ISSG online searchable Database

Btech 451

Final Report

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Abstract

This project is designed to develop an online searchable database and asp.net website for the Invasive Species Specialist Group (ISSG). The main goal of this project is not only develop a webpage that enable users to search from the database, it is more focus on develop a highly user friendly website that reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them. The database will be involved for this project is Global Islands Invasive Vertebrate Eradication Database, which is a database that mainly focuses on the eradication record for a specific species in a particular location and time. At the end, both of the database and website will be hosted online to the public as free resources.

1 Project Overview

1.1 Introduction

This project is a one year project for Btech451 from The University of Auckland. It is a real world project as it involves organizations that are outside the university (ISSG). In order to successfully complete this project, not just academic works will be required. Several other factors such as: time management, budget concerns, usability, flexibility and future development concerns will be all played big roles for this project. It will be a precious experience for me.

1.1.1 Background for ISSG

ISSG is stands for Invasive Species Specialist Group, it is a non-profitable organization aims to reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them. The Figure 1.1 shows the logo for ISSG [1].

Fig 1.1: The ISSG Logo

ISSG is a global network of scientific and policy experts on invasive species, organized under the auspices of the Species Survival Commission (SSC) of the International Union for Conservation of Nature (IUCN). The ISSG was established in 1994. It currently has 196 core members from over 40 countries and a wide informal global network of over 2000 conservation practitioners and experts who contribute to its work. The Chair of the ISSG is Dr. Piero Genovesi, of the Institute for Environmental Protection and Research, in Italy. Mrs.Shyama is the industry advisor for this project.

ISSG manage the Global Invasive Species Database and Global Islands Invasive Vertebrate Eradication Database online for public and other organization to search information on invasive species, their ecology, spread, management and impacts. The ISSG has also undertaken to develop **thematic datasets** which can be used as analytical tools by stakeholders. These datasets will be made freely available on the ISSG portal. Themes of projects under progress include threatened species on the IUCN Red List of Threatened Species impacted by at least one invasive species threat type, Invasive species on island ecosystems and protected areas. Both of the tools will be used by public and stakeholders. As many of the users are not professional biologist, it is important for the developers to design the interface with high level of usability for all level of people. More information can be found on ISSG official website: http://www.issg.org.

1.1.2 Global Invasive Species Database (GISD) & Global Islands Invasive Vertebrate Eradication Database (GIIVED)

Global Invasive Species Database and Global Islands Invasive Vertebrate Eradication Database are both used by ISSG to store species information. They both contain several category of information such as: Island, Specie, Eradication Method, Baiting Method and Human habitation etc. The main difference is the Global Invasive Species Database is more focus on the information about species, mostly the features of the species. The Global Islands Invasive Vertebrate Eradication Database is mainly focus on finding the best way to eradicate the species. In this project only the Global Islands Invasive Vertebrate Eradication Database will be used.

1.2 Project Requirements

Just like any other research group, database is playing a big role for ISSG. The Global Islands Invasive Vertebrate Eradication Database contains all of the data for species, eradication method and more. It is one of the main ways that ISSG used to public and store their research results. Because Global Islands Invasive Vertebrate Eradication Database contains more than 1600 of records, the first requirement is to optimize the database structure. As the structure of the original version of database is very missy. It requires me to reconstruct the relationship between tables and rows first. This will be the first condition in order to perform high quality of SQL queries.

After the database is being optimized and deployed to the server, an asp.net web site is needed to enable public users to search from it. As mentioned early, lots of public users are not professional biologist. Therefore the web page needs to carefully design to maintain the balance between professional analysis and usability. The best solution for this kind of problem is providing different way to search.

Build a simple website that only provide users some basic search function is obviously not enough. The website needs to provide some extra functions such as filter control, specific search and export the searching results etc. However all these functions must not affects the overall performance and usability. Also it will be great if the webpage can contains some kind of analyse diagram or filter based on the data. This will improve the level of satisfaction while users searching with webpage. These concerns are not out first priority, it will be an extra works if I have enough of time.

1.3 Challenges & Motivation

Now days, most of the organizations and companies have their own database. People are strongly relying on their database to record data and search from previous results. However it is still impossible to let everyone fully understand SQL language and perform it correctly. For a large database such as The Global Islands Invasive Vertebrate Eradication Database, it is almost impossible for users to check the data manually. Due to these issues, we have to build a user friendly interface to make sure every user can perform their tasks correctly. By using the interface, users can easily search from the database without knowing any of the SQL queries.

There are five major reasons motivate the organization to do this project.

1.3.1 The database

The original Global Islands Invasive Vertebrate Eradication Database contains many unclear relations and inconsistent data. It will confuse the developer and user while they are using it. Also it is bad for any other future development.

1.3.2 Efficiency

The previous webpage for the database is extremely inefficiency. It contains five list boxes that display all possible selections as the inputs, users need to match all of the input requirements to get their data. It takes a long time for the users to find their desired information.

1.3.3 Layout

The layout of the previous page doesn't fit to the ISSG main page. In order to provide an easy way for the users to search from the database, a new website with better layout is definitely necessary. The previous webpage only contains a single picture without any other useful links.

1.3.4 Usability

The usability of the previous webpage is poor. It doesn't contain any kind of filter control or export functions. Most of the users expect more than a simple search engine. They require functions such as data analyze, data filter and data exports etc.

1.3.5 Reliability

The response time and errors for the previous webpage is not acceptable. It rarely works and even when it works, the response time of loading the data can be over a minute. It is important for the developer to improve the response time and reliability.

2 Special Announcement

There used to be two parts for my project, the second part of the project is to develop a mobile application for the Black Hawk Tracking Ltd. The mobile application should provide users multiple ways to search from the Black Hawk Mobile services. This part of the project has been cancel due to several technical issues such as:

- Not able to get the IPod SDK tertiary developer account for 6 months.
- Unable to get the mobile service from the company, not even the export version of the mobile database
- Not enough of time, the online searchable database for the ISSG took more time than we expect to complete.
- Staying with one part can always improve the consistency of the project and therefore provide a better product.

3 Project Goal

The overall goal for this project is to develop an online searchable database for ISSG. They are several small goals for the ISSG topic. First of all I need to optimize the structure of exists MySQL database. This will involve changing in tables, rows and relationships. Then I will convert MySQL database to MSSQL database in order to perform high quality of SQL query. Finally the main goal is to create a website by using ASP.NET to perform SQL query and display results. After the all implementation is done, I need to upload both of the database and website to the service and complete some performance testes. Below is a list of all goals I have to achieve for this project.

The goals include:

- Transfer database between different database platforms.
- Fix the issue of inconsistent data (null and empty values).
- Refine & reconstruct the structure of an existed database.
- Find an efficiency way to link the database to the website.
- Find out what kind of layout is more efficiency and easier for the users to search the database.
- How to provide extra functions without decrease the efficiency of the webpage.
- Keep the loading time and response time for the website under a reasonable range.

4 Project Plan

4.1 Project Schedule

The schedule for this project has been shown below in figure 2. The schedule actually includes eight major phases. Start from the kick off meeting to the final deployment and testing. As this is a one year project, it will be enough of time for multiple meetings with the ISSG. Each meeting with the ISSG will play a big role for this project in order to gather feedbacks and information.

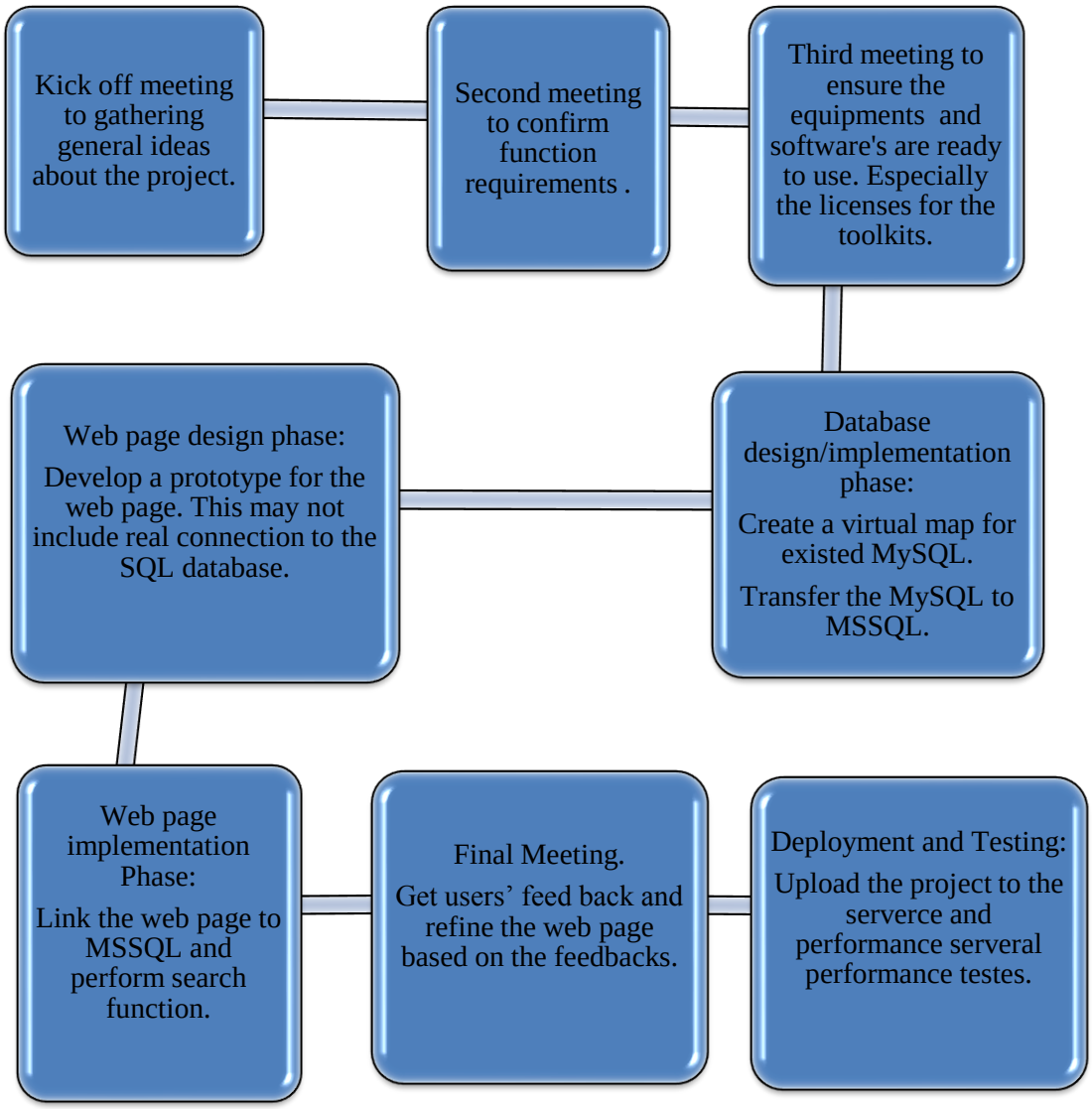


Figure 2 the schedule of the building the ISSG online database

4.2 Project Budget & Resources Concerns

All hardware and software for this project will be provided by either the university of Auckland or ISSG. Especially for the implementation of the website, the ISSG will provide full licenses for all software and third toolkits that the project will use. For example: Microsoft database 2008, Visual Studio 2010, Telerik toolkits and Ajax control toolkits. As the final database and website will be host in the university services. The database service will not be a big concern for this project.

5 Related Work

5.1 The Global Invasive Species Database (GISD)

The most related work for this project is the website for The Global Invasive Species Database (GISD). The GISD website is made by a previous Auckland University student for public users to search detail information about specific specie. The website is also build under asp.net environment. It provides two major ways to search: standard search and taxonomic search. The website is well formatted and designed. It could be a good reference and example for this project. The figure 3 shows the main page for the GISD.

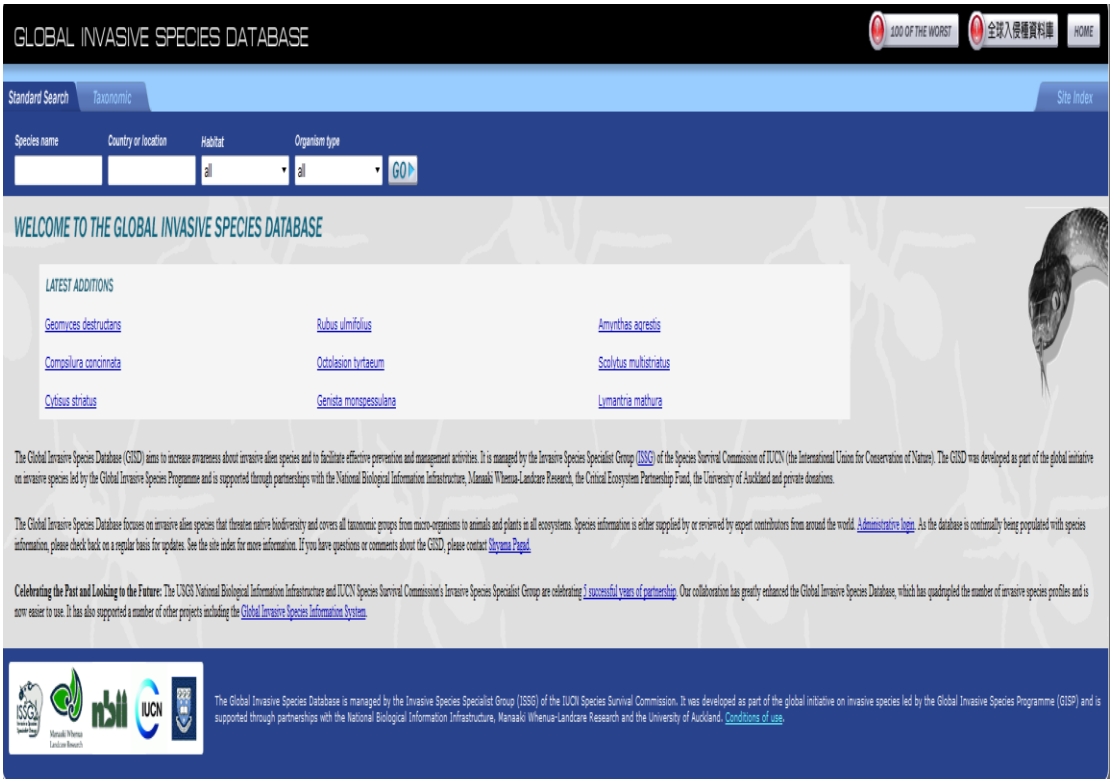


Figure 3 the main page for Global Invasive Species database (http://www.issg.org/database/welcome/)

5.2 Other Invasive Species Database

There are many other online webpage for invasive species such as: Baltic Sea Alien Species Database and Texas Invasive Database. Most of them let the user search the database by using dropdown list and text input files. It is obvious the dropdown lists and text input files are the most common and easiest way for the user to get the information they want. However none of these websites provide extra data analysis tools and export functions to the end users. Also because the style of dropdown list and text input files, theses websites are hardly attractive. In this project, I will try to find a new way to represent various data from a big database with a reasonable high level of usability and attractions. At the end of this project, it will be interesting to compare the difference between the ISSG database website and other websites. The figure 4 shows the main page for Texas Invasive Database.

Figure 4 the main page for Texas Invasive Database
(http://www.texasinvasives.org/invasives_database/)

5.3 Previous website for Global Islands Invasive Vertebrate Eradication Database

The figure 5 below is the previous website for the Global Islands Invasive Vertebrate Eradication Database. It is a temporary website that allows public users to search from the previous MySQL database. From the figure 5 we can see, users have to select five different inputs for each searching category. It is obvious that the usability of this website is very poor and it has lots of room to improve. It is hard to find the correct input files from a list over 100 rows. The website doesn't even provide a simplest filter function to sort the data. Also the layout for the website is extremely unattractive for the users. Despite these problems about this website, it provides a download link that allows user to download their searching results. This is a good function that will be kept to the new version of the website.

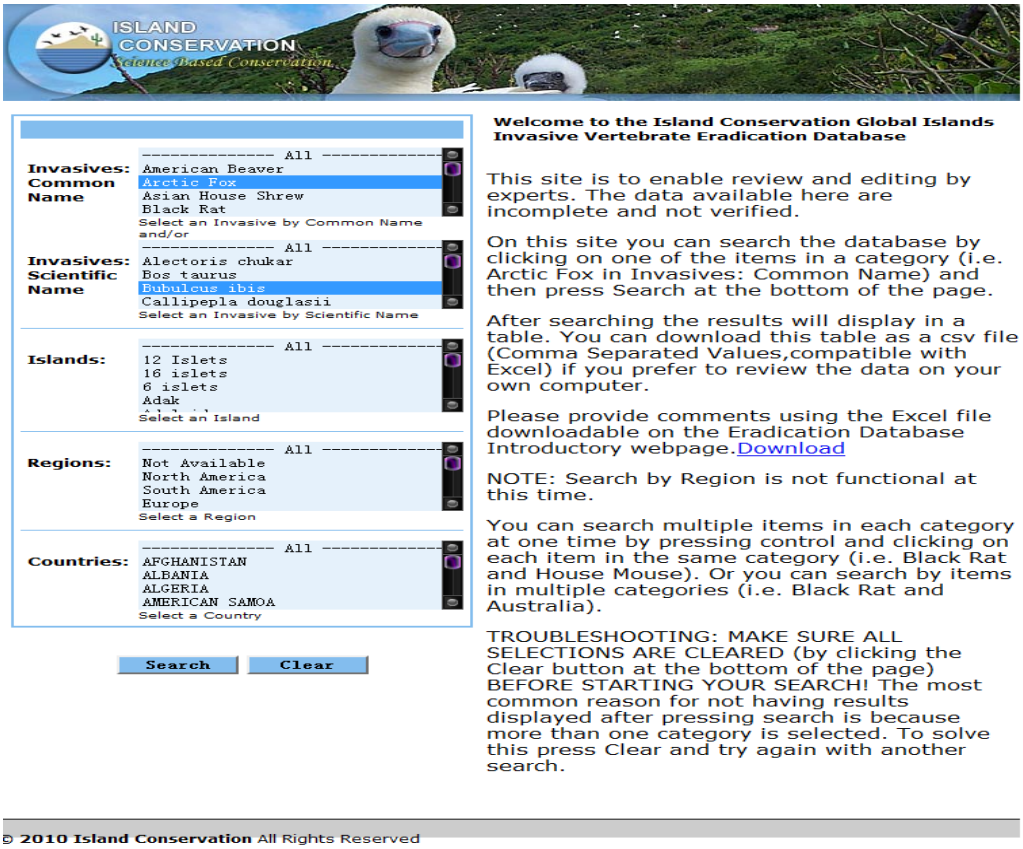


Figure 5 the main page for Texas Invasive Database

Another big problem for this website is the reliability. This website rarely has any level of error handling functions. It crashed pretty often if a wrong combination of inputs has been selected. Also even if the inputs values are correct, the response time for the searching results can be over a minutes. This is not acceptable for any kind of searching engine. The efficiency and reliability of the website definitely need to be improved.

6 Project Design

6.1 Architecture

The basic idea for this topic is any users can connect to the Island Conservation Global Islands Invasive Vertebrate Eradication Database website when they have internet. First of all, the webpage will require some inputs or specific filter option from the users. Then the webpage will modify users' inputs to related SQL query and send it to the SQL database. At the end the SQL database will return the selected data (based on the SQL queries) and display them to the users in a new webpage. The result webpage may also provide some status analyse based on the returning data. The status analyse will be performed by the webpage, not the database. Fig3.1 shows the basic ideas about how it will work step by step.

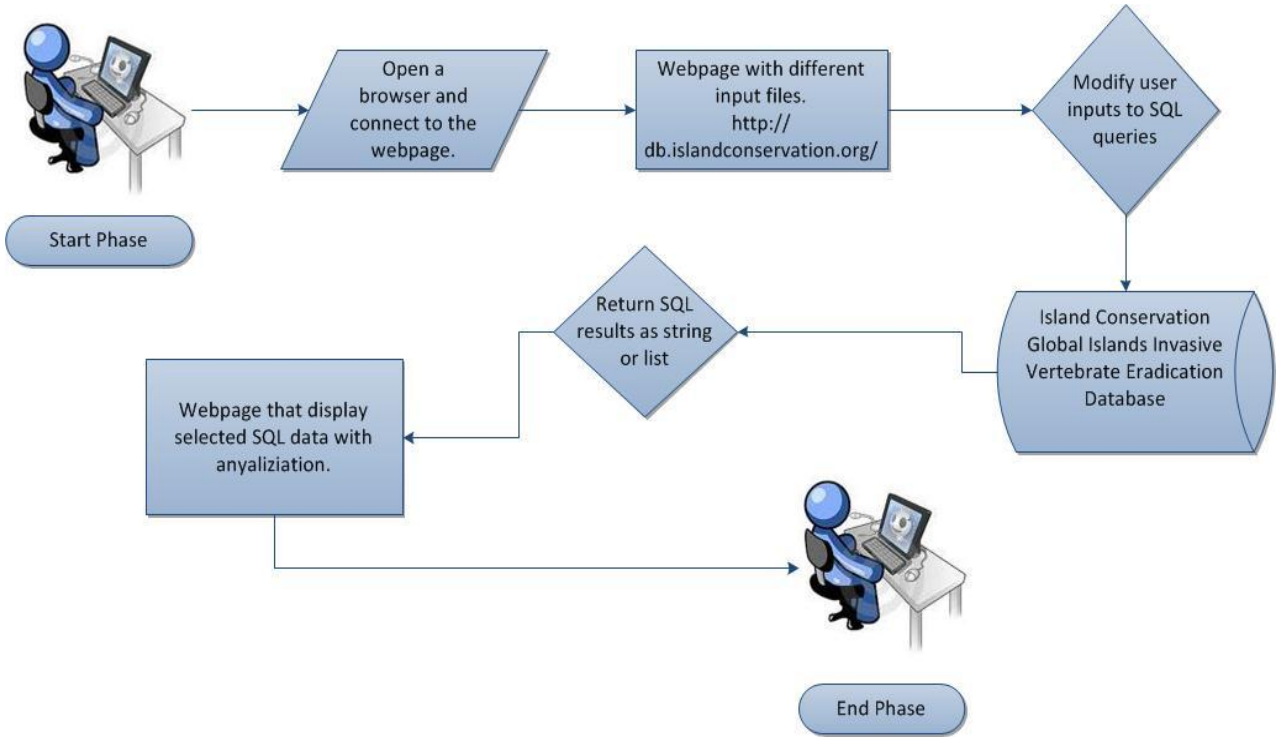
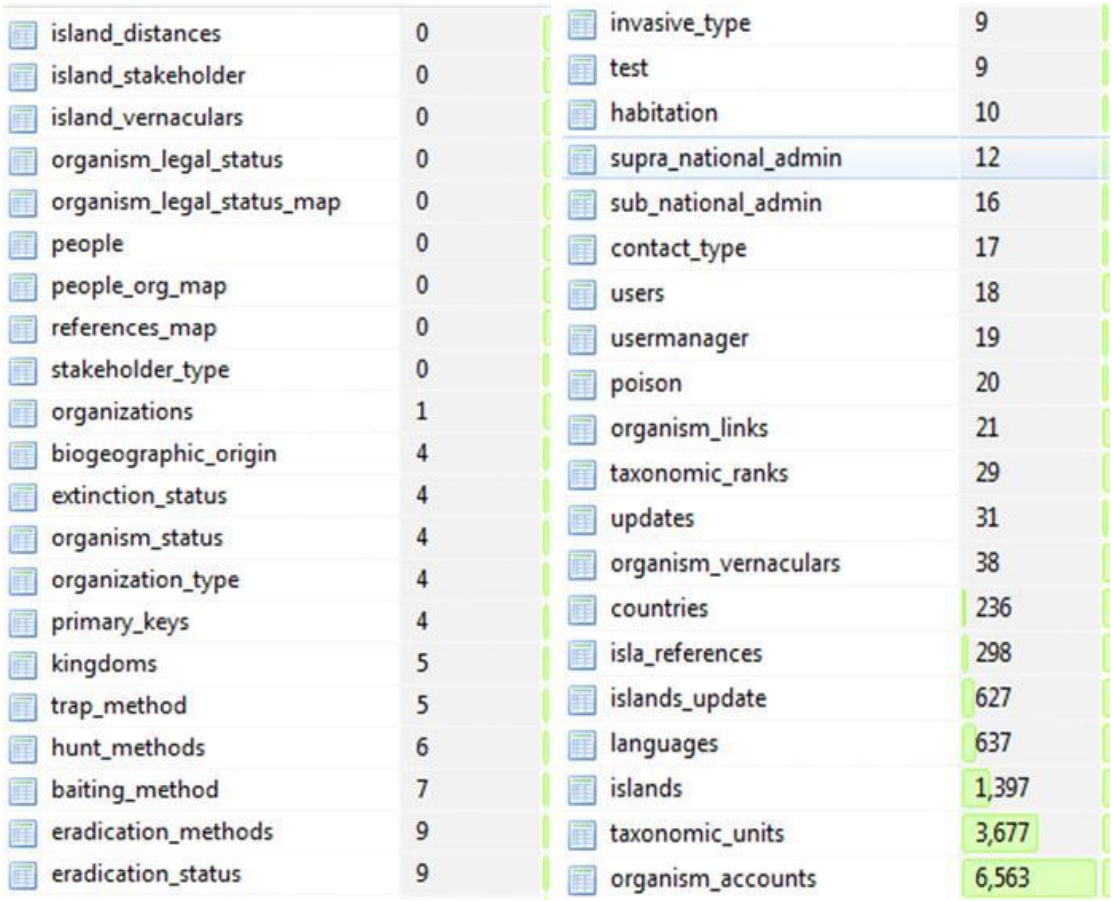


Fig3.1 Bird view of the architecture for ISSG

6.2 Database design for ISSG

The Island Islands Conservation Global Islands Invasive Vertebrate Eradication Database is a big database that contains around 40 tables and more than 16,000 of record shown in Fig 6. For building a website that access this database online, it is necessary for us to refine the structure first. From Fig6, we can see there are some tables with empty data. I will delete them in order to decrease the size of database and faster the loading process. Also they are many tables which are not relevant to our website, such as orgnazitaion_account and users

tables. These tables need to be filter out in order to speed up the SQL requests.



island_distances	0	invasive_type	9
island_stakeholder	0	test	9
island_vernaculars	0	habitation	10
organism_legal_status	0	supra_national_admin	12
organism_legal_status_map	0	sub_national_admin	16
people	0	contact_type	17
people_org_map	0	users	18
references_map	0	usermanager	19
stakeholder_type	0	poison	20
organizations	1	organism_links	21
biogeographic_origin	4	taxonomic_ranks	29
extinction_status	4	updates	31
organism_status	4	organism_vernaculars	38
organization_type	4	countries	236
primary_keys	4	isla_references	298
kingdoms	5	islands_update	627
trap_method	5	languages	637
hunt_methods	6	islands	1,397
baiting_method	7	taxonomic_units	3,677
eradication_methods	9	organism_accounts	6,563
eradication_status	9		

Fig6 all tables for the existed Island Islands Conservation Global Islands Invasive Vertebrate Eradication Database

During the implementation phase, I definitely need to create some extra tables to the existed database. These tables will be used to store statistical data and extra searching information. For example, the existed database doesn't have a separate table for the country name and country code. Therefore it is no way for us to search the eradication record by country.

By only optimize the database is not enough for build a good database access website. There should be several separate layers to cooperate with the asp.net web site in order to perform high quality of searching. One of the best solutions to link the database and the website is input the MSSQL to visual studio project and build Data Access Layer (DAL) by using Typed Datasets. The DAL will provide simplified access to data stored in persistent storage for ISSG database. By using DAL, our asp.net website will not contain any of the actual SQL queries. As the DAL is independent form the user interface and database, we will be able to modify the webpage and database anytime without changing the whole architecture of the project. This is a huge advantage compare to the other approaches as our database is keep changing during the whole project period.

Build the Business Logic Layer (BLL) over the DAL will be optional for this project. The

BLL will separate the business logic from the DAL and website. For example, enforce seniority rules, prohibiting situations for unauthorized input etc. Fig 7 shows the detail for each layer between the asp.net webpage and database [3].

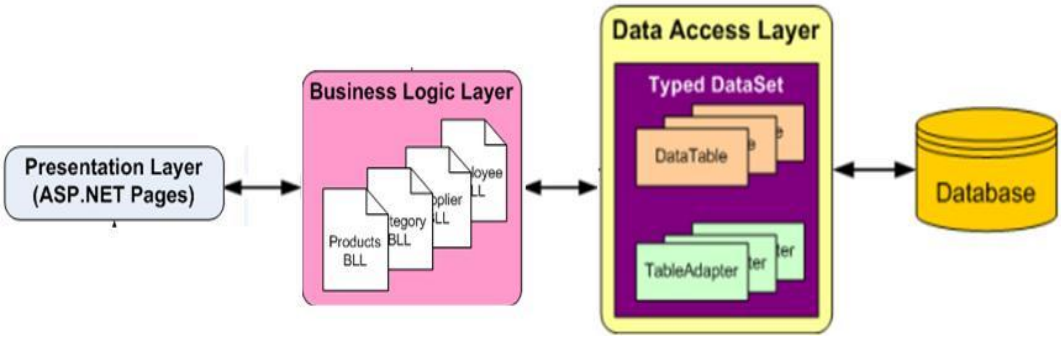


Fig7 Database layers (DAL, BLL)

6.3 Webpage design for ISSG

6.3.1Website architecture

There will be two ASP.NET web pages for the interface: Search by Location & Search by Name. Each of them will contain a different way to search the eradication record from the database. The basic layouts for both pages are very similar.

The default page for the ISSG webpage will be Search by Location page. Search by location is designed for the users who don't know what exactly they are looking for or they want to see a list of information in one island location. The search function will be build based on several inputs files to get the correct island from the users. After the search button has been clicked, a list of species based on the input island will be shown to the use by using a list view. The user will be able to select specific specie from the list view and go for further details. The eradication details informations will be displayed inside of a detail view. The steps of search by location is shown below in Fig8, from fig8 we can see the search by location involve 5 steps from the most general key world region to the most specific key eradication details.

Fig8 Steps for Search by Location page

The Search by Species Name page is quite similar to the Search by Location page, except the users will only need to input the common or scientific name of a specific species instead of select a location. This type of search is designed for the users (mostly biologists) to select specific invasive species based on either common or scientific name. It will be a faster way to search if we know what specie we are looking for at the start. The steps for search by name are shown in the Fig9. From Fig9 we can see the steps for search by name is less than the steps for search by location. Hopefully it will be a faster way to search the eradication record from the database.

Fig9 Steps for Search by Name page

6.3.1Website Functions

Except the two basic search functions: search by location and search by name, there will be some other functions available for the new webpage. The new webpage will include three major other functions:

1. Multiple filter control option for the users to refine the input and output data. For example, there will be filter options like not contain, less and more. This will increase the flexibility of the search.
2. Exports the searching results to either csv or word documents. The users will be able to download the data and import it to their own database or documents.
3. Data analysis, the website will provide some simple data analyse figures such as number of species available for each island and data quality to the end users. This will increase the usability of the webpage.

If I still have enough of time after I completed all of the function listed above, I will try to implement the Google map into the website and crate an external link that enable users to search from the Google map instead of using dropdown lists. Another thing that the project has to be awarded is the database response time. All of the extra functions that the new webpage provide should not decrease the overall performance and reliability. The response time should be less than three seconds for any kind of search. And there should be an error handling system to handle all kind of possible errors.

6.3.1Website Layout

The layout of the new website is quite important for the ISSG. They want the website attract people's attention as well as providing database search functions. The figure10 is a design view for the new website. It is made by 6 major sections. At the top, the logos and title will be displayed as header. The information of the selected island will be shown below the header after the user select an island. Below the island information list, there will be a major area for the users to input the searching values such as country, island or name. After the user inputted the searching values and click the search button, a list of species based on the searching value will displayed on the left hand side of the webpage. The user will be able to select from the list and go for further details. The furtherer details of the selected species will be displayed in the centre of the webpage. At the end, the copy right and protocols will be shown on the bottom. There will be several links on the left hand side of the web page.

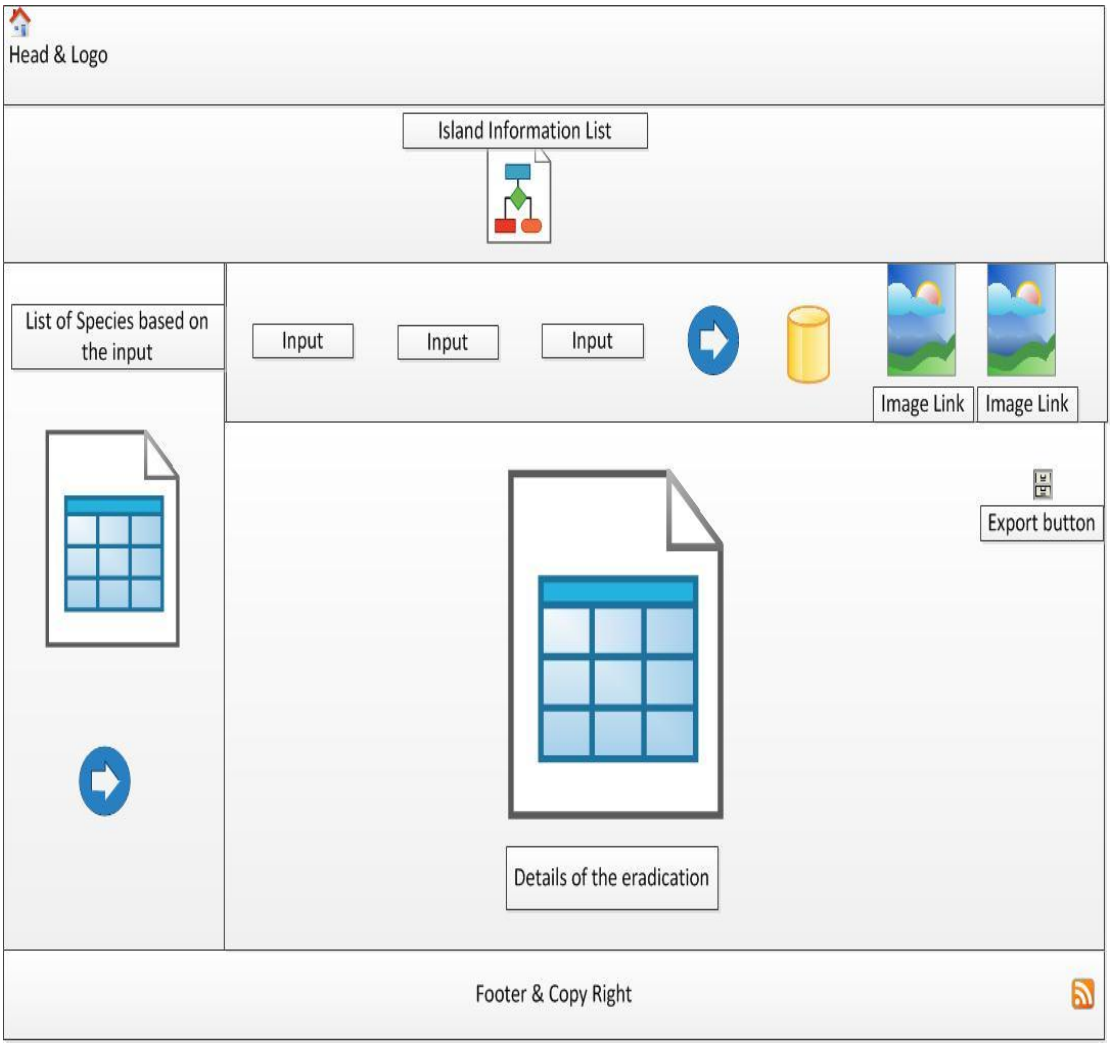


Fig9 Design view for the website

7 Learning Object & Technologies Used

For this project, they are many new technologies and objects that I have never used before. It will be a great learning process for me to get involve in these areas. For the ISSG website, the most challenging object for me is to learn is the ASP.NET framework. ASP.NET will be used as the user interface for the ISSG website. It is a widely used platform that designed and developed by Microsoft. The website layers will be all build on visual studio 2010(both DAL and BLL). For the data access in visual studio, fortunately there are many good tutorials online such as the asp.net official tutorial on: http://www.asp.net/data-access/tutorials . I will use these tutorials to guide me through the implementation phase. Hopefully after this project, I will become familiar with ASP.NET framework.

This project is heavily relying on database server and SQL queries. Because the best option for database to link to the visual studio is MSSQL, in this project I have to understand the difference between each database platforms and how to transfer database between them. Therefore software such as HeidiSQL, Microsoft Silverlight, Microsoft SQL Server 2008 and Access to Database 2008 will all be used in this project. Further details can be found in the link below.

HeidiSQL: http://www.heidisql.com/

Microsoft SQL Server 2008: www.microsoft.com/sqlserver/2008/

Microsoft Visual Studio 2010: http://www.microsoft.com/visualstudio

8 Project Implementation

8.1 Database Implementation

The very first thing I have done to the database is transfer the existed Microsoft data access document to MSSQL database. The transformation is been done by using the SQL Server Migration Assistant for Access. However the MSSQL database I got from the SQL Server Migration Assistant for Access doesn't contain any relationships and links between tables as shown in figure 10. Therefore I have to add these relationships by myself based on the previous MySQL database.

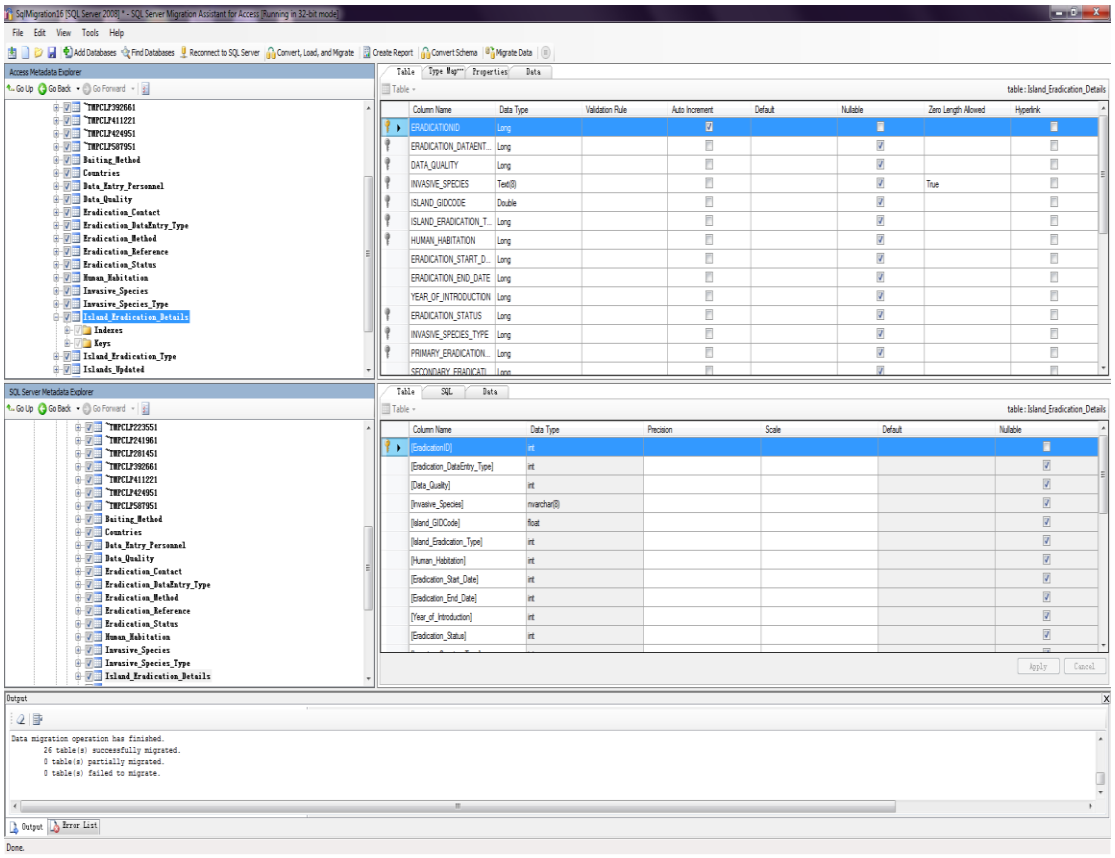


Figure 10 the database from the SQL Server Migration Assistant for Access.

After a few hour of analysis, I found out there are many tables from the original database are unnecessary for the website shown in the figure 11. Some of them are completely empty and others are not related to this project. Therefore I decided to delete these irrelevant

tables. A list of tables that I have deleted is shown in the next page:

Name of the table	Reason for delete
Island distance	Empty
Island stakeholder	Empty
Island vernaculars	Empty
Organism legal status	Empty
Organism legal status map	Empty
People	Empty
People org map	Empty
References map	Empty
Stakeholder type	Empty
Test	Irrelevant
Users	Irrelevant
User manager	Irrelevant
Languages	Irrelevant
Organism links	Irrelevant
Organism accounts	Irrelevant

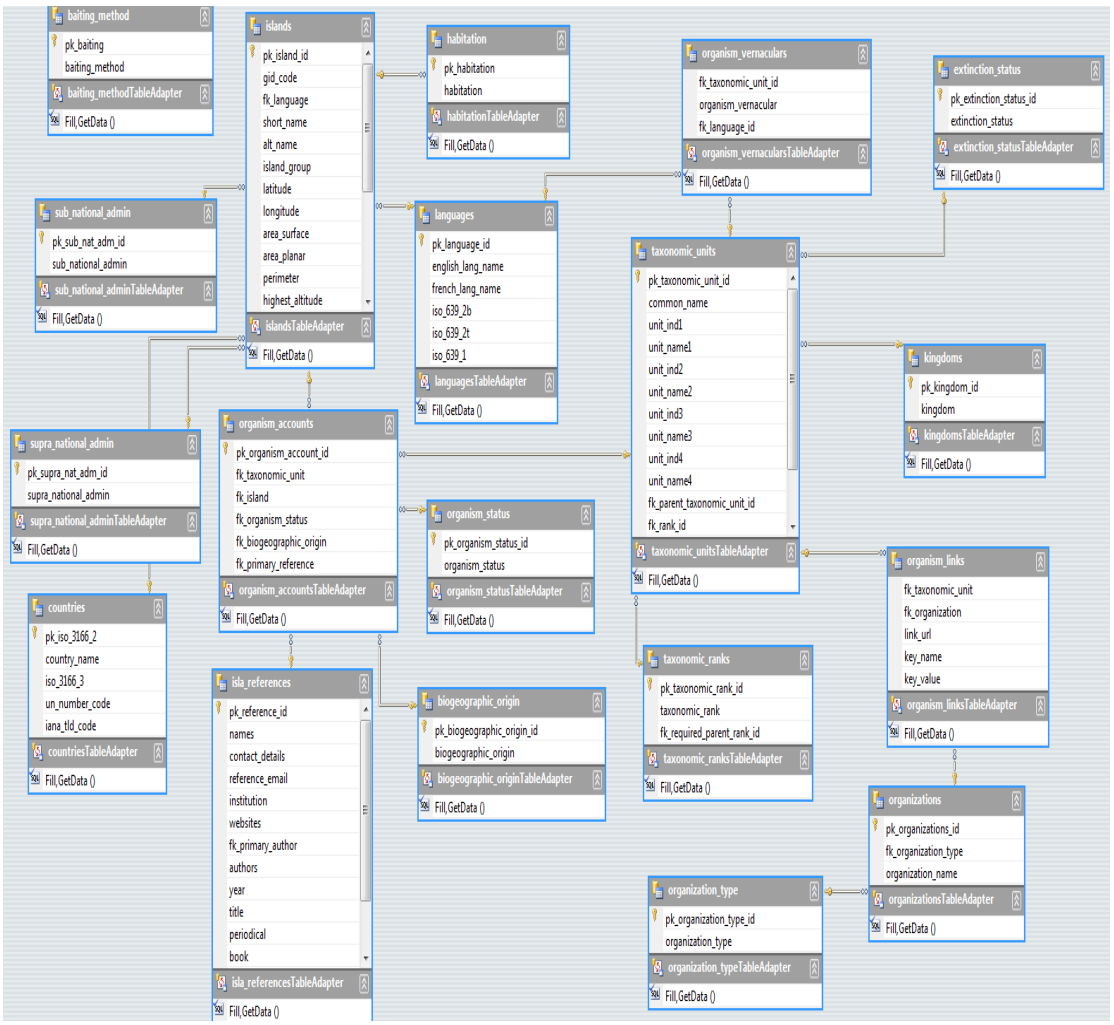


Figure 11 represent the first version of the database, it contain all tables that are transferred from the Microsoft data access document with relationships.

During the analyze phase, I also found out there are some important tables missing from the original database. In order to perform the search by location I decided to add two extra tables: World region and country to the database. The world region tables have two attributes: region name and world region code. The country tables also have two attributes: country code and country name. These tables will be link to the island eradication detail table as the child tables. The final structure of the database with complete relationship is shown in the figure 12 below:

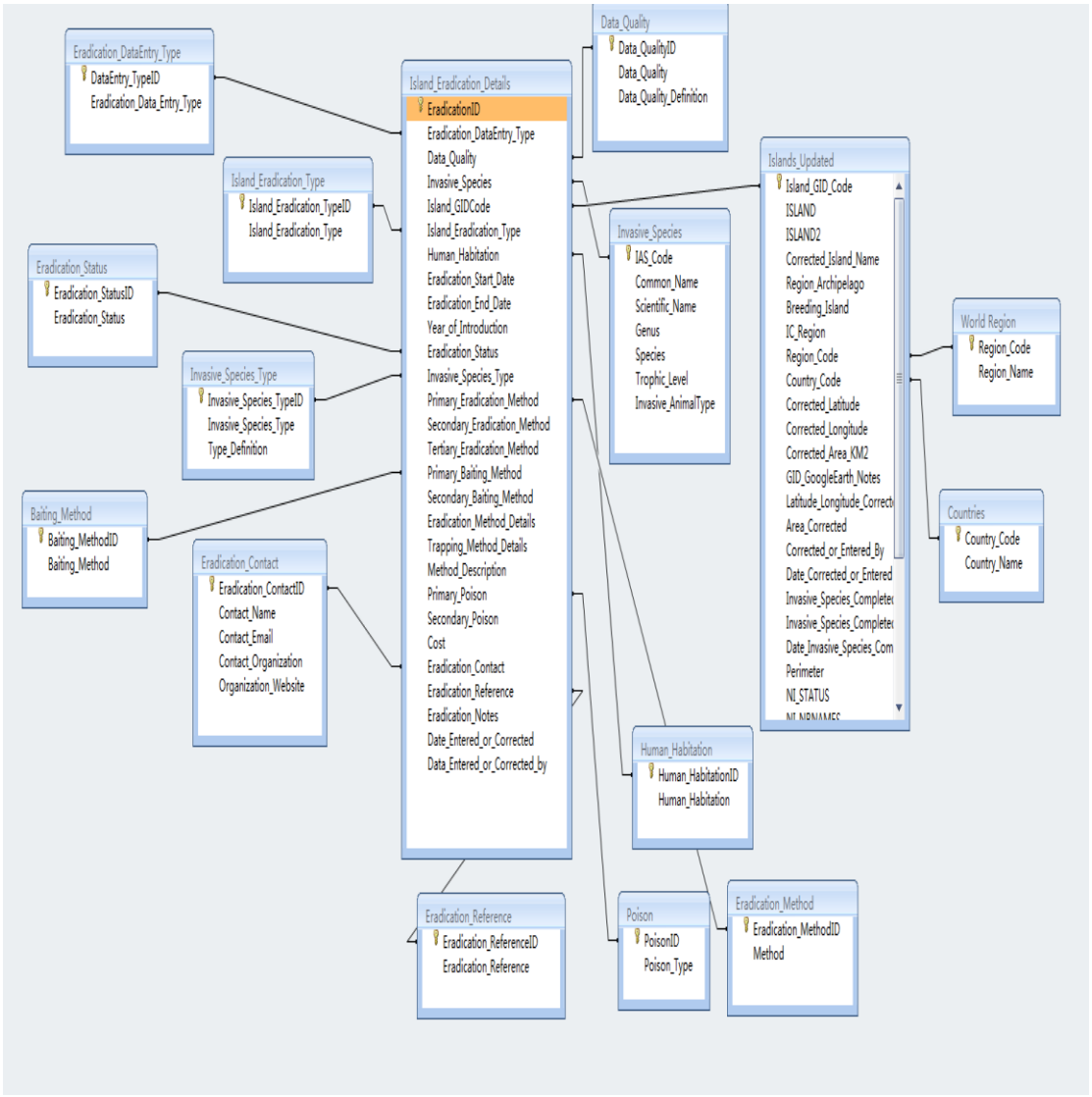


Figure 11 the structure of the finial ISSG MSSQL database.

From the Figure 12 we can see the database is build by two major tables: Islands Eradication Details and Islands Updates. All of other tables are the child tables to these two tables. All of the tables have their own primary key. However the only unique key for the entire database is the eradication id from the Islands Eradication Details. This means no matter what kind of inputs that users decide to use, the SQL searches have to be related back to the Islands Eradication Details tables and then find out the related eradication id. In order to get the correct eradication id from the Islands Eradication Details, the SQL select query needs to be carefully designed. More details about the SQL query will be explained in the DAL section

8.2 Data Access Layer (DAL) Implementation

Data Access Layer has been widely used as the object data source for this project, the actual webpage will not contain any SQL queries. All the SQL queries will be store as a fill function from

the table adapter. For example, to display general information of an eradication record after users have input the searching values will require a table adapter from the DAL. The table adapter for selecting general information is shown in the figure 12.

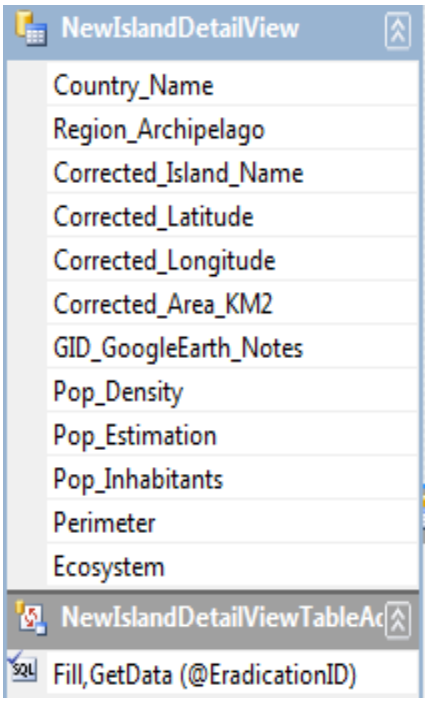


Figure 12 the table adapter for selecting general information

From the figure 12 we can see, the table adapter will select 12 different attributes based on the value of eradication id. The SQL language of selecting these attributes is shown below:

```
SELECT      Countries.Country_Name, Islands_Updated.Region_Archipelago,
Islands_Updated.Corrected_Island_Name, Islands_Updated.Corrected_Latitude,
                  Islands_Updated.Corrected_Longitude, Islands_Updated.Corrected_Area_KM2,
Islands_Updated.GID_GoogleEarth_Notes, Islands_Updated.Pop_Density,
                  Islands_Updated.Pop_Estimation, Islands_Updated.Pop_Inhabitants, Islands_Updated.Perimeter,
Islands_Updated.Ecosystem
FROM        Islands_Updated INNER JOIN
                  Countries ON Islands_Updated.Country_Code = Countries.Country_Code RIGHT OUTER JOIN
                  Island_Eradication_Details ON Islands_Updated.Island_GID_Code =
Island_Eradication_Details.Island_GIDCode
WHERE      (Island_Eradication_Details.EradicationID = @EradicationID)
```

From the SQL query we can see all tables have been outer join to the island eradication detail table as they are all the child tables to the island eradication detail table. They have a relationship of one to many. The @Eradication means the Eradication ID will be an external parameter control from another source in the webpage. It will be most likely comes from another table adapter that use user inputs to select the related eradication id. The final details view that shows all general information about specific invasive specie eradication is shown below in figure 13.

General Information	
Year of Introduction	No Data Available.
Cost	No Data Available.
Data Updated in	2011/8/3 0:00:00
Quality of the data	Unknown
Quality Definition	Unknown Data quality
Eradication Data Entry Type	New Eradication Entry
Human Habitation	No Data Available.
Data Modified By	Kelly
Data Modified By1	Newton
Affiliation	UC Santa Cruz

Figure 13 the general information Details view that use table adapter from DAL as object sources.

After a few meeting with Mrs Shyama who is the industry advisor form ISSG, we found out this online searchable database webpage rarely have any kind of business roles. Also it does contain and required a user login or any kind of user level control. Therefore we decide to not implement the Business Logic Layer at all and link the webpage directly to the Data Access Layer. In total, there are 23 different table adapters in the DAL layer. Most of them are used as object data source for details view and list views. The figure 14 shows all table adapters in DAL

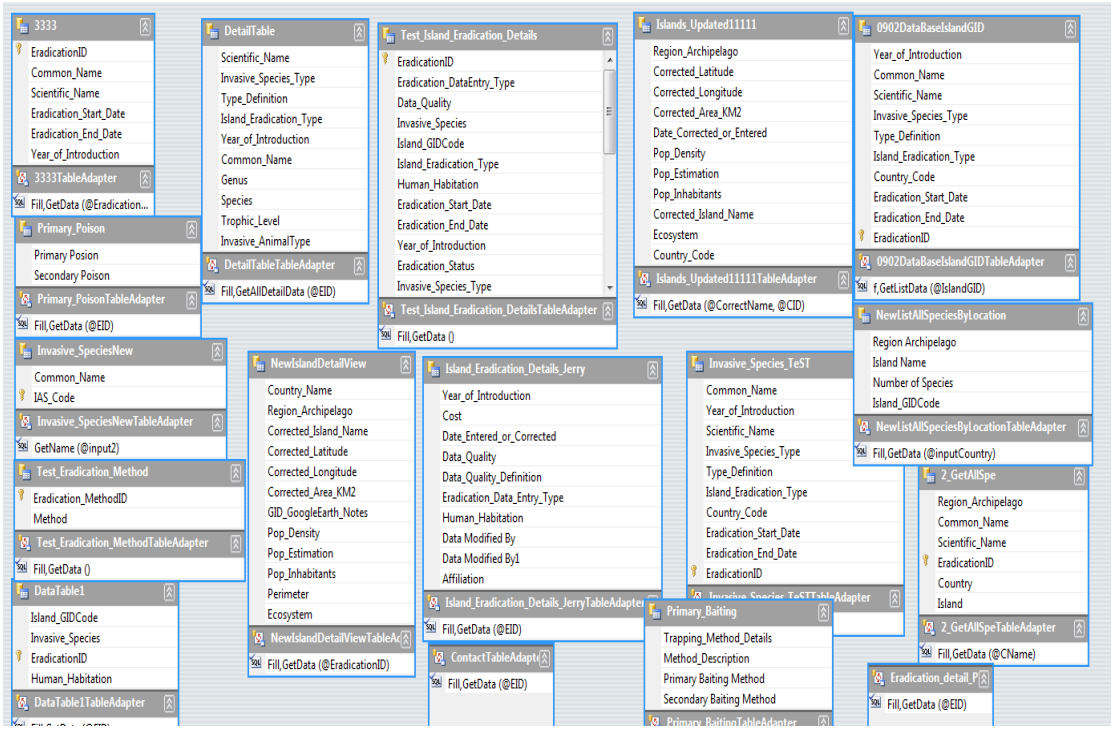


Figure 14 all table adapters in DAL

8.3 Webpage Implementation

8.3.1 Version 1 of the webpage

The first version of the webpage is implemented based on my previous design, the figure 15 below shows the first look when a user enter the search by location website. From the figure 15 we can see, the user have to select a country first to continue the search. After they have selected a country, a list of island from that country will be displayed in a dropdown list. The user will be able to select an island from it.

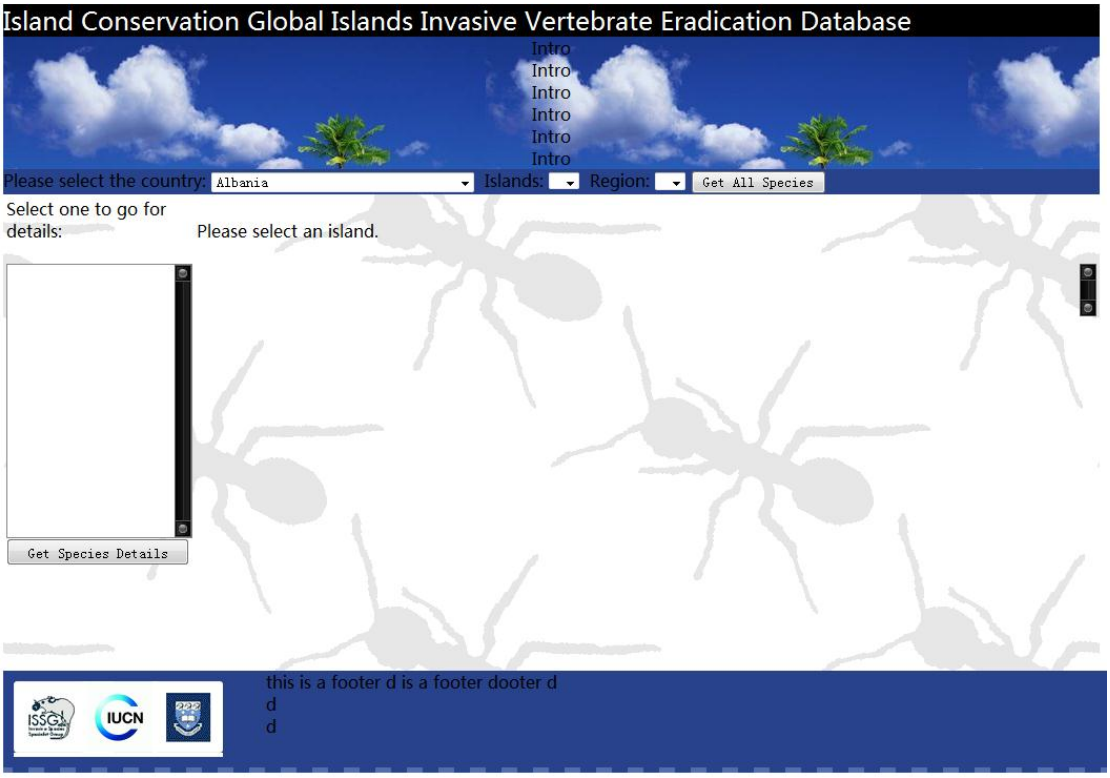


Figure 15 the first look of the webpage version1

From the databases SQL tests, I found out by only list out all island names for a specific country is not enough to identify a unique Island GID from the Island update table. There will be cases where multiple islands with the same name all belong to the same country. For example, New Zealand has two islands both named as Stewart, but they are different island from different region. In order to separate the islands with the same name, I decided to add the island region dropdown list to separate the island region. A complete flow diagram that shows how the webpage use the user input to display a list of species is shown in figure 16.

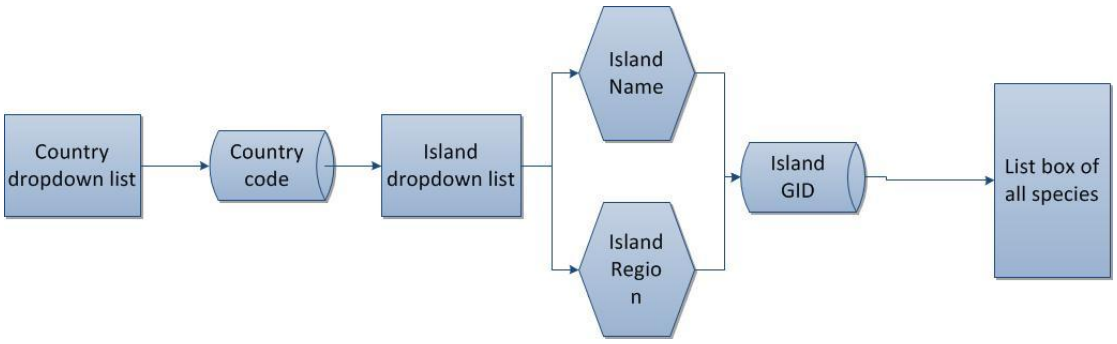


Figure 16 the flow diagram for user input.

After the user has click the “Get All Species” button, the text label for the introduction at the top will be replaced by a grid view that shows all information about the island the user has selected. Also the list box from on the left hand side of the webpage will display all species based on the selected island. All these functions are achieved by data bind and visibility attributes shown in figure 17. An example of the webpage has been shown in the figure 18, where the country is New Zealand, island name is Auckland, and Region is Auckland Islands.

```
protected void Button1_Click(object sender, EventArgs e)
{
    ListView1.DataBind();
    Label4.Visible = false;
    Label5.Visible = true;
    GridView2.Visible = false;
```

Figure 17 the background code for “Get All Species”.

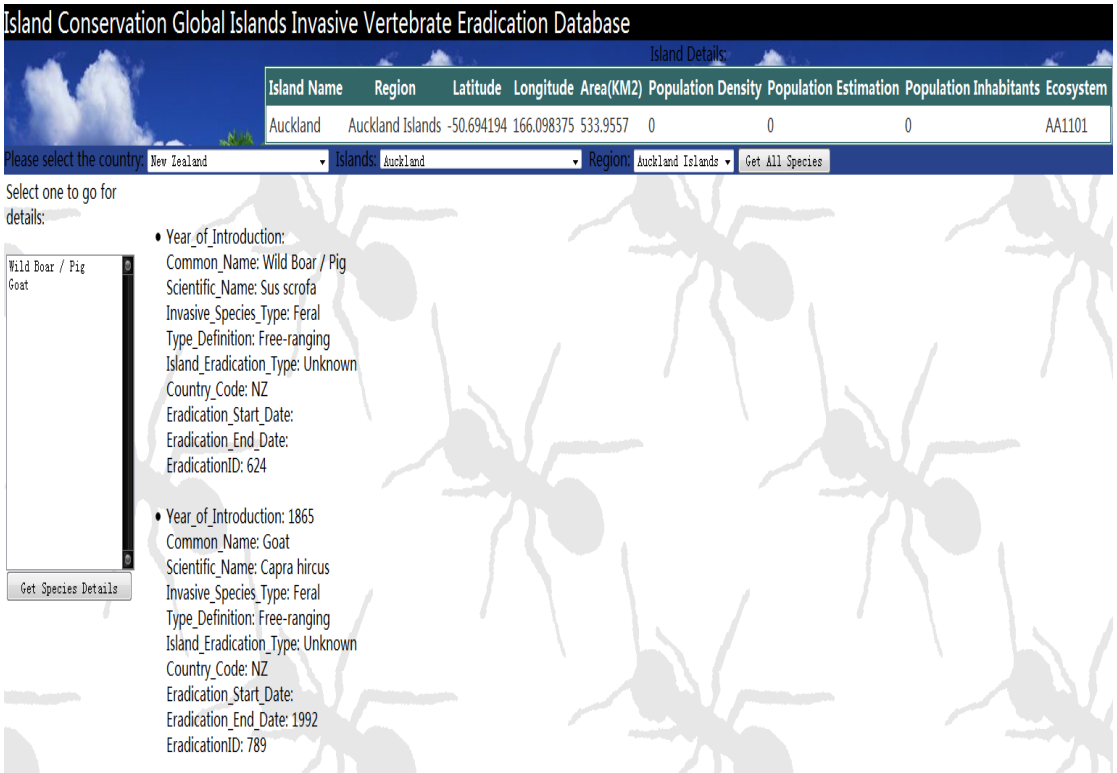


Figure 18 the example page that for Auckland with two species.

The list view at the centre of the webpage is a list of species that available for the selected island. As invasive specie will have two eradication records for different eradication time even if they are from the same island. Therefore at this stage, the user will be able to select from the list box and then click the “Get Species Details” button to go for the further information about the selected invasive species. The list view will be replaced by several details view after the button has been clicked shown in the figure 19. The figure 20 below is an example after the user selects the goat specie from the list box and clicks the “Get Species Detail” button.

```
protected void Button1_Click1(object sender, EventArgs e)
{
    ListView1.Visible = false;
    DetailsView2.DataBind();
    DetailsView3.DataBind();
    LinkButton1.Visible = true;
    LinkButton2.Visible = true;
    LinkButton4.Visible = true;
    LinkButton5.Visible = true;
    LinkButton6.Visible = true;
    Image1.Visible = true;
    Image2.Visible = true;
    Image3.Visible = true;
    Image4.Visible = true;
    Image5.Visible = true;
    Label8.Visible = true;
    Label9.Visible = true;
    Label10.Visible = true;
    Label11.Visible = true;
    Label12.Visible = true;
}
```

Figure 19 background codes for “Get All Species” button

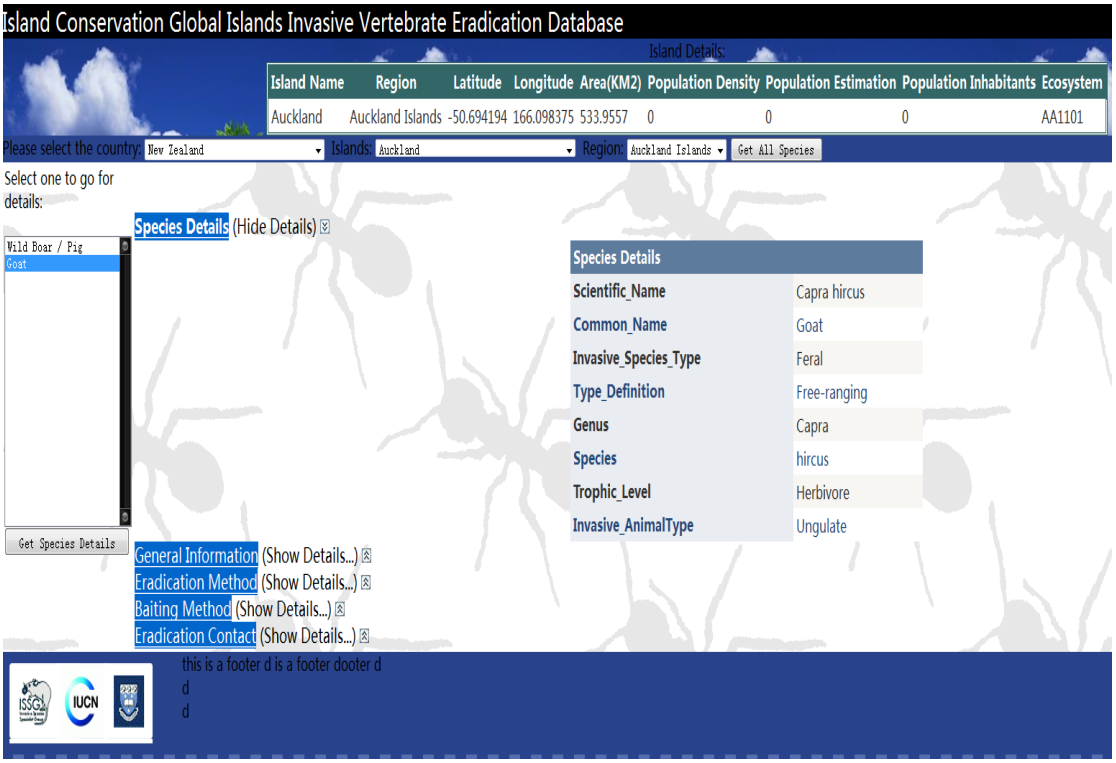


Figure 19 the detail views that for goal from Auckland. User can select display different categories by select the header.

8.3.2 Problems and Concerns for Version1

Version 1 is the first version of the webpage that perform the two basic search functions. It solved most of the problem of how to select a unique eradication id from the database. However it still has many usability problems and concerns:

- This webpage obviously contains way too many dropdown lists and list boxes. It is quite hard for the new users to know what exactly they need to do without any instructions. This decreased the efficiency of the webpage as well as the attraction of the webpage.
- Users can be confused after they click “Get all species” button form the list view, as the same species will display twice in the list box just because the eradication time is different. There is no other information to guide the user to select the correct eradication record.
- Search by location and search by name are made in two separate web pages. It is easier for the developer to manage the code, but it may be harder for the end user to find the other search function. A better solution can be using a tab or external links.
- The layout of the webpage doesn’t fit to the new official ISSG website. The new ISSG website changed the style of the webpage. The ISSG database website should follows the changes.
- One important function is missing, the export function. Most of the users want to export their searching results to csv, excel or word documents for further implementations. The webpage have to supply the related export functions. The new ISSG website is shown in figure 20.
- Some basic statistical figures need to be displayed to the webpage, such as number of species for an island or the quality of the data.

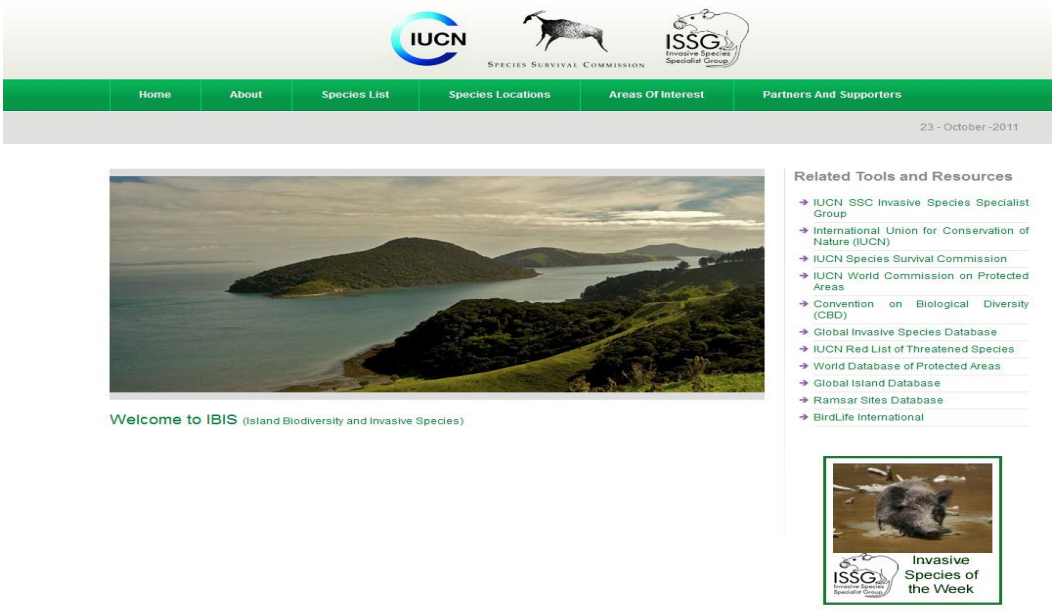


Figure 20 the new ISSG webpage (not published yet) http://ibis.fos.auckland.ac.nz/

8.3.3 Version2 of the Webpage

After a few meeting with Mrs.Shyama the industry advisor from ISSG, we decide to make a new version of the ISSG database website based on the previous version. Fortunately the ISSG will be able to provide me the license for Telerik tool kit, therefore in the new version. The Telerik tool kit will be implemented and play a big role. For further information of Telerik tool kit such as license and usages, please log in to the official website: www.**telerik**.com for details.

The biggest change for the version 2 is I decide to implement a Telerik Radgrid View instead of the list box and list views. The three level hierarchies Radgrid view has dramatically improve the efficiency and usability of the webpage. From the figure 21 we can see, the new webpage contain less dropdown lists that users have to select at the start for search by location. This is way easier for the user to start the search without any instructions. Also the search by location and search by name have been combined to one page by using tab view. This will be easier for the user to switch between theses two kinds of searches any time they want. For the search by location, two dropdown lists: world region and country have been kept in order to reduce the loading time from the database. These two dropdown lists will be acted as control filters that avoid load all data from the database. Therefore reduce the overall response time and increase the efficiency of the webpage.

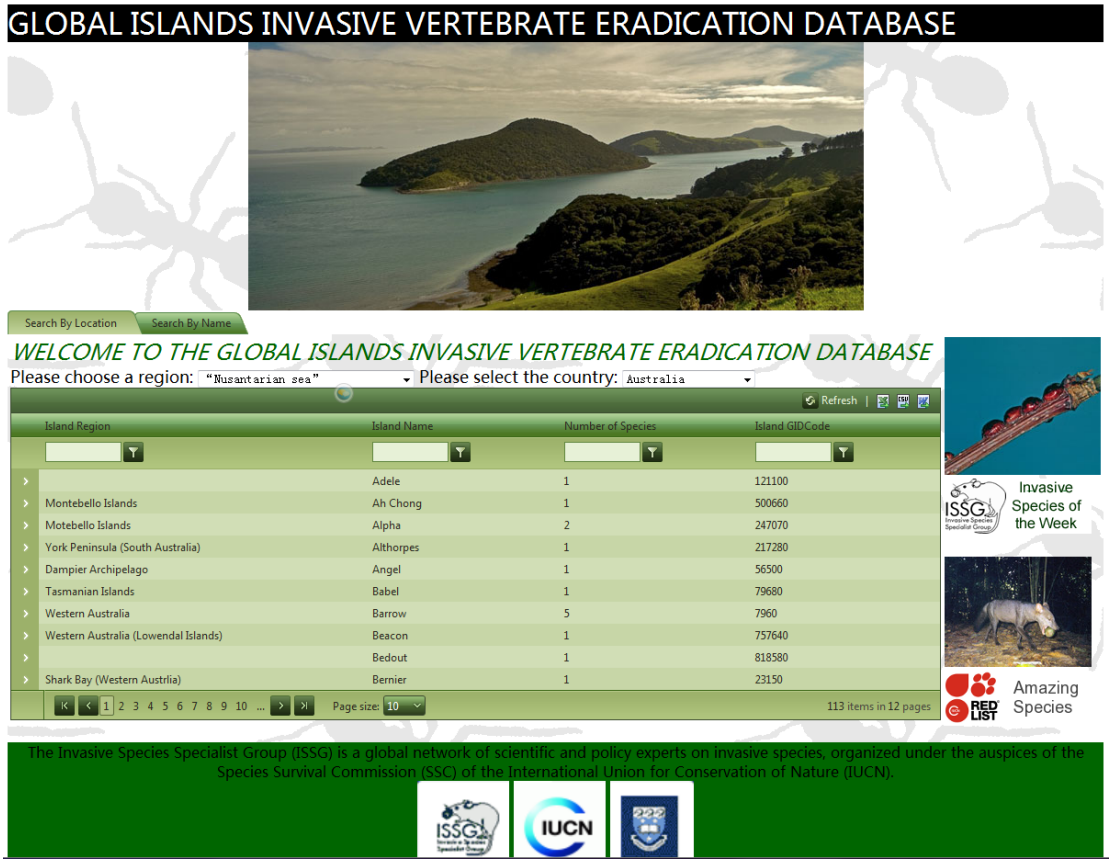


Figure 21 the new search by location.

Figure 22 first level of the Radgrid View with filter option.

From the figure 22 above us can see. After the user has select a world region and country from the dropdown list, the first level of the hierarchy Radgrid View will shows up. At the first level of the hierarchy, the user will be able to see a list of island based on the country they have selected. The lists will cover important information such as: island region, island name, number of species (this is not attributes directly load from the database) and island Gid code. Of course the list will only contain the islands that have at least one invasive species, as some of the islands from the database have none. At the top of the Radgrid View, the user will be able to select a way to filter the list, such as: contain, not contain, greater, lesser or equals to. After the user find the related island they want, they can click an island from the first level of the Radgrid View to go for further information, the level two of the Radgrid View. One thing I have to declare for the level one of the Radgrid View before we go to the next level. You may wonder why we need the island GID code to be shown to the users, it makes no sense. The answer is simple; we need this attribute to be the parent attribute for our next level of Radgrid View. The code of passing the Island GID code for the next level is shown in the figure 23.

```
<mastertableview allowmulticolumnsorting="true" autogeneratecolumns="False"
    commanditemdisplay="Top" datakeynames="Island_GIDCode" datasourceid="list1">
```

```
<parenttablerelation>
  <telerik:GridRelationFields DetailKeyField="Island_GIDCode"
      MasterKeyField="Island_GIDCode" />
</parenttablerelation>
```

Figure 23 the code of declare parent table relationships.

The second level of the Radgrid View is design to show the list of species based on the parent Island GID code. It contains attributes such as: Eradication id, Common Name, Scientific Name, Eradication Start Date and Eradication End Date. At the second level of the Radgrid view, all species that have at least one eradication record will be displayed to the user.

This level is mainly used solve the problem for eradication time. As mentioned early, the eradication record can have no data for eradication start & end date (not keys), but an identical specie will have two separate eradication records based on the time period. Therefore it is not a good idea to let user manually input it. The best and only solution is list out all possible selections and let the user select what they want.

For example in the figure 24 we can see, the island Barrow from Australia contains four different eradication record for the House Mouse invasive species. The only different between these records are the eradication end date. After use has decided to go for further information about one specific eradication record, they can click on the eradication id and go to the third level of the Radgrid view. Just like the previous level, the eradication id will be past as a parent key attribute to the next level of Radgrid view.

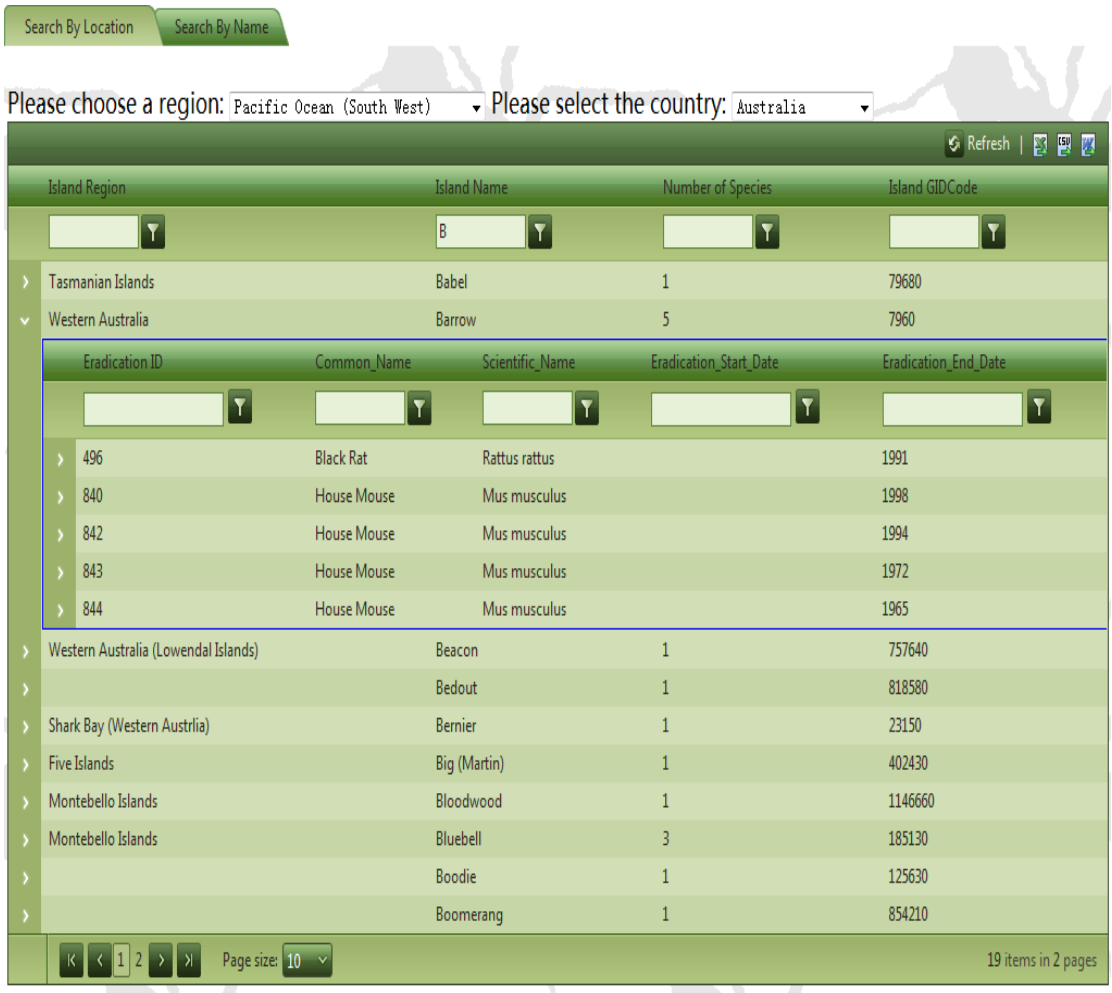


Figure 24 the second level of the Radgrid view for island Barrow.

The third level of the Radgrid view contains several different details view such as: General Information, Island Information, Species Information, Eradication Details and Baiting Details. The details view is managed by a multi-tab control based on their category. In this level, one important change is: only the information that is not null (empty) from the related database table will be displayed. This is handled by evaluation the data entry type as a Boolean value before showing the data, and then set the visibility attribute equals to this Boolean value. An example of the code for the row “Year of Introduction” is shown below in the figure 25.

```
<asp:BoundField DataField="Year_of_Introduction"
    HeaderText="Year of Introduction" NullDisplayText="No Data Available." SortExpression="Year_of_Introduction" Visible="false" />

<asp:TemplateField >
    <HeaderTemplate> <asp:Label ID="Label1" runat="server" Text="Year of introduction"  Visible='<%#Eval("Year_of_Introduction")!=DBNull.Value%>'></asp:Label>
     </HeaderTemplate>
      <EditItemTemplate>
         <asp:TextBox ID="TextBox1" runat="server" Text='<%# Bind("Year_of_Introduction") %>'></asp:TextBox>
      </EditItemTemplate>
      <InsertItemTemplate>
         <asp:TextBox ID="TextBox1" runat="server" Text='<%# Bind("Year_of_Introduction") %>'></asp:TextBox>
      </InsertItemTemplate>
      <ItemTemplate>
         <asp:Label ID="Label1" runat="server" Text='<%# Bind("Year_of_Introduction") %>'   Visible='<%#Eval("Year_of_Introduction")!=DBNull.Value%>'></asp:Label>
      </ItemTemplate>
    </asp:TemplateField>
```

Figure 25 Background of for only display the non null values.

The final view of the third level of the Radgrid view for eradication details is shown in the figure 26.

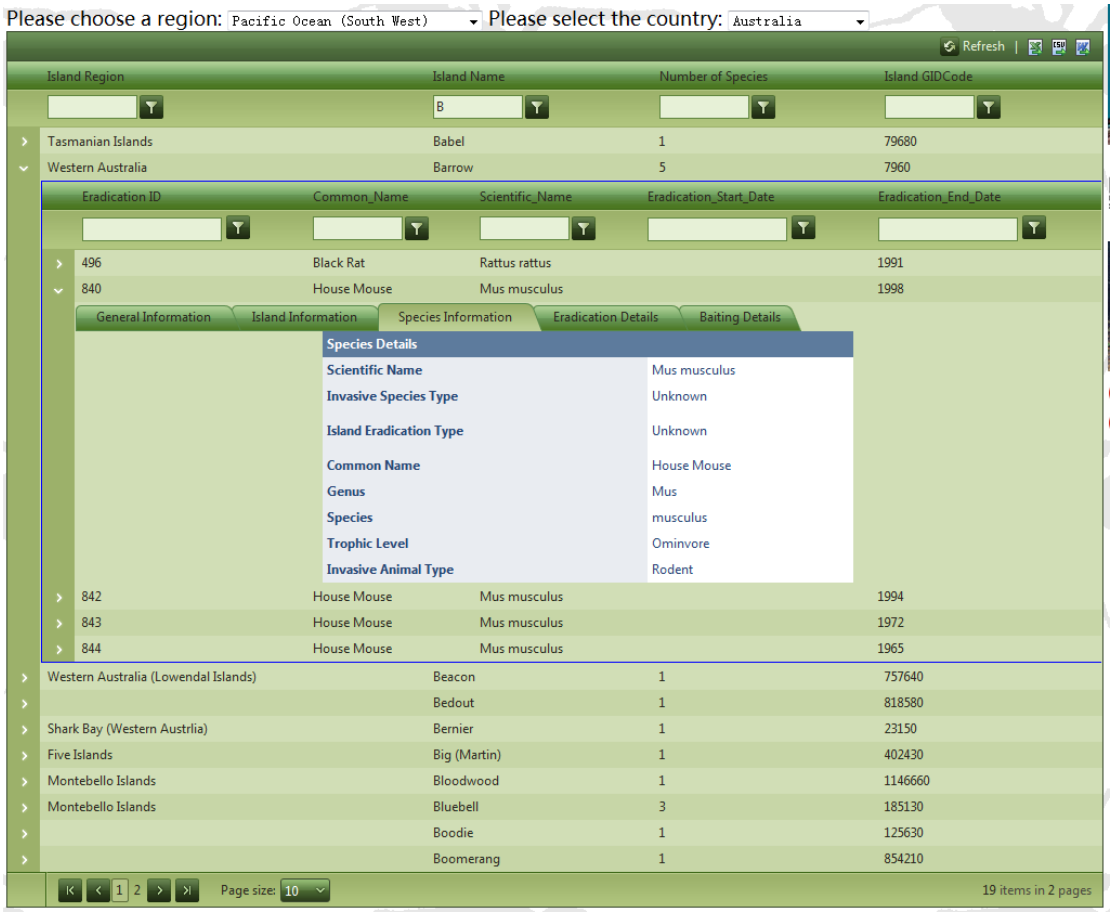


Figure 26 the detail views

An important extra feature for the new ISSG database website is the users are allowed to export and download their searching results to three different platforms: csv, excel and word documents. The steps are very simple; the user needs to click one button at the top right side of the Radgrid View shown in figure 27. The export functions for each platform is a build in feature from the Telerik tool kit. An example of the export result in Microsoft word is shown in figure 28.

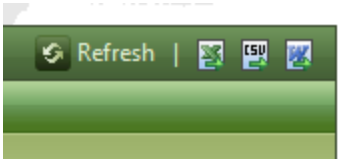


Figure 27 the three export functions.

Figure 28 the export result in Microsoft word

8.3.3 Pros and Cons for the version2

The new version of the webpage has many advantages compare to the previous version:

- First of all, it provides us a better structure for the entire page. It combined the two search functions together. This is easier for the user to switch between the two search function without going to another webpage.

- Secondly, the new layout fit to the new ISSG website well. The major colour for the new webpage has been changed from blue to green. Also two image links: species of the weak & amazing species.com has been added to the webpage to provide extra information.

- Thirdly and most importantly, the Telerik Radgrid view has dramatically increased the efficiency and usability of the searching. It is always easier for the user to search from the database with Radgrid view compare to dropdown lists and list views.

- Fourthly, the webpage provide multiple search filters for the Radgrid view. The search filters can makes the process of finding the correct record faster and become more flexibility to the end users.

- Fifthly, the details view in the third level of Radgrid views will only shows the data that are not null(empty). This will avoid some confusing cases, where only the header of the information is shown, but the rows contain no data.

- Lastly, the webpage provide three export functions to export their searching results to three different platforms. These will enable users to use the database results as references or sources for their own work.

Despite the exciting new features and other advantages for the version2, there is still one major concern for the new webpage: loading time. The loading time for the version2 is slightly increased compare to version1. This is caused by loading all data to the Radgrid without enough filter controls. At the moment, it might not affect the overall performance as the size of database is still relatively small. However as the size of database increase, it may become a big problem.

8.3 Testing & Deployment

Both database and website has been host within the Auckland University service for testing purpose. Therefore the database and website will be temporary only accessible within the Auckland University. The connection string for the database is: studdb-mssql08.sfac.auckland.ac.nz. The table for performance tests is shown in the table below:

	On Laptop (seconds)	On Service(seconds)
Search By Location(Version1)	1.5	2.0
Search By Name(Version1)	1	1.5
Search By Location(Version2)	1.5	2.5-3.0
Search By Name(Version2)	1	2.0

From the performance test result table we can see the response time for the webpage on the service is longer than the response time on my own laptop. This is majorly caused by internet speed and the connection between webpage and database. Also the response time for version 2 is longer than the version1, especially for the search by location function. As mentioned early, this is majorly caused by loading all islands information from a specific country without any further control. Where the version 1 directly loads a list of species based on a selected island. If the size of island will increase to a large number in the future, I may concern to add an extra dropdown list to let the user to select the island name first before they load the data to the Radgrid view.

Overall, all functions for the webpage is doing fine and the response time for loading the database is still within a reasonable range. We are all quite satisfied with this final result.

9 Progress Log

4th March 2011: Get the project from Dr S.Manoharan. Build a bird view of ISSG through their official website.

9th March 2011: Kick-off meeting with Mrs. Shyama. Mrs. Shyama provided a brief introduction about ISSG. Also we have a look about the existed web-page and database. We have discussed some possible layout and functions about the future website.

15th March 2011: Angela has sent me an email about how the project should work. After a few discussions with her, we decided to transfer the existed MySQL database to MSSQL database and use Asp.net to construct the webpage.

21st March 2011:Mrs. Shyama has sent me the existed MySQL database issg_mssql_export. I have loaded this database to my local service and looks through the details about this database.

2nd April 2011: A second copy of MySQL database has been created for testing purpose. The existed database is being uploaded to the university database service.

8th April 2011: All bugs from the existed database are being fixed. Start to convert the MySQL database to MSSQL database by using third party application: MySQL to MSSQL v4.3.

14th April 2011

Another meeting with Angela to confirm the web page layout and designs. SQL data structures for all tables as a virtual map is created for analyze purpose.

21st April 2011: Research paper for how to build user friendly web page is collected from the university library and internet. A paper design of how the web page will looks like is been created.

3rd May 2011: Introduction presentation is done in Tamaki Campus. A presentation can be found in the related works web page.

27th May 2011: Another meeting with Mrs.Shyama. During the meeting, we have discussed the structure and content of the new database. We have also confirmed that we are going to use MSSQL. At the end, we request a new SQL file as the previous SQL database have empty data for some important tables such as (eradication).

30th May 2011: A excel file rather than SQL file has been received from Mrs.Shyama. The excel file contains most of the data for the eradication table. We have to input these data manually by ourselves.

4th June 2011: The main table (eradication) has been restructured to with actual data.

5th June 2011: A prototype of DAL has been created. All interfaces for the websites has been designed on paper.

20th June 2011: A new database form Microsoft Access has replaced the previous MySQL database.

27th June 2011: The structure of the new database has been refined with two extra tables: world region and country.

1st August 2011: DAL for select island and species is done.

3rd August 2011: All DAL for the version1 of the webpage is done.

7th August 2011: An incomplete version for testing purpose is done. This page will only select the related island based the user input.

Exam & Holiday

30th August 2011: DALs have been reconstructed with the correct outer join instead of inner join. The previous inner join will crashed in some rare cases.

5th September 2011: The search by location is done for version1.

7th September 2011: The search by name is done for vesrion1.

8th September 2011: Background image and buttons have been added to the version1, a copy version of the webpage has been emailed to Mrs.Shyama.

16th September 2011: the database has been updated with more eradication records and islands. Also some unnecessary tables have been deleted.

26th September 2011: A meeting with Mrs.Shyama. During the meeting we decide to implement Telerik Control Kit to the project and make a new version of the webpage.

28th September 2011: A Telerik Radgrid View has been added to the webpage.

1st October 2011: The first two level of the Radgrid View has been completed for both search by location and search by Name.

5th October 2011: The third level of the Radgrid view has been completed; search by location and search by name have been merged to one webpage by using tab view.

6th October 2011: The layout of the new webpage has been completed with new images and

links.

17th October 2011: Null data will not display in the details view any more. Also the presentation has been made.

20th October 2011: Final presentation has been made.

21st October 2011: Webpage and database has been uploaded to the services, performance tests have been completed.

24th October 2011: Final report is done and host to the main page.

10 Conclusion & Future Development

For this project, the first semester is mainly about designing and planning. During the first semester, I have done lots of researches about ASP.NET and DAL. These researches will helps me to build the project more efficiently. As most of the work for designing and planning is already done in the first semester, the second semester is majorly focused on implementation. They are several goals that I have achieved for the second semester:

1. Reconstruct the structure of the database
2. Fully implement the Data Access Layer for the ISSG database.
3. Implement all websites interface with contents and links.
4. Finish the two search functions.
5. Add Telerik tool kit to the project
6. Add filter control to the website.
7. Add export functions to the website.
8. Test and publish the website.

For the ISSG, unfortunately I haven't implemented any data analysis tools as the time is running short. If I have more time on it, I will definitely try to implement some analyze tool based on the data I got. The analyze tool will help user to identify related species and successful hunting method. As the user only concentrate on the website that is displayed to them, I may spend more time on improve the usability of each web site as well.

Overall I am extremely satisfied with this project. As this project is my first real-world project, I have learned a lot from it. I have gain huge amount of experiences of how to communicate between users and developers. It also helps me to understand how to transfer the user requirements to a real product. It has been a great year of learning how to use MSSQL database and Asp.net for me. Hopefully I can keep this kind of right attitude and keep learning in the future.

11.Acknowledgements

I would like to thanks to my Academic Mentor Dr S. Manoharan for providing me the opportunity to learn from this project. Dr S. Manoharan has also provided me lots of information and advices which will be very useful in my future study.

And I would like to thanks my Supervisor Angela Chan. Her advices on Visual Studio and database access layer are extremely important for helping me on the ISSG website.

12 References

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