

Geographic Expansion of the Puget Sound Seabird Survey and Volunteer Training for Early On-Scene Reconnaissance

FINAL PROJECT REPORT



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This report describes monitoring in 2013-2014 of seabird density and distribution in the Strait of Juan de Fuca and portions of Whidbey Island. It also describes a pilot project to gather observations in the event of an oil spill.

Copies of this final project publication are available from the Seattle Audubon Society <http://www.seattleaudubon.org/sas/WhatWeDo/Science/CitizenScience/PugetSoundSeabirdSurvey/PugetSoundSeabirdSurveyExpansion.aspx> and Puget Sound Marine and Nearshore Grant Program website, hosted by the Washington State Department of Fish & Wildlife (http://wdfw.wa.gov/grants/ps_marine_nearshore/).

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Abstract

The existing Puget Sound Seabird Survey is a shore-based survey in south and central Puget Sound. It uses distance sampling to record all species of coastal seabirds/waterfowl. This report presents results from the expansion of the PSSS into the area of the Strait of Juan de Fuca and Admiralty Inlet. The program established 26 survey sites that were surveyed by skilled observers each month for 12 months. Volunteers were grouped together into 13 different survey teams and each survey team was assigned from one to three survey sites. Seventeen of the survey sites had four surveyors assigned to them, two sites had teams of three surveyors, and seven sites were surveyed by teams of two. Fifty different seabird species were identified and recorded during the monthly surveys.

Observers were also trained on oil observations in the event of an oil spill in the area. A drill was conducted to test the viability of the procedures and showed that valuable information could be gathered quickly from the observers. In the drill, of the 26 survey sites, 12 would have had observers on site within four hours of being contacted, and within 24 hours, 22 of the 26 sites would have had observers. Additionally, 23 of the 26 (88%) survey sites had observers available for a full seabird survey during the next day's survey window.

Introduction

The Puget Sound Seabird Survey (PSSS) is a monthly shore-based survey of seabirds in Puget Sound. The intent of the survey is to determine the status and trends of marine birds over time and area. The PSSS has been conducted since 2007, primarily in south and central Puget Sound during winter months.

This project expanded the PSSS geographically by establishing survey sites along the southern coast of the Strait of Juan de Fuca, along the west coast of Whidbey Island, and in parts of Admiralty Inlet (Figure 1). The PSSS was also expanded in duration at project sites by conducting the surveys monthly throughout the year.

This expansion is in response to the identified need to “improve community oil spill preparedness in regions most at-risk” as stated in the request for proposals (RFP, 2012). The intent of this program is to use community resources to develop baseline data on seabird density and distribution over this geographic area. This program also addresses a Near-Term Action called for in the 2012-13 Puget Sound Action Agenda (PSP, 2013):

Near-Term Action C8.3 NTA 3 “Identify Species and Locations at Risk in Spills.”

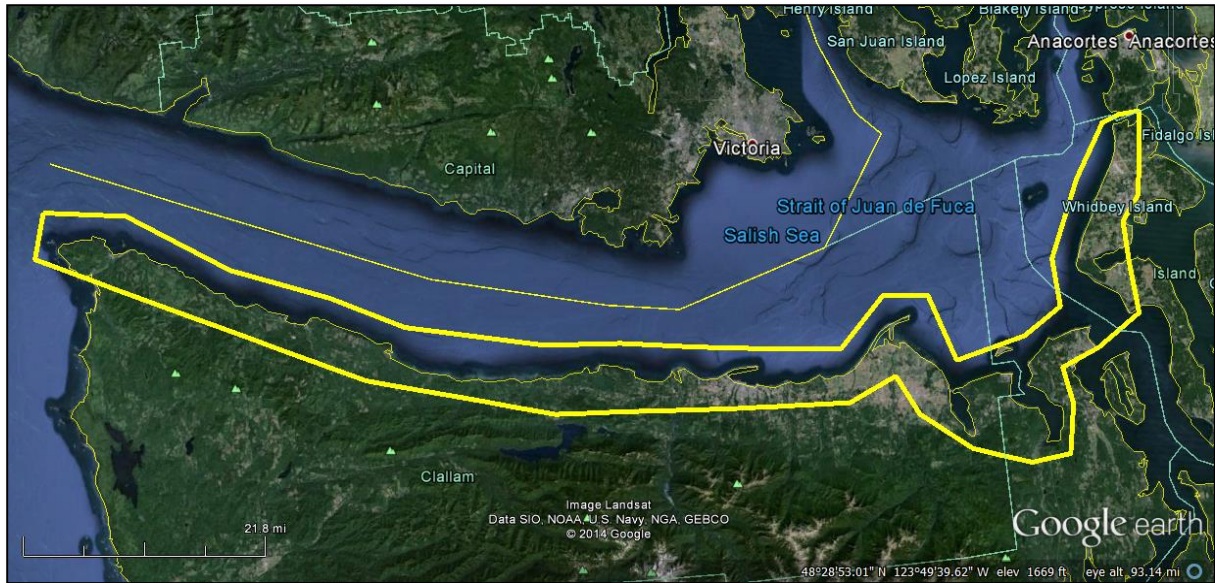


Figure 1: Area of focus in this program.

Grant Background

Seattle Audubon was awarded the grant *Geographic Expansion of the Puget Sound Seabird Survey and Volunteer Training For Early On-Scene Reconnaissance*, Grant Agreement: #12-1939 in March 2013. This grant was provided by the Puget Sound Marine and Nearshore Grant Program, a partnership between Washington Departments of Fish & Wildlife (WDFW) and Natural Resources (WDNR) that is funded by the Environmental Protection Agency (EPA). In addition to increasing the geographic scope of the PSSS and the duration of surveys, the grant expanded the program in the grant project area to include observations of oil and to conduct additional surveys in the event of an oil spill.

The Strait of Juan de Fuca and the areas near and in Admiralty Inlet are major shipping channels with ships heading into and out of the large ports of Tacoma, Seattle, and Vancouver, British Columbia. Additionally, the area also has ships servicing five oil refineries that receive crude oil and export petroleum products. This region also includes the major commercial and fishing ports of Port Angeles, Port Townsend, and Neah Bay, along with several other recreation ports. There is also a possibility of major increases in ship traffic caused by development and expansion of coal and oil facilities both in the US and Canada.

This program requires close coordination with state and federal agencies, as well as private groups. In addition to multiple discussions with staff at WDFW, WDNR, WDOE, and the United States Coast Guard (USCG), the planned program was presented to the February 13, 2013 meeting of the Northwest Area Committee. According to their website, the mission of the “...Northwest Area Committee (NWAC) is to protect public health and safety and the environment by ensuring coordinated, efficient, and effective support of the federal, state, tribal, local, and international responses to significant oil and hazardous substance incidents within the Pacific Northwest Region as mandated by the National Contingency Plan” (NWAC, 2014). Discussions, coordination, and presentations with state and federal agencies, as well as

with local governments and Marine Resource Committees have continued throughout the duration of this project.

Part of developing this project included creating a Quality Assurance Project Plan (QAPP). This document provides extensive details on the design, goals, data collection methods, and analysis for the study (Joyce and Skumanich, 2013).

Puget Sound Seabird Survey Background

The Science Committee of the Seattle Audubon Society conducted a review of gaps and priorities in regional bird data and methodology in 2006, and recognized that a comprehensive land-based seabird survey using state of the art survey techniques and analysis would be critical in understanding the status and trends of seabirds in Puget Sound. The Puget Sound Seabird Survey was implemented in central and south Puget Sound in 2007 and has continued annually since. This project expands the survey to include the area considered most at-risk of large and catastrophic oil spills.

The survey data created by this project is examined at different levels of analysis. In its basic form, it provides information on species distribution, seasonality, and relative density. However, the survey also collects distance and angle data that enables an abundance estimate to be calculated using the modeling and analysis technique of distance sampling.

Distance sampling provides a robust approach to estimating density and allows for the calculation of density estimates that are less biased than those derived from other survey methodologies. This includes incorporating the effects of change in detection of each species due to changes in distance from the observer, sighting conditions, quality of observing equipment, and observer experience. Distance sampling also provides methods to determine variation, thus providing a metric on the robustness and confidence of estimates. Determination of variance has been a major issue with other survey methods (Buckland et al., 2008).

Multiple years of survey are required to create a dataset that is sufficient to calculate abundance and variance using distance sampling; therefore, the data from this first year of study is summarized to look at species richness, distributions, and relative densities.

Survey Methodology

The Puget Sound Seabird Survey is a shore-based survey that uses distance sampling to record all species of coastal seabirds/waterfowl including geese, ducks, swans, loons, grebes, cormorants, gulls, terns, and alcids. The PSSS uses a “point transect” method in distance sampling. A point transect is essentially a line transect of zero length. While this may be slightly non-intuitive, it is a well-documented, robust methodology (Buckland, 2006; Thomas et al., 2010).

Distance sampling requires the position of each bird sighting to be determined with as much accuracy as possible. In the PSSS, this is accomplished using measuring devices for both distance and angle from the survey location. Additionally, each survey site is selected based on it being representative of nearshore waters of the area, be publically accessible, and, in most cases, be at least 1.6 km apart. Details of site selection, measuring techniques, and equipment are given in the QAPP for this program (Joyce and

Skumanich, 2013) and in the Survey Expansion Toolkit, available on the PSSS pages of the Seattle Audubon Website (Seattle Audubon, 2014a).

The survey engages teams of 2-4 volunteer surveyors proficient in seabird identification to visit assigned survey sites on the first Saturday of each month for 12 months. Each survey takes 15-30 minutes and occurs within a pre-set four-hour window, timed to be two hours either side of the daylight high tide.

Volunteers were trained on the PSSS methodology and provided with survey kits that consisted of a storage clipboard, ruler, compass, Velcro strap for attaching the compass to optics, pencil, and enough data sheets to last the season printed on Rite-in-the-Rain paper. In addition, the surveyors were provided with printed copies of the survey schedule, and the protocol for reference, as well as printed descriptions of their assigned sites that included photographs of the exact survey location and images with landmarks and their distances used to aid the surveyor in estimating the 300 m survey boundary.

Data Entry

Once seabird surveys are completed, data are submitted to Seattle Audubon using a specifically designed online data entry website, located at www.seattleaudubon.org/seabirdsurvey. In order to maintain the security and integrity of the data, each surveyor requires a personalized username and password to access the data entry pages of the site. Once data have been entered into the site, anyone with the site's URL can access rudimentary data summaries by exploring the various tabs featured on the site. The 'Home' tab provides basic information about the program, when and how the surveys are conducted. The 'Sites' tab presents a map of the Puget Sound and Strait of Juan de Fuca with the PSSS Expansion Project survey locations indicated (as well as other survey locations utilized by the regular PSSS program). Clicking on a particular survey location produces a pop up box with tabs containing a continually updated species list with tallies for each species, data from the most recent survey, and information about the survey site (Figure 2). The 'Birds' tab presents a list of all the seabird species that have been recorded on the PSSS (with data from the regular program included). Clicking on the 'Find this bird in Puget Sound' button produces a map of the Puget Sound and Strait of Juan de Fuca with markers showing where that particular species has been recorded. Clicking on a marker provides more detail of the sightings at that locality. Conducting a more advanced search of the database with the production of graphs using various parameters including date, site, and species can be accomplished using the 'Search' tab.

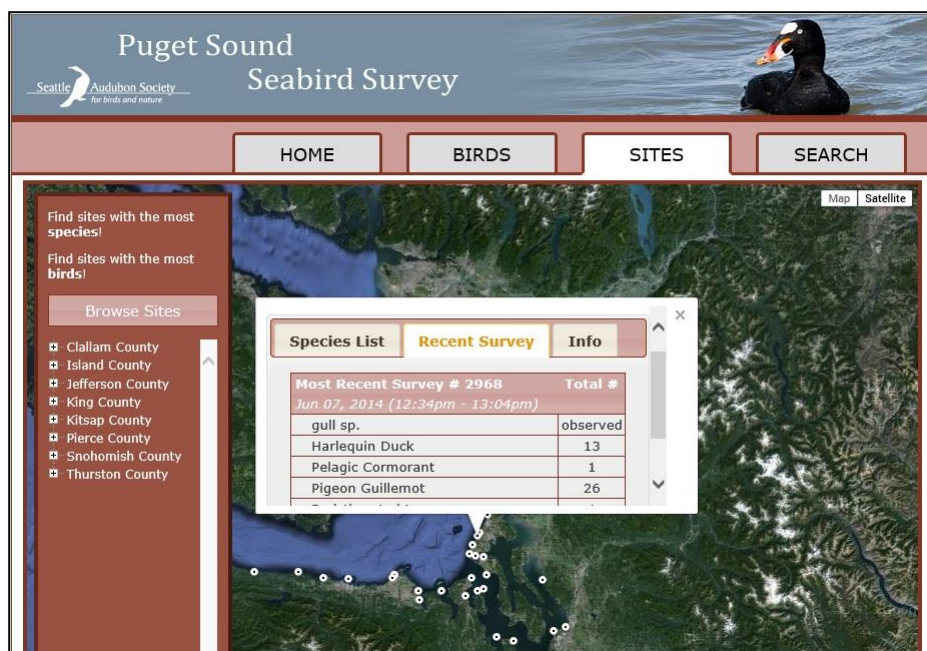


Figure 2: The PSSS website with an Expansion Project survey site selected (West Hastie Lake Rd).

Periodic Data Summaries

Seabird survey data that were submitted through the dedicated website were aggregated into a database and verified for accuracy. Data summaries were created on a quarterly basis and provided to the survey volunteers to encourage and ensure continued, high-level participation in the project. The data were summarized for each month to indicate species richness across all sites, abundance of species, total number of individual observed birds, and “busiest” survey location. In addition to the various graphs that were produced to depict the data, leaderboards were created to provide context on how each survey location compared with another. Only the top three survey sites or seabird species were highlighted on the leaderboard which served to encourage the volunteer surveyors and give a sense of pride that your site had a wide richness of species or attracted a great abundance of birds, etc. Conversely, not seeing your survey site listed provided encouragement to try to identify more individual birds, etc. The leaderboards included species richness, seabird abundance (by species and by survey site), busiest survey site, and total seabird observations.

Project Goals and Objectives

The goals and objectives for this program are defined in the QAPP (Joyce and Skumanich, 2013) and summarized below.

Goals

The first goal of this project is to establish a robust baseline, by species and time of year, of the density and distribution of seabirds in areas that are at risk to the effects of major and catastrophic oil spills and where current baseline data may be insufficient for proper evaluation of the effects of a spill.

The second goal is to increase the geographic range of the time series collected using this survey methodology and to improve estimates of seabird density and distribution within most of Puget Sound and identify changes throughout the region over time.

The final goal is to improve reconnaissance of oil spills and improve the efficiency of oil-spill response.

Objectives

The main objective of this program is to establish a systematic, citizen-science based seabird survey throughout an area that is not currently being assessed using methods that can detect intra- and inter-annual changes. Through these surveys and analyses, the seasonal distribution and density data can be used in oil-spill response planning and operations. The development of a spatial time-series enables assessment of the status and trends of seabird populations, including those endangered, threatened, and species of concern. With the development of this series, the data can also be used for the assessment of damages to natural resources that result from an oil spill or other event.

The secondary objective is to develop a geographically distributed and coordinated network of observers trained in recognizing and characterizing oil spills that can report their observations quickly to responsible agencies.

Expansion of the Puget Sound Seabird Survey

The first goal, to establish a baseline on the density and distribution of seabirds was addressed by establishing survey sites throughout the focal area, training volunteers in appropriate survey methodology, and coordinating seabird surveys at these sites. The establishment of these surveys also addresses the second goal of expanding the range of the existing PSSS. The compatibility of the data between the established PSSS area and the expansion area is assured by using the standardized PSSS training and protocols in both areas.

Methods

The program established 26 survey sites that were surveyed by skilled observers each month for 12 months (Figure 3). While most survey sites are separated by considerable distance, two locations, on Dungeness Spit and Ediz Hook, have two survey sites at the same location—one facing north and the other facing south. The targets of this research were all seabird/water bird species in Puget Sound and Strait of Juan de Fuca throughout the year. This includes geese, ducks, swans, loons, grebes, cormorants, gulls, terns, and alcids. Surveying includes using optics (binoculars and spotting scopes) to identify and count all birds within a 300 m survey area.



Figure 3: Location of all observation sites in the expansion area.

The PSSS expansion project utilizes techniques developed in previous and current work being conducted in central and south Puget Sound. Utilizing this protocol, data were collected that are both descriptive of the distribution and presence of seabirds as well as to enable future analysis using advanced analysis methodologies, including distance sampling.

Narrative of Survey

Forty-nine volunteers were recruited from within Seattle Audubon’s citizen science network with assistance from project partners—Port Townsend Marine Science Center, Olympic Peninsula Audubon Society, Admiralty Audubon Society, and Whidbey Audubon Society. Volunteers were grouped together into 13 different survey teams and each survey team was assigned from one to three survey sites. Each survey team contained volunteers that were expert in identifying the birds of the region. Seventeen of the survey sites had four surveyors assigned to them, two sites had teams of three surveyors, and seven sites were surveyed by teams of two.

Of a possible 312 individual surveys, 304 were conducted over the 12 month period, with a total of 127.68 hours spent surveying. The majority (5) of missed surveys were at the three Dungeness National Wildlife Refuge locations. In October 2013, surveys at Dungeness Spit were missed due to the closure of the refuge as a result of the 16 day “Government Shutdown”. Two further surveys were missed in November 2013 at two of the Dungeness sites due to severe weather that brought winds upwards of 50 mph to parts of the coast and significant swell for multiple days after the storm, preventing safe access to the survey locations along the Dungeness Spit.

On five occasions, some survey sites were surveyed on different dates than scheduled due to reasons ranging from adverse weather to unavailability of team members. Although this is not ideal, it is anticipated and does not adversely affect the data. Over the course of the 12 months, the volunteer surveyors spent a total of 329.58 hours conducting all of the surveys at the 26 sites.

Results

Training of observers in the Puget Sound Seabird Survey methodology and data entry was received with interest and enthusiasm. A poll conducted subsequent to the training produced the results shown in Table 1.

Table 1: Poll results on PSSS protocol and data entry training.

Question	Very Satisfied / Excellent / Very Confident	Satisfied / Good / Confident	Needs Improvement / Not confident	I have not completed training	Total
How satisfied are you with the PSSS training?	17 (60.7%)	8 (28.6%)	0	3 (10.7%)	28
How would you rate written material?	15 (53.6%)	9 (32.1%)	0	4 (14.3%)	28
How would you rate the trainers and presentations?	18 (64.3%)	7 (25.0%)	0	3 (10.7%)	28
How confident do you feel in your ability to conduct the PSSS?	16 (57.1%)	11 (39.3%)	1 (3.6%)		28
How would you rate communication leading up to the trainings?	17 (63.0%)	10 (37.0%)	0		27
How would you rate communication, follow-up, and support after the trainings?	14 (56.0%)	11 (44.0%)	0		25

Regarding the data in Table 1, the individuals that stated that they had not completed the PSSS training were volunteers who have been involved in the regular PSSS over many years and therefore did not require additional PSSS training. In addition, the one individual who did not feel confident conducting the PSSS stated that they were a novice birder but an experienced biological note taker (marine mammals). As a result, this individual was placed in a team with confident birders and ultimately functioned very well as a team member.

The seabird surveys produced a significant amount of temporal and geographic data that constitute a unique and important baseline dataset. Due to the data only being across the 12 months of a single year, it is not possible to calculate population densities utilizing the distance-sampling methods on the data. However, important and useful inferences can be made by summarizing this data in various ways. It is anticipated that surveys will continue at many of the survey locations, and so population estimates will be calculated once sufficient data have been collected. Therefore, the results presented in this report are summaries of observations made during the surveys under this project.

Species Richness

Understanding the species composition of seabirds across the geographic and temporal range of the focus area is important in evaluating the relative ecological importance of each of the 26 survey locations. As expected, species richness increased during winter months when seabirds migrate to the Puget Sound to overwinter and was reduced in summer months when many of the Puget Sound's wintering species migrated away to breeding sites (Figure 4). In addition, it is interesting to see from the graph that there appear to be two peaks in species richness, the first in November, before falling in December and January, and then a second peak in February. The initial peak is due to the expected increase in over-wintering migrants. However, the authors are unsure the reason for the second peak, but propose that it may be due to the addition of spring breeders migrating into the region early.

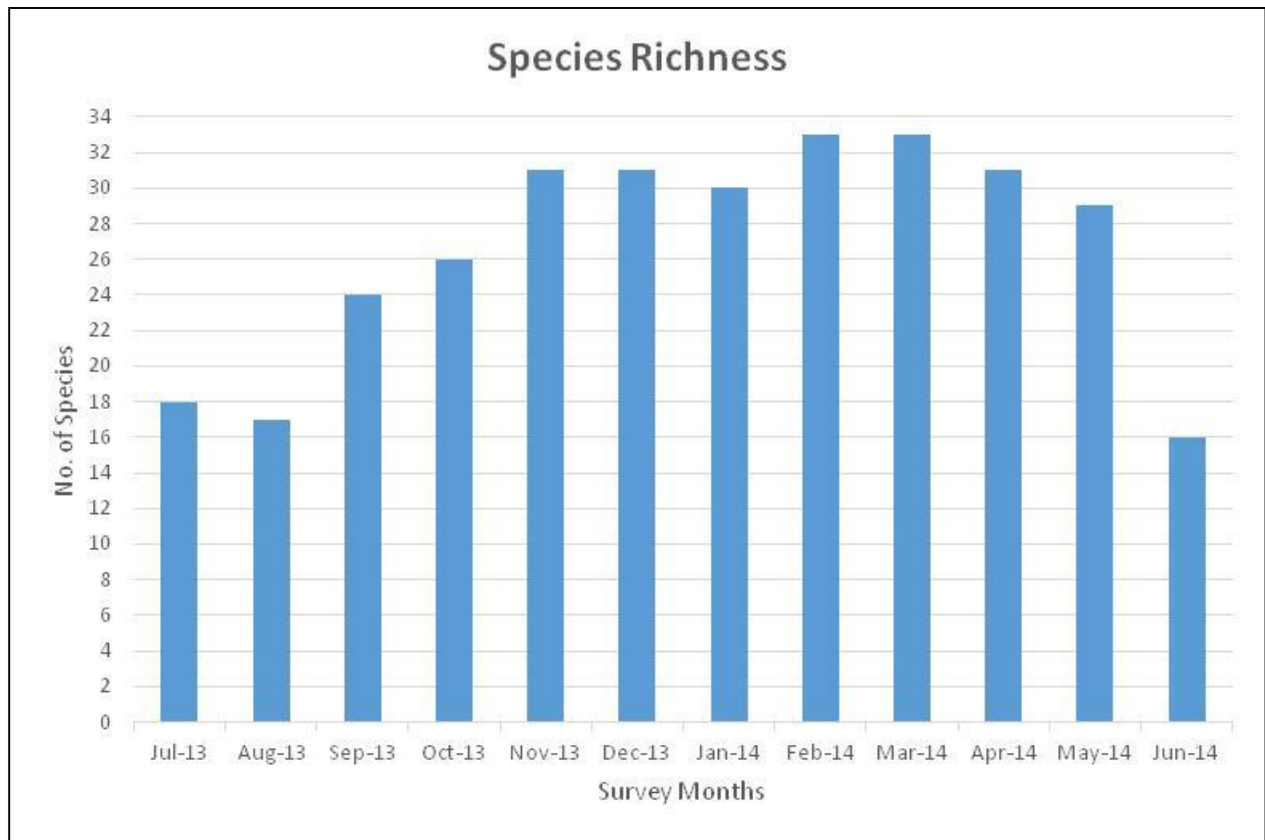


Figure 4: Total species richness recorded at all sites during each of the 12 surveys.

Converting the species richness data into a Geographical Information System (GIS) layer enables visual analysis of how species richness is distributed geographically across the survey locations. The species richness by survey site is shown in Figure 5 and Figure 6. Figure 5 shows the number of species that were recorded at each site. Recorded species are those that are within the survey area, during the survey timeframe, and where distance and angle measurements could be made. Figure 6 shows all the species observed at each site. Observed species include all the species recorded plus other species observed in the area but that did not meet the parameters for recording. There is substantial variation in species richness between sites, with some sites recording numerous species (up to 27) and others with little richness, with as few as six species recorded.



Figure 5: Number of species recorded at each survey site.

There are few differences between the number of species recorded versus observed per site except for the Cape Flattery site where 12 species were recorded but 27 species were observed. This could be a result of the localized weather and sea conditions at this site, the species composition, or an artifact of the observers spending more time observing outside of the survey period.



Figure 6: Number of species observed at each survey site.

Species List

Fifty different seabird species were identified and recorded during the monthly surveys. An additional five species were observed during the surveys but were not recorded as they were beyond the 300m

survey area, in flight, or the horizon was obscured when taking measurements preventing accurate data collection. A list of the species, in taxonomic order, is provided in Table 2. Records that did not identify to species level were not included within this total, e.g. Gull sp.

Table 2: Species identified during surveys, in taxonomic order. Species with an asterisk were observed but not recorded during the surveys.

Greater White-fronted Goose	Horned Grebe
Brant	Red-necked Grebe
Cackling Goose*	Eared Grebe
Canada Goose	Western Grebe
Trumpeter Swan*	Sooty Shearwater
Eurasian Wigeon	Brandt's Cormorant
American Wigeon	Double-crested Cormorant
Mallard	Pelagic Cormorant
Northern Pintail	Brown Pelican
Green-winged Teal	Great Blue Heron
Greater Scaup	Red-necked Phalarope
Lesser Scaup	Common Murre
Harlequin Duck	Pigeon Guillemot
Surf Scoter	Marbled Murrelet
White-winged Scoter	Ancient Murrelet
Black Scoter	Rhinoceros Auklet
Long-tailed Duck	Tufted Puffin
Bufflehead	Black-legged Kittiwake*
Common Goldeneye	Bonaparte's Gull
Barrow's Goldeneye	Heermann's Gull
Hooded Merganser	Mew Gull
Common Merganser	Ring-billed Gull
Red-breasted Merganser	Western Gull
Ruddy Duck	California Gull
Red-throated Loon	Herring Gull*
Pacific Loon	Glaucous-winged Gull
Common Loon	Caspian Tern*
Pied-billed Grebe	

Seabird Relative Abundance

The total number of birds recorded each month at all sites provides an indication of the number of individual birds utilizing near-shore habitat within the focal geographic area (Figure 7). Furthermore, understanding which species constitute the total seabird abundance and the seasonality of these species aids in understanding the ecology of near-shore habitat of the region (Figure 8).

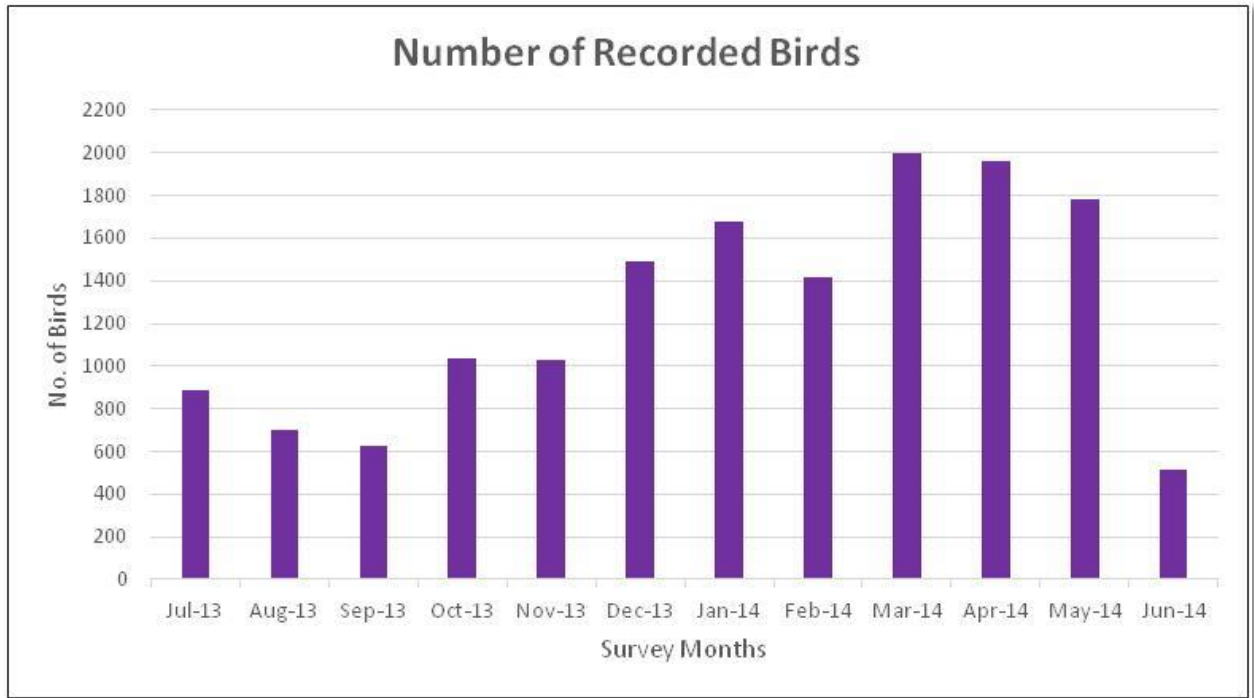


Figure 7: Total number of individual birds recorded at all sites during each of the 12 surveys.

Focal Species

Gaydos and Pearson (2011) identified 172 species of birds that are dependent on the Puget Sound ecosystem, including seabirds, shorebirds, and terrestrial birds. Of these, the PSSS identified 50 species in this expansion zone. To address management and monitoring issues raised by the Puget Sound Partnership (PSP) and WDFW, we examined the observations of two groups of focal species, the marine bird indicators adopted by the PSP and the Species of Concern identified by WDFW.

Puget Sound Indicators

The PSP is an agency within the Washington State Governor’s Office working to oversee the recovery of the health of Puget Sound. Part of its performance monitoring was to adopt indicators for multiple aspects of the ecosystem. These indicators are known as Vital Signs. Based on work by Pearson and Hamel (2013) the PSP adopted four metrics for marine birds that serve as measures of population abundance, breeding, and diet (PSP, 2013). Of these, two are addressed in this survey. These are:

- Spring/summer at-sea densities of Rhinoceros Auklet, Pigeon Guillemot, and Marbled Murrelet
- Winter at-sea abundance of Scoter species

The two other parameters deal with feeding and reproductive success and are being addressed by other studies outside the purview of this project.

All of the indicator species were observed during the surveys and results for Pigeon Guillemot *Cephus columba* (Figure 9 and Figure 10), Rhinoceros Auklet *Cerorhinca monocerata* (Figure 11 and Figure 12), Marbled Murrelet *Brachyramphus marmoratus* (Figure 13 and Figure 14), and Scoter species *Melanitta fusca*, *M. perspicillata* and *M. nigra* (Figure 15-Figure 18) are found below. Although these indicators require specific temporal data, the data collected during the Expansion project, along with data from future surveys will provide abundance and trend information for these indicators.

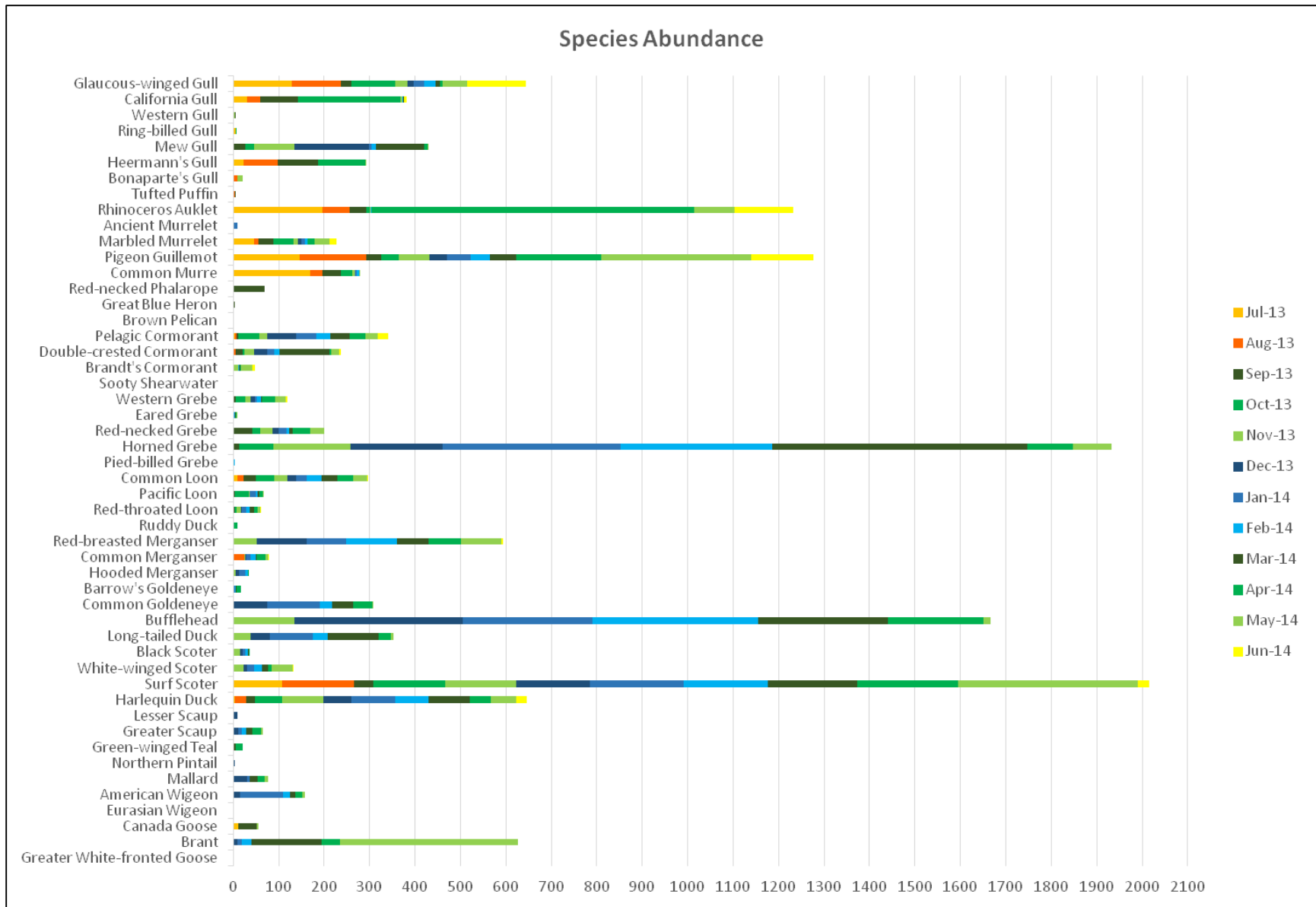


Figure 8: Abundance and temporal data for each recorded species, in taxonomic order, across all sites.

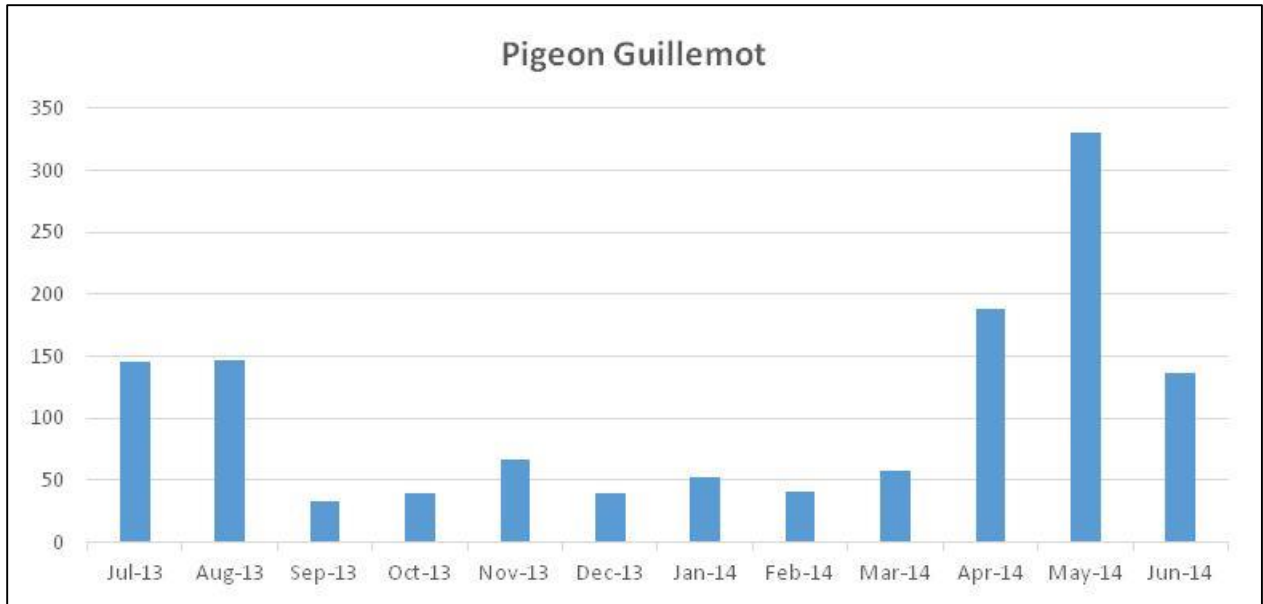


Figure 9: Total number of recorded Pigeon Guillemot at all sites during each of the 12 surveys.



Figure 10: Numbers of recorded Pigeon Guillemot seen at each site.

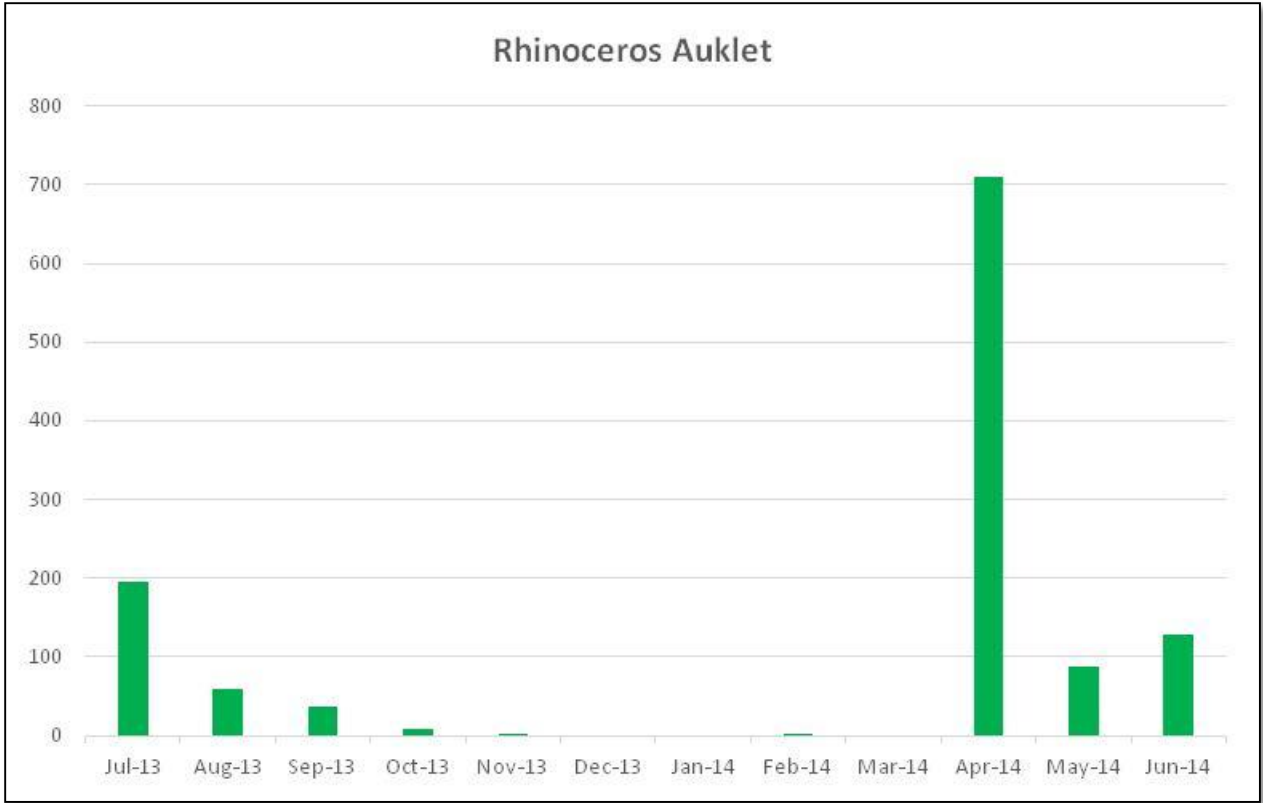


Figure 11: Total number of recorded Rhinceros Auklet at all sites during each of the 12 surveys.

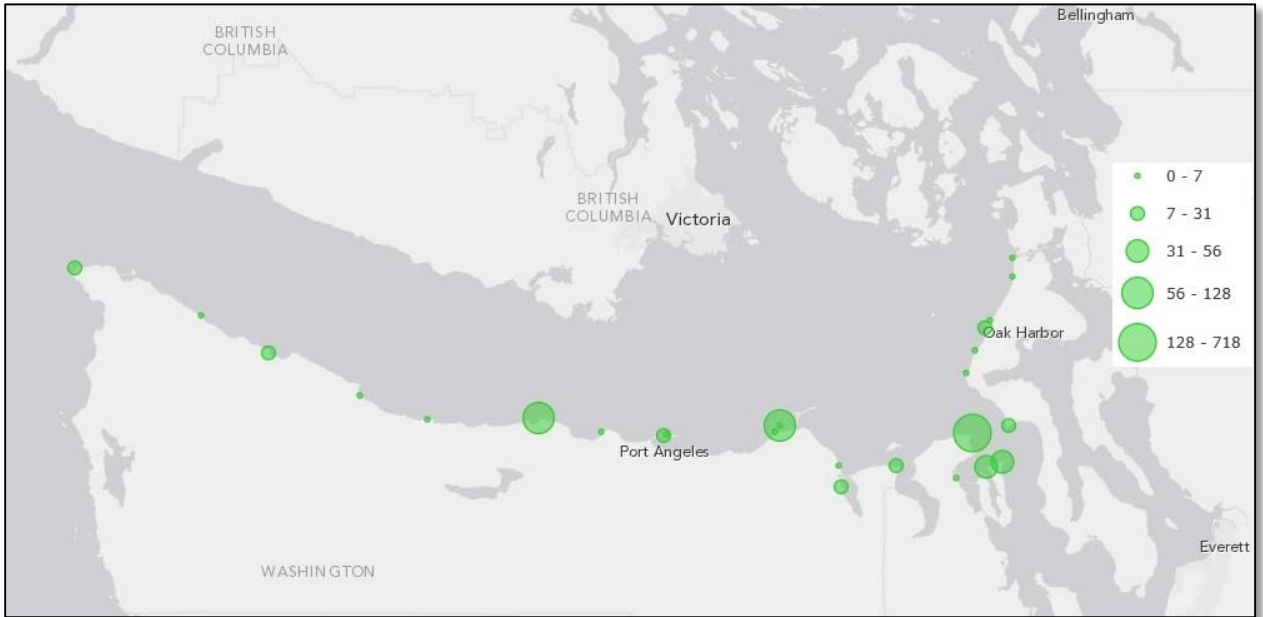


Figure 12: Number of recorded Rhinceros Auklet at each site.

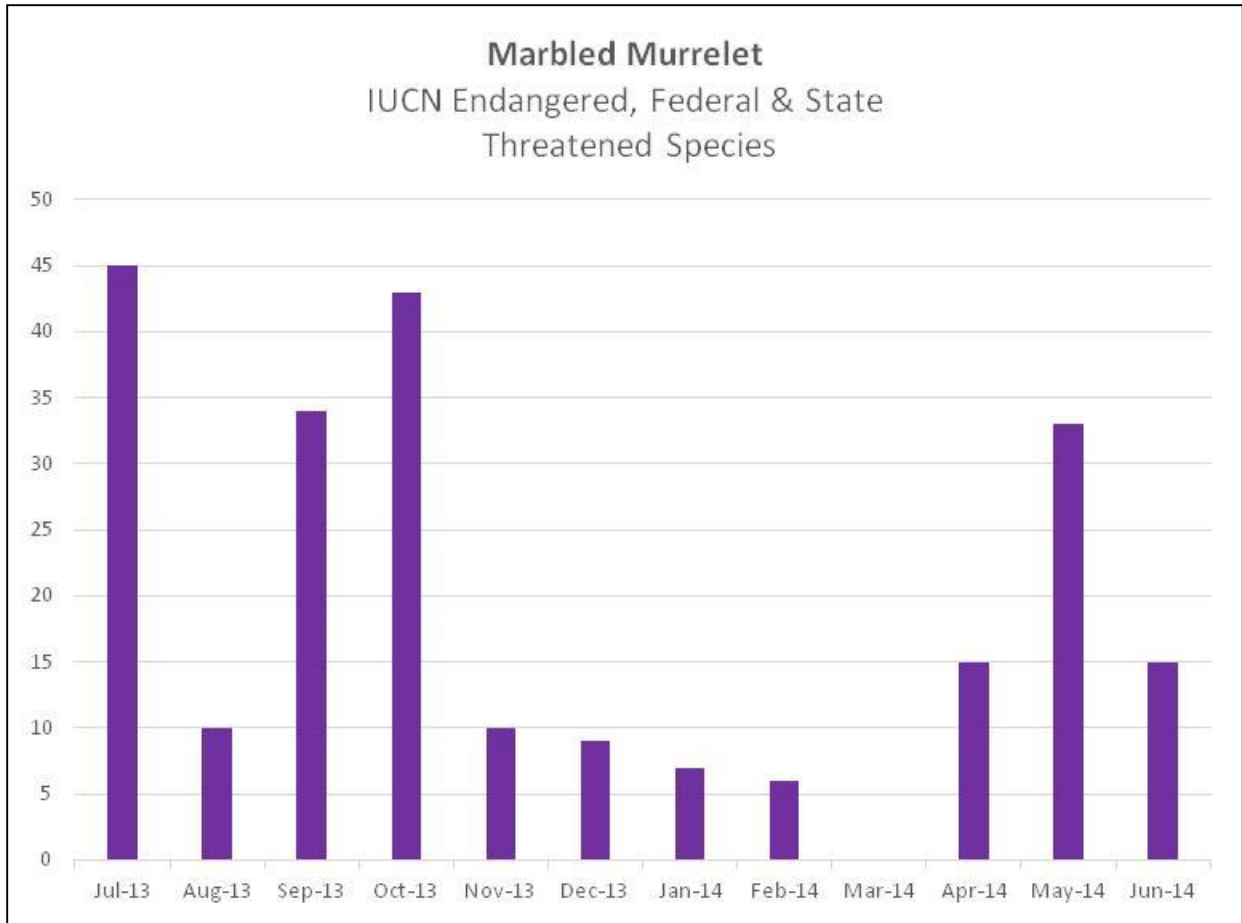


Figure 13: Total number of recorded Marbled Murrelet at all sites during each of the 12 surveys.

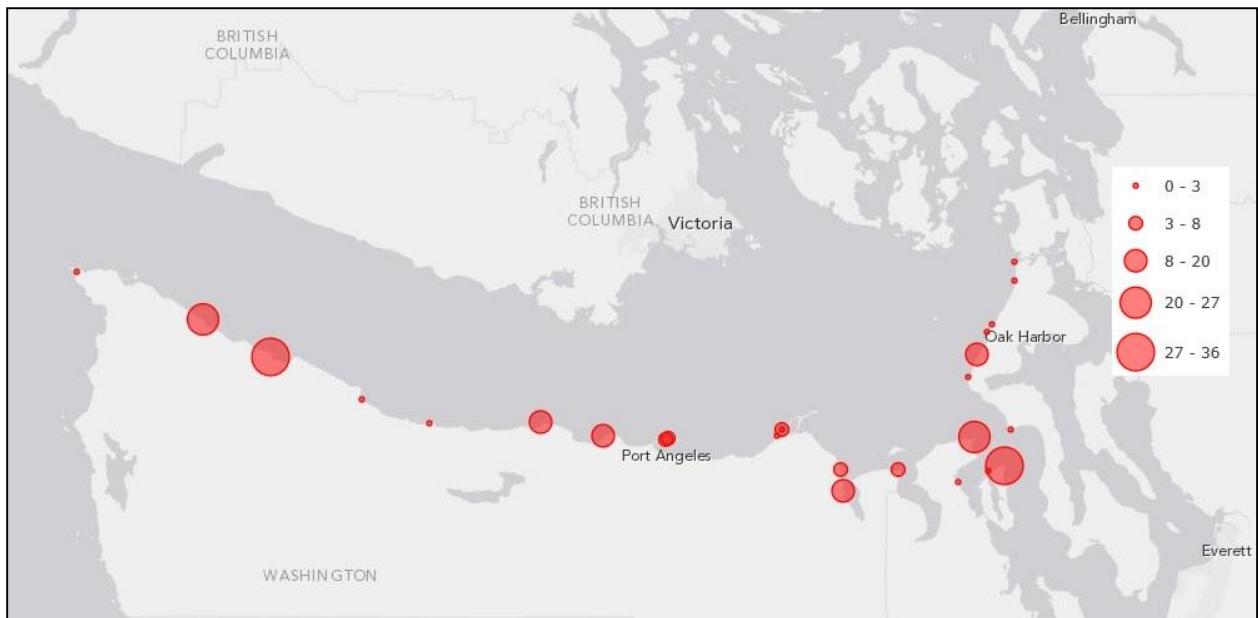


Figure 14: Number of recorded Marbled Murrelet at each site.

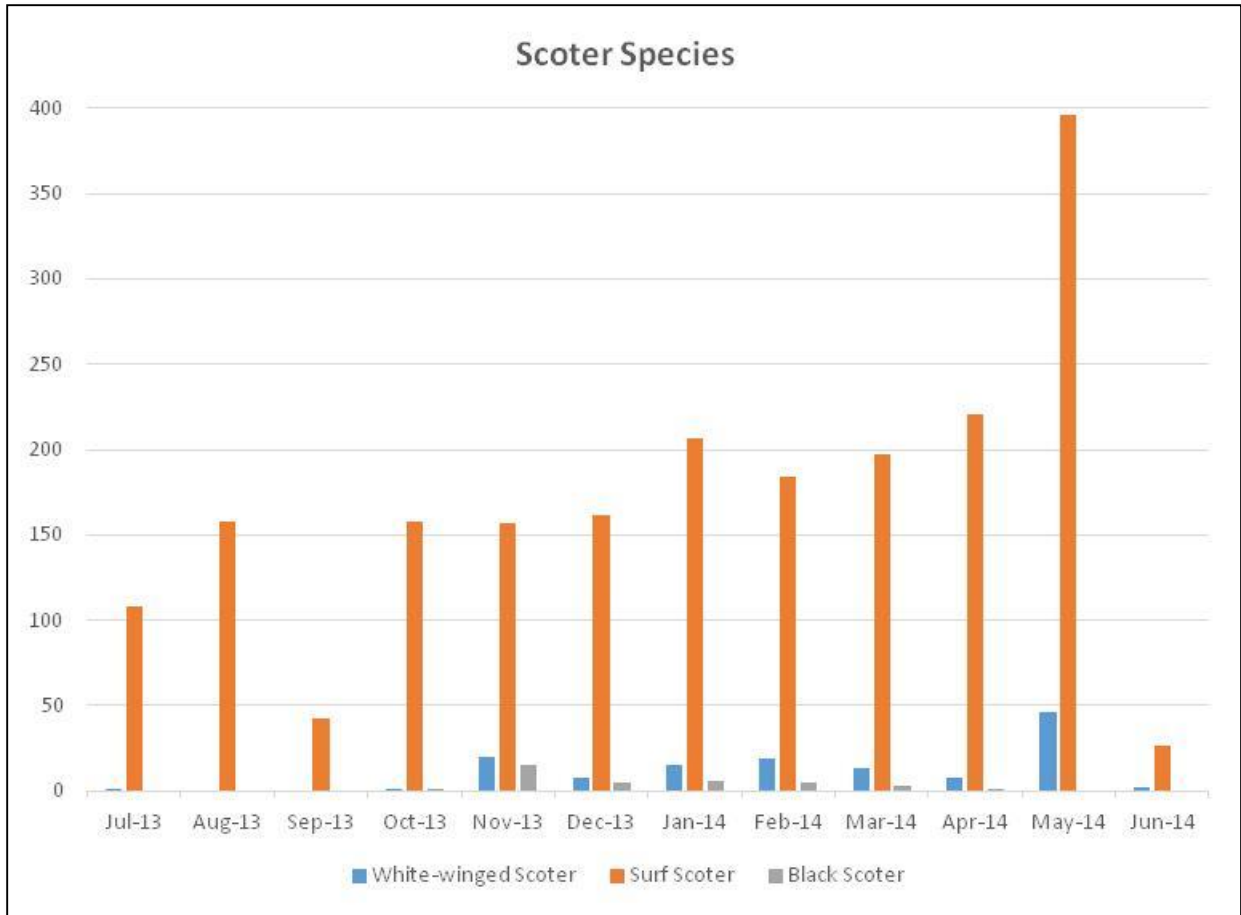


Figure 15: Total numbers of each Scoter species recorded at all sites during each of the 12 surveys.

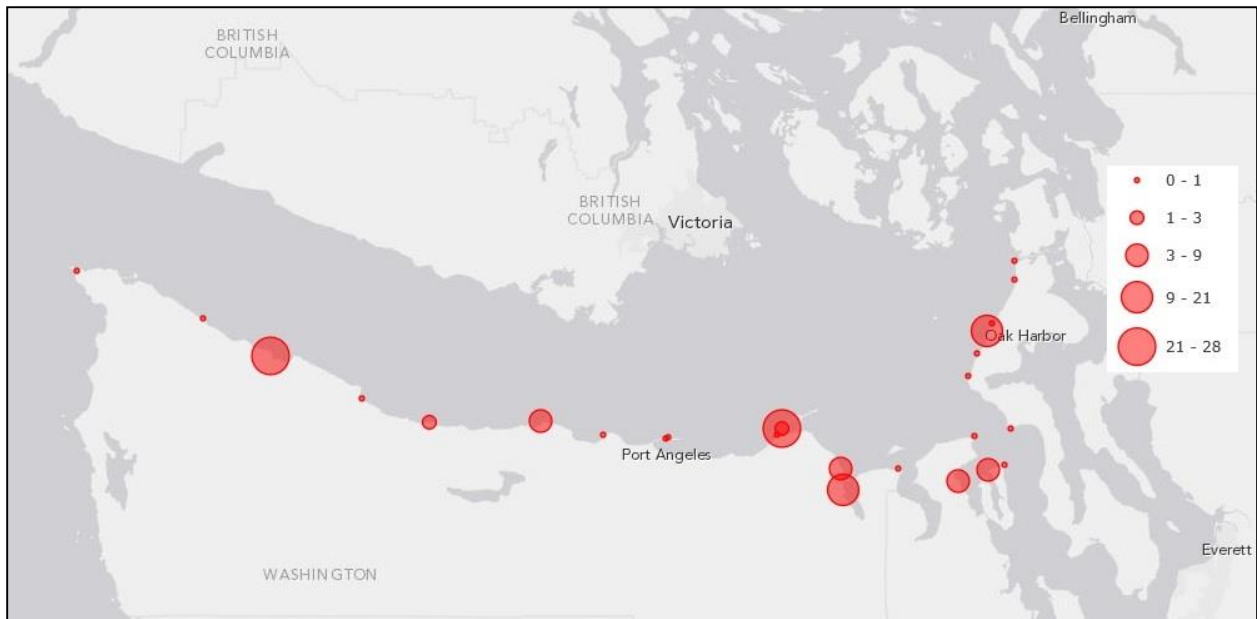


Figure 16: Number of recorded White-Winged Scoter at each site.



Figure 17: Number of recorded Surf Scoter at each site.

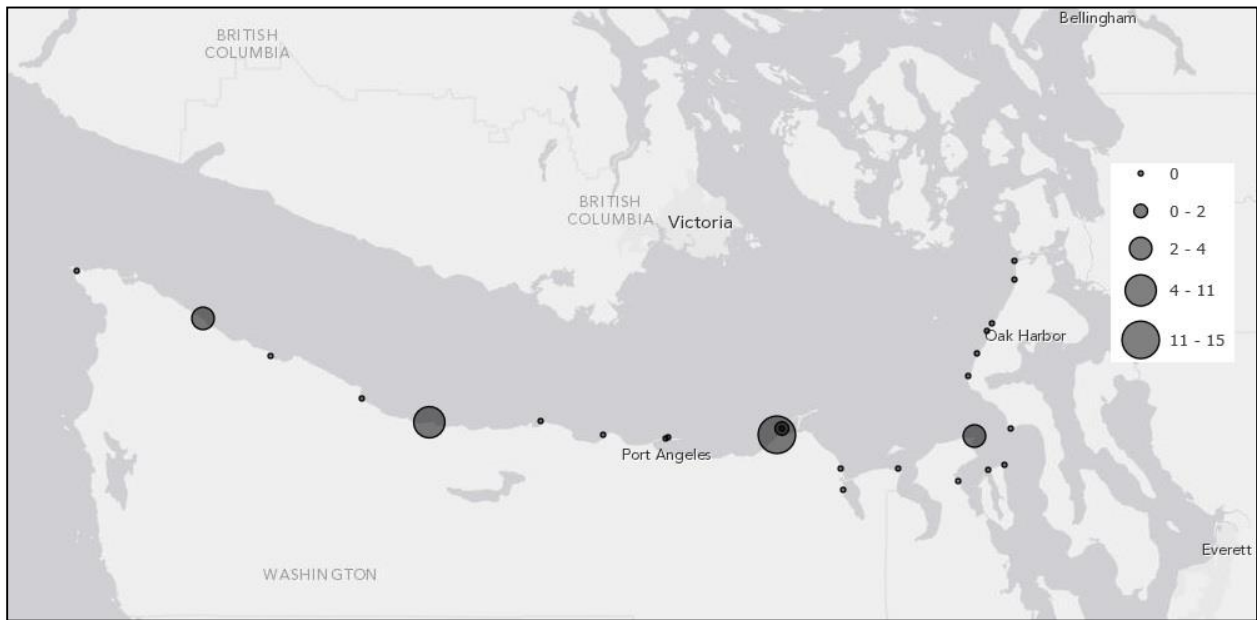


Figure 18: Number of recorded Black Scoter at each site.

Species of Concern in Washington

The Washington Department of Fish & Wildlife’s Threatened and Endangered Species section oversees the listing and recovery of species in danger of extinction statewide. The Threatened and Endangered Species section maintains a list of endangered, threatened, and sensitive species in Washington State. Each listed species is assigned a status based on population trends, habitat trends, population demographics, and species management practices. The list was examined to identify which of the 50 species recorded during this project appeared on the list (Table 3, Figure 13-Figure 14 and Figure 19-Figure 21).

Table 3: WA State Species of Concern that were observed in the survey.

State Status	Species
State Monitored	Surf Scoter <i>Melanitta fusca</i> Pacific Loon <i>Gavia pacifica</i> Sooty Shearwater <i>Puffinus griseus</i> Great Blue Heron <i>Ardea Herodias</i> Horned Grebe <i>Podiceps auritus</i> Red-necked Grebe <i>Podiceps grisegena</i>
State Sensitive	Common Loon <i>Gavia immer</i>
State Candidate	Canada Goose <i>Branta canadensis</i> , Eurasian Wigeon <i>Anas Penelope</i> , Common Murre <i>Uria aalge</i> , Brandt’s Cormorant <i>Phalacrocorax penicillatus</i> Tufted Puffin <i>Fratercula cirrhata</i> Western Grebe <i>Aechmophorus occidentalis</i>
State Threatened	Marbled Murrelet <i>Brachyramphus marmoratus</i>

State Monitored species are not considered species of concern, but are monitored for status and distribution. These State Monitored species are managed as needed to prevent them from becoming endangered, threatened or sensitive (Figure 19).

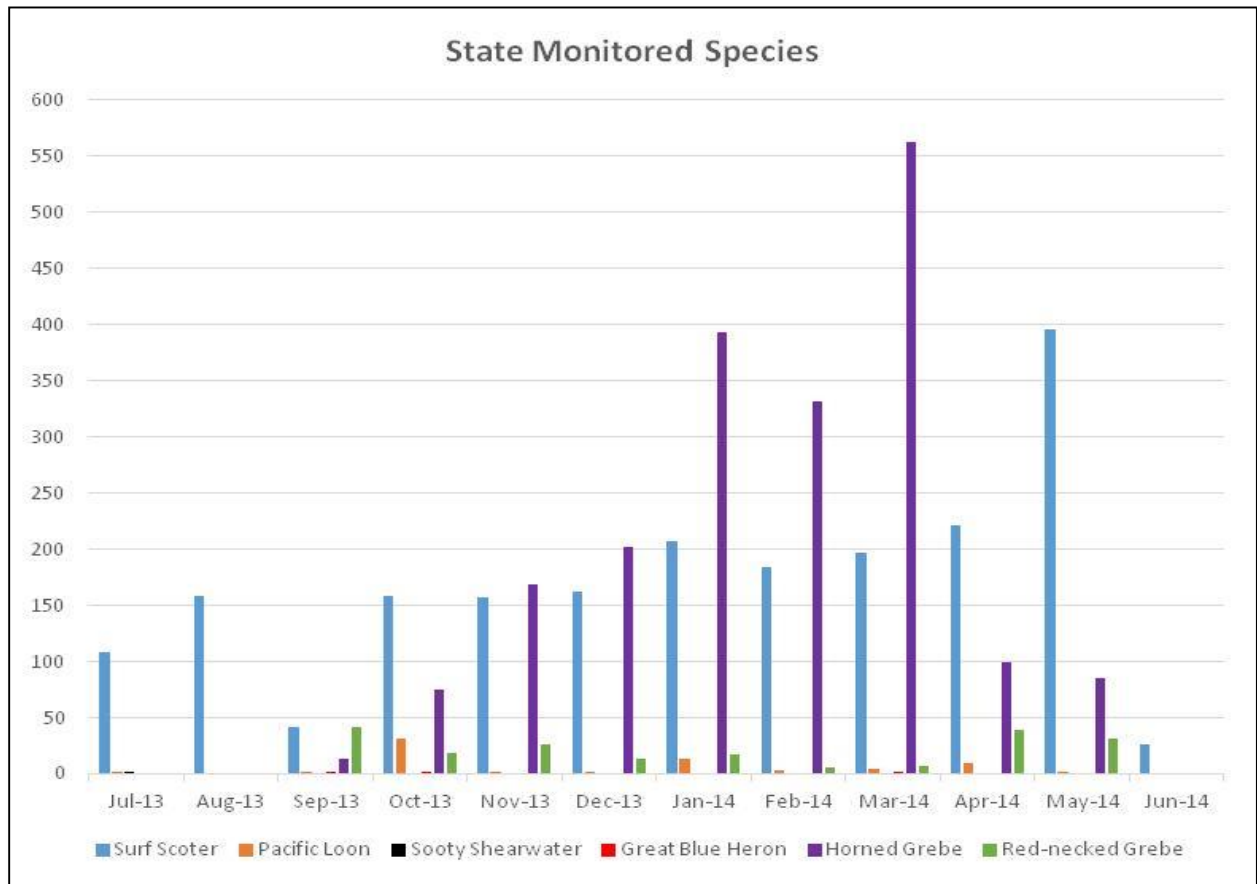


Figure 19: numbers of WA State Monitored Species recorded at all sites during each of the 12 surveys.

State Sensitive species are any WA native species that is considered vulnerable or declining and is likely to progress to being endangered or threatened throughout a significant portion of its natural range without some sort of active management or threat removal (Figure 20).

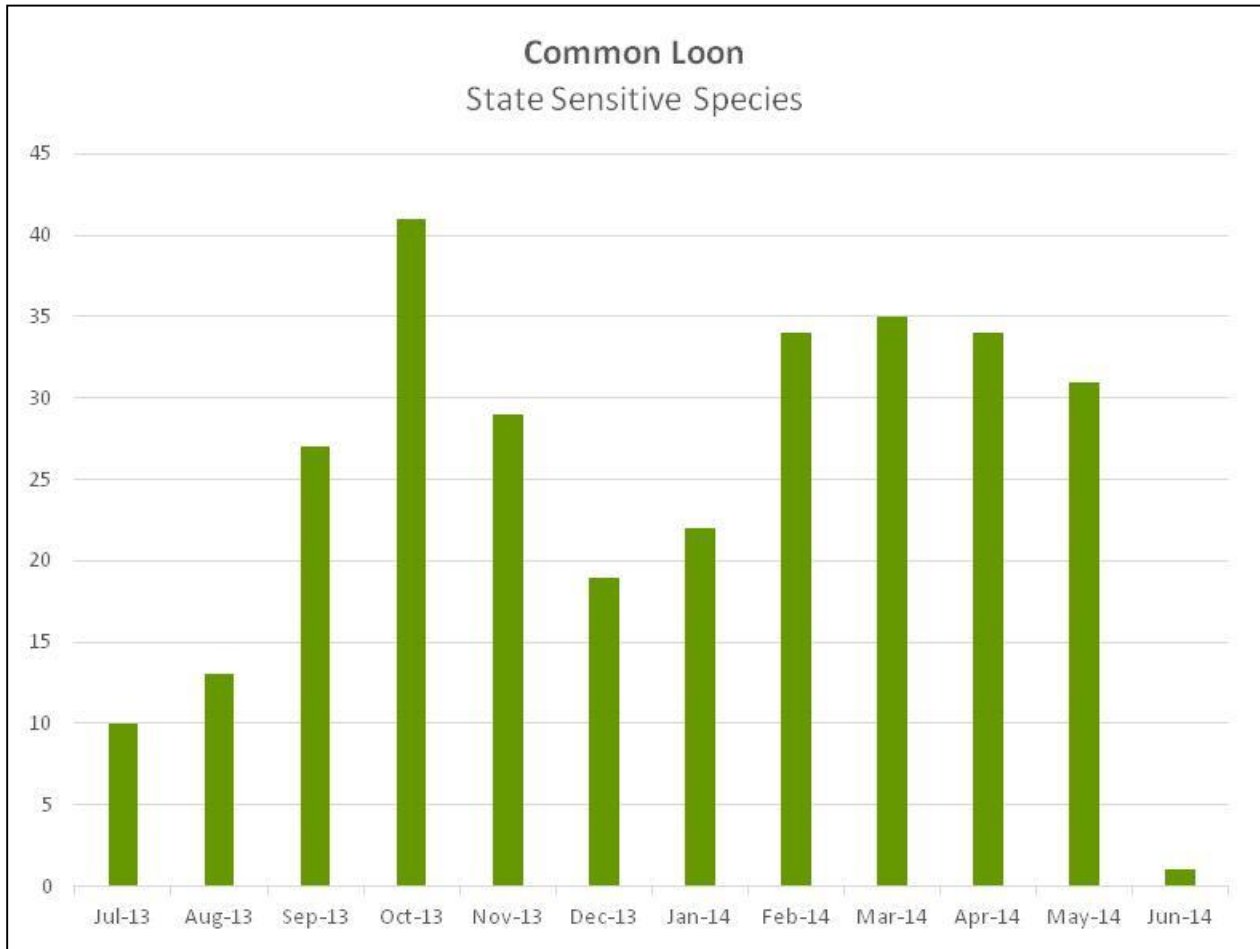


Figure 20: Total number of the WA State Sensitive Species, Common Loon, recorded at all sites during each of the 12 surveys.

A State Candidate Species is one that the Dept. of Threatened and Endangered Species will review for possible listing for State Endangered, Threatened, or Sensitive status (Figure 21).

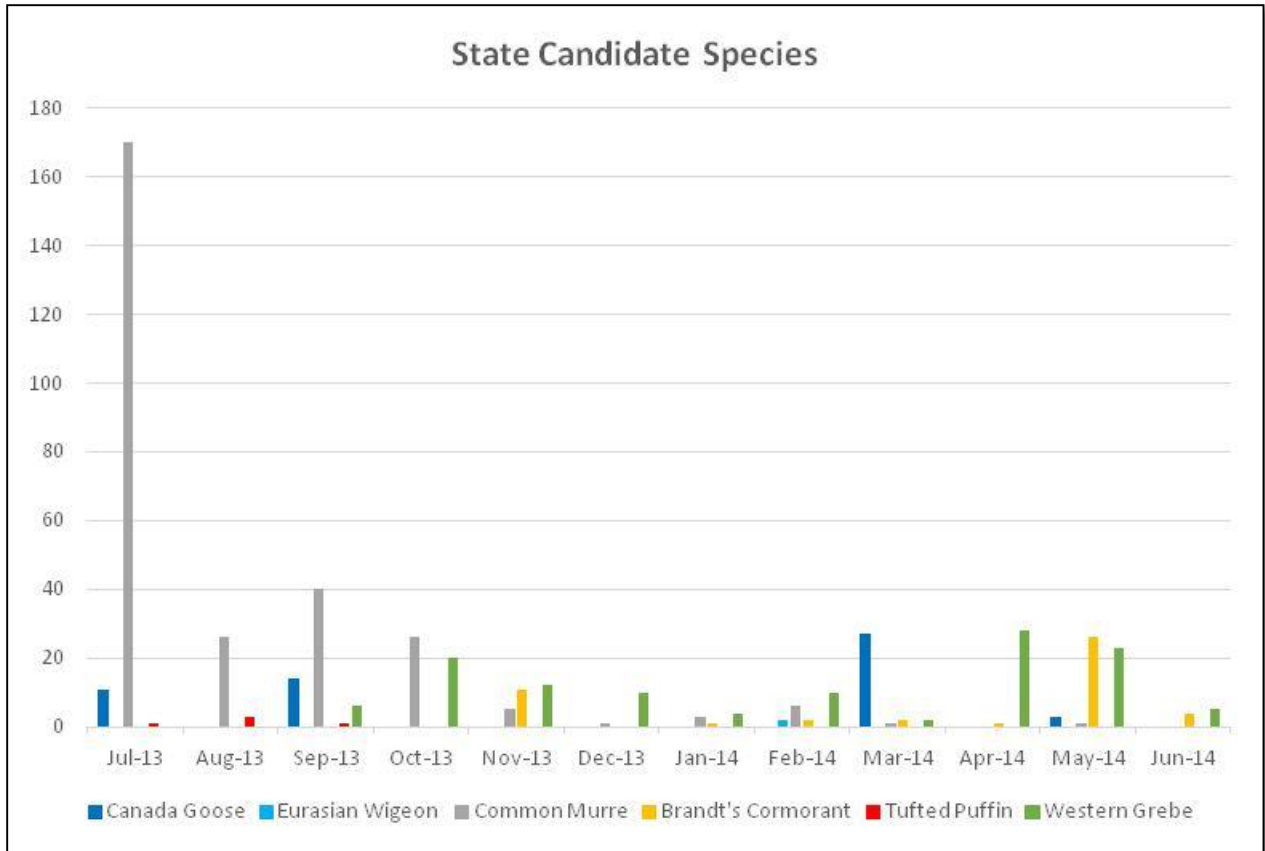


Figure 21: Total number of individuals of WA State Candidate Species recorded at all sites during each of the 12 surveys.

Early On-Scene Oil Spill Reconnaissance

There are three different functions in this project for early on-scene reconnaissance in the event of a reported oil spill and in the event of a confirmed oil spill. The first is to make observations after a spill has been reported but not confirmed. The second is to make standardized observations from regular PSSS sites regarding the presence of oil once a spill has been confirmed. The third is to conduct a standard seabird survey from the established locations at the next available daylight high-tide window after the spill, provided a survey had not been recently conducted. While the oil-spill data collected by the observers is not conducted by oil spill professionals and is intended only to provide generalized information to responsible agencies, the information can be critical in the deployment of professional survey teams.

Methods

Observers were trained on oil observations and provided with the Oil Spill Early On-Scene Reconnaissance User Manual (Seattle Audubon, 2013a). In addition to training on the identification and classification of oil on water and land, they were instructed to make no contact with oil, oiled areas, or oiled birds; to obey first responder instructions; and leave any area where the smell of oil or other volatile chemicals is noticeable.

The observers were provided data sheets to record any oil observations. The observation forms were based on the latest adopted standards used by the Coast Guard for airborne observations (ASTM F1779-08) and the standards used by NOAA for oiled shorelines in the NOAA Shoreline Assessment Manual (NOAA, 2000). The forms are shown in the user manual (Seattle Audubon, 2013a).

Confirmation of a Spill

Direct contact with observers, either from Agency staff or through Seattle Audubon, was developed to obtain early observations to confirm a spill. This was facilitated by creating a confidential list of observers and their contact information by location. The observers were instructed to use the standardized oil observation forms and to relay standardized information as soon as possible by phone, text, or email.

Observation of the Presence of Oil

Observers in the region of a known oil spill are contacted by Seattle Audubon staff through emails, phone calls, or a dedicated listserv in the event of a spill. They are requested to go to their assigned site(s) and look for any signs of oil on the water or beach, or the presence of oiled wildlife. They may also be requested to go to other sites where there are no available observers. Observations are recorded on the standard oil observation forms. The observations are then relayed through the dedicated web-based listserv, by email, or by phone. The hard copy of the form is maintained by the observer to be collected by coordinators and/or shared with first responders.

Additional Seabird Survey

In addition to observing for oil on the water or shoreline, observers are asked to conduct an additional seabird survey at the next available daylight high-tide window, provided one had not been conducted in the past five days. This survey uses the standard PSSS protocols. The observations are entered through the PSSS web portal as soon as possible. Once entered, the observations are publically available through the website. As with the standard PSSS data, the posted data are unchecked and will go through a validation procedure prior to analysis. Information on oiled wildlife is not posted on the website but relayed through the State hotline to responders.

Oil-Spill Drill

A call out drill was developed to examine the availability of observers and the functionality of the methods. In the drill, observers were informed a drill would be conducted at some point the following week but were not given the date or time. The drill was called on Thursday, April 10, 2014 at 12:26 pm and all observers were sent an email and a notice through the listserv. They were not asked to go to their sites but only to respond by the listserv, email, or phone if they were available to observe at their sites for oil within the next four hours, and if not, when they would be available. Additionally, they were asked if they were available to conduct a seabird survey the next day during the daylight high-tide window. The protocol for the drill is given in the *Oil Spill Early On-Scene Reconnaissance Drill Protocol* (Seattle Audubon, 2013b).

Results

Fortunately, no major spill events occurred in the area during this project’s timeframe so the procedures were not tested in real conditions. Instead, we had to rely on feedback from observers and agency personnel as well as the oil-spill drill results.

Training of observers in oil recognition was received with enthusiasm. The results of a poll conducted following the training is shown in Table 4.

Table 4: Poll results on oil identification training.

Question	Very Satisfied / Excellent / Very Confident	Satisfied / Good / Confident	Needs Improvement / Not confident	I have not completed training	Total
How satisfied are you with the Oil Spill training?	17 (60.7%)	10 (35.7%)	0	1 (3.6%)	28
How would you rate written material?	12 (42.9%)	15 (53.6%)	0	1 (3.6%)	28
How would you rate the trainers and presentations?	17 (60.7%)	9 (32.1%)	0	2 (7.1%)	28
How confident do you feel in your ability to take action in the event of an oil spill?	10 (35.7%)	17 (60.7%)	0	1 (3.6%)	28

There were no reported oil-spill incidents requiring verification by the PSSS observers. Instead, local, trained first responders provided adequate coverage for this verification process.

We found it difficult to provide agency staff with the names and contact information of the observers by site as planned while maintaining confidentiality of this information. Instead, to maintain confidentiality, agency personnel would be required to contact Seattle Audubon staff who would then connect with the appropriate observers. To facilitate this, we created an interactive GIS map that showed all the observation sites, and when clicked, showed the observers for each site in a separate window (Figure 22). The GIS web map access is restricted but can be shared with specific individuals. In the figure below, the surnames and contact information for the volunteers was deleted to protect their privacy.

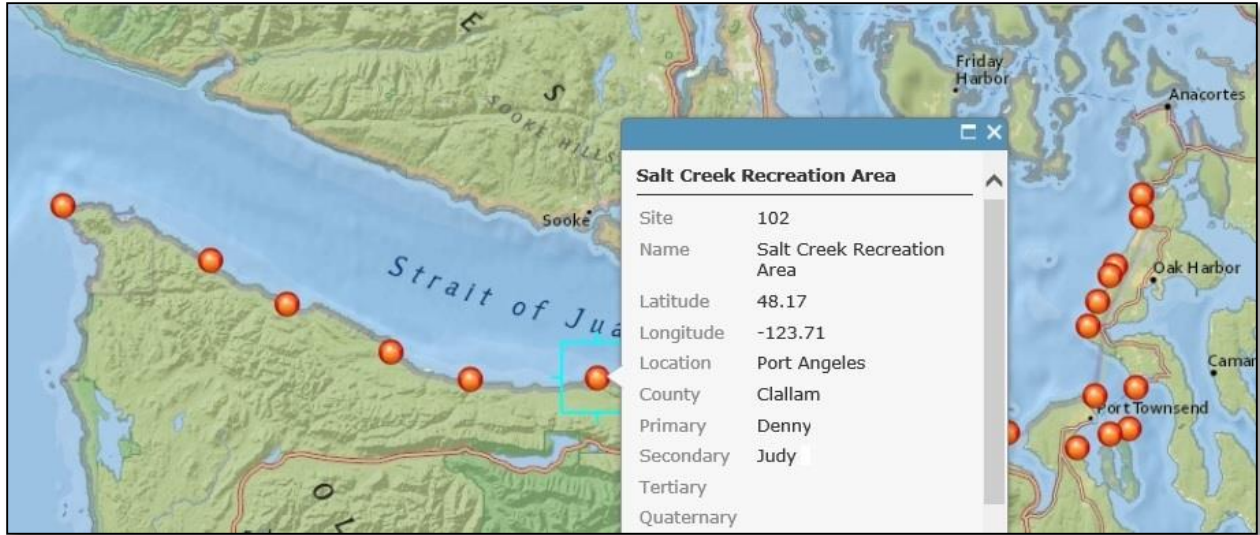


Figure 22: Interactive GIS application showing observers assigned to a specific survey site.

The drill was used to determine the availability of the observers at that moment, indicating the feasibility of using volunteers for early on-scene reconnaissance. Of the 49 observers assigned to the sites, 16 responded within 4 hours of the drill announcement. Another nine observers responded by the end of the day, with one additional response early the following day, and one a day later. Twenty-one observers did not respond. Of the 26 survey sites, 12 would have had observers on site within four hours of being contacted and, within 24 hours, 22 of the 26 (85%) of the sites would have had observers, as shown in Figure 23 and Figure 24. Full details of the drill are available in *the Oil Spill Early On-Scene Reconnaissance Drill* report (Seattle Audubon, 2014b).



Figure 23: Twelve of 26 sites where observations could have been made within four hours of the call out drill.



Figure 24: Twenty-two of 26 sites with observers within 24 hours of the call out drill.

The next available high-tide daylight survey window was on Friday, April 11, 12:00-16:00 hrs. Twenty-three of the 26 (88%) survey sites had observers available for that survey. An additional two sites had observers available one day later. However, in eleven of the sites there was only one observer available; the PSSS protocol advises at least two surveyors per team. This indicates that only 12 sites (46%) would have had adequate personnel to conduct a survey on the day after the spill. Figure 25 shows the PSSS sites with at least one observer.

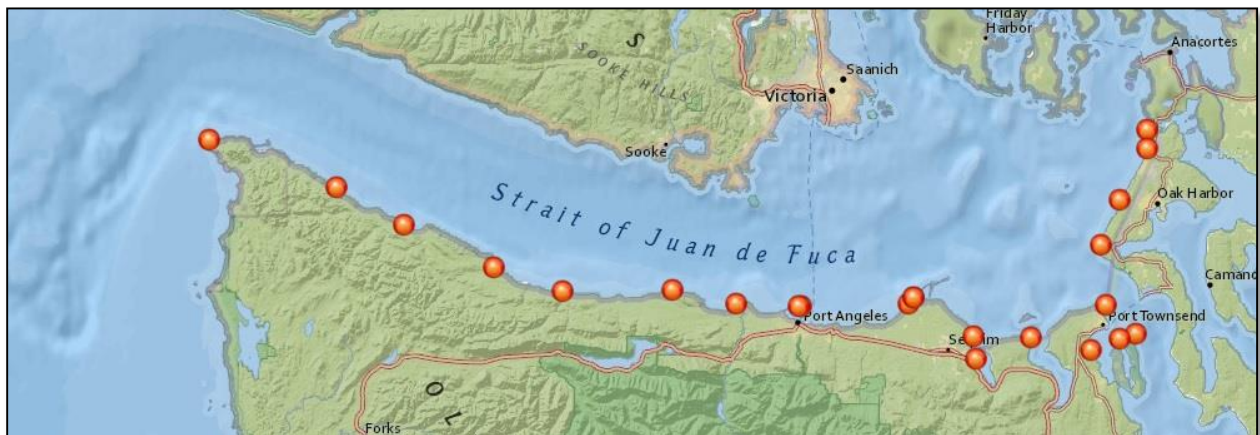


Figure 25: Twenty-three out of 26 sites with at least one observer for the seabird survey during the next daylight high-tide window after the call out drill.

The most revealing aspect of the drill was that there was some difficulty communicating with the observers. The notification of the drill was delayed for some observers who do not routinely check their email during the day. A suggested solution by several observers was to use text messages and/or phone calls in addition to the emails. In any future training sessions, cell phone numbers for each observer will be routinely collected.

Discussion

The program expansion and survey execution was successfully conducted. This substantially expands the area of the PSSS and provides data on abundance, distribution, and seasonality of marine birds in areas

that are highly vulnerable to marine shipping accidents as well as other stressors. It also provides the opportunity to greatly increase the number of “eyes on the water” to gather intelligence in the event of a major marine disaster. Despite having some resources available from the existing PSSS and having willing partners, the implementation of the expansion was very demanding and could not have been done without the support of the project grant, strong staff support from Seattle Audubon, assistance from the partner organizations, and the donation of extensive effort by multitudes of volunteers.

Reaching the Goals and Objectives

The primary goal of this project is to establish a robust baseline, by species and time of year, of the density and distribution of seabirds in areas that are at risk of the effects of major and catastrophic oil spills, and where current baseline data may be insufficient for proper evaluation of the effects of a spill.

Data were gathered at survey sites throughout the area of interest for one entire year. While these data constitute a baseline, it may be better described as a one-year “snapshot” of the density and distribution of the birds. With variability in weather conditions as well as the effects of major external oceanographic factors, robust estimates require additional years of survey. Therefore, we have met the goal to gather data for a baseline, but further surveys are needed to increase the robustness of this baseline.

The secondary goal is to expand the geographic range of the time series collected using this survey methodology and to improve estimates of seabird density and distribution within most of Puget Sound and identify changes throughout the region over time.

Figure 26 shows the geographic range of the entire PSSS study, including the expansion area. While the range still does not cover all of Puget Sound, particularly the San Juan Islands area, Hood Canal, and parts of the western shoreline of central Puget Sound, the geographic area of the study has been substantially increased. The figure also shows that the area of interest in this grant, the area that has the greatest threat of an oil spill, is now included in this program. The surveys at all sites are conducted utilizing the same protocol and observers receive the same level of training for the seabird survey. This goal has been met and the robustness of the work should increase if the program is continued into future years.

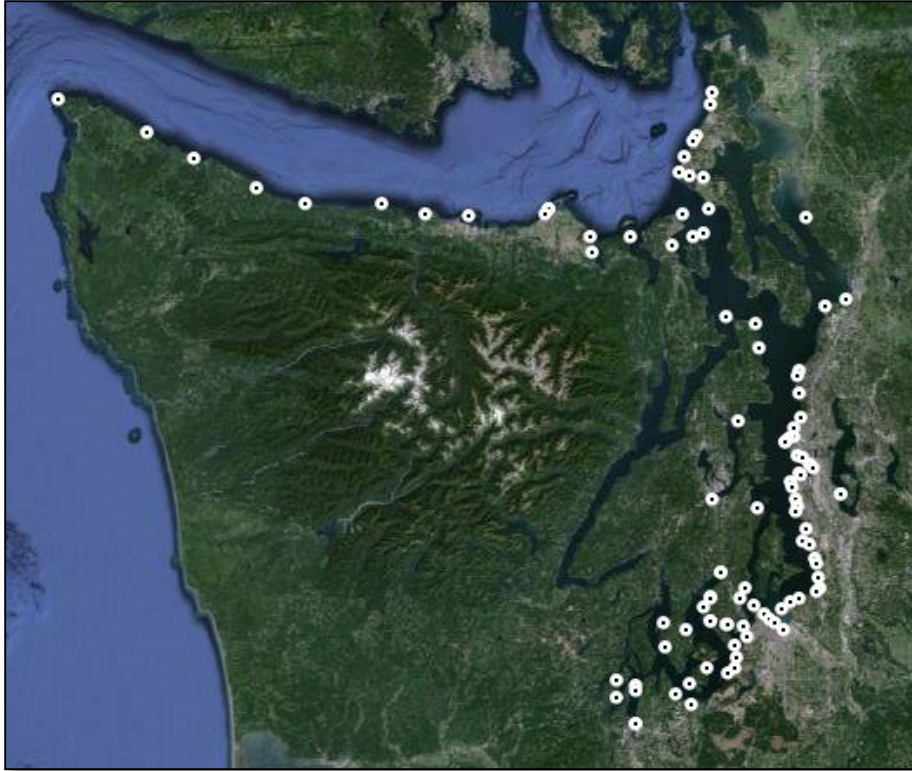


Figure 26: Location of all (Regular + Expansion) PSSS survey sites.

The final goal is to improve reconnaissance of oil spills and to improve the efficiency of oil-spill response.

Fortunately, we did not have an opportunity to field test these tools due to the lack of a large oil spill. However, the call out drill showed that the procedures that were developed would provide additional early on-scene reconnaissance in the event of a large spill.

The main objective of this program is to establish a systematic, citizen-science based seabird survey throughout an area that is not currently being assessed, using methods that can detect intra-annual and inter-annual changes. Through these surveys and analyses, the seasonal distribution and density data can be used in oil-spill response planning and operations. The development of a spatial time series enables assessment of the status and trends of seabird populations, including those endangered, threatened, and species of concern. With the development of this series, the data may also be useful for the assessment of damages to natural resources that result from an oil spill or other event.

The secondary objective is to develop a geographically distributed network of observers trained in recognizing and characterizing oil spills that can report their observations quickly to responsible agencies. This objective was met, as shown by the results of the drill. However, the drill also showed that methods of communication could be improved.

Assessment of the Feasibility of this Program

This expansion of the PSSS was successfully executed with well-trained surveyors, excellent geographic coverage, comprehensive surveys, and creation of a unique baseline dataset. There were two key areas of success within the seabird survey portion of this project.

Firstly, the success of this project hinges on the fact that we were able to engage dedicated, committed, and knowledgeable volunteers who care deeply about the health of the Puget Sound and its fauna. This project enabled the recruitment of almost 50 new volunteers to the PSSS, substantially increasing the number of people engaged in environmental stewardship and conservation issues in the region. This increased knowledge and awareness of the impacts to the environment, and more specifically understanding the trends and dynamics of seabird ecology, results in an increase in the number of environmental ambassadors. Recruiting these individuals was made possible through the development and maintenance of relationships with valuable project partners.

Secondly, the dataset that was produced forms the baseline for understanding seabird populations occupying near-shore habitat throughout the geographic focal area. This platform will be built upon in future years through repeat surveys utilizing identical methodology. Future PSSS work in the region will function as a monitoring program for seabirds. The addition of further data will enable the better understanding of population trends which in turn can be used to inform management practices and aid in recovery during oil spill events.

The oil-spill portion of the program was also successfully executed, with full training of the observers, establishment of protocols, and a successful drill. However, only an actual oil spill in the region would provide a full assessment of the protocols and management system.

The oil-spill portion consisted of three sections—verification of a spill, observations of the sites for the presence of oil, and conducting an additional seabird survey. The verification portion was difficult to implement and seemed unnecessary as there were other local sources to verify reported spills. The oil observation at survey sites was untested but seemed feasible. However, it was resource-intensive to produce oil spill manuals, conduct training, and execute a drill. Additionally, the quality and usefulness of the land-based observation by non-professionals has not been evaluated. The oil observations, while potentially valuable, are not among the highest priorities for Seattle Audubon and other partners, and may be difficult to provide staffing, unless external funds are available.

However, the supplemental seabird survey after an oil spill is an action that is both a high priority for Seattle Audubon and partners, and utilizes the expertise and resources that the birding community can provide.

Recommendations for Changes to the Program

The PSSS is a well-established program with a robust set of protocols and therefore no changes to the basic seabird survey are needed. The surveys rely heavily on engaging enough experienced and dedicated volunteers to cover all of the survey locations. Organizations such as Seattle Audubon and other Audubon chapters are able to source this manpower, but it is always a challenge. Ideally, the

project would over subscribe volunteers thereby providing cover if individuals were absent from a PSSS or emergency oil spill survey.

There are also potential changes in the structure of the program. This includes evaluating the results of all survey sites to determine which sites might be unproductive or redundant. Additionally, the results need to be evaluated to determine if a 12-month survey is productive or whether the survey should be limited to the seven winter surveys as is practiced in the regular PSSS. This standardization of the survey timing would also reduce logistic difficulties and expenses.

For the oil observations, instead of attempting to gather quantitative and qualitative data through the utilization of a spill manual and standardized data forms, the program could be simplified by simply asking observers if oil was observed at and near the survey site, and if so, if it is just a sheen or more extensive. Additionally, immediate communications with observers could be improved by collecting mobile-phone contact information so text messages could be sent when needed. Observers should also be informed to call the Washington Emergency Management Division at 1-800-258-5990 immediately if oiled wildlife is observed.

The extra seabird survey in the event of an oil spill is even more critical if the PSSS is reduced to a seven-month survey. Therefore, the communication protocol with the observers should be improved. The utilization of the GIS interactive map could be highly useful if mobile-phone data is included.

Conclusions

The expansion of the PSSS was successfully completed and the goals and objectives of this program were met. During the course of this project we learnt that there is a strong concern within the general public of the threat of an oil spill in the region, and that there is a desire in the birding community in particular to get involved in a project that in some way addresses this concern. This project confirmed that a program such as the PSSS could be successfully replicated and expanded to new geographic areas with the inclusion of specific training on local threats, such as oil spill response. The PSSS is an engaging program that satisfies the desires of the birding community and the needs of scientists, and with a few minor adjustments could potentially be replicated anywhere there is a knowledgeable birding community and coastline.

In addition, this project produced data that will be used to understand seabird population trends in a geographic area that has not been intensively surveyed. More surveys will be required before data will be useful in some management decisions, but the work during this project establishes an excellent foundation from which to build. Continuing analysis of the data should indicate if the program needs to be adjusted geographically and in its timing.

The oil-spill observations portion of the program needs to be further evaluated. This work is not among the highest priorities of the organizations that will be continuing this study and there is no external funding for the training and evaluation of this work. However, the observations program could continue at less cost if the observations are made opportunistically and the reports were more narrative than quantitative. The planning for an additional seabird survey in the event of an oil spill should continue as

part of the contingency plan as this addresses a high priority of the organization and utilizes the specialized expertise of observers.

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