Oregon Coast Wide Tufted Puffin Colony Survey 2021

Photo credit Tiffany Boothe

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April 2022

Cite as: Stephensen, S.W. 2022. Oregon Coast Wide Tufted Puffin Survey 2021. U.S. Fish and Wildlife Service Unpublished Report, Oregon Coast National Wildlife Refuge Complex, Newport, Oregon 97365. 36pp.

‘‘The findings and conclusions in this article are those of the author(s) and do not necessarily represent the views of the U.S. Fish and Wildlife Service.’’

EXECUTIVE SUMMARY

The Tufted Puffin (*Fratercula cirrhata*) is a medium-large pelagic seabird and member of the Auk family. The distribution of the Tufted Puffin is widespread in the North Pacific Ocean and nests on the coastline and offshore islands in California, Oregon, Washington, British Columbia, Alaska, Japan, and Russia. Tufted Puffin populations have generally declined throughout the southern portion of their range from British Columbia to northern California. Possible causes of puffin decline included factors related to conditions at breeding sites, at-sea mortality due to direct human impacts, and long-term changes in marine food webs. The U.S. Fish and Wildlife Service conducted a Species Status Assessment for listing under the U.S. Endangered Species Act and concluded that listing the Tufted Puffin as endangered or threatened is not warranted.

The U.S. Fish and Wildlife Service conducted a burrow-nesting seabird survey that encompassed the entire coastline of Oregon in 2008 and documented an order of magnitude decline from thousands to hundreds in the puffin breeding population since the previous official coast wide survey in 1988. The 2021 Oregon coast wide Tufted Puffin survey was conducted during the chick rearing period from 14 July to 25 August. The number of Tufted Puffin individuals present at each colony were documented by conducting instantaneous counts of birds on the land, water, and in air from a boat or from mainland vantage points. A count of active burrows was documented at each colony by noting bird behavior and burrow entrance condition. A total of 62 historical colonies were surveyed, 17 active colonies were documented, and no new colonies were found. Colonies were active if occupied burrows or adult birds in breeding plumage were observed at the site. The current Tufted Puffin estimated breeding population of Oregon is 553 individuals. The breeding population was calculated by multiplying the number of burrows by two at each site except for Face Rock and Island Rock where the actual bird count was used. The estimated breeding population remains low but stable compared to previous coast wide surveys.

Oregon Coast National Wildlife Refuge Complex personnel collected Tufted Puffin samples for population genetic structure and diet analysis. Genetic samples (feathers, blood, dead bird, egg shell, guano, etc.) were collected opportunistically at accessible colony sites during the 2021 coast wide survey. All samples were sent to Theresa Burg at the University of Lethbridge Biological Sciences genetics lab for analysis.

A rapid assessment of the habitat associated with each Tufted Puffin colony (active and non-active) was conducted. Photographs of vegetation at the sites were taken to determine native and invasive plant species distribution and abundance. The overall condition of the habitat was documented with notes on erosion, vegetation, and soils and invasive plant species identified.

Repeating boat-based rapid assessment surveys at Tufted Puffin colonies on an annual basis is recommended and future cooperative research projects are needed to fill data gaps.

INTRODUCTION

The Tufted Puffin (*Fratercula cirrhata*) is a member of the Auk (Alcidae) family and is one of three puffin species that make up the *Fratercula* genus. It is a medium-large pelagic seabird that is approximately 40 cm in length and weighs 775 g. Breeding-plumage adults have black-brown bodies and a white face-mask with long golden head-plumes that drape down the neck. The laterally compressed triangular orange bill has variable number of grooves on the upper mandible and bright orange rictal rosettes at the base of gape. Legs and feet are bright yellowish-orange to reddish (Piatt and Kitaysky 2002). Its bright colors have earned the Tufted Puffin the nickname, "parrot of the sea," and are highly favored among ornithologists and bird watchers.

The distribution of the Tufted Puffin is widespread in the North Pacific Ocean, from mid-transition zone (about 35° N) to the Beaufort Sea (Udvardy 1963). The Tufted Puffin has an extensive breeding range and nests on the coastline and offshore islands in California, Oregon, Washington, British Columbia, Alaska, Japan, and Russia. The total world population estimate is 2,970,000 breeding birds, of which 82% (2,440,000) breed in North America (Piatt and Kitaysky 2002, Hanson and Wiles 2015). Most of the North American breeding population occurs in Alaska at 693 colonies with 2,280,000 birds (USFWS 2013). The Oregon population was estimated at 4,600 individual birds using data collected sporadically during multiple surveys from 1979-2003 (Naughton et al. 2007), however, the Tufted Puffin population has declined dramatically from these historic accounts.

Tufted Puffin populations have generally declined throughout the southern portion of their range from British Columbia to northern California, during the past twenty years (Piatt and Kitaysky 2002). The Tufted Puffin was listed as Endangered in Japan in 1993 (Osa and Watanuki 2002). Environment Canada included Tufted Puffin as a Priority Species in the North Pacific Rainforest Bird Conservation Strategy in 2013 (Environment Canada 2013), and British Columbia increased the conservation status of breeding populations from Vulnerable to Imperiled/Vulnerable in 2015 (B.C. Conservation Data Center 2018). Possible causes of puffin decline include factors related to conditions at breeding sites, at-sea mortality due to direct human impacts such as net bycatch and oil spills, and long-term changes in marine food webs that affect reproductive success, winter survival, and distribution (Piatt and Kitaysky 2002, Gjerdrum et al. 2003). Basic information on puffin breeding status in the lower Columbia River coastal region is needed to fill a large data gap for this species in the Northeast Pacific Ocean California Current System.

The Tufted Puffin is listed as Endangered in Washington State, Sensitive in Oregon, and a Species of Special Concern in California (Pearson et al. 2018). In addition, it was petitioned for listing under the U.S. Endangered Species Act and the U.S. Fish and Wildlife Service (USFWS) found that the petition presented substantial information. As a result, a Species Status Assessment was completed (USFWS 2020). The Service concluded that listing the contiguous U.S. Distinct

Population Segment of Tufted Puffin or the Tufted Puffin species as endangered or threatened is not warranted (85 FR 78029). A detailed discussion of the basis for this finding can be found in the Tufted Puffin Species Status Assessment and other supporting documents.

The Oregon Islands and Three Arch Rocks National Wildlife Refuges, managed by the U.S. Fish and Wildlife Service, consist of 1,863 rocks, reefs, and islands and spans 320 miles (~88%) of the Oregon coast. Nesting seabird colonies are the most distinctive biological feature of the Oregon Islands providing nesting habitat for 1.3 million seabirds of 15 species (Naughton et al. 2007, Boone 1985). Historically, Finley Rock at Three Arch Rocks National Wildlife Refuge was the largest Tufted Puffin colony on the Oregon Coast and supported 2,700 breeding birds (Naughton et al. 2007). An intensive monitoring study to determine population size and productivity occurs annually at the Tufted Puffin colony at Haystack Rock at Cannon Beach and has been monitored since 2010 (Stephensen 2022). Wildlife inventory and monitoring surveys are necessary to support adaptive management decisions on the Oregon Islands and Three Arch Rocks National Wildlife Refuges (USFWS 2005). Specific goals, objectives, and strategies are identified in the Comprehensive Conservation Plan to aid in the preservation of these islands and associated wildlife (USFWS 2009).

The Tufted Puffin is a diurnally active cavity nesting seabird species that raises its young on a few vegetated islands along the Oregon coast. The U.S. Fish and Wildlife Service conducted a burrow-nesting seabird survey that encompassed the entire coastline of Oregon in 2008, which documented only 142 Tufted Puffins at 15 colonies. This is an order of magnitude decline in the puffin breeding population since the previous official coast wide survey in 1988, when it was estimated that there were 4,858 breeding Tufted Puffins (Kocourek et al. 2009; USFWS unpublished data). With the tremendous decline in the Oregon breeding population, anthropogenic-caused mortality of even a few birds will negatively affect the Oregon population.

The purpose of this project was to conduct a survey of all known historical and current Tufted Puffin breeding sites on the Oregon coast in order to accurately document colony locations and estimate the breeding population. To quantify annual breeding population size, counts of puffins outside their burrows occurred during the breeding season. Total numbers of puffins attempting to nest were based on the number of active or occupied burrow sites used during the chick rearing period in late summer when puffins are most visible (USFWS 2005, Walsh et al. 1995, Williams et al. 2000, Stephensen 2022, Nelson et al. 2009). This method provided a more accurate measure of population size than previous estimates that were largely based on instantaneous counts of individual birds. The “occupied burrow” method was used to refine population estimates at Castle Rock National Wildlife Refuge from shore (Jaques and Strong 2001) and is the standard methodology used to census puffins at Southeast Farallon Island National Wildlife Refuge (R. Bradley, PRBO Conservation Science, pers comm.). Instantaneous counts of puffins at each colony were also completed to compare with previous Oregon coast wide survey data.

As part of this assessment, Oregon Coast National Wildlife Refuge Complex (OCNWRC) personnel collected Tufted Puffin samples for population genetic structure analysis. Genetic samples including feathers and eggshells were collected opportunistically at accessible colony sites during the coast wide survey. The objective of this related work is to explore and describe genetic structure of Tufted Puffins throughout their North American range. These data will help identify and refine important conservation units and baseline measures of genetic diversity of the Tufted Puffin. Effective conservation strategies require an understanding of genetic structuring and the relationships between population structure, connectivity and species declines. COASST (Beached Bird Surveyors) and rehabilitation centers have been contacted to obtain dead birds from Oregon. The Pacific Seabird Group Tufted Puffin Technical Committee has been working cooperatively for the past several years to obtain samples, and biologists from Washington, California, Alaska, and Canada are also collecting samples.

Tufted Puffin fecal samples are also being collected and analyzed for prey through DNA amplification and sequencing in an attempt to identify prey taxa (Deagle et al. 2009, Bowser et al. 2013). Primers have been developed for fish species likely to constitute puffin prey in California (Bowser et al. 2013), and primers are being developed for northern populations of the 14 potential prey species of fish using sequences in the National Center for Biotechnology Information (NCBI) database (http://www.ncbi.nlm.nih.gov/).

The rocks, reefs, and islands of Oregon Islands and Three Arch Rocks National Wildlife Refuges are infrequently visited or accessed. This survey will provide the opportunity to gather as much information as possible while exploring the islands thus a rapid assessment of habitat at the breeding sites of the Tufted Puffin was also conducted during the survey. The goals of the assessment included documentation of the presence or absence of invasive plant species, overall habitat condition, erosion documentation, and predator abundance.

METHODS

The Oregon coast wide Tufted Puffin survey was conducted during the chick rearing period from 14 July to 25 August 2021. A total of 62 Tufted Puffin colonies along 320 miles of Oregon coastline were surveyed (Figure 1, Table 1, Appendix 1). The survey field crew consisted of a boat operator, two puffin observers, and one rapid habitat assessment observer. Observers included Shawn Stephensen, Alyssa Nelson, Noah Dolinajec, Hannah Buschert, Tiffany Boothe, Frances Bowman, Mike Szumski, Samantha Luginbuhl, Charlie Neher, Madeleine Vander-Heyden, and Lee Whitmer (Appendix 2). We launched the boat from Tillamook Bay (Garibaldi), Yaquina Bay (Newport), Coos River (Florence), Coquille River (Bandon), Rogue River (Gold Beach), and Chetco River (Brookings) and surveyed colonies in close proximity to each associated port. A float plan was completed and provided to personnel conducting float following. The survey crew contacted the float follower when departing and arriving at port and at the top of each hour via cell

phone. U.S. Coast Guard and Oregon State Troopers were contacted when departing and arriving at the various ports. Ocean conditions were closely monitored and surveys by boat were only conducted when a combination of wind wave height and swell was 8 ft. or less.

Colony Survey

The Oregon Coast National Wildlife Refuge Complex staff and other personnel conducted a Tufted Puffin coast wide colony survey by boat and/or land that included all known historical and current breeding sites (Figure 1, Table 1) to estimate breeding population. We also searched for new colonies with binoculars at suitable nesting habitat locations while in transit from previously documented colony sites. Boat-based surveys were conducted from 6:00 AM to 2:00 PM (high activity period) between 12 July and 25 August 2021, coincident with the Tufted Puffin chick rearing period. Colonies that were easily accessible were explored and grubbing was utilized to further assess population and phenology. Miscellaneous notes including weather, general observation conditions, start and end times, tide, and disturbance events were recorded. All observation data were recorded onto an iPad with the Survey123 App. Individual colony maps were loaded onto Survey123 App that provided information to the observers (Figure 2). Data will be compiled and entered into the Oregon Seabird Colony Catalog database and all data will be distributed to interested agencies and individuals. The data files are archived at the Oregon Coast National Wildlife Refuge Complex office in Newport, Oregon for future reference.

The number of Tufted Puffin individuals present at each colony were documented by conducting instantaneous counts of birds on the land, water, and in air from a boat or from mainland vantage points. All observations were made during daylight hours. Birds in adult plumage observed on each colony or on the water nearby were counted as breeding individuals for that colony. A count of active burrows was documented at each colony by noting bird behavior (bird entered, exited, or sat in front of the burrow) or burrow entrance condition (disturbed soil or trampled vegetation) (USFWS 2005, Walsh et al. 1995, Williams et al. 2000, Stephensen 2022, Nelson et al. 2009, Jaques and Strong 2001). New Tufted Puffin colonies were located, surveyed, and assigned colony identification numbers according to the protocol of the Catalog of Oregon Seabird Colonies (Naughton et al. 2007).

Figure 1. Map of historical and active Tufted Puffin colonies in Oregon.

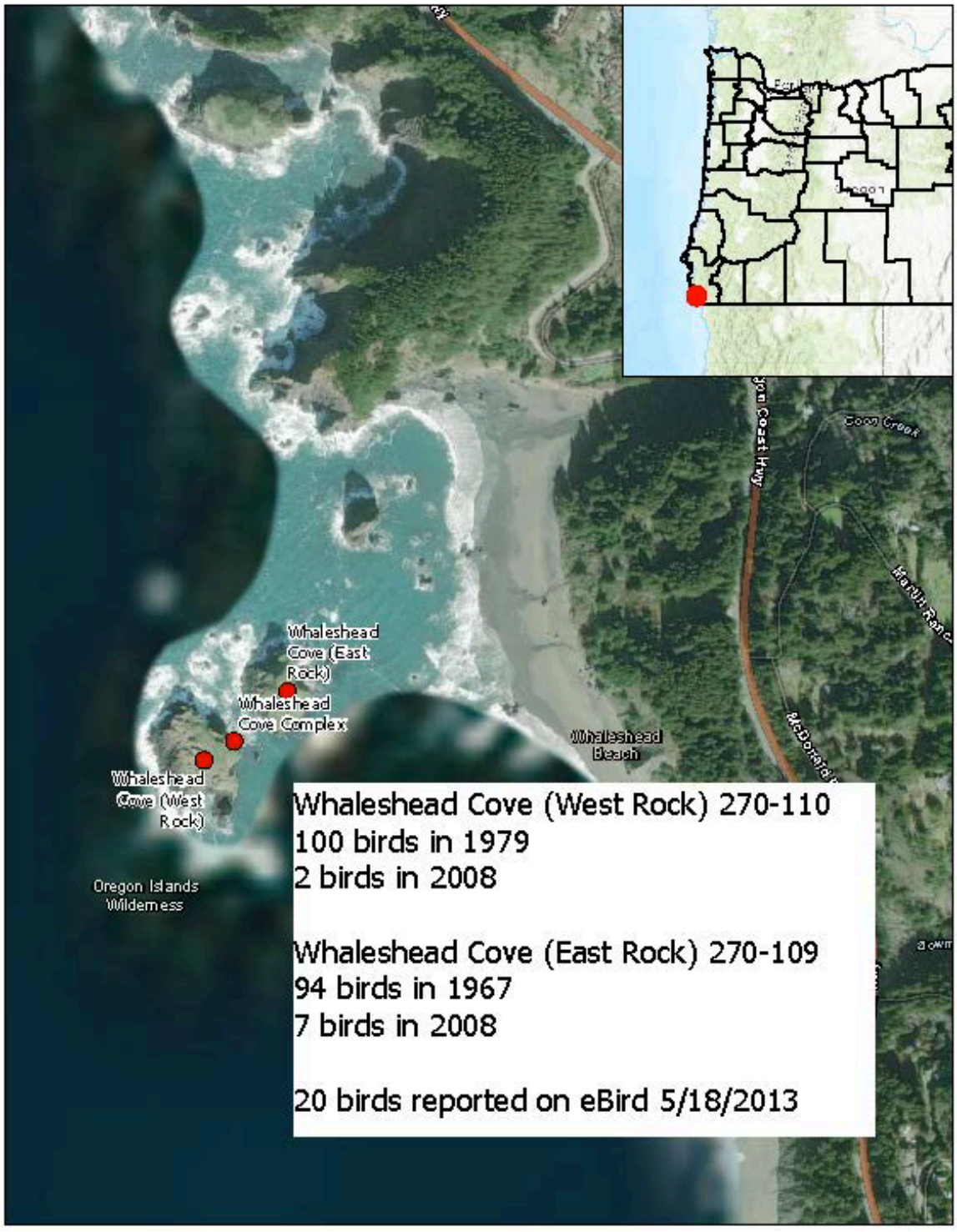

Figure 2. Example of Tufted Puffin colony map displayed in Survey123 App.

Table 1. Oregon coast wide Tufted Puffin colony survey schedule 2021.

Colony	Port (Town)	Survey Date	Survey Method	Survey Personnel
219-020 Bird Rocks (Eastern), 219-021 Haystack Rock, 219-023 The Needles (Southwest), 219-025 Jockey Cap, 219-044 Pyramid Rock, 219-045 Pillar Rock, 219-047 "Unnamed Colony", 219-048 "Unnamed Colony", 219-049 "Unnamed Colony", 219-050 "Unnamed Colony", 219-051 "Unnamed Colony", 219-053 "Unnamed Colony"	Tillamook Bay (Garabaldi)	14 July	Boat/Shore	1 - Shawn 2 - Alyssa 3 - Noah 4 - Hannah
219-054 Three Arch Rocks (Finley Rock), 219-055 Three Arch Rocks (Middle Rock), 219-056 Three Arch Rocks (Shag Rock), 219-058 "Unnamed Colony", 219-060 "Brown Rock", 219-061 "Unnamed Colony", 219-062 "Unnamed Colony", 219-063 "Unnamed Colony", 219-064 Haystack Rock	Tillamook Bay (Garabaldi)	15 July	Boat	1 - Shawn 2 - Alyssa 3 - Noah 4 - Tiffany
219-071 "Unnamed Colony", 243-007 Otter Crest Headland, 243-010 Gull Rock, 243-011 "Unnamed Colony", 243-015 "Colony Rock", 243-016 "Unnamed Colony"	Yaquina Bay (Newport)	20 July	Boat	1 - Shawn 2 - Alyssa 3 - Mike 4 - Fran
243-027 Heceta Head, 243-028 Conical Rock, 243-028.1 "Heceta Head South", 243-029 "Blast Rock", 243-030 "Parrot Rock", 243-031 Devils Elbow, 243-033 "Sea Lion Caves Headlands", 243-036 "Cox Rock Mainland"	Siuslaw Bay (Florence)	21 July	Boat	1 - Shawn 2 - Alyssa 3 - Mike 4 - Fran

Table 1 (cont.).

Colony	Port (Town)	Survey Date	Survey Method	Survey Personnel
270-004 Chiefs Island, 270-014 Table Rock, 270-015 "North Coquille Point Rock", 270-016 "Middle Coquille Point Rock", 270-018 "Elephant Rock", 270-019 Cat and Kittens Rock, 270-020 Face Rock, 270-020.1 "Grave Point Rock", 270-021 Haystack Rock, 270-027 Gull Rock, 270-029 Best Rock, 270-035 West Conical Rock	Coquille River (Bandon)	28 July	Boat/Shore	1 - Shawn 2 - Alyssa 3 - Sam 4 - Charlie
270-043 Redfish Rocks (Northern), 270-044 Redfish Rocks (Northwestern), 270-045 Redfish Rocks (East Central), 270-047 Redfish Rocks (Southern), 270-048 "Unnamed Colony", 270-049 Island Rock, 270-067 Double Rock, 270-068 Needle Rock	Rogue River (Gold Beach)	05 August	Boat	1 - Shawn 2 - Alyssa 3 - Madeleine 4 - Noah 5 - Lee
270-071 Hunters Island, 270-076 "North Crook Point Rock", 270-079 Saddle Rock, 270-087 Mack Arch	Rogue River (Gold Beach)	06 August	Boat/Shore	1 - Shawn 2 - Alyssa 3 - Noah 4 - Lee
270-109 "Whaleshead Cove" (East Rock), 270-110 "Whaleshead Cove" (West Rock), 270-123 Goat Island	Chetco River (Brookings)	25 August	Boat/On-island	1 - Shawn 2 - Alyssa 3 - Sam 4 - Charlie

During boat-based surveys, the surveyors approached within 50 meters (or safe distance to avoid underwater obstacles) of every colony known to have previously supported nesting Tufted Puffins. Islands and larger rocks were circumnavigated whenever possible. Canon 10x42 Image Stabilizer binoculars were used to identify individual burrows and associated birds. Boat surveys were conducted from a 26’ Boston Whaler “Justice” model powered by twin Yamaha four-stroke 150 horsepower outboard engines. Boat-based surveys were conducted opportunistically, dependent upon weather, ocean conditions, staff schedules, and availability of the survey vessel.

Shore-based surveys were conducted whenever a colony rock or island could not be safely circumnavigated or approached by boat. During shore-based surveys, surveyors counted birds at colonies from vantage points along headlands or beaches adjacent to colonies. Canon 10x42 Image Stabilizer binoculars as well as a Swarovski Habicht ST80 HD 80mm 20-60X zoom high power spotting telescope on a tripod were used. Some colonies were surveyed both by boat and from shore to provide complete coverage, both counts will be recorded in the database with the higher count coded to represent the best data.

On-island surveys were conducted when islands could be safely accessed and other surface and burrow nesting seabirds were not disturbed by observer presence. A count of active burrows and birds were obtained while traversing the nesting area. Burrows were grubbed (insert hand and arm inside burrow) opportunistically to document bird, egg, or chick presence or non-presence. On-island surveys were conducted on 270-067 Hunters Island and 270-123 Goat Island.

Genetic Samples

Genetic samples (feather, fecal, egg shell) were collected opportunistically at accessible colony sites at confirmed active Tufted Puffin burrows. These samples will allow identification of puffin diet and examination of genetic structuring throughout the species range. Samples were collected and placed in individual Ziploc or Whirl-Pac plastic bags and labelled with date, time, collector, and contents. Latex gloves were worn by personnel when samples were collected as not to cause cross contamination. All samples were placed in a cooler for transport and placed in a freezer upon return from the field. All samples were cataloged and sent to Theresa Burg at the University of Lethbridge Biological Sciences Genetics Lab for analysis. A separate report will be written by University of Lethbridge personnel upon completion of genetic analysis.

Rapid Habitat Assessment

A rapid assessment of the habitat associated with each Tufted Puffin colony (active and non-active) was conducted. One person on the survey crew was dedicated to the rapid habitat assessment observations and data recording. Photographs of vegetation at the sites were taken to determine native and invasive plant species distribution and abundance. Botanists (Dave and Diane Bilderback) reviewed the habitat photographs to assist with plant species identification. The overall condition of the habitat was documented including notes on erosion, vegetation, and soils. Avian and mammal predator presence was documented by recording abundance and noting signs of presence (trails, scat, nests). The field notes and photographs are archived at the Oregon Coast National Wildlife Refuge Complex office in Newport, Oregon for future reference.

RESULTS

Colony Survey

A total of 62 historic Tufted Puffin colonies were surveyed, 17 active colonies were documented, and no new colonies were found during the 2021 coast wide survey (Figure 3, Table 2). The current Tufted Puffin estimated breeding population of Oregon is 553 individuals (Table 2). The estimated breeding bird population was calculated by multiplying the number of burrows observed by two at each site except for 270-020 Face Rock and 270-049 Island Rock where the actual count of birds observed was used. The bird count at 270-020 Face Rock was obtained by observers from the mainland on multiple visits throughout the summer (D. and D. Bilderback pers comm.). Accurate burrow counts were not collected at 270-049 Island Rock because of island topography and burrow locations (i.e. some parts of the island could not be surveyed for burrows because of poor visibility), thus, it was concluded the more accurate count was of individual birds rather than count of burrows. The burrow counts at Three Arch Rocks National Wildlife Refuge colonies 219-054 Finley Rock, 219-055 Middle Rock, and 219-056 Shag Rock were not recorded in the Survey123 App data files during the 2021 survey due to data entry omission or device malfunction. Burrow count data collected on 16 July 2019 were used to determine the breeding population at those sites. The actual bird count (individual birds) data were recorded correctly in Survey123 App during the 2021 survey and reported (Table 2). The individual bird counts collected during 2019 and 2021 were comparable. The burrow count data collected at 219-021 Haystack Rock by personnel (USFWS unpublished data, T. Halloran pers comm.) conducting productivity monitoring during 2021 was used to estimate the breeding population at that site. The number of active burrows (4) on the west side of Haystack Rock was counted during the boat-based survey on 14 July and added to the east side burrow count (45). No birds or active burrows were observed or documented at the remaining 45 historical Tufted Puffin colonies (Table 2). Note: We observed one adult Tufted Puffin in breeding plumage on the water several miles north of 219-064 Haystack Rock. The bird was foraging away from the colony and was not included in any colony count.

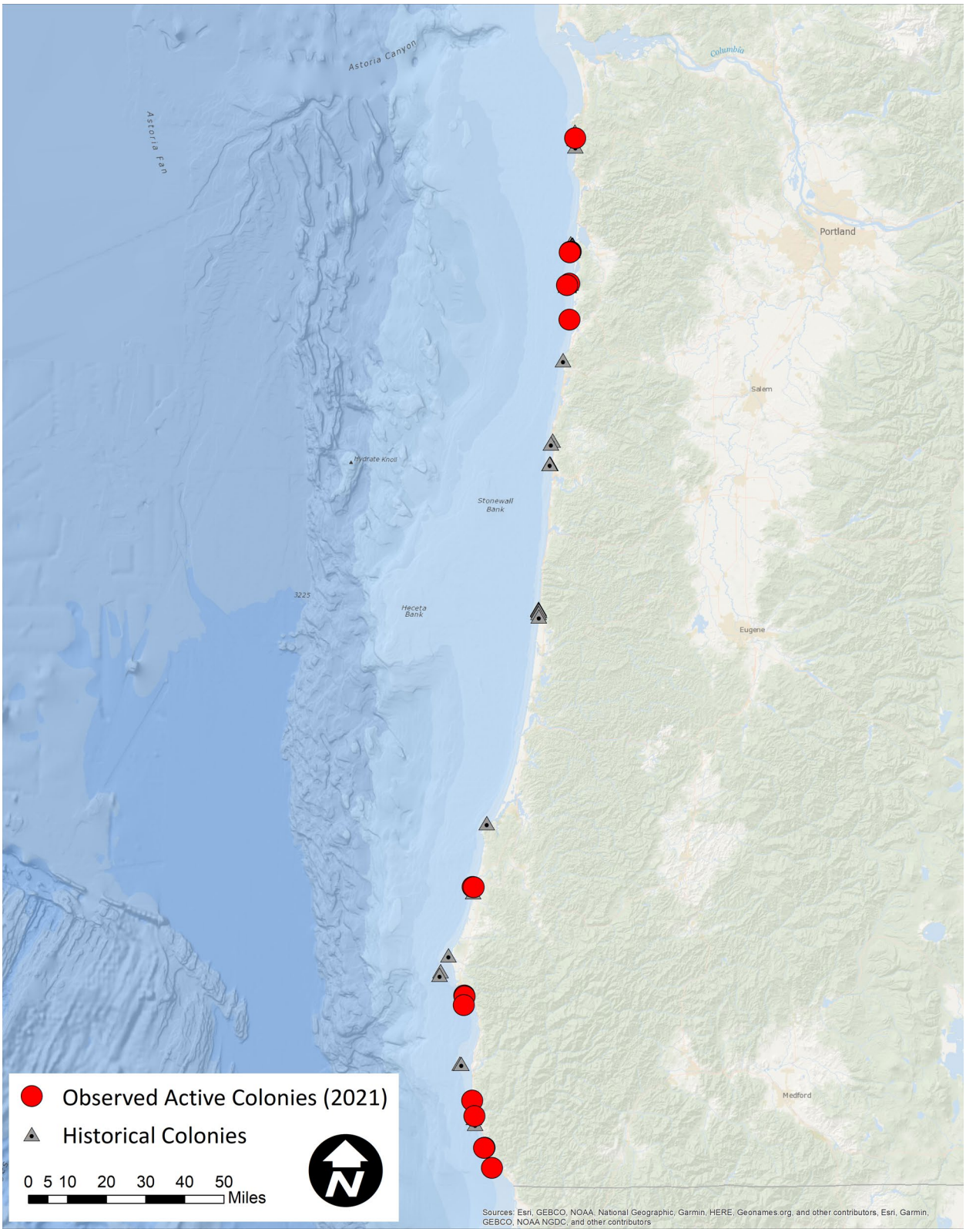

Figure 3. Map of historical and active tufted puffin colonies in Oregon. The red circles indicate observed active tufted puffin colonies in 2021 and black triangles indicate historical colonies.

Table 2. 2021 Oregon coast wide Tufted Puffin colony survey data.

County	Colony ID	Site Name	Survey Date	Survey Type	Bird Count	Burrow Count	Breeding Bird Estimate
Clatsop	219-020	Bird Rocks (Eastern)	14 Jul	B/M	0	0	**0**
Clatsop	219-021	Haystack Rock	14 Jul	B/M	26	49[1]	**98**
Clatsop	219-023	The Needles (Southwest)	14 Jul	B	0	0	**0**
Clatsop	219-025	Jockey Cap	14 Jul	B/M	0	0	**0**
Tillamook	219-044	Pyramid Rock	14 Jul	B	0	0	**0**
Tillamook	219-045	Pillar Rock	14 Jul	B	0	0	**0**
Tillamook	219-047	"Unnamed Colony"	14 Jul	B	0	0	**0**
Tillamook	219-048	"Unnamed Colony"	14 Jul	B	0	0	**0**
Tillamook	219-049	"Unnamed Colony"	14 Jul	B	0	0	**0**
Tillamook	219-050	"Unnamed Colony"	14 Jul	B	0	0	**0**
Tillamook	219-051	"Unnamed Colony"	14 Jul	B	0	0	**0**
Tillamook	219-053	"Unnamed Colony"	14 Jul	B	0	0	**0**
Tillamook	219-054	Three Arch Rocks (Finley Rock)	15 Jul	B	23	75[2]	**150**
Tillamook	219-055	Three Arch Rocks (Middle Rock)	15 Jul	B	5	24[2]	**48**
Tillamook	219-056	Three Arch Rocks (Shag Rock)	15 Jul	B	5	11[2]	**22**
Tillamook	219-058	"Unnamed Colony"	15 Jul	B	0	0	**0**
Tillamook	219-060	"Brown Rock"	15 Jul	B	0	6	**12**
Tillamook	219-061	"Unnamed Colony"	15 Jul	B	0	2	**4**
Tillamook	219-062	"Unnamed Colony"	15 Jul	B	0	0	**0**
Tillamook	219-063	"Unnamed Colony"	15 Jul	B	0	0	**0**
Tillamook	219-064	Haystack Rock	15 Jul	B	9	16	**32**
Tillamook	219-071	"Unnamed Colony"	20 Jul	B	0	0	**0**
Lincoln	243-007	Otter Crest Headland	20 Jul	B	0	0	**0**
Lincoln	243-010	Gull Rock	20 Jul	B	0	0	**0**
Lincoln	243-011	"Unnamed Colony"	20 Jul	B	0	0	**0**
Lincoln	243-015	"Colony Rock"	20 Jul	B	0	0	**0**
Lincoln	243-016	"Unnamed Colony"	20 Jul	B	0	0	**0**
Lane	243-027	Heceta Head	21 Jul	B	0	0	**0**
Lane	243-028	Conical Rock	21 Jul	B	0	0	**0**
Lane	243-028.1	"Heceta Head South"	21 Jul	B	0	0	**0**
Lane	243-029	"Blast Rock"	21 Jul	B	0	0	**0**

Table 2 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Bird Count	Burrow Count	Breeding Bird Estimate
Lane	243-030	"Parrot Rock"	21 Jul	B	0	0	**0**
Lane	243-031	Devils Elbow	21 Jul	B	0	0	**0**
Lane	243-033	"Sea Lion Caves Headlands"	21 Jul	B	0	0	**0**
Lane	243-036	"Cox Rock Mainland"	21 Jul	B	0	0	**0**
Coos	270-004	Chiefs Island	28 Jul	M	0	0	**0**
Coos	270-014	Table Rock	28 Jul	B/M	0	0	**0**
Coos	270-015	"North Coquille Point Rock"	28 Jul	B/M	0	0	**0**
Coos	270-016	"Middle Coquille Point Rock"	28 Jul	B/M	0	0	**0**
Coos	270-018	"Elephant Rock"	28 Jul	B/M	0	0	**0**
Coos	270-019	Cat and Kittens Rock	28 Jul	B/M	0	0	**0**
Coos	270-020	Face Rock	28 Jul	B/M	8	0	**8**
Coos	270-020.1	"Grave Point Rock"	28 Jul	B/M	0	2	**4**
Coos	270-021	Haystack Rock	28 Jul	B/M	0	0	**0**
Curry	270-027	Gull Rock	05 Aug	M	0	0	**0**
Curry	270-029	Best Rock	28 Jul	B	0	0	**0**
Curry	270-035	West Conical Rock	28 Jul	B	0	0	**0**
Curry	270-043	Redfish Rocks (Northern)	05 Aug	B	0	1	**2**
Curry	270-044	Redfish Rocks (Northwestern)	05 Aug	B	0	0	**0**
Curry	270-045	Redfish Rocks (East Central)	05 Aug	B	0	2	**4**
Curry	270-047	Redfish Rocks (Southern)	05 Aug	B	0	0	**0**
Curry	270-048	"Unnamed Colony"	05 Aug	B	0	0	**0**
Curry	270-049	Island Rock	05 Aug	B	67	21	**67**
Curry	270-067	Double Rock	05 Aug	B	0	0	**0**
Curry	270-068	Needle Rock	05 Aug	B	0	0	**0**
Curry	270-071	Hunters Island	06 Aug	B/C	0	1	**2**

Table 2 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Bird Count	Burrow Count	Breeding Bird Estimate
Curry	270-076	"North Crook Point Rock"	06 Aug	B/M	0	3	**6**
Curry	270-079	Saddle Rock	06 Aug	B/M	0	0	**0**
Curry	270-087	Mack Arch	06 Aug	B	0	0	**0**
Curry	270-109	"Whaleshead Cove" (East Rock)	25 Aug	B	0	25	**50**
Curry	270-110	"Whaleshead Cove" (West Rock)	25 Aug	B	0	1	**2**
Curry	270-123	Goat Island	25 Aug	B/C	0	21	**42**
				Totals	**143**	**260**	**553**

Footnotes: [1]Burrow count data collected by T. Halloran. [2]Burrow count data collected 16 July 2019.
Key to Survey Type Codes: B = Boat; C = Colony (on island); M = Mainland

The estimated Tufted Puffin breeding populations documented during the Oregon coast wide surveys in 1979, 1988, 2008, and 2021 were 6,632 individual birds at 38 colonies, 4,858 individual birds at 49 colonies, 142 individual birds at 15 colonies, and 553 individual birds at 17 colonies respectively (Figure 4, Kocourek et al. 2009, Appendix 1). The 2021 estimated breeding population remains low when compared to the 1979 and 1988 coast wide surveys but stable compared to the 2008 coast wide survey. Note: The estimated breeding population is described as the number of individual birds derived from a count of burrows times two, count of individual birds, or a combination of those counts.

The colony survey conducted at 270-109 Whaleshead Cove (East Rock), 270-110 Whaleshead Cove (West Rock), and 270-123 Goat Island was late in the breeding season because of poor ocean conditions. Summer 2021 was very windy which produced large wind waves (3-6 ft), large swell (3-8 ft), and small craft advisories posted weekly. Thus, the wave height precluded the survey to be conducted on scheduled days and the survey was postponed until ocean conditions improved. No birds were present at all three sites, however, burrows that were utilized during the 2021 breeding season were counted. The burrows utilized in 2021 were identified since vegetation was trampled and fresh soil deposited at the burrow entrances indicated usage.

Only Goat and Hunters Islands were accessed (set foot on the island) during the 2021 survey. The 270-123 Goat Island Tufted Puffin colony was accessed on 25 August and the nesting area was documented. Puffin burrows were observed on the north side of Goat Island near the rock and vegetation interface zone. The birds constructed burrows in an area with soil and surface vegetation. The east side of 270-071 Hunters Island was also investigated. Several burrows were

detected from the boat, but once on island it was determined the burrows were Leach's Storm-petrel rather than Tufted Puffin.

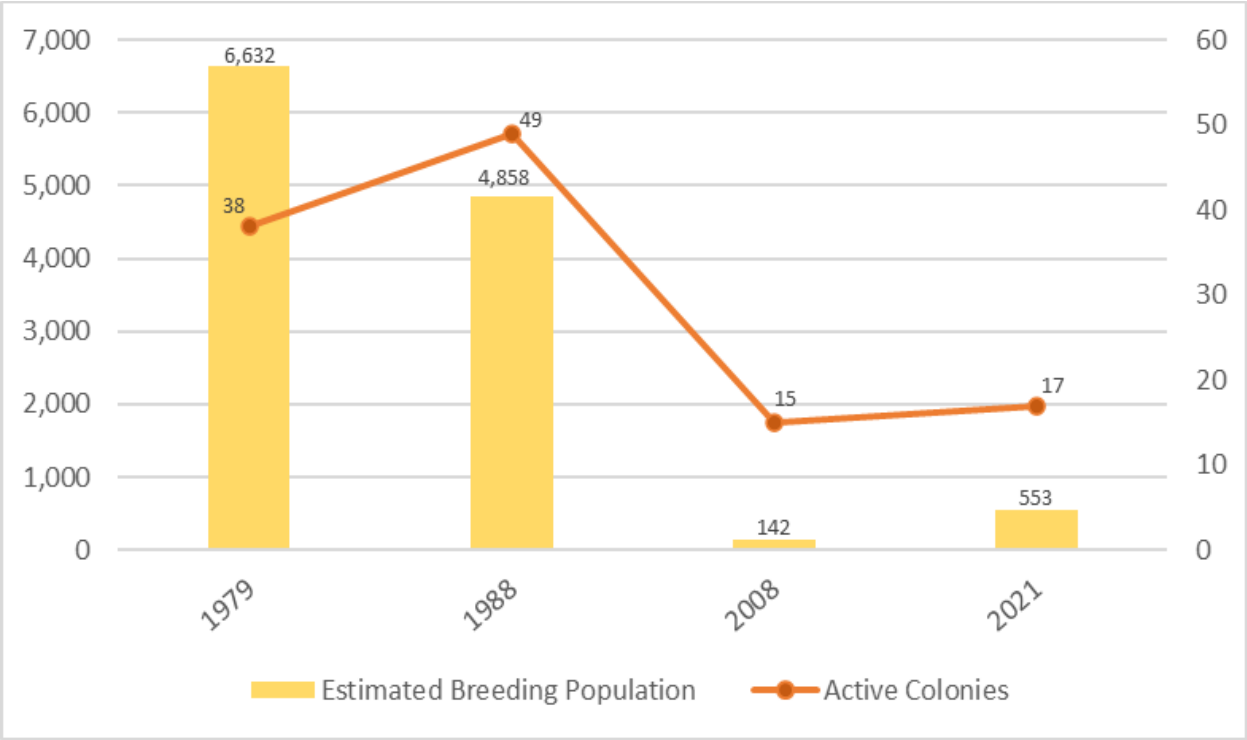

Figure 4. Tufted Puffin breeding population estimates, and number of colonies documented during 1979, 1988, 2008, and 2021 Oregon coast wide surveys.

Genetic Samples

270-123 Goat Island was accessed by survey personnel on 25 August and samples were collected (Table 3). Tufted Puffin feathers and eggshell fragments were collected at the entrance or within the burrow for population genetic structure analysis. Fecal samples were collected for diet or prey analysis. All samples were sent to Theresa Burg at the University of Lethbridge for analysis. Results have not been received at the time of this report. A separate report will be completed with genetic analysis results.

Genetic samples were also collected at Destruction Island and Ocean Shores, Washington by Scott Pearson (Washington Department of Fish and Wildlife) and Middleton Island, Alaska by Scott Hatch (retired U.S. Geological Survey Wildlife Biologist). All genetic samples were shipped as one package to Theresa Burg at University of Lethbridge in November 2021. All genetic samples information was entered onto FWS Form 3-177 and submitted to the eDecs (Electronics Declarations) web page for export clearance.

Table 3. Tufted Puffin samples collected at Goat Island on 25 August 2021.

Sample ID	Sample Notes
GI-TP1-2021	One feather, two fecal samples.
GI-TP2-2021	Feathers, one eggshell.
GI-TP3-2021	Feathers, one eggshell, one fecal sample.
GI-TP4-2021	Feathers.
GI-TP5-2021	Feathers.
GI-TP6-2021	Feathers, eggshell fragments.
GI-TP7-2021	Feathers.
GI-TP8-2021	Feathers, eggshell fragments - possible western gull.
GI-TP9-2021	Feathers, eggshell fragments. Two whirl pacs.
GI-TP10-2021	Feathers.
GI-TP11-2021	Feathers.
GI-TP12-2021	Feathers, fecal, one eggshell fragment.
GI-TP13-2021	Feathers.

Rapid Habitat Assessment

Hundreds of photographs were taken at the Tufted Puffin colony sites during the 2021 survey. Selected photographs were sent to Dave and Diane Bilderback (retired botanists) for plant species identification and to determine invasive species presence.

Bull thistle (*Girsium vulgare*) was discovered in photographs that were taken 14 July at several locations on the south coast (Figure 5). The Bilderbacks speculated that Bull Thistle may be in many more places than just a single photo (photograph 6013) in this area. Several large patches of the exotic ice plant, (*Carpobrotus chilensis*) have become established on 270-079 Saddle Rock in the saddle and on the southern horn of the island as well as on the vertical slope of the eastern side of the island. New Zealand spinach (*Tetragonia tetragonioides*) on 270-071 Hunters Island and wild radish (*Raphanus sativas*) on 270-123 Goat Island was detected during the rapid habitat assessment and confirmed during an aerial survey conducted during October 2021. Grass species were difficult to identify from the photographs, thus native and invasive grass species could not be differentiated. Some plant species are beneficial to maintain good Tufted Puffin burrow nesting habitat. For example, a native leather-leaf fern (*Polypodium scouleri*) provides soil stability and without this plant that has many roots off of the rhizomes, hillside burrows for Tufted Puffin might not be stable during heavy winter rains (D. and D. Bilderback pers comm., Figure 6).

Figure 5. Photograph 6013 documentation of Bull Thistle (*Girsium vulgare*) (circled) at South coast Tufted Puffin colony on 14 July 2021.

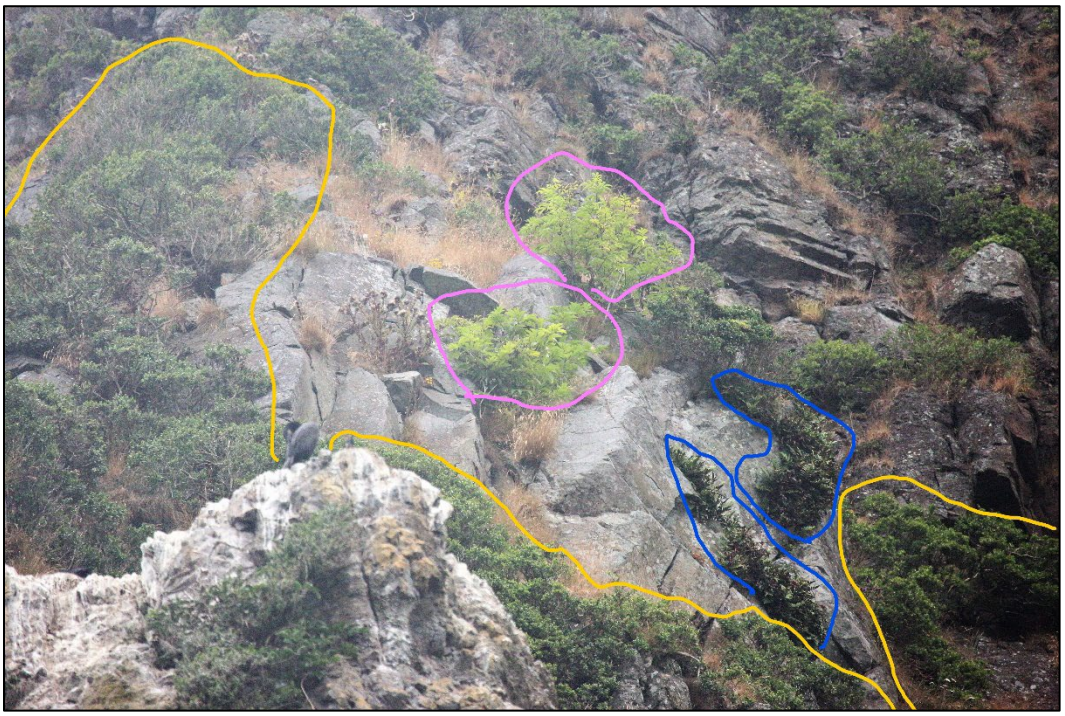

Figure 6. Photograph 6013 with native plant species circled. The pink circles are elderberry (*Sambucus sp.*), the yellow circled areas are patches of coast silk-tassel (*Garrya elliptica*), and the blue circled area are leather-leaf fern (*Polypodium scouleri*).

Many historical colony sites that were discovered during the 1979 and 1988 coast wide surveys were void of soil and vegetation in 2021. The preferred habitat components of nesting Tufted Puffins are soil with surface vegetation in which to construct burrows, however, some puffins have been documented nesting in rock crevices. The loss of preferred habitat components could be a contributing factor to the puffin decline in Oregon and further studies must be conducted.

Recommendations and Future Studies

Burrow nesting seabirds are difficult to survey. The best method to obtain a breeding population estimate is to count the number of active burrows and multiply by two as described in survey protocols (USFWS 2005, Walsh et al. 1995, Williams et al. 2000, Nelson et al. 2009, Jaques and Strong 2001). Previous coast wide surveys included count of individual birds, count of burrows, or a combination of both parameters. We recommend obtaining a count of active burrows and count of birds on the land, water, and air at each colony. Enter all count data, both count of burrows and individual birds, into the Oregon Seabird Colony Database and properly describe the data with data evaluation codes (USFWS 2013, Naughton et al. 2007). Note: caution should be used when comparing between year data since survey protocol and observers differ.

We recommend future coast wide Tufted Puffin surveys be conducted from south to north due to differences in breeding phenology. The birds on the south coast may have a slightly earlier breeding season (initiate nesting) compared to birds on the central and north coast. Another option is to have more than one team conducting the survey to shorten the length of time needed to complete the coast wide survey and still be conducted during the chick rearing period.

The standard frequency for conducting burrow nesting seabird species surveys is once every ten years. Repeating boat-based rapid assessment surveys on an annual basis is recommended to keep track of sites actively used by puffins. Selected colony sites may be surveyed annually to further define populations at those sites. Tufted Puffin productivity monitoring will continue on an annual basis at 219-021 Haystack Rock. A similar productivity monitoring effort is being considered for 270-123 Goat Island Tufted Puffin colony.

Collecting images of islands from the air, assembling these via structure from motion, defining colony extents, calculating area, and sampling burrows for occupancy on some islands would allow density and breeding population estimates with a measure of variance to be developed for those islands and modeled for others. Structure from motion is a photogrammetric range imaging technique for estimating three-dimensional structures from two-dimensional image sequences that may be coupled with local motion signals. Structure from motion allows accurate determination of elevation without the use of lidar, which then allows for precise calculation of area which is used to determine density of breeding birds. This could be done for any burrow nesting seabird species if enough islands are accessible by humans for sampling. This would also allow changes in habitat quality to be assessed quantitatively.

Investigation of chick diet composition through analysis of digital photography will be attempted in a cooperative effort between USFWS and Oregon State University Masters Student (Noah Dolinajec). Understanding the composition of a seabird's diet supplies vital information regarding regional variations in the health and function of marine ecosystems and provides insight into the marine food web structure. For Tufted Puffins in Oregon, this information could fill valuable data gaps in pelagic feeding habits, that rely heavily on forage fish, and how these habits may affect population numbers. Photographic analysis of seabirds carrying bill loads has proven to be a dynamic and effective way to collect data on seabird diet in virtually complete non-invasive methods (Gaglio et al. 2017). Using a DSLR camera, an observer will trial vantage points, times of day, and weather/tide conditions for taking photos of puffins with bill loads.

As the outreach component of the study, N. Dolinajec will develop a community science driven program to promote the involvement of skilled wildlife photographers to submit photographs and metadata of birds with fish along near known Tufted Puffin colonies. The main species of interest will be the Tufted Puffin, but photographers will be encouraged to submit photos/metadata for other species as well (e.g. Common Murre, Pigeon Guillemot, Marbled Murrelet, Osprey, and Bald Eagle). The campaign will be advertised in collaboration with the OCNWRC, Friends of Haystack Rock, Haystack Rock Awareness Program, and the Oregon Wildlife Foundation through social media, blogs and targeted outreach to groups such as the Portland Audubon Society and Lincoln County Audubon Society.

The Tufted Puffin Species Status Assessment determined that factors related to breeding site conditions are one of the most probable causes of puffin population decline (USFWS 2020). However, little is known about the specific characteristics of nesting habitat along the Oregon coast, or how it relates to their population demographics. To address this knowledge gap, USFWS and graduate student (Carina Kusaka) from Oregon State University will conduct a spatial analysis to examine the distribution of suitable breeding habitat for Tufted Puffins on the Oregon Islands National Wildlife Refuge. Specifically, the topography, vegetation, and percent cover of Tufted Puffin breeding sites over the past 40 years using aerial photos of the islands, data from the National Agriculture Imagery Program (NAIP), and other remote sensing data sets will be compared. We hypothesize that the vegetation and topography on nesting sites will have changed over time, due to environmental factors like erosion and climate change. Assessing how suitable puffin breeding habitat characteristics have changed over time will provide necessary information to guide refuge managers in habitat restoration and support adaptive management. Photographs taken during the 2021 coast wide survey will also be submitted for analysis.

A PhD student (Katelyn Stoner) at Oregon State University is currently conducting research on Tufted and Horned Puffins breeding in the Kodiak Archipelago, Alaska and will include estimating trends in the Archipelago and deploying geolocators on both species to track non-breeding distributions. An assessment and comparison of isotopic diet of Tufted Puffins between breeding

locations, including the Oregon coast, will be conducted, aiming for maximum representation across the breeding range. Samples will be analyzed using bulk stable isotope analysis and a subset of these samples using compound specific isotope analysis of amino acids. The goal is to collect samples throughout the breeding range from the same breeding year to minimize annual variability. Sample collections should be prioritized from colonies with concurrent or previous geolocator deployments and from colonies at the northern and southern extent of the breeding range. It would be extremely valuable to include and analyze samples from the California Current for comparison with Alaskan samples. OCNWRC personnel will opportunistically collect eggshell samples from Tufted Puffin colony sites in Oregon during the 2022 breeding season.

Invasive plant species were documented during the 2021 rapid habitat assessment and need to be removed. Some islands on the South Coast were accessed in 2007-09 and a list of plant species present on those islands was developed (Bilderback and Bilderback 2010). In 2021, 7 sites (and some additional locations) were flown by helicopter and photographed by a contractor that will be assessing invasive species present at those locations. The Refuge will be obtaining all images and associated metadata. These images may be useful for structure from motion, but will need to be evaluated when obtained. The Refuge is interested in assessing habitat quality and managing invasive plants on islands if these are determined to negatively affect burrow nesting seabird species. Early detection with rapid response is the best management practice to effectively control invasive plant species.

ACKNOWLEDGEMENTS

The survey crew included Shawn Stephensen, Alyssa Nelson, Noah Dolinajec, Tiffany Boothe, Hannah Buschert, Frances Bowman, Mike Szumski, Samantha Luginbuhl, Charlie Neher, Madeleine Vander-Heyden, and Lee Whitmer. Float Following was accomplished by Mary Kostiew and Kate Iaquinto. Mike Olson (Confederated Tribes of Coos, Lower Umpqua, and Suislaw Indians law enforcement official) allowed the survey crew access to tribal land at Gregory Point. Friends of Haystack Rock contributed funds to support the project. Dave and Diane Bilderback reviewed habitat photographs to identify plant species. Oregon Coast National Wildlife Refuge Complex personnel reviewed and made edits to this report. The dedication, support, and contributions by many individuals made the project a success.

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Appendix 1. Tufted Puffin data from the Oregon Seabird Colony Database.

County	Colony ID	Site Name	Survey Date	Survey Type	Actual Count	# Nests	Breeding Birds
Clatsop	219-020	Bird Rocks (Eastern)	10-Jun-79	B			20
Clatsop	219-020	Bird Rocks (Eastern)	01-Jul-88	M		1	2
Clatsop	219-020	Bird Rocks (Eastern)	19-Jun-08	B	0		0
Clatsop	219-021	Haystack Rock	25-Jul-60	M	45		45
Clatsop	219-021	Haystack Rock	14-May-63	A	300		X
Clatsop	219-021	Haystack Rock	01-Jul-63	M	200		200
Clatsop	219-021	Haystack Rock	07-May-66	M	30		30
Clatsop	219-021	Haystack Rock	05-May-67	M			X
Clatsop	219-021	Haystack Rock	13-May-67	M	60		60
Clatsop	219-021	Haystack Rock	01-Aug-70	M	40		40
Clatsop	219-021	Haystack Rock	26-Jun-72	A	150		X
Clatsop	219-021	Haystack Rock	30-Apr-78	M	400		400
Clatsop	219-021	Haystack Rock	10-Jun-79	B,M			400
Clatsop	219-021	Haystack Rock	08-Jun-88	B,M		306	612
Clatsop	219-021	Haystack Rock	13-Jul-93	B	0		0
Clatsop	219-021	Haystack Rock	19-Jun-08	B	10		10
Clatsop	219-021	Haystack Rock	02-Jul-08	M	51		51
Clatsop	219-021	Haystack Rock	04-Jun-08	M	38		38
Clatsop	219-021	Haystack Rock	03-Jun-14	AP	23		X
Clatsop	219-023	The Needles (Southwest)	08-Jun-88	B		1	2
Clatsop	219-023	The Needles (Southwest)	19-Jun-08	B	0		0
Clatsop	219-025	Jockey Cap	10-Jun-79	B			2
Clatsop	219-025	Jockey Cap	19-Jun-08	B	0		0
Tillamook	219-044	Pyramid Rock	06-Jun-88	B	1		1
Tillamook	219-044	Pyramid Rock	20-Jun-08	B,M	0		0
Tillamook	219-044	Pyramid Rock	03-Jun-14	AP	1		X
Tillamook	219-045	Pillar Rock	11-Jul-89	B	1		1
Tillamook	219-045	Pillar Rock	20-Jun-08	B,M	0		0
Tillamook	219-046C	"Cape Meares Mainland Complex"	01-May-75	M			X
Tillamook	219-046C	"Cape Meares Mainland Complex"	12-May-79	M			70
Tillamook	219-047	"Unnamed Colony"	11-Jun-79	B			4
Tillamook	219-047	"Unnamed Colony"	06-Jun-88	B	12		12
Tillamook	219-047	"Unnamed Colony"	11-Jul-89	B	8		8
Tillamook	219-047	"Unnamed Colony"	11-Jul-91	B	3		3
Tillamook	219-047	"Unnamed Colony"	20-Jun-08	B	0		0
Tillamook	219-048	"Unnamed Colony"	11-Jun-79	B			50
Tillamook	219-048	"Unnamed Colony"	20-Jun-08	B	0		0

Appendix 1 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Actual Count	# Nests	Breeding Birds
Tillamook	219-049	"Unnamed Colony"	11-Jun-79	B			24
Tillamook	219-049	"Unnamed Colony"	20-Jun-08	B,M	0		0
Tillamook	219-050	"Unnamed Colony"	11-Jun-79	B			50
Tillamook	219-050	"Unnamed Colony"	31-May-88	B,M	4		4
Tillamook	219-050	"Unnamed Colony"	11-Jul-89	B	7		7
Tillamook	219-050	"Unnamed Colony"	12-Jul-90	B,M	10		10
Tillamook	219-050	"Unnamed Colony"	11-Jul-91	B	2		2
Tillamook	219-050	"Unnamed Colony"	20-Jun-08	B,M	0		0
Tillamook	219-051	"Unnamed Colony"	11-Jun-79	B	11		90
Tillamook	219-051	"Unnamed Colony"	11-Jul-91	B	2		2
Tillamook	219-051	"Unnamed Colony"	20-Jun-08	B,M	0		0
Tillamook	219-052C	"Three Arch Rocks Complex"	03-Jul-14	C			X
Tillamook	219-052C	"Three Arch Rocks Complex"	27-Jun-40	M			X
Tillamook	219-052C	"Three Arch Rocks Complex"	26-Jun-72	A	200		X
Tillamook	219-053	"Unnamed Colony"	15-Jul-03	B		1	2
Tillamook	219-053	"Unnamed Colony"	20-Jun-08	B	0		0
Tillamook	219-054	Three Arch Rocks (Finley Rock)	12-Jun-79	B			4000
Tillamook	219-054	Three Arch Rocks (Finley Rock)	06-Jun-88	B		1350	2700
Tillamook	219-054	Three Arch Rocks (Finley Rock)	30-Mar-90	M	10		10
Tillamook	219-054	Three Arch Rocks (Finley Rock)	20-Jul-93	B	2		2
Tillamook	219-054	Three Arch Rocks (Finley Rock)	20-Jun-08	B	16		16
Tillamook	219-054	Three Arch Rocks (Finley Rock)	10-Jun-94	AP	1		X
Tillamook	219-055	Three Arch Rocks (Middle Rock)	12-Jun-79	B			100
Tillamook	219-055	Three Arch Rocks (Middle Rock)	06-Jun-88	B		100	200
Tillamook	219-055	Three Arch Rocks (Middle Rock)	20-Jul-93	B	1		1
Tillamook	219-055	Three Arch Rocks (Middle Rock)	20-Jun-08	B	0		0
Tillamook	219-055	Three Arch Rocks (Middle Rock)	03-Jun-14	AP	9		X
Tillamook	219-056	Three Arch Rocks (Shag Rock)	09-Jun-01	C			X
Tillamook	219-056	Three Arch Rocks (Shag Rock)	01-Jan-03	C			X
Tillamook	219-056	Three Arch Rocks (Shag Rock)	12-Jun-79	B			100
Tillamook	219-056	Three Arch Rocks (Shag Rock)	06-Jun-88	B			130
Tillamook	219-056	Three Arch Rocks (Shag Rock)	20-Jun-08	B	3		3
Tillamook	219-058	"Unnamed Colony"	06-Jun-88	B	5		5
Tillamook	219-058	"Unnamed Colony"	11-Jul-91	B	3		3
Tillamook	219-058	"Unnamed Colony"	20-Jul-93	B	1		1
Tillamook	219-058	"Unnamed Colony"	20-Jun-08	B	0		0
Tillamook	219-060	"Brown Rock"	06-Jun-88	B	2		2
Tillamook	219-060	"Brown Rock"	11-Jul-91	B	4		4

Appendix 1 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Actual Count	# Nests	Breeding Birds
Tillamook	219-060	"Brown Rock"	20-Jun-08	B	0		0
Tillamook	219-061	"Unnamed Colony"	06-Jun-88	B	2		2
Tillamook	219-061	"Unnamed Colony"	20-Jun-08	B	0		0
Tillamook	219-062	"Unnamed Colony"	15-Jul-03	B	1		1
Tillamook	219-062	"Unnamed Colony"	20-Jun-08	B	0		0
Tillamook	219-063	"Unnamed Colony"	12-Jun-79	B			50
Tillamook	219-063	"Unnamed Colony"	06-Jun-88	B			20
Tillamook	219-063	"Unnamed Colony"	11-Jul-91	B	2		2
Tillamook	219-063	"Unnamed Colony"	13-Aug-08	M	1		1
Tillamook	219-063	"Unnamed Colony"	10-Jun-94	AP	1		X
Tillamook	219-064	Haystack Rock	01-Jan-29	M			X
Tillamook	219-064	Haystack Rock	01-Jan-35	M			X
Tillamook	219-064	Haystack Rock	24-Jun-51	M	100		100
Tillamook	219-064	Haystack Rock	08-Jun-52	M	100		100
Tillamook	219-064	Haystack Rock	02-Jun-57	M	70		70
Tillamook	219-064	Haystack Rock	14-May-63	A	10		X
Tillamook	219-064	Haystack Rock	09-Jul-64	A			X
Tillamook	219-064	Haystack Rock	05-May-67	C		69	138
Tillamook	219-064	Haystack Rock	26-Jun-72	M	100		100
Tillamook	219-064	Haystack Rock	26-Jun-79	C			300
Tillamook	219-064	Haystack Rock	11-May-88	B			300
Tillamook	219-064	Haystack Rock	24-Jun-91	B	120		120
Tillamook	219-064	Haystack Rock	20-Jun-08	B	0		0
Tillamook	219-065C	"Cascade Head Complex"	19-Jun-33	B,M			X
Tillamook	219-065C	"Cascade Head Complex"	04-Jun-34	B,M			X
Tillamook	219-071	"Unnamed Colony"	12-Jun-79	B			30
Tillamook	219-071	"Unnamed Colony"	11-May-88	B	14		14
Tillamook	219-071	"Unnamed Colony"	09-Jun-89	AP	3		X
Tillamook	219-071	"Unnamed Colony"	24-Jun-91	B	15		15
Tillamook	219-071	"Unnamed Colony"	26-May-99	M	8		8
Tillamook	219-071	"Unnamed Colony"	17-Jun-08	B	0		0
Lincoln	243-007	Otter Crest Headland	27-Jun-79	B			50
Lincoln	243-007	Otter Crest Headland	20-May-88	B	8		8
Lincoln	243-007	Otter Crest Headland	10-Jul-89	B	3		3
Lincoln	243-007	Otter Crest Headland	25-Jul-90	B	1		1
Lincoln	243-007	Otter Crest Headland	21-Jun-91	B	5		5
Lincoln	243-007	Otter Crest Headland	30-Jun-92	B	1		1
Lincoln	243-007	Otter Crest Headland	23-Jun-93	B	1		1

Appendix 1 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Actual Count	# Nests	Breeding Birds
Lincoln	243-007	Otter Crest Headland	22-Jun-94	B	1		1
Lincoln	243-007	Otter Crest Headland	17-Jun-08	B	0		0
Lincoln	243-007	Otter Crest Headland	09-Jul-18	B	0	0	0
Lincoln	243-010	Gull Rock	29-Jun-95	B	1		1
Lincoln	243-010	Gull Rock	02-Jun-00	M			X
Lincoln	243-010	Gull Rock	01-Jan-01	M			X
Lincoln	243-010	Gull Rock	02-Jun-33	M			X
Lincoln	243-010	Gull Rock	10-Jun-38	M			X
Lincoln	243-010	Gull Rock	26-Jun-72	A	4		X
Lincoln	243-010	Gull Rock	27-Jun-79	B			4
Lincoln	243-010	Gull Rock	20-May-88	B			6
Lincoln	243-010	Gull Rock	10-Jul-89	B	5		5
Lincoln	243-010	Gull Rock	24-Jun-92	B		1	2
Lincoln	243-010	Gull Rock	25-Jul-94	B	0	0	0
Lincoln	243-010	Gull Rock	21-May-97	M	2		2
Lincoln	243-010	Gull Rock	17-Jun-08	B	0		0
Lincoln	243-010	Gull Rock	27-Jul-10	B	1		2
Lincoln	243-010	Gull Rock	09-Jul-18	B	0	0	0
Lincoln	243-011	"Unnamed Colony"	03-Jun-92	M	2		2
Lincoln	243-011	"Unnamed Colony"	06-Jul-94	M	2		2
Lincoln	243-011	"Unnamed Colony"	17-Jun-08	B,M	0		0
Lincoln	243-011C	"Yaquina Head Complex"	01-Jan-38	M			X
Lincoln	243-011C	"Yaquina Head Complex"	02-Jun-40	M			X
Lincoln	243-011C	"Yaquina Head Complex"	26-Jun-72	A	3		X
Lincoln	243-011C	"Yaquina Head Complex"	01-Jan-78	U			X
Lincoln	243-015	"Colony Rock"	23-Jun-79	M			4
Lincoln	243-015	"Colony Rock"	17-May-88	M	12		12
Lincoln	243-015	"Colony Rock"	01-Jun-89	B,M	10		10
Lincoln	243-015	"Colony Rock"	30-Mar-90	M	2		2
Lincoln	243-015	"Colony Rock"	13-Jun-91	B,M	3		3
Lincoln	243-015	"Colony Rock"	24-Jun-92	B		1	2
Lincoln	243-015	"Colony Rock"	07-Jun-93	B,M	1		1
Lincoln	243-015	"Colony Rock"	22-Jun-94	B		1	2
Lincoln	243-015	"Colony Rock"	02-Jul-97	B	0	0	0
Lincoln	243-015	"Colony Rock"	17-Jun-08	B	0	0	0
Lincoln	243-016	"Unnamed Colony"	21-Jun-91	B	7		7
Lincoln	243-016	"Unnamed Colony"	03-Jun-92	M	2	1	2
Lincoln	243-016	"Unnamed Colony"	28-Jun-95	B		1	2

Appendix 1 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Actual Count	# Nests	Breeding Birds
Lincoln	243-016	"Unnamed Colony"	20-Jun-10	B	1		2
Lincoln	243-016	"Unnamed Colony"	17-Jun-08	B	0		0
Lincoln	243-022C	"Seal Rocks Complex"	01-Jan-38	M			X
Lane	243-026C	"Heceta Head Complex"	26-Jun-72	A	35		X
Lane	243-027	Heceta Head	06-Jul-88	B	6		6
Lane	243-027	Heceta Head	25-Jun-91	B	2		2
Lane	243-027	Heceta Head	24-Jun-08	B	0		0
Lane	243-028	Conical Rock	27-Jun-79	B		2	4
Lane	243-028	Conical Rock	04-Jun-88	AP	2		X
Lane	243-028	Conical Rock	19-Jul-89	M	4		4
Lane	243-028	Conical Rock	16-Jun-08	M	1		1
Lane	243-028	Conical Rock	24-Jun-08	B	0		0
Lane	243-028	Conical Rock	01-Jul-08	M	5		5
Lane	243-028.1	"Heceta Head South"	20-Jun-91	M		1	2
Lane	243-028.1	"Heceta Head South"	24-Jun-08	B	10		10
Lane	243-029	"Blast Rock"	24-Jun-88	M	6		8
Lane	243-029	"Blast Rock"	12-Apr-90	M	11		11
Lane	243-029	"Blast Rock"	25-Jun-91	B,M	6	3	6
Lane	243-029	"Blast Rock"	14-Jul-92	B	2		2
Lane	243-029	"Blast Rock"	24-Jun-08	B	0		0
Lane	243-030	"Parrot Rock"	06-May-67	M		13	26
Lane	243-030	"Parrot Rock"	27-Jun-79	C			50
Lane	243-030	"Parrot Rock"	06-Jul-88	B		4	8
Lane	243-030	"Parrot Rock"	12-Apr-90	M	4	3	6
Lane	243-030	"Parrot Rock"	25-Jun-91	B,M	6	9	6
Lane	243-030	"Parrot Rock"	14-Jul-92	B		1	2
Lane	243-030	"Parrot Rock"	24-Jun-08	B	0		0
Lane	243-030	"Parrot Rock"	19-Aug-08	M	0		0
Lane	243-031	Devils Elbow	14-Jul-92	B	2		2
Lane	243-031	Devils Elbow	24-Jun-08	B	0		0
Lane	243-031	Devils Elbow	19-Aug-08	M	0		0
Lane	243-033	"Sea Lion Caves Headlands"	05-Jun-88	M	7		7
Lane	243-033	"Sea Lion Caves Headlands"	24-Jun-08	B	0		0
Lane	243-033	"Sea Lion Caves Headlands"	19-Aug-08	M	0		0
Lane	243-036	"Cox Rock Mainland"	05-Jun-88	M	4	2	4
Lane	243-036	"Cox Rock Mainland"	25-Jun-91	B,M	4		4
Lane	243-036	"Cox Rock Mainland"	24-Jun-08	B	0		0
Lane	243-036	"Cox Rock Mainland"	19-Aug-08	M	0		0

Appendix 1 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Actual Count	# Nests	Breeding Birds
Coos	270-004	Chiefs Island	30-Apr-79	M			4
Coos	270-004	Chiefs Island	13-Jun-88	B	13		13
Coos	270-004	Chiefs Island	24-Jun-08	B	0		0
Coos	270-014	Table Rock	30-Apr-79	C			30
Coos	270-014	Table Rock	27-Jun-88	B			24
Coos	270-014	Table Rock	27-Jun-89	M	7		7
Coos	270-014	Table Rock	18-Apr-91	M	12		12
Coos	270-014	Table Rock	06-Apr-96	M	1		1
Coos	270-014	Table Rock	14-Jun-08	M	1		2
Coos	270-014	Table Rock	10-Jul-08	B,M	0		0
Coos	270-015	"North Coquille Point Rock"	27-Jun-88	B	4		4
Coos	270-015	"North Coquille Point Rock"	17-Jul-08	B,M	0		0
Coos	270-016	"Middle Coquille Point Rock"	30-Apr-79	B			4
Coos	270-016	"Middle Coquille Point Rock"	23-Jun-88	M	2		2
Coos	270-016	"Middle Coquille Point Rock"	27-Jun-89	M	6		6
Coos	270-016	"Middle Coquille Point Rock"	17-Jul-08	B,M	0		0
Coos	270-018	"Elephant Rock"	30-Apr-79	B,M			24
Coos	270-018	"Elephant Rock"	23-Jun-88	M		17	34
Coos	270-018	"Elephant Rock"	18-Apr-91	M	17		17
Coos	270-018	"Elephant Rock"	17-Jul-08	B,M	0		0
Coos	270-018	"Elephant Rock"	12-Jul-13	M	1		2
Coos	270-019	Cat and Kittens Rock	04-Jun-14	AP	1		X
Coos	270-020	Face Rock	30-Apr-79	B			6
Coos	270-020	Face Rock	27-Jun-88	B	6		6
Coos	270-020	Face Rock	12-May-03	M	2	1	2
Coos	270-020	Face Rock	15-May-10	M	4		4
Coos	270-020	Face Rock	10-Jul-08	M	5		5
Coos	270-020	Face Rock	15-Jul-10	M	10		10
Coos	270-020.1	"Grave Point Rock"	23-Jun-88	C	1		1
Coos	270-020.1	"Grave Point Rock"	10-Jul-08	B,M	0		0
Coos	270-021	Haystack Rock	26-Jun-72	A	60		X
Coos	270-021	Haystack Rock	05-Jul-79	C			4
Coos	270-021	Haystack Rock	13-Jul-88	M	6		6
Coos	270-021	Haystack Rock	27-Jun-89	M	1		1
Coos	270-021	Haystack Rock	28-Mar-90	M	2		2
Coos	270-021	Haystack Rock	18-Apr-91	M	3		3
Coos	270-021	Haystack Rock	17-Jul-08	B	0		0
Curry	270-024C	"Sixes River Complex"	26-Jun-72	A	10		X

Appendix 1 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Actual Count	# Nests	Breeding Birds
Curry	270-027	Gull Rock	15-May-79	B			10
Curry	270-027	Gull Rock	03-Jun-88	AP	6		X
Curry	270-027	Gull Rock	22-Jul-08	B	0		0
Curry	270-029	Best Rock	16-May-79	B			10
Curry	270-029	Best Rock	22-Jul-08	B	2		2
Curry	270-035	West Conical Rock	16-May-79	B			2
Curry	270-035	West Conical Rock	28-Jun-88	B	8		8
Curry	270-035	West Conical Rock	22-Jul-08	B	0		0
Curry	270-043	Redfish Rocks (Northern)	28-Jun-88	B	1		1
Curry	270-043	Redfish Rocks (Northern)	22-Jul-08	B	0		0
Curry	270-044	Redfish Rocks (Northwestern)	28-Jun-88	B	1		1
Curry	270-044	Redfish Rocks (Northwestern)	22-Jul-08	B	0		0
Curry	270-045	Redfish Rocks (East Central)	03-Jul-79	B			2
Curry	270-045	Redfish Rocks (East Central)	28-Jun-88	B	2		2
Curry	270-045	Redfish Rocks (East Central)	22-Jul-08	B	0		0
Curry	270-047	Redfish Rocks (Southern)	28-Jun-88	B	5		5
Curry	270-048	"Unnamed Colony"	28-Jun-88	B	2		2
Curry	270-048	"Unnamed Colony"	22-Jul-08	B	0		0
Curry	270-049	Island Rock	15-Jun-30	M			X
Curry	270-049	Island Rock	22-Apr-67	C		13	26
Curry	270-049	Island Rock	03-Jul-79	B		175	350
Curry	270-049	Island Rock	28-Jun-88	B		150	300
Curry	270-049	Island Rock	31-Aug-89	B	18		18
Curry	270-049	Island Rock	22-Jul-08	B	15		15
Curry	270-067	Double Rock	16-Jun-88	B			2
Curry	270-067	Double Rock	17-Jul-08	B	0		0
Curry	270-068	Needle Rock	16-Jun-88	B	6		6
Curry	270-068	Needle Rock	26-Jul-89	B	1	1	2
Curry	270-068	Needle Rock	24-Jun-94	B	2		2
Curry	270-068	Needle Rock	17-Jul-08	B	2		2
Curry	270-071	Hunters Island	10-Jul-64	A			X
Curry	270-071	Hunters Island	18-Mar-67	C		13	26
Curry	270-071	Hunters Island	12-Jul-79	C		75	150
Curry	270-071	Hunters Island	15-Jun-88	B			100
Curry	270-071	Hunters Island	26-Jul-89	B			X
Curry	270-071	Hunters Island	16-Jul-08	B	1		1
Curry	270-075C	"Crook Point Complex"	26-Jun-72	A	50		X
Curry	270-076	"North Crook Point Rock"	21-Mar-67	C		7	14

Appendix 1 (cont.).

County	Colony ID	Site Name	Survey Date	Survey Type	Actual Count	# Nests	Breeding Birds
Curry	270-076	"North Crook Point Rock"	04-Jul-79	C		25	50
Curry	270-076	"North Crook Point Rock"	15-Jun-88	B			40
Curry	270-076	"North Crook Point Rock"	26-Jul-89	B	16		16
Curry	270-076	"North Crook Point Rock"	16-Jul-08	B	0		0
Curry	270-079	Saddle Rock	23-Jul-79	C			10
Curry	270-079	Saddle Rock	15-Jun-88	B	11		11
Curry	270-079	Saddle Rock	16-Jul-08	B	0		0
Curry	270-087	Mack Arch	29-Jun-79	B			4
Curry	270-087	Mack Arch	15-Jun-88	B	7		7
Curry	270-087	Mack Arch	16-Jul-08	B	0		0
Curry	270-109	"Whaleshead Cove" (East Rock)	23-Apr-67	C		47	94
Curry	270-109	"Whaleshead Cove" (East Rock)	01-Jun-79	B			70
Curry	270-109	"Whaleshead Cove" (East Rock)	14-Jul-88	C		25	50
Curry	270-109	"Whaleshead Cove" (East Rock)	15-Jul-08	B	7		7
Curry	270-109C	"Whaleshead Cove Complex"	26-Jun-72	A	65		X
Curry	270-110	"Whaleshead Cove" (West Rock)	23-Apr-67	C			X
Curry	270-110	"Whaleshead Cove" (West Rock)	01-Jun-79	C			100
Curry	270-110	"Whaleshead Cove" (West Rock)	03-Aug-88	C		20	40
Curry	270-110	"Whaleshead Cove" (West Rock)	15-Jul-08	B	2		2
Curry	270-110	"Whaleshead Cove" (West Rock)	29-Jul-09	B	3		3
Curry	270-123	Goat Island	23-May-79	C			400
Curry	270-123	Goat Island	14-Jun-88	B	120		120
Curry	270-123	Goat Island	25-Mar-66	C		75	150
Curry	270-123	Goat Island	26-Jun-72	A	10		X
Curry	270-123	Goat Island	02-Jul-73	M	80		80
Curry	270-123	Goat Island	15-Jul-08	B	12		12

Appendix 2. Photographs of some of the Tufted Puffin survey crew during the 2021 coast wide survey.

Photo credit Lee Whitmer

Photo 1. Left – Madeleine Vander-Heyden, middle – Noah Dolinajec, right – Shawn Stephensen.

Photo credit Lee Whitmer

Photo 2. Left – Noah Dolinajec, middle – Shawn Stephensen, right – Alyssa Nelson.

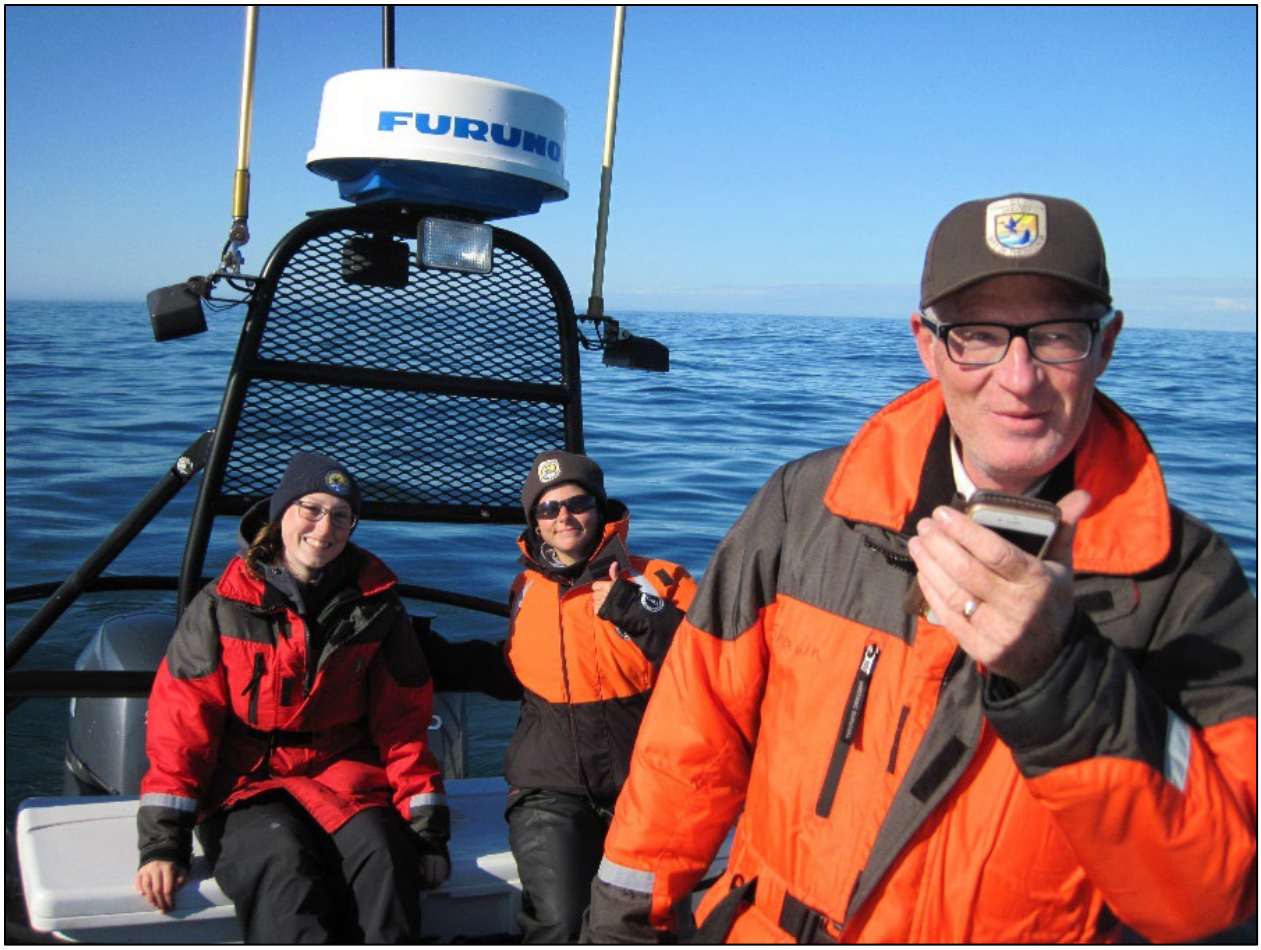

Photo credit Mike Szumski

Photo 3. Left – Alyssa Nelson, middle - Frances Bowman, right – Shawn Stephensen.