AMNWR 2014/07

CORMORANT SURVEYS IN THE PRIBILOF ISLANDS, ALASKA, IN 2005 AND 2013

Marc D. Romano, Gregory Thomson, Jeffrey C. Williams, and Sadie K. Wright

Key words: circumnavigation survey, Otter Island, pelagic cormorant, *Phalacrocorax pelagicus*, *Phalacrocorax urile*, Pribilof Islands, red-faced cormorant, St. George Island, St. Paul Island, Walrus Island

U.S. Fish and Wildlife Service
Alaska Maritime National Wildlife Refuge
95 Sterling Highway, Suite 1
Homer, AK 99603

May 2014

Cite as: Romano, M. D., G. Thomson, J. C. Williams, and S. K. Wright. 2014. Cormorant surveys in the Pribilof Islands, Alaska, in 2005 and 2013. U.S. Fish and Wildl. Serv. Rep., AMNWR 2014/07. Homer, Alaska

TABLE OF CONTENTS **Page**

INTRODUCTION 1
STUDY AREA 1
METHODS 2
RESULTS 2
DISCUSSION 3
REFERENCES 4
FIGURES AND TABLES 6

INTRODUCTION

During the 2005 breeding season, we conducted an island group-wide population survey for red-faced (*Phalacrocorax urile*) and pelagic (*P. pelagicus*) cormorants in the Pribilof Islands. Separate surveys were conducted for St. George Island, St. Paul Island (including Sea Lion Rock), Otter Island, and Walrus Island, using a combination of boat-based and land-based surveys. During the summer of 2013 we conducted another cormorant survey of St. Paul Island only. During all surveys, observers counted adult and immature cormorants on land and on the water. In addition they counted individual red-faced cormorant nests.

A great deal of seabird monitoring work has been conducted on the Pribilof Islands, and both St. Paul and St. George have been used as annual biological monitoring sites for Alaska Maritime National Wildlife Refuge since 1985 (Klostermann et al. 2013, Thomson et al. 2013). Prior to that, between 1975 and 1984, the Minerals Management Service (MMS) funded studies to monitor trends in populations and productivity of ledge-nesting seabirds on St. Paul and St. George due to concerns over potential offshore oil development along the continental shelf (Hickey and Craighead 1977, Hunt et al. 1981, Craighead and Oppenheim 1985, Lloyd 1985, Johnson and Baker 1985, Troy and Baker 1985). The U.S. Fish and Wildlife Service purchased most of the seabird nesting areas in the Pribilof Islands between 1982 and 1985, and these areas were incorporated into the Bering Sea Unit of Alaska Maritime National Wildlife Refuge.

The Alaska Maritime National Wildlife Refuge conducts annual ecological monitoring at nine sites throughout Alaska. Red-faced cormorants are monitored annually at two other locations outside the Pribilof Islands; Buldir Island and Aiktak Island, both in the Aleutian Islands. Pelagic cormorants are monitored annually at Buldir and Aiktak islands, as well as St. Lazaria Island in southeast Alaska. In 2004-2005, we initiated detailed studies on the breeding biology of red-faced cormorants on St. Paul Island (Wright et al. 2013)

Detailed results of the 2005 and 2013 Pribilof Islands cormorant surveys are contained in this report and archived, along with cormorant data from other monitoring sites, at the Alaska Maritime National Wildlife Refuge headquarters in Homer, Alaska.

STUDY AREA

The Pribilof Islands group is located in the southeastern Bering Sea, Alaska (Figure 1) and it is comprised of five islands: St. Paul Island (57º10'N, 170º15'W; Figure 2), St. George Island (56º35'N, 169º35'W; Figure 3), Otter Island (57º03'N, 170º24'W; Figure 4), Walrus Island (57º11'N, 169º56'W; Figure 4) and Sea Lion Rock (57º06'N, 170º18'W; Figure 2). The islands are volcanic in origin, and they lie near the outer edge of the continental shelf that connects Alaska and Russia. Water exchange between the Bering Sea and North Pacific Ocean forms a zone of upwelling and ocean fronts around the continental shelf that is rich in nutrients. These conditions create some of the highest primary productivity rates in the world's oceans (Lewbel 1983), which in turn support one of the highest densities of seabirds on Earth (Hood 1981). St. Paul and St. George islands are about 90 km apart with St. Paul lying farther north at a greater distance from the highly-productive shelf break region, and closer to the maximum extent of winter pack ice.

Cliffs extend along approximately 11 km of St. Paul's coastline and reach up to 115 m high, providing breeding habitat to an estimated 250,000 seabirds (Sowls et al. 1978). St. George is ringed by extensive

cliffs around most of the island, spanning nearly 50 km in coastline and rising to elevations of up to 300 m. These cliffs provide breeding habitat to some of the largest ledge-nesting seabird populations in the North Pacific (Sowls et al. 1978), including over 75 percent of the world's population of red-legged kittiwakes (*Rissa brevirostris*; Byrd and Williams 1993) and Alaska's largest population of thick-billed murres (*Uria lomvia*). In contrast, Otter and Walrus islands are much smaller in area, with cliffs significantly smaller than either St. Paul or St. George, and the islands support a fraction of the number of breeding birds (approximately 15,400 on Otter [Byrd 1984] and 1,300 on Walrus [Byrd 1997]) that St. Paul or St. George do.

METHODS

During July 2005 we conducted land- and boat-based counts of cormorants for all five Pribilof Islands (Figure 1). In addition, a boat-based survey of cormorants was conducted on St. Paul Island during July 2013. A 5.5m (18-ft.) inflatable skiff was used as the boat survey platform in both years, and the research vessel R/V *Tiĝlax̂* supported the survey crew and served as a base for operations in 2005. Boat surveys were conducted by a three-person crew, with one person operating the skiff and two others serving as observers (one observer also served as the data recorder). Land-based surveys were conducted by either a one- or two-person crew. Each coastline segment was counted either from the land or from sea depending on its access and visibility. One coastline segment, Zapadni on St. Paul, required both methods to complete a count.

Boat-based surveys were conducted at St. Paul Island on 26-27 July 2005, and 9 July 2013. Surveys of Walrus and Otter islands were conducted on 27 July 2005, and St. George Island was surveyed on 28 July 2005. Due to its proximity to St. Paul Island, the count of Sea Lion Rock in 2005 was combined with the count of St. Paul Island. The survey vessel generally maintained a distance of 50-100m offshore, though it was brought closer if conditions allowed. All cormorants visible on land and in the water (regardless of distance from shore) were recorded to species and age (adult or immature) when possible. In an effort to save time on the boat-based survey and to record nesting cormorants on St. Paul Island in areas not visible from the water, land-based surveys were completed from 19-30 July 2005 by field personnel stationed on the island.

RESULTS

Red-faced cormorants were by far the most abundant cormorant species observed during our surveys of the Pribilof Islands. They accounted for 95 percent of all cormorants counted in 2005 and >99 percent of all cormorants counted in 2013 (Tables 1-4).

2005

We counted a total of 3,585 red-faced cormorants and 176 pelagic cormorants in the Pribilof Islands in 2005 (Tables 1-3). We also counted 1,015 red-faced cormorant nests during the same survey. St. Paul Island had the largest population of red-faced cormorants (2,203) and pelagic cormorants (93), and the highest count of red-faced cormorant nests (714) of all the islands surveyed (Table 1).

At St. George Island we counted a total of 940 red-faced cormorants, 206 red-faced cormorant nests, and 42 pelagic cormorants (Table 2). On Otter Island we counted a total of 383 red-faced cormorants, 91 red-faced cormorant nests, and 2 pelagic cormorants (Table 3). Finally, at Walrus Island we counted a total of 59 red-faced cormorants, 4 red-faced cormorant nests, and 39 pelagic cormorants (Table 3).

2013

Due to time and weather constraints we were unable to survey the entire coastline of St. Paul Island during 2013, so we concentrated our effort on areas that have historically contained the greatest number of nesting cormorants and the most appropriate habitat for nesting (i.e., rocky cliffs). We began our survey at Lukanin Point (point "T" on Figure 2), and proceeded clockwise around St. Paul, ending our survey at the northwest corner of the island (point "M" on Figure 2). Although our survey effort covered barely 40 percent of the coastline of the island (approximately 25 km surveyed of the 62 km of total coastline), we surveyed nearly all 11 km of the island's cliff habitat. During the 2005 St. Paul Island cormorant survey, 85 percent of the red-faced cormorants and 99 percent of the red-faced cormorant nests occurred in the area covered by the 2013 survey.

We counted a total of 328 red-faced cormorants and 1 pelagic cormorant during our 2013 survey of St. Paul Island (Table 4). In addition, we counted 173 red-faced cormorant nests in our 2013 survey. During our 2005 St. Paul Island cormorant survey we counted 1,880 red-faced cormorants, 706 red-faced cormorant nests, and 47 pelagic cormorants in the area covered by our 2013 survey (Table 5 and Figure 6).

DISCUSSION

Determining the size and trends of red-faced cormorant populations can be quite difficult. Most known red-faced cormorant colonies in North America are located in remote areas (e.g., Aleutian Islands and Alaska Peninsula) that can be expensive and logistically challenging to access. As a result, there are only a few areas that have been surveyed with enough regularity to detect trends in cormorant populations.

Based on our observations at St. Paul Island, red-faced cormorants do not appear to have strong breeding site fidelity, and annual use of a particular area can vary greatly from year to year. As a result, localized, plot-based counts are not an effective method for monitoring population change of red-faced cormorants due to localized shifts in breeding distribution. At St. Paul Island red-faced cormorant use of a given cliff site can be highly variable. Photographs of a single population monitoring plot on St. Paul Island show 29 adult cormorants and at least 27 nests in 2005, and no adult birds or nests in 2006 (Figure 7). It is generally agreed that population trends of red-faced cormorants need to be assessed on a regional scale, as opposed to a colony or island-wide scale. This obviously makes monitoring of red-faced cormorant population trends much more difficult than monitoring of a species with high breeding site fidelity.

Unfortunately, systematic, region-wide surveys for cormorants in the Pribilof Islands were not conducted prior to our survey in 2005, and have not been conducted since. Our only points of comparison to evaluate cormorant population trends in the Pribilof Islands are at the individual island scale. This approach is problematic because it does not take into account potential movement between islands, but it is all that is possible with the limited data available.

Counts of red-faced and pelagic cormorants, and red-faced cormorant nests at St. Paul Island all declined between 2005 and 2013 (Figure 6). However, given the limits of our data, it is not possible to determine definitively if the reduction in our counts on St. Paul represent a true decline or just a redistribution of birds, either to other parts of St. Paul Island not surveyed in 2013 or to other islands within the Pribilof Islands. It is unlikely that a large number of cormorants were present, but not counted on St. Paul in 2013

because we surveyed nearly the entire cliff habitat on the island, which is where the majority of cormorants were found during the 2005 survey. There are two smaller areas of cliff habitat that were not surveyed in 2013, Polovina and Sea Lion Rock. Although Sea Lion Rock is off the coast of St. Paul, it is typically included in surveys of St. Paul, as it was in 2005. These two areas accounted for 225 red-faced cormorants (163 adults, 62 juveniles) or approximately 10 percent of the total, during the 2005 survey

A good time-series of Pribilofs cormorant population count data exists for Walrus Island (Table 6), with counts conducted in 6 years between 1987 and 2008. Counts of both red-faced cormorant individuals (immature and adult combined) and red-faced cormorant nests declined between 1987 and 2008. Walrus Island appears to be used by immature red-faced cormorants as a roosting site. In 1997, 74 percent of all red-faced cormorants observed on Walrus Island were immature birds (Byrd 1997), and in 2005, 59 percent of the total was immature birds (Table 6). Throughout the Pribilof Islands in 2005 between 7 and 26 percent of all cormorants observed were immature birds (this latter estimate assumes that all unknown birds were immature). We recommend that a complete resurvey/recensus of the entire Pribilof Island group be conducted at the earliest opportunity to determine if the apparent population declines are present on all islands.

REFERENCES

Byrd, G. V. 1984. Observations of flora and fauna in the Bering Sea Unit Alaska Maritime NWR in July 1984. U.S. Fish and Wildl. Serv. Rep., AMNWR 84/02. Homer, Alaska.

Byrd, G. V. 1987. Wildlife surveys of Walrus Island, Pribilof Islands, Alaska, 28 July 1987. U.S. Fish and Wildl. Serv. Rep., AMNWR 87/08. Homer, Alaska.

Byrd, G. V. 1997. Wildlife observations at Walrus Island, Pribilof Islands, Alaska, July 24, 1997. U.S. Fish and Wildl. Serv. Rep., AMNWR 97/14. Homer, Alaska.

Byrd, G. V. and J. C. Williams. 1993. Red-legged kittiwake (*Rissa brevirostris*). *In* A. Poole and F. Gill (eds.). The Birds of North America, No. 60. The Academy of Natural Sciences, Philadelphia; The American Ornithologists' Union, Washington D.C.

Craighead, F. L. and J. Oppenheim. 1985. Population estimates and temporal trends of Pribilof Island seabirds. U.S. Dept. Commerce, NOAA, OCSEAP. Final Rep. 30: 307-356.

Hickey, J. J. and F. L. Craighead. 1977. A census of seabirds on the Pribilof Islands. Environ. Assess. Alaskan Contin. Shelf. Ann. Rep. 2: 96-195. NOAA Environ. Res. Lab., Boulder, Colorado.

Hood, D. W. 1981. Introduction. Pp. iii-xviii *in* D. W. Hood and J. A. Calder (eds.). The Eastern Bering Sea Shelf: oceanography and resources. University of Washington Press, Seattle, Washington.

Hunt, G. L., Z. Eppley, B. Burgeson, and R. Squibb. 1981. Reproductive ecology, foods, and foraging areas of seabirds nesting on the Pribilof Islands, 1975-1979. Environ. Assess. Alaskan Contin. Shelf. Ann. Rep. 12:1-258. NOAA Environ. Res. Lab., Boulder, Colorado.

Johnson, S. R. and J. S. Baker. 1985. Productivity studies. Pages 191-256 *in* S. R. Johnson (ed.). Population estimation, productivity, and food habits of nesting seabirds at Cape Peirce and the Pribilof Islands, Bering Sea, Alaska. LGL Ecol. Res. Assoc., Inc., Bryant, Texas.

Klostermann, M.R., M.L. St. Pierre, and M.D. Romano. 2013. Biological monitoring at St. George Island, Alaska in 2013. U.S. Fish and Wildl. Serv. Rep., AMNWR 2013/08. Homer, Alaska.

Lewbel, G. S. 1983. Bering sea biology: an evaluation of the environmental data base related to Bering Sea oil and gas exploration and development. LGL Alas. Res. Assoc., Inc., Anchorage, Alaska; SOHIO Alas. Petroleum Co., Anchorage, Alaska.

Lloyd, D. S. 1985. Breeding performance of kittiwakes and murres in relation to oceanographic and meteorological conditions across the shelf of the southeastern Bering Sea. M. Sc. thesis, University of Alaska, Fairbanks, Alaska.

Sowls, A. L., S. A. Hatch, and C. J. Lensink. 1978. Catalog of Alaskan seabird colonies. U.S. Fish and Wildl. Serv., FWS/OBS-78/78, Anchorage, Alaska.

Thomson, G. and L. Spitler 2008. Results of seabird monitoring at St. Paul Island, Alaska, in 2008: Summary appendices with additional observations at Otter Island and Walrus Island. U.S. Fish and Wildlife Service Report, AMNWR 08/19. 87pp.

Thomson, G. and M. D. Romano. 2013. Biological monitoring at St. Paul Island, Alaska in 2013. U.S. Fish and Wildl. Serv. Rep., AMNWR 2013/10. Homer, Alaska.

Troy, D. M. and J. S. Baker. 1985. Population studies. Pp. 34-190 in S. R. Johnson (ed.). Population Estimation, Productivity, and Food Habits of Nesting Seabirds at Cape Pierce and the Pribilof Islands, Bering Sea, Alaska. LGL Ecol. Res. Assoc., Inc., Bryant, Texas.

Wright, S. K., G. V. Byrd, H. M. Renner and A. L. Sowls (2013), Breeding ecology of Red-faced Cormorants in the Pribilof Islands, Alaska. Journal of Field Ornithology, 84: 49–57.

FIGURES AND TABLES

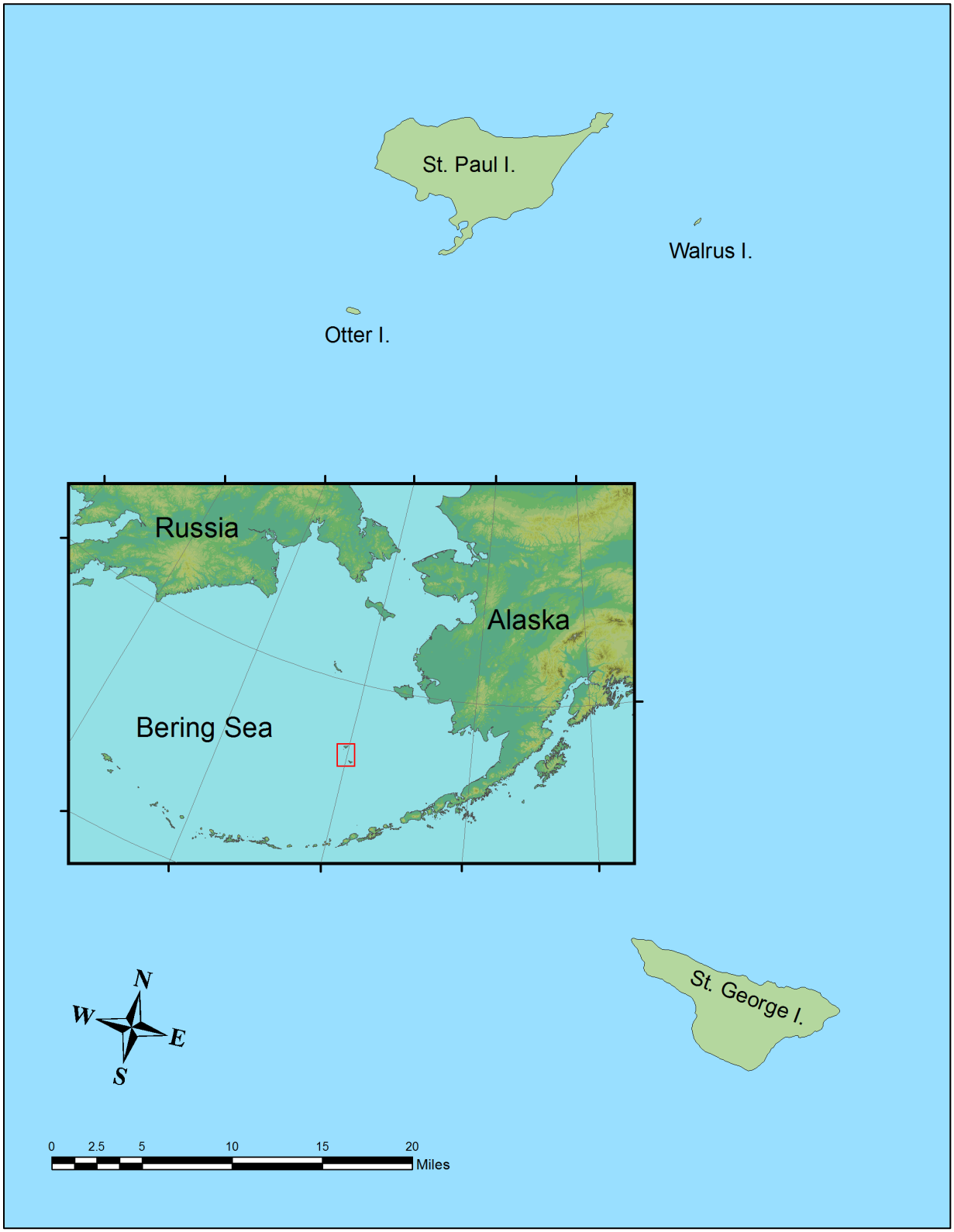

Figure 1. Map of the Pribilof Islands, Alaska.

Figure 2. Map of St. Paul Island, Alaska. Red letters indicate the start and end points of survey areas.

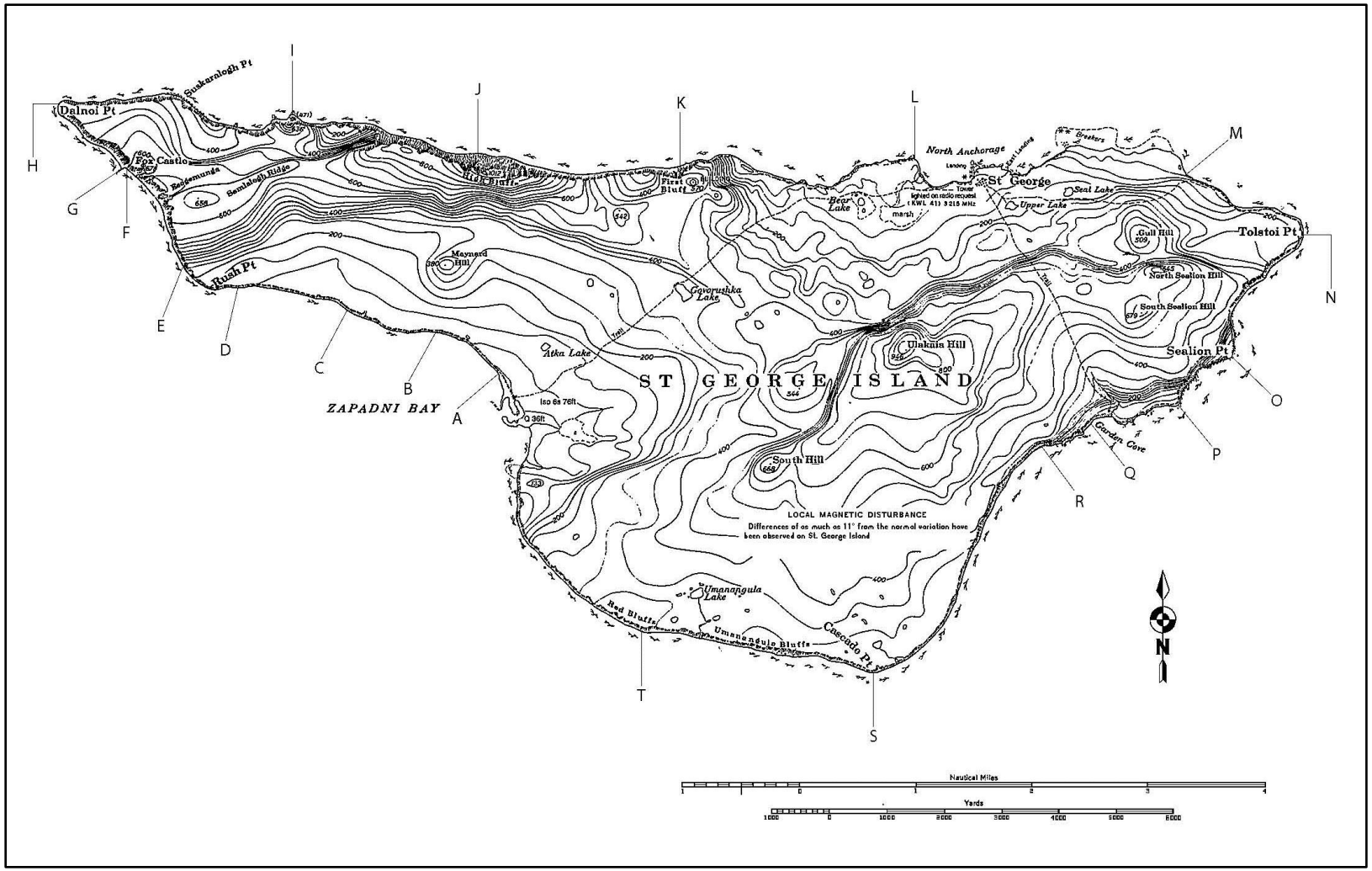

Figure 3. Map of St. George Island, Alaska. Letters indicate start and end points of survey areas.

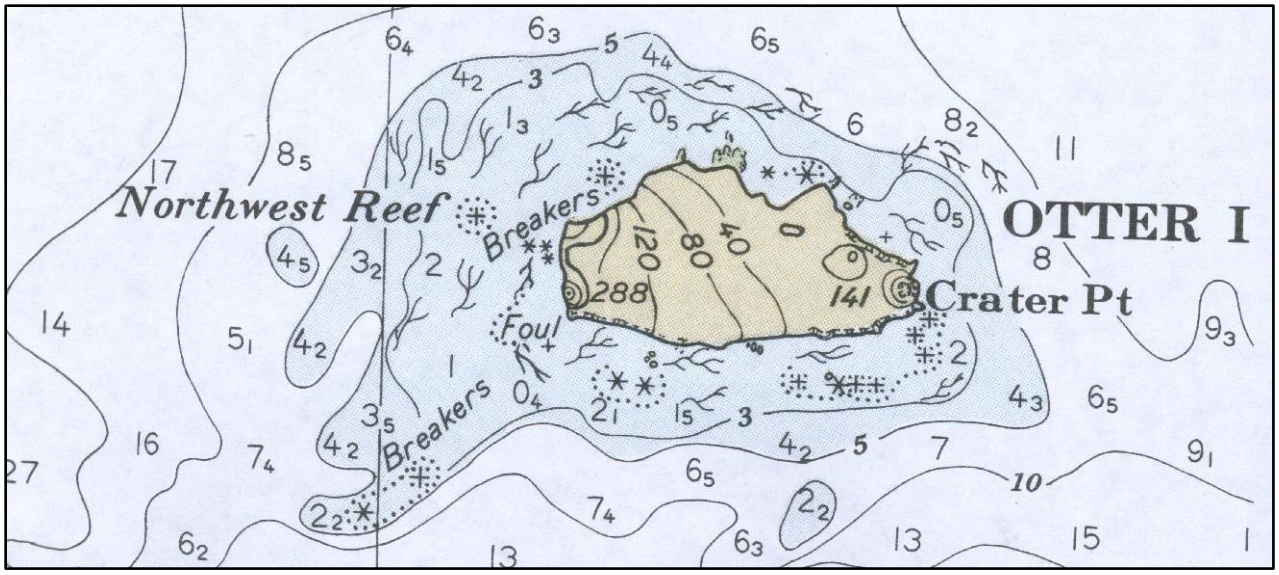

Figure 4. Map of Otter Island, Alaska.

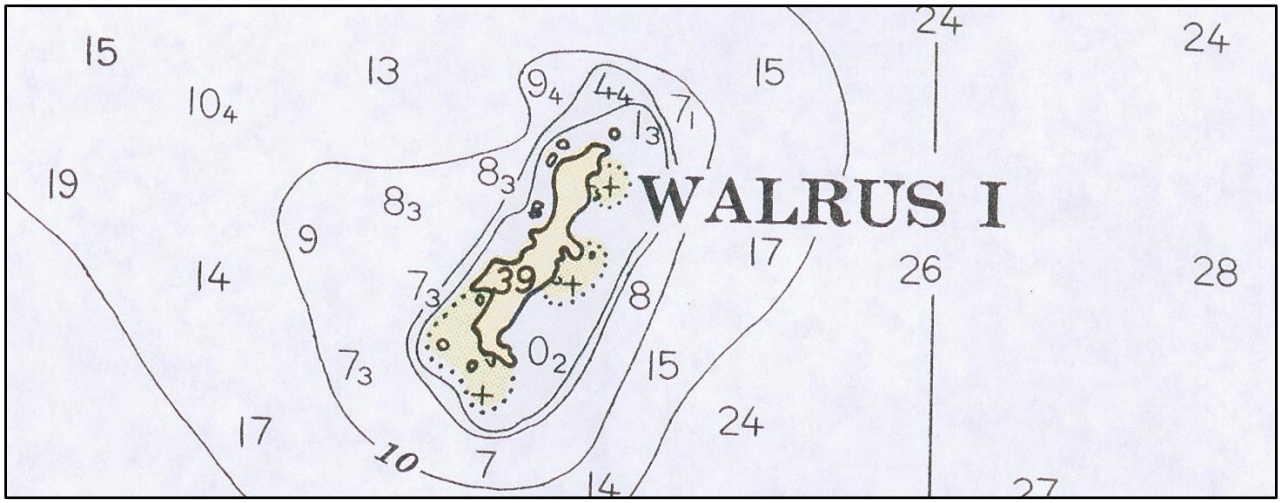

Figure 5. Map of Walrus Island, Alaska.

Table 1. Boat- and land-based counts of red-faced (RFCO) and pelagic (PECO) cormorants from St. Paul Island, Alaska, 26-27 July 2005.

Map Location	Coastline Segment	Survey Method [a]	RFCO Adult	RFCO Immature	RFCO unk.	RFCO Nests	RFCO (water)	PECO (land)	PECO (water)
A	Sea Lion Rock	B	69	33	0	5	2	38	6
B - C	West Reef Point	B	177	2	0	95	4	1	0
C - D	Tolstoi Point	B	98	3	0	53	0	0	0
D - E	no name	B	0	0	0	0	0	0	0
E - F	Zapadni	B/L	592	38	3	276	21	5	0
F - G	Ridgewall East	L	0	0	22	0	0	0	0
G - H	Ridgewall West	L	0	0	1	0	0	0	0
H - I	Southwest Point	B	7	0	0	7	0	0	0
I - J	South High Bluffs	B	47	6	66	10	0	0	0
J - K	North High Bluffs	B	148	14	7	4	0	40	0
K - L	Final Wall to Tidal Barrier	L	0	0	186	103	0	0	0
L - M	NW Corner	L	8	0	126	45	0	0	0
M - N	NW Corner W. of Marunich	L	0	0	96	0	0	0	0
N - O	no name	B	0	0	0	0	0	0	0
O - P	no name	B	0	0	0	0	0	0	0
P - Q	no name	B	0	0	0	0	0	0	0
Q - R	no name	B	0	0	0	0	0	0	0
R - S	Polovina	L	94	29	0	3	0	2	0
S - T	no name	B	0	0	0	0	0	0	0
T - B	East Reef Point	B	265	39	0	113	0	1	0
	TOTALS		1505	164	507	714	27	87	6

[a] B = Boat-based survey, L = Land-based survey

Table 2. Boat-based counts of red-faced (RFCO) and pelagic (PECO) cormorants from St. George, Alaska, July 28 2005

Map Location	Coastline Segment	RFCO Adult	RFCO Immature	RFCO unk.	RFCO Nests	RFCO (water)	PECO (land)	PECO (water)
A - B	Harbor Beach to Rush, East	50	5	0	3	0	0	0
B - C	Harbor Beach to Rush	32	0	0	11	1	0	0
C - D	Harbor Beach to Rush, West	60	3	0	40	0	2	0
D - E	Rush Point	2	0	0	2	0	0	0
E - F	Rush Pt. to Fox Castle	20	0	0	14	0	0	0
F - G	Fox Castle	0	0	0	0	0	0	0
G - H	South Dalnoi Pt.	32	0	3	0	2	11	1
H - I	North Dalnoi Pt.	49	0	0	6	6	0	0
I - J	NeedleRock W to HB	22	0	0	4	11	0	0
J - K	High Bluffs to First Bluff	17	2	0	3	3	0	0
K - L	Rosy Finch	0	0	85	0	0	0	0
L - M	Village	0	0	28	0	0	0	0
M - N	North Tolstoi Pt.	161	2	4	50	0	0	0
N - O	Tolstoi Pt. – Sea lion Pt.	79	10	1	5	4	5	0
O - P	South Sea lion Pt.	81	12	0	6	0	12	0
P - Q	Garden Cove	0	0	0	0	0	0	0
Q - R	Garden Cove South	0	0	0	0	0	0	0
R - S	Cascade Pt. East	22	0	0	12	0	1	0
S - T	Cascade Pt. West	16	1	0	11	0	10	0
Other-1 (SE)	Other-1 (SE)	93	0	0	39	2	0	0
Other-2 (South)	Other-2 (South)	19	0	0	0	0	0	0
TOTALS		755	35	121	206	29	41	1

Table 3. Boat-based counts of red-faced (RFCO) and pelagic (PECO) cormorants from Otter and Walrus islands, Alaska, 27 July 2005.

Island	Map Location	Coastline Segment	RFCO Adult	RFCO Immature	RFCO unk.	RFCO Nests	RFCO (water)	PECO (land)	PECO (water)
Otter	A - B	East Otter	99	3	0	20	2	1	0
Otter	B - C	South Otter	114	3	0	42	0	0	0
Otter	C - D	West Otter	145	17	0	29	0	1	0
Otter	D - A	North Otter	0	0	0	0	0	0	0
Otter	TOTALS		358	23	0	91	2	2	0
Walrus[1]	TOTALS	Walrus	19	34	5	4	1	39	0

[1]Walrus Island numbers are reported as an entire island count, although they were originally recorded as “North Half” and “South Half.”

Table 4. Boat-based counts of red-faced (RFCO) and pelagic (PECO) cormorants from St. Paul Island, Alaska, July 9, 2013.

Map Location	Coastline Segment	RFCO Adult	RFCO Immature	RFCO unk.	RFCO Nests	RFCO (water)	PECO (land)	PECO (water)
A	Sea Lion Rock	ns [a]	ns	ns	ns	ns	ns	ns
B - C	West Reef Point	6	3	0	0	8	0	0
C - D	Tolstoi Point	89	0	0	77	9	0	0
D - E	no name	0	0	0	0	1	0	0
E - F	Zapadni	3	0	0	3	0	0	0
F - G	Ridgewall East	0	0	0	0	4	0	0
G - H	Ridgewall West	0	0	0	0	9	0	0
H - I	Southwest Point	7	0	0	0	3	1	0
I - J	South High Bluffs	27	3	0	18	9	0	0
J - K	North High Bluffs	19	0	0	14	6	0	0
K - L	Final Wall to Tidal Barrier	46	0	0	31	6	0	0
L - M	NW Corner	49	0	0	30	4	0	0
M - N	NW Corner W. of Marunich	ns	ns	ns	ns	ns	ns	ns
N - O	no name	ns	ns	ns	ns	ns	ns	ns
O - P	no name	ns	ns	ns	ns	ns	ns	ns
P - Q	no name	ns	ns	ns	ns	ns	ns	ns
Q - R	no name	ns	ns	ns	ns	ns	ns	ns
R - S	Polovina	ns	ns	ns	ns	ns	ns	ns
S - T	no name	ns	ns	ns	ns	ns	ns	ns
T - B	East Reef Point	10	0	0	0	7	0	0
	TOTALS	256	6	0	173	66	1	0

[a] ns – not surveyed,

Table 5. Comparison of survey results from 26-27 July 2005 and 9 July, 2013 of red-faced (RFCO) and pelagic (PECO) cormorant counts of St. Paul Island, Alaska. Only coastline segments that were completed in both 2005 and 2013 are shown. A combination of boat- and land based surveys was used in 2005, while only boat-based surveys were conducted in 2013.

2005 Survey Results									
Map Location	Coastline Segment	Survey Method [a]	RFCO Adult	RFCO Immature	RFCO unk.	RFCO Nests	RFCO (water)	PECO (land)	PECO (water)
B - C	West Reef Point	B	177	2	0	95	4	1	0
C - D	Tolstoi Point	B	98	3	0	53	0	0	0
D - E	no name	B	0	0	0	0	0	0	0
E - F	Zapadni	B/L	592	38	3	276	21	5	0
F - G	Ridgewall East	L	0	0	22	0	0	0	0
G - H	Ridgewall West	L	0	0	1	0	0	0	0
H - I	Southwest Point	B	7	0	0	7	0	0	0
I - J	South High Bluffs	B	47	6	66	10	0	0	0
J - K	North High Bluffs	B	148	14	7	4	0	40	0
K - L	Final Wall to Tidal Barrier	L	0	0	186	103	0	0	0
L - M	NW Corner	L	8	0	126	45	0	0	0
T - B	East Reef Point	B	265	39	0	113	0	1	0
	TOTALS		1342	102	411	706	25	47	0
2013 Survey Results									
B - C	West Reef Point	B	6	3	0	0	8	0	0
C - D	Tolstoi Point	B	89	0	0	77	9	0	0
D - E	no name	B	0	0	0	0	1	0	0
E - F	Zapadni	B	3	0	0	3	0	0	0
F - G	Ridgewall East	B	0	0	0	0	4	0	0
G - H	Ridgewall West	B	0	0	0	0	9	0	0
H - I	Southwest Point	B	7	0	0	0	3	1	0
I - J	South High Bluffs	B	27	3	0	18	9	0	0
J - K	North High Bluffs	B	19	0	0	14	6	0	0
K - L	Final Wall to Tidal Barrier	B	46	0	0	31	6	0	0
L - M	NW Corner	B	49	0	0	30	4	0	0
T - B	East Reef Point	B	10	0	0	0	7	0	0
	TOTALS		256	6	0	173	66	1	0

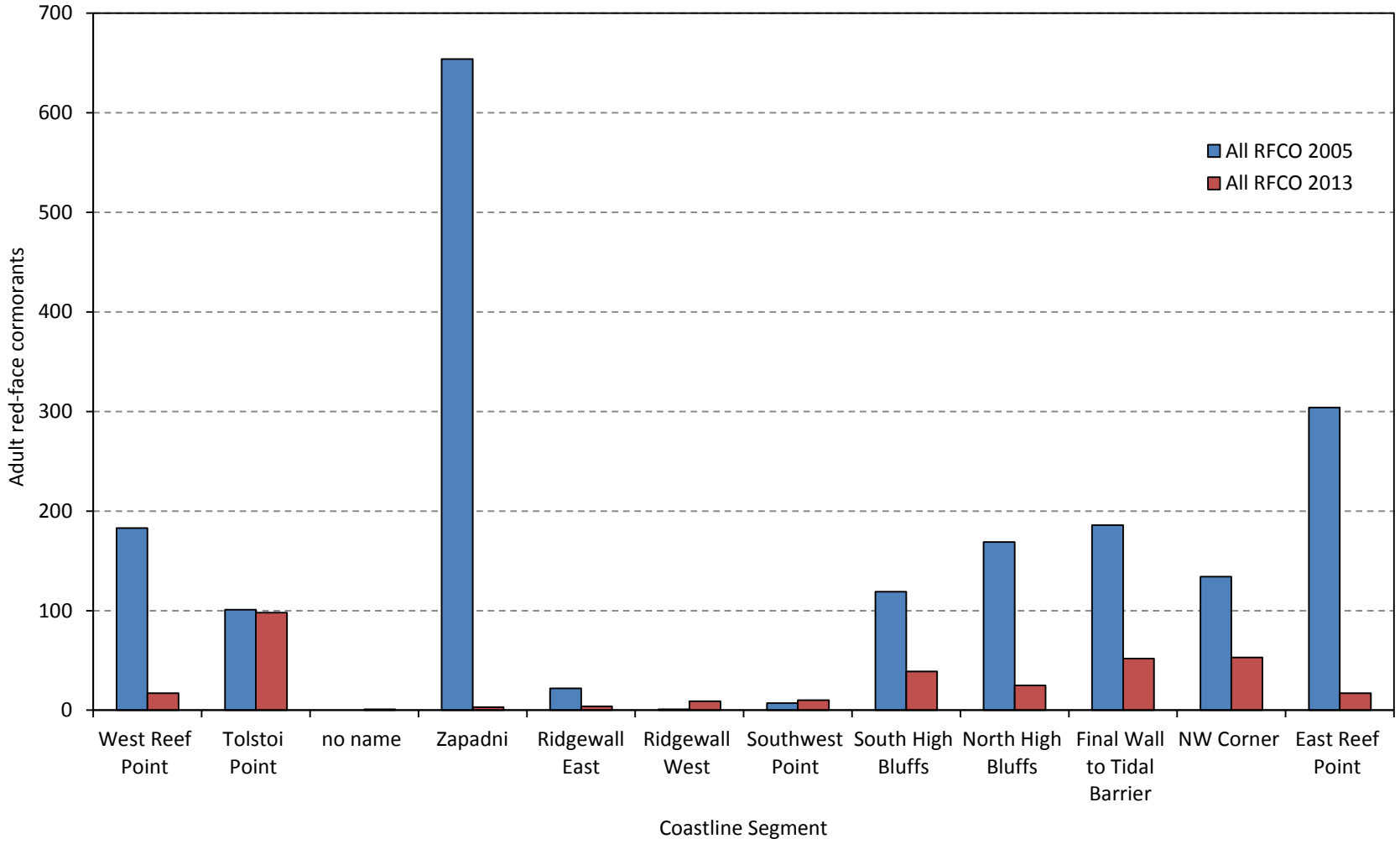

Figure 6. Comparison of survey results from 26-27 July 2005 and 9 July, 2013 of combined red-faced cormorant (RFCO) counts (adult, immature, and unknown age class) of St. Paul Island, Alaska. Only coastline segments that were completed in both 2005 and 2013 are shown.

Table 6. Comparison of red-faced cormorant counts at Walrus Island, Alaska 1987-2008.

Year	1987[a]	1997[b]	2005[c]	2006[d]	2007	2008[e]
Red-faced cormorants	131	95	59	68	X[f]	17
Red-faced cormorant nests	34	21	4	7	X	3
Red-faced cormorant chicks	73	26	-	-	18	2

[a]Counts were made from land and boat on 28 July (Byrd 1987).
[b]Counts made from land on 24 July (Byrd 1997).
[c]Counts made from boat on 27 July 2005
[d]Counts made from land on 20 July (Thomson 2006).
[e]Counts were made from land and boat on 8 August.
[f]"X" denotes the data not available, a "-" means no count was made.

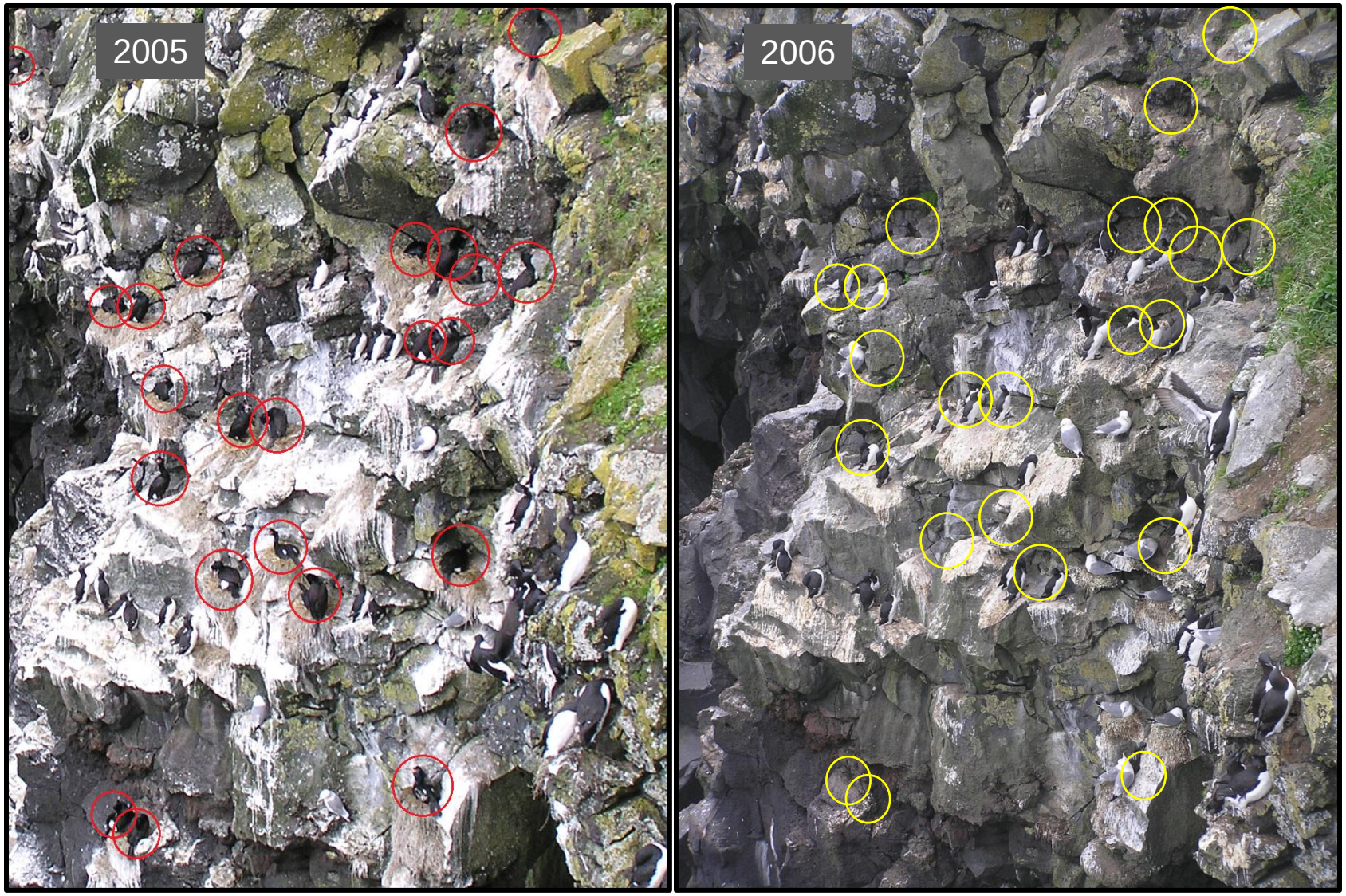

Figure 7. A comparison of a St. Paul Island seabird reproductive productivity monitoring plot (Plot 89 – Zapadni area) from June 2005 (left) and June 2006 (right). Red circles indicate adult red-faced cormorants in 2005 and yellow circles indicate the same areas, unoccupied by red-faced cormorants in 2006.