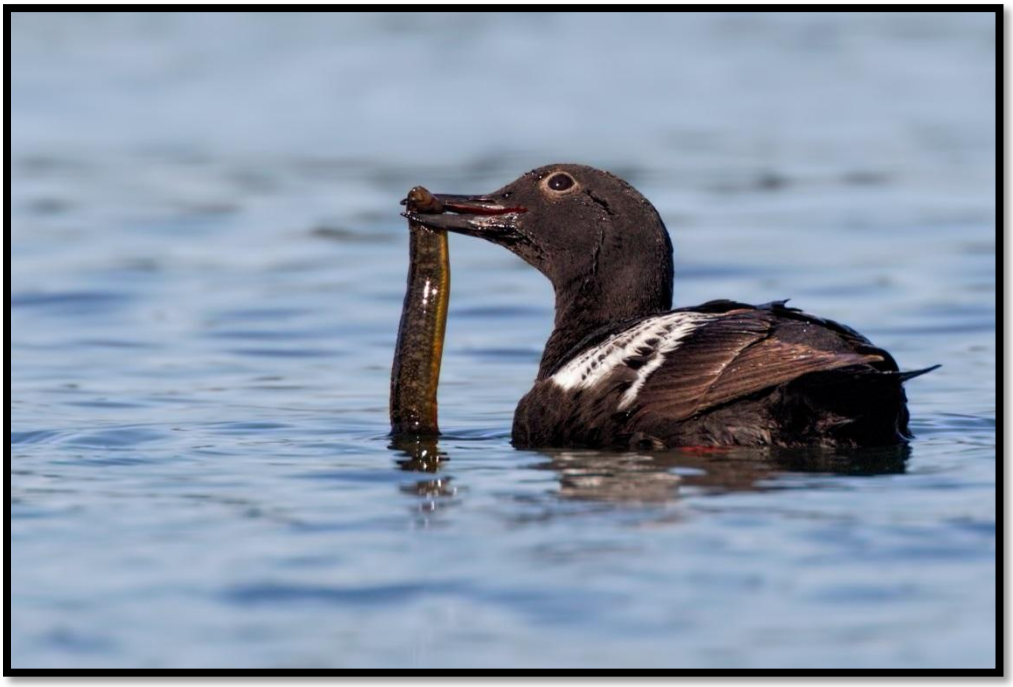
Pigeon Guillemot Foraging and Breeding Survey in and Near the Nisqually Reach Aquatic Reserve

2014 Monitoring Report



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Ensuring regulatory effectiveness in Puget Sound's most special places

Prepared for:

Nisqually Reach Aquatic Reserve Citizen Stewardship Committee

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Copies of this Monitoring Report are available http://www.dnr.wa.gov/ResearchScience/Topics/AquaticHabitats/Pages/aqr_rsve_aquatic_reserves_program.aspx and http://www.aquaticreserves.org/resources/

Cover photo: Pigeon Guillemot with gunnel at Burfoot Park, Olympia. Photo by Jeff Schwilk.

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2014 Monitoring Report

Abstract

The second season of the Nisqually Reach Aquatic Reserve and South Sound Pigeon Guillemot Foraging and Breeding Survey was conducted in summer 2014 as part of the Nisqually Reach Aquatic Reserve Citizen Stewardship Committee monitoring program. Sixty volunteers and substitute monitors collected data weekly at 28 sites for one hour in the early morning, mainly during June, July, and August. Data collected included the number of adult birds seen in colonies, number of active burrows, trips to burrows, fish delivered to burrows, and disturbances to nesting areas. Gunnels were the most frequently observed prey item delivered for chicks, followed by sculpins. Volunteers observed 77 active burrows. This two-year pilot project continues to establish a baseline dataset of the breeding population of Pigeon Guillemots in the Nisqually Reach Aquatic Reserve and local region. Additional sites were added to the 2014 survey to make the study more complete. Results of the study are provided to federal and state agencies, and organizations monitoring the health of Puget Sound.

Introduction

The first Nisqually Reach Aquatic Reserve and South Sound Citizen Science Pigeon Guillemot Breeding and Foraging Survey was conducted in summer 2013, in Thurston and Pierce County, Washington State, in and adjacent to the Salish Sea. The first year was pilot project developed and designed by the Nisqually Reach Aquatic Reserve Citizen Stewardship Committee (NRARCSC) with assistance from the Washington Environmental Council (WEC) and in association with the Washington Department of Natural Resources (WDNR). The protocol for this survey was adapted from the research conducted by the Whidbey Island Pigeon Guillemot Research Group (WIPGRG) (Mills & Joyce, 2014). This second year implements many of the lessons learned and resulting recommendations from the 2013 pilot study.

The Nisqually Reach Aquatic Reserve (NRAR) is part of the WDNR Aquatic Reserves Program. It is designated as an **educational, environmental, and scientific** reserve. **Educational reserves** are accessible areas of aquatic lands typical of selected habitat types which are suitable for educational projects; **environmental reserves** are areas of environmental importance, sites established for the continuance of environmental baseline monitoring, and/or areas of historical, geological or biological interest requiring special protective management; **scientific reserves** are sites set aside for scientific research projects and/or areas of unusually rich plant and animal communities suitable for continuing scientific observation (WDNR, 2011).

The NRAR encompasses approximately 14,826 acres (6,000 hectres) of state-owned and DNR-managed tidelands and bedlands. The ownership of adjacent lands is diverse. This includes state parks; the

Nisqually National Wildlife Refuge; local park districts; and private, tribal, Washington Department of Fish & Wildlife (WDFW), military, city, and county lands. There are nearly 39 miles (63 km) of shoreline adjacent to the reserve, the majority privately owned. The NRAR area is shown in Figure 1.

As part of the *Ensuring regulatory effectiveness in Puget Sound's most special places* project, the NRARCSC developed a monitoring program for a resident species, the Pigeon Guillemot, *Cepphus columba.* These birds are commonly seen in Puget Sound throughout the year and are the only member of the alcid family breeding in South Puget Sound. Breeding-bird surveys have shown that Pigeon Guillemots nest throughout North and Central Puget Sound (Opperman, et al., 2006). However, only a single formal study of baseline breeding population or documentation of breeding sites exists for South Puget Sound (Evenson, et al, 2003). Past studies have also identified the presence of Pigeon Guillemots throughout the Sound in the fall, winter and spring seasons (Nysewander, et al, 2005; PSSS, 2012).

Pigeon Guillemots are viewed as one of the key marine bird indicators in Puget Sound (Pearson and Hamel, 2013). They nest in burrows on the shoreline, whether in the bluffs or among driftwood or other debris on the beach. They are a fish-eating species and catch their prey in the nearshore waters. The NRAR is home to foraging Pigeon Guillemots that nest in adjacent cliffs. Breeding pairs are believed to establish burrows in May and June, where they normally lay two eggs. Both the male and female incubate the eggs. For successful nests both adults are delivering fish and other marine prey to the young from hatching (late of June) until they fledge (usually in August).

The management plan (WDNR, 2011) for the Nisqually Reach Aquatic Reserve identifies five management goals:

1. Preserve, restore and enhance aquatic nearshore areas including intertidal and subtidal ecosystems with a special emphasis on native habitats for forage fish, salmonids, and marine birds.
2. Protect and restore the functions and natural processes of nearshore ecosystems in support of the natural resources of the reserve.
3. Promote stewardship of riparian and aquatic habitats and species by supporting and providing opportunities for outdoor education, scientific research including citizen science and interpretive studies.
4. Promote sustainable management of traditional recreational (e.g., boating, water skiing, fishing), commercial (e.g., marinas), and cultural uses in the aquatic reserve in a manner consistent with the other goals and objectives for the reserve.
5. Support the recovery and protection efforts for federal and state threatened, endangered and sensitive species, species of special concern and their habitats.

This Pigeon Guillemot monitoring program was developed to support these goals. Nest monitoring can provide basic biological information on this population, including reproductive success and diet composition. It can also provide critical information about health of the local food web as these birds feed primarily on small fish and other marine creatures. Observations can also help quantify behavioral responses of Pigeon Guillemots to disturbances of various types, including human, domestic animals, and predators, such as raptors. This study also has the potential of providing trends in population, fecundity, and chick diet over time, as this project continues beyond the first year.

The aquatic reserve area encompasses only state tidelands and bedlands. Therefore, because all burrows are on bluffs and shoreline adjacent to tidelands and bedlands and many are on private property, all the nesting burrows of Pigeon Guillemots are outside the reserve; some are immediately adjacent to the reserve while others are more distant. Much of the foraging occurs within the reserve boundaries.

Long-term studies of Pigeon Guillemot breeding and prey selection have been conducted by the WIPGRG, with 12 years of observations recorded using a standardized methodology. The study in NRAR was modeled after the Whidbey Island program. Data collection procedures, field cards, training, mentoring, and support were provided by WIPGRG.

Additional details regarding the development and design of the program are given in the project QAPP, *Pigeon Guillemot Breeding Survey in the Nisqually Reach Aquatic Reserve and South Puget Sound Quality Assurance Project Plan* (Mills & Joyce, 2013).

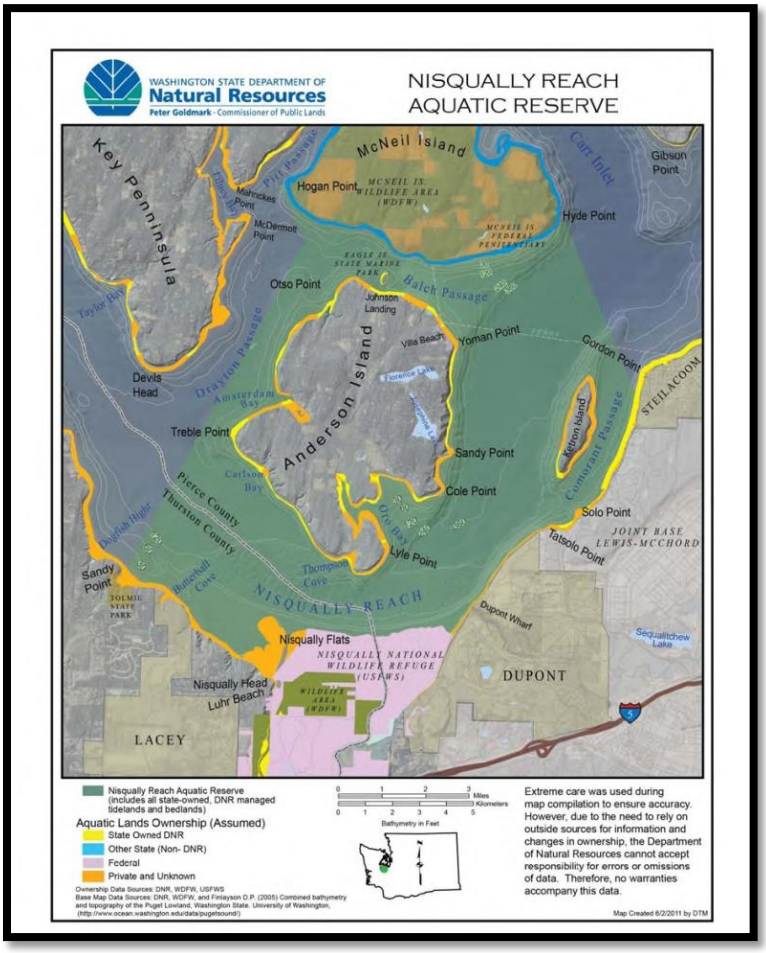

Figure 1: Nisqually Reach Aquatic Reserve and surrounding areas. (Source, WDNR, 2011)

Goals and Objectives

The two main goals for this study, as stated in the quality assurance planning documents are:

1) Create a dataset of:
   - The number of Pigeon Guillemot breeding sites adjacent to and in the vicinty of the NRAR
   - The number of breeding pairs using those sites
   - Total breeding population within the area
2) Create vital monitoring resources by involving, educating, and training citizen scientists to monitor the Pigeon Guillemot breeding sites.

The project objectives for 2014 are:

- Train at least 30 citizens to identify and monitor active breeding burrows of Pigeon Guillemots
- Record weekly observations of Pigeon Guillemots using burrows for breeding during the 2014 breeding season at 20 or more sites
- Compile field data and analyze
- Distribute data or results to appropriate local and state agencies and the public, via website and other outreach, such as presentations to community groups
- Make recommendations to land owners (public or private) on how to protect breeding sites.

Survey Methodology

The data-collection procedures for the project were derived from the WIPGRG's standard operating procedure (Wood and Kind, 2013). The standard operating procedure for this project and the data-collection card used in recording data are provided in the QAPP.

The primary data collected were behavioral observations and counts of birds and burrows. Additionally, prey items were identified and counted. Data recorded included:

- The highest bird count during the survey period
- The number of active burrows*
- The type and frequency of fish delivered to each burrow
- Disturbances, responses to disturbances, and time for behavior to return to normal.

**An active burrow is defined as one where an adult Pigeon Guillemot was observed entering or leaving the burrow.*

Narrative of the Field Research

Wyatt Hersey, spring term intern from The Evergreen State College, recorded pre-season obeservations of breeding and potential breeding sites during April and May 2014. This provided information about the time of arrival of guillemots at breeding sites, guillemot interest in specific burrows, and possible additional breeding sites. Volunteers were recruited from a wide variety of backgrounds via email, flyer distribution, presentations, word of mouth, and outreach by Stream Team and Black Hills Audubon. Fourteen people attended a volunteer training on Anderson Island Fire Station on May 29, 2014. A lecture and volunteer training was held on June 7 at LOTT WET Science Center in Olympia and attended by 28 people.

Observations were made from designated observation locations and conducted for one hour in the early morning and completed by 09:00 am. Observers supplied their own binoculars and some used spotting

scopes for monitoring activity near a burrow. Data were recorded on field cards with information subsequently entered into Excel spreadsheets.

Surveys were conducted weekly over 11 weeks, from June 9th through August, 2014. Surveys started two weeks earlier in 2014 than in 2013 because fish deliveries in 2013 were documented in the 3rd week of June. Therefore it was believed an earlier start date would provide a more accurate assessment of the breeding season by including sites where earlier breeding occurs.

Volunteer monitors contributed 729 hours to the Pigeon Guillemot Breeding Survey. Figures 2 and 3 show volunteers collecting data in the field. Volunteer project coordination (272 hours) and intern time (320 hours) totaled an additional 535 hours.

Figure 2: Volunteers Bobby Moody (left) and Paul Moody (right) surveying at Zangle Cove.

Results

The goal for Year 2 (2014 season) was to continue establishing a baseline dataset of breeding sites, breeding pairs, and total breeding population. The dataset is believed to be incomplete as a census, because anecdotal information indicates that there may be additional breeding sites in the area. However, this expansion of the survey likely provides a good representation of the breeding sites in the area. A full analysis of these results will likely require additional years of data.

Site Monitoring

Sixty volunteers participated in monitoring Pigeon Guillemot nesting activities. Of the 28 sites monitored, 26 were active, with a total of 77 active burrows documented (Table 1). Figure 4 shows the location of the monitored colonies. Yellow circles indicate sites that were monitored in 2013 and 2014. Green circles indicate new sites. Green stars indicate colonies with new sites.

Figure 3: Treesa Hertzel, tracking and counting Pigeon Guillemots at Butterball Cove North (Photo by Judy Murphy).

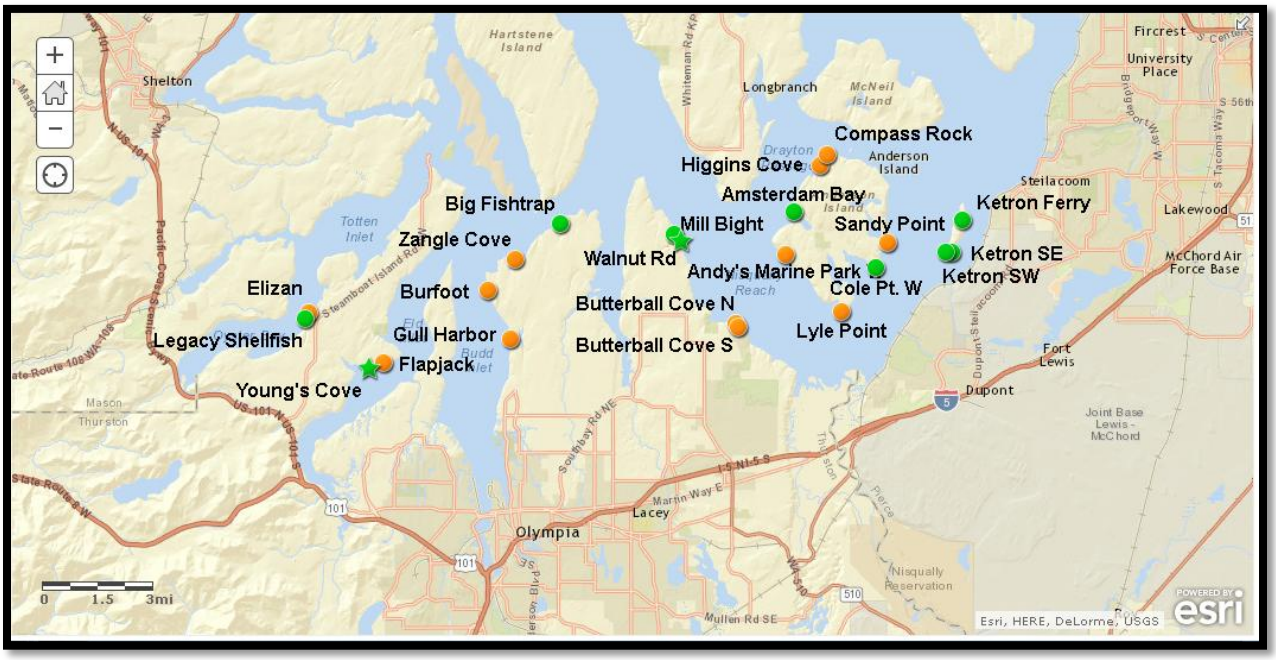

Figure 4: Colony locations for Pigeon Guillemot observations. (Lee, 2014).

Table 1: Survey sites and active burrows.
Vicinity codes: NRAR-A: Adjacent to the Nisqually Reach Aquatic Reserve on Anderson Island; NRAR-M: Adjacent to the Nisqually Reach Aquatic Reserve on the Mainland; SS: South Sound and not adjacent to the Reserve.

Location	SiteCode	Survey Dates	Vicinity	Status of Site	Active Burrows	Highest Bird Count
Andy's Marine Park - West Bluff	AMPWAI	6/10-8/22/2014	NRAR	Active	4	20
Amsterdam Bay	AmsbyAI	6/13- 8/23/2014	NRAR	Active	2	16
Big FishtrapA	BiFiA	6/12 – 8/21/2014	SS	Active	2	11
Burfoot Park	BurPk	6/10-8/19/2014	SS	Active	6	18
Butterball Cove North	BubaN	6/11-8/23/2044	NRAR-M	Active	1	*
Butterball Cove South	BubaS	6/10- 8/28/2014	NRAR-M	Active	6	34
Cole Point W	CoPtWAI	6/11 – 8/7/2014	NRAR-A	Active	2	14
Flapjack Beach A	FlJaA	6/10 – 8/20/2014	SS	Active	4	15
Gull Harbor	GuHaN	6/15- 8/3/2014	SS	Active	8	23
Higgins Cove	HiCoAI	6/22-8/3/2014	NRAR-A	Active	1	9
Jacobsens - Compass Rock	JaCRAI	6/12-7/10/2014	NRAR-A	Active	2	7
Ketron Ferry	Ketfer	6/13-8/8/2014	NRAR-A	Active	8	19
Ketron SE	KetSE	8/15-8/29/2014	NRAR-A	Not Active	0	8
Ketron SW	KetSW	6/12-8/21/2014	NRAR-A	Active	3	22
Lyle Point	LyPtAI	6/12-8/17/2014	NRAR-A	Active	8	32
Mill BightA	MilBtA	6/20-8/26/2014	SS	Active	1	11
Mill BightB	MilBtB	7/4-8/11/2014	SS	Active	2	*
Totten @ Elizan A	TotElzA	6/15- 8/2/2014	SS	Active	0	10
Legacy Shellfish	LegSh	6/10 – 8/25/2014	SS	Active	2	8
Walnut RdA	WalRdA	6/11-8/20/2014	SS	Active	1	22
Walnut RdB	WalRdB	6/11-8/20/2014	SS	Active	1	*
Walnut RdC	WalRdC	6/11-8/14/2014	SS	Active	2	*
Young's CoveA	YoCoA	6/9-8/20/2104	SS	Active	1	14
Young's CoveB	YoCoB	6/9-8/20-2014	SS	Active	3	*
Young's CoveC	YoCoC	6/9-8/20/2014	SS	Active	2	*
Young's CoveD	YoCoD	7/3-8/20/2014	SS	Active	1	*
Young's CoveE	YoCoE	7/10-8/20/2014	SS	Active	1	*
Zangle Cove	ZaCoE	6/9-8/19/2014	SS	Active	3	9
Totals					**77**	**322**

* Birds observed at this site are included in a colony total in another row. Indicates a colony with multiple sites for which the highest bird count is used.

Prey Observations

Observations were made of fish being delivered to burrows by adult Pigeon Guillemots. The results, by prey species, are shown in Table 2. Most prey were gunnels, with a substantial number of sculpins also

observed. The category *Other Prey* includes observations of fish identified (perch for example) that were not sculpin or gunnel, or fish that were unknown/not identified. Observations of prey delivery ranged from June to late August.

Table 2: Observed fish deliveries at each site.

Location	Gunnel	Sculpin	Other prey	Date of First Fish Delivery	Date of Last Fish Delivery
Andy's Marine Park - West Bluff	0	2	0	7/15/2014	7/22/2014
Amsterdam Bay	1	0	0	7/4/2014	7/4/2014
Big FishtrapA	0	0	0	NA	NA
Burfoot Park	9	3	0	6/17/2014	8/5/2014
Butterball Cove North	1	0	0	7/21/2014	7/21/2014
Butterball Cove South	5	1	0	7/11/2014	8/15/2014
Cole Point W	0	0	0	NA	NA
Flapjack Beach A	4	5	2	6/10/2014	7/18/2014
Gull Harbor	6	5	6	6/22/2014	8/3/2014
Higgins Cove	2	1	0	7/13/2014	7/20/2014
Jacobsens - Compass Rock	0	0	0	NA	NA
Ketron Ferry	7	0	2	7/21/2014	8/1/2014
Ketron SE	0	0	0	NA	NA
Ketron SW	0	3	0	7/13/2014	8/3/2014
Lyle Point	8	5	0	7/3/2014	7/31/2014
Mill BightA	4	0	0	7/4/2014	7/26/2014
Mill BightB	2	0	1	7/21/2014	7/26/2014
Totten @ Elizan A	0	0	0	NA	NA
Legacy Shellfish	2	1	1	7/8/2014	8/15/2014
Walnut RdA	7	0	0	7/16/2014	7/30/2014
Walnut RdB	5	0	0	7/16/2014	8/6/2014
Walnut RdC	4	0	1	7/9/2014	8/6/2014
Young's CoveA	1	0	4	6/19/2014	7/3/2014
Young's CoveB	4	0	2	6/19/2014	8/6/2014
Young's CoveC	6	1	4	6/10/2014	8/5/2014
Young's CoveD	2	0	1	7/23/2014	8/6/2014
Young's CoveE	0	0	0	NA	NA
Zangle Cove	7	2	0	7/6/2014	8/4/2014
Totals	**87**	**29**	**24**		

Discussion

Monitoring efforts continued to build toward achieving the goals and objectives of this project in this second season. In the 2014 study, major progress was made toward achieving the first goal, to create a dataset for the number of breeding sites, the number of breeding pairs, and an estimate of the total population size. Twelve new sites (not monitored in 2013) were documented in 2014, and the total number of Pigeon Guillemots observed increased by 33% (from 213 birds in 2013 to 322 birds in 2014). The number of active burrows (reflecting the number of breeding pairs) increased by 35% (from 50 burrows in 2013 to 77 in 2014).

The second goal was to create a monitoring program that involves education and training volunteers to become citizen scientists. This goal along with the stated objectives to train at least 30 citizen scientists to identify and monitor active breeding burrows at five or more active sites was met and exceeded. Forty-two volunteers were trained to become citizen scientists. Sixty volunteers and substitute monitors participated in weekly monitoring of 28 sites. The collected data have been digitized and analyzed and are being released through public outreach programs and this report.

Volunteers reported that they enjoyed participating in the survey on a Puget Sound/Salish Sea beach and hoped to come back next year. New volunteers learned about citizen-science methods and Pigeon Guillemot behaviors. Returning volunteers deepened their roots and knowledge of South Puget Sound and the Guillemot breeding population. These benefits have not been measured, but contribute to satisfying lives of the volunteers and possibly increased stewardship.

Additionally, an online map has been created showing the location of the observed colonies and provides location specific information, including number of burrows, highest number of Pigeon Guillemots observed, and prey delivered. The map also features a photo for each site. This map is available at the website, http://bit.ly/1DdkJ5X. The map is currently incomplete, but will eventually be fully interactive and available to the public. Currently the map only shows colony locations. Figure 5 shows an example of the 2013 interactive map.

The 2014 interactive map will provide a great opportunity for public education and outreach and can assist in developing stewardship for both adjacent landowners and for the public. This interactive map was created by Terence Lee, the Nisqually Reach Nature Center Science Technician, with assistance from Mike Ruth (ESRI).

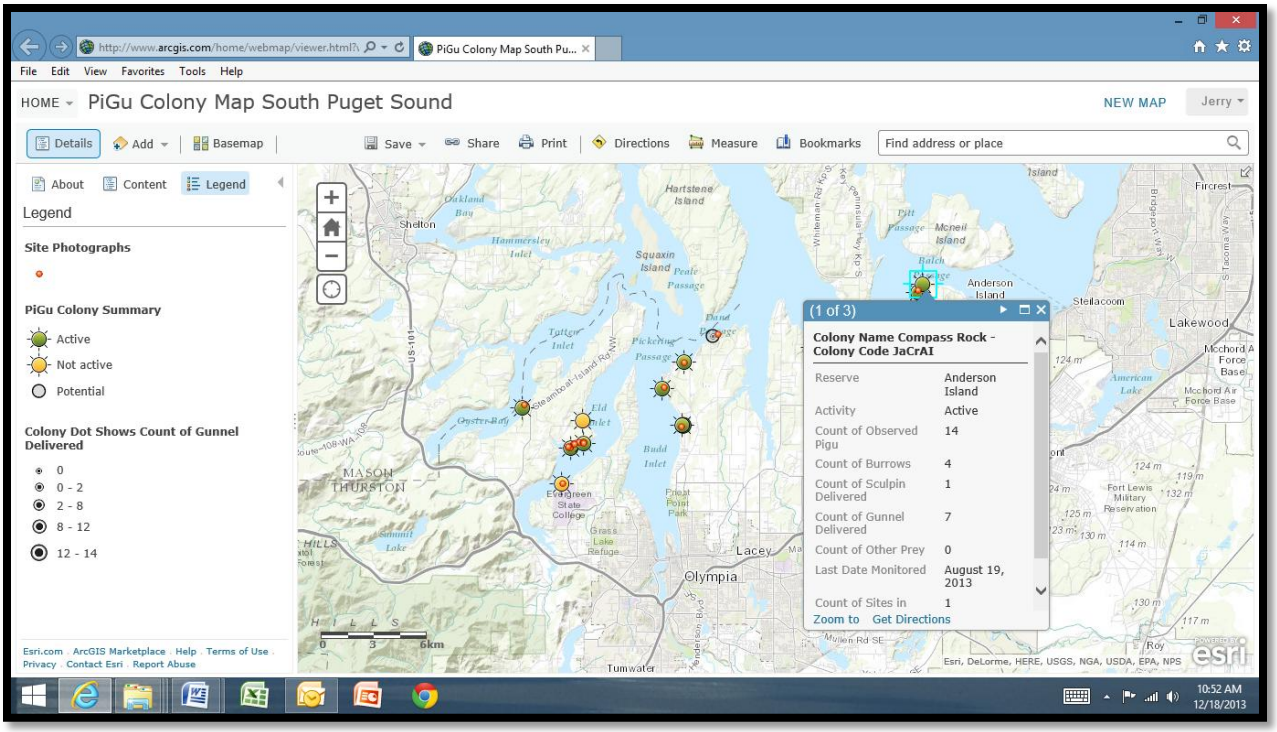

Figure 5: 2013 Interactive map showing details for each colony (Ruth, 2013).

The total number of guillemots observed ranged from seven at Jacobsens/Compass Rock to 34 at Butterball Cove South (Figure 6). Forty-seven percent of the total birds observed were breeding birds, based on the number of active burrows (assuming one pair of breeding birds per active burrow). The birds also gathered outside of the burrows and showed strong social interactions (Figure 7).

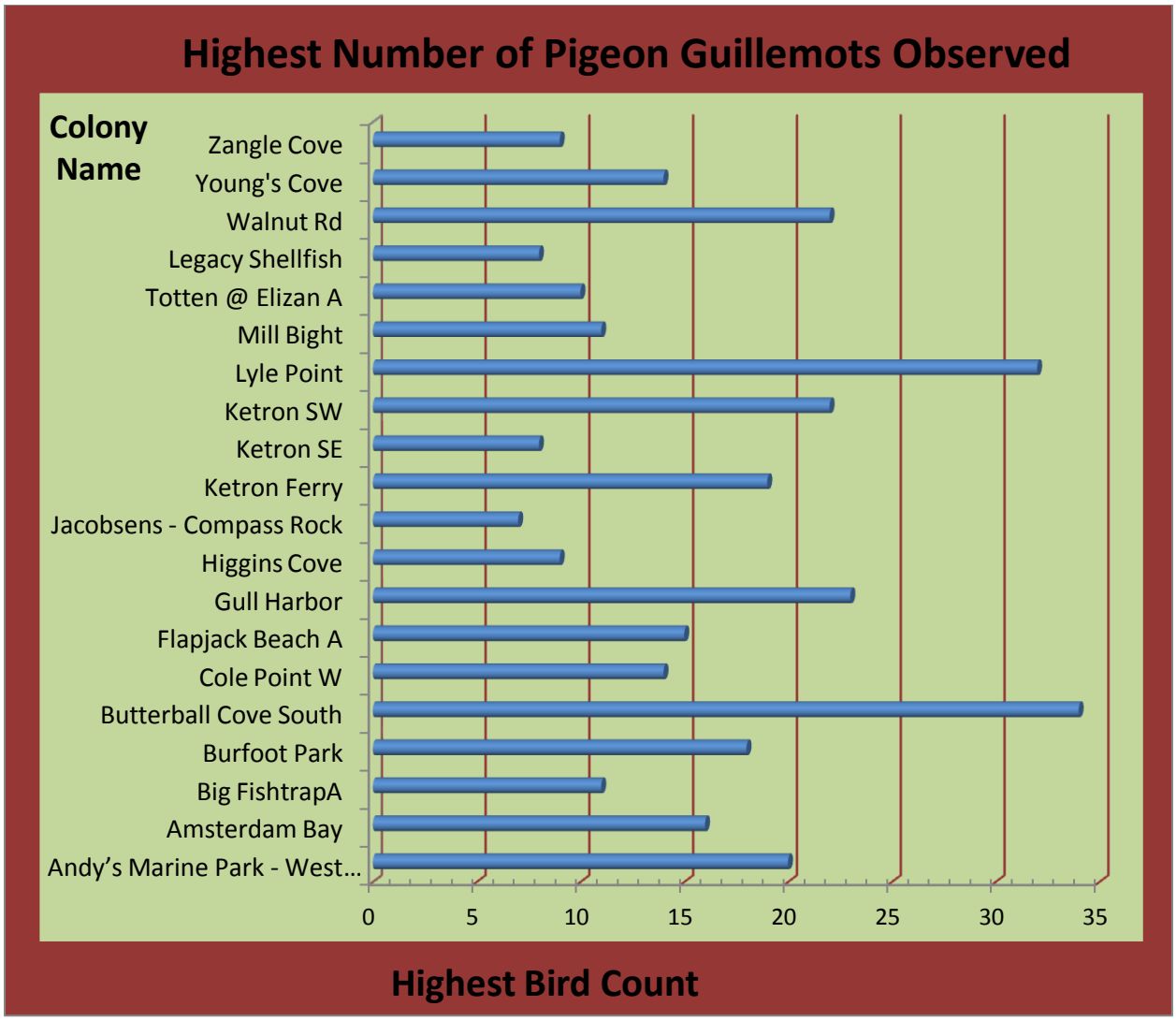

Figure 6: Highest number of Pigeon Guillemots observed.

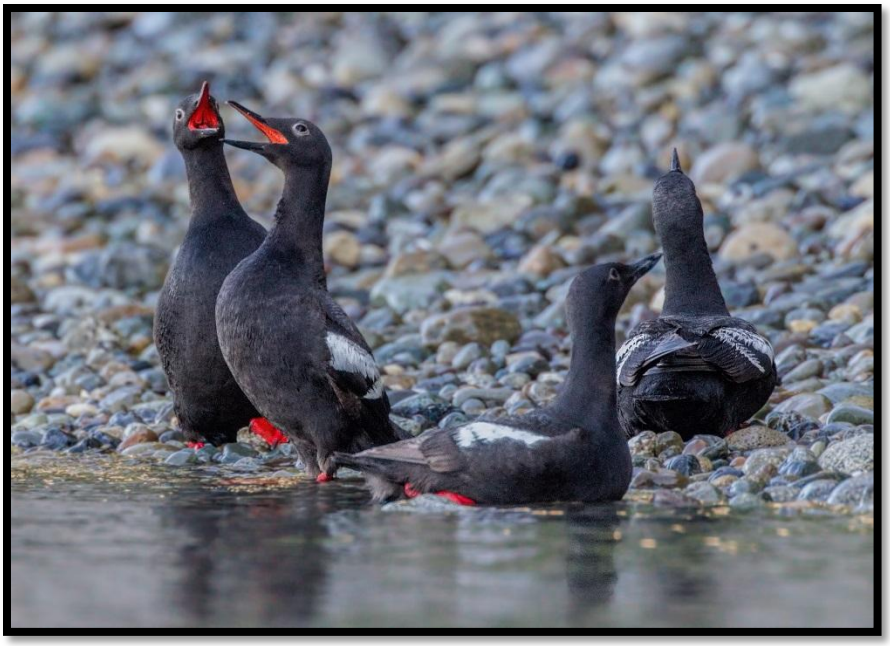

Figure 7: Pigeon Guillemots vocalizing and demonstrating the red mouth lining and red feet of adult plumage. (Photo by Jeff Schwilk)

Delivery of Prey

The 2013 study began the week of June 25. Because four sites reported fish deliveries the first week of 2013 survey, the period for the 2014 study was expanded to begin the week of June 9. The earlier start of the 2014 season resulted in six additional fish deliveries observed in the first two weeks of the survey.

The 2014 prey composition, shown in Figure 8, consisted of 62% gunnels, 21% sculpin, and 17% other fish. Other fish is defined as perch, cod, ratfish, or in some instances, fish that were observed but could not be identified. It was common for volunteers to have trouble with fish identification. In some instances, this was due to the birds being distant but more often the prey delivery occurred so quickly that it was not possible to clearly see what kind of fish was being brought to the burrow. Gunnels were the most common prey of choice in both 2013 and 2014. In 2014, they were observed three times as often as sculpin.

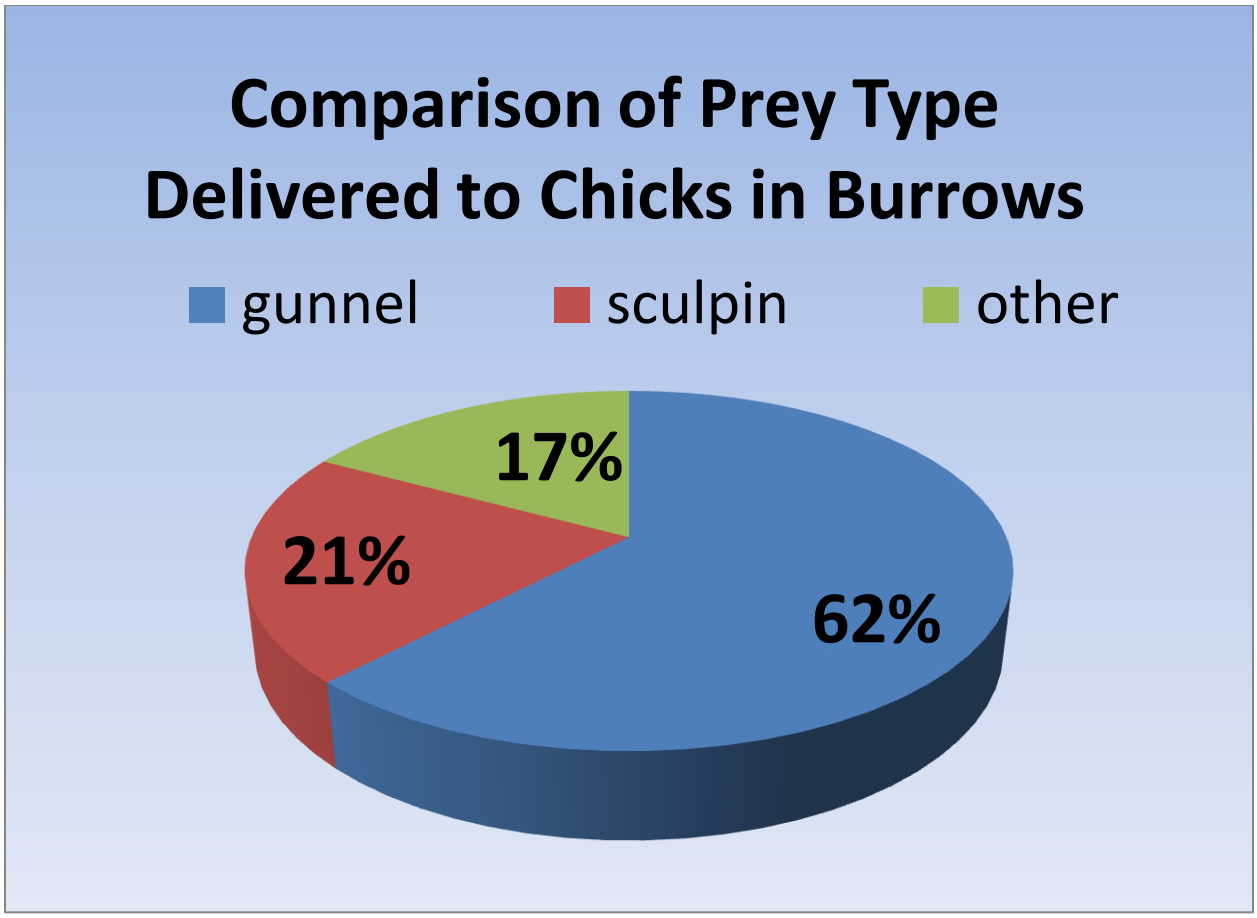

Figure 8: Type of Prey Delivered to Pigeon Guillemot burrows.

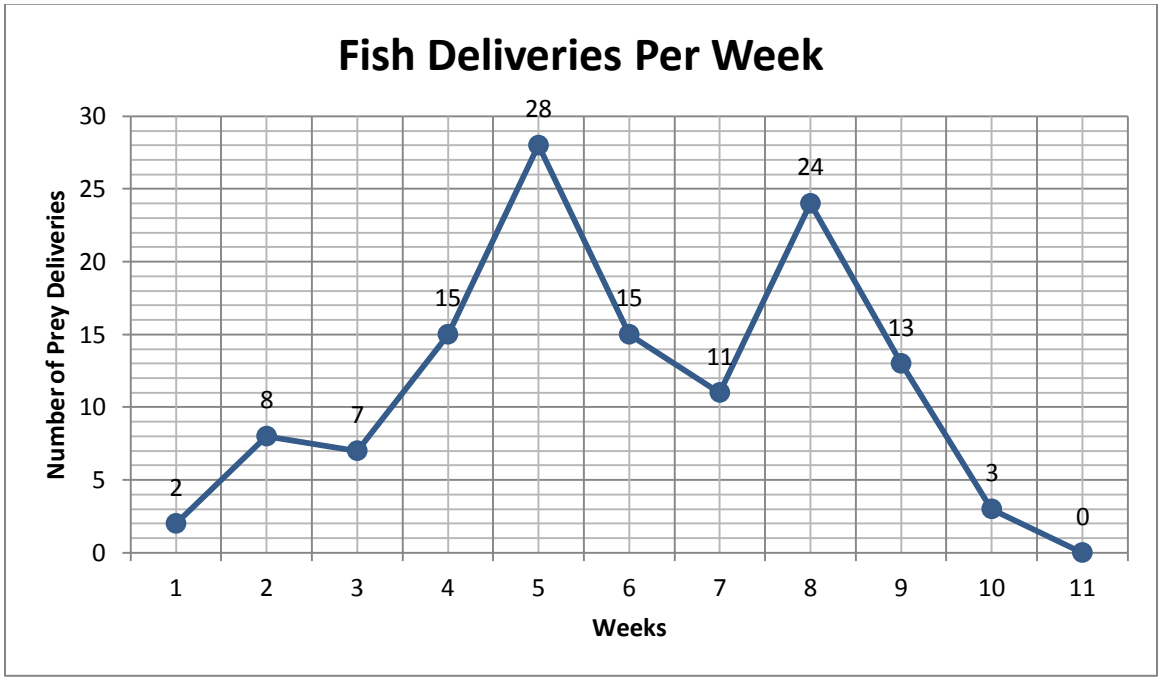

Figure 9: Number of fish deliveries observed each week.

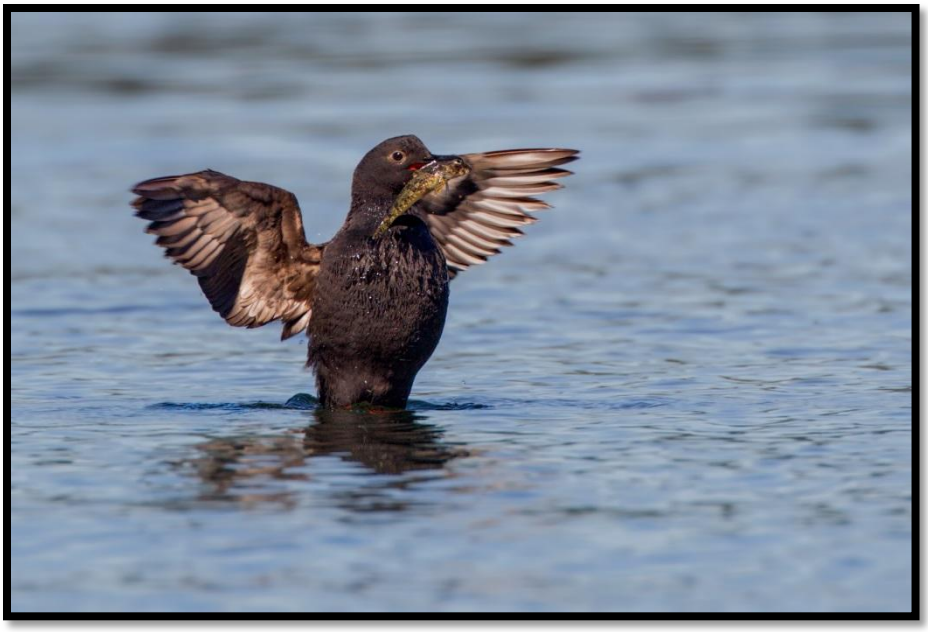

Figure 10: Pigeon Guillemot with sculpin (photo by Jeff Schwilk)

Completeness of the Pigeon Guillemot Breeding Survey

Fourteen new sites were added for the 2014 survey:

- Big Fishtrap
- Ketron Island Ferry
- Ketron Island SW
- Ketron Island SE
- Mill Bight A
- Mill Bight B
- Legacy Shellfish
- Amsterdam Bay
- Cole Point West
- Walnut Road B
- Walnut Road C
- Young's Cove C
- Young's Cove D
- Young's Cove E

As is typical, we found additional burrows mid-season and so surveys of these newfound sites did not encompass the entire breeding season.

To achieve completeness for "all breeding sites" the monitoring team hopes to include the southern tip of Harstine Island and Squaxin Island in the 2015 survey. Additional sites on Ketron Island and Anderson Island may also contain active burrows. These all will likely require monitoring by boat or by Island residents. These sites are thought to be active because of 1) the appearance of the burrows and bluffs with colonies of birds observed near shore, and/or 2) reports of anecdotal observation. Accessibility of sites, landowner identification and permission, limitation of scouting hours and opportunities, and available boat captains and volunteers all contributed to these sites not being monitored during the

2014 season. However, the large number of sites currently being monitored likely provides a representative sample to determine considerable information, including prey utilization, and feeding rates.

Discovery of new sites is a continual endeavor that will resume in the off-season. We plan to conduct scouting surveys during the off-season to get a better look at sites with suspected or potential burrows as well as to get a better look at burrows with an obscured view during the summer. We are interested in conducting the same monthly winter surveys that WIPGRG does so that we have a better understanding about the whereabouts and behaviors of these birds when they are not breeding.

Variation of Coverage per Site

Volunteers are allowed to schedule their monitoring day/time, as long as they conduct observations on the same day each week when possible and complete the hour of observations by 9 a.m. Therefore monitoring did not consistently occur on the same day or time throughout the area. Conditions such as temperature, tide, precipitation, wind, and possibly location of prey varied between monitoring events and locations. In addition, tides affected site accessibility and forced volunteers to change their monitoring day about once a month. This resulted in monitoring events being more or less than a week apart.

Monitoring at most sites ended at the end of August, when no Pigeon Guillemots were observed, or when there was no burrow activity for two consecutive weeks.

On multiple occasions, some sites were not monitored at all due to lack of volunteers. This was a result of both miscommunication as well as lack of communication. This explains some of the inconsistencies in survey completeness. It is anticipated that with additional dedicated staff along with an intern and co-coordinator, this problem will be minimal.

Recommendations for Changes to the Procedures and Program

The following procedural changes were recommended and implemented in 2014 as a result of the 2013 study:

1) Begin monitoring the second week of June, about two weeks earlier than in the 2013 study.

   Result of change: Fish deliveries were observed during the earlier two-week expansion period; it is recommended that the 2014 change be maintained and that the 2015 survey again begin the 2nd week of June.

2) Add tide level (and incoming or outgoing) at the beginning of the survey to the field data card. This information may be instrumental in determining if feeding activity is greater during high tides.

   Result of change: Volunteers did not record tides in a consistent manner. Therefore, in the future, tidal information will be excluded from the survey form and instead be generated internally by staff and/or interns.

Recommendations for 2015 include:

1) Provide additional on-site mentoring and training for volunteers to ensure surveys are consistently conducted according to protocol and that data forms are filled out correctly.

2) Continue regional networking to provide consistent and usable data for stakeholders.

3) Review survey forms promptly for errors and/or other issues and resolve problems promptly to minimize confusion later when analyzing the data; enter data into a spreadsheet promptly.

4) Institute regular check-ins and establish regional leads to improve coordination and ensure adequate coverage of sites.

Recommendations for Landowners

Possible actions landowners could take to protect the breeding process and habitat of Pigeon Guillemots:

- Public sites should include signage with education about Pigeon Guillemot breeding and warnings of the danger and damage from climbing on bluffs or defacing bluffs.
- Removal of vegetation and construction above or near the bluff should be avoided during breeding season if possible.
- Covering bluff habitat with erosion prevention material should be avoided if possible.

Landowners can help by reporting dead birds and suspicious activity near burrows. They can report observed adults and juveniles. Landowners can participate fully in the survey or allow volunteers to monitor from the property if they are unable or unwilling to commit.

Conclusions

The 2014 season added information about Pigeon Guillemot breeding sites monitored in 2013 and provided substantial documentation for many new active breeding sites. The monitoring team would like to continue the project in 2015 for the following reasons:

- Pigeon Guillemots are Puget Sound/Salish Sea dependent and widely distributed throughout the Sound and are indicators of Sound ecosystem health.
- Volunteers develop citizen-science skills and connections to the Salish Sea and are very willing to give time to the project. Their efforts contribute to the knowledge about this species in the Sound.
- Additional years of study would substantially increase the robustness of the dataset and, over time, provide population trends for the South Sound Pigeon Guillemots.

Figure 11: Pigeon Guillemots “Sky trilling” (photo by Jeff Schwilk)

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Appendix: Acknowledgements and Volunteers

The second annual Nisqually Reach Aquatic Reserve (NRAR) and South Sound Pigeon Guillemot Breeding Survey (2014) was completed with effort from many volunteers and community partners.

The dedicated volunteer monitors and their monitoring sites are listed in the table below. These 60 volunteers and substitutes showed up weekly by eight am or before, regardless of weather, recorded their observations, and were consistent in sending in their completed field cards.

Site Name	Volunteers
Andy's Marine Park - West	Merry McNutt, Lead
	Beverly Papazion
	Linda Carpenter
	Patsy Bean
Amsterdam Bay	Merry McNutt, Lead
	Mikey Sleight
	Beverly Papazion & daughter
Big Fishtrap A	Sharon Bergquist-Moody, Lead
	Dawn McHugh
	Nora Mena
	Laura Kraig
	Judy Oliver
	Jake Lehman
Burfoot Park	Cindy Coble, Lead
	Melody Meyer
	Bert Stevens
	Cathy Tarabulski
	Cindy Eaton
	Lilly Hamilton
Butterball North	Judy Murphy, Lead
	Treesa Hertzel
Butterball South	Hal and Pat Michael, Co-Leads
Cole Point West	Carol Paschal, Lead
	Jeane McGoldrick
Flapjack Point A	Anand Maliakal, Lead
Gull Harbor	Leslie Cushman, Lead
Higgins Cove	Liane Heckman, Lead
Compass Rock	Lynne Jacobsen, Lead
Ketron ferry	Joe Howells, Lead
	Jerry Atkission
	Jeremiah Howells
Ketron SE	Terence Lee, Lead
	Ross Skinner
	Keith Guerin
	Mary Romoser

Ketron SW	Merry McNutt, Lead
	Tuja Hajnal
	Kelly Hinds
	Tony McNutt
	Lisa, Larry, and Kendall Cheever
Lyle Point	Jane Groppenberger, Lead
	Krystal Wallace
	Carol Paschal
	Jeana McGoldrick
Mill Bight A	Laura Milleville, Lead
	Ann Leach
	Anne Mills
	Allison Swan
Mill Bight B	Ann Leach, Lead
Totten @ Elizan (tower)	Lois Ward, Lead
Totten @ Legacy Shellfish	Leslie Sikora, Lead
	Lois Ward
	Michele Burton
	Jake Lehman
	Judy Oliver
	Llyn DeDanaan
Walnut Rd. A	Nora Mena, Lead
	Alyssa Wilson
	Ursula Smircich
	Laura Kraig
Walnut Rd. B	Norine Meyer, Lead
Walnut Rd. C	Ursula Smircich, Lead
	Laura Kraig
	Margaret Thompson
	Terence Lee
	Michael Bloom
Young's Cove Colony A- E	Maria Ruth,Lead
	Steve Curry
	Sharon Moore
	Jan Weiser
	Lesley Willardson
	Anne Mills
	Cindy Eaton
	Terence Lee
Zangle Cove	Bobbie and Paul Moody, Lead
	Cedar Bouta
	Cindy Eaton
	Larry Goldstein

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- Wyatt Hersey, spring intern, for conducting pre-season surveys, refining the survey data sheets, and assisting with both volunteer trainings.
- Allison Swan, summer intern, for data entry and photos of birds with prey.
- Merry McNutt for coordinating the Anderson Island volunteers, hosting Anderson Island volunteer events, serving as team lead for three Anderson Island sites (including weekly kayak trips to Ketron Island), and recruiting and training new volunteers on Anderson Island.
- Carol Paschal for recruiting and training new volunteers on Anderson Island.
- Mike Ruth, ESRI, for creating and sharing the initial GIS map and teaching team members how to use the map.
- Jeff Schwilk for the use of photos for fish identification and prey size estimate.

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