Atlas of Living Australia

Putting the citizen in science

Citizen science requirements report

Gaia Resources

October 2009

Executive Summary

This report details an investigation into the Citizen Science area, undertaken by Gaia Resources on behalf of the Atlas of Living Australia (ALA).

It looks at what projects are active in this space, both in Australia and abroad, and then looks at the common functions of these applications. Following this, several exemplar projects in Australia are reviewed and are then used to build a set of requirements for a more generic citizen science toolkit.

This document also looks past the requirements of the toolkit to look at the opportunities for the ALA in this space, including looking at the technology, development and implementation opportunities that are present.

A series of key recommendations are made on these opportunities, as listed below. In addition, a plan for forwarding these recommendations is also included.

Key recommendations

- A citizen science toolkit be developed on top of the existing Climatewatch code, which is;
    - Modular,
    - Able to integrate other applications (e.g. the Global Biodiversity Information Facility's Integrated Publishing Toolkit), and
    - Has uses in other parts of the ALA (e.g. Collection Data Management).
- Further development of the toolkit should be immediately pursued with Museum Victoria to provide mobile device integration,
- Implementations of this toolkit should be pursued with two organisations, with the toolkit installed on their existing infrastructure:
    - Birds Australia, and
    - Department of the Environment, Heritage, Water and the Arts.
- Hosted implementations should also be investigated further, and then set up and trialled with:
    - The Great Australian Shark Count, and,
    - Plant Biosecurity.

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1 Background

During the planning for the Atlas of Living Australia (ALA), Citizen Science was seen as an important source of data. In an outline developed early on in the ALA project (the "Nature Net Australia" proposal), the background to the citizen science space was outlined as:

- Amateur naturalists and others are responsible for large amounts of observational data which does not normally become available to researchers, policy-makers and other naturalists in a structured form,
- These naturalists participate in many societies, clubs, organisations and projects of all sizes, most of which have limited capacity for managing data on behalf of their members,
- The Internet provides new models for building communities of interest and for engaging members of the public in collaborative information management activities. Flickr and Wikipedia are good examples of rich archives generated through community activity, and
- Users join such communities for many reasons, but these include:
    - Contact with others sharing similar interests,
    - Opportunities to learn more about their area of interest,
    - Free (or very low-cost) tools for managing personal information in interesting or exciting ways, and
    - Ability to contribute to large projects considered to have public value.

(from "Nature Net Australia – an outline proposal")

However, the ALA had yet to undertake a deliberate analysis of this space. This project was borne from the need to review this space formally, with the aim of looking at:

- Documenting requirements for the Citizen Science portal (also referred to as "Nature Net Australia"),
- Developing relationships with a variety of exemplar citizen science projects, to determine how the ALA can best work with these groups,
- Identifying opportunities for further work with technology, development and implementation partners, and
- Putting forth a plan for the ALA to use in the development of the Citizen Science portal.

The end result of this project is this document.

2 Objective of this study

This study had four objectives:

- Documenting requirements for the Citizen Science portal (also referred to as "Nature Net Australia"),
- Developing relationships with a variety of exemplar citizen science projects, to determine how the ALA can best work with these groups,
- Identifying opportunities for further work with technology, development and implementation partners, and
- Putting forth a plan for the ALA to use in the development of the Citizen Science portal.

These objectives have been used in structuring this document.

In section 3, we review a range of citizen science projects that were suggested or found from a brief search. While this is not exhaustive, we believe it covers projects in various stages of development and with a variety of technologies employed. This provides some context for the citizen science space, and provides ideas for the portal.

In order to flesh out the requirements for the Citizen Science portal, a number of projects (called 'exemplar projects') were chosen for further requirements analysis, which is undertaken in section 4. These projects were chosen in conjunction with ALA staff, who had a broader understanding of the relationships with these other organisations. This also fulfils the second objective, in creating or strengthening relationships with the organisations involved in these exemplar projects.

The opportunities for the ALA to further work in this space are then documented in section 5, with technology, development and implementation opportunities listed in some detail. These provide some detail of the opportunities and fulfil the third objective of this report.

The final objective is fulfilled as part of the recommendations from this project in section 6. In this section, along with the recommendations from this report, a project plan has been put in place for the ALA to consider.

3 Existing Citizen Science Efforts

There are a wide range of citizen science efforts being made both in Australia and across the globe. While it is not possible to review all of these efforts in detail, we include in this section details of some of these projects, namely:

- Artportalen (http://www.artportalen.se/)
- Birddata (http://www.birdata.com.au/)
- Birds in Backyards (http://www.birdsinbackyards.net/)
- Climatewatch (http://www.climatewatch.org.au/)
- Great Australian Shark Count (http://www.auf-spearfishing.com.au/public/protected_species/protected_species.php)
- Info-fish (http://www.info-fish.net/)
- iSpot (http://www.ispot.org.uk/)
- Northern Australian Frogs Database System (http://www.frogwatch.org.au/)
- Rabbitscan (http://www.rabbitscan.net.au/
- Streamwatch (http://www.streamwatch.org.au/streamwatch/)
- Wildobs (http://wildobs.com/)

Note that several of these projects have been chosen as exemplar projects and in section 4, we review their requirements for a Citizen Science portal. We have also summarised the functionality of the web sites listed above in section 3.12.

Appendix One contains a list of all web sites, organisations and individuals who were consulted during this phase of the project.

3.1 Artportalen

Artportalen ("Species Portal") is a web portal developed in Sweden. It has been in operation since 2000, and has over 20 million records in the six portals running at http://www.artportalen.se/ (see Figure 3.1). As such, it is an example of a long running, successful citizen science portal. The Artportalen web site software has also been used by Landcare Research New Zealand (LRNZ), and is in place at http://www.nzbrn.org.nz/.

Artportalen's workflow is relatively simple;

- Registered users can create a geographic location or "site" (or use an existing one), and
- Then a record is entered, with information about the species observed, the purpose of the record, a diary about weather conditions, and flags for uncertain, hidden or protected records.

Artportalen's main web site is developed in Active Server Pages (ASP), with Javascript included in the pages and throughout the web site. It also uses some other software (ArcGIS) to assist with the mapping components.

Figure 3.1 Artportalen – Swedish Implementation

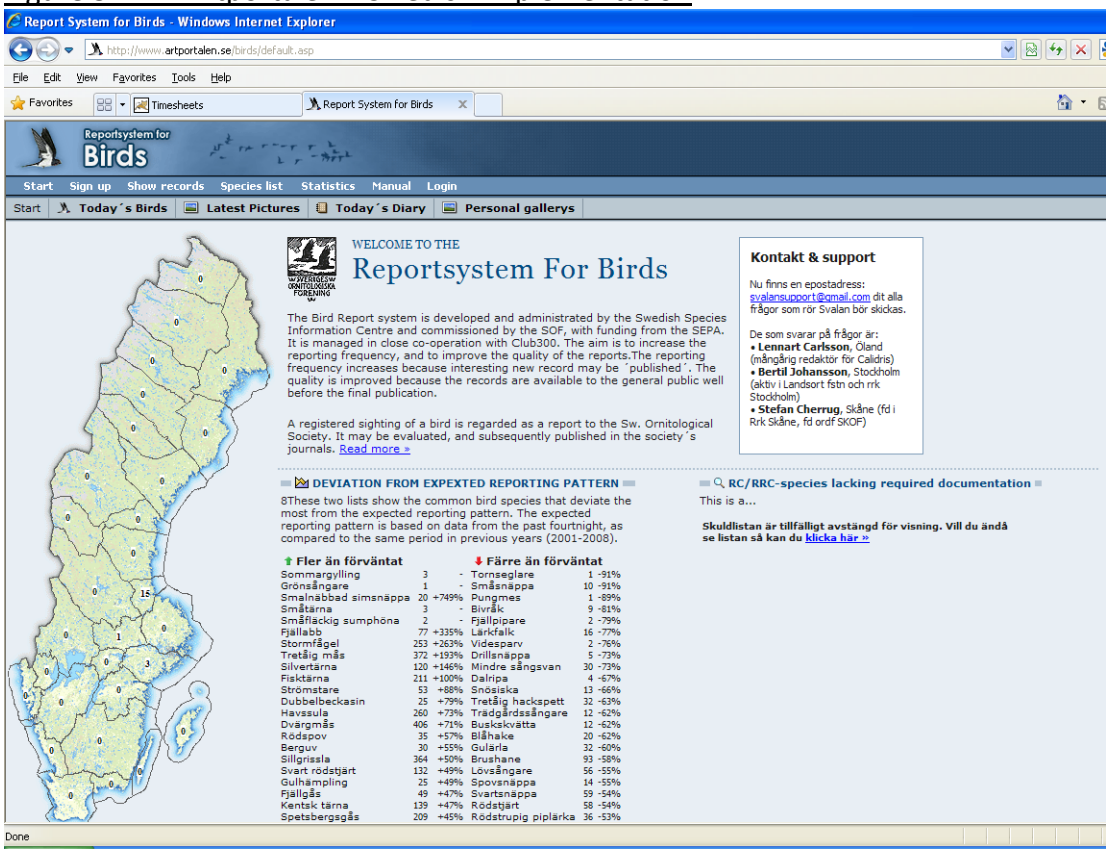


Figure 3.2 Artportalen – New Zealand Implementation

One of the key observations about Artportalen's original implementation in Sweden is the sheer volume of data that it collects. Over 5,000 bird records are recorded by the site each day, indicating a very active community behind this site. This may be due to a range of reasons; such as the fact that sightings are treated as reports to the Swedish Ornithological

Society. This is certainly unusual, and that this was not mirrored in the LRNZ implementations, where uptake has been slow.

Discussions with LRNZ (K. Richards, pers. comm.) indicated that the Artportalen software had some limitations:

- heavily based on existing site names, but could handle co-ordinates,
- architecture was old, and needed re-factoring (delivered in ASP),
- Geospatial component delivered using ArcGIS proprietary software (refactored by LRNZ to Google maps), and
- multiple completely separate skinned instances instead of a centralised data store.

LRNZ perceived one of the main strengths of Artportalen was its flexibility, although this came about with a much higher overhead on the application than some other portals (such as Ebird from Cornell University).

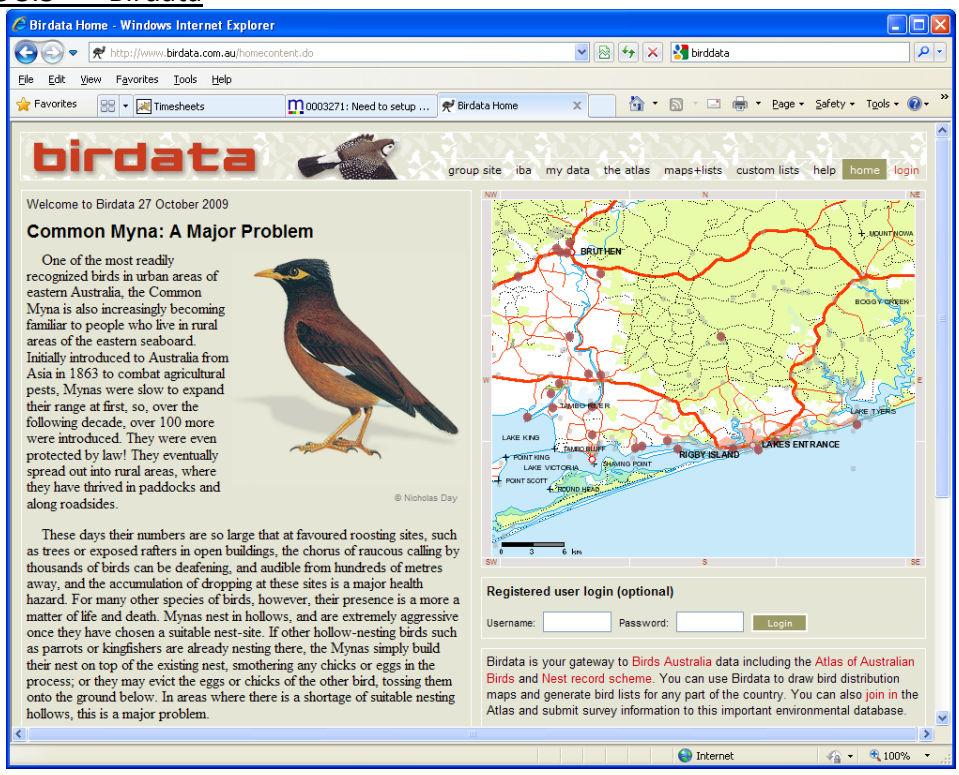
LRNZ also mentioned that using an existing platform that was so complex may not have been the most efficient solution. Instead, it may have been better to start again from scratch. Their perception was that the main reason to pick up existing code would now be an active development community – something that Artportalen does not have.

LRNZ is still persisting with the Artportalen implementations, however, and intend to include uploading of bulk data through spreadsheets, standardised data forms across all of their instances, and mobile data uploading from phones and other devices in the future.

3.2 Birdata

Birdata (http://www.birdata.com.au/) is the public face to the centralised data store of Birds Australia, including their Atlas of Australian Birds and Nest Record Scheme datasets. A screenshot of the public face of the application is shown in Figure 3.3.

Figure 3.3 Birdata



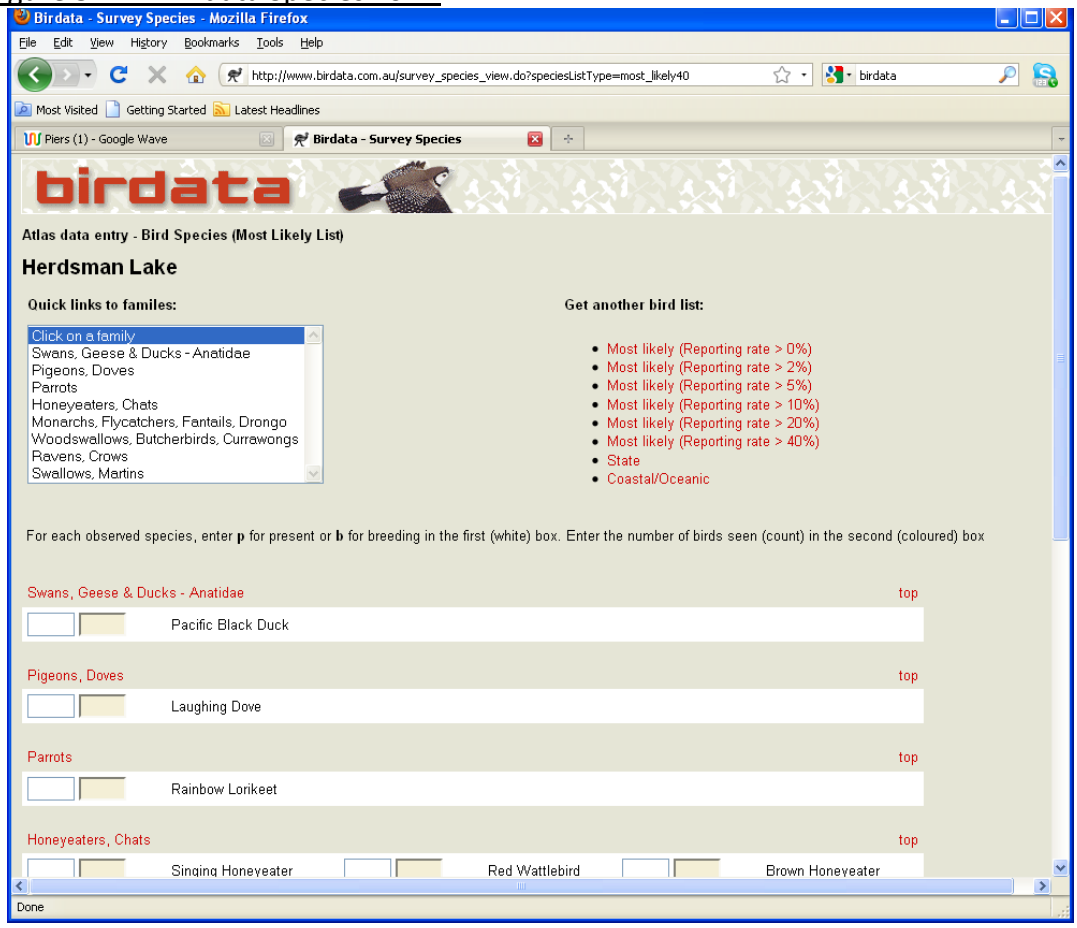
Birdata was developed by Geographic Web Solutions, a private company based in Adelaide. As part of the discussions with Birds Australia about their own needs for their Carnabys Cockatoo project (see section 4.2), the technical requirements and underlying infrastructure to Birddata was requested. This was not provided at the time of writing this document. However, from superficial examination, the web site has been developed using Java and Javascript.

Members (and only members) can log records into the site, through a series of web forms. These web forms have the work flow process of:

1. Define a site (using a dynamic map window)
2. Define a survey (methodology, start and finish times), and
3. Record the bird species.

The bird species form is a single form, which is able to be sub-setted to allow for the most likely species at the location defined, as shown in Figure 3.4.

Figure 3.4 Birdata Species Form



This project has been underway for some time. As of the 20th November, 2009, it contained:

- 472,112 surveys,
- 245,070 sites,
- 811 species,
- 7,859,223 records (species x surveys), and
- 11,358 registered members.

Discussions with Birds Australia about their additional requirements for their web sites (including a new portal for the Carnaby's Cockatoo project) is presented in section 4.2.

3.3 Birds in Backyards

Birds in Backyards (http://birdsinbackyards.net/) is a program run jointly by Birds Australia and the Australian Museum, which commenced in 1998. The current state of the web site is shown in Figure 3.5. The site has been developed using Cold Fusion Markup (CFM) pages, and utilises some Javascript functions.

Figure 3.5 Birds in Backyards

The Birds in Backyards web site provides a wide range of resources about birds, including fact sheets, distribution, behaviour, and habitat requirements, and allows for members of the web site to enter details about the birds they have recorded in their own backyards. They currently have 30 fact sheets about species, and run general and targeted survey programs for specific species (e.g. Common Koel, Superb Fairy-wren and Australian White Ibis).

You must be a member to contribute to the Birds in Backyards project, and indeed to see much of the content on the web site. The membership form includes a note that data will be used for research purposes, but privacy will be maintained. There is no mention of any licences or agreements in particular.

The community tools seem to be highly active. For example, the forums are active, and contain a range of information including an active photography forum with many quality

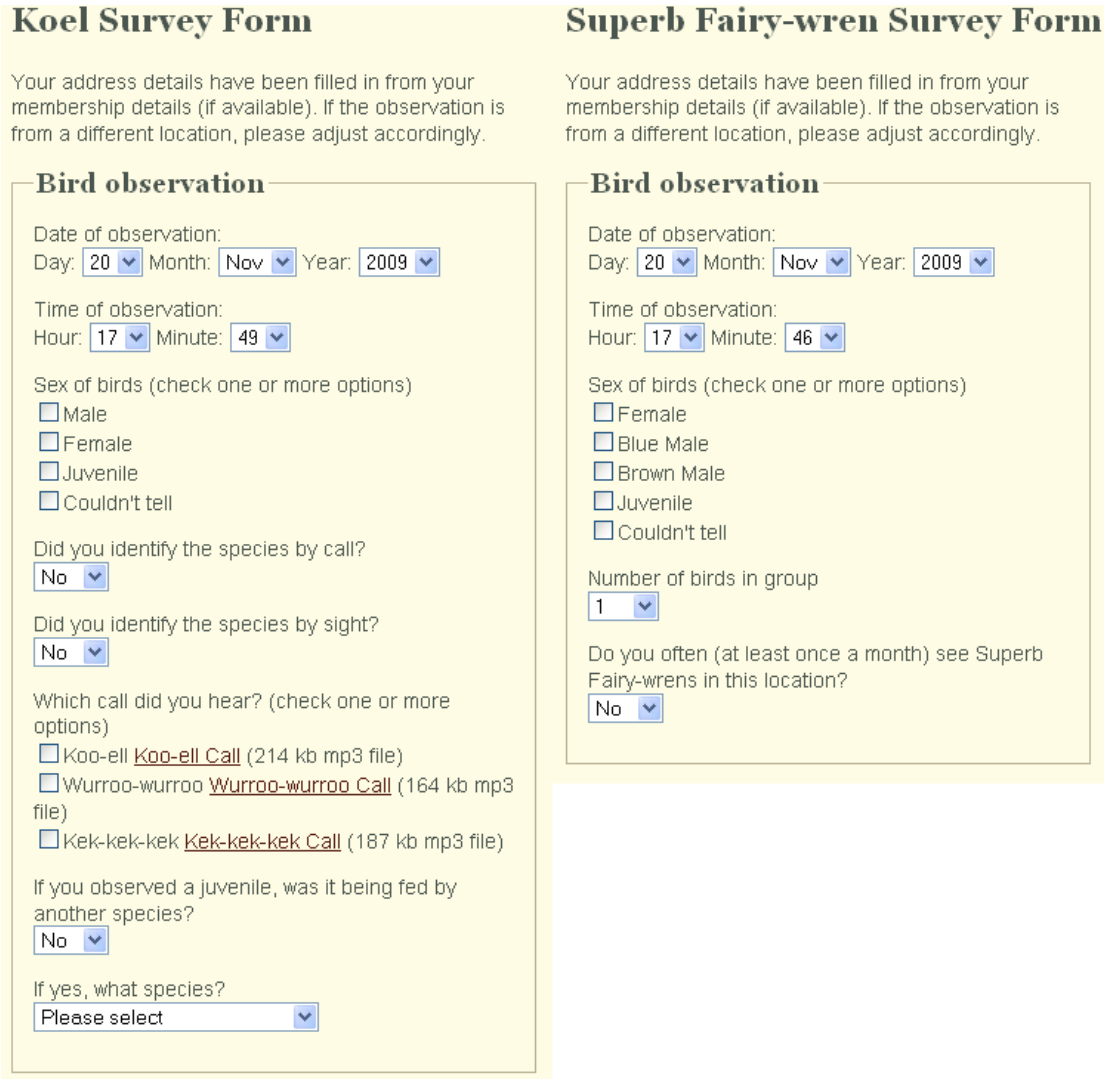
photographs taken by members (with over 8,000 messages in the photography forum). They also run competitions such as photography competitions.

Data entry is done through a series of relatively simple web forms. The general workflow for this application is simply to:

- Choose a species (and hence the survey form),
- Record the details of your observation, and
- Record the location (using street addresses).

There are different web forms for each of the species specific surveys, as indicated in Figure 3.6.

Figure 3.6 Superb Fairy-Wren and Common Koel Survey forms



Interestingly, there are no facilities for members to review their own data, or undertake reporting of any kind. The maps shown on the fact sheets are also simple static images, drawn from the BA Birdata application (see section 3.2).

3.4 Climatewatch (Stage 1)

Climatewatch (http://www.climatewatch.org.au/) allows the public to provide and review data on indicator species, with the aim of then analysing that data to track climate change. By providing a powerful, yet easy to use tool on the web, Climatewatch is set to gather much meaningful data that will raise public awareness, provide people with the capacity to contribute and most importantly help scientists understand climate change.

The Climatewatch application was developed for the EarthWatch Institute by Gaia Resources. The application was developed with funding from the ALA, on the proviso that the portal be made available as an open source application. To date, the software has not been made publicly available through an open source site.

Climatewatch's database is based upon the Darwin Core (DwC) format. The database schema has been normalised and extended to support additional features such as user accounts, saved locations and expert review.

The three key functions of the application (in regards to data) are:

- Setting up locations for species sightings – The system allows for individuals to set up multiple locations where they have seen species. These locations are set up using a Google Maps interface and are stored against the user's account details. They can be used later for future recordings as well as for reviewing the data, and a screenshot of this is shown in Figure 3.7)
- Recording sightings of indicator species – The recording component of the system guides the user through entry of the key DwC fields (those that cannot be automatically derived) through a multi page wizard interface. This makes it simple for the users to enter all the required data and ensures that it is recorded in a consistent format (see Figure 3.8), and
- Review records – Users are able to query not only their own records, but records logged by other users via the interactive mapping interface. Each of the user's locations can be queried for sightings, or alternatively, the user may specify a search radius from any of their locations and include other users results (see Figure 3.9).

Figure 3.7 Climatewatch - Site Setup

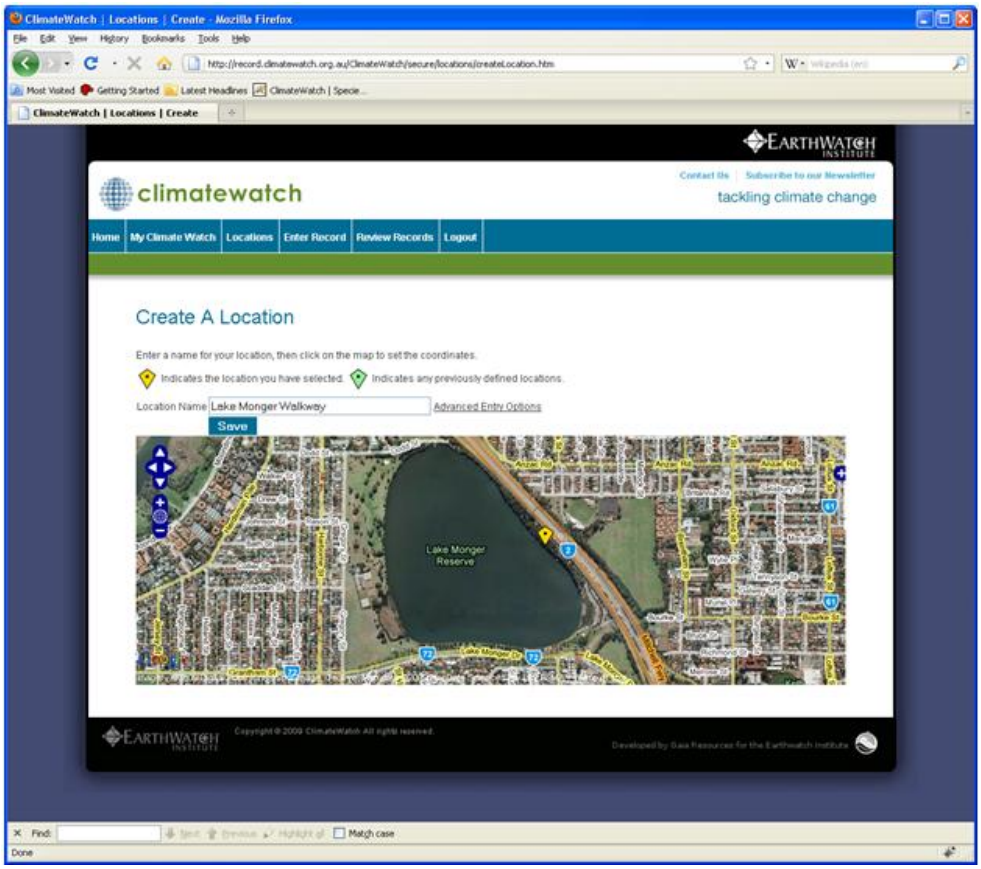


Figure 3.8 Climatewatch – Enter Sighting

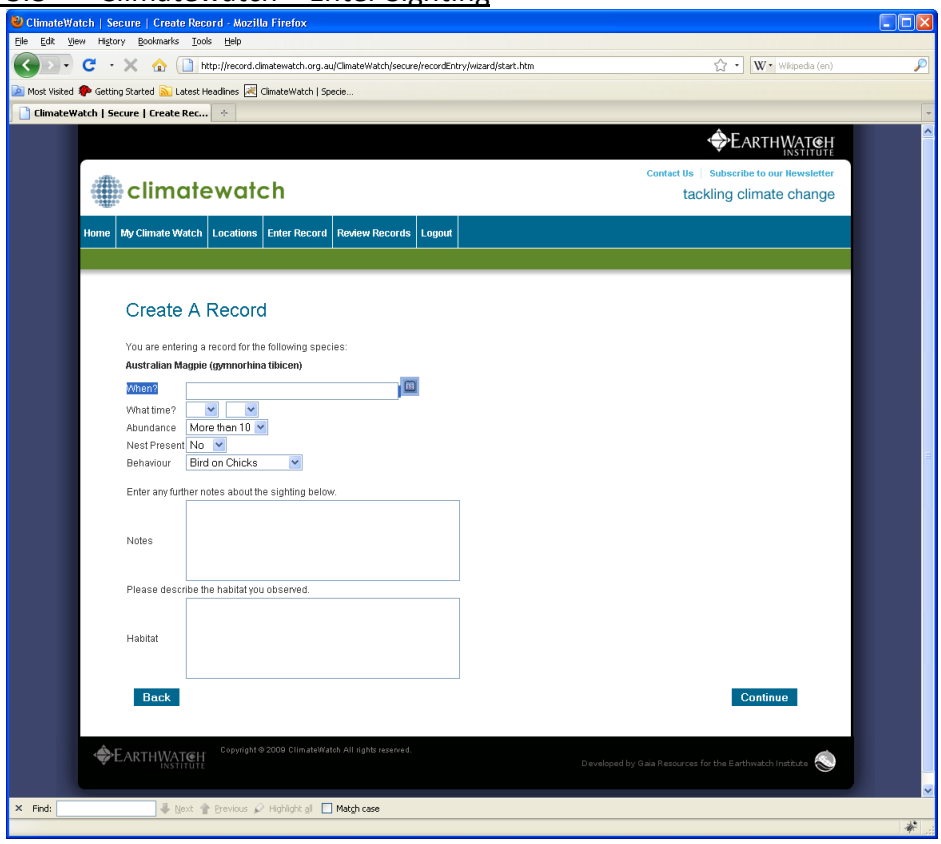
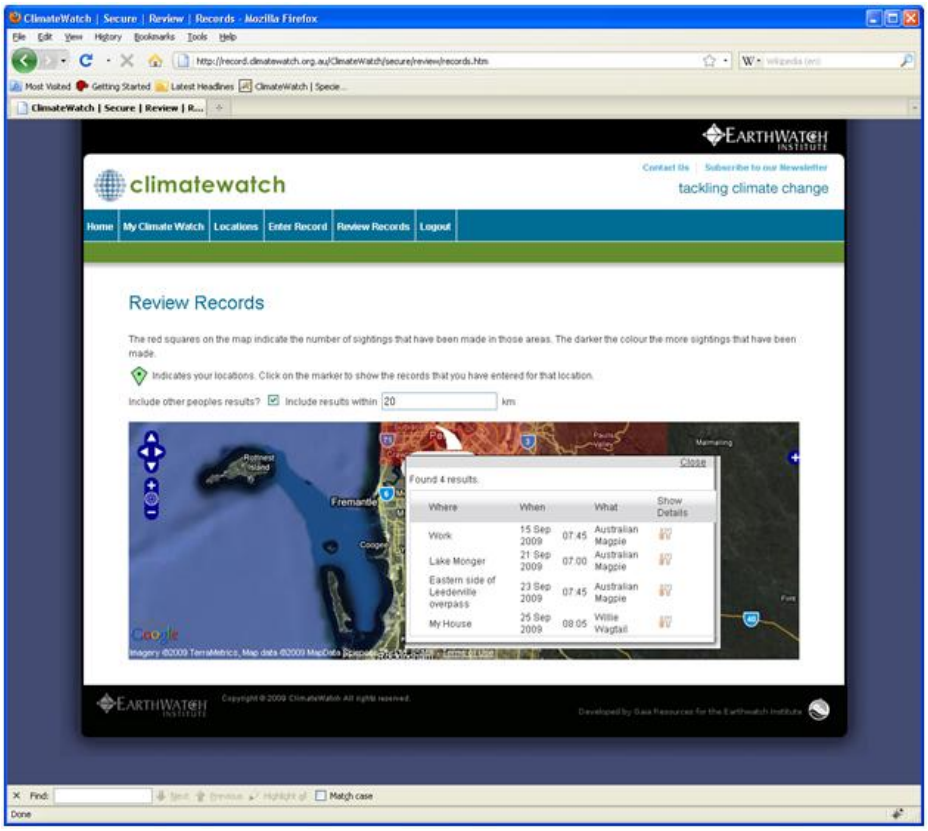


Figure 3.9 Climatewatch - Review Records



In addition, Climatewatch links to other tools that have been developed separately from the data application. These tools are built on a proprietary content management system, cm3. The cm3 software provides a range of functions like file management and permission management. In this implementation, permissions are handled by the cm3 software, although the Climatewatch data application does contain functionality to handle logins and permissions. From a technical viewpoint, Climatewatch's implementation of the Model View Controller (MVC) architecture is based on the Spring MVC Framework, written in Java & JavaServer Pages (JSP)and backed by the Postgresql database.

Climatewatch has some community tools, in the form of news articles and a forum. The forum is not actively used by the members, however, with only three posts since the inception of the project in September, 2009. Members can also provide photographs of the indicator species, or attach files to their records.

The EarthWatch Institute has employed considerable resources in publicising the Climatewatch project. Apart from lead up articles, Climatewatch was launched on the 14th September, 2009 by Acting Prime Minister, Julia Gillard. In addition, there is regular public relations and news items being produced. This indicates the level of engagement required to implement and maintain a citizen science project.

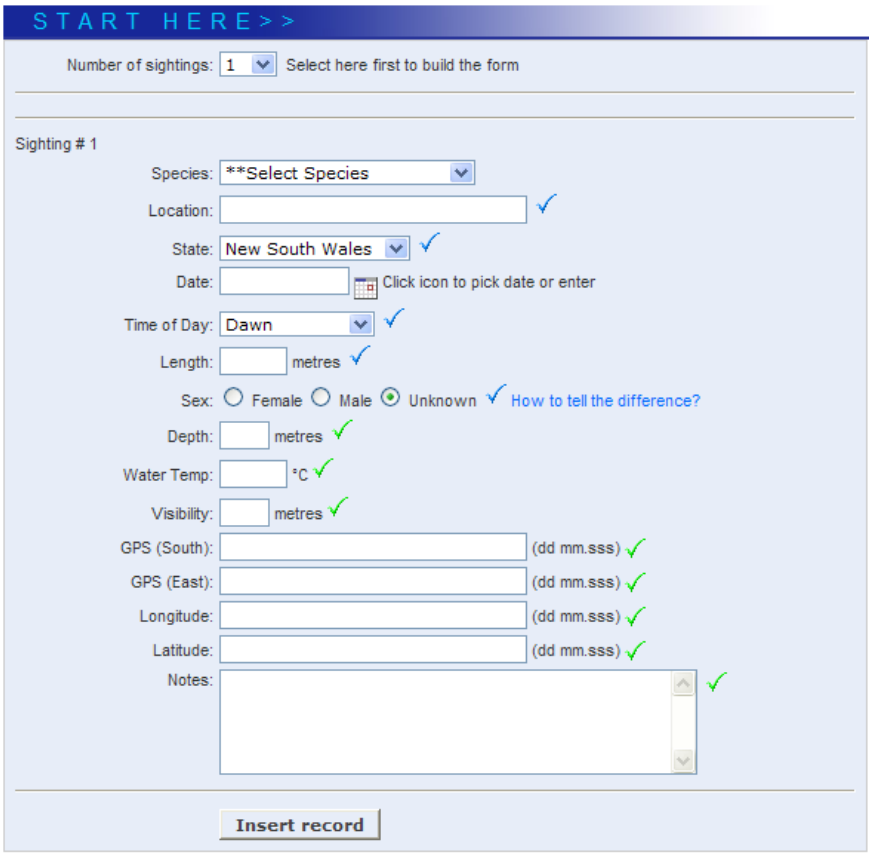
3.5 Great Australian Shark Count

Identified as one of the exemplar projects (see section 4.4.2), the Great Australian Shark Count (GASC) is a citizen science project to "provide the community, managers and decision makers with a valuable data source". The GASC has been funded by the Commonwealth

Community, and is an initiative of the Australian Underwater Federation. The concept is modelled on the successful "Great American Fish Count".

Participants in the GASC must firstly register with the site, and then can log either a single or multiple sightings of a shark on the web site (http://www.auf-spearfishing.com.au/). The form for entering records is relatively simple, and is a single record entry form, as shown in Figure 3.10.

Figure 3.10 The Great Australian Shark Count Record Entry Form



As noted on the GASC web site, it has over 7,500 sightings at the end of September 2008. At this time, this was described as the "largest community shark count in the world". However, these results are now over a year out of date, and a quick tally of the state ranking on the front page indicates 12,266 records in the system.

There does not appear to be a method in the system for being able to review records once they are entered into the system, apart from to see the summary tallies by species, top 10 sighters, and the States, as shown on the front page of the web site.

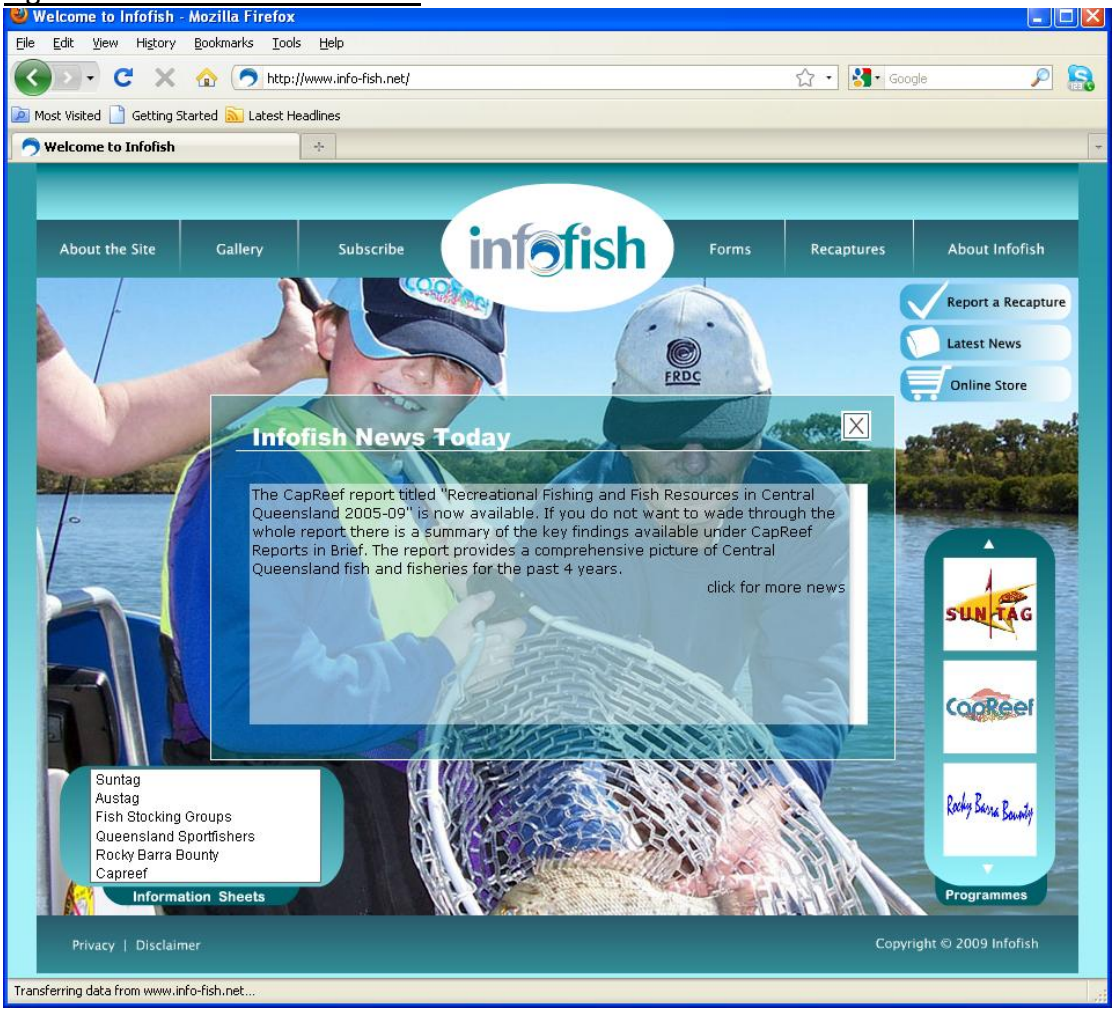
It should be noted that the web site for the GASC is also the main web site for the Australian Underwater Federation, and as such includes features such as a photogallery, events calendar, records listing, membership and other details. These appear to be handled quite separately from the GASC functionality, although they may share a common infrastructure and database platform. The GASC web site is developed in using the PHP: Hypertext Preprocessor (PHP) scripting language.

More details on the future requirements of the GASC can be found in section 4.4.2.

3.6 Info-Fish

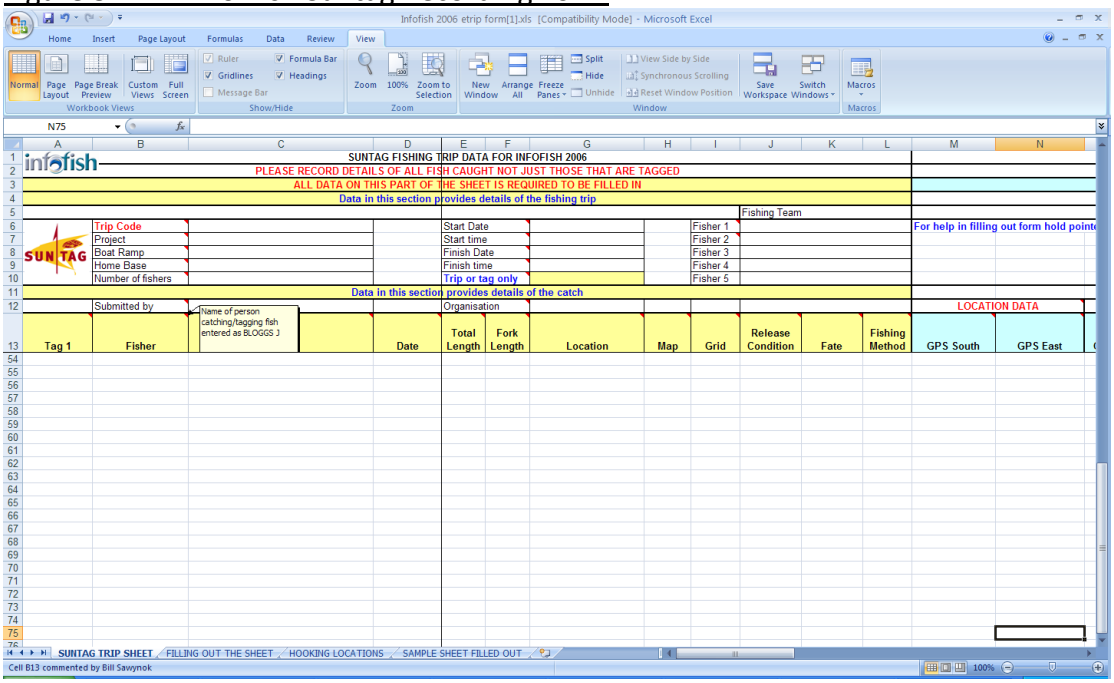
The Info-fish web site (www.info-fish.net) is a front end to the Info-fish Services group, who provide a range of services to help groups to collect information through a range of community programs, and make the information readily and freely available through the web site, although through limited methods. Info-fish is primarily funded through grants and research projects, and the current web site design is shown in Figure 3.11.

Figure 3.11 Info-Fish Web site



The web site, built using HyperText Markup Language (HTML), allows for people to download forms to fill out about their captures of fish. These forms are Microsoft Excel format forms, with some help sections included as comments, or as separate help worksheets within the form itself. An example of the forms is included in Figure 3.12. Once these forms are filled out, they can then be submitted back to Info-fish via email or facsimile.

Figure 3.12 Info-Fish Suntag Recording Form



The data collection methodology underway at info-fish receives primarily electronic versions of the Excel spreadsheets, delivered to their staff. Info-fish staff then undertake data cleaning and validation on the forms. This is based on the principle of making the data entry method as simple as possible, and has been very successful, with info-fish gathering over 600,000 records in their database.

The data from these forms are then used for a variety of publications that are available on the web site. These include newsletters, reports and static maps. None of these publications appear to be dynamic, and all appear to be generated through a form of manual process. Info-fish indicated (see section 4.4.1) that this is an area where they are currently undertaking development and see benefits from liasing with the Atlas.

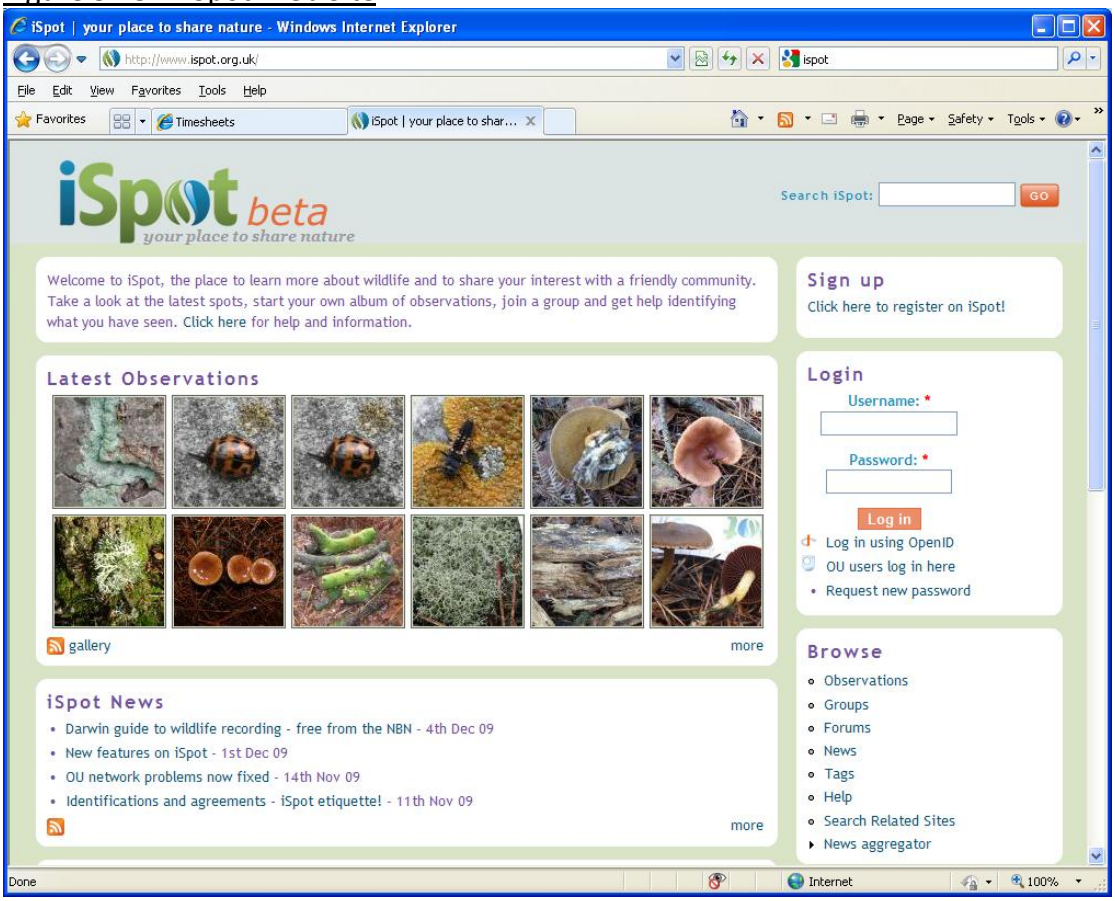
Of particular note is that Info-fish manages a range of data on behalf of other institutions such as the Department of Primary Industries, and individual researchers in addition to the data they gather from the public programs. They also undertake some research or searches for commercial organisations.

The site also has a link to a Picasaweb public gallery, news items, and an online store, where a range of tagging equipment (tags, starter kits, notepads, etc) can be purchased on-line.

3.7 iSpot

iSpot (http://www.ispot.org.uk/) is a visually striking wildlife reporting web application based in the United Kingdom. It was developed by The Open University as part of their OPen Air Laboratories (OPAL) project, funded by the National Lottery. iSpot is currently in beta testing and has been opened to the public to use, and a screenshot of the site is provided in Figure 3.13.

Figure 3.13 iSpot Web Site



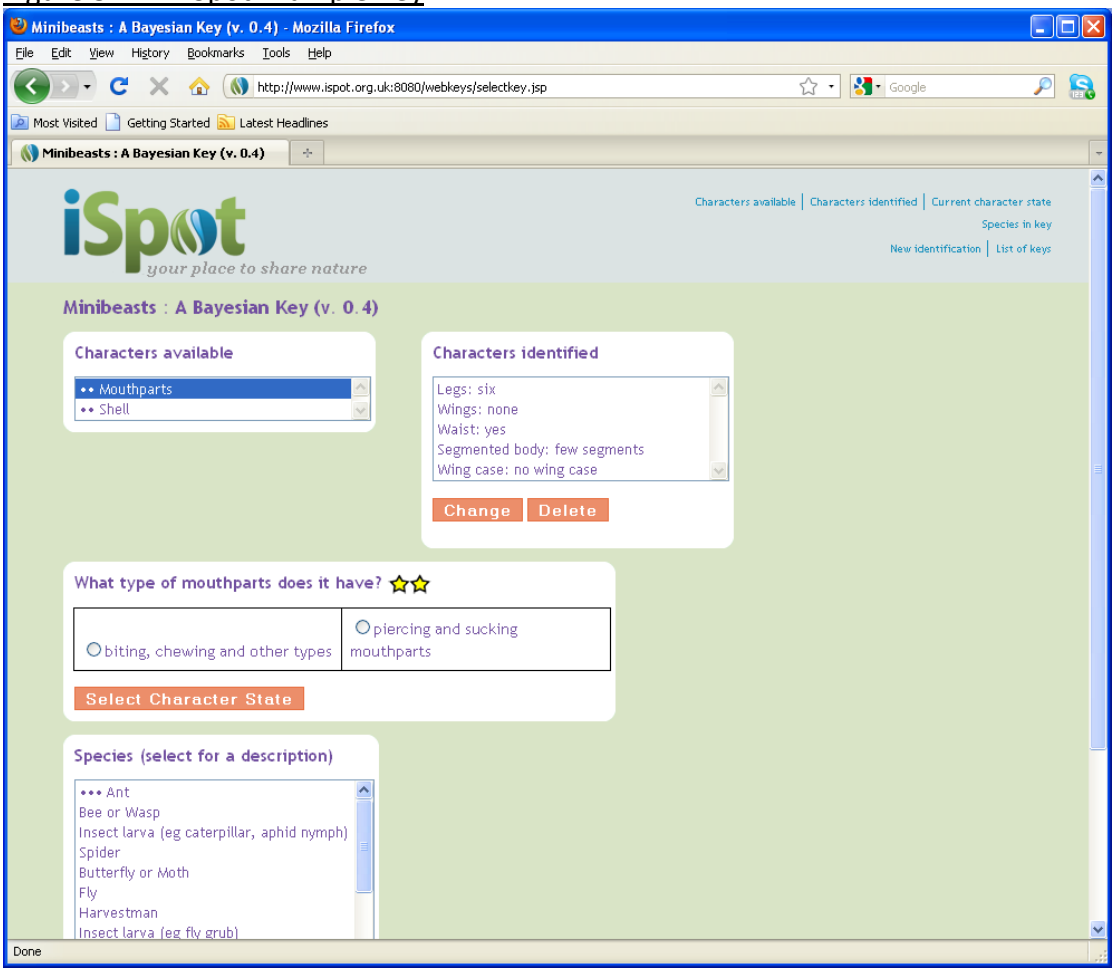
iSpot takes records of birds, amphibians and reptiles, fish, fungi and lichens, invertebrates, mammals, plants and other organisms. It does this through a single recording form that has details of:

- Outline of the observation (date),
- Species identification,
- Observation grouping (higher level taxonomic groupings),
- Location, and
- Photographs.

Several things are of particular note on the iSpot website, including the fact that it supports the OpenID system for user management, has an image based “latest observations” feed and uses tags in the web site. It also links to some species identification tools (keys), as shown in Figure 3.14. iSpot also has some community tools, such as a forum and a news feed.

iSpot uses HTML and Javascript – but appears to be driven from a Drupal based content management system. It should also be noted that iSpot is still in the beta stage of development.

Figure 3.14 iSpot Example Key

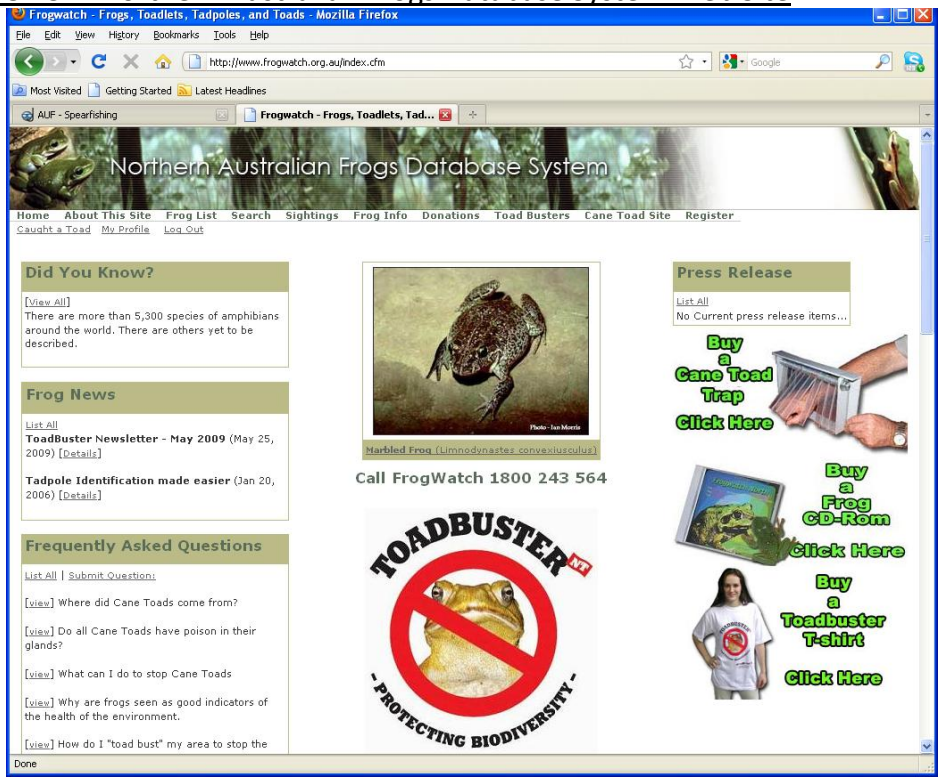


3.8 Northern Australian Frogs Database System

The Northern Australian Frogs Database System (http://www.frogwatch.org.au/) has been developed to provide information about frogs across northern Australia, with a particular focus on the Cane Toad, and education of the public.

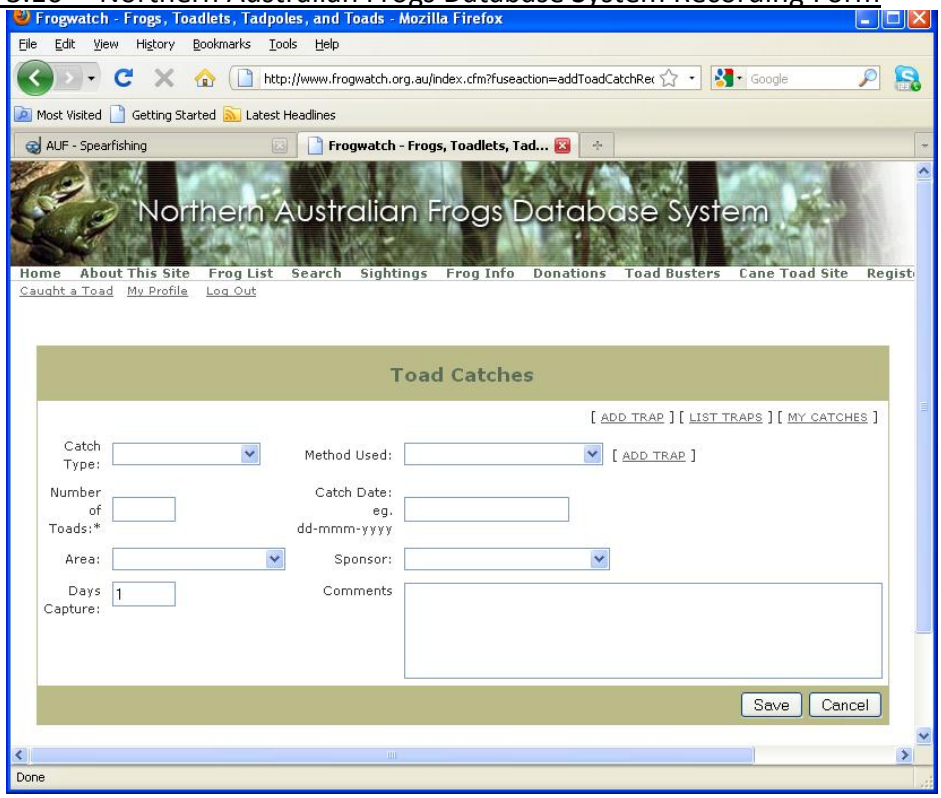
The web site for the Northern Australian Frogs Database System has been developed in Cold Fusion. The web site is shown in Figure 3.15.

Figure 3.15 Northern Australian Frogs Database System Web Site



At this point in time, only records of the Cane Toad can be recorded in the database system. This is done through a simple web form, as shown in Figure 3.16. This is a single form for all of the record information.

Figure 3.16 Northern Australian Frogs Database System Recording Form



Sightings can be seen in a simple publicly available listing, which indicates the last record entered was on 30th July, 2009.

While this site may not be actively recording large numbers of records, it has a wide range of information about frogs, including fact sheets that include distribution maps, images, call recordings and movies. In addition there are many different information sheets about a wide range of information relating to frogs. It also hosts a range of information about Toadbusters, and includes links to purchase traps, clothing and call recordings.

3.9 Rabbitscan

Rabbitscan (www.rabbitscan.net.au) is the web presence attached to a wider national rabbit threat mapping and awareness campaign, focussed on the 150 year anniversary since rabbits were introduced into Australia. The current Rabbitscan web site is shown in Figure 3.17.

Figure 3.17 Rabbitscan Web Site

As a citizen science project, it has some different technologies in place than some of the other projects discussed in this section. One noticeable technology in place on the Rabbitscan site is the facility to send text messages to the site, using a standard format Short Messaging Service (SMS) message to a mobile number.

In addition to the SMS process, registered users can also log into the site and use a Google Maps interface to enter details about where they have seen rabbits into the system. The terms of registration of the web site are quite restrictive, and hence no further details of the interface can be provided here. However, once again only registered users can lodge records into the system.

Rabbitscan appears to be developed using PHP, under the Joomla content management system.

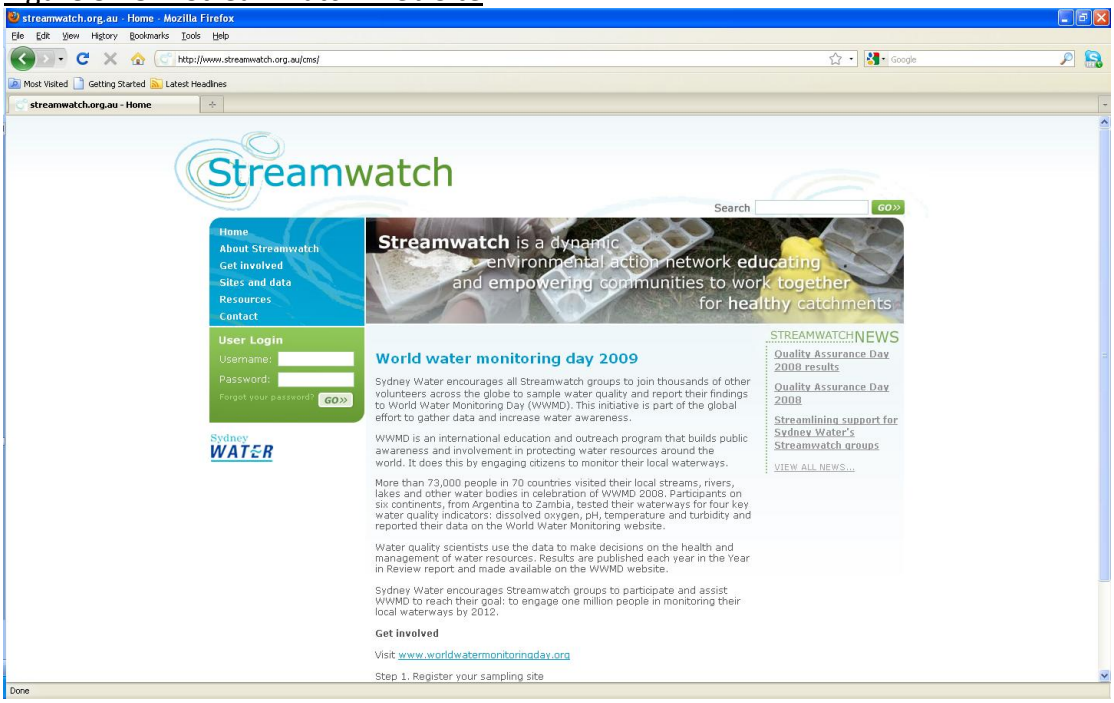
In November, 2009, the web site indicated that there were 3,323 sites recorded in the system. Registered members can see some information about their own records in the mapping application, but reporting is very limited, and appears to be proceeding through a manual evaluation and validation process.

Several community tools are provided by the web site, including a blog, newsletters and a range of supporting information about rabbits. In particular, the "how to" guide for this web site is particularly well documented.

3.10 Streamwatch

Streamwatch (http://www.streamwatch.org.au/) is a web site that acts as a public face to a long term water monitoring program run for the Sydney area, and began in 1990. It has a relatively simple web site, as shown in Figure 3.18, developed in HTML and Javascript.

Figure 3.18 Streamwatch Web Site



Streamwatch records information on water chemistry and the biology of the water samples, and registered participants receive sampling equipment and access to the on-line database. Only registered users can record data in the database, due to the quality assurance methods put in place for the project. Anyone, at any time, can also enter the web site without registered, and view and download the data for a specific site (in Microsoft Excel format).

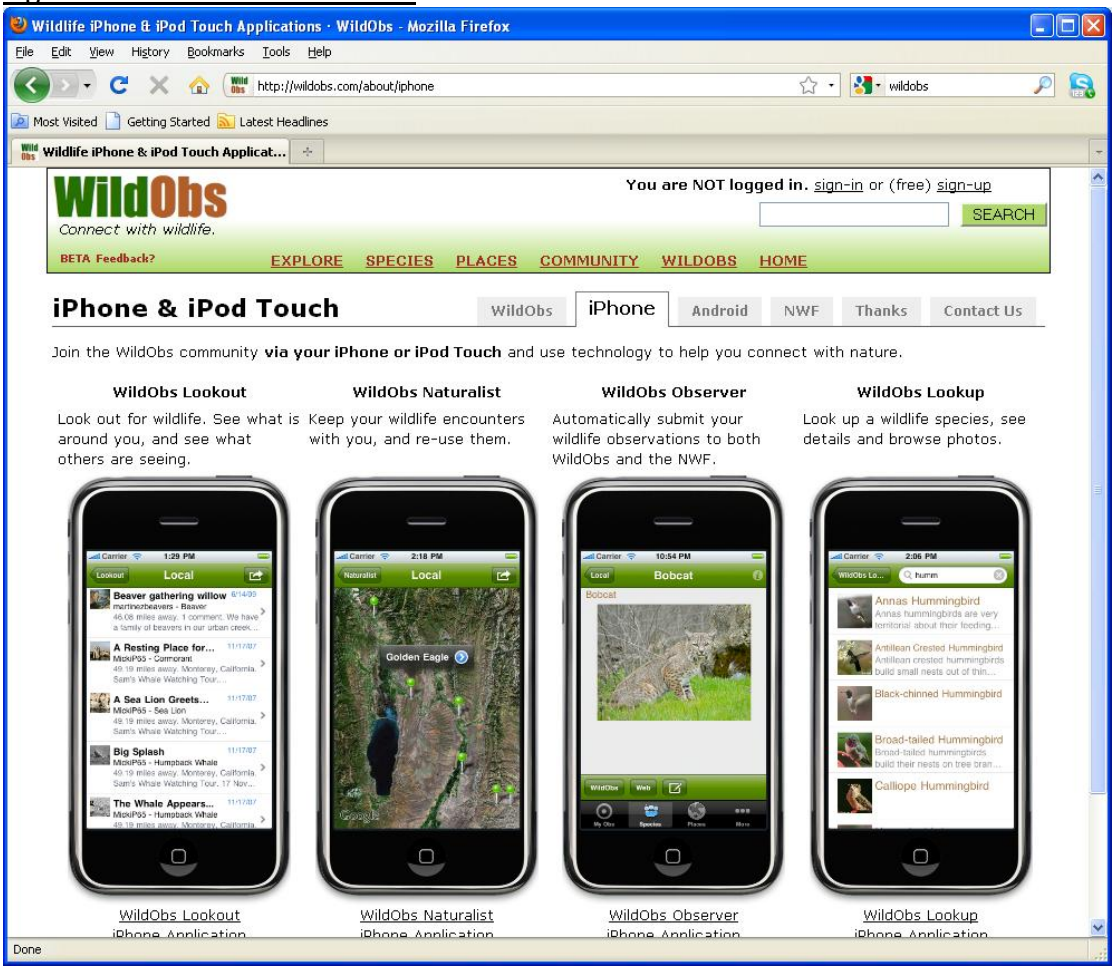
A range of community tools, such as fact sheets and newsletters, are provided from the web site, but this project also undertakes training and technical advice for participants (which generally are schools and interest groups rather than individuals).

3.11 Wildobs

Wildobs is a north American web site, aiming to track and record wildlife observations for that region. It has been developed by Neukadye, a private development company.

Wildobs is actually a family of mobile applications based on the principles of reporting on wildlife observations. While the web site acts as a hub for the Wildobs project (as shown in Figure 3.19), the focus of the project are the four iPhone applications, and one Android application.

Figure 3.19 Wildobs Web Site



WildObs Lookout iPhone Application | WildObs Naturalist iPhone Application | WildObs Observer iPhone Application | WildObs Lookup iPhone Application

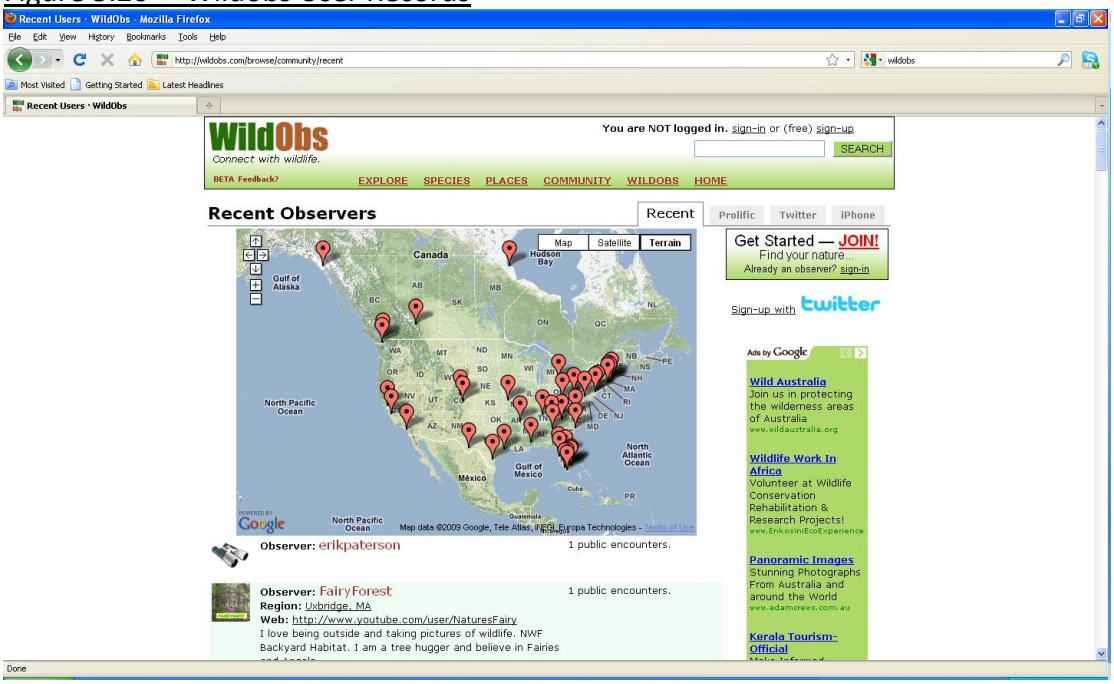
Wildobs iphone applications are available through the iPhone Apps Store, and the Android version through the Android Marketplace. The iPhone applications retail on the iPhone apps store for the prices listed below (as at 7th December, 2009):

- Wildobs Lookout US$4.99
- Wildobs Naturalist US$4.99
- Wildobs Observer Free
- Wildobs Lookup US$2.49

There are no details on how many copies of the software have been sold.

Wildobs also has strong links to social networking tools, including Flickr, Youtube, Twitter and Facebook, as well as a strong set of tools on their own site including a blog. Many of the records are made public, and can be viewed on the web site using Google Map interfaces, as shown in Figure 3.20.

Figure 3.20 Wildobs User Records



3.12 Functionality Summary

In this section, we have identified some common threads to the existing citizen science projects in Australia, and summarised them into a simple table of functionality, based on categories of:

- Community features
- Data Entry
- Mapping
- Reporting

The details of the various sites are provided in Table 3.1, along with the frequency of which these features were implemented. A short summary of what each of the points listed under the Functionality column is provided in Appendix Two.

In addition, in Table 3.2, we summarise the development environments used for these projects, to provide some technical context for future development.

Finally, in Table 3.3, we provide a summary of the workflows for these web sites (as much as can be summarised). This provides some insight into the ways in which each of the reviewed projects handles the entering of data.

Table 3.1 Functionality Summary – Existing Projects

	Artportalen	Bird-data	Birds in Backyards	Climate-watch	Great Australian Shark Count	Info-fish	iSpot	Northern Australian Frogs Database System	Rabbit-scan	Stream-watch	Wildobs	Freq
Community features												
Blog			X		X				X		X	36%
Email list			X								X	18%
Fact sheets			X	X				X	X	X		45%
Forum			X	X	X		X					36%
Image/photos	X		X	X		X		X			X	55%
News articles		X	X	X		X	X	X	X	X	X	91%
Newsletter			X	X		X		X	X		X	55%
Other sites											X	9%
Data Entry												
Bulk upload						X						9%
Members only	X	X	X	X	X			X		X	X	73%
Mobile phone (SMS)									X			9%
Mobile application											X	9%
Web form	X	X	X	X	X		X	X	X	X		82%
Mapping												
Dynamic web maps		X		X			X		X		X	45%
Static images	X		X			X		X				36%
No mapping					X					X		18%

	Artportalen	Bird-data	Birds in Backyards	Climate-watch	Great Australian Shark Count	Info-fish	iSpot	Northern Australian Frogs Database System	Rabbit-scan	Stream-watch	Wildobs	Freq
Reporting												
Area lists	X						X				X	27%
Member lists	X	X		X			X				X	45%
Other	X					X				X		27%
Species lists	X	X					X				X	36%
Total records	X	X			X				X		X	45%
No reporting			X					X				18%

Table 3.2 Development Environment Summary – Existing Projects

	Artportalen	Bird-data	Birds in Backyards	Climate-watch	Great Australian Shark Count	Info-fish	iSpot	Northern Australian Frogs Database System	Rabbit-scan	Stream-watch	Wildobs	Freq
Development Environment												
ASP	X											9%
CFM			X					X				18%
HTML						X	X			X		27%
Java		X		X								18%
Javascript	X	X					X			X		36%
JSP				X								9%
Mobile											X	9%
PHP					X				X			18%

Table 3.3 Workflow Summary – Existing Projects

	Artportalen	Bird-data	Birds in Backyards	Climate-watch	Great Australian Shark Count	Info-fish	iSpot	Northern Australian Frogs Database System	Rabbit-scan	Stream-watch	Wildobs
Workflow											
Enter a location/site	1[1]	1	3	1							
Enter a survey		2									
Choose a species			1								
Enter a record	2	3	2	2	1		1	1	1	1	1
Download form						1					
Submit form						2					

[1] Numeric values in this form indicate the order in which the forms are used in the workflow of the web site

4 Exemplar Projects

In undertaking community consultation of a range of citizen science requirements, a number of exemplar projects were identified by the ALA, and were then followed up with in order to determine their specific requirements for toolsets for their projects.

One project, the Plant Biosecurity project with the South Australian Herbarium, was also proposed as an exemplar project. However, this project is still in its infancy and it is too early to begin to gather requirements on this project apart from in a broad sense. While this project is not listed in this section, it is specifically listed as an implementation opportunity in section 5.3.3.

In order to categorise the requirements, feedback was sought on;

- General Design,
- Community features,
- Data Entry,
- Mapping,
- Reporting, and
- Technical Requirements

In each of the following sections, feedback from the groups has been categorised into these seven areas. In the requirements summary, there are several matrices indicating the specific feedback for each of the seven categories across the four exemplar projects.

As previously noted, Appendix One contains a list of all web site, organisations and individuals who were consulted during this phase of the project.

4.1 Australian Koala Foundation

In the early stages of this project, the Department of Environment, Heritage, Water and the Arts (DEWHA) and the Atlas discussed the potential for a joint project relating to data about Koalas in Australia. This is due to the imminent process to review the status of Koalas for potential nomination as a threatened species under the Environmental Protection and Biodiversity Conservation (EPBC) Act.

It was revealed during initial investigation about the data available for the Koala that there were many groups throughout its distribution that manage data about this iconic species. These include wildlife carers, veterinarians, university researchers, state government organisations, not for profit groups and commercial organisations.

The author of this document attended a workshop, held by DEWHA in Canberra on the 10th November, 2009, which looked at the current distribution and abundance of Koalas throughout Queensland, New South Wales, Victoria and South Australia. During this workshop it was revealed that the Australian Koala Foundation (AKF) was likely the holder of the most consolidated database on the Koala, and was investigating ways of utilising this data. An offer was made to the representatives at the meeting, and was followed up with further contact. However, the AKF did not respond to any offers of assistance and were not able to be included in this phase of the project. Further collaboration with this group should not be ruled out.

Many other individuals and organisations present at the Canberra workshop also had data that they would like to make available to the process of reviewing the Koala for listing under the EPBC Act. While it is unlikely that the Atlas can contribute to the listing process directly, another opportunity was identified in that DEWHA would be running this process a number of times in the future, and a tool for them to receive data directly from data suppliers was seen as a potential for longer term use within the Department. This is outlined as an opportunity in section 5.3.2.

4.2 Birds Australia

The Western Australian branch of Birds Australia (BA), Birds Australia Western Australia (BAWA) approached Gaia Resources independently of this project to discuss development of a portal for the Carnaby's Cockatoo project. Coincidentally, a second request from a different section of BAWA to Gaia Resources asked to expand the scope of that project to other databases held by BAWA. At the same time, Birds Australia (BA) and the ALA were in the initial stages of investigation of a formal agreement to assist BA with their data management requirements. Given these multiple requests and obvious overlaps, BA's data requirements were an obvious choice for an exemplar project.

In order to keep the requirements to a manageable level, it was decided to initially focus on the Carnaby's Cockatoo requirements as a starting point, but to continue to involve BA in discussions of their broader requirements.

The Carnaby's Cockatoo portal requirements were provided via email from Raana Scott (Carnaby's Cockatoo co-ordinator) and technical requirements for the broader BA infrastructure were requested from Geographic Web Solutions, who developed the BA Birddata application. These were not provided at the time of writing this document. It should be noted that BA's main data store, Birdata (section 3.2) is already in existence and any additional work must be tied to this system.

BA's requirements for the Carnaby's Cockatoo portal are listed below, categorised into the seven areas.

<u>General Design</u>

- Any tools that are developed must be easy to use for a wide range of BAWA volunteers (who have a broad range computer literacy)

<u>Community features</u>

- No specific community features were raised by BA staff.

<u>Data Entry</u>

- Able to undertake data entry through simple, easy to use web forms, potentially with two forms with different security levels:
    - Anonymous access for simple sightings (no login required)
    - Secure access for the nesting information (login required)
- The sole data entry method discussed was web forms,
- Data requirements include:
    - Only for Carnaby's Cockatoos in terms of species recording (at this stage, with expansion to other species later)
    - Simple sightings of the species (Global Positioning System [GPS] location, date, behaviour) as one form

    - Nesting information on the species including and activity description, date, observer name, GPS location, and a range of tree characteristics such as tree height, Diameter at Breast Height, condition, hollow aspect and hollow height,
    - Data fields to be compatible with the Western Australian Department of Environment and Conservation's (DEC) own database on threatened species
- Ability for each registered user to “tick a box” to indicate that their data should be made available to other databases (e.g. DEC, ALA, etc).
- All data recorded via the portal must be also stored in the Birddata main database repository for BA.

Quality Control

- Nesting information must be provided with user information so that details can be checked.

Mapping

- To be able to generate report-quality maps, specifically time series maps of active nesting hollows.

Reporting

- To be able to provide queries on specific hollows (i.e. a site-specific query) that provides a listing of all sites, and
- To be able to provide summary reports for particular areas (potentially defined by spatial areas, e.g. NRM boundaries, shires, etc).

Technical Requirements

- The technical requirements of the BA infrastructure were not provided at the time of writing this document despite several requests.

A further workshop between the ALA and Birds Australia is slated to be held early in 2010. This will likely provide the information that has not been provided for this report, and will also likely present a range of further opportunities for the ALA to work with Birds Australia.

4.3 Climatewatch (Stage 2)

In responding to the requirements request for this project, EarthWatch Australia sent out a request to various stakeholder groups to gather requirements for the next version of the Climatewatch web site (known as “Stage 2” of the site described in section 3.1).

As noted in section 3.1, Climatewatch is an existing and functional web site. The basic functionality of recording observational data is already present in the Climatewatch application. Therefore, the reviewers looked primarily at enhancing the existing application rather than providing the basic underlying functionality. The feedback that was provided included the following feature requests for the Stage 2 application.

General Design

- Different design completely than the one used now ("funky and very simple")

Community features

- Educational resources available, to both teachers and directly to students
- Ability for the community to post "ideas", "worries" and links, chat with each other and to generally form a community,

- Ability to incorporate blog functionality into the tools

Data Entry

- Data entry from a range of devices, including
  - mobile phones (including iPhones), including sending photographs from these devices, using SMS and Multimedia Messaging Service (MMS) technologies, potentially with spatial tags
  - Personal Digital Assistants (PDAs), including sending photographs from these devices, again with locations
  - Laptops being used in the field, with photos, spatial locations, etc.
  - Web forms as per stage 1, but with modifications to the workflow,
- Data collection or "harvesting" from other services, including
  - Twitter feeds (potentially using tags to highlight records),
  - General comment here included "follow the latest 'cool' technology", e.g. Facebook, Twitter, etc.
- Bulk data loading of datasets from Excel spreadsheets and other data formats,
- The ability to record "favourite" sites/species (.i.e. For commonly recorded species in commonly visited locations)
- The ability to enter data on any species at all rather than just the indicator species that have been set up as indicator species,
- Identification "tools" and tips for the species available on any data entry platform (also links to the educational resources),
- Ability to ask subject matter experts for additional information on their observations ("ask a scientist")

Mapping

- Better mapping (although it should be noted that there are technical reasons why these two things in particular were done)
  - removing the "red squares" that indicate surveying efforts, and
  - making the map window larger.

Reporting

- Basic data analysis made available to data recorders and other interested parties, including
  - What are the latest sightings (including a "ticker tape" of latest sightings)
  - changes over time (e.g. Similar to the "time slider" control in Natures Calendar),
  - trends over time

Technical Requirements

- Currently the only place to store the information from a Stage 2 of Climatewatch is in the same location as Stage 1. Therefore, the technical requirements of the system for Stage 2 are the same as those in place in Stage 1.

In addition to the desire for Climatewatch to be moved forward to Stage 2, an opportunity arose from discussions with Earthwatch and Museum Victoria. Museum Victoria have a funded project to develop mobile based biodiversity applications for the education sector, with an emphasis on identification and data entry. Their project must deliver this data to a “real world” project, and Climatewatch has been chosen as the best fit for this data.

A follow up meeting with Earthwatch and Museum Victoria was held in Melbourne in November, 2009. During this meeting, the requirements list above was reviewed by the

Earthwatch staff present. This was also discussed in the light of Gaia Resources' continued involvement in the Climatewatch project. More discussion of this opportunity for the ALA is provided in section 5.2.1.

4.4 Recreational Fisheries

"Recreational Fisheries" was chosen as an exemplar project based on the previous discussions that have been held between the ALA and the federal Department of Agriculture, Fisheries and Forestry (DAFF). An initial meeting with Catherine Schmutter from DAFF and Gerry Maine from Australian Government Land and Coasts indicated the need for this recreational fishery data within the federal government framework. The data from recreational fisheries was seen as a way of formulating better policy and plans, as well as to assist with scientific research within government. As such, this ability for government to access the data has been added to all of the recreational fisheries requirements.

The recreational fisheries groups in Australia are many and varied, but there are two groups that stand out as potential exemplar projects of citizen science in Australia, namely:

- Info-fish (http://www.info-fish.net/)
- The Great Australian Shark Count (http://www.auf-spearfishing.com.au/)

In addition, a commercial enterprise, Olfish Australia (http://www.olfish.com/), was approached as another potential exemplar project in this space. Olfish have been working on a commercial log book application that was subsequently determined to be better to be considered as a potential source of collaboration for development. This is outlined in more detail in section 5.2.2.

4.4.1 Info-fish

Info-fish's web site (http://www.info-fish.net/) is the central point for many of the grants and research projects being undertaken by the company, and it is via this web site that the public obtain the simple Microsoft Excel based recording sheets. Details of the Info-fish operations in this area are described in section 3.6.

Discussions with Info-fish management staff indicated two things;

- They have no desire to change their data collection methods at all, preferring the simple Excel forms and the semi-manual validation methodologies that they undertake, and
- They do have a desire to find ways of making their data more readily accessible, through both their own site, and through the initiatives of the Atlas at large.

They have a strong preference for being involved in any development of tools, and said they would only be comfortable participating if this involved their own technical staff. This has been noted and is discussed in section 5.2.2, as a potential development opportunity for the Atlas.

General Design

- The strong preference in this area is that the current Info-fish design is kept.

Community features

- No specific community features were discussed. It should be noted that several community features are already present in the Info-fish web site.

Data Entry

- The strong preference in this area is for there to be no change to the existing data entry/collection methods currently underway, namely through the use of bulk uploading to the site

Mapping

- Info-fish are currently investigating a new mapping solution for their web site. These aim to include:
    - Google maps interface to provide a good quality background, and a "typical" interface
    - Display of the records in the database is summarised to 1km^2 grid cells across the areas that are covered by Info-fish programs (parts of the state of Queensland, including marine and freshwater areas)
    - Information about the collectors is kept hidden for privacy reasons

Reporting

- Mapping tools are seen as a primary method of reporting back to the individual users
- Record searches based on
    - Individual (i.e. individual members can see own records)
    - Area (so that people can plan trips)

Technical Requirements

- Info-fish did not provide details of their technical requirements, but specified clearly that any development they would use would require their technical staff to be involved in the development of these tools.
- It is requested by the federal government that data from these recreational fisheries sources is available for their use in policy, planning and research (note this is an external requirement).

Info-fish were subsequently identified as a group that was more likely to be a development partner than an implementation partner, however, their feedback on what the requirements are for a citizen science web application was considered invaluable and included in this document.

4.4.2 The Great Australian Shark Count

Discussions with the GASC were primarily held over e-mail. Representatives from GASC did express a desire to "transfer" all data to the Atlas to remove this burden of data management from their own group, although this is not specifically something within the brief, it does fit into a larger hosted services requirement discussed in section 6.

GASC personnel indicated that there were interested in a range of functions to be implemented as an upgrade to their web site, as listed below.

General Design

- No comment on design provided.

Community features

- Educational resources included such as reports, articles, scientific papers, media, links to YouTube, drawings and others.

Data Entry

- Using maps to be able to record sightings
- The ability to be able to record multiple sightings per species and location, rather than having to duplicate recordings
- Additional data fields added to the database
- The ability for the GASC Manager to review all the data and to "correct" it as necessary

Mapping

- Summary maps by species and geographic region (State) as maps as well as simpler reports
- Data entry via maps

Reporting

- Participants can view all of their own records
- Summary reports by species and geographic region (as well as via maps)

Technical Requirements

- It is requested by the federal government that data from these recreational fisheries sources is available for their use in policy, planning and research (note this is an external requirement).
- Would prefer not to have the burden of managing the web and the data given the size of their organisation.

The GASC involvement in the future of this project is likely to be as an implementation partner. Their current state, and their desire to be involved, mean that they are a potentially rewarding implementation partner.

4.5 Requirements Summary

In a similar manner to section 3.12, we have endeavoured to summarise the functionality required from the exemplar projects into Table 4.1. Definitions for these summary terms are provided in Appendix Two.

Table 4.1 Requirements Summary – Exemplar Projects

Functionality	Carnabys	Climatewatch (stage 2)	Info-fish	GASC	Frequency
General Design					
Maintain existing web site design			X		20%
Simple design required	X	X			40%
Hosting required				X	
Community Features					
Ask an expert		X			20%
Blog		X			20%
Chat		X			20%
Educational resources		X		X	40%
Data Entry					
Bulk upload		X	X		40%
Data harvesting		X			20%
Identification tips		X			20%
Maintain existing workflow			X		20%
Maps used in data entry			X	X	40%
Members only	X		X	X	60%
Mobile applications		X			20%
Multiple sightings	X			X	40%
Public data entry	X				20%
Quality control required	X	X		X	60%
Restricted taxonomic scope	X	X	X	X	80%
Single sightings	X			X	40%
Unrestricted taxonomic scope		X			20%
Web forms	X	X		X	60%

Functionality	Carnabys	Climatewatch (stage 2)	Info-fish	GASC	Frequency
Mapping					
Dynamic web maps	X	X	X	X	80%
Summary maps		X	X	X	60%
Reporting					
Area lists	X		X	X	60%
Changes/trends over time		X			20%
Latest sightings		X			20%
Links to other internal systems	X				20%
Member lists			X	X	40%
Members can choose to make public	X				20%
Reporting via maps			X	X	40%
Species lists	X			X	40%

5 Opportunities

There are a number of opportunities for the ALA in terms of citizen science projects that have been identified in the course of this project. These can be generally categorised as:

- Technology opportunities,
- Development opportunities, or
- Implementation opportunities.

These are listed in the following sections. It should be noted that some of the organisations included in these opportunities have been also discussed in other sections in this document.

Of particular note, the Climatewatch project appears in two of the three opportunity 'types'. The code developed for Climatewatch was made available to the ALA under an open source agreement (specifics are not yet defined), which makes it a potential technology opportunity. In conjunction with Museum Victoria, the Climatewatch project is also a potential implementation opportunity for the ALA.

5.1 Technology Opportunities

During the course of this project, we have identified opportunities with a range of existing or planned projects, including:

- Other ALA sub-projects,
- The Global Biodiversity Information Facility's Integrated Publishing Toolkit (GBIF IPT),
- Other Citizen Science software.

These are discussed in the following sub-sections.

5.1.1 Other ALA Projects

The ALA has a range of activities scheduled for the coming development cycle. As per the ALA strategic plan, there are a range of sub-projects that could use common functionality or services. As an example, taxonomic validation services could be created once within the ALA and then used by citizen science, collections data management, rich data stores (e.g. keys), and other sub-projects.

In this same manner, there are parts of the requirements of citizen science that may be common to other areas of the ALA. One of the biggest perceived overlaps is between the citizen science and collections data management aspects – especially if the ALA is investigating on-line collections data management.

In order to demonstrate some of the overlaps to other sub-projects in the ALA, Table 5.1 indicates the functions summarised from section 4.5, and then these are mapped across to some of the other areas of the ALA. This has been done based on experience from the ALA All Hands Workshop held in Canberra in November, 2009.

Table 5.1 Complementary Functionality across the ALA from Citizen Science

	Citizen Science	Biodiversity Information Explorer	Biosecurity Portal	Conservation Portal	Data Integration	Rich Data Stores	Collections Data Management
General Design							
Maintain existing web site design	X						
No preference	X						
Simple design required	X						
Community Features							
Educational resources	X						X
Chat	X						X
Blog	X						X
Ask an expert	X						X
Data Entry							
Maintain existing workflow	X						X
Bulk upload	X		X				X
Single sightings	X		X				X
Multiple sightings	X		X				X
Maps used in data entry	X						X
Member data entry	X		X		X		X
Public data entry	X		X				
Web forms	X		X				X
Quality control required	X		X		X		X
Mobile applications	X						X
Data harvesting	X	X	X		X		X

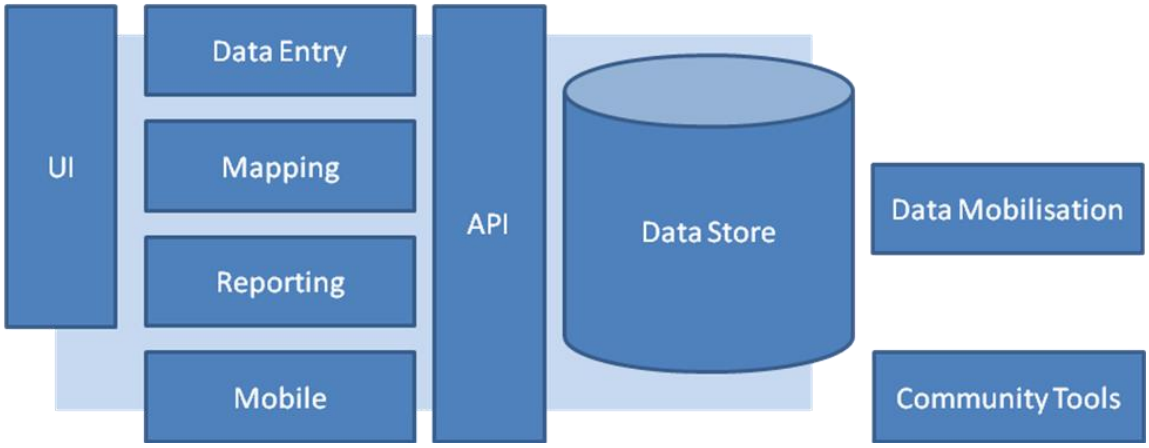
	Citizen Science	Biodiversity Information Explorer	Biosecurity Portal	Conservation Portal	Data Integration	Rich Data Stores	Collections Data Management
Data Entry (continued)							
Restricted taxonomic scope	X						X
Unrestricted taxonomic scope	X						X
Identification tips	X						X
Mapping							
Dynamic mapping	X	X	X	X			X
Summary maps	X	X	X	X			X
Reporting							
Member lists	X	X					X
Area lists	X	X	X	X			X
Species summary lists	X	X	X	X			X
Reporting via maps	X	X	X	X			X
Members can choose to make public	X						
Links to other internal systems	X					X	X
Changes/trends over time	X	X		X			
Latest sightings	X	X	X	X			

Of particular note in Table 5.1 are the strong ties with the Collections Data Management area of the ALA. This warrants considerable further investigation and may lend itself to joint development.

In addition to this complementary development, there are efficiencies that can be gained from collaboration across the ALA. Avoiding duplication of effort, building a consistent user interface across the ALA, and minimising future maintenance are all examples of the outcomes that can be obtained from further collaboration within the ALA.

The key outcome of this opportunity is that any development that is undertaken for the Citizen Science portal should be modular enough to be able either to utilise other components of the ALA software being developed or to contribute to the achievement of other goals for the ALA. This is particularly important when the Collections Data Management component of the ALA is considered. In previous discussions, a technical diagram showing the modular style system has been presented, and is reproduced here in Figure 5.1.

Figure 5.1 Conceptual Citizen Science Framework



5.1.2 Climatewatch

One of the biggest assets the ALA has to bring to the Citizen Science space is the investment previously made in Climatewatch (Stage 1, see section 3.4). The ALA brought funding to the Climatewatch project to assist with development with the understanding that the Climatewatch code will be provided to the ALA under an open source licence.

One of the potential issues about this arrangement is that the original development contract for Gaia Resources did not include this provision. Hence, the original scope and the project itself are currently not suitable for deployment as an open source codebase. However, there are many aspects of the Climatewatch web site that would be able to be further developed and would be of use to the ALA in a Citizen Science portal or toolkit.

The opportunity here revolves around taking an existing codebase that is already deployed, bug tested, and has a working implementation, and further developing it. This would involve:

- Taking the existing Climatewatch web site application,
- Refactoring it to be a more modular toolkit and suitable for a wider range of requirements (i.e. turning it into the Citizen Science Portal), and
- Using the existing Climatewatch web site as a test bed for these changes.

This codebase could then also be reviewed in the light of larger ALA requirements (e.g. Collections Data Management). Furthermore, this also ties in strongly to an implementation opportunity with Museum Victoria (see section 5.2.1).

5.1.3 GBIF IPT

Another example of a technological opportunity is the Global Biodiversity Information Facility (GBIF) Integrated Provider Tookit (IPT). The GBIF IPTs primary function is to act as a middleman between a primary data store (e.g. a citizen science database) and the broader community, through GBIF. It is an open source project, developed in Java, that is available at http://code.google.com/p/gbif-providertoolkit/..

The GBIF IPT presents an opportunity for citizen science and the ALA. Instead of developing and implementing a new data serving toolkit as part of the citizen science development, it may be better to incorporate the GBIF IPT into the development, and instead contribute to the ongoing development of that existing tool.

Previous discussions with the ALA also indicate that some other solutions, such as HermesLite (http://www.gaiaresources.com.au/products_hermes.php), may also be able to operate in this space, and may be worth considering.

This model, of a modular codebase that incorporates existing code, is one that is worth further consideration. This is discussed further in section 6.

5.1.4 Other Citizen Science Software

During this project, several citizen science projects (Artportalen, as discussed in section 3.1, and iSPOT, as per section 3.7) were raised as potential platforms for future development. While these may be considerable technological opportunities, there are still some unknowns about the way in which collaboration could be achieved with these projects. Given the fact that there is an existing codebase available in Climatewatch, this was not pursued further.

5.2 Development Opportunities

"Development opportunities" is an umbrella term that covers organisations that have expressed an interest in being active partners with the ALA in the development of a citizen science toolkit. There are two main development opportunities here:

- The Museum Victoria and Earthwatch project to further develop Climatewatch, and
- Some partners from the exemplar projects.

There are also a range of commercial organisations (including Gaia Resources) that would be interested to be involved in development work for the ALA. This is not specifically described here.

5.2.1 Climatewatch and Museum Victoria

By far the largest identified opportunity for implementation lies in the work being undertaken by Museum Victoria (MV). MV has recently begun a project to develop a mobile biological data recording system for the education sector (schools) under funding from their state Education Department. One of the stipulations of this project is that the data collected must end up in a real world project, and Climatewatch was chosen as the place for this to reside.

MV needs to undertake a range of education related tasks for this project, as well as to undertake tests and trials with the mobile collection devices. However, there is an opportunity for the ALA to be involved here for three reasons;

- The development of mobile biological data recording software is a requirement of the Citizen Science exemplar projects,
- The acquisition and trialling of mobile device hardware is also a necessary component of a mobile recording system, and
- The Climatewatch code is identified as a key technology opportunity for the ALA.

By partnering with MV on this project, the ALA could acquire mobile data collection technologies, further develop Climatewatch code (for re-use in the generic toolkit), and work with a partner in MV that has a proven track record, established relationships with the end users (schools) and is funded to deliver this outcome.

The key issue about this opportunity is timeframe. In order for this to be pursued, the ALA needs to agree to the timeframe set by MV's funders, namely to have this in place by May 2010. This will require the ALA signing an agreement with MV in January at the latest, and as early as possible to ensure more likelihood of success.

5.2.2 Exemplar Projects

To date, Info-fish and Olfish Australia have expressed an interest in participating in this project as development partners. Both were originally contacted as exemplar projects, but have expressed an interest in the development work that would be required to create a citizen science toolkit rather than contributing their own code. Both organisations have an interest in incorporating new functionality into their own (proprietary) existing code base, rather than a generic toolkit. This is likely to not be in alignment with the goals of this project, but should be considered as a possible way forward.

They have also expressed an interest in obtaining funding from the ALA to further develop their own tools to be more compatible with the ALA, and make their data available on-line. This is an opportunity that should not be discounted, but may not fit into the broader vision of the ALA.

5.3 Implementation Opportunities

The ALA faces many different potential implementation opportunities. Here, we mean opportunities where a Citizen Science toolkit can be installed or tested. This generally comes down to one of two forms of opportunity;

- Not hosted – whereby an organisation takes the software and installs it on their own infrastructure, or
- Hosted – whereby the organisation has no hardware and requires support to host the Citizen Science application.

Of the exemplar projects outlined in section 4, Birds Australia expressed an interest in being implementation partners with the ALA of a generic toolset on their own infrastructure. The GASC fitted the second case, whereby they also needed hosting support for the implementation.

Of the remaining exemplar projects, note that the other two, Info-fish and Olfish Australia, preferred to be development partners and work with their existing code base rather than take a new code base on board. As such, they may be a development partner, but are not

considered an implementation partner at this time. The AKF chose not to be involved in this project, but could be considered to be a future development or implementation partner should they change their mind.

In addition, DEWHA are listed here as an implementation opportunity due to the work being undertaken on their SPRAT and ANHAT databases by Gaia Resources under a separate contract, and their own expressions of interest in this project.

5.3.1 Birds Australia

Initial discussions with BA were very productive, with excellent feedback being provided on the requirements for their Carnaby's Cockatoo portal (section 4.2). There has obviously been substantial work put into the BA relationship by the ALA previously.

BA is an implementation opportunity for the reason that they fit one of the two main use cases for the citizen science toolkit; namely that they have infrastructure, but require additional software. This is different from some of the other groups (such as the GASC in section 4.4.2) which do not have hardware, and need a hosted implementation (outlined in section 5.3.3). Hence, BA represents an excellent opportunity to test this workflow, and to implement the revised Citizen Science toolkit on their infrastructure.

During this project, BA not only expressed an interest in being an implementation partner, but also asked for other more general advice and assistance from the ALA. BA is looking to run a data management workshop early in 2010, and have asked that the ALA send along nominees to assist them in this process. This is an opportunity that the ALA should not miss.

5.3.2 DEWHA

DEWHA emerged rather unexpectedly from this project as an implementation partner.

During discussions at the Koala Workshop help in Canberra, DEWHA staff indicated that having a direct route for the public to lodge records about any species directly to their database would be advantageous to their work. This was also discussed separately with the staff from the Environmental Resources Information Network (ERIN) group of DEWHA. The ERIN group also thought this was of benefit and had been considering ways to implement this.

Gaia Resources is currently working with DEWHA to amalgamate the two separate species databases powering the Species PRofile And Threats (SPRAT) application and Australian Natural Heritage Assessment Tool (ANHAT) into one single, centralised database. This centralised database will be an ideal location to also store appropriately tagged citizen science records.

As a result of this, DEWHA is listed as an implementation partner and effectively replaces the Australian Koala Foundation, who declined the offer to participate in this project.

5.3.3 Hosted Implementation Support

While a number of organisations, such as BA and DEWHA, have infrastructure that would be able to support the implementation of a citizen science portal, others, such as the GASC project and others, do not have this ability. For these organisations, we have included the opportunity for a hosted service for citizen science.

This option also links to the opportunities presented by the Australian National Data Service and the Australian Research Collaboration Service, both of which have existing relationships with the ALA. It is hoped that these projects can assist the ALA in the acquisition and location of servers and hosting space for the implementation services. Should this not be the case, then the ALA will need to look at alternative sourcing (and maintenance) arrangements for this opportunity.

From the initial phase of this project, resulting in this document, two projects stand out as potential implementations on a hosted service, namely the GASC and a new project being run from the South Australian Herbarium about plant biosecurity. As noted in section 4, the plant biosecurity project is still in its infancy, but it fits well with the hosted model proposed here.

There are also a number of additional projects that may exist that are candidates for hosted services. These should not be discounted as they arise but at this stage we have not exhaustively listed the possibilities.

A futher potential method to implement these services is in conjunction with Museums around Australia. Museums have an educational role, and this can mesh well with the citizen science projects. However, most Museums in this country are short on funding, and would be unlikely to be able to contribute to these projects at this stage – however, again, the potential exists for this collaboration and should not be discounted.

Finally, it should be noted that there are commercial companies that provide hosting services that may be able to step in and provide a robust, reliable environment for the citizen science tools. However, the commercial fees and charges that may be part of this offer are likely to be well outside the budgets of the smaller citizen science projects, and may restrict entry into the field. Again, this should not be discounted, but is left to provide context for the other options.

6 Recommendations

Based on the opportunities identified in section 5, there are a range of recommendations for the ALA as a result of this project. These recommendations are as follows:

- A citizen science toolkit be developed on top of the existing Climatewatch code, which is;
  - Modular,
  - Able to integrate other applications (e.g. GBIF IPT), and
  - Has uses in other parts of the ALA (e.g. Collection Data Management).
- Further development of the toolkit should be immediately pursued with Museum Victoria to provide mobile device integration,
- Implementations of this toolkit should be pursued with two organisations, with the toolkit installed on their existing infrastructure:
  - BA, and
  - DEWHA.
- Hosted implementations should also be investigated further, and then set up and trialled with:
  - GASC, and
  - Plant Biosecurity.

These recommendations can then be turned into an implementation plan for Citizen Science and is included in the following sub-section. This plan includes a discussion of the development tasks that are required, as well as the implementation projects.

6.1 ALA Citizen Science Plan

The following section is broken down into a development stream and an implementation stream. Both of these should occur concurrently, and with considerable overlap. All times in the document are provisional, and are tied to the ALA Release Schedule.

6.1.1 Development Tasks

There are three main development tasks required for the project, namely:

- Refactoring the existing Climatewatch code to create a more modular, generic "Naturenet" codebase,
- Undertaking the mobile development in conjunction with MV of the existing Climatewatch codebase, and
- Development of the generic toolkit (the Citizen Science Portal or "Nature Net Australia").

These tasks are split into component tasks in the following table. At the end of this section on the plan, a complete timeframe is provided with both development and implementation tasks included. No time estimates or costs are provided with these tasks, although delivery dates are indicated in an attempt to tie into the ALA release schedule.

Table 6.1 Development Task Listing

Main task	Sub-task	Deliverable Dates
Climatewatch Refactoring		
	Design workshop with ALA	January 2010
	Redevelopment of existing code to modular framework	19 May 2010 (R3)
Mobile device integration project		
	Design workshop with MV	January 2010
	Purchase of equipment	January 2010
	Trial units to schools	19 May 2010 (R3)
	Project completion with MV	30 June 2010
	Incorporation to ALA Code	14 Jul 2010 (R4)
Naturenet Development		
	Release 1.0 - modular framework and mobile integration	15 Sep 2010 (R5)
	Minor release (version 1.1, 1.2, etc) for additional functions (e.g. adding IPT integration, adding community tool integration)	Each ALA release
	Final ALA release (version 2.0)	17 Aug 2011 (R10)

6.1.2 Implementation Tasks

The main tasks associated with implementation relate to the organisations that will be using the toolkit. This is coupled with an initial set of workshops that address the formalisation of the ANDS and ARCS partnership with the ALA, with the aim of delivering infrastructure to use in the hosted deployments of the citizen science toolkit. These tasks will involve:

- Developing the ANDS/ARCS partnership to obtain hosting infrastructure,
- Implementing the toolkit at;
    - Birds Australia, and
    - DEWHA.
- Implementing hosted versions for;
    - GASC, and
    - Plant Biosecurity.

These are outlined in Table 6.2.

Table 6.2 Implementation Task Listing

Main task	Sub-task	Deliverable Dates
Hosting Infrastructure		
	ANDS/ARCS hosting workshop	Jan 2010
	Test servers in place	17 Mar 2010 (R2)
	ANDS/ARCS Infrastructure rollout	Ongoing
BA Implementation		
	BA workshop	Jan – Feb 2010
	Implementation in test servers	15 Sep 2010 (R5)
	Implementation at BA infrastructure	17 Nov 2010 (R6)
DEWHA Implementation		
	DEWHA Workshop	Mar 2010
	Implementation in test servers	17 Nov 2010 (R6)
	Implementation at DEWHA infrastructure	16 Feb 2011 (R7)
GASC Implementation		
	GASC Meetings and workshop	Mar 2010
	Implementation in test servers	17 Nov 2010 (R6)
	Implementation at Hosted Infrastructure	16 Feb 2011 (R7)
Plant Biosecurity Implementation		
	Plant Biosecurity Meetings and workshop	June 2010
	Implementation in test servers	16 Feb 2011 (R7)
	Implementation at Hosted Infrastructure	20 Apr 2011 (R8)

6.1.3 Timeframe

A timeframe for the project has been amalgamated from Table 6.1 and Table 6.2, and is presented in Table 6.3. Again, this is only provisional, but provides some idea of what may be possible in the implementation of the citizen science portal.

Table 6.3 Plan Timeframe

	2010												2011											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
			R2		R3		R4		R5		R6			R7		R8		R9		R10		R11		R12
Climatewatch Refactoring																								
Design workshop with ALA																								
Redevelopment of existing code to modular framework																								
Mobile device integration project																								
Design workshop with MV																								
Purchase of equipment																								
Trial units to schools																								
Project completion with MV																								
Incorporation to ALA Code																								
Naturenet Development																								
Release 1.0 - modular framework and mobile integration																								
Minor release (version 1.1, 1.2, etc) for additional functions (e.g. adding IPT integration, adding community tool integration)																								
Final ALA release (version 2.0)																								
Bug fix releases																								
Hosting Infrastructure																								
ANDS/ARCS hosting workshop																								
Test servers in place																								
ANDS/ARCS Infrastructure rollout																								

	2010												2011											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
			R2		R3		R4		R5		R6			R7		R8		R9		R10		R11		R12
BA Implementation																								
BA workshop																								
Implementation in test servers																								
Implementation at BA infrastructure																								
DEWHA Implementation																								
DEWHA Workshop																								
Implementation in test servers																								
Implementation at DEWHA infrastructure																								
GASC Implementation																								
GASC Meetings and workshop																								
Implementation in test servers																								
Implementation at Hosted Infrastructure																								
Plant Biosecurity Implementation																								
Plant Biosecurity Meetings and workshop																								
Implementation in test servers																								
Implementation at Hosted Infrastructure																								

7 Abbreviations

AKF	Australian Koala Foundation
ALA	Atlas of Living Australia
ANDS	Australian National Data Service
ANHAT	Australian Natural Heritage Assessment Tool
ARCS	Australian Research Collaboration Service
ASP	Active Server Pages
BA	Birds Australia
BAWA	Birds Australia Western Australia
DAFF	Department of Agriculture, Forestry and Fisheries
DEC	Department of Environment and Conservation
DEWHA	Department of Environment, Water, Heritage and the Arts
DwC	Darwin Core
EPBC	Environment Protection and Biodiversity Conservation
ERIN	Environmental Resources Information Network
GASC	Great Australian Shark Count
GBIF	Global Biodiversity Information Facility
GPS	Global Positioning System
IPT	Integrated Provider Toolkit
JSP	JavaServer Pages
LRNZ	Landcare Research New Zealand
MMS	Multimedia Messaging Service
MV	Museum Victoria
MVC	Model View Controller
OPAL	OPen Air Laboratories network
PDA	Portable Digital Assistant
PHP	PHP Hypertext Preprocessor
RSS	Really Simple Syndication
SMS	Simple Messaging Service
SPRAT	Species Profile And Threats
TAPIR	TDWG Access Protocol for Information Retrieval

8 Appendix One – List of agencies and organisations consulted

Representatives of these agencies contributed to the content of this report through personal and telephone interviews and discussions.

Atlas of Living Australia
Australian Museum
Australian Government Land and Coasts
Australian Koala Foundation
Australian Underwater Federation
Birds Australia
Department of Agriculture, Fisheries and Forestry
Department of Environment, Water, Heritage and the Arts
Info-Fish
Museum Victoria
Olfish Australia
Birds Australia (Western Australia)
South Australian Herbarium
Great Australian Shark Count
Earthwatch Australia
Western Australian Museum

9 Appendix Two – Functionality Definitions

This appendix lists the definitions from Table 3.1 in Section 3.12, and Table 5.1 in Section 4.5.

General design

- **Maintain existing web site –** one requirement mentioned was that the operator of the project wanted to maintain their existing workflow
- **Simple design required** – another respondent indicated that the design of any new site had to be simple and easy to use.

Community features

- **Ask an expert** – this was requested as a form of education – the ability to be able to ask an expert in the field to validate their records or to provide additional information
- **Blog** – has some form of regularly updated blog on the web site. Differs from news items in that it has a different purpose than news (e.g. education, updates that are not marketing focussed), and may be authored by many different people
- **Chat –** real-time chat between members (e.g. using Skype or MSN Messenger chat tools)
- **Educational Resources –** unspecified in detail, but basically resources for both those seeking to educate (teachers) and those seeking education (students)
- **Email list** – a mailing list conducted over email, as a form of communications with members. Often used as a simple replication of news or blog posts, but in some cases is also a form of forum in itself, conducted through a different medium
- **Fact sheets** – comprehensive, but usually one-page, outlines of a particular object (such as a species) being recorded for the citizen science project
- **Forum** – a bulletin-board style communications method. Often employed as a way of supporting a community, and enables registered participants to post comments, files, etc.
- **Image/photos** – this term is used to indicate if the community can contribute their own images or photos to the project, through either specific functionality developed by the site, or by using existing tools (e.g. fora or web sites like Flickr and Picasaweb).
- **News articles** – short articles with a marketing focus that aim to provide information about the project to a wider audience.
- **Newsletter** – a regularly (or irregularly) produced information sheet provided to members of the project, that has a range of information in it that is relevant to the project.

Data Entry

- **Bulk upload** – the ability to upload a file that contains many sightings or observations into the web site at once, rather than uploading each record individually. Usually done through the uploading of spreadsheet style files.
- **Data harvesting –** the ability to harvest data from other machine-readable sources, e.g. TAPIR feeds, RSS feeds, etc.
- **Identification tips –** the provision of identification resources to assist people in identifying the biological organism they are looking at – keys being one example
- **Maintain existing workflow –** this means that the respondent did not want to change the way they were currently working in under any circumstance

- **Maps used in data entry –** this means that the respondent wanted to use a map during the data entry process
- **Members only** – this means that only the registered members of the project (usually through an on-line registration process) can contribute data to the project.
- **Mobile applications –** this covers a range of applications and operating systems, and is a catch all for any mobile application that does not use SMS – e.g. web applications, software developed specifically for the operating system, an iPhone application, etc.
- **Mobile phone (SMS)** – this is the ability to upload a record to the database through the use of the SMS protocols. It does not include any other mobile phone input method (e.g. mobile web applications, which were not in place anywhere in the sites reviewed)
- **Multiple sightings** – the ability to enter details of multiple sightings at once (but different from a bulk upload in that the web form/entry tool is still used)
- **Public data entry** – allowing the public to enter data without registering on the site
- **Quality control required** – requiring some form of review of the data prior to it being passed into the system as an accepted record
- **Restricted taxonomic scope** – only allowing data entry from a particular taxonomic group (e.g. birds)
- **Single sightings** – ability to lodge a single opportunistic sighting of an organism into the system
- **Unrestricted taxonomic scope** – allowing data to be entered on anything in the entire taxonomic hierarchy (although none specfied which to use)
- **Web form** – a form on the web, with a range of functionality aimed at allowing the people using it to upload records to the database.

Mapping

- **Dynamic web maps** – this is the use of a dynamic web map (such as an embedded Google map) on their web site. There was no differentiation between using the map as a data entry tool or a reporting tool.
- **Static images** – this is providing maps as simple image files. While they may be used in creative ways (such as linking parts of the image to pre-canned reports), they are not using dynamic mapping functionality.
- **Summary maps** – seeing summary results through a map interface
- **No mapping** – projects with this had no evidence of maps on their site at all.

Reporting

- **Area lists** – the ability to generate a list or report of the data from the citizen science project for a specific geographic area.
- **Changes/trends over time** – the ability to see how changes over time have occurred in the particular scope of the project
- **Latest sightings** – a "tickertape" of the latest sightings should be visible somewhere on the site
- **Links to other internal systems** – in specific circumstances (e.g. BA, DEWHA, etc), there are existing systems that are in production, to which the citizen science application needs to be linked to,
- **Member lists** – to allow each member to generate a list of their own records in the database
- **Members can choose to make public** – each member can determine if they wish to allow their records to be made public
- **Other** – the ability to generate other reports than those listed here

- **Reporting via maps –** reporting via a map interface, e.g. showing survey effort as a range of tiled squares of particular colours
- **Species lists** – to be able to generate species lists from the data, potentially restricted by area or taxonomic group
- **Total records** – showing the total number of records in the database to either the general public or the registered members via the web site
- **No reporting** – no ability to report was provided at all.