Interactive Mapping System for *Monachus schauinslandi* (Hawaiian monk seal) Sightings Data

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Introduction

In 1976 the Hawaiian monk seal was listed as an endangered species under the Endangered Species Act and designated as "depleted" under the Marine Mammal Protection Act. Therefore, the Protected Species Division in Honolulu is required to prohibit any forms of "take" by managing and monitoring the species. Currently, the population is at its lowest level in recorded history estimated to be approximately 1,100 to 1,200 seals. Although the majority of individuals are located in the Northwest Hawaiian Islands (NWHI) within the Papahānaumokuākea Marine National Monument there is a small subpopulation of unknown size in the main Hawaiian Islands (MHI). Because the total number is unknown, we use the number of individually identified seals, approximately 100 individuals as a minimum population estimate for this region. Threats presented to monk seals in the NWHI include lack of food, entanglement in marine debris, shark predation, and male aggression, all contributing to the total population decline. In contrast, the MHI population appears to be increasing in recent years despite additional threats such as human disturbance, infectious disease, fisheries interactions, and habitat loss in the MHI. The MHI population increase may potentially lead to more human/monk seal interactions, resulting in more disturbance and need for management and outreach. There is thus a critical need to geo reference the existing sightings data and create a mapping system to display the data in way that will increase our understanding of monk seal haul out patterns and areas of importance in the MHI, ultimately informing management decisions affecting this endangered species.

Methods

1. Completed transcribing, organizing, entering, and standardizing the appropriate sightings data into the Access Database. This required the use of the handwritten monk seal sightings forms and the database developed to correspond (Figure2).
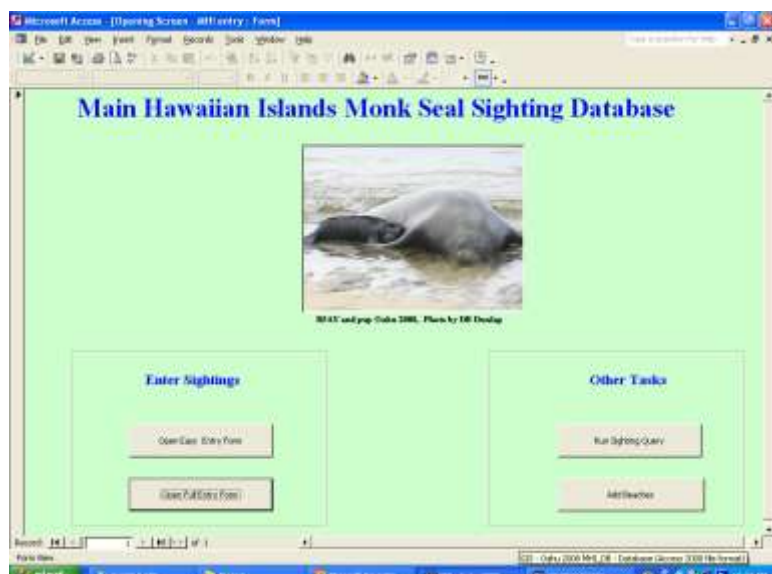

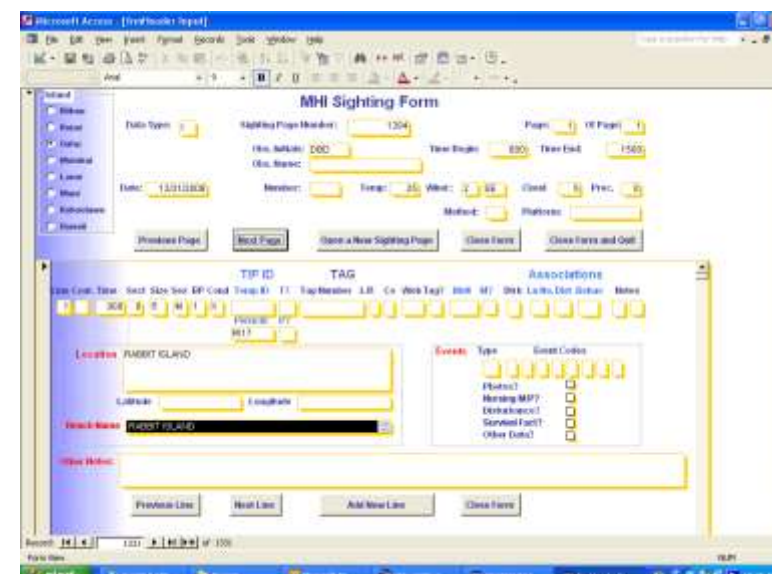Figure 1. Main Page of the Access Database for Oahu 2008.

Figure 2. Full Entry Form that corresponds to the sightings forms.

2. Updated and associated the Beach List to the proper GPS coordinates. This required the help of Tracy Wurth to identify local names of places with locations using Google Earth (Figure 3).
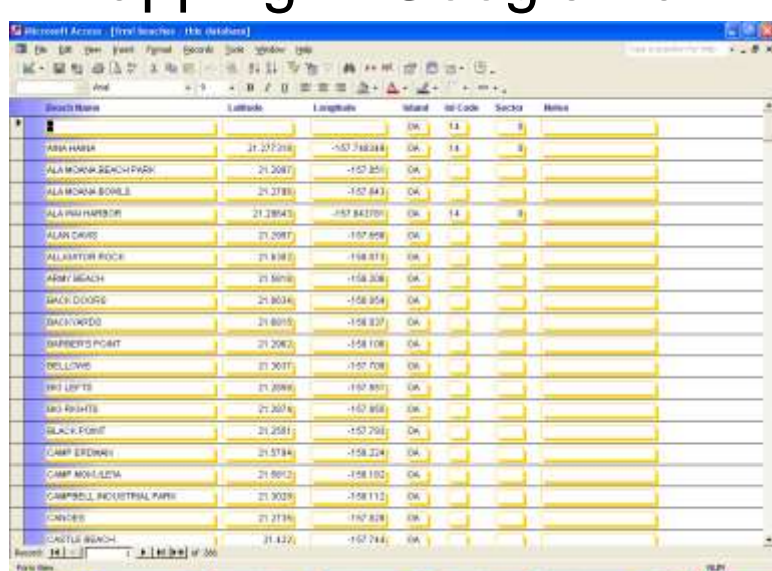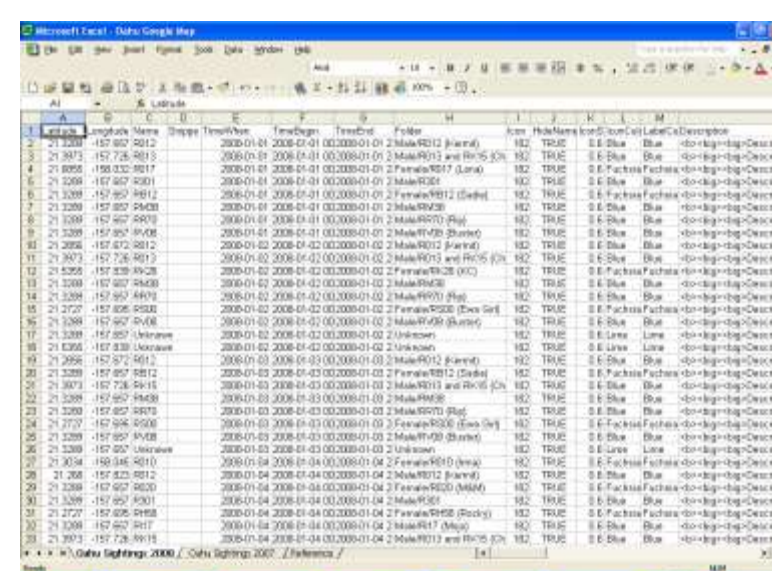
3. Exported the Access Database Sighting Query to a Microsoft Excel 97-2002 format for easier copying and pasting into an Excel spreadsheet designed for mapping in Google Earth.

Figure 3. Beach List in the Access Database for Oahu 2008.

Figure 4. Excel Spreadsheet designed to be converted into KML.

4. Designed an Excel spreadsheet with the appropriate parameters following the format provided at http://www.earthpoint.us/ExcelToKml.aspx. This required the use of the photo database to design individual seal bios and the internet to convert the spreadsheet into a KML file to be viewed and saved in Google Earth (Figure 4).

5. Designed a template Excel file with step by step instructions, the heading required with all the proper columns, and a sample row of data to go along with written methods. The intentions for this are that anyone who wishes to further develop or expand my map when I leave can do so with little effort.

6. Viewed product in Google Earth to fix issues and create screenshots of trends for simple viewing later.

RA12 (Duke) July 2, 2009

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RH58 (Rocky) June 28, 2009

R020 (M&M) and Pup Day 1 June 26, 2009

Photos courtesy of DB Dunlap, 2009

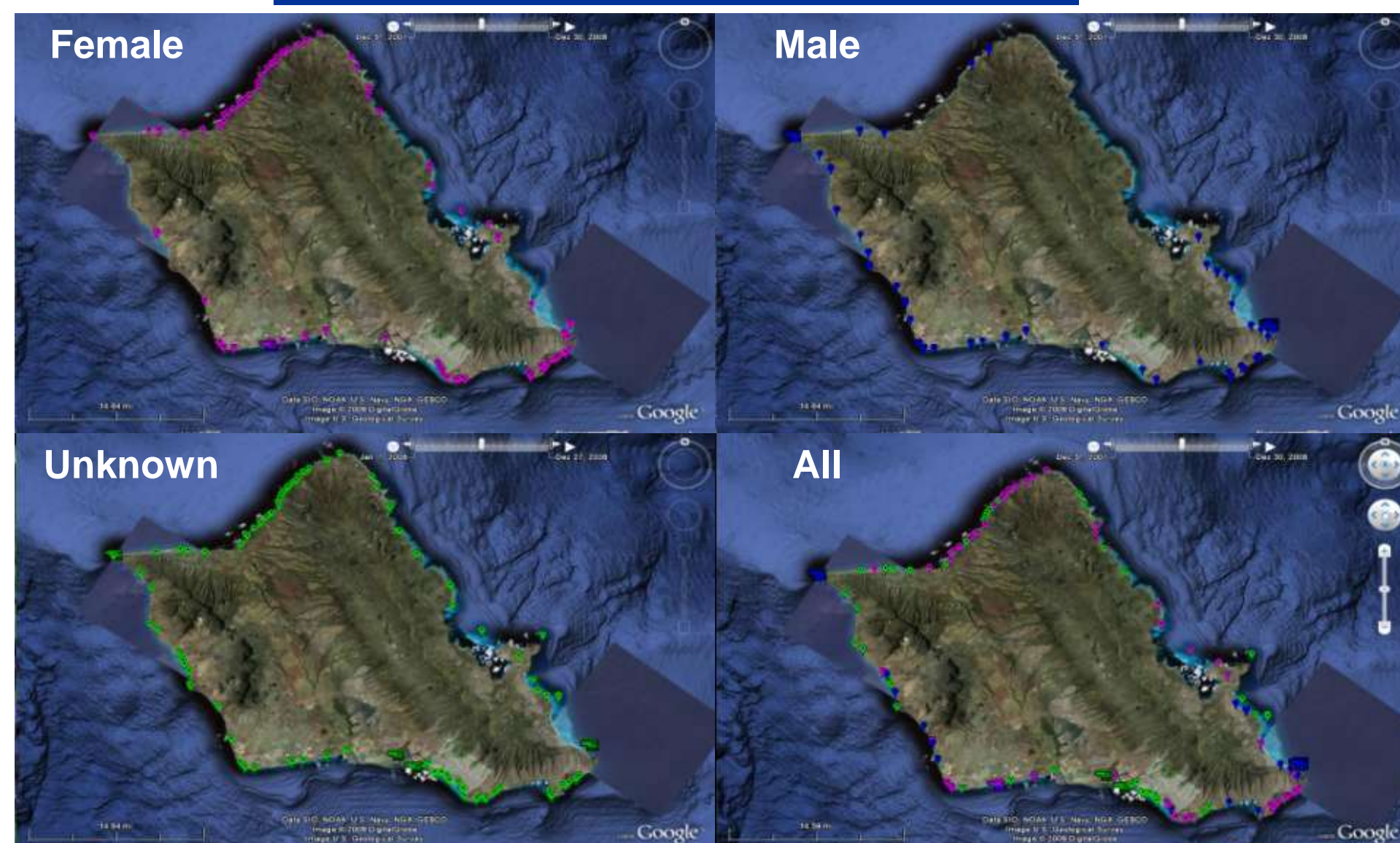## Product/Results

Female   Male   Unknown   All

Figure 5. (above) Screenshots of Google Earth showing the various sex parameters (female, male, unknown, and all) over the entire year of 2008.

Figure 6. (below) Screenshots of Google Earth showing some select individuals who appear to have particular patterns over the entire year of 2008.

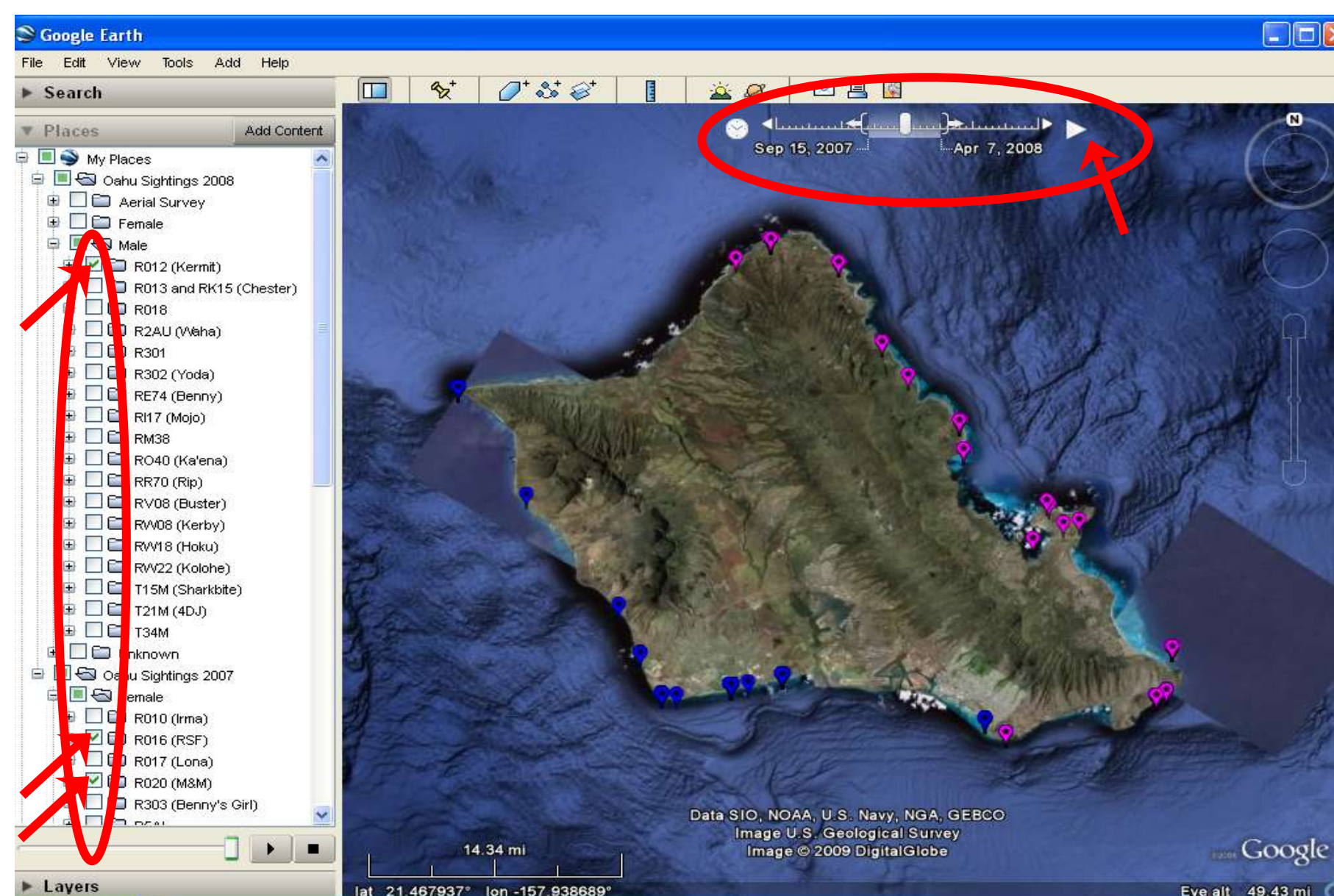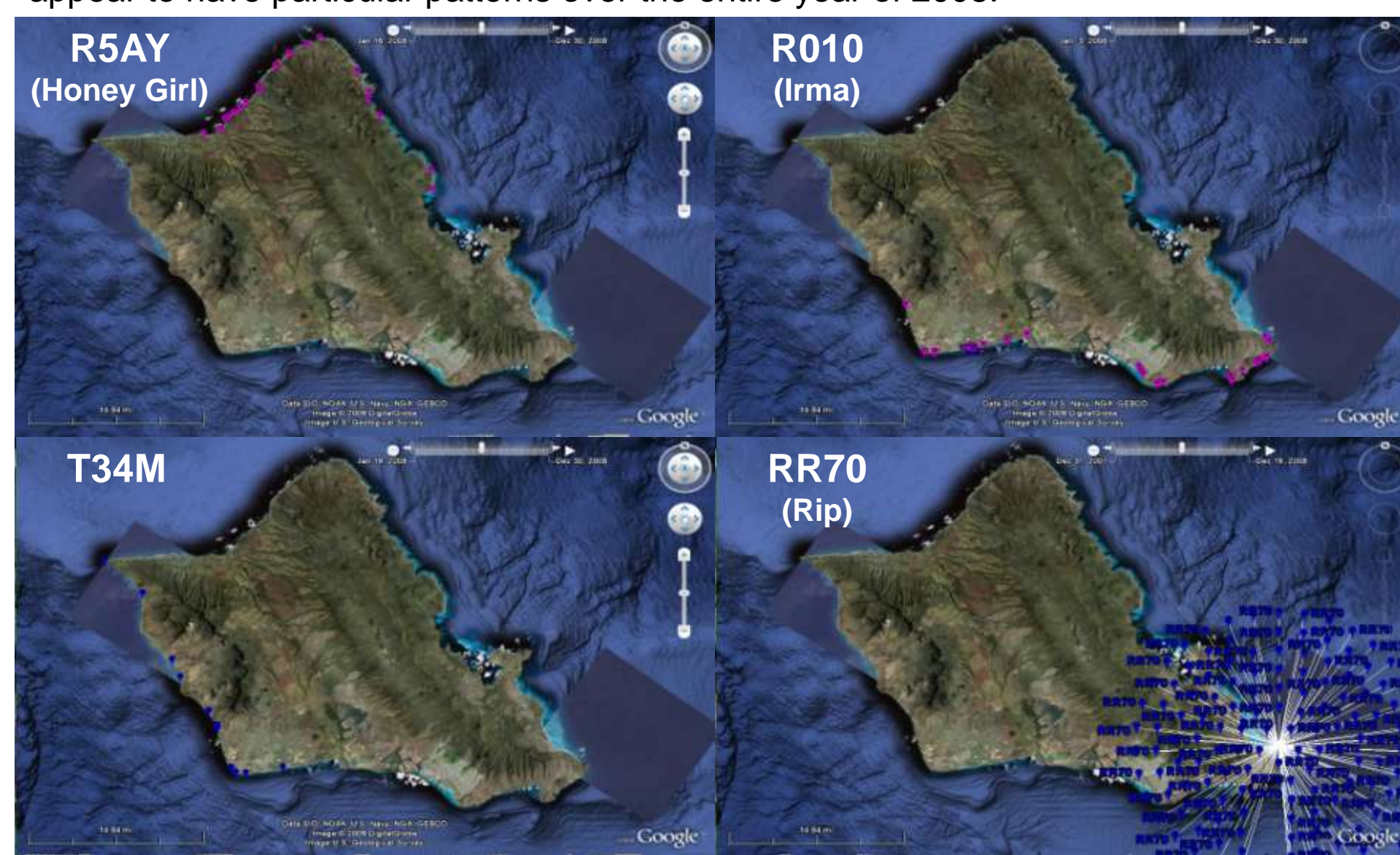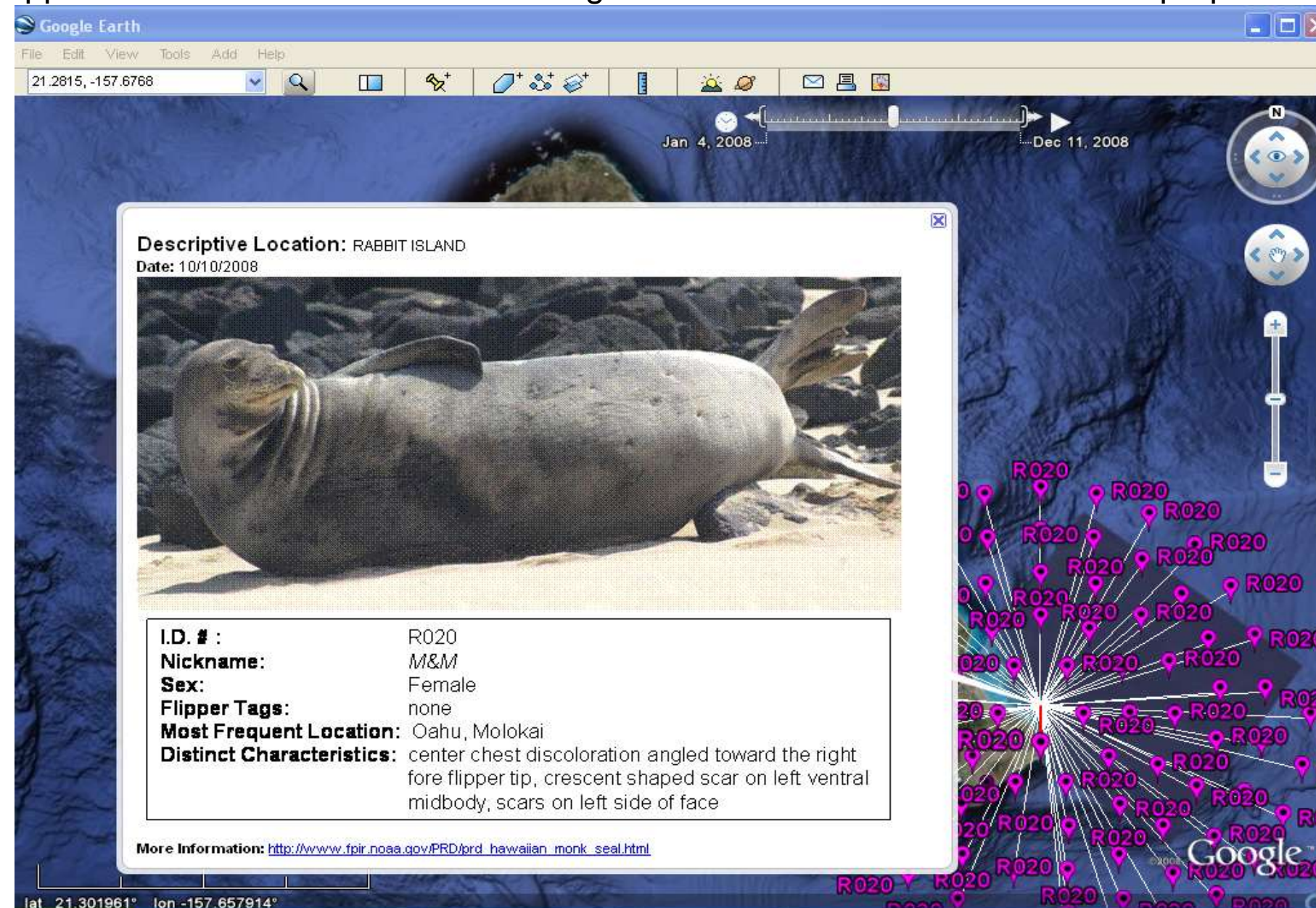R5AY (Honey Girl)   R010 (Irma)   T34M   RR70 (Rip)

Figure 7. (above) Screenshot showing how different parameters are selected and altered within Google Earth. Red arrows on the left show selected individuals and the upper right arrow shows the "Play" function over time.

Figure 8. (below) Screenshot of Google Earth displaying the unique pop up bubble that appears when an icon is clicked. Designed for outreach/further information purposes.

Descriptive Location: RABBIT ISLAND
Date: 10/10/2008

I.D. #: R020
Nickname: M&M
Sex: Female
Flipper Tags: none
Most Frequent Location: Oahu, Molokai
Distinct Characteristics: center chest discoloration angled toward the right fore flipper tip, crescent shaped scar on left ventral midbody, scars on left side of face

More Information: http://www.fpir.noaa.gov/PRD/prd_monk_seal.html

Project Goal

To develop a quick and easy "hands on" way of viewing sightings data with the ability to change one or more variables or parameters to instantly produce the desired map. Intended use is to be able to make quick visual comparisons to identify trends, inform management decisions, and potentially use as a public outreach tool.

Problems

➢ **Sightings Data is Biased**
  ➢ Certain areas are viewed more frequently than others, resulting in a much higher volume of data for those areas and skewing the map.
  ➢ Multiple sightings for the same seal at the same time and place from different people can occur.
  ➢ Even though a seal might not have been seen does not mean it was not there.

➢ **Questionable Accuracy**
  ➢ Inconsistent information: not every person describes or reports the same thing in the same way.
  ➢ Relies on public knowledge, information marked as questionable in the database is not reflected in the maps, thus all points appear confirmed when in fact may not be.

➢ **Time/Play Function**
  ➢ Not every report contains a time.
  ➢ Times are often estimated or rounded.
  ➢ Solution: Each point contains a date, thus when the play function is used, a point indicating a seal sighting will be shown for the 24 hours in one day but that does not mean the seal was necessarily hauled out at that point for the duration of 24 hours, it simply suggests that at some period in time during that day a seal was sighted.

➢ **Satellite Tagging**
  ➢ Sightings data does not have the quality or accuracy of tagging an animal with a tracking device. For this reason sightings information should not be evaluated in the same way as satellite data. It is simply incidental data and its ramifications are limited.

Conclusion

This interactive map enables an easy, visual picture of the data it represents to be shown to scientists, managers, and the general public. It is a "hands on" computer program that can be distributed in one file via the internet for interested individuals to explore. It is a great tool where the realms of education are limitless since it provides links to updated monk seal information and can always be added to, changed, or expanded with little effort. It is also useful to the professional who can quickly identify trends amongst different variables such as time, sex, or individual seals without having to create or develop a different chart or map for each variable.

This data demonstrates that there are individual seals who tend to hang around certain areas and beaches, while other individuals may seem to appear anywhere. When the "Play" function is utilized, an individual can be tracked or followed, in a loose sense. For example, R010 (Irma), an adult female appeared to have traveled east to west along the south shore about 7 times throughout the year. But there were no sightings of her during August and September and it is a mystery as to where she went. However, knowing her patterns from previous years, it is possible that she traveled to another island, or unpopulated area to have a pup and then returned.

These maps can also be compared to satellite tracking maps. If there are individuals who were tagged with tracking devices, the maps formed can be overlaid the sightings map for that individual. It is possible that the results will provide information about where the seal goes when it is not being observed. New areas of importance can be identified and the Seal Response Team can adjust their efforts accordingly.

Detailed instructions were written so the map can be further developed and expanded with ease.