connectivity of community-collected conservation data?

The goal is that this research will improve understanding of community-collected data and from that, provide practical guidance on how it could be better used, ultimately leading to better conservation outcomes.

This research is relevant for a number of reasons. Firstly, Peters, et al. (2016) found that two thirds of groups surveyed wanted to continue or expand their monitoring programmes. Additionally, citizen science has gained significant momentum recently, with a proliferation of smartphones and similar devices providing the ability to easily contribute to biodiversity monitoring projects (e.g. by simply taking a photo) (Catlin-Groves, 2012). Finally, there is potential for even more work to be done by community conservation groups through the DOC Community Fund, a source of funding for community-led conservation projects (Department of Conservation, n.d.). Given all of these factors, community conservation is likely to become increasingly relevant, hence it will be even more important to have good practices in place with regards to data management.

2. Methodology

The main methods used for this qualitative research were a series of semi-structured interviews to develop case studies, complemented with a review of local and international literature covering the technical, social and practical aspects of conservation data and sharing. As stated, most studies to date on New Zealand community conservation groups have been overviews of their objectives and monitoring methods, with limited research being conducted on their practices with data. In order to develop a better understanding of this, an in-depth qualitative research approach was chosen, rather than another broad overview study.

Semi-structured interviews were chosen over online surveys/questionnaires because the approach allows for a flexible and in-depth approach to getting data. Interviews allow for the capturing of nuance and emphasis, and the ability to respond to queries and prompt for further relevant information, whereas a survey-based approach might miss some detail, especially where not much is known about the subject (Secor, 2010). If a rigid interview approach was taken, there would have been few benefits beyond what an online survey could achieve. As stated, there is limited previous research looking at New Zealand community conservation data specifically, hence the flexible, semi-structured approach was important to ensure that details were captured.

With regards to case studies, this method was chosen in tandem with the semi-structured interviews. Case study research is a widely used approach, with the idea that studying a few instances of a phenomenon can help with understanding the wider situation (Baxter J. , 2016). Case studies also allows for the discovery of unexpected and unusual information, which may not be found with more rigid approaches (Hodkinson & Hodkinson, 2001). Additionally, using evidence from multiple case studies can make the results of the study more robust, as it enables comparisons between cases (Yin, 2014). Choosing the number of case studies to develop is “discretionary, not formulaic” (Yin, 2014, p. 61), with six ultimately being chosen for this research, attempting to balance time constraints with producing more robust conclusions.

Many approaches of varying complexity exist for analysing case study data, however given time constraints with this research a simple categorisation/theme approach was used, involving the classification of information into categories consistent with research and interview questions. Kohlbacher (2006) states that organising data around certain topics, key

themes or central questions is useful, as data can be examined to see how well they fit or fail to fit the expected categories. It is typical for case study researchers to look for what is common among case studies, but also to consider what is unusual (Baxter J. , 2016; Hodkinson & Hodkinson, 2001). Kohlbacher (2006) also states that enhancing analysis through using existing literature is also beneficial, as findings can be compared to see whether they are consistent with extant research.

As a general analytical strategy, Yin (2014) discusses how the original design of the case study research would have been based on some theoretical propositions, hence these same propositions could be used to help with analysis. Hence, both the categories that case studies were classified into, and the themes that became apparent were strongly guided by the research and interview questions. A summary table was used to condense and present the categorised case study information to assist with analysis, another common technique of qualitative analysis (Secor, 2010).

Methods: Interviews and Case Studies

Interview participants were chosen from a list of South Island based community conservation groups on the DOC website (Department of Conservation, n.d.) and through personal connections. Following approval from the university human ethics committee, over ten community conservation groups were emailed based on geographic availability (i.e. accessible to be interviewed) using email addresses obtained from their websites. An information sheet was provided outlining the research and the available dates/times for interviews. All emailed groups responded to the request for an interview, however selection was ultimately based on availability to be interviewed, resulting in six groups from the Nelson/Tasman and Canterbury regions (Appendix I). Interviewees were either the group chairperson, and/or the person with the most amount of knowledge on the topic of data.

Interviews were conducted in a public place (e.g. café) or at workplaces. Interviews ranged from 30 minutes to 1 hour 15 minutes, usually depending on the amount of data being collected by each group. Fifteen questions were used to guide the interviews (Appendix II), covering some background information, current practices with regards to data, and opinions on improving data availability. The interviews were semi-structured, meaning that the ordering of the questions sometimes changed during the interview, depending on the comments made by the interviewee. Interviews were recorded, and notes taken during the

interview to facilitate the writing of case studies. As part of ethics requirements, interviewees were required provide written consent prior to their interviews.

Following the conclusion of the interviews, case studies were written up detailing the points made during the interviews, augmented by information from conservation groups' websites and newsletters/reports obtained from interviewees. To facilitate analysis, the case studies used broad headings linked to the research questions. The case studies were then condensed into a summary table (Table 1), allowing for comparison in order to determine practical and technical themes common across case studies.

Finally, the information obtained through the case studies and summary table was then validated and extended with literature to explore these themes in depth, and provide guidance on how data can be better used. This addresses the research aims of determining current data practices and exploring potential new practices to get more value from the data.

Limitations

The methodology used for this research is subject to a few limitations, derived from both the choice of research methods and the execution of research.

Selection of interviewees

Criterion sampling was used to select interview participants, that is, groups were contacted on the basis of meeting the criterion of being a 'community conservation group'. However, participation was ultimately determined on the basis of availability to be interviewed, both in terms of access and time constraints.

This meant that the geographic distribution was limited to the Canterbury and Nelson/Tasman regions of the South Island. Whilst interviewed groups were a mixture of types, involving different environments, focusses and funding situations, it would have been beneficial to interview a wider range of groups in different geographical settings, given the diversity of environmental challenges around the country (Peters, Hamilton, & Eames, 2015). Additionally, five of the six groups interviewed had an active working relationship with the local DOC office, but given that Peters, Hamilton, & Eames (2015) found that only 21.2% of 296 respondents were supported by DOC, it would have been good to interview more groups that had to be self-sufficient, or rely on other entities for support e.g. local/district councils.

Positionality

The nature of qualitative research is that it is susceptible to personal subjectivity and bias (Winchester & Rofe, 2016). Hence, it is important to summarise the researcher's positionality, that is, recognising the position and embodied knowledge of the researcher, and their relationship to the research and its intended audience (Waitt, 2016).

Positionality statement: I am a male pākehā geography student at the University of Canterbury and a part-time open-source web developer, with a strong interest in the outdoors, conservation and the environment. The idea for this research came out of interactions with various conservation groups that seemed to suggest there was no coherent approach to managing data across groups, despite them undertaking very similar activities. Hence the idea for this research came about, that is, looking into practices with data across conservation groups. This means that I conducted this research expecting to see a particular result, which may have influenced how I interpreted interviews and the subsequent case study write-up. For example, what I might have considered to be relevant and interesting may not have been seen as such by a different researcher. Some interviews were conducted with people that I already knew from prior interactions, which may also have had an effect on the final write-up.

Hodkinson & Hodkinson (2001) *discuss how case studies benefit from researcher expertise and intuition. For example, based on prior knowledge, the researcher chooses what to ask and what to record (and what to exclude), and are continually making judgements about what is useful. This can also ultimately shape what is written up in case studies.*

Recognising positionality does not invalidate the conclusions of the study, it simply means being aware of how my position and knowledge might influence the results.

Limitations with methodology

Whilst there were sound reasons for using a case study based methodology, there are some limitations that must be acknowledged. By design, case studies provide a depth of knowledge, however this can mean that too much data are available for proper analysis (Hodkinson & Hodkinson, 2001). It is difficult to represent the data in a succinct manner, and in order to make sense of the data, it often needs to be simplified, at the expense of detail (Baxter & Jack, 2008; Hodkinson & Hodkinson, 2001). To help address this limitation, whilst a summary table was used to enable comparisons between case studies and distil the relevant information, each case study was written in full and included as an appendix. This approach

enables analysis to be undertaken across studies, whilst still retaining some of the more in-depth details recorded in each case study, should they need to be referred to.

Another weakness of case studies is their limited ability to be 'generalised', that is determining the degree to which findings from case study research are applicable in other instances (Hodkinson & Hodkinson, 2001; Baxter J. , 2016). Yin (2014) and Baxter (2016) argue that whilst it is not possible to generalise case studies in a statistical sense, as is the case for quantitative analyses, it is instead possible to undertake theoretical generalisation, that is, determining credible explanatory theories. In this research, issues with generalisation have been somewhat mitigated through using multiple case studies, thus enabling comparison to see what might be common across case studies. Also, as mentioned earlier, this research is designed to be exploratory, rather than being a wide-ranging overview on data practices for New Zealand as a whole.

The approach of using semi-structured interviews as a method for getting case studies allowed for interesting and in-depth information to be gained. The method allowed for prompting for more relevant information, and the flexibility allowed interviewees to jump back to questions if they thought of another point pertinent to the research. However, the semi-structured approach also meant that what was said in interviews was not always relevant to this research. The main effect of this was that it became necessary to filter out what was not relevant to this research whilst writing up the case studies, though all information was of general personal interest.

3. Results

A summary table was constructed from the six case studies (Appendices I,III), with categories based off research and interview questions (Table 1). The table shows the key points relating to current data practices and use; value and barriers to sharing; and key comments made in the interviews. From this it is possible to examine similarities and differences between the groups. Indicative case studies relating to a comment are denoted in square brackets, but the comments may be applicable to other case studies as well. CS- is used when referring to a fact about a group (Appendix III), IP- is used when the interviewee is expressing a personal opinion (Appendix I).

Background and context

The case studies represented a variety of different situations with regards to activities, funding and locations. Three of the groups worked in a coastal environment [CS-03,04,05], two in alpine environment [CS-01,02] and one on an island [CS-06]. Five of the six groups [CS-01,02,04,05,06] were all 'active' environmental groups, i.e. working to restore or protect some environment through direct action, such as pest control or plantings. One of the six groups [CS-03] was mainly a 'reactive' environmental group, i.e. responding to threats to the environment by human activities via legal means. As such, the information requirements of the active and reactive groups differed, with active groups requiring more information to support their day-to-day activities, compared to the reactive group, that gathered information as it was relevant to the current legal challenges.

Funding sources varied between groups, with only one group having a major private financial backing [CS-04]. As all groups are registered charities, they are all funded by individual donations to a greater or lesser extent. Other funding sources included financial support from local authorities [CS-06], grants from legal funds [CS-03] or charitable foundations [CS-06], ongoing funding from organisations operating in the area [CS-05] and one-off grants for specific projects or animal species [CS-01,02]. Some groups have historically had access to ongoing funds that are no longer available due to a loss of sponsorship [CS-01], or changes to funding eligibility rules [CS-03].

Current data practices

Addressing RQ-01 (What types of community-collected conservation data exist, and who has ownership of it?), RQ-02 (What methods are used to collect and store the data?), RQ-03 (How is the data used, and is it presently shared with others?).

Types of data collected

Regarding the active environmental groups (the five groups undertaking direct action in the environment), most of the information collected was either outputs/operational, i.e. the direct results of work done, or related to animal/plant species in the area. The most common data type collected was about pest trapping, i.e. information about traps, what they caught, catch rates, baits and issues. For most of the active groups, this was a major part of data gathered, however for one group [CS-06] it formed a very minor aspect because their area of operation is an island free from rats and mustelid pests—traps are only there in case of reincursion. Other pest control data collected included sightings of larger ungulate pests [CS-04,05,06], wasp control areas [CS-04], and data on plant pests, such as wilding conifer areas and undesirable weed species [CS-04].

Other data collected related to outcomes monitoring, i.e. the measuring effects of environmental restoration on desired species. This included bird sightings, both formal surveys and citizen science observations [CS-01,04,06], species specific data (e.g. relating to kiwi and whio) [CS-01,04,06], vegetation surveys [CS-04,06] and snail monitoring [CS-04]. Photographs (often using designated photo points) were also sometimes used as a visual method of seeing change over time [CS-05,06].

The reactive environmental group [CS-03] collected data on an as-needed basis to support their court cases, so it has varied significantly over the group's 44-year history, but has included seabird, marine mammal and surface-fish surveys and ecological assessments.

Two groups undertook very little environmental monitoring themselves [CS-02,05], instead using their strong working relationship with DOC and other groups for information.

Reasons for collection

Reasons for data collection were varied, with some groups simply collecting information to support their work, whilst others had very specific reasons. Amongst the active environmental groups, the most common reason for collection was to support operational work, i.e. volunteers checking traplines [CS-01,02,04,05]. Trap data also provided a simplistic

measure of the number of pests killed, which was useful as far as demonstrating to volunteers all of the work that has been achieved (IP-02a called it a “feel good factor”).

Four groups collected data on desired species (e.g. birds) [CS-01,04,05,06], but two of those groups [CS-04,06], collected data to measure progress against specific restoration plans/targets. In the case of CS-06, a twenty-year plan was developed in 2005 that had a list of targets and ideas on how they could be attained, and data are collected to measure progress against the plan. CS-04 has signed an agreement called the ‘Tomorrow Accord’, that means the government will maintain results achieved in the long-term, once the group has met certain thresholds (e.g. predator numbers below a certain level). This means that CS-04 has to collect and review data regularly.

A lot of the data collected was useful for funding applications, in that it was an indication of all the work done by environmental groups. One group even tracked volunteer hours as a measured of work done [CS-01]. Two groups explicitly stated that funding applications was a benefit of data collection [CS-02,06].

One of the key reasons CS-04 collected data was to “improve general knowledge and understanding of complex ecological relationships and species interactions” [IP-04], with the goal of being able to help other projects and science in general.

The reactive environmental group collected information to support their court cases [CS-03]. IP-03 said that much of what is known about the coastlines in the Nelson/Tasman/Marlborough area has come from court cases, as both sides are required to collect information to support their applications, though the information is not necessarily objective.

Collection methods

Across the active environmental groups, simply using paper was the dominant method of collecting data for all activities [CS-01,02,04,05,06], however one group used an app ‘Walk The Line’ for trapping data [CS-04].

Across all active environmental groups, most data were collected by regular volunteers or staff/contractors, but one group reported citizen science sightings formed part of their data collection, via its purpose-built app for the national park they operate in [CS-04].

In most instances data collected in the field on paper was then entered into a database/spreadsheet/website, but groups took a contrasting approaches to how this was

entered. One group preferred volunteers to enter the information they collected directly into the database system, reducing double-handling and encouraging ownership of the data [CS-01]. Conversely two groups had one designated person to enter data digitally from paper forms, meaning there was more oversight and less likelihood for error [CS-02,05].

In at least one instance, data were simply kept on paper because of the low volume of information, such as island trap data (where most animal pests are not extant) [CS-06]. Some groups also reported collecting data using cameras, both film (historical) and digitally [CS-05,06].

The reactive environmental group's data collection methods varied depending on what was being studied. The website also asks for the public to email in information that might be useful to support their work [CS-03].

Storage methods

There was great variance in the ways in which data were stored, including both physical, digital and online storage methods. For example, trap data storage methods included paper [CS-06], a customised website [CS-01] and DOC internal systems [CS-02,04,05]. CS-02 also trialled an online database for storing trap data 'CatchIT' for a while.

Other digital techniques employed for storing data included Excel spreadsheets and Access databases [CS-04], eBird (a global citizen science website) [CS-04], Google Drive [CS-04], and simply on personal computers [CS-04,05].

Some groups had physical records and data (including paper and photographs), which were stored on paper either on site [CS-05,06], at home [CS-03,05] or in one case, at the local museum because of the volume of records [CS-03].

In some instances, data were duplicated in multiple locations, such as by CS-01, which has specific information duplicated between their own customised website and DOC systems, with a manual process being used for transfer. At least one group reported keeping the original paper records even after information was entered into a database, just in case verification was needed in future [CS-05]. Additionally, data stored in DOC's internal systems were exported by some groups to generate spreadsheets, reports and maps [CS-02,04,05]

When scientists or consultants wrote up scientific or evidential reports, the storage of data was often up to the individual, with only the written report being made available [CS-03,06].

Data use

Data collected was used to inform decision making practices, create reports and monitor the effectiveness of restoration efforts. Two groups reported analysing trap data on an ongoing basis to watch for predator spikes, i.e. a rapid increase in trap catch numbers [CS-01,02]. IP-01 has configured the database to send an email notification if trap catch numbers were above a certain threshold. Three groups reported that their data were used by DOC to inform their decisions about whether to undertake aerial landscape-scale pest control [CS-01,02,04]. One group reported that they used trap data to help inform future trap-line locations [CS-05].

All groups used the data collected for some form of reporting. Trap data were used to make reports showing numbers of pests killed in a given time period, with this information being emailed to volunteers by at least two groups [CS-02,05]. One group reported that their trapping information was used by DOC for their annual reports of nature recovery in the area [CS-02]. Another group said that data on plant pests was sometimes used to create maps showing locations/extent of the problem [CS-04].

In terms of monitoring effectiveness, one group reported that they were implementing an 'adaptive management' approach to monitoring that involves the regular review of data to ensure that work being undertaken is effective, and to see whether there are things that could be done differently to improve outcomes [CS-04]. Another group said that they reviewed trap data annually to help determine traps that were 'hot' (high catch numbers) and 'cold' (no catches) to see whether improvements to the trap network and/or trap maintenance was required [CS-05]. As stated earlier, two groups use data to monitor the effectiveness of their restoration efforts against a long-term plan or strategy [CS-04,06].

Three groups reported that data were collected and used to create scientific papers or consultant reports [CS-03,04,06], including on the topic of lessons learnt with pest-control [CS-06]. As previously mentioned, the reactive environmental group collected data as evidence to support court cases [CS-03].

Current data sharing

All groups shared knowledge by some means, but only one group specifically shared raw data by default [CS-01]. CS-01 has a customised website built and run by IP-01 that enables anyone to access general statistics, reports and tables without logging in. A subset of data is publicly available in raw form, but if signed into the system it is possible to download

more information, including trapping data and other conservation-related datasets. IP-01 also reported that data from the website was manually shared with other DOC databases, such as the whio database (an internal DOC database specifically for whio recovery).

Four of the five active environmental groups shared data with DOC by virtue of using their systems for storing information, mostly related to trapping [CS-01,02,04,05]. This meant that data were available to others under DOC's access policies, but as the systems are internal-facing it was mostly limited to DOC staff or other conservation groups with some form of access. IP-05 reported that access could be restricted to a geographic area. Both CS-04 and CS-05 had access to each other's data because they both work in the same national park, and use DOC's systems for storing information. CS-04 loads some information related to bird sightings into the international database 'eBird'.

In terms of groups using data from other sources, groups that had a strong working relationship with DOC had access to some of DOC's data, especially relating to trapping [CS-01,02,04,05]. One group reported using information published online by the Marlborough District Council [CS-03].

Whilst not data sharing per se, there were multiple examples of knowledge sharing practices within conservation groups. Most groups had a newsletter or similar to inform volunteers of the latest news [CS-02,04,05,06], and there was even example of shared newsletters, such as the Nelson/Tasman Conservation Volunteers newsletter, compiled with news from over twelve local conservation groups, including two of those interviewed [CS-02,05]. Information was also shared by published reports [CS-03,04,06], and available as public documents due to court processes [CS-03].

When asked about whether data would be provided on request, all groups indicated a willingness to share information within reason, however one interviewee said that they would rather work with the person to ensure that they had relevant context for the data.

Opinions on data sharing

Addressing RQ-04 (How can the data be better shared and connected?), RQ-05 (What are some of the barriers to sharing the data?), RQ-06 (What benefit is there in improving the sharing and connectivity of community-collected conservation data?).

Benefit of sharing

All interview participants saw some benefit to data sharing, however there were a few reservations expressed. Data sharing was seen as a useful tool between groups operating in the same region, because the effects of environmental restoration and predator control are likely to impact on surrounding areas [CS-01,04,05]. For example, two groups reported looking at data from surrounding areas to see whether trends they observed in their own trap catches were reflected in the wider area [CS-01,05]. Similarly, IP-06 suggested that being able to share data in the area was good insofar as getting a better understanding of the overall picture of restoration efforts for a wider area (e.g. Ōtamahua/Quail Island restoration is part of the wider restoration of Banks Peninsula). Another benefit was suggested by IP-02a, that making raw data available allows anyone to verify interpretations of the data.

However, some of the reservations around data sharing were also related to the interpretation of data. IP-05 expressed reservations about the potential for over-interpretation, and also drawing conclusions from data without having the necessary explanatory context—in effect the data would be meaningless without context. IP-02a also only saw limited value in sharing information about trap catch counts, beyond simply showing the scale of the problem.

Five of the six interviewees said that information sharing was of equal, if not more importance than simply sharing raw data [IP-02,03,04,05,06]. Suggested information could include successes, failures and lessons learnt; learning and networking events; conservation-related news and new techniques for pest control.

IP-04 suggested that with an increase in private and community projects, the need for collaboration and sharing of data will only increase, so finding a solution using common (and therefore comparable) standards for managing this data would be necessary.

Issues/barriers to sharing

Many issues were highlighted as being barriers to sharing data, from both a social, practical and technical perspective. The most common social issues highlighted related to data ownership and sensitivity, but also included buy-in of systems and the reluctance of people wanting to share data. Data ownership was mentioned as an issue by three interviewees, as in ‘who owns the data, and what rights do people have to the data’ [IP-02,04,05]. This issue is compounded by the fact that many people might have contributed to the generation of a data set, and responsibility for the data might lie with multiple

stakeholders (e.g. DOC and the community group). The sensitivity of data was highlighted by five interviewees, in that not all datasets are appropriate to publish (i.e. potential for abuse or vandalism), and that it is necessary to figure out what is or is not suitable to share, and to whom [IP-01,02,04,05,06]. This also ties in with some concerns around the potential for data to be misinterpreted, or over-interpreted (with regards to short-term or incomplete datasets) [IP-04,05]. The other main social issue with data sharing was related to 'buy-in', referring to the motivation of people to use, and continue to use a new system. This was highlighted by two interviewees [IP-01,04], but IP-04 suggested that it could potentially be mitigated by adequate support, and also over time with more 'digital-savvy' people getting involved with conservation.

A number of practical issues were also highlighted, including issues with funding, organisation, and resourcing. For example, if a new data-sharing system was to be built, the funding for it would have to come from some source, and it would have to be adequately resourced to be successful into the future [IP-01,02]. Another barrier to sharing highlighted by three interviewees is that the data currently collected by community groups can be disorganised, either because the data is scattered amongst people/places, or that it is stored as physical (paper and film) records [IP-03,04,06]. Two interviewees also said that data sharing was not the issue that needed solving, rather it was more useful to have access to resourcing to gain meaning from the data through analysis—whilst improved data practices might be useful, it would not solve the problem alone [IP-04,05].

Finally, a few technical issues were highlighted around data flexibility, security and management. Because the needs and nature of conservation data changes over time, a 'one-size-fits-all' solution would need to be adequately designed and managed [IP-01,02]. Systems that handle sensitive data would also need to be adequately managed and protected against abuse [IP-01].

Key comments

Using a semi-structured interview/case study approach allows for some flexibility in what is recorded, and in most interviews there were key comments that were either emphasised, repeated or stood-out as useful information to capture.

IP-01 highlighted the incompatibility between a lot of the current conservation databases that exist: "There are a lot of databases out there that all want some form of the

data [the community group collects]. None of [the databases] seem to communicate between themselves".

The participants in IP-02 mentioned on a number of occasions that "people keep re-inventing the wheel… it is all about communication and information sharing", referring to the lack of collaboration between community groups about successes, failures and lessons.

IP-03 stated that most of the information of coastlines at the top of the South Island was due to court hearings on environmental cases that require the collection of data by both sides of the court case, in order to understand the environmental effects. IP-03 also stated that any information or data that can help with court cases is beneficial to be shared.

IP-04 emphasised that "the collection and storage of data is not the limiting factor… it is the lack of the ability to have the data analysed properly". They also said that having a forum for exchanging experiences and lessons would be helpful, and that buy-in issues would be mitigated as more young (and hence technically able) people get involved.

IP-05 referred to the necessity for providing context when undertaking study of datasets: "context is everything". This is because ecosystems are very complex with many variables, and that it would be easy to draw incorrect conclusions just looking at numbers alone. IP-05 also thought it would be useful to visually map the extent of all conservation groups, so people in groups could easily see other groups and activities in a particular area.

IP-06 said that it would be useful to have access to people with GIS ability to assist with map-making. They also highlighted that there are already presently a lot of 'umbrella' organisations seeking to work across conservation groups, and that there needs to be caution about introducing more entities of a similar ilk.

Table 1: Summary table of case studies data collection and use, as well as views on current and potential sharing practices

Case study	**Type of data collected**	**Reasons for collection**	**Collection methods**	**Storage methods**	**Data use**	**Current data sharing**	**Benefit of sharing**	**Issues/barriers to sharing**	**Key comment(s)**
CS-01: Arthur's Pass Wildlife Trust	Trap data (kill count and tracking tunnels), bird sightings (casual and formal), specific kiwi data, specific kea data, volunteer hours, weather data.	Supporting ongoing active conservation work, measuring outcomes and effects on wildlife.	Data is typically collected by regular volunteers on paper, then entered (by the volunteers or occasionally Kates) into customised APWT website built by Kates.	APWT customised website, running on PHP and MySQL. Some data manually transferred to DOC databases (e.g. whio database).	Analysis of trapping data to see predator numbers (including spikes). Used by DOC for decision making around pest-control programmes.	Shared with DOC. Some data synchronised manually with Whio database. Most data publicly downloadable by default from website (CSV files, reports).	IP-01 sees value in sharing data, especially locally, considering connected landscapes (e.g. for landscape-scale predator control).	Issues with data sensitivity, funding (e.g. species-specific funding), conservation group buy-in. A potential 'one-size-fits-all' database would need to be well managed and adequately protected.	"There are a lot of databases out there that all want some form of the data [CS-01 collects]" None of [the databases] seem to communicate between themselves.
CS-02 Friends of Rotoiti	Primarily trap data (kill counts). Other data (e.g. vegetation plots, tracking tunnels) is collected by local DOC office.	Helping support ongoing trapping work: shows work undertaken by volunteers and number of pests killed. Also operational data, i.e. traps that need fixing or bait replaced.	Volunteers note down trap data on paper forms, not yet using latest DOC systems (allowing for smartphone entry). Paper form data entered manually by IP-02a into DOC systems. Trialled CatchIT for a while.	Data are stored on DOC systems, and exported into spreadsheets for the purposes of making catch reports and graphs.	Trapping reports (i.e. numbers of pests killed)—useful when applying for funding, showing work achieved. DOC uses data for annual biodiversity reports in area. Sometimes used to determine predator spikes.	Shared with DOC. Data is not publicly accessible by default, however it is available on request. There have been researchers asking for information in the past. Information is shared around Nelson/Tasman area via the 'Nelson/Tasman Conservation Newsletter'.	IP-02a and IP-02b support making data more available within reason, however IP-02a was not convinced that there was much value in sharing trap data: "…the data are showing the scale of the problem"—more value in sharing info like bird counts (i.e. outcome monitoring). Making raw data available means that anyone can verify interpretations.	Issues with data sensitivity, ownership and technical methods. More important to share information (i.e. not just data), and make sure the right information is getting to the right people. Resourcing is an issue: needs to be support for data analysis at DOC and for community groups.	"People keep re-inventing the wheel… it is all about communicatio n and information sharing."

Case study	Type of data collected	Reasons for collection	Collection methods	Storage methods	Data use	Current data sharing	Benefit of sharing	Issues/barriers to sharing	Key comment(s)
CS-03 Friends of Nelson Haven & Tasman Bay	Data collected varies depending on the court case—it is collected to support hearings. Has included seabird, marine mammal and surface-fish surveys; kings shag studies and ecological assessments.	Data collected to make submissions to local body and government agencies, as well as for public talks and working groups.	Because of variation in court cases undertaken, collection methods of data for evidence and reports varies. The website asks for people to email information that might be useful.	Data typically contained within reports, e.g. assessments of environmental effects. Some reports on website. Lots of documents at Nelson Provincial Museum because of society's long history.	Data generally collected on an as-needed basis to provide evidence. Both sides are typically required to do research on environmental effects, however this is not always objective.	Information collected for public hearings is often available by default through local authorities /government departments. IP-03 said that on occasion people request information from the society.	Any environmental data that can help with CS-03's court hearings is beneficial to be shared. CS-03 already uses data provided online by the Marlborough District Council.	Because the research commissioned is undertaken by various consultants, experts and scientists the raw data underlying reports is not simply accessible from one location. A lot of historical information is also stored physically.	Most of the knowledge of the coastlines at the Top of the South has come out of court hearings over the years. CS-03 often uses data provided online by local authorities.
CS-04 Project Janszoon	Trapping data, weed data (exotic weeds, wilding conifers), outcome monitoring (e.g. snail surveys, acoustic monitoring), bird monitoring (formal counts, informal observations), data on hunting (goats), wasps and tree plantings.	To support conservation activities in the Abel Tasman National Park, to measure success against the goals of CS-04, to help bring conservation methods forward in general, and to review data regularly in line with the "Tomorrow Accord".	Collection of data is undertaken by many people, including citizen science observations via their own app, CS-04 staff (including IP-04), DOC staff and ornithologists. Variety of methods used, e.g. trap data uses 'Walk the Line' app from DOC, which reduces double handling—works offline. Other work is done on paper.	CS-04 tries to use DOC systems wherever possible for storing data, sometimes data still in spreadsheets/ Access databases, however this is likely to change in the future due to the volume of data being collected. Bird sighting data are often added to eBird. CS-04 is looking at using Google Drive for sharing information internally.	CS-04 collects a variety of data, which are used for different reasons. For example, wilding conifer and weeding data is used to draw up maps. Some data used by DOC, e.g. regarding beech masting and landscape-scale pest control. CS-04 is working towards an 'adaptive management' approach, requiring review of data every few years to ensure the work being undertaken is effective.	CS-04 shares all of its data with DOC. Because the majority of its data is stored in DOC's systems, essentially DOC's access policy applies by default. IP-04 thought that whilst it has not yet been the case, they would be happy to provide data to anyone for research.	Value in sharing includes learning general lessons from analysing both local and wider datasets. IP-04 also said that with an increase in private and community conservation projects, there should be a nationwide citizen science database, which would need to adhere to certain standards to be useful.	Some of the barriers include the need for sensitivity around certain datasets, especially when data are preliminary and not yet scientifically analysed. IP-04 also thought that databases will not solve the problem alone, that an info sharing platform is also crucial. IP-04 also said that data sharing was not necessarily the barrier to getting value: access to analysis was. Data ownership was another issue identified.	"The collection and storage of data is not the limiting factor… it is the lack of the ability to have the data analysed properly." A forum for exchanging experiences and lessons would be helpful—need to have buy-in, but this is likely to get better with next generation of digital-savvy conservationists.

Case study	Type of data collected	Reasons for collection	Collection methods	Storage methods	Data use	Current data sharing	Benefit of sharing	Issues/barriers to sharing	Key comment(s)
CS-05 Abel Tasman Birdsong Trust	Mostly trapping data, some work with plant restoration. Photographic record of wilding conifer work. Bird counts done in conjunction with CS-04.	To see results of trapping efforts, demonstrate what CS-05 achieves. Operational data, e.g. traps that need maintenance etc.	Trap data collected by volunteers on a paper form, which IP-05 then collects and enters into a DOC database (since August 2015). Bird count data are entered into 'some sort of GIS system', but it is quite difficult to draw conclusions with this data.	Trapping data stored on DOC's systems, which IP-05, CS-04 and DOC staff have access to. The physical paper forms are also kept just in case verification is required.	IP-05 produces reports across the year showing kill counts in graphs, tables and maps. DOC GIS system provides data, but due to issues with export features maps are often screenshotted. Data also exported as spreadsheets. Trap count data useful for finding 'hot' and 'cold' traps, i.e. which traps catch a lot of pests or not. Data also used for performing annual maintenance, and also to find future trap-line locations.	Reports written up by IP-05 are shared to CS-05 volunteers. Excerpts sent more widely via Nelson/Tasman Volunteers Newsletter. IP-05 said the CS-05 would consider sharing data on request, but they said they would prefer to work with people to ensure they have adequate context. Data shared with DOC and CS-04 by default.	IP-05 thought there was value in sharing data amongst community groups in similar areas, but it was more important to share information than just raw data. IP-05 already looks are datasets more widely to see if trends that are being observed in CS-05's data are also being seen generally.	IP-05 was wary about potential for misinterpretation of raw data—he said that having context to explain differences in kill-counts was crucial. IP-05 also said there was potential to over-interpret data, especially with short-term datasets—ecosystems are very complex, with many variables. Data ownership was another barrier, especially when multiple groups contribute to a single source.	"Context is everything." IP-05 also thought it would be useful to visually map the extent of all conservation groups, so groups would be able to know what else was happening in their area.
CS-06 Ōtamahua/Quail Island Restoration Trust	Variety of data collected as guided by 20-year plan. Includes bird surveys, minimal trap data, photographic records and vegetation surveys (historically).	Data collected to help measure the effectiveness of restoration efforts compared to the 20-year plan for the island.	Bird surveys voluntarily undertaken twice per year by skilled amateur—data is managed by person. Trap data are minimal due to island nature, hence kept in a notebook. Photo points are set up for consistent photos.	Bird surveys are done on paper by the regular volunteer, and are then written up into a report. Trap data is kept on a notebook. Photos are stored on film and digitally, but there is no one location yet. There is a Nature Watch project for the island.	Data mostly used to monitor the effectiveness of restoration efforts against the long-term plan. Scientific papers have also been written up using the data, including a paper looking at the 'successes, failures and lessons learnt' from pest control on the island. Data also used to support funding applications.	Data is not presently shared by default, but if it was requested for research it would likely be provided (if possible). Some information is released as scientific reports, and summaries are included in trust's annual reports.	IP-06 saw value in sharing data in the region, as it would help get an overall picture of restoration efforts in the Banks Peninsula from all groups.	One constraint identified by IP-06 is because CS-06 has more than 10 years of data collection, it is not well organised at the moment. Like other groups, some data are not suitable for publishing, such as on sensitive species.	Would be good to have access to people with GIS ability. IP-06 saw value in sharing data regionally. There are already lots of 'umbrella' organisation, need to be careful about introducing more services.

4. Discussion

As discussed in the methodology section, an approach to analysing case study data is to organise data around key themes and topics. Using the research questions as guidance, a number of themes were determined covering practical, social and technical aspects to community-collected conservation data. These themes are not seeking to repeat the results section, rather they are insights obtained across case studies and enhanced with relevant literature.

Themes: Practical and Social

Resolving barriers to data sharing (RQ-03,04,05,06)

As discussed in the results, most groups saw some benefit to sharing data, especially on a regional basis to help understand trends in the wider connected landscape. However, some issues were pointed out, including buy-in, ownership, the reluctance to share data and data sensitivity. Additionally, little value was seen in sharing outputs data (e.g. trap catches) beyond simply showing the scale of the problem [IP-02a].

Existing literature discusses some of the ways that these issues can be mitigated. Sullivan & Molles (2016) discuss that data entry into systems needs to be incentivised, as it can often be the last thing volunteers want to do after being in the field. An example of an incentive would be if the database was able to provide immediate and interesting feedback on results just entered, such as looking at trends over time or differences amongst sites.

Data ownership was a key issue raised across community groups, especially where the information has been collected by a large number of people over time. To resolve this problem, it should be made clear who owns the data from the outset, especially when it might be stored on DOC's systems as is the case for many groups [CS-01,02,04,05]. Having a clear definition of the owner gives the owner options as to future uses of the data, such as publishing, licensing or sharing the information. CS-04 reported having a 'gentlemen's agreement' with DOC to use their systems to store data they collect, but this should be formalised to ensure longevity of access to data in the unlikely possibility of a future dispute.

At least one interviewee expressed reluctance about sharing data because of its potential to be misinterpreted without adequate context [IP-05]. Enke et al. (2012) undertook a significant study into the obstacles to data sharing, and demonstrated that this reluctance was a common reason cited for not wanting to share data. Their research even specifically

mentioned inappropriate use of data to harm environmentally-sensitive areas as a cause of concern to researchers. However, as a solution, the authors simply suggest that researchers must accept that they will not able to maintain control over their data forever, otherwise it will be ultimately lost. Ensuring that data when published has adequate guidelines and context would also help mitigate this issue.

As mentioned, data sensitivity was a concern of many groups interviewed. Costello & Wieczorek (2014) suggest when data sensitivity is an issue that the data be generalised so it is still sharable in public, but without enough detail for potential misuse. Alternatively, they suggest that data sensitivity might decline over time, meaning that datasets could eventually be published to assist with future work.

Whilst not a point raised in the case studies, Costello, et al. (2013) also mention that some clarity around 'data sharing' versus 'data publication' is necessary. They argue that data used to support a scientific paper should be published rather than simply shared, as sharing suggests a negotiation between parties on the use of the data whereas publication guarantee data availability. This distinction is perhaps less relevant for the ongoing collection of community conservation data where there is no finite end-date for 'publication'.

Overall, interviewees thought that there were some benefits to sharing data relating to biodiversity, but not as much value in sharing simple outputs data such as trap counts. Many barriers to sharing were mentioned by interviewees, however as discussed many of these already have solutions from literature. Hopefully addressing these barriers will result in an increase in the ability of groups to share data, leading to a better understanding of biodiversity at a national level.

Data management (RQ-04,05,06)

As mentioned in the results, data management practices varied significantly across groups. However, despite this variation it appears that groups were able to find a workable solution for managing their outputs data—the collection and storage of data was not impinging on their ability to undertake the work depending on that information. However, it is still worth evaluating their efficacy to see whether the data can be managed better, especially with regards to sharing.

Firstly, a number of groups reported using DOC's internal systems for storing information, such as relating to traps [CS-01,02,04,05]. These systems typically are inwards facing to DOC staff and require a DOC login, and in many instances groups had a member

who was DOC staff member with access. This system, whilst workable, is not ideal in that the data are limited to the way DOC handles their data, and its availability is dependent on DOC's access policies, which may be more restrictive than those of other more public systems. It appears that DOC systems are used for the sake of simplicity. Ideally, data collected by community groups should be available at least to all of the people who contribute it, through a more outwards-facing system. However, a long term goal might be for DOC itself to share more of the (non-sensitive) information they collect, given the benefits of sharing data.

Using established public-facing systems, such as the citizen science platform Nature Watch or sharing with the Global Biodiversity Information System (GBIF) would also have the effect of complementing collected data with existing data from others (Nature Watch NZ, n.d.; Global Biodiversity Information Facility, n.d.). As listed by Costello & Wieczorek, (2014) there are many existing systems available covering species nomenclature, environmental data, genetics, vegetation plots, and species distribution. Citizen-science systems such as Nature Watch also allow for the peer review and moderation of data by experts to ensure its quality, a necessary step for the usefulness of any biodiversity resource (Costello, et al., 2013).

In any case, with every system it is crucial to ensure that there is buy-in from the people that are meant to use it, especially when moving from a physical/paper-based system to a digital system. Ensuring there is adequate support from the outset for less-technical conservation volunteers, or alternatively having designated data entry people can help with this. However, as IP-04 suggested this might be less of a problem over time as more (generally younger) digital-savvy people get involved in community conservation.

Overall whilst present data management practices employed by the community groups surveyed are sufficient, it is worth considering the benefits that other systems might provide. This includes not only being able to share the data they collect, but also supplement their data with data collected by others. Using an established public-facing system also has other benefits, such as features enabling the peer-review of data to ensure quality. However, irrespective of the system used, ensuring buy-in of group members is crucial to the system's ongoing success. This could include ensuring adequate technical support is provided to less-technical members.

Knowledge sharing (RQ-04,05,06)

When asked about data sharing, at least four of the six interviewees thought that sharing knowledge was of equal, if not more importance to sharing data [CS-02,03,04,05].

Knowledge sharing, as in the sharing of successes, failures and lessons learnt, was especially highlighted by IP-02a who emphasised that "people keep re-inventing the wheel… it is all about communication and information sharing", and backed by literature supporting its value to conservation (Moritz, 2004).

Services already exist to facilitate this to some extent, such as the website 'Nature Space' run by a governance board with representatives from DOC and other environmental groups (Nature Space, n.d.). However, only three of the six case studies were on the system [CS-02,05,06], and none of the interviewees reported knowing anything more about the service other than recognising they were part of it. This suggests that the system is not presently facilitating knowledge sharing particularly well due to lack of awareness. With technical solutions to information sharing being well established, raising awareness of a system such as Nature Space, and understanding what people would want to get from such a system is crucial to it being a success. This is corroborated by Deng, et al. (2010) who state that the user satisfaction, i.e. that they are getting value from a system, is the key determinant of continued usage for IT systems.

It is important to note that websites are not the only way by which sharing can take place. Forums, workshops and collaborative events represent another way to share knowledge, but also a simple approach such as a regional newsletter can also be beneficial. This is the case in the Top of the South, where a volunteer compiles news from over twelve conservation groups in the Nelson/Tasman region, including noteworthy news, events/workshops, trap statistics and lessons learnt. This newsletter is distributed via email around the respective groups and interested individuals, and is proving to be a simple but effective way of facilitating more knowledge sharing [CS-02,05]. IP-05 also said that maintaining a map of the working areas of conservation groups would help other groups to realise what other work is being done in the region, and potentially facilitate community building.

In essence, knowledge sharing has been highlighted as crucial by many case studies interviewed. Online services, such as Nature Space, already exist to facilitate this but are limited in their use, and research should be done to understand what users would want to get out of a sharing system to ensure its ongoing use. Alternatively, sharing information regionally can be simply facilitated by physical events such as forums and workshops, or having a regional newsletter like the established 'Nelson/Tasman Conservation Newsletter'.

Discoverability and the necessity for a coherent source of community conservation information (RQ-05)

One issue noticed from the start of this research was the lack of definitive information on community conservation groups. DOC has a list of about 200 community groups on their website, but this falls well short of the 600 figure stated by Peters, et al. (2016). Peters, et al. (2016) had to resort to using eight different databases to compile their list of groups to contact for their research into monitoring methods, three of which were non-public databases accessed with permission. This scattered information means simply trying to make contact with community conservation groups across the country is problematic.

Similarly, for community groups themselves there is no single source of information to help support their activities. For example, if a group wanted to know more about starting a pest trapping exercise there is information available on over four websites including the Predator Free New Zealand Trust, Nature Space, Kiwis For Kiwi and the National Pest Controls agency (National Pest Control Agencies, 2015; Kiwis For Kiwi, n.d.; Nature Space, n.d.; Predator Free New Zealand, n.d.). The Nature Space web page on trapping simply provides a list of links to other websites, and trying to distil the relevant information and latest best practices is difficult with so many sources of information, especially for volunteer-based groups who may not have the time or expertise to figure it out.

Monitoring toolkits have been created for community groups, with the intention of making science, such as species monitoring, more accessible to those with no formal science. Peters, et al. (2016) found that whilst volunteers who used the toolkits reported their success in providing robust monitoring data, very few groups used them which suggests a lack of knowledge about available toolkits. It appears that a lack of information is not the hindering factor for groups, rather it is issues with discoverability, that is, finding the relevant information.

In essence, the problem requiring solving is distilling what is or is not pertinent to community groups, and making sure that information gets to the relevant people. This was a point made by IP-02a who said that sharing information and making sure it is getting to the ‘right people’ was more important than just simply sharing data. Having a complete list of community conservation groups would also help the groups themselves understand who else is doing similar work in their region.

Resolving this issue requires different stakeholders, including government bodies, scientific entities and charitable trusts, to work together to reduce duplication and provide a definitive source of information for community groups seeking to undertake conservation projects and biodiversity monitoring. If these resources are consolidated, the resultant website would also need to be actively maintained as practices change, and awareness-raising efforts should be made to ensure buy-in from community groups. However, as stated by IP-06, any such outcome should be done through an existing entity or project, as they said there are already a number of 'umbrella' organisations out there seeking to work across community groups, and they would be wary of introducing another one. As previously discussed, the site should also have the ability for community groups themselves to contribute and share knowledge as they find solutions to problems, such as CS-02 did with designing a 'mouse excluder' for traps.

Overall, the lack of definitive information, both about existing community groups and information for the community themselves, is an issue that needs solving. This should be resolved through multiple stakeholders working together to build on an already existing entity to create a 'single source' of the relevant information for community groups. Making arrangements for the active upkeep of information, and ensuring awareness of the system in community groups would be crucial to success.

Access to funding and resources (RQ-05)

As discussed, the lack of funding is a typical issue for conservation, especially with regards to ongoing funds, hence it is an important factor to consider for data management. Five of the six case studies did not have a source of ongoing funding, relying on donations and charitable grants to sustain their activities [CS-01,02,03,05,06]. Unreliable funding can be problematic for data collection, especially for long-term datasets. Many systems have been built using a one-off grant from the (former) Terrestrial and Freshwater Biodiversity Information System fund (Department of Conservation, 2013), however without ongoing support a lot of the effort expended on developing systems was useless. As discussed in a later theme, uncertain funding is a key reason for making sure data is stored in an established, sustainable system for longevity.

However, it can be argued that funding itself is not the main barrier to assisting community conservation groups with data, rather it is a lack of commitment from

government entities, tertiary institutes and CRIs to take responsibility and work together to support community groups (M. J. Costello, personal communication, August 27, 2017). This view was backed by two community groups, who stated that if a new system was built to help with community conservation, it would have to be adequately resourced to be successful into the future [IP-01,02a].

Another issue related to resourcing concerned access to people with the knowledge to interpret data collected by community groups. At least two of the groups had committee or staff members with a career background in science [CS-04,05], which meant that those individuals were able to perform analysis of data to get additional meaning from it. However, access to the ability for information to get analysed is intermittent as it simply depends on whether there is someone with the appropriate background involved with the group. IP-04 suggested that this lack of access to have data analysed was more of a limiting factor than issues with data storage and sharing. Ideally, community groups would be able to access expertise relating to statistical analysis, and GIS to help with map making as suggested by IP-06.

Overall, access to funding is intermittent and can impinge on the ability of community conservation groups to manage long-term datasets. This can be mitigated if government entities, tertiary institutes and CRIs work together to determine who has responsibility for maintaining community collected biodiversity datasets. Access to analysis is not an issue unique to community groups—as expressed by IP-02a the ability to have more data analysed would be useful for DOC staff as well. Whilst a difficult issue to resolve without funding, if the data made available to tertiary institutes it might be possible for it to be analysed as part of course assessment for undergraduate students in relevant disciplines, as demonstrated by the GEOG309 community-based assessment course, in which students do real-world work for community partners (University of Canterbury, 2017).

Data storage and publishing (RQ-05)

According to Costello & Wieczorek (2014), most ecological data used for scientific research are not accessible after the analyses have been published, which is problematic for both independently verifying analyses, and also potentially gaining new insight from the data collected. The paper states that often the data collected simply remains with those who collected it, for reasons including cost, sensitivity, organisation and ownership. This

evaluation is consistent with two case studies, in which the groups had reports and scientific/consultant papers written up, without having access to the raw data underlying their analyses [CS-03,06].

Another similarly related issue is the storage of data—many groups reported that the data collected was scattered across different locations, including volunteers' homes and personal computers [CS-03,04,05,06]. In the case of CS-03, one of the key comments made by IP-03 was that most of the knowledge on coastlines at the Top of the South had come out of environmental court cases fought by them. However, there was no coherent source for this information, let alone raw data, with information being published in various scientific and consultant reports, and also stored in file boxes at a local museum. IP-04 reported that a lot of data collected for CS-04 was typically stored by the scientist who was doing the analyses. Similarly, with CS-06 regular bird surveys were conducted twice per year by a knowledgeable volunteer, who would then write a report—the raw data were not available by default, but would possibly be available on request.

The issue of data publishing is not a simple one to resolve, but simply being made aware of the benefits of publishing to the wider science community is a first step. Costello & Wieczorek (2014) state that putting the effort in to publish data is simply the "right thing to do for science" (Costello & Wieczorek, 2014, p. 69) and can also lead to increased visibility of the work being done. They also state the special importance of publishing collected data for conservation, so assuming that the person collecting the data is doing so to assist with conservation, it would seem logical to also publish the data. However, in some regards, issues with data storage simply related to disorganisation, especially with conservation groups that have been around for decades [CS-03,06].

Themes: Technical

Sustainability of databases (RQ-04,05)

With the rapid pace of technological change nowadays, websites and online databases require active and ongoing maintenance in order to be secure, reliable, resilient, available and easy-to-use (Dawson, 2012). As such, it is important to consider the sustainability of these systems into the future, especially if they're meant to handle long-term datasets, as is often the case with biodiversity information.

Two of the case studies reported using a customised mobile application or database for the storage of their information [CS-01,04]. CS-01 had a customised website, designed

and maintained by the interview participant (IP-01), and over time it has been built to contain all of the information required to support the community group's output and outcomes monitoring. It has data sharing built in by default, and excellent buy-in where all volunteers use the system to store the information they collect. Similarly, CS-04 has a customised mobile application targeted at visitors to the national park they operate in, which allows for the reporting of native and pest species sightings.

However, one of the issues with a customised approach is that the systems require ongoing support to be sustainable in the long term. In the case of CS-01, whilst the database functions well presently, the question remains over what will happen both to the website and the data it contains when the current maintainer (IP-01) is no longer able to maintain it. Similarly, in the case of CS-04, mobile applications must be continually updated as the mobile phones themselves are updated. CS-04 is set to be well-funded for thirty years and presumably able to afford the upkeep during that time, but like the customised website, due consideration must be given to what happens to the app and data in the long term.

The issue of database sustainability has been discussed at length by Costello, et al. (2014) who advise that in order to ensure longevity, data should be integrated with larger collaborative databases, and also be owned or managed by an organisation, society or similar with a suitable mandate. In the context of community conservation data, this could be the Department of Conservation itself, or potentially a tertiary institute or CRI. A similar conclusion was reached in a report on citizen science biodiversity monitoring, which recommended the use of a resilient, standardised framework to ensure longevity, especially as personnel involved change over time (Collier, et al., 2016).

An example of a long-term database meeting the guidelines suggested by Costello, et al. (2014) is Nature Watch, which is a nationwide citizen science database, using an established underlying system and with its longevity supported by a charitable trust (Sullivan & Molles, 2016). Using a nationwide database such as this also has the advantage of ensuring commonality, so that information can be compared across different groups and projects.

Another study, by Costello & Wieczorek (2014) list some of the many well-established databases available for publishing data, such as the Global Biodiversity Information Facility (GBIF). Sullivan & Molles (2016) also list some of the many established solutions to collecting and storing trapping (outputs) data, including CatchIT and Walk the Line.

Overall, it is important to consider the sustainability of databases when storing data, to ensure that datasets are available in the long-term, especially if a project does not have ongoing funding. For community conservation groups looking to start or expand monitoring programmes, such as CS-04, it is recommended that all steps should be taken to use an existing system before considering creating a new one. If there is no other option but to create a new or customised system, then due consideration should be given to its longevity, especially with regards to funding, and it should adhere to already defined standards, such as Darwin Core (Wieczorek, et al., 2012).

Incompatibility between systems (RQ-04,05,06)

One of the key comments made by IP-01 was "there are a lot of databases out there that all want some form of the data [CS-01 collects]". In this instance, some data relating to whio (endemic blue duck) was being collected and stored in CS-01's customised database, however DOC also required that the information was stored in their database as well. IP-01 said that the two systems were entirely incompatible, with attempts to automate the data transfer unsuccessful, resulting in data having to be manually transferred between systems with extra identifiers added to facilitate the process. Part of the reason the two databases exist is that they meet different needs—one is DOC's internal-facing whio-specific database, and the other is the publicly available customised site run by IP-01. Page (2008), highlights that it is often the case whereby different data providers exist in order to cater for their own specific users.

This subject of database incompatibility is not unique to community conservation groups such as CS-01, and technical solutions to the issue have been well researched. One example is creating shared identifiers, such as recommended by Page (2008), whereby suggestions are made as to how to define globally unique identifiers for biodiversity information, in a similar methodology to how DOI numbers are used for academic referencing. This would ensure data across disparate database systems would be able to be linked. In general, the idea of globally unique identifiers is useful for providing structure across disparate databases (Wood, Zaidman, Ruth, & Hausenblas, 2014).

Adhering to common standards across databases, such as Darwin Core (Wieczorek, et al., 2012) or JSON-LD (2016), whereby unique identifiers and relationships to other data are explicitly defined, also ensures compatibility amongst databases.

Given that over four pest trapping systems exist, an example of shared identifiers in a community conservation context might be the establishment of a nationwide unique pest trap identifier system, whereby trap data across different databases can be matched up, compared and possibly even consolidated in future. Unique identifiers would also help solve the problem of IP-01, instead of having to use different identifiers for different systems.

Overall, incompatibility between databases is not a problem unique to community conservation groups. In order to facilitate management of the issue, shared identifiers could be added to old databases to ensure that they can be matched up with other databases, and when new databases are designed they should adhere to well-established technical standards to ensure that the data collected is usable and comparable elsewhere.

Future research

Given that this research evaluates some of the issues and potential for community-collected conservation data and makes suggestions, it would make sense to assess their efficacy in the real world. Therefore, future research could involve undertaking small-scale real-world trials with a few community groups to validate the recommendations. The results of these trials, if successful, would provide the grounds to pursue more funding in order to support community groups with their data in monitoring, and hopefully achieve better outcomes for the community groups and the environments they seek to protect.

5. Conclusions

In summary, over 600 community environment groups work in New Zealand to help improve the state of the environment. The work undertaken by these community groups is diverse and in order to support these activities, many groups collect data and information on both their outputs, and their desired outcomes. Previous research has looked at the objectives and monitoring practices of community conservation groups, but has not considered data management practices. Investigating these practices is especially useful considering that research suggests there are benefits to the increased sharing and linking of biodiversity datasets.

Through a case-study based methodology, this research looked at the current practices of six groups, including on data sharing already taking place and its perceived value. Themes across case studies were determined and then extended with literature to provide suggestions on improving data management. Themes identified looked at the value of data sharing and knowledge sharing, as well as issues relating to as data storage and information discoverability. The sustainability of systems, and access to resources and funding were also covered.

This research is relevant because the increase in work done by community conservation groups means there is a need to future-proof by improving data management practices. Future research could be conducted through undertaking small-scale real-world trials, to validate some of the many literature-based recommendations thus providing solid grounds to pursue more funding to support community conservation groups with their data and monitoring efforts.

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Ethics

Prior to conducting the interviews, this research was submitted to the University of Canterbury Human Ethics Committee and was approved in June 2017. Participants (and their community groups) have consented to the use of their name(s) for the purposes of attribution and acknowledgement in this report.

Further Reading

For further reading on the activities of community conservation groups beyond their use of data:

- Peters, Hamilton, & Eames (2015) undertook a wide-ranging study via an online survey that covers the objectives, activities and partnerships of many of New Zealand's 600 community environmental groups.
- Sullivan & Molles (2016) make a number of suggestions to improve the practices by which community groups collect biodiversity data

Appendix I: Interview Participants

IP-01: Graeme Kates
Arthur's Pass Wildlife Trust

IP-02: [a] Peter Hale, [b] Wayne Sowman
Friends of Rotoiti

IP-03: Gwen Struik
Friends of Nelson Haven & Tasman Bay

IP-04: Ruth Bollongino
Project Janszoon

IP-05: Alistair Sheat
Abel Tasman Birdsong Trust

IP-06: Ian McLennan
Ōtamahua/Quail Island Ecological Restoration Trust

Figure 1: Approximate location of the community groups interviewed.
Base map: (Geographx, 2009)

Appendix II: Interview Questions

The following questions were used as prompts during the interviews, with examples being given to provide further context for each question.

1. Tell me about your job
   (e.g. workplace, position, responsibilities…)
2. Do you collect (or are you responsible for) conservation biodiversity data?
3. What sort of data is collected?
   (e.g. trap data, bird data, sighting data, geospatial…)
4. How is this data collected?
   (e.g. on GPS units, tablets, website, paper notebooks…)
5. How is this data stored?
   (e.g. spreadsheets, Access database, online databases, paper forms…)
6. Is this data already shared with other projects?
7. What happens to the data after collection?
   (e.g. data maps, published online…)
8. Is it used to inform any management practices?
   (e.g. trap networks, pest control…)
9. Is the data publicly accessible?
   (i.e. available online, available on request…)
10. What barriers do you foresee in making the data available/more accessible?
    (e.g. technical issues, time, financial problems, data sensitivity…)
11. Are there resources that you wish you had access to that would assist with data collection?
    (e.g. a helpdesk, a person responsible for data entry…)
12. What value, if any, do you think might be obtained by making the data more available/accessible?
13. Is there someone that has ultimate responsibility for maintaining your data?
14. Do you use any datasets from other sources/projects?
15. Anything else?

Appendix III: Case Studies

CS-01: Arthur's Pass Wildlife Trust

Background and funding

Graeme Kates, a long-time Arthur's Pass resident, first set up a self-funded trapping network in Arthur's Pass Village in 1998, and in 2004 began to get a volunteer base helping out with traps, including the expansion of the trapping network because the existing traps were proving to be highly effective.

Originally the Arthur's Pass Wildlife Trust (APWT) was part of 'Kiwis for Kiwis' (formerly 'BNZ Save the Kiwi') from about 2004. In 2008 they decided that they needed to expand away from kiwi as the kiwi programme was coming to an end, hence the Arthur's Pass Wildlife Trust was born. The Trust was formally incorporated in 2010 and it provides an umbrella for private and community conservation/recovery projects throughout the region.

The APWT is almost entirely self-funded nowadays. Earlier on they used to have funding via 'Kiwis for Kiwis', but this was lost due to a loss of sponsorship of the whole programme, resulting in the truncation of some projects (e.g. one kiwi project that was meant to be undertaken over ten years ended up being only about six years long). The APWT also took over all of the trap-lines placed as part of the Coast-to-Coast race's environmental efforts, however they also no longer fund any trap networks. The trap networks are so extensive that they sometimes have to pay contractors to check them.

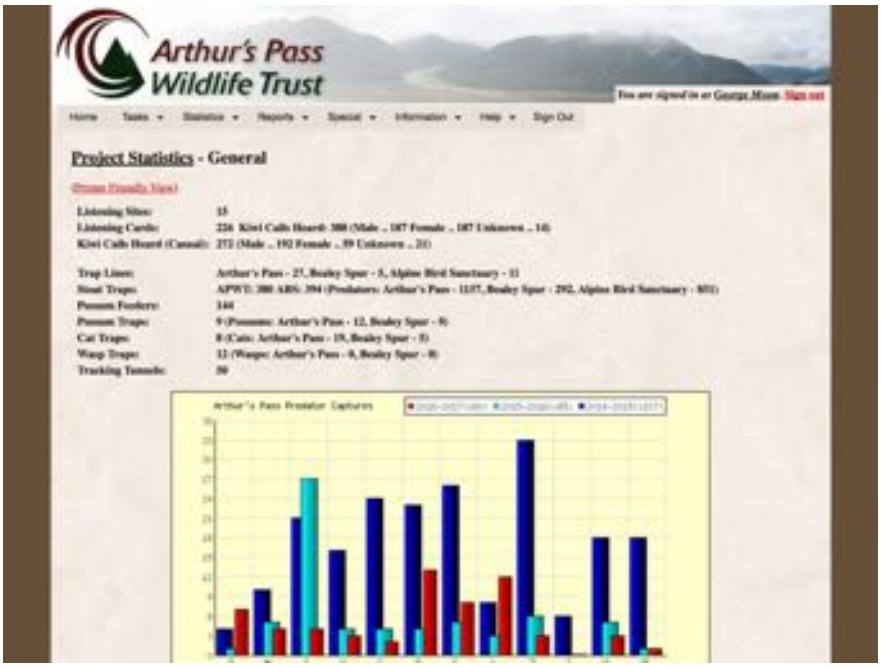


Figure 2: An example of a trapping report from the Arthur's Pass Wildlife Trust website

Data: type, collection, storage, availability

The APWT has had an online database since 2004, available at http://www.apwt.org.nz/. Anybody with an official login can enter data, and much of the data is also publicly accessible by default however some data, e.g. GPS coordinates of sensitive locations, is not publicly available.

The Trust collects a wide variety of data including: trapping data (including pest catch count), bird sighting data (casual observations and annual bird censuses), extensive data on kiwi (because of history with Kiwis for Kiwi project), a kea band database, volunteer hours and weather data.

All raw data is stored in a (backed up) MySQL database—Kates can pull out any data from this, but the website provides access to everybody else. The website has the ability to generate reports (with graphs and tables), sort/search/filter datasets, create printable views and export data as CSV/XLS files (Figure 2). In the early days, data were stored in Excel spreadsheets but that has not been the case for years.

The APWT also uses the DOC whio database, however is this complicated by the fact that the APWT also have their own whio database. This means that the data has to be entered twice, as the two systems are completely incompatible. Kates has tried transferring data but was not able to make it work.

The majority of data are collected by volunteers. As far as the trapping network is concerned, volunteers 'adopt' lines and are then responsible for checking them every two to four weeks, depending on what is happening predator-wise. Using their own logins, they enter all data online, including what was caught, whether traps were rebaited etc. Includes data on all traps: cat traps, stoat traps, possum traps and tracking tunnel data. Whilst volunteers tend to write down data on paper in the field, the APWT has excellent volunteer buy-in with the website—everybody ultimately enters data into the website themselves, without simply handing paper forms on for someone else to enter. Mobile phones are not typically used for data entry because cell coverage is often limited.

Kiwi listening surveys are the only activity that is conducted on paper forms with the data entry handled by Kates, because a lot more data needs to be entered in. Kates' system then exports this data as a spreadsheet which can be sent to DOC where they can add it to their own spreadsheet-based system.

The APWT website also currently has a kea band database, but this will be made redundant because of the Arthur's Pass Kea Team's new Kea Database.

At one point the Nina Valley Restoration Group used a database set up by Kates, as they were also doing work with kiwi, but this has not been used for a while—potentially because the kiwi project in the area is finishing up. They are still doing trapping, but Kates is not sure where that data is going anymore.

Lots of people at DOC have full access to the APWT databases, both regionally and in the national office. Any data that is not available to the public is usually to prevent vandalism (e.g. in the past traps have been stolen and damaged intentionally), or to reduce the potential for data to be misinterpreted or misused. Kates has ultimate responsibility for maintaining the data.

Data: purpose, use

Following the collection of data on the website, Kates undertakes analysis of the data, including looking at what is happening with predator trapping, e.g. whether there are spikes in numbers that require a response. The database is set up to email Kates at certain thresholds (e.g. a sudden increase in pests trapped) so that he can contact volunteers to let them know they may need to check their traps more regularly.

As mentioned, whilst most of the data is available publicly, Kates is not aware of any individuals or community groups using the data and making decisions based on it. On one occasion DOC used the tracking tunnel data on mice numbers as part of their decision making process around conducting landscape-scale aerial predator control.

Data: connectivity, views on improving availability and cohesiveness

One of the issues Kates has run into with data connectivity is that there is a lot of databases out there that all want some form of the data (e.g. DOC and the Predator Free New Zealand Trust). Kates has tried to use the DOC whio database to add historical data from 1998 in, with little success. None of these databases actually communicate between themselves and update each other. Kates believes that fixing this is not going to happen in the short-term, and he agrees with the viewpoint that people build databases and systems designed to suit their needs, even if similar systems exist.

Kates has built in extra identifiers in the APWT whio database so when data is transferred (manually) to the DOC database it can be matched up. There is a mismatch

between the straight-forward APWT database and the DOC database, which is not as intuitive to use. Additionally, the DOC database requires a DOC-provided login to access, and also requires a now-obsolete Microsoft Silverlight compatible browser & operating system. Access to this more complex database needs to be managed by the group to maintain accuracy, meaning that general volunteers of the APWT cannot directly add information themselves, and is limited to two group members who manage all of the Whio protection trap-lines. Currently only trapping data associated directly with Whio protection is entered into the Whio database, although other non-Whio trap-line networks are present in the system, capture data is not entered as this requires 'double-manual-handling' of a lot more data.

Kates mentioned that there are people at DOC who are able to help out with managing this data, but they are overwhelmed with the amount of work required. Kates says that DOC is supportive, but ultimately DOC should be the repository of all of this data. There can be some conflict with regards to funding, where a funding provider might be sponsoring one particular species, but in reality the conservation work being undertaken applies to the wider ecosystem (e.g. pest trapping sponsored to protect one species will also protect other species in the area). For example, traps that have been placed to protect whio in Arthur's Pass National Park also protect kiwi.

Kates thinks there is value in making this data more available—everyone is talking about 'landscape scale predator control' nowadays. For example, DOC has their databases for trap lines in the Hawdon Valley, APWT has all of the valleys leading off from the Bealey River, including the Waimakariri—they are aware that predators are travelling over mountain ranges between different valleys. Craigieburn Forest Park is another adjacent area with predator control regimes—there is already communication between the different groups in the area about what is happening, but the people undertaking pest control there use a paper and spreadsheet based system. They are able to see the APWT's data but the APWT has to wait for them to send information. It is likely that this is the case because they do not have the technical capability to do anything else.

The APWT uses some data from other sources, mostly DOC's data from the Hawdon Valley, particularly with respect to beech masting years—DOC is able to provide a much more intensive dataset with regard to this than the APWT has for the valleys they maintain. The APWT is often able to extrapolate data about beech masting in the areas they maintain from DOC's data. As Kates is an employee of DOC he is able to go directly into their systems to get the data required.

Kates thinks that there should be a ‘one size fits all’ database that is managed by DOC for this conservation information. He said that the whio database is good, but it is very species-specific and not easy to use—if the database is too difficult to use, it is unlikely there would be buy-in from volunteers. If the public has access to this kind of database, it would need to be well managed and protected.

CS-02: Friends of Rotoiti

Background and funding

Friends of Rotoiti (FOR) was originally formed in 2001 as a partnership between DOC and a group of motivated locals living in the Nelson Lakes area of the South Island. The goal was to help support the Rotoiti Nature Recovery Project (RNRP), one of six 'mainland islands' established in in the 1990s, whose aim was to achieve similar results with regards to pest management and species recovery as those achieved on protected offshore islands.

Nowadays FOR undertakes a number of pest control measures including rat trapping around St. Arnaud, seasonal wasp control, monitoring of local species (such as lizards), live cat trapping and the maintenance of 40 possum traps and over 40km of stoat trap lines. In the past 15+ years, FOR has removed over 30 000 pests from their trapping networks.

For many years most of FOR's organisational work was undertaken by a DOC Community Ranger. However, following a restructure of DOC resulting in a change of work roles, much of this work fell onto the community. Consequently, in 2017 FOR incorporated as a charitable trust so they were able to formalise working arrangements with DOC in order to continue with the strong partnership built up over the years.

FOR receives its funding primarily through monetary donations, but is also supported by DOC through the use of its vehicles, and other companies providing resources for trapping (e.g. peanut butter).

Peter Hale is one of the trap-line coordinators, and is partly responsible for FOR communications. He also works part-time at DOC in the visitor centre. Wayne Sowman is the current chairperson of FOR and his primary role is the coordinator of the village rat group.

Figure 3: An example of one of the graphs produced using Friends of Rotoiti's trapping data

Data: type, collection, storage, availability

The primary type of data FOR collects is catch data relating to the various trap lines that they are responsible for. Because they have a strong working relationship with DOC, this is directly entered into DOC's trapping database. They are then able to export the data into spreadsheets from which they can generate pivot tables and graphs.

FOR relies on DOC for vegetation plots and most tracking tunnel data—they still maintain some tracking tunnels around the peninsula, Black Hill and Gibbs Walk (around the village environs) (DOC's tracking tunnels are further out in the park). FOR is lucky in that because there is a major DOC headquarters in the area they are able to rely on DOC's monitoring, rather than having to do it themselves.

FOR is also able to consult with the biodiversity team at Nelson Lakes, for example if they notice something is a bit out of the ordinary in the data they collect (e.g. a predator spike). However, one of Hale's concerns is that other community groups do not have as much communications with DOC, who have most of the expertise on conservation—in some instances this might be because of disagreements. Hale mentioned that there has been a mind-set change over many years within DOC that volunteers are nowadays a huge part of conservation work.

Trapping data out in the field is collected on paper forms. Hale said that the very latest DOC trapping system works from smartphones, but it is not in active service yet. The data collected on paper is then entered manually by Hale into DOC's system. DOC's system includes all trap data from their own traps, as well as FOR's trap networks—all of which is used for the RNRP annual report. Hale said it is not always easy to use DOC's database, and that it would be nicer to have a more modern system. Ideally DOC would like all community groups using their systems, but there already a few trapping systems out there (e.g. Cat chit from the University of Auckland) that are being used by community groups. CatchIT was trialled on one trap-line for a period of time by FOR.

Hale said that he personally liked the CatchIT setup as it allowed people to enter data themselves (i.e. they could just select the trap that was sprung and tick the relevant box). Hale reckons that entering data yourself gives you more ownership/responsibility of a particular line. However, a downside with this approach is that there would not necessarily be any error checking—little errors probably would not matter too much, but in some cases (e.g. tracking tunnels) it was more important to have accurate datasets.

Sowman attended a Kiwis for Kiwis hui in 2015, where some Whakatāne conservationists described a system they had set up that would collate a wide range of trapping related data such as who checked what trap, volunteer hours—and anybody was able to access it.

Data: purpose, use

In Hale's view a lot of the time the trap data is used by conservation groups simply as a 'look at the number of predators we killed' tally—he believes it is a meaningless number, as the important statistic concerns what is left in the environment. However, Sowman mentioned it is still good information to have, especially when applying for funding—it gives an outline of what FOR has done, and where they have done it. The catch total also reflects the amount of effort that FOR has put in.

By the nature of its storage, data is shared with DOC. DOC mainly uses the data to feed into their annual RNRP report, that reflects on the efficacy of pest control, biodiversity restoration and management techniques in the area. At this point the data is not used by any other projects outside of DOC.

Aside from feeding into DOC's RNRP work, on an irregular basis FOR uses the data to generate bar charts (Figure 3) and pivot tables on a per trap-line basis. This is so there is an uncomplicated visual way to show volunteers what is being observed in trap lines they check, and the result of all of their effort. There are many different ways the charts can be produced, e.g. on a target species (stoats/rats), all species, trap type or by-catch basis. Typically, only the processed report gets emailed to the wider FOR membership as the spreadsheet is complicated and not particularly useful to share—not everybody is a scientist. Printed copies of the reports are also made available at meetings.

In terms of using the collected data to inform management practices, the data can sometimes show events that might merit a response (e.g. a predator spike). However, Sowman said the ability of FOR to respond to those events ultimately comes down to man-power—if some trap-lines are catching a lot of pests they might be checked more frequently. Things like possum bait/lures and trap positions are changed on a random basis. Trap positions are GPSed, but the location information is handled by DOC. The data can also show what traps catch a lot, compared to traps that catch nothing (hotspot analysis) which can be used to inform where other traps might be placed or shifted to. When they trialled CatchIT, hotspots were shown visually on a map.

The data is not publicly accessible by default, but it is available on request—in the last 10 years there has been at least one example of researchers wanting some data on the village rat trapping. However, FOR are looking at updating their website which might make it easier to share this data online.

Data: connectivity, views on improving availability and cohesiveness

More broadly, Hale and Sowman support data being made available, within reason—there is some data that is not appropriate to publish, e.g. trap locations. Alongside data sensitivity issues, they also agree that technical issues are another barrier to making the data more available.

In terms of resourcing, they also agree that most community groups would like to have help with data—but needing help with data is not unique to community groups. Even biodiversity staff at DOC would find it useful, as data (and its analysis) is a specialist area. Hale said that there are all sorts of grey areas with data (especially large datasets), so it is important that analysis is undertaken carefully—lots of variables.

Regarding the value in making the data more widely available, Hale was not convinced that sharing trap data was particularly useful: "In the end, all the data is showing is the scale of the problem". The data reflects on food availability and what predators are out there—in of itself it is meaningless. Hale reckons that more useful data to share would be something like bird counts (i.e. the impact on species that the pest-control efforts are trying to aid). FOR relies on DOC (RNRP) for bird count information, but DOC is also constrained with staff resourcing. Hale believes bird counts are very useful, and much better that people anecdotally observing more bird species around.

FOR is privy to other Nelson/Tasman conservation groups' trapping data, but they do not use it. A lot of information sharing in the 'Top of the South' is run through the Tasman/Nelson Conservation Newsletter, in which a volunteer (Will Rickerby) compiles a newsletter made up of news from many conservation groups in the area.

Regarding NatureSpace (an online platform designed to enable resource and information sharing), FOR is on NatureSpace but it is not checked often. Hale reckons the idea is right, i.e. getting communities across NZ sharing information (not just data), but at this point it is not working as well as it could. In his view it is uncommon see community groups in an area communicating as a whole—there is a lot of "reinvention of the wheel". The Tasman/Nelson Newsletter is often used as a way to share information, an example of which

the mouse excluder (for traps) that FOR designed is not being used by other conservation groups.

Hale and Sowman both agree that the most important thing is getting the right information (i.e. not just data) to the right people. There is so much information out there, but a lot of the important stuff is not being seen by the people who need to see it: “it is all about communication and information sharing”. Hale subscribes to a number of newsletters, and often forwards on the information he sees as relevant to the wider FOR, who might not otherwise see it.

One part of sharing raw data that Hale mentioned was important, is that by making it available, anyone can verify the interpretations and conclusions that others have made on the same datasets.

CS-03: Friends of Nelson Haven & Tasman Bay

Background and funding

The Friends of Nelson Haven & Tasman Bay (FNHTB) was formed in 1973 as a result of public concern around plans for the extensive infilling of tidal areas of the Nelson Haven estuary at the top of the South Island. In the decades since, FNHTB has been at the forefront of many environmental issues threatening the shores, estuaries and waters of Nelson Haven, Tasman Bay and the Marlborough Sounds.

Dr. Gwen Struik, who completed her PhD in plant and animal ecology, was one of the founding members of the FNHTB, and is still actively involved as the chairperson. The committee has eight members, and Struik is responsible for coordinating meetings and organising annual reports.

The FNHTB gets most of its funding through donations, with some money from grants. In the past it has received funding for cases from the Ministry for the Environment via the Environmental Legal Fund.

The group differs from the other case studies in that it is mostly reactive—responding to threats against the environment through legal processes. This is in contrast to the other groups interviewed which typically undertake active environment restoration or protection, thus providing valuable insight into the data requirements of a different type of environmental group.

Figure 4: An example of some of the scientific reports available on the Friends of Nelson Haven & Tasman Bay website

Data: type, collection, storage, availability

In order for FNHTB to achieve its aims of protecting the coastal environment, it needs to be informed about the literature, biodiversity and history of the areas it works to protect. Because of its over 40-year history, there is a lot of information gathered over the years, much of which is now stored at the local museum. The FNHTB does not collect data on a day-to-day basis, instead it typically commissions studies (often by 'expert witnesses') as part of its legal campaigns, many of which are fought under the Resource Management Act (RMA). In the past, hearings could often be undertaken by FNHTB members with knowledge of the subject, however nowadays lawyers and expert witnesses are typically required, often costing significant sums of money. Committee members bring knowledge by writing submissions on district RMA plans, resource consent applications as well as attending council biodiversity forums and other public groups such as the Harbour Board.

Over the years of court battles, many 'assessments of environmental effects' (AEE) and reports by expert witnesses have been written, many of which are publicly available. For example, the FNHTB has published three major scientific reports undertaken in the last few years on its website (Figure 4), including topics on 'Oil & Gas Ecological Assessment', 'King Shag in Marlborough Sounds' and 'Seabird, marine mammal and surface-fish surveys of Tasman and Golden Bay, Nelson'. In the case of the 'Oil & Gas Ecological Assessment' report, this was commissioned because there were gaps in the data available for undertaking a full AEE as required by the RMA.

A small example of 'citizen science' undertaken by FNHTB is that on their website they request people to contact them with information that may be useful for submissions and research, including ocean mammal/bird activities, pollution, and 'inappropriate activities' such as draining of wetlands or illegal activities around river mouths.

Regarding 'type' of data, recent data collected by FNHTB has included species-specific studies, surveys of seabird, marine mammals and surface-fish completed both aerially and by boat. Data were collected by scientists, private consultants or institutes such as NIWA (Crown Research Institute).

Data: purpose, use

As mentioned, FNHTB tends to collect data as evidence to support its court hearings, rather than as an active day-to-day activity. However, because the society has been active for so long it has accrued a significant amount of knowledge. Struik said that a lot of what is

known about the coastlines at the 'Top of the South' has come out of court hearings, in which both sides usually have to do research on the coastlines. However, she said that the evidence provided was not necessarily objective.

Data: connectivity, views on improving availability and cohesiveness

Information and data collected to support public hearings by the FNHTB and its expert witnesses is by default often available through government departments, such as the Ministry of Justice and Environmental Protection Authority, as well as local authorities, such as the Nelson, Tasman District and Marlborough District councils. Struik said that on occasion they also have individuals request information from the FNHTB, such as for a book on the Boulder Bank called "Rolling Stones", published in 2009 by Karen Warren.

Because the research commissioned by the FNHTB is undertaken by various consultants, experts and scientists, the raw data underlying their reports is not accessible from any one particular location. If a person was wanting to conduct further study in a particular area, they would need to get in contact with the person who undertook the research for information.

FNHTB often uses data provided online by the Marlborough District Council, as more environmental information is being added to the internet.

CS-04: Project Janszoon

Background and funding

Project Janszoon (PJ) is a privately-funded trust based in the Abel Tasman National Park (ATNP), who work with DOC, the Abel Tasman Birdsong Trust, the community and local iwi to help restore the ecology of the national park. The project, launched in 2012 aims to look at the 'bigger picture' of ecological restoration, and wants to help bring conservation methods forward for the benefit of all conservation. Over a thirty-year period, there aims for ATNP include reducing predator numbers and weeds, restoring ecosystems and re-introducing native animals and plants into the environment.

Ruth Bollongino joined PJ in 2015 as a Scientific Consultant, and she has an "eye on the bigger picture", for example she reviews the conservation policy and methods that are used by PJ. Bollongino reads a lot of literature to find out about new techniques. She also keeps an eye on new projects, such as acoustic monitoring, and snail monitoring where they are trialling methods that have not been used in NZ before.

Project Janszoon differs from the other major community conservation group in the ATNP, Abel Tasman Birdsong Trust, in that it brings in funds to allow for conservation management in addition to what DOC is doing. It is meant to help enhance development of conservation practices, but with less constraints—it is free to try out novel methods and ideas. PJ has a very strong partnership with DOC.

PJ also invests a lot into education, for example schools can adopt a section of the park, and help with weeding, planting and traps in that particular section. Bollongino said that education is very important as the next generation of scientists and conservationists are only a few years away, which is only a short time with regards to conservation!

PJ is privately funded, initially by a family trust and now by the umbrella organisation NEXT Foundation, who also fund other conservation initiatives such as Zero Invasive Predators (ZIP) and the Cacophony Project. Because PJ is well-funded by the foundation, they have a certain level of responsibility to bring conservation forward in general, and develop things that can be applied to other projects.

Data: type, collection, storage, availability

The data types of data collected by PJ includes trap line data (pest control—stoats, rats, possums etc.), weeding (exotic weeds, 'garden escapees', wilding conifers), outcome monitoring (being implemented currently), bird monitoring (counts, transects and regular surveys), hunting data (goat control), wasp control and restoration of habits (plantations). All of the data collected is merged with data collected by DOC, for example they have people that monitor 'category A' species.

The collection of data is carried out by many people across the organisation, including PJ's Operations Manager, ornithologists and Bollongino herself—the responsibilities are shared across the group.

A variety of methods are used to obtain the data. Trap line data is mainly collected using 'Walk the Line' a mobile app developed by DOC that enters trap data straight into DOC's databases. Because of PJ's strong partnership with DOC they are able to store data within their systems, rather than necessarily having to develop their own. PJ tries to use DOC systems as much as they are able to—but it is not necessarily the only place where data is stored.

Other data that is stored with DOC includes weeding control, plant pest control data and kill numbers from hunters. PJ still also uses spreadsheets, which often ultimately end up in an Access database—this is likely to change in the future, as PJ is already foreseeing that the volume of data they are likely to collect will probably surpass the capability of the current Access databases.

Phone apps (e.g. Walk the Line) are quite useful as there is no double-handling of data. Many of them are capable of working offline, for sending in at a later date. There are also some Wi-Fi hotspots installed around the ATNP by PJ.

PJ is not yet sure what future apps or databases will look like, Bollongino thought that they will likely be done in a way that could be used by other projects—she said it was important to think beyond single projects, especially where datasets require integration/merging later on.

PJ also puts a lot of their data into eBird, an online bird observation platform developed by Cornell University. PJ also has its own phone app (Figure 5), where they encourage visitors to the park to report the birds they see, for example if they see a banded

robin—all of this data is connected to eBird as well (and backed up). Visitors to the ATNP can also report when they see goats, so that they are able to be controlled. Bollongino said that they were surprised at how successful the app has been to date, with over 2000 downloads in the last summer season (and increasing). The app also has weather forecasts, maps, tides and other useful information for visitors.

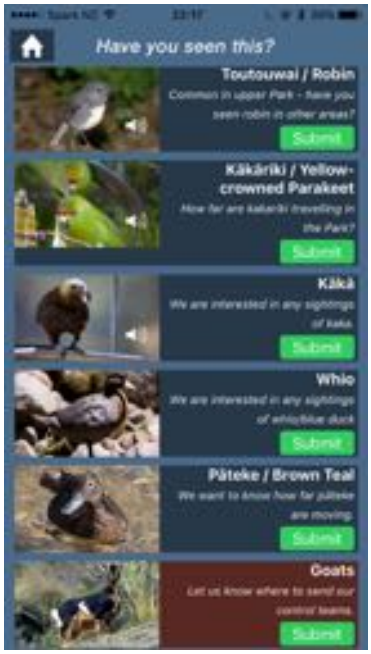


Figure 5: A screenshot of Project Janszoon's app, showing the observation screen (desirable species and pest species)

Over time, the way data has been collected and stored has changed as PJ gets more data. In the beginning, people would often keep data on their own computers. PJ is in the process of setting up cloud-based storage (Google Drive) for their whole team—it supports keywords and metadata, which is useful for finding data without a formal hierarchy of folders.

One issue with data collection mentioned by Bollongino was that people are happy to invest in results monitoring (e.g. how many pests killed), but not necessarily long-term outcome monitoring (e.g. how many more birds are in the park).

Data: purpose, use

PJ uses the data collected for various purposes. For example, maps are made on a regular basis showing wilding conifers and weeding work. PJ is ultimately working towards an adaptive management approach, which essentially involves reviewing data collected every five years. As part of this review, they would undertake statistical analysis on the data collected to date and do some modelling to see if they are on the right track, so they ensure

that the work they are doing is effective—if some of the responses they are aiming for are not there, they can change their strategy to make it work. It is important that this is done so they can adapt methods, rather than just checking the data at the end of the project.

With regards to other data collected, for example on beech masting, a lot of work is done by DOC because of their strong partnership. Much of the field-work itself is also done by DOC, and in some instances PJ pays the DOC stuff to do this (e.g. checking trap lines). Work done by DOC has to follow DOC's reporting system, which usually involves publicly-available annual reports.

PJ also has to review data regularly because of the requirements of the 'Tomorrow Accord' agreement signed between the Government and the NEXT Foundation (PJ's funders). This accord involves the definition of 'transitional objectives', i.e. targets the PJ is aiming to reach. Once these targets are reached, the agreement states that DOC will then take over the management and become responsible for ongoing maintenance in the long-term. For example, a transitional target might be to have stoat numbers in the national park at a certain threshold. Because of this, PJ has to regularly prove what the situation is like, with regards to these targets. The idea behind the targets is that when private money for projects such as PJ is no longer available, all of the work that has been achieved will be maintained into the future. For example, kākā monitoring is undertaken by PJ, and the idea is that once they are doing well (i.e. at a quantifiable point with regards to their breeding, survival and sex ratio) DOC can take over.

Data: connectivity, views on improving availability and cohesiveness

As mentioned, PJ already shares all of its data with DOC, and hence anyone within DOC can also access it. Because it is stored in DOC systems, essentially DOC's access policy with regards to data is what applies to PJ's data by default. Bollongino thought that whilst it has not been the case to date, they would be happy to provide data to anyone for research—as PJ's vision is to 'bring things forward' for conservation.

As far as data sharing is concerned, Bollongino believes that it is also really important for conservation that not just local data is analysed, but instead look at the wider datasets of several projects and see if there are more general lessons that could be learnt—there is no point in hiding the data.

Bollongino said that there are some things that are in a preliminary stage (e.g. work with snails), that will eventually be published once they're assured of results—ultimately this work may even end up in a peer-reviewed journal.

Regarding improving the availability of data, with an increase in private conservation projects, Bollongino thinks there should be a nationwide citizen science database, that all projects can contribute to—however it would need to have certain standards to ensure that data collected is comparable and useful. For example, this might involve defining standard techniques that should be used (e.g. five-minute bird counts), as there are so many different ways to collect data in the field. This use of standards has not necessarily been done at this stage, but Bollongino believes it should be discussed in future. She also said that databases also have their limitations because they do not necessarily show lessons learnt from the data—there should also be a communication platform in which people can exchange experiences and solve problems. She said databases will not do the job alone!

Regarding data sensitivity, Bollongino did not support 'hiding' datasets necessarily (e.g. accidental bycatch), as she said it is important to learn from mistakes to ensure that they do not happen again. However, she also said that some datasets should not be published automatically, such as with preliminary data for scientific research. There are also other datasets (e.g. locations of traps) that should not be published because of potential for vandalism, however Bollongino was keen to point out that you cannot do conservation without the support of local communities, and the wider NZ population—you need to have the people on board!

Bollongino said that the collection and storage of data is not the limiting factor with regards to community conservation data—rather it is the lack of the ability to have the data analysed properly (e.g. statistical analysis, predictions, modelling). She has seen many reports that are not based on numbers—and if she has seen data analysis, it has mostly been simple 'axis graphs'. The issue is that proper analysis of the data can be complex and generally requires statistical skills—many community conservation groups might not know who to contact, and even if they did they would likely be expensive.

When asked about the support that community groups should receive with their data, Bollongino said that access to people who know how to analyse the data would be most valuable (e.g. statisticians with an ecological background). She said there are very powerful tools out there, e.g. computation modelling, that could have big benefits for conservation.

Bollongino thinks there is huge value to be gained through the sharing of data and methods—there is no use in knowledge if it is not made available. Practical field studies are the basis for ecological research!

On the subject of data ownership, Bollongino said that there is no such thing as 'one person' who is responsible for everything, and hence it is something that needs addressing. Currently with PJ it is mostly a 'gentlemen's agreement' with DOC, but she believes there should be a written agreement based on simple principles (e.g. the group that pays for the collection of the data is the owner, but people who are involved in the work have rights as well).

Whilst PJ does not currently do so now, in future PJ they are aiming to use datasets from other community groups where it makes sense for their own analysis. For example, in a few years' time when they will have some vegetation outcome data, it would be good to compare results with other areas. Similar with bird translocations—would be good to compare success. Whilst they are not necessarily using data per se, PJ does use lessons learnt from other projects, for example with kākā in the Nelson Lakes National Park—they are not trying to reinvent the wheel everywhere.

As mentioned earlier, Bollongino thought a forum for exchanging experiences and lessons would be really helpful. Regarding buy-in for online data/experience sharing platforms, she thought it would be good to have the necessary infrastructure up and running and then using education with the next generation to get people on board—it would also help support the longevity of conservation projects.

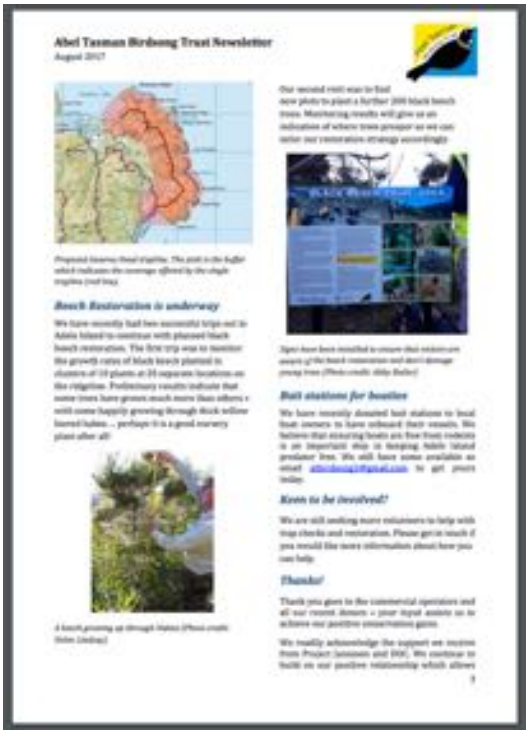
CS-05: Abel Tasman Birdsong Trust

Background and funding

Abel Tasman Birdsong Trust (ATBT) was founded in 2007 with the vision that "the forests and beaches of Abel Tasman are once again filled with birdsong". They aim to do this through measures including pest control (possums, stoats, rats, wasps), bird translocations, tree planting, and wilding conifer control.

Alistair Sheat lives on the edges of the national park, and is one of the trustees of the ATBT. He has a background in science, with an MSc in Chemistry and 20 years' experience at crown research institute Environment Science and Research (ESR). Sheat has many responsibilities within the ATBT, including data entry and the analysis of trapping data.

ATBT is a charitable trust, and they get some of their funding from commercial enterprises that operate in the park, such as water-taxi and bed & breakfast operators. Some funding is on a voluntary basis, whilst some of it is semi-compulsory through a foreshore management fund. Funding goes towards regular expenses (e.g. baits, traps), and just recently they were able contract a part-time administrator/volunteer coordinator through the DOC community grants fund. Sometimes for big projects (e.g. wilding conifer removal) the ATBT applies for grants, for example from the NZ Lottery Grants Board.


Abel Tasman Birdsong Trust Newsletter

August 2017

Beech Restoration is underway

Bait stations for boaties

Keen to be involved?

Thanks!

Figure 6: A page from the Abel Tasman Birdsong Trust August 2017 newsletter showing maps and photos from the work being done in the national park

Data: type, collection, storage, availability

ATBT collects a variety of data related to the work they undertake, but the majority of it is related to trapping efforts. Trap checking is done fortnightly, and presently volunteers fill out a form about the status of each trap as it is checked. Sheat enters the data into the DOC trapping database 'Animal Pests – Trapping', a GIS based system (with trap locations). Data has been entered into this system from August 2015, and DOC was keen for ATBT to use it to contribute to efforts looking at pest trapping data from a national perspective.

There is some work done by the ATBT around plant restoration, but there is no regular record keeping at this stage. With wilding pines, there is a photographic record but it is not GIS based. ATBT also undertakes bird counts in conjunction with Project Janszoon.

The maps Sheat generates for his reports are from DOC's GIS system, but he reports that it can be clunky at times. For example, he has to screenshot maps to add them to his written reports as the export features are not able to create the maps he requires. Sheat generates these reports for personal interest, but he thinks that they should be done anyway for the benefit of conservation. The GIS system does do some hotspot analysis, but it is somewhat limited.

DOC's system for trap information is password login only, and typically it is restricted to a particular 'management extent', which in ATBT's case is the Abel Tasman National Park. Sheat mentioned that there have been some efforts in the past to get more community groups using DOC's system, but in his opinion there is not a particularly obvious way for them to do this.

The ATBT uses some Goodnature self-resetting traps, but because of the way they work, they do not know what is being trapped (beyond possibly a 'kill count'), as the deceased pests are often then predated.

The raw trapping data is collected on paper forms, but Sheat has trialled a smartphone app 'Walk the Line' to see how easy it is to use. Presently though, Sheat enters in the data himself from the paper forms, which he says is a reasonably fast process as he only needs to add data when something of significance happens (e.g. trap sprung, pest caught, bait taken). However, he stated that care needed to be taken with data entry, for example changing the default date to the date of data collection. Sheat does keep hard copies of the data just in case verification is required—this also includes printing off emails from volunteers that email him with the results of their trap line checks. The ATBT has been trapping since 2007, and

Sheat has been trying to get historical records but has been having some difficulties (e.g. data might be stored somewhere in someone's house).

Whilst data is entered into DOC's system, Sheat exports a 'trapping report' spreadsheet (or a complete data dump as a CSV) from which he is able to generate graphs and tables.

ATBT also does bird-counts as well (with Project Janszoon), but the way in which these are done has changed over time. There is some sort of GIS system that captures this information, but it is quite difficult to understand what is going on with the bird population using this data.

Data: purpose, use

Sheat has been trying to adjust the formats of the trapping reports he produces to show more of a 'citizen science' view to the data. He said that it was necessary to do something else with the data (beyond kill counts) for it to be useful. He also said that he thinks it will be possible to do more statistical analysis on the data, but this would require more long-term data than they currently have.

One of the things the trap count data is useful for is for doing annual maintenance of traps. For example, the data can identify 'hot and cold traps', i.e. which traps catch a lot of pests, and which traps do not. If there are no rats ever caught in a trap, it could be that the trap sensitivity is set wrong, meaning that they are then able to re-calibrate the traps based on the data.

Sheat also saw the value in data analysis to see where future trap lines might need to go, for example setting up additional trap lines to stop pests travelling from catchment to catchment—he said there is a lot of potential for guiding trapping practices. He said that Zero Invasive Predators (ZIP) is a group that are attempting to figure out whether a 'virtual' fence is possible to maintain a pest-free area on the mainland, and it is possible that collecting trap data could be useful for that sort of work.

Data: connectivity, views on improving availability and cohesiveness

The reports, such as in Figure 6, that Sheat generates are shared to ATBT volunteers and stakeholders through their volunteer administrator, but he typically does not receive a lot of feedback on them. Some parts of the reports are sent more widely to other community groups, and excerpts are often used in ATBT's newsletters.

Sheat has looked at datasets more widely to see if trends they are observing in their data are generalised, i.e. being reflected in data collected by DOC and Project Janszoon. ATBT can see data entered by Project Janszoon (the other major non-governmental group in the national park) via DOC's systems.

One of the things Sheat was wary about was the potential for misinterpretation of raw data, and the need for context to be provided to explain differences in trap count numbers. For example, one dataset showed a minimal catch area around the Anchorage Access Track—this might have been because of the A24 traps there (that would not necessarily indicate the number of kills), or it could have simply been because that section of track is relatively exposed to the elements and hence does not see many pests in the area.

Concerning data accessibility, as mentioned earlier, reports are emailed and published to the website. However, the raw data itself is not accessible to the public as it is stored in DOC systems. Sheat said the ATBT would consider sharing data on request, but he said he would rather work with researchers on results as it was very important to make sure they had adequate context—he said there are sometimes well-meaning people wanting to get data, but can end up with inappropriate results.

Regarding making data open by default, Sheat thought there was some data that could potentially be made available, but it would make more sense to have long-term data. He said it was easy to over-interpret the data to draw too many conclusions, especially with eco-systems in which there are a large number of variables that could cause changes.

With regards to barriers to data sharing, Sheat identified data ownership as a potential barrier. For example, the databases in the Abel Tasman National Park have had contributions from ATBT, Project Janszoon and DOC meaning that there is not necessarily an 'owner' of these datasets. He said issues with this have not occurred to date, but there may be potential for them to happen if there are disagreements in future.

Another barrier identified concerned the potential for misinterpretation, as mentioned earlier. For example, if someone did faulty analysis on data from the Abel Tasman National Park to reach a conclusion that was then used against DOC, Project Janszoon or ATBT, then they might not want to share data in future. He said it was important to consider not just the ecosystems involved, but the social aspects to conservation.

When asked about resources that would be useful for data, Sheat said he would like to see improvements to DOC's GIS trap data system, such as the ability to download exported maps and an improved user interface. Sheat also said that more generally, there is a growing number of community groups who should have access to DOC systems, such as the pest trapping system, for their own uses.

Regarding the value in sharing data, Sheat could see the value in sharing amongst community groups in similar areas, but he said that it was more important to share information rather than just raw data itself. He had not heard of the Nature Space website.

Sheat also said that it would be useful to visually map the extent of all of the various groups working in conservation, i.e. who is looking after what parts of the country. He said it would be useful so community groups would know who else was working in the area, and hence who to talk to.

Sheat also thought that having national structures for handling community conservation data was of value, but that it would need to be adequately resources and meet local needs—if users get too frustrated, they will likely stop using the systems. They need to "buy-in" to the system.

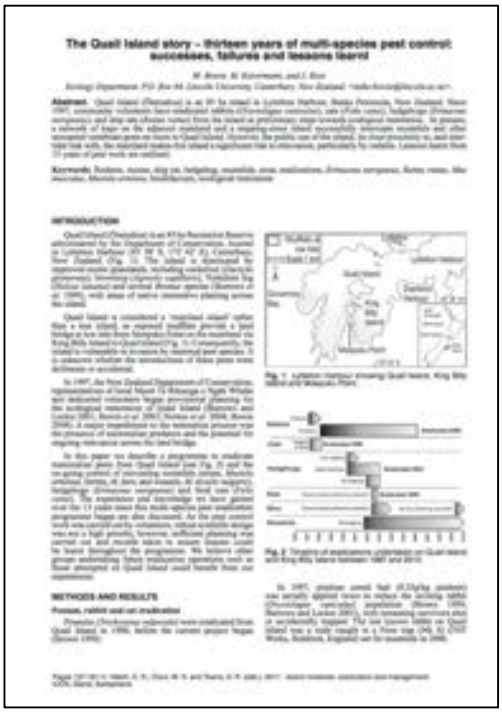
CS-06: Ōtamahua/Quail Island Ecological Restoration Trust

Background and funding

The *Ōtamahua*/Quail Island Ecological Restoration Trust (OQIERT) was founded in 1998 to support ecological restoration of *Ōtamahua*/Quail Island, situated in Lyttelton Harbour near Christchurch. The trust's aims include restoring indigenous vegetation and fauna; enhancing the landscape; recognising historical sites of both Māori and non-Māori origin; encouraging public understanding of the island and restoration project; and encourage research on the natural features and history of the island. OQIERT works with DOC and tangata whenua to work towards these goals and assist in the management of the island. They are over halfway through a 20-year restoration plan for the island, which aims to provide direction and guidance to achieve the trust's goals.

Ian McLennan has been the chairperson of the trust for five years, and is responsible for many aspects of the trust's work, including facilitating the organisation of volunteers, meetings, emails, funding and the management of part-time employees. The trust, which meets every month, has a diverse board of nine trustees including businesspeople, scientists, tangata whenua and 'laypeople'.

OQIERT gets the majority of its funding from charitable grants, such as from the Rātā Foundation and the Christchurch City Council, but it also is funded by volunteer donations.



The Quail Island story – thirteen years of multi-species pest control: successes, failures and lessons learnt

Figure 7: One of the scientific reports produced using data collected on Ōtamahua/Quail Island

Data: type, collection, storage, availability

OQIERT collects a variety of data in order to support restoration work under their 20-year plan. This includes bird surveys, trap data, photographic records, and has also included vegetation surveys in the past.

The restoration plan that guides their work was written in 2005, and is currently in the process of being re-written, as McLennan said that considering the size of the trust, the aspirations outlined in the original plan are too high. For example, he thought that if they undertook all of the monitoring suggested in the plan, they would not have the time to do anything else. The new plan is being written considering what the trust is practically able to achieve.

The bird surveys are voluntarily undertaken twice per year by Nick Allen, of the Ornithological Society of New Zealand. He has been doing the surveys for years, and it is how the OQIERT knows that they have had success with kererū and korimako species nesting on the island, both key indicators in the restoration plan. Allen uses standard bird survey techniques, including transects with 'five-minute bird counts'. The surveys are completed on paper, then written up into a report.

Regarding trap data, the island is in a great position as they do not have any animal pests aside from mice. McLennan said that there has not been a rat caught on the island for over seven years, but they still have about 160 monitored Fenn and DOC200 traps around the island just in case. Because they generally do not catch anything, there is not much trap data to be collected, hence the OQIERT has no need to use any online tools. Currently trap data is simply kept in a notebook by one of the island's permanent volunteers.

In the past, vegetation monitoring has been undertaken on the island by a University of Canterbury student, using standard protocols, i.e. designating 10m by 10m plots and marking trees with aluminium tags. Six plots were set up, but the OQIERT has found that whilst they know where the plots are, in the time since it was set up the aluminium tags have disappeared, and it would be an enormous task to go back through and re-measure plots—they are looking for a simpler method of vegetation monitoring that is less time intensive, and potential doable by amateurs rather than scientists. They are currently looking at using a method from the Trees that Count programme.

The use of 'photo points' is another method used on the island to monitor restoration efforts. Since the start of the project there have been informal photo points, but in 2016 some

permanent markers were set up and marked with a GPS so that consistent photos can be taken—essentially a couple of waratahs, using a standardised camera set up. Another one has been set up on the Port Hills to monitor changes over time from a distance. There is not yet any central storage facility for the photos collected over the years, as some of the photos are digital whilst the earlier ones are on film.

Data is collected on the all of the plantings undertaken on the island, i.e. where and when. Most of the information is on paper, and includes DOC nursery order lists, and hand-drawn maps.

Data: purpose, use

As mentioned, data is collected to monitor the effectiveness of restoration efforts against the 20-year plan, but the amount and type of data is constrained by the resources available to the OQIERT.

McLennan said that one of the issues with monitoring is that due to university funding pressures and an increase in community restoration projects, a lot of knowledgeable people that once were able to help out do not have as much time to assist these groups with their work. He suggested that one potential solution could be to have data collection methods whereby amateurs can collect the information, but it could be analysed by experts.

However, McLennan said that with universities as they currently funded, are it is not necessarily possible for conservation groups to have access to scientists who can understand the data—there are consultancies that could help, but cost is an issue.

Much of the information collected on the island is written up as scientific papers such as in Figure 7, which is the primary method by which information on the restoration project is distributed. An example of this is a paper written by Bowie, Kavermann, & Ross (2011) titled “The Quail Island story – thirteen years of multi-species pest control: successes, failures and lessons learnt”. Annual reports of the trust also have some information about what has been achieved during the year. OQIERT is fortunate in that it is in an area with two universities nearby that they are able to use for scientific analysis of data.

The data collected also helps contribute to any funding applications the trust makes, i.e. showing what has been achieved on the island.

Data: connectivity, views on improving availability and cohesiveness

When asked about making data more available, McLennan said one constraint was the fact that data collected is not particularly well organised at the moment. For example, the photo points were originally collected on film, and with the transition to digital photos there has not yet been an attempt to collate them all. Other data were often collected and stored by scientists, who would then publish papers and make them available to the trust.

McLennan also said that there was also some data that would not be appropriate to share, such as on sensitive species and some pests.

Regarding access to resources, McLennan said it would be useful to have access to people with mapping/GIS ability—currently the restoration plan uses an old map that is somewhat distorted from east to west. The map is used to plot yearly planting sites, but due to limitations with the maps locating planting areas accurately is difficult, and because of the long-term nature of the project most of the maps are paper-based and sometimes even hand-drawn from the person who planned the planting. McLennan identified updating this year-by-year planting data as an area for improvement.

When asked about the value in sharing more data, McLennan thought that in terms of looking at the restoration of native vegetation in Banks Peninsula it would be good to get an overall picture of the various conservation efforts. At this stage they do not use any data from other conservation groups.

As chairperson, McLennan has the ultimate responsibility for data collected by the OQIERT, but in some instances (such as the bird surveys), responsibility for the data lies with the people who collect it.

The OQIERT is on NatureSpace, however one of the problems McLennan identified is that the trust is being called upon all the time to join these 'umbrella' organisations—it is also an issue of associated costs.

There is a 'project' associated with Ōtamahua/Quail Island on citizen science platform Nature Watch that allows for the general public to upload sightings, though it's unclear if this data is used for anything.