Seabird Monitoring at the Cape Perpetua and Cape Falcon Marine Reserves

A Community Science Project

Report prepared by Amelia J. O'Connor[1], Joe Liebezeit[1], Jennifer Nelson[2], Shawn Stephensen[2], Paul Engelmeyer[1], and Rob Suryan[3]

[1]Audubon Society of Portland, 5151 NW Cornell Rd, Portland, OR 97210

[2]U.S. Fish and Wildlife Service, Oregon Coast National Wildlife Refuge Complex, 2127 S.E. Marine Science Drive, Newport, Oregon 97365

[3]Oregon State University, Hatfield Marine Science Center, 2030 S.E. Marine Science Drive, Newport, Oregon 97365

January 2018

Background

Brandt's Cormorants nesting at Cape Perpetua's southeastern MPA.

Oregon currently has five Marine Reserve / Marine Protected Areas (MR/MPA). These areas prohibit extractive uses, such as commercial fishing, in order to support stable populations of marine life and protect key nearshore habitats. In MRs all extractive uses are prohibited while MPAs are areas protected for a specific conservation purpose, allowing for some but not all uses. The last of Oregon's five proposed marine reserves, Cape Falcon, entered the implementation phase in January of 2016.

Oregon Department of Fish and Wildlife (ODFW), the lead agency tasked with managing the marine reserves, began monitoring the reserves in 2010 as part of a larger effort to assess the effectiveness of MR/MPAs for both human benefit and ecological health. ODFW's ecological monitoring is focused on benthic habitats and fish communities. Complementing these efforts, the Audubon Society of Portland, the U.S. Fish and Wildlife Service (USFWS), Oregon State University (OSU), Friends of Cape Falcon, and Haystack Rock Awareness Program have partnered to learn more about seabird use at the Cape Perpetua MPA and Cape Falcon MR as well as provide local citizens an opportunity to contribute to this effort. Globally, research on seabird reproductive and foraging ecology has informed MR/MPA site identification and assessment, and has provided vital information on the subsequent changes in the marine community following MR/MPA establishment.[1]

The Cape Perpetua MR/MPA is the largest of Oregon's MR/MPA complexes. It includes a "Seabird Protection Area" which protects forage fish species including Pacific Herring (*Clupea pallasii*), Pacific sardines (*Sardinops sagax*), anchovies (*Engraulis mordax*), smelt (*Osmeridae*), and Pacific sand lance (*Ammodytes hexapterus*). These small fish are a critical link in the ocean ecosystem providing a primary food source for many top predators like salmon, marine mammals, and seabirds. When seabird populations are not doing well, the decline of forage fish prey is often a primary cause.[2] Seabird populations are also influenced by many other factors including pollution, invasive predators, and human disturbance.[3]

The "science goal" of this project is to establish a baseline of information on nearshore, piscivorous (fish-eating) seabird populations in the Cape Perpetua MR/MPA and Cape Falcon MR, and compare breeding success to nearby seabird colonies outside of the MR/MPAs. We accomplish this by:

1) Determining breeding success of Brandt's (*Phalacrocorax penicillatus*), Pelagic (*P. pelagicus*), and Double-crested Cormorants (*P. auritus*) at multiple colonies in the MR/MPA and compare with other Oregon colonies including at Yaquina Head and Haystack Rock.
2) Determine abundance of crevice nesting species, Pigeon Guillemot and Rhinoceros Auklets, at Sea Lion Caves in Cape Perpetua's MR/MPA.
3) Record avian predator abundance and disturbances at monitored colonies.

---

[1] Pichegru et al. 2010. Marine no-take zone rapidly benefits endangered penguin. Biology Letters 6:498-501; Thaxter, C.B, et al. 2012. Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biol Conserv 156: 53-61 doi http://dx.doi.org/10.1016/j.biocon.2011.12.009

[2] Cury et al. 2011. Global Seabird Response to Forage Fish Depletion – One-Third for the Birds. Science 334 : 1703-1706.

[3] Croxall et al. 2012. Seabird conservation status, threats, and priority actions: a global assessment. Bird Conservation International 22: 1–34.

The “outreach goal” of this project is to promote wider recognition of Oregon’s marine reserves, forage fish, and seabird conservation through local community participation and associated outreach and education. We have the unique opportunity to reach more than 100,000 visitors that go to Sea Lion Caves (a local business), Heceta Head Lighthouse, and Haystack Rock (a popular tourist destination) annually. This report provides a summary of our findings for the fourth year of this project.

Study Area & Methods

From 9 June to 17 September 2017, we monitored breeding productivity of cormorant species for the fourth year at the Cape Perpetua MPA and for the second year at Cape Falcon MR. We established four plots at Cape Falcon MR near the Devil's Cauldron area south of Cannon Beach, Oregon (Figure 1 & 2, Appendix). These plots included 46 cormorant nests (13 Double-crested, 16 Pelagic, and 17 Brandt's). At Cape Perpetua and we monitored 66 cormorant nests (10 Double-crested, 4 Pelagic, and 52 Brandt's) in five different plots on headland and island colonies between the Heceta Head Lighthouse and Sea Lion Caves south of Yachats, Oregon (Figure 1 & 2, Appendix). Each plot included a subset of 4-21 nests within a given colony. All monitored island colonies are part of the Oregon Islands National Wildlife Refuge.

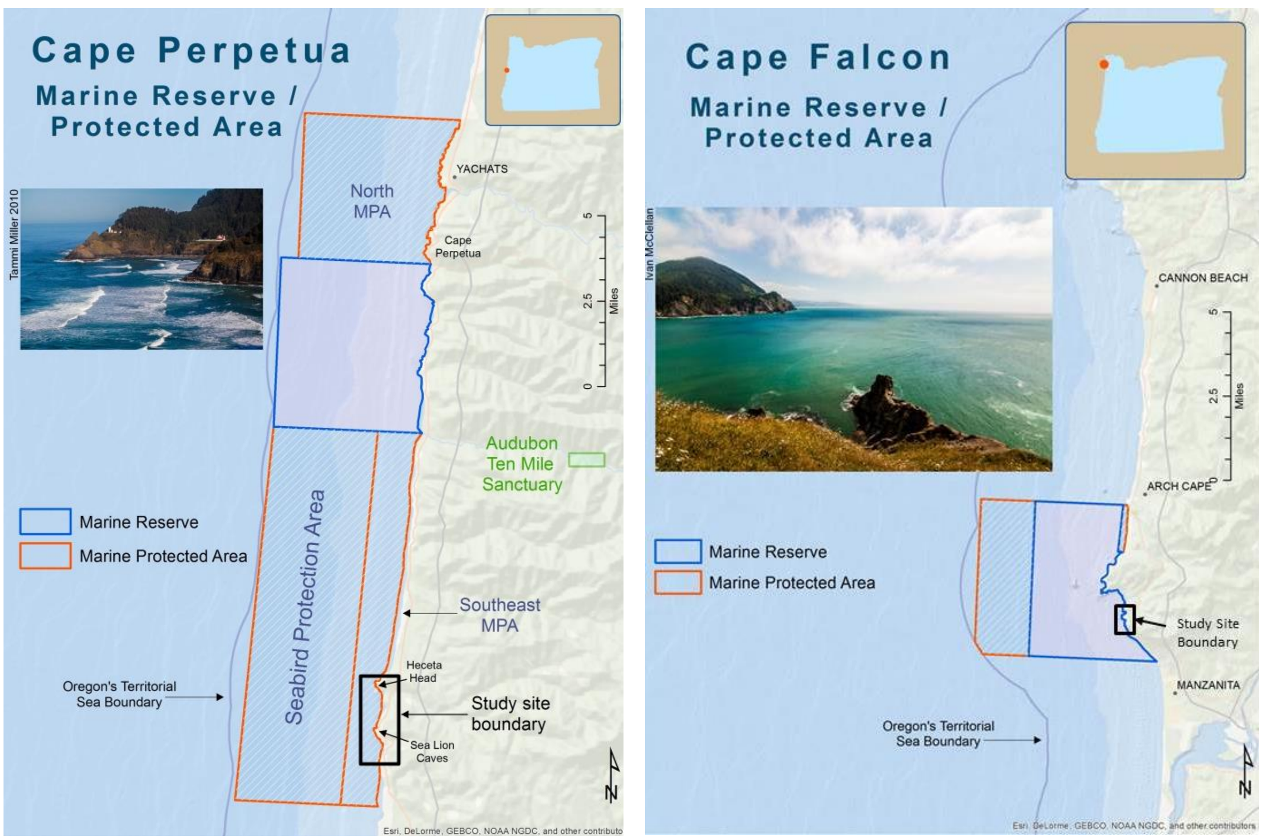
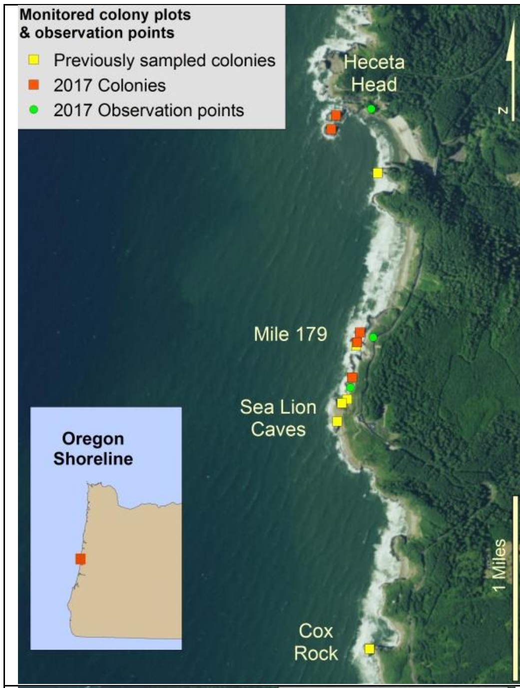


Figure 1. Maps of the Cape Perpetua (left) and Cape Falcon (right) MR/MPA highlighting the seabird monitoring study areas.

Sites were selected based on proximity to existing seabird colonies within the MR/MPAs, visibility of the colony, and tourist and visitor use to promote outreach. Plots and nests were selected based on visibility from land, specifically nests that were lower elevation and were less likely to be blocked by other nests or roosting birds. Plots were compared with data collected at a comparison site at Haystack Rock in Cannon Beach and by the Seabird Oceanography Lab at Yaquina Head, just north of Newport, Oregon. In addition, Pigeon Guillemots and Rhinoceros Auklets were counted at the Sea Lion Caves from 9 June to 25 August.

Thirty-nine “community scientist” volunteers monitored sites alongside an Audubon Society of Portland employee and USFWS intern (see acknowledgements). An initial training on project goals and field methods was provided by the Audubon Society of Portland at both monitoring sites. Volunteers monitored sites weekly from 9 June to 17 September comprising a combined total of 46 days (71 hours) monitoring at sites.



Blast Rock. A medium-sized nearshore island adjacent to Parrot Rock and Heceta Head Lighthouse State Park. This colony had more vegetation and had medium to steep-sloped breeding habitat.

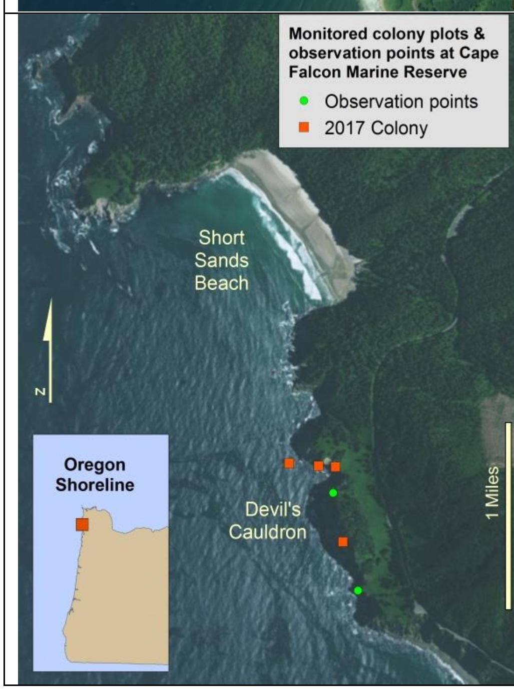
Parrot Rock. A medium-sized nearshore rocky island with no vegetation and medium-sloped nesting habitat. Near Heceta Head lighthouse and a regular roosting and breeding spot for common murres.

Mile 179 North. A small nearshore rocky island with no vegetation and low slope to flat nest habitat. Adjacent to a popular highway pullout.

Mile 179 South. An on-shore ridge with relatively high vegetation and medium to low slope adjacent to highway pullout.

Sea Lion Caves. An on-shore steep sloping rocky headland adjacent to a tourist viewing deck. Some vegetation on cliff side.

Cox Rock. A medium-sized nearshore rocky island with flat slope at top and some vegetation. Little human disturbance.



Devils Cauldron Area. A section of coves and steep headland with small off-shore rocks. The largest Island in this area is a small nearshore rocky island with no vegetation and sloped southern side where Brandt’s Cormorants nest. Just east of this island is Treasure Cove with large steep cliff walls where Pelagic Cormorants, Western Gulls and Pigeon Guillemots may nest. Near the base of the northwestern wall of Treasure Cove there are large ledge areas where Brandt’s Cormorants may nest. To the south a large section of the headland cliff wall is less steep where double-crested Cormorants nested. Little human disturbance.

Figure 2. Colonies monitored at Cape Perpetua (top) and Cape Falcon (bottom) MR/MPA in 2014-17.

All plots were monitored at least once every two weeks with most plots monitored once a week or more. In 2017, monitoring occurred during 13 days (22 hours) at Cape Falcon and 19 days (33 hours) at Cape Perpetua throughout the breeding season. Recorded observations included number of eggs/chicks observed, chick size, predators within 100 meters of the plot, whale sightings, and general weather conditions. Any disturbance resulting in an adult leaving the nest during monitoring regardless of the cause (e.g. predators, human disturbance, boat or aircraft) was documented in detail including disturbance duration and any loss of young or eggs. In addition, auklets and guillemots were counted at the Sea Lion Caves before the adjacent cormorant plots were monitored. The auklet and guillemot counts lasted no more than 15 minutes. Monitoring was conducted with binoculars (Canon and Swarovski 10x42), and spotting scopes (Swarovski and Leupold, 25-60X).[4]

Analyses included calculating breeding productivity which we defined as the average number of fledglings produced per nest. We defined a fledgling as a cormorant chick that was present 25 days old (same criteria used at the Yaquina Head study area)[5] with the assumption that by this time they possess fully-developed wings. This method is comparable to those used for cormorants in the California Current system.[6] We monitored nests weekly not daily and some nests were not ideal for observations, thus the first observation for some chicks were not in the "tiny" size phase and their first observation time (hatch date) was adjusted for the 25-day fledgling definition. For chicks first observed at size small hatching was assumed to be a week earlier, the estimated minimum time a chick takes to get to that size, and two weeks earlier for "medium" chicks. We also compared the 25-day fledging definition to other potential fledgling definitions including creching[7] behavior and chick size. Basic summary statistics including cormorant hatch and fledge success, eggs and chicks per nest, frequency of predators and whales, and average and maximum guillemot and auklet counts are also reported. Observation points for monitored cormorant nests were not all ideal because nest contents were only partially visible for many nests. As a result, egg numbers are underestimated for most nests and were not used in any calculations of hatch or fledge success. Summary statistics and graphs were created using Microsoft Excel and the R Project for Statistical Computing (R core team 2014).

Results & Discussion

Summer 2017 marked our fourth year of monitoring at Cape Perpetua's southeastern MPA and our second year at the Cape Falcon MR. Overall 2017 was a less successful breeding season for cormorants at our monitored sites than 2016, with few exceptions. It was the first year that Cape Perpetua and our comparison colony at the Yaquina Head Outstanding Natural Area (Yaquina Head) did not show similar interannual fluctuations in breeding productivity (average number of fledglings per nest). The largest disparity was in Pelagic Cormorant breeding productivity, this was slightly higher in 2017 compared to 2016 for Yaquina Head while it was much lower in 2017 for Cape Perpetua. Central Coast and North Coast sites yielded similar breeding productivity across all three species of cormorants, although high variability was seen between sites for Pelagic Cormorants. This contrasts with 2016 where we observed higher breeding success for Pelagic and Brandt's Cormorants at the northern coast sites (Cape Falcon and Haystack Rock). Double-crested cormorants did relatively well at both MR/MPA sites compared to Brandt's and Pelagic Cormorants. Consistent with 2016, we observed

---

[4] For detailed sampling protocols contact Joe Liebezeit or visit http: http://audubonportland.org/issues/community-science

[5] Suryan et al. 2015. Yaquina Head seabird colony monitoring – 2015 summary report. Oregon State University, Hatfield Marine Science Center, Unpublished report, 10pp.

[6] Elliott et al. 2014. Changes in forage fish community indicated by the diet of the Brandt's cormorant (*Phalacrocorax penicillatus*) in the central California Current, Journal of Marine Systems. doi: 10.1016/j.jmarsys.2014.07.015; Wires, L.R., F.J. Cuthbert, D.R. Trexel and A.R. Joshi. 2001. Status of the Double-crested Cormorant (*Phalacrocorax auritus*) in North America. Final Report to USFWS.

[7] Creching behavior: Groups of chicks from 2 or more broods in or adjacent to the breeding colony.

avian predators more frequently at Cape Perpetua compared to Cape Falcon and we documented summer storm impacts to nest success. In addition to weather and predation factors, local food availability likely impacts breeding productivity at these sites. The "Blob", a large mass of abnormally warm water in the Pacific Ocean off the coast of North America could also have impacted seabird productivity in this region in recent years, likely by affecting food availability. First documented in 2013, the Blob persisted through 2016[8,9].

In 2017, 39 volunteers contributed to seabird monitoring. Volunteers included a range of local families, high school and college students, and retired community members. During 2017 volunteers engaged with 699 visitors about Oregon's marine reserves, importance of forage fish, and goals of this project. Visitors ranged from local Oregonians to those who traveled cross-county or internationally to see the Oregon Coast.

Annual variability in breeding productivity

Consistent to previous years, cormorant colonies continued to change locations at Cape Perpetua occupying some of the abandoned colonies from 2014 and abandoning some of the 2015 and 2016 colonies. At Cape Falcon we saw cormorants nest on a new cliff colony in addition to the colonies used in both 2016 and 2017. This behavior is most noticeable with the Brandt's Cormorant colonies and does not seem to correlate to breeding productivity and nest success findings. For most sites and species cormorant nesting was less successful in 2017 than it was in 2016.

Table 1. Summary statistic for Cape Perpetua (CP), Yaquina Head (YH), Cape Falcon (CF), Haystack Rock (HR) cormorant nests in 2017.
***fledging is defined as a chick observer in the nest for 25 days or more.**

Species and Loc.	No. Nests	Eggs / Chicks	Nests w/ Hatch Success	Nests w/ Fledge Success	Chicks per Nest (M±SE)	Fledglings per Nest* (M±SE)	No. Chicks at 25 days	No. Chicks Crech / "large"	No. Chicks "huge"
Brandt's (CP)	52	49 / 42	37%	33%	0.77±0.16	0.58±0.13	30	29	26
Brandt's (YH)	82	NA / 127	76%	44%	1.55±0.12	0.79±0.11	65	NA	NA
Brandt's (CF)	17	40 / 24	71%	59%	1.41±0.24	1.06±0.22	18	18	16
Brandt's (HR)	15	NA / 18	53%	53%	1.20±0.35	0.93±0.27	14	16	13
Pelagic (CP)	4	NA / 2	25%	0%	0.50±0.50	0.00±0.00	0	0	0
Pelagic (YH)	46	NA / 101	91%	85%	2.20±0.14	1.65±0.14	75	NA	NA
Pelagic (CF)	16	33 / 16	56%	50%	1.00±0.23	0.63±0.16	10	12	10
Pelagic (HR)	6	NA / 11	83%	83%	1.83±0.40	1.17±0.31	7	8	7
Double-crested (CP)	10	NA / 23	90%	80%	2.30±0.30	2.10±0.38	21	21	18
Double-crested (CF)	13	NA / 21	77%	69%	1.62±0.31	1.54±0.32	20	20	20

At Cape Perpetua, cormorants returned to more colonies than in 2015 and 2016. As a result, we monitored five plots, sampling one mixed colony for Double-crested (DCCO) and Brandt's Cormorants (BRAC), one colony for Pelagic Cormorants (PECO) and three colonies for Brandt's Cormorants. From these five plots 66 cormorant nests (52 BRAC, 4 PECO, 10 DCCO) were monitored and 49 eggs (49 BRAC),

[8] https://www.nationalgeographic.com/magazine/2016/09/warm-water-pacific-coast-algae-nino/
[9] Bond, N.A., M.F. Cronin, H. Freeland, and N. Mantua. 2015, Causes and impacts of the 2014 warm anomaly in the NE Pacific. Geophysical Research Letters 42: 3414-3420.

67 chicks (42 BRAC, 2 PECO, 23 DCCO), and 51 fledglings (30 BRAC, 0 PECO, 21 DCCO) were observed (Table 1). Few Pelagic Cormorants returned to nest in the Cape Perpetua area in 2017 and we observed no chicks fledge from the monitored plot (Table 1). However, consistent to previous years we did see four Pelagic Cormorant nests inside Sea Lion Caves which were successful in producing at least one fledgling each. Brandt's and Double-crested Cormorants had relatively higher breeding productivity, compared to Pelagic Cormorants, with 0.58±0.13 and 2.10±0.38 fledglings per nest, respectively. However, at Yaquina head Brandt's Cormorants had a poor season compared to Pelagic Cormorants with 0.79±0.11 compared to 1.65±0.14 fledglings per nest (Figure 3; Table 1). Brandt's Cormorant breeding productivity at both sites was similar compared to previous years, while Pelagic Cormorant breeding productivity showed more variability. This is the first year since monitoring began that we have seen opposite interannual trends in breeding productivity at these sites, observed most notably for Pelagic Cormorants which saw a slight increase in breeding productivity at Yaquina Head from 2016 to 2017 and large decrease at Cape Perpetua (Figure 3). It is important to note due to few birds returning our Pelagic Cormorant nest sample size is only four nests at Cape Perpetua.

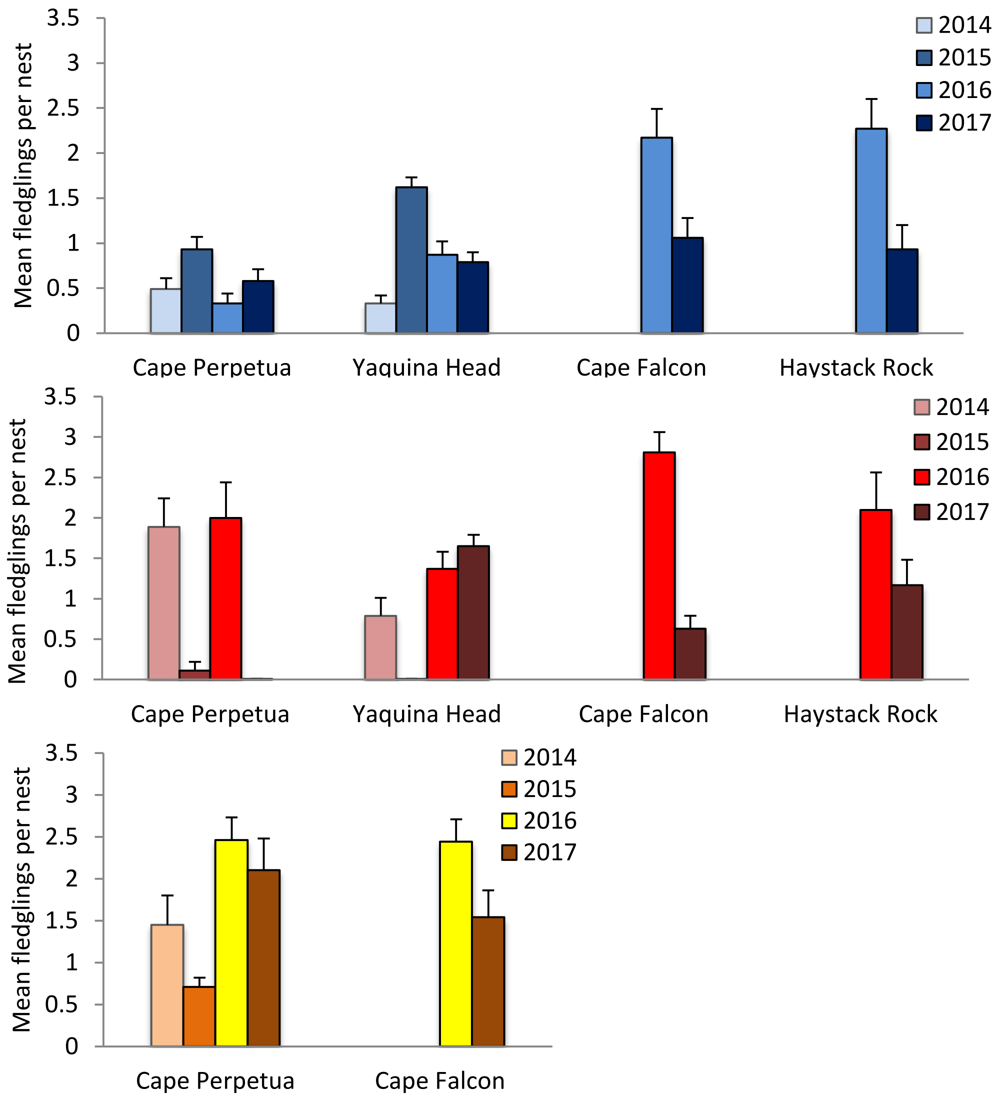


Figure 3. Breeding productivity (mean ± standard error) for Brandt's (top), Pelagic (middle), and Double-crested (bottom) Cormorants, showing variability between years (2014, 2015, 2016 and 2017) and locations (Cape Perpetua and Yaquina Head).

At Cape Falcon, cormorants also returned to more colonies than in 2016. We monitored four plots, sampling one Double-crested Cormorant (DCCO) colony, one Pelagic Cormorants (PECO) colony and two colonies for Brandt's Cormorants (BRAC). From these four plots 46 cormorant nests (17 BRAC, 16 PECO, 13 DCCO) were monitored and 73 eggs (40 BRAC, 33 PECO), 61 chicks (24 BRAC, 16 PECO, 21 DCCO), and 48 fledglings (18 BRAC, 10 PECO, 20 DCCO) were observed (Table 1). Pelagic Cormorants had the lowest breeding productivity of 0.63±0.16 fledglings per nest. Brandt's and Double-crested cormorants produced 1.06±0.22 and 1.54±0.32 fledglings per nest, respectively. At the Haystack Rock comparison site Brandt's and Pelagic Cormorants was similar and comparable to Brandt's at Cape Falcon. Both sites and all cormorant species produced roughly half the fledglings per nest observed in 2016 (Figure 3).

North Coast and Central Coast sites exhibited similar breeding success despite high variability for Pelagic Cormorants between sites. This is the first year we have seen the Marine Reserve sites have lower breeding productivity than their comparison sites. While Brandt's Cormorants nest success were similar between marine reserve and comparison sites, Pelagic cormorants had much higher breeding success at the comparison colonies (Figure 4; Table 1). However, sample sizes for Pelagic Cormorants nests varied significantly between sites ranging from less than 10 nests monitored for Cape Perpetua and Haystack Rock to 46 at Yaquina Head which may have impacted findings. For Double-crested Cormorants, the northern colonies at Cape Falcon produced slightly less fledglings per nest as Cape Perpetua (Figure 4; Table 1).

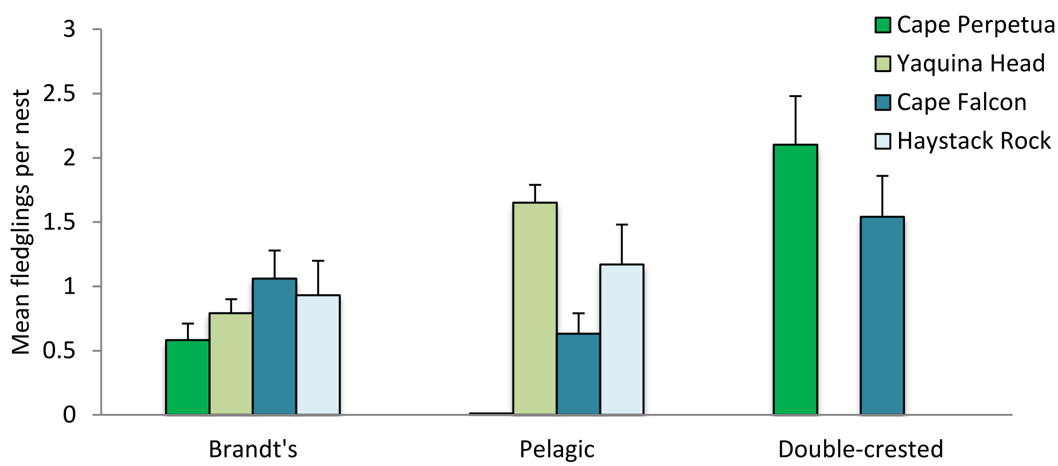


Figure 4. 2017 Breeding productivity (mean ± standard error) for Brandt's, Pelagic, and Double-crested Cormorants showing variability between study sites from south to north (Cape Perpetua MPA, Yaquina Head, Cape Falcon MR, and Haystack Rock).

Predation or disturbances, weather, and food availability are likely key factors impacting cormorant breeding productivity in 2017. Similar to 2016, monitored Brandt's and colonies were notably affected by summer storms in June and early July that produced high winds and rain. Two Brandt's colonies at Cape Perpetua completely failed by mid-June and 5 Brandt's and 7 Pelagic nests failed by early July in Cape Falcon. Double-crested nests did not appear to be as impacted by the storms and only lost one nest at each site. This may be due to differences in nesting behaviors with hardier stick nests being used by Double-crested and more fragile grass nests used by the other two cormorant species. Although avian predator abundance has fluctuated interannually, Brown Pelicans and Turkey Vultures are the most common potential avian predator for all years. Turkey vulture and Brown Pelican abundances were low compared to previous years at Cape Perpetua and Cape Falcon. Although Brown Pelicans are a known avian nest predator we believe they are less likely avian predator for nesting cormorants because their observations all occur in late summer when chicks are mostly grown. Turkey Vultures, Bald Eagles, Ospreys and Peregrine Falcons however were observed near colonies during early summer incubation and hatching. At Cape Perpetua we saw more Bald Eagles in 2017 than in 2016, 0.18 compared to 0.09 eagles per hour, respectively. One disturbance resulting in an eagle taking a cormorant chick adjacent to a monitored plot was observed on 30 June 2017. In 2017 three Peregrine Falcons were observed at both site for the first time. We also kept track of whale sightings during avian predator monitoring and observed 7 Grey Whales at Cape Perpetua and 1 Grey Whale at Cape Falcon.

In addition to storms and predation, food availability and a late summer heat wave may have affected Pelagic Cormorants. It was notable that Pelagic Cormorant nests failures that occurred later in the season at Cape Falcon happened during or just after a heat spell hit the North Coast in early August, resulting in temperatures in the 80s and 90s. Two dead chicks were observed adjacent to nests during the following monitoring period and four total chicks were lost during this time. No Pelagic Cormorant nest produced more than two fledglings and five of the seven nests that did successfully fledge a chick only had one fledgling. This occurred despite most nests rearing two or more chicks to medium size. In previous years Pelagic nests have had three and even occasionally four fledglings in a successful nest. Food availability may have also limited these nests to fledging less chicks or weakened chicks before the heat wave. Different cormorant species have slightly different foraging strategies and this may have hindered Pelagic Cormorants during the 2017 breeding season. Breeding productivity for all three species may also exhibit natural variability, other studies in the California Current Ecosystem often have documented naturally high interannual variability for other seabird species[10] as well as cormorants[11].

Annual variability in abundance counts

For the first time in four years we have seen a noticeable difference in the number of Rhinoceros Auklets and Pigeon Guillemot using the Sea Lion Caves. In 2017 a maximum count of 109 Pigeon Guillemot and 19 Rhinoceros Auklet adults were observed on 4 August 2017 and 16 June 2017, respectively (Table 2). Chicks were observed late in the breeding period and had a maximum count of six guillemots and no auklet chicks. The average adult Pigeon Guillemot count has been slowly declining from 2014 to 2016 from 118.35±5.66 to 90.72±3.85, however 2017 saw a steeper decline to 60.67±6.65 (Table 2). Counts varied throughout the breeding period although only once in 2017 was the count above 80 guillemots where in previous years the average count was well above 80 birds. Similarly, the average count of Rhinoceros Auklets was half of the average counts of previous years (Table 2). Food availability may have played a role in less guillemots and auklets nesting in the caves.

Table 2. Summary Statistics for Sea Lion Cave Pigeon Guillemot and Rhinoceros Auklet counts for summers of 2014 through 2017.

Species	Year	Adults Mean Count	Adult Max Count	Date Adult Max Count	Chick Max Count	Date Chick Max Count	Total Adults with Fish
Pigeon Guillemot	**2017**	**60.67±6.65**	**109**	**8/4/2017**	**6**	**7/28/2017**	**2**
	2016	**90.72±3.85**	**131**	**8/8/2016**	**12**	**8/13/2016**	**0**
	2015	**108.69±8.35**	**165**	**8/4/2015**	**4**	**8/18/2015**	**5**
	2014	**118.35±5.66**	**163**	**7/1/2014**	**4**	**8/22/2014**	**8**

[9] Leising et al. 2015. State of the California Current 2014-2015: Impacts of the warm-water "Blob". California Cooperative Oceanic Fisheries Investigations Reports **56**:31-68.
[11] Jones et al. 2008. Breeding phenology and reproductive success of the Brandt's Cormorant at three nearshore colonies in central California, 1997-2001.Waterbirds 31:505-681.

Species	Year	Adults Mean Count	Adult Max Count	Date Adult Max Count	Chick Max Count	Date Chick Max Count	Total Adults with Fish
Rhinoceros Auklet	**2017**	**5.69±1.42**	**19**	**6/16/2017**	**0**	**NA**	**0**
	2016	**8.24±1.39**	**26**	**42550**	**0**	**NA**	**0**
	2015	**11.63±2.24**	**24**	**6/18 & 7/21**	**0**	**NA**	**0**
	2014	**10.87±1.21**	**25**	**6/19/2014**	**1**	**8/6 & 7/9**	**0**

Note: All counts and particularly counts of adults with fish may be largely underestimated due to poor lighting in the cave.

Next Steps

We will continue this monitoring effort to build on our baseline of seabird reproductive success information and usage patterns for the MR/MPA and discern factors affecting seabird and overall ecosystem health. In 2018 we plan to continue the monitoring effort at both the Cape Falcon MR and at the Cape Perpetua MPA. Additionally, we will continue to document avian predator and cetacean abundance adjacent to our seabird colony sites. In concert with the monitoring effort, we aim to expand outreach efforts associated with this project so that more visitors to Oregon's Coast learn about the marine reserve network and the coast's amazing natural history.

Acknowledgements

This project was made possible by a collaboration of organizations and people. Funding and project concept was provided by the Audubon Society of Portland. The U.S. Fish and Wildlife Service provided gear and the involvement of a full-time intern, Jennifer Nelson. The Haystack Rock Awareness Program and Friends of Cape Falcon Marine Reserve assisted with staff members, volunteer monitoring and conducting outreach at Cape Falcon and Haystack Rock sites. We thank Norb Leupold at Leupold Optics for donating two spotting scopes for the Project. Also, thanks to Jim McMillan, and his staff for providing access to the Sea Lion Caves and for being a pleasure to work with. Funding support was provided by the David and Lucille Packard Foundation. Oregon State University's Seabird Oceanography Lab supplied access to Yaquina Head cormorant monitoring data and assisted with summarizing the data. Stephanie Loredo collected and summarized data at Yaquina Head.[12]

There were 39 incredible volunteers that monitored during the 2017 season. Special thanks to: Clare Hawkins, Heather Wilson, Phyllis Thompson, Tamara Layden, Judith Jones, Ruth Craig, Mike Sydow, Ann Caples, Nikki Thomas, Tara and Abbey Dubois, Patricia and Mark Johnson, Jeremy Sappington, Kari Henningsgaard, Amy and Steave Grace, Barry and Barbara Ripley, Chrissy Smith, Shelley Taylor, Lori Robertson, Nadia Gardener, Jhonnattan Valdes, Tamara Kramer, Roberta Swift, Max Parson-Scherban, Michelle Smith, Tristan Mitchell and Travis Torgerson. Thank you for your invaluable monitoring efforts!

[12] Suryan et al. 2017. Yaquina Head Seabird Colony Monitoring - 2017 Season Summary, Oregon State University. http://hmsc.oregonstate.edu/research-labs/seabird-oceanography-lab/research/foraging-reproductive-ecology/oregon

Photographs from the monitoring season:

Community science volunteers at Cape Perpetua looking at Mile 179 cormorant plots. (Photo: A. O'Connor)

Volunteers at Cape Falcon monitoring plots. (Photo: A. O'Connor)

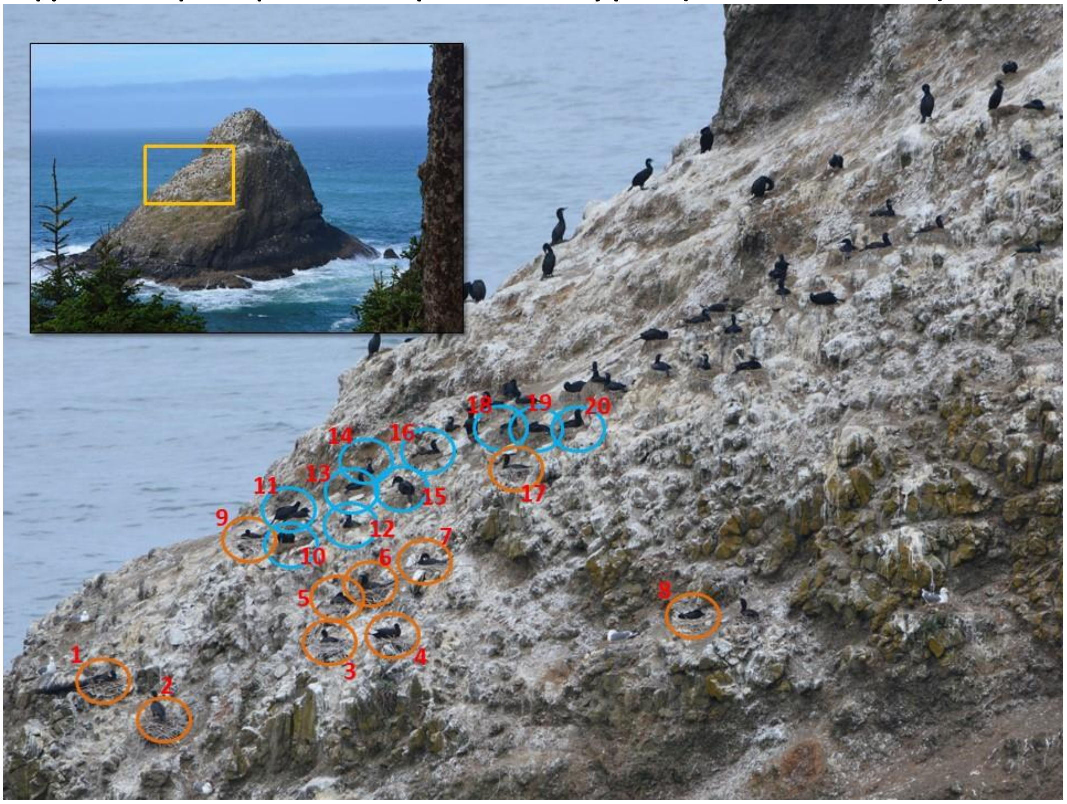
USFWS and Portland Audubon interns monitoring at Haystack Rock. (photo: A. O'Connor)

Outreach at Cape Falcon. (Photo: A. O'Connor).

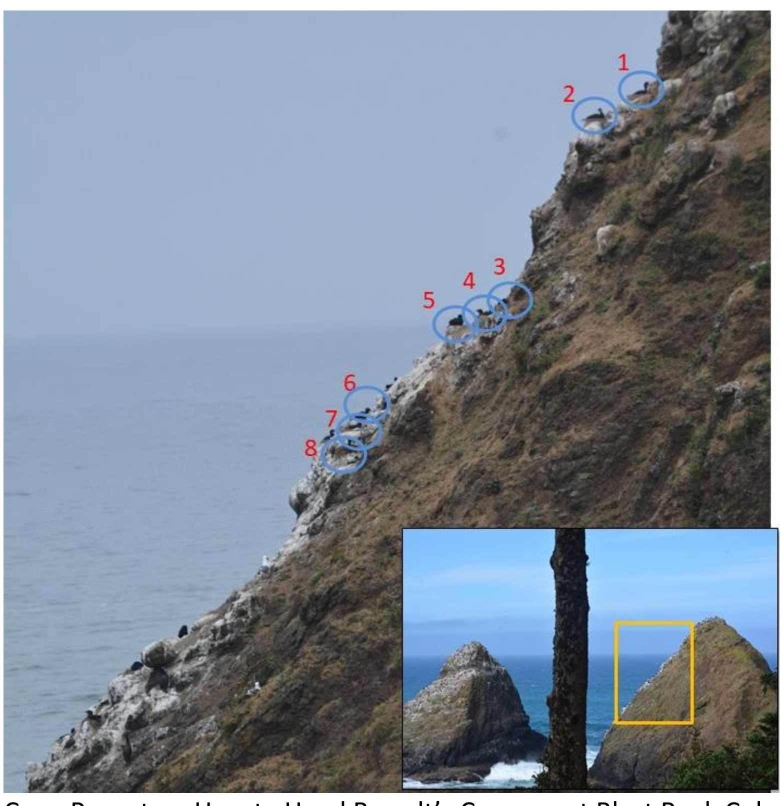
Pigeon Guillemots and Pelagic Cormorants at the Sea Lion Caves. (Photo: A. O'Connor).

View inside the Sea Lion Caves. (Photo: A. O'Connor).

Appendix. Cape Perpetua and Cape Falcon study plots (Photos: A. O'Connor).



Cape Perpetua: Heceta Head Parrot Rock Brandt's and Double-crested Cormorant Colony Plot 1.



Cape Perpetua: Heceta Head Brandt's Cormorant Blast Rock Colony Plot 1.

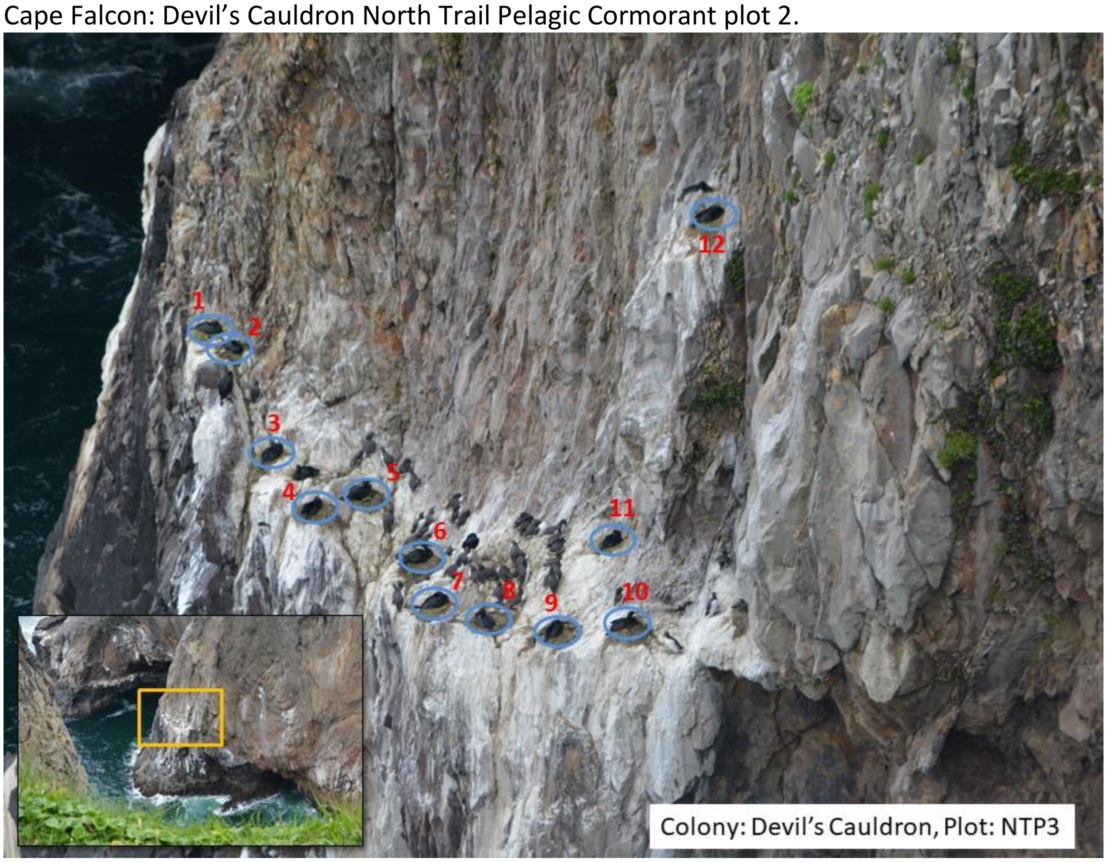
Cape Perpetua: Sea Lion Caves Pelagic Cormorant headland cliffs colony Plot 1.

Cape Perpetua: Mile 179 South Colony Brandt’s Cormorant plot 1.

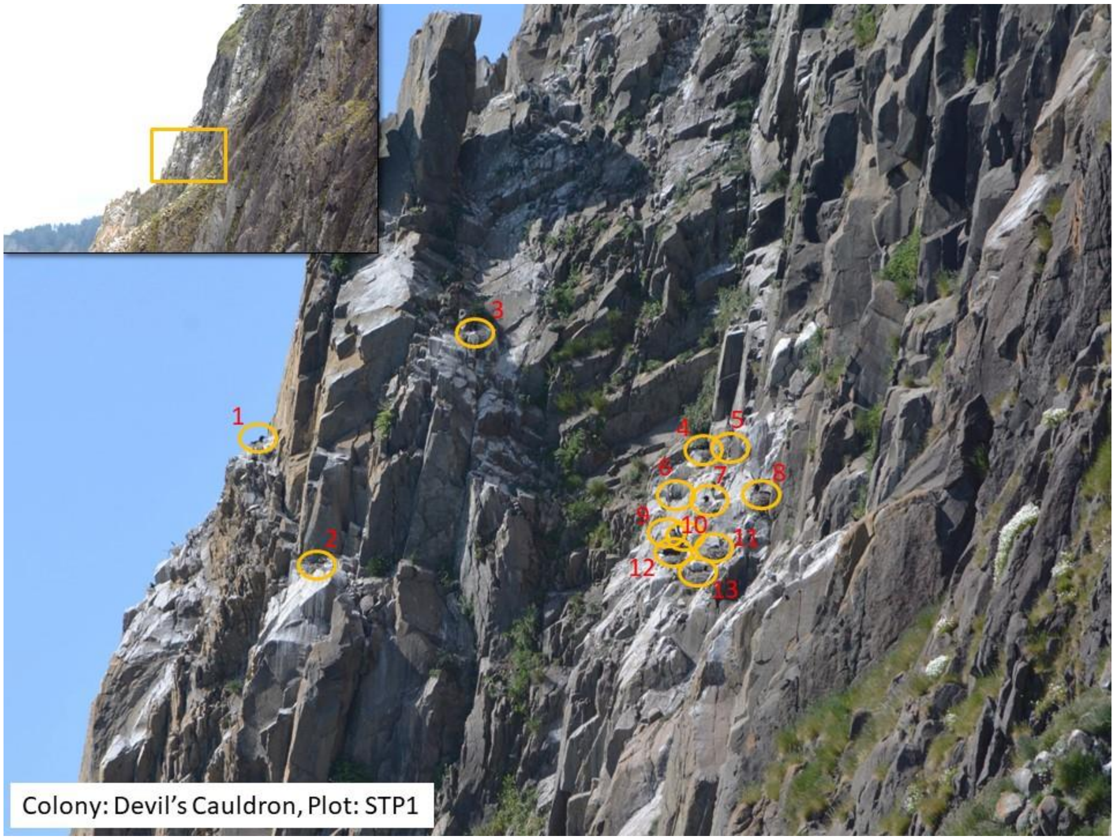
Cape Perpetua: Mile 179 North Colony Brandt's Cormorant plot 1.

Cape Falcon: Devil's Cauldron North Trail Brandt's Cormorant plot 1.

Cape Falcon: Devil's Cauldron North Trail Pelagic Cormorant plot 2.



Cape Falcon: Devil's Cauldron North Trail Pelagic Cormorant plot 3.



Cape Falcon: Devil's Cauldron South Trail Double-crested Cormorant colony plot 1.